DEFENDER

Workshop Manual

Werkplaatshandboek

Manuel D' Atelier

Werkstatthandbuch

Manuale D' Officina

Manual De Taller

Manual de Oficina

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

Raise rear of vehicle

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

HYDRAULIC VEHICLE RAMP (FOUR POST)

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

TWO POST VEHICLE RAMPS

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

DYNAMOMETER TESTING

The front and rear axles cannot be driven independently.

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

Four wheel dynamometers

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

Two wheel dynamometers

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

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

FUEL SYSTEM

Fuel lift pump type	Mechanical with hand primer
Fuel lift pump pressure	42 - 55 Kgf/cm^2 (3 - 4 lbf/in^2) at 1800 rpm
Fuel filter	Paper element in disposable canister
Air cleaner	Paper element type

COOLING SYSTEM

System type	Pressurised, spill return, thermostatically controlled water and anti freeze mixture. Pump assisted thermo syphon. Coolant radiator combined with oil cooler and turbo intercooler.
Cooling fan	11 blade axial flow 433 mm diameter, 1.29:1 drive ratio, with viscous coupling.
Pump type	Centrifugal, impellor, belt driven
Thermostat opening	88° C
Expansion tank cap pressure	1,06 Kgf/cm^2 (15 Ibf/in^2) (system pressure)

CLUTCH

Type	Valeo diaphragm spring
Centre plate diameter	235 mm
Facing material	Verto F202 grooved
Release bearing	Ball journal

TRANSMISSION

Main gearbox

Type R380	Single helical constant mesh
Speeds	5 forward, 1 reverse, all synchromesh

Transfer box

Type LT230	Two speed reduction on main gearbox output. Front and rear drive permanently engaged via a lockable differential

Rear axle

Type	Spiral bevel, fully floating shafts
Ratio	3.54:1

300 Tdi ENGINE

Type ..... 2.5 Litre Turbo diesel intercooled

Firing order 1-3-4-2

Injection timing ..... 1,54 mm lift at T.D.C.

Injection timing with electronic EGR ..... 1,40 mm lift at T.D.C.

Timing marks:

Valve timing - manual ..... Slot for pin in flywheel and TDC mark on front pulley.
Injection timing ..... Timing pin (service tool)
Tappet clearances inlet and exhaust ..... 0,20 mm cold

Valve timing:	**Inlet**	**Exhaust**
- Opens	16° B.T.D.C.	51° B.B.D.C.
- Closes	42° A.B.D.C.	13° A.T.D.C.
- Peak	103° A.T.D.C.	109° B.T.D.C.
- Lift	9,67 mm	9,97 mm

Maximum governed speeds:

- No load (neutral/full throttle) ..... 4600 + 40 - 120 rev/min
- Idle speed at running temperature ..... 720 ± 20 rev/min
- Die-down time ..... 4 seconds

INJECTION PUMP

Make & type - standard ..... Bosch rotary R509 type with boost control and two speed mechanical governor with auto advance and solenoid electrical shut-off. Tamper proof sealing on, no load governed speed and fuel adjustment screws. Constant volume delivery valves

Make & type - Electronic EGR ..... Bosch rotary R509/1 type with boost control and two speed mechanical governor with auto advance and solenoid electrical shut-off. Tamper proof sealing on flight speed and fuel adjustment screws. Constant volume delivery valves. Throttle position sensor for EGR control.

HEATER PLUGS

Make & type ..... Probe type, No.0100226129A Beru 12 volts
Time to reach operating temperature of 850° C ..... 8 seconds

Propeller shaft Front and Rear Lubrication nipples (hubs, ball joints etc.) Seat slides Door lock striker	NLGI - 2 Multi-purpose Lithium based GREASE
Brake and clutch reservoirs	Brake fluids having a minimum boiling point of 260° C (500° F) and complying with FMVSS 116 DOT4
Engine coolant (Pre-99MY)	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. Maximum concentration is 60%.**
Engine coolant (99MY on)	Use Texaco XLC long life coolant. Use one part anti-freeze to one part water for protection down to -36° C (-33° F). **IMPORTANT: Coolant solution must not fall below 50% anti-freeze otherwise damage to the engine is liable to occur. Maximum concentration is 60%.**
Battery lugs, earthing surfaces where paint has been removed.	Petroleum jelly. **NOTE: Do not use Silicone Grease**
Air Conditioning System Refrigerant	Use only refrigerant R134a
Compressor Oil	Sanden oil

LUBRICATION PRACTICE

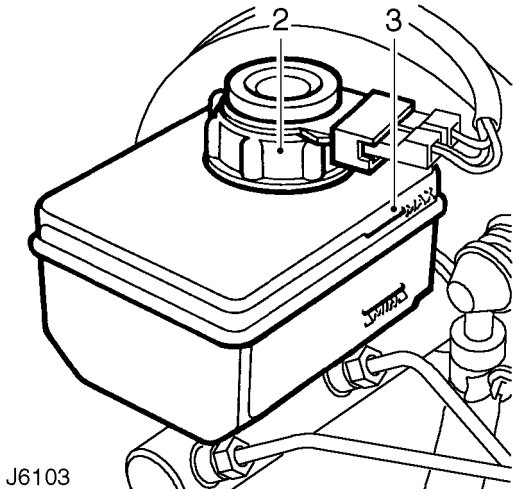
Use a high quality oil of the correct viscosity range and service classification in the engine during maintenance and when topping up. The use of oil not to the correct specification can lead to high oil and fuel consumption and ultimately to damaged components.

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

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

CHECK/TOP UP BRAKE FLUID RESERVOIR

WARNING: DO NOT drive the vehicle with the fluid level below 'MIN' mark.
Brake fluid will damage painted surfaces; clean up any spillage immediately and rinse with plenty of water.
If brake fluid should come into contact with skin or eyes, rinse immediately with plenty of water.



1. Check the fluid level visually through transparent side of reservoir without removing cap.
2. If level is below 'MAX' mark clean and remove reservoir cap.
3. Top up to 'MAX' mark with recommended brake fluid ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended lubricants and fluids***

CHECK/TOP UP WASHER RESERVOIR

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

LUBRICATE ACCELERATOR LINKAGES

Lubricate accelerator cable at adjustment ferrule and linkage with injector pump and at pedal clevis pin.

CHECK/ADJUST ENGINE IDLE SPEED

Check/adjust low and high engine idle speed with engine at normal running temperature. ***See FUEL SYSTEM, Adjustment, low and high idle speed adjustment***

CHECK/ADJUST STEERING BOX

Check steering box and pipes/hoses for fluid leaks.

Check that there is no backlash in steering box when in straight ahead position. Adjust steering box if necessary. ***See STEERING, Adjustment, Power steering box***

VISUALLY CHECK INTERCOOLER/RADIATOR FOR EXTERNAL OBSTRUCTIONS

Check intercooler/radiator for external obstructions. If necessary, apply air pressure to engine side of matrix to clear obstruction. If mud or dirt is evident, carefully use a hose to wash away obstruction.

FLUSH DIESEL INTERCOOLER

Remove

1. Remove intercooler matrix. ***See FUEL SYSTEM, Repair, Intercooler***
2. Flush matrix with ICI 'GENKLENE' proprietary cleaner, following manufacturers instructions.
3. Dry intercooler completely ensuring that no liquid remains in matrix.

Refit

4. Refit intercooler matrix. ***See FUEL SYSTEM, Repair, Intercooler***

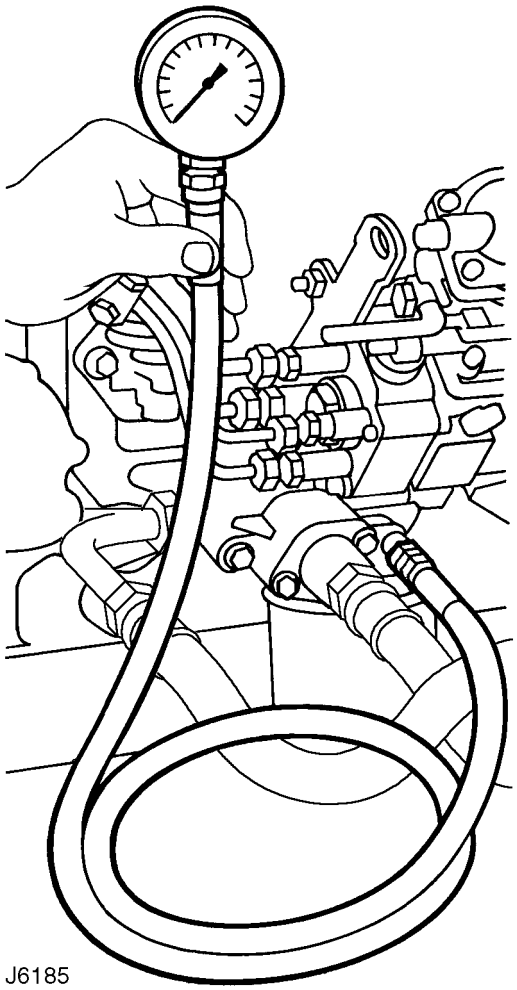
ENGINE OIL PRESSURE TEST

Service repair no - 12.90.09/01

WARNING: Use suitable exhaust extraction equipment if an engine test is being carried out in a workshop.

WARNING: If vehicle has been running, engine wil be hot; care must be taken when fitting test equipment to prevent personal injury.

1. Check that engine lubricant is to correct level.
2. Remove oil pressure switch .



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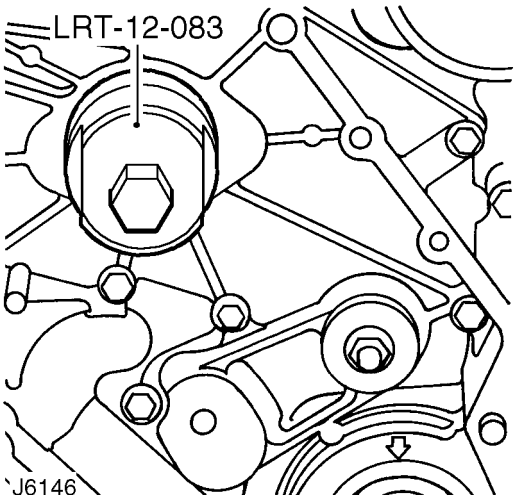
3. Connect pressure test gauge **LRT-12-052A**, as shown.
4. Start and run engine to normal operating temperature.
5. With engine running at idle check oil pressure, which should read 1.76 bar (25.87 lbf/in^2).
6. If pressure is low it can be caused by the following:-
   Thin or diluted oil.
   Low oil in sump.
   Choked oil strainer.
   Faulty oil pressure relief valve.
   Excessively worn or damaged oil pump displacement gears.
   Excessive crankshaft bearing clearance.
7. If excessive pressure is indicated it can be caused by :-
   Overfilling engine with lubricant.
   Sticking oil pressure relief valve.
   Blockage in breather system.

CAMSHAFT OIL SEAL

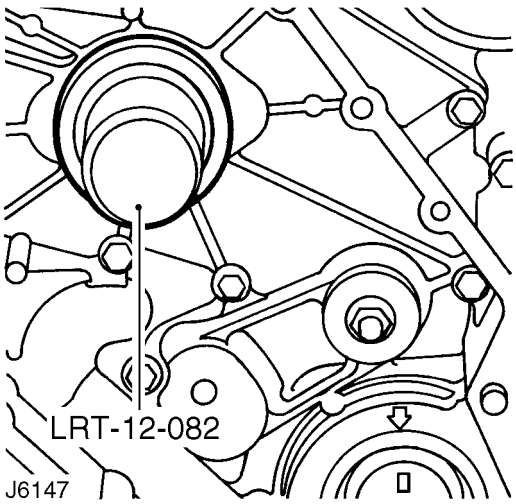
Service repair no - 12.13.05

Remove

1. Remove camshaft gear. ***See Camshaft gear***



2. Remove camshaft oil seal from front cover using special tool **LRT-12-083**.



Refit

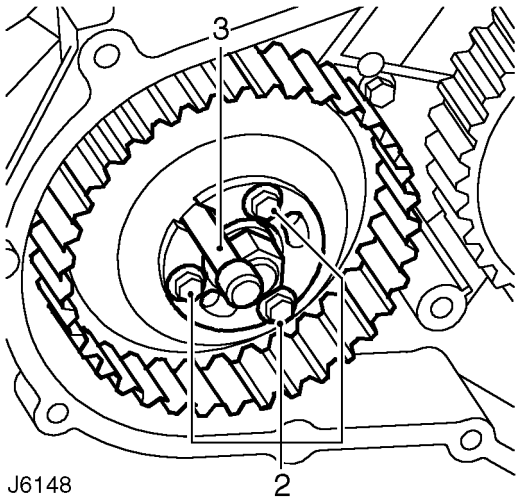
3. Lubricate a new camshaft oil seal with clean engine oil.
4. With lip side leading, drive in seal squarely using special tool **LRT-12-082**.
5. Fit camshaft gear. ***See Camshaft gear***

INJECTION PUMP GEAR

Service repair no - 19.30.06

Remove

1. Remove camshaft drive belt. ***See Camshaft drive belt***

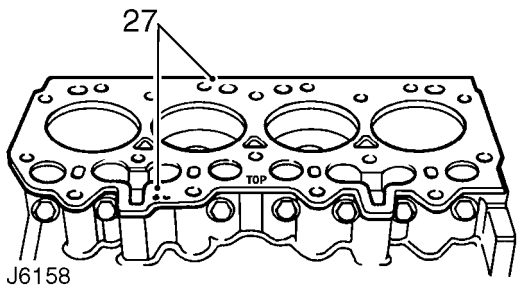


2. Slacken 3 bolts on front of injector pump gear.
3. Remove special tool pin from gear.
4. Remove 3 bolts and withdraw gear and retaining plate.

Refit

CAUTION: It is important to ensure that when the injection pump is locked no attempt must be made to rotate it. Take care not to allow the crankshaft to be turned.

5. Fit gear and retaining plate. Tighten bolts to ***25 Nm (18 lbf/ft).***
6. Insert pin from special tool **LRT-12-045** in injection pump gear and through into pump flange.
7. Fit camshaft drive belt. ***See Camshaft drive belt***



28. Lower cylinder head onto block ensuring correct location with dowels.

NOTE: Cylinder head retaining bolts can be used up to a maximum of five times.

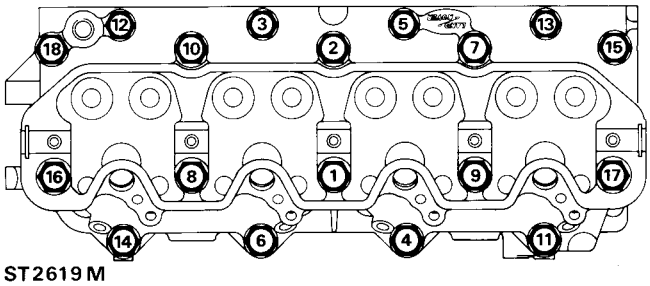
29. Lubricate threads of bolts with light oil and fit to positions shown below. (Fit air cleaner mounting bracket at positions 6 and 14).

Bolt sizes:

M10 x 117mm locations 3, 5, 12, and 13.

M12 x 140mm locations 1, 2, 7, 8, 9, 10, 15, 16, 17, and 18.

M12 x 100mm locations 4, 6, 11, 14.



