Chapter 12-1

COOLING SYSTEM 2.5 LITRE DIESEL

CONTENTS

INTRODUCTION

1 This chapter covers the Unit and Field repairs to the cooling system as fitted to Land Rover 90 and 110 vehicles having 2.5 litre non-turbo diesel engines.

WARNING ...

DO NOT REMOVE THE RADIATOR OR EXPANSION TANK FILLER CAPS WHEN THE ENGINE IS HOT BECAUSE THE COOLING SYSTEM IS PRESSURIZED AND PERSONAL SCALDING COULD RESULT.

GENERAL

2 To prevent corrosion of the aluminium alloy engine parts it is imperative that the cooling system is filled with a solution of clean fresh water and the correct type of anti-freeze, winter and summer, or a solution of clean fresh water and inhibitor if frost precautions are not required. Never fill or top-up with water only, always add an inhibitor (Marstons SQ36) if anti-fre ze is not used. Never use salt water otherwise corrosion will occur. In certain territories where the only available water supply may have some salt content, use only clean rain water or distilled water.

3 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.

4 Vehicles leaving the factory have the cooling system filled with 50% of anti-freeze mixture. This gives protection against frost down to minus 47°C (minus 53°F). Vehicles so filled can be identified by a label affixed to the windscreen and radiator.

5 After the second winter the system should be drained and thoroughly flushed before adding new anti-freeze examine all joints and renew any defective hoses to make sure the system is leakproof. Inhibitor solution should be drained, flushed out and new solution introduced every two years, or sooner where the purity of the water is questionable.

Recommended solutions

6 The following solutions are recommended for use in Land Rover engines:

6.1 Anti-freeze - Unipart Universal Anti-freeze or permanent type ethylene base, without methanol, with a suitable inhibitor for aluminium engines and engine parts. The anti-freeze should be diluted to one part anti-freeze and one part water.

6.2 Inhibitor - Marston Lubricants SQ36 inhibitor concentrate. Use 100cc of inhibitor per litre of water.

Draining

7 To drain the cooling system carry out the following:

7.1 Remove the cap from the expansion tank and the filler plug from the radiator.

7.2 If fitted, remove the radiator drain plug, or alternatively disconnect the bottom hose, and allow the coolant to drain into a suitable container.

7.3 Remove the cylinder block drain plug, from the left hand side of the engine, allow coolant to completely drain then refit the plug.

7.4 After draining has completed refit the radiator drain plug or reconnect the bottom hose as necessary.

7.5 To drain the expansion tank, disconnect the hoses and remove the tank. Drain and flush the tank then refit to the vehicle.

Filling

8 To fill the cooling system carry out the following:

8.1 Using a separate container, mix a solution of anti-freeze or inhibitor, whichever is applicable, with water to the concentration required. To allow for topping up and the expansion tank prepare a quantity in excess of the capacity of the system.

8.2 Check all hoses, connections and drain plugs for security.

8.3 Fill the system through the expansion tank until it is approximately three quarters full.

8.4 Fit the expansion tank cap and the radiator filler plug and run the engine until normal operating temperature is reached.

8.5 Allow the engine to cool completely, then remove the expansion tank cap and if necessary top up the tank to half full. Remove the radiator filler plug and check that the coolant level is just below the fill r n ck. After refitting tighten the radiator filler plug to a torque of 5 to 6 Nm (4 to 4.50 lbf ft).

8.6 Finally examine the cooling system for leaks.

RADIATOR

Removal

9 To remove the radiator carry out the following:

9.1 Disconnect the battery.

9.2 Drain the cooling system (Para 7).

9.3 Disconnect the overflow hose and the top and bottom hoses from the radiator.

9.4 Release the air cleaner hose (Fig 1 (4)) from the manifold and remov the air cleaner (5) complete with hose.

9.5 Release the fixings (2) securing the cowling to the engine.

9.6 Remove the bolts securing the radiator retaining brackets ((1) and (3)) and withdraw the brackets.

9.7 Pull back the cowling towards the radiator and lift the radiator complete with cowl from the vehicle.

9.8 Remove the five screws securing the cowling to the radiator (6). Separate the two units noting that the cowling is held to the bottom of the radiator by two clips.

Refitting

10 To refit the radiator carry out the following:

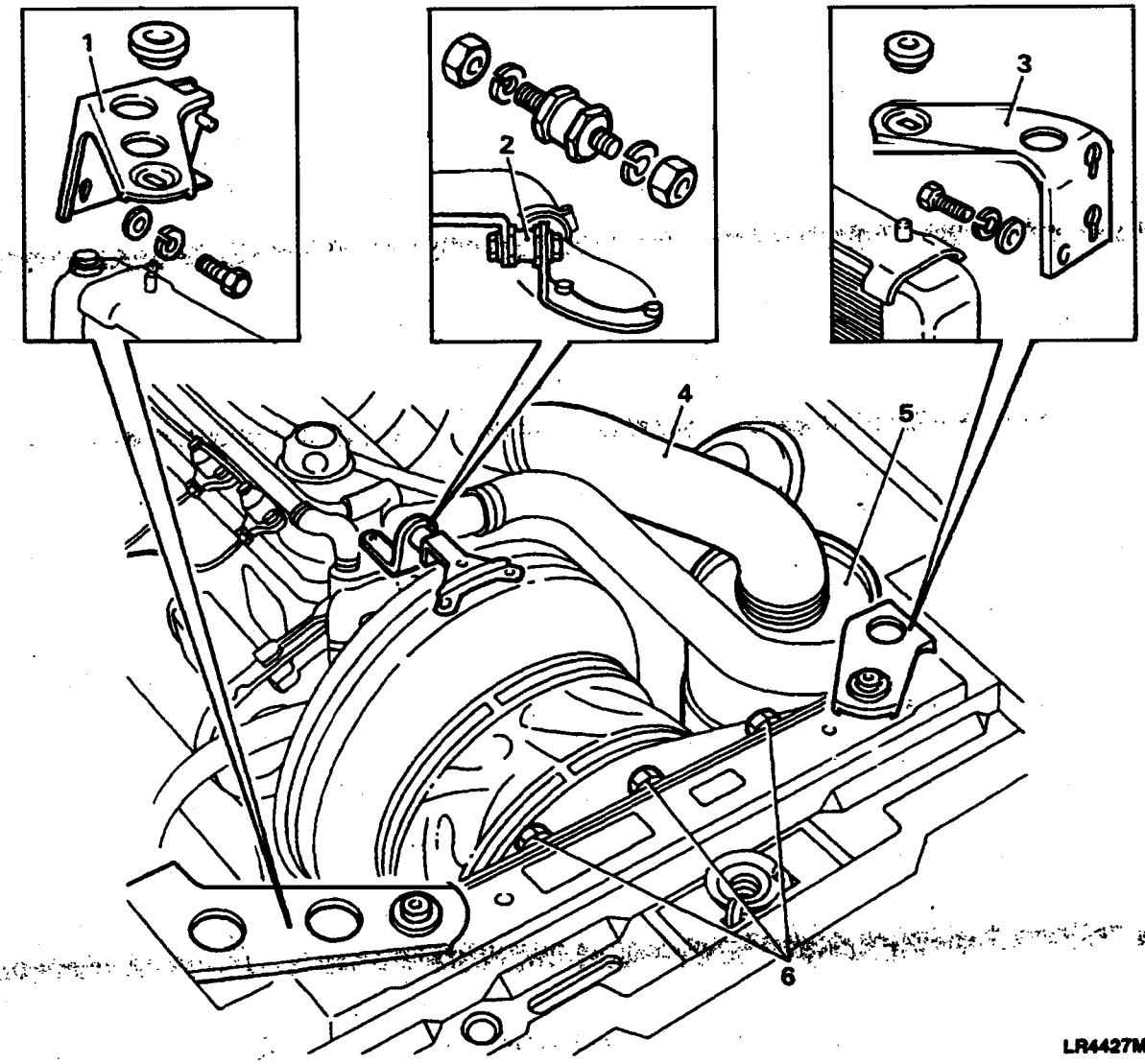
10.1 Locate the cowling into the clips at the bottom of the radiator and secure it to the top with the five screws.

10.2 Lower the assembled radiator and cowl into position in the vehicle ensuring that the two pegs at the bottom of the radiator locate in the corresponding rubber pads in the cross member brackets (Fig 2).

10.3 Secure the top of the radiator with the two brackets and bolts.

10.4 Secure the cowling to the engine with the three fixings.

10.5 Connect the top and bottom hoses and the overflow hose.



1	RH Radiator bracket	4	Air cleaner hose
2	Top cowling fixing	5	Air cleaner
3	LH Radiator bracket	6	Front cowling fixings

