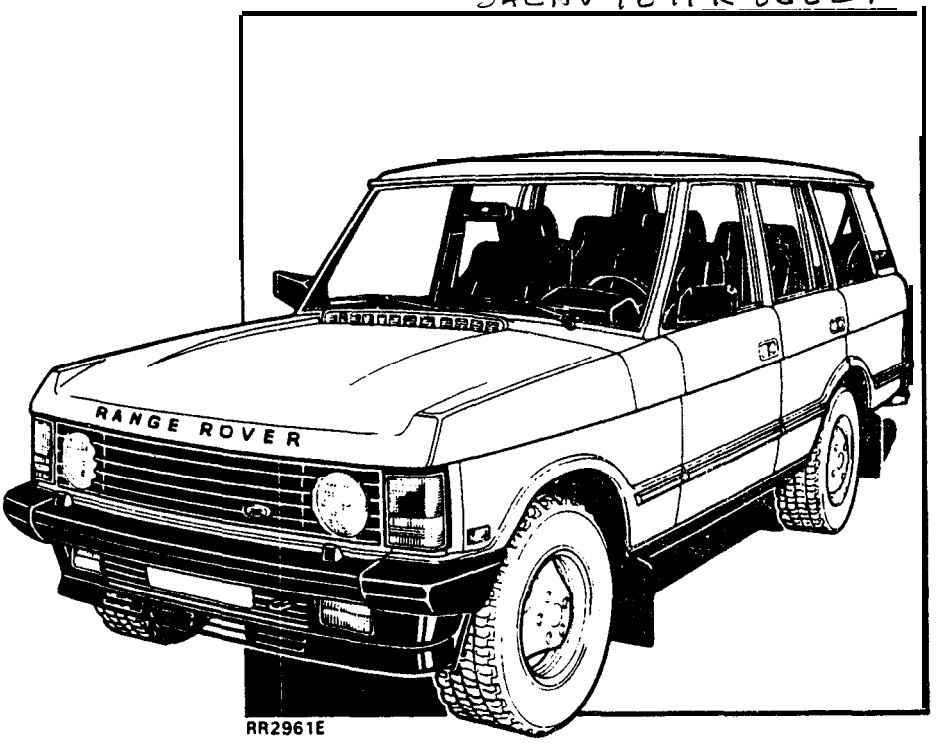
RANGE ROVER

SALHV 1241 K 362371



RR2961E

RANGE ROVER WORKSHOP MANUAL

PUBLICATION NUMBER SRR652USWM A

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REAR -

TIMKIN LM 603049 (#37)

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OUTTER

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INTRODUCTION

NOTE: This workshop manual covers 1987 to 1991 model year vehicles, pages that incorporate model year additions are identified by the header at the top of the page. Example: 1987-91 for a combination of previous model years or 1991 if change is only applicable to latest model year.

This Workshop Manual is designed to assist skilled technicians in the efficient repair and maintenance of Range Rover 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, or suspension should be carried out by a Range Rover Dealer. Repairs to such items should NEVER be attempted by untrained individuals.

WARNINGS and CAUTIONS 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 to perform.

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 water pump 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.

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.

REPAIRS AND REPLACEMENTS

When replacement parts are required it is essential that Range 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 Range Rover parts are fitted. In certain territories, legislation prohibits the fitting of parts not to the vehicle manufacturer's specification. Torque wrench 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 in motor vehicles are poisonous and should under no circumstances be consumed and should be kept away from open wounds. These substances among others include anti-freeze, brake fluid, fuel, windscreen washer additives, air conditioning refrigerant, lubricants and various adhesives.

Continued

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 Marshal or Fire Department.

Fuel vapor is highly flammable and in confined spaces is also very explosive and toxic.
When fuel evaporates it produces 150 times its own volume in vapor, which when diluted with air becomes a readily ignitable mixture. The vapor 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, 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 vapor in the atmosphere. Always disconnect the vehicle battery BEFORE carrying out work on a 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 head-lamps used must be flameproof 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 VAPOR 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.

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

MARSTON BENTLEY INC.
1848 Star Batt Drive East
Rochester
Michigan 48063

Tel: 313 232 1534

BAYPORT CHEMICAL SERVICE INC.
223 North Brookman Street
Pasadena
Texas 77506

Tel: 713 472 5081

USED ENGINE OIL HANDLING PRECAUTIONS

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

WARNING:

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, gas oil, 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.

ACCESSORIES AND CONVERSIONS

DO NOT FIT unnapproved 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 fitment of non-approved conversions to the Range Rover.

WHEELS AND TYRES

WARNING: DO NOT replace the road wheels with any type other than genuine Range 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 water pipes, hose clips and ignition coil clamp.

SPECIFICATION

The specification details and instructions set out in this Manual apply only to Range Rover vehicles manufactured specifically for the U.S.A. and Canada.
The Manufacturers reserve the right to vary their specifications with or without notice, and at such times and in such manner as they think fit. Major as well as minor changes may be involved in accordance with the Manufacturer's policy of constant product improvement.

While 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.

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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.

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	c o
Centimetre	cm
Centigrade (Celsuis)	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	E.C.U.
Electronic Fuel Injection	E.F.I.
Fahrenheit	F
Feet	ft
Feet per minute	ft/min
Fifth	5th
First	1st
Fluid ounce	fl oz
Foot pounds (torque)	ft lb
Fourth	4th
Gramme (force)	gf
Gramme (mass)	g
Gallons	gal
Gallons (US)	US 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 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 meters (torque)	Nm
Number	No.
Ohms	ohm
Ounces (force)	ozf
Ounces (mass)	oz
Ounce inch (torque)	ozf.in.
Outside diameter	O.D.
Part number	Part No.
Percentage	%
Pints	Pt
Pints (US)	US pt
Plus (tolerance)	+
Positive (electrical)	+
Pound (force)	lbf
Pounds inch (torque)	in.lbf.
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.
Synchromesh/Synchroniser	synchro.
Third	3rd
Top dead centre	TDC
United Kingdom	UK
Vehicle Identification Number	VIN
Volts	V
Watts	W

SCREW THREADS

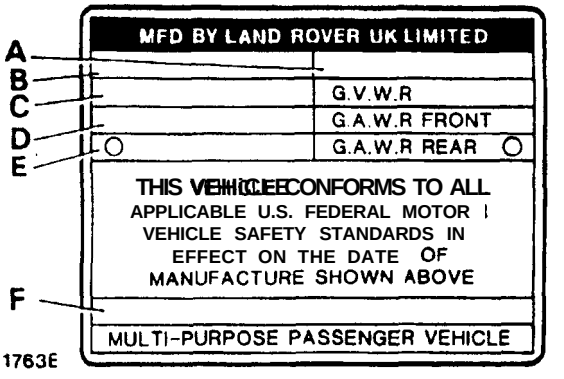
American Standard Taper Pipe	NPTF
British Standard Pipe	BSP
Unified Coarse	UNC
Unified Fine	UNF

GLOSSARY OF TERMS

Aerial - Antenna
Anti-clockwise - Counter-clockwise
Battery flat - Dead battery
Bedding in - Break in
Bonnet - Hood
Bulkhead - Front of dash
Circlip - Snap ring
Crown wheel - Ring gear
Dampers - Shock absorbers
Direction indicators - Turn signals
Down-change - Down-shift
End float - end clearance
Extractor - Puller
Fascia - Dashboard
Fascia panel - Dashboard
Fuel filler flap - Fuel filler door
Caiters - Boots
Gearbox - Transmission
Grub screw - Lock or set screw
Number plate - License plate
Fuel - Gasoline
Pipe - Hose
Rear screen heater - Rear window defogger
Renew/Refit - Replace/Reinstall
Reversing lamps - Back-up lamps
Set screw - Bolt
Silencer - Muffler
Sill - Rocker panel
Spanner - Wrench
Spigot - Pilot
Spigot bearing - Pilot bearing
Split pin - Cotter pin
Spring washer - Lock washer
Sump - Oil pan
Swivel pin - Spindle
Tappets - Lash adjusters
Gudgeon pin - Piston pin
Hydraulic damper - Shock absorber
Ignition/No charge - Generator/No charge
Inflammable - Flammable
joint washer - Casket
Throttle - Accelerator
Top-up - Fill
Transporter lashing - Transporter tie down
Up-change - Up-shift
Windscreen - Windshield
Wing - Fender

VEHICLE IDENTIFICATION NUMBER WIN)

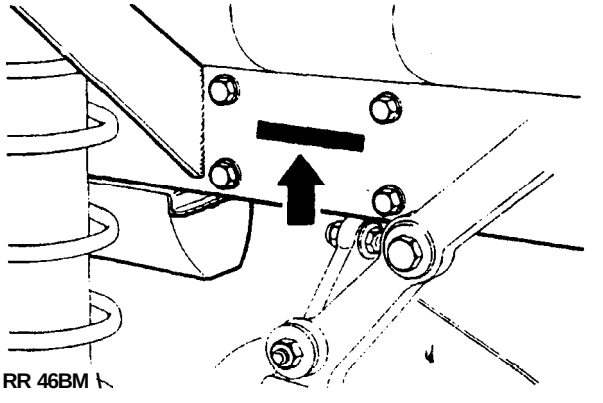
The Federal Vehicle Identification Number, the gross axle weight ratings together with other information is stamped on a label riveted to the lock face of the front left hand door.



KEY TO VEHICLE IDENTIFICATION LABEL

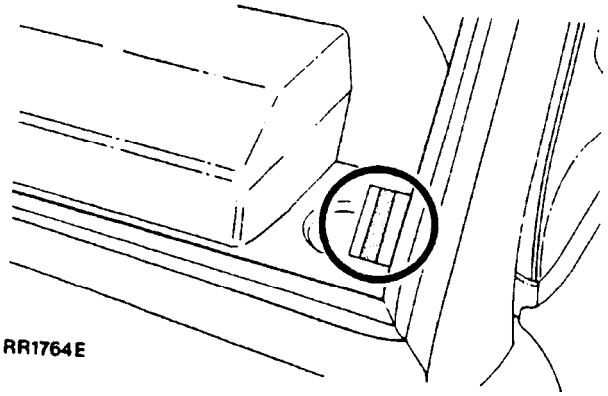
A. Year of manufacture
B. Month of manufacture
C. Gross vehicle weight rating
D. Gross axle weight rating for front axle
E. Cross axle weight rating for rear axle
F. Vehicle identification number (minimum of 17 digits)

The European Vehicle Identification Number is stamped on the right hand side chassis member forward of the front spring mounting turret.



FEDERAL VEHICLE IDENTIFICATION NUMBER

The Federal Vehicle Identification Number is stamped on a plate which is riveted to the upper left hand A - post adjacent to the instrument binnacle and is visible through the front screen of the vehicle.



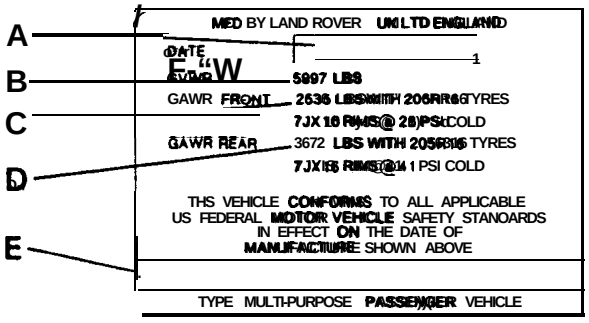
RR1764E

VEHICLE IDENTIFICATION NUMBER (VIN)

- 1989 model year onwards

An adhesive label containing the Federal Vehicle Identification Number, date of manufacture and gross axle weight ratings is fixed to the lock face of the front left hand door. The information includes wheel and tyre sizes and tyre pressures at gross axle weight ratings.

- 1989 model year



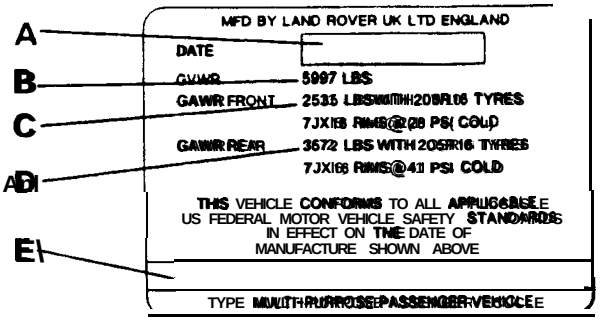
RR2629E

KEY TO VEHICLE IDENTIFICATION LABEL

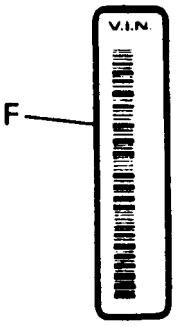
A. Month and year of manufacture
B. Gross vehicle weight rating
C. Gross axle weight rating for front axle
D. Gross axle weight rating for rear axle
E. Vehicle identification number (minimum of seventeen digits)
F. Vehicle identification number - bar code

- 1990 model year (interim condition)

An additional label contains the Vehicle Identification Number in both bar code and digi form.



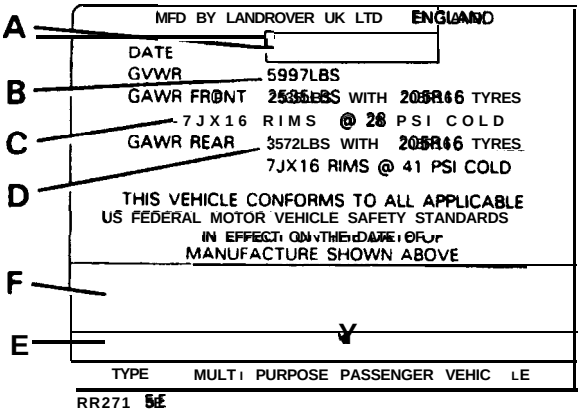
RR2629E



RR2797E

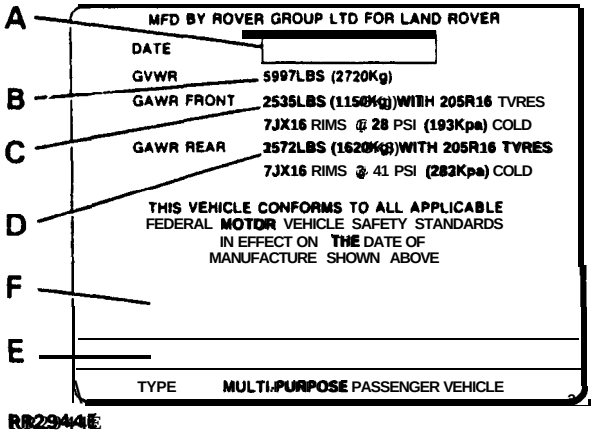
- 1990 model year

The Vehicle Identification Number bar code is incorporated in the VIN label.



RR2715E

- 1991 model year



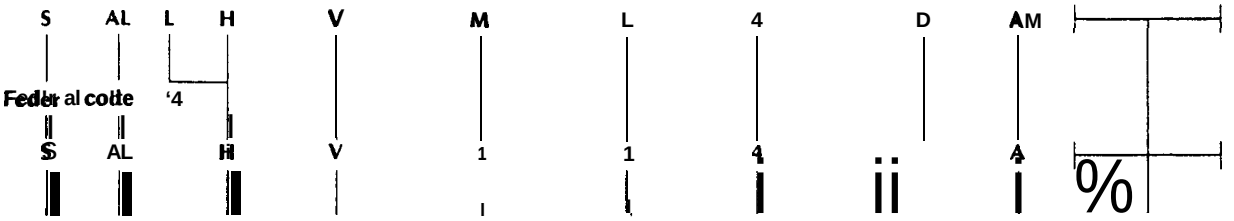
RR2944E

VEHICLE IDENTIFICATION NUMBER

The Federal Vehicle Identification Number consists of similar information to the European number and is made up of a minimum of 17 digits. These numbers are used, to identify manufacturer, model range, specification, body type, engine, transmission/steering, model year, plant and build sequence number and serve to identify the vehicle.

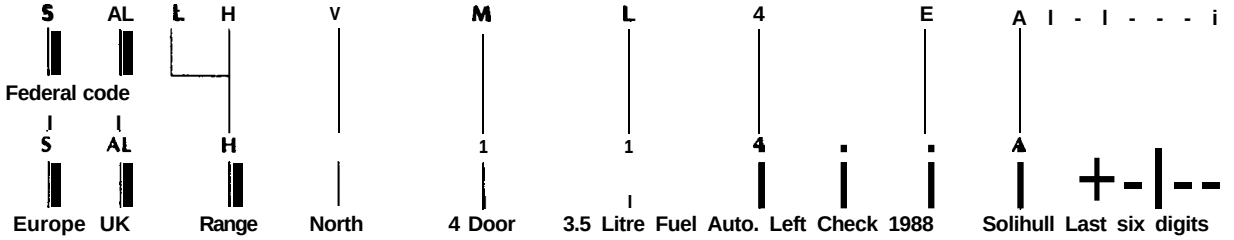
The following example briefly shows the coding process:

European code



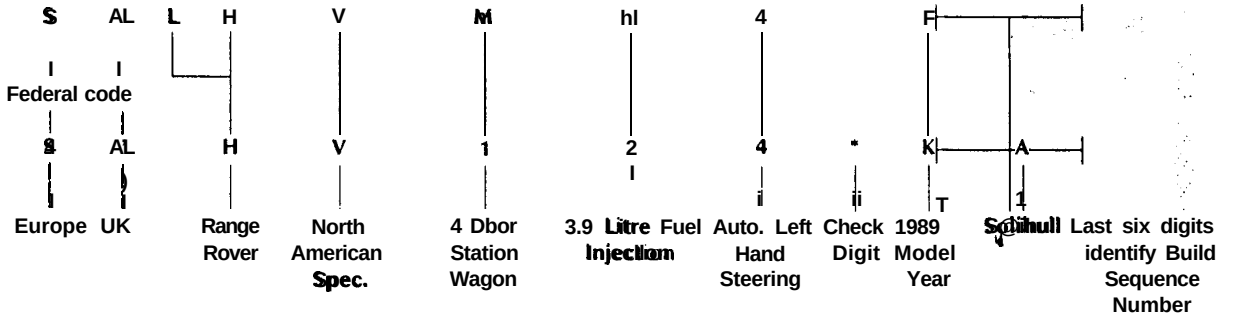
1988 MODEL YEAR

European code



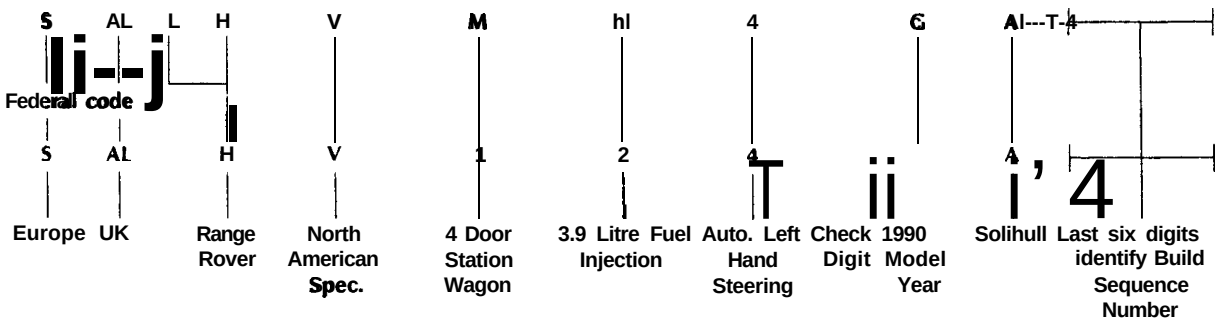
1989 MODEL YEAR

European code



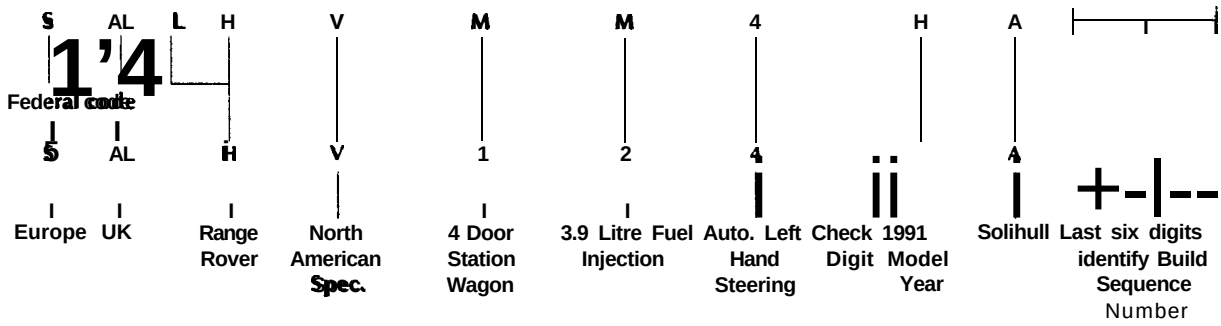
1990 MODEL YEAR

European code



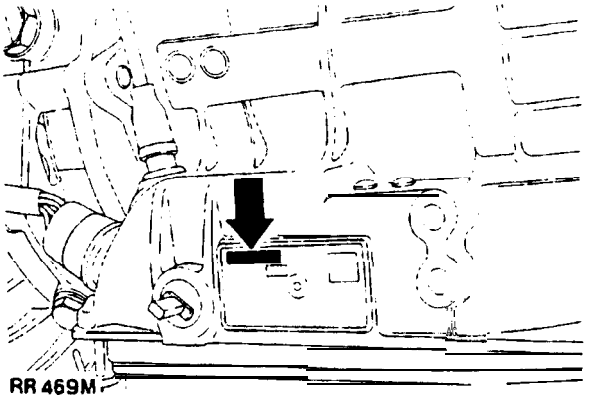
1991 MODEL YEAR

European code



AUTOMATIC GEARBOX ZF4HP22

The serial number is stamped on a plate riveted to the bottom left hand side of the gearbox casing.

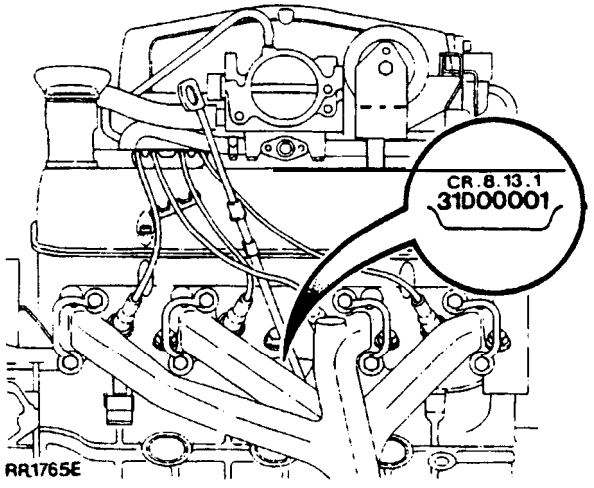


FRONT AND REAR AXLE

The axle serial numbers are stamped on the top of the left hand axle tubes.

ENGINE SERIAL NUMBER - 3.5 AND 3.9 V8 ENGINE

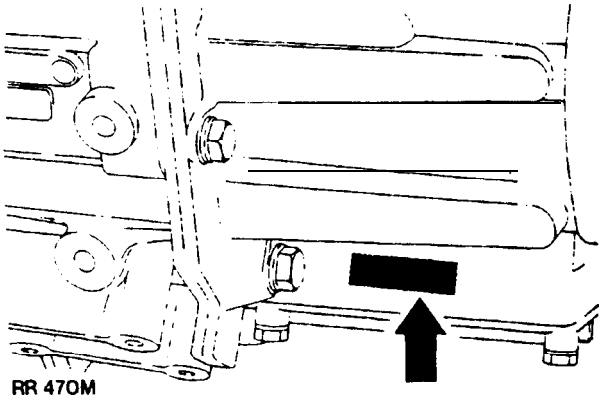
The V8 engine serial number and engine compression ratio is stamped on a cast pad on the cylinder block, between numbers 3 and 5 cylinders.



NOTE: 3.9 Litre Models can be identified by the suffix 38D.

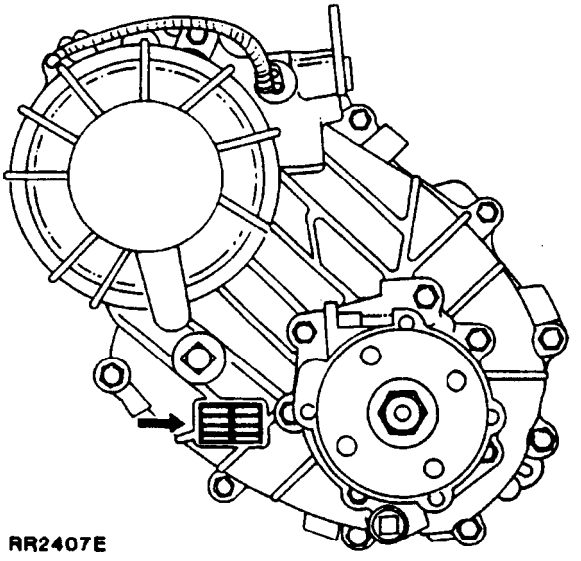
TRANSFER GEARBOX LT230

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



TRANSFER GEARBOX-BORG WARNER -1989 MODEL YEAR

The gearbox serial number is stamped on a plate which is attached to the gearbox casing and is located between the filler/level and drain plug adjacent to the rear output housing.



ENGINE

Type	V8
Number of cylinders	Eight, two banks of four
Bore	88.90mm (3.500 in)
Stroke	71.14mm (2.800 in)
Capacity	3528 cc (215 in')
Valve operation	Overhead by push-rod
Maximum power-bhp-8.13:1	150 at 4750 rev/min (SAE J1349)

Crankshaft

Main journal diameter	58.409-58.422 mm (2.2996-2.3001 in)
Minimum regrind diameter	57.393-57.406 mm (2.2596-2.2601 in)
Crankpin journal diameter	50.800-50.812 mm (2.0000-2.0005 in)
Minimum regrind diameter	49.784-49.797 mm (1.9600-1.9605 in)
Crankshaft end thrust/ (end float)	Taken on thrust washers of centre main bearing 0.10-0.20 mm (0.004-0.008 in)

Main bearings

Number and type	5, Vandetvell shells
Material	Lead-indium
Diametrical clearance	0.010-0.048 mm (0.0004-0.0019 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	143.81-143.71 mm (5.662-5.658 in)

Big-end bearings

Type and material	Vandervell VP lead-indium
Diametrical clearance	0.015-0.055 mm (0.0006-0.022 in)
End-float crankpin	0.15-0.36mm (0.006-0.014 in)
Undersize bearing shells	0.254 mm, 0.508 mm (0.010 in, 0.020 in)

Piston pins

Length	72.67-72.79 mm (2.861-2.866 in)
Diameter	22.215-22.220 mm (0.8746-0.8748 in)
Fit-in connecting rod	Press fit
Clearance in piston	0.002-0.007 mm (0.0001-0.0003 in)

Pistons

Clearance in bore, measured at bottom of skirt at right angles to piston pin	0.018-0.033 mm (0.0007-0.0013 in)

Piston rings

Number of compressions rings	2
Number of oil control rings	1
No. 1 compression ring	Chrome parallel faced
No. 2 compression ring	Stepped to 'L'shaped and marked 'T'or 'TOP'
Width of compression rings	1.56-1.59 mm (0.0614-0.0626 in)
Compression ring gap	0.44-0.57 mm (0.017-0.022 in)
Oil control ring type	Perfect circle, type 98-6
Oil control ring width	4.811 mm (0.1894 in) maximum
Oil control ring gap	0.38-1.40 mm (0.015-0.055 in)

Continued

Camshaft

Location	Central
Bearings	Non serviceable
Number of bearings	5
Drive	Chain 9.52 mm (0.375 in) pitch x 54 pitches.
Tappets	Hydraulic-self-adjusting

Valves

Length:	Inlet	116.59-117.35 mm (4.590-4.620 in)
	Exhaust	116.59-117.35 mm (4.590-4.620 in)
Seat angle:	Inlet	45° to 45 1/2°
	Exhaust	45° to 45 1/2°
Head diameter:	Inlet	39.75-40.00 mm (1.565-1.575 in)
	Exhaust	34.226-34.480 mm (1.3475-1.3575 in)
Stem diameter:	Inlet	8.664-8.679 mm (0.3411-0.3417 in)
	Exhaust	8.651-8.666 mm (0.3406-0.3412 in)
Stem to guide clearance:	Inlet	0.025-0.066 mm (0.0010-0.0026 in)
	Exhaust	0.038-0.078 mm (0.0015-0.0031 in)
Valve lift (Inlet and Exhaust)		9.49 mm (0.374 in)
Valve spring length fitted		40.4 mm (1.590 in) at pressure of 29.5 kg (65 lb)

lubrication

System type	Wet sump, pressure fed
Oil pump type	Gear
Oil pressure	2.11 to 2.81 kg/cm² (30 to 40 p.s.i) at 2400 rev/min with engine warm
Oil filter-internal	Wire screen, pump intake filter in sump
Oil filter-external	Full flow, self-contained cartridge

FUEL SYSTEM

Fuel system type	Lucas hot wire system electronically controlled
Fuel pump-make/type	AC Delco-high pressure (electrical) immersed in the fuel tank
Fuel pump delivery pressure	2.4-2.6 kg/cm² (34-37 p.s.i.)
Fuel filter	Bosch in-line filter 'canister' type

Airflow Sensor

Make and type	Lucas 'Hot Wire' 3AM

Injectors

Make and type	Lucas 8Nf

Electronic Control Unit

Make and type	Lucas 13CU

Fuel pressure regulator

Make and type	Lucas 8RA'

Fuel temperature sensor

Make and type	Lucas 6TT

Coolant temperature sensor

Make and type	Lucas 3TT

Bypass Airvalve (Stepper motor)

Make and type	Lucas 2ACM

Throttle potentiometer

Make and type	Lucas 215SA

Lambda sensor

Make and type	Lucas 3LS

COOLING SYSTEM

Type	Pressurized system with cross-flow radiator and remote header tank, thermostat control, pump and fan assisted
Type of pump	Centrifugal
Thermostat	88°C (190°F)

TRANSMISSION

Transfer gearbox-LT230

Type	Two speed reduction on main gearbox output. Front and rear drive permanently engaged via a lockable differential.

Transfer gearbox ratios

High	1.222:1
Low	3.320:1

Automatic gearbox

Model	ZF4HP22
Type	Four speed and reverse epicyclic with fluid torque converter and lock up.
4th	0.728:1
3rd	1.000:1
2nd	1.480:1
1st	2.480:1
Reverse	2.086:1

Overall ratio (final drive):	High transfer	Low transfer
4th	3.155:1	8.555:1
3rd	4.332:1	11.745:1
2nd	6.400:1	17.388:1
1st	10.722:1	29.131:1
Reverse	9.022:1	24.505:1

Continued

SHIFT SPEED SPECIFICATION
Automatic ZF4HP22 Gearbox

OPERATION	SELECTOR POSITION	VEHICLE SPEED APPROX. MPH	VEHICLE SPEED APPROX. KPH	ENGINE SPEED APPROX. (RPM)
		KICKDOWN		
KD4-3	D	78-95	125-153	
KD3-2	3(D)	56-61	90-98	
KD2-1	2(D3)	27-34	43-55	
KD3-4	D	N/A	N/A	
KD2-3	D(3)	59-64	95103	4750-5200
KDI-2	D(32)	34-39	55-63	4600-5250
		FULL THROTTLE		
FT4-3	D	60-66	97-106	
FT3-2	3(D)	39-45	63-72	
FT3-4	D	73-79	117-127	3980-4330
FT2-3	D(3)	54-59	87-95	4350-4800
FTI-2	D(32)	29-34	47-55	3950-4650
		ZERO THROTTLE		
ZT4-3	D	19-25	31-40	
ZT3-2	D(3)	12-15	19-24	
ZT2-1	D(32)	6-7	IO-11	
		PART THROTTLE		
PT4-3	D	46-53	74-85	
PT3-2	D(3)	29-36	47-58	
PT2-1	D(32)	10-12	16-19	
		LIGHT THROTTLE		
LT3-4	D	26-30	42-48	1430-1650
LT2-3	D(3)	18-22	29-35	1420-1820
LT1-2	D(32)	9-10	14-16	1180-1220
		TORQUE CONVERTER		
1987 Model year				
Lock Up (IN)		40-43	64-69	1480-1820
Unlock (OUT)		38-41	61-66	1430-1560
1988 Model year				
Lock Up (IN)		SO-53	80-85	1875-2000
Unlock (OUT)		48-51	77-82	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.

Drive shafts

Type	
Front	Solid bar 28.6mm (1.125 in) diameter
Rear	51mm (2in) diameter
Universal joints	Open type 03EHD

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

STEERING

Power steering box

Make/type	Adwest Varamatidlinkage
Ratio	Variable: straight ahead 17.5:1

Steering pump

Make/type	Hobourn-Eaton series 200
Operating pressure - straight ahead position - at idle	7 kgf/cm² (100 p.s.i.) maximum
Full lock (left or right) at idle	28 kgf/cm² (400 p.s.i.) minimum
Full lock (left or right) 1000 rev/min	70.77 kgf/cm² (1000-1100 p.s.i.)
Steering wheel turns, lock-to-lock	3.375
Steering wheel diameter	406.4mm (16 in)
Toe-out measurement	1.2 to 2.44mm (0.046 to 0.093 in) toe out
Toe-out included angle	0° 10' to 0° 20'
Camber angle	0° Check with vehicle in static unladen condition, that is, vehicle with water, oil and
Castor angle	3° five gallons of fuel. Rock the vehicle up and down at the front to allow it to take up a
Swivel pin inclination	7° static position

Continued

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
Rear	Fore and aft movement inhibited by two tubular trailing links. Lateral location of axle by a centrally positioned 'A' bracket bolted at the apex to a ball joint mounting. A levelling unit is positioned between the ball joint and upper cross member.

ROAD SPRING DATA

Specification	Part No.	Colour Code	Rating	Free length	No of Coils
A	572315	Blue Stripe	2375.1 kg/m (133 lb/in)	391.16 mm (15.4 in)	7.18
B	NRC4306	Blue & White Stripe	2375.1 kg/m (133 lb/in)	417.57 mm (16.44 in)	7.55
C	NRC8113	Pink & Purple Stripe	3182.1 kg/m (178.2 lb/in)	418.36 mm (16.47 in)	8.75
D	NTC3285	Green & Pink Stripe	3182.1 kg/m (178.2 lb/in)	435.2 mm (17.134 in)	10.21

Standard Suspension	Specification	
	Right Side	left Side
LHD Front	A	B
LHD Rear	C	D

Shock absorbers (dampers)

Type	Telescopic, double-acting non-adjustable
Bore diameter	35.47 mm (1.375 in)

BRAKES

Front service brake

Type	Outboard discs with four piston calipers
Operation	Hydraulic, servo assisted self-adjusting
Disc diameter	298.17mm (11.75 in)
Total pad area	98.1cm² (15.2 in²) per brake
Total swept area	816 cm² (126.48 in²) per brake
Pad material	DON 230
Pad wear indicator	Inboard pad right hand caliper

Rear service brake

Type	Outboard discs with two piston calipers
Operation	Hydraulic, servo assisted, self-adjusting
Disc diameter	290.0mm (11.42 in)
Total pad area	65.81 cm² (10.2 in²) per brake
Total swept area	717 cm² (111.2 in²) per brake
Pad material	DON 230
Pad wear indicator	Inboard pad left hand caliper
1987 model year improvement pad wear indicator	Inboard pad right hand caliper

Parking brake

Type	Mechanical-cable operated drum brake on the rear of the transfer gearbox output shaft
Drum diameter	254mm (10 in)
Width	70mm (2.75 in)
Lining material	DON 269

Servo/master cylinder

Manufacturer	Automotive Products
Servo type	AP 50 + 50
Boost ratio	4.0:1
Master cylinder type	AS AS 15/16 Cast iron
Fluid displacement - Primary	5.13 cm³
- Secondary..	9.15 cm³
Nominal split	38/62
Unit weight	8.7 Kg
Maximum bleed pressure	2,76 bar (40 lbf/in²)

Servo/master cylinder - 1987 Model year improvement

Manufacturer	Lucas Girling
Servo type	LSC 115
Boost ratio	5.6:1
Master cylinder type	25.4mm AS/AS (steel tube construction)
Fluid displacement - Primary..	5.16 cm³
- Secondary	9.17 cm³
Nominal split	36/64
Unit weight	3.75 Kg
Maximum bleed pressure	2,76 bar (40 lbf/in²)

Continued

WHEELS AND TYRES

Type and size	Alloy 7.00J X 16
Tyre size	205R16 (tubeless). Note: Vehicles must be fitted with 'S' rated tyres

AIR CONDITIONING

System	A.R.A.
Compressor	Sanden SD510
• 1988 introduction	Sanden SD 709

WIPER MOTORS

Tailgate wiper motor

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

Windscreen wiper motor

Make/type	Lucas 28W 2-speed
Running current (Link disconnected)	1.5 amps at 39 to 45 rev/min (normal speed)
Rotary link speed	60 to 73 rev/min (high speed)

ELECTRICAL

System	12 volt, negative ground

Battery

Makeltype	Land Rover Parts and Equipment/Chloride maintenance free 14-plate-380/120/90

Alternator

Manufacturer	Lucas
Type	133/80
Polarity	Negative ground
Brush length	
New	20 mm (0.78 in)
Worn, minimum free protrusion from brush box	10 mm (0.39 in)
Brush spring pressure flush with brush box face	136 to 279 g (5 to 10 oz)
Rectifier pack output rectification	6 diodes (3 positive side and 3 ground side)
Field winding supply rectification	3 diodes
Stator windings	3 phase-delta connected
Field winding rotor poles	12
Maximum speed	16,000 rev/min
Winding resistance at 20°C	2.6 ohms
Control	Field voltage sensed regulation
Regulator-type	15 TR
voltage	13.6 to 14.4 volts
Nominal output	
Condition	Hot
Alternator speed	6000 rev/min
Control voltage	14 volt
Amp	80 amp

Coil

Make/type	Lucas 32C5

1988 Model Year

Make/type	Bosch 0221 122 392

Distributor

Make/type	Lucas 35 DLM8
Firing angles	0°-45°-90° (every 45°) ± 1°
Application	12V Negative ground
Pick-up air gap adjustment (Pick-up limb/reluctor tooth)	0.20 mm to 0.35 mm (0.008 in to 0.014 in)
Pick-up winding resistance	2k to 5k ohms

Fuses

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

Horns

Make/type	Klamix (Mixo) TR99

Ignition module

Make/type	Lucas 9EM amplifier module, distributor mounted

Spark plugs

Make/type	Champion RN1 2YC
Gap	0.85 to 0.95 mm (0.033 to 0.038 in)

Starter motor

Make/type	Lucas M78R pre-engaged
Minimum brush length	3.5 mm (0.138)
Minimum commutater diameter	28.8 mm (1.13 in)

Continued

REPLACEMENT BULBS		TYPE		
Headlamps	Exterior lights	12V	60/55W	(Halogen) sealed beam
Auxiliary driving lamps		12V	55W H3	(Halogen)
Sidelamps		12v	5W	bayonet
rail lamps		12v	5/21W	bayonet
Reverse lamps		12v	21W	bayonet
Stop lamps		12v	21w	bayonet
Direction indicator lamps		12v	21w	bayonet
Rear side marker lamps		12v	4w	bayonet
Number plate lamps		12v	5w	capless
Instrument panel lamps and warning lamps	Interior lights	12v	1.2W	bulb/holder unit
Ignition warning lamp (Instrument panel)		12v	2w	capless
Interior roof lamps		12v	10W	'Festoon'
Clock illumination		12v	2w	bayonet
Cigar lighter illumination		12v	1.2W	capless
Door edge/puddle lamps		12v	5W	capless
Auxiliary switch panel illumination (green)		12V	1.2W	capless
Heated rear screen warning lamp (amber)		12v	1.2W	capless
Hazard warning lamp		12V	1.2W	capless
Automatic graphics illumination		24V	5w	capless
Heater/air conditioning graphics illumination		12v	1.2W	capless
Differential lock warning lamp		12V	2w	bayonet
Column switch illumination		12V	1.2W	capless

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

VEHICLE DIMENSIONS

Overall length	4.45m (175 in)
Overall width	1.82m (71.6 in)
Overall height	1.80m (70.8 in)
Wheelbase	2.54m (100 in)
Track: front and rear	1.49m (58.5 in)
Ground clearance: under differential	190mm (7.5 in)
Turning circle	11.89m (39 ft)
Loading height	715mm (28.1 in)
Maximum cargo height	1.02m (40.2 in)
Rear opening height	0.87m (34.3 in)
Usable luggage capacity, rear seat folded	2.00m³ (70.6ft³)
Usable luggage capacity, rear seat in use	1.03m³ (36.2ft³)
Maximum roof rack load	75 kg (165 lb)

VEHICLE WEIGHTS AND PAYLOAD

When loading a vehicle to its maximum (Gross Vehicle Weight), consideration must be taken of the vehicle curb 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 Gross Vehicle Weight are exceeded.

	Front		Rear		Total	
	kg	(lb)	kg	(lb)	kg	(lb)
Curb weight	980	(2160)	972	(2143)	1952	(4303)
Cross Vehicle Weight					2720	(5997)
Maximum axle loads	1150	(2535)	1620	(3572)		

NOTE: CURB WEIGHT equals the minimum unladen vehicle weight plus full fuel tank.

GROSS VEHICLE WEIGHT equals the maximum all up weight, with the driver, passengers, payload equipment and towing attachment load (where applicable)

GROSS VEHICLE WEIGHT CONDITION - the maximum axle weights shown are individual axle loadings which allow for the fitting of optional equipment. The loading of both axles up to their respective maximums MUST BE AVOIDED, as the overall maximum vehicle weight would then be exceeded.

Maximum permissible tongue weight is 250kg (550 lb).

Maximum permissible towed weights

	On-road	Off-road
Trailers without brakes	750 kg 1650 lb	750 kg 1650 lb
Trailers with brakes require Class III hitch	3500 kg 7700 lb	1000 kg 2200 lb

NOTE: It is the Owner's responsibility to ensure that all regulations with regard to towing are complied with. This applies also when towing abroad. All relevant information should be obtained from the appropriate motoring organisation.

TYRE PRESSURES

Pressures: Check with tyres cold	Normal on and off-road use. All speeds and loads		Off-road 'emergency' salt use maximium speed of 40 kph (25 mph)	
	Front	Rear	Front	Rear
bars	1.91	2.6	1.1	1.6
lbf/in²	28	38	16	23
kgf/cm²	2.0	2.7	1.1	1.6

These pressures may be increased for high speed motoring, Any such increase in pressures may be up to an absolute maximum pressure of 2.8 bars (41 psi) i) 2.9 kgf/cm².
Normal operating pressures should be restored as soon as reasonable road conditions or hard ground is reached.
After any usage off the road, tyres and wheels should be inspected for damage particularly if high cruising speeds are subsequently to be used.

Towing: When the vehicle is used for towing, the reduced rear tyre pressures for extra ride comfort are not applicable.

WARNING: Tubeless wheels and tyres are fitted to this vehicle and under no circumstances must an inner tube be fitted.

TYRE PRESSURES - 1989 model year

Rear axle tyre pressures must be increased to 2.8 bars (41 p.s.i.) 2.9 Kgf/cm² for either of the following operating conditions:

1. Sustained high speed driving.
2. When rear axle loads exceed 3410 lbs (1550 kgs) e.g. with five passengers plus 220 lb (100 kgs) payload.

ENGINE 3.9 V8

Type	V8
Number of cylinders	Eight, two banks of four
Bore	94.00 mm (3.700 in)
Stroke	71.12 mm (2.800 in)
Capacity	3950 cc (241 in ^{3})
Valve operation	Overhead by push-rod
Maximum power-bhp	178 at 4750 rev/min (SAE) 1349)
Compression ratio	8.13:1

Pistons

Clearance in bore, measure at bottom of skirt at right angles to piston pin	0.018-0.041 mm (0.0007-0.0016 in)

Piston rings

Number of compression rings	2
Number of control rings	1
No 1 compression ring	Molybdenum barrel faced
No 2 compression ring	Tapered and marked 'T' or 'TOP'
Width of compression rings	1.478-1.49 mm (0.058-0.059 in)
Compression ring gap	0.40-0.65 mm (0.016-0.026 in)
Oil control ring type	Hepworth and Grandage
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)

ELECTRICAL

Electronic control unit

Make/Type	Lucas 14CU

Coil

Make/Type	Bosch 0-221-122-392

TRANSMISSION

Borg Warner transfer gearbox

Type ..... Two speed reduction on main gearbox output, front and rear drive permanently engaged via a centre differential controlled by a Viscous unit giving a 50/50 nominal front and rear torque split.

Transfer gearbox ratios

High 1.206:1
Low 3.244:1

Automatic gearbox ratios

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

Overall ratio (final drive):

	High transfer	Low transfer
4th	3.11:1	8.36:1
3rd	4.27:1	11.48:1
2nd	6.32:1	17.00:1
1st	10.59:1	28.50:1
Reverse	8.91:1	23.96:1

SHIFT SPEED SPECIFICATION - 1989 MODEL YEAR ONWARDS
Automatic ZF4HP22 Gearbox

* Denotes 1989 model year specification

OPERATION	SELECTOR POSITON	VEHICLE SPEED APPROX		ENGINE SPEED APPROX (RPM)
		KICKDOWN		
		MPH	KPH	
KD4 - 3	D	84 - 92	136 - 150	
* KD4 - 3	D	79 - 96	127 - 155	
KD3 - 2	3(D)	57 - 62	91 - 99	
KD2 - 1	2(D,3)	27 - 34	44 - 56	
KD3 - 4	D	N/A	N/A	
KD2 - 3	D(3)	60 - 63	96 - 104	4750 - 5200
KD1 - 2	D(3,2)	34 - 40	56 - 64	4600 - 5250
		FULL THROTTLE		
FT4 - 3	D	61 - 67	98 - 108	
FT3 - 2	3(D)	40 - 46	64 - 73	
FT3 - 4	D	74 - 80	119 - 129	3980 - 4330
FT2 - 3	D(3)	55 - 60	88 - 96	4350 - 4800
FT1 - 2	D(3,2)	29 - 34	48 - 56	3950 - 4650
		PART THROTTLE		
PT4 - 3	D	47 - 54	75 - 86	
PT3 - 2	D(3)	29 - 37	48 - 59	
PT2 - 1	D(3,2)	10 - 12	16 - 19	
		LIGHT THROTTLE		
LT3 - 4	D	26 - 30	43 - 49	1430 - 1650
LT2 - 3	D(3)	18 - 22	29 - 35	1420 - 1820
LT1 - 2	D(3,2)	9 - 10	14 - 16	1180 - 1220
		ZERO THROTTLE		
ZT4 - 3	D	19 - 25	31 - 41	
ZT3 - 2	D(3)	12 - 15	19 - 24	
ZT2 - 1	D(3,2)	6 - 7	10 - 11	
		TORQUE CONVERTER		
Lock up (IN)	D	51 - 54	81 - 86	1875 - 2000
Unlock (OUT)	D	49 - 52	78 - 83	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.

ENGINE TUNING DATA

Type	3.5 Litre V8
Firing order	1-8-4-3-6-5-7-2
Cylinder Numbers	
Left bank..	1-3-s-7
Right bank	2-4-6-8
No 1 Cylinder location	Pulley end of left bank
Timing marks	On crankshaft vibration damper
Spark plugs	
Make/type	Champion RN1 2YC
Gap	0.84-0.96mm (0.033-0.038 in)
Coil	
Make/type	Lucas 32C5 or Bosch O-221-122-392
Compression ratio	8.13:1
Fuel injection system	Lucas Hot-wire air flow sensor system electronically controlled

Valve Timing	**Inlet**	**Exhaust**
Opens	24" BTDC	62" BBDC
Closes	52" ABDC	14" ATDC
Duration	256"	256"
Valve peak	104" ATDC	114" BTDC

Idle speed	665 to 735 rev/min
Ignition Timing at	800 rev/min max
Ignition Timing	
Dynamic	6" B.T.D.C. ± 1"
Distributor	
Make/type	Lucas 35DLM8 electronic
Rotation	Clockwise
Air gap	0.20-0.35mm (0.008-0.014 in)
Despatch number	42620

Centrifugal Advance

Decelerating check-vacuum hose disconnected

Distributor rpm decelerating speeds		
2300	Distributor advance	8' to 11"
1600		8' 54' to 11°
600		1° 18' to 3" 18'
No centrifugal advance below	150 rev/min	

Fuel	
Regular unleaded	CLC or AKI octane rating 87 minimum RON octane rating 91 minimum

1988 Model Year

Fuel	
Premium unleaded	CLC or AKI octane rating 90 minimum RON octane rating 95 minimum

ENGINE TUNING DATA

Type	3.9 Litre V8
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
Timing marks	On crankshaft vibration damper
Spark plugs	
Make/type	Champion RN12YC
Gap	0.84-0.96mm (0.033-0.038 in)
Coil	
Make/type	Bosch o-221-122-392
Compression ratio	8.13:1
Fuel injection system	Lucas Hot-wire air flow sensor system electronically controlled

Valve Timing	**Inlet**	**Exhaust**
Opens	32" BTDC	70" BBDC
Closes	73" ABDC	35" ATDC
Duration	285"	285"
Valve peak	104" ATDC	114° BTDC

Idle speed	665 to 735 rev/min
Base idle speed	See setting procedure • 525 ± 25 rev/min.
Ignition Timing at	800 rev/min max
Ignition Timing	
Dynamic	6" B.T.D.C. ± 1"
Distributor	
Make/type	Lucas 35DLM8 electronic
Rotation	Clockwise
Air gap	0.20-0.35mm (0.008-0.014 in)
Despatch number	42648

Centrifugal Advance

Decelerating check-vacuum hose disconnected

Distributor rpm decelerating speeds		
2300	Distributor advance	8" to 11"
1600		8" 54' to 11°
600		l" 18' to 3' 18'

Fuel	
Premium unleaded (PUG)	CLC or AKI octane rating 90 minimum RON octane rating 95 minimum

TORQUE VALUES

Lubricants/sealants have been specified in certain applications for assembly purposes.

* These bolts must have threads coated with Loctite 572 prior to assembly. For this purpose it is necessary to use an approved dispenser to apply the sealant/lubricant to the first three threads of the bolts.

** These bolts must have threads coated in lubricant EXP16A (Marston Lubricants) prior to assembly.

*** These bolts must have threads coated in sealant Loctite 270 prior to assembly.

It is essential that all bolts are securely tightened and it is imperative that the correct torques values are adhered to.

	Nm	ft lb	in lb
COOLING SYSTEM			
Oil cooler pipes.	26-34	19-25	
Radiator filler plug (plastic)	5-6		45-54
EMISSION CONTROL			
Lamda sensor	20	15	
ENGINE			
Adaptor plate to crankshaft	77 - 90	57 - 66	-
Alternator mounting bracket to cylinder head	3s - 43	26 - 32	-
Alternator to mounting bracket	22 - 28	16 - 21	-
Alternator to adjusting link..	22 - 28	16 - 21	-
Chainwheel to camshaft	54 - 61	40 - 45	
Connecting rod bolt	47 - 54	35 - 40	
Cylinder head:			
Outer row	54 - 61	40 - 45 *	
Centre row	88 - 9s	65 - 70 ***	
Inner row	88 - 95	65 - 70 *	
Damper to crankshaft	257 - 285	190 - 210	
Distributor clamp nut	19 - 22	14 - 16	-
Drive plate to converter	35 - 42	25-30 ***	-
Engine mountings to engine and chassis	52	38	-
Engine mounting rubbers to brackets	17 -22	13 16	
Exhaust manifold to cylinder heads.	19 - 22	14 - 16	
Fan to viscous unit	26 - 32	19 - 24	
Flexible drive plate to crankshaft adaptor plate	35 - 46	26-34 ***	
Intake manifold to cylinder heads	34 - 41	25 - 30	
Lifting eye to cylinder heads	35 - 43	26 - 32	
Main bearing cap bolts	68 - 75	SO-55 **	-
Main bearing cap rear bolts	88 - 95	65-70 **	-
Manifold gasket clamp bolt	14 - 20	10 - 15	-
Oil pump cover to timing cover	11 - 14	8 - 10	-
Oil plug	24 - 30	18 - 22	-
Oil relief valve plug	40 - 47	30 - 35	
Oil sump drain plug	40 - 47	30 - 35	
Oil sump to cylinder block	7 - 11	5 - 8	
Oil sump rear to cylinder block	17 - 20	13 - 15	
Plenum chamber to ram housing	22 - 28	16 - 21	
Ram housing to intake manifold	20 - 27	15 - 20	
Rocker cover to cylinder head	7 - 10	5 - 7	
Rocker shaft bracket to cylinder head	34 - 40	25 - 30	
Spark plug..	19 . 22	14 - 16	
Starter motor attachment	41 - 47	30 - 35	
Thermostat housing to intake manifold	24 - 30	18 - 22	
Timing cover to cylinder block	24 . 30	18 - 22 *	
Viscous unit to water pump hub	40 - 50	30 - 37	
Water pump pulley to water pump hub	8 - 12	6-9 ***	
Water pump timing cover to cylinder block	24 . 30	18 - 22	
Water jacket to plenum chamber	11 - 14	8 - 10 *	
1989 Model Year			
Oil cooler adaptor to oil pump cover	40-50	30-37	

	Nm	ft lb	in lb
FUEL SYSTEM			
Air-Bypass valve (stepper motor)	17 • 22	13 • 16	
All flexible house securing clamps	1,1 -1,3		10 • 12
Fuel feed pipe • hose to fuel rail	22	16	
1991 Model Year			
Fuel filter	27-34	20-25	
EVAPORATIVE LOSS CONTROL SYSTEM			
All flexible hose securing clamps	1,7		15

Charts below give torque values for all screws and bolts used except for those that are specified otherwise.

SIZE	METRIC		SIZE	UNC		UNF	
	Nm	ft lb		Nm	ft lb	Nm	ft lb
M5	5-7	3.7-5.2	1/4	6.8-9.5	5-7	8.1-12.2	6-9
M6	7-10	5.2-7.4	5116	20.3-27.1	15-20	20.3-27.1	15-20
M8	22-28	16.2-20.7	3/8	35.3-43.4	26-32	35.3-43.4	26-32
M10	40-50	29.5-36.9	7/16	67.8-88.1	SO-65	67.8-88.1	50-65
M12	80-100	59.0-73.8	1/2	81.3-101.7	60-75	81.3-101.7	60-75
M14	90-120	66.4-88.5	5/8	122.0-149.1	90-110	122.0-149.1	90-110
M16	160-200	118.0-147.5					

TORQUE VALUES - TRANSFER GEARBOX LT230

WARNING: Components in bold type must not be reused.

COMPONENT	Nm	ft lb
Pinch bolt - operating arm to crank arm	7 to 10	5 to 7
End cover gear change housing	7 to 10	5 to 7
Speedometer cable retainer	7 to 10	5 to 7
Rear output/speedometer housing	See note	
Bottom cover to transler case	22 to 28	16 to 21*
Front output housing to transfer case	22 to 28	16 to 21*
Cross shaft housing to front output housing	22 to 28	16 to 21
Gear change housing	22 to 28	16 to 21
Pivot shaft to link arm	22 to 28	16 to 21
Connecting rod to adjustable clevis	22 to 28	16 to 21
Anti-rotation plate intermediate shaft	22 to 28	16 to 21'
Front output housing cover	22 to 28	16 to 21'
Pivot bracket to extension housing	22 to 28	16 to 21*
Finger housing to front output housing	22 to 28	16 to 21'
Bearing housing to transfer case	22 to 28	16 to 21
Brake drum to coupling flange	22 to 28	16 to 21
Bearing housing cover to transfer gearbox	40 to 50	29 to 37'
Rear output speedometer housing to transfer gearbox	40 to 50	29 to 37*
Selector finger to cross shaft high/low	22 to 28	16 to 21*
Selector fork, high/low to shaft	22 to 28	16 to 21*
Transmission brake to speedometer housing	65 to 80	48 to 59
Intermediate shaft stake nut	See text	
Gate plate to grommet plate	7 to 10	5 to 7
Plunger switch setting	6.75 max	4.82 max
Gearbox to transfer case	40 to 50	29 to 37
Gearbox to transfer case	See note	
Oil drain plug	25 to 35	19 to 26
Differential case (front to rear)	55 to 64	40 to 47
Output flanges	146 to 179	108 to 132
Differential case rear stake nut	66 to 80	50 to 59
Oil filler/level plug	25 to 35	19 to 26
Transfer breather	14 to 16	10 to 12
Transfer box front drive flange to drive shaft	41 to 52	30 to 38
Transfer box rear drive flange to drive shaft	41 to 52	30 to 38
Transfer gearbox mounting brackets to chassis	33 to 27	24 to 20
Mounting brackets to transfer gearbox	52	38
Mounting rubbers to mounting brackets	20 to 22	13 to 16

NOTE: Studs to be assembled into casings with sufficient torque to wind them fully home, but this torque must not exceed the maximum figure quoted for the associated nut on final assembly.

NOTE: 'These bolts must have threads coated with Loctite 290 prior to assembly.

ZF4HP22 AUTOMATIC GEARBOX	Nm	ft lb
Coupling shaft to mainshaft	36 to 48	26 to 34'
Filler tube to sump	60 to 75	45 to 55
Gear change lever to gearbox	22 to 28	16 to 21
Cooler pipe adaptor to gearbox	36 to 48	26 to 34
Securing screws - clutch F	10	7
Securing screw - parking pawl	10	7
Securing screws - pump	10	7
Intermediate plate plugs (M20)	50	37
Intermediate plate plugs (M14)	40	29
Bell housing mounting bolts	46	34
Governor mounting screws	10	7
Extension housing bolts	23	17
Control unit mounting bolts	8	6
Sump plug	10	7
Mounting screws for sump	8	6
Drive plate to converter	35 to 42	25 to 30'
Gearbox to engine	36 to 48	26 to 34
Strut (threaded end)	36 to 48	26 to 34
Bottom cover to converter housing	7 to 10	5 to 7
Cover - converter housing	7 to 10	5 to 7
Drive plates to crankshaft adaptor	35 to 46	25 to 33*
Adaptor to crankshaft	77 to 90	55 to 65

NOTE: *These bolts must have threads coated with Loctite 270 prior to assembly.

FRONT AXLE	Nm	ft lb
Hub driving shaft to hub	41 to 52	30 to 38
Brake disc to hub	65 to 80	48 to 59
Stub axle to swivel pin housing	60 to 70	44 to 52*
Brake caliper to swivel pin housing	75 to 88	55 to 65
Upper swivel pin to swivel pin housing	68 to 88	50 to 65*
Lower swivel pin to swivel pin housing	68 to 88	50 to 65*
Oil seal retainer to swivel pin housing	9 to 12	7 to 9
Swivel bearing housing to axle case	65 to 80	48 to 59'
Pinion housing to axle case	36 to 46	26 to 34
Crown wheel to differential housing	55 to 61	40 to 45
Differential bearing cap to pinion housing	80 to 100	59 to 74
Differential drive flange to drive shaft	41 to 52	30 to 38
Mudshield to bracket lower swivel pin	9 to 12	7 to 9
Bevel pinion nut	95 to 163	70 to 120
Draglink to hub arm	40	30
Panhard rod to axle bracket	88	65
Radius arm to axle	190	140
Radius arm to chassis side member..	190	140

FRONT AXLE ABS VEHICLES		
Hub driving member to hub	60 to 70	44 to 52*
Brake disc to hub	65 to 80	48 to 59'
Stub axle to swivel pin housing	60 to 70	44 to 52*
Brake caliper to swivel pin housing	75 lo 88	55 to 65
Upper swivel pin to swivel pin housing	60 to 70	44 to 52
Lower swivel pin to swivel pin housing	22 to 28	16 to 21*
Oil seal retainer to swivel pin housing	9 to 12	7 to 9
Swivel pin bearing housing to axle case	65 to 80	48 to 59'
Disc shield .to bracket lower	7 to 10	5 to 7

NOTE: *These bolts to be coated with Loctite 270 prior to assembly.

REAR AXLE	Nm	ft lb.	in lb
Axle shaft to hub	41to 52	30 to 38	
Brake disc to hub	65 to 80	48 to 59	
Stub axle rear to axle case	60 to 70	44 to 52	
Brake caliper to axle case	75to 88	55 to 65	
Pinion housing to axle case	36 to 46	26 to 34	
Crown wheel to differential case	55 to 61	40to 45	
Differential bearing cap to pinion housing	80 to 100	59 to 74	
Differential drive flange to drive shaft	41to 52	30 to 38	
Mudshield to axle case	9 to 12	7 to 9	
Bevel pinion nut	95 to 163	70to 120	
Lower link to axle	176	130	
Pivot bracket ball joint to axle	176	130	
REAR AXLE ABS VEHICLES			
Hub driving member to hub	60 to 70	44 to 52'	
Brake disc to hub	65 to 80	48 to 59'	
Stub axle rear to axle case	60 to 70	44 to 52	
Brake caliper to axle case	75 to 88	55 to 65	
Disc shield to axle case	9 to 12	7 to 91	
Sensor ring to brake disc	7 to 10	5 to 7	

NOTE: • These bolts to be coated with loctite 270 prior in assembly.

BORG WARNER TRANSFER GEARBOX

Brake drum back plate to rear output housing	65-80	48-59	
Brake drum to drive flange	22-28	16-21	
Centre differential (front to rear)	36-41	27-30	
Centre differential to sprocket	41-61	30-45	
Drive flanges to transfer gearbox	203-244	150-180	
Drive shafts to drive flanges	41-52	30-38	
Front cover to rear cover-main case	30-49	22-36	
Front output housing to main case	24-31	18-23	
Gearbox mounting brackets to chassis	52	29-37	
Mounting bracket to gearbox	52	68-83	
Neutral warning switch	14-19	10-14	
Oil drain plug	IV-30	14-22	
Oil filler/level plug	IV-30	14-22	
Oil pump fixings..	4-8.5		35-75
Rear output housing to main case	30-49	22-36	
Selector lever shaft-Torx screw	7-9	5-7	60-84
Selector fork operating arm-Torx screw	7-9	5-7	60-84

CHARTS BELOW GIVE TORQUE SETTINGS FOR ALL SCREWS AND BOLTS USED EXCEPT FOR THOSE THAT ARE SPECIFIED OTHERWISE.

SIZE	METRIC		SIZE	UNC		UNF	
	Nm	ft lb		Nm	ft lb	Nm	ft lb
M5	5-7	3.7-5.2	1/4	6.8-9.5	5-7	8.1-12.2	6-9
M6	7-10	5.2-7.4	5/16	20.3-27.1	15-20	20.3-27.1	IS-20
M8	22-28	16.2-20.7	3/8	35.3-43.4	26-32	35.3-43.4	26-32
M10	40-50	29.5-36.9	7/16	67.8-88.1	50-65 90-110	67.8-88.1	50-65
M12	80-100	59.0-73.8	1/2	81.3-101.7	60-75	81.3-101.7	60-75
M14	90-120	66.4-88.5	5/8	122.0-149.1		122.0-149.1	90-110
M16	160-200	118.0-147.5					

	Nm	ft lb	in lb
POWER STEERING BOX			
Clamp bolt nuts	14	10	
Ball joint nuts	40	30	
Universal joint pinch bolt	35	26	
Drop arm nut	176	130	
Steering wheel nut	38	28	
Sector shaft cover to steering box	22 • 27	16-20	
Tie bar to steering box	81	60	
Steering box to chassis	81	60	
Power steering pump mounting	35	26	
Pulley bolts, power steering pump	8-12	6-9	
Union nut, inlet adaptor, power steering pump	38 • 41	28 • 30	
Steering column bracket nuts	27	20	
FRONT SUSPENSION			
Anti-roil bar front			
• Strap nyloc nuts	30	22	
• Ball link self lock nut	68	50	
• Castellated nut	40	30	
Drag link to axle	40	30	-
Securing ring for mounting turret	14	10	-
Radius arm to chassis	176	130	-
Panhard rod mounting arm to chassis	88	65	-
Panhard rod to axle	88	65	-
Panhard rod to mounting bracket	88	65	-
Tie bar to Panhard rod	88	65	-
Radius arm to axle (front only)	197	145	-
REAR SUSPENSION			
Anti-roll bar rear			
• Strap nyloc nuts	30	22	
• Ball link self lock nut	68	50	
• Castellated nut	40	30	
Ball joint • levelling unit to rear axle	176	130	
Top link to levelling unit	115	85	
Top link to mounting bracket	176	130	
Upper joint to levelling unit	34	25	
Lower joint to levelling unit	34	25	
Bottom link to axle	176	130	-
Bottom link to chassis	176	130	-
Top link bracket to rear cross member	47	35	-
Levelling unit to cross member	47	35	-
Shock absorber to axle	37	28	-
BRAKES			
Brake pipe connections to:			
• Brake calipers	12	9	
• Jump hoses to brackets	11 • 13.5	8-10	
• Jump hose to three • way connection	12	9	
• Front caliper jump hoses	11 • 13.5	8-10	
• Rear caliper jump hoses	11 • 13.5	8-10	
• Jump hoses to calipers (all)	12	9	
PDWA switch (AP type master cylinder)	1.4 • 1.7	1 • 1.3	•
Master cylinder to servo (AP type master cylinder and servo)	13.6 • 17	10 • 12.5	
Brake caliper to swivel pin housing	75 • 88	55 • 65	
Parking brake linkage to transfer box	26 • 32	19 - 24	
Brake disc to hubs	65 - 80	48 - 59	
Bleed screws	9 - 11		80 -100

Continued

	Nm	ft lb	in lb
Support plate and tube to valve body (AP type servo)	2 - 3		16 - 20
Separator shell to valve body (AP type servo)	13.5 - 17		120 - 150
Clamp ring to servo (AP type servo)	1 - 1.6		10 - 15
Lucas Girling servo and master cylinder			
Servo assembly to pedal box	22 - 25	16 - 19	
Brake pipes to master cylinder	9 - 11	7 - 8	
Master cylinder to servo	21 - 29	15 - 22	
Bleed screws	9 - 11		80 - 100
Support plate and tube to valve body (servo)	2 - 3		16 - 20
Separator shell to valve body (servo)	13.5 - 17		120 - 150
Clamp ring to servo	1 - 1.6		10 - 15
Wabco ABS system			
Brake pipe connections to:			
- Hydraulic booster - M10	12 - 16	9 - 12	
- M12	15 - 20	11 - 15	
- Calipers	9 - 11	7 - 8	
- Fourway connector rear axle	9 - 11	7 - 8	
- Jump hose to brackets	11 - 13,5	8 - 10	
- Jump hose female connectors	11 - 13.5	8 - 10	
- Hydraulic pump and accumulator	12 - 16	9 - 12	
- PCRV - M10	11 - 13,5	8 - 10	
- PCRV - M12	12 - 14	9 - 10	
- Hydraulic booster to pedal box	22.5 - 27,5	17 - 20	
- Securing bolt, reservoir bracket	9 - 11	7 - 8	-
ROAD WHEELS			
Wheel nuts			
- Alloy wheels	122 - 129	90 - 95	-
BODY			
Front and rear seat belt fixings (ALL)	20.3	IS	
Front door hinges to door and body	25	19	
Rear passenger door hinges to door and body	25	19	-

Charts below give torque values for all screws and bolts used except for those that are specified otherwise.

SIZE	METRIC		SIZE	UNC		UNF	
	Nm	ft lb		Nm	ft lb	Nm	ft lb
M5	5-7	3.7-5.2	114	6.8-9.5	5-7	8.1-12.2	6-9
M6	7-10	5.2-7.4	5/16	20.3-27.1	15-20	20.3-27.1	15-20
M8	22-28	16.2-20.7	3/8	35.3-43.4	26-32	35.3-43.4	26-32
M10	40-50	29.5-36.9	7/16	67.8-88.1	50-65	67.8-88.1	50-65
M12	80-100	59.0-73.8	1/2	81.3-101.7	60-75	81.3-101.7	60-75
M14	90-120	66.4-88.5	5/8	122.0-149.1	90-110	122.0-149.1	90-110
M16	160-200	118.0-147.5					

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 COURSE IN 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 covers to protect fenders 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 hoist or pit 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 negative (grounded) terminal of vehicle battery.

WARNING: Do not disconnect any pipes in air conditioning refrigeration 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 nuts or fittings; 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. Before removing a component, clean it and its surrounding areas as thoroughly as possible.
2. Seal off any openings exposed by component removal, using greaseproof paper and masking tape.
3. Immediately seal fuel, oil or hydraulic lines when separated, using 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. When 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 the agent is suitable for all material and components.
7. Clean bench and provide marking materials, labels, containers and locking wire before dismantling a component.

Continued

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.

WARNING: Before using an air line ensure all necessary safety precautions are taken to prevent personal injury, i.e. safety glasses, protective clothing etc.

2. Blow out all tapped holes, crevices, oilways and fluid passages with an air line. If new O-rings are being fitted or existing O-rings are disturbed ensure they are fitted correctly to their respective positions.
3. Mark mating parts to ensure that they are replaced as dismantled. Whenever possible use marking ink, which avoids possibilities of distortion or initiation of cracks, liable if centre punch or scriber are used.
4. Wire together mating parts where necessary to prevent accidental interchange (e.g. roller bearing components).
5. Wire labels on to all old components which are to be replaced with new parts or if they require further inspection before being passed for reassembly; place these parts in separate containers from those containing parts for rebuild.
6. Do not discard a component until it has been compared with the new part, to ensure that its correct replacement has been obtained.

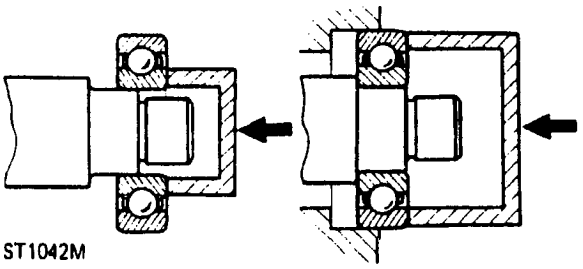
INSPECTION-GENERAL

1. Never inspect a component for wear or dimensional check unless it is absolutely clean; a slight coating 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' for checking bearing clearances. Directions for its use, and a scale giving bearing clearances in 0.0025mm (0.0001 in) steps are provided with it.

BALL AND ROLLER BEARINGS

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 discoloration 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. (Refer to ST1042M).



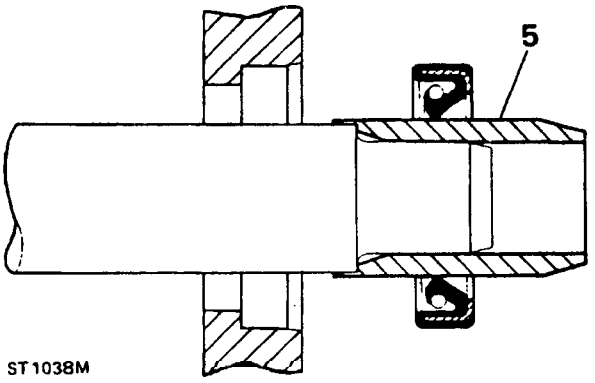
ST1042M

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.

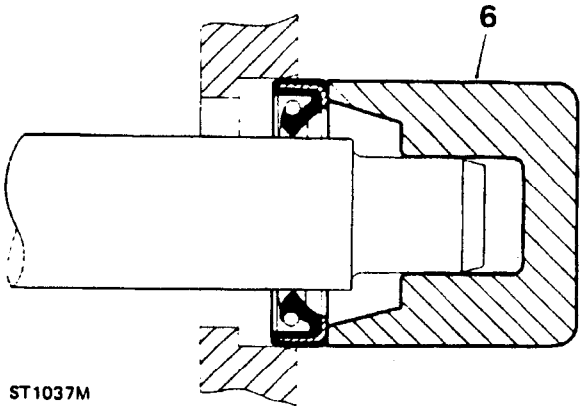
1. Always fit new oil seals when rebuilding an assembly.
2. Carefully examine seal before fitting to ensure that it is clean and undamaged.
3. Coat the sealing lips with clean grease; pack dust excluder seals with grease, and heavily grease duplex seals in cavity between sealing lips.
4. Ensure that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



ST1038M

Continued

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.



ST1037M

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

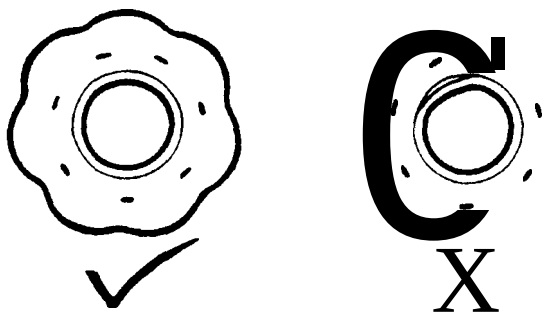
1. Always use correct gaskets where they are specified.
2. Use jointing compound only when recommended. Otherwise fit joints dry.
3. When jointing compound is used, apply in a thin uniform film to metal surfaces; take great care to prevent it from entering oilways, pipes or blind tapped holes.
4. Remove 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

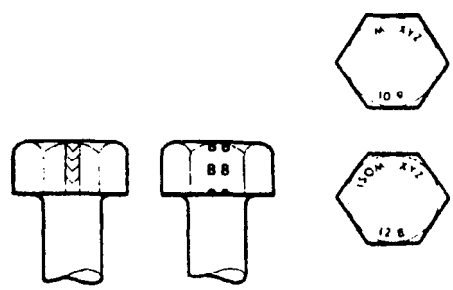
CAUTION: ALL FUEL HOSES ARE MADE UP OF TWO LAMINATIONS, AN ARMOURED RUBBER OUTER SLEEVE AND AN INNER VITON CORE. IF ANY OF THE FUEL SYSTEM HOSES HAVE BEEN DISCONNECTED, IT IS IMPERATIVE THAT THE INTERNAL BORE IS INSPECTED TO ENSURE THAT THE VITON LINING HAS NOT BECOME SEPARATED FROM THE AMOURED OUTER SLEEVE. A NEW HOSE MUST BE FITTED IF SEPARATION IS EVIDENT.



RR2302M

METRIC BOLT IDENTIFICATION

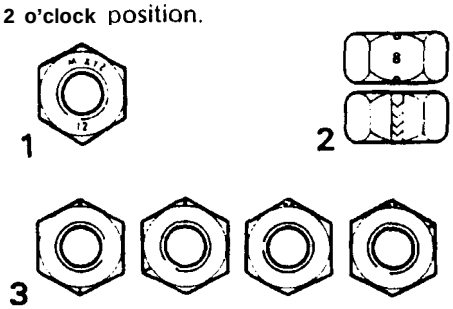
1. An ISO metric bolt or screw, made of steel and larger than 6 mm in diameter can be identified by either of the symbols ISO M or M embossed or indented on top of the head.
2. In addition to marks to identify the manufacture, the head is also marked with symbols to indicate the strength grade, e.g. 8.8, 12.9 or 14.9, where the first figure gives the minimum tensile strength of the bolt material in tens of kgf/mm².
3. Zinc plated ISO metric bolts and nuts are chromate passivated, a gold-bronze colour.



ST1035M

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.



ST1036M

Continued

KEYS AND KEYWAYS

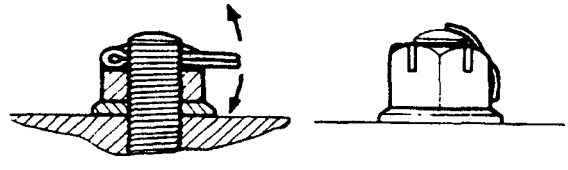
1. Remove burrs from edges of keyways with a fine file and clean thoroughly before attempting to refit key.
2. Clean and inspect key closely; keys are suitable for refitting only if indistinguishable from new, as any indentation may indicate the onset of wear.

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.

COTTER PINS

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



ST1030M

NUTS

1. When tightening a slotted or castellated nut never loosen it back to insert cotter 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-lccking 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

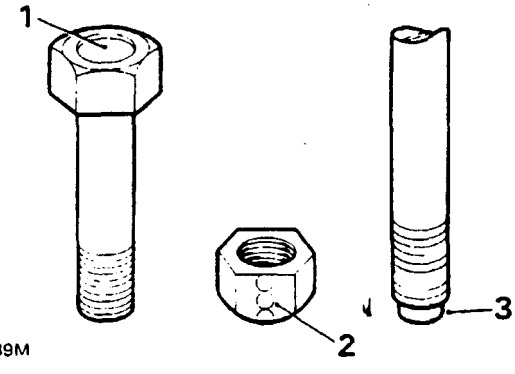
1. Fit new locking wire of the correct type for all assemblies incorporating it.
2. Arrange wire so that its tension tends to tighten the bolt heads, or nuts, to which it is fitted.

SCREW THREADS

1. Both UNF and Metric threads to ISO standards are used. See below 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 (see section 06 - Torque Values), 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.



ST1039M

RECOMMENDED LUBRICANTS AND FLUIDS

COMPONENT	SPECIFICATION		AMBIENT TEMPERATURE
			°C: -30 -20 -10 0 10 20 30 40 50 / °F: -22 -4 +14 +32 50 68 86 104 122
fngine	Use oils to API service levels SE or SF or SE/CC or SF/CC	Viscosity	
		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		
Transfer gearbox(LT230) Final drive units Swivel pin housings ROVER	APICL4 or GL5 MIL-L-2105 or MIL-L-2105B STC 3534	Viscosity	
		90 EP	
		80W EP	
Power steering	ATF Dexron IID		
Borg Warner transfer gearbox	ATF Dexron IID ATF M2C 33C ATF Texaco 4291A Universal		
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		

Engine cooling system	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.
Battery lugs, Earthing surfaces where paint has been removed	Petroleum jelly. NOTE: Do not use Silicone Grease
Air Conditioning System Refrigerant	METHYLCHLORIDE REFRIGERANTS MUST NOT BE USED Use only with refrigerant 12. This includes 'Freon 12' and 'Arcton 12'
Compressor Oil	Shell Clavus 68 BP Energol LPT68 Sunisco 4GS Texaco Capella F Wax/Free 68. Castrol Icematic 99
ABS Sensor bush-rear	Silicone grease: Staborags NBU • Wabco 830 502,0634 Wacker chemie 704 • Wabco 830 502.0164 Kluber CL301

ANTI-FREEZE

ENGINE TYPE	MIXTURE STRENGTH	PERCENTAGE CONCENTRATION	PROTECTION LOWER TEMPERATURE LIMIT
V8 (aluminium)	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% -53°F

Capacities (approx.)*	Litres	Imperial unit	US unit
Engine sump and filter from dry	5.68	10 pints	12.0 pints
Gearbox from dry-automatic ZF	9.1	16 pints	20 pints
LT230 Transfer gearbox from dry	2.5	4.4 pints	5.3 pints
Front axle from dry	1.7	3.0 pints	3.6 pints
Front axle swivel pin housing (each)	0.35	0.6 pints	0.7 pints
Rear axle from dry	1.7	3.0 pints	3.6 pints
Power steering box and reservoir	2.9	5.0 pints	6.0 pints
Cooling system	11.4	20 pint	24 pints
Fuel tank	76.4	16.8 gallons	20 gallons
Fuel tank (91 model year)	81.8	18 gallons	21.4 gallons
Borg Warner transfer gearbox from dry	1.7	3.0 pints	3.6 pints

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

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

LUBRICATION PRACTICE

The engine is filled with special oil to protect it during the running-in-period. The engine must be drained after 1600 km (1,000 miles) and refilled with an appropriate lubricant.

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 and should under no circumstances be consumed and should be kept away from open wounds. These substances among others include anti-freeze, brake fluid, fuel, windscreen washer additives, lubricants and various adhesives.

FUEL REQUIREMENTS

The engine is 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 two oxygen sensors. Leaded fuel will damage the sensors, and will deteriorate the emission control system.

Federal 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.

In the United States, Federal law also requires that fuel octane ratings be posted on the pumps. The Cost of Living Council Octane Rating (CLC) or Anti-knock Index (AKI) shown is an average of Research Octane Number (RON) and Motor Octane Number (MON). Fuel with a CLC or AKI rating of at least 87 should be used.

Continued

1988 Model Year Vehicles: Premium unleaded gasoline should be used with a CLC or AKI rating of 90 or 91 (95 or 96 RON), use of the higher of these ratings will enhance engine smoothness and overall performance.

1989 Model Year Vehicles: Premium unleaded gasoline must be used with a CLC or AKI rating of 90 minimum (95 RON). Fuel used other than that specified for the Model Year could seriously impair vehicle performance.

Using unleaded fuel with an octane rating lower than stated above can cause persistent, heavy 'spark knock' ('spark knock' is a metallic rapping noise). If severe, this can lead to engine damage. If a heavy spark knock is detected even when using fuel of the recommended octane rating, check the ignition timing system.

CAUTION: Do not use oxygenated fuels such as blends of methanol/ gasoline or ethanol/gasoline (e.g. 'Gasohol'). Take care not to spill fuel during refuelling.

RANGE ROVER REQUIRED MAINTENANCE • 49 STATES AND CALIFORNIA
FIRST 1,000 MILE SERVICE ONLY

Renew engine oil

Renew transfer box oil (LT230)

Check/top up transfer box oil (Borg Warner)

Renew front axle oil

Renew rear axle oil

Renew steering swivel oil

Check/top up power steering fluid

Check/top up automatic transmission fluid

Check for oil/fluid leaks from:- Suspension, dampers and self levelling unit, engine and transmission units, front and rear axles

Check brake pipes/unions for security, chafing, leaks and corrosion

Check power steering system for leaks, hydraulic pipes/unions for security, chafing and corrosion

Check fuel system for leaks

Check cooling and heater systems for leaks, hoses for security and condition

Check security and operation of park brake

Check foot brake operation

Check condition and security of steering unit, joints and gaiters

Check/adjust steering box

Check front wheel alignment

Check PCV system for leaks and hoses for security and condition (Positive crankcase ventilation).

Check operation of throttle mechanical linkage and transmission cable

Check ignition wiring and HT leads for security, and fraying

Check/adjust all drive belts

Check operation of all instruments fuel and temperature gauges, warning indicators, lamps, horns and audio unit

Check operation of front and rear screen and headlamp wash/wipers

Check operation of rear view mirrors and for security, cracks and crazing

Check condition and security of seats, seat belt mountings, belts and buckles

Check exhaust system for leaks, security and damage

Check tyres comply with Manufacturers specification

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

Check and adjust tyre pressures including spare

Check and tighten road wheel retaining nuts

RANGE ROVER REQUIRED EMISSION MAINTENANCE • CALIFORNIA

INTERVALS MILES X 1000	7.5	15	22.5	30	37.5	45
Renew engine oil	•	•	•	•	•	•
Renew engine oil filler	•	•	•	•	•	•
Renew spark plugs				•		
Check exhaust system for leaks, security and damage	•	•	•	•	•	•
Check condition of driving belts-adjust if required	•	•	•	•	•	•

CALIFORNIA MODELS • FOR MAINTENANCE AFTER 45,000 MILES WE RECOMMEND THAT THE 49 STATES REQUIRED MAINTENANCE BE CARRIED OUT IN ADDITION TO THE RECOMMENDED MAINTENANCE.

Continued

RANGE ROVER REQUIRED EMISSION MAINTENANCE • 49 STATES

MAINTENANCE INTERVALS MILES X 1000	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	SO	97.5	105
Renew PCV intake filter check and clean PCV system (Positive crankcase ventilation)							•							•
Renew engine oil	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Renew engine oil filter	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Renew fuel filter							•							•
Renew air cleaner element/check/clean dump valve				•				•				•		
Renew charcoal canister														•
Renew spark plugs				•				•				•		
Renew catalytic converters														•
Renew oxygen sensors											•			
• Check exhaust system for leaks, security and damage	•	•	•	•	•	•	•	•	•	•	•	•	•	•
• Check condition of driving belts-adjust if required	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Check/top up cooling system	•	•	•	•	•	•	•	•	•	•	•	•	•	•
• Check ignition wiring and HT leads for fraying, chafing and deterioration							•							•
Clean distributor cap and rotor arm, check for cracks and tracking. Lubricate rotor spindle with rotor arm removed							•							•
• Check/adjust ignition timing							•							•
• Check engine idle speed							•							•
• Check fuel evaporative loss control system for leaks							•							•
• Check fuel filler cap seal for leaks							•							•
• Check fuel pipes, filler hoses and connections for leaks and security							•							•
• Check engine emission control system hoses, tubes and vacuum lines for security and condition							•							•
• Check operation of electronic control unit/systems														•
• Check operation of auxiliary emission control devices							•							•
Reset emission maintenance reminder							•							•

NOTE: The owner of the vehicle need not perform the items marked • in order to maintain the emission warranty or manufacturer's recall liability.

NOTE: The above Required Emission Maintenance Schedule for 49 States reflects 1988 model year vehicles. Vehicles prior to 1988 model year require maintenance to be carried out on the following components at the stated service intervals:-

Renew charcoal canister and check operation of electronic control unit/systems) **at 52,500 and 105,000 miles**

Renew oxygen sensors) **at 52,500 and 105,000 miles instead of 82,500 miles**

RANGE ROVER RECOMMENDED MAINTENANCE

MAINTENANCE INTERVALS MILES X 1000	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105
Check/top up transfer box oil	·	·	·		·	·	·		·	·	·		·	·
Renew transfer box oil				·				·				·		
Check/top up front axle oil	·	·	·		·	·	·		·	·	·		·	·
Renew front axle oil				·				·				·		
Check/top up rear axle oil	·	·	·		·	·	·		·	·	·		·	·
Renew rear axle oil				·				·				·		
Check/top up steering swivel housing oil	·	·	·		·	·	·		·	·	·		·	·
Renew steering swivel housing oil				·				·				·		
Renew automatic transmission fluid				·				·				·		
Renew automatic transmission fluid filter				•				•				•		
Check/top up power steering fluid	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Check/top up automatic transmission fluid	•	•	•		•	•	•		•	•	•		•	•
Check/top up brake fluid	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Check for oil/fluid leaks from: Suspension, dampers and self levelling unit	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Check foot brake operation	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Check condition and security of steering unit, joints and gaiters		•		•		•		•		•		•		•
Check/adjust steering box		•		•		•		•		•		•		•
Check front wheel alignment		•		•		•		•		•		•		•
Check PCV system for leaks and hoses for security and condition (Positive crankcase ventilation)				•				•				•		
Check and clean PCV system and breathers (Positive crankcase ventilation)				•				•				•		
Check/clean air cleaner dump valve and element		•		•		•		•		•		•		•
Check operation of throttle mechanical linkage and transmission cable		•		•		•		•		•		•		•
Check battery condition		•		•		•		•		•		•		•
Clean and grease battery terminals	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Check ignition wiring and HT leads for security, fraying, chafing, deterioration		•		•		•		•		•		•		•
Clean distributor cap and rotor arm, check for cracks and tracking		•		•		•		•		•		•		•
Lubricate distributor rotor spindle with rotor arm removed				•				•				•		

Continued

RANGE ROVER RECOMMENDED MAINTENANCE
Continued

MAINTENANCE INTERVALS MILES X 1000	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105
Clean/adjust spark plugs		•				•				•				•
Check/adjust ignition timing			•				•			•				•
Check condition and security of seats, seat belt mountings, belts and buckles	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Check tightness of propeller shaft coupling bolts		•		•		•		•		•		•		•
Check exhaust system for leaks, security and damage	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Check operation of cruise control		•		•		•		•		•		•		•
Check tyres comply with Manufacturer's specification	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Check tyres for cuts, lumps, bulges, uneven wear, tread depth and road wheels for damage	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Check/adjust tyre pressures including spare	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Check/adjust headlamp and auxiliary	lamp		align	ment		•	•	•		•	•			•
Check operation of all instruments, gauges, warning indicators, lamps, horns and stereo unit	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Check operation of front and rear screen and headlamp wash/wipers		.		.		.		.		.		.		.
Clear sunroof drain tubes • if applicable	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Check operation of all doors, hood, and tailgate locks and window controls	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lubricate all locks (not steering lock) and door check mechanisms		.		.		.		.		.		.		.
Check operation of heater and air conditioning systems		.		.		.		.		.		.		.
Check brake pipes/unions for security, chafing, leaks and corrosion	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Check power steering system for leaks, hydraulic pipes/unions for security, chafing and corrosion	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Check fuel lines/hoses for leaks	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Check cooling and heater systems for leaks, hoses for security and condition		.		.		.		.		.		.		.
Check/top up cooling system	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Inspect brake pads for wear, calipers for leaks and discs for condition	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Check security and operation of parking brake	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Lubricate parking brake mechanical linkage	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lubricate drive shaft universal joints	.	.	.	.	.	.	.	.	.	●			•	•
Lubricate drive shaft sealed sliding joints			.			.			.			.		

It is recommended that:

At 15,000 mile intervals or every 18 months, whichever is the sooner, the hydraulic brake fluid should be completely renewed.

At 37,500 mile intervals or every 3 years, whichever is the sooner, all hydraulic brake fluid, seals and flexible hoses should be renewed, all working surfaces of the master cylinder, wheel cylinders and caliper cylinders should be examined and renewed where necessary.

At 37,500 mile intervals remove all suspension dampers, test for correct operation, refit or renew as necessary.

At 2 yearly intervals or at the onset of the second winter the cooling system should be drained, flushed and refilled with the required water and antifreeze solution.

The battery electrolyte level should be checked and topped up if required, once per year in high ambient temperatures, and once every three years in moderate ambient temperatures.

NOTE:

Climatic and operating conditions affect maintenance intervals to a large extent; in many cases, therefore, the determination of such intervals must be left to the good judgement of the owner or to advice from a Range Rover Authorized Dealer, but the recommendations will serve as a firm basis for maintenance work. Vehicles operating under arduous conditions will require more frequent servicing, therefore, at a minimum, the maintenance intervals should be reduced by half.

For low mileage vehicles it is recommended that the maintenance is carried out at periodic intervals, for example the 7,500 mile service should be carried out at 7.5 months, the 15,000 mile service at 15 months and so on.

The owner need not perform recommended maintenance in order to maintain the emission warranty or manufacturer recall liability.

JACKING

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

1. Use a solid level ground surface.
2. Apply the parking brake.
3. Select 'P' in main gearbox.
4. Select Low range in transfer gearbox with differential lock engaged.

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 bellhousing

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 Floor Jack

A hydraulic jack with a minimum 3,300 lbs load capacity must be used.

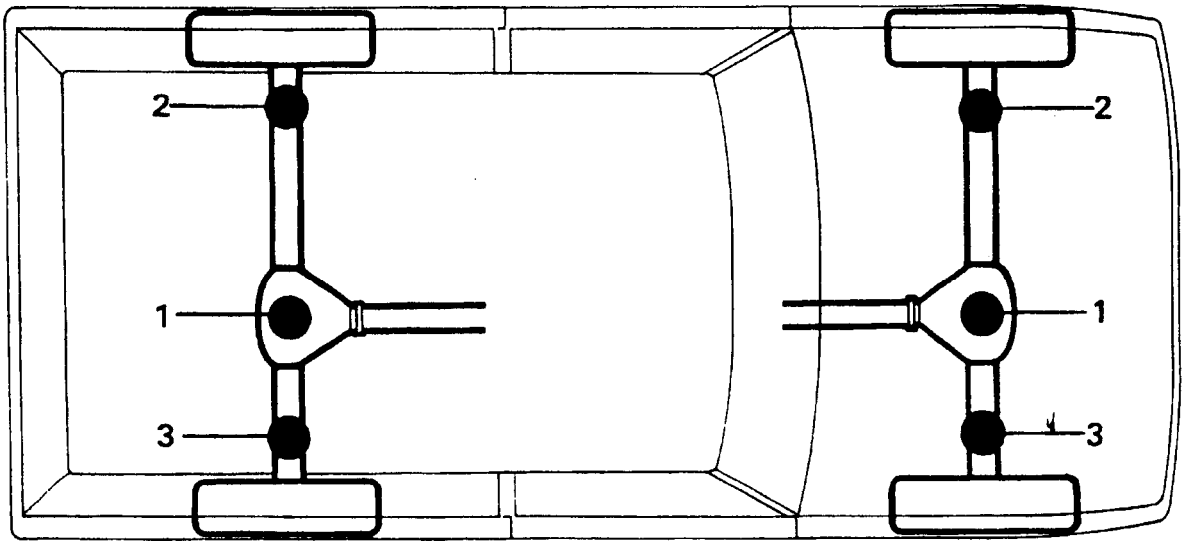
CAUTION: DO NOT COMMENCE WORK ON THE UNDERSIDE OF THE VEHICLE UNTIL SUITABLE AXLE STANDS HAVE BEEN POSITIONED UNDER THE AXLE(S):

Raise the front of the vehicle

1. Position the cup of the hydraulic arm under the 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.

Continued



RR1839E

2. Raise the front road wheels off the ground high enough to enable an axle stand to be installed under the left hand axle tube.
3. Position an axle stand under the right hand axle tube, carefully lower the floor jack until the axle sits securely on both axle stands, remove the floor jack.
4. Before commencing work on the underside of the vehicle recheck the security of the vehicle on the stands.
5. Reverse the procedure when removing the vehicle from the stands.

Raise the rear of the vehicle

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

HYDRAULIC VEHICLE HOIST (FOUR POST)

Use only a 'drive on' type hoist which supports the vehicle by its own road wheels. If a 'wheel-free' condition is required, use a 'drive on' hoist incorporating a 'wheel-free' system that supports under the axle casings. Alternatively, place the vehicle on a firm, flat floor and support on axle stands.

TWO POST VEHICLE HOISTS

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

DYNAMOMETER TESTING OF PERMANENT FOUR-WHEEL DRIVE VEHICLES (Vehicles fitted with LT230 transfer gearbox)

Four-wheel dynamometers

Provided that front and rear rollers of the equipment are rotating at the same peripheral speed and that normal workshop safety standards are observed, there is no speed restriction on the use of four-wheel (double axle) roller rigs for the testing of permanent four-wheel drive vehicles.

NOTE: The centre differential must not be locked during brake testing. The brake servo-assistance will not be maintained without the engine running.

Two-wheel dynamometers

Testing of a four-wheel drive vehicle on a single axle roller rig must be restricted to a maximum roller peripheral speed of 5kph (3 mph) with the centre differential unlocked and the transfer gearbox in neutral. For tests above this speed on a single axle rig, the centre differential must be locked and the drive shaft to the stationary axle must be removed.

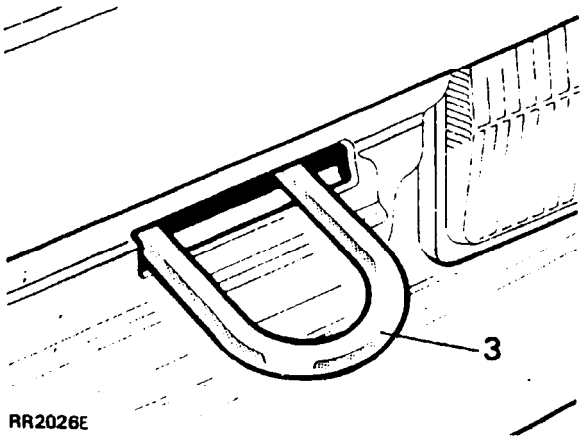
TOWING

CAUTION: Range Rovers have permanent four-wheel drive. Should the vehicle need to be towed, the following instructions must be adhered to:

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

1. Insert the ignition key and turn to the auxiliary switch position '1' to release the steering lock.
2. Select neutral in main gearbox and transfer gearbox with the differential unlocked.
3. Towing rope, chain or cable should be fitted to the towing eye that protrudes out of the front of the spoiler immediately below the front bumper.
4. Release the parking brake.

Continued



RR2026E

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.

Suspended tow by breakdown vehicle

CAUTION: To prevent damage to the vehicle the front or rear drive shaft MUST BE removed, dependent upon which axle is being trailed.

1. Mark the drive shaft drive flanges at the transfer gearbox and axle differential with identification lines to enable the drive shaft to be refitted in its original position,
2. Remove the fixings from the differential drive flange to drive shaft/transfer box drive flange to drive shaft, withdraw the shaft complete from beneath the vehicle.
3. If the front axle is to be trailed it is necessary to insert the ignition key and turn to the auxiliary switch position '1' to release the steering lock.

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.

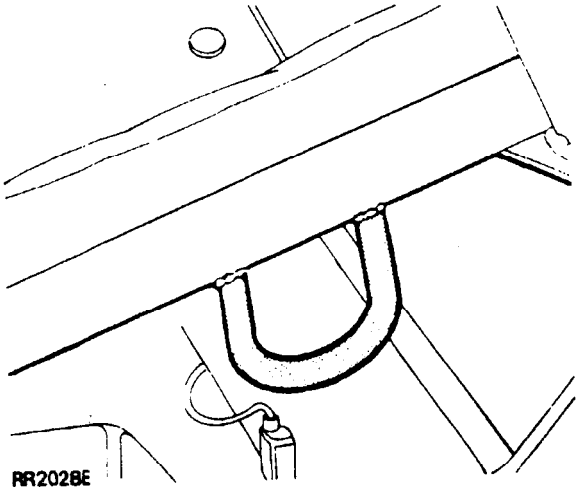
TRANSPORTING THE VEHICLE BY TRAILER

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

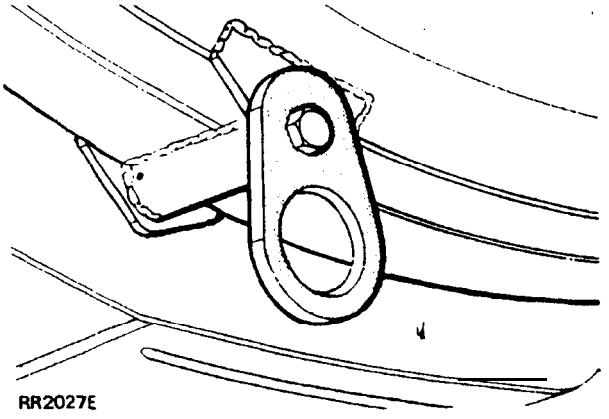
CAUTION: Underbody components must not be used as lashing points.

Install the vehicle on the trailer and apply the parking brake. To prevent damage occurring to the parking pawl of the automatic gearbox select neutral 'N' gear in main gearbox.

FRONT OF CHASSIS


RR2028E

REAR OF CHASSIS


RR2027E

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 the battery. When charging or using a battery in an enclosed space, always provide ventilation and shield your eyes.

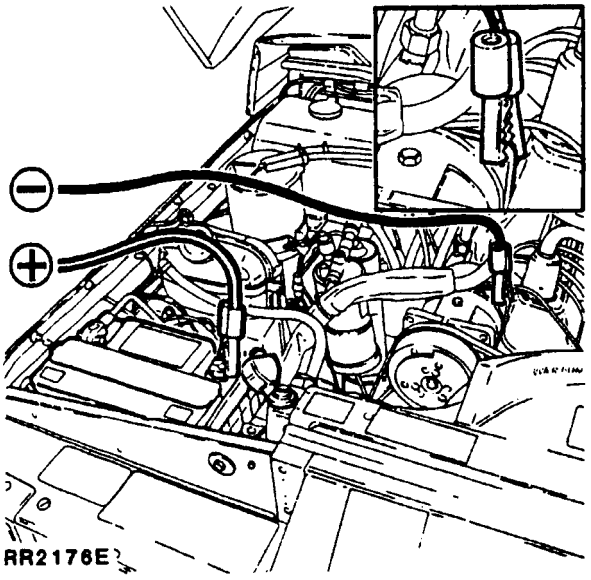
Keep out of reach of children. Batteries contain sulphuric 'acid. Avoid contact with skin, eyes, or clothing. Also, shield your eyes when working near the battery to protect against possible splashing of the acid solution. In case of acid contact with skin, eyes, or clothing, flush immediately with water 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 the vehicles so that the jumper leads will reach, ensuring also that the vehicles DO NOT TOUCH, alternatively a fully charged slave battery may be used positioned on the floor adjacent to the vehicle.**
2. **Ensuring that the ignition and all electrical accessories are switched off, that the parking brake is applied and neutral (N) or park (P) is selected in main gearbox, connect the jumper cables as follows;**

   A. **Connect one end of the first jumper cable to the positive (+) terminal of the booster battery.**
   B. **Connect the other end of the first jumper cable to the positive (+) terminal of the discharged battery.**
   C. **Connect one end of the second jumper cable to the negative (–) terminal of the booster battery.**



   D. **Connect the other end of the second jumper cable to the rear lug of the air conditioning compressor, keep the jumper lead well away from any engine moving parts ie pullies, drive belts and fan blade assembly. NOT TO THE NEGATIVE (–) TERMINAL OF THE DISCHARGED BATTERY.**

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

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

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

5. **Remove the positive (+) jumper cable from the positive terminals of both the booster battery and discharged battery.**
6. **Likewise remove the negative (–) jumper cable.**

LUBRICATION

This first part of the maintenance section covers renewal of lubricating oils for the major units of the vehicle and other components that require lubrication, as detailed in the 'Maintenance Schedules'. Refer to Section 09 for Capacities and Recommended Lubricants.

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

Draining of used oil should take place after a run when the oil is warm. Always clean the drain and filler-level plugs before removing. In the interests of safety disconnect the vehicle battery to prevent the engine being started and the vehicle moved inadvertently, while oil changing is taking place.

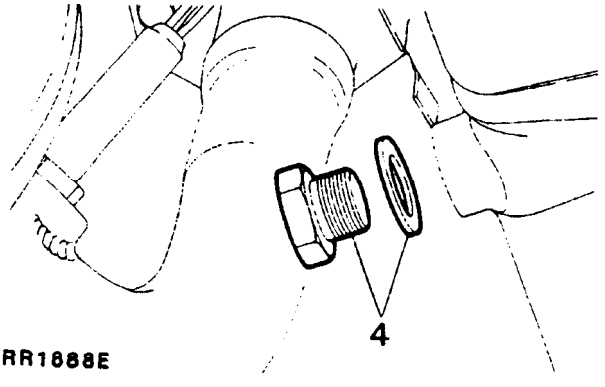
Allow as much time as possible for the oil to drain completely except where blown sand or dirt can enter the drain holes. In these conditions clean and refit the drain plugs immediately the main bulk of oil has drained.

Where possible, always refill with oil of the make and specification recommended in the lubrication charts and from sealed containers.

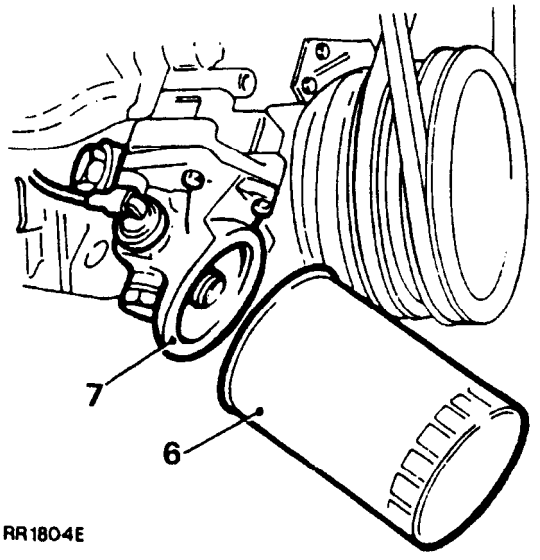
RENEW ENGINE OIL AND FILTER

DRAIN THE OIL

1. Before changing the oil ensure that the vehicle is level on either hoist or ground.
2. Run the engine to warm the oil; switch off the ignition and disconnect the battery for safety.
3. Place an oil tray under the drain plug.
4. Remove the drain plug in the bottom of the sump at the left-hand side. Allow oil to drain away completely. Fit new copper washer and replace the plug, tighten to the correct torque value.



RR1688E



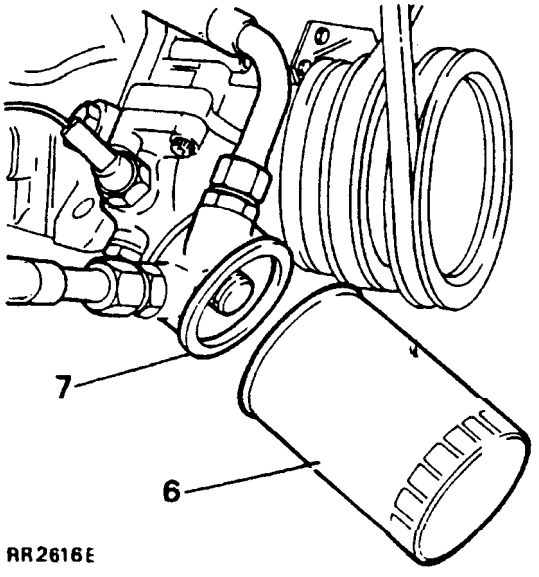
RR1804E

Fit new oil filter

5. Remove the engine under-tray if the vehicle is a 7989 model year (See Section 76, page 60). Place an oil tray under the engine.

NOTE: 1989 model year vehicles have an engine oil cooler. The oil cooler adaptor is secured to the oil pump cover, see RR2616E.

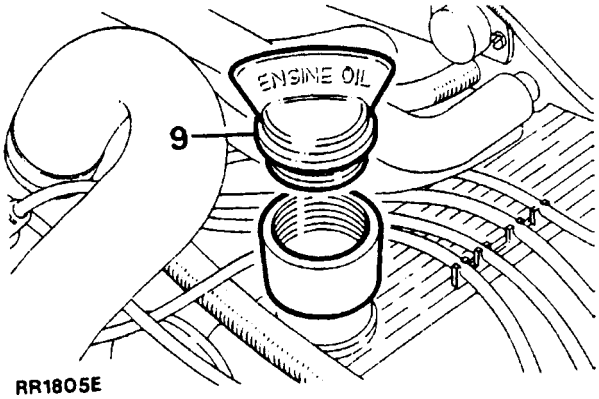
6. Unscrew the filter counter -clockwise, using a strap wrench as necessary.
7. Clean the oil pump mating face (1989 Models: oil cooler adaptor mating face) and coat the rubber washer of the new filter with clean engine oil, screw the filter on clockwise until the rubber sealing ring touches the machined face, tighten a further half turn by hand only. DO NOT over-tighten.



RR2616E

Refill sump with oil

8. Check that the drain plug is tight.
9. Clean the outside of the oil filler cap, remove it from the extension filler neck and clean the inside.



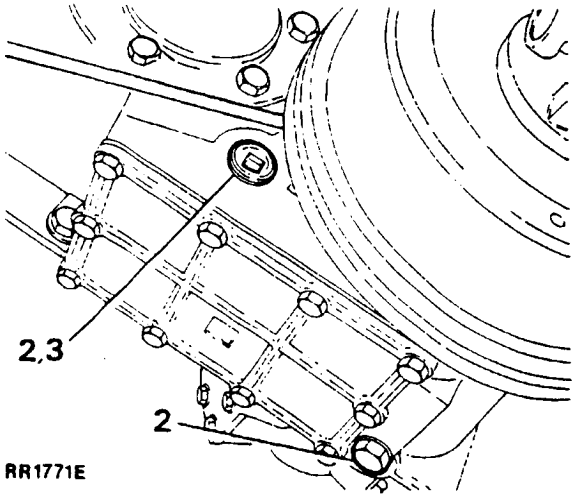
RR1805E

10. Pour in the correct quantity of new oil of the correct grade from a sealed container to the high mark on the dipstick and firmly replace the filler cap. DO NOT FILL ABOVE 'HIGH' MARK. Reconnect the battery.
11. Run the engine and check for leaks from the filter. Stop the engine, allow the oil to run back into the sump for a few minutes, then check the oil level again and top up if necessary.

RENEW MAIN AND TRANSFER GEARBOX OILS

DRAIN AND RENEW LT230 TRANSFER GEARBOX OIL

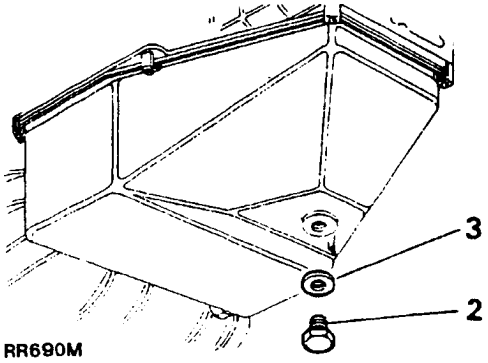
1. Before changing the oil ensure that the vehicle is level on either hoist or ground. Place a container under the gearbox to catch the old oil. Disconnect the battery.
2. Remove the drain and level/filler plugs and allow the oil to drain. Fit the drain plug using a new washer, if necessary, and tighten to the correct torque value. Do not over-tighten.
3. Inject the approximate quantity of the recommended oil until it reaches the level/filler plug hole. Fit the level/filler plug and tighten to the correct torque value, do not over-tighten, wipe away any surplus oil.



RR1771E

RENEW ZF AUTOMATIC GEARBOX FLUID

1. Before changing the oil ensure that the vehicle is level on either hoist or ground. Obtain a suitable container to drain the gearbox fluid into. Disconnect the battery.
2. Remove the gearbox dipstick located at the rear of the right hand rocker cover, to aid oil drainage. Release the plug from the bottom of the sump and allow time for the fluid to drain.
3. Refit the plug using a new sealing washer and tighten to the correct torque value. Do not over-tighten.



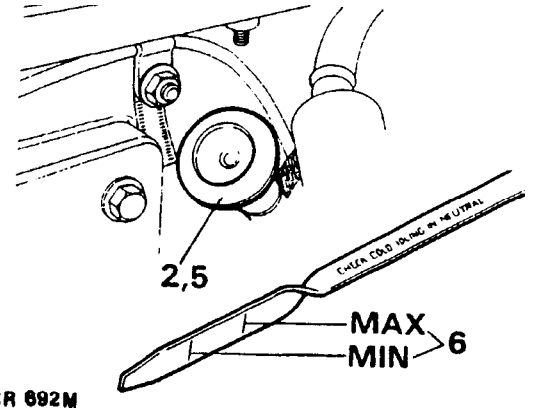
RR690M

Continued

Refill ZF Automatic Gearbox and Check Fluid level.

NOTE: The fluid level in the ZF automatic gearbox is checked when the fluid is cold and the engine idling in neutral gear.

4. Ensure the vehicle is on level ground.
5. Refill or top-up with the correct quantity and grade of fluid (see Lubricants and Fluids Section 09) at the combined filler/dipstick tube.
6. Reconnect the battery, start and run the engine, ensure that the fluid level registers between the minimum and maximum level markings on the dipstick.



RR 692M

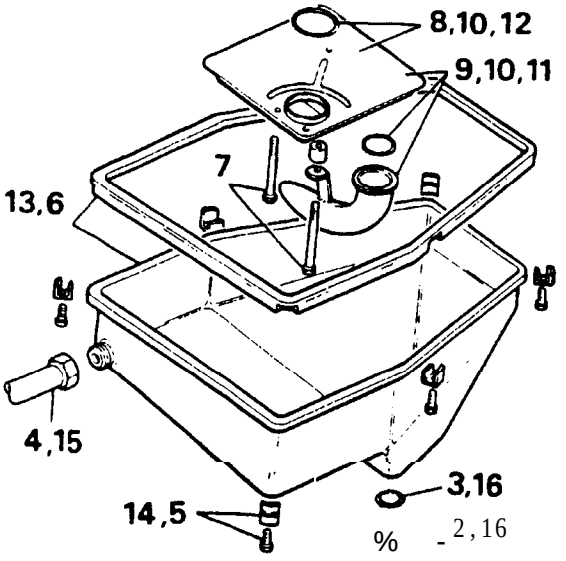
OIL SCREEN REPLACEMENT ZF AUTOMATIC GEARBOX

Removing

1. Place the vehicle on a hoist or over a pit, open the hood and disconnect the battery leads.
2. From underneath the vehicle drain the gearbox using a suitable container.
3. Discard the oil pan plug seal ring.
4. Remove the filler/level tube from the oil pan.
5. Remove the six retaining plates and bolts.
6. Remove the oil pan and discard the gasket.
7. Using TX27 Torx bit remove the three screws which hold the oil screen.
8. Remove the oil screen and discard the 'O' rings.
9. Separate the oil screen from the suction tube and discard the 'O' ring and oil screen.

Refitting

10. Fit two new '0' rings to the oil screen using a light grease for ease of assembly.
11. Fit the suction tube to the oil screen.

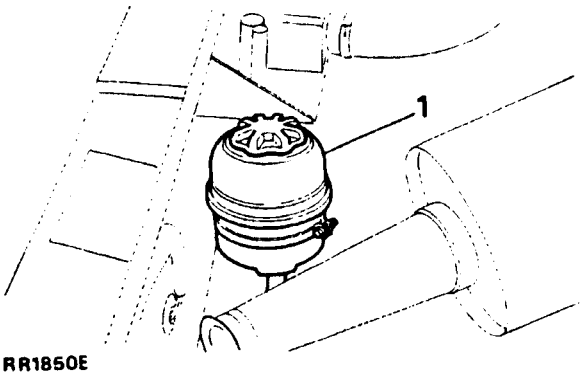


RR691M

12. Fit the oil screen to the control unit and secure with three bolts using TX27 Torx bit tighten to the specified torque value.
13. Refit the oil pan using a new gasket.
14. Secure using the six retaining plates and bolts (two straight and four corner plates), tighten to the specified torque value.
15. Reconnect the oil level/filler tube.
16. Fit oil pan plug using a new seal.
17. Connect the battery leads.
18. Fill the gearbox with the correct oil through the filler/level tube located within the engine bay (see Lubricants and Fluids Section 09).
19. Ensuring the vehicle is on level ground with the park-brake applied, check oil level while engine is running at idle with neutral selected.

POWER STEERING-FLUID RESERVOIR

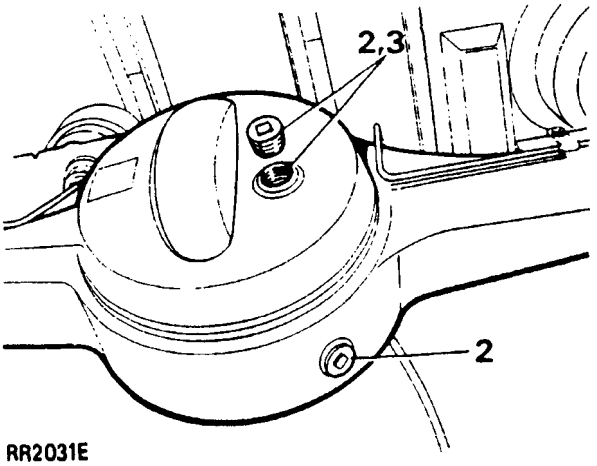
1. Clean and remove the reservoir cap, wipe the dipstick which is incorporated into the cap and refit the cap. Remove the cap again and check the fluid level is up to the high mark on the dipstick.
2. If necessary top-up with a recommended fluid (see Lubricants and fluids Section 09).
3. Refit the cap.



RR1850E

RENEW FRONT AND REAR AXLE OIL

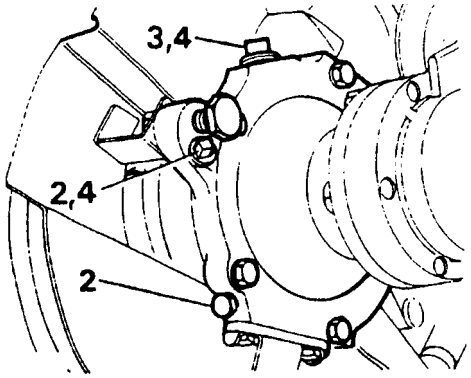
1. The vehicle must be level. Place a container under the axle to be drained.
2. Using a wrench with a 13mm (0.5 in) square drive remove the drain and filler/level plugs from the axle and allow the oil to drain completely. Clean and refit the drain plug.
3. Inject new oil of a recommended make and grade until it reaches the level hole. Clean and refit the filler/level plug and wipe away any surplus oil.



RR2031E

RENEW SWIVEL PIN HOUSING OIL

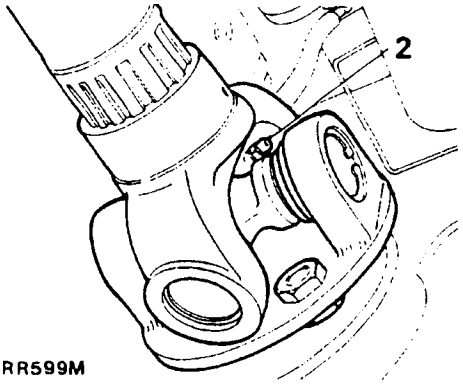
1. **The vehicle must be level. Place a container under each swivel housing to catch the old oil.**
2. **Remove the drain and level plugs and allow the oil to drain completely, clean and refit the drain plug.**
3. **Remove the filler plug and inject the recommended make and grade of oil until oil reaches the level hole.**
4. **Clean and refit the level and filler plugs, wipe away any surplus oil.**



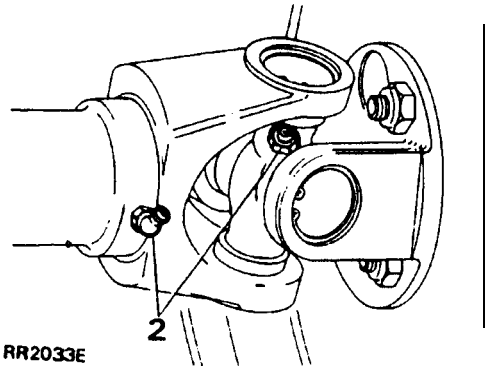
RR2032E

LUBRICATE FRONT AND REAR DRIVE SHAFT UNIVERSAL AND SLIDING JOINTS

1. **Clean all the grease nipples on the front** and **rear drive shafts.**
2. **Charge a low pressure hand-grease gun with grease of a recommended make and grade and apply to the grease nipples at the front** and **rear drive shaft universal and sliding joints.**



RR599M



RR2033E

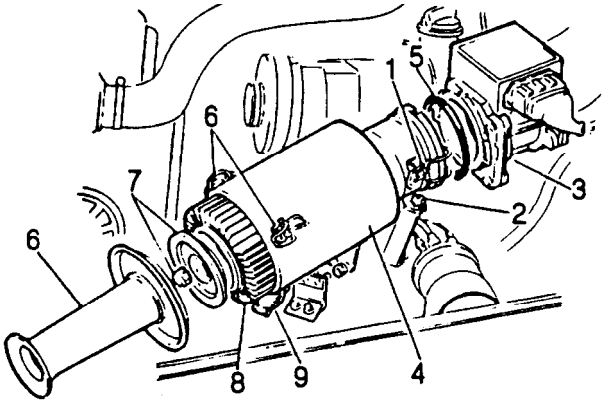
FILTERS

AIR CLEANER ELEMENT

Remove and refit

Removing

1. Release the two clips securing the air cleaner to the airflow sensor.
2. Release the two nuts and bolts securing the air cleaner to the left hand valance mounting bracket.
3. Detach the airflow sensor from the air cleaner, and lay carefully to one side.
4. Detach the air cleaner from the centre mounting bracket and withdraw from the engine compartment.
5. Remove the large 'O' ring from the outlet tube of the air cleaner, inspect for condition, fit a new 'O' ring if in poor condition.
6. Unclip the three catches securing the inlet tube to the air cleaner canister and remove the inlet tube.
7. Remove the nut and end plate securing the air cleaner element in position.
8. Withdraw the air cleaner element and discard.
9. Inspect the dump valve for condition and check that it is clear of obstructions.



RR1854E

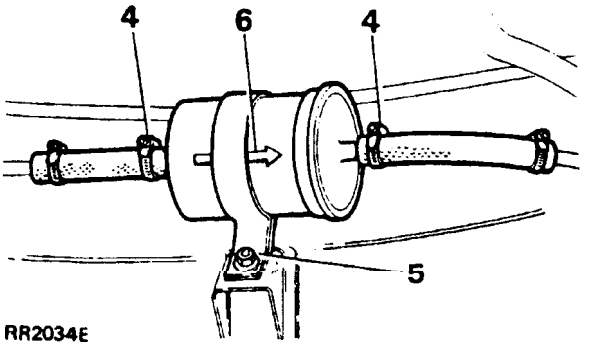
Refitting

10. Fit new element and secure in position.
11. Refit the inlet tube to the air cleaner canister.
12. Refit the air cleaner to the mounting bracket and tighten the two nuts and bolts.
13. Clip the air flow sensor to the air cleaner.

FUEL LINE FILTER

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

1. Depressurize the fuel system. (Refer to Fuel Injection System - Section 19)
2. The fuel line filter is located on the right hand chassis side member forward of the fuel tank filler neck. Access to the filter is gained through the right hand rear wheel arch.
3. Thoroughly clean the immediate area around the hose connections to prevent ingress of foreign matter into the fuel system.
4. Loosen the two hose clamps nearest the filter to enable the hoses to be removed from the filter canister. Plug the end of the hoses to prevent ingress of dirt.
5. Release the securing bolt and bracket and remove the filter from the chassis side member.



RR2034E

Fit new filter

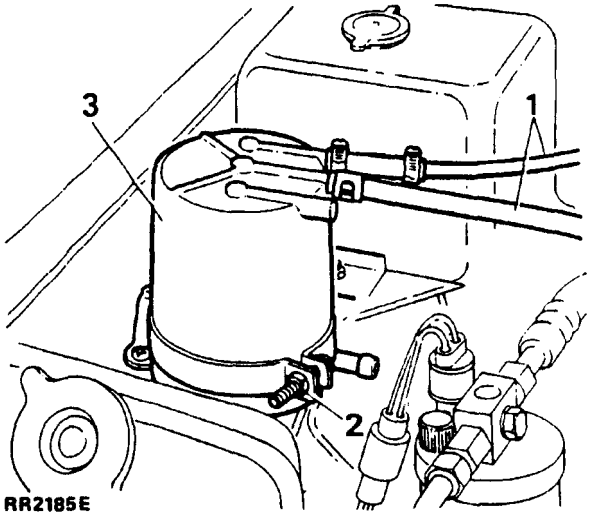
6. Fit a new filter observing the direction of flow arrows stamped on the canister.
7. Start the engine and inspect for fuel leaks around the hose connections.

CHARCOAL CANISTER

1. Disconnect from the canister:

   (i) Canister line to fuel tank.
   (ii) Canister purge line.

2. Loosen the clamp pinch bolt
3. Remove the canister.



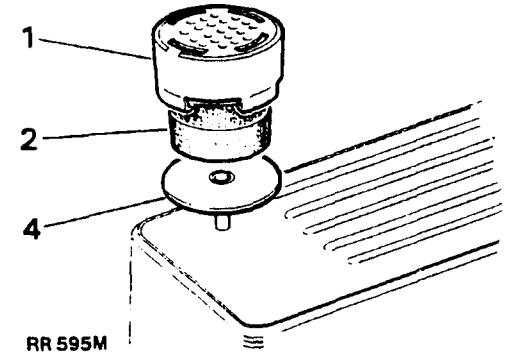
Fit new canister

4. Secure the canister in the clamp.
5. Reverse instructions 1 and 2 above.

WARNING: **The use of compressed air to clean a charcoal canister or to clear a blockage in the evaporative system is highly dangerous.** An explosive gas present in a fully saturated canister may be ignited by the heat generated when compressed air passes through the canister.

POSITIVE CRANKCASE VENTILATION INTAKE FILTER

1. Pry the filter holder upwards to release it from the rocker cover.
2. Discard the sponge filter.



fit new filter

3. insert a new filter into the plastic body.
4. Push the filter holder onto the rocker cover until it clips firmly into place.

CLEAN PLENUM CHAMBER VENTILATION PASSAGEWAY

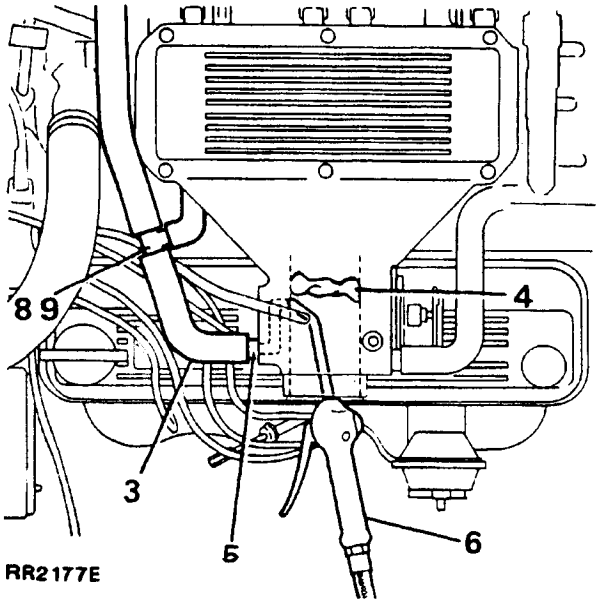
The cleaning of the plenum chamber ventilation passageway can be carried out without removing the plenum chamber from the ram housing.

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

WARNING: Safety glasses must be worn when performing this operation. Ensure that debris is not blown into the atmosphere which could be harmful to other personnel within the vicinity.

1. Disconnect the battery negative terminal.
2. Release the hose clamp and remove the hose from the plenum chamber inlet neck.
3. Remove the crankcase ventilation hose from the side of the plenum chamber.
4. insert a piece of lint free cloth down the throttle valve bore to prevent debris passing beyond the throttle valve.
5. Place a cloth over the tube protruding from the side of the plenum from which the ventilation hose was removed to prevent debris from the passageway being blown into the atmosphere.

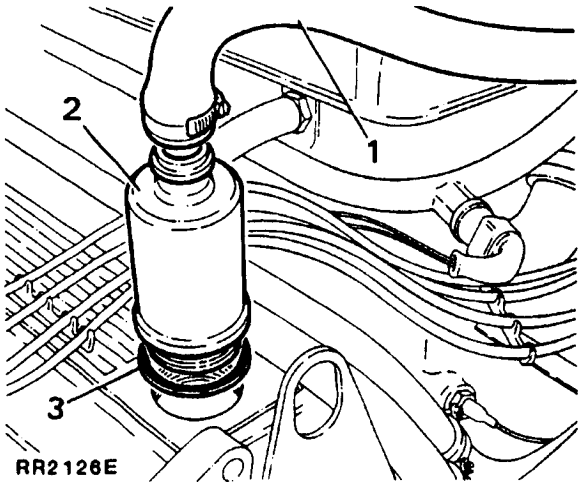
NOTE: 1988 Model Year Vehicles - The ventilation passageway has been modified and is now a straight through drilling into the throttle disc bore. Check and clean as stated in the recommended maintenance schedule.



6. Use a compressed air line with a slim bent nozzle to enable the passageway to be cleaned out from within the throttle valve bore.
7. Any remaining consolidated matter can be dislodged using a piece of soft bent wire or a pipe cleaner. Finally the passageway must again be blown out to remove any remaining debris.
8. Remove the small 'T' piece between the crankcase ventilation hoses and check that it is free from blockages, clean as necessary.
9. Refit the 'T' piece and hoses, tighten the hose clamps securely.

CLEAN POSITIVE CRANKCASE VENTILATION BREATHER FILTER

1. Release the hose clamp and pull the hose off the canister.
2. Unscrew the canister and remove if from the rocker cover.
3. Remove the large 'O' ring from the threaded end of the canister.
4. Visually inspect the condition of the wire screen within the canister, if in poor condition fit a new assembly, if in an acceptable condition clean the screen as follows:



5. Immerse the canister in a small amount of solvent and allow time for the solvent to dissolve and loosen any engine fume debris within the canister.
6. Remove canister from solvent bath and allow to dry out in still air.

WARNING: Do not use a compressed air line to remove any remaining solvent or particles of debris within the canister as this could cause fire or personal injury.

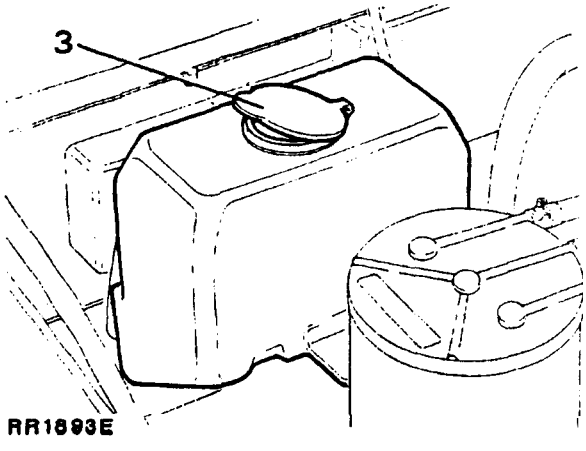
Refitting the breather/filter

7. Fit a new rubber '0' ring.
8. Screw the canister into the rocker cover, hand tight only.
9. Refit hose and tighten hose clamp securely.

GENERAL MAINTENANCE AND ADJUSTMENTS

CHECK/ADJUST OPERATION OF ALL WASHERS AND TOP-UP RESERVOIR

1. Check the operation of windscreen, tailgate and headlamp washers.
2. Adjust jets if necessary by inserting a needle or very fine sharp implement into the jet orifice and maneuvring to alter the jet direction.
3. Unclip the reservoir cap.
4. Top up reservoir to within 25mm (1 in) below the bottom of the filler neck.
   Use a screen washer solvent/anti-freeze in the reservoir, this will assist in removing mud, flies and road film and protect against freezing.



CHECK

Check ignition wiring and high tension leads for fraying, chafing and deterioration.

CHECK

Check/adjust ignition timing. (See Engine Tuning Data/Procedure) using suitable electronic equipment.

FUEL SYSTEM

Check all hose connections for leaks and hose deterioration, fit new hoses or tighten hose clamps as necessary.

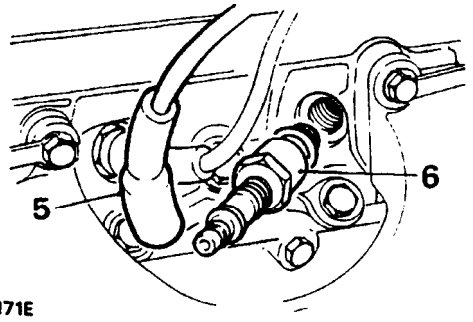
IGNITION

Spark plugs

1. Take great care when fitting spark plugs not to cross-thread the plug, otherwise costly damage to the cylinder head will result.
2. Check or replace the spark plugs as applicable.
3. it is important that only the correct type of spark plugs are used for replacements.
4. Incorrect grades of plugs may lead to piston overheating and engine failure.

To remove spark plugs proceed as follows:

5. Disconnect the battery negative lead and remove the leads from the spark plugs.
6. Remove the plugs and washers.

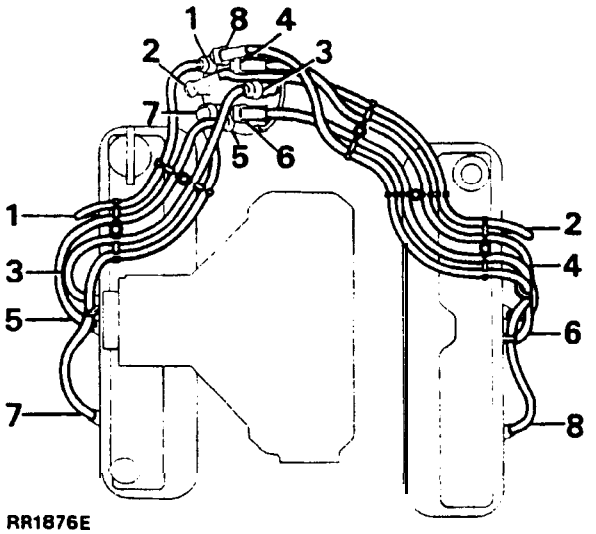


RR2171E

7. Set the electrode gap to the recommended clearance.
8. When pushing the leads onto the plugs, ensure that the shrouds are firmly seated on the plugs.

Fitting H.T. leads

9. Ensure that replacement H.T. leads are refitted in their spacing cleats in accordance with the correct layout illustrated.
   Failure to observe this instruction may result in cross-firing between two closely fitted leads which are consecutive in the firing order.



RR1876E

DISTRIBUTOR-LUCAS 35DLM8

The electronic ignition employs a Lucas 35DLM8 distributor.

The internal operating parts of the distributor are pre-set at the factory and should not normally require resetting.

Adjustments should only be made, if the unit is known to be faulty or damaged. Maintenance of the distributor consists of the following items.

1. Clean outer surfaces of distributor cap to remove dirt, grease etc.
2. Unclip the cap, check cap for signs of cracking.
3. Wipe inside cap with a lint free cloth.
4. Check rotor arm, cap and flash shield for signs of tracking.
5. Apply a spot of clean engine oil into the rotor spindle after the rotor arm has been removed.

DO NOT DISTURB the clear plastic insulating cover (flash shield) which protects the magnetic pick-up module.

CHECK AIR CONDITIONING SYSTEM

WARNING: Adjustments or rectification operations should be carried out by a Range Rover dealer or a trained automotive air conditioning specialist. Under no circumstances should non-qualified personnel attempt repair or servicing of air conditioning equipment.

The following items should be checked:

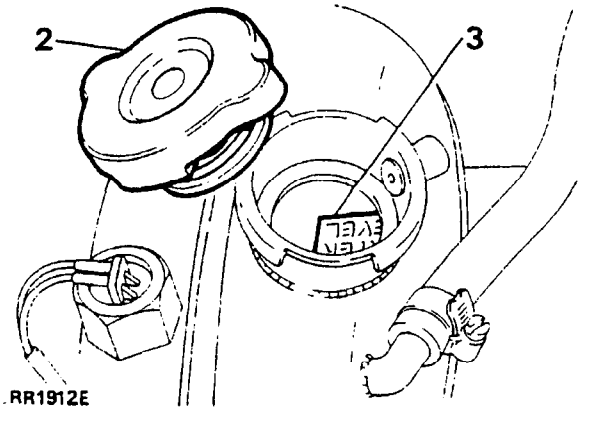
1. **Condenser:** Clean the exterior of the condenser matrix using a water hose or compressed air-line.
2. Check pipe connections for signs of fluid leakage.
3. **Evaporator:** Examine the pipe connections for signs of fluid leakage.
4. **Receiver/drier sight glass:** After running the engine for five minutes with the air conditioning system in operation, examine the sight glass, there should be no sign of bubbles.
5. Check pipe connections for signs of fluid leakage.
6. **Compressor:** Check the pipe connections for fluid leakage and the hoses for swellings.

CHECK/TOP UP COOLING SYSTEM

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

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

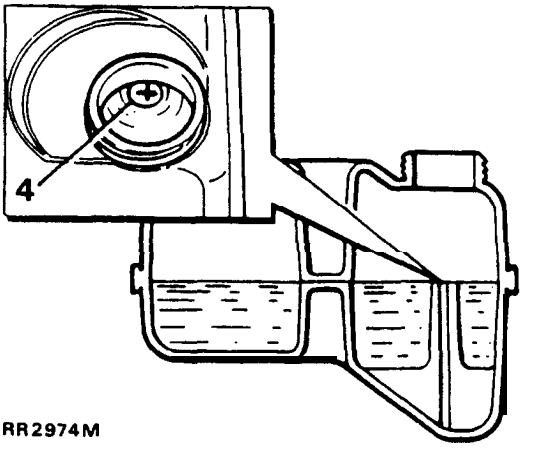
2. When removing the filler cap, first turn it counter-clockwise a quarter of a turn and allow all pressure to escape, before turning further in the same direction to lift it off.



3. With a cold engine, the correct coolant level should be up to the 'Water Level' plate situated inside the expansion tank below the filler neck.

NOTE: The water level plate on later models has been deleted from the expansion tank, therefore the coolant should be filled to the top of the sensor float which is approximately 1.00 inch (25 mm) below the filler neck.

4. From 1990 model year, the expansion tank coolant should be level with the top of the indicator post, visible inside the tank through the filler hole.

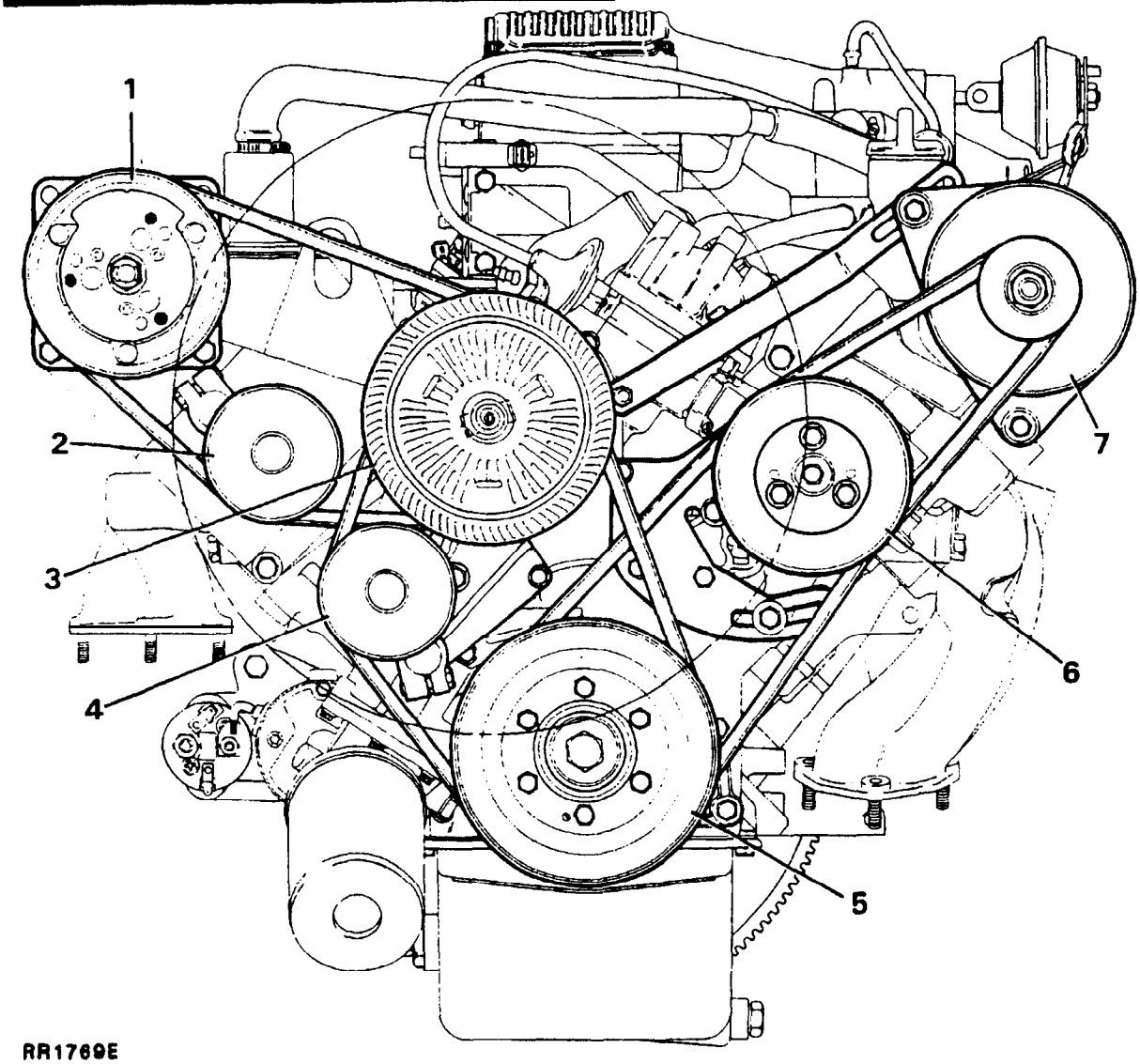


5. If necessary, top up the cooling system with premixed coolant. Use soft water whenever possible, if local water supply is hard, rainwater should be used.
6. When replacing the filler cap it is important that it is tightened down fully. Failure to tighten the filler cap properly may result in water loss, with possible damage to the engine through over-heating.

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

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

The cooling system should be drained and flushed at 2 year intervals or at the onset of the second winter. Refer to Coolant Requirements in Section 26 - Cooling System.



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1. Air conditioning compressor.
2. Idler pulley
3. Viscous fan-water pump unit.
4. Idler pulley
5. Crankshaft.
6. Power steering pump.
7. Alternator

WARNING: DISCONNECT THE BATTERY NEGATIVE TERMINAL BEFORE ADJUSTING DRIVE BELTS TO AVOID THE POSSIBILITY OF THE VEHICLE BEING STARTED.

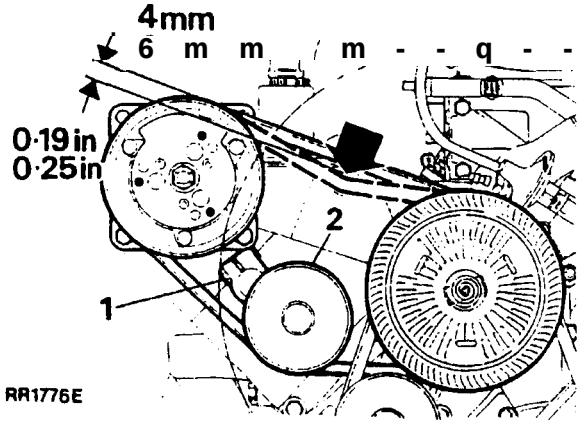
DRIVE BELTS-adjust or fit new belts

COMPRESSOR DRIVE BELT

The belt must be tight with not more than 4 to 6mm (0.19 to 0.25 in) total deflection when checked by hand midway between the pulleys on the longest run.

Where a belt has stretched beyond the limits, a noisy whine or knock will often be evident during operating, if necessary adjust as follows:

1. Loosen the idler pulley securing bolt.
2. Adjust the position of the idler pulley until the correct tension is obtained.
3. Tighten the securing bolt and recheck the belt tension.



Check driving belts, adjust or fit new belts as necessary.

1. **Examine the following belts for wear and condition and fit new belts if necessary:**

   (A) Crankshaft-idler pulley-Water Pump
   (B) Crankshaft-Steering Pump
   (C) Steering Pump-Alternator

ILLUSTRATION A

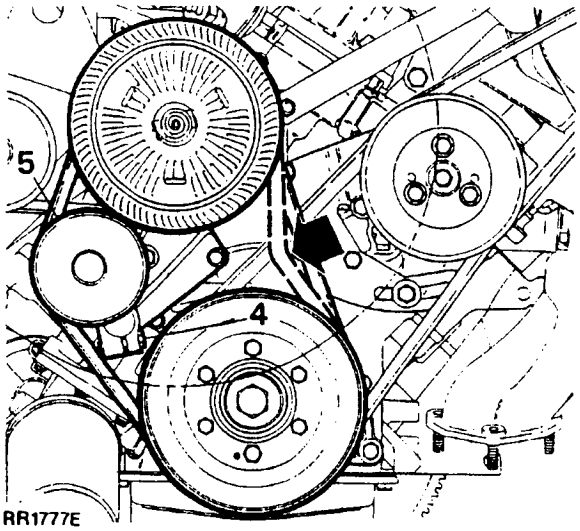


ILLUSTRATION B

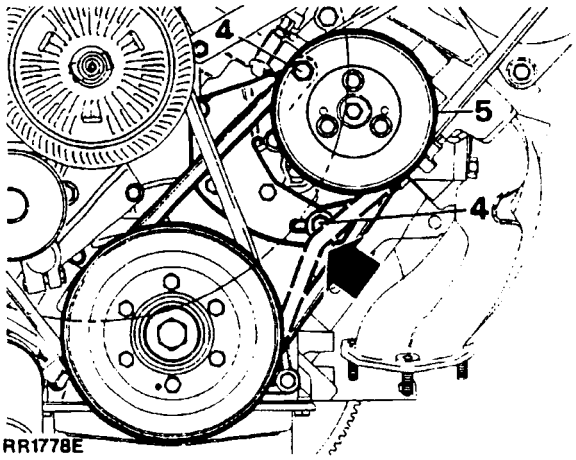
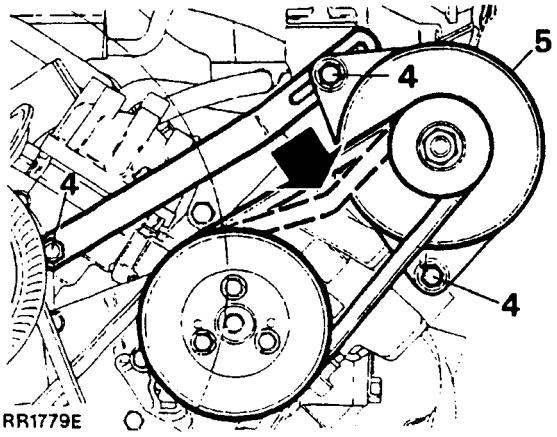


ILLUSTRATION C



Continued

2. Each belt should be sufficiently tight to drive the appropriate auxiliary without undue load on the bearings.
3. Loosen the bolts securing the unit to its mounting bracket.
4. Loosen the appropriate pivot bolt or idler pulley and the fixing at the adjustment link where applicable.
5. Pivot the unit inwards or outwards as necessary and adjust until the correct belt tension is obtained.

CAUTION: When tensioning the power steering pump drive belt DO NOT use the pump casing as a point of leverage. Failure to comply may result in damage to the pump casing and distortion to the seal face causing fluid leakage.

6. Belt deflection should be approximately 4 to 6mm (0.19 to 0.25 in) at the points denoted by the bold arrows.
7. Tighten all unit adjusting bolts. Check adjustment again.

CAUTION: When fitting a new drive belt, tension the belt as described above. Reconnect the battery and start and run the engine for 3 to 5 minutes at fast idle, after which time the belt must be re-checked, re-tension the belt if necessary.

STEERING AND SUSPENSION

Check condition and security of steering unit, joints, relays and boots.

Check steering box for oil/fluid leaks.

Check shock absorbers for fluid leaks.

Check power steering system for leaks, hydraulic pipes and unions for chafing and corrosion.

CHECK STEERING BALL JOINTS

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

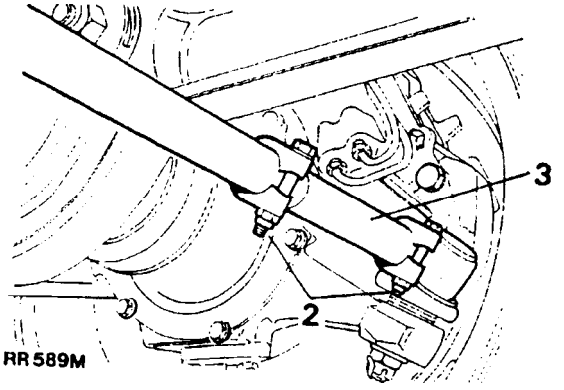
1. Check for wear in the joints by moving the ball joint up and down vigorously. If free movement is apparent fit a new joint assembly.

Check/adjust front wheel alignment

Use recognised wheel alignment equipment to perform this check and adjustment. See 'General Specification' section for the correct alignment.

To adjust

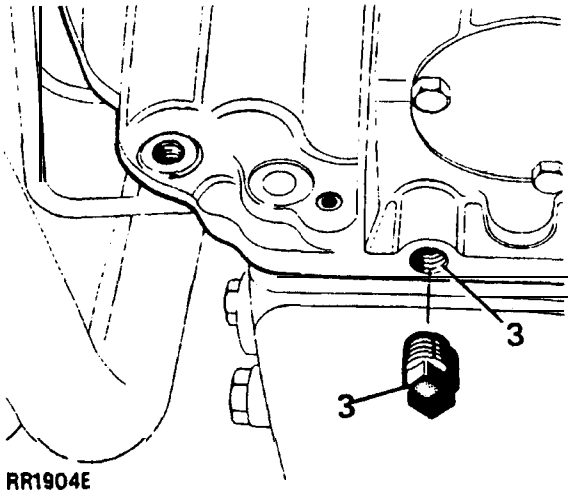
1. Set the vehicle on level ground, with the road wheels in the straight ahead position, and push it forward a short distance.
2. Loosen the clamps securing the adjusting shaft to the track rod.
3. Turn the adjusting shaft to decrease or increase the effective length of the track rod, as necessary, until the toe-out is correct.



4. Retighten the clamps.
5. Push the vehicle rear-wards, turning the steering wheel from side JO side to settle the ball joints. Then with the road wheels in the straight ahead position, push the vehicle forward a short distance.
6. Recheck the toe-out. If necessary carry out further adjustment.

CONVERTER HOUSING WADING PLUG

1. The converter housing can be completely sealed to exclude mud and water under severe wading conditions, by means of a plug fitted in the bottom of the housing.
2. The plug is stored in the vehicle tool kit and should only be fitted when the vehicle is expected to do wading or very muddy work.
3. When the plug is in use it must be removed periodically to check for possible oil seepage due to defective seals.

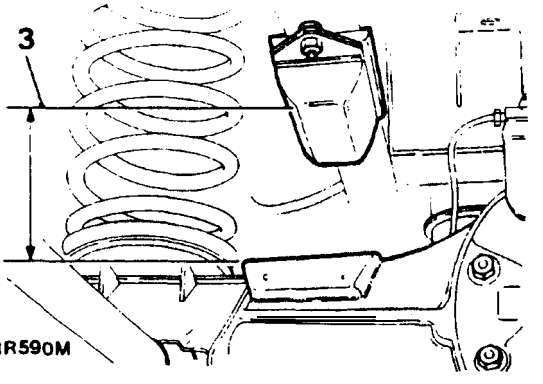


RR1904E

CHECK ROAD SPRINGS

Verify that the vehicle is being operated within the specified maximum loading capabilities. Drive the vehicle onto level ground and remove all loads. Should the vehicle lean to one side it indicates a fault with the springs or shock absorbers, not the self-levelling unit. If the levellina unit is believed to be at fault, the procedure "below should be followed:

1. Check the levelling unit for excessive oil leakage and if present the unit must be changed. Slight oil seepage is permissible.
2. Remove any excessive mud deposits and loose items from the rear seat and load area.
3. Measure the clearance between the rear axle bump pad and the bump stop rubber at the front outer corner of the bump pad on both sides of the vehicle. The average clearance should be in excess of 67mm (2.8 in). If it is less than this figure remove the rear springs and check their free length against the 'Road Spring Data'. Replace any spring whose free length is more than 20mm (0.78 in) shorter than the figure given. If after replacing a spring the average bump clearance is still less than 67 mm (2.8 in), replace the levelling unit.



RR590M

4. With the rear seat upright, load 450 kg (992 lb) into the rear of the vehicle, distributing the load evenly over the floor area. Check the bump stop clearance, with the driving seat occupied.
5. Drive the vehicle for approximately 5 km (3 miles) over undulating roads or graded tracks. Bring the vehicle to rest by light brake application so as not to disturb the vehicle loading. With the driving seat occupied, check the bump stop clearance again.
6. If the change in clearance is less than 20 mm (0.787 in) the levelling unit must be replaced.

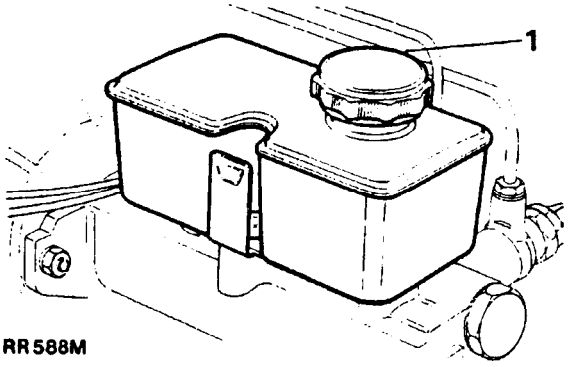
BRAKES

Check visually, hydraulic pipes and unions for chafing, leaks and corrosion.

Check/top up brake fluid reservoir • AP Type master cylinder and servo.

The tandem brake reservoir is integral with the servo unit and master cylinder.

1. Remove cap to check fluid level; top up if necessary until the fluid reaches the bottom of the filler neck. (See recommended Lubricants, Fluids and Capacities, Section 09). DO NOT OVERFILL.
2. If significant topping up is required check master cylinder, brake disc cylinders and brake pipes and connections for leakage; any leakage must be rectified immediately.



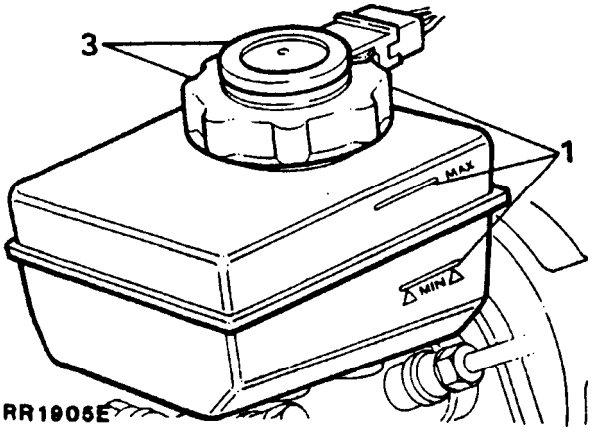
RR588M

CAUTION : When topping up the reservoir care should be taken to ensure that the brake fluid does not come into contact with any of the vehicle paintwork. Should this occur, wash the affected area IMMEDIATELY with a large quantity of water.

CHECK AND TOP UP BRAKE FLUID RESERVOIR -Lucas Girling master cylinder and servo

1. Visually check the brake fluid level against the 'MIN' and 'MAX' level markings on the side of the reservoir.
2. If necessary top up with the recommended grade of fluid (refer to section 09 lubricants, fluids and capacities). DO NOT OVERFILL.
3. Release the cap with combined fluid level switch by rotating counter- clockwise. Withdraw the cap and switch, top up the reservoir.

CAUTION : When topping up the reservoir care should be taken to ensure that the brake fluid does not come into contact with any of the vehicle paintwork. Should this occur, wash the affected area IMMEDIATELY with a large quantity of water.



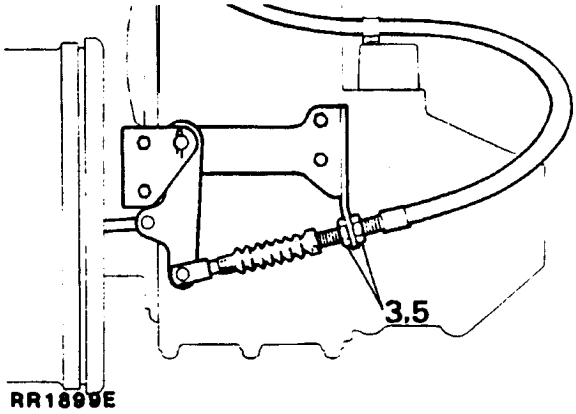
RR1905E

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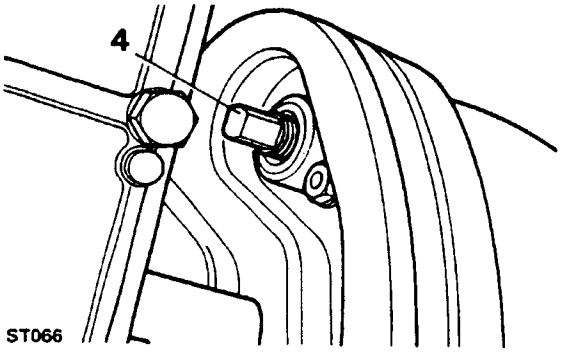
ADJUST PARKING BRAKE

The parking brake lever acts on a brake drum at the rear of the transfer box.

1. Set the vehicle on level ground and select 'P' in main gearbox. Disconnect the battery negative lead.
2. Fully release the parking brake.
3. From underneath the vehicle loosen the two locknuts securing the parking brake outer cable to the mounting bracket, to enable the brake drum to be adjusted without putting any tension on the parking brake outer cable.



4. Rotate the adjuster on the brake drum back plate clockwise, until the brake shoes are fully expanded against the drum.



5. Rotate the two outer cable locknuts until contact is made with the mounting bracket, tighten the two nuts consecutively to prevent any movement occurring on the outer cable.
6. Loosen the adjuster on the back of the brake drum until the parking brake lever becomes fully operational on the second or third notch of the parking brake ratchet,
7. Lightly grease the parking brake linkage with a general purpose grease.

CAUTION: DO NOT overadjust the parking brake, the drum must be free to rotate when the parking brake is released, otherwise serious damage will result.

CHECK SERVICE BRAKE OPERATION

If the service brake pedal is 'spongy' bleed the brake system (refer to Brakes, section 70). Check all hoses and pipes for security, fractures and leaks. Fit new hoses and pipes as necessary.

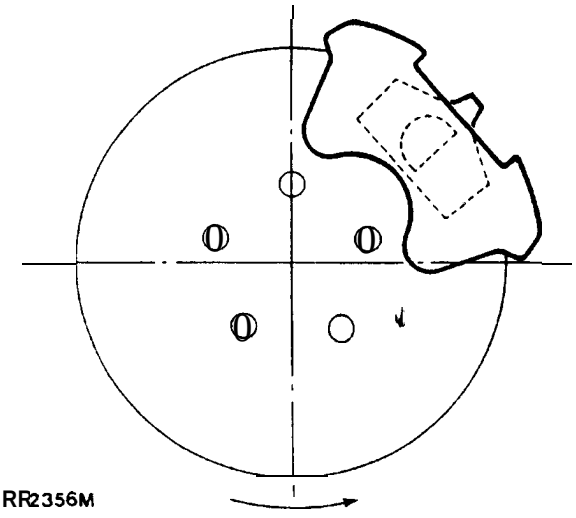
FRONT AND REAR BRAKE PADS (Service Brakes)

Brake pad wear is indicated by a pad wear warning light incorporated in the instrument binnacle. The warning lamp is illuminated when pad wear is reduced to approximately 3.0mm (0.118 in). The system is operated by an electrical sensor incorporated into both the front right and rear left hand side inboard brake pads, on early models. Later models have the rear pad wear sensor located in the inboard pad of the rear right hand caliper. When pad wear is sufficient in either front or rear pads the sensor within the pads will complete a circuit to ground through the disc, thus illuminating the warning lamp in the instrument binnacle.

Brake pad identification

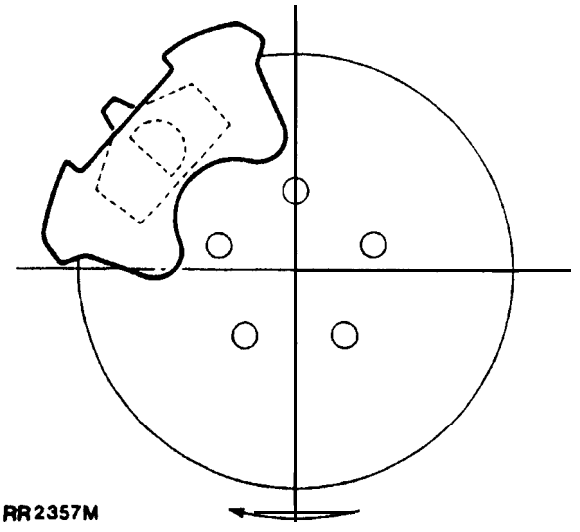
From the side of the vehicle, looking through the disc and caliper at the inboard pad, the 'D' shaped material on the rear of the inboard pad should face the direction of forward rotation of the road wheel so that the curved part of the 'D' is always at the trailing end of the caliper.

Brake pad wear sensed at left rear wheel



Direction of rotation

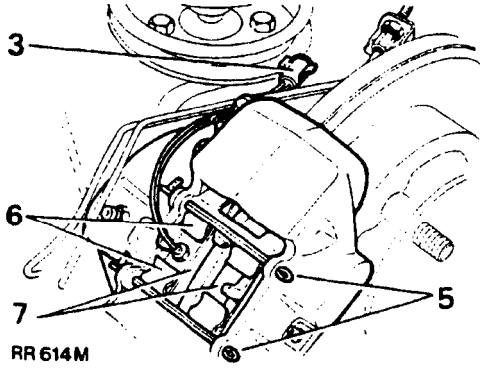
Brake pad wear sensed at right rear wheel



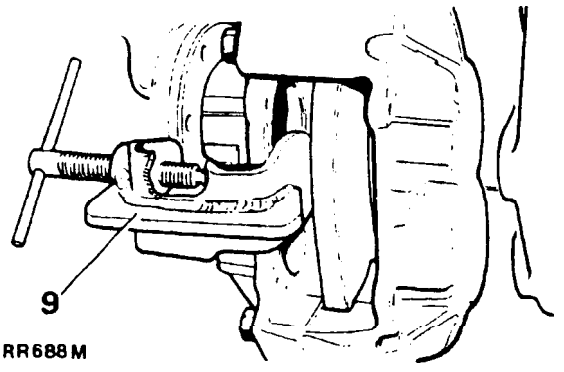
Fit new front brake pads

NOTE: Ensure 'P' is selected in main gearbox, differential lock is engaged and that the parking brake is applied.

1. Loosen the wheel nuts on both front wheels, raise the front of the vehicle and lower onto axle stands, and remove the front road wheels.
2. Disconnect the battery negative terminal.
3. Disconnect the two-pin electrical plug at the rear of the disc mudshield (front right hand side only).
4. Clean the exterior of the calipers.
5. Remove the cotter pins from the brake caliper.
6. Remove the retaining springs.
7. Withdraw the brake pads.



8. Clean the exposed parts of the pistons, using new brake fluid.
9. Using piston clamp 18G672 press each piston back into its bore, while ensuring that the displaced brake fluid does not overflow from the reservoir.



10. Coat the faces of the pistons with Lockheed disc brake lubricant taking care not to let any reach the lining material.
11. Insert the new brake pads.
12. Place the brake pad retaining springs in position, fit new cotter pins and spread the ends.
13. Apply the service brake pedal several times to locate the pads.
14. Check the fluid reservoir and top up if necessary.
15. Fit the road wheels, and secure them in position with the wheel nuts, do not fully tighten the wheel nuts at this stage, lower the vehicle and finally tighten the wheel nuts to the specified torque value.

Fit new rear brake pads

Jacking up the rear of the vehicle, follow the procedure as for front pads.

1. Early vehicles • The two-pin electrical plug for rear brake pad wear indication is located on the left hand rear caliper inboard pad.
   later vehicles • The two pin electrical plug for rear brake pad wear indication is located on the right hand rear caliper inboard pad.

CHECK BRAKE SERVO HOSE(S)

Visually inspect all servo hoses and connections for condition and security.

BRAKE FLUID

Brake fluid absorbs water and in time the boiling point of the fluid will be lowered sufficiently to cause the fluid to be vapourised by the heat generated when the vehicle brakes are applied.
This will result in loss of braking efficiency or in extreme cases brake failure.
Therefore, all fluid in the brake system should be changed at the service intervals quoted in the recommended maintenance schedules.

Fluid should also be changed before touring in mountainous areas if not changed in the previous nine months.

Care must be taken always to observe the following points:

(a) At all times use the recommended brake fluid.
(b) Never leave fluid in unsealed containers as it absorbs moisture quickly and can be dangerous if used in the braking system in this condition.
(c) Fluid drained from the system or used for bleeding should be discarded.
(d) The necessity for absolute cleanliness throughout cannot be over emphasised.

BATTERY

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 the 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 your eyes when working near the battery to protect against possible splashing of the 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.

A low maintenance battery is installed in the vehicle. Dependent upon climate conditions the electrolyte levels should be checked as follows:

Temperate climates every three years.
Hot climates every year.

The exterior of the battery should be occasionally wiped clean to remove any dirt or grease.

Periodically remove the battery terminals to clean and coat with petroleum jelly.

NOTE: If a new battery is fitted to the vehicle it should be the same type as fitted to the vehicle when new. Alternative batteries may vary in size and terminal positions and this could be a possible fire hazard if the terminals or leads come into contact with the battery clamp assembly. When fitting a new battery ensure that the terminals and leads are clear of the battery clamp assembly.

RESET EMISSION MAINTENANCE REMINDER

The emission maintenance reminder is designed to activate at 52,500 and 105,000 miles respectively and will illuminate a 'Check Engine' red warning light in the auxiliary switch panel.

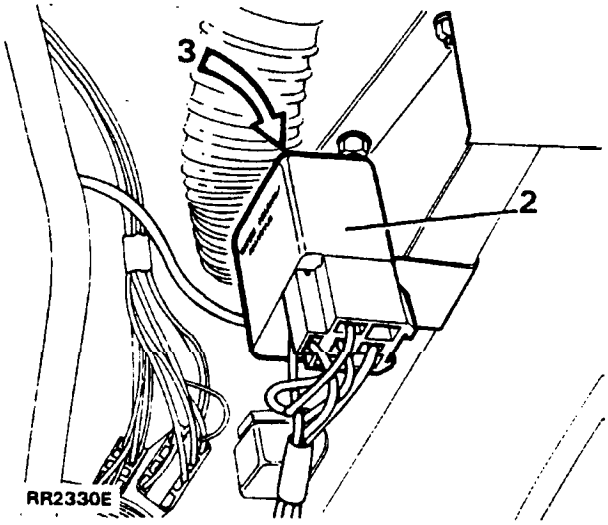
The control unit is located behind the lower dash panel and is attached to the side of the steering column support bracket above the relays. Access to the unit is gained by removing the lower dash panel.

The control unit colour is brown, mounted on a brown plug, 'EMISSION MAINTENANCE REMINDER' is embossed in white on the side of the unit. A tamper-proof label is attached to the top of the unit.

The emission maintenance reminder must be reset after the required maintenance has been carried out and a new tamperproof label fitted by a Range Rover of North America dealer. This Emission maintenance reminder is part of the Emission Control System, refer to section 17.

The unit can be reset as follows:

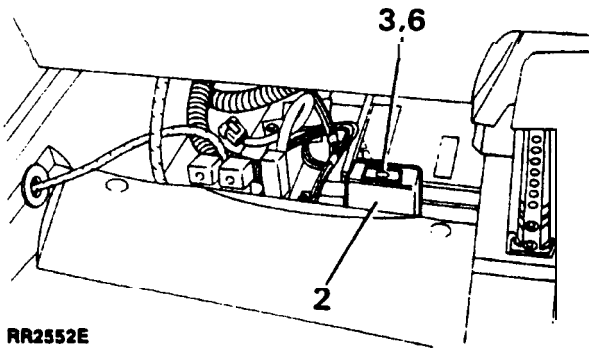
1. Remove the fixings and lower the lower dash panel.
2. Identify the control unit and remove it from the plug.
3. Remove the tamperproof label to reveal the access hole for resetting.



4. Using a small thin metallic probe, place the probe into the access hole and momentarily electrically short between the reset pins within the unit.
5. Refit the control unit to the plug, switch on the ignition, the 'CHECK ENGINE' warning light in the auxiliary switch panel will initially light up as part of the unit's inbuilt check feature, if the unit has been reset correctly the warning light will go out after a few seconds. Should the warning light remain illuminated, repeat the resetting procedure.
6. Fit a new tamperproof label.
7. Endorse the Passport to service.

EMISSION MAINTENANCE REMINDER - 1989 MODEL YEAR

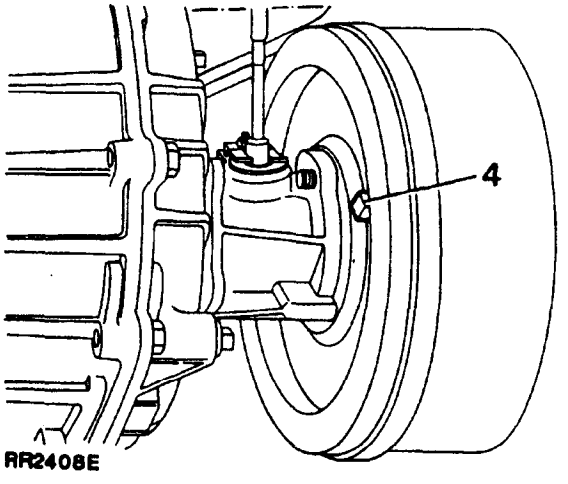
The mileage intervals for 88 Model year also apply to 89 Model year.
The control unit is now located under the rear of the right hand front seat.



Follow instructions 2. to 7. to reset the unit.

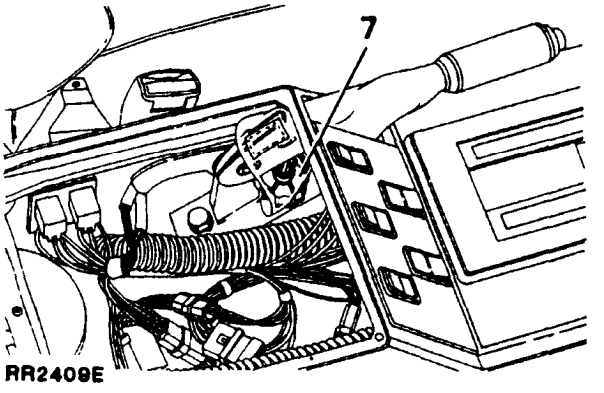
ADJUST PARKING BRAKE

1. Set the vehicle on level ground and select 'P' in automatic gearbox or neutral in manual gearbox. Disconnect the battery negative terminal.
2. Chock the road wheels.
3. Fully release the parking brake lever.
4. From underneath the vehicle, rotate the adjuster on the brake drum back plate clockwise until the brake shoes are fully expanded against the brake drum.



5. Back off the adjuster until the drum is free to rotate.
6. Release the four screws and remove the glove box liner.
7. Rotate the adjustment thumbwheel below the parkbrake lever until the parkbrake is fully operational on the third notch of the ratchet.

NOTE: The parking brake adjustment thumbwheel 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 continue to be adjusted at the brake drum.

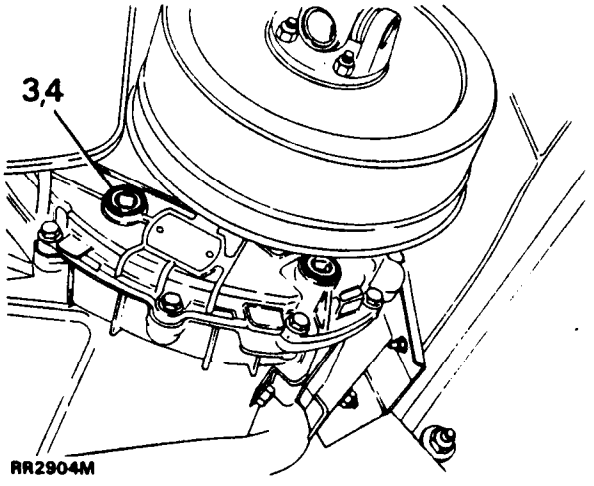


8. Operate the parkbrake once or twice to settle the brake shoes, recheck that the parkbrake is fully operational on the third notch of the ratchet. Readjust as necessary.
9. Refit the glove box liner.
10. Reconnect the battery and remove the wheel chocks.

TOP UP TRANSFER GEARBOX OIL
- Borg Warner gearbox

NOTE: The existing maintenance intervals for the LT230 are also applicable to the Borg Warner transfer gearbox.

1. Before topping up the oil ensure that the vehicle is level, either on a hoist or on the ground.
2. Disconnect the battery negative terminal.
3. Clean the immediate area around the filler/level plug.
4. Remove the plug and fill the gearbox with the recommended grade of oil, until oil starts to seep from the filler/level hole.
5. Clean any previously applied sealant from the filler/level plug.
6. Apply Hylomar sealant to the threads of the plug and refit the plug. Tighten to the specified torque.



7. Wipe away any surplus oil.
8. Reconnect the battery.

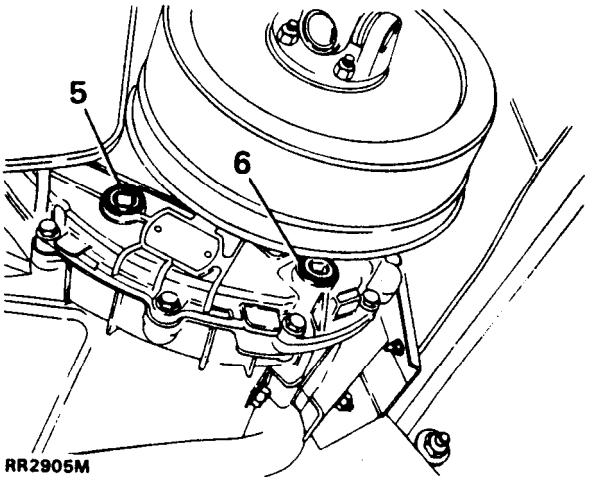
RENEW TRANSFER GEARBOX OIL
- Borg Warner gearbox

NOTE: The existing maintenance intervals for the LT230 are also applicable to the Borg Warner transfer gearbox.

1. Before renewing the oil ensure that the vehicle is level, either on a hoist or on the ground.
2. Disconnect the battery negative terminal.
3. Clean the immediate area around the filler/level and drain plugs.

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

4. Place a container under the gearbox to drain the oil into.
5. Remove the filler/level plug to vent the gearbox and assist draining.
6. Remove the drain plug and allow the oil to drain.



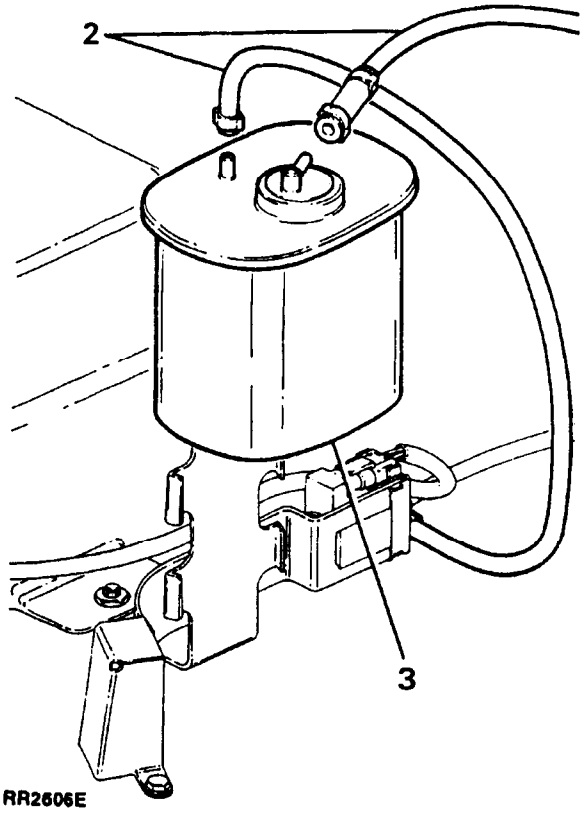
7. Thoroughly clean the drain plug threads prior to applying fresh 'Hylomar' sealant. Fit and tighten the plug to the specified torque.
8. Fill the gearbox with the correct quantity and grade of oil until oil seeps from the filler level hole. Wipe away any surplus oil.
9. Thoroughly clean the filler/level plug threads prior to applying fresh 'Hylomar' sealant. Fit and tighten the plug to thd specified torque.
10. Reconnect the battery.

Charcoal canister

Remove and refit

Removing

1. Disconnect battery negative lead.
2. Disconnect both purge lines.
3. Release canister from its mounting braket.



Refitting

4. Reverse the removal procedure, ensuring that the canister is securely located in its mounting bracket and both purge lines are fitted correctly to the canister.

DYNAMOMETER TESTING OF PERMANENT FOUR WHEEL DRIVE VEHICLES

NOTE: THIS INFORMATION APPLIES TO VEHICLES FITTED WITH BORG WARNER TRANSFER GEARBOX WITH VISCOUS COUPLING

These vehicles are identified by the absence of the diff-lock position on the transfer gearbox lever.

Viscous coupling

The front and rear axles cannot be driven independently due to the viscous coupling. This eliminates the need for the differential lock by progressively locking the centre differential automatically if any slip occurs at any wheel.

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

Four wheel dynamometers

Provided that the 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 for 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 the drive shaft to the 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 the drive shaft to the stationary axle must be removed.

TOWING

Note the towing procedure (Section 10, page 7) for previous models applies to vehicles fitted with Borg Warner transfer gearbox. The main gearbox and transfer gearbox must be in neutral when the vehicle is being towed.

DYNAMOMETER TESTING OF PERMANENT FOUR WHEEL DRIVE VEHICLES

NOTE: THIS INFORMATION APPLIES TO VEHICLES FITTED WITH ANTI-LOCK BRAKE SYSTEM

WARNING: DO NOT ATTEMPT TO TEST ABS FUNCTION ON A DYNAMOMETER

Four wheel dynamometers

NOTE: Before testing the vehicle on a four wheel dynamometer disconnect the valve relay - see Section 70 Brakes, page 54. The ABS function will not work, the ABS warning light will illuminate. Normal braking will be available.

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

Two wheel dynamometers

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

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

If brake testing on a single rig is necessary it must be carried out with the drive shaft to the rear axle removed, AND neutral selected in BOTH main gearbox and transfer gearbox.

If checking engine performance, the transfer box must be in high range and the drive shaft to the stationary axle must be removed.

ABS BRAKE FLUID RESERVOIR

Check/top up fluid level

1. Park the vehicle on level ground.
2. Turn ignition ON, to activate hydraulic pump. If pump does not activate depress brake pedal several times until it is heard to operate.
3. When the pump stops, check that the level is between the 'MIN' and 'MAX' marks.
4. If the level is below the 'MIN' mark on reservoir, using the correct fluid, - see Section 09, Lubricants and Fluids.

WARNING: Clean reservoir body and filler cap before removing the cap. Use only fluid from a sealed container.

FUEL FILTER - 1991 MODEL YEAR

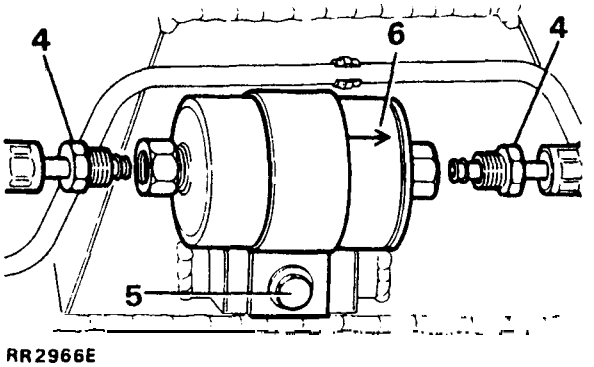
Remove and refit

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

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

Removing

1. Depressurise the fuel system.
2. The fuel filter is located on the right-hand chassis side member forward of the fuel tank filler neck. Access to the filter is gained through the right-hand rear wheel arch.
3. Clamp the inlet and outlet hoses to prevent the minimum of fuel spillage when disconnecting the hoses.
4. Loosen the two fuel unions and remove the hoses from the filter canister.
5. Release the single nut and bolt securing the filter and clamp and remove the filter.



RR2966E

Refitting

6. Fit a new filter observing the direction of flow arrow on the canister.
7. Tighten the single nut and bolt.
8. Fit the inlet and outlet hoses. Tighten the unions to a torque of 20-25 ft lb(27-34Nm).
9. Refit the fuel pump relay. Reconnect the battery and recode the radio.
10. Start the engine and inspect for fuel leaks around the hose connections.

ENGINE

REMOVAL OF THE ENGINE FROM THE VEHICLE

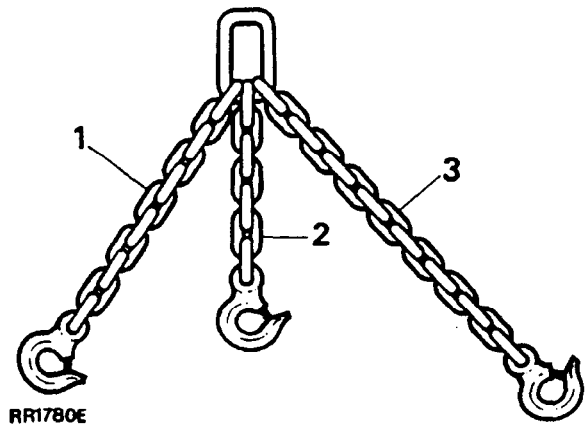
1. Prop the hood open, disconnect the screen washer hose from the reservoir and electrical leads to the engine compartment illumination lamp. Remove the fixings, hinges to hood and lift the hood clear.
2. Set the vehicle on level ground and apply the transmission brake.
3. De-pressurize the fuel system. (See Fuel Injection System, Section 19).
4. Disconnect the battery terminals and remove the battery from the vehicle.
5. Release the hose clamp and remove the radiator bottom hose to enable the cooling system to be drained.
6. Release the hose clamps and remove the radiator top hose and expansion tank hose.
7. Remove the fan cowl, drive belt and viscous unit/fan assembly.
8. Release the fixings and remove the radiator.
9. Place an absorbent cloth around the fuel feed hose at the fuel rail and release the compression nut, remove the feed hose from the rail, seal the end of the pipes with masking tape to prevent ingress of dirt.
10. Release the hose clamp and remove the fuel return hose from the pressure regulator, seal both openings with masking tape to prevent ingress of dirt. Remove the vacuum hose from the rear of the regulator.
11. Detach the throttle lever return springs, remove the fixings securing the kickdown cable anchor bracket to the plenum chamber bracketry and lay the assembly to one side. DO NOT DISTURB THE KICK DOWN CABLE SETTING.
12. Disconnect the multi-plug from the air bypass valve (stepper motor).
13. Release the hose clamp securing the hose to the inlet neck of the plenum chamber.
14. Disconnect the multi-plug from the air flow sensor, release the two clips securing the air cleaner to the air flow sensor, remove the sensor complete with hose from the engine compartment.
15. Release the fixings and remove the air cleaner assembly from the engine compartment.
16. Release the alternator pivot bolts and remove the drive belt, remove the alternator fixings and withdraw the alternator.
17. Release the idler pulley between the crankshaft pulley and compressor pulley and remove the drive belt.
18. Release the compressor from its mounting and lay to one side. DO NOT discharge the air conditioning system.

    NOTE: Release the bolts securing the compressor mounting bracket to the engine and remove the bracket to enable a temporary lifting eye ETC 5964 to be fitted. Secure the lifting eye to the mounting bracket fixing points with suitable bolts of equivalent size, pitch and thread. Leave the lifting eye attached to the engine until the engine has been reinstalled in the vehicle.

19. Place a drain tray underneath the vehicle to catch any power steering fluid which may seep from the steering fluid reservoir when the hose is disconnected from the steering pump.
20. Disconnect the hose and secure the end of it above the level of the fluid reservoir to avoid the loss of any more fluid than necessary. Seal the power steering pump and pipe opening with masking tape to prevent ingress of dirt.

Continued

21. Disconnect the power steering pump to power steering box hose, seal the hose and pump opening with masking tape to prevent ingress of dirt. Wipe away any fluid that may have come into contact with the chassis or steering box.
22. Remove the two coolant hoses and one crankcase breather hose from the potentiometer side of the plenum chamber.
23. Disconnect the potentiometer multi-plug.
24. Remove the distributor vacuum hose from the top of the plenum chamber and disconnect the vacuum supply hose to the cruise control actuator.
25. Remove the six bolts and maneuver the plenum chamber off the ram housing.
26. Disconnect the hoses from around the outside of the ram housing and remove the six bolts securing the ram housing to the intake manifold.
27. Lift the ram housing clear of the intake manifold and remove it from the engine compartment. Place a protective cover over the intake manifold openings to prevent ingress of dirt.
20. Disconnect the fuel temperature and coolant temperature sensor multi-plugs.
29. Disconnect the High tension and Low tension leads from the coil.
30. Identify each injector multi-plug for re-assembly and disconnect the plugs from the injectors.
31. Maneuver the harnesses from behind the fuel rails and place aside , clear of the engine assembly.
32. Remove the two clamps securing the automatic gearbox oil cooler pipes to the bottom left hand side of the engine block.
33. Remove the top and bottom nuts securing the engine mountings at either side of the cylinder block.
34. Fit suitable lifting chains to the engine lifting eyes located at the front of both cylinder heads and the rear of the right hand cylinder head.(See illustration for recommended chain lengths).



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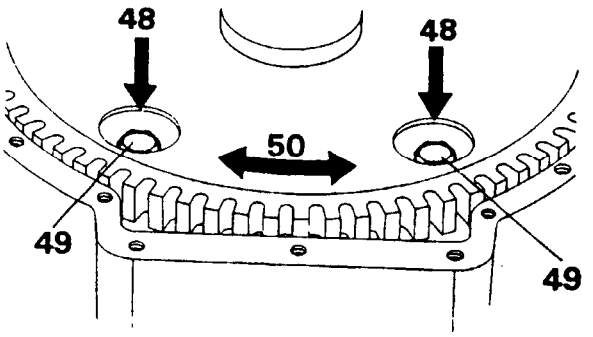
KEY TO CHAIN LENGTHS

1. L/H Front chain 356mm (14 in.) total overall length.
2. R/H Front chain 330mm (13 in.) total overall length.
3. R/H Rear chain 457mm (18 in.) total overall length.

NOTE: All chain dimensions are measured from the end of the lifting hook to the end of the last link in the chain.

35. Fit the chain lifting eye to a suitable hydraulic hoist. Raise the hoist sufficiently high enough to enable the engine mounting rubbers to be removed, and withdraw the rubber mountings.
36. Lower the hoist until the engine rests securely on the engine mounting brackets. Remove the lifting chains and hoist.
37. Disconnect the two heater hoses located on the top of the right hand rocker cover.
38. Remove the ground strap from the rear of the left hand cylinder head.
39. Remove the cylinder block to hood ground strap from the retaining clip at the engine compartment closure panel.
40. Remove all electrical harnesses from the retaining clips on and around the rear of the engine.

41. Remove the gearbox breather pipe from the retaining clip at the rear right hand lifting eye.
42. Remove the top two bolts securing the bell housing to cylinder block.
43. Position a suitable hydraulic floor jack under the front differential casing, raise the front of the vehicle sufficiently to enable two axle stands to be positioned under the front axle, lower the vehicle on to the axle stands.
44. Remove the bolts securing the bell housing bottom cover, detach the cover from the bell housing and remove the gasket from the bell housing face.
45. Remove the transfer box to engine block tie bar.
46. Remove the nuts securing the exhaust downpipes to the manifolds, remove the heat shield from the right hand side downpipe.
47. Remove the electrical leads from the rear of the starter motor solenoid, and disconnect the multi-plug from the oil level sensor on the side of the sump.
48. With the assistance of a second person to rotate the engine at the crankshaft pulley, rotate the crankshaft until two of the access holes in the drive plate/ring gear assembly are visible through the bellhousing bottom cover opening.
49. Remove the two bolts that are visible through the access holes, which secure the flexible drive plate to the torque converter. Mark one of the access holes and one of the bolt holes with some means of identification to enable the unit to be fitted in the same position on re-assembly to maintain the original build setting.
50. Rotate the crankshaft 180° until the two remaining access holes are visible, and remove the two bolts.



RR1808E

51. Remove the remaining bell housing to cylinder block bolts.
52. Raise the vehicle off the axle stands using a suitable hydraulic floor jack under the front axle, remove the stands and lower the vehicle to rest on its road wheels.
53. Fit the engine lifting eyes, locate the chain lifting eye into the floor crane.
54. Remove the starter motor ground strap from the chassis.
55. Place a hydraulic floor jack under the gearbox bell housing to support the gearbox when the engine and gearbox are separated.
56. Carefully raise the crane a little, ease the engine to gearbox joint faces apart, steady the engine on the crane.
57. Ensure there are no restricting electrical harnesses, hoses, pipes, or components that will prevent the engine being raised clear of the engine compartment.
58. Slowly-raise the engine clear of the engine compartment, move the engine away from vehicle and place on a suitable engine stand.

FITTING THE ENGINE TO THE VEHICLE

59. Fit the lifting chains to the lifting eyes on the engine as previously described in the removal procedure.
60. Raise the engine on a floor crane and lower it into the engine compartment, ensuring that all harnesses, hoses, pipes and components are clear of the engine assembly.

Continued
3

61. With assistance, maneuver the engine until the bottom two engine bolt holes align with the appropriate two holes in the bell housing. Fit the two bolts and partially tighten. Ensure that the two cylinder block dowels locate in their respective holes in the bell housing.
62. Remove the hydraulic floor jack and lower the hoist until the engine rests securely on the engine mounting brackets.
63. Fit the top two bell housing to engine cylinder block securing bolts. Tighten to the specified torque (see section 06-Torque values).
64. Fit the remaining bell housing to cylinder block bolts, and tighten to the specified torque (including the two bottom bolts).(see section 06-Torque values).
65. With assistance from a second person to rotate the crankshaft pulley, line up the previously marked drive plate access hole with the respective bolt hole in the torque converter. Fit the two bolts and tighten to the specified torque (see section 06-Torque values).
66. Rotate the crankshaft 180" and fit the remaining two bolts to the flexible drive plate, tighten to the specified torque (see section 06-Torque values).
67. Fit new gasket and refit the bottom cover, tighten the bolts to the specified torque (see section 06-Torque values).
68. Fit new exhaust flange gaskets, fit the exhaust to the manifold.
69. Refit all harnesses, ground straps breather pipes and hoses to their correct locations at the rear of the engine.
70. Raise the engine and refit the engine mounting rubbers, tighten the nuts to the specified torque (see section 06-Torque values).
71. Remove the temporary lifting eye ETC 5964 and reverse the instructions 1 to 32, ensuring that all electrical plugs and harnesses are fitted to their correct locations.

DISMANTLE AND OVERHAUL THE ENGINE

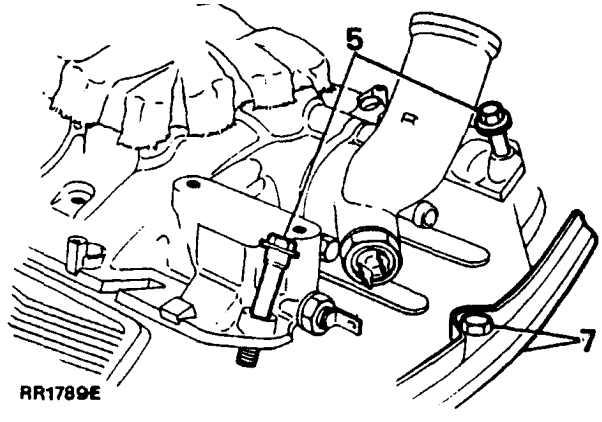
Remove the engine from the vehicle and clean the exterior. In the interests of safety and efficient working secure the engine to an approved engine stand. Drain the sump oil into a suitable container.

Special tools:

R0605351	Guide bolts
186537	Torque wrench
18G1150	Piston pin remover/replacer Basic tool
18G1150E	Adaptor remover/replacer piston pin
18G106A	Spring compressor
R0600959	Drift Valve guide replacement intake and exhaust
MS76	Valve cutter handle set
MS621	Valve seat cutter
RO605774A	Distance piece for valve guide
RO274401A	Drift for guide removal intake and exhaust
R01014	Crankshaft rear seal sleeve

REMOVE THE INTAKE MANIFOLD

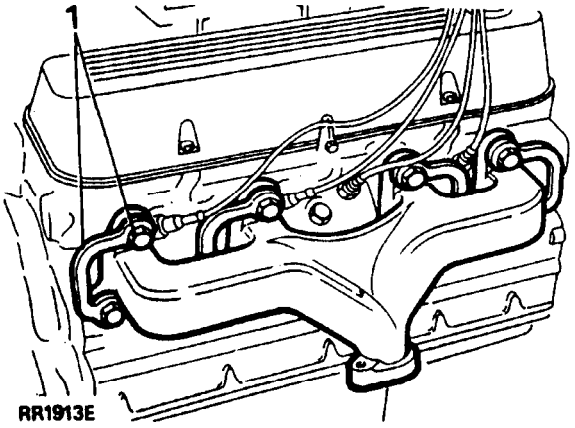
1. Release the hose clamp securing the hose to the rear of the water pump
2. Detach the retaining clips from the top of the injectors.
3. Remove the four bolts securing the fuel rail to the manifold.
4. Withdraw the fuel rail and injectors.



5. Evenly loosen and remove the twelve bolts securing the intake manifold to the cylinder heads.
6. Lift the intake manifold from the cylinder heads.
7. Wipe away any surplus coolant lying on the manifold gasket and remove the gasket clamp bolts and remove the clamps.
8. Lift off the gasket and seals.

Remove exhaust manifolds

1. Bend back the lock tabs, and remove the eight bolts securing each manifold, and withdraw the manifolds and gaskets.

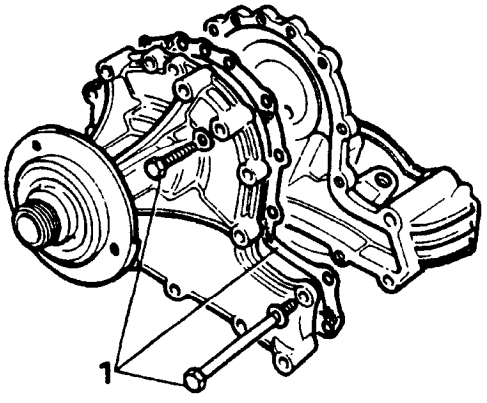


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Remove water pump

1. Remove the fifteen bolts and withdraw the water pump and joint washer.

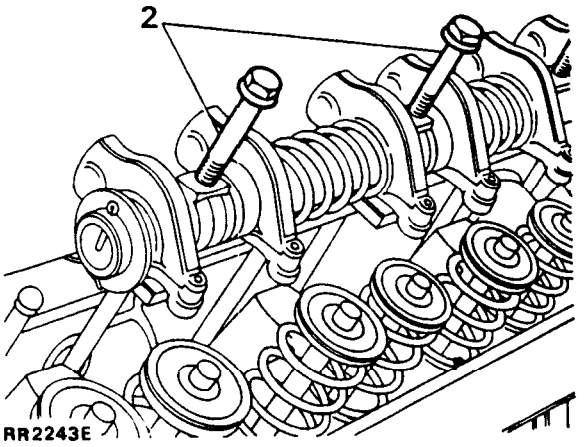
NOTE: The water pump is not a serviceable item, in the event of bearing failure or severe corrosion to the pump impeller vanes, fit a new water pump assembly.



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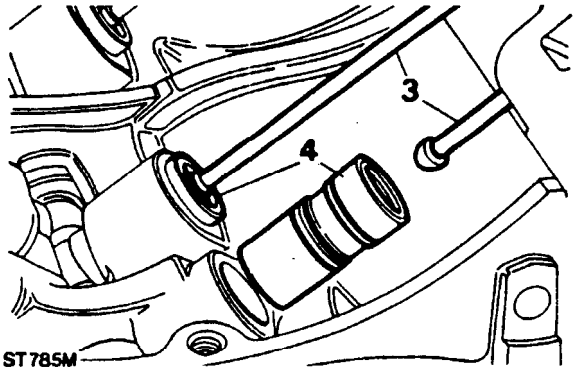
REMOVE AND OVERHAUL ROCKER SHAFTS AND VALVE GEAR

1. Remove the spark plug leads from the spark plugs and retaining clips, release the four screws and lift off the rocker covers.
2. Remove the four rocker shaft retaining bolts and lift off the assembly.



RR2243E

3. Withdraw the pushrods and retain in the sequence removed.
4. Remove the hydraulic tappets and place to one side with their respective pushrods. If a tappet cannot be removed leave in position until the camshaft is removed.

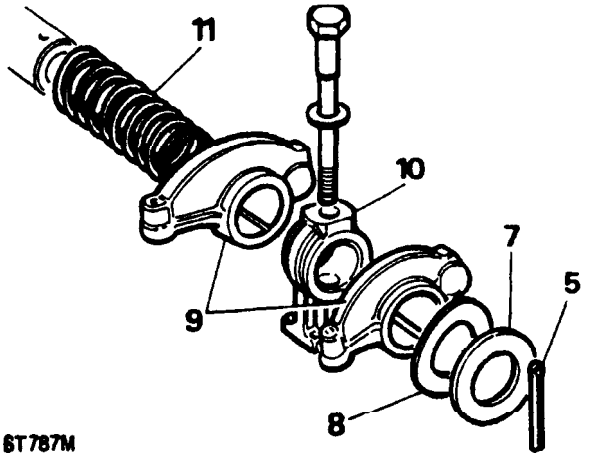


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Dismantle rocker shafts

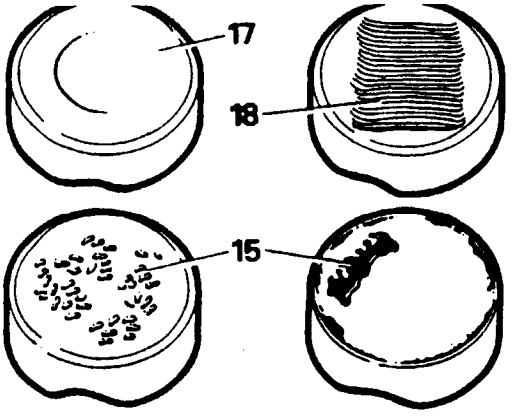
5. Remove the cotter pin from one end of the rocker shaft.
6. Withdraw the following components and retain them in the correct sequence for re-assembly:
7. A plain washer.
8. A wave washer.
9. Rocker arms.
10. Brackets.
11. Springs.
12. Examine each component for wear, in particular the rockers and shafts. Discard weak or broken springs.



6T787M

Inspect tappets and pushrods

13. Hydraulic tappet; inspect inner and outer surfaces of the body for blow holes and scoring. Replace hydraulic tappet if body is roughly scored or grooved, or has a blow hole extending through the wail in a position to permit oil leakage from the lower chamber.
14. The prominent wear pattern just above the lower end of the body should not be considered a defect unless it is definitely grooved or scored. It is caused by side thrust of the cam against the body while the tappet is moving vertically in its bore.
15. Inspect the cam contact surface of the tappets. Fit new tappets if the surface is excessively worn or damaged.
16. A hydraulic tappet body that has been rotating will have a round wear pattern and a non-rotating tappet body will have a square wear pattern with a very slight depression near the centre.
17. Tappets MUST rotate and a circular wear condition is normal. Tappets with this wear pattern can be refitted provided there are no other defects.
18 In the case of a non-rotating tappet, fit a new replacement and check camshaft lobes for wear; also ensure the new tappet rotates freely in the cylinder block.

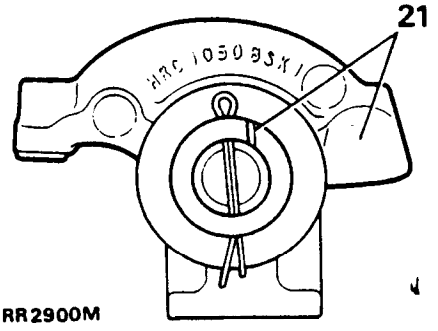


RR750M

19. Fit a new hydraulic tappet if the area where the pushrod contacts is rough or otherwise damaged.
20. Fit a new pushrod if it is bent or has a rough or damaged ball end or seat.

Assemble rocker shafts

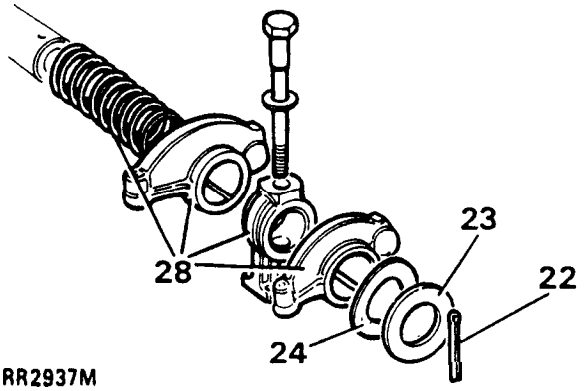
21. Both shafts must be assembled so that the identification groove is at the one o'clock position with the push rod end of the rockers to the right.



RR2900M

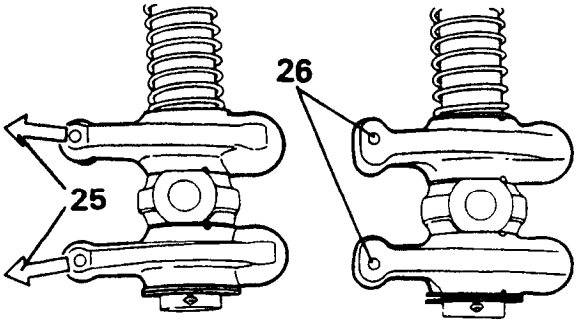
CAUTION: If the shafts and rockers are incorrectly assembled and fitted to the engine, the oil supply to the rocker shafts will be restricted.

22. Fit a cotter pin to one end of the rocker shaft.
23. Slide a plain washer over the long end of the shaft to contact the cotter pin.
24. Fit a wave washer to contact the plain washer.



RR2937M

25. Early type rocker arms are angled. They must be fitted so that the valve end of the rocker arms angle away from each other as shown.
26. On later type rocker arms the valve end is offset and must be fitted as shown.
27. Early and late types of rocker arms interchangeable provided the complete set is changed.

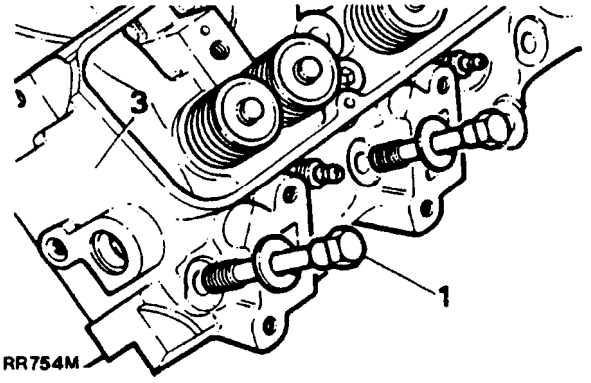


RR2899M

28. Assemble the rocker arms, brackets and springs to the rocker shaft.
29. Compress the springs, brackets and rockers, and fit a wave washer, plain washer and cotter pin to the end of the rocker shaft.
30. Fit the locating bolts through the brackets and place the assemblies to one side.

REMOVE AND OVERHAUL THE CYLINDER HEADS

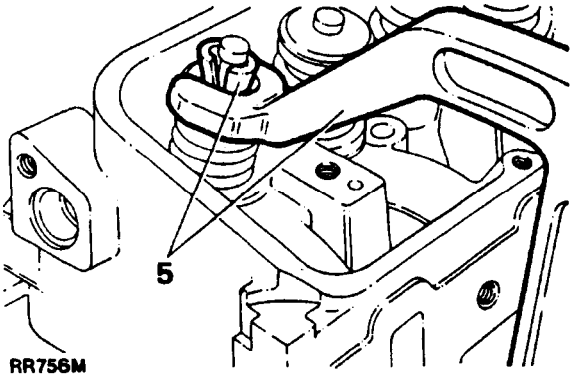
1. Evenly loosen the fourteen cylinder head bolts reversing the tightening order.
2. Before removing the heads mark them relative to the LH and RH side of the engine.
3. Lift off the cylinder heads and discard the gasket.



RR754M

Dismantle cylinder heads

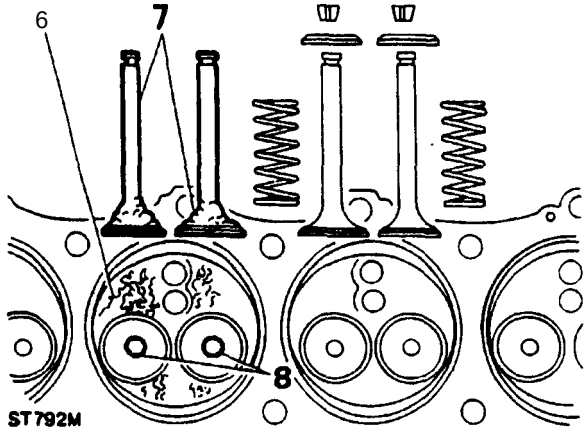
4. Remove the spark plugs.
5. Using the valve spring compressor 18G 106A or a suitable alternative, remove the valves, springs and umbrella seals, retain them in sequence for refitting. Discard the umbrella seals fitted to the inlet valves only.



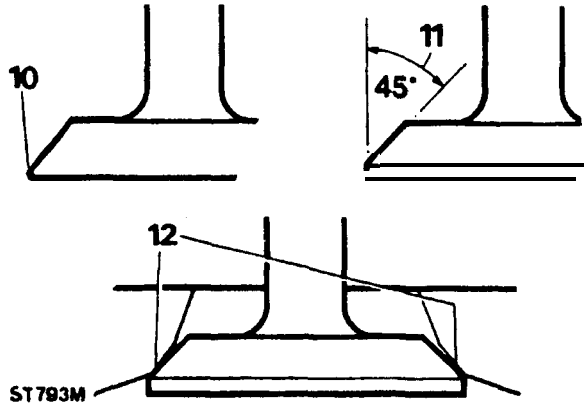
RR756M

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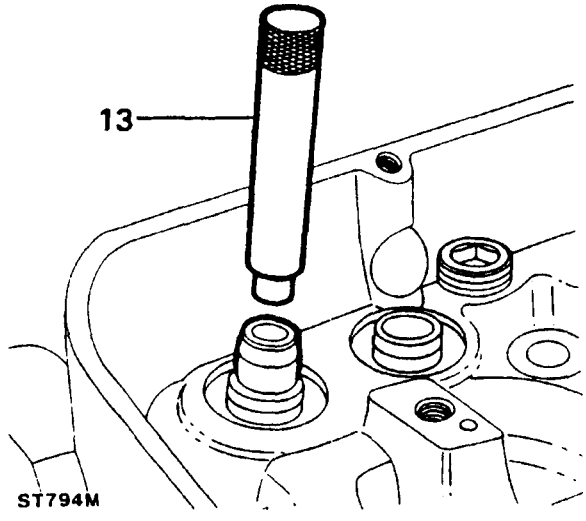
6. Clean the combustion chambers with a soft wire brush.
7. Clean the valves.
8. Clean the valve guide bores.



9. Regrind or fit new valves as necessary.
10. If a valve must be ground to a knife-edge to obtain a true seat, fit a new valve.
11. The correct angle for the valve seating face is 45 degrees ± 1/4.
12. The correct angle for the seat is 46± 1/4 degrees and the seat witness should be towards the outer edge.



13. Check the valve guides and fit replacements as necessary. Using the valve guide remover 274401, drive out the old guides from the valve spring seat face of the cylinder head.

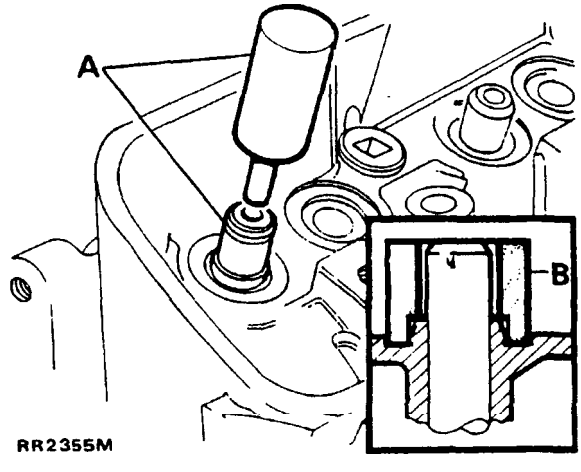


Fit new valve guides

NOTE: Service valve guides are 0.025 mm (0.001 in) larger on the outside diameter than the original equipment to ensure interference fit.

14. Lubricate the new valve guide and place in position.

A. Using guide drift R0600959 partially drive the guide into the cylinder head.
B. Remove the drift R0600959 and place distance piece RO605774A over the valve guide, continue to drift the guide into the cylinder until drift contacts the distance piece.
C. Alternatively drift the guide into the cylinder head until it protrudes 19 mm (3/4 in) above the valve spring recess in the head.



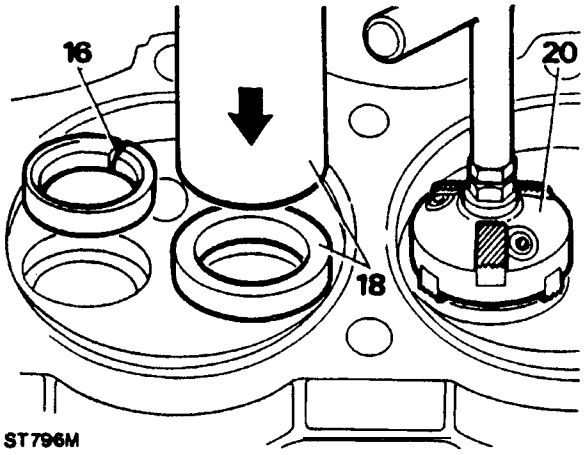
Examine and fit new valve seats

15. Check the valve seats for wear, pits and burning and fit new inserts if necessary.

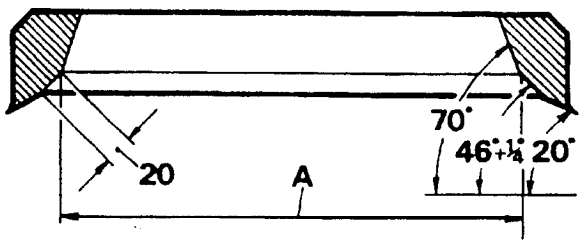
16. Remove the old seat inserts by grinding them away until they are thin enough to be cracked and pried out.
17. Heat the cylinder head evenly to approximately 65°C (150°F).
18. Press the new insert into the recess in the cylinder head.

NOTE: Service valve seat inserts are available in two over-sizes 0.25 and 0.50 mm (0.010 and 0.020 in) larger on the outside diameter to ensure interference fit.

19. Using service tool MS621 if necessary, cut the valve seats to 46 ± 1/4 degrees.
20. The nominal seat width is 1.5 mm (0.059 in). If the seat exceeds 2.0 mm (0.078 in) it should be reduced to the specified width by the use of 20" and 70" cutters.
21. The inlet valve seat diameter: 'A' is 37.03 mm (1.458 in) and the exhaust valve seat is 31.50 mm (1.240).

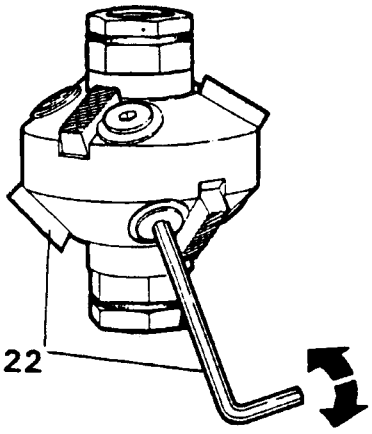


ST796M



ST797M

22. Ensure that the cutter blades are correctly fitted to the cutter head with the angled end of the blade downwards facing the work, as illustrated.
Check that the cutter blades are adjusted so that the middle of the blade contacts the area of material to be cut. Use the key provided in the hand set MS76. Use light pressure and remove only the minimum material necessary.



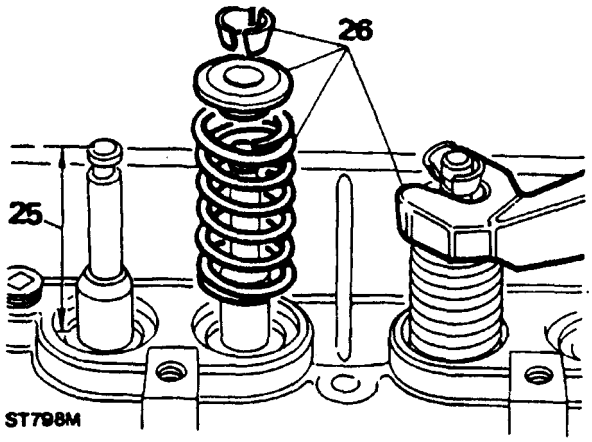
ST1 024M

23. Coat the valve seat with a small quantity of 'engineers' blue, revolve a properly ground valve against the seat. A continuous fine line should appear round the valve. If there is a gap of not more than 12 mm it can be corrected by lapping.
24. Alternatively, insert a strip of cellophane between the valve and seat, hold the valve down by the stem and slowly pull out the cellophane. If there is a drag the seal is satisfactory in that spot. Repeat this in at least eight places. Lapping-in will correct a small open spot.

Continued

Re-Assemble valves to cylinder head

25. Before fitting the valves and springs the height of each valve above the head must be checked. Insert each valve in turn in its guide and while holding the head firmly against the seat, measure the height of the stem above the valve spring seat surface. This dimension must not exceed 47.63 mm (1.875 in). If necessary fit a new valve or grind the end of the valve stem.
26. Lubricate the valve stems and assemble the valves, fit new umbrella seals and springs, fit the caps, compress the springs and caps using spring compressor 18G 106A and secure the springs in place with the collets. Note that the umbrella seals are only fitted to the inlet valves.



Reclaiming cylinder head threads

Damaged or stripped threads in the cylinder head can be salvaged by fitting Helicoils as follows:

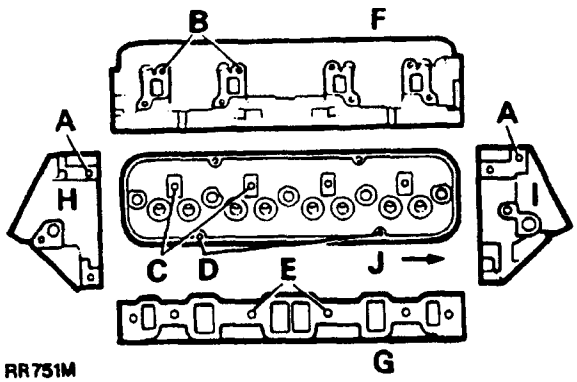
Holes A - These three holes may be drilled 0.3906 in dia. x 0.937 + 0.040 in deep. Tapped with Helicoil Tap No. 6 CPB *or* 6CS x 0.875 in (min) deep (3/8 UNC 1.5D insert).

Holes B - These eight holes may be drilled 0.3906 in dia. x 0.812 + 0.040 in deep. Tapped with Helicoil Tap No. 6 CBB 0.749 in (min) deep (3/8 UNC 1.5D insert).

Holes C - These four holes may be drilled 0.3906 in dia x 0.937 + 0.040 in deep. Tapped with Helicoil Tap No. 6 CPB or 6CS x 0.875 in (min) deep (3/8 UNC 1.5D insert).

Holes D - These four holes may be drilled 0.261 in dia x 0.675 + 0.040 in deep. Tapped with Helicoil Tap No. 4 CPB or 4CS x 0.625 in (min) deep (1/4 UNC 1.5D insert).

Holes E - These six holes may be drilled 0.3906 in dia x 0.937 + 0.040 in deep. Tapped with Helicoil Tap No. 6 CPB or 6CS x 0.875 in (min) deep (3/8 UNC 1.5D insert).



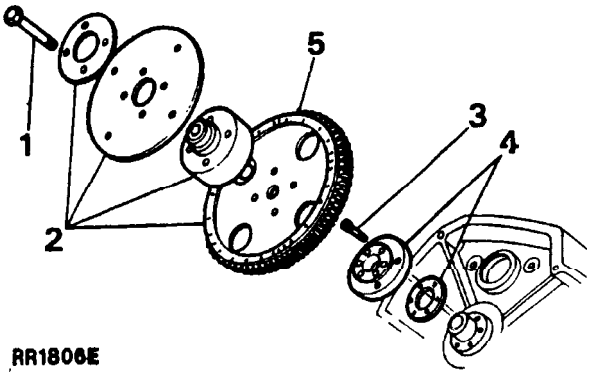
NOTE: Right-hand cylinder head illustrated.

F Exhaust manifold face
G Intake manifold face
H Front face
I Rear face
J Front of engine

REMOVE THE FLEXIBLE DRIVE PLATE AND RING GEAR ASSEMBLY

NOTE: To ensure the following components are re-assembled in their correct radial positions, scribe each component with an identification line to enable each part to be re-assembled in the correct relationship to one another.

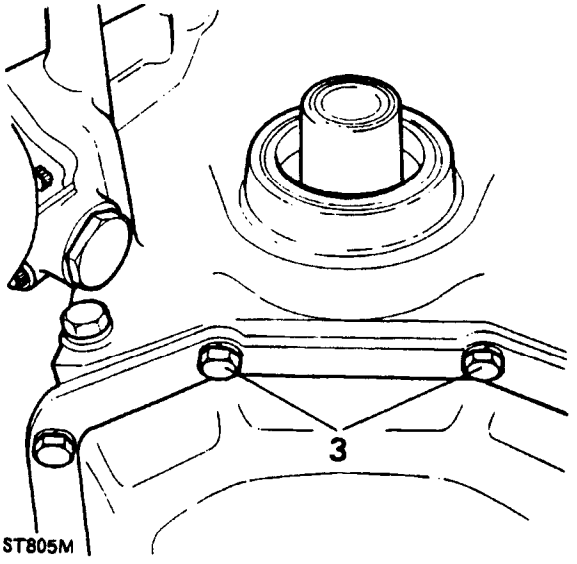
1. Remove the four retaining bolts.
2. Withdraw the clamp ring, flexible drive plate, hub aligner and ring gear assembly.
3. Remove the six socket head bolts securing the crankshaft adaptor plate and shim to the crankshaft flange.
4. Withdraw the crankshaft adaptor plate and shim.
5. Inspect the ring gear assembly for distortion, cracks, chipped or badly worn teeth. If ring gear is in poor condition fit a complete new assembly.



RR1806E

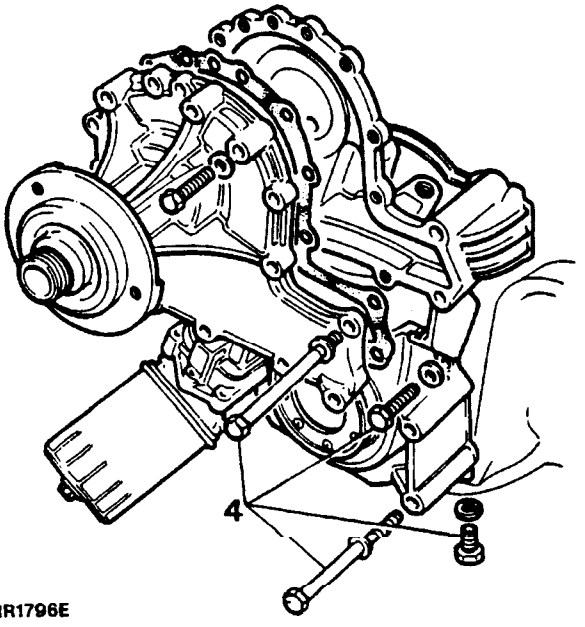
REMOVE TIMING GEAR COVER AND WATER PUMP

1. Place an oil drip-tray beneath the timing cover and remove the oil filter element.
2. Remove the crankshaft pulley bolt and special washer and withdraw the pulley.



ST805M

3. Remove the two bolts securing the sump to the bottom of the timing cover.
4. Remove the remaining timing cover retaining bolts and withdraw the cover complete with oil pump.

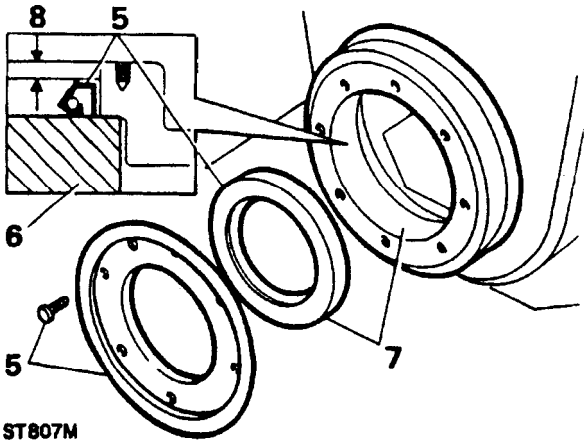


RR1796E

Continued

Fit a new timing cover oil seal

5. Remove the seven drive screws and withdraw the mud shield and the oil seal.
6. Position the gear cover with the front face uppermost and the underside supported across the oil seal housing bore on a suitable wooden block.
7. Enter the oil seal, lip side leading, into the housing bore.
8. Press in the oil seal until the plain face is 1.5 mm (0.059 in) approximately below the gear cover face.
9. Fit the mud shield and secure with the screws.



ST807M

REMOVE THE DISTRIBUTOR

1. Release the single nut securing the distributor clamp.
2. Remove the clamp and withdraw the distributor.
3. If necessary overhaul the distributor, (see distributor overhaul in Section 86 Electrical).

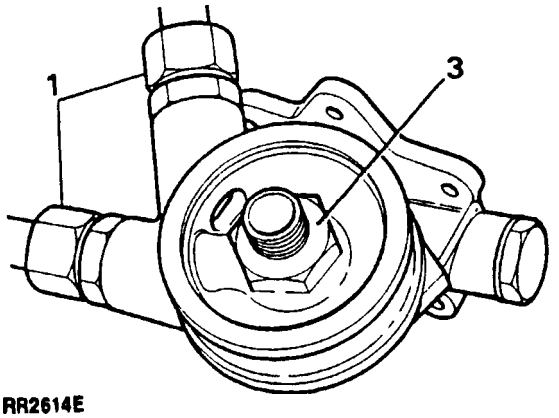
REMOVE ENGINE OIL COOLER ADAPTOR PLATE

1989 Model Year

1. Remove both oil cooler pipes.
2. Mark the position of the adaptor plate relative to the oil pump cover.
3. Remove the centre fixing and withdraw the adaptor plate.

Refit

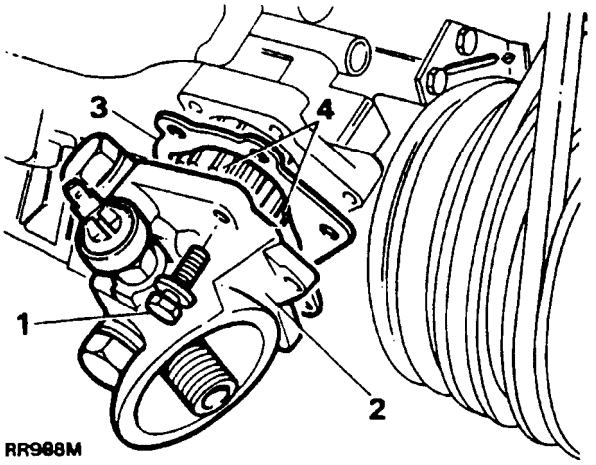
4. Reverse the removal procedure, lining up the location marks to ensure pipe runs are correct. Ensure the pipes and centre fixing are tightened to the specified torque, see Torque values - section 06.



RR2614E

REMOVE AND OVERHAUL THE OIL PUMP

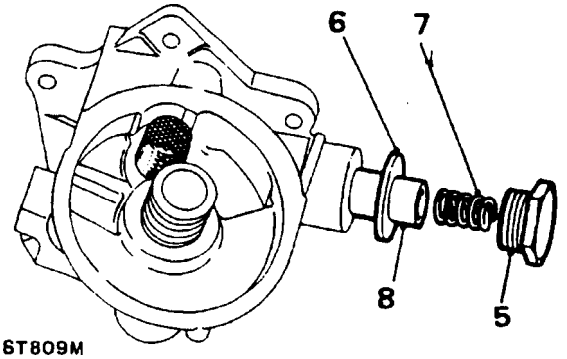
1. Remove the bolts from the oil pump cover.
2. Withdraw the oil pump cover.
3. Lift off the cover and remove the gasket.
4. Withdraw the oil pump gears.



RR988M

Dismantle pump

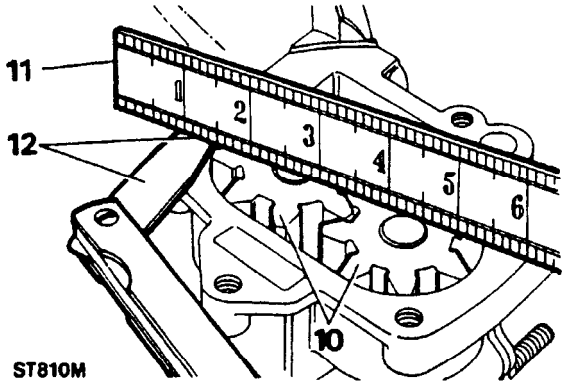
5. Unscrew the plug from the pressure relief valve.
6. Lift the sealing washer from the plug.
7. Withdraw the spring from the relief valve.
8. Withdraw the pressure relief valve.



ST809M

Examine pump

9. Check the oil pump gears for wear or scores.
10. Fit the oil pump gears and shaft into the front cover.
11. Place a straight edge across the gears.
12. Check the clearance between the straight edge and the front cover. If less than 0.05 mm (0.002 in), check the front cover gear recess for wear.



ST810M

13. Check the oil pressure relief valve for wear or scores.
14. Check the sides of the relief valve spring for wear or signs of collapse.
15. Clean the wire screen filter for the relief valve.
16. Check the fit of the relief valve in its bore. The valve must be an easy slide fit with no perceptible side movement.

Assemble pump

17. Insert the relief valve spring.
18. Locate the sealing washer on to the relief valve plug.
19. Fit the relief valve plug and tighten to correct torque(see section 06-Torque values).
20. Fully pack the oil pump gear housing with Petroleum Jelly. Use only Petroleum Jelly; no other grease is suitable.
21. Fit the oil pump gears so that the Petroleum Jelly is forced into every cavity between the teeth of the gears.

IMPORTANT: Unless the pump is fully packed with Petroleum Jelly it may not prime itself when the engine is started.

22. Place a new gasket on the oil pump cover.
23. Locate the oil pump cover in position.
24. Fit the special fixing bolts and gradually tighten to the specified torque (see section 06-Torque values).

ENGINE OIL PRESSURE TEST

Special tools:
LST502-1: Adaptor pressure take off
18G502A: O-300 p.s.i. Pressure guage
18G502K: Hose and adaptors

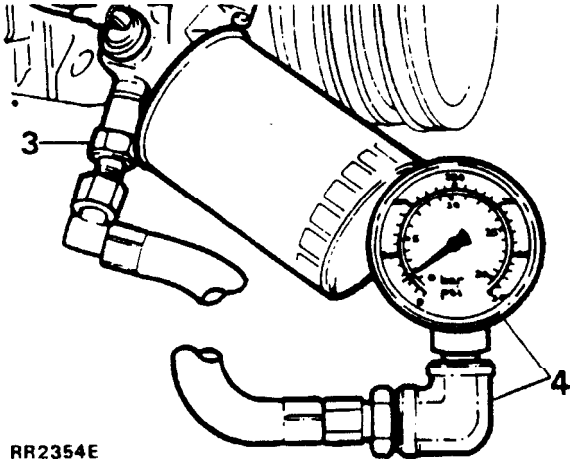
The following procedure applies to engines that have completed in excess of 1,000 miles and are filled with 15W/40 engine oil. The engine must be installed in the vehicle.

WARNING: Suitable extraction equipment must be fitted to the exhaust system of the vehicle, if the test is being carried out in the workshop.

WARNING: If the vehicle has been running the engine oil will be hot, care must be taken when fitting the equipment to prevent the possibility of personal injury due to scalding.

TEST

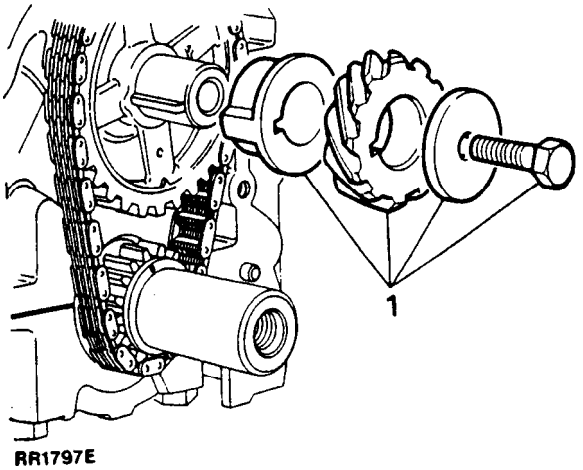
1. Place the vehicle on a suitable hoist.
2. Disconnect the battery negative terminal,
3. Remove the bolt from the oil pump housing and install adaptor LST502-1.
4. Fit pressure guage 18G502A to hose 18G502K, fit the hose and guage to adaptor LST502-1. Tighten all joints securely.
5. Connect the battery terminal and ensuring that the park brake is applied and that 'P' *or* 'N' is selected in the main gearbox start and run the engine. Run the engine until normal engine operating temperature is achieved (thermostat open).
6. With the engine speed maintained at 2400 rpm there should be a minimum engine oil pressure of 1.76 kg/cm² (25 p.s.i.)



RR2354E

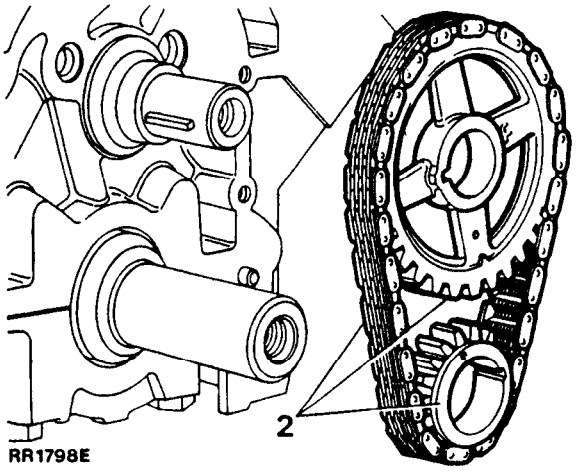
REMOVE TIMING CHAIN SPROCKET AND CAMSHAFT

1. Remove the retaining bolt and washer and withdraw the distributor drive gear and spacer.



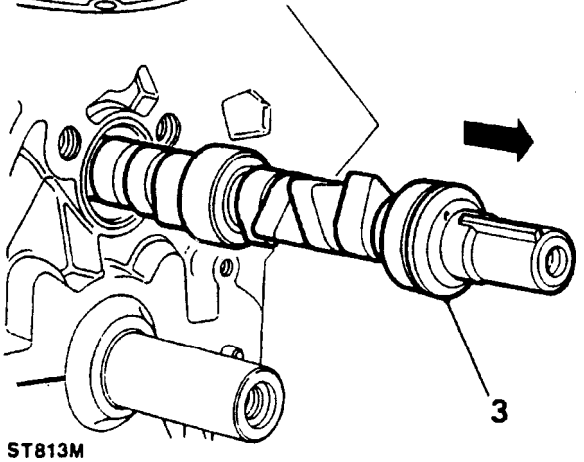
RR1797E

2. Withdraw the sprocket complete with timing chain.



RR1798E

3. Withdraw the camshaft while taking particular care not to damage the bearings in the cylinder block.



ST813M

Examine components

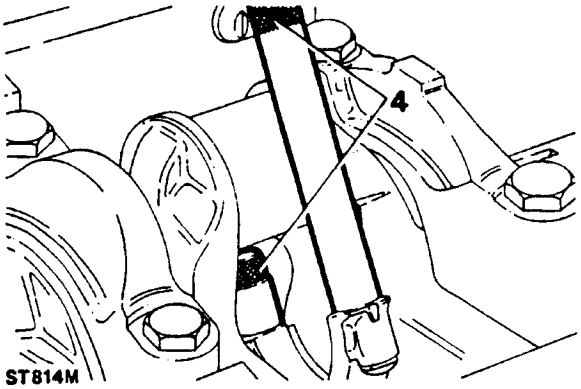
4. Visually examine all parts for wear. Check the camshaft bearing journals and cams for wear, pits, scores and overheating. Should any of these conditions be present fit a new camshaft.
5. Examine the links and pins of the timing chain for wear and compare its condition with that of a new chain. Similarly the teeth of the sprockets should be inspected and if necessary fit a new sprocket.
6. Measure the camshaft journals for overall wear, out of roundness and taper. The diameters of the five journals are as follows starting from the front of the shaft:

   Number 1 journal 1.786 to 1.785 in (45.4 to 45.3 mm)
   Number 2 journal 1.756 to 1.755 in (44.6 to 44.5 mm)
   Number 3 journal 1.726 to 1.725 in (43.84 to 43.81 mm)
   Number 4 journal 1.696 to 1.695 in (43.07 to 43.05 mm)
   Number 5 journal 1.666 to 1.665 in (42.31 to 42.29 mm)

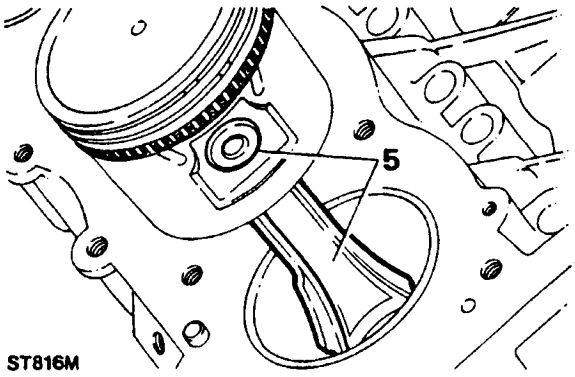
7. To check the camshaft for straightness rest the two end journals i.e. numbers 1 and 5 on 'V' blocks and mount a dial gauge on the centre journal. Rotate the shaft and note the reading. If the run out is more than 0.05 mm (0.002in) fit a new camshaft.

REMOVE AND OVERHAUL CONNECTING RODS AND PISTONS

1. Withdraw the retaining bolts and remove the sump.
2. Remove the sump oil strainer.
3. Remove the connecting rod caps and retain them in sequence for reassembly.
4. Screw the guide bolts 605351 onto the connecting rods.



5. Push the connecting rod and piston assembly up the cylinder bore and withdraw it from the top. Retain the connecting rod and piston assemblies in sequence with their respective caps.
6. Remove the guide bolts 605351 from the connecting rod.



Overhaul

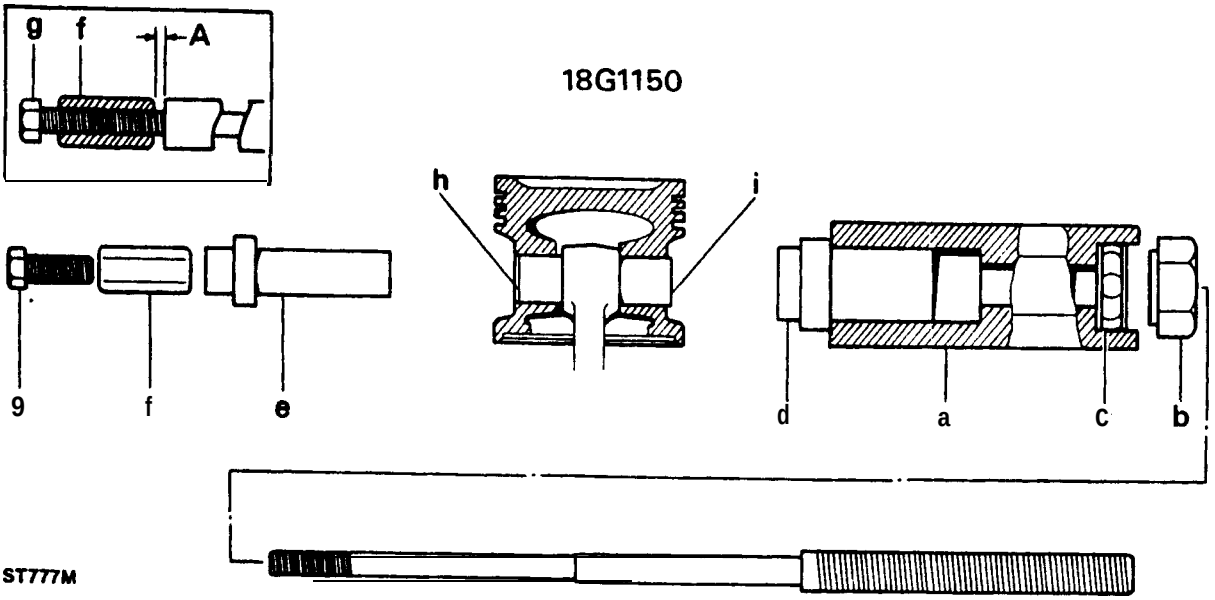
NOTE: The connecting rods, caps and bearing shells must be retained in sets, and in the correct sequence. Remove the piston rings over the crown of the piston. If the same piston is to be refitted, mark it relative to its connecting rod to ensure that the original assembly is maintained.

7. Withdraw the piston pin, using toot 18G 1150 as follows:

a. Clamp the hexagon body of 18G 1150 in a vice.
b. Position the large nut flush with the end of the centre screw.
c. Push the screw forward until the nut contacts the thrust race.
d. Locate the piston adaptor 18G 1150E with its long spigot inside the bore of the hexagon body.
e. Fit the remover/replacer bush of 18G 11 SO on the centre screw with the flanged end away from the piston pin.
f. Screw the stop-nut about half-way onto the smaller threaded end of the centre screw, leaving a gap 'A' of 3 mm (1/8 in) between this nut and the remover/ replacer bush.
g. Lock the stop-nut securely with the lock screw.
h. Check that the remover/ replacer bush is correctly positioned in the bore of the piston.
i. Push the connecting-rod to the right to expose the end of the piston pin, which must be located in the end of the adaptor 'd'.
j. Screw the large nut up to the thrust race.

Continued

k. Hold the lock screw and turn the large nut until the piston pin has been withdrawn from the piston. Dismantle the tool.



Original pistons

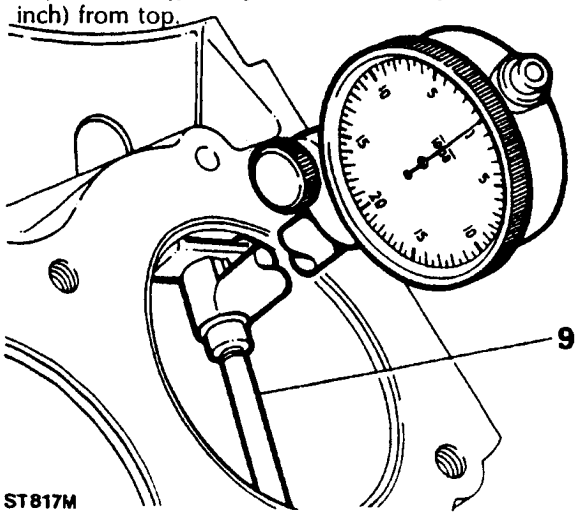
8. Remove the carbon deposits, particularly from the ring grooves. Examine the pistons for signs of damage or excessive wear; refer to 'new pistons' for the method of checking the running clearance. Fit new pistons if necessary.

New pistons

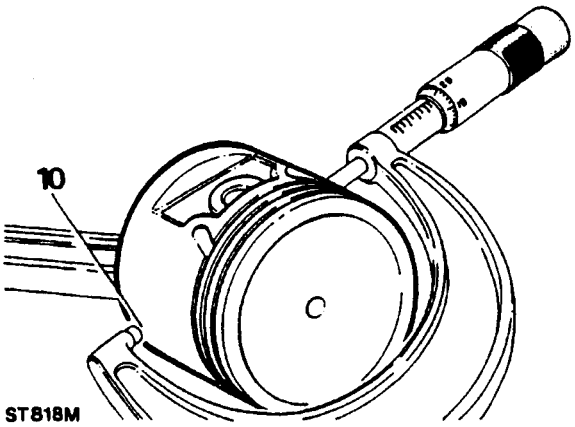
NOTE: Pistons are available in service standard size and in oversizes of 0.25 mm (0.010 in) and 0.50 mm (0.020 in). Service standard size pistons are supplied 0.0254 mm (0.001 in) oversize. When fitting new service standard size pistons to a cylinder block, check for correct piston to bore clearance, honing the bore if necessary. Bottom of piston skirt/bore clearance should be 0.016 to 0.033 mm (0.0007 to 0.0013 in).

NOTE: The temperature of the piston and cylinder block must be the same to ensure accurate measurement. When reboring the cylinder block, the crankshaft main bearing caps must be fitted and tightened to the correct torque (see section 06-Torque Values).

9. Check the cylinder bore dimension at right angles to the piston pin 40 to 50 mm (1.5 to 2 inch) from top.



10. Check the piston dimension at right angles to the piston pin, at the bottom of the skirt.

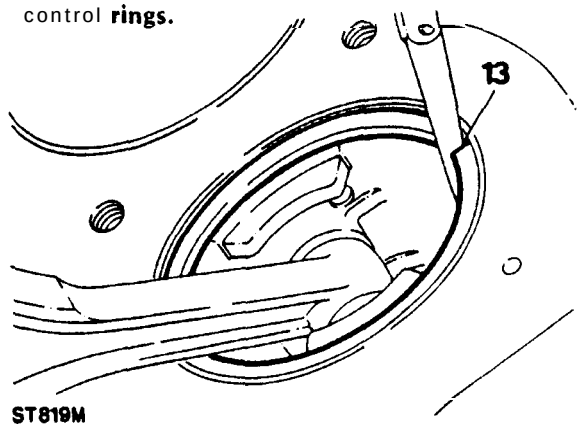


11. The piston dimension must be 0.018 to 0.033 mm (0.0007 to 0.0013 in). smaller than the cylinder.

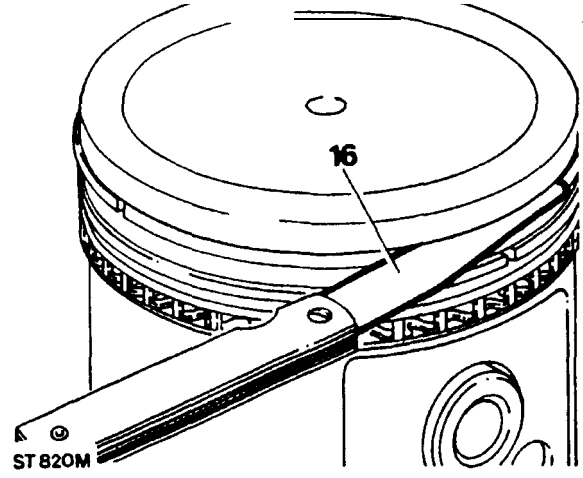
12. If new piston rings are to be fitted without reboring, deglaze the cylinder walls with a hone, without increasing the bore diameter, to provide a cross-hatch finish. After honing, thouroughly clean the piston bores to remove all traces of foreign matter.

13. **Check the compression ring in the applicable cylinder, held square to the bore with the piston. Gap limits: 0.44 to 0.56 mm (0.017 to 0.022 in). Use a fine-cut flat file to increase the gap if required. Select a new piston ring if the gap exceeds the limit.**

NOTE: Gapping does not apply to oil control **rings.**

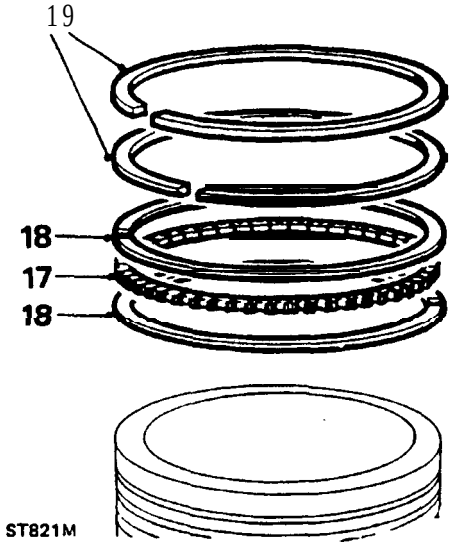


14. **Temporarily fit the compression rings to the piston.**
15. **The ring marked 'TOP' must be fitted with the marking uppermost and into the second groove. The chrome ring is for the top groove and can be fitted either way round.**
16. **Check the compression ring clearance in the piston groove. Clearance limits: 0.05 to 0.10 mm (0.002 to 0.004).**



Fit piston rings

17. **Fit the expander ring into the bottom groove making sure that the ends butt and do not overlap.**
18. **Fit two ring rails to the bottom groove, one above and one below the expander ring.**
19. **Fit the second compression ring with the marking 'TOP' uppermost and the groove, either way round.**

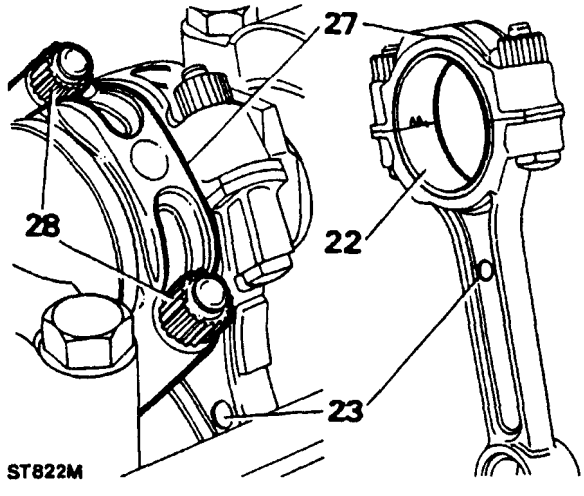


Examine connecting rods

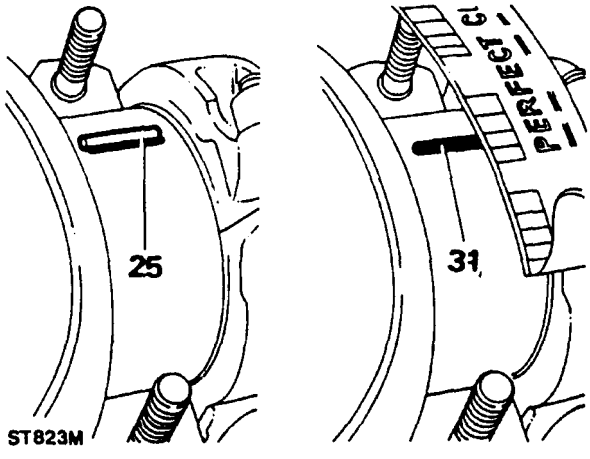
20. Check the alignment of the connecting rod.
21. Check the connecting rod small end, the piston pin must be a press fit.

Check crankshaft bearings

22. Locate the bearing upper shell into the connecting rod.
23. Locate the connecting rod and bearing onto the applicable crankshaft journal, noting that the domed shape boss on the connecting rod must face towards the front of the engine on the right hand bank of cylinders and towards the rear on the left hand bank.
24. When both connecting rods are fitted, the bosses will face inwards towards each other.



25. Place a piece of Plastigauge (P61) across the centre of the lower half of the crankshaft journal.
26. Locate the bearing lower shell into the connecting rod cap.
27. Locate the cap and shell onto the connecting rod. Note that the rib on the edge of the cap must be *on* the same side as the domed shape boss on the connecting rod.
20. Secure the connecting rod cap. Tighten to the correct torque (see section 06-Torque values).
29. Do not rotate the crankshaft or connecting rod while the Plasiigauge is in use.



Continued

30. Remove the connecting rod cap and shell.
31. Using the scale printed on the Plastigauge packet, measure the flattened Plastigauge at its widest point.
32. The graduation that most closely corresponds to the width of the Plastigauge indicates the bearing clearance.
33. The correct bearing clearance with new or overhauled components is 0.015 to 0.055 mm (0.0006 to 0.0022 in).
34. If a bearing has been in service, it is advisable to fit a new bearing if the clearance exceeds 0.08 mm (0.003 in).
35. If a new bearing is being fitted, use selective assembly to obtain the correct clearance.
36. Wipe off the Plastigauge with an oily rag. DO NOT scrape it off.

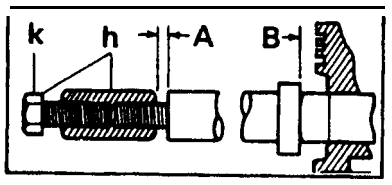
NOTE: It is important that the connecting rods, caps and bearing shells be retained in sets, and in the correct sequence.

Assembling pistons to connecting rods

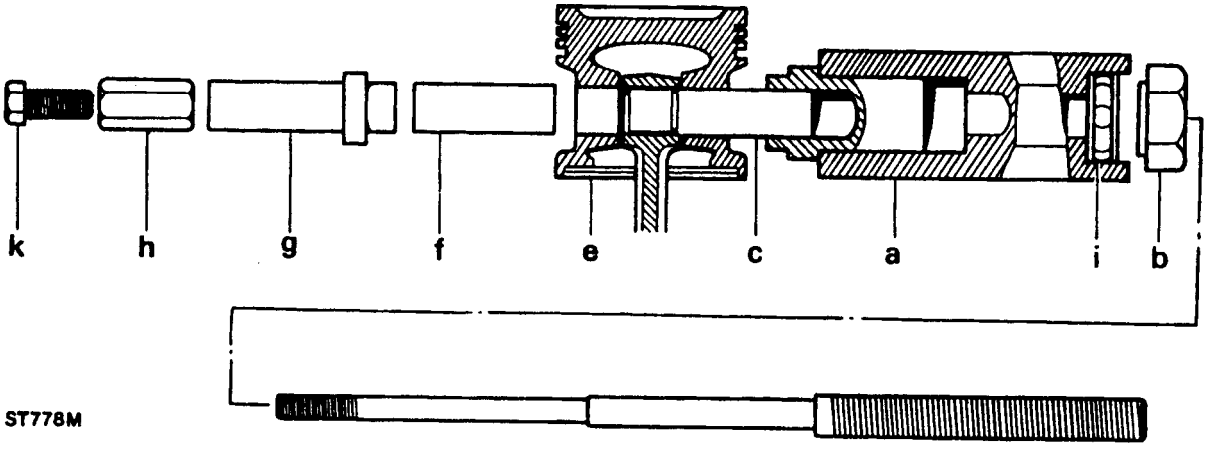
37. Using tool 18G 1150 refit each piston to its connecting rod as follows:

a. Clamp the hexagon body of 18G 1150 in a vice, with the adaptor 18G 1150 E positioned as in 7d.
b. Remove the large nut of 18G 1150 and push the centre screw approximately 50 mm (2 in) into the body until the shoulder is exposed.
c. Slide the parallel guide sleeve, grooved end last, onto the centre screw and up to the shoulder.
d. Lubricate the piston pin and bores of the connecting rod and piston with graphited oil (Molykore 2). Also lubricate the ball race and centre screw of 18G 1150.
e. Fit the connecting rod and the piston together onto the tool with the markings aligned if the original pair are being used and with the connecting rod around the sleeve up to the groove.
f. Fit the piston pin into the piston bore, up to the connecting rod.
g. Fit the remover/replacer bush 18G 11 50/3 with its flanged end towards the piston pin.
h. Screw the stop nut onto the centre screw and adjust this nut to obtain an 0.8 mm (0.031 in) end float 'A' on the whole assembly, and lock the nut securely with the screw.
i. Slide the assembly back into the hexagon body and screw on the large nut up to the thrust race.
j. Set the torque wrench 18G 537 to 16 Nm (12 ft lb). This represents the minimum load for an acceptable interference fit of the piston pin in the connecting rod.
k. Using the torque wrench and socket 18G 587 on the large nut, and holding the lock screw, pull the piston pin in until the flange of the remover/replacer bush is 4mm (0.157 in) 'B' from the face of the piston. Under no circumstances must this flange be allowed to contact the piston.

CAUTION: If the torque wrench has not reached at least 12 ft.lbs throughout the pull, the fit of the piston pin to the connecting rod is not acceptable and necessitates the fitting of new components. The large nut and centre screw of the tool must be kept well oiled.



18G.1150

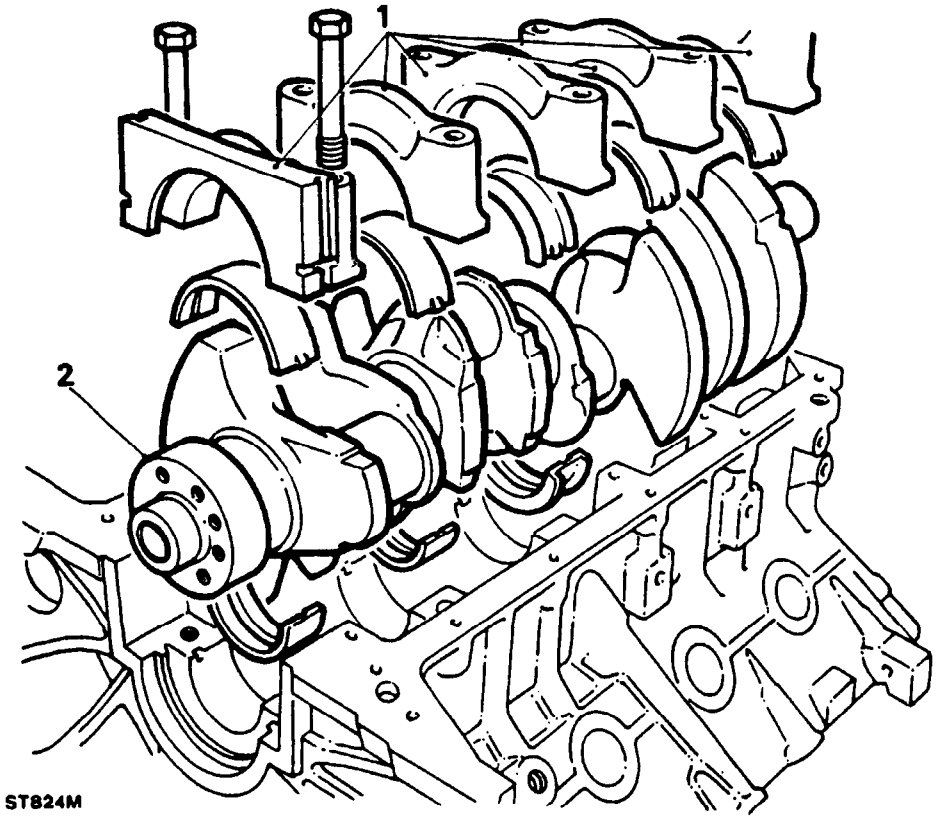


ST778M

38. Remove the tool and check that the piston moves freely on the piston pin and that no damage has occurred during pressing.

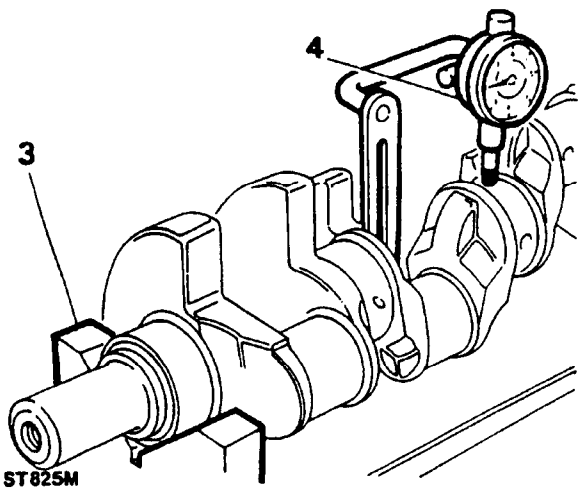
REMOVE AND OVERHAUL CRANKSHAFT

1. Remove the main bearing caps and lower bearing shells and retain in sequence. It is important to keep them in pairs and mark them with the number of the respective journal until it is decided if the bearing shells are to be refitted.
2. Lift out the crankshaft and rear oil seal.



Inspect and overhaul crankshaft

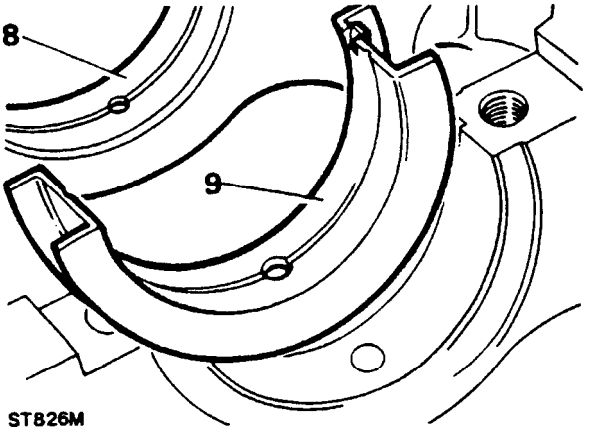
3. Rest the crankshaft on vee-blocks at numbers one and five main bearing journals.
4. Using a dial indicator, check the run-out at numbers two, three and four main bearing journals. The total indicator readings at each journal should not exceed 0.08 mm (0.003 in).



5 While checking the run-out at each journal, note the relation of maximum offset on each journal to the others. The maximum on all journals should all come at very near the same angular location.
6. If the crankshaft fails to meet the foregoing checks it is bent and is unsatisfactory for service.
7. Check each crankshaft journal for out of round. If the out of round exceeds 0.040 mm (0.0016 in) around the crankshaft journal, a reground or new crankshaft should be fitted.
8. Bearings for the crankshaft main journals and the connecting rod journals are available in the following undersizes:

0.25mm (0.010 in)
0.50mm (0.020 in)

9. The centre main bearing shell, which controls crankshaft thrust, has the thrust faces increased in thickness when more than 0.25 mm (0.010 in) undersize, as shown on the following chart.



10. When a crankshaft is to be reground, the thrust faces on either side of the centre main journal must be machined in accordance with the dimensions in the charts that follow:

Main bearing journal size	Thrust face width
Standard	Standard
0.25 mm (0.010 in) undersize	Standard
0.50 mm (0.020 in) undersize	0.25 mm (0.010 in oversize

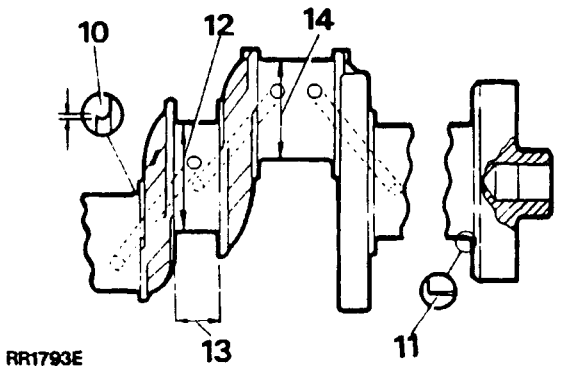
11. For example: If a 0.50 mm (0.020 in) undersize bearing is to be fitted, then 0.12 mm (0.005 in) must be machined off each thrust face of the centre journal, maintaining the correct radius.

Crankshaft dimensions

12. The radius for all journals except the rear main bearing is 1.90 to 2.28 mm (0.075 to 0.090 in).
13. The radius for the rear main bearing journal is 3.04 mm (0.120 in).

Continued

14. Main bearing journal diameter, see the following charts.
15. Thrust face width, and connecting rod journal diameter, see the following charts.



Crankshaft dimensions-millimetre

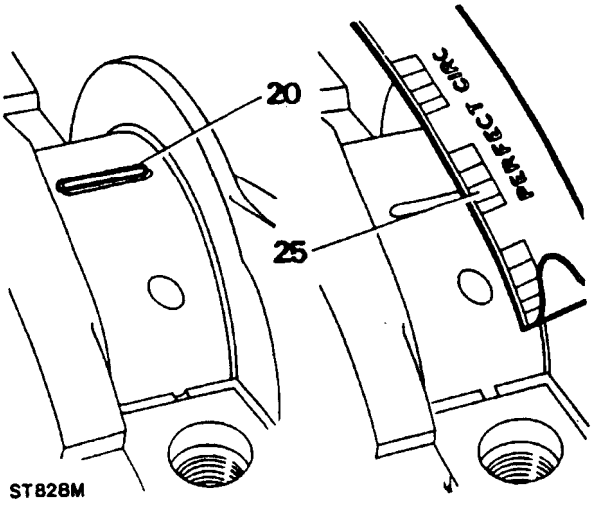
Crankshaft Grade	Diameter '12'	Width '13'	Diameter '14'
Standard	58.400-58.412	26.975-27.026	50.800-50.812
0.254 U/S	58.146-58.158	26.975-27.026	50.546-50.558
0.508 U/S	57.892-57.904	27.229-27.280	50.292-50.304

Crankshaft dimensions - inches

Crankshaft Grade	Diameter '12'	Width '13'	Diameter '14'
Standard	2.2992-2.2997	1.062-1.064	2.0000-2.0005
0.010 U/S	2.2892-2.2897	1.062-1.064	1.9900-1.9905
0.020 U/S	2.2792-2.2797	1.072-1.074	1.9800-1.9805

Check main bearing clearance

16. Remove the oil seals from the cylinder block and the rear main bearing cap.
17. Locate the upper main bearing shells into the cylinder block. These must be the shells with the oil hole and oil grooves.
18. Locate the flanged upper main bearing shell in the centre position.
19. Place the crankshaft in position on the bearings.
20. Place a piece of Plastigauge across the centre of the crankshaft main bearing journals.
21. Locate the bearing lower shell into the main bearing cap.



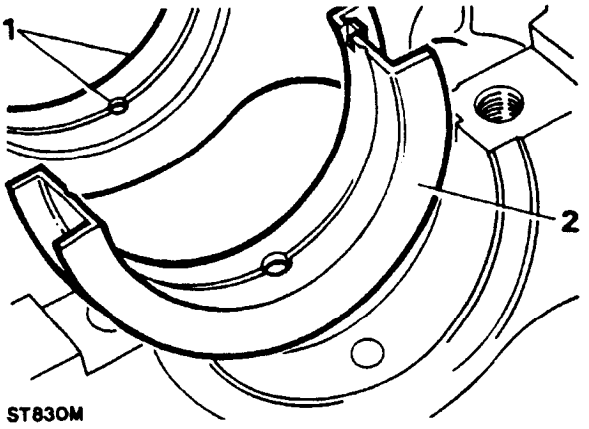
22. Fit numbers one to four main bearing caps and shells, tighten to the correct torque (see section 06-Torque values).

23. Fit the rear main bearing cap and shell and tighten to the correct torque (see section 06-Torque values). Do not allow the crankshaft to be rotated while the Plastigauge is in use.
24. Remove the main bearing caps and shells.
25. Using the scale printed on the Plastigauge packet, measure the flattened Plastigauge at its widest point.
26. The graduation that most closely corresponds to the width of the Plastigauge indicates the bearing clearance.
27. The correct bearing clearance with new or overhauled components is 0.023 to 0.065 mm (0.0009 to 0.0026 in).
28. If the correct clearance is not obtained initially, select a suitable bearing to give the required clearance.
29. Wipe off the Plastigauge with an oily rag. Do NOT scrape it off.
30. Maintain the bearing shells and caps in sets and in the correct sequence.

ASSEMBLING ENGINE

FIT CRANKSHAFT AND MAIN BEARINGS

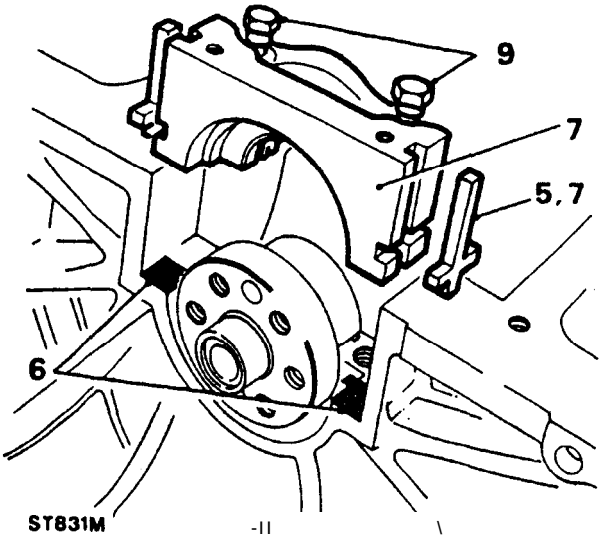
1. Locate the upper main bearing shells into the cylinder block; these must be the shells with the oil holes and oil grooves.
2. Locate the flanged upper main bearing shell in the centre position.
3. Lubricate the crankshaft main bearing journals and bearing shells with clean engine oil and lower the crankshaft into position.



ST830M

4. Lubricate the lower main bearing shells and fit numbers one to four main bearing caps and shells only, leaving the fixing bolts finger-tight at this stage.
5. Fit the cross shaped side seals to the grooves each side of the rear main bearing cap. Do not cut the side seals to length, they must protrude 1.5 mm (0.062 in) approximately above the bearing cap parting face.
6. Apply Hylomar SQ32M jointing compound to the rearmost half of the rear main bearing cap parting face or, if preferred, to the equivalent area on the cylinder block as illustrated.
7. Lubricate the bearing half and bearing cap side seals with clean engine oil.
8. Fit the bearing cap assembly to the engine. Do not tighten the fixings at this stage but ensure that the cap is fully home and squarely seated on the cylinder block.
9. Tension the cap bolts equally by one-quarter turn approximately, then back off one complete turn on each fixing bolt.

Continued

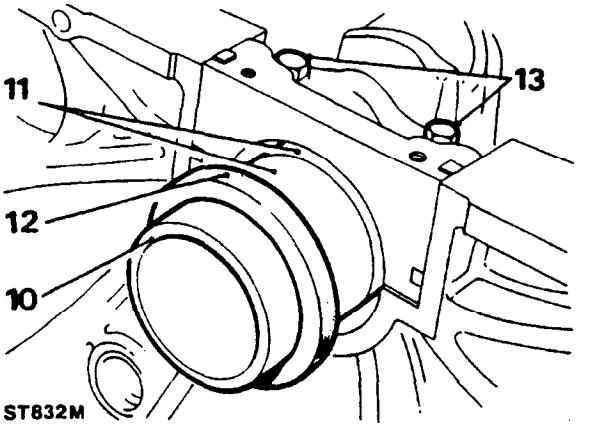


CAUTION: Do **not handle the oil seal lip, visually check that it is not damaged and ensure that the outside diameter remains clean and dry.**

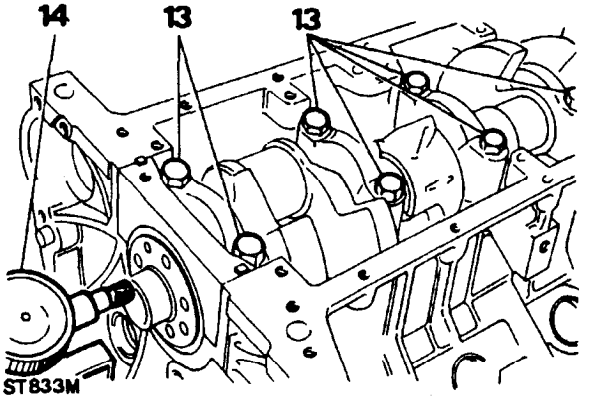
10. **Position the seal guide RO 1014 on the crankshaft flange.**
11. **Ensure that the oil seal guide and the crankshaft journal are scrupulously clean, then coat the seal guide and oil seal journal with clean engine oil.**

NOTE: The lubricant coating must cover the seal guide outer surface completely to ensure that the oil seal lip is not turned back during assembly.
Position the oil seal, lipped side towards the engine, on to the seal guide. The seal outside diameter must be clean and dry.

12. **Push home the oil seal fully and squarely by hand into the recess formed in the cap and block until it contacts the machined step in the recess.**
Withdraw the seal guide.

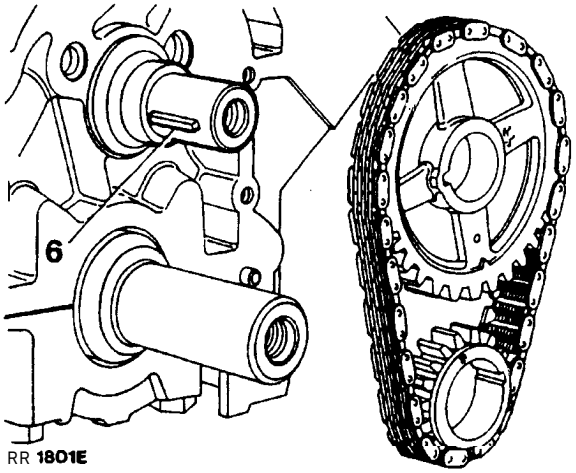


13. **Tighten the main bearing cap bolts to the correct torque (see section 06-Torque values) noting that the bolts for numbers one to four bearings have a different torque to number five bearing cap bolts.**
14. **Using a feeler gauge or a dial indicator check the crankshaft end-float, 0.10 to 0.20 mm (0.004 to 0.008 in).**



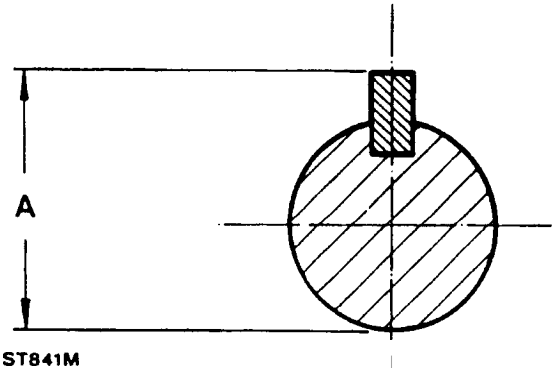
CAUTION: Do **not exceed 1,000 engine rev/min for 15 seconds when first starting the engine, otherwise the crankshaft rear oil seal will be damaged.**

6. Engage the sprocket assembly on the camshaft and crankshaft key locations and check that the camshaft key is parallel to the shaft axis to ensure adequate lubrication of the distributor drive gear.



RR 1801E

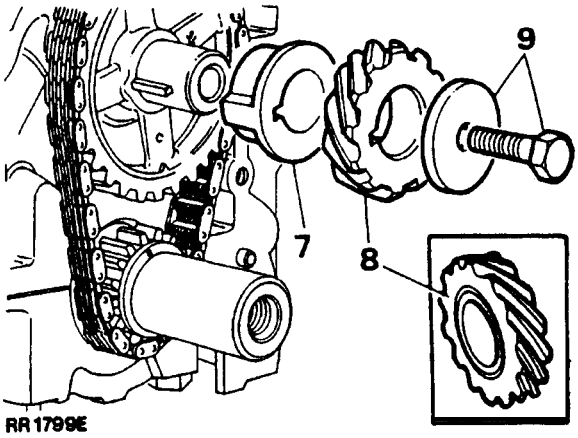
CAUTION: The space between the key and keyway acts as an oilway for lubrication of the drive gear. Ensure that the key is seated to the full depth of the keyway. The overall dimension of shaft and key must not exceed 30.15 mm (1.187 in). Dimension A below.



ST841M

7. Check that the timing marks line up and fit the spacer with the flange to the front.

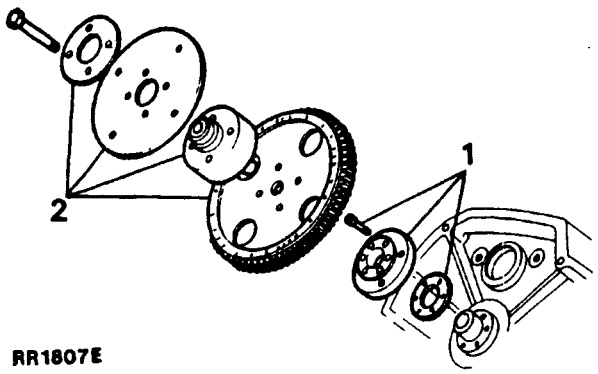
8. Fit the distributor drive gear ensuring that the annular grooved side is fitted to the rear, that is towards the spacer.
9. Secure the drive gear and camshaft sprocket assembly with the bolt and washer and tighten to the correct torque (see section 06-Torque values).



RR 1799E

FIT THE RING GEAR AND FLEXIBLE DRIVE PLATE
ASSEMBLY

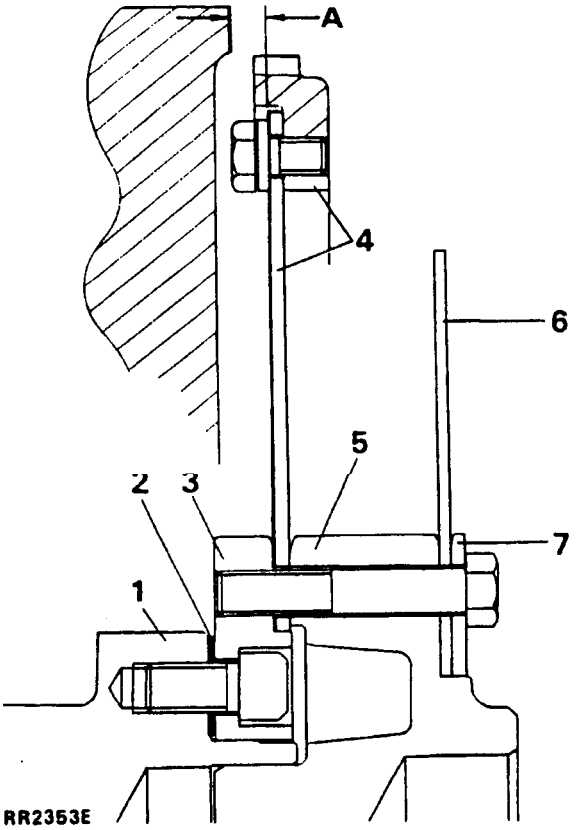
1. Fit the shim and crankshaft adaptor plate to the crankshaft flange noting the previously marked identification lines and secure in position with the six socket head bolts. Do not fully tighten the bolts at this stage.
2. Fit the ring gear assembly, hub aligner, flexible drive plate noting the previously marked identification lines and secure in position with the four bolts and clamping ring. Do not fully tighten the bolts at this stage.



RR1807E

3. To ensure that there is no distortion to the flexible drive plate when bolted to the torque converter, check the setting height of the drive plate as follows.
4. To prevent excessive clearance, a shim is fitted between the crankshaft drive flange and crankshaft adaptor plate. The setting height, dimension A, is measured between the front face of the ring gear drive plate and engine cylinder block to gearbox mating face, a dimension of 8.08 to 8.20 mm (0.318 to 0.323 in) is to be maintained. Should this dimension not be achieved a selection of shims in progressive thicknesses is available. Select the appropriate shim to maintain the dimension, as shown below.

PART NO.	DIMENSION (MM)
FRC 7084	1.20 • 1.25
FRC 7085	1.30 • 1.35
FRC 7086	1.40 • 1.45
FRC 7087	1.50 • 1.55
FRC 7088	1.60 • 1.65
FRC 7089	1.70 • 1.75
FRC 7090	1.80 • 1.85
FRC 7091	**1.90 - 1.95**
FRC 7092	2.00 • 2.05
FRC 7093	2.10 • 2.15

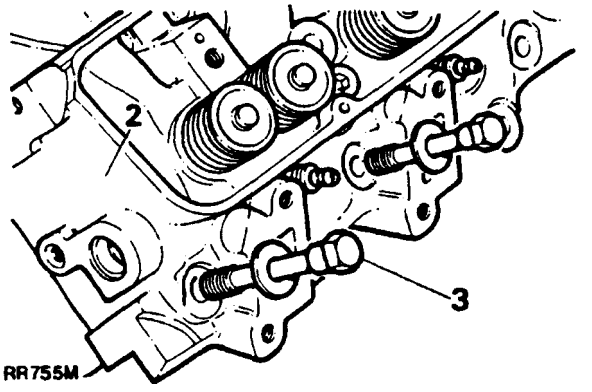


RR2353E

KEY:

1. Crankshaft flange.
2. Shim.
3. Crankshaft adaptor flange.
4. Drive plate and ring gear assembly.
5. Hub aligner.
6. Flexible drive plate.
7. Clamp ring.

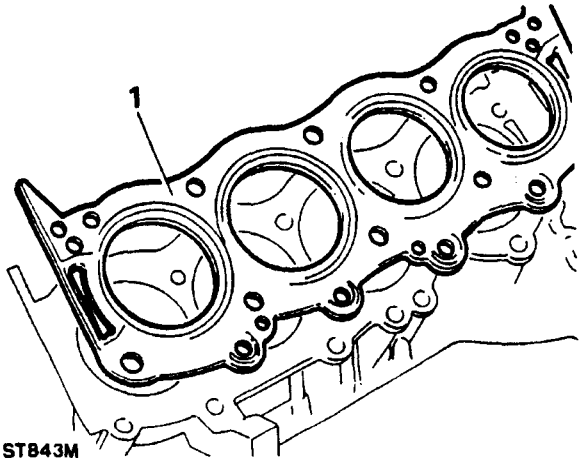
5. Remove the four bolts clamp ring flexible drive plate hub aligner and ring gear assembly.
6. Remove the six socket head bolts and crankshaft adaptor.
7. Fit the appropriate shim, refit the adaptor and six socket head bolts, tighten to the specified torque (see section 06-Torque values).
8. Fit the ring gear assembly, hub aligner, flexible drive plate and clamp ring.
9. Coat the threads of the four securing bolts with Loctite 270 prior to assembly, fit the bolts and tighten to the specified torque (see section 06-Toque values).



RR755M

FIT CYLINDER HEADS

1. Fit new cylinder head gaskets with the word 'TOP' uppermost. Do NOT use sealant.

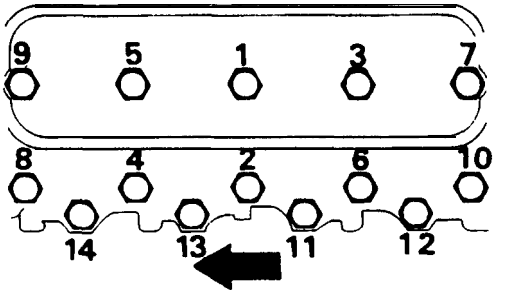


ST843M

2. Locate the cylinder heads on the block dowel pins.
3. Clean the threads of the cylinder head bolts then coat them with Thread Lubricant-Sealant Loctite 572.
4. Locate the cylinder head bolts in position as illustrated and fit dipstick tube.

   Long bolts - 1, 3 and 5.
   Medium bolts - 2,4,6,7,8,9 and 10.
   Short bolts - 11,12,13 and 14.

5. Tighten the cylinder head bolts a little at a time in the sequence shown. (See section OC-Torque values for correct tightening torque).
6. When all bolts have been tightened, recheck the torque values.



ST845M

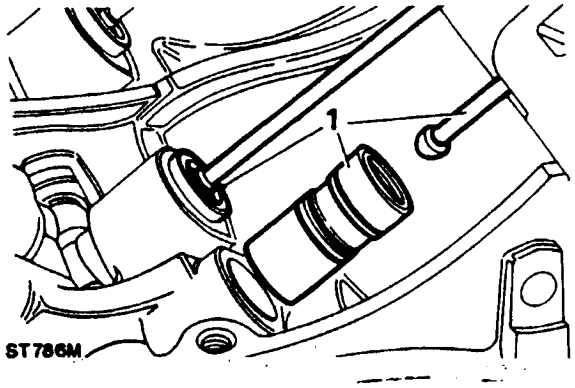
NOTE: left-hand cylinder head illustrated. Arrow points to front of vehicle.

Continued

FIT TAPPETS, PUSH RODS AND ROCKER ASSEMBLIES

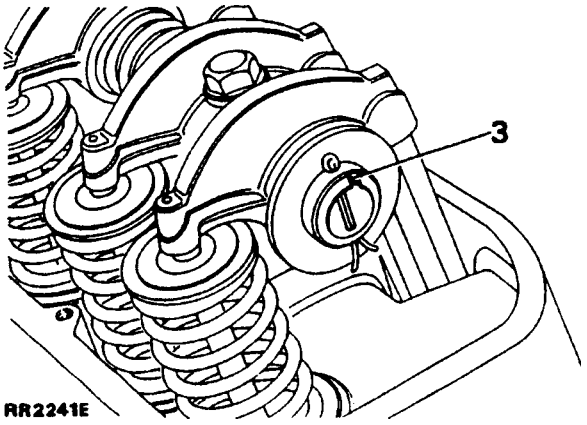
Fit tappets and push rods

1. Fit the tappets and push rods to their original locations, Ensure that the tappets move freely in their respective bores. Before fitting the tappets immerse them in clean engine oil to reduce tappet noise when the engine is first started after the overhaul.

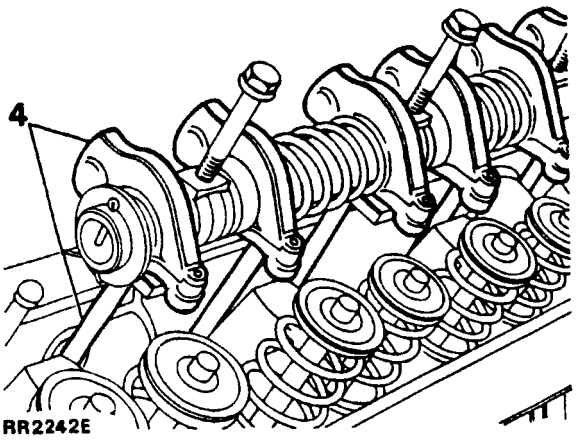


Fit the rocker assemblies

2. The rocker shafts are handed and must be fitted correctly to align the oilways.
3. Each rocker shaft is notched at one end and on one side only. The notch must be uppermost and towards the front of the engine on the right hand side, and towards the rear on the left hand side.



4. Fit the rocker shaft assemblies. Ensure that the pushrods engage the rocker cups. Tighten the bolts to the correct torque (see Section 06 • Torque Values).

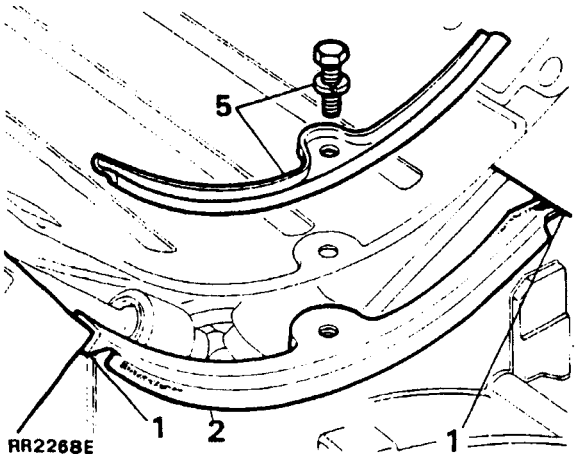


It should be noted that tappet noise can be expected on initial starting up after an overhaul due to oil drainage from the tappet assemblies or indeed if the vehicle has been standing over a very long period. If excessive noise should be apparent after an overhaul, the engine should be run at approximately 2,500 rev/min for a few minutes (subject to the following caution), when the noise should be eliminated.

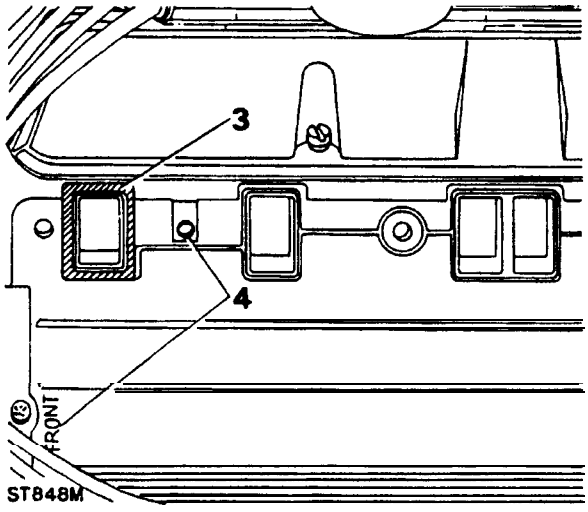
CAUTION: Do not exceed 1,000 engine rev/min for 15 seconds when first starting the engine, othemise the crankshaft rear oil seal will be damaged.

FIT THE INTAKE MANIFOLD

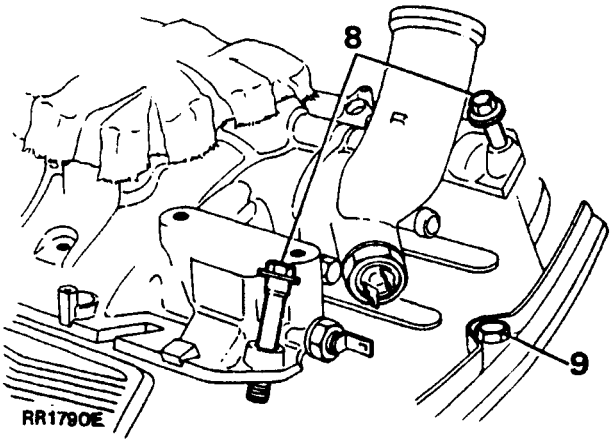
1. Apply a globule of Hylomar SQ32M sealing compound to the notches formed between the cylinder head and block.
2. Locate the NEW seals in position with their ends engaged in the notches formed between the cylinder heads and block.



3. Apply 'Hylomar' SQ32M sealing compound on the corners of the cylinder head, manifold gasket and manifold, around the water passage joints.
4. Fit the manifold gasket with the word 'FRONT' to the front and the open bolt hole at the front R.H. side.
5. Fit the gasket clamps but do not fully tighten the bolts at this stage.

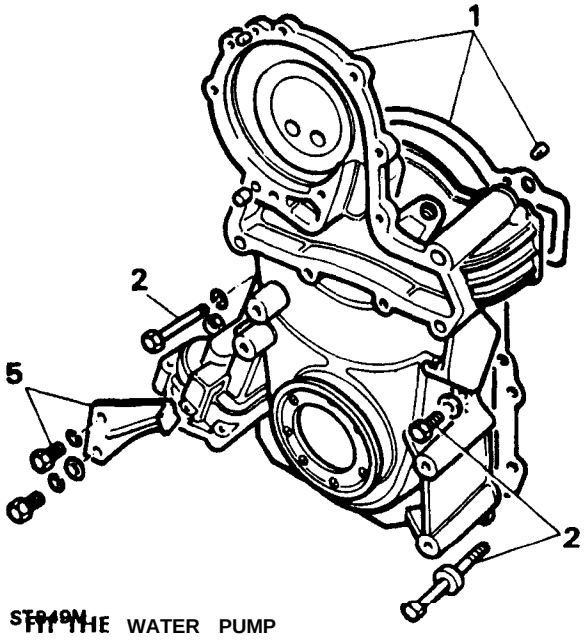


6. Locate the manifold on to the cylinder head.
7. Clean the threads of the manifold securing bolts.
8. Fit all the manifold bolts and tighten them a little at a time, evenly, alternate sides working from the centre to each end and finally tighten to the correct torque (see section 06-Torque values).
9. Tighten the gasket clamp bolts to the correct torque (see section 06-Torque values).



FIT THE TIMING COVER AND CRANKSHAFT PULLEY

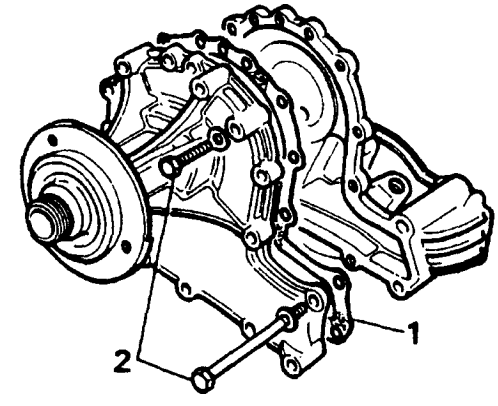
1. Place a new timing cover joint washer in position and fit the timing cover locating it on the two dowels.
2. Clean the threads of the timing cover securing bolts, then coat them with Thread Lubricant-Sealant Loctite 572.
3. Fit and evenly tighten the timing cover bolts to the correct torque (see section 06-Torque values).
4. Fit the crankshaft pulley and tighten the retaining bolt to the correct torque (see section 06-Torque values).
5. Fit timing pointer,



ST919N

FIT THE WATER PUMP

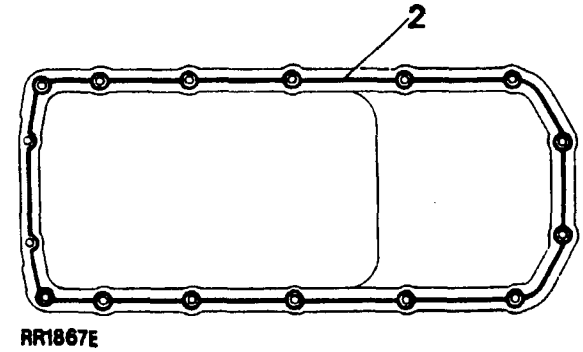
1. Lightly grease a new joint washer and place it in position on the timing cover.
2. Clean the threads of the four long bolts and coat them with Loctite 572 thread lubricant sealant.
   Locate the water pump in position.
3. Locate the alternator adjusting link on the water pump.
4. Leave the alternator adjusting link loose and tighten the remaining water pump housing bolts evenly and to the correct torque (see section 06-Torque values).



RR1795E

FIT THE SUMP

1. Remove any traces of previous sealant from the sump and cylinder block joint faces.
2. Apply a 2 mm (0.08 in) wide bead of Hylosil 102 to the joint face of the sump as shown in the illustration below.

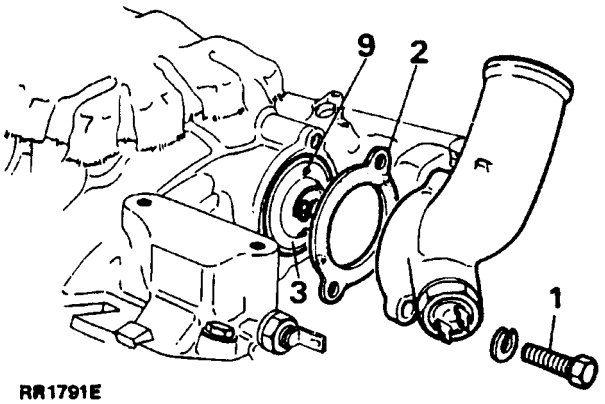


RR1867E

3. Place the sump in position, fit the sump bolts and evenly tighten the bolts to the specified torque (see section 06-Torque values).
4. Allow the vehicle to stand for a period of 30 minutes to ensure that the Hylosil is cured. Failure to do so could possibly result in repeating the sump fitting operation.

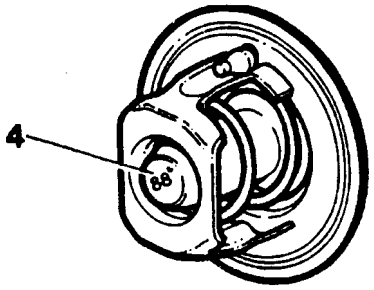
TEST AND FIT THE THERMOSTAT

1. Remove the two bolts securing the thermostat housing to the intake manifold.
2. Remove the housing gasket.
3. Withdraw the thermostat.



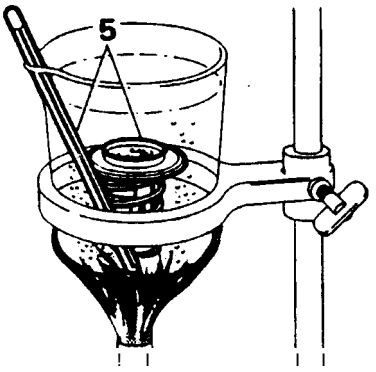
RR1791E

4. Note the temperature stamped on the thermostat at which it should be fully open, 88°C (190°F).



RR799M

5. Place the thermostat and a Centigrade thermometer in a laboratory beaker, or a suitable alternative, half full of water.
6. Heat the water and observe the temperature at which the thermostat opens.
7. If faulty discard the thermostat.
8. Clean the intake manifold and thermostat housing mating faces.

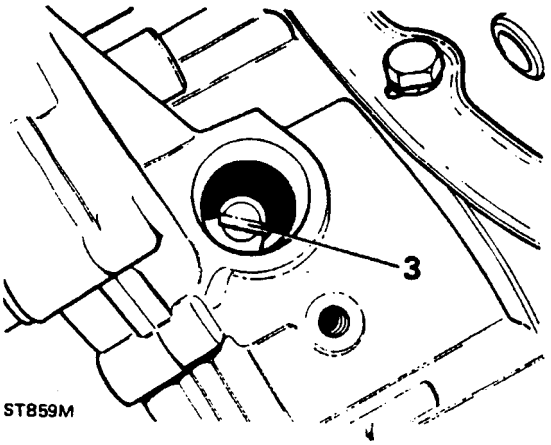


ST858M

9. Fit the thermostat with the jiggle pin uppermost at 12 o'clock.
10. Fit the housing using a new gasket, and tighten the two bolts to the correct torque (see section 06-Torque values).

FIT THE DISTRIBUTOR

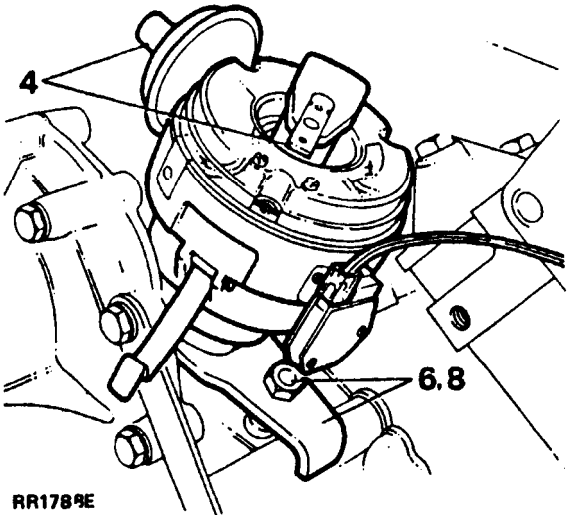
1. Turn the crankshaft to bring number one piston to 6" BTDC on the compression stroke (both valves closed number one cylinder).
2. Turn distributor drive until rotor arm is approximately 30" counter-clockwise from number one spark plug lead position on cap.
3. Turn the oil pump and distributor common drive shaft so that the tongue is in the approximate position as illustrated.



ST859M

Continued

4. Fit the distributor to the engine and check that the centre line of the rotor arm is now in line with number one spark plug lead position in the distributor cap. Reposition distributor if necessary. The vacuum capsule should be at approximately 90" to the camshaft.
5. If distributor does not seat correctly in front cover, oil pump drive is not engaged. In this event, remove distributor, reset oil pump drive tongue as necessary, and repeat operation.
6. Fit the clamp and nut leaving both loose at this stage.



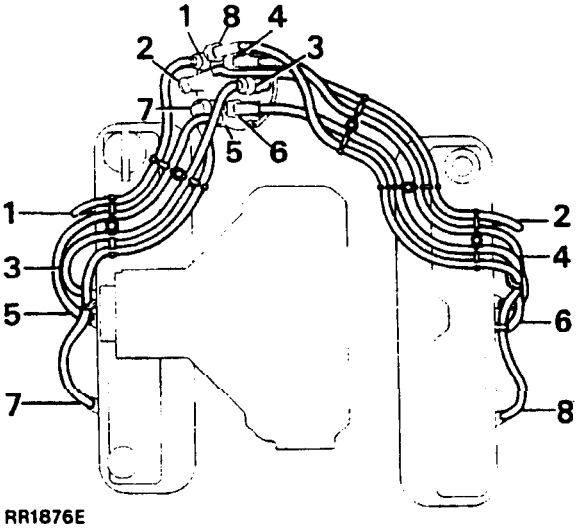
RR1788E

7. Rotate the distributor until the peak on the pick-up lines up with a peak on the reluctor ring. The rotor arm may be removed to afford a better view.

CAUTION: On no account must the engine be started before this operation is carried out.

8. Secure the distributor in this position by tightening the clamp nut.
9. Fit the distributor cap and spark plugs and connect the H.T. leads in accordance with illustration RR. 1876E.

NOTE: The above distributor setting is to enable the engine to be run so that the correct setting given in 'Engine Tuning Data' can be achieved once the engine is refitted to the vehicle.

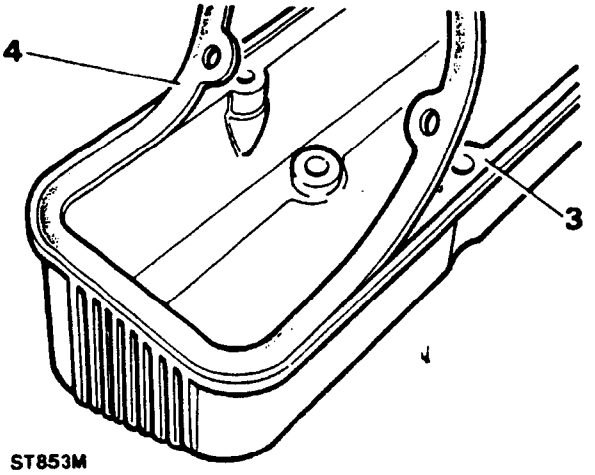


RR1876E

FIT ROCKER COVERS

1. Remove all traces of old gasket and sealant from the covers and cylinder heads.
2. Clean and dry the gasket mounting surface, using Bostik cleaner 6001.
3. Apply Bostik 1775 impact adhesive to the seal face and the gasket, using a brush to ensure an even film. Allow the adhesive to become touch-dry, after approximately fifteen minutes.

NOTE: The gasket fits one way round only and must be fitted accurately first time; any subsequent movement would destroy the bond.



ST853M

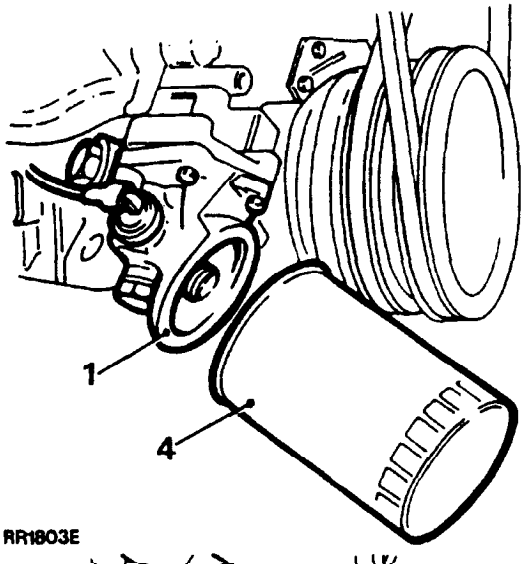
Continued

4. Place one end of the gasket into the cover recess with the edge firmly against the recess wall: at the same time hold the remainder of the gasket clear; then work around the cover, pressing the gasket into place ensuring that the outer edge firmly contacts the recess wall.
5. Allow the cover to stand for thirty minutes before fitting it to the cylinder heads.
6. Secure the rocker covers to the cylinder heads with the four screws. Short screws inboard, long screws outboard.

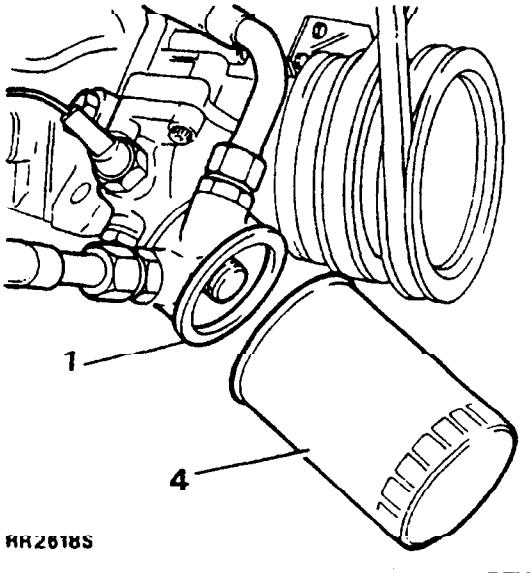
FIT ENGINE OIL FILTER

RR2618S shows 1989 Model Year condition

1. Clean the oil pump/oil cooler adaptor mating face.
2. Coat the sealing ring of the new filter with clean engine oil.
3. Fill the filter with new oil as far as possible, noting the angle at which the filter is to be fitted.
4. Screw on the filter until the sealing ring touches the oil pump/oil cooler mating face, then tighten it a further half turn by hand only. Do not over-tighten.
5. Refill the engine with the specified grade and quantity of oil.



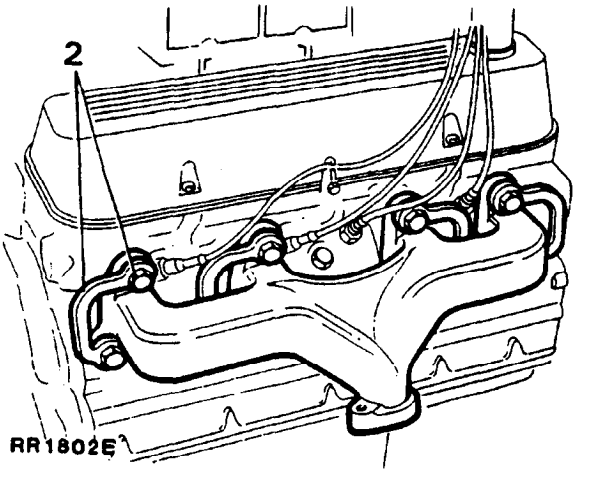
RR1803E



RR2618S

FIT EXHAUST MANIFOLD

1. Ensure that the mating surfaces of the cylinder head and exhaust manifold are clean, fit new gaskets to the exhaust manifold and coat the threads of each bolt with anti-seize compound.
2. Place the manifold in position on the cylinder head and fit new lockplates, securing bolts, and plain washers. The plain washers are fitted between the manifold and lockplates. Evenly tighten the manifold bolts to the correct torque (see section 06-Torque values) and bend *over* the lock tabs.

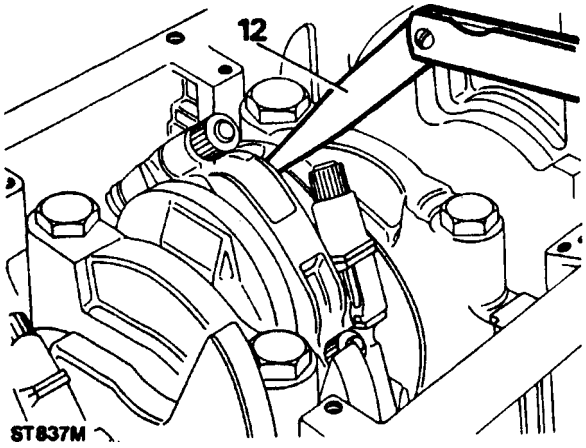


RR1802E

MISCELLANEOUS AND NON-STANDARD ITEMS

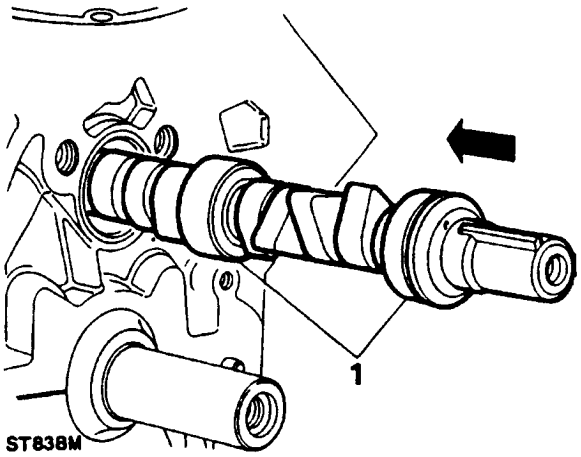
Fit any other items of equipment and miscellaneous hoses, pipes, filters, clips and brackets to the positions noted during dismantling.

9. Place the bearing lower shell in the connecting rod cap.
10. Locate the cap and shell onto the connecting rod, noting that the rib on the edge of the cap must be towards the front of the engine on the right hand bank of cylinders and towards the rear on the left hand bank.
11. Check that the connecting rods move freely sideways on the crankshaft. Tightness indicates insufficient bearing clearance or a misaligned connecting rod.
12. Check the end-float between the connecting-rods on each crankshaft journal. Clearance limits: 0.15 to 0.37 mm (0.006 to 0.015 in).
13. Tighten the connecting rod nuts to the correct torque (see section 06-Torque values). Fit the oil strainer and joint washer.

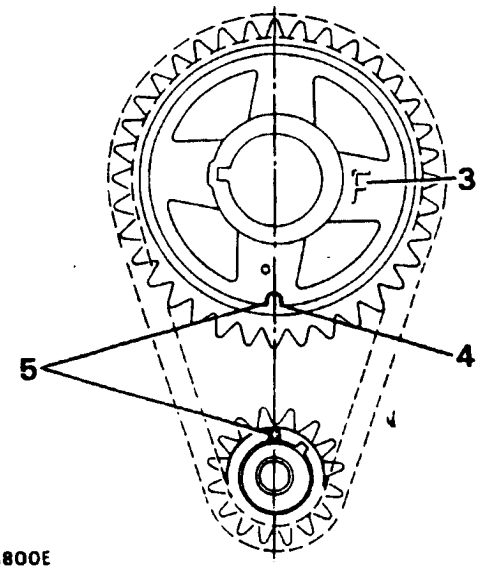


FIT CAMSHAFT TIMING CHAIN AND SPROCKET

1. Lubricate the camshaft journals and carefully insert the camshaft into the cylinder block.

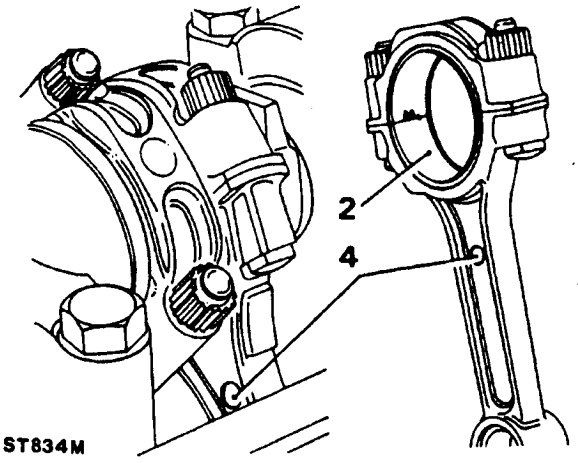


2. Turn the crankshaft to bring number one piston to TDC.
3. Temporarily fit the camshaft sprocket with the marking 'F' or 'FRONT' outward.
4. Turn the camshaft until the mark on the camshaft sprocket is at the six o'clock position, then remove the sprocket without disturbing the camshaft.
5. Encircle the sprockets with the chain keeping the timing marks aligned.



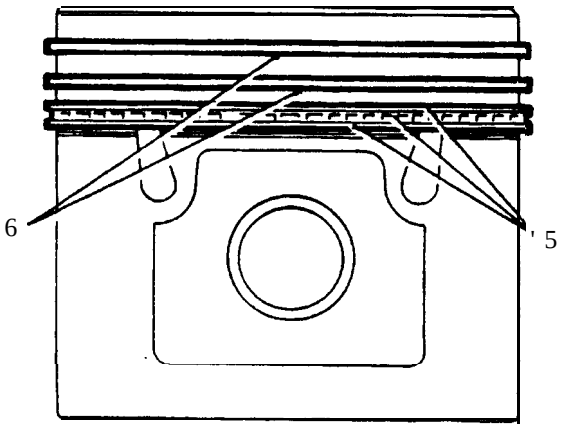
FIT CONNECTING RODS AND PISTONS

1. Locate the applicable crankshaft journal at B.D.C.
2. Place the bearing upper shell in the connecting rod.
3. Retain the upper shell by screwing the guide bolts 605351 onto the connecting rods.
4. Insert the connecting rod and piston assembly into its respective bore, noting that the domed shape boss on the connecting rod must face towards the front of the engine on the right hand bank of cylinders and towards the rear on the left hand bank. When both connecting rods are fitted, the bosses will face inwards towards each other.



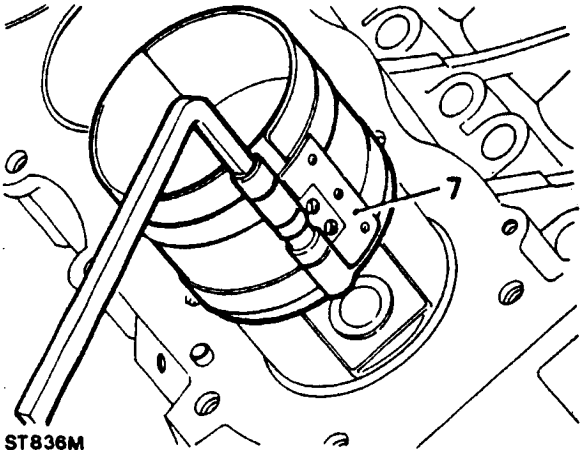
ST834M

5. Position the oil control piston rings so that the ring gaps are all at one side, between the piston pin and piston thrust face. Space the gaps in the ring rails approximately 25 mm (1 in) each side of the expander ring joint.
6. Position the compression rings so that their gaps are on opposite sides of the piston between the piston pin and piston thrust face.



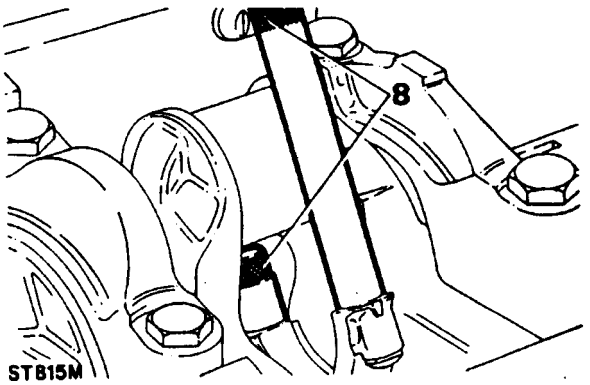
ST835M

7. Using a piston ring compressor, locate the piston into the cylinder bore, until the piston crown is just below the cylinder block top face.



ST836M

8. Pull the connecting rods on to the crankpins using the guide rods. Use extreme care when pulling the pistons down their respective bores to prevent scratching the crank pins.

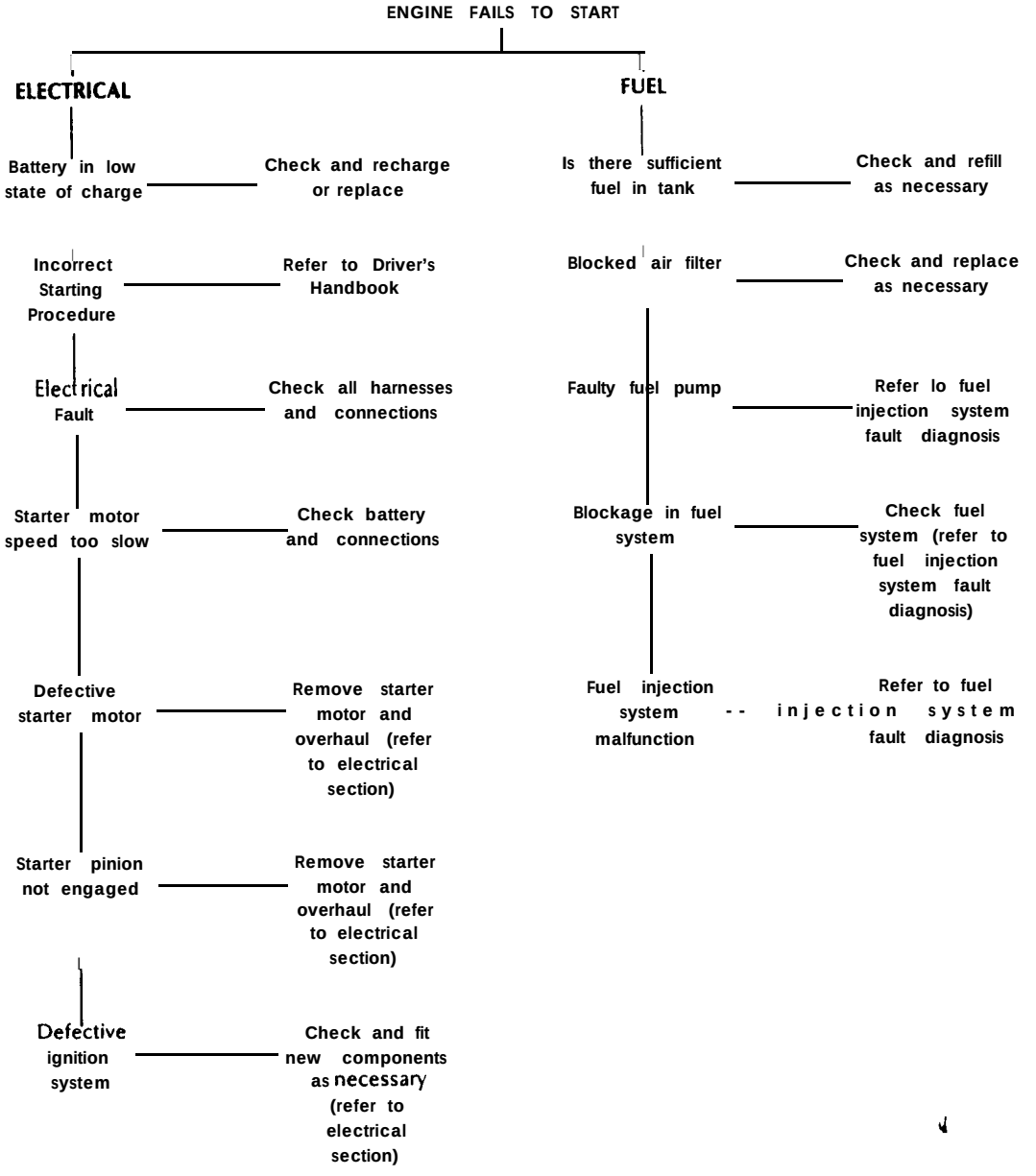


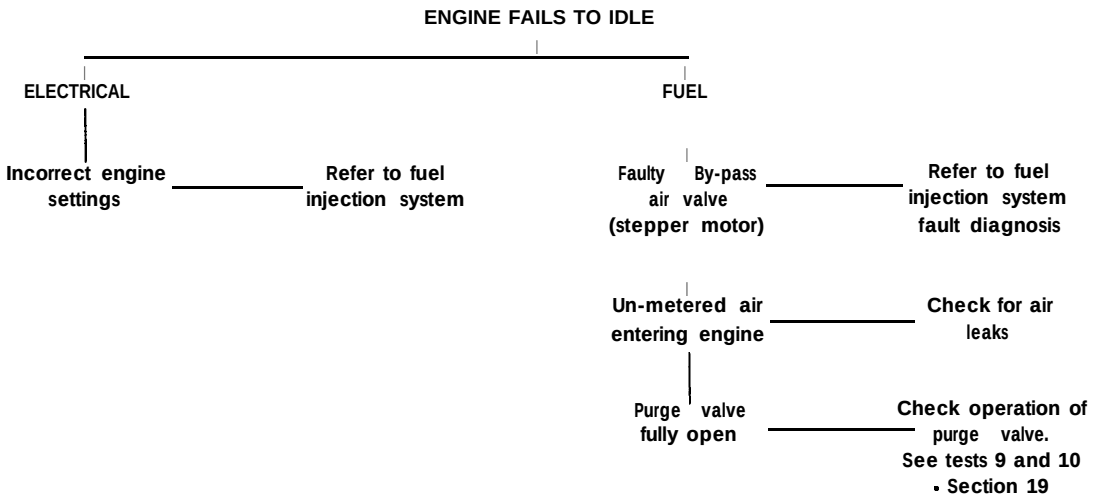
ST815M

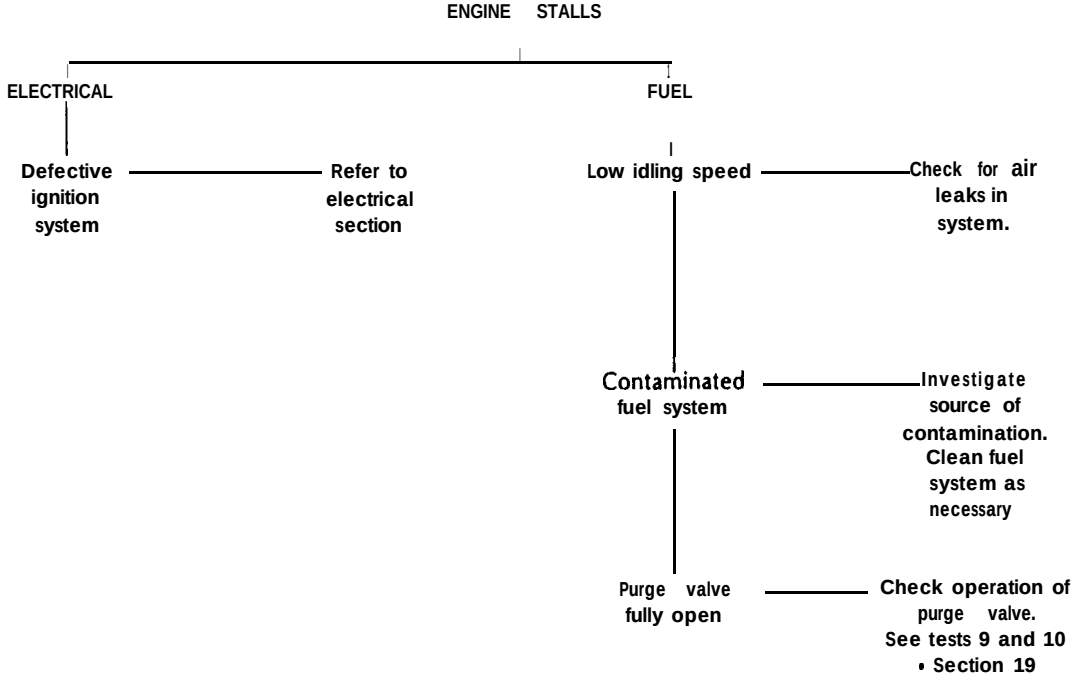
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FAULT DIAGNOSIS

NOTE: The following fault diagnosis charts are intended as a guide only, having determined the possible fault refer to the appropriate section within the manual.
The charts have been updated to include 1989 Model Year charcoal canister and purge valve. Refer to Emmission Control • Section 17 and Fuel Injection System • Section 19 for full details of charcoal canister/purge valve.



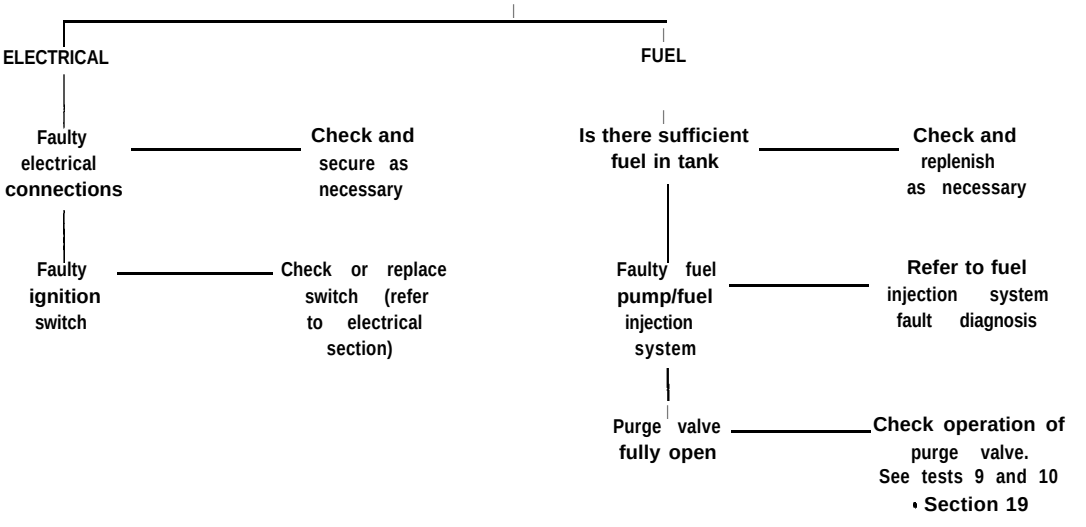




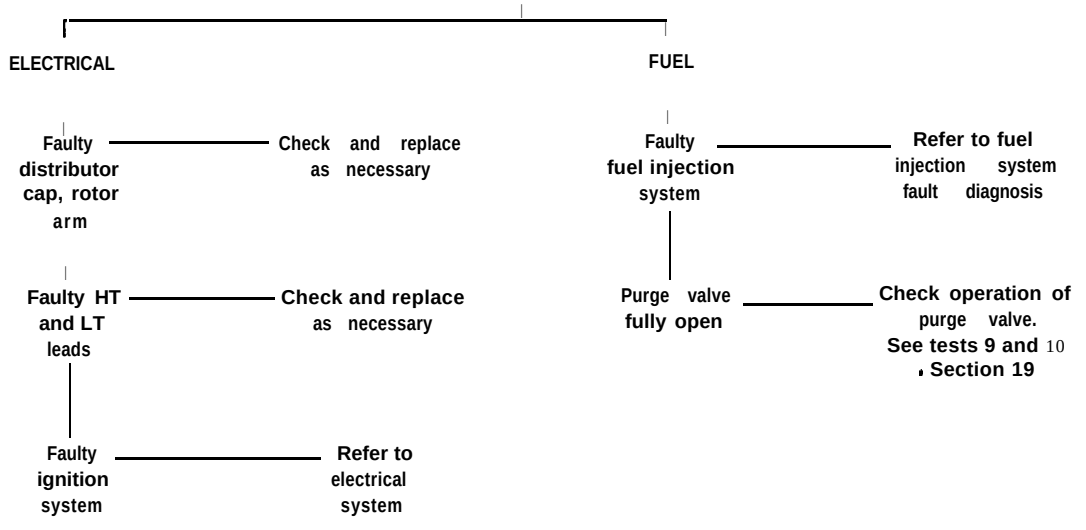
NOTE: SMELL OF PETROL IN ENGINE COMPARTMENT, POSSIBLE CAUSE: PURGE VALVE STUCK CLOSED (NO PURGE ON CHARCOAL CANISTER) See tests 9 and 10 • Section 19.