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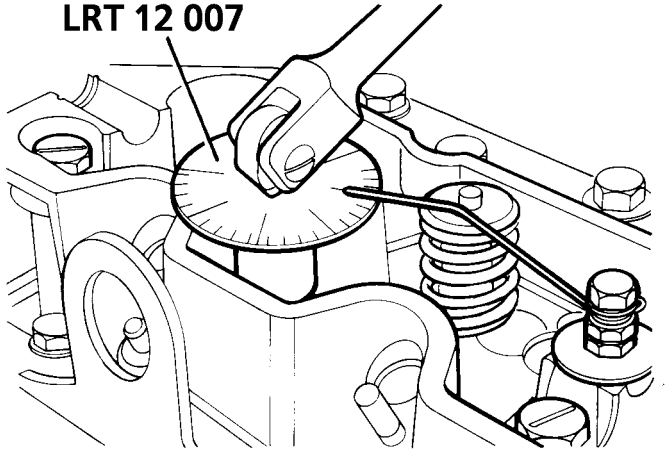
30. Tighten bolts so that underside of heads just make contact with cylinder head.
31. Following the sequence indicated, tighten all bolts to ***40 Nm (30 lbf/ft).***



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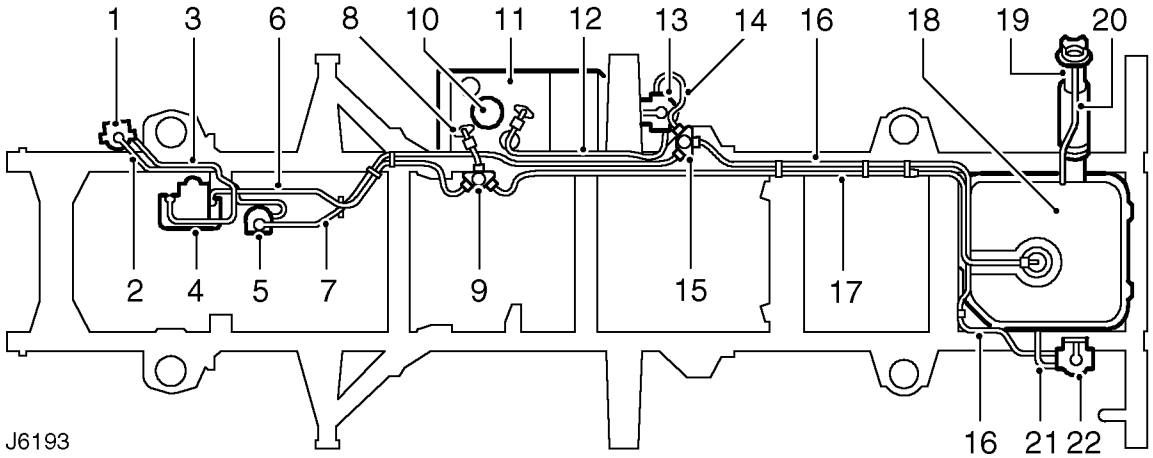
32. Attach angle gauge **LRT-12-007**.
33. Make a suitable pointer from welding rod and attach to a bolt screwed into a rocker shaft securing bolt hole.
34. Tighten all bolts through 60° strictly in sequence illustrated.
35. Repeat 60° tightening procedure, again strictly in sequence illustrated.
36. Tighten the 10 longer bolts (M12 x 140mm) a further 20°, again following the sequence illustrated.

NOTE: Repositioning of the pointer will be necessary to reach all bolts, the pointer can be fitted to the rocker shaft securing studs using 2 nuts.

CAUTION: The double tightening procedure MUST be carried out, on no account should the bolt tightening be performed in one operation, otherwise damage to the cylinder head may occur.

37. Fit valve stem caps.
38. Fit push rods to locations from which they were removed.
39. Position rocker shaft assembly over locating studs and fit retaining nuts and bolts, but do not tighten at this stage.
40. Attach angle gauge **LRT-12-007**.
41. Make a suitable pointer and attach to one of the rocker shaft locating studs.
42. Tighten all fixings in turn to ***5 Nm (4 lbf/ft).*** Then tighten a further 50° in same sequence.

NOTE: Repositioning of the pointer will be necessary to reach all fixings.



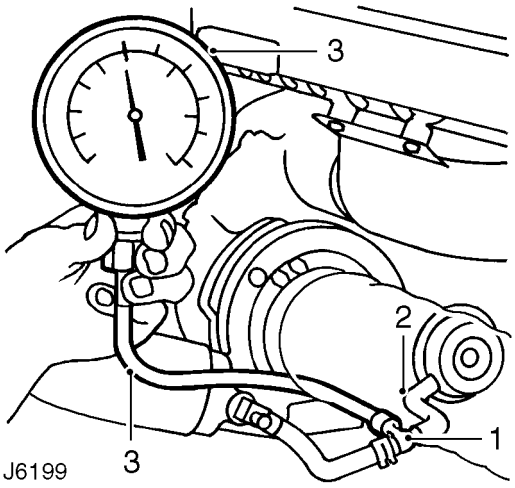
110/130 TWIN TANK FUEL SYSTEM - 5 DOOR VEHICLES

1. Fuel filter
2. Supply pipe, lift pump to filter
3. Supply pipe, filter to injection pump
4. Fuel injection pump
5. Fuel lift pump
6. Spill return pipe, injection pump to change-over tap
7. Supply pipe, fuel tank change-over tap to lift pump
8. Spill return pipe, change-over tap to side tank
9. Change-over tap, spill return
10. Fuel filler cap
11. Side fuel tank
12. Supply pipe, side tank to sedimentor
13. Sedimentor, if fitted, side tank
14. Supply pipe, sedimentor to fuel tank change-over tap
15. Change-over tap, side and rear tanks
16. Supply pipe, rear sedimentor to fuel tank change-over tap
17. Spill return pipe, change-over tap to rear tank
18. Rear fuel tank
19. Fuel filler pipe
20. Breather pipe
21. Supply pipe, rear tank to sedimentor
22. Sedimentor, if fitted, rear tank

NOTE: If sedimentors are not fitted, the fuel supply pipe from the side and rear tanks connects directly to the fuel tank change-over tap.

TURBOCHARGER BOOST PRESSURE - CHECK

Service repair no - 19.42.06



1. Disconnect actuator hose from turbocharger and insert a suitable 'T' piece connector.
2. Connect a short length of suitable hose to turbocharger and 'T'piece.
3. Connect further hose to 'T' piece and pressure gauge **LRT-12-011**. The pressure gauge hose must be long enough to reach into the vehicle cab so that the gauge can be observed by driver or passenger.
4. To check maximum boost pressure, drive vehicle normally, but in such a manner that full throttle can be maintained whilst climbing a hill with engine speed held steady between 2,500 and 3,000 rev/min. Under these circumstances boost pressure should read 0,95 - 1,09 Kgf/cm^2 (13.5 - 15.5 lb/in^2).

PRIMING THE FUEL SYSTEM

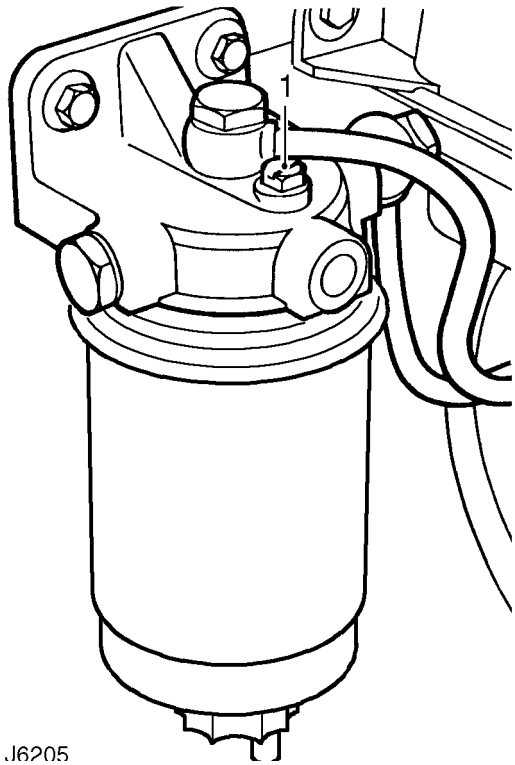
Service repair no - 19.50.01

NOTE: If the fuel system has been completely drained carry out the procedures for priming both the sedimentor, if fitted, and fuel filter and injection pump.

Sedimentor and fuel filter

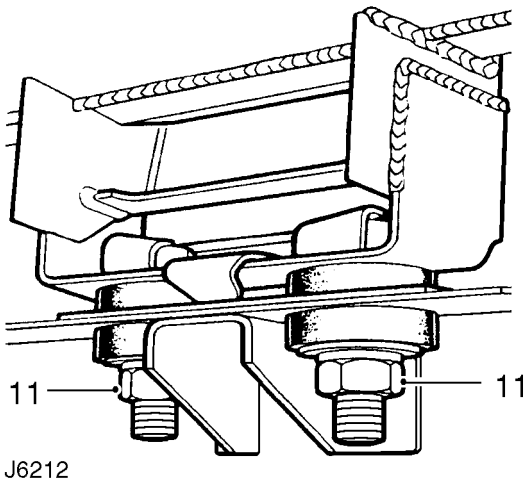
If the sedimentor or fuel filter have been dismantled and air has entered the fuel system carry out the following procedure:

1. Slacken fuel filter bleed screw.
2. Operate hand priming lever on fuel lift pump until fuel, free from air, emerges from filter.



NOTE: Ensure that the fuel pump lever is on the bottom of operating cam when priming, otherwise maximum movement of the lever cannot be achieved.

3. Tighten filter bleed screw whilst fuel is still emerging.



11. Remove 2 nuts that secure front fixing assembly of the tank to chassis mounting bracket.
12. Remove tank rear mounting nuts.
13. With care, lower tank sufficiently to enable nut and olive of spill return to be disconnected from elbow in centre of tank.
14. Continue to lower tank until it can be removed from vehicle.

△ **NOTE: On later vehicles a separate stone guard is fitted and is attached to the tank with the existing front and rear fixings.**

15. If required, remove tank gauge unit. ***See INSTRUMENTS, Repair, Fuel gauge tank unit - side fuel tank*** or ***See INSTRUMENTS, Repair, Fuel gauge tank unit - rear fuel tank, 110/130***

Refit

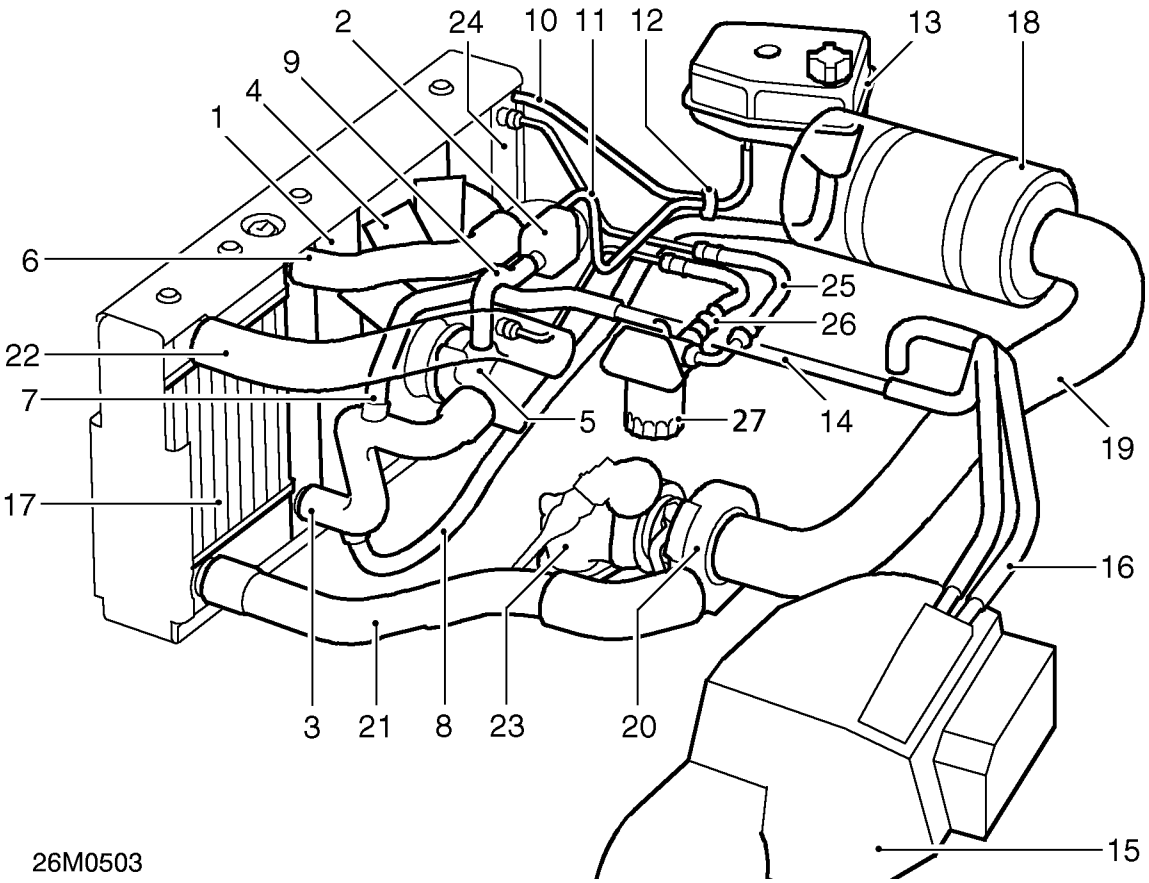
16. If applicable, locate stone guard under tank.
17. Raise rear tank into position and connect spill return pipe to the elbow with the nut and olive.
18. Continue to raise tank so that front and rear mounting bolts locate in respective tank flange holes.
19. Fit and tighten fixings to ***20 Nm (15 lbf/ft).***
20. Connect fuel suppnly pipe to the tank unit.
21. Fit fuel filler hose and breather pipe to filler tube and secure with retaining clips.
22. Fit LH lashing eye to chassis.
23. Fit anti-roll bar chassis mountings. ***See REAR SUSPENSION, Repair, Anti-roll bar***
24. Check that drain plug is secure and fill fuel tank.
25. Reconnect battery.
26. Prime fuel system. ***See Adjustment, Priming the fuel system*** and start engine.
27. Check system for leaks and operation of fuel gauge.

ENGINE COOLING SYSTEM

Description

The complete cooling system of the 300Tdi engine incorporates three independent functions:- Engine (coolant) cooling; Turbo (charge air) intercooling; Engine oil cooling.

The intercooler is a separate aluminium unit, located on the LH side of the engine compartment adjacent to the radiator, sharing the same upper and lower mountings. For details of turbo intercooling ***See FUEL SYSTEM, Description and operation, Operation*** . The oil cooler matrix is an integral part of the radiator. Pre-formed pipes/hoses are used to link the components within the separate systems as shown below.



Engine cooling system

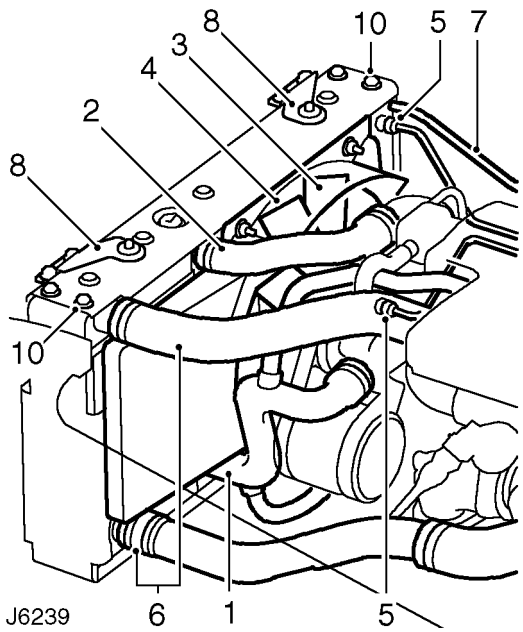
1. Radiator
2. Thermostat housing
3. Radiator bottom hose
4. Viscous fan
5. Water pump
6. Radiator top hose
7. Heater return hose
8. Coolant supply hose
9. By-pass hose
10. Radiator bleed (purge) hose
11. Bleed (purge) hose, thermostat housing
12. 'Y' piece ejector
13. Expansion tank
14. Heater rail
15. Heater unit
16. Heater feed hose
17. Intercooler
18. Air cleaner
19. Air feed hose
20. Turbocharger
21. Charge air supply pipe/hose
22. Cooled charge air supply hose
23. Exhaust manifold
24. Engine oil cooler
25. Feed pipe, engine oil cooler
26. Return pipe, engine oil cooler
27. Oil filter

RADIATOR

Service repair no - 26.40.01

Remove

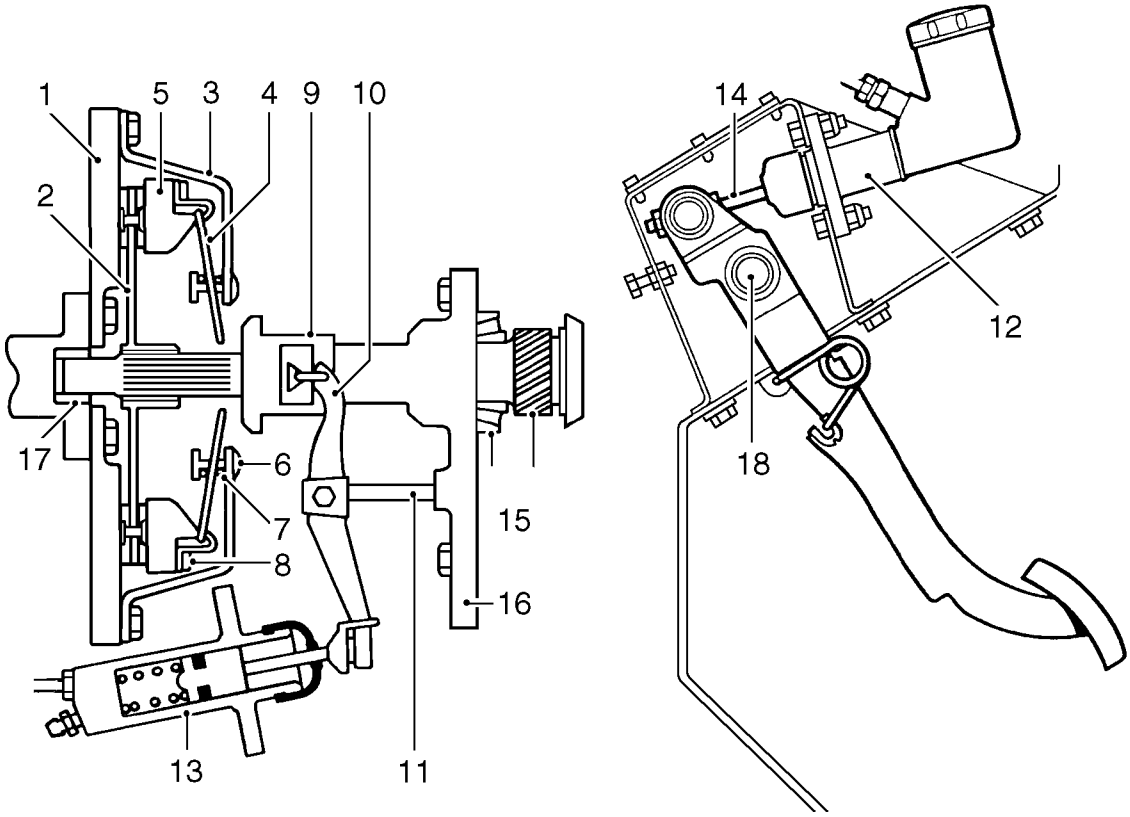
1. Disconnect radiator bottom hose and drain cooling system. ***See Adjustment, Drain and refill cooling system***
2. Disconnect radiator top hose.
3. Remove viscous fan unit. ***See Viscous coupling and fan***
4. Remove fan cowl. ***See Fan cowl***



5. Disconnect oil cooler pipes. Plug all connections to prevent oil spillage and ingress of dirt.
6. Disconnect top and bottom intercooler hoses.
7. Disconnect bleed hose at radiator.
8. Remove 2 bolts from both sides securing radiator mounting brackets to bonnet platform.
9. Lift and remove radiator/intercooler assembly from vehicle.
10. Remove 2 bolts from both sides and detach radiator top cover from side covers.
11. Lift and remove radiator from intercooler and RH side frame.
12. Check condition of locating grommets in radiator top cover and lower mounting bushes. Renew if necessary.