Fig. 1 Radiator/fan cowling fixings and air cleaner

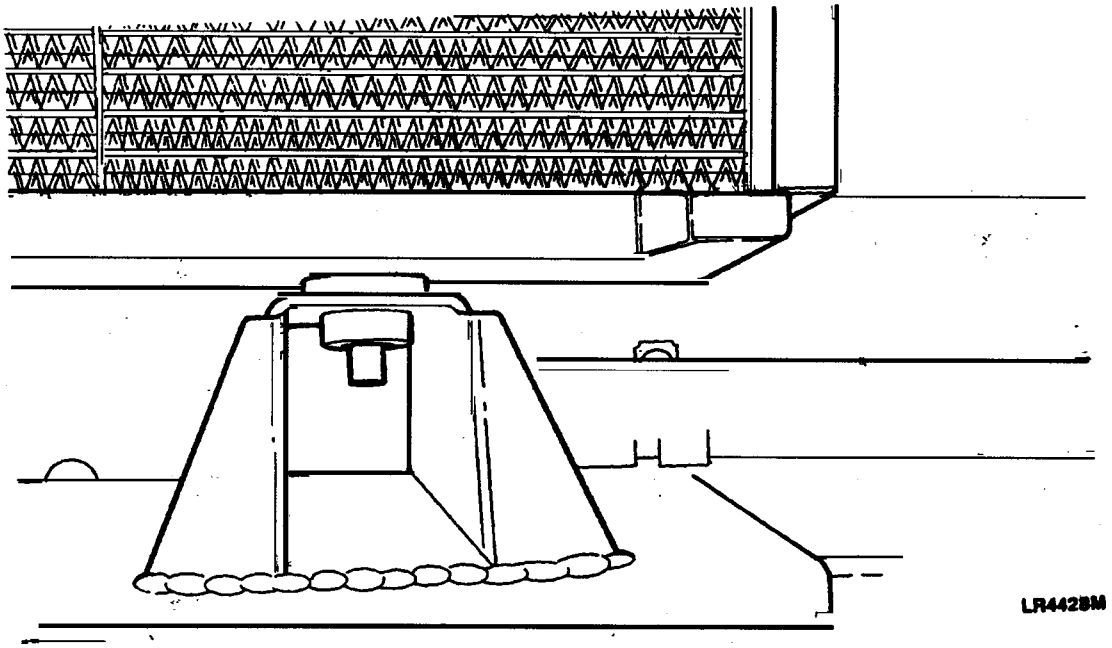


Fig 2 Radiator lower location

10.6 Fit the air cleaner and reconnect the hose to the air intake manifold.

10.7 Where fitted, check that the radiator drain plug is tight and fill the cooling system (Para 8).

THERMOSTAT

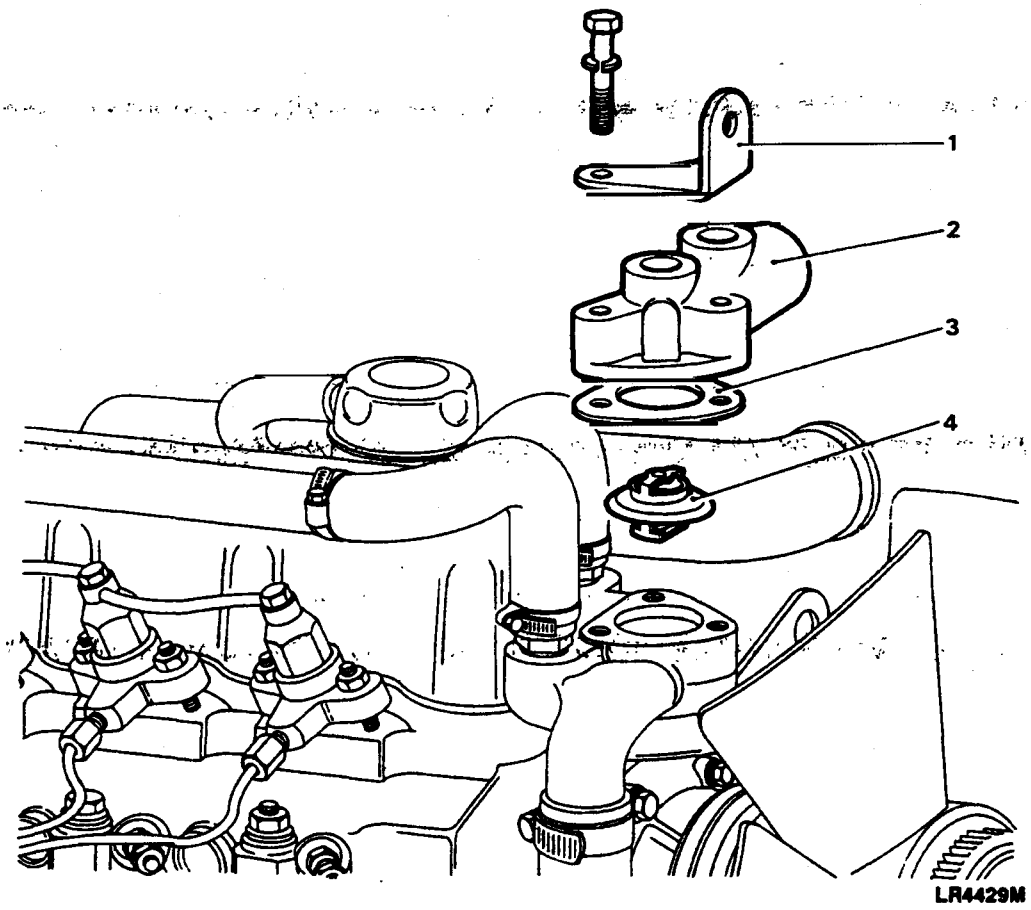
Removal

11 To remove the thermostat carry out the following:

11.1 Partially drain the cooling system until the coolant level is below the thermostat housing.

11.2 Disconnect the top hose from the thermostat housing cover (Fig 3 (2)).

11.3 Remove the cover complete with gasket (3) and withdraw the thermostat (4) from the housing.



1	Cowling securing bracket	3	Gasket
2	Thermostat housing cover	4	Thermostat

Fig 3 Thermostat

Testing

12 The rating of the thermostat is 82°C, to test it carry out the following:

12.1 Place the thermostat in a suitable container of water. Heat the water and observe the temperature at which the thermostat opens. If the thermostat opens between 79 and 83°C the unit is operating satisfactorily.

Refitting

13 R fit the thermostat in reverse order of removal, using a new gasket between the cover and body and topping up the coolant as necessary.

VISCOUS COUPLING AND FAN

Removal

14 To remove the viscous coupling and fan assembly carry out the following:

14.1 Disconnect the battery to prevent the engine being started whilst working on the fan assembly.

14.2 Release the fixings securing the cowling to the engin and pull back the cowling towards the radiator.

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.

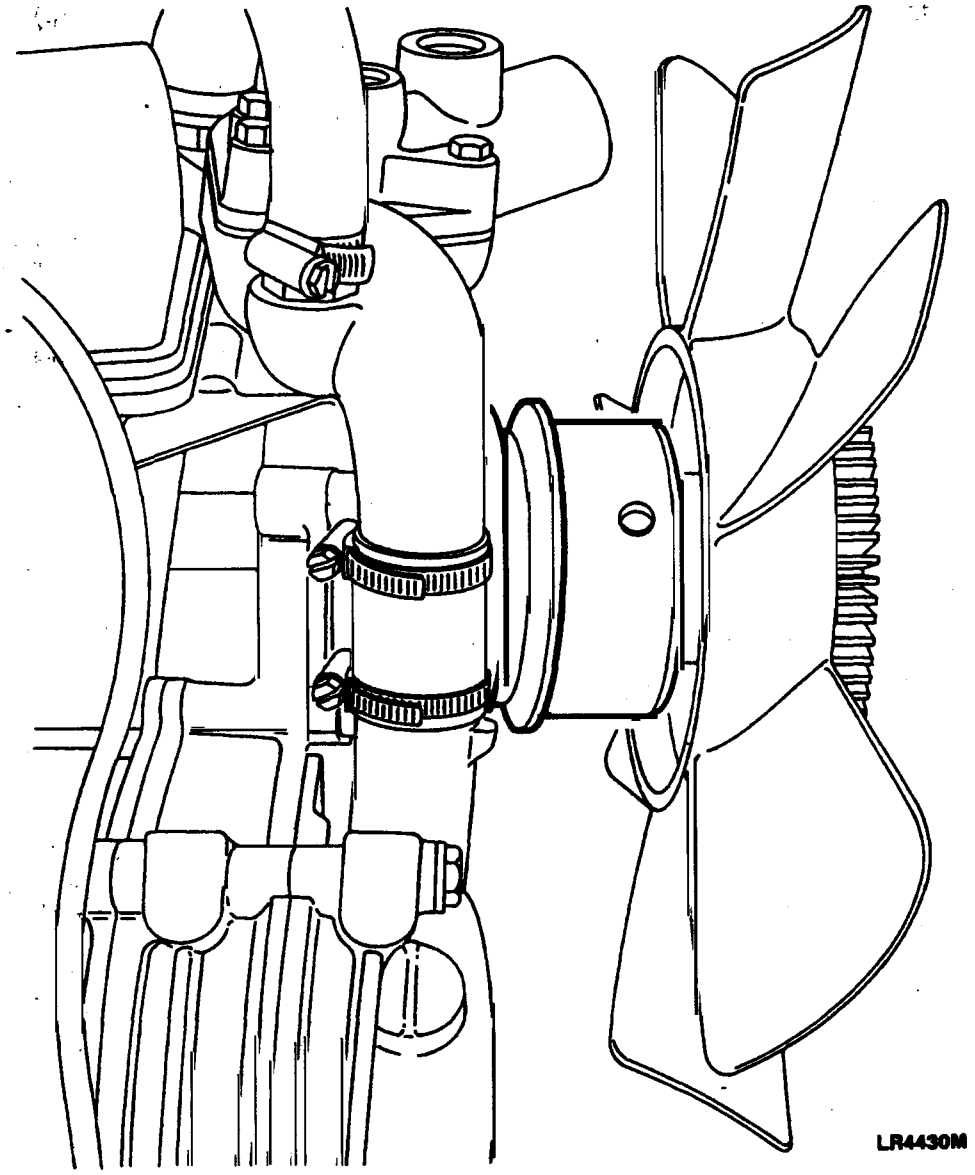


Fig 4 Tommy bar location in water pump pulley

14.3 Insert a suitable tommy bar into the hole in the water pump pulley (Fig 4), restrain the pulley and unscrew the viscous unit and fan.

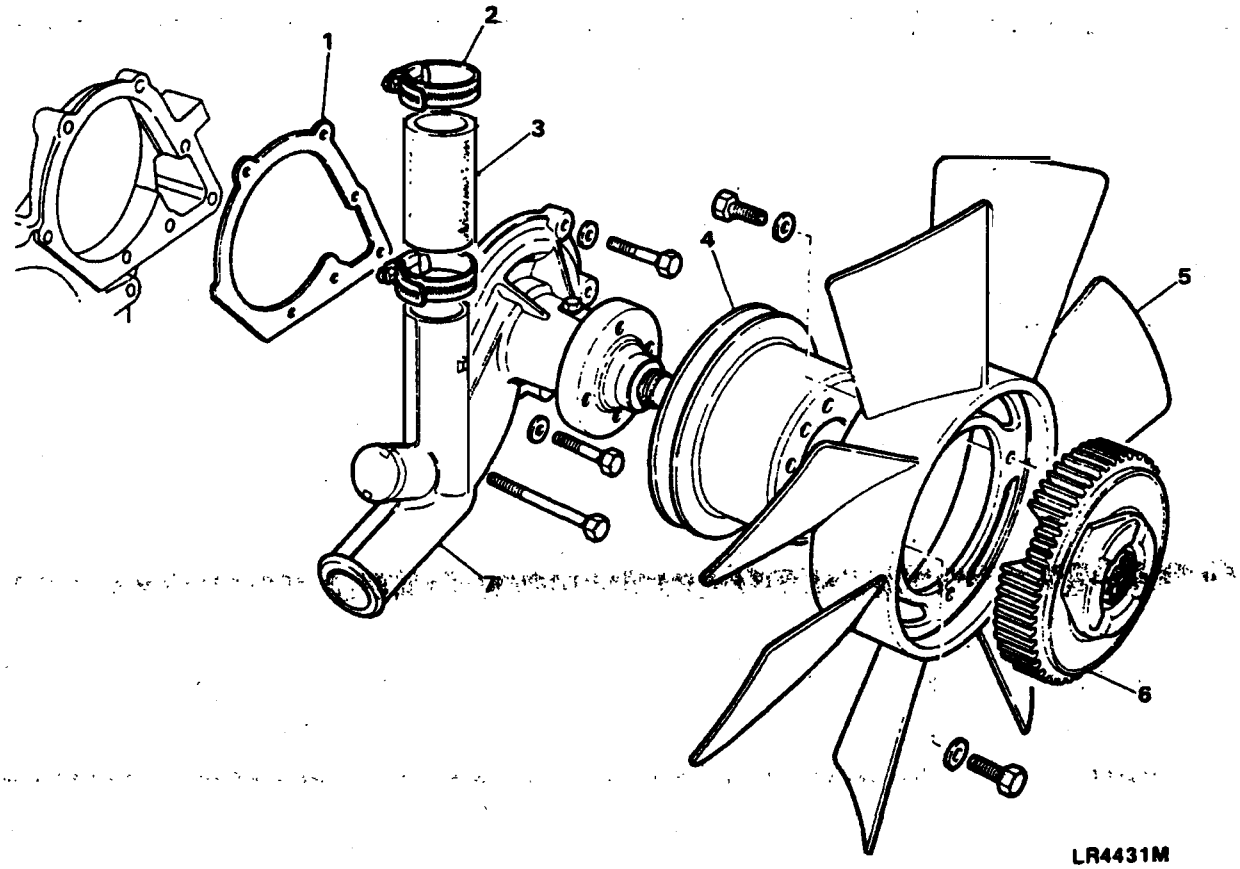
14.4 If necessary remove the bolts securing the fan to the viscous unit and d tach the fan.