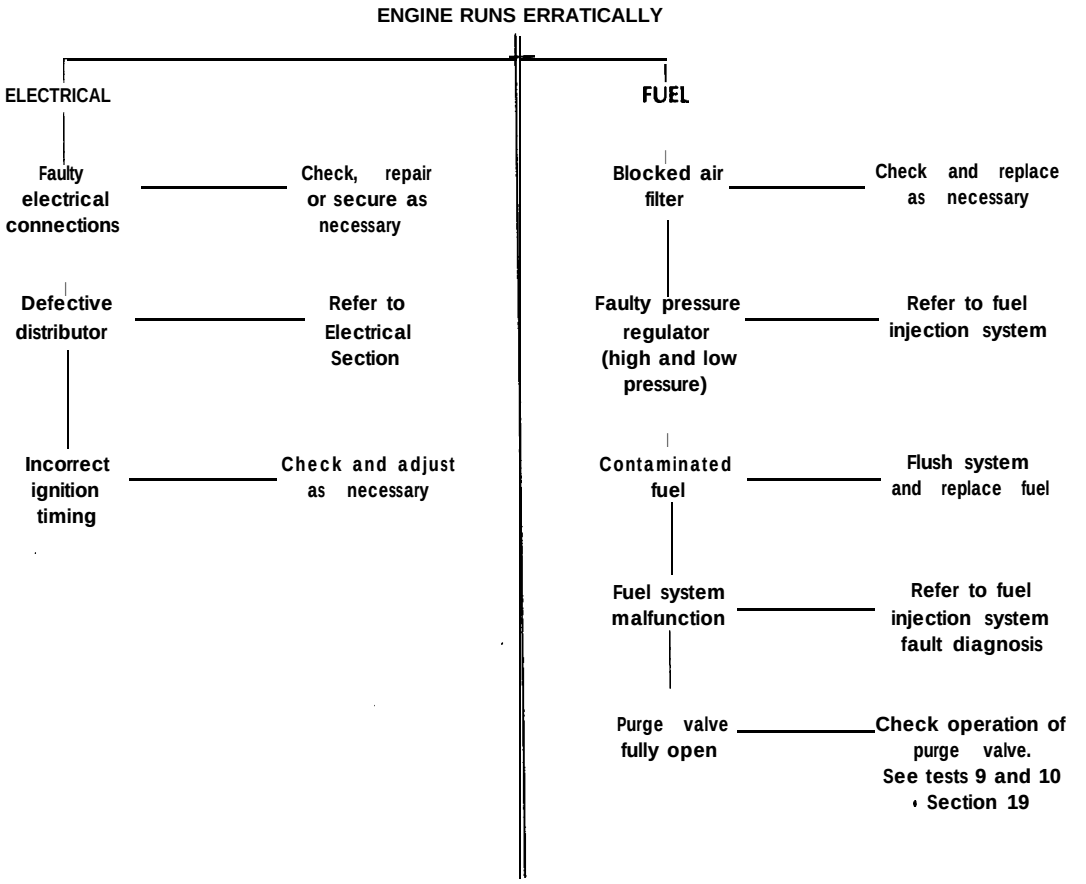
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ENGINE STARTS, BUT STOPS IMMEDIATELY

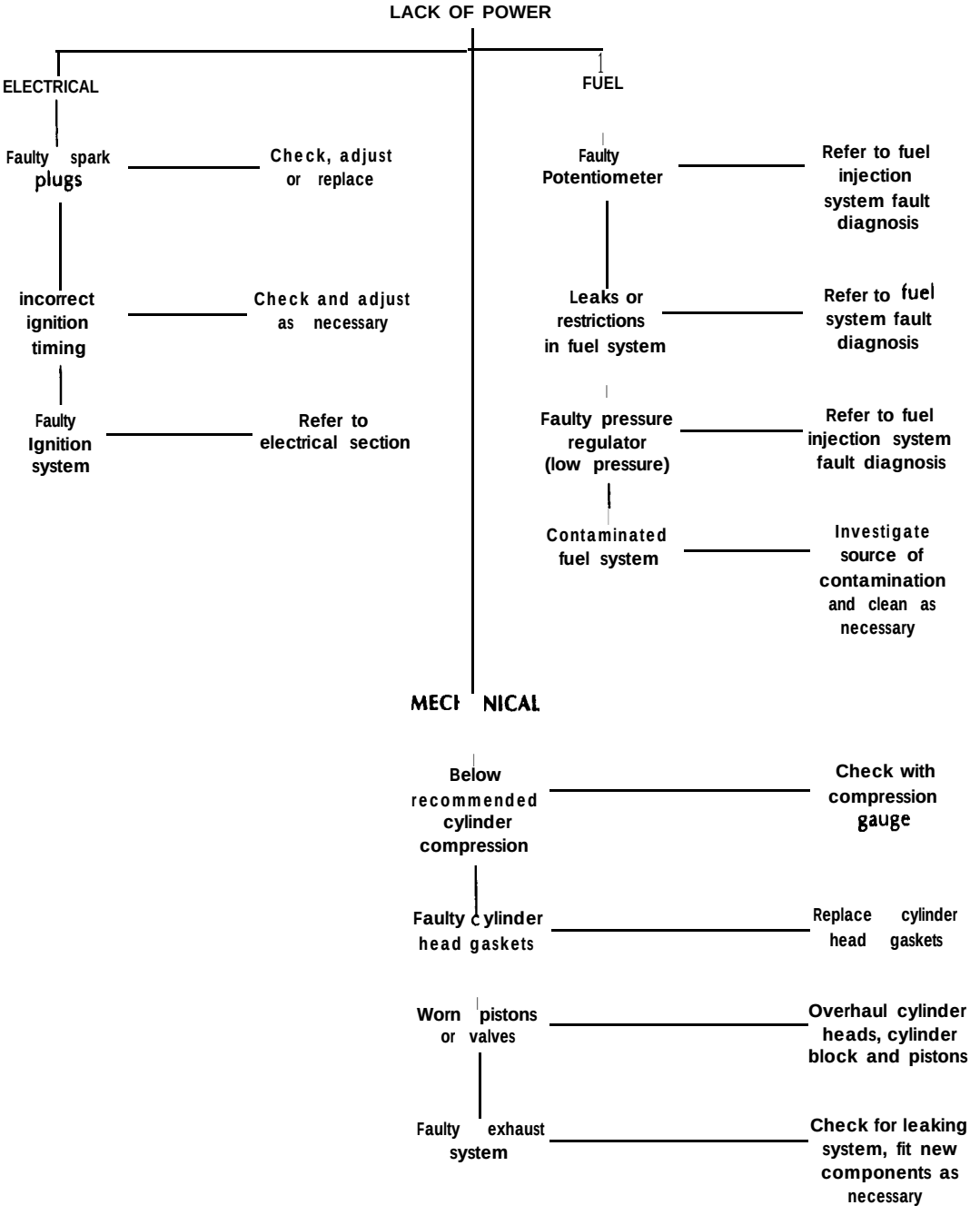


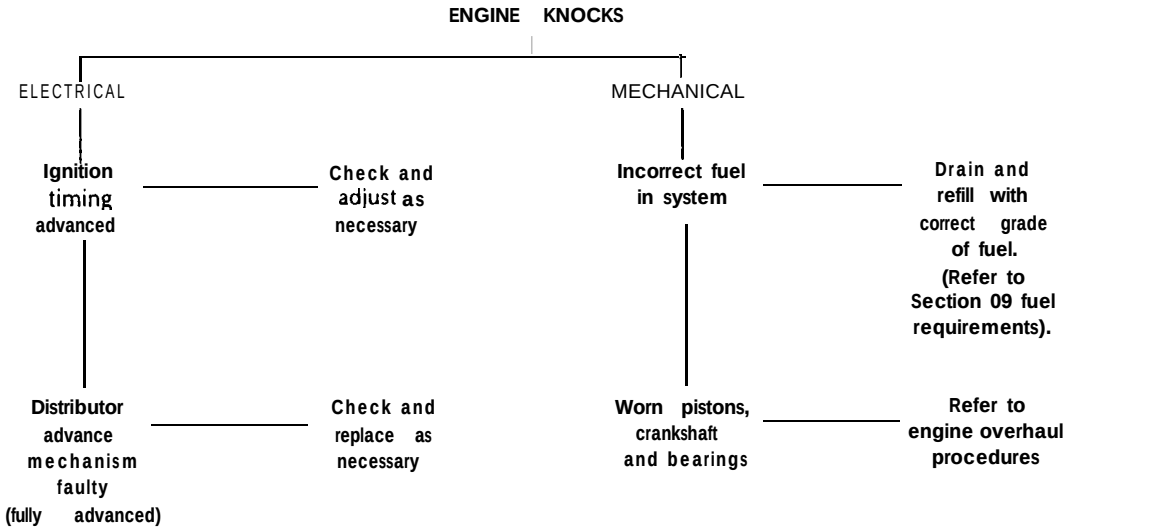
ENGINE MISFIRES ON ACCELERATION

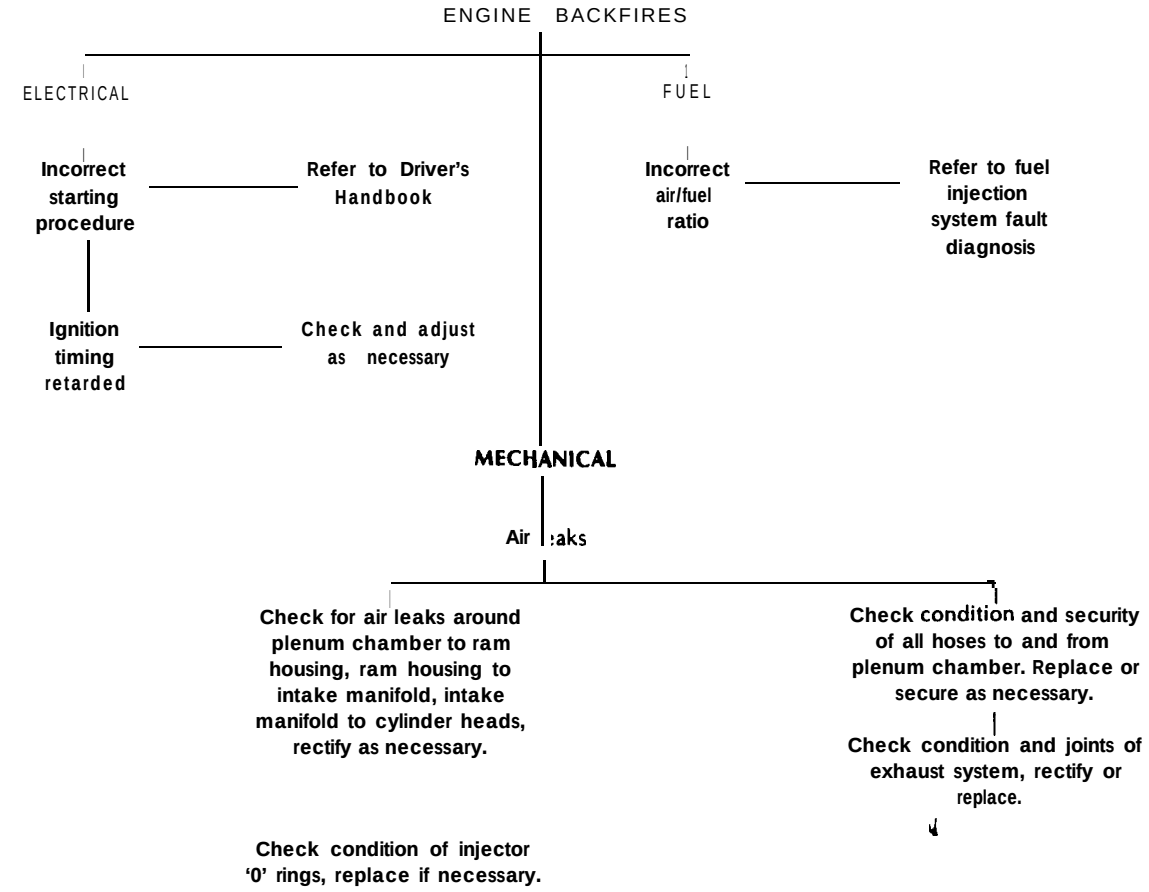



ENGINE RUNS ERRATICALLY
ELECTRICAL
Faulty electrical connections
Check, repair or secure as necessary
Defective distributor
Refer to Electrical Section
Incorrect ignition timing
Check and adjust as necessary
FUEL
Blocked air filter
Check and replace as necessary
Faulty pressure regulator (high and low pressure)
Refer to fuel injection system
Contaminated fuel
Flush system and replace fuel
Fuel system malfunction
Refer to fuel injection system fault diagnosis
Purge valve fully open
Check operation of purge valve. See tests 9 and 10 • Section 19
MECHANICAL
Vacuum hoses disconnected or damaged
Reconnect or replace as necessary
Below recommended cylinder pressure
Check with compression gauge
Faulty cylinder head gaskets
Replace cylinder head gaskets
Worn valve or valve guides
Overhaul cylinder heads

Continued

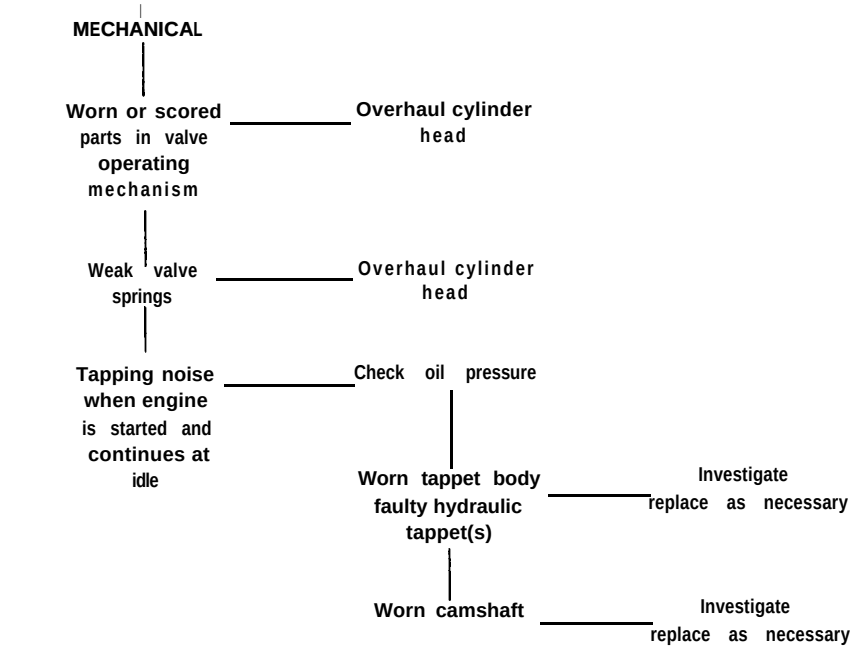

LACK OF POWER
ELECTRICAL
Faulty spark plugs
Check, adjust or replace
incorrect ignition timing
Check and adjust as necessary
Faulty Ignition system
Refer to electrical section
FUEL
Faulty Potentiometer
Refer to fuel injection system fault diagnosis
Leaks or restrictions in fuel system
Refer to fuel system fault diagnosis
Faulty pressure regulator (low pressure)
Refer to fuel injection system fault diagnosis
Contaminated fuel system
Investigate source of contamination and clean as necessary
MECHANICAL
Below recommended cylinder compression
Check with compression gauge
Faulty cylinder head gaskets
Replace cylinder head gaskets
Worn pistons or valves
Overhaul cylinder heads, cylinder block and pistons
Faulty exhaust system
Check for leaking system, fit new components as necessary


ENGINE KNOCKS
ELECTRICAL
MECHANICAL
Ignition timing advanced
Check and adjust as necessary
Incorrect fuel in system
Drain and refill with correct grade of fuel. (Refer to Section 09 fuel requirements).
Distributor advance mechanism faulty (fully advanced)
Check and replace as necessary
Worn pistons, crankshaft and bearings
Refer to engine overhaul procedures

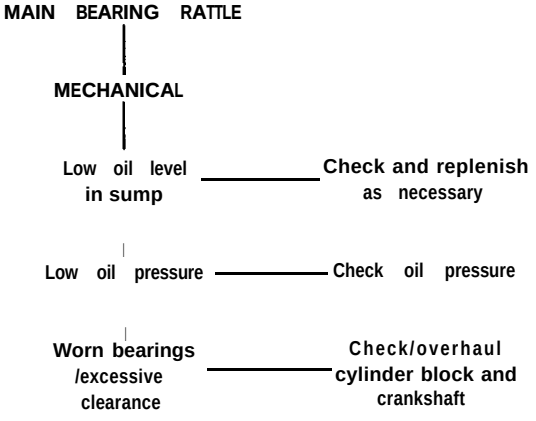

ENGINE BACKFIRES
ELECTRICAL
FUEL
Incorrect starting procedure
Refer to Driver's Handbook
Incorrect air/fuel ratio
Refer to fuel injection system fault diagnosis
Ignition timing retarded
Check and adjust as necessary
MECHANICAL
Air leaks
Check for air leaks around plenum chamber to ram housing, ram housing to intake manifold, intake manifold to cylinder heads, rectify as necessary.
Check condition and security of all hoses to and from plenum chamber. Replace or secure as necessary.
Check condition and joints of exhaust system, rectify or replace.
Check condition of injector '0' rings, replace if necessary.

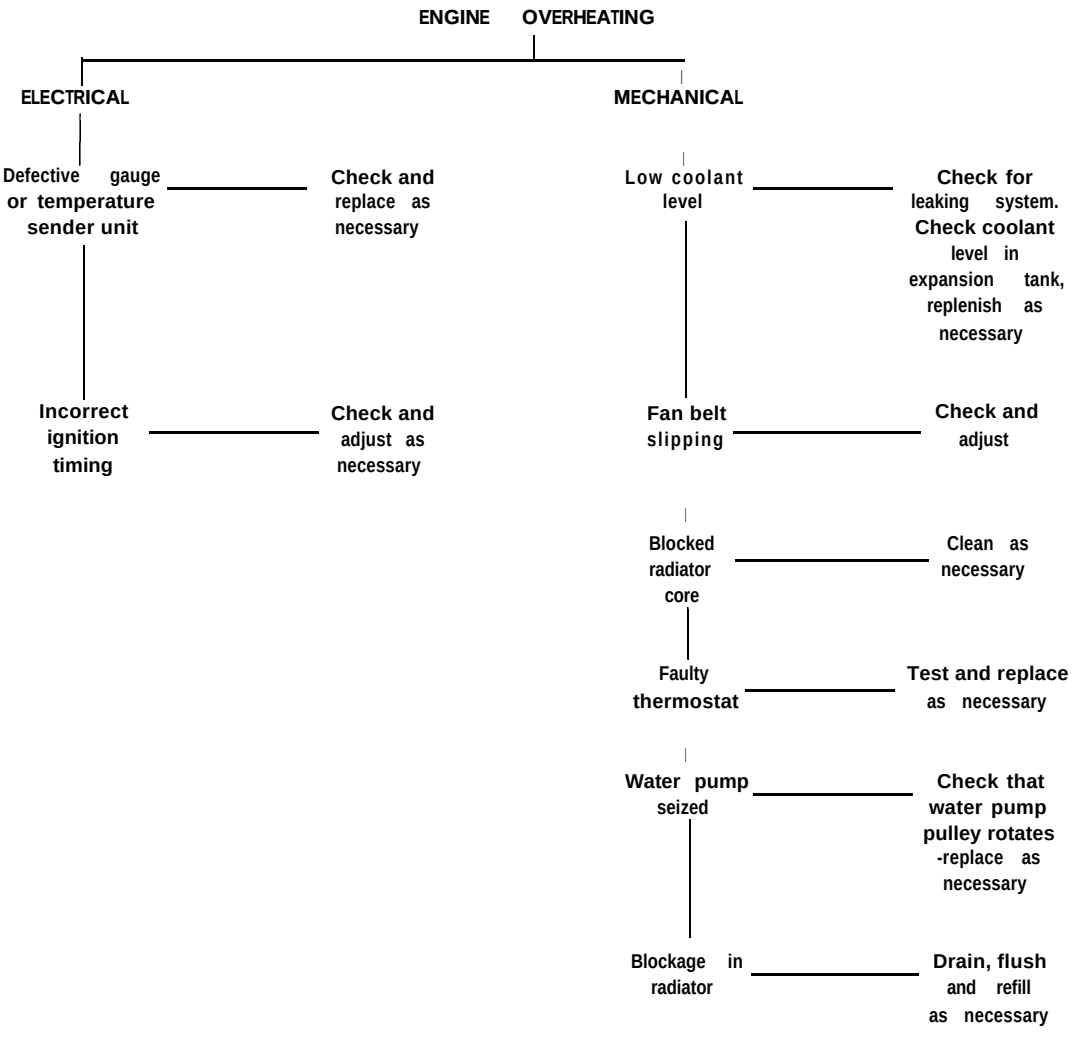
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NOISY VALVE MECHANISM

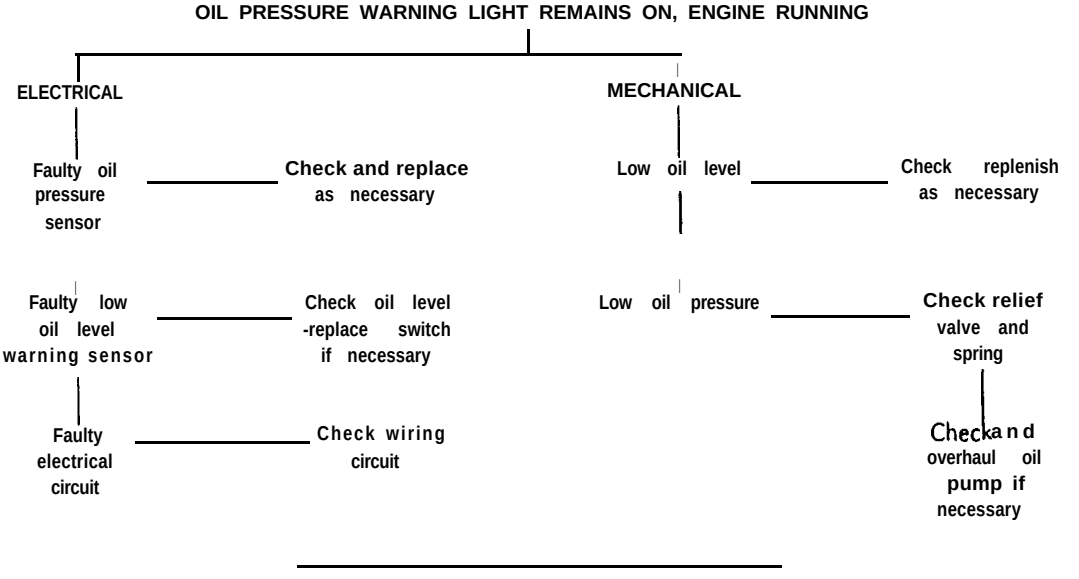


MAIN BEARING RATTLE




ENGINE OVERHEATING
ELECTRICAL
MECHANICAL
Defective gauge or temperature sender unit
Check and replace as necessary
Incorrect ignition timing
Check and adjust as necessary
Low coolant level
Check for leaking system. Check coolant level in expansion tank, replenish as necessary
Fan belt slipping
Check and adjust
Blocked radiator core
Clean as necessary
Faulty thermostat
Test and replace as necessary
Water pump seized
Check that water pump pulley rotates -replace as necessary
Blockage in radiator
Drain, flush and refill as necessary

Continued


OIL PRESSURE WARNING LIGHT REMAINS ON, ENGINE RUNNING
ELECTRICAL
MECHANICAL
Faulty oil pressure sensor
Check and replace as necessary
Low oil level
Check replenish as necessary
Faulty low oil level warning sensor
Check oil level -replace switch if necessary
Low oil pressure
Check relief valve and spring
Faulty electrical circuit
Check wiring circuit
Check and overhaul oil pump if necessary

EMISSIONS

EMISSION AND EVAPORATIVE CONTROL

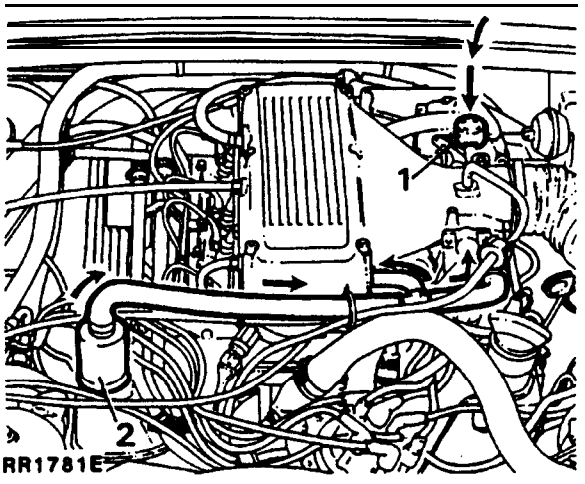
Range Rovers are fitted during manufacture with various items of emission and evaporative control equipment to ensure that they meet stringent exhaust emission regulations.

Unauthorised replacement or modification of the emission or evaporative control equipment will invalidate the Emission Warranties and render the user and/or repairer liable to legal penalties.

CRANKCASE CONTROL SYSTEM

Clean air is drawn into the crankcase via an intake filter located at the rear of the left hand rocker cover.

Crankcase emissions and clean air are drawn through a breather filter located at the front of the right hand rocker cover into the plenum chamber and then burnt in the engine.



KEY TO DIAGRAM

1. PCV intake filter
2. PCV breather filter

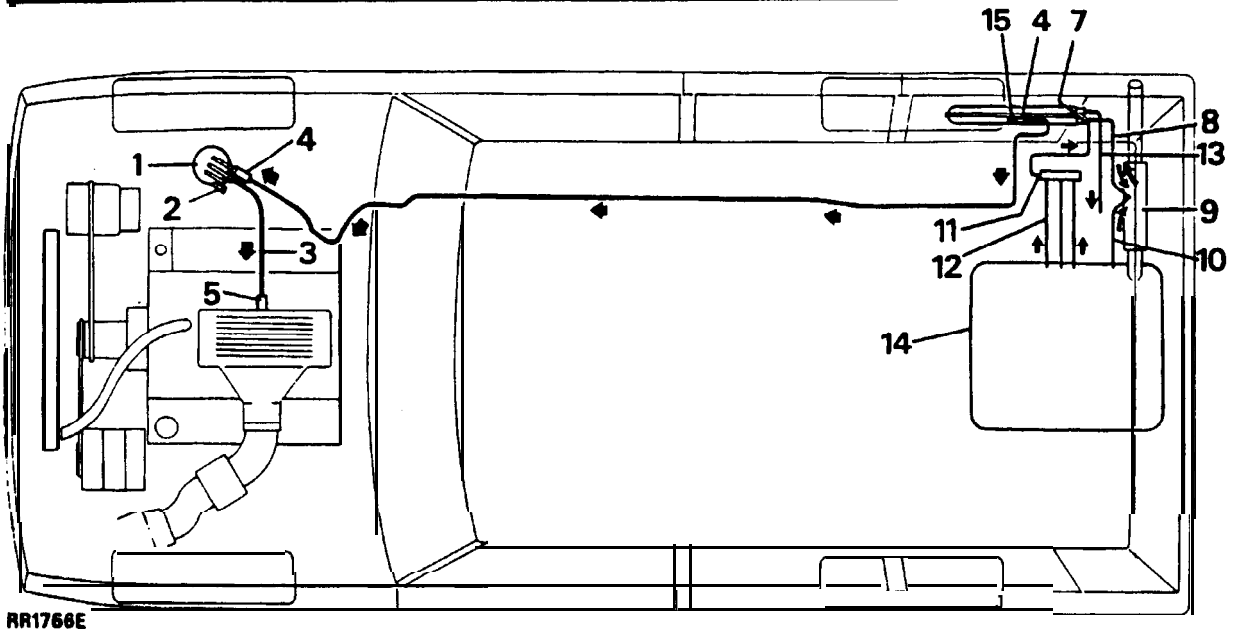
EVAPORATIVE EMISSION CONTROL SYSTEM

This system prevents fuel vapour from reaching the atmosphere. The system consists of a fuel expansion tank located between the inner right hand body side and rear right hand fender, and an adsorption canister located in the engine compartment attached to the front right hand valance.

When the fuel expands in the fuel tank due to temperature increase it is vented into the bottom of the expansion tank, any liquid fuel can be siphoned back into the main tank. Fuel vapour is directed as the fuel cools through the outlet pipe at the top of the expansion tank to the adsorption (charcoal) canister by means of a pipe running along the underside of the vehicle.

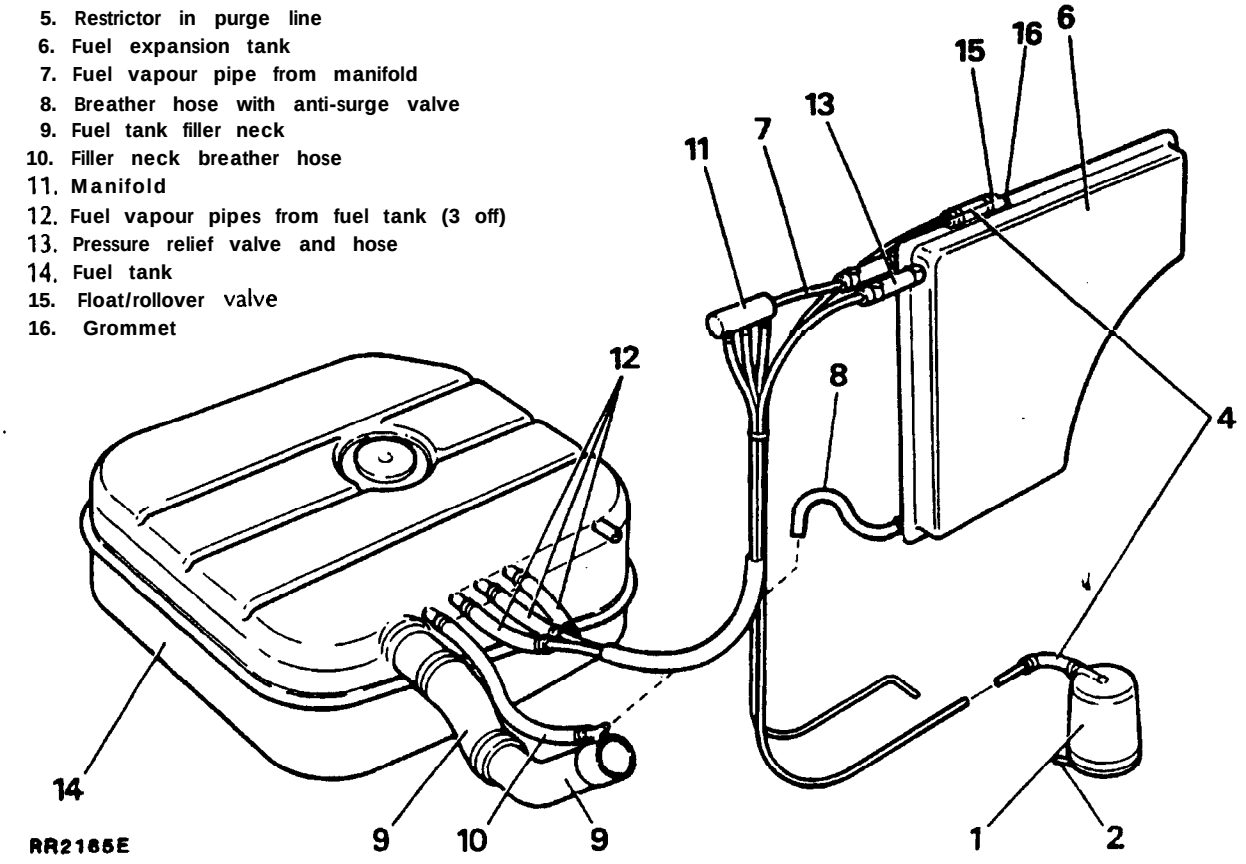
A restrictor located in the purge line at the plenum chamber controls purge line flow.

The adsorption canister containing activated charcoal is used to store fuel vapour from the fuel tank. Filter pads are fitted above and below the charcoal to prevent ingress of foreign matter of charcoal into the purge line. Emissions from the fuel tank enter the top of the canister and the purging air enters at the bottom. The canister is purged of its vapours by the vacuum generated within the plenum chamber, the vapour being drawn into the plenum chamber and burnt with the in-going mixture.



KEY TO DIAGRAM

1. Charcoal canister
2. Air inlet to canister
3. Purge line to plenum chamber
4. Connector hoses with restrictors
5. Restrictor in purge line
6. Fuel expansion tank
7. Fuel vapour pipe from manifold
8. Breather hose with anti-surge valve
9. Fuel tank filler neck
10. Filler neck breather hose
11. Manifold
12. Fuel vapour pipes from fuel tank (3 off)
13. Pressure relief valve and hose
14. Fuel tank
15. Float/rollover valve
16. Grommet



CATALYTIC CONVERTORS

Three catalytic convertors are fitted into the exhaust system to reduce carbon monoxide, oxides of nitrogen and hydrocarbon emissions. The two down pipes from the exhaust manifolds each house an oxygen sensor located forward of the catalytic convertors.

The active constituents of the catalytic device are platinum and rhodium. In order for the device to function correctly, it is necessary to control very closely the oxygen concentration in the exhaust gas entering the catalyst. This is achieved by the use of a fuel control system which continuously monitors the oxygen content of the exhaust gas by means of the oxygen sensor and adjusts the mixture level to obtain the required oxygen content.

Unleaded fuel must be used on catalyst equipped vehicles, and labels to indicate this are displayed on the instrument panel and inside the fuel filler flap. The filler neck is designed to accommodate unleaded fuel pump nozzles only.

The emission control system fitted to this engine is designed to keep emissions within legislated limits, providing the engine is correctly maintained and is in sound mechanical condition.

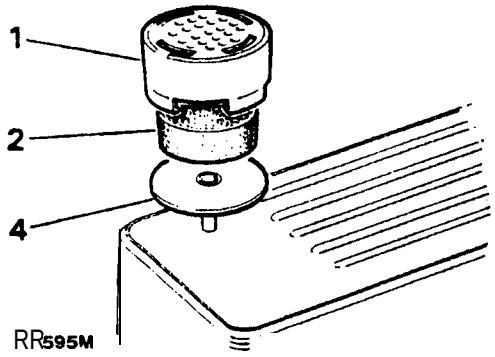
POSITIVE CRANKCASE VENTILATION AIR INTAKE FILTER

The PCV air intake filter is located at the rear of the left hand rocker cover, beneath the throttle linkage bracket.

Remove and Refit

Removing

1. Pry the filter outer cover upwards to release it from its mounting.
2. Remove the sponge filter from the cover and discard the sponge.



Refitting

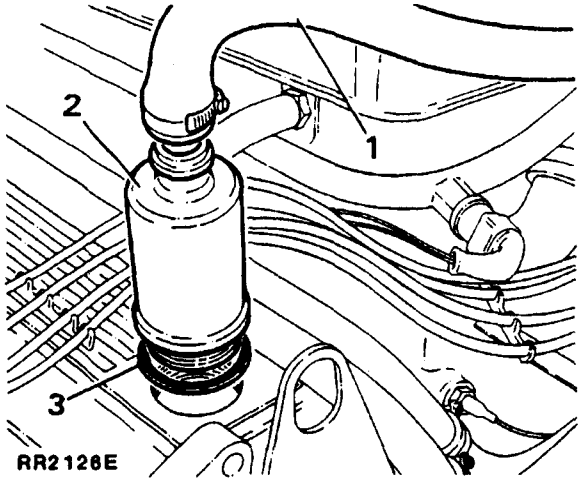
3. Insert a new filter into the filter cover.
4. Press the filter onto its mounting until it clips firmly into position.

POSITIVE CRANKCASE VENTILATION BREATHER FILTER

Remove and Refit

Removing

1. Release the hose clamp and pull the hose off the canister.
2. Unscrew the canister and remove it from the rocker cover.
3. Remove the large rubber 'O' ring and inspect for deterioration.



4. Visually inspect the condition of the wire screen within the canister, if in poor condition, replace the whole assembly, if the filter unit is in an acceptable condition, clean as follows.
5. Immerse the canister in a small amount of solvent (mineral spirits) and allow time for the solvent to dissolve or loosen any debris.
6. Remove the canister from the solvent bath and allow to dry in still air.

WARNING: DO NOT USE A COMPRESSED AIR LINE TO DRY; CLEAN OR REMOVE ANY REMAINING PARTICLES OF DEBRIS WITHIN THE CANISTER AS THIS COULD CAUSE FIRE OR PERSONAL INJURY.

Refitting

7. If the original canister is being refitted, fit a new 'O' ring.
8. Screw the canister into the rocker cover securely - hand tight only.
9. Refit the hose and tighten the hose clamp securely.

ADSORPTION (CHARCOAL) CANISTER

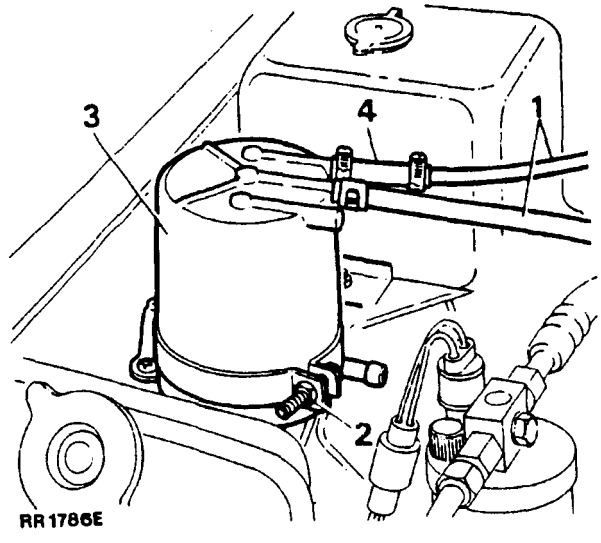
Remove and Refit

Removing

1. Disconnect from the canister:-

   (i) Canister line to expansion tank
   (ii) Canister purge line

2. Loosen the clamp nut screw.
3. Remove the canister.
4. Remove the short hose from the inlet vapour pipe and check that the restrictor is free from blockages.



Refitting

5. Secure the canister in the clamp.
6. Reverse instructions 1 and 2 above.

WARNING: The use of compressed air to clean an adsorption canister or clear a blockage in the evaporative system is very dangerous. An explosive gas present in a fully saturated canister may be ignited by the heat generated when compressed air passes through the canister.

FUEL EXPANSION TANK

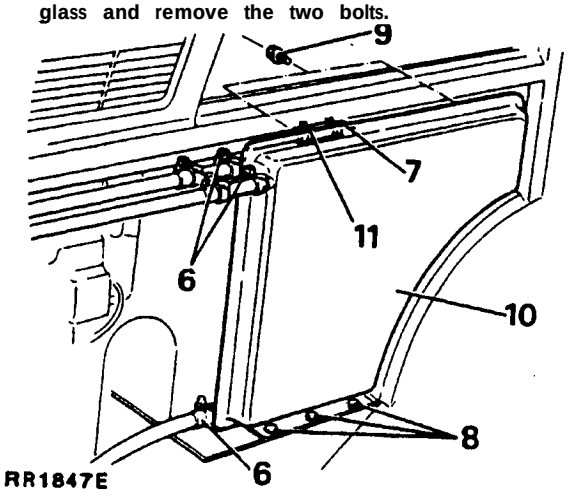
Remove and Refit

The fuel expansion tank is located between the right hand rear fender and inner body side assembly, access to the tank is gained by removing the rear fender and body corner panel. See Section 76 Body, for the removal and refit of the rear fender assembly.

WARNING: Ensure all necessary precautions are taken against the spillage of fuel when disconnecting the expansion tank hoses.

Removing

1. Depressurize the fuel system. (see Depressurizing procedure in Fuel Injection System-section 19 page 34)
2. Disconnect negative battery terminal.
3. Remove the rear lamp cluster.
4. Remove the wrap around bumper end cap.
5. Remove the rear fender and comer panel assembly.
6. Release the three hose clamps and remove the three hoses from the expansion tank.
7. Release the hose clamp and remove the hose from the float valve located on top of the expansion tank.
8. Remove the three bolts retaining the bottom of the expansion tank.
9. Lift the trim covering the vehicle tool kit at the right hand side of the rear stowage area to gain access to the two expansion tank securing bolts located below the rear side glass and remove the two bolts.

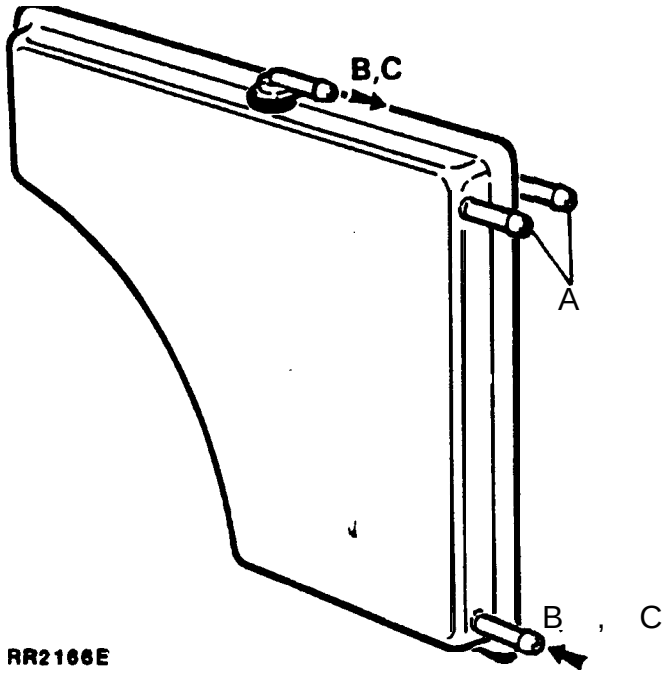


RR1847E

10. Remove the tank from the vehicle.
11. Remove the short hose connection from the top vapour hose and check that the restrictor in the hose is free from blockages.
12. While the tank is still removed from the vehicle check the operation of the float/rollover valve as follows:

A. Seal the top two outlet pipes.
B. Apply air pressure at 2 p.s.i to the bottom pipe. With the tank in its upright position air flow will pass through the valve. Rotate the tank 90" onto its side air flow should not pass through the valve.
C. Disconnect the air supply to the tank. With the bottom pipe sealed fill the tank with mineral spirit, hold the tank in its upright position, the float valve should shut off and prevent fluid passing through the valve.
D. If the valve does not operate accordingly with the above instructions; replace the float valve.

NOTE: DO NOT remove the float valve unless faulty. if a new valve is fitted ,always fit a new grommet.



RR2166E

Continued

13. Before refitting the tank remove the breather hose attached to the top of the filler neck, identify filler neck to breather hose end to aid reassembly. Vigourously shake the hose and listen for valve ball movement; no sound from the valve-replace the hose assembly.

Refitting

14. Refit the expansion tank ensuring that all hose and pipe connections are secure and that all hose clamps are securely tightened.

VACUUM DELAY VALVE

The coloured side of the vacuum delay valve should always be fitted to the hose from the distributor.

Test: Check Valve Air Flow

1. Attach a 10.00 ± .250 cu.inch vacuum tank to the coloured side of the valve.
2. Expose the black side to atmospheric pressure.
3. Expected result: The time required for the vacuum to drop from minus 20 inch Hg to minus 2 inch Hg will be 0.5 seconds maximum.
4. Vacuum recovery air flow: Attach a 22.75 ± .5 cu.inch vacuum tank to the black side of the valve.
5. Expose the coloured side to atmospheric pressure.
6. Expected result: The time required for the vacuum to drop from 16 inch Hg to 8 inch Hg will be 240 to 360 seconds.

Test: External leakage Check

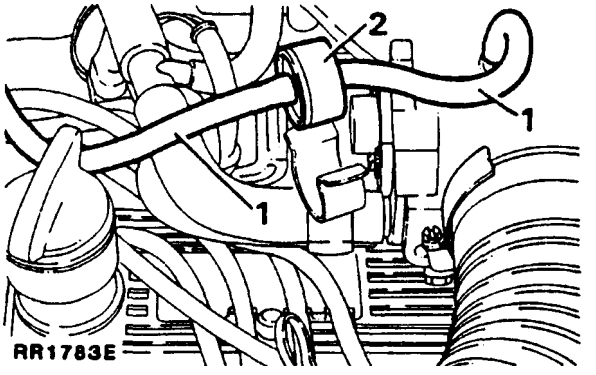
1. Seal the coloured side of the valve and attach a short flexible pipe to the other end.
2. Submerge the valve in water and orally blow through the valve.
3. If any external leakage is noticeable, fit a new valve.

If the delay valve does not comply with any of the test results, replace the unit.

Remove and Refit

Removing

1. Pull the two flexible hoses from the delay unit.
2. Remove the unit from its retaining clip and withdraw it from the engine compartment.



Refitting

3. Reverse the removal instructions ensuring that the coloured side of the valve is fitted to the longer hose from the distributor.

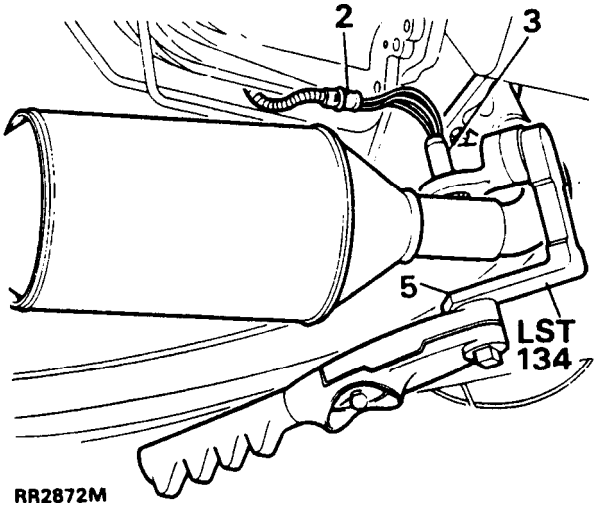
LAMBDA (OXYGEN) SENSOR

Remove and Refit

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

Removing

1. Disconnect the battery negative lead.
2. Disconnect the electrical plugs from the sensors.
3. Unscrew and remove the sensors from the two exhaust downpipes.



Refitting

4. Coat the threads of the sensor with anti-seize compound.

   CAUTION: To ensure that the efficiency of the sensor is not impaired. DO NOT allow anti-seize compound to come into contact with sensor nose.

5. Screw in the sensor and tighten to the correct torque using special tool LST134.
6. Connect the electrical plugs and battery lead.

EMISSION LABEL

A vehicle Emission Control information label is attached to the hood locking platform located above the right hand headlamp assembly. The label gives Engine Tune Details to ensure that correct Emissions Levels are achieved. The label is fitted to comply with U.S Federal and State of California Regulations and should not be removed from its location within the vehicle.

Example of Label - 1987 Model Year

LAND ROVER U.K. LTD.

VEHICLE EMISSION CONTROL INFORMATION.

ENGINE FAMILY :HLR3.5T5FRR7
DISPLACEMENT :215.3 CU INS
EVAP FAMILY :RAFI
EX.EM.CONTROL SYSTEM :EFI:TWC/EGS(2)

IGNITION TIMING 6° B.T.D.C AT BELOW 800 r.p m WITH DISTRIBUTOR VACUUM UNIT DISCONNECTED
IDLE SPEED 665-735 r.p.m
SPARK PLUG GAP 0.033-0.038in

MWC2384

IDLE MIXTURE ADJUSTMENT
NO MEANS OF ADJUSTMENT - CLOSED LOOP CONTROL.

IDLE SPEED ADJUSTMENT
ENGINE HAS IDLE SPEED CONTROL-
NO ADJUSTMENT NORMALLY REQUIRED.

REFER TO WORKSHOP MANUAL.

THIS VEHICLE CONFORMS TO U.S. E.P.A. AND STATE OF CALIFORNIA REGULATIONS APPLICABLE TO 1987 MODEL YEAR NEW LIGHT DUTY TRUCKS.

RR1896E

Example of Label - 1988 Model Year

LAND ROVER U.K. LTD

VEHICLE EMISSION CONTROL INFORMATION.

ENGINE FAMILY :JLR3.5T5FRR0
DISPLACEMENT :2 15.3 CU INS.
EVAP FAMILY :RAFI
EX.EM.CONTROL SYSTEM :EFI:TWC/EGS(2)

IGNITION TIMING 6° B.T.D.C AT BELOW 800 r.p.m WITH DISTRIBUTOR VACUUM UNIT DISCONNECTED
IDLE SPEED 665-735 r.p.m
SPARK PLUG GAP 0 033-0.038in

MWC8568

IDLE MIXTURE ADJUSTMENT.
NO MEANS OF ADJUSTMENT - CLOSED LOOP CONTROL.

IDLE SPEED ADJUSTMENT
ENGINE HAS IDLE SPEED CONTROL-
NO ADJUSTMENT NORMALLY REQUIRED

REFER TO WORKSHOP MANUAL.

OBD EXEMPT

THIS VEHICLE CONFORMS TO U.S. EPA AND STATE OF CALIFORNIA REGULATIONS APPLICABLE TO 1988 MODEL YEAR NEW LIGHT DUTY TRUCKS.

RR2287E

Example of Label - 1989 Model Year

LAND ROVER LTD.

VEHICLE EMISSION CONTROL INFORMATION.

ENGINE FAMILY	:KLR3.9T5FSS4
DISPLACEMENT	:240 CU HS.
EVAP FAMILY	:RAFI
EX.EM.CONTROL SYSTEM	:FI:2-TWC/2-HOS

IGNITION TIMING 6° B.T.D.C AT BELOW 800 r.p.m. WITH DISTRIBUTOR VACUUM UNIT DISCONNECTED

IDLE SPEED 665-735 r.p.m.

SPARK PLUG GAP 0.033-0.038in

MWC9365

IDLE MIXTURE ADJUSTMENT.

NO MEANS OF ADJUSTMENT - CLOSED LOOP CONTROL

IDLE SPEED ADJUSTMENT.

ENGINE HAS IDLE SPEED CONTROL-
NO ADJUSTMENT NORMALLY REOUIRED.

REFER TO WORKSHOP MANUAL.

OBD EXEMPT

THIS VEHICLE CONFORMS TO U.S. EPA AND STATE OF CALIFORNIA REGULATIONS APPLICABLE TO 1989 MODEL YEAR NEW LIGHT DUTY TRUCKS.

RR2311E

Example of Label - 1990 Model Year

LAND ROVER LTD.

IMPORTANT VEHICLE INFORMATION

ENGINE FAMILY	:LLR3.9T5FSS5
DISPLACEMENT	:241 CU INS
EVAP. FAMILY	:RAF 1
EX.EM.CONTROL SYSTEM	:MP1 :2-TWC/2 HO2S

IGNITION TIMING 6° + 1 °6 T.D.C AT BELOW 600 r.p.m WITH DISTRIBUTOR VACUUM UNIT DISCONNECTED

IDLE SPEED 665.735 r.p.m.

SPARK PLUG GAP 0.033-0.038in

IDLE SPEED ADJUSTMENT

ENGINE HAS IDLE SPEED CONTROL
NO ADJUSTMENT NORMALLY REOUIRED.

REFER TO WORKSHOP MANUAL.

NO OTHER ADJUSTMENTS NEEDED.

3T39T5FSSA

THIS VEHICLE CONFORMS TO U.S. EPA AND STATE OF CALIFORNIA REGULATIONS APPLICABLE TO 1990 MODEL YEAR NEW LIGHT DUTY TRUCKS.

RR2698E

Example of Label - 1991 Model Year

ROVER GROUP LIMITED

IMPORTANT VEHICLE INFORMATION - RANGE ROVER

ENGINE FAMILY	:MLR3.9T5FSS6
DISPLACEMENT	:241 CU INS / 3.9 LITERS
EVAP.FAMILY	:RBFI
EXHAUST EMISSION CONTROLSYSTEM	:MPI:2-TWC/2-H02S

39T5FSSA

TUNE UP SPECIFICATIONS CATALYST

TUNE UP CONDITIONS :-
ENGINE AT NORMAL OPERATING TEMPERATURE
TRANSMISSION IN PARK
IDLE SPEED - 665-735 rpm
ENGINE HAS IDLE SPEED CONTROL
NO ADJUSTMENT NORMALLY REOUIRED
SPARK PLUG GAP . 0.033-0.038 inch
IGNITION TIMING - 6' : 1° BTDC AT BELOW 600 rpm
WITH DISTRIBUTOR VACUUM UNIT DISCONNECTED
NO OTHER ADJUSTMENTS NEEDED

THIS VEHICLE CONFORMS TO U.S. EPA AND STATE OF CALIFORNIA REGULATIONS APPLICABLE TO 1991 MODEL YEAR NEW LIGHT DUTY TRUCKS.

RR 2935E

EMISSION CONTROL

1989 model year vehicles incorporate evaporative emission control by a new charcoal canister with solenoid operated purge valve.

The charcoal canister adsorbs and stores the fuel vapor that is emitted from the fuel tank when the engine is not running. The vapor is purged from the canister by outside air drawn through an orifice at the bottom of the canister by the application of manifold vacuum to the top.

A solenoid operated valve controls purging of the canister. The valve is controlled by the fuel injection ECU to ensure that purge normally takes place at engine speeds above idle and when the vehicle is in motion. The rate of purge will depend on engine speed, road speed and throttle position.

Purge valve fault diagnosis is included in Engine Fault Diagnosis - Section 12.

Testing purge valve operation is included in Fuel Injection Test Procedure - Section 19, Tests 9 and 70.

NOTE: If crimped hoses are removed it is essential that they are recrimped on reassembly to ensure a leak free joint.

Vacuum delay valve

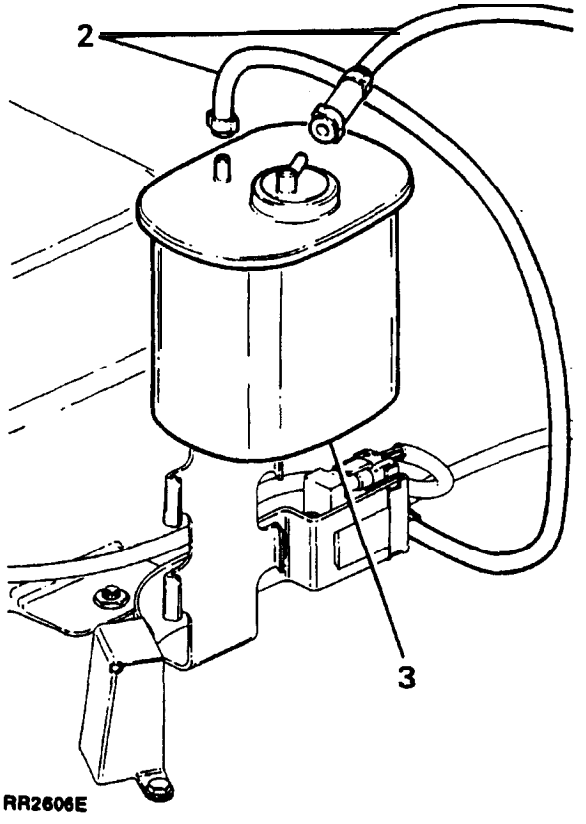
The vacuum delay valve is not fitted to 3.9 litre models.

Charcoal canister

Remove and refit

Removing

1. Disconnect battery negative lead.
2. Disconnect both purge lines.
3. Release canister from its mounting brackets.



RR2606E

Refitting

4. Reverse the removal procedure, ensuring that the canister is securely located in its mounting bracket and both purge lines are fitted correctly to the canister.

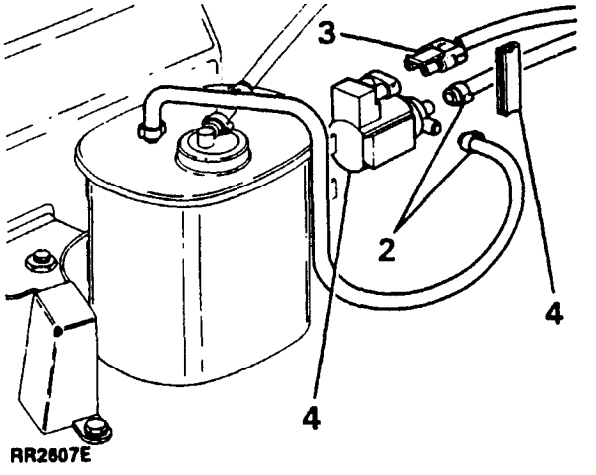
Charcoal canister

Purge valve

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the crimped connectors from the two purge valve pipes.
3. Disconnect the electrical connection.
4. Remove the edge clip retaining the purge valve and withdraw the purge valve.

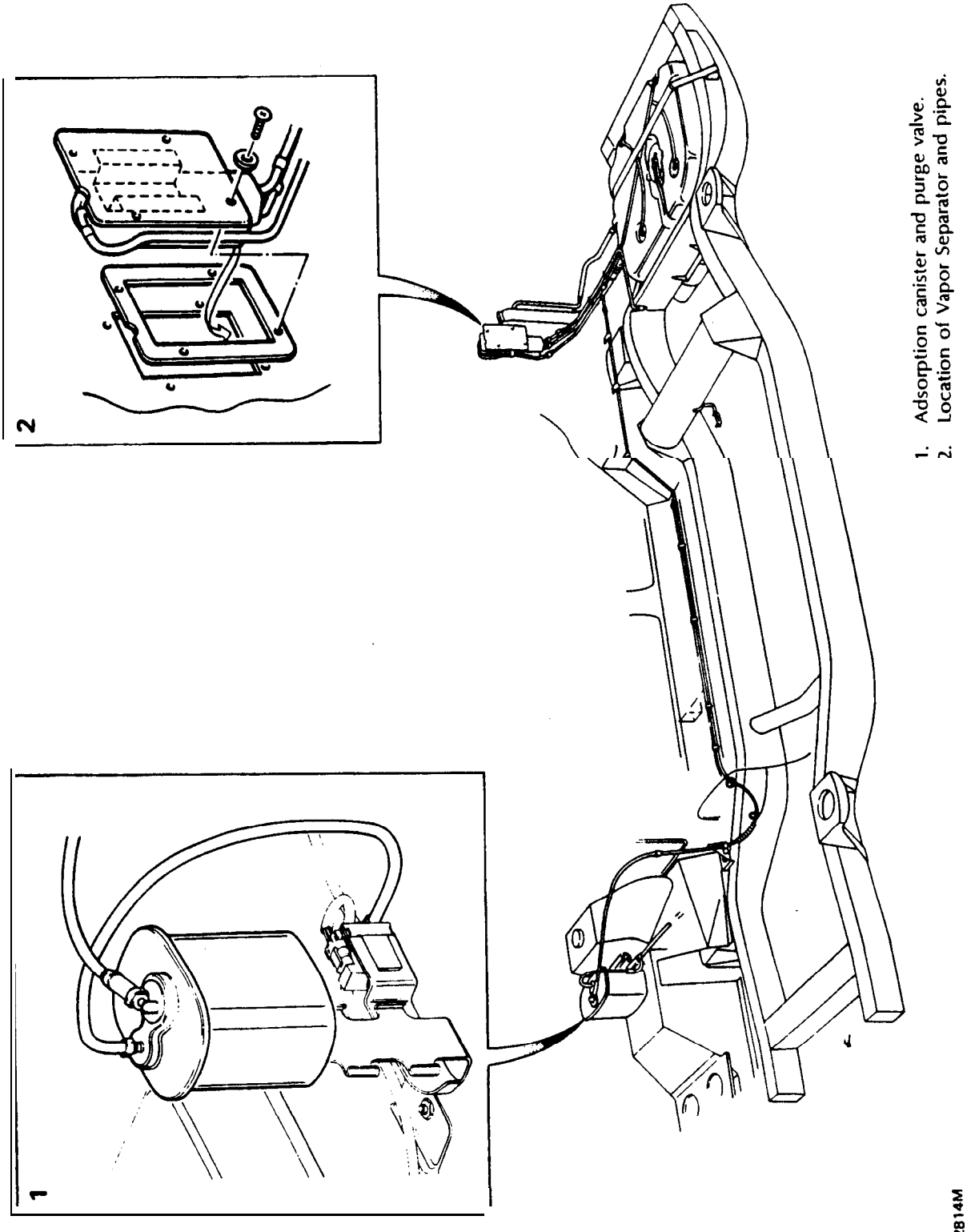


RR2607E

Refitting

5. Reverse the removal procedure ensuring the pipes are securely crimped.

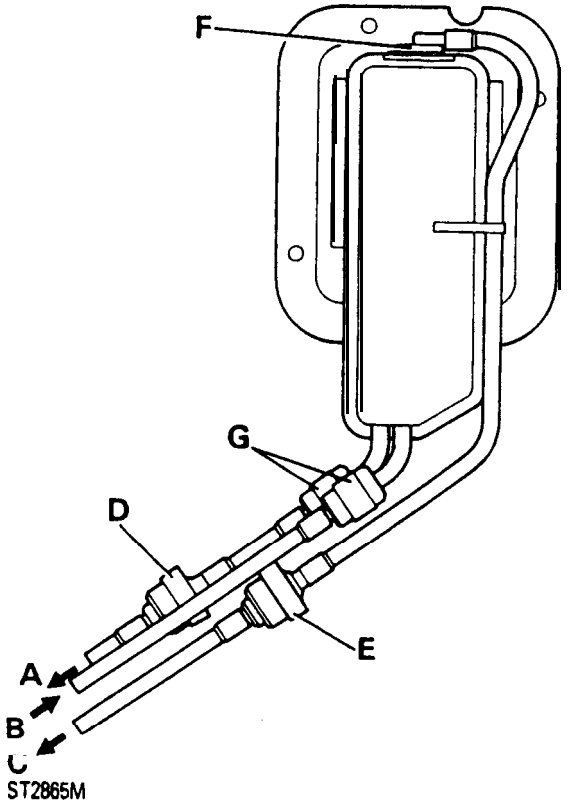
EVAPORATIVE CONTROL SYSTEM • 1991 model year



1. Adsorption canister and purge valve.
2. Location of Vapor Separator and pipes.

Evaporative emission control system • 1991 model year

The system is designed to prevent harmful fuel vapor from escaping to the atmosphere. The system consists of a new vapor 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 adsorption canister, containing activated charcoal, is positioned in the engine compartment attached to the front right hand fender valance. The two components are connected by a pipe running the length of the chassis.



ST2865M

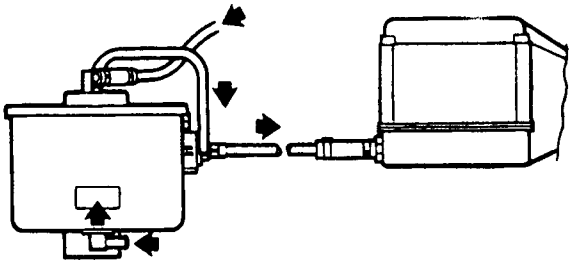
A Pressure relief to atmosphere.
B From fuel tank to separator.
C To adsorption canister.
D Pressure relief valve.
E Pressure relief valve.
F Shut-off valve.
G "Speed Fit" connectors.

A pressure relief valve is fitted in the hose open to atmosphere, which would act 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 vapor emitted, in such an instance, would be acceptable.

A pressure relief valve is also fitted in the hose to the adsorption canister and releases vapor to the canister when the pressure in the separator reaches between .75 and 1.0 psi.

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

The adsorption canister, which is connected by hose to the plenum chamber, adsorbs and stores the fuel vapor from the fuel tank while the engine is not running. The vapor 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 vapor drawn into the plenum chamber through a solenoid operated purge valve is finally burnt in the combustion chambers.


ST2866M

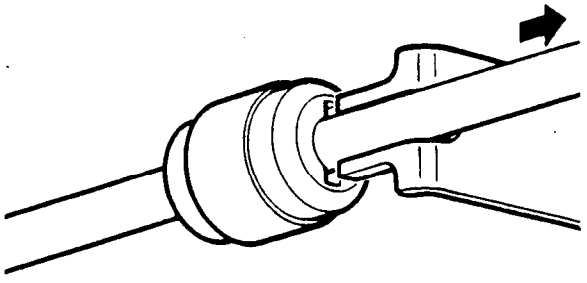
The purge valve, which is attached to the adsorption canister support bracket, is controlled by the fuel injection E.C.U. which determines the most emission acceptable time at which purging should take place. This will normally be at engine speeds above idle and when the-vehicle is in motion. A signal from the E.C.U. to the purge valve operates the solenoid and opens the valve to purge the canister of fuel vapor.

VAPOR SEPARATOR

Remove

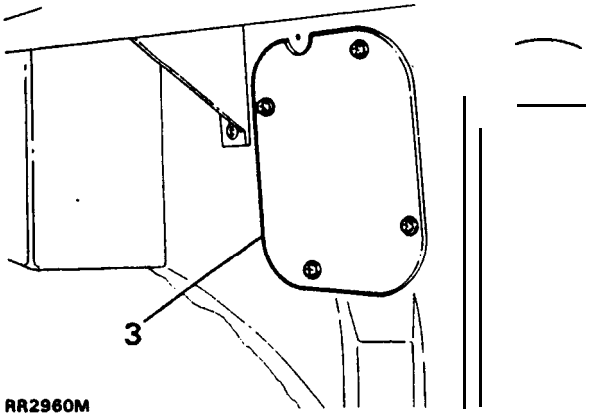
WARNING: Ensure that ail necessary precautions are taken against fuel spillage and fuel vapor to prevent fire or explosion.

1. Disconnect the battery negative terminal.
2. Working from beneath the vehicle, disconnect the evaporative control pipes from the green end of the "speedfit" connectors. To achieve this, manufacture a suitable tool with a forked end to fit into the two slots in the end of the connector as shown in the illustration below. Press down on the collet and while depressed pull the pipe from the connector.



ST2877M

3. Remove the four screws securing the vapor separator support plate to the body panel situated in the right hand side of the load space.
4. Withdraw the separator and pressure relief valves from the vehicle.



RR2960M

NOTE: While the pressure relief valves are renewable, the shut-off valve in the top of the separator is only available complete with a new separator assembly.

Fitting vapor separator.

5. Fit the separator and pipes into the vehicle side panel, if necessary using a new seal. Fit the self adhesive side to the separator. Secure with the four screws.
6. From beneath the vehicle, fit the pipes from the separator to the connectors. Push each pipe into the corresponding connector as far as it will go so that it is locked by the collet. Check that the pipes are free and not trapped or kinked. Secure the pipes to the under body clips.

TESTING EVAPORATIVE EMISSION CONTROL

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.

Equipment required.

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

Water manometer (0 • 30" H20 or more).

Pipework and a "T" piece.

Method.

1. Ensure that there is at least two gallons of fuel in the fuel tank unless there has never been any fuel in the system.
2. Disconnect, at the adsorption canister, the pipe to the vapor separator.
3. Connect this pipe to the nitrogen cylinder and the water manometer using the "T" piece.
4. Pressurize the system to between 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 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 adsorption canister.

CRUISE CONTROL SYSTEM-HELLA GR66

CAUTION: DO NOT ENGAGE CRUISE CONTROL WHEN THE VEHICLE IS BEING USED IN LOW TRANSFER GEARS.

DESCRIPTION

The Cruise Control system consists of electro-mechanical devices, and comprises of the following components.

ELECTRONIC CONTROL UNIT (ECU)

The electronic control unit is located behind the lower dash panel attached to the underside of the instrument binnacle. The Microprocessor based E.C.U. evaluates the signals provided by the driver controls, brake pedal switch and the road speed transducer, and activates the vacuum pump in an appropriate manner. The E.C.U. also has a memory function for set speed storage.

DRIVER OPERATED SWITCHES

The main cruise control switch is located in the auxiliary switch panel and activates the cruise control system. The steering wheel switches provide 'set/accelerate' and 'resume/decelerate features. These switches provide the interface between driver and cruise control system.

BRAKE PEDAL SWITCH

The Brake Pedal Switch is located under the lower dash attached to the brake pedal mounting bracket. The switch provides for fast disengagement of the cruise control system and rapid return of the throttle levers to the idle position when the brake pedal is applied.

ROAD SPEED TRANSDUCER

The Road Speed Transducer is fitted between the upper and lower speedometer cables. It is mounted on a bracket located on the left hand chassis side member adjacent to the rear engine mounting. The transducer provides road speed data to the E.C.U. The cruise control system cannot be engaged until the road speed exceeds 28 mph (45 km/h), the system will automatically disengage at a road speed of 26 mph (42 km/h).

VACUUM PUMP

The Vacuum Pump is located in the engine compartment attached to the left hand valance. The vacuum pump is energised when the main control panel is operated, and is actuated by the steering wheel and brake pedal switches. The pump provides a vacuum source to the cruise control actuator at the throttle levers. A control valve in the pump provides for steady increase of road speed or rapid purge of the system when the brake pedal is applied.

ACTUATOR

The Actuator is located in the engine compartment and is bolted to the throttle lever bracketry. The actuator provides the servo mechanism link between the cruise control system and throttle linkage and is operated by vacuum from the vacuum pump.

FAULT DIAGNOSIS

If the system does not function the following checks must be carried out.

Fuse A6 • intact
Vacuum hoses • not split or disconnected
Actuator • diaphragm ruptured
Vacuum Pump • motor operational
Brake Switch • faulty or out of adjustment
Speed Transducer • faulty • check operation of unit
Electrical Leads • loose connections • faulty leads
Stop Lamp Bulbs • both bulbs faulty • replace: Fuse 13 intact.

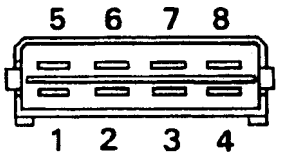
PRELIMINARY CHECKS PRIOR TO TESTING

1. Ignition switch **"ON".**
2. **Fuse A-6 "OK".**
3. Cruise Control master switch "ON".
4. Minimum 12.0V (Battery) available.

CRUISE CONTROL OPERATIONAL CHECKS

All system testing may be performed with a multi-meter and jumper wire at the ECU connector.

Sequence of connections viewed on harness plug connector to ECU



RR 2173E

Colour coding/function of wiring to plug:

TERMINAL NO.	COLOUR	FUNCTION
1.	White/Yellow	Main power from master switch
2.	Red/White	12V + from set switch (when pressed)
3.	Purple/Green	Ground via vent valve switch and brake light filaments
4.	Black/Red	To vacuum pump motor
5.	Yellow	To speed transducer
6.	Blue/White	12V + from resume switch (when pressed)
7.	Black/Yellow	To vacuum pump solenoid valve
8.	Black	ECU ground

TEST PROCEDURE

Volt Meter Connections	Specified Result	Possible Problem if Results not as Specified
1. Terminal 1 and ground	Battery voltage	Fuse, wiring, master switch
2. Terminal 1 and 8	Batter voltage	Poor ground
3. Terminal 1 and 3	Battery voltage	Brake light ground, vent valve switch, wiring, brake light bulbs
4. Terminal 6 and 8 (press resume)	Battery voltage	Wiring, resume switch, cassette
5. Terminal 2 and 8 (press set)	Battery voltage	Wiring, set switch cassette
6. Terminal 5 and 8 • Rotate left-rear wheel, right-rear wheel remains on ground	0-12V fluctuating 6 times per revolution	Wiring, speed transducer

VACUUM SYSTEM • VACUUM PUMP TESTS

Connect a jumper wire between: Terminal 4 and 8 & 7 and 8 • vacuum pump must run and fully retract activator diaphragm. Remove jumper from Terminal 4 (7 & 8 still connected). Pump stops, but diaphragm remains retracted. Remove jumper from Terminal 7 • diaphragm extends.

If results are not as specified check: vacuum hose/connections, vent valve/adjustment, wiring to vacuum pump, vacuum pump.

ROAD TEST

CAUTION: DO NOT ENGAGE CRUISE CONTROL WHEN THE VEHICLE IS BEING USED IN LOW TRANSFER GEARS

WARNING: The use of cruise control is not recommended on winding, snow covered or slippery roads or in heavy traffic conditions where a constant speed cannot be maintained.

1. Start the engine and depress the main control switch to actuate the cruise control system. Accelerate to approximately 30 mph (50 km/h) and operate the 'set/acc' switch, immediately release the switch, remove the foot from the accelerator pedal, the vehicle should maintain the speed at which the 'set/acc' switch was operated.
2. Operate the 'set/acc' switch and hold at that position, the vehicle should accelerate smoothly until the switch is released. The vehicle should now maintain the new speed at which the 'set/acc' switch was released.
3. Apply the 'res/decel' switch while vehicle is in cruise control mode, the cruise control should disengage. Slow to approximately 35 mph (55 km/h), operate the 'res/decel' switch, immediately release the switch and remove the foot from the accelerator, the vehicle should smoothly accelerate to the previously set speed. Increase the speed using the accelerator pedal and release the pedal, the vehicle should return to the previously set speed.
4. Operate the brake pedal, the cruise control system should immediately disengage returning the vehicle to driver control at the accelerator pedal. Operate 'res/decel' switch, vehicle should accelerate to previously memorised set speed without driver operation of the accelerator pedal.
5. Operate 'res/decel' switch and allow vehicle to decelerate to below 26 mph (42 km/h). Operate 'res/decel' switch, cruise control system should remain disengaged.
6. Operate the 'set/acc' switch below 28 mph (45 km/h), the cruise control system should remain disengaged. Accelerate, using the accelerator pedal to above 28 mph (45 km/h), operate 'res/decel' switch, and remove the foot from the accelerator pedal, vehicle should smoothly adjust to the previously memorised speed.
7. Depress the main control switch in the auxiliary switch panel, cruise control system should immediately disengage and erase the previously set speed from the E.C.U. memory.

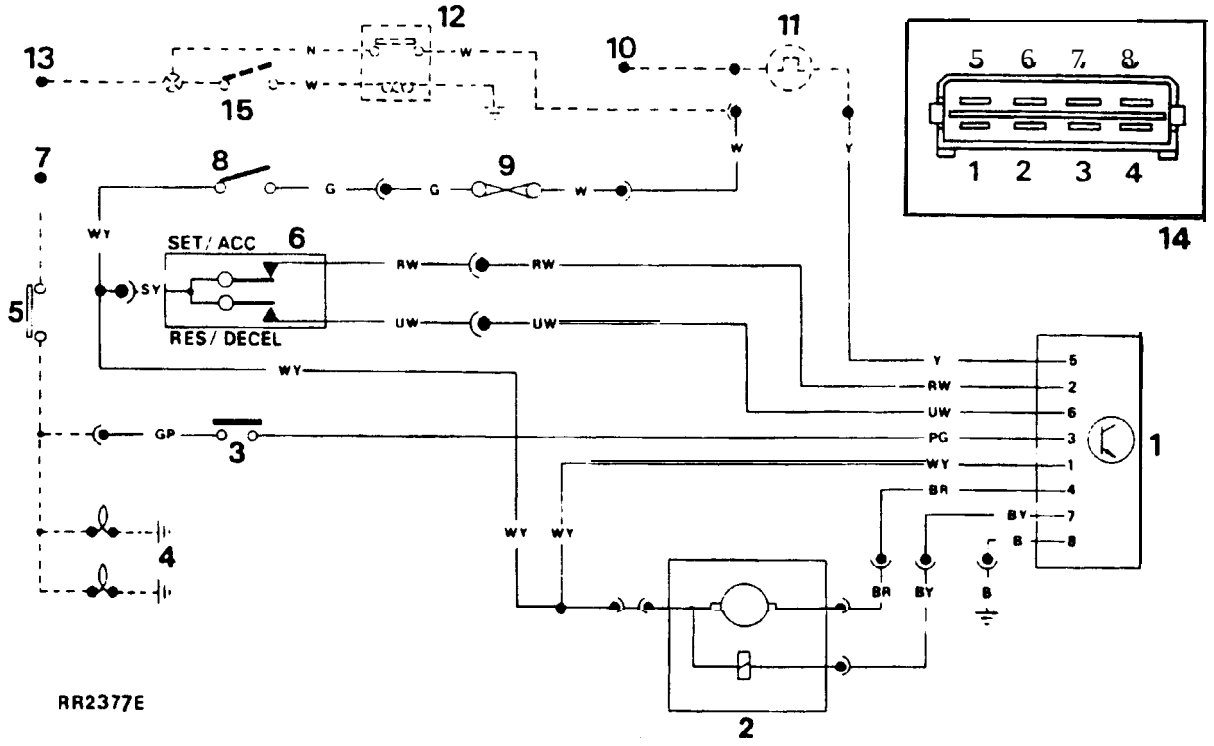
CRUISE CONTROL-circuit diagram

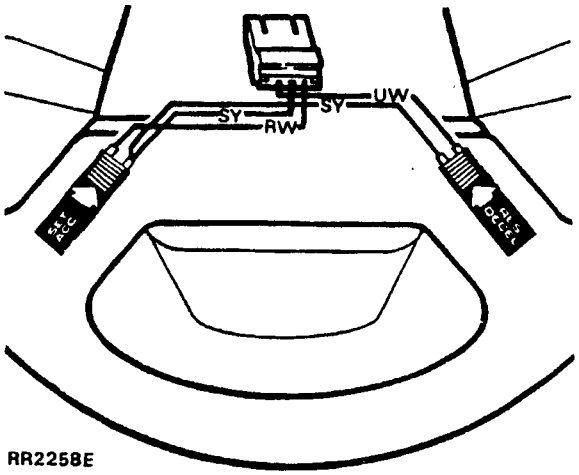
1. Electronic cruise control unit.
2. Vacuum pump.
3. Brake switch/vent valve.
4. Stop lamps.
5. Brake switch.
6. Steering wheel set and reset switches.
7. Ignition supply to stop lamp circuit.
8. Cruise control switch • auxiliary switch panel.
9. Fuse A6-auxiliary fuse panel (7.5A).
10. 12V+ supply to speed transducer.
11. Speed transducer.
12. ignition load relay • item 1 main circuit diagram.
13. Battery feed.
14. Cruise control harness multi-plug pin identification.
15. Ignition switch • item 8 main circuit diagram

••• Denotes existing main cable circuit.

Cable Colour Code - The last letter of a colour code denotes the tracer.

W. White	G. Green	U. Blue	R. Red
Y. Yellow	P. Purple	B. Black	S. Crey





EARLY MODELS • Wiring identification

Illustration RR2258E shows the current cruise control wiring condition and colour coding from the steering wheel switches to the cassette plug, earlier models were colour coded differently and can be identified as follows:-

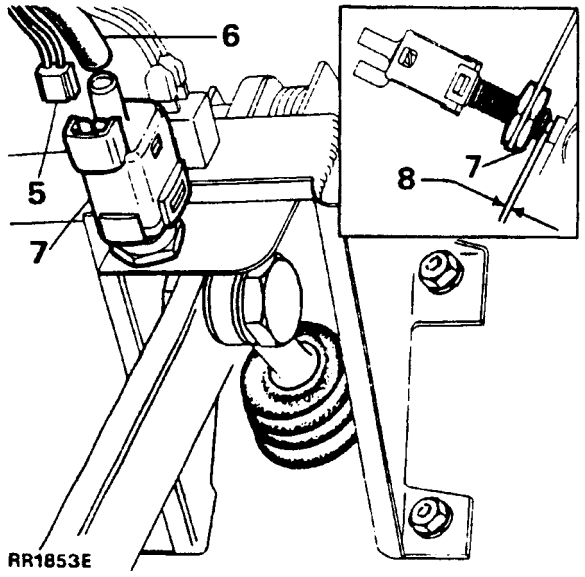
Latest condition	Early condition
Red/white	Green/red
Blue/white	Green/black
Grey/yellow	Red/blue

BRAKE SWITCH-VENT VALVE

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Remove the six screws securing the lower dash panel.
3. Lower the panel and disconnect the rheostat switch multi-plug and remove the warning lamp control unit from the retaining clip.
4. Withdraw the lower dash panel from the vehicle.
5. Disconnect the electrical multi-plug from the brake switch/vent valve.
6. Pull the hose from the switch.
7. Unscrew the adjusting nut and withdraw the switch.



Refitting

8. Refit the switch and fit the adjusting nut. Adjust the valve to provide a clearance of 1.0 mm (0.039 in) between the valve body and Inside shoulder of the contact button.
9. Fit the hose and multi-plug ensuring that the) are secure.
10. Reverse the remaining removal instructions.

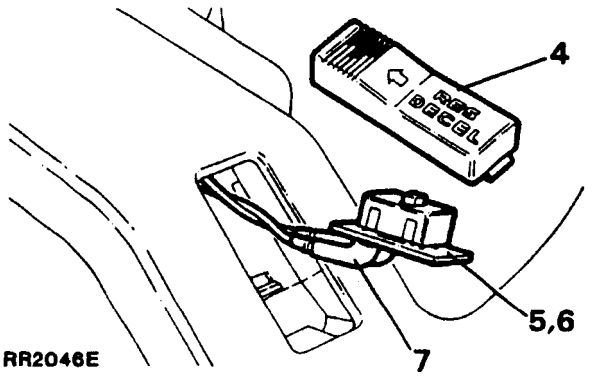
DRIVER OPERATED CRUISE CONTROL SWITCHES-STEERING WHEEL

NOTE: MAIN CONTROL SWITCH. The removal and refit of the main control switch and bulb replacement is included in the Electrical Section 86, as part of the auxiliary switch panel removal.

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Carefully pry the centre trim pad off the steering wheel.
3. Disconnect the electrical multi-plug located in the small opening below the steering wheel retaining nut.
4. Carefully pry the switch(es) out of the steering wheel spoke(s).
5. Release the small switch button from the opening within the spoke(s).
6. Carefully pull the switch and electrical leads through the spoke until access is gained to the electrical connections beneath the switch.
7. Disconnect the electrical leads from the switch and withdraw the switch(es).



Refitting

8. Reverse the removal procedure ensuring that the electrical leads are fitted securely.

SPIRAL CASSETTE

The spiral cassette is located below the steering wheel encased in the steering column shroud. Access to the unit is gained by removing the aforementioned items.

NOTE: To enable the steering wheel to be refitted in its correct radial position, ensure the front road wheels are in the straight ahead position.

Remove and refit

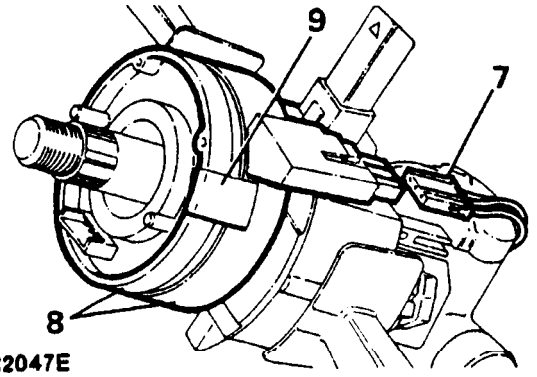
Removing

Service Tools:
18G 1014 Steering wheel remover
18G 1014-2 Adaptor pins

1. Disconnect the battery negative terminal.
2. Remove the steering wheel centre trim panel.
3. Disconnect the electrical multi-plug located in the small opening in the centre of the steering wheel.
4. Remove the steering wheel securing nut and serrated washer, using service tool 18G 1014 and adaptor pins, withdraw the steering wheel.

CAUTION: Apply adhesive tape to the upper and lower halves of the cassette to prevent the upper half of the spiral cassette rotating after the steering wheel is removed. Failure to do this will result in damage to the flexible tape inside the cassette.

5. Remove the six lower fixings securing the steering column shroud.
6. Release either the left hand or right hand fixing securing the top of the shroud.
7. Carefully ease the two halves of the shroud apart until access is gained to the electrical multi-plug on the bottom half of the cassette and disconnect the multi-plug.
8. Withdraw the cassette from the steering column.



RR2047E

Refitting

9. Remove the adhesive tape retaining the upper and lower halves of the spiral cassette.

NOTE: Ensure that the two driving pegs on the spiral cassette locate in the two holes on the underside of the steering wheel before refitting the steering wheel securing nut.

10. Reverse the removal instructions, ensuring that all electrical leads located beneath the steering column shroud are arranged so they do not become trapped between the shroud mating faces.

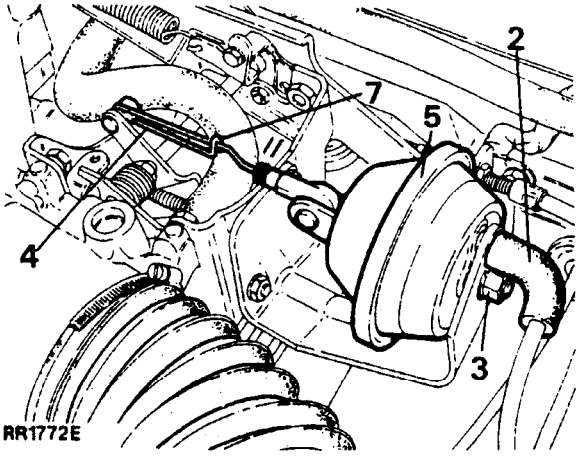
ACTUATOR

NOTE: The actuator itself is not a serviceable item, in the event of failure or damage fit a new unit.

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Pull the short rubber elbow from the actuator.
3. Remove the nut securing the actuator to the throttle bracketry.
4. Detach the actuator from the bracket and maneuver the actuator operating link off the throttle lever.
5. Withdraw the actuator from the engine compartment.



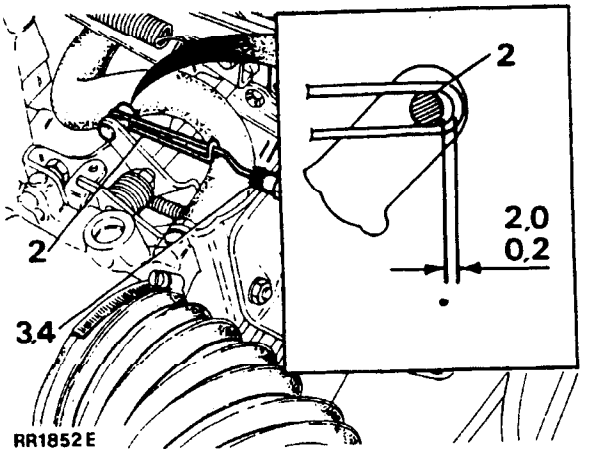
Refitting

6. Inspect the rubber diaphragm for condition. Fit a new Actuator assembly if the diaphragm is in poor condition.
7. Reverse the removal procedure, ensuring that the hook is fitted uppermost

ACTUATOR LINK-SETTING

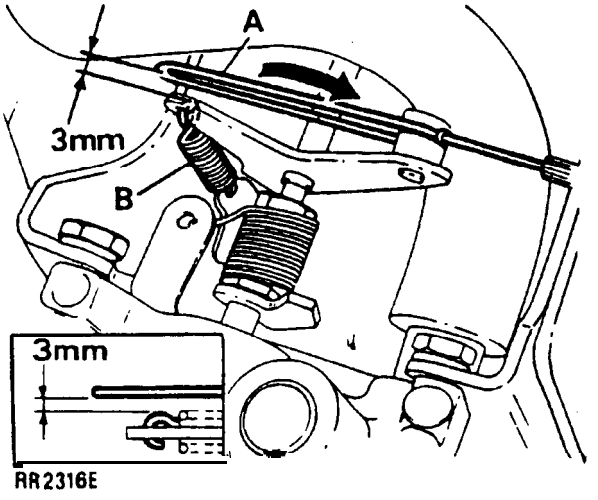
NOTE: The setting procedure outlined is at minimum throttle condition only.

1. Ensure ignition is switched 'OFF'.
2. Check the clearance between the inside edge of the actuator link and recessed diameter of the throttle lever. Clearance should be 0.2 to 2.0 mm (0.008 to 0.080 in).



Adjust the link

3. Remove the link from the actuator.
4. Rotate the socket joint on the actuator link clockwise or counter-clockwise to decrease or increase the operating length of the link.
5. Refit the link to the actuator and recheck the clearance between the link and lever.
6. With the trottle fully open, check that a gap of at least 3mm (1/8") exists between the side of the actuator link ("A" in illustration) and the side of the small spring which connects the inner throttle level to the outer throttle lever ("B" in illustration). Realign the actuator link by bending to achieve the correct gap if it is less than 3mm. Recheck the clearance at closed throttle/open throttle and check that the actuator link slides smoothly in the groove of the throttle lever.



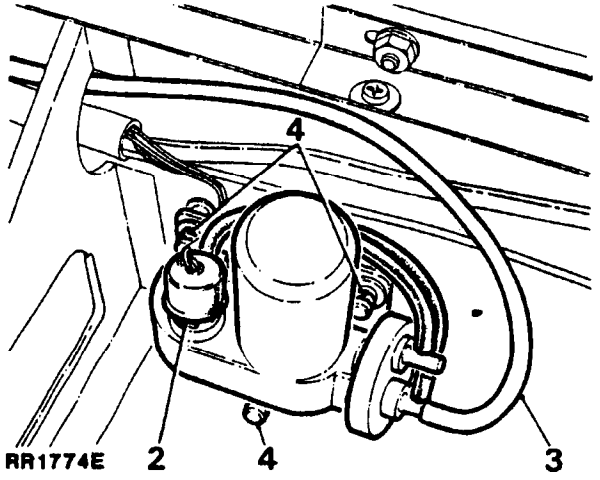
VACUUM PUMP

NOTE: The vacuum pump is not a serviceable item, in the event of failure fit a new unit.

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Disconnect the multi-plug from the top of the vacuum pump.
3. Disconnect the vacuum feed hose from the vacuum pump.
4. Withdraw the three vacuum pump rubber mountings from the left hand valance/inner fender assembly.



5. Withdraw the pump from the engine compartment.

Refitting

6. Reverse the removal procedure ensuring that the hose and electrical connections are secure.

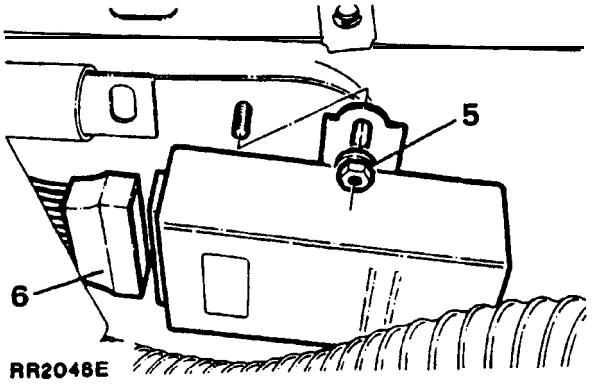
ELECTRONIC CONTROL UNIT (ECU) - CRUISE CONTROL.

The cruise control electronic control unit (ECU) is located behind the lower dash panel below the steering column, and is attached to the underside of the instrument binnacle, access to the ECU is gained by removing the lower dash panel.

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Remove the six screws retaining the lower dash panel.
3. Lower the panel and disconnect the electrical multi-plug from the rheostat switch and detach the warning lamp control unit from the retaining clip.
4. Withdraw the lower dash panel from the vehicle.
5. Remove the two fixings to enable the ECU to be lowered to give access to the electrical multi-plug.
6. Disconnect the multi-plug to the ECU, and remove the unit from the vehicle.



Refitting

7. Reverse the removal instructions ensuring that the electrical multi-plug is securely reconnected.

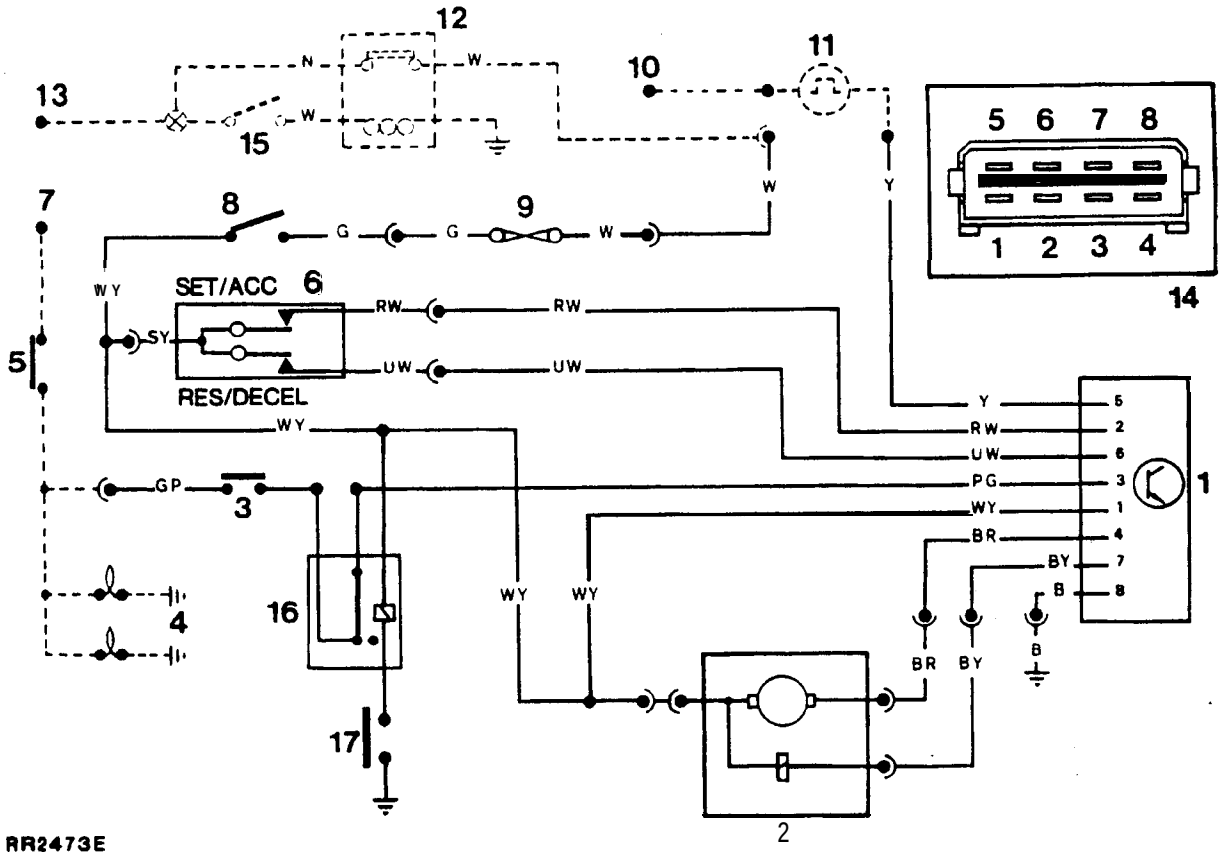
CRUISE CONTROL - Circuit diagram - 1989 Model Year

1. Electronic cruise control unit
2. Vacuum pump
3. Brake switch/vent valve
4. Stop lamps
5. Brake switch
6. Steering wheel set and reset switches
7. Ignition supply to stop lamp circuit
8. Cruise control switch-auxiliary switch panel
9. Fuse A6-auxiliary fuse panel (7.5A)
10. 12V + supply to transducer
11. Speed transducer
12. Ignition load relay-item 1 main circuit diagram
13. Battery feed
14. Cruise control harness multi-plug identification
15. Ignition switch-item 8 main circuit diagram
16. Relay - neutral lockout
17. Start inhibit switch

--- Denotes exiting main cable circuit

Cable colour code-the last letter of a colour code denotes the tracer.

W White	G Green	U Blue	R Red	N Brown
Y Yellow	P Purple	B Black	S Grey	



RR2473E

ECU multi-plug identification

TERMINAL NO.	COLOUR	FUNCTION
1.	White/Yellow	Main power from master switch
2.	Red/White	12V + from set switch (when pressed)
3.	Purple/Green	Ground via vent valve switch, brake light filaments. neutral relay
4.	Black/Red	To vacuum pump motor
5.	Yellow	To speed transducer
6:	Blue/White	12V + from resume switch (when pressed)
7.	Black/Yellow	To vacuum pump solenoid valve
8.	Black	ECU ground

NEUTRAL LOCKOUT RELAY-CRUISE CONTROL

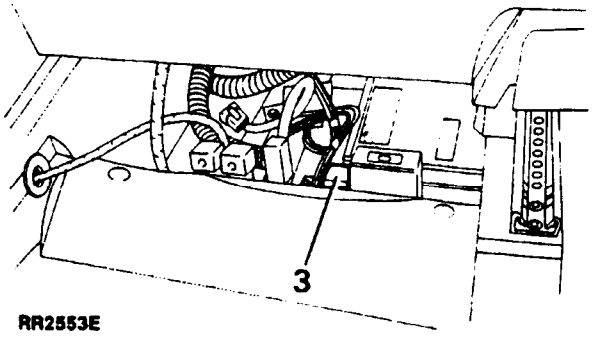
1989 Model Year vehicles have a relay in the electrical circuit which will disengage the cruise control system if neutral, or park, is selected in the main gearbox, when the system is engaged.

The relay is located under the rear of the front right hand seat adjacent to the emission maintenance reminder. Access to the unit is gained through the opening at the bottom of the seat when the seat is in its fully forward position.

Remove and refit

Removing

1. Ensure the seat is adjusted fully forward.
2. Disconnect the battery negative terminal
3. Pull the relay from the terminal block.



RR2553E

Refitting

4. Reverse the removal instructions.

FAULT DIAGNOSIS

If the system does not function the following checks must be carried out,

Fuse A6 - intact (C5 1990 Model Year).
Vacuum hoses - not split or disconnected
Actuator - diaphragm ruptured
Vacuum Pump - motor operational
Brake Switch - faulty or out of adjustment
Speed Transducer - faulty - check operation of unit
Electrical Leads - loose connections - faulty leads
Stop Lamp Bulbs - both bulbs faulty - replace: Fuse 13 intact, (A5 1990 Model Year)
Neutral Relay - operational.

PRELIMINARY CHECKS PRIOR TO TESTING

1. **Ignition switch "ON".**
2. **Fuse A-6 "OK".**
3. **Cruise Control master switch "ON".**
4. **Shift lever in 'D'.**
5. **Minimum 12.0V (Battery) available.**

CRUISE CONTROL OPERATIONAL CHECKS

All system testing may be performed with a multi-meter and jumper wire at the ECU connector.

TEST PROCEDURE

Volt Meter Connections	Specified Result	Possible Problem if Results not as Specified
1. Terminal 1 and ground	Battery voltage	Fuse, wiring, master switch
2. Terminal 1 and 8	Batter voltage	Poor ground
3. Terminal 1 and 3	Battery voltage	Brake light ground, vent valve switch, wiring, brake light bulbs
4. Terminal 6 and 8 (press resume)	Battery voltage	Wiring, resume switch, cassette
5. Terminal 2 and 8 (press set)	Battery voltage	Wiring, set switch cassette
6. Terminal 5 and 8 - Rotate left-rear wheel, right-rear wheel remains on ground	0-12V fluctuating 6 times per revolution	Wiring, speed transducer

NOTE: Complete test procedure by carrying out the Vacuum System Test and Road Test procedure - see page 3, Section 19 - Cruise Control.

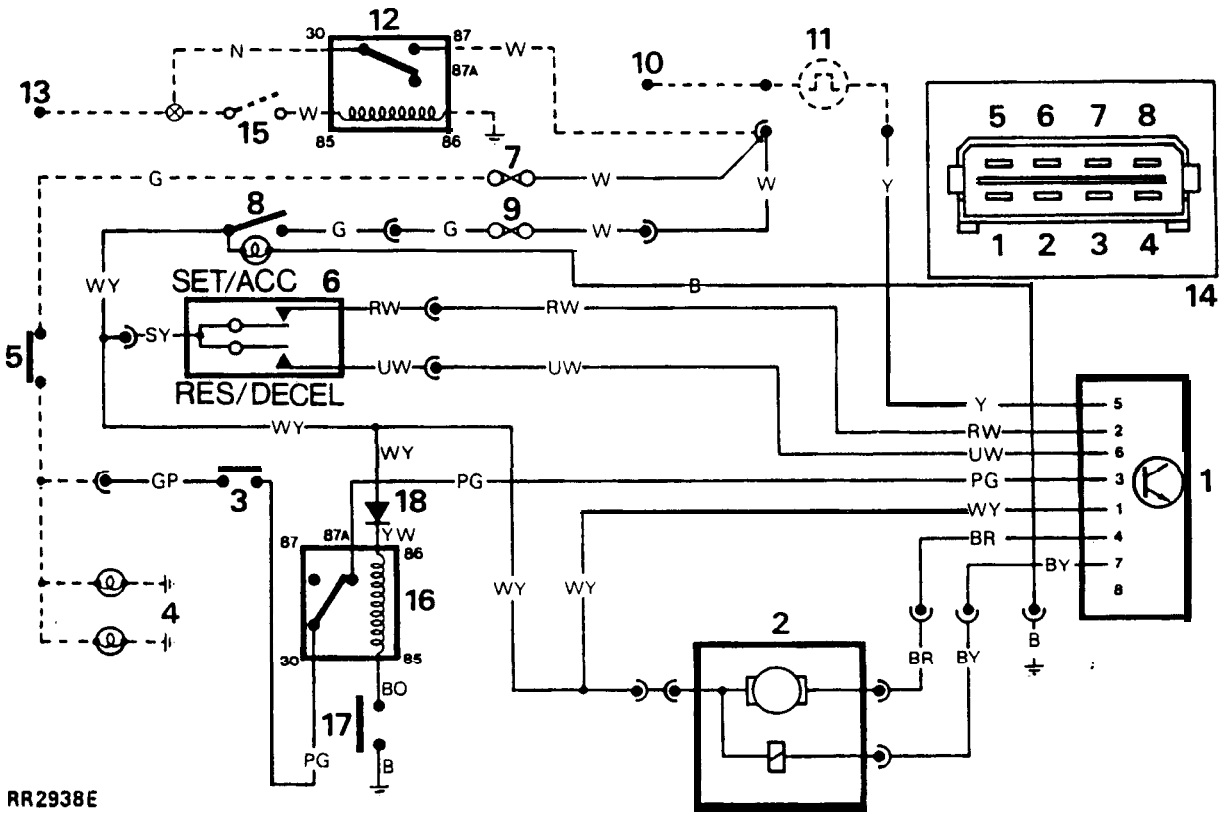
CRUISE CONTROL - Circuit diagram - 1990 Model Year onwards

1. Electronic cruise control unit
2. Vacuum pump
3. Brake switch/vent valve
4. Stop lamps
5. Brake switch
6. Steering wheel set and reset switches
7. Fuse AS
8. Cruise control switch-auxiliary panel
9. Fuse C5 (10A)
10. 12V + supply to transducer
11. Speed transducer
12. ignition load relay-item 1 main circuit diagram
13. Battery feed
14. Cruise control harness multi-plug identification
15. Ignition switch-item 8 main circuit diagram
16. Relay - neutral lockout
17. Start inhibit switch
18. Diode

---Denotes exiting main cable circuit

Cable clour code the last letter of a colour code denotes the tracer.

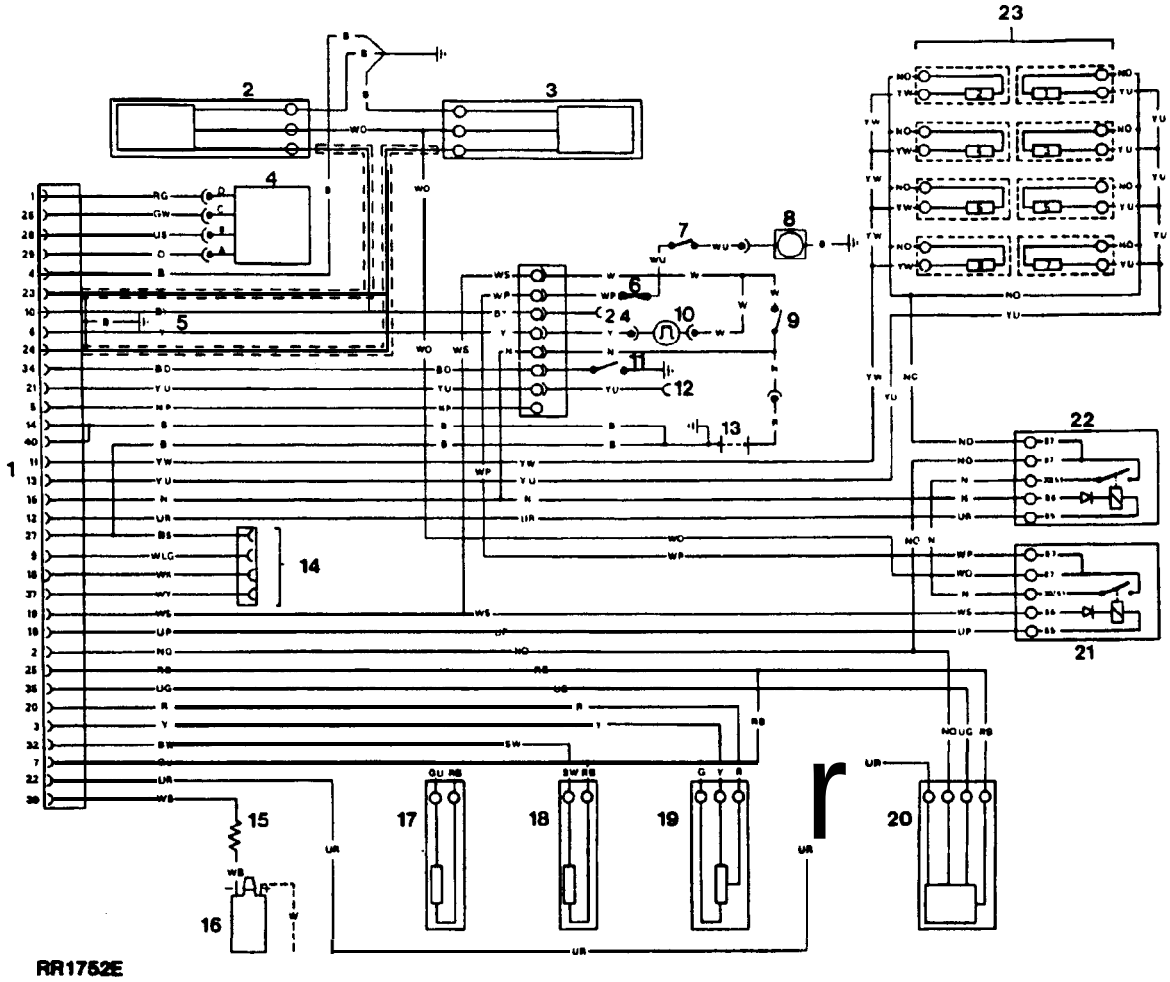
W White	**G** Green	**U** Blue	**R** Red	N Brown
Y Yellow	P Purple	**B** Black	S Grey	



RR2938E

ECU multi-plug identification

TERMINAL NO.	COLOUR	FUNCTION
1.	White/Yellow	Main power from master switrh
2.	Red/White	12V + from set switch (when pressed)
3.	Purple/Green	Ground via vent valve switch, brake light filaments. neutral relay
4.	Black/Red	To vacuum pump motor
5.	Yellow	Tcj speed transducer
6.	Blue/White	12V + from resume switch (when pressed)
7.	Black/Yellow	TO vacuum pump solenoid valve
8.	Black	ECU ground



FUEL INJECTION - Circuit Diagram

1. 40 way connector to Electronic Control Unit (ECU).
2. Lambda sensor (left side - bank A).
3. Lambda sensor (right side - bank B).
4. By-pass air valve (stepper motor) (fast idle).
5. Lambda sensor screened ground.
6. Fuse 18 - main fuse panel.
7. Inertia switch.
8. Fuel pump.
9. Ignition switch.
10. Speed transducer (road speed input).
11. Neutral switch (automatic gearbox) (load input).
12. Pick-up point-air conditioning circuit (load input).
13. Battery.
14. Diagnostic plug.
15. In-line resistor.
16. Coil/-ve (engine RPM input).
17. Coolant temperature thermistor (sensor) (input).
18. Fuel temperature thermistor (sensor) (input).
19. Throttle potentiometer.
20. Air flow sensor.
21. Fuel pump relay.
22. Main relay.
23. Injectors-1 to 8.
24. Pick-up point E.F.I. warning symbol (instrument binnacle).

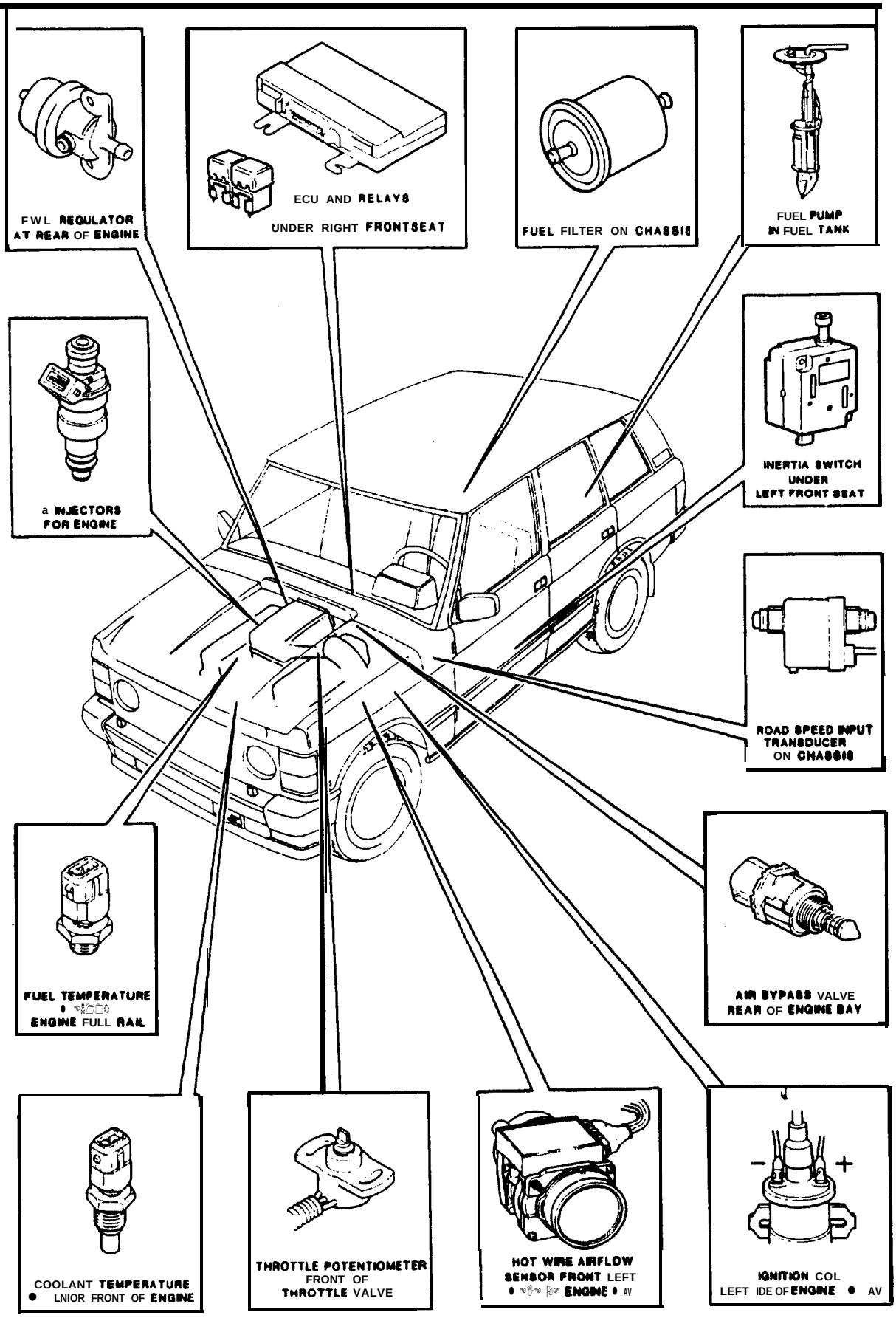
= = = Denotes screened ground.

NOTE: Reference to left and right side is made when viewing vehicle from rear.

Cable colour code

B	Black	G	Green	R	Red	S	Grey
U	Blue	O	Orange	W	White	K	Pink
N	Brown	P	Purple	Y	Yellow	LG	Light green

The last letter of a colour code denotes the tracer.


FWL REGULATOR AT REAR OF ENGINE
ECU AND RELAYS UNDER RIGHT FRONTSEAT
FUEL FILTER ON CHASSIS
FUEL PUMP IN FUEL TANK
a INJECTORS FOR ENGINE
INERTIA SWITCH UNDER LEFT FRONT SEAT
ROAD SPEED INPUT TRANSDUCER ON CHASSIS
FUEL TEMPERATURE ENGINE FULL RAIL
AIR BYPASS VALVE REAR OF ENGINE BAY
COOLANT TEMPERATURE LNIOR FRONT OF ENGINE
THROTTLE POTENTIOMETER FRONT OF THROTTLE VALVE
HOT WIRE AIRFLOW SENSOR FRONT LEFT ENGINE AV
IGNITION COL LEFT IDE OF ENGINE AV

RR2178E

INTRODUCTION

The Electronic Fuel injection system provides a reliable and efficient microprocessor controlled fuel management system.

The function of the system is to supply the exact amount of fuel directly into the inlet manifold according to the prevailing engine operating conditions.

To monitor these conditions, various sensors are fitted to the engine to measure engine parameters. Data from the sensors is received by the Electronic Control Unit (E.C.U.), the E.C.U. will then determine the exact amount of fuel required at any condition.

The E.C.U. having received data from the sensors produces pulses, the length of which will determine the simultaneous open time of each bank of injectors in turn, which will govern the amount of fuel injected.

DESCRIPTION

ELECTRONIC CONTROL UNIT-ECU

The Electronic Fuel Injection system is controlled by the E.C.U. which is located under the front right hand seat. The control unit is a microprocessor with integrated circuits and components mounted on printed circuit boards. The E.C.U. is connected to the main harness by a 40 pin plug.

INJECTORS

The eight fuel injectors are fitted between the pressurized fuel rail and inlet manifold. Each injector comprises a solenoid operated needle valve with a movable plunger rigidly attached to the nozzle valve. When the solenoid is energized the plunger is attracted off its seat and allows pressurized fuel into the intake manifold.

ENGINE COOLANT TEMPERATURE THERMISTOR (SENSOR)

The coolant thermistor (sensor) is located by the front left hand branch of the intake manifold. The thermistor provides engine coolant information to the E.C.U. The E.C.U. on receiving the signal from the thermistor will lengthen slightly the time that the injectors are open, and reducing this time as the engine reaches normal operating temperature.

FUEL TEMPERATURE THERMISTOR (SENSOR)

The fuel temperature thermistor (sensor) is located in the fuel rail forward of the ram housing. The thermistor sends fuel temperature data to the E.C.U, the E.C.U on receiving the data will adjust the injector open time accordingly to produce good hot starting in high ambient temperatures.

BYPASS AIR VALVE (STEPPER MOTOR)

The bypass valve is screwed into a housing attached to the rear of the plenum chamber, between the plenum chamber and bulkhead. The bypass valve has two windings which enable the motor to be energised in both directions thus opening or closing the air valve as required by the E.C.U.
The bypass valve will open and allow extra air into the plenum chamber to maintain engine idle speed when the engine is under increased (Electrical and Mechanical) loads.
The bypass valve will control engine idle speed when the vehicle is stationary.

LAMBDA SENSORS (O_2 SENSORS)

The two Lambda sensors are located forward of the catalysts mounted in the exhaust downpipes.
The sensors monitor the oxygen content of the exhaust gases and provide feedback information of the air/fuel ratio to the E.C.U. Each sensor is heated by an electrical element to improve its response time when the ignition is switched on.

Continued

FUEL PRESSURE REGULATOR

The fuel pressure regulator is mounted in the fuel rail at the rear of the plenum chamber. The regulator is a mechanical device controlled by plenum chamber vacuum, it ensures that fuel rail pressure is maintained at a constant pressure difference of 2.5 bar above that of the manifold.
When pressure exceeds the regulator setting excess fuel is returned to the fuel tank.

FUEL PUMP

The electric fuel pump is located in the fuel tank, and is a self priming 'wet' pump, the motor is immersed in the fuel within the tank.

AIR FLOW SENSOR

The hot-wire air flow sensor is mounted on a bracket attached to the left hand valance, rigidly connected to the air cleaner and by hose to the plenum chamber inlet neck.
The air flow sensor consists of a cast alloy body through which air flows. A proportion of this air flows through a bypass in which two wire elements are situated: one is a sensing wire and the other is a compensating wire. Under the control of an electronic module which is mounted on the air flow sensor body, a small current is passed through the sensing wire to produce a heating effect. The compensating wire is also connected to the module but is not heated, but reacts to the temperature of the air taken in, as engine intake air passes over the wires a cooling effect takes place.

The electronic module monitors the reaction of the wires in proportion to the air stream and provides output signals in proportion to the air mass flow rate which are compatible with the requirements of the E.C.U.

THROTTLE POTENTIOMETER

The throttle potentiometer is mounted on the side of the plenum chamber inlet neck and is directly coupled to the throttle valve shaft.
The potentiometer is a resistive device supplied with a voltage from the E.C.U. Movement of the throttle pedal causes the throttle valve to open, thus rotating the wiper arm within the potentiometer which in turn varies the resistance in proportion to the valve position. The E.C.U. lengthens the injector open time when it detects a change in output voltage (rising) from the potentiometer.
In addition the E.C.U. will weaken the mixture when it detects the potentiometer output voltage is decreasing under deceleration and will shorten the length of time the injectors are open.
When the throttle is fully open, the E.C.U. will detect the corresponding throttle potentiometer voltage and will apply full load enrichment. This is a fixed percentage and is independent of temperature. Full load enrichment is also achieved by adjusting the length of the injector open time.
When the throttle is closed, overrun fuel cut off or idle speed control may be facilitated dependant on other inputs to the E.C.U.

ROAD SPEED TRANSDUCER

The road speed transducer is fitted between the upper and lower speedometer cables. It is mounted on a bracket located on the left hand chassis side member adjacent to the rear engine mounting. The transducer provides road speed data to the ECU. The ECU in turn detects vehicle movement from the road speed input and ensures that idle speed control mode is disengaged. Should the speed transducer fail in service the ECU idle speed control would become erratic.

INERTIA SWITCH

The inertia switch is a mechanically operated switch located under the left hand front seat attached to the seat base rear cross-member.
The switch is normally closed and is in the ignition feed (fuse to fuel pump). In the event of a sudden impact the switch opens, and disconnects the electrical feed to the fuel pump. The switch is reset by pressing down the button.

RELAYS

The two electronic fuel injection relays are located under the front right hand seat mounted forward of the E.C.U. The main relay is energized via the E.C.U when the ignition is switched on and supplies current to the fuel injection system. The fuel pump relay is energized by the E.C.U. which in turn operates the fuel pump to pressurize the fuel system.

E.F.I. WARNING SYMBOL (Instrument binnacle)

An E.F.I. warning symbol incorporated into the instrument binnacle will illuminate when the E.C.U. detects that it cannot maintain correct air/fuel ratio due to a fault in one of the following fuel injection system components.

Air flow sensor.
Lambda sensor.
Water temperature thermistor. (sensor)
Throttle potentiometer.

The symbol will illuminate on initial turn of the ignition key as part of the bulb check feature, and will go out after a few seconds.
If the symbol illuminates when the engine is idling or the vehicle is being driven it indicates a failure of one of the four functions, the vehicle should be driven with care, and the cause rectified, refer to test procedure for the particular functions. Should one of the functions fail, the vehicle can still be driven due to a limp home feature incorporated into the fuel injection system.

FUEL INJECTION SYSTEM

CAUTION: The fuel system incorporates fine metering components that would be affected by any dirt in the system; therefore it is essential that working conditions are scrupulously clean. If it is necessary to disconnect any part of the fuel injection system, the system MUST be depressurized. All openings left open after the removal of any component from the fuel system, MUST be sealed off to prevent ingress of dirt.

ENGINE SETTING PROCEDURE

If a major overhaul has been undertaken on the fuel injection/engine system, the following check and adjustments must be carried out before attempting to start the engine.

A. Throttle potentiometer setting - see 'Throttle potentiometer' setting procedure.
B. Spark plug gaps - see 'Section 05 Engine tuning data'.
C. Throttle levers - see 'Throttle lever setting procedure'.
D. Ignition timing - static - see 'Section 86 Electrical'.

CAUTION: IF THE ENGINE IS MISFIRING, IT SHOULD BE IMMEDIATELY SHUT DOWN AND THE CAUSE RECTIFIED. FAILURE TO DO SO WILL RESULT IN IRREPARABLE DAMAGE TO THE CATALYSTS.

NOTE: If the previous checks and adjustments are satisfactory but the engine will not start the ignition and fuel injection electrical circuitory must be checked using the appropriate recommended equipment.

Recommended Equipment -

Lucas 'Electronic Ignition Analyser'
Lucas Part Number - YWB 119.

Lucas Diagnostic Equipment
Lucas Part Number - 60600965 (complete kit)

Individual part numbers for the above kit are as follows:

Hand held test unit	- Model 2HHT
Lucas Part Number	- 84772
Interface unit	- Model 21U
Lucas Part Number	- 84773
Serial link lead	
Lucas Part Number	- 54744753
Memory card	
Lucas Part Number	- 54744754
Operating manual	
Lucas Part Number	. XXB825
Plastic case	
Lucas Part Number	- 54744755

NOTE: The Lucas diagnostic equipment can be connected to the diagnostic plug located by the E.C.U.

Use in conjunction with the Lucas Operating InstructionManuals.

If the above equipment is unavailable the tests can be carried out using a multi-meter, following the instructions given in the charts.

CAUTION: Ensure the multi-meter is correctly set to volts or ohms, dependent upon which test is being undertaken.

Carry out the following static checks before undertaking the continuity procedure:-

A. Fuse 18 - in main fuse panel - is intact.
B. Inertia switch - not tripped.
C. Fuel - ample fuel in fuel tank.
D. Battery Condition - state of charge.
E. Air Leaks - no unmetered air entering engine system.
F. Electrical Connections - dry, clean and secure.

CONTINUITY TEST PROCEDURE

The continuity procedure and instructions on the following pages must be followed precisely to prevent damage occurring to any of the fuel system components.

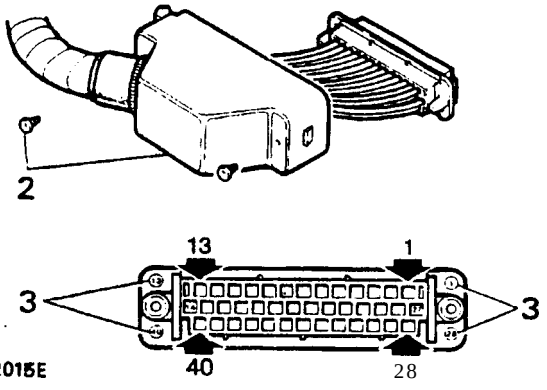
To enable the tests to be carried out when the 40 way multi-plug is connected to the E.C.U., it is necessary to remove the two screws securing the shroud to the plug to enable the multi-meter probes to be inserted into the back of the appropriate pin.

CAUTION: Tests that require the plug to be removed from the E.C.U., must also have the meter probes inserted into the back of the plug. If the probes are inserted into the plug sockets, damage will occur to the sockets resulting in poor connections when the plug is reconnected.

TESTING

1. **Remove the E.C.U., and harness plug from beneath the front right hand seat, access is gained through the rear opening of the seat base.**
2. **Remove the plug shroud and maneuver it along the harness until there is enough clearance enabling meter probes to be inserted into the back of the plug.**
3. **There are 4 pin numbers, 1, 13, 28, 40 moulded onto the rear of the plug for pin position identification as shown in the illustration below, (for clarity the electrical leads have been omitted).**

Pins 1 to 13 top row.
Pins 14 to 27 centre row (Pin 14 is below pin 13 but is not identified on the rear of the plug).
Pins 28 to 40 bottom row.



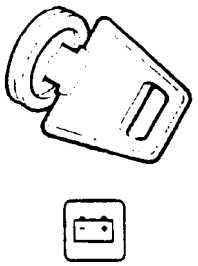
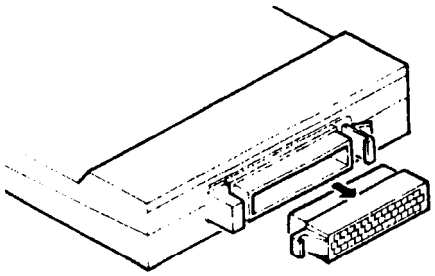
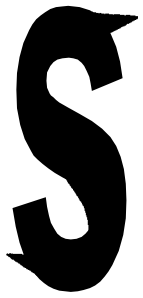
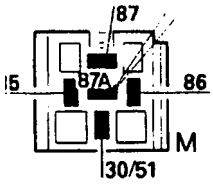
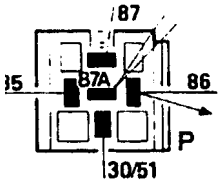
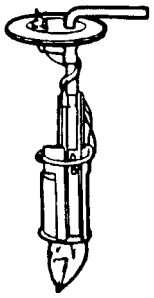
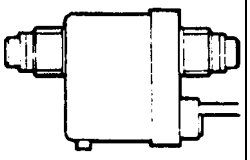
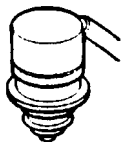
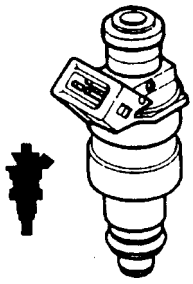
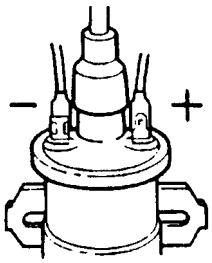
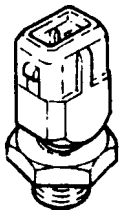
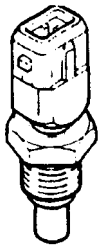
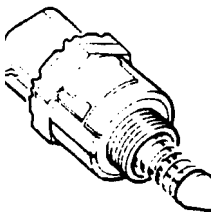
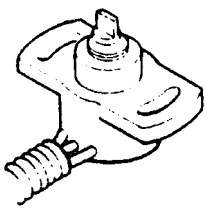
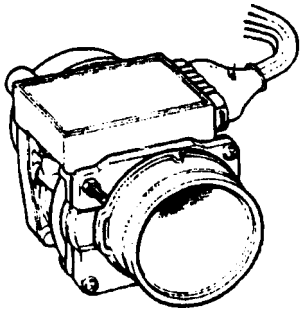
PIN NOS.	CABLE COLOUR
1.	Red/green
2.	Brown/orange
3.	Yellow
4.	Black
5.	Brown/purple
6.	Yellow
7.	Green/blue
8.	Not used
9.	White/light green
10.	Black/Yellow
11.	Yellow/white
12.	Blue/red
13.	Yellow/blue
14.	Black
15.	Brown
16.	Blue/purple
17.	Not used
18.	White/pink
19.	White/grey
20.	Red
21.	Yellow/blue
22.	Blue/red
23.	Blue
24.	Blue
25.	Red/black
26.	Green/white
27.	Black/grey
28.	Blue/grey
29.	Orange
30.	Not used
31.	Not used
32.	Grey/white
33.	Not used
34.	Black/orange
35.	Blue/green
36.	Not used
37.	White/yellow
38.	Not used
39.	White/black
40.	Black

The last colour denotes the wire tracer colour.

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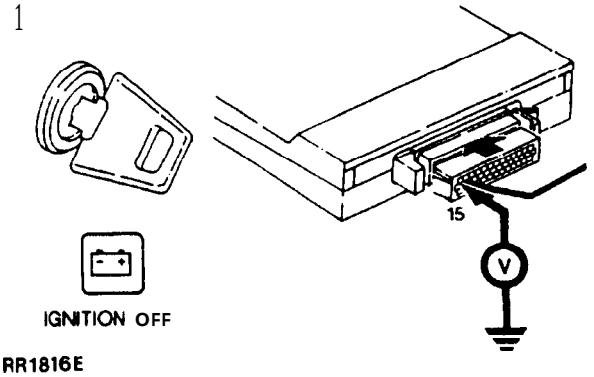
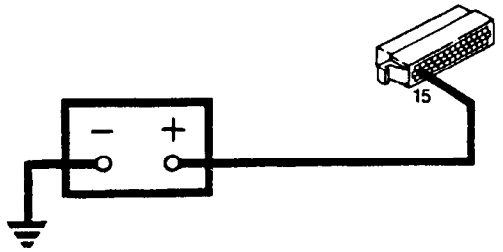
TESTS • Using a Multi-Meter

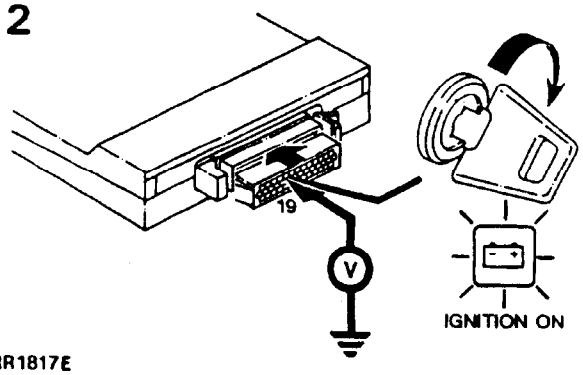
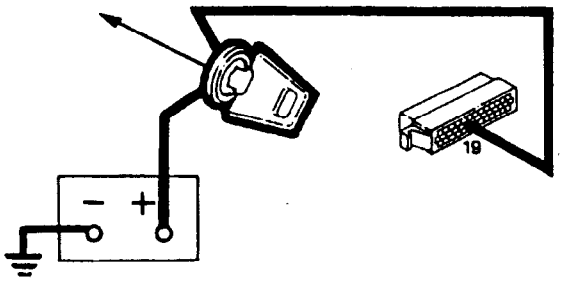
The following continuity tests are intended as a guide to identifying where a fault may be within a circuit; reference should be made to the fuel injection circuit diagram for full circuit information.

KEY TO SYMBOLS	 IGNITION SWITCH	 **ELECTRONIC CONTROL UNIT** AND MULTIPLUG		 TEMPORARY CONNECTION
 OHMMETER CONNECTIONS	 **VOLTMETER CONNECTIONS**	 MAIN RELAY	 **PUMP RELAY**	 **FUEL PUMP**
 ROAD SPEED INPUT (SPEED **TRANSDUCER)**	 **GEAR INPUT SWITCH (INHIBITOR SWITCH)**	 **INJECTOR**	 **IGNITION COIL**	 **FUEL TEMPERATURE SENSOR**
 **COOLANT** TEMPERATURE SENSOR	 **AIR** BYPASS **VALVE**	 **THROTTLE POTENTIOMETER**	 **HOT WIRE AIRFLOW SENSOR**	

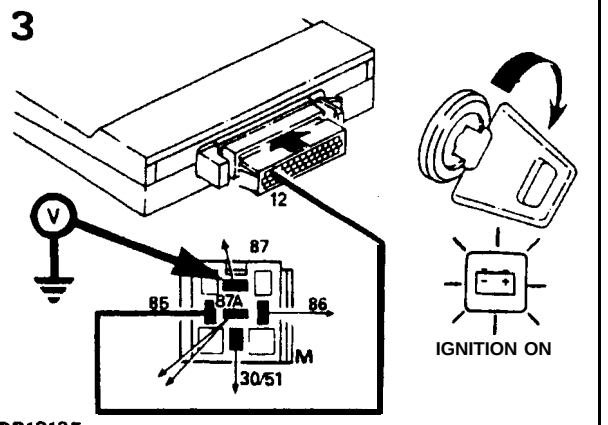
RR1782E

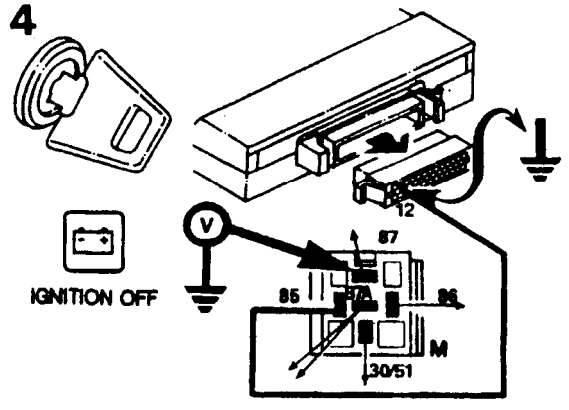
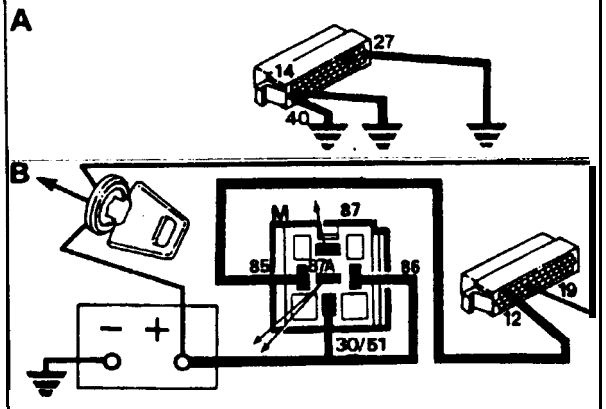
NOTE: All tests are carried out from the electronic control unit (ECU) harness multi-plug unless stated otherwise in the test procedure.

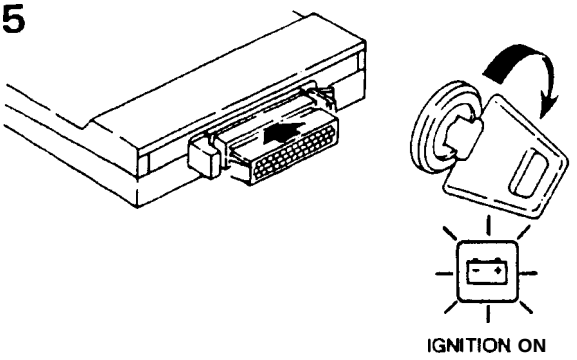
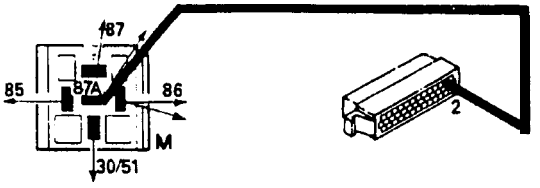
TEST PROCEDURE	RESULTS . Check cables and units shown in bold
1. Check battery supply to ECU	Voltmeter reading of battery volts - (mimimum battery voltage 10 volts) Proceed to Test 2 Voltmeter reading of zero volts Check:-
1  RR1816E	

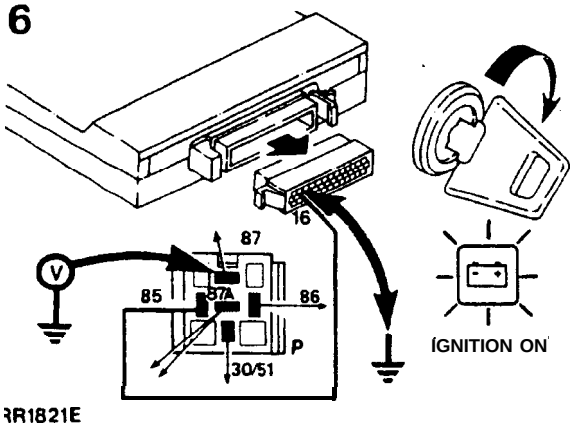
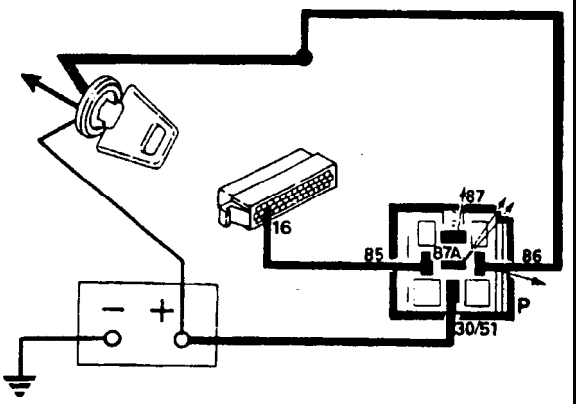
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
2. Check ignition supply to ECU	Voltmeter reading of battery volts - (minimum battery voltage 10 volts) Proceed to Test 3 Incorrect reading check:-
2  RR1817E	

Continued

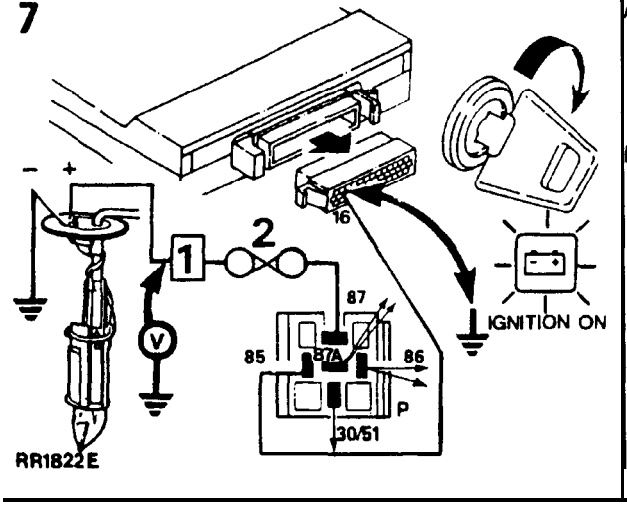
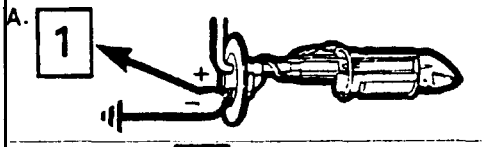
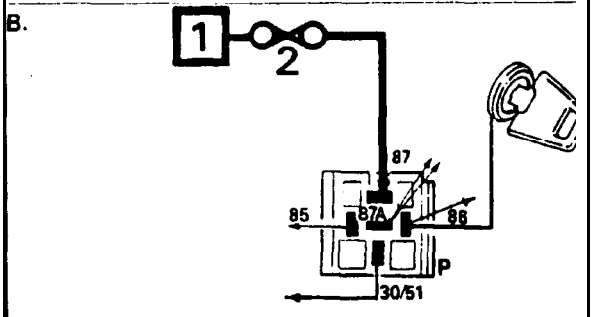
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
3. Check operation of Main relay	Voltmeter reading of battery volts - Proceed to Test 5 Voltmeter reading of zero volts - Proceed to Test 4
	

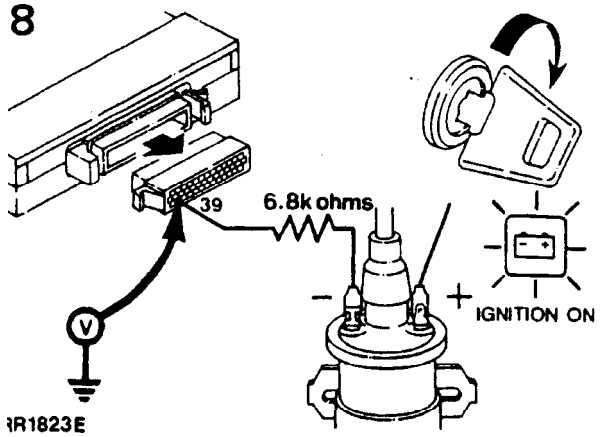
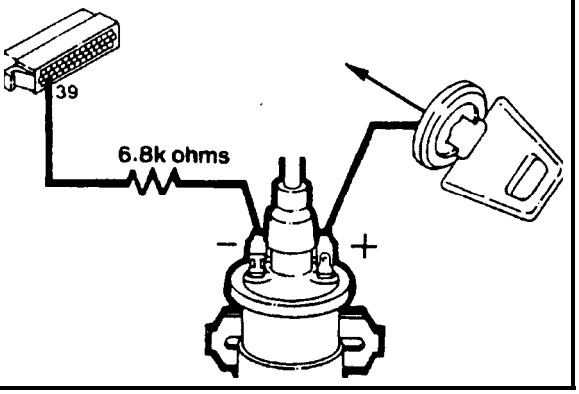
TESTPROCEDURE	RESULTS - Check cables and units shown in bold
4. Fault Diagnosis Main relay circuits	A. Voltmeter reading of battery volts - Check:- If OK Suspect ECU B. Voltmeter reading of zero volts Check:-
	

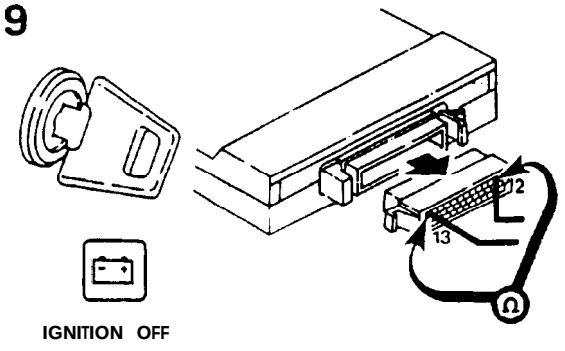
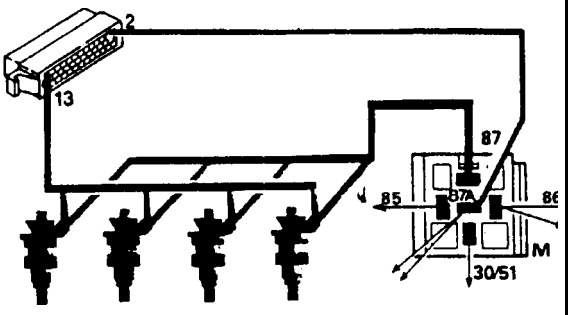
'EST PROCEDURE	RESULTS - Check cables and units shown in bold
;. Check operation of pump relay	Listen for audible 'click' from pump relay. If O.K - Proceed to Test 7
	No audible 'click' from pump relay Check:- If OK proceed to Test 6.
5  RR1820E	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
;. Fault diagnosis Pump relay circuits	Voltmeter reading of battery volts - Suspect ECU
	Voltmeter reading of zero volts Check:-
6  RR1821E	

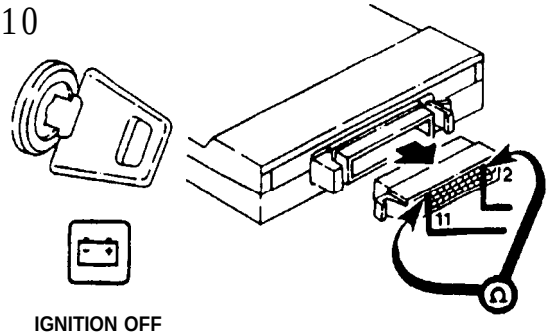
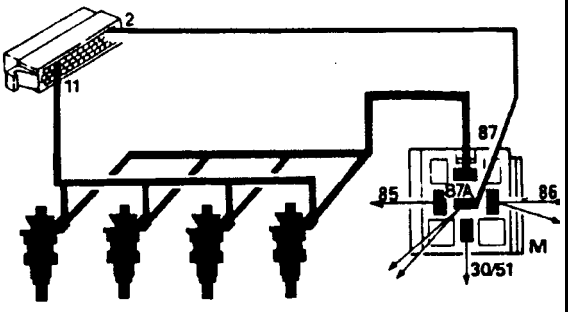
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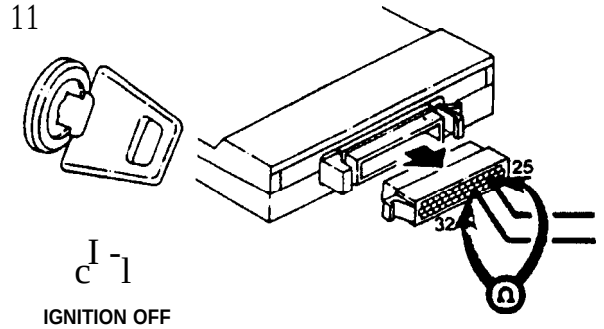
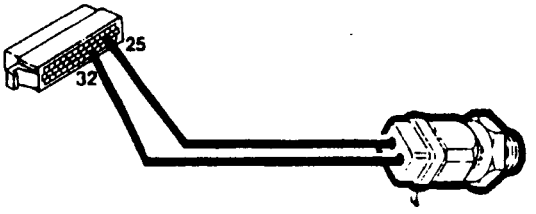
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
7. Check operation of Fuel pump NOTE: It is not possible lo place the multi-meter probes directly onto the pump terminals. A link lead attached to the pump is accessible behind the rear left hand wheel located between the chassis and stowage area floor panel. KEY: 1. Inertia switch 2. Fuse 18	Voltmeter reading of battery volts - Pump operating - Proceed to Test 8
	(A) Voltmeter reading of battery volts - Pump not operating Check:-
	(B) Voltmeter reading of zero volts Check:-
7  RR1822E	A.  B. 

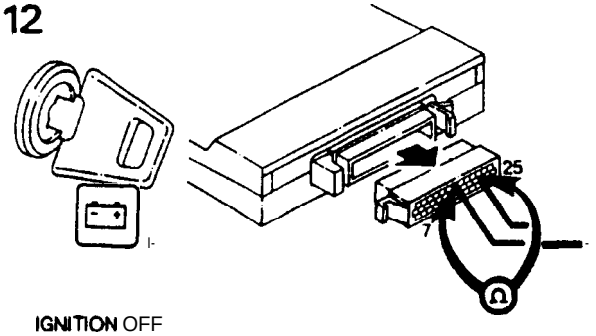
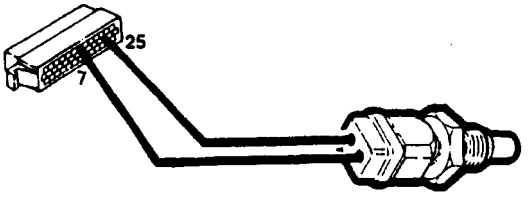
'ESTPROCEDURE	RESULTS • Check cables and units shown in bold
I. Check engine speed signal Cable and resistor	Voltmeter reading of battery volts • Proceed to Test 9
	Voltmeter reading of zero volts Check:-
8  ?R1823E	

TEST PROCEDURE	RESULTS • Check cables and units shown in bold
9. Check injectors, Injector circuit	Ohm-meter reading of 4-5 Ohms • Proceed to Test 10
	Ohm-meter reading of 5-6 Ohms • Suspect 1 injector Ohm-meter reading of 8-9 Ohms • Suspect 2 injectors Ohm-meter reading of 16-17 Ohms • Suspect 3 injectors Check for open circuit injector(s) or wiring faults.
(Pin 13 left bank injectors 1,3,5,7).	Ohm-meter reading of Infinity Check:
9  IGNITION OFF IR1824E	

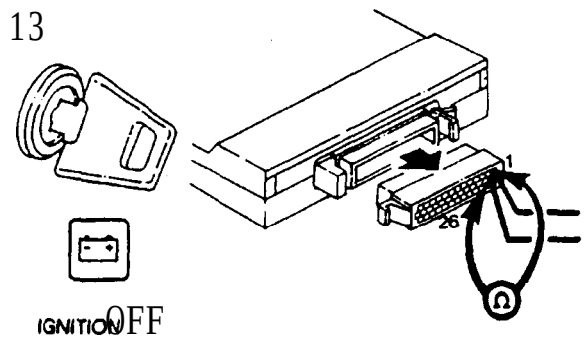
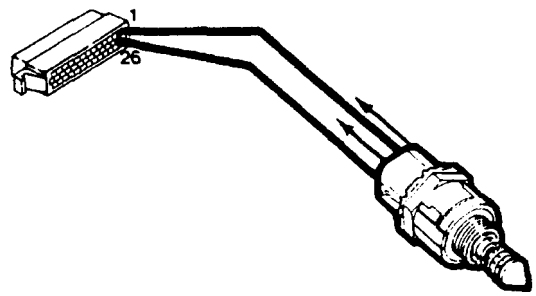
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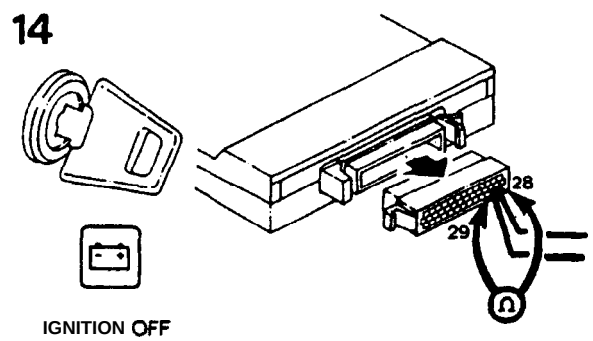
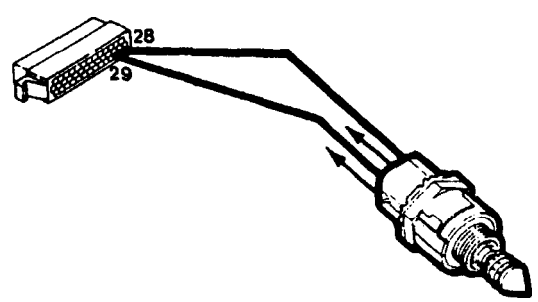
'ESTPROCEDURE	RESULTS • Check cables and units shown in bold
0. Check injectors Injector circuit pin 11 rightbank njectors 2,4,6,8)	Ohm-meter reading of 4-5 Ohms • Proceed to Test 11.
	Ohm-meter reading of 5-6 Ohms • Suspect 1 injector Ohm-meter reading of 8-9 Ohms • Suspect 2 injectors Ohm-meter reading of 16-17 Ohms • Suspect 3 injectors Check for open circuit injector(s) or wiring faults.
	Ohm-meter reading of Infinity Check:
10  IGNITION OFF RR1825E	

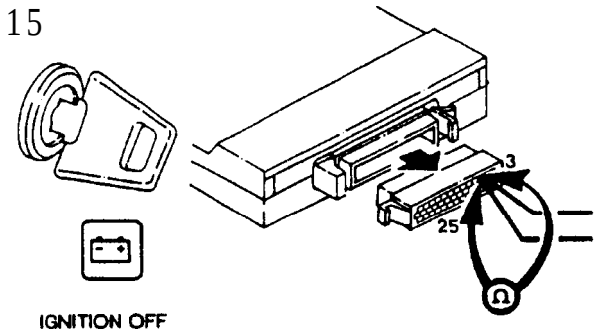
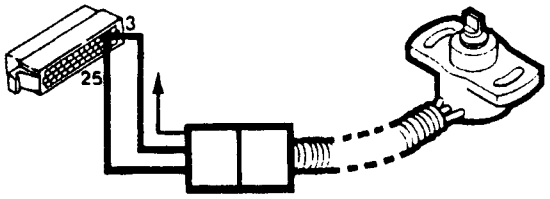
TEST PROCEDURE	RESULTS • Check cables and units shown in bold
11. Check fuel temperature thermistor (sensor)	Correct reading-temperature to resistance - Proceed to Test 12 (Refer to Temperature Conversion Charts in Test 12
	Incorrect Ohm-meter reading Check
11  IGNITION OFF RR1826E	

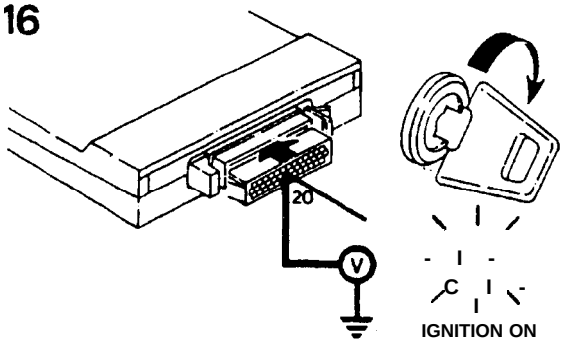
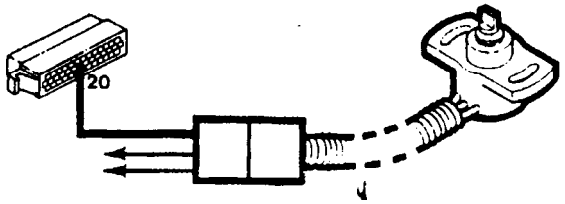
'ESTPROCEDURE	RESULTS - Check cables and units shown in bold
2. **Check coolant temperature thermistor (sensor)**	Correct reading-Temperature to resistance - Proceed to Test 13 (Refer to Temperature Conversion Chart below.
	Fuel and Coolant Temperature °C / °F — Ohm-meter Reading Should be Ohms -10° / 14° — 9100 - 9300 0° / 32" — 5700 - 5900 20° / 68° — 2400 - 2600 40° / 104° — 1100 - 1300 60" / 140° — 500 - 700 80° / 176° — 300 - 400 100° / 212° — 150 - 200
	Incorrect Ohm-meter reading Check:-
12  IGNITION OFF RR1827E	

Continued

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
13. Check air bypass valve - Part 1	Ohm-meter reading of 48-58 Ohms - Proceed to Test 14
	Incorrect reading Check:-
13  RR1828E	

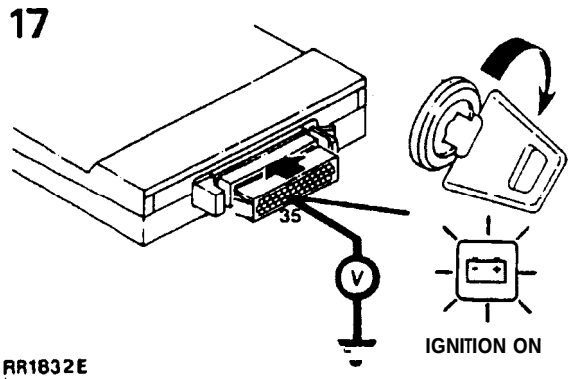
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
14. Check air bypass valve - Part 2	Ohm-meter reading of 48-58 Ohms - Proceed to Test 15
	Incorrect reading Check:-
14  RR1829E	

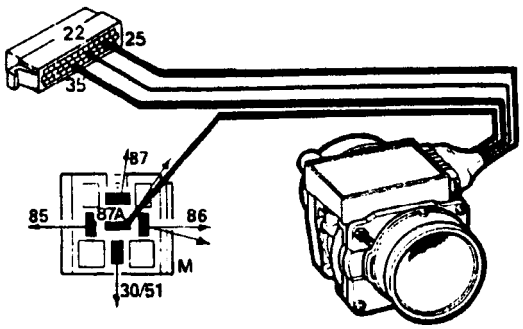
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
15. Check throttle potentiometer - Part 1	Ohm-meter reading of 5000 Ohms - Proceed to Test 16
	Incorrect reading of Infinity Check:-
15  IGNITION OFF RR1830E	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
16. Check throttle potentiometer - Part 2	Correct voltmeter readings- Proceed to Test 17 Throttle closed — Throttle open 0.29) (4.6 Volts) smooth ( ) ..... (0.36) swing (5.0 Volts
	Incorrect voltmeter readings Check:-
16  IGNITION ON RR1831E	

Continued

'EST PROCEDURE	RESULTS . Check cables and units shown in bold
17. Check output of Airflow sensor	Voltmeter reading of 0.3-0.6 volts- Proceed to Test 18
	Incorrect voltmeter reading Check:-





PRECAUTION:

Depressurize the fuel system when fitting the fuel pressure gauge or disconnecting/replacing fuel system components.

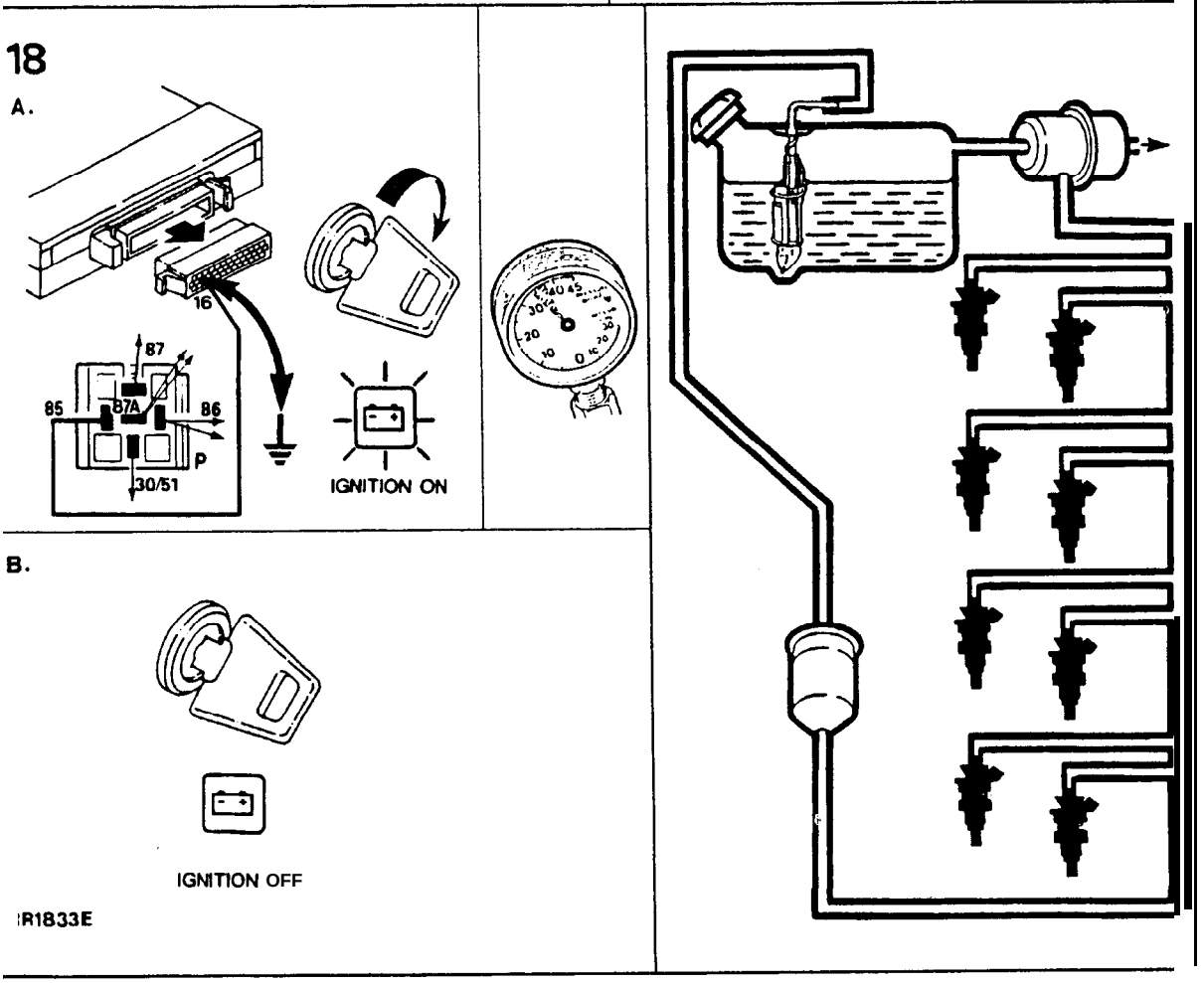
CAUTION: Thoroughly clean the immediate area around the fuel filter and hose connections before disconnecting the fuel feed line from the filter. Failure to do so could cause foreign matter to be present in the fuel system which would be detrimental to the fuel system components.

WARNING: The spillage of fuel from the fuel filter is unavoidable when disconnecting the fuel feed line, ensure that all necessary precautions are taken to prevent fire and explosion due to fuel vapour and fuel seepage.

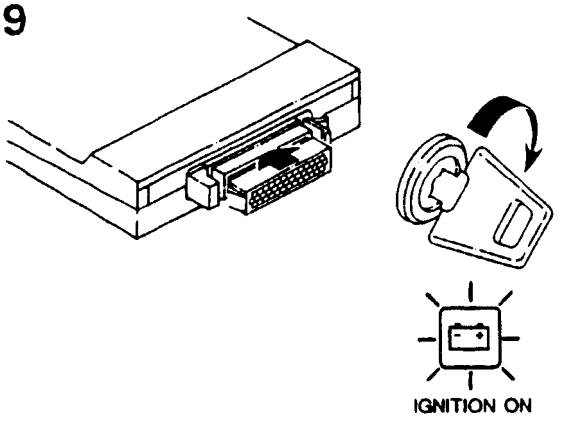
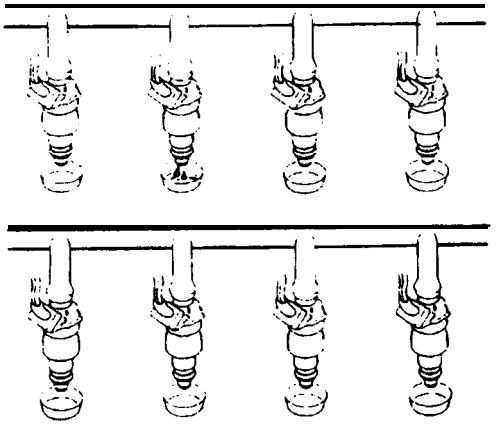
DEPRESSURIZING PROCEDURE

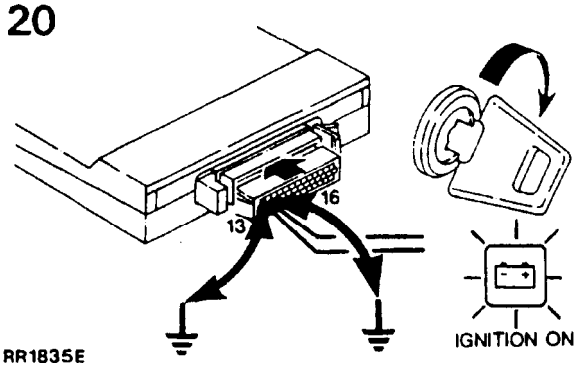
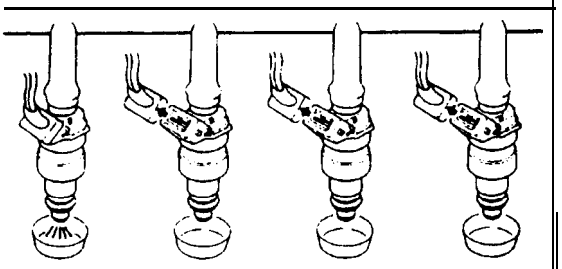
a) **Ignition off, pull pump relay off its terminal block.**
b) **Crank engine for a few seconds - engine may fire and run until fuel pressure is reduced.**
c) **Switch off the ignition.**
d) **Connect fuel pressure gauge in the fuel supply line between the fuel rail and the fuel filter, adjacent to the filter (see Test 18).**
e) **Reconnect the pump relay.**

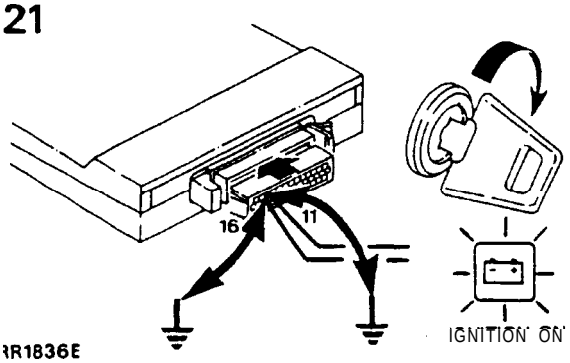
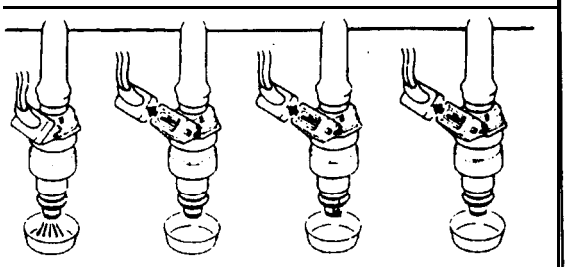
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
18. **Check fuel system pressure** **Service tool 18G 1500** **NOTE: Insert the pressure gauge in the fuel feed line immediately after the fuel line filter. The filter is located beneath the right hand rear wheel arch attached to the chassis**	(A) Expected reading 2,4-2,6 kgf/cm² (34.0-37.0 p.s.i.) (B) **Pressure drop-max 0.7 kgf/cm² (IO p.s.i.) in one minute**



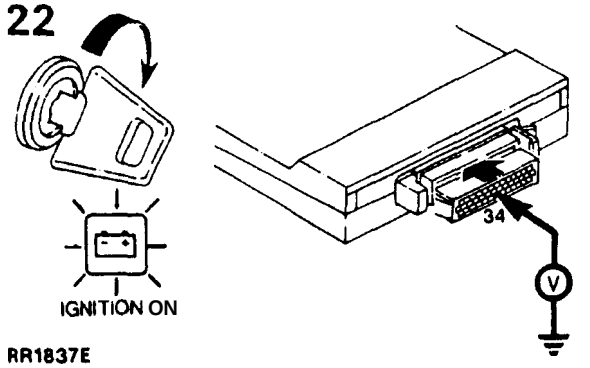
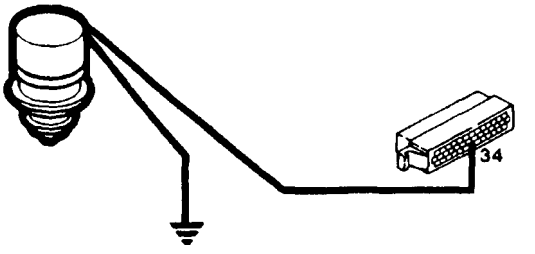
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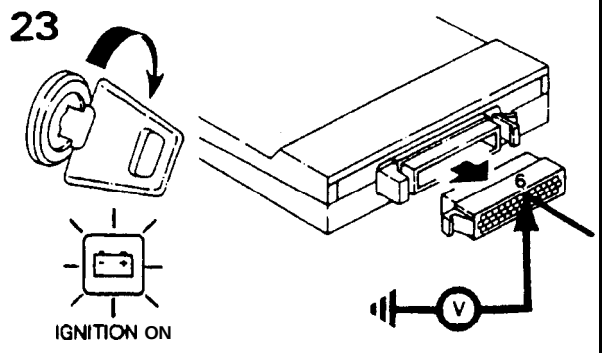
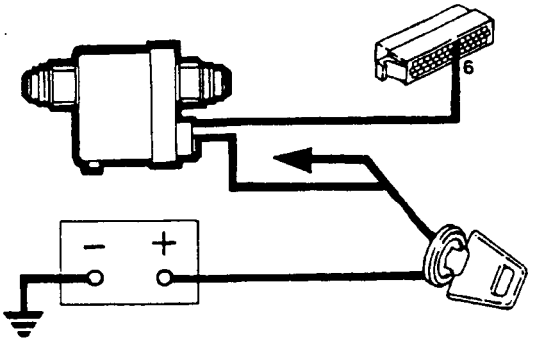
EST PROCEDURE	RESULTS - Check cables and units shown in bold
9. Check for leaking injector NOTE: Before removing any of the injectors, remove and examine the spark plugs. check for consistent colouration of plugs. A leaking injector will result in the appropriate spark plug being 'sooted up'. Remove all injectors from manifold but do not disconnect from fuel rail	WARNING: Ensure that all necessary precautions are taken IO prevent fire and explosion. Replace any injector which leaks more than 2 drops of fuel per minute.
19  IR1834E	

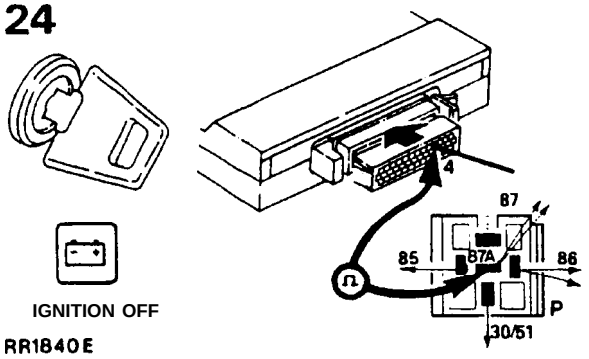
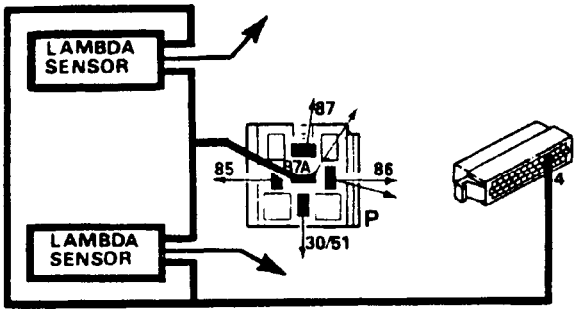
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
20. Check for injector operation Left bank injectors 1,3,5,7	**WARNING: Ensure that all necessary precautions are taken to prevent fire and explosion.** Repeat test for other injectors Replace any injector which does not operate. **NOTE: Fuel flow is 167cc minimum per minute per injector**
20  RR1835E	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
21. Right bank injectors 2,4,6,8	**WARNING: Ensure that all necessary precautions are taken to prevent fire and explosion** Repeat test for other injectors Replace any injector which does not operate **NOTE: Fuel flow is 167cc minimum per minute per injector**
21  RR1836E	

Continued

'EST PROCEDURE	RESULTS • Check cables and units shown in bold
!2. Check gear switch input	Voltmeter reading of zero volts- Neutral and park
	Voltmeter reading of 4.5-5.0 Volts -R.D.3.2.1 • Proceed to Test 23
	Incorrect reading Check:
	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
23. Check road speed input NOTE: Raise and rotate the left hand rear road wheel slowly	Voltmeter reading of 0 to 12V fluctuating 6 times per revolution - Proceed to Test 24 Incorrect reading Check:
	

TEST PROCEDURE	RESULTS . Check cables and units shown in bold
24. Check Lambda sensor heater coils NOTE: Remove pump relay from its connector	Ohm-meter reading of 2.65-3.35 Ohms Incorrect reading Check: NOTE: A reading of 5.3 lo 6.7 Ohms indicates a faulty Lambda sensor
	

After completing the tests with either the 'Diagnostic' equipment or multi-meter, re-test the vehicle to ensure the faults have been rectified. If faults still persist, recheck using the Lucas diagnostic equipment.

ENGINE TUNING PROCEDURE

Before carrying out 'Engine Tuning' on fuel injection vehicles, it is important that all other engine related setting procedures are undertaken first; air flow sensor to air cleaner correctly fitted, ignition and throttle potentiometer correcty set; all hoses correctly fitted and secured.

These checks should be carried out with the engine coolant temperature beween 80" to 95°C (176" to 203°F).

CHECK AND ADJUST IGNITION TIMING

1. Check that ignition timing is at 6" ± 1" BTDC.
2. Timing to be checked when engine speed is less than 800 rev/min using a stroboscopic lamp.
3. If adjustment is necessary, loosen the distributor clamp nut and rotate clockwise to retard or 'counter -clockwise to advance. When the required setting has been attained, tighten the clamp nut and recheck the setting.

   NOTE: Timing to be checked with vacuum hose connected.

IDLE SPEED is preset at the factory and should not normally require adjustment.

CAUTION:

A. If engine fails to start within a maximum time of 12 seconds the cause must be rectified. Following rectification the engine must be run at 1500 rpm (no load) for 3 minutes to clear any accumulation of fuel in the catalysts.

B. If the engine is misfiring, it should be immediately shut down and the cause rectified.

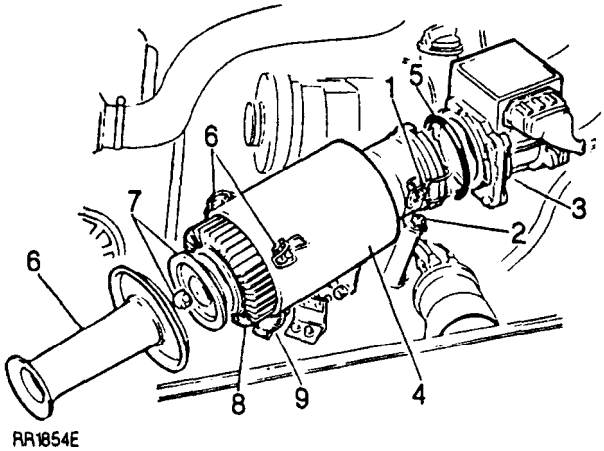
Failure to comply with A or B will result in irreparable damage to the catalysts.

AIR CLEANER

Remove and Refit

Removing

1. Release the two clamps securing the air cleaner to the airflow sensor.
2. Release the two nuts and bolts securing the air cleaner to the left hand valance mounting bracket.
3. Detach the airflow sensor from the air cleaner, and lay carefully to one side.
4. Detach the air cleaner from the centre mounting bracket and withdraw from the engine compartment.
5. Remove the large 'O' ring from the outlet tube of the air cleaner, inspect for condition, fit a new 'O' ring if in poor condition.
6. Unclip the three catches securing the inlet tube to the air cleaner canister and remove the inlet tube.
7. Remove the nut and end plate securing the air cleaner element in position.
8. Withdraw the air cleaner element and discard.
9. Inspect the dump valve for condition and that it is clear of obstructions.



RR1854E

Refitting

10. Fit a new element and secure in position.
11. Refit the inlet tube to the air cleaner canister.
12. Refit the air cleaner to the mounting bracket and tighten the two nuts and bolts.
13. Clip the air flow sensor to the air cleaner.

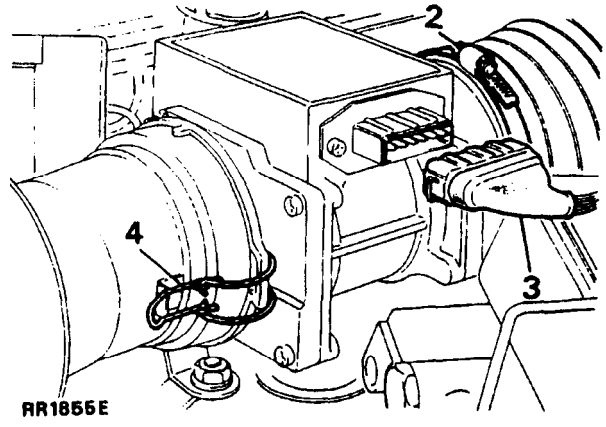
AIR FLOW SENSOR

Remove and refit

Removing

NOTE: The air flow sensor is not a serviceable item. In the event of failure or damage the complete unit is to be replaced.

1. Disconnect the battery negative terminal.
2. Release the large hose clamp at the rear of the air flow meter and disconnect the hose from the sensor.
3. Disconnect the multi-plug.
4. Release the two clips securing the air flow sensor to the air cleaner case detach the sensor from the case and withdraw it from the engine compartment.



RR1855E

Refitting

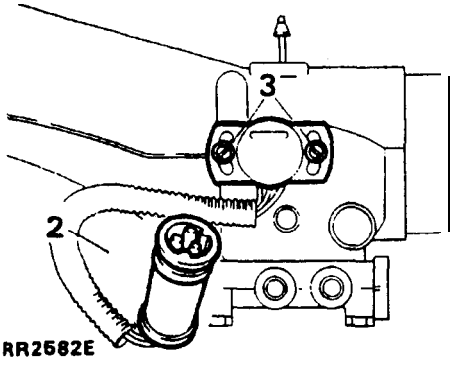
5. Reverse the removal procedure ensuring that the multi-plug is firmly reconnected to the air flow sensor and that the hose clamp at the rear of the sensor is securely tightened, to prevent un-metered air entering the engine.

THROTTLE POTENTIOMETER

Remove, refit and reset

Remove

1. Disconnect the battery negative terminal.
2. Disconnect the electrical three-pin plug.
3. Remove the two screws securing the switch to the plenum chamber and carefully pull the switch off the throttle valve shaft.



4. Remove the old gasket.

Refit

5. Fit a new gasket between the throttle switch and plenum chamber.
6. Align the switch and shaft fiats; slide the switch *on* to the throttle shaft and secure the switch to the plenum chamber.
7. The throttle potentiometer must be reset using the following procedure.

CAUTION: The throttle mechanism must not be operated while the potentiometer is loosely fitted, otherwise damage may be caused to the potentiometer wiper track.

Setting the Potentiometer using a multi meter.

ENSURE THE MULTI METER USED TO CARRY OUT THIS CHECK IS SET TO VOLTS. A MULTI METER SETTING OTHER THAN VOLTS WILL RESULT IN DAMAGE TO THE POTENTIOMETER.

8. Loosen the potentiometer securing screws.
9. Reconnect the potentiometer three-pin plug and reconnect the battery. Switch on the ignition.
10. Connect the multi meter between the red and green leads at the potentiometer electrical plug.
11. Rotate the potentiometer clockwise or counter-clockwise, until the multi meter reads 325 $\pm$ 35 mV.
12. Tighten the potentiometer securing screws.
13. Re-check the multi-meter reading. Check also for a 'smooth swing' of the meter needle between minimum and maximum throttle opening between the voltage reading of 4.6 - 5.0 volts

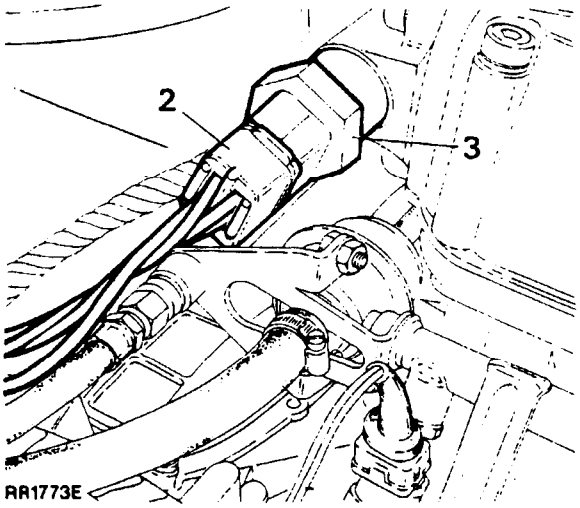
NOTE: After setting the potentiometer, lock and tamperproof each screw head by coating them with yellow paint.

BY-PASS AIR VALVE (STEPPER MOTOR)

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Remove the multi-plug from the unit.
3. Unscrew the valve from its location at the rear of the plenum chamber.
4. Remove the captive washer.



Refitting

5. Fit a NEW sealing washer.

NOTE: If the same by-pass valve is being refitted clean any previous sealing compounds from the threads. Apply Loctite 241 to threads of the valve before reassembly.

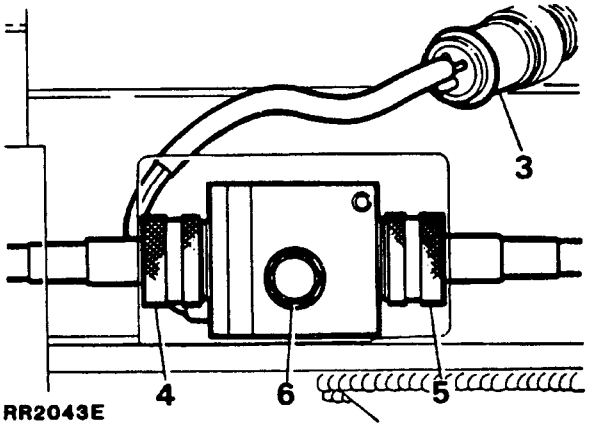
6. Tighten the valve to the specified torque (see Torque values-section 06).
7. Reverse the remaining removal instructions.

SPEED TRANSDUCER

Remove and refit

Removing

1. Place the vehicle on a hydraulic hoist and apply the parking brake.
2. Disconnect the battery negative terminal.
3. Raise the hoist and disconnect the speed transducer electrical plug.
4. Disconnect the speedometer cable from the transducer to the binnacle at the transducer.
5. Disconnect the speedometer cable from the transducer to the speedometer housing at the transducer.
6. Remove the single bolt securing the transducer to its mounting bracket and withdraw the unit from the vehicle.



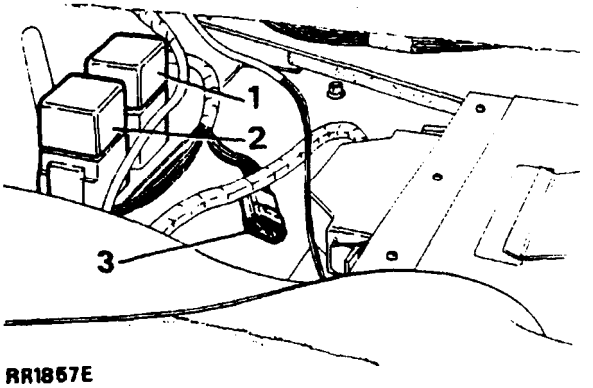
Refitting

7. Reverse the removal instructions.

ELECTRONIC FUEL INJECTION RELAYS

incorporated into the fuel injection electrical circuits are two relays. The relays are located beneath the front right-hand seat, adjacent to the E.C.U.

1. Fuel pump relay (mounted on a blue terminal block).
2. Main relay (mounted on a black terminal block).
3. Diagnostic plug.



RR1857E

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Pull the relay(s) from the multi-plug(s).

Refitting

3. Reverse the removal procedure.

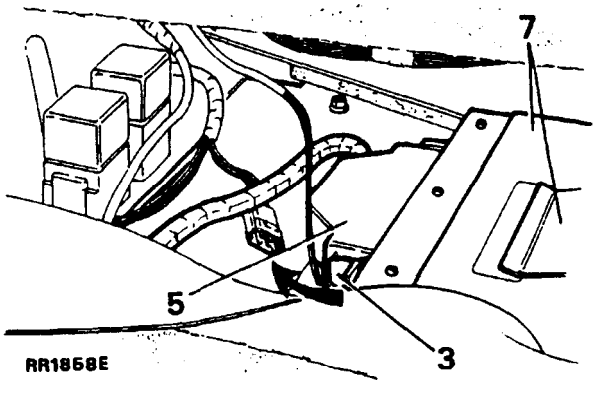
ELECTRONIC CONTROL UNIT-ECU

NOTE: The ECU is not itself a serviceable item, in the event of a unit failure, the ECU must be replaced.

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. The ECU is located under the front right hand seat and is accessible through the rear opening of the seat base when the seat is in its most forward position.
3. Release the E.C.U plug retaining clip.
4. Pull the rear of the multi-plug out of the ECU.
5. Maneuver the tront of the plug fin the direction of the bold arrow) to release the hooked rear end of the plug from the retaining peg.
6. Release the screws securing the ECU to the mounting bracket.
7. Withdraw the ECU from the spring clip and remove it from the vehicle.



RR1858E

Refitting

8. Refit the E.C.U. securely in the spring clip and tighten the two screws.
9. Re-connect the E.C.U. harness plug, ensure the plug is firmly pushed into its location and that the retaining clip secures the plug in position.

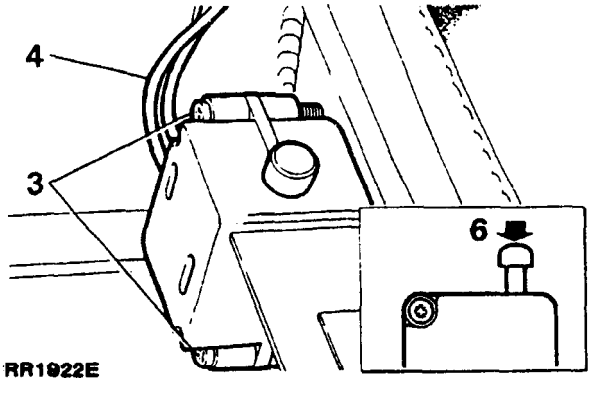
INERTIA SWITCH

The inertia switch is located under the left hand front seat attached to the inner face of the rear front seat base. Access to the switch is gained through the opening at the rear of the seat base.

Remove and refit

Removing

1. Ensure the seat is in its fully forward position.
2. Disconnect the battery negative terminal.
3. Remove the two screws securing the switch to the cross member.
4. Withdraw the switch and disconnect the electrical multi-plug.
5. Remove the switch from the vehicle.



RR1922E

Refitting

6. Reverse the removal procedure ensuring that the multi-plug clips firmly into position, and that the plunger is reset (plunger is in its lowest position).

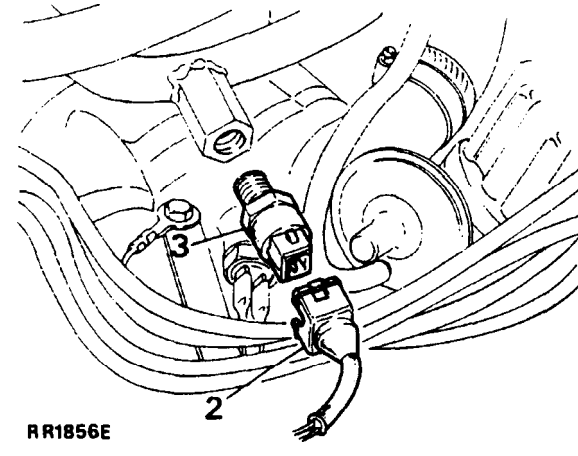
FUEL TEMPERATURE THERMISTOR (SENSOR)

Remove and refit

Removing

NOTE: No fuel leakage will occur when the thermistor is removed from the fuel rail therefore it is not necessary to depressurize the fuel system before removal.

1. Disconnect the battery negative terminal.
2. Remove the electrical multi - plug from the thermistor.
3. Release the thermistor from the fuel feed rail.



RR1856E

Refitting

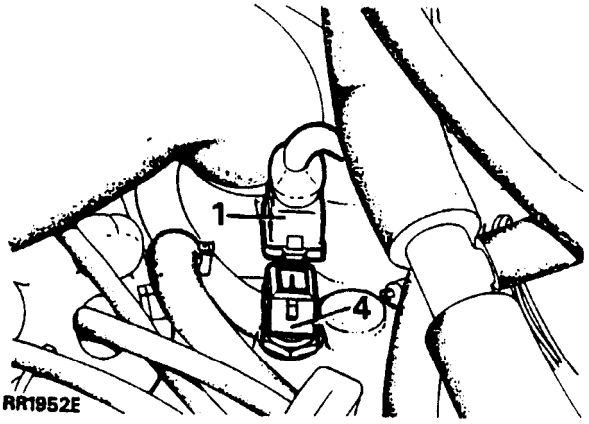
4. Reverse the removal procedure, ensuring that the thermistor is tightened securely in the fuel rail.

COOLANT TEMPERATURE THERMISTOR (SENSOR)

Remove and refit

Removing

1. Remove the multi-plug from the thermistor.
2. Release the radiator bottom hose and partially drain the cooling system.
3. Refit the hose and tighten the clamp securely.
4. Remove the thermistor from the left hand front branch of the intake manifold.
5. Remove the copper washer.



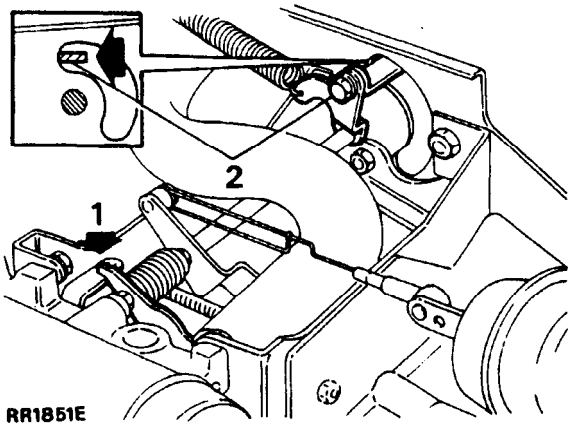
Refitting

6. Fit a NEW copper washer to the thermistor.
7. Fit the thermistor to the intake manifold and tighten securely.
8. Refill the cooling system.
9. Run the engine, check for water leaks around the coolant temperature thermistor.

RESETTING THROTTLE LEVERS

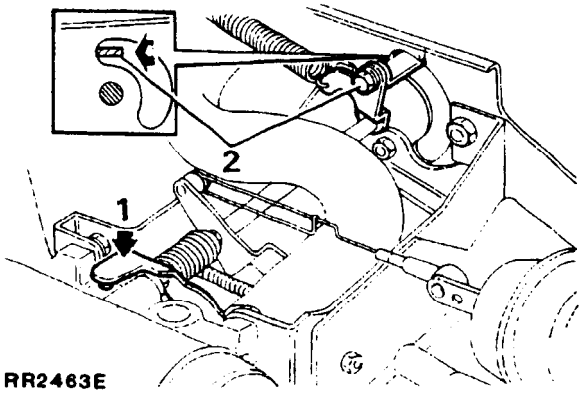
NOTE: The setting procedure outlined is applicable at minimum throttle condition only.

1. Ensure that the throttle valve is retained at its 90" vertical setting by holding down the stop lever and throttle/kick down lever denoted by the bold arrow while adjusting the throttle operating levers.
2. Release the throttle operating lever securing screw and adjust the lever until contact is made with the top end of the slot in the throttle lever mounting bracket; retaining the lever in this position retighten the screw.
3. Lightly grease all throttle lever bearing surfaces and torsion spring with Admax 13 grease or a suitable equivalent.



NOTE: Check the clearance between the cruise control actuator link and throttle lever (see Cruise Control Actuator Setting-Section 19, Page 47).

LATER MODELS:- have a redesigned stop lever that seats on a factory-set adjustment screw which is located in the plenum chamber casting. The screw should not normally require adjustment. If new throttle bracketry and linkages are fitted it is advisable to check that the throttle valve is vertical before adjusting the screw.

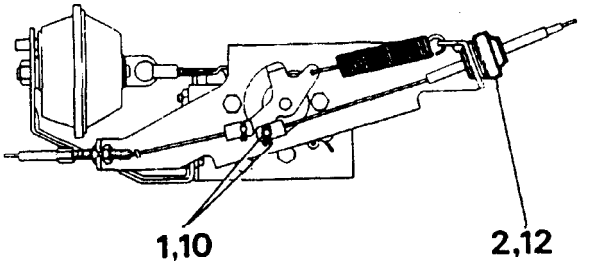


THROTTLE CABLE

Remove and refit

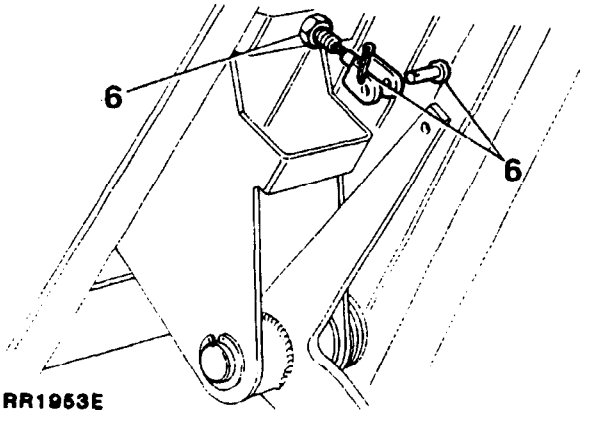
Removing

1. Remove the cotter pin and clevis pin securing the cable to the lever.
2. Carefully pry the throttle cable adjustment nut out of the linkage mounting bracket.
3. Withdraw the cable from the mounting bracket.



RR1964E

4. Release the outer cable from the retaining clips within the engine compartment.
5. Remove the lower dash pane! from beneath the steering column.
6. Disconnect the cable from the throttle pedal and release the cable locknut.
7. Feed the cable through the bulkhead grommet and into the engine compartment.



RR1963E

FIT NEW THROTTLE CABLE

8. Feed the new cable from the engine compartment through the bulkhead grommet.
9. Connect the cable to the throttle pedal.
10. Connect the cable to the throttle linkage, fit a new cotter pin and secure in position.
11. Clip the outer cable adjustment nut into the mounting bracket.
12. Adjust the outer cable to give 1.57 mm (0.062 in) free play in the throttle cable and check the throttle operation.

THROTTLE PEDAL

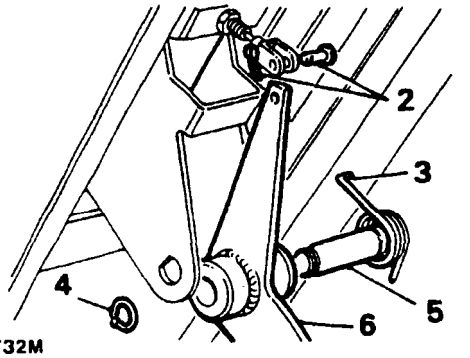
Remove and refit

Remove

1. Release the six screws securing the lower dash panel, lower the panel and disconnect the two electrical leads to the rheostat switch, detach the bulb check unit from the spring clip and remove the dash panel from the vehicle.
2. Remove the cotter pin and clevis pin securing the throttle cable to the throttle pedal.
3. Release the tension from the pedal return spring.
4. Remove the circlip from the pedal pivot pin.
5. Withdraw the pivot pin.

NOTE: It may be necessary to remove the steering column fixings enabling the column to be lowered to gain access to the pedal pivot pin circlip.

6. Withdraw the throttle pedal.



RR 732M

Refitting

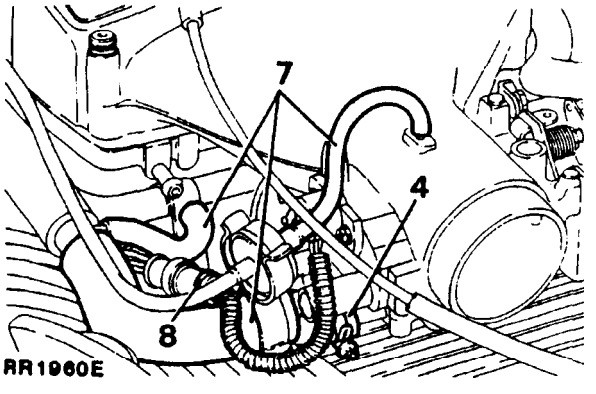
7. Lightly grease the pivot pin and clevis pin before re-assembly.
8. Fit a NEW cotter pin to the clevis pin.
9. Reverse the remaining removal instructions.

PLENUM CHAMBER

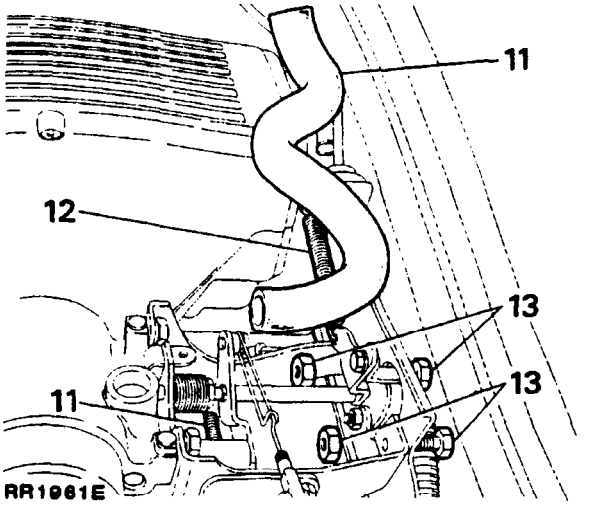
Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Release the radiator bottom hose and partially drain the cooling system, reconnect the hose to the radiator.
3. Release the two large hose clamps from the neck of the plenum chamber and outlet bore of the airflow sensor and remove the hose from its location.
4. Release the clamps and remove the two coolant hoses from the bottom of the plenum chamber inlet neck. Identify each hose to aid re-assembly.
5. Remove the vacuum supply hose from the cruise control actuator.
6. Disconnect the actuating link at the cruise control actuator.
7. Remove the distributor vacuum hose, positive crankcase ventilation breather filter hose and servo hose.
8. Disconnect the throttle potentiometer multi-plug.

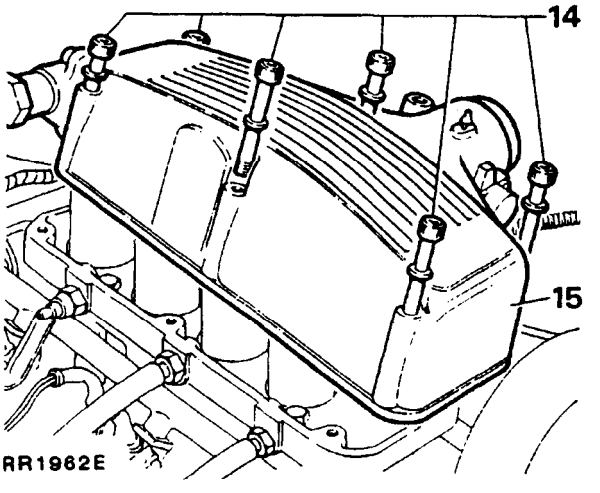


9. Disconnect the multi-plug from the air by-pass valve.
10. Disconnect the small vacuum hose at the rear of the plenum chamber, located below the air by-pass valve.
11. Remove the hose from the air by-pass valve to plenum chamber to enable the small return spring located below the throttle levers to be unhooked.
12. Release the two throttle return springs.
13. Remove the two bolts (with spring washers) securing the throttle cable and kick-down cable anchor bracket to the throttle lever support bracket, lay the assembly to one side.



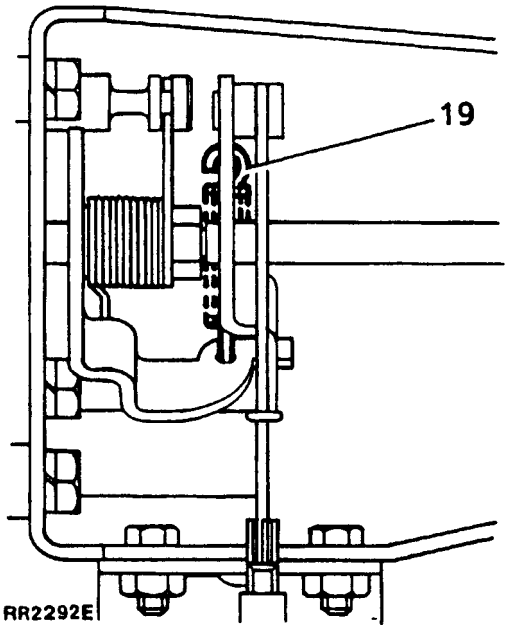
14. Remove the six socket head bolts (with plain washers) securing the plenum chamber to the ram housing.
15. Maneuver the plenum chamber and remove it from the ram housing.

NOTE: To prevent ingress of dirt into the ram tubes, place a protective cover over the ram tube openings.



Refitting

16. Ensure that all mating faces are free from any previous sealing compounds.
17. Coat the mating faces of the plenum chamber and ram housing with 'Hylomar' sealant.
18. Refit the plenum chamber and tighten the six bolts to the specified torque (see torque values-section 06).
19. When refitting the small return spring, item 11 in the removal procedure, it must be noted that the 'hooked' open end of the spring **MUST** face the plenum chamber as shown in illustration RR2292E below.



20. Reverse the remaining removal instructions.

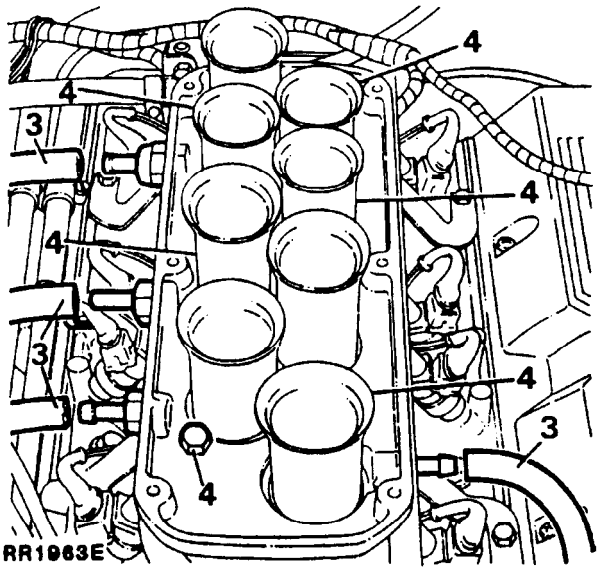
NOTE: Ensure that all hoses are connected securely to prevent un-metered air entering the engine.

RAM HOUSING

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Remove the plenum chamber (see Plenum Chamber remove and refit).
3. Release the hoses from around the outer edges of the ram housing.
4. Remove the six through bolts (with plain washers) securing the ram housing to the intake manifold.



5. Lift the ram housing off the intake manifold and remove it from the engine compartment.
6. Place a protective cover over the top of the intake manifold inlet bores to prevent ingress of dirt.

Refitting

7. Ensure that all mating faces are clean and free from dirt and any previous sealing compounds.
8. Apply 'Hylomar' sealant to the intake manifold face before refitting the ram housing.
9. Fit the ram housing and retighten the bolts, working from the two centre bolts, diagonally towards the outer four bolts.
10. Tighten to the correct torque (See section 06-Torque values).

DEPRESSURIZING THE FUEL SYSTEM

WARNING: Under normal operating conditions the fuel injection system is pressurized by a high pressure fuel pump, operating at up to 2.3 to 2.5 bar (34 to 37 p.s.i.). When the engine is stationary this pressure is maintained within the system. To prevent pressurized fuel escaping and to avoid personal injury it is necessary to depressurize the fuel injection system before any service operations are carried out.

NOTE: If the vehicle has not been run there will still be a small amount of residual pressure in the fuel line. The depressurizing procedure must still be carried out before disconnecting the component within the fuel system.

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

1. The fuel pump relay is located under the front right hand seat.
2. Pull the fuel pump relay off its multi-plug (see Electronic Fuel Injection Relays-Section 19, Page 28).
3. Start and run the engine.
4. When sufficient fuel has been used up causing the fuel line pressure to drop, the injectors will become inoperative, resulting in engine stall. Switch the ignition off.
5. Disconnect the battery negative terminal.

   NOTE: Fuel at low pressure will remain in the system. To remove this low pressure fuel, place an absorbent cloth around the fuel feed hose at the fuel rail and release the fuel feed hose at the appropriate end.

6. Disconnect either:
   a) The nut and ferrule at the fuel rail
   OR
   b) The hose at the inlet end of the fuel filter.

Refitting

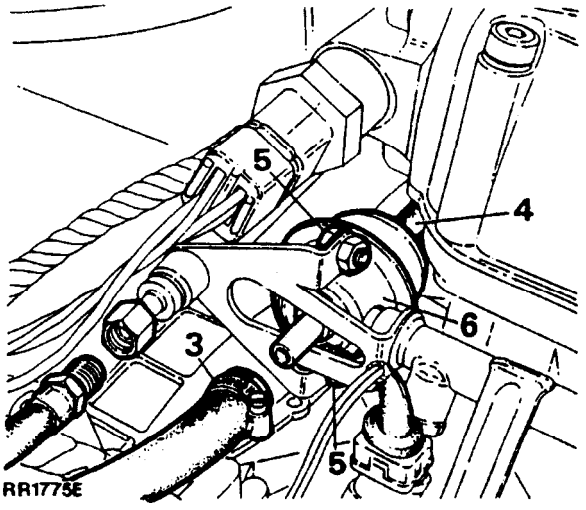
7. Refit the fuel feed hose.
8. Refit the fuel pump relay, reconnect the battery.
9. Crank the engine (engine will fire within approximately 6 to 8 seconds).

FUEL PRESSURE REGULATOR

Remove and refit

Removing

1. Depressurize the fuel system.
2. Disconnect the negative battery terminal.
3. Release the hose clamp securing the fuel return hose to the regulator and remove the hose.
4. Pull the vacuum hose from the rear of the regulator.
5. Remove the two nuts and bolts securing the regulator to the fuel rail, carefully ease the regulator fuel inlet pipe out of the fuel rail.
6. Withdraw the regulator from the engine compartment.



NOTE: If the original regulator is being refitted, fit a NEW 'O' ring to the fuel inlet pipe.

Refitting

7. Lightly coat the 'O' ring with silicon grease 300 before fitting the regulator to the fuel rail.
8. Reverse the removal procedure.
9. Reconnect the batter), and pressurize the fuel system and check that there are no fuel leaks around the regulator connections.

FUEL RAIL-INJECTORS R/H AND L/H

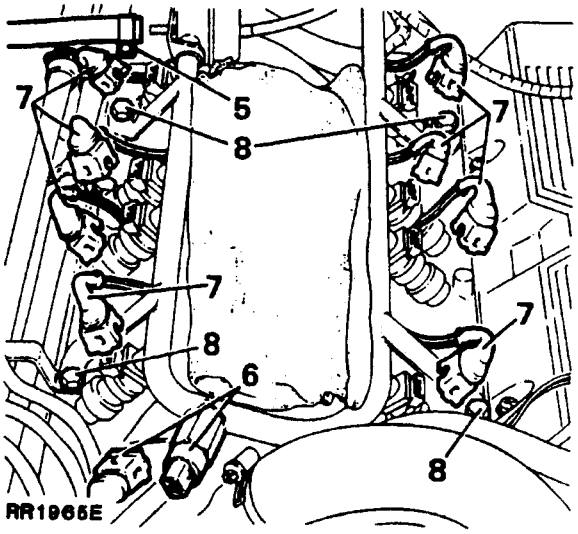
Remove and refit

Removing

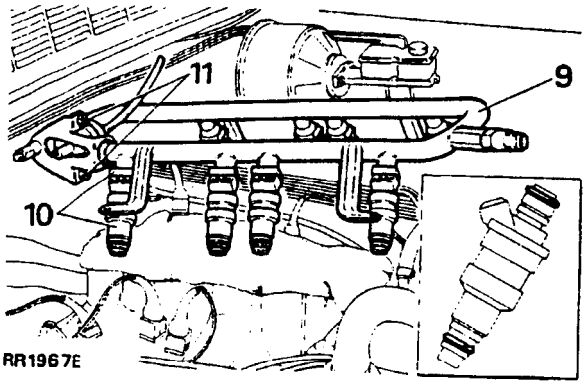
1. Depressurize the fuel system.
2. Disconnect the negative battery terminal.
3. Remove the plenum chamber. (See Plenum Chamber, remove and refit).
4. Remove the ram housing. (See Ram Housing remove and refit).

NOTE: Place a cloth over the ram tube openings to prevent ingress of dirt into the engine.

5. Release the hose clamp and remove the fuel return hose from the pressure regulator.
6. Disconnect the multi-plug from the fuel temperature thermistor (sensor).
7. Disconnect the multi-plugs from the eight injectors.
8. Remove the five bolts securing the fuel rail support and heater pipe brackets to the intake manifold. Lay the heater pipes to one side.



9. Remove the fuel rail, complete with injectors, from the intake manifold.
10. Remove the retaining clips securing the injectors to the fuel rail, ease the injectors from the rail.
11. If necessary, remove the two nuts and bolts securing the regulator to the fuel rail, and carefully pull the regulator away from the rail.



Refitting

12. Fit NEW 'O' rings, protective cap and supporting disc to the injectors, lightly coat the 'O' rings with silicon grease 300 and insert the injectors into the fuel rail, multi-plug connections facing outwards.
13. Refit the retaining clips.

CAUTION: Care must be taken when refitting the fuel rail and injectors to the intake manifold to prevent damage occurring to the '0' rings.

14. Fit a NEW 'O' ring to the pressure regulator lightly coat the 'O' ring with silicon grease 300 and secure the regulator to the fuel rail.
15. Fit the fuel rail and heater pipe assemblies to the intake manifold, secure the rail and pipes in position with the five bolts.
16. Reverse the remaining removal instructions.
17. Pressurize the fuel system and check for fuel leaks around the injectors and pressure regulator.

INTAKE MANIFOLD

Remove and refit

Removing

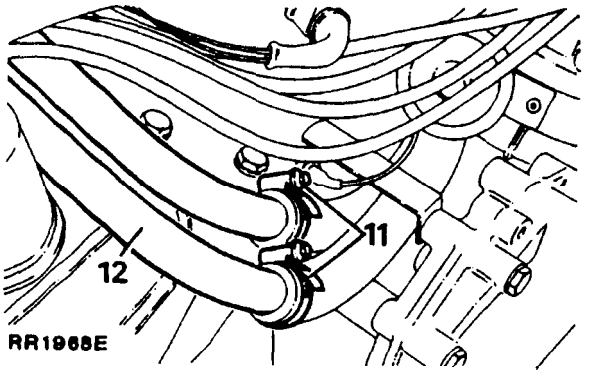
1. Depressurize the fuel system.
2. Disconnect the battery negative terminal.
3. Release the hose clamp and remove the radiator bottom hose to enable the cooling system to be partially drained, so that coolant level is below the thermostat housing, refit the hose and secure in position with the hose clamp.
4. Remove the plenum chamber (see Plenum Chamber, remove and refit).
5. Remove the ram housing (see ram housing remove and refit).

CAUTION: Place a protective cover over the intake manifold openings to prevent ingress of dirt.

6. Disconnect the electrical multi-plugs to the fuel temperature thermistor (sensor), coolant temperature thermistor (sensor) and injectors.
7. Remove the two nuts and bolts securing the pressure regulator to the fuel rail, ease the regulator out of the rail, seal the end of the fuel rail with suitable plastic plugs to prevent ingress of dirt.

NOTE: The intake manifold can be removed from the cylinder block without removing the fuel rail and injectors.

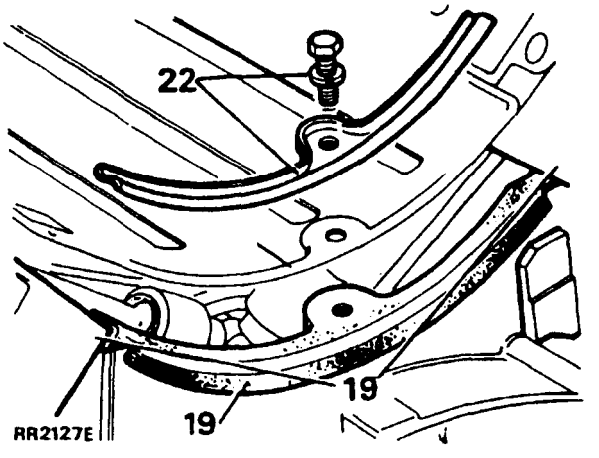
8. Disconnect the electrical leads from the air-conditioning engine coolant sensor located on the thermostat elbow.
9. Disconnect the electrical leads to the coolant temperature transmitter (sensor) located at the front of the intake manifold.
10. Remove the injector harnesses from behind the fuel rail and lay to one side.
11. Release the hose clamps securing the two heater hoses to the rigid heater pipes at the front of the right hand rocker cover.
12. Remove the two bolts securing the rigid heater pipes to the intake manifold and ease the pipes out of the hoses.



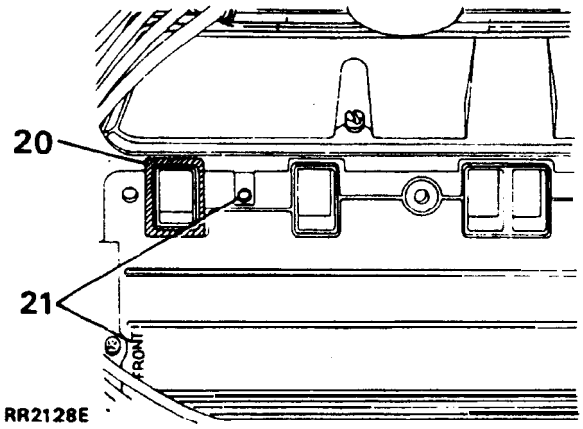
13. Lay the heater pipe assembly to one side.
14. Release the twelve bolts securing the intake manifold to the cylinder heads.
15. Lift the manifold off the cylinder heads and remove from the engine compartment.
16. Remove the two gasket clamps from the top of the cylinder block.
17. Lift off the gasket and remove the gasket seals.
18. Remove previous sealing compound from around the water passage openings of the cylinder heads.

Refitting

19. Locate the NEW seals in position with their ends engaged in the notches formed between the cylinder heads and block.



20. Lightly apply 'Hylomar' sealant around the outside of the water passage openings on the cylinder heads, manifold gasket and intake manifold.



21. Fit the manifold gasket with the word 'FRONT' to the front and the open bolt hole to the front right hand side.
22. Fit the gasket clamps but DO NOT fully tighten the bolts at this stage.
23. Locate the intake manifold onto the cylinder heads, clean the threads of the manifold securing bolts.
24. Fit all manifold bolts and tighten them a little at a time, evenly, alternate sides working from the centre outwards.
25. Tighten to correct torque (see section 06 Torque values).
26. Tighten the gasket clamps to the correct torque (see section 06 Torque values).
27. Reverse remaining removal instructions.
28. Replenish the cooling system.
29. Start the engine, check for water and fuel leaks.

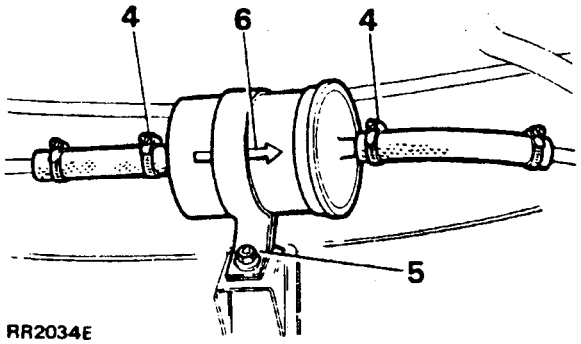
FUEL FILTER

Remove and refit

Refitting

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

1. Depressurize the fuel system.
2. The fuel filter is located on the right hand chassis side member forward of the fuel tank filler neck. Access to the filter is gained through the right hand rear wheel arch.
3. Thoroughly clean the immediate area around the hose connections to prevent ingress of foreign matter into the fuel system.
4. Loosen the two hose clamps nearest the filter to enable the hoses to be removed from the filter canister. Plug the end of the hoses to prevent ingress of dirt.
5. Release the securing bolt and bracket and remove the filter from the chassis side member.



Refitting

6. Fit a new filter observing the direction of flow arrows stamped on the canister.
7. Start the engine and inspect for fuel leaks around the hose connections.

FUEL TANK

Remove and refit

Removing

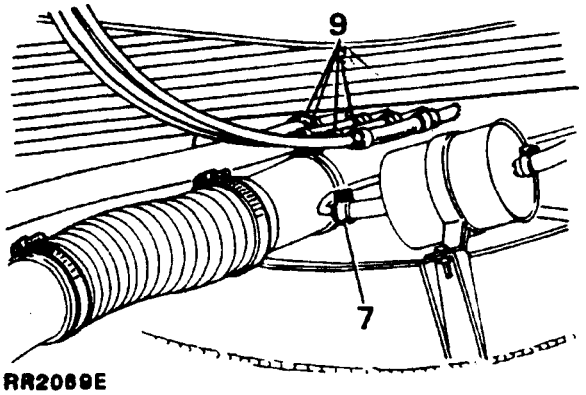
WARNING: Ensure that the Fuel Handling Precautions given in Section 01 - Introduction regarding fuel handling are strictly adhered to when carrying out the following instructions.

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

1. Drive the vehicle onto a suitable hoist.
2. Depressurize the fuel system. (see depressurizing procedure-page 34)
3. Disconnect the battery negative terminal.
4. Disconnect the electrical leads to the fuel tank sender unit. Disconnect the fuel pump electrical multiplug, access to which is gained through the left hand rear wheel arch, the plug is located between the underside of the body and chassis side member.
5. Raise the hoist.
6. Remove the drain plug from the bottom of the fuel tank and drain the fuel into a suitable container that can be sealed afterwards.
   ENSURE THAT THE TANK IS DRAINED COMPLETELY.
   Refit the drain plug (refer to Warning concerning fuel handling at start of this procedure.

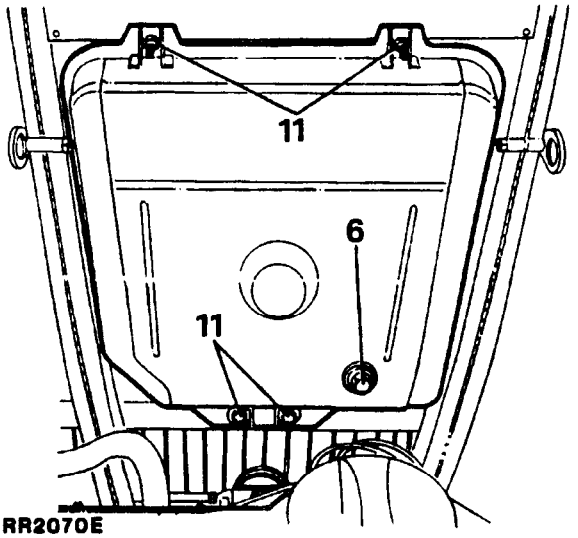
From underneath the vehicle

7. Disconnect the fuel hose from the inlet side of the fuel filter.
8. Disconnect the fuel return pipe to the fuel tank.
9. Remove the breather hose and three evaporative loss hoses from the fuel tank, seal all hose and pipe openings to prevent ingress of foreign matter.



RR2069E

IO. Release the two large hose clamps, securing the inter-connecting hose to tank and filler tube, maneuver the hose up the outside of the filler tube to enable it to be withdrawn from the tank filler neck.
11. With assistance from a second person supporting the fuel tank, remove the four tank fixings.



RR2070E

12. Tilt the left hand side of the tank downwards and maneuver it out of the chassis frame. Care should be taken to ensure that the fuel feed pipe to filter is not damaged when lowering the tank.
13. Place the tank in a safe area and ensure that all necessary precautions are undertaken to make all personnel within the vicinity aware that the tank will give off residual fuel fumes.
14. If necessary remove the fuel pump from the tank. (See Fuel Pump remove and refit).

Refitting

15. Refit the fuel tank to the chassis, taking care to relocate the fuel feed pipe grommets between the fuel tank and chassis.
16. Reverse the removal procedure, ensuring that the sealing ring. fuel line and hose connections are secure.
17. Run the engine and re-check all connections to ensure no fuel leaks exist. Reverse the remaining removal procedure. Recode the radio.

FUEL PUMP

Remove and refit

Removing

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

1. Drive the vehicle onto a suitable hoist.
2. Depressurize the fuel pump system. (see depressurizing procedure-page 34)
3. Disconnect the battery negative terminal.
4. Remove the fuel tank from the chassis frame. (see fuel tank remove and refit-page 38)
5. Place the tank in a safe area.
6. Disconnect the fuel supply hose from the pump.
7. Remove any previous sealant from the top of the pump flange.
8. Remove the five screws and withdraw the pump from the tank.

Refitting

9. Clean the immediate area around the pump opening in the fuel tank.
10. Fit a NEW pump seal.
11. Secure the pump to the tank and tighten the screws securely.
12. Liberally coat the heads of the screws and flange of the fuel pump with Sikaflex 221 flexible adhesive sealant.
13. Reverse the removal procedure, ensuring that the sealing ring, fuel line and hose connections are secure. Recode the radio.
14. Run the engine and re-check all connections to ensure no fuel leaks exist. Reverse the remaining removal procedure.

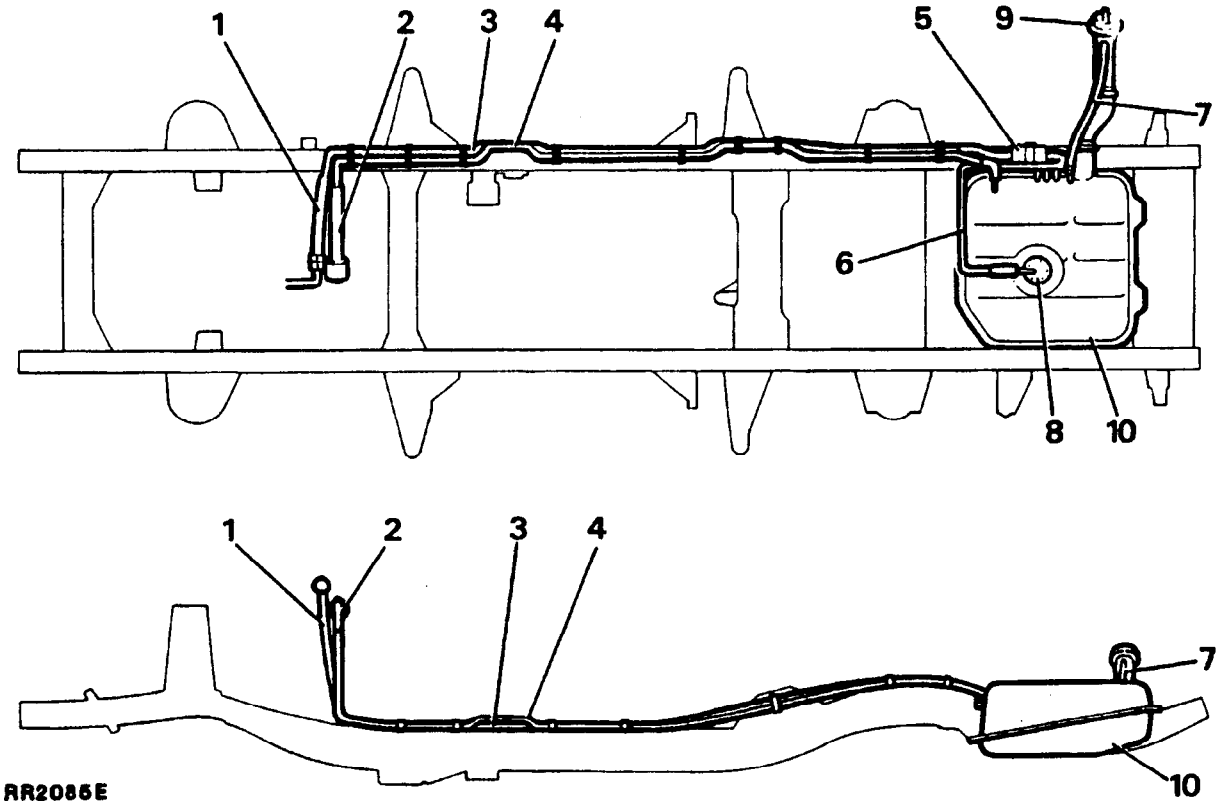
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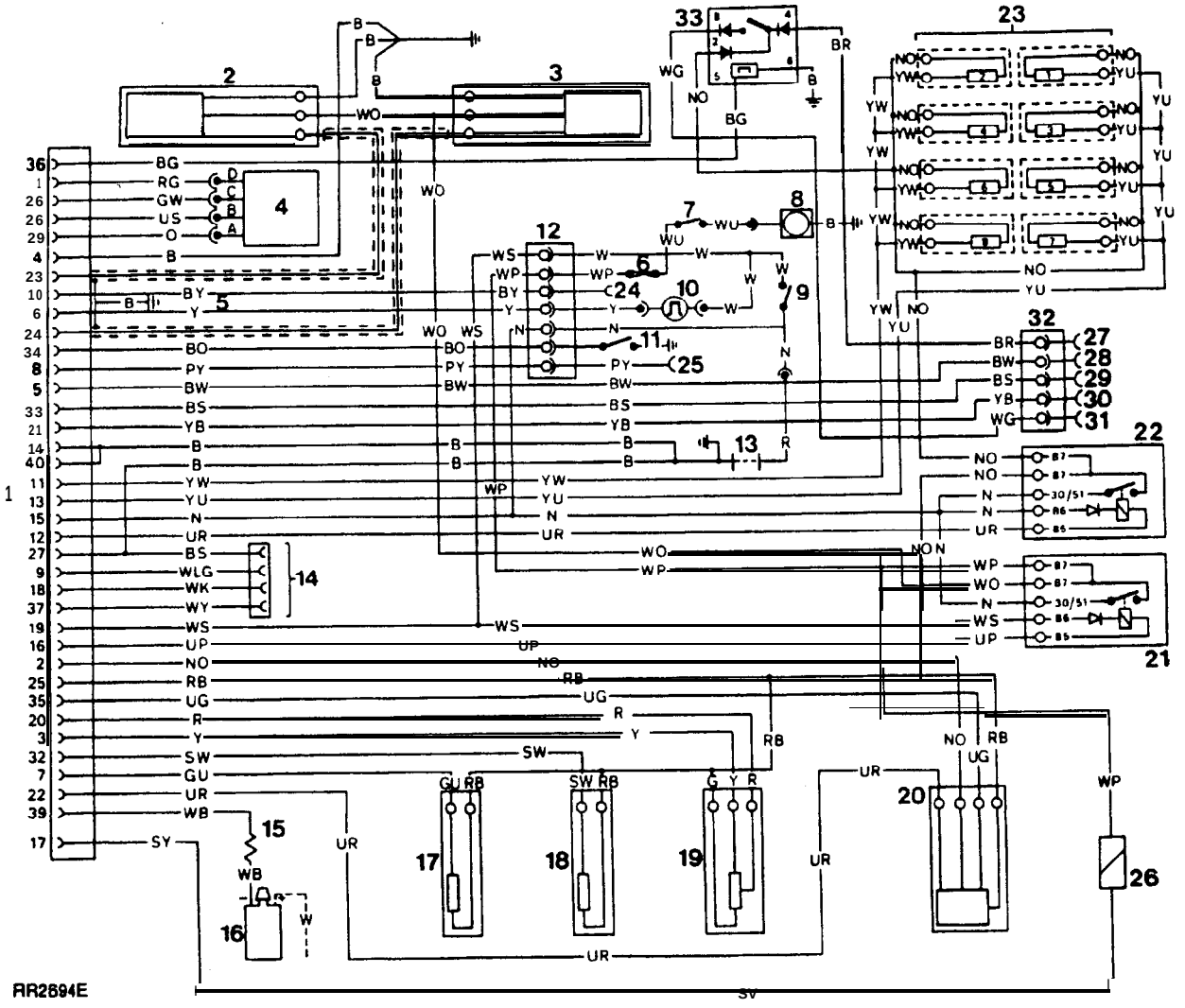
FUEL PIPES

WARNING: Depressurize fuel system before disconnecting any of the fuel pipes and ensure that all necessary precautions are taken against fuel spillage.

KEY

1. Fuel feed hose to fuel rail.
2. Fuel return hose to fuel tank.
3. Rigid fuel feed pipe.
4. Rigid fuel return pipe.
5. Fuel filter.
6. Rigid fuel feed pipe to filter.
7. Breather hose.
8. in-tank fuel pump.
9. Fuel filler neck.
10. Fuel tank.





FUEL INJECTION - Circuit Diagram - 1989 Model Year

1. 40 way connector to Electronic Control Unit (ECU).
2. Lambda sensor (left side - bank A).
3. Lambda sensor fright side - bank B).
4. By-pass air valve (stepper motor) (fast idle).
5. Lambda sensor screened ground.
6. Fuse 18 - main fuse panel.
7. Inertia switch.
8. Fuel pump.
9. Ignition switch.
10. Speed transducer (road speed input).
11. Neutral switch (automatic gearbox) (load input).
12. Main cable connector.
13. Battery.
14. Diagnostic plug.
15. In-line resistor.
16. Coil/-ve (engine RPM input).
17. Coolant temperature thermistor (sensor) (input).
18. Fuel temperature thermistor (sensor) (input).
19. Throttle potentiometer.
20. Air flow sensor.
21. Fuel pump relay.
22. Main relay.
23. Injectors-l to 8.
24. Pick-up point E.F.I. warning symbol (instrument binnacle).
25. Heated front screen sense.
26. Purge control valve.
27. 12V from fan relay.
28. Air conditioning switch sense.
29. Air conditioning output control.
30. Air conditioning load input.
31. Fan relay feed.
32. Heater/air con. cable connector.
33. Condenser fan timer control.

= = = Denotes screened ground.

NOTE: Reference to left and right side is made when viewing vehicle from rear.

FUEL INJECTION SYSTEM

For 1989 model year, the EFI system has a Lucas 14CU electronic control unit. This is a development of the 13CU used on 3.5 litre vehicles.
In most respects the 14CU works in the same way using the same engine components, it does however have additional capacity, enabling it to control fuel tank vapour purging and air conditioning.

Condenser fans

It should be noted that under high coolant temperatures, when the engine is switched off, the condenser fans will be activated and will run for approximately ten minutes.

Throttle potentiometer

A further improvement is the fitting of a 'self adaptive' throttle potentiometer. This means that adjustment of the throttle potentiometer is no longer possible. It also means that the potentiometer setting is not lost, for example, when throttle stop wear occurs.

Purge valve

The operation of the charcoal canister purge valve is checked during the fuel injection system test. See TESTS 9 and 10 Section 19, page 48.

Recommended equipment

The diagnostic equipment used for checking out the 14CU system is the same as that used for 13CU, with the addition of a new memory card for the Hand held test unit.

14CU Memory card
Lucas Part Number - 54746500

CONTINUITY TEST PROCEDURE

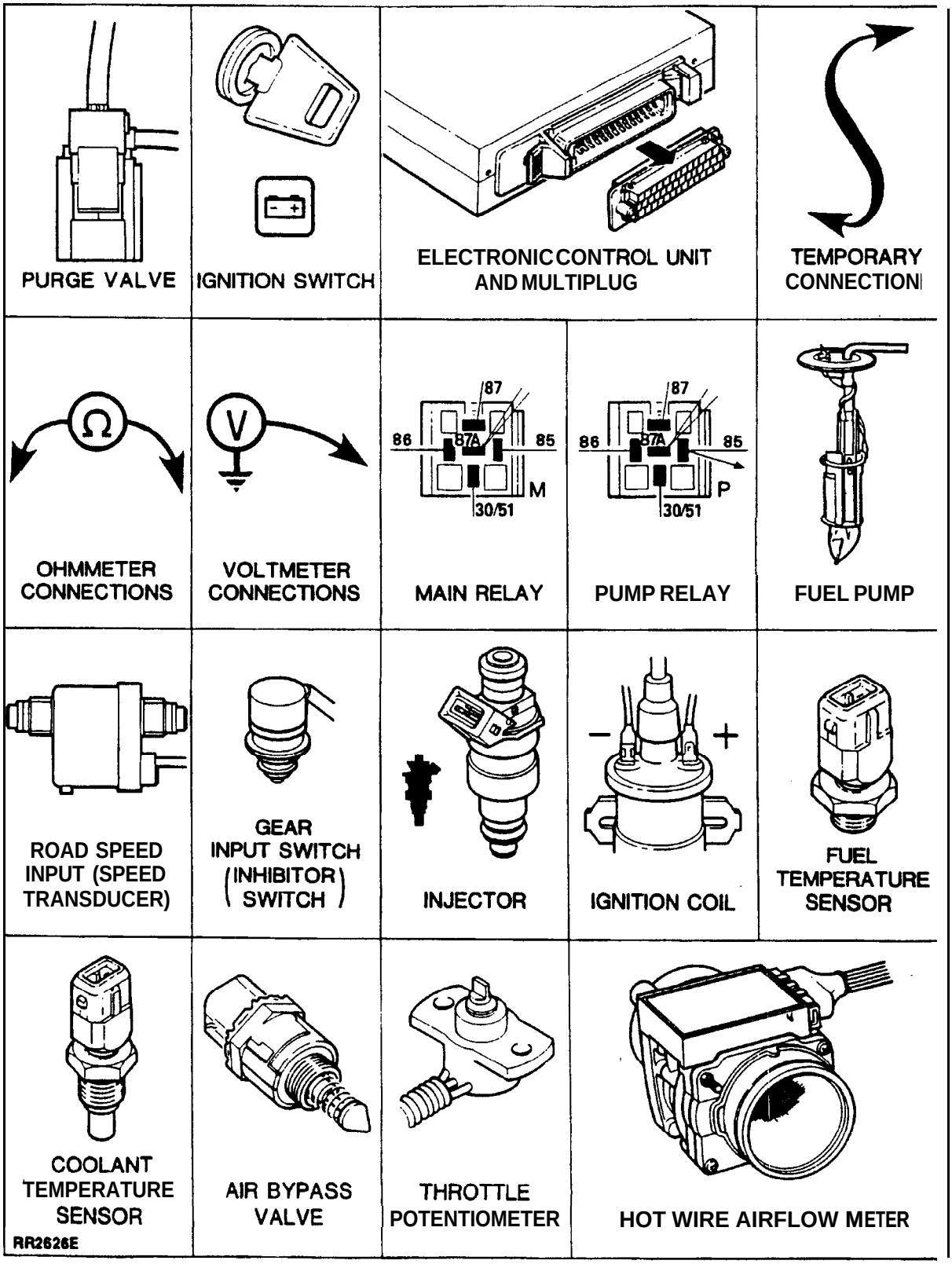
Test procedure using a multi-meter is carried out as for 13CU, with the addition of tests for the purge control valve, air conditioning, heated front screen and condenser fan inputs.
The use of a hand held vacuum pump, for example a 'Mityvac', is required to carry out Tests 9 and IO.
Note that the 40 way multi-plug to the ECU is wired as in the following table.

PIN NOS.	CABLE COLOUR
1.	Redigreen
2.	Brown/orange
3.	Yellow
4.	Black
5.	Black/white
6.	Yellow
7.	Green/blue
8.	Purple/yellow
9.	White/light green
10.	Black/Yellow
11.	Yellow/white
12.	Blue/red
13.	Yellow/blue
14.	Black
15.	Brown
16.	Blue/purple
17.	Grey/yellow
18.	White/pink
19.	White/grey
20.	Red
21.	Yellow/black
22.	Blue/red
23.	Blue
24.	Blue
25.	Red/black
26.	Green/white
27.	Black/grey
28.	Blue/grey
29.	Orange
30.	Not used
31.	Not used
32.	Grey/white
33.	Black/grey
34.	Black/orange
35.	Blue/green
36.	Black/green
37.	White/yellow
38.	Not used
39.	White/black
40.	Black

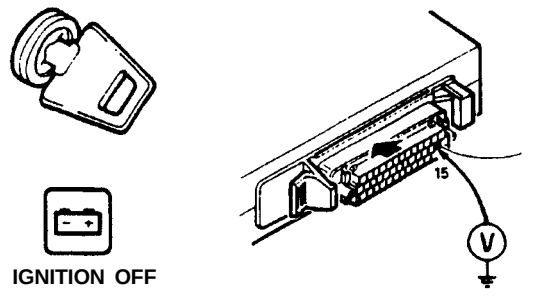
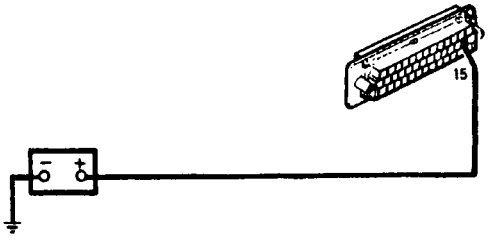
The last colour denotes the wire tracer colour.

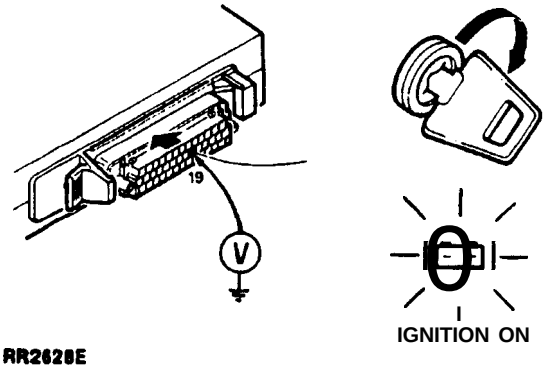
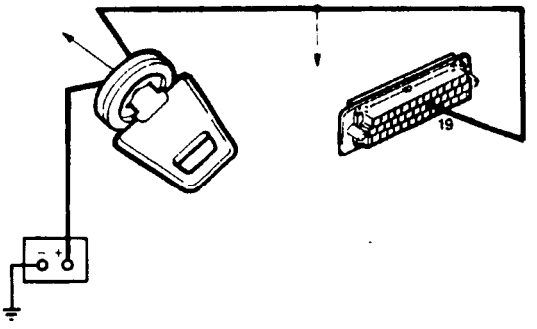
TESTS • Using a Multi-Meter • 14CU system • Key to Symbols

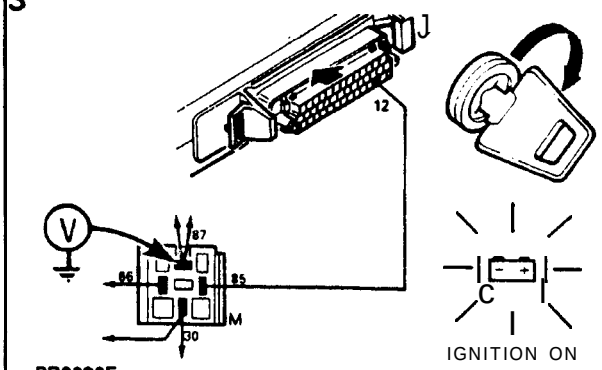
The following continuity tests are intended as a guide to identifying where a fault may be within a circuit; reference should be made to the fuel injection circuit diagram for full circuit information.

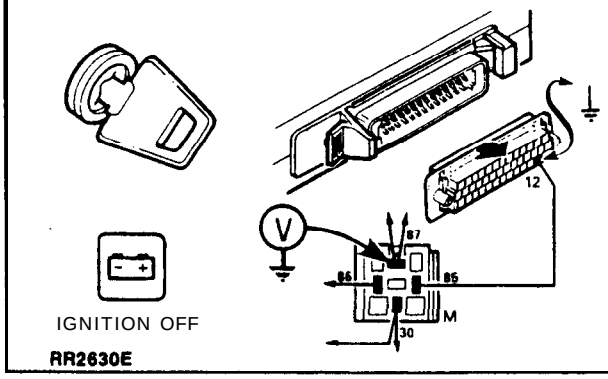
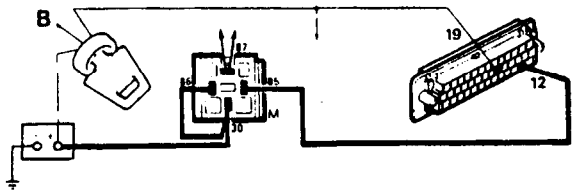


NOTE: All tests are carried out from the electronic control unit (ECU) harness multi-plug unless stated otherwise in the test procedure.

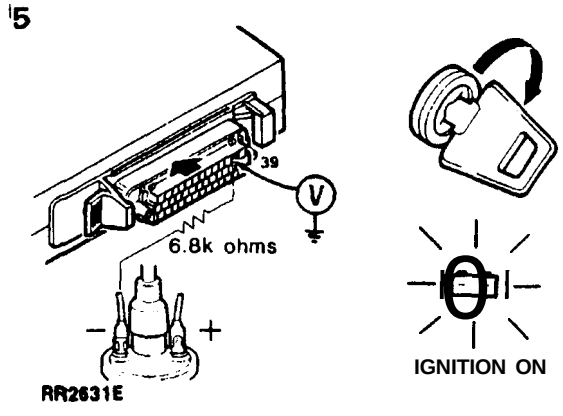
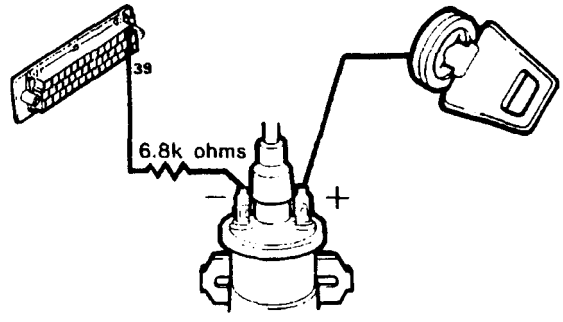
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
1. Check battery supply to ECU	Voltmeter reading of batten/ volts - (mimimum battery voltage 10 volts) Proceed to Test 2 Voltmeter reading of zero volts Check:-
1  IGNITION OFF RR2627E	

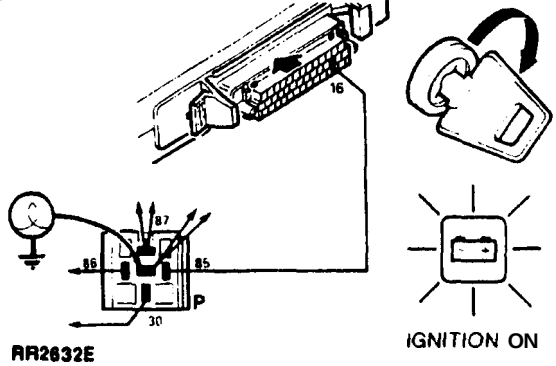
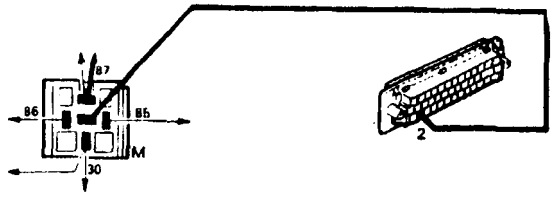
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
2. Check ignition supply to ECU	Voltmeter reading of battery volts - (minimum battery voltage 10 volts) Proceed to Test 3 Incorrect reading check:-
2  IGNITION ON RR2628E	

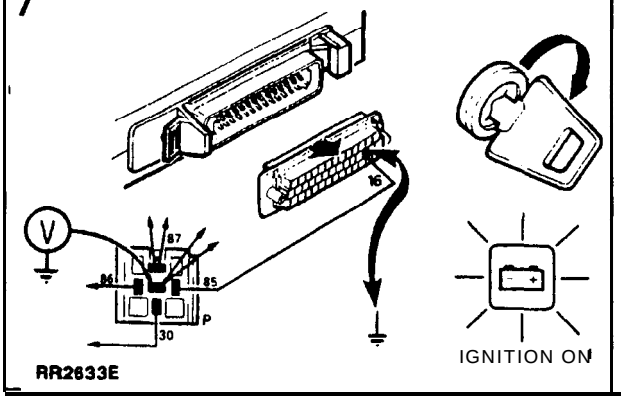
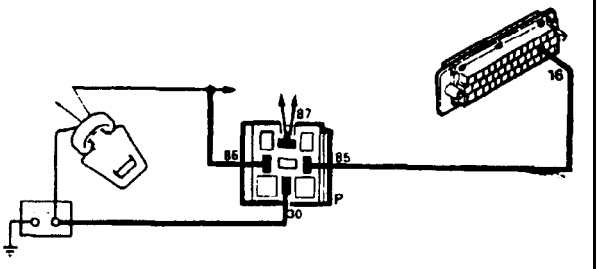
TEST PROCEDURE	RESULTS • Check cables and units shown in bold
3. Check operation of Main relay	**Voltmeter reading of battery volts - Proceed to Test 5**
	Voltmeter reading of zero volts - Proceed to Test 4
3  RR2629E	

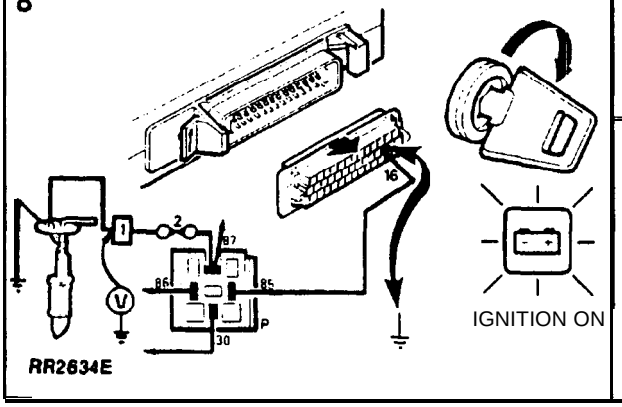
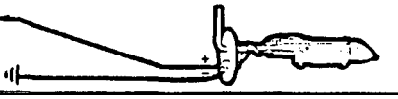
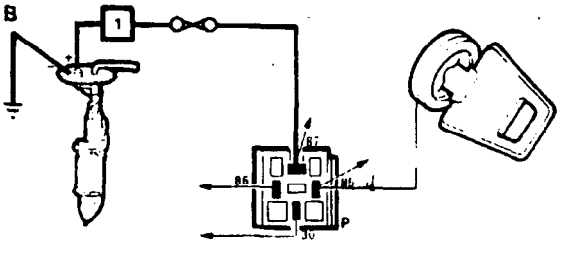
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
4. Fault Diagnosis **Main relay circuits**	A. **Voltmeter reading of battery volts -** Check:- If OK Suspect ECU
	B. Voltmeter reading of zero volts Check:-
4  RR2630E	A  B 

Continued

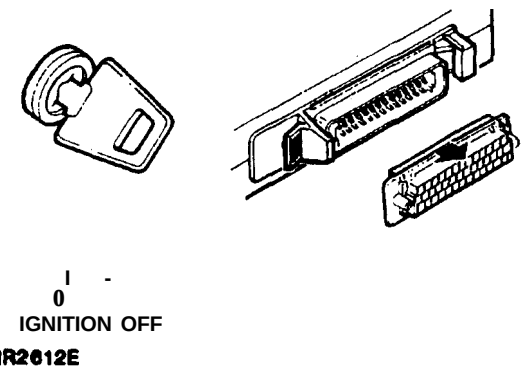
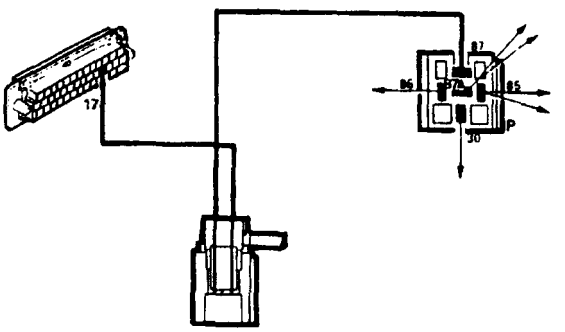
TEST PROCEDURE	RESULTS • Check cables and units shown in bold
5. Check engine speed signal Cable and resistor	Voltmeter reading of 9.5 volts ± 1 volt Proceed to Test 6
	Voltmeter reading of zero volts Check:-
5  RR2631E	

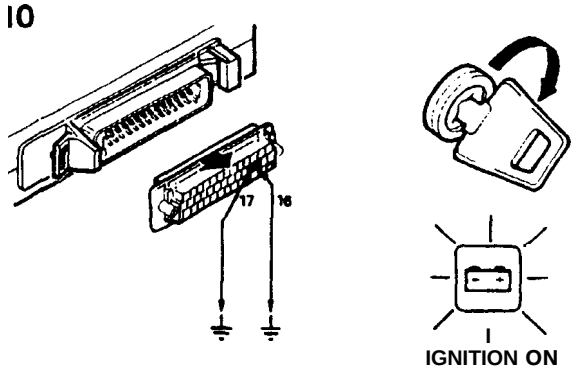
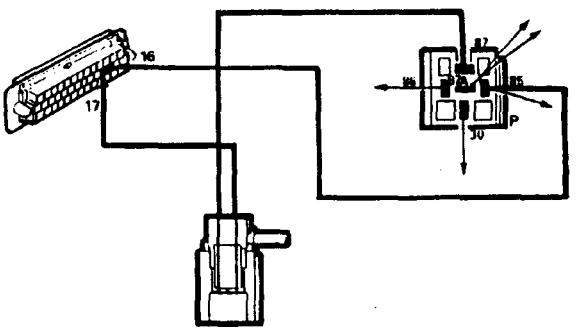
TEST PROCEDURE	RESULTS • Check cables and units shown in bold
6. Check operation of pump relay	Test lamp will illuminate for approximately 1 second when ignition is switched on If O.K • Proceed to Test 8
	Lamp does not illuminate Check:- If OK proceed to Test 8
6  RR2632E	

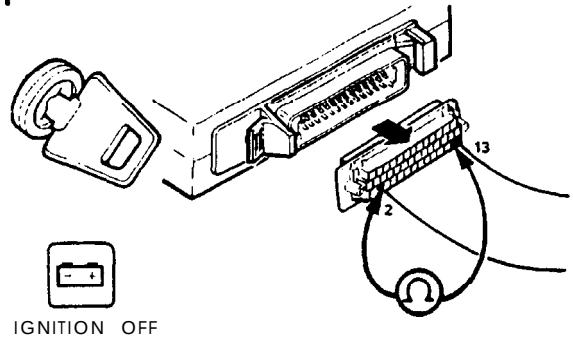
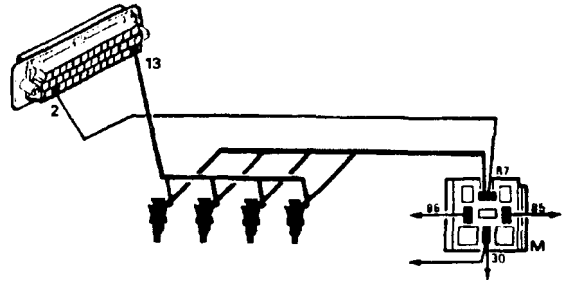
TEST PROCEDURE	RESULTS • Check cables and units shown in bold
7. Fault diagnosis Pump relay circuits	Voltmeter reading of battery volts - Suspect ECU
	Voltmeter reading of zero volts Check:-
7  RR2633E	

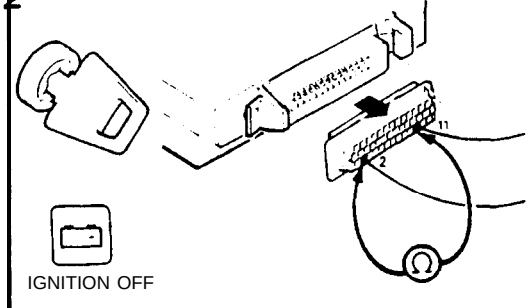
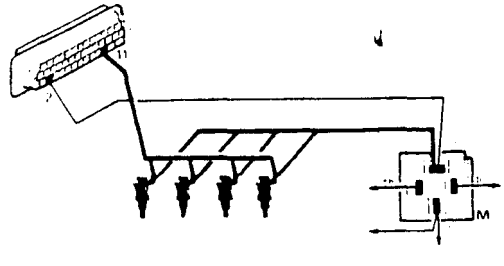
TEST PROCEDURE	RESULTS • Check cables and units shown in bold
8. Check operation of Fuel pump NOTE: It is not possible to place the multi-meter probes directly onto the pump lerminals. A link lead attached lo the pump is accessible behind the rear left hand wheel located between the chassis and stowage area floor panel. KEY: 1. Inertia switch 2. Fuel 18	Voltmeter reading of battery volts - Pump operating • Proceed to Test 10
	(A) Voltmeter reading of battery volts - Pump not operating Check:-
	(B) Voltmeter reading of zero volts Check:-
8  RR2634E	A  B 

Continued

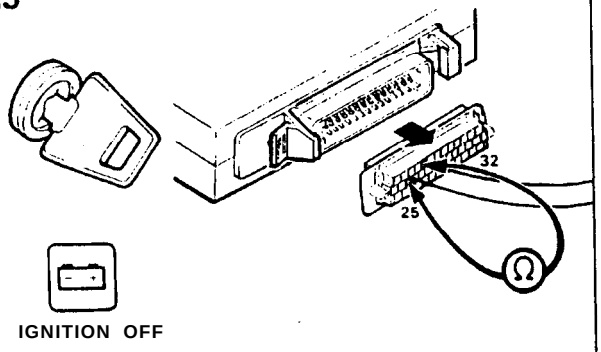
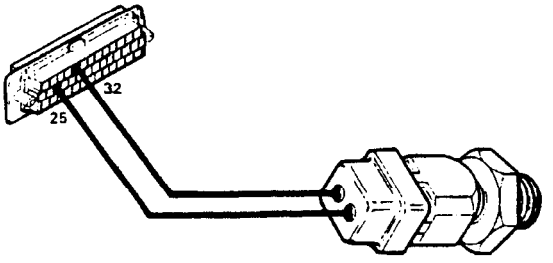
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
9. Check purge valve. Part 1 - seating 1. Disconnect pipe from purge valve lo plenum (al plenum) 2. Connect vacuum pump to pipe to purge valve 3. Apply vacuum of 2.5 *in*/Hg	Vacuum should hold for 2.5 minutes If vacuum correct proceed to test 10 If vacuum incorrect check:
3  I - 0 IGNITION OFF RR2612E	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
10. Check purge valve. Part 2 - operation 1. Apply vacuum - 2.5 in/Hg, switch ignition on 2. Connect pins 16 and 17 to earth to energise pump relay.	Vacuum should be released If OK proceed to test 11 If vacuum not released check:
10  I IGNITION ON RR2613E	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
11. **Check injectors, Injector circuit** **(Pin 13 left bank 'A' injectors 1,3,5,7).**	Ohm-meter reading of 4-4.5 Ohms - Proceed to Test 12 Ohm-meter reading of 5-6 Ohms - Suspect 1 injector Ohm-meter reading of 8-9 Ohms - Suspect 2 injectors Ohm-meter reading of 16-17 Ohms - Suspect 3 injectors Check for open circuit injector(s) or wiring faults. Ohm-meter reading of Infinity Check:
11  IGNITION OFF RR2635E	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
12. **Check injectors, Injector circuit** **(Pin 11 rightbank 'B' injectors 2,4,6,8)**	Ohm-meter reading of 4-4.5 Ohms - Proceed to Test 13 Ohm-meter reading of 5-6 Ohms - Suspect 1 injector Ohm-meter reading of 8-9 Ohms - Suspect 2 injectors Ohm-meter reading of 16-17 Ohms - Suspect 3 injectors Check for open circuit injector(s) or wiring faults. Ohm-meter reading of Infinity Check:
12  IGNITION OFF RR2636E	

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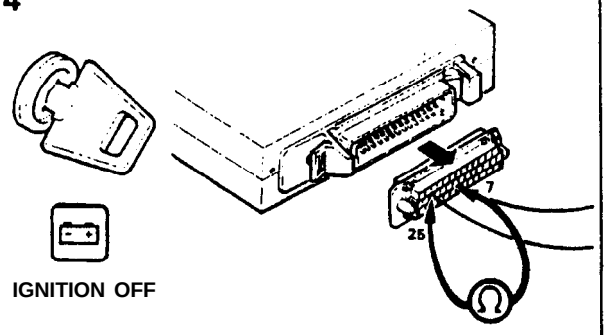
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
13. **Check fuel temperature thermistor (sensor)**	Correct reading-temperature to resistance - Proceed to Test 14 (Refer to Temperature Conversion Charts in Test 14
	Incorrect Ohm-meter reading Check
13  IGNITION OFF RR2638E	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
14. **Check coolant temperature thermistor (sensor)**	Correct reading-Temperature to resistance - Proceed to Test 15 (Refer to **Temperature Conversion** Chart below.

Fuel and Coolant Temperature		Ohm-meter Reading Should be
°C	°F	Ohms
-10°	14°	**9100 - 9300**
0°	32°	**5700 - 5900**
20°	68°	2400 - 2600
40°	104°	1100 - 1300
60°	140°	500 - 700
80°	176°	300 - 400
100°	212°	150 - 200

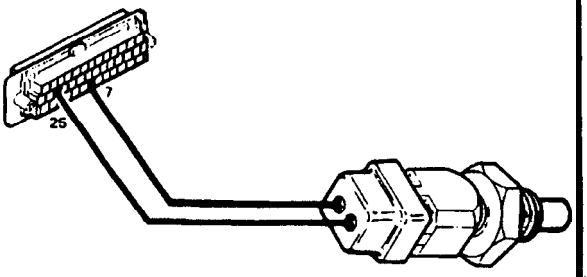
Incorrect Ohm-meter reading
Check:-

14

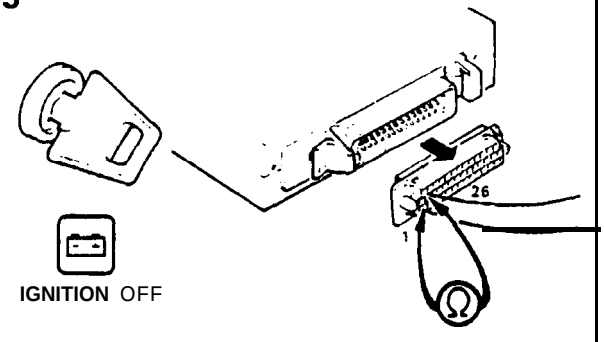
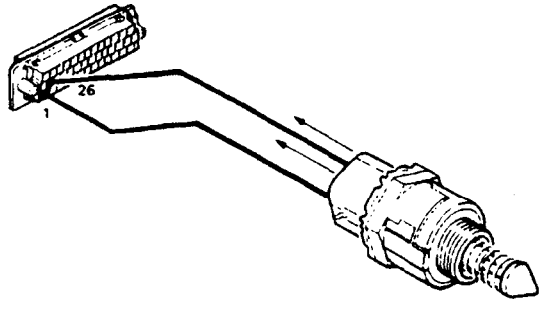


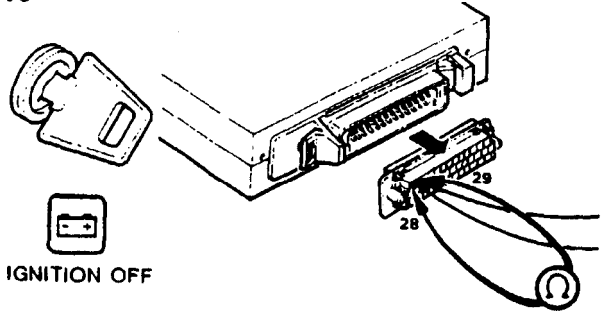
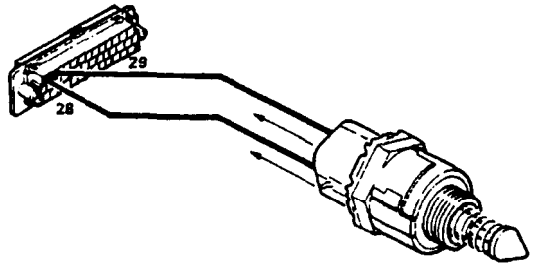
IGNITION OFF

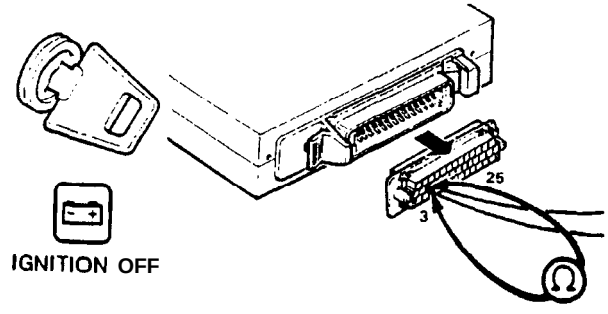
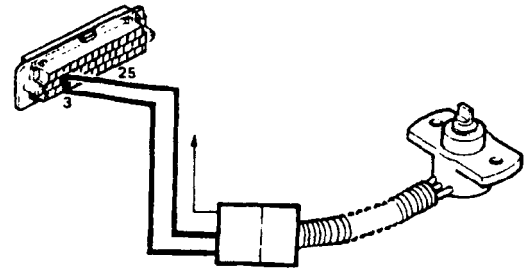
RR2637E

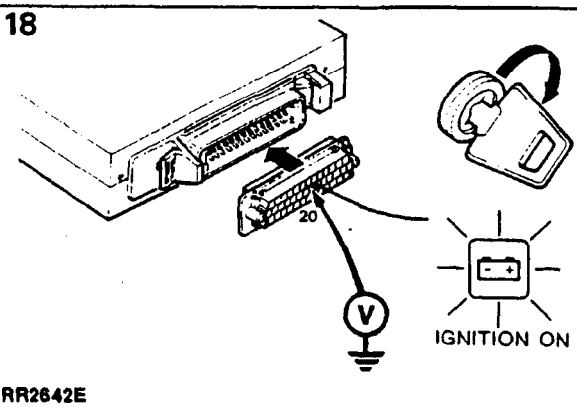
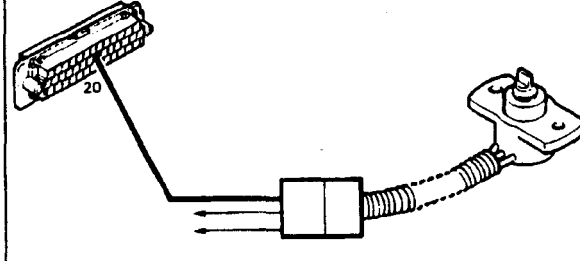


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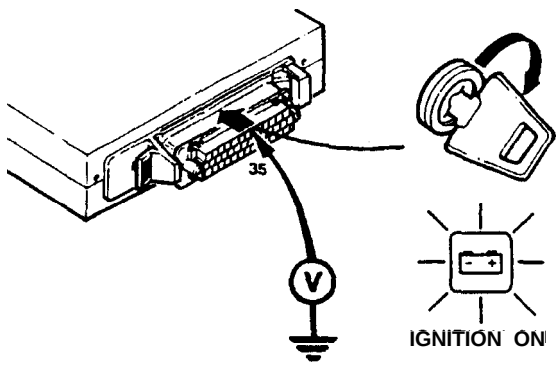
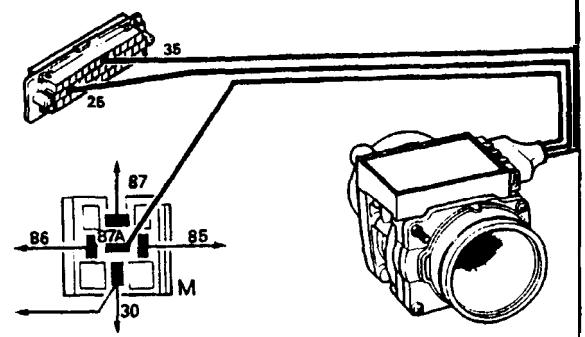
MT PROCEDURE	RESULTS - Check cables and units shown in bold
15. Check air bypass valve - Part 1	Ohm-meter reading of 40-60 Ohms - Proceed to Test 16
	Incorrect reading Check:-
15  AR2639E	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
16. Check air bypass valve - Part 2	Ohm-meter reading of 40-60 Ohms - Proceed to Test 17
	Incorrect reading Check:-
16  IR2640E	

TEST PROCEDURE	RESULTS - Check cables and **units** shown in bold
17. Check throttle potentiometer - Part **1**	**Ohm-meter reading of 4000-6000 Ohms - Proceed to Test 18** **Incorrect reading of Infinity** Check:-
17  RR2641E	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
18. Check throttle potentiometer - Part 2	Correct voltmeter readings- Proceed to Test 18 **Throttle closed: 0.085-0.545 volts**) **smooth swing between closed and** *Throttle open: 4.2-4.9 volts*) *open* Incorrect voltmeter readings Check:-
18  RR2642E	

Continued

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
IS. Check output of Airflow sensor	Voltmeter reading of 0.2-0.7 volts- Proceed to Test 20
	Incorrect voltmeter reading Check:-
 IR2643E	

PRECAUTION:

Depressurize the fuel system when fitting the fuel pressure gauge or disconnecting/replacing fuel system components.

CAUTION: Thoroughly clean the immediate area around the fuel filter and hose connections before disconnecting the fuel feed line from the filter. Failure to do so could cause foreign matter to be present in the fuel system which would be detrimental to the fuel system components.

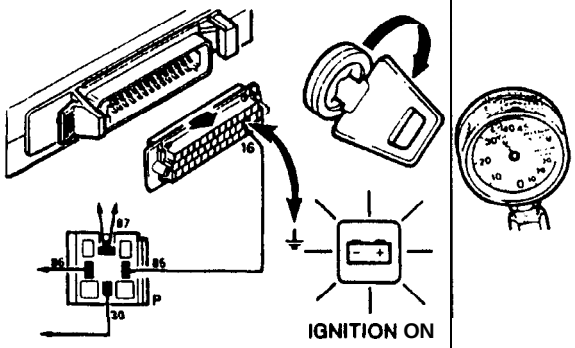
WARNING: The spillage of fuel from the fuel filter is unavoidable when disconnecting the fuel feed line, ensure that all necessary precautions are taken to prevent fire and explosion due to fuel vapour and fuel seepage,

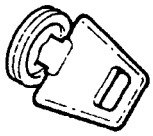
DEPRESSURIZING PROCEDURE

a) **Ignition off, pull pump relay off its terminal block.**
b) **Crank engine for a few seconds - engine may fire and run until fuel pressure is reduced.**
c) **Switch off the ignition.**
d) **Connect fuel pressure gauge in the fuel supply line between the fuel rail and the fuel filter, adjacent to the filter (see Test 20).**
e) **Reconnect the pump relay.**

TEST PROCEDURE	RESULTS • Check cables and units shown in bold
20. **Check fuel system pressure** **Service tool 18G 1500** **NOTE: Insert the pressure gauge in the fuel feed line immediately after the fuel line filter. The filter is located beneath the right hand rear wheel arch attached lo the chassis**	(A) **Expected reading 2,39-2,672 kgf/cm²** (34.0-38.0 p.s.i.) (B) **Pressure drop-max 0.7 kgf/cm²** (10 p.s.i.) **in one minute** **Proceed to Test** 21

20

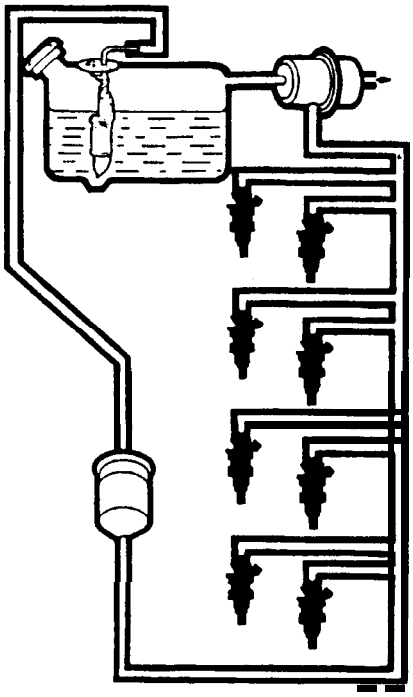




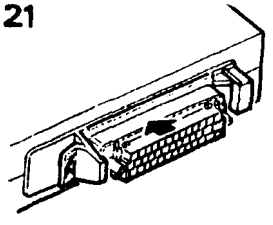
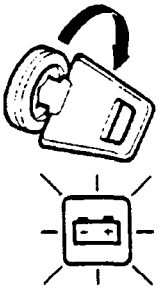
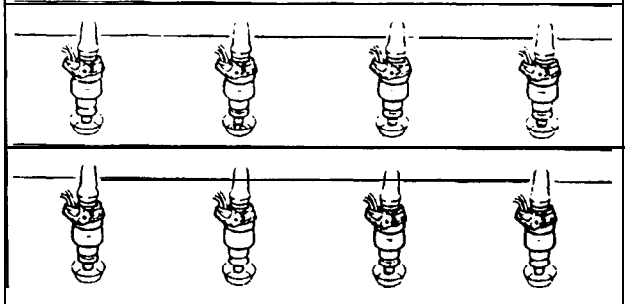
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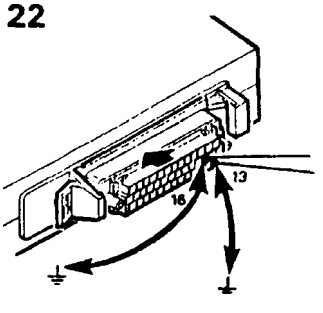
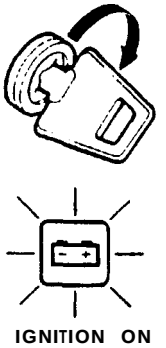
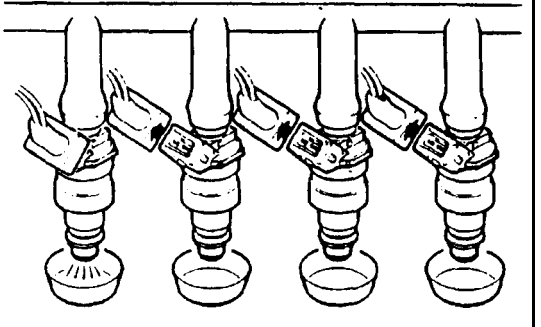
IGNITION OFF

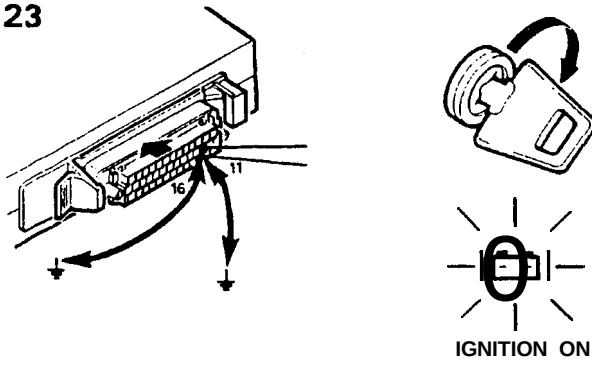
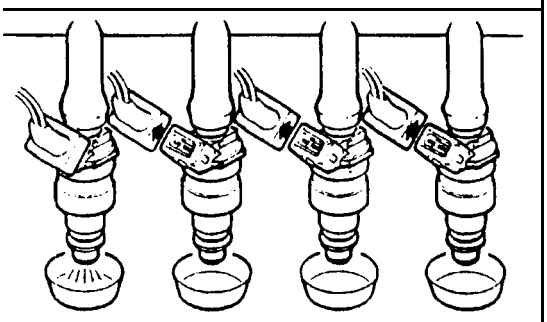
RR2644E

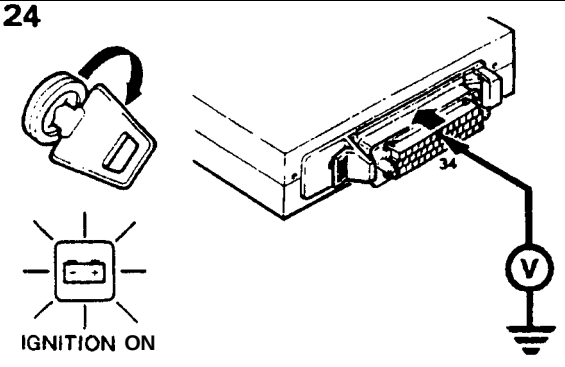
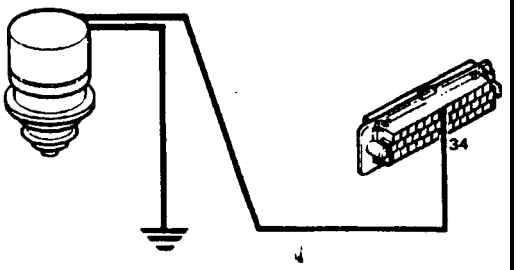


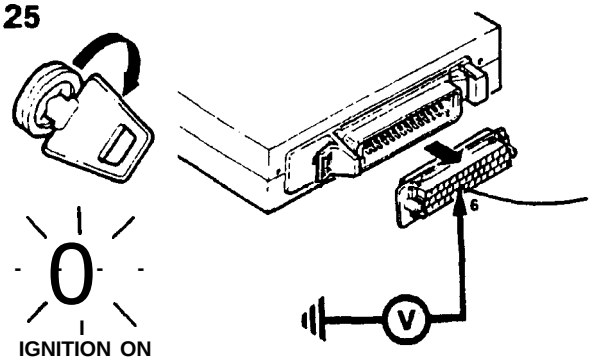
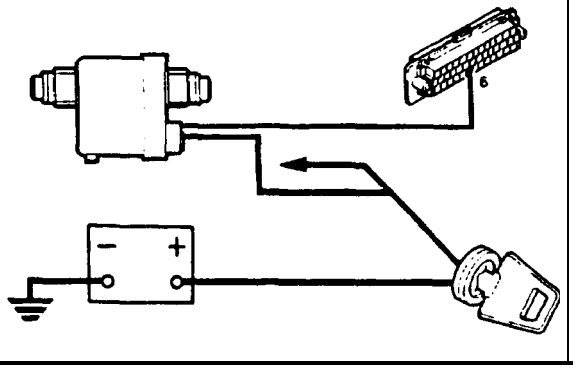
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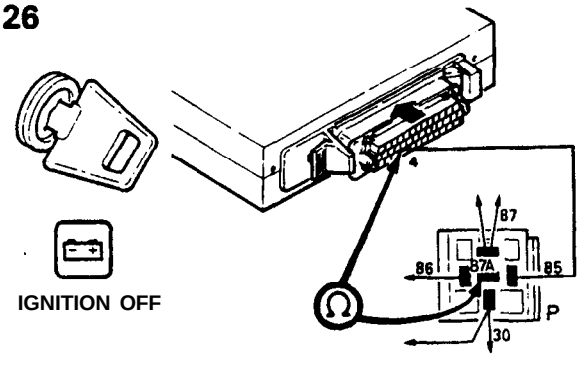
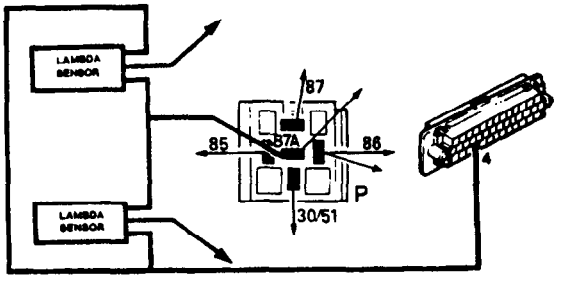
EST PROCEDURE	RESULTS - Check cables and units shown in bold
11. Check for leaking injector NOTE: Before removing any of the injectors, remove and examine the spark plugs, check for consistent colouration of plugs. A leaking injector will result in the appropriate spark plug being 'sooted up'. Remove all injectors from manifold but do not disconnect from fuel rail	WARNING: Ensure that all necessary precautions are taken to prevent fire and explosion. Replace any injector which leaks more than 2 drops of fuel per minute.
21   IGNITION ON RR2645E	

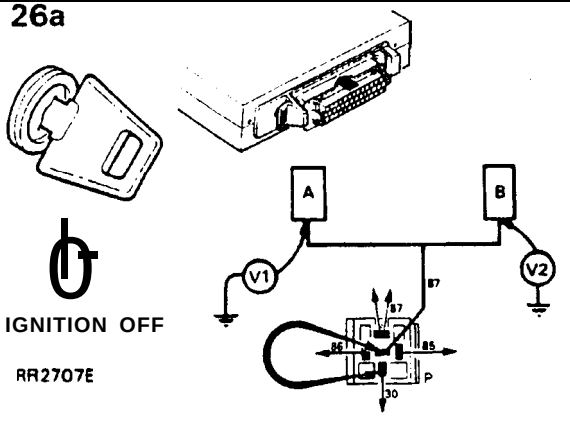
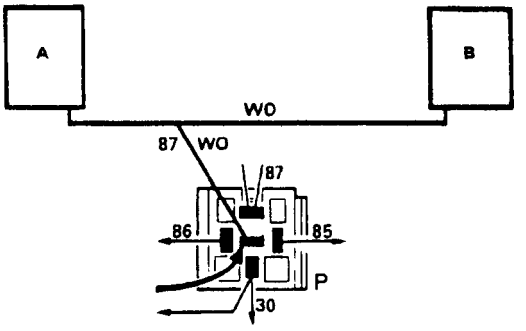
'EST PROCEDURE	RESULTS - Check cables and units shown in bold
12. Check for injector operation Left bank 'A' injectors 1,3,5,7	WARNING: Ensure that all necessary precautions are taken to prevent fire and explosion. Repeat test for other injectors Replace any injector which does not operate. NOTE: Fuel flow is 160-175 cc (using white spirit) or 180-195 cc fusing petrol) (minimum) per minute per injector, al 2.54 kgf/cm² (36.25 psi) system pressure at 20°C ± 2°C
22   IGNITION ON RR2646E	

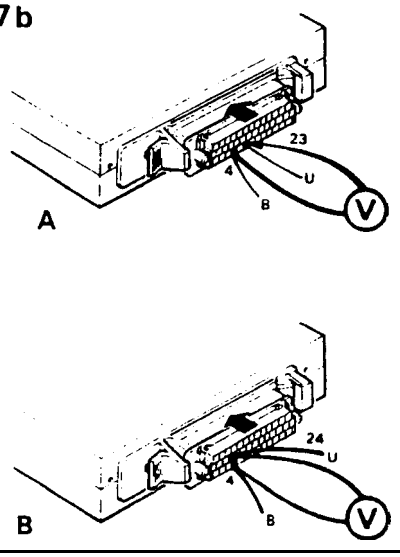
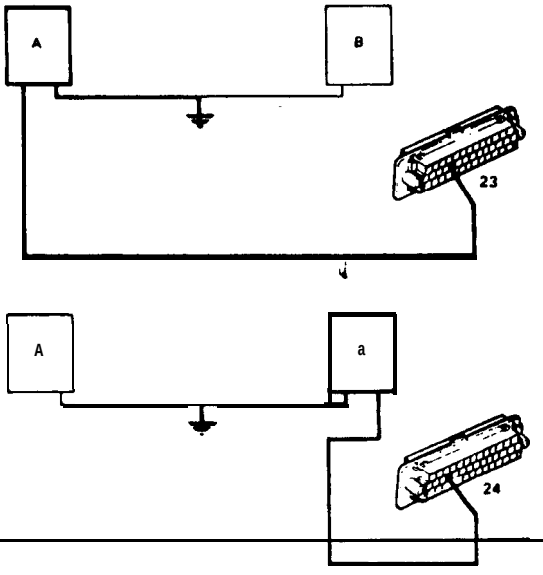
TEST PROCEDURE	RESULTS • Check cables and units shown in bold
23. Right bank 'B' injectors 2,4,6,8	WARNING: Ensure that all necessary precautions are taken to prevent fire and explosion Repeat test for other injectors Replace any injector which does not operate NOTE: Fuel flow is 160-175 cc fusing mineral spirits) or 180-195 cc (using gasoline) (minimum) per minute per injector, al 2.54 kgf/cm² (36.25 psi) system pressure at 20°C ± 2°C
23  RR2647E	

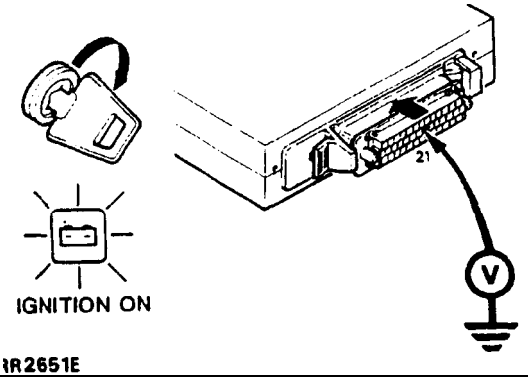
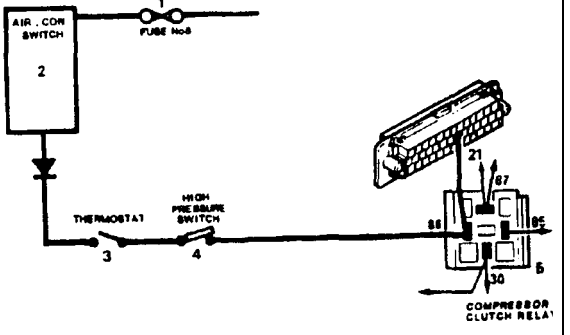
TEST PROCEDURE	RESULTS • Check cables and units shown in bold
24. Check gear switch input	Voltmeter reading of zero volts- Neutral and park
	Voltmeter reading of 2.5-5.0 Volts -R.D.3.2.1• Proceed to Test 25
	Incorrect reading Check:
24  RR2648E	

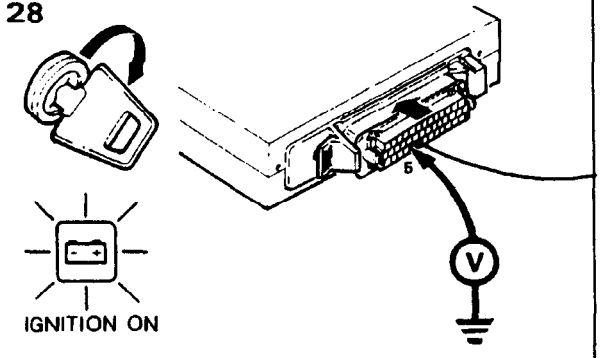
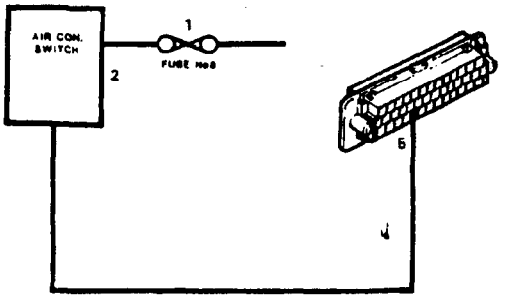
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
25. Check road speed input NOTE: Raise and rotate the left hand teat road wheel slowly	Voltmeter reading of 0 to 12V fluctuating 6 times per revolution - Proceed to Test 26 Incorrect reading Check:
25  RR2649E	

TEST PROCEDURE	RESULTS - Check cables and units shown in bold
26. Check Lambda sensor heater coils VOTE: Remove pump relay from its connector	Ohm-meter reading of 2.5-6.0 Ohms Incorrect reading Check:
26  RR2650E	

TEST PROCEDURE	RESULTS • Check cables and units shown in bold
26a. Check Lambda sensor supply A. LH Lambda sensor B. RH Lambda sensor	Correct V1 and V2 • 12 volts Proceed to Test 26b Incorrect reading Check:
26a  	

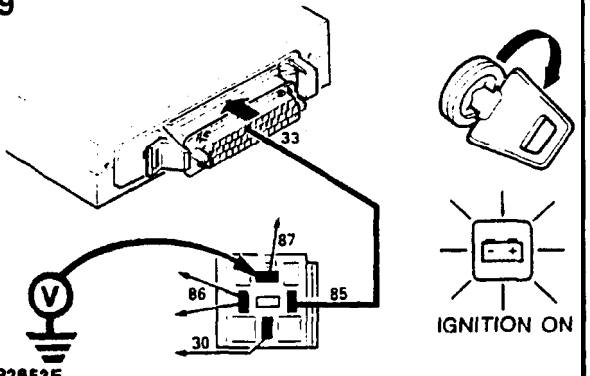
TEST PROCEDURE	RESULTS • Check cables and units shown in bold
26b. Check Lambda sensor operation Nole: Select 'P' in main gearbox and run engine at 1000 revlmin, normal operating temperature A. LH Lambda sensor B. RH Lambda sensor	Correct 0.50V • 1.00V fluctuating Incorrect 0.050 V • Check: Air leaks, faulty or contaminated injectors, low fuel pressure • if OK fit new Lambda sensor Incorrect 1.00V • Check: High fuel pressure, leaking injectors, saturated carbon canister • if OK fit new Lambda sensor.
27b  	

'ESTPROCEDURE	RESULTS - Check cables and units shown in bold
!7. Check air conditioning thermostat input NOTE: Select air conditioning position and move thermostat switch to cold KEY: 1. Fuse 8 2. Air conditioning switch 3. Air conditioning thermostat 4. High pressure switch - air conditioning 5. Compressor clutch relay	Voltmeter reading of battery volts - Proceed to Test 28 Incorrect reading Check:
27  RR2651E	

'EST PROCEDURE	RESULTS - Check cables and units shown in bold
!8. Check air conditioning input NOTE: Select heater fan speed I, II or III KEY: 1. Fuse 6 2. Air conditioning switch	Voltmeter reading of battery volts - Proceed to Test 29 Incorrect reading Check:
28  RR2652E	

TEST PROCEDURE	RESULTS • Check cables and units shown in bold
29. Check operation of compressor clutch relay NOTE: Select air conditioning position, thermostat cold, and tan speed I, II, or III	**Voltmeter reading of 12 volts - Proceed to Test 31** **Incorrect reading of zero volts Proceed to Test 30**

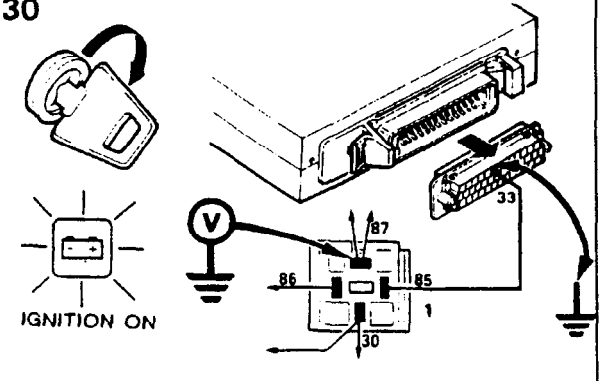
29



RR2653E

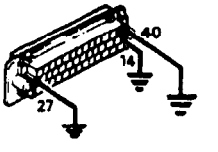
TEST PROCEDURE	RESULTS - Check cables and units shown in bold
30. Fault diagnosis • compressor clutch relay **NOTE:** Select air conditioning position, thermostat cold, and tan speed I, II or III KEY: 1. Compressor clutch relay 2. Compressor clutch 3. High pressure switch 4. Thermostat **5. Air conditioning switch** **6. Fan speed switch** **7. Fuse A3**	Voltmeter reading of 12 volts - Check A Voltmeter reading of zero volts Check B

30

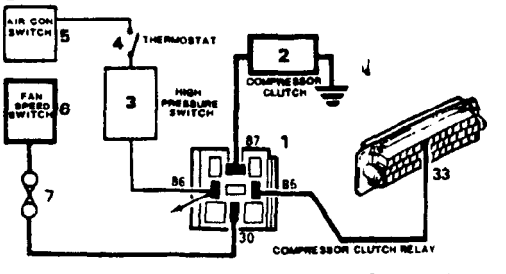


RR2654E

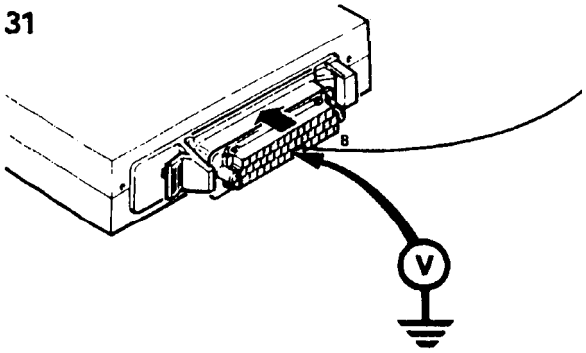
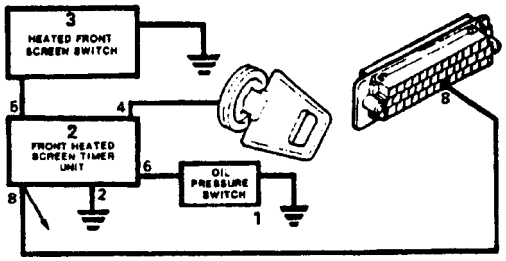
A

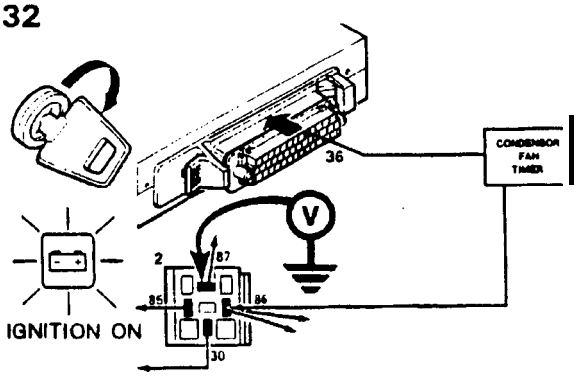


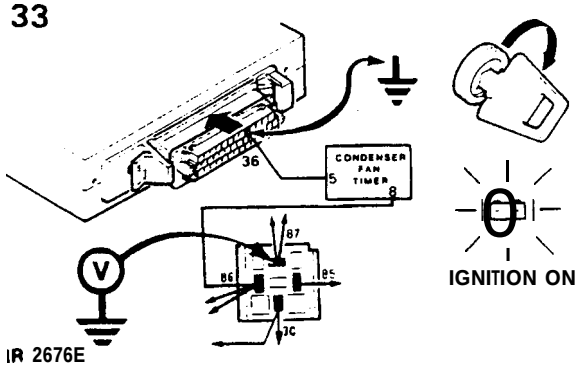
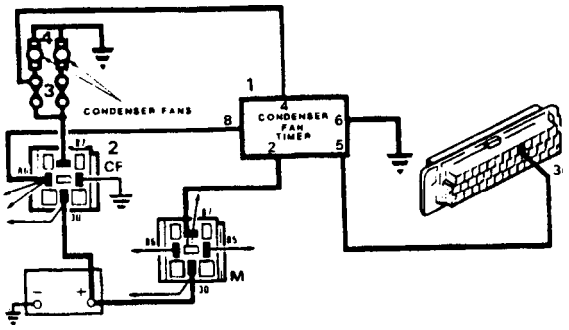
B



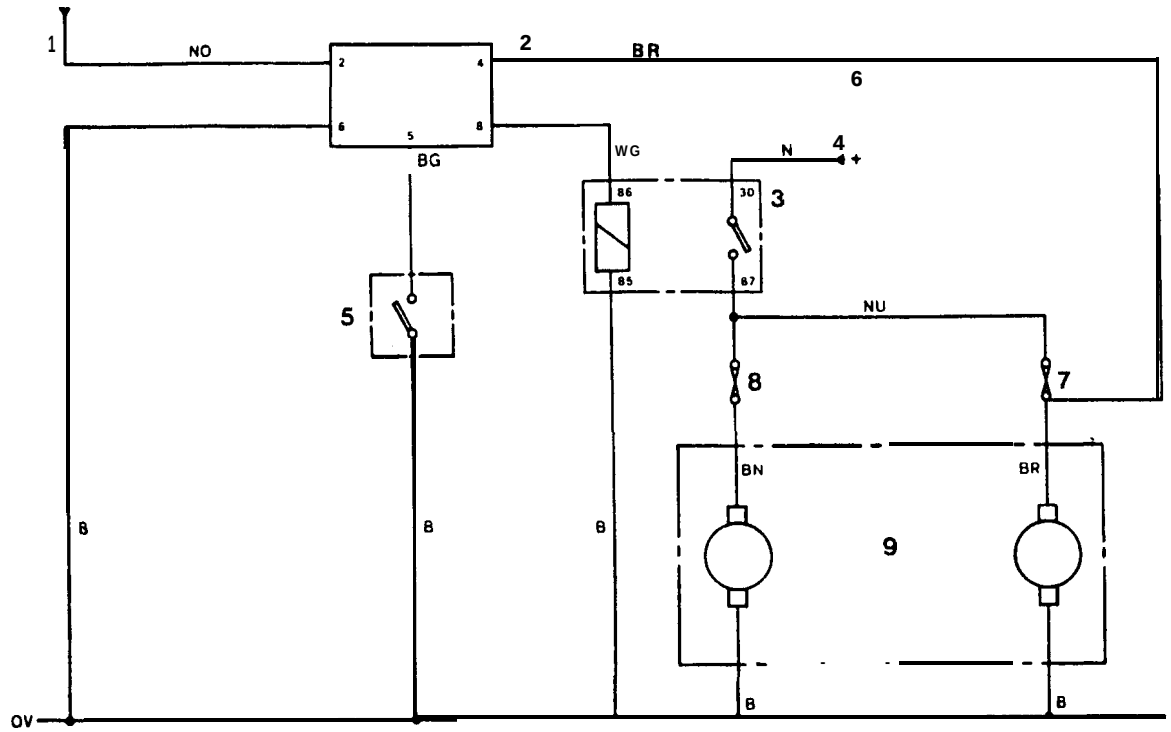
Continued

TEST PROCEDURE	RESULTS • Check cables and units shown in bold
31. Check heated front screen input NOTE: Engine running, heated front screen switched 'ON' KEY: 1. Oil pressure switch 2. Front screen timer unit 3. Front screen switch	Voltmeter reading of 12 volts • Proceed to Test 32 Incorrect reading of zero volts Check:
31  RR2655E	

TEST PROCEDURE	RESULTS • Check cables and units shown in bold
32. Check operation of condenser fan output Disconnect coolant temperature sensor and fuel temperature sensor and bridge plug connectors NOTE: Switch ignition 'ON' for 5 seconds, switch ignition 'OFF' The fan timer will operate the fans for approximately 10 minutes unless it is disconnected KEY: 1. Condenser fan timer 2. Condenser fan relay	Voltmeter reading of 12 volts • end of tests Voltmeter reading of zero volts Proceed to Test 33
32  RR2660E	

'EST PROCEDURE	RESULTS • Check cables and units shown in bold
13. Fault diagnosis • condenser fan output KEY: 1. Condenser fan timer 2. Condenser fan relay 3. Fuses Al and A2 4. Condenser fans	Voltmeter reading of 12 volts - Suspect ECU Incorrect reading Check:
33  IR 2676E	

After completing the tests with either the 'Diagnostic' equipment or multi-meter, re-test the vehicle to ensure the faults have been rectified. If faults still persist, recheck using the Lucas diagnostic equipment.



RR2610E

Condenser fan circuit diagram RR2610E

1. 12V from EFI main relay.
2. Condenser fan timer unit.
3. Fan relay.
4. 12V battery feed.
5. Trigger, from ECU.
6. 12V from fan relay.
7. Fuse Al-20 amp.
8. Fuse A2-20 amp.
9. Fan motors

Condenser fans/Condenser fan timer

Check operation

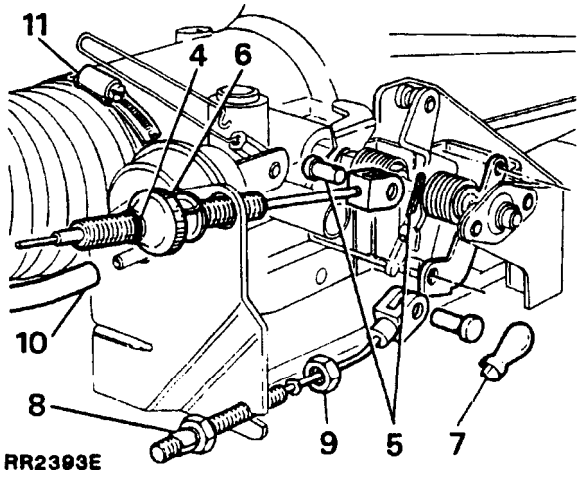
1. Start engine.
2. Move air con/heater control to air conditioning position.
3. Check condenser fans, if working the condenser fan relay and wiring to the fans is functioning.
4. If not working check fuses Al and A2, and the voltage between connections 86 on fan relay and earth. If 12 volts is not present, check wiring back to air con switch.
5. If 12 volts is present, but fans NOT working, short out connections 30 and 87 on fan relay. If fans work fit new relay. If fans NOT working, check supply to fan relay from main harness.
6. Apply a 12 volt supply for at least two seconds to connection 5 on fan timer within SIX SECONDS of switching engine off. The condenser fans should run for 9.5 minutes ± 0.5 minutes, and switch off.
7. If the fans do not work after applying voltage to timer, short out connections 4 and 8 on fan timer, if fans work fit new fan timer. If fans do not work, check wiring.

OVERHAUL THROTTLE LEVERS AND THROTTLE VALVE - 3.9 V8 Model

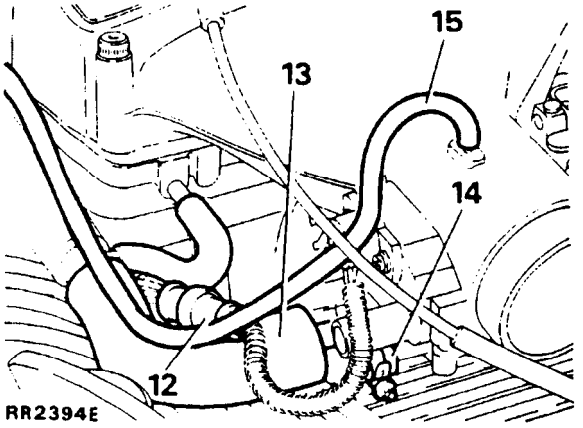
Preparation, remove, overhaul and refit

Preparation

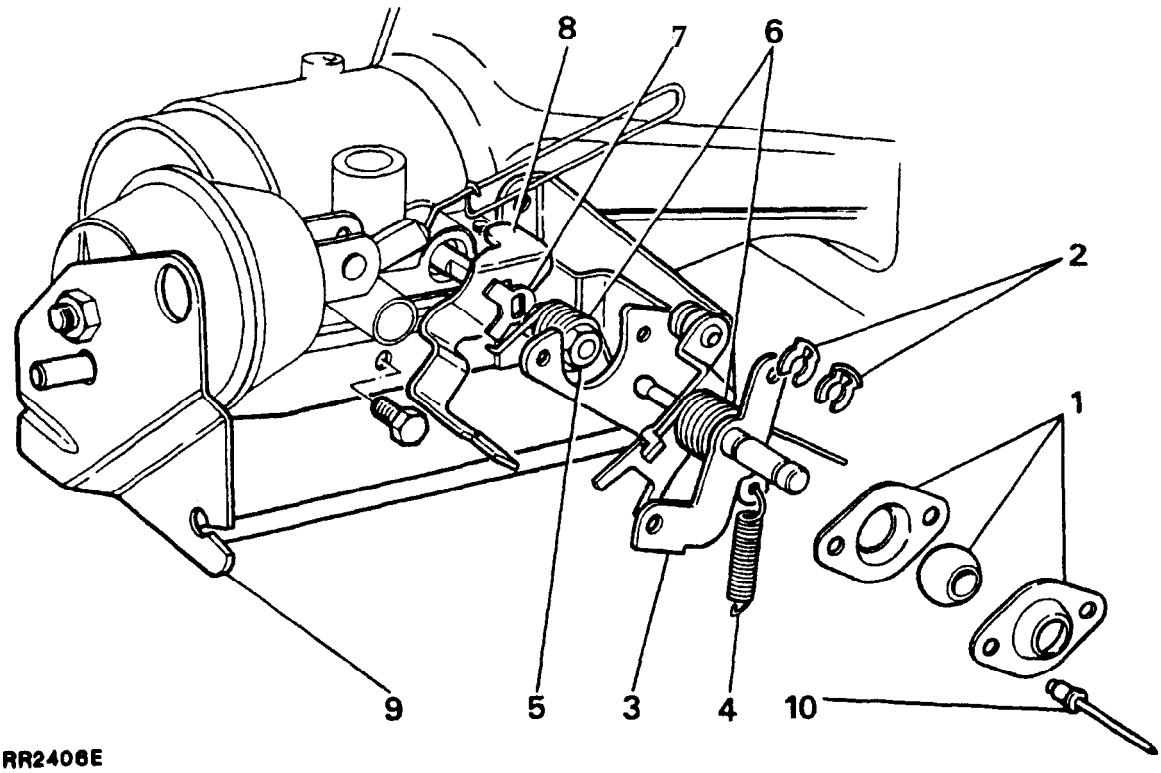
1. Disconnect the battery negative terminal.
2. Disconnect the electrical multi-plug from the bypass air valve (stepper motor).
3. Disconnect the small vacuum hose at the rear of the plenum chamber, located below the bypass air valve.
4. To assist re-assembly mark an identification line on the throttle cable outer covering directly behind the adjustment thumb wheel before disconnecting the throttle cable from the throttle lever.
5. Remove the cotter pin and clevis pin securing the throttle cable to the lever.
6. Carefully pry the adjustment thumb wheel from the throttle bracket. Lay the cable aside.
7. Release the retaining clip from the kick down cable and remove the clevis pin.
8. To assist re-assembly apply adhesive tape behind the rear adjustment nut on the kick down cable outer sleeve to prevent the nut moving out of position.
9. Release the front lock nut and remove it from the outer sleeve to enable the cable to be removed from the throttle bracket. Lay the cable aside.
10. Remove the vacuum hose from the cruise control actuator.



11. Remove the large hose from the neck of the plenum chamber.
12. Disconnect the multi-plug to the throttle potentiometer.
13. Remove the PCV breather hose.
14. Disconnect the two coolant hoses in turn and immediately plug the end of each hose to prevent excessive loss of coolant. Identify each hose for re-assembly.
15. Remove the distributor vacuum hose.



16. Release the two screws and remove the potentiometer.



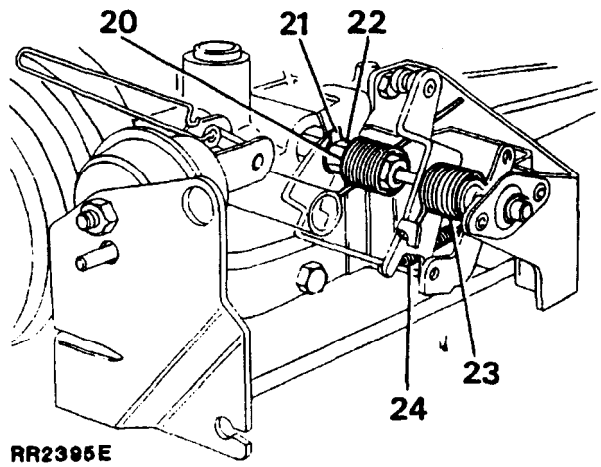
RR2406E

KEY

1. Spherical bearing
2. Retaining clips (2)
3. Countershaft assembly
4. Overtravel spring
5. Throttle spindle nut
6. Throttle return spring (2)
7. Tab washer
8. Throttle stop lever
9. Throttle bracket assembly
10. Pop rivets (2)

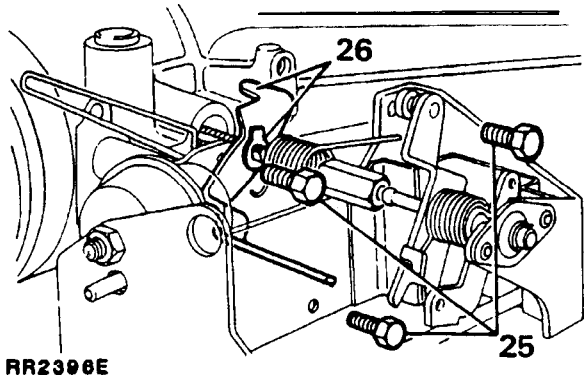
Remove throttle lever assembly

17. Remove the six screws securing the plenum chamber to the ram housing. Lift off the plenum chamber.
18. Remove the hose from the air bypass valve housing and plenum chamber air inlet pipe.
19. Unclip the cruise control actuator link. While holding the throttle valve fully open release the link from the countershaft assembly. Carefully return the lever assembly to the closed throttle position.
20. Release the tension on the inboard throttle return spring and slide the spring along the countershaft assembly to give access to the throttle shaft nut.
21. Bend back the the tabs of the lock washer.
22. While holding the throttle stop lever in the closed position, release the nut until it is free of the throttle valve shaft.
23. Release the tension on the outboard throttle return spring.
24. Unhook and remove the over-travel spring.



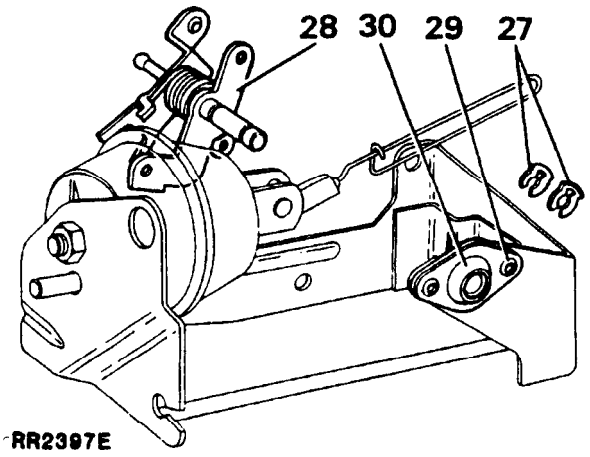
RR2395E

25. Remove the three bolts securing the throttle bracket to the plenum chamber and withdraw the bracket assembly.
26. Remove the tab washer and throttle stop lever from the throttle valve shaft.

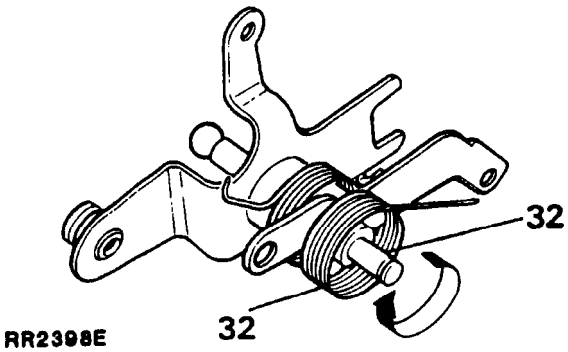


Inspect and overhaul throttle lever assembly

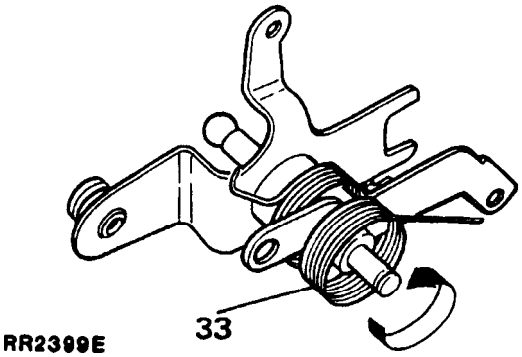
27. Remove the two retaining clips from either side of the spherical bearing.
28. Remove the countershaft assembly from the bearing.
29. If the spherical bush appears to be worn, dismantle as follows. Using a 4,7 mm (3/16 in) diameter drill, drill out the two pop rivets securing the spherical bearing to the throttle bracket assembly.
30. Split the bearing assembly and discard the bearing bush.



31. Pre-grease a new bush with Admax L3 or Energrease LS3 assemble the bush into the bearing retaining plates and pop-rivet the assembly to the throttle bracket with two 4.7 mm (3/16 in) diameter domed head rivets 9 mm (0.361 in) long.
32. Examine the bearing surface of the countershaft assembly. If worn fit a new assembly, otherwise wind the throttle return spring off the levers.



33. Wind a new spring onto the countershaft assembly noting that the small hooked end of the spring is wound on first.

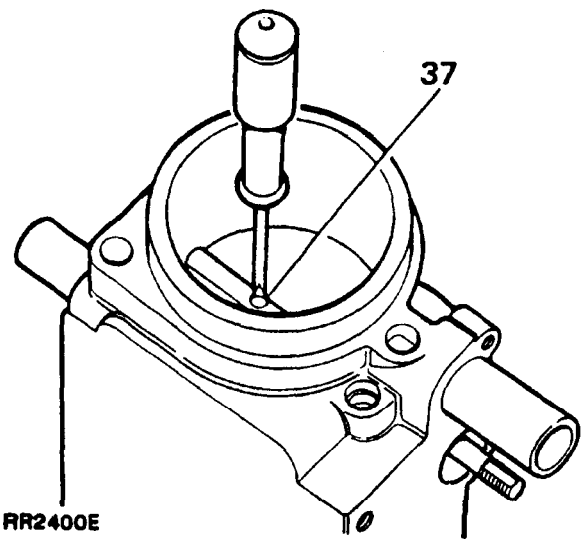


34. Pre-grease the shaft with Admax L3 or Energrease LS3 and fit the countershaft assembly to the spherical bearing and secure with the two clips.
35. Examine the throttle stop lever for wear, fit a new lever if necessary.

Continued

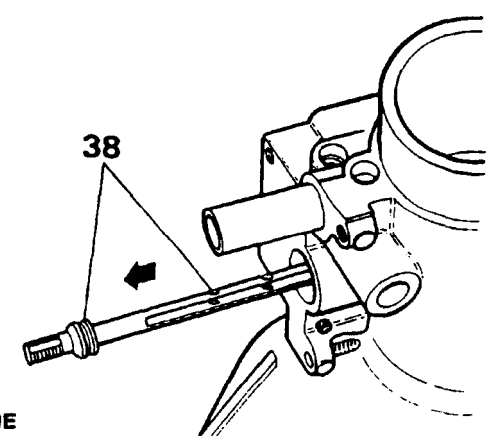
Inspect and overhaul throttle valve

36. Examine the throttle valve shaft for excessive wear between the bearing bushes in the plenum chamber and the shaft. A small amount of clearance is permissible. If excessive wear is evident fit new shaft and bushes as follows.
37. Remove the two split screws securing the throttle valve disc and withdraw the disc, taking care not to damage the shaft.



RR2400E

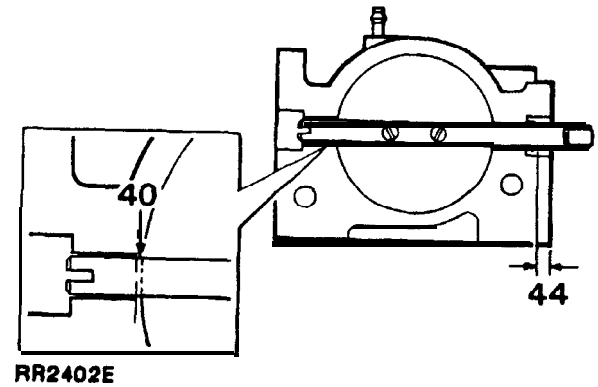
38. Remove the shaft and air seal from the plenum chamber.



RR2401E

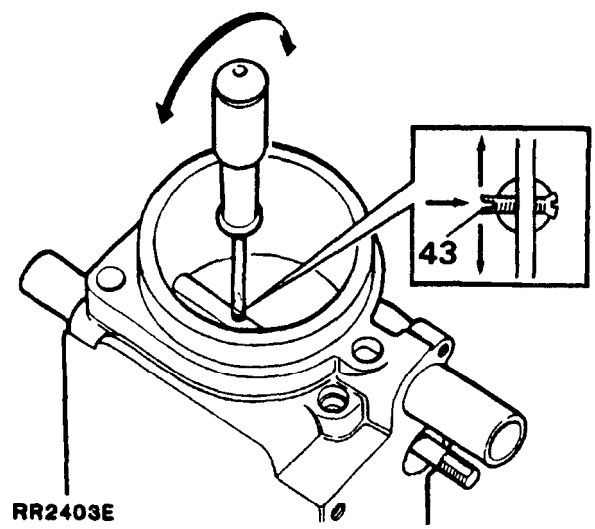
39. Using a suitable drift, drive out the bushes taking care not damage the bores in the plenum chamber.
40. Press in new bushes until they are flush with the throttle valve bore.

CAUTION: Ensure that the bushes do not protrude into the bore as they will interfere with the movement of the throttle valve disc.



RR2402E

41. Fit the throttle valve shaft and disc, secure in position with the two split screws. Do not fully tighten the screws at this stage.
42. Rotate the throttle shaft 360" once or twice to centralise the disc in the bore. Tighten the two screws.
43. Rotate the shaft until the split end of the screws are accessible. Using the blade of a screw driver spread the split to *secure* the screws in the shaft.

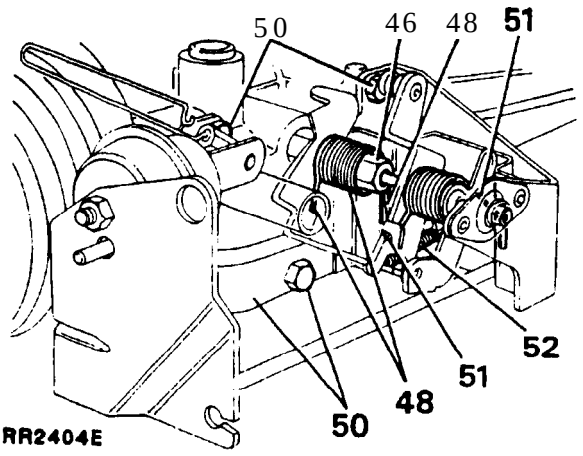


RR2403E

44. Pre-grease a new air seal with Admax L3 or Energrease LS3. Fit the seal pushing it down the shaft and into the counterbore until the seal is 6.0 mm (0.236 in) below the face of the plenum chamber.

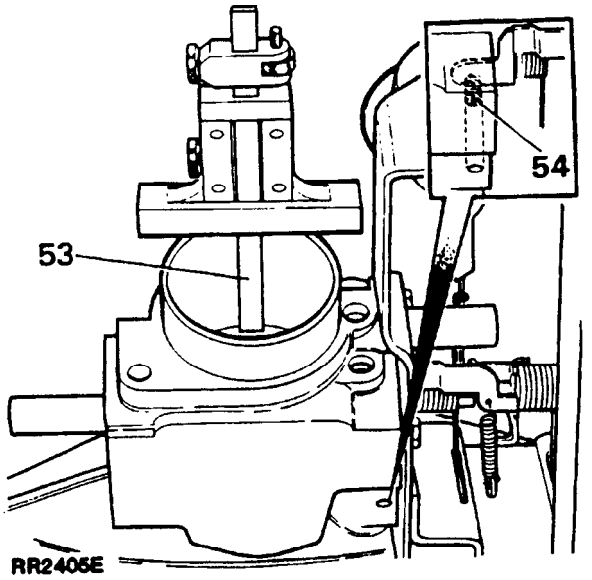
Assemble throttle levers and bracket

45. Fit the stop lever to the throttle valve shaft followed by a new tab washer and secure with the interconnecting nut.
46. Holding the stop lever on its stop, tighten the interconnecting nut securely and bend over the tabs of the tab washer to lock the nut in position.
47. Fit the inboard throttle return spring noting that the small hooked end of the spring is nearest the plenum chamber.
40. Locate the hooked end of the inboard spring on the stop lever and wind up the straight end one full turn and anchor it in the appropriate slot.
49. Fit the countershaft to the interconnecting nut of the throttle valve shaft.
50. Fit the throttle bracket assembly and secure with the three retaining bolts.
51. Ensuring that the hooked end of the outboard spring is anchored by the lever, wind the spring up one full turn and locate the free end in its appropriate slot.
52 Fit the over-travel spring.
Lightly grease the throttle return and over-travel springs with Admax L3 or Energrease LS3.



NOTE: If new throttle levers have been fitted the minimum throttle setting of the disc must be checked to ensure that it is SO" to the bore.

53. Using a depth vernier or depth micrometer from the mouth of the bore check the top and bottom of the valve disc. The disc must be within 0.5 mm (0.019 in) total indicator reading across the full diameter of the disc.
54. If the throttle disc is out of limits adjust the small set screw below the stop lever. Access to the screw is gained from the bottom of the plenum chamber neck adjacent to the throttle levers support bracket.



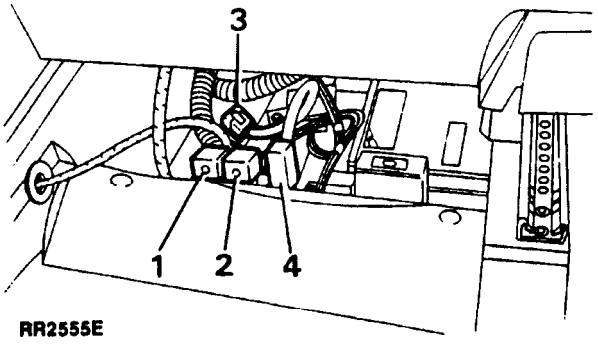
Refitting

55. Reconnect and adjust the cruise control actuator link. (See cruise control-actuator link setting)
56. Clean any previous sealant from the joint face of the plenum chamber and ram housing. Apply 'Hylomar' sealant to the faces and refit the plenum chamber. Tighten the bolts to the correct torque value-see section 06.
57. Reverse the remaining preparation instructions.

ELECTRONIC FUEL INJECTION-RELAYS

Incorporated in the fuel injection electrical system are two relays which are located beneath the front right hand seat adjacent to the cruise control relay and emission maintenance reminder. Access to the relays is gained through the opening at the bottom of the seat when the seat is in its fully forward position on the seat slides.

1. Fuel pump relay (mounted on a blue terminal block).
2. Main relay (mounted on a black terminal block).
3. Diagnostic plug.
4. Condenser fan timer unit.



RR2555E

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Pull the relay(s) from the terminal block(s).

Refitting

3. Reverse the removal procedure.

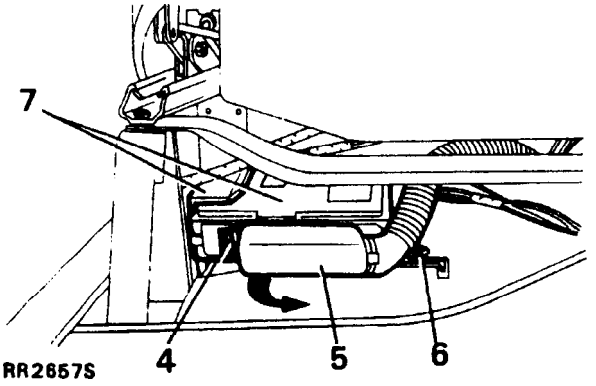
ELECTRONIC CONTROL UNIT (ECU)-14 CU

NOTE: The ECU is not a serviceable item. In the event of a unit failure the ECU must be replaced.

Remove and refit

Removing

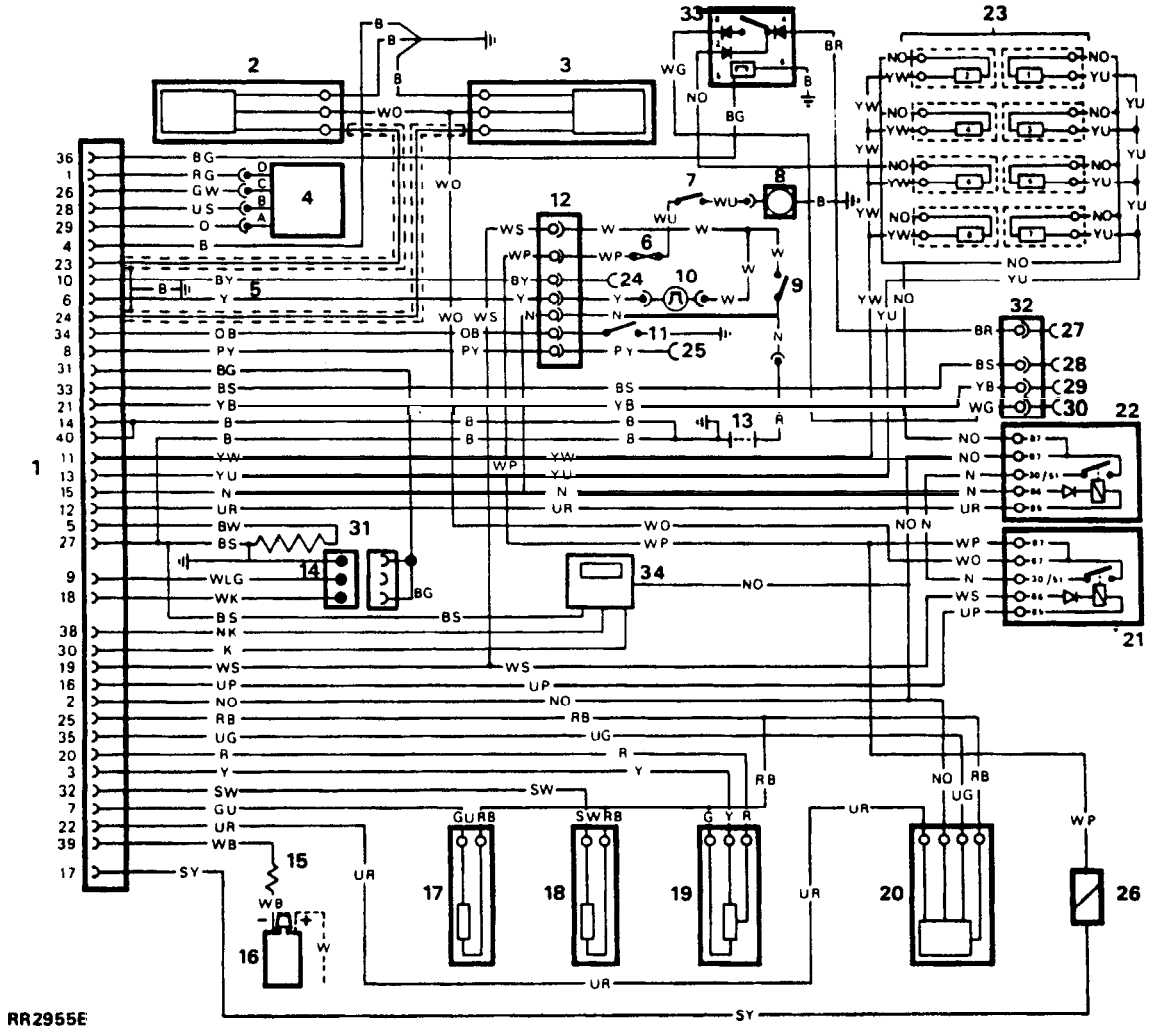
1. Remove the front and side seat base trim of the front right hand seat.
2. Adjust the seat to its most rearward position and raise the seat cushion height to allow access to the ECU fixings.
3. Disconnect the battery negative terminal.
4. Release the ECU plug retaining clip.
5. Maneuver the front of the plug (in the direction of the bold arrow) and detach the other end of the plug from the retaining peg.
6. Release the two screws securing the ECU to the mounting bracket.
7. Withdraw the ECU from the spring clip and remove it from the vehicle.



RR2657S

Refitting

8. Refit the ECU securely in the spring clip and fit and tighten the two screws.
9. Reconnect the ECU harness plug. Ensure that the plug is pushed firmly into its location and that the retaining clip secures the plug in position.
10. Remove remaining removal procedure.



FUEL INJECTION - Circuit Diagram - 1990/91 model year

1. 40 way connector to Electronic Control Unit (ECU).
2. Lambda sensor (left side - bank A).
3. Lambda sensor (right side - bank B).
4. By-pass air valve (stepper motor) (fast idle).
5. Lambda sensor screened ground.
6. Fuse C4 - main fuse panel.
7. Inertia switch.
8. Fuel pump.
9. Ignition switch.
10. Speed transducer (road speed input).
11. Neutral switch (automatic gearbox) (load input).
12. Main cable connector.
13. Battery.
14. Diagnostic plug.
15. In-line resistor.
16. Coil/-ve (engine RPM input).
17. Coolant temperature thermistor (sensor) (input).
18. Fuel temperature thermistor (sensor) (input).
19. Throttle potentiometer.
20. Air flow sensor.
21. Fuel pump relay.
22. Main relay.
23. Injectors-1 to 8.
24. Pick-up point E.F.I. warning symbol (instrument binnacle).
25. Heated front screen sense.
26. Purge control valve.
27. 12V from fan relay.
28. Air conditioning output control.
29. Air conditioning load input.
30. Fan relay feed.
31. Tune resistor (early vehicles).
32. Heater/air con. cable connector.
33. Condenser fan timer control.
34. Fault display input.

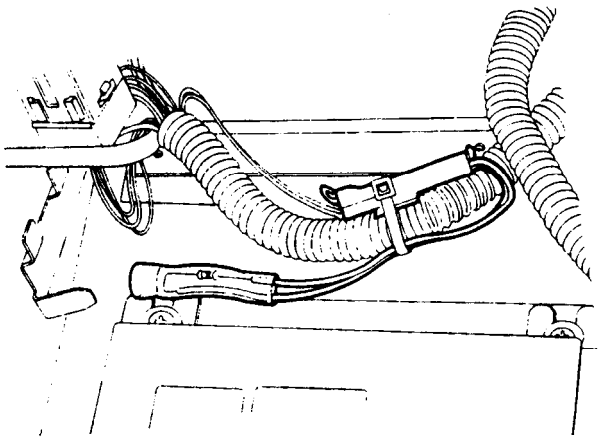
= = = Denotes screened ground.

NOTE: Reference to left and right side is made when viewing the vehicle from the rear.

ELECTRONIC FUEL INJECTION -LUCAS 14CUX SYSTEM

1990 model year vehicles have an enhanced fuel injection system, using a Lucas 14CUX electronic control unit, The system is a development of the 14CU sytem introduced on 3.9 litre vehicles.
The system works in the same way, new components being a tune select resistor and a fault code display unit.

TUNE SELECT RESISTOR - RR281 1M



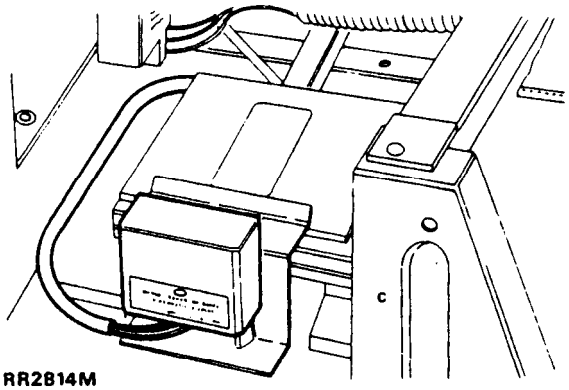
RR2811M

The 14CUX system is used in various markets, but a common ECU is used. To suit individual market requirements a tune select resistor is connected across pins 5 and 27 of the ECU.
It is located adjacent to the ECU, and strapped to the EFI cable assembly. The value of the resistor is dependent on the market application.

NOTE: For USA market models the resistor value is 3900 Ohms, wire colour, white.

NOTE: Vehicles after VIN No 451518 are fitted with a new ECU, Part No. PRC 8747 to replace PRC 7081. This ECU no longer requires the tune select resistor, which is therefore deleted. Fault code 21 is no longer stored by the ECU.

17EM FAULT CODE DISPLAY UNIT - RR2814M



RR2814M

1990 model year vehicles have a fault code display unit which is located underneath the right hand front seat, adjacent to the EFI ECU. The unit will display the relevant fault code, in addition to the EFI warning light being illuminated.

NOTE: Fault code 59 will NOT be indicated by the EFI warning light.

Recommended equipment

The diagnostic equipment for checking out the 14CUX system is the same as that used for 14CU, with the addition of two new memory cards for Hand Held Tester.

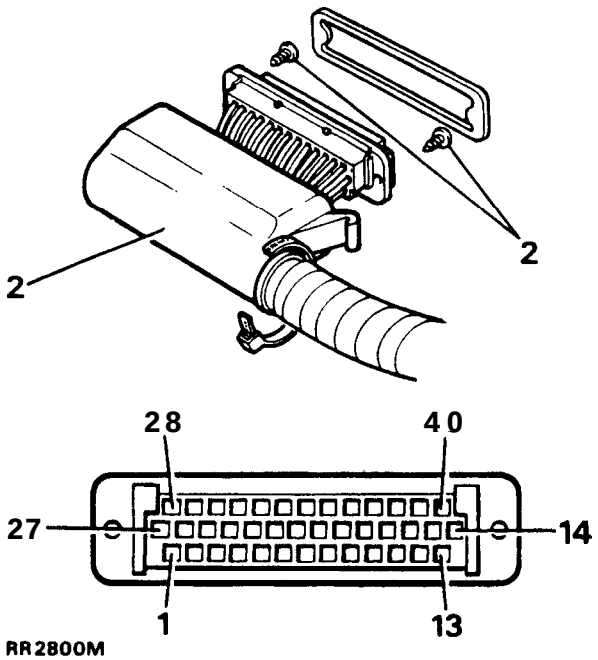
14CUX Memory cards, Lucas Part Number:
- 606 01 379.

CONTINUITY TEST PROCEDURE

NOTE: The continuity test procedure for 14CUX systems is similar to that for 14CU. Note the addition of the tune select resistor test and the deletion of Test 28, which does not apply to 14CUX systems.

TESTING

1. Release the ECU plug retaining clip and remove the plug from the ECU. Access is gained by removing the front seat base trim of the right hand front seat.
2. Remove the plug shroud and manoeuver it along the harness until there is enough clearance to enable meter probes to be inserted into the back of the plug.
3. There are six pin numbers 1, 13, 14, 27, 28 and 40 moulded onto the rear of the plug as shown in the illustration below, for clarity the electrical leads have been omitted.



RR2800M

Pins 1 to 13 bottom row.
Pins 14 to 27 centre row.
Pins 28 to 40 top row.

CONNECTIONS TO 40 WAY CONNECTOR

PIN Nos. CABLE COLOUR

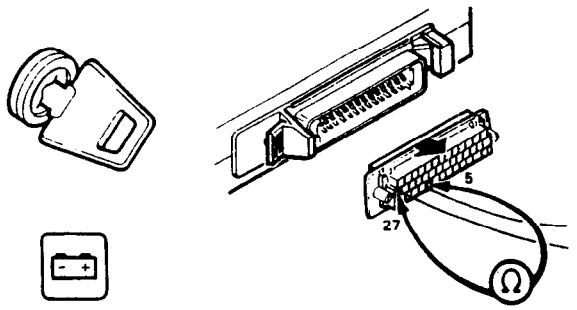
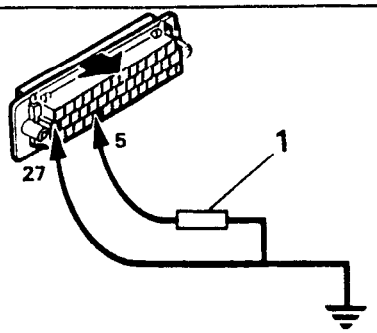
1. Red/green
2. Brown/orange
3. Yellow
4. Blak
5. Grey/Black
6. Yellow
7. Green/blue
8. Purple/yellow
9. White/light green
10. Black/yellow
11. Yellow/white
12. Blue/red
13. Yellow/blue
14. Black
15. Brown
16. Blue/purple
17. Grey/yellow
18. White/pink
79. White/grey
20. Red
21. Yellow/black
22. Blue/red
23. Blue
24. Blue
25. Red/black
26. Green/white
27. Black/grey
28. Blue/grey
29. Orange
30. Pink
31. Black/green
32. Grey/white
33. Black/grey
34. Orange/black
35. Blue/green
36. Black/green
37. Not used
38. Brown/pink
39. White/black
40. Black

The last colour denotes the wire tracer colour

Tune select resistor test

It is recommended that this test is carried out before Test 1. of Continuity Test Procedure, Section 19, page 44.