Refit

13. Position radiator between intercooler and RH side frame.
14. Fit radiator top cover to side covers.
15. Lower radiator/intercooler assembly into position.
16. Secure radiator mounting brackets to bonnet platform.
17. Fit radiator bleed hose.
18. Fit top and bottom intercooler hoses.
19. Fit oil cooler pipes.
20. Fit fan cowl ***See Fan cowl*** .
21. Fit viscous fan unit. ***See Viscous coupling and fan***
22. Fit radiator top hose.
23. Fit radiator bottom hose and refill cooling system. ***See Adjustment, Drain and refill cooling system***



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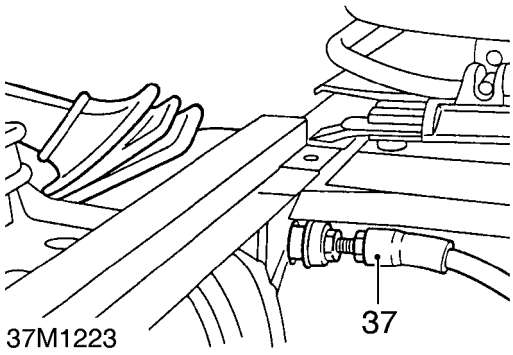
When the clutch pedal is depressed, hydraulic fluid transmits the movement via the slave cylinder, release lever (10), bearing (9), to the inner fingers of the diaphragm spring (4).

The diaphragm spring (4) pivots on the bearing rings (7) and fulcrum posts (6) causing the pressure plate (5) to release the clamping force on the friction plate and linings (2).

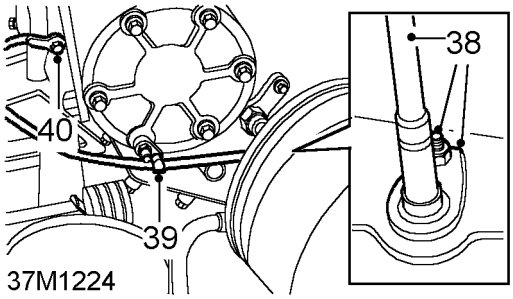
As the the clamping force is removed from the friction plate (2), the plate slides on the splines of the primary shaft (15) and takes up a neutral position between the flywheel (1) and the pressure plate (5), thus disconnecting the drive between the engine and the gearbox.

Assemble

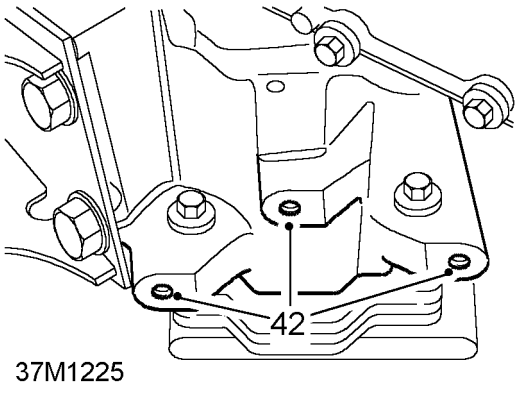
10. Fit bleed valve to cylinder body, do not overtighten.
11. Lubricate seals, piston and bore with new hydraulic fluid.
12. Fit seal into piston groove with lip of seal towards fluid inlet end of cylinder.
13. Locate spring over front end of piston.
14. Fit assembly, spring first, into cylinder ensuring seal lip does not fold back.
15. Fill dust cover with suitable rubber grease and fit cover to cylinder.
16. Fit slave cylinder ***See Repair, Slave cylinder*** .



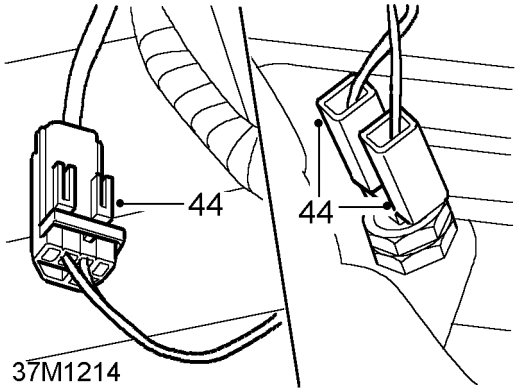
37. Pull handbrake cable through heel board and tie aside.



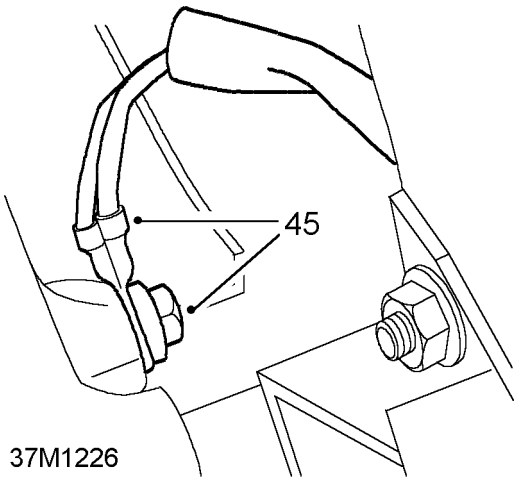
38. Remove retaining nut, release clamp, and disconnect speedometer cable from transfer box.
39. Release speedometer cable from retaining clip on transfer box.
40. Remove retaining nut and release battery earth strap from transfer box.



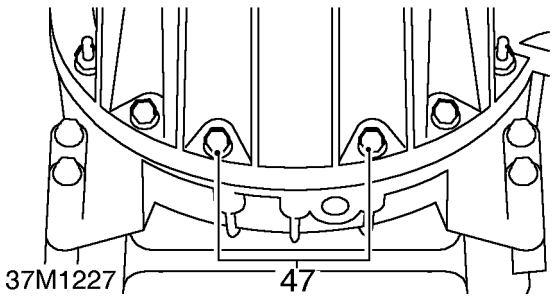
41. Secure manufactured cradle **LRT-99-007** to a suitable hydraulic hoist.
42. Raise hoist and secure to gearbox with 3 bolts in location provided.
43. Lower hoist sufficiently to allow transfer lever to clear transmission tunnel aperture.



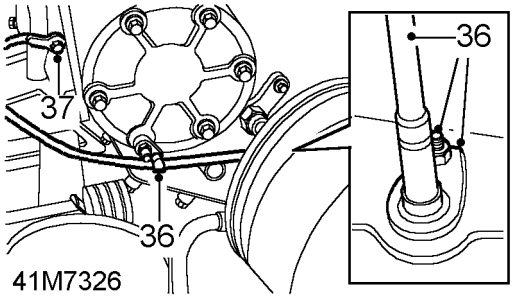
44. Disconnect differential lock switch and reverse light connectors.



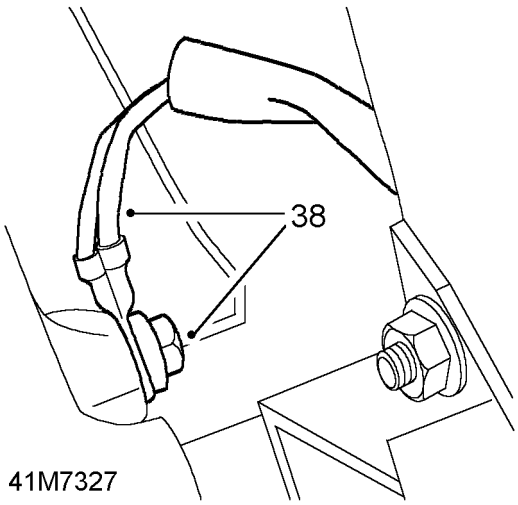
45. Remove bolt and release earth leads from RH side of transfer box.



46. Support engine under sump with a jack.
47. Remove 14 bell housing to engine fixings.
48. Withdraw transmission whilst ensuring all connections to engine and chassis are released.
49. Lower hoist and remove gearbox assembly.



36. Remove retaining nut, release clamp, and disconnect speedometer cable from transfer gearbox.
37. Remove battery earth strap retaining nut, 1 nut and 4 bolts, securing transfer box to main gearbox extension case.



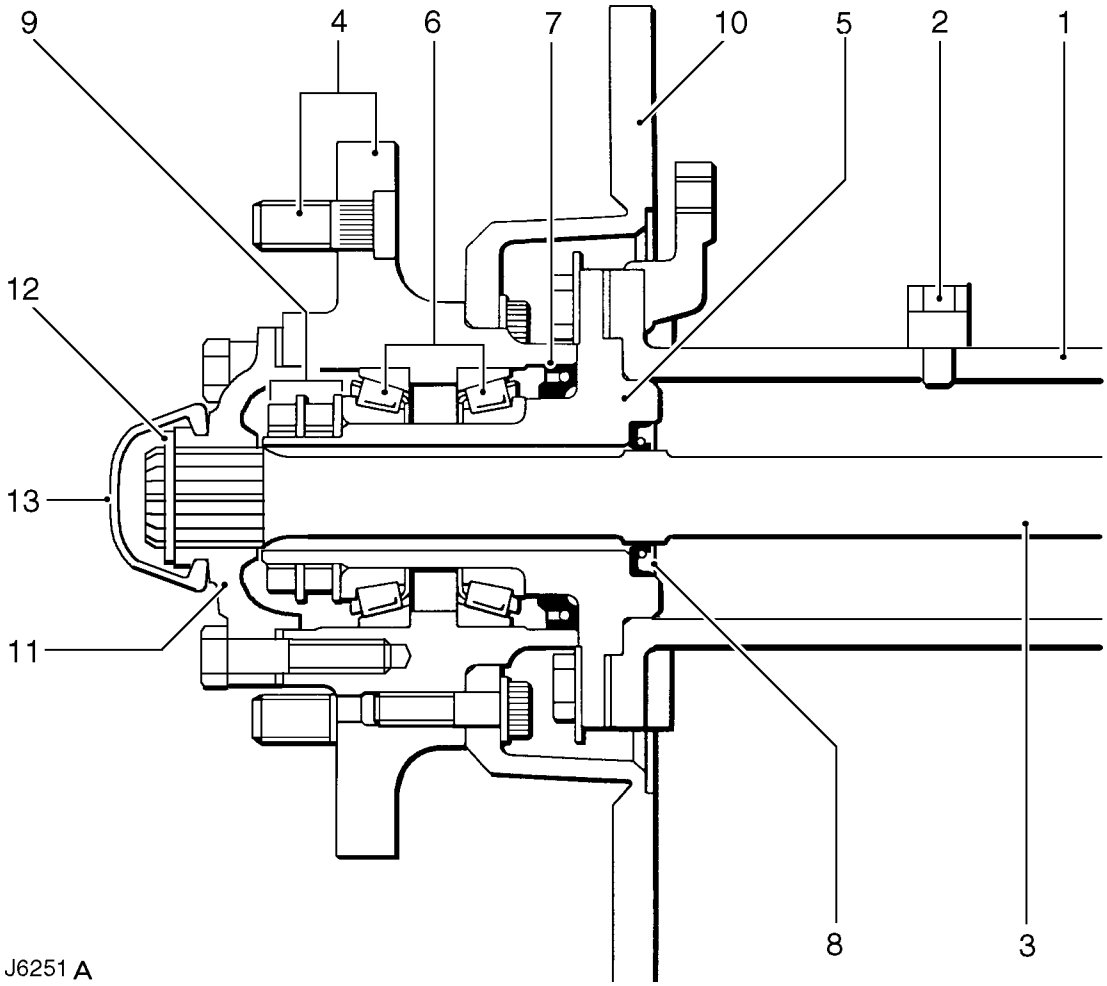
38. Remove retaining nut securing earth leads to RH side of transfer box.
39. Fit three guide studs, **LRT-41-009**, through transfer box bolt holes to support it during removal.
40. Lower hoist and withdraw transfer box from main gearbox.
41. Remove transfer box.

Refit

42. Ensure joint faces of transfer box and main gearbox are clean and guide studs, **LRT-41-009**, are fitted to extension case.
43. Lubricate oil seal in joint face of transfer box.
44. Secure transfer box to adaptor plate on lifting hoist and raise hoist until transfer box can be located over guide studs.
45. Remove guide studs, fit battery earth strap, and secure transfer box to main gearbox extension case. Tighten fixings to ***45 Nm (33 lbf/ft).***
46. Fit electrical leads to differential lock switch.
47. Raise hoist and remove wooden block supporting main gearbox.
48. Secure LH and RH mounting brackets to gearbox and tighten fixings to ***55 Nm (41 lbf/ft).***
49. With assistance and using a body jack between chassis longitudinals, jack chassis sufficiently to enable fitment of crossmember.
50. Position chassis crossmember and locate over fixing studs of LH and RH gearbox mounting rubbers .
51. Align crossmember and secure to chassis with 4 nuts and bolts on each side.

NOTE: Fit battery earth strap retaining clip to LH top bolt.

52. Remove body jack.
53. Fit retaining nut to LH and RH mounting rubbers. Tighten to ***21 Nm (15 lbf/ft).***
54. Remove 4 bolts securing hoist adaptor plate to transfer box bottom cover.
55. Lower hoist and move aside.
56. Clean threads of the 4 bolts, coat with Loctite 290, and fit to transfer box bottom cover. Tighten to ***25 Nm (18 lbf/ft).***
57. Fit earth leads to RH side of transfer box.
58. Connect differential lock control operating rod to pivot arm.
59. Fit speedometer cable to transfer box.
60. Fit front and rear propeller shafts to transfer box. Tighten nuts to ***47 Nm (33 lbf/ft).***
61. Fit intermediate silencer. ***See MANIFOLD AND EXHAUST SYSTEM, Repair, Intermediate silencer - 90; Refit*** or ***See MANIFOLD AND EXHAUST SYSTEM, Repair, Intermediate pipe - 110/130; Refit*** .
62. Refill transfer box with recommended oil ***See SECTION 10, Maintenance, Under vehicle maintenance***

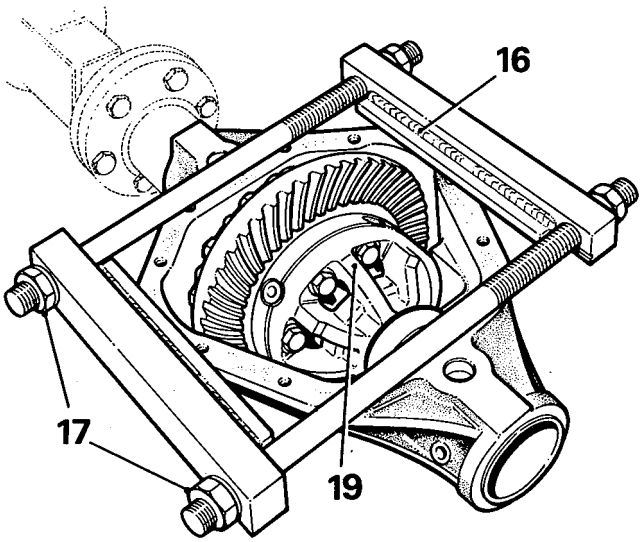


Rear axle hub - 110/130

1. Axle casing
2. Ventilation pipe
3. Axle shaft
4. Wheel studs and hub
5. Wheel bearing stub axle
6. Wheel bearings
7. Inner hub seal
8. Outer hub/axle shaft seal
9. Hub lock plate, thrust washer and nuts
10. Brake disc
11. Drive flange
12. Drive shaft circlip
13. Dust cap

CAUTION: To prevent permanent damage to the gear carrier case, it must not be over-stretched. Each flat on the turnbuckle is numbered to enable a check to be made on the amount turned. The maximum stretch permitted is 0,30 mm, equivalent to three flats.