Repairs and replacement

15 The viscous coupling is a non-repairable unit, should it be found to be defective a new unit must be fitted.

Refitting

16 Refit the viscous coupling and fan in reverse order of removal, remembering that the nut securing the unit has a left hand thread.



1	Gasket	5	Fan
2	By-pass hose clip	6	Viscous coupling
3	By-pass hose	7	Water pump

Fig 5 Water pump, fan and viscous coupling

WATER PUMP

Removal

17 To remove the water pump carry out the following:

17.1 Disconnect the battery to prevent the engine being started whilst working on the water pump.

17.2 Drain the cooling system (Para 7).

17.3 Release the fixings securing the cowling to the engine and pull back the cowling towards the radiator.

17.4 On 12/24 Volt vehicles, slacken the 90 amp generator adjuster and remove the drive belt.

17.5 Slacken the 12 Volt alternator adjuster, remove the drive belt and move the alternator aside.

17.6 Remove the viscous coupling and fan assembly (Para 14).

17.7 Remove the bolts and washers securing the pulley (Fig 5 (4)) to the water pump (7) and detach the pulley.

17.8 Slacken the by-pass hose top clip (2), remove the water pump securing bolts, noting the locations of the different length bolts, and withdraw the water pump (7) complete with gasket (1). Discard the gasket.

17.9 Remove the by-pass hose (3) from the water pump.

Refitting

18 To refit the water pump carry out the following:

18.1 Fit the by-pass hose (3) to the water pump and secure with the lower clip.

18.2 Place a new gasket (1) in position and offer up the water pump (7), at the same time engaging the by-pass hose (3).

18.3 Fit the bolts to their respective locations and evenly tighten to a torque of 22 to 28 Nm (16 to 20.6 lbf ft). Tighten the by-pass hose clip.

18.4 Fit the fan pulley to the adaptor on the water pump shaft and tighten the securing bolts to a torque of 22 to 28 Nm (16 to 20.6 lbf ft).

18.5 Fit the viscous coupling and fan assembly (Para 16).

18.6 Fit the drive belt to the fan pulley, crankshaft pulley and alternator pulley. Pivot the alternator away from the engine to tension the belt, tighten the clamp bolt and with thumb pressure check that the deflection at the mid-point between the fan and alternator pulleys is 7 to 9 mm (0.250 to 0.375 in). Tighten the alternator pivot nuts to a torque of 22 to 28 Nm (16 to 20.6 lbf ft).

18.7 On 12/24 Volt vehicles fit the 90 amp generator drive belt to the crankshaft pulley and to the generator pulley. Adjust the generator to give a belt deflection at the mid-point of 12 to 19 mm (0.500 to 0.750 in).

18.8 Draw the cowling over the fan and secure to the engine with the three fixings.

18.9 Refill the cooling system (Para 8).

18.10 Reconnect the battery.

Chapter 12-2

3.5 LITRE PETROL COOLING SYSTEM 110/127

CONTENTS

INTRODUCTION

1 This chapter details the Unit and Field repair procedures for the cooling system fitted to Land Rover 3.5 Litre Petrol 110 and 127 vehicles.

WARNING ...

DO NOT REMOVE THE RADIATOR OR EXPANSION TANK FILLER CAPS WHEN THE ENGINE IS HOT BECAUSE THE COOLING SYSTEM IS PRESSURIZED AND PERSONAL SCALDING COULD RESULT.

GENERAL

2 To prevent corrosion of the aluminium alloy engine parts it is imperative that the cooling system is filled with a solution of clean fresh water and the correct type of anti-freeze, winter and summer, or a solution of clean fresh water and inhibitor if frost precautions are not required. Never fill or top-up with water only, always add an inhibitor if anti-freeze is not used. Never use salt water otherwise corrosion will occur. In certain territories where the only available water supply may have some salt content, use only clean rain water or distilled water.

3 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.

4 Prior to leaving the factory, vehicle cooling systems are filled with a 1:1 ratio of water to anti-freeze. This gives protection against frost down to minus 47°C (minus 53°F). Vehicles so filled can be identified by a label affixed to the windscreen radiator.

5 After the second winter the system should be drained and thoroughly flushed. Before adding new anti-freeze examine all joints and renew any defective hoses to make sure the system is leakproof. Inhibitor solution should be drained, flushed out and new solution introduced every two years, or sooner where the purity of the water is questionable.

Recommended solutions

6 The following solutions are recommended for use in Land Rover engines:

6.1 Anti-freeze - AL39 or permanent type ethylene base, without methanol, with a suitable inhibitor for aluminium engines and engine parts. The anti-freeze should be diluted to one part anti-freeze and one part water.

6.2 Inhibitor - Marston Lubricants SQ36 inhibitor concentrate. Use 100 cc of inhibitor per litre of water.

Draining

7 To drain the cooling system proceed as follows:

7.1 Remove the cap from the expansion tank (Fig 1(1)) and the filler plug (10) from the radiator (4).

7.2 If fitted, remove the radiator drain plug, or alternatively disconnect the bottom hose (9), and allow the coolant to drain into a suitable container.

7.3 Remove the engine drain plugs one each side of the cylinder block beneath the exhaust manifold, allow coolant to completely drain then refit plugs complete with new washers.

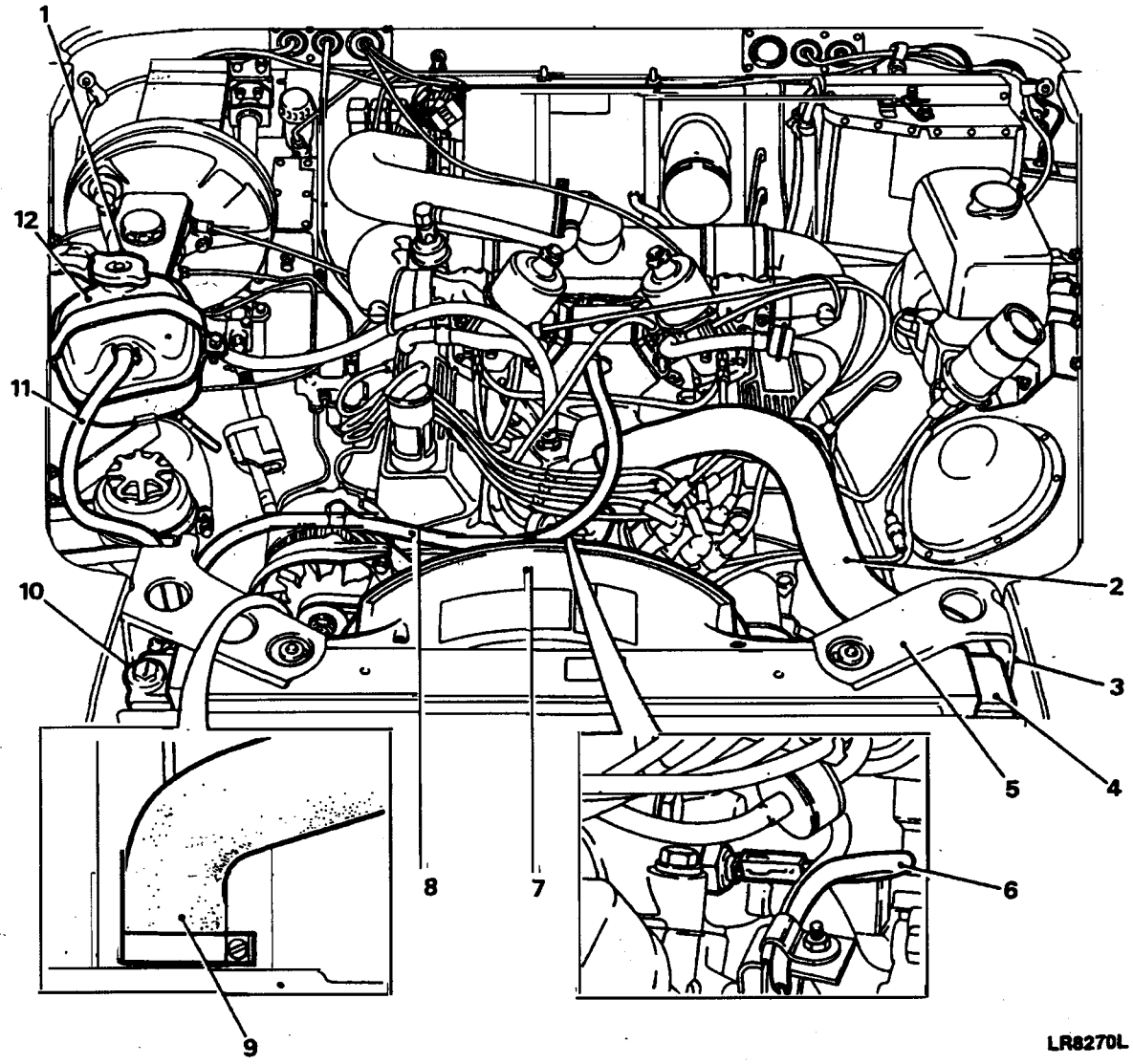
7.4 After draining has completed refit the radiator drain plug complete with new washer or reconnect the bottom hose (9) as necessary.

7.5 To drain the expansion tank, disconnect the hoses (11) and remove the tank (12). Drain and flush the tank then refit to the vehicle.

Filling

8 To fill the cooling system proceed as follows:

8.1 Using a seperate container, mix a solution of anti-freeze or inhibitor, whichever is applicable, with water to the concentration required. To allow for topping up and the expansion tank prepare a quantity in excess of the capacity of the system.



1	Reservoir cap	7	Cowl
2	Top Hose	8	Pent house bleed hose
3	Radiator Bracket Fixings	9	Bottom hose
4	Radiator	10	Filler plug
5	Bracket	11	Reservoir hose
6	Sender	12	Reservoir

Fig 1 Radiator

8.2 Ensure all hose connections and drain plugs are secure.

8.3 Fill the system through the radiator filler plug (10) until the coolant is just below the filler neck. Fit the plug, but do not overtighten.

8.4 Half fill the expansion tank (12) with coolant and secure the cap (1).

8.5 Run the engine until normal operating temperature is reached.

8.6 Allow the engine to cool completely.

8.7 Check coolant levels in radiator (4) and expansion tank (12), top up if necessary.

8.8 Secure the expansion tank cap (1). Refit and tighten the radiator filler plug (10) to a torque of 29 to 37 Nm (40 to 50 lbf ft).

8.9 Finally examine the cooling system for leaks.

RADIATOR

Removal

9 To remove the radiator proceed as follows:

9.1 Disconnect the battery.

9.2 Remove the split pin and clevis pin securing the lower end of the bonnet stay and lift off the bonnet.

9.3 Remove front grille, panel and grille top panel (Cat 522 Chap 16)

9.4 Disconnect oil cooler supply and return hoses at the oil cooler connections (Fig 2 (4,6)). Lower connection first, provide suitable container to collect any residue oil in the cooler (12/24 V vehicles only).

9.5 Disconnect the cross brace tubes (1) and remove complete with oil cooler (2). Blank off exposed ends to prevent the ingress of dirt.