NOTE: This test is not required on vehicles after VIN No 451518, which are no longer fitted with a tune select resistor.

TEST PROCEDURE	RESULTS - check cables and units shown in bold
TUNE SELECT RESISTOR TEST KEY 1) Tune select resistor	CORRECT READING: 3700-4100 OHMS Resistor wire colour: White INCORRECT OHMETER READING CHECK:
 IGNITION OFF RR2812M	 RR2813M

Description of fault codes

The fault codes are listed in order of priority. Where more than one fault exists, clearing the first fault code will permit the next code to be displayed.

NOTE: Fault code 02 will show if the ECU has just been reconnected. Switch on ignition to clear the display.

Clearing fault code display

It is necessary to clear the code displayed when the fault has been rectified, and to access any further fault codes that may exist. Clear the fault code displayed using the following procedure:

1. Switch On ignition.
2. Disconnect serial link mating plug, wait 5 seconds, reconnect.
3. Switch OFF ignition, wait for main relay to drop out.
4. Switch ON ignition. The display should now reset. If no other faults exist, and the original fault has been rectified, the display will be blank.
5. If multiple faults exist repeat Steps 1. to 4. as each fault is cleared the code will change, until all faults are cleared. The display will now be blank.

Code 29 - ECU MEMORY CHECK - If this fault is detected, all other faults are unreliable and must therefore be ignored.

Proceed as follows:

1. Leave battery connected
2. Switch ignition off
3. Wait for approximately 5 seconds
4. Disconnect ECU plug
5. Re-connect ECU plug
6. Switch ignition on and check display unit.

NOTE: If fault code 29 is detected again, substitute ECU and restart test sequence.

Code 44 - LAMBDA SENSOR A - left bank
Code 45 - LAMBDA SENSOR B - right bank

If one of these fault codes is displayed check the wiring to that particular lambda sensor.

If both codes are displayed, the voltage supply to the heater coils of the sensors must be checked. Refer to Test 26, continuity test procedure.

Code 25 - IGNITION MISFIRE - This code indicates that an ignition system misfire has been detected. Codes 40 or 50 indicate on which bank the misfire has occured.

Code 40 - MISFIRE BANK A - left bank
Code 50 - MISFIRE BANK B - right bank

If both fault codes are displayed check the following components commom to both banks:

Distributor cap
Rotor arm
Coil
Electrical connections
Pick-up (air gap)
Amplifier
Injectors - if code 34 or 36 displayed.

If either fault code 40 or 50 is displayed check components applicable to the particular bank that the misfire has occured on:

Spark plugs
HT leads
Distributor cap
Injectors - if code 34 bank A or 36 bank B displayed.

Code 12 - AIRFLOW METER - Refer to Test 19, continuity test procedure.

Code 21 - FUEL TUNE SELECT - Identifies that the tune select resistor is open circuit - Refer to tune select resistor test.

Code 34 - INJECTOR BANK A - The display will indicate if the injector/s are causing the engine to run rich or lean.

If the bank is running rich, check for:-
- faulty injector wiring and connectors
- stuck open injectors

If the bank is running lean, check for:-
- faulty injector wiring and connectors
- blocked injectors

Code 36 - INJECTOR BANK B - As code 34 except relevant to bank A injectors.

Code 14 - COOLANT THERMISTOR - Refer to Test 14, continuity test procedure.

Code 17 - THROTTLE POTENTIOMETER - Refer to Test 17, continuity test procedure.

Code 18 - THROTTLE POTENTIOMETER input high/AIRFLOW METER - low. - Refer to Tests 17, 18 and 19 of the continuity test procedure

Code 19 - THROTTLE POTENTIOMETER input low/ AIRFLOW METER - high. - Refer to Tests 17, 18 and 19 of the continuity test procedure

Code 88 - PURGE VALVE LEAK - Refer to Test 9 and 10 of the continuity test procedure.

Code 28 - AIR LEAK - Check for air leaks in the following areas.
Hose, air flow meter to plenum
Breather system hoses to plenum
Brake servo hose
Vacuum reservoir hose (fresh air solenoid)
Distributor vacuum advance
Hose, purge valve to plenum
Injector seals
Joint - By pass air valve to plenum
- Plenum chamber to ram housing
- Ram housing to inlet manifold
- Inlet manifold to cylinder head
By pass air valve hose

Code 23 - FUEL SUPPLY - Check fuel system pressure, Test 20 of the continuity test procedure.

Code 48 - STEPPER MOTOR - Check base idle speed - see setting procedure. - Refer to Tests 15 and 16 of the continuity test procedure. Check road speed sensor - Refer to Test 25 of the continuity test procedure.

Code 68 - ROAD SPEED SENSOR - Refer to Test 25 of the continuity test procedure.

Code 69 - GEARSWITCH - Refer to Test 24 of the continuity test procedure.

Code 59 - GROUP FAULTS 23/28 - This indicates that a fault has been registered that is caused by the fuel supply or an air leak but the exact fault cannot be identified. Check all items outlined under code 23 and 28.

Code 15 - FUEL THERMISTOR - Refer to Test 13 of the continuity test procedure.

BASE IDLE SPEED SETTING

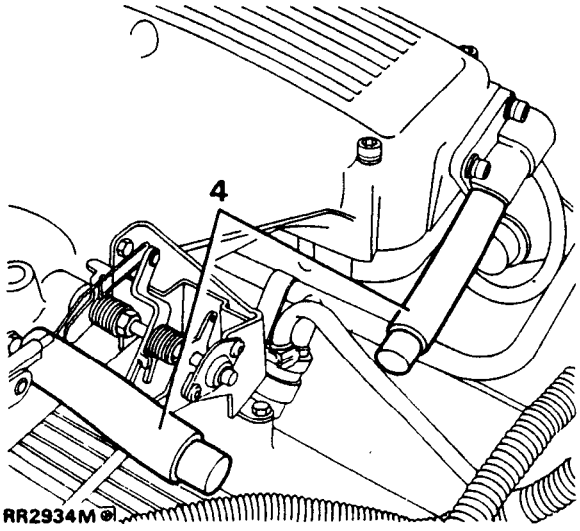
NOTE: the base idle speed is set at the factory. It should not require further adjustment unless the plenum chamber is changed. The adjustment screw is sealed with a plug to prevent unauthorised alteration. Check the ignition timing before attempting the following procedure, since this will affect the idle speed.

Equipment required

Two blanking hoses. It is recommended that these are manufactured using a new air by-pass valve hose - Part No.ETC7874. Cut two equal pieces 90mm (3 1/2 inches) long from the hose and seal one end of each, using 13mm (1/2 inch) diameter bar. A suitable clamp can be used to ensure an air tight seal

Checking procedure

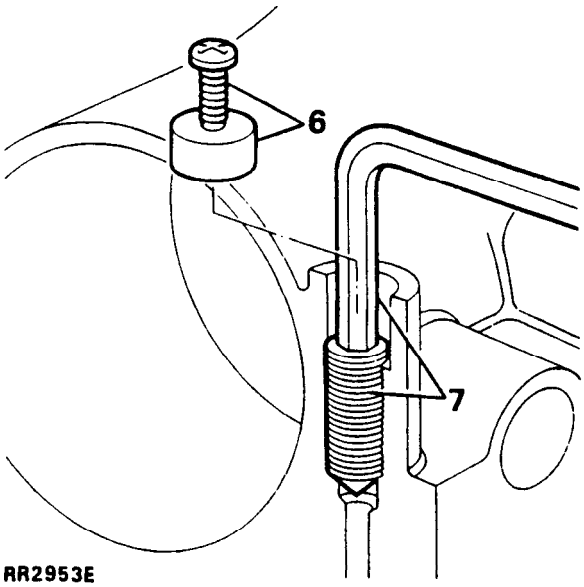
1. Drive the vehicle for at least two miles until the engine and transmission are hot. Switch off the engine.
2. Check that all electrical loads are off including airconditioning.
3. Remove the air by-pass valve hose.
4. Fit the blanking hoses to both the plenum chamber and the air by-pass valve. Ensure the hoses are securely fitted to prevent air leaks. Note that the throttle cable and cruise control actuator have been omitted from the illustration for clarity.



5. Start the engine and check that the idle speed is within the limits specified in Section 05 - Engine Tuning Data.

Adjusting base idle speed

6. Remove the tamper proof plug that protects the idle speed screw. Drill the plug and insert a self tapping screw to enable the plug to extracted.



7. Start the engine, and using a suitable Allen key, adjust the idle screw clockwise to decrease or counter-clockwise to increae the idle speed.
8. Check fault code display, and clear the memory - see 'Clearing fault code display' - section 19, page 74.

FUEL SYSTEM 1991 MODEL YEAR

A revised fuel sytem is fitted to 1991 model year vehicles. The major change is the fitting of a plastic fuel tank with improved breather system. The remote expansion tank is now deleted.
A further improvement is the fitting of a combined fuel pump and sender unit. A panel in the floor of the vehicle permits access to the fuel pump/sender unit

FUEL PUMP/SENDER UNIT

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

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

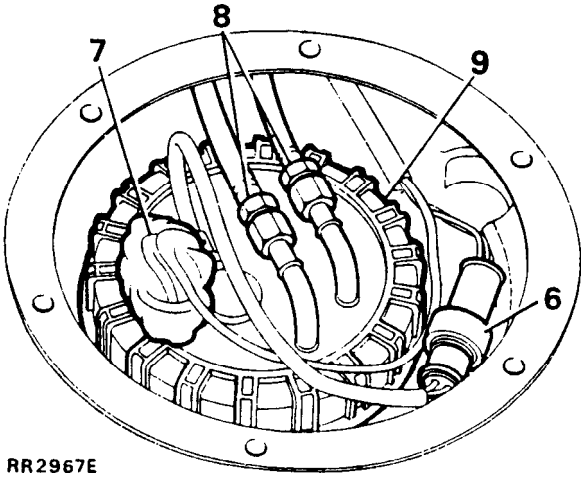
Special Tool - LST131, wrench - pump retaining ring

- LST 144 -'Speedfit' disconnector

Remove and refit

Removing

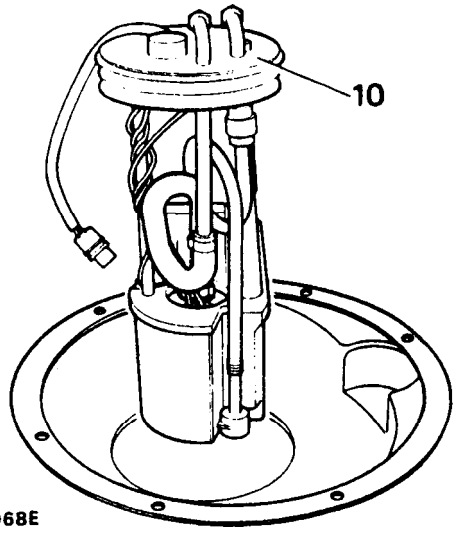
1. Depressurise the fuel system.
2. Disconnect battery negative lead.
3. Syphon at least 9 litres (2 gallons) of fuel from the fuel tank using a suitable container that can be sealed afterwards.
4. Remove carpet from loadspace floor and tailgate.
5. Fold back the sound insulation to reveal the access panel.



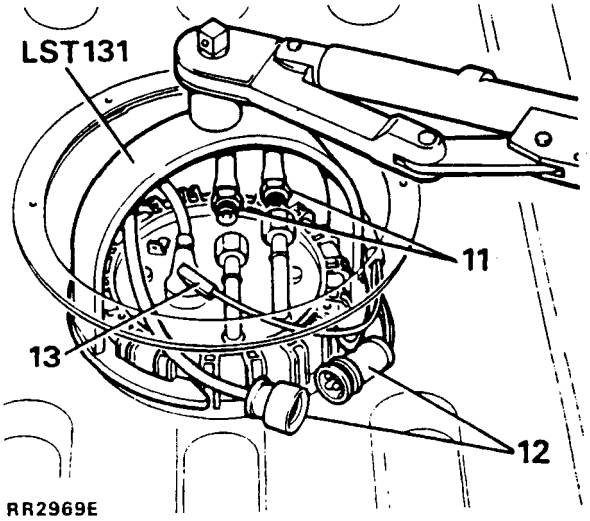
RR2967E

6. Remove the securing screws and detach the access panel from the floor.
7. Disconnect the electrical connections at the multi-plug.
8. Remove the insulation sealant from around the ground lead, and disconnect the ground lead.
9. Disconnect the two fuel line unions from the fuel pump.
10. Using Special Tool No. LST131, remove pump assembly retaining ring and withdraw the pump from the fuel tank.

WARNING: A quantity of fuel will be retained in the body of the unit, care must be taken to prevent fuel spillage when the unit is removed.



RR2968E



RR2969E

Refitting

11. **Insert the fuel pump into the tank. Fit the retaining ring and tighten to a torque of 45-50 Nm (34-37 lbf ft).**
12. **Connect the fuel lines to the pump.**
13. **Connect the electrical leads at the multi-plug.**
14. **Connect the ground lead to the pump and insulate with suitable sealant.**
15. **When the fuel system has been reassembled check all fuel pipes, sealing rings and hose connections are secure.**
16. **Run the engine to check for fuel leaks before final assembly.**
17. **Inspect the access panel seal, fit a new seal if necessary.**
18. **Fit the access panel and secure to the floor with the screws.**
19. **Reverse operations 4 - 5 to refit the sound insulation and carpet.**

FUEL TANK

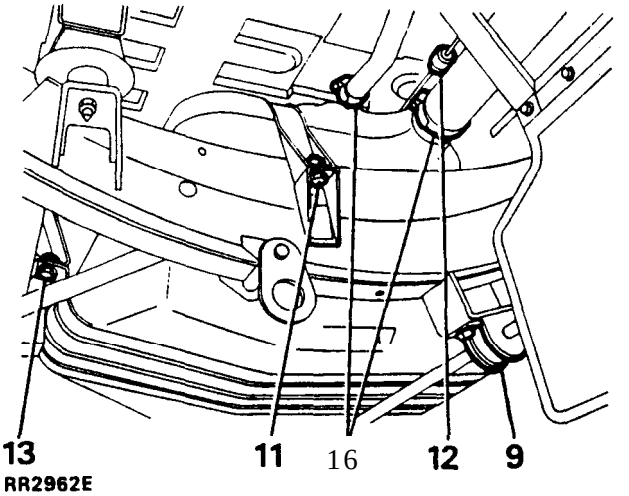
WARNING: Ensure that the Fuel Handling Precautions given in Section 01 - Introduction regarding fuel handling are strictly adhered to when carrying out the following instructions.

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

Remove and refit

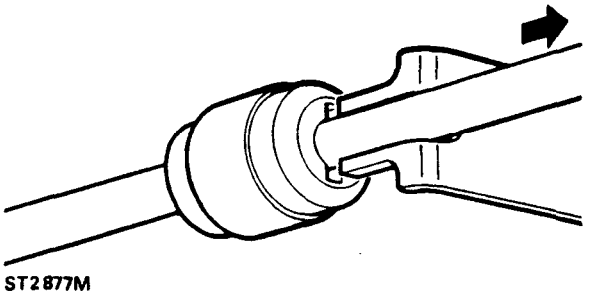
Removing

1. **Depressurise fuel system. Disconnect battery negative lead.**
2. **Syphon the fuel tank into a suitable container that can be sealed afterwards.**
   ENSURE THAT THE TANK IS DRAINED **COMPLETELY. (refer to Warning concerning fuel vapor and spillage at start of this procedure).**
3. **Remove carpet from loadspace floor and tailgate.**
4. **Fold back the sound insulation to reveal the access panel.**
5. **Remove the securing screws and detach the access panel from the floor.**
6. **Disconnect the electrical connections at the multi-plug.**
7. **Remove the insulation sealant from around the ground lead, and disconnect the ground lead.**
8. **Disconnect the two fuel line unions from the fuel pump.**
9. **Working underneath the vehicle, remove the rear anti-roil bar straps, and allow the bar to swing down clear of the tank.**

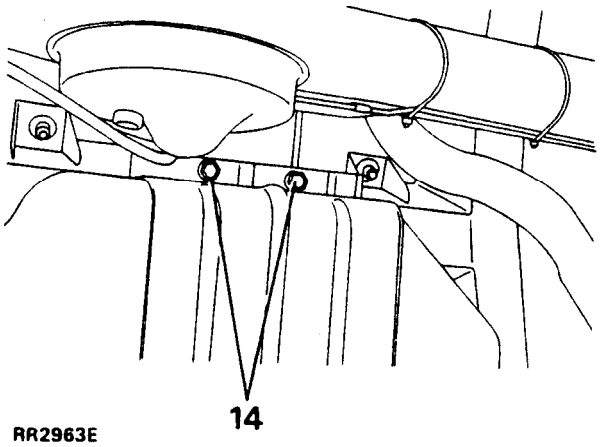


RR2962E

10. **Remove the tank filler and vent hoses at the fuel tank.**
11. **Remove the nut and bolt securing the right hand side of the fuel tank strap.**
12. **Disconnect the evaporative control pipe at the green end of the 'speedfit' connector.**


ST2877M

NOTE: To disconnect the 'speedfit' connector, forked end into the two slots of the connector as shown in the illustation above. Press down on the collet and simultaneously pull the pipe from the connector. Special tool LST 144 is available for this operation.



RR2963E

13. Remove the back two bolts and nut plates securing the fuel tank cradle.
14. Remove the front nuts, bolts and washers, and remove the fuel tank cradle.
15. With the aid of an assistant, tilt the right hand side of the tank upwards and manouver the tank through the chassis to remove.

Refitting

16. Reverse the removal procedure, ensuring that the sealing ring, fuel pipe and hose connections are secure.
17. Run the engine and recheck all connections to ensure no fuel leaks exist. Reverse the remaining removal procedure.

FUEL FILTER

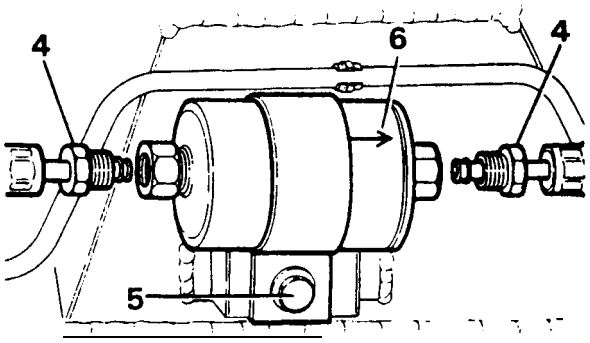
Remove and refit

WARNING: ENSURE THAT THE FUEL HANDLING PRECAUTIONS GIVEN IN SECTION 01 • INTRODUCTION REGARDING FUEL HANDLING ARE STRICTLY ADHERED TO WHEN CARRYING OUT THE FOLLOWING INSTRUCTIONS.

WARNING: THE SPILLING OF FUEL IS UNAVOIDABLE DURING THIS OPERATION. ENSURE THAT ALL NECESSARY PRECAUTIONS ARE TAKEN TO PREVENT FIRE AND EXPLOSION.

Removing

1. Depressurise the fuel system.
2. The fuel filter is located on the right-hand chassis side member forward of the fuel tank filler neck. Access to the filter is gained through the right-hand rear wheel arch.
3. Clamp the inlet and outlet hoses to prevent the minimum of fuel spillage when disconnecting the hoses.
4. Loosen the two fuel line unions and remove the hoses from the filter canister.
5. Release the single nut and bolt securing the filter and clamp and remove the filter.



RR2966E

Refitting

6. Fit a new filter observing the direction of flow arrow on the canister.
7. Tighten the single nut and bolt.
8. Fit the inlet and outlet hoses. Tighten the unions to a torque of 20-25 ft lb(27-34Nm).
9. Refit the fuel pump relay, reconnect the battery. Recode the radio.
10. Start the engine and inspect for fuel leaks around the hose connections.

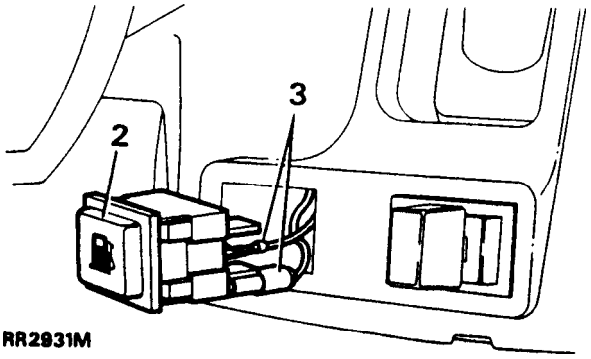
FUEL FILLER FLAP RELEASE BUTTON

The fuel filler flap is no longer part of the central locking system on 1991 model year vehicles. The filler flap is permanently locked. To release the flap press the button situated on the steering column shroud. On closing, the filler flap will be locked automatically. Note that the release button will only work with ignition switched OFF.

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Carefully pry the release button from the steering column shroud.



RR2931M

3. Remove the release button from the shroud and disconnect the two wiring connectors. Ensure that the wires protrude through the shroud to facilitate reassembly.

Refitting

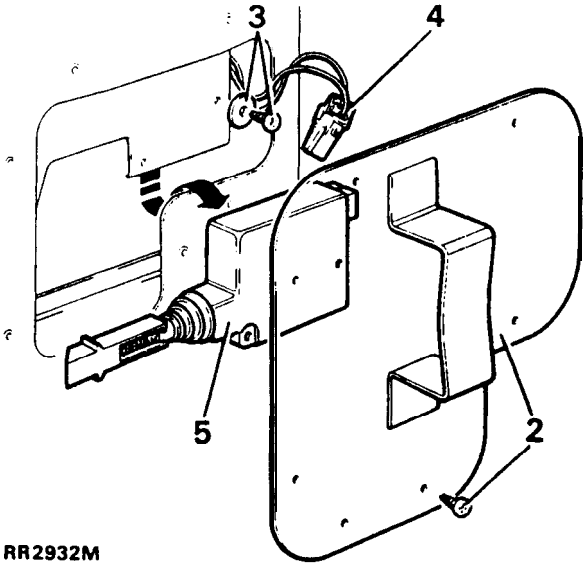
4. Reverse the removal procedure. Recode the radio.

FUEL FILLER FLAP RELEASE ACTUATOR

Remove and refit

Removing

1. Ensure that the fuel filler flap is released. Disconnect the battery negative lead.
2. Remove eight screws, and withdraw the closure panel, situated in the right hand side of the load space.
3. Release two screws and maneuver the actuator clear of its mounting.
4. Disconnect the wiring plug.
5. Withdraw the actuator.



RR2932M

Refitting

6. Reverse the removal procedure. Recode the radio.

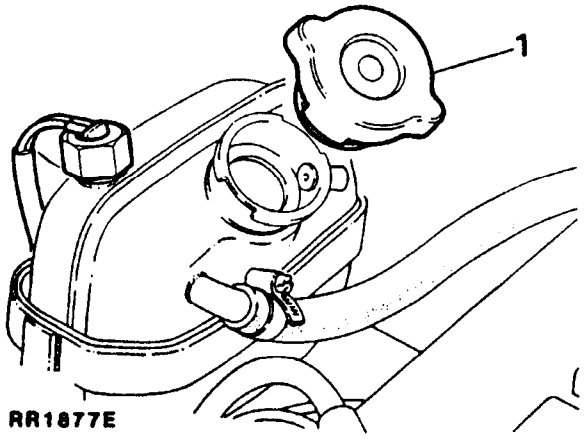
COOLANT

Drain and refill

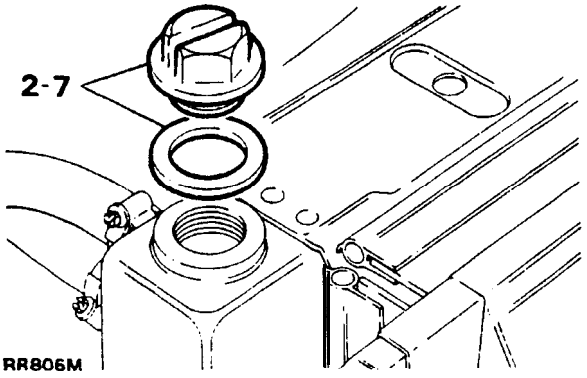
Draining

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

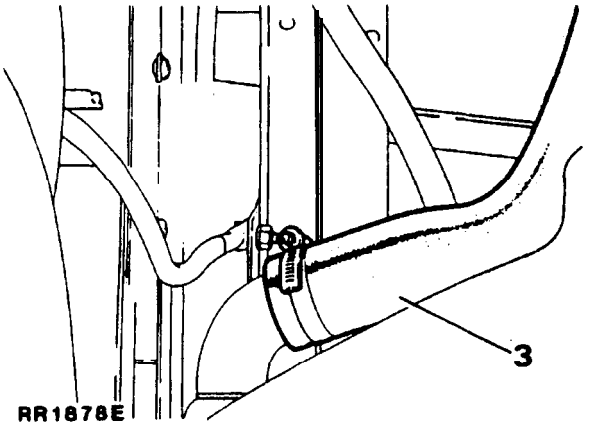
1. Remove the expansion tank filler cap by first turning it counter -clockwise a quarter of a turn to allow pressure to escape, then turn it further in the same direction and lift off.



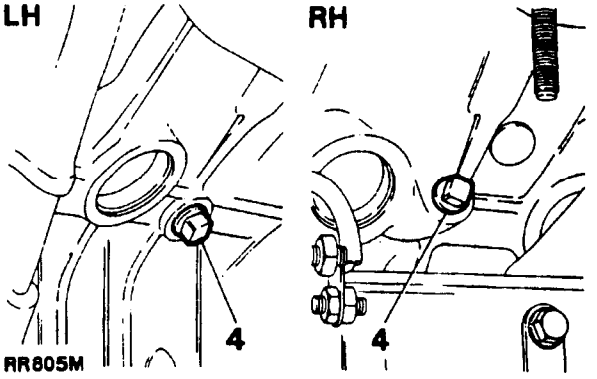
2. Remove the radiator filler plug and washer to assist drainage.



3. Disconnect the radiator bottom hose and allow the coolant to drain into a suitable container. Use a clean container if the coolant solution is to be reused. Reconnect the bottom hose after draining and tighten the hose clamp.



4. Remove the engine drain plugs, one each side of the cylinder block, beneath the exhaust manifolds. Allow the coolant to drain and refit the plugs.



See the following coolant requirements before refilling the system.

Continued

Coolant requirements

Frost precautions and engine protection.

The engine cooling system MUST ALWAYS be filled and topped-up with a solution of water and anti-freeze, winter and summer. NEVER use water alone as this may corrode the aluminiun alloy.

CAUTION: Do not use salt water otherwise corrosion will occur. In certain territories where the 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.

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 the specific gravity of the coolant is checked before the onset of the second winter and topped-up with new anti-freeze as required.

Vehicles leaving the factory have the cooling system filled with 50% anti-freeze and 50% water mixture. This gives protection against frost down to minus 36°C (minus 33°F). Vehicles so filled can be identified by a label affixed to the radiator.

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

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 leakproof.

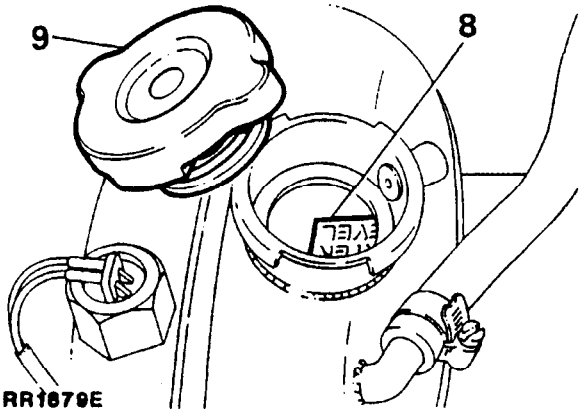
See the 'Recommended Lubricants Fluids and Capacities', Section 09, for protection quantities.

Refilling

5. Pour 4.5 litre (1 gall) of water into the radiator.
6. Add the recommended quantity of anti-freeze.
7. Top-up the radiator with water, refit the radiator filler plug and washer and tighten.
8. Add water to the expansion tank, up to the 'WATER LEVEL' plate.

NOTE: The water level plate on later models has been deleted from the expansion tank, therefore the coolant should be filled to the top of the sensor float which is approximately 1.00 inch (25 mm) below the filler neck

9. Fit the expansion tank filler cap.



10. Run the engine until normal operating temperature is attained, that is, thermostat open.
11. Allow the engine to cool, then check the coolant level and top-up if necessary.

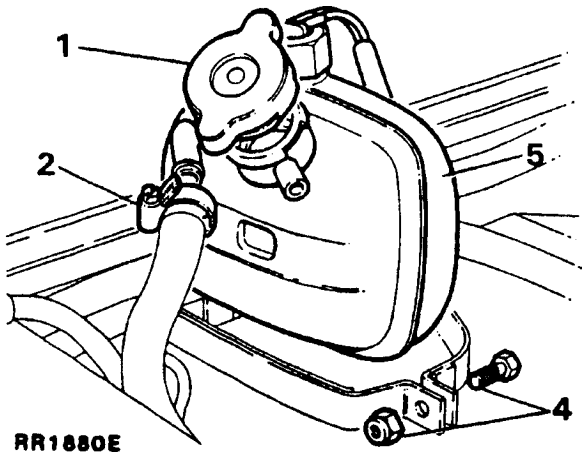
EXPANSION TANK

Remove and refit

Removing

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

1. Remove the expansion tank filler cap by first turning it counter -clockwise a quarter of a turn to allow pressure to escape, then turn it further in the same direction and lift off.
2. Disconnect the hose to the radiator.
3. Disconnect the multi-plug to the coolant level sensor.
4. Remove the pinch bolt.



5. Lift out the expansion tank.

Refitting

6. Reverse 1 to 5.
7. Replenish the cooling system.
8. Check for leaks around all hose connections.

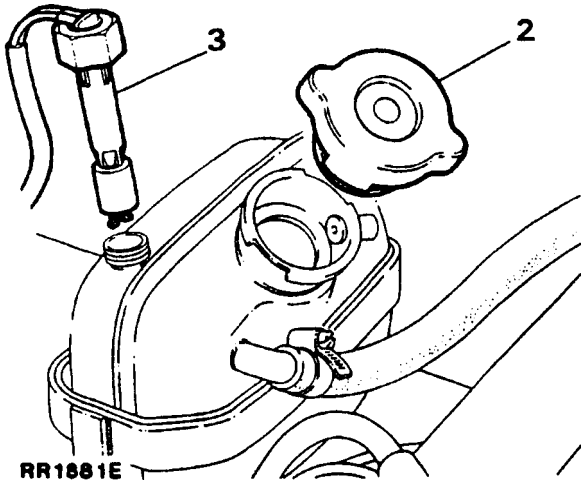
COOLANT LEVEL SENSOR

Remove and refit

Removing

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

1. Disconnect the multi-plug from the sensor.
2. Remove the expansion tank filler cap by first turning it counter -clockwise a quarter of a turn to allow pressure to escape, then turn it further in the same direction and lift off.
3. Release the retaining nut and withdraw the sensor from the expansion tank.



Refitting

4. Reverse the removal instructions.
5. Start engine and run until normal running temperature is attained, thermostat open, check for coolant leaks around the sensor.

FAN BELT

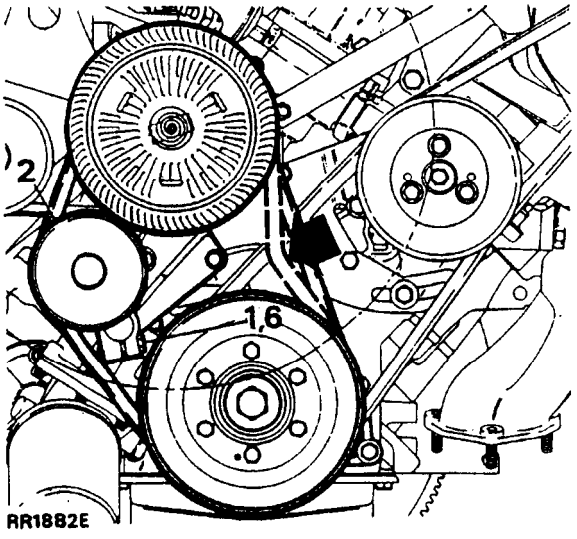
Check and adjust tension, 1 and 5 to 6

Remove and refit, 1 to 6

Removing

WARNING: Disconnect the battery negative terminal to prevent the engine being started before removing or adjusting drive belts.

1. Loosen the idler pulley pivot bolt.
2. Pivot the idler pulley inwards.
3. Lift off the fan belt.



RR1882E

Refitting

4. Locate the fan belt on the pulleys.
5. Adjust the fan belt using the idler pulley to give 4 to 6 mm (0.19 to 0.25 in) free movement when checked midway between the fan and crankshaft pulleys by hand.
6. Tighten the idler pulley pivot bolt and check the adjustment.

NOTE: Re-check the belt adjustment after approximately 1500 km (1,000 miles) running when a new belt has been fitted.

VISCOUS COUPLING, FAN BLADES, PULLEY AND FAN COWL

Viscous coupling-remove and refit 1 to 5

Fan blades-remove and refit 1 to 5 and 8

Fan cowl-remove and refit 1 to 4

Fan pulley-remove and refit 1 to 7

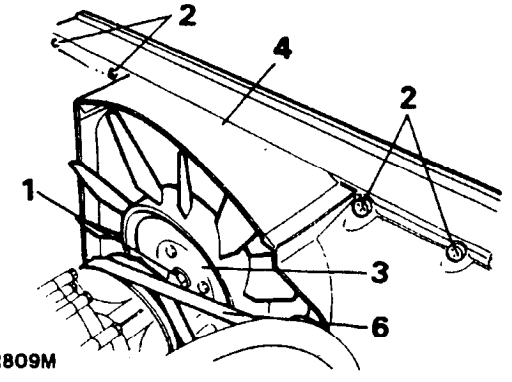
Removing

WARNING: Disconnect the battery negative terminal to prevent the engine being started before removing or adjusting drive belts.

1. Loosen the nut securing the viscous coupling and fan blade assembly to the water pump shaft.

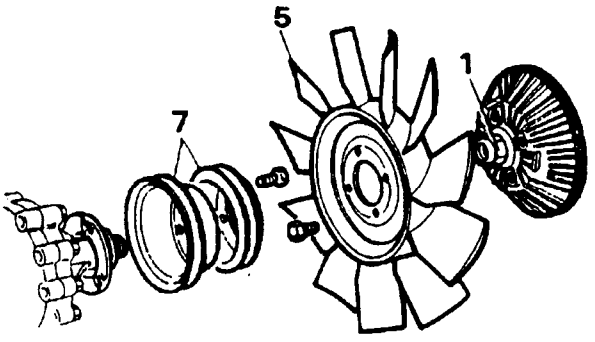
   NOTE: The nut securing the viscous unit to the water pump has a left hand thread, to release the nut, turn in a clockwise direction when viewed from the front of the viscous unit.

2. Remove the four fan cowl fixings and lift the cowl out of its lower mountings.



RR809M

3. Remove the viscous coupling securing nut and withdraw the assembly.
4. Remove the fan cowl, if necessary.
5. Remove the fan blades from the viscous coupling. if necessary.
6. Remove the fan belt and, if fitted, the compressor belt.
7. Remove the pulley fixings and withdraw the pulley.



RR810M

Refitting

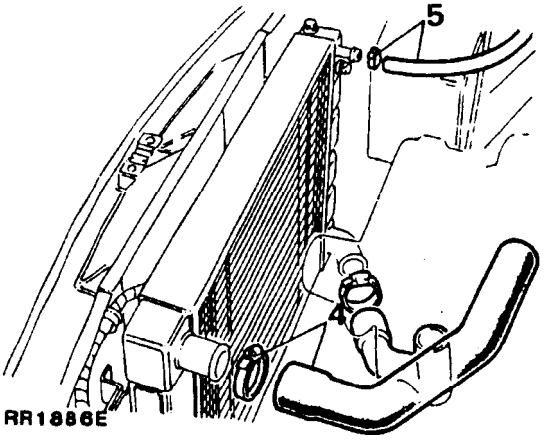
8. Reverse the above procedure, ensuring the fan blades are fitted correctly. The fan is marked **FRONT** and should be fitted with the word **FRONT** closest to the radiator. See Torque values-Section 06 for correct torque figure.
9. Adjust the fan belt and compressor belt.

RADIATOR

Remove and refit

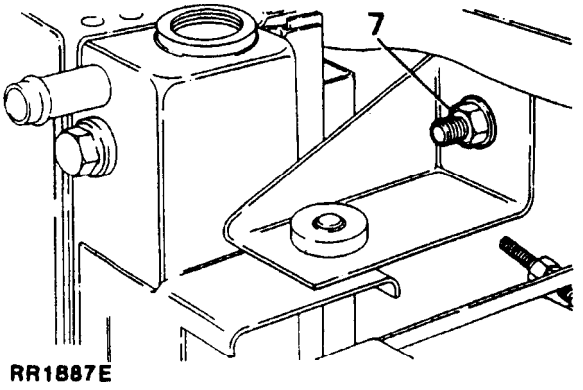
Removing

1. Drain the cooling system.
2. Remove the fan blades.
3. Remove the fan cowl.
4. Disconnect the top hose from the radiator.
5. Disconnect the hose to the expansion tank at the radiator.



RR1886E

6. Disconnect the hose to the thermostat elbow at the intake manifold.
7. Remove the fixings trom each side of the radiator.



RR1887E

8. Withdraw the radiator by lifting from its locations. Check the condition of the rubber mounting pads.

Refitting

9. Reverse 1 to 8 noting the assembly order of the radiator side fixings and ensuring that the radiator sealing strips are correctly located and secure.
10. Check for coolant leaks around all hose connections.

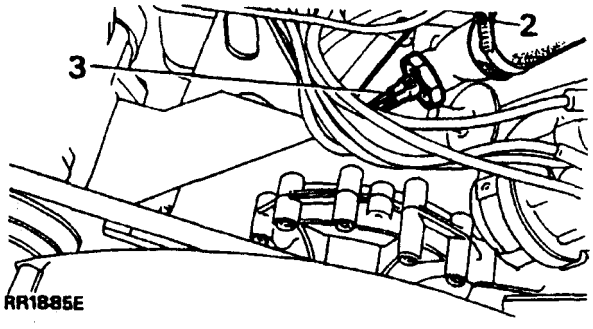
THERMOSTAT

Remove and refit

Test

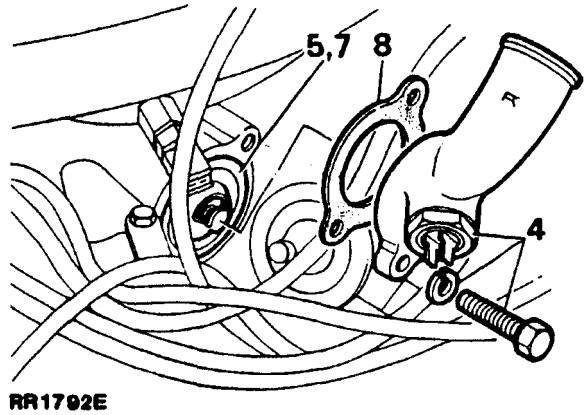
Removing

1. Partially drain the cooling system, until coolant level is below thermostat housing.
2. Disconnect the hose from the thermostat housing.
3. Disconnect the electrical connections to the water temperature switch.



RR1885E

4. Remove the outlet elbow.
5. Withdraw the thermostat.



RR1792E

Testing

6. Note that the rating of the thermostat is 88°C (190°F). Place the thermostat in a suitable container half full of water. Heat the water and observe the temperature at which the thermostat opens. Should the thermostat open between 85°C (185°F) and 89°C (192°F) the unit is operating satisfactorily.

Refitting .

7. Insert the thermostat with the jiggle pin/vent hole uppermost (12 o'clock position).
8. Using a new joint washer, fit the outlet elbow and tighten to the correct torque, see Torque values-Section 06.
9. Reverse 1 to 3.
10. Check for coolant leaks around all hose connections and joint faces.

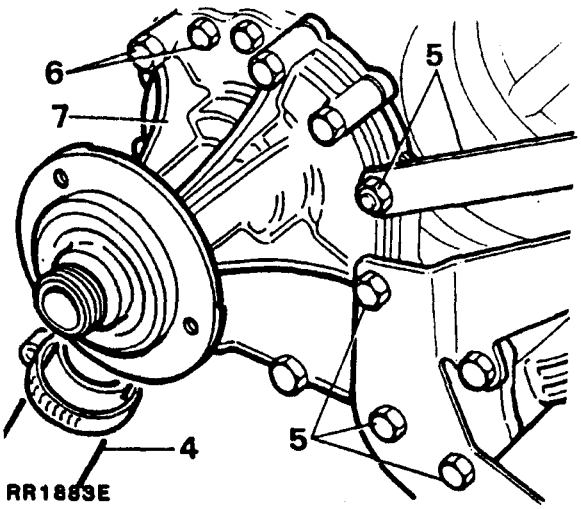
WATER PUMP

Remove and refit

Removing

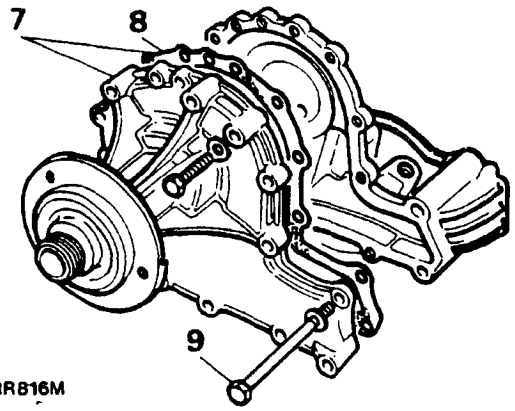
WARNING: Disconnect the battery negative terminal to prevent the engine being started before removing or adjusting drive belts.

1. Drain the engine cooling system.
2. Remove the fan belt, power steering pump and compressor belt.
3. Remove the fan blades and pulley.
4. Disconnect the inlet hose from the water pump.
5. Release the alternator adjusting link and the power Steering pump fixings.
6. Remove the remaining water pump bolts.
7. Remove the water pump and joint washer.



Refitting

8. Lightly grease a new joint washer and place it in position on the timing cover.



9. Clean the threads of the four long bolts and coat with Loctite 572 thread lubricant-sealant.
10. Locate the water pump in position.
11. Locate the alternator adjusting link and power-steering pump bracket.
12. Leave the alternator adjusting link loose and tighten the remaining water pump housing bolts evenly and to the correct torque, see Torque values-Section 06.
13. Connect the inlet hose to the water pump.
14. Fit the fan pulley.
15. Fit and adjust the fan belt, power steering pump belt and compressor belt.
16. Fit the fan blade assembly.
17. Refill the cooling system.
18. Check for coolant leaks around all hose connections and joint faces.

COOLING SYSTEM FAULT DIAGNOSIS

5YMPTOM	POSSIBLE CAUSE	CURE
4. EXTERNAL LEAKAGE	1. Loose hose clamps 2. Defective rubber hose 3. Damaged radiator seams 4. Excessive wear in the water pump 5. Loose core plugs 6. Damaged gaskets 7. Leaks at the heater connections. 8. Leak at the water temperature transmitter	1. Tighten 2. Replace 3. Rectify 4. Replace 5. Replace 6. Replace 7. Rectify 8. Tighten the transmitter
B • INTERNAL LEAKAGE	1. Defective cylinder head gasket 2. Cracked cylinder wall 3. Loose cylinder head	1. Replace. Check engine oil for contamination and refill if necessary 2. Replace cylinder block 3. Tighten. Check engine bolts for oil contamination and refill as necessary
C • WATER LOSS	1. Boiling 2. Internal or external leakage 3. Restricted radiator or inoperative thermostat	1. Ascertain the cause of engine overheating and correct as necessary 2. See items A and B 3. Flush radiator or replace the thermostat as necessary.
D • POOR CIRCULATION	1. Restriction in system 2. Insufficient coolant 3. Inoperative water pump 4. Loose fan belt 5. Inoperative thermostat	1. Check hoses for crimps, reverse-flush the radiator, and clear the system of rust and sludge 2. Top-up coolant 3. Replace 4. Adjust 5. Replace

SYMPTOM	POSSIBLE CAUSE	CURE
E • CORROSION	1. Excessive impurity in the waler 2. Infrequent flushingand draining of system 3. Incorrect anti-freeze mixtures	1. Use only soft, clean water together with correct anti-freeze mixture. 2. The cooling system should be drained and flushed thoroughly at least once a year. 3. Certain anti-freeze solutions have a corrosive effect on parts of the cooling. system. Only recommended solutions should be used.
F • OVERHEATING	1. Poor circulation 2. Dirty oil and sludge in engine. 3. Radiator fins choked with chaff, mud etc. 4. Incorrect ignition timing 5. Insufficient coolant 6. Low oil level 7. Choked or damaged 8. Dragging brakes 9. Overloading vehicle 10. Driving in heavy sand or mud 11. Engine labouring on gradients 12. Low gear work 13. Excessive engine idling 14. Inaccurate temperature gauge 15. Defective thermostat	1. See item D 2. Refill 3. Use air pressure from the engine side of the radiator and clean out passages thoroughly 4. Check using electronic equipment 5. See item D 6. Replenish 7. Rectify or replace exhaust pipe or muffle 8. Adjust brakes 9. In the hands of the operator 10. In the hands of the operator II. In the hands of the operator 12. In the hands of the operator 13. In the hands of the operator 14. Check or replace 15. Check or replace
G • OVERCOOLING	1. Defective thermostat 2. Inaccurate temperature gauge	I. Check or replace 2. Check or replace

COOLING SYSTEM - 1989 model year.

The 3.9 litre engine has a revised 'partial flow' type cooling system. A new radiator incorporates oil coolers in both end tanks - left hand side, transmission oil cooler - right hand side, engine oil cooler.
A supplementary transmission oil cooler is still fitted in front of the radiator and condenser fans.
The transmission oil high temperature warning light sensor is now fitted under the hood adjacent to the radiator end tank.

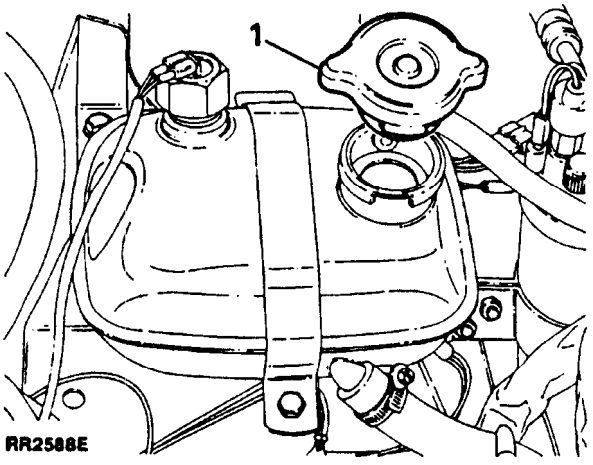
COOLANT

Drain and refill

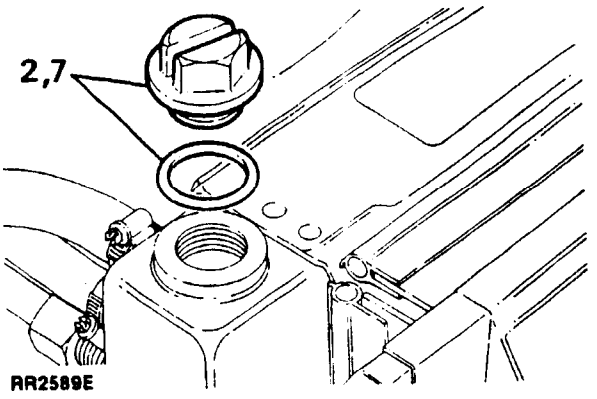
Draining

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

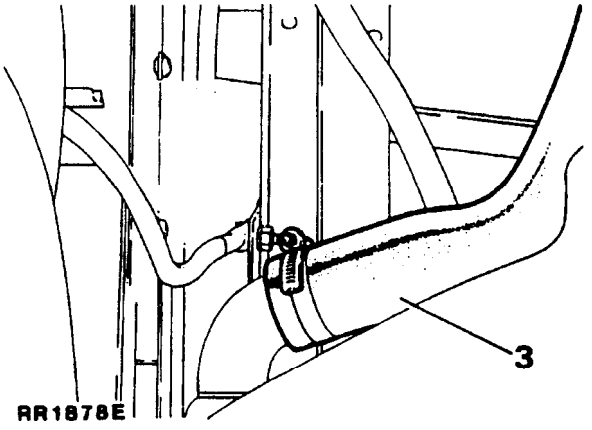
1. Remove the expansion tank filler cap by first turning it counter-clockwise a quarter of a turn to allow pressure to escape, turn it further in the same direction and lift off.



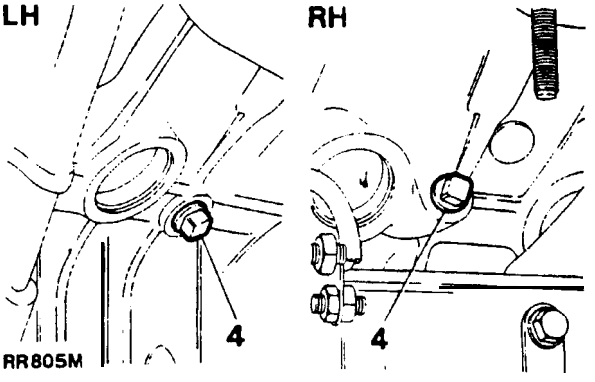
2. Remove the radiator filler plug and 'O' ring to assist drainage.



3. Disconnect the bottom hose at its junction with the radiator and allow the coolant to drain into a suitable container. Ensure that the container is clean if the coolant solution is to be re-used. Reconnect the bottom hose after draining and re-tighten the hose clamp.



4. Remove the engine drain plugs, one each side of the cylinder block, beneath the exhaust manifolds. Allow the coolant to drain, refit and tighten the plugs.

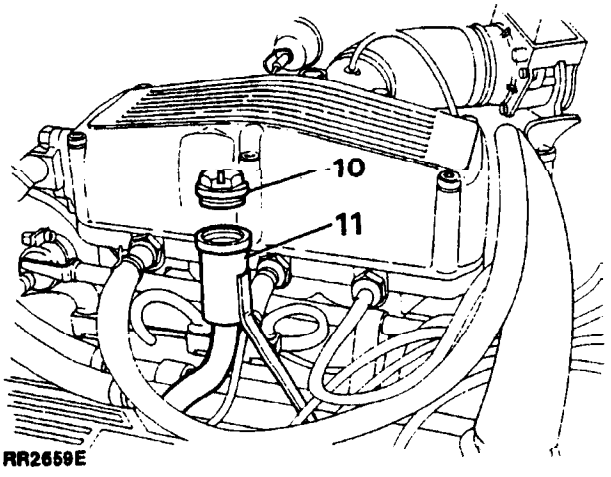


Continued

NOTE: It is not possible to drain all the coolant retained in the heater system. Flush through the system, after draining, by pouring clean water into the fill tower, (see RR2659E), with the bottom hose disconnected and engine drain plugs removed.

5. Pour the correct solution of water and anti-freeze into the expansion tank until the radiator is full.
6. Start the engine and run it until normal operating temperature is attained, topping up as necessary.
7. Refit the radiator filler plug and 'O' ring, fitting a new 'O' ring if required. Tighten to the correct torque, see Torque Values, section 06.
8. Fit the expansion tank filler cap.
9. Allow the engine to cool, check coolant level and top up the expansion tank until the level reaches the level indicator on the inside of the tank.

CAUTION: The following fill procedure MUST be followed if the heater pipes mounted on top of the rocker cover have been removed for any reason.



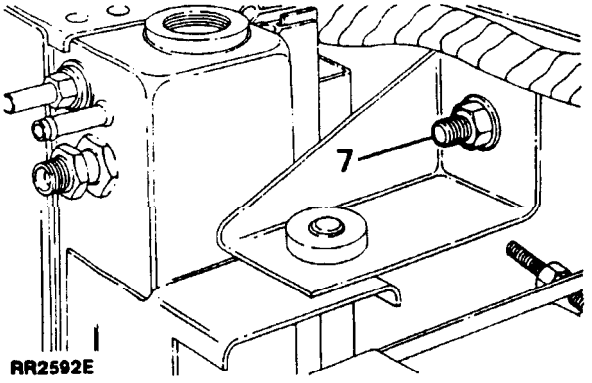
10. Remove the plug from the fill tower.
11. Briskly pour the correct solution of water and anti-freeze into the fill tower until the radiator is full.
12. Start the engine and run it until normal operating temperature is attained, topping up as necessary.
13. Refit the radiator filler and fill tower plugs, fitting new 'O' rings if required. Tighten to the correct torque, See Torque Values, section 06.
14. Fit the expansion tank filler cap.
15. Allow the engine to cool, check coolant level in the expansion tank and top up until the level reaches the level indicater on the inside of the tank.

RADIATOR/OIL COOLERS

Remove and refit

Removing

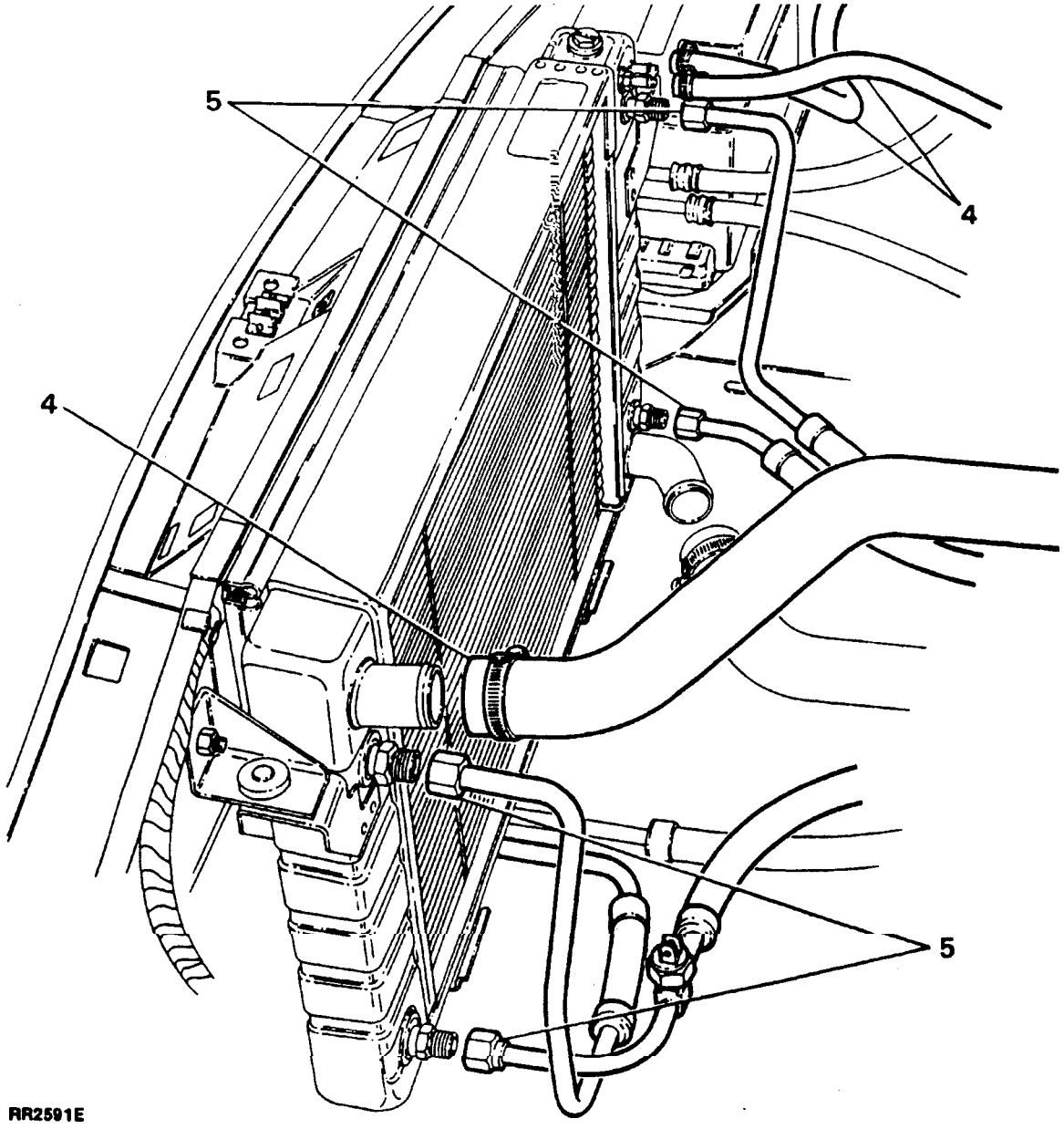
1. Drain the cooling system.
2. Remove the fan blade assembly.
3. Remove the fan cowl.
4. Disconnect the radiator top hoses.
5. Disconnect the four transmission and engine oil cooler connections to the radiator end tanks. Note that oil spillage will occur when connections are loosened. Blank off exposed oil connections.
6. Disconnect the transmission oil temperature sensor plug.
7. Remove the radiator securing brackets from each side.



8. Remove the radiator unit by lifting from its location. Check the condition of the rubber mounting pads.

Refitting

9. Check that the radiator sealing strips are securely located.
10. Transfer the oil cooler adaptors if fitting a new radiator.
11. Reverse the removal procedure, ensuring that oil cooler connections are tightened to the specified torque values before fitting the fan blades and cowl.
11. Clean any coolant/oil spillage from the vehicle.
12. Check all connections for coolant/oil leaks.



Continued

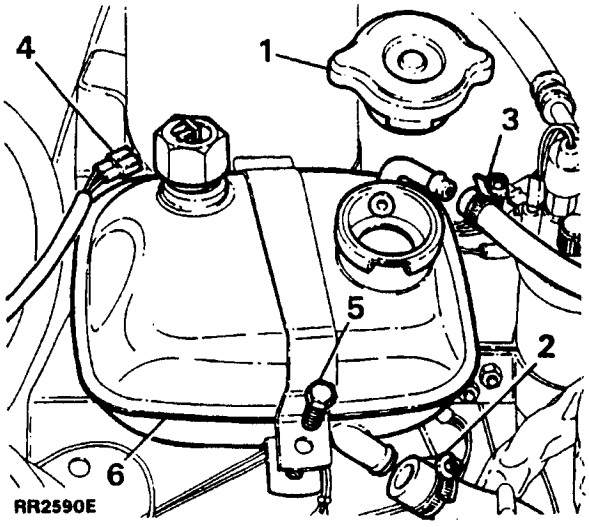
EXPANSION TANK

Remove and refit

Removing

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

1. **Remove the expansion tank filler cap by first turning it counter-clockwise a quarter of a turn to allow presure to escape, turn it further in the same direction and lift off.**
2. **Disconnect the radiator hose from the bottom of the expansion tank, allowing the coolant to drain into a suitable container.**
3. **Disconnect the' bleed hose to the top of the radiator.**
4. **Disconnect the wiring to the coolant sensor.**
5. **Remove the bolt from the securing strap.**
6. **Lift out the expansion tank.**



Refitting

7. **Reverse removal instructions.**
8. **Replenish the cooling system.**
9. **Check for leaks around all hose connections**

COOLING SYSTEM - 1990 model year

The cooling system is improved by the introduction of a larger, plastic expansion tank.

COOLANT

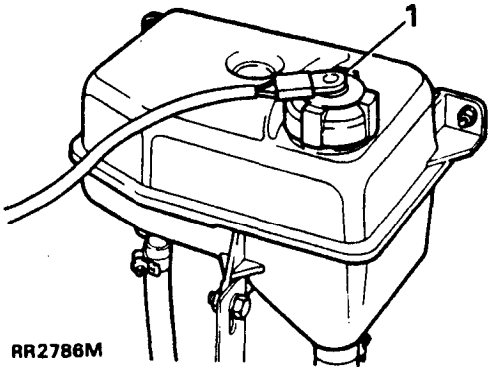
Drain and refill

Draining

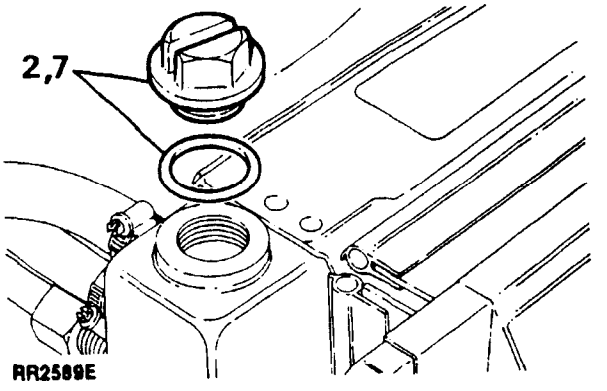
WARNING: Do not remove the expansion tank filler cap when the engine is hot, because the cooling system is pressurised and personal scalding could result.

NOTE: The expansion tank is fitted with a screwed filler cap which incorporates a low coolant sensing unit.

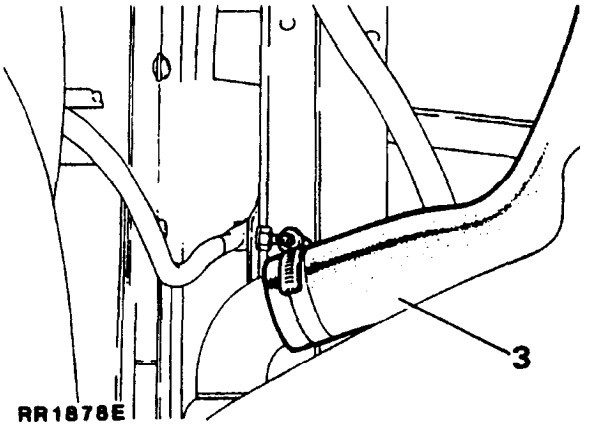
1. Remove the expansion tank filler cap by slowly turning it anti-clockwise, pause to allow pressure to escape, continue turning it in the same direction and lift off.



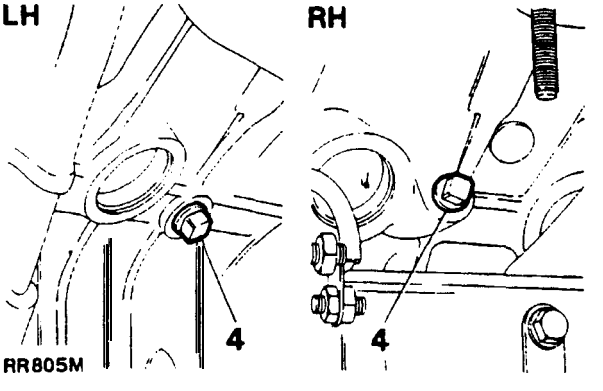
2. Remove the radiator filler plug and 'O' ring to assist drainage.



3. Disconnect the bottom hose at its junction with the radiator and allow the coolant to drain into a suitable container. Ensure that the container is clean if the coolant solution is to be re-used. Reconnect the bottom hose after draining and re-tighten the hose clamp.



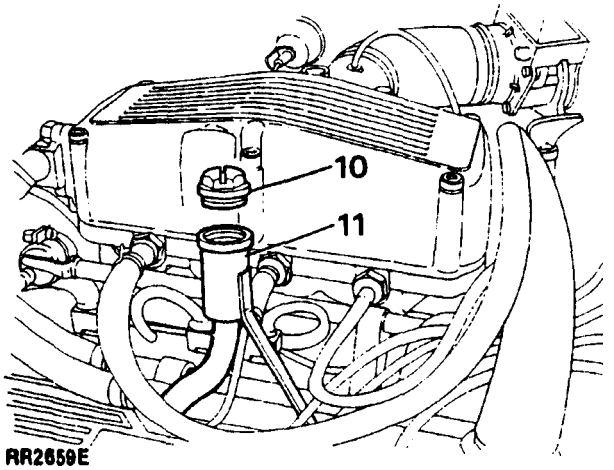
4. Remove the engine drain plugs, one each side of the cylinder block, beneath the exhaust manifolds. Allow the coolant to drain, refit and tighten the plugs



NOTE: It is not possible to drain all the coolant retained in the heater system. Flush through the system, after draining, by pouring clean water into the fill tower, tsee RR2659E), with the bottom hose disconnected and engine drain plugs removed.

5. Pour the correct solution of water and anti-freeze into the expansion tank until the radiator is full.
6. Start the engine and run it until normal operating temperature is attained, topping up as necessary.
7. Refit the radiator filler plug and 'O' ring, fitting a new '0' ring it required. Tighten to the correct torque, see Torque Values, section 06.
8. Fit the expansion tank filler cap.
9. Allow the engine to cool, check coolant level and top up the expansion tank until the level reaches the seam of the expansion tank.

CAUTION: The following fill procedure MUST be followed if the heater pipes mounted on top of the rocker cover have been removed for any reason.



RR2659E

10. Remove the plug from the fill tower.
11. Briskly pour the correct solution of water and anti-freeze into the fill tower until the radiator is full.
12. Start the engine and run it until normal operating temperature is attained, topping up as necessary.
13. Refit the radiator filler plug and fill tower plug, fitting new 'O' rings if required. Tighten to the correct torque, Set Torque Values, section 06.
14. Fit the expansion tank filler cap.
15. Allow the engine to cool. check coolant level in the expansion tank and top up until the level reaches the seam of the expansion tank.

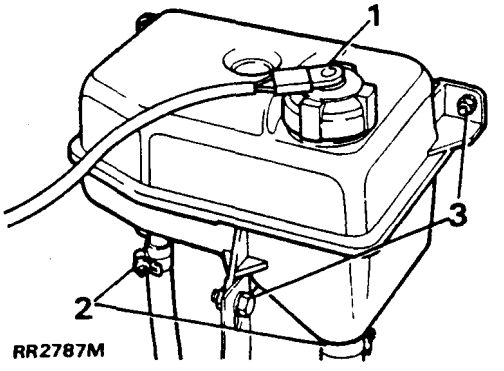
EXPANSION TANK

Remove and refit

Removing

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

1. Remove the expansion tank filler cap by first turning it slowly anti-clockwise, pause to allow pressure to escape, continue turning it in the same direction and lift off.
2. Disconnect the two hoses from the bottom of the expansion tank, allowing the coolant to drain into a suitable container.
3. Remove three fixing bolts and remove the expansion tank from its mountings.

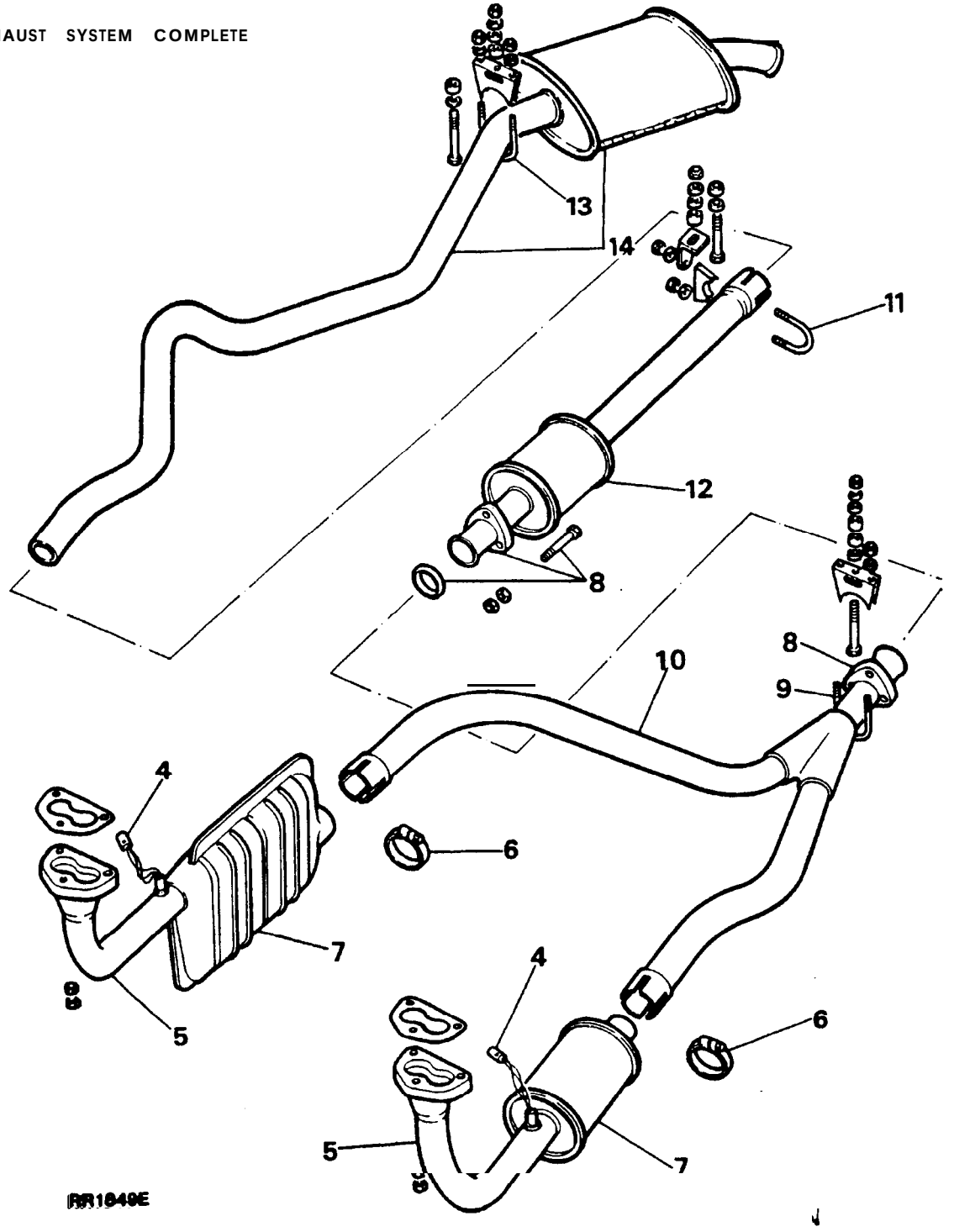


RR2787M

Refitting

4. Reverse removal instructions.
5. Replenish the cooling system.
6. Check for leaks around all hose connections.

EXHAUST SYSTEM COMPLETE



EXHAUST SYSTEM COMPLETE

NOTE: Ensure that no exhaust leaks are evident in either a new or an old exhaust system, as this will affect vehicle performance, and contravene Federal emission regulations.

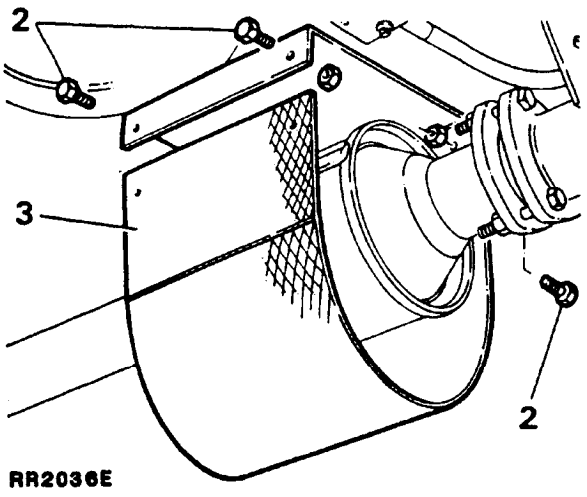
WARNING: To prevent personal injury occurring from a hot exhaust system, DO NOT attempt to disconnect any of the components until ample time has elapsed to allow the exhaust system to cool.

Continued

Remove and refit

Removing

1. Raise the vehicle on a suitable hoist and apply the parking brake.
2. Remove the four fixings securing the grass shield (if fitted) to the mounting bracket at the centre catalyst.
3. Withdraw the grass shield from the bracket.



RR2036E

4. Disconnect the electrical plugs from the Lambda sensors.
5. Remove the nuts and disconnect the front pipe(s) from the manifold(s) and remove the gaskets.
6. Loosen the pinch bolt clamps securing the front pipe to the intermediate pipe.
7. Withdraw the front pipe(s) with catalysts.
8. Remove three bolts securing the intermediate pipe to the centre catalyst and withdraw the doughnut.
9. Remove the U-bolt from the pipe mounting bracket.
10. Withdraw the intermediate pipe.
11. Remove the U-bolt securing the centre catalyst to the main muffler.
12. Withdraw the catalyst.
13. Remove the U-bolt from the tail pipe mounting bracket.
14. Withdraw the tail pipe and rear muffler.

Refitting

NOTE: Apply Firegum Putty, Part No. 15608 to all exhaust system joints with the exception of the exhaust flange to manifold flange where new gaskets should be fitted.

15. Reverse the removal instructions.

EXHAUST MANIFOLD

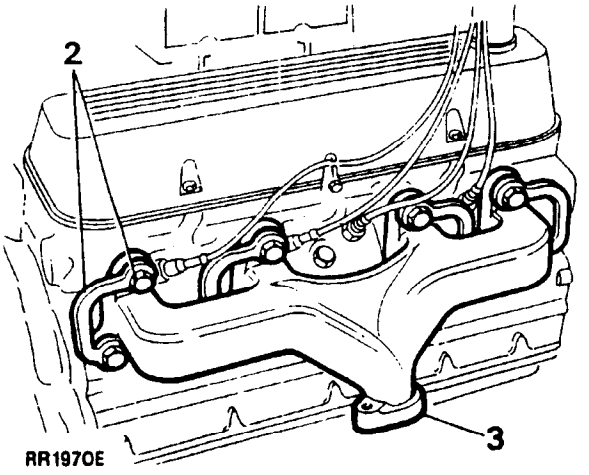
Remove and refit

Left hand

Right hand

Removing

1. Disconnect the front exhaust pipe(s) from the manifold(s).
2. Tap back the bolt locking tabs and remove the eight bolts, lock tabs and washers.
3. Remove the manifold(s) and old gaskets.



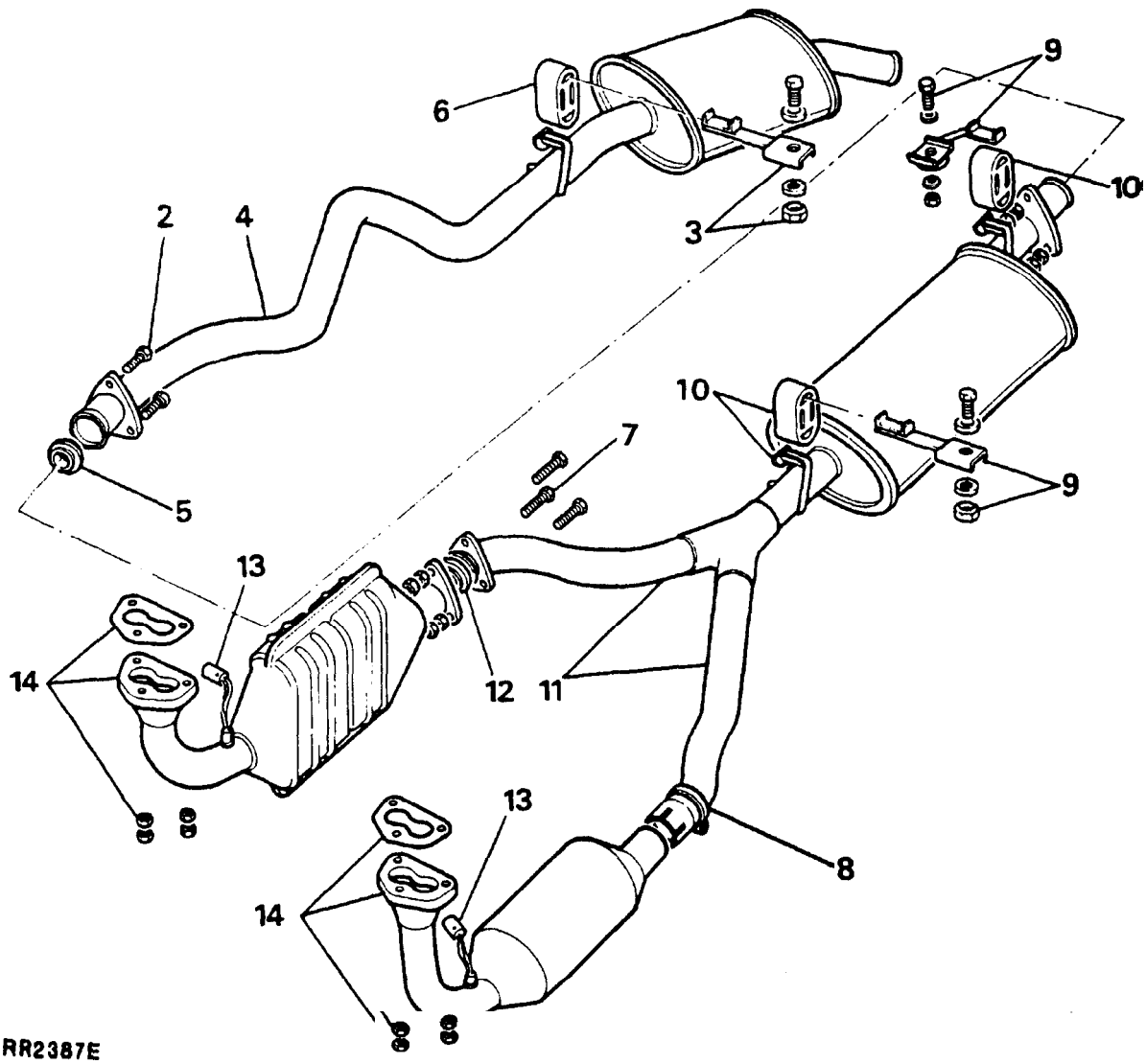
RR1970E

Refitting

4. Ensure that the mating surfaces of the cylinder head and exhaust manifold are clean and smooth.
5. Coat the threads of each bolt with anti-seize compound.
6. Place the manifold and new gaskets in position on the cylinder head and fit the securing bolts, new lockplates and plain washers. The plain washers are fitted between the manifold and lockplates.
7. Evenly tighten the manifold bolts to the correct torque, see torque values-section 06, and bend over the lockplate tabs.
8. Reconnect the front exhaust pipe, using new exhaust flange gaskets.

INTAKE MANIFOLD

The removal and refit of the intake manifold is incorporated in the Fuel Injection System, Section 19.



EXHAUST SYSTEM COMPLETE

NOTE: Ensure that no exhaust leaks are evident in either a new or old exhaust system, as this will affect vehicle performance, and contravene Federal emission regulations.

WARNING: To prevent personal injury occurring from a hot exhaust system, DO NOT attempt to disconnect any of the components until ample time has elapsed to allow the exhaust system to cool.

Remove and refit

Removing

Tail pipe and rear muffler

1. **Raise the vehicle on a suitable hoist and apply the parking brake.**
2. **Remove the three bolts securing the tail pipe assembly to the intermediate pipe assembly.**
3. **Remove the bolt securing the rear mounting bracket. to the chassis.**
4. **Maneuver the tail pipe over the rear axle and remove from the vehicle.**
5. **Retain the doughnut from the intermediate pipe for reassembly.**

Continued

6. Detach the rubber from the tailpipe and hanger.

intermediate pipe and centre muffler

7. Remove the three bolts securing the right hand branch of the intermediate pipe to the right hand catalyst.
8. Release the pinch bolt clamp securing the left hand branch of the intermediate pipe to the left hand catalyst and slide the clamp along the pipe.
9. Remove the bolts securing the front and rear hanger brackets to the chassis.
10. Detach the rubbers from the main muffler assembly and hangers.
11. Carefully separate the intermediate pipes from the front downpipes.
12. Retain the doughnut from the right hand joint.

Front downpipes

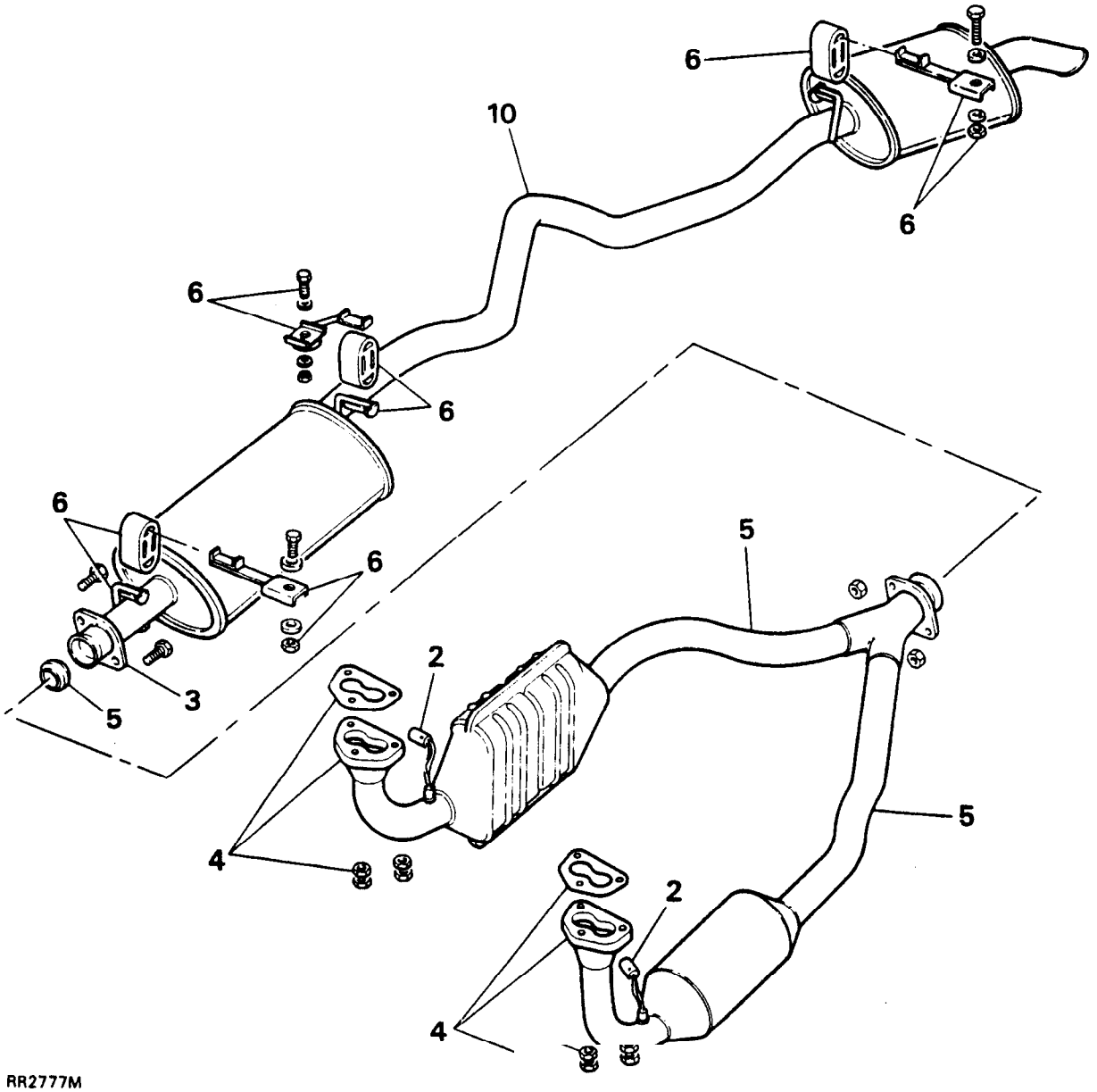
13. Disconnect both Lambda sensor multiplugs.
14. Remove the nuts and release the front downpipes from the manifolds, discard the gaskets.

Refitting

15. If the original system is being refitted, examine the system for damage and general condition renew sections as necessary.
16. Clean any previous putty from the doughnuts and exhaust pipe joints.
17. Fit NEW gaskets to the manifold joint face.

NOTE: Apply exhaust sealer to all exhaust system joints with the exception of the exhaust flange to manifold flange.

18. Reverse the removal instructions.
19. Examine a new or original system for leaks and ensure that the system does not foul any underbody components. If exhaust leaks or interference exists loosen the joints reseal and reset as necessary.



RR2777M

EXHAUST SYSTEM COMPLETE

To improve sealing and accuracy of assembly, 1990 model year vehicles have a new two piece exhaust system.

NOTE: Ensure that no exhaust leaks are evident in either a new or old exhaust system, as this will affect vehicle performance.

WARNING: To prevent personal injury occurring from a hot exhaust system, DO NOT attempt to disconnect any of the components until ample time has elapsed to allow the exhaust system to cool.

Remove and refit

Removing

1. Raise the vehicle on a suitable ramp. apply the parking brake.
2. Catalyst vehicles only: Disconnect the two lambda sensor wiring connectors.
3. Remove the two bolts securing the rear exhaust assembly to the front exhaust assembly.
4. Remove the nuts and release the front downpipes fromt the manifolds. Discard the gaskets.

5. Lower the front exhaust assembly, retrieving the doughnut from the joint.

NOTE: The assistance of a second mechanic is required for removing and refitting the rear exhaust assembly.

6. Remove the bolts securing the three hanger brackets to the chassis. Lower the exhaust assembly onto the rear axle. Detach the rubbers from the hanging brackets.
7. Place extended axle stands underneath the chassis, in front of the chassis mounted rear towing brackets.
8. Lower the hoist until the vehicle weight is supported securely on the stands.
9. Lower the hoist until the rear shock absorbers are almost fully extended.
10. Move the rear exhaust to a diagonal position with the centre silencer to the right of the vehicle.
11. Facing the rear of the vehicle, twist the assembly counter-clockwise until it clears the rear axle.
12. Remove the rear exhaust assembly from the vehicle.

Refitting

13. Position the rear exhaust assembly over the rear axle in a diagonal position, as for removing.
14. Twist the assembly clockwise until it is in the mounting position.
15. Reverse the removing instructions 1. to 9. using new manifold gaskets and applying exhaust sealer to the system joint.
16. Examine the system for leaks and ensure that the system does not foul any underbody components. Rectify as necessary.

LT230 TRANSFER BOX

The following operations can be carried out with the gearbox in the vehicle. For ease of working, the vehicle should be raised on a suitable hoist or placed over a pit.

SPEEDOMETER DRIVE PINION

Remove and refit

Removing

1. Disconnect the battery.
2. Raise the vehicle on a suitable hoist.
3. Remove the speedometer drive clamp and nut and withdraw the cable.
4. Pry out the drive pinion assembly.

Refitting

5. Push in a new assembly and fit the speedometer cable and secure with the clamp and nut.

REAR OUTPUT SHAFT OIL SEAL

Service tool:
18G1422-Mainshaft rear oil seal replacer

Remove and refit

Removing

1. Disconnect the battery.
2. Raise the vehicle on a suitable hoist.
3. Disconnect the rear drive shaft from the output flange and tie to one side of the chassis.
4. Remove the brake drum retaining screws and withdraw the drum.
5. Remove the four back plate bolts that also retain the oil catcher and remove the brake back plate and catcher.

NOTE: An hexagonal type socket should be used for these bolts.

6. Remove the output shaft nut, steel washer, felt washer and withdraw the flange.
7. Using the slot provided, lever off the dust cover.
8. Pry out the output shaft oil seal(s).

Refitting

9. Pre-grease between the seal lips. Insert the double lipped oil seal, open side inwards, using service tool 18G1422 until contact is made with the bearing circlip. Take care not to touch the seal lips while fitting.
10. Fit the dust cover.
11. Lubricate the surface of the flange which runs in the seal and carefully fit the flange.

NOTE: To replace the flange bolts first remove the circlip before fitting the flange.

12. Secure the flange with the nut and washer and tighten to the specified torque (see section 06-Torque values).
13. Fit the back plate to the output housing using the 4 bolts and plain washers.

NOTE: The two lower fixings also hold the oil catcher which before fitting is coated with a silicone rubber sealant on the mating face.

14. Fit the brake drum and retain with the two screws.
15. Reconnect the drive shaft and tighten to the specified torque (see section 06-Torque values).

FRONT OUTPUT SHAFT OIL SEAL

Service tool:
18G1422-mainshaft rear oil seal replacer

Remove, refit and adjust

Removing

1. Disconnect the batten/.
2. Raise the vehicle on a suitable hoist.
3. Disconnect the front drive shaft from the flange and tie to one side of the chassis.
4. Remove the output shaft nut, steel washer, felt washer and withdraw the flange.
5. Remove the oil seal shield.
6. Pry out the oil seal(s).

Refitting

7. Pre-grease between the seal lips. Insert the new double lipped oil seal, open side inwards, using service tool 18G1422 until contact is made with the bearing circlip. Take care not to touch the seal lip while fitting.
8. Lubricate the running surface of the flange and fit it together with the oil seal shield.
9. Secure the flange with the nut and washer and tighten to the specified torque.
10. Refit the drive shaft and tighten to the specified torque (see section 06-Torque values).

TRANSFER BOX NEUTRAL WARNING SWITCH

Remove and refit

Removing

1. Disconnect the battery.
2. Raise the vehicle on a suitable hoist.
3. Disconnect the rear drive shaft from the output flange and tie to one side of the chassis.
4. Remove the brake drum retaining screws and withdraw the drum.
5. Remove the four back plate bolts that also retain the oil catcher and remove the brake back plate and catcher.

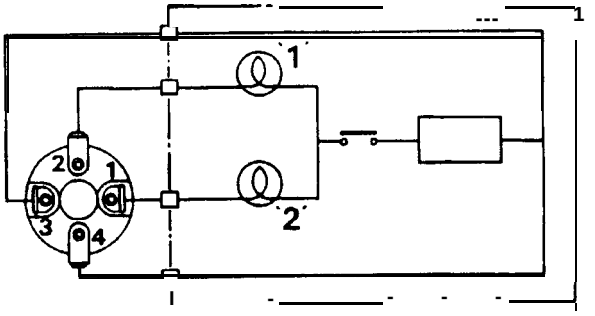
NOTE: An hexagonal type socket should be used for these bolts.

6. Disconnect the four wiring connections to the switch.
7. Loosen the lock nut using a suitable wrench and unscrew the warning light switch.

Refitting and adjusting

NOTE: Adjust switch position ONLY with transfer box neutral selected.

8. Connect suitable test equipment as shown.
9. Refit the switch and screw in until test lamp 1 is extinguished.
10. Screw in switch a further 1/3 to 1/2 turn.
11. Lock switch in position using the locknut.
12. Select 'Low Range' test lamp 1 should illuminate. Select 'High Range' test lamp 2 should illuminate. Select neutral, both test lamps should extinguish.



RR1990E

13. If adjustment is satisfactory, remove the test equipment and reconnect wiring leads correctly and check operation of the audible warning unit.
14. Fit the back plate to the output housing using the 4 bolts and plain washers.

NOTE: The two lower fixings also hold the oil catcher which before. fitting is coated with a silicone rubber sealant on the mating face.

15. Fit the brake drum and retain with the two screws.
16. Reconnect the drive shaft and tighten to the specified torque (see section 06-Torque values).

LT230 TRANSFER GEARBOX

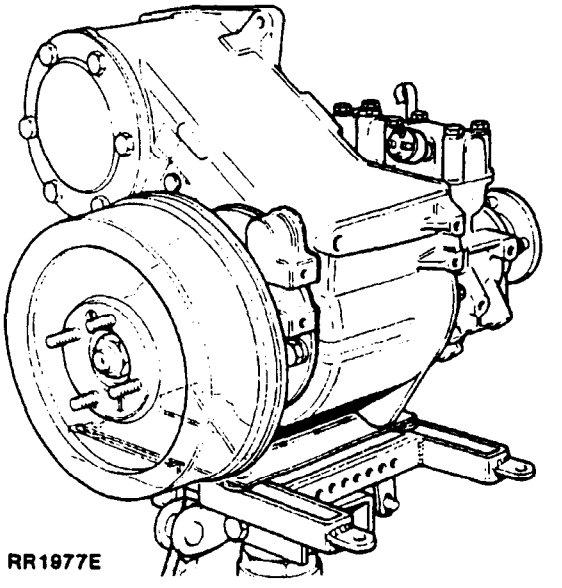
Service tool: 18G 1425 - Guide studs (3) Also, locally manufactured adaptor plate, see below.

Remove and refit

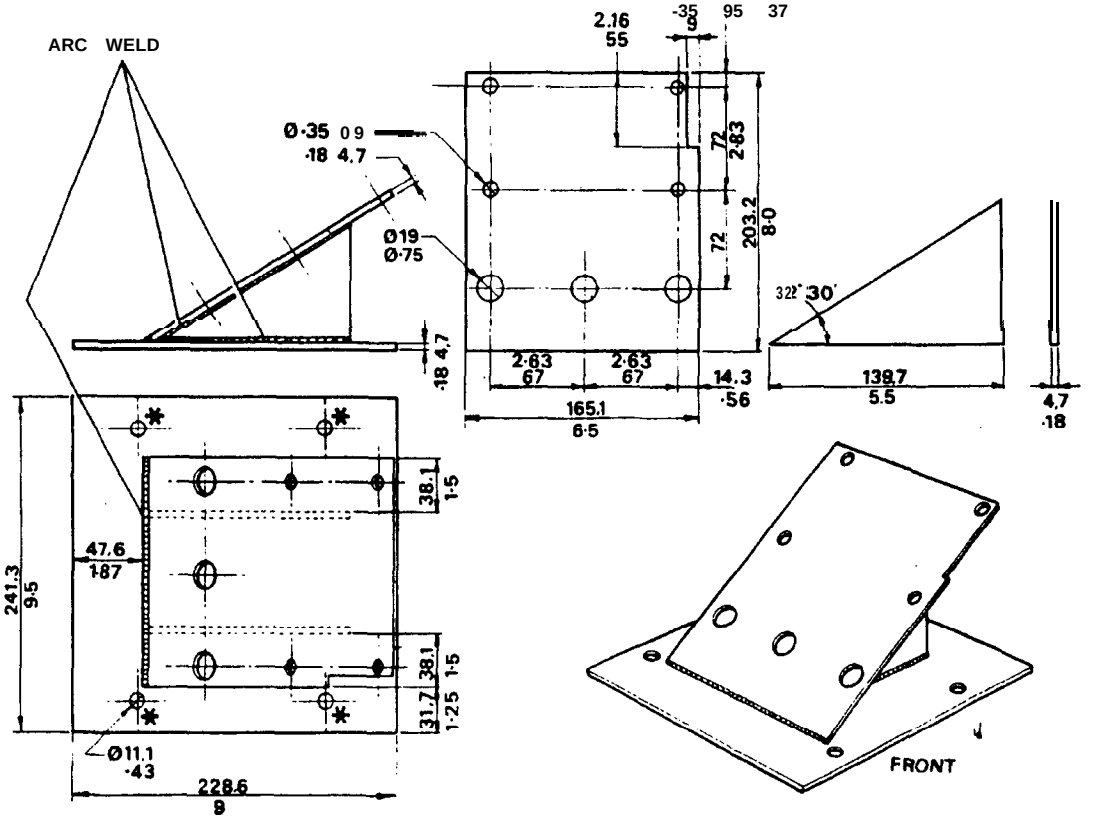
Adaptor plate for removing transfer gearbox

The transfer gearbox should be removed from underneath the vehicle, using a suitable transmission jack. An adaptor plate for locating the transfer gearbox onto the jack can be manufactured locally to the drawing RR2195E.

WARNING: Where the use of a transmission hoist is necessary, it is ABSOLUTELY ESSENTIAL to follow the hoist manufacturer's instructions to ensure safe and effective use of the equipment.



RR1977E



MATERIAL: STEEL PLATE

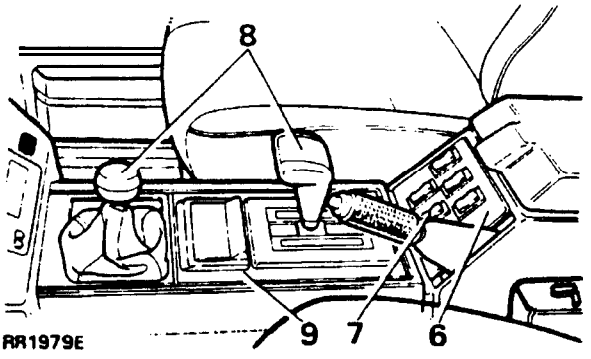
✱= TO BE DRILLED TO FIT TRANSMISSION JACK BEING USED

RR2195E

Continued

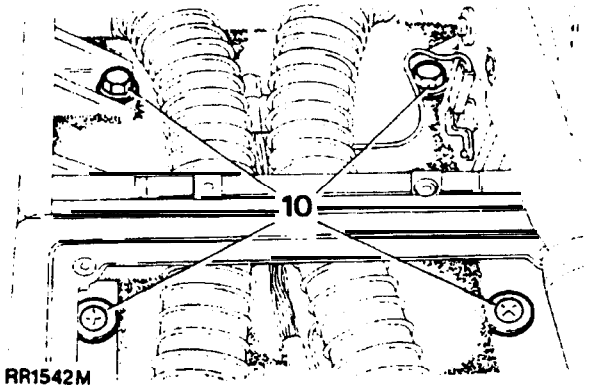
Removing

1. Install the vehicle on a suitable hoist.
2. Open the hood.
3. Disconnect the battery.
4. Release the airflow meter to plenum chamber hose.
5. Remove the four screws securing the glove box liner to the glove box and lift out the liner.
6. Carefully pry the window lift switch panel away from the front of the glove box.
7. Identify each switch connection for re-assembly, disconnect the plugs and remove the switch panel.
8. Remove the main and transfer gearbox knobs.
9. Carefully pry the centre panel out of the floor mounted console and remove it from the vehicle.



RR1979E

10. Release the two bolts and two screws securing the console assembly to the gearbox tunnel.

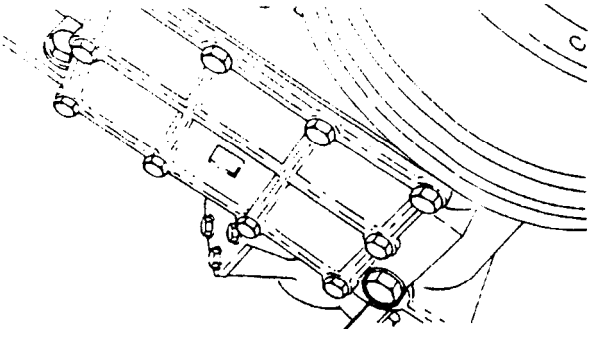


RR1542M

11. Release the parking brake and remove the cotter pin, clevis pin and washer securing the parking brake cable to the parking brake lever.
12. Carefully maneuver the assembly away from the radio housing and remove it from the vehicle.
13. Release the large nut retaining the parking brake outer cable to the top of the gearbox tunnel.
14. Remove the nut and feed the cable through the hole to the underside of the vehicle.

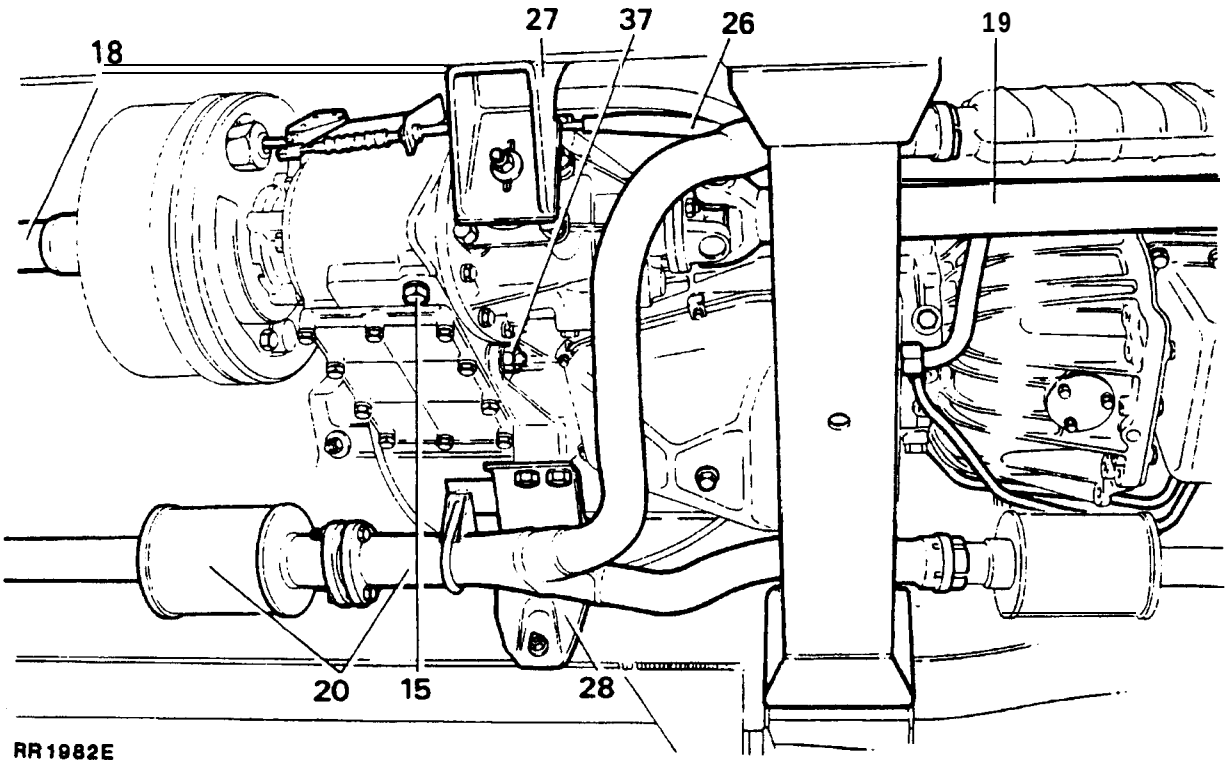
NOTE: The illustration for the following removal instructions is located at the top of the following page.

15. Raise the vehicle on the hoist and drain the transfer gearbox.
16. Release the nut and clamp securing the speedometer cable to the rear of the transfer box.
17. Withdraw the cable from the speedometer drive pinion.


RR1981E

15'

18 Release the four nuts securing the rear drive shaft to the rear output flange and tie to one side of the chassis.
19. Remove the four nuts securing the front drive shaft to the front output flange and tie to one side of the chassis.



RR1982E

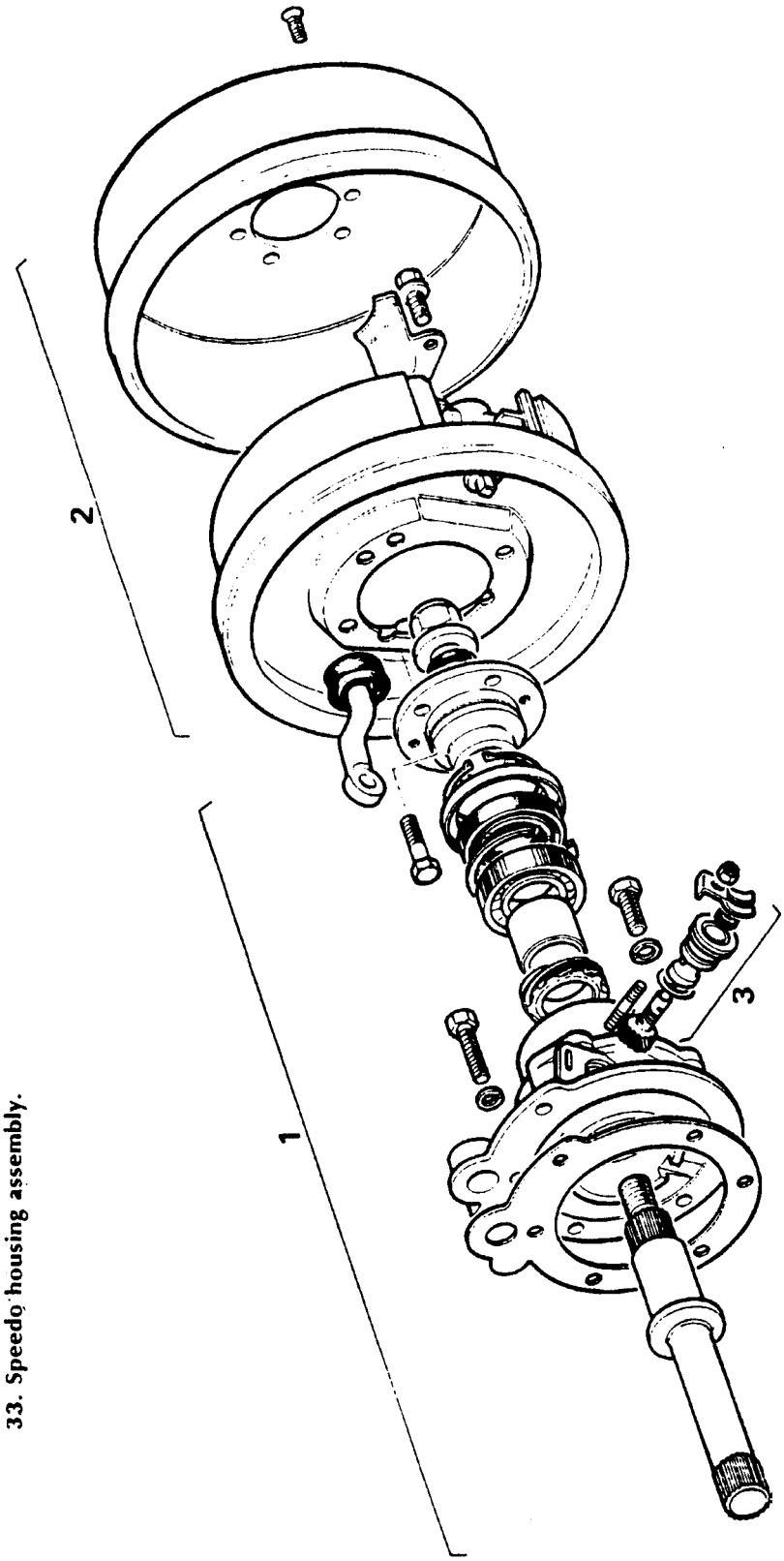
20. Release the bolts securing the intermediate exhaust pipe to the centre catalyst and separate the pipes. Retrieve the dougnut.
21. Remove the clamp at the tailpipe bracket, carefully tie the exhaust to the chassis side member.
22. Manufacture an adaptor plate in accordance with the drawing, to attach to the transmission jack and transfer box to facilitate removal (RR2195E).
23. Place four, 30mm (1.250 in) long spacers between the top of the hoist and the adaptor plate at the securing points and secure the adaptor plate to the hoist.
24. Remove the four central bolts from the transfer box bottom cover, move the jack into position and secure the adaptor plate to the transfer box.
25. Adjust the jack to take the weight of the transfer box.
26. Remove the tie bar from the transfer gearbox.
27. Remove the right-hand side mounting bracket to chassis nuts and bolts.
28. Remove the rear left-hand side mounting bracket to chassis nuts and bolts.
29. Remove right-hand side mounting bracket to flexible mounting rubber retaining nut and place bracket aside.
30. Lower the jack until the rear brake drum clears the rear passenger footwell.
31. Remove the cotter pin and washers securing the differential lock lever to the connecting rod, and disconnect the lever from the rod.
32. Disconnect the electrical leads from the differential lock switch and neutral warning switch.
33. Remove the breather pipe from the top of the transfer gearbox.
34. Select low range transfer box gear position.'
35. Release the high/low rod lower lock nut and remove the rod from the yoke.

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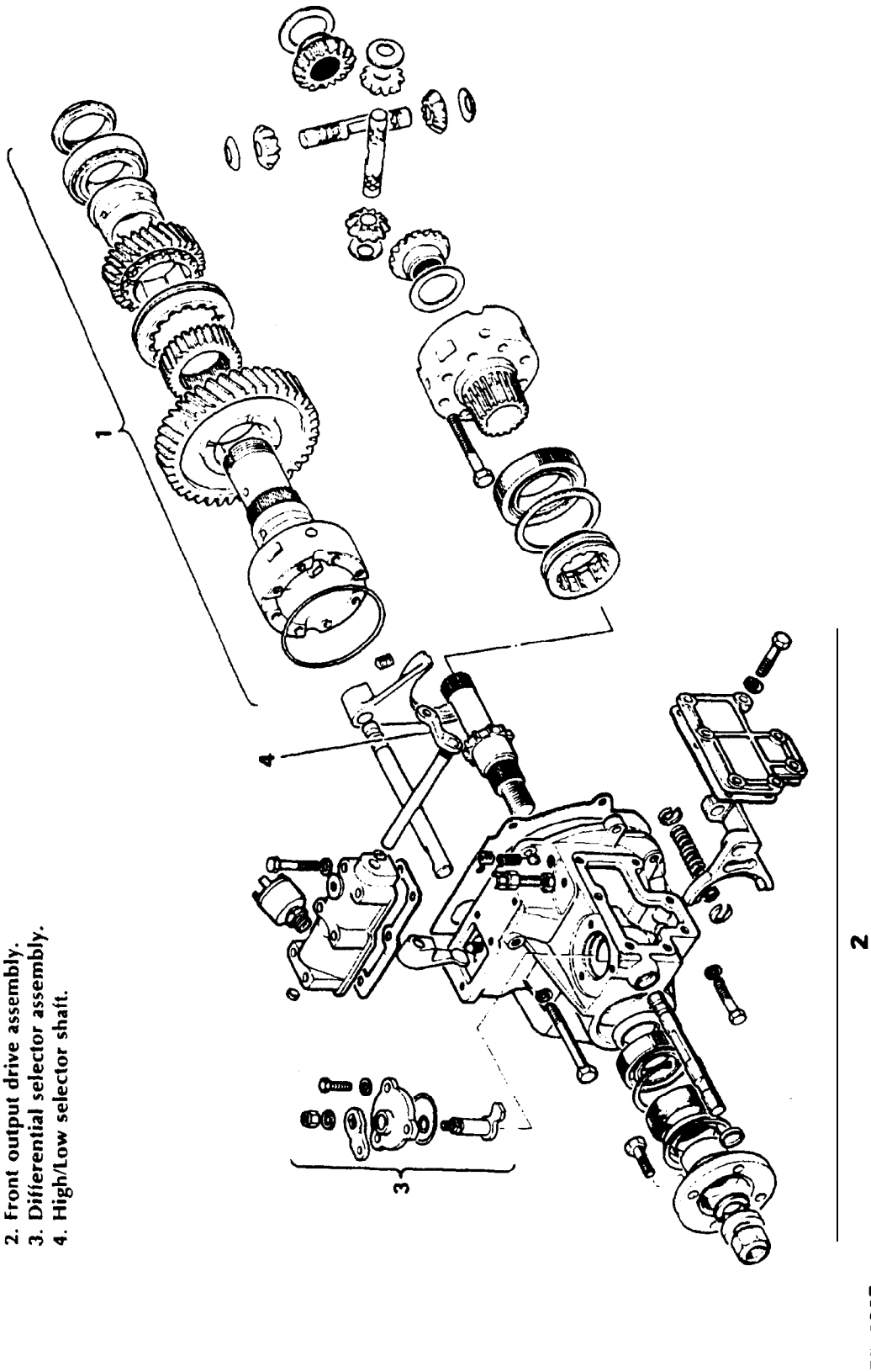
36. Place a suitable wooden block between the main gearbox and chassis cross-member, then lower the jack until the gearbox contacts the wooden block.
37. Remove the upper and lower bolts securing the transfer box to the main gearbox.
38. Fit three guide studs to the main gearbox 18G 1425 and maneuver the transfer gearbox rearwards to detach it from the main gearbox.

Refitting

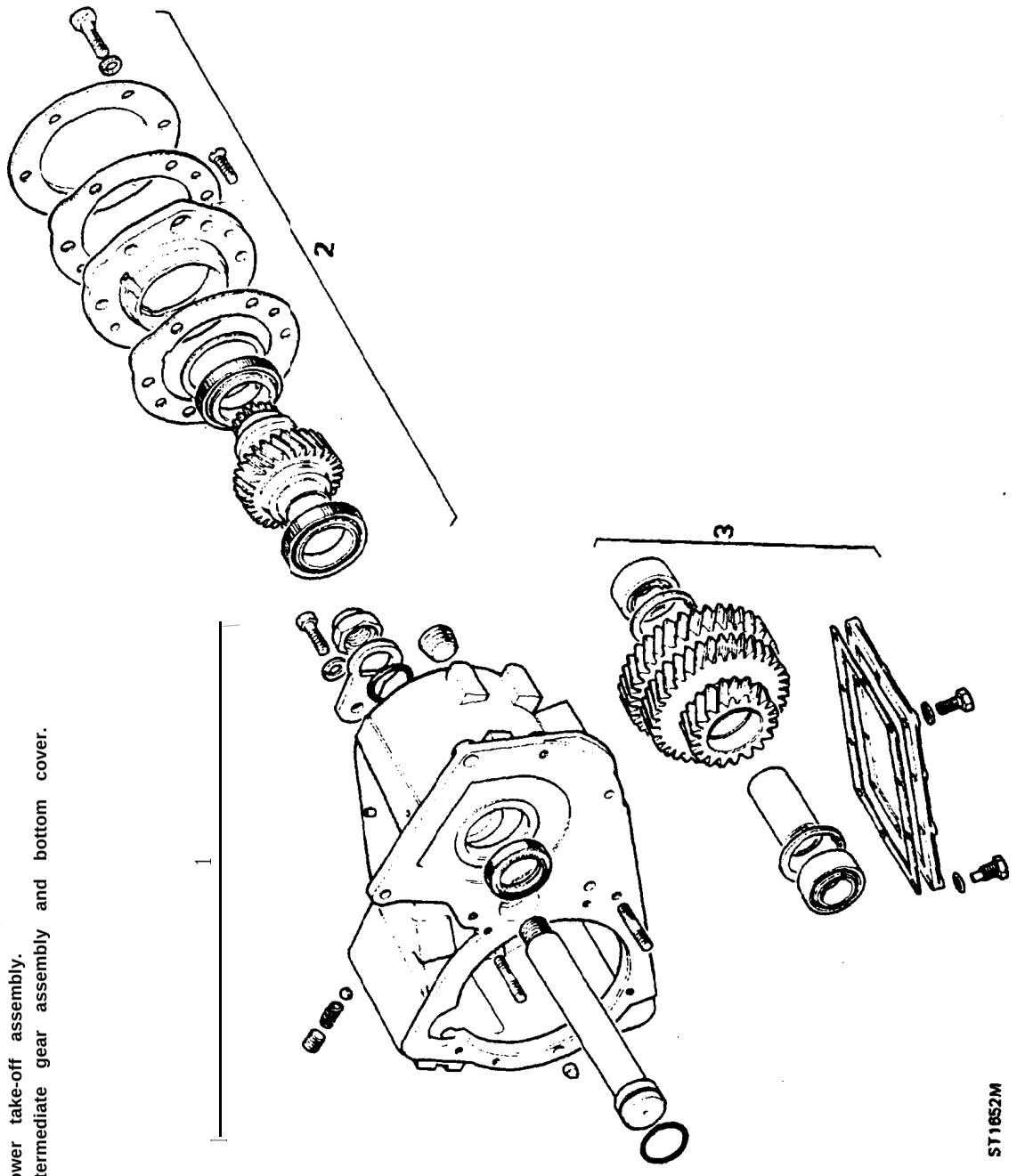
39. Make sure that the joint faces of the transfer box and main gearbox extension case are clean and that the three guide studs, 18G 1425, are fitted to the extension case.
40. Lubricate the oil seal in the joint face of transfer box, secure the transfer box to the adaptor plate on the lifting hoist and raise the hoist until the transfer box can be located over the guide studs.
41. Remove the guide studs and secure the transfer box to the main gearbox extension case. Tighten the nuts and bolts to the correct torque (see section 06-Torque values).
42. Complete the refitting procedure by reversing the removal sequence, noting the following important points.
43. After removing the lifting hoist and adaptor plate from the transfer box, clean the threads of the four bolts for the transfer box bottom cover, coat them with Loctite 290 and fit them together with spring washers. Tighten to the specified torque.
44. Refill the transfer box with the correct grade oil to the oil level plug hole. (See Section 09).
45. Check, and if necessary top-up the oil level in the main gearbox. Use the correct grade oil. (see section 09).
46. Check the operation of the parking brake and adjust as necessary. (see section 10).



1. Rear output drive assembly.
2. Transmission brake drum assembly.
33. Speedo housing assembly.



1. Centre differential assembly.
2. Front output drive assembly.
3. Differential selector assembly.
4. High/Low selector shaft.



1. Transfer box. Case assembly.
2. Power take-off assembly.
3. tntermediate gear assembly and bottom cover.

LT230 TRANSFER GEARBOX OVERHAUL

Service Tools:

18G 47-7	-input gear cluster bearing cones remover/replacer
18G 47BB-1	-Adaptor centre differential bearing remover
18C 47BB-3	-Adaptor centre differential bearing remover button
18G 257	-Circlip pliers
18G 1205	-Drive flange wrench
18G 1271	-Oil seal remover
18G 1422	-Mainshaft rear oil seal replacer
18G 1423	-Adaptor/socket centre differential locknut remover/replacer
18G 1424	-Centre differential bearing replacer
MS 47	-Hand press
MS 550	-Bearing and oil seal replacer handle
LST 47-1	-Adaptor centre differential bearing remover
LST 104	-Intermediate gear dummy shaft
LST 105	-Input gear mandrel
LST 550-4	-Intermediate gear bearing races replacer

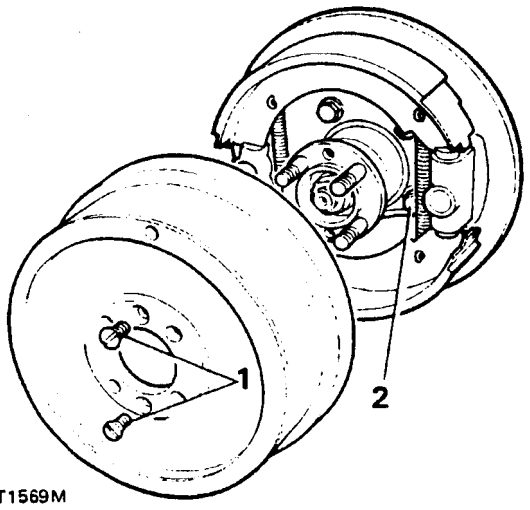
TRANSFER BOX DATA

Front and rear bevel gear pre-load	See text
High range gear end-float	0.05 to 0.15 mm (0.002 to 0.006 in)
Front differential bearing pre-load	0.56 to 1.69 Nm (S-15 in lb)
Input Rear bearing pre-load	0.56 to 2.25 Nm (S-20 in lb)
Intermediate shaft bearing pre-load	0.56 to 1.69 Nm (S-15 in lb)

Parking brake removal

1. Remove two countersunk screws and withdraw brake drum.
2. Remove four bolts securing the brake back-plate; the two bottom fixings retain the oil catcher.

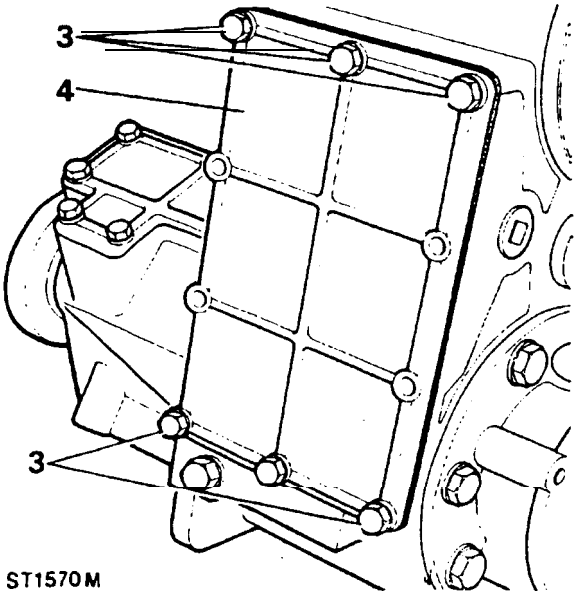
NOTE: An hexagonal type socket should be used for these bolts.



ST1569M

Bottom cover removal

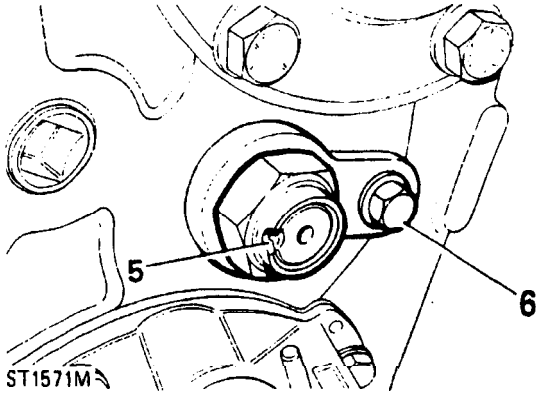
3. Remove the six bolts and washers retaining the bottom cover.
4. Remove the bottom cover and gasket, discard the gasket.



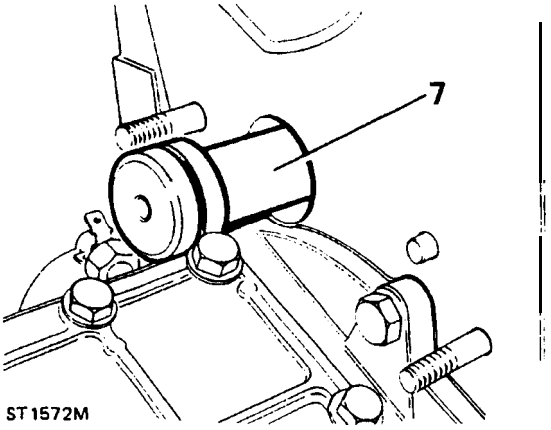
ST1570M

intermediate shaft and gear cluster removal

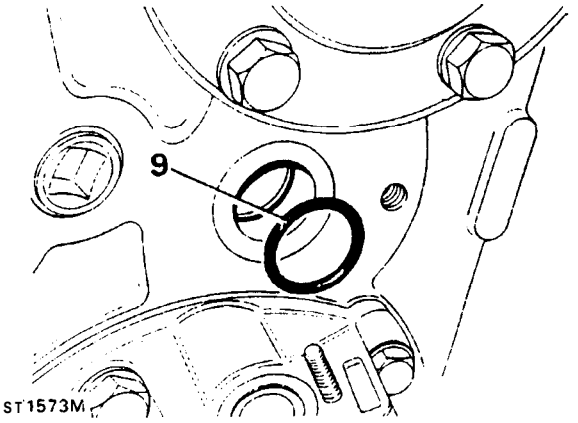
5. Release stake nut from recess in intermediate shaft, remove stake nut and discard.
6. Unscrew the single bolt and remove anti-rotation plate at the rear face of the transfer box.



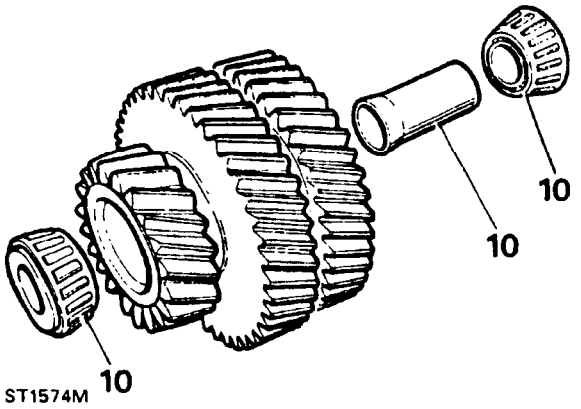
7. Tap the intermediate gear shaft from the transfer box.



8. Lift out the intermediate gear cluster and bearing assembly.
9. Remove the 'O' rings from the intermediate gear shaft and from inside the transfer box and discard.

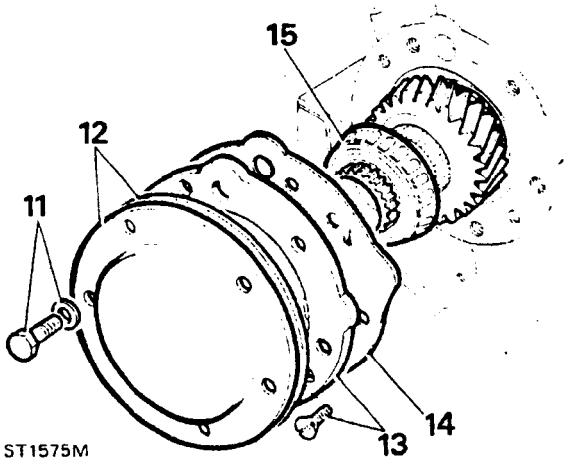


10. Remove the taper roller bearings and bearing spacer from the intermediate gear cluster assembly.



Power take-off cover removal

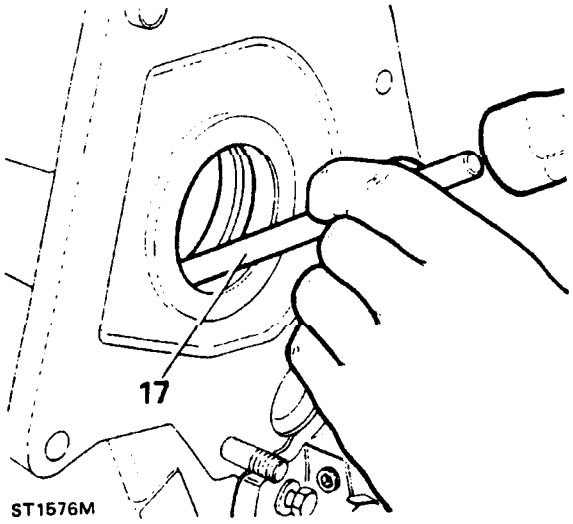
11. Remove five bolts and washers retaining the take-off cover
12. Remove the cover and gasket, discard the gasket.



Continued

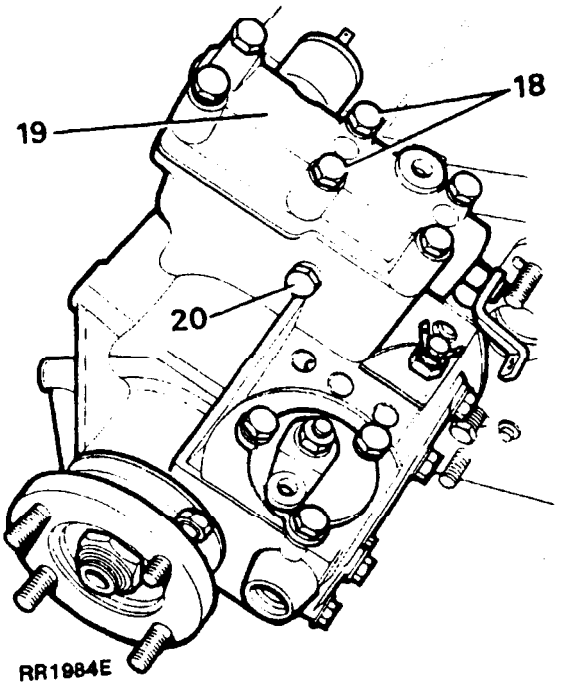
input gear removal

13. Remove the two countersunk screws and detach the main shaft bearing housing.
14. Remove the gasket and discard.
15. Withdraw the input gear assembly.
16. Pry out and discard the oil seal at the front of the transfer box casing using service tool 18C 1271.
17. Drive out the input gear front bearing track.



High/low cross-shaft housing removal

18. Remove the six bolts and washers retaining the cross-shaft housing, ground lead and retaining clip.
19. Remove the cross-shaft housing and gasket, discard the gasket.

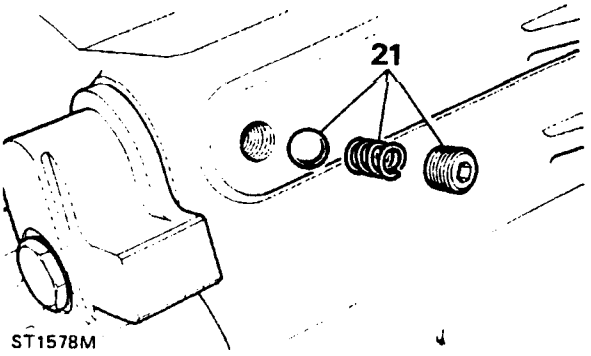


Front output housing removal

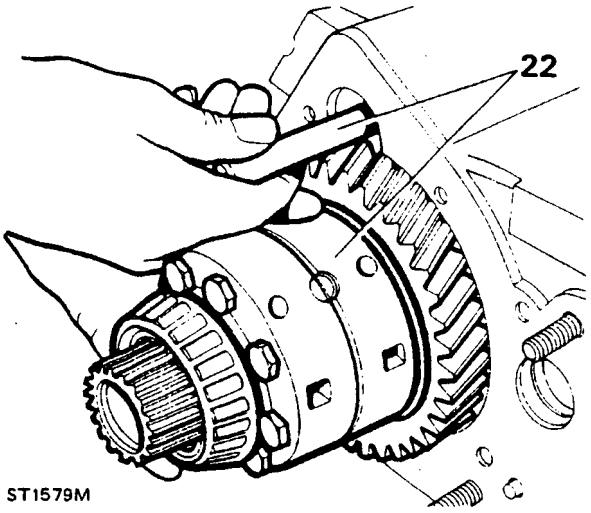
20. Remove the eight bolts and washers and detach the output housing from the transfer box casing, taking care not to mislay the dowel. Remove the gasket and discard.

Centre differential removal

21. Remove high/low selector shaft detent plug, spring and retrieve the ball with a suitable magnet.

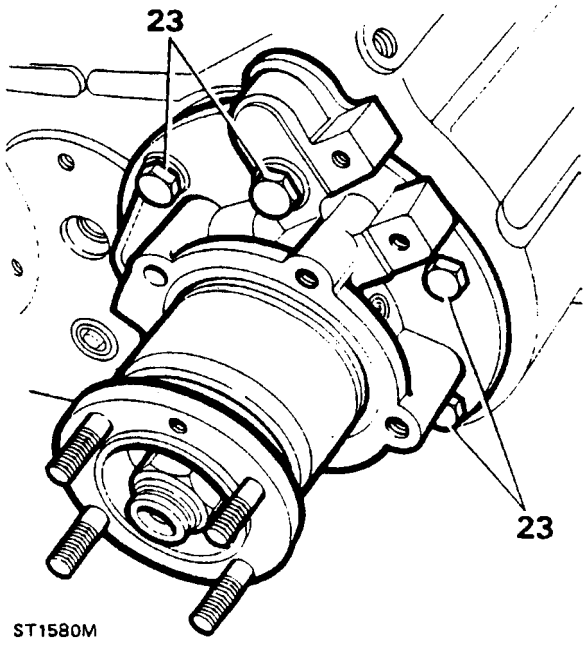


22. Withdraw the centre differential and selector shaft/fork assembly.



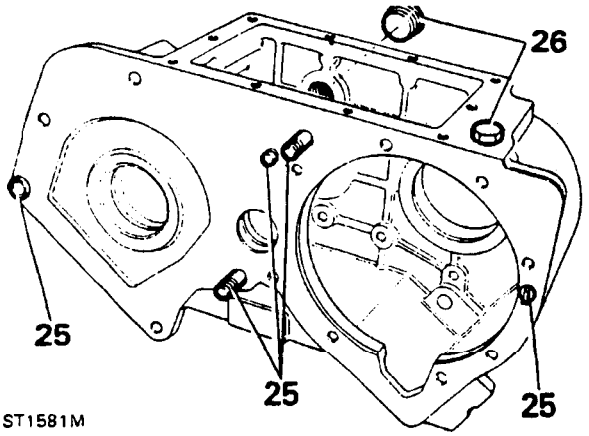
Rear output housing removal

23. Remove six bolts and washers and detach the rear output housing and shaft assembly from the transfer casing.
24. Remove the gasket and discard.

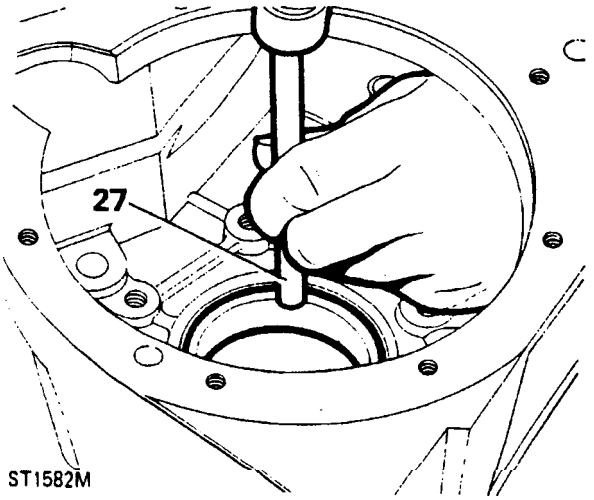


Transfer case overhaul - dismantling

25. Inspect the studs and dowels for wear or damage. Remove if replacements are required.
26. Remove the magnetic drain plug, copper washer and filler/level plug. Discard the washer.



27. Drive out differential rear bearing track.
28. Clean all areas of the transfer casing ensuring all traces of 'Loctite' are removed from faces and threads.



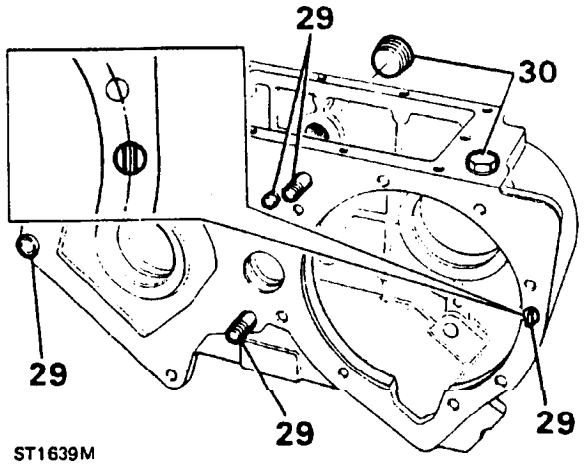
Continued

Transfer case overhaul - re-assembling

29. If previously removed, fit studs and dowels to front face of the transfer casing. Use new components where necessary.

NOTE: The position of the radial dowel blade is set in line with the circle which is formed by the front output housing fixing holes.

30. Refit magnetic drain plug with new copper washer and tighten to the specified torque, loosely fit the filler/level plug.

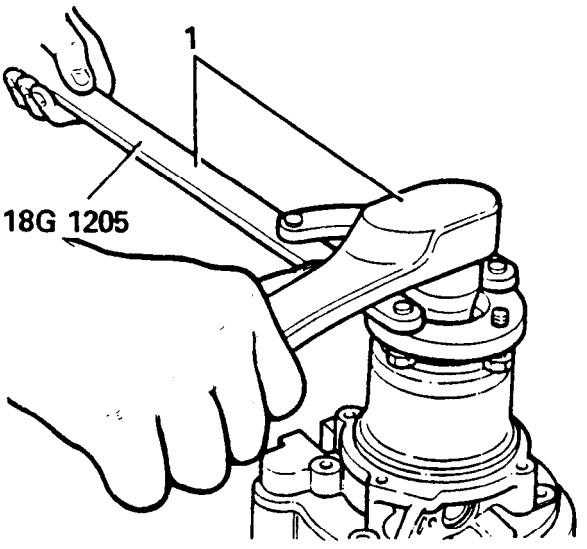


ST1639M

Rear output housing overhaul-dismantling

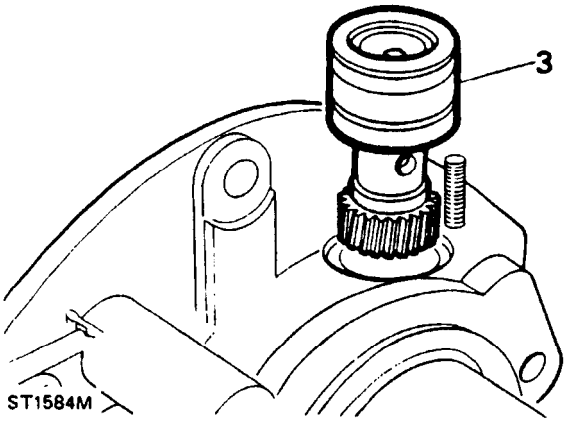
1. Using flange wrench 18G1205 and socket wrench remove the flange nut, steel and felt washers, Ensure flange bolts are fully engaged in the wrench.
2. Remove output flange with circlip attached. If necessary, use a two-legged puller.

NOTE: The circlip need only be released if the flange bolts are to be replaced.



ST1583M

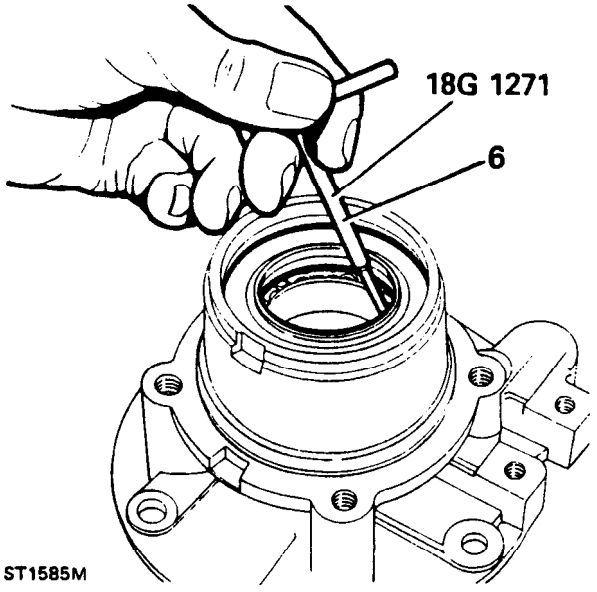
3. Remove speedo-drive housing. This can be eased out with a screwdriver.



ST1584M

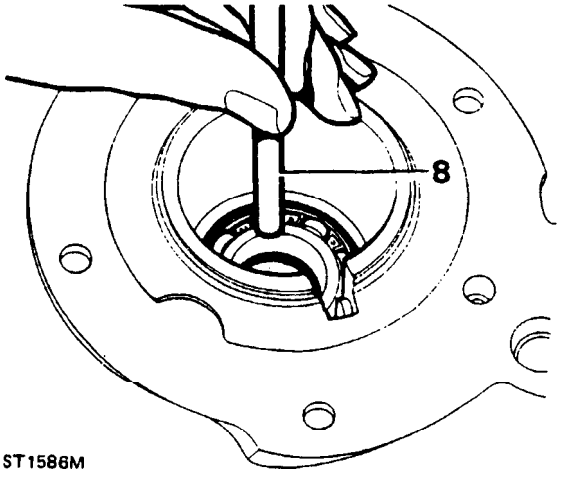
4. Remove housing from the vice and drive out the output shaft, by striking the flange end of the shaft.
5. Carefully pry off the oil catch ring using a screwdriver in the slot provided.

6. Pry out and discard the seal from the output housing using tool 18G1271.



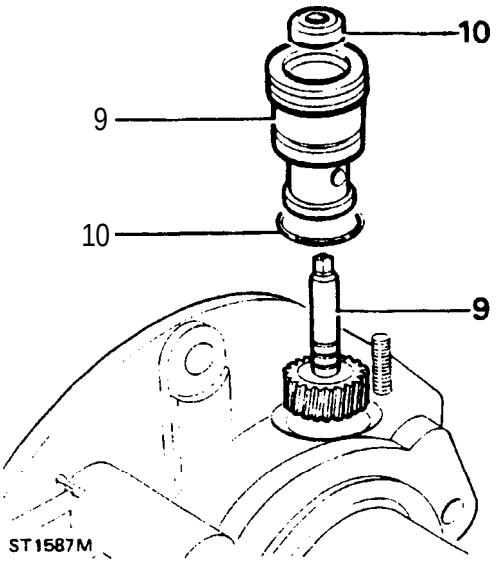
ST1585M

7. Using circlip pliers 18G257, remove the circlip retaining the bearing.
8. Drive out the bearing from the rear of the housing.



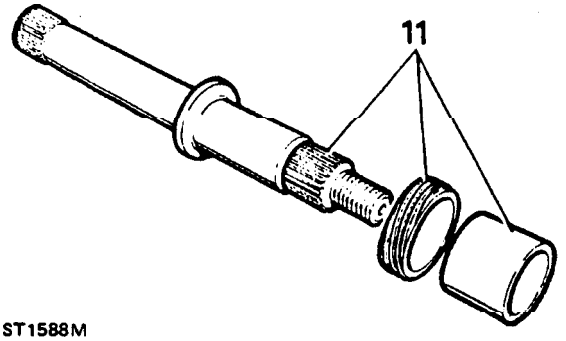
ST1586M

9. Remove speedometer gear (driven) from its housing.
10. Remove the 'O' ring and oil seal and discard.



ST1587M

11. Slide off spacer and speedometer drive gear from output shaft.
12. Clean all parts, replace the 'O' ring, oil seals, felt seal and flange nut. Examine all other parts for wear or damage and replace, if necessary.



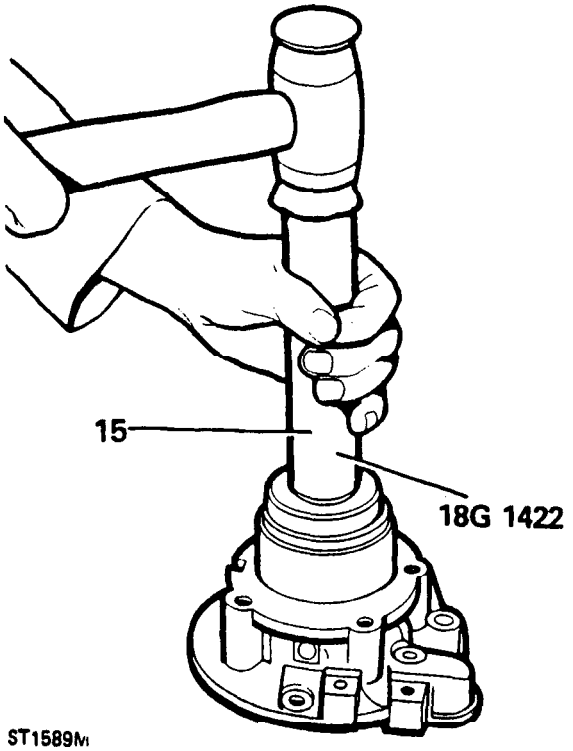
ST1588M

Re-assembling

13. Press output bearing into the housing. Do not use excessive force. To facilitate fitting the bearing, heat the output housing case. This is not to exceed 100°C (212°F).
14. Retain bearing with circlip, using circlip pliers 18G257.

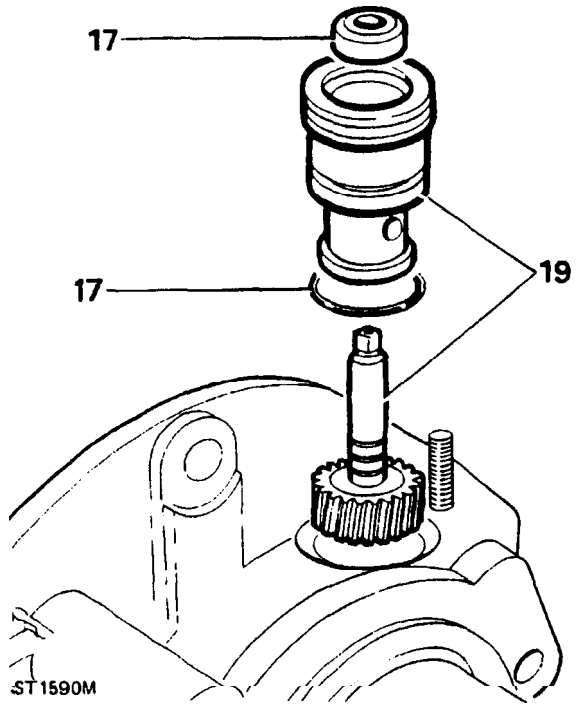
Continued

15. Pre-grease between the seal lips and fit new seal (open side inwards) using tool 18G1422. The seal should just make contact with the bearing circlip.



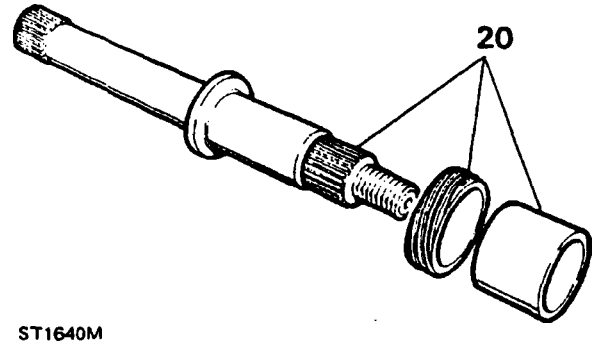
ST1589M

16. Carefully coat the lips of the seal with clean grease and refit oil catch ring onto output housing.
17. Fit the 'O' ring and oil seal (open side inwards) to speedometer housing.
16. Lubricate the 'O' ring and seal with oil.
19. Locate speedometer gear (driven) in housing and press into position.



ST1590M

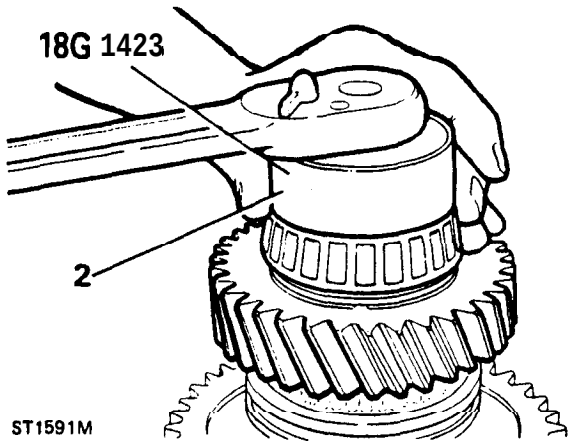
20. Slide drive gear and spacer on to the output shaft.
21. Locate output shaft into the bearing in the housing and drive into position.
22. Locate speedometer gear (driven) housing assembly into the output housing and press in until flush with the housing face.



ST1640M

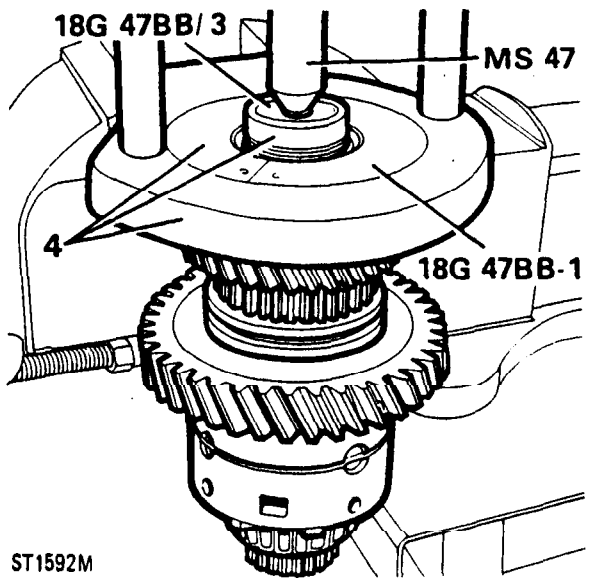
Centre differential unit overhaul -dismantling

1. Secure centre differential unit to a vice fitted with soft jaws, and release stake nut from recess.
2. Remove stake nut using tool 18G1423 and suitable socket wrench and discard stake nut.
3. Remove the differential unit from the vice.



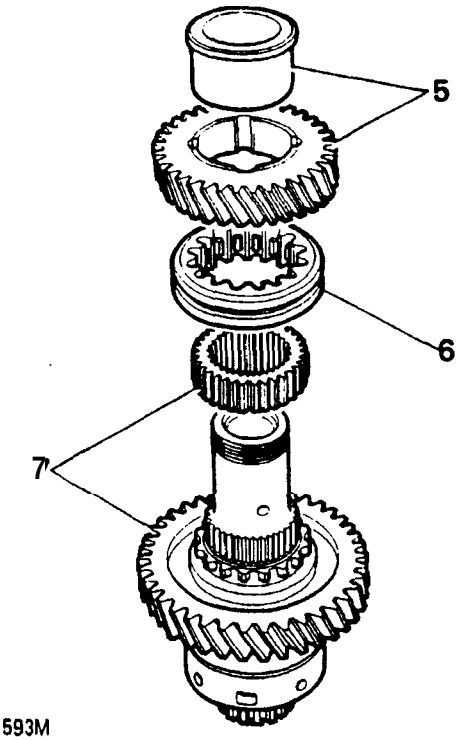
ST1591M

4. Secure hand press MS47 in vice with collars 18G47BB-1 and using button 18G47BB/3 remove the rear taper bearing and collars.



ST1592M

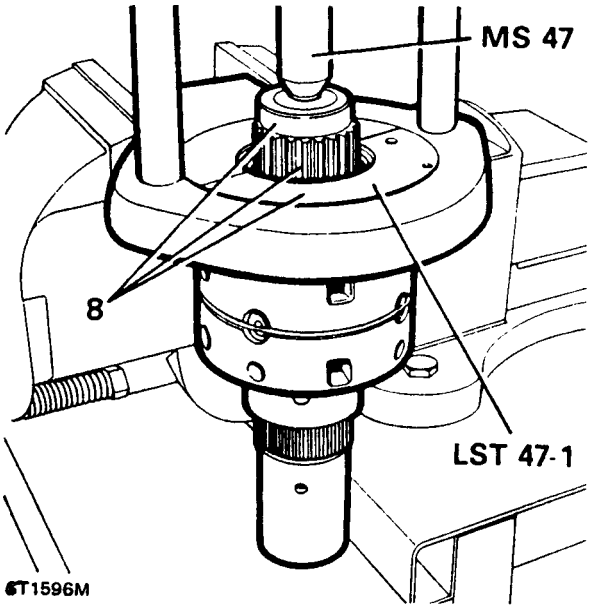
5. Remove the high range gear and bush, taking care not to disturb the high/low sleeve.
6. Mark-the relationship of the high/low sleeve to the hub and then remove the sleeve.
7. Using a suitable press behind the **low range** gear carefully remove the high/low hub and low range gear.



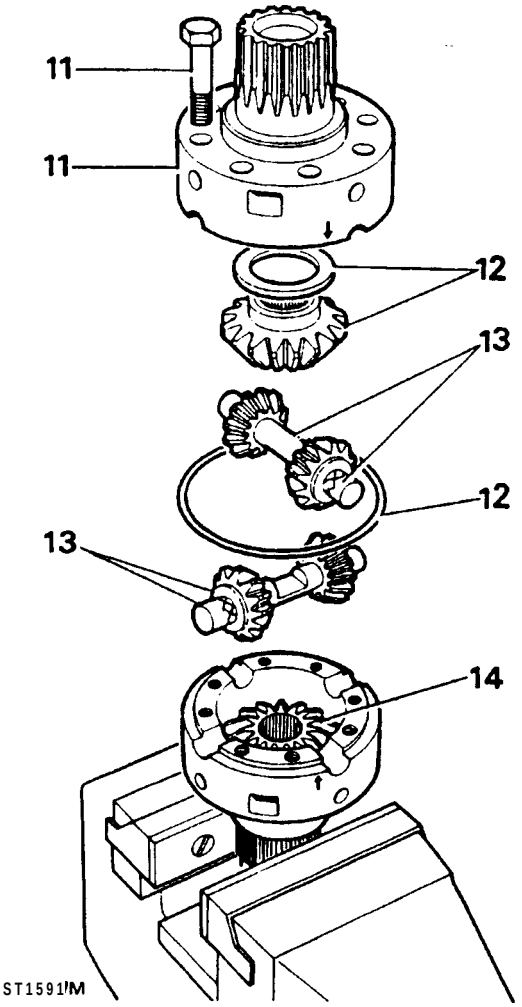
ST1593M

Continued

8. Substituting collar LST47-1 remove front taper roller bearing.
9. Remove hand press from the vice.
10. Using soft jaws secure the differential unit in the vice by gripping the hub splines.

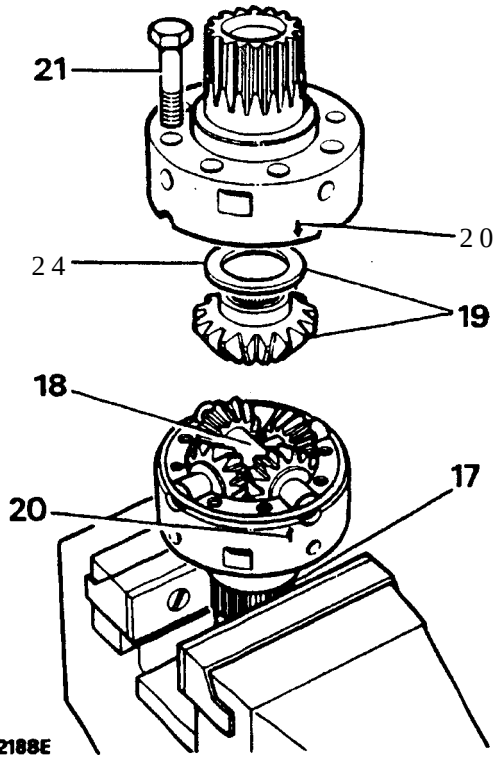


11. Remove the eight retaining bolts and lift off the front part of the differential unit.
12. Release the retaining ring and remove front upper bevel gear and thrust washer.
13. Remove the pinion gears and dished washers along with the cross shafts.
14. Remove the rear lower bevel gear and thrust washer from the rear part of the differential unit.
15. Remove the rear differential unit from the vice and clean all components.



16. Inspect all components for damage or wear, fit new components if necessary.
17. Using soft jaws secure the rear (longest half) of the differential unit in the vice by gripping the hub splines.
18. Lubricate and install the cross shafts and pinion gears with new dished washers. **DO NOT** fit the rear bevel gear at this stage.

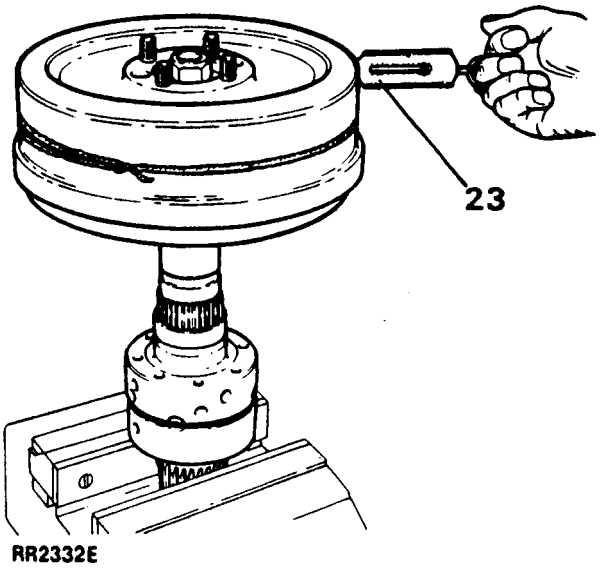
19. Lubricate and fit the front bevel gear and thinnest thrust washer (FRC6956 1.05 mm).
20. Fit front half of the differential casing ensuring that the two engraved arrows are aligned.
21. Fit securing bolts and tighten to the correct torque (see section 06 - Torque values).
22. Lubricate and insert the rear output shaft into the bevel gear and check that the gears are free to rotate.



23. Fit the parkbrake drum **to the output drive flange and check the torque required to rotate** the gears. Tie a length of string around the brake drum, attach a spring **balance to the** string and carefully tension the string until a load to turn is obtained. Alternatively use a torque wrench applied to the brake drum flange nut. Rotate the drum slowly by hand to overcome initial load when using either method. Note that illustration RR2332E shows checking torque at rear bevel gear.

NOTE: Gears that have been run will rotate smoothly and will require a torque of 0.56 Nm (5 in lb). Equivalent force using spring balance: 0.45 kg (1 lb).
New gears will rotate with a notchy feel and will require a torque of not more than 2.26 Nm (20 in lb). Equivalent force using spring balance: 1.72 kg (3.8 lb).
Keep all components well lubricated when carrying out these adjustments.

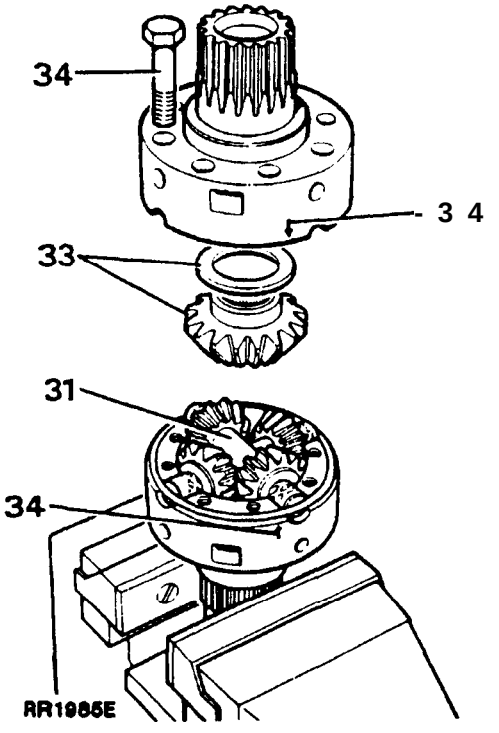
24. Change the thrust washer for a thicker one if the torque reading is too low. Five thrust washers are available in 0.10 mm steps ranging from 1.05 mm to 1.45 mm.
25. Dismantle the unit when the front bevel gear thrust washer is selected.
26. Remove and retain the front bevel and thrust washer combination.
27. Reassemble the unit with the rear bevel gear and thinnest thrust washer in position.
28. Using soft jaws secure the front (shortest half) of the differential unit in the vice by gripping the hub splines.
29. Repeat the above procedure to obtain the correct thrust washer for the rear bevel gear.



Continued

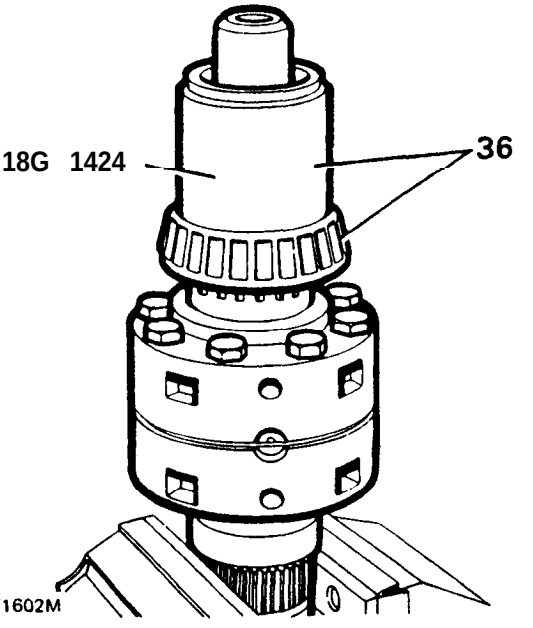
Re-assembling

30. Fit the selected thrust washer and bevel gear into the rear differential unit.

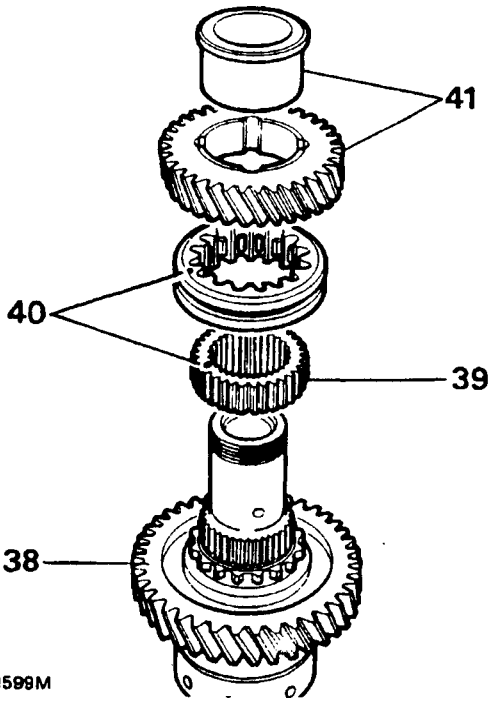


31. Assemble both pinion assemblies and dished washers on to their respective shafts and fit the rear differential unit. Secure the assemblies with the retaining ring.
32. Lubricate all the components.
33. Fit the selected thrust washer and bevel gear into the front upper differential unit.
34. Align both units as previously described and secure with the eight bolts to the specified torque (see Section 06 - Torque values).
35. Check the overall torque required to turn the differential. This should be approximately equal to the resistance of both bevel gears added together.
36. Locate the front differential bearing onto the front, upper differential shaft and press into position using larger end of tool 18G1424 as shown.
37. Invert the differential unit and secure in the vice.

NOTE: During the following sequences all parts should be lubricated as they are fitted.

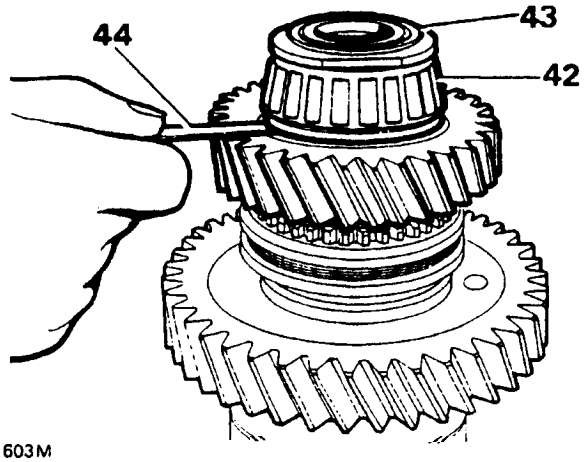


38. Fit the low range gear, with its dog teeth away from the differential assembly.
39. Press the high/low hub on to the differential splines.
40. Slide the high/low selector sleeve on to the high/low hub ensuring that the alignment marks are opposite each other.
41. Fit the bush into the high range gear so that the flange is fitted on the opposite side of the gear to the dog teeth. Slide the bushed gear on to the differential assembly with the dog teeth down.



ST1599M

42. Locate the rear differential bearing on to the hub and press it into position using the smaller end of tool 18G1424.
43. Fit the stake nut and tighten to the specified torque using tool 18G1423 (see section 06-Torque values).
44. Check the end float of the high and low range gears 0.05 to 0.15 mm (0.002 to 0.006 in).

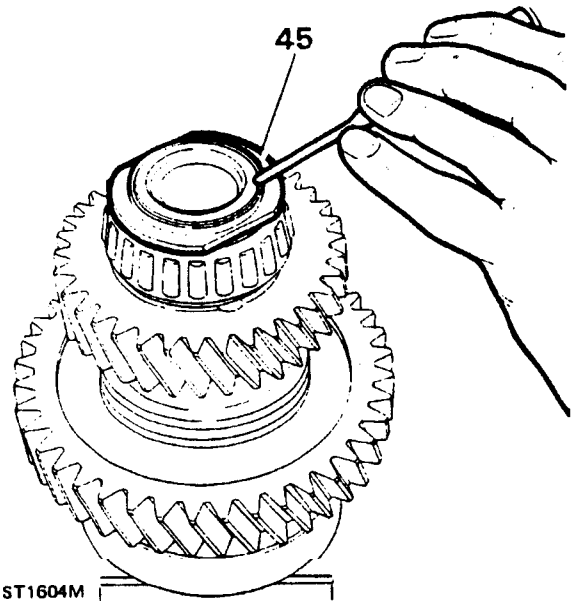


ST1603M

NOTE: If the clearances vary from those specified in the data, at the beginning of the overhaul: the assembly must be rebuilt using the relevant new parts.

45. Peen the stake nut collar by carefully forming the collar of the nut into the slot as illustrated.

CAUTION: A round nose tool must be used for this operation to avoid splitting the collar of the nut.

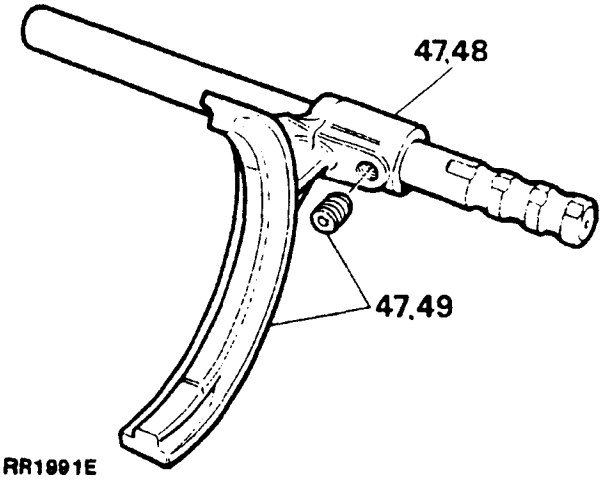


ST1604M

46. Clean and check high/low selector fork assembly for wear and replace if necessary.

Continued

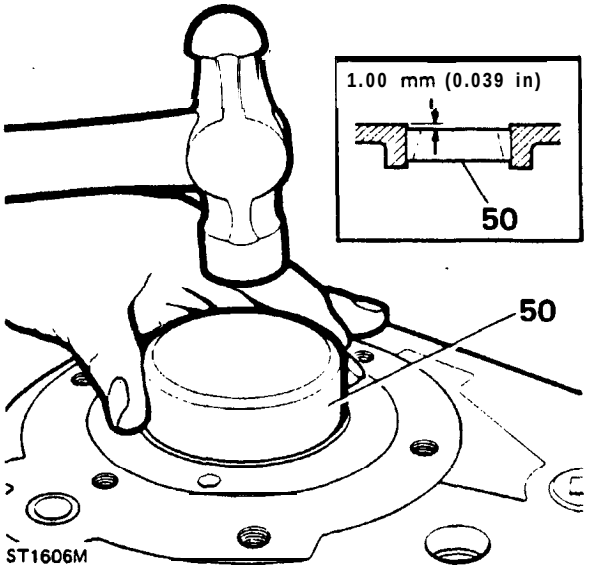
47. To replace the selector fork remove the set screw and slide the fork from the shaft.
48. Fit the new selector fork with its boss towards the three detent grooves. Align the tapped hole in the fork boss with the indent in the shaft nearest to the detent grooves.
49. Apply Loctite 290 to the set screw threads and fit the set screw and tighten to the specified torque (see section 06-Torque values).



RR1991E

Centre differential rear bearing track

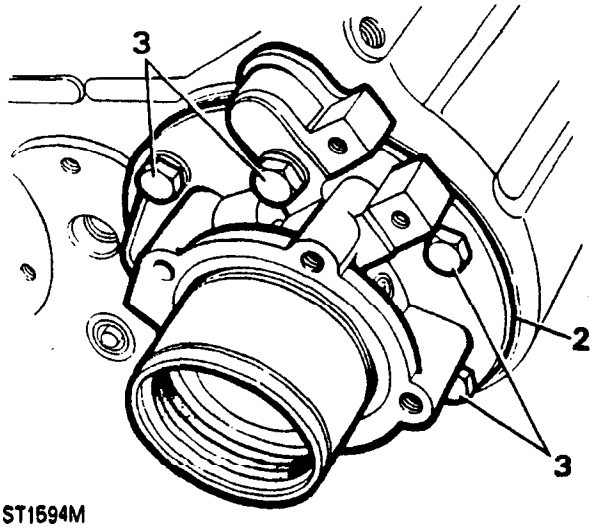
50. Fit the differential rear bearing track 1.00 mm (0.039 in) below the outer face of casing using a suitable tool as shown.



ST1606M

Rear output housing-refit

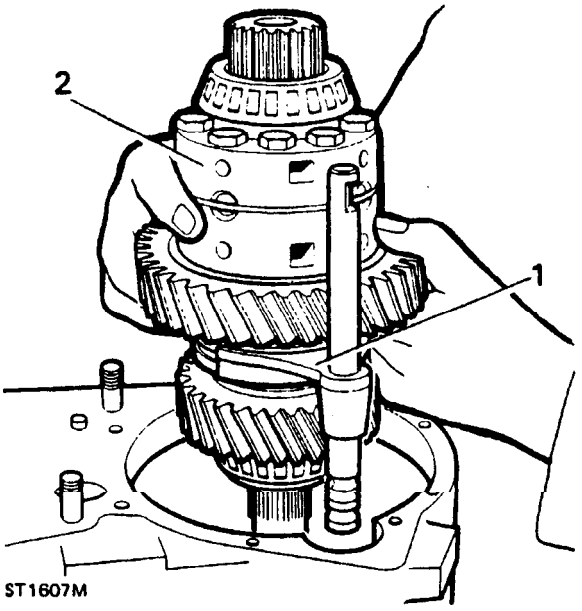
1. Grease output housing gasket and position on to the rear face of the transfer box casing.
2. Fit output housing and ensure clearance of 1.00 mm (0.039 in) between housing face and gasket.
3. Fit the six output housing bolts with Loctite 290 on the threads, with washers and tighten evenly to the specified torque, which will pull the rear bearing into position (see section 06-Torque values).



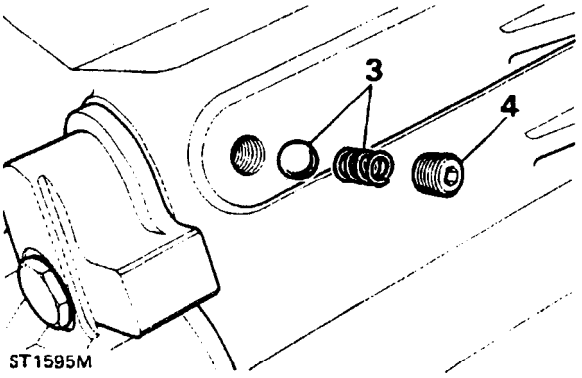
ST1594M

Centre differential unit refit

1. Fit the selector fork/shaft assembly to the high/low selector sleeve on the differential assembly, with detent groove to the rear of the differential assembly.
2. Locate the differential assembly complete with selector fork into the transfer box casing. It may be necessary to rotate the output shaft to ease fitment, and guide selector shaft into its hole.

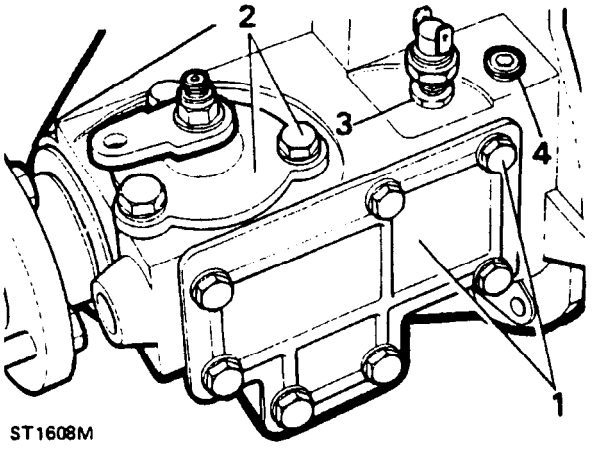


3. Fit selector shaft ball and spring through the side of the transfer box casing.
4. Apply Loctite 290 to detent plug; fit and locate, by screwing gently fully home and then unscrewing two turns.

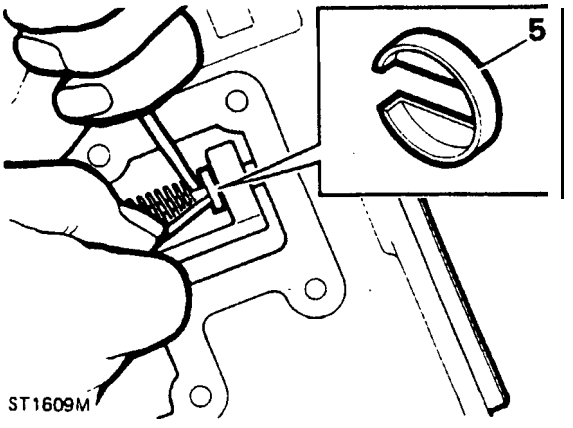


Front output housing overhaul -dismantling

1. Unscrew seven retaining bolts and washers and remove the differential lock selector side cover and gasket, discard the gasket.
2. Unscrew three retaining bolts and washers and lift the differential lock finger housing and actuator assembly from the front output housing.
3. Loosen the locknut and unscrew the differential lock warning light switch.
4. Remove selector shaft detent plug. spring and ball using a suitable magnet.

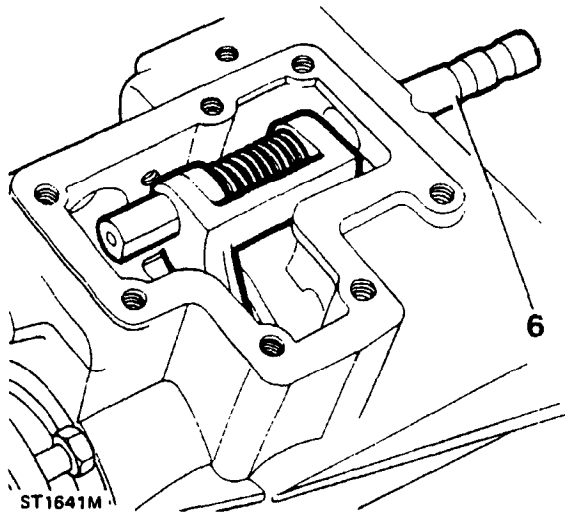


5. Compress the selector fork spring and remove the two spring retaining clips.



Continued

6. Withdraw the selector shaft from the rear of the output housing.
7. Remove the selector fork and spring through the side cover aperture.
8. Remove lock-up sleeve from the rear of the output housing.



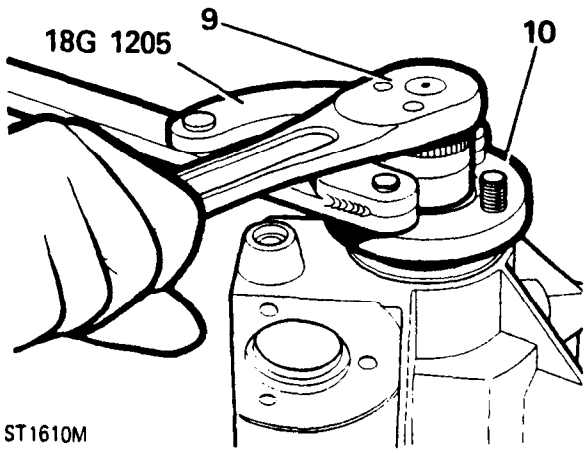
9. Using flange wrench 18G1205 and socket wrench, remove the flange nut, steel and felt washers.

NOTE: Ensure that flange bolts are fully engaged in the wrench.

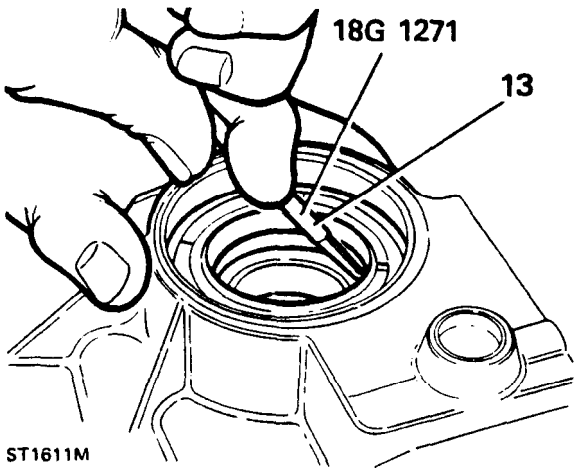
10. Remove the output flange with oil seal shield.

NOTE: These parts need not be separated unless the flange bolts are to be replaced.

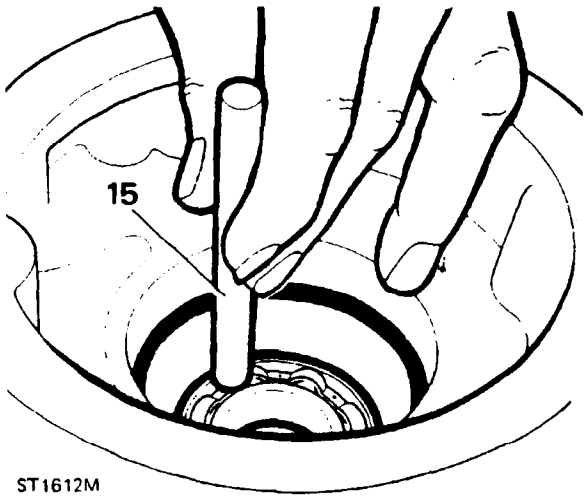
11. Drive output shaft rearwards from housing using a soft headed mallet.
12. Slide off the collar from the output shaft.



13. Pry out and discard oil seal from output housing using service tool 1861271.
14. Remove circlip with circlip pliers 18G257.

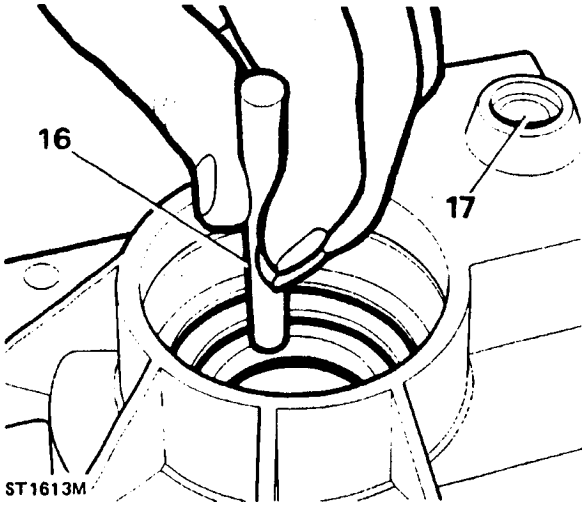


15. Invert housing and drive out bearing from inside the case as shown.



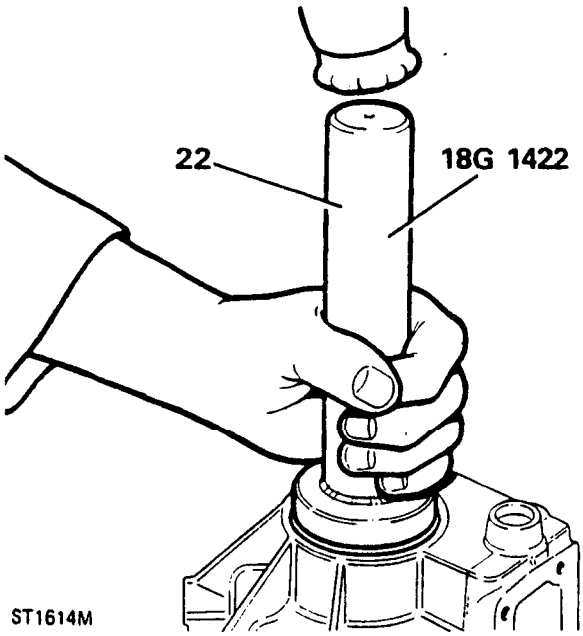
16. Drive out centre differential front taper roller bearing track and shim.
17. Drive out selector shaft cup plug from housing.
18. Clean all components ensuring all traces of 'Loctite' are removed from faces and threads.
19. Examine components for wear or damage and replace if necessary.

NOTE: Replace oil seal, felt seal and flange nut.



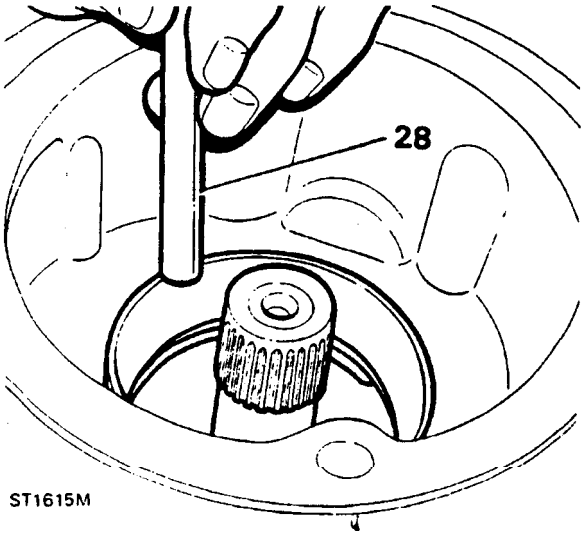
Re-assembling

20. Press the bearing into the housing; do not use excessive force. To facilitate fitting the beating, heat the front output housing. This is not to exceed 100°C (212°F).
21. Using circlip pliers 18G257, fit the bearing retaining clips.
22. Pre-grease and fit a new oil seal (open side inwards) using replacer tool 1861422, until the seal just makes contact with the circlip.
23. Carefully coat the lips of the seal with clean grease.
24. Slide collar on to the output shaft, with its chamfered edge away from the dog teeth.
25. Fit the output shaft through the bearing and drive home.



Adjusting front differential bearing pre-load

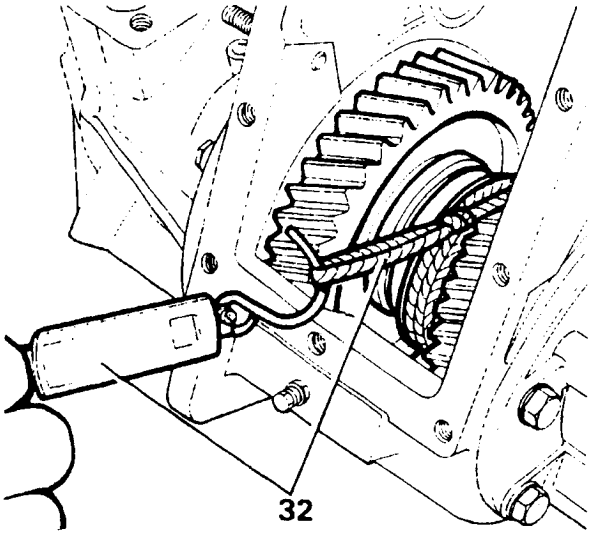
26. Measure original differential front bearing track shim.
27. Refit original shim into the output housing.
28. Drift differential front bearing track into the housing using a soft driver.



29. Grease and fit new gasket and locate the front output housing on the transfer box casing.

Continued

30. Fit the eight housing retaining bolts and washers, the upper middle bolt being longer than the rest. Do not tighten at this stage.
31. Engage high or low gear.
32. Check the rolling resistance of the differential using a spring balance and a length of string wound around the exposed splines of the high/low hub. With the bolts finger tight, little or no resistance should register.

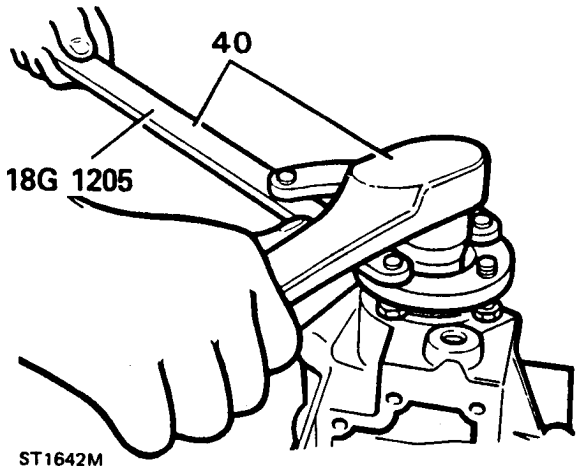


ST1616M

33. Tighten the bolts a little at a time, occasionally checking the roiling resistance. With the correct shim fitted and the bolts tightened to the specified torque the load to turn should be 1.36 kg to 4.53 kg (3lb to 10 lb).

NOTE: Alternatively, using a suitable torque wrench to achieve the torque to turn, the readings should be as follows: 0.56 to 1.69 Nm (5 to 15 in lb). The flange nut must be fitted to enable the use of a torque wrench. This applies to new or used bearings. (New bearings will register at the top end and used bearings will register at the low end).

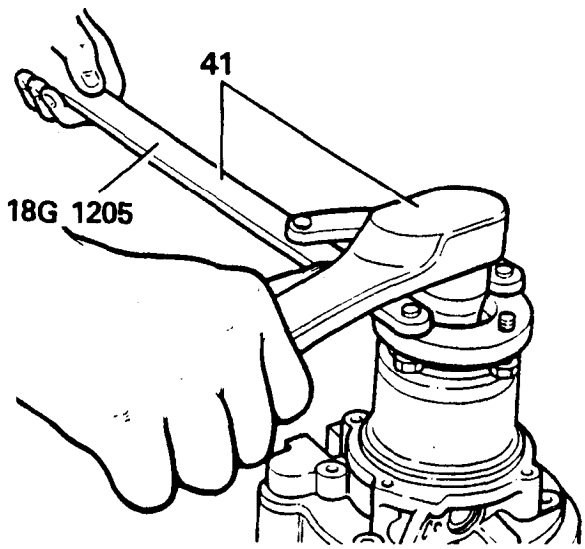
34. If the reading is in excess of the above measurements, remove the front output housing assembly from the transfer box casing.
35. Using a suitable extractor, withdraw the centre differential bearing track and change the shim for one of a suitable thickness. (A thinner shim will reduce the rolling resistance).
36. Fit the new shim and drift the differential bearing track back into its housing until fully home.
37. Having obtained the load to turn, prop-up the transfer box casing on the bench with the front face uppermost.
38. Apply Loctite 290 to the threads of the housing retaining bolts and fit the eight bolts and washers into the front output housing and tighten to the specified torque (see section 06-Torque values).
39. Fit front output flange, felt washers, steel washers and flange nut.
40. Using flange wrench 18G1205 and torque wrench, pull the output shaft up to the correct position. Check that the oil seal shield does not foul the housing. Ensure the nut is tightened to the specified torque (see section 06-Torque values).



ST1642M

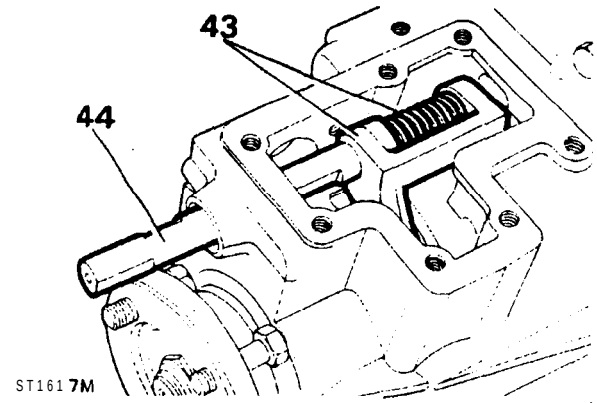
NOTE: Ensure that the flange bolts are fully engaged in the wrench.

41. Repeat the above operation for the rear output flange.



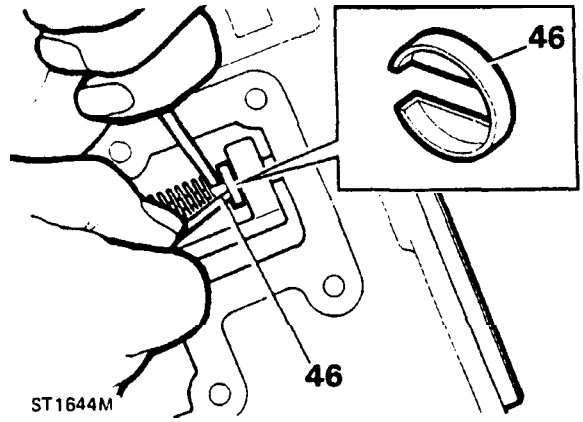
ST1643M

42. Compress the selector shaft spring and fit to the selector fork.
43. Locate selector fork through front output housing side cover aperture, ensuring that the fork engages in the groove of the lock-up sleeve.
44. Fit selector shaft through the aperture in the front of the output housing and pass it through the selector fork lugs and spring into the rear part of the housing.
45. Rotate the selector shaft until the two flats for the spring retaining caps are at right angles to the side cover plate face.



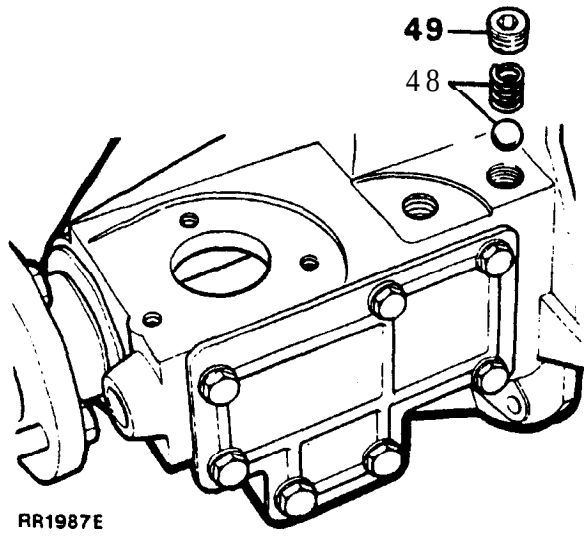
ST1617M

46. Compress the spring between the fork lugs and slide the retaining caps on to the shaft ensuring the spring is seated in the 'cupped' side of the caps.
47. Apply a suitable sealant, a new seal cup, and drive the cup into position.



ST1644M

48. Fit selector shaft detent ball and spring in the tapped hole on top of the output housing.
49. Apply Loctite 290 to detent plug threads. Screw detent plug gently home and then unscrew two turns.



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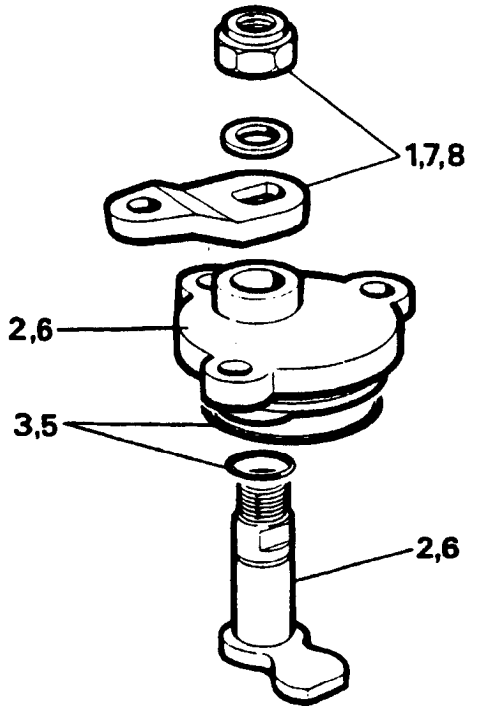
Continued

Differential lock finger housing overhaul-dismantling

1. Unscrew and discard the 'Nyloc' nut and remove the operating lever and washer.
2. Remove the pivot shalt from differential lock finger housing.
3. Remove the 'O' rings from the pivot shaft and housing and discard.
4. Clean all components; examine for wear or damage and replace if necessary.

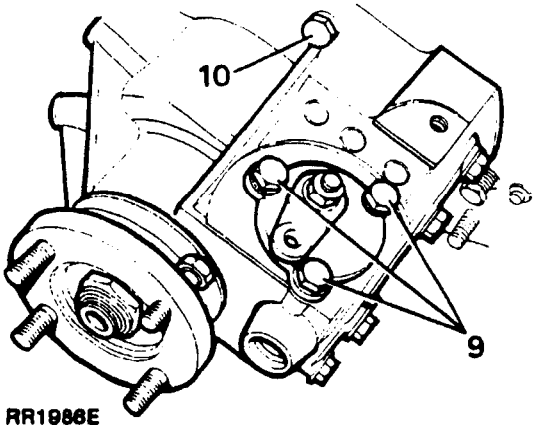
Re-assembling

5. Fit new 'O' rings on to pivot shaft and lock finger housing and lubricate with oil.
6. Locate the pivot shaft in the housing.
7. Fit the differential lock lever over the pivot shaft so that the lever will point forward as shown. This lever is then in the correct operating position.
8. Retain the lever with a plain washer and new 'Nyloc' nut.



ST1618M

9. Fit the differential lock finger housing into its seating on the front output housing, ensuring that the selector finger is located in the flat of the selector shaft.
10. Apply Loctite 290 to the bolt threads and retain the lock finger housing with the three bolts and washers to the specified torque (see section 06-Torque values).

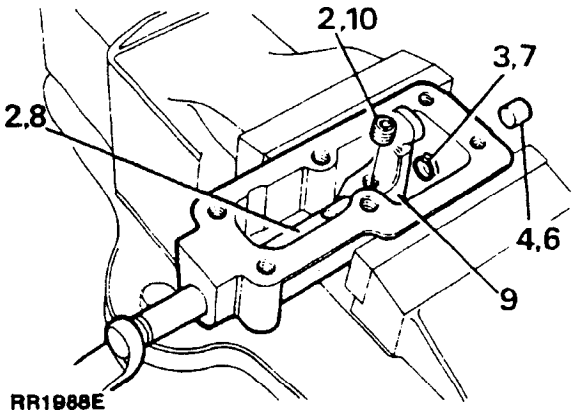


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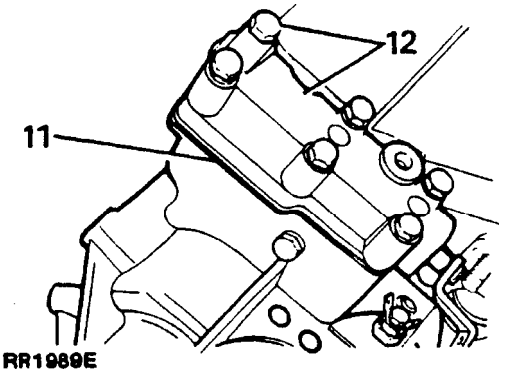
High/low cross-shaft housing overhaul

1. Release the locknut and remove the neutral warning switch.
2. Remove the selector finger set screw and withdraw the cross-shaft from the cross-shaft housing and remove the selector finger.
3. Remove the 'O' ring from the cross-shaft.
4. Drive out selector housing cup plug if necessary.
5. Clean all the components and check for damage or wear, replace if necessary.
6. Apply sealant to a new cup plug and fit so that the cup is just below the chamfer for the cross-shaft bore.
7. Fit new 'O' ring to cross-shaft.
8. Lubricate the shaft and insert into the cross-shaft housing.

9. Fit selector finger ensuring that it aligns with the recess in the cross-shaft.

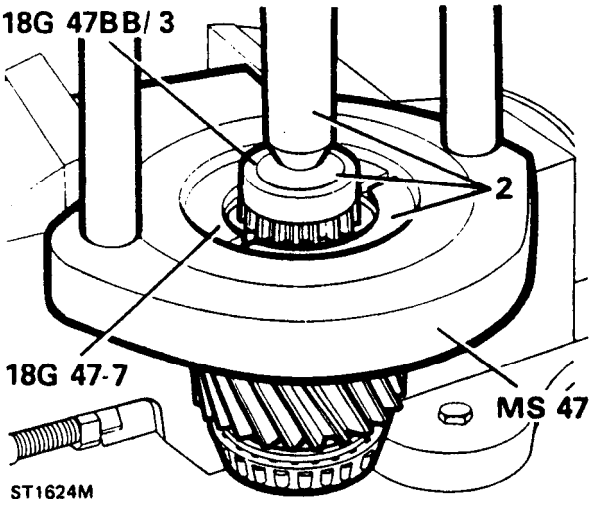


10. Apply Loctite 290 to the set screw and secure the selector finger to the cross-shaft and fully tighten to the specified torque (see section 06-Torque values).
11. Grease and fit the high/low selector housing gasket on the front output housing.
12. Fit high/low cross-shaft housing, ensuring that the selector finger locates in the slot of the selector shaft, and secure with six bolts and washers to the specified torque (see section 06-Torque values).



Input gear overhaul-dismantling

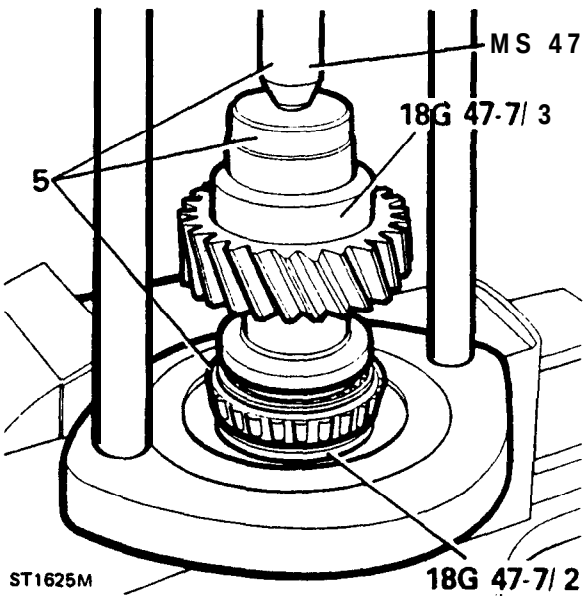
1. Clean the input gear assembly and examine for wear or damage. Remove the bearings only if they are to be replaced.
2. Secure hand press MS47 in the vice and using collars 18G47-7 and button 18G47BB3, remove rear taper roller bearing from input gear assembly.
3. Invert input gear assembly in hand press and remove front taper roller bearing.
4. Clean input gear.



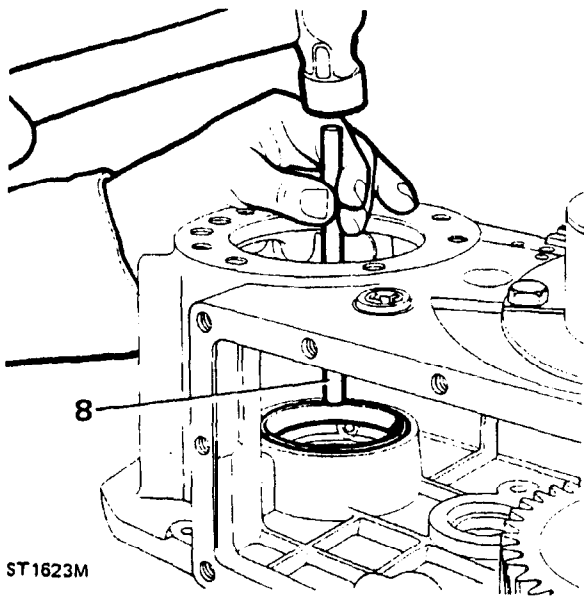
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Re-assembling

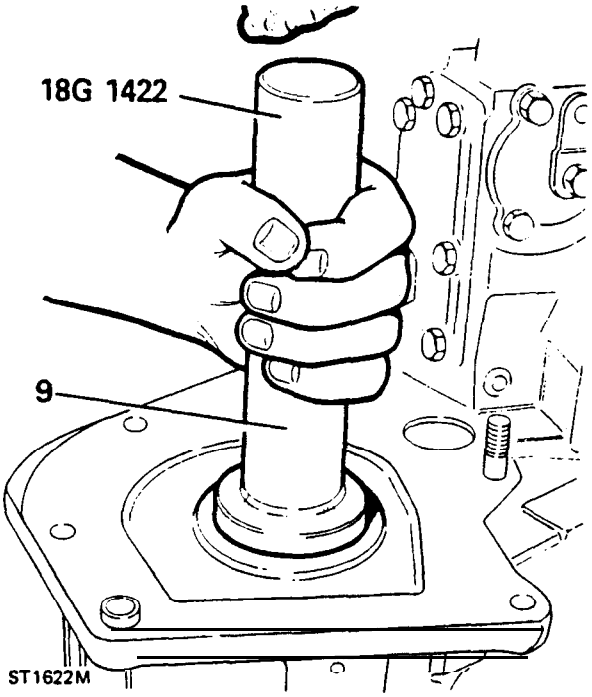
5. Position rear taper roller bearing on input gear and using hand press MS47 and collars 18G47-7 press the bearing fully home.
6. Invert input gear and fit the front taper roller **bearing using the** press and collars.



7. **Prop up the transfer box casing on the bench** with the rear face uppermost.
8. Drive in the front taper bearing track.



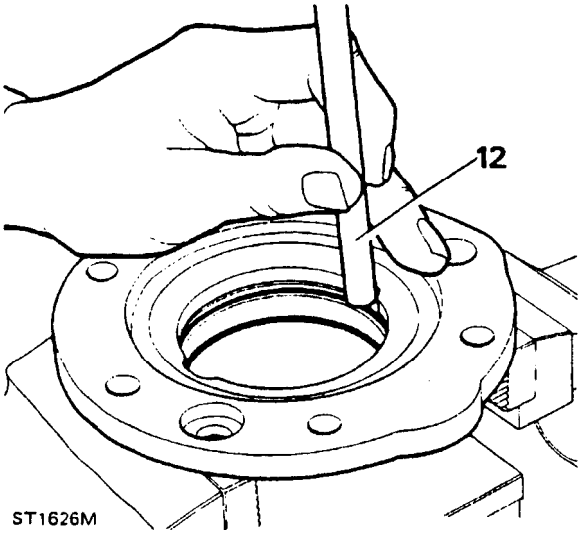
9. Reposition transfer box casing so the front face is uppermost and fit oil seal (open side inwards) using replacer tool 18G1422.



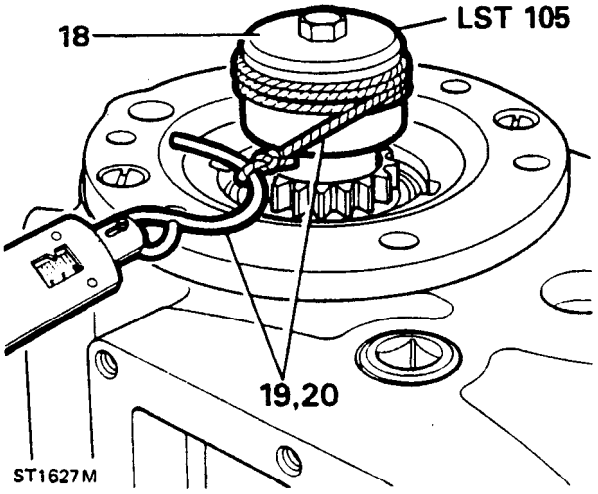
10. Lubricate both bearings with clean oil.
11. Fit the input gear assembly into the transfer box casing with the dog teeth uppermost.

Checking input gear bearing pre-load

12. Secure bearing support plate in the vice. Drive out input gear bearing track, and remove shim.



13. Clean bearing support plate and shim. Measure original shim and note its thickness.
14. Fit the original shim to the support plate.
15. Locate the bearing track in the support plate and press fully home.
16. Apply grease to the gasket and fit on to the transfer box casing.
17. Fit the bearing support plate on to the transfer box casing and secure with the six bolts, but do not tighten.
18. Fit the service tool LST105 to input gear and engage the spline.

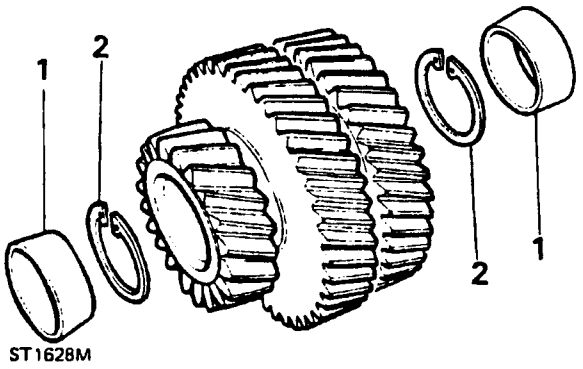


19. Tie a length of string to the cotter pin and fit it to the service tool as shown.
20. Carefully tension the string using a spring balance, little or no resistance will be felt at this stage. Tighten the bolts a little at a time, occasionally checking the rolling resistance. With the bolts tightened to the specified torque the rolling resistance should be 2.26 kg to 9 kg (5 to 20 lb). NOTE: Alternatively using a suitable torque wrench applied to the nut on the service tool, a reading for a torque to turn should be 0.56 to 2.25Nm (5 to 20 in lb).
21. If the reading obtained is outside the above limits, the original shim must be changed.
22. Remove the spring balance, string and service tool.
23. Remove the six bolts and the bearing support plate.
24. Drive out the input gear bearing track from the support plate and discard original shim.
25. Select the correct size shim to obtain a load to turn of 0.56-2.25Nm (5 to 20 in lb).
26 Fit shim to support plate, locate bearing track and press home.
27 Fit bearing support plate and secure to transfer box casing with the six bolts but do not tighten.
28. Repeat the rolling resistance check as previously described, and note the value obtained.

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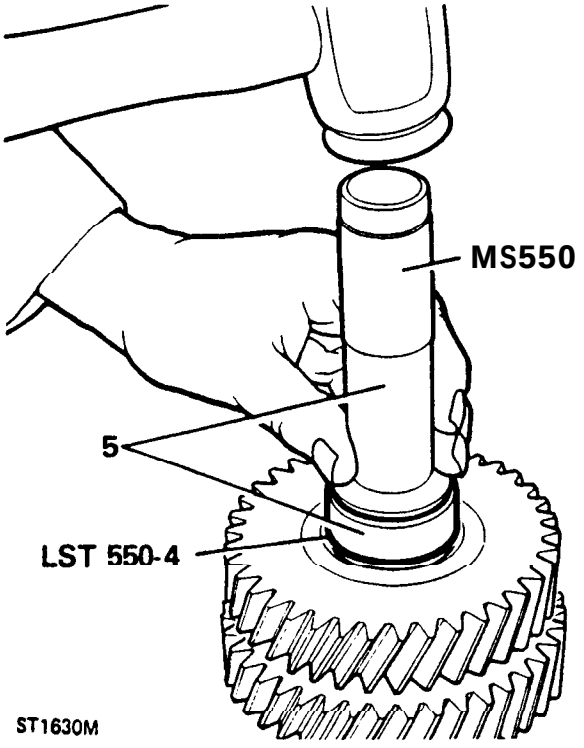
Intermediate gear assembly overhaul

1. Drive out intermediate gear bearing tracks.
2. Remove circiips.



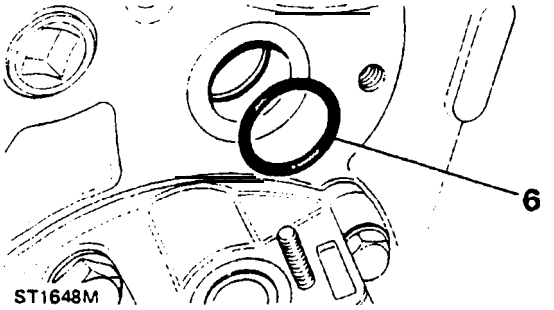
ST1628M

3. Clean all intermediate gear components and lock plate. Check for damage or wear and replace as necessary.
4. Fit new circlips into the intermediate gear cluster.
5. Using tools LST550-4 and MS550 fit bearing tracks into the intermediate gear cluster.



ST1630M

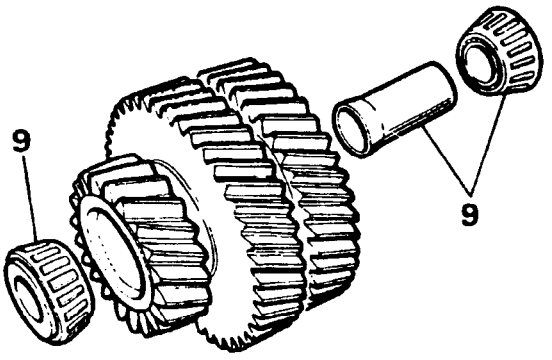
6. Fit the '0' rings to the intermediate shaft and into the intermediate shaft bore at the front of the transfer box casing.



ST1648M

Intermediate gear re-assembly

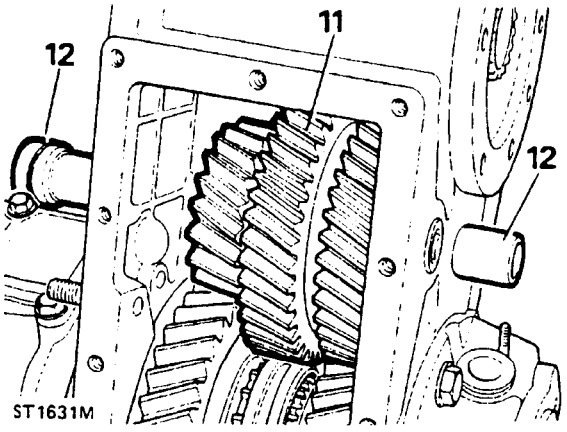
7. Check for damage to the intermediate shaft thread and if necessary clean up with a fine file or stone.
8. Lubricate the taper roller bearings and intermediate gear shaft.
9. Insert new bearing spacer to gear assembly, followed by the taper roller bearings.



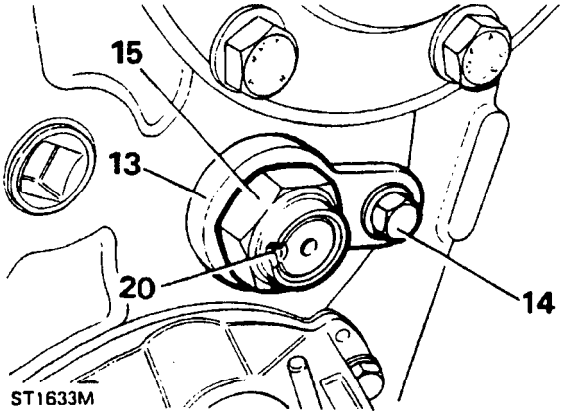
ST1 649M

10. Fit dummy shaft LST104 into the intermediate gear cluster.
11. Locate the gear assembly into the transfer box casing from the bottom cover aperture.

12. Insert intermediate shaft from the front of the transfer box casing, pushing the dummy shaft right through as shown and remove. (Making sure that the intermediate gear cluster meshes with the input gear and higher range and low range gears).



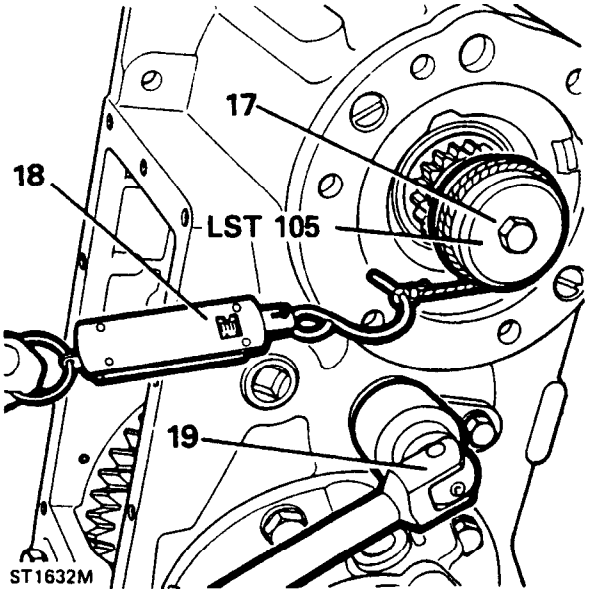
13. Turn the intermediate shaft to allow fitting of retaining plate.
14. Fit retaining plate and secure with retaining bolt and washer.
15. Fit the intermediate gear shaft retaining stake nut. Do not tighten at this stage.



Adjusting intermediate gear torque-to-turn

16. Select neutral.
17. Fit service tool LST105 to input gear and engage spline.
18. Tie a length of string to a cotter pin and fit to the service tool as shown. Attach the spring balance to the string.
19. To obtain the correct figures and to collapse the spacer within the intermediate gear cluster, tighten the intermediate shaft nut until the load-to-turn has increased by 3.7 kg (7 lb) ± 1.63 kg (± 3 lb) on that noted when checking input shaft load-to-turn.
20. Peen the stake nut by carefully forming the collar of the nut into the intermediate shaft recess, as illustrated.

CAUTION: A round nose tool must be used for this operation to avoid splitting the collar of the nut.



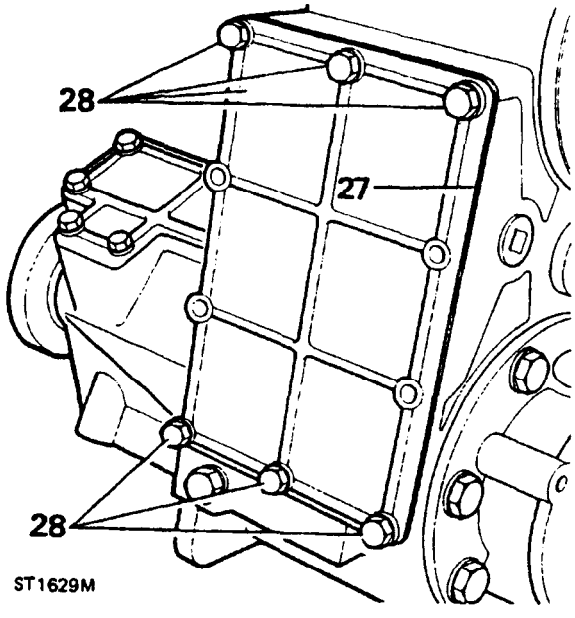
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Power take-off cover-reassemble

21. Clean power take-off cover and gasket face.
22. Fit the two countersunk screws and tighten to the specified torque (see section 06-Torque values).
23. Remove the six bolts from the bearing support plate.
24. Apply sealant to the cover plate gasket and fit it to the bearing support plate.
25. Apply Loctite 290 to bolt threads and secure the power take-off cover with the six bolts and washers to the specified torque (see section 06-Torque values).

Bottom cover-reassemble

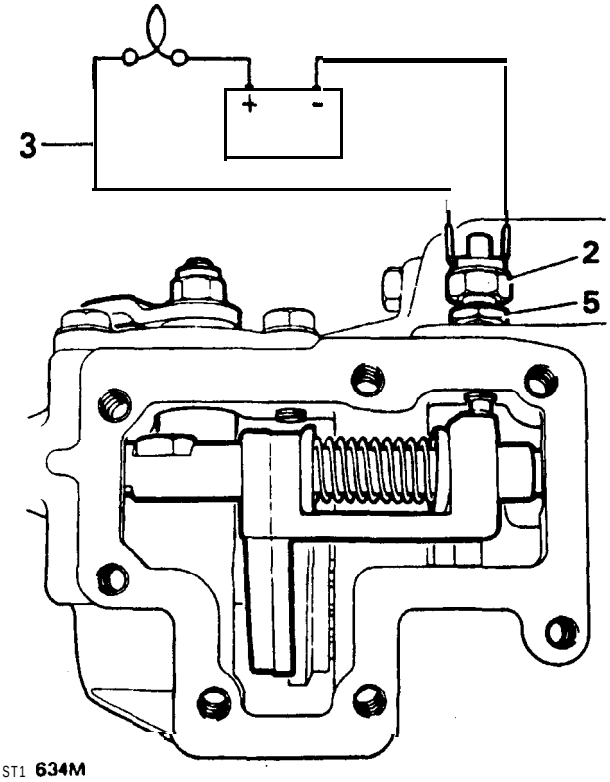
26. Clean bottom cover and gasket face.
27. Apply sealant to cover gasket and fit to transfer box casing.
28. Apply Loctite 290 to bolt threads and secure the bottom cover with six bolts and washers to the specified torque (see section 06-Torque values).



ST1629M

Differential lock switch adjustment

1. Select differential locked position by moving the differential lock lever towards the right side of the transfer box casing.
2. Apply sealant to the differential lock warning light switch and fit to the top of the front output housing.
3. Connect a test lamp circuit to the differential lock switch.
4. Screw in the lock switch until the bulb is illuminated.
5. Turn in the switch another half a turn and tighten with the locknut against the housing.

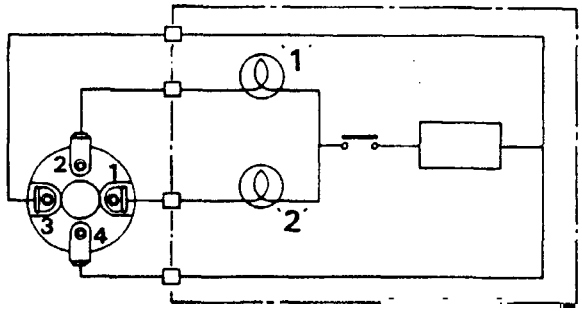


ST1 634M

6. Disconnect the battery and move the differential lock lever to the left to disengage differential lock.
7. Clean the front output housing side cover.
8. Grease and fit side cover gasket.
9. Apply Loctite 290 to bolt thread& fit side cover and secure with seven bolts and washers to the specified torque (see section 06-Torque values).

Neutral warning switch adjustment

1. Connect suitable test equipment as shown.
2. Fit the switch and neutral warning switch locknut ensuring correct setting for switch.
3. To attain the correct setting the following procedure is applied:
4. Screw the switch in until test lamp 1 is extinguished.
5. Screw in switch a further 1/3 to 1/2 turn.
6. Lock switch in position using locknut.
7. Select 'Low Range' test lamp 1 should illuminate. Select 'High Range' test lamp 2 should illuminate. Select neutral both test lamps should extinguish.



RR1990E

8. If adjustment is satisfactory remove the test equipment.

Parking brake drum-reassemble

1. Clean brake backplate and oil catcher and apply sealant to the catcher joint face.
2. Locate brake backplate on the rear output housing with the brake operating lever on the right side of the transfer box casing.
3. *Secure* the backplate (including the oil catcher) with the four special bolts and tighten using a hexagonal socket to the specified torque (see section 06-Torque values).
4. Clean and fit brake drum and secure with two countersunk screws to the specified torque (see section 06-Torque values).
5. Adjust the parking brake. (Refer to Section 70 Brakes or Section 10 Maintenance).

FAULT DIAGNOSIS: ZF4HP22 Automatic Gearbox

Before referring to the fault diagnosis chart, ensure that the following static checks are carried out first:

INITIAL STATIC CHECKS

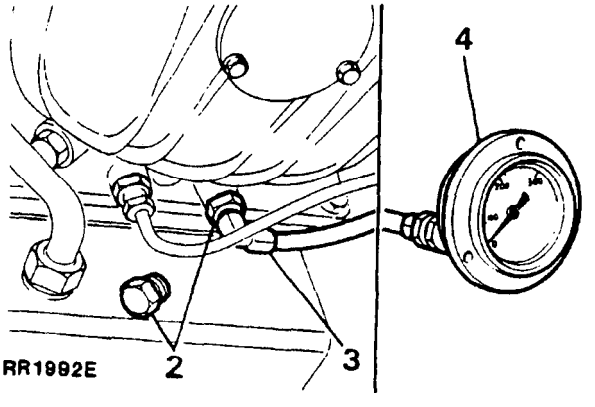
Check start positions	"P" & "N" only
Reverse lights	"R" only
Gear engagements	N-D, N-3, N-2, N-1, N-R
Full throttle	Engine switched off, check full travel at engine and at pedal.
Oil level	"N" selected, engine running at normal running temperature.
Pressure test	
2000 rev/min	150 ± 5 p.s.i.
Idle pressure	100 ± 5 p.s.i. at 665 to 735 rev/min.

FIT PRESSURE GAUGE

Service tools:

18G502A 0-300 PSI (O-22 kg/cm*) pressure gauge.
18G502-Flexible hose
LST502-11 Hose adaptor

1. Drive the vehicle onto a suitable hoist.
2. From beneath the vehicle, remove the plug from the bottom of the gearbox, fit the adaptor LST502-11 and tighten securely.
3. Fit the hose to the adaptor and tighten securely.
4. Fit the gauge 18G502A to the other end of the hose and route to the interior of the vehicle, ensuring that the hose is fastened clear of any rotating parts and exhaust pipes.



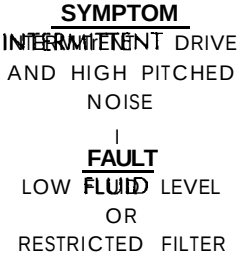
5. Remove the vehicle from the hoist and carry out road test.

Remove the pressure gauge

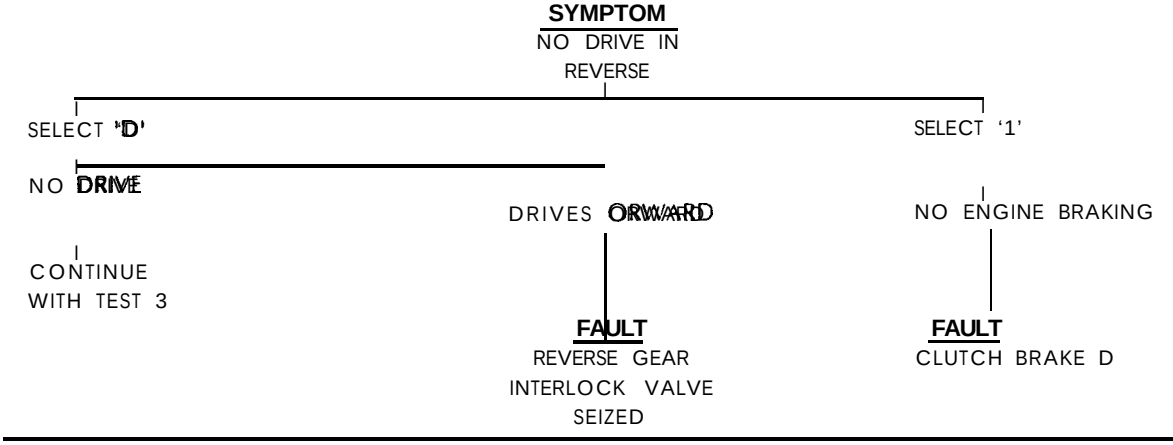
6. Drive the vehicle onto a suitable hoist and then reverse instructions 1 to 4.

FAULT DIAGNOSIS-ZF4HP22 AUTOMATIC GEARBOX:

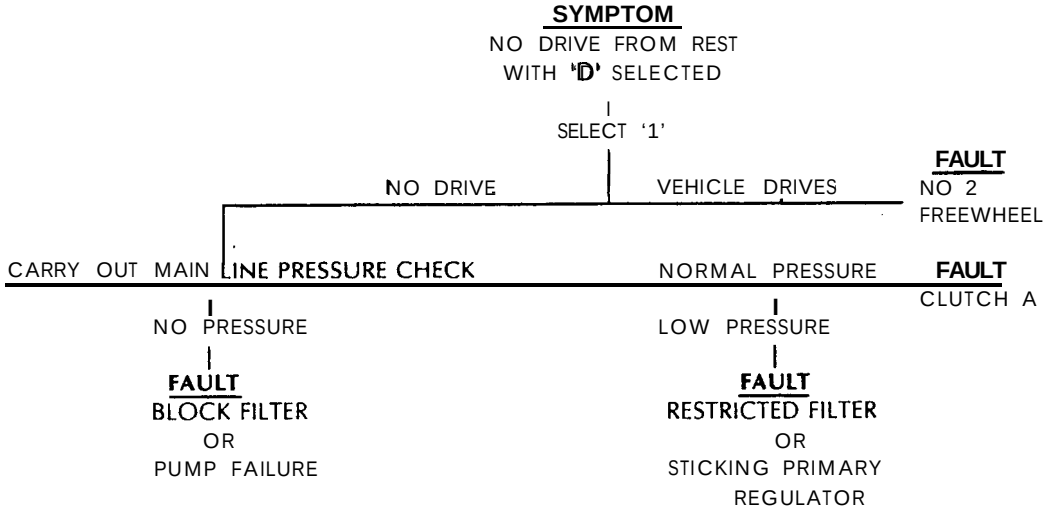
TEST 1



TEST 2



TEST 3



TEST 4

SYMPTOM
SLIP IN ALL FORWARD GEARS
CARRY OUT MAIN LINE PRESSURE CHECK

NO PRESSURE	LOW PRESSURE	NORMAL PRESSURE
FAULT	**FAULT**	**FAULT**
BLOCKED FILTER OR PUMP FAILURE	RESTRICTED FILTER STICKING PRIMARY REGULATOR	CLUTCH 'A'

TEST 5

SYMPTOM
HARSH ENGAGEMENT 'N' TO 'D'
CHECK ENGINE IDLE SPEED
CARRY OUT MAIN LINE PRESSURE CHECK

HIGH P ESSURE	NORMAL PRESSURE
FAULT	**FAULT**
PRIMARY REGULATOR SEIZED	CLUTCH 'A' OR DAMPER FOR CLUTCH'A'

TEST 6

SYMPTOM
FIERCE SHIFT OR FLARE 1ST TO 2ND SHIFT
CARRY OUT
MAINLINE PRESSURE CHECK

HIGH PRESSURE		NORMAL PRESSURE
CONTINUE WITH TEST 5	MODULATOR VALVE OR DAMPERS FOR CLUTCH BRAKE C' AND/OR CLUTCH BRAKE C	**FAULTS** POSSIBLE CLUTCH BRAKE C' AND/OR CLUTCH BRAKE C

TEST 7

SYMPTOM
FIERCE SHIFT OR FLARE
2ND TO 3RD

CARRY OUT MAIN LINE PRESSURE CHECK

HIGH PRESSURE → CONTINUE WITH TEST 5

NORMAL PRESSURE → **FAULTS** POSSIBLE

- MODULATOR VALVE OR CLUTCH 'B' DAMPER
- CLUTCH 'B'

TEST 9

SYMPTOM
NO 3RD GEAR

FAULTS
POSSIBLE

- **2-1 SHIFT VALVE**
- CLUTCH 'B'

TEST 9

SYMPTOM
NO 4TH GEAR
'D' SELECTED

FAULTS
POSSIBLE

- 4TH **TO 3RD DOWNSHIFT VALVE SEIZED OR 3RD TO 4TH UPSHIFT VALVE SEIZED.**
- CLUTCH BRAKE 'F'

TEST 10

SYMPTOM
NONE OR HARSH ENGAGEMENT OF DIRECT DRIVE CLUTCH

NOTE:THE DIRECT DRIVE CLUTCH WILL-ONLY ENCAGE IF 4TH GEAR IS ENGAGED SEE SECTION 04 FOR LOCK-UP AND UNLOCK SPEEDS APPROPRIATE TO MODEL YEAR.

CARRY OUT ROAD TEST PRESSURE CHECK WITH GAUGE CONNECTED TO TORQUE CONVERTER.

PRESSURE NORMAL

FAULT
FAILED DIRECT DRIVE CLUTCH

PRESSURES CORRECT BUT REMAIN HIGH

FAULTS
POSSIBLE

DIRECT DRIVE CLUTCH AND TORQUE CONVERTER CONTROL VALVE SEIZED

HYSTERESIS VALVE SEIZED

DIRECT DRIVE CLUTCH CONTROL VALVE SEIZED

TEST 11

SYMPTOM
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 MAIN LINE AND TORQUE CONVERTER PRESSURE CHECK

PRESSURE NORMAL

FAULT
GOVERNOR VALVE STICKING

LOW OR INCORRECT PRESSURE

FAULTS
POSSIBLE

DIRECT DRIVE CLUTCH CONTROL VALVE STICKING

HYSTERESIS VALVE STICKING

DIRECT DRIVE CLUTCH AND TORQUE CONVERTER CONTROL VALVE STICKING

TEST 12

SYMPTOM
DRIVES IN 'D' 1ST BUT IMMEDIATELY UPSHIFTS TO 3RD

FAULT
2ND TO 3RD SHIFT VALVE SEIZED

TEST 13

SYMPTOM
WITH 'D' SELECTED
VEHICLE STARTS
IN 2ND

FAULTS
POSSIBLE

- 1ST AND 2ND SHIFT VALVE SEIZED
- GOVERNOR SLEEVE STICKING

TEST 14

SYMPTOM
WITH 'D' SELECTED
VEHICLE STARTS IN 2ND OR 3RD
WITH NO FURTHER UP OR DOWNSHIFTS

FAULTS
POSSIBLE

- GOVERNOR SLEEVE STICKING
- 1ST TO 2ND AND 2ND TO 3RD SHIFT' VALVES SEIZED

TEST 15

SYMPTOM
NO KICKDOWN
4TH TO 3RD

FAULT
4TH TO 3RD KICKDOWN VALVE SEIZED

TEST 16

SYMPTOM
UPSHIFTS/DOWNSHIFTS
AND KICKDOWN SHIFTS
AT INCORRECT ROAD SPEEDS

CHECK THROTTLE KICKDOWN CABLE ADJUSTMENT

CARRY OUT MAIN LINE PRESSURE CHECK

- INCORRECT PRESSURE
  - **FAULTS** POSSIBLE
    - INCORRECT THROTTLE VALVE ADJUSTMENT
    - PRIMARY REGULATOR STICKING
- NORMAL'PRESSURE
  - **FAULTS** GOVERNOR VALVE STICKING

TEST 17

SYMPTOM
NO UPSHIFTS AT LIGHT THROTTLE

FAULTS POSSIBLE

- GOVERNOR VALVE STICKING
- SHIFT VALVES STICKING

TEST 18

SYMPTOM
NO ENGINE BRAKING
'3' SELECTED 3RD GEAR

FAULT
CLUTCH 'C'

TEST 19

SYMPTOM
DELAYED OR NO DOWNSHIFT
OCCURS WHEN MAKING A MANUAL SELECTION FROM '3' TO '2'

FAULTS POSSIBLE

- GOVERNOR VALVE STICKING
- '2' POSITION INTERLOCK VALVE STICKING
- 2ND AND 3RD UPSHIFT VALVE STICKING

TEST 20

SYMPTOM
AT SPEEDS BELOW 28 MPH
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
- '1' POSITION INTERLOCK VALVE STICKING

TEST 21

SYMPTOM
'1' SELECTED 1ST GEAR
NO ENGINE BRAKING
|
FAULT
CLUTCH BAND 3

TEST 22

SYMPTOM
"2" SELECTED 2ND GEAR
NO ENGINE BRAKING
|
FAULT
CLUTCH BAND 1

TEST 23

SYMPTOM
VEHICLE DRIVES
FORWARD IN "N"
|
FAULT
CLUTCH 'A' SEIZED

The following repair instructions for the ZF automatic gearbox are divided into three parts. Stage one covers repairs that can be made with the gearbox installed in the vehicle, stage two is with the gearbox removed and stage three a major overhaul procedure.

NOTE: Refer lo transfer box section for removal of transfer gearbox.

Service Tools

LST108	-Rear oil seal replacer
LST109	-Selector linkage setting gauge.
LSTI11	-Oil pump rotation sleeve and end float gauge.
LSTI12	-Kickdown cable remover.
LSTI13	-Control unit inlet oil seals remover/replacer.
LSTI14	-Selector shaft oil seal replacer.
TX27	-Torx bit.
TX30	-Torx bit.
18G1501	-Torque converter remove/refit handles.
LSTII5	-B clutch assembly puller hooks.
LSTII6	-B clutch 'O' ring and snap ring replacer.
LSTII7	-Gear train remover and replacer.
LSTII8	-Transmission holding fixture.
LSTI016-11	-Adaptor clutch spring compressor.

Gearbox Data

Axial end float 0.2 to 0.4 mm (0.008 to 0.016 in).

From torque converter boss to torque converter housing face SO mm (1.96 in).

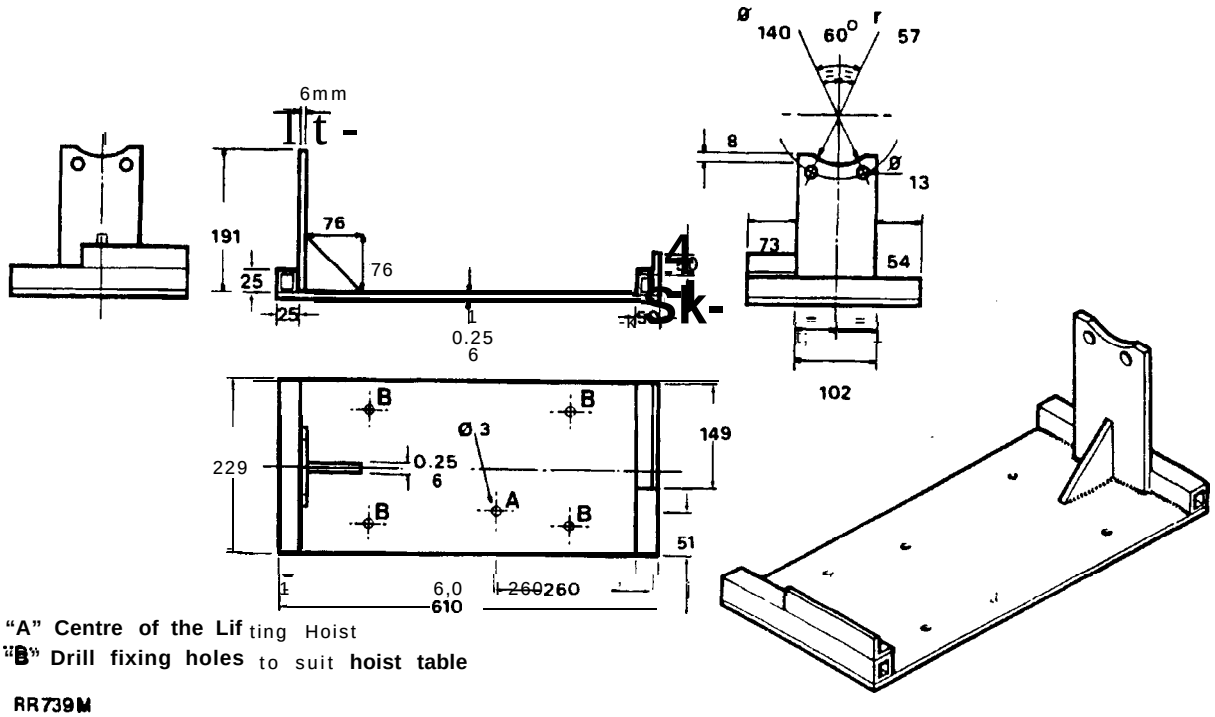
Freewheel cage assembly to ring gear; minimum clearance 0.1 mm (0.0039 in).

Output shaft above cylinder F assembly; dimension 10.00 mm (0.354 in).

A cylinder protrusion above gearbox front face not more than 8.5 mm (0.33 in).

In addition to the above service tools, the following items should be manufactured locally to facilitate dismantling and re-assembly of the gearbox.

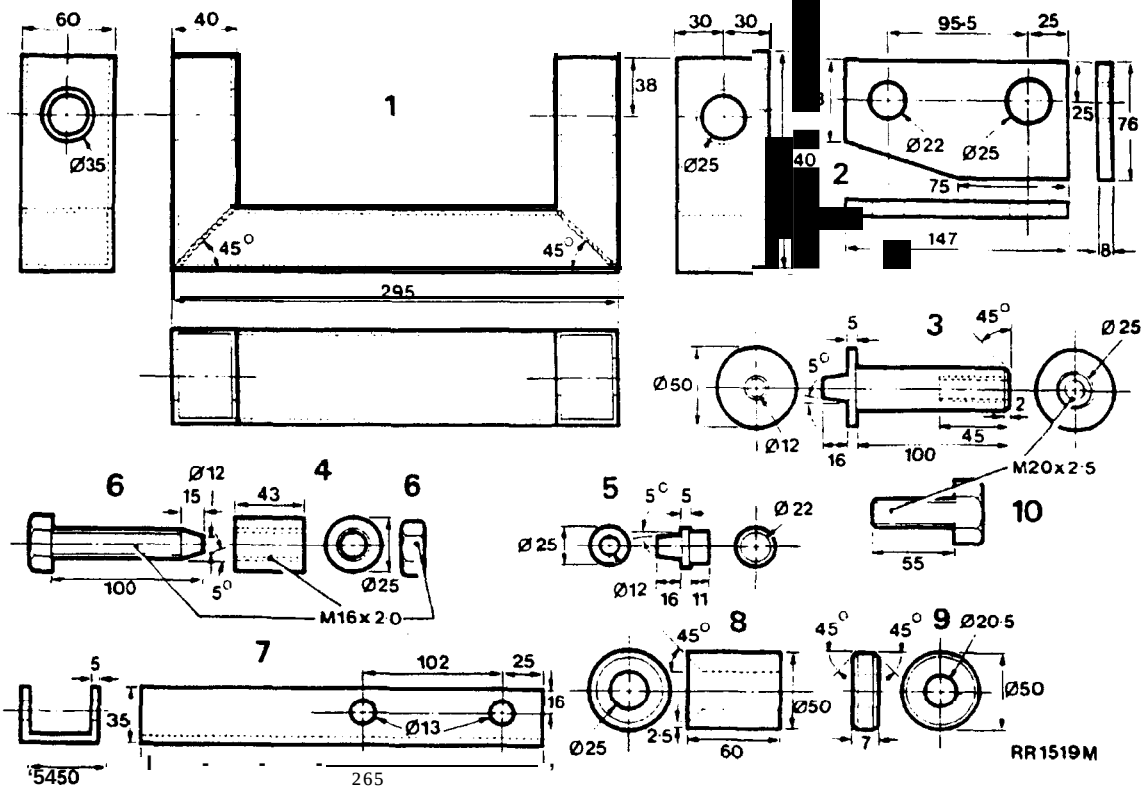
TRANSFER AND AUTOMATIC ADAPTOR PLATE



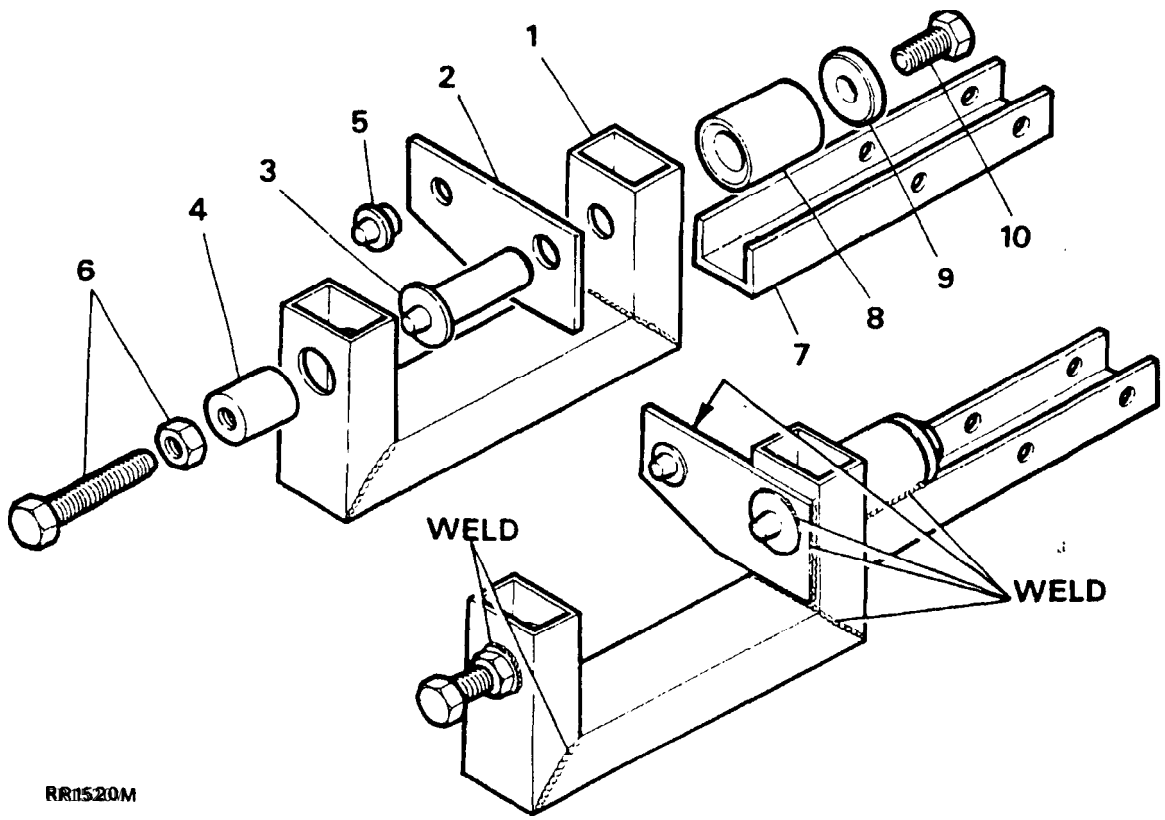
"A" Centre of the Lifting Hoist
"B" Drill fixing holes to suit hoist table

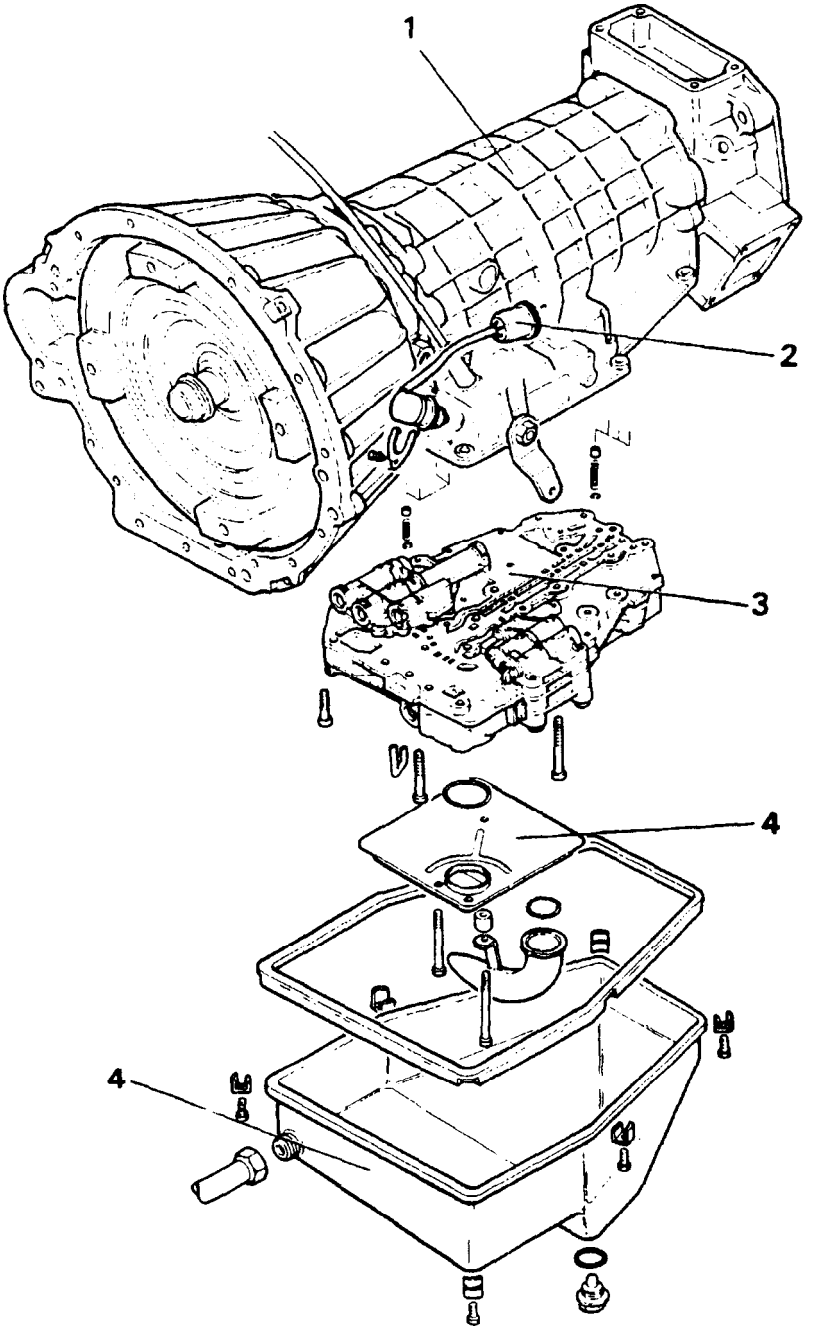
RR739M

NOTE: The fixture below can either be manufactured or purchased: fixture number LST 118.



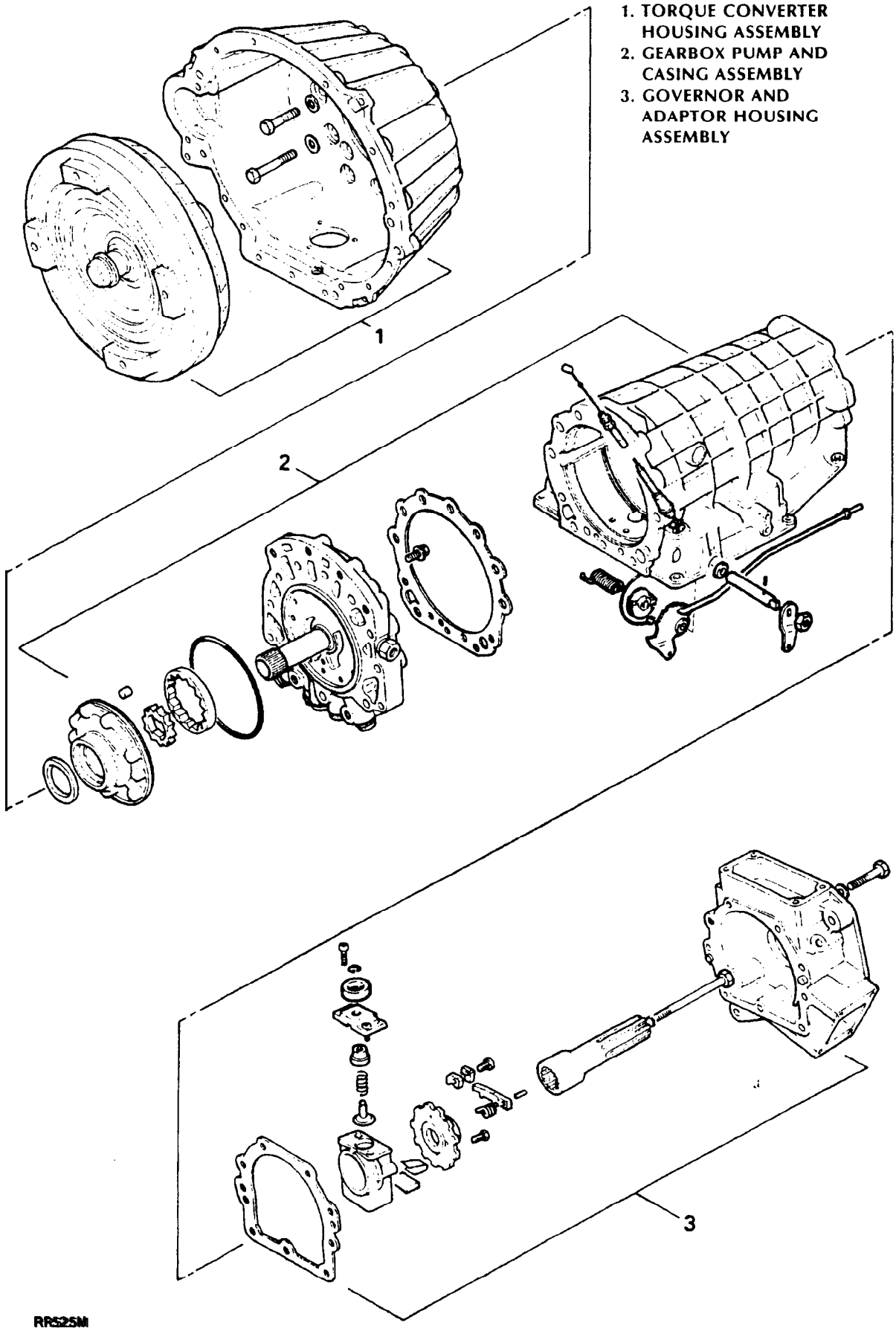
AUTOMATIC GEARBOX HOLDING FIXTURE





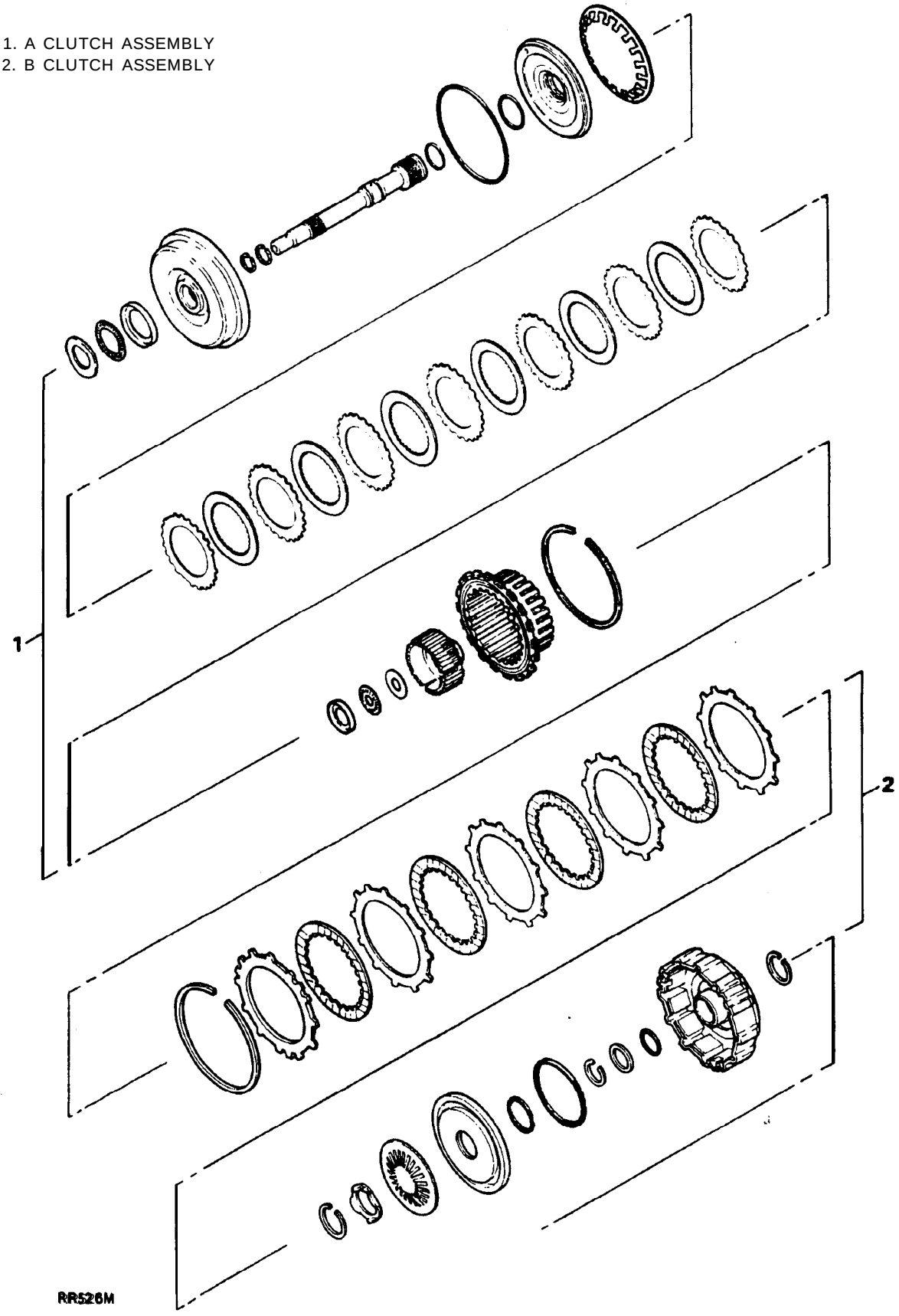
RR524M

1. GEARBOX ASSEMBLY
2. INHIBITOR SWITCH ASSEMBLY
3. CONTROL UNIT ASSEMBLY
4. FILTER AND SUMP ASSEMBLY

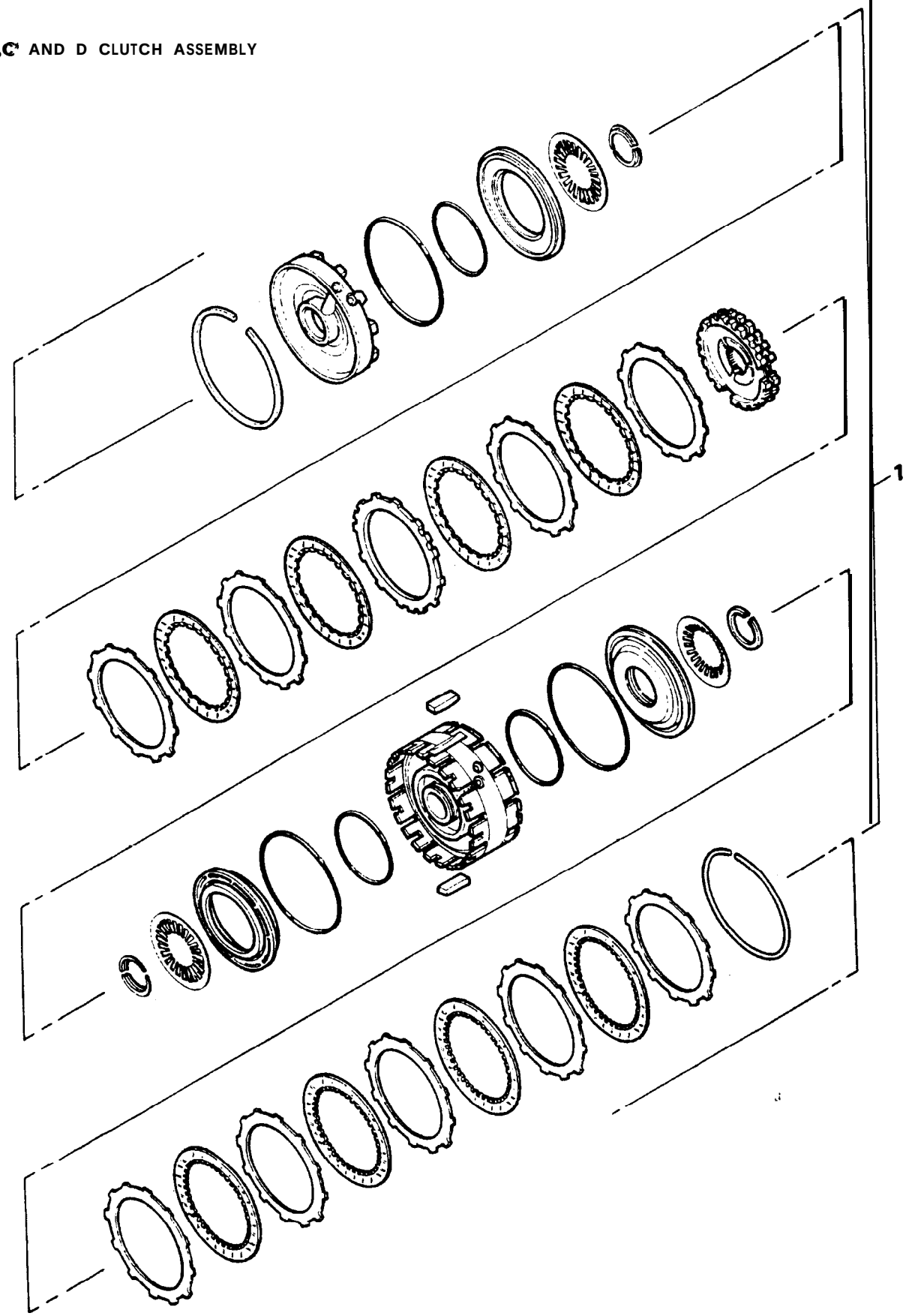

1. TORQUE CONVERTER HOUSING ASSEMBLY
2. GEARBOX PUMP AND CASING ASSEMBLY
3. GOVERNOR AND ADAPTOR HOUSING ASSEMBLY
1
2
3

RR525M

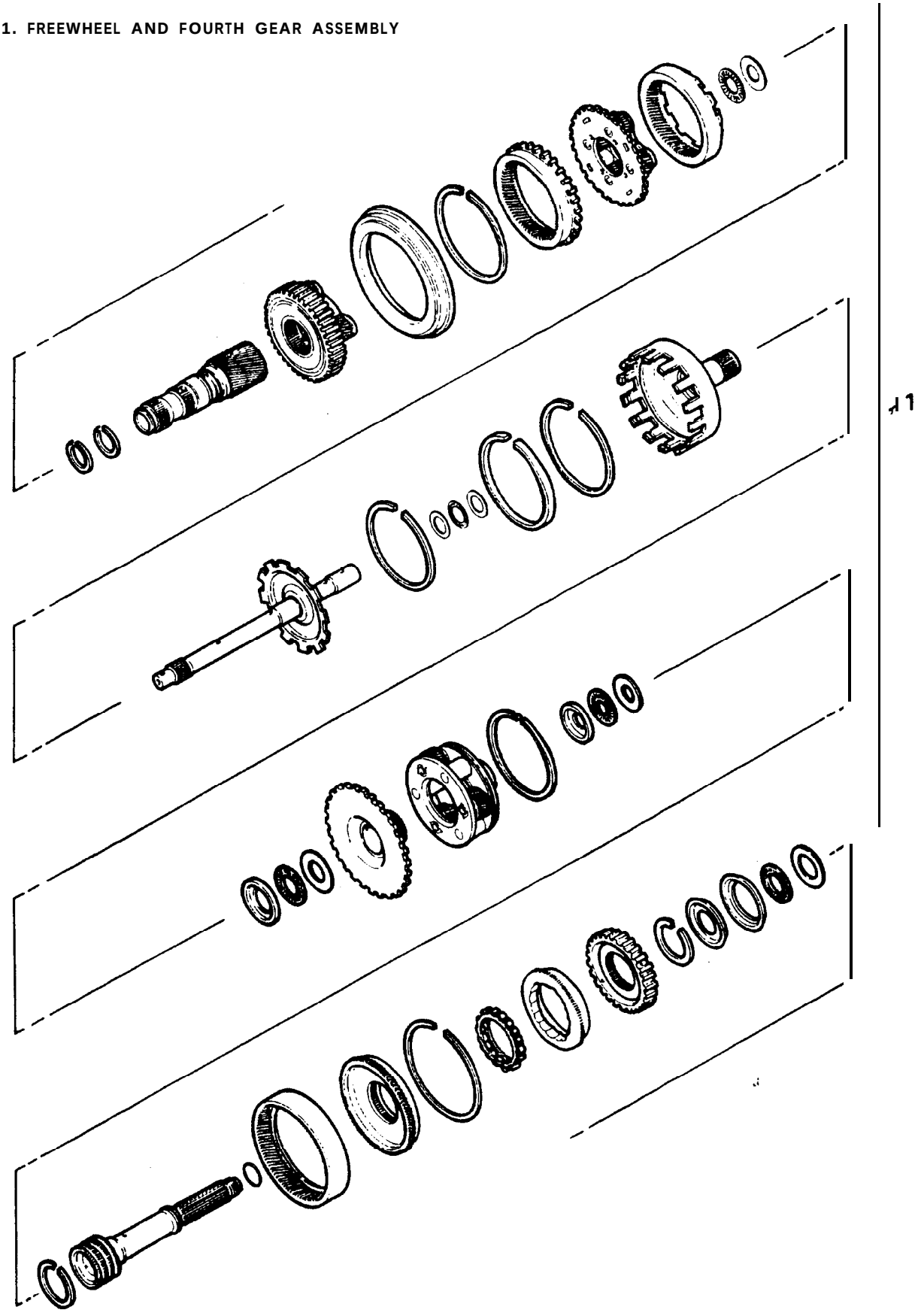
1. A CLUTCH ASSEMBLY
2. B CLUTCH ASSEMBLY



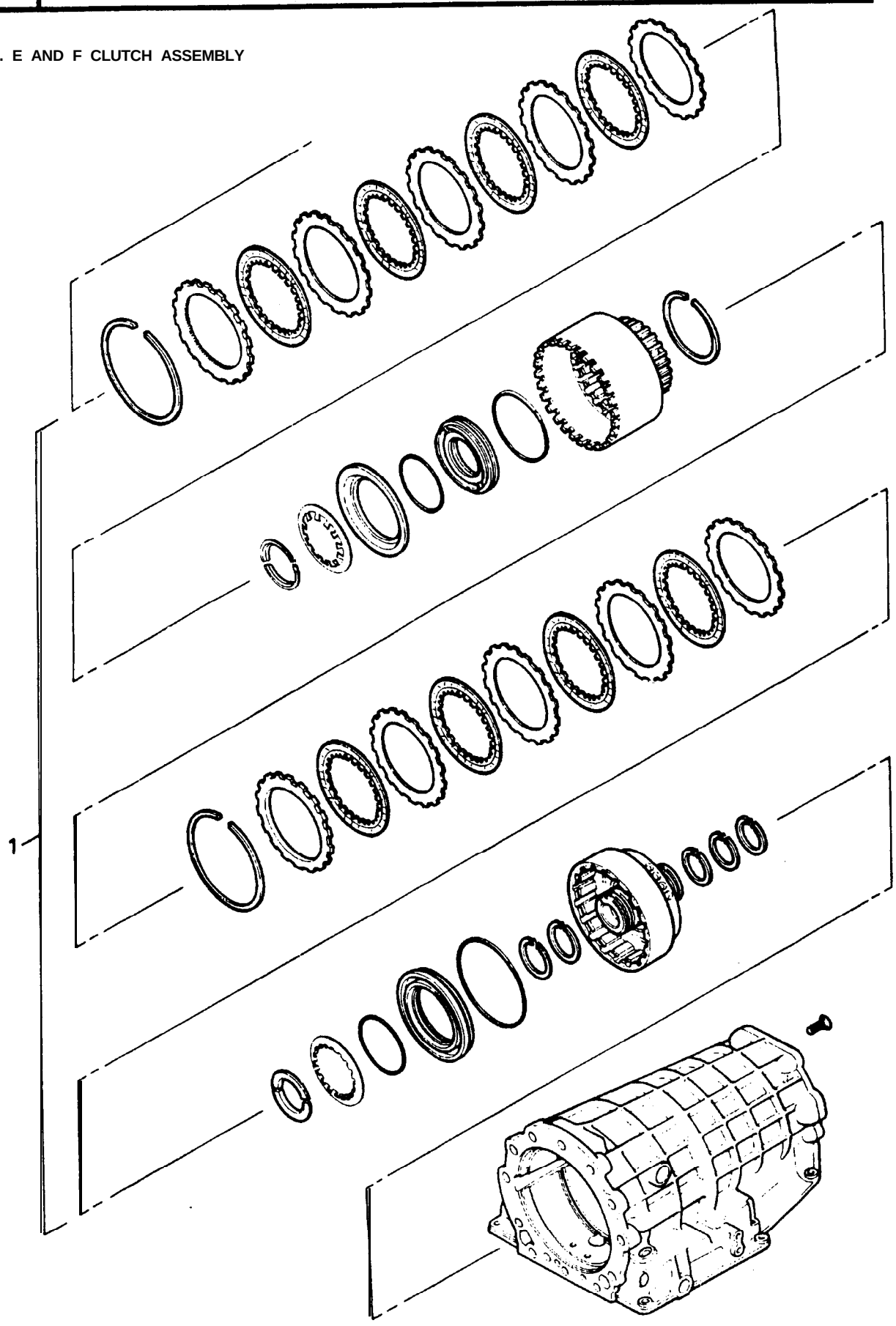
1. C,C' AND D CLUTCH ASSEMBLY



1. FREEWHEEL AND FOURTH GEAR ASSEMBLY



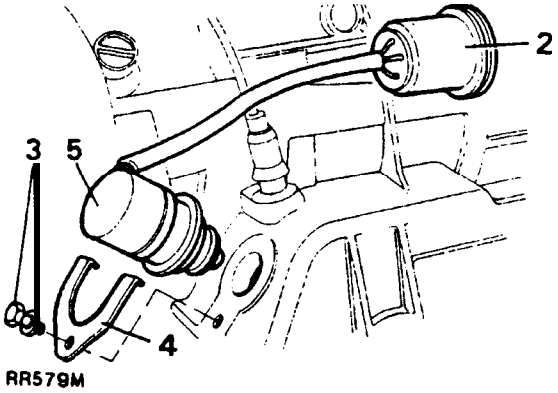
1. E AND F CLUTCH ASSEMBLY



STAGE 1

Inhibitor switch leak elimination

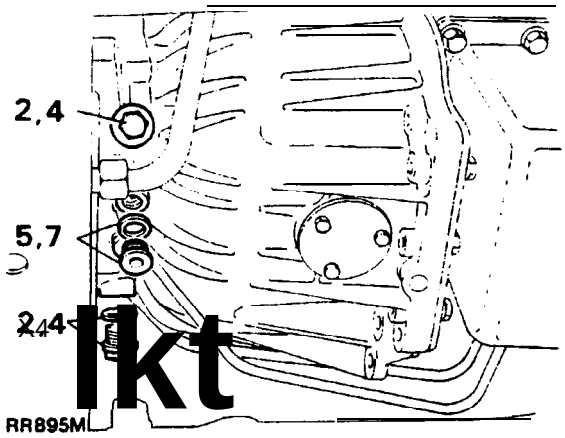
1. Place vehicle on a suitable hoist or over a pit, open the hood and disconnect the battery leads.
2. From underneath the vehicle disconnect the inhibitor lead.
3. Undo and remove the bolt and spring washer.
4. Remove the retaining plate.
5. Using a suitable tool remove the inhibitor switch from the casing.
6. Fit a new inhibitor switch, retaining plate if existing one is damaged, spring washer and bolt.
7. Reconnect the inhibitor leads.



Intermediate plate screw plugs leak elimination.

NOTE: The following procedure is for all four plugs on the plate. Seals that actually leak should be replaced.

1. Place the vehicle on a suitable hoist or over a pit, open the hood and disconnect the batten/ leads.
2. From underneath the vehicle, using a suitable wrench remove the two hexagon headed plugs situated in the intermediate plate, catching any oil that may leak from the plate.

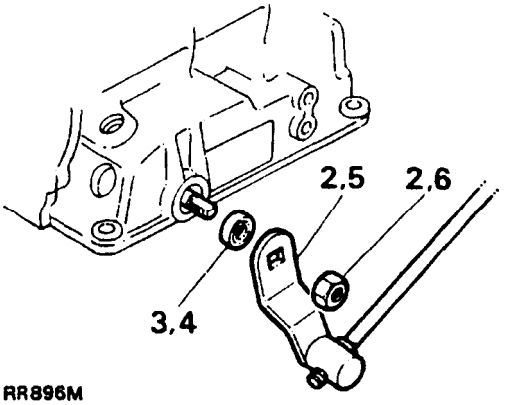


3. Remove and discard the sealing rings.
4. Fit new sealing rings and refit the plugs to the specified torque.
5. Using a suitable hexagon shaped tool, remove the two hexagon socket plugs, catching any oil that may leak from the plate.
6. Remove and discard the sealing rings.
7. Fit new sealing rings and refit the plugs to the specified torque.
8. Connect the battery.
9. Top up the gearbox with the correct oil through the filler level tube located within the engine bay. (See Section 09).
10. Ensuring the vehicle is on level ground with the parking brake applied check oil level while engine is running at idle with neutral selected after selecting each gear.

Continued

Selector shaft leak elimination

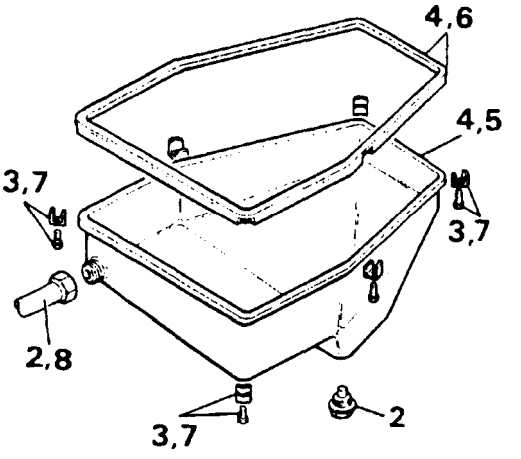
1. Place vehicle on a hoist or over a pit, open the hood and disconnect the battery leads.
2. From underneath the vehicle remove the nut and gear-change lever.
3. Using a suitable tool remove the oil seal.
4. Fit the new oil seal using the selector shaft oil seal replacer LST114. For ease of fitment use a light grease or Petroleum Jelly.
5. Refit gear-change lever, ensure that it is located correctly.
6. Fit and tighten nut to the specified torque (see section 06-Torque values).



RR896M

Oil pan leak elimination

1. Place vehicle on a suitable hoist or over a pit open the hood and disconnect battery leads.
2. From underneath the vehicle drain the gearbox using a suitable container and remove the oil filler level tube.
3. Remove the six retaining plates and bolts.
4. Remove the sump and discard the gasket.
5. Inspect sump for wear or damage. Replace if necessary.
6. Fit new gasket onto sump.
7. Refit sump using the six retaining plates and screws (two straight and four corner plates) to the specified torque (see section 06-Torque values).



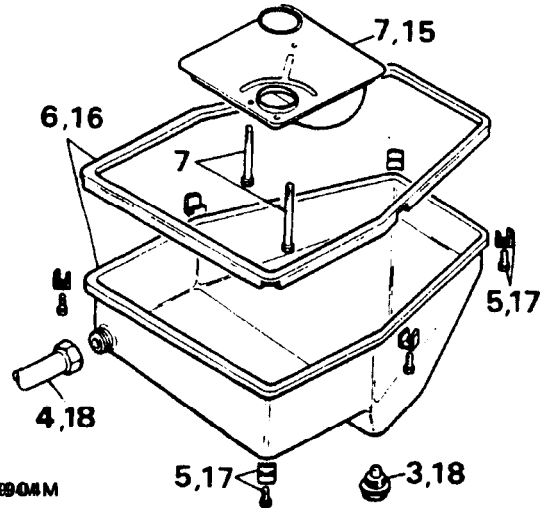
RR903M

8. Reconnect oil filler level tube, sump plug with a new seal to the specified torque (see section 06-Torque values).
9. Connect the battery leads.
10. Fill the gearbox with the correct oil (See Section 09).
11. Ensuring the vehicle is on level ground with the parking brake applied check oil level while engine is running at idle with neutral selected after selecting each gear.

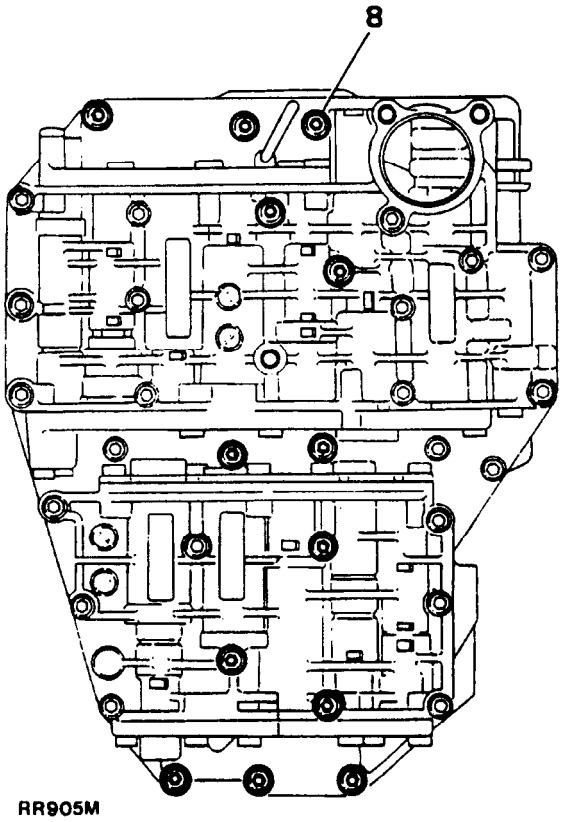
NOTE: If leak persists and existing oil pan has been refitted, change the oil pan using the same procedure as above.

Kickdown cable leak elimination

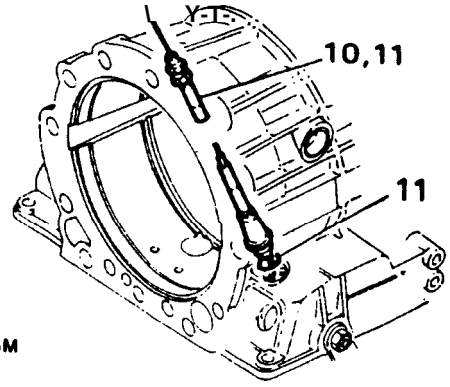
1. Place the vehicle on a suitable hoist or over a pit, open the hood and disconnect the battery leads.
2. Disconnect the kickdown cable from the rear of the engine.
3. from underneath the vehicle, using a suitable container drain the gearbox and discard the gearbox sump seal.
4. Remove the oil filler level tube.
5. Remove the six retaining plates and bolts.
6. Remove the sump and discard the gasket.



7. Remove the oil screen, undoing the three bolts using a TX27 **Torx** bit.
8. Remove the control unit, undoing the thirteen remaining bolts using a TX27 **Torx** bit.

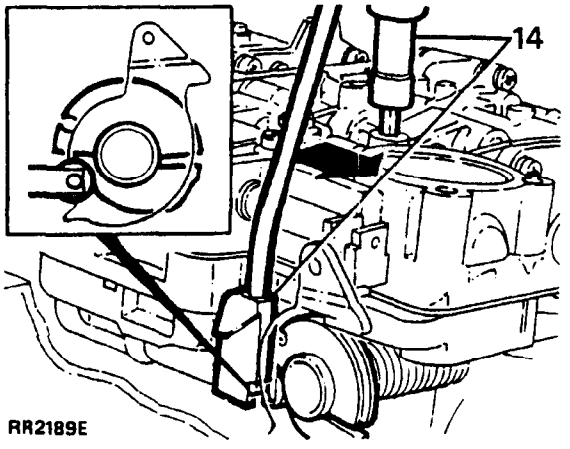


9. Locate the selector cam and remove the nipple holding the kickdown cable from its seat.
10. Using the kickdown cable remover LST112 remove the cable and it's housing from the casing and discard.
11. Fit new throttle cable with new 'O' ring into the casing.



Continued

12. Fit the nipple into the cam seat ensuring that the cam has been turned once before fitment. This will spring load the cam.
13. Fit the control unit after cleaning the face with a lint free rag, ensuring the selector shaft locates into the gear shift fork and fit the thirteen bolts loosely by hand.
14. Place the selector linkage setting gauge LST109 in position and gently press the control unit in the direction as shown and tighten all thirteen bolts using TX27 Torx bit to the specified torque (see section 06-Torque values).



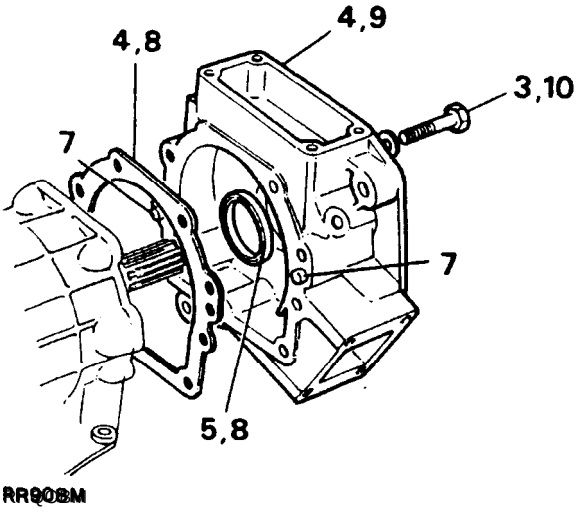
15. Remove setting gauge and fit oil screen using TX27 Torx bit to the specified torque (see section 06-Torque values).
16. Refit sump with new gasket.
17. Refit the six retaining plates and screws (two straight and four corner plates) to the specified torque (see section 06-Torque values).
18. Reconnect oil filler tube and sump plug with a new seal to the specified torques (see section 06-Torque values).
19. Connect the battery leads.
20. Fill the gearbox with the correct oil (see Section 09).
21. Connect the kickdown cable to the rear of the engine.

NOTE: The kickdown cable must be adjusted while the vehicle is running at idle.

22. Adjust the cable sheath to achieve a crimp gap of 0.25 to 1.25 mm (.010 to .050 in).
23. Hold the cable sheath while tightening the locknuts.
24. Ensuring the vehicle is on level ground with the parking brake applied, check oil level while engine is running at idle with neutral selected, after selecting each gear.

Extension case leak elimination

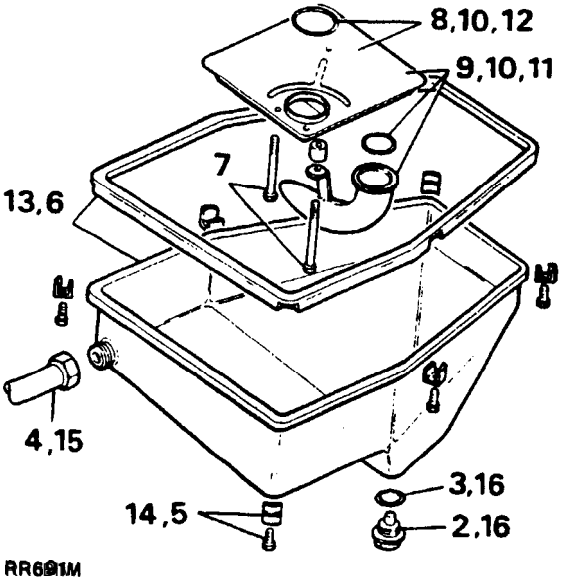
1. Remove the transfer box as described in Section 37.
2. Using a suitable tool release the four bolts from inside the vehicle holding the transfer gear selector housing and adaptor bracket.
3. From underneath the vehicle using a suitable tool release the nine bolts holding the extension housing.
4. Remove the extension housing and discard the gasket.
5. Place extension housing on the bench and remove the oil seal.
6. Ensure that all the surfaces are clean and the case is free from damage. If damage has been found on the case, replace the case.
7. If the case has to be replaced, fit the two dowels to the case.
8. Fit a new gasket and oil seal using the rear oil seal replacer LST108.



9. Fit the extension case onto the gearbox ensuring the oil seal is not damaged by the extension shaft.
10. Fit and tighten the nine bolts to the specified torque (see section 06-Torque values).
11. From inside the vehicle refit the four bolts which hold the transfer gear selector housing and adaptor bracket.
12. Secure the four bolts to the specified torque (see section 06-Torque values).
13. Refit the transfer box as described in Section 37.

Oil Screen

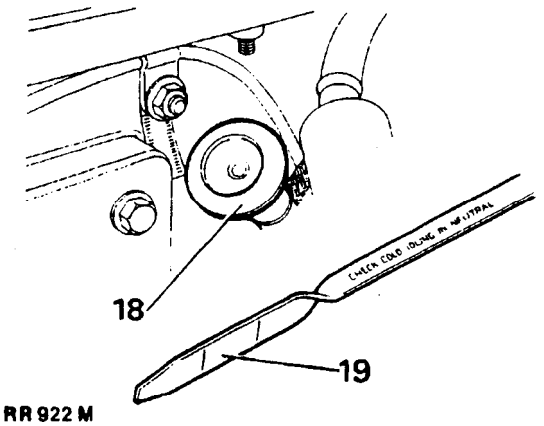
1. Place the vehicle on a suitable hoist or over a pit, open the hood and disconnect the battery leads.
2. From underneath the vehicle drain the gearbox using a suitable container.
3. Discard the sump plug seal ring.
4. Remove the filler/level tube from the sump.
5. Remove the six retaining plates and bolts.
6. Remove the sump and discard the gasket.
7. Using TX27 Torx bit undo the three screws which hold the oil screen.
8. Remove the oil screen and discard the '0' rings.
9. Separate the oil screen from the suction tube and discard the '0' ring and oil screen.
10. Fit two new '0' rings to the oil screen using a light grease for ease of assembly.
11. Fit the suction tube to the oil screen.
12. Fit the oil screen to the control unit and secure with three bolts using TX27 Torx bit tighten to the specified torque (see section 06-Torque values).



13. Refit the sump using a new gasket.
14. Secure using the six retaining plates and bolts (two straight and four comer plates), tighten to the specified torque (see section 06-Torque values).
15. Reconnect the oil level/filler tube to the specified torque (see section 06-Torque values).
16. Fit sump plug using a new seal to the specified torque (see section 06-Torque values).
17. Connect the battery leads.

Continued

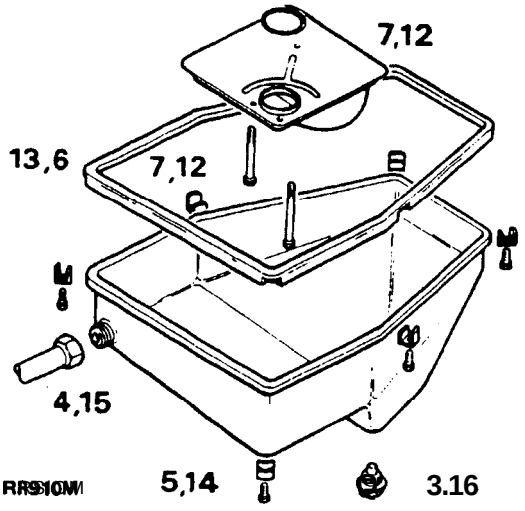
18. Fill the gearbox with the correct oil through the filler/level tube located within the engine bay. (See Section 09).
19. Ensuring the vehicle is on level ground with the parking brake applied, check oil level while engine is running at idle with neutral selected.



RR 922 M

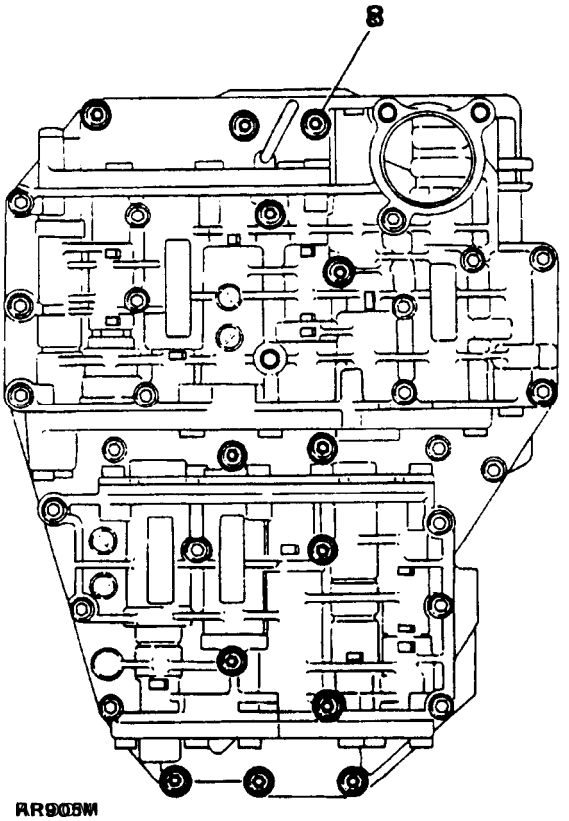
Control Unit

1. Place the vehicle on a suitable hoist or over a pit, open the hood and disconnect the battery leads.
2. From underneath the vehicle drain the gearbox using a suitable container.
3. Discard the sump plug seal ring.
4. Remove the oil filler/level tube from the sump.



RR910M

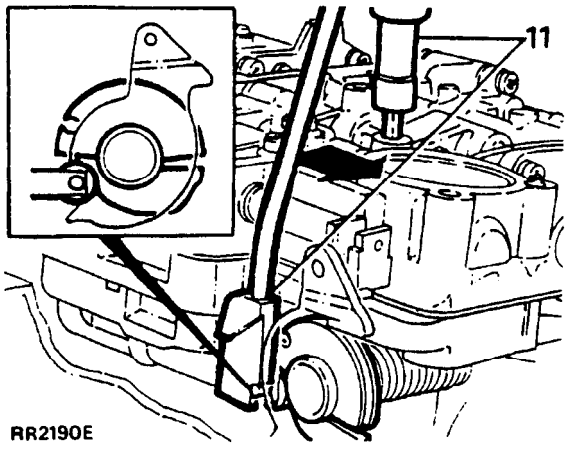
5. Remove the six retaining plates and bolts.
6. Remove the sump and discard the gasket.
7. Using a TX27 Torx bit undo the three bolts which hold the oil screen.
8. Using a TX27 Torx bit undo the remaining thirteen bolts retaining the control unit.



RR905M

9. Clean the surfaces ensuring no damage has occurred to the mounting face of the case, using a lint-free rag.
10. Fit the new control unit ensuring the selector shaft locates into the gear shift fork and fit the thirteen bolts loosely by hand.

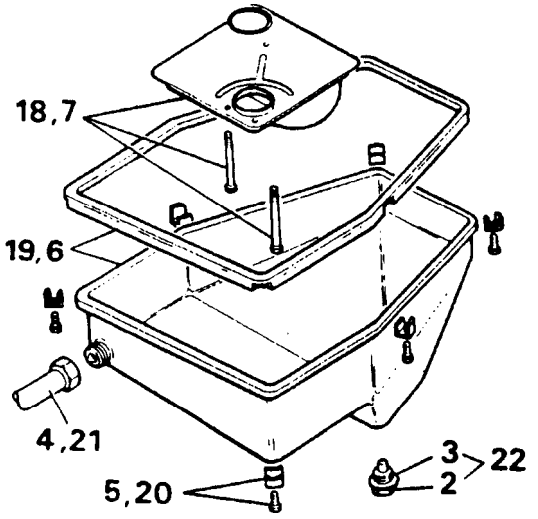
11. Place the selector linkage setting gauge LST109 in position and gently press the control unit against the tool and tighten all thirteen bolts using TX27 Torx bit to the specified torque (see section 06-Torque values).



12. Remove the setting gauge and fit the oil screen using TX27 Torx bit to the specified torque (see section 06-Torque values).
13. Refit the sump using a new gasket.
14. Secure with the six retaining plates and bolts (two straight and four corner plates), tighten to the specified torque (see section 06-Torque values).
15. Reconnect the oil filler/level tube to the specified torque (see section 06-Torque values).
16. Fit sump plug using a new seal to the specified torque (see section 06-Torque values).
17. Connect the battery leads.
18. Fill the gearbox with the correct oil through the filler/level tube located within the engine bay. (See Section 09).
19. Ensuring the vehicle is on level ground with the parking brake applied, check oil level while engine is running at idle with neutral selected, after selecting each gear.

Oil Inlet Sealing Rings

1. Place the vehicle on a suitable hoist or over a pit, open the hood and disconnect the battery leads.
2. From underneath the vehicle drain the gearbox using a suitable container.

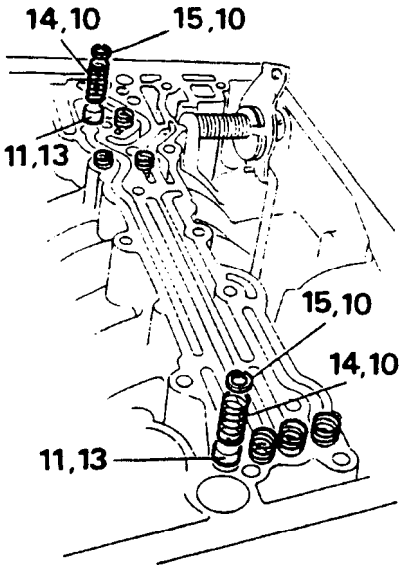


3. Discard the sump plug seal ring.
4. Remove the oil filler/level tube from the sump.
5. Remove the six retaining plates and bolts.
6. Remove the sump and discard the gasket.
7. Using a TX27 Tom bit undo the three bolts which hold the oil screen.
8. Using a TX27 Torx bit undo the remaining thirteen bolts retaining the control unit and remove the control unit.
9. Clean the surfaces ensuring no damage has occurred to the mounting face of the case, using a lint-free rag.
10. Using circlip pliers remove the eight circfips and springs from the gearbox.
11. Using control unit inlet oil seals remover/replacer LST113 remove the eight oil seals.
12. Clean the orifices and check for damage.

NOTE: If damage has occurred replace the box as described in Stage II.

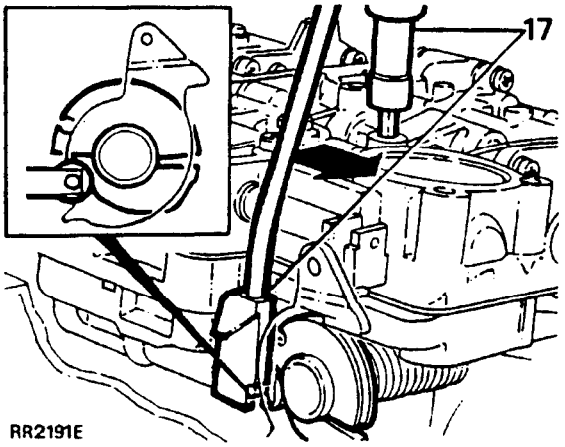
Continued

13. Using the control unit inlet oil seal remover/replacer LST113 fit the new seals ensuring they are seated fully home.
14. Fit the eight compression springs, the four short ones at the front and the four long ones at the rear of the box.
15. Using circlip pliers fit the eight circlips which retain the compression springs.
16. Fit the control unit ensuring the selector shaft locates into the gear shift fork and fit the thirteen bolts loosely by hand.



RR580M

17. Place the selector linkage setting gauge LST109 in position and gently press the control unit against the tool and tighten all thirteen bolts using TX27 Torx bit to the specified torque (see section 06-Torque values).

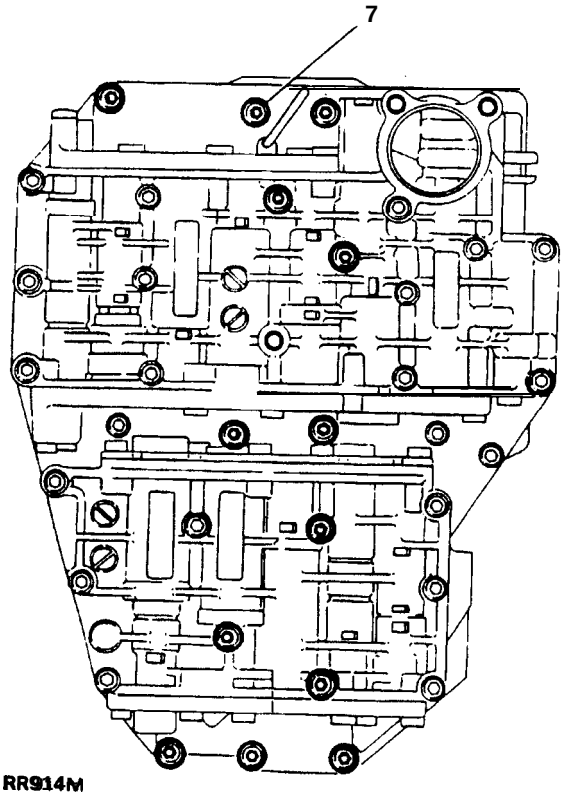


RR2191E

18. Remove the setting gauge and fit the oil screen using TX27 Torx bit to the specified torque (see section 06-Torque values).
19. Refit the oil pan using a new gasket.
20. Secure with the six retaining plates and bolts (two straight and four corner plates), tighten to the specified torque (see section 06-Torque values).
21. Reconnect the oil filler/level tube to the specified torque (see section OC-Torque values).
22. Fit sump plug using a new seal to the specified torque (see section 06-Torque values).
23. Connect the battery leads.
24. Fill the gearbox with the correct oil through the filler/level tube located within the engine bay. (See Section 09).
25. Ensuring the vehicle is on level ground with the parking brake applied, check oil level while engine is running at idle with neutral selected, after selecting each gear.

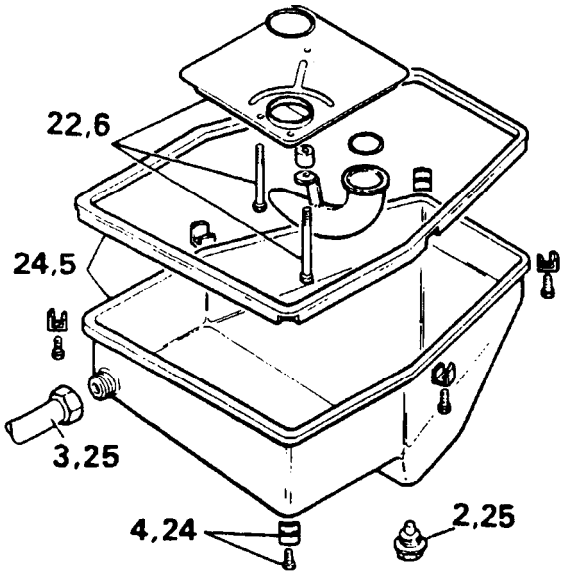
Manual Valve Operating Mechanism

1. Place the vehicle on a suitable hoist or over a pit, open the hood and disconnect the battery leads.
2. From underneath the vehicle, using a suitable container drain the gearbox and discard the gearbox sump seal.
3. Remove the oil filler level tube.
4. Remove the six retaining plates and bolts.
5. Remove the sump and discard the gasket.
6. Remove the oil screen, undoing the three bolts using a TX27 Torx bit.
7. Remove the control unit, undoing the thirteen remaining bolts using a TX 27 Torx bit.



RR914M

NOTE: The illustration for the following instructions is located at the top of the following page.

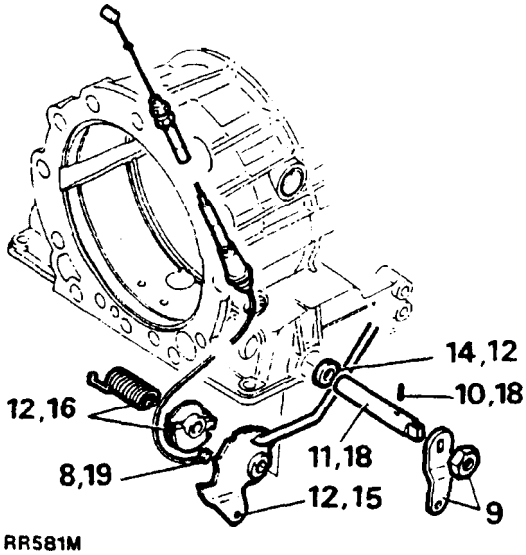


RR582M

8. Locate the selector cam and remove the nipple holding the kick-down cable from its seat.
9. Remove the nut and gear change lever.
10. Using a suitable punch drift out the roll pin from the selector shaft and discard it.
11. Using a suitable tool remove the selector shaft from the box, noting the position of the detent plate.
12. Remove the connecting rod complete with detent plate, accelerator cam, spring and using a suitable tool remove the oil seal and discard.
13. Check all parts for wear or damage and replace as necessary.
14. Using selector shaft oil seal replacer LST 114, fit the oil seal. For ease of fitment use a light grease or Petroleum jelly.
15. Fit connecting rod to detent plate and locate in the box by pushing the selector shaft through from outside of the casing.

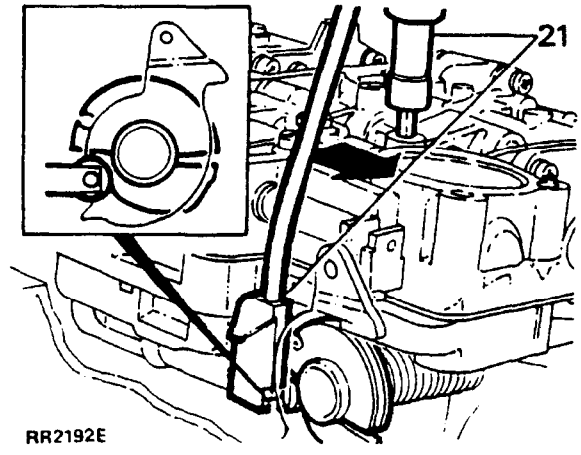
NOTE: The detent plate should go back into the box in the same position as noted earlier.

Continued"



RR581M

16. Fit the accelerator cam with the spring
17. Fit the assembly into the box and secure it by pushing the selector shaft through.
18. Align the hole in the selector shaft with the hole in the detent plate and secure with a new roll pin, using a suitable punch.
19. Fit kickdown cable nipple into the cam seat ensuring that the cam has been turned once before fitment. This will spring load the cam.
20. Fit the control unit ensuring the selector shaft locates into the gear shift fork and fit the thirteen bolts loosely by hand.
21. Place the selector linkage setting gauge LST109 in position and gently press the control unit against the tool and tighten all thirteen bolts using TX27 Torx bit to the specified torque (see section OC-Torque values).



RR2192E

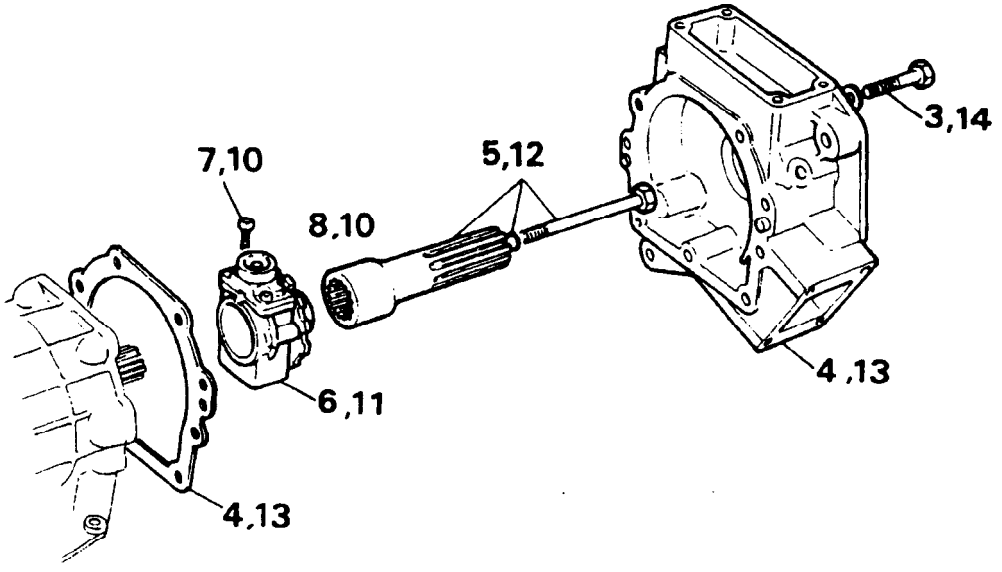
22. Remove the setting gauge and fit oil screen using TX27 Torx bit to the specified torque (see section 06-Torque values).
23. Refit the oil pan with a new gasket.
24. Refit the six retaining plates and screws (two straight and four corner plates) to the specified torque (see section 06-Torque values).
25. Reconnect the oil filler/level tube, sump plug with new seal to the specified torques (see section 06-Torque values).
26. Connect the battery leads.
27. Fill the gearbox with the correct oil. (See Section 09).
28. Ensuring the vehicle is on level ground with the parking brake applied, check oil level while engine is running at idle with neutral selected, after selecting each gear.

GOVERNOR HOUSING

1. Remove the transfer box as described in Section 37.
2. Using a suitable tool release the four bolts from inside the vehicle holding the transfer gear selector housing and adaptor bracket.
3. From underneath the vehicle using a suitable tool release the nine bolts holding the extension housing.
4. Remove the extension housing ensuring that the seal is not damaged and discard the gasket.
5. Remove the extension shaft and retaining bolt with 'O' ring.
6. Remove the governor assembly with parking wheel.
7. Remove the two screws holding the governor housing using TX27 Torx bit.
8. Remove the governor housing complete and discard.
9. Inspect the governor hub and parking wheel for damage, if satisfactory, clean.
10. Fit new governor housing complete to governor hub and parking wheel using TX27 Torx bit to the specified torque (see section 06-Torque values).
11. Refit the governor assembly with parking wheel onto the output shaft and push the assembly till fully seated.

NOTE: To avoid damage to 'O' ring use a light grease or Petroleum Jelly. Ensure the seal rings are snapped together and are seated correctly.

12. Fit the extension shaft, apply Loctite 270 to the retaining bolt and using a new '0' ring, tighten the bolt to the specified torque (see section 06-Torque values).
13. Fit new gasket onto rear of gearbox and fit the extension housing, taking care not to damage the seal on assembly.
14. Secure the extension housing using the nine bolts to the specified torque (see section 06-Torque values).
15. From inside the vehicle refit the four bolts which retain the transfer gear selector housing and adaptor bracket.
16. Secure the four bolts to the specified torque (see section 06-Torque values).
17. Refit the transfer box as described in Section 37.



RR5880M

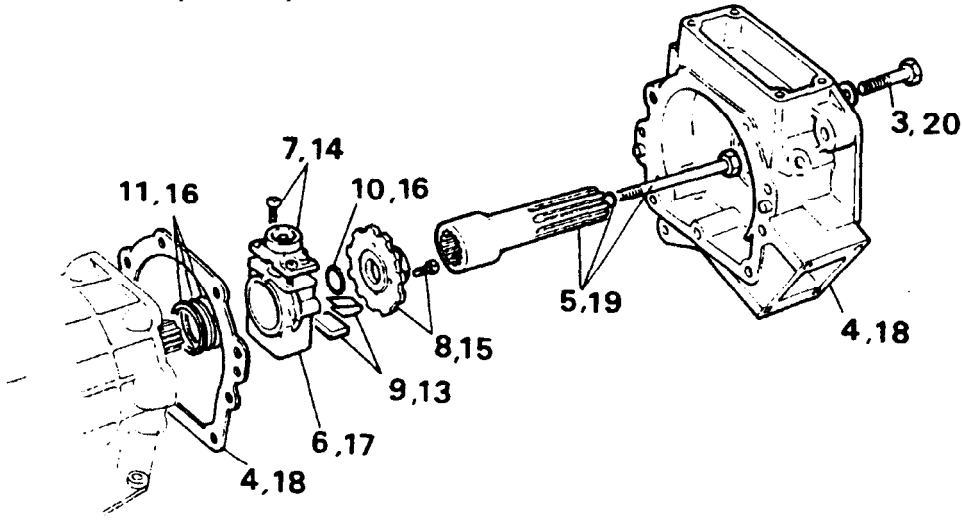
GOVERNOR HUB

1. Remove the transfer box as described in Section 37.
2. Using a suitable tool release the four bolts from inside the vehicle holding the transfer gear selector housing and adaptor bracket.
3. From underneath the vehicle using a suitable tool release the nine bolts holding the extension housing.
4. Remove the extension housing ensuring that the seal is not damaged and discard the gasket.
5. Remove the extension shaft and retaining bolt with '0' ring and discard 'O' ring.
6. Remove the governor assembly with parking wheel.
7. Remove the two screws holding the governor housing using TX27 Torx bit.
8. Using a TX27 Torx bit unscrew the two bolts and remove the parking wheel and discard governor hub.
9. Remove the security clip and counter-weight.
10. Remove the 'O' ring from off the output shaft and discard.
11. Remove the three seal rings from the 'F' clutch housing shaft.
12. Inspect all parts for damage or wear, replace if necessary.
13. Fit the counter-weight and security clip into the new governor hub.
14. Secure governor housing onto governor hub using TX27 Torx bit to the specified torque (see section OC-Torque values).
15. Fit the parking wheel to the governor hub using TX27 Torx bit to the specified torque (see section 06-Torque values).
16. Fit three new seal rings onto the 'F' clutch housing shaft and fit 'O' ring onto output shaft.

    NOTE: For ease of fitment of the 'O' ring use a light grease or Petroleum Jelly.

17. Fit governor assembly and parking wheel onto the output shaft and push the assembly till fully seated.

    NOTE: To avoid damage to 'O' ring use a light grease or Petroleum Jelly. Ensure the seal rings are snapped together and are seated correctly.
18. Fit new gasket onto rear of gearbox and fit the extension housing taking care not to damage the seal or assembly.
19. Fit the extension shaft and retaining bolt using a new 'O' ring.
20. Secure the extension housing using the nine bolts to the specified torque (see section 06-Torque values).
21. From inside the vehicle refit the four bolts which retain the transfer gear selector housing and adaptor bracket. Secure the four bolts to the specified torque (see section 06-Torque values). Refit the transfer box as described in Section 37.



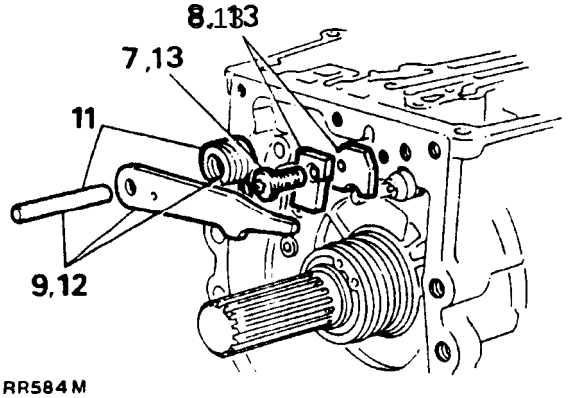
RR919M

PARKING PAWL MECHANISM

1. Remove the transfer box as described in Section 37.
2. Using a suitable tool, release the four bolts from inside the vehicle holding the transfer gear selector housing and adaptor bracket.
3. From underneath the vehicle, using a suitable tool, release the nine bolts holding the extension housing.

NOTE: The illustration for the following replacement is located at the top of the iollowing page.

4. Remove the extension housing ensuring that the seal is not damaged and discard the gasket.
5. Remove the extension shaft and retaining bolt with 'O' ring, discard the '0' ring.
6. Remove the governor assembly with parking wheel.



RR584M

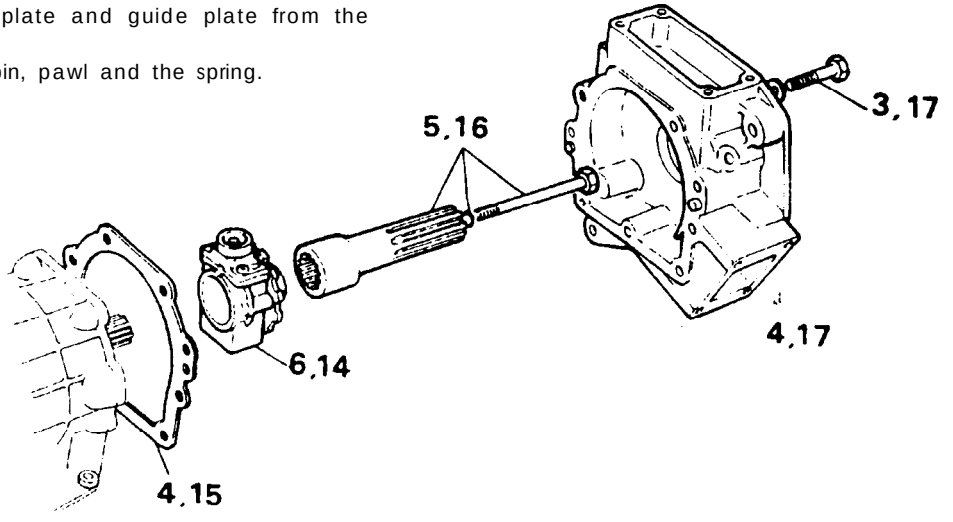
7. Remove guide plate bolt, using TX27 Torx bit.
8. Remove the plate and guide plate from the gearbox case.
9. Remove the pin, pawl and the spring.

NOTE: Take care when removing the assembly. Do not damage parts which-could weaken spring tension.

10. Inspect all parts for wear or damage and replace if necessary.
11. Fit the pin and the leg spring ensuring that the spring is located correctly.
12. Fit the pawl onto the pin and the spring leg into the hole in the pawl. This creates tension in the spring.
13. Fit the plate and guide plate using TX27 Torx bit to the specified torque (see section 06-Torque values).
14. Refit the governor assembly with parking wheel onto the output shaft and push the assembly till fully seated.

NOTE: To avoid damage to 'O' ring use a light grease or Petroleum Jelly. Ensure the seal rings are snapped together and are seated correctly.

15. Fit new gasket onto rear of gearbox and fit the extension housing, taking care not to damage the seal or assembly.
16. Fit the extension shaft and retaining bolt using a new 'O' ring.
17. Secure the extension housing using the nine bolts to the specified torque (see section 06-Torque values).
18. From inside the vehicle refit the four bolts which retain the transfer gear selector housing and adaptor bracket.
19. Secure the four bolts to the specified torque (see Section 06-Torque values).
20. Refit the transfer box as described in Section 37.



RR920M

STAGE II

WARNING: Where the use of a transmission hoist is necessary, it is ABSOLUTELY ESSENTIAL to follow the hoist manufacturers instruction to ensure safe and effective use of the equipment.

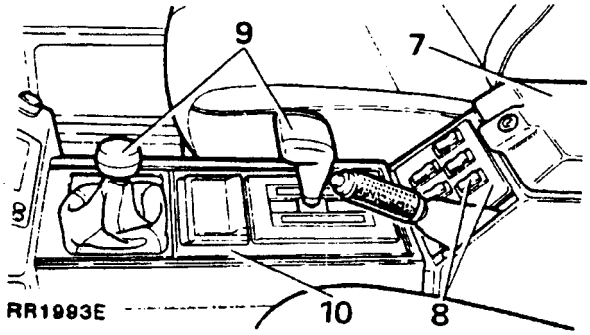
ZF Gearbox-Remove and refit

Removing

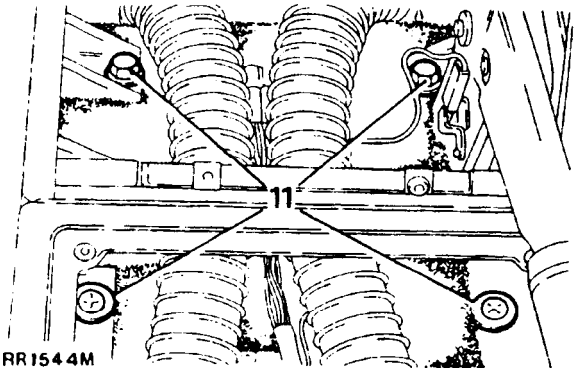
1. Install the vehicle on a hydraulic hoist.
2. Open the hood.
3. Disconnect the battery leads.
4. Release the airflow meter to plenum chamber hose.
5. Disconnect the kickdown cable from throttle linkages located on the throttle lever bracketry at the rear of the plenum chamber. Remove the transmission dipstick.
6. Remove the fan cowl from the radiator.
7. From inside the vehicle remove the four screws securing the glove box liner to the glove box and lift out the liner.
8. Carefully pry the window lift switch panel away from the front of the glove box. Identify each switch connection for re-assembly, disconnect the plugs and remove the switch panel.
9. Remove the main and transfer gearbox knobs.

NOTE: Refer to Automatic Gear Selector-Panel Illumination in Section 86-Electrical, page 27, for the removal and refit of the main gear selector lever.

10. Carefully pry the centre panel out of the floor mounted console and remove it from the vehicle.



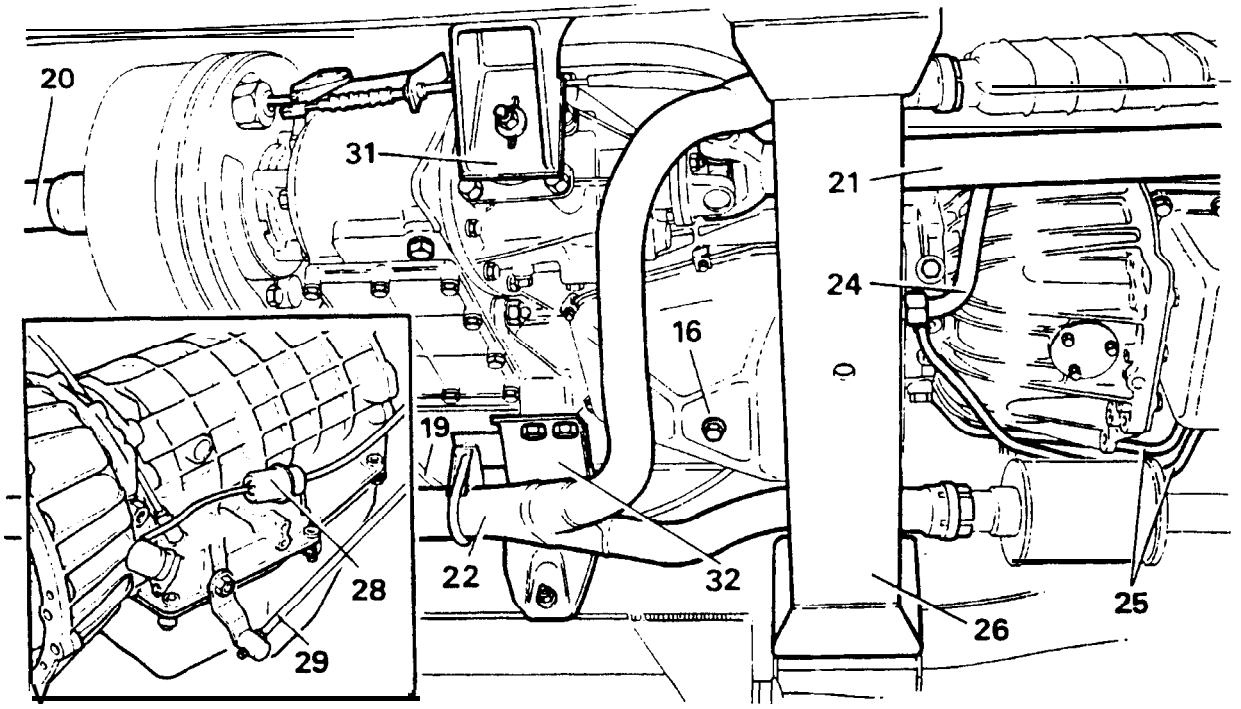
11. Release the two bolts and two screws securing the console assembly to the gearbox tunnel.
12. Release the parking brake and remove the cotter pin, clevis pin and washer securing the parking brake cable to the parking brake lever.



13. Carefully maneuver the console assembly away from the radio housing and remove it from the vehicle.
14. Release the large nut retaining the parking brake outer cable to the top of the gearbox tunnel.
15. Remove the nut and feed the cable through the hole in the tunnel to the underside of the vehicle.
16. Raise the vehicle on the hoist and drain the gearbox.

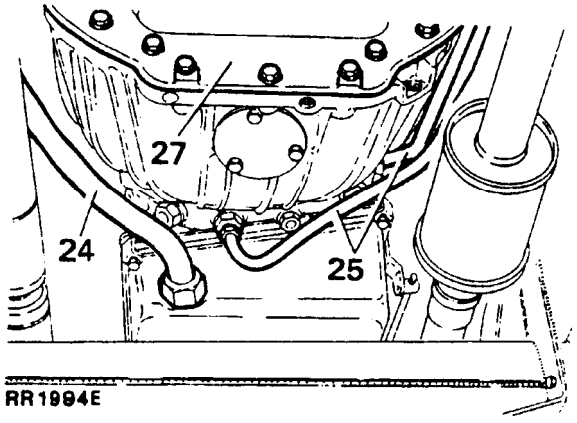
NOTE: The illustration for the following removal instructions is located at the top of the following page.

17. Release the nut and clamp securing the speedometer cable to the rear of the transfer box.
18. Withdraw the cable from the speedometer drive pinion.
19. Release the cable from the clips at the side of the gearbox.
20. Release the four nuts and bolts securing the rear drive shaft to the rear output flange and tie the shaft to one side.
21. Remove the four nuts and bolts securing the front drive shaft to the front output flange and tie the shaft to one side.
22. Release the nuts and bolts securing the front down-pipes to the front catalysts.
23. Release the nut at the rear tailpipe bracket, disconnect the catalysts from the downpipes, and tie the rear tail pipe and muffler to one side.



RR1005E

24. Disconnect the oil filler tube from the front of the gearbox oil pan.
25. Disconnect the two oil cooler pipes from the rear of the gearbox bellhousing.
26. Remove the bolts securing the cross-member in position, using suitable equipment expand the chassis and withdraw the cross-member.
27. Remove the front cover from the bottom of the torque converter housing. Remove one converter drive bolt. Mark both the flexible drive plate and the torque converter to ensure the unit is reassembled in the original build position. Remove the remaining three bolts.



RR1994E

28. Disconnect the inhibitor switch.
29. Disconnect the selector linkage.
30. Attach the transmission jack using the adaptor plate (illustration RR7339M).
31. Remove the nuts and bolts holding rear left-hand side, mounting bracket to chassis.
32. Remove the nuts and bolts holding right-hand side mounting bracket to chassis.
33. Lower the jack until the rear brake drum clears the rear passenger footwell.
34. Remove the cotter pin and washers securing the differential lock lever to the connecting rod, and disconnect the lever from the rod.
35. Disconnect the electrical leads from the differential lock switch and neutral warning switch.
36. Remove the breather pipe from the top of the transfer gearbox.
37. Using a suitable floor jack support the rear of the engine.
38. Remove the torque converter housing to engine bolts.
39. Carefully withdraw the gearbox and transfer box from the engine taking care not to damage any seals.

Continued

Refitting

40. Reverse the removal instructions.

Observe the following points:
Ensure that the torque converter and flexible plate are in their original positions.

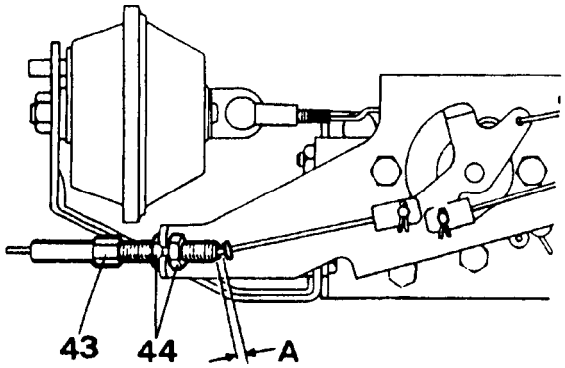
41. Refill the gearbox with the correct grade and quantity of oil (see Section 09).

Kickdown cable adjustment

42. Kickdown cable must be checked and adjusted as follows:

NOTE: The kickdown cable must be adjusted while the vehicle is running at idle.

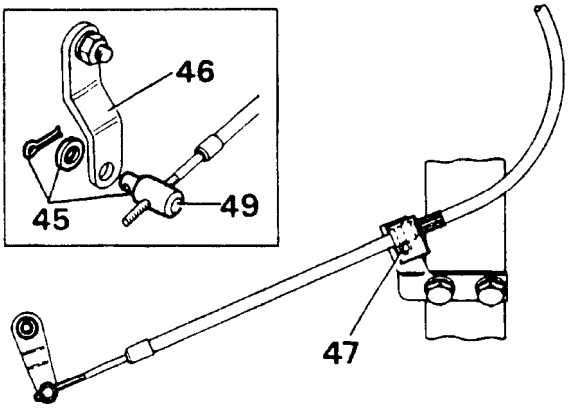
43. Adjust the outer cable to achieve a crimp gap of 0.25 to 1.25mm (.010 to .050 in) dimension A.
44. Hold the outer cable while tightening the locknuts.



RR2080E

Gear lever selector cable setting

45. Remove the split pin and washer securing the trunnion to the gear change lever at the gearbox and disconnect the trunnion from the lever.
46. Select neutral gear at the gearbox using the gear change lever.
47. Release the clamp securing the outer selector cable, the clamp is attached to a bracket which is mounted on the side of the gearbox extension housing.
48. Select neutral gear. at the gear shift, within the vehicle.
49. Rotate the trunnion clockwise or counter clockwise, until the trunnion will engage with the gear change lever at the gearbox, fit the trunnion and secure in position using a NEW cotter pin and washer.



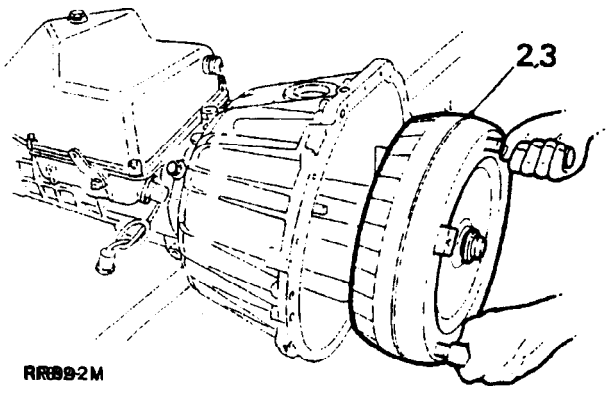
RR2086E

50. Tighten the outer cable clamp to 22 - 28Nm (16 - 21ft lb).
51. Reconnect the battery leads.
52. Ensuring the vehicle is on level ground with the parking brake applied, check the oil level while engine is running at idle with neutral selected, after selecting each gear.

There are several places where leaks can occur at the front of the gearbox. The following are remedies for curing any one of these problems.

Eliminating leaks/replacing Torque Converter.

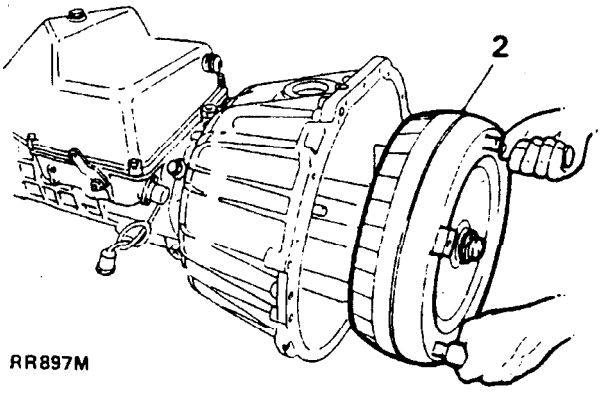
1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench using the torque converter handles 18G1501, remove the torque converter, taking care not to damage the torque converter/oil pump housing oil seal.
3. Replace with new torque converter using torque converter handles 18G1501, checking that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.
4. Refit the gearbox and transfer box assembly as previously described.



RR992M

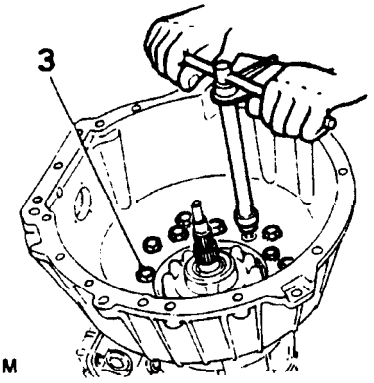
Eliminating Leaks on the Pump Housing

1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench and remove the torque converter using torque converter handles 18G150, taking care not to damage the converter/oil pump housing oil seal.



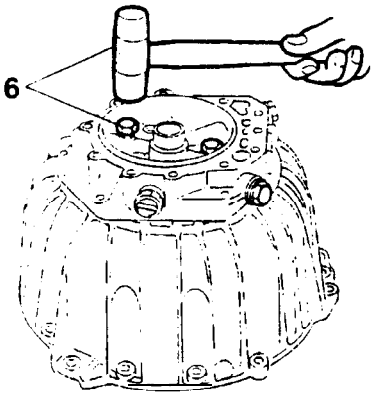
RR897M

3. Remove the twelve hexagonal bolts (inner ring pattern).



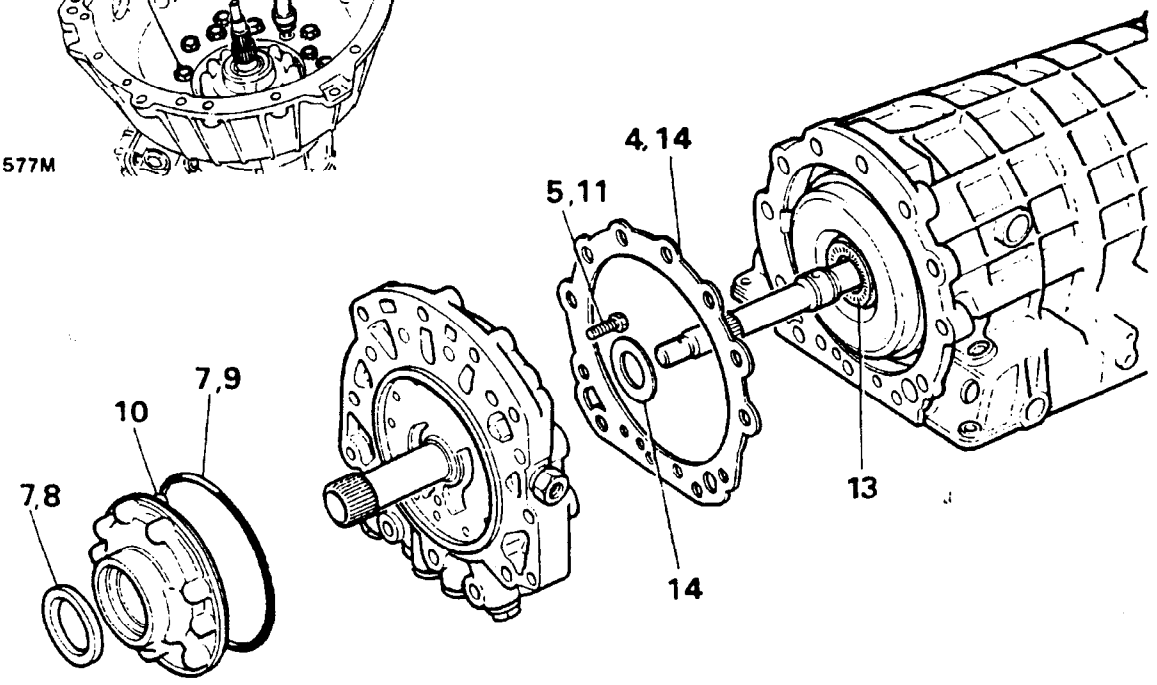
RR577M

4. Remove bellhousing and pump assembly from gearbox case and discard the gasket.
5. Remove the eight hexagonal bolts on the rear of the pump.
6. Screw in two of the bolts, diagonally opposite each other, tap lightly using a soft headed mallet; this will free the pump assembly from the intermediate plate.