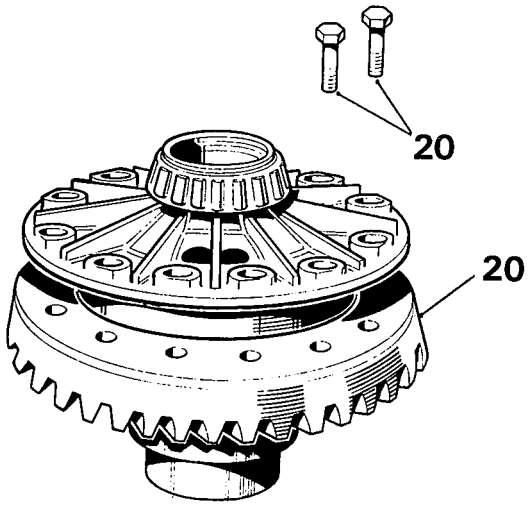
15. Ease off adjuster and remove spreader.



ST597M

Using axle compressor LRT-51-503 (GKN 131)

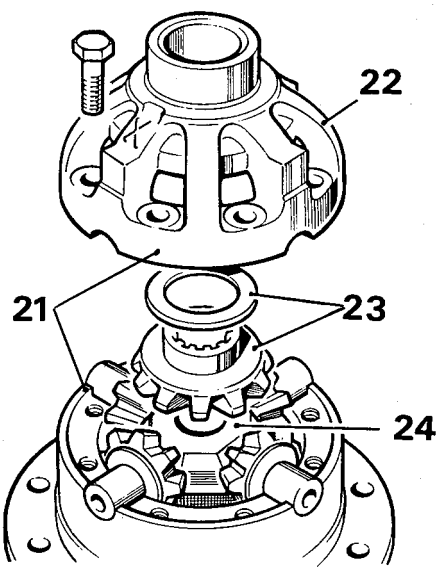
16. Place tool on to differential casing, as illustrated, with weld seam uppermost. Ensure that plates rest squarely on differential machined surface and end bars butt against edges of casing.
17. Tighten adjusting nuts by hand only, until all slack is taken up.
18. Continue to tighten both nuts alternately with a spanner, one flat at a time, to a maximum of three flats.
19. Carefully lever-out differential assembly.



ST652M

Dismantle differential

20. Add alignment marks between crown wheel and differential case for reassembly purposes, then remove fixings and withdraw crown wheel.

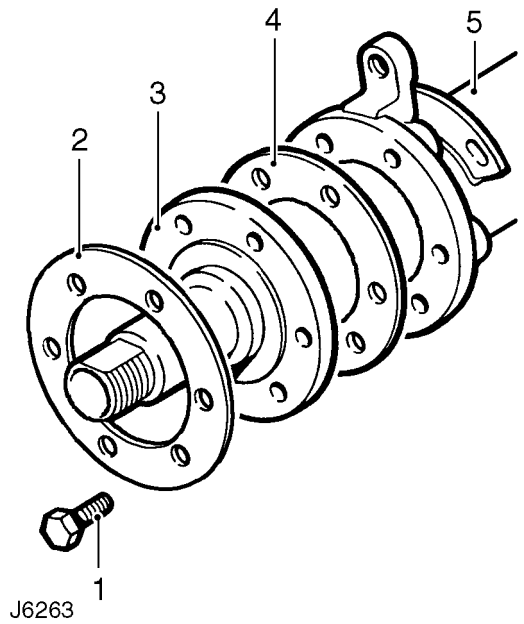


ST653M

21. Note alignment markings on two differential casings to ensure correct refitting, then remove fixings.
22. Lift off upper case.
23. Withdraw upper differential wheel and thrust washer.
24. Lift out cross-shaft and pinions.

REAR STUB AXLE - 90

Service repair no - 64.15.22.



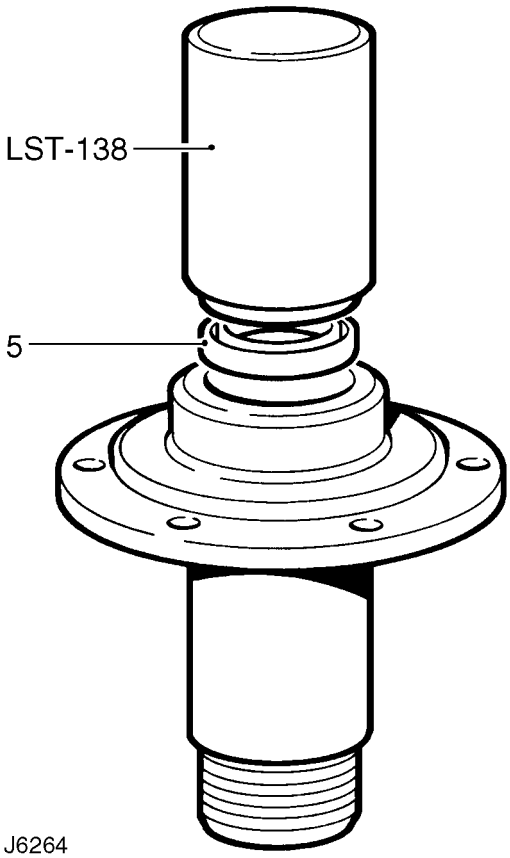
STUB AXLE COMPONENTS

1. Stub axle to axle casing bolt.
2. Mudshield.
3. Stub axle.
4. Stub axle joint washer.
5. Axle case.

Overhaul

1. Remove hub assembly ***See Repair, Rear hub assembly*** .
2. Remove 6 bolts from stub axle to axle casing.
3. Remove mudshield.
4. Remove stub axle and joint washer.

Renew rear stub axle oil seal



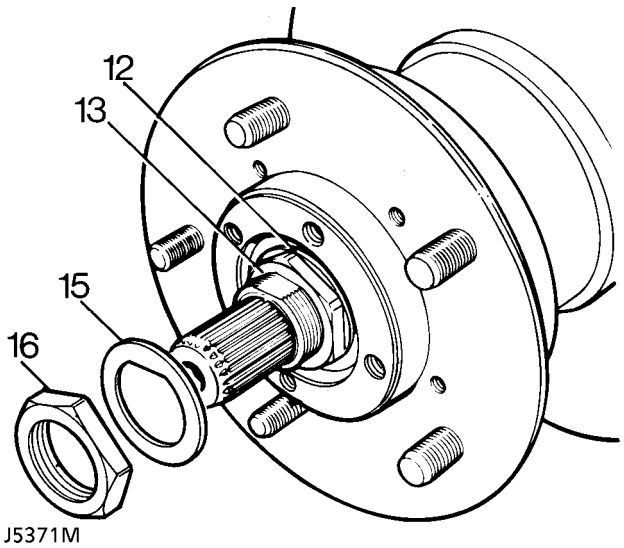
5. Remove and discard oil seal. Lubricate seal and lip with EP90 oil. Using special tool **LRT-51-004 (LST 138)** fit new oil seal lip side trailing so that seal is flush with rear face of stub axle.

Refit

6. Fit new joint washer, stub axle and mudshield bolts. Tighten bolts to ***65 Nm (48 lbf/ft).***
7. Refit hub assembly ***See Repair, Rear Hub Assembly*** .

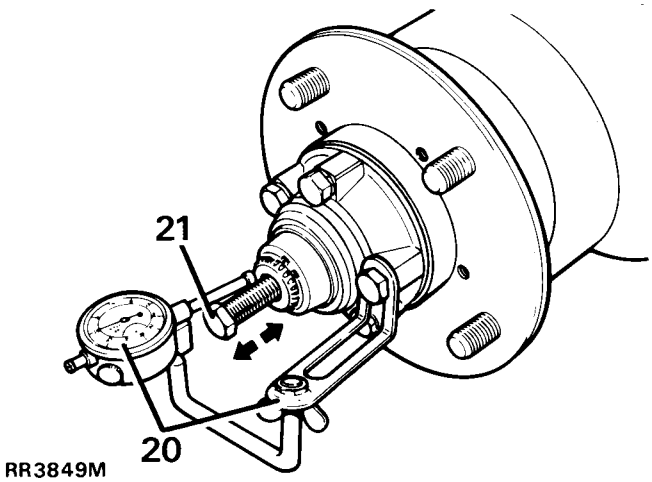
Refit

11. Clean stub axle and drive shaft and fit hub assembly to axle.



J5371M

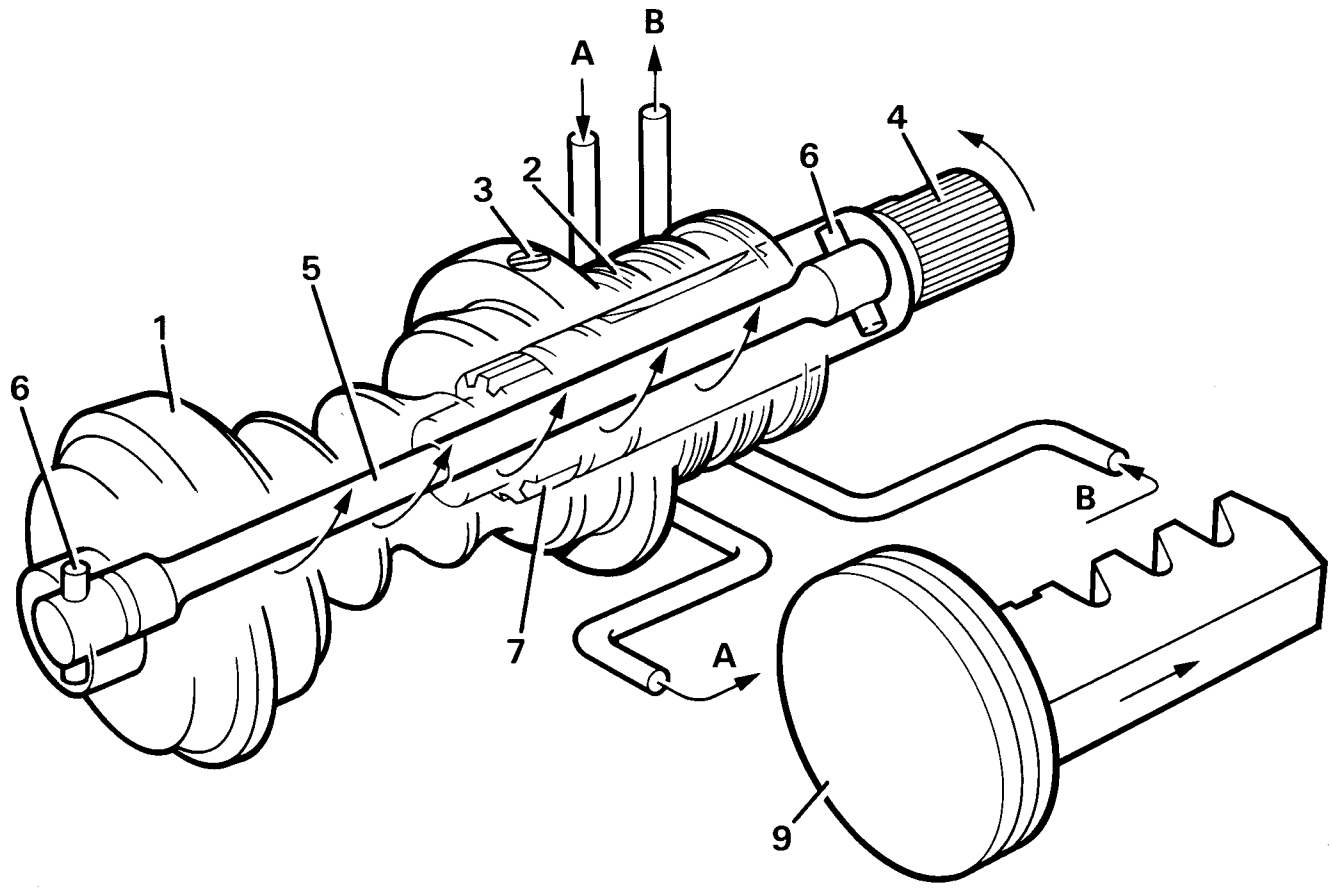
12. Fit spacing washer.
13. Fit hub adjusting nut. Tighten to ***50 Nm (37 lbf/ft).*** Ensure hub is free to rotate with no bearing play.
14. Back off adjusting nut 90° and tighten to ***10 Nm (7 lbf/ft).***
15. Fit a new lock washer.
16. Fit locknut. Tighten to ***50 Nm (37 lbf/ft).***
17. Tab over lock washer to secure adjusting nut and locknut.
18. Fit a new joint washer to driving member and fit member to hub. Tighten bolts to ***65 Nm (48 lbf/ft).***
19. Fit original drive shaft shim and secure with a circlip.



RR3849M

20. To check drive shaft end play, mount a dial gauge using bracket **LRT-99-503** and rest pin in a loaded condition on end of drive shaft.
21. Fit a suitable bolt to threaded end of drive shaft. Move drive shaft in and out noting dial gauge reading. End play should be between 0,08 to 0,25 mm.
22. If end play requires adjustment, remove circlip, measure shim thickness and fit an appropriate shim to give required end-play.
23. Remove bolt from drive shaft, fit circlip and dust cap.
24. Fit brake disc shield and brake caliper. Tighten fixings to ***82 Nm (60 lbf/ft).***
25. Bleed brake system ***See BRAKES, Repair, Brake system bleed*** .
26. Fit road wheel, remove axle stands and tighten road wheel nuts to correct torque:
Alloy wheels - ***130 Nm (96 lbf/ft)***
Steel wheels - ***100 Nm (80 lbf/ft)***
Heavy duty wheels - ***170 Nm (125 lbf/ft)***
27. Operate footbrake to locate brake pads before driving vehicle.

Rotary valve misaligned



RR3621M

Demand for assistance (Valve misaligned)

When the steering wheel and input shaft is turned, steering resistance transmitted to the worm causes the torsion bar to be twisted and the valve ports to be misaligned for a right or left turn. The misalignment of the valve ports directs all fluid pressure A to one side of the piston only and allows displaced fluid B on the other side.

When demanding maximum assistance, any excessive fluid output from the pump due to high pump speed, will circulate through the regulator valve located in the pump unit, causing the temperature of the fluid and the pump to rise rapidly.

⚠ **CAUTION: To avoid excessive fluid temperatures which could damage the oil seals, the steering must not be held on full lock for more than 30 seconds in one minute.**

Only when the steering wheel, and the demand for assistance, is released, will the torsion bar return the valve to neutral, allowing the fluid to circulate through the reservoir where it is cooled.

In the unlikely event of mechanical failure of the torsion bar, a coarse splined connection (7) between the input shaft and worm, ensures steering control is maintained sufficient to allow the vehicle to be recovered.

POWER STEERING SYSTEM - EXCESSIVE NOISE

1. Is fluid level correct?
YES - go to 3.
NO - Refill or drain to correct level. Bleed system, check for leaks ***See Repair, Power Steering System - Bleed*** .

2. Is problem resolved?
YES - end
NO - continue.

3. Is pressure hose from pump to box touching body in a hard foul condition?
YES - route hose away from body.
NO - go to 5.

4. Does noise remain?
YES - continue.
NO - end.

5. Is noise a whistle or hiss on full lock?
YES - noise is not a fault unless excessive. Compare with other vehicles
NO - go to 8.

6. Is noise excessive?
YES - continue.
NO - end.

7. Change steering box and/or pump.

8. Is noise a squeal on full lock?
YES - check drive belt tension and remove belt if necessary ***See ELECTRICAL, Repair, Auxiliary drive Belt*** .
NO - go to 10.

9. Does squeal remain?
YES - drive belt contaminated, change belt.
NO - end.

10. Is noise a continuous moan?
YES - bleed PAS system ***See Repair, Power Steering System - Bleed*** .
NO - go to 13.

11. Does moan remain?
YES - do figure 8 manoeuvres.
NO - end.

12. Does moan remain?
YES - continue
NO - end.

13. Is noise an intermittent "grunt"?
YES - ***See Power Steering System - Grunt*** .
NO - continue.

14. Is it a clunking noise?
YES - check drive belt tension and renew belt if necessary ***See ELECTRICAL, Repair, Auxiliary drive Belt*** .
NO - contact local technical office.