9.6 Remove the four screws with lock washers securing the fan cowl (Fig 1(7)) to the radiator (4).

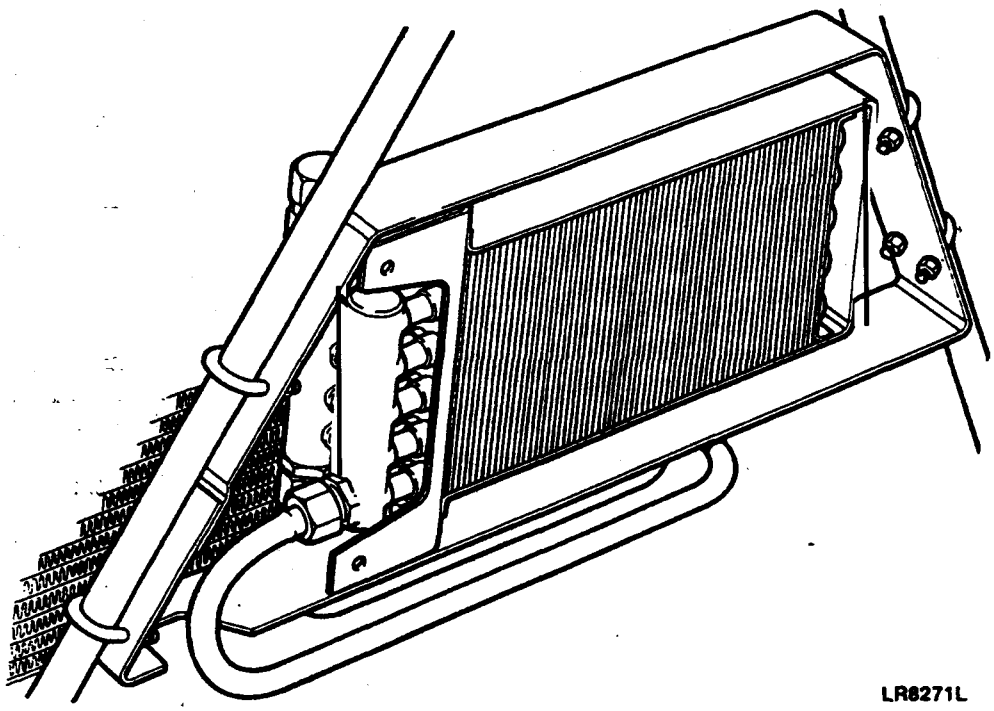
9.7 Remove the three screws each side securing the l.h. and r.h. radiator retaining brackets (3), and remove brackets.

9.8 Drain the cooling system (Refer to Para 7).

9.9 Disconnect the bottom (9), top (2), expansion tank (1) and penthouse bleed (8) hoses at the radiator connections.

9.10 Lift the radiator sufficiently to clear the locating pegs and remove from the front of the vehicle.

9.11 If the radiator is to be renewed, remove the oil cooler unions (Fig 2 (4,6)) and fit to the replacement unit.



1 'A' Frame
2 Oil cooler
3 'U' Bolts
4 Oil cooler supply
5 Radiator
6 Oil cooler return

Fig 2 Oil cooler

Refitting

10 Refitting the radiator is a reversal of the removal procedure.

10.1 Refill the system and check for leaks (Para 8).

THERMOSTAT

Removal

11 To remove the thermostat proceed as follows:

11.1 Partially drain the cooling system until the coolant level is below the thermostat housing (Refer to Para 7).

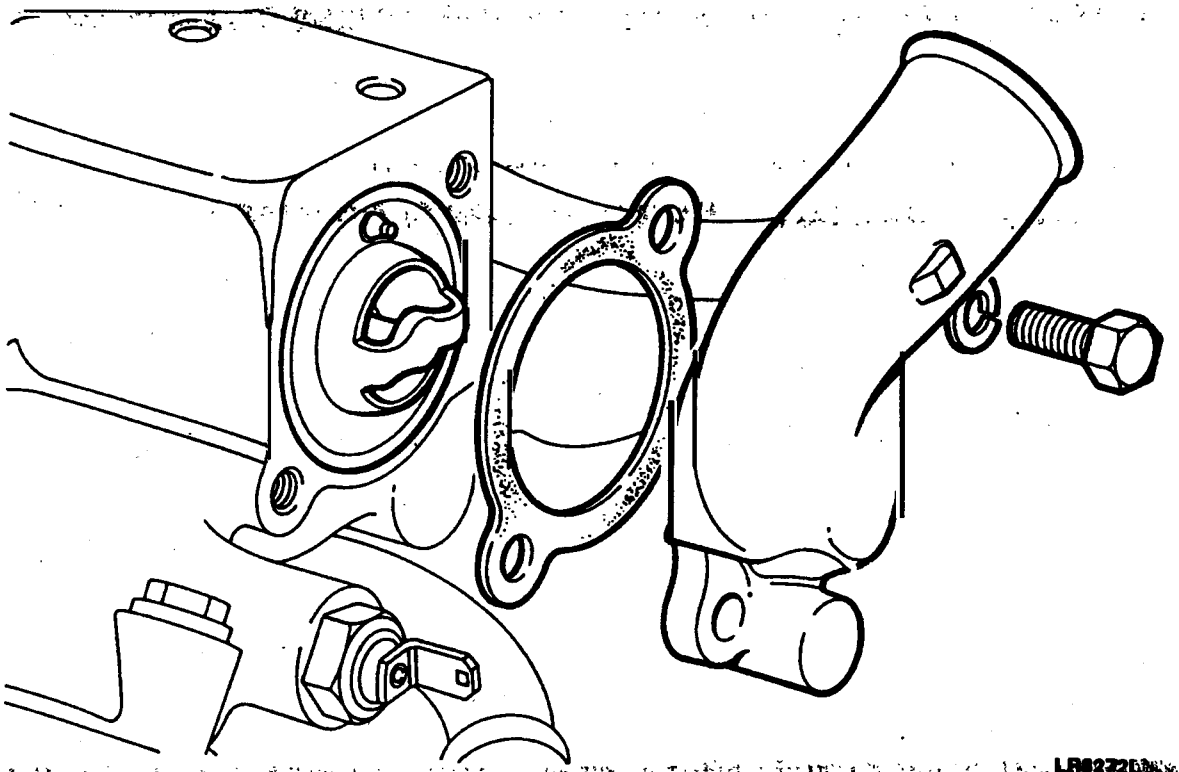
11.2 Disconnect the top hose from the thermostat housing cover (Fig 3 (4)).

11.3 Remove the cover (4) complete with gasket (3) and withdraw the thermostat (2) from the housing.

Testing

12 The rating of the thermostat is 82°C, to test it carry out the following:

12.1 Using a suitable container of water immerse the thermostat. Heat the water and observe the temperature at which the thermostat opens. If the thermostat opens between 79 and 83°C the unit is operating satisfactorily.



1 Housing
2 Thermostat
3 Gasket
4 Cover
5 Bolt
6 Sender

Fig 3 Thermostat housing

Refitting

13 Refit the thermostat in reverse order of removal.

13.1 Use a new gasket (3) between the cover (4) and body (1).

13.2 Top up with the recommended coolant to the correct level as necessary.

13.3 Run engine check for leaks.

VISCOUS COUPLING AND FAN

Removal

14 To remove the viscous coupling (Fig 4 (8)) and fan (7) assembly carry out the following:

14.1 Disconnect the battery.

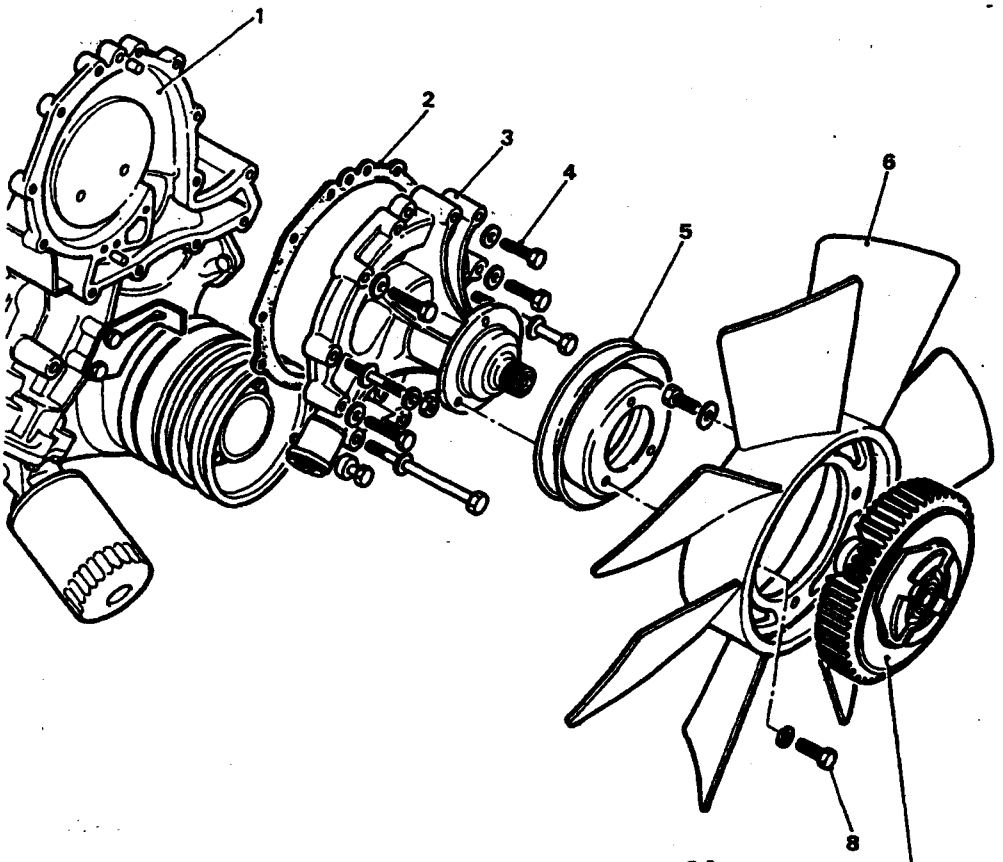
14.2 Proceed as for removal of the radiator (Para 9).

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.

14.3 Insert a suitable tommy bar into the hole in the water pump pulley (6), restrain the pulley and unscrew the viscous unit (8) and fan (7).

14.4 If necessary remove the bolts (10) securing the fan (7) to the viscous unit (8) and detach the fan.



1 Cover
2 Gasket
3 Water pump
4 Bolt
5 Bolt
6 Pulley
7 Fan
8 Viscous coupling
9 Bolt

Fig 4 Water pump, fan and viscous coupling

Repairs and Replacements

15 The viscous coupling is a non-repairable unit, should it be found to be defective a new unit must be fitted.

Refitting

16 Refit the viscous coupling and fan in reverse order of removal, remembering that the nut securing the unit has a left hand thread.

WATER PUMP

Removal

17 To remove the water pump carry out the following:

17.1 Disconnect the battery.

17.2 Remove the radiator (Para 9).

17.3 Remove the Fan and Viscous coupling assembly (Para 14)

17.4 Slacken the 90 ampere generator adjuster and remove the drive belt. Also the water pump to fan drive belt (12/24 V vehicles only).

17.5 Slacken the 45 ampere alternator adjuster, remove the drive belt and move the alternator aside (12 V vehicles only).

17.6 Remove the bolts and washers securing the pulley (9) to the water pump (3) and detach the pulley (6).

17.7 Remove the bolts (4,5) securing the water pump to the cover (1).

Refitting

18 To refit the water pump carry out the following:

18.1 Clean mating services and use a new gasket (2).

18.2 Locate bolts (4,5) evenly tighten to a torque of 22 to 28 Nm (16 to 20.6 lbf ft).

18.3 Fit the fan pulley (6) to the adaptor on the water pump shaft and tighten the securing bolts to a torque of 22 to 28 Nm (16 to 20.6 lbf ft), and secure with spring washers and set screws.