RR578M

7. Remove the shaft sealing ring and '0' ring from the pump housing and discard.
8. Using oil seal replacer LST108 fit the shaft seal ring into the pump housing.
9. Fit the '0' ring onto the circumference of the pump housing.
10. Align the dowel with its hole in the intermediate plate and press the pump housing home.

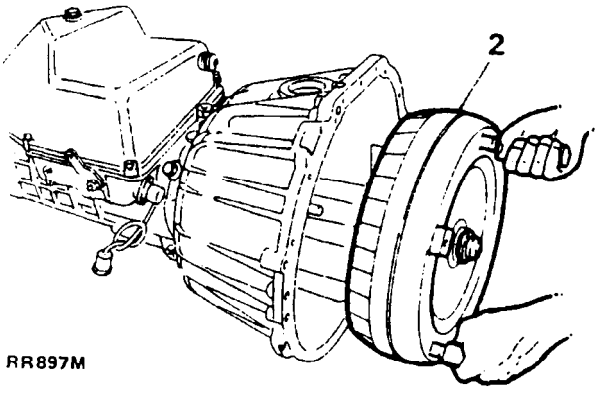


RR878M

11. Secure the pump housing to the intermediate plate using the eight hexagonal bolts and tighten to their specified torque (see section 06-Torque values).
12. Place the bellhousing and intermediate plate assembly on the bench, front face up. Using the oil pump rotation sleeve LST 111, check that the pump gears rotate freely.
13. Before replacing the intermediate plate and bellhousing assembly, check that the thrust washer and axle cage are seated on the A clutch housing.
14. Place the gasket and disc washer onto the bellhousing and intermediate plate assembly using a light grease or Petroleum Jelly.
15. fit bellhousing and intermediate plate assembly onto gearcase and secure with the twelve hexagonal bolts tightened to the specified torque (see section 06-Torque values).
16. Place the end float gauge LST111 onto the pump housing and check that the axial play is between 0.2-0.4 mm (0.008 in to 0.016 in). If the end float is excessive or tight, replace existing washer, situated at the rear of the intermediate plate, with a suitable washer to give the required end float as stated above.
17. Refit torque converter into housing using torque converter handles 18G1501, checking that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.
18. Refit the gearbox/transfer box assembly as previously described.

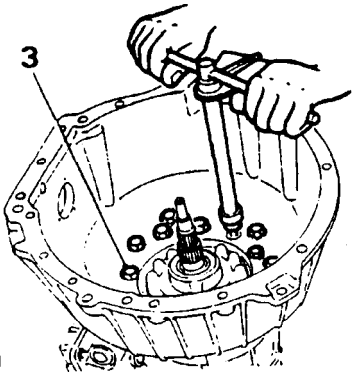
Eliminating leaks between gearbox housing and intermediate plate.

1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench and remove the torque converter using torque converter handles 18G1501, taking care not to damage the converter/oil pump housing-oil seal.

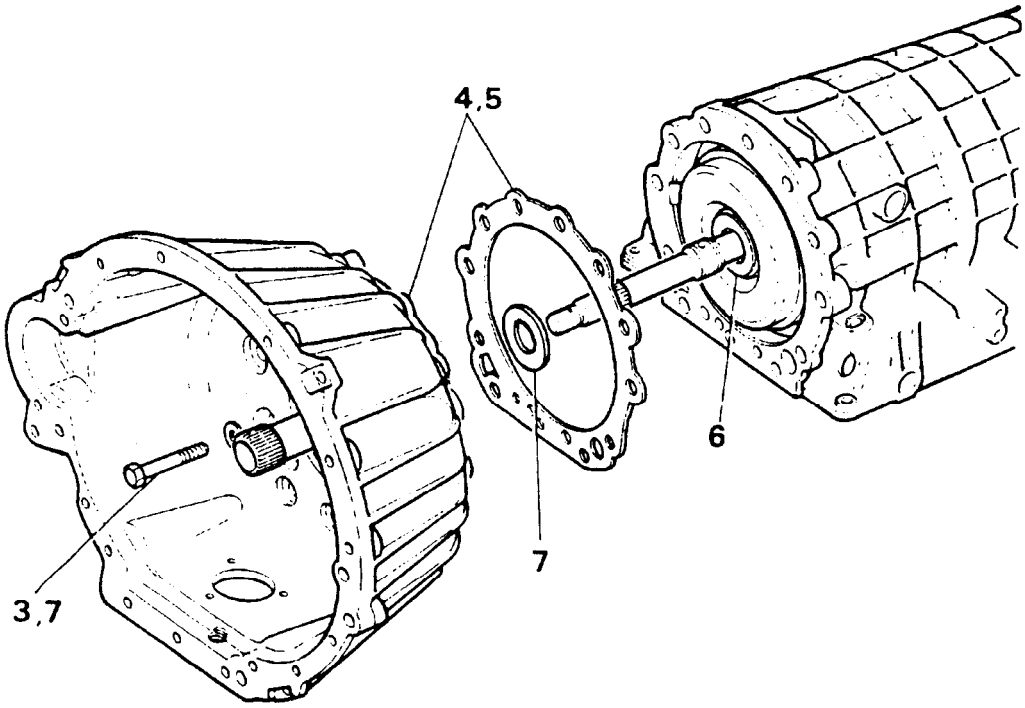


RR897M

3. Remove the 12 hexagonal bolts tinner ring pattern).
4. Remove the bellhousing intermediate plate assembly from gearbox case and discard the gasket.



RR577M



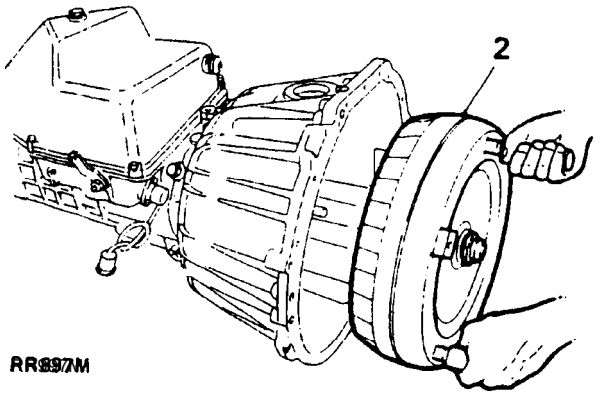
RR576M

5. Place new gasket onto intermediate plate using a light grease or Petroleum Jelly.
6. Before replacing the intermediate plate/bellhousing assembly check that the thrust washer and axle cage are seated on the A clutch housing.
7. Fit bellhousing/intermediate plate assembly with disc washer onto gearcase and secure with the twelve hexagonal bolts tightened to the specified torque (see section 06-Torque values).
8. Place the end-float gauge LST111 onto the pump housing and check that the axial play is between 0.2-0.4 mm (0.008 in to 0.016 in). If the end-float is excessive or tight, replace existing washer, situated at the rear of the intermediate plate, with a suitable washer to give the required end-float as stated above.
9. Refit torque converter into housing using torque converter handles 18G1501, checking that the dimension from the converter fixing bolt boss to the converter housing case is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.
10. Refit the gearbox/transfer box assembly as previously described.

Continued

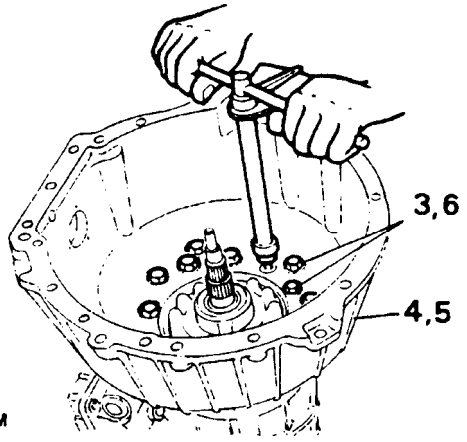
Replacing Bellhousing

1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench and using the torque converter handles 18G1501 remove the torque converter, taking care not to damage the converter/oil pump housing oil seal.



RR897M

3. Remove the eighteen hexagonal bolts.
4. Remove bellhousing.
5. Fit new bellhousing.
6. Secure bellhousing with the eighteen hexagonal bolts to the specified torque (see section 06-Torque values).

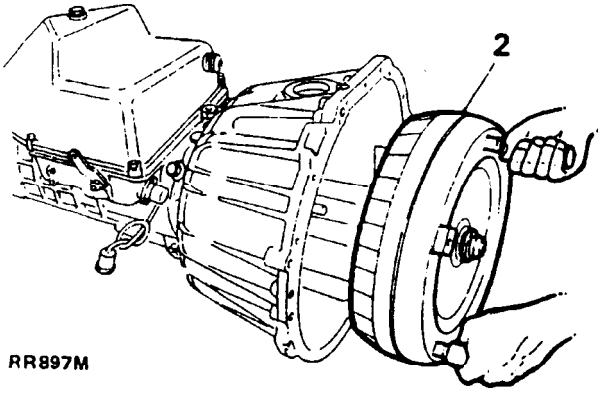


RR899M

7. Refit the torque converter into the housing using torque converter handles 18G1501, checking that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.
8. Refit the gearbox/transfer assembly as previously described.

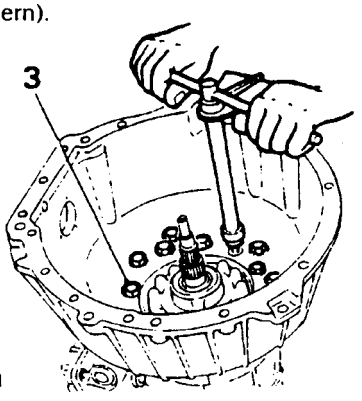
REPLACING PUMP

1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench and remove the torque converter using torque converter handles 18G1501, taking care not to damage the converter/oil pump housing oil seal.



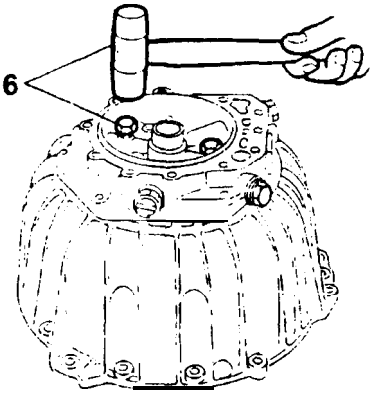
RR897M

3. Remove the twelve hexagonal bolts (inner ring pattern).



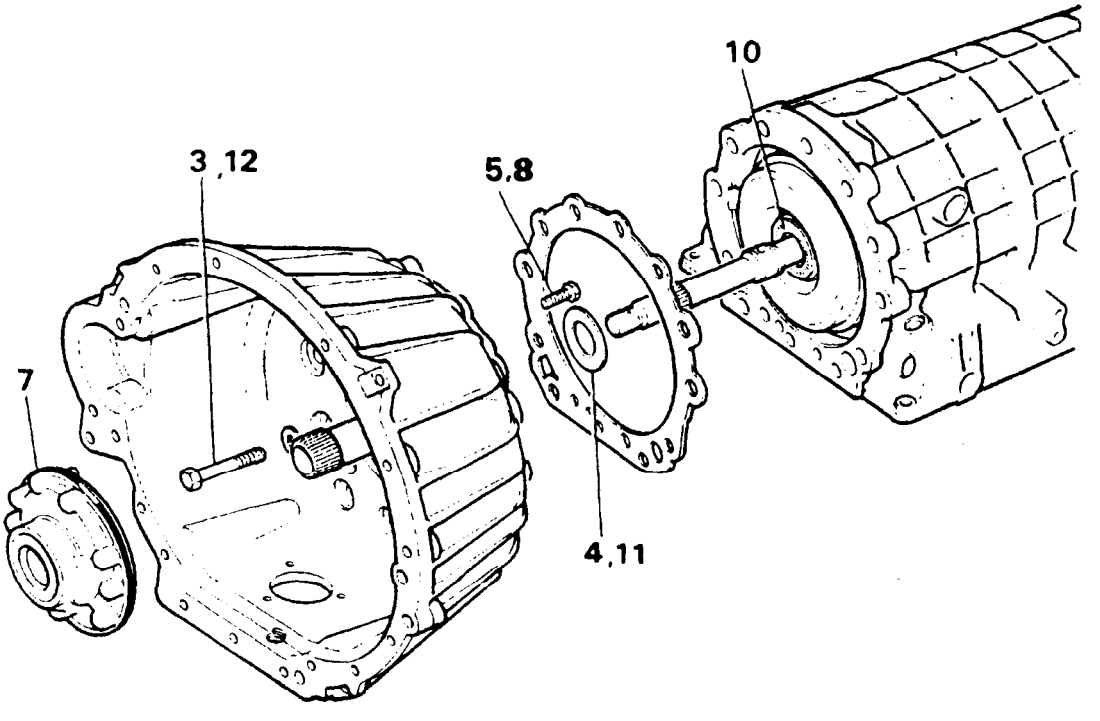
RR577M

4. Remove bellhousing and pump assembly from gearbox case and discard the gasket.
5. Remove the eight hexagonal bolts on the rear of the pump.
6. Screw in two of the bolts, diagonally opposite each other, tap lightly using a soft headed mallet; this will free the pump assembly from the intermediate plate.



RR578M

7. Fit new pump assembly aligning the dowel with its hole in the intermediate plate and press the pump housing home.
8. Secure the pump housing to the intermediate plate using the eight hexagonal bolts and tighten to their specified torque (see section 06-Torque values).
9. Place the bellhousing and intermediate plate assembly on the bench, front face up. Using the oil pump rotation sleeve LST111, check that the pump gears rotate freely.
10. Remove bellhousing and pump assembly from gearbox case and discard the gasket.
11. Place the new gasket and disc washer onto the bellhousing and intermediate plate assembly using a light grease or Petroleum Jelly.
12. Fit bellhousing and intermediate plate assembly onto gearcase and secure with the twelve hexagonal bolts tightened to the specified torque (see section 06-Torque values).



RR891M

Continued

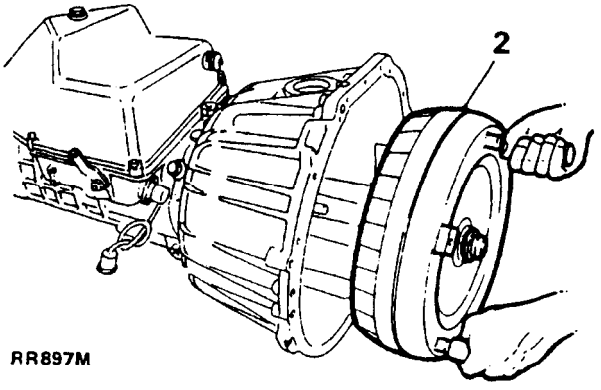
13. Place the end-float gauge LST111 onto the pump housing and check that the axial play is between 0.2-0.4 mm (0.008 in to 0.016 in). If the end-float is excessive or tight, replace existing washer, situated at the rear of the intermediate plate, with suitable washer to give required end-float as stated above.

    NOTE: If damage is apparent to the bolts they should be replaced.

14. Refit the torque converter into the housing using torque converter handles 18G150/1, checking that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved, the converter is property seated in the housing.
15. Refit the gearbox/transfer box assembly as previously described.

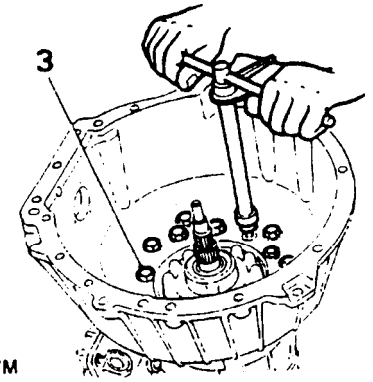
Replacing Intermediate Plate

1. Remove the gearbox/transfer box assembly as previously described.
2. Place the gearbox on the bench, and remove the torque converter using torque converter handles 18G150/1, taking care not to damage the torque converter/oil pump housing oil seal.



RR897M

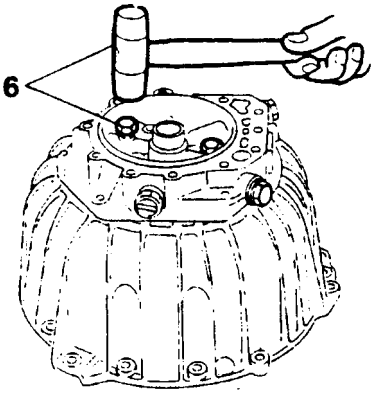
3. Remove the twelve hexagonal bolts (inner ring pattern).



RR577M

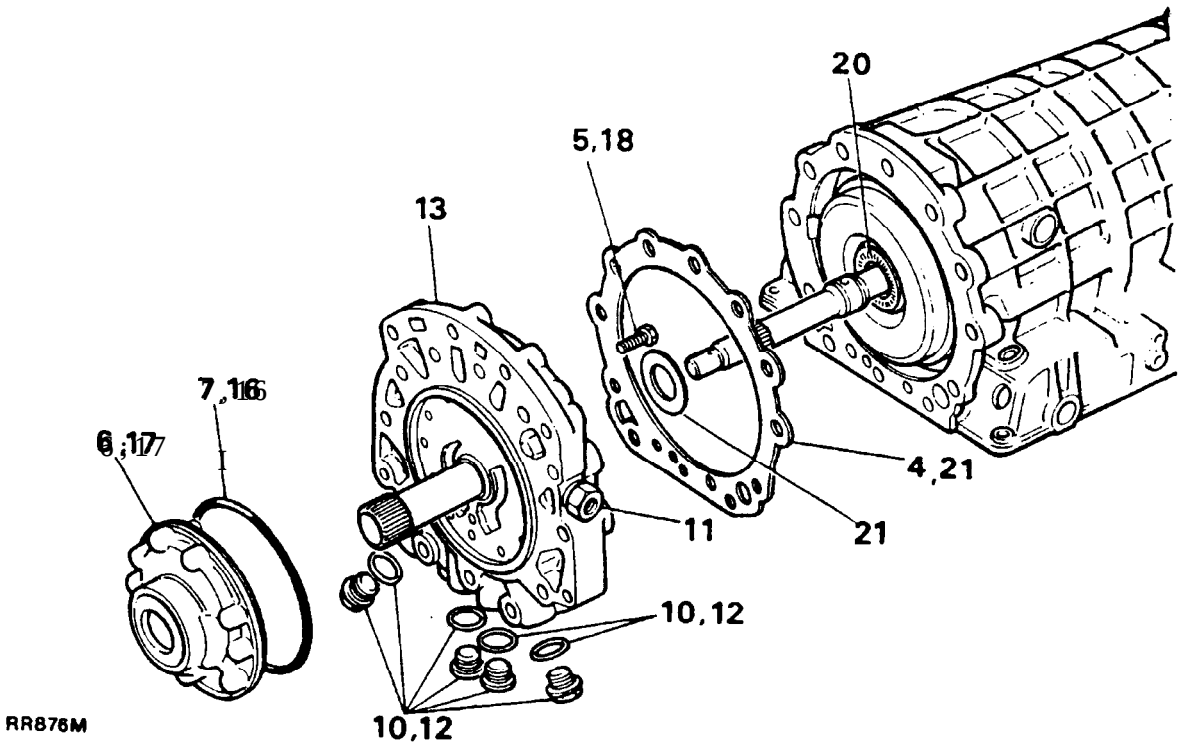
NOTE: The illustration for the following replacement instructions is located at the top of the following page.

4. Remove bellhousing and pump assembly from gearbox case and discard the gasket.
5. Remove the eight hexagonal bolts on the rear of the pump.
6. Screw in two of the bolts, diagonally opposite each other, tap lightly using a soft headed mallet; this will free the pump assembly from the intermediate plate.



RR578M

7. Remove the 'O' ring from the pump housing and discard.
8. Place the bellhousing and intermediate plate assembly on the bench, front side up.



9. Remove the six remaining hexagon bolts and remove the bellhousing from the intermediate plate assembly.
10. Remove the four screw plugs and seal rings from the intermediate plate, discard the seal rings.
11. Remove the oil cooler pipe adaptors and fit them into the new intermediate plate.
12. Fit plugs and new seal rings into the new intermediate plate.
13. Fit intermediate plate assembly onto the bellhousing.
14. Secure with six hexagonal bolts (outer ring pattern) and tighten to the specified torque (see section 06-Torque values).
15. Place intermediate plate and bellhousing assembly on bench, front face up.
16. Fit the 'O' ring onto the circumference of the pump housing.
17. Align the dowel with its hole in the intermediate plate and press the pump housing home.
18. Secure the pump housing to the intermediate plate using the eight hexagonal bolts and tighten to the specified torque (see section 06-Torque values).
19. Place the bellhousing and intermediate plate assembly on the bench, front face up. Using the oil pump rotation sleeve LST111, check that the pump gears rotate freely.
20. Before replacing the intermediate plate and bellhousing assembly check that the thrust washer and axle cage are seated on the A clutch housing.
21. Place the gasket and disc washer onto the bellhousing and intermediate plate assembly using a light grease or Petroleum Jelly.
22. Fit bellhousing and intermediate plate assembly onto gearcase and secure with the twelve hexagonal bolts tightened to the specified torque (see section OC-Torque values).
23. Place the end-float gauge LST111 onto the pump housing and check that the axial play is between 0.2-0.4 mm (0.008 -0.016 in). If end-float is incorrect, replace existing washer, situated at the rear of the intermediate plate, with suitable washer to give required end-float stated above.
24. Refit the torque converter into the housing using torque converter handles 18G550, checking that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.
25. Refit the gearbox/transfer box assembly as previously described.

AUTOMATIC GEARBOX-OVERHAUL

Remove Torque Converter

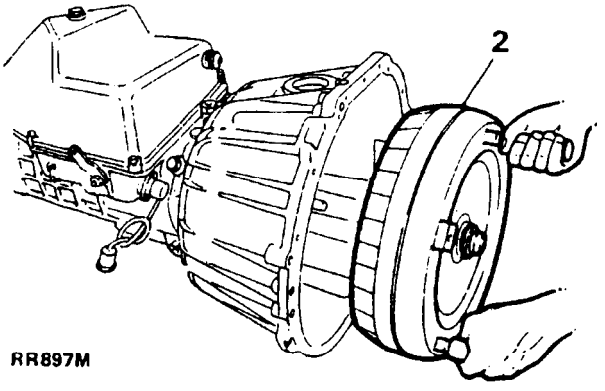
NOTE: Refer to Stage II Section for removal of the gearbox from the vehicle.

1. Place gearbox into the transmission holding fixture LST118 and tighten.

NOTE: Care must be taken not to over-tighten as casing will distort.

2. Using the torque converter handles 18G1501 remove the converter from the bell housing.

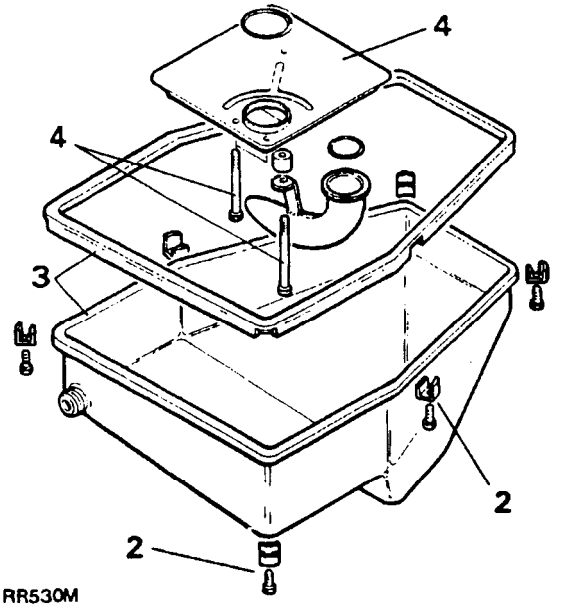
CAUTION: Ensure no damage occurs to the pump bush and seal ring lip when removing the torque converter. The converter is still full of oil even after the gearbox has been drained, so care should be taken when removing the unit.



RR897M

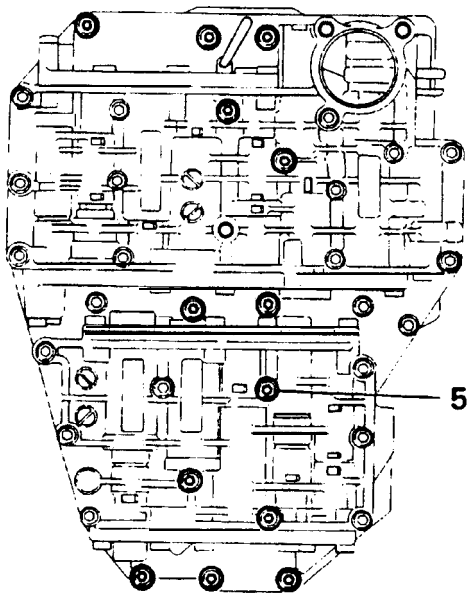
Remove Valve Body

1. Turn the gearbox upside down in the fixture.
2. Remove the six bolts and retaining plates which hold the oil pan.
3. Remove the oil pan and rubber seal and discard seal.
4. Using Torx bit TX27, unscrew the three Torx headed bolts which hold the oil screen and remove. Separate the oil screen from the suction tube and discard the two 'O' rings and oil screen.



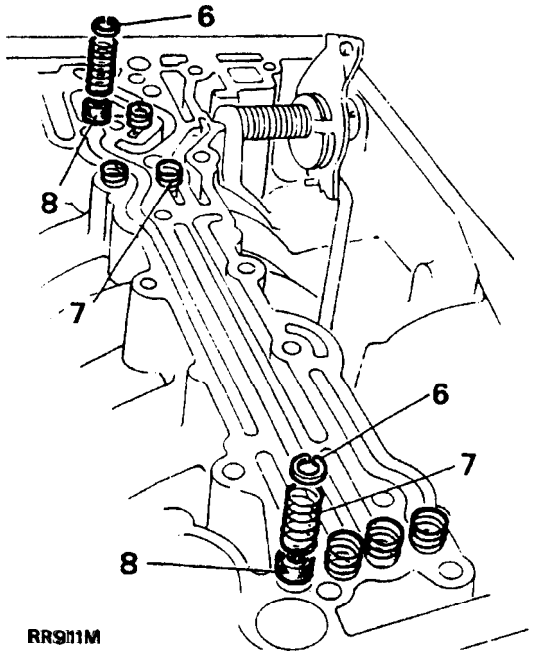
RR530M

5. Using Torx bit TX27, unscrew the thirteen Torx headed bolts which retain the valve block to the gearbox.



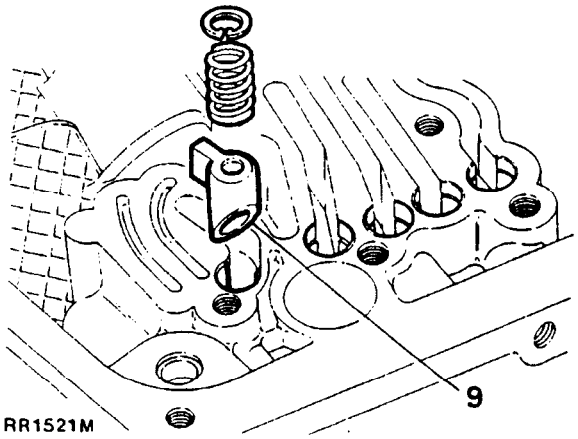
RR531M

6. Using circlip pliers remove the eight circlips.
7. Remove the eight springs (four short springs at the front of the gearbox and four long springs at the rear of the gearbox).



RR911M

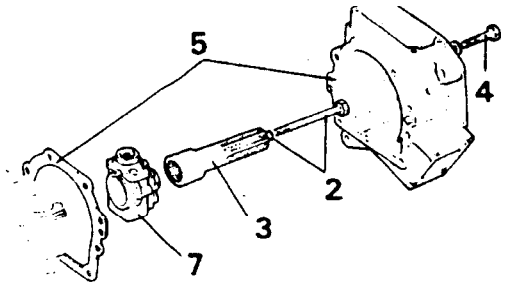
8. Remove the eight sealing rubbers using tool LST113 and discard.
9. Remove the circlip, spring and using the tool LST113 remove the restrictor at the rear of the gearbox.



RR1521M

Remove Parking Pawl and Governor

1. Engage 'Park' position.
2. Using a suitable wrench unscrew the coupling shaft bolt and remove the '0' ring.
3. Remove the coupling shaft.
4. Remove the nine bolts and washers from the extension housing.
5. Remove the extension housing and gasket from the gearbox and discard the gasket.
6. Disengage 'Park' position.
7. Withdraw the parking wheel and governor hub.

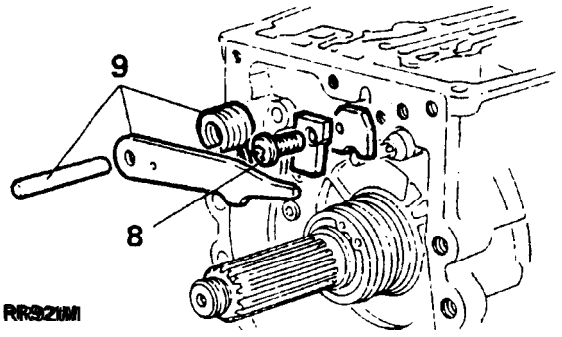


RR918M

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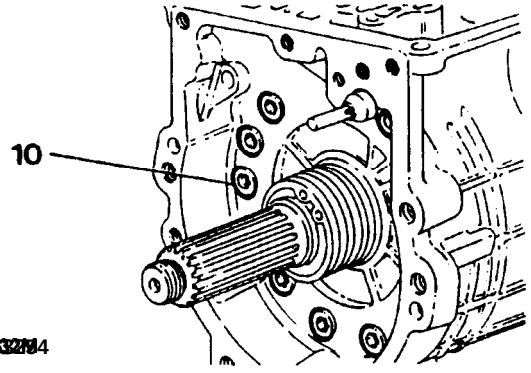
8. Unscrew the bolt which retains the guide plate using Torx bit TX27.
9. Disengage the spring and remove, also the pin and pawl.

NOTE: Take care when removing the assembly. Do not damage parts which could weaken the spring tension.



RR921M

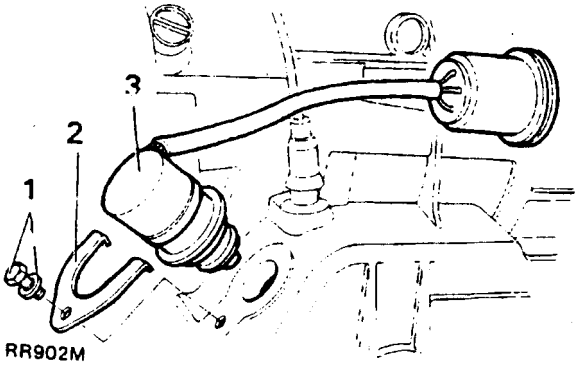
10. Using Torx bit TX30 remove the ten Torx bolts from the rear of casing.



RR532M4

Remove inhibitor Switch

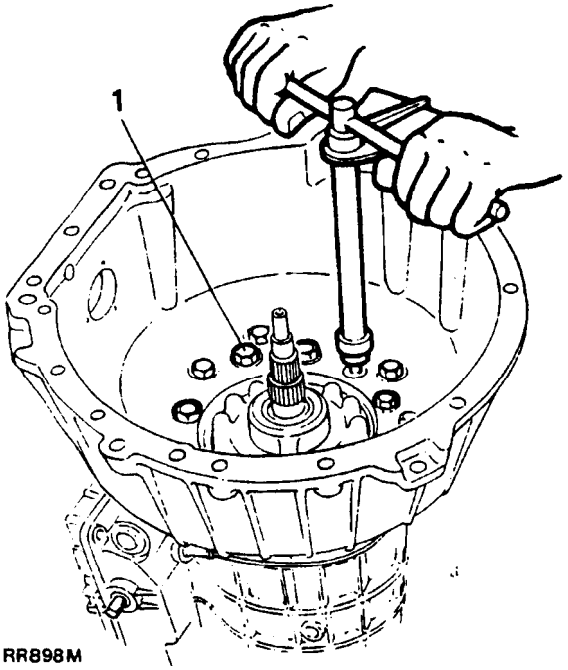
1. Using a suitable wrench remove the bolt and spring washer.
2. Remove the retaining plate.
3. Using a suitable tool remove the inhibitor switch from the casing.
4. Discard switch if damaged.



RR902M

Remove Bell Housing and Intermediate Plate

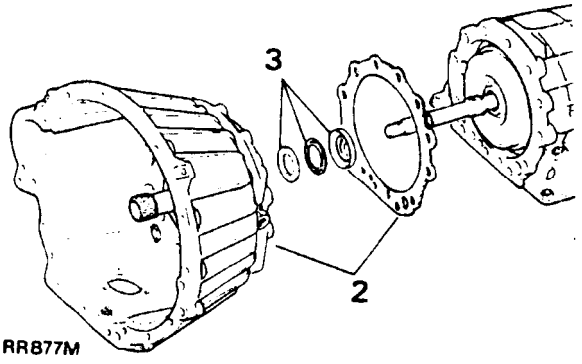
1. Using a suitable socket wrench remove the twelve bolts (inside diameter bolt pattern) holding the bell housing.



RR898M

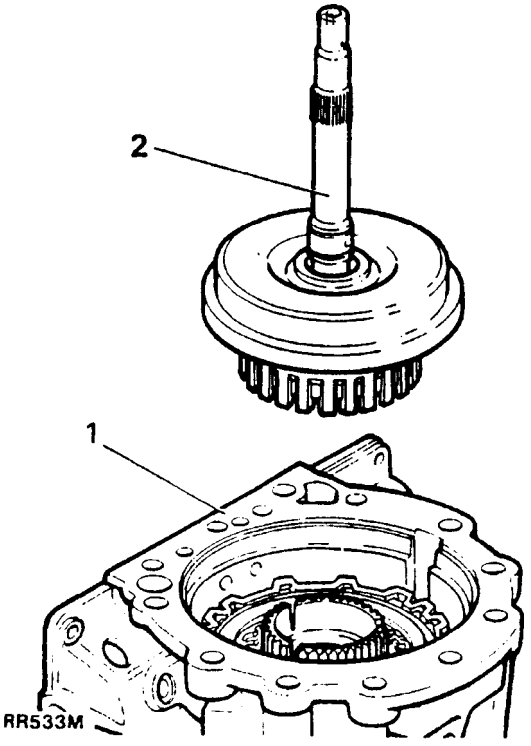
2. Remove the bell housing and intermediate plate assembly complete, and discard the gasket.
3. Remove the thrust washer, axle bearing and disc washer from the input shaft.

NOTE: Under normal working conditions there is no need to separate the bell housing from the intermediate plate assembly. If damage has occurred to either the bell housing or intermediate plate see the appropriate section.

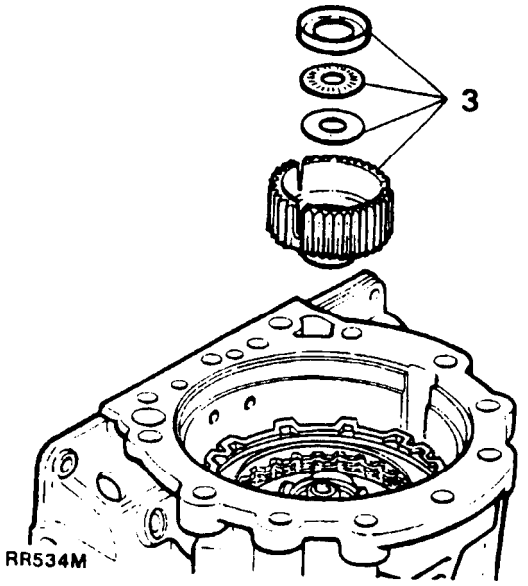


Remove A Clutch Assembly

1. Turn gearbox with front facing upwards.
2. Remove input shaft and A clutch assembly from gearbox.

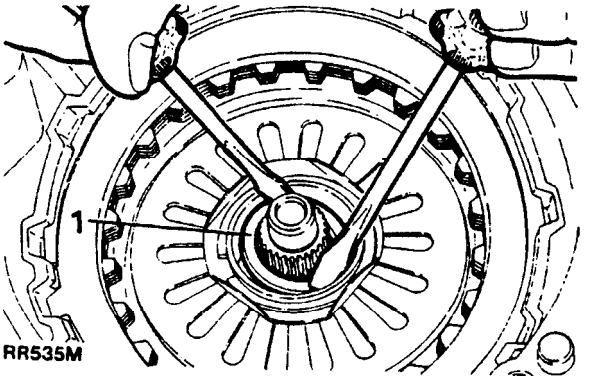


3. Remove inner carrier A, disc, axial bearing and thrust washer.



Remove B Clutch Assembly

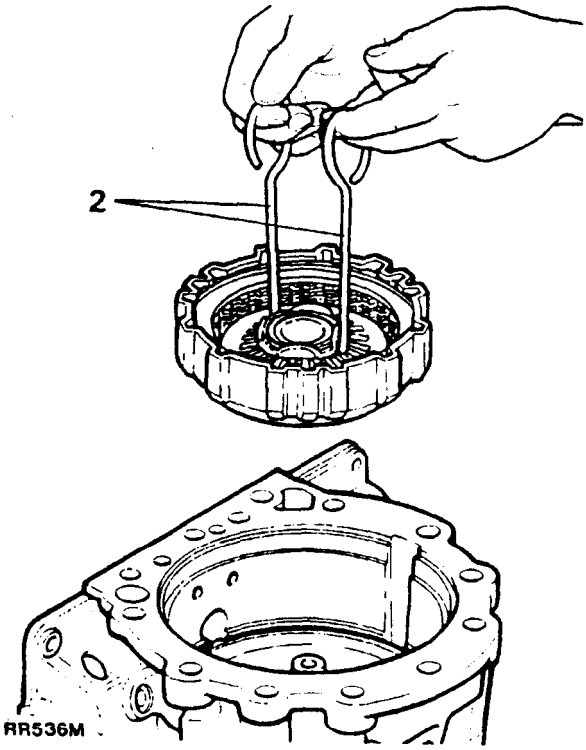
1. Using two suitable screwdrivers remove the small snap ring in cylinder B.



2. Using the B clutch assembly puller hooks LST1515 remove the B clutch assembly.

NOTE: To remove assembly, lift up cylinder B until it stops, push assembly back down and lift up again using more weight.

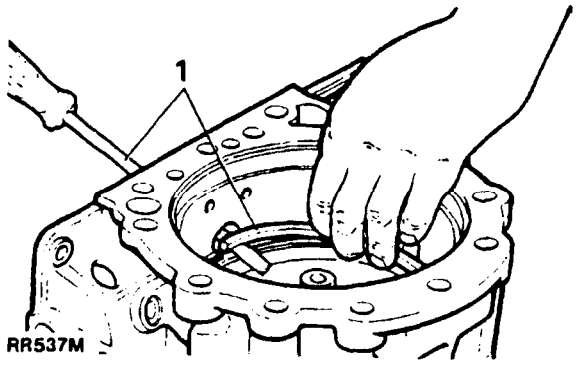
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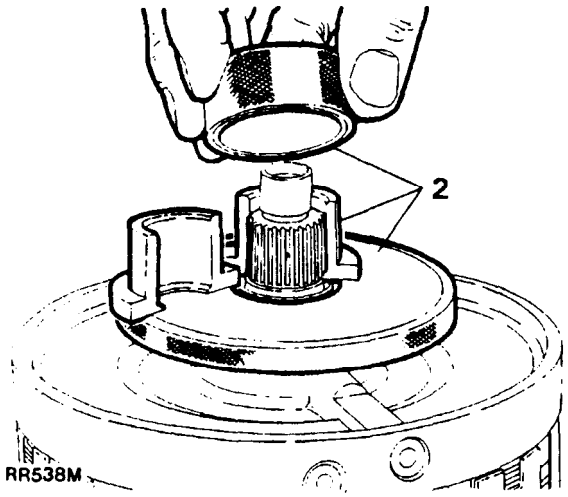
3. Remove support ring and 'O' ring.

Remove C, C' and D Clutch Assembly

1. Using a suitable screwdriver remove centre plate snap ring via a hole in the casing.



2. Using tool LST717 attached to intermediate shaft remove C, C' and D clutch assembly.



3. Remove disc, axial bearing and thrust washer.

Remove 4th Gear Assembly

1. Turn gearbox to the horizontal position.
2. Push assembly out from the rear, guiding it from the front of the casing.

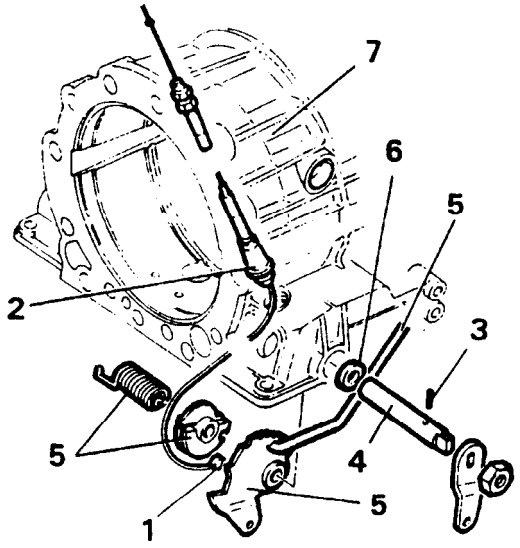
Transmission Gear Selector Assembly and Kickdown Cable

Remove and overhaul

1. Remove the kickdown cable from the cam.
2. Using kickdown cable remover LST112, remove the kickdown cable from the casing.
3. Using a punch remove the roll pin from the selector shaft.
4. Using a pair of pliers or grips pull the selector shaft from the casing.
5. Remove the stop washer, connection rod, cam and leg spring.
6. Using a screwdriver pry out the seal ring located in the gearbox casing and discard.

NOTE: At this stage the gearbox is totally stripped.

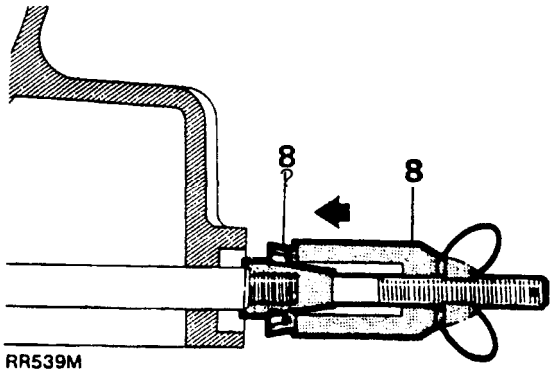
7. Inspect and clean casing ensuring no damage has occurred.



RR915M

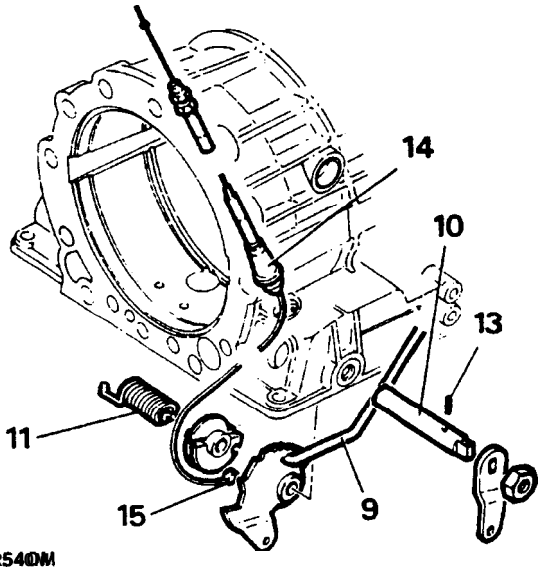
Assemble

8. Fit new seal ring into gearbox casing using selector shaft oil seal replacer LST114.



RR539M

9. Fit connection rod into the stop washer.
10. Place stop washer with connection rod into the gearbox casing and then feed the selector shaft into the casing.
11. Fit the leg spring onto the cam.
12. Place the assembly into the gearbox casing and push the selector shaft through until the hole in the shaft aligns with the hole in the stop washer.
13. Using a suitable punch, fit roll pin with the open side facing the rear of the gearbox casing.
14. Fit new kickdown cable assembly into its seat on the gearbox casing.



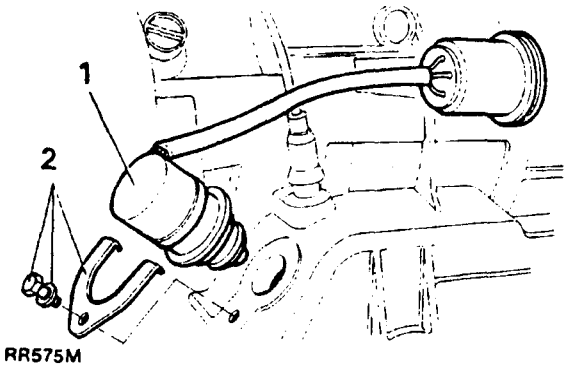
RR540M

15. Fit the nipple of the kickdown cable into the cam seat ensuring the cam has been turned one revolution to load the spring.

NOTE: After gearbox has been refitted check the kickdown cable and gear selector adjustments are correct. (See kickdown cable adjustment and gear lever selector cable setting).

Fit Inhibitor Switch

1. Fit new inhibitor switch if existing one was damaged.
2. Replace retaining plate and fix with spring washer and bolt, securing tightly.



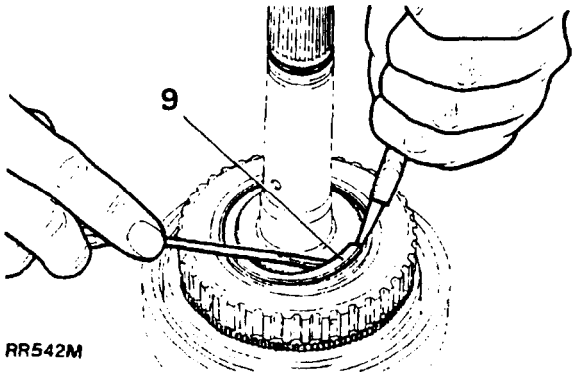
RR575M

4th Gear Assembly Overhaul

1. Using soft-jawed vice secure the 4th gear assembly by gripping the output shaft.
2. Remove the sungear.
3. Remove the planet gear assembly.

NOTE: Removal of snap-ring on assembly is not necessary unless damage has occurred.

4. Remove the disc washer, axial bearing and thrust washer.
5. Remove assembly from the vice and turn upside down onto the bench.
6. Remove cylinder F from cylinder E.
7. Remove cylinder E from the freewheel 3rd.
8. Remove axial disc, cage and two thrust washers.
9. Using pliers and screwdriver remove the snap-ring on carrier E.



RR542M

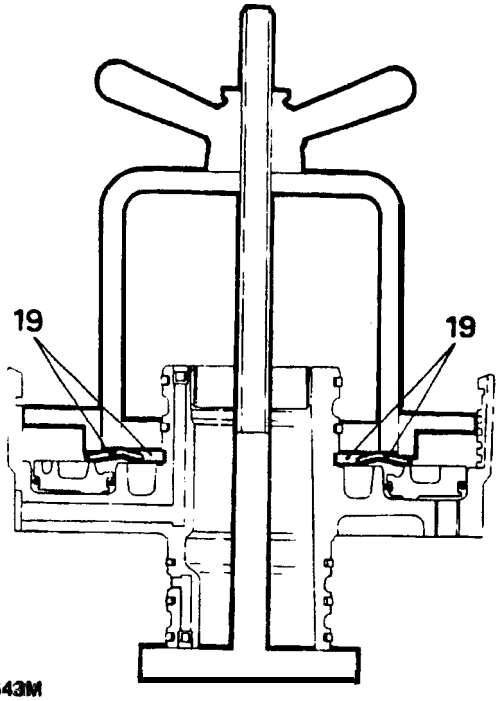
10 Turn the assembly around and remove the output shaft from ring gear by pushing the gear downwards.

NOTE: Do not remove the snap-ring on output shaft.

11. Place ring gear on bench, teeth side down.
12. Remove carrier E from the ring gear assembly.
13. Remove the freewheel cage assembly from the ring gear by using an upward turning motion.
14. Remove the snap-ring retaining the freewheel ring (inner) to the hollow gear.
15. Remove the freewheel ring (inner) from the hollow gear.
16. Remove freewheel cage from freewheel ring (outer).

NOTE: Care should be taken when removing the freewheel ring, which due to the rollers and springs becoming loose may fall out.

17. Remove the snap-ring retaining the clutch plates and steel plates in cylinder F.
18. Remove four clutch plates and five steel plates from cylinder F.
19. Using clutch spring compressor LST1016-1, press down on the spring plate and remove the split rings.

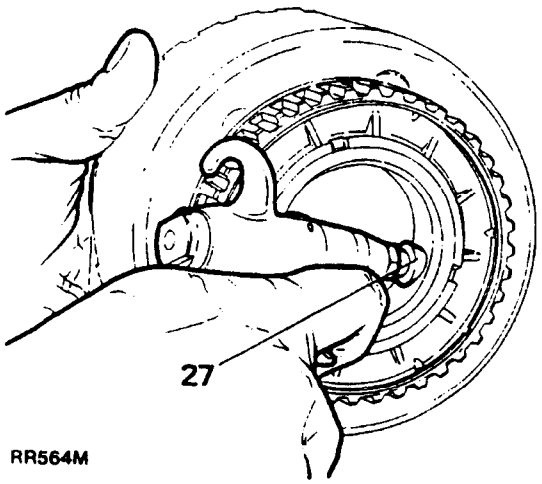


RR543M

20. Remove the spring plate.
21. Turn the cylinder upside down, using two small punches placed in the holes (diametrically opposite each other), push down and remove the piston.
22. Remove and discard the two 'O' rings from the piston.

NOTE: The five sealing rings do not need to be removed on the cylinder unless any damage has occurred to them.

23. Remove the snap ring from cylinder E.
24. Remove the four clutch plates and five steel plates from cylinder E.
25. Using clutch spring compressor LST1016-1, press down on the spring plate and remove the split rings.
26. Remove the pressure plate.
27. Remove piston E by using air pressure directed into the oil feed hole.



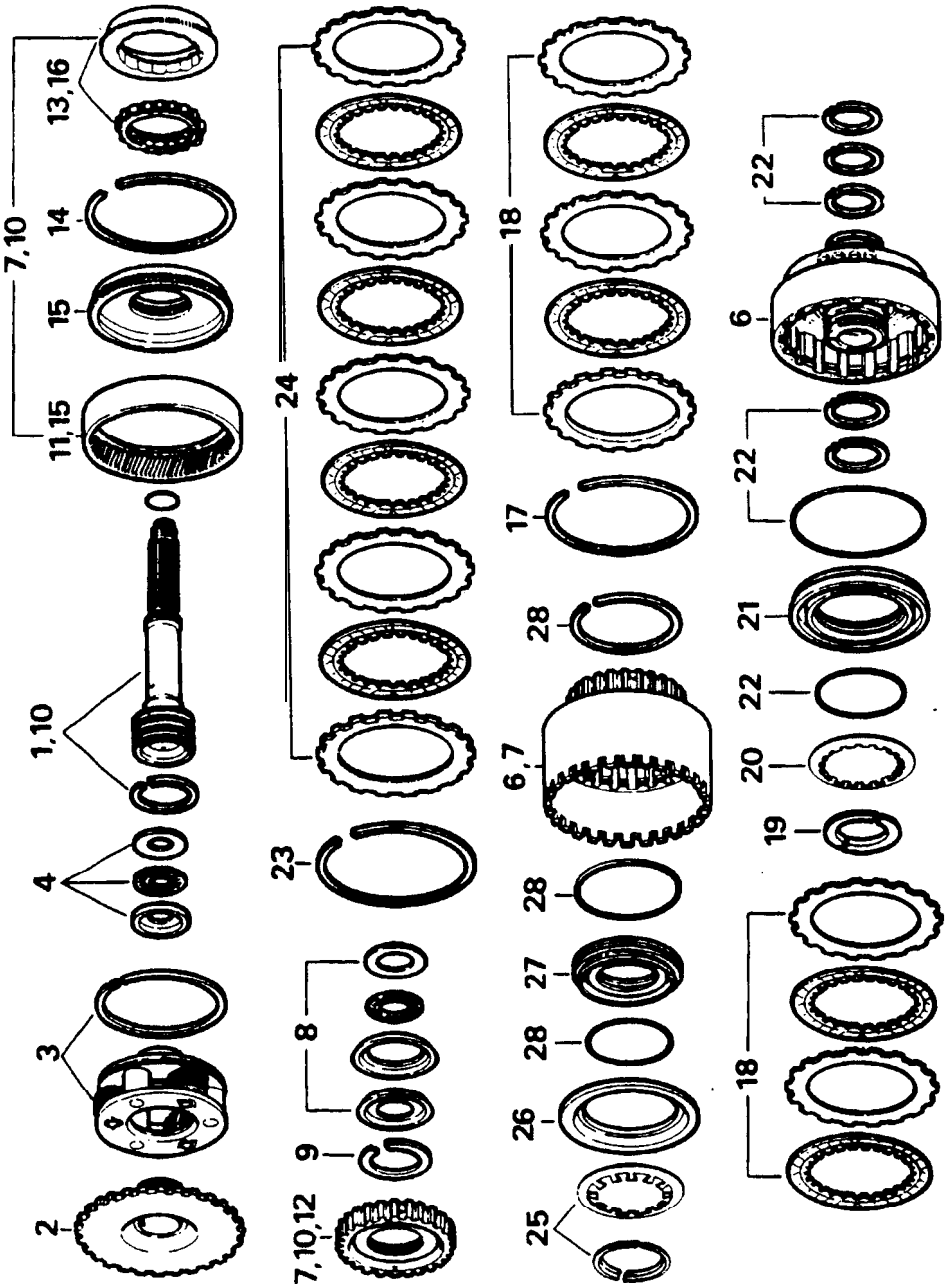
RR564M

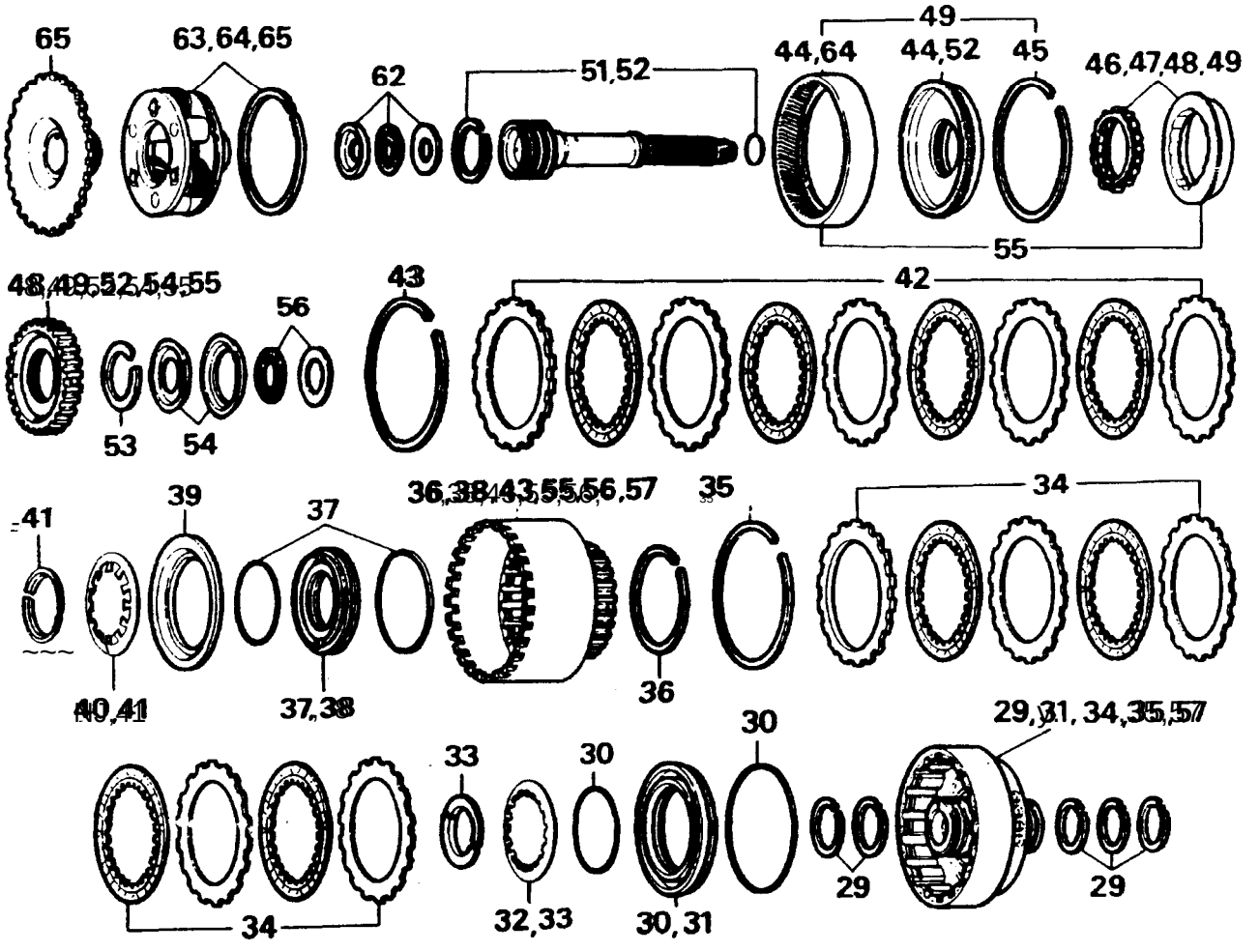
28. Remove and discard the two 'O' rings from the piston.

WARNING: Before using an air line ensure all necessary safety precautions are taken to prevent personal injury, i.e., safety glasses, protective clothing etc.

NOTE: Do not remove the snap-ring at the bottom of the E cylinder, unless damaged.

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RR541M


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RR547M

Assemble

29. Fit three seal rings on the outside hub and two seal rings on inside hub of cylinder F if they have been removed.

    NOTE: Ensure each seal ring is snapped together.

30. Fit new 'O' rings onto the F piston.

    NOTE: For ease of assembly apply Petroleum Jelly on '0' rings and stretch the inner '0' ring to avoid damage on installation.

31. Fit piston F into cylinder F.
32. Fit spring plate using clutch spring compressor LST1166.1.
33. Fit the two halves of the split ring to secure the spring plate in position, then remove the clutch spring compressor.
34. Install the clutch plates and steel plates into the F cylinder starting with a steel plate then clutch plate finishing up with the end plate which is thicker than the normal steel plates.
35. Fit the snap-ring into cylinder F to retain the clutch plate assembly.

    NOTE: Do not confuse the steel plates of F clutch with that of the E clutch. The differences are thus: F clutch-steel plates are thicker and the end plate has no inner teeth.

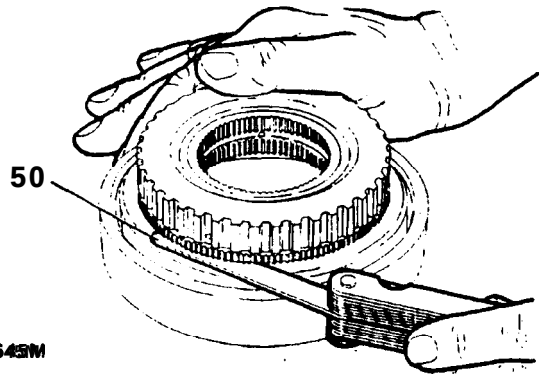
36. Fit new snap-ring at bottom of cylinder E if it has been removed.
37. Fit the two 'O' rings onto the E piston.

    NOTE: For ease of assembly apply Petroleum Jelly.

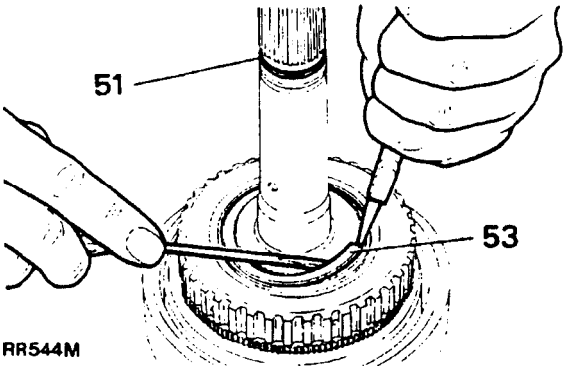
38. Fit E piston into cylinder E.
39. Fit the pressure plate with 'depression' facing downwards.
40. Fit spring plate using clutch spring compressor LST1166.1.
41. Fit the two halves of the split ring to secure the spring plate in position then remove the clutch spring compressor.
42. Install the clutch plates and steel plates, starting with a steel plate then clutch plate, finishing up with the end plate which is thicker than the normal steel plates.
43. Fit the snap-ring into cylinder E to retain the clutch plate assembly.

    NOTE: Do not confuse the steel plates of E clutch with that of the F clutch. The differences are thus: E clutch-steel plates are thinner and the end plate has inner teeth.

44. Fit the freewheel ring (inner) to the hollow gear.
45. Secure using the snap-ring.
46. Fit freewheel cage into the freewheel ring (outer), and press home.
47. Turn the freewheel cage in the freewheel ring (outer) until rim of the cage has been seated.
48. Fit carrier E to freewheel cage assembly.
49. Fit freewheel cage assembly to ring gear assembly using a clockwise motion.
50. A minimum clearance of 0.1 mm (0.0039 in) should be obtained between the freewheel cage assembly and ring gear.



51. Inspect the output shaft for damage to the snap-ring, if any, replace snap-ring; also remove '0' ring and discard, replace with new 'O' ring.
52. Align inner teeth of carrier E with freewheel ring (inner) teeth and then place freewheel 3rd assembly onto the output shaft.
53. Secure snap-ring into position, retaining the freewheel 3rd.
54. Fit the steel thrust washer and then the copper thrust washer onto the freewheel 3rd assembly.

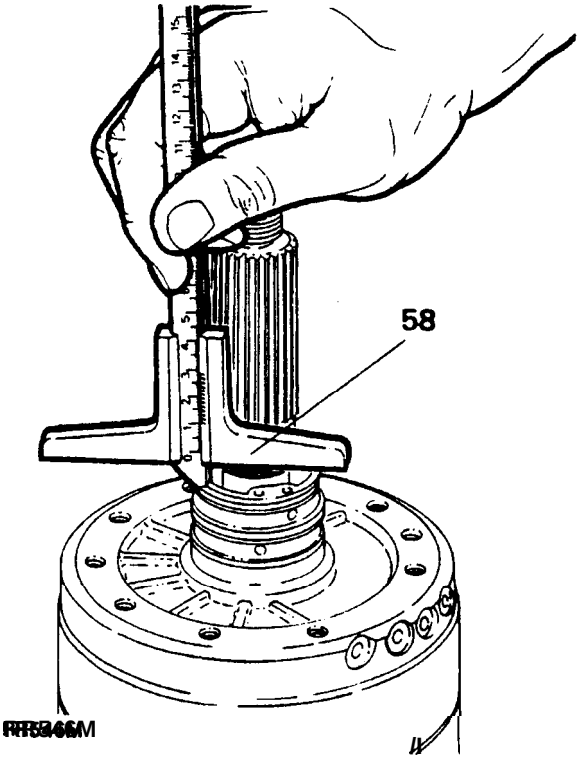


55. Fit cylinder E onto freewheel 3rd assembly using a turning motion, ensuring that the teeth of the end plate line up with the freewheel ring touter).

NOTE: When correctly assembled, copper thrust washer must be touching cylinder E assembly. The cylinder E assembly will turn in a clockwise direction when holding the output shaft. If the cylinder E assembly is turned in a counter clockwise direction the freewheel will lock up.

56. Fit the axial cage and axial disc onto the rear of cylinder E.
57. Using a turning motion, fit cylinder F assembly onto cylinder E assembly.
58. When correctly mounted the raised edge of the output shaft will be 10.00 mm (0.393 in) above the top surface of cylinder F assembly.

NOTE: Disengagement of end plate and freewheel ring (inner) will occur if end play exceeds 3.00 mm (0.118 in).



59. Fit the complete 4th gear assembly into the gearbox, ensuring that the oil feed holes in cylinder F line up with the corresponding holes in the gearbox casing.
60. Secure the 4th gear assembly to the gearbox using ten countersunk screws. Tighten screws to the specified torque using Torx bit TX30 (see section 06-Torque values).

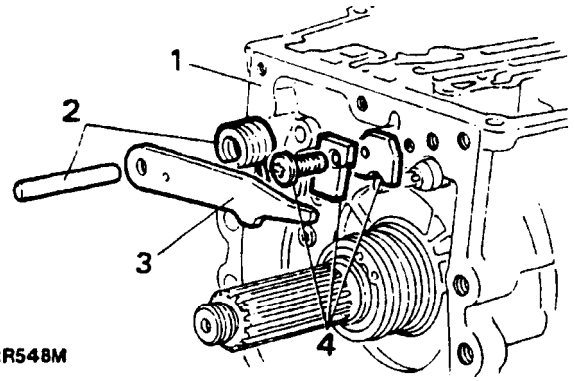
NOTE: If screws are not tightened correctly, clutch pressure will be lost in clutch F.

61. Turn the gearbox so that the front of the case is uppermost.
62. Fit the disc washer, axial cage and thrust washer onto the 4th gear assembly.
63. Fit the seal ring onto the planetary case and snap together if ring has been removed.
64. Fit the planetary set into the hollow gear using a turning motion.
65. Fit the sun gear onto the planetary set.

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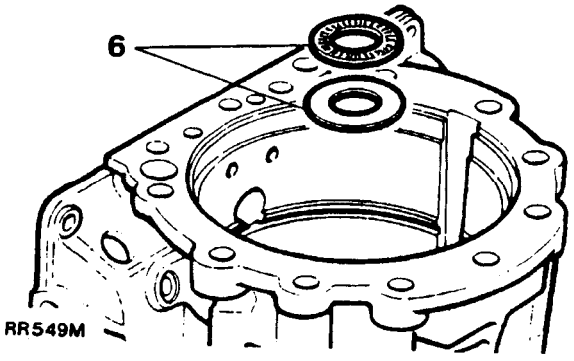
Refit park mechanism

1. Turn gearbox into a horizontal position.
2. Fit leg spring over pin and place into rear of gearbox.
3. Fit pawl onto pin, to tension spring fit leg of spring into hole of pawl.
4. Fit plate and guide plate and tighten to specified torque using Torx bit TX27 (see section 06-Torque values).



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5. Turn gearbox so that the front of the case is uppermost.
6. Fit the disc and axial cage.



RR549M

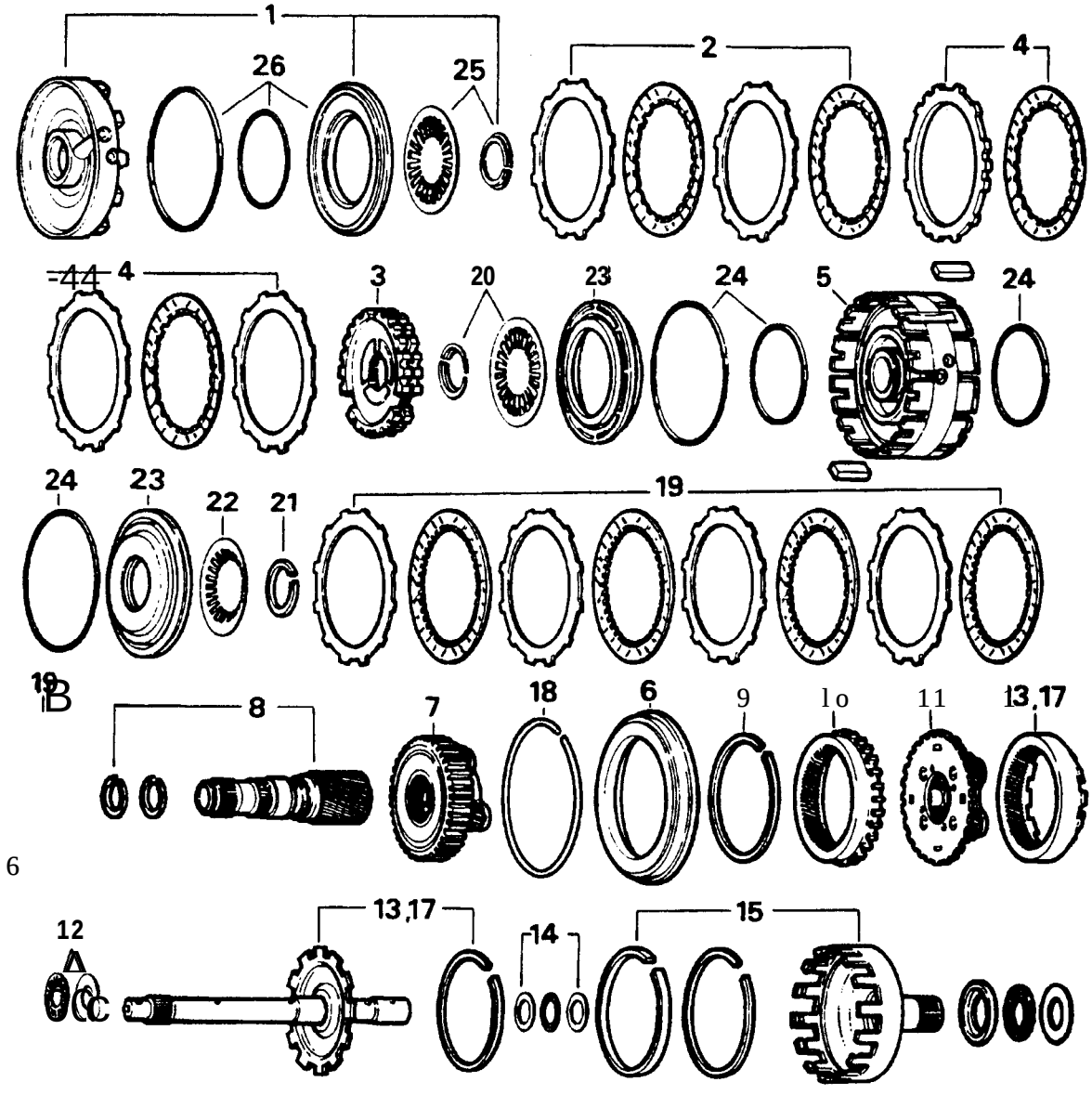
Brakes C, C' and D with planetary sets-overhaul

1. Remove the centre plate assembly.
2. Remove the two brake C' clutches and two steel plates from cylinder C-D.
3. Remove freewheel 2nd complete.
4. Remove the two brake C' clutches and three steel plates from cylinder C-D.
5. Remove the cylinder C-D with brake D assembly.
6. Remove the support ring from the planetary sets assembly.
7. Remove the front planetary set with freewheel assembly.
8. Remove the sunshaft from the assembly.

NOTE: Do not remove the seal ring from the sunshaft unless damaged.

9. Remove the snap-ring from the hollow gear.
10. Remove the hollow gear from the assembly.
11. Remove the rear planetary set.
12. Remove the thrust washer and axial bearing.
13. Remove the intermediate shaft with the hollow gear complete.
14. Remove the axial bearing and two thrust washers, one from each side of the bearing.
15. Remove the distance ring.

NOTE: The snap-ring in the webshaft need only be removed if damaged.

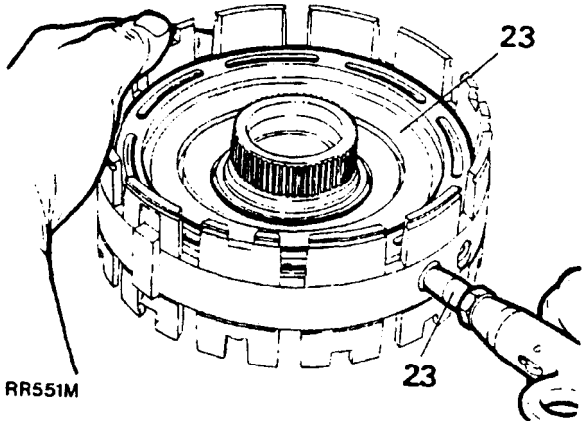


16. Holding the hollow gear with the rear face uppermost, remove the snap-ring.
17. Disconnect the hollow gear from the intermediate shaft.
18. Remove the external snap-ring from the brake D assembly.
19. Remove the four clutch plates and five steel plates from the assembly.
20. Using clutch spring compressor LST0164-1 press down on the spring plate to remove the split rings.
21. Turn cylinder C-D upside down and using the clutch spring compressor, remove the snap-ring with pliers.
22. Remove the spring plate.

Continued

23. For ease of removal of both piston C and piston D, use air pressure fed through the oil feed holes.

WARNING: Before using an air line ensure all necessary safety precautions are taken to prevent personal injury, i.e., glasses, protective clothing etc.

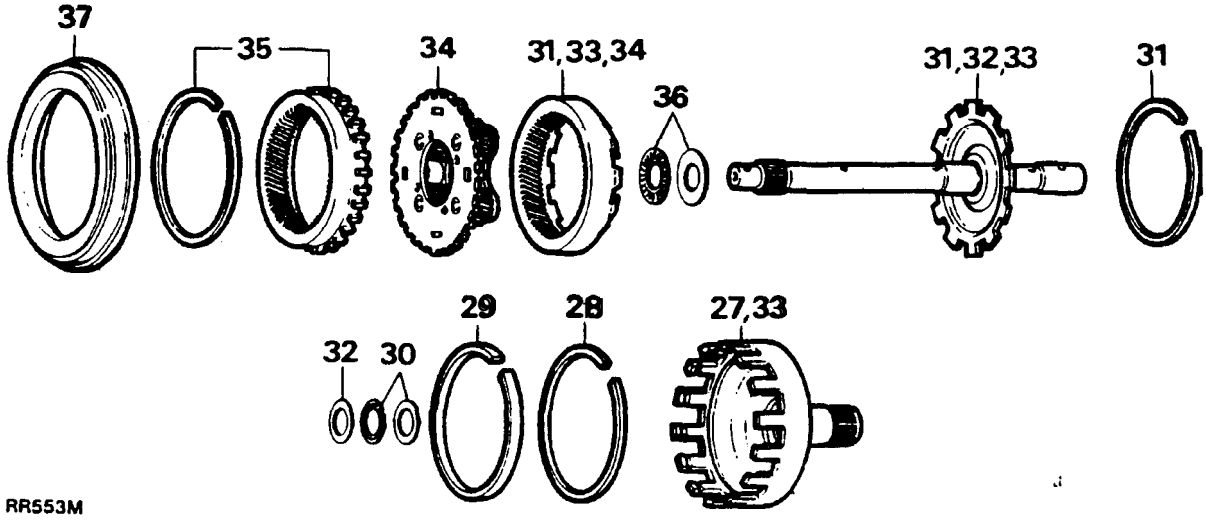


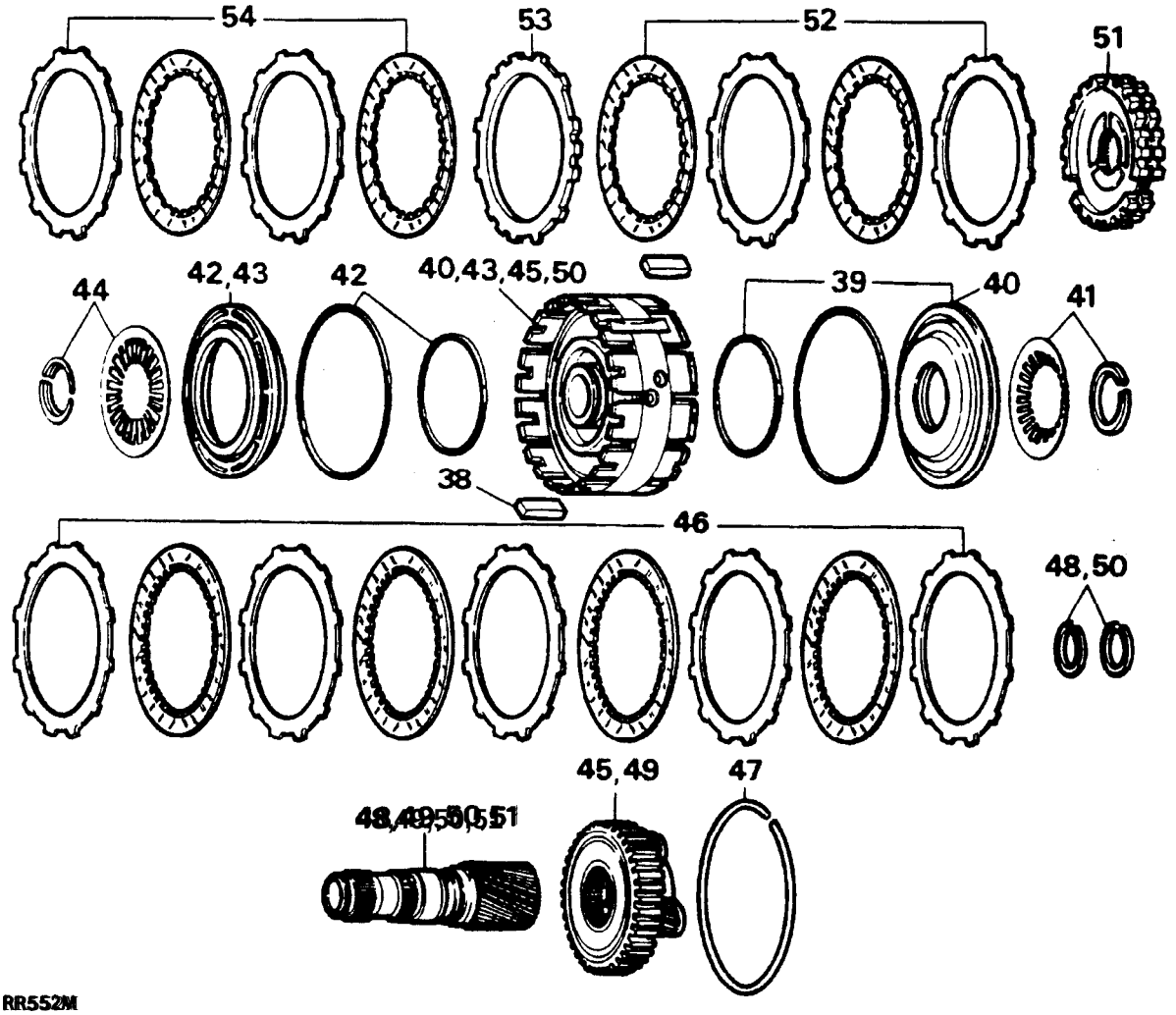
24. Discard 'O' rings from both piston assemblies.
25. Using the clutch spring compressor remove the spring plate, as previously explained, from the centre plate assembly.
26. To remove the piston use air pressure as previously described and discard 'O' rings.

Assemble

27. Secure the webshaft into a soft-jawed vice.
28. Fit the snap-ring if it has been removed into the lower groove.
29. Fit the distance ring into the webshaft.
30. Place a disc washer and axial cage into the assembly.
31. Assemble together the hollow gear with the intermediate shaft and secure with the snap-ring.
32. Place the other disc washer onto the rear of the intermediate shaft using grease.
33. Fit the intermedrate shaft assembly into the webshaft ensuring the disc washer mates up to the axial cage.
34. Using a turning motion fit the rear planetary set into the hollow gear.
35. Fit the front hollow gear into the webshaft assembly and secure with a snap-ring.
36. insert disc washer and axial cage.
37. Place support ring onto the webshaft assembly.
38. Tap the two fitting pegs down into the slots on the side of the cylinder C-D if they have been removed.
39. Place the two '0' rings onto piston D.

NOTE: For ease of assembly, apply Petroleum jelly to the 'O' rings.





RR552M

40. Fit the D piston into cylinder C-D ensuring that the correct side is selected, that is, the side with the least number of slots in cylinder C-D.
41. Fit the spring plate and using the clutch spring compressor LST1016-1, fit the snap-ring into the groove.
42. Place the two 'O' rings onto piston C.

    NOTE: For ease of assembly, apply Petroleum Jelly to the 'O' rings.

43. Fit the C piston into cylinder C-D.
44. Using the clutch spring compressor LST1016-1, fit the spring plate and the two halves of the split rings.
45. With the clutch D opening uppermost, fit the planetary set with freewheel 1st gear onto the hub of cylinder C-D.
46. Fit the clutch plates and steel plates starting with a steel plate then a clutch plate, finishing up with the thin end plate.
47. Fit the snap-ring on the outside of the C-D cylinder which secures the D clutch assembly.
48. Fit two seal rings onto the sunshaft and snap together if they have been removed.
49. Fit the sunshaft into the planetary set, splines first.
50. Turning the whole assembly around so the C clutch side is uppermost, fit the assembly into the webshaft assembly.
51. Fit freewheel second onto the sunshaft, before fitting align the upper and lower halves.

    NOTE: To ensure correct fitment of the freewheel second, the top of the assembly is marked with the word 'OBEN'

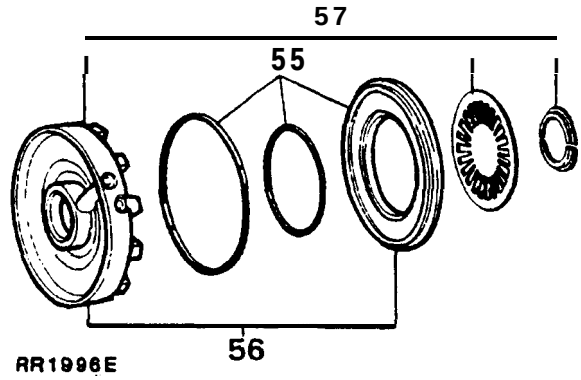
52. Fit the C clutch plates and steel plates starting with a steel plate then a clutch plate into the longer slots of C-D cylinder.

Continued

53. Fit end plate which has three groups of three teeth, of which the middle tooth must fit into the short slots in the C-D cylinder.
54. Fit the 'C' clutch assembly starting with a clutch plate ending with a steel plate.

    NOTE: When fitting these plates ensure teeth on the outside do not go into the 'V' shaped area of the C-D cylinder.

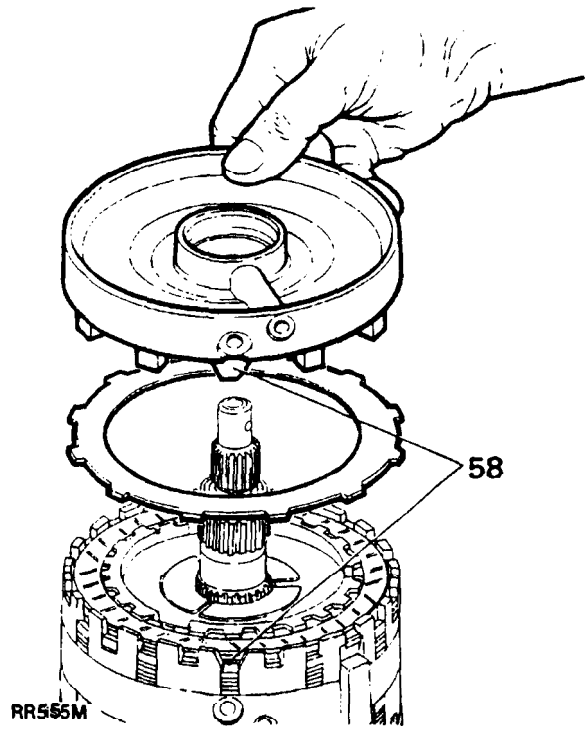
    If thin steel plates have to be added into the C or 'C' clutch assembly ensure that these plates are placed on the side nearer to the respective pistons.

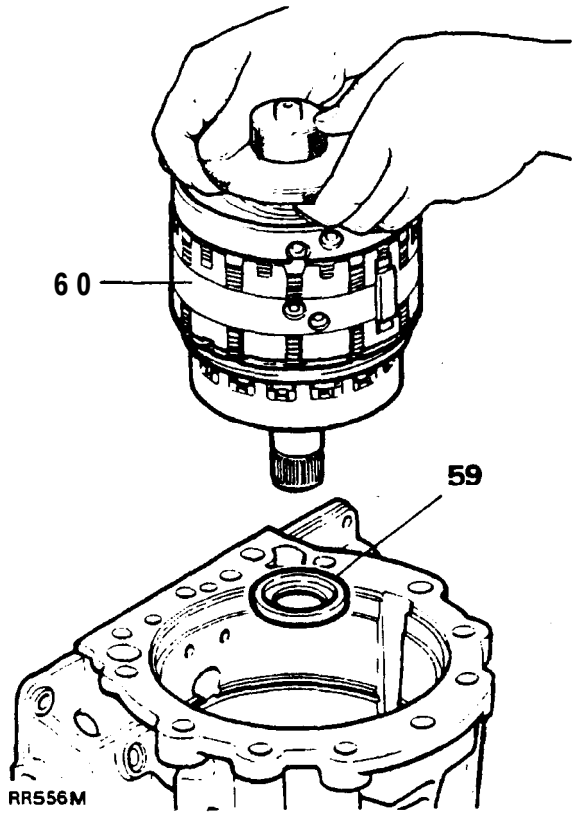


55. Fit the two 'O' rings onto the piston 'C'.

    NOTE: For ease of assembly, use Petroleum Jelly.

56. Fit 'C' piston assembly into centre plate.
57. Using clutch spring compressor LST0156-1, fit spring plate and the two halves of the split rings.
58. Place the centre plate onto the C-D cylinder making sure that the 'W' shape in the plate locates in the 'V' shaped hollow in the C-D cylinder.
59. Remove the C, 'C' and D clutch assembly from vice and place a greased thrust washer to the rear face of the webshaft.
60. Fit the whole assembly into the transmission case using the gear train remover/replacer LST117, ensuring that the oil feed holes are aligned with those in the bottom of the casing.
61. Secure the whole assembly with a snap-ring which fits into the groove inside the casing.

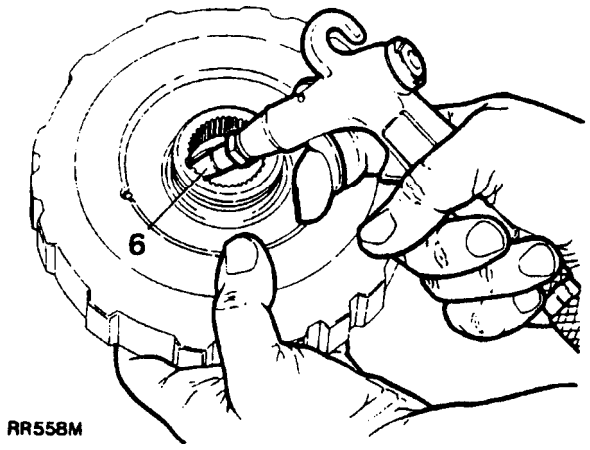




Clutch B Overhaul

NOTE: The illustration for the following overhaul instructions is located at the top of the following page.

1. Place B clutch assembly with open face upwards.
2. Remove the snap-ring from inside the assembly.
3. Remove the four clutch plates and five steel plates.
4. Using clutch spring compressor LST1 016-1, depress spring plate and remove snap-rrng and retaining washer.
5. Remove the spring plate.
6. For ease of removal of the piston B, use air pressure fed through the oil feed hole, then turn assembly upside down and tap lightly on the working surface.



RR558M

WARNING: Before using an air line ensure all necessary safety precautions are taken to prevent personal injury, i.e., safety glasses, protective clothing etc.

7. Remove and discard the two 'O' rings on piston B.
8. Remove seal ring on bottom of B cylinder if damage has occurred.

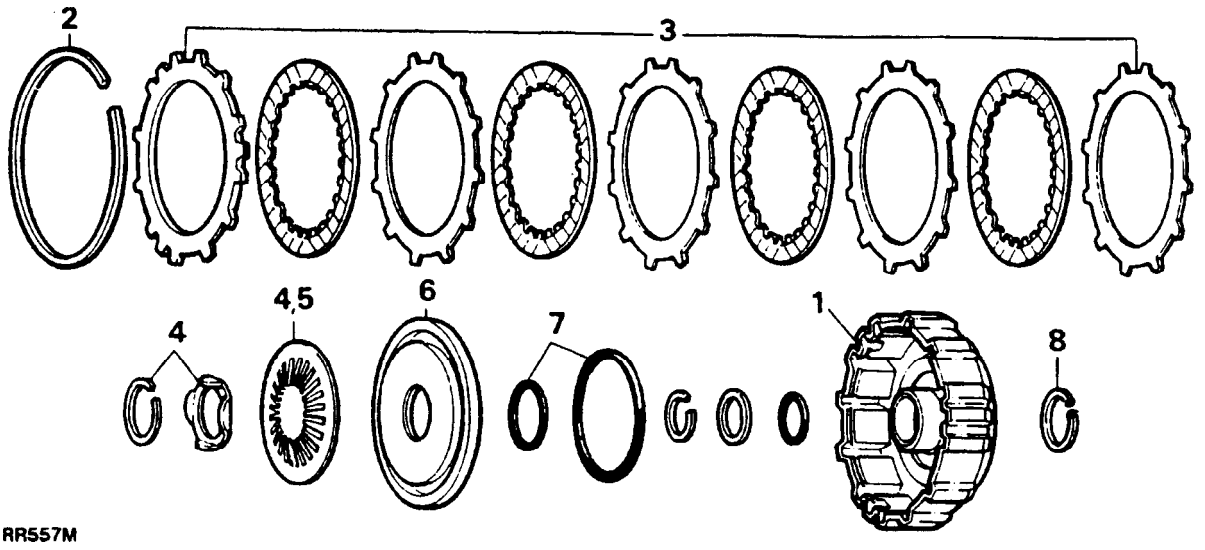
Assemble

9. Fit the two 'O' rings onto piston B.

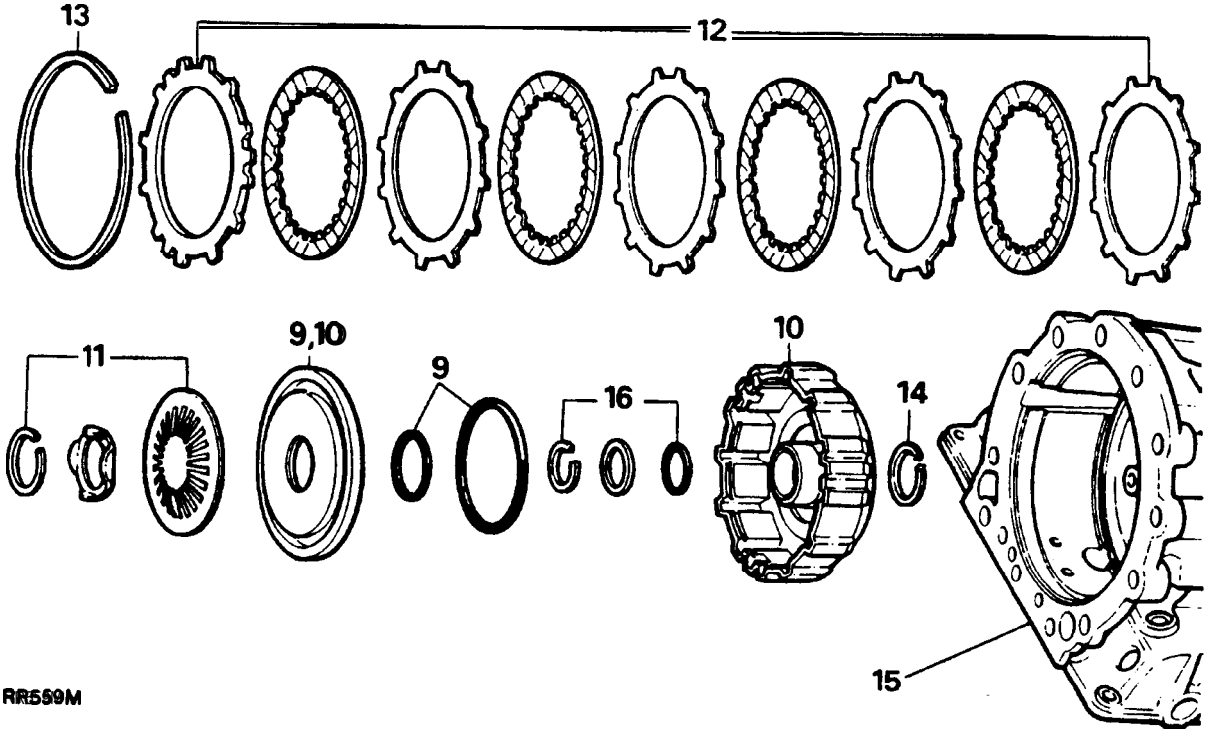
NOTE: For ease of assembly use a Petroleum Jelly.

10. Install piston B into cylinder B.
11. Place spring plate into cylinder B and using clutch spring compressor LST1 016-1, fit retaining washer (lips facing upward) and snap-ring.
12. Fit the clutch and steel plates starting with a steel plate finishing with the steel plate with three sets of three teeth grouped together.
13. Fit snap-ring into the clutch B assembly.
14. Turn upside down and fit seal ring and snap together if removed.
15. Install B clutch assembly into the transmission case, clutch plates facing upwards.
16. Using B clutch 'O' ring and snap-ring replacer LST116, fit 'O' ring, support ring and finally the snap-ring.

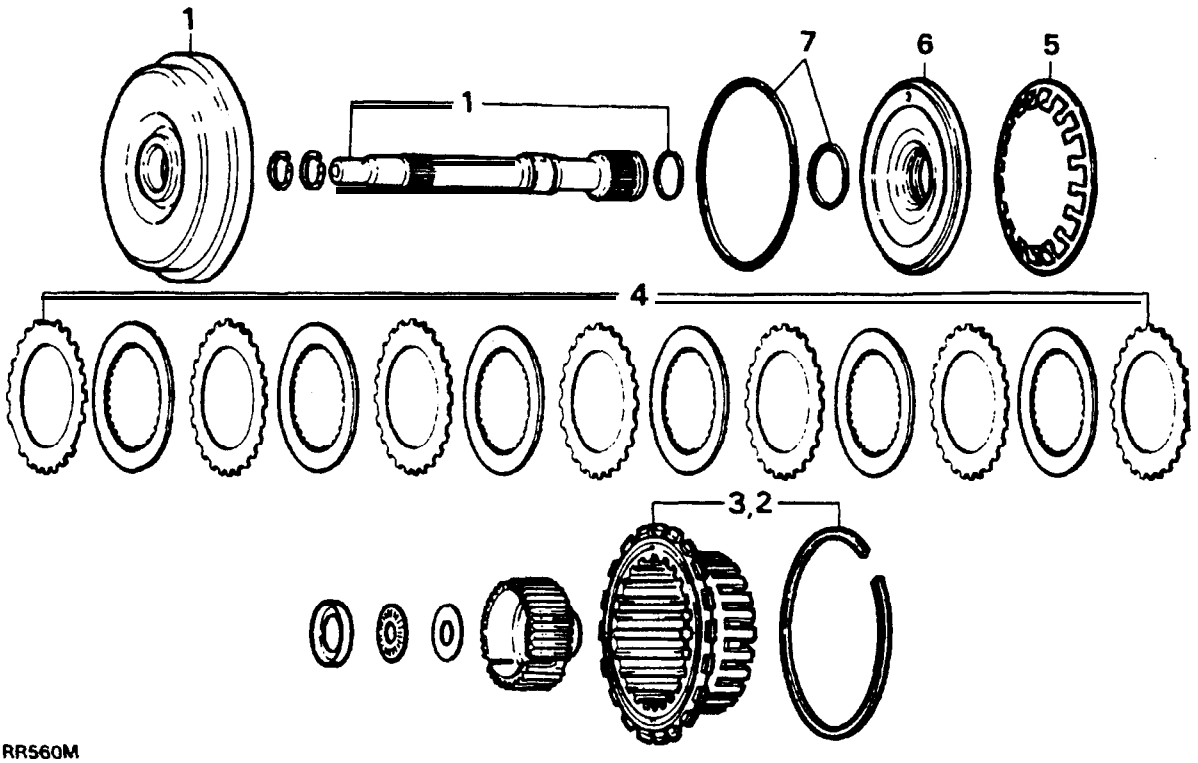
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RR557M



RR559M



RR560M

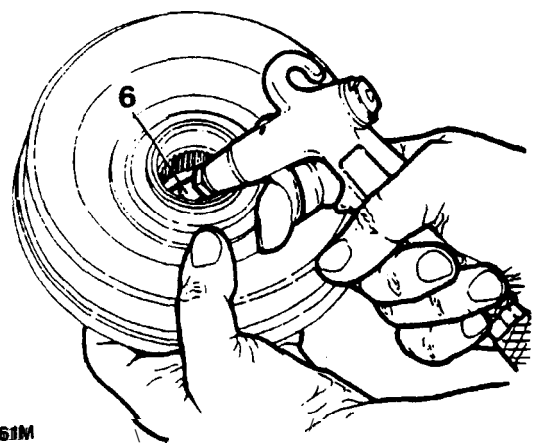
A Clutch Assembly Overhaul

1. Remove the input shaft by holding the A clutch assembly firmly and pushing the shaft against the working surface. Remove the 'O' ring and discard.
2. Using a suitable press, depress the A-B carrier and remove the snap-ring.
3. Remove carrier A-B.
4. Remove the six clutch plates and seven steel plates, plus two wavy spring plates fitted to later transmissions.

   NOTE: If there is evidence of clutch slip or if the plates are worn, replace the clutch unit using the latest type.

5. Remove spring plate.
6. For ease of removal of piston A, use air pressure fed through the oil feed hole.

WARNING: Before using an air line ensure all necessary safety precautions are taken to prevent personal injury, i.e., safety glasses, protective clothing etc.



RR561M

7. Remove and discard both 'O' rings on piston A.

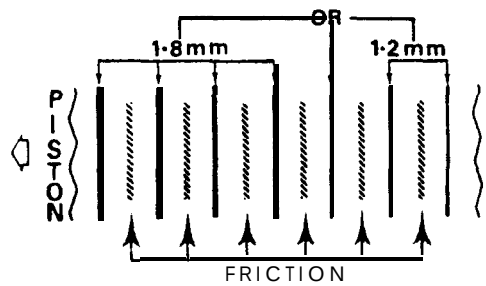
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Assemble

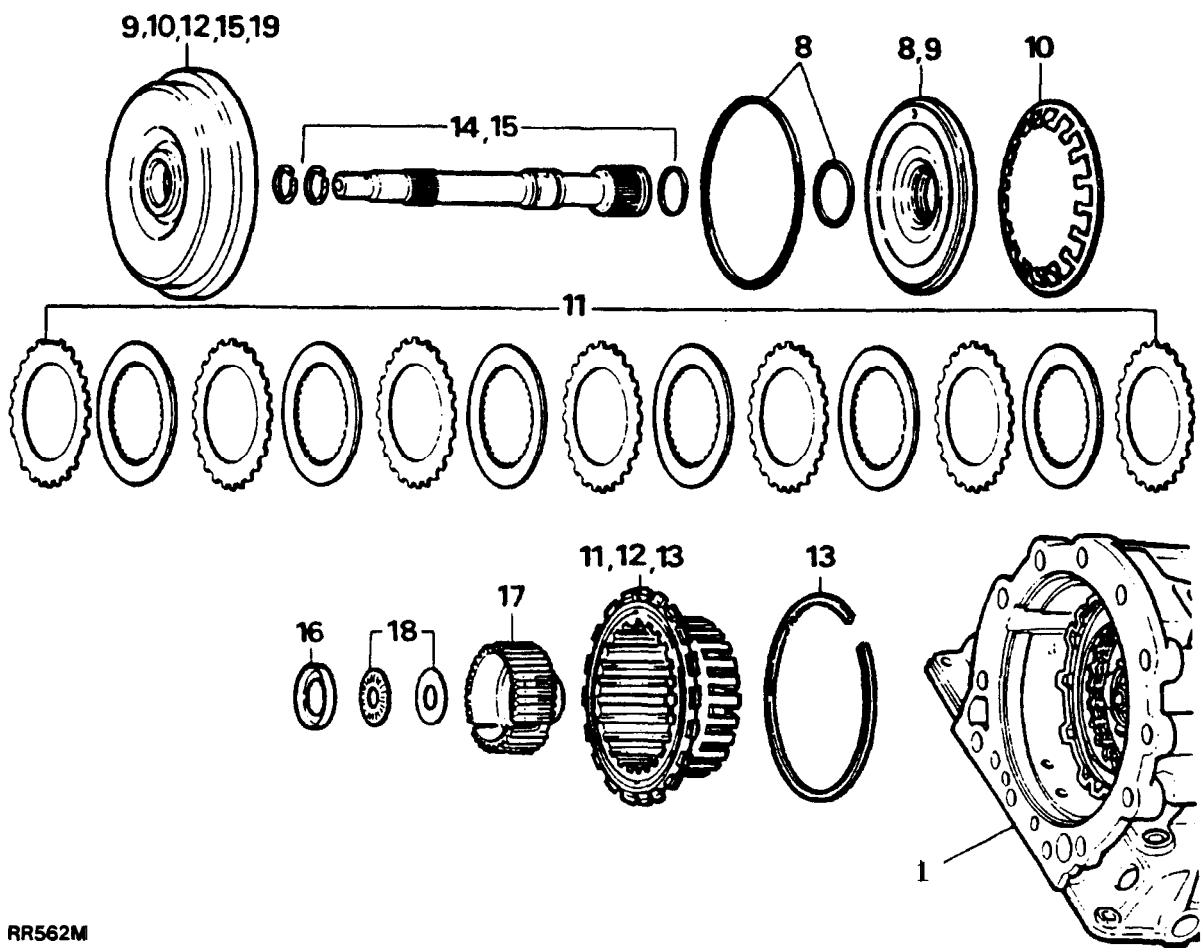
8. Fit the two '0' rings onto piston A.
9. Place the piston into cylinder A.
10. Fit the spring plate into the cylinder A with the convex side facing the piston.
11. Placing carrier A-B on the bench, fit the clutch unit. If the latest clutch unit is being fitted, see RR2669E for the correct build sequence. Note also that one steel plate is of alternative thickness.
12. Fit carrier A-B with the clutch assembly onto cylinder A.
13. Using a suitable press, depress the A-B carrier and secure with the snap-ring.
14. Fit the two seal rings, if removed, and an '0' ring onto the input shaft.
15. Fit the input shaft into the cylinder A assembly and press downwards until shaft meets the stop.
16. Fit the thrust washer onto the input shaft seat.

NOTE: Use Petroleum Jelly to retain washer in place.

17. Install the inner carrier A onto the intermediate shaft within the gearbox.
18. Place the disc washer and axial cage into the inner carrier A.
19. Fit cylinder A assembly into the gearbox using a right to left twisting motion. This will enable the teeth of the clutch plates to mesh into the A-B carrier and inner carrier.

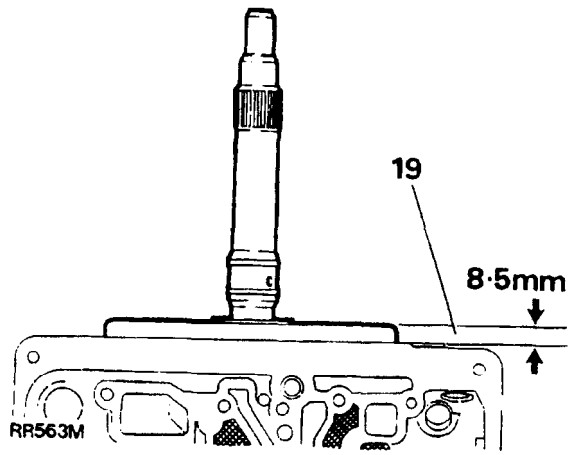


AR2669E



RR562M

NOTE: When properly engaged the top of the cylinder A should not protrude more than 8.5 mm (0.33 in) above the gearbox front face.

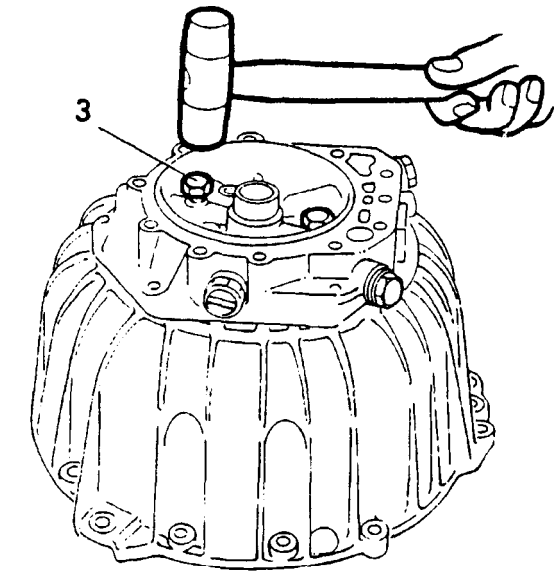


20. Place the thrust washer and axial cage onto the A cylinder.

Pump, Intermediate Plate and Bell Housing

Remove and Overhaul

1. Place the bell housing on the bench, open face down.
2. Remove the eight hexagonal bolts on the rear of the pump.
3. Screw in two bolts, diagonally opposite each other, tap lightly using a soft-headed mallet, this will free the pump assembly from the intermediate plate.



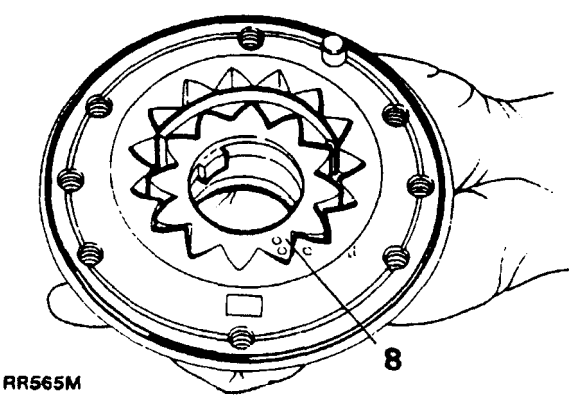
4. Remove the six remaining bolts situated on the inside of the bell housing.
5. Separate the bell housing from the intermediate plate.

Pump Assembly

6. Using a suitable tool remove the shaft sealing ring and 'O' ring from the pump housing and discard.
7. Strip, inspect and clean the pump assembly using a lint-free rag.

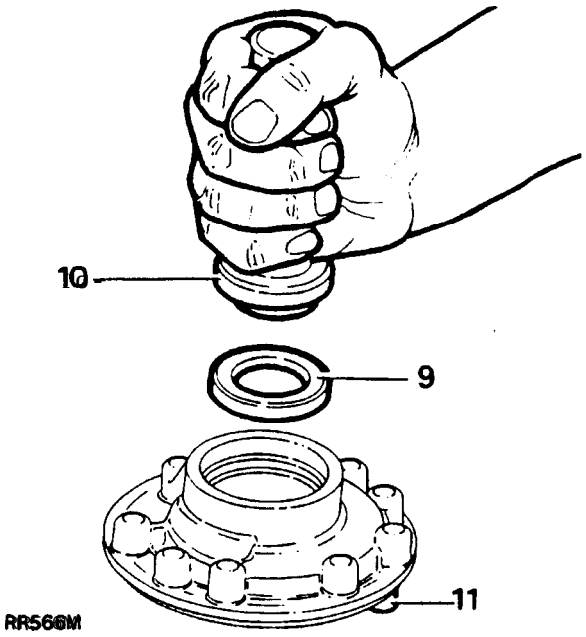
   NOTE: If damage has occurred to the assembly, replace the whole pump.

8. Replace the pump hollow gear and pump gear into pump housing with the marked side of gears facing upwards.



Continued

9. Fit the 'O' ring onto the circumference of the pump housing.
10. Using oil seal replacer LST108, fit the shaft seal ring into the pump housing.
11. Fit the alignment pin into the pump housing.

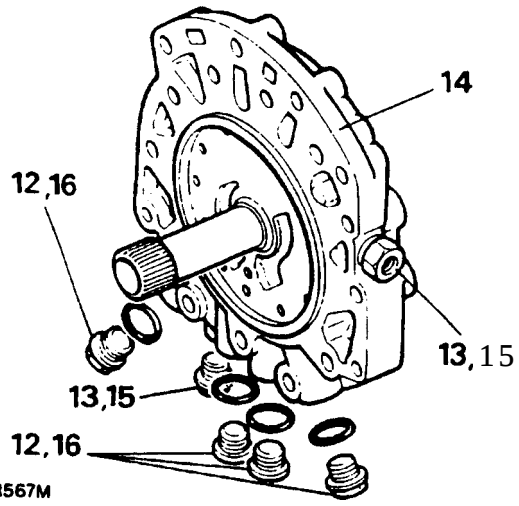


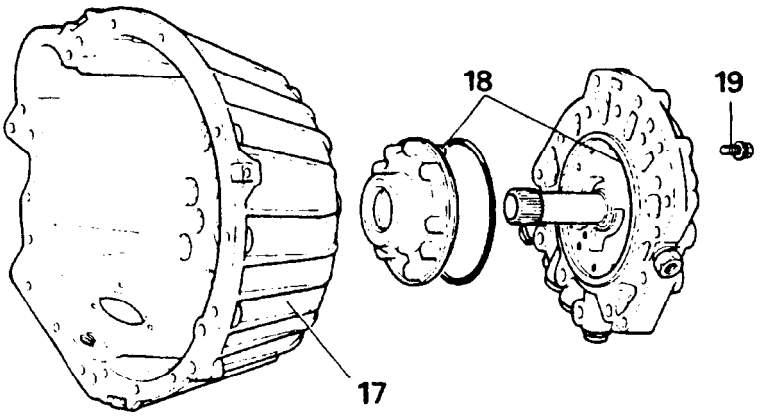
Intermediate Assembly

12. Remove the four screw plugs and seal rings from the plate and discard the seal ring.
13. Remove the oil cooler pipe adaptors.
14. inspect and clean the intermediate plate with a lint-free rag.

NOTE: If damage is found replace the intermediate plate.

15. Fit the oil cooler pipe adaptors.
16. Fit the four screw plugs into their correct locations with new seal rings.





RR568M

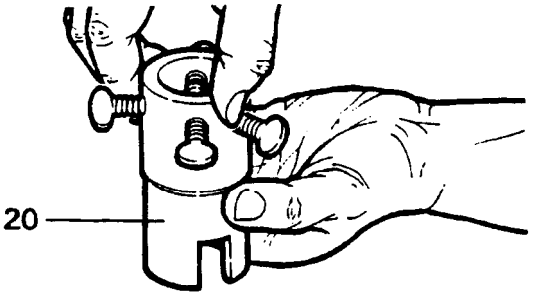
Refit bell housing, intermediate plate and pump assembly

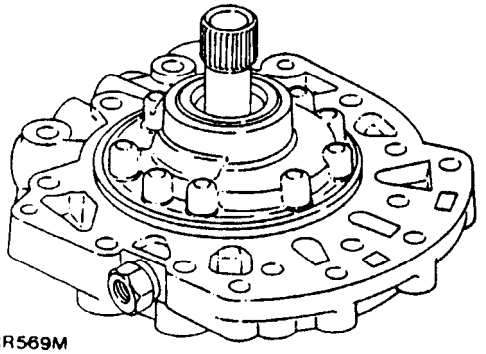
17. Inspect and clean the bell housing.

    NOTE: If damage is found replace the bell housing

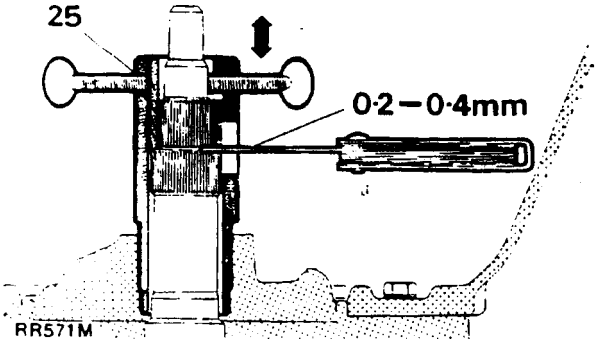
18. Align the dowel in the pump with its hole in the intermediate plate and press the housing into position.
19. Secure the pump housing to the intermediate plate with the eight hexagonal bolts and tighten to the specified torque (see section 06-Torque values).
20. Using the oil pump rotation sleeve LST111 check that the pump gears rotate freely.
21. Place the gasket and disc washer onto the intermediate plate assembly using a petroleum jelly.
22. Fit the intermediate plate onto the gearbox.
23. Fit the bell housing onto the intermediate plate assembly.
24. Secure with the six short bolts which locate on the outside diameter ring pattern within the bell housing and the twelve long bolts which are located in the inner diameter ring pattern. Tighten all the bolts to the specified torque (see section 06-Torque values).

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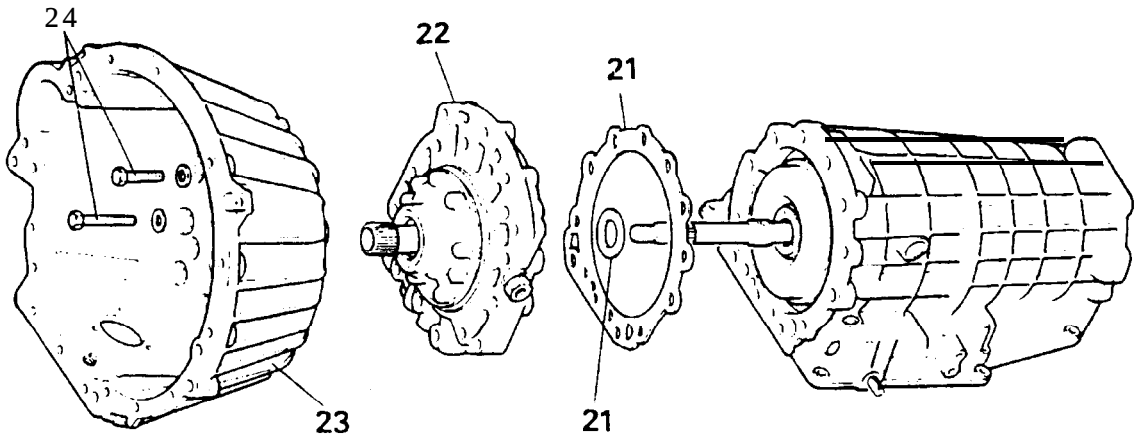




RR569M



RR571M



RR570W

25. Using the end-float gauge LST111 check the axial clearance 0.2 to 0.4 mm (0.008 to 0.016 in). If the axial clearance is not achieved, remove the bell housing/intermediate plate assembly complete and replace existing disc washer using a thicker or thinner one depending on the reading first taken. Re-assemble bell housing/intermediate plate and check the axial clearance once again. Repeat this operation until axial clearance has been achieved.

Checking Axial Clearance

1. Fit LST111 end-float gauge onto the output shaft, making sure the outer shaft engages into the pump.
2. Pressing the output shaft towards the rear of the gearbox and tighten the three screws on the gauge.
3. Measure the clearance and note.
4. Now secure the remaining screw which retains the outer shaft to the inner collar.
5. Pull the whole assembly away from the bell housing, measure the clearance and note.
6. Subtract the first measurement from the second to obtain the axial clearance.

Extension Housing and Governor-Overhaul

1. Remove the two bolts using Torx bit TX27 retaining the parking wheel.
2. Remove the clip and counterweight from inside the governor hub.
3. Remove the two bolts from the top of the governor hub which releases the housing and discard.
4. Release the retaining clip and discard.
5. Remove the pin, spring, piston and weight from the governor housing.
6. Clean and inspect all parts for damage.

NOTE: Replace any part which may be damaged.

7. Remove the seal ring from the extension housing.
8. Clean and inspect the extension housing for damage.

NOTE: If the dowels are damaged replace the dowels only. If extension casing is damaged replace the case and dowels.

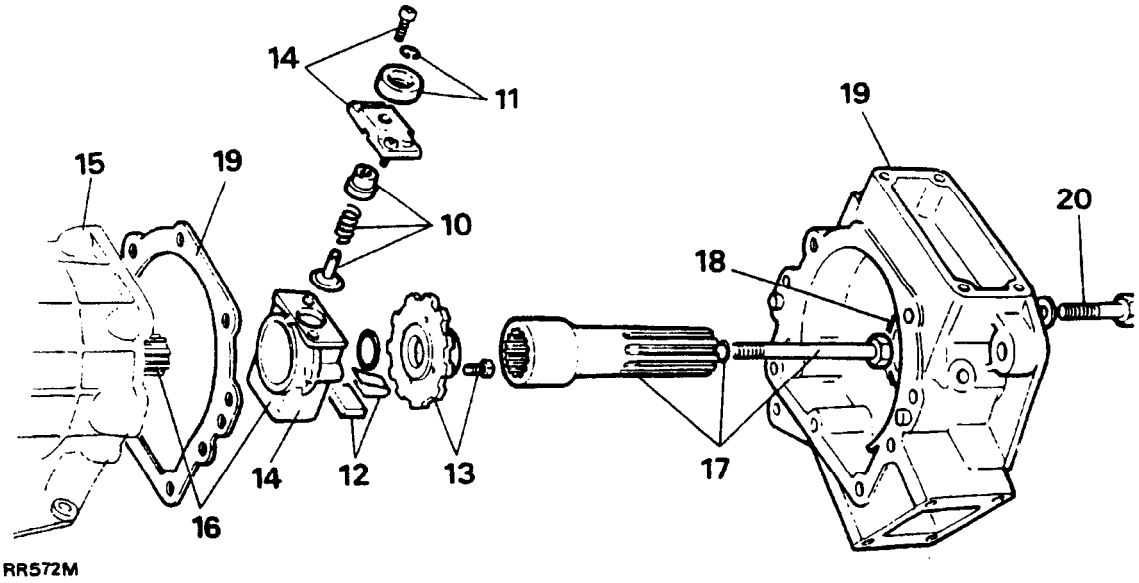
9. Inspect and clean extension- shaft and bolt for damage, replace if necessary.

Assemble

10. Fit the pin, spring and piston to the governor housing.
11. Fit the weight on the top of the governor housing and secure with a new retaining clip.
12. Fit the counterweight into the governor hub and secure with the clip.
13. Fit the parking wheel and secure with two bolts using Torx bit TX27 to the specified torque (see section 06-Torque values).
14. Fit the governor housing assembly to the hub and secure with two bolts using Torx bit TX27 to the specified torque (see section 06-Torque values).
15. Turn gearbox over in holding fixture so that the rear of the box is uppermost.
16. Fit the governor/parking wheel assembly onto the output shaft and press the assembly until fully seated.

    NOTE: To avoid damage to the 'O' ring use a Petroleum jelly. Ensure the seal rings are snapped together and are seated correctly.

17. Fit the extension shaft and retaining bolt using a new 'O' ring.
18. Fit a new seal to the extension housing using the rear oil seal replacer LST108.
19. Fit a new gasket onto the rear of the gearbox and fit the extension housing taking care not to damage the seal on assembly.
20. Secure the extension housing using the nine bolts to the specified torque (see section 06-Torque values).



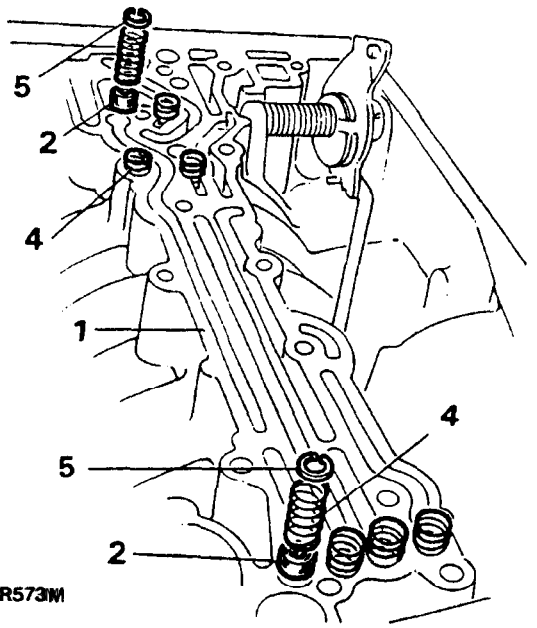
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Refit Valve Body, Oil Pan and Torque Converter

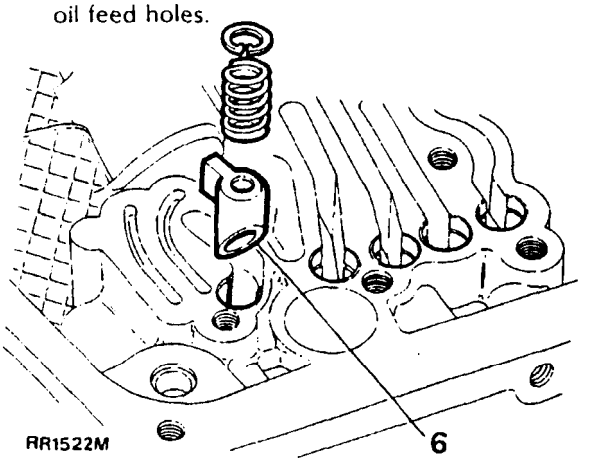
1. Position the gearbox so that the bottom is uppermost.
2. insert the eight sealing bushes into the oil feed holes using the control unit inlet oil seal remover/replacer LST113.

WARNING: Before using an air line ensure all necessary safety precautions are taken to prevent personal injury, i.e., safety glasses, protective clothing etc.

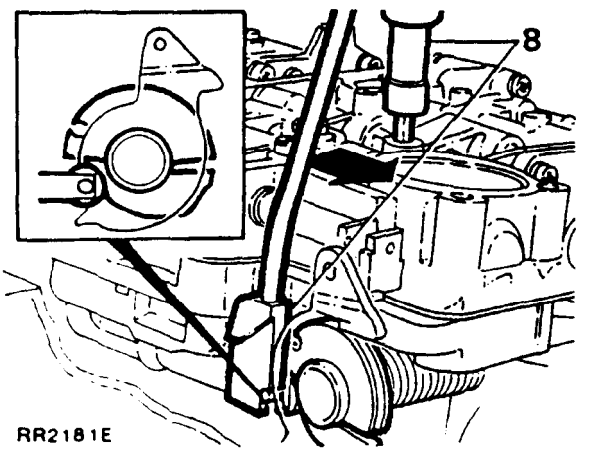
3. As a test to check the function oi the clutch and brake assemblies, insert an air gun into the oil feed holes and exert a pressure of S to 6 bar (72.5 to 87 p.s.i.).
4. Fit the four short springs into the oil feed holes at the front of the gearbox and four long springs into the oil feed holes at the rear of the gearbox.
5. Fit the eight circlips to retain the springs and sealing bushes.



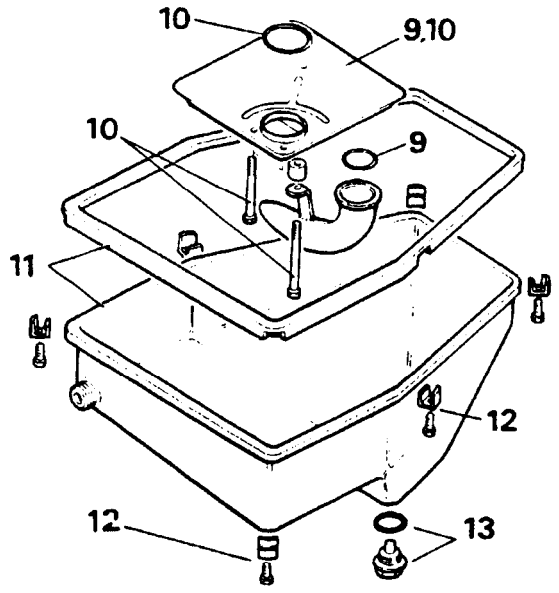
6. Fit the restrictor, spring and circlip using LST113 into the hole adjacent to the four rear oil feed holes.



7. Place the control unit ensuring the selector shaft locates into the gear shift fork and fit the thirteen bolts loosely by hand.
8. Place the selector linkage setting gauge LST109 in position and gently press the control unit in the direction shown and tighten all thirteen bolts using Torx bit TX27 to the specified torque (see section 06 Torque values).



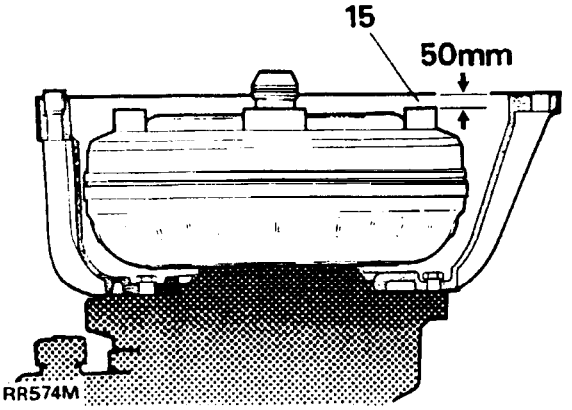
9. Remove the setting gauge and fit the suction hose and 'O' ring to new oil screen.
10. Fit the new oil screen with new 'O' ring and secure with the three bolts using Torx bit TX27 to the specified torque (see section 06-Torque values).
11. Fit the oil pan using a new gasket.
12. Secure the oil pan with the six retaining plates (two straight and four corner plates), tighten to the specified torque (see section 06-Torque values).
13. Fit oil pan plug with a new seal.



RR918M

14. Turn the gearbox around until the gearbox is horizontal.
15. Using the torque converter remove/refit handles 18G1501, install the torque converter into the gearbox.

NOTE: Check that the dimension from the converter fixing bolt boss to the converter housing face is 50 mm (1.96 in). If this dimension is achieved the converter is properly seated in the housing.



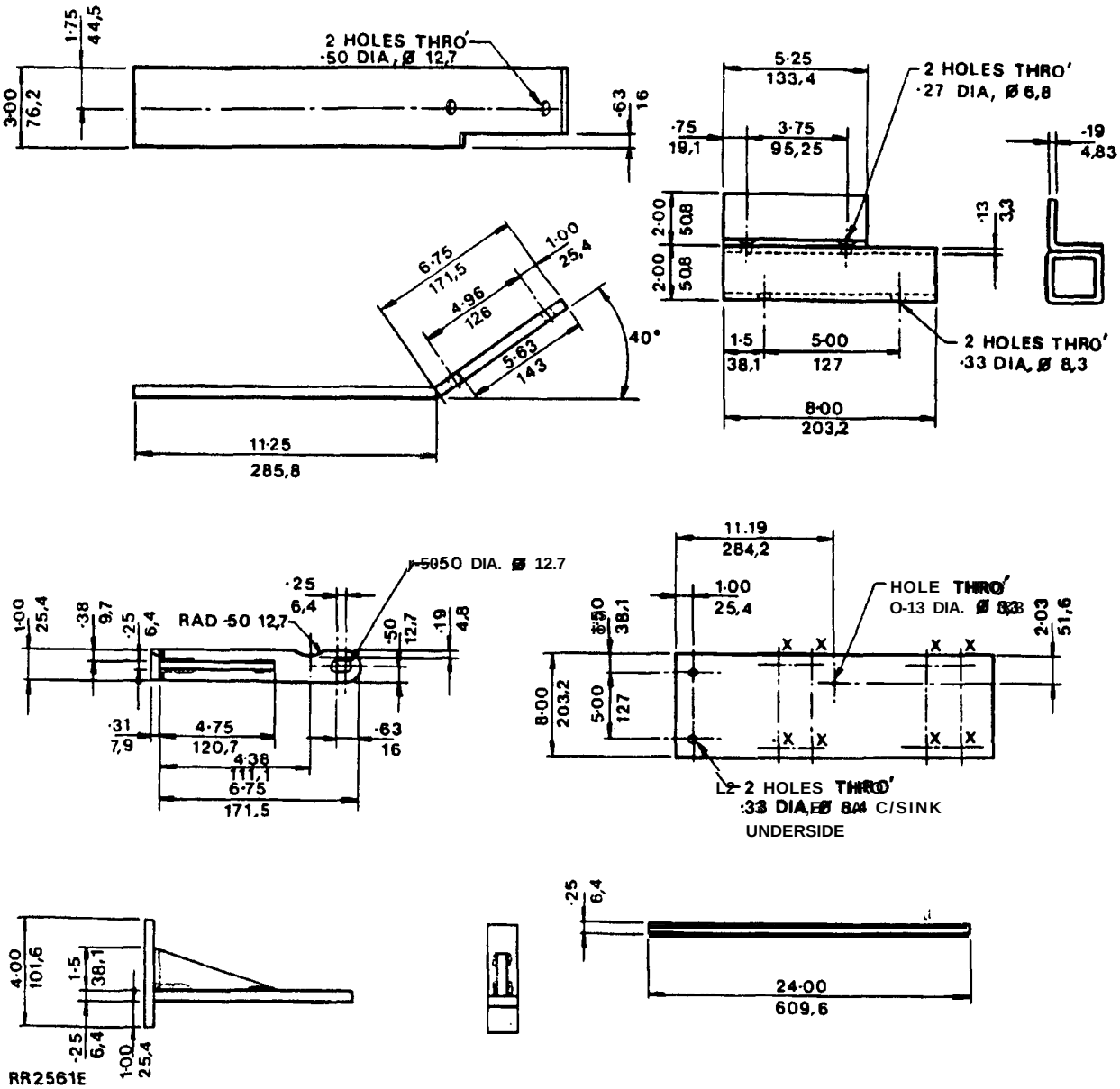
RR574M

16. Refit the gearbox to the vehicle.
17. Refill the gearbox with the correct quantity of recommended fluid.
18. Reconnect the battery ground terminal.
19 Ensuring that the parkbrake is applied, select neutral gear in the main gearbox and start the engine. While the vehicle is idling in neutral, select all forward and reverse gears and return the gear selector to neutral. Check the fluid level in the gearbox, if necessary, top up to between the maximum and minimum levels on the dipstick. Recheck the fluid level.

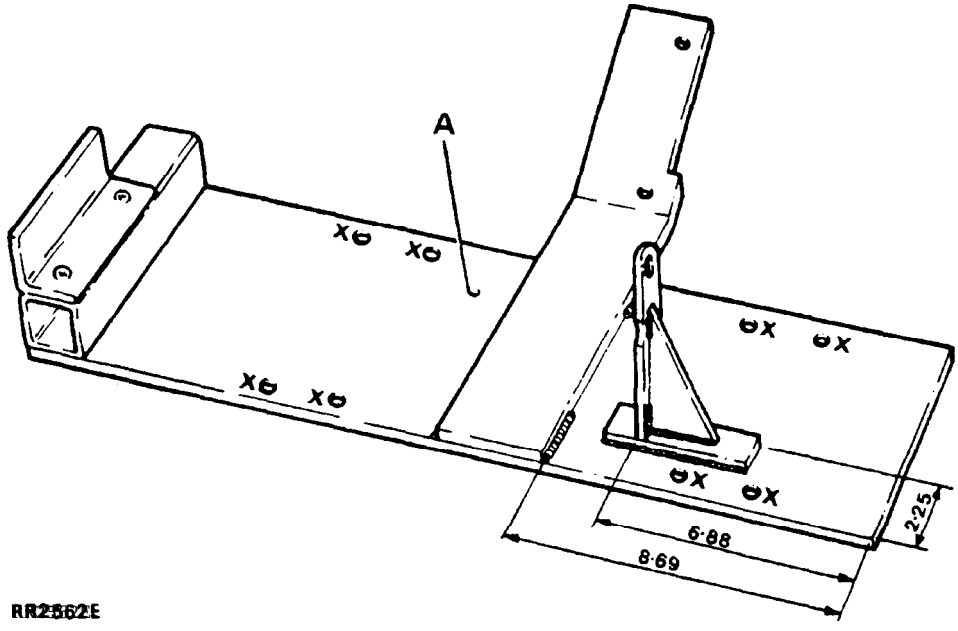
ZF MAIN GEARBOX AND BORG WARNER TRANSFER GEARBOX - ADAPTOR PLATE

To assist in the removal of the transmission assembly from the vehicle it is necessary to locally manufacture an adaptor plate to use in conjunction with a transmission hoist.

NOTE: Four holes (A) to be countersunk on underside to suit hoist.



Continued



RR2562E

A: Centre of the lifting hoist
x: Drill fixing holes to suit hoist table

Material: Steel plate BS 1449 Grade 4 or 14 (Mild Steel).

ZF MAIN GEARBOX AND BORG WARNER TRANSFER GEARBOX

Remove and refit

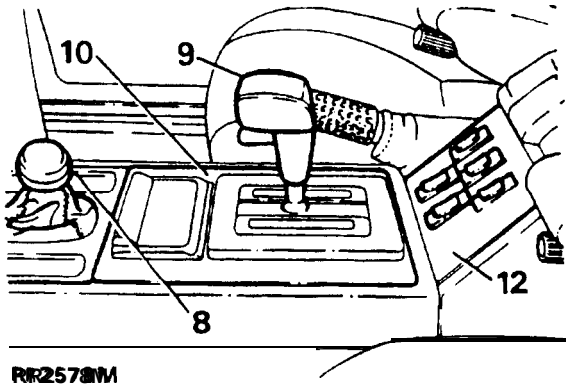
Preparation - under bonnet

WARNING: Where the use of a transmission hoist is necessary, it is ABSOLUTELY ESSENTIAL to follow the hoist manufacturer's instructions to ensure safe and effective use of the equipment.

1. Place the vehicle on a hydraulic hoist and chock the road wheels.
2. Disconnect the battery negative terminal.
3. Release and remove the fan blade assembly. Note the assembly has a left hand thread.
4. Release the clamp and remove the air intake hose from the neck of the plenum chamber.
5. Disconnect the kickdown cable from the throttle linkage.
6. Release the two gearbox breather pipes from the clip located on the lifting eye at the rear of the right hand cylinder head.
7. Remove the gearbox dipstick.

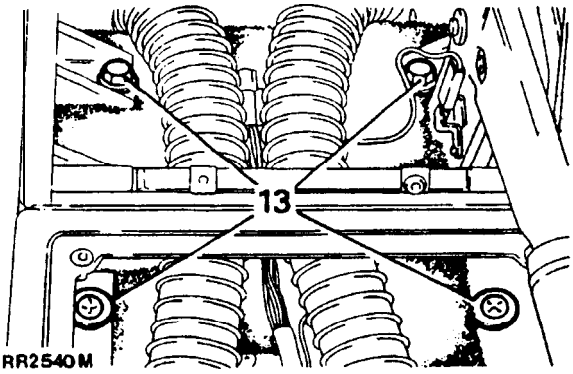
Inside the vehicle

8. Select low range, unscrew and remove the transfer gearbox knob.
9. Unclip the top cover of the main gearbox selector and remove the circlip, withdraw the detent button. Remove the circlip above the selector knob retention nut, remove the nut, serrated washer and withdraw the selector knob.
10. Carefully pry the inset panel out of the floor mounted console, complete with gear selector illumination panel and ashtray. Disconnect the electrical multi - plug to the graphics panel, and remove the inset panel.
11. Release the four screws and remove the glove box liner.
12. Carefully pry the window lift switch panel from the front of the glove box. Push the panel complete with switches back through the panel opening and place on the gearbox tunnel.



RR2578M

13 Release the two bolts and two screws securing the glove box/console assembly to the gearbox tunnel.



RR2540M

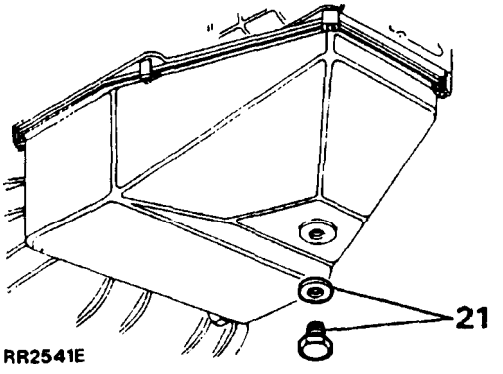
14. Detach the two relays from the inner side of the glove box.
15. Disconnect the electrical leads to the rear cigar lighter.
16. Disconnect the parkbrake cable from the parkbrake lever. Raise the lever while simultaneously detaching the glove box/console assembly from the lower dash. Remove the assembly from the vehicle.
17. Remove the retaining clip and pull the parkbrake adjustment thumb wheel from the outer sleeve. Push the inner sleeve to the underside of the vehicle.
18. Remove the sound deadening trim from the top of the gearbox tunnel.
19. Remove the screws and detach the retaining plate from around the transfer gearbox lever.

Continued

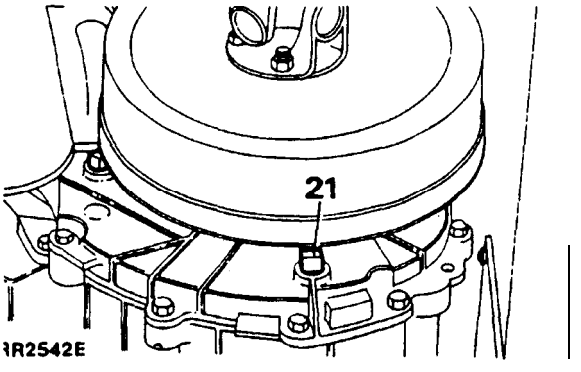
Under the vehicle

20. Raise the hydraulic ramp.

21. Remove the main and transfer gearbox oil drain plugs. Where applicable remove the filler plug to assist draining and drain the oil into suitable containers. While the oil is draining continue with the following operations.



RR2541E



RR2542E

22. Disconnect the multi - plugs to the Lambda sensors.

23. Remove the front exhaust down pipes and intermediate pipe complete with centre muffler.

NOTE: The above operation will require the assistance of a second mechanic to support the exhaust system while the various fasteners are released.

24. Remove the eight bolts securing the cross member. Note it may be necessary to spread the chassis to enable the cross member to be withdrawn.

25. Release the two clamps at the side of the engine sump that secure the two gearbox oil cooler feed and return pipes.

26. Place a suitable container below the gearbox, disconnect the oil cooler feed and return pipes from the bottom and side of the gearbox. Plug the pipes and openings to prevent ingress of foreign matter.

27. Disconnect the dipstick tube from the front of the gearbox oil pan.

28. Mark each drive shaft flange at the transfer gearbox with an identification line to aid re-assembly. Remove the fasteners and disconnect the propeller shafts at the output flanges. Tie the shafts to one side.

29. Release the nut and disconnect the speedometer cable from the rear output housing, tie the cable to one side.

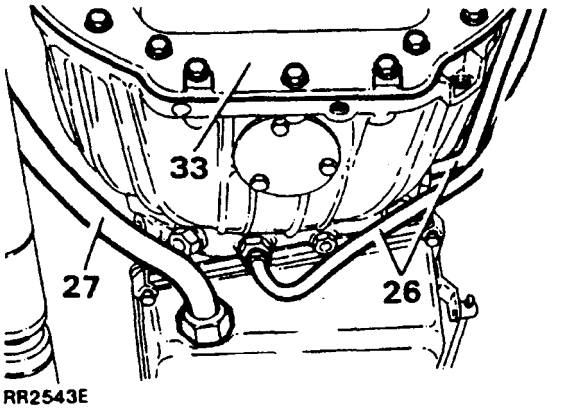
30. Disconnect the main gearbox selector cable and rod from the left side of the gearbox. Lay the cable aside.

31. Disconnect the main gearbox inhibitor switch multi - plug from the main harness.

32. If fitted disconnect the speed transducer multi - plug from the main harness.

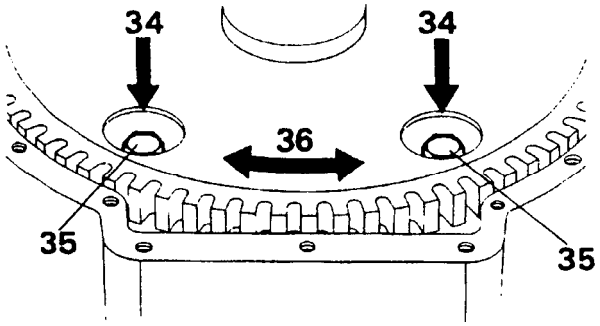
Remove the transmission assembly

33. Remove the nine front cover plate bolts from the bottom of the gearbox bellhousing. Detach the cover plate to gain access to the four torque converter tixing bolts.



RR2543E

34. Rotate the engine using the crankshaft pulley until two of the access holes in the drive plate/ring gear assembly are visible through the bell housing bottom cover opening.
35. Remove the two bolts that are visible through the access holes, which secure the drive plate to the torque converter. Mark one of the access holes and a bolt hole in the converter with an identification line to aid re - assembly and to maintain original build setting.
36. Rotate the crankshaft 180" until the remaining access holes are visible. Remove the remaining two bolts.



RR2554E

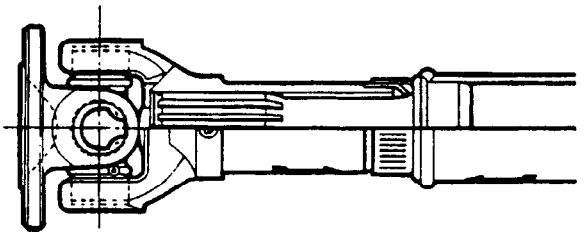
37. Position a suitable transmission floor jack on the rear output housing or brake drum to support the weight of the transmission assembly.
38. Remove the bolts and withdraw the transfer gearbox mountings.
39. Fit the previously manufactured fixture on a transmission hoist, raise the hoist and position the fixture and hoist under the transfer gearbox mounting points.
40. Using the original gearbox mounting bolts secure the fixture to the gearbox.
41. Remove the transmission floor jack from the rear of the transfer gearbox.
42. Carefully lower the transmission until the top of the transfer gearbox clears the rear passenger footwell.
43. Position the transmission floor jack under the engine to support the weight while the bellhousing bolts are removed.
44. Remove the bellhousing bolts noting that one of the bolts also secures the gearbox dipstick tube.
45. Withdraw the transmission assembly from the engine, ensuring that the torque convertor is removed with the gearbox and does not stay on engine.

Refitting

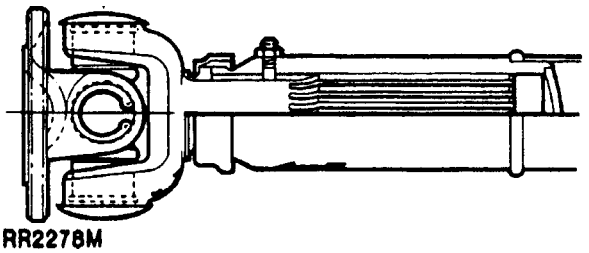
46. Refitting the gearbox is a reversal of the removal procedure noting the following points.
47. The flexible drive plate to torque converter bolts are to be coated with Loctite 270 prior to assembly.
48. Tighten all fasteners to the specified torque values.
49. New gaskets are to be fitted to the exhaust flanges, all joints other than those fitted with doughnuts, to be coated with exhaust sealer. Check the system, if any leaks are evident reseal as necessary.

DRIVE SHAFTS • OVERHAUL

NOTE: Rear drive shafts fitted to early models have a universal joint assembly with an internal splined bore which moves along the outside of the main drive shaft spline.
Later models have a re-designed rear drive shaft, the universal joint assembly has been modified to incorporate a splined shaft which moves inside a hollow drive shaft, refer to the illustrations for identification as to which drive shaft is fitted to the vehicle.
The design change does not affect the overhaul of the yoke and spider assemblies.



RR2277M

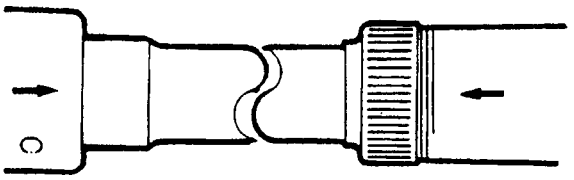


RR2278M

Dismantle

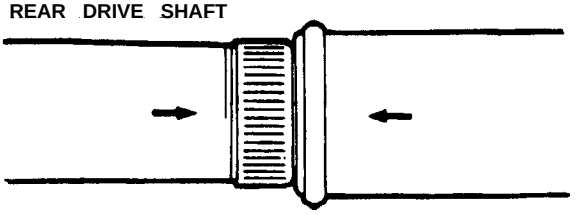
1. Place the vehicle over a pit or on a suitable hoist.
2. Undo the 8 nuts and using the sliding joint, remove the drive shafts from the vehicle.
3. Note the alignment markings on the yoke and the drive shaft (front), sliding member and the drive shaft (rear).

FRONT DRIVE SHAFT



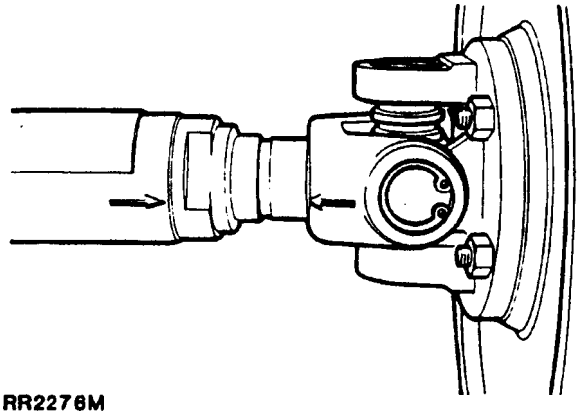
RR1997E

REAR DRIVE SHAFT



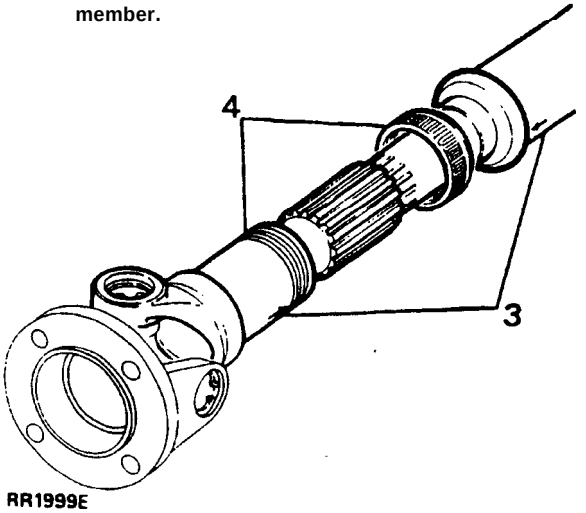
RR1998E

REAR DRIVE SHAFT: NEW CONDITION



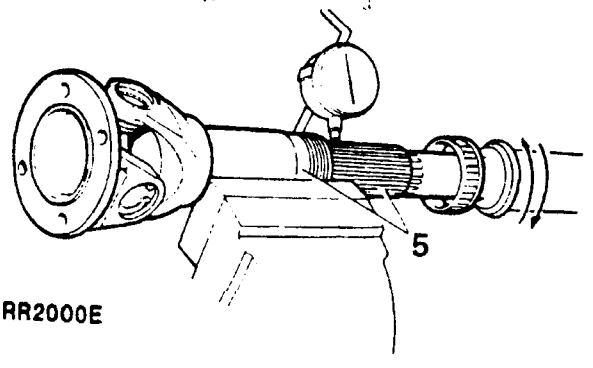
RR2276M

4. Unscrew the dust cap and withdraw the sliding member.



RR1999E

5. Clean and examine the splines for wear. Worn splines or excessive back-lash will necessitate drive shaft replacement

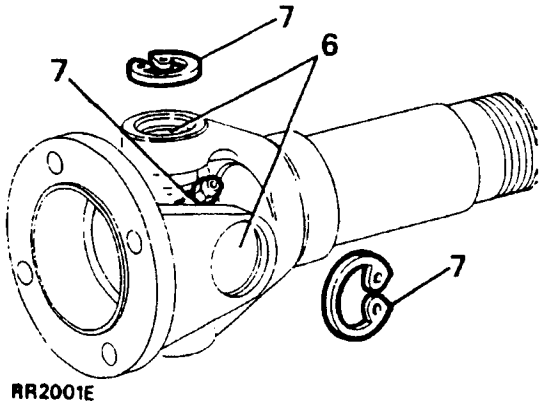


RR2000E

6. Remove paint, rust, etc., from the vicinity of the universal joint bearing cups and circlips.

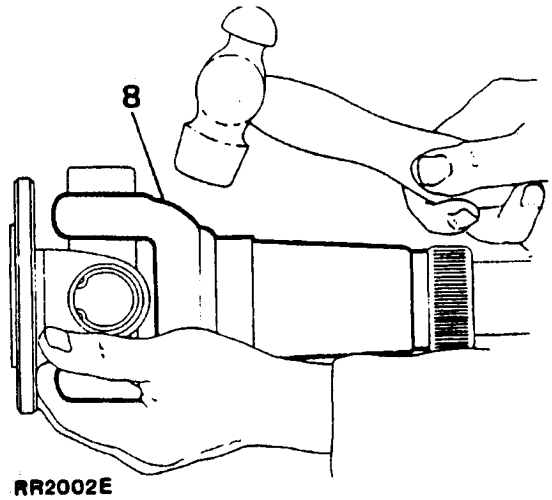
NOTE: Before dismantling the drive shaft joint, mark the position of the spider pin lubricator relative to the journal yoke ears to ensure that the grease nipple boss is re-assembled in the correct running position to reduce the possibility of imbalance.

7. Remove the circlips, and grease nipple.



RR2001E

8. Tap the yokes to eject the bearing cups.



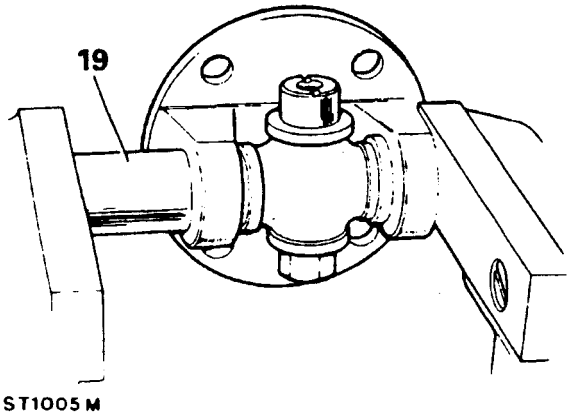
RR2002E

9. Withdraw the bearing cups and spider and discard.
10. Repeat instructions 5 to 8 for opposite end of drive shaft.
11. Thoroughly clean the yokes and bearing cup locations.

Assemble

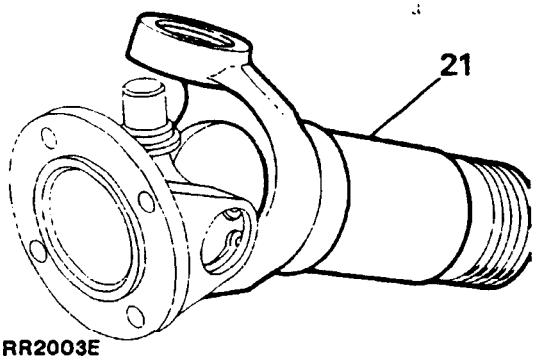
12. Remove the bearing cups from the new spider.
13. Check that all needle rollers are present and are properly positioned in the bearing cups.
14. Ensure bearing cups are one-third full of fresh lubricant. See Recommended Lubricants.
15. Enter the new spider complete with seals into the yokes of the sliding member flange.
16. Partially insert one bearing cup into a flange yoke and enter the spider trunnion into the bearing cup taking care not to dislodge the needle rollers.
17. Insert the opposite bearing cup into the flange yoke. Using a vice, carefully press both cups into place taking care to engage the spider trunnion without dislodging the needle rollers.
18. Remove the flange and spider from the vice.
19. Using a flat faced adaptor of slightly smaller diameter than the bearing cups press each cup into its respective yoke until they reach the lower land of the circlip grooves. Do not press the bearing cups below this point or damage may be caused to the cups and seals.

NOTE: When replacing joints use only 03EHD series replacement spider packs.

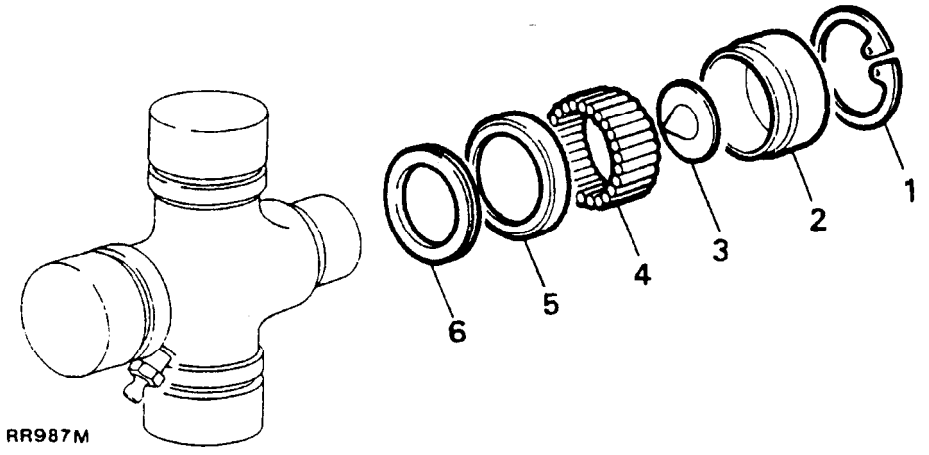


ST1005M

20. Fit the circlips.
21. Engage the spider in the yokes of the sliding member. Fit the bearing cups and circlips as described in instructions 15 to 20.



RR2003E



KEY TO SPIDER ASSEMBLY

1. Circlip
2. Bearing cup
3. Nylatron washer
4. Needle rollers (27 per cup)
5. Seal retainer
6. Seal

22. Lubricate the sliding member splines and fit the sliding member to the drive shaft ensuring that the markings on both the sliding member and drive shaft align.
23. Fit and tighten the dust cap.
24. Fit the grease nipples to the spider and the sliding member and lubricate.
25. Apply instructions 15 to 20 to the opposite end of the drive shaft.
26. Fit the grease nipple and lubricate.

NOTE: FRONT DRIVE SHAFT:
On refitting the front drive shaft it should be noted that the drive flange at the sliding joint end of the shaft is to be fitted to the drive flange at the front end of the transfer gearbox.

REAR DRIVE SHAFT
On refitting the rear drive shaft the drive flange at the sliding joint end of the shaft is to be fitted to the brake drum at the rear of the transfer gearbox.

27. Fit the drive shaft to the vehicle and tighten to the specified torque (see section 06-Torque values).

REAR AXLE

Remove and Refit

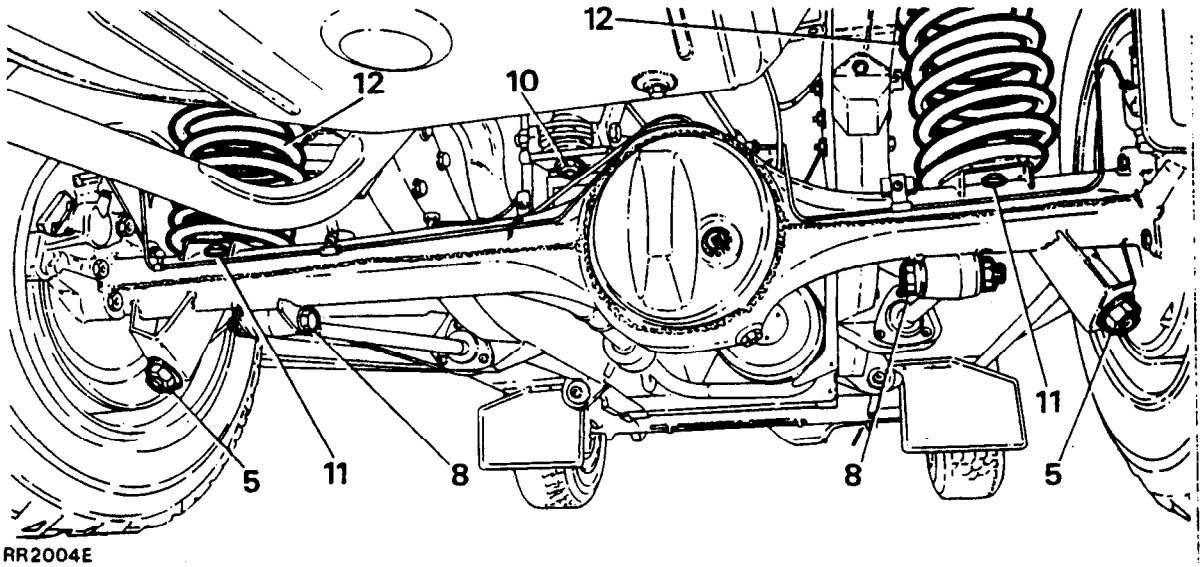
Removing

WARNING: The removal and refitting of the axle from the vehicle requires the assistance of a further two personnel to steady the axle, when lowering or repositioning the axle.

1. Drain the brake system.
2. Jack-up the rear of the vehicle and support the chassis.
3. Remove the road wheels.
4. Support the axle weight with a suitable hydraulic jack.
5. Disconnect the shock absorbers.
6. Disconnect the flexible brake hose at the connection under the floor, ensuring any excess of fluid is stemmed.
7. Disconnect the pad wear multi-plug at the bracket mounted on the underside of the floor. Pry the rubber grommet out of the bracket and feed the plug through the hole.
8. Disconnect the lower links at the axle.
9. Mark the differential and drive shaft drive flanges with identification marks to aid re-assembly. Remove the four nuts and bolts, lower the drive shaft and tie it to one side.
10. Disconnect the pivot bracket ball joint at the axle bracket.
11. Release the bolts and remove the coil spring retaining plates.
12. Lower the axle and remove the road springs.
13. Withdraw the axle assembly.

Refitting

14. Position the axle and fit the lower links, and tighten the bolts to the specified torque (see section 06-Torque values).
15. Reverse the removal instructions.
16. Tighten the pivot bracket ball joint to axle to the specified torque (see section 06-Torque values).
17. Tighten the drive shaft to differential drive flange to the specified torque (see section 06-Torque values).
18. Refill the brake system and bleed as described in Section 70.



RR2004E

OVERHAUL AXLE DIFFERENTIAL ASSEMBLY

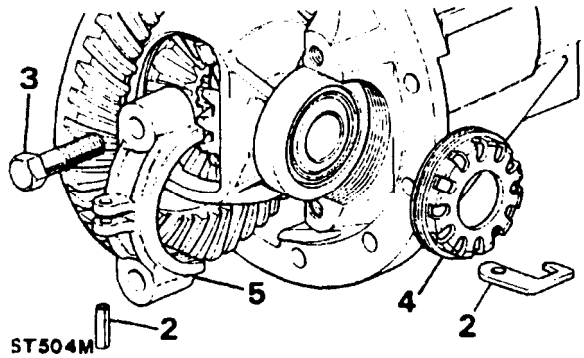
Service Tools:

1861295	-Flange holder tool
18C191	-Pinion height setting gauge
18C191-4	-Universal setting block
18G47-6	-Pinion head bearing remover/ replacer
LST106	-Oil seal replacer
RO262757/A	-Extractor for pinion bearing races
RO262757-11	-Replacer-use with RO262757/A
RO262757.22	-Adaptor tail bearing cap replacer
RO530105	-Wrench flange and carrier bearing nuts
R0530106	-Bracket for dial gauge and indicator
MS47	-Press

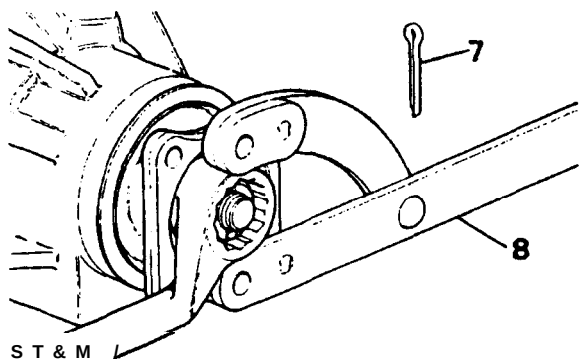
DISMANTLE

It is essential that differential components are marked in their original positions and relative to other components so that, if refitted, their initial setting is maintained. Note that the bearing caps must not be interchanged.

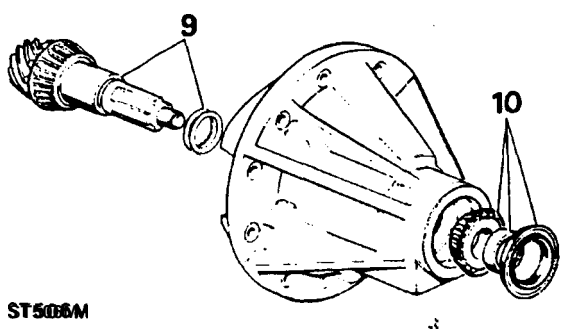
1. Remove the axle shafts then the differential assembly from the axle.
2. Drive out the roll pin securing the bearing nut locking fingers to the bearing caps. Remove the locking fingers.
3. Loosen the bearing cap bolts and mark the caps for re-assembly.
4. Using service tool R0530105, remove the bearing adjusting nuts.
5. Remove the bearing cap bolts and bearing caps.
6. Lift out the crown wheel, (ring gear) differential unit and bearings.



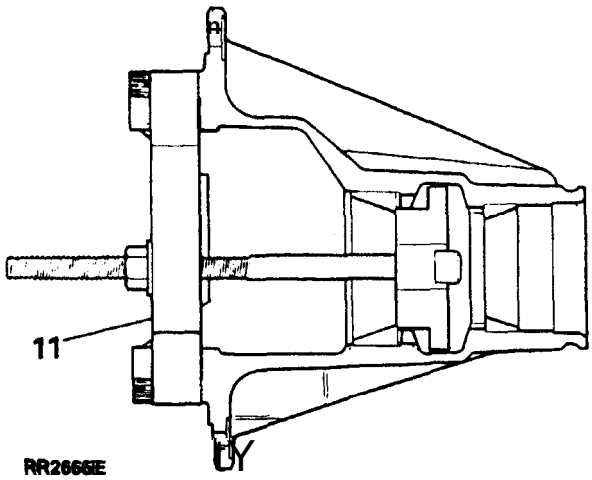
7. Remove the cotter pin securing the pinion flange nut.
8. Remove the pinion flange nut using service tool 18C1205 to restrain the flange.



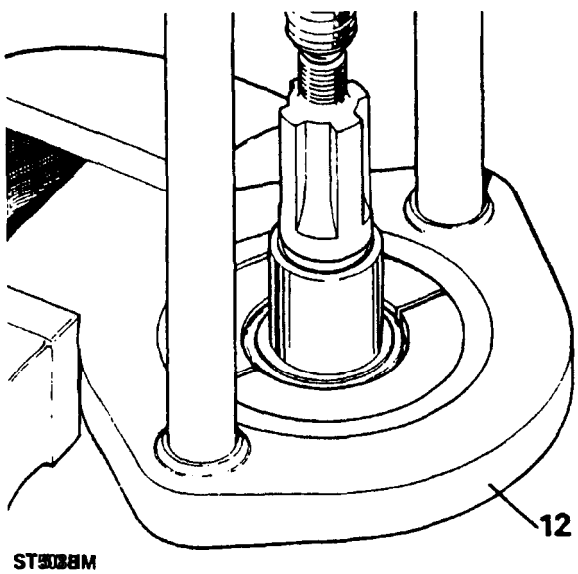
9. Withdraw the pinion complete with pinion head bearing and outer bearing shims. Withdraw the shims.
10. Remove the pinion flange oil seal, spacer and bearing. Discard the oil seal.



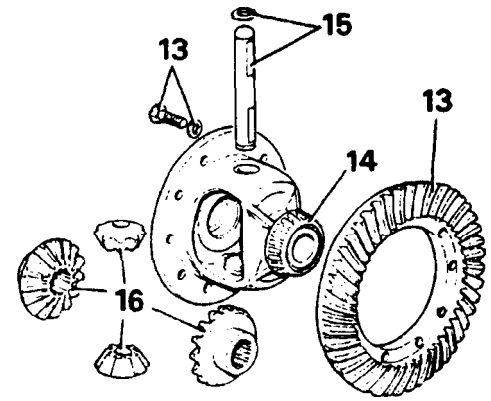
11. Using service tool RO262757A, remove the pinion head bearing track and shim and drive out the outer bearing track from the differential housing.



12. Remove the pinion head bearing with service tool MS47 and adaptor 18G47-6.



13. Remove the bolts and washers securing the crown wheel to the differential flange. Withdraw the crown wheel.
14. Remove the differential carrier bearings.
15. Remove the circlips securing the differential cross shaft. Extract the cross shaft.
16. Withdraw the differential gears and pinions.
17. Thoroughly clean all components.



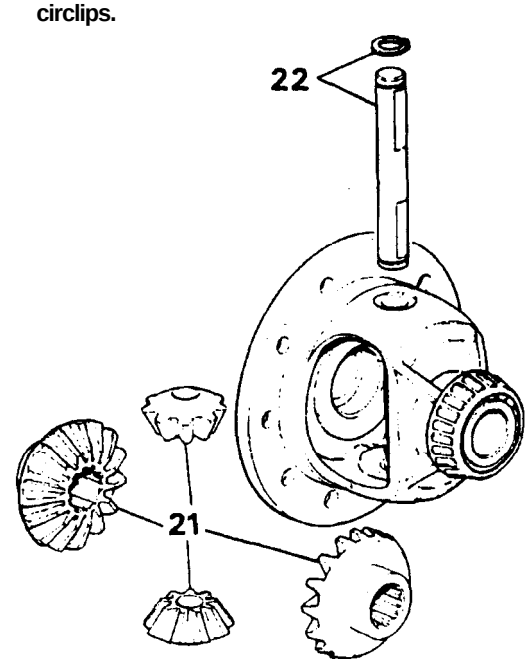
INSPECTION

18. Check all bearings for wear and/or pitting.
19. Check all gears for wear, scuffing, pitting and damaged teeth.
20. NOTE: The crown wheel and pinion are supplied as a matched set, also the pinion housing and bearing caps.

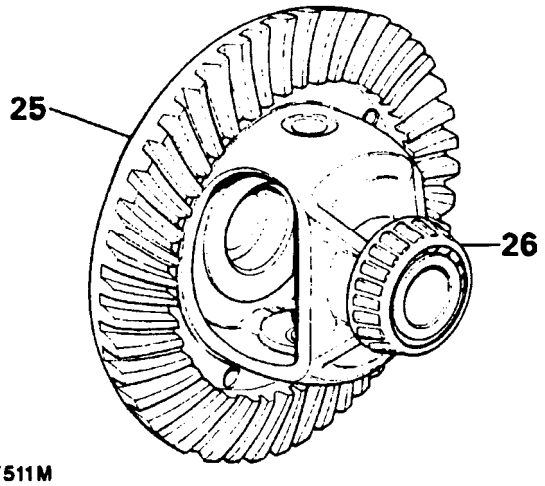
ASSEMBLE

Differential gears

21. Fit the differential gears to the differential housing.
22. Fit the differential cross shaft and retaining circlips.

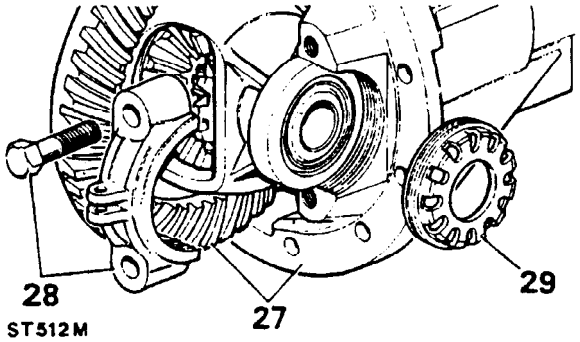


23. Check the gear for freedom of rotation and backlash. Nominal backlash should be present. Excessive backlash will necessitate replacement of the gears and/or the differential housing. No provision is made for backlash adjustment.
24. Check that the serial number marked on the pinion end face matches that marked on the crown wheel.
25. Ensuring that the differential housing flange and crown wheel are thoroughly clean fit the crown wheel.
26. Fit the carrier bearings using a suitable press or drift and assemble the tracks traces) to the bearings.



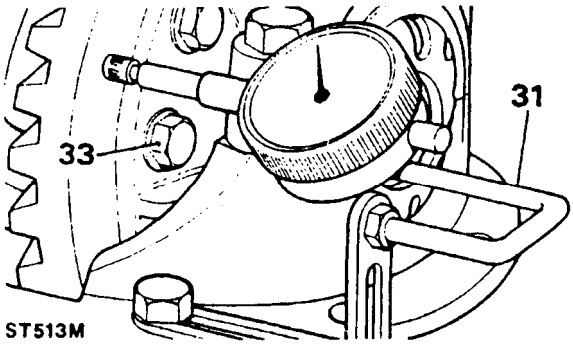
ST511M

27. Place the differential housing complete with crown wheel and bearings in the pinion housing.
28. Fit the bearing caps and bolts. Do not fully tighten the bolts.
29. Fit the bearing adjusting nuts and adjust to obtain zero end-float.



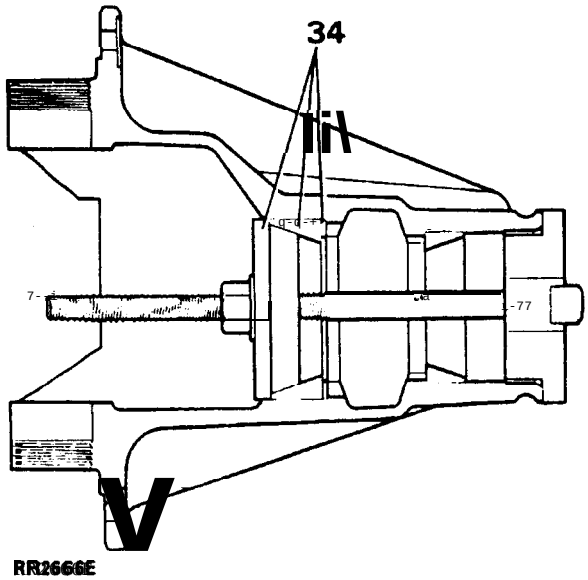
ST512M

30. Tighten the bearing cap bolts to the specified torque (see section 06-Torque values).
31. Using a dial gauge check the crown wheel for run-out. This should not exceed 0.10 mm (0.004 in). If excessive run-out is recorded remove the crown wheel and examine crown wheel and mounting flange for burrs, grit, etc. Refit the crown wheel and recheck. Run-out, attributable to a buckled or damaged differential housing flange can be corrected only by replacing the differential gear housing.
32. When satisfied that run-out is within the specified limits remove the differential housing from the pinion housing.
33 Remove the crown wheel bolts and refit them using Loctite 'Stud lock'. Evenly tighten the bolts to the specified torque (see section 06-Torque values).



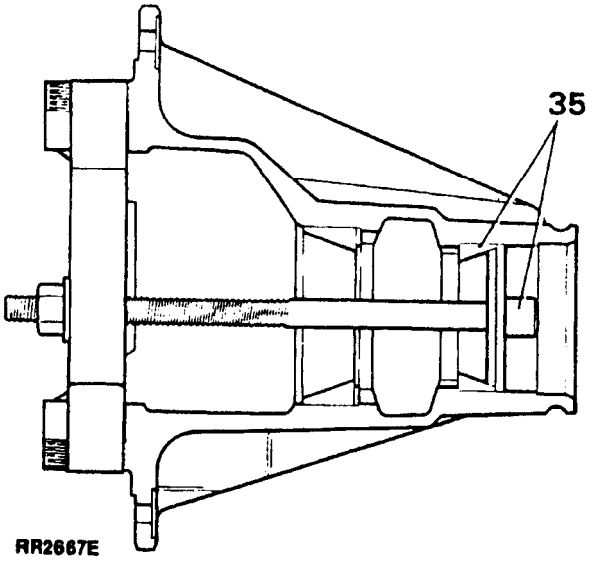
ST513M

34. Fit the pinion head bearing track and the original shim to the pinion housing using service tools RO 386757A and RO 386757-1. If the original shim was damaged or mislaid use a new shim of at least 1.27 mm (0.050 in) thickness.

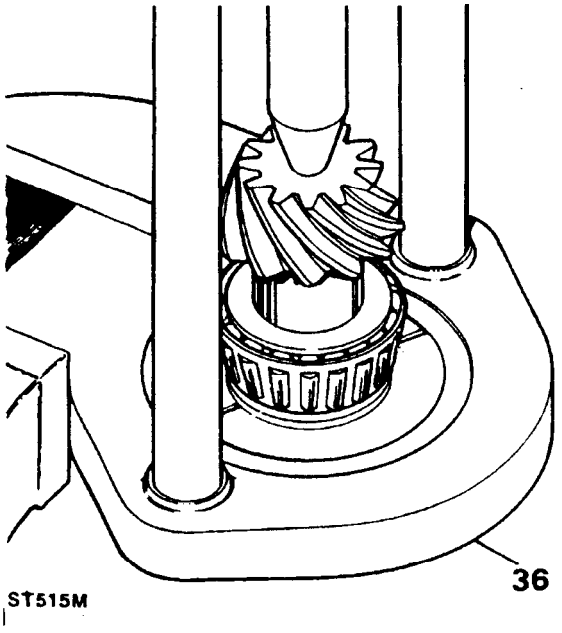


RR2666E

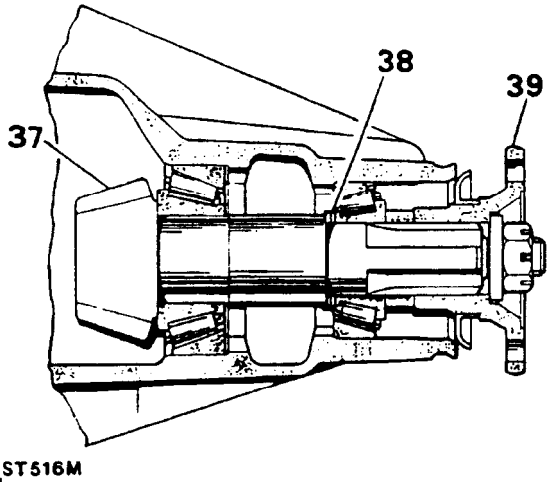
35. Fit the pinion outer bearing track to the pinion housing with service tools RO262757A and RO262757-2.



36. Fit the pinion head bearing to the pinion using service tool 18G47-6.



37. Enter the pinion into its location in the pinion housing. Do not fit the shims for bearing pre-load at this stage.
38. Fit the outer bearing and spacer.
39. Fit the driving flange, washer and nut.



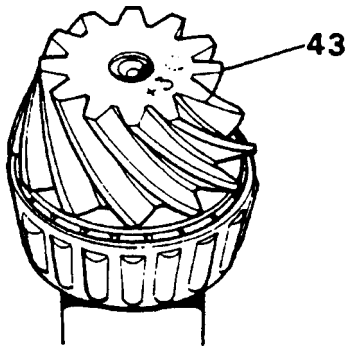
40. Do not fit the oil seal at this stage.
41. Tighten the pinion flange nut slowly until the force required to rotate the pinion is 23 to 40.25 kgf cm (20 to 35 in lb) if new beatings are fitted. This will pre-load the bearings in order to check the pinion height dimension.

NOTE: If using original bearings, which are bedded in, the pre-load figure is 11.5 to 17.25 kgf cm (10 to 15 in lb)

Drive pinion markings

42. The markings on the end face adjacent to the serial number are of no significance during servicing.

43. The figure marked on the end face opposite to the serial number indicates, in thousandths of an inch, the deviation from nominal required to correctly set the pinion. A pinion marked plus (+) must be set below nominal, a minus (-) pinion must be set above nominal. An unmarked pinion must be set at nominal.



ST507M

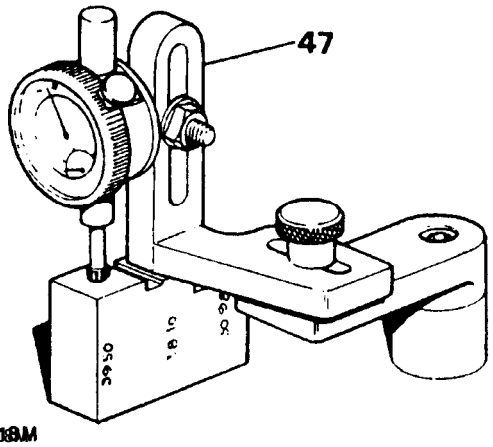
44. The nominal setting dimension is represented by the setting gauge block 18C191-4 which is referenced from the pinion end face to the bottom radius of the differential bearing bore.

Drive pinion adjustment

45. Ensure that the pinion end face is free of raised burrs around the etched markings.
46. Remove the keep disc from the magnetized base of dial gauge tool 18G191.
47. Place the dial gauge and setting block on a flat surface and zero the dial gauge trace pin on the setting block. Use of a surface plate is recommended.

NOTE: The setting block has three setting heights as follows.

Use only the 39.50mm setting mark for this differential.

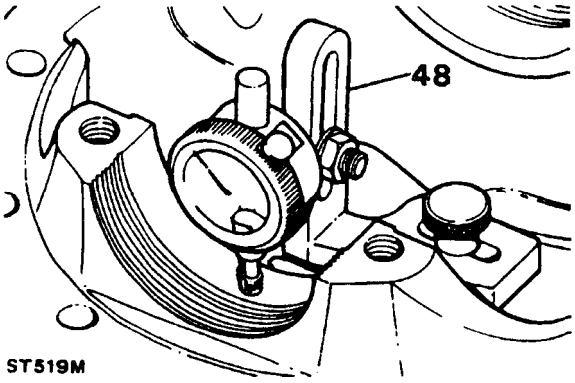


ST518M

PINION HEIGHT SHIMS

PART No.	INCH	MM
549230	.038	0.97
549232	.040	1.02
549234	.042	1.07
549236	.044	1.12
549238	.046	1.17
549240	.048	1.22
549242	.050	1.27
549244	.052	1.32
549246	.054	1.37
549248	.056	1.42
549250	.058	1.47
549252	.060	1.52
576236	.062	1.57
576237	.063	1.60
576238	.064	1.63
576239	.065	1.65

48. Position the dial gauge centrally on the pinion end face with the trace pin registering on the lowest point on one differential bearing bore. Note the dial gauge deviation from the zeroed setting.



ST519M

49. Repeat on the other bearing bore. Add together the readings then halve the sum to obtain the mean reading. Note whether the trace pin has moved up or down from the zeroed setting.

a. Where the trace pin has moved down, the amount is equivalent to the thickness of shims that must be removed from under the pinion inner track to bring the pinion down to the nominal position.

b. Where the trace pin has moved up, the amount is equivalent to the additional thickness of shims required to bring the pinion up to the nominal position.

INCH		MM
.001	=	.025
.002	=	.05
.003	=	.075
.004	=	.10
.005	=	.125
.006	=	.15
.007	=	.175
.008	=	.20
.009	=	.225
.010	=	.25

NOTE: DIAL INDICATOR IS METRIC! Conversion must be made to SAE (INCH) UNITS when performing measurements and selecting shims.

50. Before adjusting the shim thickness, check the pinion face marking and if it has a plus (+) figure, subtract that amount in thousandths of an inch from the shim thickness figure obtained in the previous item.

51. Alternatively, if the pinion has a minus (-) figure, add the amount to the shim thickness figure. Adjust the shim thickness under the pinion head bearing track as necessary.

52. Recheck the pinion height setting. If the setting is correct, the mean reading on the dial gauge will agree with the figure marked on the pinion end face. For example, with an end face marking of +3, the dial gauge reading should indicate that the pinion is + 0.003 in.

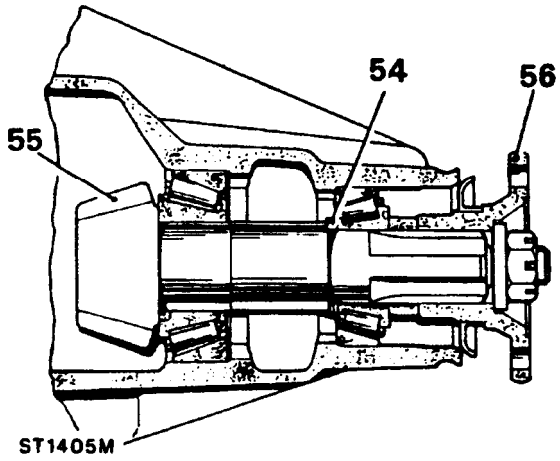
Bearing pre-load adjustment

53. Remove the pinion flange, pinion, outer bearing and spacer.

54. Slide new shims, of the same thickness as the originals (bearing pre-load) into position on the pinion shaft. If the original shim was damaged or mislaid use a new shim of at least 4.06 mm (0.160 in) thickness.

55. Enter the pinion in its location in the pinion housing and fit the outer bearing and spacer.

56. Fit the driving flange, washer and nut.



57. Do not fit the oil seal at this stage.

58. Tighten the pinion flange nut to the specified torque (see section 06-Torque values). The force required to rotate the pinion shaft should be within 23 to 40.25 kgf cm (20 to 35 in lb) using new bearings, when initial inertia has been overcome. Change the bearing pre-load shim as necessary to obtain this requirement. A thicker shim will reduce pre-load; a thinner shim will increase pre-load.

NOTE: If using original bearings, which are bedded in, the pre-load figure is 11.5 to 17.25 kgf cm (10 to 15 in lb)

59. Remove the pinion flange.

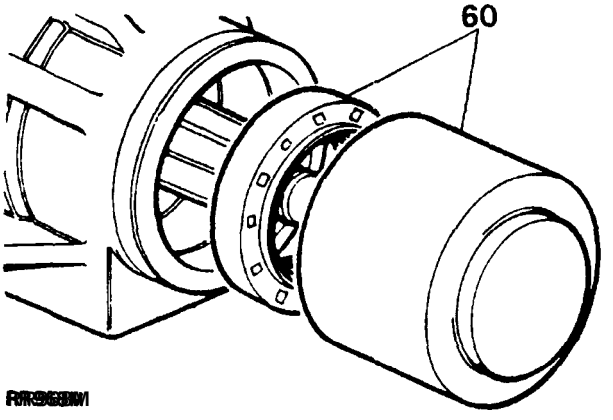
PINION PRELOAD SHIMS

PART No.	INCH	MM
FRC1193	.060	1.52
FRC1195	.062	1.57
FRC1197	.064	1.63
FRC1199	.066	1.68
FRC1201	.068	1.73
FRC1203	.070	1.78
539718	.072	1.83
539720	.074	1.88
539722	.076	1.93
539724	.080	2.03

Fitting Pinion Oil Seal

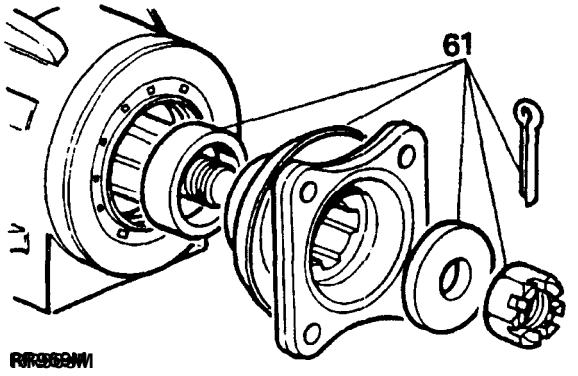
CAUTION: Before fitting the new seal to the differential, examine the seal to ensure that it is clean, undamaged and that the garter spring is properly located. A small scratch on the seal lips could impair its efficiency.

60. Coat the outer diameter of the new seal width with an all purpose grease and fit the seal, lip side leading squarely on the pinion nose housing and drive the seal into position flush with the end face of the housing using seal replacing tool LST106.



RR960M

61. Lightly lubricate the seal lips with a recommended oil. Fit the distance piece and flange and secure with washer and nut. Tighten the nut to the specified torque and fit a new cotter pin (see section 06-Torque values).

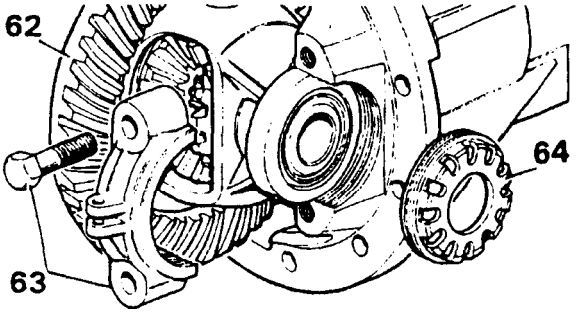


RR960M

CROWN WHEEL/PINION BACKLASH ADJUSTMENT

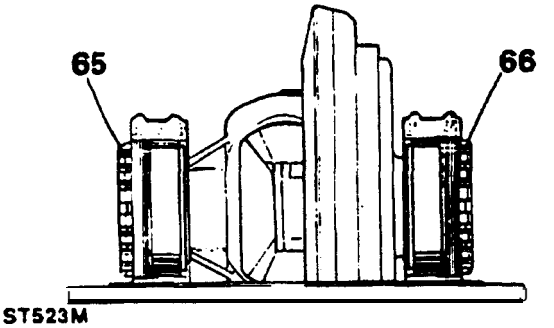
62. Place the differential housing in the pinion housing.
63. Fit the bearing caps and bolts. Do not fully tighten the bolts.

64. Fit the bearing adjusting nuts.



ST522M

65. Push the crown wheel into mesh with the pinion, loosening the left hand bearing adjuster nut, using service tool 530105.
66. Tighten the right hand nut until crown wheel/pinion backlash is just removed.

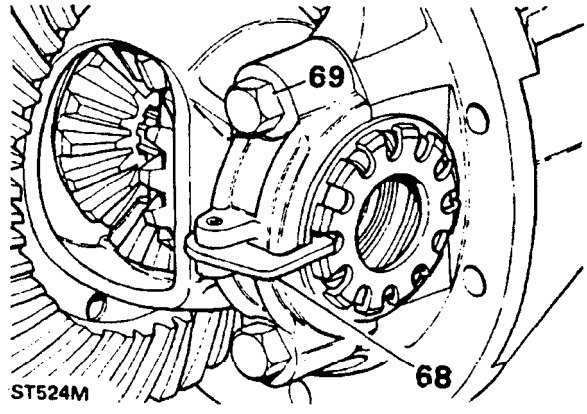


ST523M

67. Tighten the left hand nut slowly until it contacts the bearing. Continue turning the left hand nut until a backlash of 0.10 to 0.17 mm (0 004 to 0.007 in) is achieved. DO NOT slacken the right hand nut at any time, otherwise the bearing preload will be affected.

CAUTION should also be taken when performing Backlash Setup i.e. convert metric readings to inches.

68. Fit the locking fingers and roll pins. If necessary, tighten the adjustment nuts slightly to align the locking finger with a slot.
69. Evenly tighten the bearing cap bolts to the specified torque (see section 06-Torque values).
70. Recheck crown wheel/pinion backlash.
71. Lubricate the bearings and gears.



DATA

Pinion bearing pre-load:	
(new bearings)	23 to 40.25 kgf cm (20 to 35 in lb)
(bearings bedded in)	11.5 to 17.25 kgf cm (10 to 15 in lb)
Crown wheel run-out	0.10 mm (0.004 in)
Crown wheel/pinion backlash	0.10 to 0.17 mm (0.004 to 0.007 in)

REAR DISCS

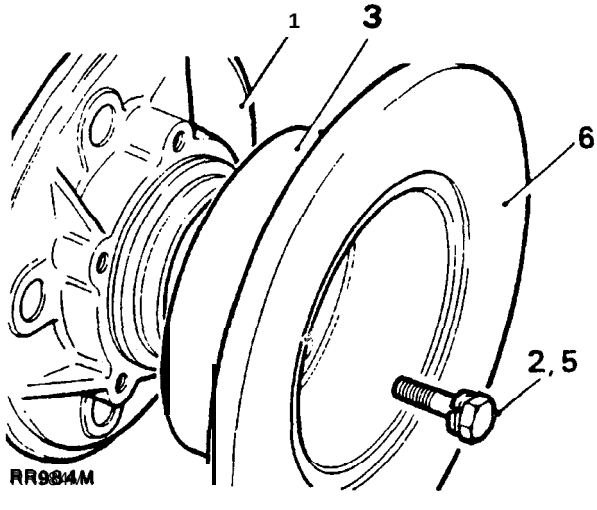
Remove and refit

Removing

1. Remove the rear hub assembly.
2. Remove the rear disc fixing bolts.
3. Tap off the disc from the rear hub.

Refitting

4. Locate the disc onto the rear hub.
5. Fit the disc fixing bolts. See Section 06 for tightening torques.
6. Using a dial indicator, check the total disc run out, this must not exceed 0.15 mm (0.006 in). If necessary reposition the disc.



7. Fit the rear hub assembly.

Disc Reclamation

Check the disc thickness marked on the disc boss-this dimension may be reduced to a minimum thickness of 13 mm (0.510 in) front and 12 mm (0.460 in) rear, by machining an equal amount off each face.

REMOVE AND OVERHAUL REAR HUBS

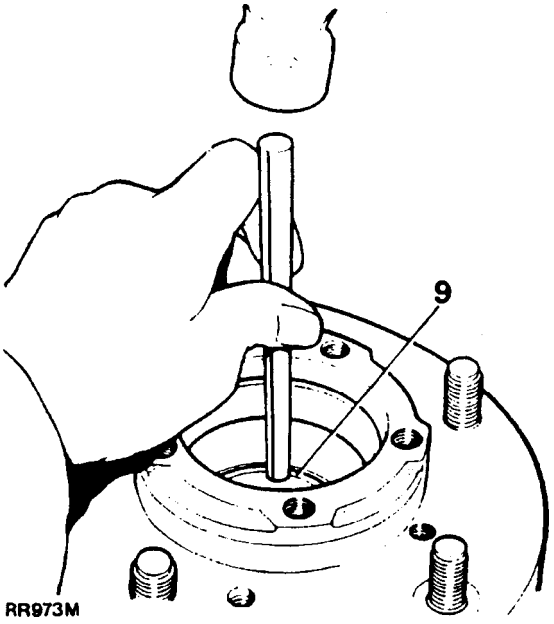
Service tools:

Oil seal replacer	-LST550-5
Drift for above tool	-MS550 or 186134
Hub nut wrench	-606435

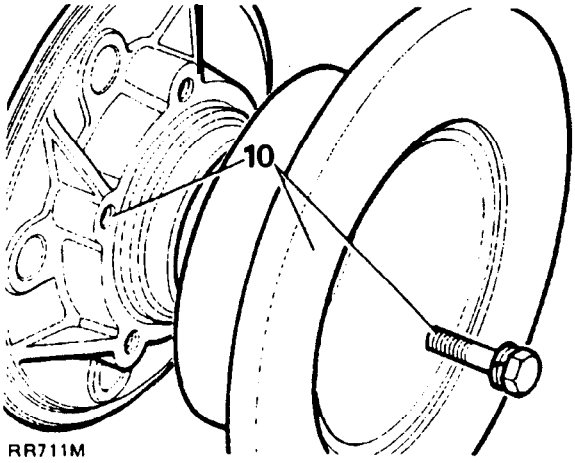
Remove

1. Jack-up the vehicle, lower on to axle stands and remove the road wheels.
2. Release the brake hose from the axle, casing clips and remove the brake caliper retaining bolts and secure the assembly to one side. Tal e care not to kink the brake hose.
3. Remove the five bolts securing the axle shaft to the hub and withdraw the shaft.

4. Bend back the lock tab and remove the outer nut using box wrench 606435 and remove - remove the lock washer. Likewise remove the inner nut.
5. Remove the seal track spacer.
6. Withdraw the hub complete with bearing oil seals and brake disc.
7. Remove the inner and outer oil seals.
8. Remove the inner and outer bearing cones (races).
9. Drive-out the inner and outer bearing cups.



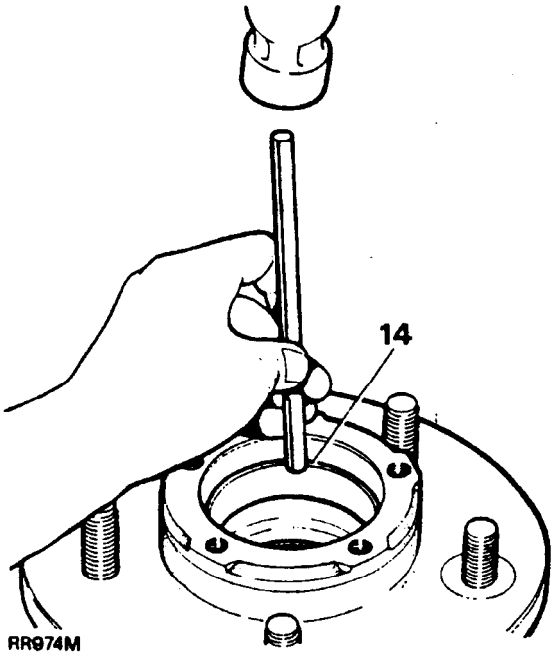
10. Degrease and examine the hub and brake disc and if necessary replace both or whichever part is unserviceable. The disc is attached to the hub with five bolts. Mark the relationship of the hub to the disc if the original parts are to be re-assembled.



11. Examine the stub axle and in particular check that the inner seal track is smooth and free from blemishes.
12. If necessary remove the six retaining bolts and remove the stub axle complete with the mudshield and joint washer.

Assemble

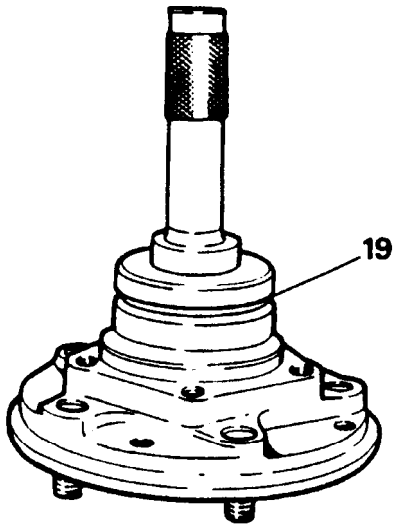
13. Using a new joint washer fit the stub axle and mud shield. Coat the threads of the retaining bolts with Loctite 270 and tighten evenly to the correct torque (see section OC-Torque values).
14. Fit the new inner and outer bearing cups to the hub, using a suitable drift or commercial - bearing race driving tool.



15. Fit the new inner bearing cone and pack with one of the recommended hub greases.

Fitting new oil seal-inner

16. Clean the hub oil seal housing and ensure that the seal locating surface is smooth and the chamfer on the leading edge is also smooth and free from burrs.
17. Examine the new seal and ensure that it is clean and undamaged and that the garter spring is properly located. Even a small scratch on the seal lip could impair its efficiency.
18. Although the new seal is already pre-greased by the manufacturer, apply one of the recommended hub bearing greases to the outside diameter of the seal before fitting, taking care not to damage the lip.
19. Place the seal, lip side leading, squarely on the hub and using the 76 mm end of seal replacer tool LST590-5 and drift 550 or 18C134, drive the seal into position, flush with the end face of the hub.



RR975M

Fitting outer oil seal

20. Fit the new outer bearing cone and pack with one of the recommended hub greases. Carry out instructions 16 to 18.
21. Place the seal, lip side leading, squarely on the hub and using the 72 mm end of seal replacer tool LST590-5 and drift 550 or 18C134, drive the seal into position to the depth determined by the tool.
22. Coat the lips of both seals with one of the recommended greases. This is important since a dry seal can be destroyed during the first few revolutions of the hub.

Fitting hub to stub axle

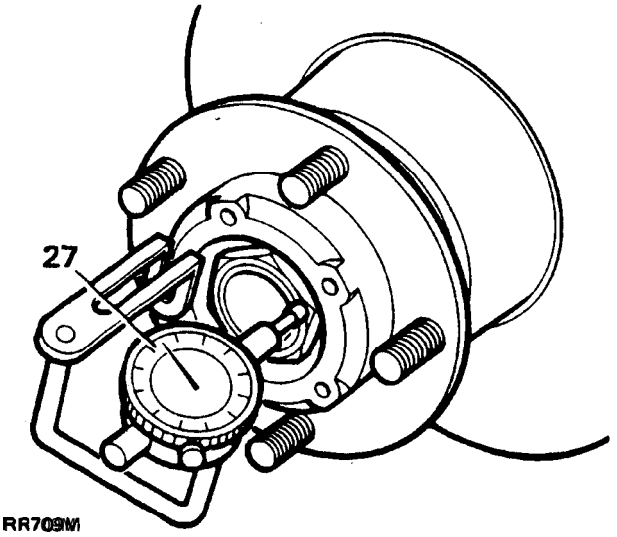
23. Select a new seal track spacer and check that the outer diameter is smooth and free from blemishes and that there are no burrs on the chamfered leading edge.
24. Taking care not to damage the seal lips fit the hub assembly to the stub axle. Do not allow the weight of the hub to rest even temporarily on the outer seal otherwise damage and distortion could occur. Therefore hold the hub clear of the stub axle until the seal track spacer is fitted.
25. Carefully fit the seal track spacer, seal lip leading.

NOTE: Instruction 26 is applicable to hubs that have been fitted with new components throughout. If original components are being refitted instruction 27 must be followed using the adjustment nut to achieve the required end-float.

26. Fit the hub inner nut and using wrench 606435 tighten the adjusting nut while slowly revolving the hub until all end-float is removed, then back-off the nut approximately half a turn and retighten the nut to 13-15 in lb which will automatically allow for compression of the rubber on the new seal track spacer giving the required hub end-float of 0.013 to 0.10 mm (0.0005 to 0.004 in).

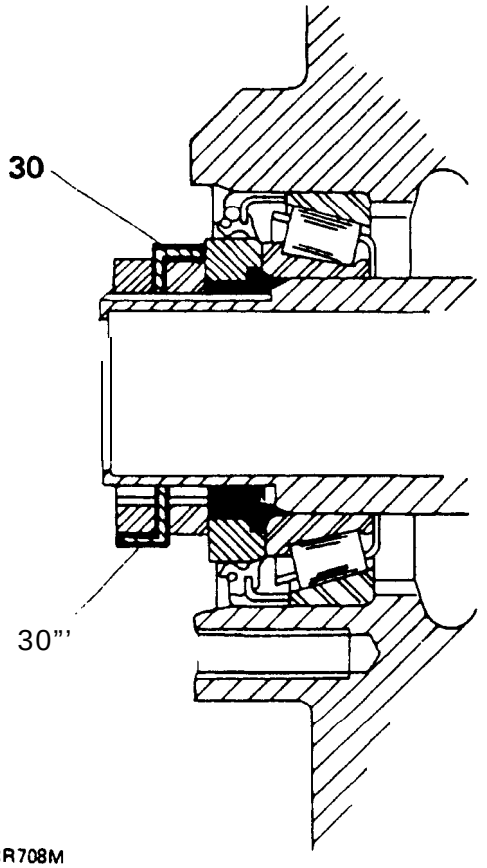
Continued

27. If the rubber on the seal track spacer has previously been compressed the hub end-float can be checked by mounting a dial indicator and bracket on the hub so that the trace pin rests in a preloaded condition on the nut. Rotate the hub to settle the bearings and check the end-float by pushing and pulling the hub. End-float must fall within the limits given in the previous instruction.
28. Fit a new lock washer and locknut. Restraining the inner adjustment nut, tighten the outer lock nut to 70 to 80 ft lb (95 to 108 Nm).
29. If original components have been refitted rotate the hub several times to settle the bearings then recheck the end-float, refer to previous note and instruction 27.



RR709M

30. Bend one segment of the lock washer over the adjusting nut and another, diametrically opposite, over the locknut taking care not to damage the outer seal.
31. Using a new joint washer, fit the hub driving shaft and evenly tighten the retaining bolts to the correct torque (see section 06-Torque values).
32. Fit the brake caliper and secure with the retaining bolts and tighten to the correct torque (see section 06-Torque values). Secure the brake pipes to the axle casing.

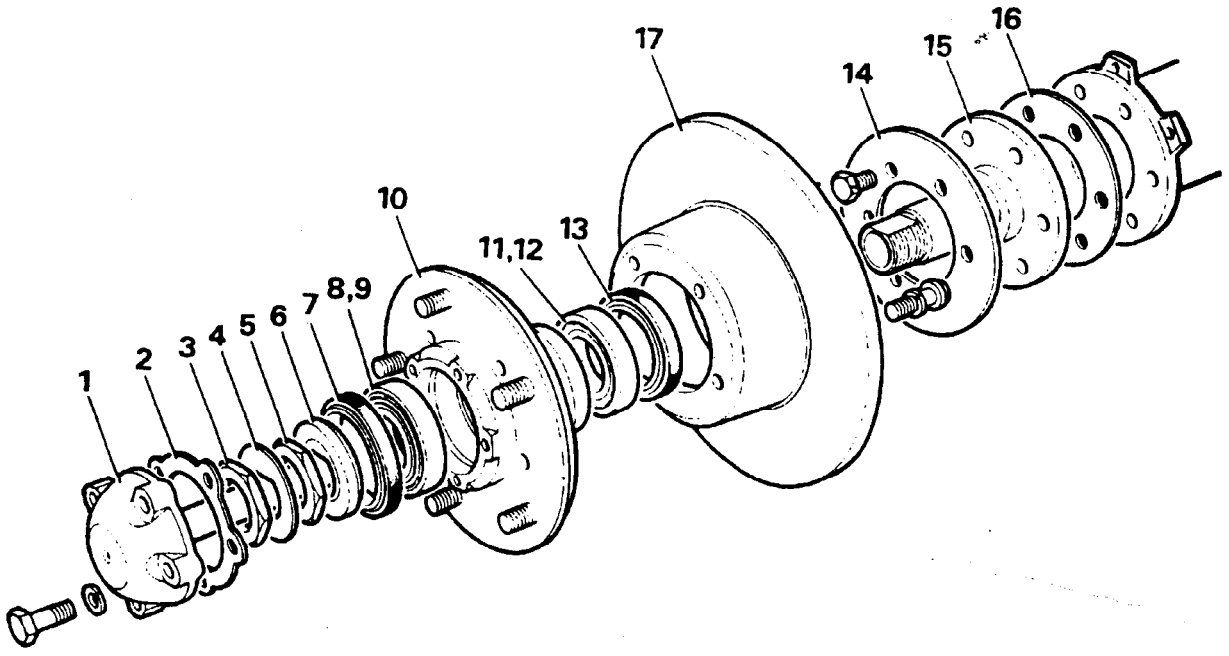


RR708M

33. Fit the road wheels, jack-up the vehicle, remove the axle stands, lower the vehicle to the ground and tighten the road wheel nuts evenly to the correct torque.

KEY TO REAR HUB COMPONENTS

1. Rear axle shaft
2. joint washer
3. locknut
4. Lock washer
5. Adjusting nut
6. Seal track spacer
7. Outer oil seal
8. Outer bearing cone
9. Outer bearing cup
10. Hub
11. Inner bearing cup
12. Inner bearing cone
13. Inner oil seal
14. Mudshield
15. Stub axle
16. Stub axle joint washer
17. Brake disc



RR706M

REAR HUB ASSEMBLY ON VEHICLES FITTED WITH ANTI-LOCK BRAKES (ABS)

REMOVE, OVERHAUL AND REFIT

Service tools:
Hub oil seal replacer LST 137.
Drift 18G 134.
Dial gauge bracket RO 530106.

Remove

1. Slacken the rear wheel nuts, jack up the vehicle, lower onto axle stands and remove the road wheel.
2. Release the brake pipe from the axle, casing clips and remove the brake caliper retaining bolts then secure the assembly to one side.

   WARNING: Take care not to kink the brake pipe.

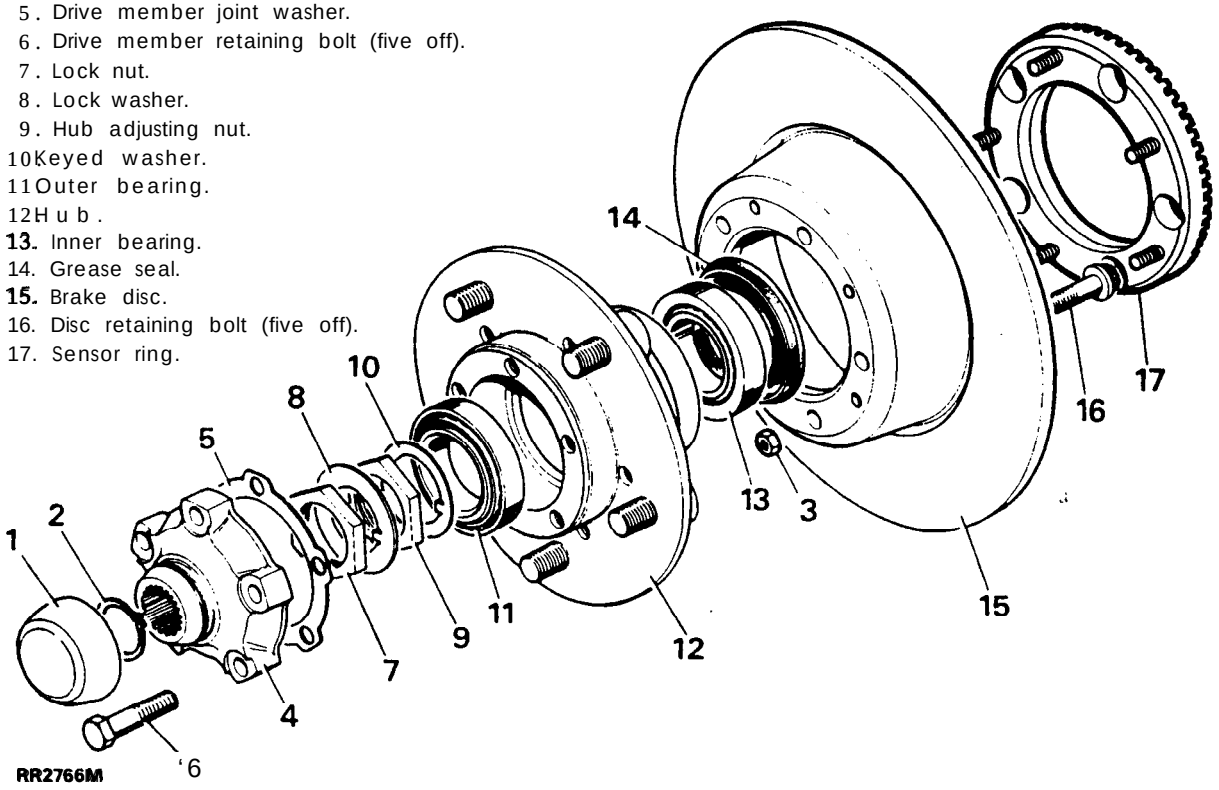
3. Lever off the dust cap.
4. Remove the circlip from the rear axle shaft.
5. Remove the five bolts and withdraw the driving member and joint washer.
6. Bend back the lock washer tab.
7. Remove the locknut and tab washer.
8. Remove the hub adjusting nut.
9. Remove the keyed washer.
10. Withdraw the hub and brake disc assembly complete with bearings.
11. Remove the outer bearing.
12. Remove the five nyloc nuts and withdraw the sensor ring.
13. Mark, for reassembly, the relationship between the hub and brake disc, if original hub is to be refitted.
14. Remove the five bolts and separate the hub from the brake disc.

    WARNING: A maximum of two road wheel retaining studs can be renewed. Should more studs be unserviceable a new hub with studs must be obtained.

15. Drift out the grease seal and inner bearing from the hub and discard the seal.
16. Drift out the inner and outer bearing tracks.

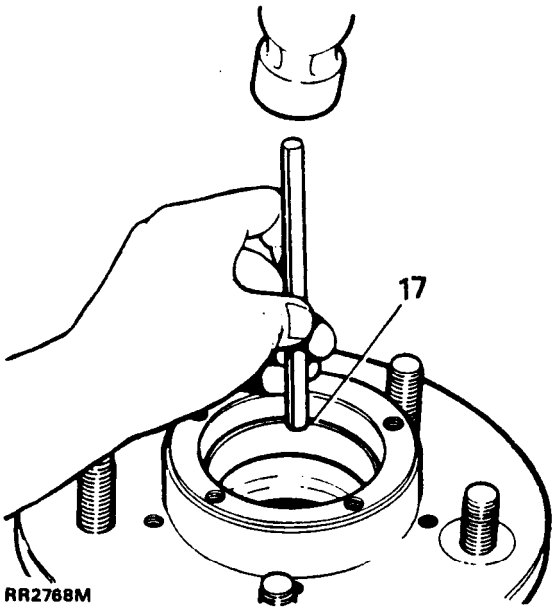
KEY TO REAR HUB COMPONENTS

1. Dust cap.
2. Circlip.
3. Sensor ring retaining nut.
4. Drive member.
5. Drive member joint washer.
6. Drive member retaining bolt (five off).
7. Lock nut.
8. Lock washer.
9. Hub adjusting nut.
10. Keyed washer.
11. Outer bearing.
12. Hub.
13. Inner bearing.
14. Grease seal.
15. Brake disc.
16. Disc retaining bolt (five off).
17. Sensor ring.

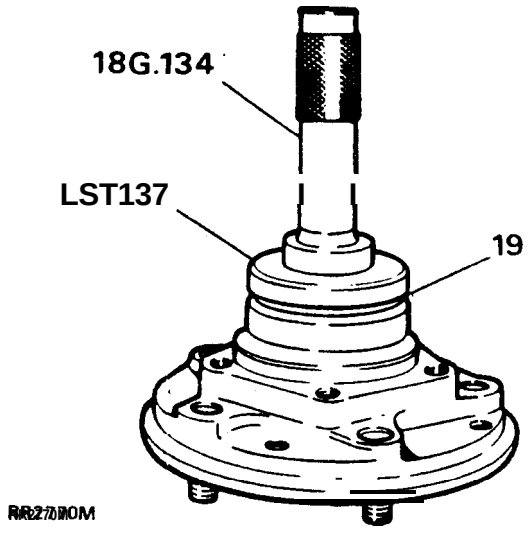


Refit

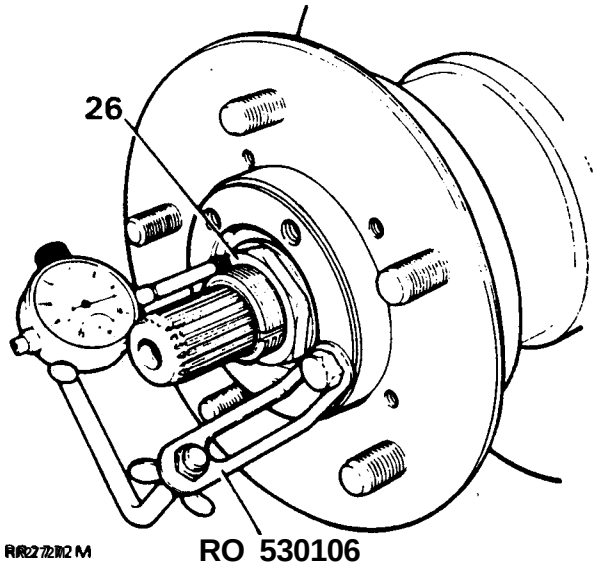
17. **Clean and degrease the hub and drift in the inner and outer bearing tracks.**



18. **Pack the hub inner bearing with a recommended grease and fit to the hub.**
19. **With the lip side leading fit a new seal to the hub using special tool LST 137 seal replacer and drift 18G 134. Drive in the seal so that it is flush with the rear face of the hub. Apply grease between the seal lips.**



20. **Assemble the brake disc to the hub, lining up to the marks made during dismantling. Applying Loctite 270, fit and tighten the five retaining bolts to the correct torque.**
21. **If necessary renew any sensor ring studs applying Loctite 270 where the stud screws into the sensor ring. Fit the sensor ring using new nyloc nuts, ensuring it is correctly fitted to avoid tooth run out.**
22. **Grease as in instruction 18 and fit the outer bearing to the hub.**
23. **Clean the stub axle and rear axle shaft and retract the ABS sensor slightly from sensor sleeve.**
24. **Fit the hub assembly to the stub axle.**
25. **Fit the keyed washer.**
26. **Fit the hub adjusting nut and tighten by hand whilst rotating the hub until all end-play is taken up.**
27. **Mount a dial gauge using bracket RO 530106 and rest the stylus in a loaded condition on the adjusting nut.**



28. **Slacken off the adjusting nut until a end-play (0.10 013 to 0,05 mm (0.0005 to 0.002 in) is obtained.**
29. **Fit a new keyed lock tab washer.**
30. **Fit and tighten the hub adjusting nut and wheel, the end-play before bending the lock tab over.**
31. **Fit a new joint washer to the driving member and fit the member to the hub and secure with the five bolts tightening evenly to the correct torque.**

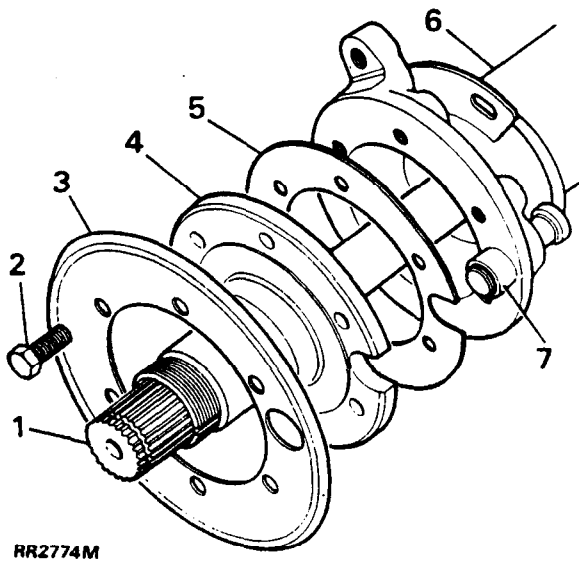
32. Fit the circlip to the rear axle shaft, ensuring that it locates in the groove.
33. Fit the dust cap.
34. Fit the brake caliper and tighten the two bolts to the correct torque. Secure the brake pipes to the axle casing.
35. Set the ABS brake sensor. Push the sensor through the bush until it touches the sensor ring. The sensor sets to its correct position when the hub is rotated.
36. Fit the road wheel, remove the axle stands and finally tighten the road wheel nuts.
37. Operate the footbrake several times to locate the brake pads before taking the vehicle on the road.

REAR STUB AXLE ON VEHICLES FITTED WITH ABS

Special tools:
Oil seal replacer LST 138.
Drift 18G 134.

KEY TO STUB AXLE COMPONENTS

1. Rear axle shaft.
2. Stub axle to axle casing bolt.
3. Mudshield.
4. Stub axle.
5. Stub axle joint washer.
6. Axle case.
7. Sensor bush sleeve.



RR2774M

REMOVE, OVERHAUL AND REFIT

Remove rear stub axle, axle shaft

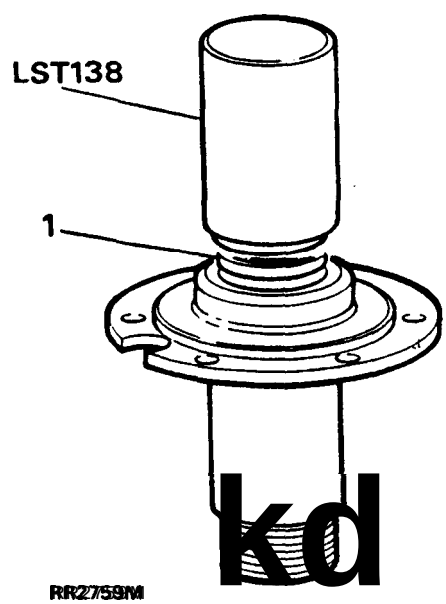
1. Remove the hub complete as described in the operation to overhaul the hub assembly instructions 1 to 10.
2. Remove the six bolts retaining the stub axle to the axle casing.
3. Remove the mud shield.
4. Remove the stub axle and joint washer.
5. Pull out the rear axle shaft from the axle casing.

Refit

6. Using a new joint washer fit, the stub axle and mudshield with the retaining bolts, to the axle casing tightening evenly to the correct torque.
7. Carefully fit the rear axle shaft to avoid damaging the stub axle seal.
8. Refit the hub assembly complete as described in the operation to refit the hub assembly instructions 23 to 37.

Renew rear stub axle oil seal

1. Remove and discard the oil seal. Lubricate the seal and lip with EP90 oil and using special tool LST 138 fit a new oil seal lipside trailing so that the seal is flush with the rear face of the stub axle.



RR2759M

REAR DISCS ON VEHICLES FITTED WITH ABS

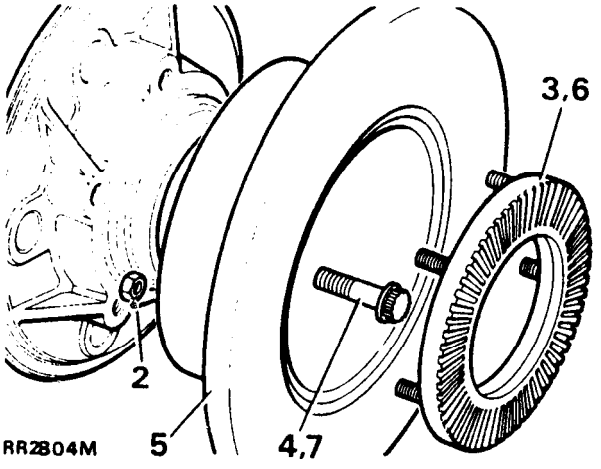
REMOVE, REFIT AND RECLAIM

Removing

1. Remove the rear hub assembly.
2. Remove the five nyloc nuts.
3. Remove the sensor ring.
4. Remove the five hub to disc retaining bolts.
5. Tap off the disc from the hub.

Refitting

6. Locate the disc onto the hub.
7. Apply loctite 270 and fit the hub to disc retaining bolts. Tighten to the correct torque.
8. Using new nyloc nuts fit the sensor ring.



9. Using a dial indicator, check the total disc runout, this must not exceed 0,15 mm (0.006 in). If necessary reposition the disc.
10. Fit the hub assembly.

Disc Reclamation

Check the disc thickness. This dimension may be reduced to a minimum thickness of 12 mm (0.460 in). Equal amounts must be machined off both sides of the disc.

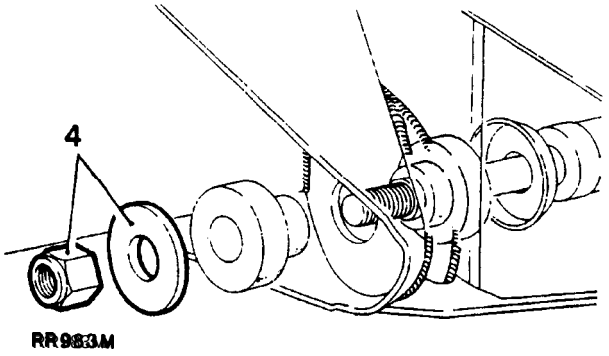
FRONT AXLE ASSEMBLY

Remove and refit

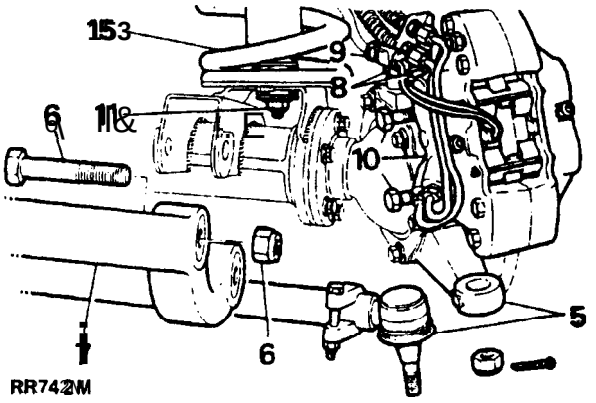
Removing

WARNING: The removal of the axle from the vehicle will require the assistance of two further personnel to steady the axle when lowering from the vehicle.

1. Jack up the front of the vehicle and support the chassis frame.
2. Remove the front road wheels.
3. Support the axle weight with a suitable hydraulic jack.
4. Remove the nuts securing the radius arms to the chassis frame side members.



5. Disconnect the steering damper at the tie rod and using a suitable extractor remove the tie rod ends from the swivel pin housing arm.
6. Remove the four nuts and bolts securing the radius arms to the axle bracket.
7. Lower the radius arms and withdraw them from the chassis side members.
8. Remove the two bolts from the top of the swivel pin housings securing the brake hose brackets. Remove the brackets and refit the bolts to prevent oil leakage.
9. Disconnect the brake pad wear electrical multi-plug at the rear of the caliper (where applicable).
10. Remove the bolts securing the brake calipers and tie the calipers to one side.



11. Remove the nuts and washers securing the shock absorbers to the axle.
12. Using a suitable extractor disconnect the drag link from the swivel pin housing arm.
13. Remove the two nuts and bolts securing the panhard rod to the axle bracket and lift the rod clear of the axle.
14. Mark the differential and drive shaft flanges with identification marks to aid re-assembly. Remove the four nuts and bolts, tie the drive shaft to one side.
15. Carefully lower the axle assembly and remove the road springs.
16. Withdraw the axle assembly.

Refitting

17. Position the axle under the vehicle, supporting the left hand side of the axle.
18. Reverse the removal instructions.
19. Tighten the drive shaft to differential bolts to the specified torque (see section 06-Torque values).
20. Tighten the panhard rod to axle bracket to the specified torque (see section 06-Torque values).
21. Tighten the drag link to hub arm to the specified torque (see section 06-Torque values).
22. Tighten the upper swivel pin retaining bolts to the specified torque (see section 06-Torque values).
23. Tighten the radius arms to axle bolts to the specified torque (see section 06-Torque values).

24. Tighten the radius arms to chassis side member nuts to the specified torque (see section 06-Torque values).
25. Tighten the track rod end to the specified torque and fit a NEW cotter pin (see section 06-Torque values).

FRONT DIFFERENTIAL-OVERHAUL

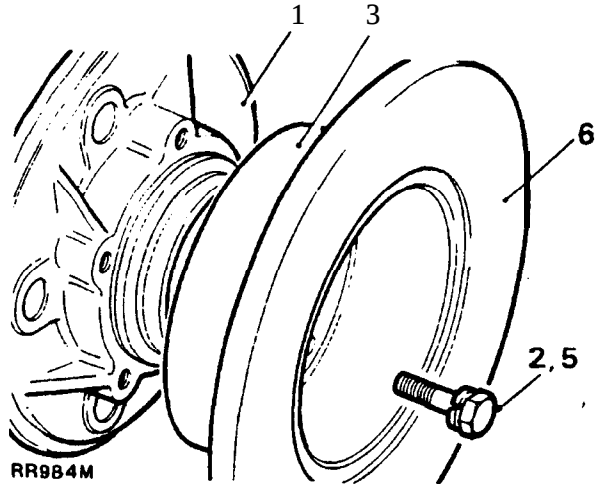
The front and rear differentials fitted to Range Rover are the same type. When overhauling the front differential refer to the rear differential overhaul procedure in Section 51 of this manual.

FRONT DISCS

Remove and refit

Removing

1. Remove the front hub assembly.
2. Remove the front disc fixing bolts.
3. Tap the disc off the front hub.



Refitting

4. Locate the disc onro the front hub.
5. Fit the disc fixing bolts. See Section 06 for tightening torques.
6. Using a dial indicator, check the total disc run-out, this must not exceed 0.15 mm (0.006 in). If necessary, reposition the disc.
7. Fit the front hub assembly.

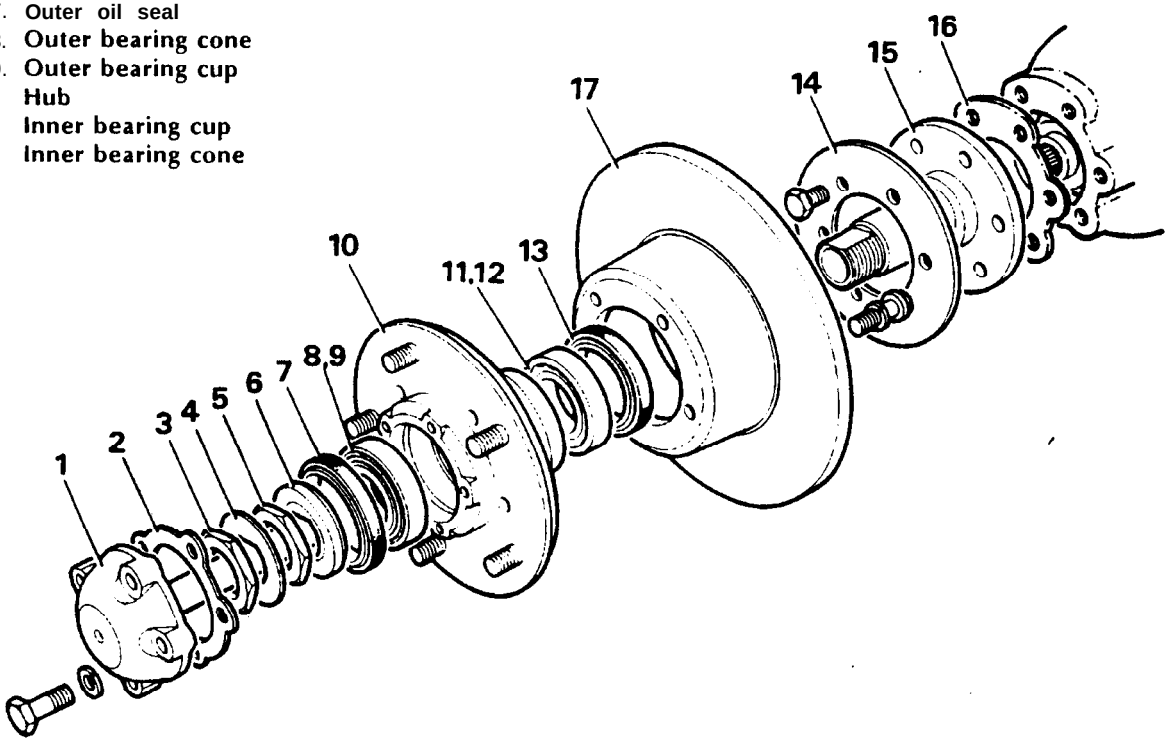
REMOVE AND OVERHAUL FRONT HUB

Service tools:

Oil seal replacer	LST5305
Drift for above tool	MS550 or 18G134
Hub nut wrench	606435

KEY TO FRONT HUB COMPONENTS

1. **Hub driving shaft**
2. **Gasket**
3. **Locknut**
4. **Lock washer**
5. **Adjusting nut**
6. **Seal track spacer**
7. **Outer oil seal**
8. **Outer bearing cone**
9. **Outer bearing cup**
10. **Hub**
11. **Inner bearing cup**
12. **Inner bearing cone**
13. **Inner oil seal**
14. **Mudshield**
15. **Stub axle**
16. **Stub axle joint washer**
17. **Brake disc**

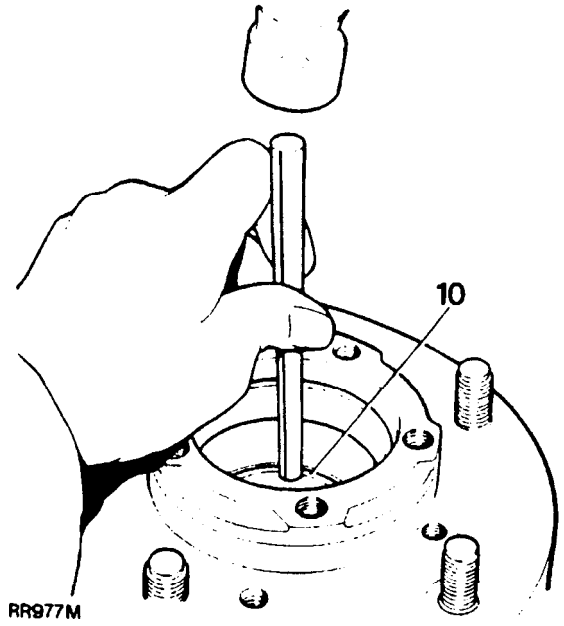


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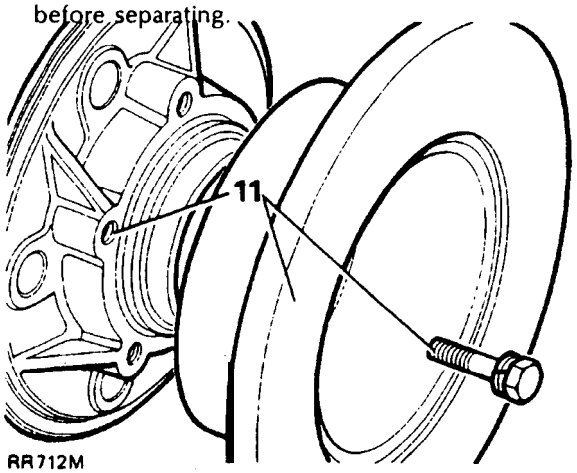
Remove

1. Jack-up the vehicle, lower onto axle stands and remove the road wheels.
2. Remove the swivel housing top bolt to release the brake hose bracket.
3. Remove the brake caliper retaining bolts and release the assembly from the brake disc and secure to one side.
4. Remove the five bolts retaining the hub driving shaft and withdraw the shaft from the hub.
5. Bend back the lock-tab and remove the outer nut using wrench 606435 and remove the lock washer. Similarly, remove the inner nut.
6. Remove the seal track spacer.
7. Withdraw the hub complete with bearings, oil seals and brake disc.
8. Remove the inner and outer oil seals.
9. Remove the inner and outer bearing cones.

10. Drive out the inner and outer bearing cups.



11. Degrease and examine the hub and brake disc and fit new components where necessary. The brake disc is attached to the hub by five bolts. Mark relation of hub to disc as necessary before separating.

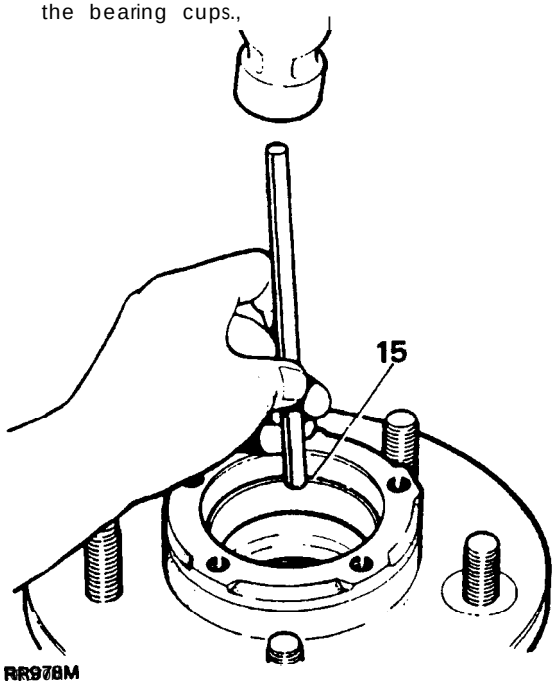


12. Clean and examine the stub axle and in particular check that the inner seal track diameter is smooth and free from blemishes.

13. If necessary remove the retaining bolts and withdraw the stub axle. Complete with the mudshield and joint washer.

Assemble

14. Using a new joint washer fit the stub axle and mudshield. Coat the threads of the retaining bolts with Loctite 270 and tighten evenly to the specified torque (see section 06-Torque values).
15. Fit the new inner and outer bearing cups to the hub, use a suitable brass drift or commercial race driver to prevent damage to the bearing cups.,

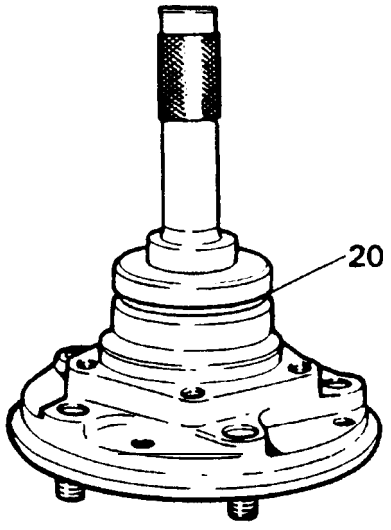


16. Fit the new inner bearing cone and pack with one of the recommended hubgreases.

Fitting new oil seal-inner

17. Clean the hub oil seal housing and ensure that the seal locating surface is smooth and the chamfer on the leading edge is also smooth and free from burrs.
18. Examine the new seal and ensure that it is clean and undamaged and that the garter spring is properly located. Even a small scratch on the seal lip could impair its efficiency.

19. Although the new seal is already pre-greased by the manufacturer, apply one of the recommended hub bearing greases to the outside diameter of the seal before fitting.
20. Place the seal, lip side leading, squarely on the hub and using the 76 mm end of seal replacer tool LST550-5 and drift 550 or 18C134, drive the seal into position flush with the end face of the hub.



Fitting outer oil seal

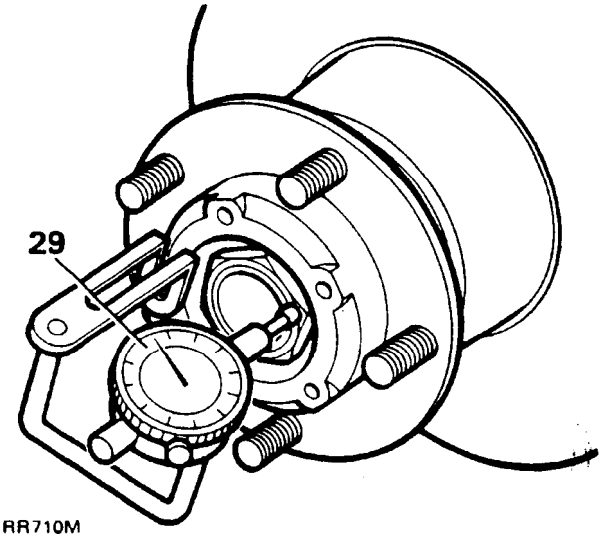
21. Fit the new outer bearing cone and pack with one of the recommended hub greases.
22. Carry out instructions 17 to 19.
23. Place the seal, lip side leading, squarely on the hub and using the 72 mm end of seal replacer tool LST550-5 and drift 550 or 186134, drive the seal into position to the depth determined by the tool.
24. Coat the lips of both seals with one of the recommended greases. This is important since a dry seal can be destroyed during the first few revolutions of the hub.

Fitting hub to stub axle

25. Select a new seal track spacer and check that the outer diameter is smooth and free from blemishes and that there are no burrs on the chamfered leading edge.
26. Taking care not to damage the seal lips fit the hub assembly to the stub axle. Do not allow the weight of the hub to rest even temporarily on the outer seal otherwise damage and distortion could occur. Therefore hold the hub clear of the stub axle until the seal track spacer is fitted.
27. Carefully fit the seal track spacer, chamfered side leading.

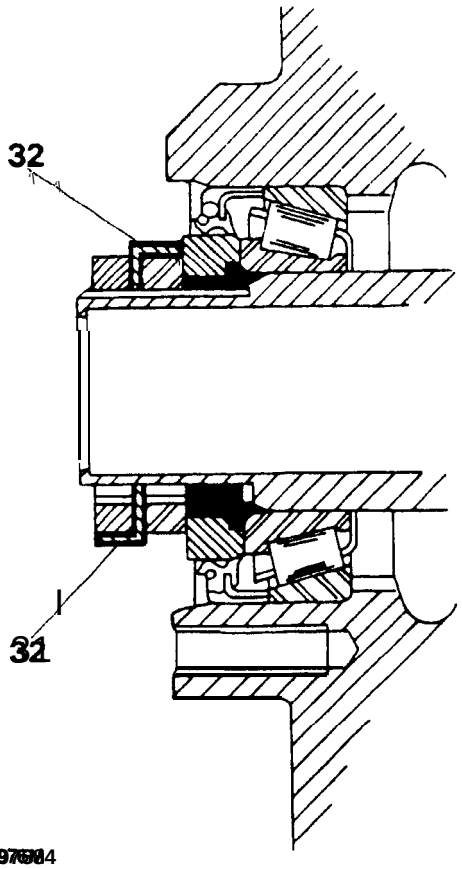
NOTE: Instruction 28 is applicable to hubs that have been fitted with new components throughout. If original components are being refitted instruction 29 must be followed using the adjustment nut to achieve the required end-float.

28. Fit the hub inner nut and using wrench 606435 tighten the adjusting nut while slowly revolving the hub until all end-float is removed then back-off the nut approximately half a turn and retighten the nut to 13-15 in lb which will automatically allow for compression of the rubber on the new seal track spacer giving the required hub end-float of 0.013 to 0.10 mm (0.0005 to 0.004 in).
29. If the rubber on the seal track spacer 'has previously been compressed the hub end-float can be checked by mouting a dial indicator and bracket on the hub so that the trace pin rests in a preloaded condition on the nut. Rotate the hub to settle the bearings and check the end-float by pushing and pulling the hub. End-float must fall within the limits given in the previous instruction.



Continued-'

30. Fit a new lock washer and locknut. Restraining the inner adjustment nut, tighten the outer lock nut to 70 to 80 ft lb (95 to 108 Nm).
31. If original components have been refitted rotate the hub several times to settle the bearings then recheck the end-float, refer to previous instruction 29.
32. Bend one segment of the lock washer over the adjusting nut and another, diametrically opposite, over the locknut.



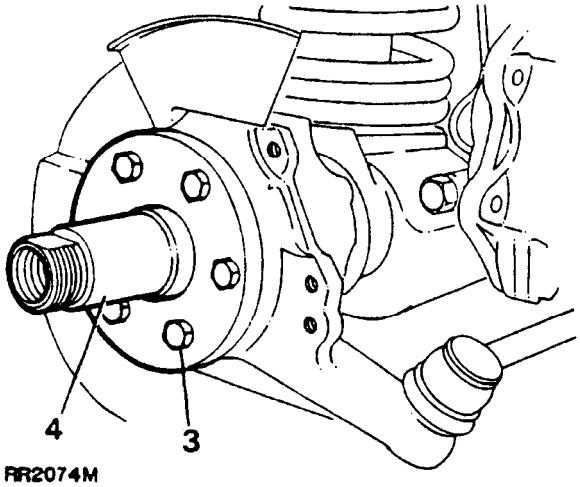
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33. Using a new gasket, fit the hub driving shaft and evenly tighten the retaining bolts to the specified torque (see section 06-Torque values).
34. Fit the brake caliper and secure with the retaining bolts and tighten to the specified torque (see section 06-Torque values).
35. Fit the swivel housing top bolt and brake hose bracket and tighten to the specified torque (see section 06-Torque values).
36. Fit the road wheels, jack-up the vehicle, remove the axle stands, lower the vehicle to the ground and tighten the road wheel nuts evenly to the specified torque (see section 06-Torque values).

OVERHAUL STUB AXLE, AXLE SHAFT, CONSTANT VELOCITY JOINT AND SWIVEL PIN ASSEMBLY

Removing hub assembly, stub axle, constant velocity joint and axle shaft.

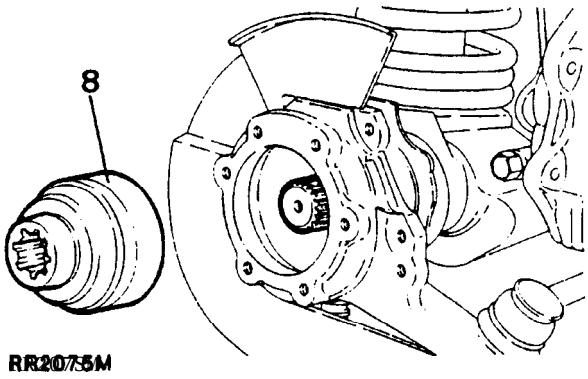
1 Remove the hub complete as described in the hub assembly overhaul operation instructions 1 to 7.
2 Drain the swivel pin housing and refit plug.
3 Remove the six bolts retaining the stub axle to the swivel pin housing.
4 Remove the mud shield, stub axle and joint washer.
5 Remove the brake disc shield secured by one nut and bolt at the bottom front, and one bolt, behind the shield, in the swivel pin housing.



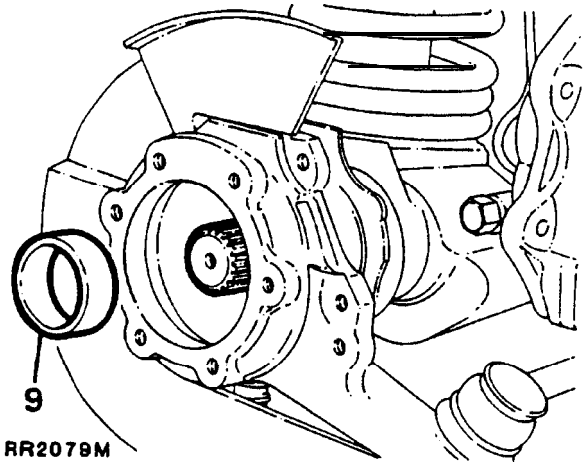
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6. Disconnect the tie-rod end ball joint from the swivel pin housing.
7. Disconnect the drag-link ball joint.

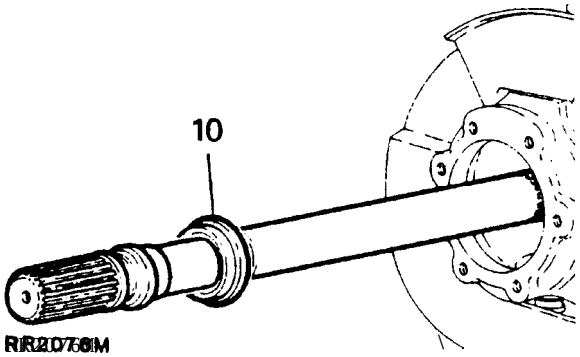
8. Remove the constant velocity joint from the axle shaft.



9. Remove the spacer from the axle shaft and then the axle shaft from the axle tube.

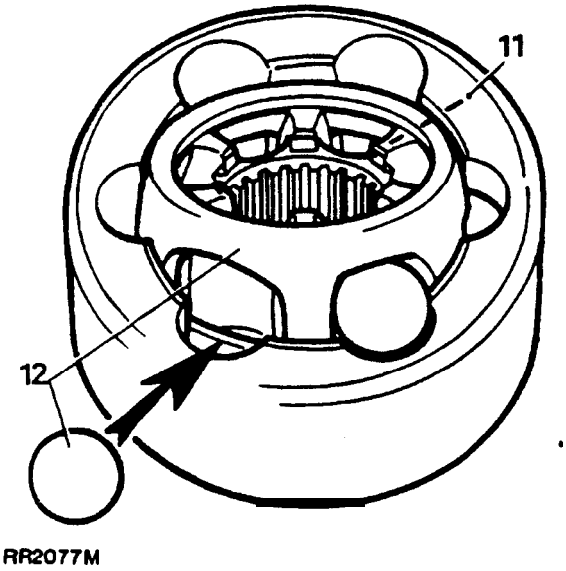


10. Remove the phosphor bronze bush from the axle shaft.

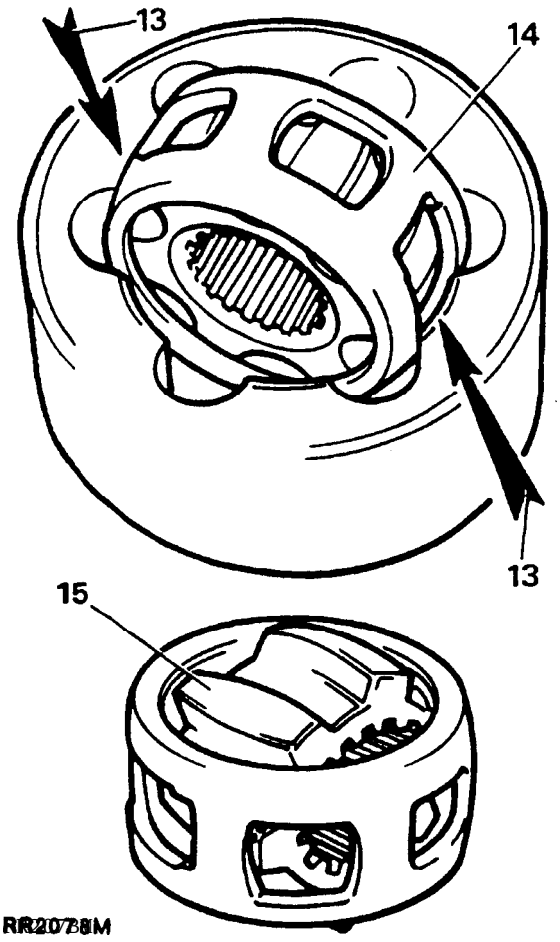


Dismantling the constant velocity joint

11. Mark -the relative positions of the constant velocity joint, inner and outer race and the cage to ensure correct re-assembly.
12. Tilt and swivel the cage and inner race to remove the ball bearings,



Continued



13. Swivel the cage into line with the axis of the joint until the two opposite windows coincide with the two lands of the joint housing.
14. Withdraw the cage.
15. Turn the inner track at right angles to the cage with two of the lands opposite the cage openings, and withdraw the inner race.
16. Examine all components for general condition and examine the inner and outer track, cage balls and bearing surfaces of the constant velocity joint for damage and excessive wear. Maximum acceptable end-float on the assembled joint 0.64mm (0.025 in).
17. To assemble the constant velocity joint reverse the dismantling instructions and lubricate with a recommended oil, ensuring that the inner and outer race marks are aligned during assembly.

Overhaul of stub axle

18. Remove the phosphor bronze bush using a suitable hammer and drift.
19. Clean and examine the stub axle. In particular check that the inner seal track diameter is smooth and free from blemishes.
20. Using a suitable block, press or drive-in a new bush up to the shoulder of the stub axle.

Removing the swivel pin housing assembly

21. Remove the seven bolts securing the swivel pin housing oil seal, retaining plate and joint washer. Release the assembly from the swivel pin housing.

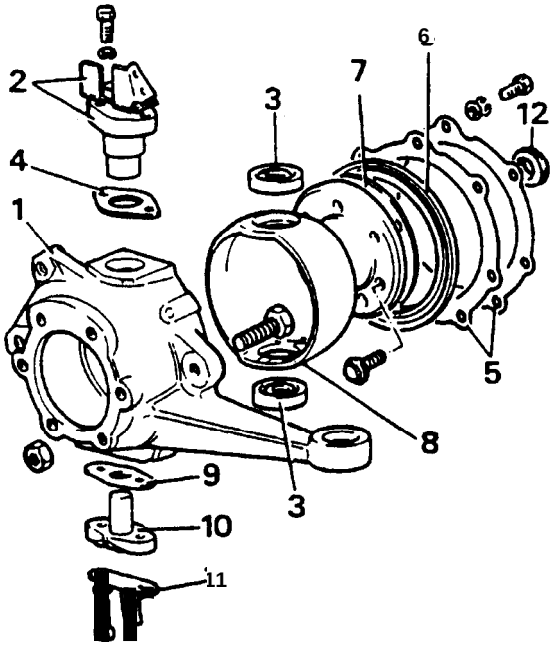
    NOTE: While the joint washer can be removed at this stage, the oil seal and retaining plate must remain until the swivel bearing housing is removed.

22. Remove the two bolts, retaining the brake disc shield bracket, and lower swivel pin to the housing.
23. Remove the brake disc shield bracket.
24. Tapping the small protruding lug remove the lower swivel pin and joint washer.
25. Remove the two bolts retaining the brake hose bracket and top swivel pin.
26. Remove the brake hose bracket, top swivel pin and shims.
27. Remove the swivel pin housing while retrieving the lower and upper tapered roller bearings.
28. If the swivel pin housing is to be replaced, remove the drain and level plugs and lock-stop bolt and nut.

Overhaul of swivel bearing housing

29. Using a suitable drift ease the lower bearing track out of the swivel bearing housing.

NOTE: Use the upper bearing opening for the drift to gain access to the lower bearing track.



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KEY TO SWIVEL ASSEMBLY

1. Swivel pin housing
2. Top swivel pin and brake hose bracket
3. Upper and lower swivel pin bearings
4. Shim
5. Swivel pin housing-oil seal plate and washer
6. Oil seal
7. Joint washer
8. Swivel bearing housing
9. joint washer
10. Lower swivel pin
11. Brake disc mudshield bracket
12. Swivel bearing housing inner oil seal

30. Remove the seven bolts retaining the swivel bearing housing to the axle case.
31. Pry out the oil seal from the back of the housing also remove the joint washer and discard both.
32. Bolt the swivel bearing housing onto the axle case with the upper bearing track located at the bottom.
33. Drive out the top bearing track from the swivel bearing housing.

NOTE: Use the lower bearing opening for the drift to gain access to the upper bearing track.

34. Remove the bolts from the housing.
35. If worn, pitted or damaged, fit a new housing.
36. Using a suitable tool, seat the upper and lower bearing tracks into the swivel bearing housing.

NOTE: Ensure the bearing tracks are fitted square or damage could occur.

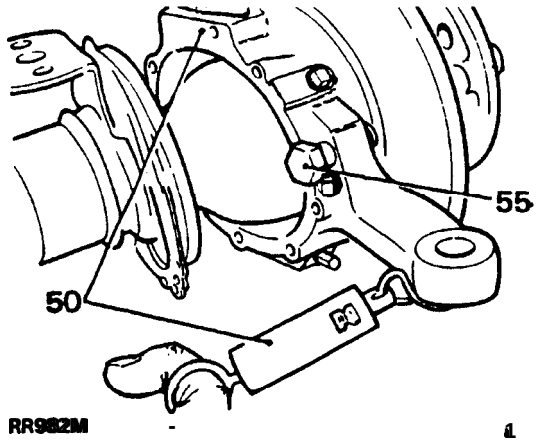
37. With the seal lips trailing press the axle shaft oil seal into the rear of the housing, also grease the lips.

Reassembling the swivel pin housing assembly

38. Coat the swivel bearing housing to axle casing. bolts with Loctite 270.
39. Coat both sides of the joint washer with a sealing compound and place in position on the swivel bearing housing to axle mating face.
40. Place the swivel pin housing cover plate joint washer and oil seal over the axle flange ready for assembly.
41. Fit and secure the swivel bearing housing to the axle flange with the seven bolts tightening evenly to the specified torque (see section 06-Torque values).
42. Grease and fit the upper and lower swivel pin taper roller bearings to the swivel bearing housing.

Continued

43. Place the swivel pin housing in position over the swivel bearing housing.
44. Coat a joint washer on both sides with a sealing compound and place in position on the lower swivel pin.
45. Fit the lower swivel pin with the lug outboard to the swivel pin housing. (DO NOT tighten the bolts at this stage).
46. Fit the top swivel pin with existing shims and brake hose bracket onto the swivel pin housing, securing with the two bolts and locking washers. (DO NOT tighten the bolts at this stage).
47. Coat the threads of the two lower swivel pin bolts with Loctite 270.
48. Fit the brake disc shield bracket and secure with the two bolts to the specified torque (see Section 06) and bend over the lock tabs of the mudshield bracket.
49. Tighten the top swivel pin bolts to the specified torque (see Section 06-Torque values).



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50. To check the top swivel pin pre-load, attach a spring balance to the track-rod and ball joint bore and pull the balance to determine the effort required to turn the swivel pin housing. The resistance, once the initial inertia has been overcome, should be 1.16 to 1.46 kg (2.6 to 3.2 lb). If necessary, adjust by removing or adding shims to the top swivel pin as required. When the correct setting has been achieved undo the bolts, coat the threads with Loctite 270 and retighten the bolts to the specified torque (see Section 06-Torque values), and bend over the tabs of the locking washer.
51. Liberally apply (but do not pack) 2.5 to 4.0g of recommended grease between the lips of the swivel oil seal.
52. Secure the oil seal, joint washer and cover plate with the seven bolts and spring washers to the specified torque (see Section 06-Torque values).
53. Fit the tie-rod and drag link and secure with new cotter pins, where applicable. Tighten to the specified tourque. (See Section 06 Torque Values)
54. Fit the brake disc shield.
55. Loosely fit the lock stop bolt and nut for later adjustment.

Constant velocity, stub axle and axle shaft reassembly

56. Fit a new phosphor bronze bush onto the axle shaft.
57. Place axle shaft into axle tube, ensuring the splines are engaged push the shaft home.

CAUTION: When inserting the axle shaft care should be taken not to damage the oil seal.

58. Fit the constant velocity bearing journal into the phosphor bronze bush at the rear of the stub axle.
59. Fit the spacer onto the axle shaft.
60. Place the joint washer in position on the swivel pin housing to stub axle mating surface.
61. Fit the stub axle with the machined flat on the splines in the 12 o'clock position, ensuring that the constant velocity bearing journal engages fully into the phosphor bronze bush.

CAUTION: Damage to this bush can occur if this precaution is not observed.

62. Place the mudshield onto the stub axle and secure to the swivel pin housing with the six bolts using Loctite 270. Evenly tighten to the specified torque (see Section 06-Torque values).
63. To complete the reassembly see instructions covering front hub overhaul.

NOTE: New hub seals should be used on reassembly.

64. Check that the swivel pin housing drain plug is tightly fitted and remove the filler/level plug.
65. Inject approximately 0.35 litres (0.6 pints) of recommended oil or until the oil reaches the filler level hole. Fit and tighten the plug and wipe away any surplus oil.
66. Set the steering lock-stop bolts to provide a minimum clearance of 20 mm (0.787 in) between the tyre wall and radius arm. Tighten the locknut.

FRONT HUB ASSEMBLY ON VEHICLES FITTED WITH ANTI-LOCK BRAKES (ABS)

Service tools:
Hub oil seal replacer LST 137.
Drift 18G 134.
Dial gauge bracket RO 530106.

REMOVE, OVERHAUL AND REFIT

Remove

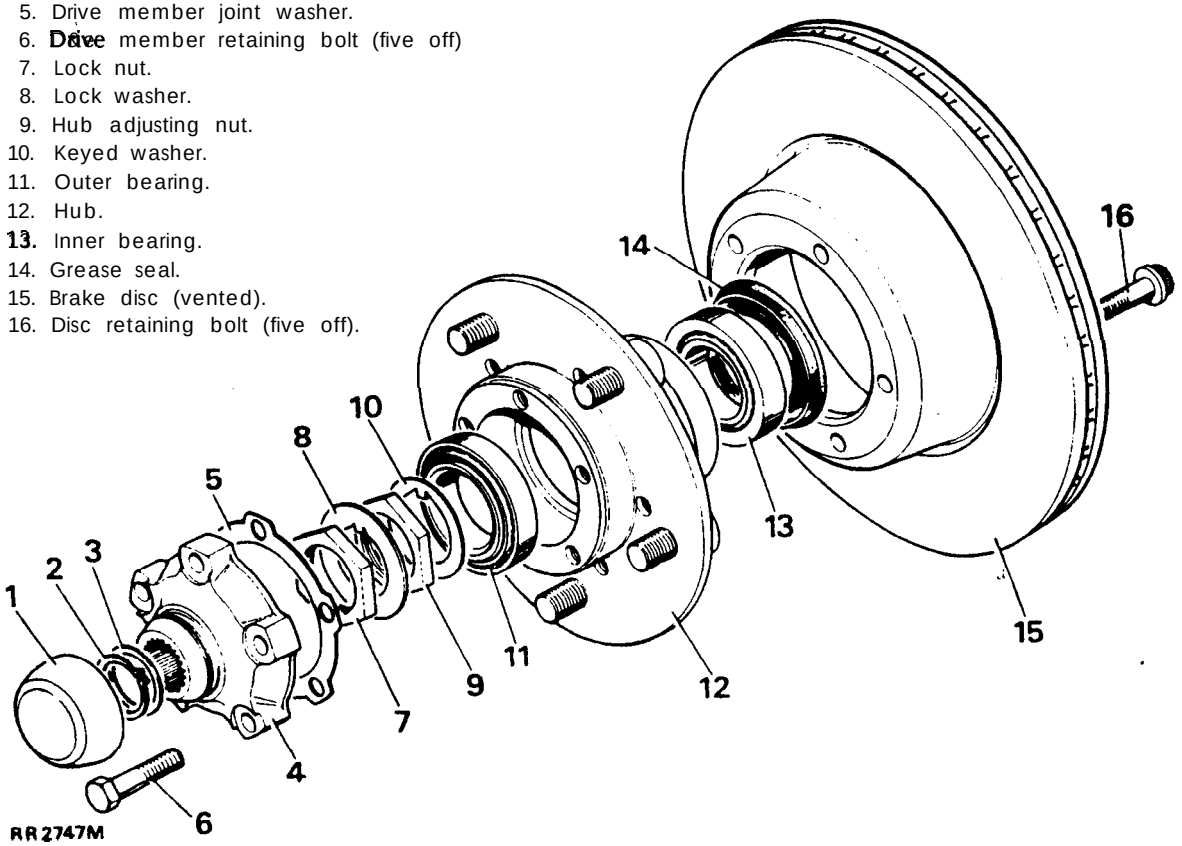
1. Slacken the front wheel nuts, jack up the vehicle and lower onto axle stands and remove the road wheel.
2. Remove the brake caliper. See BRAKES section.
3. Lever off the dust cap.
4. Remove the circlip and drive shaft shim from the drive shaft.
5. Remove the five bolts and withdraw the driving member and joint washer.
6. Bend back the lock washer tab.
7. Remove the locknut and tab washer.
8. Remove the hub adjusting nut.
9. Remove the keyed washer.
10. Withdraw the hub and brake disc assembly complete with bearings.
11. Remove the outer bearing.
12. Mark, for reassembly, the relationship between the hub and brake disc, if original hub is to be refitted.
13. Remove the five bolts and separate the hub from the brake disc.

WARNING: A maximum of two road wheel retaining studs can be renewed. Should more studs be unserviceable a new hub with studs must be obtained.

14. Drift out the grease seal and inner bearing from the hub and discard the seal.
15. Drift out the inner and outer bearing tracks.

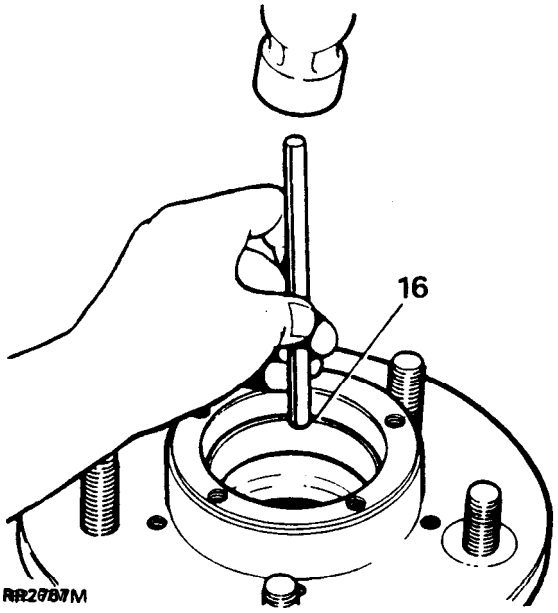
KEY TO HUB ASSEMBLY

1. Dust cap.
2. Drive shaft circlip.
3. Drive shaft shim.
4. Drive member.
5. Drive member joint washer.
6. Drive member retaining bolt (five off)
7. Lock nut.
8. Lock washer.
9. Hub adjusting nut.
10. Keyed washer.
11. Outer bearing.
12. Hub.
13. Inner bearing.
14. Grease seal.
15. Brake disc (vented).
16. Disc retaining bolt (five off).

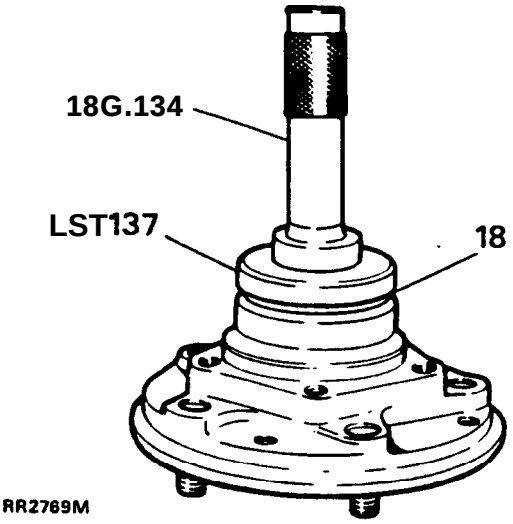


Refit

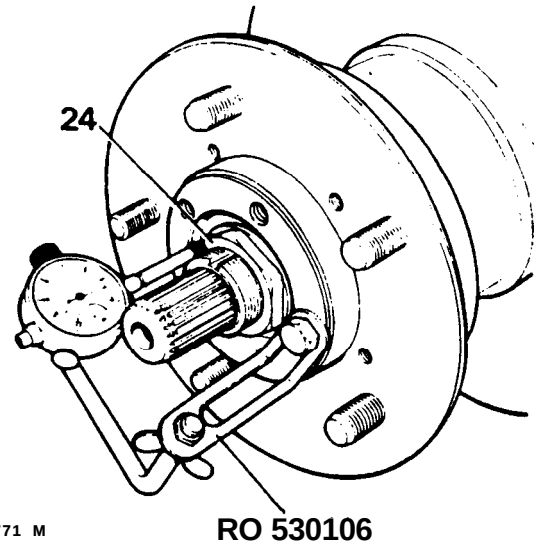
16. Clean and degrease the hub and drift in the inner and outer bearing tracks.



17. Pack the hub inner bearing with a recommended grease and fit to the hub.
18. With the lip side leading fit a new seal to the hub using special tool LST 137 seal replacer and drift 18G 134. Drive in the seal so that it is flush with the rear face of the hub. Apply grease between the seal lips.

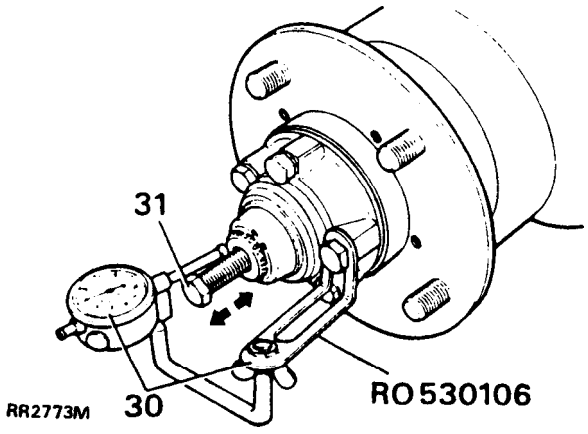


19. Assemble the brake disc to the hub, lining up to the marks made during dismantling. Applying Loctite 270, fit and tighten the five retaining bolts to the correct torque.
20. Grease as in instruction 17 and fit the outer bearing to the hub.
21. Clean the stub axle and drive shaft and fit the hub assembly to the axle.
22. Fit the keyed washer.
23. Fit the hub adjusting nut and tighten by hand whilst rotating the hub until all end-play is taken up.
24. Mount a dial gauge using bracket RO 530106 and rest the stylus in a loaded condition on the adjusting nut.



25. Slacken off the adjusting nut until a hub end-play of 0,013 to 0,05 mm (0.0005 to 0.002 in) is obtained.
26. Fit a new keyed lock tab washer.
27. Fit and tighten the hub adjusting nut and recheck the end-play before bending the lock tab over.
28. Fit a new joint washer to the driving member and fit the member to the hub and secure with the five bolts tightening evenly to the correct torque.
29. Fit the original drive shaft shim and secure with a circlip.

30. To check the drive shaft end-play mount a dial gauge using bracket RO 530106 and rest the stylus in a loaded condition on the end of the drive shaft.
31. Fit a suitable bolt to the threaded end of the drive shaft and using a pair of pliers move the drive shaft back and forth noting the dial gauge reading. The end-play should be between 0.08 to 0,25 mm (0.003 to 0.010 in).



32. If the end-play requires adjustment, remove the circlip, measure the shim thickness and fit an appropriate shim to give the required end-play.
33. Remove the bolt from the drive shaft, fit the circlip and dust cap.
34. Fit the brake caliper, see BRAKES section.
35. Bleed the brake system, see ABS brake bleed procedure.
36. Fit the road wheel, remove the axle stands and finally tighten the road wheel nuts.
37. Operate the footbrake several times to locate the brake pads before taking the vehicle on the road.

FRONT DISCS ON VEHICLES Fill-ED WITH ABS

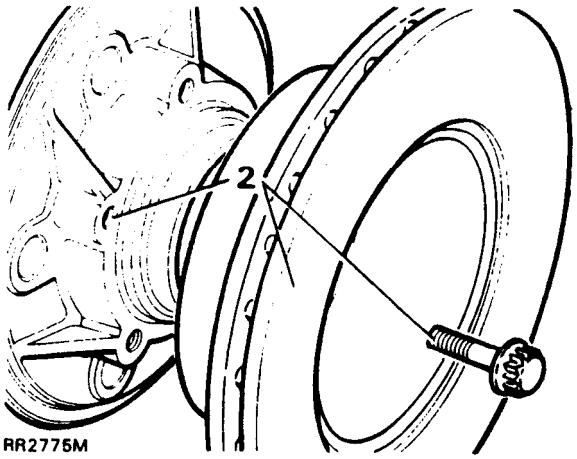
REMOVE, REFIT AND RECLAIM

Removing

1. Remove the front hub assembly.
2. Remove the five hub to disc retaining bolts,
3. Tap off the disc from the hub.

Refitting

4. Locate the disc on to the hub.
5. Apply Loctite 270 and fit the hub to disc retaining bolts. Tighten to the correct torque.



6. Using a dial indicator, check the total disc runout, this must not exceed 0,15 mm (0.006 in). If necessary reposition the disc.
7. Fit the hub assembly.

Disc reclamation

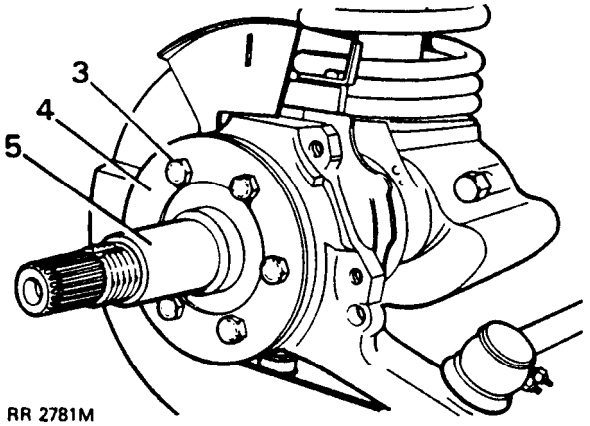
Check the vented disc thickness. This dimension may be reduced to a minimum thickness of 22 mm (0.866 in).
Material may be machined off the disc faces.
On completion equal thicknesses of disc must remain each side of the vent.

OVERHAUL FRONT STUB AXLE, CONSTANT VELOCITY JOINT AND SWIVEL ASSEMBLY ON VEHICLES FITTED WITH ABS

Service tools:
18G 284AAH extractor.
LST 132 bearing installer.
LST 133 seal installer.

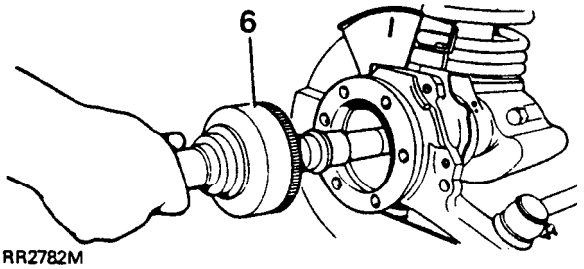
Remove stub axle, axle shaft and constant velocity joint.

1. Remove the hub complete as described in the operation to overhaul the hub assembly on ABS fitted vehicles.
2. Drain the swivel pin housing and refit plug.
3. Remove the six bolts retaining the stub axle to the swivel housing.
4. Remove the mud shield.
5. Remove the stub axle and joint washer.



RR 2781M

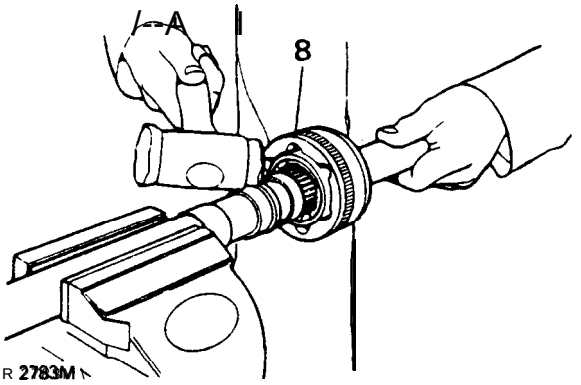
6. Pull out the axle shaft and constant velocity joint from the axle casing.



RR2782M

Remove constant velocity joint from axle shaft

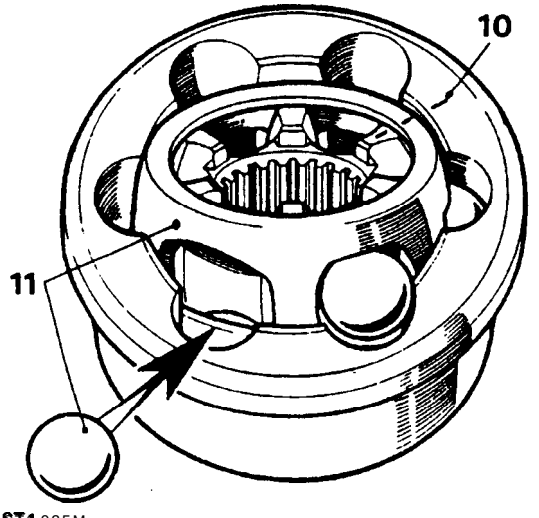
7. Hold the axle shaft firmly in a soft jawed vice.
8. Using a soft mallet drive the constant velocity joint from the shaft.
9. Remove the circlip and collar from the axle shaft.



RR 2783M

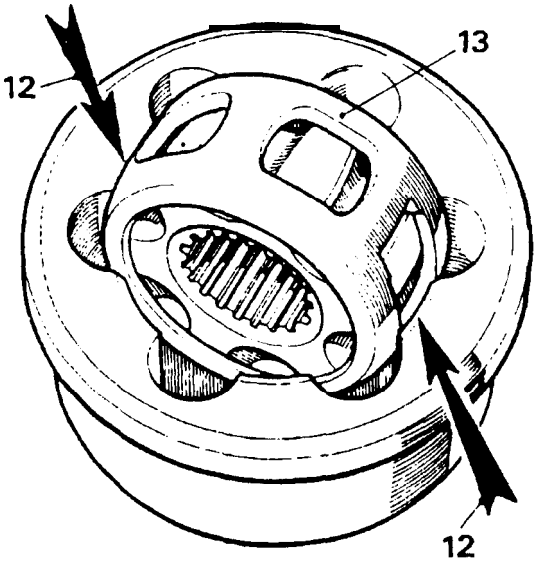
Dismantle the constant velocity joint

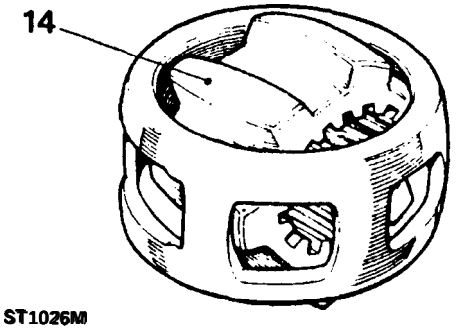
10. Mark the relative positions of the constant velocity joint inner and outer race and the cage for correct reassembly.
11. Tilt and swivel the cage and inner race to remove the balls.



ST1025M

12. Swivel the cage into line with the axis of the joint and turn it until two opposite windows coincide with two lands of the joint housing.
13. Withdraw the cage.
14. Turn the inner track at right angles to the cage with two of the lands opposite the cage openings and withdraw the inner race.



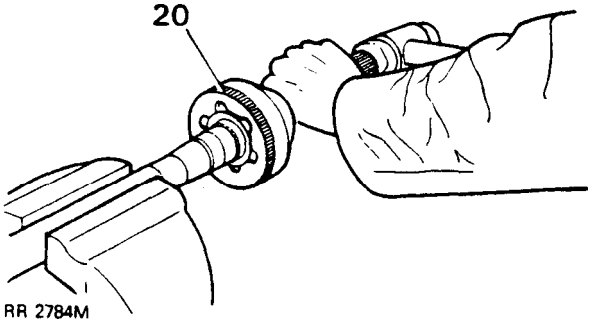


ST1026M

15 Degrease and examine all components for general wear and condition.
16. Examine the inner and outer track, cage balls and bearing surfaces of the constant velocity joint for damage and excessive wear.
17 To assemble the constant velocity joint, reverse the dismantling instructions and lubricate with a recommended oil.
18. Check that the end-float of the assembled joint does not exceed 0.64 mm (0.025 in).

Fit constant velocity joint to axle

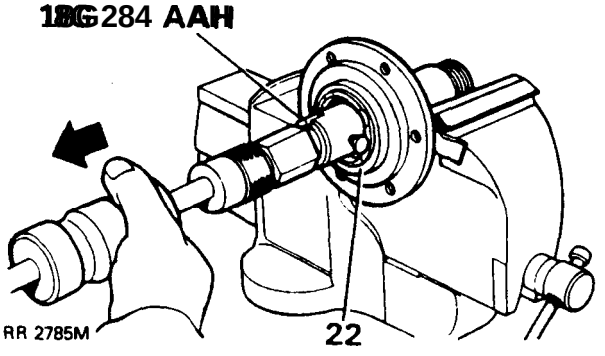
19. Fit the collar and a new circlip.
20. Engage the constant velocity joint on the axle shaft splines and using a soft mallet, drive the joint home.



RR 2784M

Renew stub axle, thrust ring, oil seal and bearing

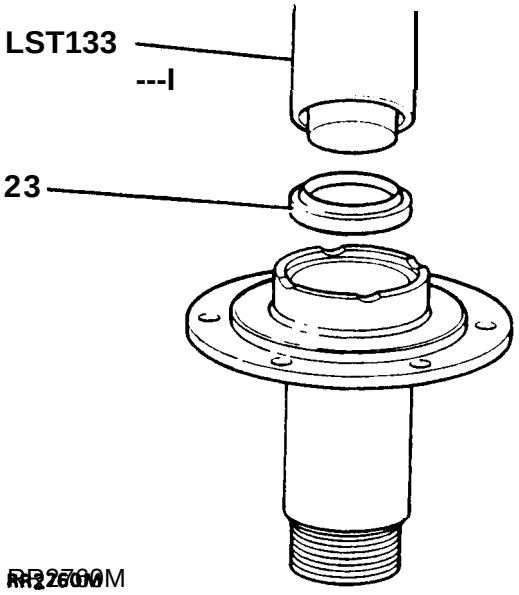
21. Drill and chisel off the thrust ring taking care to avoid damaging the stub axle.
22. Remove the bearing and oil seal using special tool 18G 284AAH and slide hammer. Ensure that the fingers of the tool locate behind the bearing to drive it out. Repeat for the oil seal.



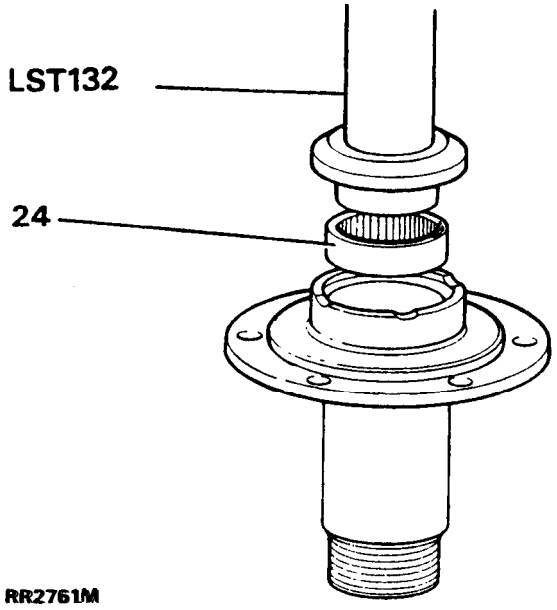
RR 2785M

Refit

23. Lubricate the seal and lip with EP90 oil and with the cavity side leading press in a new oil seal using special tool LST 133.



24. Using special tool LST 132, fit bearing with its part number visible when fitted, and flush with the end face of the stub axle.



25. Press fit a new thrust ring onto the stub axle

Remove swivel pin housing.

26. Remove the brake shield secured at the bottom by one nut and bolt, and midway by the lock stop nut.
27. Disconnect the track-rod end ball joint from the housing.
28. Disconnect the drag-link ball joint.
29. Disconnect the jump hoses from the brake jump hose bracket.
30. Remove the ABS brake sensor.
31. Remove the six bolts securing the oil seal and retaining plate to the swivel pin housing. Prise the seal irom the swivel pin housing.

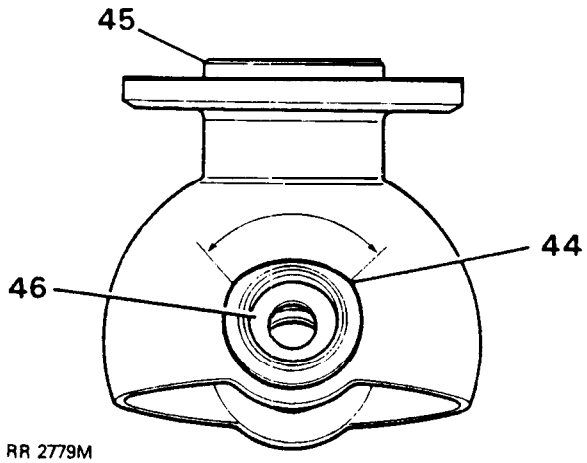
    NOTE: The oil seal and retaining plate cannot be removed until the swivel pin bearing housing is removed.

32. Remove the two countersunk screws securing the brake damper/shield bracket, and the lower swivel pin to the housing.
33. Withdraw the lower swivel pin and joint washer by tapping the small protruding lug.
34. Remove the top swivel pin retaining bolts complete with the brake jump hose bracket.
35. Withdraw the top swivel pin and shims.
36. Remove the swivel pin housing while retrieving the lower taper bearing.
37. If the swivel pin housing is to be renewed, the drain, level and filler plugs and lock-stop bolt.

Remove and overhaul swivel pin bearing housing

38. Remove the seven bolts securing the swivel pin bearing housing to the axle case. Remove the swivel pin bearing housing.
39. Remove and discard the oil seal and joint washer.
40. Drift out the lower swivel pin bearing track.
41. Press out the top swivel pin bush housing assembly. Discard the thrust washer. From 1991 model year, discard the thrust washers and bearing.
42. If worn, pitted or damaged; renew the swivel pin bearing housing.
43. Press in a new lower swivel pin bearing track.

44. Press in a new bush and bush housing. Ensure that the relieved lip of the bush housing faces towards the rear oil seal, as shown.



45. With the seal lips trailing press the axle shaft oil seal flush into the rear of the housing. Grease the lips.
46. Fit a new thrust washer into the top swivel pin bush with the black P.T.F.E. coating uppermost. Check it is in position when fitting the top swivel pin. From 1991 model year fit new thrust washers and thrust bearing.
47. Hang the swivel pin bearing housing oil seal and retainer plate over the back of the housing. Ensure they are in the correct assembly order.
48. Fit a new joint washer and secure the swivel pin bearing housing to the axle. Starting with the top fixing dowel bolt. Tighten evenly to the correct torque.

Fit swivel pin housing

49. Grease and fit the lower swivel pin bearing to the bearing housing.
50. Place the swivel pin housing in position over the swivel pin bearing housing.
51. Using a new joint washer, fit the lower swivel pin with lip outboard. Do not secure with screws at this stage.
52. Fit a new sensor bush and new oil seal, lip side leading to the top swivel pin.
53. Lubricate with a recommended oil and fit the top swivel pin with existing shims.
54. Coat the threads of the top swivel pin bolts with Loctite 542. Fit the bolts and jump hose bracket (do not tighten).
55. Coat the threads of the lower swivel pin screws with Loctite 270 and fit, together with the damper and shield bracket. Tighten to the correct torque.
56. Tighten the top swivel pin and brake jump hose bracket securing bolts to the correct torque.

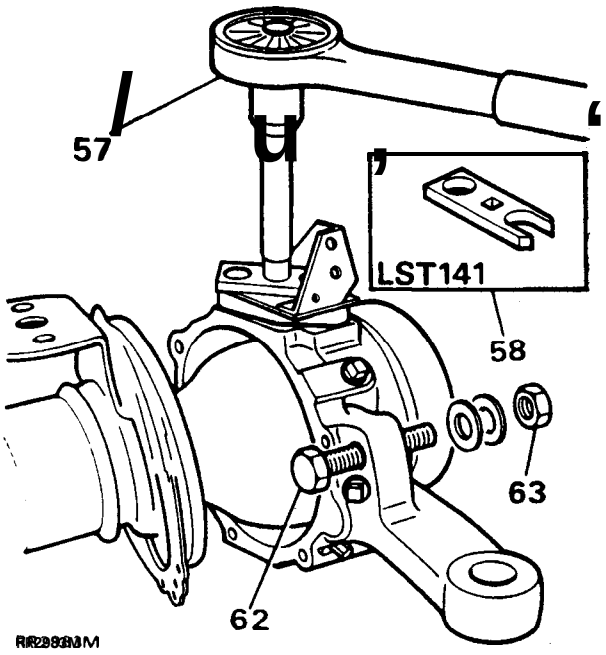
Check and adjust preload on bearings 1990 model year

57 The preload on bearings to be 0,18 to 0,23 mm (0.007 to 0.009 ins), without the swivel housing oil seal and axle fitted, and reading from the centre of the swivel pin. The torque required to turn the swivel assembly from lock to lock to be 5.1 to 7.3 Nm (45 to 65 in.lbs). Adjust by removing or adding shims to the top swivel pin.

Check and adjust preload on bearings 1991 model year on

The preload on bearings to be 0,25 to 0,30 mm (0.010 to 0.012 ins), without the swivel housing oil seal and axle fitted, and reading from the centre of the swivel assembly from lock to lock to be 2.0 to 2.8 Nm (18 to 25 in.lbs). Adjust by removing or adding shims to the top swivel pin.

58 To take a reading use special tool LST 141 torque test adaptor, with a torque wrench and extension as shown.

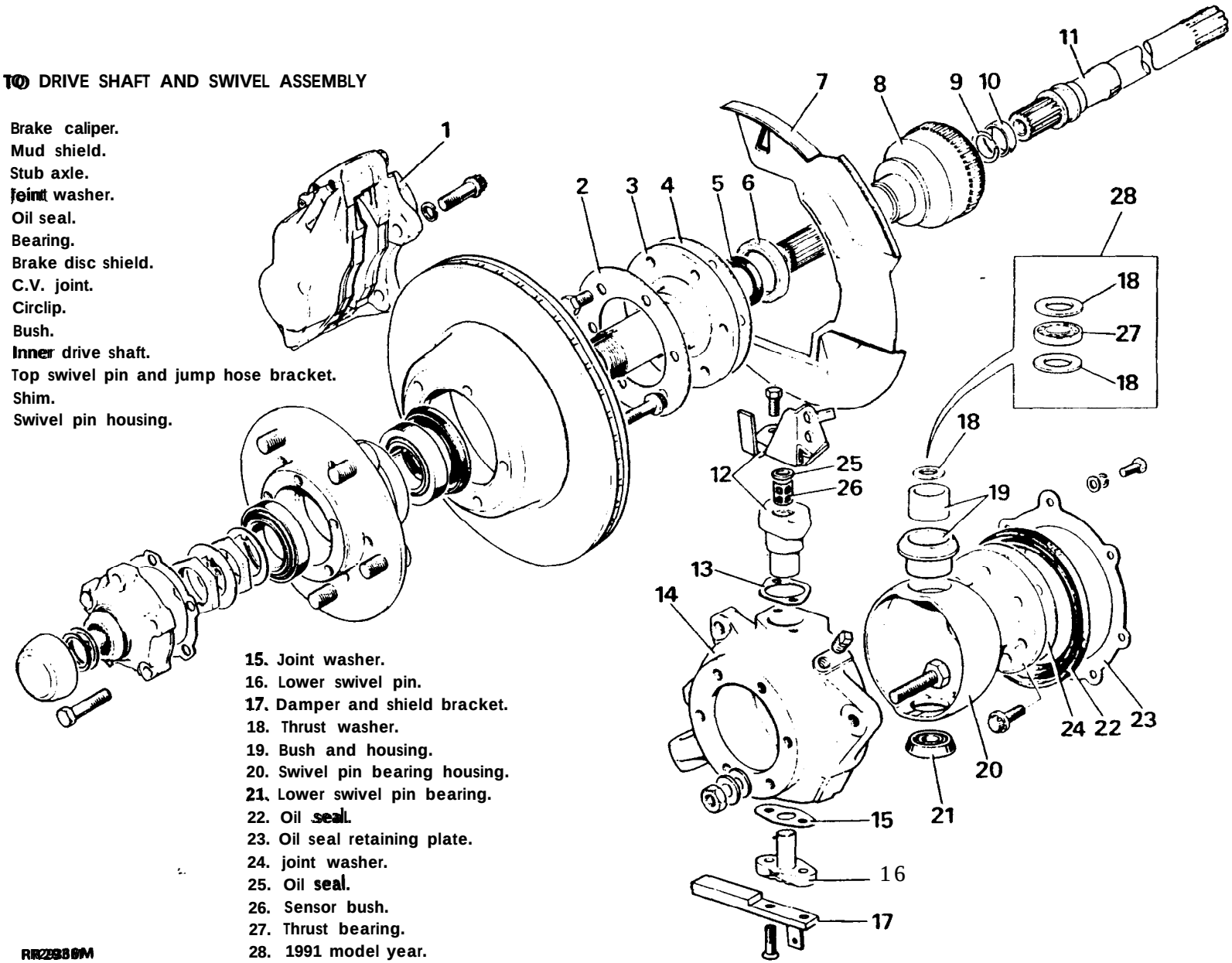


Fit remaining components

59. Liberally apply (do not pack) a recommended grease between the lips of the swivel housing oil seal.
60. Secure the oil seal with the retaining plate and securing bolts tightening evenly to the correct torque.

KEY TO DRIVE SHAFT AND SWIVEL ASSEMBLY

1. Brake caliper.
2. Mud shield.
3. Stub axle.
4. Joint washer.
5. Oil seal.
6. Bearing.
7. Brake disc shield.
8. C.V. joint.
9. Circlip.
10. Bush.
11. Inner drive shaft.
12. Top swivel pin and jump hose bracket.
13. Shim.
14. Swivel pin housing.
15. Joint washer.
16. Lower swivel pin.
17. Damper and shield bracket.
18. Thrust washer.
19. Bush and housing.
20. Swivel pin bearing housing.
21. Lower swivel pin bearing.
22. Oil seal.
23. Oil seal retaining plate.
24. joint washer.
25. Oil seal.
26. Sensor bush.
27. Thrust bearing.
28. 1991 model year.



RR2380M

61. Fit the track-rod and drag link and secure with new split pins.
62. Loosely fit the lock stop bolt for later adjustment.
63. Fit the brake disc shield. Leaving the middle fixing nut loose until the lock stop has been set.

Fit drive shaft and stub axle

64. Insert the axle shaft, and when the differential splines are engaged, push the assembly home.

CAUTION: Take care not to damage the axle shaft oil seals.

65. Place a new joint washer in position on the swivel pin housing to stub axle mating face. Coat the threads of the stub axle bolts with Loctite 270.
66. Fit the stub axle with the keyway at the 12 o'clock position.

CAUTION: Ensure that the constant velocity joint bearing journal is butted against the thrust ring on the stub axle. Before the stub axle is secured.

67. Place the mud shield in position and secure the stub axle to the swivel pin housing with the six bolts and tighten evenly to the correct torque.
68. Fit the brake jump hoses to the brake jump hose bracket.
69. To complete the assembly, follow instructions to fit front hub on ABS fitted vehicles.
70. Check that the swivel pin housing oil drain plug is tightly fitted and remove the filler and level plugs.
71. Inject approximately 0,35 litres (0.6 pints) of recommended oil until the oil reaches the level hole. Fit and tighten the filler and level plugs and wipe away any surplus oil.
72. Set the steering lock-stop bolt to provide a clearance of 20mm (0.787in) between the tyre wall and radius arm. Tighten the locknut which also secures the brake disc shield.
73. Fit the ABS brake sensor following the instructions in the brake section.

POWER STEERING BOX

Remove and refit

Service tools:
Drop arm extractor-MS252A

NOTE: It is important that whenever any part of the system, including the flexible piping, is removed or disconnected, that the utmost cleanliness is observed.

All ports and hose connections should be suitably sealed off to prevent ingress of dirt, etc. If metallic sediment is found in any part of the system, the complete system should be checked, the cause rectified and the system thoroughly cleaned.

Under no circumstances must the engine be started until the reservoir has been filled. Failure to observe this rule will result in damage to the pump.

Metric pipe fittings are used with 'O' ring pipe ends on the fittings to the steering box.

Follow normal 'O' ring replacement procedure whenever pipes are disconnected.

Ensure that compatible metric components are used when fitting replacement pipes.

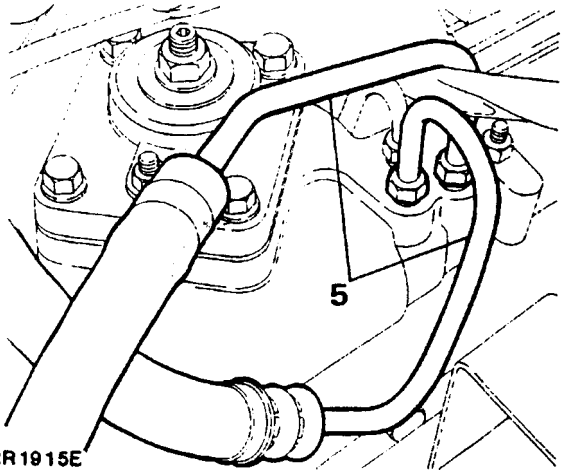
CAUTION: PRIOR TO REMOVING ANY OF THE COMPONENTS INCORPORATED IN THE STEERING LINKAGE, IT IS IMPERATIVE THAT THE ROAD WHEELS ARE IN A STRAIGHT AHEAD POSITION AND THAT THE STEERING WHEEL IS THEN REMOVED TO PREVENT THE CRUISE CONTROL SPIRAL CASSETTE BEING WOUND UP OR DAMAGED IF THE STEERING LINKAGE IS INADVERTENTLY MOVED OR ROTATED.
AFTER REFITTING STEERING LINKAGE COMPONENTS, THE ROAD WHEELS MUST BE RE-POSITIONED STRAIGHT AHEAD BEFORE FITTING THE STEERING WHEEL, DO NOT RECONNECT THE MULTI-PLUG TO THE CASSETTE OR FIT THE TRIM PAD AT THIS STAGE. IF, AFTER THE VEHICLE HAS BEEN DRIVEN, IT IS FOUND THAT THE STEERING WHEEL REQUIRES RE-POSITIONING, REMOVE THE WHEEL. RE-ALIGN THE DRIVE PEGS ON THE CRUISE CONTROL CASSETTE BY SLIGHTLY ROTATING THE UPPER PART OF THE CASSETTE IN THE APPROPRIATE DIRECTION UNTIL THE PEGS LIE HORIZONTAL TO THE STEERING COLUMN.

FIT THE STEERING WHEEL ENSURING THAT THE DRIVE PEGS LOCATE IN THEIR RESPECTIVE HOLES ON THE REAR OF THE STEERING WHEEL.

AFTER FINAL ALIGNMENT RECONNECT THE MULTI-PLUG TO THE CASSETTE, TIGHTEN THE STEERING WHEEL SECURING NUT AND FIT THE TRIM PAD.

Removing

1. Park the vehicle on a level surface.
2. Prop open the hood.
3. Remove the filler cap from the power steering fluid reservoir.
4. Disconnect the fluid pipes from the pump. Drain and discard the fluid. Replace the filler cap.
5. Disconnect the fluid feed and return pipes from the steering box.

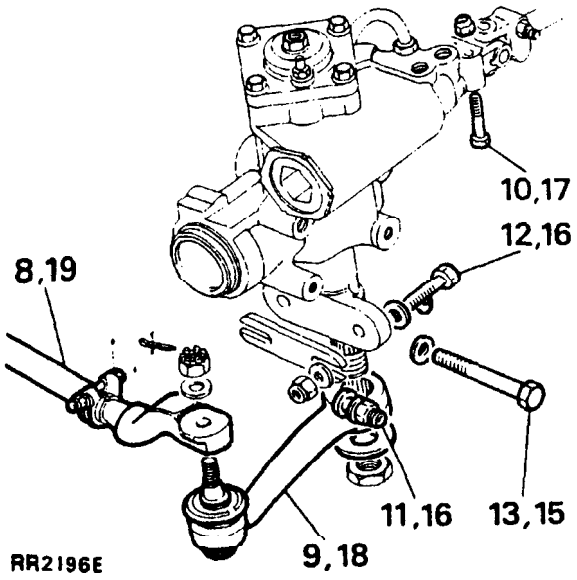


6. Seal all disconnected hose connections to prevent ingress of foreign matter.
7. Jack up and support the chassis front end with axle stands. Alternatively, raise the vehicle on a hoist.

WARNING: Whichever method is adopted, it is essential that the wheels are chocked, the parking brake is applied, and low range selected with differential lock engaged.

Continued-'

8. Disconnect the drag fink from the drop arm using a suitable extractor.
9. Remove the drop arm, using drop arm extractor MS252A.
10. Remove the pinch bolt attaching the universal joint to the power steering box.
11. Loosen the nut securing the tie bar to the chassis.
12. Remove the bolts securing the tie bar to the steering box and move the tie bar aside.
13. Remove the fixings attaching the power steering box to the chassis side member.
14. Withdraw the power steering box.



Refitting

15. Refit the steering box to the chassis side member and tighten the four Nyloc nuts to the correct torque (see section 06-Torque values).
16. Refit the tie bar to the steering box, and tighten the tie bar securing nut to the correct torque (see section 06-Torque values).
17. Reconnect the pinch bolt, attaching the universal joint to the power steering box, and tighten to the correct torque (see section 06-Torque values).
18. Refit the drop arm.
19. Refit the drag link and secure.
20. Lower the vehicle to ground level.
21. Remove the sealing. plugs and reconnect the flexible hoses to the steering box.
22. Remove the sealing plug and refit the flexible hose to the power steering pump.
23. Ensure that the steering wheel is correctly aligned when the wheels are in the straight-ahead position.

NOTE: It may be necessary to remove the steering wheel and reposition on the splines to obtain this condition. See steering wheel- remove and refit.

24. Remove the filler cap from the power steering fluid reservoir. Fill the reservoir to the oil level mark on the dipstick attached to the filler cap with the recommended fluid (see Section 09) and bleed the power steering system. See power steering system-bleed.
25. Check the fluid level and replace the filler cap.
26. Check, and if necessary, adjust the steering box.
27. Test the steering system for leaks. with the engine running, by holding the steering hard on full lock in both directions.

CAUTION: Do not maintain this pressure for more than 30 seconds in any one minute, to avoid causing the oil to overheat and possible damage to the seals.

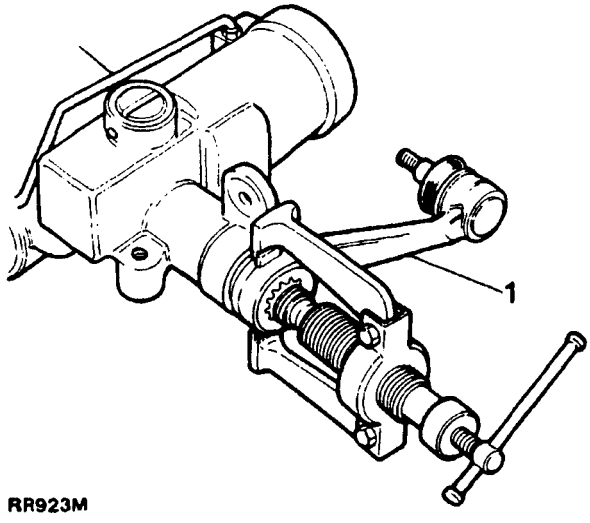
28. Close the hood.
29. Road test the vehicle.

POWER STEERING BOX OVERHAUL

Service tools:
LST120 -'C' Wrench
LSTII9 -Worm adjusting wrench
MS252A -Drop arm extractor
606602 -Ring expander
606603 -Ring compressor
606604 -Seal saver, sector shaft
RO1015 -Seal saver, valve and worm
R01016 -Torque setting tool

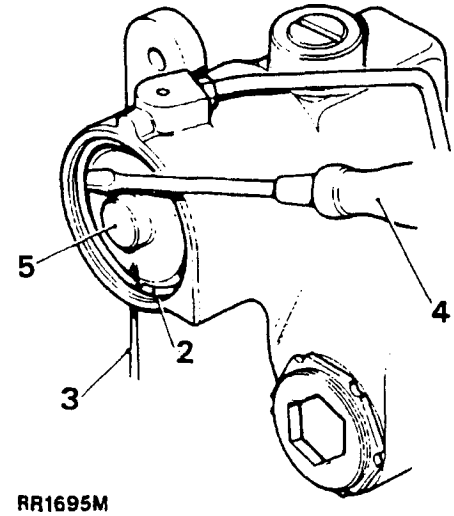
Dismantle

1. Remove the steering box from the vehicle, and withdraw the drop arm.



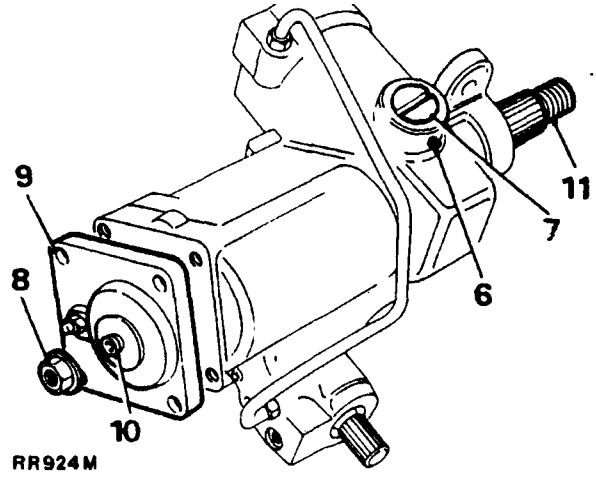
RR923M

2. Rotate the retainer ring, as necessary, until one end is approximately 12 mm (0.500 in) from the extractor hole.
3. Lift the cover retaining ring from the groove in the cylinder bore, using a suitable pointed drift applied through the hole provided in the cylinder wall.
4. Complete the removal of the retainer ring, using a screwdriver.
5. Turn on left lock until the piston pushes out the end cover.



RR1695M

6. Loosen the set screw retaining the rack pad adjuster.
7. Remove the rack pad adjuster.
8. Remove the sector shaft adjuster locknut.
9. Remove the sector shaft cover fixings.
10. Screw in the sector shaft adjuster until the cover is removed.
11. Slide out the sector shaft.

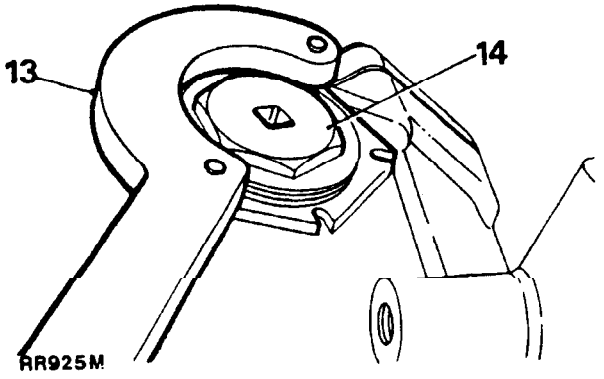


RR924M

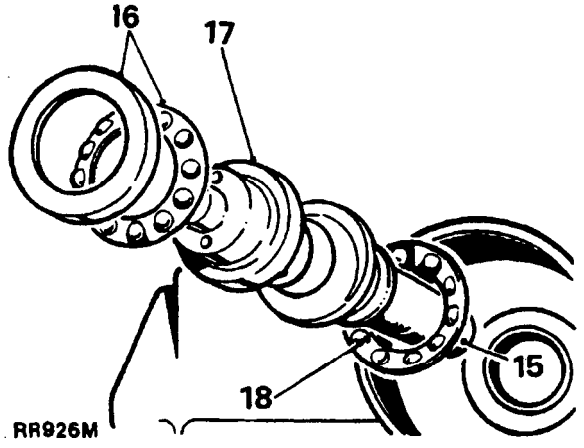
12. Withdraw the piston. using a suitable bolt screwed into the tapped hole in the piston.

Continued

13. Remove the worm adjuster locknut using 'C' Wrench, LST1 20.
14. Remove the worm adjuster using wrench LST119.



15. Tap the splined end of the shaft to free the bearing.
16. Withdraw the bearing cup and caged ball bearing assembly.
17. Withdraw the valve and worm assembly.
18. Withdraw the inner bearing ball race and shims.
19. Retain the shims for reassembly

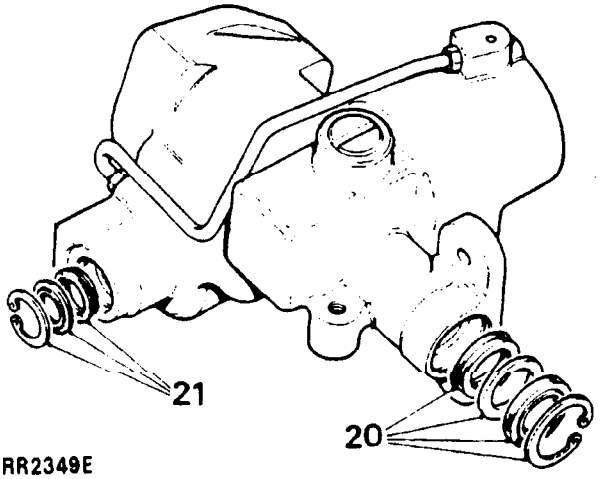


Steering box seals

20. Remove the circlip and seals from the sector shaft housing bore.

NOTE: Do not remove the sector bushes from the casing, Replacement parts are not available.

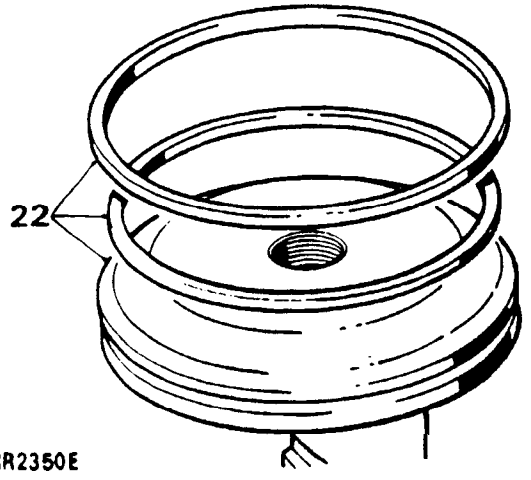
21. Remove the circlip and seals from the input shaft housing bore.



Inspecting

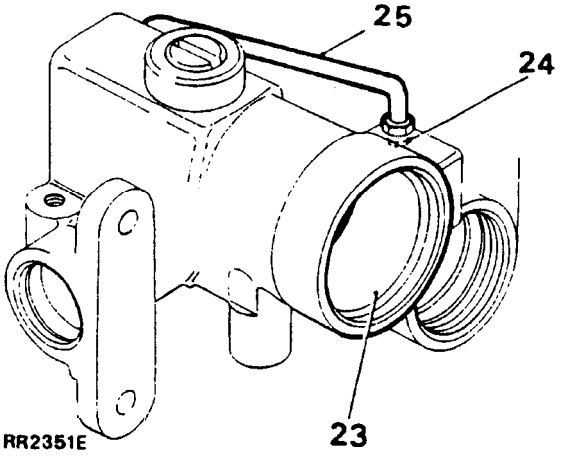
22. Discard all rubber seals and provide replacements.

NOTE: A rubber seal is fitted behind the plastic ring on the rack piston. Discard the seal and also the plastic ring and provide replacements.



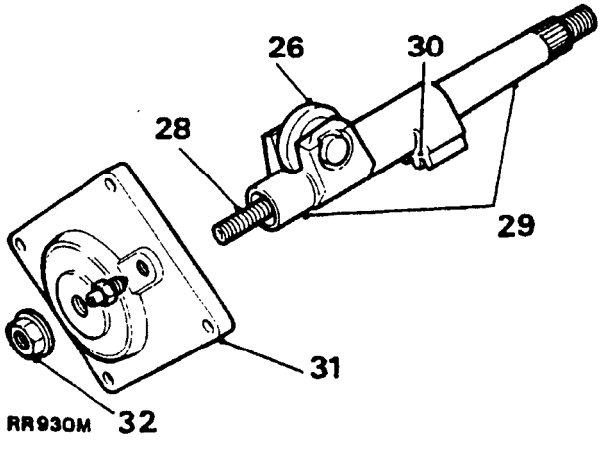
Steering box casing

23. Examine the piston bore for traces of scoring and wear.
24. Examine the inlet tube thread for damage. If repair is necessary this can be undertaken by using a suitable tap.
25. Examine the feed tube for signs of cracking.



Sector shaft assembly

26. Check that there is no side play on the rollers.
27. If excessive side play on the roller does exist fit a new sector shaft.
28. Check the condition of the adjuster screw threads.
29. Examine the bearing areas on the shaft for excessive wear.
30. Examine the gear teeth for uneven or excessive wear.



Sector shaft cover assembly

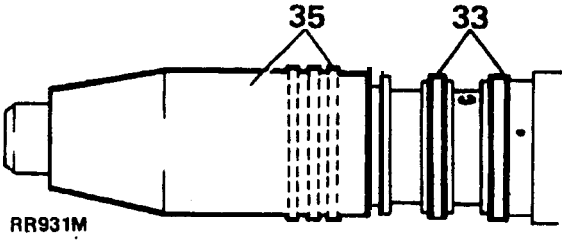
31. The cover, bush and seat are supplied as a complete assembly for replacement purposes.

Sector shaft adjuster locknut

32. The locknut functions also as a fluid seal, a new nut be fitted at overhaul.

Valve and worm assembly

33. Examine the valve rings which must be free from cuts, scratches and grooves. The valve rings should be a loose fit in the valve grooves.
34. Remove the damaged rings ensuring that no damage is done to the seal grooves.
35. If required, fit replacement rings, using the ring expander 606602. Warm the rings and expander tool to aid assembly, using hot water for this purpose. Fit the rings to the expander, slide the expander over the valve and worm assembly, in turn fit the rings to their respective grooves. Remove the expander, slide the valve and worm assembly into the ring compressor 606603 and allow the rings to cool.

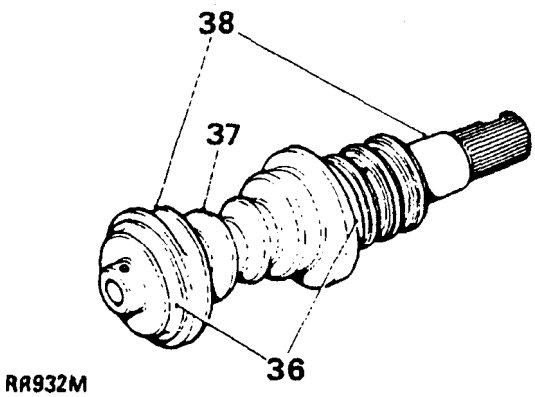


NOTE: The expander will not pass over rings already fitted. The rings must be discarded to allow access and then new rings must be fitted.

Continued

36. Examine the bearing areas for wear. The areas must be smooth and not indented.
37. Examine the worm track which must be smooth and not indented.
38. Check for wear on the torsion bar assembly pins; no free movement should exist between the input shaft and the worm.

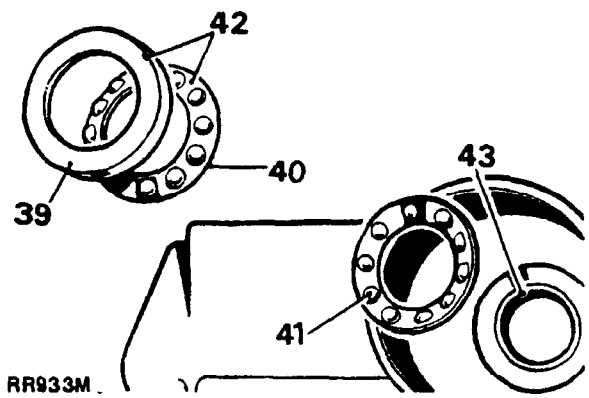
NOTE: Any sign of wear makes it essential that a new valve and worm assembly is fitted.



RR932M

Ball bearing and cage assemblies

39. Examine the ball races and cups for wear and general condition.
40. If the ball cage has worn against the bearing cup, fit replacements.
41. Bearing balls must be retained by the cage.
42. Bearings and cage repair are carried out by the complete replacement of the bearings and cage assembly.



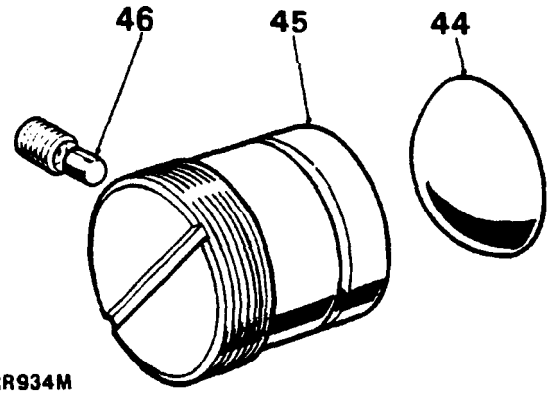
RR933M

43. To remove the inner bearing cup and shim washers, jar the steering box on the work bench, or use a suitable extractor.

NOTE: Should difficulty be experienced at this stage, warm the casing and the bearing assembly. Cool the bearing cup using a suitable mandrel and jar the steering box on the bench.

Rack thrust pad and adjuster

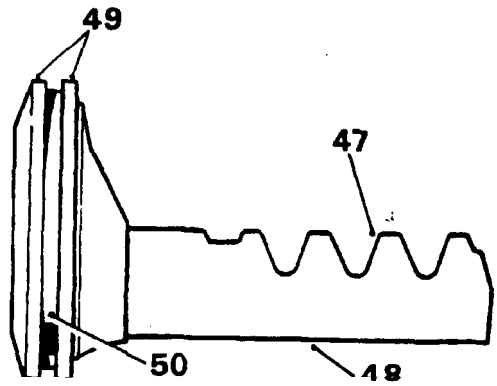
44. Examine the thrust pad for scores.
45. Examine the adjuster for wear in the pad seat.
46. Examine the nylon pad for distortion and adjuster set screw assembly for wear.



RR934M

Rack and piston

47. Examine for excessive wear on the rack teeth.
48. Ensure the thrust pad bearing surface is free from scores and wear.
49. Ensure that the piston outer diameters are free from burrs and damage.
50. Examine the seal and ring groove for scores and damage.



RR935M

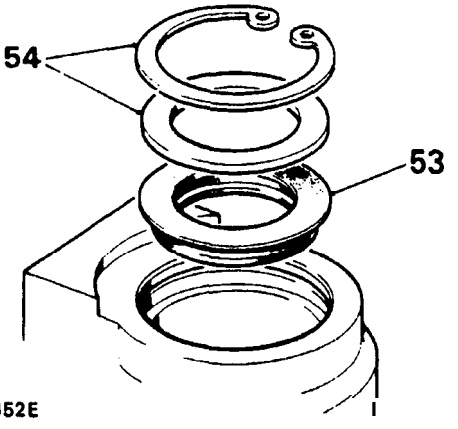
51. Fit a new rubber ring to the piston. Warm the white nylon seal and fit this to the piston.
52. Slide the piston assembly into the cylinder with the rack tube outwards. Allow to cool.

Reassemble

NOTE: When fitting replacement oil seals, these must be lubricated with recommended fluid. Also ensure that absolute cleanliness *is* observed during assembly.

Input shaft oil seal

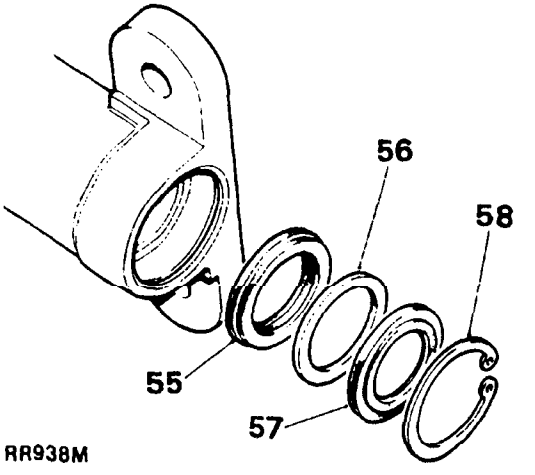
53. Fit the seal, lipped side first, into the housing. When correctly seated, the seal backing will lie flat on the bore shoulder.
54. Fit the extrusion washer and secure with the circlip.



RR2352E

Sector shaft seal

55. Fit the oil seal, lipped side first.
56. Fit the extrusion washer.
57. Fit the dust seal, lipped side last.
58. Fit the circlip.



RR938M

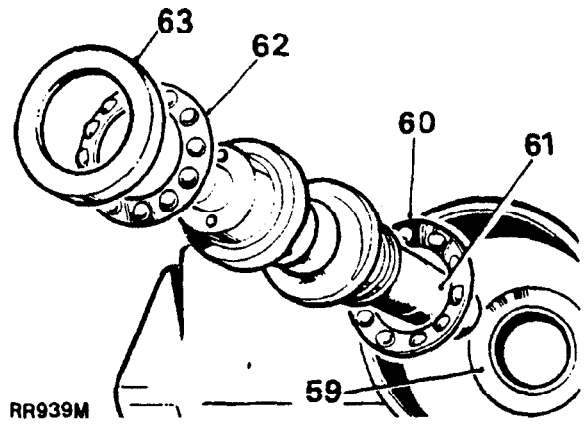
Fitting the valve and worm assembly

59. If removed, refit the original shim washer(s) and the inner bearing cap. Only Petroleum Jelly may be used as an aid to assembling the bearings.

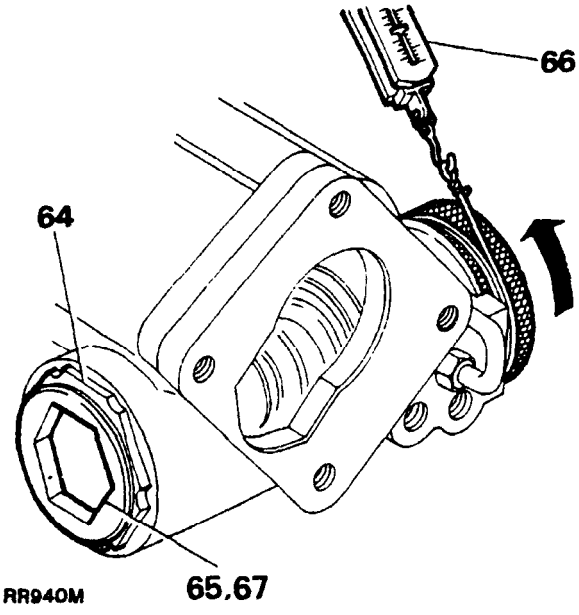
NOTE: If the original shims are not available, fit shim(s) of 0.76 mm (0.030 in) nominal thickness.

Continued

60. Fit the inner cage and bearings assembly.
61. Fit the valve and worm assembly, using seal saver RO1015 to protect the input shaft seal.
62. Fit the outer cage and bearings assembly.
63. Fit the outer bearing cup.

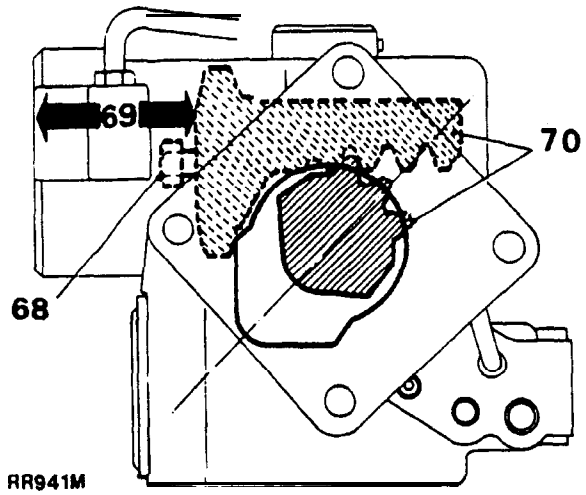


64. Fit a new worm adjuster sealing ring and loosely screw the adjuster into the casing. Fit the locknut, but do not tighten.
65. Turn in the worm adjuster until the end-float at the input is almost eliminated.
66. Measure and record the maximum rolling distance of the valve and worm assembly, using a spring balance and cord coiled around the torque setting tool RO1016.
67. Turn in the worm adjuster to increase the figure recorded in instruction 66 by 1.8 to 2.2 kg (4 to 5 lb) at 1.250 in (31.7 mm) radius to settle the bearings, then back off the worm adjuster until the figure recorded in instruction 66 is increased by 0.9 to 1.3 kg (2 to 3 lb) only, with locknut tight. Use worm adjusting wrench LST119 and 'C' wrench LST120.



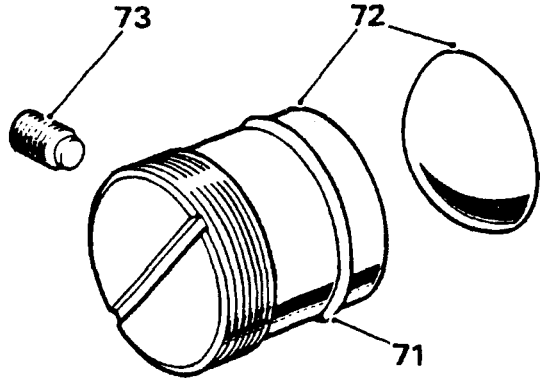
Fitting the rack and piston

68. Screw a slave bolt into the piston head for use as an assembly tool.
69. Fit the piston and rack assembly so that the piston is 63.5 mm (2.5 in) approximately from the outer end of the bore.
70. Feed in the sector shaft using seal saver 606604 aligning the centre gear pitch on the rack with the centre gear tooth on the sector shaft. Push in the sector shaft, and, at the same time rotate the input shaft about a small arc to allow the sector roller to engage the worm.



Fitting the rack adjuster

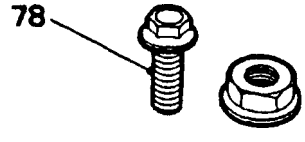
71. Fit the sealing ring to the rack adjuster.
72. Fit the rack adjuster and thrust pad to engage the rack. Back off a half turn on the adjuster.
73. Loosely fit the nylon pad and adjuster set screw assembly to engage the rack adjuster.

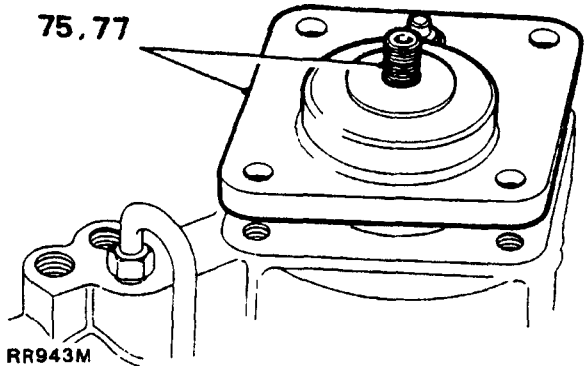


RR942M

Fitting the sector shaft cover

74. Fit the sealing ring to the cover.
75. Screw the cover assembly fully on to the sector shaft adjuster screw.
76. Position the cover on to the casing.
77. Tap the cover in place. It necessary back off on the sector shaft adjuster screw to allow the cover to joint fully with the casing.





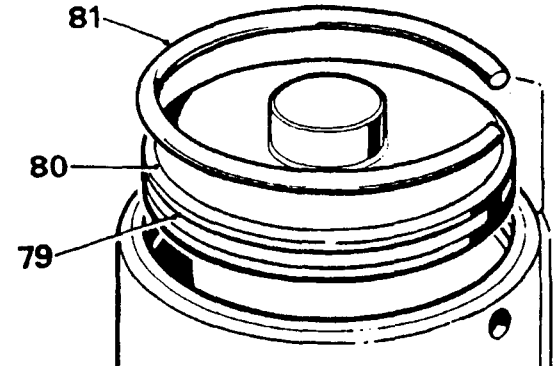
RR943M

NOTE: Before tightening the fixings, rotate the input shaft about a small arc to ensure that the sector roller is free to move in the valve worm.

78. Fit the cover fixings and tighten to the correct torque (see section 06-Torque values).

Fitting the cylinder cover

79. Fit the square section seal to the cover.
80. Remove the slave bolt fitted at operation 68 and press the cover into the cylinder just sufficient to clear the retainer ring groove.
81. Fit the retainer ring to the groove with one end of the ring positioned 12 mm (0.5 in) approximately from the extractor hole.

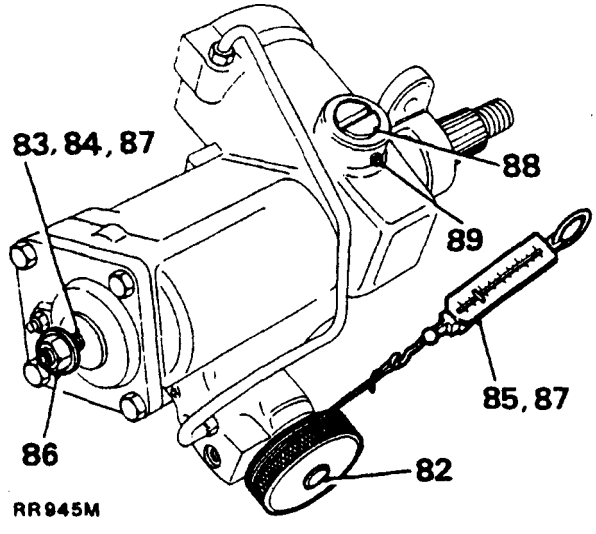


RR944M I II

Continued

Adjusting the sector shaft

82. Set the worm on centre by rotating the input shaft half the total number of turns from either lock.
83. Rotate the sector shaft adjusting screw counter-clockwise to obtain backlash between the input shaft and the sector shaft.
84. Rotate the sector shaft adjusting screw clockwise until the backlash is just eliminated.
85. Measure and record the maximum rolling resistance at the input shaft, using a spring balance, cord and torque tool RO1016.
86. Hold the sector shatt adjuster screw and loosely tit a new locknut.
87. Turn in the sector shaft adjuster screw until the figure recorded in instruction 85 is increased by 0.9 to 1.3 kg (2 to 3 lb) with the locknut tightened.



Adjusting the rack adjuster

88. Turn in the rack adjuster to increase the figure recorded in instruction 87 by 0.9 to 1.3 kg (2 to 3 lb). **The final figure may be less than 7.25 kg (16 lb) but must not exceed this figure.**
89. Lock the rack adjuster in position with the set screw.

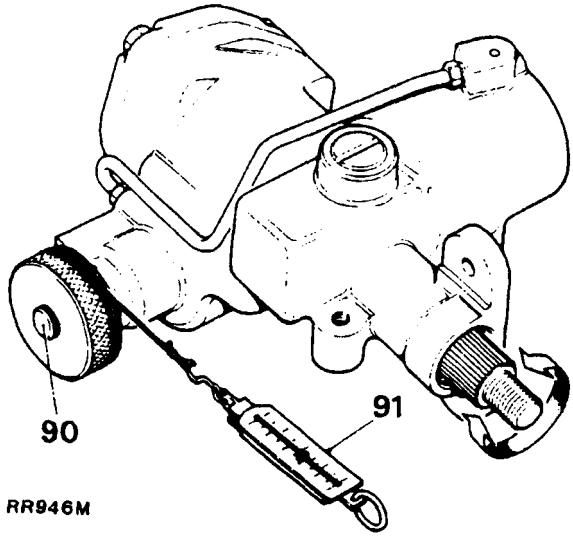
Torque peak check

With the input shaft rotated from lock-to-lock, the rolling resistance torque figures should be greatest across the centre position (1.5 turns approximately from full lock) and equally disposed about the centre position.