15. Does noise remain?
YES - Suspect suspension or drive train.
NO - end.

POWER STEERING SYSTEM - GRUNT

Steering box grunts intermittently when turning from lock to lock:

1. Is fluid level correct?
YES - go to 3.
NO - refill or drain to correct level. Bleed system, check for leaks ***See Repair, Power Steering System - Bleed*** .

2. Does grunt remain?
YES - continue
NO - end.

3. Is correct low pressure hose, steering box to reservoir, fitted?
YES - go to 5.
NO - Fit correct hose.

4. Does grunt remain?
YES - continue
NO - end.

5. Purge box by doing figure 8 manoeuvres e.g. on car park, followed by 10 minutes normal road use.

6. Does grunt remain?
YES - Contact local technical office
NO - end.

POWER STEERING BOX

Service repair no - 57.10.01

NOTE: A chassis undertray may be fitted on some vehicle derivatives to conform to legal requirements. When under chassis remove and refit procedures are required, it may be necessary to remove the undertray *See CHASSIS AND BODY, Repair, Front undertray* .

General precautions

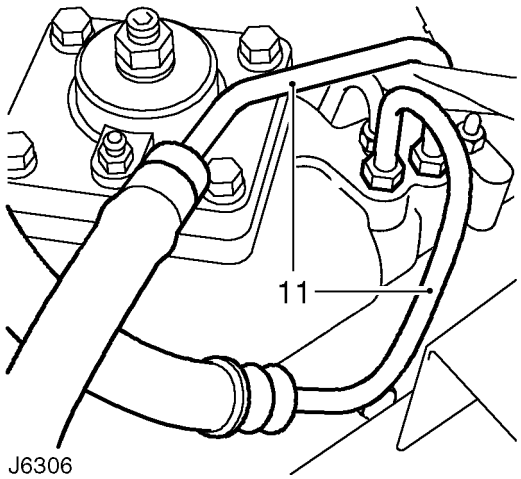
- **Whenever any part of system, is removed or disconnected, utmost cleanliness must be observed.**
- **Disconnected ports and hoses must be plugged to prevent ingress of dirt. If metal sediment is found in system, establish cause, rectify and flush system.**
- **Do not start engine until reservoir is full as pump will be damaged.**
- **Metric pipe fittings are used with 'O' ring pipe ends on fittings to steering box.**
- **Follow normal 'O' ring replacement procedure whenever pipes are disconnected.**
- **Ensure compatible metric components when fitting replacement pipes.**

CAUTION: After refitting steering linkage parts follow correct procedure to ensure that road wheels, steering box and steering wheel are correctly positioned relative to each other when in straight ahead condition.

NOTE: When drag link is disconnected from steering box, travel available at steering wheel to each full lock is not equal.

Remove

1. Site vehicle on level surface.
2. Apply park brake, chock rear wheels, raise vehicle and locate axle stands. Alternatively, raise vehicle on a hoist.
3. Remove road wheel.
4. Remove panhard rod ***See FRONT SUSPENSION, Repair, Panhard rod*** .
5. Disconnect steering damper from drag link.
6. Disconnect drag link from drop arm, see J6305 on opposite page, using a suitable extractor.
7. Slacken, but do not remove nut securing tie bar to mounting arm.
8. Remove 2 bolts securing tie bar to steering box and move aside.
9. Remove filler cap from power steering fluid reservoir.
10. Position suitable container under steering box.
11. Disconnect feed and return pipes from steering box and drain fluid.



J6306

12. Plug open pipes and steering box ports to prevent ingress of dirt. Refit fluid reservoir filler cap.
13. Centralise steering ***See Centralise steering box*** .
14. Remove pinch bolt securing lower shaft universal joint to power steering box.
15. Remove 4 bolts and 2 tab washers securing steering box to chassis side member.
16. Withdraw steering box.
17. Clean all mounting faces, unions etc. prior to refitting.

Refit

18. Position steering box to chassis side member, ensuring locating peg is engaged. Fit tab washers and tighten bolts to ***81 Nm (60 lbf/ft).***
19. Fit pinch bolt and nut securing universal joint to power steering box spline. Tighten to ***25 Nm (18 lbf/ft).***
20. Secure tie bar to mounting arm and steering box. Tighten fixings to ***81 Nm (60 lbf/ft),*** starting with tie bar to mounting nut, then loosen fixings by one complete turn.
21. Check steering box and adjust if necessary ***See Adjustment, Power steering box - adjust*** .
22. Refit drag link to drop arm and tighten nut to ***40 Nm (30 lbf/ft).*** Fit new split pin to retaining nut.

Refit

10. Fit new ball joints to track rod and loosely tighten clamp bolts.
11. Screw in ball joints to full extent of threads and fully tighten clamp bolts.

CAUTION: A track rod that is damaged or bent must be renewed. DO NOT attempt to repair or straighten it.

12. Fit track rod to swivel housing arms and tighten ball joint nuts to ***40 Nm (30 lbf/ft).*** Fit new split pin.
13. Fit track rod protection bracket to axle differential housing.
14. Check wheel alignment ***See Adjustment, Front wheel alignment*** .
15. Remove axle stands or vehicle from ramp.

84. Refit locknut and tighten.

△ **NOTE: It is important steering box is centralised before any adjustments are made.**

85. Check maximum rolling torque one and a quarter turns either side of centre position, using a torque wrench and spline socket **LRT-57-025**. Rotate adjuster screw to obtain across centre torque of 0.34 Nm plus torque figure at one and a quarter turns. Tighten adjuster locknut to ***60 Nm (44 lbf/ft).***

Adjusting rack adjuster.

86. Turn in rack adjuster to increase figure measured in instruction 85. by 0.23 - 0.34 Nm. **The final figure may be less, but must not exceed 1.35 Nm.**

87. Lock rack adjuster in position with grub screw. Tighten to ***5 Nm (4 lbf/ft).***

Torque peak check

With input shaft rotated from lock to lock, rolling torque figures should be greatest across centre position and equally disposed about centre position.

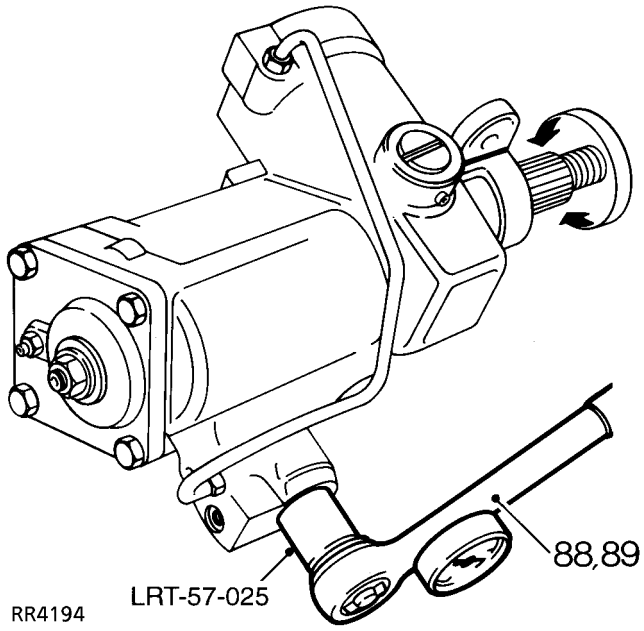
The condition depends on value of shimming fitted between valve and worm assembly inner bearing cup and casing. The original shim washer value will give correct torque peak position unless major components have been replaced.

Procedure

88. With input coupling shaft toward the operator, turn shaft fully counter-clockwise.

89. Check torque figures obtained from lock to lock using torque wrench and spline socket **LRT-57-025**.

90. Check also for equal engagement either side of centre.



Adjustments

91. Note where greatest figures are recorded relative to steering position.If greatest figures are not recorded across centre of travel (steering straight-ahead), adjust as follows:

If torque peak occurs **before** centre position, **add** to shim washer value; if torque peak occurs **after** centre position, **subtract** from shim washer value, ***refer to fitting valve and worm assembly*** .

Shim washers are available as follows:
0.03mm, 0.07mm, 0.12mm and 0.24mm.

△ **NOTE: Adjustment of 0.07mm to shim value will move torque peak area by 1/4 turn on the shaft.**

⚠ **CAUTION: When reshimming valve and worm, extreme caution must be exercised to prevent seal damage during reassembly.**

DESCRIPTION

The rear suspension design locates the rear axle with two round section steel lower link arms and a forged 'A' frame, upper link assembly. This system allows maximum axle articulation and wheel travel while maintaining roll stiffness and directional stability.

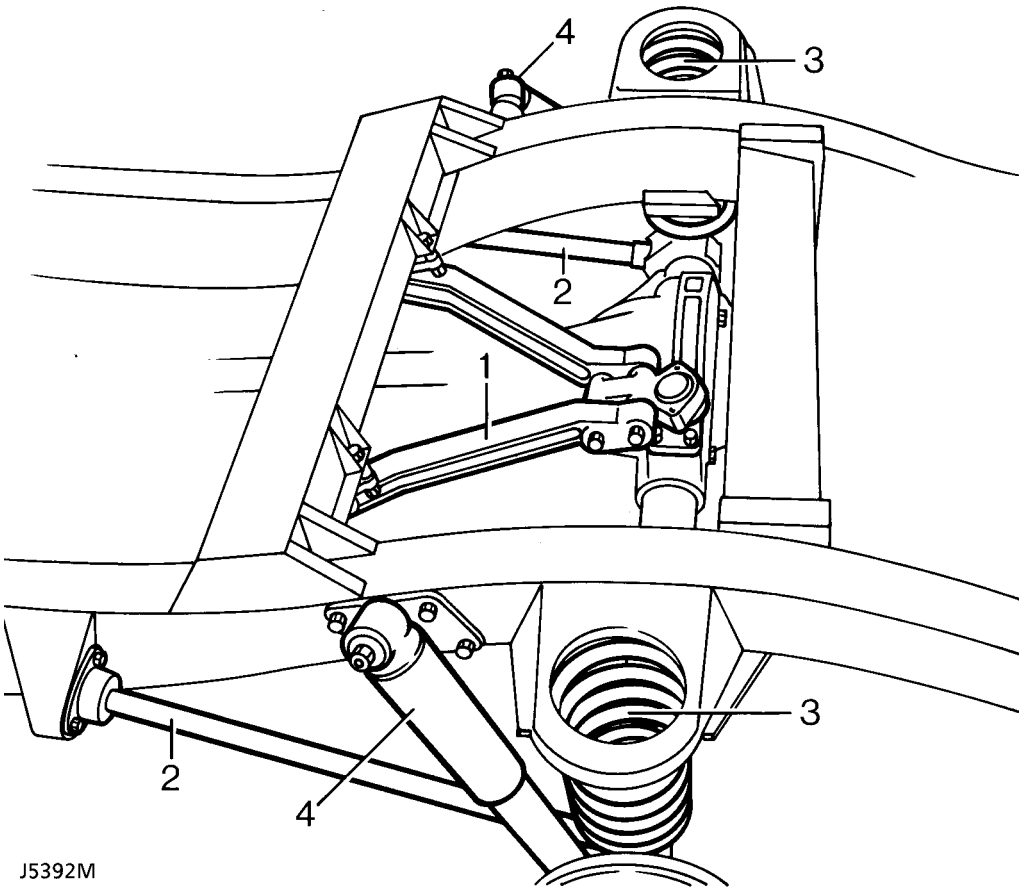
The link arm is secured by a single retaining nut to the chassis mounting, comprising a rubber bushed bracket, which is retained by three fixings. A ferrule rubber bush with a single retaining bolt is used to secure the link arm to its axle mounting.

The upper link assembly is located on the rear differential housing by a pivot ball-pin assembly. Two brackets bolted to the chassis crossmember support both sides of the 'A' frame of the link assembly, secured by single retaining bolts.

A Boge Hydromat self levelling unit can be fitted, as an option, on 110/130 models to give additional support when the vehicle is used to carry heavier loads.

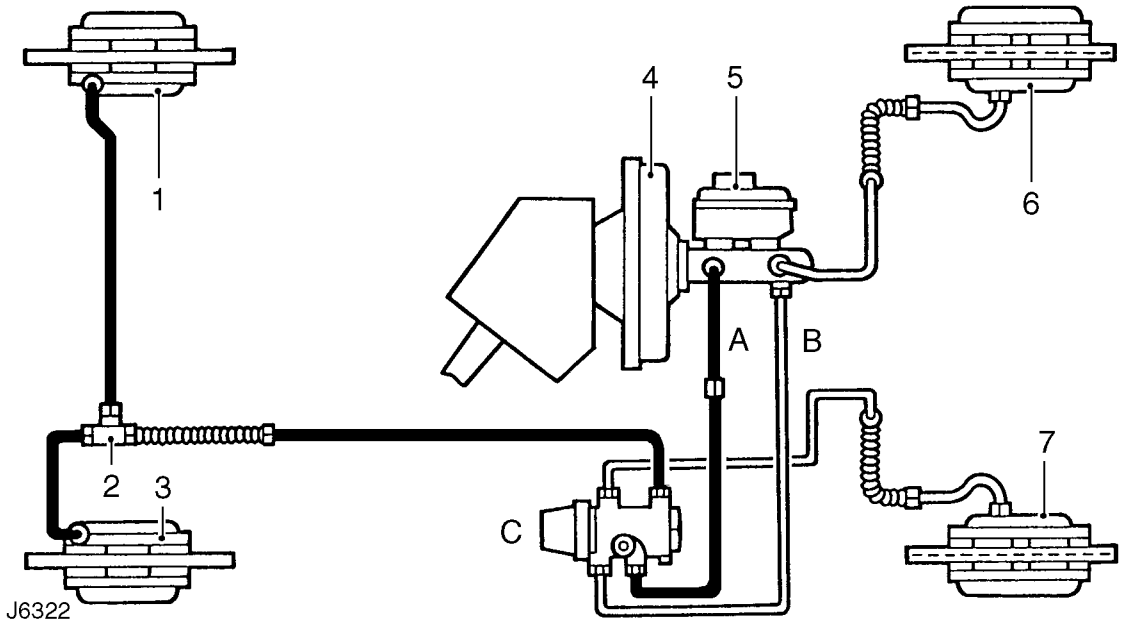
Two rubber bearing bushes, with retaining straps, secure the rear of the anti-roll bar, if fitted, to the chassis mountings, while bushed links support the front of the anti-roll bar to the axle.

Conventional long travel coil springs and hydraulic shock absorbers are used to control body movement. The shock absorbers are secured to chassis mounting brackets and fabricated lower mountings welded to to the rear axle. Retaining plates are used to secure the coil springs to the axle mounting while fabricated brackets, welded to the chassis, are used for the upper spring location.

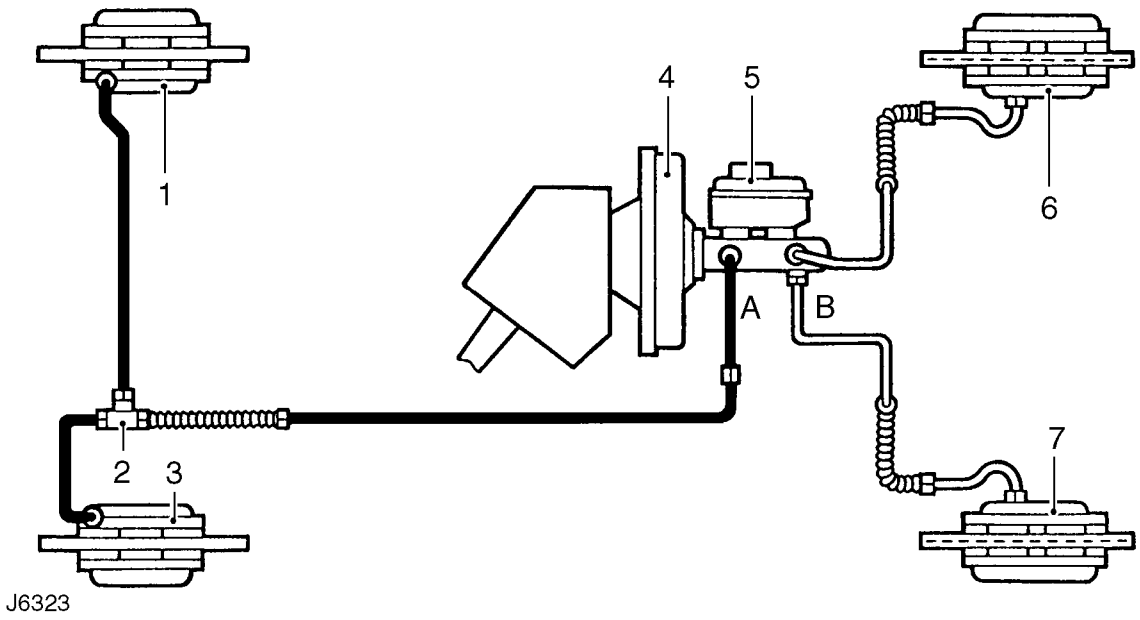


Rear axle suspension

1. 'A' frame, upper link assembly
2. Lower link
3. Coil springs
4. Shock absorber



90 Models



110/130 Models

Hydraulic system

A- Primary circuit
B- Secondary circuit
C- Pressure reducing valve (PRV)

1. LH rear brake caliper
2. T connector
3. RH rear brake caliper
4. Brake servo
5. Master cylinder and reservoir
6. LH front brake caliper
7. RH front brake caliper

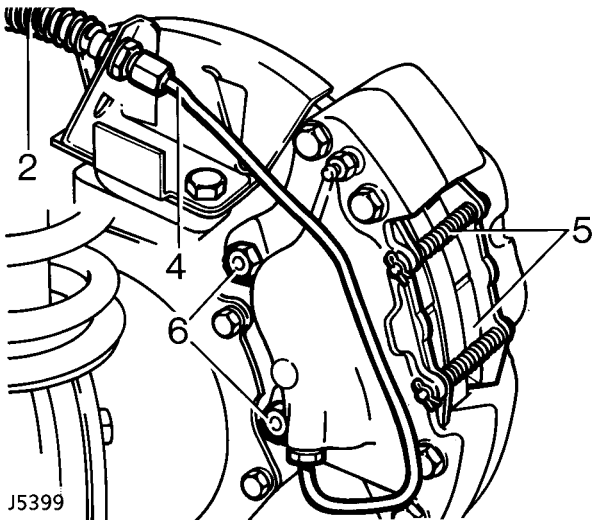
FRONT BRAKE CALIPERS

Service repair no - 70.55.05
Service repair no - 70.55.16

Before starting repair refer to general brake service practice ***See General Brake Service Practice*** .