18.4 Fit the viscous coupling and fan assembly (Para 16).

18.5 Refit fan and drive belts as applicable and adjust to the correct tension (Cat 522 Chap 1-2 Para 49 to 55).

18.6 Refit radiator assembly (Para 9).

18.8 Refill system and check for leaks (Para 8).

18.9 Reconnect the battery.

Chapter 12-3

WINTERISED COOLING SYSTEM

CONTENTS

INTRODUCTION

1 This chapter details the Unit and Field repair procedures for the cooling system fitted to Land Rover 2.5 litre diesel winterised 90 and 110 vehicles. Unit and Field repair procedures for other winterised cooling system components are detailed in Chapters 12-1 and 18-1.

WARNING ...

DO NOT REMOVE THE RADIATOR OR EXPANSION TANK FILLER CAPS WHEN THE ENGINE IS HOT. THE COOLING SYSTEM IS PRESSURISED AND THE RAPID RELEASE OF HOT COOLANT COULD RESULT IN PERSONAL INJURY.

GENERAL

2 To prevent corrosion of engine components, it is imperative that the cooling system is filled with a solution of clean fresh water and the correct type of anti-freeze. If frost precautions are not required the system can be filled with a solution of clean fresh water and an inhibitor. Never fill or top-up with water only, always add an inhibitor if anti-freeze is not used. Never use salt water otherwise corrosion will occur. In certain territories where the only available water supply may have some salt content, use only clean rain water or distilled water.

3 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.

4 Prior to leaving the factory, vehicle cooling systems are filled with a 1:1 ratio of water to anti-freeze. This gives protection against frost down to minus 47°C (minus 53°F). Vehicles so filled can be identified by a label affixed to the windscreen radiator.

5 After the second winter the system should be drained and thoroughly flushed. Before adding new anti-freeze examine all joints and renew defective hoses to make sure the system is leakproof. Inhibitor solution should be drained, flushed out and a new solution introduced every two years, or sooner where the purity of the water is in doubt.

Recommended solutions

6 The following solutions are recommended for use in Land Rover engines:

6.1 Anti-freeze - AL39 or permanent type ethylene base, without methanol, with a suitable inhibitor for aluminium engines and engine parts. The anti-freeze should be diluted to one part anti-freeze and one part water.

6.2 Inhibitor - Marston Lubricants SQ36 inhibitor concentrate. Use 100 cc of inhibitor per litre of water.

Draining

7 To drain the cooling system refer to Cat 522 Chap 12-1.

Filling

8 To fill the cooling system refer to Cat 522 Chap 12-1.

RADIATOR/OIL COOLER

Removal

9 To remove the radiator/oil cooler proceed as follows:

9.1 Disconnect the battery.

9.2 Remove the split pin and clevis pin securing the lower end of the bonnet stay and lift off the bonnet.

9.3 Remove front grille, panel and grille top panel (Cat 522 Chap 16)

9.4 Drain the cooling system (Cat 522 Chap 12-1).

9.5 Remove the fan and viscous assembly (Cat 522 Chap 12-1).

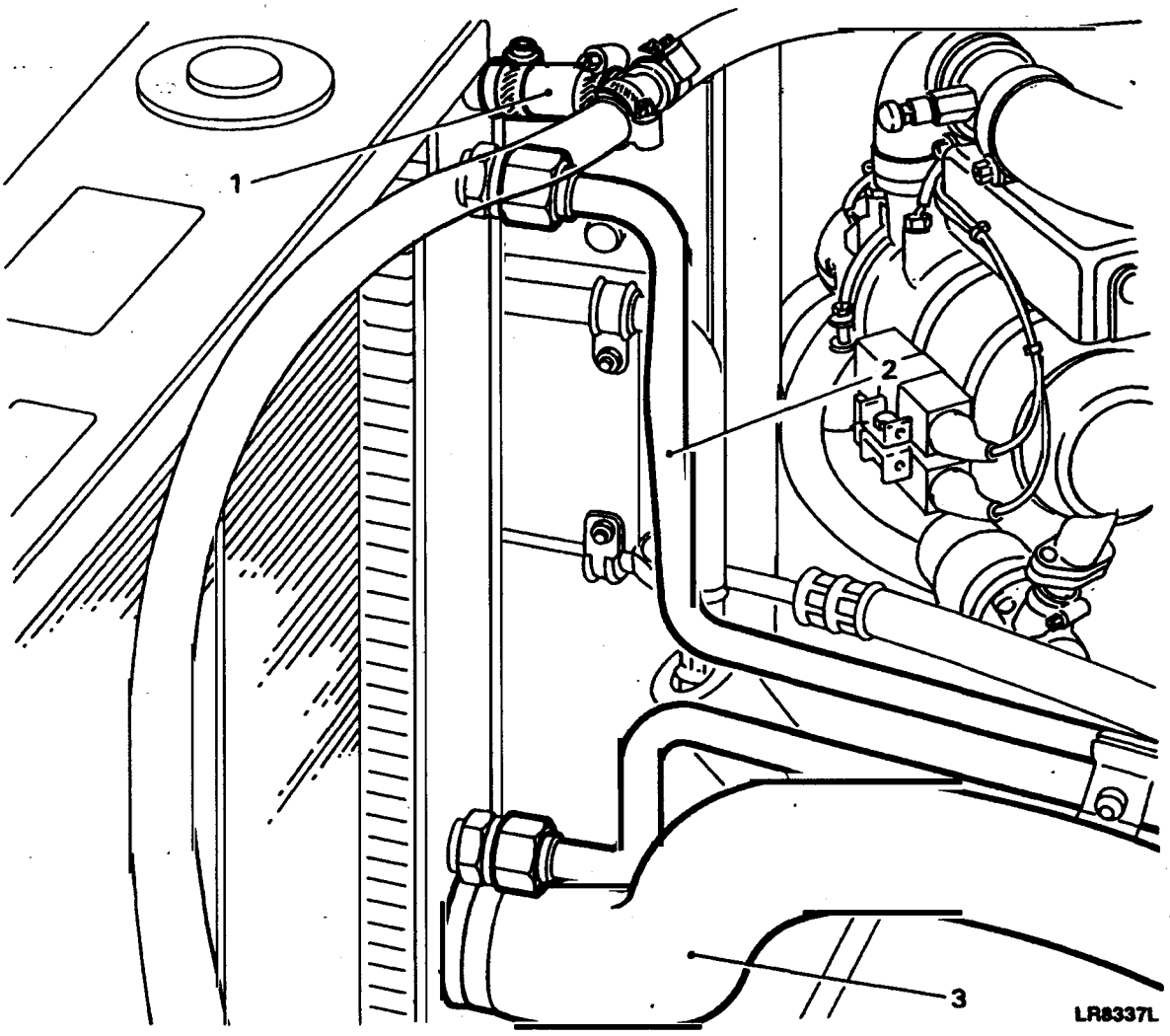
9.6 Remove the fan cowl.

9.8 Disconnect the expansion tank hose (Fig 1 (1)) from the radiator.

9.9 Disconnect the oil cooler pipes (2) from the radiator and cover the ends to prevent the ingress of dirt.

9.10 Disconnect the bottom hose (3) from the radiator.

9.11 Disconnect the top hose (Fig 2 (1)) from the radiator.

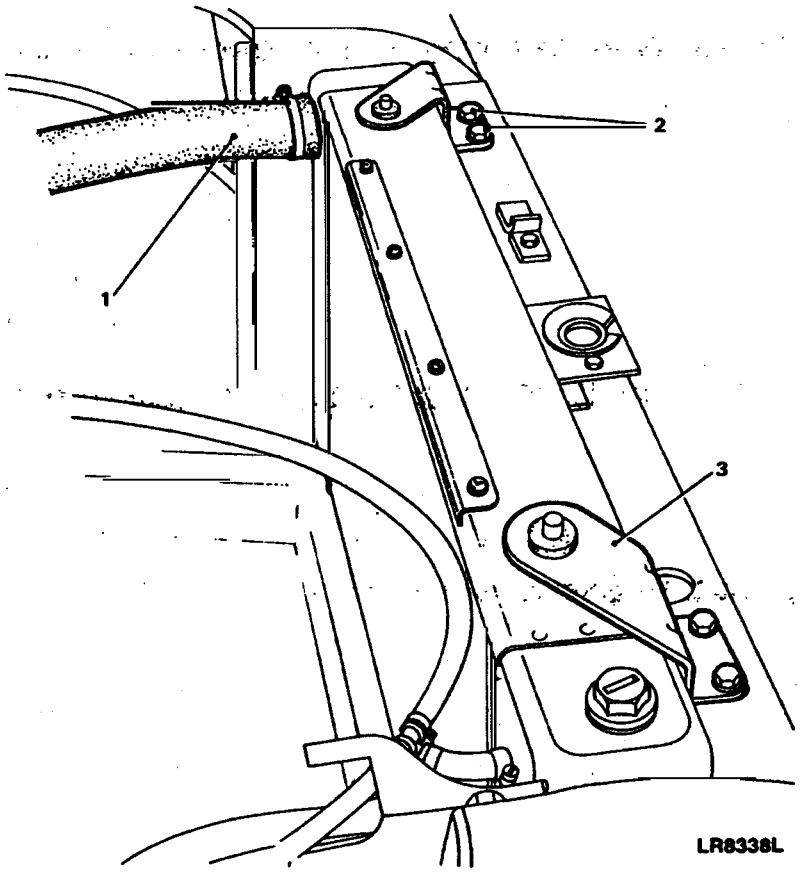


1 Expansion tank hose
2 Oil cooler pipes
3 Bottom hose

Fig 1 Radiator hose and pipe connections

9.12 Remove the four bolts (Fig 2 (2)), two each side retaining the radiator top securing brackets, and remove the brackets (3).

9.13 Carefully lift out the radiator/oil cooler.



1 Top hose
2 Bolts
3 Top securing brackets

Fig 2 Radiator top securing brackets

Refitting

10 To refit the radiator/oil cooler proceed as follows:

10.1 Check that the rubber grommets (Fig 3 (2)) on the radiator locating pegs and beneath the radiator mounting brackets on the chassis cross member are in position.