The condition depends on the value of shimming fitted between the valve and worm assembly inner bearing cup and the casing. The original shim washer value will give the correct torque peak position unless major components have been replaced.

Procedure

90. With the input coupling shaft toward the operator, turn the shaft fully counter-clockwise.
91. Check the torque figures obtained from lock-to-lock using a spring balance cord and torque tool R01016.



Adjustments

92. Note where the greatest figures are recorded relative to the steering position. If the greatest figures are not recorded across the **centre of** travel (i.e. steering straight-ahead position), adjust as follows:

If the torque peak occurs before the centre position, add to the shim washer value; if the torque peak occurs after the centre position, subtract from the shim washer value.

Shim washers are available as follows:
0.03mm, 0.07mm, 0.12mm and 0.24mm (0.0015 in, 0.003 in, 0.005 in and 0.010 in).

NOTE: Adjustment of 0.07mm (0.003 in) to the shim value will move the torque peak area by 1/4 turn approximately on the shaft.

93. Fit the drop arm to the steering box using a new tab washer. Tighten the nut to the correct torque (see section 06-Torque values)and bend over tab.
94. Refit the steering box to the vehicle.
95. Replenish the system with the correct grade of fluid. Refer to Recommended Lubricants and Power Steering System-bleed.
96. Test the system for leaks, with the engine running, by holding the steering hard on full lock in both directions.

NOTE: Do not maintain this pressure for more than 30 seconds in any one minute to avoid overheating the fluid and possibly damaging the seals.

97. Road test the vehicle.

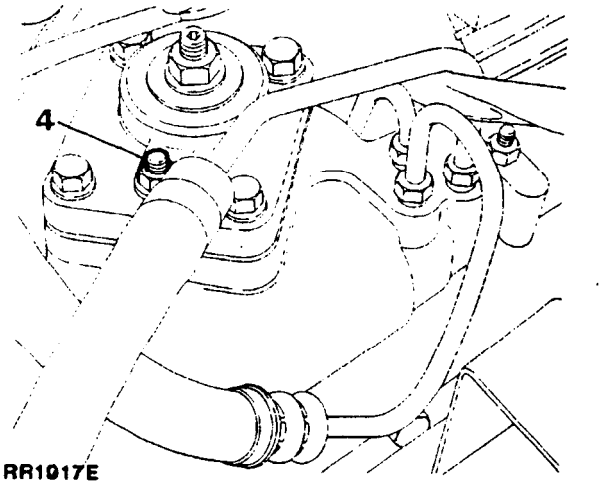
POWER STEERING SYSTEM

Bleed

1. Fill the steering fluid reservoir to the appropriate level marking on the dipstick with one of the recommended fluids.
2. Start and run the engine until it attains normal operating temperature.
3. Check and correct the reservoir fluid level.

NOTE: During the carrying out of items 4, 5 and 6, ensure that the steering reservoir is kept full. Do not increase the engine speed or move the steering wheel.

4. Run the engine at idle speed, loosen the bleed screw. When fluid seepage past the bleed screw is observed, retighten the screw.



5. Ensure that the fluid level is in alignment with the mark on the dipstick.
6. Wipe off all fluid lost during bleeding.
7. Check all hose connections, pump and steering box for fluid leaks under pressure by holding the steering hard on full lock in both directions.

CAUTION: Do not maintain this pressure for more than 30 seconds in any one minute, to avoid causing the oil to overheat and possible damage to the seals. The steering should be smooth. lock-to-lock in both directions, that is, no heavy or light spots when changing direction when the vehicle is stationary.

8. Carry out a short road test. If necessary, repeat the complete foregoing procedure.

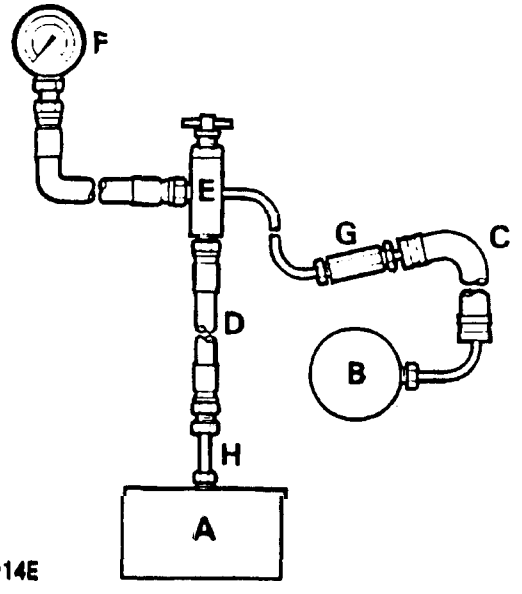
POWER STEERING SYSTEM

Test

If there is a lack of power assistance for the steering the pressure of the hydraulic pump should be checked first before fitting new components to the system. The fault diagnosis chart should also be used to assist in tracing faults in the power steering system.

SERVICE TOOLS

HY23 -Pressure gauge
jD10-2 -Test adaptor
LST10-11 -Thread adaptor



RR1914E

A. Steering box.
B. Steering pump.
C. Existing hose, steering box to pump.
D. Hose JD10-3A.
E. Test adaptor JD10-2.
F. Pressure gauge HY23.
G. Thread adaptor LST10-11.
H. Thread adaptor LST1 O-I 1.

Procedure

1. The hydraulic pressure gauge in conjunction with the test adaptor is used for testing the power steering system. This gauge is calibrated to read up to 140 kgf/cm² (2000 p.s.i.) and the normal pressure which may be expected in the power steering system is 77 kgflcm' (1100 p.s.i.).
2. Under certain fault conditions of the hydraulic pump it is possible to obtain pressures up to 105 kgf/cm² (1500 p.s.i.). Therefore, it is important lO realise that the pressure upon the gauge is in direct proportion to the pressure being exerted upon the steering wheel. When testing, apply pressure to the steering wheel very gradually while carefully observing the pressure gauge.
3. Check, and if necessary replenish, the fluid reservoir.
4. Examine the power steering units and connections for leaks. All leaks must be rectified before attempting to test the system.
5. Check the steering pump drive belt for condition and tension, rectify as necessary.
6. Assemble the test equipment and fit to the vehicle, as shown in the diagram.
7. Open the tap in the adaptor.
8. Bleed the system but exercise extreme care when carrying out this operation so as not to overload the pressure gauge.
9. With the system in good condition, the pressures should be as follows:

   (a) Steering wheel held hard on full lock and engine running at 1,000 rev/min, the pressure should be 70 to 77 kgflcm' (1000 to 1100 p.s.i.).
   (b) With the engine idling and the steering wheel held hard on full lock, the pressure should be 28 kgflcm' (400 p.s.i.) minimum.

These checks should be carried out first on one lock, then on the other.

CAUTION: Under no circumstances must the steering wheel be held on full lock for more than 30 seconds in any one minute, otherwise there will be a tendency for the oil to overheat and possible damage to the seals may result.

10. Release the steering wheel and allow the engine to idle. The pressure should be below 7 kgf/cm² (100 p.s.i.).
11. If the pressures recorded during the foregoing tests are outside the specified range, or pressure imbalance is recorded, a fault exist in the system. To determine if the fault is in the steering box or the pump, close the adaptor tap for a period not exceeding five seconds.
12. If the gauge fails to register the specified pressure, the pump is at fault and a new unit must be fitted.
13. Repeat the foregoing test after fitting a new pump and bleeding the system. If pump delivery is satisfactory but low pressure or a substantial imbalance exists, the fault must be in the steering box valve and worm assembly.

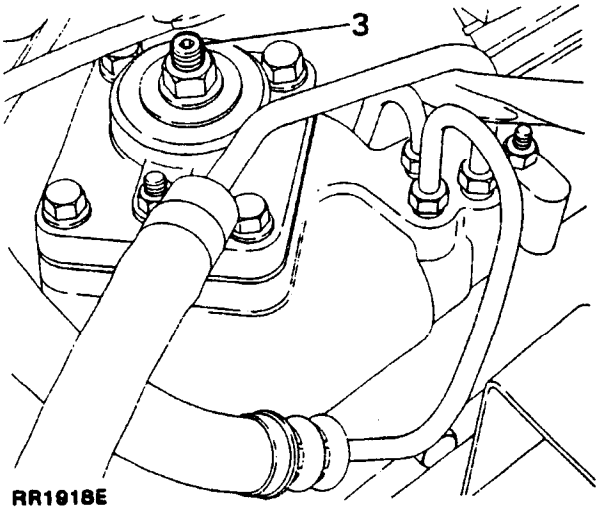
ADJUST POWER STEERING BOX

NOTE: The condition of adjustment which must be checked is one of minimum backlash without overtightness when the wheels are in the straight-ahead position.

1. Jack up the front of the vehicle until the wheels are clear of the ground and support the chassis with axle stands.

WARNING: It is essential that the wheels are chocked, the parking brake applied, and low range selected with differential lock engaged.

2. Gently rock the steering wheel about the straight-ahead position to obtain the 'feel' of the backlash present. This backlash must not be more than 9.5mm (0.375 in).
3. Continue the rocking action while an assistant slowly tightens the steering box adjuster screw after loosening the locknut until the steering wheel movement is reduced to 9.5mm (0.375 in) maximum.



RR1918E

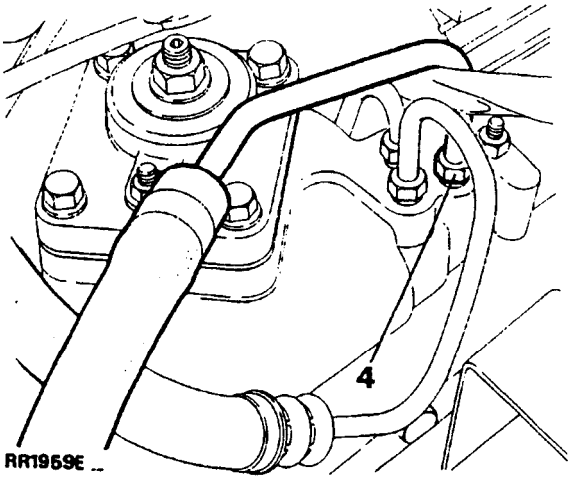
4. Tighten the locknut,. then turn the steering wheel from lock to lock and check that no excessive tightness exists at any point.
5. Lower the vehicle to ground level and remove the wheel chocks.
6. Road test the vehicle.

POWER STEERING FLUID RESERVOIR

Remove and refit

Removing

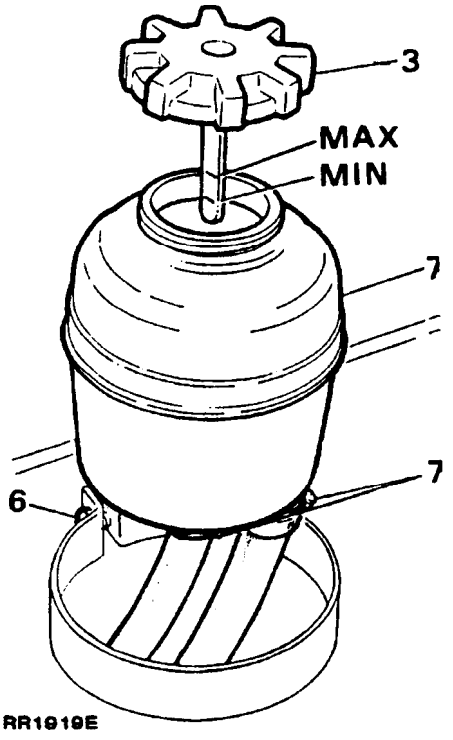
1. Place a drain tray beneath the power steering box.
2. Prop open the hood.
3. Remove the reservoir filler cap.
4. Disconnect the return hose from the steering box. Drain the fluid completely from the reservoir, reconnect the hose.



CAUTION: Power steering fluid is harmful to paintwork Should any fluid seep onto body, chassis, or any other components. immediately wipe clean. It is most important that fluid drained from the power steering system is not re-used.

5. Refit the return hose to the steering box.
6. Release the pinch bolt and remove the reservoir from the bracket.
7. Release the hose clamps and remove the flexible hoses, withdraw the reservoir from the engine compartment.

NOTE: If the reservoir is not to be refitted immediately, the hoses must be sealed to prevent the ingress of foreign matter.



NOTE: The reservoir contains an integral filter which is not serviceable, however, in normal use the reservoir unit should last the life of the vehicle. Should the power steering system malfunction and under inspection it is found that the steering fluid has been contaminated by foreign matter a new FLUID RESERVOIR MUST be fitted.

Refitting

8. Reconnect the flexible hoses to the reservoir. Tighten the hose clamps securely.
9. Refit the reservoir to the bracket and tighten the pinch bolt securely.
10. Fill the reservoir to the prescribed level on the dipstick with one of the recommended fluids (Section 09) and bleed the power steering system See Power Steering System-bleed.
11. Fit the reservoir filler cap.
12. Close the hood.

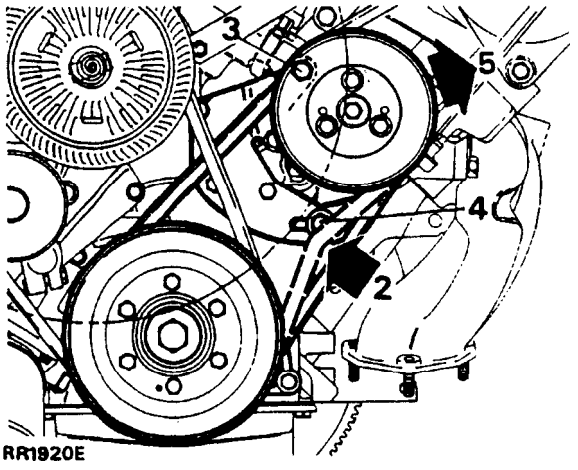
POWER STEERING PUMP DRIVE BELT

Adjust

Procedure

1. Prop open the hood and disconnect the battery negative lead.
2. Check, by thumb pressure, the belt tension between the crankshaft and the pump pulley. There should be a free movement of between 4 to 6mm (0.19 to 0.25 in).
3. Loosen the two nuts at the side of the pump to allow the pump to be pivoted.
4. Loosen the bolt securing the pump lower bracket to the slotted adjustment link.
5. Pivot the pump (in the direction of the bold arrow) as necessary and adjust until the correct belt tension is obtained.

CAUTION: Do not use the pump casing as a point of leverage when tensioning the power steering drive belt. Damage to the pump casing may be caused leading to fluid leakage.



RR1920E

6. Maintaining the tension, tighten the pump adjusting bolt and the top pivot nuts.

   NOTE: Check the alternator drive belt tension after adjusting the power steering pump belt.

7. Reconnect the battery negative lead and close the hood.

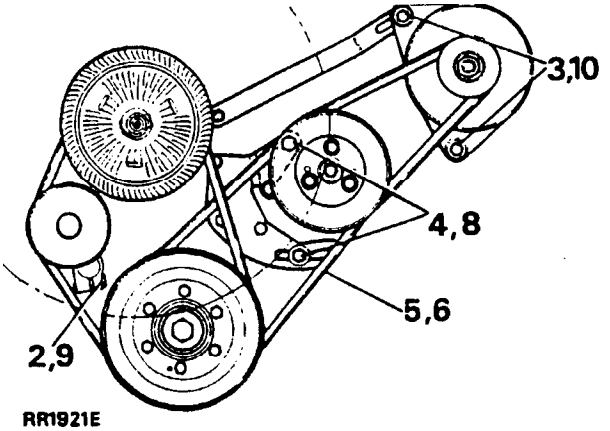
   NOTE: Check adjustment after running engine at fast idle speed for 3 to 5 minutes if a new belt has been fitted.

POWER STEERING PUMP DRIVE BELT

Remove and refit

Removing or preparing for the fitting of a new belt.

1. Prop open the hood and disconnect the battery negative lead.
2. Loosen the idler pulley bolt and remove the fan belt.
3. Loosen the alternator mountings and remove the drive belt.
4. Loosen the power steering pump mountings.
5. Pivot the pump and remove the drive belt.



RR1921E

Refitting

6. Locate the driving belt over the crankshaft and pump pulleys.
7. Adjust the position of the pump to give a driving belt tension of 4 to 6mm (0.19 to 0.25 in) movement when checked by thumb pressure midway between the crankshaft and pump pulleys.

CAUTION: Do not use the pump casing as a point of leverage when- tensioning the power steering drive belt. Damage to the pump casing may be caused leading to fluid leakage.

8. Maintaining the tension, tighten the pump adjusting bolt and the top pivot nut.
9. Refit the fan belt and adjust the tension to give 4 to 6mm (0.19 to 0.25 in) movement when checked by thumb pressure midway between the crankshaft and water pump pulleys.

Continued

10. Refit the alternator drive belt and adjust to give 4 to 6mm (0.19 to 0.25 in) movement when checked midway between the power steering pump and alternator pulleys.
11. Reconnect the battery negative lead and close the hood.

NOTE: Check adjustment after running engine at fast idle speed for 3 to 5 minutes if a new belt has been fitted.

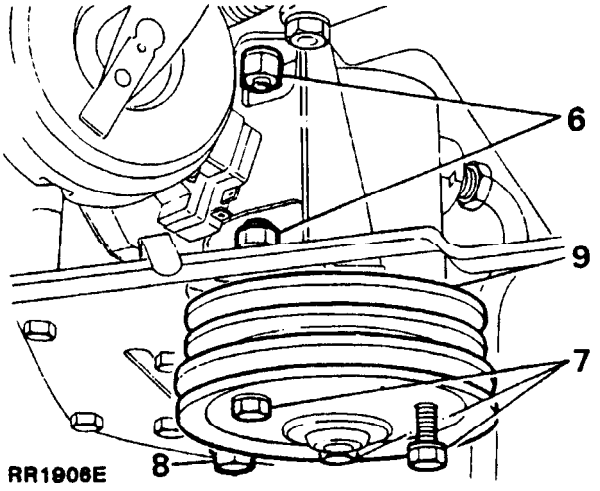
STEERING PUMP

NOTE: The power steering pump is not a serviceable item. In the event of failure or damage a new pump must be fitted.

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Loosen the alternator pivot bolts and adjustment link bolts, pivot the alternator inwards and remove the drive belt.
3. Loosen the water pump drive belt idler pulley and remove the drive belt.
4. Remove the left hand bank spark plug leads and detach the distributor cap, place the leads and cap to one side.
5. Disconnect the electrical plug from the distributor amplifier unit.
6. Loosen the two nuts securing the power steering pump pivot bracket.
7. Release the three bolts securing the pulley to the steering pump, do not remove them at this stage.
8. Release the bottom adjustment bolt below the steering pump and pivot the pump inwards towards the water pump to enable the drive belt to be removed.

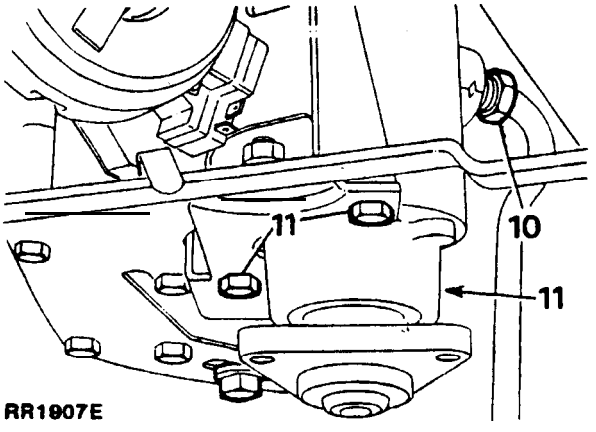


9. Remove the three bolts with plain washers retaining the pulley to the pump and withdraw the pulley.

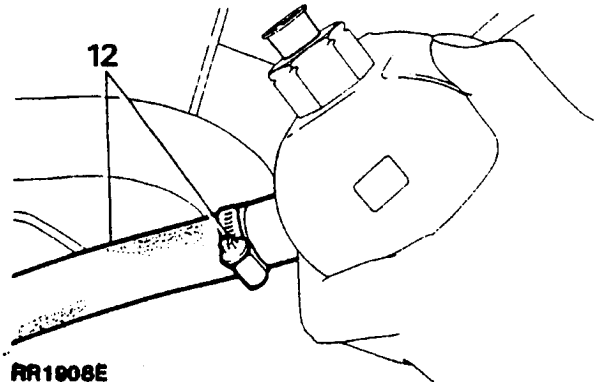
NOTE: Place a drain tray underneath the vehicle to catch any power steering fluid which will seep from the pump when the fluid pipe is disconnected.

CAUTION: Power steering fluid is harmful to paintwork. Should any fluid seep onto the body, chassis, or any other components immediately wipe clean. It is most important that fluid drained from the power steering system is not re-used.

10. Disconnect the fluid pipe from the side of the pump, plug the pipe and pump openings to prevent ingress of dirt.



11. Remove the three bolts securing the pump to the pivot bracket, maneuver the pump out of the bracket and withdraw it from the engine compartment as far as the remaining connected fluid hose will permit.
12. Release the clamp securing the hose to the pump, remove the hose and plug both openings to prevent ingress of dirt.



Refitting

13. Remove the plug from the fluid hose and secure the hose to a NEW pump. Tighten the hose clamp securely.
14. Maneuver the pump into the pivot bracket and secure in position with the three retaining bolts. Tighten the bolts to the specified torque (see section 06-Torque values).
15. Remove the plugs from the fluid pipe and steering pump openings and fit the pipe. Tighten the pipe securely.

CAUTION: Care should be taken to ensure that the high pressure fluid pipe is well clear of both the drive belt and the top of the power steering box.

16. Fit the pulley to the steering pump drive flange, coat the three bolts with Loctite and fit to the steering pump, do not-fully tighten the bolts at this stage.
17. Refit the crankshaft to steering pump drive belt, pivot the steering pump outwards to tension the belt, tighten the pivot bolts securely. Check that the belt deflects approximately 4 to 6 mm (0.19 to 0.25in) when checked by thumb pressure midway between the crankshaft and pump pulleys.
18. Tighten the three steering pump pulley retaining bolts to the specified torque (see section 06-Torque values).
19. Reverse the remaining removal instructions.
20. Bleed the power steering system.
21. Test the power steering system for leaks with the engine running, holding the steering on full lock in both directions.

CAUTION: Do not maintain this pressure for more than 30 seconds in any one minute, to avoid causing the oil to overheat and possible damage to the seals.

22. Close the hood.
23. Road test the vehicle.

POWER STEERING

FAULT DIAGNOSIS

SYMPTOM	CAUSE	TEST ACTION	CURE
INSUFFICIENT POWER ASSISTANCE WHEN PARKING	(1) Lack of fluid	Check hydraulic fluid tank level	If low, fill and bleed the system
	(2) Driving belt	Check belt tension	Adjust the driving belt
	(3) Defective hydraulic pump	(a) Fit pressure guage between high pressure hose and steering pump with steering held hard on full lock, see Note 1 and 'Power Steering System Test'	If pressure is outside limits (high or low) after checking items 1 and 2, see Note 2
		(b) Release steering wheel and allow engine to idle. See 'Power Steering System Test'	If pressure is greater, check box for freedom and self- centering action
POOR HANDLING WHEN VEHICLE IS IN MOTION	Lack of castor action (wheels will not return to centre)	This is caused by over-tightening the rocker shaft backlash adjusting screw on top of the steering box	It is most important that this screw is correctly adjusted. See instructions governing adjustment
HYDRAULIC FLUID LEAKS	Damaged pipework, loose connecting unions etc.	Check by visual inspection; leaks from the high pressure lines are best found while holding the steering on full lock with engine running at fast idle speed (See Note 1)	Tighten or renew as necessary
NOTE: Leaks from the steering box tend to show up under low pressure conditions, that is, engine idling and no pressure on steering wheel		Check 'O' rings on pipework	Renew as necessary

Continued

SYMPTOM	CAUSE	TEST ACTION	CURE
EXCESSIVE NOISE	(1) If the high pressure hose is allowed to come into contact with the body shell, or any component not insulated by the body mounting, noise will be transmitted to the car interior	Check the loose runs of the hoses	Alter hose route or insulate as necessary
	(2) Noise from hydraulic pump	Check oil level and bleed system	If no cure, change hydraulic pump

Note 1. Never hold the steering wheel on full lock for more than 30 seconds in any one minute, to avoid causing the oil to overheat and possible damage to the seals.

Note 2. High pressure- In general it may be assumed that excessive pressure is due to a fault in the hydraulic pump.

Low pressure- Insufficient pressure may be caused by one of the following:

1. Low fluid level in reservoir) Most usual cause of
2. Pump belt slip) insufficient pressure
3. Leaks in the power steering system
4. Hydraulic pump not delivering correct pressure
5. Fault in steering box valve and worm assembly
6. Leak at piston sealing in steering box
7. Worn components in either steering box or hydraulic pump

Steering pump

Make/type	Hobourn-Eaton series 200
Operating pressure - straight ahead position - at idle	7 kgf/cm² (100 p.s.i.) maximum
Full lock (left or right) at idle	28 kgf/cm² (400 p.s.i.) minimum
Full lock (left or right) 1000 rev/min	70-77 kgf/cm² (1000-1100 p.s.i.)

COUPLING SHAFT AND UNIVERSAL JOINTS

Remove and refit

CAUTION: PRIOR TO REMOVING ANY OF THE COMPONENTS INCORPORATED IN THE STEERING LINKAGE, IT IS IMPERATIVE THAT THE ROAD WHEELS ARE IN A STRAIGHT AHEAD POSITION AND THAT THE STEERING WHEEL IS THEN REMOVED TO PREVENT THE CRUISE CONTROL SPIRAL CASSETTE BEING WOUND UP OR DAMAGED IF THE STEERING LINKAGE IS INADVERTENTLY MOVED OR ROTATED.

AFTER REFITTING STEERING LINKAGE COMPONENTS, THE ROAD WHEELS MUST BE RE-POSITIONED STRAIGHT AHEAD BEFORE FITTING THE STEERING WHEEL, DO NOT RECONNECT THE MULTI-PLUG TO THE CASSETTE OR FIT THE TRIM PAD AT THIS STAGE. IF, AFTER THE VEHICLE HAS BEEN DRIVEN, IT IS FOUND THAT THE STEERING WHEEL REQUIRES RE-POSITIONING, REMOVE THE WHEEL. RE-ALIGN THE DRIVE PEGS ON THE CRUISE CONTROL CASSETTE BY SLIGHTLY ROTATING THE UPPER PART OF THE CASSETTE IN THE APPROPRIATE DIRECTION UNTIL THE PEGS LIE HORIZONTAL TO THE STEERING COLUMN.

FIT THE STEERING WHEEL ENSURING THAT THE DRIVE PEGS LOCATE IN THEIR RESPECTIVE HOLES ON THE REAR OF THE STEERING WHEEL.

AFTER FINAL ALIGNMENT RE-CONNECT THE MULTI-PLUG TO THE CASSETTE, TIGHTEN THE STEERING WHEEL SECURING NUT AND FIT THE TRIM PAD.

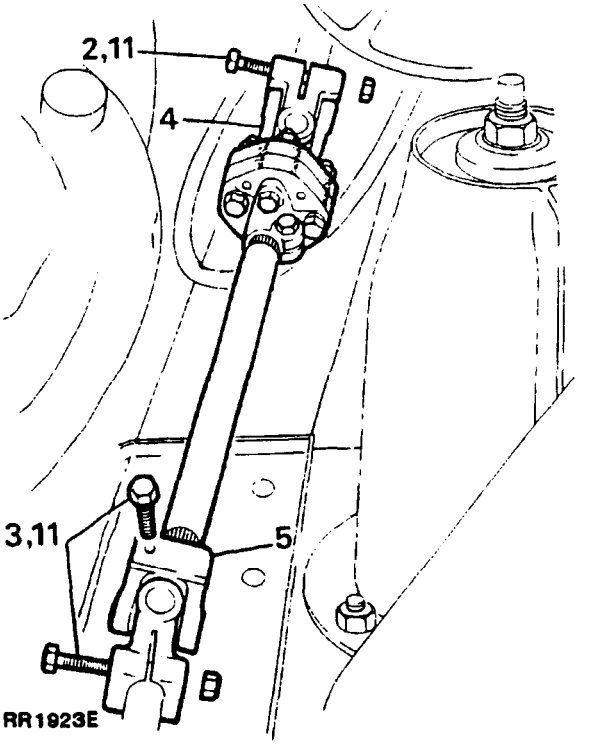
Removing

1. Ensure the road wheels are in the straight ahead position.

NOTE: To gain access to the coupling shaft it is necessary to remove the air flow sensor and air filter canister.

2. Remove one pinch bolt from the top universal joint to the steering column.
3. Remove two pinch bolts from the lower universal joint.
4. Maneuver the coupling shaft top universal joint up the steering column splines to release the lower joint from the steering box splines. Withdraw the shaft from the steering column splines.
5. Withdraw the lower universal joint from the coupling shaft.

NOTE: Do not dismantle the upper coupling joint. The steering shaft, rubber coupling and top universal joint is only available as an assembly.



6. Inspect both universal joints for wear and excessive play, fit new joints if necessary.
7. Inspect the rubber coupling for condition - rubber deterioration, fit a new rubber coupling assembly if necessary.

Refitting

NOTE: When refitting the universal joints to their respective components ensure that the pinch bolt holes line up with their respective grooves.

8. Position the lower universal joint on the shaft.
9. Position the shaft assembly toward the end of the steering column, maneuver the assembly up the steering column splines until it is possible to locate the lower universal joint onto the steering box splines.
10. Locate the bolt holes in the universal joints with their respective grooves in the steering column, coupling shaft and steering box splines.
11. Fit the pinch bolts, and tighten to the correct torque (see section 06-Torque values).

STEERING WHEEL

Remove and refit

CAUTION: PRIOR TO REMOVING ANY OF THE COMPONENTS INCORPORATED IN THE STEERING LINKAGE, IT IS IMPERATIVE THAT THE ROAD WHEELS ARE IN A STRAIGHT AHEAD POSITION AND THAT THE STEERING WHEEL IS THEN REMOVED TO PREVENT THE CRUISE CONTROL SPIRAL CASSETTE BEING WOUND UP OR DAMAGED IF THE STEERING LINKAGE IS INADVERTENTLY MOVED OR ROTATED.

AFTER REFITTING STEERING LINKAGE COMPONENTS, THE ROAD WHEELS MUST BE RE-POSITIONED STRAIGHT AHEAD BEFORE FITTING THE STEERING WHEEL! DO NOT RECONNECT THE MULTI-PLUG TO THE CASSEITE OR FIT THE TRIM PAD AT THIS STAGE. IF, AFTER THE VEHICLE HAS BEEN DRIVEN, IT IS FOUND THAT THE STEERING WHEEL REQUIRES RE-POSITIONING, REMOVE THE WHEEL. RE-ALIGN THE DRIVE PEGS ON THE CRUISE CONTROL CASSETTE BY SLIGHTLY ROTATING THE UPPER PART OF THE CASSETTE IN THE APPROPRIATE DIRECTION UNTIL THE PEGS LIE HORIZONTAL TO THE STEERING COLUMN.

FIT THE STEERING WHEEL ENSURING THAT THE DRIVE PEGS LOCATE IN THEIR RESPECTIVE HOLES ON THE REAR OF THE STEERING WHEEL.

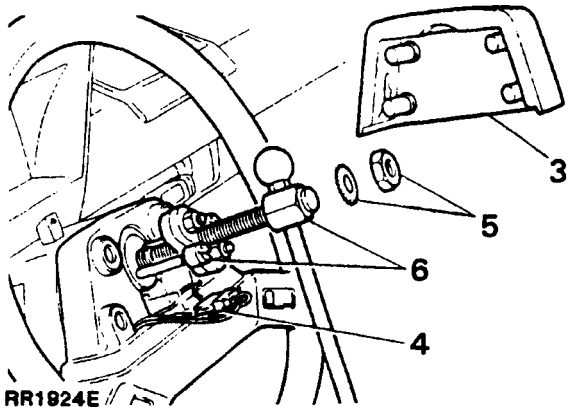
AFTER FINAL ALIGNMENT RE-CONNECT THE MULTI-PLUG TO THE CASSEITE, TIGHTEN THE STEERING WHEEL SECURING NUT AND FIT THE TRIM PAD.

Removing

Service Tools:
18G 1014 Steering wheel remover
18G 1014-2 Adaptor pins

NOTE: The steering column is of a 'safety' type and incorporates shear pins. Therefore do not impart shock loads to the steering column during removing and refitting the steering wheel or at any time.

1. Disconnect the battery negative lead.
2. Ensure the road wheels are in the straight ahead position to enable the steering wheel to be fitted in its correct location on re-assembly.
3. Carefully ease the centre trim pad off the steering wheel.
4. Disconnect the cruise control electrical multi-plug located in the small opening below the centre retaining nut.
5. While holding the steering wheel remove the retaining nut and serrated washer.
6. Extract the steering wheel using service tool 18G 1014. Ensure the extractor pins are inserted in the threads up to shoulder of the pins.

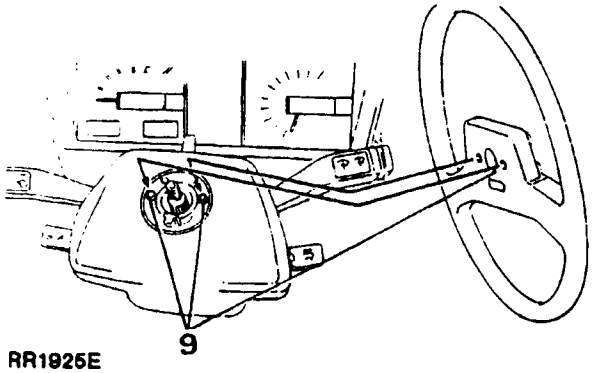


RR1924E

CAUTION: IT IS IMPERATIVE THAT THE UPPER PART OF THE CRUISE CONTROL CASSEITE IS NOT ROTATED AFTER THE STEERING WHEEL IS REMOVED. TO PREVENT ROTATION SECURE THE UPPER AND LOWER PART OF THE CASSEITE IN POSITION WITH ADHESIVE TAPE.

Refitting

7. Ensure the road wheels are in the straight ahead position.
8. Place the steering wheel on the column splines and remove the previously applied adhesive tape to the spiral cassette.
9. Ensure the two drive pegs on the upper part of the cassette align with their respective location holes on the underside of the steering wheel, ease the wheel onto the pegs.



RR1925E

Continued

CAUTION: Do not apply shock loads to the steering wheel.

10. Fit the nut and washer and tighten to the specified torque (see section 06-Torque values).
11. Reconnect the cruise control multi-plug and refit the steering wheel centre cover.
12. Reconnect the battery.

STEERING COLUMN

NOTE: The steering column assembly is not a serviceable component.

Remove and refit

Service tool:
18G1014-Extractor for steering wheel.
18G1014-2 Adaptor pins.

CAUTION: The steering column is of a 'safety' type and incorporates shear pins. Therefore do not impart shock loads to the steering column at any time.

CAUTION: PRIOR TO REMOVING ANY OF THE COMPONENTS INCORPORATED IN THE STEERING LINKAGE, IT IS IMPERATIVE THAT THE ROAD WHEELS ARE IN A STRAIGHT AHEAD POSITION AND THAT THE STEERING WHEEL IS THEN REMOVED TO PREVENT THE CRUISE CONTROL SPIRAL CASSETTE BEING WOUND UP OR DAMAGED IF THE STEERING LINKAGE IS INADVERTENTLY MOVED OR ROTATED.

AFTER REFITTING STEERING LINKAGE COMPONENTS, THE ROAD WHEELS MUST BE RE-POSITIONED STRAIGHT AHEAD BEFORE FITTING THE STEERING WHEEL, DO NOT RECONNECT THE MULTI-PLUG TO THE CASSETTE OR FIT THE TRIM PAD AT THIS STAGE. IF, AFTER THE VEHICLE HAS BEEN DRIVEN, IT IS FOUND THAT THE STEERING WHEEL REQUIRES RE-POSITIONING, REMOVE THE WHEEL. RE-ALIGN THE DRIVE PEGS ON THE CRUISE CONTROL CASSETTE BY SLIGHTLY ROTATING THE UPPER PART OF THE CASSETTE IN THE APPROPRIATE DIRECTION UNTIL THE PEGS LIE HORIZONTAL TO THE STEERING COLUMN.

FIT THE STEERING WHEEL ENSURING THAT THE DRIVE PEGS LOCATE IN THEIR RESPECTIVE HOLES ON THE REAR OF THE STEERING WHEEL.

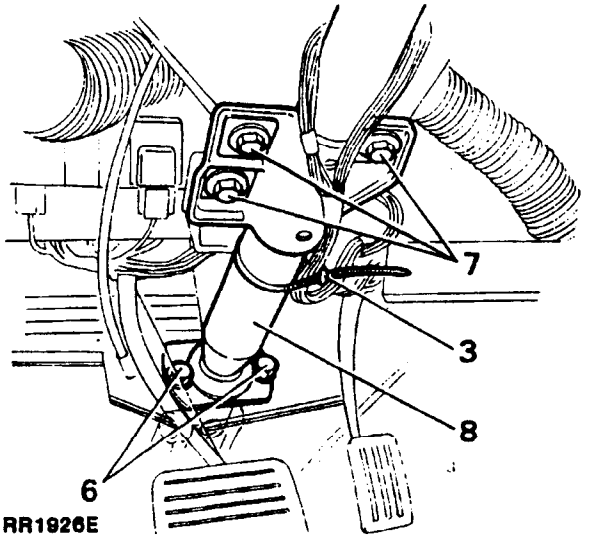
AFTER FINAL ALIGNMENT RECONNECT THE MULTI-PLUG TO THE CASSETTE, TIGHTEN THE STEERING WHEEL SECURING NUT AND FIT THE TRIM PAD.

Removing

1. Remove the steering wheel using extractor 18G1014 and adaptor pins.

CAUTION: IT IS IMPERATIVE THAT THE UPPER PART OF THE CRUISE CONTROL CASSETTE IS NOT ROTATED AFTER THE STEERING WHEEL IS REMOVED. TO PREVENT ROTATION SECURE THE UPPER AND LOWER PART OF THE CASSETTE IN POSITION WITH ADHESIVE TAPE.

2. Remove the lower dash panel and unclip the lower trim pad from the driver's side.
3. Disconnect the electrical multi-plugs from the steering column switches and release the electrical wiring from the retaining clip located half way down the steering column.
4. Remove the steering column shroud fixings and maneuver the shroud off the column switches.
5. Remove the top pinch bolt, universal joint to steering column.
6. Remove the fixings, steering column to floor board.
7. Remove the fixings, steering column to dash bracket.
8. Withdraw the steering column assembly.



RR1926E

Refitting

9. Position the sealing gasket on the end of the column assembly.
10. Feed the steering shaft through the floor board and engage the drive splines at the coupling shaft.
11. Fit the column upper fixings, do not full) tighten at this stage.
12. Fit the column lower fixings, do not fully tighten at this stage.
13. Tighten the lower fixings to the specified torque (see section 06-Torque values).
14. Fit universal joint pinch bolt, and tighten to the correct torque (see section 06-Torque values).
15. Tighten the column upper fixings to the specified torque (see section 06-Torque values).
16. Reverse 1 to 4.

STEERING COLUMN LOCK ASSEMBLY

Remove and refit

Service tool:
18G1014 Extractor for steering wheel.
18G1014-2 Adaptor pins.

For ignition/starter switch-remove and refit as described in Electrical Section 86.

CAUTION: PRIOR TO REMOVING ANY OF THE COMPONENTS INCORPORATED IN THE STEERING LINKAGE, IT IS IMPERATIVE THAT THE ROAD WHEELS ARE IN A STRAIGHT AHEAD POSITION AND THAT THE STEERING WHEEL IS THEN REMOVED TO PREVENT THE CRUISE CONTROL SPIRAL CASSETTE BEING WOUND UP OR DAMAGED IF THE STEERING LINKAGE IS INADVERTENTLY MOVED OR ROTATED.

AFTER REFITTING STEERING LINKAGE COMPONENTS, THE ROAD WHEELS MUST BE RE-POSITIONED STRAIGHT AHEAD BEFORE FITTING THE STEERING WHEEL, DO NOT RECONNECT THE MULTI-PLUG TO THE CASSEITE OR FIT THE TRIM PAD AT THIS STAGE. IF, AFTER THE VEHICLE HAS BEEN DRIVEN, IT IS FOUND THAT THE STEERING WHEEL REQUIRES RE-POSITIONING, REMOVE THE WHEEL. RE-ALIGN THE DRIVE PEGS ON THE CRUISE CONTROL CASSEITE BY SLIGHTLY ROTATING THE UPPER PART OF THE CASSETTE IN THE APPROPRIATE DIRECTION UNTIL THE PEGS LIE HORIZONTAL TO THE STEERING COLUMN.

FIT THE STEERING WHEEL ENSURING THAT THE DRIVE PEGS LOCATE IN THEIR RESPECTIVE HOLES ON THE REAR OF THE STEERING WHEEL.

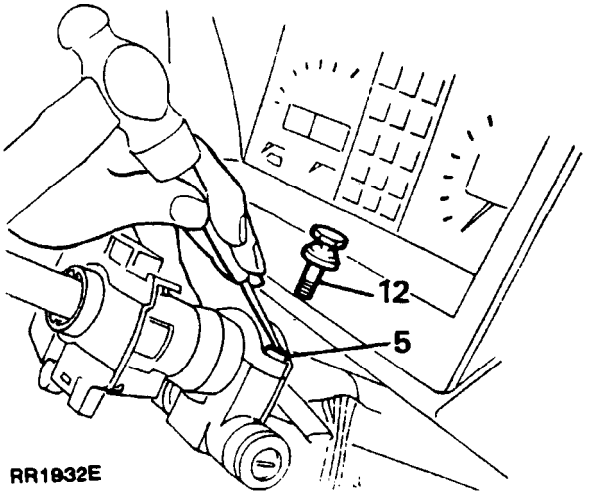
AFTER FINAL ALIGNMENT RE-CONNECT THE MULTI-PLUG TO THE CASSETTE, TIGHTEN THE STEERING WHEEL SECURING NUT AND FIT THE TRIM PAD.

Removing

1. Disconnect the battery negative lead.
2. Carefully detach the steering wheel centre cover and using service tool 18G1014 and adaptor pins remove the steering wheel.

CAUTION: IT IS IMPERATIVE THAT THE UPPER PART OF THE CRUISE CONTROL CASSEITE IS NOT ROTATED AFTER THE STEERING WHEEL IS REMOVED. TO PREVENT ROTATION SECURE THE UPPER AND LOWER PART OF THE CASSEITE IN POSITION WITH ADHESIVE TAPE.

3. Release the fixings securing the shroud to the steering column and withdraw the shroud.
4. Release the column switches from the switch housing to gain access to the column lock fixings.
5. Using a sharp punch and a hammer, lightly tap the head of the shear pins in a counter-clockwise direction to release them from the column lock housing.



RR1932E

6. Remove the sheared bolts.
7. Detach the upper cap.
8. Withdraw the lower column lock assembly.

Continued

Refitting

9. Position the steering lock upper cap on the outer column, locating the spigot in the hole provided.
10. Place the lower lock assembly into the column.
11. Fit the shear bolts to retain the cap and lock.
12. Tighten the bolts sufficient to shear off the heads.
13. Reverse 1 to 4.

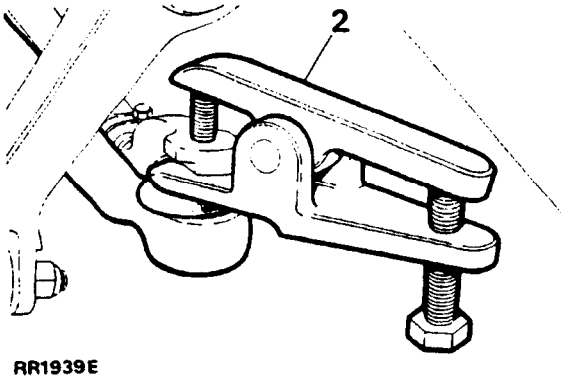
DROP ARM

Remove and refit

Service tools:
MS252A Drop arm extractor

Removing

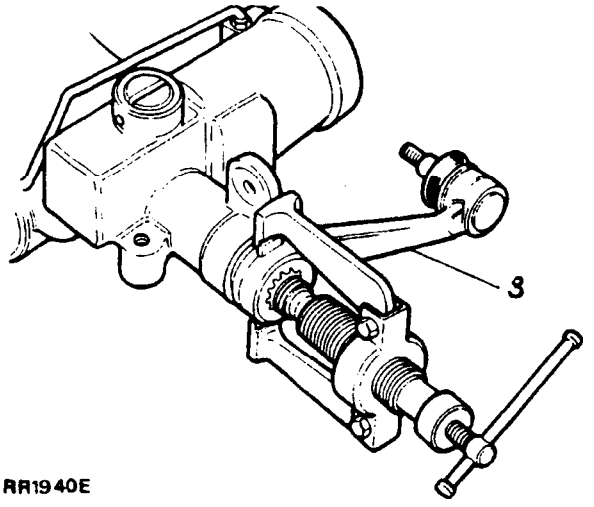
1. Place the vehicle on a suitable hydraulic hoist, alternatively raise the front of the vehicle using a hydraulic floor jack and install axle stands under the front axle, remove the floor jack.
2. Disconnect the drag link from the drop arm ball joint, using a suitable extractor.



RR1939E

3. Remove the drop arm from the steering box rocker shaft, using extractor MS252A.

NOTE: The drop arm ball joint is integral with the drop arm.



RR1940E

Refitting

4. Set the steering box in the midway lock-to-lock position.
5. Fit the drop arm in position, aligning the master splines.
6. Fit the drop arm fixings and tighten to the correct torque (see section 06-Torque values).
7. Fit the drag link and tighten to the correct torque (see section 06-Torque values).

DROP ARM BALL JOINT

Overhaul

The drop arm ball joint can be overhauled with a repair kit available which consists of the the following items:

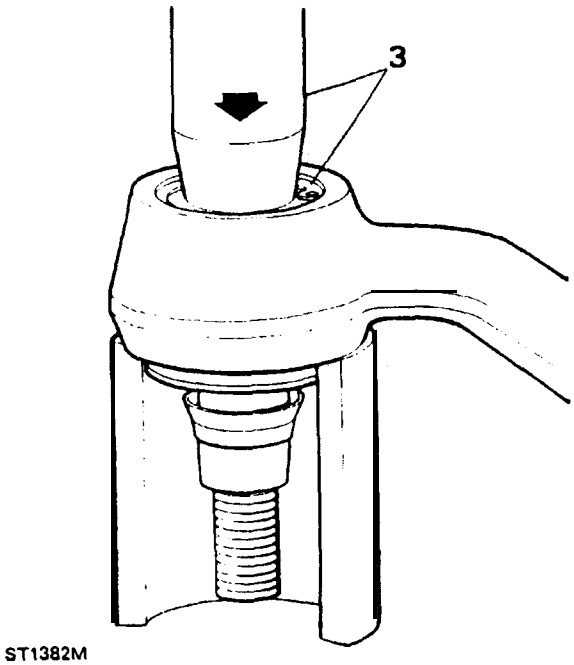
Ball pin	Ball lower socket
Retainer	Spring
Spring rings	'O' ring
Dust cover	Cover-plate
Ball top socket	Circlip

Dismantle

1 Remove the drop arm from the vehicle and clean the exterior.
2 Remove the spring rings and prise off the dust cover
3 In the Interests of safety, position the ball joint under a press to relieve the spring tension and support the housing both sides of the ball pin, as illustrated. Apply pressure to the cover plate and remove the circlip and slowly release the pressure.

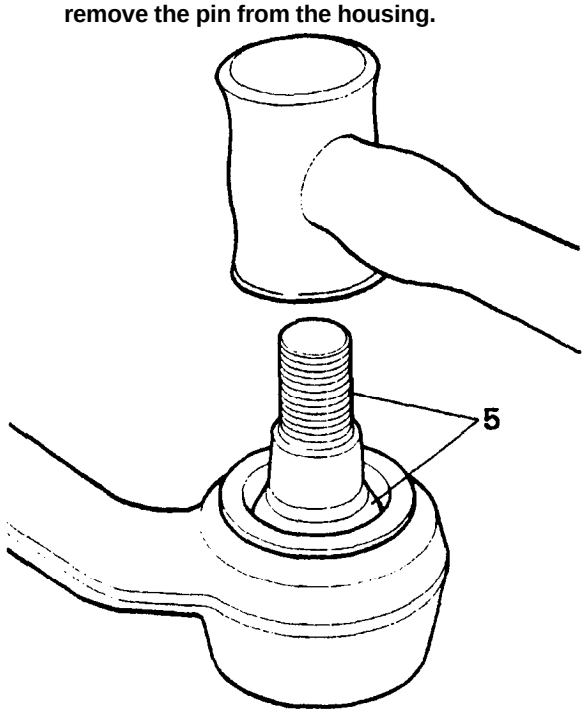
WARNING: Personal injury could result if the circlip is removed without pressure being applied and maintained to the cover plate.

Continued

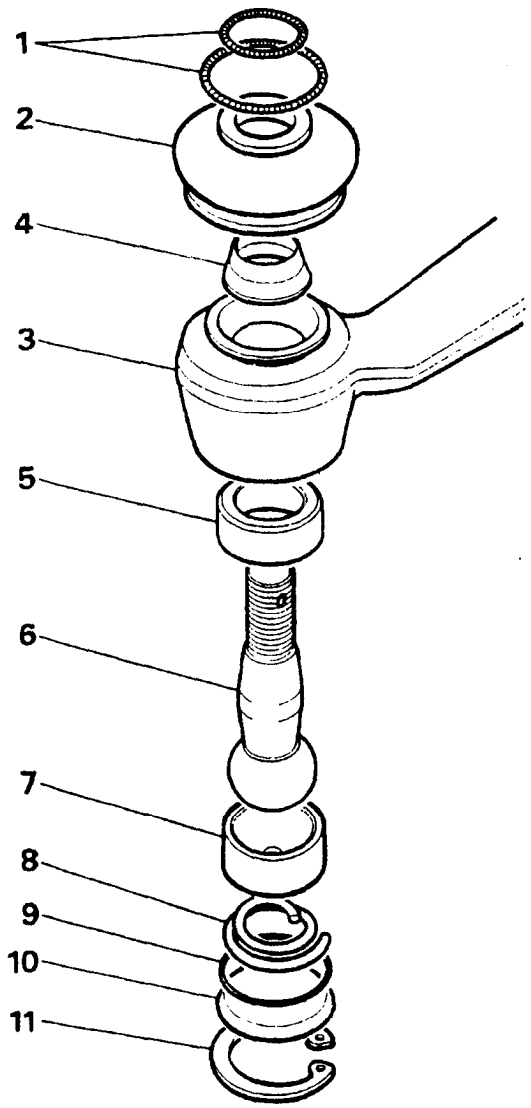


ST1382M

4. **Remove the spring, top socket and '0' ring.**
5. **Since the ball pin cannot be removed with the retainer in position, tap the threaded end of the ball pin to release the retainer and to remove the pin from the housing.**



ST1383M



ST1381M

KEY TO BALL JOINT

1. Spring rings
2. Dust cover
3. Bill housing
4. Retainer
5. Bottom socket
6. Ball pin
7. Top socket
8. Spring
9. 'O' ring
10. Cover-plate
11. Circlip

6. Using a sharp-edged punch or chisel, drive the ball lower socket from the housing.
7. Clean the housing and remove any burrs.

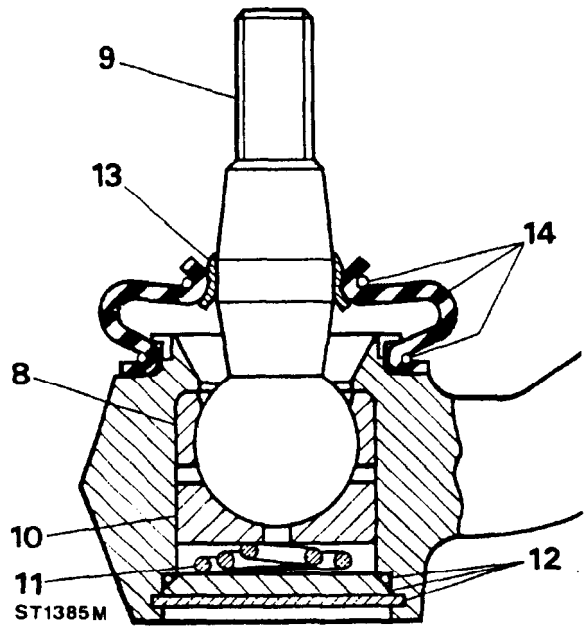


ST1384M

Assemble

8. Press in the lower socket squarely up to the shoulder.
9. Dip the ball in Duckhams LB10 grease, or equivalent and fit to the housing and pack with grease.
10. Fit the top socket.
11. Fit the spring, small diameter towards the ball.
12. Fit the 'O' ring and using the same method as for removing the circlip, compress the cover plate and secure with the circlip. Ensure that the circlip is fully seated in the machined groove

13. Press the retainer onto the ball pin so that the top edge is level with the edge of the taper.



14. Fit the dust cover and retain with the two spring rings.
15. Fit the drop arm to the steering box using a new lock washer. Tighten the retaining nut to the correct torque (see section 06-Torque values)and bend over the lock washer.
16. Assemble the ball pin to the drag link, see instructions for fitting drag link and track rod, tighten the castle nut to the correct torque (see section 06-Torque values)and secure with a new cotter pin.

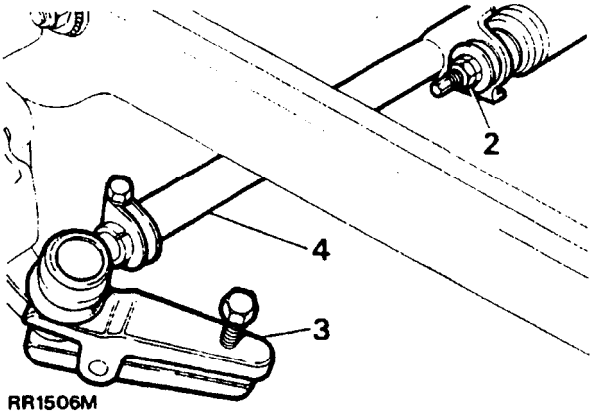
TRACK ROD AND LINKAGE

Remove and refit

TRACK ROD

Removing

1. Place the vehicle on a suitable hydraulic hoist, alternatively raise the front of the vehicle using a hydraulic floor jack and install axle stands under the front axle, remove the floor jack.
2. Disconnect the steering damper at the track rod.
3. Disconnect the track rod at the ball joints, using a suitable extractor.
4. Withdraw the complete track rod.

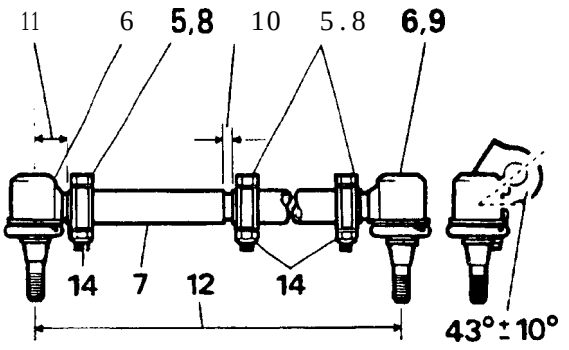


RR1506M

LINKAGE

Removing

5. Loosen the clamp bolts.
6. Unscrew the ball joints.
7. Unscrew the track rod adjuster, left hand thread.



RR1507M

Refitting

8. Fit the replacement parts. Do not tighten the clamp pinch bolts at this stage.
9. Screw in a ball joint to the full extent of the threads.
10. Set the adjuster dimensionally to the track rod as illustrated, to 8.9mm (0.350 in).
11. Set the adjuster end ball joint dimensionally, as illustrated to 28.57mm (1.125 in).
12. The track rod effective length of 1230.0mm (48.4 in) is subject to adjustment during the subsequent wheel alignment check.

TRACK ROD

Refitting

13. Fit the track rod and tighten the ball joint nuts to the correct torque (see section 06-Torque values).
14. Check the front wheel alignment.
15. Reverse 1 and 2.

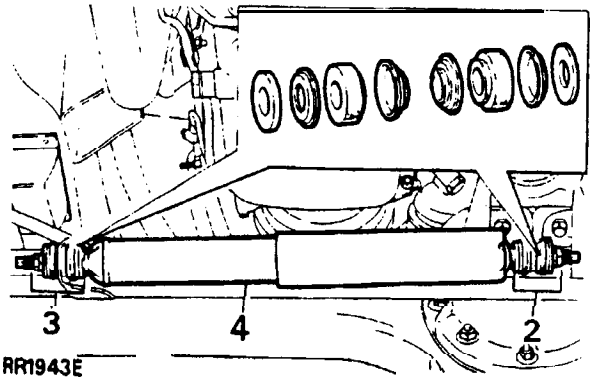
CAUTION: A new track rod must be fitted if the existing track rod is damaged or bent. No attempt should be made to repair or straighten it.

STEERING DAMPER

Remove and refit

Removing

1. Place the vehicle on a suitable hydraulic hoist, alternatively raise the front of the vehicle using a hydraulic floor jack and place axle stands under the front axle, remove the floor jack.
2. Remove the fixings at the differential case bracket.
3. Remove the fixings at the track rod bracket.
4. Withdraw the steering damper.



RR1943E

Refitting

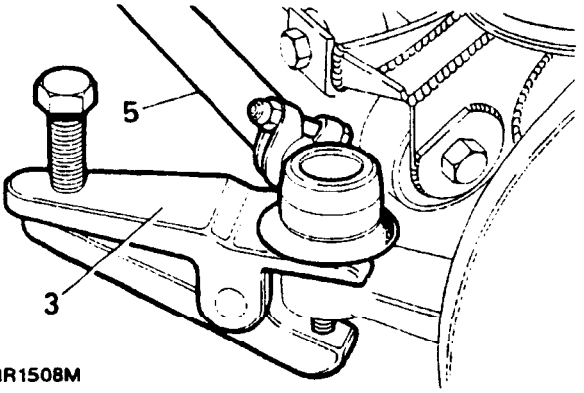
5. Reverse 1 to 4.

DRAG LINK AND DRAG LINK ENDS

Remove and refit

Removing

1. Place the vehicle on a suitable hydraulic hoist, alternatively raise the front of the vehicle using a hydraulic floor jack and place axle stands under the front axle-remove the floor jack.
2. Remove the right hand front road wheel.
3. Disconnect the drag link ball joint at the swivel housing arm, using a suitable extractor.
4. Disconnect the drag link end at the drop arm ball joint, using a suitable extractor.
5. Withdraw the drag link.

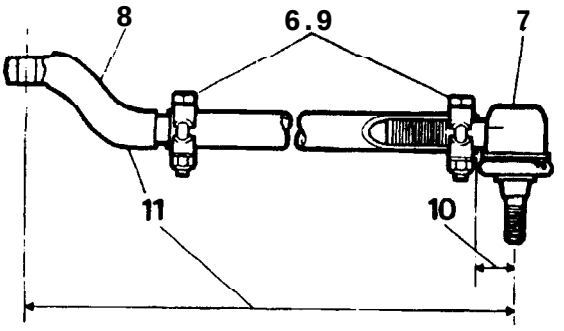


RR1508M

DRAG LINK ENDS

Removing

6. Loosen the clamp bolts.
7. Unscrew the ball joint.
8. Unscrew the offset end.



RR 1509M

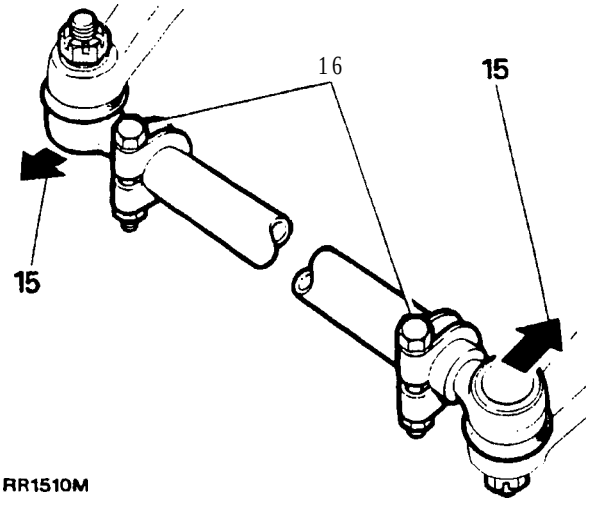
Refitting

9. Fit the replacement ends. Do not tighten the clamp bolts at this stage.
10. Set the ball joint dimensionally to the drag link, as illustrated, to 28.57mm (1.125 in).
11. Adjust the offset end to obtain the nominal overall length of 919.0mm (36.2 in). The final length is adjusted during refitting.

DRAG LINK

Refitting

12. Fit the drag link. Tighten the ball-joint nuts to the correct torque (see section 06-Torque values).
13 Check, and if necessary, set the steering lock stops.
14. Turn the steering and ensure that full travel is obtained between the lock stops. Adjust the drag link length to suit.
15. Using a mallet, tap the ball joints in the direction indicated so that both pins are in the same angular plane.
16. Tighten the clamp bolts to the correct torque (see section 06-Torque values).



RR1510M

17. Reverse 1 and 2.

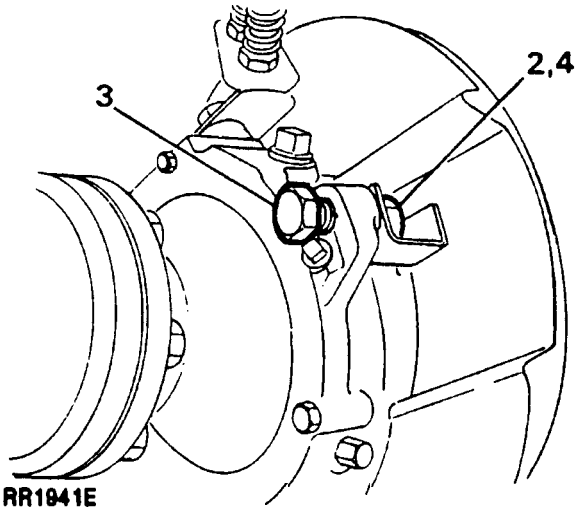
CAUTION: A new drag link nmust be fitted if the existing drag link is damaged or bent. No attempt should be made to repair or straighten it.

STEERING LOCK STOPS

Check and adjust

Checking

1. Measure the clearance between tyre wall and radius arm at full lock. This must be 20 mm (0.787 in).



RR1941E

Adjusting

2. Loosen the stop bolt locknut.
3. Turn the stop bolt in or out as required.
4. Tighten the locknut.
5. Check the clearance between tyre wall and radius arm on each lock.

FRONT WHEEL ALIGNMENT

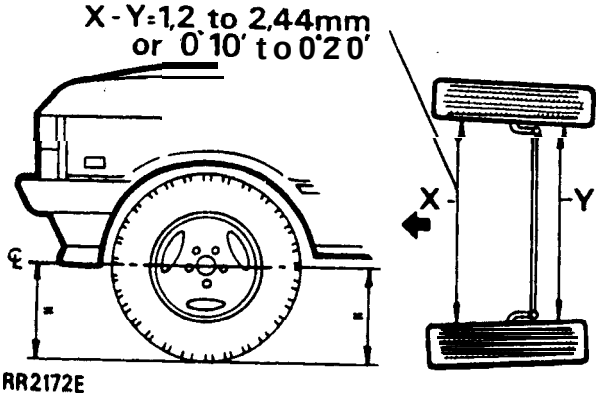
Check and adjust

Checking

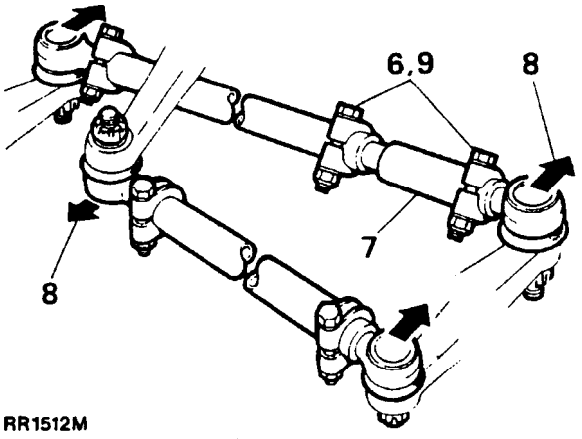
Toe-out dimensions

NOTE: No Adjustment is provided for castor, camber or swivel pin inclinations.

1. Set the vehicle on level ground with the road wheels in the straight-ahead position.
2. Push the vehicle back then forwards for a short distance to settle the linkage.
3. Measure the toe-out at the horizontal centre-line of the wheels.
4. Check the tightness of the clamp bolt fixings for the correct torque (see section 06-Torque values).



RR2172E



RR1512M

Adjusting

6. Loosen the adjuster sleeve clamp.
7. Rotate the adjuster to lengthen or shorten the track rod.
8. Check the toe-out setting as in instructions 1 to 4. When the toe-out is correct lightly tap the steering linkage ball joint, in the directions illustrated, to the maximum of their travel to ensure full unrestricted working travel.
9. Finally, tighten the clamp bolts to correct torque (see section 06-Torque values).

SELF LOCKING NUTS

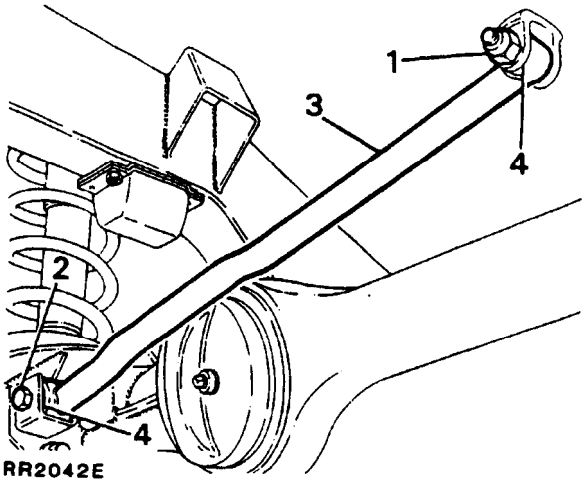
Many steering and suspension items are secured using self locking nuts. Where self locking nuts have been removed, they MUST be replaced with new items of the correct type.

PANHARD ROD

Remove and refit

Removing

1. Working underneath the vehicle remove the fixings at the mounting arm.
2. Remove the fixings at the axle bracket.
3. Withdraw the Panhard rod.
4. Using a suitable hydraulic or bench press and a piece of metal tubing slightly smaller than the outside diameter of the bush, press out the rubber mounted bushes. Ensure the steel tubing locates on the outer edge of the bush and not on the rubber inner.



RR2042E

Refitting

5. Fit replacement bushes centrally in the rod.

CAUTION: When pressing in the new bushes ensure that pressure is applied to the outer edge of the bush only and not to the rubber inner.

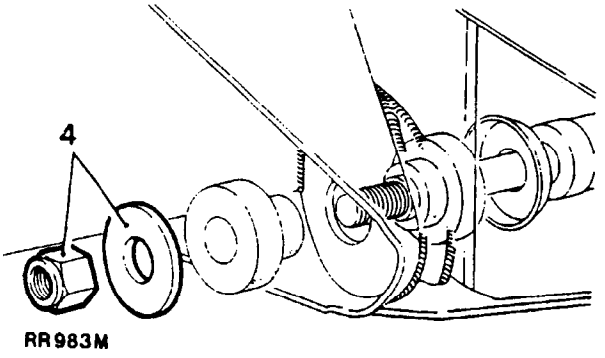
6. Reverse 1 to 4. Tighten the fixings to the correct torque (see section 06-Torque values).

RADIUS ARM

Remove and refit

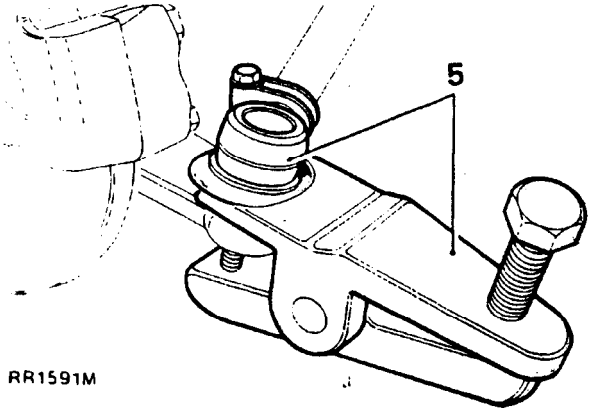
Removing

1. Loosen the road wheel retaining nuts.
2. Raise the front of the vehicle using a suitable hydraulic floor jack. Support chassis on suitable stands and remove the wheel, (remove both front wheels only if removing both radius arms).
3. Support the front axle weight using the hydraulic floor jack.
4. Remove the fixings - radius arm to chassis side member.



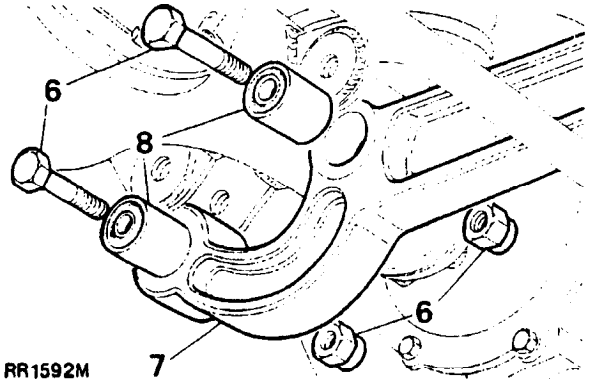
RR983M

5. Disconnect the track rod at the ball joint, using a suitable extractor.
6. Remove the fixings, radius arm to axle.
7. Lower the radius arm front end to clear the axle and remove it from the vehicle.



RR1591M

Continued



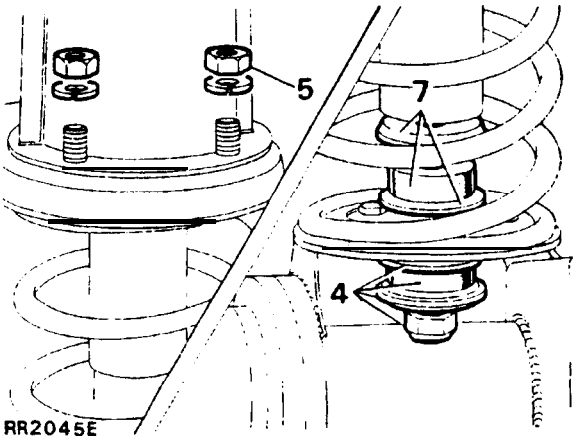
8. Using a suitable hydraulic or bench press and a piece of metal tubing slightly smaller than the outside diameter of the bush, press out the rubber mounted bushes. Ensure the steel tubing locates on the outer edge of the bush and not on the rubber inner.

Refitting

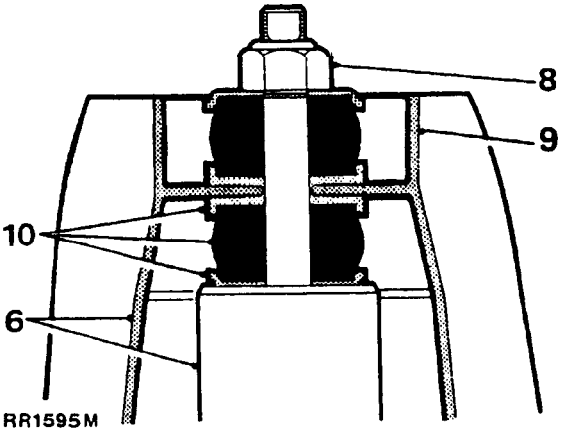
9. Fit the replacement bushes centrally in the arm.

CAUTION: When pressing in the new bushes ensure that pressure is applied to the outer edge of the bush only and not to the rubber inner.

10. Reverse 1 to 7. Tighten the fixings to the correct torque (see section 06-Torque values).



4. Remove the shock absorber lower fixing and withdraw the cupwasher, rubber bush and seating washer.
5. Remove the four shock absorber bracket fixings.
6. Withdraw the shock absorber and bracket complete.



FRONT SHOCK ABSORBER

Remove and refit

Removing

1. Loosen the road wheel retaining nuts.
2. Raise the front of the vehicle using a suitable hydraulic floor jack. Support the chassis on suitable stands and remove the road wheel. (Remove both front wheels only if removing both shock absorbers).
3. Support the front axle weight using the hydraulic floor jack.
7. Withdraw the lower seating washer, rubber bush and cupwasher.
8. Remove the fixings, shock absorber to mounting bracket.
9. Withdraw the mounting bracket.
10. Lift off the top seating washer, rubber bush and cupwasher.

Refitting

11. Reverse instructions 1 to 10.

FRONT ROAD SPRING

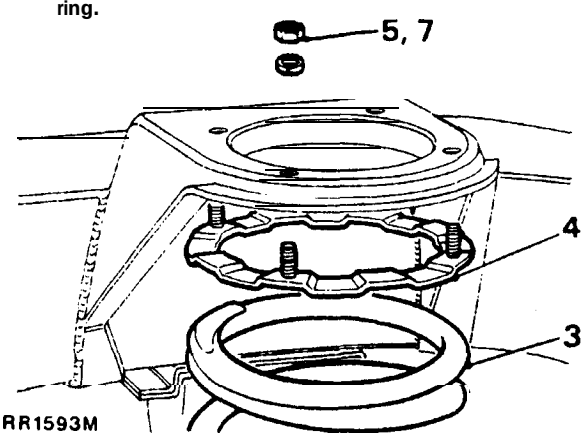
Remove and refit

Removing

1. Remove the front shock absorber.

CAUTION: During the following procedure avoid over stretching the brake hoses. If necessary, loosen the hose connector locknuts to allow the hoses to follow the axle.

2. Lower the axle sufficient to free the road spring.
3. Withdraw the road spring.
4. Withdraw the shock absorber bracket securing ring.



Refitting

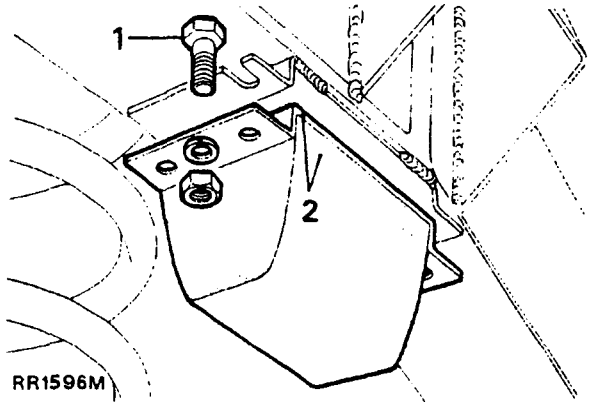
5. Fit the shock absorber bracket retaining ring. Retain in position with a nut.
6. Reverse 2 and 3.
7. Remove the nut retaining the securing ring.
8. Fit the front shock absorber.

BUMP STOP

Remove and refit

Removing

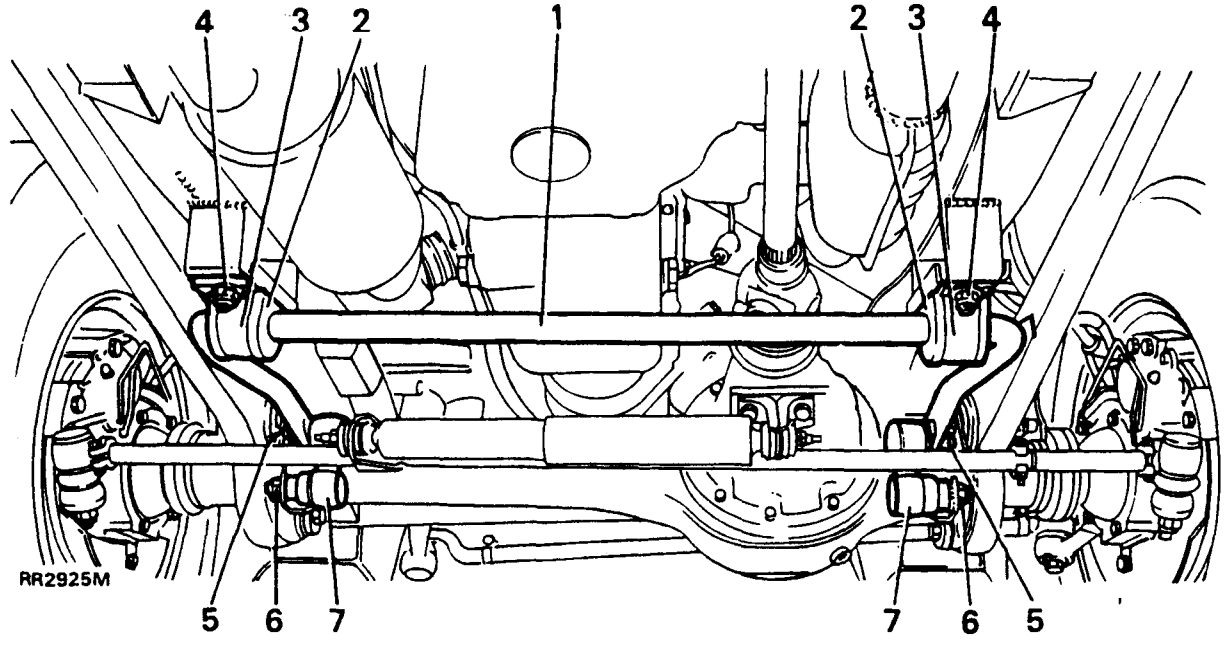
1. Remove the fixings.
2. Withdraw the bump stop assembly.



Refitting

3. Position the fixing bolts in the slots in the chassis brackets.
4. Fit the bump stop assembly.

ANTI-ROLL BAR ASSEMBLY FRONT



KEY

1. Anti-roll bar
2. Rubber bush
3. Strap
4. Nut, bolt, washer
5. Nut and washer
6. Castellated nut and cotter pin
7. Ball joint link arm

ANTI-ROLL BAR FRONT

Remove and refit

Remove

1. Mark for reassembly position of rubber bushes on the anti-roll bar.
2. Remove the tour nuts, bolts and washers securing the two bush straps.
3. Remove the nuts, bolts, washers and rubber bushes from the ball joint links and remove anti-roll bar.

Refit

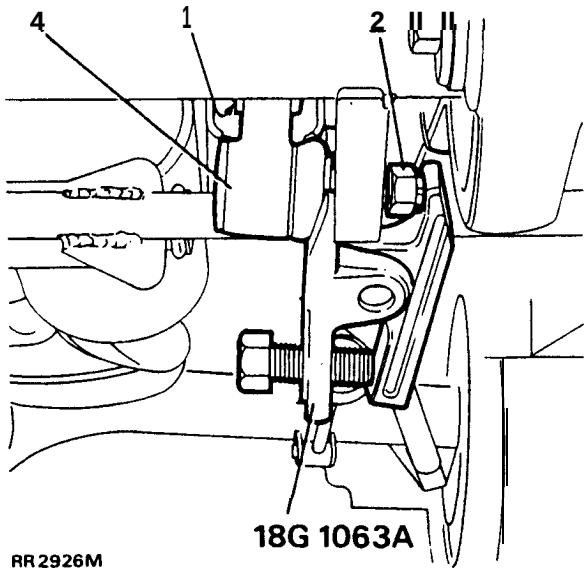
4. Position bushes on the anti-roll bar. Ensure the split points towards axle.
5. Fit the anti-roll bar with the two straps. To ensure correct fit the angled sides of the bar should point down as shown. Loosely fit the bolts washers and nyloc nuts.
6. Fit bolt washers and rubber bushes. Using new nuts fit anti-roll bar to ball joint links. Tighten to the correct torque.
7. Tighten to the correct torque the nuts securing the straps.

ANTI-ROLL BAR BALL JOINT LINKS-FRONT

Remove and refit

Remove

1. Remove the two nuts, bolts, washers and rubber bushes from the ball joint links.
2. Remove cotter pin and loosen castellated nut a few turns.
3. Release ball joint using special tool 18G 1063A as shown.
4. Remove castellated nut and ball joint link.



Refit

5. Fit ball joint link and castellated nut. Ensure the ball joint link arm points up. Tighten to the correct torque and fit new cotter pin.
6. Align anti-roll bar to ball joint links.
7. Fit bolts, washers and rubber bushes using new self locking nuts secure anti-roll bar to ball joint links. Tighten to the correct torque.

SELF LOCKING NUTS

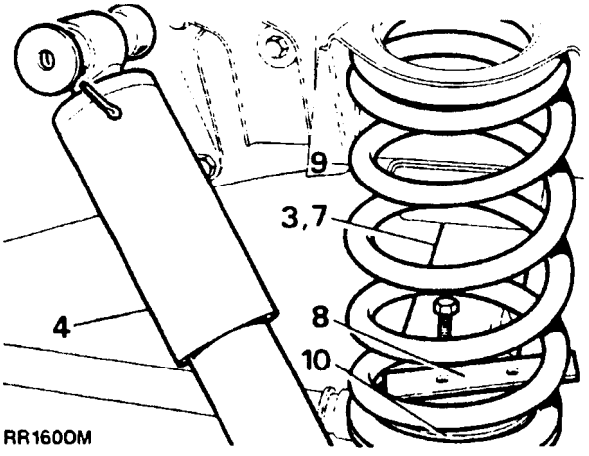
Many steering and suspension items are secured using self locking nuts. Where self locking nuts have been removed, they MUST be replaced with new items of the correct type.

REAR ROAD SPRING

Remove and refit

Removing

1. Loosen the rear road wheel retaining nuts.
2. Raise the rear of the vehicle using a suitable hydraulic floor jack. Support the chassis on stands and remove the wheels.
3. Support the rear axle weight with the floor jack.
4. Disconnect the shock absorbers at one end.



RR1600M

5. Position a suitable coil spring compressor correctly on the road spring.
6. Compress the spring evenly to facilitate removal.
7. Lower the axle sufficient to free the road spring from the upper seat.

CAUTION: Avoid lowering the axle further than necessary otherwise the rear brake flexible hose wil be damaged.

8. Remove the spring retainer plate.
9. Withdraw the road spring.
10. Lift off the spring seat.

Refitting

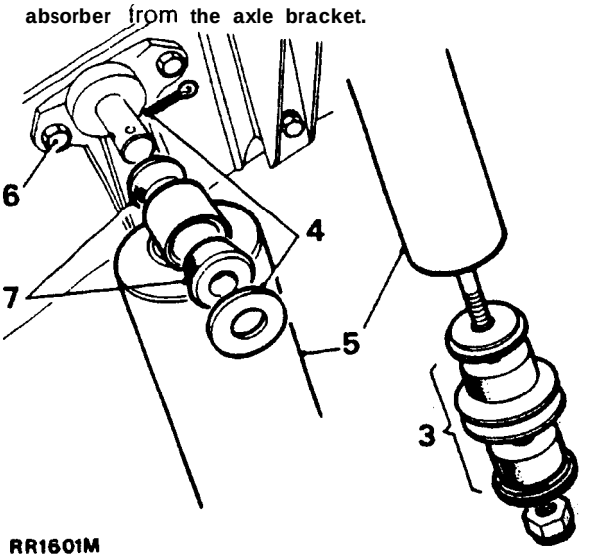
11. Reverse 1 to 10. Ensure that the cotter pin securing the top shock absorber mounting is located in the inboard hole.

REAR SHOCK ABSORBER

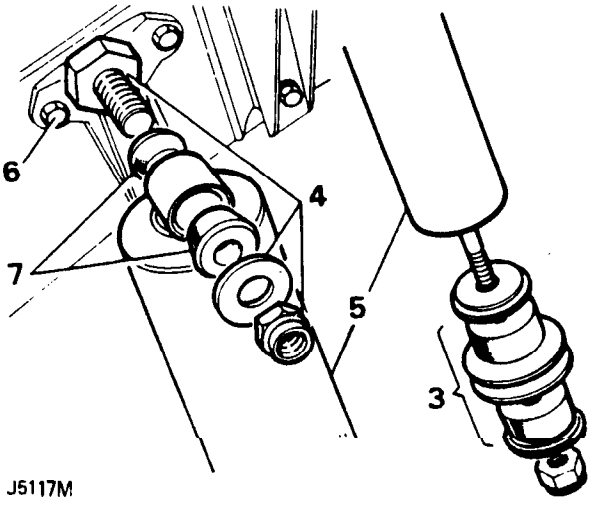
Remove and refit

Removing

1. Loosen the road wheel retaining nuts and raise the rear of the vehicle using a suitable hydraulic floor jack.
2. Support the chassis on stands. Remove the road wheels and support the rear axle weight with the floor jack.
3. Remove the fixings and withdraw the shock absorber from the axle bracket.



RR1601M



J5117M

4. Remove upper fixings.

NOTE: J511M shows 1990 Model Year top damper fixing.

5. Withdraw the shock absorber.
6. If required, remove the mounting bracket at the chassis side member.
7. If required, lift out the mounting rubbers at the upper end.

Refitting

8. Reverse items 7 and 6 as applicable.
9. Reverse items 1 to 5. Vehicles up to 1990 Model Year - when fitting the top shock absorber fixings compress the mounting rubbers and locate the cotter pin in the INBOARD hole. The outer hole is NOT designed for this purpose.

LEVELLING UNIT

Functional check

A Boge Hydromat levelling unit is located in the centre of the rear axle.

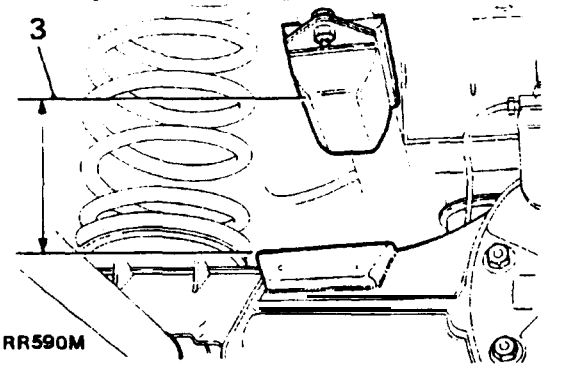
When the vehicle is unladen the levelling unit has little effect. The unit is self-energising and hence the vehicle has to be driven before the unit becomes effective, the time taken for this to happen being dependent upon the vehicle load, the speed at which it is driven and the roughness of the terrain being crossed.

If the vehicle is overloaded the unit will fail to level fully and more frequent bump stop contact will be noticed.

Should the vehicle be left for a lengthy period, e.g. overnight, in a laden condition, it may settle. This is due to normal internal fluid movement in the unit and is not detrimental to the unit performance.

Before carrying out the checks below, verify that the vehicle is being operated within the specified maximum loading capabilities. If the levelling unit is then believed to be at fault, the procedure below should be followed.

1. Check the levelling unit for excessive oil leakage and if present the unit must be changed. Slight oil seepage is permissible.
2. Remove excessive mud deposits from underneath the vehicle and any heavy items from inside the vehicle that are not part of the original equipment.
3. Measure the clearance between the rear axle bump pad and the bump stop rubber at the front outer corner on both sides of the vehicle. The average clearance should be in excess of 67mm (2.8 in). If it is less than this figure remove the rear springs and check their free length against the 'Road Spring Data'. Replace any spring whose free length is more than 20mm (0.787 in) shorter than the figure given. If after replacing a spring the average bump clearance is still less than 67mm (2.8 in), replace the levelling unit.



4. With the rear seat upright, load 450 kg (992 lb) into the rear of the vehicle, distributing the load evenly over the floor area. Check the bump stop clearance, with the driving seat occupied.
5. Drive the vehicle for approximately 5 km (3 miles) over undulating roads or graded tracks. Bring the vehicle to rest by light brake application so as not to disturb the vehicle loading. With the driving seat occupied, check the bump stop clearance again.
6. If the change in clearance is less than 20mm (0.787 in) the levelling unit must be replaced.

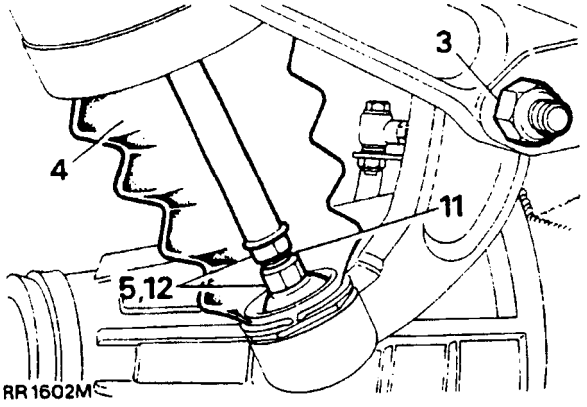
LEVELLING UNIT

Remove and refit

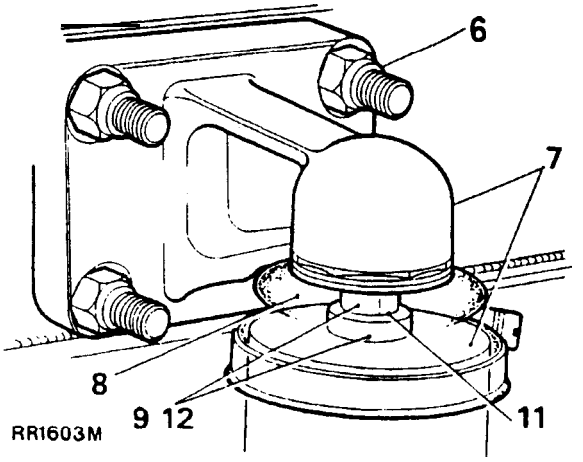
Removing

WARNING: The levelling unit contains pressurized gas and must not be dismantled nor the casing screws removed. Repair is by replacement of complete unit only.

1. **Raise the rear of the vehicle using a suitable hydraulic floor jack. Support the chassis on stands.**
2. **Support the axle weight using the floor jack.**
3. **Disconnect the suspension upper links at the pivot bracket.**



4. **Ease up the lower boot.**
5. **Unscrew the lower ball joint at the levelling unit push rod, using thin jawed wrenches.**
6. **Remove the top bracket fixings at the cross member.**
7. **Withdraw the levelling unit and top bracket complete.**
8. **Ease back the upper boot.**
9. **Unscrew the upper ball joint at the levelling unit, using thin jawed wrenches.**
10. **Withdraw the upper and lower boots and their retaining spring rings.**



Refitting

11. **Coat the ball pin threads with 'Loctite' grade CVX or suitable equivalent sealant.**
12. **Reverse items 1 to 10. Do not fully tighten the fixings until all items are in their fitted position. Finally tighten to the correct. torque (see section 06-Torque values).**

LEVELLING UNIT BALL JOINTS

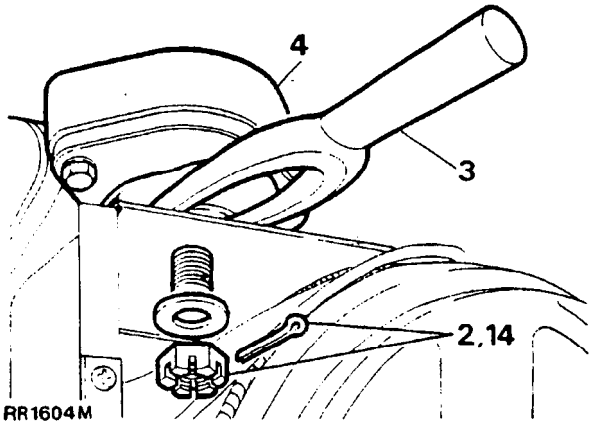
Remove and refit

Service tools:

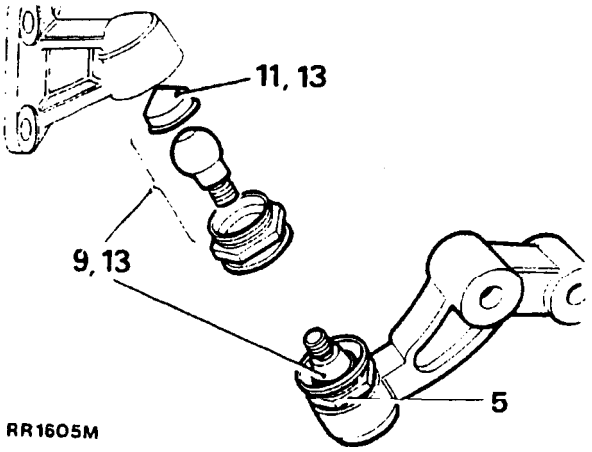
R01006 Extractor for axle bracket ball joint

Removing

1. **Remove the levelling unit.**
2. **Remove the cotter pin and nut at the rear axle bracket.**
3. **Extract the ball pin from the axle bracket using Extractor RO1006.**



4. Withdraw the pivot bracket complete with ball joints.
5. Unscrew the ball joint assembly for the levelling unit.
6. Remove the ball joint assembly from the axle bracket.

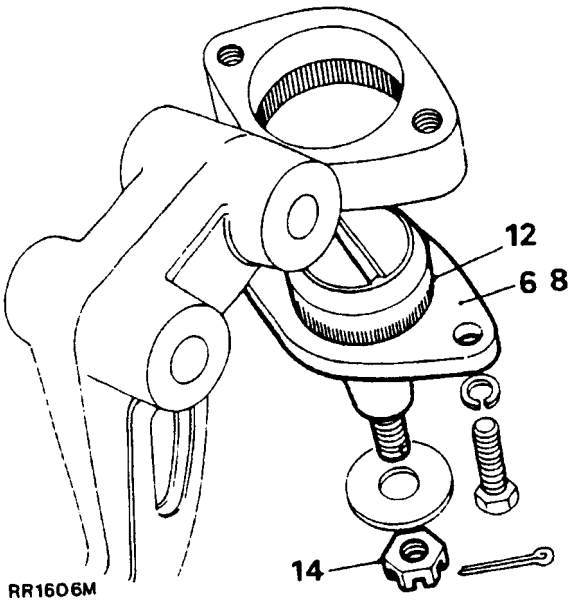


RR1605M

7. Replacement ball joints are supplied as complete assemblies, less fixings, and are pre-packed with grease.
8. The ball joint for the axle bracket must not be dismantled.
9. The ball joints for the levelling unit may be dismantled and cleaned if required.
10. Pack the ball joint with Dextagrease GP or an equivalent grease when assembling.
11. Ensure that the ball seating is square in its housing before refitting.

Refitting

12. Press the knurled ball joint into the pivot bracket.
13. Screw the ball joints for the levelling unit into the mounting brackets. If the ball joints do not screw in easily and fully, remove and the assemblies ensuring that the plastic seats do not jam in the housings. Tighten to the correct torque (see section 06-Torque values).



RR1606M

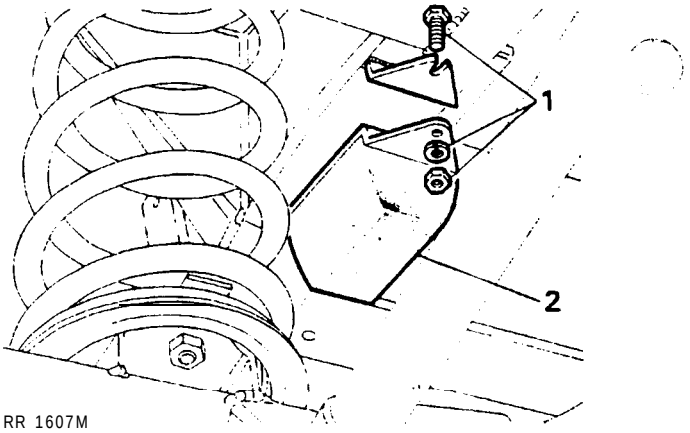
14. Fit the pivot bracket complete with ball joints to the rear axle. Tighten to the correct torque (see section 06-Torque values).
15. Fit the levelling unit.

BUMP STOP

Remove and refit

Removing

1. Remove the fixings.
2. Withdraw the bump stop assembly.



RR 1607M

Refitting

3. Position the fixing bolts in the slots in the chassis brackets.
4. Fit the bump stop assembly, position the shoulder on the carrier to suit the chassis configuration.

UPPER SUSPENSION LINK

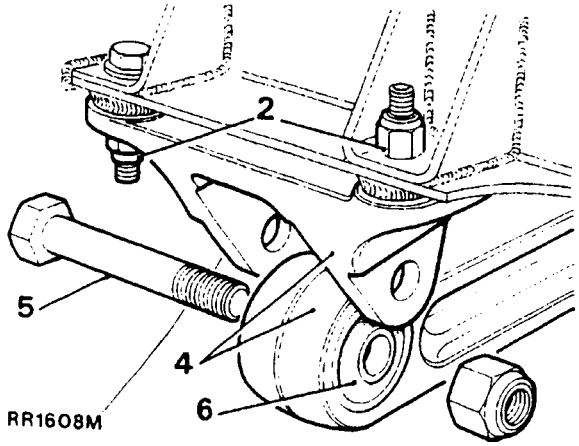
Remove and refit 1 to 6 and 9

BUSH

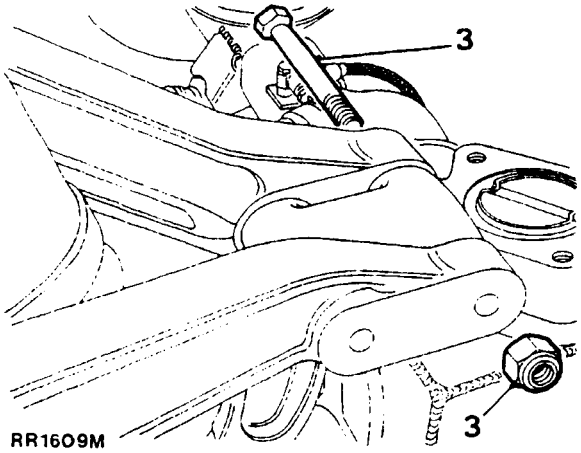
Remove and refit 7 and 8

Removing

1. Raise the rear of the vehicle using a suitable hydraulic floor jack. Support the rear of the chassis on stands allowing the axle to be freely suspended.
2. Remove the fixings, upper link bracket to frame.



3. Remove the fixings, upper links to pivot bracket.
4. Withdraw the upper link complete with frame bracket.
5. Remove the fixing bolt.
6. Separate link and bush assembly from bracket.



Replacing the bush

7. Using a suitable hydraulic or bench press and a piece of metal tubing slightly smaller than the outside diameter of the bush, press out the rubber mounted bushes. Ensure the steel tubing locates on the outer edge of the bush and not on the rubber inner.
8. Fit the replacement bush assembly centrally in the housing.

CAUTION: When pressing in the new bushes ensure that pressure is applied to the outer edge 01 the bush only and not to the rubber inner.

Refitting

9. Reverse **1** to 6. Do not fully tighten the fixings until all components are in position.

10. Finally tighten all fixings to the correct torque (See Section 06 Torque Values).

LOWER SUSPENSION LINK

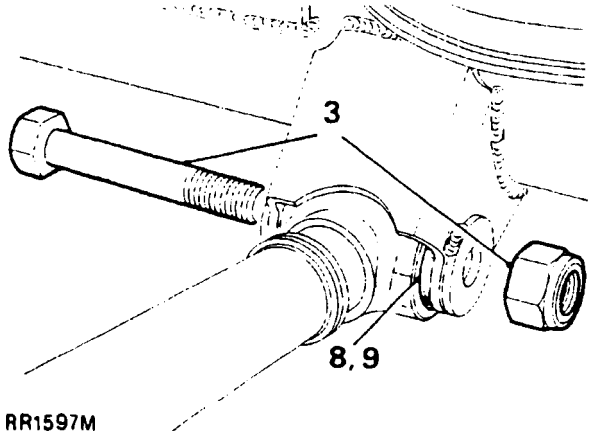
Remove and refit 1 to 7, 10 to 12

BUSH

Remove and refit 8 and 9

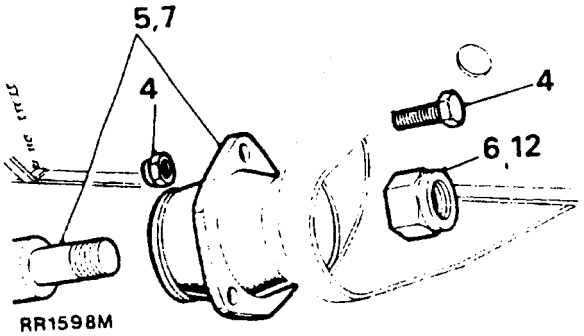
Removing

1. Place the vehicle on a suitable hydraulic hoist for accessibility.
2. Alternatively, raise the rear of the vehicle using a suitable hydraulic floor jack and support the vehicle using stands placed under the axle.
3. Remove the link rear fixings.



RR1597M

4. Remove the mounting bracket fixings at the side member bracket.
5. Withdraw lower link complete with mounting bracket.
6. Remove the locknut.
7. Withdraw the mounting bracket from the lower link.



RR1598M

Replacing the bush

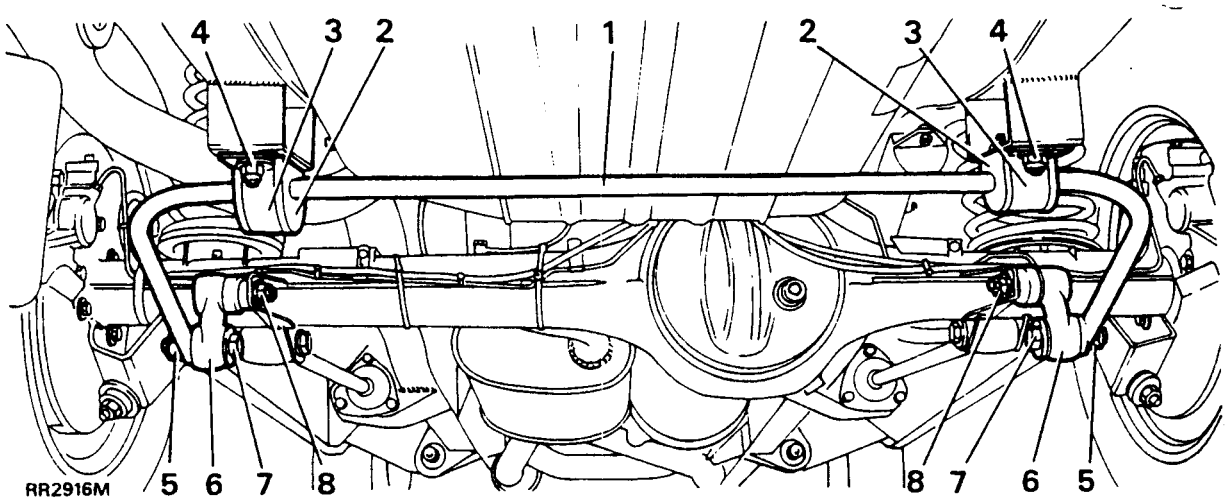
8. Using a suitable hydraulic or bench press and a piece of metal tubing slightly smaller than the outside diameter of the bush, press out the rubber mounted bushes. Ensure the steel tubing locates on the outer edge of the bush and not on the rubber inner.
9. Fit the replacement bush assembly centrally in the housing.

CAUTION: When pressing in the new bush ensure that pressure is applied to the outer edge of the bush only and not to the rubber inner.

Refitting

10. Reverse items 6 and 7. Do not tighten the locknut at this stage.
11. Reverse items 3 to 5.
12. Lower the vehicle, remove the jack and allow the axle to take up its static laden position. Finally tighten the locknut to the correct torque (see section 06-Torque values).

ANTI-ROLL BAR ASSEMBLY REAR



KEY

1. Anti-roll bar
2. Rubber bush
3. Strap
4. Nut, bolt, washer
5. Nut and washer
6. Ball joint link arm
7. Bolt and washer
8. Castellated nut and cotter pin

ANTI-ROLL BAR REAR

Remove and refit

Remove

1. Note for reassembly, the position of rubber bushes on the anti-roll bar.
2. Remove the four nuts, bolts and washers securing the two bush straps.
3. Remove the nuts, bolts, washers and rubber bushes from the ball joint links and remove anti-roll bar.

Refit

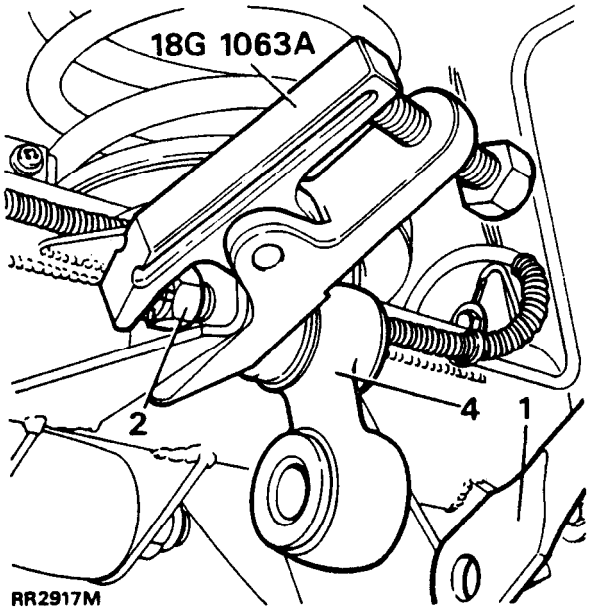
4. Position the rubber bushes on the anti-roll bar. Ensure the split points towards axle.
5. Fit the anti-roll bar with the two straps. Ensure the ball joint link arms point down as shown. Loosely fit, the bolts, washers and new nyloc nuts.
6. Fit bolt, washers and rubber bushes. Using new nuts fit anti-roll bar to ball joint links. Tighten to the correct torque.
7. Tighten to the correct torque the nuts securing the straps.

ANTI-ROLL BAR BALL JOINT LINKS-REAR

Remove and refit

Remove

1. Remove the two nuts, bolts, washers and rubber bushes from the ball joint links and lower anti-roll bar to clear links.
2. Remove cotter pin and loosen castellated nut a few turns.
3. Release ball joint using special tool 18G 1063A as shown.
4. Remove castellated nut and ball joint link.



Refit

5. Fit ball joint link arm and castellated nut. Ensuring the ball joint link arm points down as shown.Tighten to the correct torque and fit new cotter pin.
6. Align anti-roll bar to ball joint links.
7. Fit bolts, washers and rubber bushes using new self locking nuts secure anti-roll bar to ball joint links. Tighten to the correct torque.

BRAKE SYSTEM - Description

The brake system fitted to Range Rovers is of the I.H. split type.

Early 1987 Range Rover vehicles were fitted during manufacture with an Automotive Products (AP) master cylinder and servo assembly, together with associated brake pipes and pedal box assembly.

The brake failure warning system on the AP type master cylinder is a Pressure Differential Warning Actuator (P.D.W.A.) switch, which is activated when the shuttle valve moves along its bore due to pressure differential in either the primary or secondary circuits caused by fluid loss or seal failure. The result of the shuttle valve movement is to illuminate a brake failure warning light in the instrument binnacle.

Later 1987 models are fitted with an uprated Lucas Girting type LSC 115 servo and 25,4mm AS/AS master cylinder plus associated brake pipes and pedal box assembly.

The brake failure warning system on the Lucas Girling type is a Fluid Level Warning Indicator (F.L.W.I.) which is incorporated into the fluid reservoir cap and is activated when fluid loss in the reservoir is sufficient so that the float in the switch drops and in turn illuminates a brake failure warning light in the instrument binnacle.

NOTE: It should be noted that the two systems are not interchangeable on a component by component basis but must be changed as a complete package, ie, servo, master cylinder, brake pipes and pedal box.

The AP system can be found on pages : 1-19 inclusive.

The Lucas Girling system can be found on pages : 31-42 inclusive.

BRAKE SYSTEM - (Vehicles fitted with AP servo and master cylinder)

Description

The hydraulic braking system fitted to the Range Rover is of the dual line type, incorporating primary and secondary hydraulic circuits.

NOTE: References made to primary and secondary do not imply main service brakes or emergency brakes but denote hydraulic line identification.

The brake pedal is connected to a vacuum-assisted mechanical servo which in turn operates a tandem master cylinder. The front disc brake calipers each house four pistons, the upper pistons are fed by the primary hydraulic circuit, the lower pistons by the secondary hydraulic circuit. The rear disc brake calipers each house two pistons and these are fed by the secondary hydraulic circuit via a pressure reducing valve.

A brake failure switch incorporated in the master cylinder will illuminate a panel warning light if a failure occurs in either the primary or secondary hydraulic circuits.

The brake fluid reservoir is divided, the front section (section closest to the servo) feeds the primary circuit and the rear section feeds the secondary circuit. Under normal operating conditions both the primary and secondary hydraulic circuits operate simultaneously on brake pedal application. In the event of a failure in the primary circuit the secondary circuit will still function and operate front and rear calipers.

Alternatively, if the secondary circuit fails, the primary circuit will still function and operate the upper pistons in the front calipers.

If the servo should fail, both hydraulic circuits will still function but would require greater pedal pressure.

The hand-operated parking brake is completely independent of the hydraulic circuits.

Brake pad wear sensors are incorporated into the front right and rear left hand side, inboard brake pads. The sensors will illuminate a brake pad wear warning light in the instrument binnacle, when pad thickness has been reduced to approximately 3mm (0.118 in).

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 BRAKE SYSTEM EFFICIENCY.

To ensure the brake system efficiency is not impaired the following warnings must be adhered to:-

WARNING:

DO NOT use brake fluid previously bled from the system.

DO NOT use old or stored brake fluid.

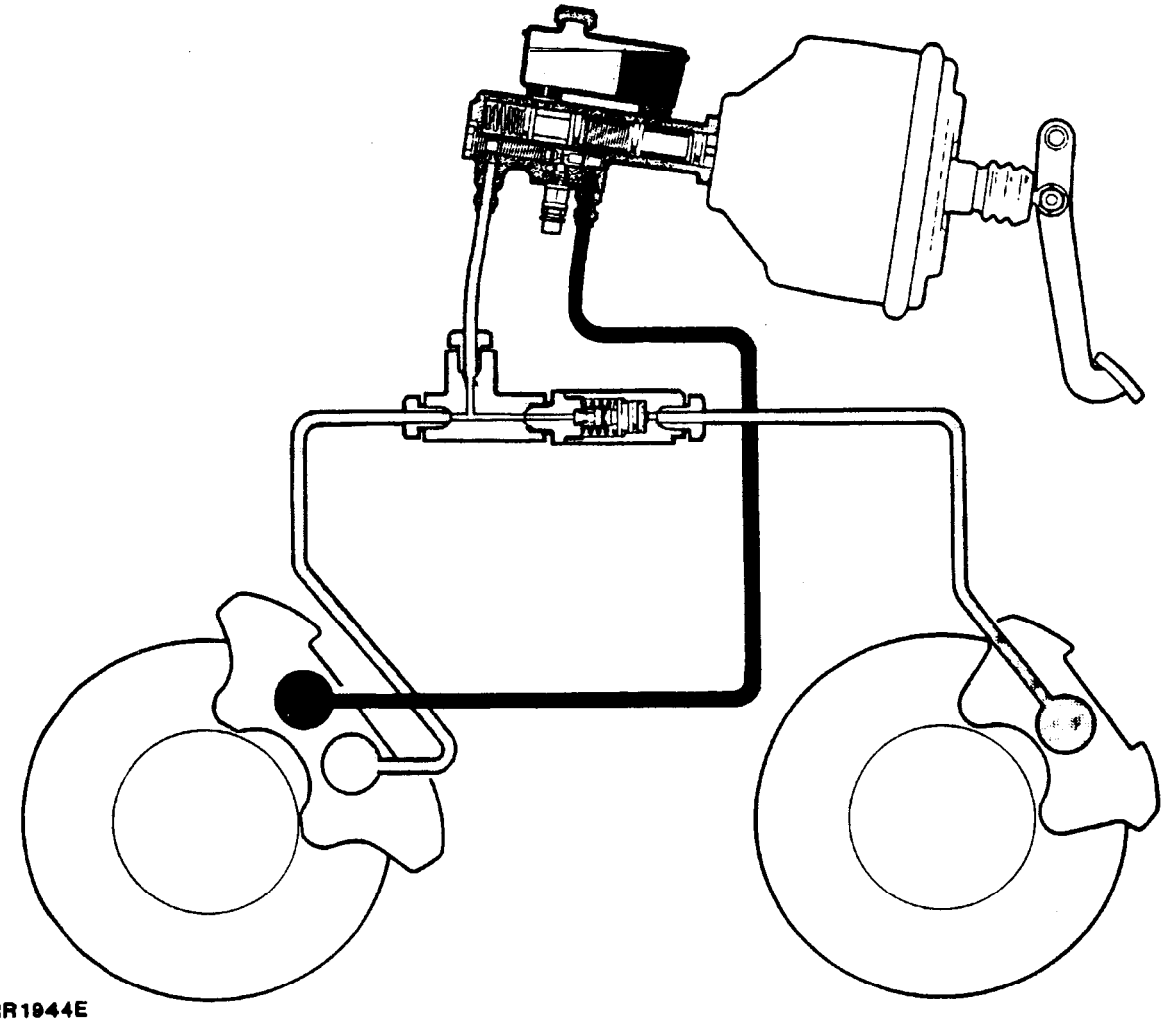
ENSURE that only new fluid is used and that it is taken from a sealed container:

DO NOT flush the brake system with any fluid other than the recommended brake fluid. (See Lubricants, Fluids and Capacities Section 09).

The brake system should be drained and flushed at the recommended service intervals. (See Maintenance Section 10).

PRIMARY HYDRAULIC CIRCUIT

SECONDARY HYDRAULIC CIRCUIT

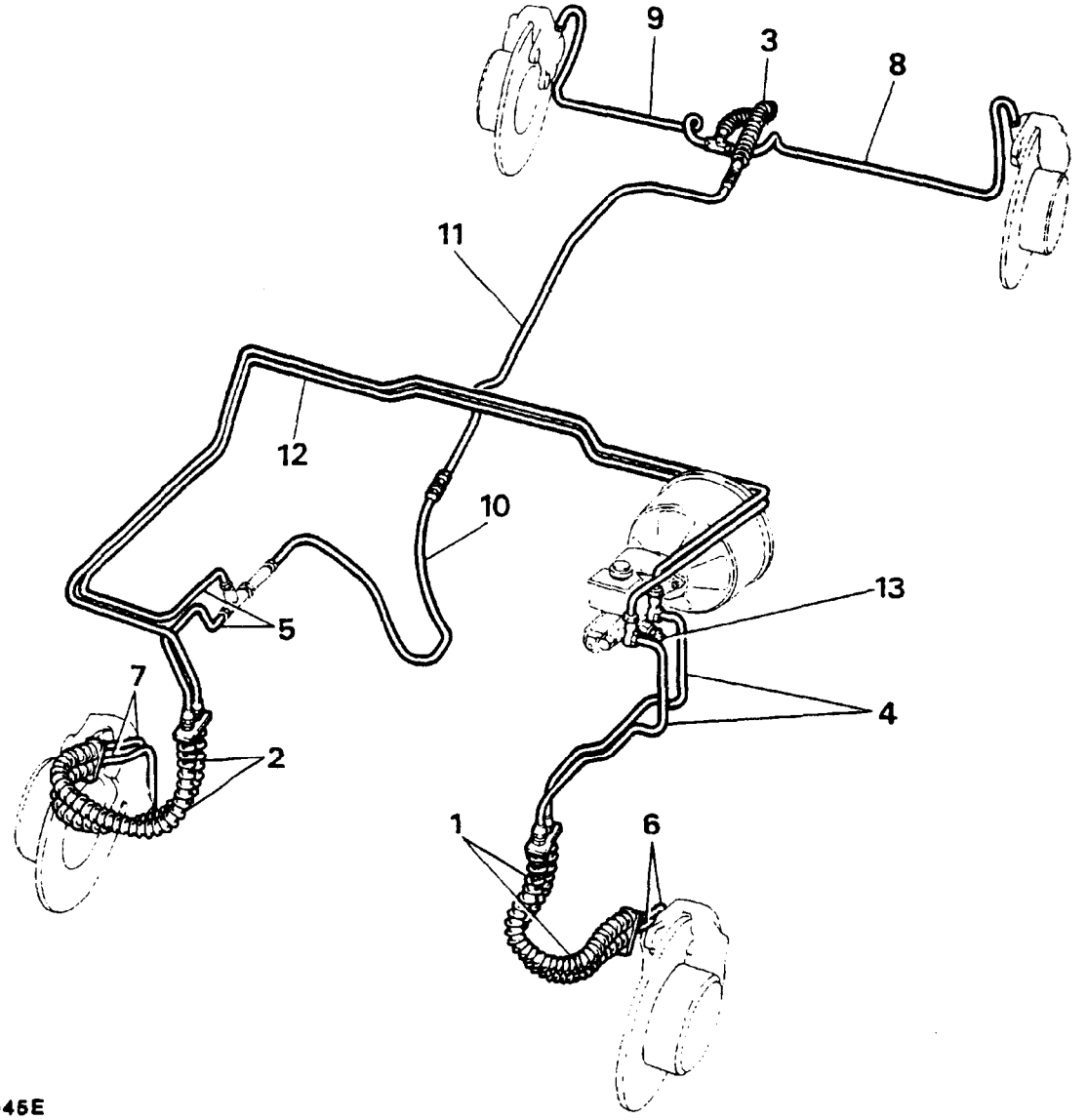


RR1944E

WARNING: Some components on the vehicle, such as gaskets and friction surfaces (brake linings, clutch discs or automatic transmission brake bands), may contain asbestos. Inhaling asbestos dust is dangerous to your health and the following essential precautions must be observed:-

- **Work out of doors or in a well ventilated area and wear a protective mask.**
- **Dust found on the vehicle or produced during work on the vehicle should be removed by vacuuming and not by blowing.**
- **Dust waste should be dampened, placed in a sealed container and marked to ensure safe disposal.**
- **If any cutting, drilling etc., is attempted on materials containing asbestos the item should be dampened and only hands tools or low speed power tools used.**

BRAKE SYSTEM LAYOUT



RR1945E

HOSES

1. Front left hand flexible hoses.
2. Front right hand flexible hoses.
3. Intermediate flexible hose.

PIPES

4. Feed to front left hand hose connector.
5. Feed to front right hand hose connector.
6. Feed to front left hand caliper.
7. Feed to front right hand caliper.
8. Feed to rear left hand caliper.
9. Feed to rear right hand caliper.
10. Feed to two way connector.
11. Feed to intermediate hose.
12. Feed to pressure reducing valve.
13. Brake failure warning switch.

BRAKES

Bleed

The hydraulic system comprises two completely independent sections. The rear calipers and the lower pistons in the front calipers form the secondary section, while the upper pistons in the front calipers form the primary section. The following procedure covers bleeding the complete system, but it is permissible to bleed one section only if disconnections are limited to that section.

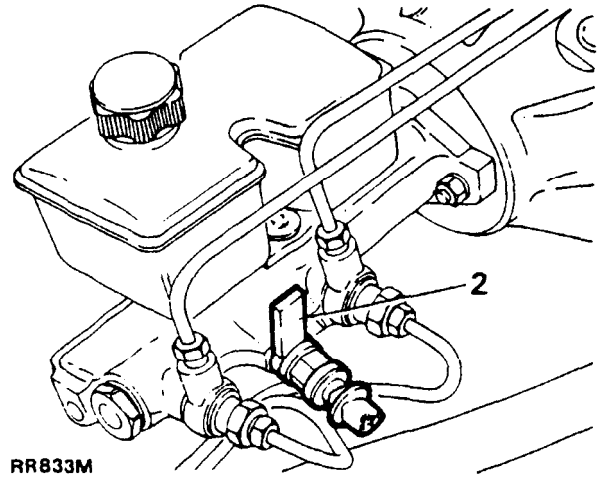
Bleeding will be assisted if the engine is run or a vacuum supply is connected to the servo.

WARNING: IF THE ENGINE IS RUNNING DURING THE BRAKE BLEEDING PROCESS ENSURE THAT NEUTRAL GEAR IS SELECTED AND THAT THE PARKING BRAKE IS APPLIED.

When bleeding any part of the secondary section, almost full brake pedal travel is available. When bleeding the primary section only, brake pedal travel will be restricted to approximately half.

WARNING: Before commencing to bleed the system it is necessary to loosen off the brake failure warning switch to prevent the shuttle valve damaging the switch unit.

1. Disconnect the leads from the switch.
2. Unscrew the switch and insert the 'C' washer between the switch and master cylinder before depressing the brake pedal.
3. After completion of bleeding, remove the 'C' washer and screw in the switch and tighten to the correct torque (see section 06-Torque values).



RR833M

NOTE: When bleeding the system commence with the caliper furthest from the master cylinder and bleed from the screw on the same side as the fluid inlet pipes, then close the screw and bleed from the screw on the opposite side of the same caliper. Tighten the bleed screws to the correct torque. (see section 06-Torque values).

Bleeding

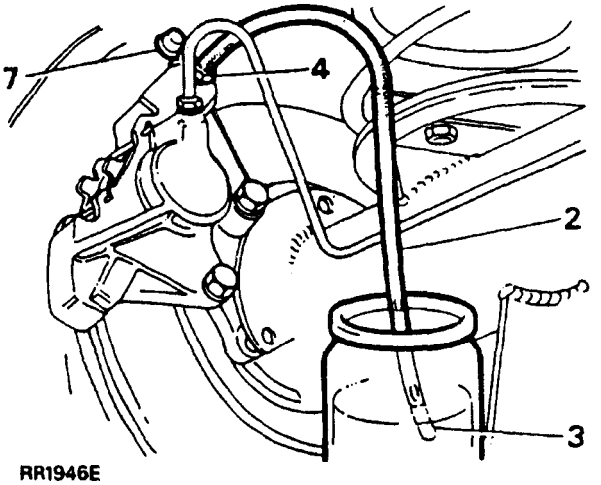
1. Fill the fluid reservoir with the correct fluid, see 'Data Section'.

NOTE: The correct fluid level must be maintained throughout the procedure of bleeding

2. Connect a bleed hose to the bleed screw on the rear caliper furthest from the master cylinder.
3. Submerge the free end of the bleed hose in a container of clean brake fluid.
4. Loosen the bleed screw.
5. Operate the brake pedal -fully and allow to return.

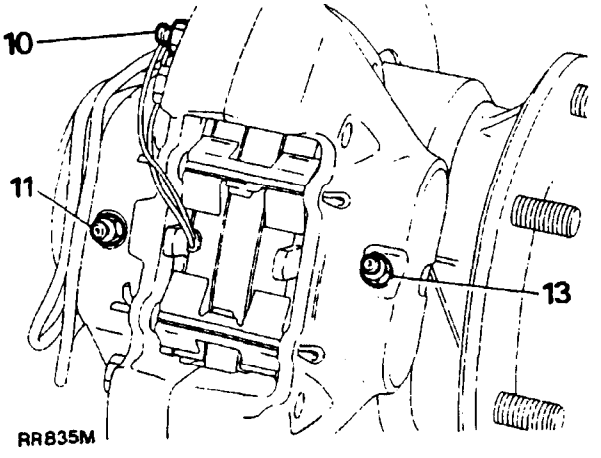
NOTE: Allow at least five seconds to elapse with the foot right off the pedal to ensure that the pistons fully return before operating the pedal again.

6. Repeat 5 until fluid clear of air bubbles appears in the container, then keeping the pedal fully depressed, tighten the bleed screw.
7. Remove the bleed hose and replace the dust cap on the bleed screw.



RR1946E

8. Repeat 1 to 7 for the other rear caliper.
9. Remove the front wheel on the side furthest from the master cylinder.
10. Connect a bleed hose to the primary bleed screw on the front caliper furthest from the master cylinder.
11. Connect a bleed hose to the secondary bleed screw on the same side of the caliper as the primary screw.
12. Repeat 3 to 7 for the front caliper, bleeding from the two screws simultaneously.



RR835M

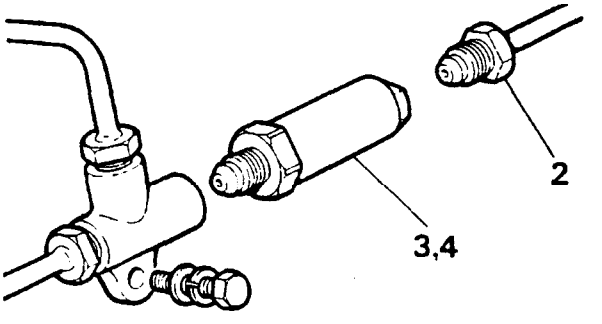
13. Connect a bleed hose to the other screw on the front caliper furthest from the master cylinder.
14. Repeat 3 to 7 for the second secondary screw on the front caliper.
15. Refit the front wheel.
16. Repeat 9 to 15 for the front caliper nearest the master cylinder.
17. Remove the 'C' washer and tighten the PDWA switch to the correct torque. (see section 06-Torque values).

BRAKE PRESSURE REDUCING VALVE

Remove and refit

Removing

1. Remove all dust, grime, etc., from the vicinity of the pressure reducing valve fluid pipe unions.
2. Disconnect the outlet fluid pipe from the pressure reducing valve. Plug the pipe and reducing valve port to prevent the ingress of foreign matter.
3. Remove the valve from the three-way connector and plug both openings.
4. Withdraw the pressure reducing valve from the engine compartment.



RR1947E

Refitting

5. Reverse the removal instructions.
6. Bleed the brake systems.

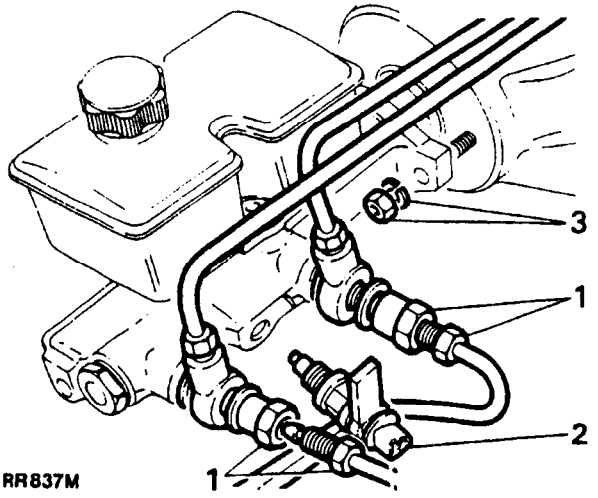
NOTE: The pressure reducing valve is not a serviceable item, in the event of failure or damage, a new unit must be fitted.

Continued

MASTER CYLINDER-OVERHAUL

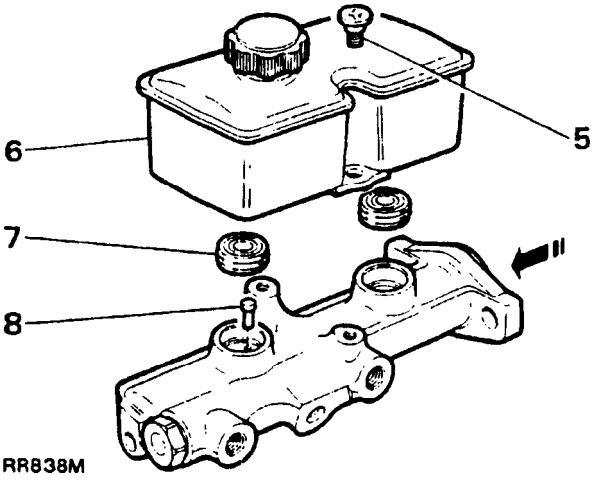
CAUTION: Brake fluid is corrosive, if any fluid comes into contact with body paintwork, immediately flush with a large quantity of water and wipe clean with a soft cloth.

1. Disconnect the brake pipes from the side of the master cylinder and plug the outlet ports.
2. Disconnect the electrical plug from the PDWA switch.
3. Remove the two nuts and spring washers securing the cylinder to the servo unit.



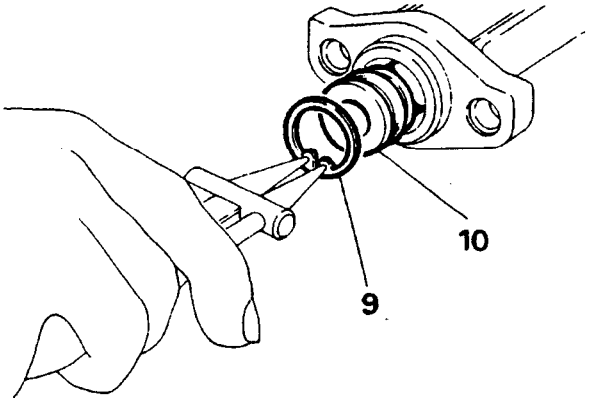
RR837M

4. Remove the reservoir filler cap and drain off the surplus fluid.
5. Remove the two screws securing the reservoir to the master cylinder.
6. Lift the reservoir off the master cylinder.
7. Carefully pry the two reservoir sealing rubbers from the master cylinder.
8. Secure the master cylinder in a vice and push the primary piston down the bore and withdraw the secondary piston stop pin.



RR838M

9. Press down the primary piston and remove the circlip.
10. Withdraw the primary piston assembly.



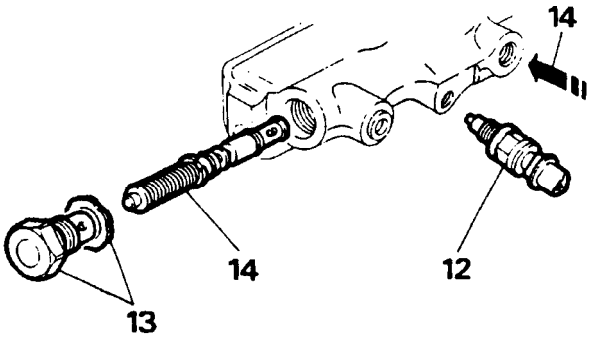
RR839M

11. Apply a high pressure air line to the secondary outlet port to expel the secondary piston assembly.

WARNING: Safety glasses must be worn. Do not operate or direct the air line towards oneself or other personnel in the workshop. Apply a short burst of air only, if the secondary piston is not expelled from its bore repeat the above instruction.

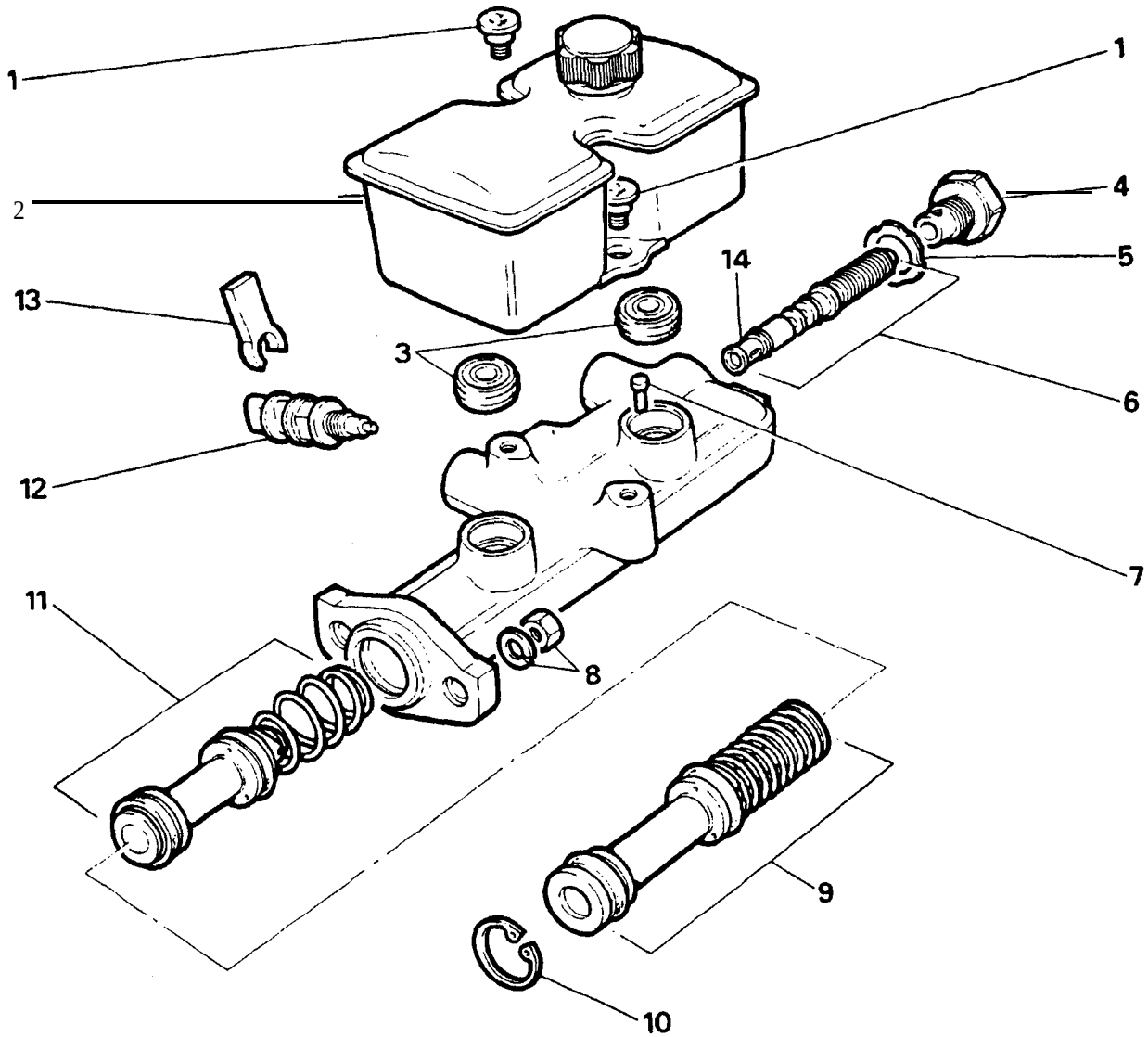
12. **Remove the PDWA switch from the side of the master cylinder.**
13. **Remove the large end plug and copper washer retaining the shuttle valve in the master cylinder.**
14. **Apply a high pressure air line to the primary outlet port to expel the shuttle valve from its bore.**

WARNING: Safety glasses must be worn. Do not operate or direct the air line towards oneself or other personnel in the workshop. Apply a short burst of air only, if the shuttle valve is not expelled from its bore repeat the above instruction.



RR840M

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RR847M

KEY TO MASTER CYLINDER

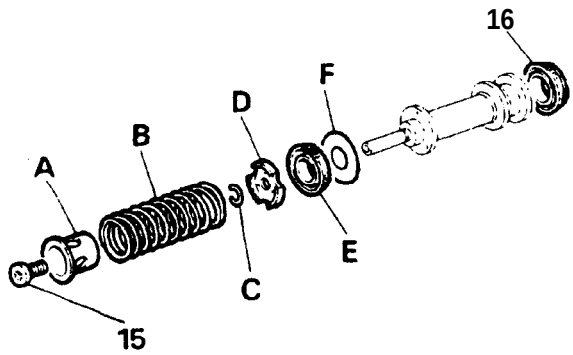
1. Securing screws
2. Reservoir
3. Reservoir seals
4. End plug
5. Copper washer
6. Shuttle valve
7. Secondary piston stop pin
8. Nuts and washers securing cylinder to servo
9. Primary piston
10. Circlip
11. Secondary piston
12. PDWA switch
13. 'C' washer
14. Plastic sleeve

PRIMARY PISTON SEALS

15. Remove the retaining screw from the primary piston and remove the following items.

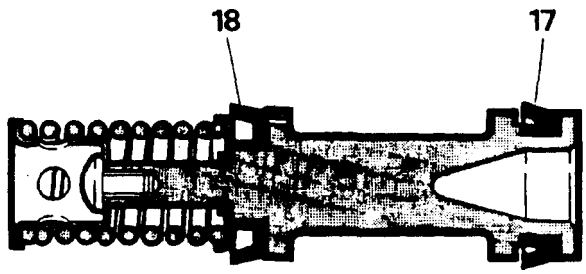
    (A) Spring retainer
    (B) Piston spring
    (C) Circlip
    (D) Seal retainer
    (E) Recuperating seal
    (F) Washer

16. Taking care not to damage the piston, pry off the outer seal.



RR841M

17. Fit a new outer seal into its groove by squeezing the seal between the finger and thumb into an oval shape and press the raised part of the seal over the flange using the fingers of the other hand.
18. Fit a new recuperating seal and assemble the parts in reverse order of removal. Compress the spring and secure the assembly with the retaining screw. Tighten the screw securely.



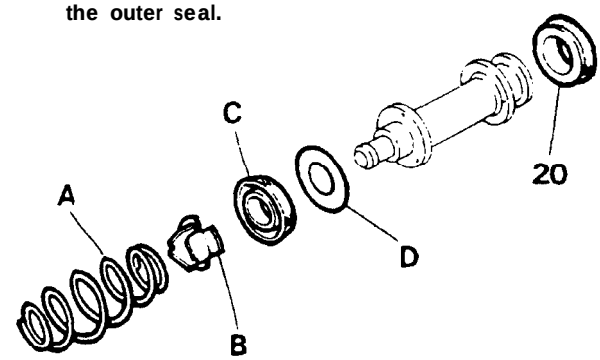
RR842M

SECONDARY PISTON SEALS

19. Remove the following items from the secondary piston:

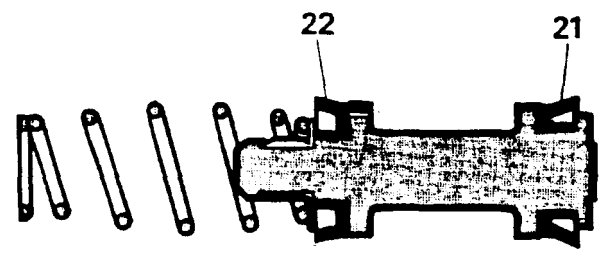
    (A) Spring
    (B) Seal retainer
    (C) Recuperating seal
    (D) Washer

20. Taking care not to damage the piston pry off the outer seal.



RR843M

21. Fit a new outer seal using the same procedure as for the primary piston outer seal by squeezing the seal between the finger and thumb into an oval shape and press the raised part of the seal over the flange using the fingers of the other hand.
22. Fit the recuperating seal assembly parts in the reverse order of removal.

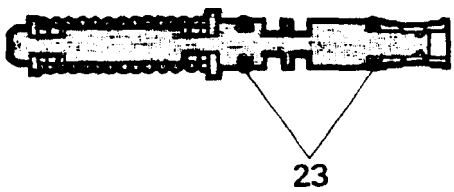


RR844M

Continued

SHUTTLE VALVE '0' RINGS

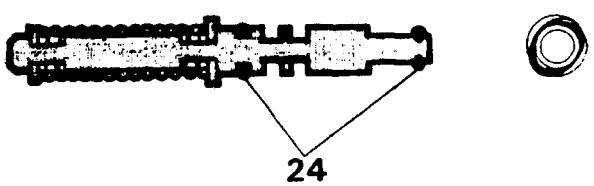
23. Withdraw the plastic sleeve and carefully remove the two 'O' rings from the valve taking care not to damage the piston.



RR845M

24. Fit a new 'O' ring into the 'O' ring groove at the centre of the valve. Fit the remaining 'O' ring into the small groove at the end of the valve. Do not fit the plastic sleeve at this stage.

NOTE: The 'O' rings should not be rolled along the piston, but should be stretched slightly and eased down the piston and into the grooves.

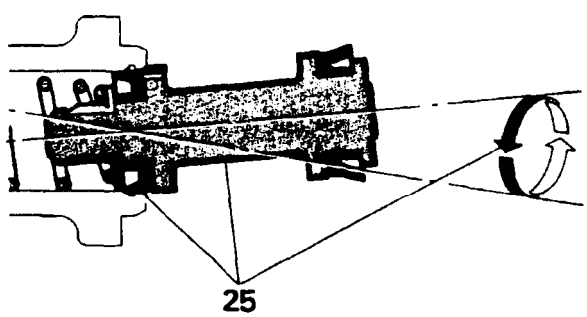


RR1948E

ASSEMBLING MASTER CYLINDER

It is important that the following instructions are carried out precisely, otherwise damage could be caused to the new seals when inserting the plungers into the cylinder bore. Generous amounts of new brake fluid should be used to lubricate the parts during assembly. Never use old fluid or any other form of cleaning and lubricating material. Cleanliness throughout is essential.

25. Clamp the cylinder in a vice and lubricate the secondary piston seals and cylinder bore. Place the piston assembly into the cylinder until the recuperation seal is resting centrally in the mouth of the bore. Gently insert the piston with a circular rocking motion. as illustrated. While ensuring that the seal does not become trapped, ease the seal into the bore and slowly push the piston down in one continuous movement.



RR846M

26. Slowly press the piston down the bore and fit the secondary piston stop-pin.
27. Fit the primary plunger assembly using the same method as for the secondary plunger. Press the plunger down and secure the assembly with the circlip.

NOTE: Insert the plastic sleeve into the shuttle valve bore, ensuring it seats at the bottom of the bore.

28. Lubricate the 'O' rings and fit the shuttle valve. Fit the end plug using a new copper sealing washer and tighten the plug securely.

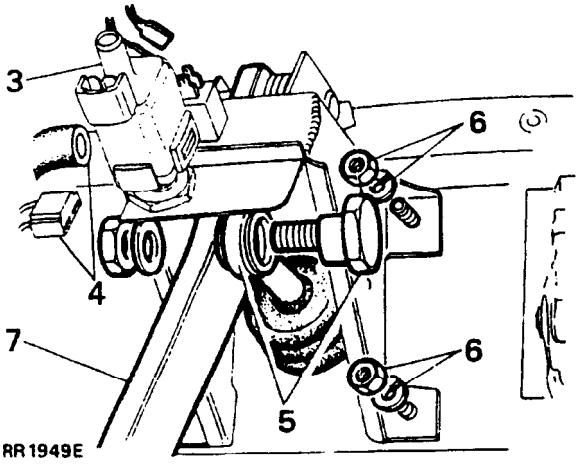
CAUTION: To prevent damage to the '0' ring at the end of the valve ensure it remains in the small groove until the valve reaches the small plastic sleeve.

29. Fit the plastic 'C' washer to the end of the PDWA switch and screw the switch into the master cylinder.
30. Fit new seals to the bottom of the reservoir.
31. Press the reservoir into the lop of the master cylinder and secure in position with the two retaining screws.
32. Fit the master cylinder to the servo and secure with the two nuts and spring washers **and** tighten to the correct torque (see section 06-Torque values).
33. Bleed the brakes, After final bleed remove the 'C' washer from the PDWA switch and tighten the switch to the correct torque (see section 06-Torque values).

PEDAL ASSEMBLY-OVERHAUL

Remove the pedal assembly

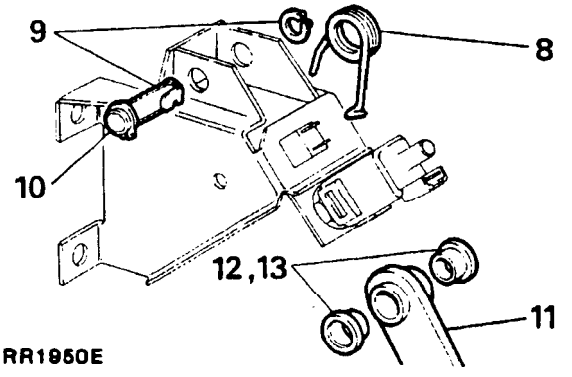
1 Disconnect the battery negative lead.
2 Remove the lower dash panel fixings, lower the panel to gain access to the electrical connections at the rheostat switch and bulb check unit. Disconnect the leads and remove the lower dash from the vehicle, detach the trim pad from around the pedal assembly.
3. Disconnect the electrical leads from the stop light switch.
4. Remove the vacuum hose and disconnect the electrical plug to the cruise control brake vent **switch.**
5. Disconnect the servo operating rod from the brake pedal.
6. Remove the four nuts and spring **washers** securing the brake pedal and servo assemblies to the engine compartment closure panel.
7. Withdraw the pedal assembly from the vehicle.



RR1949E

DISMANTLING

8. Disconnect the pedal return spring.
9. Remove the circlip from the 'D' shaped end of the pedal shaft.
10. Withdraw the pedal shaft.
11. Withdraw the pedal from the box.



RR1950E

Continued

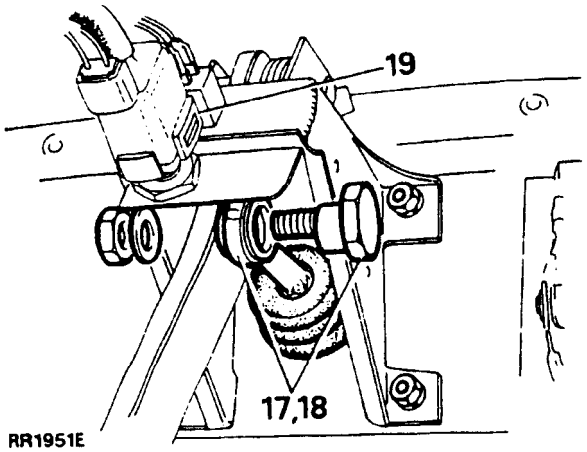
12. Remove the bushes from the pedal pivot tube.

Assembling

13. Press the new bushes into the pedal pivot hose. If necessary, ream the bushes to 15.87mm plus 0.05mm (.625 in plus .002 in).
14. Lightly oil the bushes and pedal shaft.

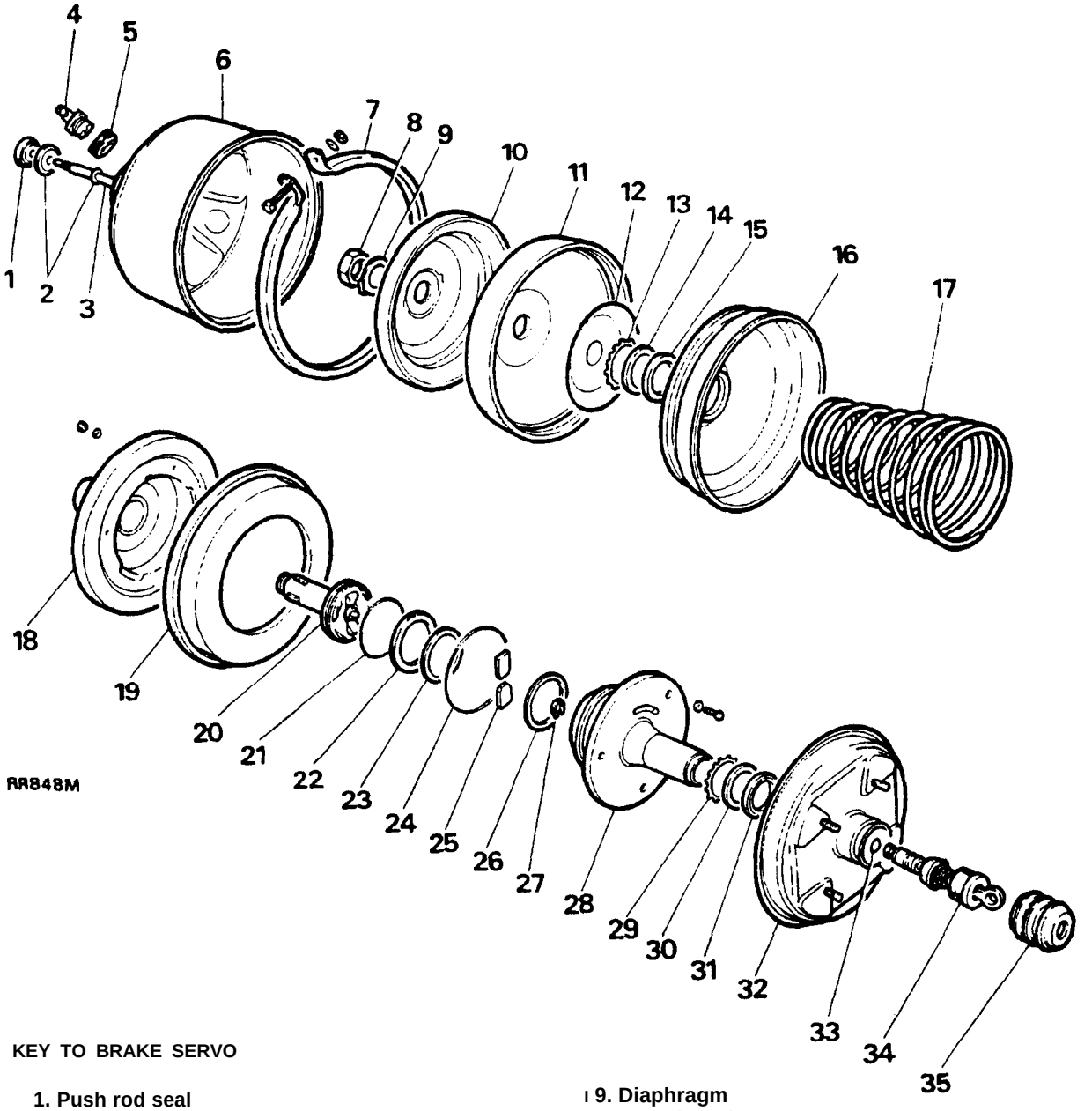
Refit the pedal assembly

15. Refit the assembly to the engine compartment closure panel, tighten the four nuts securely.
16. Connect the electrical leads to the stop light switch.
17. Connect the servo operating rod to the brake pedal with the pivot bolt eccentric, in the forward position. Do not fully tighten the pivot bolt nut.
18. Turn the pivot bolt to bring the brake pedal back until it just contacts the rubber buffer, then secure the pivot bolt nut.



RR1951E

19. Check the cruise control brake switch vent valve setting (see 'Setting Procedure' in Section 19 Cruise Control)
20. Clip the lower trim pad into position and refit the lower dash.
21. Re-connect the battery.



KEY TO BRAKE SERVO

1. Push rod seal
2. Retainer
3. Push rod
4. Non-return valve
5. Seal
6. Servo shell
7. Clamp ring
8. Locknut
9. Lock washer
10. Support plate
11. Diaphragm
12. Backing washer
13. Bearing retainer
14. Nylon bearing
15. Seal
16. Separator shell
17. Spring
18. Diaphragm support and tube
19. Diaphragm
20. Reaction piston
21. Rubber 'O' ring
22. Sponge seal
23. Backing ring
24. Rubber '0' ring
25. Levers
26. Bearing ring
27. Circlip
28. Valve body
29. Bearing retainer
30. Nylon bearing
31. Seal
32. Servo cover
33. Rubber '0' ring
34. Valve/push rod assembly
35. Rubber boot

BRAKE SERVO-Overhaul

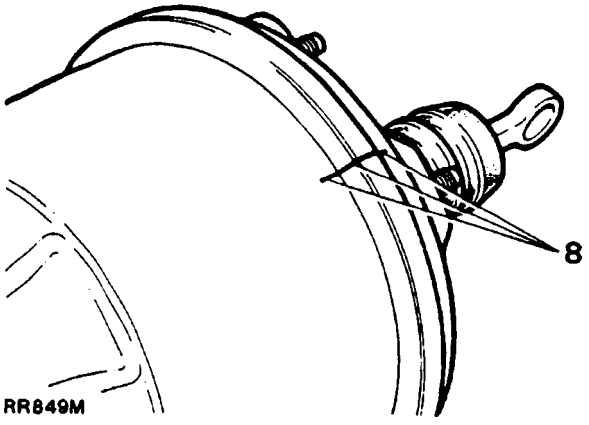
REMOVING THE SERVO

1. Remove the master cylinder from the servo.
2. Disconnect the servo vacuum hose from the non-return valve.
3. Remove the lower dash within the vehicle to gain access to the brake pedal linkage and servo retaining nuts located on the rear of the engine compartment closure panel.
4. Disconnect the brake pedal linkage.
5. Remove the four nuts with spring washers securing the servo to the closure panel.
6. Remove the servo from the engine compartment and place on a suitable clean bench.
7. Thoroughly clean the exterior of the servo.

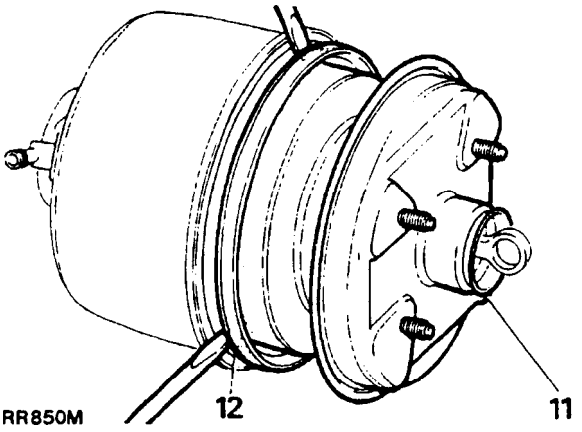
CAUTION: CARE MUST BE TAKEN TO ENSURE THAT ALL COMPONENTS ARE SCRUPULOUSLY CLEAN BEFORE UNDERTAKING THE OVERHAUL PROCEDURE. ANY DIRT OR GRIT WITHIN THE SERVO COULD RESULT IN DAMAGE TO THE DIAPHRAGMS.

DISMANTLING THE SERVO

8. Before dismantling the servo lightly scribe identification marks on the servo shell, clamp ring and cover plate to aid the assembly procedure.



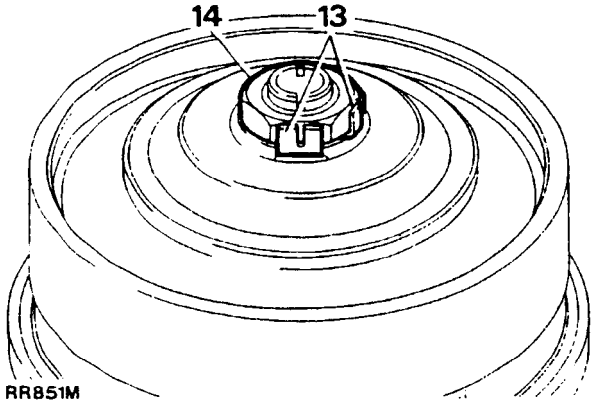
9. Remove the nut, bolt and plain washer securing the clamp to the servo.
10. Remove the rubber boot from the valve/push rod assembly.
11. Slide the servo cover off the valve body.
12. Using two screwdrivers inserted between the separator shell outer lip and servo shell, carefully lever the diaphragm assembly out of the shell.



13. Bend back the tabs of the locking washer.

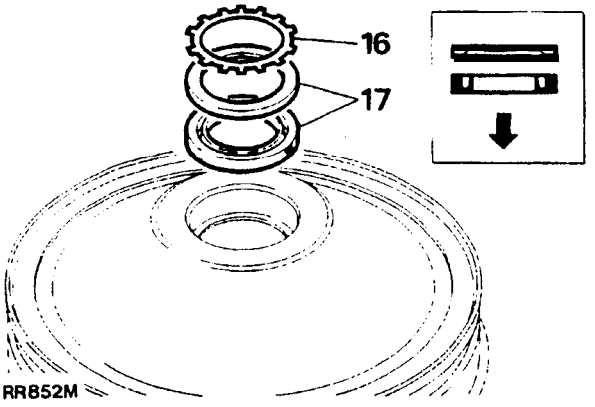
WARNING: Assistance may be required, to hold the diaphragm assembly together while the locknut is released, to prevent the unit separating due to internal spring pressure.

14. Remove the locknut and separate the assembly.

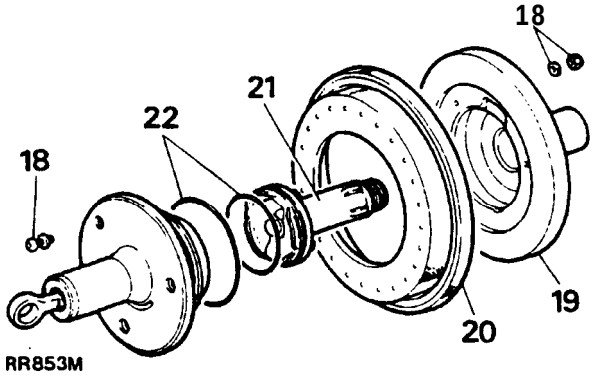


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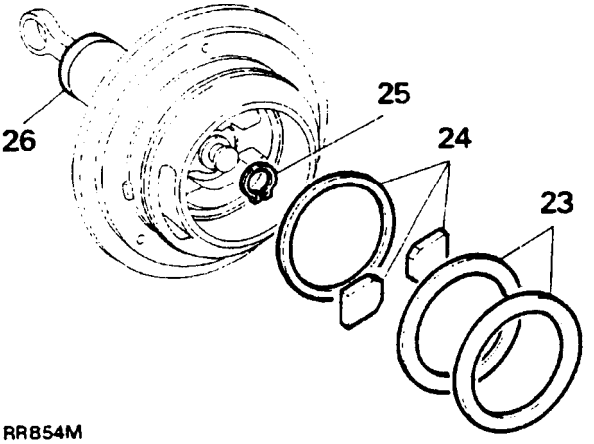
15. Remove the support plate, diaphragm and backing washer from the separator shell.
16. Pry the serrated bearing retainer out of the separator shell.
17. Remove the nylon bearing and rubber seal from the separator shell. Note their position for reassembly.



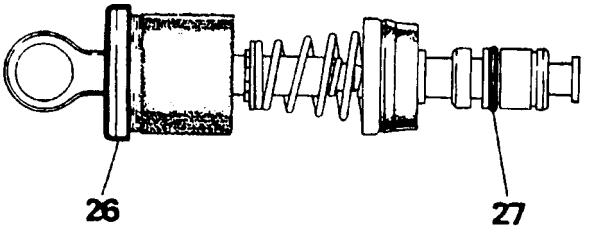
18. Remove the three screws, locknuts plain and fibre washers securing the diaphragm to the valve body.
19. Remove the diaphragm support and tube from the front of the diaphragm.
20. Remove the diaphragm from the valve body.
21. Pull the piston out of the valve body.
22. Remove the 'O' rings from the valve body and piston.



23. Remove the sponge seal and backing ring from the valve body.
24. Lift out the two levers and remove the bearing ring.
25. Release the circlip securing the valve/push rod assembly in the valve body.
26. Carefully pry the end cap from the opposite end of the valve body and withdraw the valve/push rod assembly complete.



27. Remove the small 'O' ring from the assembly.

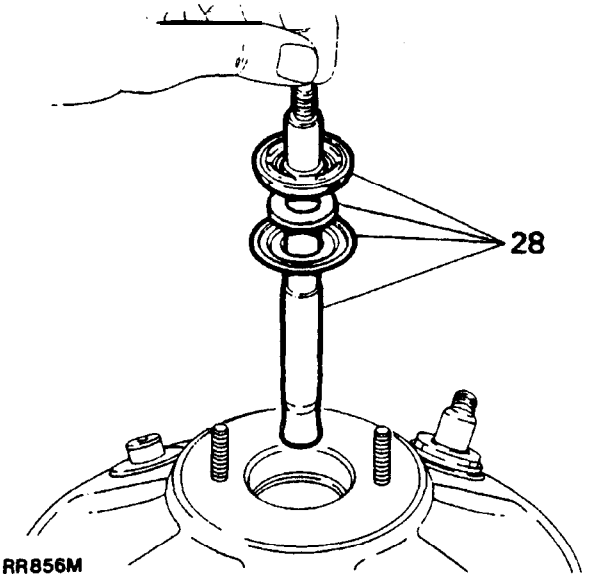


NOTE: The valve/push rod assembly cannot be further dismantled, if the seals and assembly are in a poor condition, fit a new assembly.

Continued

28. Remove the push rod, seal, washer and retainer from the servo shell.

NOTE: If a new push rod is fitted the operating length must be set after the servo has been assembled, see assembling procedure instruction number 61.



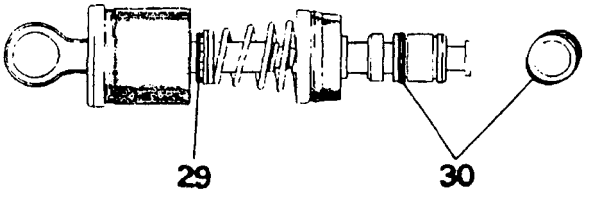
RR856M

ASSEMBLE THE SERVO

Carefully inspect all parts for wear and damage. Absolute cleanliness of all parts of the servo is essential.

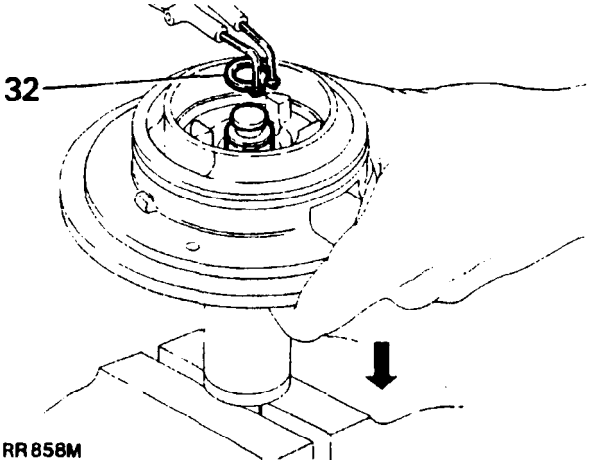
29. If a new valve/push rod assembly is being fitted it will be necessary to compress the spring located in the centre of the valve, to enable the circlip to be inserted into the groove, thus tensioning the seal.

30. Fit a new 'O' ring to the end of the valve. **DO NOT ROLL THE '0' RING INTO THE GROOVE.** Carefully stretch the seal and ease it down the valve and into the groove.



RR857M

31. Lubricate the seals with a suitable disc brake lubricant and push the assembly fully into the bore of the valve body.
32. Clamp the eye of the assembly in a bench vice. Press the valve body down to expose the circlip groove at the end of the valve/push rod assembly and fit the circlip.

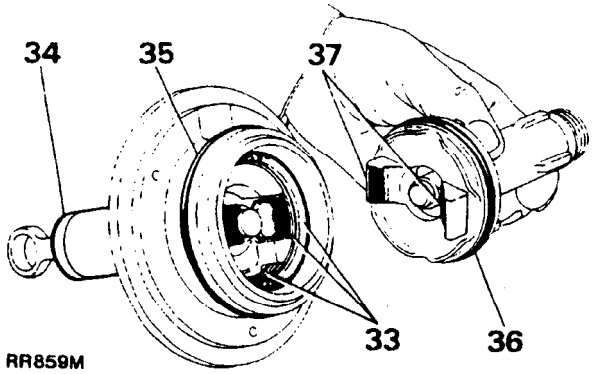


RR858M

33. Fit the bearing ring (thicker of the two rings), levers, backing ring and sponge seal to the valve body.

NOTE: Ensure that the chamfered edges of the levers are fitted firmly into the groove at the end of the push rod assembly.

34. Feed the sponge filter and felt pad into the opposite end of the valve body and press the end cap into position.
35. Lightly coat the new valve body 'O' ring with disc brake lubricant and ease the seal into the groove.
36. Lightly coat the new reaction piston 'O' ring with disc brake lubricant and ease the seal into the groove.
37. Push the piston into the valve body ensuring that the two projections on the piston are located over the levers in the valve body, push the piston firmly into position.

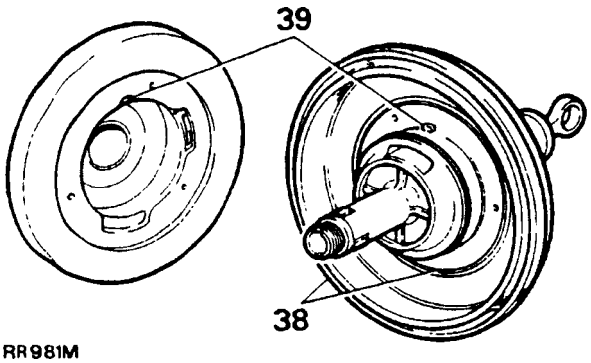


RR859M

38. Place the new diaphragm onto the valve body, locating the inner diaphragm bore onto the shoulder just outside the three bolt holes.

NOTE: DO NOT LUBRICATE THE DIAPHRAGM.

39. Fit the diaphragm support plate and tube to the valve body ensuring that the indent in the support plate lines up with the corresponding projection on the valve body.



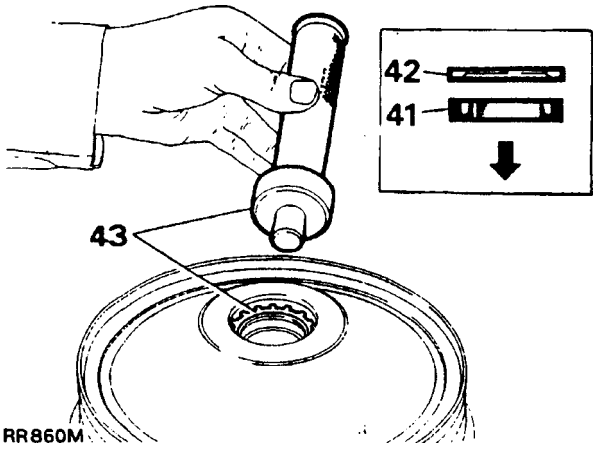
RR981M

40. Fit the three securing screws, washers and nuts, entering the bolts from the valve body side.

NOTE: The fibre washer is inserted behind the screw head.

Tighten to the correct torque see section 06-Torque values.

41. Coat the new nylon bearing and seal with a suitable disc brake lubricant and insert the seal into the separator shell, with the open edge of the seal facing upwards.
42. Fit the nylon bearing washer with the chamfered inner edge downwards.
43. Using a suitable service tool, example M5550, press in the new retaining ring, convex side first, until the retainer sits firmly on the nylon bearing.



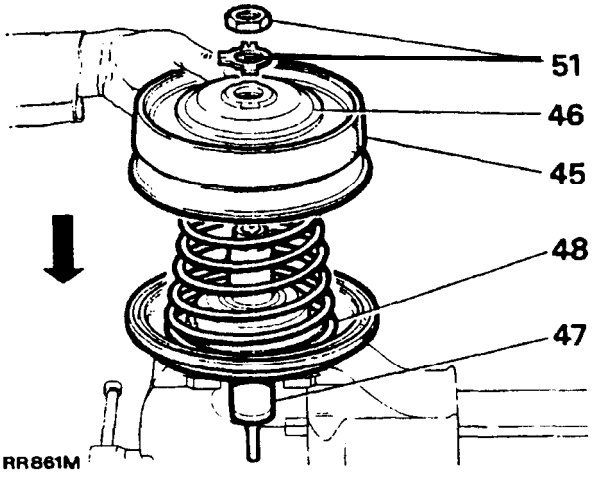
RR860M

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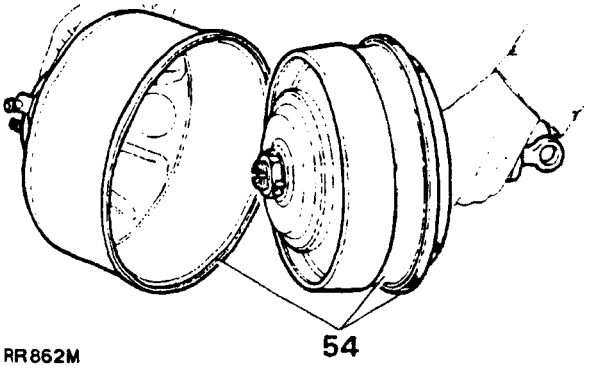
44. Fit the backing washer to the concave side of the separator shell diaphragm.
45. Fit the diaphragm to the separator shell, concave side first, locate the sealing lip over the edge of the separator.
46. Place the support plate onto the face of the diaphragm.
47. Mount the valve body into a bench vice.

CAUTION: DO NOT OVERTIGHTEN THE VICE. USE JAW PROTECTORS/COVERS. Coat the support plate tube with disc brake lubricant.

48. Place the spring onto the valve body, largest diameter to sit on support plate and tube.
49. Holding the separator shell assembly together place it on to the top of the spring.
50. Compress the complete assembly until the thread on the end of the reaction piston protrudes beyond the separator shell assembly.
51. Fit a new tab washer and screw on the large nut.



52. Remove the complete assembly from the vice. Tighten the locknut to the correct torque (see section 06-Torque values).
53. Bend up the tabs on the lock washer.
54. Locate the outer edge of the valve body diaphragm into the indent around the separator shell and push the assembly into the servo vacuum shell, ensure that the diaphragm remains in position.



55. Coat the new nylon bearing and seal for the servo end cover with disc brake lubricant and press the seal into the cover.

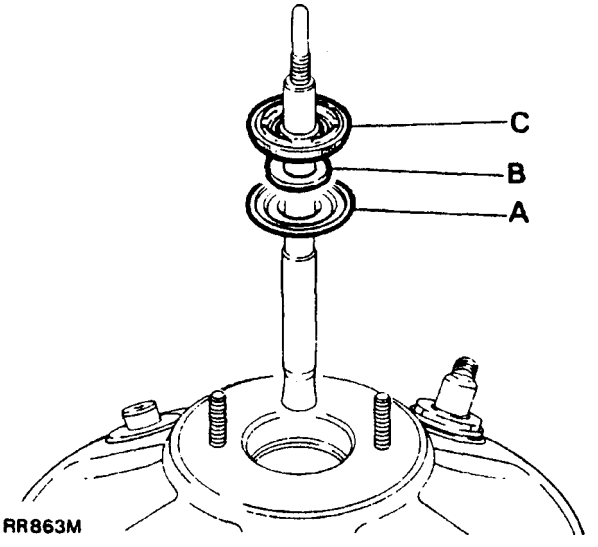
NOTE: THE OPEN FACE OF THE SEAL DOWNWARDS.

56. Fit the new bearing retainer using a suitable service tool example: MS550. Ensure the retainer sits firmly on top of the nylon bearing.
57. Lightly coat the valve body with disc brake lubricant ease the end cover onto the assembly and align the identification marks. Locate the beaded edge of the diaphragm between the end cover and servo shell.
58. Fit the clamp ring, bolt and nut, rotate the ring until the identification mark lines up with those on the servo unit. Tighten the clamp ring to the correct torque (see section 06-Torque values).
59. Fit a new rubber boot over the valve/push rod assembly.

60. Fit a new retainer, nylon washer and seal to the push rod, fit the push rod to the servo.

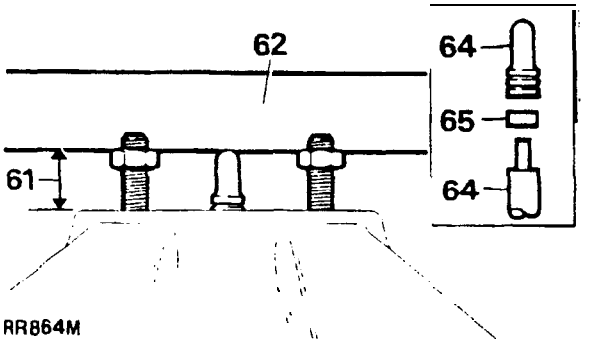
NOTE: Flat face of the seal to the bottom of the seal recess in the servo shell.

(A) Retainer
(B) Nylon washer
(C) Seal



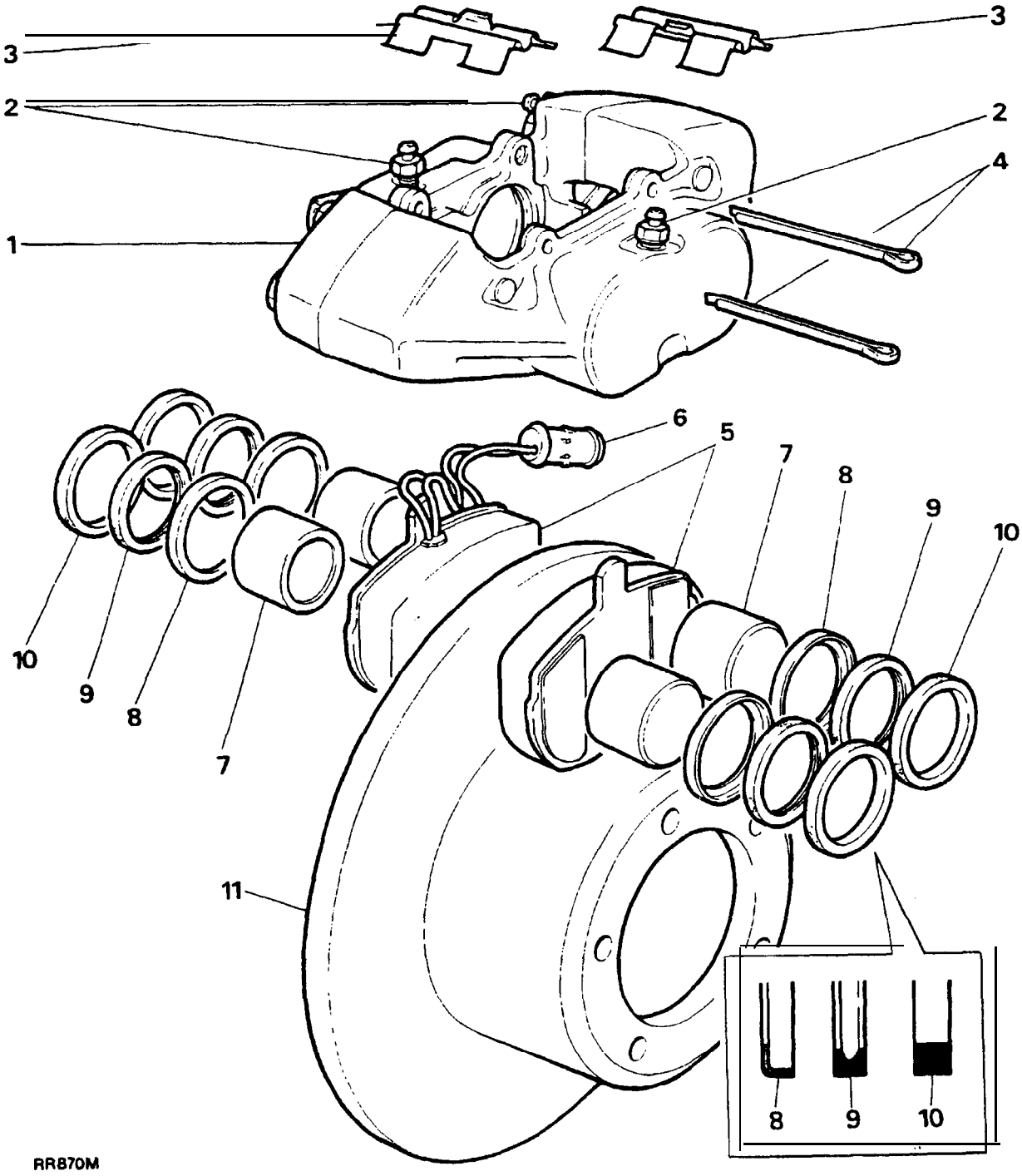
NOTE: If a new push rod is fitted, the operating length must be checked, if adjustment to the rod is required, adjust as follows.

61. Run two nuts down the studs at the master cylinder joint face of the servo. Set the top of the nuts to a dimension of 22.3-22.4 mm (0.876-0.881 inch).
62. Lay a straight edge across the top of the two nuts. Check the height of the push rod to the bottom of the straight edge.
63. If the push rod is out of the limits specified adjust as follows.
64. Remove the push rod from the servo, clamp the small domed end of the rod in a bench vice and detach the main stem.
65. Remove the small spacer. Increase or decrease the size of the spacer accordingly until the correct dimension is attained.
66. Coat the push rod seal with Lockheed disc brake lubricant and fit to the servo.



67. Carefully pry the non-return valve and seal out of the servo shell.
68. Fit new seal.
69. Inspect the non-return valve for condition, fit a new valve if necessary.
70. Fit non-return valve.
71. install the servo into the vehicle and tighten all bolts to the correct torque (see section 06-Torque values).
72. Reconnect the servo operating rod to the brake pedal with the pivot bolt eccentric in the forward position, do not fully tighten the pivot bolt nut.
73. Turn the pivot bolt to bring the brake pedal back until it just contacts the rubber then secure the pivot bolt nut.

FRONT BRAKE CALIPER ASSEMBLY



RR870M

KEY TO CALIPER

1. Caliper
2. Bleedscrews
3. Pad retaining springs
4. Retaining pins
5. Friction pads
6. Pad wear indicator plug
7. Piston
8. Wiper seal retainer
9. Wiper seal
10. Fluid seal
11. Brake disc

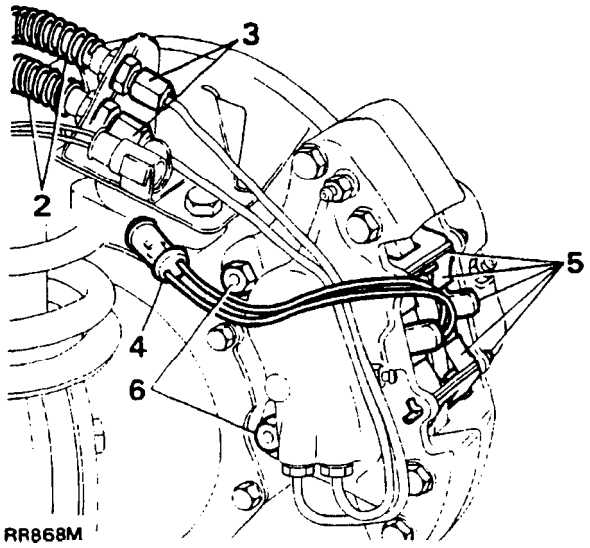
REMOVE AND OVERHAUL FRONT BRAKE CALIPERS

Service tool:
18G672-Piston clamp

NOTE: Pad wear warning indicators are incorporated into the front and rear right hand inboard pads.

Remove caliper

1. Loosen the front wheel retaining nuts, using a suitable hydraulic floor jack raise the front of the vehicle and lower onto axle stands and remove the wheels.
2. Expose the two flexible brake hoses by moving the coiled protective covering.
3. Using a recognised hose clamp, clamp both hoses to prevent loss of brake fluid, disconnect the rigid brake pipes from the flexible hoses, seal the ends of the hoses and pipe openings to prevent ingress of dirt. (If necessary the two rigid brake pipes to the caliper can be disconnected when the caliper is removed from the swivel pin housing).
4. Disconnect the pad wear warning indicator (front right hand side only).
5. Remove the retaining pins and springs, withdraw the pads. If the same pads are to be refitted, identify them for assembly to their original locations.
6. Remove the two bolts and withdraw the caliper from the disc.

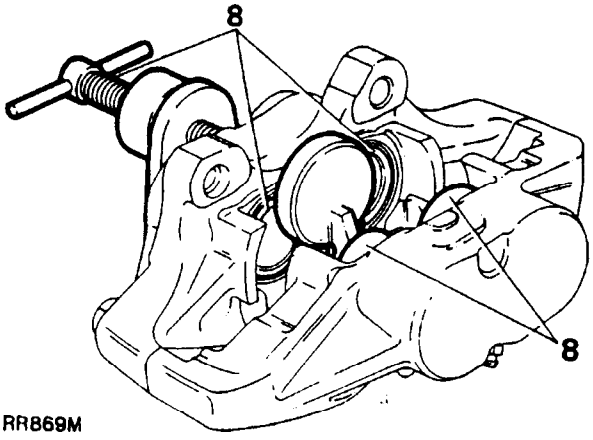


RR868M

DISMANTLE AND OVERHAUL

Do not separate the caliper halves

7. Clean the outer surfaces of the caliper with aerosol brake cleaner.
8. Using special tool 18G672, clamp the pistons in the inboard half of the caliper and gently, keeping fingers clear, and with CAUTION, apply air pressure to the fluid inlet port to expel the rim half pistons. Since it is unlikely that all pistons will expel at the same time, regulate the rate with a suitable piece of wood between the appropriate piston and caliper.



RR869M

Continued

9. Finally, remove the pistons keeping them identified with their respective bores.
10. Remove the wiper seal retainer by inserting a blunt screwdriver between the retainer and the seal and pry the retainer carefully from the mouth of the bore.
11. Taking care not to damage the seal grooves, extract the wiper seal and fluid seal.
12. Clean the bores, pistons and particularly the seal grooves with clean brake fluid or aerosol brake cleaner only. If the caliper or pistons are corroded or if their condition is not perfect new parts must be fitted.

Assemble outboard pistons

13. Coat a new fluid seal with a suitable disc brake lubricant. Ease the seal into the groove in the bore using only the fingers and ensure that it is properly seated. The fluid seal and the groove are not the same in section so that when the seal is seated it feels raised to the touch at the edge furthest away from the mouth of the bore.
14. Coat the appropriate piston with disc brake lubricant and insert it squarely into the bore by hand only. Do not tilt the piston during insertion and leave approximately 8mm (0.312 inch) projecting from the bore,
15. Coat a new wiper seal with disc brake lubricant and fit it to a new seal retainer. Slide the assembly, seal first, over the protruding piston and into the bore recess. Remove the piston clamp from the mounting half and use the clamp to press home the seal retainer and piston.

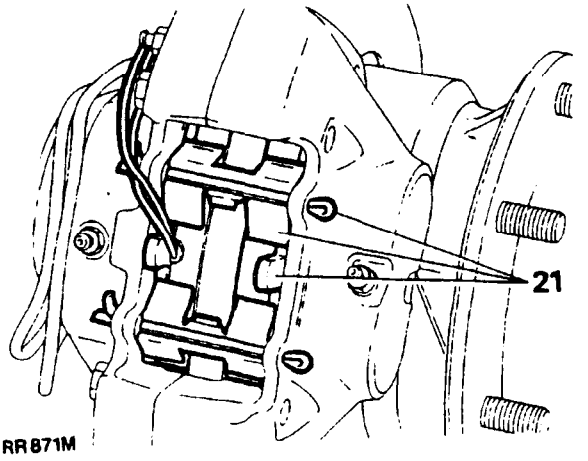
Mounting inboard pistons

16. Clamp the outboard pistons and carry out the same procedure as for removing and fitting the outboard pistons and seals, instructions 8 to 15.

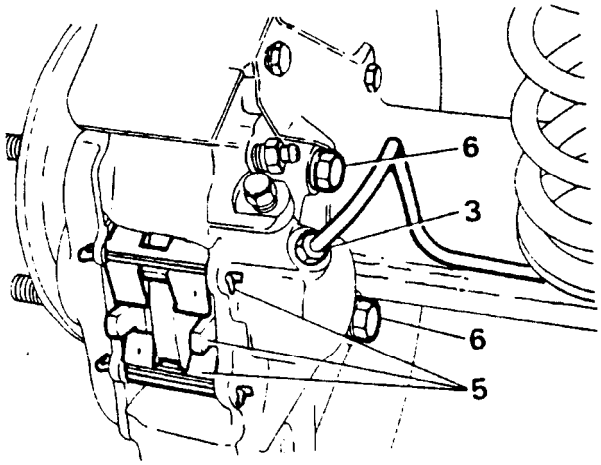
Fit calipers and pads to vehicle

17. Fit the caliper to the axle and secure with the two bolts tightening evenly to the correct torque (see section 06-Torque values).
18. Connect the brake flexible hoses to the caliper and tighten to the correct torque (see section 06-Torque values).
19. Remove the clamps from the hoses.
20. Lightly coat the back and edges of the pads with a suitable disc brake lubricant carefully avoiding the friction material.
21. Insert the pads and retaining springs, secure in position using new retaining pins and open out the ends. Note the correct position of the retaining springs.

NOTE: Ensure that the friction pad with the wear indicator is fitted to the inboard side of the front right hand caliper



22. Reconnect the pad wear indicator electrical plug.
23. Bleed both the primary and secondary brake systems. (Refer to page 4 for the brake bleeding procedure).
24. When the foregoing instructions have been completed on all calipers, press the brake pedal firmly several times to locate the friction pads.
25. Fit the road wheels, remove the axle stands and finally tighten the road wheel nuts.
26. Road test the vehicle, remembering that if new friction pads have been fitted they are not 'bedded-in' and may take several hundred miles before the brakes are at maximum efficiency.

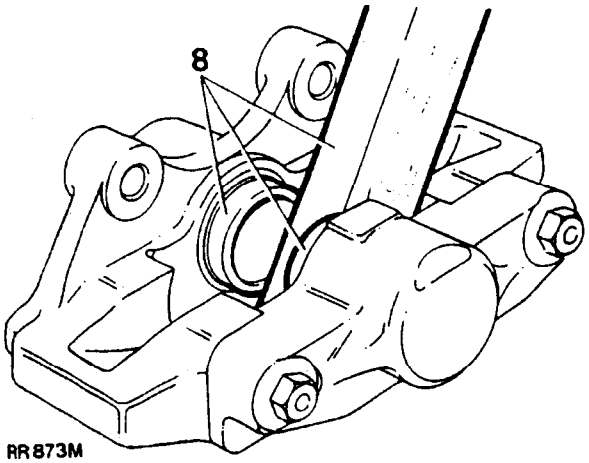


RR2007E

Dismantle and overhaul

Do not separate the caliper halves

7. Clean the outer surfaces of the caliper with aerosol brake cleaner.
8. **WITH CAUTION** expel the pistons from their bores by applying air pressure to the fluid inlet port. Since it is unlikely that both pistons will expel at the same time, regulate the rate with a suitable piece of wood inserted between the two pistons.



RR873M

9. Finally, remove the pistons keeping them identitied with their respective bores.

Continued

REMOVE AND OVERHAUL REAR BRAKE CALIPERS

Service tool:
18G672-Piston clamp

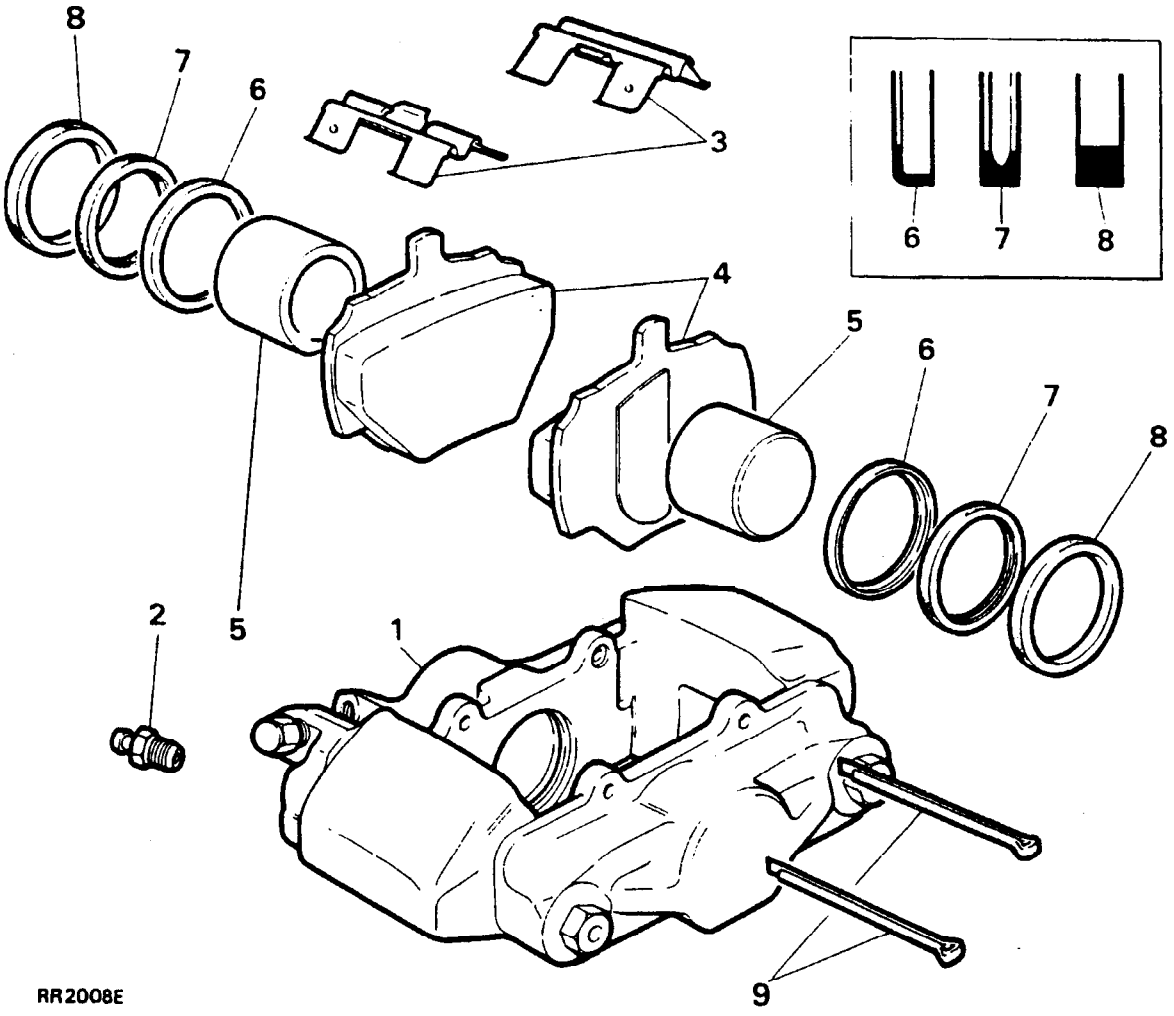
Remove caliper

1. Loosen the rear road wheel nuts and jack up the rear of the vehicle, lower onto axle stands and remove the wheels.
2. Using a recognised hose clamp, clamp the flexible brake hose above the rear axle, to prevent loss of fluid.
3. Remove the brake pipe(s) from the rear brake caliper(s). Seal the ends of the pipe to prevent ingress of dirt.
4. Rear right hand caliper only, disconnect the pad wear indicator.
5. Remove the retaining pins and springs and withdraw the pads. If the same pads are to be refitted, identify them for assembly to their original locations.
6. Remove the two bolts and withdraw the caliper from the axle.

10. Remove the wiper seal retainer by inserting a blunt screwdriver between the retainer and the seal and pry the retainer carefully from the mouth of the bore.
11. Taking care not to damage the seal grooves, extract the wiper seal and fluid seal.
12. Clean the bores, pistons and particularly the seal grooves with clean brake fluid or aerosol brake cleaner only. If the caliper or pistons are corroded or their condition is not perfect new parts must be fitted.

REAR BRAKE CALIPER ASSEMBLY

LH Rear Caliper illustrated



KEY TO CALIPER

1. Caliper
2. Bleed screw
3. Pad retaining springs
4. Friction pads
5. Piston
6. Wiper seal retainer
7. Wiper seal
8. Fluid seal
9. Retaining pins

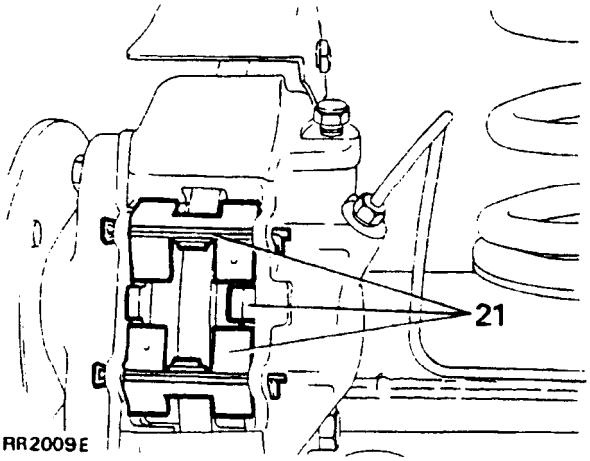
13. Coat a new fluid seal with a suitable disc brake lubricant. Ease the seal into the groove in the bore using only the fingers and ensure that it is properly seated. The fluid seal and the groove are not the same in section so that when the seal is seated it feels raised to the touch at the edge furthest away from the mouth of the bore.
14. Coat the appropriate piston with a suitable disc brake lubricant and insert it squarely into the bore by hand only. Do not tilt the piston during insertion and leave approximately 8mm (0.312 inch) projecting from the bore.
15 Coat a new wiper seal with a suitable disc brake lubricant and fit it to a new seal retainer. Slide the assembly, seal first, over the protruding piston and into the bore recess.
16 Using special tool 18G672-piston clamp, press home the seal retainer and piston.

Mounting inboard piston

17. Carry out the same procedure as for removing and fitting the outboard piston and seals, instructions 8 to 16.

Fit calipers and pads to vehicle

18. Fit the caliper to the axle and secure with the two bolts tightening evenly to the correct torque (see section 06-Torque values).
19. Connect the brake pipes to the calipers and remove the clamp from the flexible brake hose above the rear axles, see section 06-Torque values for brake pipe to caliper tightening torque.
20. Lightly coat the back and edges of the pads with disc brake lubricant carefully avoiding the friction material.
21. Insert the pads and retaining springs, secure in position with new retaining pins and spread the ends. Note the correct position of the retaining springs.



NOTE: Ensure that the friction pad with the wear indicator is fitted to the inboard side of the rear right hand, brake caliper.

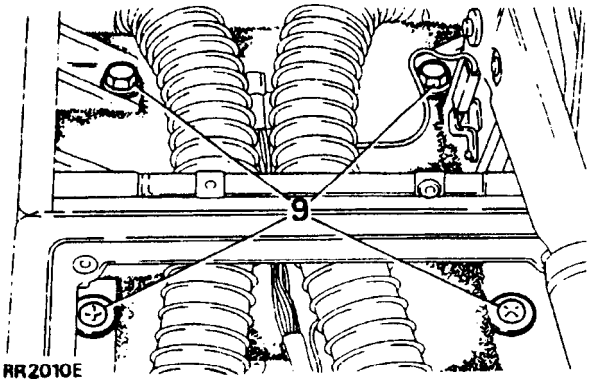
22. Reconnect the pad wear indicator electrical multi-plug.
23. Bleed the secondary brake system at the rear calipers, starting at the caliper furthest away from the master cylinder.
24. When the foregoing instructions have been completed on both calipers, press the brake pedal firmly several times to locate the friction pads.
25. Fit the road wheels, remove the axle stands and finally tighten the road wheel nuts, (see section 06 - Torque values).
26. Road test the vehicle, remembering that if new friction pads have been fitted they are not 'bedded-in' and may take several hundred miles before the brakes are at maximum efficiency.

PARKING BRAKE LEVER

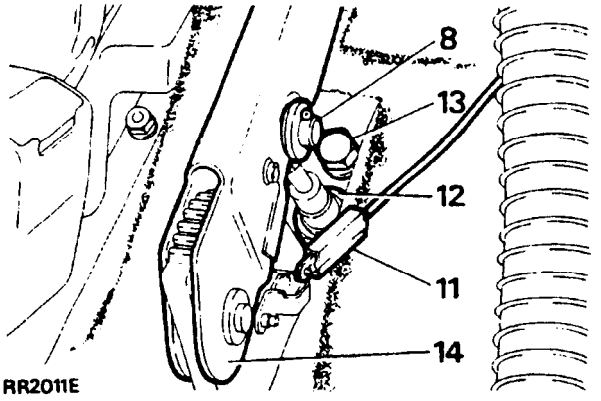
Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Chock the road wheels and release the parking brake.
3. Open the glove box lid and remove the four screws securing the glove box liner to the outer surround and lift out the liner.
4. Remove the two electrical leads at the rear of the glove box cigar lighter and release the two heater hoses from their retaining clamps.
5. Carefully pry the window lift switch panel away from the front of the glove box. Maneuver the panel through the opening and into the inside of the glove box.
6. Remove the main gear selector knob and transfer gearbox knob.
7. Carefully pry the centre panel out of the gearbox tunnel mounted console, and disconnect the electrical multi-plug to the inset graphics panel, withdraw the panel off the main gearbox selector.
8. Remove the cotter pin, plain washer and clevis pin securing the parking brake cable to the parking brake lever.
9. Remove the four bolts and plain washers. Two are located immediately behind the parking brake lever accessible from inside the glove box. The remaining two bolts are located forward of the parking brake lever accessible from the floor mounted console opening.



10. Raise the parking brake lever to its uppermost position and ease the glove box and console assembly rearwards to release the location tab from the radio housing, lift the assembly off the gearbox tunnel.
11. Disconnect the electrical lead from the parking brake warning switch.
12. Release the parking brake cable outer retaining nut.
13. Remove the remaining single bolt with plain washer securing the front of the parking brake mounting bracket.
14. Withdraw the parking brake lever assembly off the parking brake outer cable.



Refitting

15. Fit the parking brake lever to the gearbox tunnel and secure in position with the single bolt (with plain washer) forward of the lever mounting bracket.
16. Secure the outer parking brake cable to the mounting plate and tighten the nut securely.
17. Refit the glove box/console assembly and secure in position, tightening the remaining bolt and two screws securely.
18. Fit the inner parking brake cable to the parking brake lever using a new cotter pin.
19. Reverse the remaining removal instructions, ensuring that the electrical wiring in the glove box assembly is arranged to prevent it from becoming trapped between any mating faces.

OVERHAUL PARKING BRAKE

WARNING: Do not use an air line to remove dust from the brake assembly. Asbestos dust from the brake linings can be a serious health risk, if inhaled.

DISMANTLING

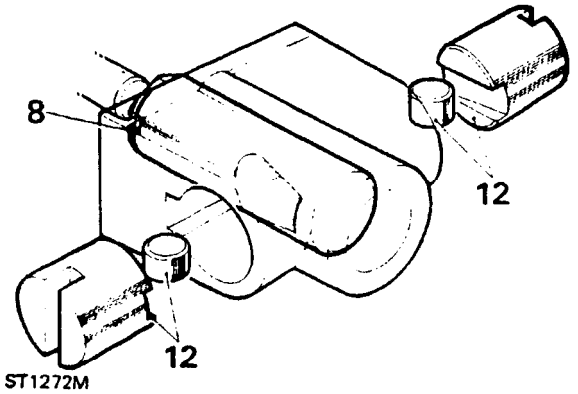
1. Disconnect the battery negative terminal and chock the road wheels for safety. Release the parking brake, select 'P' in main gearbox and release the parking brake.
2. Disconnect the drive shaft from the output flange.
3. Loosen off the brake adjuster, remove the two screws and withdraw the brake drum. Inspect the friction surface of the drum, turn if excessively scored or oval.

   NOTE: If drum requires skimming the maximum diameter is 255.65 mm (10.06 in).

4. Remove the cotter pin and clevis pin connecting the parking brake inner cable to the brake actuating lever.
5. Remove the brake shoes complete with pull-off springs. Note position of springs in relation to the shoes.
6. Remove the four bolts securing back plate to transfer box and withdraw the back plate complete with oil catcher.

Remove and overhaul expander assembly

7. Remove the rubber dust cover.
8. Remove the expander and drawlink.
9. Remove the retainer spring plate.
10. Remove the locking plate.
11. Remove the packing plate and withdraw the expander assembly from the back plate.
12. Remove the two plungers and rollers.



ST1272M

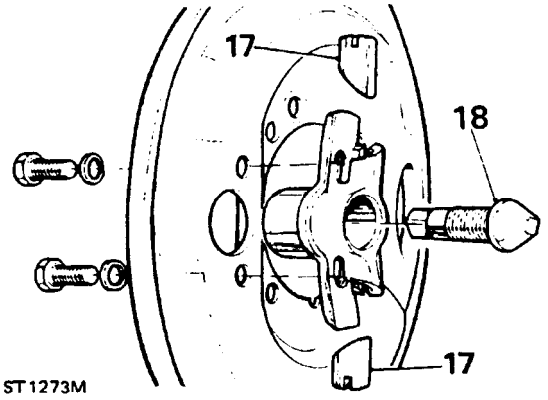
13. Clean all parts in aerosol brake cleaner and allow to dry. Examine the components for wear and discard if unsatisfactory.

Assemble expander assembly

14. Grease and fit the expander and drawlink.
15. Grease and fit the plungers and rollers, fitting the plungers with the highest end of the roller groove towards the backplate.

Remove and overhaul adjuster assembly

16. Remove the two bolts and withdraw the adjuster assembly from the back plate.
17. Remove the plungers.
18. Screw the adjuster cone inwards to remove from the housing.

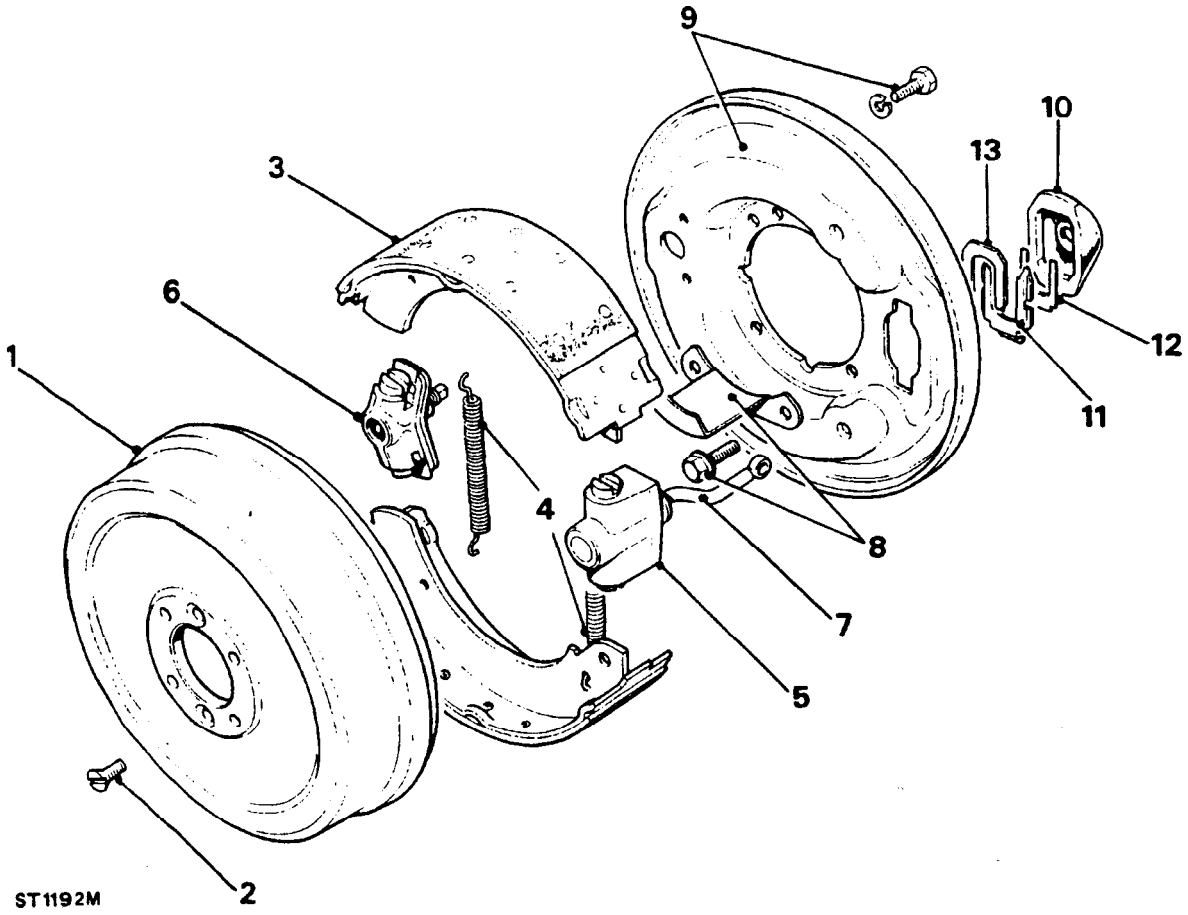


ST1273M

19. Thoroughly clean the parts in aerosol brake cleaner and discard any unsatisfactory components.

KEY TO PARKING BRAKE

1. Brake drum
2. Brake drum retaining screws
3. Brake shoes
4. Brake shoes pull-off springs
5. Expander assembly
6. Adjuster assembly
7. Drawlink
8. Oil catcher
9. Back plate and retaining bolts
10. Dust cover
11. Locking plate
12. Packing plate
13. Spring plate



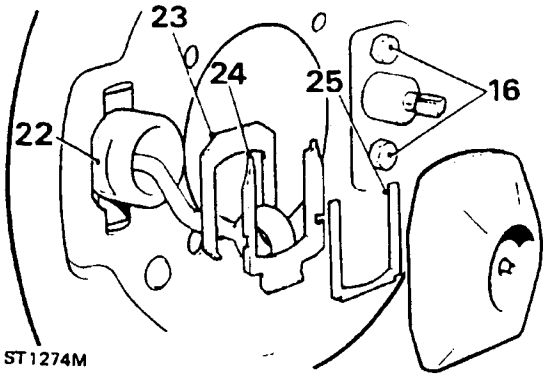
Assembly adjuster assembly

20. Grease and screw in the adjuster cone.
21. Grease and fit the adjuster plungers and align the chamfered ends with the adjuster cone. Note that the two plungers are identical and can be fitted to either bore. Secure the assembly with a rubber band to prevent the plungers falling out.

ASSEMBLE

NOTE: If the brake linings are oil-soaked, fit new brake shoes. Check and if necessary fit a new output shaft oil seal.

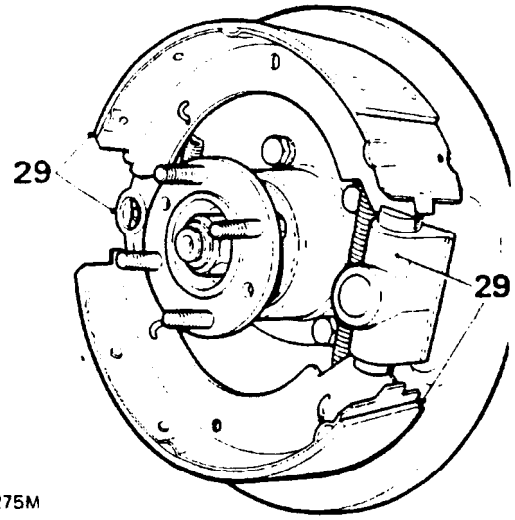
22. Position the expander assembly on the inside of the back plate and secure with the following plates at the rear of the back plate.
23. Spring plate.
24. Locking plate.
25. Packing plate.
26. Fit the rubber dust cover.



ST1274M

27. Fit the adjuster assembly to the back plate with the two bolts but do not fully tighten at this stage.
28. Fit the back plate assembly and oil catcher to the transfer box with the four bolts and tighten to the correct torque (see section 06-Torque values).
29. Fit new pull-off springs to the brake shoes and fit to the back plate.

NOTE: That the fully lined end of the lower shoe must be toward the expander assembly and the fully lined end of the upper shoe towards the adjuster assembly.



ST1275M

30. Fit the brake drum and tighten the two screws to the correct torque (See Section 06 Torque Values)
31. Connect the actuating lever to the inner parking brake cable using a new clevis pin, washer and cotter pin.
32. Turn the adjuster cone fully in and tighten the two retaining bolts left loose in instruction 27.
33. Loose off the adjuster two 'clicks' and firmly apply and release the parking brake lever to centralise the shoes. The drum should then rotate freely.
34. Adjust the parking brake cable lock nuts until the parking brake lever is fully operational on the second or third notch of the parking brake rachet.
35. Connect the drive shaft and evenly tighten the retaining nuts to the correct torque (see section 06-Torque values).
36. Remove chocks from wheels and connect the battery.

PARKING BRAKE CABLE

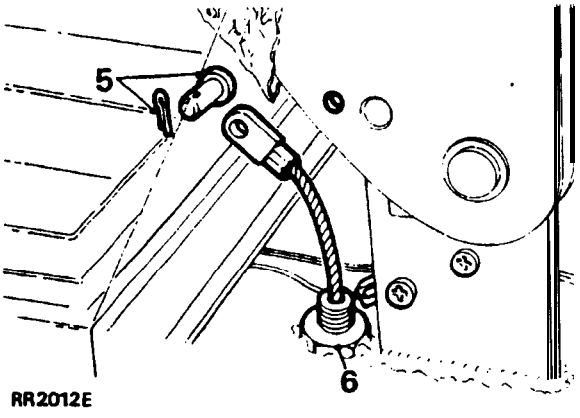
Remove and refit

Removing

1. Set the vehicle on a level surface and chock the road wheels and select 'P' in the main gearbox.
2. Disconnect the battery negative terminal and release the parking brake.

From inside the vehicle

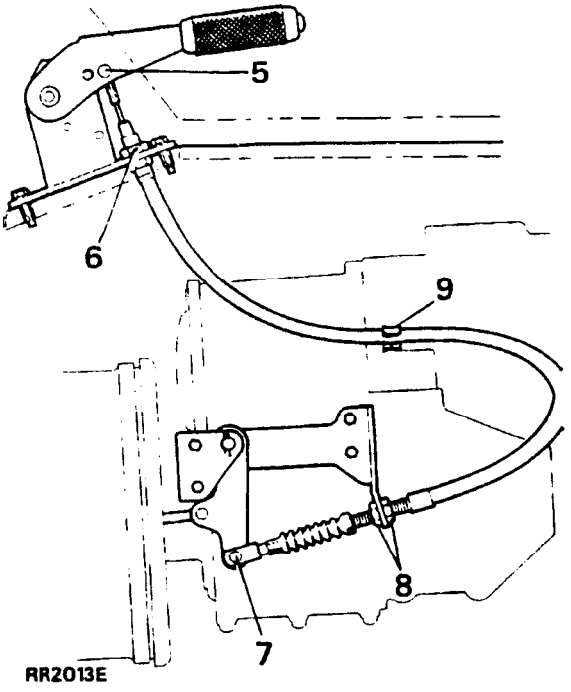
3. Remove the four screws securing the liner in the glove box.
4. Lift out the liner to gain access to the bottom of the parking brake pivot bracket.
5. Remove the cotter pin and clevis pin from the parking brake lever.
6. Release the nut securing the parking brake outer cable to the top of the parking brake mounting bracket. Slide the nut up the cable and push the inner and outer cable through the floor panel to the underside of the vehicle.



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From underneath the vehicle

7. Remove the cotter pin, plain washer and clevis pin securing the adjustment link to the brake drum actuating lever.
8. Release the locknuts securing the parking brake outer cable to the retaining bracket.
9. Release the outer cable from the 'P' clamp located on top of the transfer gearbox, and withdraw the cable assembly from the vehicle.



RR2013E

Fit new cable

10. Feed the parking brake cable assembly through the floor opening and secure the outer cable in position with the retaining nut.
11. Secure the cable to the parking brake lever, using a new cotter pin.
12. Secure the outer cable into the 'P' clamp.
13. Position the outer cable into the retaining bracket bolted to the side of the transfer gearbox and loosely secure in position with the two outer cable lock nuts.
14. Reconnect the outer cable to the brake drum actuating lever. Fit the clevis'pin, plain washer and new cotter pin.
15. Rotate the brake drum adjuster clockwise until the brake shoes are fully expanded against the drum.
16. Tighten the two brake cable outer lock nuts to secure the cable to its mounting bracket.
17. Apply the parking brake, and loosen the brake drum adjuster until the parking brake lever fully operates the brake shoes on the second or third notch of the parking brake ratchet.
18. Refit the glove box liner.

BRAKE SYSTEM-(Vehicles fitted with Lucas Girling master cylinder and servo)

Description

The hydraulic braking system fitted to Range Rovers is the dual line type, incorporating primary and secondary hydraulic circuits.

NOTE: References made to primary or secondary do not imply main service brakes or emergency brakes but denote hydraulic line identification.

The brake pedal is connected to a vacuum assisted mechanical servo which in turn operates a tandem master cylinder. The front disc brake calipers each house four pistons, the upper pistons are fed by the primary hydraulic circuit, the lower pistons by the secondary hydraulic circuit. The rear disc brake calipers each house two pistons, these are fed by the secondary hydraulic circuit via a pressure reducing valve.

A brake fluid level switch is incorporated into the reservoir cap assembly, the switch having detected either low or sudden fluid loss will immediately illuminate a warning light in the instrument binnacle.

The brake fluid reservoir is divided, the section closest to the servo feeds the primary circuit and the section furthest from the servo feeds the secondary circuit. Under normal operating conditions both the primary and secondary circuits operate simultaneously on brake pedal application. In the event of a failure in the primary circuit the secondary circuit will still function and operate front and rear calipers. Alternatively, if the secondary circuit fails the primary circuit will still function and operate the lower pistons in the front calipers, allowances should be made and vehicle speed adjusted accordingly to allow for the lack of full braking efficiency.

If the servo should fail, both hydraulic circuits will still function but would require greater pedal effort due to the lack of vacuum assistance.

The hand operated parking brake acts on a brake drum at the rear of the transfer gearbox and is completely independant of the hydraulic circuits.

Brake pad wear sensors are incorporated in the front and rear right hand side inboard brake pads. The sensors will illuminate a brake pad wear warning light in the instrument binnacle, when pad thickness has been reduced to approximately 3mm (0.118 in).

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 (gasoline) based cleaning fluids or any proprietary fluids containing petroleum (gasoline). The prefered fluids are clear methylated spirits, industrial alcohol or a proprietary aerosol brake cleaning product.

DO NOT use brake fluid previously bled from the system.

DO NOT use old or stored brake fluid.

ENSURE that only new fluid is used and that it is taken from a sealed container.

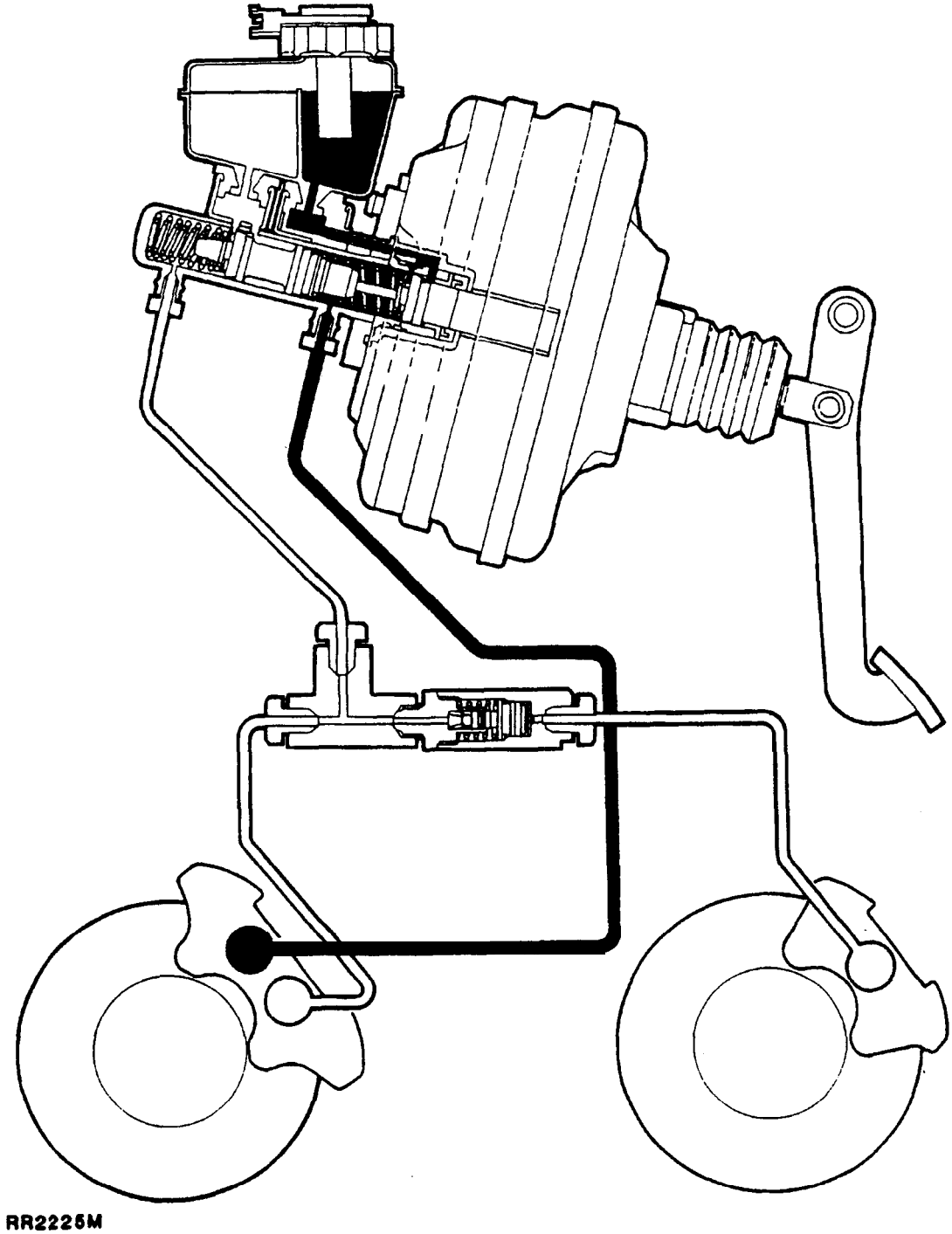
DO NOT flush the brake system with any fluid other than the recommended brake fluid.

The brake system should be drained and flushed at the recommended service intervals.

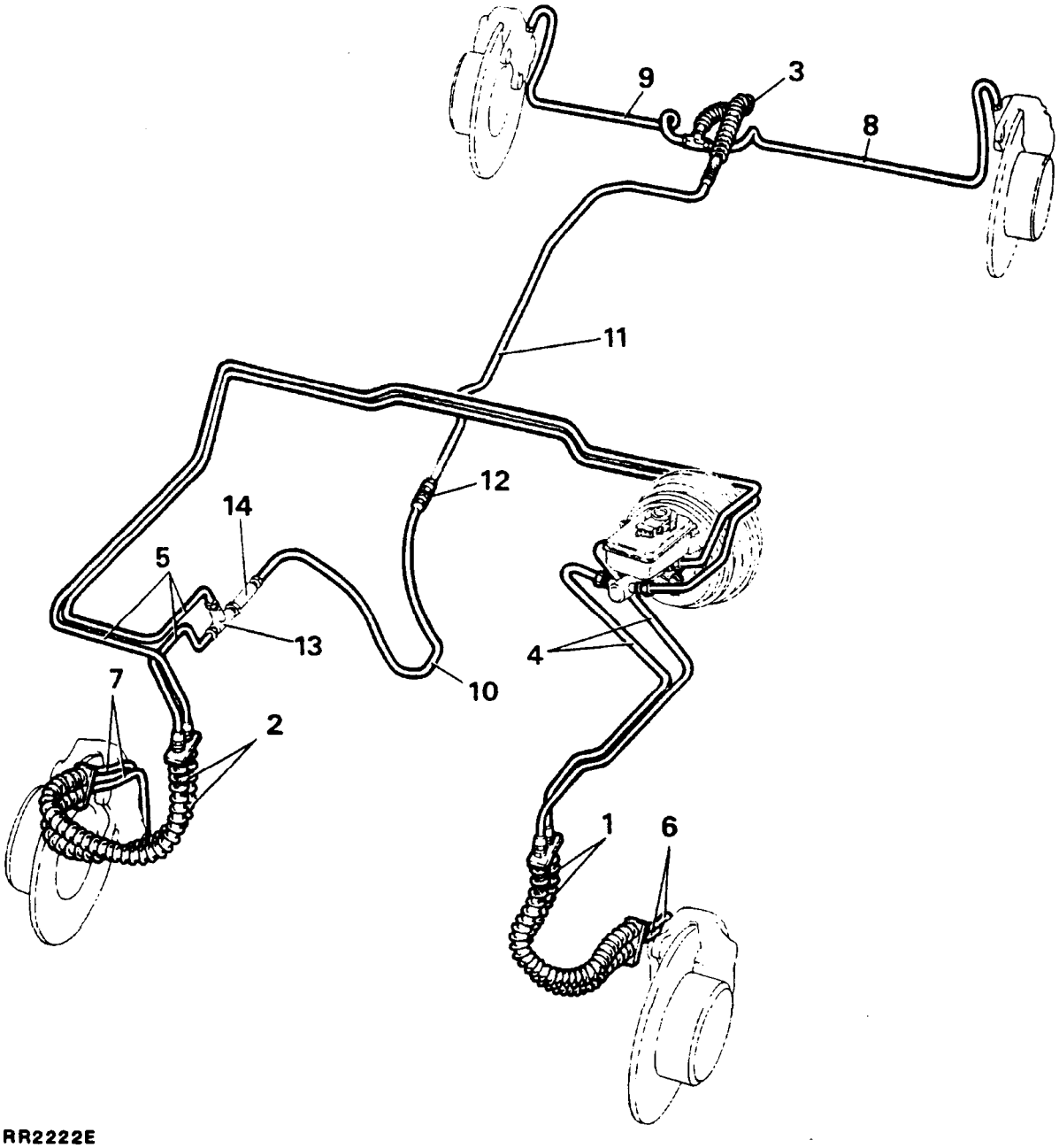
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PRIMARY HYDRAULIC CIRCUIT

SECONDARY HYDRAULIC CIRCUIT



RR2225M



RR2222E

BRAKE PIPE LAYOUT
Left hand drive

HOSES

1. Front left hand flexible hoses.
2. Front right hand flexible hoses.
3. Intermediate flexible hose.

PIPES

4. Feed to front left hand hose connector.
5. Feed to front right hand hose connector.
6. Feed to front left hand caliper.
7. Feed to front right hand caliper.
8. Feed to rear left hand caliper.
9. Feed to rear right hand caliper.
10. Feed to two way connector.
11. Feed to intermediate hose.
12. Two way connector.
13. Three way connector.
14. Pressure reducing valve.

Continued

WARNING: Some components on the vehicle such as gaskets and friction surfaces (brake linings, clutch discs, or automatic transmission brake bands), may contain asbestos. Inhaling asbestos dust is dangerous to your health and the following essential precautions must be observed :-

* Work out of doors or in a well ventilated area and wear a protective mask.

* Dust found on the vehicle or produced during work on the vehicle should be removed by vacuuming or by using a well dampened cloth and not by blowing.

* Dust waste should be dampened, placed in a sealed container and marked to ensure safe disposal.

* If any cutting, drilling etc, is attempted on materials containing asbestos the item should be dampened and only hand tools or low speed power tools used.

BRAKES

Bleed

The hydraulic system comprises two completely independent circuits. The rear calipers and the lower pistons in the front calipers form the secondary circuit, while the upper pistons in the front calipers form the primary circuit, The following procedure covers bleeding the complete system, but it is permissible to bleed one circuit only if disconnections are limited to that circuit.

Bleeding will be assisted if the engine is run or a vacuum supply is connected to the servo.

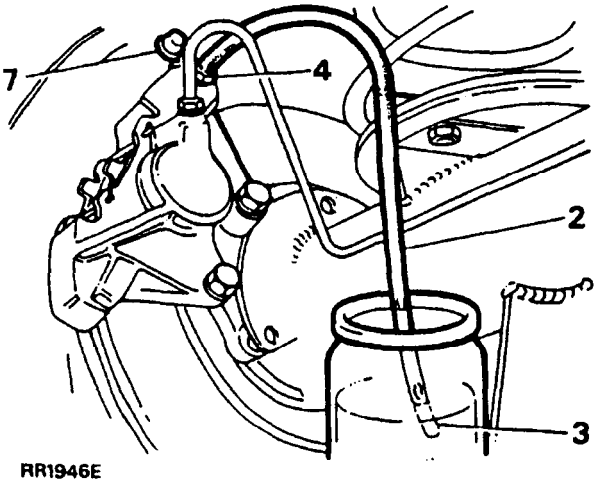
WARNING: IF THE ENGINE IS RUNNING DURING THE BRAKE BLEEDING PROCESS ENSURE THAT NEUTRAL OR PARK IS SELECTED IN THE MAIN GEARBOX AND THAT THE PARKING BRAKE IS APPLIED.

When bleeding any part of the secondary circuit, almost full brake pedal travel is available. When bleeding the primary circuit only, brake pedal travel will be restricted to approximately half.

NOTE: When bleeding the system commence with the caliper furthest from the master cylinder and bleed from the screw on the same side as the fluid inlet pipes, then close the screw and bleed from the screw on the opposite side of the same caliper. Tighten the bleed screws to the correct torque value. See section 06

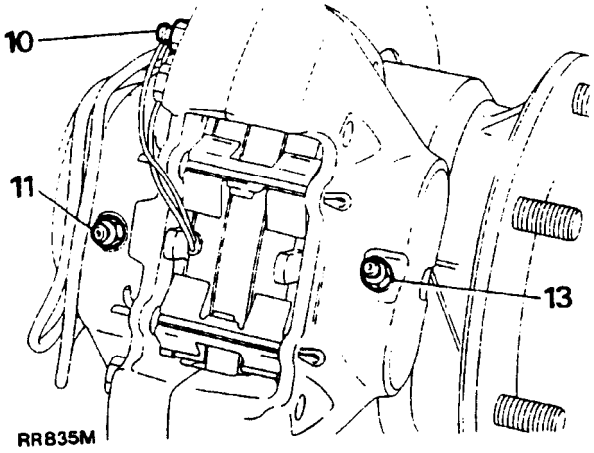
Bleeding

1. Fill-the fluid reservoir with the correct grade of fluid, see section 09 lubricants and fluids.
   NOTE: The correct fluid level must be maintained throughout the procedure of bleeding.
2. Connect a bleed hose to the bleed screw on the rear caliper furthest from the master cylinder.
3. Submerge the free end of the bleed hose in a container of clean brake fluid.
4. Loosen the bleed screw 1/2-3/4 of a turn.
5. Operate the brake pedal fully and allow to return.
   NOTE: Allow at least five seconds to elapse with the foot right off the pedal to ensure that the pistons fully return before operating the pedal again.
6. Repeat 5 until fluid clear of air bubbles appears in the container, then keeping the pedal fully depressed, tighten the bleed screw.
7. Remove the bleed hose and replace the dust cap on the bleed screw.



RR1946E

8. Repeat 1 to 7 fr the other rear caliper.
9. Remove the front wheel on the side furthest from the master cylinder.
10. Connect a bleed hose to the primary bleed screw on the front caliper furthest from the master cylinder.
11. Connect a bleed hose to the secondary bleed screw on the same side of the caliper as the primary screw.
12. Repeat 3 to 7 for the front caliper, bleeding from the two screws simultaneously.
13. Connect a bleed hose to the other screw on the front caliper furthest from the master cylinder.



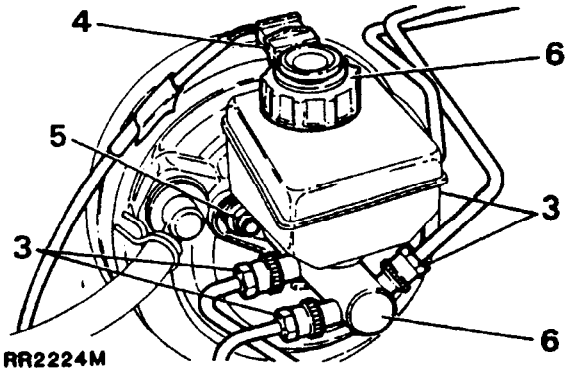
14. Repeat 3 to 7 for the second secondary screw on the front caliper.
15. Refit the front wheel.
16. Repeat 9 to 15 for the front caliper nearest the master cylinder.

MASTER CYLINDER • Lucas Girling • Type 25.4mm AS/AS

Remove, overhaul and refit

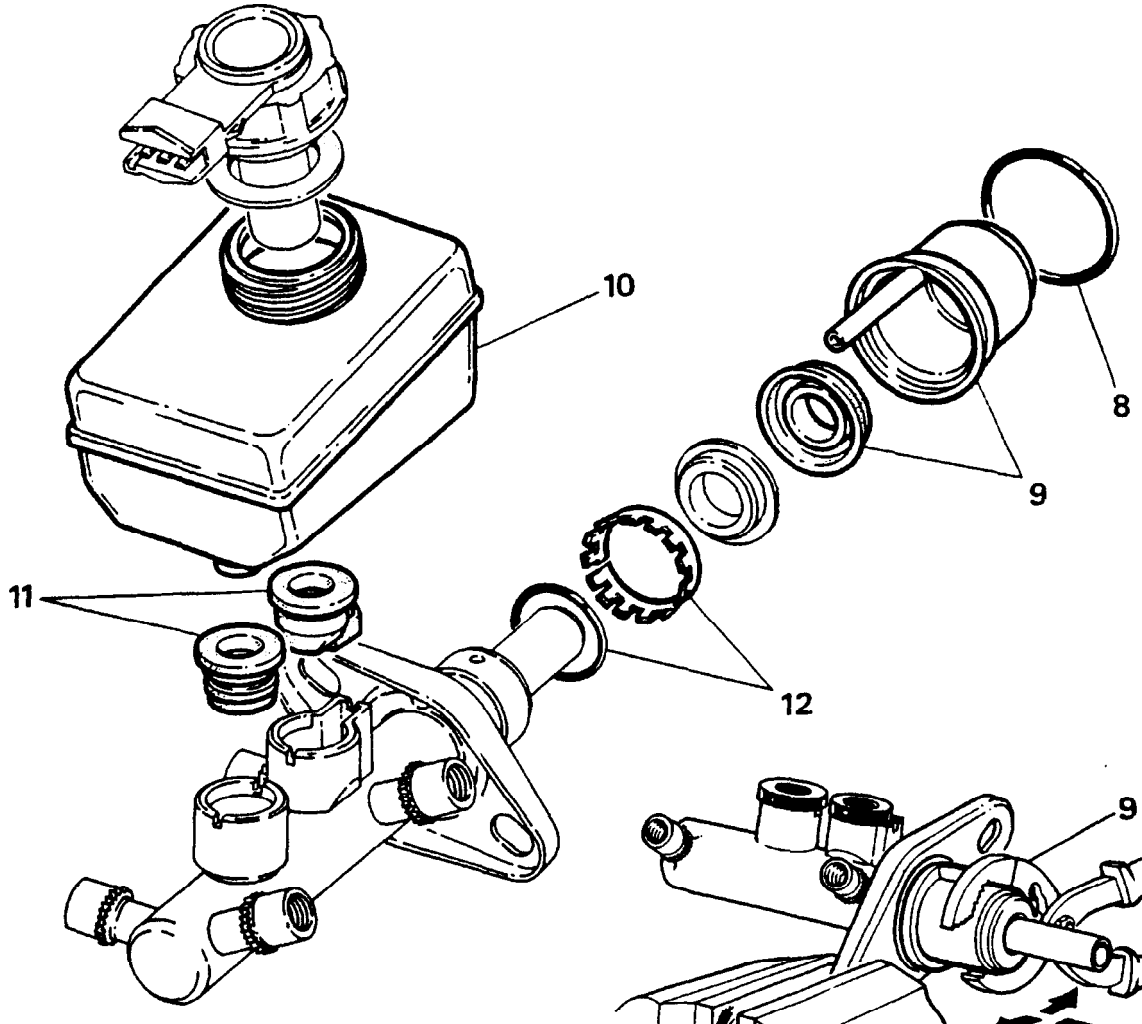
Removing

1. Disconnect the battery negative terminal.
2. Place a suitable container under the master cylinder to catch any brake fluid which may seep from the cylinder when the brake pipes are disconnected from the outlet ports.
3. Thoroughly clean the immediate area around all outlet ports. Remove each of the brake pipes from the master cylinder in turn, sealing each pipe and outlet port with suitable plugs as they are disconnected, to prevent ingress of foreign matter and excessive fluid loss.
4. Disconnect the electrical plug from the low fluid switch located on the reservoir cap.
5. Remove the two nuts securing the master cylinder to the servo unit remove also the spring and plain washers.
6. Detach the the master cylinder from the servo, remove the reservoir cap and drain the brake fluid into a suitable container.



WARNING: Do not use brake fluid previously drained or bled from the system. Carefully dispose of unwanted fluid, if stored in a sealed container, ensure that the container is marked USED BRAKE FLUID.

Continued

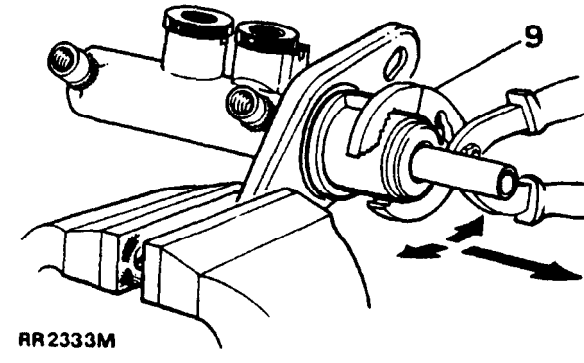


RR2237M

Overhaul

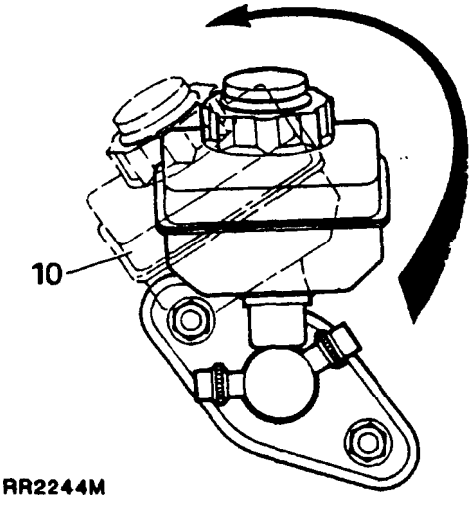
WARNING: Use only clear methylated spirit or unused brake fluid to clean any part of the brake system. DO NOT use petrol, kerosene or other mineral based fluids.

7. Before commencing the overhaul procedure thoroughly clean the master cylinder and inspect the outer surfaces for damage and condition, renew the complete assembly if necessary.
8. Using two soft jaws, one either side of the master cylinder flange, clamp the flange in a suitable vice. Remove the water ingress 'O' ring seal from the master cylinder to servo flange and discard.
9. Grip the outside of the transfer housing with asuitable pair of pliers, carefully pull, while working the pliers in a backwards and forwards rocking motion to ease the housing off the master cylinder, discard the housing and vacuum seal.



RR2333M

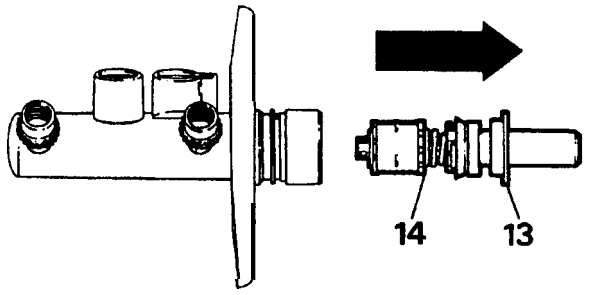
10. Ease the reservoir out of the master cylinder taking care to ensure that the two outlet ports on the bottom of the reservoir do not become damaged during this process.



RR2244M

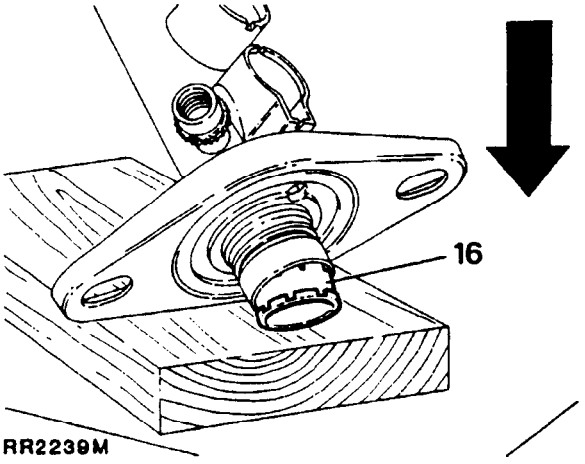
11. Withdraw the two reservoir seals from the master cylinder inlet ports the seals are different and should be noted for assembly, discard both of the seals.
12. Remove the retaining ring and 'O' ring seal from the machined outer surface of the master cylinder, discard both the seal and retaining ring.
13. Remove the guide ring from the mouth of the master cylinder which supports the primary plunger assembly and place to one side, this component is not part of the master cylinder service kit and is to be refitted on assembly of the unit.
14. Pull the primary plunger assembly out of the master cylinder.

NOTE: The primary plunger assembly cannot be broken down any further and is serviced as a complete unit. Discard the assembly.



RR2238M

15. The secondary plunger assembly will remain at the bottom of the master cylinder bore, the plunger can be easily expelled by tapping the assembly on a piece of wood until the plunger appears at the cylinder mouth, carefully pull the plunger out of the master cylinder.
16. If the swirl tube was not expelled at the same time as the secondary plunger, repeat the above operation to expel it from the bottom of the master cylinder bore and discard.



RR2239M

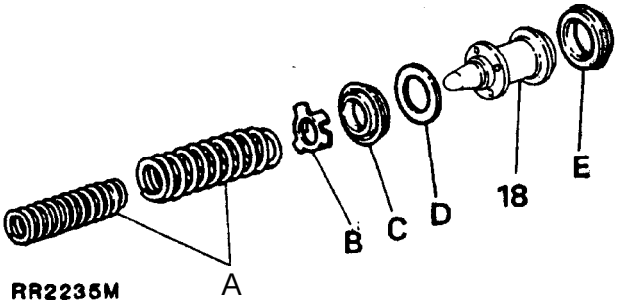
17. Clean all parts with Cirling cleaning fluid or unused brake fluid and place the cleaned parts onto a clean sheet of paper. Inspect the cylinder bore and plungers for signs of corrosion, ridges and score marks. Provided the working surfaces are in perfect condition, new seals from a Cirling Service repair kit may be used.

Renewing secondary plunger seals

18 Remove from the following components from the secondary plunger and discard:

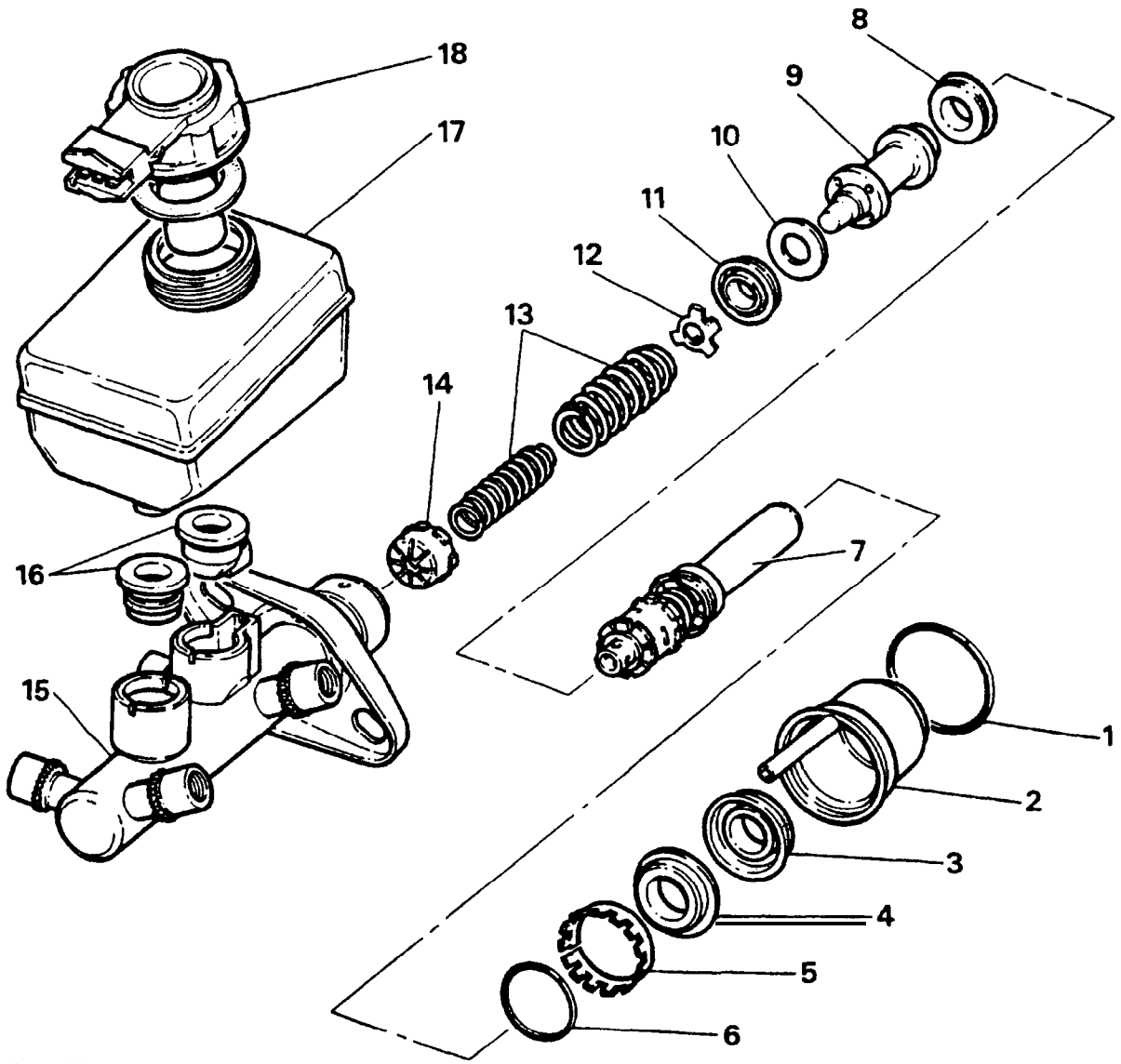
NOTE: A small screwdriver with the end rounded off and polished is required to remove the 'L' seal. DO NOT damage secondary plunger.

(A) Springs
(B) Seal retainer
(C) Recuperating seal (primary cup)
(D) Washer
(E) 'L' seal



RR2235M

Continued



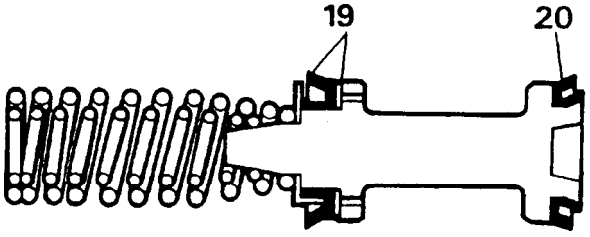
RR2234M

KEY TO MASTER CYLINDER

1. Water ingress seal
2. Transfer housing
3. Vacuum seal
4. Guide ring
5. Retaining ring
6. 'O' ring seal
7. Primary plunger assembly
8. 'L' seal
9. Secondary plunger
10. Washer
11. Recuperating seal (primary cup)
12. Seal retainer
13. Springs (2 off)
14. Swirl tube
15. Master cylinder body
16. Reservoir seals
17. Reservoir
18. Low fluid level switch and cap

NOTE: Thoroughly check that no debris of any description is lodged in any of the fluid passageways and drillings. If debris is found, carefully remove, re-clean the cylinder and re-check.

19. Coat the new seals in unused brake fluid and firstly fit the 'L' seal to the plunger.
20. Fit the washer followed by the recuperating seal. Fit the seal retainer and springs, ensure the springs are correctly seated.

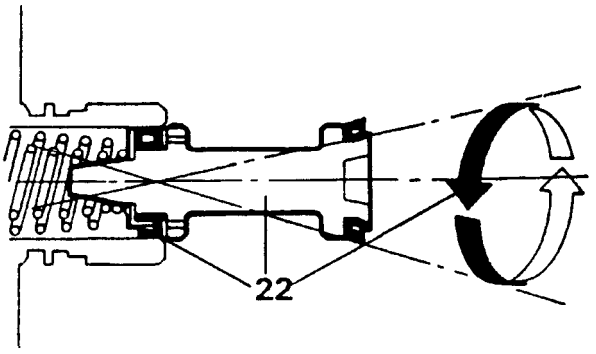


RR2236M

ASSEMBLING THE MASTER CYLINDER

CAUTION: It is important that the following instructions are carried out precisely, otherwise damage could be caused to the new seals when inserting the plungers into the cylinder bore. Generous amounts of new brake fluid should be used to lubricate the the parts during assembly. Never use old fluid or any other form of cleaning and lubricating material. Cleanliness throughout is essential.

21. Fit the new swirl tube to the bottom of the cylinder bore.
22. Lubricate the secondary plunger and cylinder bore. Offer the plunger assembly to the cylinder until the recuperation seal is resting centrally in the mouth of the bore. Gently introduce the plunger with a circular rocking motion, as illustrated. Ensuring that the seal does not become trapped, ease the seal into the bore and slowly push the plunger down the bore in one continuous movement.



RR2240M

23. Fit the primary plunger assembly using the same method as for the secondary plunger, push the plunger down the bore.
24. Fit the original guide ring to support the primary plunger.
25. Coat a new 'O' ring with brake fluid and fit to its respective groove on the outer location surface of the master cylinder.

    NOTE: The 'O' ring should not be rolled down the outer location surface of the master cylinder but should be slightly stretched and eased down the cylinder and into its groove. DO NOT OVER STRETCH THE SEAL.

26. Fit a new retaining ring on the outer surface of the master cylinder ensuring that the serrations of the ring are facing the mounting flange.
27. Fit the two new reservoir seals in their respective ports.
28. Fit a new vacuum seal to either the primary plunger or to the bottom of the transfer housing bore, open face of the seal towards the primary plunger guide ring.
29. Lubricate the vacuum seal with brake fluid, fit the transfer housing to the master cylinder, push the housing fully upto the cylinder mounting flange, DO NOT ADJUST THE TRANSFER HOUSING AFTER FITTING.
30. Lubricate a new water ingress seal with brake fluid, slightly stretch the seal and ease it down the housing until the seal is in the correct position between the housing and flange.
31. Roll the reservoir into the top of the master cylinder, reversing the procedure described in instruction 10.

32. Fit the master cylinder to the servo fit the plain and spring washers and secure in position with the two nuts. Tighten to the specified Torque value- see section 06.
33. Fit the brake pipes to the master cylinder and tighten to the specified Torque value- see section 06
34. Top-up the master cylinder with the correct grade of brake fluid (see section 09) bleed the brake systems.

    WARNING: Do not use brake fluid previously drained or bled from the system. Carefully dispose of unwanted fluid, if stored in a sealed container, ensure that the container is marked USED BRAKE FLUID.

35. Fit the cap with combined low level fluid switch and reconnect the electrical lead. Re-connect the battery.

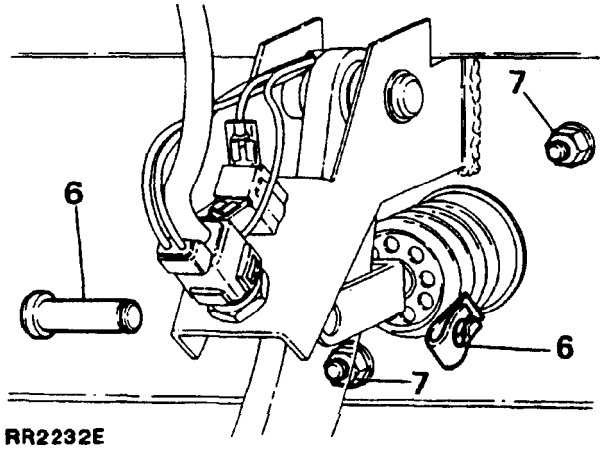
SERVO ASSEMBLY

Remove and refit

NOTE: Other than replacing the filter, non-return valve and grommet, the servo is not a serviceable component, in the event of failure or damage fit a new unit.

Removing

1. Disconnect the battery negative terminal.
2. Disconnect the electrical plug to the low fluid level switch.
3. Thoroughly clean the immediate area around all master cylinder outlet ports. Remove each of the brake pipes from the master cylinder in turn, sealing each pipe and outlet port as they are disconnected with suitable plugs, to prevent ingress of foreign matter and excessive fluid loss.
4. Disconnect the vacuum supply hose to the servo.
5. From inside the vehicle remove the lower dash panel to gain access to the spring clip securing the servo push rod to the brake pedal assembly.
6. Release the spring clip and remove the clevis pin securing the servo push rod to the brake pedal.
7. Remove the two nuts and plain washers securing the servo to the bulkhead pedal box.

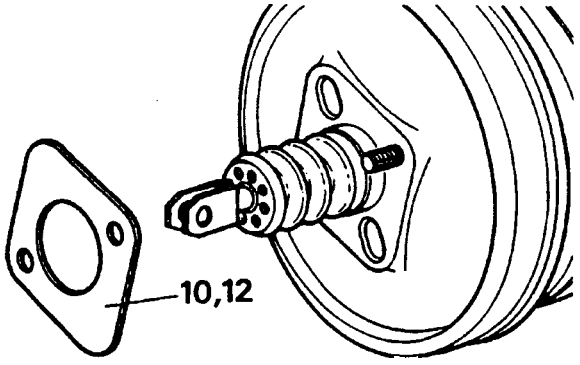


RR2232E

8. From within the engine compartment withdraw the servo and master cylinder assembly.
9. Remove the cap from the reservoir and drain the brake fluid into a suitable container. If the master cylinder assembly can be kept horizontal it will not be necessary to drain the fluid.

WARNING: Do not use brake fluid previously drained or bled from the system. Carefully dispose of unwanted fluid, if stored in a sealed container, ensure that the container is marked USED BRAKE FLUID.

IO. Detach the spacer from the pedal box mounting face of the servo, it is important that the spacer is fitted to the mounting face of the new servo to ensure that stringent pedal to servo operating dimensions are maintained.



RR2233M

11. If a new servo is being fitted it will be necessary to remove the master cylinder from the existing servo and refitted to the new unit.

Refitting

12. Fit the spacer previously removed from the old servo, to'the new servo.
13. Fit the servo to the pedal box assembly.
14. From inside the vehicle lightly grease the brake pedal around the area that the servo push rod pivots.
15. Fit the push rod to the brake pedal and secure in position with the clevis pin and clip.
16. Fit the plain washers and secure the servo with the two nuts. Tighten the nuts to the specified Torque value-see section 06.
17. Refit the lower dash panel.
18. Fit the master cylinder to the servo, refit the plain and spring washers and secure the master cylinder to the servo with the two nuts. Tighten the nuts to the specified torque-see section 06 -Torque values.
19. Remove the sealing plugs, fitted to the master cylinder outlet ports during the removal procedure and refit the brake pipes to their respective ports. Tighten the brake pipes to the correct torque-see section 06-Torque values.
20. Refit the vacuum supply hose.
21. Fill the master cylinder to between the 'MAX' and 'MIN' level markings with the correct grade of brake fluid-see section 09.
22. Bleed the brake systems.

PEDAL ASSEMBLY

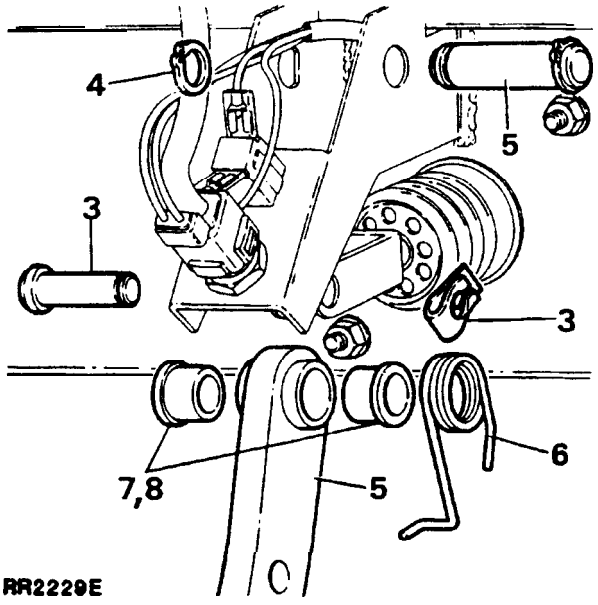
Remove, overhaul and refit

Remove

1. Disconnect the battery negative terminal.
2. From inside the vehicle remove the lower dash panel to gain access to the pedal assembly.
3. Release the spring clip ad remove the clevis pin securing the servo push rod to the brake pedal.
4. Remove the circlip from the 'D' shaped end of the pedal shaft.
5. Remove the pedal shaft from the pedal assembly and withdraw the pedal from the pedal box.
6. Remove the return spring from the pedal.

Overhaul

7. Remove the bushes from the pedal pivot tube.
8. Press new bushes into the pedal pivot tube. If necessary ream out the bushes to 15.87mm plus 0.05mm (.625 in plus .002in).
9. Lightly grease the bushes.



RR2220E

Refitting

10. Fit the return spring to the pedal.
11. Fit the pedal to the pedal box assembly and refit the pedal shaft.
    Secure the pedal assembly in position with a new circlip.
12. Lightly grease the servo push rod and secure in position with the clevis pin and clip.
13. Refit the lower dash panel and reconnect the battery.

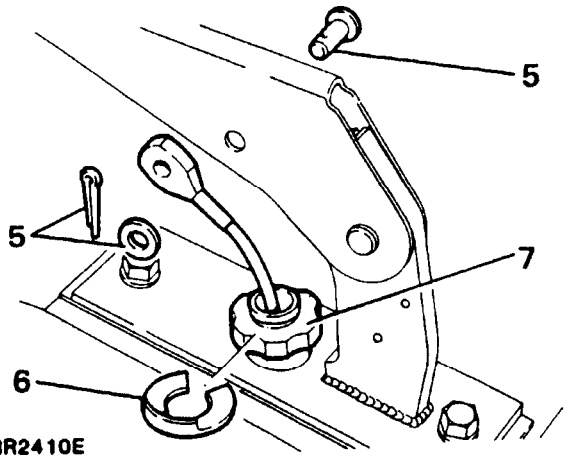
PARKING BRAKE CABLE

Remove and refit

Removing

Inside the vehicle

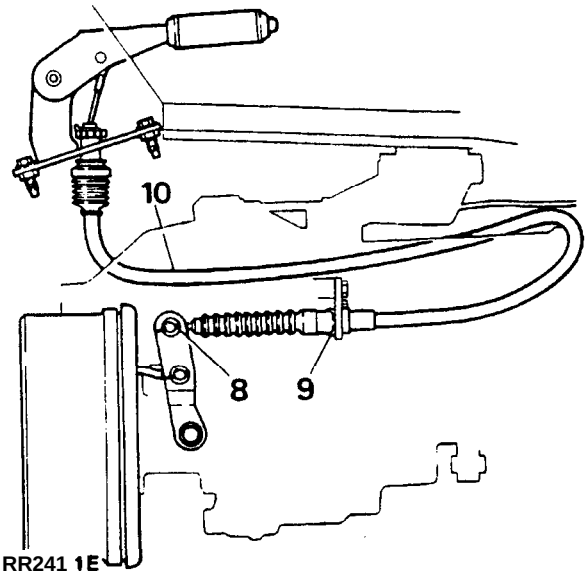
1. Set the vehicle on level ground or place on a hoist, select 'P' in main gearbox. Disconnect the battery negative terminal.
2. Chock the road wheels.
3. Fully release the parkbrake lever.
4. Remove the four retaining screws and lift out the glove box liner to gain access to the bottom of the parkbrake lever.
5. Remove the cotter pin and withdraw the cfevis pin and washer securing the cable to the parkbrake lever.
6. Remove the clip from above the adjustment thumbwheel, push the inner and outer cable to the underside of the vehicle.
7 Pull the thumbwheel from the outer sleeve.



RR2410E

Underneath the vehicle

8. Remove the cotter pin and withdraw the clevis pin and washer.
9. Detach the retaining clip securing the outer cable to the support bracket located on the front cover of the transfer gearbox.
10. Release the cable from the 'P' clip located on the left hand side of the transfer gearbox.



RR2411E

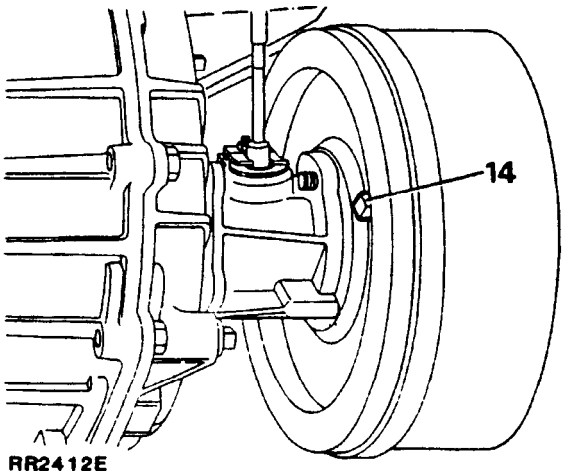
11. Withdraw the cable.

Fit new cable

12. Reverse instructions 5 to 11 when fitting a new cable.

Adjust parkbrake

13 Ensure that the parkbrake lever is fully released.
14 From underneath the vehicle, rotate the adjuster on the brake drum back plate clockwise until the brake shoes are fully expanded against the brake drum.

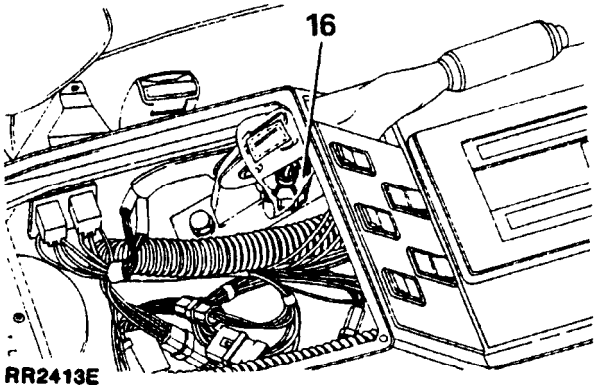


RR2412E

Continued

15. Back off the adjuster until the drum is free to rotate.
16. Rotate the adjustment thumbwheel below the parkbrake lever until the parking brake is fully operational on the third notch of the ratchet.

NOTE: The parking brake adjustment thumbwheel 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 continue to be adjusted at the brake drum.



17. Operate the parkbrake once or twice to settle the brake shoes, recheck that the parkbrake is fully operational on the third notch of the ratchet. Re - adjust as necessary.
18. Refit the glove box liner.
19. Reconnect the battery and remove the wheel chocks.

CLAYTON DEWANDRE - WABCO POWER ASSISTED HYDRAULIC BRAKE SYSTEM WITH INTEGRATED ANTI-LOCK BRAKE SYSTEM - ABS

INTRODUCTION

The purpose of ABS is to prevent the vehicle wheels locking during brake application, thus maintaining vehicle steerability and stability. This allows the vehicle to be steered whilst the brakes are applied, even under emergency conditions, and to avoid obstacles where there is sufficient space to redirect the vehicle.

WARNING: ABS IS AN AID TO RETAINING STEERING CONTROL AND STABILITY WHILE BRAKING.

- ABS CANNOT DEFY THE NATURAL LAWS OF PHYSICS ACTING ON THE VEHICLE.

- ABS WILL NOT PREVENT ACCIDENTS RESULTING FROM EXCESSIVE CORNERING SPEEDS, FOLLOWING ANOTHER VEHICLE TOO CLOSELY OR AQUAPLANING, I.E. WHERE A LAYER OF WATER PREVENTS ADEQUATE CONTACT BETWEEN THE TYRE AND ROAD SURFACE.

- THE ADDITIONAL CONTROL PROVIDED BY ABS MUST NEVER BE EXPLOITED IN A DANGEROUS OR RECKLESS MANNER WHICH COULD JEOPARDISE THE SAFETY OF THE DRIVER OR OTHER ROAD USERS.

SYSTEM DESCRIPTION

The brake system is hydraulically power assisted with an integrated, electronically controlled four channel anti-lock brake system (ABS).
The use of a power assisted brake system means that during brake application, additional hydraulic energy is provided by a hydraulic power unit.
This hydraulic power unit consists of an electrically driven pump and an accumulator which stores hydraulic energy in readiness for brake application. A pressure switch controls the hydraulic pump to maintain fluid pressure in the accumulator.

The hydraulic system comprises two completely independent circuits. The rear calipers and upper pistons of the front calipers form the POWER CIRCUIT The lower pistons in the front calipers form the COMBINED POWER/HYDROSTATIC CIRCUIT ,

CAUTION: THOROUGHLY CLEAN ALL BRAKE COMPONENTS, CALIPERS, PIPES AND FITTINGS BEFORE COMMENCING WORK ON THE BRAKE SYSTEM. FAILURE TO DO SO COULD CAUSE *FOREIGN MATTER TO ENTER THE SYSTEM AND* DAMAGE SEALS AND PISTONS, WHICH WILL SERIOUSLY IMPAIR BRAKE SYSTEM EFFICIENCY.

WARNING:

DO NOT use brake fluid previously bled from the system.

DO NOT use old or stored brake fluid.

ENSURE that only new fluid is used and that it is taken from a clean sealed container.

DO NOT flush the brake system with any fluid other than the recommended brake fluid.

The brake system must be drained and flushed at the recommended service intervals.

Fluid pressures of 170 bar (2466 psi) are produced by the hydraulic pump. It is essential that the procedure for depressurising the system is carried out where instructed.

COMPONENT DESCRIPTION

- Numbers refer to RR2705

Hydraulic booster unit (1)

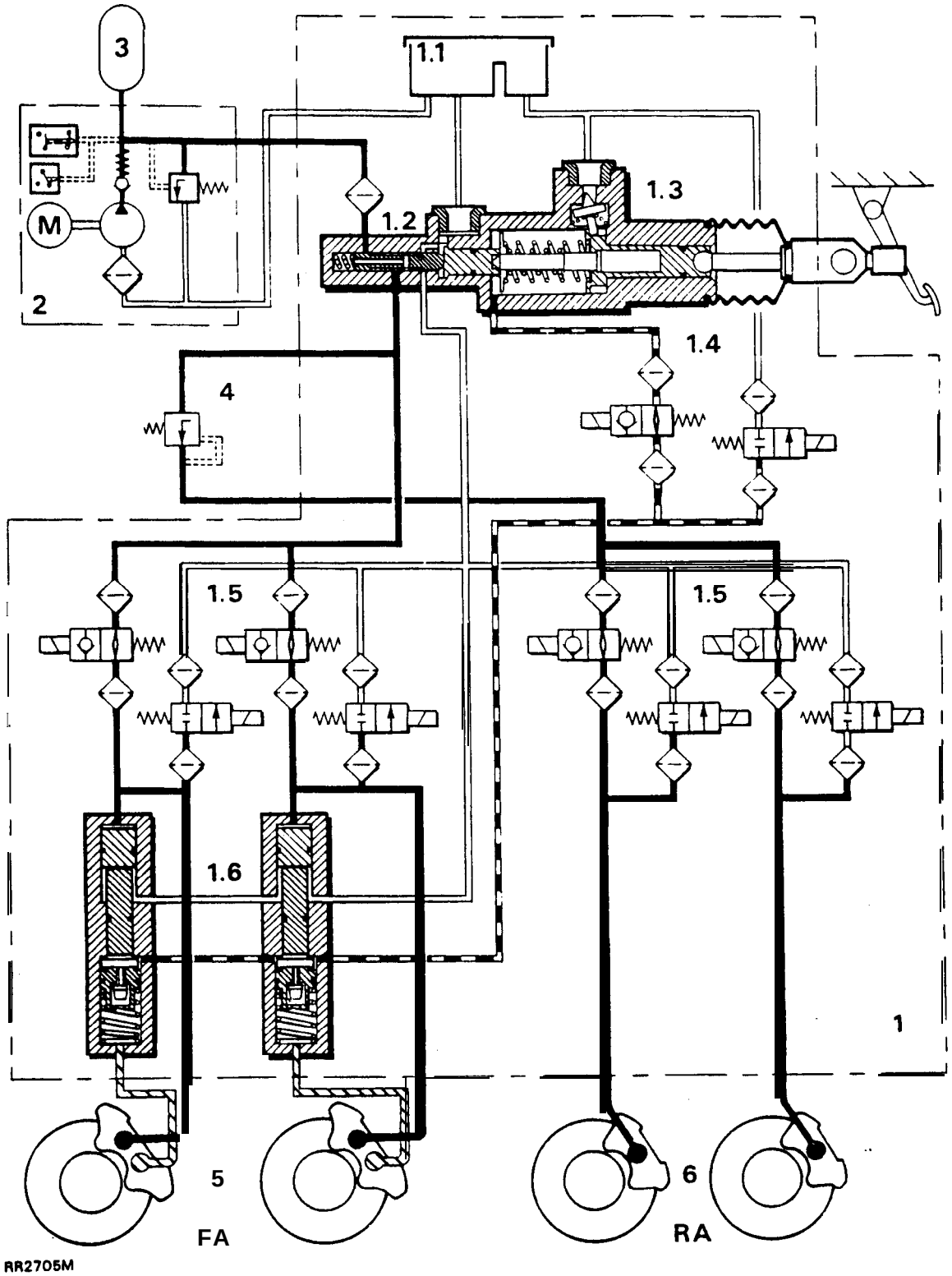
Mounted in the same position as the conventional master cylinder/servo unit, the booster unit contains the following components: Fluid reservoir, power valve, master cylinder, isolating valve, ABS solenoid control valves, servo cylinder.

NOTE: The hydraulic booster unit is not a serviceable item, if internal failure occurs a new unit must be fitted. The fluid reservoir and its seals may be changed in the event of damage. Extreme care must be taken when changing seals to avoid ingress of debris.

Fluid reservoir (1 .1)

Mounted on top of the booster unit, the plastic reservoir is subdivided internally to provide separate capacity for the brake fluid used in the hydrostatic and power circuits. A central tube incorporates a filter and a low fluid warning level switch.

HYDRAULIC COMPONENTS



A ——— B ——— C - D - E - - - -

Key to diagram

A - Fluid feed/return
B - Power circuit
C - Hydrostatic (master cylinder) circuit
D - Combined hydrostatic/power circuit
E - Component enclosure

Power valve (1.2)

The power valve is an extension of the master cylinder, it controls fluid pressure in the power circuit in direct proportion to pressure in the master cylinder. The power valve is of spool valve design.

Master cylinder (1.3)

Operation of the master cylinder displaces a volume of brake fluid into the servo cylinders and increases fluid pressure. Piston movement inside the master cylinder will also activate the power valve. A tilt valve is incorporated to supply fluid to the master cylinder from the reservoir connection.

Isolating valve (1.4)

The isolating valve consists of two solenoid valves controlling fluid inlet and outlet. Their function is to disconnect the master cylinder from the servo cylinder and to connect the servo cylinder to the reservoir return during ABS function.

ABS solenoid control valves - 8 off (1.5)

Each pair, comprising inlet and outlet solenoid valves, controls ABS braking to each wheel. In response to signals from the ECU, the valves decrease, hold or increase brake pressure according to the need to retain wheel rotation and obtain optimum braking. The solenoid valves are designed to respond rapidly to ECU signals.

Servo cylinders - 2 off (1.6)

The servo cylinders have four functions.

1. To provide combined energy from both the hydrostatic and the power circuit to the brake calipers.
2. To provide 'brake feel' at the brake pedal.
3. To provide hydrostatic (master cylinder) braking through the servo cylinder to the calipers in the event of no power circuit pressure to the servo cylinder.
4. To provide braking from both the power circuit and from hydrostatic fluid remaining in the servo cylinder, in the event of no hydrostatic circuit pressure from the master cylinder.

Hydraulic power unit (2)

The hydraulic power unit comprises an electrically driven pump and a pressure switch. The pressure switch incorporates three electro-mechanical switches: one for the pump, another, at a different presure setting, to illuminate the pressure warning light, The latter switch plus the third switch inform the ECU of low pressure and that ABS function should cease whilst pressure remains low.
The pump also incorporates a non-return valve, a low pressure inlet filter, and a pressure relief valve to protect the system.

Accumulator (3)

The diaphragm accumulator is precharged with nitrogen, its function is to store hydraulic energy.

Pressure conscious reducing valve (PCRV) (4)

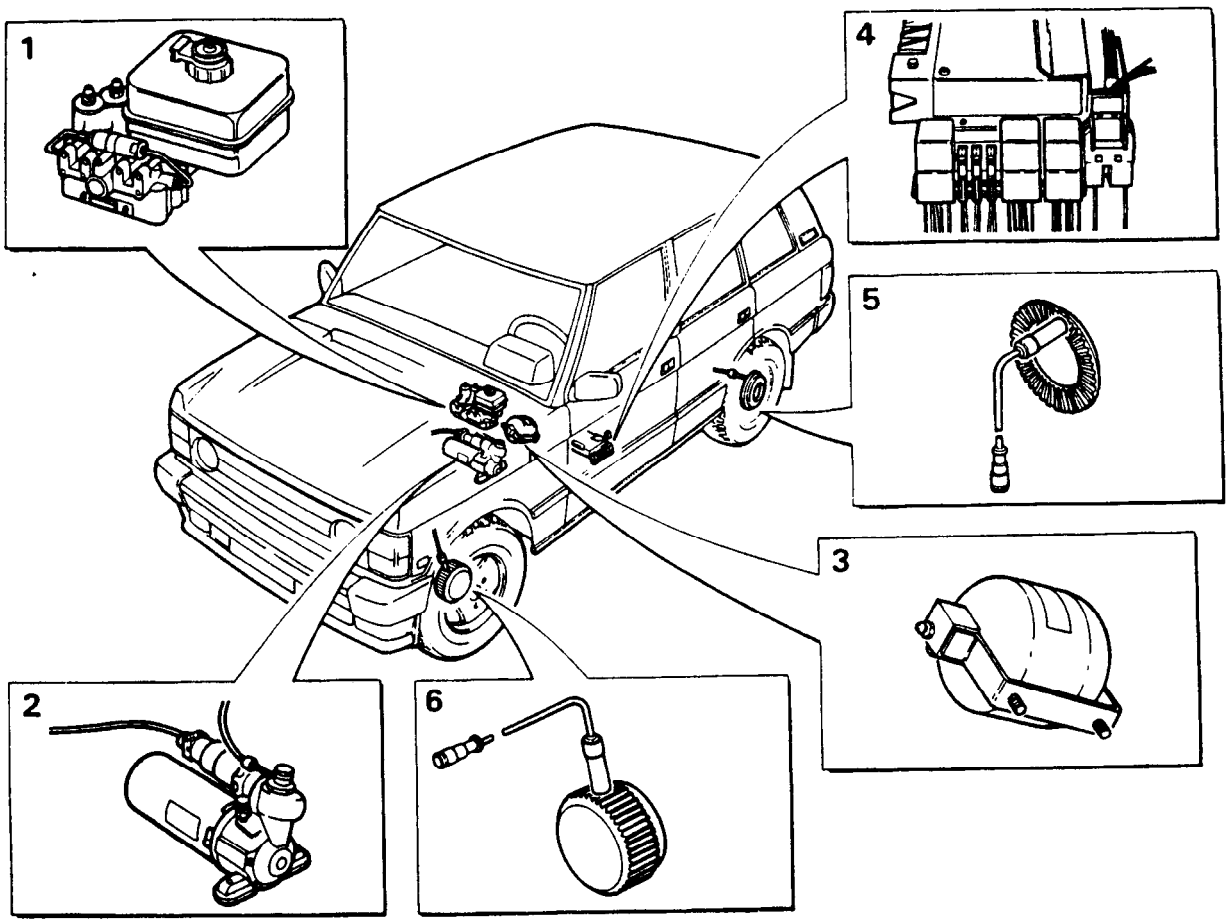
The PCRV valve is located between the power valve and the ABS solenoid valves for the rear axle. Its function is to limit the brake pressure to the rear axle.

Brake calipers - front - (5) rear - (6)

NOTE: To identify the separate hydraulic circuits, they are referred to as Hydrostatic and Power circuits.

Power circuit - The rear calipers and the upper pistons in the front calipers form one circuit, supplied by direct hydraulic power from the power valve.

Hydrostatic circuit - The lower pistons in the front calipers form the other circuit, supplied with hydraulic energy from the servo cylinders comprising a combination of master cylinder pressure and direct hydraulic power.



RR2706M

LOCATION OF COMPONENTS (RR2706M)

1. Hydraulic booster unit.
2. Power unit - hydraulic pump.
3. Accumulator.
4. Electronic control unit (ECU), relays and fuses.
5. Rear sensors/exciter rings.
6. Front sensors/exciter rings.

Electronic control unit - ECU

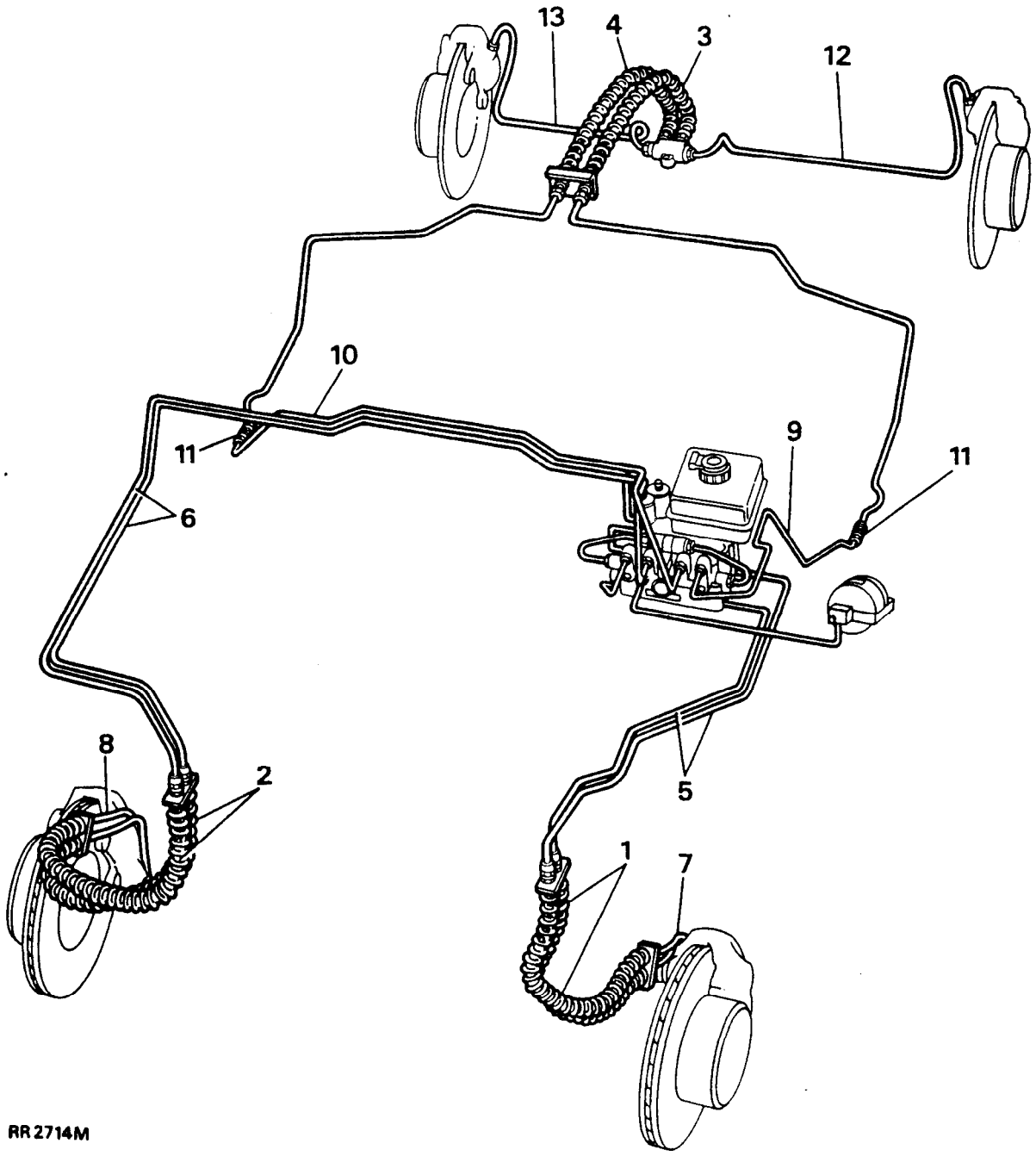
ABS operation is controlled by the ECU located under the left hand front seat, and earthed to the centre tunnel.

The ECU is connected to the ABS harness by a 35 way connector.

The ECU is a non-serviceable- item, it must be replaced if failure occurs.

Sensors, exciter rings - 4 off

A sensor is mounted at each wheel, sensing a 60 tooth exciter ring. When the vehicle' is in motion the inductive sensors send signals to the ECU. The front exciter ring is fitted to the outside diameter of the constant velocity joint in each front hub. The rear exciter ring is bolted to the rear of each brake disc bell.



RR 2714M

Brake pipe layout - left hand drive

HOSES

1. Front left hand flexible hoses.
2. Front right hand flexible hoses.
3. Left hand intermediate hose
4. Right hand intermediate hose

PIPES

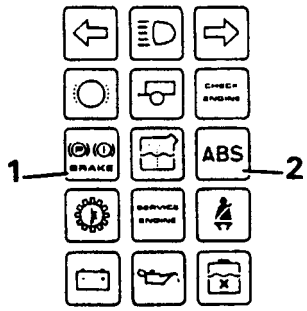
5. Feed to front left hand hose connector.
6. Feed to front right hand hose connector.
7. Feed to front left hand caliper.
8. Feed to front right hand caliper.
9. Feed to left hand intermediate hose.
10. Feed to right hand intermediate hose.
11. Two way connector.
12. Feed to rear left hand caliper.
13. Feed to rear right hand caliper.

WARNING LIGHTS

Brake fluid pressure/level and parking brake warning light - (red) - 1

The warning light situated in the instrument binnacle indicates that there is insufficient pressure in the system and/or the fluid level is too low. The light will illuminate when ignition is switched ON as part of initial bulb check, and when the parking brake is applied.
If the pressure in the hydraulic system is lower than the cut-in pressure for the warning light, the light will illuminate. When the light is on the hydraulic pump will start. Therefore, if the light remains illuminated after bulb check and releasing handbrake, DO NOT drive the vehicle until the light extinguishes.

WARNING: IF THE LIGHT ILLUMINATES WHILE THE VEHICLE IS IN MOTION, THE FAULT MUST BE INVESTIGATED IMMEDIATELY. BRAKING WILL BE AVAILABLE AFTER A LOSS OF PRESSURE, BUT GREATER FORCE WILL BE REQUIRED AT THE PEDAL TO SLOW THE VEHICLE.



RR2756E

ABS warning light - (amber) - 2

WARNING: Power assisted braking is not available if the ignition is switched off. An increase in effort at the pedal will be required to apply the brakes.

The ABS warning light situated in the instrument binnacle indicates that there is a failure in the ABS system. The light will illuminate when the ignition is switched ON , and will extinguish when the vehicle exceeds 7 km/h (5 mph) This indicates that the system sell monitoring check was successful, and the system performs correctly.
If the light remains on or subsequently illuminates with the ignition ON a fault in the ABS system is indicated. The self monitoring procedure is repeated frequently while the ignition is ON . If a fault is detected during self monitoring, the light will illuminate indicating that one or more wheels are not under ABS control.

WARNING: Reduced ABS control is possible with the ABS warning light illuminated depending on the severity and type of fault. If both ABS and brake failure warning lights are illuminated, loss of system pressure or hydraulic pump failure is indicated.
IT IS ESSENTIAL THAT THE DRIVER HAS THE FAULT INVESTIGATED IMMEDIATELY.

DRIVING THE VEHICLE

WARNING: On surfaces which are soft and deep, for example deep powdery snow, sand or gravel, braking distance may be greater than with non ABS braking. In these conditions wheel lock and the build up of snow or gravel under the wheels may be an aid to shorter stopping distance. However it is still an advantage to maintain the stability and manouevrability available with ABS control.

1. Switch on ignition, the system will automatically carry out its self test function. This will be felt as a slight movement in the brake pedal and a short, rapid series of clicks indicating that the solenoid valves have been checked.

2. Observe the warning lights, check that the parking brake/fluid pressure/level warning light extinguishes after initial bulb check or when the parking brake is released, indicating that power assistance is available. Note that the time taken to pressurise the system is approximately 20 seconds.
3. Start the vehicle and drive away, at 7 km/h (5 mph) the ABS warning light must be extinguished - see Warning Lights.
4. In road conditions where surface friction is sufficient to slow or stop the vehicle without wheel lock, the ABS does not operate.
5. In an emergency braking situation, if one or more wheels begin to slow rapidly in relation to vehicle speed, ABS will detect the wheel locking tendency and will regulate the brake pressure to maintain wheel rotation.
6. ABS operation will be felt as a vibration through the pedal, at the same time the solenoid cycling will be heard.

   NOTE: Constant pressure on the foot pedal whilst ABS is operating is more effective than cadence braking. Do not pump the brake pedal as this may reduce ABS efficiency and increase stopping distance.

7. Downward travel of the pedal will also feel hard at the point at which ABS operates. little further pedal travel is possible at this point, BUT, force on the pedal can be varied to influence braking while ABS retains control.

BRAKE APPLICATION WITH PARTIAL FAILURE

WARNING: IF A FAULT DEVELOPS IN THE BRAKE SYSTEM IT IS ESSENTIAL THAT THE DRIVER HAS THE FAULT INVESTIGATED IMMEDIATELY.

NOTE: If, during braking, a drastically reduced resistance is detected at the pedal and braking effectiveness is very much reduced, failure of the non-powered (master cylinder) portion of the system is indicated. When this occurs DO NOT PUMP THE BRAKE PEDAL. Push the pedal through the free movement to obtain braking effort. For this reason it is essential that brake pedal travel is not obstructed by the addition of items such as extra footwell mats.

1. When power assistance is not available, ABS braking is not operative. Both warning lights are illuminated. Braking effort is available from the master cylinder only. This results in longer pedal travel and greater pedal effort required to decelerate the vehicle.

   WARNING: FOOT PRESSURE ON THE PEDAL, USING MASTER CYLINDER ONLY, WILL NOT ACHIEVE THE SAME DEGREE OF BRAKING AS THAT AVAILABLE FROM POWER ASSISTANCE.

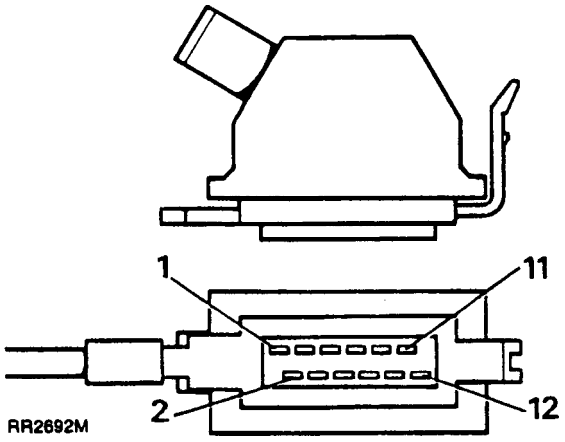
2. If the master cylinder fails, i.e. there is insufficient fluid in the master cylinder to create pressure, braking to all four wheels is retained and ABS remains operative. The red warning light will be illuminated if the cause of the master cylinder failure is a fluid leak and the level in the master cylinder is low enough to actuate the fluid level switch.

   WARNING: LONGER PEDAL TRAVEL IS REQUIRED, BUT POWER ASSISTED BRAKING IS AVAILABLE AT A REDUCED EFFICIENCY.

3. If brake failure occurs due to a fractured brake pipe between a servo unit and a wheel, there will be no pressure in the reservoir. The fluid warning light will be illuminated when the level in the master cylinder is low enough to actuate the fluid level switch. The master cylinder and power valve will operate as for master cylinder failure. BUT, fluid from the power circuit will push all the moving parts in the servo cylinder associated with the failure to the limit of their travel. No pressurised fluid passes to those brake pistons served by the servo cylinder, but all other pistons in front and rear calipers will be supplied with direct pressure from the power valve. The pistons served by the other servo cylinder retain braking as fluid from the master cylinder is retained in the servo cylinder not associated with the leakage.

   WARNING: BRAKE PEDAL TRAVEL WILL BE GREATER AND EXTRA PEDAL EFFORT WILL BE REQUIRED, ACCOMPANIED BY THE VEHICLE PULLING TO ONE SIDE.

Booster harness plug wiring details



RR2692M

1. Slate/yellow.
2. Not used.
3. Slate/white.
4. Slate/green.
5. Slate/black.
6. Slate/purple.
7. Slate/orange.
8. Slate/brown.
9. Slate/blue.
10. Slate/pink.
11. Slate/red.
12. Not used.

CIRCUIT DIAGRAM . **RR2689M**

ST1. Battery
ST2. Terminal post
ST5. Ignition switch
AB1. 30 amp MAXI fuse - pump relay
AB2. Pump relay - black
AB3. Hydraulic pump
AB4. Hydraulic pump pressure cut off switch
AB5. Pump low pressure warning switch
AB6. Reservoir fluid level switch
AB7. Diode
AB8. Brake fluid pressure/level warning light
AB9. ABS warning light
AB10. 5 amp fuse, pump relay
AB11. 5 amp fuse, pin 9 ECU, diagnostic plug, brake light switch
AB12. ABS warning light relay - green
AB13. 25 amp fuse, valve relay
AB14. Valve relay - black
AB15. Diagnostic plug
AB16. Electronic control unit (ECU)
AB17. 35 way connector to ECU
AB18. Brakelight switch
AB19. Brakelights
AB20. Multiplug to booster unit

Booster unit components AB21-25

IV Inlet valve
OV Outlet valve

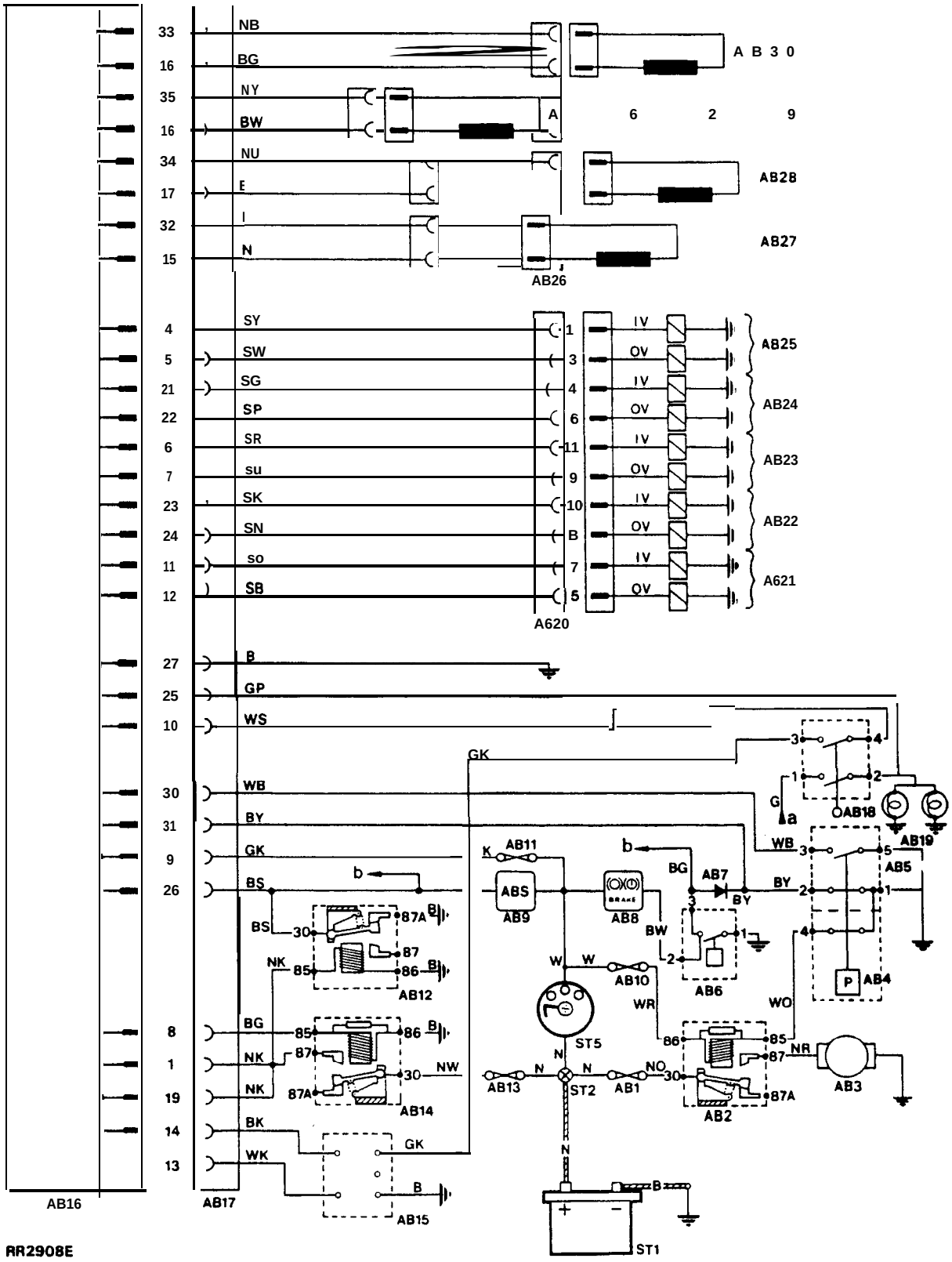
AB21. Isolating valve
AB22. Front left solenoid valves
AB23. Front right solenoid valves
AB24. Rear left solenoid valves
AB25. Rear right solenoid valves
AB26. Sensor connectors (4)
AB27. Front left sensor
AB28. Front right sensor
AB29. Rear left sensor
AB30. Rear right sensor

a. 12 volts from fuse A5
b. To bulb check unit

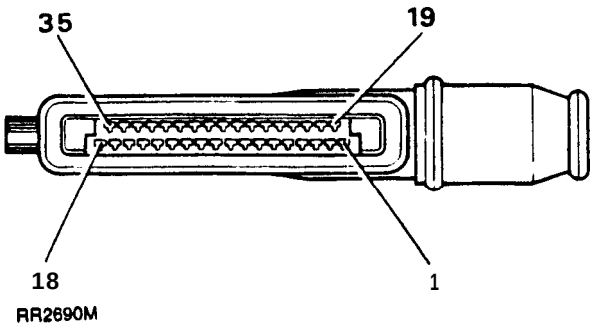
CABLE COLOUR CODE

B Black	G Green
U Blue	S Crey
N Brown	0 Orange
K Pink	W White
P Purple	Y Yellow
R Red	

ABS - Circuit diagram



ECU HARNESS PLUG



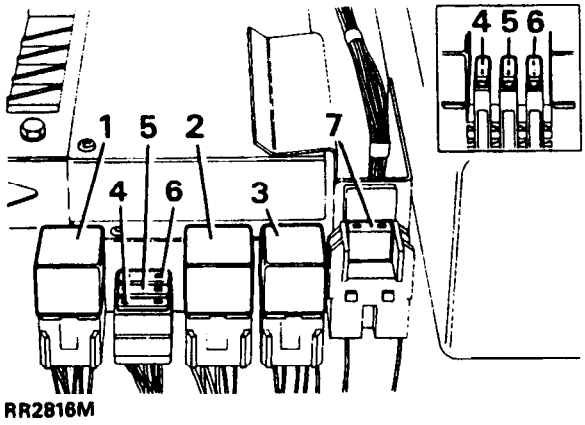
RR2690M

ECU harness plug wiring details - RR2690M

1. Brown/pink.
2. Not used.
3. Not used.
4. Slate/yellow.
5. Slate/white.
6. Slate/red.
7. Slate/blue
8. Black/green
9. Green/pink
10. White/slate
11. Slate/orange
12. Slate/black
13. White/pink.
14. Black/pink.
15. Brown.
16. Black/green.
17. Black/brown.
18. Black/white.
19. Brown/pink.
20. Not used.
21. Slate/green.
22. Slate/purple.
23. Slate/pink.
24. Slate/brown.
25. Green/purple.
26. Black/slate.
27. Black.
28. Not used
29. Not used
30. White/black.
31. Black/yellow.
32. Black/orange.
33. Brown/black.
34. Brown/blue.
35. Brown/yellow.

RELAYS AND FUSES

Incorporated in the ABS electrical system are three relays, located beneath the left hand front seat adjacent to the ABS ECU. Access to the relays is gained by removing the seat side trim.



RR2816M

Inset shows fuse position on early 1990 vehicles.

Relay and fuse identification (RR2816M)

1. ABS warning light relay, green base - AB12
2. Valve relay, black base - AB14
3. Hydraulic pump relay, black base - AB2
4. Hydraulic pump relay fuse, 5amp tan - AB10
5. Stop light switch, diagnostic plug, ECU pin 9 fuse, 5 amp tan - AB11
6. Valve relay fuse, 25 amp white - AB13
7. Hydraulic pump relay fuse 30 amp green MAXI type fuse - AB1

GENERAL SERVICE INFORMATION

NOTE: ABS components ARE NOT! serviceable. Replace components that are found to be faulty.

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 the correct brake fluid. If an assembly fluid is required use brake fluid. Do NOT use mineral oil, i.e. engine oil etc.

Check/top up fluid level

1. Park the vehicle on level ground.
2. Turn ignition ON, to activate hydraulic pump. If pump does not activate depress brake pedal several times until it is heard to operate.
3. When the pump stops, check that the level is between the 'MIN' and 'MAX' marks.
4. If the level is below the 'MIN' mark top up fluid level to the 'MAX' mark on reservoir, using the correct fluid, - see Section 09, Lubricants and Fluids.

WARNING: Clean reservoir body and filler cap before removing the cap. Use only fluid from a sealed container.

DO NOT OVER FILL THE RESERVOIR

DEPRESSURISE

WARNING: Before bleeding the system or working on any component in the brake system the following procedure MUST be carried out to depressurise the accumulator.

1. Switch off ignition.
2. Operate the brake pedal 30 times. Pedal travel will increase slightly and reduced resistance will be felt as pressure decreases.
3. Wait for 60 seconds, press the brake pedal four more times. This procedure will ensure that all pressure is evacuated from the system.

SYSTEM BLEED

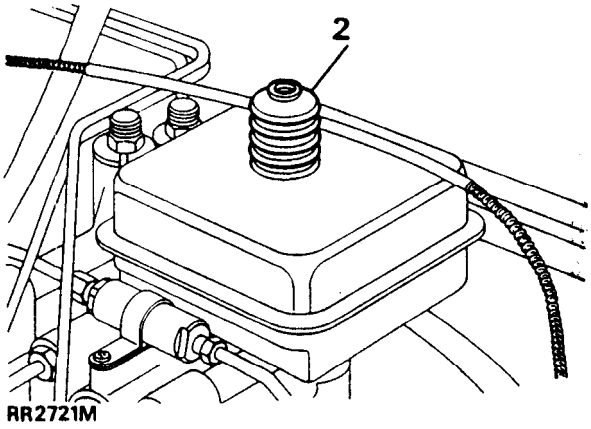
EQUIPMENT: Bleed the system using a bleed tube and a clean bottle containing a small amount of clean liquid.

CAUTION: Clean all bleed screws, filler cap and connections thoroughly using clean brake fluid only. DO NOT USE MINERAL OIL I.E. ENGINE OIL ETC.
MAINTAIN CLEANLINESS THROUGHOUT.

NOTE: During bleed procedure the reservoir fluid level must not fall below the 'MIN' level. Regularly check level and keep topped up to 'MAX' level.

WARNING: Do not use previously used brake fluid. Ensure that only new fluid is used and that it is taken from a clean sealed container. Carefully dispose of unwanted fluid in a sealed container, marked USED BRAKE FLUID.

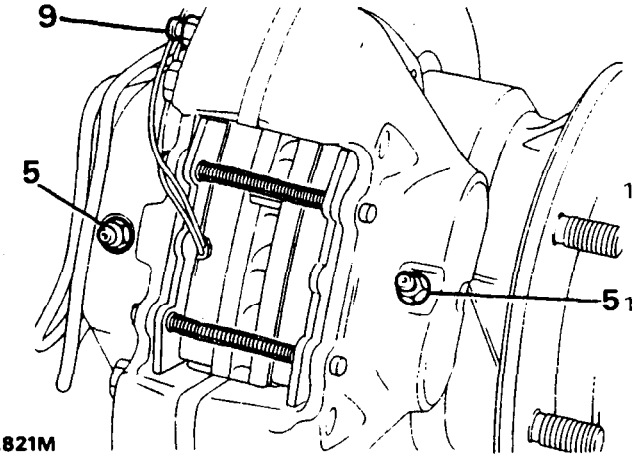
1. Switch off ignition and depressurise the system. Ensure that ignition remains OFF until instruction 7.
2. Fill the fluid reservoir with the specified fluid to the 'MAX' level.



NOTE: Time consumed in filling the booster may be reduced by fitting a rubber bellows unit to the filler neck, and using hand pressure to pressurise the reservoir. A spare bellows unit from the booster push rod is suitable for this purpose.
Ensure the bellows unit is perfectly clean to avoid foreign matter entering the system. Raising the rear of the vehicle will assist the fill procedure.

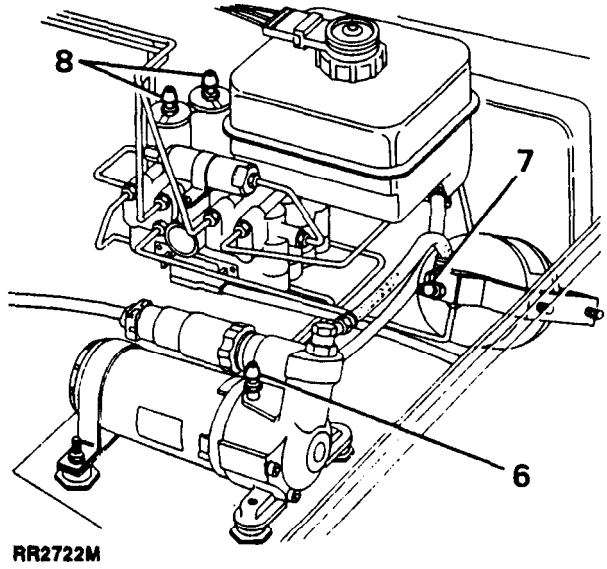
3. Depress brake pedal slowly and progressively five times, using full pedal stroke. Release the pedal for five to ten seconds, during this time air bubbles will rise into the reservoir.

4. Repeat instruction 3. until some resistance is felt. If no resistance is felt check that the clevis pin is connected to the correct (UPPER) hole in the brake pedal
5. Bleed the four front caliper lower (hydrostatic) bleed screws in the conventional manner. Proceed in the order: outer bleed screw on the driver's side, opposite caliper outer bleed screw, inner bleed screw, inner bled screw driver's side. Depress the brake pedal slowly and progressively. Lock the bleed screw at the bottom of each stroke.



RR2821M

6. Bleed the hydraulic pump - open the bleed screw on the pump and allow fluid to flow until it is clear of air bubbles. Do not use the bleed bottle, use a clean absorbant cloth to prevent fluid spillage.



RR2722M

7. Bleed the accumulator - ooen the bleed screw. Switch on ignition, run pump for 3-4 secs, switch off and repeat procedure until no further air bubbles enter bleed bottle. Switch off ignition. Close the bleed screw.
8. Bleed the two hydraulic booster bleed screws. Open one bleed screw, depress the brake pedal, switch on ignition, run pump until no further air bubbles enter the bleed bottle. Close booster bleed screw, switch off ignition and release pedal. Repeat for other bleed screw.
9. Bleed power circuit at four calipers in turn. Depress pedal, open bleed screw, (upper bleed screw on front calipers). Switch on ignition, run pump for 3-4 secs, switch off and repeat procedure until no further air bubbles enter bleed bottle. Switch off ignition, close caliper bleed screw, release pedal.
10. Bleed master cylinder - switch ignition on. System pressure will increase until pump Cuts out. If pump does not cut out after running for 45 secs, check system for leaks.
11. Bleed hydrostatic circuit calipers - open one front lower caliper bleed screw. Actuate brake pedal several times, using only the lower two thirds of pedal travel, until no further air bubbles enter the bleed bottle. Stop actuation if fluid warning light comes on and allow pressure to build up.
12. Close caliper bleed screw before releasing pedal, repeat for remaining three hydrostatic bleed screws.
13. Check/top up reservoir fluid level - see Check/top up fluid level.
14. Dry all connections, fully pressurise system and check for leaks. If two full brake applications switch on pump, from fully charged, rebleed system.

CALIPERS - Front and rear

Refer to main workshop manual for caliper remove and refit. Use a recognised hose clamp, using the approved procedure. If one caliper has been removed, and the use of a brake hose clamp'has been effective in preventing fluid level falling below the minimum mark in the reservoir, bleed the brakes as follows:

Front caliper - bleed the front caliper at both power and hydrostatic circuits.

Rear caliper - bleed the rear caliper.

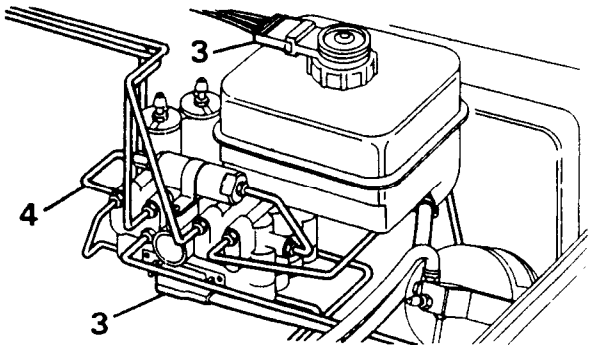
NOTE: If the excessive fluid loss has occured, bleed the complete brake system.

HYDRAULIC BOOSTER UNIT
Remove and refit

Removing

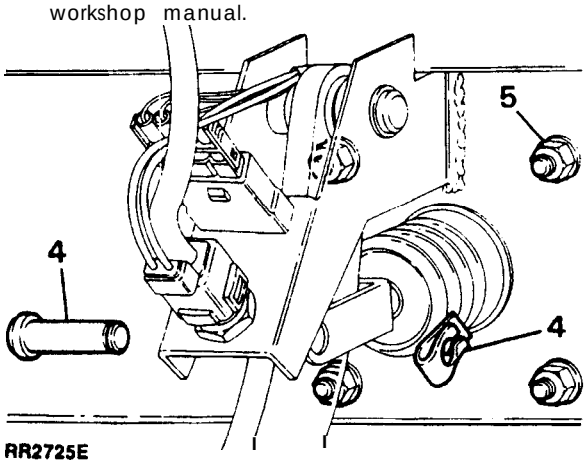
CAUTION: Do not allow the booster unit to be dropped or rested on its front face. Damage to the plastic tangs of the multiplug could occur which will require the fitting of a new booster unit

1. Disconnect battery negative lead, and depressurise the system.
2. Thoroughly clean the immediate area around the booster unit outlet ports and electrical connector.
3. Disconnect the electrical multiplug from the booster, and the connector to the low fluid switch located in the reservoir cap. Remove the booster earth strap.



RR2723M

4. Remove brake pipes from booster unit including hydraulic pipes to the accumulator and hydraulic power unit. Note that each booster outlet port is numbered, and each brake pipe is marked with the corresponding number to aid reassembly. Seal each pipe and outlet port, as they are disconnected, with suitable plugs, to prevent ingress of foreign matter.
3. Working inside the vehicle remove the lower dash panel - see Body Section 76, main workshop manual.



RR2725E

4. Release the spring clip from the clevis **pin** securing the booster push rod to the brake pedal.
5. Remove the four nuts and plain washers securing the booster unit to the bulkhead.
6. Remove the booster unit.

Refitting

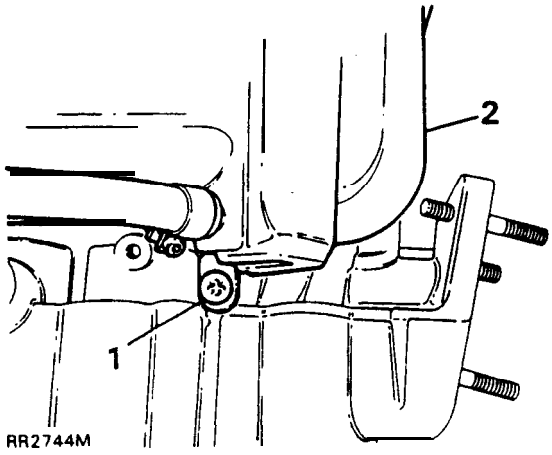
NOTE: New booster units are supplied in a sealed pack marked with a 'use by' date. DO NOT fit a booster if the date has elapsed, or if the pack is not sealed. DO NOT open the sealed pack until ready to fit the unit.

7. Reverse the removal procedure, ensuring correct fitment of pipes to booster unit. Finally tighten booster fixings and pipes to the correct torque value. Ensure that the clevis pin is fitted into the UPPER of the two holes in the brake pedal.
8. Adjust the brake light switch, pull out the black plunger, pull the brake pedal back fully to reset the switch.
9. Carry out the brake bleeding procedure.

RESERVOIR SEALS • Renew

With the booster unit removed, and brake fluid drained, is possible to fit new reservoir seals. Clean the unit thoroughly before removing the reservoir.

1. Remove the reservoir bracket securing bolt adjacent to the low pressure suction hose outlet.
2. Carefully ease the reservoir away from the booster unit.



RR2744M

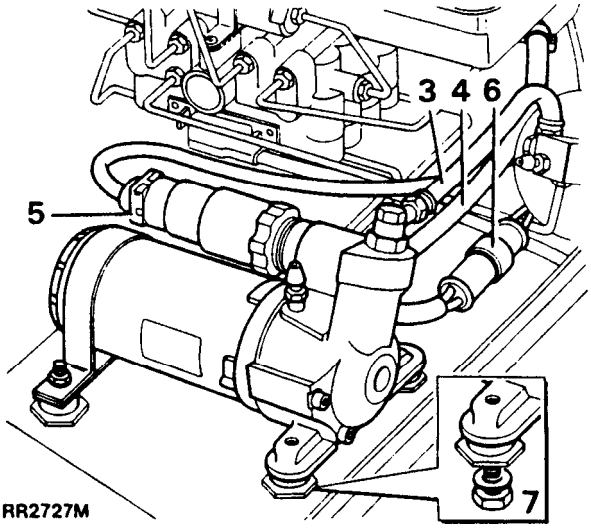
3. Remove the two seals located in the top of the booster unit. Avoid damage to the seals which could result in rubber particles entering the system.
4. Fit new seals and refit the reservoir, tightening the securing bolt to the correct torque.
5. Carry out the booster refitting procedure.

HYDRAULIC POWER UNIT

Remove and refit

Removing

1. Disconnect battery negative lead.
2. Depressurise the system.
3. Disconect the braided hose to the accumulator, and the power unit multiplug.
4. Loosen the hose clip and disconnect the low pressure suction hose to the reservoir, clamp the hose to present fluid and ingress of debris.



RR2727M

5. Disconnect the pressure switch plug.
6. Disconnect the power unit connector.
7. Working from below the unit remove four nuts and plain washers.
8. Remove the hydraulic power unit complete with mountings.

Refit

7. Reverse removal procedure. Check condition of sealing washers on high pressure hose. Fit new washers if necessary.
8. Bleed system, finally top up fluid reservoir.

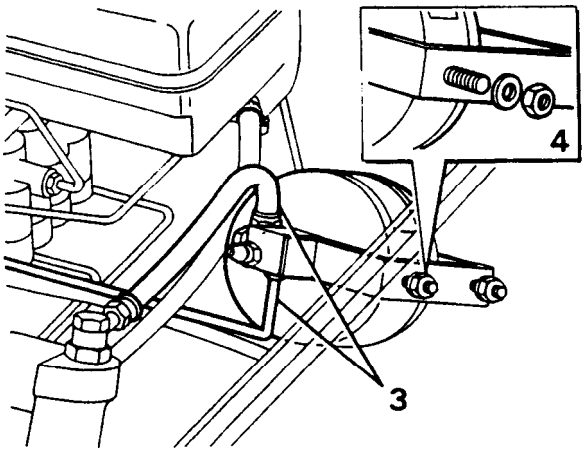
ACCUMULATOR

WARNING: The accumulator is precharged with nitrogen. Handle with extreme caution. DO NOT puncture or burn if disposal is necessary.

Remove and refit

Removing

1. Disconnect battery negative lead.
2. Depressurise the system.
3. Remove the fluid inlet and outlet pipes from the accumulator.



RR2728M

4. Remove the wheelarch inner liner and remove the two nuts and plain washers securing the accumulator.
5. Remove accumulator.

Refitting

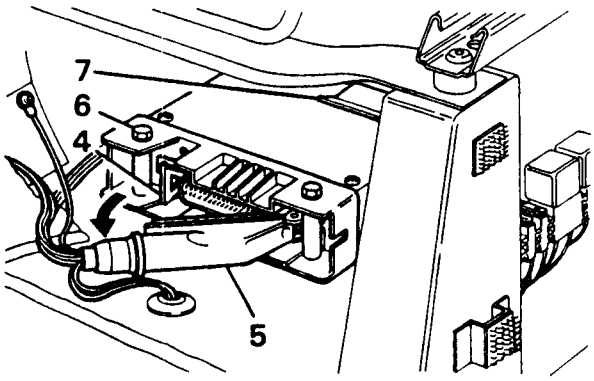
6. Reverse removal procedure. Check condition of sealing washers on high pressure hose. Fit new washers if necessary.
7. Carry out brake bleed procedure.

ELECTRONIC CONTROL UNIT - ECU

Remove and refit

Removing

1. Remove the front and side trim from the left hand front seat.
2. Adjust the seat to its most rearward position and raise the seat cushion height to allow accesss to the ECU.
3. Disconnect the battery negative lead.
4. Release the ECU plug retaining clip.
5. Manoeuvre the plug in the direction of the arrow and detach the hooked end of the plug from the retaining post.
6. Remove the two screws securing the ECU to the mounting bracket.
7. Withdraw the ECU from the retaining clip and remove it from the vehicle.



RR2726M

Refitting

8. Refit the ECU securely in the retaining bracket, fit and tighten the two screws.
9. Reconnect the ECU harness plug. Ensure that the plug is pushed firmly in to its location and that the retaining clip secures the plug in position.
10. Reverse the remaining removal procedure.

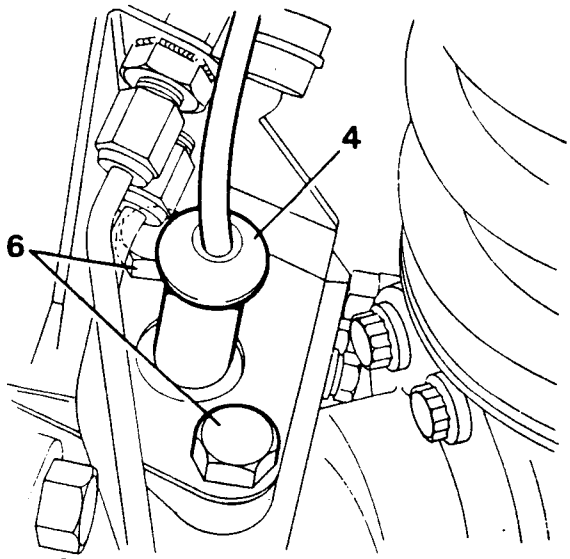
SENSORS - front

CAUTION: If a sensor is removed for any reason, a NEW sensor bush and seal must be fitted.

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Disconnect the required sensor electrical connection, located on the inner wing panel adjacent to the decker panel.
3. Remove the sensor lead and pad wear harness plug from locating clips.
4. Thoroughly clean the area surrounding the sensor to prevent ingress of dirt. Using a suitable lever prise the sensor from its mounting bush.
5. Release the harness cable ties, remove the sensor lead from vehicle.
6. Remove the top swivel retaining bolts complete with brake jump hose bracket. Remove the sensor seal, and remove the sensor bush.



RR2752M

Refitting

7. Insert the new sensor bush and seal.
8. Refit the brake jump hose bracket, coating the bolts with Loctite 270.
9. Lightly coat the new sensor using EP 90 oil. Push the sensor through the bush until it contacts the exciter ring. Rotate the wheel, at the same time turn the steering from lock to lock to set the sensor air gap.

10. Ensure that the original routing is used for the sensor lead. Secure the lead in position.
11. Reconnect the sensor electrical connection.
12. Clear the error code - see FAULT DIAGNOSIS PROCEDURE. Drive the vehicle to ensure the ABS warning light is extinguished.

SENSORS - rear

CAUTION: If a sensor is removed for any reason, a NEW sensor bush must be fitted.

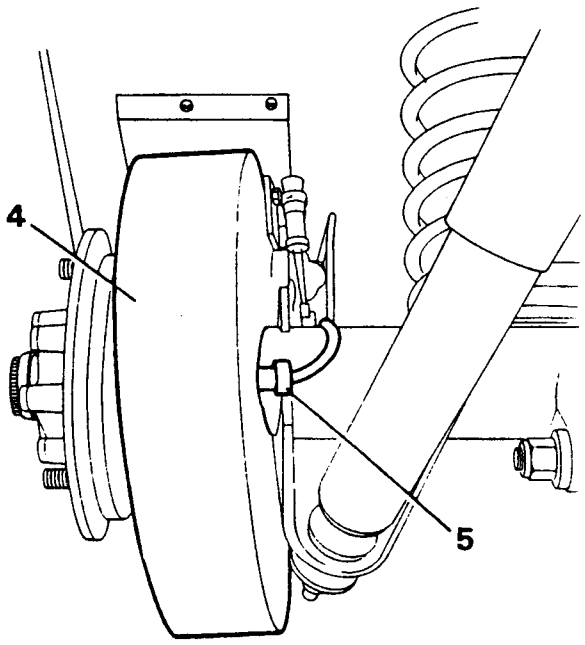
Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Disconnect the required sensor electrical connection, located above the rear axle.
3. Remove the sensor from its locating clip.
4. Remove the bolts securing the mudshield.
5. Using a suitable lever prise the sensor from its mounting bush.
6. Release the harness cable ties, remove the sensor lead from vehicle.

   NOTE: The two rear sensor leads are integral with the pad wear harness. In the case of sensor failure the complete harness must be changed.

7. Remove the sensor bush.



RR2753M

Refitting

8. Fit the new sensor bush.
9. Lightly grease the new sensor using silicone grease - see section 09 for correct grease specification. Push the sensor through the bush until it touches the exciter ring. The sensor will be 'knocked back' to its correct position when the vehicle is driven.
10. Ensure that the original routing is used for the sensor lead. Secure the lead in position.
11. Reconnect the sensor electrical connection.
12. Clear the error code - see FAULT DIAGNOSIS PROCEDURE. Drive the vehicle to ensure the ABS warning light is extinguished.

STOP LIGHT SWITCH

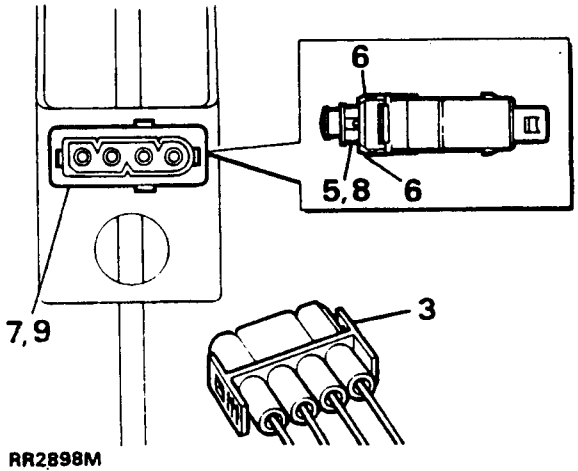
Remove and refit

Removing

1. Turn ignition off and disconnect the battery negative lead.
2. Remove the lower fascia panel.
3. Disconnect the electrical connection to the switch.
4. Depressurise the system.
5. While depressing the brake pedal, pull the red sleeve and the black plunger of the switch FULLY forward.
6. Release the switch retaining clips.

   NOTE: If clips are difficult to release, check that the red sleeve is FULLY forward.

7. Remove the switch.



RR2898M

Refitting

8. Pull the red sleeve and the black plunger of the switch fully forward.
9. While depressing the brake pedal, fit the switch, ensuring the retaining clips are FULLY located.
10. While holding the switch firmly in place, pull the brake pedal back fully, to set the switch.
11. Check operation of the switch using the diagnostic box.
12. Reverse the remaining removal instructions.

EXCITER RINGS SEE AXLE SECTION OF MANUAL

ABS FAULT DIAGNOSIS

If a fault has occurred, or has been identified by the ECU self diagnostic function and the ABS warning light is illuminated, the system and components must be checked to locate and rectify the fault, enabling the faulty component or harness to be replaced.

NOTE: If the warning lamp has indicated a fault in the system, and no fault code has been stored in the memory, the cause of the fault is:

a) Failure in electrical supply
b) Loss of hydraulic pressure
c) Faulty pressure switch
d) Bad ECU earth
e) Faulty warning light relay
f) System not fully charged before driving away
g) ECU not connected

Before commencing the fault diagnosis procedure the following items must be checked:

1. Inspect all exposed cables for damage or abrasion.
2. Check earths on ABS system.
3. Battery - state of charge.
4. Fluid level in reservoir.
5. All ABS fuses and electrical connections.
6. Check hub end-float.

Fault rectification

1. The complete harness must be replaced if faults are found in the wiring harness.
2. DO NOT use unspecified cables or connectors, as this could jeopardise the safe function of the ABS.
3. DO NOT attempt to open the sealed 35 way connector to ECU.

Recommended equipment

Wabco diagnostic controller
- 446 300 300 0

FAULT DIAGNOSIS PROCEDURE

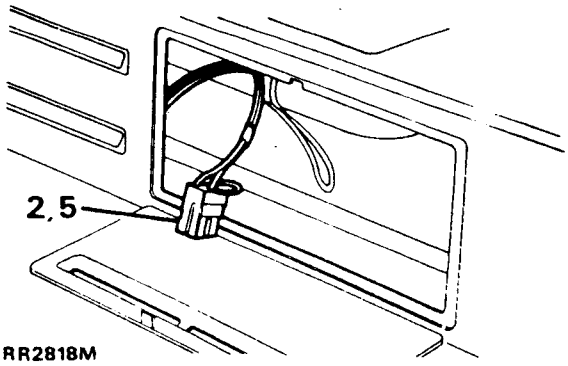
If diagnostic equipment is not available the following procedure can be carried out using the 'Blink Code' and a multi-meter. Faults are stored in the ECU memory in code form. The information can be retrieved by initiating and reading a series of flash and pause sequences on the ABS warning light.
Use of the blink code will determine the location of the fault prior to carrying out a multi-meter check, thus reducing multi-meter checking time.
Additionally the blink code can be used exclusively where a fault has occurred, and no other diagnostic equipment is available.

Recommended equipment

A female plug to fit the diagnostic plug, prewired to connect ECU pin 14 to earth by bridging the black/pink and black diagnostic plug wires.

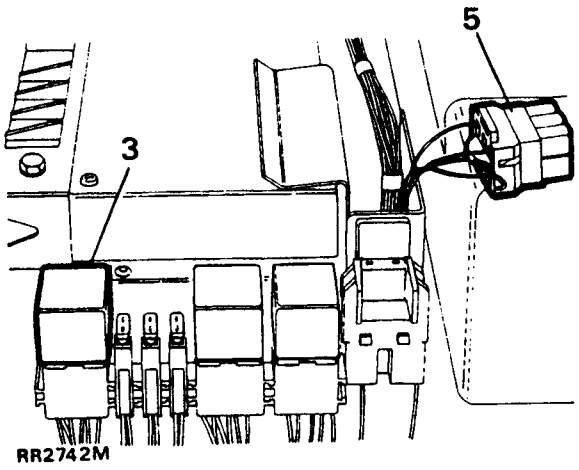
To initiate the blink code carry out the following procedure:

1. Switch off ignition.
2. Remove the seat side trim to gain access to the ECU and relays, and on early vehicles the diagnostic plug. Unclip the access plate from the seat base front trim panel. Pull the blue diagnistic plug from its clip through the opening. Note that the diagnostic plug and fuse condition on early vehicles is shown in RR2742M.



RR2818M

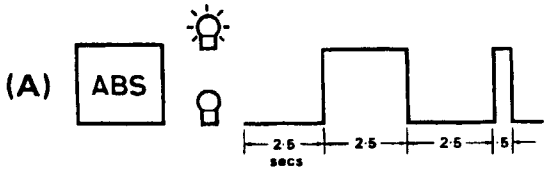
3. Remove the ABS warning light relay.



RR2742M

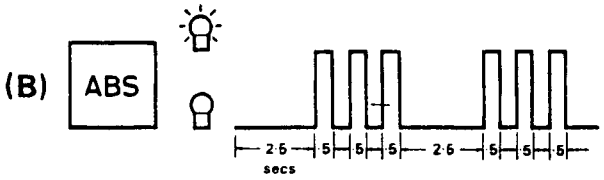
4. Switch on ignition, ABS warning light will illuminate.
5. Connect the prewired plug to the diagnostic plug.
6. Five seconds after connecting diagnostic plug the ABS warning light will extinguish, indicating the start of the blink code cycle.

7. **Start phase:** Observe the ABS warning light, the start phase consists of:
   Pause - 2.5 secs (long)
   Flash - 2.5 secs (long)
   Pause - 2.5 secs (long)
   Flash - 0.5 secs (short)
   (A) shows flash sequence at start of blink cycle.



RR2719M

8. **First part of code number:** A pause of 2.5 secs precedes a series of short flashes. Count the flashes until the next long pause occurs, the number obtained is the first part of the code number.
9. **Second part of code number:** A pause of 2.5 secs occurs between first and second parts, before a second series of short flashes occurs. The number of flashes forms the second part of the code number.
   (B) shows flash sequence for code number 3 - 3.



RR2720M

10. The sequence of start phase, first and second parts will continue until terminated by the operator, thus allowing the code obtained to be rechecked.
11. To terminate the sequence disconnect the prewired plug from the diagnostic plug. Wait for cycle to end before code will clear.

    NOTE: Termination will clear the memory of that particular fault. Do not terminate the sequence if unsure of the code number.

12. The memory is capable of storing more than one fault. To search the memory, reconnect the diagnostic plug, and await the next start phase.
13. Repeat procedure until no further faults are stored in the memory. The memory is cleared when a long pause of 7.5 secs occurs after start phase.
    WARNING: Be sure to reconnect the relay after completing test.

FAULT CODE /LOCATION	CAUSE	REMEDY
NOTE: If the ABS warning light illuminates due to a large sensor air gap, the fault will be retained by the ECU memory. Where the wheel sensors have been pushed fully home prior to test, the blink code will indicate a fault that has been rectified.		
2-12 front right 2-13 rear left 2-14 front left 2-15 rear right	Sensor air gap too large -sensor has been pushed outwards by exciter ring	Run-out on sensor rings due to rough roads/potholes, installation Check bearing freeplay, or failure fit new sensor bush, refit sensor
5-12 front right 5-13 rear left 5-14 front left 5-15 rear right	Sensor or wiring has intermittent contact	Carry out multi-meter check -check and repair If rough road causing fault - test vehicle on rough road.
6-12 front right 6-13 rear left 6-14 front left 6-15 rear right	No sensor output Sensor has extremely large air gap	Check sensor installation, bearings, disc mounting fit new sensor bush, refit sensor
4-12 front right 4-13 rear left 4-14 front left 4-15 rear right	Sensor wiring broken or impedance of sensor too high	Check wiring with multi-meter if OK, fit new sensor
2-6 brake light switch	Brake light switch failed, fault in wiring to switch or not connected Fuse A5 blown or not fitted	Check pedal is set back to rear resting position, slowly operate pedal by hand, two clicks must be heard from switch (brake lights on at first click) prior to hissing noise of booster If OK continue with multi-meter check, if not OK check switch and installation. Check fuse A5
2-7	Continuous supply to ECU, with ignition off, faulty valve relay AB14 or wiring	Carry out multi-meter check
2-8	No voltage to ABS solenoid valves, faulty valve relay AB14 or wiring	Carry out multi-meter check

NOTE: After any steering adjustment, bearing replacement/adjustment, brake disc replacement: Check hub end-float and sensor clearance.

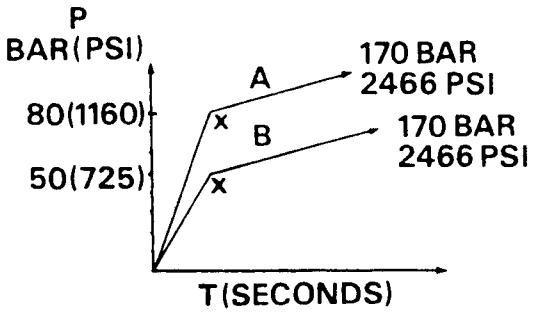
NOTE: Having fixed faults clear ALL memory codes and road test vehicle.