Remove

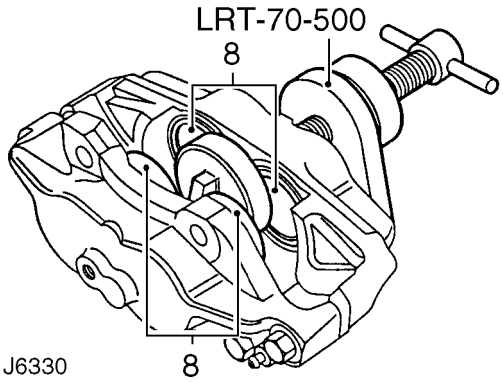
1. Remove front road wheels.



2. Expose flexible brake hose by moving coiled protective covering.
3. Using a recognised hose clamp, clamp hose to prevent loss of brake fluid.
4. Disconnect rigid brake pipe from flexible hose, seal exposed ends to prevent ingress of dirt.
5. Remove split pin, retaining pins and springs, withdraw pads. If refitting pads, identify them for assembly to original locations.
6. Remove 2 bolts and withdraw caliper from swivel housing.

WARNING: Do not separate caliper halves

7. Clean outer surfaces of caliper using aerosol brake cleaner.



8. Using special tool **LRT-70-500**, clamp pistons in inboard half of caliper. Gently, keeping fingers clear, and with **CAUTION**, apply air pressure to fluid inlet port to expel pistons. It is unlikely that pistons will expel at same time, regulate rate with a suitable piece of wood between appropriate piston and caliper.
9. Finally remove pistons, identifying them with their respective bores.
10. Remove wiper seal retainer by inserting a blunt screwdriver between retainer and seal. Pry retainer carefully from mouth of bore.
11. Taking care not to damage seal grooves, extract wiper seal and fluid seal.
12. Clean bores, pistons and seal grooves using clean brake fluid only. If caliper or pistons are corroded, or their condition is not perfect, new parts must be fitted.

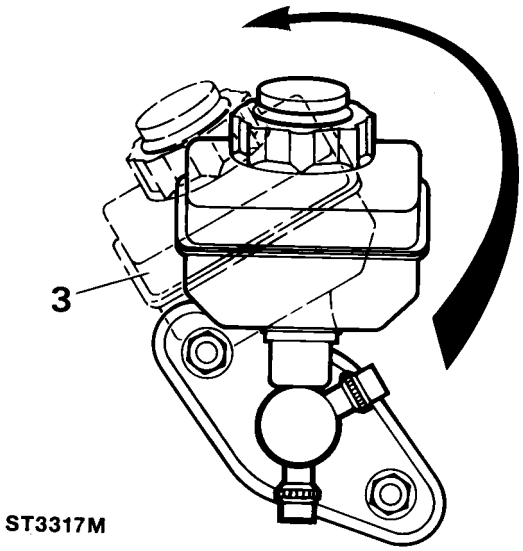
MASTER CYLINDER

Service repair no - 70.30.09

Before starting overhaul procedure refer to general brake service practice ***See Repair, General brake service practice*** .

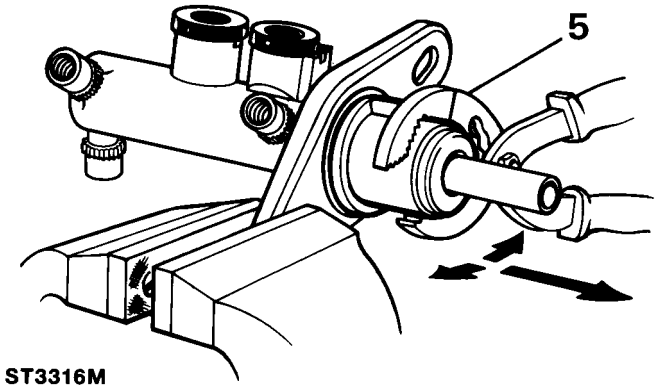
Dismantling master cylinder

1. Disconnect battery and remove master cylinder from servo ***See Repair, Master cylinder*** .
2. Before commencing overhaul procedure thoroughly clean master cylinder and inspect outer surfaces for damage and condition, renew complete assembly if necessary.



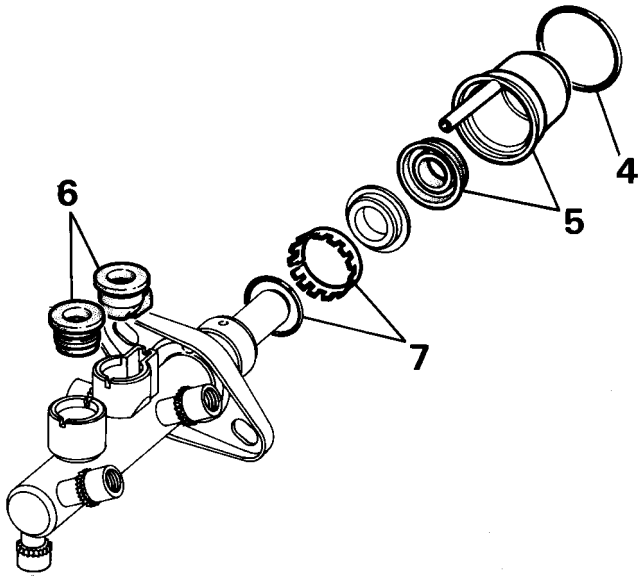
ST3317M

3. The reservoir is a push fit in master cylinder and secured by seals. Carefully ease reservoir from master cylinder by rolling it from seals as illustrated.
4. Using soft jaws, one either side of master cylinder flange and clamp flange in a suitable vice. Remove water ingress 'O' ring seal from master cylinder to servo flange and discard.



ST3316M

5. Hold outside of transfer housing with a suitable pair of grips, carefully pull, while working pliers in a backwards and forwards rocking motion to ease housing off master cylinder, discard housing and vacuum seal.



ST3318M

6. Withdraw 2 reservoir seals from master cylinder and note their positions in inlet ports for reassembly. Discard both seals.
7. Remove retaining ring and 'O' ring seal from machined outer surface of master cylinder, discard both seal and retaining ring.

Off Vehicle Balancing

Balance wheel assembly referring to 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 surface on alloy wheels.

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 wheel rim.

Puncture repair

Remove punctured tyre from wheel and repair using a combination service plug and vulcanising patch. Always follow manufacturer's instructions when using a puncture repair kit.

Only punctures in tread area are reparable, **DO NOT** attempt to repair punctures in tyre shoulders or sidewalls.

Do not attempt to repair a tyre that has sustained the following: bulges or blisters, ply separation, broken or cracked beads, wear indicators visible and punctures larger than 6 mm diameter.

CAUTION: Do not use tyre sealants that are injected through valve stem to repair punctured tyres, 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, bead area should be well lubricated with a suitable tyre lubricant.

TYRE FITTING

Alloy wheels

1. Install a new valve assembly.
2. Ensure wheel and tyre is adequately lubricated.
3. Mount tyre in normal manner. Inflate tyre and at same time apply hand pressure to area around valve to aid seating over valve first.

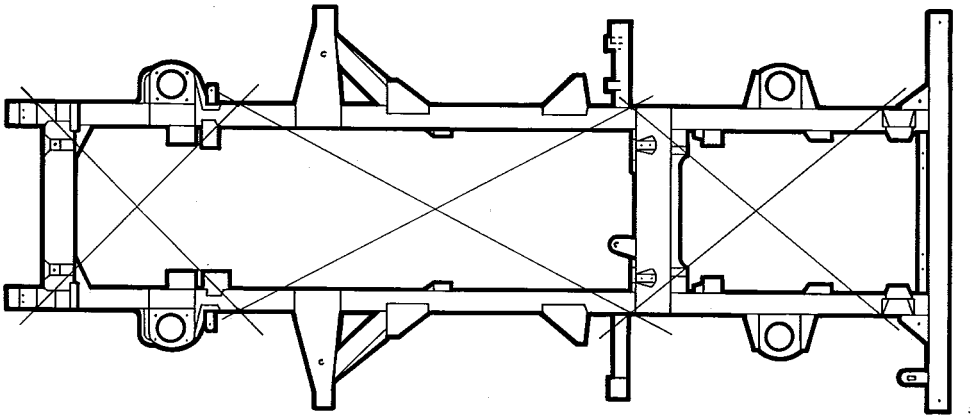
NOTE: Stop inflation immediately if tyre seats opposite valve, as this will result in valve being blocked by tyre beading, making further inflation impossible, and carry out following procedure.

4. Deflate tyre, unseat and rotate it around the rim until valve is in line with that part of tyre which seated initially. This part of beading having seated over hump previously will automatically seat first when tyre is re-inflated.
5. Inflate tyre to seat beads correctly, finally inflate to correct pressure.

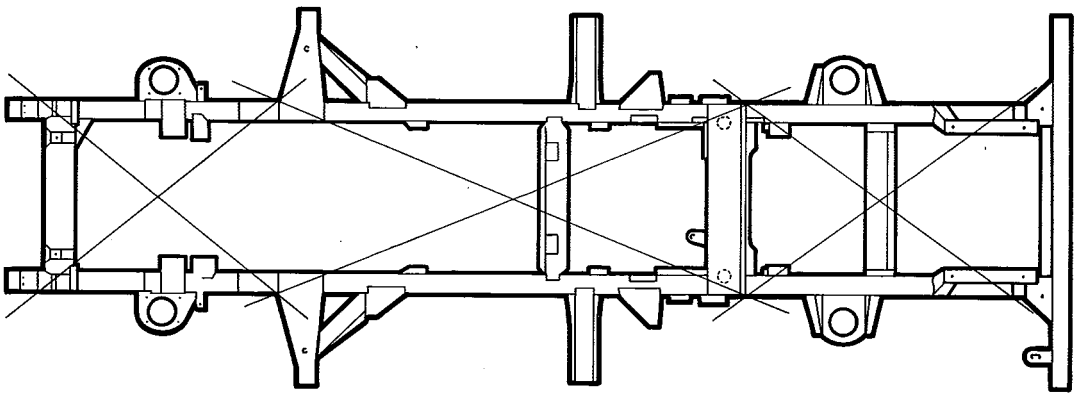
CHASSIS FRAME ALIGNMENT

With the vehicle assembled, a check for chassis squareness can be made as follows:

1. Place the vehicle on a level floor.
2. Mark measuring points at approximately the locations shown in LR4412M ensuring that the marks are exactly opposite on each side of the chassis frame.
3. Hold a plumb line against each of the measuring points in turn and mark the floor directly beneath the plumb-bob.
4. Move the vehicle and measure diagonally between the marks made on the floor, if the chassis is square the diagonals between the related measuring points should agree within 9,50 mm.
5. Chassis frame dimensional checks can be made, with the vehicle upper structure removed, referring to the applicable illustration and associated key.



LAND ROVER 90



LAND ROVER 110

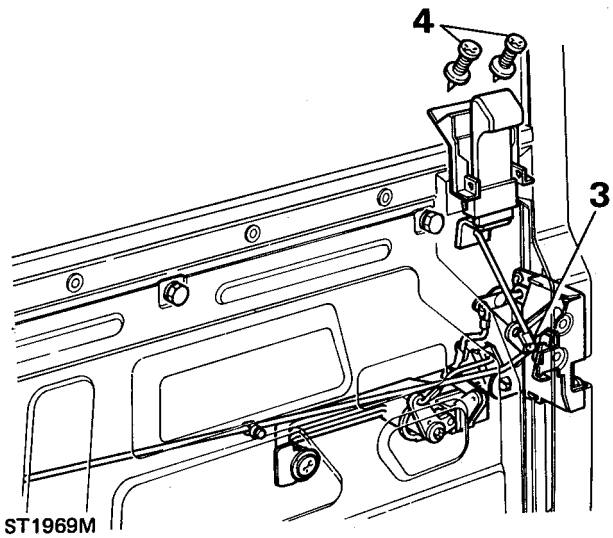
LR4412M

SILL LOCKING BUTTON - FRONT DOOR

Service repair no - 76.37.29

Remove

1. Remove door trim casing ***See Door trim casing*** .
2. Peel back sufficient of plastic sheet to expose mechanism.



3. Release spring clip and disconnect operating rod from latch mechanism.
4. Remove 2 screws and withdraw locking button assembly.

Refit

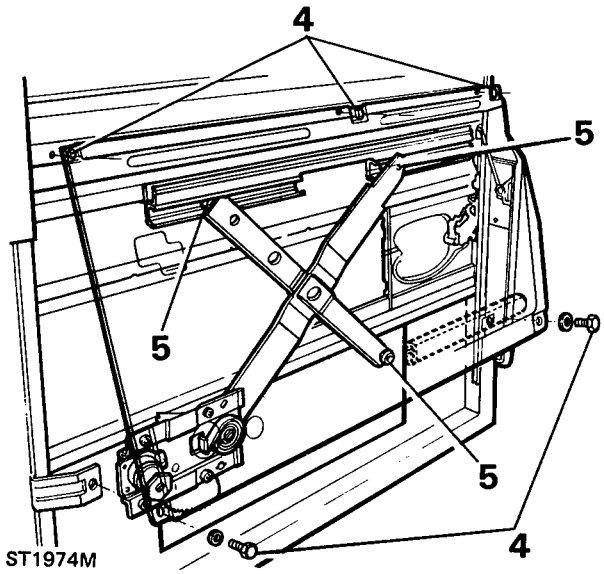
5. Secure locking button assembly to door with 2 screws.
6. Connect operating rod to latch mechanism and secure with spring clip.
7. Re-seal plastic sheet and fit door trim casing ***See Door trim casing*** .

WINDOW REGULATOR - FRONT DOOR

Service repair no - 76.31.45

Remove

1. Remove door trim casing ***See Door trim casing*** .
2. Remove plastic sheet.
3. Temporarily fit handle, position window half open and support with a length of timber.



4. Remove 2 lower screws securing mounting panel to door and slacken 3 upper screws.
5. Remove 4 screws retaining window regulator to mounting panel and slide operating arms from channels attached to glass and mounting panel and remove regulator.

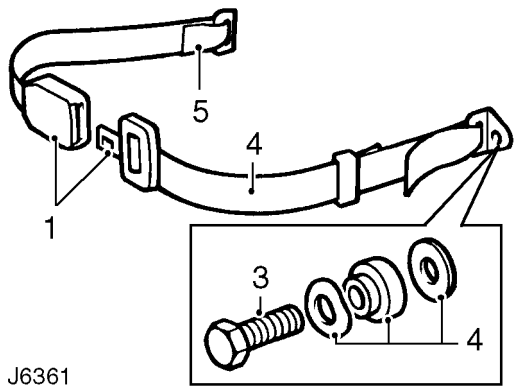
Refit

6. Insert regulator operating arms into channels.
7. Fit and tighten mounting panel lower screws and tighten upper screws.
8. Position holes in regulator to line-up with holes in mounting panel and secure with 4 screws.
9. Temporarily fit regulator handle and check that glass can be raised and lowered without tight spots.
10. Secure plastic sheet.
11. Fit door trim casing ***See Door trim casing*** .

REAR SEAT BELTS - 90/110 STATION WAGON, INWARD FACING SEATS

Service repair no - 76.73.18

Remove



1. Release belt straps from buckles.
2. Release stowage straps and lower both seat cushions.
3. Unscrew bolt securing lap strap to body mounting.
4. Remove lap strap, wavy washer, spacer and plain washer.
5. Repeat operation for buckle strap.