10.2 Lower the radiator into position ensuring that the pegs (1) locate in the mounting brackets.

10.3 Fit the radiator top securing brackets (Fig 2 (3)) and secure with the four bolts (2).

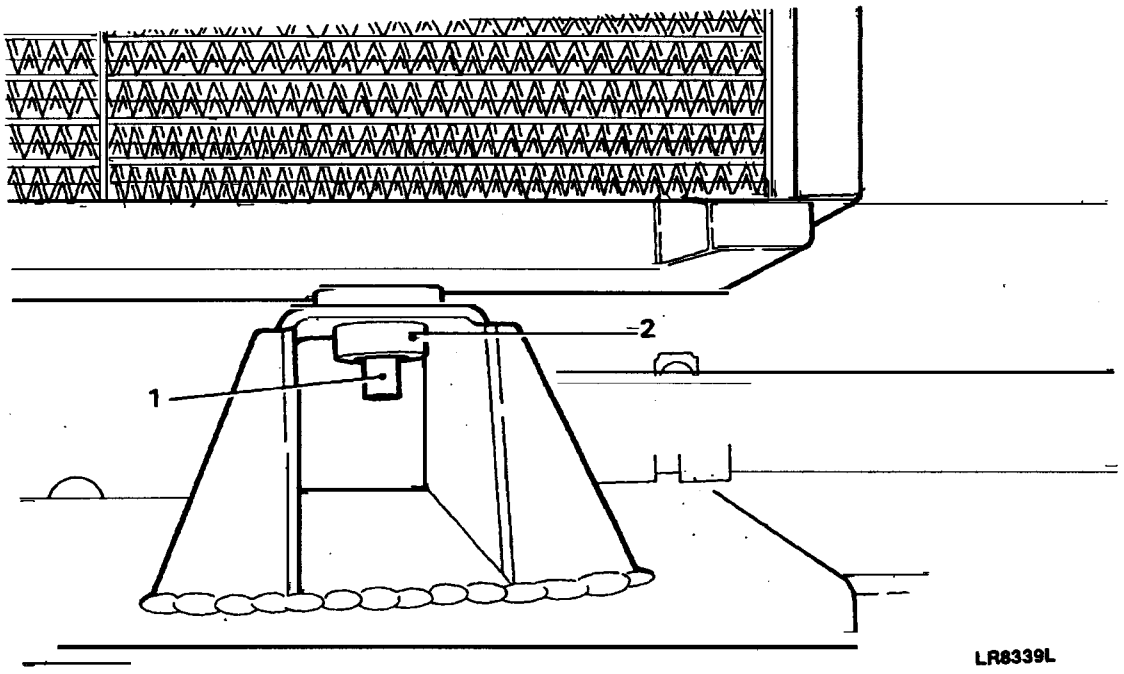
10.4 Connect the radiator top hose (1)

10.5 Connect the radiator bottom hose (Fig 1 (3)).

10.6 Remove the temporary end covers and fit the oil cooler pipes (2) to the radiator.

10.7 Connect the expansion tank hose (1).

10.8 Place the fan cowl in position, but do not secure at this stage.



1 Locating peg

2 Rubber grommet

Fig 3 Radiator locating pegs

10.9 Fit the fan and viscous coupling and secure the cowl (Cat 522 Chap 12-1).

10.10 Check that all the coolant hose clips are tight and refill the coolant system with the correct concentration of water and anti-freeze (Cat 522 Chap 12-1).

10.11 Fit front grille, panel and grille top panel (Cat 522 Chap 16)

10.12 Top-up the engine with lubrication oil to compensate for any loss during radiator/oil cooler removal.

10.13 Connect the battery.

10.14 Run the engine for a short while to allow oil circulation through the cooler. Switch off the engine, allow the oil to settle in the sump and re-check the oil level. Top-up if necessary.

10.15 Fit the bonnet and secure the lower end of the bonnet stay with the clevis pin and split pin.

WATER HEATER UNIT

11 Land Rover winterised 90 and 110 vehicles have been specifically designed to operate in extreme sub-zero climatic conditions. In order to meet the required specification a 'Webasto' DBW 46 water heater has been incorporated as an aid to the engine cold start procedure.

Removal

12 To remove the water heater unit from the vehicle proceed as follows:

12.1 Disconnect the vehicle battery.

12.2 Drain the cooling system (Cat 522 Chap 12-1).

12.3 Disconnect the exhaust tube (Fig 4 (1)) from the water heater burner head.

12.4 Disconnect the four pin electrical plug connector (7) from the main cable harness.

12.5 Disconnect the water inlet hose (6).

12.6 Disconnect the water outlet hose (2).

12.7 Clamp the water heater diesel fuel inlet hose at the fuel filter connection. Disconnect the diesel fuel inlet hose (8) from the dosing pump connection and allow the excess fuel in line to drain into a suitable container.

12.8 Remove the two nuts (5) and washers (3) securing the water heater bracket to the inner wing, and remove the earth lead connector (4).

12.9 Carefully withdraw the water heater unit complete with bracket from the inner wing stud plate.

Refitting

13 To fit the water heater unit to the vehicle proceed as follows:

13.1 Locate the bracket holes of the water heater unit on the inner wing stud plate.

13.2 Place the earth lead connector (Fig 4 (4)) over the rear stud and secure the water heater bracket with the two nuts (5) and washers (3).

13.3 Connect the diesel fuel inlet hose (8) to the dosing pump connection and remove the clamp.

13.4 Connect the water outlet hose (2).

13.5 Connect the water inlet hose (6).

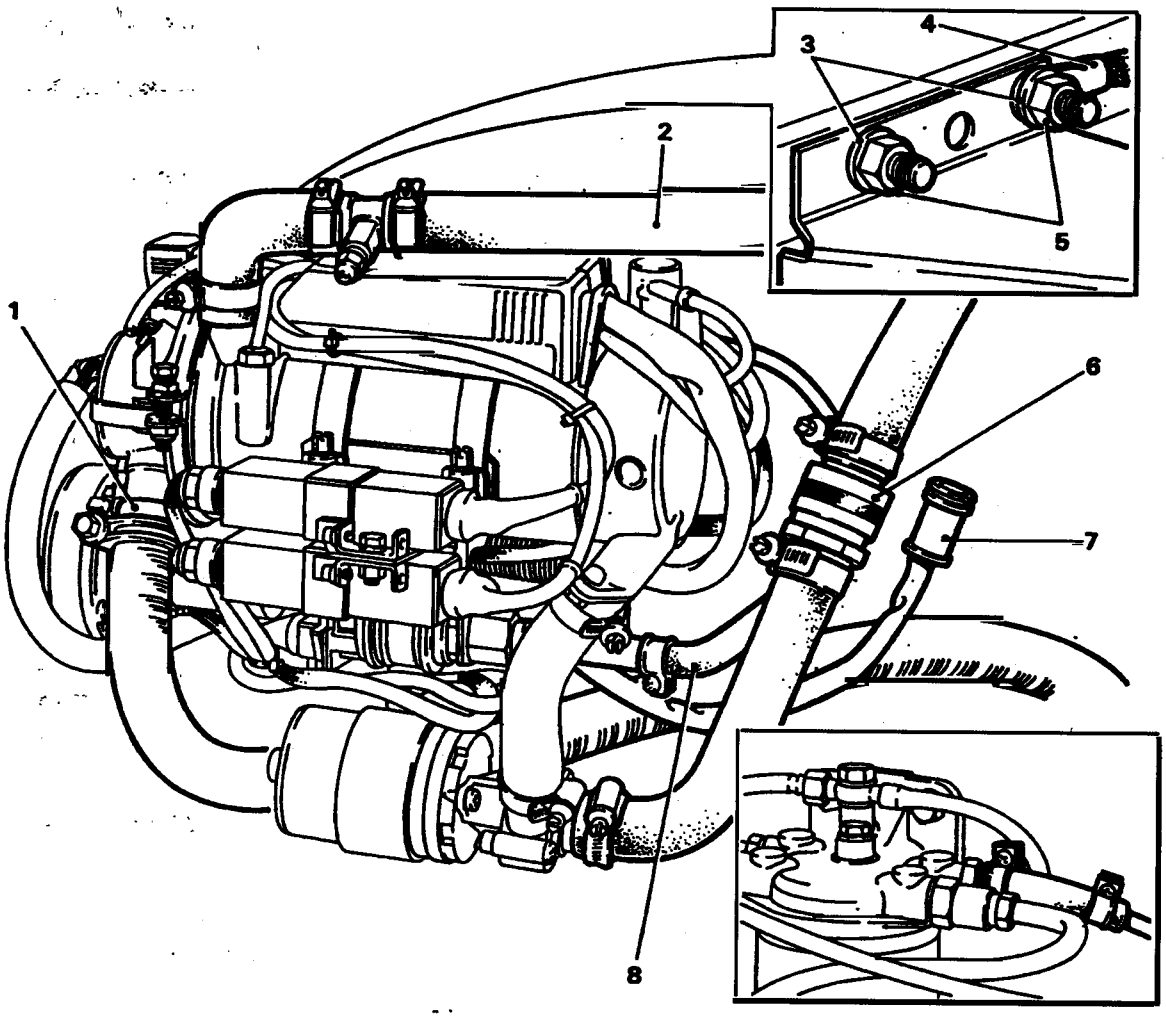
13.6 Connect the four pin electrical plug connector (7) to the main cable harness.

13.7 Connect the water heater exhaust system (1).

13.8 Refill the cooling system (Cat 522 Chap 12-1).

13.9 Connect the vehicle battery.

13.10 Bleed the water heater circuit (Cat 522 Chap 18-1).



1 Exhaust tube
2 Water outlet hose
3 Washers
4 Earth lead connector
5 Nuts
6 Water inlet hose
7 Electrical plug connector
8 Fuel inlet hose

Fig 4 Water heater unit installation

Bleeding the fuel supply system

14 If the water heater fuel supply line has been disconnected, or has been sucked dry due to an empty tank, filling time can take several minutes (approximately one minute for every meter length of 3 mm diameter fuel line). In order to extract as little power as possible from the vehicle battery, switch the heater on and off several times whilst the engine is running until combustion takes place. Alternatively remove the glow plug coil for the initial period of fuel fill time.

WATER HEATER EXHAUST SYSTEM

Removal

15 To remove the water heater exhaust system proceed as follows:

15.1 Disconnect the exhaust tube (Fig 5 (1)) from the water heater burner head.

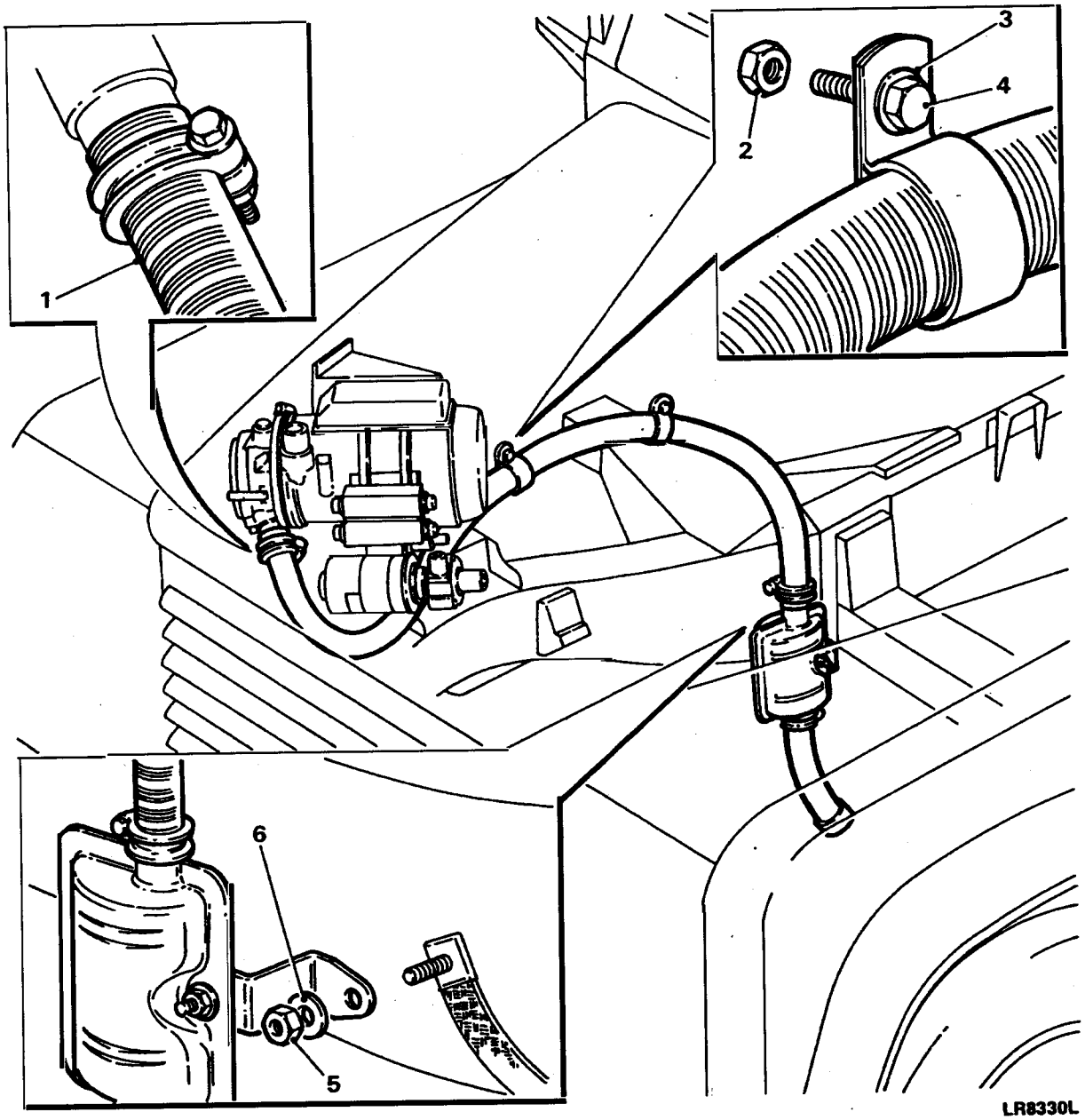
15.2 Remove the screws (4), nuts (2) and washers (3) from the two inner wing exhaust support brackets.