FAULT CODE /LOCATION	CIRCUIT DIAGRAM ITEM NUMBER	CAUSE/REMEDY
3-0 inlet front right 3-1 outlet front right 3-2 inlet front left 3-3 outlet front left 3-4 inlet rear right 3-5 outlet rear right 3-6 inlet rear left 3-7 outlet rear left 3-8 inlet isolating 3-9 outlet isolating	AB 23 IV AB 23 OV AB 22 IV AB 22 OV AB 25 IV AB 25 OV AB 24 IV AB 24 OV AB 21 IV AB 21 OV	Open circuit in connection ECU to solenoid valve in booster, or inside ECU - possibly intermittent Carry out multi-meter check to: Wiring harness including connectors, booster Renew defective component, if all OK fit new ECU. Road test vehicle.
4-0 inlet front right 4-1 outlet front right 4-2 inlet front left 4-3 outlet front left 4-4 inlet rear right 4-5 outlet rear right 4-6 inlet rear left 4-7 outlet rear left 4-8 inlet isolating 4-9 outlet isolating	AB 23 IV AB 23 OV AB 22 IV AB 22 OV AB 25 IV AB 25 OV AB 24 IV AB 24 OV AB 21 IV AB 21 OV	Short circuit to ground in connection ECU to solenoid valve in booster - possibly intermittent Carry out multi-meter check to: Wiring harness including connectors, booster Renew defective component, if all OK fit new ECU. Road test vehicle.
5-0 inlet front right 5-1 outlet front right 5-2 inlet front left 5-3 outlet front left 5-4 inlet rear right 5-5 outlet rear right 5-6 inlet rear left 5-7 outlet rear left 5-8 inlet isolating 5-9 outlet isolating	AB 23 IV AB 23 OV AB 22 IV AB 22 OV AB 25 IV AB 25 OV AB 24 IV AB 24 OV AB 21 IV AB 21 OV	Short circuit to 12V in connection ECU to solenoid valve in booster - possibly intermittent Carry out multi-meter check to: Wiring harness including connectors, Booster Possible earth fault Renew defective component, if all OK fit new ECU. Road test vehicle
6-0 inlet front right 6-1 outlet front right 6-2 inlet front left 6-3 outlet front left 6-4 inlet rear right 6-5 outlet rear right 6-6 inlet rear left 6-7 outlet rear left 6-8 inlet isolating 6-9 outlet isolating	AB 23 IV AB 23 OV AB 22 IV AB 22 OV AB 25 IV AB 25 OV AB 24 IV AB 24 OV AB 21 IV AB 21 OV	Short circuit between two connections ECU to solenoid valve in booster - possibly intermittent **NOTE: Failure codes for both affected valves will be stored** Carry out multi-meter check to: a) Wiring harness, plug connectors, b) Booster Renew defective component, if all OK fit new ECU. Road test vehicle

Accumulator - check precharge

The accumulator, of the diaphragm type, is precharged with nitrogen at 80 bar, its function is to store hydraulic energy. If a problem is suspected, the following procedure will indicate if the precharge pressure has fallen.

1. Depressurise the brake system fully.
2. Connect a pressure gauge, capable of reading at least 170 bar (2466 psi), to the M10 thread of the accumulator after removing the bleed screw.
3. Switch ignition on and observe the pressure gauge.



RR2743M

4. There should be a rapid rise in pressure to accumulator precharge of 80 bar (1160 psi), then a slowing down in the rate of increase as the pressure rises to system pressure, 170 bar (2466 psi) - see graph A.
5. If point x is low as in graph B, ie. 50 bar (725 psi) it indicates that the accumulator has lost its precharge.
6. If faulty, fit a new accumulator.

CONTINUNITY TEST USING A MULTI-METER

Recommended equipment

CAUTION: USE ONLY a multi-meter with compatible male blades to match female spring sockets. Damaged female sockets will necessitate unnecessary component replacement.

To avoid damage to the contacts of the 35 way connector, the manufacturers recommend the use of the adaptor plug shown in the illustrations.
When this adaptor is fully engaged with the 35 way connector, multimeter probes can be inserted into the numbered contacts on the face of the adaptor. The adaptor plug is supplied as a spares item.

MULTI-METER CHECK PROCEDURE

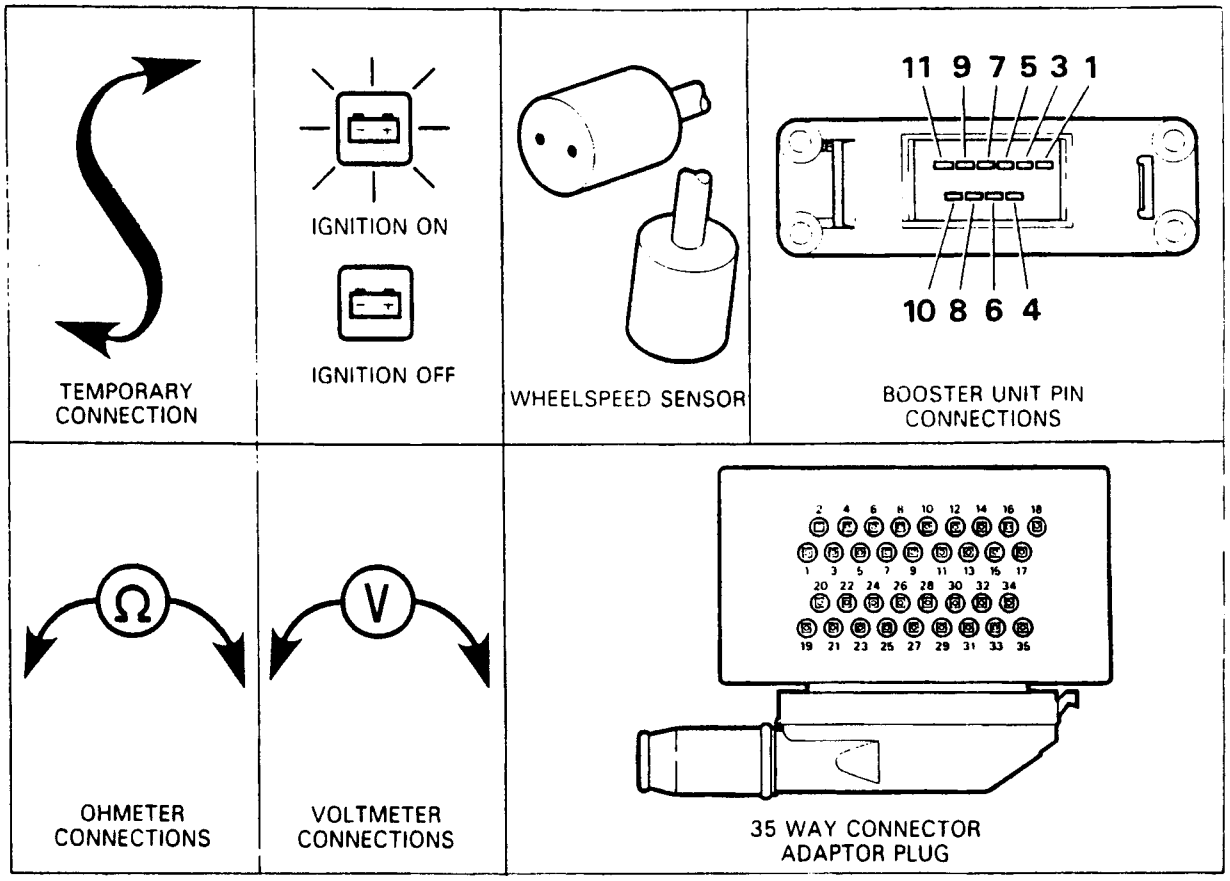
CAUTION: Ensure the multi-meter is correctly set to volts or ohms, dependant on which test is being carried out. Ensure ignition is switched ON or OFF as test requires.

1. Disconnect 35 way connector from ECU, connect adaptor plug. Commence check at appropriate pin on 35 way on wiring harness.
2. Check harness wires for continuity, check fuses and relays.
3. Test related components.
4. If intermittent contact is suspected, attempt to locate the fault by flexing the harness and cables or moving contacts.

TESTS - using a multi-meter

THE following tests are intended as a guide to locating a fault within a circuit. Refer to the ABS circuit diagram for full circuit information.

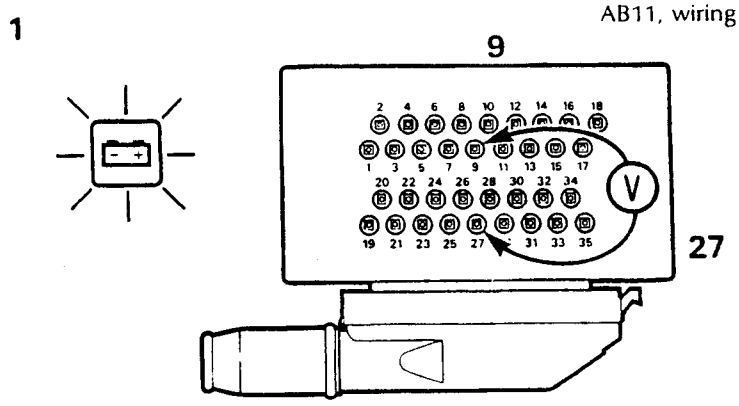
Key to symbols



RR2838M

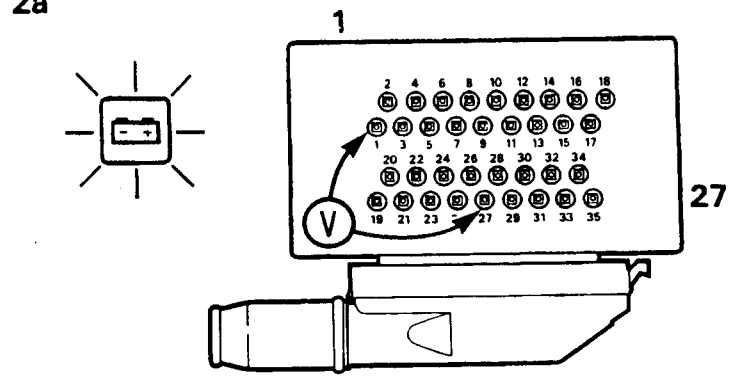
NOTE: If the correct reading is obtained at the component connector and NOT at the 35 way connector, the harness is at fault.

TEST PROCEDURE	RESULTS/CHECKS
1 Check battery voltage.	Correct result: 10V + Incorrect result: Check fuse AB11, wiring from ignition switch and earth.



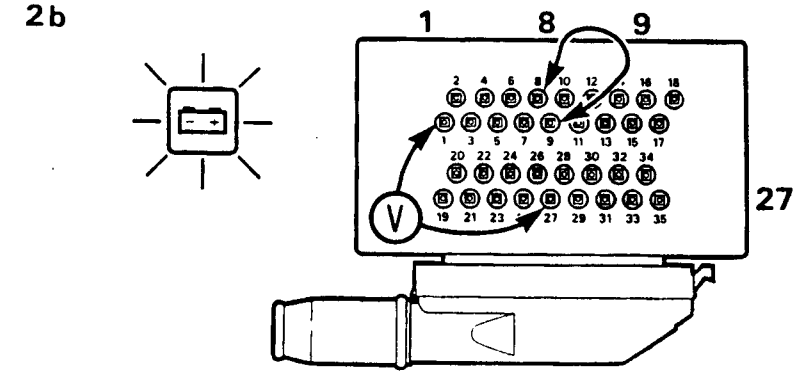
RR2839M

2a Check valve relay AB14.	Correct result: O V If voltage reading obtained check relay



RR2840M

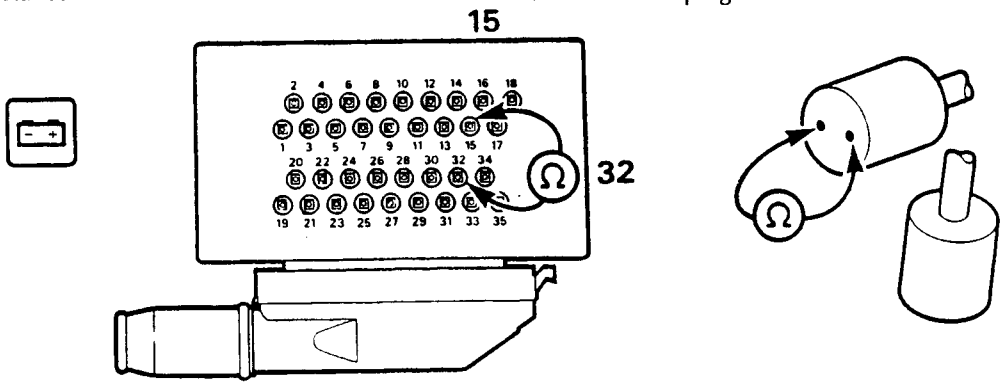
2b Check valve relay power supply.	Correct result: 10V + Incorrect result: Check wiring to relay, pins 8, 9 and 27 to earth



RR2841M

TEST PROCEDURE	RESULTS/CHECKS
3a Check front left wheelspeed sensor resistance.	Correct result: 1.5 to 2kOhm Incorrect result at sensor plug. Fit new sensor.

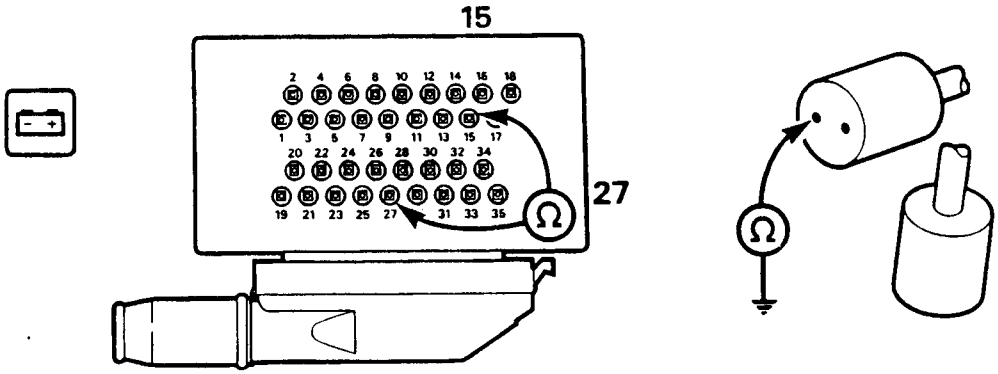
3a



RR2842M

3b Check front left wheelspeed sensor insulation.	Correct result: 100kOhm + Incorrect result at sensor plug: Fit new sensor.

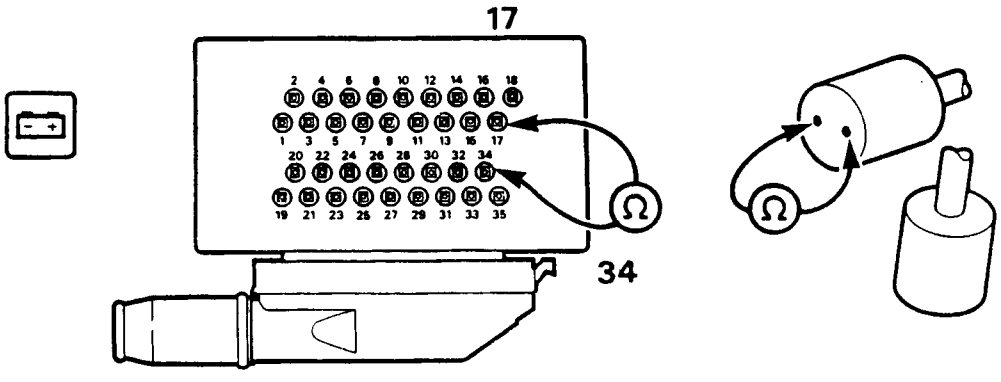
3b



RR2843M

4a Check front right wheelspeed sensor resistance.	Correct result: 1.5 to 2kOhm Incorrect result at sensor plug: Fit new sensor.

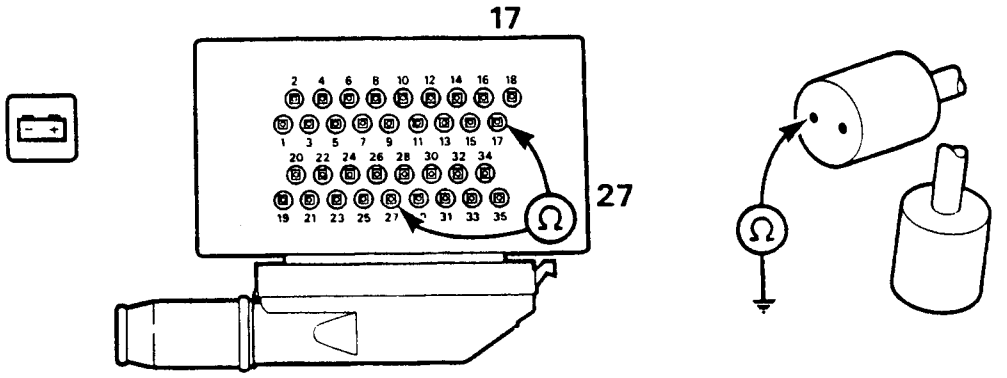
4a



RR2844M

TEST PROCEDURE	RESULTS/CHECKS
4b Check front right wheelspeed sensor insulation.	Correct result: 100kOhm + Incorrect result at sensor plug: Fit new sensor.

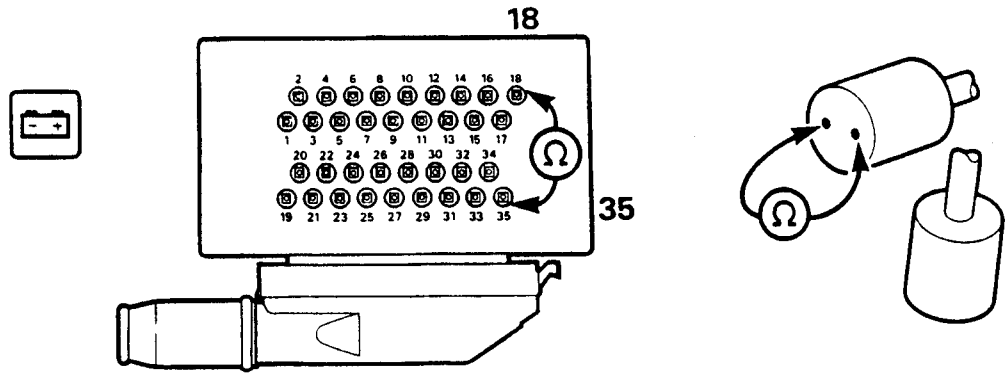
4b



RR2845M

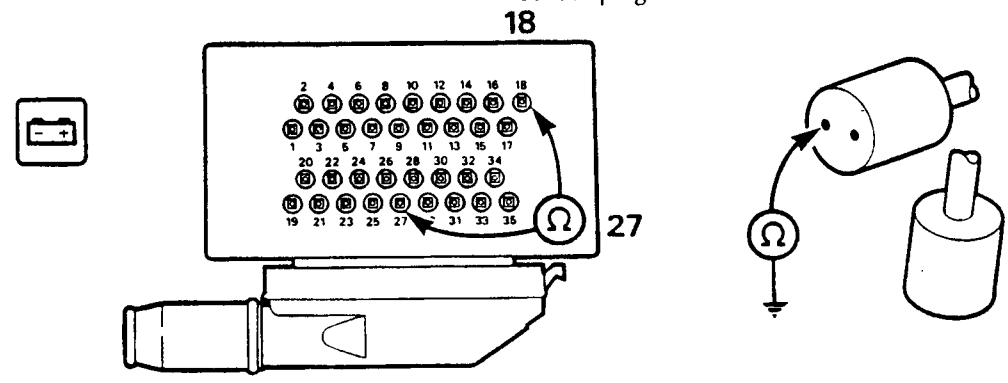
5a Check rear left wheelspeed sensor resistance.	Correct result: 1.5 to 2kOhm Incorrect result at sensor plug: Fit new sensor.

5a



5b Check rear left wheelspeed sensor insulation.	Correct result: 100kOhm + Incorrect result at sensor plug: Fit new sensor.

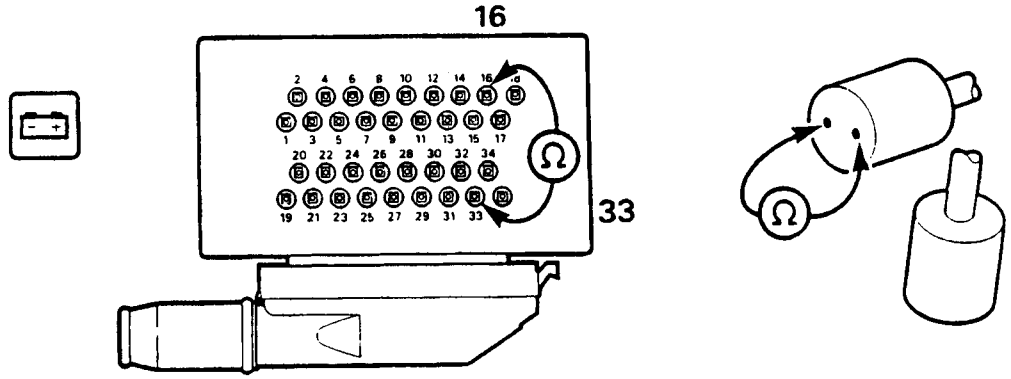
5b



RR2847M

TEST PROCEDURE	RESULTS/CHECKS
6a Check rear right wheelspeed sensor resistance.	Correct result: 1.5 to 2kOhm Incorrect result at sensor plug: Fit new sensor.

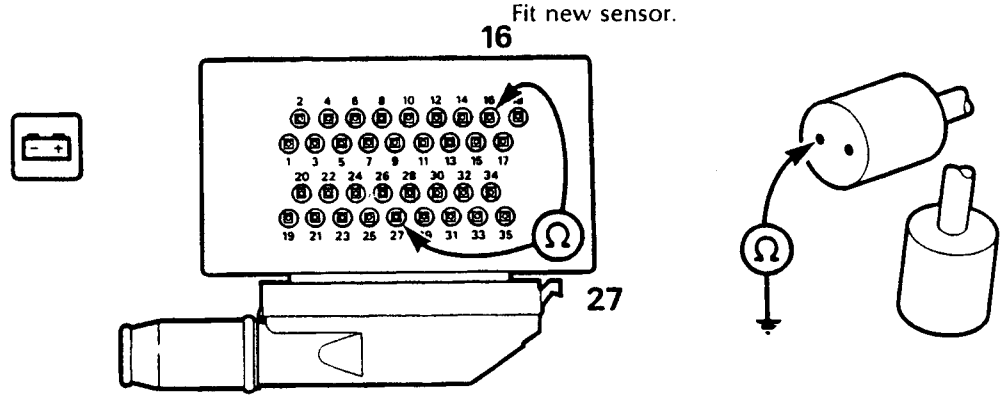
6a



RR2848M

6b Check rear right wheelspeed sensor insulation.	Correct result: 100kOhm + Incorrect result at sensor plug: Fit new sensor.

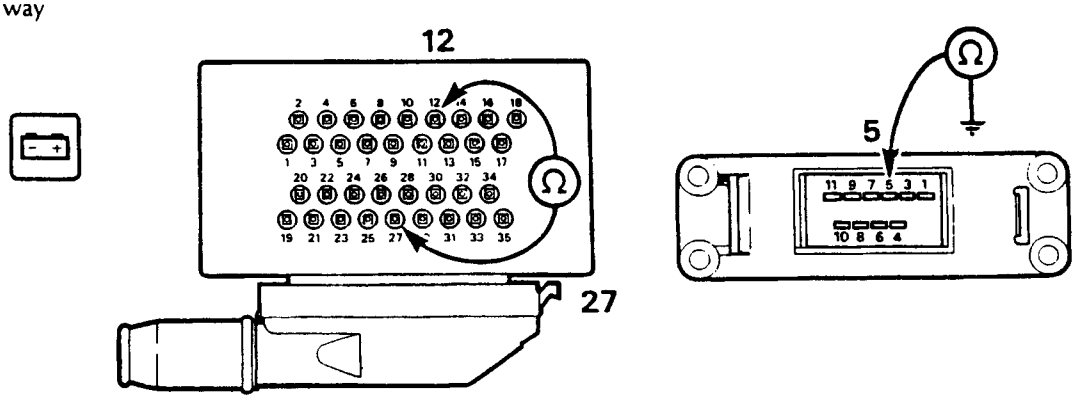
6b



RR2849M

7a Check isolation valve outlet.	Correct result: 5 to 7 Ohm
(1) Remove booster harness plug, carry out check at booster	
(2) Refit booster harness plug, carry out check at 35 way	Incorrect result at booster: fit new booster

7a



RR2850M

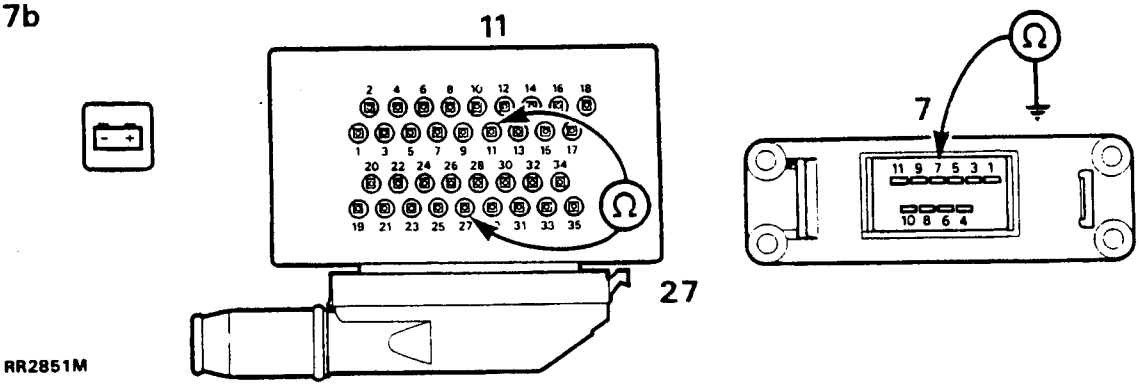
TEST PROCEDURE

7 Check isolation valve, inlet.
(1) Remove booster harness plug, carry out check at booster
(2) Refit booster harness plug, carry out check at 35 way Incorrect result at booster: fit new booster

RESULTS/CHECKS

Correct result: 5 to 7 Ohm

7b



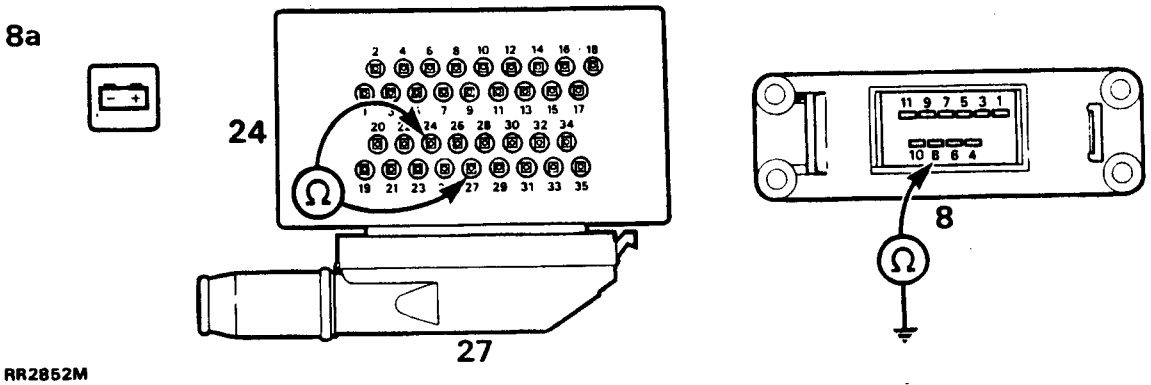
RR2851M

8a Check ABS solenoid valve front left, outlet.
(1) Remove booster harness plug, carry out check at booster
(2) Refit booster harness plug, carry out check at 35 way

Correct result: 2.5 to 4.5 ohm

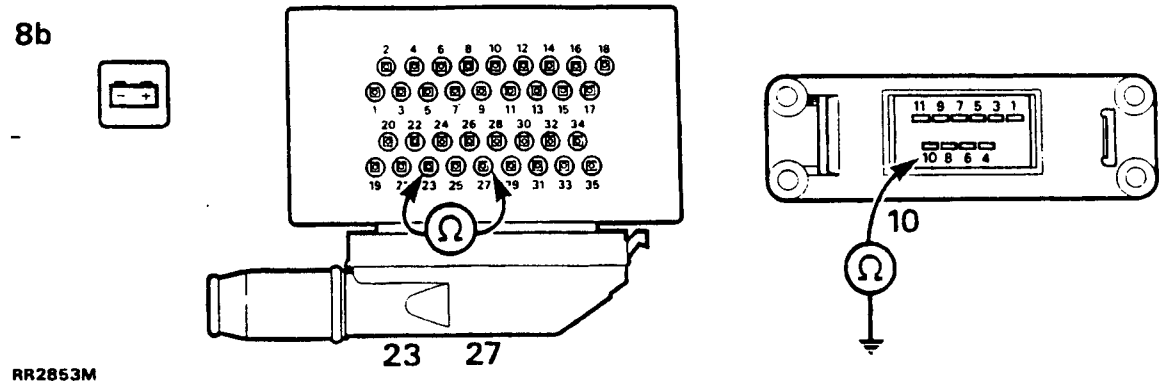
Incorrect result at booster: fit new booster

8a

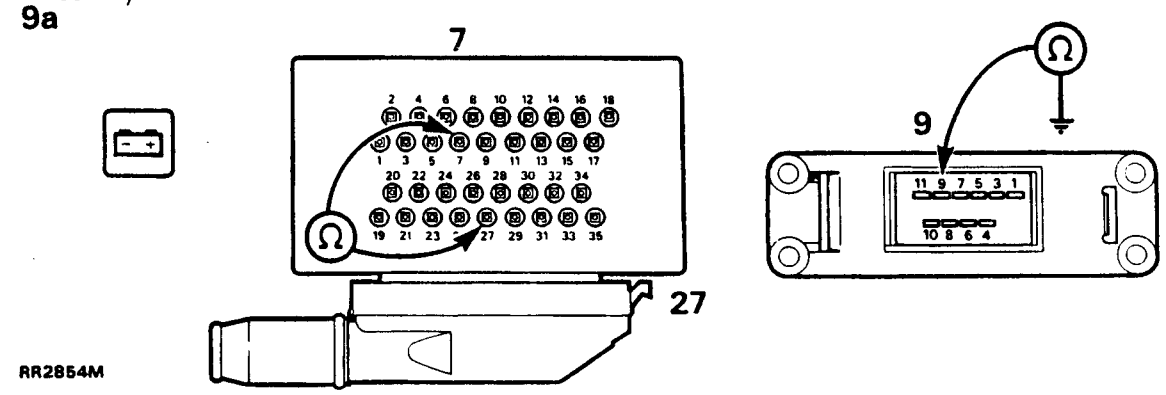


RR2852M

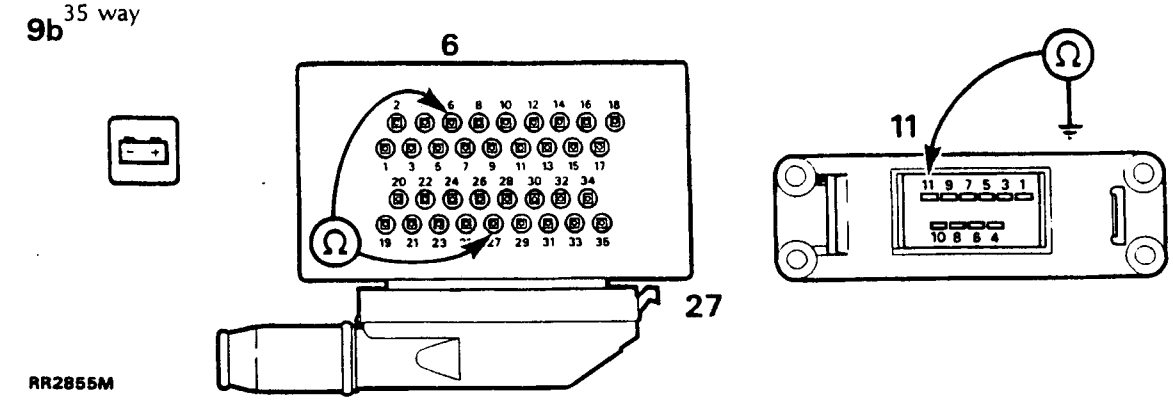
TEST PROCEDURE	RESULTS/CHECKS
8b Check ABS solenoid valve front left, inlet.	Correct result: 5 to 7 Ohm
(1) Remove booster harness plug, carry out check at booster	
(2) Refit booster harness plug, carry out check at 35 way	Incorrect result at booster: fit new booster



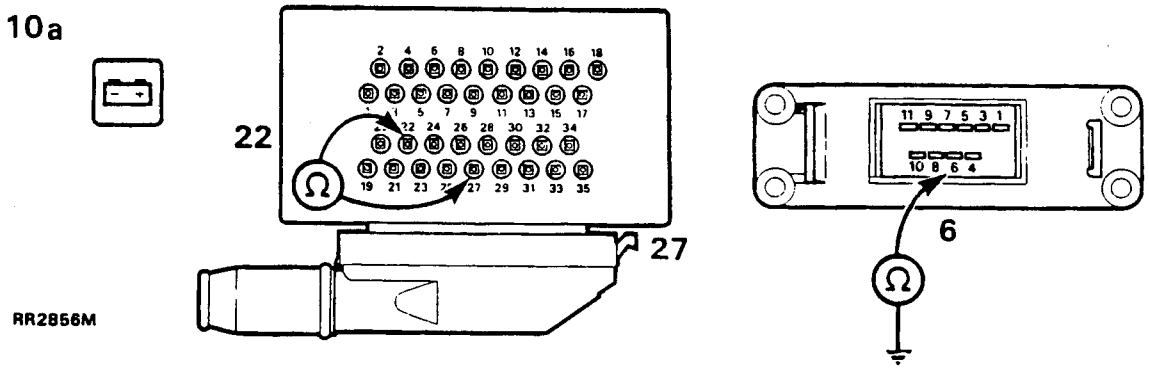
9a Check ABS solenoid valve front right, outlet.	Correct result: 2.5 to 4.5 Ohm
(1) Remove booster harness plug,carry out check at booster	
(2) Refit booster harness plug, carry out check at 35 way	Incorrect result at booster: fit new booster



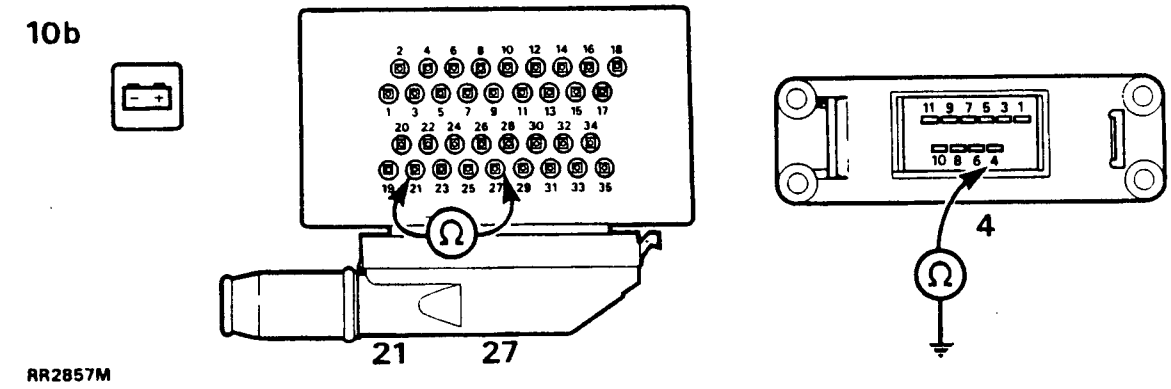
9b Check ABS solenoid valve front right, inlet.	Correct result: 5 to 7 Ohm
(1) Remove booster harness plug,carry out check at booster	
(2) Refit booster harness plug, carry out check at 35 way	Incorrect result at booster: fit new booster



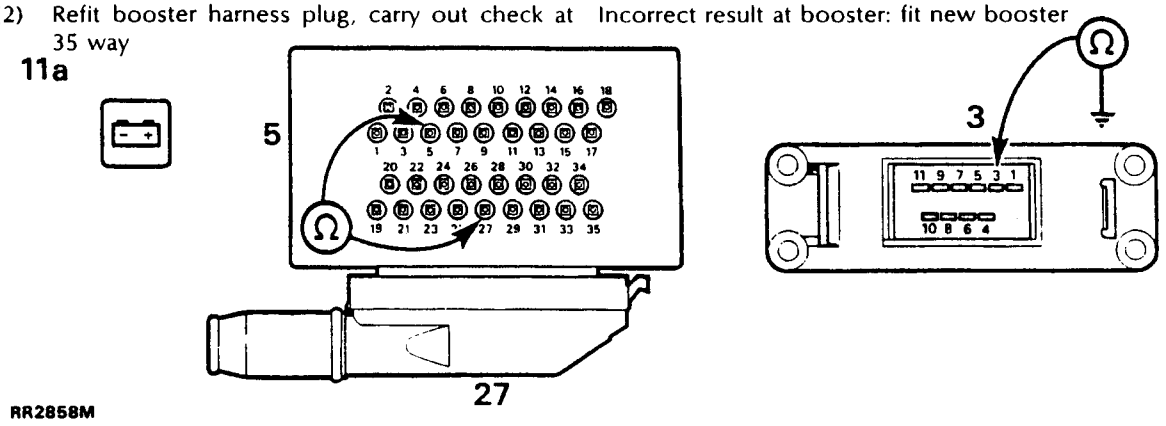
TEST PROCEDURE	RESULTS/CHECKS
10a Check ABS solenoid valve rear left, outlet.	Correct result: 2.5 to 4.5 Ohm
(1) Remove booster harness plug,carry out check at booster	
(2) Refit booster harness plug, carry out check at 35 way	Incorrect result at booster: fit new booster



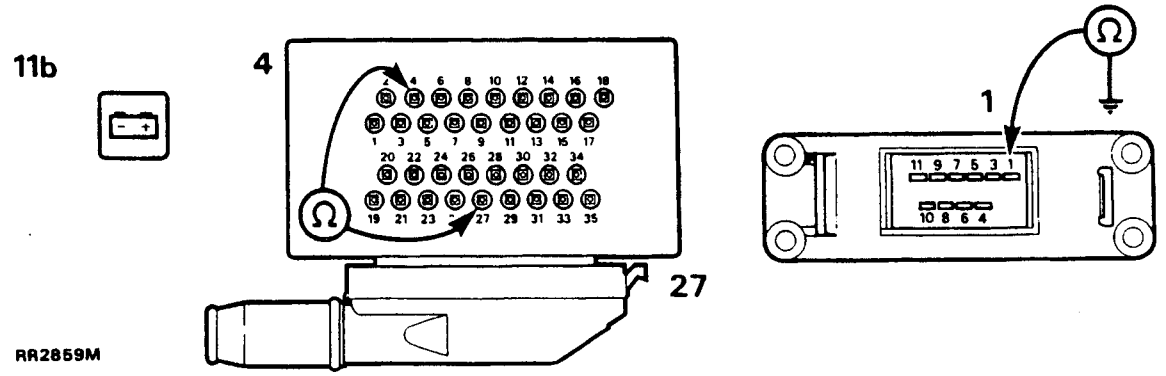
10b Check ABS solenoid valve rear left, inlet.	Correct result: 5 to 7 Ohm
(1) Remove booster harness plug,carry out check at booster	
(2) Refit booster harness plug, carry out check at 35 way	Incorrect result at booster: fit new booster



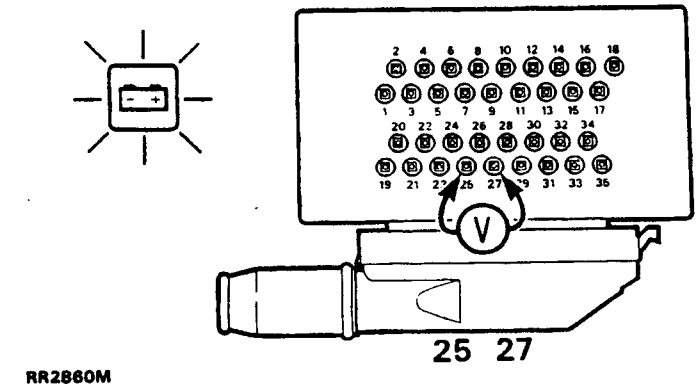
TEST PROCEDURE	RESULTS/CHECKS
11a Check ABS solenoid valve rear right, outlet.	Correct result: 2.5 to 4.5 Ohm
(1) Remove booster harness plug, carry out check at booster	
(2) Refit booster harness plug, carry out check at 35 way	Incorrect result at booster: fit new booster



11b Check ABS solenoid valve rear right, inlet.	Correct result: 5 to 7 Ohm
(1) Remove booster harness plug, carry out check at booster	
(2) Refit booster harness plug, carry out check at 35 way	Incorrect result at booster: fit new booster

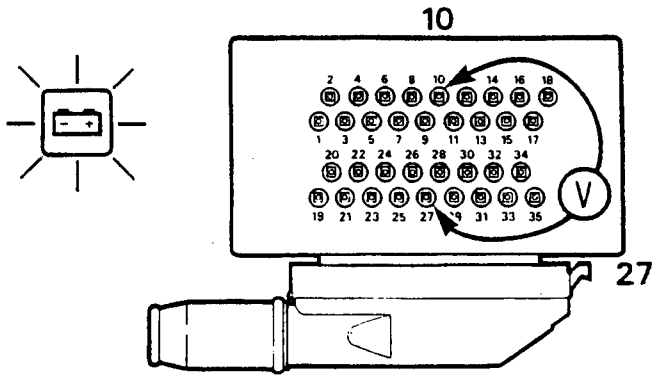


12a Check brake light switch - pedal down.	Correct result: 10V + This contact must operate first and switch the brake lights.Incorrect reading: fit new brake light switch and recheck. Check cable if fault persists.



TEST PROCEDURE	RESULTS/CHECKS
12 Check brake light switch - pedal down.	Correct result: 10V+ Incorrect reading: fit new brake light switch and recheck. Check cable if fault persists.

12b



RR2919M

FAULT DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
ABS warning light on	ABS electrical fault High sensor air gaps	Check ABS electrical circuit to identify fault	Change component if necessary Push in sensors
Both warning lights ON. Pedal travel and pedal force increased	No booster pressure (fluid loss) No booster pressure (pump not operating) Pump faulty	Check reservoir fluid level and inspect system for leaks Check electrical supply to pump	Rectify as necessary and refill reservoir Rectify electrical supply if necessary Change hydraulic pump
Both warning lights ON (no additional symptoms)	Malfunction of pressure switch	Disconnect pressure switch a) If light remains illuminated vehicle wiring faulty b) If lights extinguish pump defective	 a) Test wiring change harness if necessary b) Change pump
Brake fluid warning light ON	Fluid loss Reservoir fluid level switch malfunction Pressure switch malfunction	Check reservoir fluid level and inspect system for leaks Check fluid level switch Check switch with pressure gauge a) If wiring faulty b) If switch faulty	Rectify leakage, refill reservoir Change reservoir cap/switch a) Replace harness b) Change hydraulic pump
Brake fluid warning light ON. Pedal travel increased, foot pressure normal	Fluid loss from hydrostatic circuit	Check reservoir level and inspect system for leaks	Rectify leakage and refill reservoir Rebleed as necessary

Fault Diagnosis - continued

SYMPTOM	POSSIBLE CAUSE	CHECK	REMEDY
Brake fluid warning light OFF. Pedal travel increased, foot pressure normal	Insufficient bleeding Master cylinder malfunction		Rebleed master cylinder circuit Change booster and bleed system
Hydraulic pump runs constantly	Fluid loss Pump non-return valve faulty	Check reservoir level and inspect system for leaks	Rectify leakage as necessary, refill reservoir Change hydraulic pump
Hydraulic pump runs constantly with warning lights OFF. Pedal travel normal.	Malfunction of pressure switch Relay switch malfunction	Disconnect pressure switch a) If pump stops b) If pump continues running	a) Change hydraulic pump b) Change relay or cable
Pedal can be moved downwards under constant pressure	Seal leaking in master cylinder Seal leaking in servo unit	Inspect system for leaks	Change booster unit Change booster unit

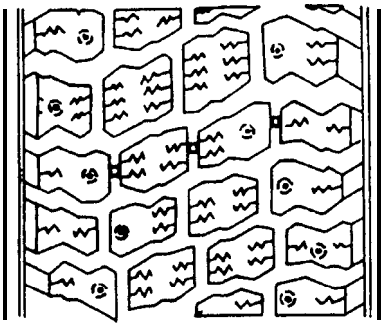
TYRES

inspection

Inspect tyres at weekly intervals to obtain maximum tyre life and performance and to ensure compliance with legal requirements. Check for signs of incorrect inflation and uneven wear, which may indicate a need for balancing or front wheel alignment. Refer to the **Tyre Wear Diagnosis Chart** if the tyres have abnormal or uneven wear patterns.

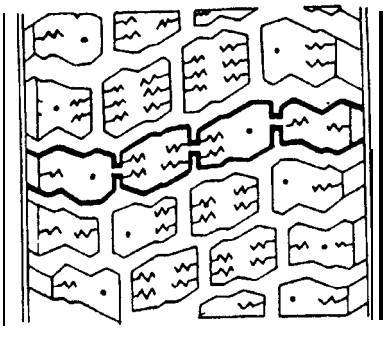
Check tyres at least weekly for cuts, abrasions, bulges and for objects embedded in the tread. More **frequent** inspections are recommended when the vehicle is regularly used in off road conditions.

To assist tyre inspection, tread wear indicators are moulded into the bottom of the tread grooves, as shown in the illustration below.



RR2145E

When the tread has worn to a remaining depth of 1.6 mm (1116 in) the indicators appear at the surface as bars which connect the tread pattern across the width of the tread as shown in the illustration below.



RR2146E

When the indicators appear in two or more adjacent grooves, at three locations around the tyre, a new tyre must be fitted.

NOTE: Do not attempt to interchange tyres, e.g. from front to rear, as tyre wear produces characteristic patterns depending on their position. If such position is changed after wear has occured, the performance of the tyre will be adversely affected.

NOTE: Territorial vehicle regulations governing tyre wear MUST be adhered to.

Tyre pressures

Maximum tyre life and performance will be obtained only if tyres are maintained at the correct pressures.

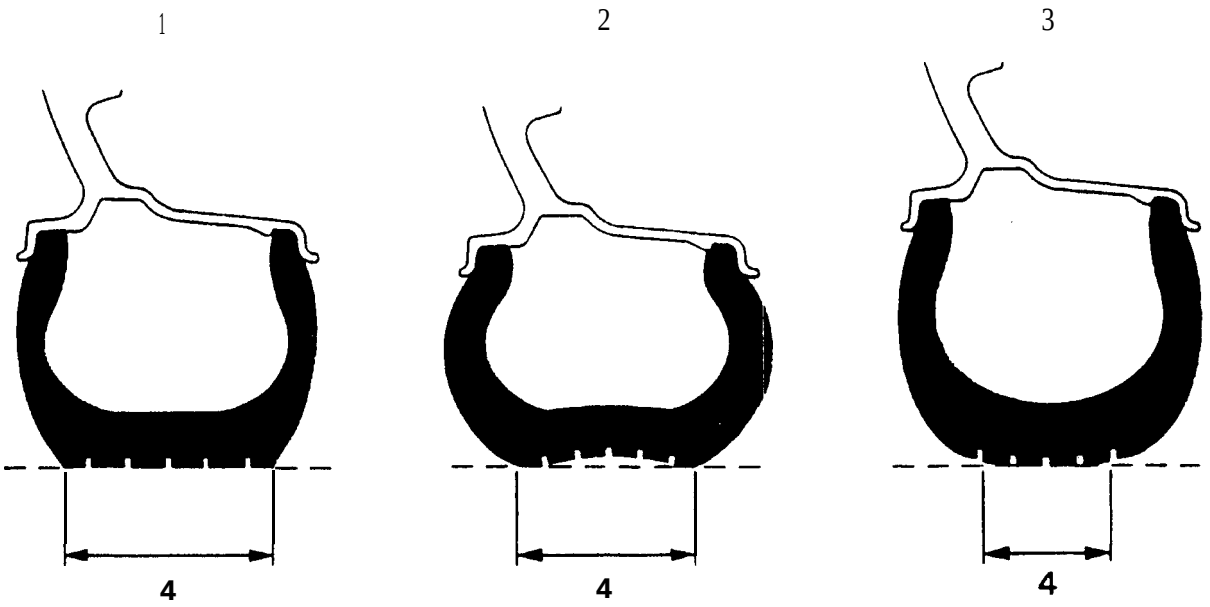
Tyre pressures must be checked at least once a month and at least once a week, preferably daily, if the vehicle is used off road.

The tyre inflation pressure is calculated to give the vehicle satisfactory ride and steering characteristics without compromising tyre tread life. The recommended tyre pressures for all conditions are given in the General Specification Data Section and the Owner's Manual. A label attached to the inside edge of the driver's door also provides tyre pressure information.

Always check tyre inflation pressures using an accurate gauge and inflate tyres to the recommended pressures only.

Check and adjust tyre pressures ONLY when the tyres are cold, vehicle parked for three hours or more, or driven for less than 3.2 km (2 miles) at speeds below 64 km/h (40 mph). Do not reduce inflation pressures if the tyres are hot or the vehicle has been driven for more than 3.2 km (2 miles) at speeds over 64 km/h (40 mph), as pressures can increase by 0.41 bars (6 p.s.i) over cold inflation pressures.

Check **ALL** tyre pressures including the spare. Refit the valve caps as they form a positive seal and keep dust out of the valve.



RR2133E

NOTE: Radial ply tyres have a flexible sidewall, which produces a sidewall bulge making the tyre appear under-inflated. This is a normal condition for radial ply tyres. Do not attempt to reduce this bulge by over-inflating the tyre.

1. Correct inflation.
2. Under-inflation.
3. Over-inflation.
4. Tread contact with road.

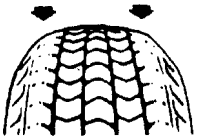
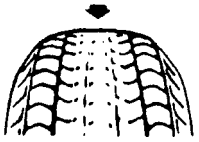
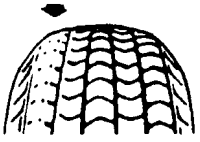
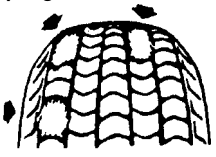
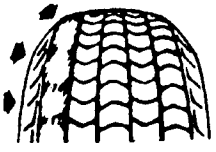
WHEELS

Regularly check the condition of the wheels. Replace any wheel that is bent, cracked, dented or has excessive runout.

VALVES

Check the condition of the inflation valve. Replace any valve that is worn, cracked, loose, or leaking air.

TYRE WEAR DIAGNOSIS •

CONDITION	POSSIBLE CAUSE	CURE
Rapid wear at the shoulders 	Tyres under-inflated Worn suspension components i.e. ball joints, panhard rod bushes, steering damper Excessive cornering speeds	Inflate to correct pressure Replace worn components
Rapid wear at centre of tread 	Tyres over-inflated	Inflate to correct pressure
Wear at one shoulder 	Toe out of adjustment Bent panhard rod Bent shock absorber	Adjust toe to correct figure Check and replace worn or damaged components
Bald spots or tyre cupping 	Wheel out of balance Excessive radial runout Shock absorber worn Excessive braking	Balance wheel and tyre assembly Check runout and replace tyre if necessary Replace shock
Tyre scalloped 	Toe out of adjustment Worn suspension components Excessive cornering speeds	Adjust toe to correct figure Replace as necessary

RR2136E

• CAUTION: This diagnosis chart is for general guidance only and does not necessarily include ev cause of abnormal tyre wear.

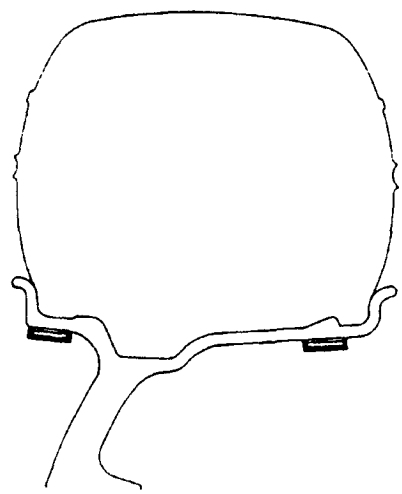
WHEELS AND TYRES

Balance

NOTE: Before attempting to balance a wheel and tyre assembly clean all mud and dirt deposits from both inside and outside rims and remove existing balance weights.

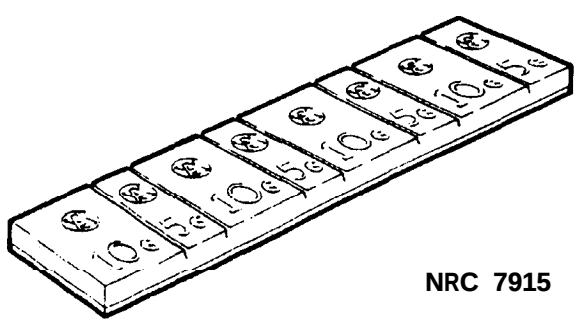
Remove stones from the tyre tread in order to avoid operator injury during dynamic balancing and to obtain the correct balance.

Inspect tyres for damage and correct tyre pressures and balance according to the equipment manufacturer's instructions.



RR2138E

Clean area of wheel rim and attach adhesive balance weights in position shown. Cut through rear face of weight strip to detach required weights.

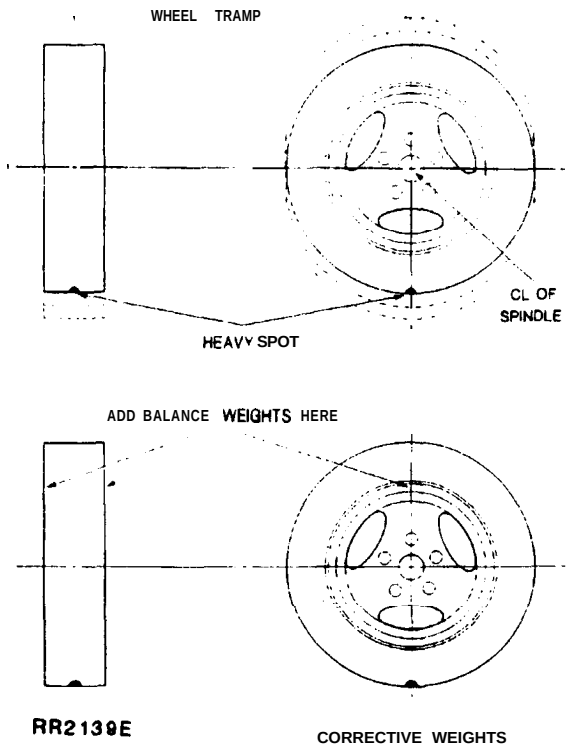


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CAUTION: Use only the correct adhesive balance weights to avoid damage to the aluminium wheel rim. DO NOT attempt to use a steel wheel weight on an aluminium wheel.

Static balance

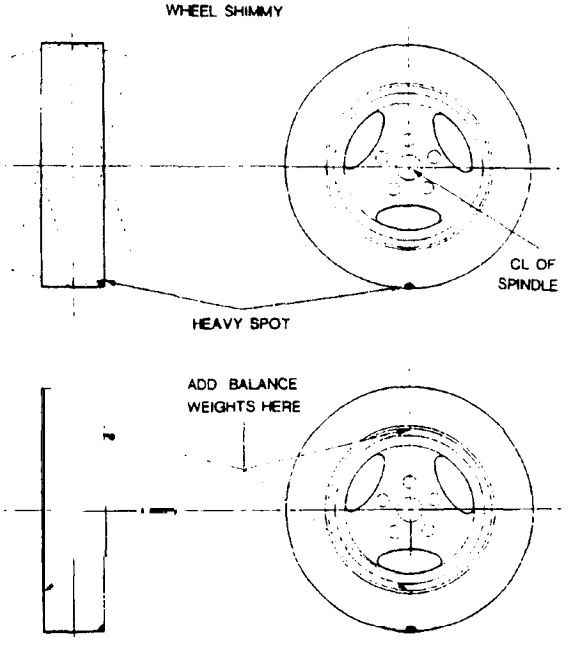


RR2139E

CORRECTIVE WEIGHTS

Static balance is the equal distribution of weight around the wheel. A statically unbalanced wheel will cause a bouncing action called wheel tramp. This condition will eventually cause uneven tyre wear.

Dynamic balance



Dynamic balance is the equal distribution of weight on each side of the centre line so that when the wheel spins there is no tendency for side to side movement. A dynamically unbalanced wheel will cause wheel shimmy.

Off vehicle balancing

Balance the wheel assembly referring to the equipment manufacturer's instructions.

It is essential that the wheel is located by the centre hole NOT the stud holes. To ensure positive wheel location the diameter of the locating collar on the machine shaft must be 112.80 to 112.85 mm (4.441 to 4.443 in). This diameter will ensure that the collar fits correctly within the centre hole of the wheel.

Where possible always use the vehicle wheel retaining nuts to locate the wheel on the balancer, to avoid damaging the wheel. If this is not possible, the locating nuts must be of a similar pattern to the original wheel nuts. The use of conical type wheel nuts for this purpose may damage the aluminium alloy.

CAUTION: It is essential that all wheel balancing is carried out off the vehicle. The use of on the vehicle balancing could cause component damage or personal injury and MUST NOT be attempted.

GENERAL INFORMATION

WARNING: THE RANGE ROVER IS A MULTI-PURPOSE VEHICLE AND AS SUCH THE WHEELS AND TYRES ARE DESIGNED FOR BOTH ON AND OFF ROAD USAGE. ONLY THE WHEELS AND TYRES SPECIFIED FOR USE ON THE VEHICLE MUST BE USED.

The Range Rover is equipped with tubeless 'S' rated radial tyres as standard equipment. The tyres are of European metric size and must not be confused with the "P" size metric tyres available in North America.

When tyre replacement is required the correct type of radial-ply tyre must be used. Under no circumstances must cross-ply or bias-belted tyres be used.

Always use the same make and type of radial-ply tyre throughout the vehicle.

See Data section for tyre specification and pressures.

The tyres are mounted on 7.0 inch wide by 16 inch diameter cast aluminium alloy wheels. The wheel rim is of the asymmetric hump type incorporating a safety hump to improve location of the tyre bead in its seat. The surface has a paint finish covered with a clear polyurethane lacquer. Care must be taken when handling the wheel to avoid scratching or chipping the finish.

Cleaning

Wash the aluminium wheels using a suitable wash and wax concentrate correctly diluted and rinse with cold clear water. DO NOT use abrasives or aluminium wheel cleaners containing acid, as they will destroy the lacquer finish.

Tyre changing

Use only tyre changing equipment to mount or demount tyres, following the equipment manufacturer's instructions. **DO NOT** use hand tools or tyre levers, as they may damage tyre beads or the aluminium wheel rim.

Puncture repair

Remove the punctured tyre from the wheel and repair using a combination service plug and vulcanising patch. Always follow the manufacturer's instructions when using a puncture repair kit.

Only punctures in the tread area are repairable, **DO NOT** attempt to repair punctures in the tyre shoulders or sidewalls.

Do not attempt to repair a tyre that has sustained the following damage: bulges or blisters, ply separation, broken or cracked beads, wear indicators visible and punctures larger than 1/4 inch diameter.

CAUTION: Do not use tyre sealants that are injected through the valve stem to repair punctured tyres as they may produce wheel corrosion and tyre imbalance.

Aluminium wheel rim bead seats should be cleaned using a non-abrasive cleaner to remove the mounting lubricants and old rubber. Before mounting or demounting a tyre, the bead area should be well lubricated with a suitable tyre lubricant.

Tyre fitting

1. Install a new valve assembly.
2. Ensure the wheel and tyre is adequately lubricated.
3. Mount the tyre in the normal manner. Inflate the tyre and at the same time apply hand pressure to the area around the valve to aid seating over the valve first.

NOTE: Stop inflation immediately if the tyre seats opposite the valve, as this will result in the valve being blocked by the tyre beading, making further inflation impossible, and carry out the following procedure.

4. Deflate the tyre, unseat and rotate it around the rim until the valve is in line with that part of the tyre which seated initially. This part of the beading having seated over the hump previously will automatically seat first when the tyre is re-inflated.
5. Inflate the tyre to seat the beads correctly, finally inflate to the correct pressure.

Wheels

Remove and refit

WARNING: The parking brake acts on the transmission, not the rear wheels, and may not hold the vehicle when jacking unless the following procedure is used. If one front wheel and one rear wheel is raised no vehicle holding or braking effect is possible. Wheels MUST be chocked in all circumstances.

Always engage the differential lock. Note that the differential lock is only engaged if the warning light is illuminated with the ignition switched on.

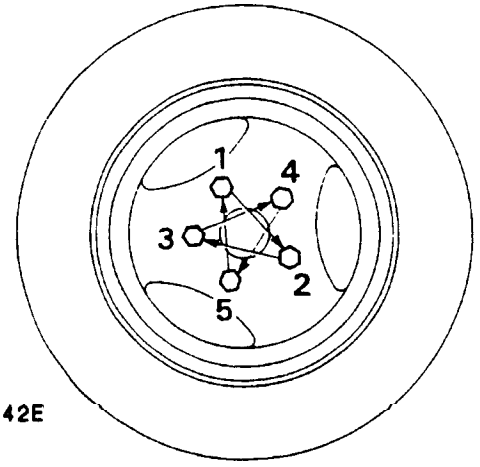
Apply the parking brake, select 'P' in the main gearbox and engage low gear in the transfer box.

Removing

1. Loosen the five wheel nuts.
2. Using a suitable floor jack raise the vehicle and place on axle stands, see jacking procedure in Maintenance- Section 10.
3. Remove the wheel nuts and carefully withdraw the wheel over the studs.

Refitting

4. Ensure that the retaining studs and nuts are clean.
5. Lightly coat the wheel mounting spigot face with a suitable anti-seize compound to minimise the possibility of adhesion between wheel and spigot face.
6. Apply a drop of oil to the wheel studs.
7. Refit the wheel taking care not to damage the stud threads.
8. Fit the wheel nuts and turn by hand for at least three full threads before using any form of wheel wrench.
9. Tighten the nuts as much as possible using a suitable wrench.



RR2142E

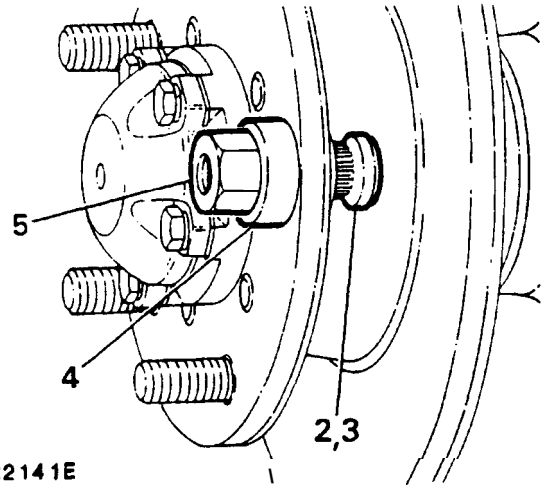
10. Lower the vehicle and finally tighten the nuts to the correct torque (see section 06-Torque values) in the sequence shown.

Wheel stud

Remove and refit

Removing

1. Remove the wheel.
2. Drive the stud out of the driveshaft flange.



RR2141E

Refitting

3. Position the stud in the flange.
4. Install a suitable spacer over the stud.
5. Using a MI6 x 1.5P nut, a slave Range Rover wheel nut is suitable, pull the stud into the flange until the shoulder of the stud abuts the flange.
6. Refit the wheel, tighten the wheel nuts to the correct torque (see section 06-Torque values).

BODY REPAIRS, GENERAL INFORMATION

The Range Rover body consists of a steel frame to which alloy outer panels are attached. The cowl panel, front fenders, side door outer panels, body side outer panels and roof are made from a special light magnesium-aluminium alloy.

The manufacture of body panels from aluminium has two distinct advantages, the first of which is a much better resistance to corrosion, the second being a decrease in the gross vehicle weight.

Aluminium panels can be effectively repaired using the 'Argon Arc ' process of welding, because the afore mentioned is a specialist operation it is necessary that only a skilled operator or specialist body shop undertake such repairs.

Under certain conditions it may' not be practical to repair an exterior damaged panel, if this is the case, then panels can be easily removed and replaced with new ones (refer to the appropriate part of the Body section for panel removal and refit).

Panel beating

1. Aluminium alloy panels can be beaten out after accidental damage in the same way as sheet steel. However, under protracted hammering the material will harden, and then it must be annealed to prevent the possibility of cracking. This is quite easily done by the application of heat, followed by slow air-cooling, but as the melting point is low, heat must be applied slowly and carefully.

CAUTION: Before applying heat to any panel ensure that the panel is clean and free from underseal and that the area to be worked on is well clear of any combustible materials. Ensure that all necessary precautions are taken against fire. IF HEAT IS TO BE APPLIED TO THE REAR RIGHT HAND FENDER, THE FENDER MUST FIRST BE REMOVED AS A FUEL EXPANSION TANK IS LOCATED BETWEEN THE FENDER AND INNER BODY SIDE.

Welding

CAUTION: The battery ground lead MUST be disconnected before commencing welding. IF WELDING IS TO BE CARRIED OUT ON THE REAR RIGHT HAND FENDER, THE FENDER MUST BE REMOVED, AS A FUEL EXPANSION TANK IS LOCATED BETWEEN THE FENDER AND INNER BODY SIDE.

1. Clean off all grease and paint, dry thoroughly and then clean the edges to be welded, and an area at least half an inch on either side of the weld, with a stiff wire scratch brush or wire wool. Cleanliness is essential. Also clean the welding rod or strip with steel wool.
2. It is strongly recommended that a few welds are made on scrap metal before the actual repair is undertaken if the operator is not already experienced in welding aluminium and its alloys.
3. Use only 5 per cent magnesium aluminium welding rod (5 Mg/A).

Welding tears and patching

1. If a tear extends to the edge of a panel, start the weld from the end away from the edge and also at this point drill a small hole to prevent the crack spreading, then work towards the edge.
2. When welding a long tear, or making a long welded joint, tack the edges to be welded at intervals of from 2 in to 4 in (50 to 100mm) with spots. This is done by melting the metal at the starting end and fusing into it a small amount of the filler rod, repeating the process at the suggested intervals. After this, weld continuously along the joint from right to left, increasing the speed of the weld as the material heats up.
3. When patching, cut the patch to the correct shape for the hole to be filled, but of such sizes as to leave a gap of 1/32 in (0.80mm) between it and the panel, and then weld as described above. Never apply an 'overlay' patch.

Spot welding

1. spot welding is mainly used in the manufacture of the Range-Rover inner steel body frame and exterior magnesium-aluminium alloy panels, and is a process which can be carried out satisfactorily by the use of the proper apparatus in a specialist body shop. Aluminium and its alloys are very good conductors of heat and electricity, and thus it is most important to maintain the right conditions for successful spot welding. The correct current density must be maintained, and so must the 'dwell' of the electrodes. Special spot welding machines have been developed, but they are expensive, and though the actual work can be carried out by comparatively unskilled labour, supervision and machine maintenance must be in the hands of properly qualified persons.

Riveting

1. Where both sides of the metal are accessible and it is possible to use an anvil or 'dolly' solid aluminium rivets may be used, with a suitable punch or 'pop' to ensure clean rounded head on the work. For riveting blind holes, 'pop-rivets' must be used. These are inserted and closed by special 'Lazy-Tong' 'pop-rivet' pliers.

PAINTWORK

General Information

Before undertaking any paintwork process on the exterior body of Range Rover, firstly ascertain which is the best method of repair either by panel repair or replacement.

The initial preparation of a panel is very important to ensure that when finished it is of a standard that meets and matches existing bodywork. Panels must be thoroughly degreased with Berger Preclean 802.0516 or a suitable equivalent, any unsound paint to be stripped using Berger Double strength Meltic 301.8051. Always refer to the paint manufacturers instructions.

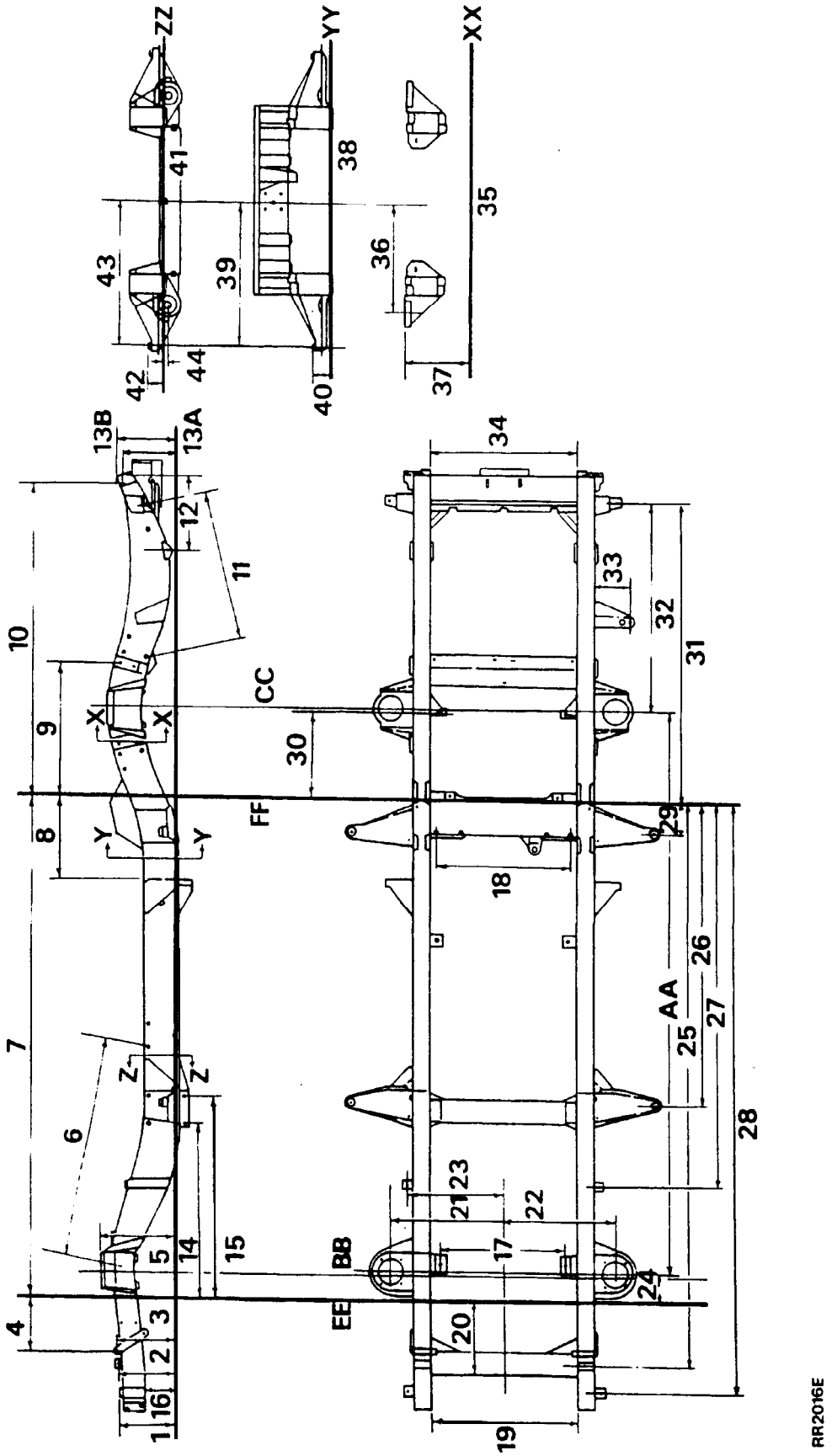
Paintwork processes should be performed by a specialist bodyshop where paint spraying can be undertaken in a controlled environment whereby temperatures are kept constant and the atmosphere dust free.

The flow chart on the following page gives a guide to preparing and painting a panel. Wherever possible refer to the Berger Vehicle Refinishes Product Data and Application Sheets for further information.

SUBSTRATE

ALUMINIUM PANELS

	PANEL REPAIR	REPLACEMENT PANEL
'REPARATION	Vet for using P60 Grade paper or dry and using P240 grit discs.	Wet flat using P60 Grade paper or dry sand using P240 grit discs. Care must be taken to avoid cutting through to bare aluminium.
)ODY FILLING	f filling is required, thoroughly ıbrade bare aluminium area to be illed and apply Standox Polyester ıtopper 430-5029.	If filling is required, fill small indentations with Standox Polyster stopper 430-5029.
:TCHING	itch the bare aluminium and filler with auto-speed self etch ɔrimer 414-1171, mixed 1:1 with activator 301-7995. Apply one coat and ıllow to dry for approximately 20 ninutes. Recoat within 1 hour.	This process is not required if the original electrocoat primer is in sound condition. IF NOT
'RIMING	To obtain maximum adhesion and excellent build, apply Standox 2K 4:1 full primer 405-0381. Coats of 30-40 microns can be wet flatted with P60 grade paper after 45 minutes at 20°C.	
COLOUR COATING	Apply either Standox 2K Standocryl or Standox Metallic Basislack to the colour required. Hardeners and thinners will vary depending upon system employed, conditions available, temperature and size of vehicle etc. Refer to paint manufacturers Technical Information Sheet for correct selection.	


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RR2016E

CHASSIS FRAME
Alignment check

	Diagram reference	millimetres	inches
AA	Wheelbase-Reference dimension	2540.00	100.000
BB	Centre line of front axle		
c c	Centre line of rear axle		
D D	Frame datum line		
EE	Side member datum line		
FF	Datum line		
1	(with mounting washers)	254.00 ± 0.63	10.000 ± .025
	(without washers)	263.525 + 1.91	10.375 + .075
		- 0.63	- .025
2		261.11 ± 2.54	10.180 ± .100
3		266.70 ± 2.54	10.500 ± .100
4		237.74 ± 1.27	9.360 ± .050
5		327.81 ± 2.54	12.906 ± .100
6		979.93 ± 1.27	38.580 ± .050
7		2244.72 ± 2.54	88.375 ± .100
8		356.74 ± 2.54	14.045 ± .100
9		605.15 ± 2.54	23.825 ± .100
10		1405.38 ± 2.54	55.330 ± .100
11		694.44 ± 2.54	27.340 ± .100
12		338.83 ± 2.54	13.340 ± .100
13A		222.25 ± 5.08	8.750 ± .200
13B		240.54 ± 2.54	9.470 ± .100
14	Reference dimension	794.91	31.296
15	To face of boss	935.43 ± 2.54	36.828 ± .100
16	Frame datum to underside of cross-member	150.79	5.937
17		535.94 ± 2.54	21.100 ± .100
18		590.55 ± 0.64	23.250 ± .025
19	Check figure	630.93 ± 1.27	24.840 ± .050
20		344.17 ± 1.27	13.550 ± .050
21		485.77 ± 2.54	19.125 ± .100
22		485.77 ± 2.54	19.125 ± .100
23		414.32 ± 2.54	16.312 ± .100
24		129.03 ± 2.54	5.080 ± .100
25		2544.44 ± 0.25	100.175 ± .010
26		1355.34 ± 0.38	53.360 ± .015
27		1722.04 ± 0.38	67.797 ± .015
28		2663.44 ± 0.38	104.860 ± .015
29		144.09 ± 0.38	5.673 ± .015
30		400.48 ± 2.54	15.767 ± .100
31		1333.88 ± 0.38	52.515 ± .015

Continued

		millimetres	inches
32	Reference dimension	925.49	36.437
33	Reference dimension	147.62	5.812
34	Reference dimension	635.00	25.000
	SECTION XX		
35	Frame datum line DD		
36		488.95 ± 2.54	19.250 ± .100
37		295.27 ± 2.54	11.625 ± .100
	SECTION YY		
38	Frame datum line DD		
39		660.40 ± 0.17	26.000 ± .007
40		MO.95 + 1.91 - 0.63	3.187 + .075 - .025
	SECTION ZZ		
41	Frame datum line DD	80.95 + 1.91	3.187 + .075
42		- 0.63	- .025
43		660.4 ± 0.17	26.000 ± .007
44		9.525 ± 2.54	0.375 ± .100

BODY

Introduction:

The information which follows is concerned solely with the 'Monocoque' assembly of the inner body shell on Range Rover models.

Body repairs often require the removal of mechanical and electrical units and associated wiring. Where necessary, reference should be made to the relevant section of the Repair Manual for removal and refitting instructions.

The inner body shell is of 'Monocoque' construction and to gain access to the repair area, it may be necessary to remove exterior body panels, all exterior body panels are bolted to the inner body shell to facilitate easier panel removal and replacement or repair.

It is expected that a repairer will select the best and most economic repair method possible, making use of the facilities available. The instructions given are intended to assist a skilled body repairer by expanding approved procedures for panel replacement with the objective of restoring the car to a safe running condition and effecting a repair which is visually acceptable.

WELDING

The following charts and illustrations show the locations and types of weld for securing the body side assembly, tailgate frame assembly and the front valance and wheel arch assembly. Before undertaking any spot weld joints to the inner body, it is advisable to make a test joint using offcuts of the damaged components, and to use this test piece to perform a weld integrity test.

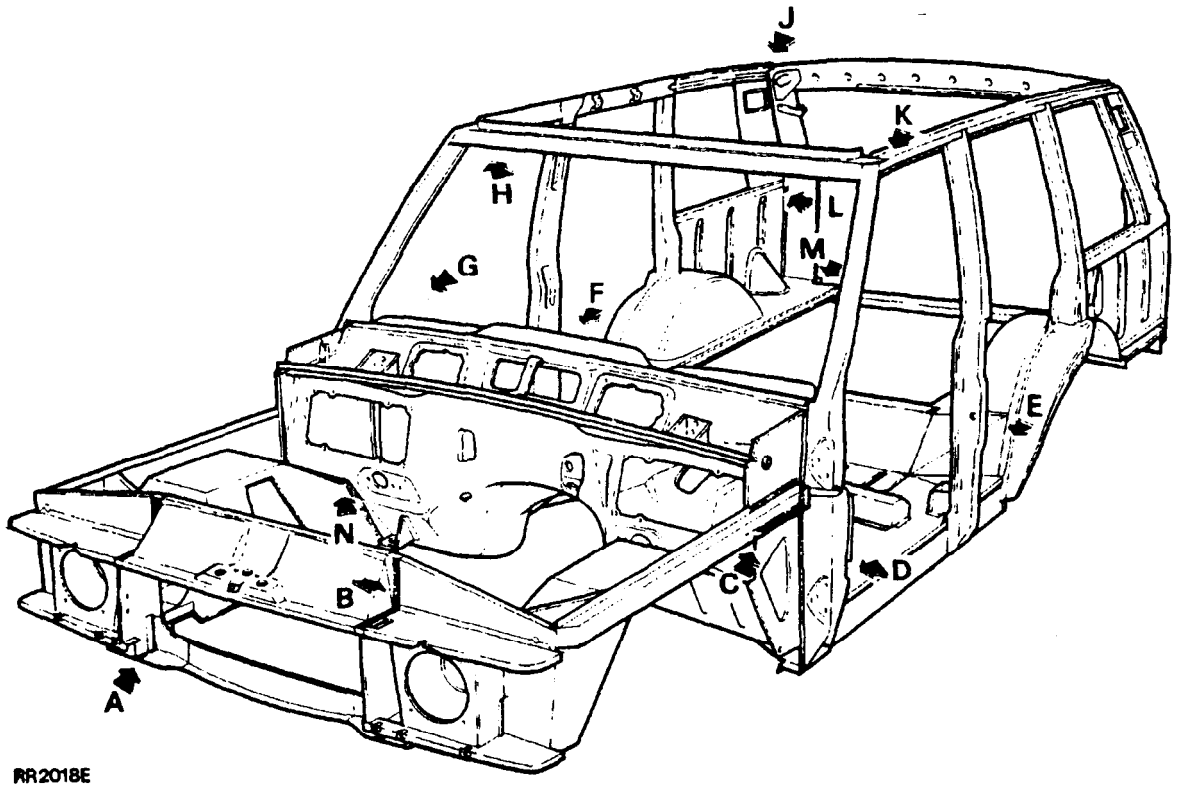
Spot welding is satisfactory if the joints do not pull apart. If the weld pulls a hole or tears the metal the weld is satisfactory. It is defective if the weld joint pulls apart or if there are signs of burning, porosity or cracking evident.

PREPARATION

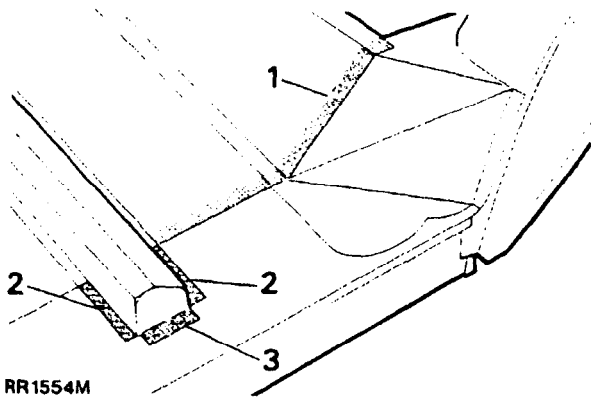
Thoroughly clean all areas to be welded, remove any sealants and corrosion protectives from around original panels. Align and clamp all new panels in position and check relationship to one another.

Continued

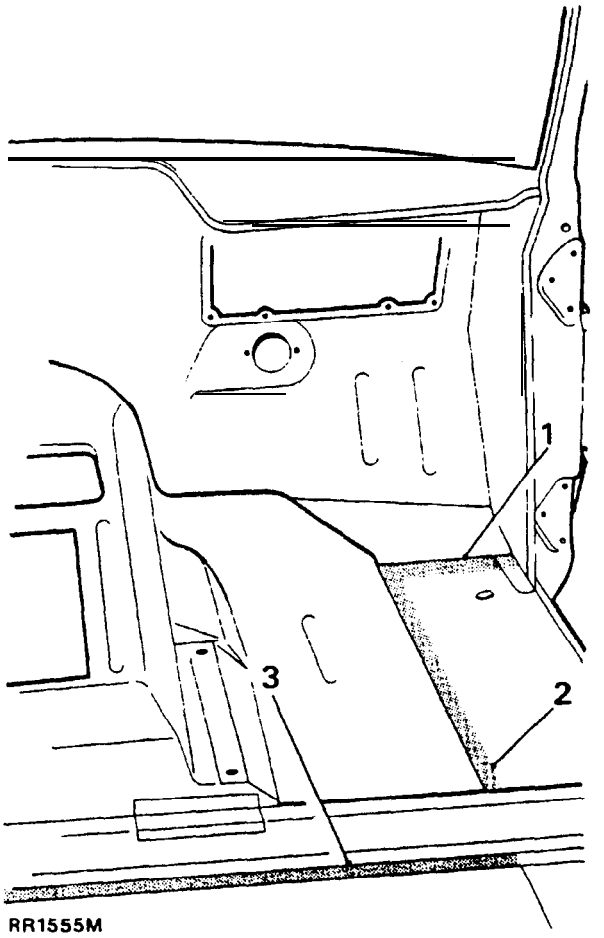
INNER BODY SHELL ASSEMBLY



	LOCATION	FACTORY JOINT (minimum number of spot welds quoted)
A.	Front cross member to valance and wheel arch assembly	6 spot welds, 20mm pitch
B.	Hood locking platform to valance and wheel arch assembly	10 spot welds, 25mm pitch
C.	Valance and wheel arch assembly to dash and tunnel assembly	16 spot welds, 25mm pitch
D.	Body side complete to dash and tunnel assembly	10 spot welds, 65mm pitch



RR1554M



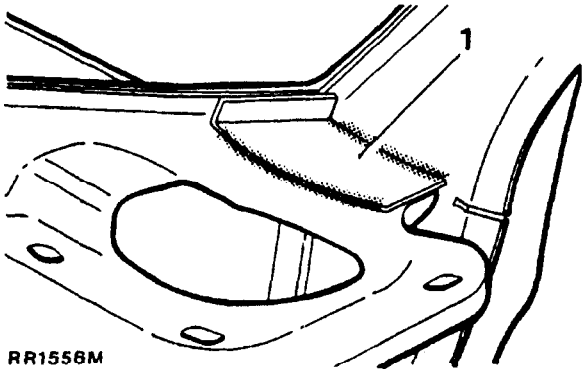
RR1555M

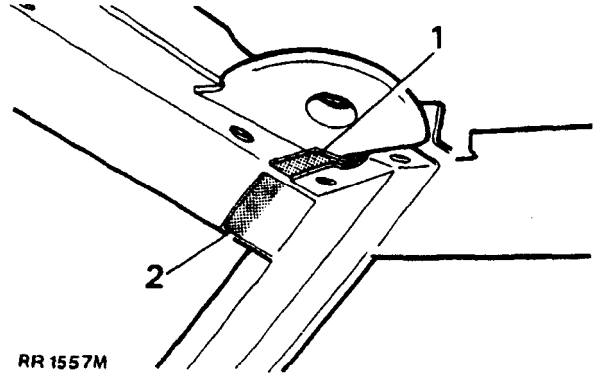
LOCATION E

LOCATION F

LOCATION	FACTORY JOINT (minimum number of spot welds quoted)
E. 1. Body side complete to heelboard panel assembly.	14 spot welds, 35mm pitch
2. Body side complete to dash and tunnel assembly complete.	10 spot welds, 25mm pitch
3. Body side complete to dash and tunnel assembly	3 spot welds, 30mm pitch
". I. Body side complete to dash and tunnel assembly complete	7 spot welds, 30mm pitch
2. Body side complete to dash and tunnel assembly complete	18 spot welds, 40mm pitch
3. Body side complete to dash and tunnel assembly complete	30 spot welds, 34mm pitch

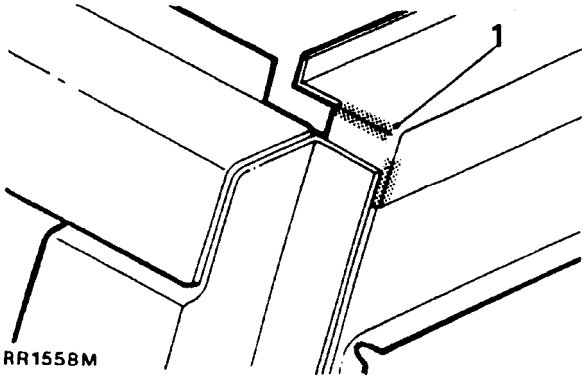
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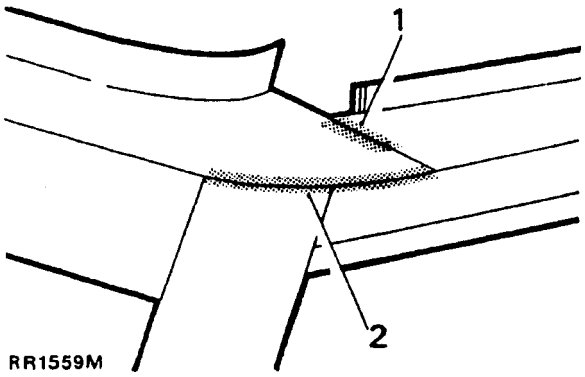




LOCATION G LOCATION H

LOCATION	FACTORY JOINT (minimum weld requirement quoted)
G. 1. Reinforcement plate to dash and tunnel assembly and body side assembly complete	CO, weld, 2 places 75mm long each weld
H. 1. Body side complete to roof header panel assembly (internal joint)	3 spot welds, 15mm pitch
2. Body side complete to roof header panel assembly (internal joint)	3 spot welds, 15mm pitch

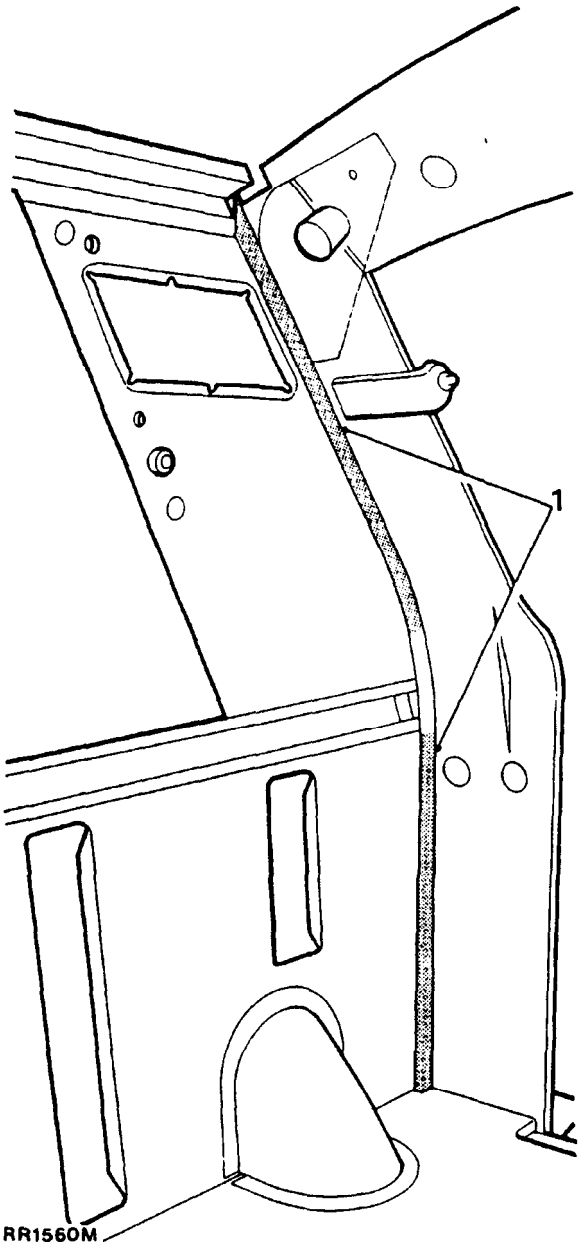


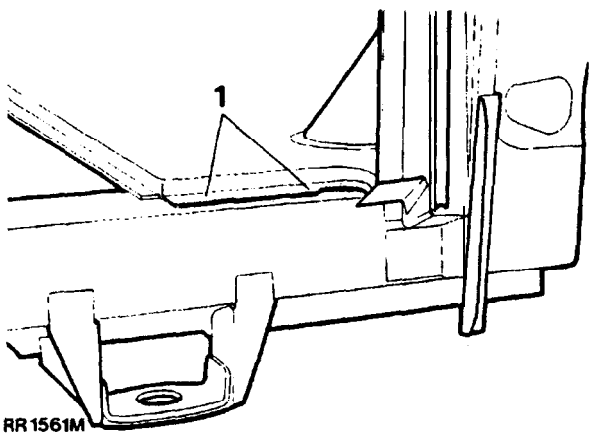


LOCATION J LOCATION K

	LOCATION	FACTORY JOINT (minimum weld requirement quoted)
I.	1. Body side complete to rear tailgate frame assembly	CO_2 weld, one run 40mm long
K.	1. Body side complete to roof header panel assembly (external joint)	CO_2 weld, one run 20mm long
	2. Body side complete to roof header panel assembly (external joint)	CO_2 weld, one run 100mm long

Continued

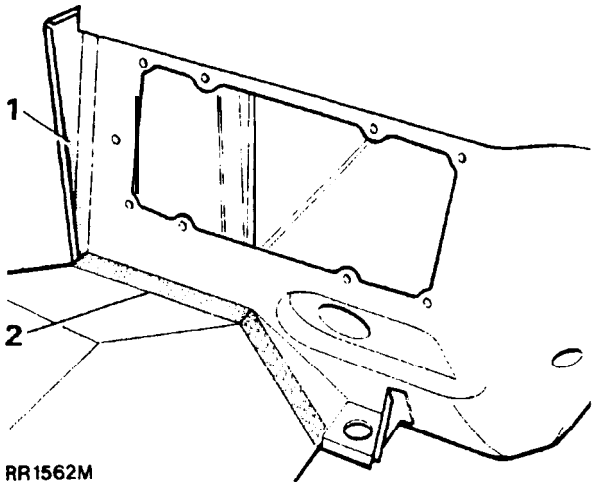




LOCATION L

LOCATION M

LOCATION	FACTORY JOINT (minimum weld requirement quoted)
L. 1. Body side complete to rear tailgate side member	32 spot welds, 30mm pitch
M. 1. Body side complete to rear tailgate bottom cross member	CO_2 weld, 2 runs 40mm long



LOCATION N

LOCATION	FACTORY JOINT (minimum number of spot welds quoted)
N. 1. Valance and wheel arch assembly to dash and tunnel assembly	4 spot welds, 45mm pitch
2. Valance and wheel arch assembly to dash and tunnel assembly.	15 spot welds, 25mm pitch

HEADLINING AND ROOF PANEL

Remove and refit

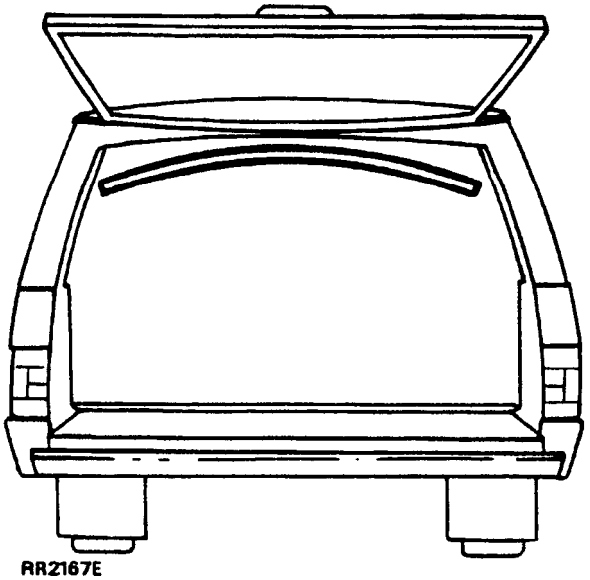
Removing

Headlining

1. Remove the two roof lamp assemblies.
2. Remove the rear view mirror and mounting bracket.
3. Remove the two sun visors and centre retaining bracket.
4. Remove the front and rear passenger grab rails.
5. Pry out the two plastic retaining clips securing the centre of the headlining to the roof panel.
6. With assistance support the front of the headlining while releasing the two rear fixings above the rear quarter light glass.
7. While the headlining is still being supported pry out the two plastic retaining clips securing the rear end of the headlining, located adjacent to the upper tailgate hinges.

CAUTION: To avoid damage and to assist in the removal of the headlining from the vehicle, slightly flex the headlining as shown in the illustration below.

8. Lower the headlining and disconnect the electrical leads from the rear radio speakers, remove the headlining from the vehicle.



Roof panel

9. Remove the screws (with washers) from around the inner edge of the roof panel.
10. With assistance lift the roof panel from the body, remove any previous sealing compounds from around the edge of the roof panel and body.

Refitting

11. Apply a waterproof sealant to roof and body mating faces.
12. Reverse the removal instructions 1 to 9.

HOOD-COWL PANEL-FRONT FENDER

Remove and refit

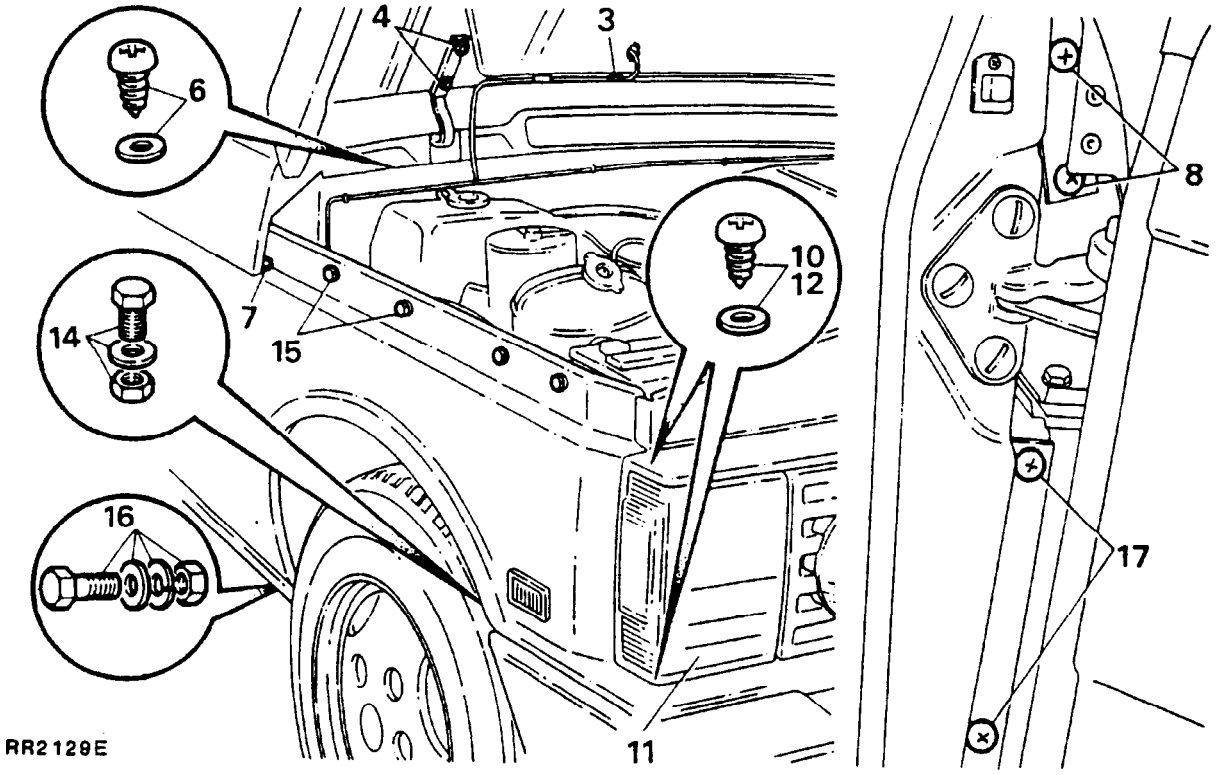
Removing

CAUTION: The assisted hood lift mechanism alone will not retain the hood in its fully open position. Always secure the hood stay to support an open hood.

1. Open the hood and disconnect the battery negative terminal.
2. Disconnect the under-hood lamp electrical leads.
3. Disconnect the windscreen washer tube at the 'T' joint.
4. Release the four bolts securing the hood to the hinges, note the ground strap located under the upper left hand hood fixing, with assistance lift the hood clear of the vehicle.

Cowl panel

5. Remove the wiper arms and two nuts securing the wheel boxes to the cowl panel and remove the two exterior sealing rubbers.
6. Remove the nine cross-head screws securing the front of the cowl panel.
7. Remove the four bolts (with spring and plain washers) retaining the cowl panel to the top of the fenders, retrieve the nylon spacing washers from between cowl panel and fender.



8. Remove the four cross-head screws retaining the panel to the 'A' post mounting brackets located above the front door hinges.
9. With assistance place a tube over each of the hinges and lower to enable the cowl panel to be fed over the hinges, carefully return the hinges to their upright position.

Front fender

10. Remove the two cross-head screws from the top of the front side light assembly, maneuver the assembly out of the two bottom location holes.
11. Remove the bulb holder waterproof cover, depress the two retaining clips and withdraw the bulb holder from the rear of the lamp unit. Remove the lamp unit.
12. Remove the two screws (with plain washers) from the bottom of the side light recess.
13. Remove the three fixings securing the bumper wrap around end cap and remove the moulding from the bumper.
14. Remove the bolt which secures the end of the spoiler to the front of the wheel arch, located forward of the road wheel at the bottom of the fender.
15. Remove the five nuts and bolts (with plain and spring washers) securing the top edge of the fender to the wheel arch and valance assembly.
16. Remove the two bolts (with plain washers) securing the sill finishing strip to the bottom of the fender.
17. Remove the two cross-head screws securing the fender to the mounting bracket attached to the 'A' post located in between the front door hinges.

Refitting

Front fender

18. Apply a suitable underseal to the inner face of the fender and a waterproof sealant to the fender to wheel arch/valance mating faces.
19. Ensure that before final tightening of the fender securing bolts the fender aligns with the edge of the front door.
20. Reverse remaining fender removal instructions.

Continued

Cowl panel

21. Lower the hinges to enable the cowl panel to be fitted.
22. Fit the securing bolts ensuring that any nylon spacers previously removed are refitted in their original position.
23. Using a soft blunt implement ease the windscreen rubber up onto the top of the cowl panel.
24. Reverse the remaining cowl panel removal instruction.

Hood

25. Fit the hood ensuring that before final tightening of the securing bolts, the engine ground strap is refitted to the forward bolt of the left hand hinge, and that the hood aligns with the cowl panel, fender and front grille, adjust the hood at the hinges as necessary.
26. Reverse the remaining removal instructions.

ASSISTED HOOD LIFT

Remove and refit

Removing

CAUTION: The assisted lift mechanism of the hood eases the hood opening and lift procedure. When the hood is fully open, secure the hood stay in position. The assisted lift mechanism alone WILL NOT retain the hood in its upright position.

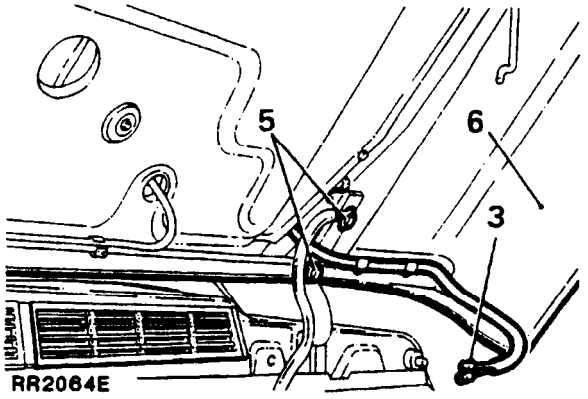
1. Carefully pry the wiper arms off the spindle bosses, noting their position for re-assembly.
2. Raise the hood and disconnect the battery negative terminal.
3. Disconnect the electrical lead to the hood illumination lamp.
4. Disconnect the screen washer fluid feed pipe at the 'T' joint, remove the feed pipe from the hood retaining clip.

NOTE: The removal of the hood will require the assistance of a second person.

5. Release the four bolts (with plain washers) securing the hood to the hinges.

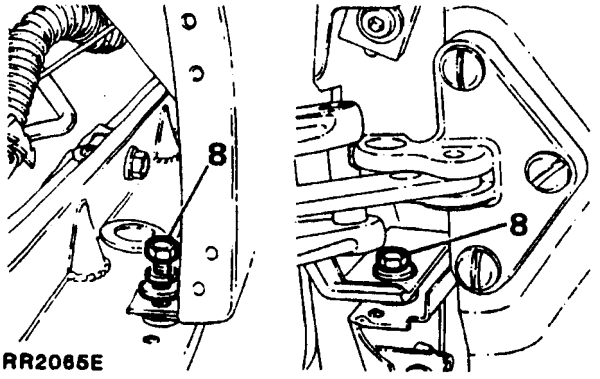
NOTE: An engine ground strap is attached to the forward bolt of the left hand hinge and must be refitted when the hood is re-bolted to the hinges.

6. With assistance lift the hood clear of the hinges and store safely to one side, cover hood to protect paintwork.



RR2064E

7. Remove the two wiper box wheel nuts and rubber spacers.
8. Remove the four fixings securing the cowl panel to the front fenders, the front two fixings are accessible from the front of the cowl panel, access to the rear two fixings is gained by opening the front doors. Note the nylon spacing washers at each bolt.



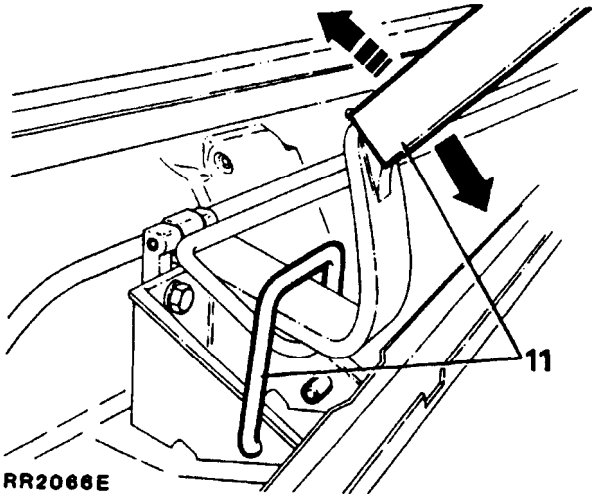
RR2065E

9. Remove the nine cross-head screws from the front of the cowl panel water channel.

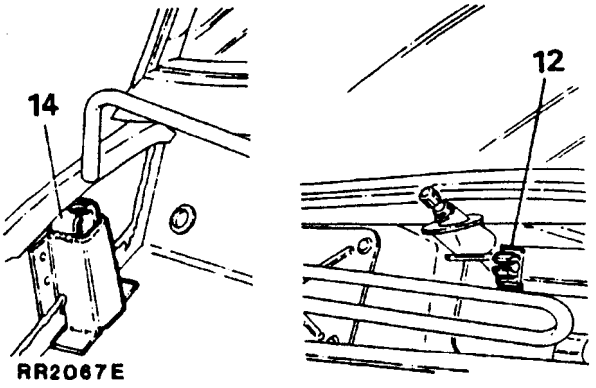
10. Place extension tubes over each hood hinge, with assistance lower the hinges, maneuver the cowl panel off the wiper arm shaft bosses and along the tubes until the panel is clear of the vehicle. Place the panel to one side and cover to protect paintwork.

WARNING: Gradually let the torsion bar spring tension return the hinges to their upright position to prevent the possibility of personal injury or damage to the vehicle.

11. Place an extension tube over the hinge, lower the hinge until the stop bracket can be removed, withdraw the bracket and gradually allow the hinge to return to its upright position.



12. Release the torsion bar from the retaining clip.
13. Maneuver the torsion bar until it can be released from the hinge.
14. Release the torsion bar from the retaining bracket.



15. Remove the two bolts (with plain washers) securing the hinge to its mounting bracket.
16. Withdraw the hinge.

Refitting

17. Fit the hinge and securely tighten the two retaining bolts (with plain washers).
18. Fit the torsion bar ensuring that it is securely located in the retaining clip and bracket.
19. Reverse the remaining removal instructions.

NOTE: Fit the ground strap under the forward bolt of the left hand hinge.

20. Using a soft blunt implement ease the bottom lip of the windscreen seal up and over onto the face of the cowl panel.

REAR CORNER PANEL AND FENDER

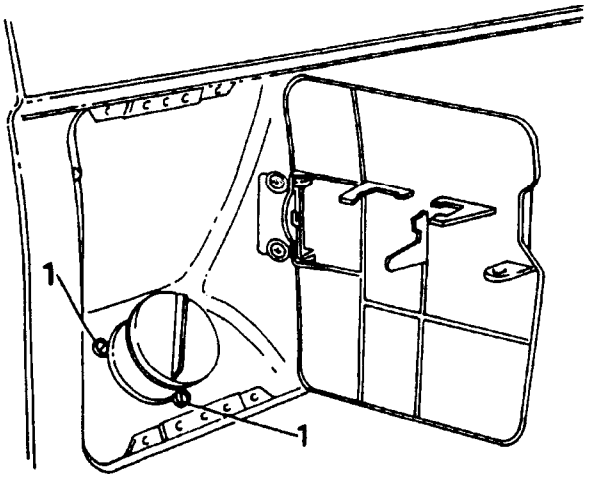
Remove and refit

CAUTION: IF A REPAIR IS BEING UNDERTAKEN ON OR AROUND THE AREA OF THE REAR RIGHT HAND FENDER AND HEAT IS TO BE APPLIED, THE FENDER MUST BE REMOVED, AS A FUEL EXPANSION TANK IS LOCATED BETWEEN THE FENDER AND INNER BODY SIDE.

Removing

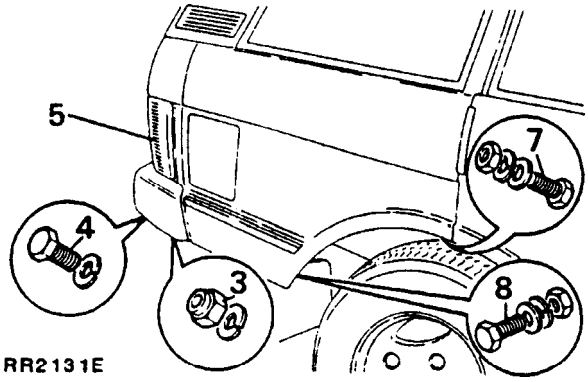
NOTE: Ensure the central locking system is de-activated to enable the fuel filler flap to be opened, disconnect the battery negative terminal.

1. Open the fuel filler flap and remove the three filler tube securing screws.(Right hand rear fender only)



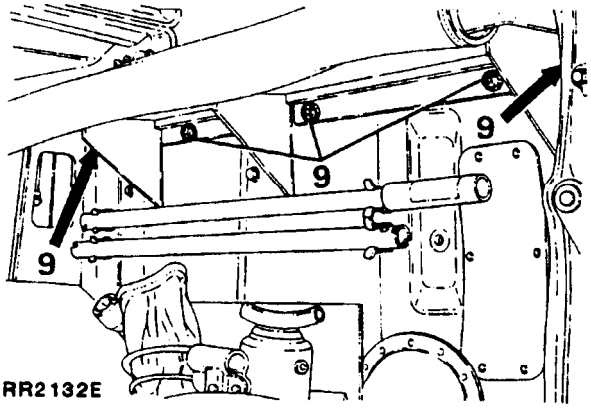
RR2130E

2. Remove the rear stowage area parcel shelf and spare wheel.
3. Remove the two nuts (with washers) securing the bumper wrap around end cap to the bottom of the corner panel.
4. Remove the single bolt securing the end cap to the bumper, accessible from behind the bumper.
5. Remove the fixings and release the rear tail light cluster from the rear corner panel and disconnect the electrical plug.
6. Drill out all the pop-rivets securing the corner panel to the tailgate frame.
7. Remove the two nuts and bolts securing the front of the fender to the 'D' post located beneath the wheel arch.
8. Release the single nut and bolt retaining the mud-flap bracket to the bottom of the fender.



RR2131E

9 From inside the stowage area remove the five cross-head screws securing the top of the fender to the bodyside panel. If necessary fold the rear seat forward and remove the seat locking mechanism housing to gain access to the screw adjacent to the 'D' post.



RR2132E

10. Remove the rear fender and comer panel complete.
11. Remove the seven bolts (with plain and spring washers) securing the fender to the corner panel and separate the two panels.

Refitting

12. Assemble the corner panel to the rear fender, fit the bolts and ensure both panels align before final tightening.

13. Coat the underside of panels with a suitable underseal.
14. Fit the assembly to the vehicle ensuring that the door edge to fender edge and corner panel to lower tailgate are in alignment before the final tightening of screws and the fitting of pop-rivets.
15. Reverse the remaining removal instructions.

FUEL FILLER FLAP

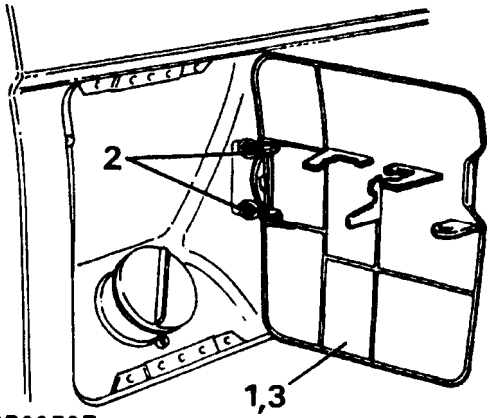
Remove and refit

Adjust

Removing

NOTE: The fuel filler flap is locked when the vehicle central locking system has been activated, ensure the system has been de-activated before attempting to open the flap.

1. Open the fuel filler flap.
2. Release the two screws (with plain washers).
3. Withdraw the flap.



RR2073E

Refitting

4. Fit the flap, but do not fully tighten the screws at this stage.
5. Close the flap and check that the outer profile of the flap aligns with the rear fender, adjust by easing the flap in or out of the opening.
6. Open the flap and securely tighten the screws.

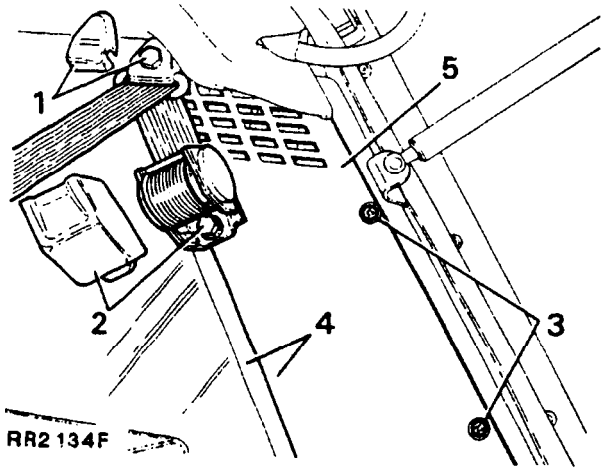
REAR QUARTER PANEL-INTERIOR

Remove and refit

Removing

NOTE: If removing the drivers side interior or exterior quarter panel it will be necessary to remove the spare wheel from the rear stowage area.

1. Detach the plastic cover from the upper seat belt guide bracket and remove the single bolt.
2. Remove the clip-on plastic cover from the seat belt inertia reel. Remove the retaining bolt and place the inertia reel to one side.
3. Release the two small cross-head screws securing the trim panel to the body side.
4. Ease the front of the trim panel from behind the quarter light glass rubber moulding.
5. Withdraw the panel from the vehicle.



RR2134F

Refitting

6. Ease the top front edge of the trim panel (approximately the first 25mm, 1 inch) as close to the headlining as is possible under the lip of the rubber moulding.
7. Push the panel up behind the headlining until the cross head screw holes line up with their respective holes in the bodyside.
8. Using a soft blunt implement ease the rubber moulding lip over the remainder of the front of the trim panel.

Continued

9. Ensuring that the electrical harness is located in the channel at the rear of the trim panel fit the two crosshead screws.
10. Ensuring that the seat belt is not twisted fit the guide bracket and inertia reel, tighten the two bolts to the specified torque (see section 06-Torque values).
71. Refit the plastic cover to the guide bracket.

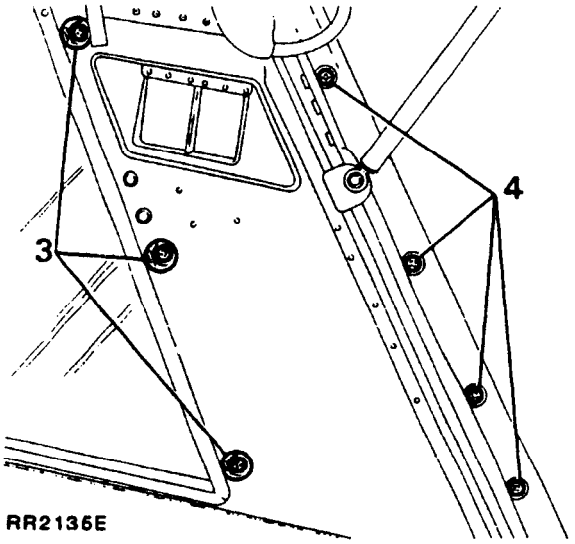
REAR QUARTER PANEL-EXTERIOR

Remove and refit

Removing

NOTE: If removing the drivers side interior or exterior quarter panel it will be necessary to remove the spare wheel from the rear stowage area.

1. Remove the rear seat belt inertia reel and guide bracket.
2. Remove the two crosshead screws and detach the interior quarter panel.
3. Remove the three nuts (with plain washers) securing the exterior quarter panel to the bodyside. The nuts are accessible through the large holes located adjacent to the rear quarter light.
4. Remove the four screws securing the quarter panel to the inside edge of the tailgate opening.
5. Withdraw the panel.



RR2136E

Refitting

6. Reverse the removal instructions.
7. Ensure that the seat belts, inertia reel and guide bracket bolts are tightened to the specified torque (see section 06-Torque values).

UPPER TAILGATE

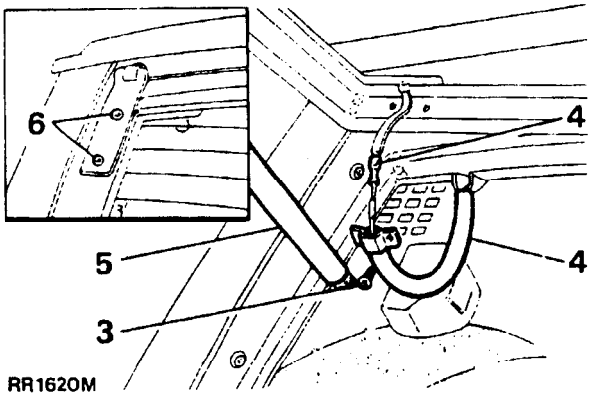
Remove and refit

Removing

1. **Disconnect the battery negative lead.**
2. **Remove the tailgate wiper arm.**
3. **Open the tailgate and remove the four screws securing the two rear screen electrical lead shrouds located at either end of the tailgate.**
4. **Maneuver the shroud away from the screen and out of the leadlining to reveal the electrical connections, disconnect the leads.**

WARNING: If a tailgate stay is weak, DO NOT attempt to repair the unit. Fit a replacement.

5. **Pry the two stays off the tailgate.**
6. **Remove the four hinge to tailgate screws.**



7. **Lift the upper tailgate clear.**

Refitting

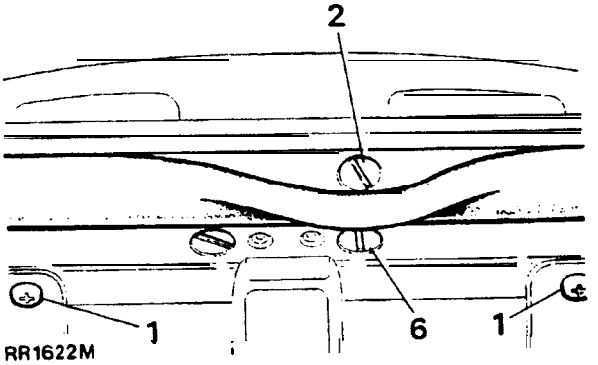
8. **Reverse the removal instructions.**

UPPER TAILGATE-LOCK

Remove and refit

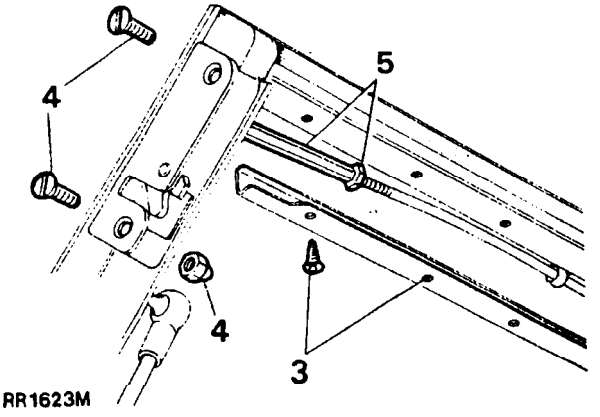
Removing

1. **Remove the two cross-head screws securing the upper tailgate release handle.**
2. **Ease the sealing rubber away to reveal the single screw securing the centre of the release handle, remove the screw and detach the handle from the lock mechanism complete with key barrel.**



NOTE: At this stage the barrel can be removed from the handle by releasing the two small cross-head screws at the joint-face. Remove the retaining plate and release the spring and key barrel from its bore.

3. **Release the eight screws and remove the operating rod covers located either side of the centre lock mechanism.**
4. **Remove the four screws and two nuts securing the lock catches to the sides of the tailgate.**



Continued

5. Release the two small locknuts on the operating rods and rotate the hexagonal connecting rod until the side catches can be removed.
6. Release the two screws securing the centre lock mechanism and remove the unit complete with operating rods.

Refitting

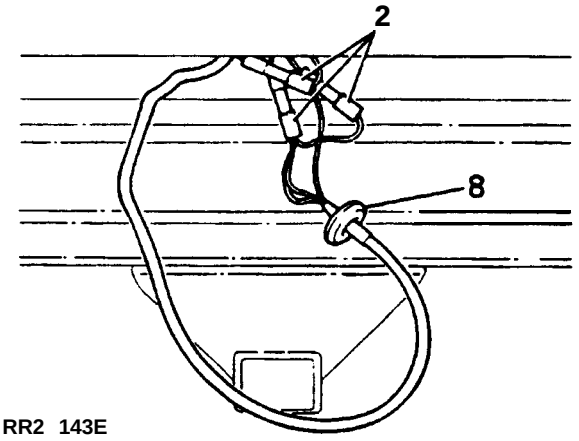
7. Reverse the removal procedure.
8. Adjustment of the side catches may be required after assembly, this is achieved by releasing the locknuts on the operating rods, and rotating the hexagonal link clockwise or counter-clockwise to shorten or extend the length of the operating rods.

LOWER TAILGATE

Remove and refit

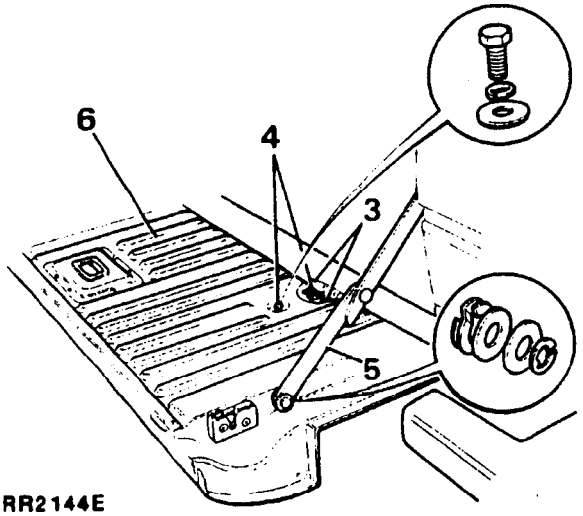
Removing

1. Disconnect the battery negative terminal.
2. Carefully pull the electrical leads out of the bottom of the lower tailgate to reveal the snap connectors. Access to the leads is gained between the top of the bumper and bottom of the tailgate.



RR2 143E

3. Remove the four cross-head screws securing the sealing rubber around the tailgate hinge bolts.
4. Remove the fixings, tailgate to hinges.
5. Disconnect the check straps.
6. With assistance withdraw the tailgate.



RR2144E

Refitting

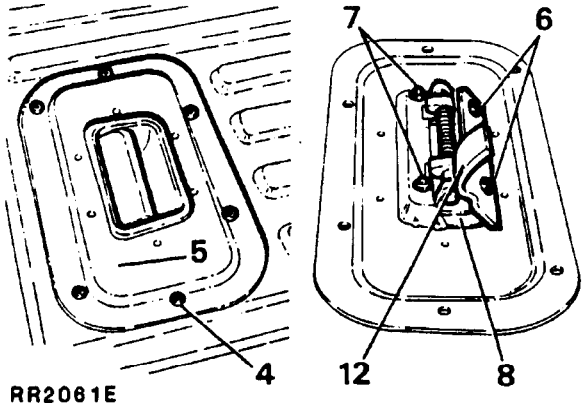
7. Reverse 1 to 5.
8. Ensure that the rubber grommet is relocated in the bottom of the tailgate.

LOWER TAILGATE RELEASE MECHANISM

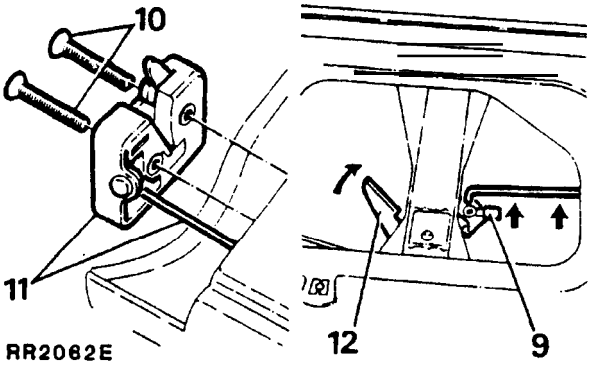
Remove and refit

Removing

1. Open and raise the upper tailgate.
2. Release and lower, the lower tailgate.
3. Lift the trim panel off the tailgate inner panel.
4. Remove the screws securing the lock cover plate.
5. Remove the cover plate complete with handle release mechanism.
6. Remove the two screws and detach the handle release actuator lever.
7. Remove the two nyloc nuts and detach the handle release retaining bracket.
8. Withdraw the handle release mechanism from the cover plate.



9. Release the spring clips securing the operating rods to the internal tailgate release mechanism.
10. Remove the screws securing the exterior locks at either side of the tailgate.
11. Withdraw the exterior locks with operating rods.



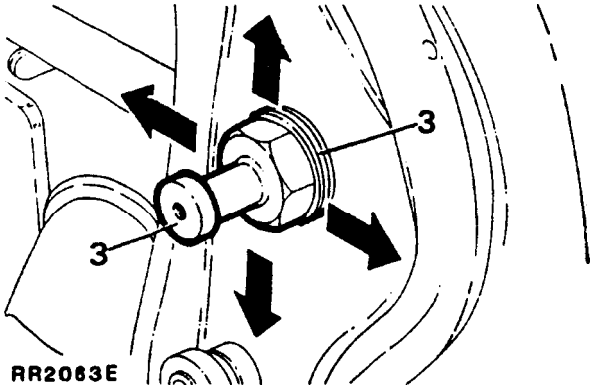
Refitting

12. Reverse the removal procedure, lightly grease the handle release actuator lever and internal tailgate operating lever.

LOWER TAILGATE STRIKER ADJUSTMENT

Adjust

1. Open and raise upper tailgate.
2. Open and lower, lower tailgate.
3. Release the striker and move in the appropriate direction, either add or subtract spacing washers between the striker and tailgate opening.
4. Adjustment is correct when outer profile of tailgate panel aligns with both rear body corner panels.

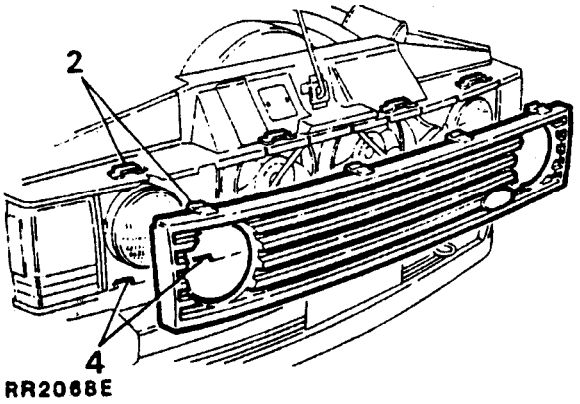


RADIATOR GRILLE

Remove and refit

Removing

1. Raise the hood and secure the hood support.
2. Depress the four upper retaining lugs and ease the grille forward.
3. Lift the grille upwards and withdraw it from the vehicle.



Refitting

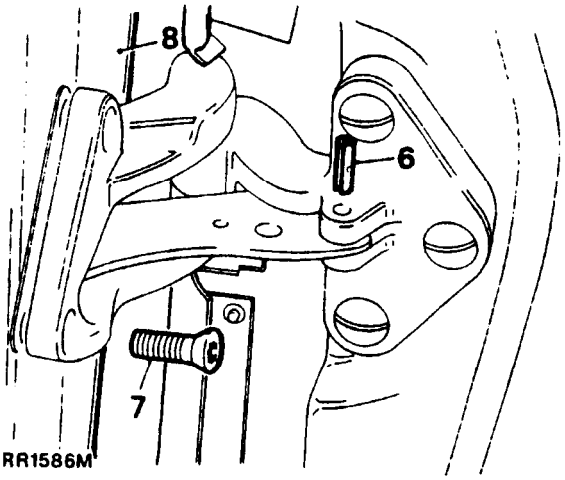
4. Fit the radiator grille ensuring that the bottom lugs of the grille locate in their respective slots below the headlamp units.
5. Ease the grille rearwards and locate the upper retaining lugs.

FRONT DOOR

Remove and refit

Removing

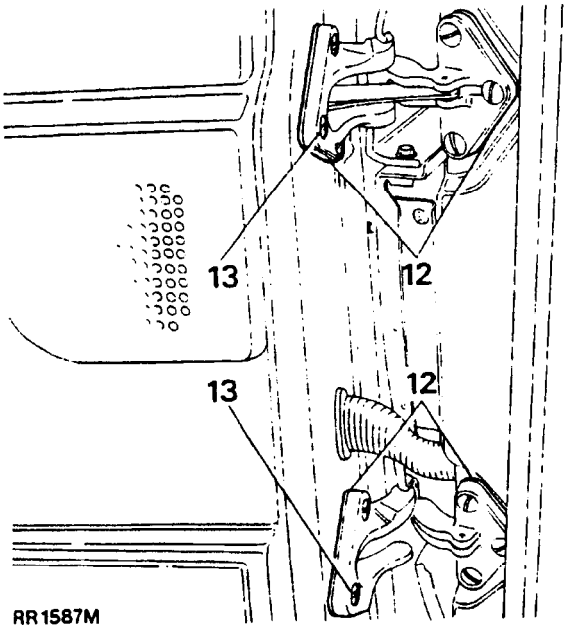
1. Disconnect the battery negative lead.
2. Open the appropriate door to be removed.
3. Remove the two screws and detach the side trim panel from the front footwell.
4. Carefully pull the door wiring harness from above the dash until the electrical plugs are exposed.
5. Disconnect the electrical plugs and feed them through the opening in the 'A' post.
6. Drive out the roll pin from the door check strap.
7. With assistance support the door and remove the screws, securing door to hinges.
8. Lift the door clear.



Refitting

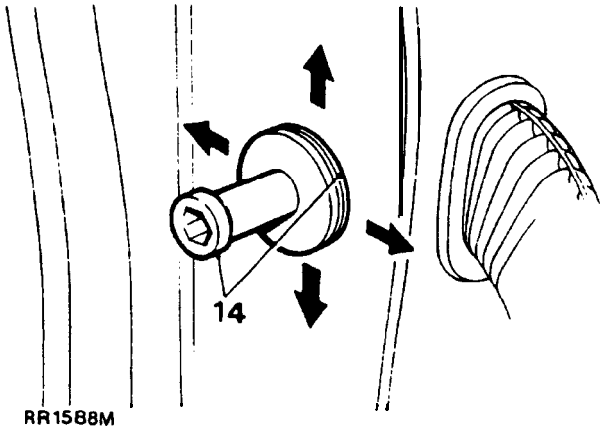
9. Refit the door and feed the electrical cables through the 'A' post.
10. Fully open the door and reconnect the electrical leads, take up the slack in the leads and clip them securely to the footwell side panel, refit the convolute grommet to the 'A' post frame.
11. Check the location of the door and the operation of the door lock. If necessary, adjust the door and striker plate.

12. Adjust the door by the addition of shims between the hinge and door or hinge and 'A' post to take the door forward or rearward in the opening.
13. By loosening the six screws securing the hinges to the door, the door can be adjusted up and down or in and out of the opening.



RR1587M

14. The door lock striker can be adjusted by loosening the striker and moving it in the appropriate direction or adding and subtracting spacing washers between the striker and 'B' post.



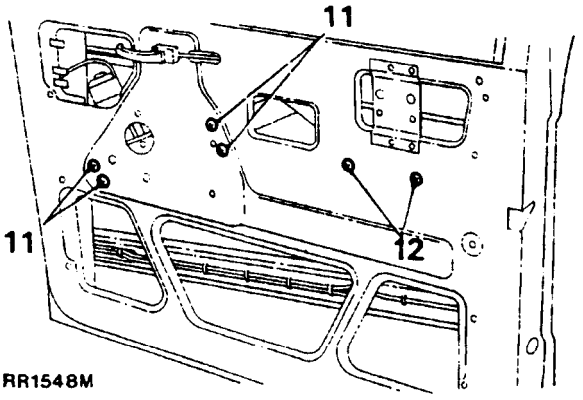
RR1588M

FRONT DOOR GLASS AND REGULATOR

Remove and refit

Removing

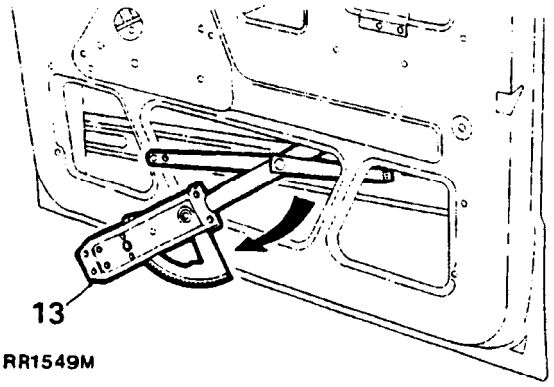
1. Ensure the window is in its fully closed position and secure it with adhesive tape to prevent the window dropping down.
2. Disconnect the battery negative terminal.
3. Detach the armrest/door-pull finisher to reveal the two securing screws.
4. Remove the two securing screws (with plain washers) to enable the armrest/door-pull to be detached from the inner door panel.
5. Remove the interior door handle finisher button to reveal the screw retaining the handle surround.
6. Remove the screw and detach the handle surround from the inner door panel.
7. Detach the inner door trim pad by inserting a screwdriver between the trim pad and inner door panel, gently pry out the nine plastic securing clips from their respective holes in the inner door panel.
8. Disconnect the two speaker connections inside the door and remove the door trim pad complete with speaker.
9. Remove the plastic vapor barrier.
10. Remove the window lift motor (refer to Electrical Section).
11. Remove the four window regulator retaining bolts with shakeproof washers from the inner door panel.



RR1548M

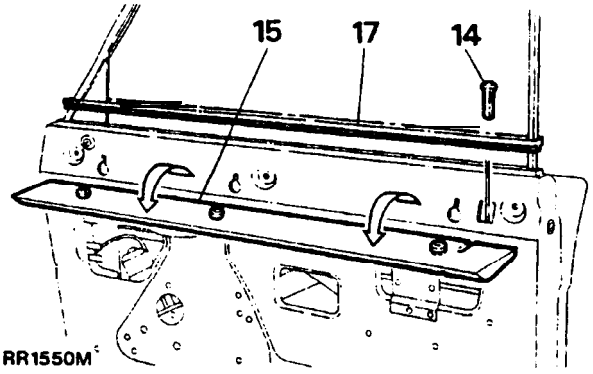
Continued

12. Remove the two screws with shakeproof washers retaining the lower window lift channel and slide the channel off the stud.
13. Disengage the lifting arm stud from the upper lifting channel, maneuver the window regulator and remove if from the lower centre opening in the inner door panel.



RR1549M

14. Remove the sill locking knob.
15. Remove the inner door capping off its keyhole location.
16. Remove the exterior driving mirror (refer to exterior driving mirrors removal and refit in Electrical Section).
17. Remove the waist rail seal from the top of the door panel.



RR1550M

18. Remove the two bolts fshakeproof and plain washers) from the hinge face of the door which secure the front door frame.
19. Remove the single bolt (spring and plain washer) from the edge of the door which secures the door rear frame.
20. Remove the bolt (spring and plain washer) from the recessed hole in the front of the inner door panel under the exterior driving mirror mounting plate.
21. Remove the single screw (spring and plain washer) from inside the door securing the bottom front glass channel.
22. Remove the single screw (spring and plain washer) from inside the door securing the bottom rear glass channel.
23. Lift the door glass frame complete with glass out of the door panel and remove to a suitable bench.
24. Remove the adhesive tape securing the glass to the frame.
25. Slide the glass out of the door frame channel.

Refitting

26. Reverse the removal instructions, items 1 to 25.

NOTE: When refitting the door glass frame, ensure it is repositioned to suit the door opening before fully tightening the door frame securing bolts.

FRONT DOOR LOCK, OUTSIDE AND INSIDE DOOR RELEASE HANDLES

Remove and refit

Removing

1. Remove the window lift motor (refer to Electrical Section).
2. Remove door glass and regulator (refer to door glass and regulator remove and refit).
3. Remove door actuator units (refer to Electrical Section).
4. Disconnect the control rod from the private key operated lock by releasing the metal clip at the bottom of the rod.
5. Disconnect the control rod from the outside door release handle by pulling it out of the plastic ferrule.

6. Disconnect the control rod connector between the inside door release handle and the door lock by releasing the metal clip and pulling one of the control rods out of the plastic connecting block. This is accessible through the small centre cut-out in the door panel. (The control rod also passes through a guide bracket on the inside of the inner door panel).
7. From inside the door panel push out the small pin which secures the quadrant to the inner door panel. Push the quadrant out of the panel.
8. Release the door lock by removing the two counter-sunk screws from the door edge and the single screw (with shakeproof washer) on the inner door panel.
9. Withdraw the lock through the lower rear cut-out on the inner door panel.

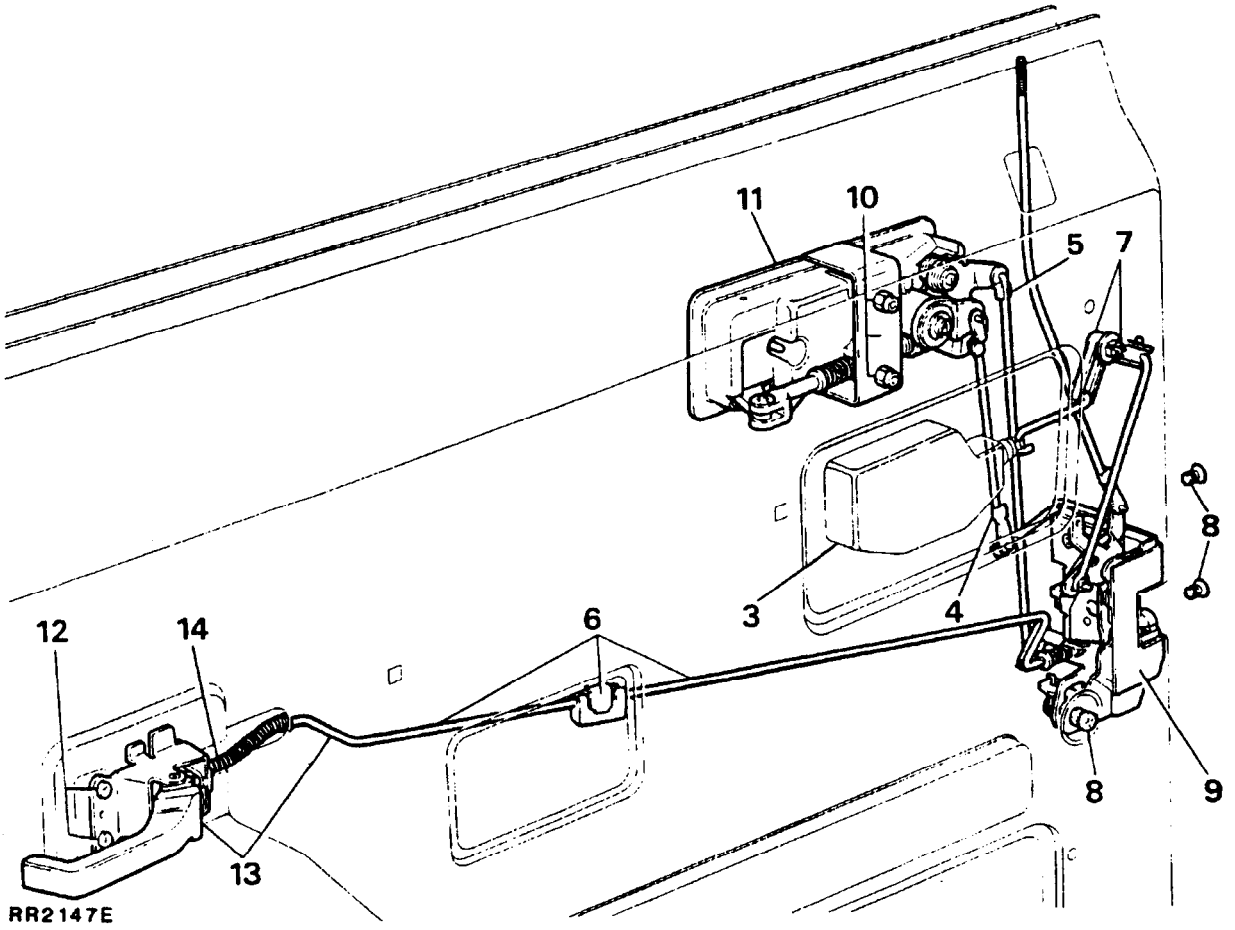
NOTE: If necessary the following items can also be removed.

10. Remove the two nuts (with shakeproof washers) and retaining bracket securing the outside door release handle to the outer door panel, accessible through the upper rear cut-out on the inner door panel.
11. Carefully detach the door release handle from the outer door panel.
12. Remove the two screws securing the inside door release handle to the inner panel.
13. Withdraw the handle from its location with half the connecting rod still attached.
14. Unclip the spring tensioned end of the connecting rod from the door release handle.

Refitting

15. Reverse the removal procedure items 1 to 13.

NOTE: When refitting the door glass frame, ensure that it is positioned to suit the door opening before fully tightening the door frame securing bolts.



ADJUSTMENT-FRONT DOOR LOCK AND HANDLE ASSEMBLY

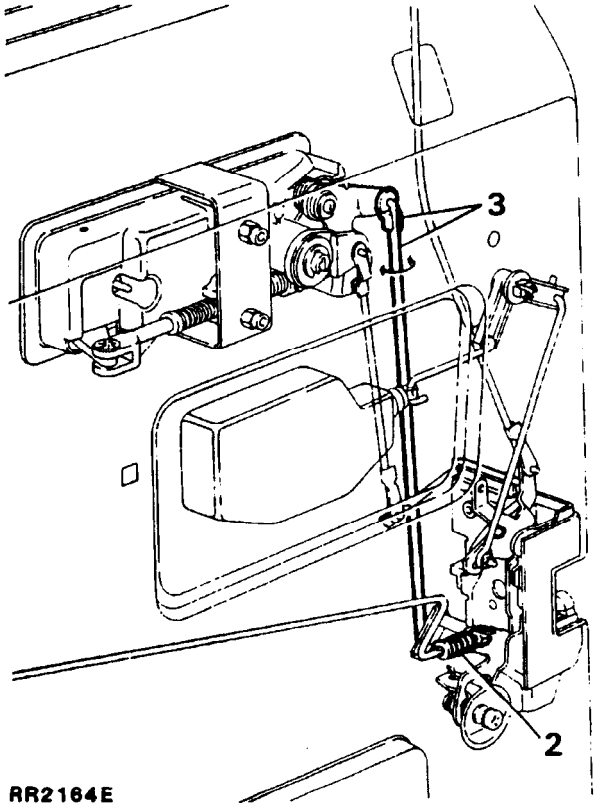
Inside door release handle to lock

1. Refit the inside door release handle surround before any adjustment is made, allowing the handle to be set from the correct operating position.
2. Rotate the spring tensioned nyloc nut at the opposite end of the interior handle connecting rod, clockwise or counter-clockwise to shorten or extend the operating length.

Outside door release handle to lock

3. Disconnect the connecting rod at the rear of the outer door release handle by releasing it from the plastic ferrule rotate the rod clockwise or counter-clockwise to shorten or extend the operating length, refit the rod to the ferrule.

NOTE: Door release should be effective before the total handle movement is exhausted to provide a small overthrow movement.



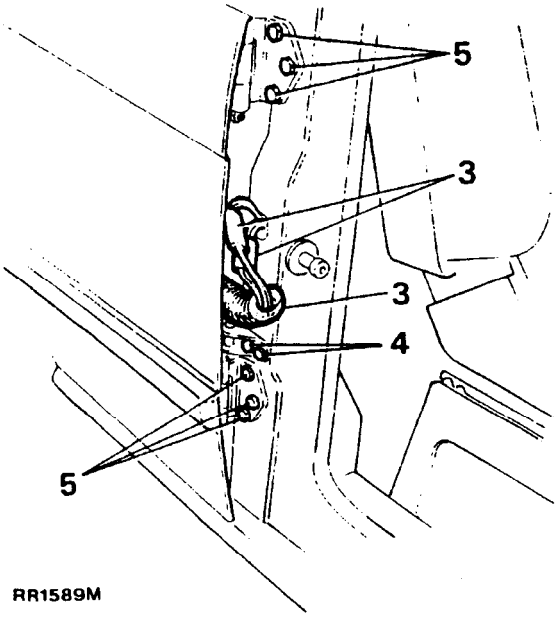
RR2164E

REAR PASSENGER DOOR

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Pull the convolute grommet out of the face of the 'B' post.
3. Withdraw the electrical leads from the 'B' post until the electrical plugs are exposed and disconnect the plugs.
4. Remove the two bolts (with spring and plain washers) securing the door check strap.
5. Open the door slightly, support the door and remove the six bolts (with spring washers) securing the hinges to the 'B' post.
6. Lift the door clear.



RR1589M

Refitting

7. Reverse the removal procedure.
8. Adjustment to the rear doors is made by releasing the six hinge securing bolts (hinge to 'B' post) and moving the door either rear-wards. forward, up or down in the door opening.
9. Adjustment to the door striker is identical to front door adjustment.

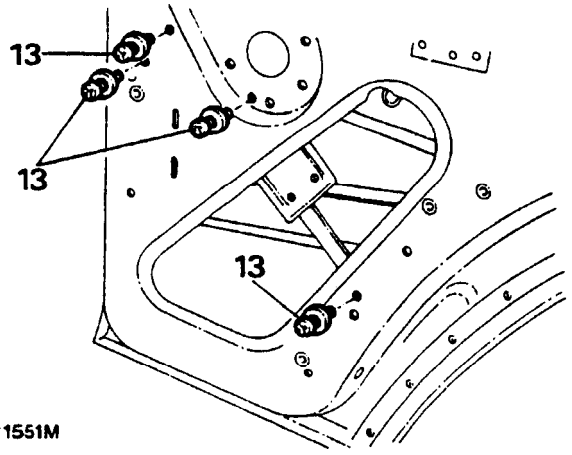
REAR DOOR GLASS AND REGULATOR

Remove and refit

Removing

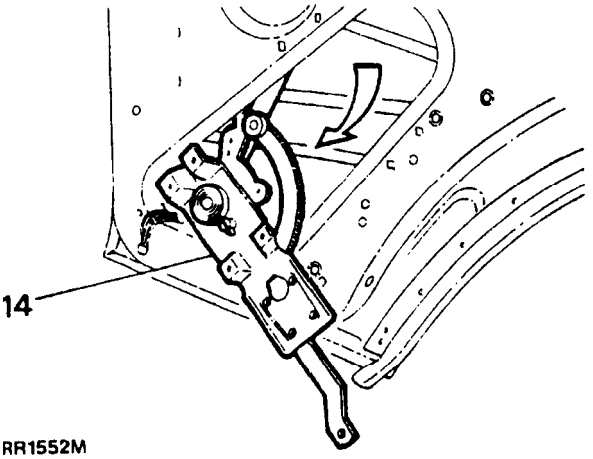
Ensure the window is in its fully closed position and secure it with adhesive tape over the top of the door to prevent the window dropping down.

2. Disconnect the battery negative terminal.
3. Remove the armrest/door-pull finisher to reveal the two securing screws.
4. Remove the two securing screws (with plain washers) and detach the armrest/door-pull from the inner door panel.
5. Disconnect the window lift switch multi-plug at the rear of the armrest/door-pull.
6. Remove the interior handle finisher button to reveal the screw retaining the handle surround.
7. Remove the screw and detach the handle surround from the door trim pad.
8. Remove the door trim pad by inserting a screwdriver between the trim pad and the inner door panel, gently pry out the six plastic clips from their respective holes around the edges of the trim.
9. Remove the sill locking button.
10. Remove the inner door capping from its keyhole location.
11. Remove the plastic vapor barrier.
12. Remove the window lift motor (refer to Electrical Section).
13. Remove the four window regulator securing screws (with shakeproof washer).



RR1551M

14. Carefully disengage the lifting arm stud from the glass lifting channel and remove the window regulator from the lower opening in the inner door panel.



RR1552M

15. Remove the waist rail seal from the top of the door panel.
16. Remove the single bolt (with spring and plain washers) from inside the door which secures the bottom of the short rear glass run channel.
17. Remove the two bolts (with spring and plain washers) from the hinge face of the door.
18. Remove the two bolts (with spring and plain washers) from the edge of the door which secure the rear door frame.
19. Lift out the door frame with the glass in position and remove to a suitable workbench.
20. Remove the tape and slide the glass out of the door frame channel.

NOTE: When refitting the door glass frame securing bolts, ensure that the door frame is adjusted to suit the door opening before fully securing the frame to the door.

Continued

REAR DOOR LOCK, OUTSIDE AND INSIDE DOOR RELEASE HANDLES

Remove and refit

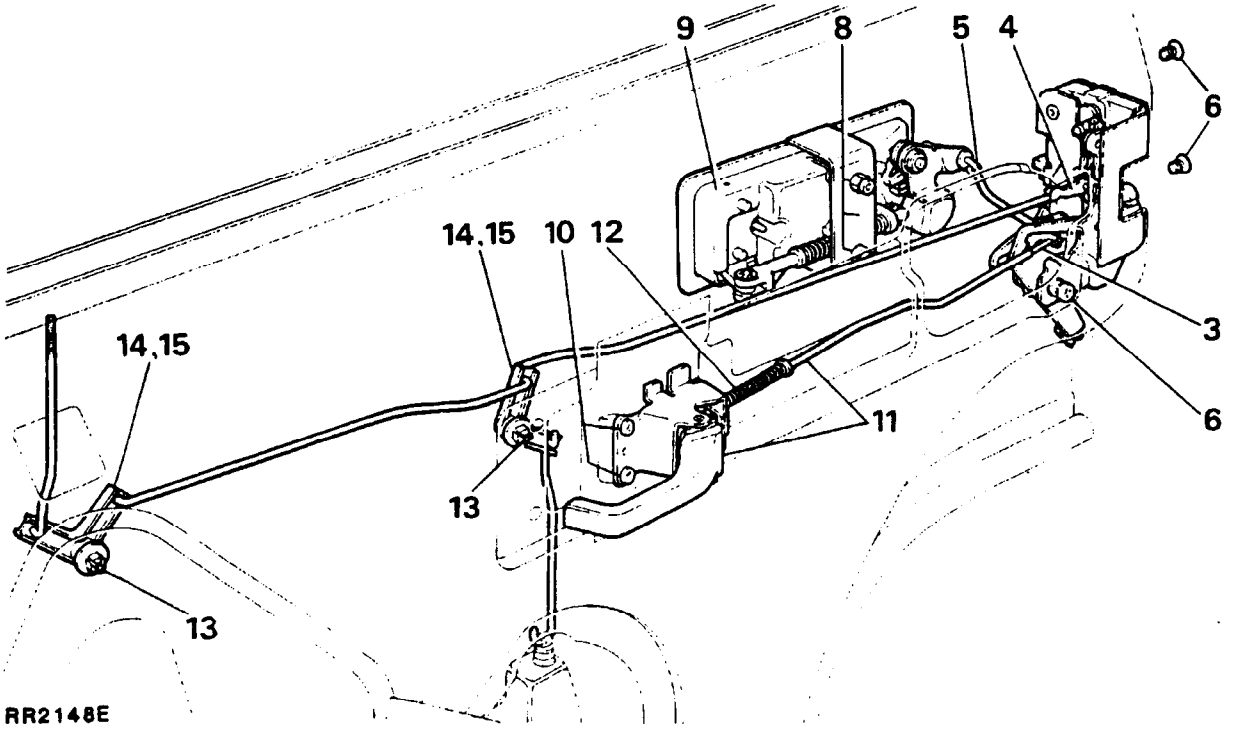
Removing

1. Ensure the window is in its fully closed position.
2. Remove all the interior door trim (refer to door glass and regulator remove and refit, items 2 to 11).
3. Disconnect the control rod from the inside door release handle by pulling the rod out of its location at the door lock.
4. Disconnect the sill locking control rod from the door lock by releasing the metal clip.
5. Disconnect the control rod from the outside door release handle by pulling it out of the plastic ferrule.
6. Release the door lock by removing the two counter-sunk screws from the door edge and the single screw (with shakeproof washer) on the inside of the door. Retrieve any spacing washers which may be fitted between the inner door panel and the lock.
7. Withdraw the lock through the upper rear opening in the inner door panel.

NOTE: If necessary the following items can also be removed.

8. Remove the two nuts (with shakeproof washers) and retaining bracket securing the outside door release handle to the outer door panel, accessible through the upper rear cut-out on the inner door panel.
9. Carefully detach the outside door release handle from the outer door panel.
10. Remove the two screws (with plain washers) securing the inside door release handle to the inner door panel.
11. Withdraw the handle from its location with the connecting rod still attached.
12. Unclip the spring tensioned end of the connecting rod from the door release handle.

Continued



Sill locking quadrants

13. Use a-small screwdriver, or 3.175mm diameter (1/8 in) rod, press the plastic locking pins through the respective square inserts in the inner door panel, until they can be retrieved from inside the door.
14. Release the quadrants from the inner door panel and unhook the respective connecting rods.
15. Withdraw the quadrant from inside the door.

NOTE: When refitting the quadrants the plastic locking pins are entered into the square insert from outside and pressed in flush.

Refitting

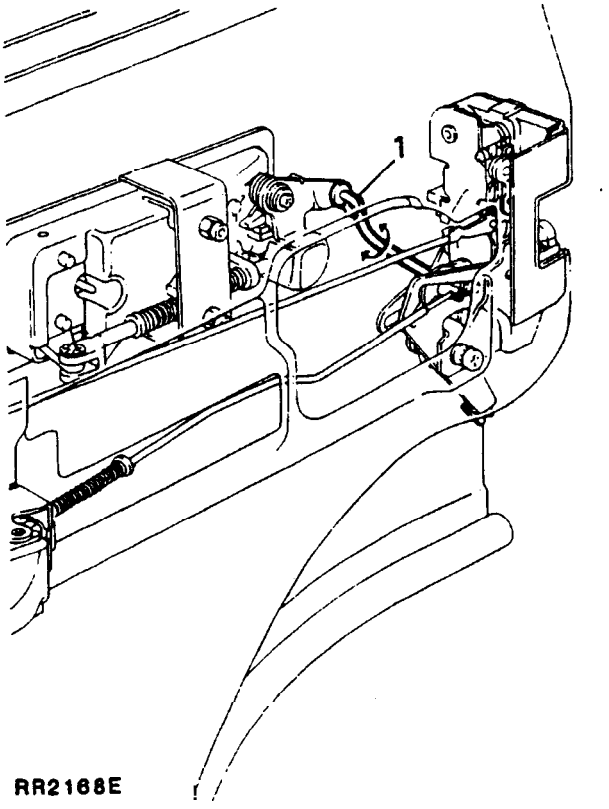
16. Reverse the removal procedure 1 to 15.

ADJUSTMENT-REAR DOOR LOCK AND HANDLE ASSEMBLY

Outside door release handle to lock.

1. Disconnect the short offset connecting rod at the rear of the outer door release handle, rotate the rod clockwise or counter-clockwise to shorten or extend the operating length.

NOTE: Door release should be effective before the total handle movement is exhausted to provide a small over-throw movement.



RR2168E

WINDSCREEN GLASS

Remove and refit

Removing

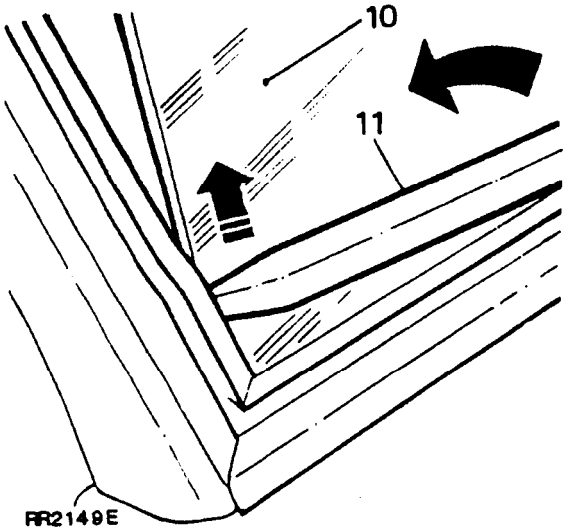
CAUTION: Place a protective covering over the cowl panel and dashboard to prevent damage to the bodywork and also to prevent broken glass entering the heater system.

1. Remove the windscreen wiper arms.
2. Remove the expander strip from the channel in the rubber moulding around the glass.
3. Remove the rubber moulding from the windscreen opening.
4. Remove any previous sealing compound from around the opening.
5. Thoroughly clean the windscreen opening and remove any broken glass.

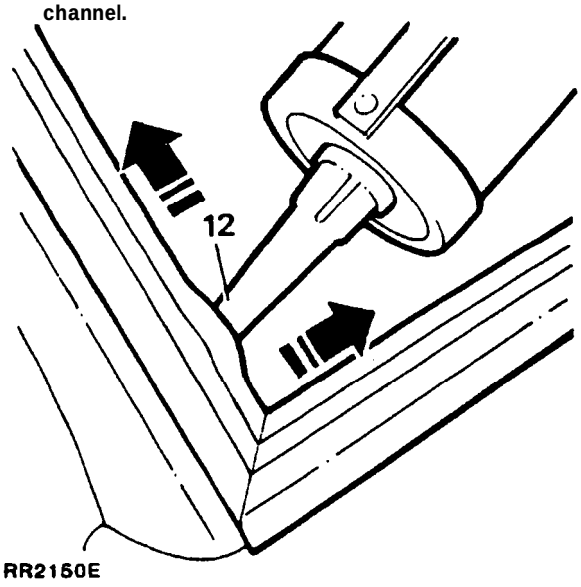
Refitting

CAUTION: To ensure a good bond is achieved between windscreen and rubber DO NOT use petroleum based solvents or liquid soap to clean or aid assembly of the windscreen to rubber.

6. Apply Sikaflex 207 cleaner primer to the windscreen and rubber to remove any oil based film that may be present.
7. Apply Sikaflex 221 or 255 adhesive sealant to the exterior channel of the NEW rubber moulding, ensure the sealant is applied to the bottom of the channel.
8. Fit the rubber moulding to the windscreen opening.
9. Ensure that the edge of the 'A' post interior trim panels are fitted under the lip of the rubber moulding.
10. Fit the windscreen into either bottom corner of the rubber moulding channel.
11. Work the glass into the bottom of the windscreen rubber using a soft blunt implement shaped with a wedge type point, working up and around the seal and at the same time pushing the screen onto the rubber, ease the lip of the seal over the windscreen glass as illustrated.



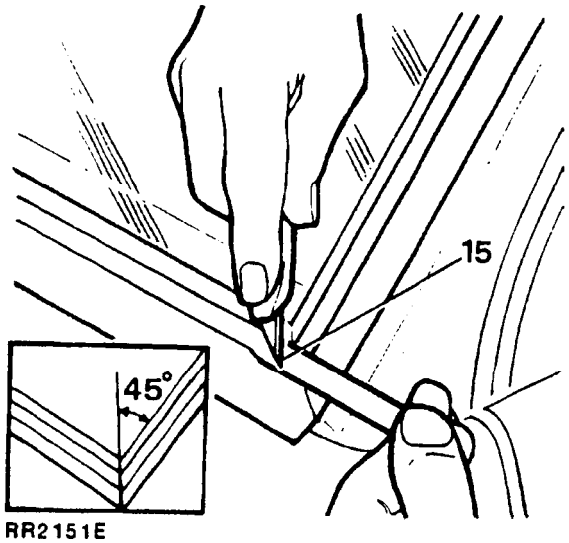
12. Apply Sikaflex 221 or 255 adhesive sealant between the outer lip of the rubber moulding and exterior surface of the windscreen, ensure the sealant is applied to the bottom of the channel.



CAUTION: To aid assembly of expander strip to the windscreen rubber apply a small amount of soap solution to the channel on the face of the rubber. Ensure that the soap solution is applied to the channel only.

13. To aid insertion apply mineral spirit to the rubber expander strip channel.

14. Fit the expander rubber to the channel, do not overstretch the rubber.
15. If any of the rubber strip protrudes beyond the channel after fitting, trim off at 45" with a sharp knife.



RR2151E

16. Surplus sealant between screen and rubber moulding will be forced out after the expander strip is fitted.
17. Remove the surplus sealant, and wipe away the remaining sealant using Sikadur cleaner.
18. With a blunt instrument lift the bottom of the rubber moulding up and over onto the top of the cowl panel, likewise repeat the operation to bring the bottom of the rubber moulding up and over onto the dashboard.
19. Refit the wiper arms, check the wiper sweep is correct.
20. Reverse the remaining removal instructions.

TAILGATE GLASS

Remove and refit

Removing

1. Remove the upper tailgate.
2. Remove the lock.
3. Remove the lift handle and trim.
4. The upper tailgate glass and frame are serviced as one unit.

Refitting

5. Reverse instructions 1 to 3.

REAR QUARTER LIGHT GLASS

Remove and refit

Removing

1. Remove the rubber moulding from around the glass opening.
2. Thoroughly clean the opening to be glazed.

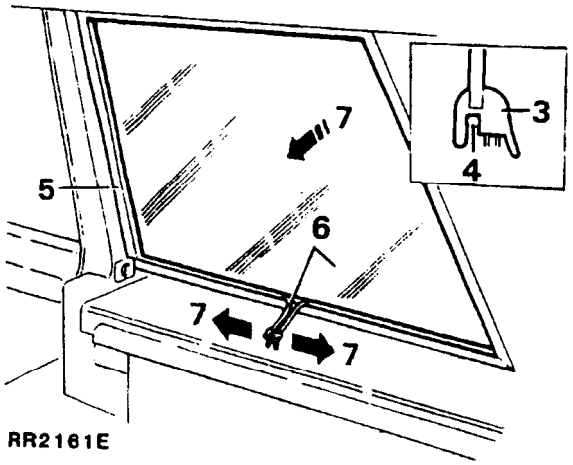
NOTE: If a new glass and moulding is being fitted to the driver's side quarter light it will be necessary to remove the spare wheel.

Refitting

3. Fit the new moulding to the glass.
4. Fit a draw cord around the exterior surface of the rubber moulding ensuring that it sits securely in the bottom of the moulding retaining channel.
5. Coat the glass opening in the body side with liquid soap to aid assembly.
6. Fit the glass and moulding to the glass opening ensuring that the draw cord is fed into the interior stowage area.

NOTE: It may be necessary to remove the seat belt inertia reel and cover.

7. With assistance from a second operator pushing the glass and moulding into the opening pull the draw cord from the moulding enabling the seal to ride up over the bodyside retaining lip.
8. Ensure the interior trim lies under the rubber moulding.



RR2161E

FRONT SEAT

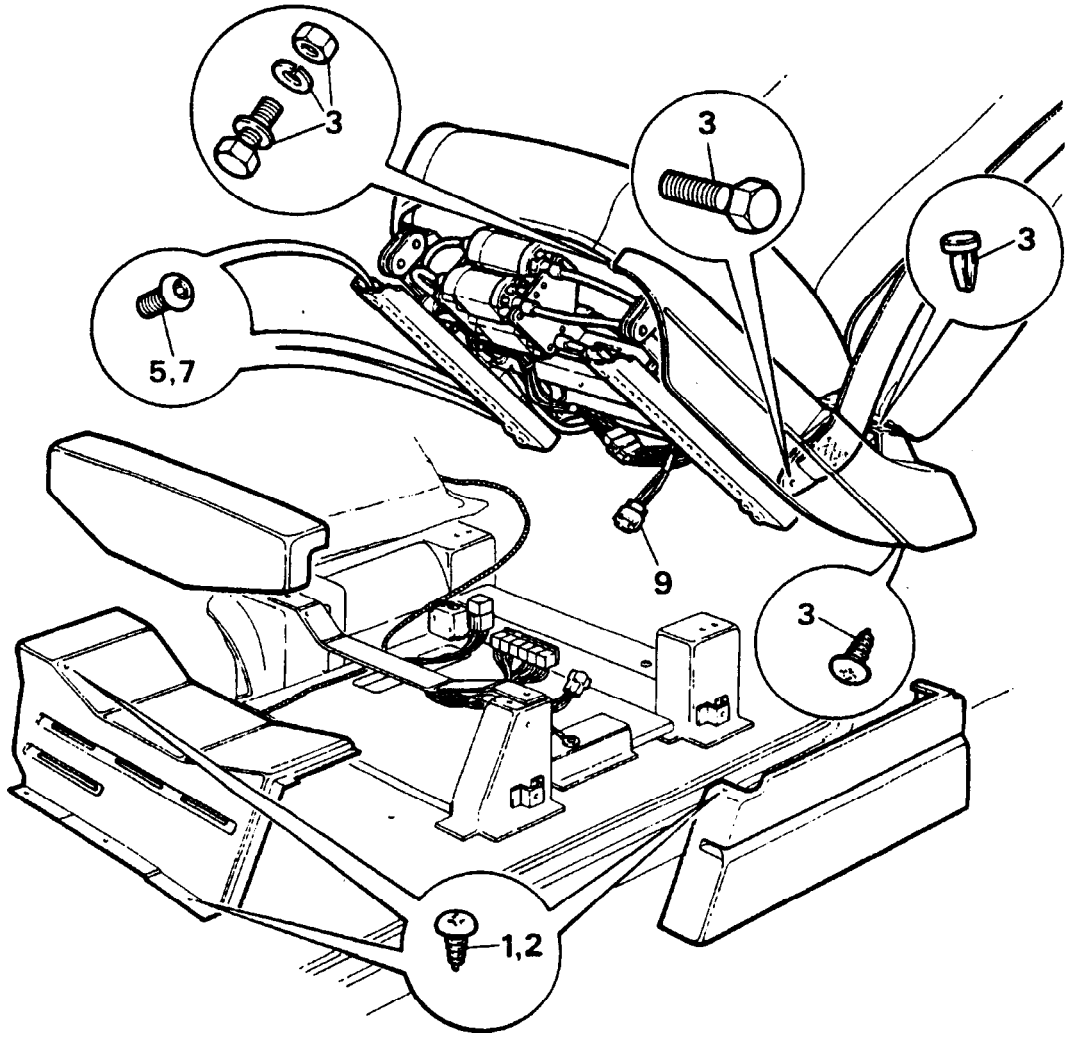
Remove and refit

Removing

1. Remove the single screw securing the seat base side trim panel and withdraw the panel.
2. Remove the three screws securing the seat base front trim panel to the front footwell, remove the single screw securing the top of the front trim panel to the seat base located under the seat base cushion, and withdraw the panel.
3. Remove the three fixings securing the seat cushion side trim panel and withdraw the panel. Remove the bolt securing the seat belt to the side of the seat.
4. Move the seat until it is in its most rearward position.
5. Remove the two fixings securing the front of the seat located in each seat slide channel.
6. Move the seat until it is in its most forward position.
7. Remove the four fixings securing the rear of the seat located inside each seat slide channel.
8. Disconnect the battery negative terminal.
9. Disconnect the electrical multi-plugs to the seat motors and seat control switch.
10. Withdraw the seat from the vehicle.
11. If necessary the seat motors and operating switch can be removed. (Refer to Section 86 Electrical).

Refitting

12. Reverse the removal instructions.
13. Arrange the electrical leads beneath the seat to ensure that they do not become trapped by the seat slide mechanism.



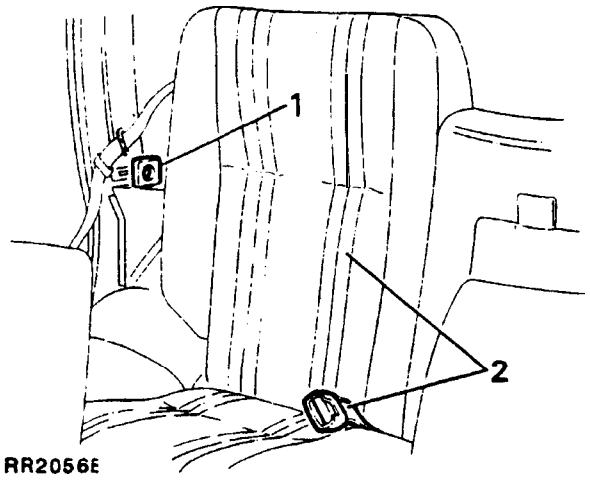
RR2152E

ASYMMETRIC SPLIT REAR SEAT

Remove and refit

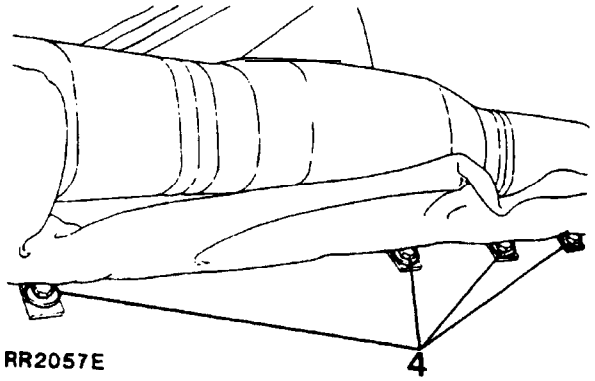
Removing

1. Lift the finger button to release the seat back rest securing catch and fold the seat forward.
2. While folding the seat forward feed the rear seat lower part of the seat belt through the opening between the seat back and cushion.



RR2056E

3. Fold the seat fully forward and remove the four rear pivot bracket bolts.
4. Fold the seat back and lift the rear footwell carpet from just below the front of the seat to gain access to the four front fixings securing the pivot brackets, remove the bolts, withdraw the seat assembly from the vehicle.



RR2057E

Refitting

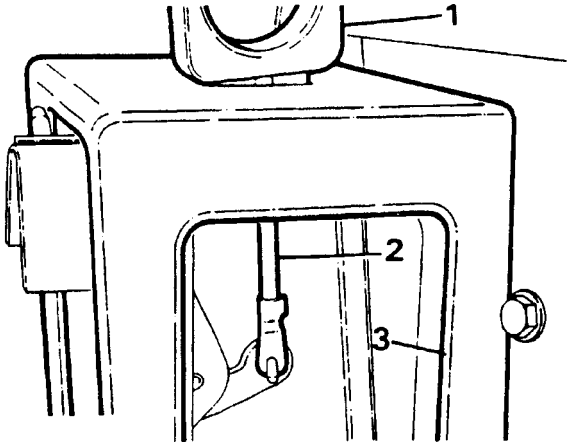
5. Reverse the removal procedure ensuring that all fixings are securely tightened.
6. Adjust the seat mechanism plate if necessary.

ASYMMETRIC SPLIT REAR SEAT LOCKING MECHANISM

Remove and refit

Removing

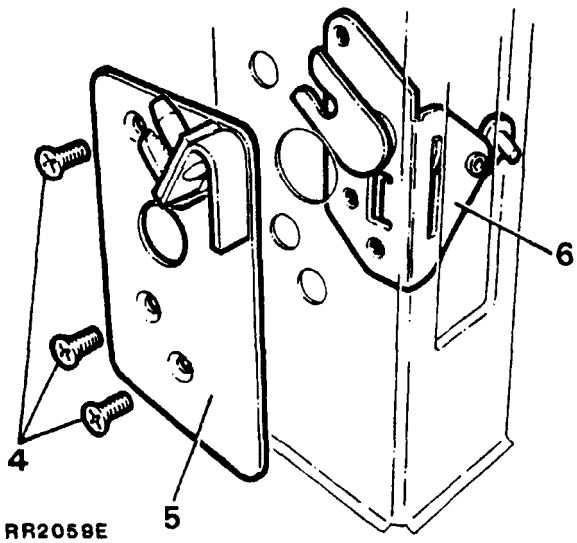
1. Lift the finger button and fold the seat back rest forward.
2. Remove the spring clip securing the finger button operating rod to the lock mechanism lever, accessible through the lock mounting bracket, withdraw the finger button.



RR2058E

3. Remove the trim stud and remove trim covering.
4. Remove the three screws from the face of the lock catch plate.
5. Maneuver the catch plate off the lock mechanism.
6. Retrieve the lock. mechanism from the mounting bracket opening.

Continued



RR2059E

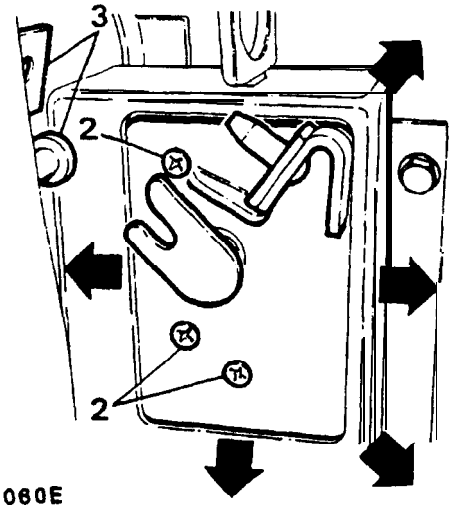
Refitting

7. Lightly grease the internal lock mechanism.
8. Reverse the removal instructions.
9. Adjust the lock catch plate to align with the seat striker.

ASYMMETRIC SPLIT REAR SEAT LOCKING MECHANISM

Adjust

1. Release the finger button and fold the seat back rest forward.
2. Loosen the three screws securing the catch plate to the lock mechanism.
3. Maneuver the lock assembly either horizontally, vertically or diagonally until the catch plate aligns with the striker at the side of the seat.
4. Securely tighten the retaining screws.



RR2060E

SEAT BELTS

Description

The seat belt assemblies are factory fitted in the correct location. If removal is necessary the procedures in this section must be followed. All seat belt fixings MUST be tightened to the correct torque (see section 06-Torque values).

Seat belt assemblies MUST be replaced after they have been subjected to loading by occupants in a collision. Where replacement is necessary, the original manufacturer's components must be used.

An audible warning and warning lamp are incorporated in the system.The warning lamp will illuminate for eight seconds when the ignition is switched on regardless of seat belt usage.

The audible warning will sound with an intermittent high and low note for four to eight seconds unless the driver's seat belt is used.

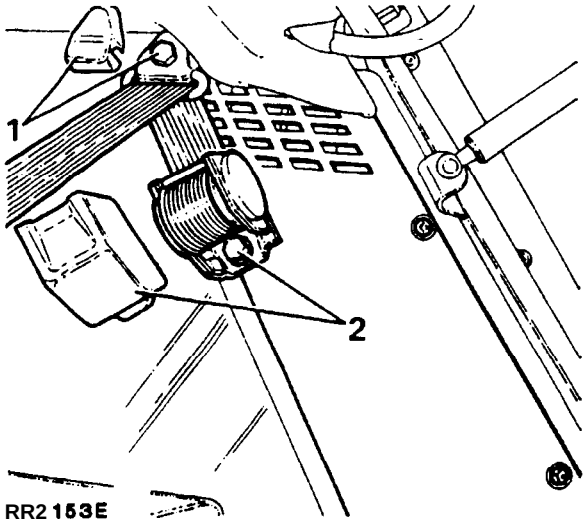
A single lap belt is provided for the occupant of the centre rear seat.

REAR SEAT BELT

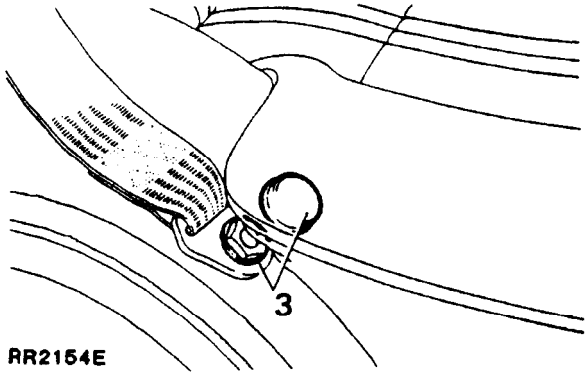
Remove and refit

Removing

1. Detach the plastic cover from the upper seat belt guide bracket and remove the securing bolt, plain and wavy washer and spacer.
2. Remove the clip-on cover from the inertia reel assembly. Remove the securing bolt and spring washer and place the reel to one side.

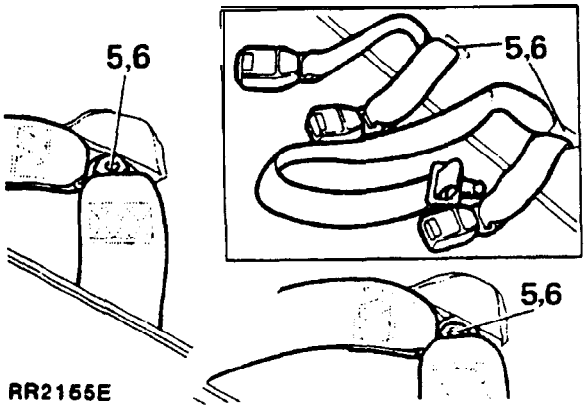


3. Remove the plastic cover and remove the bolt securing the belt to the rear wheel arch.



4. Withdraw the assembly.

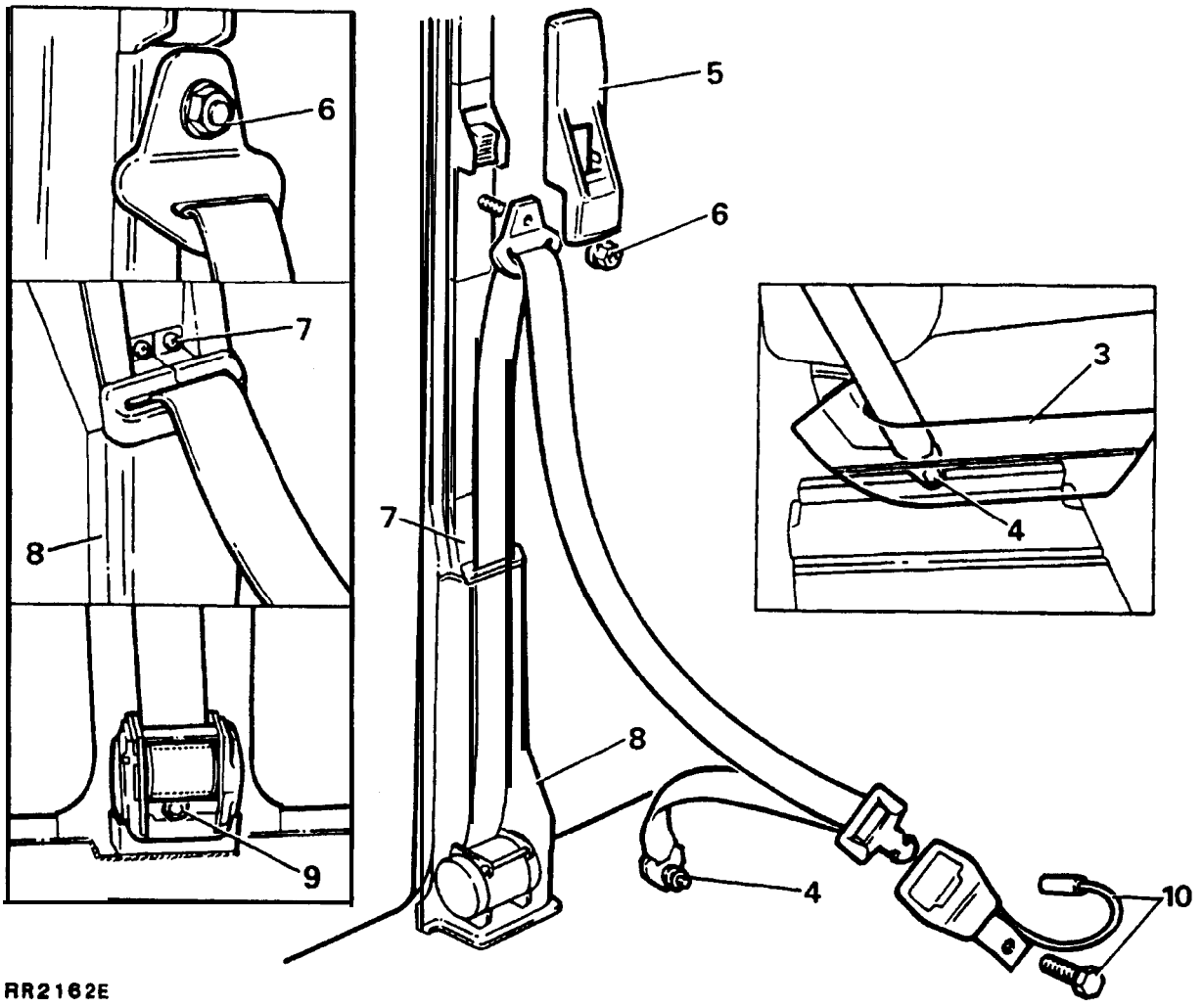
Continued



5. Working behind the rear seats, remove the bolt and plain washer and withdraw the buckle assembly.
6. Centre lap strap only: working behind the rear seats, remove the bolts securing the lap strap and the buckle assembly and withdraw both components.

Refitting

7. Reverse the removal procedure ensuring that the harnesses are not twisted. Finally tighten the fixings to the correct torque (see section 06-Torque values).



RR2162E

FRONT SEAT BELT

Remove and refit

Removing

1. Adjust the front seat to the mid-position.
2. Disconnect the battery negative lead.
3. Remove the seat cushion side trim panel - see Front Seat - remove and refit, page 34, Section 76.
4. Remove the bolt, plain washer and spacer securing the belt to the seat base.
5. Remove the moulding from the adjustable seat belt mounting.
6. Remove the shouldered nut and spacer securing the seat belt to the 'B' post.
7. Remove the two screws securing the trim finisher and release the finisher from the belt.
8. Ease the door seal away and remove the lower 'B' post trim casing.
9. Remove the bolt and spring washer securing the inertia reel assembly to the 'B' post and withdraw the assembly.
10. Disconnect the electrical connection and remove the bolt securing the buckle to the seat base.

Refitting

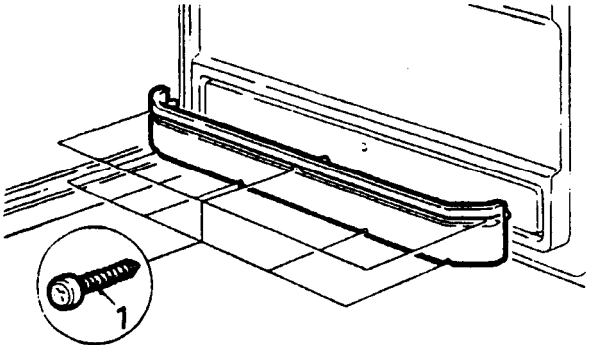
11. Reverse the removal procedure ensuring that the belt is not twisted. Finally tighten the fixings to the correct torque (see section 06-Torque values).

FRONT DOOR STOWAGE BINS

Remove and refit

Removing

1. Remove the seven fixings securing the stowage bin to the inner door trim pad.
2. Withdraw the stowage bin.



RR2064E

Refitting

3. Reverse the removal procedure.

CLOVE BOX AND FLOOR MOUNTED CONSOLE ASSEMBLY

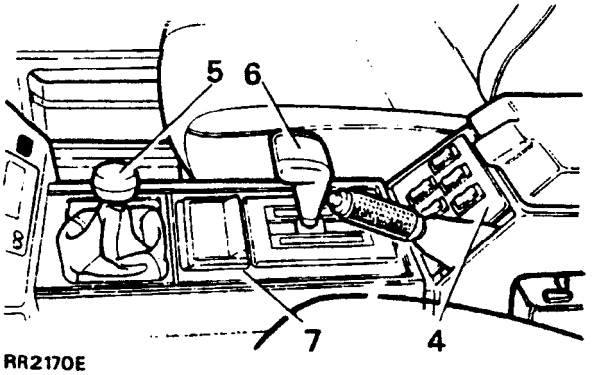
Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the four cross-head screws securing the glove box liner to the glove box and withdraw the liner.
3. Disconnect the electrical leads to the rear passenger cigar lighter.
4. Maneuver the switch panel through the panel opening and place inside the glove box.

NOTE: To enable the glove box/ console assembly to be removed, disconnect the parking, brake cable from the parking brake lever, to allow the lever to be raised to its uppermost position.

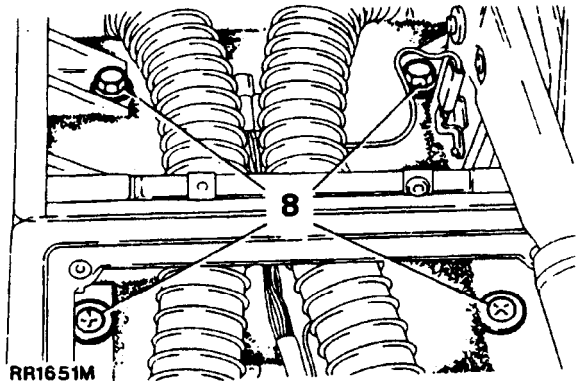
5. Unscrew and remove the transfer gear knob.



RR2170E

NOTE: Refer to Section 86 **Electrical-** Automatic gear selector **illumination** panel, for full instructions on dismantling the main gear selector knob and illumination panel.

6. Remove the main gear selector knob.
7. Carefully pry the outer inset panel out of the floor mounted console, disconnect the electrical multi-plug to the inset graphics panel, withdraw the assembly off the main gearbox selector.
8. Remove the two bolts (with plain and spring washers) and 'two screws (with plain washers) securing the floor-mounted console to the gearbox tunnel.



9. Ease the assembly rear-wards to detach the small location tab at the front of the console from the bottom of the radio housing.
10. Maneuver the assembly from the parking brake and gear levers and remove it from the vehicle.

Refitting

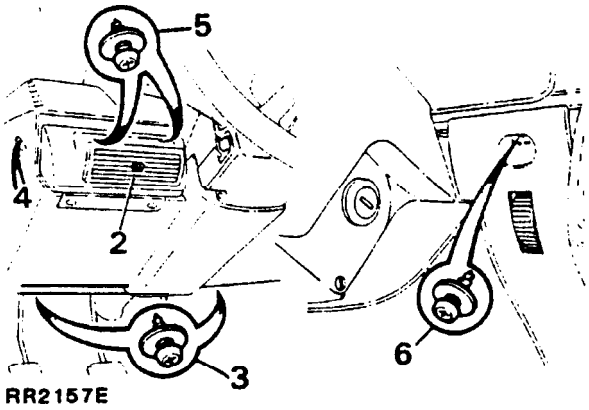
11. Reverse the removal procedure ensuring that all electrical plugs are fitted securely and correctly. Arrange the electrical wiring beneath the console to ensure it does not become trapped between any joint faces.

LOWER DASH PANEL

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Pry the louvre from the dash.
3. Remove the two cross-head screws from the bottom of the panel located above the pedals.
4. Remove the single cross-head screw from the side of the panel adjacent to the front door courtesy light switch.
5. Remove the two cross-head screws from the top of the louvre opening.
6. Remove the single cross-head screw above the rheostat switch.



7. Lower the dash panel and disconnect the electrical plug at the rear of the rheostat switch and detach the bulb check unit from the spring clip.
8. Remove the panel from the vehicle.

Refitting

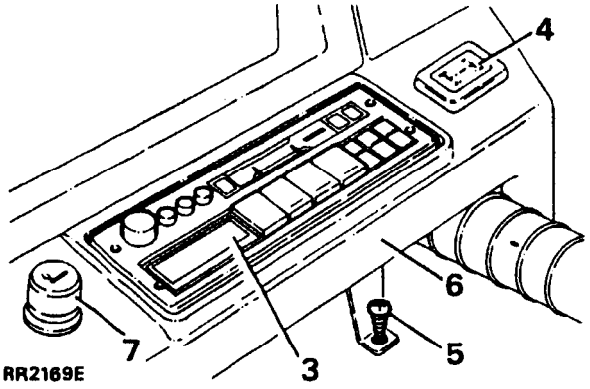
9. Reverse the removal procedure.

RADIO HOUSING

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the glove box and floor-mounted console assembly.
3. Remove the radio from the housing (See Manufacturers instructions for removal and installation).
4. Pry the differential lock warning lamp out of the radio console and disconnect the electrical leads.
5. Remove the single screw securing the housing to the gearbox tunnel.
6. Tilt the front of the housing upwards and maneuver it away from the centre dash unit as far as the cigar lighter electrical leads will permit.
7. Disconnect the leads from the rear of the cigar lighter and remove radio housing complete with lighter unit.



Refitting

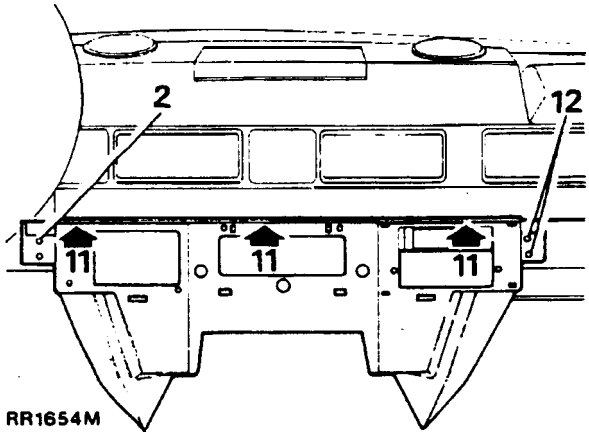
8. Reverse the removal procedure ensuring the radio electrical leads do not become trapped when refitting the radio to the housing.

CENTRE DASH PANEL

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the lower dash panel to give access to the single screw securing the side of the centre dash and release the screw.
3. Remove the glove box and floor-mounted console assembly.
4. Remove the radio and radio housing.
5. Detach the fuse box cover and remove the three screws securing the main and auxiliary fuse box body to the dash.
6. Pull the five heater control knobs off their levers.
7. Remove the two screws at the top of the heater graphics panel. Pull the panel away from the dash and remove the illumination bulbs from their locations.
8. Withdraw the graphics panel.
9. Pry the auxiliary switch panel away from the dash.
10. Identify each switch multi-plug to aid reassembly, and disconnect them from the switches.
11. Release the three screws securing the top of the centre dash to the louvre dash panel.
12. Remove the two screws securing the side of the centre dash unit (front passenger side).



13. Maneuver the centre dash away from the louvre dash and remove it from the vehicle.

Refitting

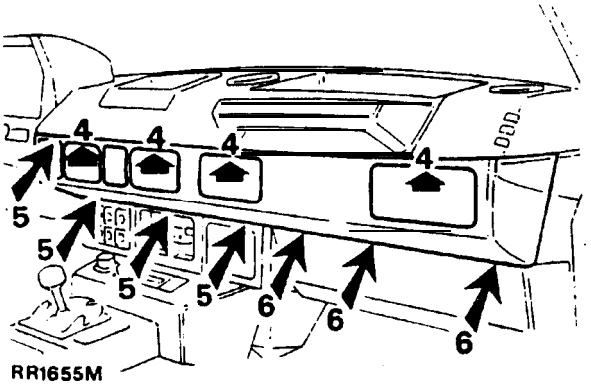
14. Reverse the removal procedure ensuring that all electrical multi-plugs are fitted correctly and secure in their respective switches.
15. Arrange all electrical wiring and harnesses so that they do not become trapped between any mating faces.

LOUVRE DASH PANEL

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Carefully pry the clock out of the dash, disconnect the electrical leads and remove the bulb and holder from its location.
3. Remove the single screw securing the end of the dash panel located adjacent to the passenger courtesy light switch.
4. Carefully pry the four louvres out of their openings to gain access to the eight screws securing the louvre panel to the dashboard.
5. Carefully pry the exterior mirror control switch out of the louvre panel and disconnect the electrical multi-plugs, remove the remaining screw at the top of the exterior driving mirror control panel opening.
6. Remove the three screws securing the bottom of the panel to the centre dash panel. Remove the remaining three screws above the blower motor trim panel.



7. Withdraw the louvre panel from the vehicle.

Refitting

8. Reverse the removal procedure.

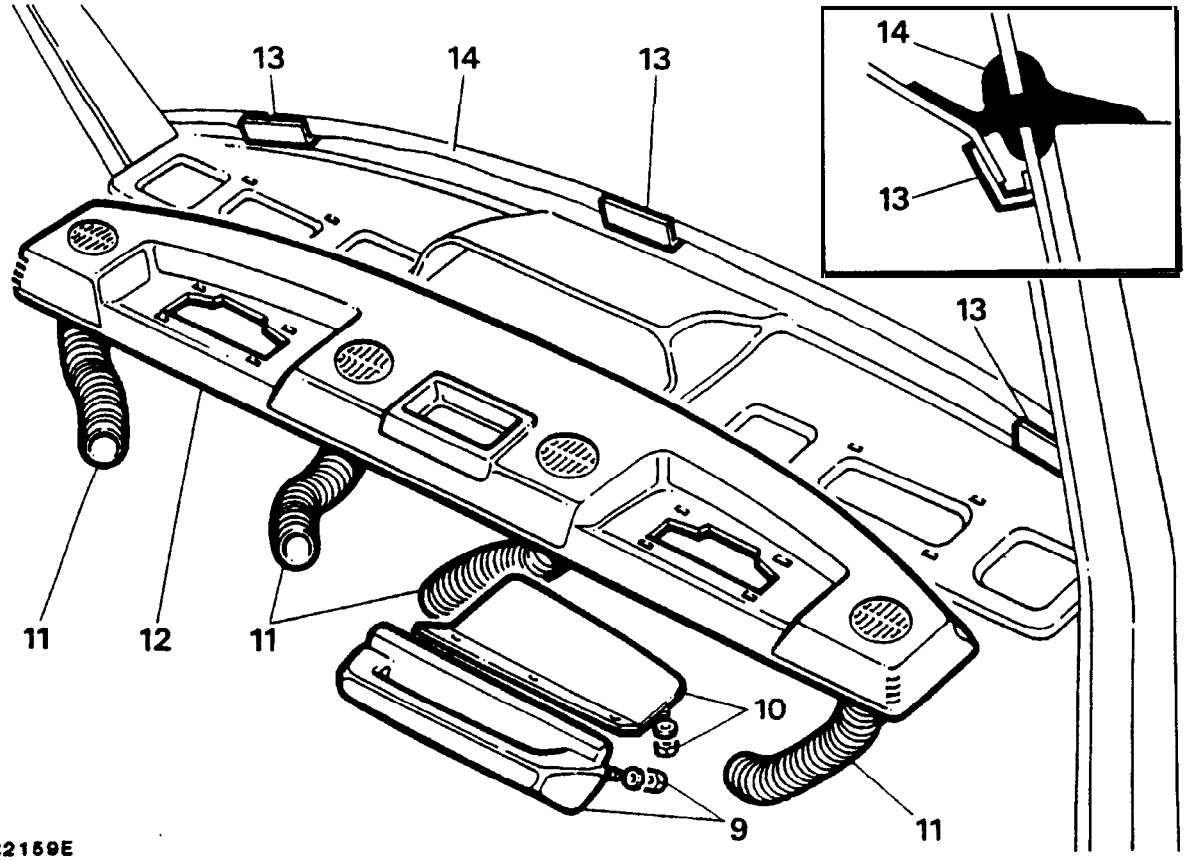
DASHBOARD

Remove and refit

Removing

Service tools:
18G1014 - Extractor for steering wheel
18G1014-2 - Adaptor pins

1. Disconnect the battery negative lead.
2. Using service tool 18G1014 and 18G1014-2 remove the steering wheel, secure the cruise control cassette in position with adhesive tape.
3. Remove the lower dash panel from below the steering column.
4. Remove the instrument binnacle (refer to instrument binnacle remove and refit in Section 86-Electrical).
5. Remove the glove box console assembiy.
6. Remove the radio housing.
7. Remove the centre dash panel.
8. Detach the dashboard evaporator assembly, do not evacuate the air conditioning assembly, with refrigerant hoses still attached ease the assembly away from the bulkhead and lay on the gearbox tunnel/passenger footwell area. (Refer to Section 82 - Air Conditioning for the removal of the dashboard assembly).
9. Remove the three nuts with washers retaining the front passenger grab handle, accessible from under the dashboard and withdraw the grab handle.
10. Remove the five nuts with washers retaining the map tray base plate, accessible from under the dashboard and withdraw the base plate from the inset in the dashboard.
11. Disconnect the side and centre air vent hoses from the heater unit.
12. Maneuver the dashboard and withdraw it from the vehicle.



RR2159E

Refitting

CAUTION: When refitting the dash components ensure that all electrical leads are arranged in such a manner as to prevent them becoming trapped between any of the dash mating faces.

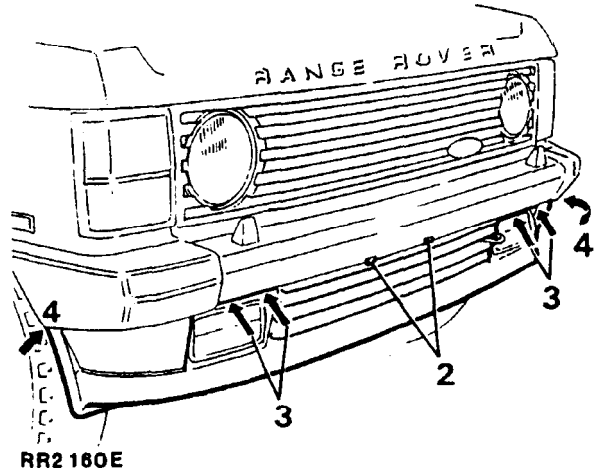
13. Reverse the removal procedure ensuring that the dashboard locates on three brackets below the windscreen inner sealing rubber.
14. Ease the sealing rubber over the top of the dashboard.

FRONT SPOILER

The spoiler will reduce the vehicle approach angle by approximately 10". Where the vehicle is expected to perform on rough or hilly terrain, it is advisable to remove the spoiler to prevent any damage which may occur due to ground contact.

The spoiler may be removed as follows:

1. Disconnect the electrical connections at the rear of both auxiliary driving lamps, accessible through the front wheel arches.
2. Remove the two screws (with spring washers) securing the centre of the spoiler.
3. Remove the four nuts (with spring washers) located behind the front bumper above the driving lamp pockets, accessible from beneath the vehicle.
4. Remove the two bolts, nuts and washers securing the outer edges of the spoiler to the corners of the front fenders, located forward of the front road wheels.
5. Remove the spoiler complete with driving lamps.

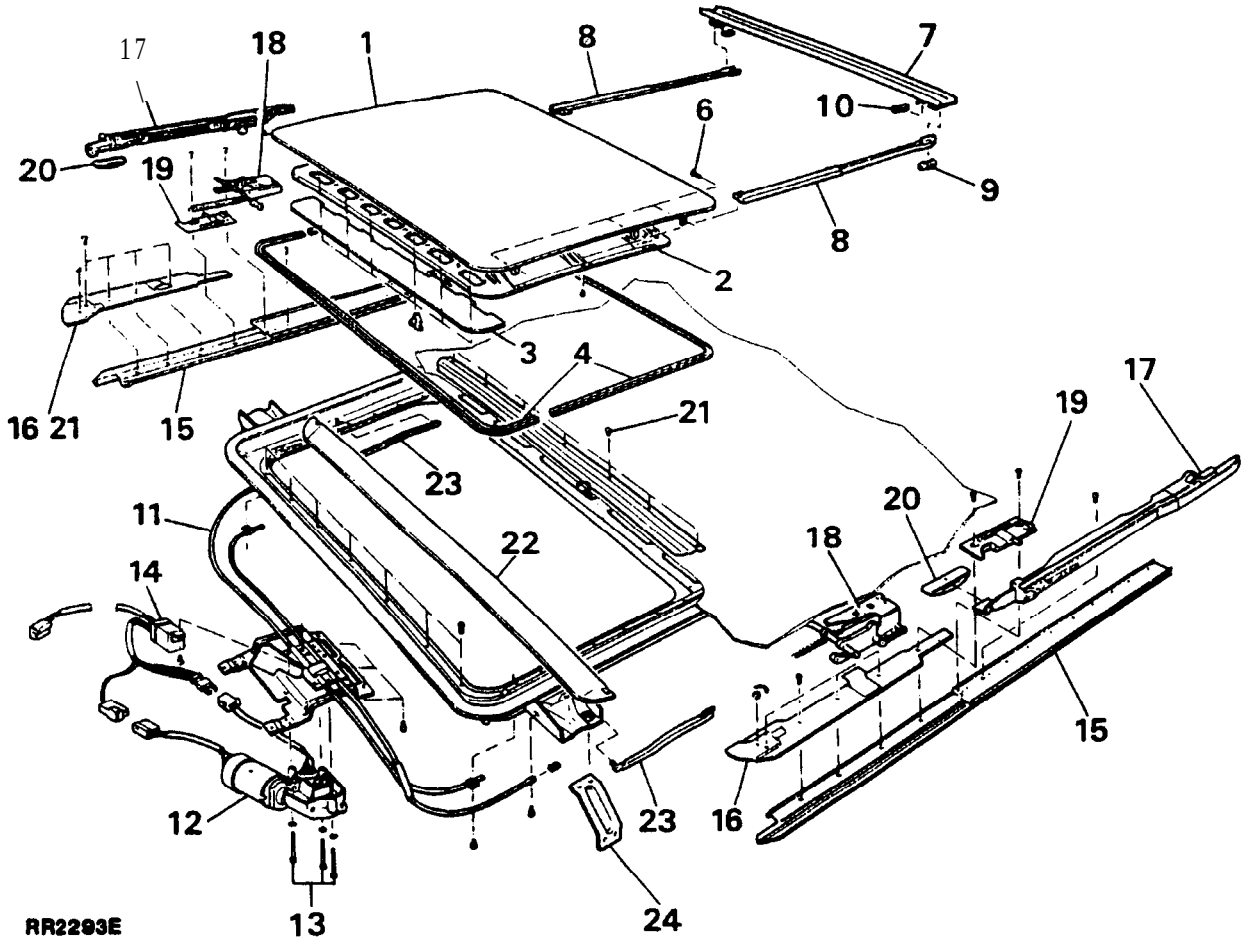


RR2 160E

Refitting

6. Reverse the removal instructions.

ELECTRICALLY OPERATED SUNSHINE ROOF



SUNROOF ASSEMBLY

1. **Roof panel**
2. **Sunroof headliner**
3. **Insulation pad**
4. **Roof seals (front and rear)**
5. **Sunroof headliner retaining clips (quantity - 6)**
6. **Roof panel retaining screws (quantity - 6)**
7. **Water channel**
8. **Water channel connectors**
9. **Support bracket-water channel**
10. **Slide shoe-water channel**
11. **Motor bracket/guide tube assembly**
12. **Operating motor**
13. **Motor retaining screws**
14. **Relay**
15. **tower guide rails**
16. **Front guide rails**
17. **Slide mechanism**
18. **Rear guide**
19. **Pivot bracket**
20. **Slide shoe**
21. **Rear edge trim finisher**
22. **Wind deflector assembly**
23. **Wind deflector operating arms**
24. **Support bracket (quantity - 6)**

OPERATION

The sunroof operates in a tilt and slide action controlled by the rocker switch adjacent to the interior roof lamp, with ignition switched 'ON'.

1. Depress front of switch to lift rear edge of sunroof into 'Tilt' position.
2. Depress rear edge of switch to close roof.
3. Depress rear of switch to slide sunroof into 'Open' position.
4. Depress front of switch to slide sunroof into 'Close' position.

NOTE: The electric drive cuts out automatically in the closed, tilt and open positions. If the switch is operated in the wrong direction in one of these positions, press the switch once to reset and again to operate roof.

EMERGENCY OPERATION

if the sun roof fails to operate, check the fuse and renew if necessary. To close the roof in the event of electrical failure carry out the following procedure.

1. Lower the interior lamp mounting panel by releasing two turnbuckles.
2. Remove the emergency handle from the vehicle tool kit.
3. Engage handle in motor drive spindle and turn to close roof.

MAINTENANCE

At each service blow drain tubes out to ensure they are not blocked or kinked. Blow upwards to clear rear drain tubes which are clipped to the rear mud flap supports. Blow downwards to clear front drain tubes which run down each 'A' post and exit at back of engine bay.
Annually: Clean sunroof opening thoroughly.

Note: Where the vehicle is operated in extremely dusty conditions more frequent cleaning is recommended.

OPERATING MOTOR, MICRO-SWITCH AND RELAY

NOTE: The motor drive spindle retaining nut is factory set to the correct torque value. If the roof fails to operate, and drive failure is suspected, check the retaining nut torque and retighten to the correct value - 37 to 44 in lb (4.15 to 5.00 Nm).

Remove and refit

Removing

1. Ensure sunroof is fully closed. Disconnect the battery negative lead.
2. Remove interior lamp mounting panel by loosening two turnbuckles to gain access to the motor.
3. Disconnect two wiring connectors.
4. Remove three securing screws and withdraw motor.
5. Remove securing screw and withdraw relay.
6. Remove micro-switch from motor by drilling out securing rivets, if required.

Refitting

7. Secure new micro-switch using suitable nuts and bolts to replace rivets. Tighten nuts and apply a spot of paint to threads.
8. Ensure motor is in the 'park' position, i.e. hole on driven gear aligned with drive spindle.
9. Reverse removal procedure.
10. Check operation of sunroof in all positions.

ROOF PANEL SEALS

Remove and refit

Removing

1. Position sunroof in the tilt position and disconnect battery negative terminal.
3. Unclip sunroof headliner from roof panel front and slide the sunroof headliner back fully.
3. Remove three roof panel fixing screws from each side and remove panel.
4. Place the roof panel on a suitable surface to avoid damage, and remove both seals.

Continued

Refitting

5. Position front seal to front edge of panel, ensuring that there is an equal length of seal each side of the centre point. Secure seal using a rubber mallet.
6. Position the rear seal on one side immediately to rear of the front seal. Secure seal around panel edge ensuring a good fit around corners. Trim off excess seal at joint with front seal using suitable snips, ensuring that the joint is closed.
7. Refit the roof panel.

SUNROOF ASSEMBLY

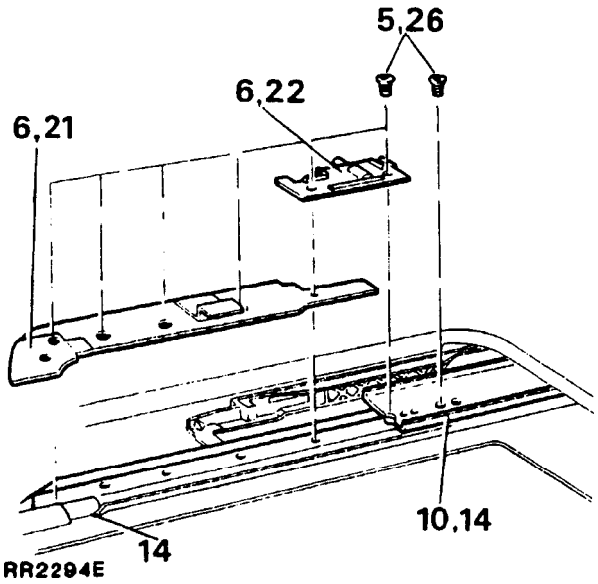
Remove and refit

- including roof panel, sliding mechanism, wind deflector,-motor- mounting bracket and guide tubes.

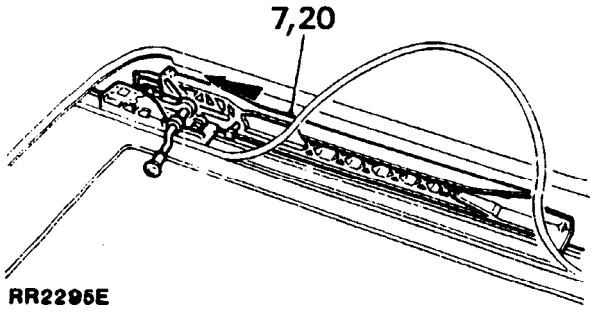
Removing

NOTE: lower vehicle headlining ONLY if removing motor mounting bracket and guide tubes. Note that the headlining is secured around the roof opening using an adhesive tape. Remove edge trim and eight edge clips, carefully peel back headlining to remove.

1. Partially open sunroof rearwards and carefully unclip sunroof headliner from roof panel front. Slide the sunroof headliner back fully.
2. Position sunroof in the tilt position and disconnect battery negative terminal.
3. Remove three roof panel fixing screws from each side and remove panel.
4. Remove motor securing screws and withdraw motor.
5. Remove the guide rail screws, seven each side.
6. Remove the pivot bracket and remove front guide rail.

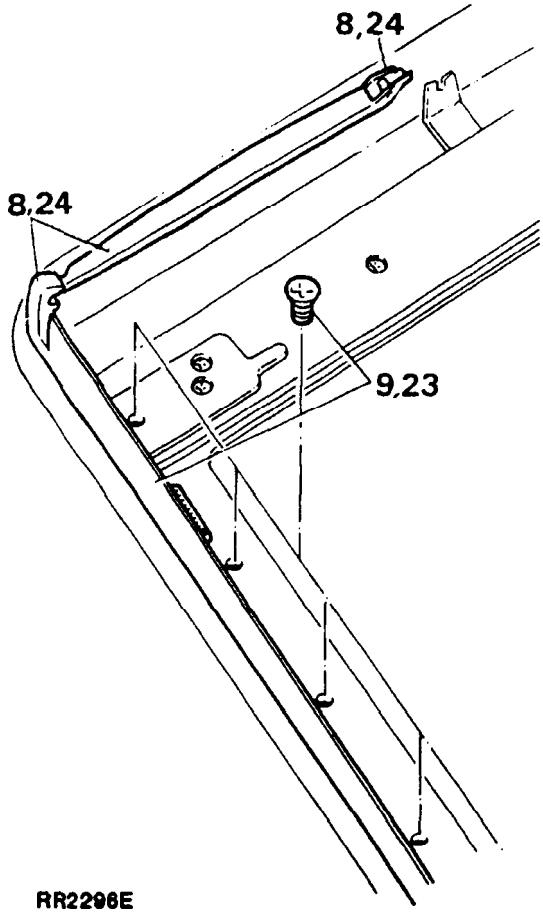


7. Remove the slide and tilt mechanism complete with flexible drive cable from both sides. Do not strip these assemblies unless replacement parts are required.



Continued

8. Unclip both wind deflector operating arms from rear mounting brackets. Remove arms from deflector, if required.



9. Remove seven fixing screws, and withdraw wind deflector.
10. Remove lower guide rails and rear edge finisher, seven screws, if required.
11. Remove fixing screws from guide tubes, two each side. Remove five fixing screws and withdraw motor mounting bracket.
12. Pull sunroof headliner assembly forward and remove.

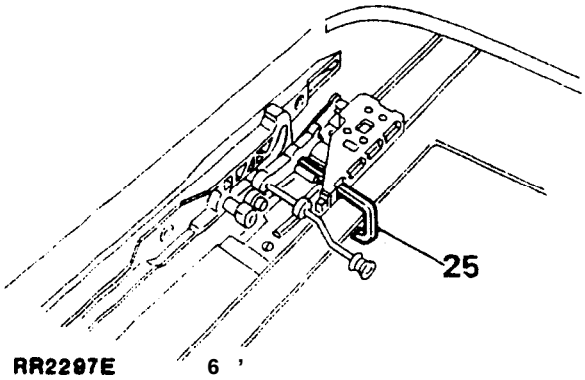
Refitting

NOTE: During assembly lightly lubricate all sliding parts using a silicon spray.

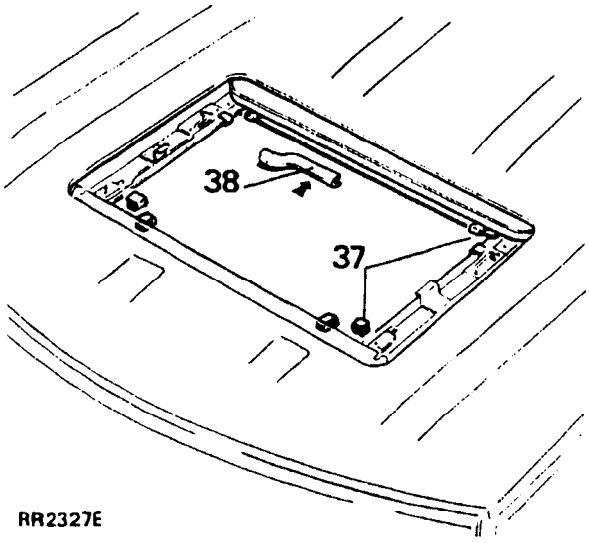
13. Position motor bracket and guide tube assembly. Fit and tighten the securing screws.
14. Position right hand guide rail in rear retaining bracket, push reanvards fully and locate leading edge under drive cable opening. Repeat operation for left hand guide rail.
15. Align fixing holes, and loosely fit screw in seventh hole from the front.
16. Position finisher to rear edge of sun roof opening and secure using seven screws.
17. Position sunroof headliner assembly into outer guide runners, and push fully rearwards.
18. Lightly lubricate drive cables. Ensure that the slide and tilt mechanism is fully assembled.
19. Push the cable fully into the right hand side guide tube. Loop remaining cable and enter the rear end into the right hand inner side runner.
20. Repeat operation 19. for left hand side. Push both assemblies rear-wards to take up slack in the cables, and push a further 75 mm (3 in) to the rear.
21. Position both front guide rails, aligning with the four forward holes. Secure with screws, do not tighten.
22. Position both pivot brackets, fit but do not tighten fixing screws.
23. Fit the wind deflector and fully tighten fixings.
24. Position right hand operating arm in locating slot in deflector. Secure opposite end in frame bracket. Repeat for left hand side.

Continued

25. Pull right hand slide and tilt mechanism forward, align with pivot bracket and secure in position using setting key. Repeat operation for left hand side.



26. Tighten screws to guide rails, seven each side.
27. Fit and secure relay.
28. Ensure operating motor is in the park position i.e. hole on driven gear aligned with drive spindle. Fit and secure to mounting bracket.
29. Remove setting keys. Temporarily connect operating switch and reconnect wiring including battery.
30. Operate switch sequence to 'tilt' position.
31. Position roof panel into roof opening and secure with six fixing screws, do not tighten.
32. Put roof into 'closed' position and adjust roof profile. The panel profile should be 0.5 mm low at forward edge, 1 mm high at rear edge.
33. Tighten roof panel screws.
34. Tilt sunroof, pull sunroof headliner forward and locate rear brackets in tilt mechanism. Align front six clips and push to secure.
35. Check operation of sunroof in all operating modes.



36. Refit vehicle headlining. The headlining is secured around the sunroof opening with '3M' adhesive tape.
37. Refit the eight edge clips as shown.
38. Finally fit the edging finisher.

SUNROOF HEADLINER ASSEMBLY

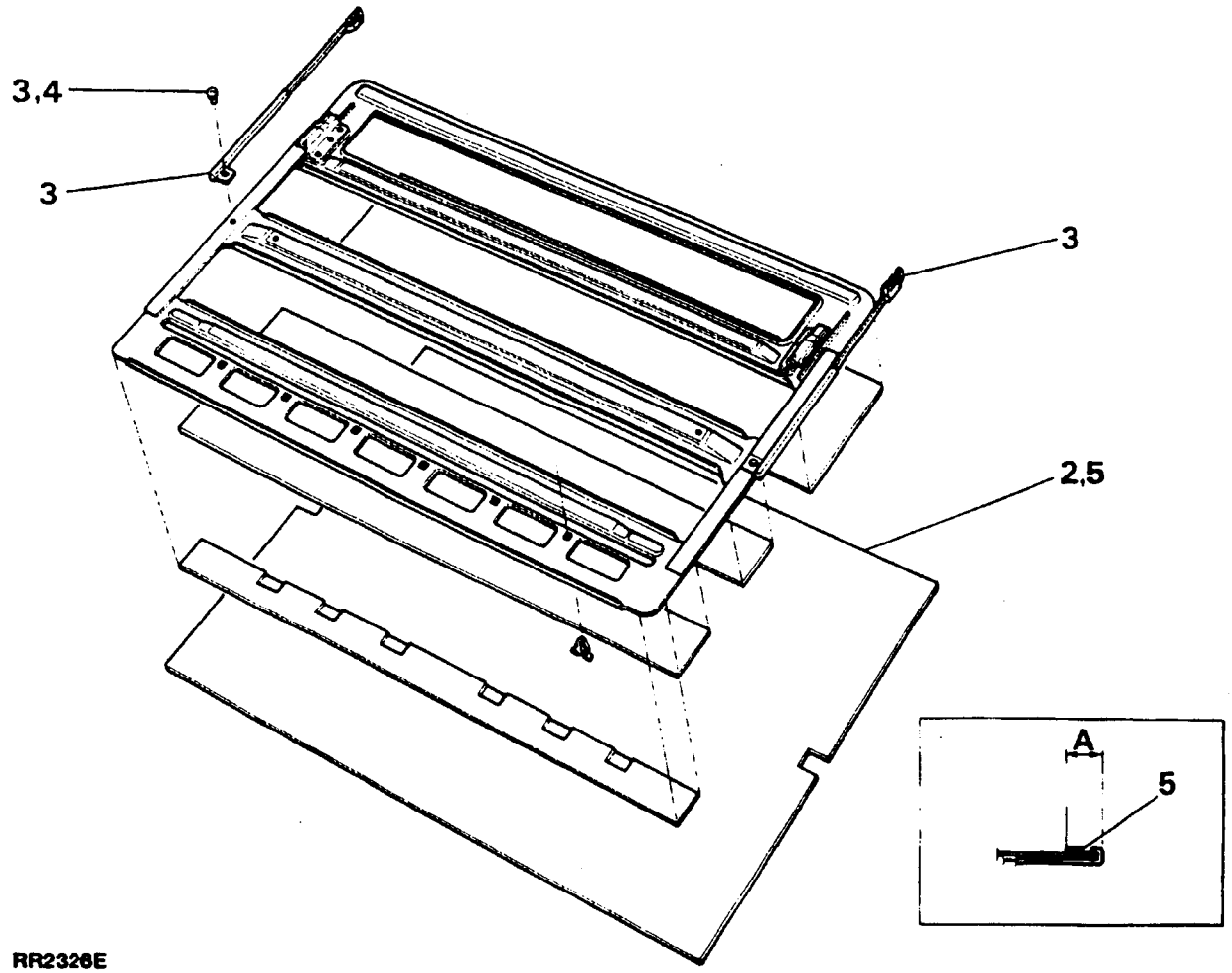
Remove, retrim and refit

Removing and retrimming

1. Remove sunroof headliner assembly as detailed in Sunroof Assembly - remove and refit.
2. Remove trim covering from frame assembly. Note that it is not normally necessary to remove the three pads and insulation pad shown in illustration.
3. If required: remove water channel by unclipping connecting arms. Drill out rivets securing connecting arms to frame.
4. Secure connecting arms to frame using suitable rivets before retrimming frame.
5. Retrim frame using a new headliner cover. inset shows section through frame indicating where adhesive is applied. Dimension 'A' should be radially constant.

Refitting

6. Refit sunroof headliner assembly and reassemble sunroof.



RR2326E

Continued

HEADLINING - 1987 MODEL YEAR IMPROVEMENT

Remove and refit

Removing

1. Remove spare wheel from the vehicle.
2. Remove the rear seat belt upper guide brackets and inertia reel assemblies.
3. Fold the rear seat backrest forward and recline the front seats as far as possible.
4. Disconnect the battery negative lead.
5. Remove the two roof lamp assemblies. (Lower and remove the interior lamp mounting panel if the vehicle has a sunroof)
6. Remove the rear view mirror and mounting bracket.
7. Remove the two sun visors and centre retaining bracket.
8. Remove the front and rear passenger grab handles. Sunroof vehicles: Remove edge trim and eight edge clips from roof opening, and carefully peel back headlining to remove.
9. With assistance support the front of the headlining, while removing the two plastic retaining clips above the rear quarter light glass.
10. While the headlining is still being supported, remove the two plastic retaining clips securing the rear end of the headlining, located adjacent to the upper tailgate hinges.
11. Pull the headlining forward to clear the rear quarter trim. Lower the headlining and disconnect the electrical leads from the roof mounted speakers.
12. Remove the headlining through the tailgate.

CAUTION: To assist removal tilt the headlining at an angle. DO NOT flex the headlining as damage may occur.

Refitting

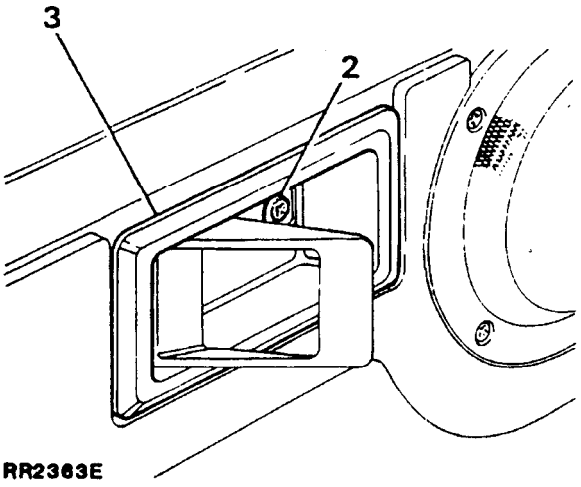
8. Reverse the removal procedure. Sunroof vehicles: The headlining is secured around the roof opening with '3M' adhesive tape. Refit the eight edge clips and fit the edging finisher. See also Sunroof assembly, remove and refit.

FRONT DOOR • TRIM PANEL

Remove and refit

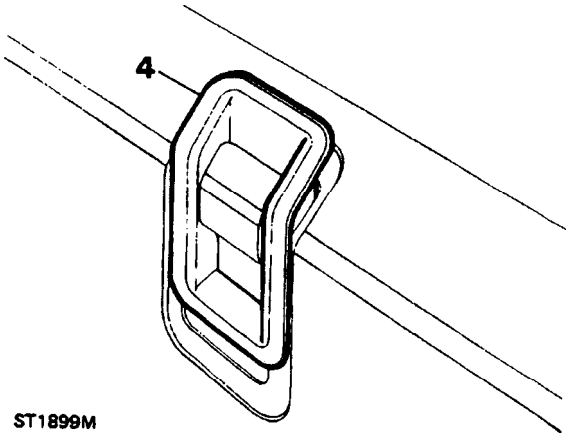
Removing

1. Disconnect the battery negative terminal.
2. Remove the screw securing the handle surround.
3. Remove the surround.



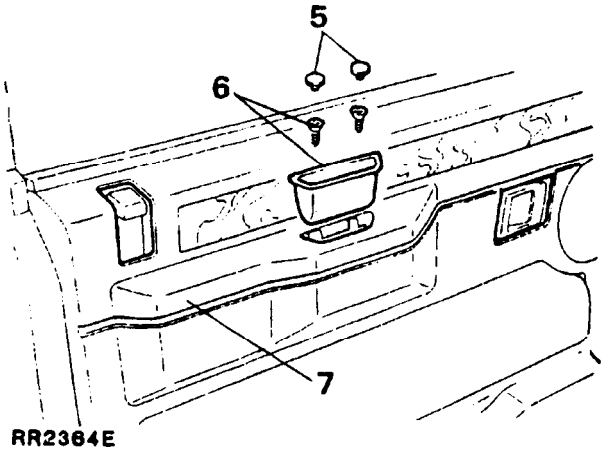
RR2363E

4. Carefully pry the sill locking button surround from the trim panel.



ST1899M

5. Remove the two finisher buttons from the bottom of the door pull pocket to reveal the securing screws.
6. Remove the screws and withdraw the pocket from the trim panel.



RR2364E

7. Using a taped screwdriver, carefully pry the trim panel away from the door.

NOTE: Support the trim panel while the speaker leads are disconnected.

8. If necessary the stowage bin front panel can be removed by releasing the screws at the rear of the trim panel.

Refitting

9. Reverse the removal procedure.

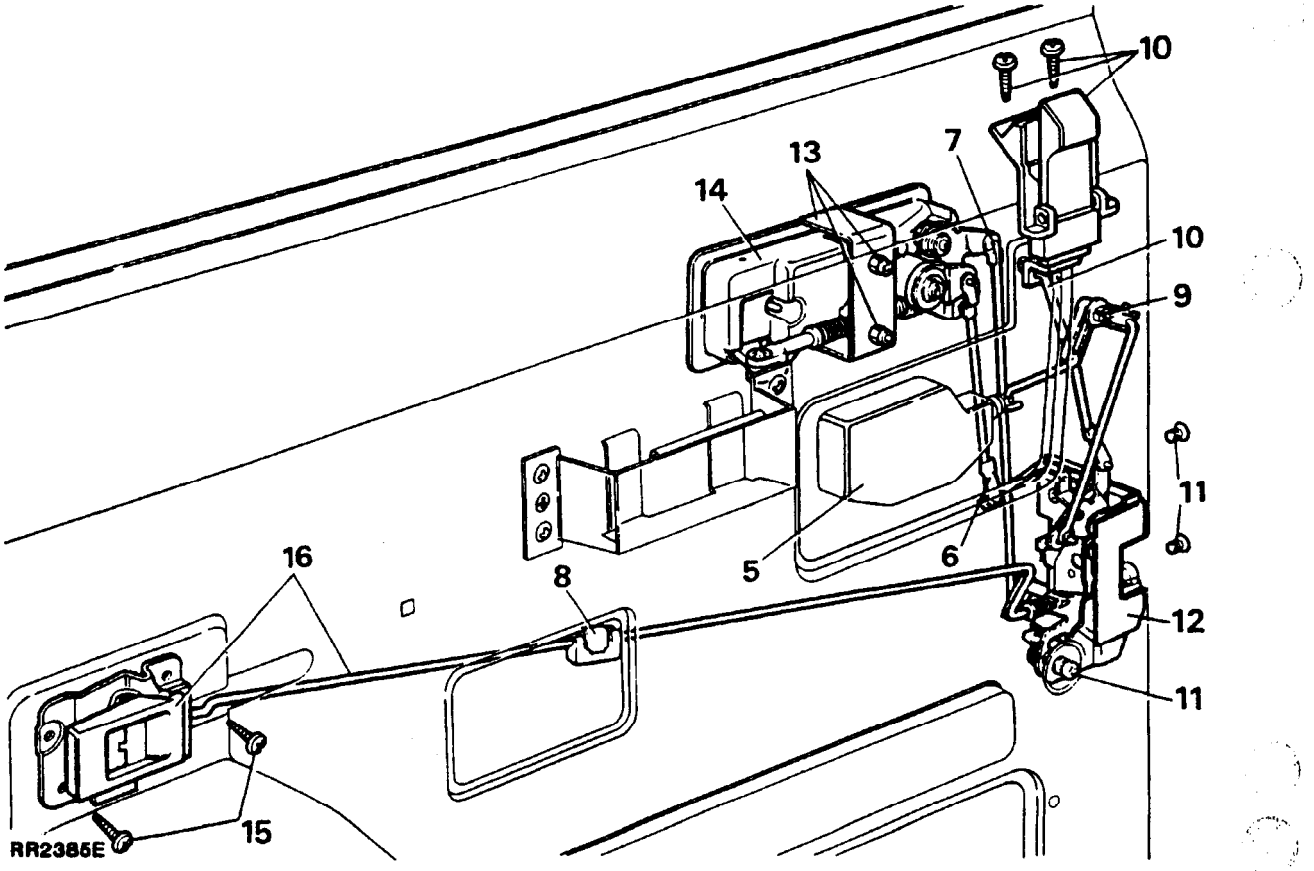
Continued

FRONT DOOR LOCK, OUTSIDE AND INSIDE DOOR RELEASE HANDLES

Remove and refit

Removing

1. Remove the interior door release handle bezel and sill locking button bezel.
2. Remove the two screws from the bottom of the door pull pocket remove the pocket and prise the door trim panel from the door. Disconnect the electrical leads to the door speaker and remove the plastic vapor barrier sheet.
   Remove the window lift motor. (Refer to the electrical section in main Workshop Manual).
4. Remove the door glass and regulator. (Refer to door glass and regulator remove and refit in main Workshop Manual).
5. Remove the door lock actuator. (Refer to electrical section in main Workshop Manual).
6. Disconnect the control rod from the key operated lock by releasing the metal clip at the bottom of the rod.
7. Disconnect the control rod from the outside door release handle by pulling it out of the plastic ferrule.
8. Disconnect the control rod connector between the inside door release handle and the door lock by releasing the metal clip and pulling one of the control rods out of the plastic connecting block. This is accessible through the small centre cut - out in the door panel. (The control rod also passes through a guide bracket on the inside of the inner door panel).
9. From inside the door panel push out the small pin which secures the quadrant to the inner door panel. Push the quadrant out of the panel.
10. Remove the two screws securing the sill locking button to the door. manouver the sill button and remove it from the control rod.
11. Release the door lock by removing the two countersunk screws from the door edge and the single screw with shakeproof washer on the inner door panel.



12. Withdraw the lock through the lower rear cut - out on the inner door panel.

NOTE: If necessary the following items can be removed.

13. Remove the two nuts (with shakeproof washers) and retaining bracket securing the outside release handle to the outer door panel, accessible through the upper rear cut - out on the inner door panel.
14. Carefully detach the door release handle from the outer door panel.
15. Remove the two screws securing the inside door release handle to the inner door panel.
16. Withdraw the handle from its location with half of the connecting rod attached.

Refitting

17. Reverse the removal procedure items 1 to 16.

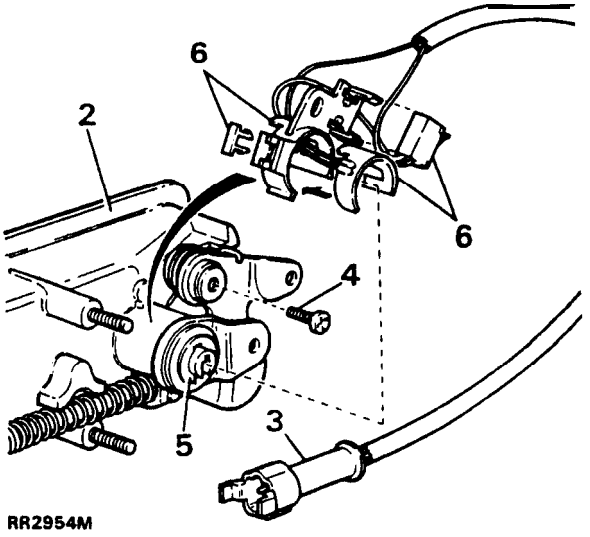
NOTE: When refitting the door glass frame, ensure that it is positioned to suit the door opening before fully tightening the frame securing bolts.

HEATED FRONT DOOR LOCK ASSEMBLY • 1991 MODEL YEAR

Remove and refit

Remove

1. Disconnect battery negative lead.
2. Remove outside front door handle assembly.



RR2954M

3. Disconnect the heaters electrical wiring at the multiplug.
4. Remove heater retaining bracket screw.
5. Remove 'C' clip and colored cam link from end of barrel assembly.

Caution: Ensure the loose barrel assembly remains in position, to avoid components falling apart.

6. Remove heater retaining bracket, complete with de-icing element, switch and wiring assembly.

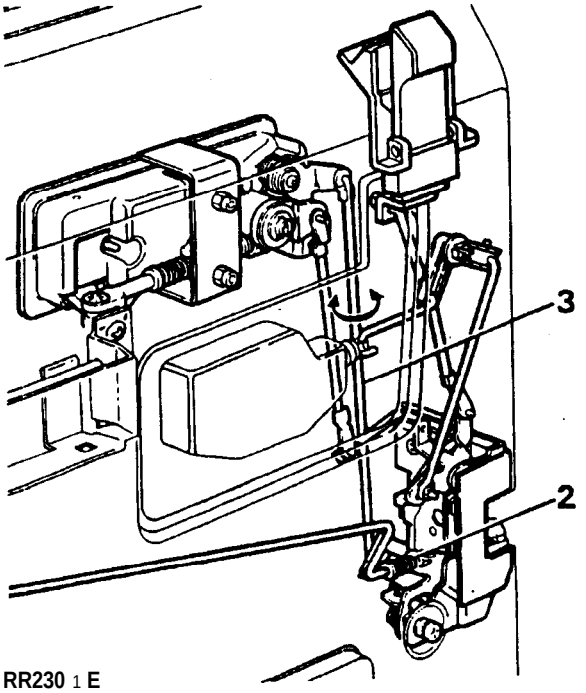
Refit

7. Hold de-icing element in position and fit heater retaining bracket assembly.
8. Reverse removal instructions 1 to 5.
9. Recode the radio.

ADJUSTMENT - FRONT DOOR LOCK AND HANDLE ASSEMBLY

Inside door release handle to lock

1. Refit the inside door release handle bezel before any adjustment is made, allowing the handle to be set for the correct operating position.
2. Rotate the spring tensioned nyloc nut at the door lock clockwise or counter - clockwise to shorten or extend the operating length of the rod as required.



RR2301E

Outside door release handle to lock

3. Disconnect the connecting rod at the rear of the outer door release handle by releasing the the rod from the plastic ferrule, rotate the rod clockwise or counter - clockwise to shorten or extend the operating length, refit the rod to the ferrule.

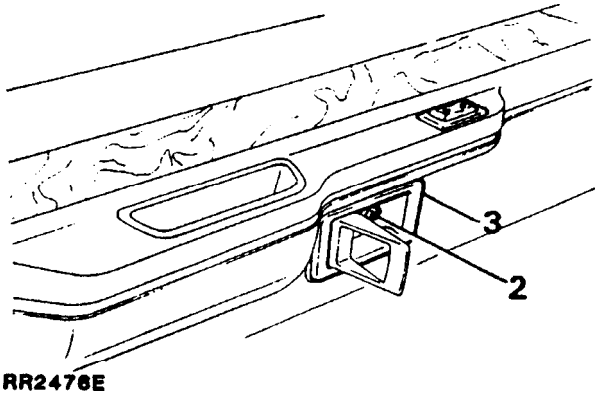
NOTE: Door release should occur before the total handle movement is made to provide a small overthrow movement.

REAR DOOR - TRIM PANEL

Remove and refit

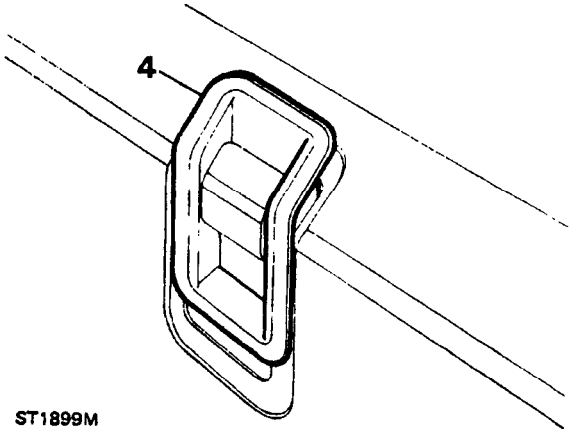
Removing

1. Disconnect the battery negative terminal.
2. Remove the screw securing the handle surround.
3. Remove the surround.



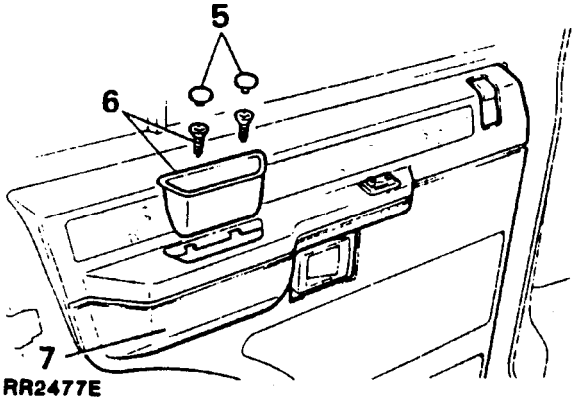
RR2476E

4. Pry the door locking button surround from the trim panel.



ST1899M

5. Remove the two finisher buttons from the bottom of the door pull pocket to reveal the securing screws.
6. Remove the screws and withdraw the pocket from the trim panel.
7. Using a taped screwdriver, carefully pry the trim panel away from the door.
8. Disconnect the electrical plug from the window lift switch.
9. Remove the window lift switch by pushing from behind the trim panel.



RR2477E

Refitting

10. Reverse the removal instructions.

REAR DOOR LOCK, OUTSIDE AND INSIDE DOOR RELEASE HANDLES

Remove and refit

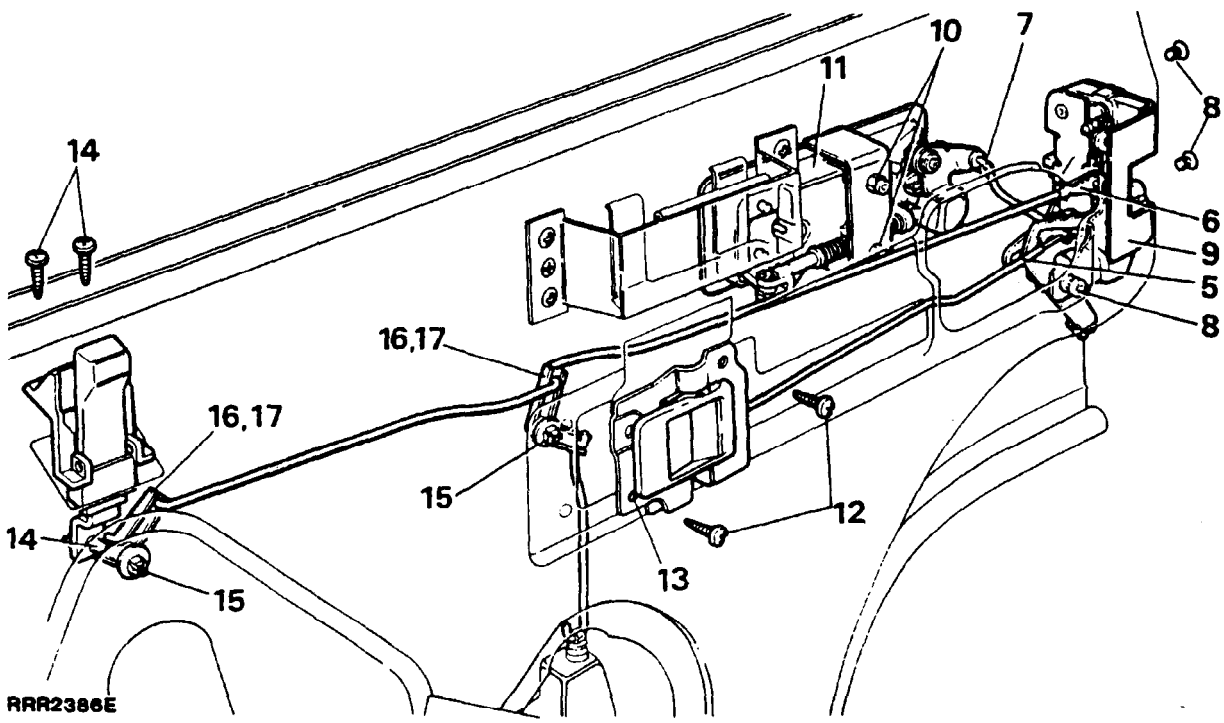
Removing

7. Ensure the window is fully closed position and disconnect the battery negative terminal.
2. Remove the interior door handle surround, pry the window lift switch from the trim panel and disconnect the electrical multi - plug.
3. Pry the sill button from the trim panel.
4. Remove the two screws from the bottom of the door pull pocket accessible after removing the two buttons and detach the trim panel from the door panel. Remove the plastic vapor barrier sheet.
5. Disconnect the control rod from the inside door release handle by pulling the rod out of its location at the door lock.
6. Disconnect the sill locking control rod from the door lock by releasing the metal clip.
7. Disconnect the control rod from the outside door release handle by pulling it out of the plastic ferrule.
8. Release the door lock by removing the two countersunk screws from the door edge and the single screw (with shakeproof washer) on the inside of the door. Retrieve any spacing washers which may be fitted between the inner door panel and lock.
9. Withdraw the lock through the upper rear opening in the inner door panel.

NOTE: If necessary the following items can also be removed.

10. Remove the two nuts (with shakeproof washers) and retaining bracket securing the outside door release handle which are accessible through the upper rear cut - out on the inner door panel.
71. Carefully detach the outside door release handle from the outer door panel.
72. Remove the two screws (with plain washers) securing the inside door release handle to the inner door panel.
13. Withdraw the handle from its location with the connecting rod attached.

Continued



14. Remove the two screws securing the sill locking button to the inner door panel and detach the sill button from the bellcrank.

Sill locking bellcranks

15. Using a small screwdriver, or 3.175 mm (0.125 in) diameter rod, press the plastic locking pins through the respective square inserts in the inner door panel, until they can be retrieved from inside the door.
16. Release the bellcranks from the inner door panel and unhook the respective connecting rods.
17. Withdraw the bellcranks from the inner door panel.

NOTE: When refitting the bellcranks the locking pins are entered into the square insert from outside and pressed in flush.

Refitting

18. Reverse the removal procedure items 1 to 17.

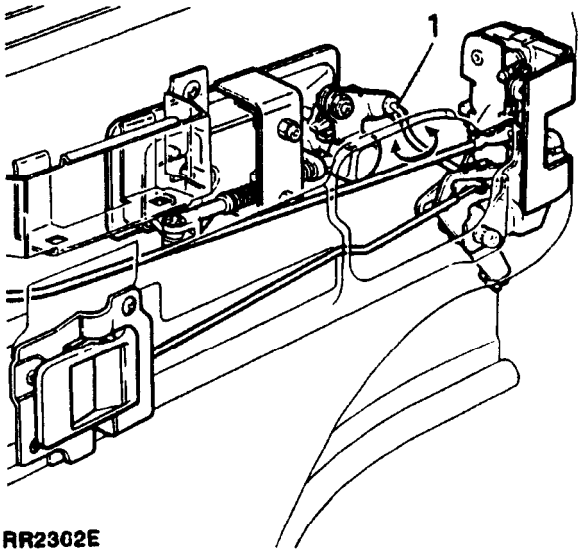
NOTE: When refitting the door glass frame, ensure that it is positioned to suit the door opening before fully tightening the frame securing bolts.

ADJUSTMENT - REAR DOOR LOCK AND HANDLE ASSEMBLY - 4 Door models

Outside door release handle to lock

1. Disconnect the short offset connecting rod at the rear of the door outer release handle, rotate the rod clockwise or counter - clockwise to shorten or extend the operating length of the rod as required.

NOTE: Door release should occur before the total handle movement is made to provide a small overthrow movement.



RR2302E

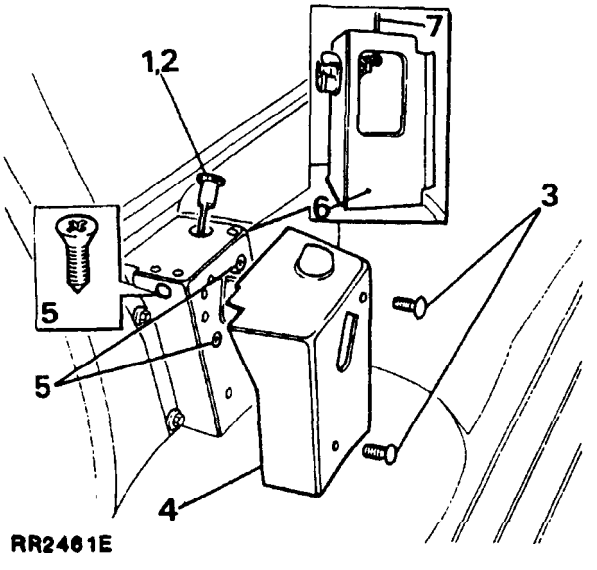
ASYMMETRIC SPLIT REAR SEAT - LOCKING MECHANISM

NOTE: 1989 Model Year vehicles have a revised seat locking mechanism which incorporates a push button release in place of a finger lift button. The revised latch and striker give the seat an improved positive location.

Remove and refit

Removing

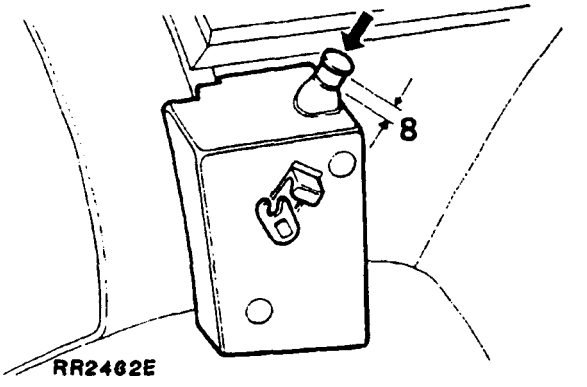
1. Depress the seat release button and fold the seat back forward.
2. Unscrew and remove the seat release button.
3. Pry out the two trim buttons securing the trim covering to the latch tower.
4. Manouver the trim covering from the tower.
5. Remove the three screws securing the latch to the tower, noting that access to the single screw is gained through the hole in the front of the tower.
6. Retrieve the latch from the opening at the rear of the tower. If necessary retrieve the single screw.
7. The operating rod can be removed from the latch by releasing the rod at the plastic clip.



RR2461E

Refitting

8. Refitting is a reversal of the removal procedure noting that when the seat release button is screwed onto the operating rod there must be a gap of 5 - 8 mm (0.196 - 0.312 inch) between the head of the button and lip of the trim covering after the button has been depressed.



RR2462E

Continued

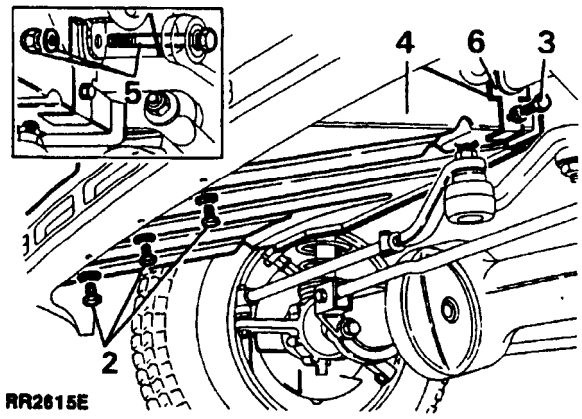
ENGINE UNDERTRAY

Removal of engine under-tray fitted to 1989 model year vehicles is necessary when changing the oil filter. Remove will also facilitate attention to engine, cooling system and steering components.

Remove and refit

Removing

1. Disconnect battery negative lead.
2. Remove three screws, securing under-tray to spoiler.
3. Remove two screws, one each side, securing rear of under-tray to chassis mounting brackets.
4. Remove under-tray by carefully flexing to clear rear mountings.
5. Removal of one or both rear mounting brackets may be necessary, for example, when removing steering box. Remove the nut and washer from the chassis bolt.
6. Withdraw the undertray mounting bracket.



Refitting

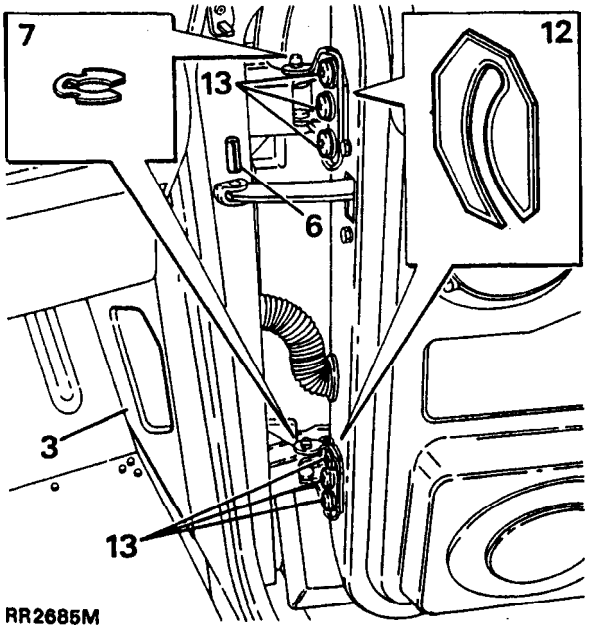
7. Reverse the removal procedure.

FRONT DOOR

Remove, refit and adjust.

Removing

1. Disconnect the battery negative lead.
2. Open the door to be removed.
3. Remove the trim panel from side of footwell by carefully levering under the trim and prising out the two plastic clips.



4. Locate and disconnect all door wiring plugs.
5. Disengage the grommets either side of 'A' post and feed wiring out.
6. Drive out the roll pin from the door check link.
7. Remove 'C' clips from grooves in hinge pins.

WARNING: Instruction 8. MUST BE carried out with assistance.

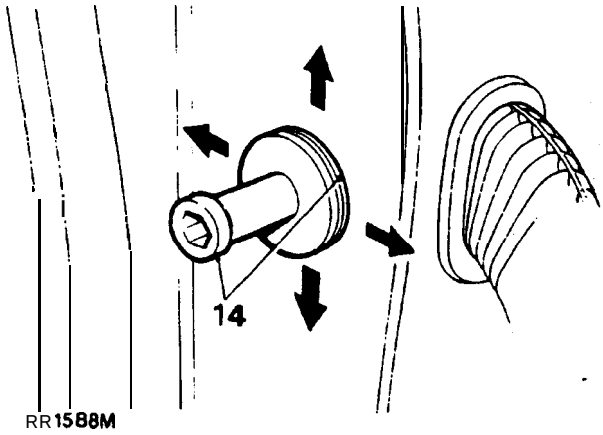
8. Carefully lift the opened door off the hinge pins.

Refitting

9. Reverse the removal procedure. Renew the 'C' clips if worn or distorted.
10. With door fully open reconnect wiring plugs ensuring they are located above the trim panel.
11. Check the operation of the door and lock. If necessary, adjust the door and striker plate.

Adjusting

12. Adjust the door by means of shims between the hinge and door to move the door forward or rearward in the opening.
13. Loosen the six Torx screws securing the hinges to the door to adjust the door up and down or in and out of the opening. Retighten the screws to the specified torque values.
14. The door lock striker can be adjusted by loosening the striker and moving it in the appropriate direction or adding and subtracting spacing washers between the striker and 'B' post.



15. Note: If it is necessary to remove hinges from 'A' post they should be refitted in exactly the same position using the same thickness of shims.

REAR PASSENGER DOOR

Remove, refit and adjust.

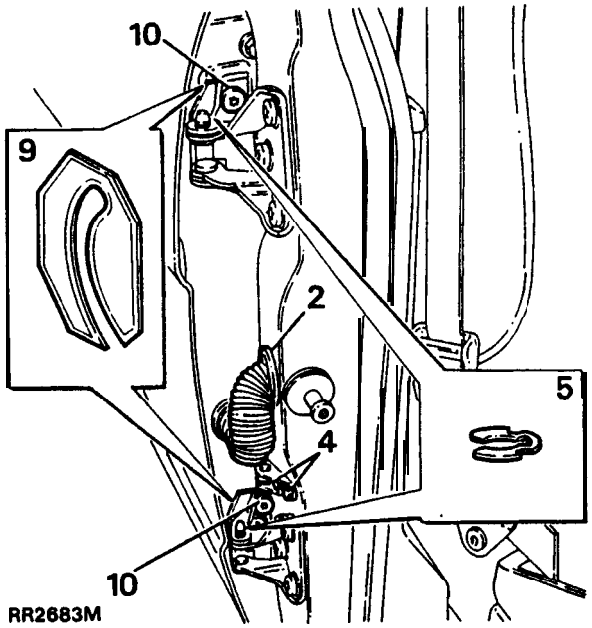
Removing

1. Disconnect the battery negative lead.
2. Remove wiring grommet from the 'B' post.
3. Withdraw the door wiring plugs from the 'B' post and disconnect them.
4. Remove the two bolts securing the check strap to 'B' post.

5. Remove 'C' clips from grooves in the hinge pins.

WARNING: Instruction 6. MUST BE carried out with assistance.

6. Carefully lift the opened door off the hinge pins.



RR2683M

Refitting

7. Reverse the removal procedure. Renew 'C' clips if worn or distorted.
8. Check the operation of the door and lock. If necessary, adjust the door and striker plate.

Adjusting

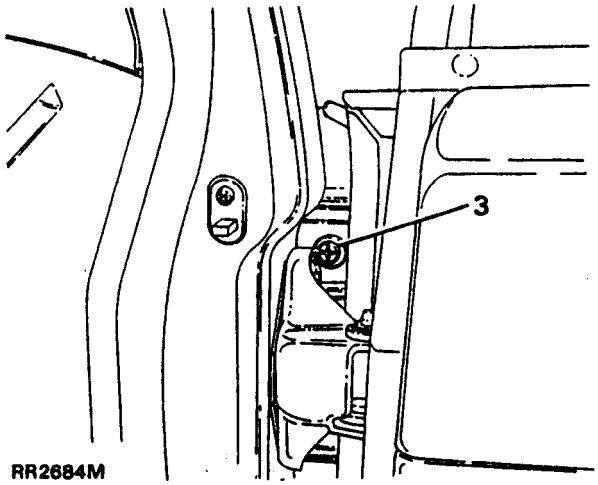
9. Adjust the door by means of shims between the hinge and door to move the door forward or rearward in the opening.
10. Loosen the six Torx screws securing the hinges to the door to adjust the door up and down or in and out of the opening. Retighten the screws to the specified torque values.
11. Adjustment to the door striker is identical to front doors.
12. Note: If it is necessary to remove hinges from 'B' post they should be refitted in exactly the same position using the same thickness of shims.

COWL PANEL

Remove and Refit

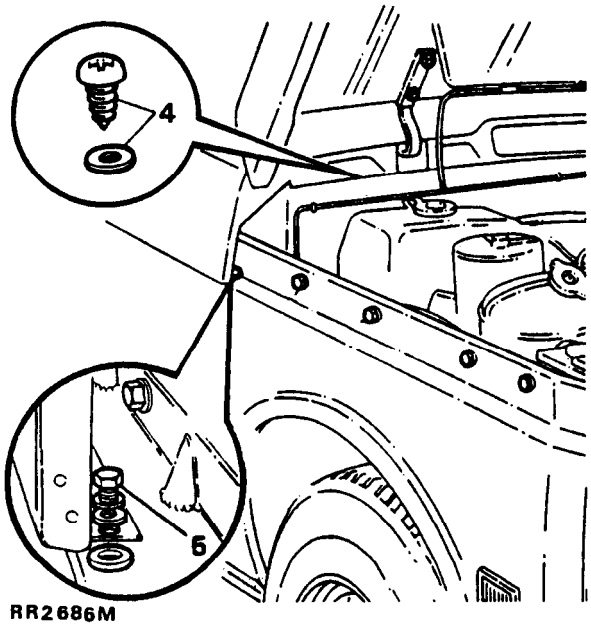
Removing

1. Disconnect the battery negative lead and remove the hood.
2. Remove the wiper arms and two nuts securing the wheel boxes to the cowl panel and remove the two sealing rubbers.
3. Remove the two cross-head screws retaining the panel to the 'A' post mounting brackets located above the front door hinges.



RR2684M

4. Remove the nine cross-head screws securing the front of the cowl panel.
5. Remove the four bolts with spring and plain washers securing cowl panel to front fenders accessible from the front of the cowl panel.



RR2686M

6. With assistance place a tube over each of the hinges and lower to enable the cowl panel to be fed over the hinges, gradually return the hinges to their upright position.

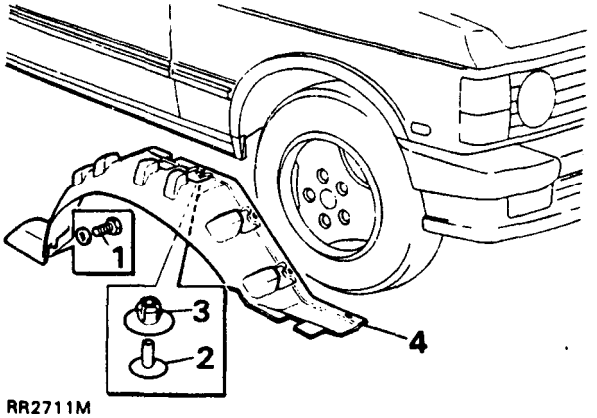
   WARNING: Gradually let the torsion bar spring tension return the hinges to their upright position to prevent the possibility of personal injury or damage to the vehicle.

Refitting

7. Reverse the cowl panel removal instruction.
8. Using a soft blunt implement ease the windscreen rubber up onto the top of the cowl panel.

FRONT WHEEL ARCH LINER

Remove and refit



RR2711M

Remove

1. Remove the bolt and washer securing the rear lower edge of the liner.
2. Carefully pry out the centre studs of the eight plastic clips spaced around the liner.
3. Carefully pry out the plastic clips.
4. Remove the liner.

Refit

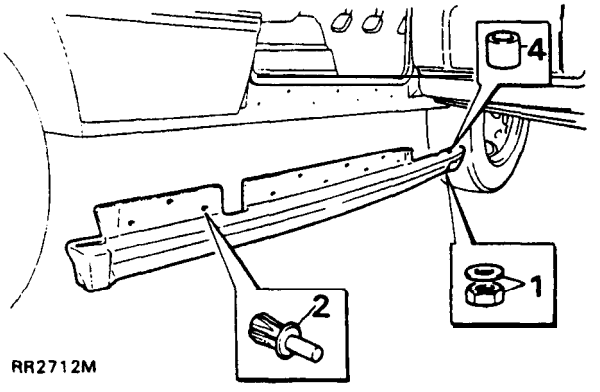
5. Reverse the removal procedure renew the clips as necessary.

SILL FINISHER

Remove and refit

Remove

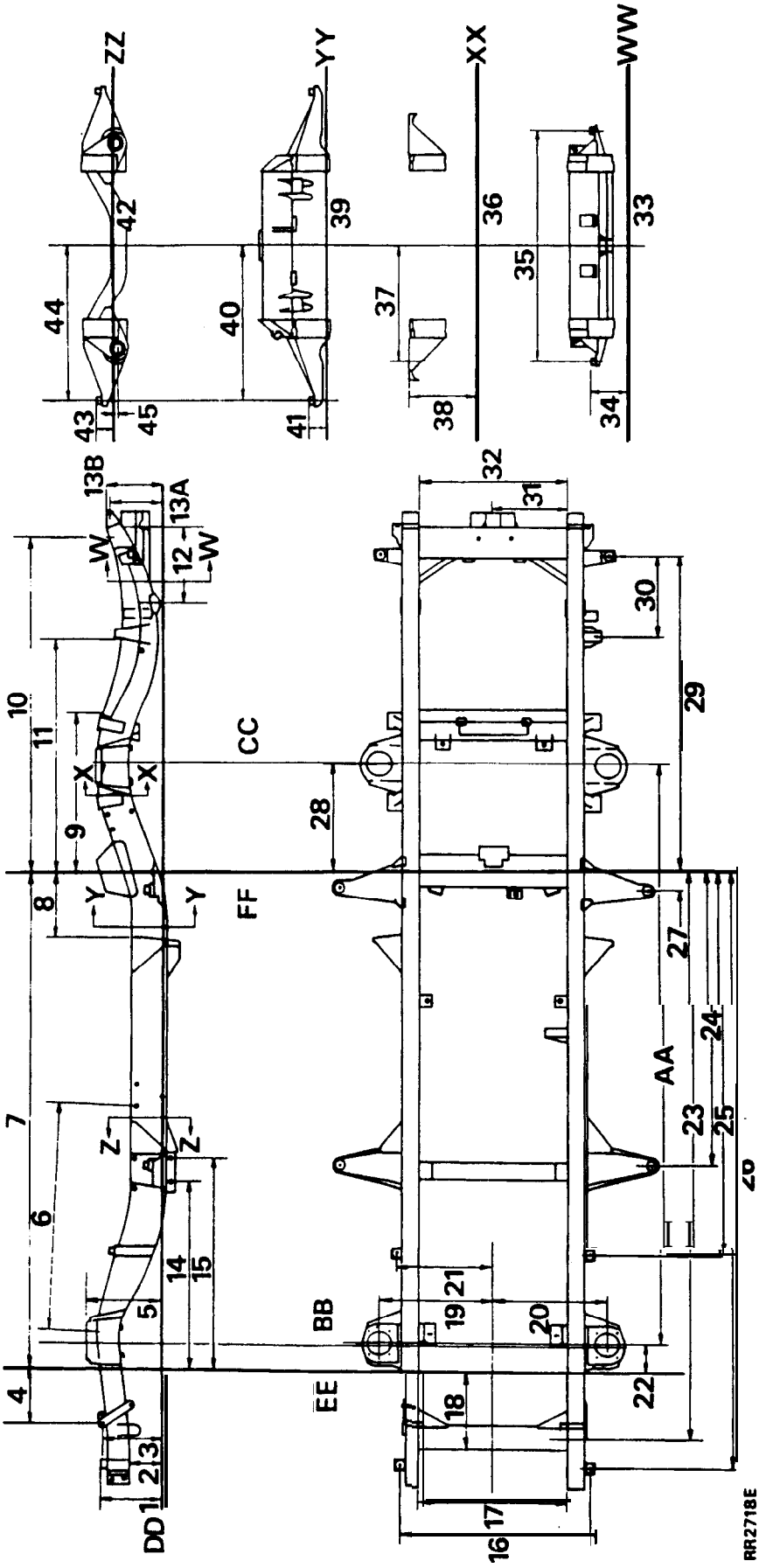
1. Remove nut and washer from underneath the front of sill finisher.
2. Using a drift tap through the centre piece of the ten 'Rocut' fixing rivets.
3. Carefully pry out the Rocut rivets and remove the sill finisher.



RR2712M

Refit

4. Reverse the removal procedure, renewing the Rocut rivets and ensuring the metal tube insert is refitted into the sill finisher where the bolt goes through.


ZZ
YY
XX
WW
42
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36
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44
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45
41
38
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13B
13A
W
12
W
32
31
30
10
11
X
X
CC
29
28
9
Y
Y
FF
8
27
7
Z
Z
AA
24
23
25
6
14
15
5
BB
19
21
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4
EE
18
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2
3
DD
1
17
16
RR2718E

CHASSIS FRAME - 1990 Model Year

Alignment check - RR2718E

	Diagram reference	millimeters	inches
AA	Wheelbase reference dimension	2540,00	100.0
BB	Centre line of front axle		
c c	Centre line of rear axle		
DD	Frame datum line		
EE	Side member datum line		
FF	Datum line		
		264,525 ± 1,27	10.400 ± .050
2	Frame datum to underside of cross-member	150,80	5.937
3		266,70 ± 2.54	10.500 ± .100
4		237.74 ± 1,27	9.360 ± .050
5		327.81 ± 2.54	12.906 ± .100
6		979,94	38.58
7		2179,73 ± 2,54	85.816 ± .100
8		291,74 ± 2,54	11.486 ± .100
9		707,96 ± 2,54	27.872 ± .100
10		1468,49 ± 2.54	57.815 ± .100
11		1025,27 ± 2,54	40.36 ± .100
12		338,84 ± 2,54	13.34 ± .100
13A		222.25 ± 2.54	8.750 ± .100
13B		252,904 ± 2.54	9.960 ± .100
14	Reference dimension	824,92	32.477
15	To face of boss (both sides)	935,43 ± 2,54	36.828 ± .100
16		838,2 ± 0,38	33.000 ± .015
17	Check figure	630.94 ± 1,27	24.840 ± .050
18		344,17 ± I,27	13.550 ± .050
19		485,77 ± 2,54	19.125 ± .100
20		405.77 ± 2,54	19.125 ± .100
21		828,68 ± 0,38	32.625 ± .015
22		129.03 ± 2,54	5.080 ± .100
23		2479.45 ± 0,25	97.616 ± .010
24		1290,34 ± 0,38	50.800 ± .015
25		1657,04 ± 0,38	65.238 ± .015
26		2598,44 ± 0,38	102.301 ± .015
27		79,09 ± 0,38	3.114 ± .015
28		465,48 ± 2,54	18.326 ± .100
29		1398,88 ± 0,38	55.074 ± .015
30		368,30 +- 2,54	14.50 ± .100
31	Reference dimension	317,50	12.50
32	Reference dimension	635,00	25.00

CHASSIS FRAME

Diagram reference	millimeters	inches
SECTION W - W		
33 Frame datum line DD		
34	155.91 ± 1,27	6.14 ± .050
35	990,6 ± 0,38	39.00 ± .015
SECTION X - X		
36 Frame datum line DD		
37	488,95 ± 2.54	19.250 ± .100
38	295.27 ± 2,54	11.625 ± .100
SECTION Y - Y		
98 Frame datum line DD		
40	660,40 ± 0,25	26.00 ± .010
41	80,39 ± 1,27	3.187 ± .050
SECTION Z - Z		
42 Frame datum line DD		
43	80.39 ± 1,27	3.165 ± .050
44	660,40 ± 0.25	26.000 ± .010
45	9.53 ± 2,54	0.375 ± .100

GLASS SUNROOF 1991 MODEL YEAR

Operation

The sunroof operates in a tilt and slide action controlled by a rocker switch near the interior lamp.

A drive motor and control unit is located behind the switch and interior lamp panel. The control units function is to stop the drive motor at the full tilt and slide positions.

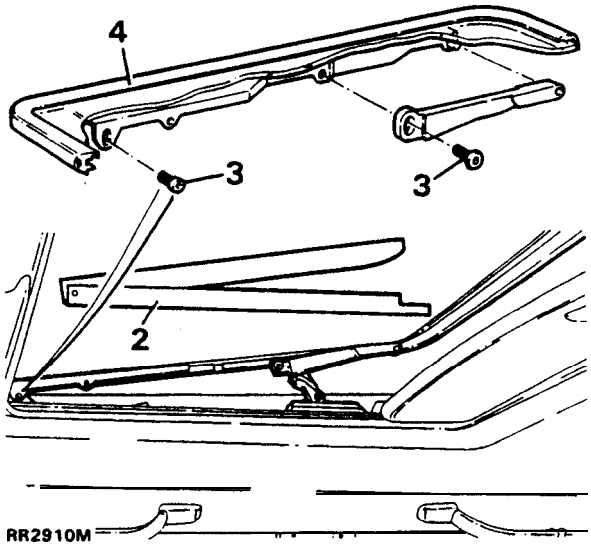
The removal and refit of the sunroof assemblies shown can be carried out without removing the complete sunroof assembly.

GLASS SUNROOF ASSEMBLY.

Remove refit and adjust

Remove

1. Open the sunroof to the tilt position.
2. Remove the two mechanism covers. Slide rearwards to disengage from their location and lift out.
3. Remove two screws from each side as shown.
4. Remove glass sunroof.



Refit and adjust

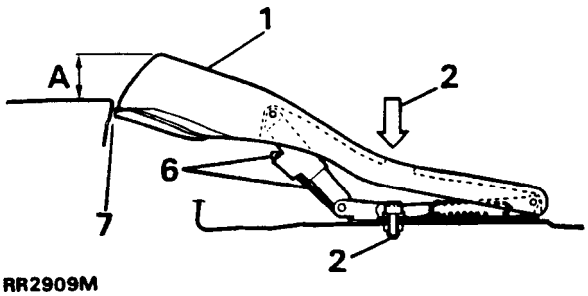
5. Replace the glass sunroof
6. Fit the lour screws firmly but do not tighten.
7. Close the sunroof
8. Check the height of the sunroof panel against the roof aperture. The trimmed edge of the glass sunroof should stand approximately lmm proud of the roof aperture.
9. Adjust by releasing the four screws and moving the sunroof up or down as required. Tighten the screws.
10. Fit the two mechanism covers.
11. Fully check the sunroof operates correctly.

SUNROOF WIND DEFLECTOR ASSEMBLY

Remove, refit and adjust

Remove

1. Open sunroof.
2. Remove the two screws accessed through the slot in the deflector
3. Remove the wind deflector assembly



Refit

4. Replace the wind deflector assembly
5. Fit the two screws firmly but do not tighten.

Adjust

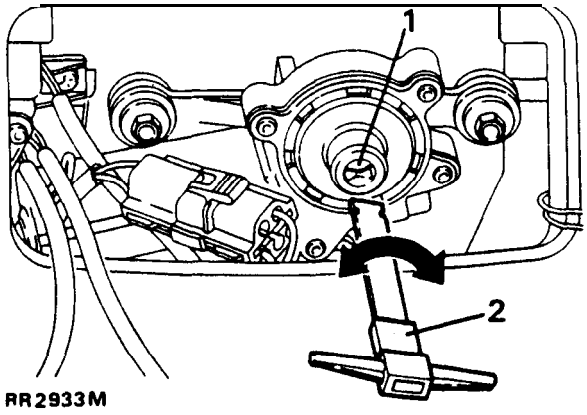
Note: Adjustment and attachment of the deflector is by the same two screws.

6. Adjust the wind deflector rearwards or forwards into the position shown. At the same time adjust the height A' to 20mm by moving the slotted metal strip rearwards or forwards. Tighten the two screws.
7. Ensure the deflector does not catch the front edge of the roof aperture when operated.
8. On completion fully check that the sunroof operates correctly.

Manual operation.

If the sunroof fails to operate by electrical means the sunroof can be opened or closed manually with the key provided.

1. Remove the two turnbuckles to access the sunroof motor spindle located behind the switch plate.
2. Engage the key into the motor spindle and turn to open or close the sunroof panel.
3. On completion of manual operation the motor spindle MUST BE TURNED BACK HALF A TURN TO ENSURE ENGAGEMENT TO THE ELECTRICAL DRIVE MOTOR.



RR2933M

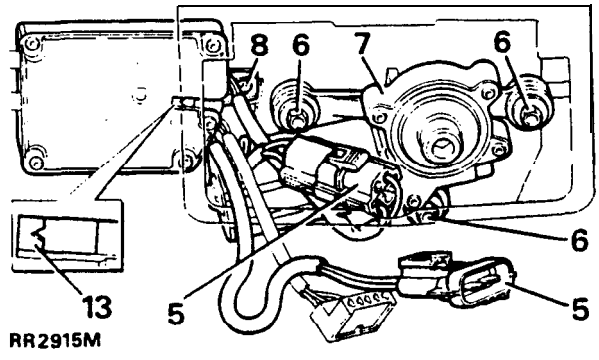
MOTOR DRIVE ASSEMBLY AND CONTROL UNIT

NOTE: The following servicing of the sunroof assembly can be carried out without removing the complete sunroof assembly.

Remove and refit

Remove

1. Fully close the sunroof then disconnect the battery negative terminal.
2. Turn to release the two turnbuckles to access the motor drive assembly and control unit, located behind the switchplate.
3. Remove the switchplate and disconnect the two multiplugs from the switch and courtesy light.
4. Release the front of the headlining sufficiently to access the motor drive assembly and control unit.
5. Disconnect the two multiplugs from the control unit to the motor drive unit and to the main harness.



RR2915M

6. Remove the three screws securing the motor drive assembly.
7. Remove the motor drive assembly.
8. To remove the control unit undo the fixing screw. Lower then move the control box inwards to release from mounting.
9. Inspect the motor drive assembly and control unit for wear and damage, renew as necessary.

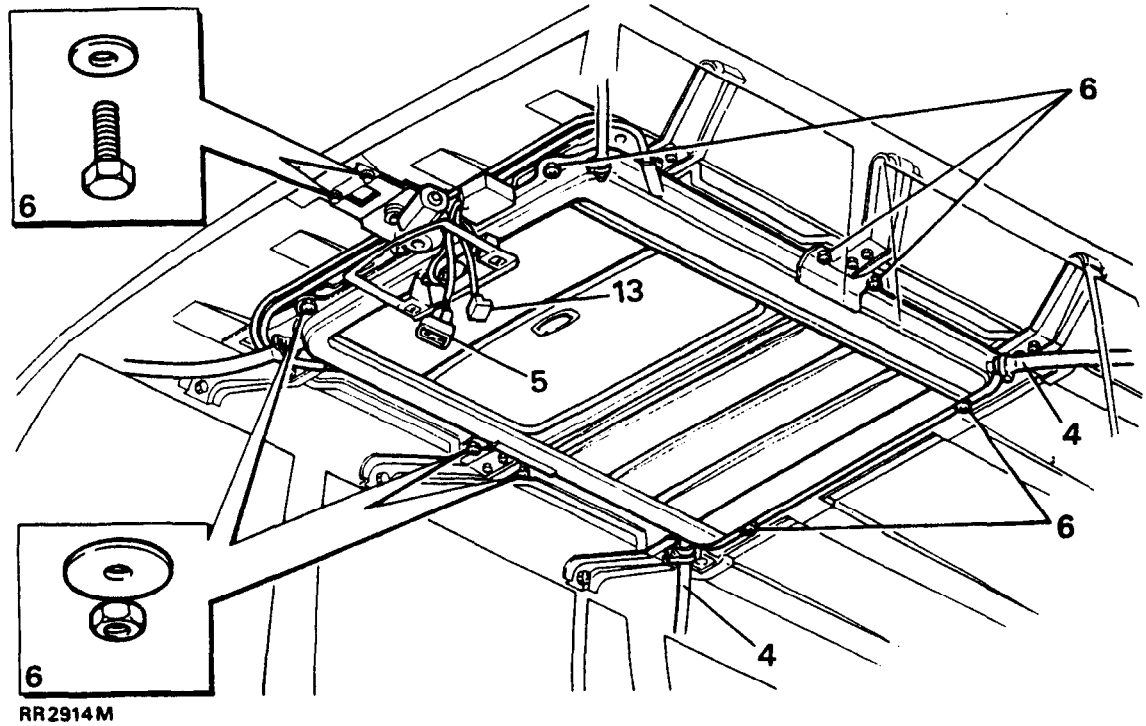
Refit

10. Refit the motor drive assembly ensuring the metal insert is fitted.

CAUTION:The motor drive assembly gear will not mesh correctly with the drive cables if the metal insert is NOT refitted.

11. Refit the control unit.
12. Check timing of the control unit to sunroof. A V'shaped notch should be visible through the slot in the control unit when the sunroof is in the fully closed position.
13. Reverse the removal instructions 2 to 5.
14. Fully check the sunroof operates correctly. Recode the radio.

GLASS SUNROOF COMPLETE ASSEMBLY



RR2914M

Remove and refit

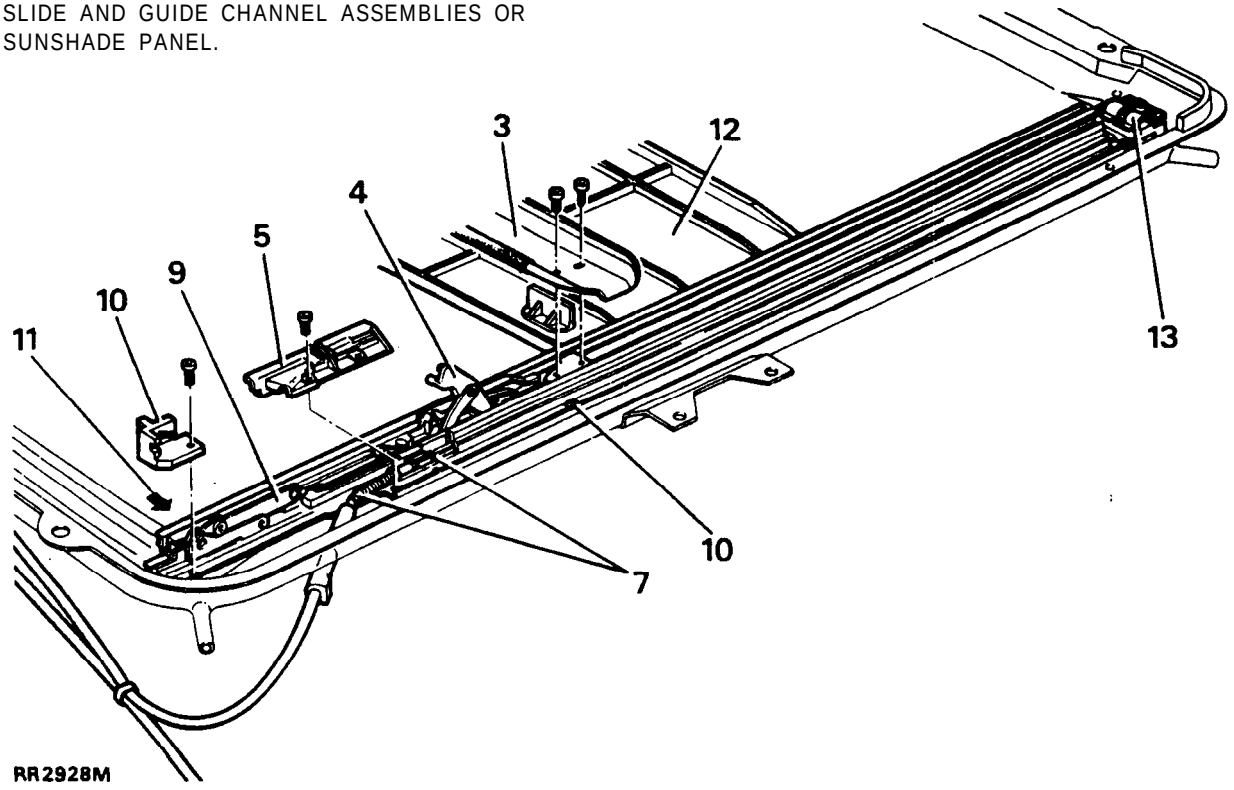
Remove

1. Fully open the sunroof rearwards then disconnect the battery negative terminal.
2. Remove the switchplate and disconnect the two multiplugs from the switch and courtesy light
3. Remove the headlining completely from the vehicle
4. Remove the four clips and disconnect the drain tubes
5. Disconnect the multiplug from the control unit to the main harness.
6. With assistance remove the eight nuts and washers and two bolts. Lower the complete sunroof assembly to enable it to be removed through the rear of the vehicle.

Refit

7. Manually operate the sunroof to the fully closed position.On completion of manual operation the motor spindle MUST BE TURNED BACK HALF A TURN TO ENSURE ENGAGEMENT TO THE ELECTRICAL DRIVE MOTOR.
8. With assistance lift the complete sunroof assembly to the roof panel.
9. Locate and fit loosely the eight retaining nuts and washers and two bolts.
10. Ensure the closed sunroof now fits equally positioned in the roof panel aperture. Tighten the retaining nuts and bolts, recheck fit.
11. Reconnect the electrical multiplugs to the main harness and sunroof switch.
12. Fully check the sunroof operates correctly and leave in the open position.
13. Disconnect the sunroof switch
14. Fit and secure the drain tubes with retaining clips.Water test to ensure a watertight seal.
15. Fit the headlining and sunroof trim.
16. Reconnect electrical multiplugs to sunroof switch and interior light then fit switchplate.
17. Close glass sunroof and draw sunshade. Recode the radio.

SLIDE AND GUIDE CHANNEL ASSEMBLIES OR SUNSHADE PANEL.



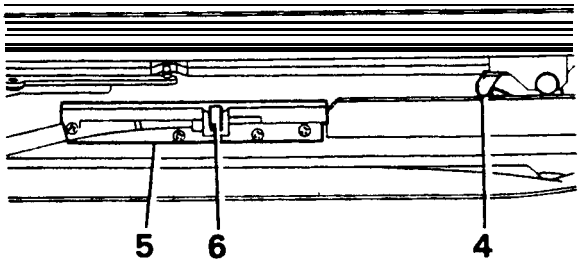
RR2928M

Remove and refit

NOTE: The following servicing of the sunroof assembly can be carried out without removing the complete sunroof assembly.
The sunshade panel is removed by releasing, either the left or right slide and guide channel assembly, instructions 1. to 12.

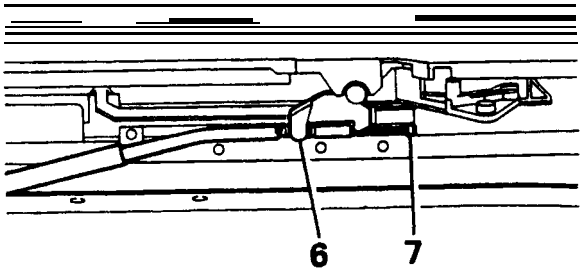
Remove

1. **Remove glass panel assembly.**
2. **Remove sunroof wind deflector assembly.**
3. **Remove rear crossmember drainchannel.**
4. **Move the tilt slide rearwards until the location cam is clear of the locator block.**
5. **Remove the locator. block.**



RR2929M

6. **Move the tilt slide forwards until the location cam has reached the position it would normally locate into the locator block. Manually adjust the cam outwards to allow the tilt slide to pass and to attain the full tilt position.**



RR2930M

7. **The drive cable end is now accessible. Disconnect drive cable from the slide assembly.**
8. **Push the tilt slide rear-wards reversing instruction 6.**
9. **Push complete slide assembly rearwards approximately 2".**
10. **Remove front end stop and the attaching screw from centre of guide channel.**

11. Push guide channel assembly out sideways to release guide channel from the roof panel.
12. Slide the sunshade panel forward and lift out of runner to remove.

Continue for removal of slide and guide channel assembly.

13. With the aid of a flashlight directed between the roof panel and sunroof assembly. Observe for reassembly the guide channel rear spring fixing point.
14. Pull the guide channel forward to release from the rear spring fixing point. Remove the guide channel asembly

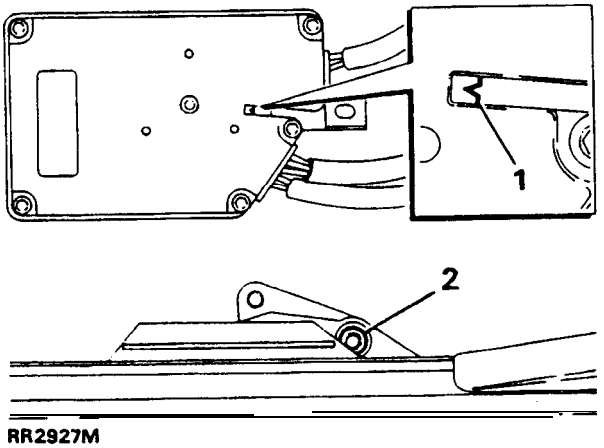
Refit

15. Reverse the removal instructions
16. Fully check the sunroof operates correctly.

TIMING OF CONTROL UNIT TO SUNROOF OPERATION.

The timing of control unit to sunroof operation will be disturbed:-
If the sunroof position is altered when the control unit is removed.
Or the control unit is removed and the control unit gear is moved manually.

1. To check timing of the control unit to sunroof. A V'shaped notch should be visible through the slot in the control unit when the sunroof is in the fully closed position.



RR2927M

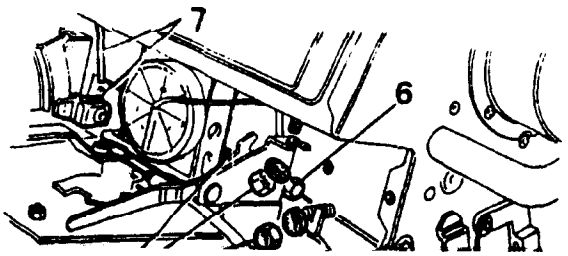
2. To check timing of the control unit when the glass sunroof panel is removed. A V'shaped notch should be visible through the slot in the control unit when the sunroof tilt mechanism is in the position shown.

HEATER AND AIR CONDITIONING CONTROLS

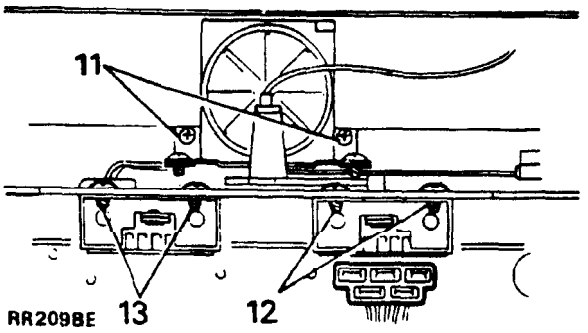
Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the transmission lever surround and radio housing.
3. Remove the lower dash panel.
4. Remove the centre dash unit.
5. Disconnect the electrical leads from the thermostat, fan speed and recirculate/fresh air switches.
6. Disconnect the relay rod from the 'SCREEN-CAR' lever.
7. Disconnect the relay rod from the 'VENT' lever.
8. Disconnect the control cable from the side of the heater unit.



13. Air conditioning/fresh air/ recirculating switch: remove fixing screws and withdraw the -- switch.



Refitting

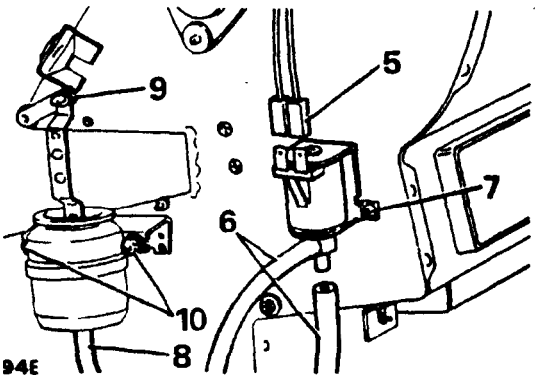
14. Reverse instructions 5 to 13.
15. Check that the control levers give full movemenr io the flaps. If necessary, adjust at the relay rod or cable end fixings.
16. Reverse instuctions 1 to 4.

RECIRCULATING/FRESH AIR SOLENOID SWITCH

VACUUM UNIT (recirculating/fresh air flap)

ove and refit

Disconnect the battery negative lead.
Remove the transmission lever surround.
Remove the radio mounting console.
Remove the centre dash unit and the lower dash panel.
Disconnect the electrical leads to the solenoid.



Continued

6. Disconnect the two vacuum hoses.
7. Remove the solenoid fixings and withdraw the solenoid.
8. Vacuum unit: remove the vacuum hose from the vacuum unit.
9. Remove the actuating rod securing clip.
10. Remove two fixing nuts and washers and withdraw the vacuum unit.

Refitting

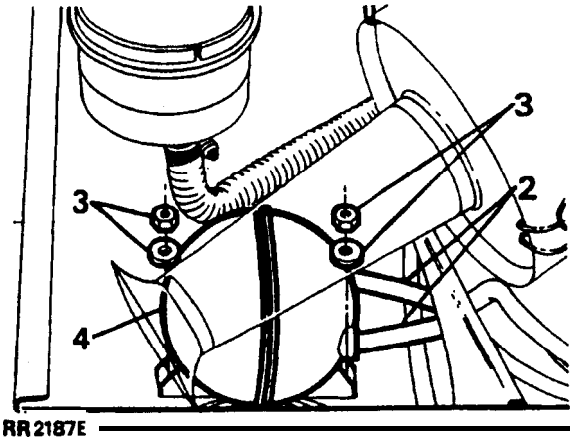
11. Reverse the removal procedure.

VACUUM RESERVOIR (recirculating/fresh air flap)

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the two vacuum hoses.
3. Looser. the reservoir fixings.
4. Withdraw the vacuum reservoir.



RR2187E

Refitting

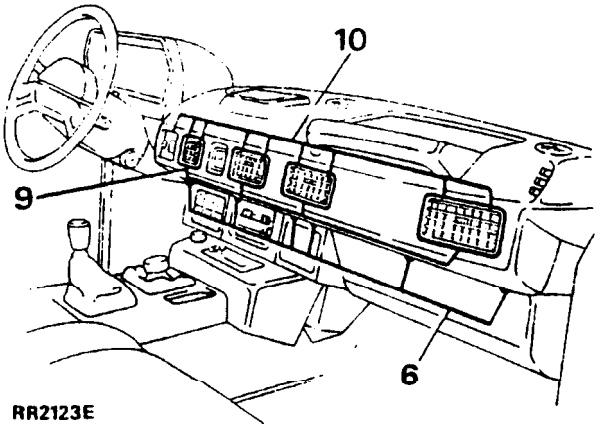
5. Reverse the removal procedure. Note that the larger diameter hose, from the inlet manifold fits the inlet marked VAC on the reservoir.

HEATER UNIT

Remove and refit

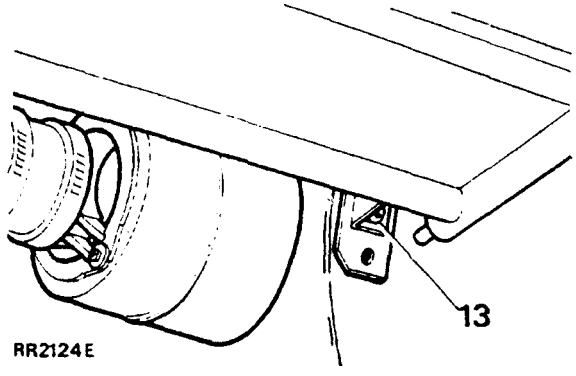
Removing

1. Disconnect the battery negative lead.
2. Drain the cooling system.
3. Disconnect the water inlet hose from the heater.
4. Disconnect the water outlet hose from the heater.
5. Working inside the vehicle withdraw the lower dash and remove the screws securing the lower edge of the centre console.
6. Remove the six screws securing the lower edge of the louvre panel to the console and evaporatot case.

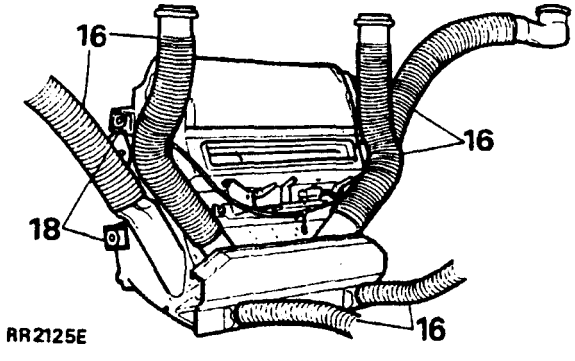


RR2123E

7. Remove the heater control panel and knobs from the centre console.
8. Remove the centre console.
9. Carefully pry out the four air vents.
10. Remove the screws securing the evaporator plenum and louvre panel to the dash top panel.
11. Withdraw the thermostat sensor from the fins of the evaporator, and pull the sensor pipe clear of the evaporator assembly.
12. Disconnect the electrical connectors at the rear of exterior driving mirror control switches and clock, and withdraw panel clear of the dash.
13. Remove the screws securing the lower right mounting bracket.



14. Support the evaporator case and remove the two nuts securing the case and reinforcing strip to the upper mounting bracket.
15. Remove the cover bracket and carefully lower the evaporator assembly to the floor of the vehicle
16. Disconnect the six hoses from the heater unit.



17. Disconnect the electrical leads from the heater unit at the multiplug.
18. Remove the four heater mounting bolts.
19. Remove the heater unit.

Refitting

20. Check that the seal for the fresh air intake is in place on the back of the heater unit.
21. Check that the seal for the heater core is in place on the hoses.
22. Reverse 1 to 19, ensuring that all openings are adequately sealed against the ingress of dust and moisture.

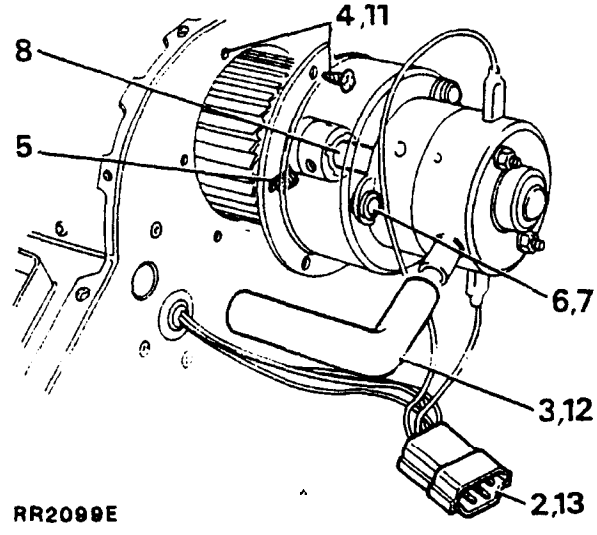
NOTE: Refer to Air Conditioning Section 82 for full instructions regarding evaporator assembly removal.

HEATER FAN MOTOR

Remove and refit

Removing

1. Remove the heater unit.
2. Disconnect the multiplug and remove the red and black leads from the multiplug.
3. Disconnect the air cooling hose.



4. Remove five screws and withdraw the fan and motor assembly.
5. Loosen two set screws securing the fan to the motor shaft and remove the fan.
6. Drill out three pop rivets and remove the fan motor.

Refitting

7. Locate the fan motor and secure using suitable pop rivets.
8. Engage the fan motor shaft into the boss on the fan and secure the set screws.
9. Locate the fan motor in position, engaging the fan shaft into the bearing.
10. Hold the fan motor firmly in position and check that the fan rotates freely. If necessary, adjust the position of the fan on the motor shaft.

Continued

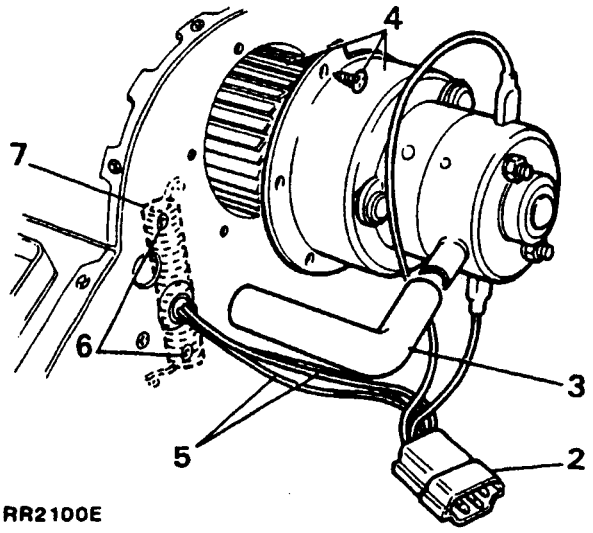
11. Align the air cooling hose connection and refit the five screws securing the fan motor assembly.
12. Connect the air cooling hose.
13. Reconnect the electrical leads.
14. Refit the heater unit.

FAN MOTOR RESISTANCE UNIT

Remove and refit

Removing

1. Remove the heater unit.
2. Disconnect the electrical leads at the multiplug.
3. Disconnect the air cooling hose.
4. Remove the fan motor and fan assembly.
5. Remove the electrical leads from the multiplug.
6. Drill out the two pop rivets securing the resistance unit.
7. Withdraw the resistance unit complete with leads.



RR2100E

Refitting

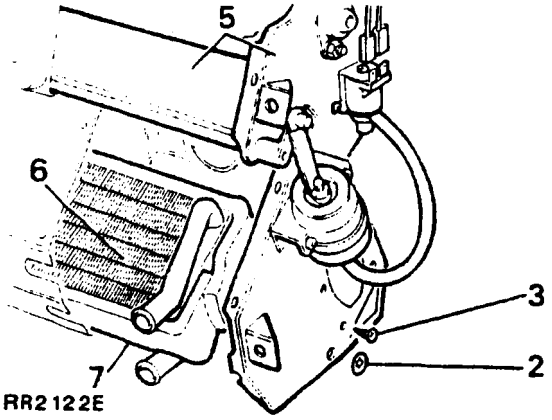
8. Reverse 1 to 7.

HEATER CORE

Remove and refit

Removing

1. Remove the heater unit.



RR2122E

2. Remove the fixings from the cam bracket for the fresh air flap, and move the cam and bracket assembly aside.
3. Remove the lock-washers from the four flap shafts.
4. Remove all the drive screws from the left hand side cover.
5. Withdraw the left hand side cover complete with the fresh air flap.
6. Withdraw the heater core complete with seals.
7. Withdraw the seals from the heater core.

Refitting

8. Apply Bostik sealing compound around the flange of the left hand side cover.
9. Reverse 1 to 7.

HEATER UNIT 1990 MODEL YEAR

Remove and Refit

To remove and refit the heater unit, refer to existing instructions ignoring reference to the thermostat sensor. In addition the following electrical controls from the heater to the air conditioning unit need to be disconnected on **removal and** connected on refit:-

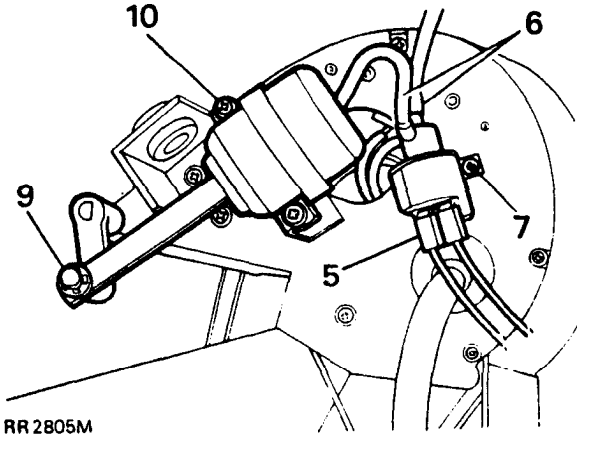
1. The electrical connector from the heater controls to the electric thermostat, sited at the rear of the evaporator housing.
2. The vent lever microswitch at the multiplug.

RECIRCULATING/FRESH AIR SOLENOID SWITCH AND VACUUM UNIT (recirculating/fresh air flaps)

Remove and refit

Remove

1. Disconnect the battery negative lead.
2. Remove the transmission lever surround.
3. Remove the radio mounting console.
4. Remove the centre dash unit and the lower dash panel.
5. **Solenoid switch:** disconnect the electrical leads to the solenoid.
6. Disconnect the two vacuum hoses.
7. Remove the two screws and withdraw the solenoid.
8. **Vacuum unit:** remove the vacuum hose.
9. Remove the actuating rod securing clip.
10. Remove two retaining screws and remove the vacuum unit.



Refit

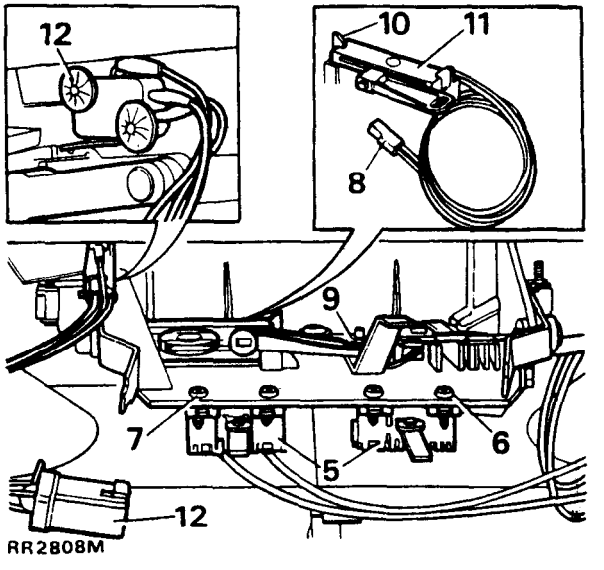
11. Reverse the removal procedure.

HEATER AND AIR CONDITIONING CONTROLS

Remove and refit

Remove

1. Disconnect the battery negative lead.
2. Remove the transmission lever surround and radio housing.
3. Remove the ***lower*** dash panel.
4. Remove the centre dash unit.
5. Disconnect the electrical plugs from the fan speed and recirculate/fresh air switches.
6. **Fan speed switch:** remove fixing screws and withdraw the switch.
7. **Air conditioning / fresh air / recirculating switch:** remove fixing screws and withdraw the switch.
8. **Potentiometer:** disconnect the electrical connector to the electronic thermostat sited at the rear of the evaporator housing.
9. Prise the wire cable connection from the heat control lever
10. Release the potentiometer from its location.
11. Remove potentiometer with connecting arm to heat control lever. Withdrawing the attached electrical leads through the gommet.
12. **Microswitch:** disconnect the multiplug, lift vent lever, remove the two retaining clips and carefully withdraw the microswitch.

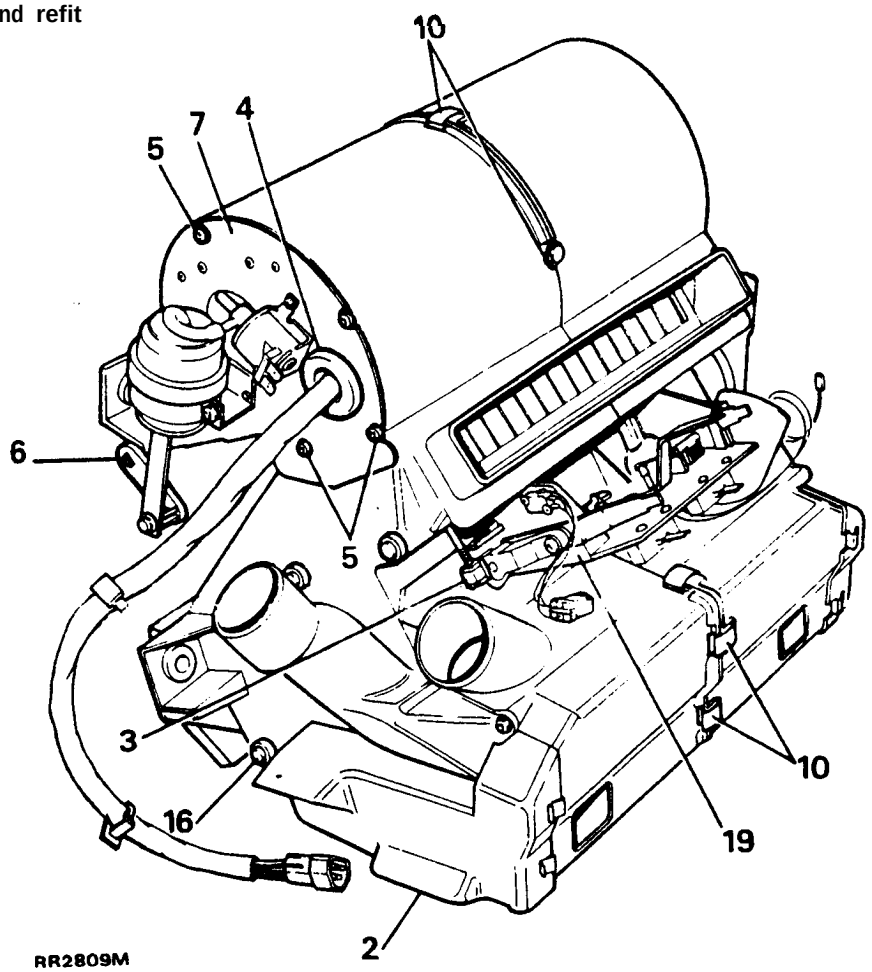


Refit

13. Reverse removal instructions. Check the satisfactory function of the controls before fitting dash and trim panels.

HEATER FAN MOTOR, ROTOR AND RESISTANCE UNIT.

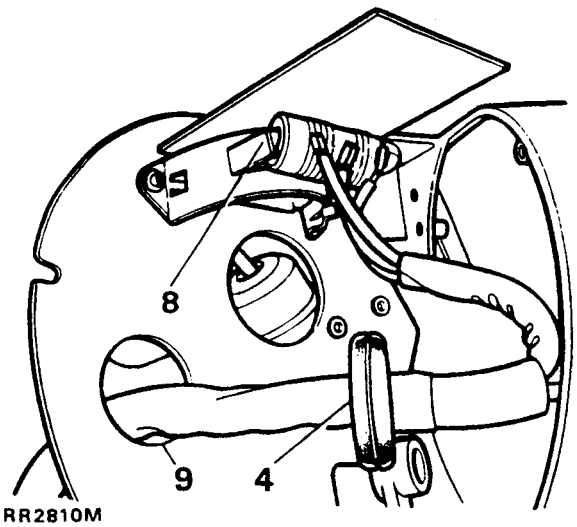
Remove and refit



RR2809M

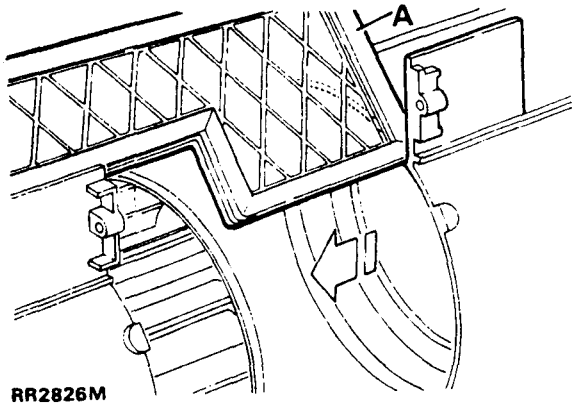
Remove

1. Remove the heater assembly.
2. Remove the left duct to footwell outlet.
3. Mark the position of vent control rod for reassembly. Disconnect by carefully prising open the plastic clip.
4. Disengage the grommet from side cover.
5. Remove the six screws retaining the side cover.
6. Remove the vacuum unit to air flap linkage.
7. Withdraw the side cover to expose the electric wires to the fan motor and resistance unit.
8. Release the resistance unit by tensioning back the metal mounting straps.
9. Remove the side cover feeding the electrical leads and the multiplug through the hole.
10. Remove the ten spring clips, three circlips and the two screws that secure the halves of the heater casing together. Ensure all fixings and foam gaskets are removed.



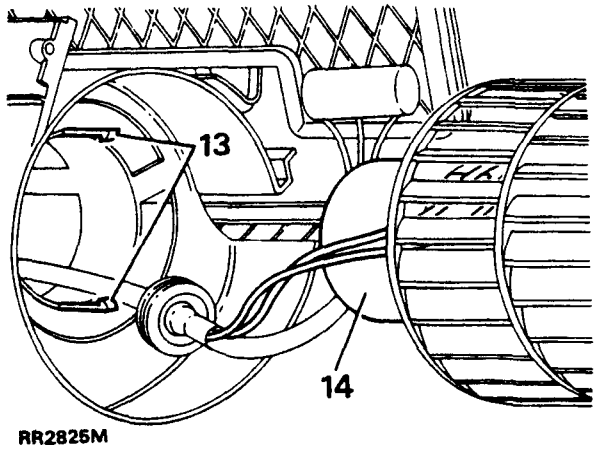
RR2810M

11. Position the flap (A) as shown, prise and slide its lower edge through the gap between motor housing and outer case. While separating each half of the heater casing.



RR2826M

12. Note the location of the air flap pivots, for reassembly.
13. The motor assembly is held into the left half of the casing by two plastic tabs, locate and prise them away from the motor.
14. Note for reassembly the position and layout of the electrical wiring. Then withdraw the motor assembly including attached wires and resistance unit from its housing.



RR2825M

Refit

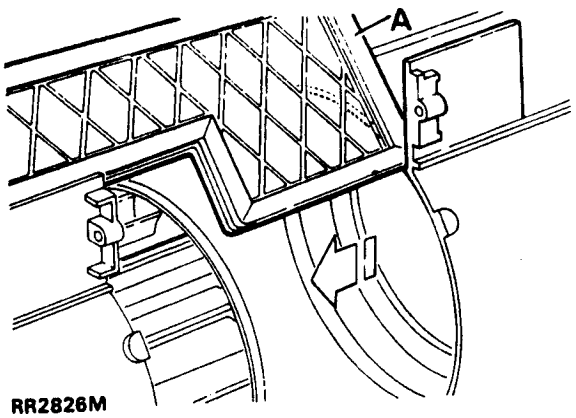
15. Feed the wiring and resistance unit through the motor housing and fit the motor assembly. Ensure the wires are positioned correctly, to avoid entangling the rotor, and the plastic tabs locate to secure the motor.
16. Mark a white spot on the end of each air flap pivot to be reassembled into the heater casing.
17. Offer the heater casing halves together. Ensure the flap (A) is positioned to *reverse* instruction 11.
18. Point the remaining air flap pivots in the direction of their location.
19. Locate and slot into the left casing the heater control panel assembly. Examine closely to ensure that both fixings engage and slide into their housing.
20. Slowly and firmly push the casing halves together checking that all components are aligned. Any solid resistance felt suggests a component is not locating correctly. Rectify and continue until the casing halves are together.
21. Refit all of the fixings holding the heater casing halves together.
22. Reverse removal instructions 4 to 9.
23. Connect the rod to the vent control lever to its marked position.
24. Check all controls operate and flaps seal against the heater casing.
25 Refit the left duct to footwell outlet.
26. Renew the foam gaskets.
27 Refit the heater assembly.

HEATER CORE

Remove and Refit

Remove

1. Remove the heater assembly.
2. Remove the left duct to footwell outlet.
3. Mark the position of vent control rod, for reassembly. Disconnect by carefully prising open the plastic clip.
4. Remove the ten spring clips, three circlips and the two screws that secure the halves of the heater casing together. Ensure all fixings and foam gaskets are removed.
5. Remove the pad from around the two coolant hose connections.
6. Position the flap (A) as shown, prise and slide its lower edge through the gap between motor housing and outer case. While separating each half of the heater casing.

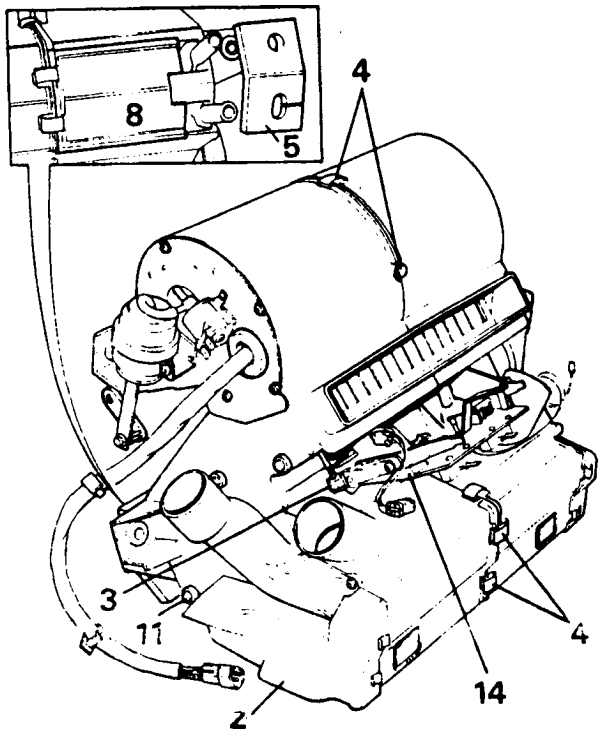


RR2826M

7. Note for reassembly the location of the air flap pivots.
8. Slide out the separate panel.
9. Remove the heater core complete with the sponge packing.

Refit

10. Fit the heater core into the left half of the casing. Slide in the separate panel (8) upto the coolant hose connections.
11. Mark a white spot on the end of each air flap pivot to be reassembled into the heater casing.



RR2827M

12. Offer the heater casing halves together. Ensure the flap (A) is positioned to reverse instruction 6.
13. Point the remaining air flap pivots in the direction of their location.
14. Locate and slot into the left casing the heater control panel assembly. Examine closely to ensure that both fixings engage and slide into their housing.
15. Slowly and firmly push the casing halves together checking that all components are aligning. Any solid resistance felt suggests a component is not locating correctly. Rectify and continue until the casing halves are together.
16. Refit all of the fixings that hold the heater casing halves together.
17. Connect the rod to the vent control lever to its marked position.
18. Check all controls operate and air flaps seal against the heater casing.
19. Renew the pad around the two coolant hose connections.
20. Refit the left duct to footwell outlet.
21. Renew the foam gaskets.
22. Refit the heater assembly.

AIR CONDITIONING-A.R.A. SYSTEM

Description

The A.R.A. air conditioning system comprises four major units:

1. An engine-mounted compressor.
2. A condenser mounted in front of the radiator.
3. A receiver/drier unit located in the engine compartment.
4. An evaporator unit mounted behind the dashboard.

The four units are interconnected by hoses carrying refrigerant, and the evaporator is linked into the vehicle ventilation system.

WARNING: Under no circumstances should refrigerant hoses be disconnected without first discharging the system

Refrigeration cycle

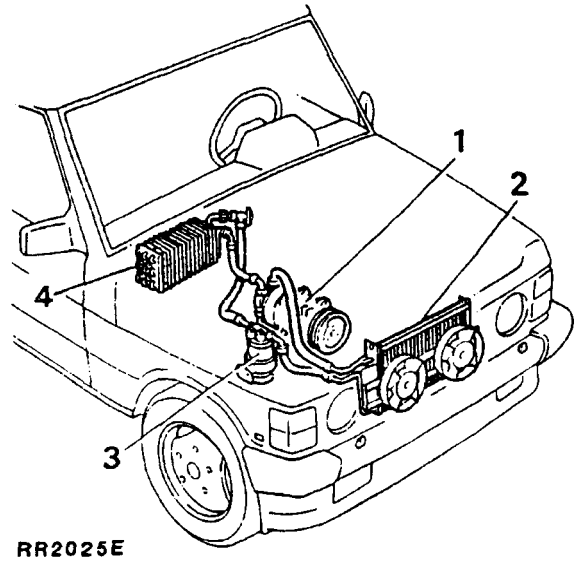
The function of the refrigeration circuit is to cool the evaporator.

1. Compressor

The compressor draws vaporized refrigerant from the evaporator. It is compressed, and thus heated, and passed on to the condenser as a hot, high pressure vapour.

2. Condenser

The condenser is mounted directly in front of the vehicle radiator. It consists of a refrigerant coil mounted in a series of thin cooling fins to provide the maximum heat transfer in a minimum amount of space. Airflow across condenser is induced by vehicle movement and is assisted by two electric condenser fans. The refrigerant enters the inlet at the top of the condenser as a heat laden high pressure vapour.



RR2025E

As this vapour passes down through the condenser coils, heat will follow its natural tendency and flow from the hot refrigerant vapour into the cooler air flowing across the condenser coils and fins.
When the refrigerant vapour reaches the temperature and pressure that will induce a change of state, a large quantity of latent heat will be transferred to the outside air. The refrigerant will change from a high pressure HOT VAPOUR to a high pressure WARM LIQUID.

3. Receiver drier

This unit filters, removes moisture, and acts as a reservoir for the liquid. To prevent icing inside the system, extreme precautions are taken during servicing to exclude moisture. The receiver drier should be considered as a second stage insurance to prevent the serious consequences of ice obstructing the flow.

NOTE: A sight glass provided in the unit top enables a visual check to be made of the high pressure liquid flow.

4. Expansion valve and evaporator

High pressure liquid refrigerant is delivered to the expansion valve. A severe pressure drop occurs across the valve and as the refrigerant enters the evaporator space at a temperature of approximately −6°C(21°F) it boils and vaporizes. As this change of state occurs, a large amount of latent heat is absorbed. The evaporator is therefore cooled and as a result heat is extracted from the air flowing across the evaporator. The air flow is controlled by two evaporator fans regulated by the air conditioner fan control.

Second cycle

Low pressure vaporized refrigerant is drawn from the evaporator by the compressor and a second cyclecommences.

GENERAL SERVICE INFORMATION

Intrnduction

Before any component of the air conditioning system is removed, the system must be discharged. When the component is replaced, the system must be evacuated to remove all traces of old refrigerant and moisture. The system must then be recharged with new refrigerant.

Any service operation that requires the loosening of a refrigerant line connection should be performed only by qualified service personnel. Refrigerant and/or oil will escape whenever a hose is disconnected.

All work involving the handling of refrigerant requires special equipment, a knowledge of its proper use and attention to safety measures.

Servicing equipment

The following equipment is required for full servicing of the air conditioning system.

Charging station
Leak detector
Safety goggles
Refrigerant charging line seals
Thermometer + 20°C to -60°C (+ 68°F to -76°F)
Compressor dipstick

SERVICING MATERIALS

Refrigerant: Refrigerant 12, which includes Freon 12 or Arcton 12.

CAUTION: Methychloride refrigerants must not be used.

Nominal charge weight:
1.19 kg (42 oz).
Compressor oil: See Recommended Lubricants.

PRECAUTIONS IN HANDLING REFRIGERANT

Refrigerant 12 is transparent and colourless in both the gaseous and liquid state. It has a boiling point of −29.8°C (−21.7°F) at atmospheric pressure and at all normal pressures and temperatures it becomes a vapour. The vapour is heavier than air, non-flammable, and non-explosive. It is non-poisonous except when in contact with an open flame, and non-corrosive until it comes in contact with water.

FIRST AID: If refrigerant should contact the eyes or skin, splash the eyes or affected area with cold water for several minutes. Do not rub. As soon as possible thereafter, obtain treatment from a doctor or eye specialist.

The following precautions in handling Refrigerant 12 should be observed at all times.

DO NOT:

- Leave refrigerant container open to atmosphere.
- Carry refrigerant container inside a vehicle.
- Subject refrigerant containers to high temperature.
- Weld or steam clean near an air conditioning system.
- Expose eyes to liquid refrigerant, ALWAYS wear goggles.
- Discharge refrigerant vapour into an area with an exposed flame or into an engine intake. Heavy concentrations of refrigerant in contact with naked flame produce a toxic gas, phosgene.
- Allow liquid refrigerant to contact bright metal, it will tarnish metal and chrome surfaces, and combined with moisture can seriously corrode all metal surfaces.

PRECAUTIONS IN HANDLING REFRIGERANT LINES

WARNING: Always wear satety goggles when opening refrigerant connections.

(a) When disconnecting any hose or flexible connection the system must be discharged of all pressure. Proceed cautiously, regardless of gauge readings. Open connections slowly, keeping hands and face well clear, so that no injury occurs if there is liquid in the line. If pressure is noticed, allow it to bleed off slowly.

(b) Lines, flexible end connections and components must be capped immediately they are opened to prevent the entrance of moisture and dirt.

(c) Any dirt or grease on fittings must be wiped off with a clean alcohol dampened cloth. Do not use chlorinated solvents such as trichloroethylene. If dirt, grease or moisture cannot be removed from inside the hoses, they must be replaced with new hoses.

(d) All replacement components and flexible end connections must be sealed, and only opened immediately prior to making the connection.

(e) Ensure the components are at room temperature before uncapping, to prevent condensation of moisture from the air that enters.

(f) Components must not remain uncapped for longer than fifteen minutes. In the event of delay, the caps must be fitted.

(g) Receiver/driers must never be left uncapped as they contain Silica Gel crystals which will absorb moisture from the atmosphere. A receiver/ drier left uncapped must not be used, fit a new unit.

(h) The compressor shaft must not be rotated until the system is entirely assembled and contains a charge of refrigerant.

(j) A new compressor contains an initial charge of 135 ml (4.6 fluid oz) of oil when received, part of which is distributed throughout the system when it has been run. The compressor contains a holding charge of gas when received which should be retained until the hoses are connected.

(k) The receiver/drier should be the last component connected to the system to ensure optimum dehydration and maximum moisture protection of the system.

(l) All precautions must be taken to prevent damage to fittings and connections. Slight damage could cause a leak with the high pressures used in the system.

(m) Always use two wrenches of the correct size, *one* on each fitting when releasing and tightening refrigeration unions.

(n) Joints and 'O' rings should be coated with refrigeration oil to aid correct seating. Fittings which are not lubricated with refrigerant oil are almost certain to leak.

(o) All lines must be free of kinks. The efficiency of the system is reduced by a single kink or restriction.

(p) Flexible hoses should not be bent to a radius less than ten times the diameter of the hoses.

(q) Flexible connections should not be within 50mm (2 in) of the exhaust manifold.

(r) Completed assemblies must be checked for refrigeration lines touching metal panels. Any direct contact of lines and panels transmits noise and must be eliminated.

PERIODIC MAINTENANCE

Routine servicing apart from visual checks is not necessary. The visual inspections are as follows:

Condenser

With a garden hose or air line, clean the fins of the condenser to remove flies, leaves, etc. Check the hose connection for signs of oil leakage.

Compressor

Check hose connections for signs of oil leakage. Check flexible hoses for swelling. Examine the compressor belt for tightness and condition. Checking the compressor oil level and topping-up is only necessary after charging the system or in the event of a malfunction of the system.

Receiver/Drier

Examine the sight glass for bubbles with the system operating. Check connections for leakage.

Evaporator

Examine the refrigeration connections at the unit. If the system should develop a fault, or if erratic operation is noticed, refer to the fault diagnosis chart.

SERVICE VALVES

These are secured to the head of the compressor, and the suction and discharge flexible end connections are secured to them by unions.

The service valves are identified as suction or low pressure, and discharge or high pressure. Whilst they are identical in operation they are not interchangeable, as the connections are of different sizes.

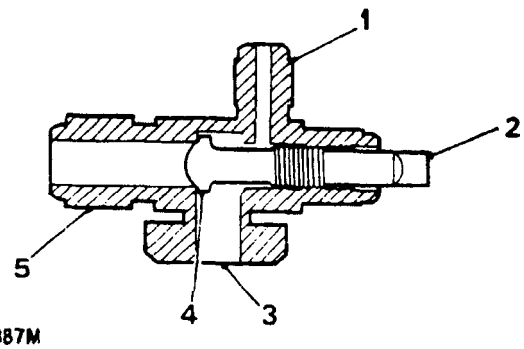
The valve with the larger connections fits the suction side. As the name suggests, these valves are for service purposes, providing connections to external pressure/vacuum gauges for test purposes. In combination with charging and testing equipment they are used to charge the system with refrigerant.

There are two types of service valves in operation: 'Stem' and 'Schrader'.

Stem type

Stem type service valves allow for the isolation of the compressor from other parts of the system. When these valves are used in conjunction with the liquid line quick-disconnect fittings, the three major assemblies of the system can be removed from the vehicle with a minimal loss of refrigerant. In addition, it is possible to remove major assemblies for repair of components which are not part of the refrigeration system, or provide access to parts of the vehicle which are obstructed by the air conditioning system, without fully discharging the system.

NOTE: A thorough understanding of the stem type service valve is necessary before undertaking servicing or repair involving the air conditioning system.



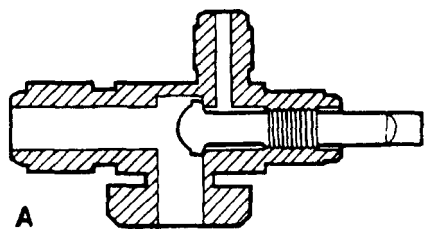
ST1387M

Stem type service valve

1. Service port.
2. Valve stem
3. Compressor port.
4. Valve seat.
5. Hose connector.

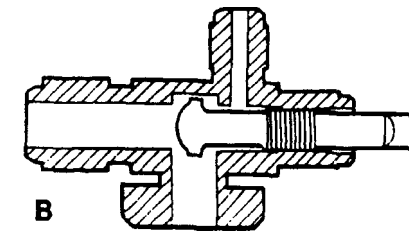
NOTE: A special wrench should be used to adjust the valve to prevent damage to the stem.

The stem type service valve has three positions, the operation of which is explained as follows:



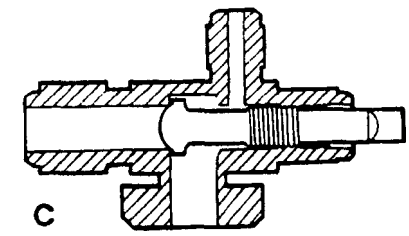
RR1734M

A. ON: FULLY COUNTER-CLOCKWISE- Normal operating position, and the position which is used for connecting and disconnecting the manifold gauge set, is the 'on' position. The stem is turned fully counter-clockwise. This seals the service gauge port from receiving any refrigerant flow.



RR1735M

B. MID (Test) POSITION-After the service gauge manifold has been installed (the valve stem is in the on position), turn the valve stem the required number of turns clockwise. This will put the valve stem seat midway in the service valve and allow full system operation while permitting refrigerant pressure to reach the gauges.

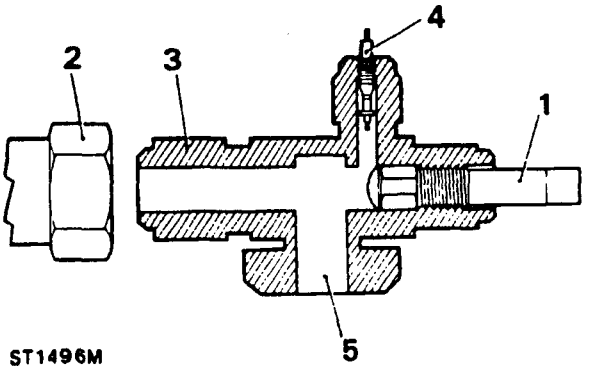


RR1736M

C. OFF: FULLY CLOCKWISE-With the service valve stem turned fully clockwise, the valve will block passage of refrigerant flow through the system. As illustrated, the refrigerant flow to or from the compressor (depending on whether it is high side or low side) is blocked.

WARNING: NEVER operate the air conditioning system with the service valves in the OFF POSITION, it will cause severe damage to the compressor.

Schrader type



Schrader service valve

1. Valve stem.
2. Hose connection.
3. Service valve.
4. Schrader valve core.
5. Compressor port.

NOTE: A special wrench should be used to adjust the valve to prevent damage to the stem.

The Schrader type service valve has two positions, the operation of which is explained as follows:

A. ON: FULLY COUNTER-CLOCKWISE- Normal operating position, and the position which is used for connecting and disconnecting the manifold gauge set, is the 'on' position. The stem is turned fully counter-clockwise. This seals the service gauge port from receiving any refrigerant flow.

B. OFF: FULLY CLOCKWISE- With the service valve stem turned fully clockwise, the valve will block passage of refrigerant flow through the system. The refrigerant flow to or from the compressor (depending on whether it is high side or low side) is blocked.

WARNING: NEVER operate the air conditioning system with the service valves in the OFF POSITION, it will cause severe damage to the compressor.