Refit

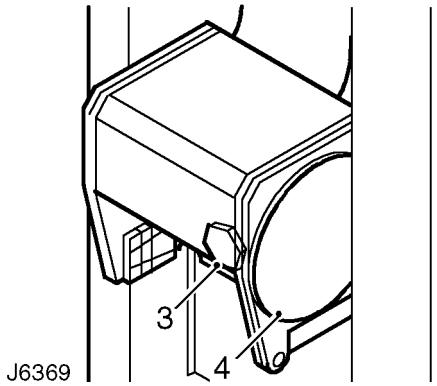
6. Secure lap strap and buckle straps to body. Tighten bolts to ***32 Nm (24 lbf/ft).***
7. If required, secure seat cushions and belts in stowed position.

REAR SEAT BELTS - 110

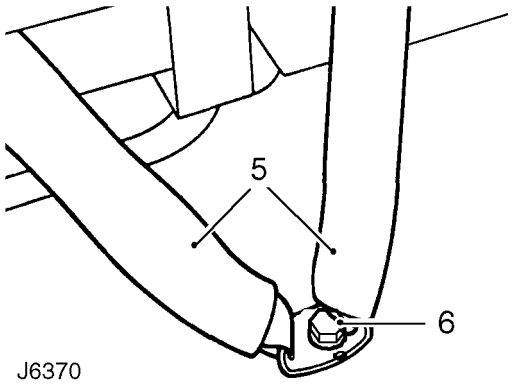
Service repair no - 76.73.18

Remove

1. Remove rear inward facing seats ***See Rear seat squab - 90*** or ***See Rear bench seat*** .
2. Remove side trim panel ***See Side trim panel*** .



3. Remove bolt securing seat belt inertia reel to 'C' post.
4. Remove seat belt assembly.



5. Pull seat belt straps between seat cushion and squab into rear of vehicle.
6. Remove finisher cap and bolt securing seat belt anchorage to floor.
7. Remove seat belt assembly.

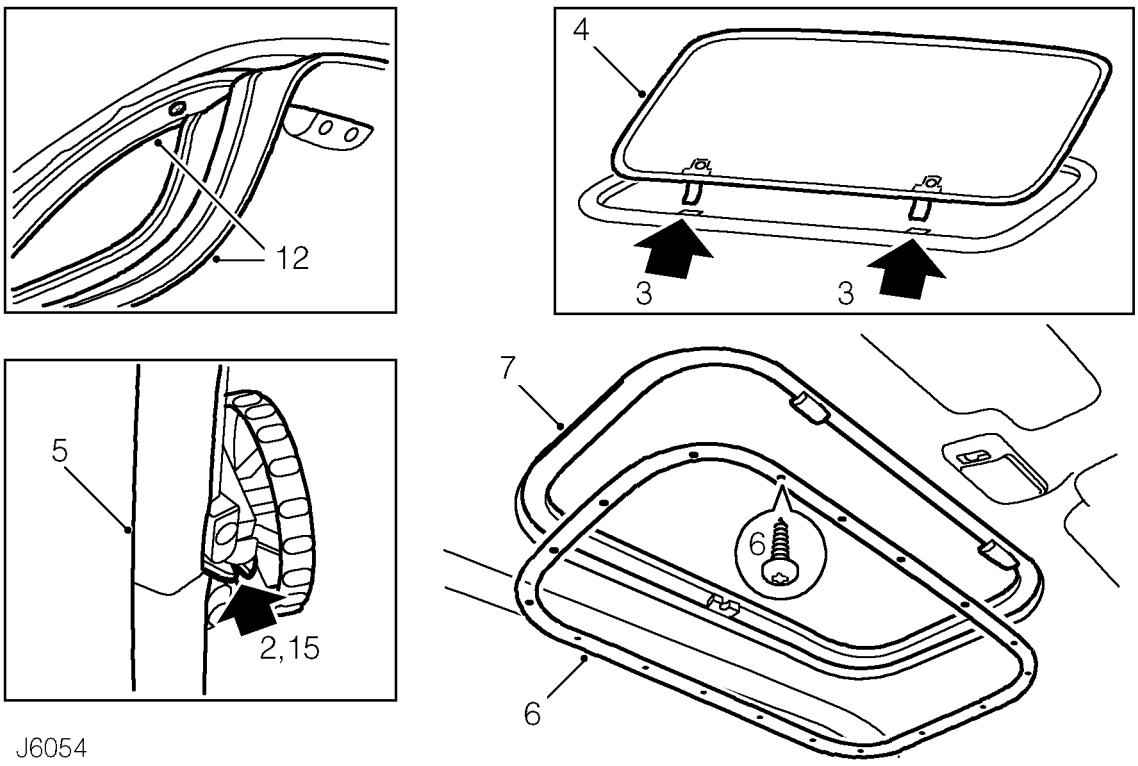
SUN ROOF

Service repair no - 76.83.01

Remove

1. Open sun roof fully.
2. Disengage spring lock from operating handle catch.
3. Holding sun roof at both sides, release hinges from locating brackets at front of outer frame.
4. Remove sun roof.
5. Starting from centre rear, peel headlining finisher from inner frame.
6. Remove 18 screws securing inner frame to outer frame and detach inner frame.
7. Lift outer frame from roof.

NOTE: Assistance may be required to remove the sun roof assembly.



J6054

Refit

8. Clean roof area around outer frame seating.
9. Position outer frame on roof.
10. Fit inner frame to headlining and secure to outer frame with 18 screws but do not fully tighten.
11. Check alignment of inner and outer frames with roof mounting and headlining, adjust as necessary, and fully tighten fixing screws to ***10 Nm (7 lbf/ft).***
12. Starting from centre rear, fit headlining finisher lip into locating channel of inner frame.
13. Press finisher firmly over inner frame and continue around complete frame, ensuring finisher lies flat on headlining.
14. Fit sun roof hinges fully into locating brackets on outer frame, and lower the glass panel.
15. Engage operating handle catch with spring lock of outer frame and close sunroof.

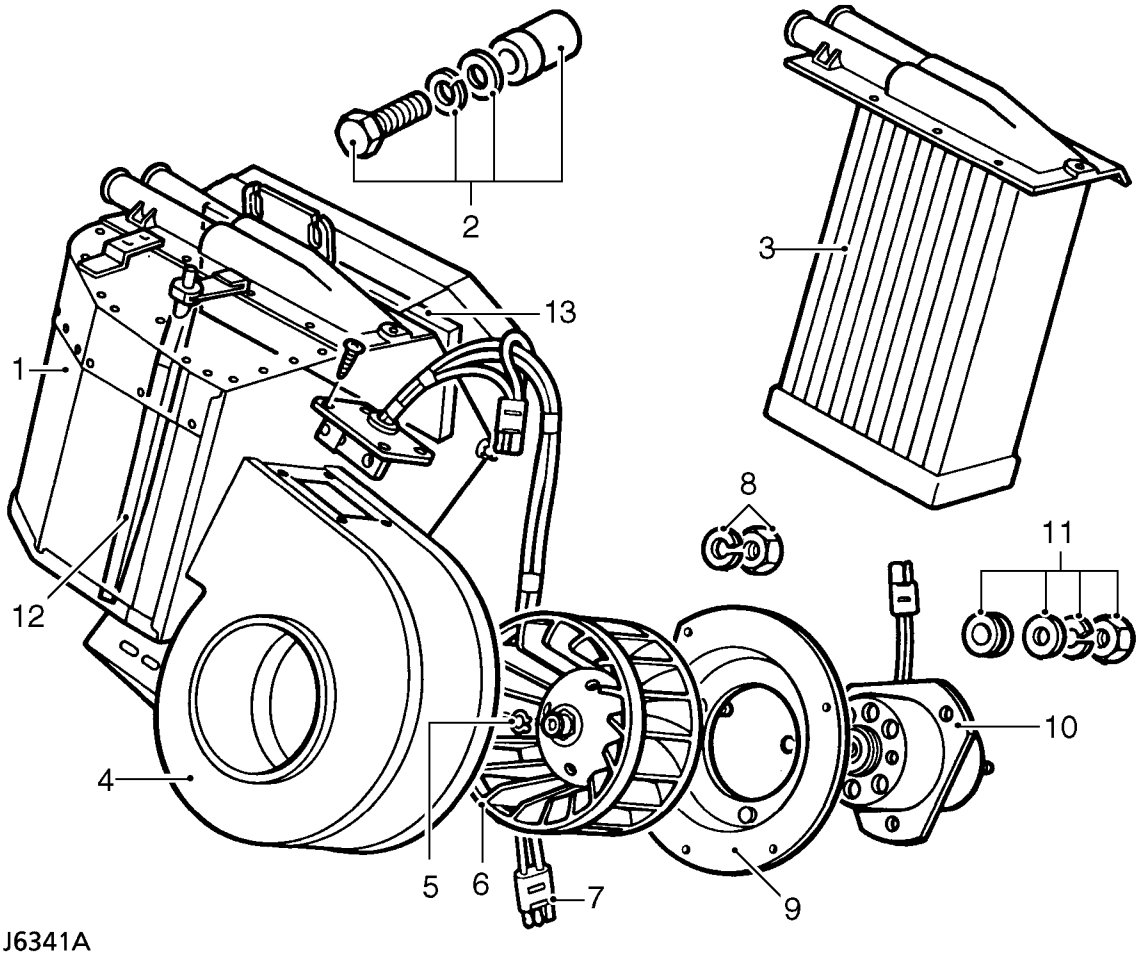
HEATING AND VENTILATION SYSTEM

Description

The heating and ventilation system is standard on all models. Air conditioning is an optional system which provides fully integrated climate control for the vehicle interior.

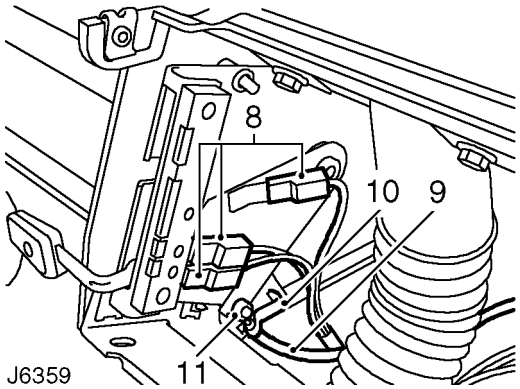
The heater assembly, comprising a matrix housed in a distribution unit and a variable speed blower motor, is located on one side of the engine compartment and attached directly to the fascia bulkhead.

The heating controls are positioned on the outside of the instrument binnacle and cable linked to mechanical flaps in the distribution unit.



Heater assembly

1. Heater distribution unit
2. Fixings, heater to fascia bulkhead
3. Heater matrix
4. Blower motor housing
5. Circlip, impeller to blower motor
6. Impeller
7. Resistor unit and harness connector
8. Fixings, blower motor mounting plate
9. Mounting plate, blower motor
10. Blower motor
11. Fixings, blower motor to mounting bracket
12. Temperature flap, air flow to heater matrix
13. Air flap, air supply to plenum chamber (heater duct)



8. Release lever assembly and disconnect 3 blower motor leads, noting their positions.
9. Pull control cable through bulkhead grommet and out from instrument panel cowl.
10. Release retaining clip securing outer cable to lever assembly.
11. Release inner cable from lever peg.

△ **NOTE: If the blower motor switch is faulty the complete lever assembly will have to be renewed.**

Refit

12. Fit new control cable to lever assembly peg.
13. Fit retaining clip to secure outer cable.
14. Reconnect blower motor leads.
15. Route cable to rear of instrument panel cowl, along bulkhead and out through grommet into engine compartment.
16. Fit lever assembly to panel cowl. Ensure screw spacers are fitted between cowl and lever assembly.
17. Fit instrument panel to fascia cowl.
18. With lever in closed position, fit control cable to heater unit flap lever trunnion.
19. Secure outer cable with retaining clip.
20. Secure control cables to engine bulkhead and heater hoses with retaining clips.
21. Reconnect battery.

SYSTEM TEST

1. Place the vehicle in a ventilated, shaded area free from excessive draught, with the doors and windows open.
2. Check that the surface of the condenser is not restricted with dirt, leaves, flies, etc. Do not neglect to check the surface between the condenser and the radiator. Clean as necessary.
3. Switch on the ignition and the air conditioner air flow control. Check that the blower is operating efficiently at low, medium and high speeds. Switch off the blower and the ignition.
4. Check that the evaporator condensate drain tubes 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 Refrigerant R134a and is deposited when the refrigerant evaporates from a leak.

7. Start the engine.
8. Set the temperature controls to cold and switch the air conditioner blower control on and off several times, checking that the magnetic clutch on the compressor engages and releases each time.
9. With the temperature control at maximum cooling and the blower control at high speed, warm up the engine and fast idle at 1000 rev/min.
10. Repeat at 1800 rev/min.
11. Gradually increase the engine speed to the high range and check the sight glass at intervals.
12. Check for frosting on the service valves.
13. Check the high pressure hoses and connections by hand for varying temperature. Low temperature indicates a restriction or blockage at that point.
14. Switch off the air conditioning blower and stop the engine.
15. If the air conditioning equipment is still not satisfactory, carry out a pressure test as previously described in this section.

PRECAUTIONS IN HANDLING REFRIGERANT LINES

WARNING: Wear eye and hand protection when disconnecting components containing refrigerant. Plug all exposed connections immediately.

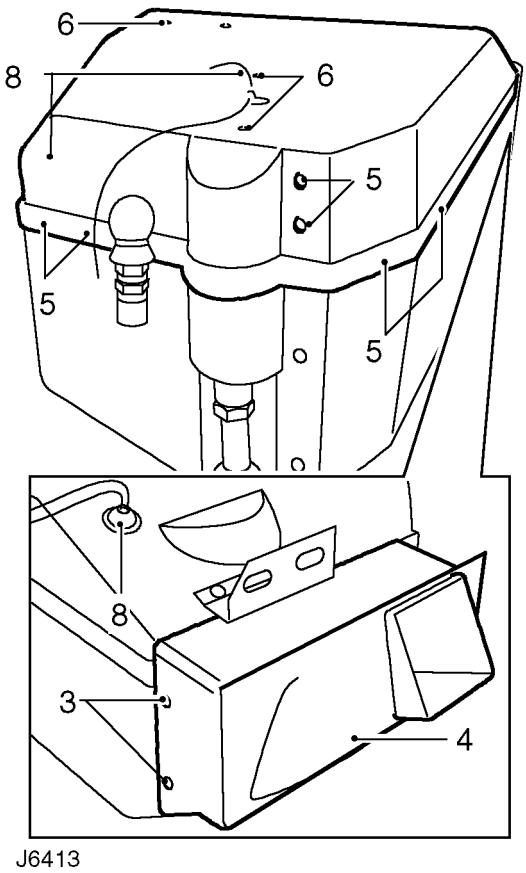
1. When disconnecting any hose or pipe connection the system must be discharged of all pressure. Proceed cautiously, regardless of gauge readings. Open connections slowly, keeping hands and face well clear, so that no injury occurs if there is liquid in the line. If pressure is noticed, allow it to bleed off slowly.
2. Lines, flexible end connections and components must be capped immediately they are opened to prevent the entrance of moisture and dirt.
3. 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.
4. All replacement components and flexible end connections must be sealed, and only opened immediately prior to making the connection.
5. Ensure the components are at room temperature before uncapping, to prevent condensation of moisture from the air that enters.
6. Components must not remain uncapped for longer than 15 minutes. In the event of delay, the caps must be fitted.
7. 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.
8. The compressor shaft must not be rotated until the system is entirely assembled and contains a charge of refrigerant.
9. A new compressor contains an initial charge of refrigerant oil. The compressor also contains a holding charge of gas when received which should be retained by leaving the seals in place until the pipes are re-connected.
10. The receiver/drier should be the last component connected to the system to ensure optimum dehydration and maximum moisture protection of the system.

EXPANSION VALVE - LH DRIVE

Service repair no - 82.25.01

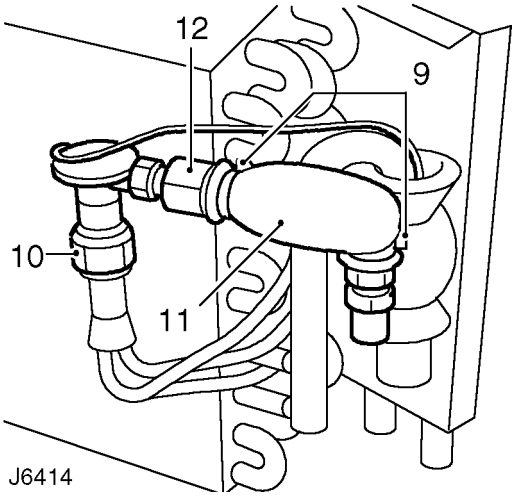
Remove

1. Remove heater/cooler unit ***See Heater/cooler unit.***
2. Suitably support unit on a bench to prevent damage to heater matrix pipes.