15.3 Remove the toebox support nut (5) and washer (6) securing the exhaust to the chassis.

15.4 Remove the complete exhaust system from the vehicle.

Refitting

16 To fit the water heater exhaust system reverse the procedures instructed in Para 15.



1 Exhaust tube
2 Nuts
3 Washers
4 Screws
5 Nut
6 Washer

Fig 5 Water heater exhaust system

Chapter 13-1

12 VOLT ELECTRICAL SYSTEM

CONTENTS

INTRODUCTION

1 This Chapter gives Unit and Field repairs for the 12 volt electrical system fitted to Land Rover 90 and 110 vehicles having 2.5 litre diesel engines. The information given is applicable to both left and right hand vehicles.

ALTERNATOR

Removal

2 Disconnect the leads from the vehicle battery.

3 Disconnect the leads from the rear of the alternator, noting their position.

4 Slacken the bolts securing the alternator to the engine block (2) and adjustment link (3).

5 Slacken the bolt (3) s curing the adjustment link to the alt rnator and pivot inwards to r move the belt from th pulley.

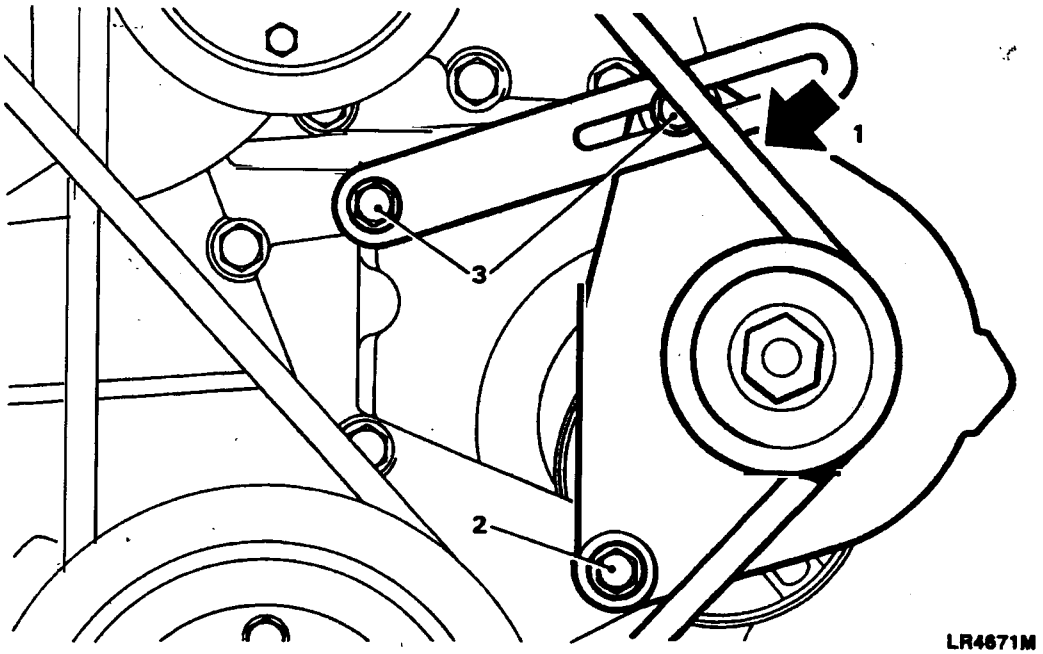
6 Remove the pivot bolts and fixing bolt and then lift the alternator clear of the vehicle.

Refitting

7 Refit the alternator by reversing the removal procedure, but do not tighten the adjustment and pivot bolts.

8 Fit the drive belt (1) and adjust to the correct tension of 12 to 19 mm.

9 Tighten the bolt at the top of the adjustment link then tighten the nut securing the bottom of the adjustment link and the two mounting brack t bolts.



1 Alternator belt 2 Pivot bolt 3 Adjustment bolts

Fig 1 Alternator adjustment

REGULATOR (Model A115)

Removal

10 For removal of the regulator, see Chapter 13-1 Cat 524 Paragraphs 3 to 3.4.

Refitting

11 For refitting of the regulator see Chapter 13-1 Cat 524 Paragraph 5.

BRUSH BOX ASSEMBLY

Removal

12 For removal of the brush box assembly, see Chapter 13-1 Cat 524 Paragraphs 3.5 to 3.7.

Refitting

13 For refitting of the brush box assembly see Chapter 13-1 Cat 524 Paragraph 5.

REGULATOR/BRUSH BOX ASSEMBLY (Model A127)

Removal

14 For removal of the regulator/brushbox assembly, see Chapter 13-1 Cat 524 Paragraphs 10.3 to 10.4.

Refitting

15 For refitting of the regulator/brushbox assembly, see Chapter 13-1 Cat 524 Paragraph 11.

STARTER MOTOR

Removal

16 Disconnect the leads from the vehicle battery.

17 Undo the nut securing the cable to the starter motor and remove.

18 Undo the nut securing the feed wire to the solenoid and remove.

19 Undo the nut securing the earth lead to the starter motor and remove.

20 Move all the cables clear of the starter motor location.

21 Locate the nut securing the starter motor to the flywheel housing and remove.

22 Undo the two remaining bolts and nuts securing the starter motor and remove.

23 Manoeuvre the starter motor clear of flywheel housing and remove.

Refitting

24 Refit the starter motor by reversing the removal procedure.

STARTER MOTOR SOLENOID

Removal

25 Disconnect the leads from the vehicle battery.

26 Undo the nuts securing the connections to the solenoid and remove.

27 Undo the two securing screws (2M113) or two nuts (Paris Rhone) and remove th solenoid from the starter motor.

Refitting

28 Refit the solenoid to the starter motor by reversing the removal procedure.

HEADLIGHTS

29 The headlights, mounted in the wing front panels, incorporate a combined reflector and front lens assembly known as the light unit. Double filament lamps give a vertical dip.

Removal

30 Disconnect the earth lead from the vehicle battery.

31 Disconnect cables at the snap connectors (13) and remove from supporting clips.

32 Press the light unit inwards against the compression springs of the adjusting screws (14) and turn anti-clockwise to release.

33 Release cable connector (11) from light unit (5) and withdraw unit.

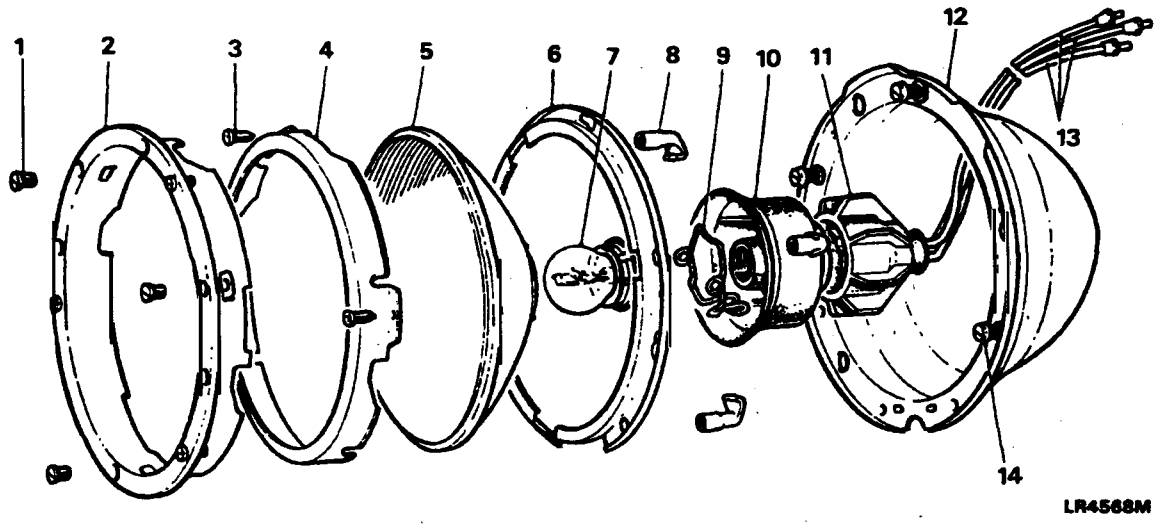
34 Remove the screws securing the body (12) to the wing and withdraw complete with cables and rubber seal.