Service valve caps must be replaced when service operations are completed. Failure to replace caps could result in refrigerant loss and system failure.

ELECTRICAL SUPPLY SWITCHES AND FUSES

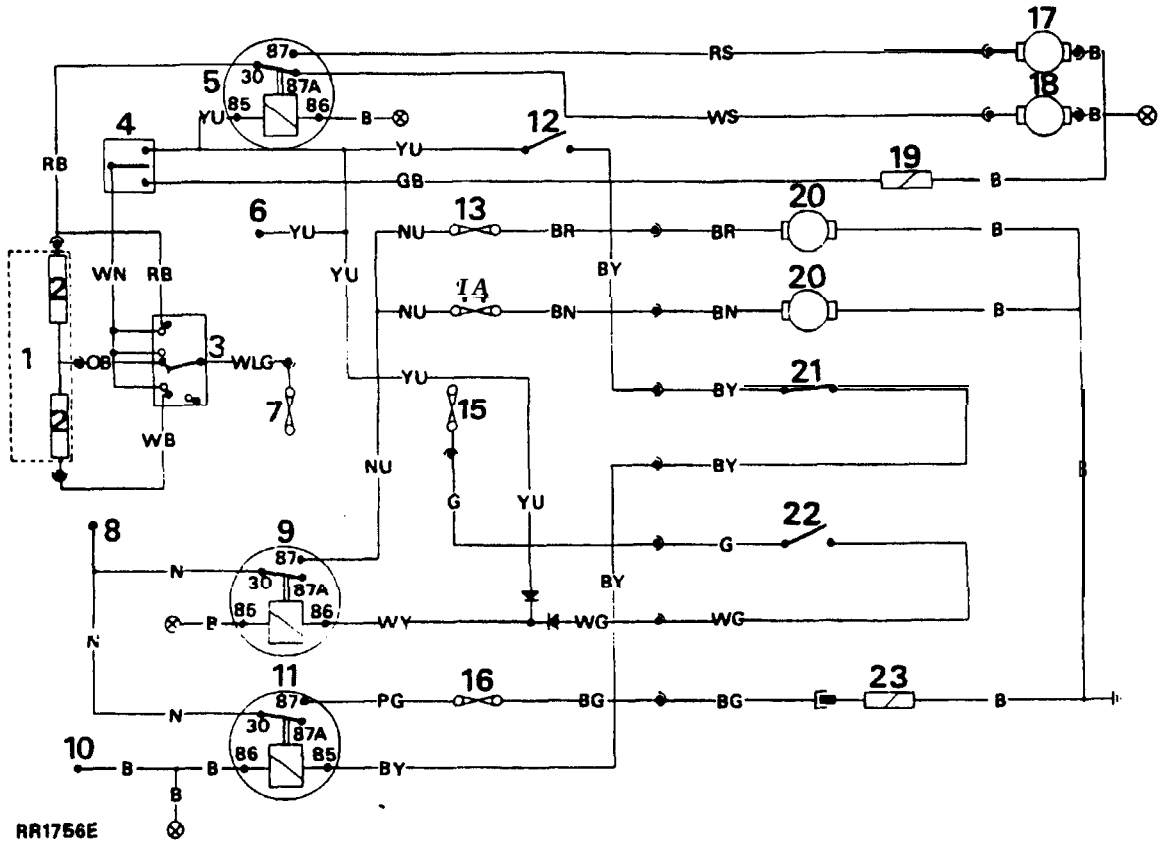
The electrical components of the air conditioning system draw current from three separate relays mounted in the engine compartment closure panel. The air conditioning system is mastered from the starter relay and is switched OFF during engine cranking.

Each component in turn is energised and controlled by a series of relays and switches as indicated by the circuit diagram.

Both condenser fans operate together when the air conditioning circuit is switched ON, and when the ignition is switched ON and the coolant temperature is high, this is sensed by the engine water temperature sensor.

The three blade type fuses are located in the fuse box mounted on the lower fascia panel. They are numbered A1 to A3. It is essential to use a fuse of the same value when fitting a replacement. See Electrical Section 86 for relay and fuse details

Continued



HEATER AND AIR CONDITIONING- circuit diagram

1. Heater unit.
2. Resistors.
3. Fan speed switch
4. Air conditioning/re-circulating/fresh air-switch.
5. Air conditioning/heater relay.
6. Cable connection to ECU.
7. Fuse 8-main fuse panel.
8. Pick up point main cable connection.
9. Fan relay.
10. Ground-via main cable.
11. Compressor clutch relay.
12. Thermostat.
13. Fuse Al-auxiliary fuse panel.
14. Fuse AZ-auxiliary fuse panel.
15. Fuse 13-main fuse panel.
16. Fuse A3-auxiliary fuse panel.
17. Air conditioning motor - dashboard unit.
18. Heater motor.
19. Heater recirculating solenoid.
20. Condenser fan motors.
21. High pressure switch.
22. Engine water temperature sensor.
23. Compressor clutch.

Cable colour code

B	Black	G	Green	P	Purple	Y	Yellow
U	Blue	S	Grey	R	Red	L	Light
N	Brown	0	Orange	W	White		

The last letter of a colour code denotes the tracer.

AIR CONDITIONING ELECTRICAL/MECHANICAL FAULT DIAGNOSIS

FAULT	CAUSE	REMEDY
A. MOTOR INOPERATIVE OR SLOW RUNNING	1. Incorrect voltage. 2. Open or defective fuse or relay. 3. Loose wire connection including ground. 4. Switch open or defective. 5. Tight, worn, or burnt motor bearings. 6. Open rotor windings. 7. Worn motor brushes. 8. Shaft binding-blade misaligned. 9. Defective resistors.	1. Check voltage. 2. Check and replace as necessary. 3. Check system wires: tighten all connections. 4. Replace switch. 5. Replace motor. 6. Replace motor. 7. Replace motor. 8. Check alignment. Repair or replace as necessary. 9. Rectify or replace.
B. CLUTCH INOPERATIVE	1. Incorrect voltage. 2. Open or defective fuse or relay. 3 Defective thermostat control or pressure switch. 4. Shorted or open field coil. 5. Bearing seized (clutch will not disengage). 6. Refrigeration circuit problem causing heavy load and excessive drive torque.	1. Check voltage. 2. Check and replace as necessary. 3 Replace thermostat or pressure switch. 4. Replace coil. 5. Replace bearing. 6. Check and rectify.
C. CLUTCH NOISY	1. Incorrect alignment. 2. Loose belt. 3. Compressor not mounted securely. 4. Bearing in clutch-pulley assembly not pressed in. 5. Low voltage to clutch. 6. Clutch will not spin freely. 7. Oil on clutch face. 8. Slipping clutch. 9. Overloaded or locked compressor. 10. Icing.	1. Check alignment; repair as necessary. 2. Adjust to proper tension. 3. Repair as necessary. 4. Remove clutch and replace bearing. 5. Check connections and voltage. 6. Refer to B5 above. 7. Check compressor seals for leaks. 8. Refer to C5 above. 9. Repair or replace compressor. 10. Check for suction line frosting. Replace expansion valve if necessary. Replace receiver/drier if necessary.
D. CONDENSER AND/OR EVAPORATOR VIBRATION	1. Motor and/or blades improperly mounted. 2. Foreign matter build-up on blades. 3. Excessive wear of motor bearings.	1. Check mountings, adjust as necessary. 2. Clean blades with a suitable non-inflammable cleaner. 3. Replace motor.

Refrigeration system fault diagnosis

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.

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 receiveridrier 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. With ambient humidity between 30% and 60%, compressor pressures and evaporator air discharge temperature should fall within the general limits given in the table below.

Type of Weather	Evaporator Air Temp °F (°C)	low Side Pressure p.s.i. (bar)	High Side Pressure p.s.i. (bar)
Cool day 70-80°F (21-27°C)	35-45°F (1.7-7.2°C)	15-20 (1.1-1.4)	160-200 (11.2-14)
Warm day 80-90°F (27-32°C)	40-50°F (4.4-I 0°C)	20-25 (1.4-1.8)	190-240 (13.4-16.9)
Hot day Over 90°F (Over 32°C)	45-60°F (7.2-15.6°C)	25-30 (1.8-2.1)	220-270 (15.5-19)

NOTE:

1. Low and high side pressures are guides not specific limits.
2. Evap. air temperatures will be lower on dry days, higher on humid days.

FAULT	CAUSE	REMEDY
A. HIGH HEAD PRESSURE	1. Overcharge of refrigerant.	1. Purge with bleed hose until bubbles start to appear in sight glass; then, add sufficient refrigerant gas to clear sight glass.
	2. Air in system.	2. Slowly blow charge to shop exhaust system. Install new drier; evacuate and charge system.
	3. Condenser air passage clogged with dirt or other foreign matter.	3. Clean condenser of debris.
	4. Condenser fan motor defective.	4. Replace motor.
B. LOW HEAD PRESSURE	1. Undercharge of refrigerant; evident by bubbles in sight glass while system is operating.	1. Evacuate and recharge the system. Check for leakage.
	2. Split compressor gasket or leaking valves.	2. Replace gasket and/or reed valve; Install new drier, evacuate and charge the system.
	3. Defective compressor.	3. Repair or replace compressor.
C. HIGH SUCTION PRESSURE	1. Loose compressor belt.	1. Adjust belt tension.
	2. Refrigerant flooding through evaporator into suction line; evident by ice on suction line and suction service valve.	2. Check thermobulb. Bulb should be securely clamped to clean horizontal section of copper suction pipe.
	3. Expansion valve stuck open.	3. Replace expansion valve.
	4. Compressor suction valve strainer restricted.	4. Remove and clean or replace strainer.
	5. Leaking compressor valves, valve gaskets and/or service valves.	5. Replace valves and/or gaskets. Install new drier evacuate and charge the system.
	6. Receiver/drier stopped; evident by temperature difference between input and output lines.	6. Install new drier, evacuate and charge the system.
D. LOW SUCTION	1. Expansion valve thermobulb not operating.	1. Warm thermobulb with hand. Suction should rise rapidly to 20 lb or more. If not replace expansion valve.
	2. Expansion valve sticking closed.	2. Check inlet side screen. Clean if clogged. Refer To C-2 and C-3.
	3. Moisture freezing in expansion valve orifice. Valve outlet tube will frost while inlet hose tube will have little or no frost. System operates periodically.	3. Install new drier, evacuate and charge the system.
	4. Dust, paper scraps, or other debris restricting evaporator blower grille	4. Clean grilles as required.
	5. Defective evaporator blower motor, wiring, or blower switch.	5. Refer to Fault Diagnosis Chart for blower motor.

FAULT	CAUSE	REMEDY
NOISY EXPANSION VALVE steady hissing)	1. Low refrigerant charge; evident by bubbles in sight glass.	1. Leak test. Repair or replace components as required.
INSUFFICIENT COOLING	1. Expansion valve not operating properly. 2. Low refrigerant charge-evident by bubbles in sight glass. 3. Compressor not pumping.	1. Refer to C-2, C-3, D-l and E. 2. Refer to B-l and E. 3. Refer to B-2 and B-3
c. COMPRESSOR BELT SLIPPING	1. Belt tension. 2. Excessive head pressure. 3. Incorrect alignment of pulleys or worn belt not riding properly. 4. Nicked or broken pulley. 5. Seized compressor.	1. Adjust belt tension. 2. Refer to A-l through A-4 and C-6. 3. Repair as needed. 4. Replace as needed. 5. Replace compressor.
H. ENGINE NOISE AND/OR VIBRATION	1. Loose or-missing mounting bolts. 2. Broken mounting bracket. 3. Loose flywheel or clutch retaining bolt. 4. Rough idler pulley bearing. 5. Bent, loose, or improperly mounted engine drive pulley. 6. Defective compressor bearing. 7. Insecure mountings of accessories; generator, power steering, air filter, etc. 8. Excessive head pressure. 9. Incorrect compressor oil level.	1. Repair as necessary. 2. Replace bracket. 3. Repair as necessary. 4. Replace bearing. 5. Repair as necessary. 6. Replace bearing. 7. Repair as necessary. 8. Refer to A-l, A-2, A-3 A-4 and C-6. 9. Refer to compressor Oil Level Check.

CHARGING AND TESTING EQUIPMENT

This is standard equipment for the servicing of automotive air conditioning systems, and is used for all testing, trouble shooting, evacuating and charging operations.
Various designs of charging and testing equipment are available depending upon the manufacturer chosen by the user. As slight variations do occur it is recommended that the operator adheres to the appropriate manufacturers' instructions for the equipment in use.

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 when opening reirigerant connections.

Connecting

1. Check that both service valves are fully open (turned counter-clockwise).
2. Wearing safety goggles remove the dust caps from the gauge connections on the service ports.
3. Coat the threads and flares with compressor oil.
4. Connect the charging and testing equipment referring to the equipment manufacturer's instructions.

Removing

5. If the engine has been operated it must be stopped prior to disconnecting the equipment.
6. Close both the service ports by turning fully counter-clockwise.
7. Disconnect the charging lines from the service ports.
8. Refit the dust caps to the compressor valve stems and service ports, and to the charging lines.

AIR CONDITIONING SYSTEM

Discharging the system

NOTE: The air conditioning refrigeration system contains 'Refrigerant 12' under pressure, and before any component is disconnected or removed, the system must be discharged of all pressure.
Refrigerant 12 evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. Extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes. Should any liquid refrigerant get into the eyes, use a few drops of sterile mineral oil to wash them out and then wash the eyes with a weak solution of boric acid. Seek medical attention immediately even though the initial irritation has ceased after first-aid treatment. Always wear safety goggles when opening refrigerant connections.

WARNING: Open connections slowly, keeping the hands and face well clear, so that no injury occurs if there is liquid in the line. If pressure is noticed allow it to bleed off slowly.

Discharging

1. Connect the manifold gauge set according to the manufacturer's instructions.
2. Run the yellow, centre hose to an open-topped container of approximately one litre capacity. Attach the hose to the container so that it will not blow out of the container. The purpose of the container is to collect any oil carried by the refrigerant.
3. Slowly open the high side valve until the refrigerant flow stops, then open the low side valve to remove any residual pressure.
4. When discharging adjust the refrigerant flow to ensure that oil is not blown out of the container.
5. Measure the amount of oil discharged from the system. Add an equal amount of new oil to the system during the charging operation. Discard the old oil.

Continued

NOTE: If it is necessary to disconnect the compressor hoses, the compressor should be sealed by fully closing the relevant service valve (turn fully clockwise). It is essential to ensure that both service valves are open before operating the compressor. Similarly any other component of the refrigeration system should be capped immediately when disconnected.

Evacuate

Whenever the system has been opened to the atmosphere it is necessary that the system be evacuated to remove all air and moisture. It is also an essential preliminary operation to charging the system with Refrigerant 12. The evacuate operation also provides a check for leaks due to faulty connections.

Evacuating

1. Discharge the system as previously described and connect the charging and testing equipment referring to the manufacturer's instructions.
2. Slowly open the vacuum control valve. If the vacuum is applied to the system too quickly, the residual oil may be drawn out.
3. In evacuating the system it is necessary to lower the pressure so that the boiling point of water in the system is lower than the surrounding air temperature. At an ambient temperature of 23.8°C (75°F), it is necessary to lower the system pressure to 29.5 in Hg vacuum to bring the boiling point of water to 22°C (72°F). Atmospheric pressure (and vacuum gauge readings) decrease as altitude increases by approximately 25mm (1 in) Hg per 300m (1000 ft). The following chart provides a guide to the various gauge readings at differing altitudes, for the same 10mm (0.4 in) Hg absolute pressure.

Altitude ft	Vacuum Reading in Hg
0	29.5
1,000	28.5
2,000	27.4
3,000	26.4
4,000	25.4
5,000	24.5
6,000	23.5
7,000	22.6
8.000	21.8
9,000	20.9
10,000	20.1

4. The low side gauge should indicate a vacuum of 660mm (26 in) Hg within five minutes.
5. If 660mm (26 in) Hg of vacuum is not achieved within five minutes, it signifies either the system has a leak or the vacuum pump is defective. Initially check the vacuum pump. if the pump proves to be functioning properly then investigate for a leak in the air conditioning system.
6. Continue evacuating for 30 minutes to ensure the removal of all moisture.
7. Stop the vacuum pump and allow the vacuum to hold for fifteen minutes, then check that there is no pressure rise (a loss of vacuum) evident on the compound gauge. Any pressure rise denotes a leak which must be rectified before proceeding further. Moisture remaining in the system will continue to boil and cause loss of vacuum. Refer to the heading titled 'Leak Detection' later in this section. With the system satisfactorily evacuated, the system is ready for charging with refrigerant.

Quick flushing

NOTE: This operation is in addition to evacuating, and is to remove moisture from systems that have been open to atmosphere for a long period, or that are known to contain excessive moisture.

1. Fit a new liquid receiver/drier, as detailed under the heading 'Receiver/Drier'.

2. Connect the charging and testing equipment and follow the equipment manufacturer's instructions for quick flushing.
3. Evacuate the system.
4. Allow a charge of refrigerant of between 0.25 and 0.45 (0.5 to 1 lb) to enter the system.
5. Allow the refrigerant introduced into the sytem to remain for ten minutes.
6. Reconnect the charging and testing equipment following the equipment manufacturer's instructions for evacuating. Evacuate the system.
7. Maintain the vacuum for twenty minutes. The air conditioning system is now ready for charging with refrigerant.

Charge

CAUTION: Do not charge liquid refrigerant into the compressor. Liquid cannot be compressed; and if liquid refrigerant enters the compressor inlet valve, severe damage is possible; in addition, the nil charge mav be absorbed into the reirigerant, causing damage when the compressor is operated.

Charging

1. Ensure that the air conditioning system is evacuated as previously described.
2. Follow the equipment manufacturer% instructions for charging the system with refrigerant.
3. Ensure that the full charge of refrigerant - LHD 1.08 kg (38 oz) is drawn into the system.
4. After completing the procedure check the air conditioning system is operating satisfactorily by carrying out a pressure test, as described in this section.

CAUTION: Do not overcharge the air conditioning system as this will cause excessive head pressure.

Leak test

The following instructions refer to an electronic type refrigerant leak detector which is the safest, most sensitive and widely used.

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. Certain detectors have visual and audible indicators.
3. Commence searching for leaks by passing the detector probe around all joints and components, particularly on the underside, as the 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 hose connections.
8. If any leaks are found, the system must be discharged before attempting rectification. If repairs by brazing are necessary, the component must be removed from the vehicle and all traces of refrigerant expelled before heat is applied.
9. After repairs check the system for leaks and evacuate prior to charging.

Pressure test

1. Fit the charging and test equipment as previously described.
2. Start the engine.
3. Run the engine at 1,000 to 1,200 rev/min with the heat control set to cold (blue) zone. Cut off the air supply to the dash vents using the left hand lever. Move the slider levers to air conditioning 'ON' and fan speed to maximum.
4. Note the ambient air temperature in the immediate test area in front of the vehicle, and check the high pressure gauge readings -discharge side-against Table 1.

The pressure gauge readings will vary within the range quoted with the rate of flow of air over the condenser, the higher readings resulting from a low air flow. It is recommended that a fan is used for additional air flow over the condenser if the system is to be operated for a long time. Always use a fan if temperatures are over 26.7°C (80°F), so that a consistent analysis can be made of readings.

5. If the pressure readings are outside the limits quoted, refer to the fault diagnosis chart at the beginning of this section.
6. Stop the engine.
7. Close both service ports (turn fully counter-clockwise) and close all valves on the charging and test equipment. Disconnect the charging lines from the compressor. Refit the dust caps to the compressor valve stems, port connections and charging lines.
8. Close the hood.

Table 1

Ambient Temperature		Compound Gauge Readings		High Pressure Gauge Readings	
°C	°F	bar	p.s.i.	bar	p.s.i.
16	60	1,03-1,4	15-20	6,9-10,3	100-I 50
26,7	80	1,4-1,72	20-25	9,6-13,1	140.190
38	100	1,72-2,1	25-30	12,4-15,5	180-225
43,5	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 londitioner 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 condensate drains are 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 Retrigerant 12 and is deposited when the refrigerant evaporates from a leak.

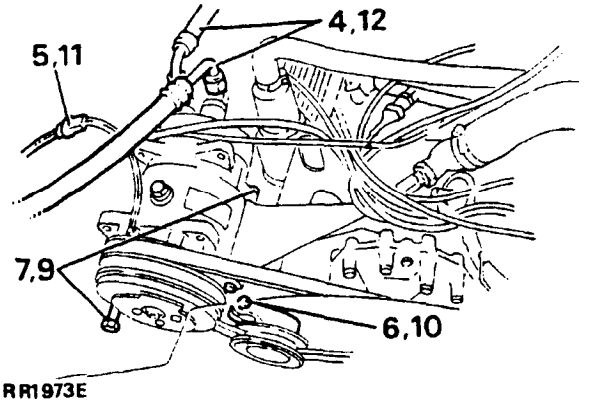
7. Start the engine.
8. Set the temperature control switch to maximum cooling and switch the air conditioner blower control on and off several times, checking that the magnetic clutch on the compressor engages and releases each time.
9. With the temperature control at maximum cooling and the blower control at high speed, warm up the engine and fast idle at 1,000 rev/min. Check the sight glass for bubbles or foam. The sight glass should be generally clear after five minutes running, occasional bubbles being acceptable. Continuous bubbles may appear in a serviceable system on a cool day, or if there is insufficient air flow over the condenser at a high ambient temperature.
10. Repeat at 1,800 rev/min.
11. Gradually increase the engine speed to the high range, and check the sight glass at Intervals.
13. Check for frosting on the service valves and evaporator fins.
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 satistactory, proceed with the pressure test as previously described in this section.

COMPRESSOR

Remove and refit

Removing

1. Place the vehicle in a ventilated area away from open flames and heat sources.
2. Stop the engine and secure the hood in an open position. Disconnect the battery negative lead.
3. Discharge the air conditioning system.
4. Using goggles to protect the eyes, and wearing gloves, disconnect the suction and discharge unions from the back of the compressor. Cap the flexible end connections and service valves immediately.
5. Disconnect the lead to the compressor magnetic clutch at the connector.
6. Loosen the idler pulley securing bolt and release the driving belt.
7. Remove the two compressor mounting bolts and lift compressor clear.



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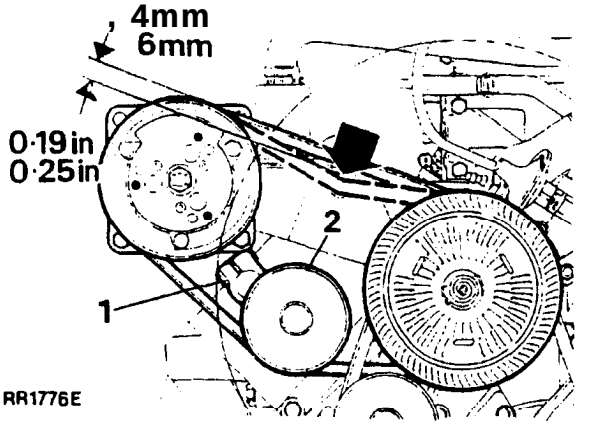
Refitting

8. If a new compressor is being fitted, drain the oil from the new compressor. Drain and measure the oil from the old compressor. Measure new oil equal to the amount drained from the old compressor. Add 30 ml (1 fluid oz) of new oil to this amount and refill the new compressor.
9. Locate the compressor in position, fit and tighten the mounting bolts.
10. Fit the compressor driving belt and adjust as described under 'Compressor drive belt -adjust'.
11. Connect the lead to the compressor magnetic clutch at the connector.
12. Refit the suction and discharge flexible end connectors to the service valves, lubricating the flares and threads of the unions with compressor oil.
13. Evacuate the air conditioning system, maintaining the vacuum for ten minutes.
14. Charge the air conditioning system.

COMPRESSOR DRIVE BELT

Adjust

1. Loosen the idler pulley securing bolt.



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2. Adjust the position of the idler pulley until the correct tension is obtained. The belt must be tight with 4 to 6mm (0.19 to 0.25 in) total deflection when checked by hand midway between the pulleys on the longest run.
3. Tighten the securing bolt and recheck the tension.

COMPRESSOR OIL LEVEL

Sanden 510 and 709

The compressor specification was changed. during 1988, to a Sanden 709. The new compressor is identified by the oil filler plug now located on the side of the compressor, and the model label.

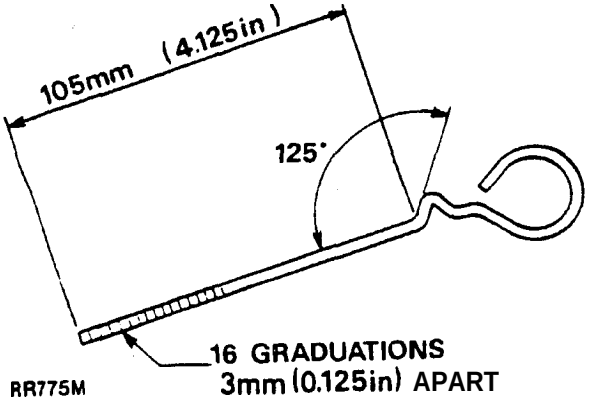
Check

It is not necessary to check the compressor oil level as part of routine mamtenance.

NOTE: The compressor oil level should be checked whenever any components, including the compressor are removed and refitted, or when a pipe or hose has been removed and reconnected or, if a refrigerant leak is suspected.

All compressors are factory charged with 135 ± 15 ml (4.6 ± 0.5 fl oz) of oil. When the air conditioning equipment is operated some of the oil circulates throughout the system with the refrigerant, the amount varying with engine speed. When the system *is* switched off the oil remains in the pipe lines and components, so the level of oil in the compressor is reduced, by approximately 30 ml (1 fl oz).

The compressor oil level must finally be checked after the system has been fully charged with refrigerant and operated to obtain a refrigerated temperature of the car interior. This ensures the correct oil balance throughout the system.
The compressor is not fitted with an oil level dipstick, and a suitable dipstick must be made locally from 3mm (0.125 in) diameter soft wire in accordance with the accompanying illustration. After shaping, mark the end of the dipstick with sixteen graduations 3mm (0.125 in) apart.

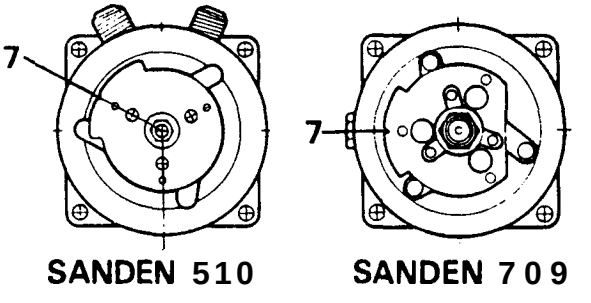


Procedure

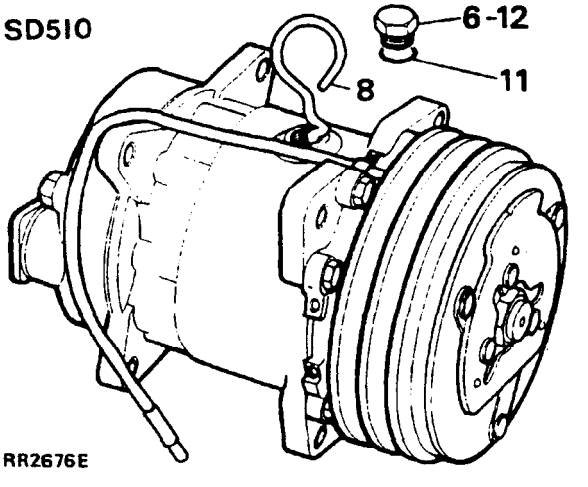
1. Open the hood.
2. Fit the charging and testing equipment.
3. Start the engine and turn the temperature control to maximum cooling position, and the air flow control to HIGH speed. Operate the system for ten minutes at engine idle speed.

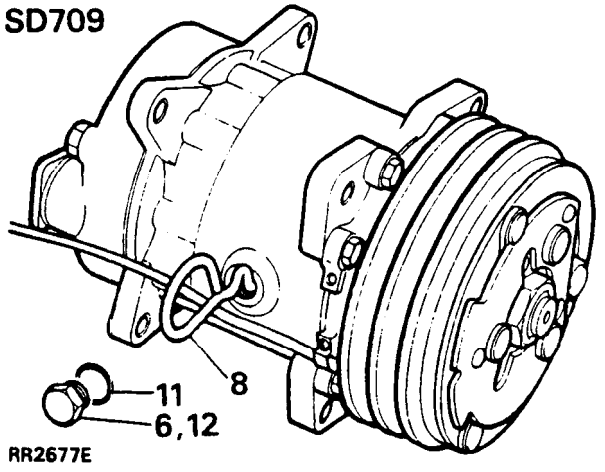
   NOTE: It is important to open the valve slowly during the following item to avoid a sudden pressure reduction in the compressor crankcase that could cause a large amount of oil to leave the compressor. Refer also to SERVICE VALVES.

4. Reduce the engine speed to idling, and SLOWLY open the suction side valve on the test equipment until the compound gauge reads 0 or a little below.
5. Stop the engine at this point and quickly open the suction valve and discharge valve.
6. Loosen the oil filler plug and unscrew it slowly by five turns to bleed off crankcase pressure.

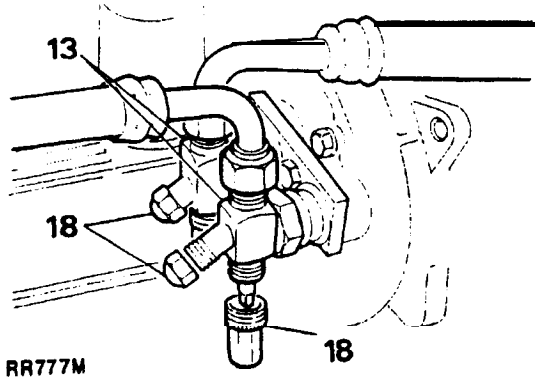


7. Remove the oil filler plug. Align the counterweight to the position shown to enable the dipstick to be inserted to its full length.
8. Wipe the dipstick and insert to its stop position, ensuring the angle of the dipstick is flush with the surface of the filler orifice.





9. Withdraw the dipstick and count the number of graduations to determine the depth of oil.
10. Oil level - SD 510: two to four graduations. SD 709: fifteen to sixteen graduations. Add or remove oil as necessary until the mid-range figure is obtained. It is recommended that a syringe is used for adding or removing oil. Use only the correct compressor oil - see Recommended Lubricants, section 09.
11. Lubricate a new 'O' ring with compressor oil, fit it over the threads of the level plug without twisting, and install the level plug loosely.
12. Evacuate the air from the compressor using the vacuum pump on the charging and testing equipment, following the equipment manufacturer's instructions. Tighten the filler plug to the correct torque, see Torque Values.
13. Close fully the suction and discharge valves.



14. Start and run the engine at 1,200 rev/min and check for leak at the compressor level plug. Do not overtighten to correct a leak. In the event of a leak isolate the compressor as previously described in items 4 to 6, and check the 'O' ring seats for dirt, etc.
15. Stop the engine.
16. Close all valves on the charging and testing equipment.
17. Disconnect the charging lines from the compressor.
18. Refit the dust caps to the compressor valve stems and gauge connections, and to the charging lines.
19. Close the hood.

CONDENSER

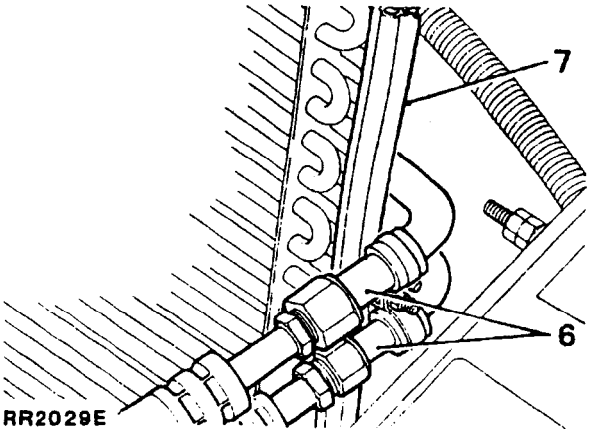
Remove and refit

Removing

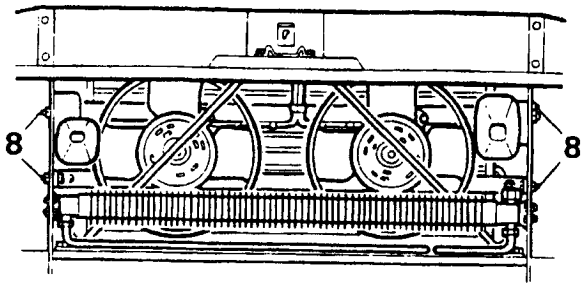
1. Open the hood and disconnect the battery negative lead.
2. Discharge the arr conditioning system.
3. Remove the front grille panel
4. Remove the radiator.
5. Disconnect the two fan motor wiring connections.

CAUTION: Before carrying out instruction 6 protect the eyes with safety goggles and wear protective gloves.

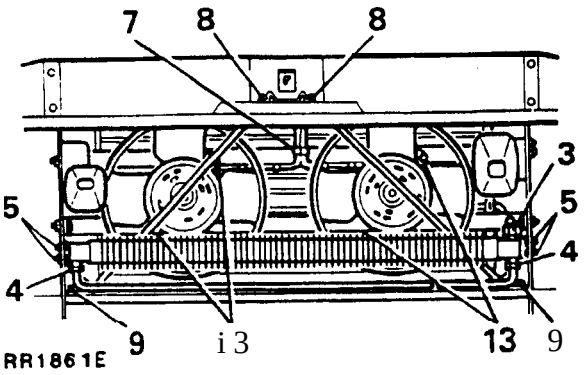
6. Using two wrenches on each fitting, carefully disconnect the hoses at the condenser end. Plug the exposed ends of the hoses.



7. Remove the vertical radiator seal from each side.
8. Remove four bolts securing the condenser and remove condenser complete with fan motor assemblies.



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Refitting

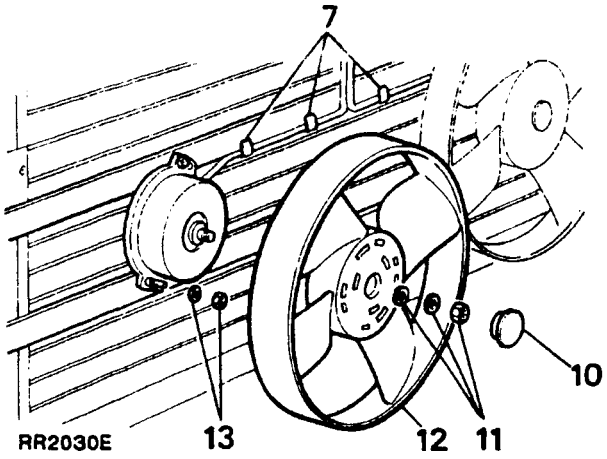
9. Reverse instructions 3 to 8 above.
10. Add 30 ml (1 fl oz) of the correct oil to the compressor to compensate for oil loss if a new condenser is to be fitted.
11. Evacuate the air conditioning system.
12. Charge the system.
13. Carry out a leak test on the disturbed joints
14. Check the air conditioning operation by carrying out a System Test.

CONDENSER FANS AND MOTORS

Remove and refit

Removing

1. Open the hood and disconnect the battery negative lead.
2. Remove the grille panel.
3. Disconnect the wiring connectors to the transmission oil cooler.
4. Loosen the fittings and detach the oil cooler hoses.
5. Remove two mounting bolts from each side and withdraw the transmission oil cooler.
6. Disconnect the two fan motor wiring connectors.
7. Release the wiring securing clips.
8. Loosen the two upper bolts securing the left and right hand hood striker support stays.
9. Remove the bolts securing the lower ends of the stays and pivot both stays forward.
10. Remove the dust caps from the fan centres.



RR2030E

11. Remove the securing nut and washers.
12. Withdraw the fan blade from the motor shaft.
13. Remove the two nuts and washers securing each motor and withdraw the fan motor assemblies from the vehicle.

Refitting

14. Reverse 1 to 13 above, ensuring that the wiring is correctly clipped and no fouling of the fan blades occurs.
15. Check automatic transmission fluid level and refill if necessary.

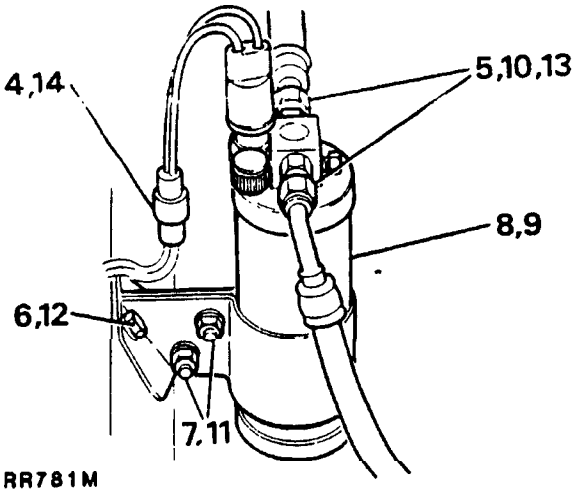
RECEIVER DRIER

Remove and refit

CAUTION: Immediate plugging of the receiver drier is important. Exposed life of the unit is only 15 minutes.

Removing

1. Disconnect the batter)) negative lead.
2. Connect the gauge set and discharge the complete system..
3. Protect the eyes with safety goggles and wear gloves during operations 4 and 5.
4. Disconnect the electrical lead at the connector and carefully unscrew the high pressure switch from the receiver drier. Cover the exposed connections immediately.



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5. Carefully disconnect the two hose connections. Use a second wrench to support the hose adaptor. Plug the exposed connections immediately.
6. Remove one bolt, nut and washers securing the mounting bracket to the fender valance.
7. Remove the clamp bolts, washers and nuts.
8. Withdraw the receiver drier from the mounting bracket.

Refitting

9. Insert the receiver drier into the mounting bracket with the inlet and outlet connections correct to the refrigerant circuit as shown.
10. Connect the two hose connections finger tight. Use refrigerant compressor oil on all mating surfaces to assist leakage prevention.
11. Fit the clamp bolts, washers and nuts.
12. Secure the mounting bracket to the fender valance.
13. Tighten the two hose connections to the correct torque. see Torque Values. Use a second wrench to support the hose adaptor.
14. Carefully refit the high pressure switch to the receiver drier. Use refrigerant compressor oil on all mating surfaces to assist leakage prevention and tighten the switch to the correct torque, see Torque Values. Reconnect the electrical lead.
15. To compensate for oil loss, add 15 ml (1/2 fl oz) of the correct oil to the compressor.
16. Evacuate the complete system.
17. Charge the complete system.
18. Perform a leak test on any disturbed joints.
19. Carry out a functional check.
20. Disconnect the gauge set.

DASHBOARD UNIT-ARA

EVAPORATOR

Remove and refit

Expansion valve
Remove and refit 1 to 22 and 32 to 53.

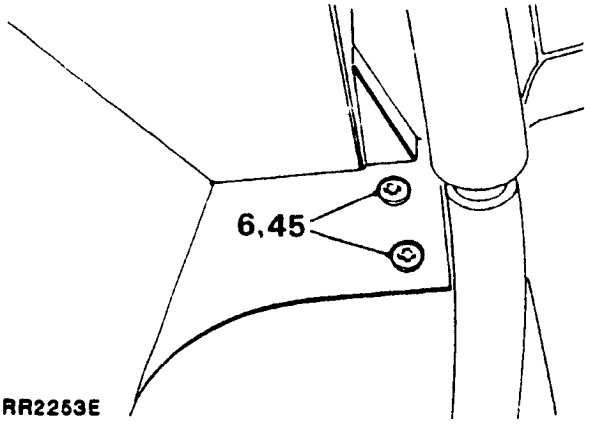
Hose-compressor to evaporator
Remove and refit 1 to 20 and 34 to 53.

Hose-receiver drier to evaporator
Remove and refit 1 to 20 and 34 to 53.

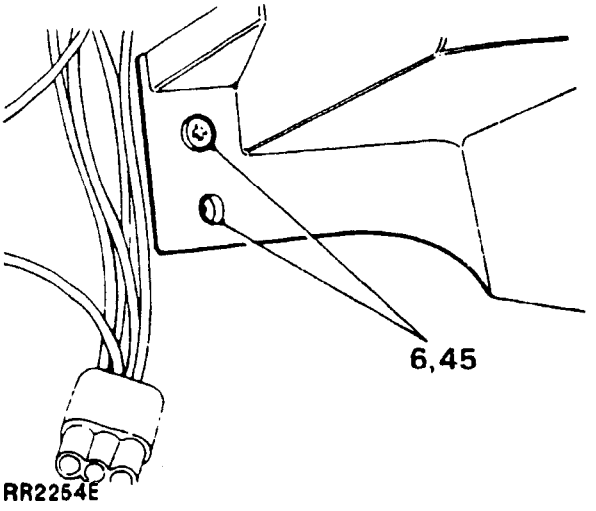
Blower units
Remove and refit 1 to 23 and 31 to 53.

Removing

1. Open the hood and connect the gauge set.
2. Discharge the system.
3. Disconnect the batten! negative lead
4. Protect the eyes with safety goggles and wear gloves during instruction 5.
5. Disconnect the evaporator hoses from the compressor and the receiver drier. Use a second wrench to support the hose adaptors and plug all the exposed connections immediately.
6. Working inside the vehicle, withdraw the lower dash and remove the screws securing the lower edge of the centre console.

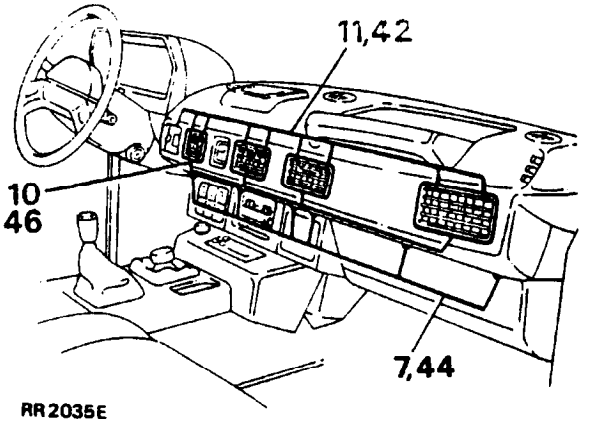


RR2263E



RR2254E

7. Remove the six screws securing the lower edge of the louvre panel to the console and evaporator case.

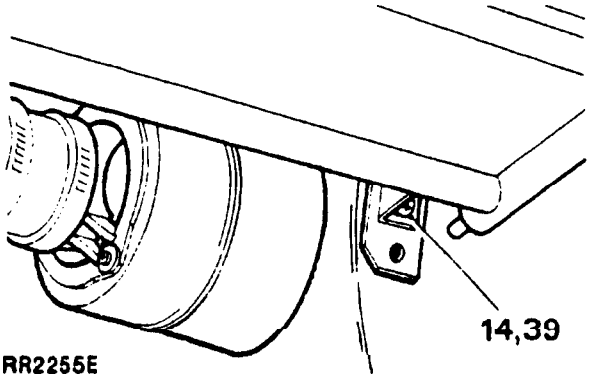


RR2035E

8. Remove the heater control panel and knobs from the centre console.
9. Remove the centre console.
10. Carefully pry out the four air vents.
11. Remove the screws securing the evaporator plenum and louvre panel to the dash top panel.
12. Carefully withdraw the thermostat sensor from the fins of the evaporator, and pull the sensor pipe clear of the evaporator assembly.
13. Disconnect the electrical connectors at the rear of exterior driving mirror control switches and clock, and withdraw panel clear of the dash.

Continued

14. Remove the screws securing the lower right mounting bracket.



15. Support the evaporator case and remove the two nuts securing the case and reinforcing strip to the upper mounting bracket.
16. Carefully withdraw the refrigerant hoses and evaporator condensate tubes through the bulkhead and remove the rear left hand air hose from the plenum.
17. Disconnect the wiring to mirror controls, blower motor and clock at the three wiring connectors.
18. Remove the evaporator and plenum assembly from the vehicle.

Dismantling

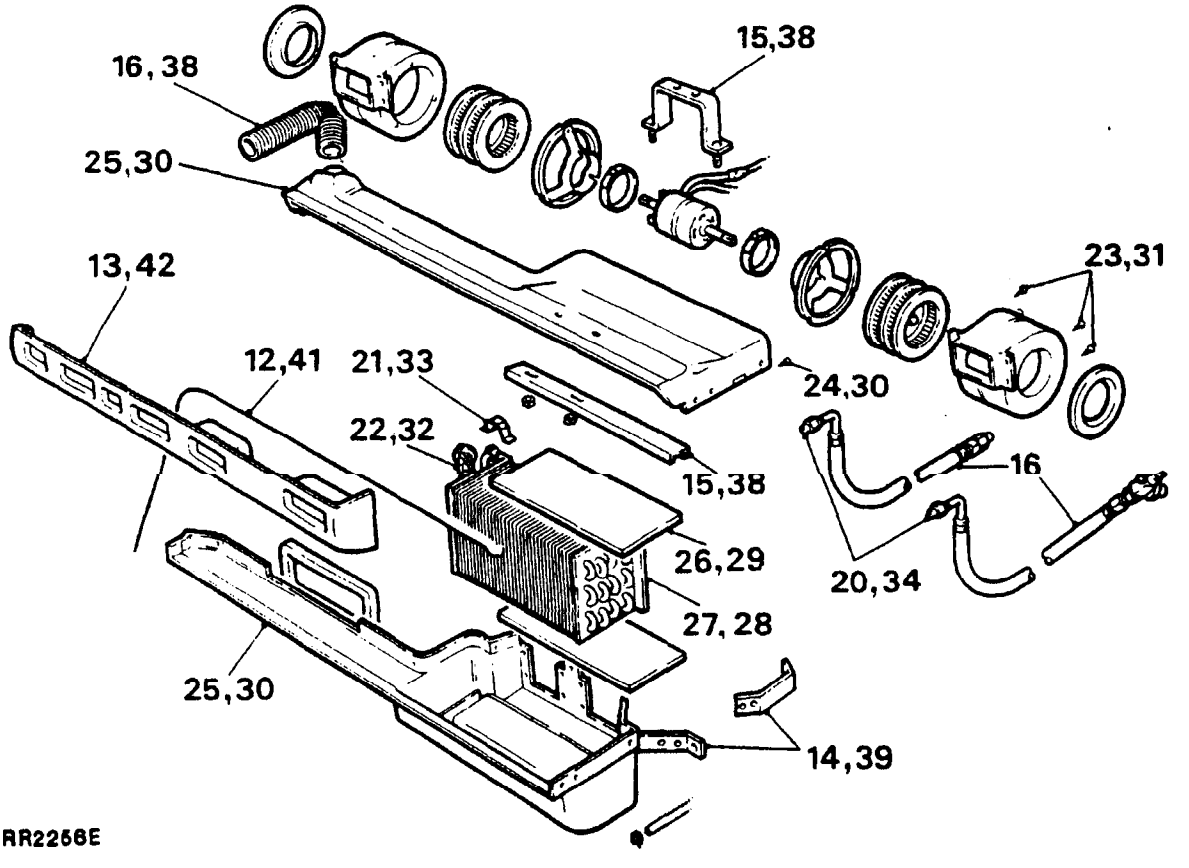
19. Remove the insulation from the evaporator and expansion valve hose connections.
20. Disconnect the hoses from the expansion valve and evaporator. Use a second wrench to support the hose adaptors and plug all the exposed connection% immediately.
21. Unclamp the sensor coil from the evaporator outlet pipe.
22. Carefully unscrew the expansion valve from the evaporator. Plug the exposed connections immediately.
23. Remove the eight securing screws and detach the blower units from the evaporator case.
24. Remove the screws securing the upper evaporator/plenum casing to the evaporator and lower casing.
25. Remove the heater seal and lift off the upper casing.
26. Remove the insulation pad and the four screws securing the evaporator to the lower casing.
27. Withdraw the evaporator from the casing.

Assembling

28. Secure the evaporator to the lower casing.
29. Fit the insulation pad.
30. Secure the casings together with the screws and refit the heater seal.
31. Refit and secure the blower units to the evaporator casing.
32. Assemble the expansion valve to the evaporator with the inlet facing downwards. Use refrigerant compressor oil on all matinp surfaces to assist leakage prevention. Tighten the connection to the correct torque, see Torque Values.
33. Clamp the sensor coil to the evaporator outlet pipe.
34. Connect the hoses to the evaporator and expansion valve. Use new 'O' rings and refrigerant compressor oil on all mating surfaces to assist leakage prevention.Tighten the connections to the correct torque,see Torque Values.
35. Wrap all exposed metal at the hose connections with no drip tape.

Refitting

36. Place the evaporator assembly on the floor of the vehicle and reconnect three wiring connectors disconnected at instruction 17.
37. Feed the hoses and evaporator condensate tubes through the bulkhead. Ensure that the openings and grommets are adequately sealed against ingress of dust and moisture.
38. Lift the unit into the mounting position and connect the rear left hand air hose. Fit the reinforcement strip and secure the casing to the upper bracket with two nuts.
39. Secure the lower right mounting bracket to the vehicle.
40. Position the left hand of the plenum so that the opening is centered over the fresh air outlet of the heater.
41. Carefully push the thermostat pipe into the evaporator fins.
42. Reconnect the wiring to the exterior mirror controls and clock, and refit the louvre panel. Secure the nlenum casing and louvre panel to the dash top panel with the fixing screws.
43. Refit the centre console.
44. Refit the six screws securing the louvre panel to the centre console and evaporator case.
45. Secure the lower edge of the console with four screws (two each side).
46. Refit the four air vents.
47. Connect the two refrigerant hoses to the compressor and receiver drier. Use refrigerant compressor oil on all mating surfaces to assist leakage prevention. Tighten the connections to the correct torque, see Torque Values.
48 To compensate for oil loss, add 45 ml (1.5 fl oz) of the correct oil to the compressor.
49. Evacuate the system.
50. Charge the complete system.
51. Perform a leak test on any accessible disturbed joints.
52. Perform a functional check.
53. Disconnect the gauge set.

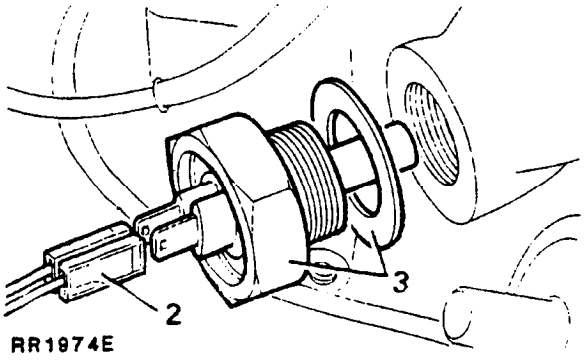


COOLANT TEMPERATURE SENSOR

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Disconnect the electrical ieads from the sensor.
3. Remove the sensor from the thermostat housing.



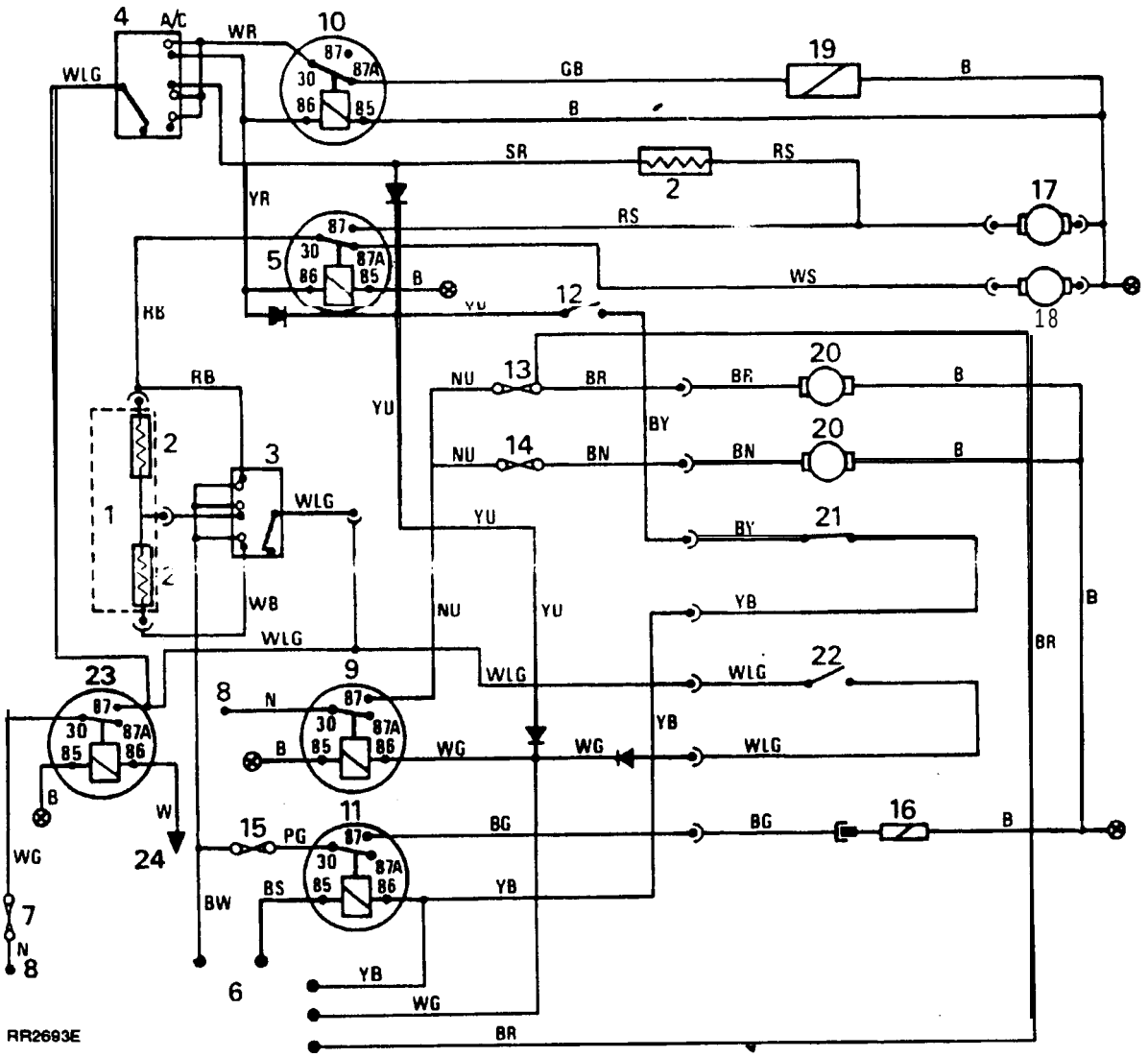
RR1974E

Refitting

4. Reverse the removal procédure, using a NEW joint washer.

AIR CONDITIONING CONTROLS/THERMOSTAT

See Heater and Air Conditioning Controls in Section 80 - Heating and Ventilation.



HEATER AND AIR CONDITIONING • circuit diagram • 89 Model year

1. Heater unit.
2. Resistors.
3. Fan speed switch.
4. Air conditioning/re-circ/fresh air switch.
5. Air conditioning/heater relay.
6. EFI harness connector.
7. Fuse 8-main fuse panel.
8. Main cable connection.
9. Fan relay.
10. Fresh air solenoid relay.
11. Compressor clutch relay.
12. Thermostat.
13. Fuse A1-auxiliary fuse panel A.
14. Fuse A2-auxiliary fuse panel A.
15. Fuse A3-auxiliary fuse panel A.
16. Compressor clutch.
17. Air conditioning motors-(2)-dashboard unit.
18. Heater motor.
19. Fresh air solenoid.
20. Condenser fan motors.
21. High pressure switch.
22. Engine coolant temperature sensor.
23. Heater / air conditioning relay (item 168 • main circuit diagram)
24. ignition load relay terminal 87.

Cable colour code overleaf

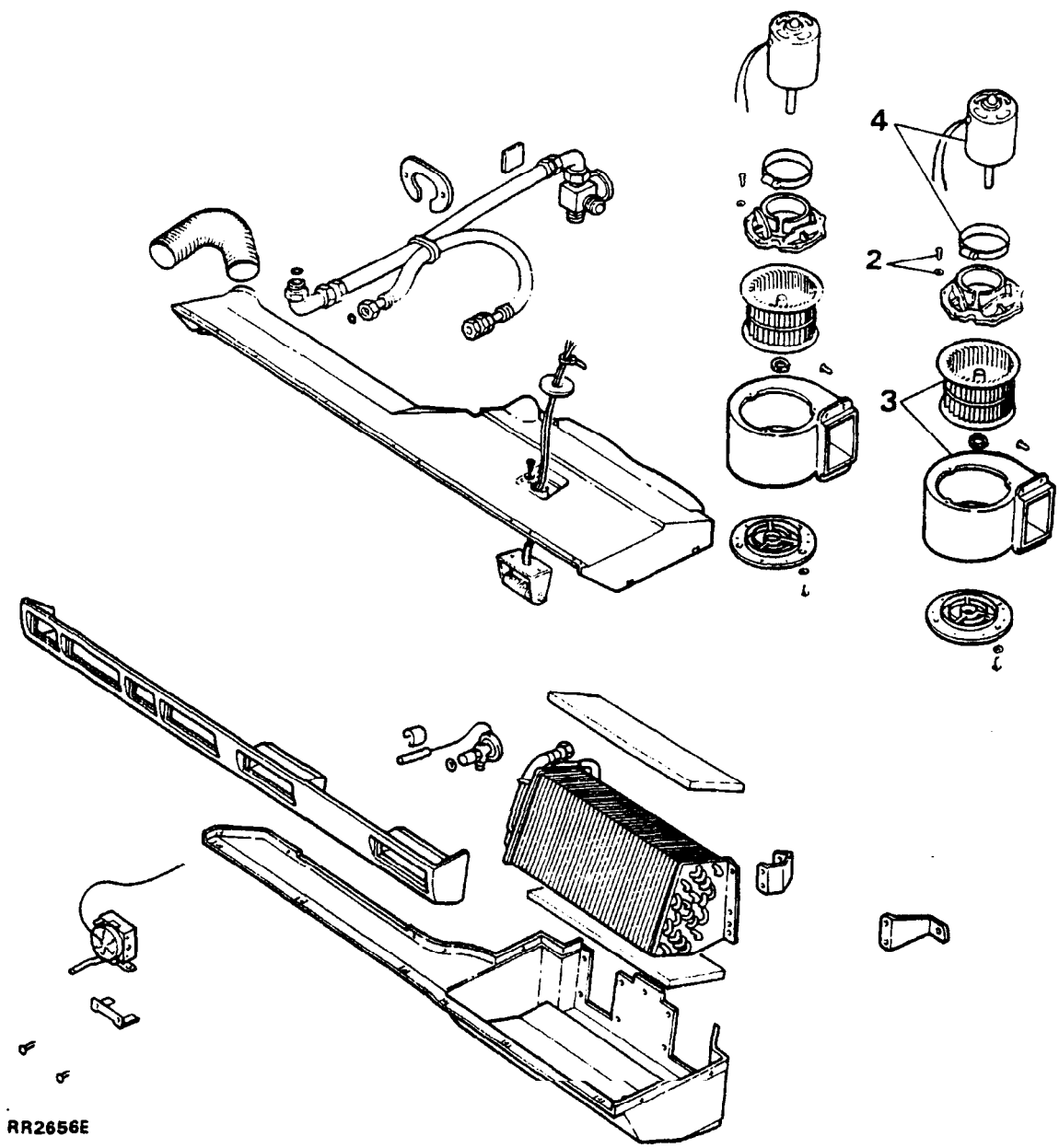
NOTE: See EFI circuit diagram for details of air conditioning inputs to ECU.

Cable colour code

B	Black	N	Brown	R	Red	W	White
G	Green	0	Orange	S	Grey	Y	Yellow
L	Light	P	Purple	U	Blue		

The last letter of a colour code denotes the tracer.

Dashboard Unit • 89 Model year



AIR CONDITIONING

1989 model year vehicles have an improved heater and air conditioning system.

Air conditioning combined with warm air (Two level), with the slider in this position, a combination of cool air at a fixed rate can be supplied through the face level vents while variable warm air is supplied to the footwells and demister vents.

CONDENSER FANS

CAUTION: It should be noted that under high coolant temperatures, when the engine is switched OFF, the condenser fans will be activated and run for approximately ten minutes.

DASHBOARD UNIT - EVAPORATOR - RR2656E

Improvements to the air conditioning system include the use of two blower motors to the evaporator. The evaporator capacity is also increased.

Blower motor

Remove and refit

Removing

1. Remove and dismantle the dashboard unit.
2. Remove three screws from the blower motor mount, and withdraw motor assembly.
3. Remove the clip from motor spindle and remove blower wheel.
4. Loosen the clamp securing the motor to the motor mount. Remove the blower motor.

Refitting

5. Reverse the removal procedure.

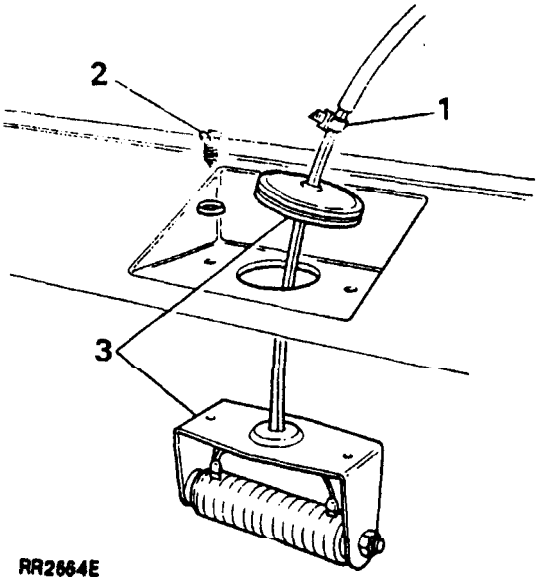
Resistor

The resistor secured to the upper evaporator casing, runs the constant speed air conditioning when the two level facility is selected.

Remove and refit

Removing

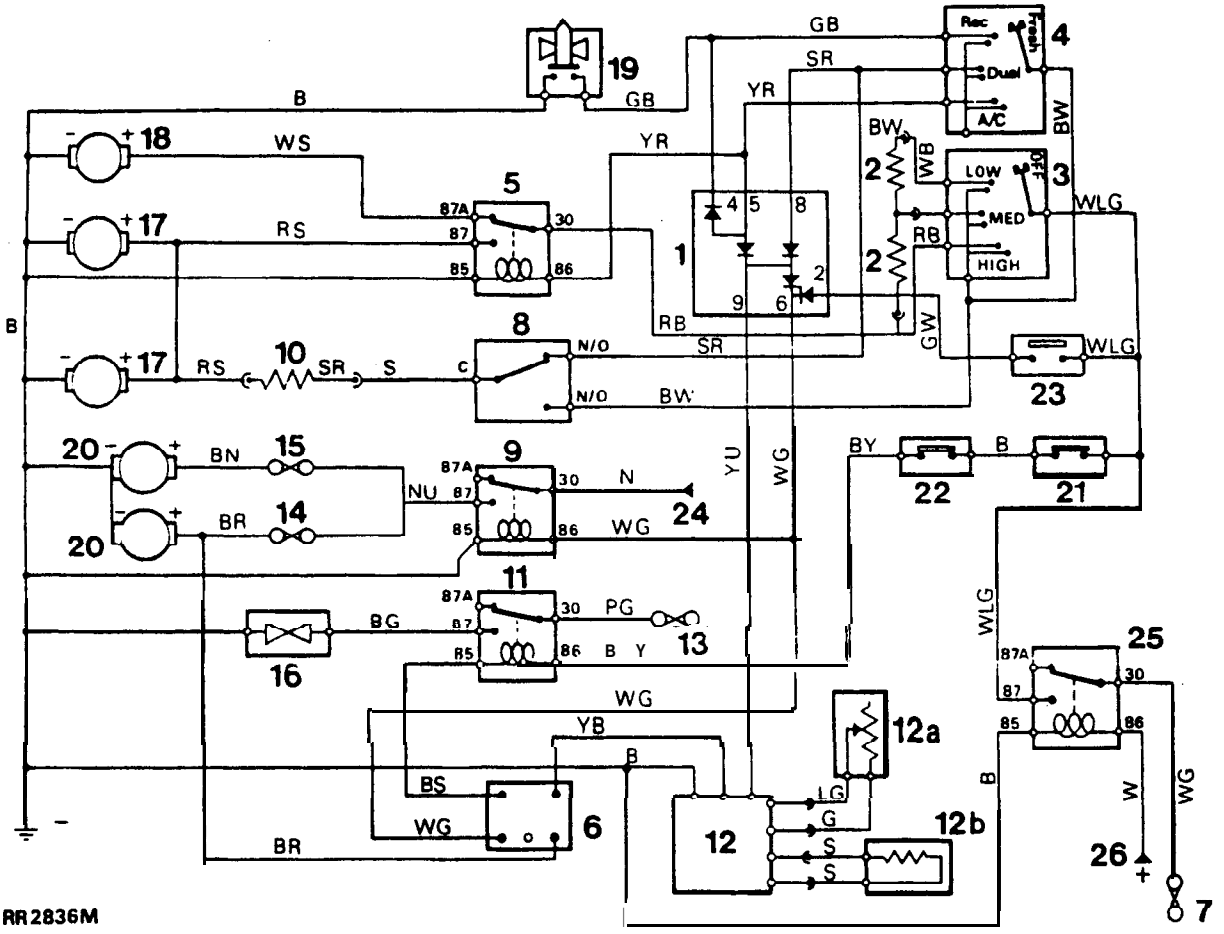
1. Release the cable tie, and release the two resistor wires from the multi-plug.
2. Remove the two screws securing the resistor to the upper casing.
3. Remove the grommet, and withdraw the resistor complete with cables.



RR2664E

Refitting

4. Reverse the removal procedure.



HEATER AND AIR CONDITIONING • circuit diagram

1. Diode pack.
2. Resistors.
3. Fan speed switch.
4. Air conditioning/re-circ/fresh air switch.
5. Heater/air conditioning relay.
6. Cable connection to ECU (EFI).
7. Fuse C9 • main fuse panel.
8. Face vent switch.
9. Condenser fan relay.
10. Two level resistor.
11. Compressor clutch relay.
12. Thermostat.
13. Fuse B7.
14. Fuse B8.
15. Fuse B9.
16. Compressor clutch.
17. Air conditioning motors (2) • dashboard unit.
18. Heater motor.
19. Fresh air solenoid.
20. Condenser fan motors.
21. Low Pressure switch.
22, High pressure switch.
23. Engine coolant temperature switch.
24. 12V from terminal post.
25. Heater/air con load relay
26. 12V from ignition load relay

NOTE: See EFI circuit diagram for details of air conditioning inputs to ECU.

Cable colour code

B	Black	N	Brown	R	Red	W	White
G	Green	O	Orange	S	Grey	Y	Yellow
L	Light	P	Purple	U	Blue		

The last letter of a colour code denotes the tracer.

AIR CONDITIONING

1990 Model year vehicles have modified air conditioning components. Details of which are given here and must be used in conjunction with the existing air conditioning text.

WARNING: All work involving the service and maintenance of the air conditioning requires special equipment, knowledge, experience and a full awareness and adhesion to the safety precautions.

EVAPORATOR ASSEMBLY

Remove and refit

Expansion valve
Remove and refit 1 to 21 and 31 to 49

Hose-Compressor to evaporator
Remove and refit 1 to 19 and 35 to 49

Hose-reciever drier to evaporator
Remove and refit 1 to 19 and 35 to 49

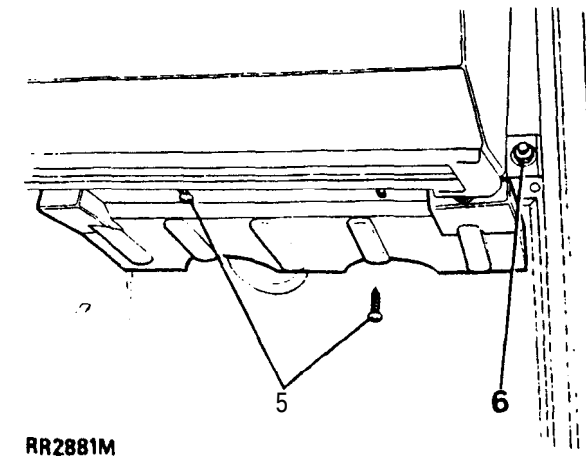
Blower units
Remove and refit 1 to 22 and 30 to 49

Removing

1. **Open the hood and connect the gauge set.**

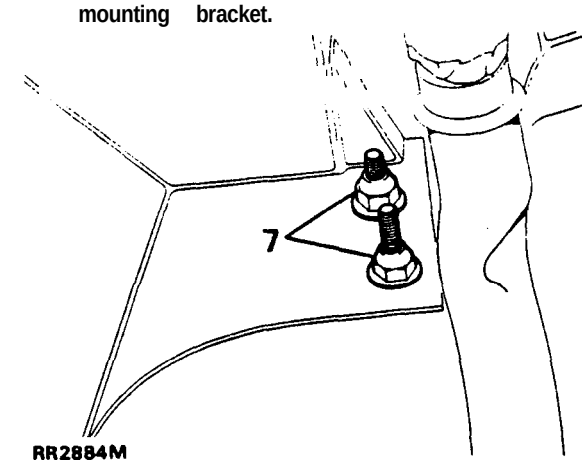
   WARNING: Wear eye and hand protection when disconnecting components containing *refrigerant.Plug* all exposed connections immediately.

2. **Discharge the system.**
3. **Disconnect the battery negative lead.**
4. **Disconnect the evaporator hoses from the compressor and the receiver drier. Use a second wrench to support the hose adaptors.**
5. **Working underneath the dash unit remove the two screws securing the blower closing panel. Slide the panel out of the two lower retaining clips.**
6. **Remove the nyloc nut and washer from the evaporator case mounting bracket.**



RR2881M

7. **Remove the two nyloc nuts securing both centre dash panel and evaporator case mounting bracket.**



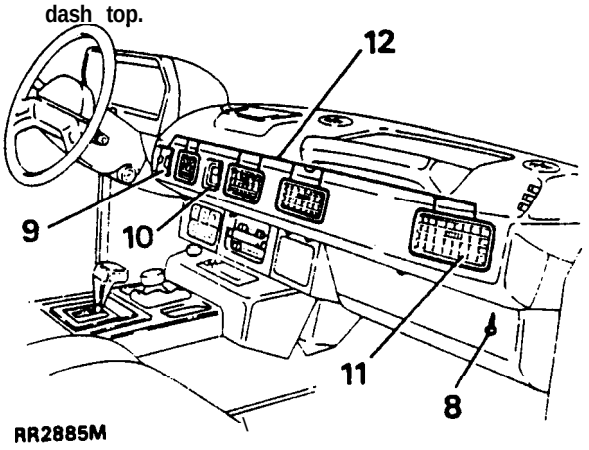
RR2884M

8. **Remove the six screws securing the lower edge of the louvre panel to the evaporator case.**

   Caution: Care must be taken when removing dash components. They can easily be scratched or -damaged by incorrect leverage and excessive force.

9. **Pry out, using equal leverage top and bottom, the mirror control switch. Disconnect the two multiplugs.**
10. **Repeat instruction 9 for removal of the clock. Disconnect electrical leads and the bulb holder.**

11. Pry out along the lower edge the four air vents.
12. Remove the nine screws securing the evaporator housing and louvre panel to the dash top.



13. Withdraw panel clear of the dash top.
14. Carefully withdraw the refrigerant hoses and evaporator condensation drain tubes through the bulkhead.
15. Remove the air hose from the end of the evaporator case upper.
16. Disconnect electric wiring to the blower motor and electronic thermostat at the multiplugs.
17. Remove the evaporator case assembly from the vehicle and place on a surface that will not scratch the casing.

Dismantling

18. Remove the insulation from the evaporator and expansion valve hose connections.
19. Disconnect the hoses from the expansion valve and evaporator. Use a second wrench to support the hose adaptors and plug the connections.
20. Unclamp the sensor coil from the evaporator outlet pipe.
21. Carefully unscrew the expansion valve from the evaporator. Plug the connection.
22. Remove the eight securing screws and detach the blower units from the evaporator case.
23. Remove the screws securing the upper evaporator casing to the evaporator lower case.
24. Remove the thermister probe and lift off the upper casing.
25. Remove the insulation pad and the screws securing the evaporator to the lower casing.
26. Withdraw the evaporator from the casing.

Assembling

27. Secure the evaporator to the lower casing.
28. Fit the insulation pad.
29. Secure the casing together with the screws and refit the thermister probe.
30. Refit and secure the blower units to the evaporator casing.

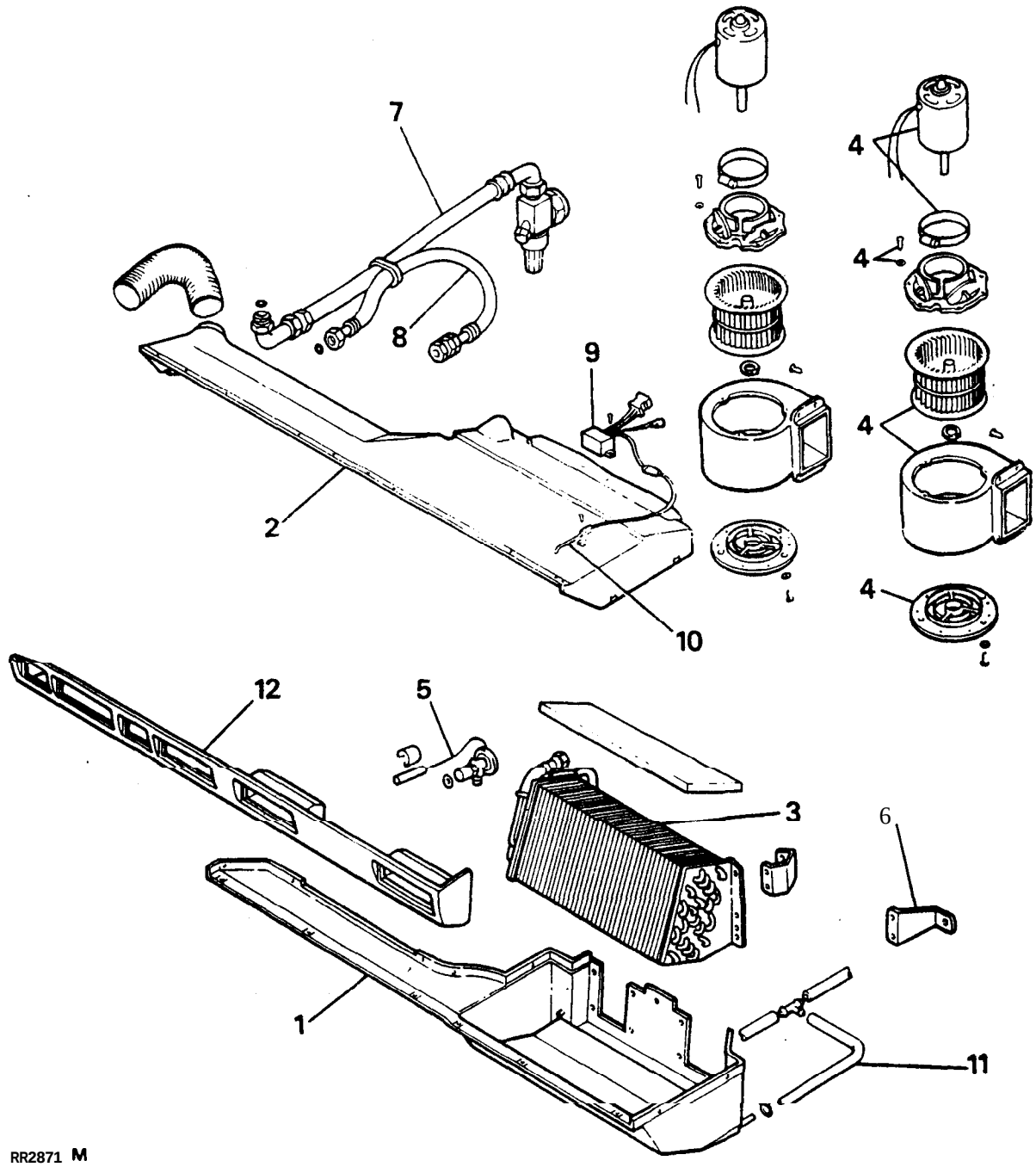
Note: Use refrigerant compressor oil on all mating surfaces to assist leakage prevention. Tighten the connections to correct torque.

31. Assemble the expansion valve to the evaporator with the inlet facing downwards.
32. Clamp the sensor coil to the evaporator outlet pipe.
33. Connect the hoses to the evaporator and expansion valve. Use new 'O' rings. See Torque valves.
34. Wrap all exposed metal at the hose connections with no drip tape.

Refitting

35. Place the evaporator assembly on the floor of the vehicle and reconnect two wiring connectors disconnected at instruction 16.
36. Feed the hoses and evaporator condensate tubes through the bulkhead. Ensure that the openings and grommets are adequately sealed against ingress of dust and moisture.
37. Fit the evaporator assembly to its location and reconnect the air hose at the end of the evaporator casing. Ensure the centre dash panel is eased over the evaporator case mounting bracket on the shared fixing point.

EVAPORATOR CASE ASSEMBLY

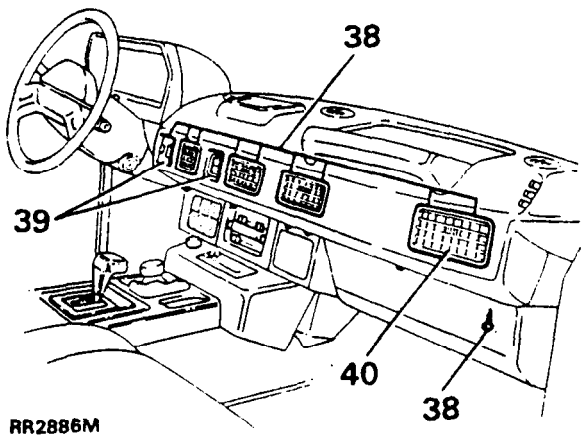


RR2871 M

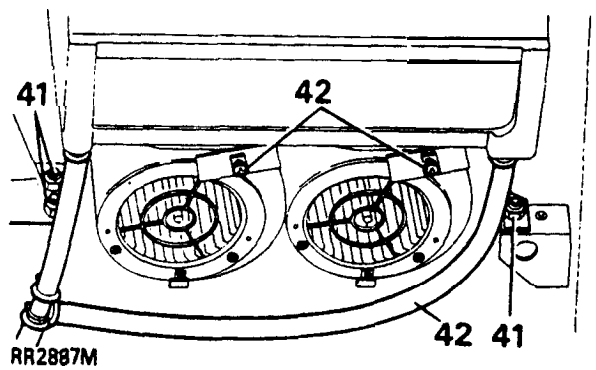
Key

1. Evaporator case lower
2. Evaporator case upper
3. Evaporator
4. Blower Assy
5. Expansion Valve
6. Mounting Bracket
7. Hose Assy Suction
8. Hose Assy Liquid
9. Thermostat
10. Thermister Probe
11. Drain Hose Assy
12. Louvre Panel

38. Feed the electrical connections to the clock and mirror control switch through their apertures in the louvre panel. Refit the louvre panel.
39. Reconnect electrics to the clock and mirror control switch and fit them to louvre panel.
40. Fit the air vents.



41. Secure, using three new nyloc nuts and plain washers, the evaporator case mounting brackets.
42. Ensure condensation tubes are free from kinks and able to drain off water. Fit the blower closing panel.
43. Connect the two refrigerant hoses to the compressor and receiver drier. Tighten to the correct torque.



44. Evacuate the system.
45. Charge the complete system.
46. Perform a leak test on any accessible disturbed joints.
47. Perform a functional check.
48. Check compressor oil level.
49. Disconnect the gauge set.

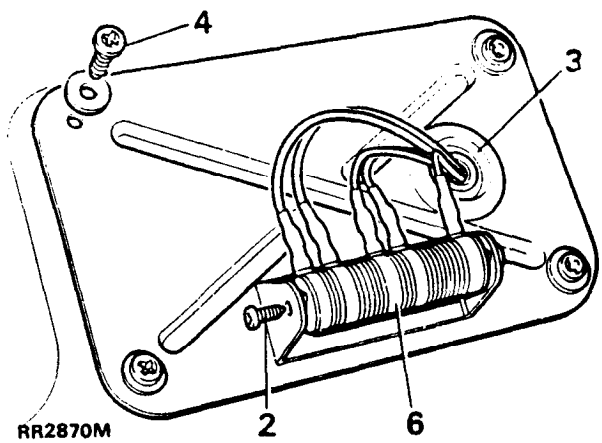
Resistor Unit

The resistor unit is located on the front dash closing panel underneath the cowl panel.

Remove and refit

Removing

1. Disconnect the battery negative lead and remove cowl panel (see body section)
2. Remove the two screws securing the resistor.
3. Release the grommet from the housing.
4. Remove the four screws from the front dash closing panel.
5. Trace the resistor electrical wiring to the multiplug and disconnect.
6. Remove the resistor complete with wiring and multiplug.



Refitting

7. Reverse the removal instructions.

RECEIVER DRIER

Remove and refit

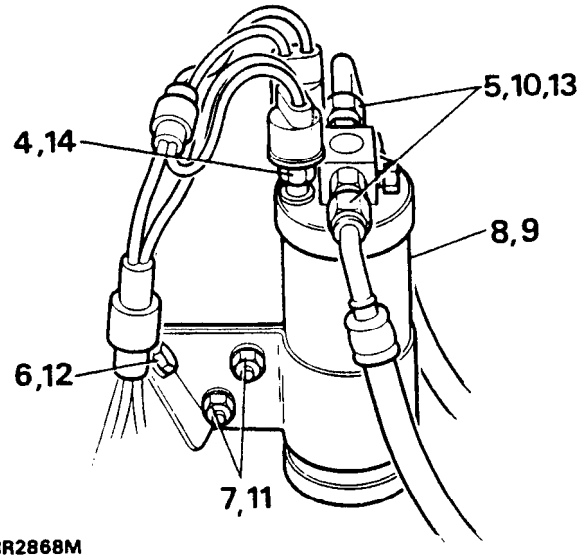
CAUTION: Immediate blanking of the receiver drier is important. Exposed life of the unit is only 15 minutes.

Removing

1. Open the hood and connect the gauge set.

WARNING: Wear eve and hand protection when disconnecting components containing refrigerant. Plug all exposed connections immediately.

2. Discharge the system.
3. Disconnect the battery negative lead.
4. Disconnect the electrical leads at the two plug connectors and carefully unscrew, at the hexagon nut, the pressure switches irom the receiver drier Plug the exnosed connections immediately.



RR2868M

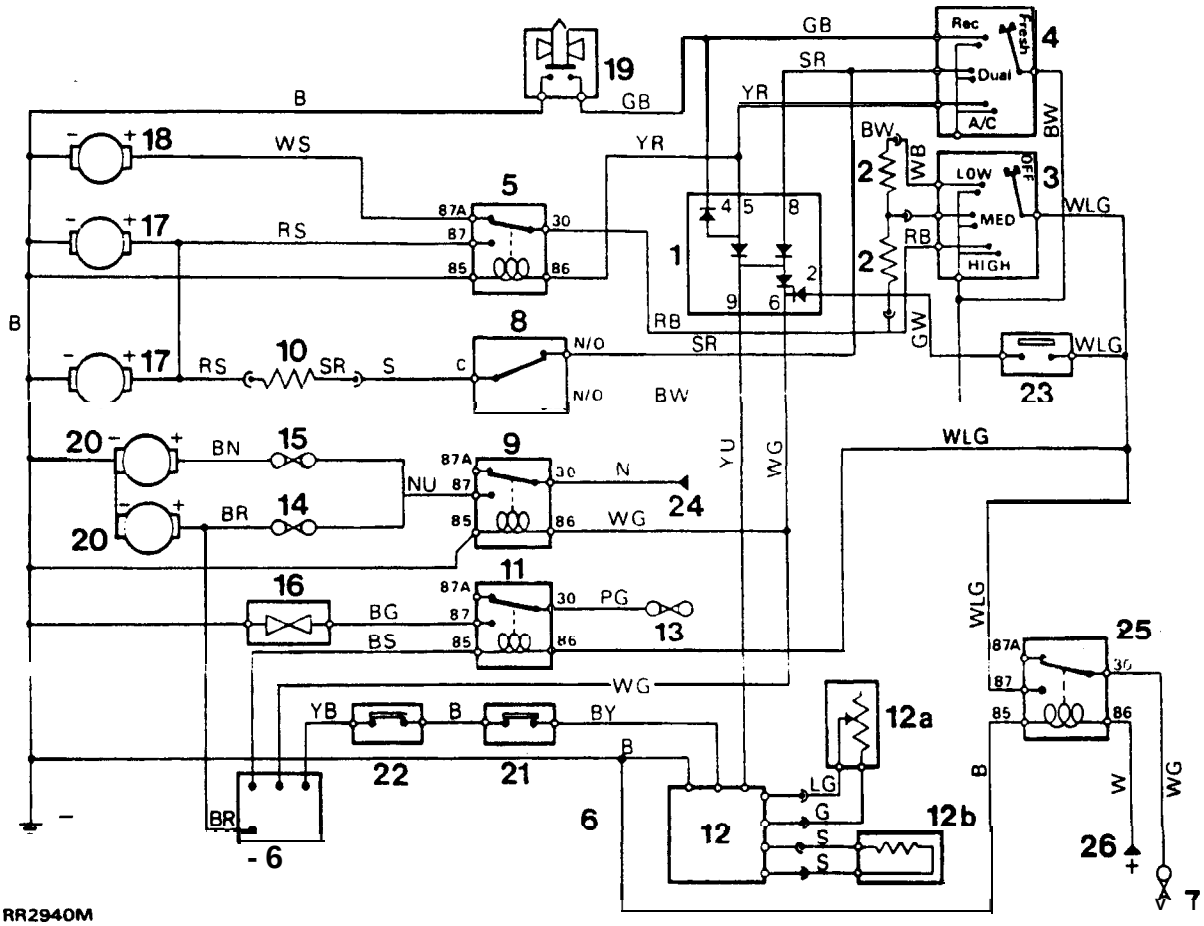
5. Carefully disconnect the two hose connections. Use a second spanner to support the hose adaptor. Plug the exposed connections immediately.
6. Remove one bolt, nut and washers securing the mounting bracket to the wing valance.
7. Remove the clamp bolts, washers and nuts.
8. Withdraw the receiver drier from the mounting bracket.

Refitting

9. Insert the receiver drier into the mounting bracket with this inlet and outlet connections correct to the refrigerant circuit as shown.
10. Connect the two hose connections finger tight.

NOTE: Use refrigerant compressor oil on all mating surfaces to assist leakage prevention.

11. Fit the clamp bolts, washer and nuts.
12. Secure the mounting bracket to the wing valance
13. Tighten the two hose connections to the correct torque. Use a second spanner to support the hose adaptor.
14. Carefully refit the pressure switches to the receiver drier. Tighten the switches to the correct torque. Reconnect the electrical leads.
15. Evacuate the complete system.
16. Charge the complete system.
17. Pertorm a leak test on anv disturbed ioints.
18. Carrv out a functional check.
19. Check compressor oil level.
20. Disconnect the gauge set.



RR2940M

HEATER AND AIR CONDITIONING - circuit diagram - 1991 model year

1. Diode pack.
2. Resistors.
3. Fan speed switch.
4. Air conditioning/re-circ/fresh air switch.
5. Heater/air conditioning relay.
6. Cable connection to ECU (EFI).
7. Fuse C9 - main fuse panel.
8. Face vent switch.
9. Condenser fan relay.
10. Two level resistor.
11. Compressor clutch relay.
12. Thermostat.
12a. Temperature control potentiometer.
12b. Evaporator temperature sensor.
13. Fuse B7.
14. Fuse B8.
15. Fuse B9.
16. Compressor clutch.
17. Air conditioning motors (2) - dashboard unit.
18. Heater motor.
19. Fresh air solenoid.
20. Condensor fan motors.
21. High pressure switch.
22. Low pressure switch.
23. Engine coolant temperature switch.
24. 12V from terminal post.
25. Heater/air con load relay.
26. 12V from ignition load relay.

NOTE: See EFI circuit diagram for details of air conditioning inputs to ECU.

Cable colour code

B	Black	L	Light	P	Purple	U	Blue
G	Green	N	Brown	R	Red	W	White
K	Pink	O	Orange	S	Grey	Y	Yellow

The last letter of a colour code denotes the tracer

AIR CONDITIONING-A.R.A. SYSTEM

Description

The A.R.A. air conditioning system comprises four major units:

1. An engine-mounted compressor.
2. A condenser mounted in front of the radiator.
3. A receiver/drier unit located in the engine compartment.
4. An evaporator unit mounted behind the dashboard.

The four units are interconnected by hoses carrying refrigerant, and the evaporator is linked into the vehicle ventilation system.

WARNING: Under no circumstances should refrigerant hoses be disconnected without first discharging the system

Refrigeration cycle

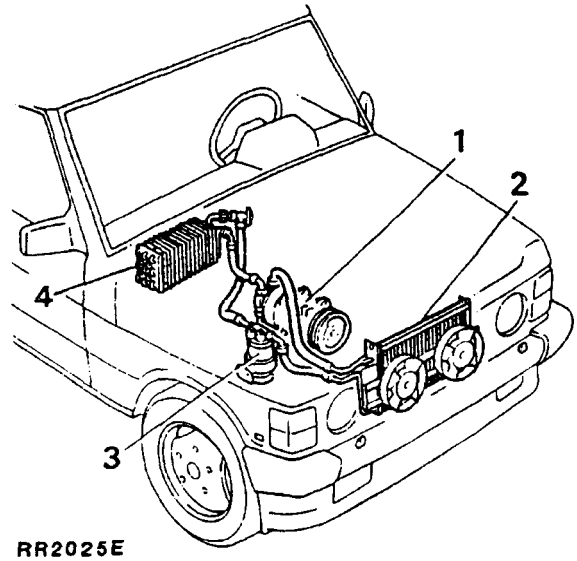
The function of the refrigeration circuit is to cool the evaporator.

1. Compressor

The compressor draws vaporized refrigerant from the evaporator. It is compressed, and thus heated, and passed on to the condenser as a hot, high pressure vapour.

2. Condenser

The condenser is mounted directly in front of the vehicle radiator. It consists of a refrigerant coil mounted in a series of thin cooling fins to provide the maximum heat transfer in a minimum amount of space. Airflow across condenser is induced by vehicle movement and is assisted by two electric condenser fans. The refrigerant enters the inlet at the top of the condenser as a heat laden high pressure vapour.



RR2025E

As this vapour passes down through the condenser coils, heat will follow its natural tendency and flow from the hot refrigerant vapour into the cooler air flowing across the condenser coils and fins.
When the refrigerant vapour reaches the temperature and pressure that will induce a change of state, a large quantity of latent heat will be transferred to the outside air. The refrigerant will change from a high pressure HOT VAPOUR to a high pressure WARM LIQUID.

3. Receiver drier

This unit filters, removes moisture, and acts as a reservoir for the liquid. To prevent icing inside the system, extreme precautions are taken during servicing to exclude moisture. The receiver drier should be considered as a second stage insurance to prevent the serious consequences of ice obstructing the flow.

NOTE: A sight glass provided in the unit top enables a visual check to be made of the high pressure liquid flow.

4. Expansion valve and evaporator

High pressure liquid refrigerant is delivered to the expansion valve. A severe pressure drop occurs across the valve and as the refrigerant enters the evaporator space at a temperature of approximately −6°C(21°F) it boils and vaporizes. As this change of state occurs, a large amount of latent heat is absorbed. The evaporator is therefore cooled and as a result heat is extracted from the air flowing across the evaporator. The air flow is controlled by two evaporator fans regulated by the air conditioner fan control.

Second cycle

Low pressure vaporized refrigerant is drawn from the evaporator by the compressor and a second cyclecommences.

GENERAL SERVICE INFORMATION

Intrnduction

Before any component of the air conditioning system is removed, the system must be discharged. When the component is replaced, the system must be evacuated to remove all traces of old refrigerant and moisture. The system must then be recharged with new refrigerant.

Any service operation that requires the loosening of a refrigerant line connection should be performed only by qualified service personnel. Refrigerant and/or oil will escape whenever a hose is disconnected.

All work involving the handling of refrigerant requires special equipment, a knowledge of its proper use and attention to safety measures.

Servicing equipment

The following equipment is required for full servicing of the air conditioning system.

Charging station
Leak detector
Safety goggles
Refrigerant charging line seals
Thermometer + 20°C to -60°C (+ 68°F to -76°F)
Compressor dipstick

SERVICING MATERIALS

Refrigerant: Refrigerant 12, which includes Freon 12 or Arcton 12.

CAUTION: Methychloride refrigerants must not be used.

Nominal charge weight:
1.19 kg (42 oz).
Compressor oil: See Recommended Lubricants.

PRECAUTIONS IN HANDLING REFRIGERANT

Refrigerant 12 is transparent and colourless in both the gaseous and liquid state. It has a boiling point of −29.8°C (−21.7°F) at atmospheric pressure and at all normal pressures and temperatures it becomes a vapour. The vapour is heavier than air, non-flammable, and non-explosive. It is non-poisonous except when in contact with an open flame, and non-corrosive until it comes in contact with water.

FIRST AID: If refrigerant should contact the eyes or skin, splash the eyes or affected area with cold water for several minutes. Do not rub. As soon as possible thereafter, obtain treatment from a doctor or eye specialist.

The following precautions in handling Refrigerant 12 should be observed at all times.

DO NOT:

- Leave refrigerant container open to atmosphere.
- Carry refrigerant container inside a vehicle.
- Subject refrigerant containers to high temperature.
- Weld or steam clean near an air conditioning system.
- Expose eyes to liquid refrigerant, ALWAYS wear goggles.
- Discharge refrigerant vapour into an area with an exposed flame or into an engine intake. Heavy concentrations of refrigerant in contact with naked flame produce a toxic gas, phosgene.
- Allow liquid refrigerant to contact bright metal, it will tarnish metal and chrome surfaces, and combined with moisture can seriously corrode all metal surfaces.

PRECAUTIONS IN HANDLING REFRIGERANT LINES

WARNING: Always wear satety goggles when opening refrigerant connections.

(a) When disconnecting any hose or flexible connection the system must be discharged of all pressure. Proceed cautiously, regardless of gauge readings. Open connections slowly, keeping hands and face well clear, so that no injury occurs if there is liquid in the line. If pressure is noticed, allow it to bleed off slowly.

(b) Lines, flexible end connections and components must be capped immediately they are opened to prevent the entrance of moisture and dirt.

(c) Any dirt or grease on fittings must be wiped off with a clean alcohol dampened cloth. Do not use chlorinated solvents such as trichloroethylene. If dirt, grease or moisture cannot be removed from inside the hoses, they must be replaced with new hoses.

(d) All replacement components and flexible end connections must be sealed, and only opened immediately prior to making the connection.

(e) Ensure the components are at room temperature before uncapping, to prevent condensation of moisture from the air that enters.

(f) Components must not remain uncapped for longer than fifteen minutes. In the event of delay, the caps must be fitted.

(g) Receiver/driers must never be left uncapped as they contain Silica Gel crystals which will absorb moisture from the atmosphere. A receiver/ drier left uncapped must not be used, fit a new unit.

(h) The compressor shaft must not be rotated until the system is entirely assembled and contains a charge of refrigerant.

(j) A new compressor contains an initial charge of 135 ml (4.6 fluid oz) of oil when received, part of which is distributed throughout the system when it has been run. The compressor contains a holding charge of gas when received which should be retained until the hoses are connected.

(k) The receiver/drier should be the last component connected to the system to ensure optimum dehydration and maximum moisture protection of the system.

(l) All precautions must be taken to prevent damage to fittings and connections. Slight damage could cause a leak with the high pressures used in the system.

(m) Always use two wrenches of the correct size, *one* on each fitting when releasing and tightening refrigeration unions.

(n) Joints and 'O' rings should be coated with refrigeration oil to aid correct seating. Fittings which are not lubricated with refrigerant oil are almost certain to leak.

(o) All lines must be free of kinks. The efficiency of the system is reduced by a single kink or restriction.

(p) Flexible hoses should not be bent to a radius less than ten times the diameter of the hoses.

(q) Flexible connections should not be within 50mm (2 in) of the exhaust manifold.

(r) Completed assemblies must be checked for refrigeration lines touching metal panels. Any direct contact of lines and panels transmits noise and must be eliminated.

PERIODIC MAINTENANCE

Routine servicing apart from visual checks is not necessary. The visual inspections are as follows:

Condenser

With a garden hose or air line, clean the fins of the condenser to remove flies, leaves, etc. Check the hose connection for signs of oil leakage.

Compressor

Check hose connections for signs of oil leakage. Check flexible hoses for swelling. Examine the compressor belt for tightness and condition. Checking the compressor oil level and topping-up is only necessary after charging the system or in the event of a malfunction of the system.

Receiver/Drier

Examine the sight glass for bubbles with the system operating. Check connections for leakage.

Evaporator

Examine the refrigeration connections at the unit. If the system should develop a fault, or if erratic operation is noticed, refer to the fault diagnosis chart.

SERVICE VALVES

These are secured to the head of the compressor, and the suction and discharge flexible end connections are secured to them by unions.

The service valves are identified as suction or low pressure, and discharge or high pressure. Whilst they are identical in operation they are not interchangeable, as the connections are of different sizes.

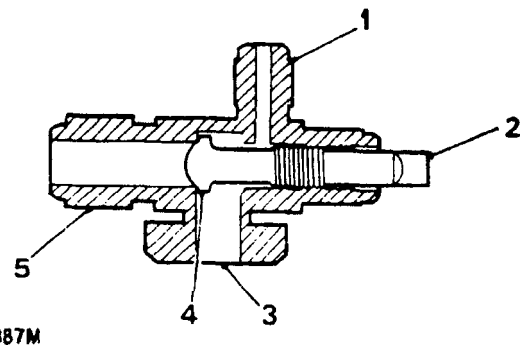
The valve with the larger connections fits the suction side. As the name suggests, these valves are for service purposes, providing connections to external pressure/vacuum gauges for test purposes. In combination with charging and testing equipment they are used to charge the system with refrigerant.

There are two types of service valves in operation: 'Stem' and 'Schrader'.

Stem type

Stem type service valves allow for the isolation of the compressor from other parts of the system. When these valves are used in conjunction with the liquid line quick-disconnect fittings, the three major assemblies of the system can be removed from the vehicle with a minimal loss of refrigerant. In addition, it is possible to remove major assemblies for repair of components which are not part of the refrigeration system, or provide access to parts of the vehicle which are obstructed by the air conditioning system, without fully discharging the system.

NOTE: A thorough understanding of the stem type service valve is necessary before undertaking servicing or repair involving the air conditioning system.



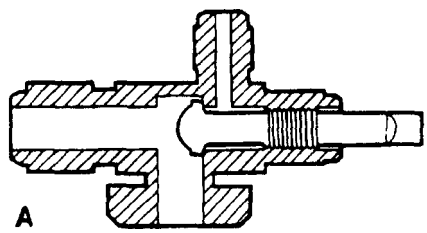
ST1387M

Stem type service valve

1. Service port.
2. Valve stem
3. Compressor port.
4. Valve seat.
5. Hose connector.

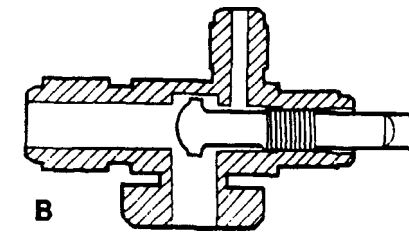
NOTE: A special wrench should be used to adjust the valve to prevent damage to the stem.

The stem type service valve has three positions, the operation of which is explained as follows:



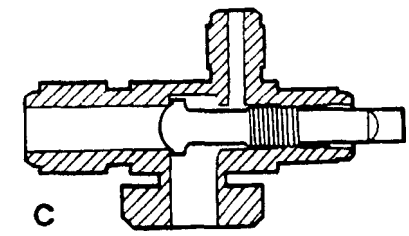
RR1734M

A. ON: FULLY COUNTER-CLOCKWISE- Normal operating position, and the position which is used for connecting and disconnecting the manifold gauge set, is the 'on' position. The stem is turned fully counter-clockwise. This seals the service gauge port from receiving any refrigerant flow.



RR1735M

B. MID (Test) POSITION-After the service gauge manifold has been installed (the valve stem is in the on position), turn the valve stem the required number of turns clockwise. This will put the valve stem seat midway in the service valve and allow full system operation while permitting refrigerant pressure to reach the gauges.

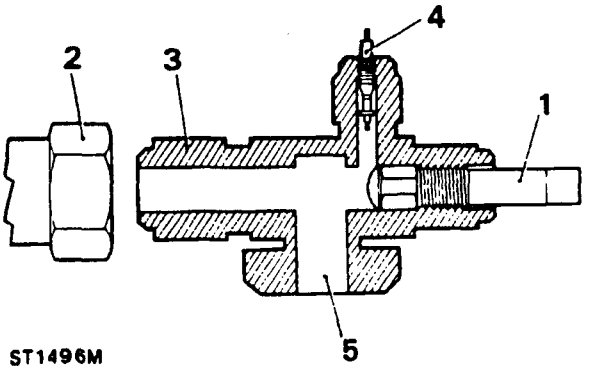


RR1736M

C. OFF: FULLY CLOCKWISE-With the service valve stem turned fully clockwise, the valve will block passage of refrigerant flow through the system. As illustrated, the refrigerant flow to or from the compressor (depending on whether it is high side or low side) is blocked.

WARNING: NEVER operate the air conditioning system with the service valves in the OFF POSITION, it will cause severe damage to the compressor.

Schrader type



Schrader service valve

1. Valve stem.
2. Hose connection.
3. Service valve.
4. Schrader valve core.
5. Compressor port.

NOTE: A special wrench should be used to adjust the valve to prevent damage to the stem.

The Schrader type service valve has two positions, the operation of which is explained as follows:

A. ON: FULLY COUNTER-CLOCKWISE- Normal operating position, and the position which is used for connecting and disconnecting the manifold gauge set, is the 'on' position. The stem is turned fully counter-clockwise. This seals the service gauge port from receiving any refrigerant flow.

B. OFF: FULLY CLOCKWISE- With the service valve stem turned fully clockwise, the valve will block passage of refrigerant flow through the system. The refrigerant flow to or from the compressor (depending on whether it is high side or low side) is blocked.

WARNING: NEVER operate the air conditioning system with the service valves in the OFF POSITION, it will cause severe damage to the compressor.

Service valve caps must be replaced when service operations are completed. Failure to replace caps could result in refrigerant loss and system failure.

ELECTRICAL SUPPLY SWITCHES AND FUSES

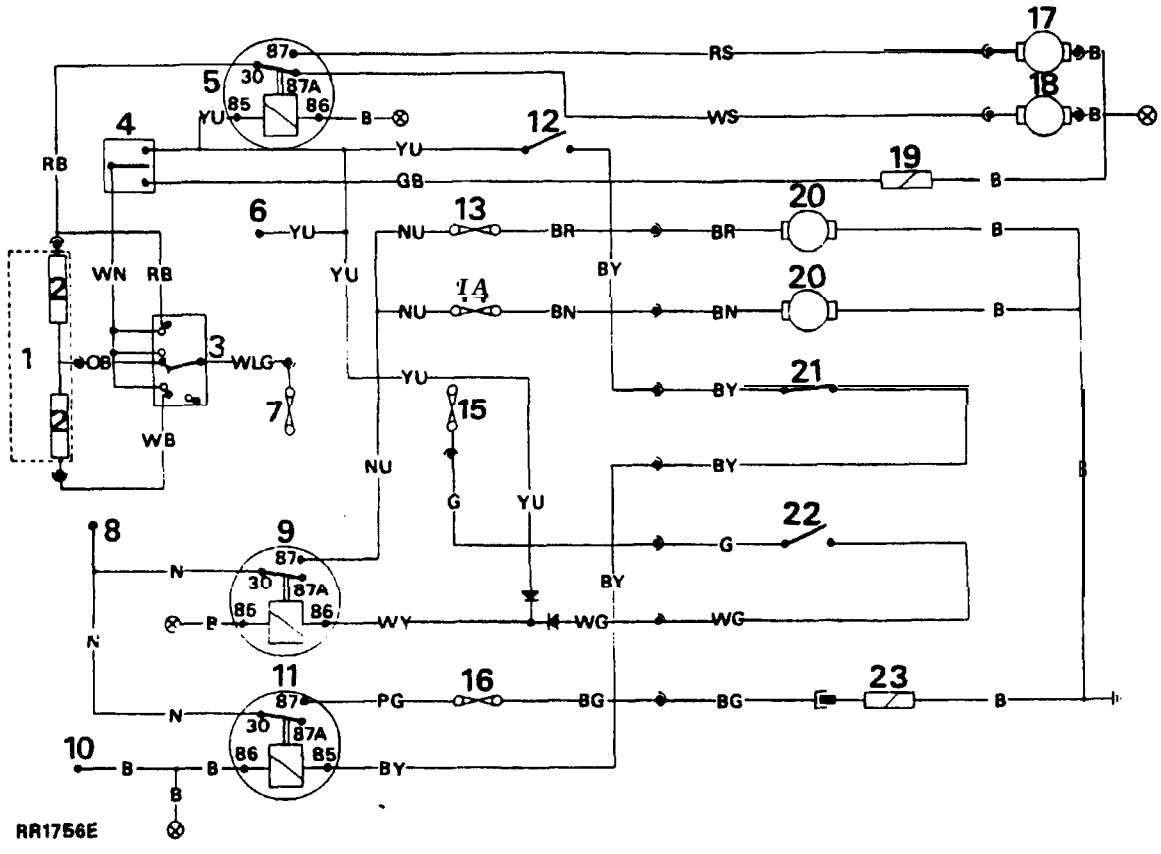
The electrical components of the air conditioning system draw current from three separate relays mounted in the engine compartment closure panel. The air conditioning system is mastered from the starter relay and is switched OFF during engine cranking.

Each component in turn is energised and controlled by a series of relays and switches as indicated by the circuit diagram.

Both condenser fans operate together when the air conditioning circuit is switched ON, and when the ignition is switched ON and the coolant temperature is high, this is sensed by the engine water temperature sensor.

The three blade type fuses are located in the fuse box mounted on the lower fascia panel. They are numbered A1 to A3. It is essential to use a fuse of the same value when fitting a replacement. See Electrical Section 86 for relay and fuse details

Continued



HEATER AND AIR CONDITIONING- circuit diagram

1. Heater unit.
2. Resistors.
3. Fan speed switch
4. Air conditioning/re-circulating/fresh air-switch.
5. Air conditioning/heater relay.
6. Cable connection to ECU.
7. Fuse 8-main fuse panel.
8. Pick up point main cable connection.
9. Fan relay.
10. Ground-via main cable.
11. Compressor clutch relay.
12. Thermostat.
13. Fuse Al-auxiliary fuse panel.
14. Fuse AZ-auxiliary fuse panel.
15. Fuse 13-main fuse panel.
16. Fuse A3-auxiliary fuse panel.
17. Air conditioning motor - dashboard unit.
18. Heater motor.
19. Heater recirculating solenoid.
20. Condenser fan motors.
21. High pressure switch.
22. Engine water temperature sensor.
23. Compressor clutch.

Cable colour code

B	Black	G	Green	P	Purple	Y	Yellow
U	Blue	S	Grey	R	Red	L	Light
N	Brown	0	Orange	W	White		

The last letter of a colour code denotes the tracer.

AIR CONDITIONING ELECTRICAL/MECHANICAL FAULT DIAGNOSIS

FAULT	CAUSE	REMEDY
A. MOTOR INOPERATIVE OR SLOW RUNNING	1. Incorrect voltage. 2. Open or defective fuse or relay. 3. Loose wire connection including ground. 4. Switch open or defective. 5. Tight, worn, or burnt motor bearings. 6. Open rotor windings. 7. Worn motor brushes. 8. Shaft binding-blade misaligned. 9. Defective resistors.	1. Check voltage. 2. Check and replace as necessary. 3. Check system wires: tighten all connections. 4. Replace switch. 5. Replace motor. 6. Replace motor. 7. Replace motor. 8. Check alignment. Repair or replace as necessary. 9. Rectify or replace.
B. CLUTCH INOPERATIVE	1. Incorrect voltage. 2. Open or defective fuse or relay. 3 Defective thermostat control or pressure switch. 4. Shorted or open field coil. 5. Bearing seized (clutch will not disengage). 6. Refrigeration circuit problem causing heavy load and excessive drive torque.	1. Check voltage. 2. Check and replace as necessary. 3 Replace thermostat or pressure switch. 4. Replace coil. 5. Replace bearing. 6. Check and rectify.
C. CLUTCH NOISY	1. Incorrect alignment. 2. Loose belt. 3. Compressor not mounted securely. 4. Bearing in clutch-pulley assembly not pressed in. 5. Low voltage to clutch. 6. Clutch will not spin freely. 7. Oil on clutch face. 8. Slipping clutch. 9. Overloaded or locked compressor. 10. Icing.	1. Check alignment; repair as necessary. 2. Adjust to proper tension. 3. Repair as necessary. 4. Remove clutch and replace bearing. 5. Check connections and voltage. 6. Refer to B5 above. 7. Check compressor seals for leaks. 8. Refer to C5 above. 9. Repair or replace compressor. 10. Check for suction line frosting. Replace expansion valve if necessary. Replace receiver/drier if necessary.
D. CONDENSER AND/OR EVAPORATOR VIBRATION	1. Motor and/or blades improperly mounted. 2. Foreign matter build-up on blades. 3. Excessive wear of motor bearings.	1. Check mountings, adjust as necessary. 2. Clean blades with a suitable non-inflammable cleaner. 3. Replace motor.

Refrigeration system fault diagnosis

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.

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 receiveridrier 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. With ambient humidity between 30% and 60%, compressor pressures and evaporator air discharge temperature should fall within the general limits given in the table below.

Type of Weather	Evaporator Air Temp °F (°C)	low Side Pressure p.s.i. (bar)	High Side Pressure p.s.i. (bar)
Cool day 70-80°F (21-27°C)	35-45°F (1.7-7.2°C)	15-20 (1.1-1.4)	160-200 (11.2-14)
Warm day 80-90°F (27-32°C)	40-50°F (4.4-I 0°C)	20-25 (1.4-1.8)	190-240 (13.4-16.9)
Hot day Over 90°F (Over 32°C)	45-60°F (7.2-15.6°C)	25-30 (1.8-2.1)	220-270 (15.5-19)

NOTE:

1. Low and high side pressures are guides not specific limits.
2. Evap. air temperatures will be lower on dry days, higher on humid days.

FAULT	CAUSE	REMEDY
A. HIGH HEAD PRESSURE	1. Overcharge of refrigerant.	1. Purge with bleed hose until bubbles start to appear in sight glass; then, add sufficient refrigerant gas to clear sight glass.
	2. Air in system.	2. Slowly blow charge to shop exhaust system. Install new drier; evacuate and charge system.
	3. Condenser air passage clogged with dirt or other foreign matter.	3. Clean condenser of debris.
	4. Condenser fan motor defective.	4. Replace motor.
B. LOW HEAD PRESSURE	1. Undercharge of refrigerant; evident by bubbles in sight glass while system is operating.	1. Evacuate and recharge the system. Check for leakage.
	2. Split compressor gasket or leaking valves.	2. Replace gasket and/or reed valve; Install new drier, evacuate and charge the system.
	3. Defective compressor.	3. Repair or replace compressor.
C. HIGH SUCTION PRESSURE	1. Loose compressor belt.	1. Adjust belt tension.
	2. Refrigerant flooding through evaporator into suction line; evident by ice on suction line and suction service valve.	2. Check thermobulb. Bulb should be securely clamped to clean horizontal section of copper suction pipe.
	3. Expansion valve stuck open.	3. Replace expansion valve.
	4. Compressor suction valve strainer restricted.	4. Remove and clean or replace strainer.
	5. Leaking compressor valves, valve gaskets and/or service valves.	5. Replace valves and/or gaskets. Install new drier evacuate and charge the system.
	6. Receiver/drier stopped; evident by temperature difference between input and output lines.	6. Install new drier, evacuate and charge the system.
D. LOW SUCTION	1. Expansion valve thermobulb not operating.	1. Warm thermobulb with hand. Suction should rise rapidly to 20 lb or more. If not replace expansion valve.
	2. Expansion valve sticking closed.	2. Check inlet side screen. Clean if clogged. Refer To C-2 and C-3.
	3. Moisture freezing in expansion valve orifice. Valve outlet tube will frost while inlet hose tube will have little or no frost. System operates periodically.	3. Install new drier, evacuate and charge the system.
	4. Dust, paper scraps, or other debris restricting evaporator blower grille	4. Clean grilles as required.
	5. Defective evaporator blower motor, wiring, or blower switch.	5. Refer to Fault Diagnosis Chart for blower motor.

FAULT	CAUSE	REMEDY
NOISY EXPANSION VALVE steady hissing)	1. Low refrigerant charge; evident by bubbles in sight glass.	1. Leak test. Repair or replace components as required.
INSUFFICIENT COOLING	1. Expansion valve not operating properly. 2. Low refrigerant charge-evident by bubbles in sight glass. 3. Compressor not pumping.	1. Refer to C-2, C-3, D-l and E. 2. Refer to B-l and E. 3. Refer to B-2 and B-3
c. COMPRESSOR BELT SLIPPING	1. Belt tension. 2. Excessive head pressure. 3. Incorrect alignment of pulleys or worn belt not riding properly. 4. Nicked or broken pulley. 5. Seized compressor.	1. Adjust belt tension. 2. Refer to A-l through A-4 and C-6. 3. Repair as needed. 4. Replace as needed. 5. Replace compressor.
H. ENGINE NOISE AND/OR VIBRATION	1. Loose or-missing mounting bolts. 2. Broken mounting bracket. 3. Loose flywheel or clutch retaining bolt. 4. Rough idler pulley bearing. 5. Bent, loose, or improperly mounted engine drive pulley. 6. Defective compressor bearing. 7. Insecure mountings of accessories; generator, power steering, air filter, etc. 8. Excessive head pressure. 9. Incorrect compressor oil level.	1. Repair as necessary. 2. Replace bracket. 3. Repair as necessary. 4. Replace bearing. 5. Repair as necessary. 6. Replace bearing. 7. Repair as necessary. 8. Refer to A-l, A-2, A-3 A-4 and C-6. 9. Refer to compressor Oil Level Check.

CHARGING AND TESTING EQUIPMENT

This is standard equipment for the servicing of automotive air conditioning systems, and is used for all testing, trouble shooting, evacuating and charging operations.
Various designs of charging and testing equipment are available depending upon the manufacturer chosen by the user. As slight variations do occur it is recommended that the operator adheres to the appropriate manufacturers' instructions for the equipment in use.

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 when opening reirigerant connections.

Connecting

1. Check that both service valves are fully open (turned counter-clockwise).
2. Wearing safety goggles remove the dust caps from the gauge connections on the service ports.
3. Coat the threads and flares with compressor oil.
4. Connect the charging and testing equipment referring to the equipment manufacturer's instructions.

Removing

5. If the engine has been operated it must be stopped prior to disconnecting the equipment.
6. Close both the service ports by turning fully counter-clockwise.
7. Disconnect the charging lines from the service ports.
8. Refit the dust caps to the compressor valve stems and service ports, and to the charging lines.

AIR CONDITIONING SYSTEM

Discharging the system

NOTE: The air conditioning refrigeration system contains 'Refrigerant 12' under pressure, and before any component is disconnected or removed, the system must be discharged of all pressure.
Refrigerant 12 evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. Extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes. Should any liquid refrigerant get into the eyes, use a few drops of sterile mineral oil to wash them out and then wash the eyes with a weak solution of boric acid. Seek medical attention immediately even though the initial irritation has ceased after first-aid treatment. Always wear safety goggles when opening refrigerant connections.

WARNING: Open connections slowly, keeping the hands and face well clear, so that no injury occurs if there is liquid in the line. If pressure is noticed allow it to bleed off slowly.

Discharging

1. Connect the manifold gauge set according to the manufacturer's instructions.
2. Run the yellow, centre hose to an open-topped container of approximately one litre capacity. Attach the hose to the container so that it will not blow out of the container. The purpose of the container is to collect any oil carried by the refrigerant.
3. Slowly open the high side valve until the refrigerant flow stops, then open the low side valve to remove any residual pressure.
4. When discharging adjust the refrigerant flow to ensure that oil is not blown out of the container.
5. Measure the amount of oil discharged from the system. Add an equal amount of new oil to the system during the charging operation. Discard the old oil.

Continued

NOTE: If it is necessary to disconnect the compressor hoses, the compressor should be sealed by fully closing the relevant service valve (turn fully clockwise). It is essential to ensure that both service valves are open before operating the compressor. Similarly any other component of the refrigeration system should be capped immediately when disconnected.

Evacuate

Whenever the system has been opened to the atmosphere it is necessary that the system be evacuated to remove all air and moisture. It is also an essential preliminary operation to charging the system with Refrigerant 12. The evacuate operation also provides a check for leaks due to faulty connections.

Evacuating

1. Discharge the system as previously described and connect the charging and testing equipment referring to the manufacturer's instructions.
2. Slowly open the vacuum control valve. If the vacuum is applied to the system too quickly, the residual oil may be drawn out.
3. In evacuating the system it is necessary to lower the pressure so that the boiling point of water in the system is lower than the surrounding air temperature. At an ambient temperature of 23.8°C (75°F), it is necessary to lower the system pressure to 29.5 in Hg vacuum to bring the boiling point of water to 22°C (72°F). Atmospheric pressure (and vacuum gauge readings) decrease as altitude increases by approximately 25mm (1 in) Hg per 300m (1000 ft). The following chart provides a guide to the various gauge readings at differing altitudes, for the same 10mm (0.4 in) Hg absolute pressure.

Altitude ft	Vacuum Reading in Hg
0	29.5
1,000	28.5
2,000	27.4
3,000	26.4
4,000	25.4
5,000	24.5
6,000	23.5
7,000	22.6
8.000	21.8
9,000	20.9
10,000	20.1

4. The low side gauge should indicate a vacuum of 660mm (26 in) Hg within five minutes.
5. If 660mm (26 in) Hg of vacuum is not achieved within five minutes, it signifies either the system has a leak or the vacuum pump is defective. Initially check the vacuum pump. if the pump proves to be functioning properly then investigate for a leak in the air conditioning system.
6. Continue evacuating for 30 minutes to ensure the removal of all moisture.
7. Stop the vacuum pump and allow the vacuum to hold for fifteen minutes, then check that there is no pressure rise (a loss of vacuum) evident on the compound gauge. Any pressure rise denotes a leak which must be rectified before proceeding further. Moisture remaining in the system will continue to boil and cause loss of vacuum. Refer to the heading titled 'Leak Detection' later in this section. With the system satisfactorily evacuated, the system is ready for charging with refrigerant.

Quick flushing

NOTE: This operation is in addition to evacuating, and is to remove moisture from systems that have been open to atmosphere for a long period, or that are known to contain excessive moisture.

1. Fit a new liquid receiver/drier, as detailed under the heading 'Receiver/Drier'.

2. Connect the charging and testing equipment and follow the equipment manufacturer's instructions for quick flushing.
3. Evacuate the system.
4. Allow a charge of refrigerant of between 0.25 and 0.45 (0.5 to 1 lb) to enter the system.
5. Allow the refrigerant introduced into the sytem to remain for ten minutes.
6. Reconnect the charging and testing equipment following the equipment manufacturer's instructions for evacuating. Evacuate the system.
7. Maintain the vacuum for twenty minutes. The air conditioning system is now ready for charging with refrigerant.

Charge

CAUTION: Do not charge liquid refrigerant into the compressor. Liquid cannot be compressed; and if liquid refrigerant enters the compressor inlet valve, severe damage is possible; in addition, the nil charge mav be absorbed into the reirigerant, causing damage when the compressor is operated.

Charging

1. Ensure that the air conditioning system is evacuated as previously described.
2. Follow the equipment manufacturer% instructions for charging the system with refrigerant.
3. Ensure that the full charge of refrigerant - LHD 1.08 kg (38 oz) is drawn into the system.
4. After completing the procedure check the air conditioning system is operating satisfactorily by carrying out a pressure test, as described in this section.

CAUTION: Do not overcharge the air conditioning system as this will cause excessive head pressure.

Leak test

The following instructions refer to an electronic type refrigerant leak detector which is the safest, most sensitive and widely used.

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. Certain detectors have visual and audible indicators.
3. Commence searching for leaks by passing the detector probe around all joints and components, particularly on the underside, as the 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 hose connections.
8. If any leaks are found, the system must be discharged before attempting rectification. If repairs by brazing are necessary, the component must be removed from the vehicle and all traces of refrigerant expelled before heat is applied.
9. After repairs check the system for leaks and evacuate prior to charging.

Pressure test

1. Fit the charging and test equipment as previously described.
2. Start the engine.
3. Run the engine at 1,000 to 1,200 rev/min with the heat control set to cold (blue) zone. Cut off the air supply to the dash vents using the left hand lever. Move the slider levers to air conditioning 'ON' and fan speed to maximum.
4. Note the ambient air temperature in the immediate test area in front of the vehicle, and check the high pressure gauge readings -discharge side-against Table 1.

The pressure gauge readings will vary within the range quoted with the rate of flow of air over the condenser, the higher readings resulting from a low air flow. It is recommended that a fan is used for additional air flow over the condenser if the system is to be operated for a long time. Always use a fan if temperatures are over 26.7°C (80°F), so that a consistent analysis can be made of readings.

5. If the pressure readings are outside the limits quoted, refer to the fault diagnosis chart at the beginning of this section.
6. Stop the engine.
7. Close both service ports (turn fully counter-clockwise) and close all valves on the charging and test equipment. Disconnect the charging lines from the compressor. Refit the dust caps to the compressor valve stems, port connections and charging lines.
8. Close the hood.

Table 1

Ambient Temperature		Compound Gauge Readings		High Pressure Gauge Readings	
°C	°F	bar	p.s.i.	bar	p.s.i.
16	60	1,03-1,4	15-20	6,9-10,3	100-I 50
26,7	80	1,4-1,72	20-25	9,6-13,1	140.190
38	100	1,72-2,1	25-30	12,4-15,5	180-225
43,5	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 londitioner 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 condensate drains are 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 Retrigerant 12 and is deposited when the refrigerant evaporates from a leak.

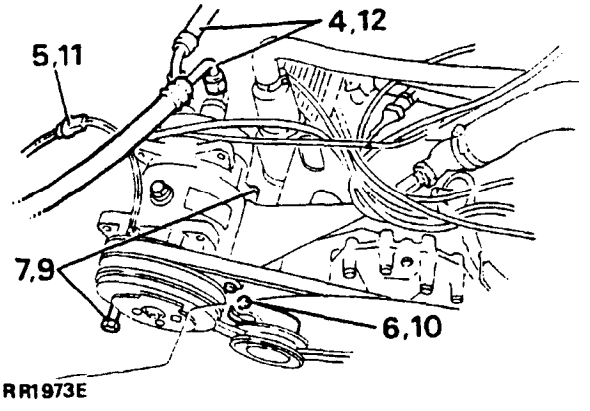
7. Start the engine.
8. Set the temperature control switch to maximum cooling and switch the air conditioner blower control on and off several times, checking that the magnetic clutch on the compressor engages and releases each time.
9. With the temperature control at maximum cooling and the blower control at high speed, warm up the engine and fast idle at 1,000 rev/min. Check the sight glass for bubbles or foam. The sight glass should be generally clear after five minutes running, occasional bubbles being acceptable. Continuous bubbles may appear in a serviceable system on a cool day, or if there is insufficient air flow over the condenser at a high ambient temperature.
10. Repeat at 1,800 rev/min.
11. Gradually increase the engine speed to the high range, and check the sight glass at Intervals.
13. Check for frosting on the service valves and evaporator fins.
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 satistactory, proceed with the pressure test as previously described in this section.

COMPRESSOR

Remove and refit

Removing

1. Place the vehicle in a ventilated area away from open flames and heat sources.
2. Stop the engine and secure the hood in an open position. Disconnect the battery negative lead.
3. Discharge the air conditioning system.
4. Using goggles to protect the eyes, and wearing gloves, disconnect the suction and discharge unions from the back of the compressor. Cap the flexible end connections and service valves immediately.
5. Disconnect the lead to the compressor magnetic clutch at the connector.
6. Loosen the idler pulley securing bolt and release the driving belt.
7. Remove the two compressor mounting bolts and lift compressor clear.



RR1973E

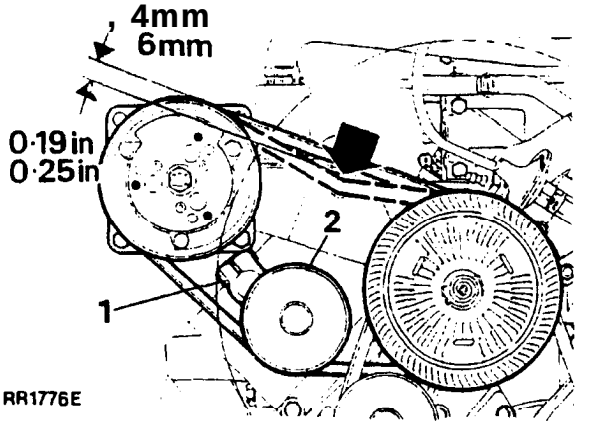
Refitting

8. If a new compressor is being fitted, drain the oil from the new compressor. Drain and measure the oil from the old compressor. Measure new oil equal to the amount drained from the old compressor. Add 30 ml (1 fluid oz) of new oil to this amount and refill the new compressor.
9. Locate the compressor in position, fit and tighten the mounting bolts.
10. Fit the compressor driving belt and adjust as described under 'Compressor drive belt -adjust'.
11. Connect the lead to the compressor magnetic clutch at the connector.
12. Refit the suction and discharge flexible end connectors to the service valves, lubricating the flares and threads of the unions with compressor oil.
13. Evacuate the air conditioning system, maintaining the vacuum for ten minutes.
14. Charge the air conditioning system.

COMPRESSOR DRIVE BELT

Adjust

1. Loosen the idler pulley securing bolt.



RR1776E

2. Adjust the position of the idler pulley until the correct tension is obtained. The belt must be tight with 4 to 6mm (0.19 to 0.25 in) total deflection when checked by hand midway between the pulleys on the longest run.
3. Tighten the securing bolt and recheck the tension.

COMPRESSOR OIL LEVEL

Sanden 510 and 709

The compressor specification was changed. during 1988, to a Sanden 709. The new compressor is identified by the oil filler plug now located on the side of the compressor, and the model label.

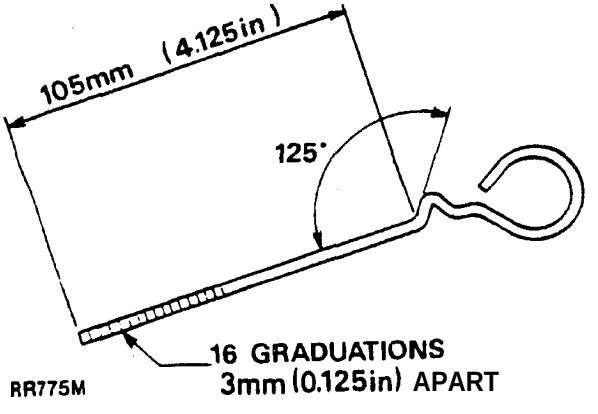
Check

It is not necessary to check the compressor oil level as part of routine mamtenance.

NOTE: The compressor oil level should be checked whenever any components, including the compressor are removed and refitted, or when a pipe or hose has been removed and reconnected or, if a refrigerant leak is suspected.

All compressors are factory charged with 135 ± 15 ml (4.6 ± 0.5 fl oz) of oil. When the air conditioning equipment is operated some of the oil circulates throughout the system with the refrigerant, the amount varying with engine speed. When the system *is* switched off the oil remains in the pipe lines and components, so the level of oil in the compressor is reduced, by approximately 30 ml (1 fl oz).

The compressor oil level must finally be checked after the system has been fully charged with refrigerant and operated to obtain a refrigerated temperature of the car interior. This ensures the correct oil balance throughout the system.
The compressor is not fitted with an oil level dipstick, and a suitable dipstick must be made locally from 3mm (0.125 in) diameter soft wire in accordance with the accompanying illustration. After shaping, mark the end of the dipstick with sixteen graduations 3mm (0.125 in) apart.

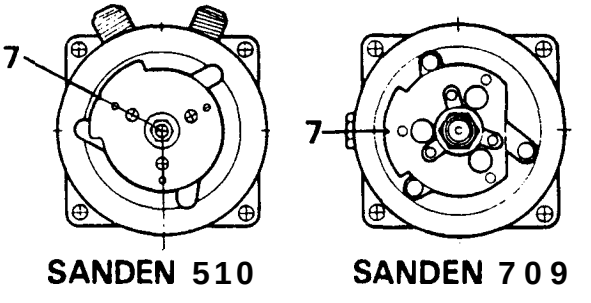


Procedure

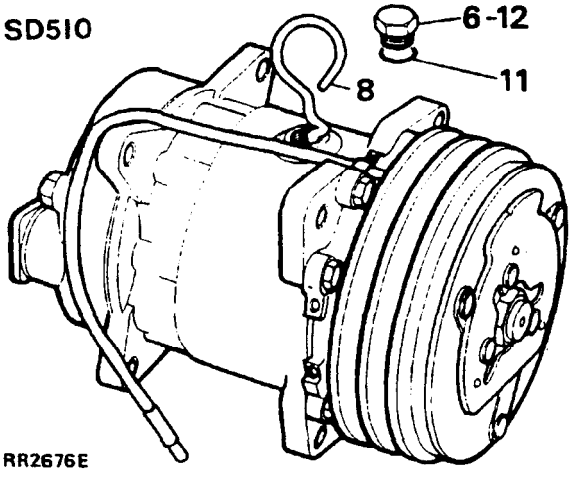
1. Open the hood.
2. Fit the charging and testing equipment.
3. Start the engine and turn the temperature control to maximum cooling position, and the air flow control to HIGH speed. Operate the system for ten minutes at engine idle speed.

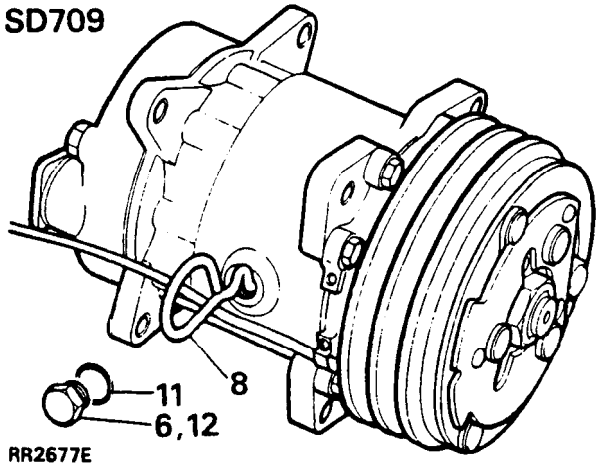
   NOTE: It is important to open the valve slowly during the following item to avoid a sudden pressure reduction in the compressor crankcase that could cause a large amount of oil to leave the compressor. Refer also to SERVICE VALVES.

4. Reduce the engine speed to idling, and SLOWLY open the suction side valve on the test equipment until the compound gauge reads 0 or a little below.
5. Stop the engine at this point and quickly open the suction valve and discharge valve.
6. Loosen the oil filler plug and unscrew it slowly by five turns to bleed off crankcase pressure.

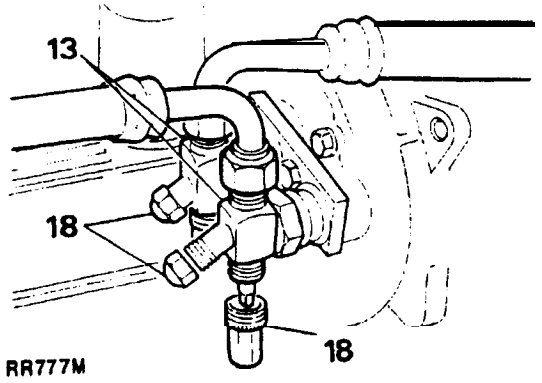


7. Remove the oil filler plug. Align the counterweight to the position shown to enable the dipstick to be inserted to its full length.
8. Wipe the dipstick and insert to its stop position, ensuring the angle of the dipstick is flush with the surface of the filler orifice.





9. Withdraw the dipstick and count the number of graduations to determine the depth of oil.
10. Oil level - SD 510: two to four graduations. SD 709: fifteen to sixteen graduations. Add or remove oil as necessary until the mid-range figure is obtained. It is recommended that a syringe is used for adding or removing oil. Use only the correct compressor oil - see Recommended Lubricants, section 09.
11. Lubricate a new 'O' ring with compressor oil, fit it over the threads of the level plug without twisting, and install the level plug loosely.
12. Evacuate the air from the compressor using the vacuum pump on the charging and testing equipment, following the equipment manufacturer's instructions. Tighten the filler plug to the correct torque, see Torque Values.
13. Close fully the suction and discharge valves.



14. Start and run the engine at 1,200 rev/min and check for leak at the compressor level plug. Do not overtighten to correct a leak. In the event of a leak isolate the compressor as previously described in items 4 to 6, and check the 'O' ring seats for dirt, etc.
15. Stop the engine.
16. Close all valves on the charging and testing equipment.
17. Disconnect the charging lines from the compressor.
18. Refit the dust caps to the compressor valve stems and gauge connections, and to the charging lines.
19. Close the hood.

CONDENSER

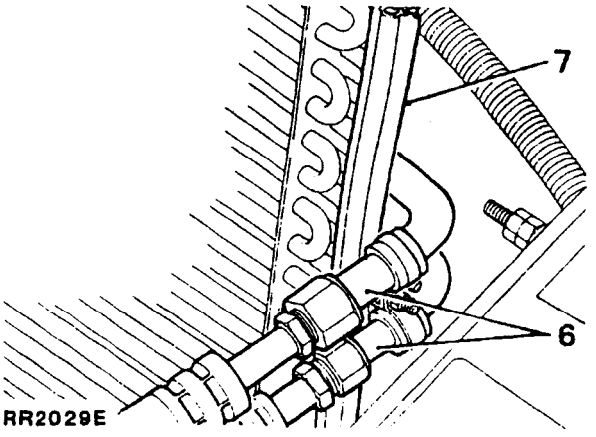
Remove and refit

Removing

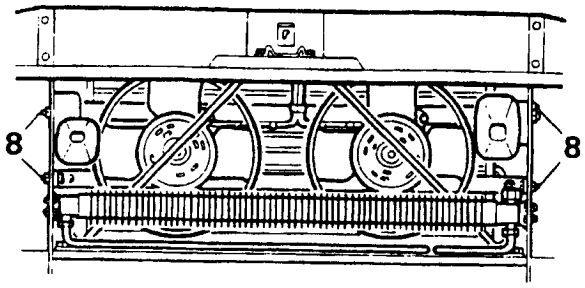
1. Open the hood and disconnect the battery negative lead.
2. Discharge the arr conditioning system.
3. Remove the front grille panel
4. Remove the radiator.
5. Disconnect the two fan motor wiring connections.

CAUTION: Before carrying out instruction 6 protect the eyes with safety goggles and wear protective gloves.

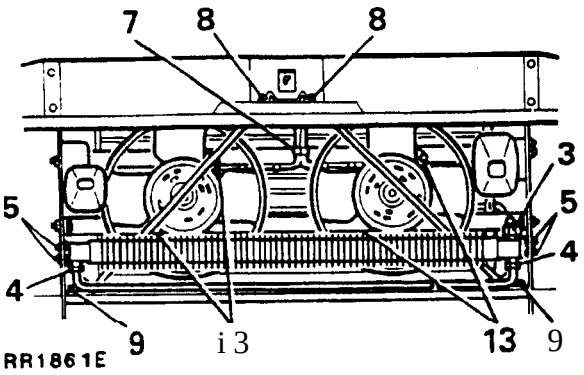
6. Using two wrenches on each fitting, carefully disconnect the hoses at the condenser end. Plug the exposed ends of the hoses.



7. Remove the vertical radiator seal from each side.
8. Remove four bolts securing the condenser and remove condenser complete with fan motor assemblies.



RR1859E



RR1861E

Refitting

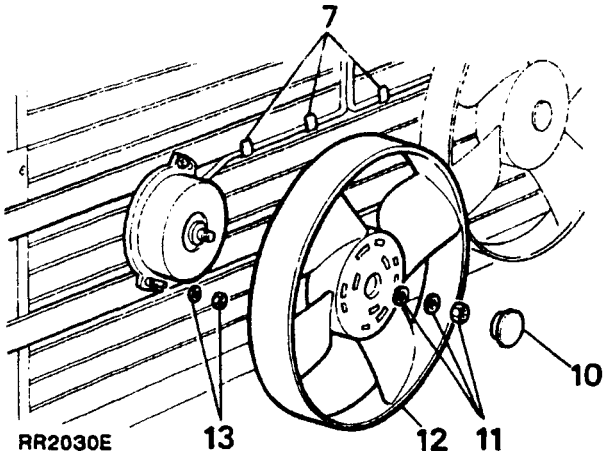
9. Reverse instructions 3 to 8 above.
10. Add 30 ml (1 fl oz) of the correct oil to the compressor to compensate for oil loss if a new condenser is to be fitted.
11. Evacuate the air conditioning system.
12. Charge the system.
13. Carry out a leak test on the disturbed joints
14. Check the air conditioning operation by carrying out a System Test.

CONDENSER FANS AND MOTORS

Remove and refit

Removing

1. Open the hood and disconnect the battery negative lead.
2. Remove the grille panel.
3. Disconnect the wiring connectors to the transmission oil cooler.
4. Loosen the fittings and detach the oil cooler hoses.
5. Remove two mounting bolts from each side and withdraw the transmission oil cooler.
6. Disconnect the two fan motor wiring connectors.
7. Release the wiring securing clips.
8. Loosen the two upper bolts securing the left and right hand hood striker support stays.
9. Remove the bolts securing the lower ends of the stays and pivot both stays forward.
10. Remove the dust caps from the fan centres.



RR2030E

11. Remove the securing nut and washers.
12. Withdraw the fan blade from the motor shaft.
13. Remove the two nuts and washers securing each motor and withdraw the fan motor assemblies from the vehicle.

Refitting

14. Reverse 1 to 13 above, ensuring that the wiring is correctly clipped and no fouling of the fan blades occurs.
15. Check automatic transmission fluid level and refill if necessary.

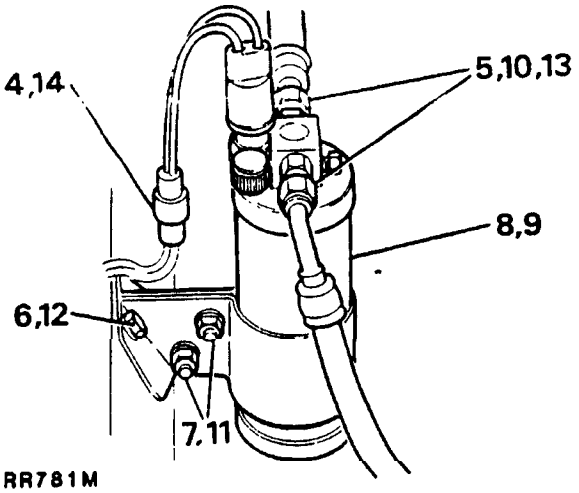
RECEIVER DRIER

Remove and refit

CAUTION: Immediate plugging of the receiver drier is important. Exposed life of the unit is only 15 minutes.

Removing

1. Disconnect the batter)) negative lead.
2. Connect the gauge set and discharge the complete system..
3. Protect the eyes with safety goggles and wear gloves during operations 4 and 5.
4. Disconnect the electrical lead at the connector and carefully unscrew the high pressure switch from the receiver drier. Cover the exposed connections immediately.



RR781M

5. Carefully disconnect the two hose connections. Use a second wrench to support the hose adaptor. Plug the exposed connections immediately.
6. Remove one bolt, nut and washers securing the mounting bracket to the fender valance.
7. Remove the clamp bolts, washers and nuts.
8. Withdraw the receiver drier from the mounting bracket.

Refitting

9. Insert the receiver drier into the mounting bracket with the inlet and outlet connections correct to the refrigerant circuit as shown.
10. Connect the two hose connections finger tight. Use refrigerant compressor oil on all mating surfaces to assist leakage prevention.
11. Fit the clamp bolts, washers and nuts.
12. Secure the mounting bracket to the fender valance.
13. Tighten the two hose connections to the correct torque. see Torque Values. Use a second wrench to support the hose adaptor.
14. Carefully refit the high pressure switch to the receiver drier. Use refrigerant compressor oil on all mating surfaces to assist leakage prevention and tighten the switch to the correct torque, see Torque Values. Reconnect the electrical lead.
15. To compensate for oil loss, add 15 ml (1/2 fl oz) of the correct oil to the compressor.
16. Evacuate the complete system.
17. Charge the complete system.
18. Perform a leak test on any disturbed joints.
19. Carry out a functional check.
20. Disconnect the gauge set.

DASHBOARD UNIT-ARA

EVAPORATOR

Remove and refit

Expansion valve
Remove and refit 1 to 22 and 32 to 53.

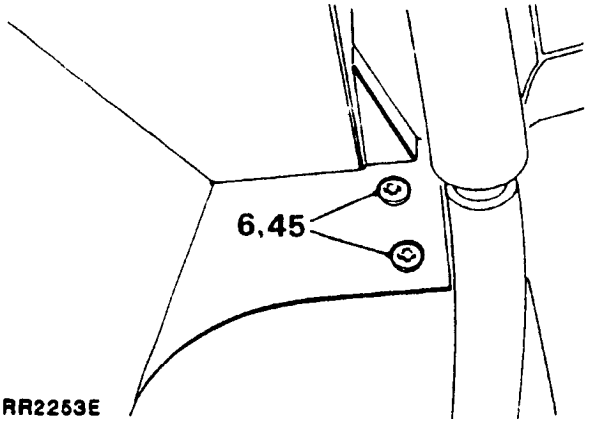
Hose-compressor to evaporator
Remove and refit 1 to 20 and 34 to 53.

Hose-receiver drier to evaporator
Remove and refit 1 to 20 and 34 to 53.

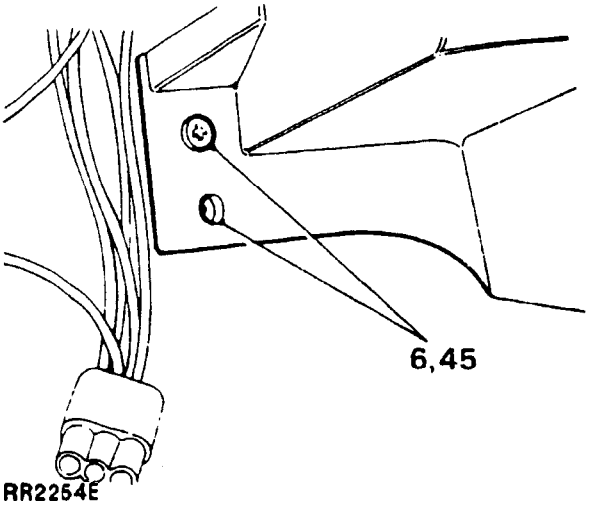
Blower units
Remove and refit 1 to 23 and 31 to 53.

Removing

1. Open the hood and connect the gauge set.
2. Discharge the system.
3. Disconnect the batten! negative lead
4. Protect the eyes with safety goggles and wear gloves during instruction 5.
5. Disconnect the evaporator hoses from the compressor and the receiver drier. Use a second wrench to support the hose adaptors and plug all the exposed connections immediately.
6. Working inside the vehicle, withdraw the lower dash and remove the screws securing the lower edge of the centre console.

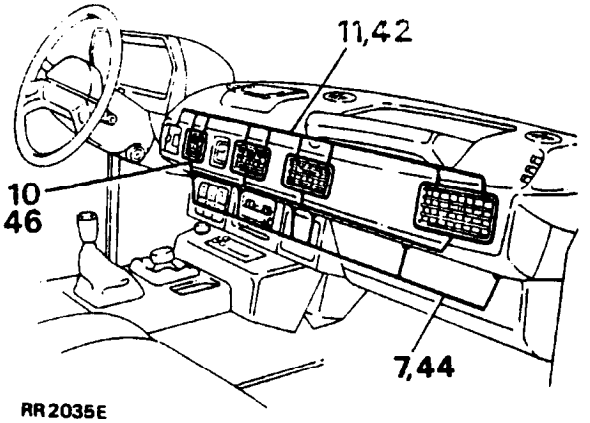


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RR2254E

7. Remove the six screws securing the lower edge of the louvre panel to the console and evaporator case.

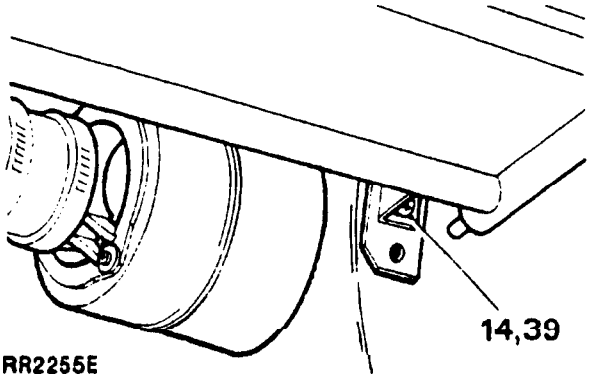


RR2035E

8. Remove the heater control panel and knobs from the centre console.
9. Remove the centre console.
10. Carefully pry out the four air vents.
11. Remove the screws securing the evaporator plenum and louvre panel to the dash top panel.
12. Carefully withdraw the thermostat sensor from the fins of the evaporator, and pull the sensor pipe clear of the evaporator assembly.
13. Disconnect the electrical connectors at the rear of exterior driving mirror control switches and clock, and withdraw panel clear of the dash.

Continued

14. Remove the screws securing the lower right mounting bracket.



15. Support the evaporator case and remove the two nuts securing the case and reinforcing strip to the upper mounting bracket.
16. Carefully withdraw the refrigerant hoses and evaporator condensate tubes through the bulkhead and remove the rear left hand air hose from the plenum.
17. Disconnect the wiring to mirror controls, blower motor and clock at the three wiring connectors.
18. Remove the evaporator and plenum assembly from the vehicle.

Dismantling

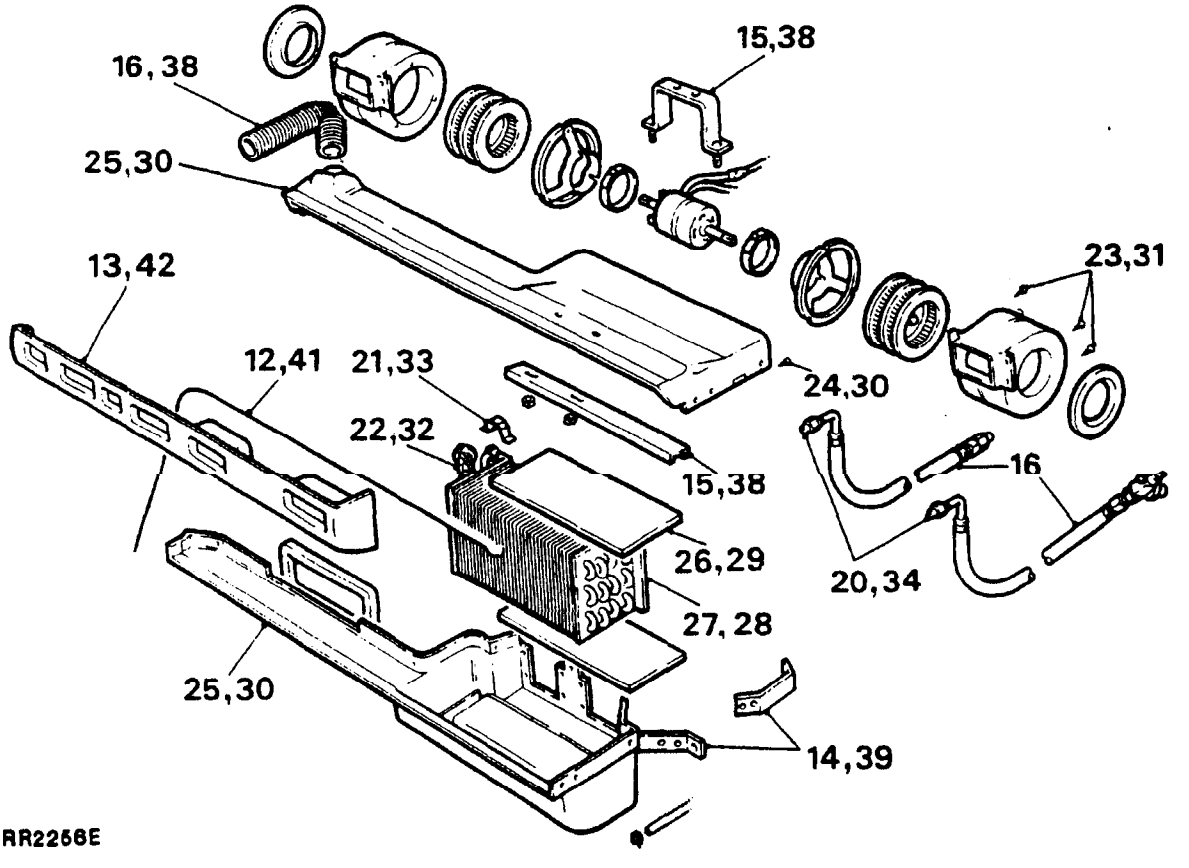
19. Remove the insulation from the evaporator and expansion valve hose connections.
20. Disconnect the hoses from the expansion valve and evaporator. Use a second wrench to support the hose adaptors and plug all the exposed connection% immediately.
21. Unclamp the sensor coil from the evaporator outlet pipe.
22. Carefully unscrew the expansion valve from the evaporator. Plug the exposed connections immediately.
23. Remove the eight securing screws and detach the blower units from the evaporator case.
24. Remove the screws securing the upper evaporator/plenum casing to the evaporator and lower casing.
25. Remove the heater seal and lift off the upper casing.
26. Remove the insulation pad and the four screws securing the evaporator to the lower casing.
27. Withdraw the evaporator from the casing.

Assembling

28. Secure the evaporator to the lower casing.
29. Fit the insulation pad.
30. Secure the casings together with the screws and refit the heater seal.
31. Refit and secure the blower units to the evaporator casing.
32. Assemble the expansion valve to the evaporator with the inlet facing downwards. Use refrigerant compressor oil on all matinp surfaces to assist leakage prevention. Tighten the connection to the correct torque, see Torque Values.
33. Clamp the sensor coil to the evaporator outlet pipe.
34. Connect the hoses to the evaporator and expansion valve. Use new 'O' rings and refrigerant compressor oil on all mating surfaces to assist leakage prevention.Tighten the connections to the correct torque,see Torque Values.
35. Wrap all exposed metal at the hose connections with no drip tape.

Refitting

36. Place the evaporator assembly on the floor of the vehicle and reconnect three wiring connectors disconnected at instruction 17.
37. Feed the hoses and evaporator condensate tubes through the bulkhead. Ensure that the openings and grommets are adequately sealed against ingress of dust and moisture.
38. Lift the unit into the mounting position and connect the rear left hand air hose. Fit the reinforcement strip and secure the casing to the upper bracket with two nuts.
39. Secure the lower right mounting bracket to the vehicle.
40. Position the left hand of the plenum so that the opening is centered over the fresh air outlet of the heater.
41. Carefully push the thermostat pipe into the evaporator fins.
42. Reconnect the wiring to the exterior mirror controls and clock, and refit the louvre panel. Secure the nlenum casing and louvre panel to the dash top panel with the fixing screws.
43. Refit the centre console.
44. Refit the six screws securing the louvre panel to the centre console and evaporator case.
45. Secure the lower edge of the console with four screws (two each side).
46. Refit the four air vents.
47. Connect the two refrigerant hoses to the compressor and receiver drier. Use refrigerant compressor oil on all mating surfaces to assist leakage prevention. Tighten the connections to the correct torque, see Torque Values.
48 To compensate for oil loss, add 45 ml (1.5 fl oz) of the correct oil to the compressor.
49. Evacuate the system.
50. Charge the complete system.
51. Perform a leak test on any accessible disturbed joints.
52. Perform a functional check.
53. Disconnect the gauge set.

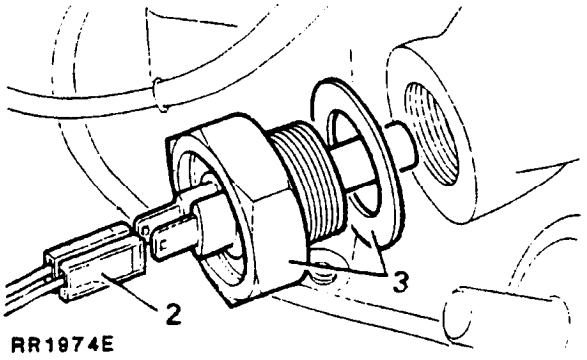


COOLANT TEMPERATURE SENSOR

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Disconnect the electrical ieads from the sensor.
3. Remove the sensor from the thermostat housing.



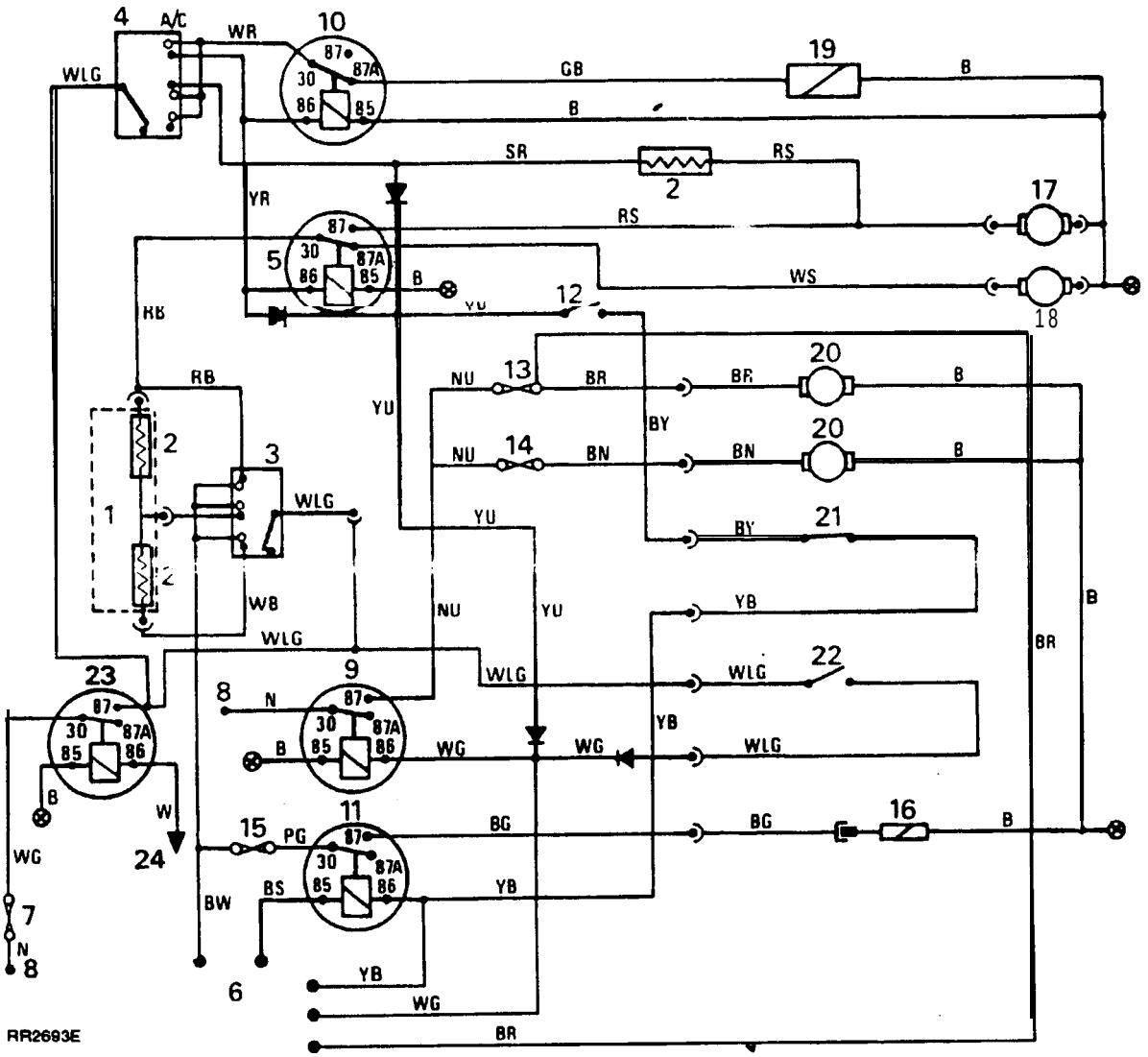
RR1974E

Refitting

4. Reverse the removal procédure, using a NEW joint washer.

AIR CONDITIONING CONTROLS/THERMOSTAT

See Heater and Air Conditioning Controls in Section 80 - Heating and Ventilation.



HEATER AND AIR CONDITIONING • circuit diagram • 89 Model year

1. Heater unit.
2. Resistors.
3. Fan speed switch.
4. Air conditioning/re-circ/fresh air switch.
5. Air conditioning/heater relay.
6. EFI harness connector.
7. Fuse 8-main fuse panel.
8. Main cable connection.
9. Fan relay.
10. Fresh air solenoid relay.
11. Compressor clutch relay.
12. Thermostat.
13. Fuse A1-auxiliary fuse panel A.
14. Fuse A2-auxiliary fuse panel A.
15. Fuse A3-auxiliary fuse panel A.
16. Compressor clutch.
17. Air conditioning motors-(2)-dashboard unit.
18. Heater motor.
19. Fresh air solenoid.
20. Condenser fan motors.
21. High pressure switch.
22. Engine coolant temperature sensor.
23. Heater / air conditioning relay (item 168 • main circuit diagram)
24. ignition load relay terminal 87.

Cable colour code overleaf

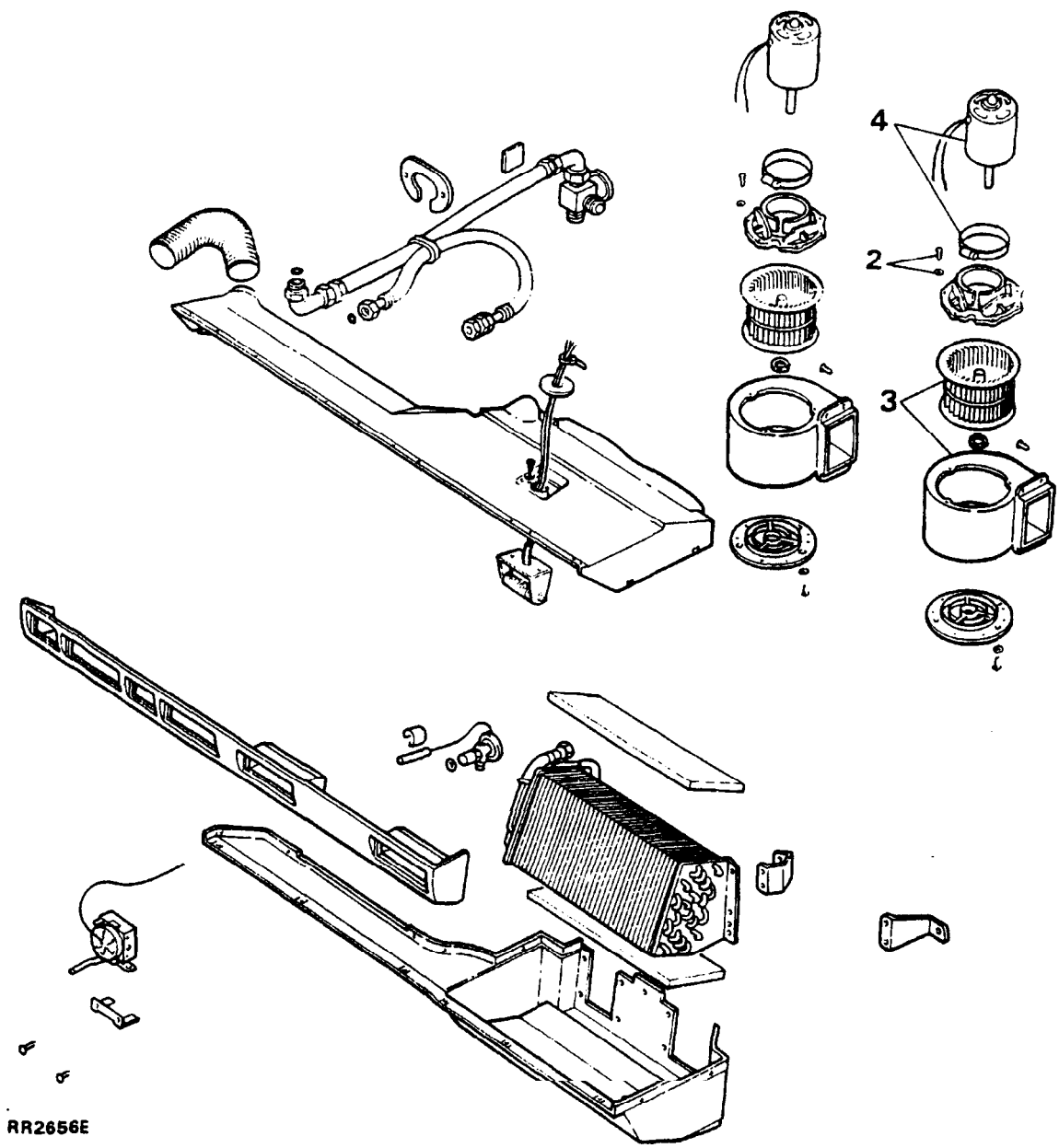
NOTE: See EFI circuit diagram for details of air conditioning inputs to ECU.

Cable colour code

B	Black	N	Brown	R	Red	W	White
G	Green	0	Orange	S	Grey	Y	Yellow
L	Light	P	Purple	U	Blue		

The last letter of a colour code denotes the tracer.

Dashboard Unit • 89 Model year



AIR CONDITIONING

1989 model year vehicles have an improved heater and air conditioning system.

Air conditioning combined with warm air (Two level), with the slider in this position, a combination of cool air at a fixed rate can be supplied through the face level vents while variable warm air is supplied to the footwells and demister vents.

CONDENSER FANS

CAUTION: It should be noted that under high coolant temperatures, when the engine is switched OFF, the condenser fans will be activated and run for approximately ten minutes.

DASHBOARD UNIT - EVAPORATOR - RR2656E

Improvements to the air conditioning system include the use of two blower motors to the evaporator. The evaporator capacity is also increased.

Blower motor

Remove and refit

Removing

1. Remove and dismantle the dashboard unit.
2. Remove three screws from the blower motor mount, and withdraw motor assembly.
3. Remove the clip from motor spindle and remove blower wheel.
4. Loosen the clamp securing the motor to the motor mount. Remove the blower motor.

Refitting

5. Reverse the removal procedure.

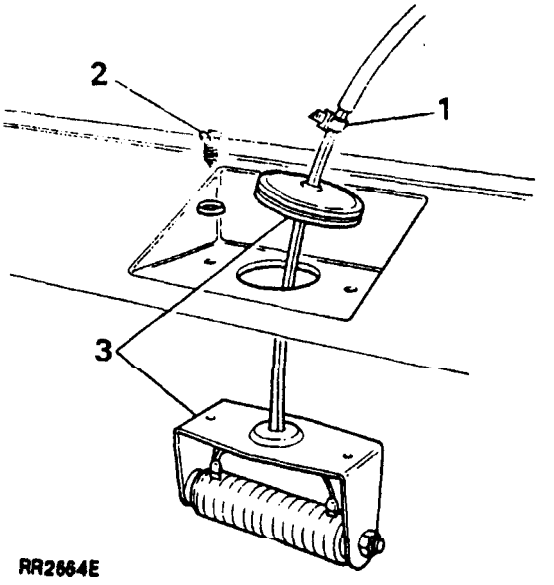
Resistor

The resistor secured to the upper evaporator casing, runs the constant speed air conditioning when the two level facility is selected.

Remove and refit

Removing

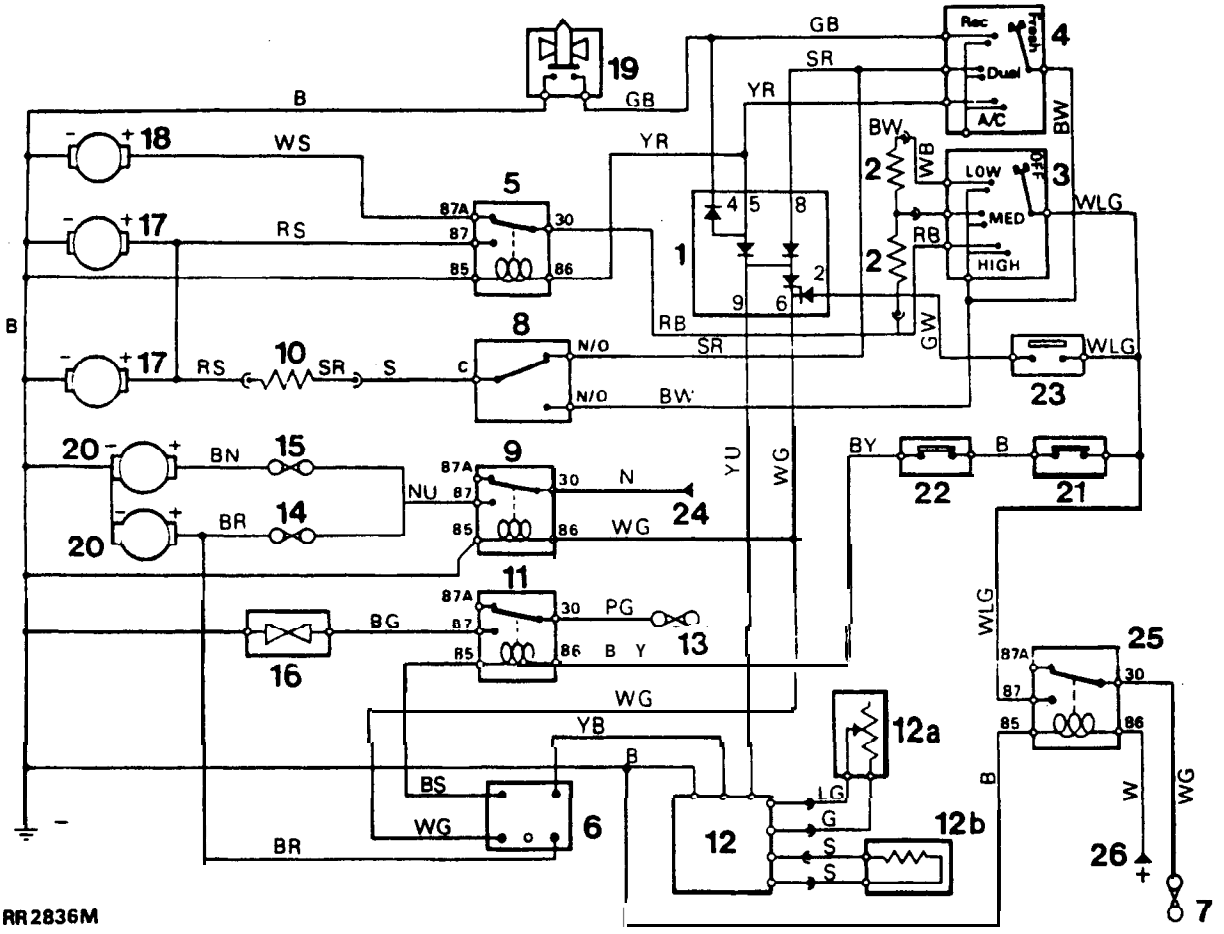
1. Release the cable tie, and release the two resistor wires from the multi-plug.
2. Remove the two screws securing the resistor to the upper casing.
3. Remove the grommet, and withdraw the resistor complete with cables.



RR2664E

Refitting

4. Reverse the removal procedure.



HEATER AND AIR CONDITIONING • circuit diagram

1. Diode pack.
2. Resistors.
3. Fan speed switch.
4. Air conditioning/re-circ/fresh air switch.
5. Heater/air conditioning relay.
6. Cable connection to ECU (EFI).
7. Fuse C9 • main fuse panel.
8. Face vent switch.
9. Condenser fan relay.
10. Two level resistor.
11. Compressor clutch relay.
12. Thermostat.
13. Fuse B7.
14. Fuse B8.
15. Fuse B9.
16. Compressor clutch.
17. Air conditioning motors (2) • dashboard unit.
18. Heater motor.
19. Fresh air solenoid.
20. Condenser fan motors.
21. Low Pressure switch.
22, High pressure switch.
23. Engine coolant temperature switch.
24. 12V from terminal post.
25. Heater/air con load relay
26. 12V from ignition load relay

NOTE: See EFI circuit diagram for details of air conditioning inputs to ECU.

Cable colour code

B	Black	N	Brown	R	Red	W	White
G	Green	O	Orange	S	Grey	Y	Yellow
L	Light	P	Purple	U	Blue		

The last letter of a colour code denotes the tracer.

AIR CONDITIONING

1990 Model year vehicles have modified air conditioning components. Details of which are given here and must be used in conjunction with the existing air conditioning text.

WARNING: All work involving the service and maintenance of the air conditioning requires special equipment, knowledge, experience and a full awareness and adhesion to the safety precautions.

EVAPORATOR ASSEMBLY

Remove and refit

Expansion valve
Remove and refit 1 to 21 and 31 to 49

Hose-Compressor to evaporator
Remove and refit 1 to 19 and 35 to 49

Hose-reciever drier to evaporator
Remove and refit 1 to 19 and 35 to 49

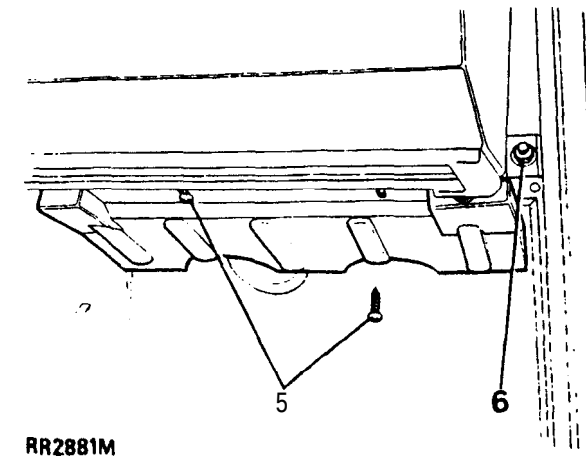
Blower units
Remove and refit 1 to 22 and 30 to 49

Removing

1. **Open the hood and connect the gauge set.**

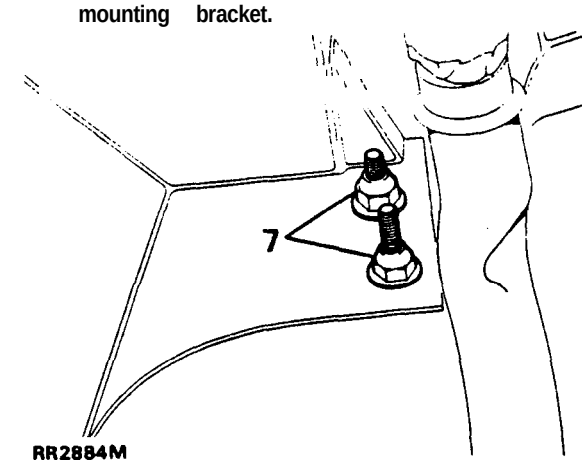
   WARNING: Wear eye and hand protection when disconnecting components containing *refrigerant.Plug* all exposed connections immediately.

2. **Discharge the system.**
3. **Disconnect the battery negative lead.**
4. **Disconnect the evaporator hoses from the compressor and the receiver drier. Use a second wrench to support the hose adaptors.**
5. **Working underneath the dash unit remove the two screws securing the blower closing panel. Slide the panel out of the two lower retaining clips.**
6. **Remove the nyloc nut and washer from the evaporator case mounting bracket.**



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7. **Remove the two nyloc nuts securing both centre dash panel and evaporator case mounting bracket.**



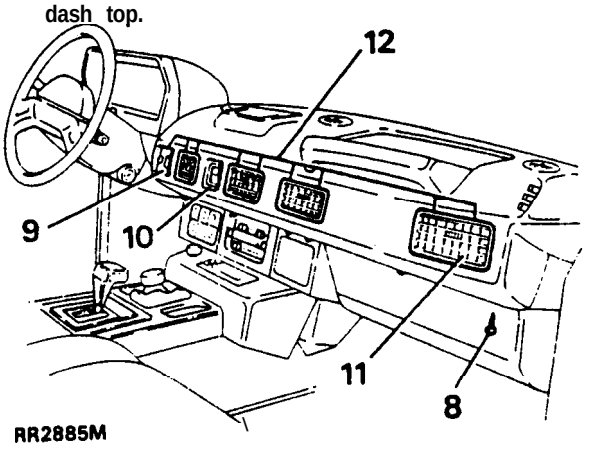
RR2884M

8. **Remove the six screws securing the lower edge of the louvre panel to the evaporator case.**

   Caution: Care must be taken when removing dash components. They can easily be scratched or -damaged by incorrect leverage and excessive force.

9. **Pry out, using equal leverage top and bottom, the mirror control switch. Disconnect the two multiplugs.**
10. **Repeat instruction 9 for removal of the clock. Disconnect electrical leads and the bulb holder.**

11. Pry out along the lower edge the four air vents.
12. Remove the nine screws securing the evaporator housing and louvre panel to the dash top.



13. Withdraw panel clear of the dash top.
14. Carefully withdraw the refrigerant hoses and evaporator condensation drain tubes through the bulkhead.
15. Remove the air hose from the end of the evaporator case upper.
16. Disconnect electric wiring to the blower motor and electronic thermostat at the multiplugs.
17. Remove the evaporator case assembly from the vehicle and place on a surface that will not scratch the casing.

Dismantling

18. Remove the insulation from the evaporator and expansion valve hose connections.
19. Disconnect the hoses from the expansion valve and evaporator. Use a second wrench to support the hose adaptors and plug the connections.
20. Unclamp the sensor coil from the evaporator outlet pipe.
21. Carefully unscrew the expansion valve from the evaporator. Plug the connection.
22. Remove the eight securing screws and detach the blower units from the evaporator case.
23. Remove the screws securing the upper evaporator casing to the evaporator lower case.
24. Remove the thermister probe and lift off the upper casing.
25. Remove the insulation pad and the screws securing the evaporator to the lower casing.
26. Withdraw the evaporator from the casing.

Assembling

27. Secure the evaporator to the lower casing.
28. Fit the insulation pad.
29. Secure the casing together with the screws and refit the thermister probe.
30. Refit and secure the blower units to the evaporator casing.

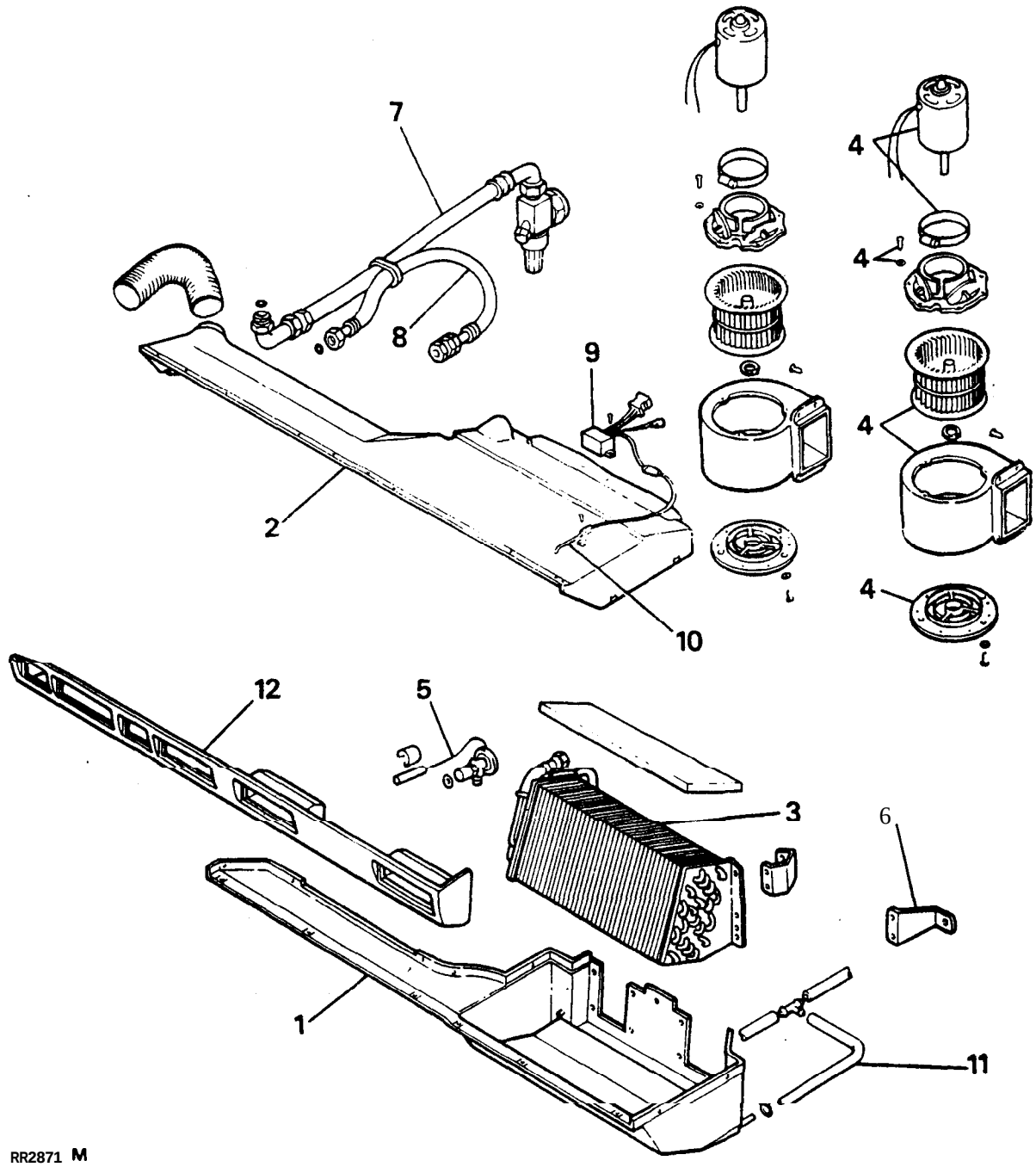
Note: Use refrigerant compressor oil on all mating surfaces to assist leakage prevention. Tighten the connections to correct torque.

31. Assemble the expansion valve to the evaporator with the inlet facing downwards.
32. Clamp the sensor coil to the evaporator outlet pipe.
33. Connect the hoses to the evaporator and expansion valve. Use new 'O' rings. See Torque valves.
34. Wrap all exposed metal at the hose connections with no drip tape.

Refitting

35. Place the evaporator assembly on the floor of the vehicle and reconnect two wiring connectors disconnected at instruction 16.
36. Feed the hoses and evaporator condensate tubes through the bulkhead. Ensure that the openings and grommets are adequately sealed against ingress of dust and moisture.
37. Fit the evaporator assembly to its location and reconnect the air hose at the end of the evaporator casing. Ensure the centre dash panel is eased over the evaporator case mounting bracket on the shared fixing point.

EVAPORATOR CASE ASSEMBLY

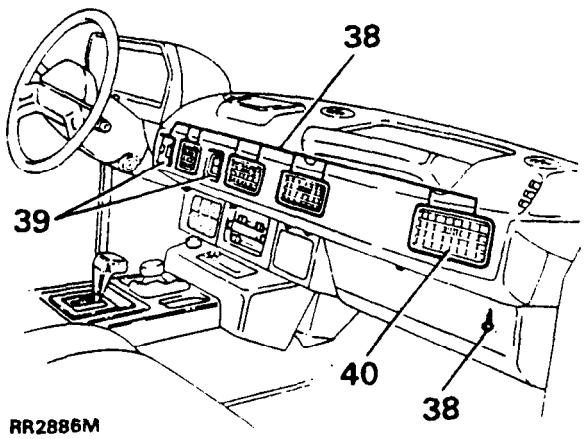


RR2871 M

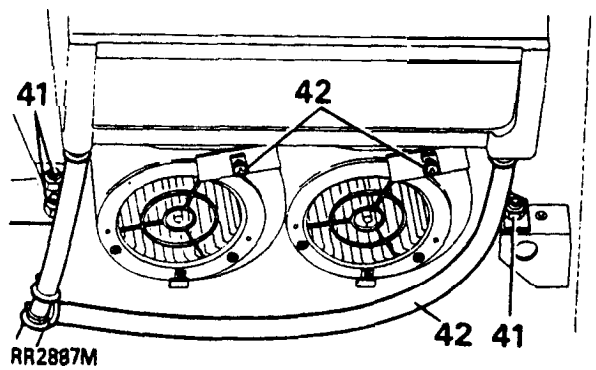
Key

1. Evaporator case lower
2. Evaporator case upper
3. Evaporator
4. Blower Assy
5. Expansion Valve
6. Mounting Bracket
7. Hose Assy Suction
8. Hose Assy Liquid
9. Thermostat
10. Thermister Probe
11. Drain Hose Assy
12. Louvre Panel

38. Feed the electrical connections to the clock and mirror control switch through their apertures in the louvre panel. Refit the louvre panel.
39. Reconnect electrics to the clock and mirror control switch and fit them to louvre panel.
40. Fit the air vents.



41. Secure, using three new nyloc nuts and plain washers, the evaporator case mounting brackets.
42. Ensure condensation tubes are free from kinks and able to drain off water. Fit the blower closing panel.
43. Connect the two refrigerant hoses to the compressor and receiver drier. Tighten to the correct torque.



44. Evacuate the system.
45. Charge the complete system.
46. Perform a leak test on any accessible disturbed joints.
47. Perform a functional check.
48. Check compressor oil level.
49. Disconnect the gauge set.

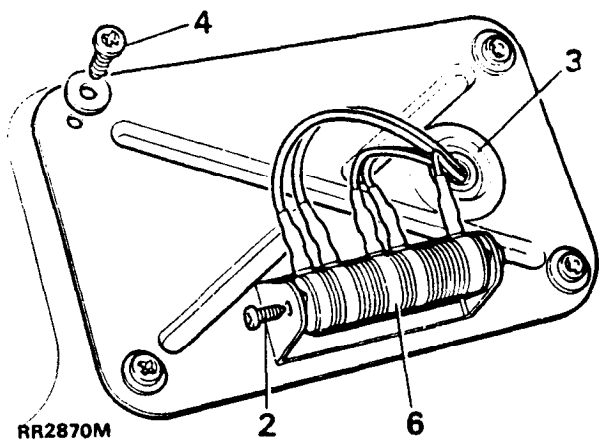
Resistor Unit

The resistor unit is located on the front dash closing panel underneath the cowl panel.

Remove and refit

Removing

1. Disconnect the battery negative lead and remove cowl panel (see body section)
2. Remove the two screws securing the resistor.
3. Release the grommet from the housing.
4. Remove the four screws from the front dash closing panel.
5. Trace the resistor electrical wiring to the multiplug and disconnect.
6. Remove the resistor complete with wiring and multiplug.



Refitting

7. Reverse the removal instructions.

RECEIVER DRIER

Remove and refit

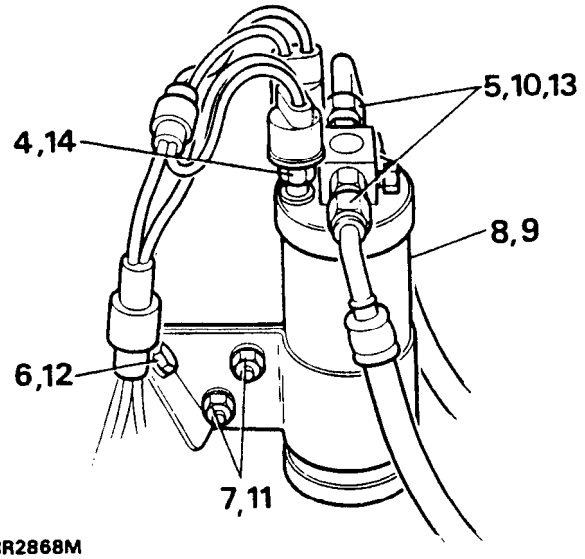
CAUTION: Immediate blanking of the receiver drier is important. Exposed life of the unit is only 15 minutes.

Removing

1. Open the hood and connect the gauge set.

WARNING: Wear eve and hand protection when disconnecting components containing refrigerant. Plug all exposed connections immediately.

2. Discharge the system.
3. Disconnect the battery negative lead.
4. Disconnect the electrical leads at the two plug connectors and carefully unscrew, at the hexagon nut, the pressure switches irom the receiver drier Plug the exnosed connections immediately.



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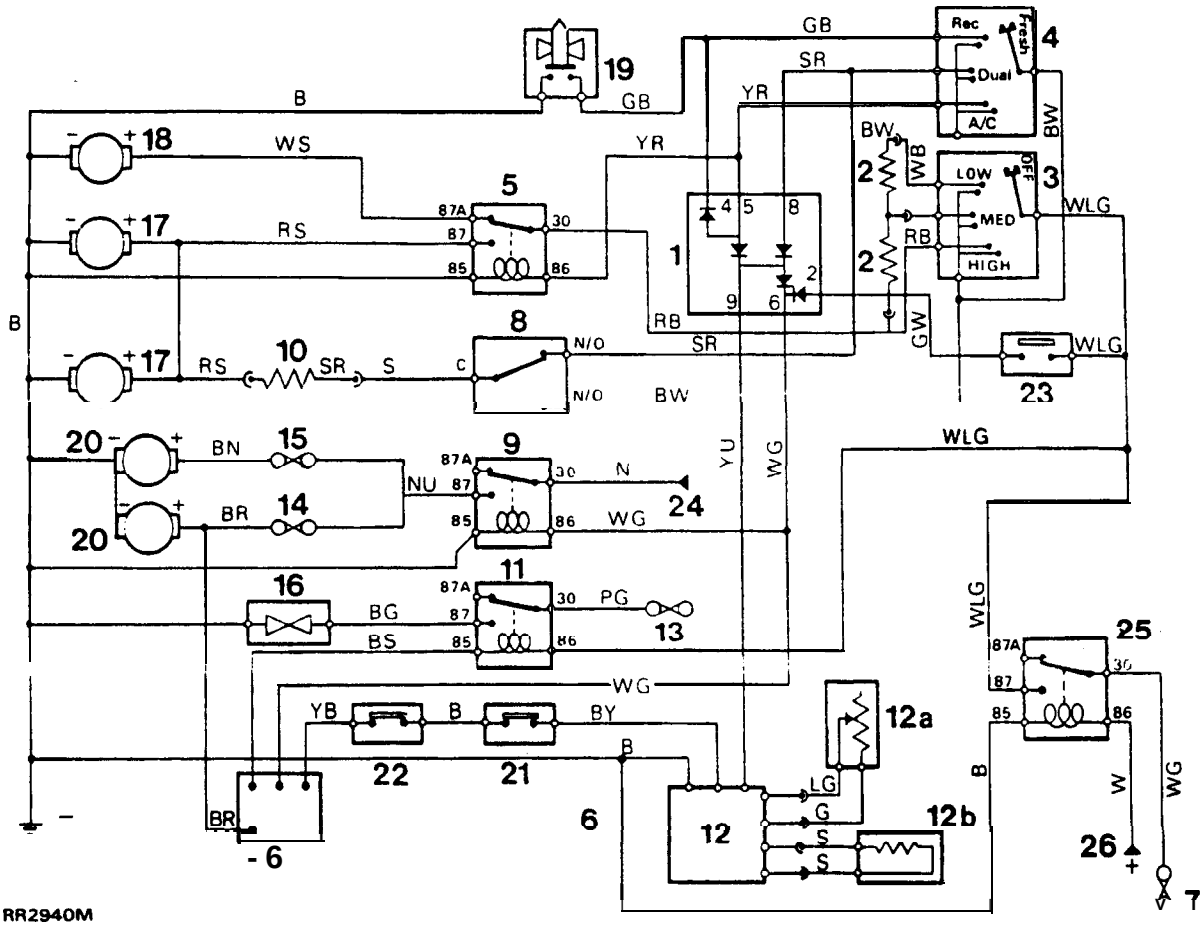
5. Carefully disconnect the two hose connections. Use a second spanner to support the hose adaptor. Plug the exposed connections immediately.
6. Remove one bolt, nut and washers securing the mounting bracket to the wing valance.
7. Remove the clamp bolts, washers and nuts.
8. Withdraw the receiver drier from the mounting bracket.

Refitting

9. Insert the receiver drier into the mounting bracket with this inlet and outlet connections correct to the refrigerant circuit as shown.
10. Connect the two hose connections finger tight.

NOTE: Use refrigerant compressor oil on all mating surfaces to assist leakage prevention.

11. Fit the clamp bolts, washer and nuts.
12. Secure the mounting bracket to the wing valance
13. Tighten the two hose connections to the correct torque. Use a second spanner to support the hose adaptor.
14. Carefully refit the pressure switches to the receiver drier. Tighten the switches to the correct torque. Reconnect the electrical leads.
15. Evacuate the complete system.
16. Charge the complete system.
17. Pertorm a leak test on anv disturbed ioints.
18. Carrv out a functional check.
19. Check compressor oil level.
20. Disconnect the gauge set.



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HEATER AND AIR CONDITIONING - circuit diagram - 1991 model year

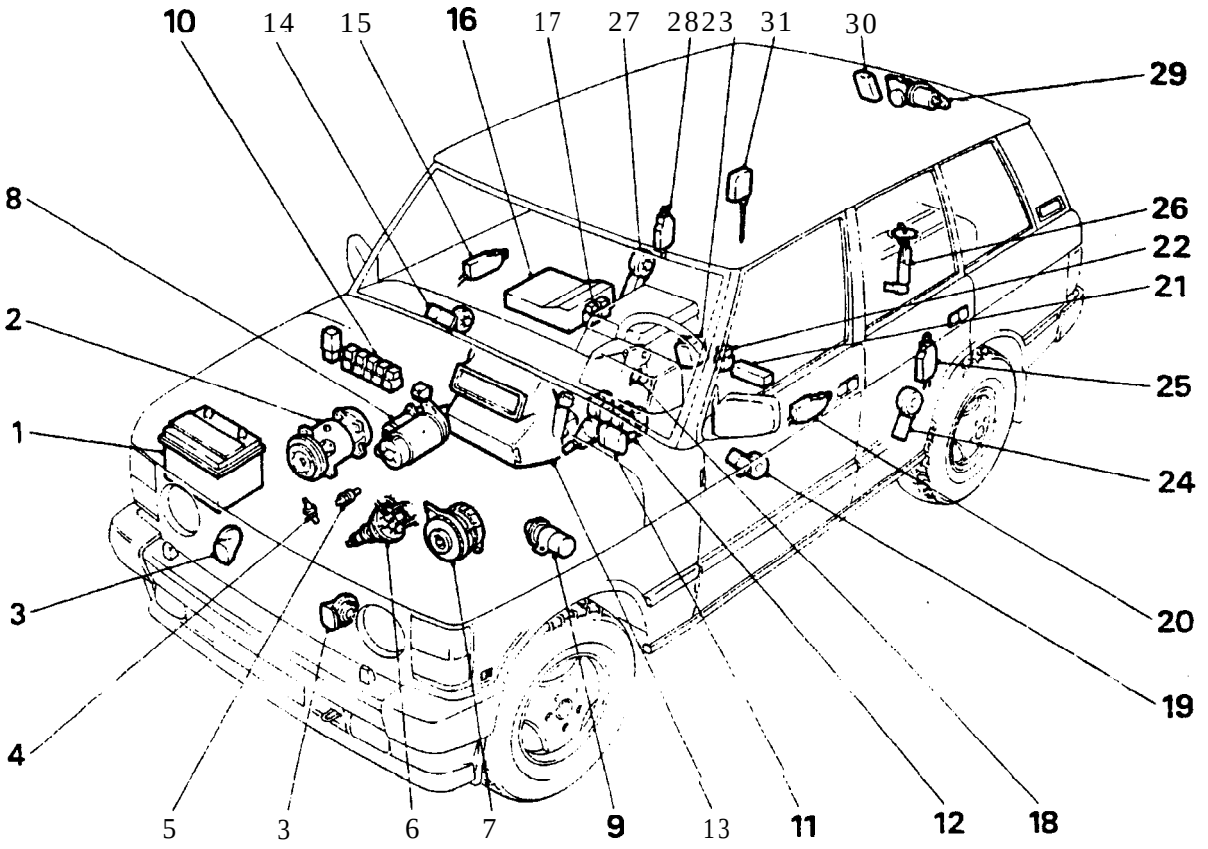
1. Diode pack.
2. Resistors.
3. Fan speed switch.
4. Air conditioning/re-circ/fresh air switch.
5. Heater/air conditioning relay.
6. Cable connection to ECU (EFI).
7. Fuse C9 - main fuse panel.
8. Face vent switch.
9. Condenser fan relay.
10. Two level resistor.
11. Compressor clutch relay.
12. Thermostat.
12a. Temperature control potentiometer.
12b. Evaporator temperature sensor.
13. Fuse B7.
14. Fuse B8.
15. Fuse B9.
16. Compressor clutch.
17. Air conditioning motors (2) - dashboard unit.
18. Heater motor.
19. Fresh air solenoid.
20. Condensor fan motors.
21. High pressure switch.
22. Low pressure switch.
23. Engine coolant temperature switch.
24. 12V from terminal post.
25. Heater/air con load relay.
26. 12V from ignition load relay.

NOTE: See EFI circuit diagram for details of air conditioning inputs to ECU.

Cable colour code

B	Black	L	Light	P	Purple	U	Blue
G	Green	N	Brown	R	Red	W	White
K	Pink	O	Orange	S	Grey	Y	Yellow

The last letter of a colour code denotes the tracer



RR 1884E

LOCATION OF ELECTRICAL EQUIPMENT

1. Battery
2. Air conditioning compressor
3. Horns
4. Oil pressure switch
5. Water temperature switch
6. Electronic distributor
7. Alternator
8. Starter motor
9. Coil
10. Relays
11. Wiper motor-front screen
12. Relays/delay units
13. Heater
14. Window lift motor (front right hand door)
15. Door lock actuator (front right hand door)
16. Electronic control unit
17. Relays
18. Parking brake warning light switch
19. Window lift motor (front left hand door)
20. Door lock actuator (front left hand door)
21. Seat adjustment fusebox
22. Seat motor-relay
23. Inertia switch
24. Window lift motor (rear left hand door)
25. Door lock actuator (rear left hand door)
26. Electrical in-tank fuel pump
27. Window lift motor (rear right hand door)
28. Door lock actuator (rear right hand door)
29. Wiper motor-rear screen
30. Radio aerial amplifier
31. Fuel filler flap lock actuator

For full information on fuel injection related items-see fuel injection section of manual.

To identify individual relays (items 10, 12, 17 and 22) see relays in Electrical Section of Manual.

FAULT DIAGNOSIS

SYMPTOM	POSSIBLE CAUSE	CURE
A-Battery in low state of charge	1. Broken or loose connection in alternator circuit	1. Examine the charging and field circuit wiring. Tighten any loose connections, repair/replace broken leads. Examine the battery connection.
	2. Current voltage regulator not functioning correctly	2. Check/fit new unit
	3. Slip rings greasy or dirty.	3. Clean
	4. Brushes worn, not fitted correctly or wrong type	4. Fit new brushes
	5. Fan belt broken	5. Fit new belt
B-Battery overcharging leading to burnt out bulbs and trequent need for topping-up	1. Current voltage regulator not functioning correctly	1. Fit new unit
C-Lamps giving insufficient illumination	1. Battery discharged	1. Charge the battery from independent supply or by a long period of daylight running.
	2. Bulbs discoloured through prolonged use	2. Fit new bulb
	3. Fan belt broken	3. Fit new belt
D-Lamps light when switched on but fade out	1. Battery discharged	1. Charge the battery from an independent supply or by a long period of daylight running
E-Lights flicker	1. Loose connection	1. Tighten/clean
F-Failure of lights	1. Battery discharged	1. Charge the battery from an independent supply or by a long period of daylight running
	2. Loose broken connection	2. Locate and rectify
	3. Fan belt broken	3. Fit new belt

SYMPTOM	POSSIBLE CAUSE	CURE
;-Starter motor lacks power or fails to turn engine	1. Stiff engine 2. Battery discharged 3. Broken or loose connection in starter circuit 4. Greasy or dirty slip rings. 5. Brushes worn, not fitted correctly or wrong type 6. Brushes sticking in holders or incorrectly tensioned. 7. Starter pinion jammed in mesh with flywheel	1. Locate cause and remedy 2. Charge the battery either by a long period of daytime running or from independent electrical supply 3. Check and tighten all battery, starter and starter switch connections and check the cables connecting these units for damage 4. Clean 5. Fit new brushes 6 . Rectify 7. Remove starter motor and Investigate
H-Starter noisy	1. Starter pinion or flywheel teeth chipped or damaged 2. Starter motor loose on engine 3. Armature shaft bearing	1. Fit new components 2. Rectify, checking pinion and the flywheel for damage 3. Fit new bearing
I-Starter operates but does not crank the engine	I. Pinion of starter does not engage with the flywheel	1. Check operation of starter solenoid. If correct, remove starter motor **and** investigate
K-Starter pinion will not disengage from the flywheel when the engine is running	1. Starter pinion jammed in mesh with the flywheel	1. Remove starter motor **and** investigate

SYMPTOM	POSSIBLE CAUSE	CURE
.-Engine will not start	1. The starter will not turn the engine due to a discharged battery	1. Recharge battery by running the car for a long period during daylight or from an independent electrical supply
	2. The starter will not turn due to incorrect gear selection.	2. Select 'P' or 'N'
	3. Sparking plugs faulty. dirty or incorrect plug gaps	3. Rectify' fit new plugs
	4. Defective coil or distributor	4. Carry out ignition checks. Fit a new coil or distributor
	5. A fault in the low tension wiring circuit	5. Examine all the ignition cables and check that the terminals are secure and not corroded.
	6. Faultv amplifier	6. Check/fit new component if necessary.
	7. Air gap out of adjustment	7. Adjust
	8. Fuel system fault	8. See Fuel System Section.
M-Engine misfired stalls	1. Faulty sparking plugs	1. Rectify
	2. Air gap incorrectly set	2. Adjust
	3. Distributor cap cracked	3. Fit new cap
	4. Faulty pick-up or reluctor	4. Fit new components
	5. Excessive wear in distributor shaft brushes, etc.	5. Fit a new components
	6. Rotor arm and flash shield cracked or showing signs of tracking	6. Fit new component

SYMPTOM	POSSIBLE CAUSE	CURE
N&Frequent recharging of the battery necessary	1. Alternator inoperative	1. Check the brushes, cables and connections or fit a new alternator
	2. Loose or corroded connections	2. Examine all connections especially the battery terminals and ground cables
	3. Slipping fan belt	3. Adjust
	4. Voltage regulator faulty	4. Fit new component
	5. Excessive use of the starter motor	5. In the hands of the operator, advise
	6. Vehicle operation confined largely to night driving	6. In the hands of the operator, advise
	7. Abnormal accessory load	7. Superfluous electrical fittings such as extra lamps, etc.
	8. Internal discharge of the batten,	8. Fit new battery
P-Alternator not charging correctly	1. Slipping fan belt	1. Adjust
	2. Voltage control not operating correctly	2. Rectify/ fit new component
	3. Greasy, charred or glazed slip rings	3. Clean
	4. Brushes worn, sticking or oily	4. Rectify/fit new brushes
	5. Shorted, open or burnt -out field coils	5. Fit new field coils
Q-Alternator noisy	1. Worn, damaged or defective bearings	1. Fit new bearings
	2. Cracked or damaged pulley	2. Fit new pulley
	3. Alternator out of alignment	3. Rectify
	4. Alternator loose in mounting	4. Rectify
	5. Excessive brush noise	5. Check for rough or dirty slip rings, badly seating brushes, incorrect brush tension, loose brushes and loose field magnets. Rectify/fit new components
R-Poor performance of horns	1. Low voltage due to discharged battery	1. Recharge
	2. Bad connections in wiring	2. Carefully inspect all connections and horn push
	3. Loose mounting nut	3. Rectify
	4. A faulty horn	4. Fit new horn

SYMPTOM	POSSIBLE CAUSE	CURE
S-Central door locking does not operate (on all doors)	1. Battery discharged 2. Control unit in driver's door lock actuator faulty 3. Loose or broken connection in driver's door 4. Blown fuse	1. Recharge 2. Fit new unit 3. Locate and rectify 4. Rectify
T-Central door locking does not operate (on one door only)	1. Loose or broken connection 2. Lock actuator failure 3. Faulty lock 4. Mechanical linkages disconnected	1. Locate and rectii) 2. Fit new actuator 3. Rectify 4. Locate and rectify
U-Window lift will not operate	1. Motor failure 2. Loose or broken connection 3. Faulty switch 4. Mechanical linkage faulty	1. Fit new motor 2. Locate and rectify 3. Fit new switch 4. Rectify
V-Exterior mirrors fail to operate	1. Loose or broken connection 2. Faulty switch 3. Mirror motor failure	1. Locate and rectify 2. Fit new switch 3. Fit new motor

ELECTRICALEQUIPMENT

DESCRIPTION

The electrical system is Negative ground, and it is most important to ensure correct polarity of the electrical connections at all times. Any incorrect connections made when reconnecting cables may cause irreparable damage to the semi-conductor devices used in the alternator and regulator. Incorrect polarity would also seriously damage any transistorized equipment such as radio and tachometer etc.

WARNING: During battery removal or before carrying out any repairs or maintenance to electrical components always disconnect the battery negative lead first. If the positive read is disconnected with the negative lead in place, accidental contact of the wrench to any grounded metal part could cause a severe spark, possibly resulting in personal injury. Upon installation of the battery the positive lead should be connected first.

ALTERNATOR - LUCAS A13380

The alternator is a three phase, field sensed unit. The rotor and stator windings produce three phase alternating current, AC, which is rectified to direct current, DC. The electronic voltage regulator unit controls the alternator output voltage by high frequency switching of the rotor field circuit. Use only the correct Range Rover replacement fan belt. Occasionally check that the engine and alternator pulleys are accurately aligned.

It is essential that good electrical connections are maintained at all times. Of particular importance are those in the charging circuit (including those at the battery) which should be occasionally inspected to see that they are clean and tight. In this way any significant increase in circuit resistance can be prevented.

Do not disconnect battery cables while the engine is running or damage to the semi-conductor devices may occur. It is also inadvisable to break or make any connections in the alternator charging and control circuits while the engine is running.

The Model 15TR electronic voltage regulator employs micro-circuit techniques resulting in improved performance under difficult service conditions. The whole assembly is encapsulated in silicone rubber and housed in an aluminium heat sink, ensuring complete protection against the adverse effects of temperature, dust. and moisture etc.

The regulating voltage is set during manufacture to give the required regulating voltage range of 14.2 $\pm$ 0.2 volts, and no adjustment is necessary. The only maintenance needed is the occasional check on terminal connections and wiping with a clean dry cloth.

The alternator system provides for direct connection of a charge (ignition) indicator warning light, and eliminates the need for a field switching relay or warning light control unit. As the warning lamp is connected in the charging circuit, lamp failure will cause loss of charge. Lamp should be checked regularly and a spare carried.

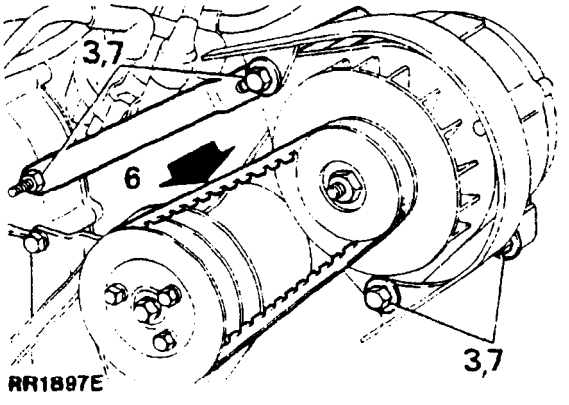
When using rapid charge equipment to re-charge the battery, the battery must be disconnected from the vehicle.

ALTERNATOR

Remove and refit

Removing

1. Disconnect battery ground lead.
2. Disconnect leads from alternator.



3. Loosen alternator fixings, pivot alternator inwards and remove drive belt.
4. Remove three mounting bolts and lift the alternator clear of the engine.

Refitting

5. Fit the alternator and mounting bolts.

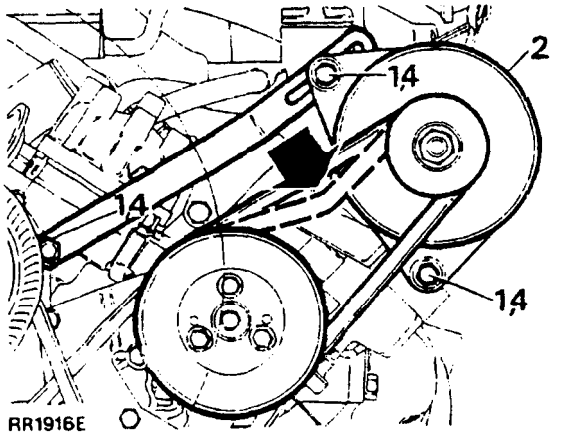
   NOTE: The fan guard is attached to the front fixing and the adjustment bracket bolt.

6. Fit the drive belt and adjust the belt tension.
7. Tighten the mounting bolts and the adjustment bracket securing nut.
8. Connect the wiring leads to the alternator.
9. Connect the battery.

ALTERNATOR DRIVE BELT

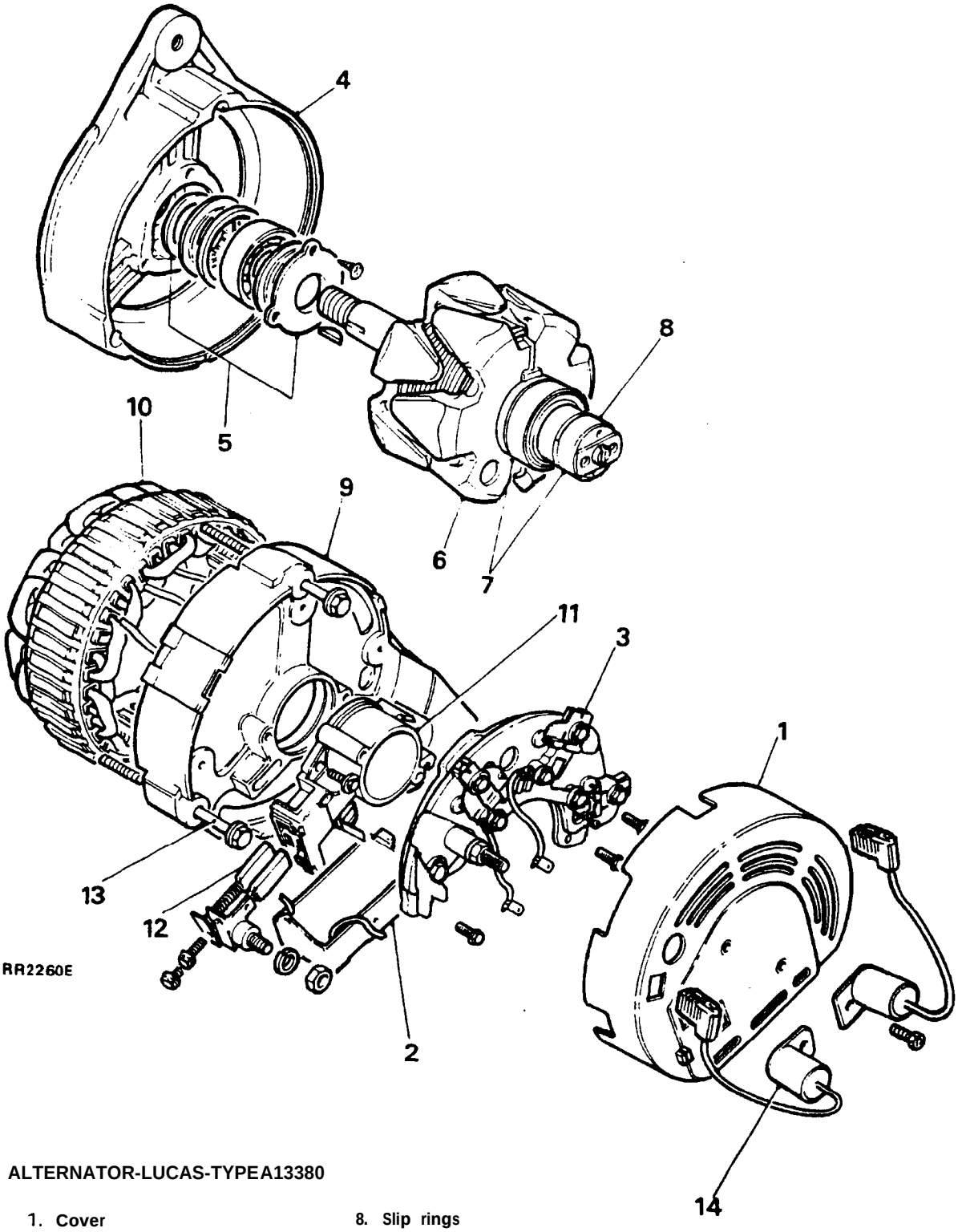
Adjust

1. Loosen the alternator fixings and the adjustment link.
2. Pivot the alternator to give the required belt tension.
3. Belt tension should be 4 to 6mm (0.19 to 0.25 in) at the point indicated by the bold arrow.



4. Tighten the alternator fixing bolts and the adjustment link.

   NOTE: Check adjustment after running engine at fast idle speed for 3 to 5 minutes if a new belt has been fitted.



ALTERNATOR-LUCAS-TYPEA13380

1. Cover
2. Regulator
3. Rectifier
4. Drive end bracket
5. Bearing assembly
6. Rotor
7. Slip ring end bearing
8. Slip rings
9. Slip ring end bracket
10. Stator
11. Brush box
12. Brushes
13. Through bolts (three)
14. Suppressors

ALTERNATOR-LUCAS-TYPE A133/80

Overhaul

Including Test (Bench)

NOTE: Alternator charging circuit-The ignition warning light is connected in series with the alternator field circuit. Bulb failure would prevent the alternator charging, except at very high engine speeds, therefore, the bulb should be checked before suspecting an alternator failure.

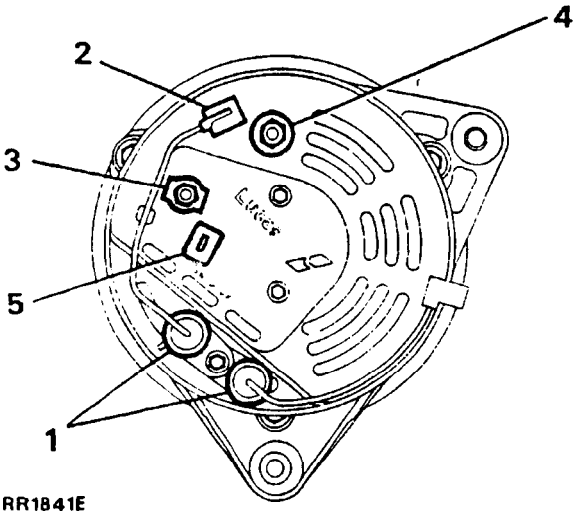
Precautions

Battery polarity is **NEGATIVE GROUND,** which must be maintained at all times.

No separate control unit is fitted; instead a voltage regulator of micro-circuit construction is incorporated on the slip ring end bracket, inside the alternator cover.

Battery voltage is applied to the alternator output cable even when the ignition is switched off, the battery must be disconnected before commencing any work on the alternator. The battery must also be disconnected when repairs to the body structure are being carried out using electric welding equipment.

Sequence of connections



RR1841E

1. Suppression capacitors (two)
2. Positive suppression terminal
3. IND terminal
4. + output terminal
5. Sensing terminal

ALTERNATOR TESTING

Charging system check

1. Check the battery is in good condition, with an open circuit voltage of at least 12.6 V. Recharge or fit a charged substitute battery to carry out test.
2. Check drive belt adjustment and condition. Rectify as necessary.
3. Check battery connections are clean and tight.
4. Check alternator connections are clean and tight.
5. Ensure that there is no continuous drain on battery due, for example, to interior, underhood or door edge lamps being left on.

Alternator test

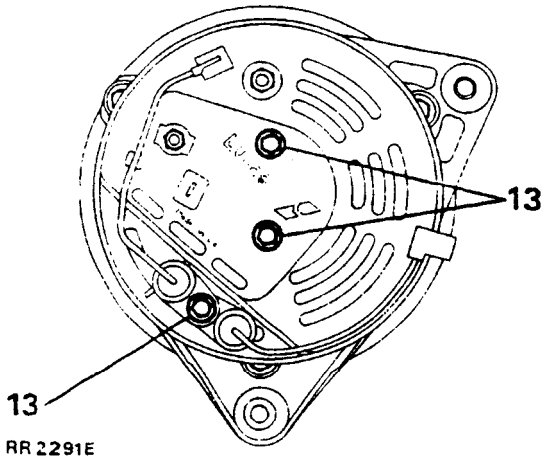
The following instructions refer to the use of suitable test- equipment using a carbon pile rheostat.

6. Connect test equipment referring to the manufacturer's instructions.
7. Start engine and run at 3000 rev/min without accesory load.
8. Rotate the carbon pile load control to achieve the greatest output (amps) without allowing voltage to fall below 12.0 V. A reading of 80 amps, minus 10% to allow for EFI and Ignition loss, should be obtained.
9. Run engine at 3000 rev/min, switch selector to regulator test, read voltmeter. A reading of 13.6 to 14.4 V should be obtained.
10. Switch selector to diode/stator test, switch on headlamps to load alternator. Raise engine speed to 3000 rev/min, read voltmeter. The needle must be within the 'OK' range.

NOTE: See also charging circuit resistance test, page 13.

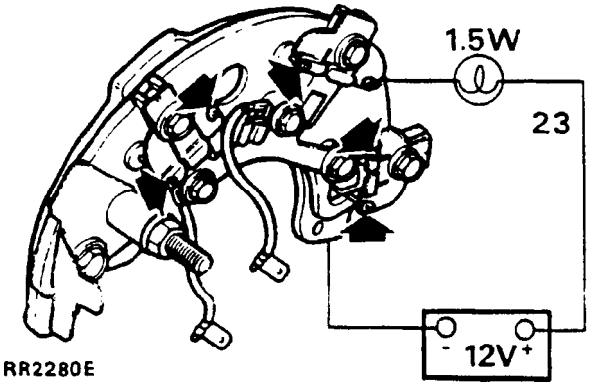
Testing-alternator removed

11. Withdraw the connectors from the alternator.
12. Remove the alternator.
13. Disconnect the suppressor and remove the alternator cover.

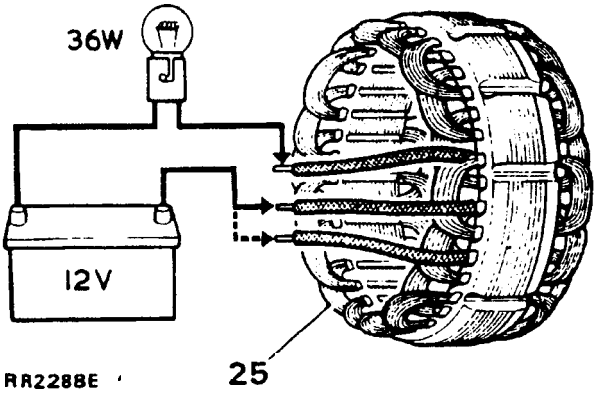


14. Disconnect the lead and remove the rectifier assembly.
15. Note the arrangement of the brush box connections and remove the screws securing the regulator to the brush box and withdraw. This screw also retains the inner brush mounting plate in position.
16. Remove the screw retaining the outer brush box in position and withdraw both brushes.
17. Check brushes for wear by measuring length of brush protruding beyond brush box moulding. If length is 10mm (0.4 in) or less, fit new brushes.
18. Check that brushes move freely in holders. If brush is sticking, clean with a mineral spirit moistened cloth or polish sides of brush with fine file.
19. Check brush spring pressure using push-type spring gauge. Gauge should register 136 to 279g (5 to 10 oz) when brush is pulled back until face is flush with housing. If reading is outside these limits, fit a new brush assembly.
20. Remove the two screws securing the brush box to the slip ring end bracket and lift off the brush box assembly.
21. Securely clamp alternator in a vice and release the stator winding cable ends from the rectifier by applying a hot soldering iron to the terminal tags of the rectifier. Pry out the cable ends when the solder melts.

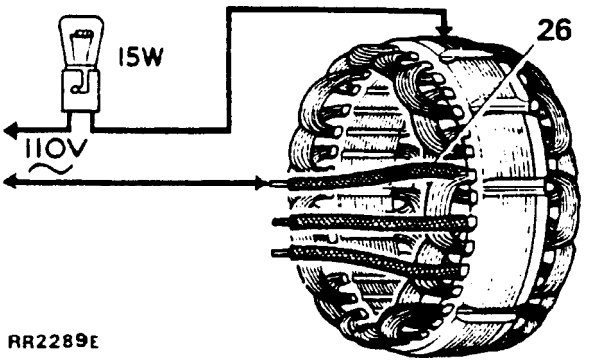
22. Remove the two remaining screws securing the rectifier assembly to the slip ring end bracket and lift off the rectifier assembly. Further dismantling of the rectifier is not required.
23. Check the diodes. Connect the test equipment as shown and test each diode in turn, note whether lamp lights, then reverse test lead connections. The lamp should light in one direction only. Renew the rectifier assembly if a faulty diode is diagnosed.



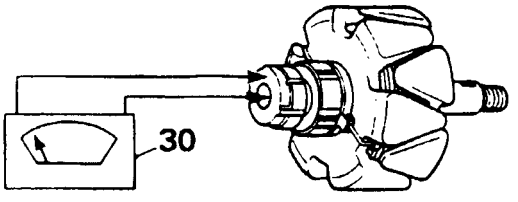
24. Remove the slip ring end bracket bolts and lift off the bracket.
25. Connect a 12 volt battery and a 36 watt test lamp to two of the stator connections. Repeat the test replacing one of the two stator connections with the third. If test lamp fails to light in either test, fit a new stator.



26. Using a 110 volt a.c. supply and a 15 watt test lamp, test for insulation between any one of the three stator connections and stator laminations. If test lamp lights, fit a new stator.



27. Clean surfaces of slip rings using a solvent moistened cloth.
28. inspect slip ring surfaces tor signs of burning; remove burn marks using very fine sandpaper On no account should emery cloth or similar abrasives be used, or any attempt made to machine the slip rings.
29. Note the position of the stator output leads in relation to the alternator fixing lugs, and lift the stator from the drive end bracket.
30. Connect an ohmmeter to the slip rings. A reading of 2.6 ohms should be recorded.



31. Using a 110 volt a.c. supply and a 15 watt test lamp, test for insulation between one of the slip rings and one of the. rotor poles. If the test lamp lights, fit a new rotor.

32. To separate the drive end bracket and rotor, remove the shaft nut, washers, woodruff key and spacers from the shaft.
33. Remove bearing retaining plate by removing the three screws. Using a press, drive the rotor shaft from the drive end bearing.
34. If necessary, to remove the slip rings or the slip ring end bearing on the rotor shaft, unsolder the outer slip ring connection and gently pry the slip ring off the shaft, repeat the procedure for the inner slip ring connection. Using a suitable extraction tool, withdraw the slip ring bearing from the shaft.

Reassembling

35. Reverse the dismantling procedure, noting the following points.

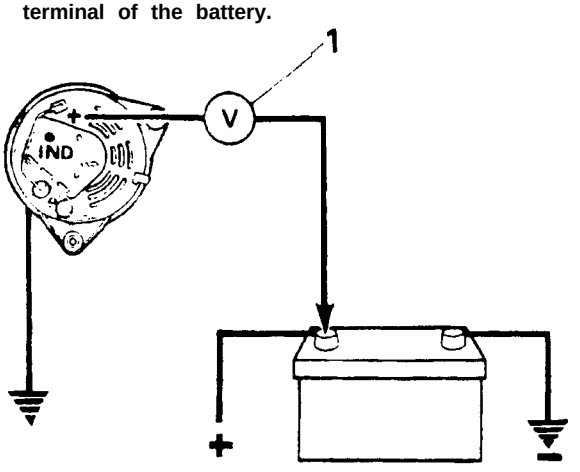
    (a) Use Shell Alvania 'RA' to lubricate bearings.
    (b) When refitting slip ring end bearing, ensure it is fitted with open side facing rotor.
    (c) Use Fry's H.T.3 solder on slip ring field connections.
    (d) When refitting rotor to drive end bracket, support inner track of bearing. Do not use drive end bracket to support bearing when fitting rotor.
    (e) Tighten through-bolts evenly.
    (f) Fit brushes into housings before fitting brush moulding.
    (g) Tighten shaft nut to the correct torque, see Torque Values.
    (h) Refit regulator pack to brush moulding.

36. Reconnect the leads between the regulator, brush box and rectifier.
37. Refit the alternator.

Testing in position

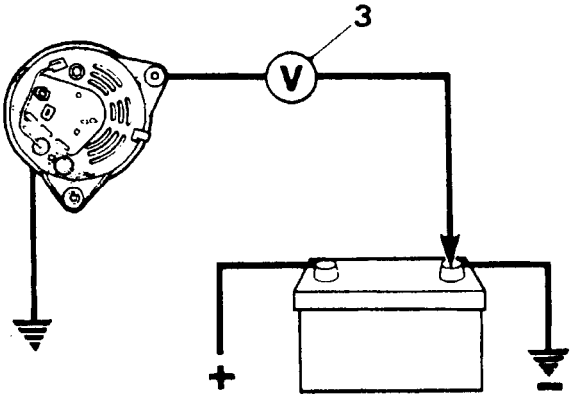
Charging circuit resistance test.

1. Connect a low range voltmeter between the alternator terminal marked + and the positive terminal of the battery.



RR2317E

2. Switch on the headlamps and start the engine. Set the throttle to run at approximately 3000 rev/min. Note the voltmeter reading.
3. Transfer the voltmeter connections to the frame of the alternator and the negative terminal of the battery, and again note the voltmeter reading.



RR2318E

4. If the reading exceeds 0.5 volt on the positive side or 0.25 volt on the negative side, there is a high resistance in the charging circuit which must be traced and remedied.

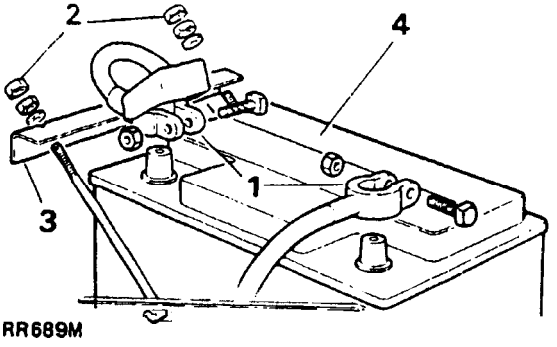
BATTERY

Remove and refit

WARNING: During battery removal or before carrying out any repairs or maintenance to electrical components always disconnect the battery negative lead first. If the positive lead is disconnected with the negative lead in place, accidental contact of the wrench to any grounded metal part could cause a severe spark, possibly resulting in personal injury. Upon installation of the battery the positive lead should be connected iirst.

Removing

1. Disconnect battery ground lead followed by the disconnection of the positive lead.
2. Release the four nuts securing the battery bracket in position.
3. Remove the bracket from the studs.
4. Remove the batten,



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Refitting

5. Reverse the removal procedure.

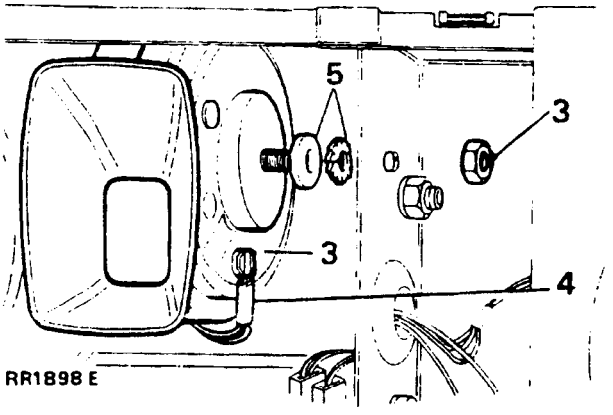
NOTE: Coat the battery clamps and terminals with petroleum jelly before refitting.

HORNS

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove radiator grille.
3. Remove the nut and withdraw the horn.
4. Disconnect the electrical leads.
5. Remove the plain and serrated washer.



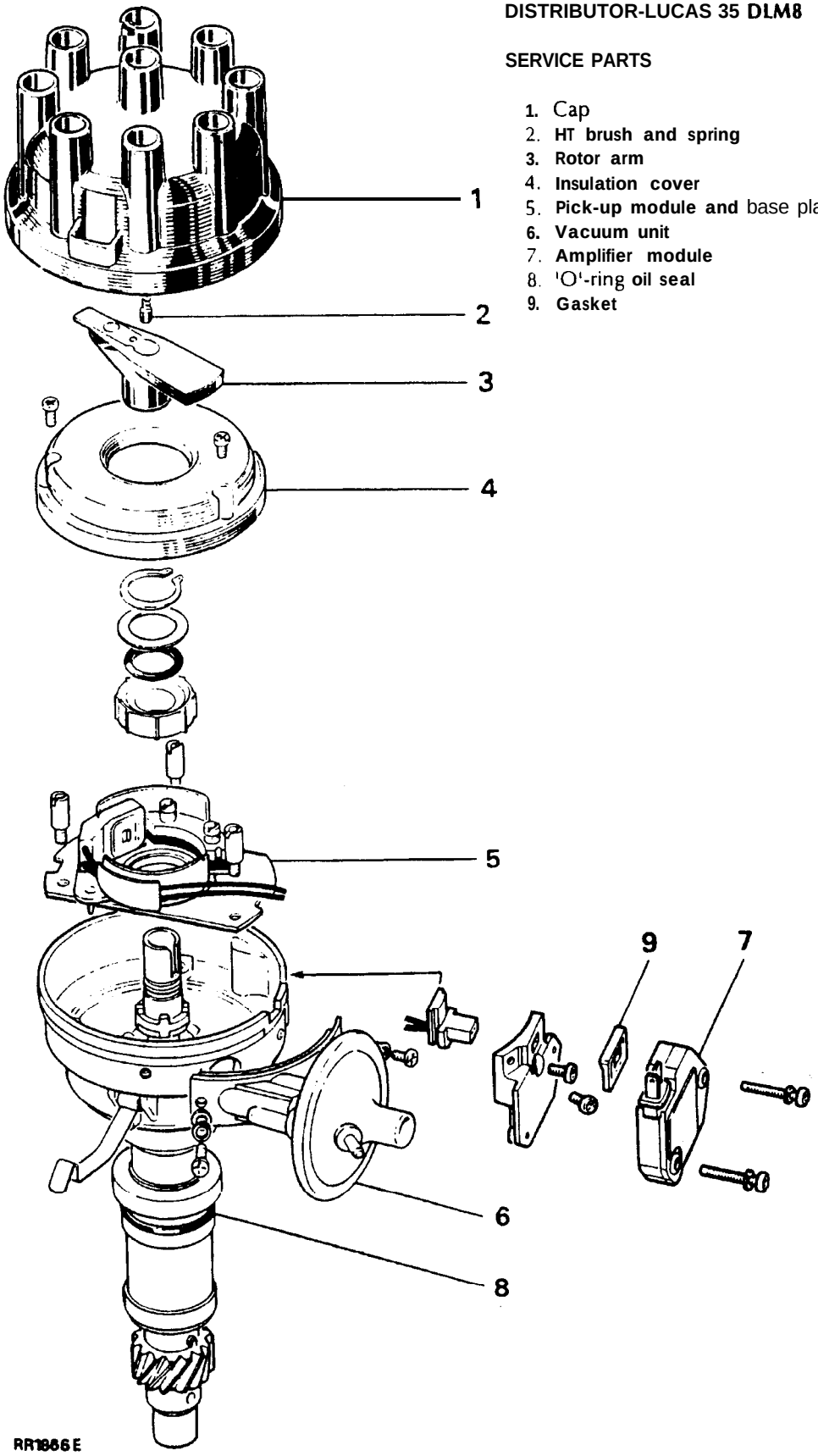
RR1898 E

NOTE: Twin horns are fitted. An identification letter is stamped on the front outer rim of the horn; 'H'-high note, 'L'-low note.

Refitting

NOTE: When refitting the horn ensure that the stud location is pushed firmly to the back of the elongated slot to prevent the horn fouling the radiator grille.

6. Reverse removal procedure.



DISTRIBUTOR-LUCAS 35 DLM8

SERVICE PARTS

1. Cap
2. HT brush and spring
3. Rotor arm
4. Insulation cover
5. Pick-up module and base plate assembly
6. Vacuum unit
7. Amplifier module
8. 'O'-ring oil seal
9. Gasket

ELECTRONIC IGNITION

A Lucas 35DLM8 distributor is employed. This has a conventional vacuum advance unit and centrifugal automatic advance mechanism.

A pick-up module, in conjunction with a rotating timing reluctor inside the distributor body, generates timing signals. These are applied to an electronic ignition amplifier module mounted on the side of the distributor body.

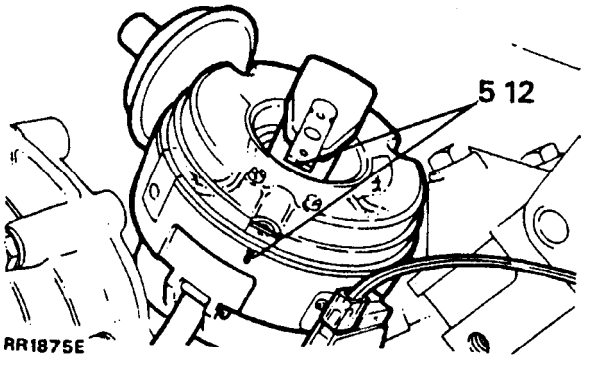
NOTE: The pick-up air gap is factory set. Do not adjust the gap unless the pick-up is being changed or the base plate has been moved. Use a non-ferrous feeler gauge to set the air gap.

DISTRIBUTOR

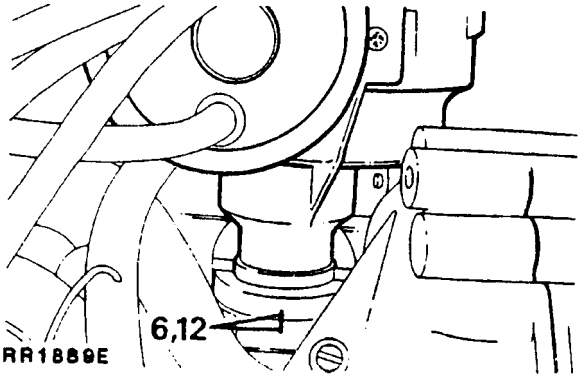
Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Disconnect the vacuum hose.
3. Remove the distributor cap.
4. Disconnect low tension lead from the coil.
5. Mark distributor body in relation to centre line of rotor arm.



6. Add alignment marks to distributor and front cover.

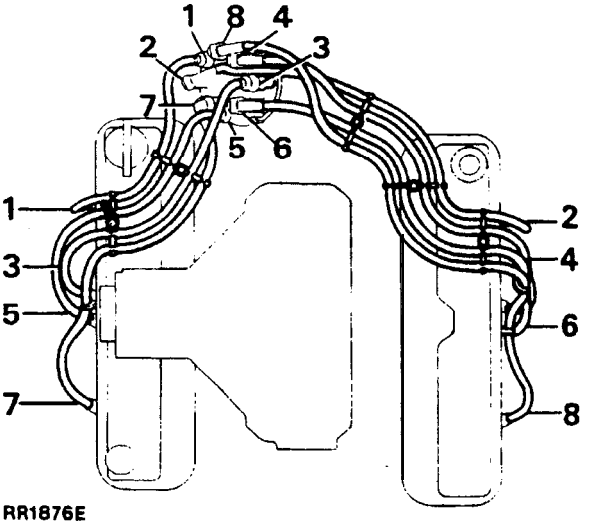


NOTE: Marking distributor enables refitting in exact original position, but if engine is turned while distributor is removed, complete ignition timing procedure must be followed.

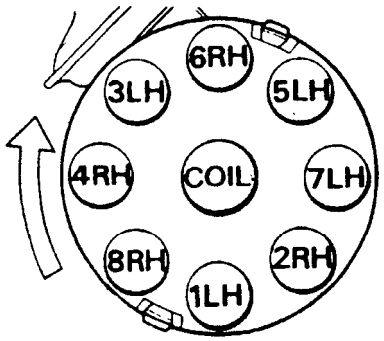
7. Release the distributor clamp and remove the distributor.

Refitting

NOTE: If a new distributor is being fitted, mark body in same relative position as distributor removed.



8. Leads for distributor cap should be connected as illustrated.
   Figures 1 to 8 inclusive indicate plug lead numbers.
   RH-Right hand side of engine, when viewed from the rear.
   LH-Left hand side of engine, when viewed from the rear.



RR616M

9. If engine has not been turned while distributor has been removed, proceed as follows (items 10 to 17). Alternatively proceed to instruction 18.
10. Fit new '0' ring seal to distributor housing.
11. Turn distributor drive until centre line of rotor arm is 30" counter- clockwise from mark made on top edge of distributor body.
12. Fit distributor in accordance with alignment markings.

NOTE: It may be necessary to align oil pump drive shaft to enable distributor drive shaft to engage in slot.

13. Fit clamp and bolt. Secure distributor in exact original position.
14. Connect vacuum hose to distributor and low tension lead to coil.
15. Fit distributor cap.
16. Reconnect battery.
17. Using suitable electronic equipment, set the ignition timing, see IGNITION TIMING-Adjust.
18. If, with distributor removed, engine has been turned it will be necessary to carry out the following procedure.
19. Set engine-No. 1 piston to static ignition timing figure (see Engine Tuning Data- Section 05) on compression stroke.
20. Turn distributor drive until rotor arm is approximately 30" . counter-clockwise from number one sparking plug lead position on cap.
21. Fit distributor to engine.
22. Check that centre line of rotor arm is now in line with number one sparking plug lead on cap. Reposition distributor if necessary.
23. If distributor does not seat correctly in front cover, oil pump drive is not engaged. Engage by lightly pressing down distributor while turning engine.
24. Fit clamp and bolt leaving both loose at this stage.
25. Set the ignition timing statically to 6" B.T.D.C.
26. Connect the vacuum hose to the distributor.
27. Fit low tension lead to coil.
28. Fit distributor cap.
29. Reconnect the battery.
30. Using suitable electronic equipment set the ignition timing, see IGNITION TIMING-Adjust.

DISTRIBUTOR-LUCAS 35DLM8

Overhaul

DISTRIBUTOR CAP

1. Unclip and remove the cap
2. Fit a new cap if known to be faulty.
3. Clean the cap and HT brush with a lint free cloth.

ROTOR ARM

4. Pull rotor arm from shaft.
5. Fit a new rotor arm if known to be faulty.

INSULATION COVER (Flash shield)

6. Remove cover, secured by three screws.
7. Fit a new cover if known to be faulty.

VACUUM UNIT

8. Remove two screws from vacuum unit securing bracket, disengage vacuum unit connecting rod from pick-up base plate connecting peg, and withdraw vacuum unit from distributor body.

Continued

AMPLIFIER MODULE

9. Remove two screws and withdraw the module.
10. Remove the gasket.
11. Remove two screws securing the cast heatsink and remove the heatsink.

WARNING: The amplifier module is a sealed unit containing Beryllia. This substance is extremely dangerous if handled. Do not attempt to open or crush the module.

PICK-UP AND BASE PLATE ASSEMBLY

12. Use circlip pliers to remove the circlip retaining the reluctor on rotor shaft.
13. Remove the fiat washer and then the 'O' ring recessed in the top of the reluctor.
14. Gently withdraw the reluctor from the shaft, taking care not to damage the teeth.

NOTE: Coupling ring fitted beneath reluctor.

15. Remove three support pillars and cable grommet. Lift out the pick-up and base plate assembly.

NOTE: Do not disturb the two barrel nuts securing the pick-up module, otherwise the air gap will need re-adjustment.

16. Fit a new pick-up and base plate assembly if module is known to be faulty, otherwise check pick-up winding resistance (2k-5k ohm).

RE-ASSEMBLY

17. This is mainly a reversal of the dismantling procedure, noting the following points:

LUBRICATION

Apply clean engine oil:

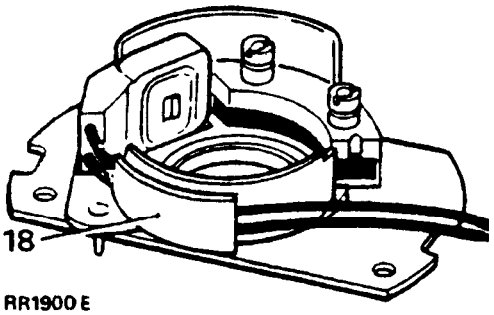
a. A spot into the rotor spindle before fitting rotor arm.

Apply Omnilube 2 (or equivalent) grease.

b. Auto advance mechanism.
c. Pick-up plate centre bearing.
d. Pre tilt spring and its rubbing area (pick-up and base plate assembly).
e. Vacuum unit connecting peg (pick-up and base plate assembly).
f. The connecting peg hole in vacuum unit connecting rod.

FITTING PICK-UP AND BASE PLATE ASSEMBLY

18. Pick-up leads must be prevented from fouling the rotating reluctor. Both leads should be located in plastic guide as illustrated. Check during re-assembly.



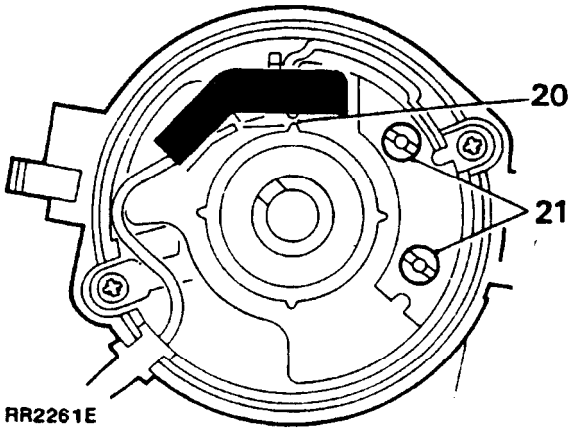
RR1900E

REFITTING RELUCTOR

19. Slide reluctor as far as it will go on rotor shaft then rotate reluctor- until it engages with the coupling ring beneath the pick-up base plate. The distributor shaft, coupling ring and reluctor are 'keyed' and rotate together. Fit the 'O' ring, flat washer and retaining circlip.

PICK-UP AIR GAP ADJUSTMENT

20. The air gap between the pick-up limb and reluctor teeth must be set within the specified limits, using a non-ferrous feeler gauge.



RR2261E

21. If adjustment is necessary, slacken the two barrel nuts to set the air gap. See Engine Tuning Data.

NOTE: **When the original pick-up and base plate assembly has been refitted the air gap should be checked, and adjusted if necessary.**

When fitting a new assembly the air gap will require adjusting to wittiin the specified limits.

AMPLIFIER MODULE

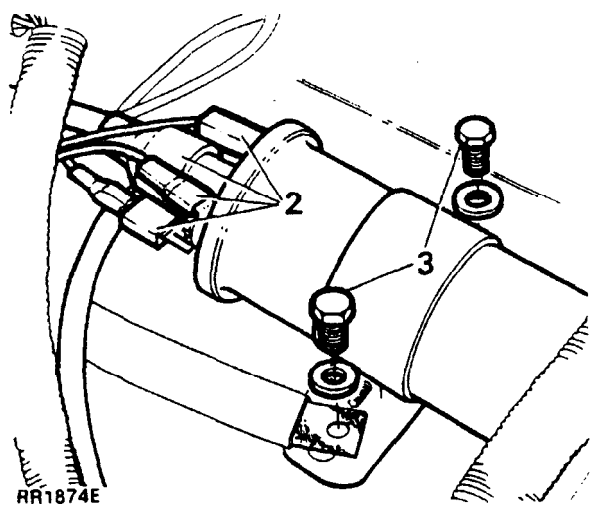
22. **Before fitting the module, apply MS4 Silicone grease or equivalent heat-conducting compound to the amplifier module backplate, the seating face on distributor body and both faces of the heatsink casting.**

IGNITION COIL

Remove and refit

Removing

1. **Disconnect the battery negative terminal.**
2. **Disconnect the High Tension and Low Tension electrical leads from the Ignition coil.**



3. **Remove the two bolts securing the coil to the valance.**

   NOTE: A ground strap is located under one of the bolts.

4. **Remove the coil from the engine compartment.**

Refitting

5. **Reverse the removal instructions.**

   NOTE: Ensure that the bolting location for the ground strap is free from paint and grease. Coat the area around the bolt with Petroleum Jelly.

IGNITION TIMING

Adjust

1 **It is essential that the following procedures are adhered to. Inaccurate timing can lead to serious engine damage and additionally create failure to comply with emission regulations. If the engine is being checked in the vehicle, the air conditioning compressor must be disengaged.**

2 **On initial engine build, or if the' distributor has been disturbed tor any reason, the ignition timing must be set statically to 6' B T.D.C. (This sequence is to give only an approximation in order that the engine may be started) ON NO ACCOUNT MUST THE ENGINE BE STARTED BEFORE THIS OPERATION IS CARRIED OUT.**

Equipment required

Calibrated Tachometer
Stroboscopic lamp

3 **Couple stroboscopic timing lamp and tachometer to engine following the manufacturer's instructions.**

4 **Disconnect the vacuum hose from the distributor.**

5. **Start engine, with no load and not exceeding 3,000 rev/min run engine until normal operating temperature is reached. (Thermostat open). Check that the normal idling speed falls within the tolerance specified in the data section.**

6. **Idle speed for timing purposes must not exceed 800 rev/min.**

7. **With the distributor clamping bolt loosened turn distributor until the timing flash coincides with the timing pointer and the correct timing mark on the rim of the torsional vibration damper as shown in the engine tuning section.**

Continued

8. Retighten the distributor clamping bolt securely. Recheck timing in the event that retightening has disturbed the distributor position.
9. Refit vacuum hose.
10. Disconnect stroboscopic timing lamp and tachometer from engine.

LUCAS CONSTANT ENERGY IGNITION SYSTEM 35DLM8-PRELIMINARY CHECKS

Inspect battery cables and connections to ensure they are clean and tight. Check battery state of charge it in doubt as to its condition.

Inspect all L.T. connections to ensure that they are clean and tight. Check the H.T. leads are correctly positioned and not shorting to ground against any engine components. The wiring harness and Individual cables should be firmly fastened to prevent chaffing.

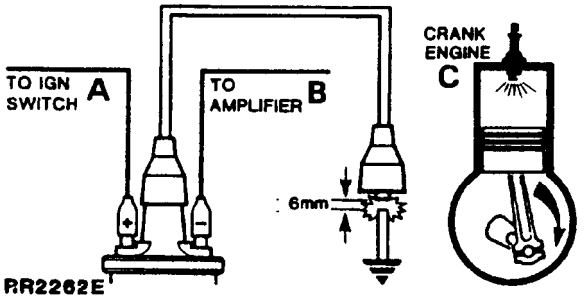
PICK-UP AIR CAP

Check the air gap between pick-up limb and reluctor teeth, using a non-ferrous gauge, see 'Engine Tuning Data'.

NOTE: The gap is set initially at the factory and will only require adjusting if tampered with or when the pick-up module is replaced.

TEST 1:

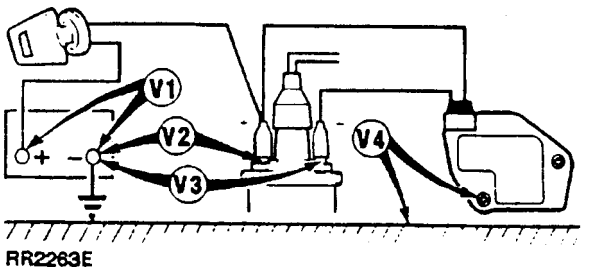
H.T. Sparking



Remove coil/distributor H.T. lead from distributor cover and hold approximately 6mm (0.25 in) from the engine block, using suitable insulated pliers. Switch the ignition 'On' and operate the starter. Regular sparking indicates fault in H.T. distribution, plugs, timing or fuelling, proceed to Test 6. If no spark or weak spark occurs proceed to Test 2.

Test 2:

L.T. Voltage



Switch the ignition 'On' - engine stationary.

(a) Connect voltmeter to points in the circuit indicated by V1 to V4 and make a note of the voltage readings.

(b) Compare voltages obtained with the specified values listed below:

EXPECTED READINGS

V1 More than 12 volts.
V2 1 volt maximum below volts at V1.
V3 1 volt maximum below volts at V1.
V4 0 volt - 0.1 volt.

(c) If all readings are correct proceed to Test 3.
(d) Check incorrect reading(s) with chart to identify area of possible faults, i.e. faults listed under heading SUSPECT and rectify.
(e) If coil and amplifier is suspected, disconnect L.T. lead at coil, repeat V3. If voltage is still incorrect, fit new coil. If voltage is now correct, check L.T. lead, if satisfactory fit new amplifier.
(f) If engine will not start proceed to Test 3.

1	2	3	4	SUSPECT
L	•	•	*	DISCHARGED BATTERY
*	L	L	*	IGN. SWITCH AND/OR WIRING
*	•	L	•	COIL OR AMPLIFIER
•	*	*	H	AMPLIFIER GROUND

KEY

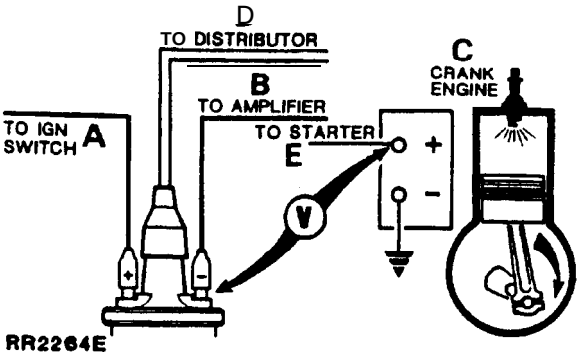
• Expected Voltage

H Voltage higher than expected

L Voltage lower than expected

TEST 3:

Amplifier Switching



RR2264E

'Connect the voltmeter between battery positive (+ ve) terminal and H.T. coil negative (-ve) terminal, the voltmeter should register 0 volts.

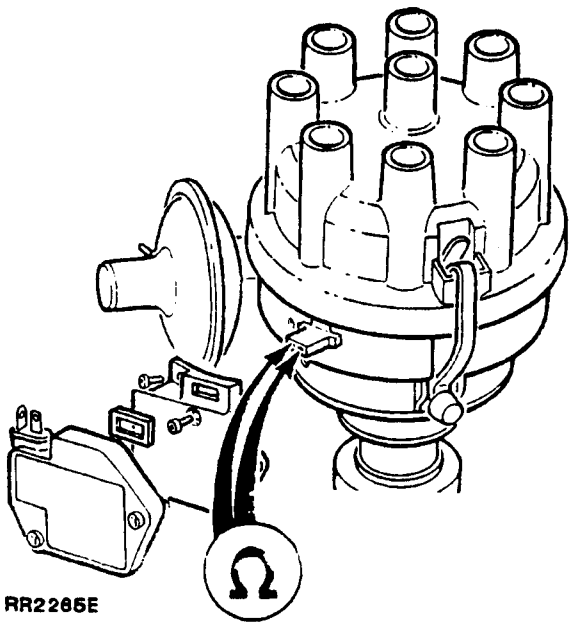
Switch the ignition 'On', the voltmeter should still register 0 volts.

Crank the engine, the voltmeter reading should increase when cranking, in which case proceed to Test 5.

If there is no increase in voltage during cranking proceed to Test 4.

TEST 4:

Pick-up Coil Resistance



RR2265E

Remove the amplifier.

Connect the ohmmeter leads to the two pick-up terminals in the body of the distributor.

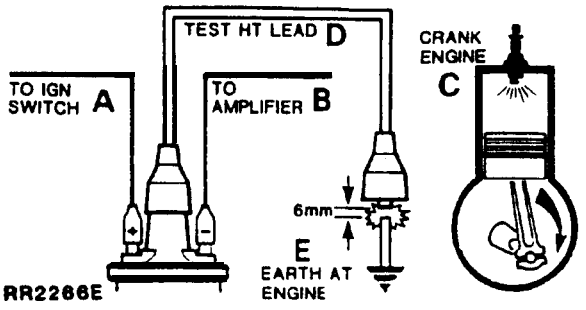
The ohmmeter should register between 2k and Sk ohm if pick-up is satisfactory. If ohmmeter reading is correct, check all connections between pick-up and amplifier, if satisfactory, fit new amplifier. If the engine still does not start carry out Test 5.

Change the pick-up if ohmmeter reading is incorrect. If the engine still does not start proceed to Test 5.

Continued

TEST 5:

Coil H.T. Sparking



Remove existing coil/distributor H.T. lead and fit test H.T. lead to coil tower. Using suitable insulated pliers, hold free end about 6mm (0.25 in) from the engine block and crank the engine. There should be good H.T. sparking.

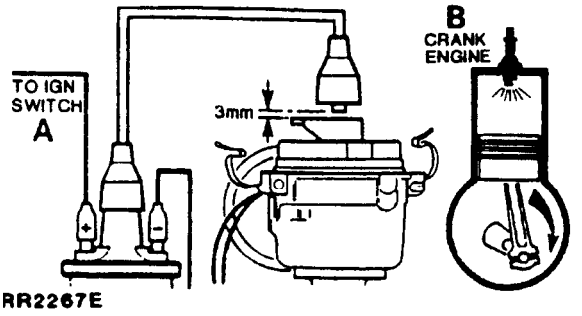
If weak or no sparking, fit new coil repeat test.

H.T. sparking good, repeat test with original H.T. lead. If sparking is good carry out Test 6.

If weak or no sparking, fit new H.T. lead, if engine will not start carry out Test 6.

TEST 6:

Rotor Arm



Remove distributor cover. Disconnect coil H.T. lead from cover, using insulated pliers hold about 3mm (0.13 in) above rotor arm electrode and crank the engine.

There should be no H.T. sparking between rotor and H.T lead. Ii satisfactory carry out Test 7.

If H.T. sparking occurs, an earth fault on rotor arm is indicated. Fit new rotor arm. If engine will not start carry out Test 7.

TEST 7:

Visual and H.T. Cable Checks

Examine:		Should be:
1.	Distributor Cover	Clean, dry, no tracking marks
2.	Coil Top	Clean, dry, no tracking marks.
3.	H.T. Cable Insulation	Must not be cracked, chafed or perished
4.	H.T. Cable Continuity	Must not be open circuit
5.	Sparking Plugs	Clean, dry, and set to correct gap

NOTE:

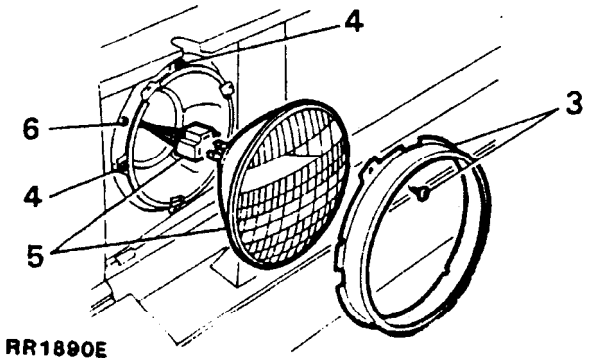
1.	Reluctor	Must not foul pick-up or leads
2.	Rotor and Insulation Cover	Must not be cracked or show signs of tracking marks

HEADLAMP ASSEMBLY/SEALED BEAM UNIT

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the radiator grille - see Body Section 76.
3. Remove three crosshead screws and the headlamp retaining rim.



RR1890E

4. DO NOT disturb the two adjusting screws.
5. Withdraw the sealed beam unit and disconnect the wiring plug from the rear of the unit.
6. Remove three securing screws, pry away the grommet and withdraw the headlamp bowl.

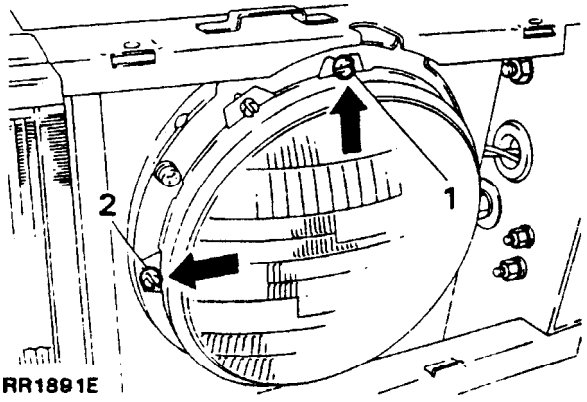
Refitting

7. Reverse removal procedure.

HEADLAMP ALIGNMENT

Headlamp beam setting should only be carried out by qualified person using suitable beam setting equipment.

1. Turn the top adjusting screw counter-clockwise to lower the beam, clockwise to raise the beam.
2. Turn the side adjusting screw counter-clockwise to move the beam to the left, clockwise to move the beam to the right.



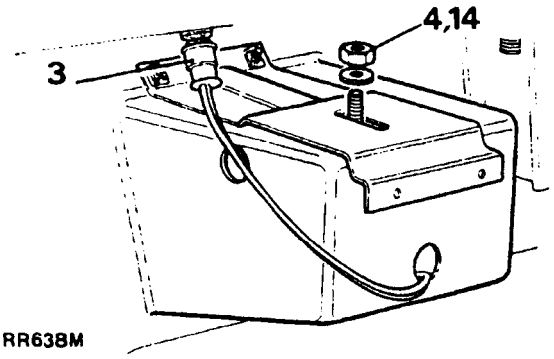
RR1891E

AUXILIARY DRIVING LAMP-RH AND LH

Remove, refit and adjust

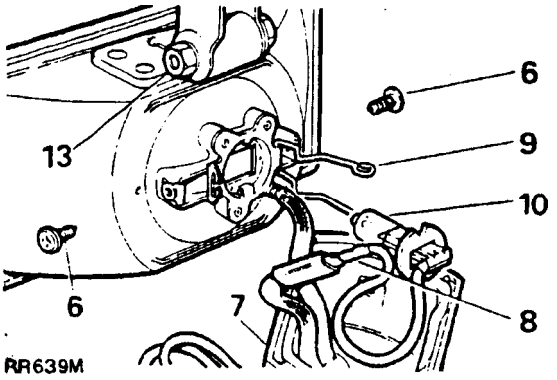
Bulb replacement

1. Disconnect the battery negative lead.
2. The auxiliary driving lamp securing nut is located beneath the front fender adjacent to the front body fixing. Access to the lamp is gained through the front wheel arch.
3. Disconnect the electrical plug.
4. Remove the single nut and washer.



RR638M

5. From the front of the vehicle, maneuver the lamp and remove it from the spoiler opening.
6. Remove the two screws securing the cover to the rear of the lamp.
7. Withdraw the cover.
8. Disconnect the lucar connector.
9. Release the spring clip securing the bulb to the lamp unit.
10. Remove the bulb.



Refitting

11. Fit a new bulb ensuring that the two notches on the bulb body locate with the registers on the lamp unit.
12. Reverse the removal procedure.

Adjusting

The correct adjustment is beam horizontal (parallel to the ground) and parallel to the vehicle axis.

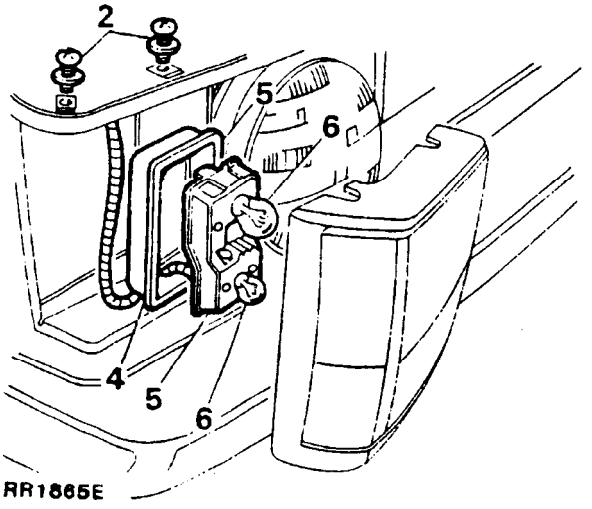
13. Loosen the lamp adjusting bolt to lower or raise the beam.
14. Loosen the lamp securing bolt to move the beam to left or right.
15. Tighten fixing bolts to the correct torque, see Torque Values.

SIDELIGHT AND FLASHER LAMP ASSEMBLY-RH AND LH AND BULB

Remove and refit

Removing

1. Open the hood and disconnect the battery negative lead.
2. Remove the two screws and plain washers securing the lamp assemly.
3. Lift the assembly away sufficiently to gain access to the rear of the lamp.
4. Remove the waterproof cover.
5. Depress the two retaining clips and withdraw the bulb holder.
6. Remove the required bulb. The direction indicator bulb is located in the upper section of the bulb holder, the side lamp bulb in the lower.
7. Disconnect the multi-plug to remove the complete assembly.



Refitting

8. Reverse the removal procedure, ensuring the waterproof cover is located correctly.

TAIL, STOP, REVERSE AND FLASHER LAMP ASSEMBLY-RH AND LH

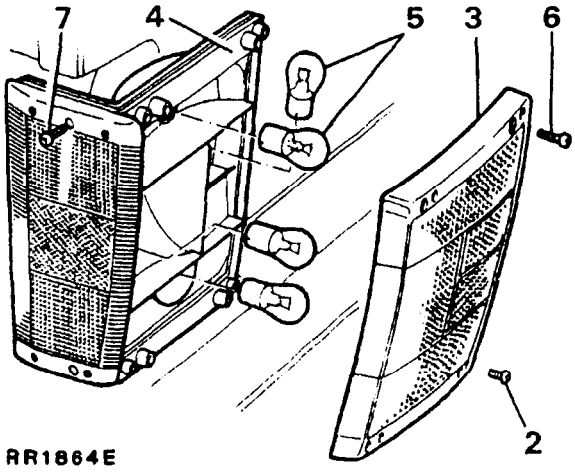
Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the four lens retaining screws.
3. Remove lens.
4. Remove sealing rubber, if required.

NOTE: To remove the sealing rubber complete it is necessary to remove the side marker lens.

5. Remove the bulbs.
6. Remove the four screws securing the lamp unit to the body.
7. Remove the two through-screws from the reflector side, which also secure the lamp unit to the body.
8. Ease the lamp unit forward and disconnect leads at moulded connectors.



RR1864E

Refitting

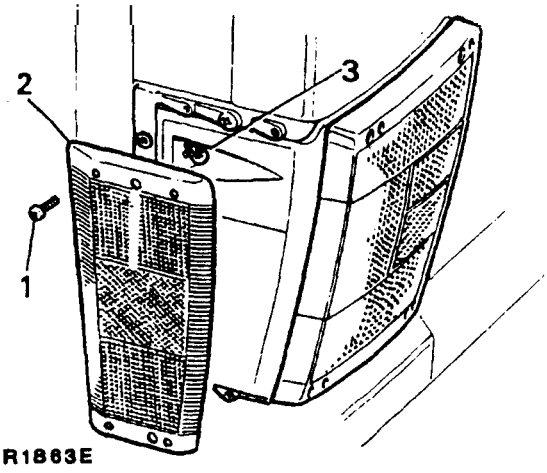
9. Reverse the removal procedure.

REFLECTORS/SIDE MARKER LAMP ASSEMBLY-RH AND LH BULB

Remove and refit

Removing

1. **Remove the four screws securing the lens.**
2. **Remove the lens.**
3. **Remove the bulb.**



RR1863E

NOTE: To remove the rubber seal completely it is necessary to remove the tail light lens.

Refitting

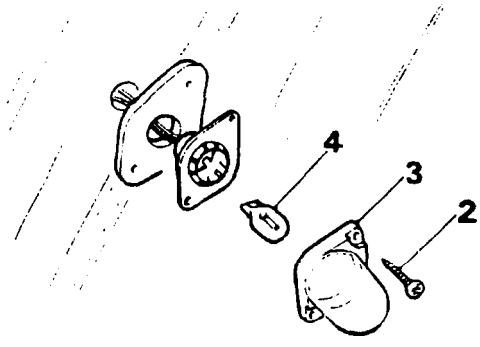
4. Reverse the removal procedure.

UNDER HOOD LAMP ASSEMBLY

Remove and refit

Removing

1. **Disconnect the battery negative lead.**
2. **Remove the two securing screws.**
3. **Remove the lamp glass.**
4. **Pull the five-watt 'wedge' type bulb from the bulb holder.**



RR483M

5. **Disconnect the electrical leads located below the hood lamp switch attached to the inner fender.**
6. **Pull the rubber grommet off the leads and pull the lamp and leads up through the hood stiffener 'channel.**

Refitting

7. Reverse operations 1 to 6.

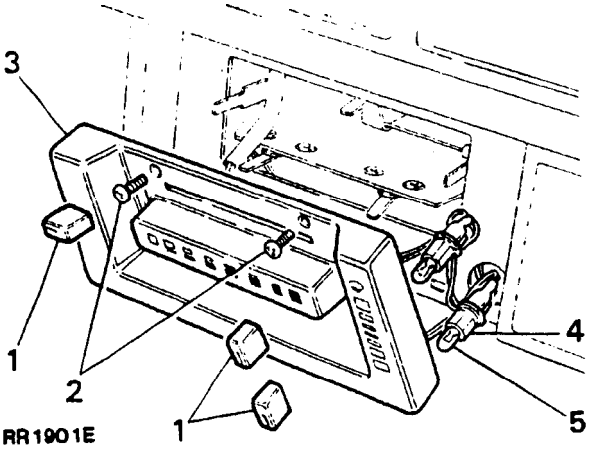
NOTE: A piece of bent wire will be needed to pull the electrical leads out of the channel exit hole when fitting a new lamp assembly.

HEATER/VENTILATION AND AIR CONDITIONING CONTROL PANEL

Bulb replacement

The heater/ventilation control panel is illuminated by four 12-volt 1.2 watt 'wedge' type (capless) bulbs, In the event of a bulb failure a replacement bulb can be fitted as follows:

1. Pull the five finger tip knobs off the control levers.
2. Remove the two screws at the top of the panel.
3. Carefully ease the panel away from the centre console only as lar as the electrical leads will permit.
4. Pull the appropriate bulb holder out of the rear of the panel.
5. Pull the bulb from the holder.
6. Fit a new bulb and push the bulb holder firmly back into its location at the rear of the panel.



Refitting

7. Ensuring that the electrical leads do not become trapped between the panel console and operating levers, refit the panel.

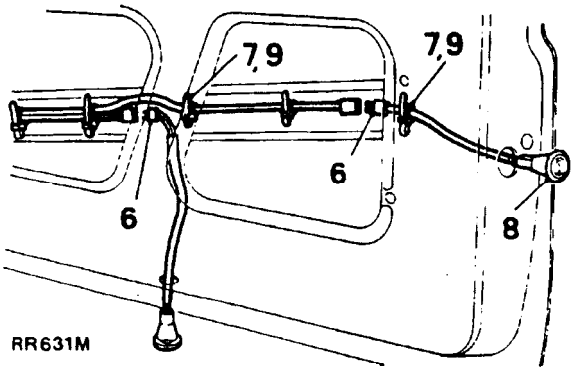
DOOR EDGE LAMPS/PUDDLE LAMPS

Incorporated into the front door assemblies are door edge lamps and puddle lamps, these are located on the door edge and bottom of the door. The lamps are activated by the courtesy light switches when either front door is opened and will immediately switch off when both doors are closed.

Remove and refit

Removing

1. Ensure the siae door glass is fully closed.
2. Disconnect the battery negative lead.
3. Remove the interior door handle and arm rest/door pull from the door.
4. Carefuliy release the interior door trim pad from the inner door panel.
5. Peel back the lower half of the plastic vapour barrier.
6. Disconnect the door edge lamp and puddle lamp two pin electrical plugs within the door. accessible through the lower centre and outer openings of the inner door panel.
7. Release the door edge lamp electrical leads from the retaining clips.
8. Remove the lens and pry the lamps out of the door and withdraw the electrical leads.



Refitting

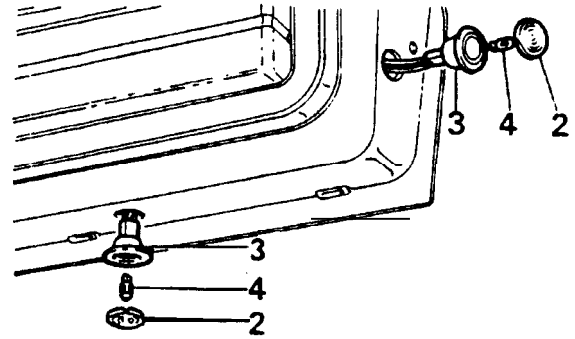
9. Reverse the removal procedure.

NOTE: Ensure the door lamp wiring harness is securely clipped to the lower stiffener plate within the door to prevent damage occurring to the electrical leads when the door glass is in its lowest position.

DOOR EDGE LAMPS/PUDDLE LAMPS

Bulb replacement

1. Disconnect the battery negative lead.
2. Carefully pry out the lamp lens.
3. Withdraw the lamp body from the door ONLY as far as the electrical leads will permit.
4. Pull the bulb from the holder.



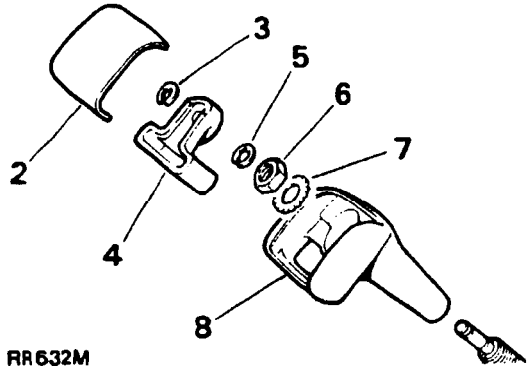
RR2120E

5. Fit a new the bulb and refit the lamp lens.
6. Push the lamp into the door. The correct bulb type is a 12-volt 5-watt capless.

AUTOMATIC GEAR SELECTOR-PANEL ILLUMINATION

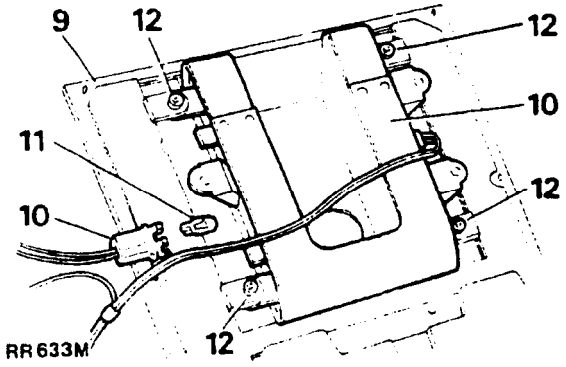
Bulb replacement

1. Disconnect the battery negative lead.
2. Unclip the cover from the top of the gear selector knob.
3. Remove the circlip retaining the detent button.
4. Withdraw the detent button.
5. Remove the lower circlip above the gear selector knob securing nut.
6. Remove the securing nut.
7. Withdraw the serrated washer.



RR632M

8. Slide the selector knob off the shaft.
9. Carefully pry the inset panel out of the floor mounted console, complete with -selector illumination panel and ash tray.
10. The two illumination bulbs are located on the reverse side of the illumination panel.
11. Pull the appropriate bulb holder from its location.
12. if necessary, to facilitate easier removal of the bulb holders, remove the four screws securing the illumination panel to the outer surround panel.



RR633M

13. Pull the bulb from the holder. The correct bulb type is a 24-volt 5-watt 'wedge' base (capless).

Refitting

14. Reverse the removal procedure ensuring that the electrical leads beneath the floor mounted console do NOT become trapped between mating surfaces.
15. To prevent damage to the gear selector knob on reassembly do NOT overtighten the retaining nut, see Torque Values.

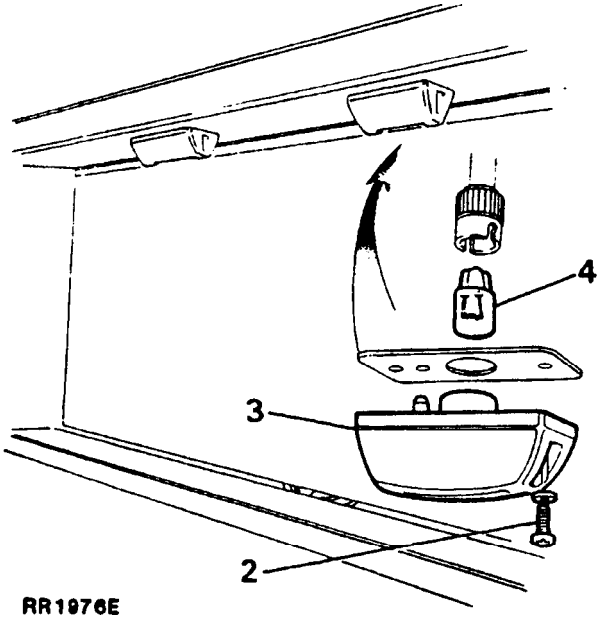
LICENSE PLATE LAMP ASSEMBLY AND BULB

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the two self-tapping screws and washers.
3. Detach the lamp assembly.
4. Disconnect the bulb holder and remove the bulb.

NOTE: Carefully pull the electrical leads out of the bottom of the lower tailgate panel to reveal the snap connectors.



RR1976E

5. Disconnect the electrical connections located at the bottom of the lower tailgate.
6. Remove the bulb holder.
7. Carefully pull the electrical leads up through the inside of the lower tailgate panels.

Refitting

8. Reverse the removal procedure. The correct bulb 'type' is a 12-volt, 5 watt wedge base (capless).

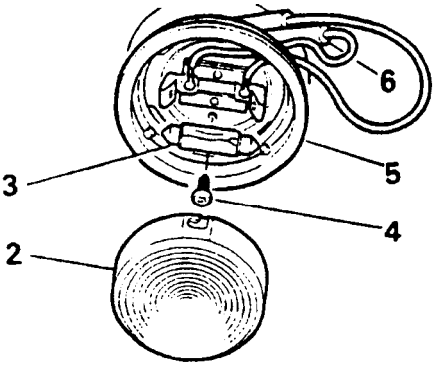
INTERIOR ROOF LAMPS

Remove and refit

The interior roof lamps are operated automatically via the side door and tailgate courtesy switches or by an independent switch located on the auxiliary switch panel.

Removing

1. Disconnect the battery negative lead.
2. Remove the lens irom the courtesy lamp by pressing upward and turning it counter-clockwise.
3. Withdraw bulb from spring clip holder.
4. Remove screws securing lamp base to roof panel.
5. Lower the lamp to reveal the cable snap connections.
6. Disconnect the electrical connections.



RR485M

Refitting

7. Reverse the removal procedure.

INTERIOR ROOF LAMPS CIRCUIT DELAY

Remove and refit

The roof lamp circuit incorporates a delay function which is designed to allow the lamps to remain on for 12 to 18 seconds after either of the front doors are closed.

NOTE; Switching on the ignition (with both doors closed) will immediately over-ride this feature, switching the interior lamps off.

Removing

1. Disconnect the battery negative lead.
2. Remove the six screws securing the lower dash panel.
3. Lower the dash panel to gain access to the red delay unit attached to the steering column support bracket.
4. Remove the delay unit by pushing the unit up off its retaining bracket, to clear the steering column support bracket.
5. Pull the red multi-plug off the delay unit.

Refitting

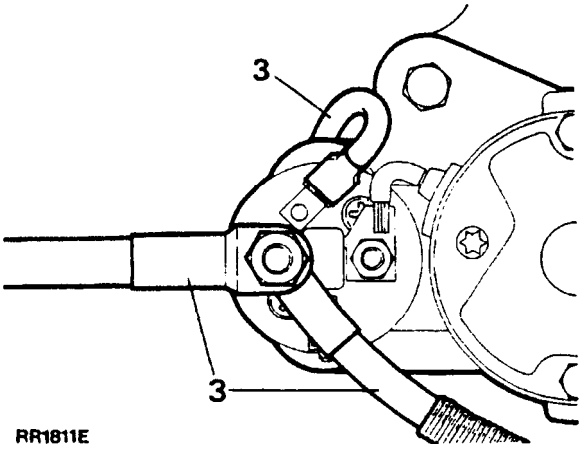
6. Reverse the removal operations.

STARTER MOTOR-LUCAS M78R

Remove and refit

Removing

1. Place the vehicle on a suitabie hoist.
2. Disconnect the battery negative lead.
3. Disconnect the leads from the solenoid and starter motor and remove the exhaust heat shield.
4. Remove the two bolts securing the starter motor to the flywheel housing.
5. Remove the starter motor from underneath the vehicle.



RR1811E

Refitting

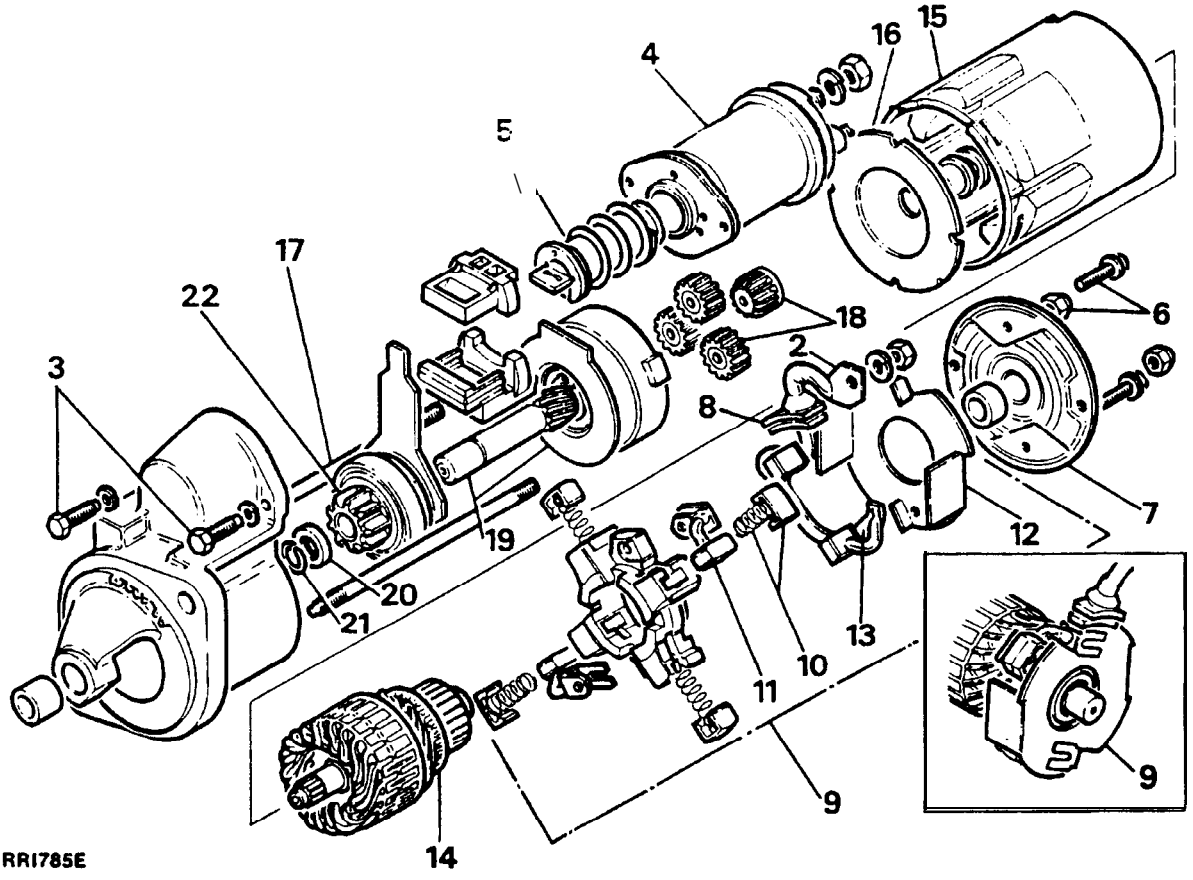
6. Reverse the removal procedure.

STARTER MOTOR-Lucas M78R

Overhaul

Dismantling

1. Remove the starter motor.
2. Remove the braid between the starter and the solenoid terminal.
3. Remove the solenoid fixing screws.
4. Withdraw the solenoid body.
5. Lift and remove the solenoid plunger.
6. Remove two nuts and two screws from the commutator end bracket.
7. Remove the commutator end bracket.
8. Remove the grommet from the yoke.
9. Lift the brushbox assembly clear of the armature.
10. Remove the brush springs.
11. Unclip and remove the ground brushes.
12. Remove the insulating plate.
13. Withdraw the brushes and bus bar.
14. Remove the armature from the yoke.
15. Remove the yoke.
16. Remove the intermediate bracket.
17. Loosen and remove the through bolts from the drive end bracket.
18. Remove the sun and planet gears.
19. Push out the drive shaft sprocket assembly from the drive end bracket.
20. Carefully tap the thrust collar from over the jump ring back towards the drive.
21. Pry the snap ring from its locating groove.
22. Remove the drive assembly from the drive shaft.

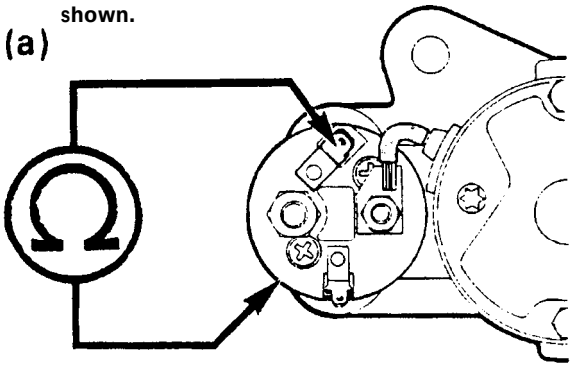


Inspecting

Solenoid

23. Check the continuity and resistance value of windings by connecting an ohmmeter as shown.

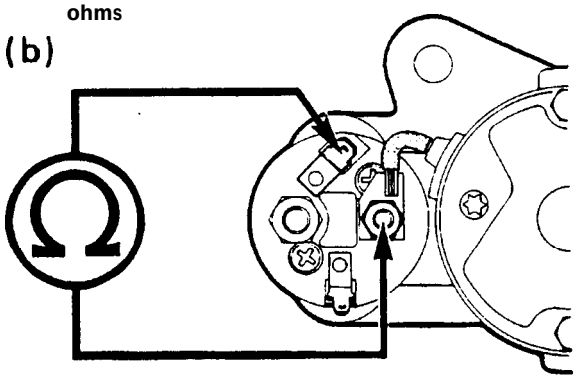
(a)



RR1812E

(a) Resistance value should be: 1.074 ± 0.035 ohms

(b)

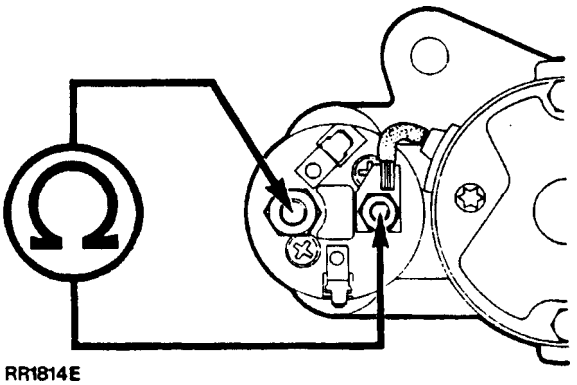


RR1813E

(b) Resistance value should be: 0.298 ± 0.015 ohms

If test results are unsatisfactory replace the solenoid.
If results are correct proceed to 24.

24. Check the contacts by connecting an ohmmeter as shown. Solenoid plunger removed, ohmmeter should read infinity.



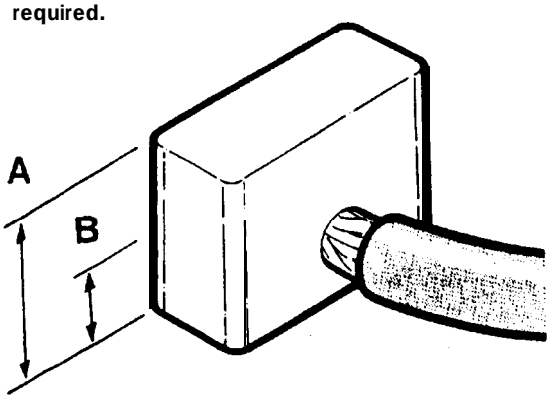
RR1814E

Solenoid plunger operated by hand, ohmmeter should read zero. If test results are unsatisfactory, replace the solenoid. If results are correct proceed to 25.

25. Check operation of spring for freedom of movement.

Brush gear

26. Check brush springs and ensure that the brushes move freely in their holders. Clean the brushes with a solvent moistened cloth, if required.

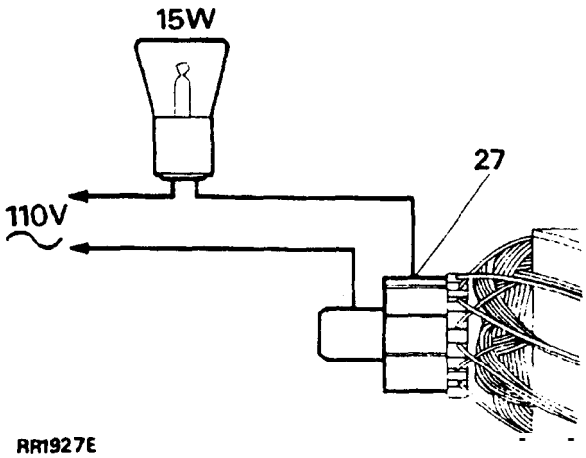


RR1815E

Brush length new, Dimension A is 9mm (0.354 in). Minimum brush length, Dimension B is 3.5mm (0.138 in).

Armature

27. Check the armature insulation using suitable test equipment. Connect the tester between any one commutator segment and the shaft. The method illustrated uses a 110V, 15W test lamp. If the lamp illuminates the armature is faulty, and a replacement component is required.



RR1927E

28. If necessary, the commutator may be machined, providing a finished surface can be obtained without reducing the diameter below 28.8mm (1.13 in), otherwise a new commutator must be fitted. Finish the surface with fine emery cloth. Do not undercut the insulation slots.

Drive assembly

29. Test the roller clutch. The pinion should rotate in one direction only, independent of the clutch body. Replace the unit if unsatisfactory or if teeth are damaged or worn.

Bearings

30. Fit new the bearing bushes if there is evidence of armature fouling magnets or if there is perceptible side play between the shaft and bush.

31. Drive end/intermediate end bracket: press out the bush using a suitable press and mandrel.

32. Press the new bush in, ensuring that on the drive end bracket, the bush is flush with the casting.

33. Commutator end bracket; thread a 9/16" Whitworth or suitable similar tap firmly into the bush. Extract the bush with the tap using a power press in reverse.

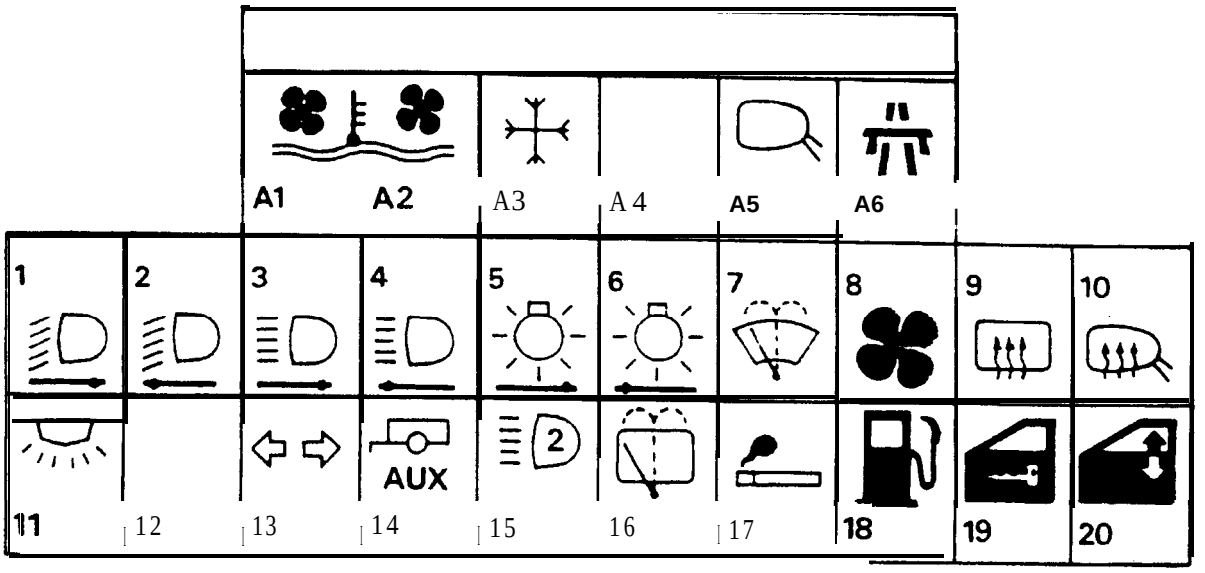
NOTE: Soak new bushes in engine oil for thirty minutes before fitting.

Reassembly

34. Reverse the instructions 1 to 22. Smear the teeth and operating collar of the roller clutch with Shell Retinax 'A' grease. Smear the pivot lever of the drive assembly with Mobil 22 grease. Smear the drive shaft sun and planet gears with Rocol BRB1200 grease.

35. Tighten all the fixings to the correct torque-see Torque Values.

FUSE BOX



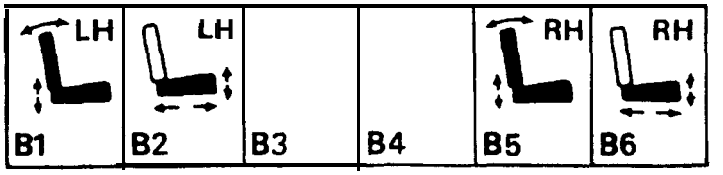
RR 1759E

FUSE NO.	COLOUR CODE	FUSE VALUE	CIRCUIT SERVED	IGNITION KEY CONTROLLED
MAIN FUSE PANEL				
1	Brown	7 5 amp	RH headlamp low beam and power wash	
2	Brown	7.5 amp	LH headlamp low beam	
3	Brown	7.5 amp	RH headlamp high beam	
4	Brown	7.5 amp	LH headlamp high beam	
5	Tan	5 amp	RH parking lights and instrument illumination	
6	Tan	5 amp	LH parking lights and radio illumination	
7	Blue	15 amp	Front wash/wiper motors	AUX
8	Yellow	20 amp	Heating/air conditioning motor	AUX
9	White	25 amp	Heated rear screen	IGN
10	Violet	3 amp	Mirror heaters	IGN
11	Blue	15 amp	Audio warning unit, headlamp flash,door, hood and internal lamps, radio, clock. horns. hazard switch, key 'IN' switch and emission maintenance reminder	
12		-----	Not used	
13	Blue	15 amp	Low coolant monitor. slop and reverse lamps, direction indicators, instruments, bulb check. low oil monitor. screen wash fluid monitor, interior lamp delay unit and speed transducer	IGN
14	Blue	15 amp	Auxiliary feed trailer	
15	Blue	15 amp	Auxiliary driving lamps	
16	Red	10 amp	Rear wash/wipe motor	AUX
17	Yellow	20 amp	Cigar lighters (front and rear), gear selector illumination	IGN
18	Red	10 amp	Fuel pump	IGN
19	Red	10 amp	Central locking	
20	White	25 amp	Window lifts	AUX

NOTE: Radio/Cassette combination. An in-line type 5 amp fuse is incorporated in the power input lead of the unit.

AUXILIARY FUSE PANEL-(A)				
A1	Yellow	20 amp	Air conditioning fan	IGN
AZ	Yellow	20 amp	Air conditioning fan	IGN
A3	Tan	5 amp	Air conditioning compressor clutch	IGN
A4			Spare	
A5	Violet	3 amp	Electric mirror motors	IGN
A6	Brown	7.5 amp	Cruise control	IGN

NOTE: Sunroof fuse is a 20 amp blade type fuse and is located on the side of the sunroof main relay. See pages 77-78 for relay location.



RR1760E

AUXILIARY FUSE BOX (B)-Located under the front left-hand seat

FUSE NO	COLOUR CODE	FUSE VALUE	CIRCUIT SERVED
B1	Green	30 amp	Seat recline
B2	Green	30 amp	Seat base
B3	----	----	Spare
B4	----	----	Spare
B5	Green	30 amp	Seat recline
B6	Green	30 amp	Seat base

FUSE BOX-Main and Auxiliarv

Remove and refit

Removing

1. **Disconnect the battery negative lead.**
2. **Remove the clip-on fuse box cover.**
3. **Remove the fuses from the main and auxiliary fuse boxes.**
4. **Remove the single screw securing the top auxiliary fuse box to the fuse box surround.**
5. Unclip **the opposite end of the fuse box.**
6. **Remove the two screws securing the main fuse box to the lower centre dash panel.**
7. **Withdraw the auxiliary fuse box surround.**
8. **Maneuver the main and auxiliary fuse box to enable them to be withdrawn through the fuse box opening.**
9. **Remove the leads from the fuse boxes, by inserting a small screwdriver into each fuse socket to depress the small retaining tab on the back of the lucar connections, withdraw the leads from the rear of the fuse box.**

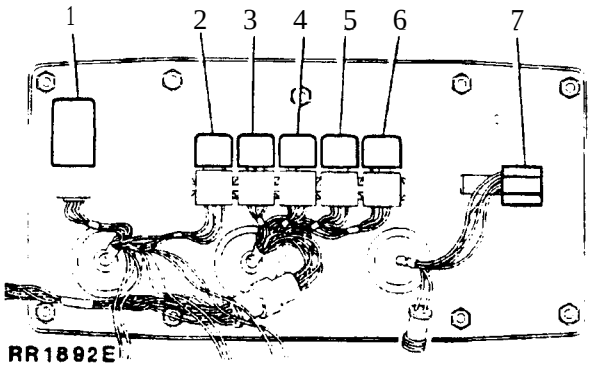
Refitting

10. **Reverse the removal instructions ensuring that all leads are refitted to the correct fuse socket (refer to main circuit diagram).**

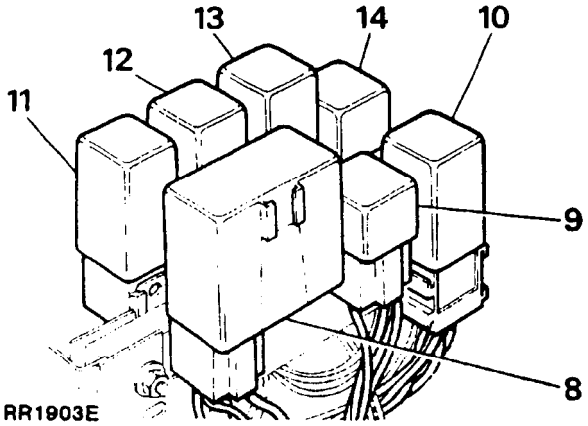
NOTE: When refitting the leads to the fuse box, the retaining tabs on the back of the lucar connectors must be in their raised position to prevent the leads being pushed out of the rear of the fuse box when the fuse is refitted.

RELAYS-Identification

incorporated in the vehicle electrical circuits are several relays, some of which are located behind the lower dash panel attached to the steering column support bracket. Relays are also located in the engine compartment attached to the closure panel. these relays are accessible having removed the black protective cover. The remaining relays are located beneath both front seats.

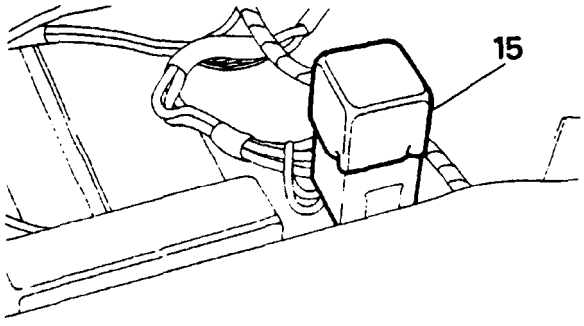


Closure panel viewed from the engine compartment, with protective cover removed.



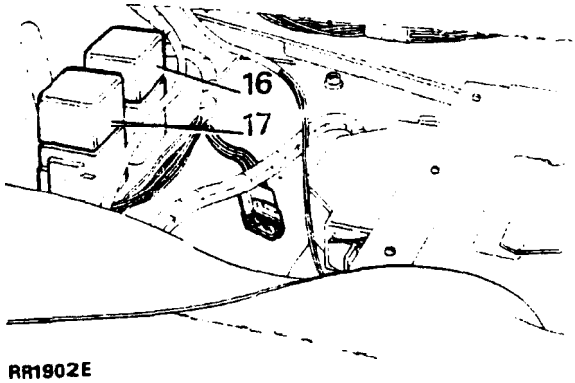
Steering column mounted relays viewed with the lower dash panel removed.

Relay	Circuit Diagram Item Number	Colour
1. Headlamp wash timer unit	17. Main circuit diagram	Black
2. Heated rear window	65. Main circuit diagram	Natural
3. Starter solenoid relay	6. Main circuit diagram	Natural
4. Compressor clutch	11. Air conditioning diagram	Natural
5. Condenser fan	9. Air conditioning diagram	Natural
6. Air conditioning/heater	5. Air conditioning diagram	Natural
7. Stowage position	Not used	-------
8. Rear wiper delay	139. Main circuit diagram	Black
9. ignition load relay	1. Main circuit diagram	Black
10. Front wiper delay	14. Main circuit diagram	Red
11. Flasher/Hazard unit	74. Main circuit diagram	Blue
12. Voltage sensitive switch	71. Main circuit diagram	Yellow
13. Interior lamp delay	100. Main circuit diagram	Red
14. Auxiliary lamp relay	87. Main circuit diagram	Natural
15. Seat adjustment relay	4. Seat adjustment diagram	Natural
16. Main EFI relay	22. EFI circuit diagram	Natural
17. Fuel pump relay	21. EFI circuit diagram	Natural



RR1928E

Seat adjustment relay located beneath the left hand front seat adjacent to fuse box (B).



RR1902E

Main EFI (black terminal block) and fuel pump relays (blue terminal block) mounted beneath right hand front seat.

NOTE: Refer to fuel injection section of manual for full information on E.F.I. relays.

RELAYS-(Mounted on the engine compartment closure panel).

Remove and refit

Removing

1. Lift the hood.
2. Disconnect the battery negative lead.
3. Remove the bolt securing the relay protective cover, located on the front of the engine compartment closure panel.
4. Remove the cover.
5. Pull the appropriate relay off its multi-plug.

Refitting

6. Reverse the removal procedure.

RELAYS-(Mounted on the steering column support bracket)

Remove and refit

Removal.

1. Disconnect the battery negative lead.
2. Remove the six screws securing the lower fascia panel.
3. Lower the dash panel, disconnect the electric leads from the dimming control switch and remove the fascia panel.
4. Locate the appropriate relay on the relay mounting bracket, carefully pull the relay off the multi-plug.

Refitting

5. Reverse the removal procedure.

RELAYS-(Floor mounted beneath front seats)

Remove and refit

Removing

1. Position seat to gain access to the required relay.
2. Disconnect the battery negative lead.
3. Carefully pull the relay off the multi-plug.

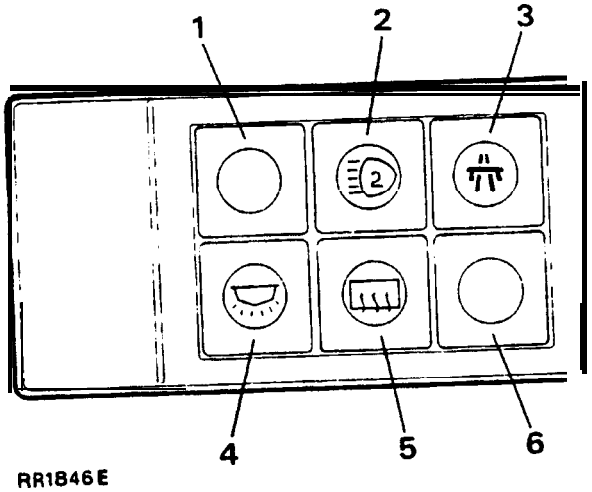
Refitting

4. Reverse the removal procedure.

AUXILIARY SWITCH PANEL

The auxiliary switch panel contains four 'push-push' type switches which incorporate integral symbols for identification.
(The first and sixth switch openings are fitted with blank covers, which are removable, to facilitate the fitting of extra switches if required).
The symbols are illuminated by two bulbs which become operational when the vehicle lights are on.

The heated rear screen switch (5) is provided with an individual warning light, illuminated when the switch is operated.



RR1846E

1. Blank.
2. Auxiliary driving lamps.
3. Cruise control master switch.
4. Interior and tailgate lamps.
5. Heated rear screen.
6. Blank.

AUXILIARY SWITCH PANEL

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Carefully pry the auxiliary switch panel surround away from the centre console.
3. Withdraw the switch panel as far as the electrical leads will permit.
4. Unclip the multi-plugs at the rear of the switches by depressing the retaining lugs.
5. Pull the plugs from the switches.
6. Remove the switch assembly complete.

NOTE: If necessary each individual switch can now be removed as follows.

7. Depress the small retaining lugs on the top and bottom of the switch and push the switch(es) through the front of the switch surround.

Refitting

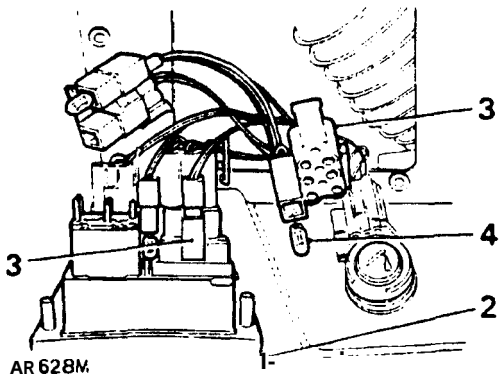
8. Reverse the removal procedure.

NOTE: To aid identification and location of multi-plug to switch, a coloured plastic tab is attached to each body which corresponds. with an appropriate coloured multi-plug.
The switches if removed, should always be refitted in their original position.

Auxiliary switch panel/heated rear screen warning light warning light

Bulb replacement (switch 5)

1. Disconnect the battery negative lead.
2. Carefully pry the switch panel surround away from the centre console.
3. Unclip the multi-plug from the rear of the switch and disconnect the plug.



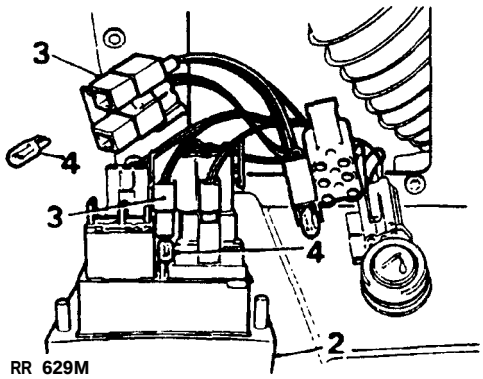
4. The warning light bulb is located in the multi-plug and is removed by pulling the bulb from its location.
5. Fit a new bulb and refit the multi-plug.
6. Press the auxiliary switch panel back into the centre console. The correct bulb type is an amber 12-volt 1.2-watt 'wedge' base (capless).

Auxiliary switch panel illumination

To replace either bulb

The auxiliary panel green illumination bulbs are located in the interior lamp/heated rear screen and multi-plugs, each bulb is positioned in the centre of a group of four switches.

1. Disconnect the battery negative lead.
2. Carefully pry the switch panel surround away from the centre console to give access to the multi-plugs at the rear of the switches.



3. Unclip and pull the multi- plugs from the rear of the appropriate switch.
4. Pull the green illumination bulb irom its location.
5. Fit a new bulb and refit the multi-plug.
6. Press the auxiliary panel surround 'back into the centre console.

The correct bulb type IS a li-volt 1.2-watt 'wedge' base (capless).

STEERING COLUMN CONTROLS

The steering column switch layout is as follows:

LEFT HAND CONTROLS

Lower switch-Main lighting switch
Upper switch-High and low beam, direction indicators and horn.

RIGHT HAND CONTROLS

Lower switch - Rear screen programmed wash/wipe.
Upper switch - Windscreen programmed wash/wipe.

STEERING WHEEL

The following operations for steering column controls show the steering wheel removed, this is for clarity only, and is not a necessary part of the procedure. If steering wheel removal is required, refer to steering wheel remove and refit on page 21 Section 57 carefully observing the spiral cassette instructions.

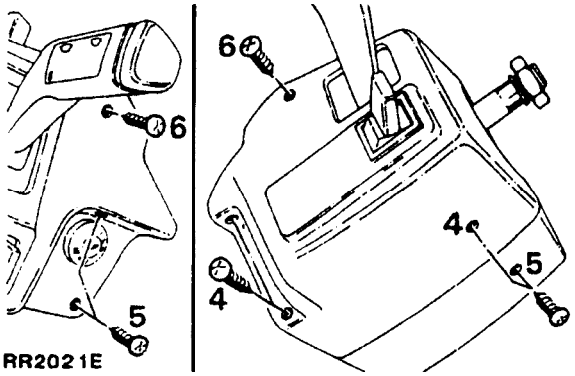
STEERING COLUMN SHROUD

Certain operations within the electrical section necessitate removal of the steering column shroud. Unless removal of both sides of the shroud is required, remove ONLY the side necessary for access.

Remove and refit

Removing

1. **Disconnect the battery negative lead.**
2. **Remove the lower dash panel.**
3. **Disconnect the electrical connections to either the master lighting switch or the rear screen wash wipe switch. (Disconnect both if removing the complete shroud).**
4. **Left hand shroud-remove three securing screws and remove the shroud over the indicator/high beam switch.**
5. **Right hand shroud-remove three securing screws and remove the shroud over the windscreen wash wipe switch.**
6. **To facilitate reassembly remove the screw securing the two halves of the shroud together from one side only.**



RR2021E

Refitting

7. **If both sides of the shroud have been removed ensure that the plate on the steering column is correctly located in the slot in the shroud.**
8. **Reverse the removal procedure.**

MAIN LIGHTING SWITCH

REAR SCREEN PROGRAMMED WASH WIPE SWITCH

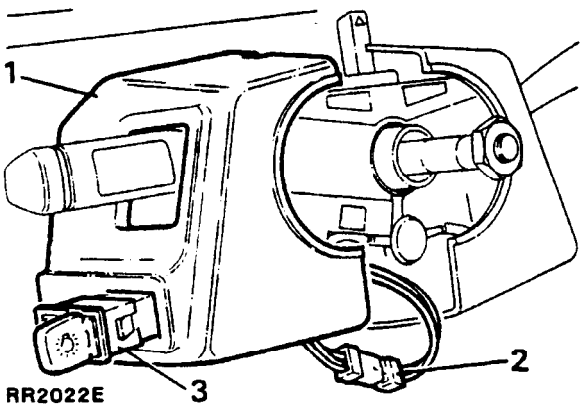
Remove and refit

Removing

1. **Remove the steering column shroud from the required side.**
2. **Disconnect cables at snap connectors.**
3. **Push the two spring clips locating the switch inwards and remove the switch from its mounting.**

Refitting

4. **Reverse the removal procedure.**



RR2022E

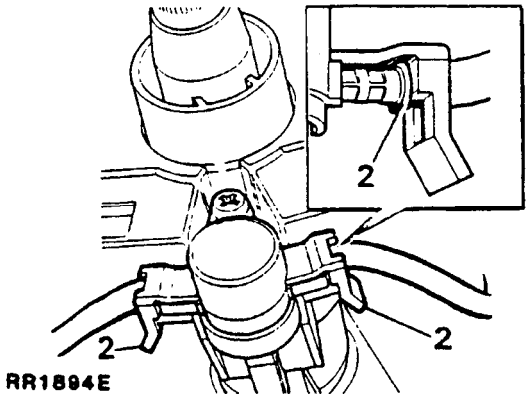
WINDSCREEN PROGRAMMED WASH WIPE SWITCH

HIGH AND LOW BEAM, DIRECTION INDICATORS AND HORN SWITCH

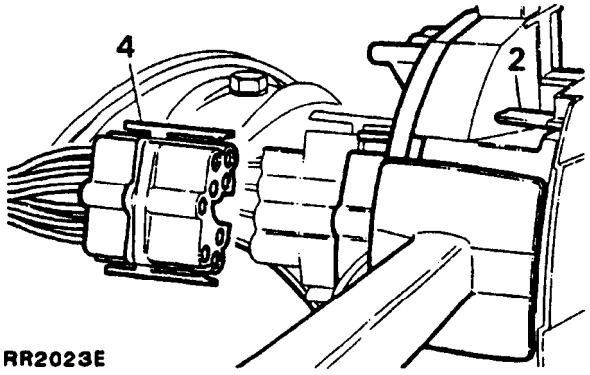
Remove and refit

Removing

1. Remove the steering column shroud from the required side.
2. Release the appropriate retaining clip and pull the fibre optic guide from the housing.



3. Depress the retainers at the top and bottom of the switch and pull combined switch assembly away from the steering column switch housing.



4. Lighting, indicator and horn switch: release the two harness multi-plugs from the back of the switch and remove the switch assembly.
   Wiper and washer switch: release the harness multi-plug from the back of the switch and remove the switch assembly.

Refitting

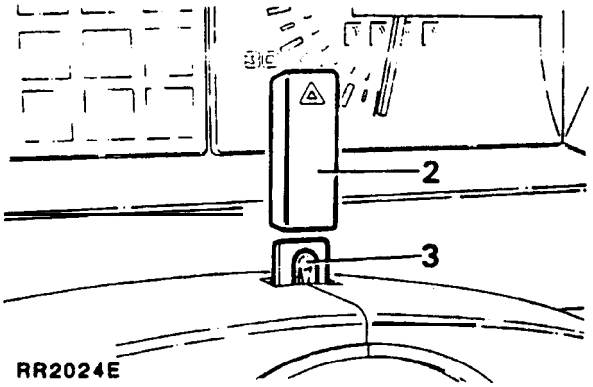
5. Reverse the removal procedure.

HAZARD WARNING SWITCH BULB REPLACEMENT

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Pull the hazard switch cover upwards and remove it to gain access to the bulb.



3. Remove the bulb by pulling it upwards. A piece of rubber tubing or adhesive tape attached to the bulb may facilitate removal and refitting.

Refitting

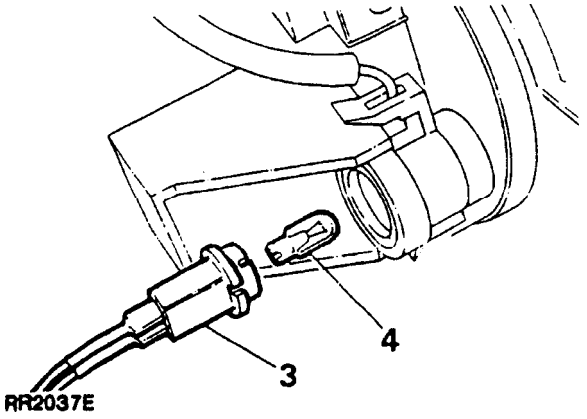
4. Locate the bulb in its holder and reverse instructions 1 to 3.
   The correct bulb is a 12V, 1.2 watt 'wedge' base (capless).

COLUMN SWITCH ILLUMINATION BULB REPLACEMENT

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the left hand side steering column shroud.
3. Working behind the column switch housing twist the bulb holder through 90° and withdraw.
4. Remove the bulb.



Refitting

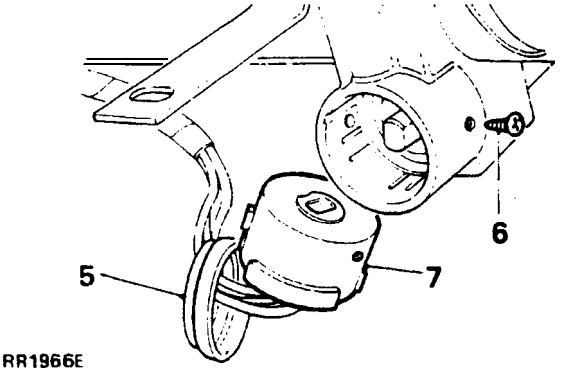
5. Reverse the removal procedure. The correct bulb type is a 12-volt, 1.2-watt 'wedge' base (capless).

IGNITION STARTER SWITCH

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the lower dash panel.
3. Remove the steering column shroud left hand side.
4. Disconnect the ignition switch cable at the multi-plug.
5. Remove the rubber cover protecting the switch.



6. Remove the single screw securing the ignition/starter switch to the housing.
7. Withdraw the switch.

Refitting

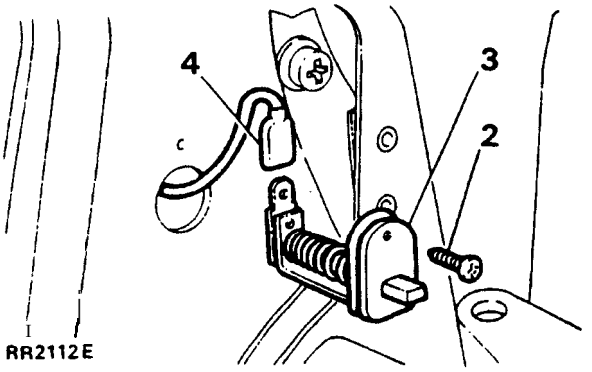
8. Reverse the removal procedure.

DOOR PILLAR SWITCH

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the screw securing the switch to door pillar.
3. Withdraw switch.
4. Disconnect electrical lead from connector blade.



Refitting

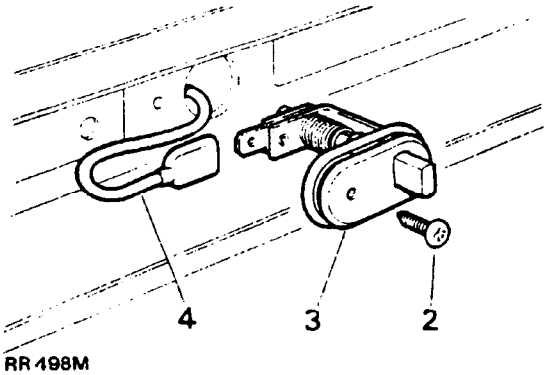
5. Reverse removal procedure.

REAR TAILGATE SWITCH

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the single screw securing the switch to the tailgate opening.
3. Withdraw the switch.
4. Disconnect the electrical lead.



RR498M

Refitting

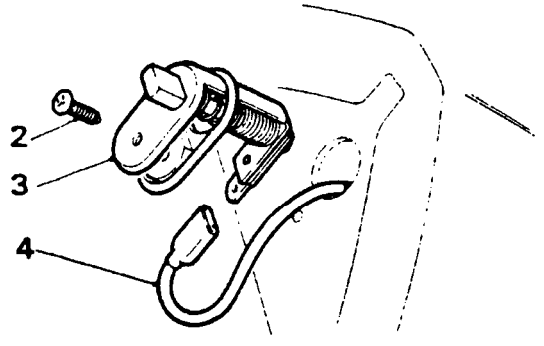
5. Reverse the removal procedure.

UNDER HOOD ILLUMINATION SWITCH

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the single screw securing the switch to the cowl panel.
3. Withdraw the switch.
4. Disconnect the electrical lead.



RR499M

Refitting

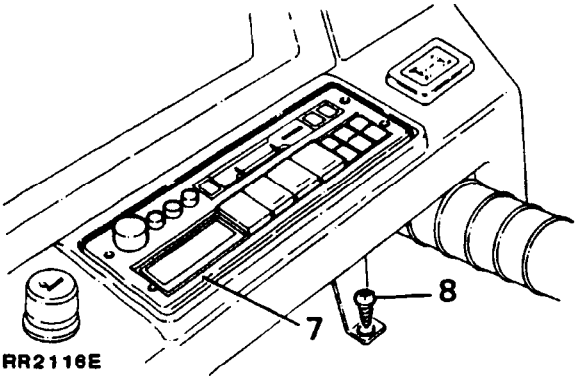
5. Reverse the removal procedure.

CIGAR LIGHTER-radio housing

Remove and refit

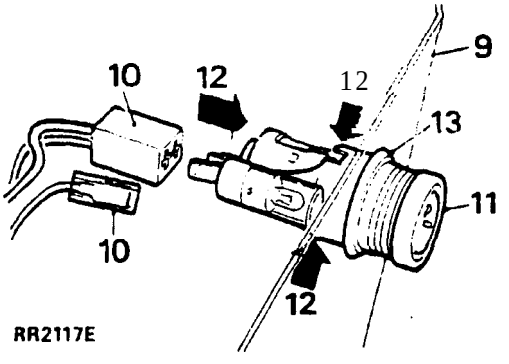
Removing

1. Disconnect the battery negative lead.
2. Remove the High/Low range gear knob.
3. Remove the main gearbox knob. See Automatic gear selector panel illumination.
4. Remove the glove box liner and release the parking brake cable from the parking brake lever, pry the inset panel out of the floor mounted console. Pull the two illumination bulbs from the selector panel.
5. Release the glove box from its four floor mounted fixings.
6. Raise the front of the glove box and console assembly and ease the unit away from the radro housing.



RR2116E

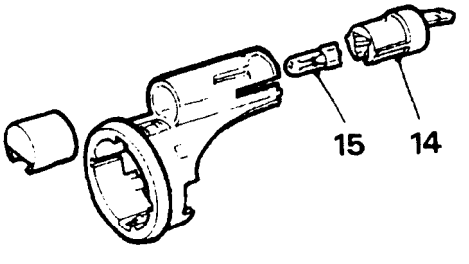
7. Remove the radio, referring to the Manufacturer's instructions for removal and installation.
8. Remove the single screw securing the housing to the top of the gearbox tunnel.
9. Pull the housing away from the lower dash panel.
10. Disconnect the electrical leads at the rear of the cigar lighter.
11. Remove the push in switch from the lighter outer body.
12. Depress the outer plastic surround where denoted by the arrows and push the outer body through the surround.
13. Maneuver the plastic surround and remove it from the radio housing.



RR2117E

CIGAR LIGHTER ILLUMINATION -Bulb replacement

14. Remove the bulb holder from the plastic surround.
15. Pull the bulb from the holder. The correct bulb type is a 12V 1.2-watt wedge base (capless).



RR2118E

Refitting

16. Reverse the removal procedure.

CIGAR LIGHTER-Glove Box

The rear cigar lighter is located in the bottom of the glove box, access to the rear of the lighter is gained through heater/air vent duct below the rear ashtray.
Follow instructions 13 to 16 of CIGAR LIGHTER - radio housing, to remove the lighter from the glove box.

REVERSE LIGHT SWITCH-START INHIBITOR SWITCH/NEUTRAL SAFETY SWITCH

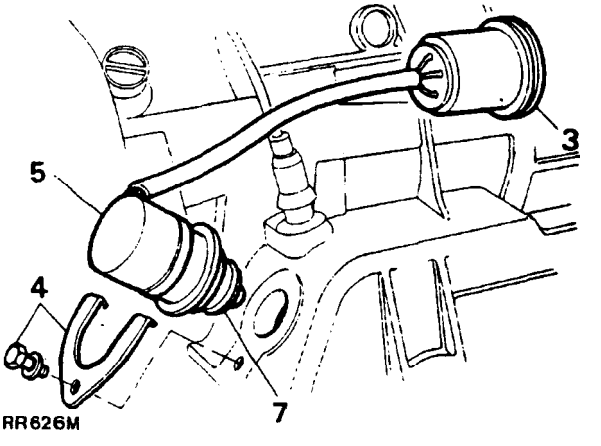
Automatic gearbox

Remove and refit

The reverse light switch is an integral part of the start inhibitor switch and is located on the left hand side of the gearbox above the front of the gearbox sump and is accessible from beneath the vehicle.

Removing

1. Drive the vehicle onto a suitable hoist.
2. Disconnect the battery negative lead.
3. Disconnect the multi-plug.
4. Release the clamp bolt and remove the clamp.
5. Withdraw the switch from its location.



RR626M

Refitting

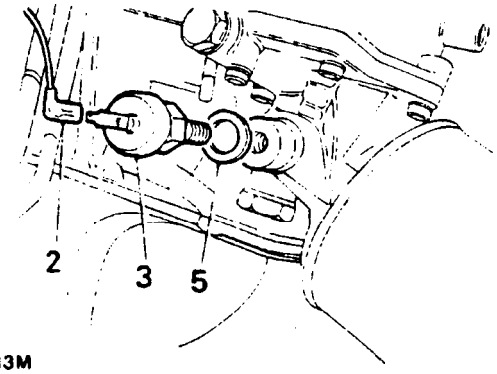
6. Reverse the removal instructions.
7. Fit a NEW 'O' ring to the switch.

OIL PRESSURE WARNING SWITCH

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Disconnect the electrical lead from the switch.
3. Unscrew the switch unit.
4. Remove switch and sealing washer.



RR513M

Refitting

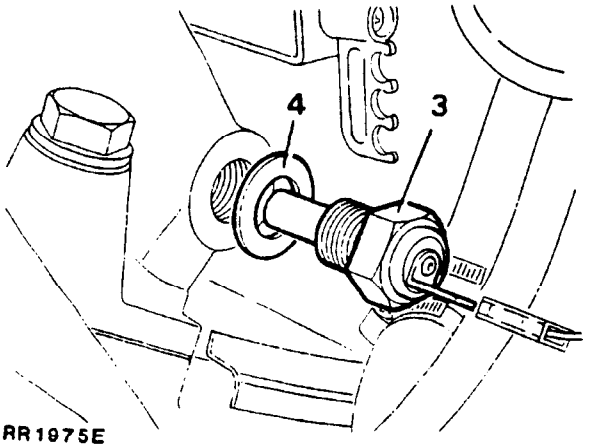
5. Reverse the removal procedure, using a NEW sealing washer.

COOLANT TEMPERATURE TRANSMITTER

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Disconnect the electrical lead from the transmitter.
3. Remove the transmitter from the inlet manifold.



RR1975E

Refitting

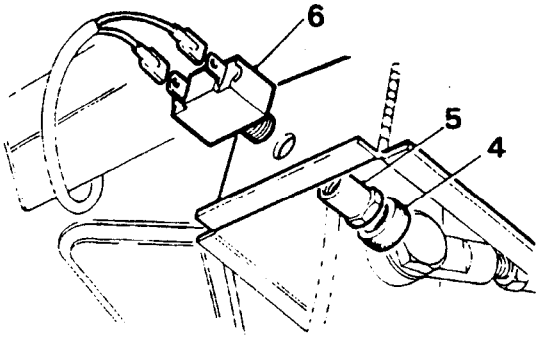
4. Reverse the removal procedure, using a NEW sealing washer.

STOP LIGHT SWITCH

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the lower dash panel.
3. Depress the foot brake.
4. Remove the rubber protector from switch (where fitted).
5. Remove the hexagon nut.
6. Withdraw the switch.
7. Disconnect the electrical leads.



RR509M

Refitting

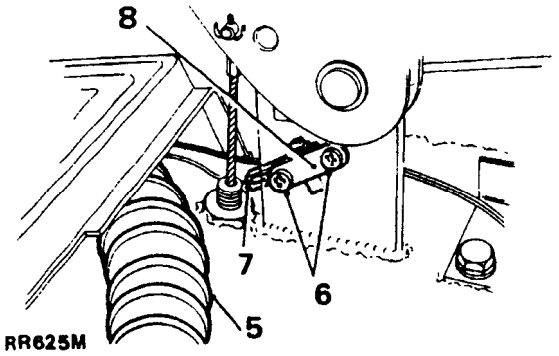
8. Reverse the removal procedure.

PARKING BRAKE WARNING SWITCH

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Apply the parking brake.
3. To gain access to the warning switch located on the side of the parking brake mounting bracket, it is necessary to remove the glove box liner.
4. Remove the four screws securing the glove box liner and lift out the liner.
5. Carefully pull the rear warm air flow hose away from the side of the parking brake mounting bracket to give access to the two screws securing the switch in position.
6. Remove the two screws.
7. Maneuver the switch around the front of the parking brake mounting bracket and disconnect the electrical lead.
8. Withdraw the switch.



Refitting

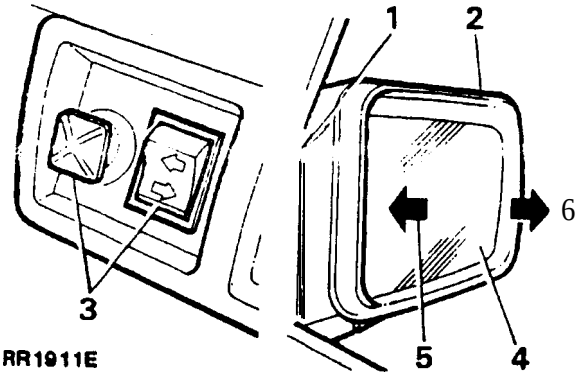
9. Reverse the removal procedure.

EXTERIOR DRIVING MIRRORS

1. The mirror housing is hinged vertically and should be set in one of the two fixed angle positions provided to suit the respective left or right side mirror location.
2. Additionally, for safety and convenience, the mirror housing is designed to fold completely forwards or rearwards against the vehicle body.

Adjusting

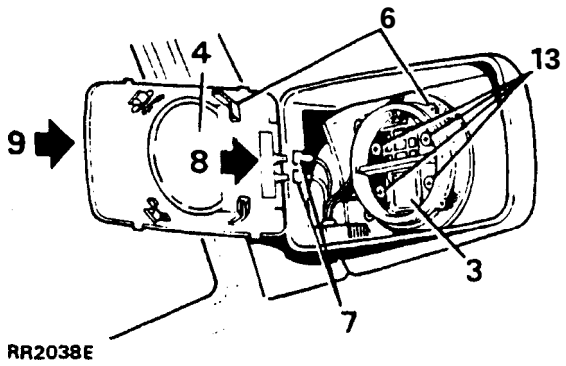
3. Fine adjustment is controlled by an electric motor inside the mirror housing. This is operated by two controls fitted in the dash panel. To adjust, select left or right hand mirror. Move the head of the finger tip control to the left, right. up or down as required.
4. The mirror also incorporates a demist facility, activated by operation of the rear window demist switch.



Replacing the mirror glass

5. Press the inner (wider) end of the glass inwards to its full extent.
6. Insert the fingers under the outer (narrower) end of the glass, and pull outwards until the glass is released from its four retaining clips.
7. Disconnect the two demister leads attached to the back of the glass unit.
8. To replace the glass, locate the inner (wider) end of the glass in the mirror housing first.

Continued



9. Carefully press the outer (narrower) end of the glass Inwards until it is safely held by its four retaining clips.
10. Reset the fine adjustment as required.

EXTERIOR DRIVING MIRRORS

ELECTRIC MOTORS

Remove and refit

Removing

71. Disconnect the battery negative lead.
12. Remove the mirror glass, as described in items 5 to 7.
13. Remove the four self-tapping screws securing the motor assembly to the mirror body.
14. Maneuver the motor assembly to reveal the electrical connections on the rear of the motor.
15. Pull the leads from the rear of the motor assembly.