J6413

3. Remove 7 screws securing outlet duct to heater/cooler unit.
4. Break sealing compound around edge of duct and pull duct from unit.
5. Remove all fixing screws securing top cover seam and cover sides to main casing.
6. Remove 4 screws and 4 nuts from top of cover.
7. Break sealing compound from unit casing and top cover.
8. Lift off top cover, release grommet and feed blower motor wiring and air flap operating rod through respective apertures. Note thermostat temperature probe which is inserted in top of evaporator.



J6414

9. Release 2 clips securing expansion valve sensor and lagging to low pressure pipe.
10. Unscrew union securing expansion valve to evaporator high pressure pipe.
11. Remove expansion valve, complete with high pressure pipe.
12. Disconnect high pressure pipe from expansion valve.
13. Discard all pipe connection 'O' rings.
14. Clean sealing compound from all joints of main casing, top cover and outlet duct.

Refit

15. Coat unions, threads and new 'O' rings with refrigerant oil prior to reassembly.
16. Fit high pressure pipe to new expansion valve.
17. Fit expansion valve to evaporator pipe connector.
18. Position valve sensor at low pressure pipe and secure with lagging and clips.
19. Apply sealing compound around top edge of main casing.
20. Feed blower motor wiring through top cover and fit grommet.
21. Fit top cover to casing. Ensure thermostat temperature probe is inserted in top of evaporator. Apply mastic sealant to air flap operating rod aperture.
22. Apply sealing compound to joint face of blower motor outlet duct.
23. Locate duct over blower motor outlet and secure to casing.
24. Fit heater/cooler unit ***See Heater/cooler unit.***

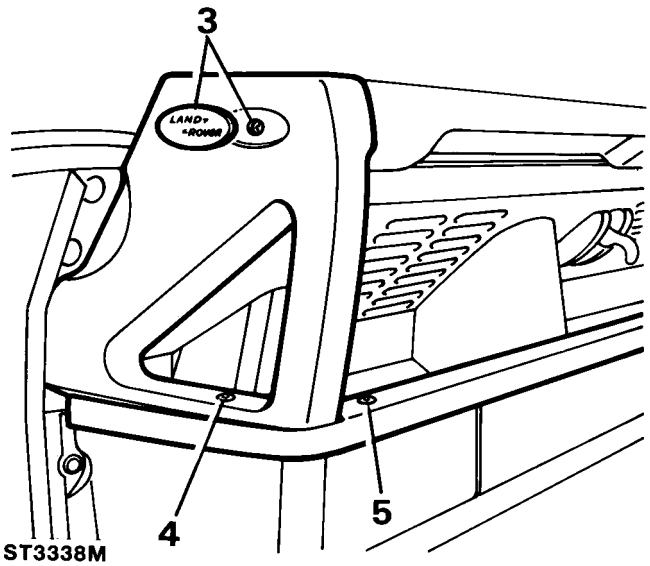
WIPER MOTOR AND DRIVE RACK

Service repair no - 84.15.09

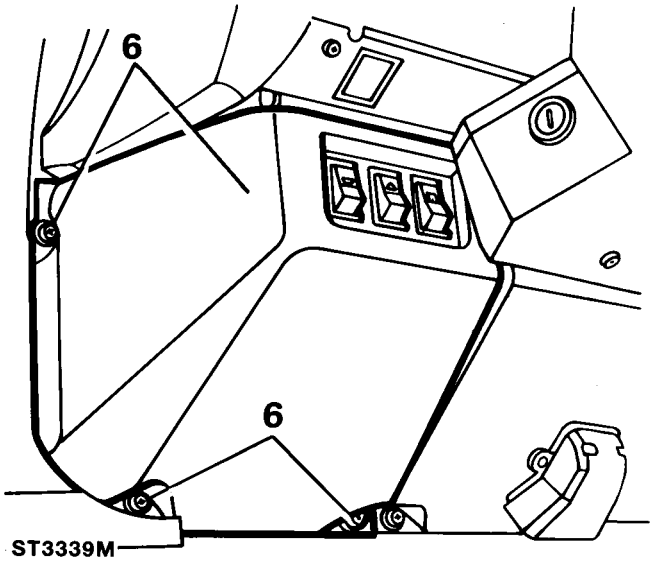
Remove

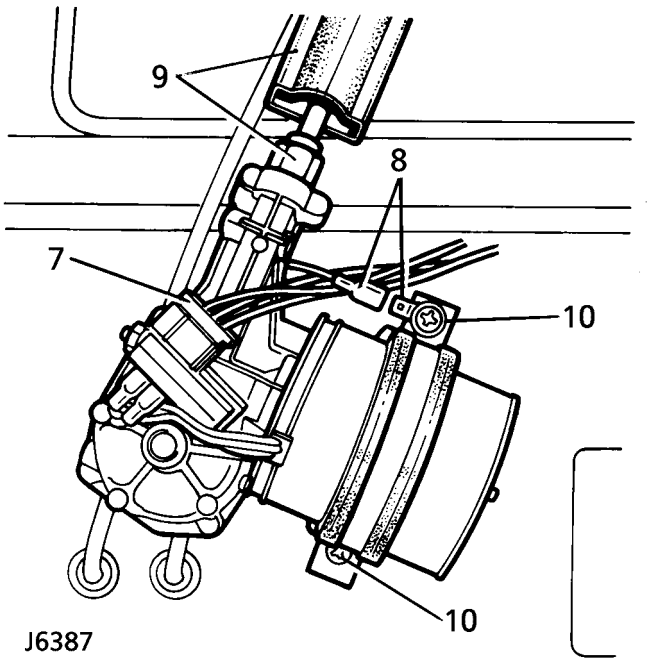
1. Disconnect battery.
2. Remove wiper arms.

NOTE: Operations 3 - 5 are for RH drive vehicles only.



3. Prise Land Rover decal from grab handle and remove screw.
4. Remove lower screw and lift handle from fascia.
5. Remove screw fixing finisher to wiper motor cover.
6. Remove door check strap cover, remove 3 screws and withdraw wiper motor cover. If applicable, disconnect switch multi-plugs and/or radio speaker leads.
7. Disconnect multi-plug from wiper motor.
8. Disconnect wiper motor earth lead. (Not applicable on later models)
9. Lift rubber sleeve and slacken wiper motor to drive tube nut.
10. Remove 2 screws and release wiper motor retaining strap.
11. Fully unscrew tube nut.
12. Pull wiper motor and drive rack clear of tube and retrieve mounting pad and earth tag.





Refit

13. Feed wiper motor drive rack into tube until fully seated.
14. Loosely fit drive tube securing nut.
15. Fit wiper motor securing strap, earth tag and mounting pad. Align motor and tighten fixing screws.

WIPER MOTOR

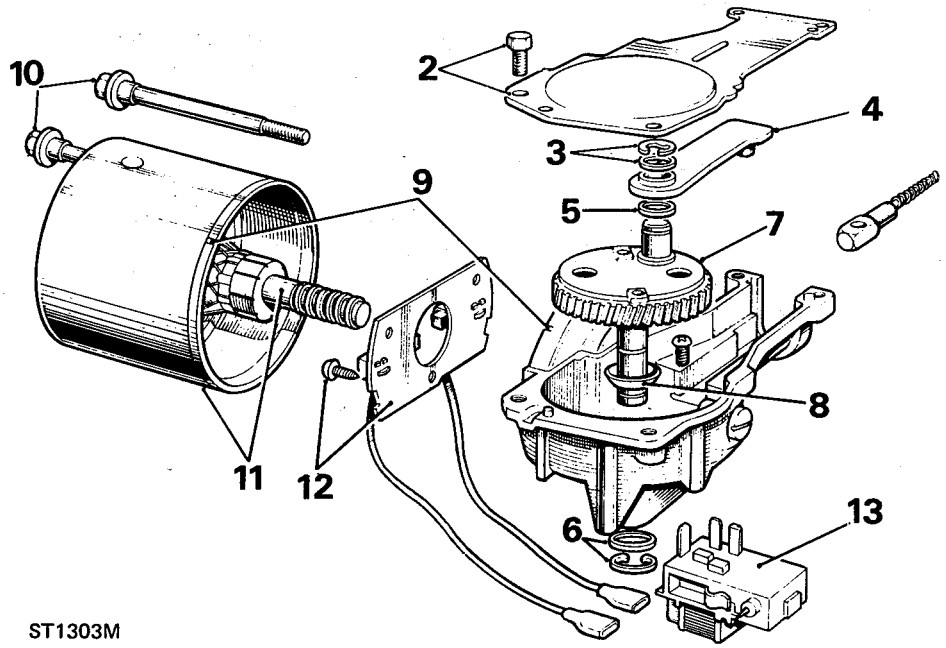
Service repair no - 84.15.18.

Dismantle

1. Remove wiper motor from vehicle ***See Repair, Wiper motor and drive rack.***
2. Remove wiper motor gearbox cover.
3. Remove circlip and plain washer securing connecting rod.
4. Withdraw connecting rod.
5. Withdraw flat washer.
6. Remove circlip and washer securing shaft and gear.
7. Clean any burrs from gear shaft and withdraw gear.
8. Withdraw dished washer.
9. Add alignment marks to yoke and gearbox for reassembly.
10. Remove yoke securing bolts.
11. Withdraw yoke and armature.
12. Remove brush gear assembly.
13. Remove limit switch.

Inspection and test

14. Check brushes for excessive wear, if they are worn to 4,8 mm in length, fit a new brush gear assembly.
15. Using a push type gauge, check that brush spring pressure is 140 to 200 g when bottom of brush is level with bottom of slot in brush box. Fit a new brush gear assembly if springs are not satisfactory.
16. Test armature for insulation and open- or short-circuits. Use a 110 V 15 W test lamp. Fit a new armature if faulty.
17. Examine gear wheel for damage or excessive wear.



Key to wiper motor components

1. Flexible drive
2. Gearbox cover
3. Connecting-rod retaining washer and circlip
4. Connecting-rod
5. Flat washer
6. Gear shaft retaining washer and circlip
7. Drive gear
8. Dished washer
9. Alignment marks - yoke to body
10. Yoke securing bolts
11. Armature and yoke
12. Brush gear assembly
13. Limit switch

IMMOBILISATION AND ALARM SYSTEM CIRCUIT DIAGRAM

1. Anti-theft alarm indicator light (LED)
2. Engine immobilisation warning light
3. Alarm system fuse - 15 amp
4. Alarm sounder relay
5. Under bonnet lighting fuse
6. Alarm sounder (without battery back-up)
7. Alarm system fuse - 5 amp (position 20)
8. Electronic control unit (ECU)
9. Bonnet switch
10. Alarm sounder protection fuse - 20 amp (position 10)
11. Starter switch
12. Under bonnet ignition fuse
13. Driver's door switch
14. Vehicle horn switch
15. Vehicle horn
16. Passive coil
17. Starter switch relay
18. Front passenger door switch
19. Hazard warning light fuse - 15 amp (position 1)
20. Ultrasonic sensor
21. Interior lamp and horn fuse - 20 amp (position 3)
22. Alarm sounder (with battery back-up)
23. LH direction indicator lamps
24. RH direction indicator lamps
25. Interior lamp
26. Immobilisation spider
27. Rear side doors and rear door switches
28. Diagnostic connector
29. Diagnostic fuse - 7.5 amp
30. Starter solenoid
31. Fuel switch-off solenoid (injection pump)
32. Generator
33. Aerial

Key to cable colours

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

The last letter of a colour code denotes the tracer colour

IMMOBILISATION SPIDER

Service repair no - 86.77.03

Remove

1. Remove LH front seat cushion.
2. Release retaining clip and remove battery access cover.
3. Slacken battery lead clamp bolts.
4. Turn starter switch 'on'.
5. Turn starter switch 'off' and remove key.
6. Disconnect battery leads.

NOTE: Operation 6 needs to be carried out within 15 seconds to avoid activating battery backed-up alarm sounder, if fitted.

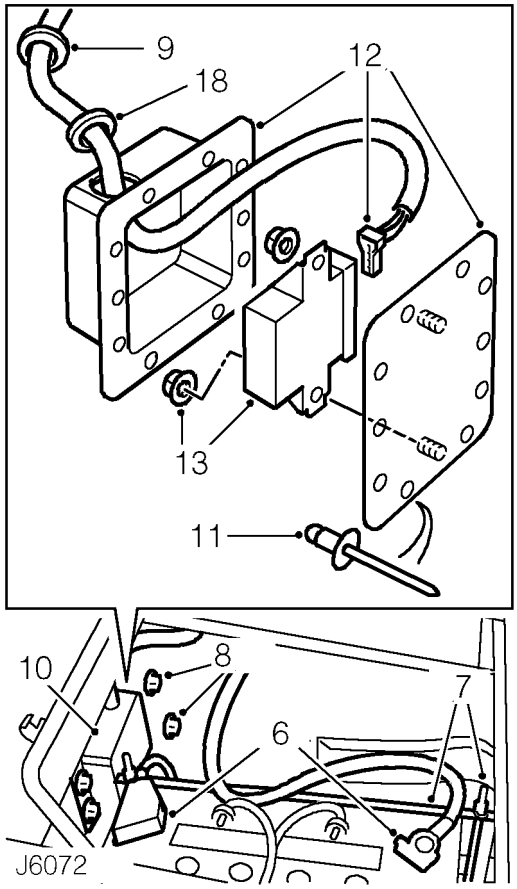
7. Remove battery clamp and 'J' bolts.
8. Remove 4 nuts securing immobilisation spider housing box to fixing studs on front face of battery box.
9. Remove grommet securing spider harness to corner face of battery box.
10. Carefully pull harness into battery box, lift spider housing box and place on front edge of seat base.
11. Using a suitable sheet to protect inside of vehicle, grind heads off 6 monobolts securing lid to spider box housing.
12. Detach lid from housing and disconnect spider harness plug.
13. Unscrew two nuts and remove immobilisation spider from lid studs.

NOTE: If spider box lid and/or sealing gasket is damaged during operation 11 a new lid will need to be fitted.

NOTE: A new immobilisation spider must be initialised using TestBook.

Refit

14. Fit immobilisation spider onto lid studs and secure with retaining nuts.
15. Reconnect harness plug to spider and ensure it fully 'clicks' home.
16. Position lid and spider assembly into box housing so that harness plug is furst away from harness entry.

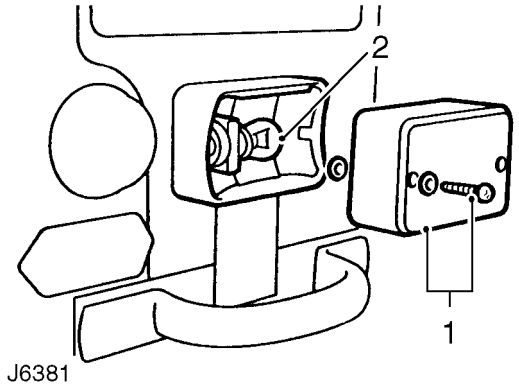


17. Secure lid to spider box housing with monobolts.
18. Refit harness grommet into spider box, if disturbed on removal procedures, and ensure harness covering is fully inserted through grommet to make water tight seal.
19. Push excess harnes cable through corner face of battery box and fit grommet.
20. Fit spider housing box to fixing studs and secure with four nuts.
21. Fit 'J' bolts and clamp to secure battery,
22. Reconnect battery leads.
23. Fit battery access cover.
24. Fit LH seat cushion.
25. Test immobilisation and alarm system.

REVERSE AND FOG GUARD LAMP - BULB RENEWAL

Service repair no - 86.40.90

Remove



1. Remove two screws with sealing washers and remove lens from lamp body.
2. Push and twist bulb to release from holder.
3. Clean interior of lamp and lens.

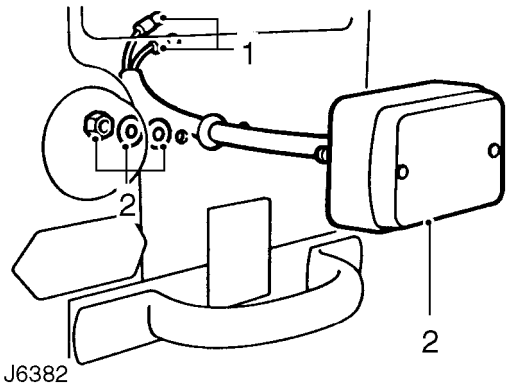
Refit

4. Fit new bulb.
5. Fit lens to lamp body.

REVERSE AND FOG GUARD LAMP

Service repair no - 86.40.91 - Reverse lamp
Service repair no - 86.40.99 - Fog guard lamp

Remove



1. From underneath the vehicle, lift protective flap and disconnect lamp leads at harness connectors.
2. Unscrew 2 nuts and washers and withdraw lamp unit from vehicle.

Refit

3. Feed lamp leads through grommet and locate lamp studs in vehicle body.
4. Fit retaining nuts and reconnect lamp leads to vehicle harness.