Refitting

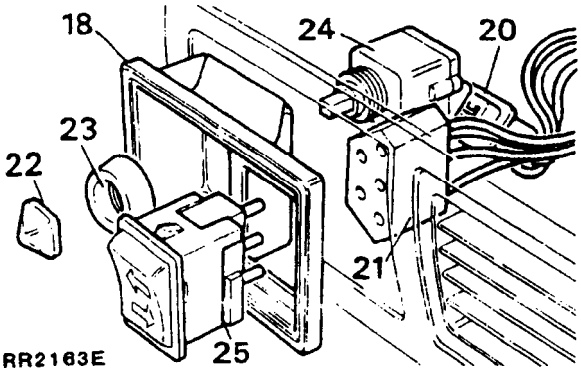
16. Reverse operations 11 to 15, ensuring that the electrical leads are correctly refitted (see electric mirror, circuit diagram).

EXTERIOR DRIVING MIRRORS

CONTROL SWITCHES

Remove and refit

17. Disconnect the battery negative lead.
18. Carefully pry the switch retaining panel out of the dash panel.
19. Withdraw the panel only as far as the electrical leads will permit.



20. Pull the multi-plug from the rear of the fingertip controlled mirror switch.
21. Disconnect the multi-plug at the rear of the selector switch and remove the panel.
22. Carefully pry off the fingertip button at the operating end of the switch.
23. Unscrew the black plastic retaining collar securing the switch.
24. Remove the switch from the panel noting the position of the locating hole in the panel retaining clip
25. Depress the two spring clips securing the selector switch and push it through the panel.

Refitting

26. Reverse operations 17 to 25.

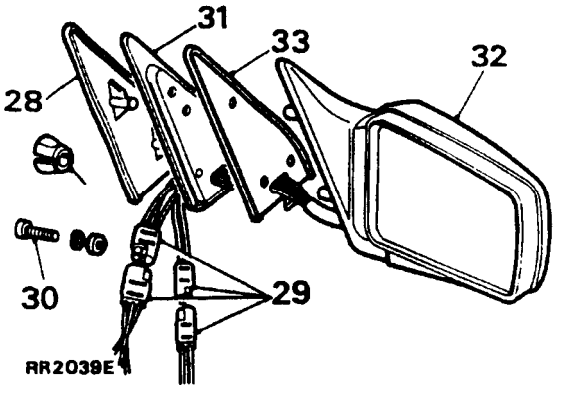
EXTERIOR DRIVING MIRRORS

COMPLETE ASSEMBLY

Remove and refit

Removing

27. Disconnect the battery negative lead.
28. Carefully pry off the interior finisher plate to reveal the three securing screws and electric wiring.
29. Disconnect the two electrical plugs (one two pin, one three pin).
30. Supporting the exterior mirror assembly remove the three securing screws (with plain and spring washer).
31. Pull the inner mounting plate away from the inner door frame complete with the two retaining clips.
32. Detach the mirror assembly from the outer door frame.
33. Remove the sealing rubber.



Refitting

34. Reverse the operations 27 to 33.

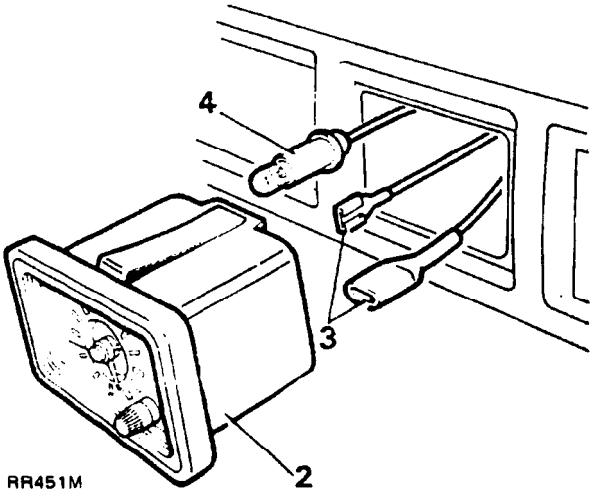
NOTE: To prevent damage to the electrical wiring do not push the leads down inside the door casing.

CLOCK

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Carefully pry the clock out of the dash panel to reveal the electrical connections.



3. Disconnect the two electrical leads.
4. Remove the illumination lead complete with holder and bulb.

NOTE: The clock is illuminated by a 2-watt bayonet type bulb.

Refitting

5. Reverse the removal procedure.

INSTRUMENT BINNACLE WARNING LIGHT SYMBOLS

Trailer connected-flashes with direction indicators (green)

Direction indicator- left turn / right turn (green)

Seat belt (red)

Headlamp high beam on (blue)

Engine oil pressure, low (red)
Flashing - engine oil level low

Electronic fuel injection warning lamp (red) indicates failure of air flow sensor, throttle potentiometer, water temperature thermistor, or Lambda sensor

Ignition on/No charge indicator (red)

Low coolant (red)

Automatic gearbox oil temperature high (red)

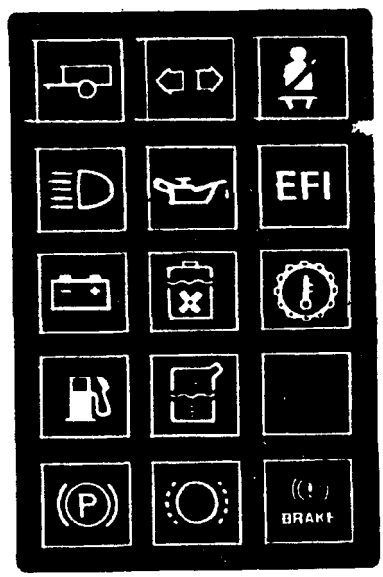
Fuel indicator, low (amber)

Low wash fluid (amber)

Symbol (not used) will illuminate on initial bulb check

Brake pad wear (amber)

Brake fluid pressure failure, AP system/Brake fluid level, Lucas Girling system/Transmission park brake on (red)



RR2044E

The differential lock warning light, (located on the radio console) and the fifteen segments of the warning light panel within the binnacle will all be illuminated when the ignition key is turned to the 'ignition On II' position as an initial check to ensure that all bulbs are operational. All bulbs, except for the 'Brake Failure/ Transmission Parking Brake'-'Engine Oil Pressure' and 'Ignition On' symbols will go out automatically.

The 'Engine Oil Pressure' and 'Ignition On' symbols will remain on when the ignition key is turned to the engine crank position 'III' and extinguished when the engine is running.

The 'Brake Failure/Transmission Parking Brake' symbol will extinguish when the parking brake lever is released.

NOTE: Should the ignition key be turned directly to the engine crank position the bulb check procedure will be overridden.

A pnoto transistor incorporated into the Instrument binnacle senses ambient light levels. During normal ambient daylight levels the warning light panel will glow at normal intensity. When ambient light levels decrease, the photo transistor senses the reduction and lowers the intensity of the warning light panel accordingly.

PANEL AND WARNING LIGHT-bulb replacement

1. Disconnect the battery negative terminal.
2. Unclip the back of the cowl from the instrument binnacle to give access to the panel and warning light bulbs in the back of the instrument case.
3. Remove the appropriate bulb holder unit by rotating it counter-clockwise and withdrawing it.

NOTE: The "No Charge/Ignition On" warning light, identified by its-red coloured bulb holder, is of a higher wattage and is the only bulb which can be pulled from its holder and replaced independently.

4. Fit a new bulb holder unit and rotate clockwise to lock in position. The correct bulb type is a 1.2 watt bulb/holder unit, except the ignition bulb which is 2 watt wedge base type.
5. Refit the cowl and reconnect the battery.

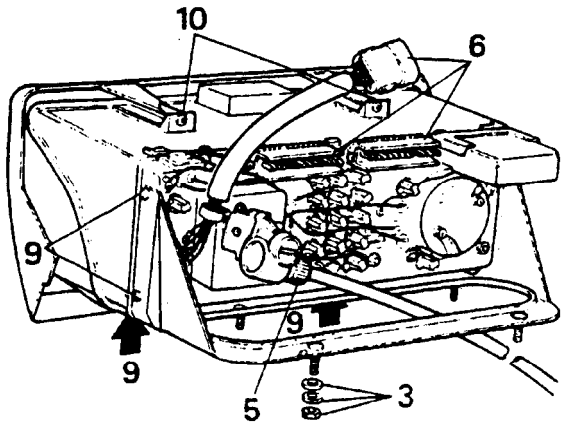
NOTE: If difficulty is experienced in changing bulbs, due to the limited space available the instrument binnacle fixings should be removed to enable the binnacle to be raised above the dash as far as other connections permit. See 'Instrument Binnacle Removal' below for details of binnacle mounting bracket fixing.

INSTRUMENT BINNACLE

Remove and refit

Remove

1. Disconnect the battery negative terminal.
2. Remove the lower dash panel by releasing the six retaining screws.
3. Remove the four nuts (with spring and plain washers) from under the top dash rail which secure the instrument binnacle to the vehicle.
4. Unclip the binnacle cowl, from the rear, to provide access to the speedometer cable.
5. Disconnect the speedometer cable from the speedometer drive on the back of the instrument case.
6. Remove the two large multi-plugs from the printed circuit, and the single plug from the warning lamp control unit.



RR1809E

7. Lift the instrument binnacle from the top dash rail and transfer it to the workbench.

Refitting

8. keversr the removal instructions 1 to 7

Removing instrument pack

9. Having removed the instrument binnacle from the vehicle, detach the binnacle mounting bracket. This is secured to the instrument case by two screws and to the bottom of the binnacle bezel by two smaller screws.
10. Remove the two screws retaining the top of the bezel to the front housing and detach the bezel.
11. Separate the instrument case from the binnacle housing by releasing the two wire clips.
12. Detach the curved lens from the binnacle housing by releasing the wire clip at the top.

Refitting instrument pack to binnacle

13. Reverse removal instructions 9 to 12.

Removing printed circuit, multi-function unit and photo transistor

NOTE: Ensure all warning light and panel illumination bulb holders are removed before removing the printed circuit. Note the position of the no charge warning light (red holder).

14. Remove the two tachometer nuts (with washers) to release the printed circuit connecting tags.
15. Remove the four nuts (with washers) securing the fuel and temperature gauges to release the printed circuit from the fixing studs.
16. Release the two retaining screws and carefully remove the multi-function unit. Using a pair of tweezers or a fine screwdriver, lift the printed circuit out of its location and extract the rubber contact pad.

NOTE: If fitting a new multi-function unit the new rubber contact pad supplied MUST be installed under the printed circuit to ensure correct contact pressure.

17. Remove the two harness connectors, retained by four screws. to release the printed circuit tags.
18. Twist the photo transistor counter clockwise to disengage from the binnacle housing. Remove the five screws securing the single multi-plug wiring connections. Note the position of the leads for reassembly.
19. Carefully ease the printed circuit from its four locating pegs.

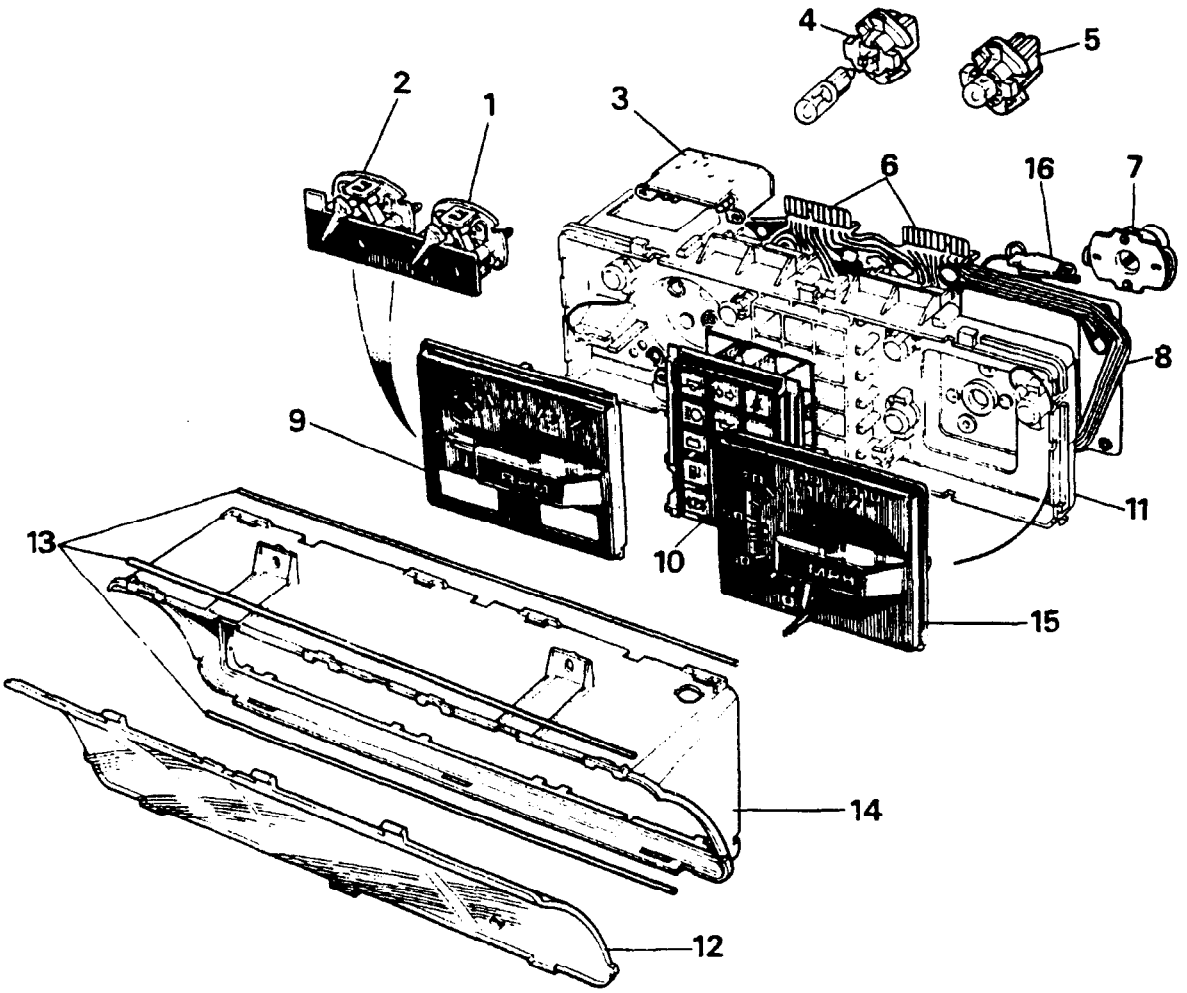
Refittine the printed circuit, multi-function unit and photo transistor

20. Reverse the removal procedure items 14 to 19.
21. Ensure that the fuel and temperature gauge mounting studs are correctly located before pressing the printed circuit on to its four locating pegs.

Removing tachometer

22. Carefully pry the needle shroud from the tachometer and disconnect the fibre optic element underneath the shroud.
23. Remove the two nuts (with washers) at the back of the instrument case which retains the tachometer and release the printed circuit tags.
24. Loosen the four nuts retaining the fuel and temperature gauges and carefully maneuver the tachometer from the front of the instrument case.

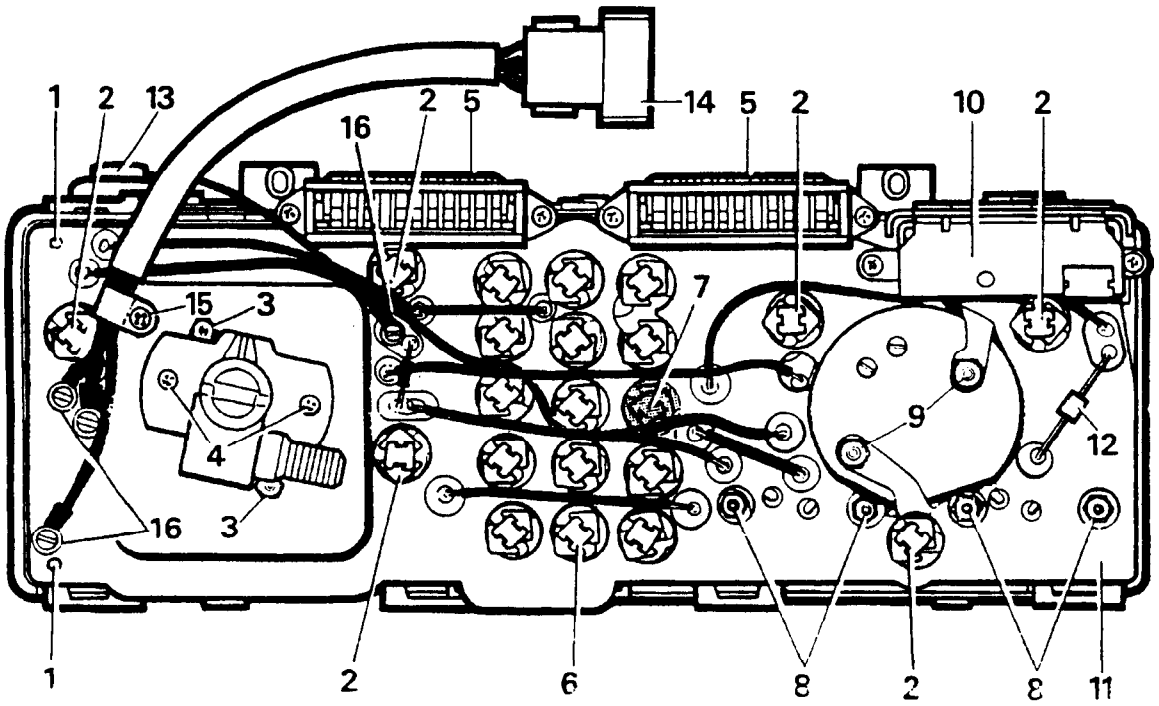
Continued



RR 2271E

instrument Pack

1. Fuel gauge
2. Temperature gauge
3. Voltage stabiliser
4. Ignition warning bulb (with separate red holder unit)
5. Panel/warning lights bulb/holder
6. Printed circuit input tags (for harness connection)
7. Speedometer drive unit
8. Printed circuit
9. Tachometer
10. Warning lights panel.
11. instrument case (front)
12. Curved lens
13. Wire connecting clips
14. Binnacle housing
15. Speedometer
16. Photo transistor - automatic dimming - warning lights

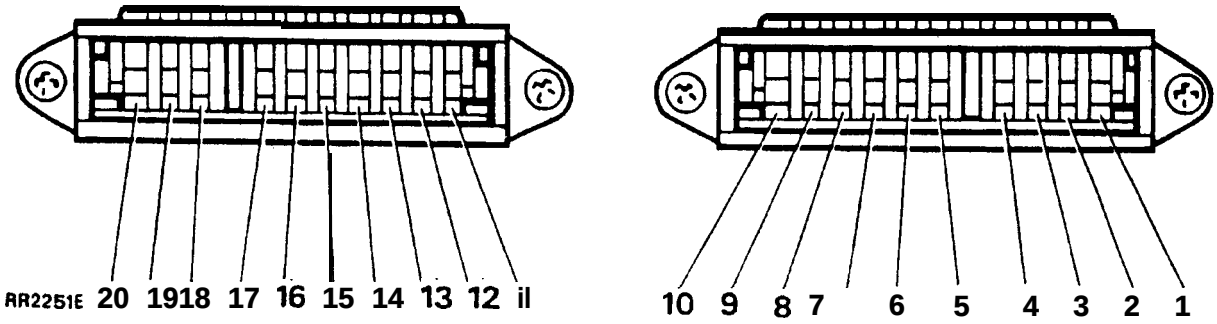


RR2272E

Instrument case (back)

1. Locating pegs
2. Panel light bulbs
3. Speedometer securing screw
4. Speedometer drive securing screws
5. Harness connectors
6. Warning light bulbs (14)
7. No charge warning light bulb (red holder)
8. Temperature and fuel gauge unit securing nuts
9. Tachometer securing nuts
10. Multi-function unit
11. Printed circuit
12. Pull-up resistor-high temperature gearbox oil
13. Photo transistor
14. Single multi-plug
15. Single multi-plug securing screw
16. Single multi-plug wiring connecting screws (5)

PRINTED CIRCUIT HARNESS CONNECTIONS



RR2251E

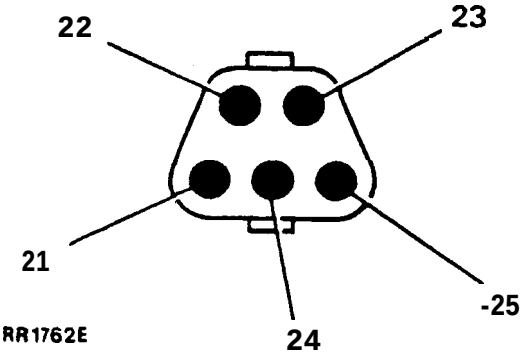
Sequence of connections looking towards the back of instrument case.

CIRCUIT SERVED

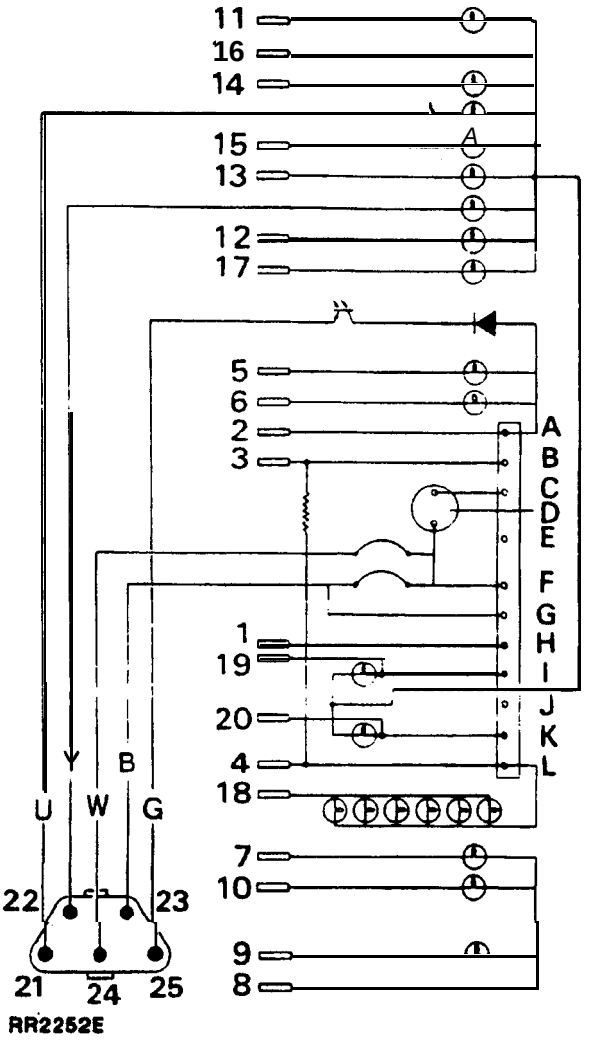
Tacho signal	1
Ignition switch 12V +	2
Low coolant input	3
Ground-VE	4
Ignition warning light	5
Low oil level/pressure warning light	6
High beam warning light	7
Ground from bulb check unit	8
Trailer warning light	9
Direction indicators warning light	10
Seat belts warning light	11
E.F.I. warning light	12
Temperature warning light (automatic gearbox)	13
Low wash fluid warning light	14
Not used	15
12V + from bulb check unit	16
Brake fail warning light	17
Panel illumination bulbs (6 off)	18
Low fuel warning light	19
Low coolant warning light	20

NOTE: The following 21 to 25 are connected at the single multiplug located behind the binnacle

Brake pad wear warning light	21
'P' symbol (initial bulb check only)	22
Fuel tank unit and fuel gauge	23
Temperature gauge	24
Photo transistor	25



Sequence of pin connections viewed on the binnacle harness plug.



MULTI-FUNCTION UNIT

A. 12V + supply
B. Input to low coolant circuit
C. Tachometer drive
D. Tachometer
E. Spare
F. 1 OV + stabilised
c. Input to fuel tank unit - stabilised
H. Tachometer signal
I. Low fuel warning light
I. Spare
K. Low coolant warning light
L. Ground

Refitting the tachometer

25. Reverse the removal procedure, items 22 to **24.**

Removing fuel and temperature gauge unit

26. Carefully pry the needle shroud from the tachometer and disconnect the fibre optic element underneath the shroud.
27. Remove the two nuts (with washers) retaining the tachometer and release the printed circuit taps.
28. Remove the four nuts (with washers) retaining the fuel and temperature gauges and carefully maneuver the tachometer, fuel and temperature gauge unit **from** the front of the instrument case.

Refitting the fuel and temperature gauges

29. Locate the fuel and temperature gauge unit in the instrument **panel** but do not fit the washers and nuts at this stage.
30. Feed the fibre optic element through the opening in the tachometer then locate the tachometer in the instrument panel.
31. Position the printed circuit tags over the two tachometer studs, fit the washers and fit and tighten the retaining nuts.
32. Fit the washers to the four fuel and temperature gauge studs and fit and tighten the retaining nuts.

Removing the speedometer and speedometer drive unit

33. Carefully pry the needle shroud from the element underneath the shroud.
34. Remove the two hexagonal headed screws (with washers) at the back of the instrument case which retain the speedometer.
35. Carefully remove the speedometer from the front of the instrument case.
36. To release the speedometer drive unit, remove the two self-tapping screws securing it to the back of the instrument case.

Refitting the speedometer and speedometer drive unit

37. Reverse the removal procedure items 33 to 36.

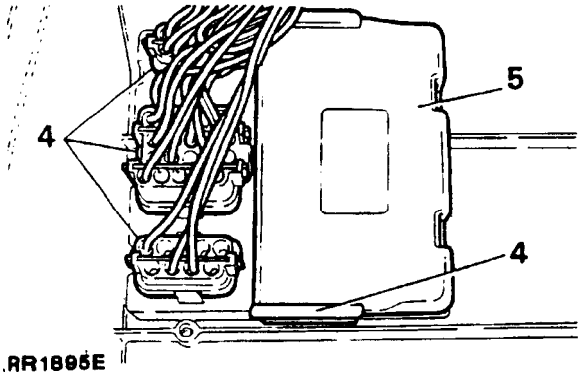
WARNING LAMP CONTROL UNIT

-see also page 69

Remove and refit

Removing

1. Disconnect the battery negative terminal.
2. Release the six screws securing the lower dash panel below the steering column.
3. Lower the dash panel and disconnect the multi-plug trom **the** rheostat switch.
4. Pull the warning lamp control unit from the spring clip on the underside of the dash panel and disconnect the three multi-plugs from the unit.
5. Remove the warning lamp control unit from the vehicle.



RR1895E

Refitting

6. Reverse the removal procedure ensuring that the multi-plugs and unit are securely pushed into position.

INSTRUMENT ILLUMINATION ELECTRONIC DIMMING CONTROURHEOSTAT

The electronic dimming control switch is located on the lower dash panel adjacent to the steering column. Rotate the control upwards to fully illuminate the instruments and downwards to reduce intensity.
The dimming control unit also controls the clock, heater and cigar lighter illumination.

Remove and refit

Removing

1. Disconnect the battery.
2. Remove the lower dash panel by releasing the six securing screws.
3. Disconnect the dimming control multi-plug.
4. Remove the two screws securing the dimmer control switch to the under-side of the lower dash panel.

Reiitting

Reverse operations 1 to 4.

SPEEDOMETER CABLE

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the lower dash panel (beneath the steering column) by releasing six retaining screws.
3. Unclip the back of the cowl from the instrument binnacle to give access to the speedometer drive.
4. Disconnect the cable from the speedometer drive.
5. Withdraw the cable and grommet through the bulkhead.
6. Working underneath the vehicle, disconnect the cable at the speed transducer.
7. Release the cable from the retaining clips.
8. To remove the shorter cable, disconnect it from the speed transducer and remove the single nut and clamp securing the cable to the speedometer drive housing at the rear of the transfer box.

Refitting

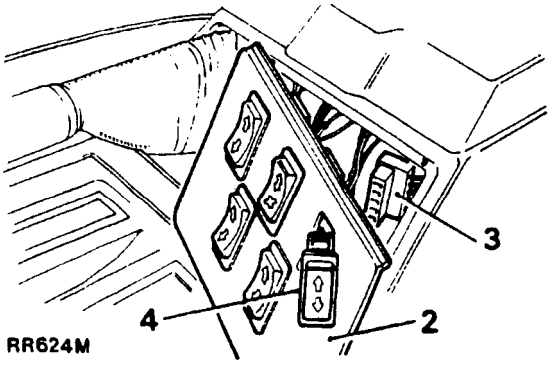
9. Reverse instructions 1 to 8.

WINDOW LIFT SWITCHES

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Carefully pry the window lift switch surround away from the front of the glove box.
3. Disconnect. the multi-plug at the rear of the switch(es).
4. Apply pressure to the rear of the switch to push it through the surround.



Refitting

5. Reverse the removal procedure.

WINDOW LIFT MOTOR-Front doors

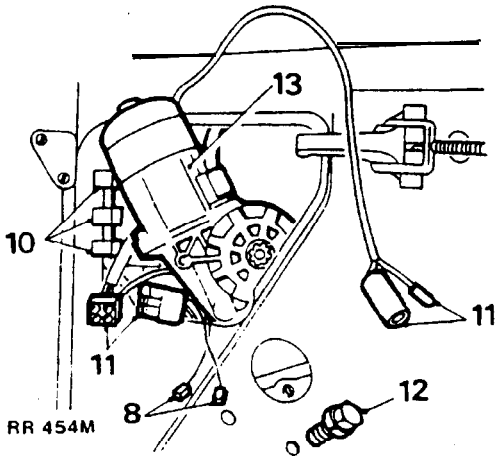
Remove and refit

Removing

1. Ensure that the side door glass is in its fully closed position and secure it with adhesive tape.
2. Disconnect the battery.
3. Detach the arm-rest/door-pull finisher to reveal the two securing screws.
4. Remove the two screws (with plain washers) to enable the arm-rest/door-pull to be detached from the inner door panel.
5. Remove the interior door handle finisher button to reveal the screw retaining the handle surround.
6. Remove the screw and detach the handle surround from the inner door panel.
7. Detach the inner door trim pad by inserting a screwdriver between the trim pad and inner door panel gently prising out the nine plastic securing clips from their respective holes in the inner door panel. Tape perimeter to prevent scratches.
8. Disconnect the two radio speaker connections behind the trim pad, remove the trim pad complete with speaker.

NOTE: At this stage the speaker can be removed by releasing the four nuts (with plain washers) located on the back of the trim pad.

9. Peel back the front top corner of the plastic vapour barrier to reveal the window lift motor.
10. Release the window lift motor wiring harness from the three retaining clips to allow the harness to be pulled out of the opening at the front of the inner door panel.
11. Disconnect the window lift motor multi-plug from the main door harness.



12. Supporting the motor, remove the three securing bolts.
13. Withdraw the motor through the top front opening of the don:

Refitting

14. Reverse operations 1 to 13.

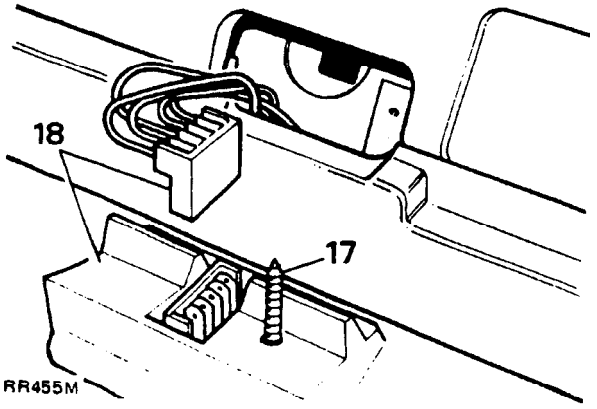
NOTE: Ensure that the drive gear is engaged and correctly aligned with the window lift linkage before fitting the securing bolts.

WINDOW LIFT MOTOR-Rear doors

Remove and refit

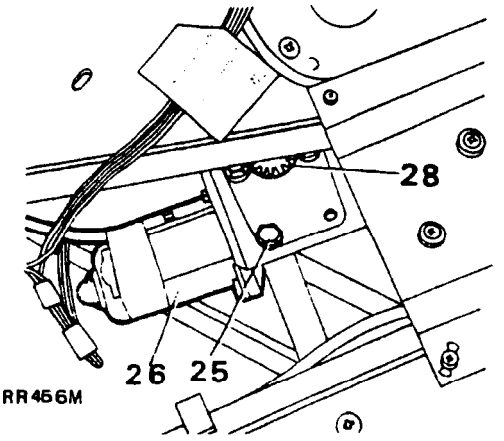
Removing

15. Ensure the side door glass is in its fully closed position and secure it with adhesive tape.
16. Disconnect the battery.
17. Remove the arm-rest/door-pull finisher to reveal the two securing screws.
18. Remove the two screws (with plain washers) and detach the arm-rest/door-pull from the inner door panel. To enable the arm-rest/door-pull to be removed from the door, the window operating switch multi-plug must be disconnected from the rear of the switch.



NOTE: At this stage the window operating switch can be removed by applying a little pressure to the rear of the switch to push it through the door-pull handle.

19. **Remove the interior handle finisher button to reveal the screws retaining the handle surround.**
20. **Remove the screw and detach the handle surround from the door trim pad.**
21. **Remove the door trim pad by inserting a screwdriver between the trim pad and inner door panel, gently prying out the six plastic securing clips from their respective holes in the inner door panel.**
22. **Carefully detach the bottom half of the vapour barrier to reveal the window lift motor.**
23. **Release the lift motor wiring harness from the retaining clips.**
24. **Disconnect the lift motor harness snap connections from the main door harness.**
25. **Supporting the lift motor release the three bolts securing the motor to the inner door panel.**
26. **Withdraw the lift motor from the lower opening in the inner door panel.**



Refitting

27. **Reverse operations 15 to 26.**
28. **Ensure the lift motor drive gear is engaged and correctly aligned with the window lift linkage before fitting the securing bolts.**

ELECTRICALLY OPERATED CENTRAL DOOR LOCKING SYSTEM

An electrically operated central door locking system is fitted as standard equipment.

Locking or unlocking the drivers door from outside by key operation, or from inside by sill knob automatically locks or unlocks all four doors and the fuel filler flap.

Front and rear passenger doors can be independently locked or unlocked from inside the vehicle by sill knob operation but can be overridden by further operation of the driver's door locking control.

On rear doors only, a child safety lock is provided which can be mechanically pre-set to render the interior door handles inoperative.

failure of an actuator will not affect the locking of the remaining three doors or the fuel filler flap. The door with the inoperative actuator can still be locked or unlocked manually, but not the fuel filler flap.

NOTE: The actuator units contain non-serviceable parts. if a fault should occur replace the unit concerned with a new one.

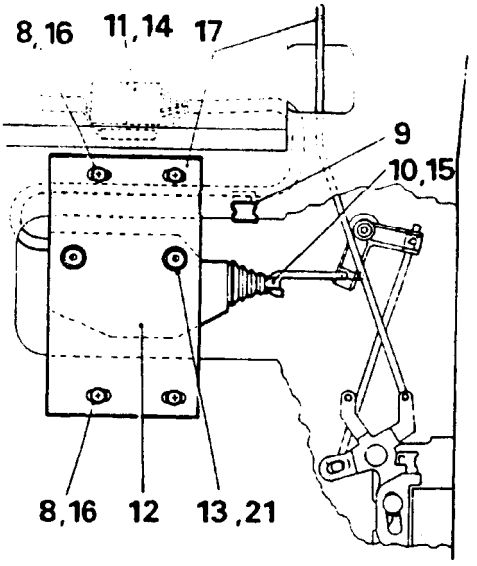
Before carrying out any maintenance work disconnect the battery negative lead.

FRONT DOOR ACTUATOR UNITS

Remove and refit

Removing

1. Ensure the window is in its fully closed position.
2. Remove the arm-rest/door-pull finisher to reveal the two retaining screws.
3. Remove the interior door handle finisher button to reveal the screw retaining the handle surround.
4. Release the screw and remove the handle surround from the interior door trim pad.
5. Release the door trim pad by inserting a screwdriver between the trim pad and the inner door panel, carefully prying out the nine plastic clips from their respective holes around the edges of the trim pad.
6. Disconnect the two speaker connections inside the door and remove the door trim pad complete with speaker.
7. Peel back the top of the plastic vapour barrier at the rear of the inner door panel to expose the lock actuator unit.
8. Remove the four screws (with plain washers) securing the lock actuator mounting plate to the inner door panel.
9. Release the clip retaining the electrical cable.
10. Maneuver the actuator assembly to detach the operating rod 'eye' from the hooked end of the actuator link on the door lock.



RR369M

11 Withdraw the actuator assembly from the door until the electrical cable is pulled out of its channel sufficiently to expose the connectors which can then be detached.

12 Remove the actuator assembly from the door.

13. The actuator unit may be changed if necessary by removing the two rubber mounted screws which secure it to the mounting plate.

Refitting

14. Locate the actuator assembly in the inner door panel and fit the electrical cable connectors. The cable, and connectors, are pulled back into the channel from the font end and the cable clip refitted.
15. Maneuver the actuator assembly to engage the operating rod 'eye' on the hooked actuator link.
16. Loosely fit the actuator mounting plate to the inner door panel with the four screws, setting the mounting plate in the centre of the slotted holes.
17. Ensure that manual operation of the sill locking control is not restricted by the operation. of the actuator operating rod and vice versa, resetting the mounting plate as necessary.
18. Reconnect the vehicle battery.
19. Check that electrical operation of the door lock occurs when the sill locking control is moved through half of its total movement. Reset the mounting plate if necessary and tighten the four screws.

NOTE: The above adjustment ensures that the full tolerance on the switching operation is utilised.

REAR DOOR ACTUATOR UNITS

Remove and refit

instructions as for front doors with the following exceptions:

20. No radio speaker is involved.
21. The electrical cable and plug is retained and is immediately accessible through the large opening in the door.
22. instruction 19 does not apply to rear actuator units which are not fitted with switches.

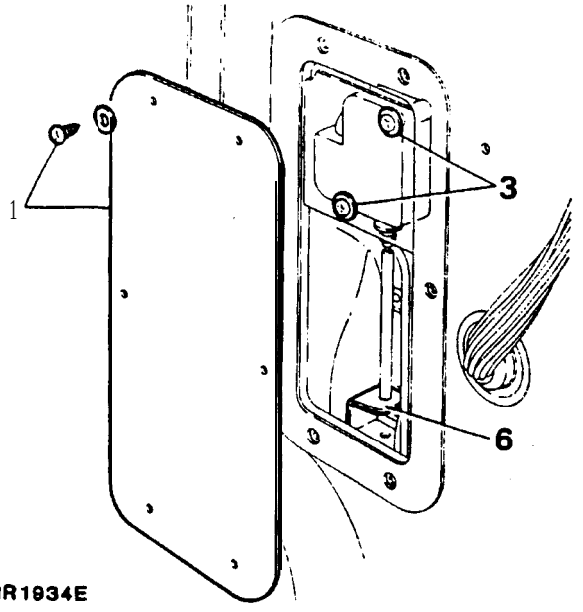
NOTE: If necessary the lock actuator may be detached from its mounting plate to facilitate the removal of the lock actuator from the connector rod inside the door panel.

FUEL FILLER FLAP ACTUATOR UNIT

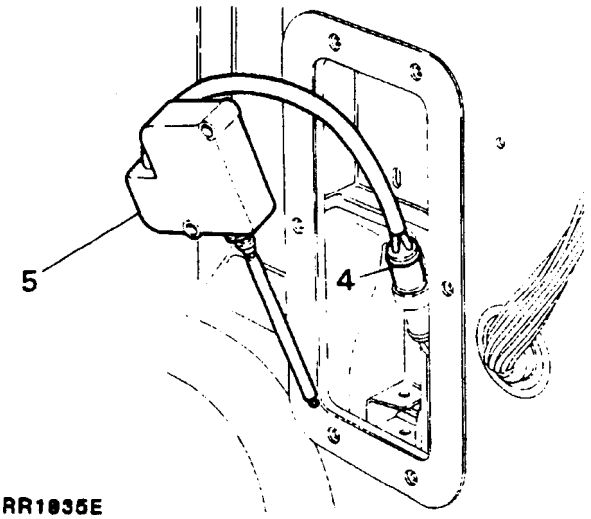
Remove and refit

Removing

1. Remove six screws and withdraw the closure panel, situated in the tool stowage area.
2. Ensure that the actuator is in the unlocked position and the fuel filler flap is open.
3. Release two screws and maneuver the actuator unit clear of its mounting.



RR1934E



RR1935E

4. Disconnect the wiring plug.
5. Withdraw the actuator.

Refitting

6. Reverse the removal procedure. The actuator mounting holes in the body are elongated. Adjust the position of fhe actuator to ensure that the rod will pass through the guide brackets without fouling.
7. Check the operation of the central locking system.

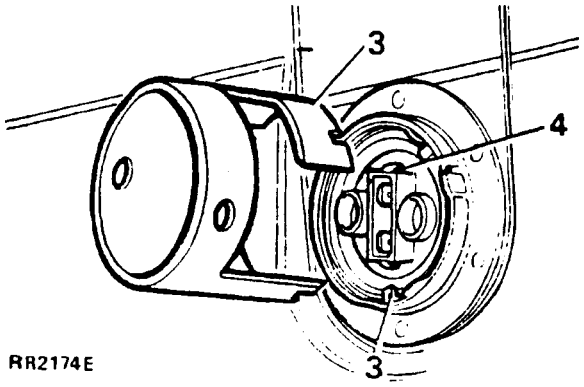
FUEL TANK GAUGE UNIT

Remove and refit

Service tool-RO 600964 Locking wrench.

Removing

1. Disconnect the battery negative lead.
2. Remove the fuel tank, referring to the instructions on page 38, Fuel Injection System, Section 19.
3. Using service tool RO 600964 release the tank unit locking ring.
4. Remove the gauge unit and sealing washer.



RR2174E

Refitting

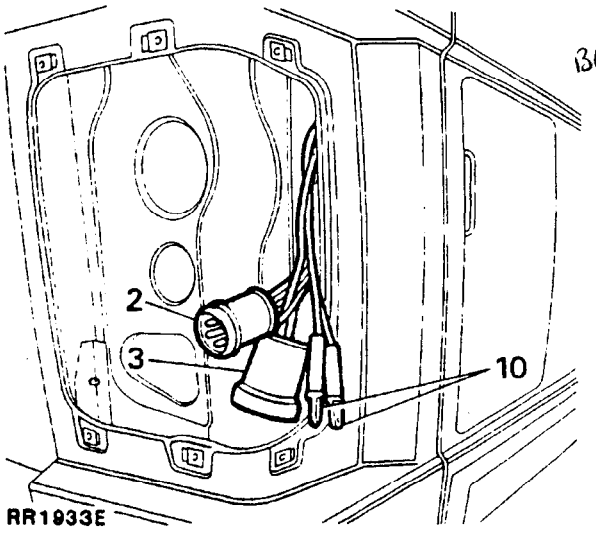
5. Coat the mating faces with Bostik 772 adhesive and fit a NEW sealing washer. Locate the gauge unit in the tank ensuring that the notch in the outer edge of the gauge unit locates with tire register in the gauge opening of the tank.
6. Retighten the locking ring.
7. Refit the fuel tank.

TRAILER SOCKET-OPTION

Incorporated in the vehicle electrical circuit is a facility for fitting a seven pin trailer lighting socket. The pick-up point is located behind the right hand rear tail light cluster and is accessible by removing the tail light assembly.
The pick-up point consists of a seven pin pre-wired plug, a separate auxiliary fused line feed and reverse light lead.

CAUTION: The fitting of the trailer socket and its associated wiring MUST be carried out by a qualified vehicle electrician.

1. Disconnect the battery.
2. Remove the rear tail light assembly and disconnect the electrical plug.



5. Remove the protective cap from the trailer pick-up point plug.

NOTE: Cable colours in this plug correspond to the main circuit diagram. The red/yellow is a spare unused wire.

4. Feed the seven core cable Part No. PRC4143 (fitted with a pre-wired plug to one end-suitable for connection to pick-up point) down between the inner and outer body panels through the rear light opening.
5. Feed the cable alongside the existing rear lighting harness.
6. Pull the cable through the opening between the chassis side member and fuel tank.
7. Fit two retaining clips to the cable and secure it to the rear end cross member.
8. Connect the electrical leads to the vehicle trailer socket. (Refer to current trailer wiring regulations).
9. Secure trailer socket to the tow bar.
10. If it is necessary to provide a line feed and reverse light feed, provision is made for this by the presence of two extra leads in the rear light opening.

Electrical lead identification

Single leads - item 10

~~Pink~~ - Fused auxiliary line feed.
Green/Brown - Reverse light feed.

Pre-wired plug - Part No. PRC4143

Yellow - Left indicator.
Green - Right indicator.
~~Red/Yellow~~ - Spare, unused.
White - Ground.
Brown - Right-hand tail lights.
Black . Left-hand tail lights.
Red - Stop lamps.

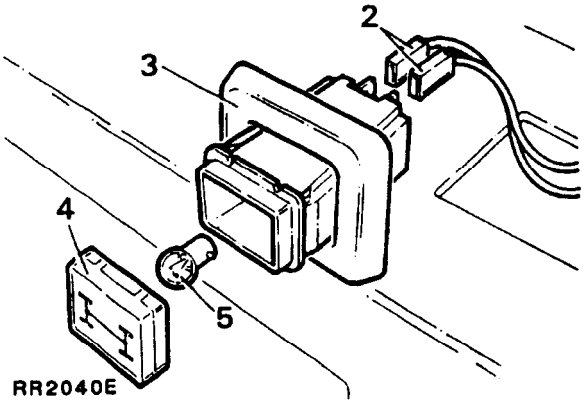
11. Refit rear tail light.
12. Reconnect the battery.

DIFFERENTIAL LOCK WARNING LAMP ASSEMBLY/BULB REPLACEMENT

Remove and refit

Removing

1. Carefully pry the warning lamp out of the radio console.
2. Remove the two wiring connectors and withdraw the lamp assembly, it required.
3. Squeeze the sides of the lamp body to enable the lens surround to be slid back along the body.



4. Remove the amber lens.
5. Remove the bayonet fitting bulb.

Refitting

6. Reverse the removal procedure.

The correct bulb type is a 12-volt, 2-watt bayonet fitting.

AUDIBLE WARNING UNIT

The audible warning unit will sound with varying notes to warn the driver of the following conditions:

(a) Intermittent high and low notes for a period of 4 to 8 seconds:
- key in ignition position 'II' and driver's seat belt unfastened.

(b) Interrupted low note:
- drivers door open with key in switch but not in ignition position.

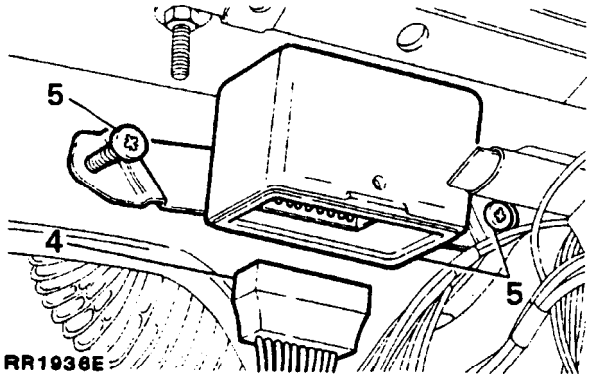
(c) Rapidly repeated low note:
- vehicle lights on and driver's door open with key removed from ignition switch.

(d) Constant high note:
- vehicle ignition switched on with transfer gearbox lever in neutral.

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the steering column shroud.
3. Remove the under dash panel.
4. Disconnect the multi-pin plug.
5. Remove two securing screws and withdraw the audible warning unit.



Refitting

6. Reverse the removal procedure.

LOW OIL LEVEL SENSOR UNIT

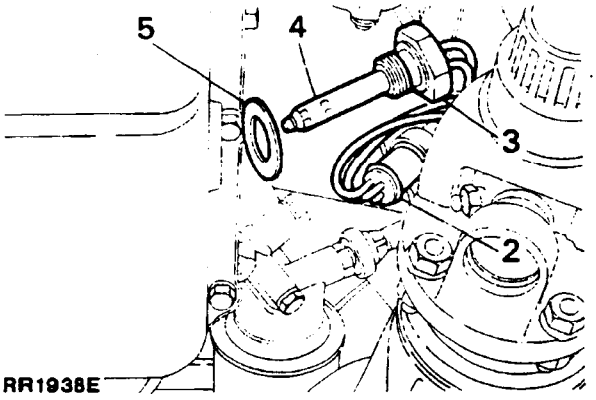
The low oil level sensor unit is fitted into the right hand side of the engine sump.

Remove and refit

NOTE: Ensure that the oil level is below the sensor before removal

Removing

1. Disconnect the battery negative lead.
2. Disconnect the wiring connector.



3. Remove the brass securing nut.
4. Withdraw the sensor unit.

Refitting

5. Fit a new sealing washer.
6. Reverse the removal procedure.
7. Top up the engine oil level. Run the engine and check for leaks around the sensor unit.

LOW OIL LEVEL WARNING LOGIC UNIT

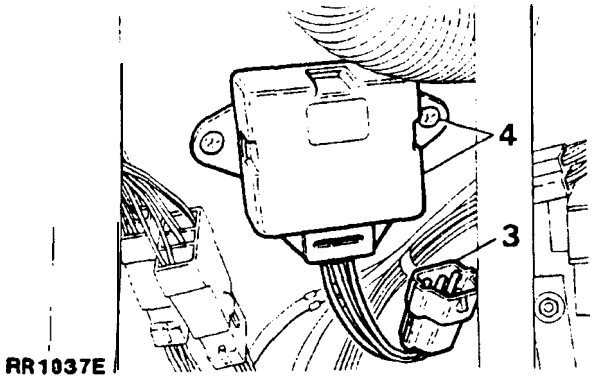
When the ignition is switched 'ON' the warning lamp in the binnacle will flash for 10 to 20 seconds if low oil level is detected. The unit will not repeat the warning until the ignition is again switched 'ON'.

If the ignition is switched 'ON' within 15 to 30 seconds of the preceeding sequence, the warning lamp will not operate.

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the lower dash panel.
3. Disconnect the wiring at the multi-plug.
4. Remove the securing screws and withdraw the logic control unit.



Refitting

5. Reverse the removal procedure.

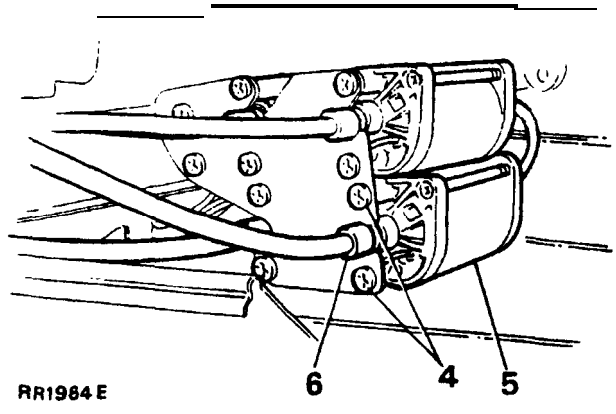
FRONT SEAT ADJUSTMENT MOTORS

Remove and refit

Four electric motors **mounted beneath each front** seat control the fore and aft movement, the cushion height front and rear, and the angle of recline of the seat. Adjustment is possible with either front door open, or with ignition switched ON.

Removing

1. Position the seat to give access to the motors.
2. Disconnect the battery negative lead.
3. Remove the seat base trim.
4. Remove two securing screws from each side of the required motor.



5. Withdraw the motor from its **mounting.**
6. Disconnect the drive cables by unscrewing the ferrule.
7. Disconnect the wires from the multi-plug **and remove the motor.**

Refitting

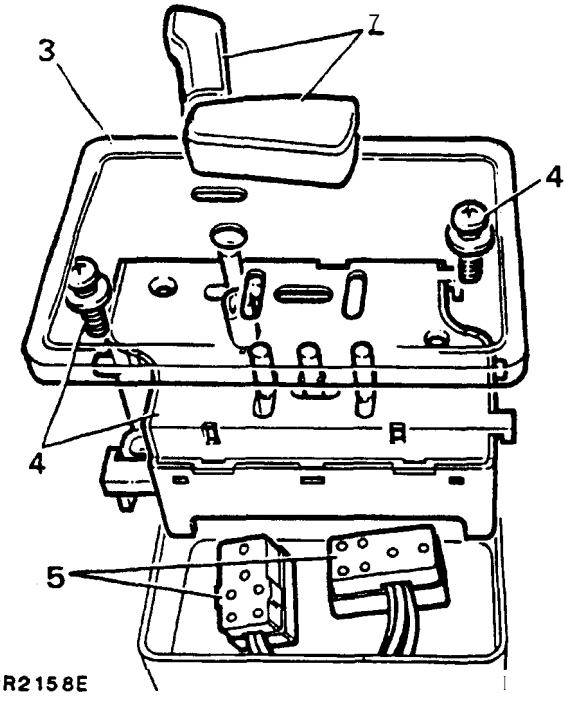
8. Reverse the removal procedure.
9. Check the seat adjustment for correct operation.

SEAT ADJUSTMENT CONTROL SWITCH

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Pry the two finger tip controls from the top of the switch housing.
3. Removing the switch housing cover by lightly depressing the sides of the cover to disengage the clips. Remove the diaphragm fitted to later models.
4. Remove two crosshead screws and washers and lift the switch assembly to gain access to the two multiplugs.
5. Disconnect the multiplugs and withdraw the switch assembly.



RR2158E

Refitting

6. Reverse instructions 1 to 5.

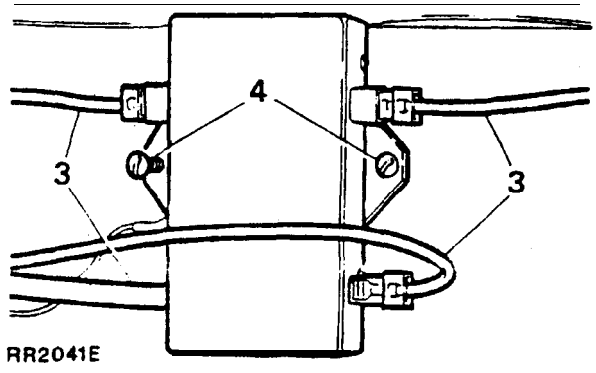
NOTE: If switch housing removal is required it is necessary to remove the seat to gain access to the two securing screws- see Body Section 76.

RADIO ANTENNA AMPLIFIER

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Lower or remove the rear headlining.
3. Remove the electrical leads and the antenna lead to the radio.
4. Remove two screws and withdraw the amplifier unit.

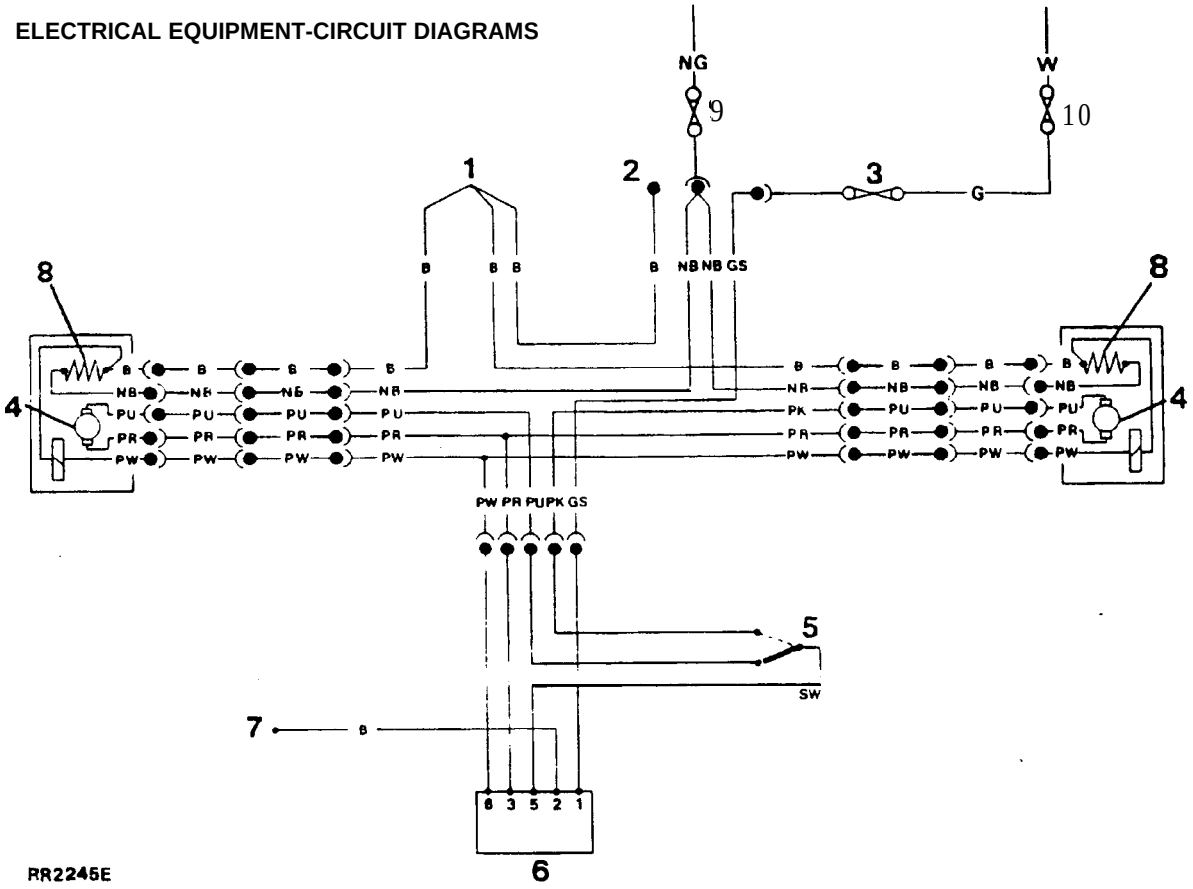


RR2041E

Refitting

5. Reverse the removal procedure.

ELECTRICAL EQUIPMENT-CIRCUIT DIAGRAMS



ELECTRICMIRRORS-
Circuit diagram

1. Clinch
2. Main cable connections
3. Fuse A5 - mirror motors
4. Mirror motors
5. Change over switch
6. Mirror control switch
7. Ground - via main cable
8. Mirror heating elements - active with heated rear screen
9. Fuse 10 - heating elements
10. Fuse 13

CABLE COLOUR CODE

B	Black
U	Blue
N	Brown
G	Green
S	Crey
0	Orange
K	Pink
P	Purple
R	Red
W	White
Y	Yellow

The last letter of a colour code denotes the tracer.

WINDOW LIFTS AND DOOR LOCKS-
Circuit diagram

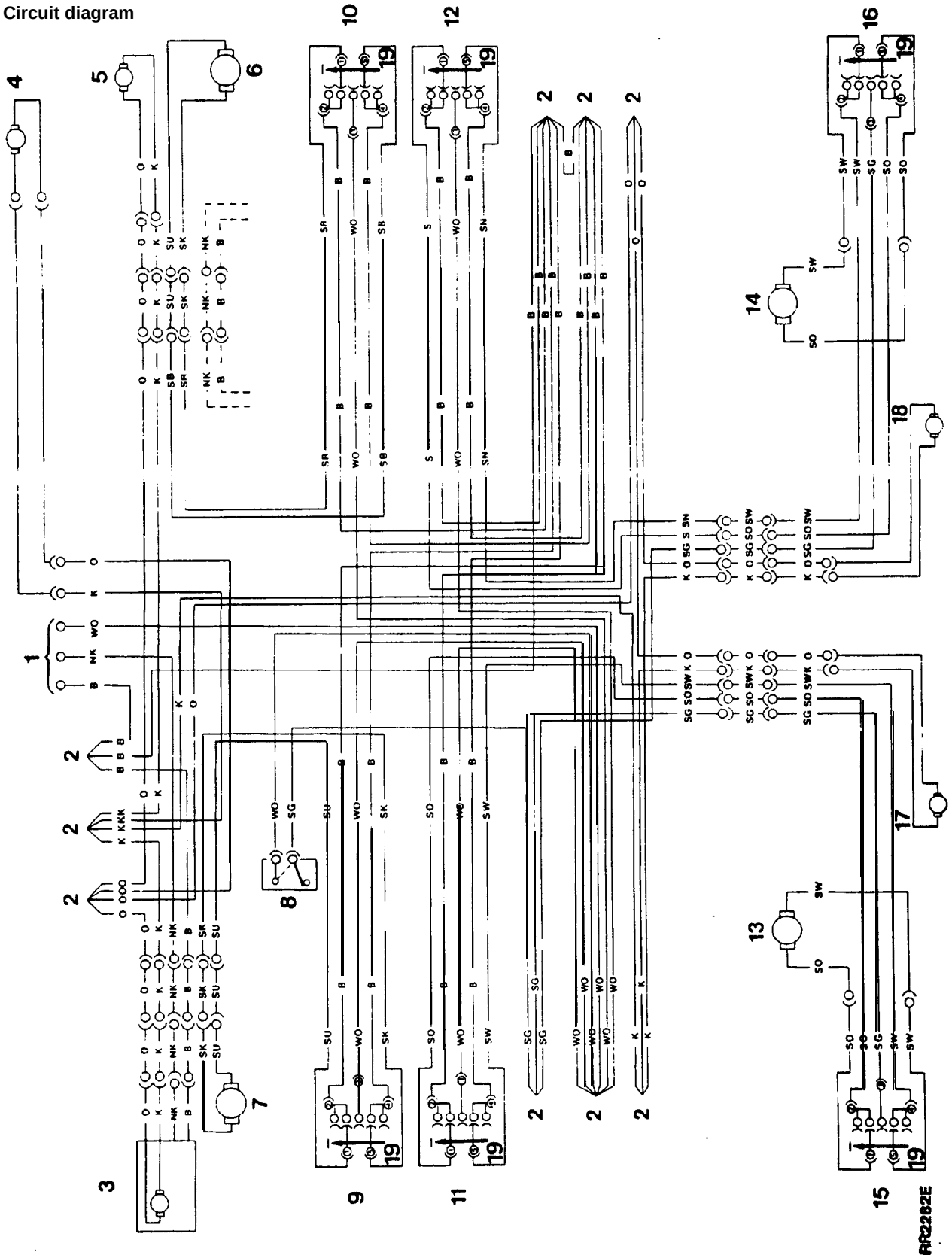
1. Main cable connections
   NK: (+) Battery feed - central locking
   WO: (+) Key position 1 - window lift
   B: (-) Ground
2. Clinches
3. Switch unit-central door locking (drivers door)
4. Fuel flap actuator
5. Lock unit-central door locking (front passenger door)
6. Window lift motor L/H front
7. Window lift motor R/H front
8. isolator switch
9. Window lift switch L/H front
10. Window lift switch R/H front
11. Window lift switch L/H rear
12. Window lift switch R/H rear
13. Window lift motor L/H rear
14. Window lift motor R/H rear
15. Window lift switch L/H rear door
16. Window lift switch R/H rear door
17. Lock unit central door locking L/H rear door
18. Lock unit central door locking R/H rear door
19. Rocker switch operating levers

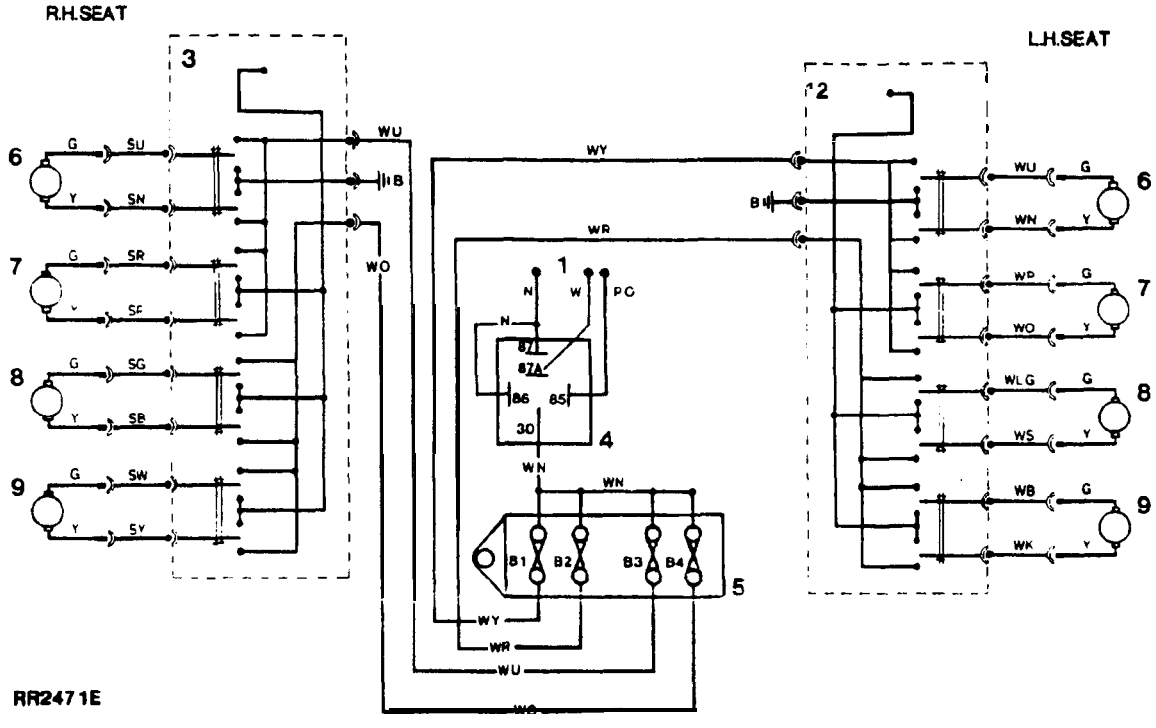
CABLE COLOUR CODE

B	Black	G	Green	K	Pink	W	White
U	Blue	S	Crey	P	Purple	Y	Yellow
h!	Brown	0	Orange	R	Red		

The last letter of a colour code denotes the tracer.

WINDOW LIFTS AND DOOR LOCKS-
Circuit diagram





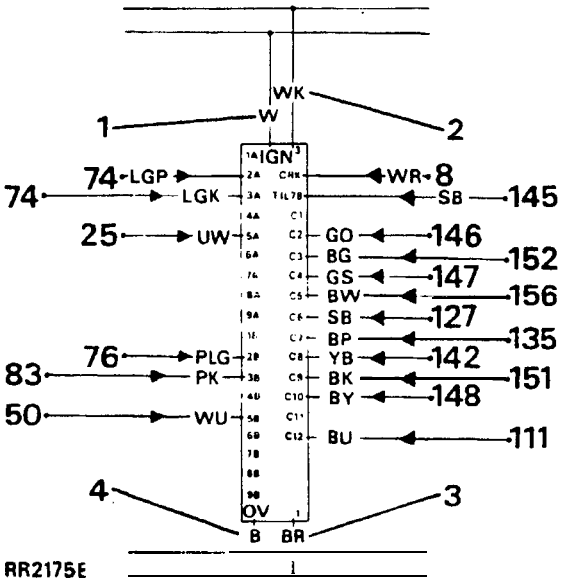
SEATADJUSTMENT-
Circuit diagram

1. **Main connections - Item 126 on main circuit diagram.**
   Brown - Live positive feed
   White - Ignition positive feed
   Purple/Orange - Door switch
2. **Driver's seat control.**
3. **Passenger seat control.**
4. **Load control relay.**
5. **Auxiliary fuse box (B).**
6. **Seat recline motor.**
7. **Seat height (rear) motor.**
8. **Seat base adjust motor.**
9. **Seat height (front) motor.**

CABLE COLOUR CODE

B Black
U Blue
N Brown
G Green
O Orange
P Purple
R Red
W White
Y Yellow

The last letter of a colour code denotes the tracer.



WARNING LAMP CONTROL UNIT-
Circuit diagram

1. **W- White:** Ignition feed
2. **WK-White/pink:** Common positive side for negative switched lamps
3. **BR-Black/red:** Common negative side for positive switched lamps
4. **B-Black:** Earth

See main circuit diagram for key.

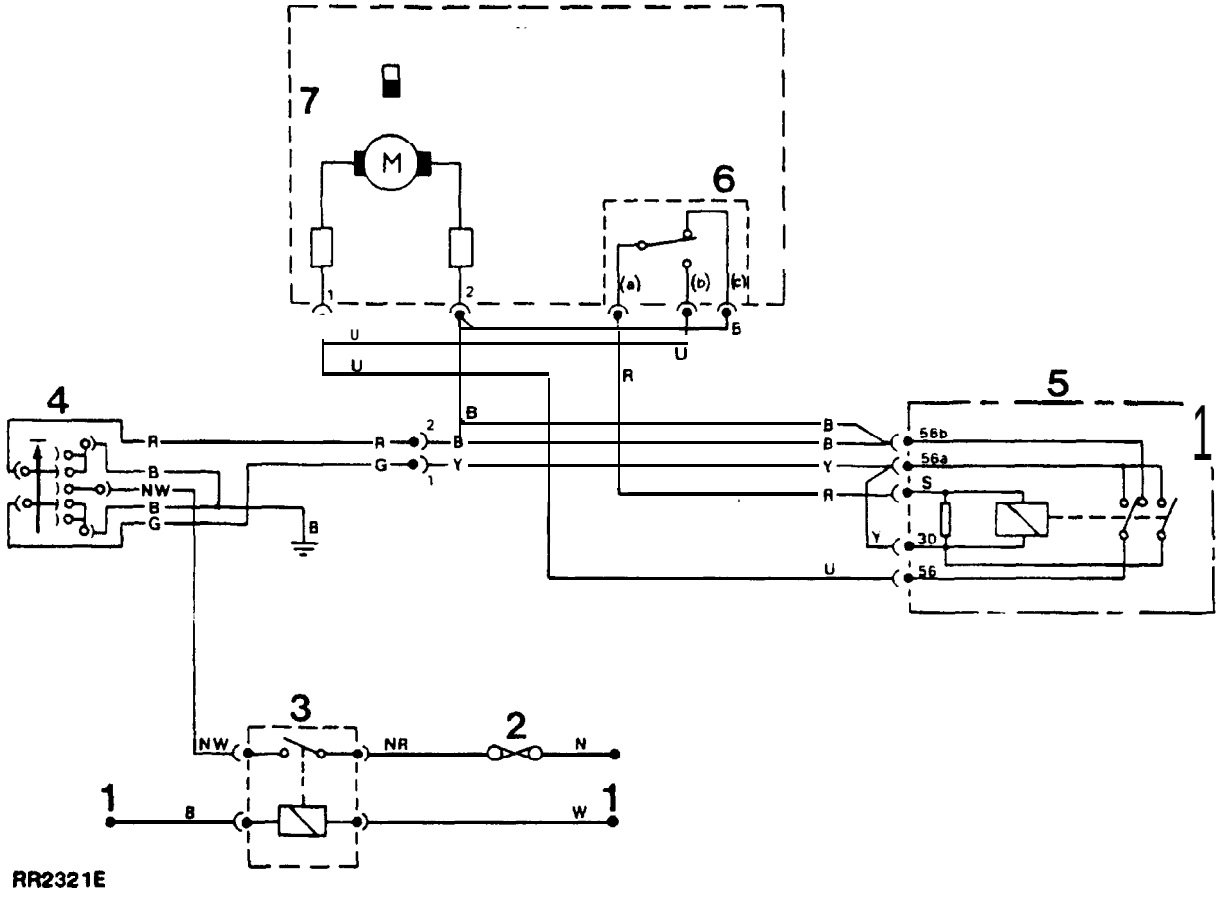
Description

Ignition ON will initiate the bulb check for 12 ± 4 secs.

If the engine is cranked during bulb check, the check will terminate in 0.75 ± 0.25 secs.

In normal ambient light the warning lamps will operate at full brightness at the end of the bulb check period, and change to reduced brightness within 20 secs. Note that the ignition and oil warning lamps will not reduce in brightness.

If a fault is suspected check the warning lamp bulbs and the continuity of the circuits before changing the warning lamp control unit.



SUNROOF - Circuit diagram

1. Main harness connections
   Brown - live positive feed
   White - ignition positve feed
   Black - ground
2. Fuse
3. Auxliary relay
4. Operating switch
5. Stepper relay
6. Micro-switch - motor switching:
   Contact (a) and (c) - CLOSED
   Contact (a) and (b) - OPEN/TILT
7. Drive motor

CABLE COLOUR CODE

B	Black
U	Blue
N	Brown
G	Green
R	Red
W	White
Y	Yellow

The last letter of a colour code denotes the tracer colour

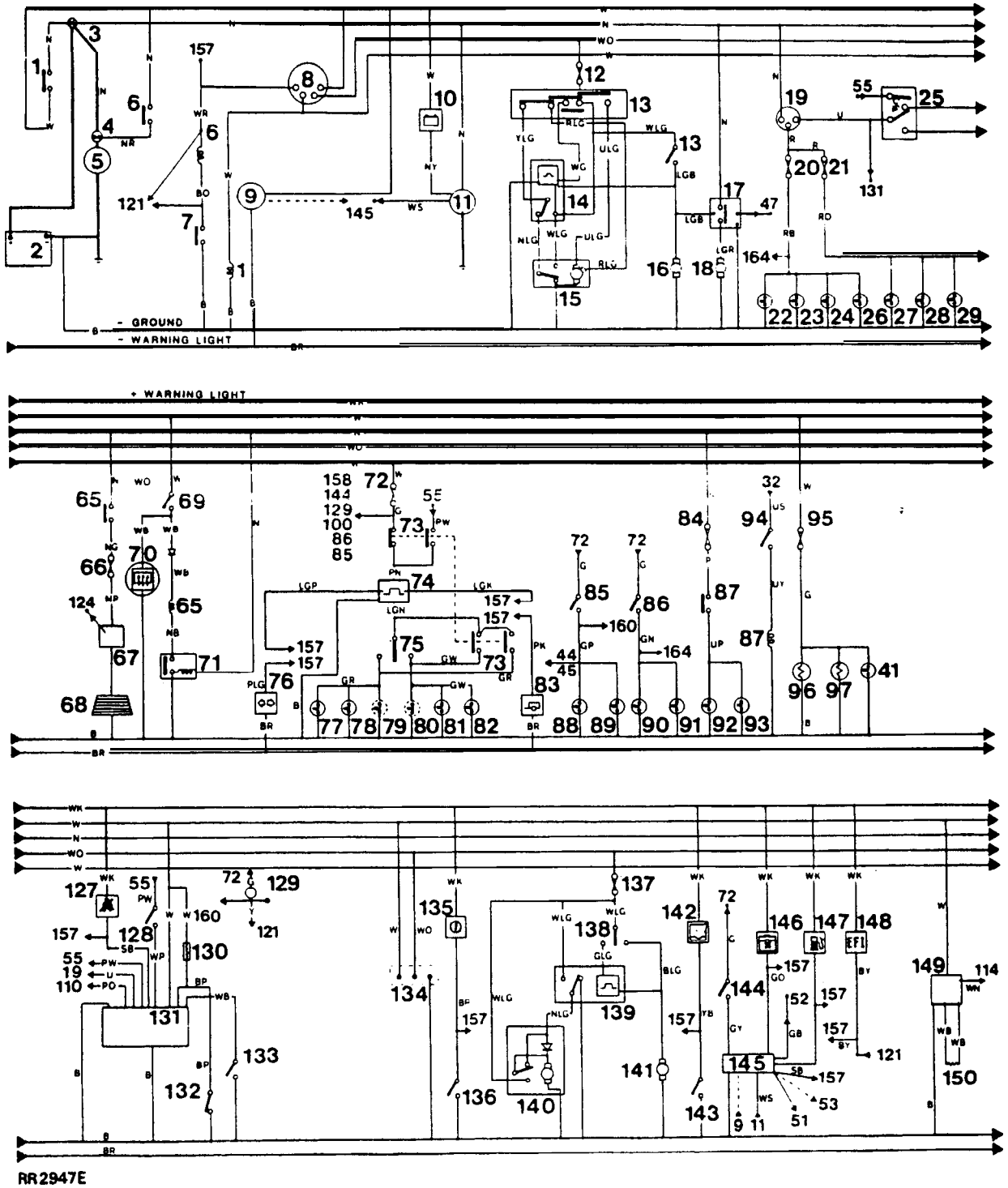
MAIN CIRCUIT DIAGRAM - 1987 Model Year - RR2947E & RR2948E

1. Ignition load relay
2. Battery
3. Terminal post
4. Starter solenoid
5. Starter motor
6. Starter relay
7. Starter inhibit switch
8. ignition switch
9. Tachometer
10. Ignition warning lamp
11. Alternator
12. Fuse 7
13. Front wipe/wash switch
14. Front wipe delay unit
15. Front wiper motor
16. Front wash pump
17. Headlamp wash timer unit
18. Headlamp wash pump
19. Main lighting switch
20. Fuse 6
21. Fuse 5
22. LH side lamp
23. LH tail lamp
24. LH license plate lamp
25. High beam dimmer/flash switch
26. Radio illumination
27. RH side lamp
28. RH tail lamp
29. RH license plate lamp
30. Rheostat
31. Fuse 3
32. Fuse 4
33. Fuse 1
34. Fuse 2
35. Not used
36. Not used
37. Switch illumination (2 off)
38. Cigar lighter illumination (2 off)
39. Heater illumination (4 off)
40. Clock illumination
41. Automatic gear selector illumination (2 off)
42. Instrument illumination (6 off)
43. Not used
44. Not used
45. Not used
46. LH low beam
47. RH low beam
48. LH high beam
49. RH high beam
50. High beam warning lamp
51. Fuel gauge
52. Fuel gauge sender unit
53. Water temperature gauge
54. Water temperature sender unit
55. Fuse 11
56. Horn switch
57. RH horn
58. LH horn
59. Under hood illumination switch
60. Under hood light
61. Clock
62. Fuse 19
63. Fuse 20
64. Pick-up point central locking/window lift
65. Heated rear window relay
66. Fuse 9
67. Radio aerial amplifier
68. Heated rear screen
69. Heated rear screen switch
70. Heated rear screen warning lamp
71. voltage sensitive switch
72. Fuse 13
73. Hazard switch
74. Flasher unit
75. Direction indicator switch
76. Hazard/indicator warning lamp
77. LH rear indicator lamp
78. LH front indicator lamp
79. LH side repeater lamp
80. RH side repeater lamp
81. RH front indicator lamp
82. RH rear indicator lamp
83. Trailer warning lamp
84. Fuse 15
85. Stop lamp switch
86. Reverse lamp switch
87. Auxiliary lamp relay
88. LH stop lamp
89. RH stop lamp
90. LH reverse lamp
91. RH reverse lamp
92. LH auxiliary lamp
93. RH auxiliary lamp
94. Auxiliary lamp switch
95. Fuse 17
96. Dash cigar lighter
97. Glove box cigar lighter
98. LH interior lamp
99. RH interior lamp
100. Interior lamp delay unit

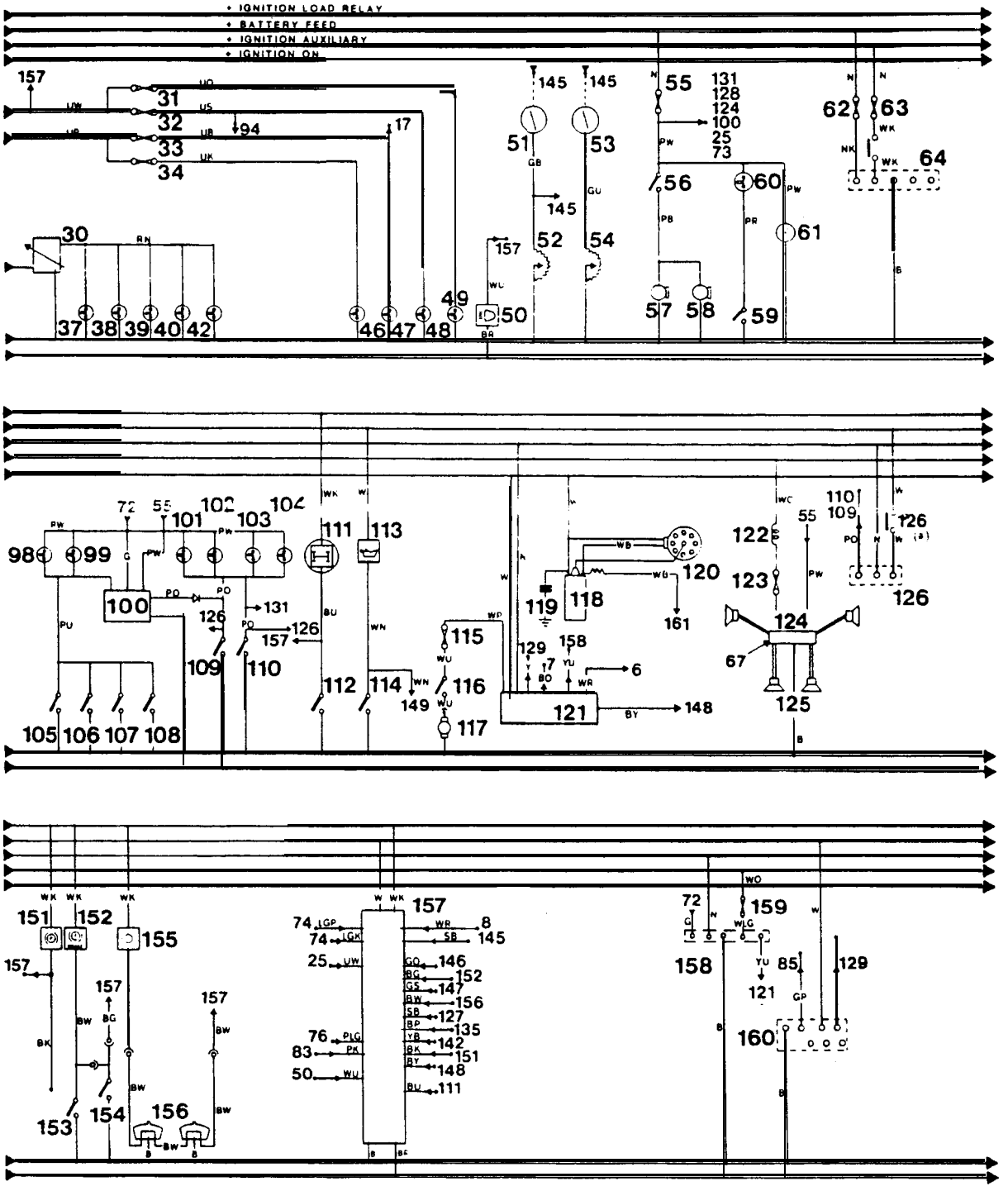
101. LH door edge lamp
102. RH door edge lamp
103. LH puddle lamp
104. RH puddle lamp
105. interior lamp switch
106. LH rear door switch
107. RH rear door switch
108. Tailgate switch
109. LH front door switch
110. RH front door switch
111. Differential lock warning lamp
112. Differential lock switch
113. Oil pressure/level warning lamp
114. Oil pressure switch
115. Fuse 18
116. Inertia switch
117. Fuel pump
118. Ignition coil
119. Capacitor
120. Distributor
121. EFI Harness plug
122. Radio choke
123. Radio fuse
124. Radio
125. Four speakers
126. Electric seats pick up point
127. Seat belt warning Lamp
128. "Key-in" switch
129. Speed transducer, see Cruise Control
130. Resistor
131. Audible warning unit
132. Transfer box neutral switch
133. Seat buckle switch
134. Ignition connection points
135. Automatic transmission oil temperature warning lamp
136. Automatic transmission oil temperature switch
137. Fuse 16
138. Rear wash wipe switch
139. Rear wipe delay unit
140. Rear wiper motor
141. Rear screen wash pump
142. Low screen wash fluid level warning lamp
143. Low screen wash switch
144. Low coolant switch
145. Multi-function unit and binnacle
146. Low coolant level warning lamp
147. Low fuel level warning lamp
148. E.F.I. warning lamp
149. Low oil level logic unit
150. Low oil level probe
151. Not used - will illuminate on initial bulb check
152. Parking brake/brake fail warning lamp
153. Parking brake warning switch
154. Brake fail warning switch
155. Brake pad wear warning lamp
156. Brake pad wear sensors
157. Warning lamp control unit
158 Heater/air conditioning connections
159. Fuse 6
160. Cruise control connection points
161. Coil negative, engine speed signal to ECU

CABLE COLOUR CODE

B	Black
U	Blue
N	Brown
G	Green
S	Grey
L	Light
O	Orange
K	Pink
P	Purple
R	Red
W	White
Y	Yellow



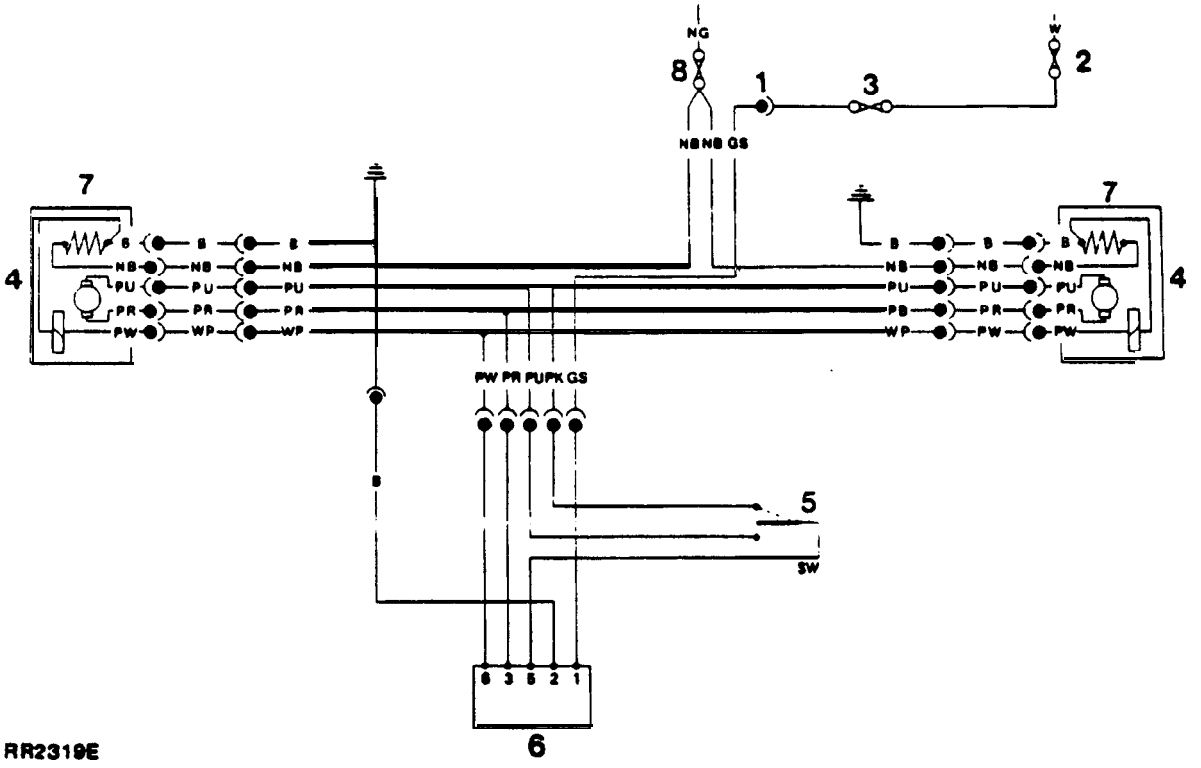
RR2947E


+ IGNITION LOAD RELAY
+ BATTERY FEED
+ IGNITION AUXILIARY
+ IGNITION ON
157
31
32
33
34
94
17
30
37 38 39 40 42
46 47 48
49
50
145
51
53
52
54
55
131
128
124
100
25
73
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60
61
57 58 59
62
63
64
98 99 100 101 102 103 104 105 106 107 108 109 110
111 112 113 114 115 116 117
119 118 120 121 122 123 124 125 126
151 152 153 154 155 156
74 25 76 83 50
146 152 147 156 127 135 142 151 148 111
158 159 160 85 129

RR2948E

ELECTRICAL EQUIPMENT - CIRCUIT DIAGRAMS

- 1988 Model year



RR2319E

ELECTRIC MIRRORS - Circuit diagram

1. Auxiliary fuse box connection
2. Fuse 13
3. Fuse AS - mirror motors
4. Mirror motors
5. Change over switch
6. Mirror control switch
7. Mirror heating elements - active with heated rear screen
8. Fuse 10 - heating elements

CABLE COLOUR CODE

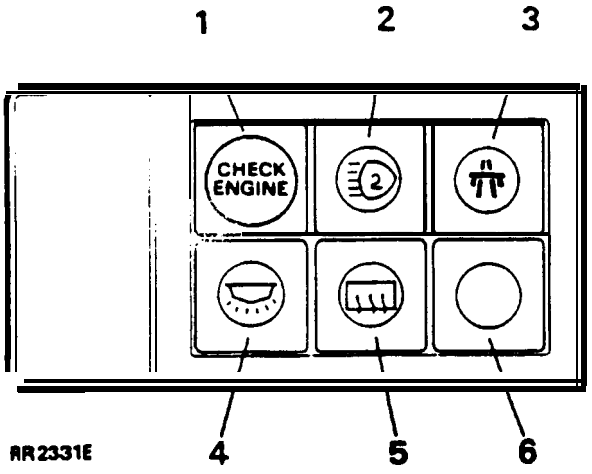
B	Black
U	Blue
N	Brown
G	Green
S	Crey
O	Orange
K	Pink
P	Purple
R	Red
W	White
Y	Yellow

The last letter of a colour code denotes the tracer.

AUXILIARY SWITCH PANEL

The auxiliary switch panel contains four 'push-push' type switches which incorporate integral symbols for identification.
(The sixth switch opening is fitted with a blank cover, which is removable, to facilitate the fitting of an extra switche if required).
The symbol in segment 1 will illuminate initially when turning the ignition on but will go out after a lew seconds. The warning light is designed to illuminate at 52,500 and 105,000 miles when critical emission maintenance intervals are reached.
The symbols are illuminated by two bulbs which become operational when the vehicle lights are on.

The heated rear screen switch (5) is provided with an individual warning light, illuminated when the switch is operated.



1. Emission maintenance reminder warning light.
2. Auxiliary driving lamps.
3. Cruise control master switch.
4. Interior and tailgate lamps.
5. Heated rear screen.
6. Blank.

AUXILIARY SWITCH PANEL

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Carefully pry the auxiliary switch panel surround away from the centre console.
3. Withdraw the switch panel as far as the electrical leads will permit.
4. Unclip the multi-plugs at the rear of the switches by depressing the retaining lugs.
5. Pull the plugs from the switches.
6. Remove the switch assembly complete.

NOTE: If necessary each individual switch can now be removed as follows.

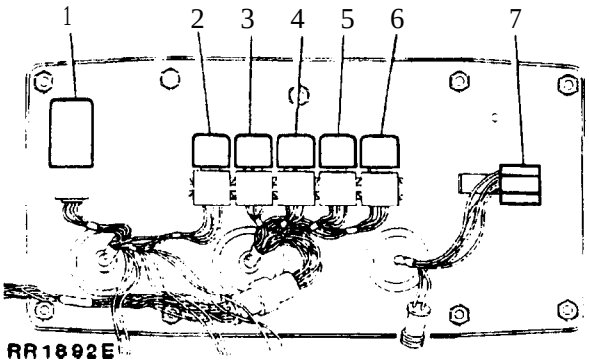
7. Depress the small retaining lugs on the top and bottom of the switch and push the switch(es) through the front of the switch surround.

Refitting

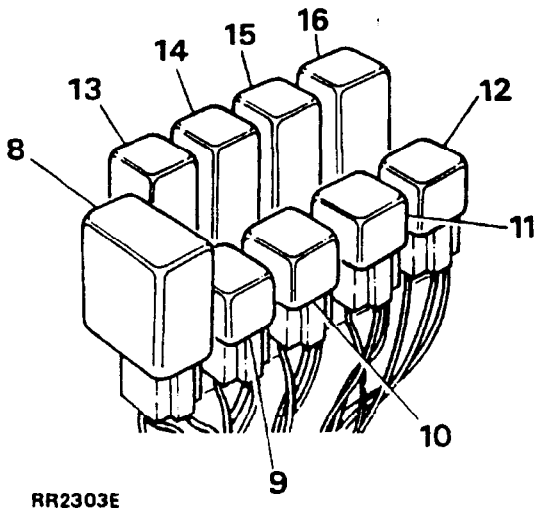
8. Reverse the removal procedure.

NOTE: To aid identification and location of multi-plug to switch, a coloured plastic tab is attached to each body which corresponds with an appropriate coloured multi-plug.
The switches if removed, should always be refitted in their original position.

NOTE: Refer to page 38 of Section 86, for bulb replacement procedure.

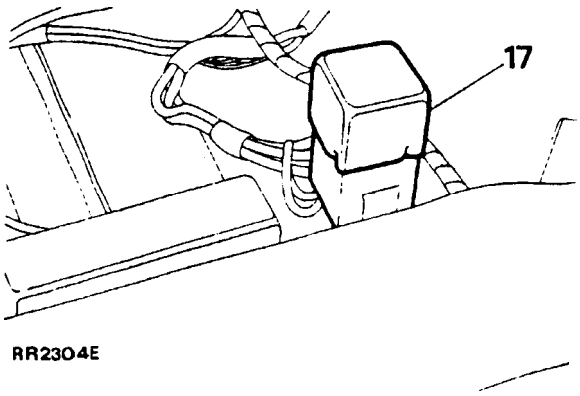


Closure panel viewed from the engine compartment, with protective cover removed.



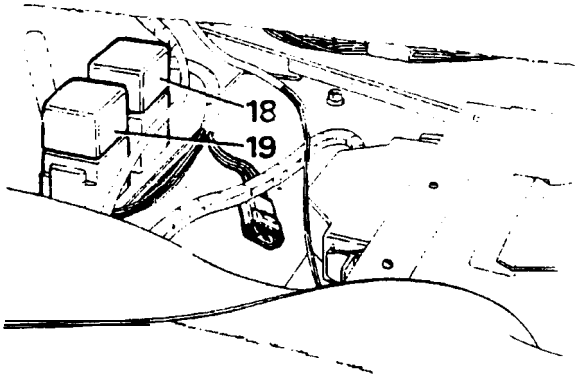
Steering column mounted relays viewed with the lower dash panel removed.

Relay	Circuit Diagram Item Number
1. Headlamp wash timer unit	17. Main circuit diagram
2. Heated rear window	65. Main circuit diagram
3. Starter solenoid relay	6. Main circuit diagram
4. Compressor clutch	11. Air conditioning diagram
5. Condenser fan	9. Air conditioning diagram
6. Air conditioning/heater	5. Air conditioning diagram
7. Stowage position	Not used
8. Rear wiper delay	139. Main circuit diagram
9. Ignition load relay	1. Main circuit diagram
10. Window lift relay	64(a). Main circuit diagram
11. Seat adjustment relay	126(a). Main circuit diagram
12. Auxiliary lamp relay	87. Main circuit diagram
13. Flasher/hazard unit	74. Main circuit diagram
14. Interior lamp delay	100. Main circuit diagram
15. Voltage sensitive switch	71. Main circuit diagram
16. Front wiper delay	14. Main circuit diagram
17. Seat adjustment relay	4. Seat adjustment diagram
18. Main EFI relay	22. EFI circuit diagram
19. Fuel pump relay	21. EFI circuit diagram
20. Sunshine roof auxiliary relay	3. Sunroof circuit diagram



RR2304E

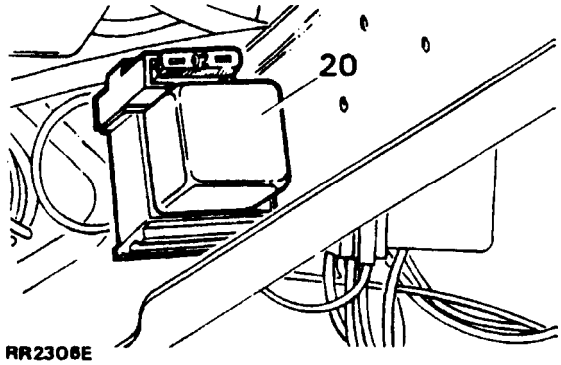
Seat adjustment relay located beneath the left hand front seat adjacent to fuse box (B).



RR2305E

Main EFI (black terminal block) and fuel pump relays (blue terminal block) mounted beneath right hand front seat.

NOTE: Refer to fuel injection section of manual for full information on E.F.I. relays.



RR2306E

Sunshine roof auxiliary relay located on side of the steering column support bracket located behind the lower dash panel.

RELAYS-(Mounted on the engine compartment closure panel).

Remove and refit

Removing

1. Lift the hood
2. Disconnect the battery negative lead.
3. Remove the bolt securing the relay protective cover, located on the front of the engine compartment closure panel.
4. Remove the cover.
5. Pull the appropriate relay off its multi-plug.

Refitting

6. Reverse the removal procedure.

RELAYS-(Mounted on the steering column support bracket)

Remove and refit

Removal.

1. Disconnect the battery negative lead.
2. Remove the six screws securing the lower fascia panel.
3. Lower the dash panel, disconnect the electric leads from the dimming control switch and remove the fascia panel.
4. Locate the appropriate relay on the relay mounting bracket, carefully pull the relay off the multi-plug.

Refitting

5. Reverse the removal procedure.

RELAYS-(Floor mounted beneath front seats)

Remove and refit

Removing

1. Position seat to gain access to the required relay.
2. Disconnect the battery negative lead.
3. Carefully pull the relay off the multi-plug.

Refitting

4. Reverse the removal procedure.

MAIN CIRCUIT DIAGRAM - 1988 Model Year
- RR2949E & RR2950E

1. Ignition load relay
2. Battery
3. Terminal post
4. Starter solenoid
5. Starter motor
6. Starter relay
7. Starter inhihit switch
8. Ignition switch
9. Tachometer
10. Ignition warning lamp
11. Alternator
12. Fuse 7
13. Front wipe/wash switch
14. Front wipe delay unit
15. Front wiper motor
16. Front wash pump
17. Headlamp wash timer unit
18. Headlamp wash pump
14. Main lighting switch
20. Fuse 6
21. Fuse 5
22. LH side lamp
23. LH tail lamp
24. License plate lamp (2 off)
25. High beam dimmer/flash switch
26. Radio illumination
27. RH side lamp
28. RH tail lamp
29. Not used
30. Rheostat
31. Fuse 3
32. Fuse 4
33. Fuse 1
34. Fuse 2
35. Not used
36. Not used
37. Switch illumination (2 off)
38. Cigar lighter illumination (2 off)
39. Heater illumination (4 off)
40. Clock illumination
41. Automatic gear selector illumination (2 off)
42. Instrument illumination (6 off)
43. Not used
44. Not used
45. Not used
46. LH low beam
47. RH low beam
48. LH high beam
49. RH high beam
50. High beam warning lamp
51. Fuel gauge
52. Fuel gauge sender unit
53. Water temperature gauge
54. Water temperature sender unit
55. Fuse 11
56. Horn switch
57. RH horn
58. LH horn
59. Under hood illumination switch
60. Under hood light
61. Clock
62. Fuse 19
63. Fuse 20
64. Pick-up point central locking/window lift
64. (a) Window liit relay
65. Heated rear window relay
66. Fuse 9
67. Radio aerial amplifier
68. Heated rear screen
69. Heated rear screen switch
70. Heated rear screen warning lamp
71. Voltage sensitive switch
72. Fuse 13
73. Hazard switch
74. Flasher unit
75. Direction indicator switch
76. Hazard/indicator warning lamp
77. LH rear indicator lamp
78. LH front indicator lamp
79. Pick up point - electric mirrors
80. Fuse 10
81. RH front indicator lamp
82. RH rear indicator lamp
83. Trailer warning lamp
84. Fuse 15
85. Stop lamp switch
86. Reverse lamp switch
87. Auxiliary lamp relay
88. LH stop lamp
89. RH stop lamp
90. LH reverse lamp
91. RH reverse lamp
92. LH auxiliary lamp
93. RH auxiliary lamp
94. Auxiliary lamp switch
95. Fuse 17
96. Dash cigar lighter
97. Glove box cigar lighter
98. LH interior lamp
99. RH interior lamp
100. Interior lamp delay unit

101. LH door edge lamp
102. RH door edge lamp
103. LH puddle lamp
104. RH puddle lamp
105. Interior lamp switch
106. LH rear door switch
107. RH rear door switch
108. Tailgate switch
109. LH front door switch
110. RH front door switch
111. Differential lock warning lamp
112. Differential lock switch
113. Oil pressure/level warning lamp
114. Oil pressure switch
115. Fuse 18
116. Inertia switch
117. Fuel pump
118. Ignition coil
119. Capacitor
120. Distributor
121. EFI Harness plug
122. Not used
123. Radio fuse
124. Radio
125. Four speakers
126. Electric seats pick up point
126. (a) Electric seat relay
127. Sea! belt warning lamp
128. "Key-in" switch
129. Speed transducer, see Cruise Control
130. Resistor
131. Audible warning unit
132. Transfer box neutral switch
133. Seat buckle switch
134. Sunroof connection points (option)
135. Automatic transmission oil temperature warning lamp
136. Automatic transmission oil temperature switch
137. Fuse 16
138. Rear wash wipe switch
139. Rear wipe delay unit
140. Rear wiper motor
141. Rear screen wash pump
142. Low screen wash fluid level warning lamp
143. Low screen wash switch
744. Low coolant switch
145. Multi-function unit and binnacle
146. Low coolant level warning lamp
147. Low fuel level warning lamp
148. E.F.I. warning lamp
149. Low oil level logic unit
150. Low oil level probe
151. Not used - will illuminate on initial bulb check
152. Parking brake/brake fluid loss warning lamp
153. Parking brake warning switch
154. Brake fluid loss warning switch
155. Brake pad wear warning lamp
156. Brake pad wear sensors
157. Warning lamp control unit
158. Heateriair conditioning connections
159. Fuse 8
160. Cruise control connection points
161. Coil negative, engine speed signal to ECU
162. Emission maintenance reminder
163. Check engine warning lamp
164. Trailer pick up point
165. Fuse 14

CABLE COLOUR CODE

B	Black
U	Blue
N	Brown
G	Green
S	Crey
L	Light
O	Orange
K	Pink
P	Purple
R	Red
W	White
Y	Yellow

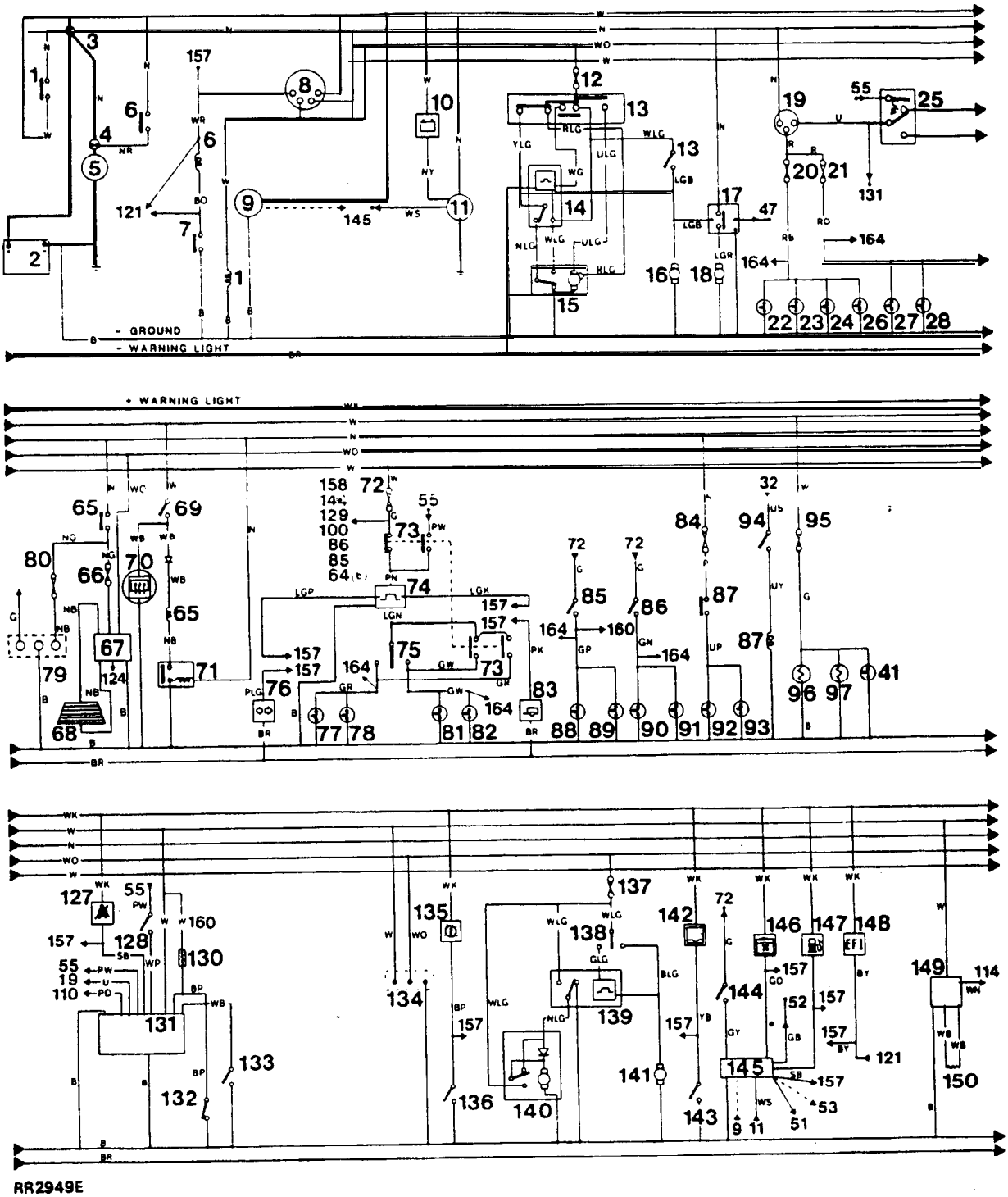
MAIN CIRCUIT DIAGRAM - RR2949E & RR2950E

Alphabetical key

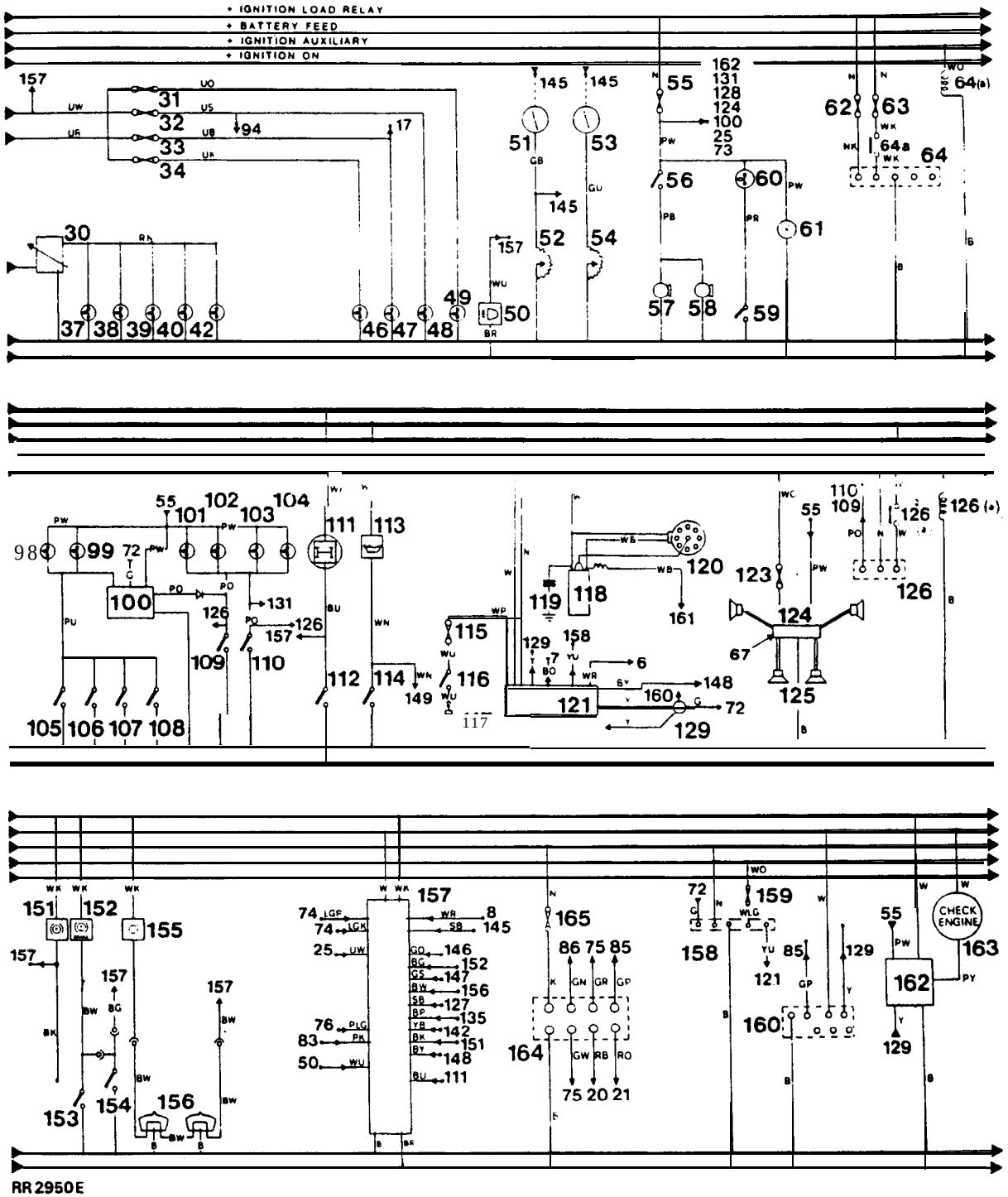
11. Alternator
131. Audible warning unit
41. Automatic gear selector iffumination (2 off)
136. Automatic transmission oil temperature switch
135. Automatic transmission oil temperature warning lamp
87. Auxiliary lamp relay
94. Auxiliary lamp switch
2. Batten!
154. Brake fluid loss warning switch
156. Brake pad wear sensors
155. Brake pad wear warning lamp
119. Capacitor
163. Check engine warning lamp
38. Cigar lighter illumination (2 off)
61. Clock
40 Clock illumination
161. Coil negative, engine speed signal to ECU
160. Cruise control connection points
96. Dash cigar lighter
112. Differential lock switch
111. Differential lock warning lamp
75. Direction indicator switch
120. Distributor
121. EFI Harness plug
148. EFI warning lamp
126. Electric seats pick up point
126. (a) Electric seat relay
162. Emission maintenance reminder
74. Flasher unit
16. Front wash pump
14. Front wipe delay unit
13. Front wipe/wash switch
15. Front wiper motor
51. Fuel gauge
52. Fuel gauge sender unit
117. Fuel pump
33. Fuse 1
34. Fuse 2
31. Fuse 3
32. Fuse 4
21. Fuse 5
20. Fuse 6
12. Fuse 7
159. Fuse 8
66. Fuse 9
80. Fuse 10
55. Fuse 71
72. Fuse 13
165. Fuse 14
84. Fuse 15
137. Fuse 16
95. Fuse 17
115. Fuse 18
62. Fuse 19
63. Fuse 20
97. Clove box cigar lighter
73. Hazard switch
76. Hazard/indicator warning lamp
18. Headlamp wash pump
17. Headlamp wash timer unit
68. Heated rear screen
69. Heated rear screen switch
70. Heated rear screen warning lamp
65. Heated rear window relay
39. Heater illumination (4 off)
158. Heater/air conditioning connections
25. High beam dimmer/flash switch
50. High beam warning lamp
56. Horn switch
118. ignition coil
1. Ignition load relay
8. Ignition switch
10. Ignition warning lamp
116. Inertia switch
42. Instrument illumination (6 off)
100. Interior lamp delay unit
105. Interior lamp switch
128. "Key-in" switch
92. LH auxiliary lamp
101. LH door edge lamp
109. LH front door switch
78. LH front indicator lamp
48. LH high beam
58. LH horn
98. LH interior Lamp
24. License plate lamp (2 off)
46. LH low beam
103. LH puddle lamp
106. LH rear door switch
77. LH rear indicator lamp
90. LH reverse lamp
22. LH side lamp
88. LH stop lamp
23. LH tail lamp
146. Low coolant level warning lamp
144. Low coolant switch
147. Low fuel level warning lamp
149. Low oil level logic unit
150. Low oil level probe
142. Low screen wash fluid level warning lamp
143. Low screen wash switch
19. Main lighting switch
145. Multi-function unit and binnacle
114. Oil pressure switch
113. Oil pressure/level warning lamp
153. Parking brake warning switch
152. Parking brake/brake fluid loss warning lamp
79. Pick up point - electric mirrors
64. Pick-up point central locking/window lift
124. Radio
67. Radio aerial amplifier
123. Radio fuse
26. Radio illumination

125. Radio speakers (4 off)
141. Rear screen wash pump
138. Rear wash wipe switch
139. Rear wipe delay unit
140. Rear wiper motor
130. Resistor
86. Reverse lamp switch
93. RH auxiliary lamp
102. RH door edge lamp
110. RH front door switch
81. RH front indicator lamp
49. RH high beam
57. RH horn
99. RH interior lamp
47. RH low beam
104. RH puddle lamp
107. RH rear door switch
82. RH rear indicator lamp
91. RH reverse lamp
27. RH side lamp
89. RH stop lamp
28. RH tail lamp
30. Rheostat
127. Seat belt warning lamp
133. Seat buckle switch
129. Speed transducer, see Cruise Control
7. Starter inhibit switch
5. Starter motor
6. Starter relay
4. Starter solenoid
85. Stop lamp switch
134. Sunroof connection points (option)
37. Switch illumination (2 off)
9. Tachometer
108. Tailgate switch
3. Terminal post
164. Trailer pick up point
83. Trailer warning lamp
132. Transfer box neutral switch
59. Under hood illumination switch
60. Under hood light
71. Voltage sensitive switch
157. Warning lamp control unit
53. Water temperature gauge
54. Water temperature sender unit
64. (a) Window lift relay

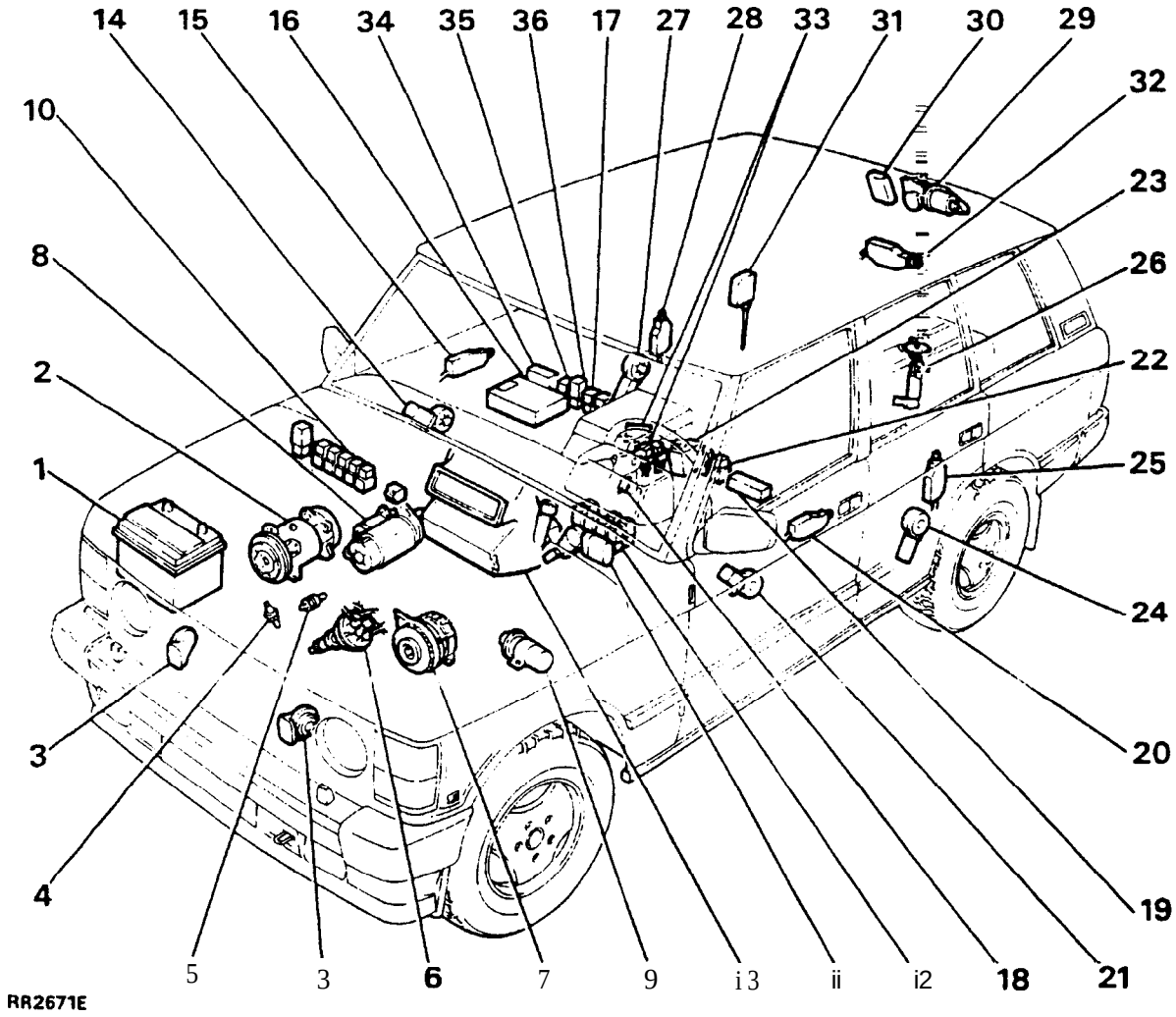
ADDITION: SEPT. 87/REVISED: SEPT. SO



RR2949E


+ IGNITION LOAD RELAY
+ BATTERY FEED
+ IGNITION AUXILIARY
+ IGNITION ON
RR2950E

ADDITION: SEPT. 87/REVISED: SEPT. 90



RR2671E

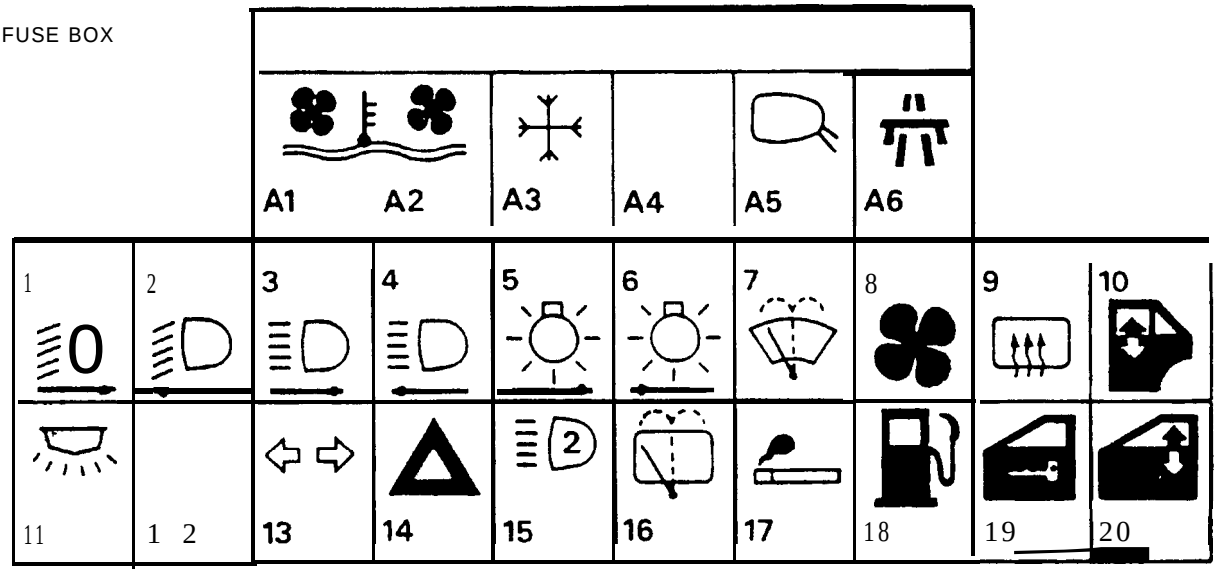
LOCATION OF ELECTRICAL EQUIPMENT
• 1989 MODEL YEAR

1. Battery
2. Air conditioning compressor
3. Horns
4. Oil pressure switch
5. Water temperature switch
6. Electronic distributor
7. Alternator
8. Starter motor
9. Coil
10. Relays
11. Wiper motor-front screen
12. Relays/delay units
13. Heater
14. Window lift motor (front right hand door)
15. Door lock actuator (front right hand door)
16. Electronic control unit (EFI)
17. EFI relays (two)
18. Parkbrake warning light switch
19. Seat adjustment fusebox
20. Door lock actuator (front left hand door)
21. Window lift motor (front left hand door)
22. Seat adjustment relays (two)
23. Inertia switch
24. Window lift motor (rear left hand door)
25. Door lock actuator (rear left hand door)
26. Electrical in-tank fuel pump
27. Window lift motor (rear right hand door)
28. Door lock actuator (rear right hand door)
29. Wiper motor-rear screen
30. Radio aerial amplifier
31. Fuel filler flap lock actuator
32. Tailgate lock actuator
33. Window lift relays and one touch control unit
34. Emission maintenance reminder
35. Cruise control relay (neutral lockout)
36. Condenser fan timer unit

For full information on fuel injection related items-see Fuel Injection Section of manual.

To identify individual relays see relays in Electrical Section of Manual.

FUSE BOX



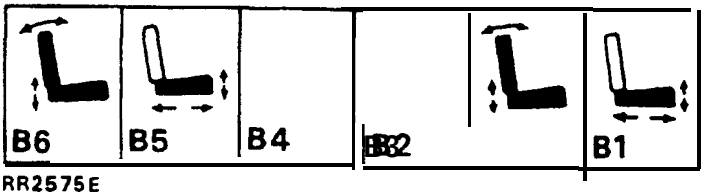
RR2474E

FUSE NO.	COLOUR CODE	FUSE VALUE	CIRCUIT SERVED	IGNITION KEY CONTROLLED
MAIN FUSE PANEL				
1	Brown	7.5 amp	RH headlamp low beam and power wash	Ign
2	Brown	7.5 amp	LH headlamp low beam	Ign
3	Brown	7.5 amp	RH headlamp high beam	Ign
4	Brown	7.5 amp	LH headlamp high beam, auxiliary lamp switch	Ign
5	Tan	5 amp	RH parking lights and instrument illumination	
6	Tan	5 amp	LH parking lights and radio illumination	
7	Blue	15 amp	Front wash/wiper motors, seat relay, window lift relay, antennae amplifier	Aux'
8	Green	30 amp	Heater/air con. motor	Aux
9	White	25 amp	Heated rear screen	Ign
10	Green	30 amp	Window lifts rear	Aux
11	Blue	15 amp	Interior light delay, clock, radio, under hood illumination, audible warning unit, cruise control, key in switch, emission maintenance reminder, seat connection	
12	--	---	NOT USED	
13	Blue	15 amp	Direction indicators, stop and reverse lights, electric mirrors, low coolant, low oil, heated jets, interior lamp delay, heater/air con relay, audible warning unit, neutral resistor	Ign
14	Yellow	20 amp	Hazard lights, horn, headlamps flash, alarm	
15	Blue	15 amp	Auxiliary driving lamps	
16	Red	10 amp	Rear wash/wipe motor, heated rear screen switch	Ign
17	Yellow	20 amp	Cigar lighters (front and rear), gear selector illumination	Ign
18	Red	10 amp	Fuel pump	Ign
19	Red	10 amp	Central door locking	
20	Green	30 amp	Electric window lifts front	Aux

NOTE: Radio Cassette combination. An in-line 5 amp fuse is incorporated in the power input lead of the unit.

AUXILIARY FUSE PANEL • (A)				
A1	Yellow	20 amp	Air conditioning fan	IGN
A2	• Yellow	20 amp	Air conditioning fan	IGN
A3	Tan	5 amp	Air conditioning compressor clutch	IGN
A4			Spare	
A5	Violet	3 amp	Electric mirror motors	IGN
A6	Brown	7.5 amp	Cruise control	IGN

AUXILIARY FUSE BOX

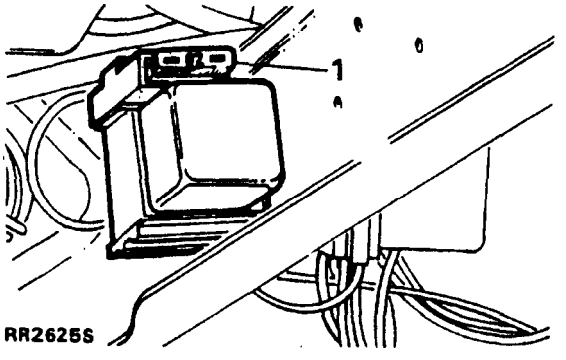


RR2575E

AUXILIARY FUSE BOX (B) - Located under the front left-hand seat

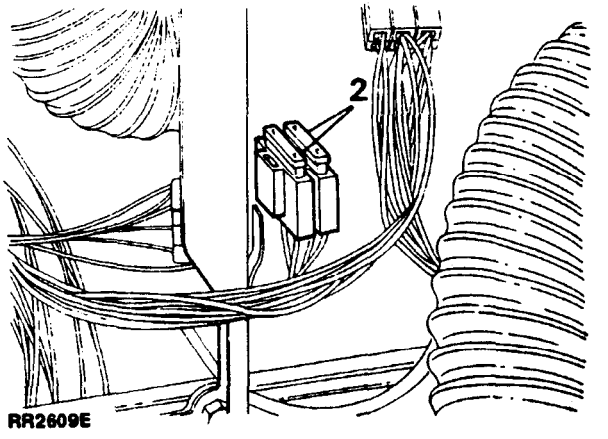
FUSE NO	COLOUR CODE	FUSE VALUE	CIRCUIT SERVED
B1	Green	30 amp	Drivers seat base/height front
B2	Green	30 amp	Drivers seat recline/height rear
B3	----	----	Spare
B4	----	----	Spare
B5	Green	30 amp	Passengers seat base/height front
B6	Green	30 amp	Passengers seat recline/height rear

ADDITIONAL FUSES



RR2625S

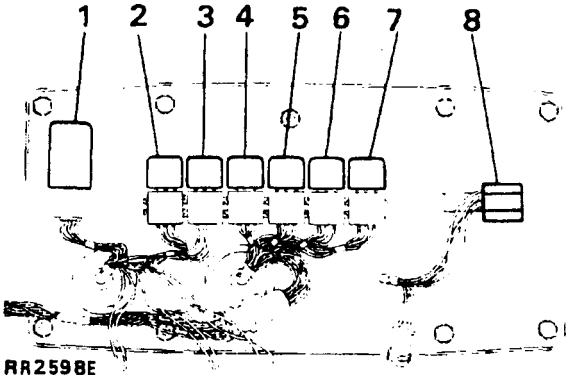
Sunroof fuse (1) is a 20 amp, yellow, blade type located on the side of the sunroof main relay



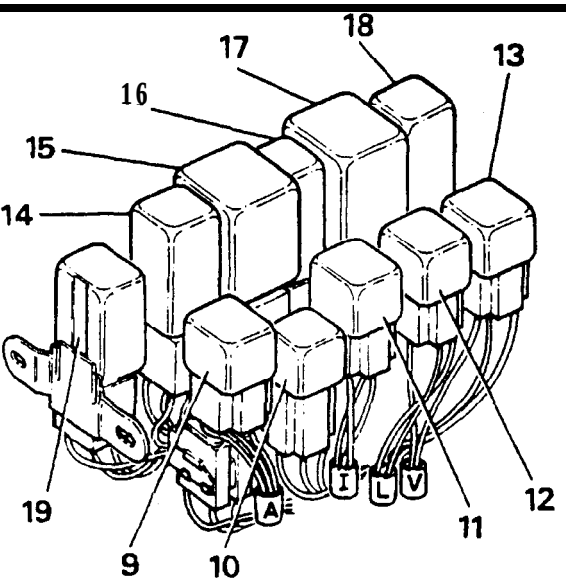
RR2609E

Heated front screen (2) has two 25 amp white, blade type fuses mounted adjacent to the bank of steering column mounted relays. Pull fuse holder off its mounting blade to gain access to fuses.

RELAYS-Identification

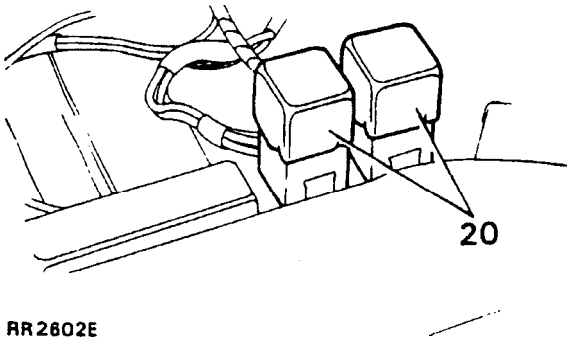


Closure panel viewed from the engine compartment, with protective cover removed.



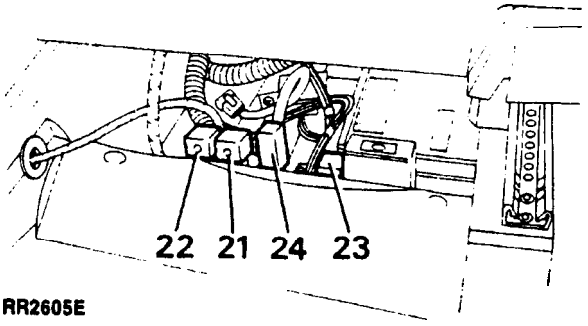
Steering column mounted relays viewed with the lower dash panel removed.

Relay/delay/timer unit	Circuit Diagram item number	Colour
1. Headlamp wash timer unit	17. Main circuit	Black
2. Heated rear window relay	65. Main circuit	Natural
3. Starter solenoid relay	6. Main circuit	Natural
4. Compressor clutch relay	11. Air conditioning	Natural
5. Condenser fan relay	9. Air conditioning	Natural
6. Air conditioning/heater relay	5. Air conditioning	Natural
7. Fresh air solenoid relay	10. Air conditioning	Natural
8. Stowage position	— Not used	-----
9. Auxiliary lamp relay	87. Main	Natural
10. Heated front screen relay	3. Heated front screen	Black
11. Ignition load relay	1. Main	Natural
12. Headlamp relay	26. Main	Natural
13. Heater/air con. relay	168. Main	Natural
14. Rear wiper delay	139. Main	Blue
15. Interior lamp delay	100. Main	Red
16. Flasher/hazard unit	74. Main	Black
17. Voltage sensitive switch	71. Main	Yellow
18. Front wiper delay-	14. Main	Red
19. Heated front screen timer unit	2. Heated front screen	Grey
20. Seat adjustment relays • two	5,6. Seat adjustment	Natural
21. Main EFI relay	22. EFI	Silver
22. Fuel pump relay	21. EFI	Silver
23. Cruise control relay	16. Cruise control	Natural
24. Condenser fan unit	23. Air conditioning	Green
25. Rear window lift relay	13. Window lift	Natural
26. Front window lift relay	14. Window lift	Natural
27. Window lift one touch unit	1. Window lift	Black
28. Sunroof auxiliary relay	3. Sunroof	Natural



RR2602E

Seat adjustment relays (load control) located beneath the left hand front seat adjacent to fuse box (B).

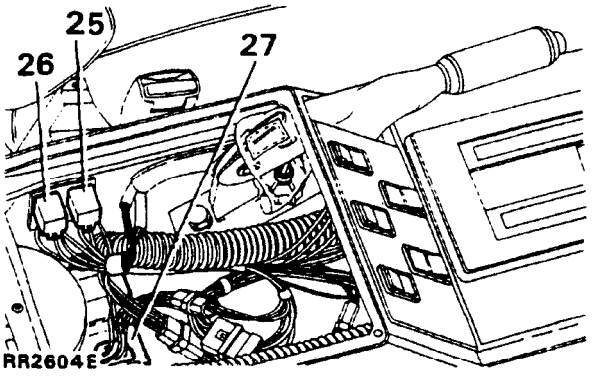


RR2605E

EFI (black terminal block) and fuel pump relays (blue terminal block) mounted beneath right hand front seat.

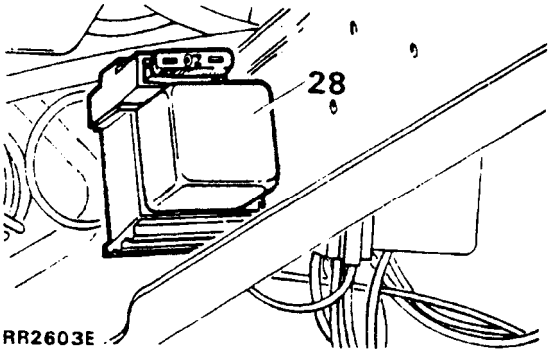
Condenser fan timer unit (24) mounted beneath right hand front seat.

Cruise control relay (23)



RR2604E

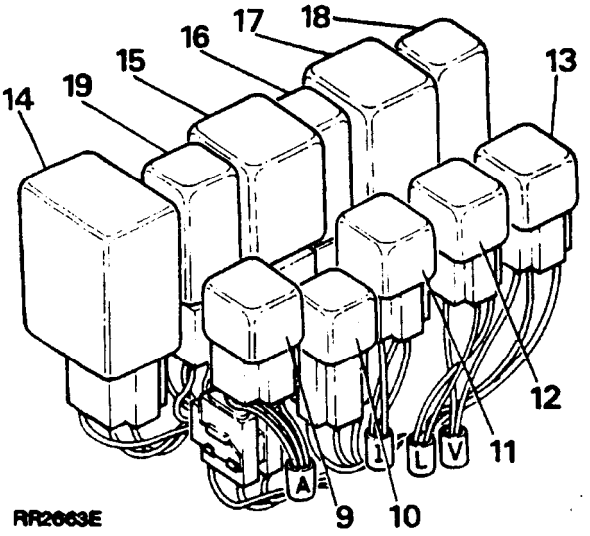
Front (black terminal block) and rear (blue terminal block) window relays. One touch control unit (27) is located inside the glove box, accessible by removing glove box liner.



RR2603E

Sunshine roof auxiliary relay located on side of the steering column support bracket located behind the lower dash panel (Left hand drive shown.

Relays - interim condition (early 1989 models)



RR2663E

Steering column mounted relays viewed with the lower dash panel removed.

ELECTRICALLY OPERATED CENTRAL DOOR LOCKING SYSTEM

The central door locking system now includes an actuator unit to lock the upper tailgate.

Locking or unlocking the drivers door from outside by key operation, or from inside by sill knob automatically locks or unlocks all four doors, the upper tailgate and the fuel filler flap.

Front and rear passenger doors can be independently locked or unlocked from inside the vehicle by sill knob operation but can be overidden by further operation of the driver locking control.

On rear doors only a child safety lock is provided which can be mechanically pre-set to render the interior door handles inoperative.

Failure of an actuator will not affect the locking of the remaining three doors, tailgate or fuel filler flap. The door/tailgate with the inoperative actuator can still be locked or unlocked manually, but not the fuel filler flap.

It is also possible to override the tailgate central locking by use of the key.

NOTE: The door lock actuator units contain non-serviceable parts. If a fault should occur replace the unit concerned with a new one.

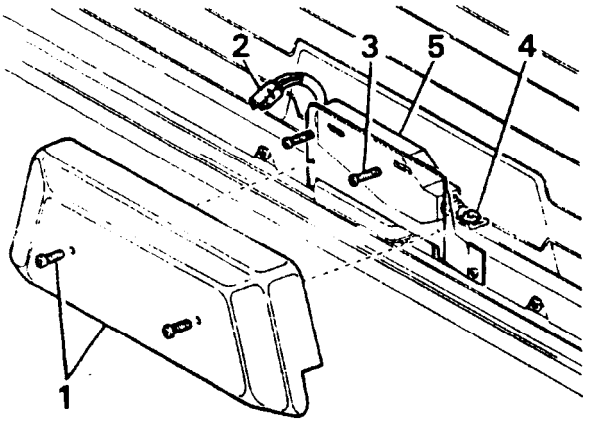
Before carrying out any maintenance work disconnect the battery.

UPPER TAILGATE ACTUATOR UNIT

Remove and refit

Removing

1. Remove two screws and the trim covering to gain access to the actuator.
2. Disconnect the electrical connection.
3. Remove the two actuator retaining screws.
4. Manouver the actuator assembly to detach the operating rod 'eye' from the actuator link to the lock.
5. Withdraw the tailgate actuator unit.



RR2570E

Refitting

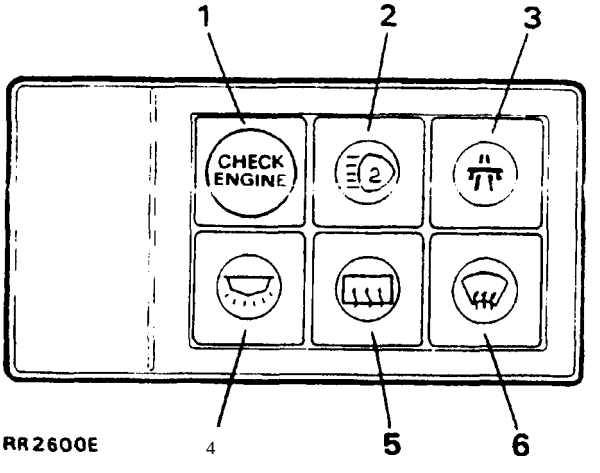
6. Reverse the removal procedure.
7. Check the operation of the central locking system.

AUXILIARY SWITCH PANEL

The auxiliary switch panel contains the Emission maintenance reminder warning light, four 'push-push' type switches and a single touch switch for the heated front screen.

The switches incorporate integral symbols for identification. The symbols are illuminated when the vehicle lights are on.

The heated front (6) and rear (5) screen switches are provided with individual warning lights, illuminated when the switch is operated.



1. Emission maintenance reminder warning light.
2. Auxiliary driving lamps
3. Cruise control master switch
4. interior and tailgate lamps
5. Heated rear screen
6. Heated front screen

HEATED FRONT SCREEN

The heated front screen will operate when the switch is operated with engine running. The timer unit, see Relays-identification, will provide a preset time cycle of 7 112 minutes ± 20%.
Switching off the ignition, or further operation of the heated front screen switch during the cycle will switch off the screen and cancel, reset and switch off the timer unit.

AUDIBLE WARNING UNIT

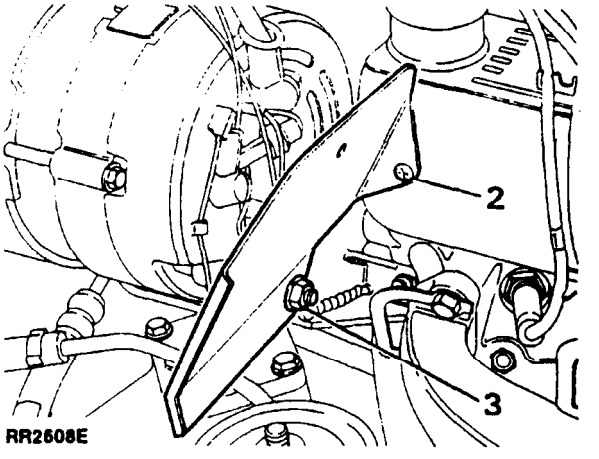
1989 model year vehicles feature ignition override of headlamps, i.e. headlamps will be switched off when ignition is switched off.
Therefore the rapidly repeated low tone described under AUDIBLE WARNING UNIT, section 86, page 62, is deleted.

ALTERNATOR HEAT SHIELD

Remove and refit

Removing

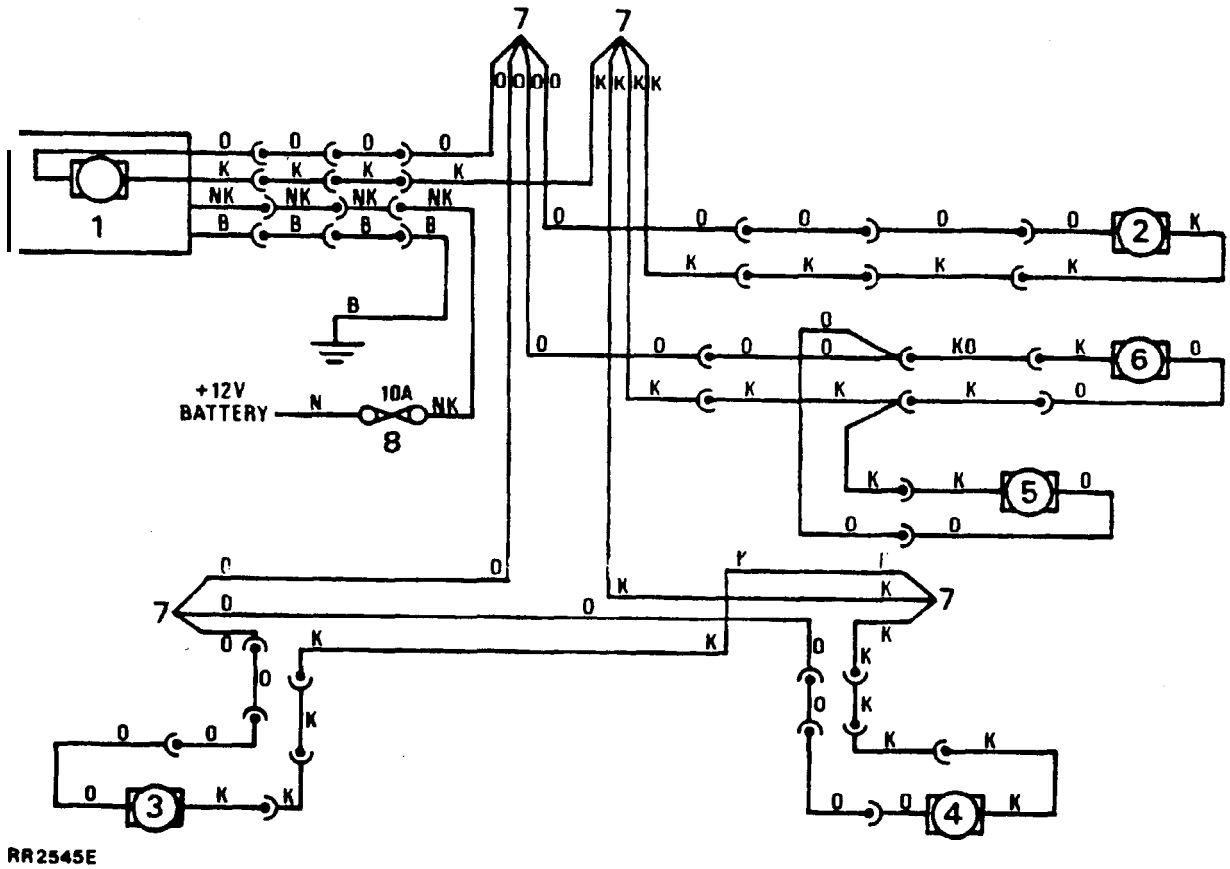
1. Disconnect the battery negative lead.
2. Remove the fixing screw to rocker cover.
3. Remove nut from alternator rear mounting bolt. Remove heat shield.



Refitting

4. Reverse removal procedure, check and adjust drive belt tension if required.

ELECTRICAL EQUIPMENT - CIRCUIT DIAGRAMS
. 1989 Model year



CENTRAL DOOR LOCKING
. Circuit diagram RR2545E

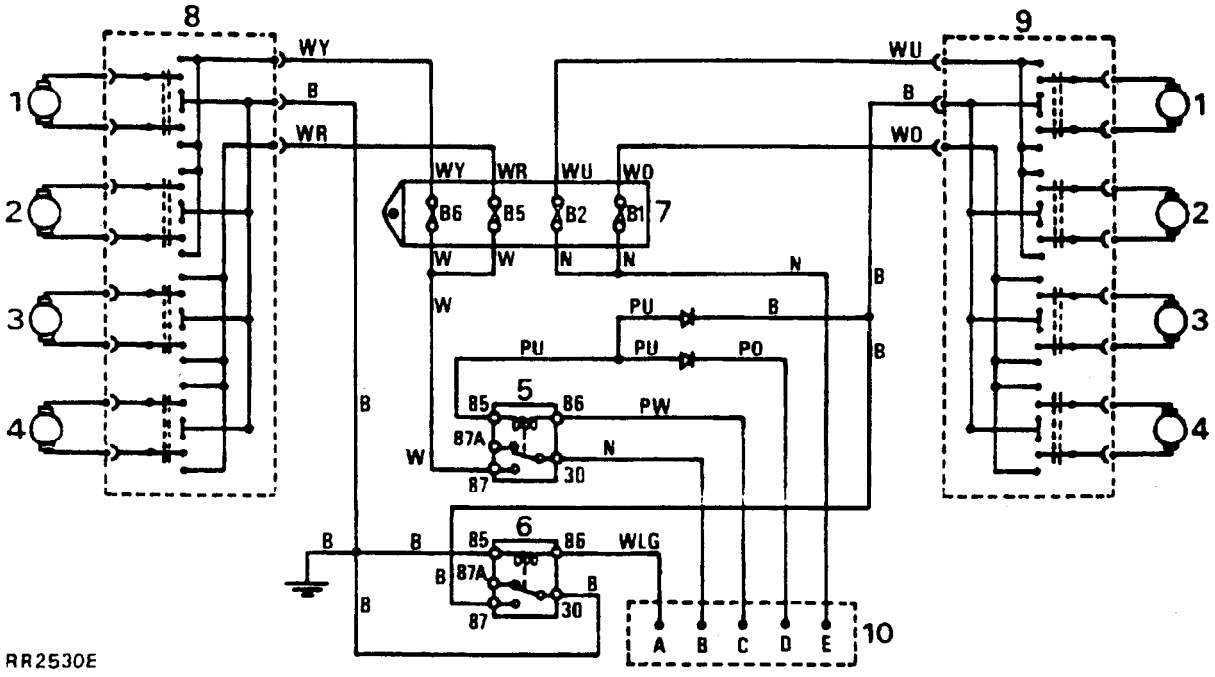
1. Switch/lock unit drivers door
2. Lock unit front passenger door
3. Lock unit-left hand rear door
4. Lock unit-right hand rear door
5. Fuel flap actuator
6. Lock unit-tailgate
7. Clinches
8. Fuse 19

Cable colour code

B	Black	L	Light	P	Purple	U	Blue
G	Green	N	Brown	R	Red	W	White
K	Pink	0	Orange	S	Grey	Y	Yellow

The last letter of a colour code denotes the tracer.

ELECTRIC SEAT ADJUSTMENT



Circuit diagram - RR2530E

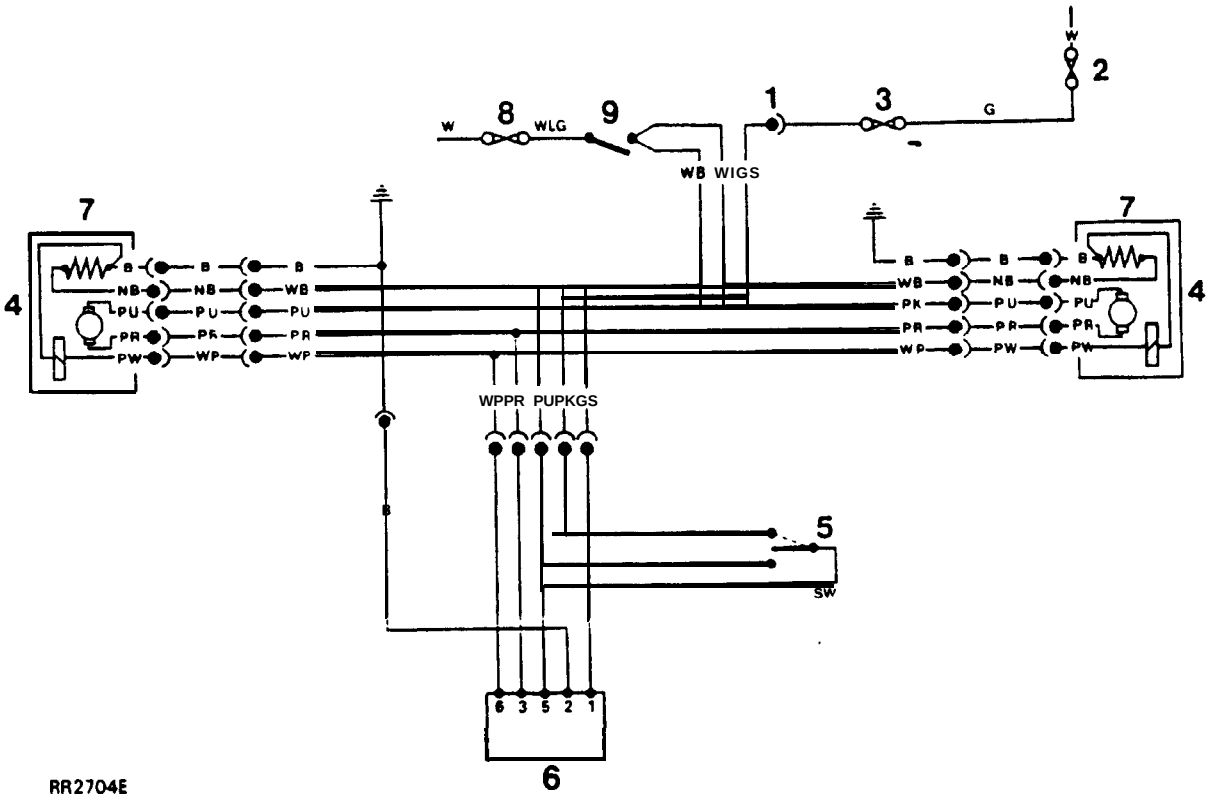
1. Seat recline motor
2. Seat height (rear) motor
3. Seat base adjust motor
4. Seat height (front) motor
5. Load relay-from driver's door courtesy switch
6. Load relay-fused auxiliary feed controled
7. Auxiliary fuse box (B)
8. Driver's seat control
9. Passenger's seat control
10. Main cable connections:
    - A: Fused auxiliary feed
    - B: Battery feed
    - C: Fused 12 volt
    - D: Courtesy switch earth
    - E: Battery feed

Cable colour code

B	Black	G	Green	P	Purple	Y	Yellow
U	Blue	S	Grey	R	Red	L	Light
N	Brown	0	Orange	W	White		

The last letter of a colour code denotes the tracer.

ELECTRIC MIRRORS



Circuit diagram - RR2704E

1. Auxiliary fuse box connection.
2. Fuse 13.
3. Fuse A5 - mirror motors.
4. Mirror motors.
5. Change over switch.
6. Mirror control switch.
7. Mirror heating elements - active with heated rear screen.
8. Fuse 16 - heating elements.
9. Heated rear screen switch.

ELECTRIC WINDOW LIFT

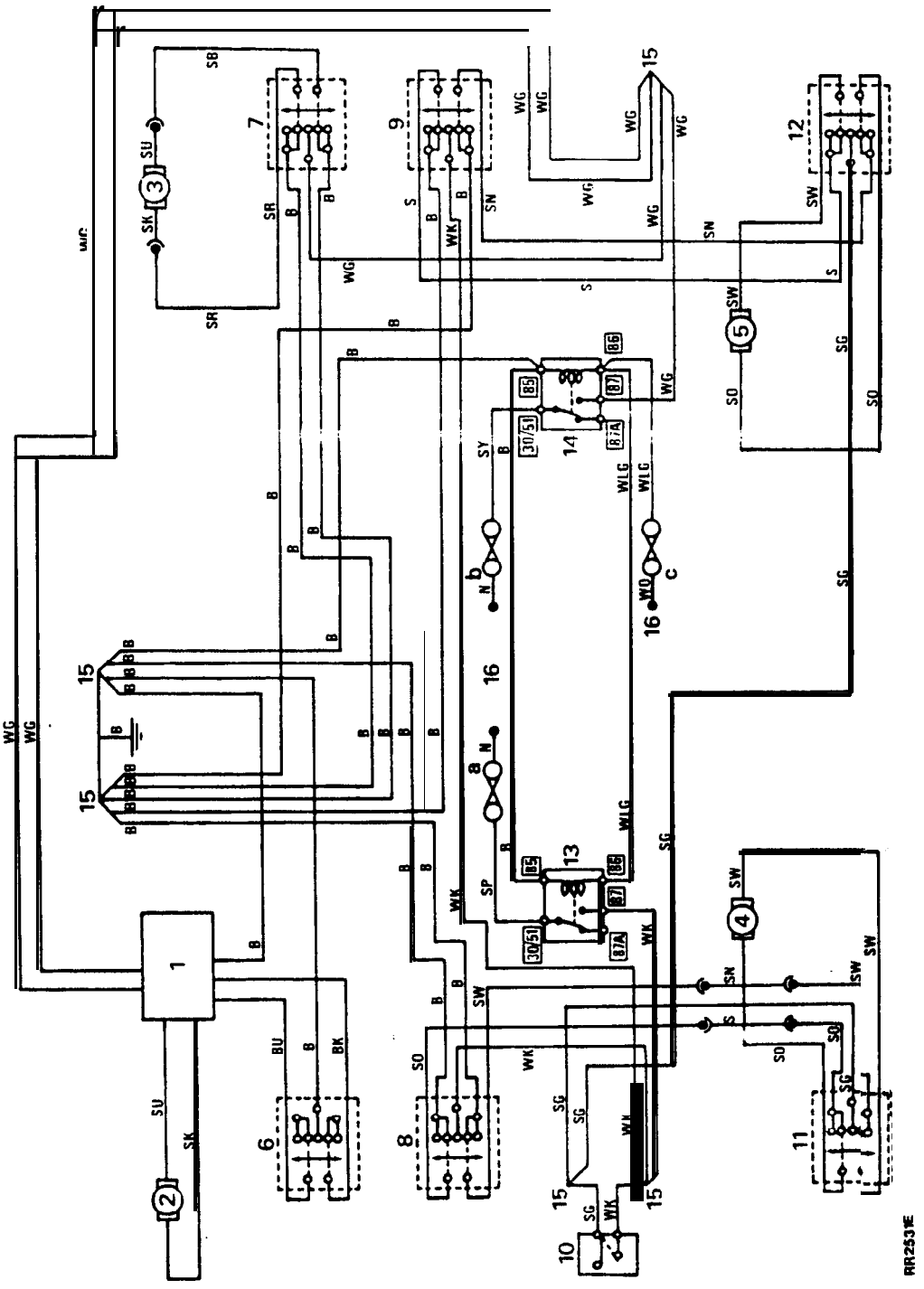
Circuit diagram - RR2531E

1. One touch control unit-drivers window
2. Window lift motor-drivers window
3. Window lift motor-front passengers side
4. Window lift motor LH rear
5. Window lift motor RH rear
6. Window lift switch drivers window
7. Window lift switch front passengers window
8. Window lift switch LH rear door
9. Window lift switch RH rear door
10. Isolator switch
11. Window lift switch in LH rear door
12. Window lift switch in RH rear door
13. Relay-rear windows
14. Relay-front windows
15. Clinches
16. Main cable fuses
    - a: Fuse 10
    - b: Fuse 20
    - c: Fuse 7

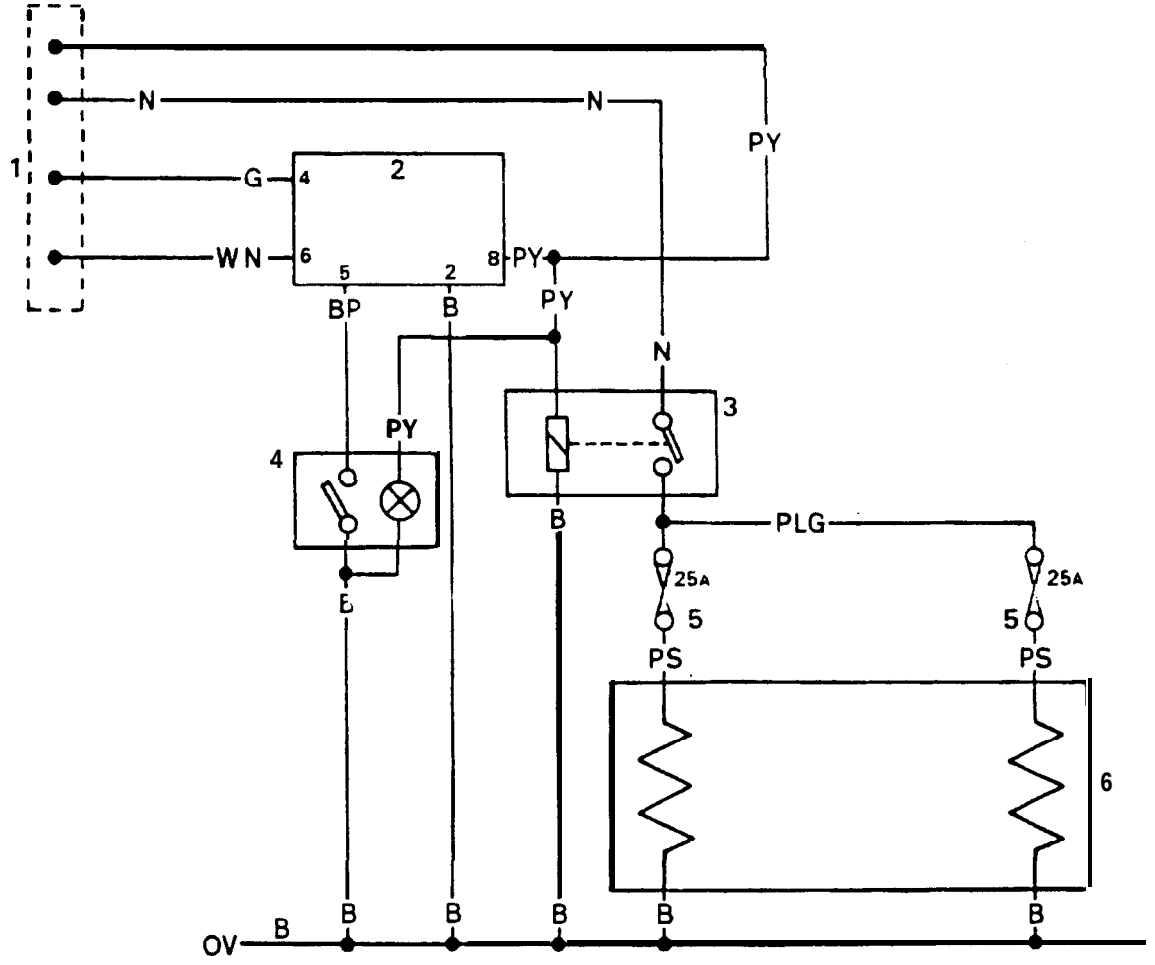
Cable colour code

B	Black	L	Light	P	Purple	U	Blue
G	Green	N	Brown	R	Red	W	White
K	Pink	O	Orange	S	Grey	Y	Yellow

The last letter of a colour code denotes the tracer.


RR2531E

HEATED FRONT SCREEN



RR2593E

Circuit diagram - **RR2593E**

1. Main harness connections
   - Brown - live positive feed
   - Green - ignition positive feed
   - Purple/yellow - EFI harness plug
   - White/brown - oil pressure switch
   - Black - earth
2. Timer unit
3. Load relay
4. Switch/warning light
5. In line fuses - 25 Amp.
6. Heated front screen

Cable colour code

B	Black	L	Light	P	Purple	U	Blue
G	Green	N	Brown	R	Red	W	White
K	Pink	O	Orange	S	Grey	Y	Yellow

The last letter of a colour code denotes the tracer.

MAIN CIRCUIT DIAGRAM - 1989 Model Year - RR2951E & RR2952E
Numerical key

1. Ignition load relay
2. Battery
3. Terminal post
4. Starter solenoid
5. Starter motor
6. Starter relay
7. Starter inhibit switch
8. Ignition switch
9. Tachometer
10. ignition warning lamp
11. Alternator
12. Fuse 7
13. Front wipe/wash switch
14. Front wipe delay unit
15. Front wiper motor
16. Front wash pump
17. Headlamp wash timer unit
18. Headlamp wash pump
19. Main lighting switch
20 Fuse 6
21. Fuse 5
22. LH side lamp
23. LH tail lamp
24. License plate lamp (2 off)
25. High beam dimmer/flash switch
26. Headlamp relay
27. RH side lamp
28. RH tail lamp
29. Not used
30. Rheostat
31. Fuse 3
32. Fuse 4
33. Fuse 1
34. Fuse 2
35. Not used
36. Not used
37. Switch illumination (2 off)
38. Cigar lighter illumination (2 off)
39. Heater illumination (4 off)
40. Clock illumination
41. Automatic gear selector illumination (2 off)
42. Instrument illumination (6 off)
43. Column switch illumination
44. Not used
45. Not used
46. LH low beam
47. RH low beam
48. LH high beam
49. RH high beam
50. High beam warn ng Lamp
51. Fuel gauge
52. Fuel gauge sender unit
53. Water temperature gauge
54. Water temperature sender unit
55. Fuse 11
56. Horn switch
57. RH horn
58. LH horn
59. Under hood illumination switch
60. Under hood light
61. Clock
62. Fuse 19
63. Fuse 20
64. Pick-up point central locking/window lift
65. Heated rear window relay
66. Fuse 9
67. Radio aerial amplifier
68. Heated rear screen
69. Heated rear screen switch
70. Heated rear screen warning lamp
71. Voltage sensitive switch
72. Fuse 13
73. Hazard switch
74. Flasher unit
75. Direction indicator switch
76. Hazard/indicator warning lamp
77. LH rear indicator lamp
78. LH front indicator lamp
79. Pick up point - electric mirrors
80. Fuse 10
81. RH front indicator lamp
82. RH rear indicator lamp
83. Trailer warning lamp
84. Fuse 15
85. Stop lamp switch
86. Reverse lamp switch
87. Auxiliary lamp relay
88. LH stop lamp
89. RH stop lamp
90. LH reverse lamp
91. RH reverse lamp
92. LH auxiliary lamp
93. RH auxiliary lamp
94. Auxiliary lamp switch
95. Fuse 17
96. Dash cigar lighter
97. Clove box cigar lighter
98. LH interior lamp
99. RH interior lamp
100. Interior lamp delay unit

101. RH door edge lamp
102. RH puddle edge lamp
103. LH door edge lamp
104. LH puddle lamp
105. Interior lamp switch
106. LH rear door switch
107. RH rear door switch
108. Tailgate switch
109. RH front door switch
110. LH front door switch
111. Not used
112. Fuse 14
113. Oil pressure/level warning lamp
114. Oil pressure switch
115. Fuse 18
116. Inertia switch
117. Fuel pump
118. Ignition coil
119. Capacitor
120. Distributor
121. EFI Harness plug
122. Not used
123. Radio fuse
124. Radio
125. Six speakers
126. Seats pick up point
127. Seat belt warning lamp
128. "Key-in" switch
129. Speed transducer, see Cruise Control
130. Resistor
131. Audible warning unit
132. Transfer box neutral switch
133. Seat buckle switch
134. Sunroof connection points (option)
135. Automatic transmission oil temperature warning lamp
136. Autoniatic transmission oil temperature switch
137. Fuse 16
138. Rear wash wipe switch
139. Rear wipe delay unit
140. Rear wiper motor
141. Rear screen wash pump
142. Low screen wash fluid level warning lamp
143. Low screen wash switch
144. Low coolant switch
145. Multi-function unit and binnacle
146. Low coolant level warning lamp
147. Low fuel level warning lamp
148. E.F.I. warning lamp
149. Low oil level logic unit
150. Low oil level probe
151. Not used - will illuminate on initial bulb check
152. Parking brake/brake fluid loss warning lamp
153. Parking brake warning switch
154. Brake fluid loss warning switch
155. Brake pad wear warning lamp
156. Brake pad wear sensors
157. Warning lamp control unit
158. Heater/air conditioning connections
159. Fuse 8
160 Cruise control connection points
161. Coil negative, engine speed signal to ECU
162. Emission maintenance reminder
163. Check engine warning lamp
164. Trailer pick up point
165. Alarm connection points
166. Heated washer iets
167. Thermostat-heated jets
168. Heater/air con. relay
169. Heated screen pick up point

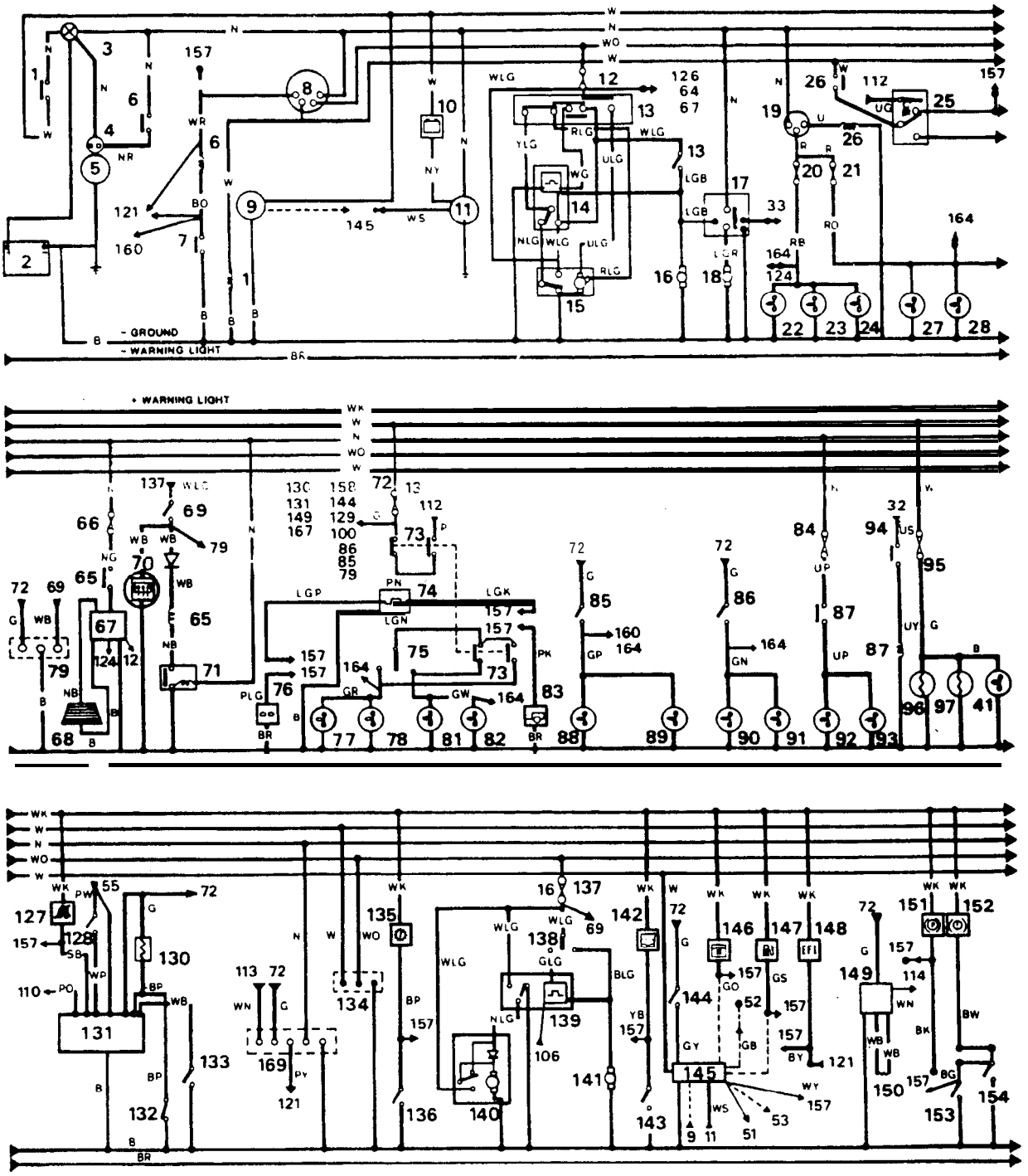
CABLE COLOUR CODE

B	Black
U	Blue
N	Brown
G	Green
S	Grey
L	Light
O	Orange
K	Pink
P	Purple
R	Red
W	White
Y	Yellow

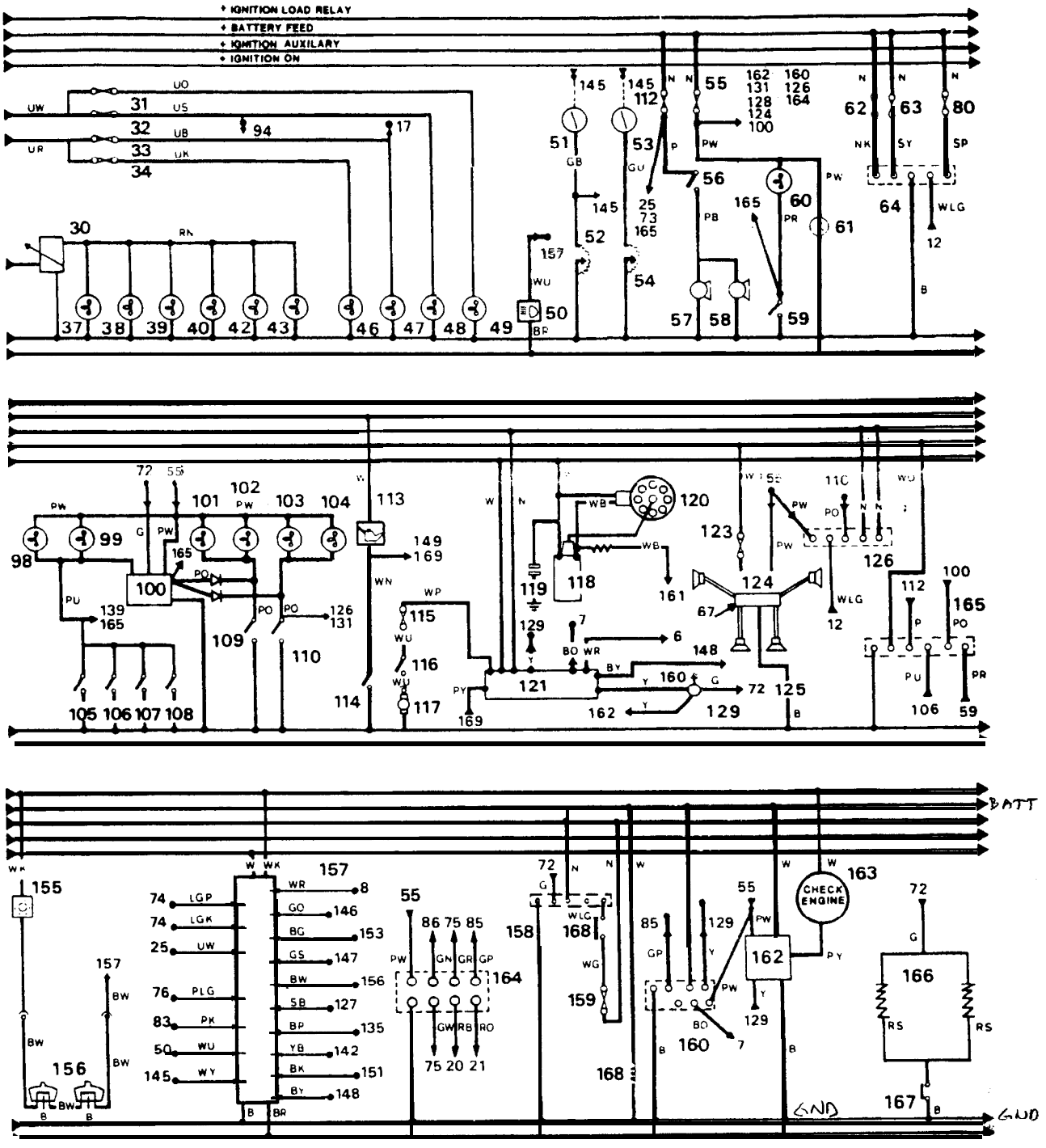
MAIN CIRCUIT DIAGRAM - 1989 Model Year - RR2951E & RR2952E
Alphabetical key

165. Alarm connection points
11. Alternator
131. Audible warning unit
41. Automatic gear selector illumination (2 off)
136. Automatic transmission oil temperature switch
135. Automatic transmission oil temperature warning lamp
87. Auxiliary lamp relay
94 Auxiliary lamp switch
3. Battery
154 Brake fluid loss warning switch
156 Brake pad wear sensors
155. Brake pad wear warning lamp
114. Capacitor
163. Check engine warning lamp
38. Cigar lighter illumination (2 off)
61. Clock
40. Clock illumination
161. Coil negative engine speed signal to ECU
43. Column switch illumination
160. Cruise control connection points
96. Dash cigar lighter
75. Direction indicator switch
120. Distributor
121. EFI Harness plug
148. EFI warning lamp
162. Emission maintenance reminder
74. Flasher unit
16. Front wash pump
14. Front wipe delay unit
13. Front wipe/wash switch
15. Front wiper motor
51. Fuel gauge
52. Fuel gauge sender unit
117. Fuel pump
33. Fuse 1
34. Fuse 2
31. Fuse 3
32. Fuse 4
21. Fuse 5
20. Fuse 6
12. Fuse 7
159. Fuse 8
66. Fuse 9
80. Fuse 10
55. Fuse 11
72. Fuse 13
112. Fuse 14
84. Fuse 15
137. Fuse 16
95. Fuse 17
115. Fuse 18
62. Fuse 19
63. Fuse 20
97. Glove box cigar lighter
73. Hazard switch
76. Hazard/indicator warning lamp
18. Headlamp wash pump
17. Headlamp wash timer unit
169. Heated front screen connections
68. Heated rear screen
69. Heated rear screen switch
70. Heated rear screen warning lamp
65. Heated rear window relay
166. Heated washer jets
39. Heater illumination (4 off)
158. Heater/air conditioning connections
168. Heater/air con. relay
35. High beam dimmer/flash switch
50. High beam warning lamp
56. Horn switch
118. Ignition coil
1. Ignition load relay
8 Ignition switch
IO. Ignitron warning lamp
116. Inertia switch
42. Instrument illumination (6 off)
100. Interior lamp delay unit
105. Interior lamp switch
128 "Key-in" switch
92. LH auxiliary lamp
103. LH door edge lamp
110. LH front door switch
78. LH front indicator lamp
48. LH high beam
58. LH horn
98. LH interior lamp
24. License plate lamp (2 off)
46. LH low beam
104. LH puddle lamp
106. LH rear door switch
77. LH rear indicator lamp
90. LH reverse lamp
22. LH side lamp
88. LH stop lamp
23. LH tail lamp
146. Low coolant level warning lamp
144. Low coolant switch
147. Low fuel level warning lamp
149. Low oil level logic unit
150. Low oil level probe
142. Low screen wash fluid level warning lamp
143. Low screen wash switch
19. Main lighting switch
145. Multi-function unit and binnacle
114. Oil pressure switch
113. Oil pressure/level warning lamp
153. Parking brake warning switch
152. Parking brake/brake fluid loss warning lamp
79. Pick up point - electric mirrors
64. Pick-up point central locking/window lift
124. Radio
67. Radio aerial amplifier
123. Radio fuse
125. Radio speakers (6 off)
141. Rear screen wash pump
138. Rear wash wipe switch

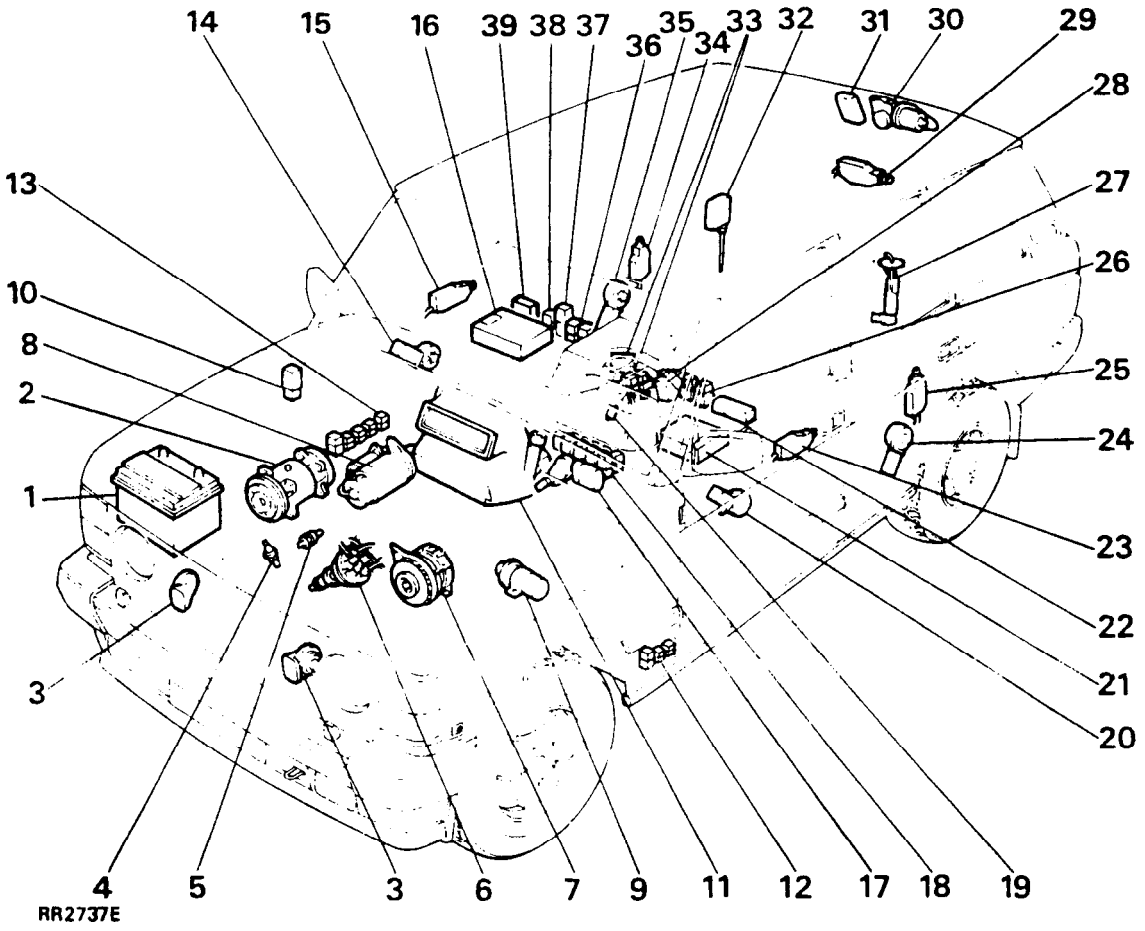
139. Rear wipe delay unit
140. Rear wiper motor
130. Resistor
86. Reverse lamp switch
93. RH auxiliary lamp
101. RH door edge lamp
109. RH front door switch
81. RH front indicator lamp
49. RH high beam
57. RH horn
99. RH interior lamp
47. RH low beam
102. RH puddle lamp
107. RH rear door switch
82. RH rear indicator lamp
91. RH reverse lamp
27. RH side lamp
89. RH stop lamp
28. RH tail lamp
30. Rheostat
127. Seat belt warning lamp
133. Seat buckle switch
126. Seats nick up point
129. Speea transducer, see Cruise Control
7. Starter inhibit switch
5. Starter motor
6. Starter relay
4. Starter solenoid
85. Stop lamp switch
134. Sunroof connection points (option)
37. Switch illumination (2 off)
9. Tachometer
108. Tailgate switch
3. Terminal post
167. Thermostat - heated jets
164. Trailer pick up point
83. Trailer warning lamp
132. Transfer box neutral switch
59. Under hood illumination switch
60. Under hood light
71. Voltage sensitive switch
157. Warning lamp control unit
53. Water temperature gauge
54. Water temperature sender unit



RR2951E


+ IGNITION LOAD RELAY
+ BATTERY FEED
+ IGNITION AUXILARY
+ IGNITION ON
BATT
GND
CHECK ENGINE

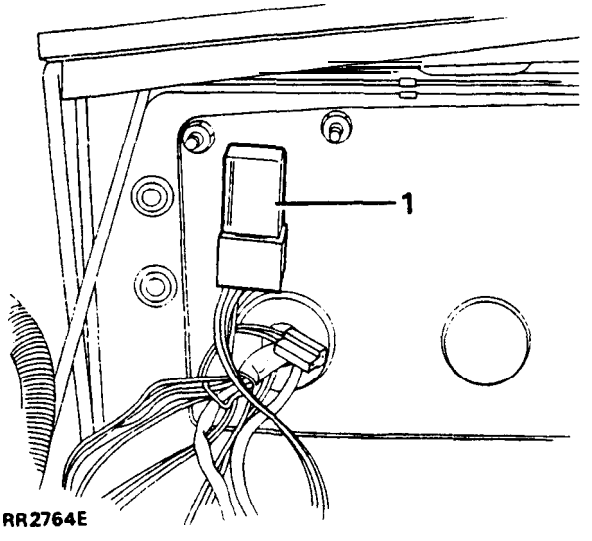
RR2952E



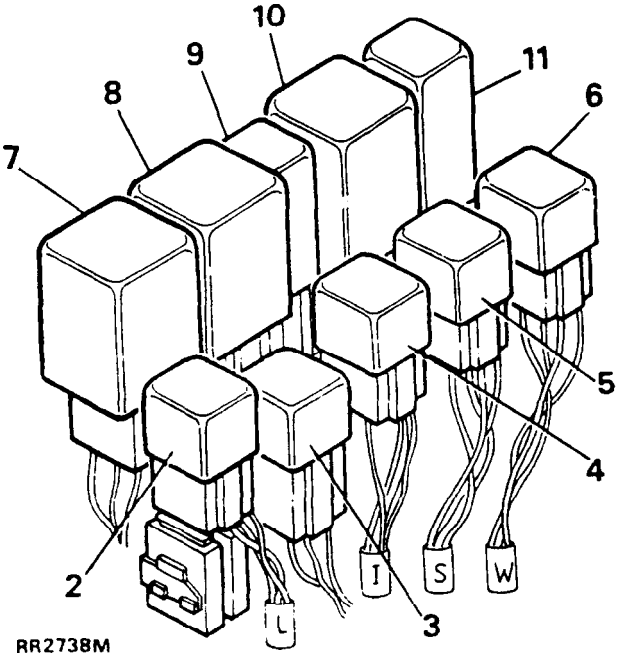
LOCATION OF ELECTRICAL EQUIPMENT - 1990 MODEL YEAR

1. Battery
2. Air conditioning compressor
3. Horns
4. Oil pressure switch
5. Water temperature switch
6. Electronic distributor
7. Alternator
8. Starter motor
9. Coil
10. Headlamp wash timer unit
11. Heater
12. Relays/flasher units
13. Air con relays/diode unit
14. Window lift motor (front RH door)
15. Door lock actuator (front RH door)
16. Electronic control unit (EFI)
17. Wiper motor - front screen
18. Relays/delay units
19. Park brake warning light switch
20. Window lift motor (front LH door)
21. Electronic control unit and relays (ABS)
22. Seat adjustment fusebox
23. Door lock actuator (front LH door)
24. Window lift motor (rear LH door)
25. Door lock actuator (rear LH door)
26. Seat adjustment relays - two
27. Electrical in-tank fuel pump
28. Inertia switch
29. Tailgate lock actuator
30. Wiper motor - rear screen
31. Radio aerial amplifier
32. Fuel filler flap lock actuator
33. Window lift relays and one touch control unit
34. Door lock actuator (rear RH door)
35. Window lift motor (rear RH door)
36. EFI relays (two!
37. Condenser fan timer unit
38. Cruise control relay
39. Emission maintenence reminder

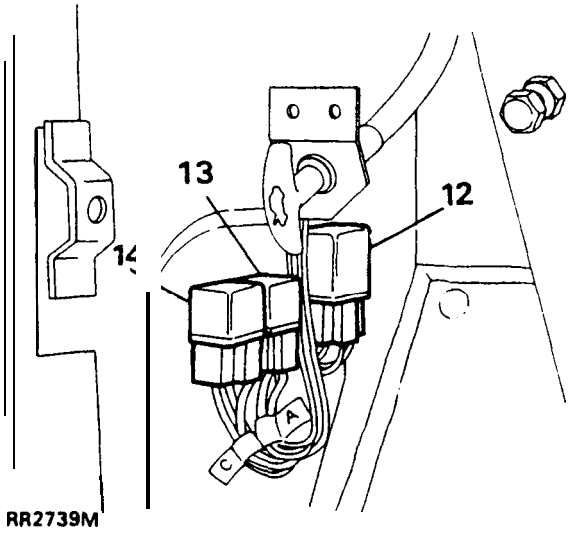
RELAYS, DELAY UNITS, TIMER UNITS, DIODE PACK • Identification



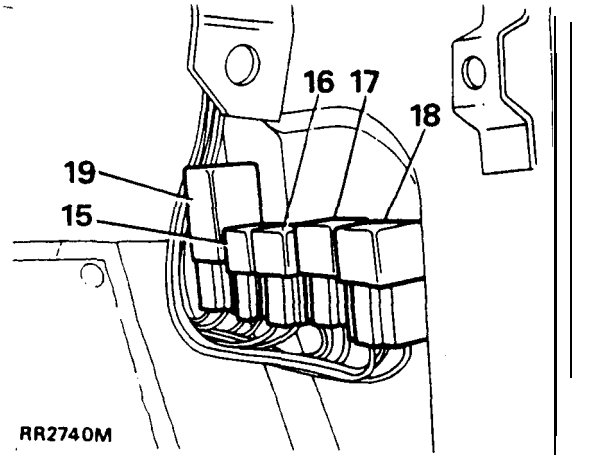
Closure panel viewed from the engine bay compartment, with protective cover removed.



Steering column mounted relays viewed with the lower dash panel removed.



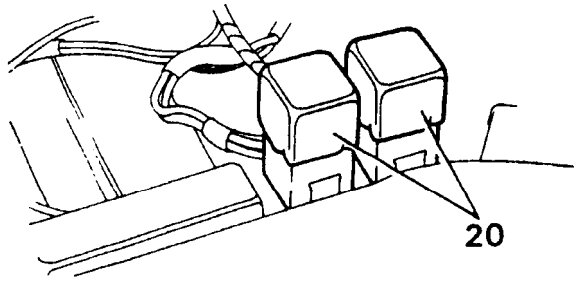
RR2379M shows relays mounted in left hand side of footwell, trim panel removed.



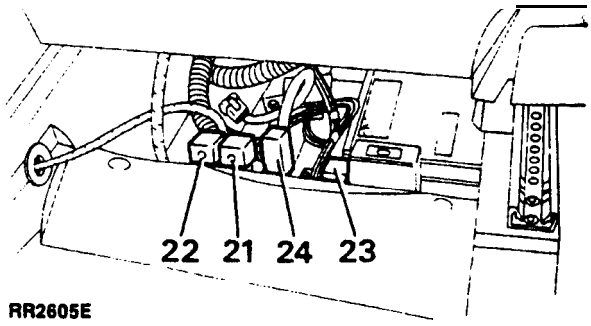
RR2740M shows relays mounted in right hand side of footwell, trim panel removed.

	Relay/delay/timer/diode unit	Circuit diagram item number	Colour
1.	Headlamp wash timer unit	18. Main	Black
2.	Headlamp relay	16. Main	Natural
3.	Heated front screen relay	3. Heated front screen	Black
4.	Ignition load relay	1. Main	Natural
5.	Starter soleniod relay	6. Main	Natural
6.	Heated rear window relay	64. Main	Natural
7.	Rear wiper delay	139. Main	Blue
8.	Interior lamp delay/timer	99. Main	Red
9.	Heated front screen timer unit	2. Heated iront screen	Crey
10.	Voltage sensitive switch	70. Main	Yellow
11.	Front wiper delay	14. Main	Red
12.	Flasher/hazard unit	73. Main	Blue
13.	Fog lamp relay	86. Main	Natural
14	Sunroof auxiliary relay	3. Sunroof	Natural
15.	Air con./heater relay	175. Main	Natural
16.	Compressor clutch relay	11. Air conditioning	Natural
17.	Heater/air con. load relay	5. Air conditioning	Natural
18.	Condenser fan relay	9. Air conditioning	Natural
19.	Air con. diode pack	1. Air conditioning	Orange
20	Seat adjustment relays - two	5 & 6 Seal adjustment	Natural
21.	Main EFI relay	'3. EFI	Silver
32.	Fuel pump relay	21. EFI	Silver
23.	Cruise control relay	16. Cruise control	Natural
24.	Condenser fan timer unit	33. EFI	Green
25.	Rear window lift relay	13. Window lift	Natural
26.	Front window lift relay	14. Window lift	Natural
27.	Window lift one touch unit	1. Window lift	Black
20.	Gear selector illumination relay	40a Main	Natural

NOTE: See Brakes, Section 70 for details of ABS relays



RR2602E



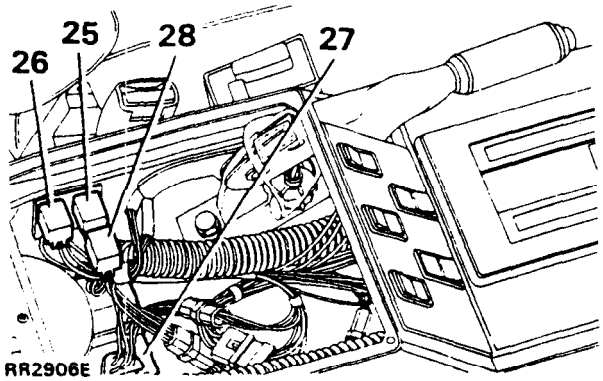
RR2605E

Seat adjustment relays (load control) located beneath the left hand front seat adjacent to fuse box (B).

EFI (black terminal block) and fuel pump relays (blue terminal block) mounted beneath right hand front seat (21 and 22).

Condenser fan timer unit (24) mounted beneath right hand front seat.

Cruise control relay (23).



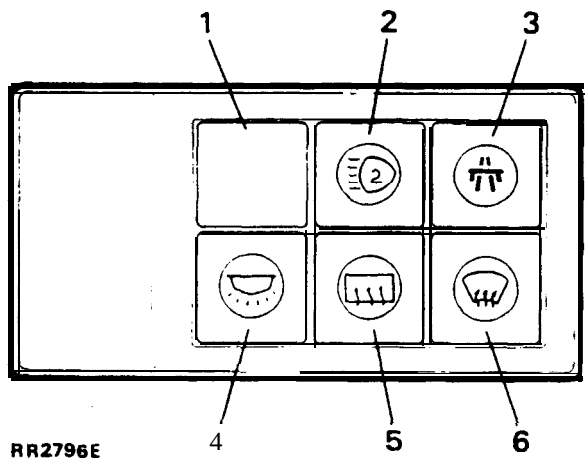
RR2906 shows relays located inside the glove box, accessible by removing the glove box liner. Front (black terminal block) and rear (blue terminal block) window relays (25 and 26) window lift one touch control unit (27). Gear shift illumination relay (28).

AUXILIARY SWITCH PANEL

The auxiliary panel contains five 'push-push' and one single push switch which incorporate integral symbols for identification.

The symbols are illuminated by two bulbs which become operational when the vehicle fights are on.

The heated front (6) and rear (5) screen switches are also provided with individual warning lights, illuminated when the switches are operated.



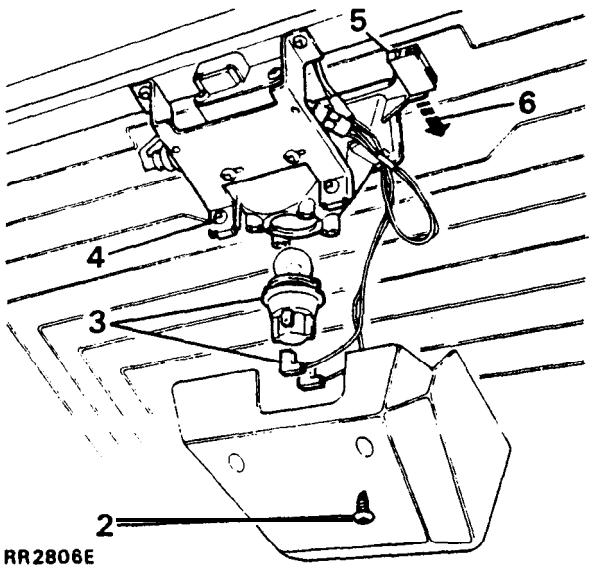
1. Blank.
2. Front fog lamps.
3. Cruise control.
4. Interior and tailgate lamps.
5. Heated rear screen.
6. Heated front screen.

HIGH LEVEL STOP LAMP

Remove and refit

Remove

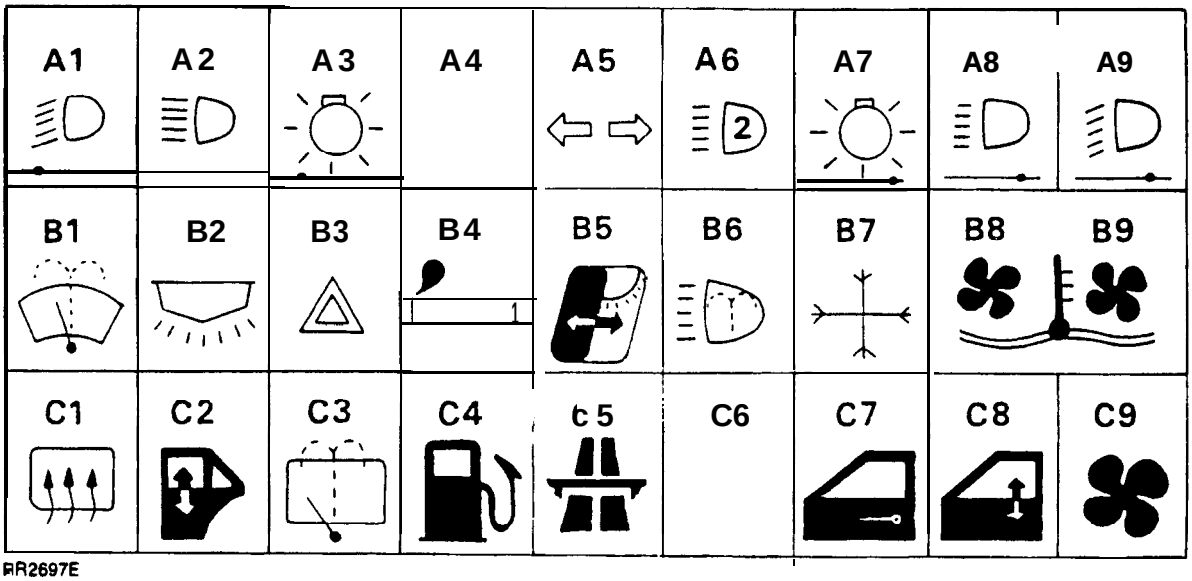
1. Disconnect the battery negative lead.



2. Remove the two cover retaining screws and remove the cover.
3. Disconnect the electrical leads to the bulb holder. Remove the bulbholder and the bulb with a counter clockwise twist.
4. Remove the two mounting plate to brake light screws.
5. Observe position of stop lamp on the rear screen. Carefully release the assembly tabs on the stop lamp from the rear screen mountings.
6. Slide the stop lamp out.

Refit

7. Renew the bulb if necessary, the correct bulb is a 12V, 21 watt, bayonet type.
8. Reverse the removal instructions.



RR2697E

FUSE BOX - RR2697M

FUSE No.	COLOUR CODE	RATING AMPS	IGN. KEY POSITION	FUNCTION
A1	Red	10	II	LH low beam
A2	Red	10	II	LH high beam, auxiliary lamp relay
A3	Tan	5	0	LH parking lamps, radio ill., trailer pickup
A4	---	---	---	Not used
A5	Yellow	20	II	Direction ind., resistor, heated jets, thermo., heated front screen timer, air con. low coolant, low oil, speed transducer, interior lamp delay, reverse lights, stop lights, audible warning unit
A6	Red	10	II	Fog lamps (from low beam)
A7	Tan	5	0	RH parking lamps, rheostat controlled instrument/switch illumination, trailer pick up
A8	Red	10	II	RH high beam
A9	Red	10	II	RH low beam
B1	Yellow	20	I	Front wash/wipe, seat relays, window lift relays, antenna amplifier
B2	Yellow	20	0	interior light, clock, underhood ill., elec. seat relays, radio, door lamps, key in switch, audible warning
B3	Yellow	20	0	Hazard switch, alarm, headlamp dip/flash, horns
04	Yellow	20	II	Cigar lighters
B5	Yellow	20	II	Sunroof motor
B6	Yellow	20	II	Headlamp wash
B7	Tan	5	II	Air conditioning compressor clutch
B8	Yellow	20	II	Air conditioning/radiator cooling fan
B9	Yellow	20	II	Air conditioning/radiator cooling fan
C1	Green	30	II	Heated rear screen (voltage switch controlled)
c2	Green	30	II	Window lifts - rear
c3	Red	10	II	Rear wash wipe motor, heated rear screen relay, mirror heaters
C4	Red	10	II	Fuel pump
c5	Red	10	II	Mirror motors, cruise control
C6	---	---	---	Not used
c7	Blue	15	0	Central locking
C8	Green	30	II	Window lifts - front
C9	Green	30	II	Heater/air conditioning motor

INSTRUMENT BINNACLE WARNING LIGHT SYMBOLS

Direction indicator - left turn (green)

Direction indicator - right turn (green)

Headlamp high beam on (blue)

Brake pad wear (amber)

Trailer connected - flashes with direction indicators (green)

EFI warning light (red)

Brake fluid pressure failure/low fluid level, transmission handbrake on (red)

Low screenwash fluid (amber)

ABS warning light (red)

Automatic gearbox oil or transfer box temperature high (red)

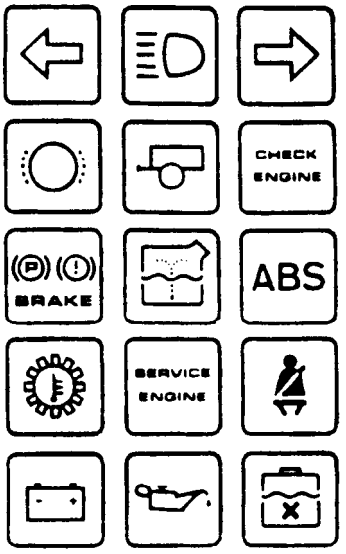
Emission maintenance reminder

Seat belt (red)

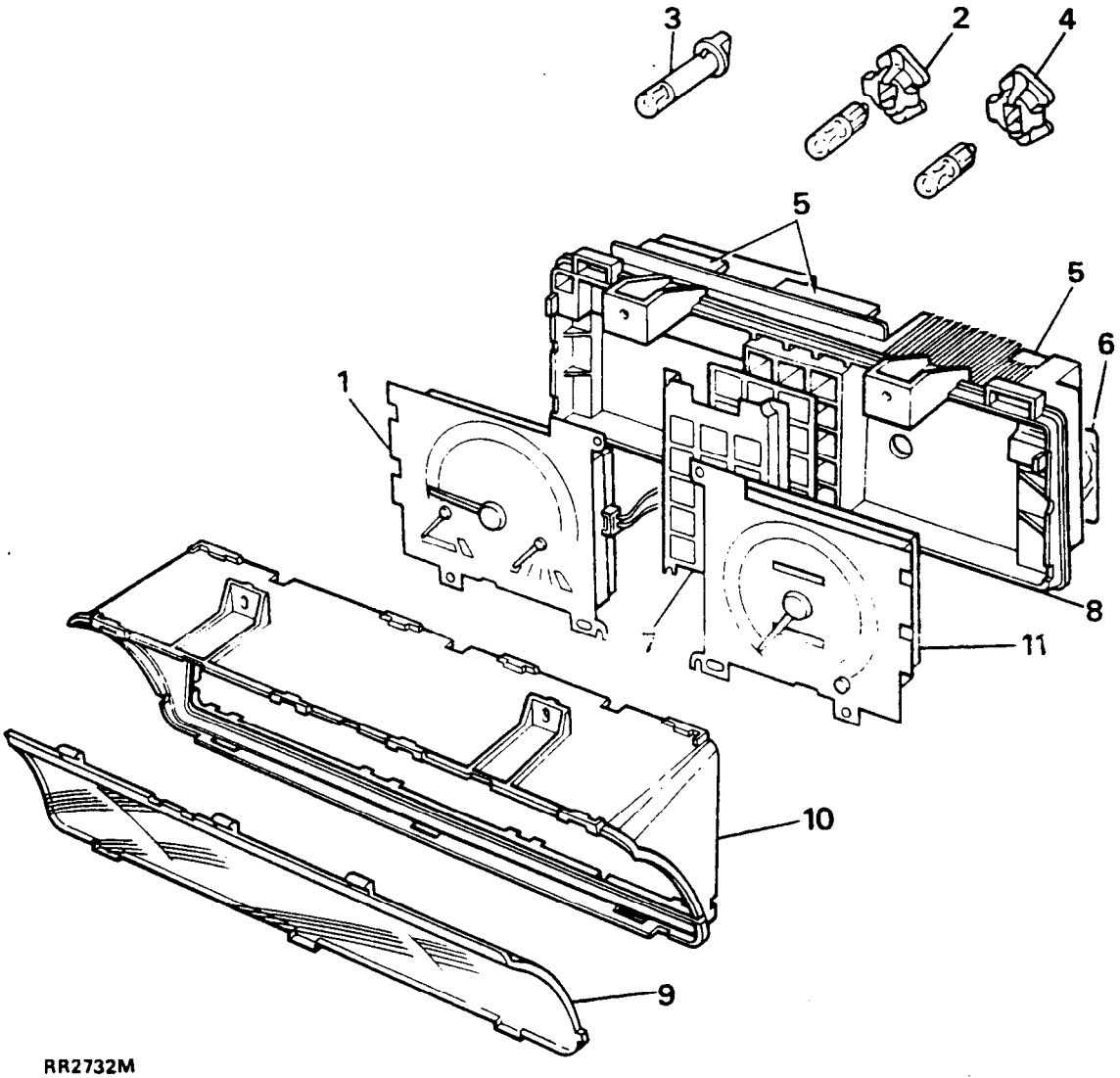
Ignition on/low charge (red)

Engine oil pressure low (red)

Low coolant (red)



RR2803E



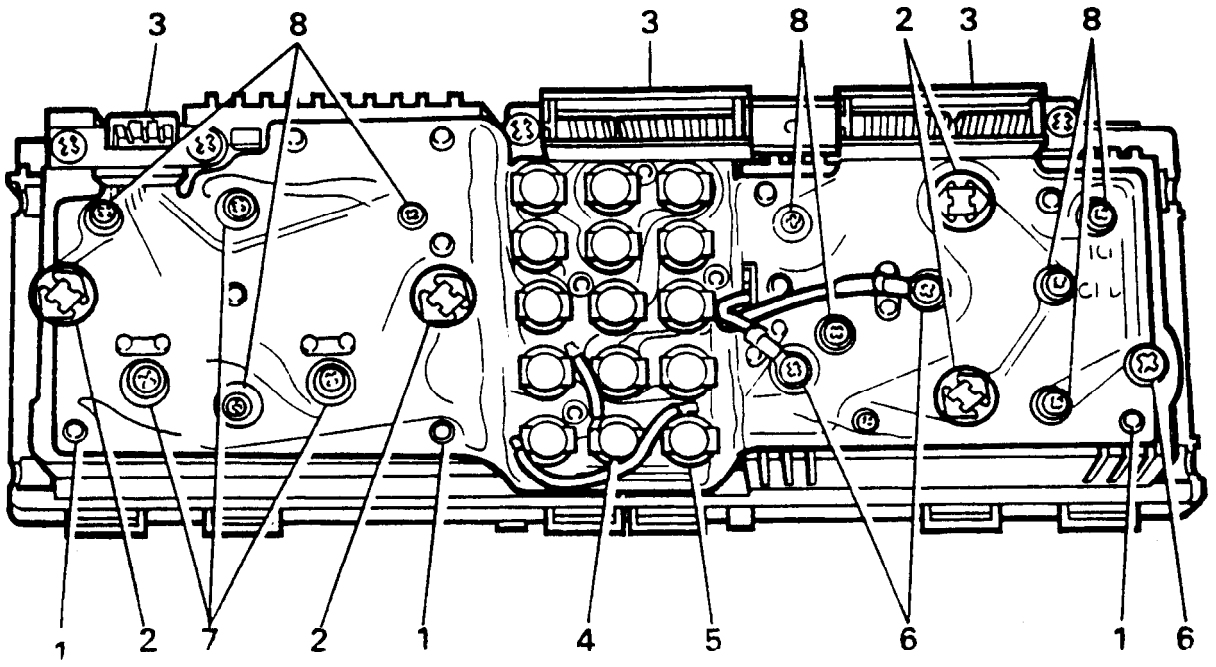
RR2732M

Instrument pack

1. Tachometer, fuel and temperature gauge.
2. ignition warning bulb (with separate blue holder unit)
3. Panel illumination bulb and holder.
4. Warning lights bulb and holder.
5. Printed circuit input tags (for harness connection).
6. Printed circuit.
7. Warning light panel.
8. Instrument case (front).
9. Curved lens.
10. Binnacle housing.
11. Speedometer.

INSTRUMENT BINNACLE

A revised instrument pack is fitted to 1990 model year vehicles. An electronic speedometer is fitted, deleting the requirement for a speedometer cable between speed transducer and speedometer. The instruments are restyled to improve the clarity of graphics.

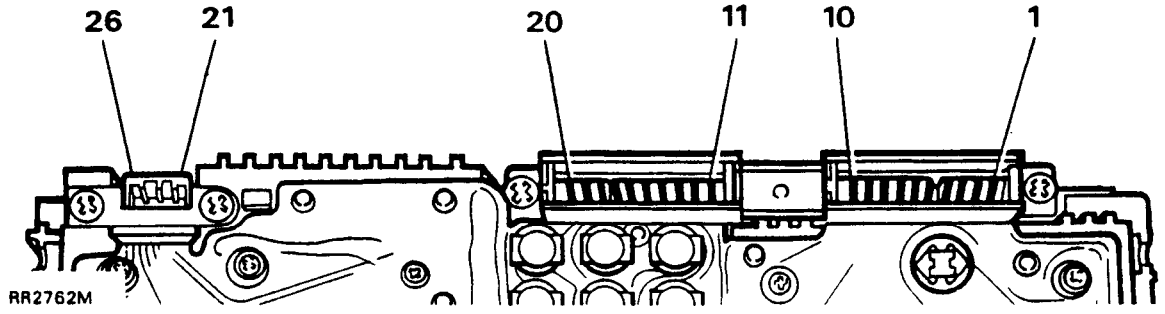


RR2733M

instrument case (back)

1. Printed circuit locating pegs.
2. Panel illumination bulbs - 4.
3. Harness connectors.
4. Warning light bulbs.
5. No charge warning light bulb (blue holder).
6. Tachometer/fuel/temperature gauge securing screws - 3.
7. Speedometer securing screws - 3.
8. Printed circuit securing screws 8.

PRINTED CIRCUIT HARNESS CONNECTIONS



RR2762M

Sequence on connections looking towards the BACK of the instrument case

RENEWAL OF PANEL AND WARNING LIGHTS

1. Disconnect the battery negative lead.
2. Unclip the back of the cowl from the instrument binnacle to give access to the panel and warning light bulbs in the back of the instrument case.
3. Remove the appropriate bulb holder unit by rotating it anti-clockwise and withdrawing it.

   NOTE: The 'No Charge/Ignition On' warning light, identified by its BLUE coloured bulb holder, is a 2 watt capless type.

4. Fit a new bulb and rotate the bulb holder clockwise to lock in position. The correct bulb type is: warning lights, 1.4 watt capless type, panel illumination, 3 watt capless type.
5. Refit the cowl and refit the battery negative lead.

   NOTE: If difficulty is experienced in changing bulbs due to the limited space available the instrument binnacle fixings should be removed to enable the binnacle to be raised above the fascia as far as other connections permit. See 'Instrument Binnacle - remove and refit' below for details of binnacle mounting bracket fixing.

INSTRUMENT BINNACLE

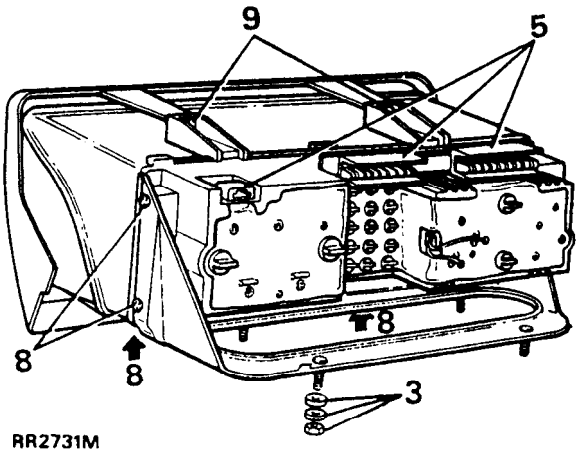
Remove and refit

Remove

1. Disconnect the battery negative lead.
2. Remove the lower fascia by releasing the six retaining screws.
3. Remove the four nuts (with spring and plain washers) from under the top fascia rail which secure the instrument binnacle to the vehicle.
4. Unclip the binnacle cowl from the rear, and remove.
5. Disconnect the two multi-plugs and the single plug from the printed circuit connectors.
6. Lift the instrument binnacle from the top fascia rail and transfer it to the workbench.

Refitting

7. Reverse the removal instructions 1 to 6.



RR2731M

REMOVING INSTRUMENT PACK

8. Having removed the instrument binnacle from the vehicle, detach the binnacle mounting bracket. This is secured to the instrument case by two screws and to the bottom of the binnacle bezel by two smaller screws,
9. Remove the two screws retaining the top of the bezel to the front housing and detach the bezel.
10. Detach the curved lens from the binnacle housing by depressing four tabs and easing the top of the lens out, the depressing three tabs and easing the lower edge of the lens out of its location.
11. Separate the instrument case from the binnacle housing by releasing the upper and lower locating tabs in turn.

Refitting Instrument Pack to Binnacle

12. Reverse removal instructions 9 to 11.

CIRCUIT SERVED

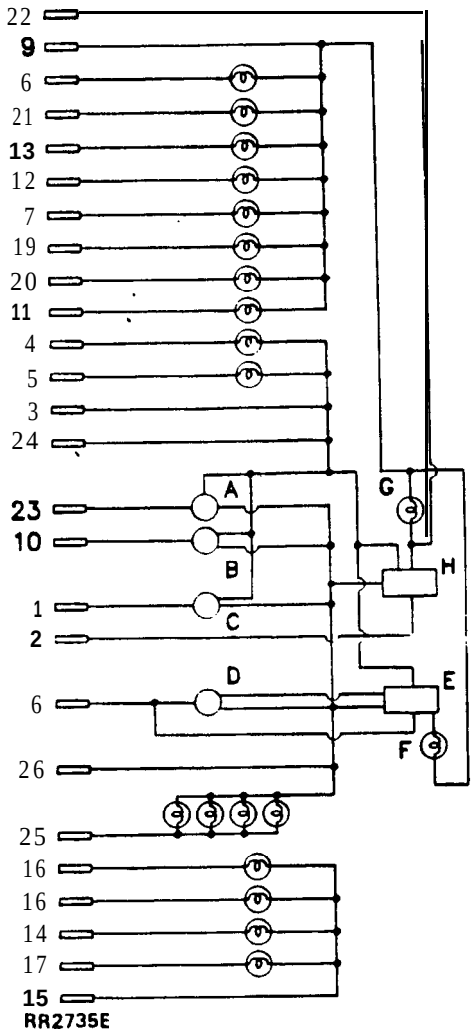
Numbers refer to pin number on instrument pack circuit diagram RR2735M

Coolant temperature	1
Low coolant input	2
Ignition switch 12V +	3
Ignition warning light	4
Oil pressure warning light	5
Fuel tank unit	6
Transmission oil temperature	7
Cold start warning (diesel)	8
12V + ignition	9
Tachometer signal	10
Brake fail/handbrake warning light	11
Brake pad wear warning light	12
Low wash fluid	13
Direction indicator - left	14
Zero volts from dimmer	15
Main beam warning light	16
Trailer warning light	17
Direction indicator - right	18
EFI warning light	19
ABS warning light	20
Seat belt warning light	21
Low coolant check	22
Speed signal	23
Photo transistor	24
Panel illumination bulbs (4)	25
Earth -ve	26

Instrument pack

Key

A. Speedometer
B. Tachometer
C. Temperature gauge
D. Fuel gauge
E. Low fuel warning unit
F. Low fuel warning light
G. Low coolant warning light
H. Low coolant warning unit



Removing Tachometer, Fuel and Temperature Gauge Unit

NOTE: The tachometer, fuel and temperature gauges are replaced as a unit if necessary.

13. Remove the two panel illumination bulb holders.
14. Remove the three larger screws retaining the tachometer, fuel and temperature gauges. Note the position of the black and white leads secured by two of the screws.
15. Carefully manoeuvre the unit from the iront of the instrument case.

Refitting the Tachometer, Fuel and Temperature Gauge Unit

16. Reverse the removal procedure, items 13 to 15.

Removing the speedometer

17. Remove the two panel illumination bulb holders.
18. Remove the three larger screws securing the speedometer.
19. Carefully remove the speedometer from the front of the instrument case.

Refitting the speedometer

20. Reverse the removal procedure items 16 to 18.

Removing the Printed Circuit

21. Remove the Speedometer and Tachometer units as described above. Removal all warning light bulbs before remving the printed circuit. Note the position of the no charge warning light, identified by its blue coloured bulb holder.
22. Remove the two harness connectors, retained by four screws to release the printed circuit tags and the input plug.
23. Remove the eight screws and plain washers securing the printed circuit.
24. Carefully ease the printed circuit from its locating pegs.

Refitting the printed circuit

25. Reverse the removal procedure, items 21 to 24.

CENTRAL DOOR LOCKING - two point

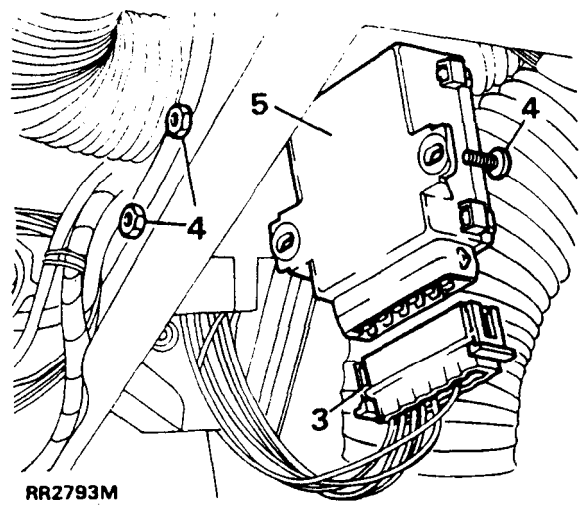
The central door locking system on four door models is now activated from both driver's and passenger's doors. A switch/lock actuator is fitted in both front doors. The system is controlled by an electronic unit situated on the steering column support bracket.

CENTRAL DOOR LOCK CONTROL UNIT

Remove and refit

Removing

1. Disconnect the battery negative lead.
2. Remove the lower fascia panel.
3. Disconnect the harness multi-plug.
4. Remove the securing screws.
5. Remove the control unit.

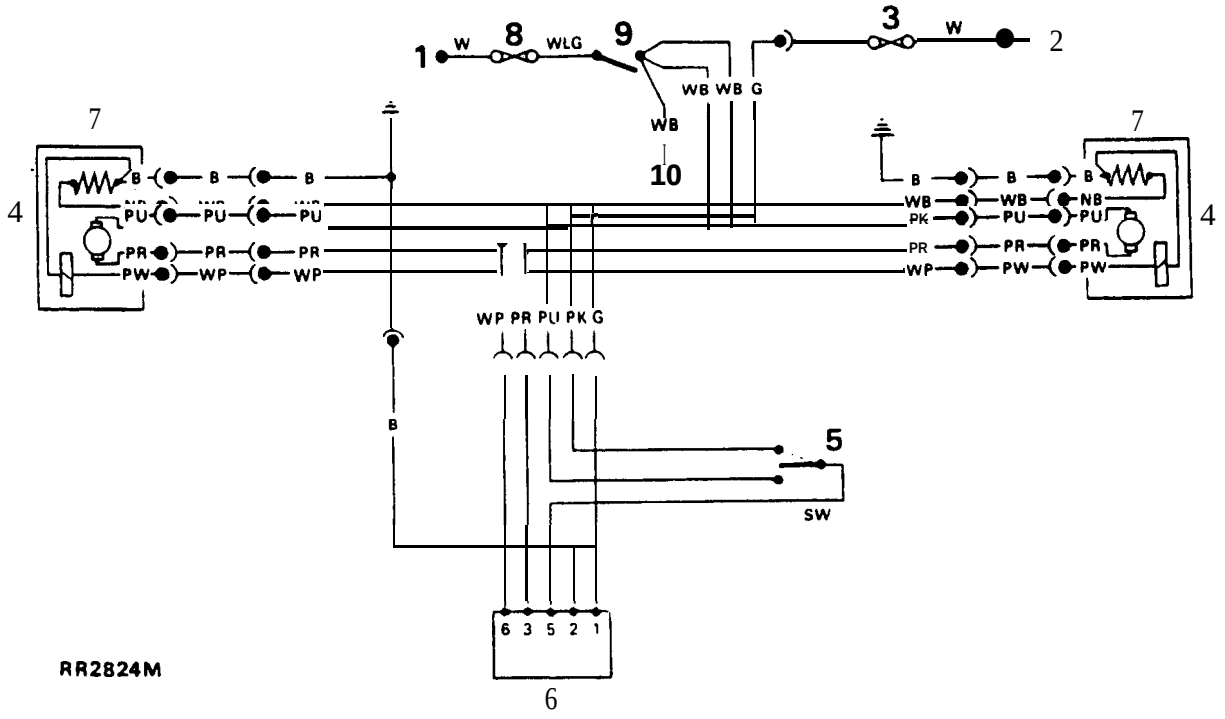


RR2793M

Refitting

6. Reverse the removal procedure.

ELECTRIC MIRRORS



Circuit diagram - RR2824M

1. Ignition 12V.
2. Ignition load relay.
3. Fuse C5 - mirror motors.
4. Mirror motors.
5. Change over switch.
6. Mirror control switch.
7. Mirror heating elements - active with heated rear screen.
8. Fuse C3 - heating elements.
9. Heated rear screen switch.
10. Feed to heated screen relay.

ELECTRIC WINDOW LIFT

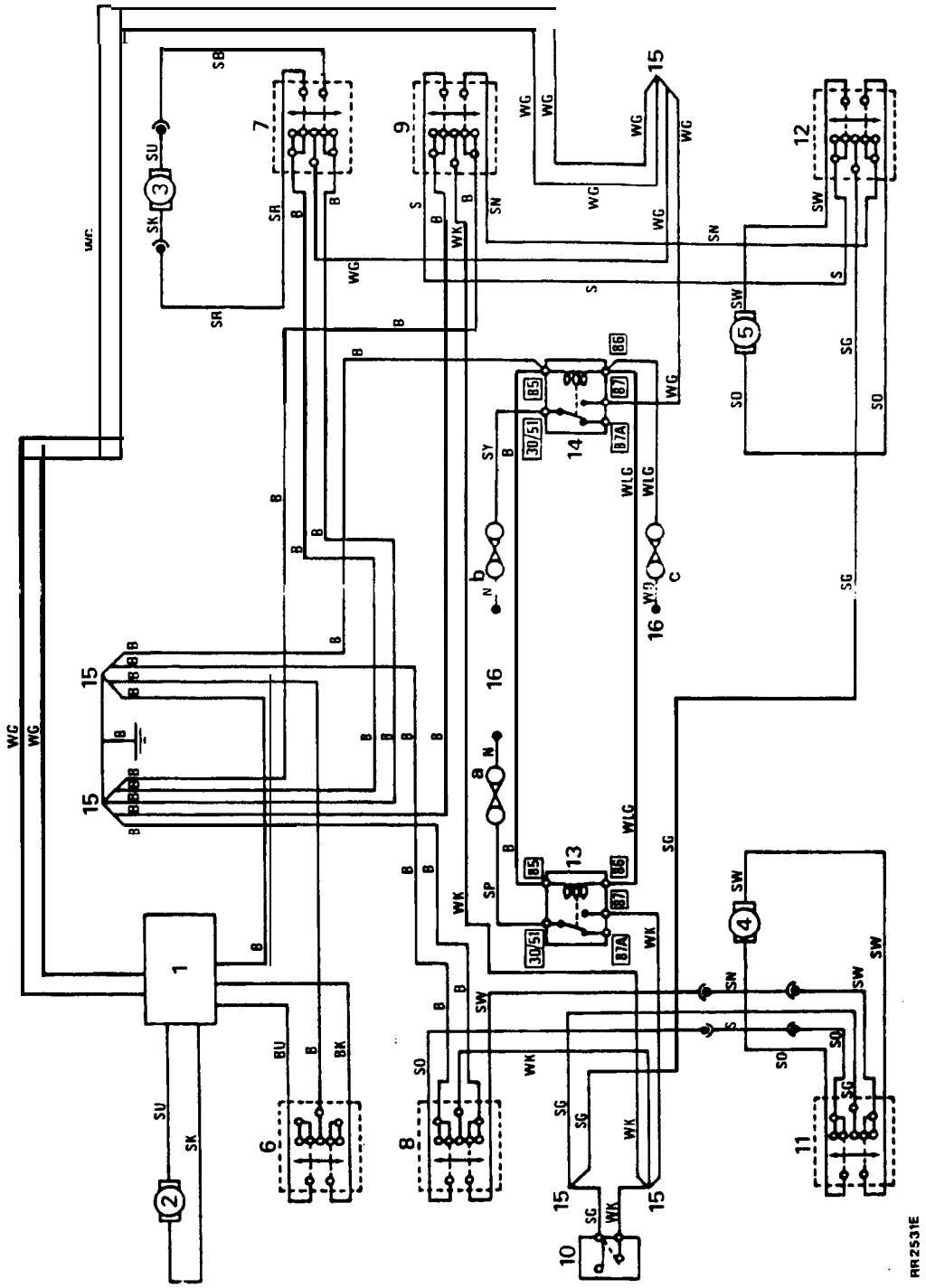
Circuit diagram - RR2531E

1. One touch control unit-drivers window
2. Window lift motor-drivers window
3. Window lift motor-front passengers side
4. Window lift motor LH rear
5. Window lift motor RH rear
6. Window lift switch drivers window
7. Window lift switch front passengers window
8. Window lift switch LH rear door
9. Window lift switch RH rear door
10. Isolator switch
11. Window lift switch in LH rear door
12. Window lift switch in RH rear door
13. Relay-rear windows
14. Relay-front windows
15. Clinches
16. Main cable fuses
    - a: Fuse C2
    - b: Fuse CL?
    - c: Fuse B1

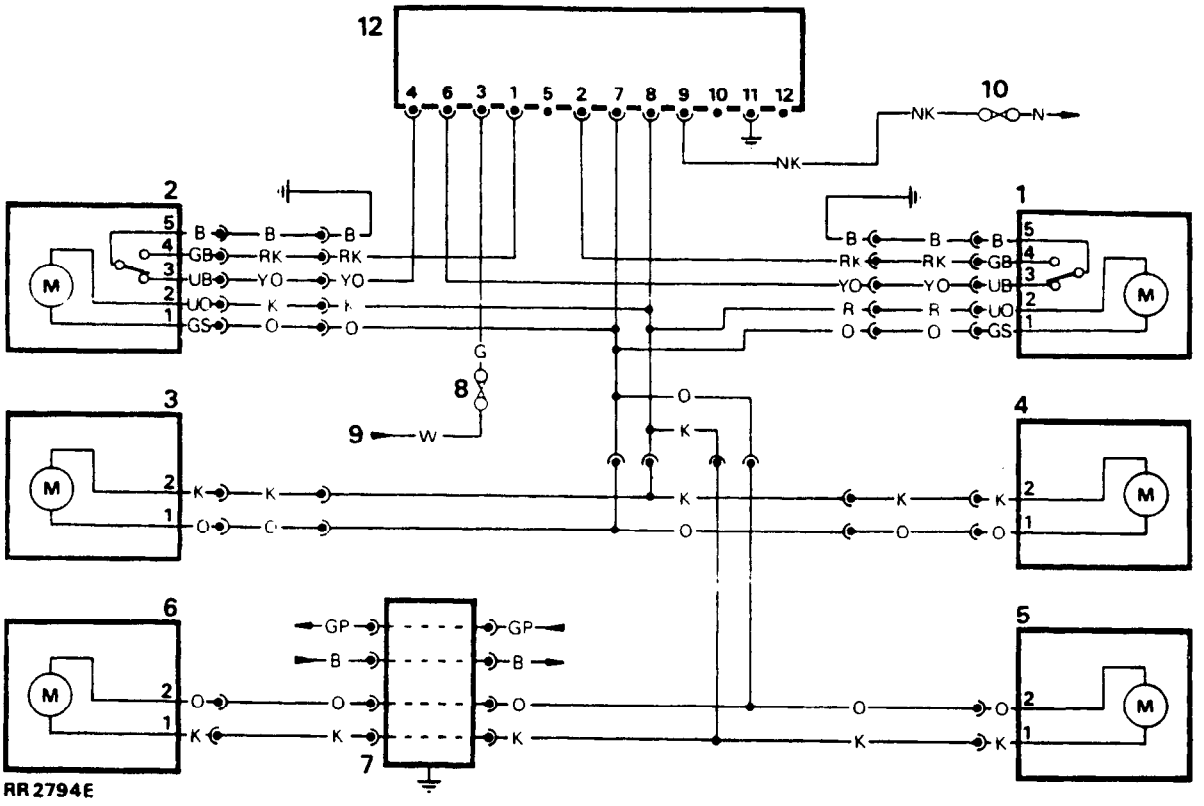
Cable colour code

B	Black	L	Light	P	Purple	U	Blue
ci	Green	N	Brown	R	Red	W	White
K	Pink	0	Orange	S	Crey	Y	Yellow

The last letter of a colour code denotes the tracer.


RR2531E

CENTRAL DOOR LOCKING



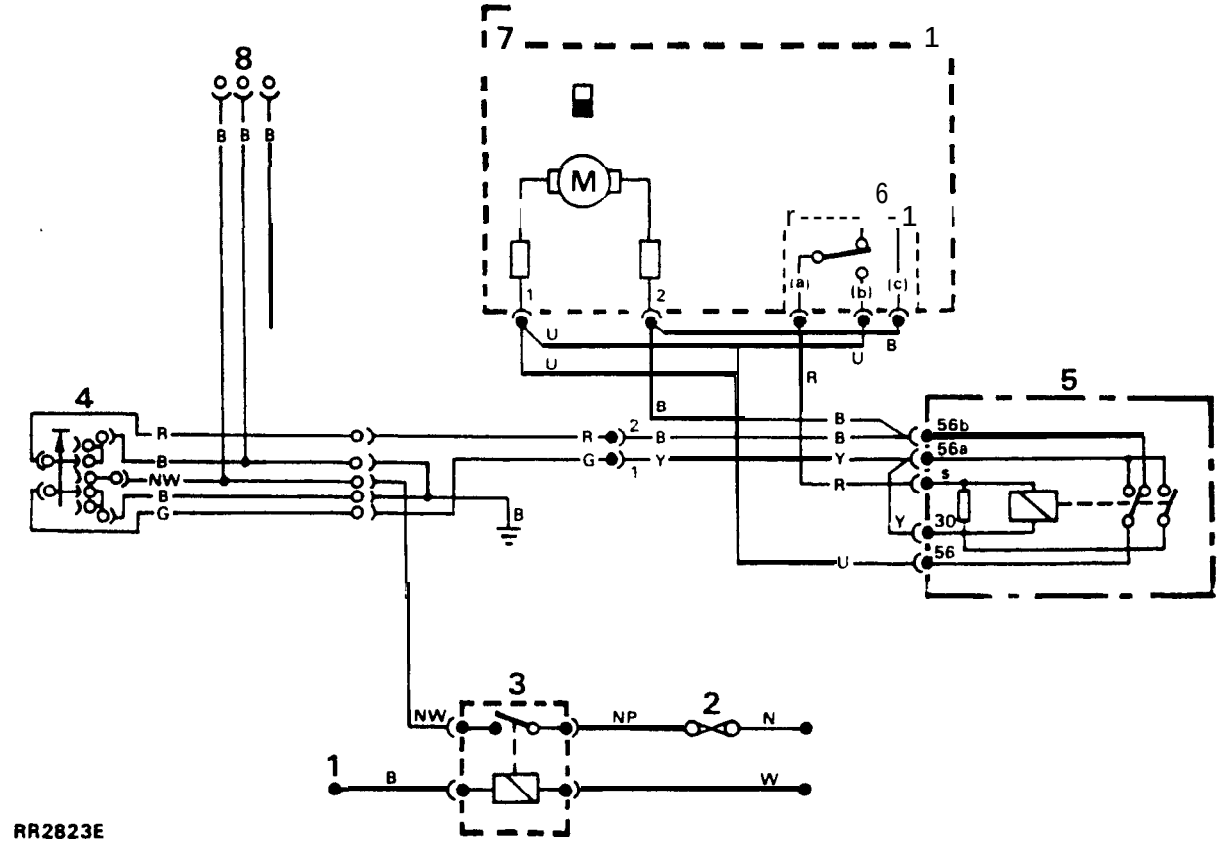
Circuit diagram - RR2794E

1. Switch/lock unit right hand front door
2. Switch/lock unit left hand front door
3. Lock unrt left hand rear door relay
4. Lock unit right hand rear door
5. Fuel flap actuator
6. Lock unit tailgate
7. Suppressor
8. Fuse A5
9. Feed from ignition load relay
10. Fuse C7
11. Battery 12V +ve
12. Central door locking control unit

Cable colour code

B	Black	L	Light	P	Purple	U	Blue
G	Green	N	Brown	R	Red	W	White
K	Pink	0	Orange	S	Grey	Y	Yellow

SUNROOF/AUTOMATIC GLARE CONTROL MIRROR CIRCUIT DIAGRAM



RR2823E

1. Main harness connections
   Brown - live positive feed
   White - ignition positive feed
   Black - ground
2. Fuse B5
3. Auxiliary relay
4. Operating switch
5. Stepper relay
6. Micro-switch - motor switching:
   Contact (a) and (c) - CLOSED
   Contact (a) and (b) - OPEN/TILT
7. Drive motor
8. Mirror

CABLE COLOUR CODE

B	Black
U	Blue
N	Brown
P	Purple
G	Green
R	Red
W	White
Y	yellow

The last letter of a colour code denotes the tracer colour.

MAIN CIRCUIT DIAGRAM - 1990 Model Year - RR2945E & RR2946E

Numerical key

1. Ignition load relay
2. Battery
3. Terminal post
4. Starter solenoid
5. Starter motor
6. Starter relay
7. Starter inhibit switch
8 Ignition switch
9. Tachometer
10. Ignition warning lamp
11. Alternator
12. Fuse B1
13. Front wipe/wash switch
14. Front wipe delay unit
15. front wiper motor
16. Headlamp relay
17. Front wash pump
IA Headlamp wash timer unit
19. Headiamp wash pump
20. Main lighting switch
21. Fuse A3
22. Fuse A7
23. LH side lamp
24. LH tail lamp
25. LH license plate lamp
25a. RH license plate lamp
26. High beam dimmer/flash switch
27. RH side lamp
28. RH tail lamp
29. Rheostat
30. Fuse A8
31. Fuse A2
32. Fuse A9
33. Fuse Al
34. Fuse B6
35. Not used
36. Switch illumination (2 off)
37. Cigar lighter illumination (2 off)
38. Heater illumination (4 off)
39. Clock illumination
40. Auto gear selector illumination (2 off)
40a. Auto gear selector illumination relay.
41. Instrument illumination (4 off)
42. Column switch illumination
42. Not used
43. Not used
44. Fuse B3
45. LH low beam
46. RH low beam
47. LH high beam
48. RH high beam
49. High beam warning lamp
50. Fuel gauge
51. Fuel gauge sender unit
52. Water temperature gauge
53. Water temperature sender unit
54. Fuse B2
55. Horn switch
56. RH horn
57. LH horn
58. Under hood illumination switch
59. Under hood light
60. Clock
61. Fuse C7
62. Fuse C2
63. Pick-up point central locking/window lift
64. Heated rear window relay
65. Fuse Cl
66. Radio aerial amplifier
67 Heated rear screen
68. Heated rear screen switch
69. Heated rear screen warning lamp
70. Voltage sensitive switch
71. Fuse A5
72. Hazard switch
73. Flasher unit
74. Direction indicator switch
75. LH indicator warning lamp
7Sa. RH indicator warning lamp
76. LH rear indicator lamp
77. LH front indicator lamp
78. Not used
79. Not used
80. RH front indicator lamp
81. RH rear indicator lamp
02. Trailer warning lamp
83. Fuse A6
84. Stop lamp switch
85. Reverse lamp switch
86. Front fog lamp relay
87. LH stop lamp
88. RH stop lamp
89. LH reverse lamp
90. RH reverse lamp
91. LH front fog lamp
92. RH front fog lamp
93. Front fog lamp switch
94. Fuse B4
95. Dash cigar lighter
96. Glove box cigar lighter
97. Front interior lamp
98. Rear interior lamp
99. Interior lamp delay unit

100. LH door edge lamp
101. LH puddle lamp
102. RH door edge lamp
103. RH puddle lamp
104. Interior lamp switch
105. LH rear door switch
106. RH rear door switch
107. Tailgate switch
108. LH front door switch
109. RH front door switch
110. Heated washer jets
111. Thermostat heated jets
112. Oil pressure/level warning lamp
113. Oil pressure switch
114. Fuse C4
115. Inertia switch
116. Fuel pump
117. Ignition coil
118. Capacitor
119. Distributor
120 EFI Harness plug
121. Speed transducer
122. Trailer nick up point
123. Radio ruse
124. Radio and six speakers
125. Sun roof relay
125a. Fuse B5
126. Alarm pick up point
127. Seat belt warning lamp
128. 'Key-in switch'
129. Resistor
130. Audible warning unit
131. Seat buckle switch
132. Transfer box neutral switch
133. Heated front screen pick up point
134. Sunroof connection point (option)
135. Auto transmission and transfer box oil temperature warning lamp
136. Auto transmission oil temperature switch
136a. Transfer box oil temperature switch
137. Fuse C3
138. Rear wash wipe switch
139. Rear wipe delay unit
140. Rear wiper motor
141. Rear screen wash pump
142. Low screen wash fluid level warning lamp
143. Low screen wash switch
144. Low coolant switch
145. Electronic speedo and instrument controls
146. Low coolant level warning lamp
147. Low fuel level warning lamp
148. E.F.I. warning lamp
149. Low oil level logic unit
150. Low oil level probe
151. Not used
152. ABS warning lamp
153. Parking brake/brake fluid loss warning lamp
153a. Brake fluid level warning switch
154. Park brake warning switch
155. Brake pad wear warning lamp
156. Brake pad wear sensors
157. Warning lamp control unit
158. Check engine warning lamp
159. Emission maintenance reminder unit
160. Heateriair conditioning connections
161. Fuse C9
162. Coil negative (engine RPM input to ECU)
163. ignition load relay (+)
164. Battery feed (+)
165. ignition auxiliary (+)
166. Ignition on (+)
167 Earth (-)
166. Warning lights supply common earth (-)
169. Warning lights supply (+)
170. Electric seats pick up point
171. Fuse C5
172. Fuse B8
173. Fuse C8
174. Electric mirrors pick up point
175. Heater/air conditioning relay
176. Cruise control connection points
177. Fuse B9
178. Condenser fan relay
179. Fuse B7
180. ABS pick up point

CABLE COLOUR CODE

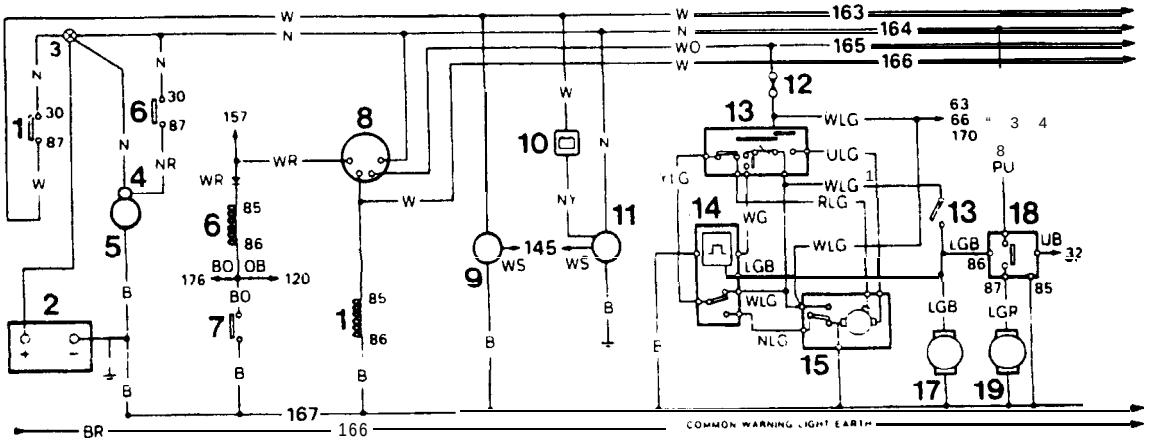
B	Black
U	Blue
N	Brown
G	Green
S	Grey
L	Light
0	Orange
K	Pink
P	Purple
R	Red
W	White
Y	Yellow

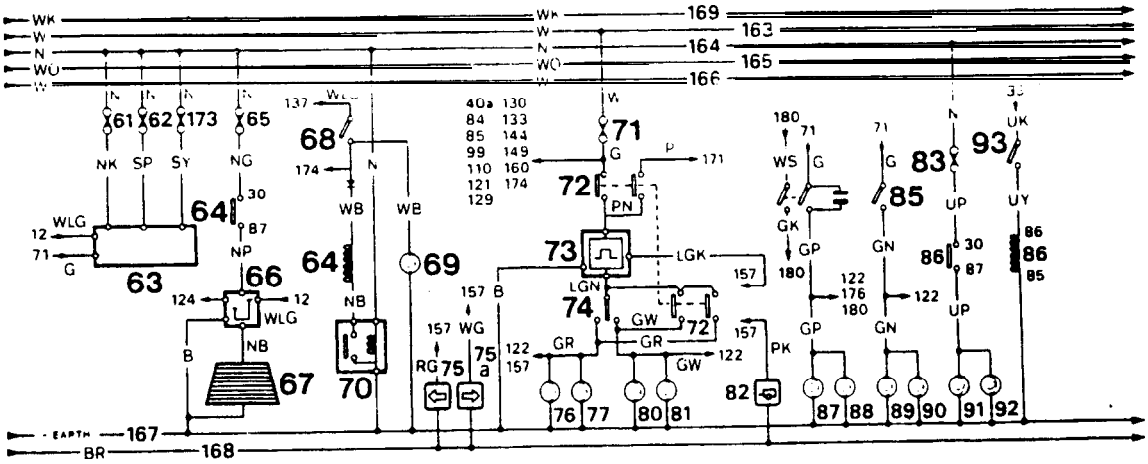
MAIN CIRCUIT DIAGRAM - 1990 Model Year - RR2945E & RR2946E

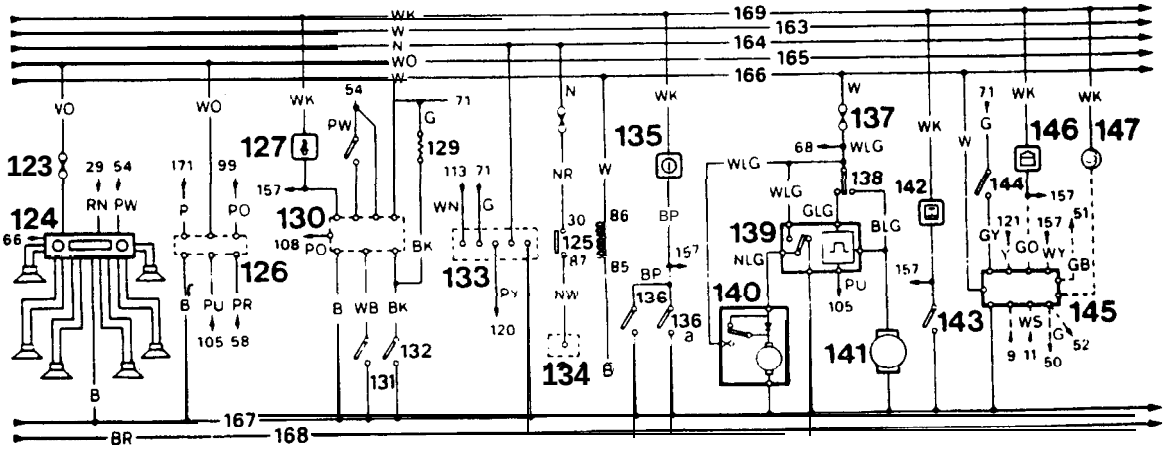
Alphabetical key

180. ABS pick up point
152. ABS warning lamp
126. Alarm pick up point
11. Alternator
130. Audible warning unit
40. Auto gear selector illumination (2 off)
40a. Auto gear selector illumination relay.
135. Auto transmission and transfer box oil temperature warning lamp
136. Auto transmission oil temperature switch
2. Battery
164. Battery feed (+)
153a. Brake fluid loss warning switch
155. Brake pad wear warning lamp
156. Brake pad wear sensors
118. Capacitor
163. Check engine warning lamp
37. Cigar lighter illumination (2 off)
60 Clock
3Y. Clock illumination
162. Coil negative (engine RPM input to ECU)
42. Column switch illumination
178. Condenser fan relay
176. Cruise control connection points
95. Dash cigar lighter
74. Direction indicator switch
119. Distributor
148. E.F.I. warning lamp
120. EFI Harness plug
167. Earth (+)
174. Electric mirrors pick up point
170. Electric seats pick up point
145. Electronic speedo and instrument controls
159. Emission maintenance reminder
73. Flasher unit
86. Front fog lamp relay
93. Front fog lamp switch
97. Front interior lamp
17. Front wash pump
13. Front wipe/wash switch
14. Front wipe delay unit
15. Front wiper motor
51. Fuel gauge sender unit
50. Fuel gauge
116. Fuel pump
33. Fuse Al
31. Fuse A2
21. Fuse A3
71. Fuse A5
83. Fuse A6
30. Fuse A8
22. Fuse A7
32. Fuse A9
12. Fuse B1
54. Fuse B2
44. Fuse B3
94. Fuse B4
125a. Fuse B5
34. Fuse B6
179. Fuse B7
172 Fuse B8
177. Fuse B9
65. Fuse Cl
62. Fuse C2
137. Fuse C3
114. Fuse C4
171. Fuse C5
61. Fuse C7
173. Fuse C8
161. Fuse C9
96. Glove box cigar lighter
72. Hazard switch
16. Headlamp relay
19. Headlamp wash pump
18. Headlamp wash timer unit
133. Heated front screen pick up point
68. Heated rear screen switch
64. Heated rear window relay
69. Heated rear screen warning lamp
67. Heated rear screen
110. Heated washer jets
38. Heater illumination (4 off)
175. Heater/air conditioning relay
160. Heater/air conditioning connections
26. High beam dimmer/flash switch
49. High beam warning lamp
55. Horn switch
165. Ignition auxiliary (+)
117. Ignition coil
1. Ignition load relay
163. Ignition load relay (+)
166. Ignition on (+)
8. Ignition switch
IO. Ignition warning lamp
115. Inertia switch
41. Instrument illumination (4 off)
104. Interior lamp switch
99. Interior lamp delay unit
128. 'Key-in switch'
100. LH door edge lamp
108. LH front door switch
91. LH front fog lamp
77. LH front indicator lamp
47. LH high beam
57. LH horn
75. LH indicator warning lamp
25. LH license plate lamp
45. LH low beam
101. LH puddle lamp
105. LH rear door switch

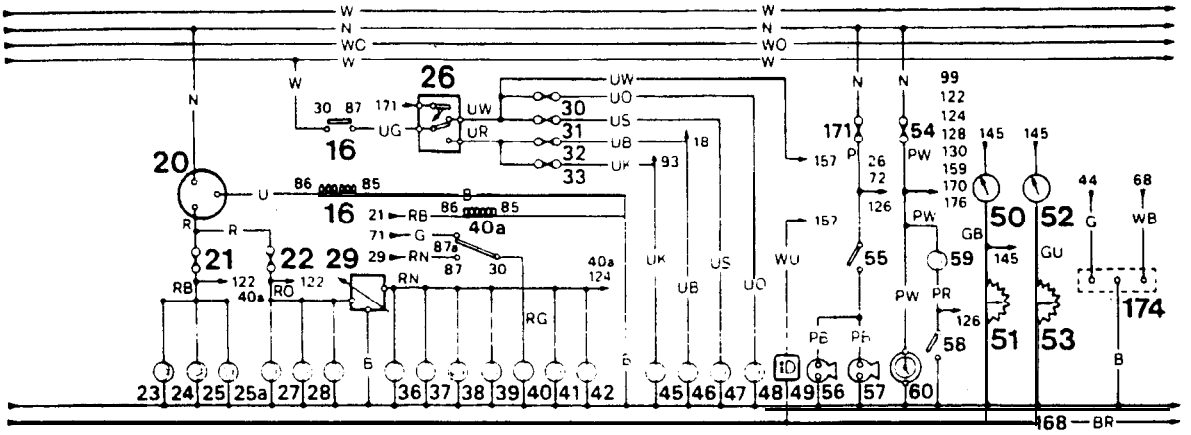
76. LH rear indicator lamp
89. LH reverse lamp
23. LH side lamp
87. LH stop lamp
24. LH tail lamp
146. Low coolant level warning lamp
144. Low coolant switch
147. Low fuel level warning lamp
150. Low oil level probe
149. Low oil level logic unit
143. Low screen wash switch
142. Low screen wash fluid level warning lamp
20. Main lighting switch
151. Not used - will illuminate on initial bulb check
113. Oil pressure switch
112. Oil pressure/level warning lamp
154. Park brake warning switch
153. Parking brake/brake fluid loss warning lamp
63. Pick-up point central locking/window lift
102. RH door edge lamp
109. RH front door switch
92. RH front fog lamp
80 RH front indicator lamn
48. RH high beam
56. RH horn
75a. RH indicator warning lamp
25a. RH license plate lamp
46. RH low beam
103. RH puddle lamp
106. RH rear door switch
81. RH rear indicator lamp
90. RH reverse lamp
27. RH side lamp
88. RH stop lamp
28. RH tail lamp
66. Radio aerial amplifier
124. Radio and six speakers
123. Radio fuse
98. Rear interior lamp
141. Rear screen wash pump
138. Rear wash wipe switch
139. Rear wipe delay unit
140. Rear wiper motor
129. Resistor
85. Reverse lamp switch
29. Rheostat
127. Seat belt warning lamp
131. Seat buckle switch
121. Speed transducer
7. Starter inhibit switch
5. Starter motor
6. Starter relay
4. Starter solenoid
84. Stop lamp switch
125. Sun roof relay
134. Sunroof connection point (option)
36. Switch illumination (2 off)
9. Tachometer
107. Tailgate switch
3. Terminal post
111. Thermostat heated jets
122. Trailer pick up point
82. Trailer warning lamp
136a. Transfer box oil temperature switch
132. Transfer box neutral -switch
58. Under hood illumination switch
59. Under hood light
70. Voltage sensitive switch
157. Warning lamp control unit
168. Warning lights supply common earth (-)
169. Warning lights supply (+)
53. Water temperature sender unit
52. Water temperature gauge temperature warning lamp

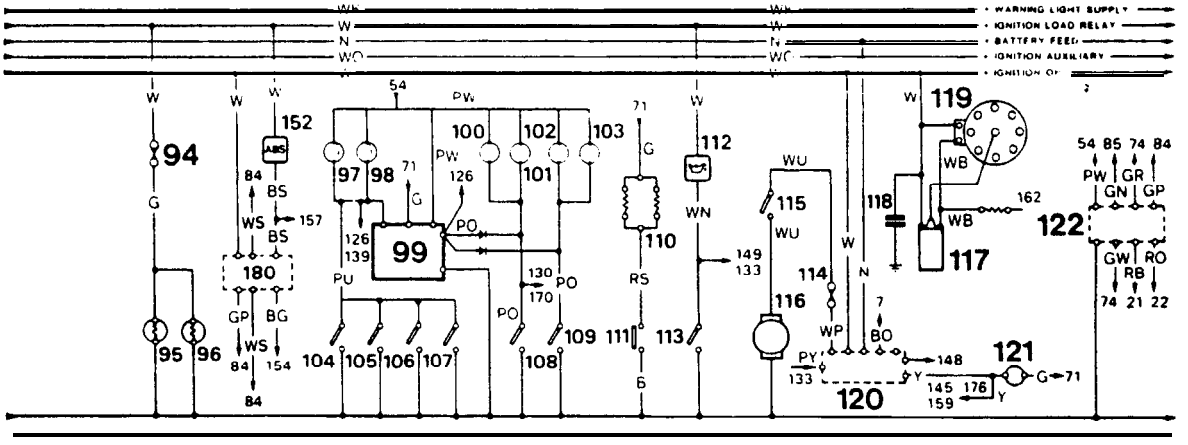


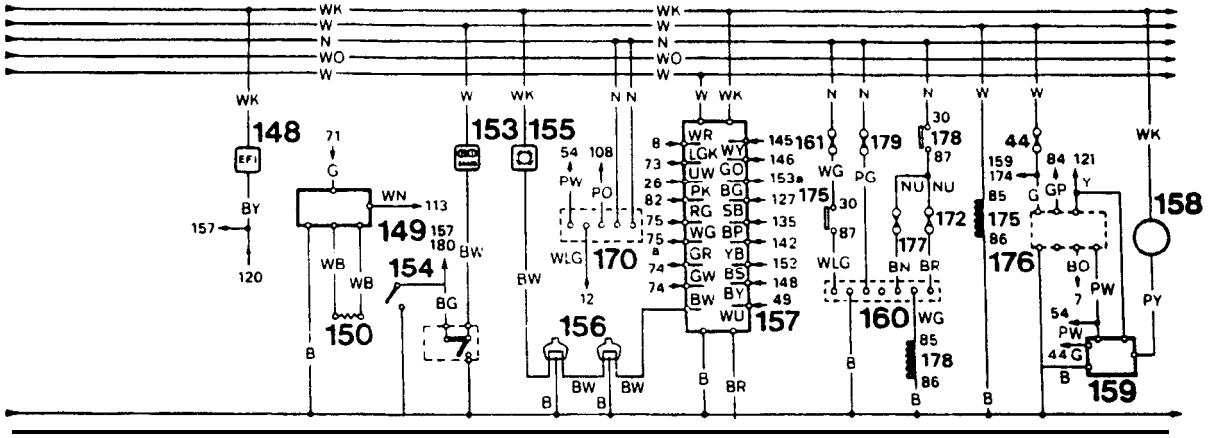




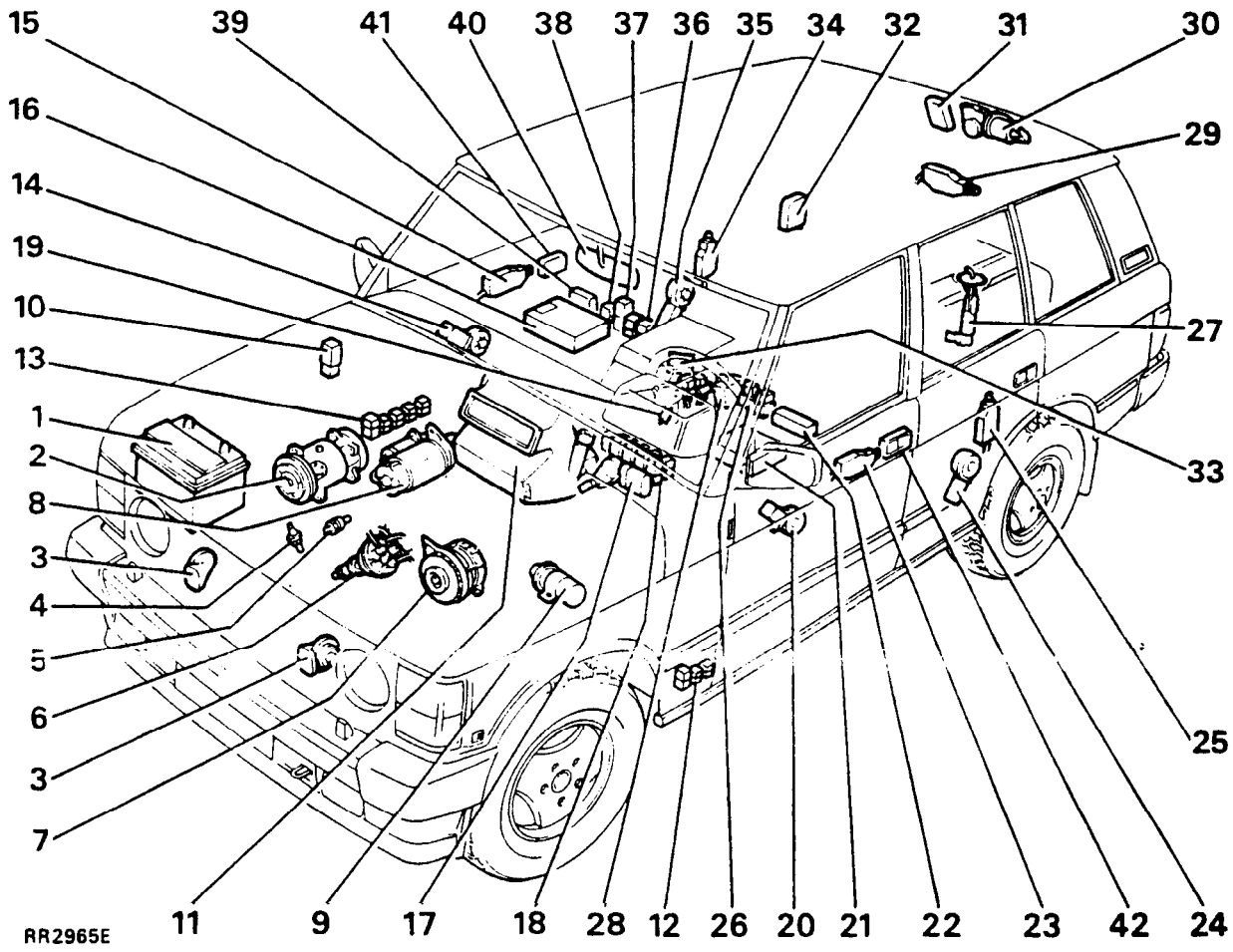
RR2945E -REVISED. SEPT. 90


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RR2946E



LOCATION OF ELECTRICAL EQUIPMENT - 1991 MODEL YEAR

1. Battery
2. Air conditioning compressor
3. Horns
4. Oil pressure switch
5. Water temperature switch
6. Electronic distributor
7. Alternator
8. Starter motor
9. Coil
10. Headlamp wash timer unit
11. Heater
12. Relays/flasher units
13. Air con relays/diode unit
14. Window lift motor (front RH door)
15. Door lock actuator (front RH door)
16. Electronic control unit (EFI)
17. Wiper motor - front screen
18. Relays/delay units
19. Park brake warning light switch
20. Window lift motor (front LH door)
21. Electronic control unit and relays (ABS)
22. Seat adjustment fusebox
23. Door lock actuator (front LH door)
24. Window lift motor (rear LH door)
25. Door lock actuator (rear LH door)
26. Seat adjustment relays - two
27. Electrical in-tank fuel pump/sender unit
28. Inertia switch
29. Tailgate lock actuator
30. Wiper motor - rear screen
31. Radio aerial amplifier
32. Fuel filler flap release actuator
33. Window lift relays and one touch control unit
34. Door lock actuator (rear RH door)
35. Window lift motor (rear RH door)
36. EFI relays (two)
37 Condenser fan timer unit
38. Cruise control relay
39. Emission maintenence reminder
40. Glare control mirror
41. RH door lock heater
42. LH door lock heater

INSTRUMENT BINNACLE WARNING LIGHT SYMBOLS

Direction indicator - left turn (green)

c l

Direction indicator - right turn (green)

Headlamp high beam on (blue)

Brake pad wear (amber)

Trailer connected - flashes with direction indicators (green)

CHECK ENGINE

EFI warning light (amber) - 1991 model year change

BRAKE

Brake fluid pressure failure/low fluid level, transmission handbrake on (red)

Low screenwash fluid (amber)

ABS

ABS warning light (red)

Automatic gearbox oil or transfer box temperature high (red)

SERVICE ENGINE

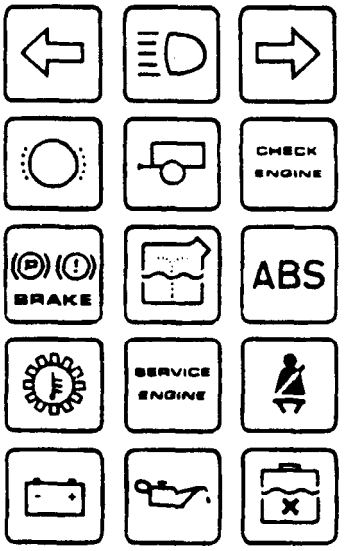
Emission maintenance reminder

Seat belt (red)

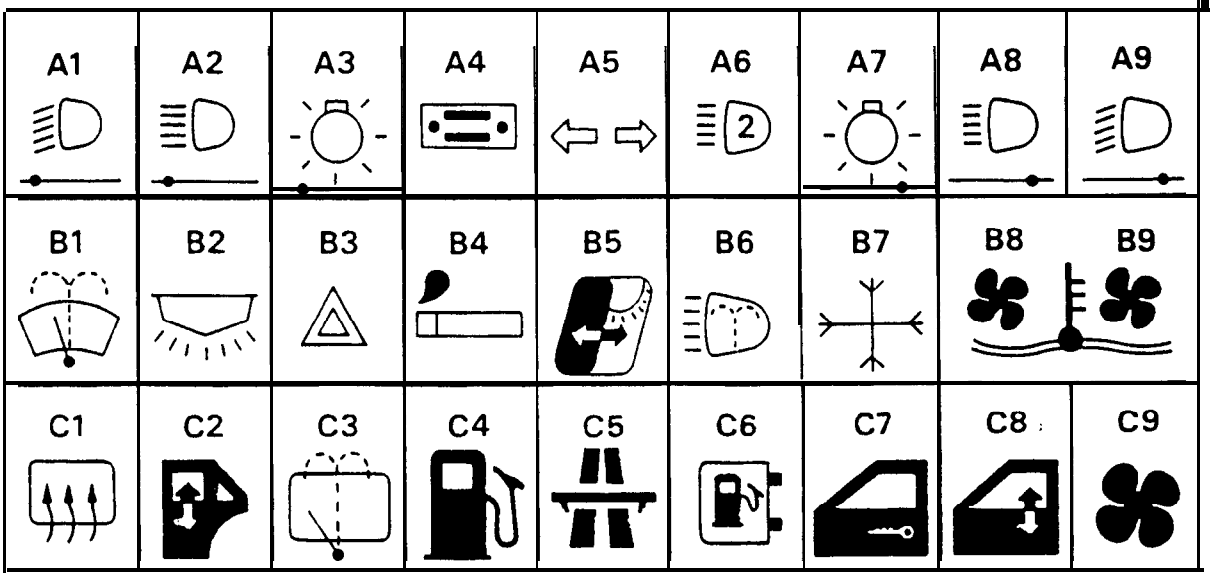
Ignition on/low charge (red)

Engine oil pressure low (red)

Low coolant (red)



RR2803E



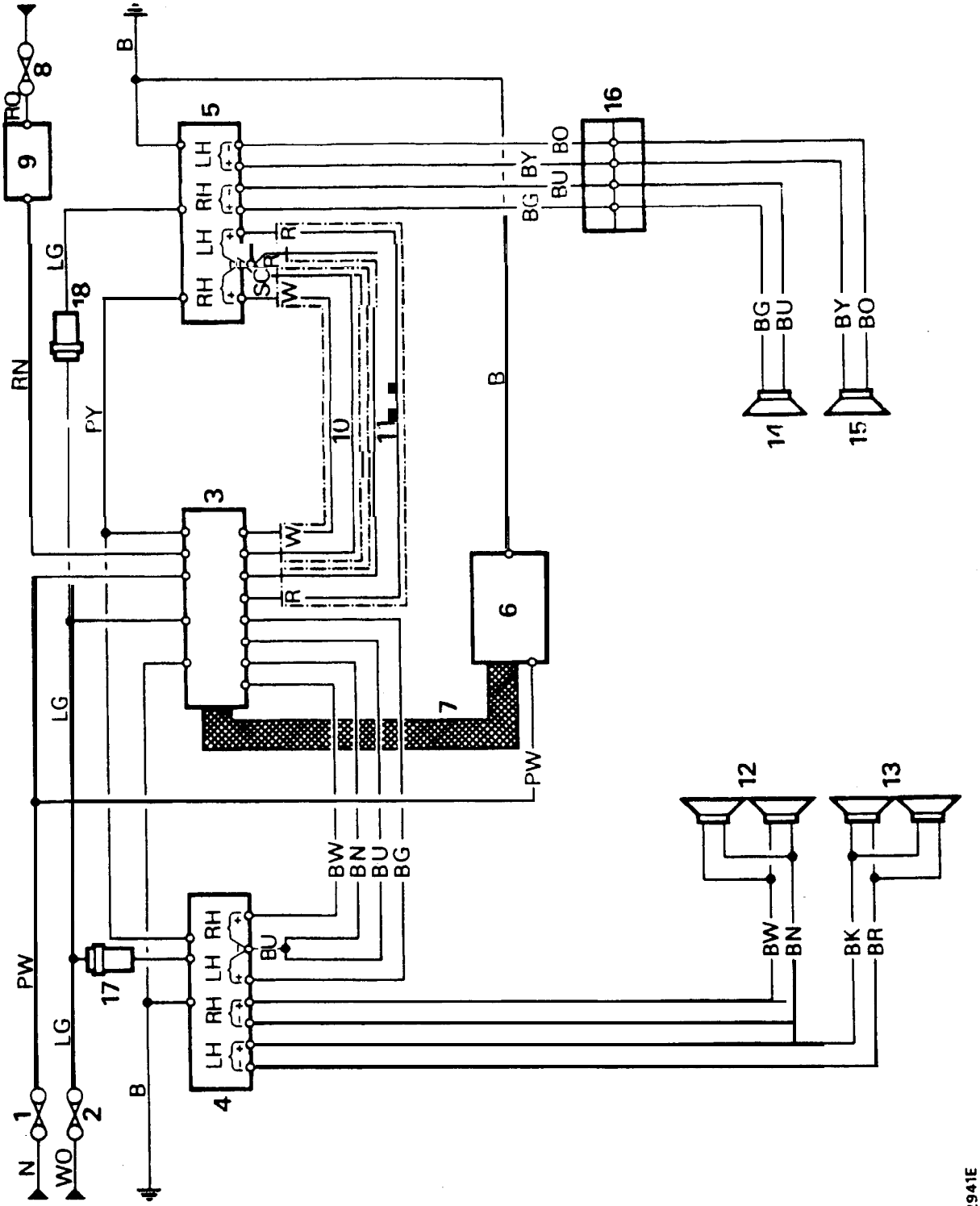
RR2918M

FUSE BOX - RR2918M

FUSE No.	COLOUR CODE	RATING AMPS	IGN. KEY POSITION	FUNCTION
A1	Red	10	II	LH low beam, front fog lamp relay
A2	Red	10	II	LH high beam, auxiliary lamp relay
A3	Tan	5	0	LH parking lamps, trailer pickup
A4	Blue	15	I	Radio, CD player
A5	Yellow	20	II	Direction ind., resistor, heated jets, thermo., heated front screen timer, air con. low coolant, low oil, speed transducer, interior lamp delay, reverse lights, stop lights, audible warning unit, glare control mirror
A6	Red	10	II	Fog lamps (from low beam)
A7	Tan	5	0	RH parking lamps, rheostat controlled instrument/switch illumination, trailer pick up
A8	Red	10	II	RH high beam
A9	Red	10	II	RH low beam
B1	Yellow	20	I	Front wash/wipe, seat relays, window lift relays, antenna amplifier
B2	Yellow	20	0	Interior light, clock, underhood ill., elec. seat relays, radio, door lamps, key in switch, audible warning, door lock heater
B3	Yellow	20	0	Hazard switch, alarm, headlamp dip/flash, horns
B4	Yellow	20	II	Cigar lighters
B5	Yellow	20	II	Sunroof motor
B6	Yellow	20	II	Headlamp wash
B7	Tan	5	II	Air conditioning compressor clutch
B8	Yellow	20	II	Air conditioningiradiator cooling fan
B9	Yellow	20	II	Air conditioning/radiator cooling fan
C1	Green	30	II	Heated rear screen (voltage switch controlled)
c2	Green	30	II	Window lifts - rear
c3	Red	10	II	Rear wash wipe motor, heated rear screen relay, mirror heaters
c4	Red	10	II	Fuel pump
C5	Red	10	II	Mirror motors, cruise control
C6	Tan	5	0	Fuel filler flap
c7	Blue	15	0	Central locking
C8	Green	30	II	Window lifts - front
C9	Green	30	II	Heater/air conditioning motor

CD PLAYER WITH POWER AMPLIFIERS

Circuit diagram - RR2941E



CD PLAYER WITH POWER AMPLIFIERS

Circuit diagram - RR2941E

1. Fuse B2
2. Fuse B4
3. Radio - head unit
4. Front power amplifier
5. Rear power amplifier
6. CD auto changer
7. Data link cable
8. Fuse A7
9. Rheostat
10. Screened cable, RH rear speaker signal
11. Screened cable, LH rear speaker signal
13. RH front door speaker
13. LH front door speaker
14. RH rear speaker
15. LH rear speaker
16. In-line connector, sub-woofer cross-over unit
17. 4 amp in-line fuse, front amplifier
18. 4 amp in-line fuse, rear amplifier

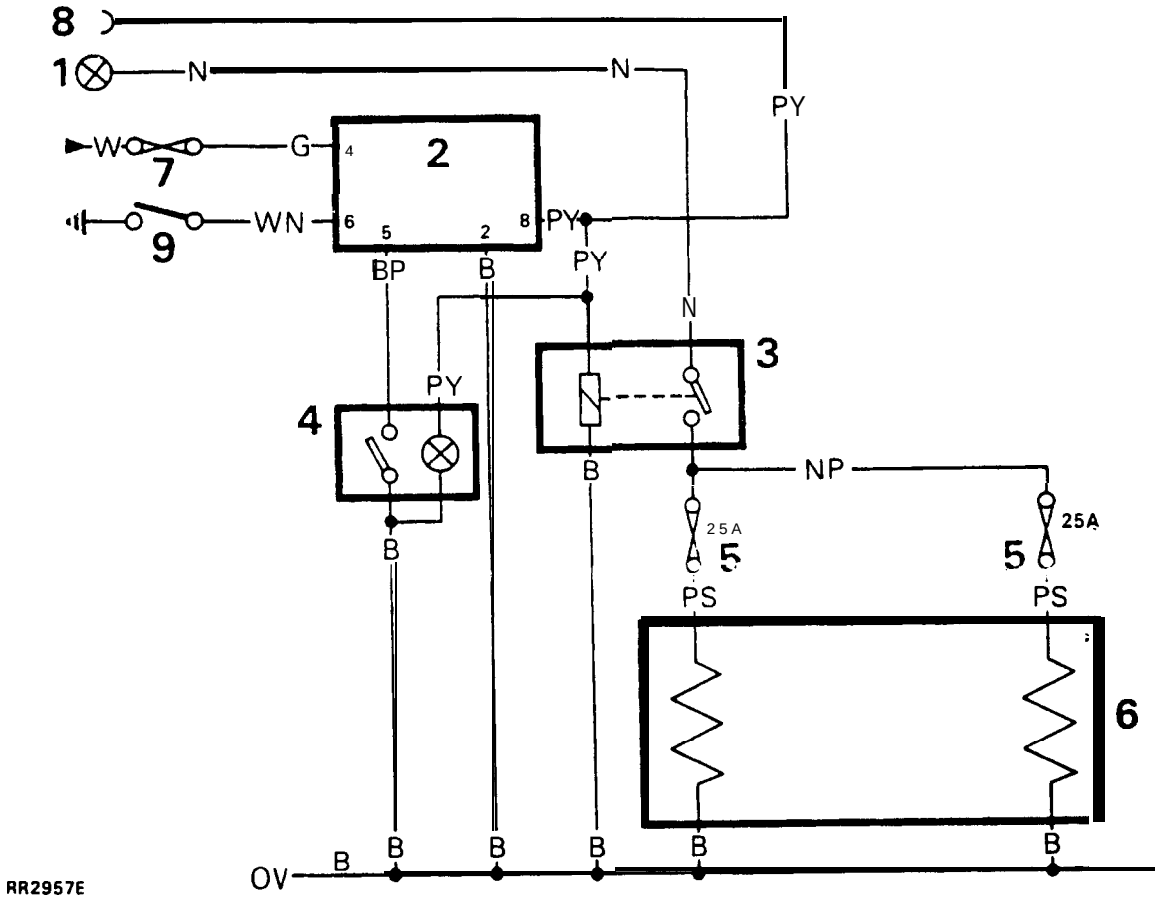
NOTE: SCK aenotes screen

Cable colour code

B	Black	**L**	Light	**P**	Purple	**U**	Blue
G	Green	N	Brown	**R**	Red	**W**	White
K	Pink	0	Orange	S	Crey	Y	Yellow

The last letter of a colour code denotes the tracer.

HEATED FRONT SCREEN



Circuit diagram - RR2957E

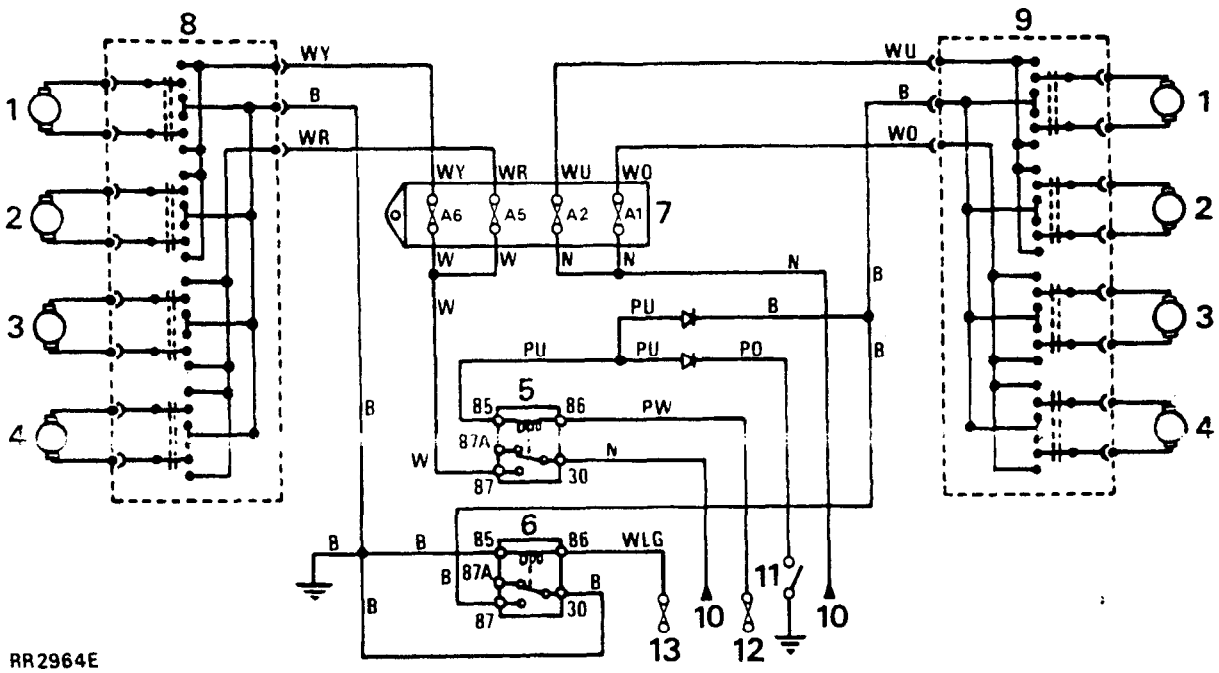
1. Terminal post
2. Timer unit
3. Load relay
4. Switch/warning light
5. In line fuses - 25 Amp
6. Heated front screen
7. Fuse A5
8. EFI ECU pin 8
9. Oil pressure switch

Cable colour code

B	Black	**L**	Light	**P**	Purple	**U**	Blue
G	Green	N	Brown	**R**	Red	**W**	White
K	Pink	0	Orange	**S**	Crey	Y	Yellow

The last letter of a colour code denotes the tracer.

ELECTRIC SEAT ADJUSTMENT



RR2964E

Circuit diagram - RR2530E

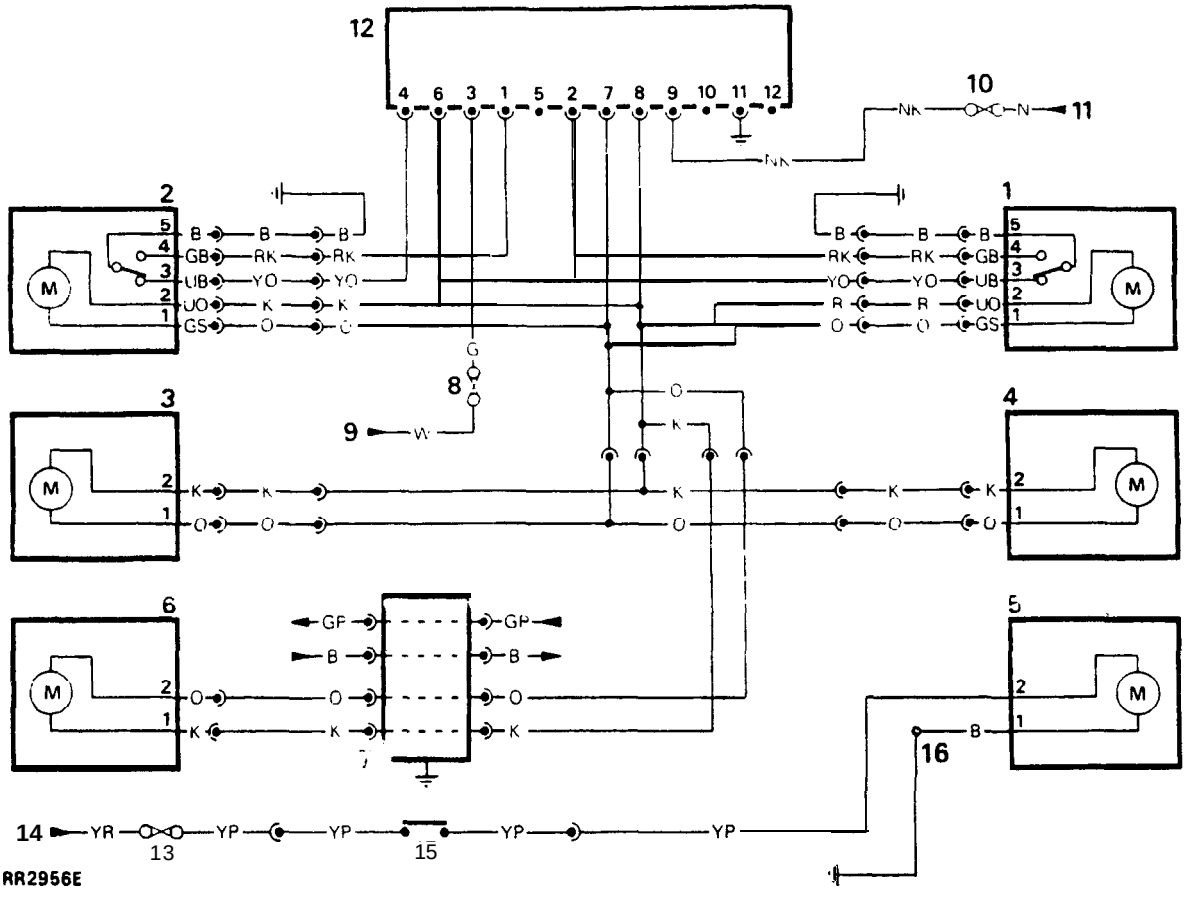
1. Seat recline motor
2. Seat height (rear) motor
3. Seat base adjust motor
4. Seat height (front) motor
5. Load relay-from driver's door courtesy switch
6. Load relay-fused auxiliary feed controled
7. Auxiliary fuse box (B)
8. Driver's seat control
9. Passenger's seat control
10. Terminal post
11. Drivers door switch
12. Fuse B2
13. Fuse B1

Cable colour code

B	Black	**L**	Light	**P**	Purple	**U**	Blue
G	Green	N	Brown	**R**	Red	**W**	White
K	Pink	0	Orange	**S**	Crey	Y	Yellow

The last letter of a colour code denotes the tracer.

DOOR LOCKS/FUEL FILLER FLAP



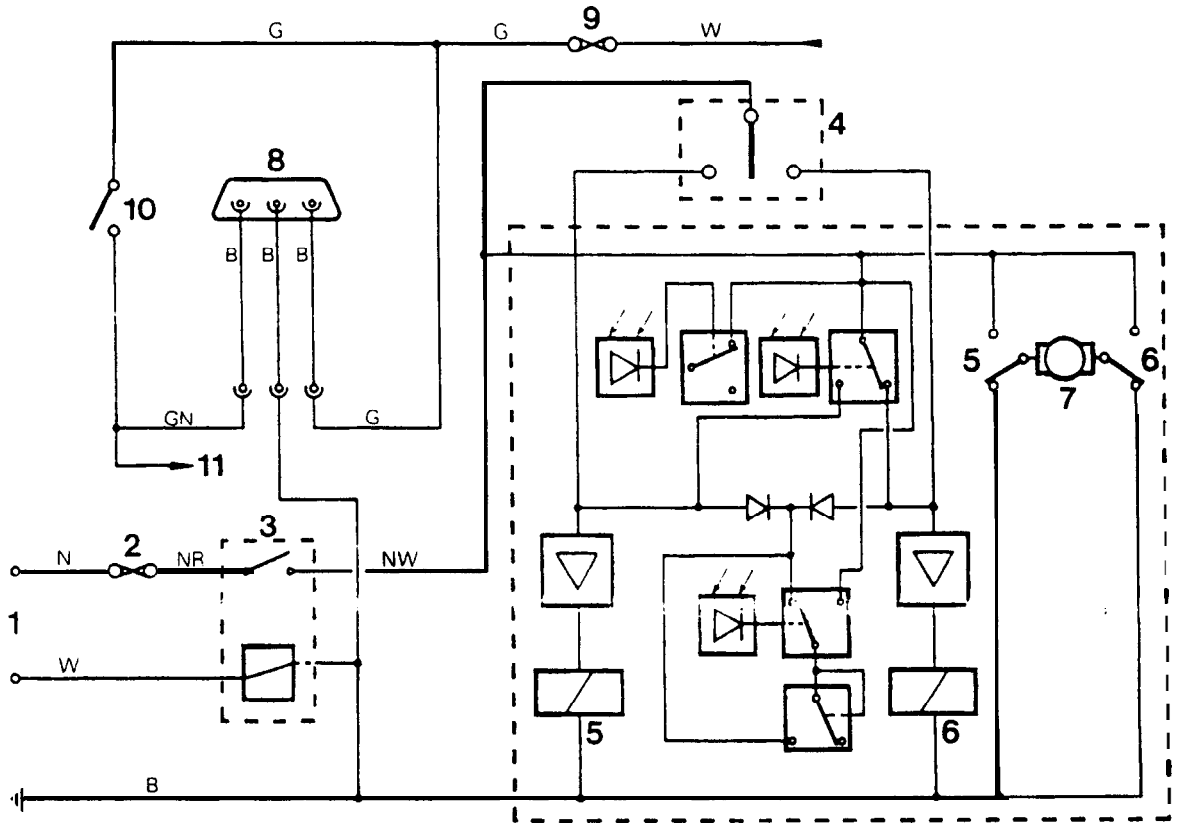
Circuit diagram - RR2956E

1. Switch/lock unit right hand front door
2. Switch/lock unit left hand front door
3. Lock unit left hand rear door relay
4. Lock unit right hand rear door
5. Fuel flap actuator
6. Lock unit tailgate
7. Suppressor
8. Fuse A5
9. Feed from ignition load relay - pin 87
10. Fuse C7
11. Battery 12V +ve
12. Central door locking control unit
13. Fuse C6
14. feed from ignition load relay - pin 87A
15. Fuel flap release switch
16. Fuel tank filler pipe ground

Cable coiour code

B	Black	L	Light	P	Purple	U	Blue
G	Green	N	Brown	R	Red	W	White
K	Pink	0	Orange	S	Grey	Y	Yellow

SUNROOF/AUTOMATIC GLARE CONTROL MIRROR



RR2958E

Circuit diagram - RR2958E

1. Main harness connections
   Brown - live positive feed
   White - ignition positive feed
   Black - ground
2. Fuse B5
3. Auxiliary relay
4. Operating switch
5. Relay - tilt, open to closed
   - slide, closed to open
6. Relay - slide, open to closed
   - tilt, closed to open
7. Drive motor
8. Mirror connection
9. Fuse A5
10. Reverse lamps switch
11. Reverse lamps

CABLE COLOUR CODE

B	Black
U	Blue
N	Brown
P	Purple
G	Green
R	Red
W	White
Y	yellow

The last letter of a colour code denotes the tracer colour.

------- Denotes component enclosure

MAIN CIRCUIT DIAGRAM - RR2942E & RR2943E

Numerical key

1. Ignition load relay
2. Battery
3. Terminal post
4. Starter solenoid
5. Starter motor
6. Starter relay
7. Starter inhibit switch
8. ignition switch
9. Tachometer
10. Ignition warning lamp
11. Alternator
12. Fuse B1
13. Front wipe/wash switch
14. Front wipe delay unit
15. Front wiper motor
16. Headlamp relay
17. Front wash pump
18 Headlamp wash timer unit
19. Headlamp wash pump
20. Main lighting switch
21. Fuse A3
22. Fuse A7
23. LH side lamp
24. LH tail lamp
25. LH license plate lamp
25a. RH license plate lamp
26. High beam dimmer/flash switch
27. RH side lamp
28. RH tail lamp
29. Rheostat
30. Fuse A8
31. Fuse A2
32. Fuse A9
33. Fuse Al
34. Fuse B6
35. Window lift connections
36. Switch illumination (2 off)
37. Cigar lighter illumination (2 off)
38. Heater illumination (4 off)
39. Clock illumination
40. Auto gear selector illumination (2 off)
40a. Auto gear selector illumination relay.
41. Instrument illumination (4 off)
42. Column switch illumination
42. Not used
43. Not used
44. Fuse B3
45. LH low beam
46. RH low beam
47. LH high beam
48. RH high beam
49. High beam warning lamp
50. Fuel gauge
51. Fuel gauge sender unit
52. Water temperature gauge
53. Water temperature sender unit
54. Fuse B2
55. Horn switch
56. RH horn
57. LH horn
58. Under hood illumination switch
59. Under hood light
60. Clock
61. Fuse C7
62. Fuse C2
63. Central door locking unit
64. Heated rear window relay
65. Fuse Cl
66. Radio aerial amplifier
67 Heated rear screen
66. heated real screen switch
69. Heated rear screen warning lamp
70. Voltage sensitive switch
71. Fuse A5
72. Hazard switch
73. Flasher unit
74. Direction indicator switch
75. LH indicator warning lamp
75a. RH indicator warning lamp
76. LH rear indicator lamp
77. LH front indicator lamp
78. Not used
79. Not used
80. RH front indicator lamp
81. RH rear indicator lamp
82. Trailer warning lamp
83. Fuse A6
84. Stop lamp switch
85. Reverse lamp switch
86. Front fog lamp relay
87. LH stop lamp
88. RH stop lamp
89. LH reverse lamp
90. RH reverse lamp
91. LH front fog lamp
92. RH front fog lamp
93. Front fog lamp switch
94. Fuse B4
95. Dash cigar lighter
96. Glove box cigar lighter
97. Front interior lamp
98. Rear interior lamp
99. Interior lamp delay unit

100. LH door edge lamp
101. LH puddle lamp
102. RH door edge lamp
103. RH puddle lamp
104. Interior lamp switch
105. LH rear door switch
106. RH rear door switch
107. Tailgate switch
108. LH front door switch
109. RH front door switch
110. Heated washer jets
111. Thermostat heated jets
112. Oil pressure/level warning lamp
113. Oil pressure switch
114. Fuse C4
115. Inertia switch
116. Fuel pump
117. Ignition coil
118. Capacitor
119. Distributor
120. EFI Harness plug
121. Speed transducer
122 Trailer nick up point
123. Fuse A4
124. Radio and six speakers
125. Sun roof relay
125a. Fuse B5
126. Alarm pick up point
127. Seat belt warning lamp
128. 'Key-in switch'
129. Resistor
130. Audible warning unit
131. Seat buckle switch
132. Transfer box neutral switch
133. Condenser fan motors
134. Sunroof connection point (option)
135. Auto transmission and transfer box oil temperature warning lamp
136. Auto transmission oil temperature switch
136a. Transfer box oil temperature switch
137. Fuse C3
138. Rear wash wipe switch
139. Rear wipe delay unit
140. Rear wiper motor
141. Rear screen wash pump
142. Low screen wash fluid level warning lamp
143. Low screen wash switch
144. Low coolant switch
145. Electronic speedo and instrument controls
146. Low coolant level warning lamp
147. Low fuel level warning lamp
148. E.F.I. warning lamp
149. Low oil level logic unit
150. Low oil level probe
151. Compressor clutch relay
152. ABS warning lamp
153. Parking brake/brake fluid loss warning lamp
153a. Brake fluid level warning switch
154. Park brake warning switch
155. Brake pad wear warning lamp
156. Brake pad wear sensors
157. Warning lamp control unit
158. Check engine warning lamp
159. Emission maintenance reminder unit
160. Diode pack fair con)
161. Fuse C9
162. Coil negative (engine RPM input to ECU)
163. Ignition load relay (+)
164. Battery feed (+)
165. Ignition auxiliary (+)
166. Ignition on (+)
167. Earth (-)
168. Warning tights supply common earth (-)
169. Warning lights supply (+)
170 Fuse C6
171. Fuse C5
172. Fuse B8
173. Fuse C8
174. Fuel filler flap release
175. Heater/air conditioning relay
176. Cruise control connection points
177. Fuse B9
178. Condenser fan relay
179. Fuse B7
180. ABS ECU
181. Front amplifier audio
182. Rear amplifier audio
183. Electric seat relays
184. Heated front screen timer unit
185. Electric mirror elements
186. Glare control mirror

CABLE COLOUR CODE

B	Black
U	Blue
N	Brown
G	Green
S	Crey
L	Light
0	Orange
K	Pink
P	Purple
R	Red
W	White
Y	Yellow

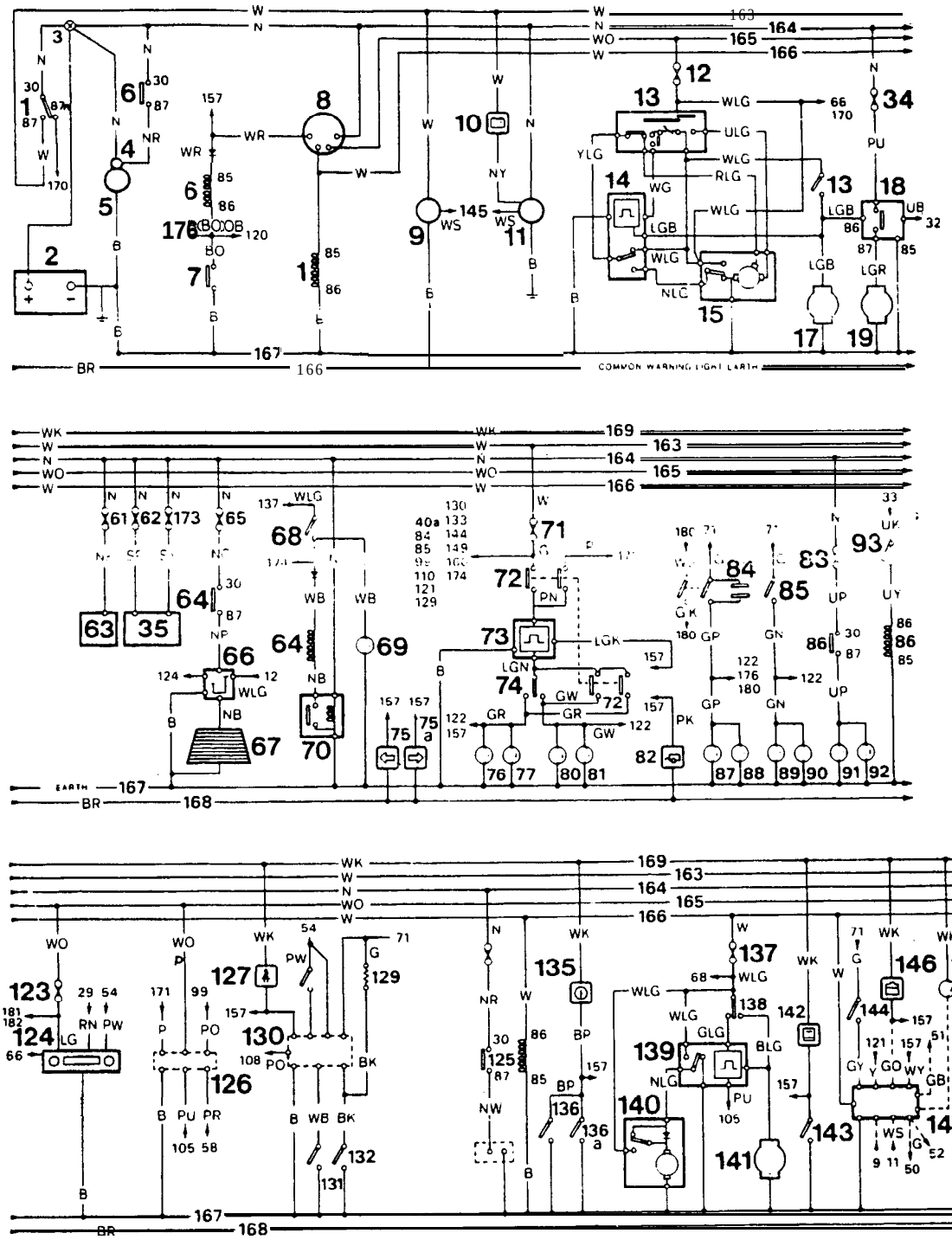
Note: The following items are now incorporated into the main harness assembly, ABS, air conditioning, CD player, electric mirrors, door locks, heated front screen and window lift. These items are shown on the main circuit diagram as a box containing the relevant number, or indicated by an arrow and the item number. Refer to the appropriate circuit diagram for details of these items.

MAIN CIRCUIT DIAGRAM - RR2942E & RR2943E

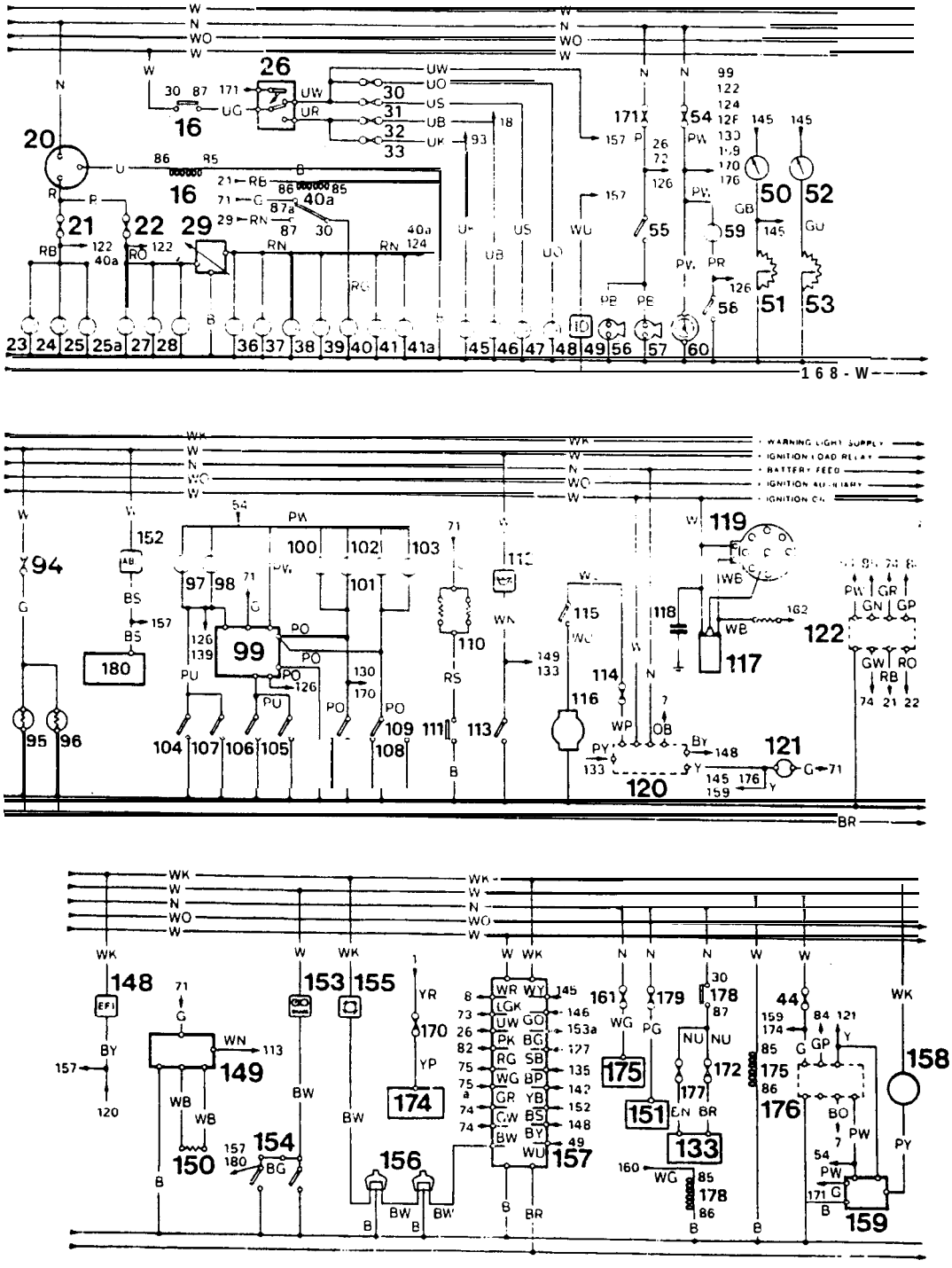
Alphabetical key

180. ABS ECU
180. ABS pick up point
152. ABS warning lamp
126. Alarm pick up point
11. Alternator
130. Audible warning unit
40. Auto gear selector iliumination (2 off)
40a. Auto gear selector illumination relay.
135. Auto transmission and tranter box oil temperature warning lamp
736. Auto transmission oil temperature switch
2. Batter)
164. Battery feed (+)
153a. Brake fluid loss warning switch
155. Brake pad wear warning lamp
156. Brake pad wear sensors
118. Capacitor
63. Central door locking unit
163. Check engine warning lamp
37. Cigar ignter illumination (2 oft)
60. Clock
39. Clock illumination
163. Coil negative (engine RPM input to ECU)
42. Column switch illumination
151. Compressor clutch relay
133. Condenser fan motors
178. Condenser fan relay
176. Cruise control connection points
95. Dash cigar lighter
160. Diode pack (air con)
74. Direction indicator switch
119. Distributor
148. E.F.I. warning lamp
120. EFI Harness plug
167. Earth (+)
185. Electric mirror elements
183. Electric seat relays
145. Electronic speedo and instrument controls
1 59. Emission maintenance reminder
73. Flasher unit
181. Front amplifier audio
86. Front fog lamp relay
93. Front fog lamp switch
97. Front interior lamp
17. Front wash pump
13. Front wipe/wash switch
14. Front wipe delay unit
15. Front wiper motor
174. Fuel filler flap release
51. Fuel gauge sender unit
50. Fuel gauge
116. Fuel pump
33. Fuse Al
31. Fuse A2
21. Fuse A3
123. Fuse A4
71. Fuse A5
83. Fuse A6
22. Fuse A7
30. Fuse A8
32. Fuse A9
12. Fuse B1
54. Fuse B2
44. Fuse B3
94 Fuse B4
125a. Fuse B5
34. Fuse B6
179. Fuse B7
172. Fuse B8
177. Fuse BY
65. Fuse Cl
62. Fuse C2
137. Fuse C3
114. Fuse C4
171 Fuse C5
170. Fuse C6
61. Fuse C7
173. Fuse C8
161. Fuse C9
186. Glare control mirror
96. Glove box cigar lighter
72. Hazard switch
16. Headlamp relay
19. Headlamp wash pump
18. Headlamp wash timer unit
184. Heated front screen timer Unit
68. Heated rear screen switch
64. Heated rear window relay
69. Heated rear screen warning lamp
67. Heated rear screen
110. Heated washer jets
38. Heater illumination (4 off)
175. Heater/air conditioning relay
160. Heater/air conditioning connections
26. High beam dimmer/flash switch
49. High beam warning lamp
55. Horn switch
165. Ignition auxiliary (+)
117. Ignition coil
1. ignition load relay
163. Ignition load relay (+)
166. Ignition on (+)
8. Ignition switch
10. Ignition warning lamp
115. Inertia switch
41. Instrument illumination (4 off)
104. Interior lamp switch
99. Interior lamp delay unit
128. 'Key-in switch'
100. LH door edge lamp
108. LH front door switch

91. LH front fog lamp
77. LH front indicator lamp
47. LH high beam
57. LH horn
75. LH indicator warning lamp
25. LH license plate lamp
45. LH low beam
101. LH puddle lamp
105. LH rear door switch
76. LH rear indicator lamp
89. LH reverse lamp
23. LH side lamp
87. LH stop Lamp
24. LH tail lamp
146. Low coolant level warning **lamp**
144. Low coolant switch
147. Low fuel level warning lamp
150. Low oil ievel probe
149. Low oil level logic unit
143. Low screen wash switch
142. Low screen wash fluid level warning lamp
20. Main lighting switch
151 **Not** used - will illuminate on Initial bulb check
113. Oil pressure switch
112. Oil pressure/level warning lamp
154. Park brake warning switch
153. Parking brake/brake fluid loss warning lamp
182. Rear amplifier audio
102. RH door edge lamp
109. RH front door switch
92. RH front fog lamp
80. RH front indicator lamp
48. RH high beam
56. RH horn
7Sa. RH indicator warning lamp
25a. RH license plate lamp
46. RH low beam
103. RH puddle lamp
106. RH rear door switch
81. RH rear indicator lamp
90. RH reverse lamp
27. RH side lamp
88. RH stop lamp
28. RH tail lamp
66. Radio aerial amplifier
124. Radio and six speakers
123. Radio fuse
182. Rear amplifier audio
98. Rear interior lamp
141. Rear screen wash pump
138. Rear wash wipe switch
139. Rear wipe delay unit
140. Rear wiper motor
129. Resistor
85. Reverse lamp switch
29. Rheostat
127. **Seat belt warning lamp**
131. Seat buckle switch
121. Speed transducer
7. Starter inhibit switch
5. Starter motor
6. **Starter relay**
4. Starter solenoid
84. Stop tamp switch
125. Sun raof relay
134. Sunroof connection point **(option)**
36. Switch illumination (2 off)
9. Tachometer
107. Tailgate switch
3. Terminal post
111. Thermostat heated jets
132. Trailer pick up point
82. Trailer warning lamp
136a. Transfer box oil temperature switch
133. Transfer box neutral switch
58. Under hood illumination switch
59. Under hood light
70. Voltage sensitive switch
157. Warning lamp control unit
168. Warnrng lights supply common earth (-)
169. Warning lights **supply (+)**
53. Water temperature sender unit
52. Water temperature gauge temperature **warning** lamp
35 Window litt connections


W
N
WO
WK
BR
B
EARTH
COMMON WARNING LIGHT EARTH
163
164
165
166
167
168
169
WLG
WR
WG
WS
NY
NR
NW
NLG
ULG
RLG
LGB
LGR
LGK
LGN
GK
GP
GN
GR
GW
PK
PN
PU
PW
PO
PR
BO
BP
BK
BLG
GLG
NB
WB
YLG
1
2
3
4
5
6
7
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9
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RR2942E

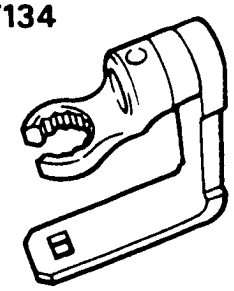


RR2943E

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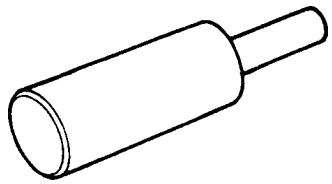
ENGINE

LST134



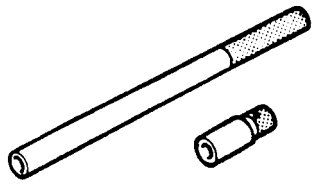
Torque Adaptor
Lambda sensor

RO600959



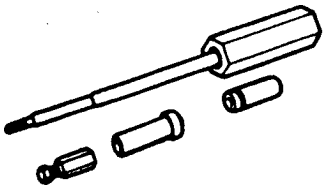
Drift for valve guide replacement (intake and exhaust)

R0605351



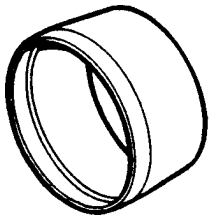
Connecting rod bolt-guide tool

18G1150



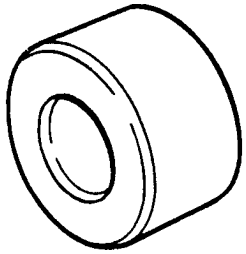
Remover/replacer piston pin, basic tool

R01014



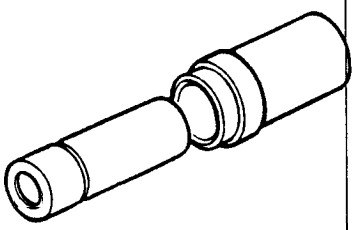
Rear crankshaft oil seal protection sleeve

RO605774A



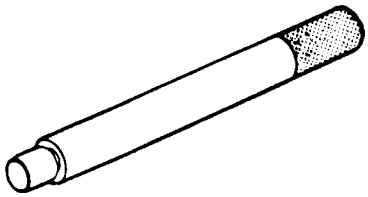
Distance piece for valve guide

18G1150E



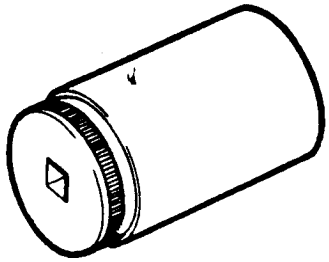
Adaptor-remover/replacer piston pin

R0274401



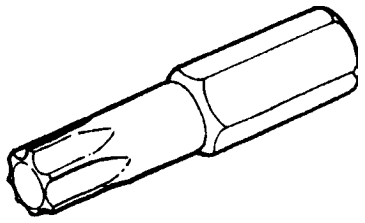
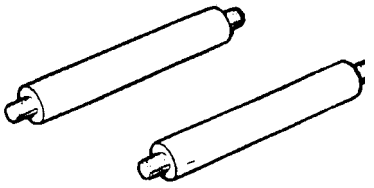
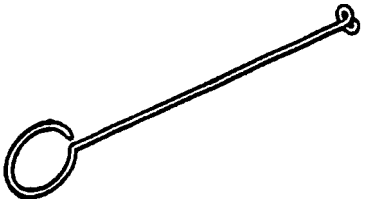
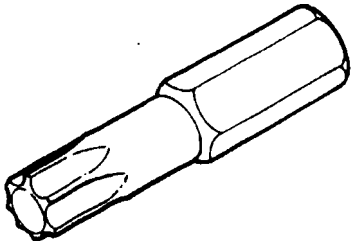
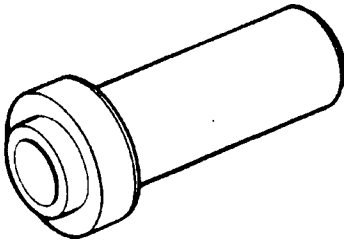
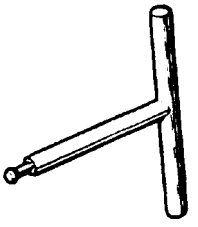
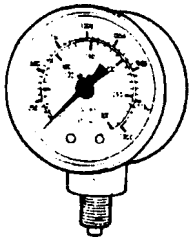
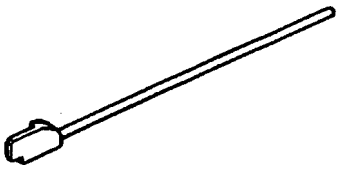
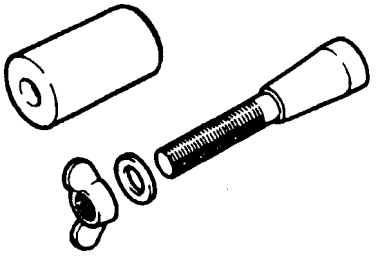
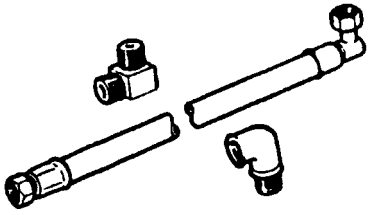
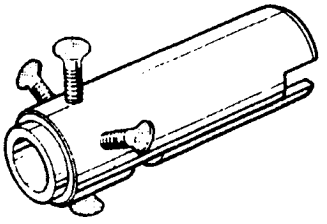
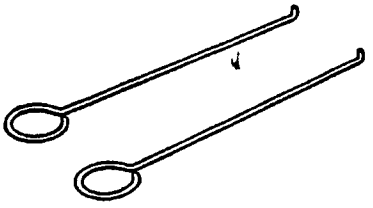
Drift for valve guide removal (intake and exhaust)

18G587

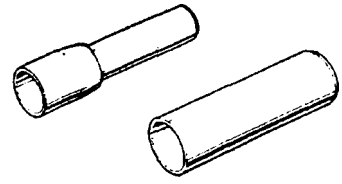
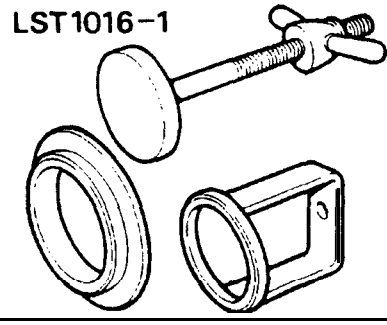
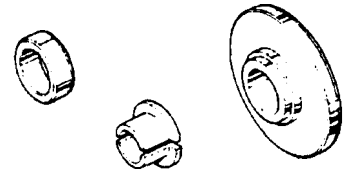
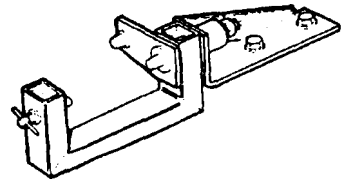
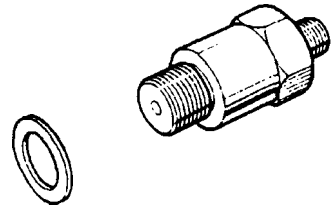


Socket- piston pin remover/replacer

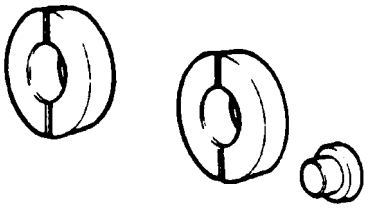
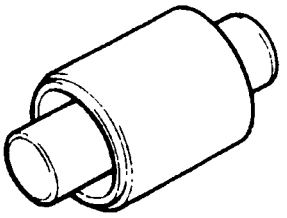
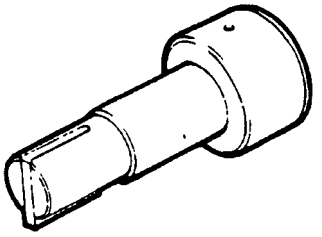
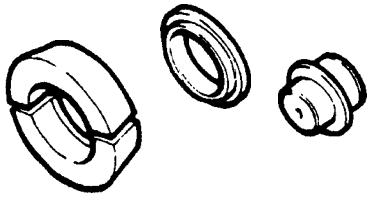
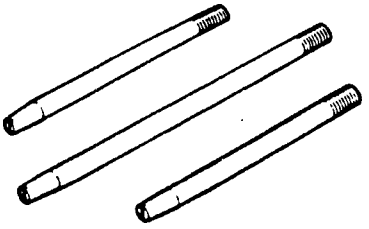
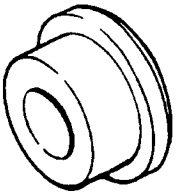
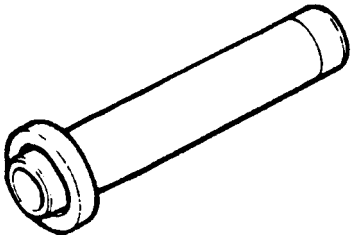
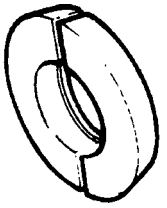
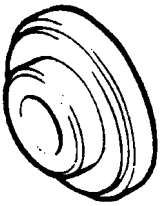
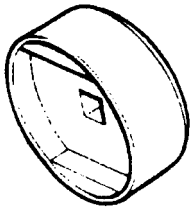
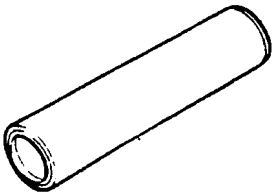
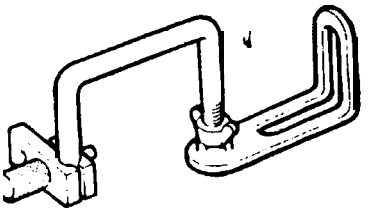
AUTOMATIC GEARBOX

TX27 	**18G1501** 	**LST112** 
Torx bit	Torque converter removing handles	Kick down cable remover
TX30 	**LST108** 	**LST113** 
Torx bit	Replacer-front and rear oil seals	Control unit inlet oil seal replacer
18G 502A 	**LST109** 	**LST114** 
O-300 P.S.I. Pressure gauge	Selector linkage setting gauge	Selector shaft oil seal replacer
18G502K 	**LST111** 	**ST115** 
Hose and adaptor	Oil pump rotation sleeve and end float gauge	'B' clutch assembly puller hooks

RR1869

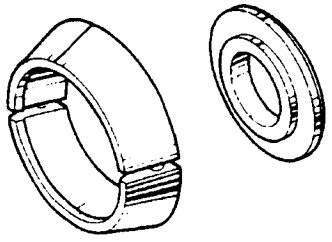
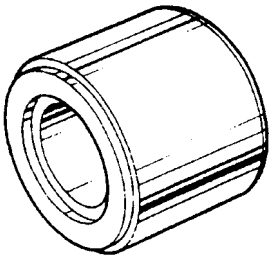
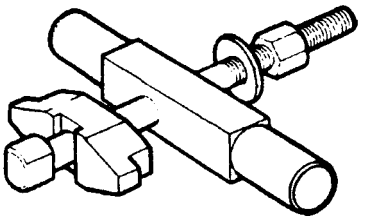
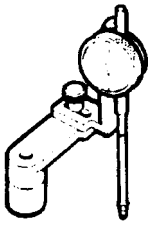
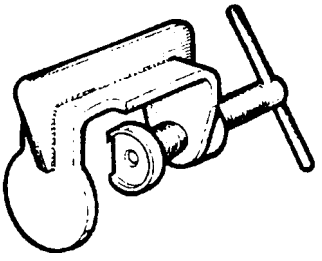
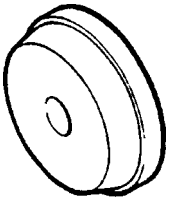
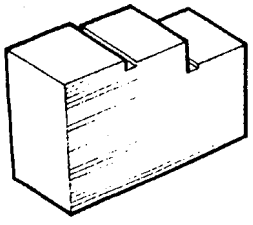
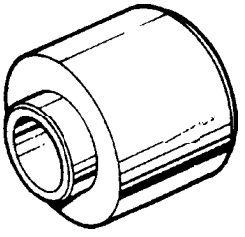
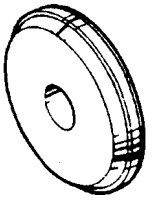
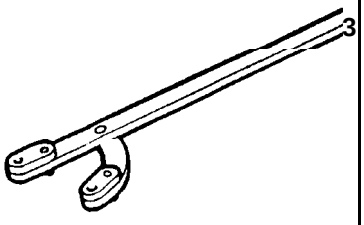
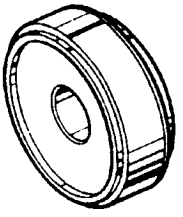
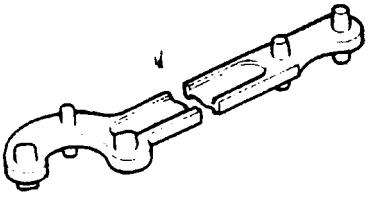
LST116 	LST1016-1 	
'B' clutch '0' ring and snap ring replacer	Adaptor-clutch spring compressor	
LST117 		
Gear train remover/replacer		
LST118 		
Transmission holding fixture		
LST502-1 		
Adaptor pressure take off		

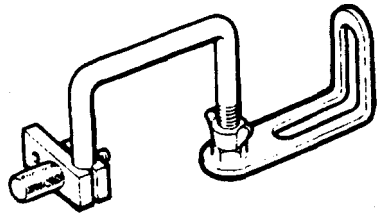
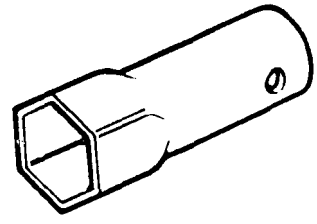
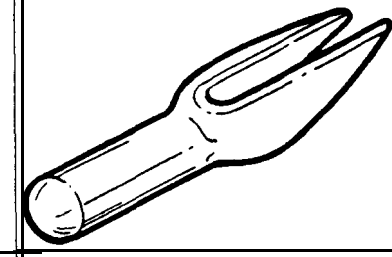
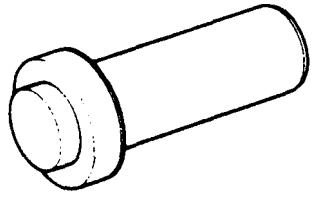
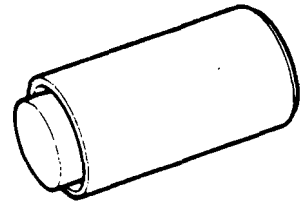
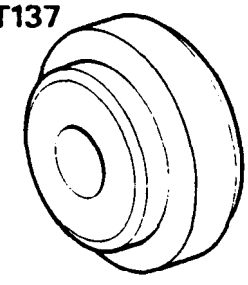
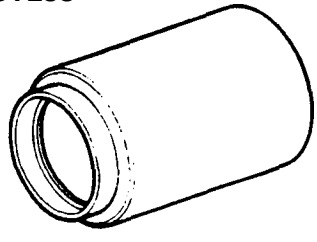
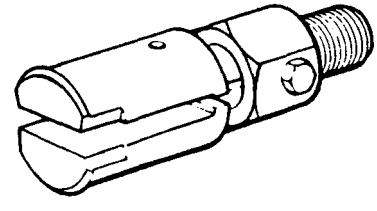
TRANSFER GEARBOX

18G47BB 	**1861424** 	**LST105** 
Adaptor centre differential remover	Centre differential bearing replacer	Input gear turning mandrel
18G47-7 	**18G1425** 	**LST550-4** 
Input gear cluster bearing cones replacer	Guide studs	Adaptor-intermediate gear bearing races replacer
1861422 	**LST47-1** 	**LST550-6** 
Mainshaft rear oil seal replacer(LT230/Borg Warner)	Adaptor-centre differential bearing remover	Input shaft oil seal replacer (Borg Warner)
1861423 	**LST104** 	**R0530106** 
Adaptor socket centre differential locknut remover/replacer	Intermediate gear dummy shaft	Bracket for dial gauge indicator

RR1871

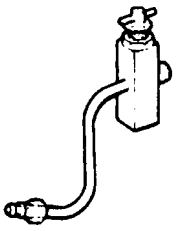
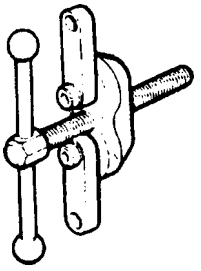
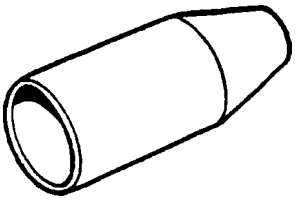
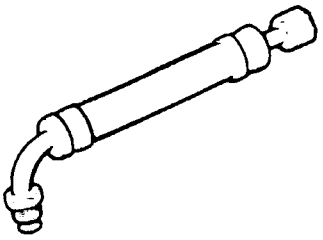
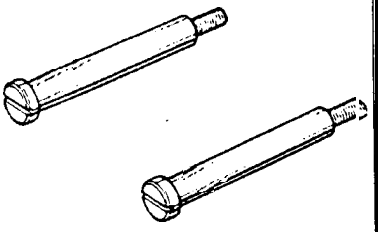
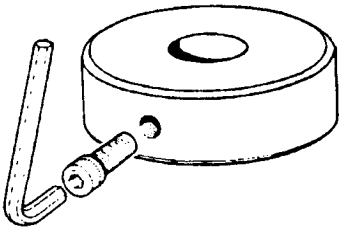
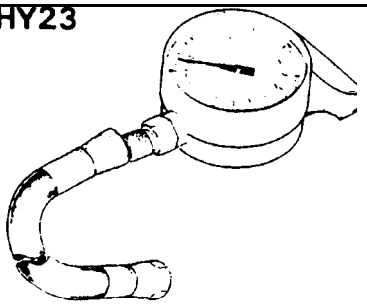
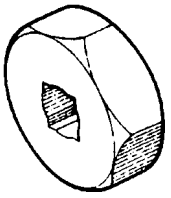
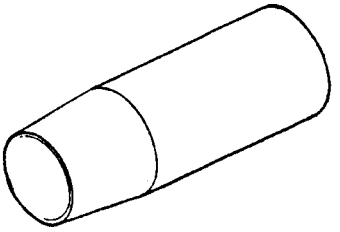
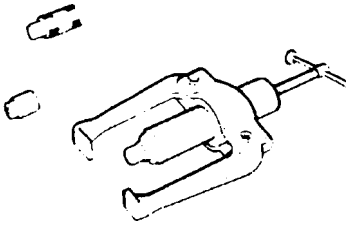
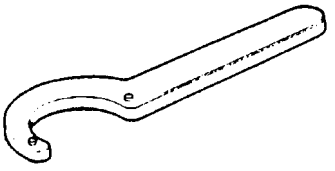
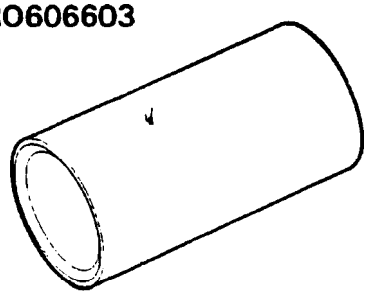
FRONT AND REAR AXLE AND FINAL DRIVE

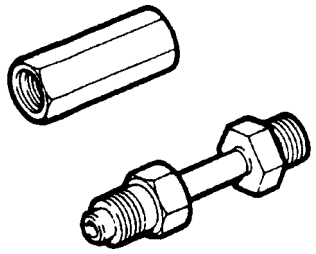
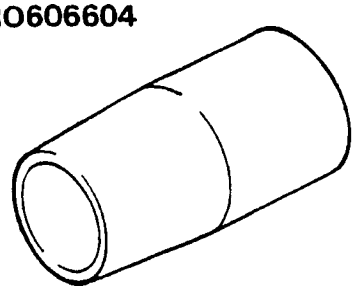
18G47-6 	1861382 	RO262757A 
Remover/replacer pinion head bearing	Drift-pinion oil seal replacer	Extractor-pinion races
18G191 	18G 672 	RO262757-1 
Bevel pinion setting gauge	Disc brake piston compressor	Replacer adaptor pinion head bearing races
18G191-4 	LST106 	RO262757-2 
Universal setting block	Pinion oil seal replacer	Adaptor-pinion tail bearing race-replacer
18G 1205 	LST550-5 	R0530105 
Adjustable flange holding wrench	Hub inner and outer oil seal installer/adaptor	Wrench-differential overhaul

R0630106 	**RO606435A** 	**RO1006** 
Bracket for dial gauge indicator	Wrench for hub adjustment	Self levelling unit- ball joint remover
LST132 	**LST133** 	**LST137** 
Bearing installer	Seal installer	Seal installer
LST138 	**18G 284AAH** 	
Seal installer	Bearing/Seal extractor	

RR2862

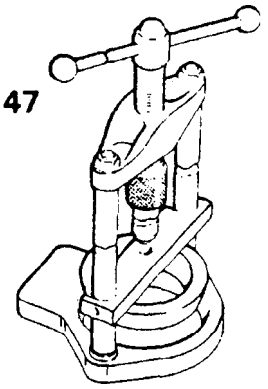
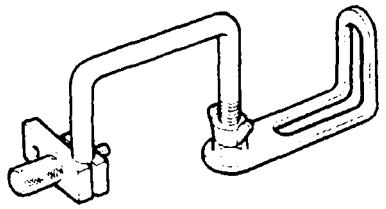
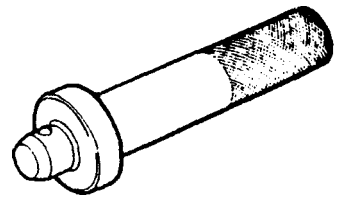
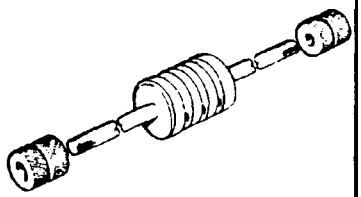
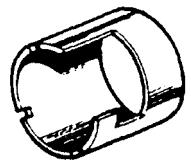
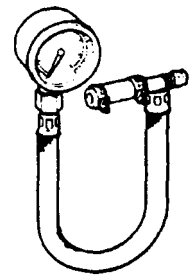
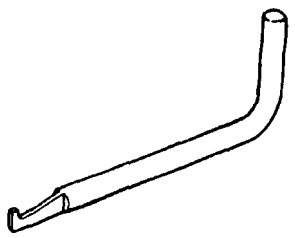
POWER STEERING • STEERING

JD10-2 	18G1014 	R01015 
Power steering test set adaptor	steering wheel puller-nain tool	Oil seal protector input shaft
JD10-3A 	18G1014 -2 	RO1016 
Adaptor hose-hydraulic pressure test	Adaptor pins- steering wheel puller	Torque setting tool
HY23 	LST119 	RO606602 
Power steering test set	Steering box adjuster screw wrench	Ring expander for steering box valve and worm seals
MS252A 	LST120 	RO606603 
Hydraulic steering arm remover	'C' wrench for adjustable screw locknut	Ring compressor for steering box valve and worm seals

LST10-11	RO606604	
		
Adaptor-hydraulic pressure test steering	Sector shaft spline, seal protector	
		3

RR2180

GENERAL AND BASIC TOOLS

MS 47 	R0530106 	18G134 
Multi purpose hand press	Bracket for dial gauge indicator	Bearing and oil seal replacer-main tool
MS284 	R0600964 	18G1500 
Impulse extractor UNF main tool	Wrench for fuel tank sender unit	Fuel Pressure Gauge
1861271 		
Oil seal remover		