Refitting and adjustment

35 Refit the unit by reversing the order of the removal procedure.

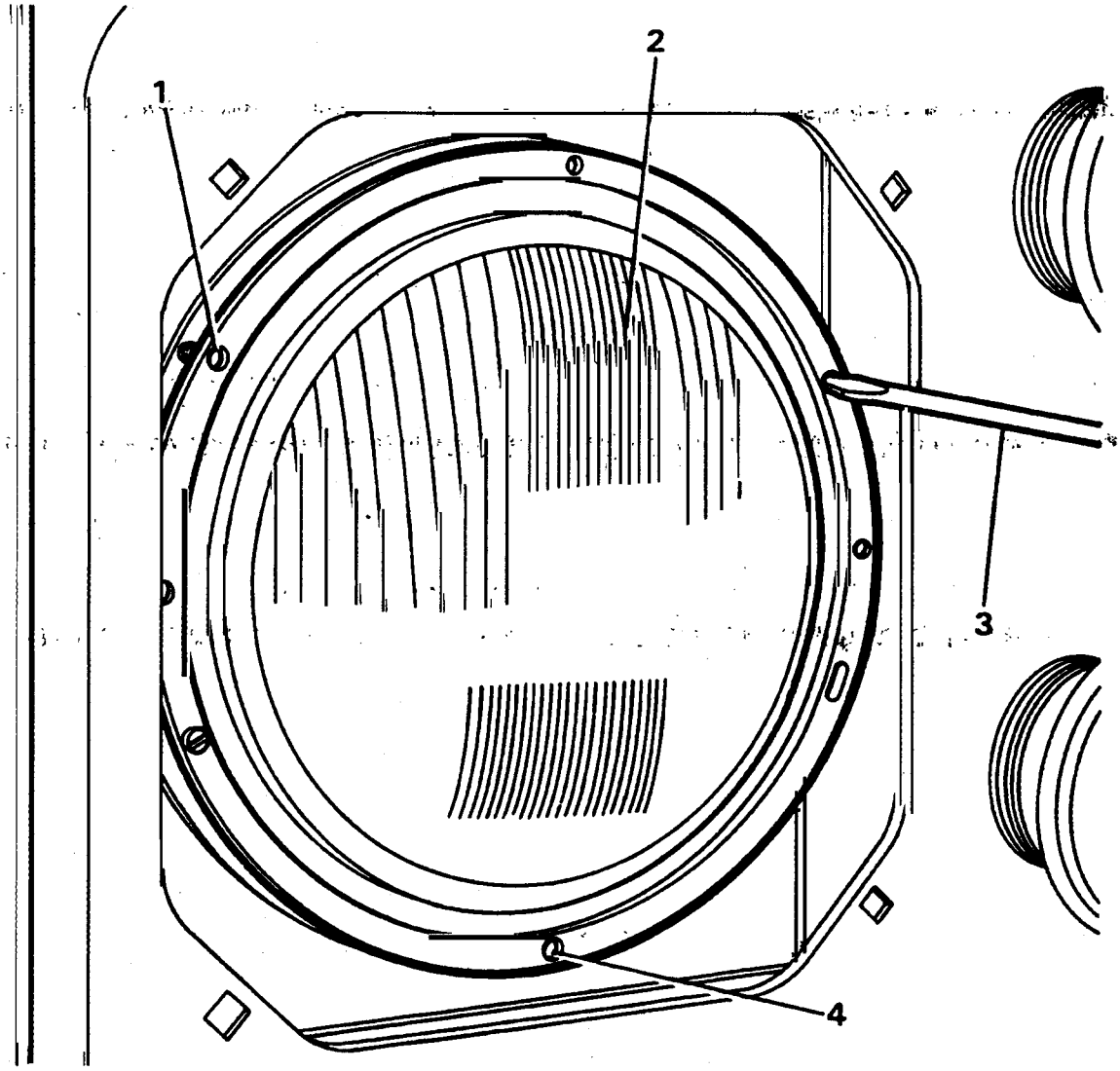
36 Adjust the lamp (2) using a screwdriver (3), in the vertical plan is effected by turning the spring loaded screws (4) at the top or bottom of the body.

37 Adjustment in the horizontal plane is made by means of the screws (1) at each side of the unit.



1	Screw	8	Fitting securing mask adaptor
2	Mask adaptor rim	9	Lamp retaining clip
3	Screw	10	Rubber boot
4	Light unit securing rim-front	11	Cable connector
5	Light unit	12	Body
6	Light unit securing rim-rear	13	Cables
7	Lamp	14	Adjusting screw

Fig 2 Headlamp assembly



1 Horizontal adjustment hole
2 Lamp
3 Screwdriver
4 Vertical adjustment hole

Fig 3 Headlamp adjustment

LAMP REPLACEMENT

Removal

38 Remove the light unit (5) by pressing inwards against the compression springs of the adjusting screws (14) and turn anti-clockwise to release.

39 Release cable connector (11) from light unit (5).

40 Remove rubber boot (10), release lamp retaining clip (9) and withdraw lamp (7).

Refitting

41 Fit new lamp and secure with retaining clip.

42 Refit rubber boot and cable connector.

43 Refit the light unit by reversing the removal procedure.

Headlight setting

44 The headlights should be set using beam setting equipment. If adjustment is required and specialist beam setting equipment is not available, temporary setting can be carried out using the following method, but should be checked and if necessary reset using beam setting equipment as soon as possible.

45 When checking headlights the vehicle must be unladen, on level ground and 12ft (365cm) from a vertical wall or screen. The horizontal and vertical centre lines of the headlights must be accurately measured from the vehicle concerned then marked on the wall or screen. Adjust the headlights, as necessary, so that the area of concentrated light corresponds with the marked crosses.

45.1 A - Measurement between headlight centres.

45.2 B - Measurement from level floor to headlight centres.

TURN, SIDE AND FOG LIGHTS

46 The lights under this heading are all of similar construction, the removal and refitting procedure is the same for each light. The construction differs only in respect of lens colours and lamp wattage.

Removal

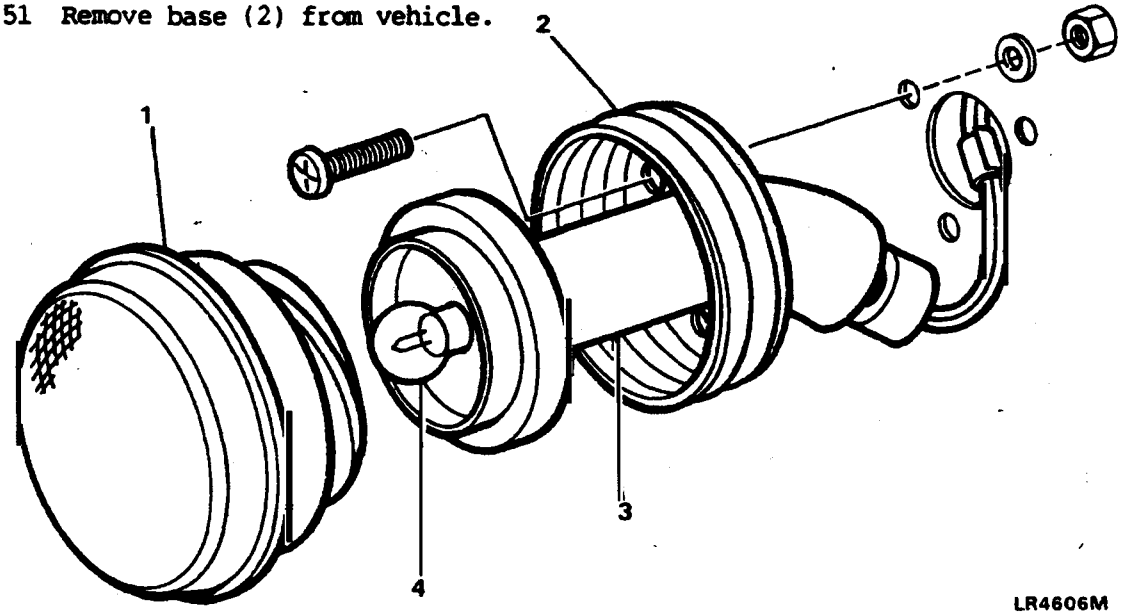
47 Disconnect the earth lead from the vehicle battery.

48 Disconnect cable from terminals.

49 Unscrew lens (1) and withdraw body complete with lampholder and cable (3).

50 Remove lampholder and cable from body.

51 Remove base (2) from vehicle.



1	Lens	3	Lampholder
2	Lamp base	4	Bulb

Fig 4 Side/tail lights

Refitting

52. Refit the light by reversing the order of removal, if fitting a new or replacement light ensure correct type is being fitted.

STOP/TAIL LIGHTS

53 Two tail/stoplights are fitted at the rear of the vehicle. The lights are similar to the sidelights but have a red lens and double contact lampholder to take 12V 21/5W double filament lamps (4). The 5W filament constitutes the tail light and the 21W the stoplight.

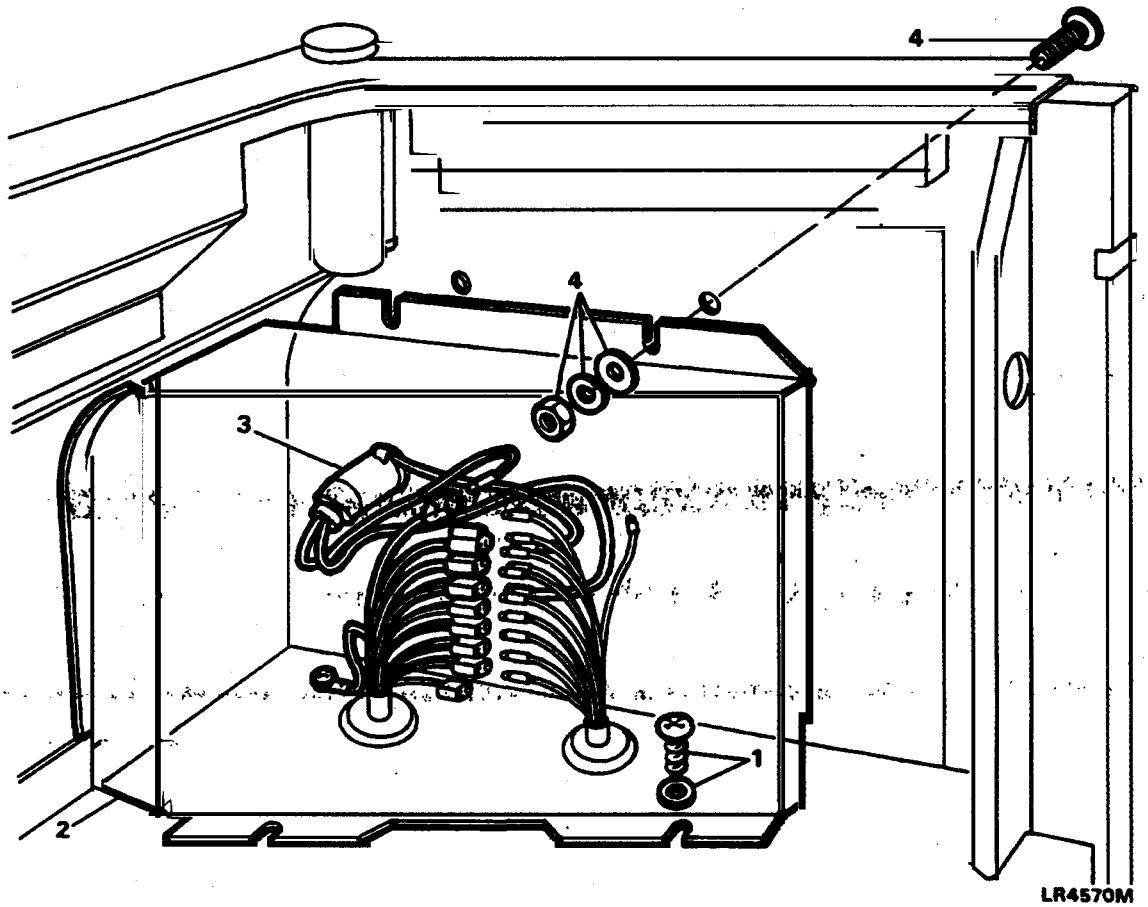
Removal and refitting

54 Disconnect the earth lead from the vehicle battery.

55 From inside the vehicle undo the two screws (Fig 5 (1)(4)) and remove the cover (2).

56 Disconnect cables from terminals (3).

57 Removal and refitting is the same as for side and turnlights (paragraphs 49 to 52).



1	Cover fixing	3	Tail lamp
2	Cover	4	Cover fixings

Fig 5 Removing the cover

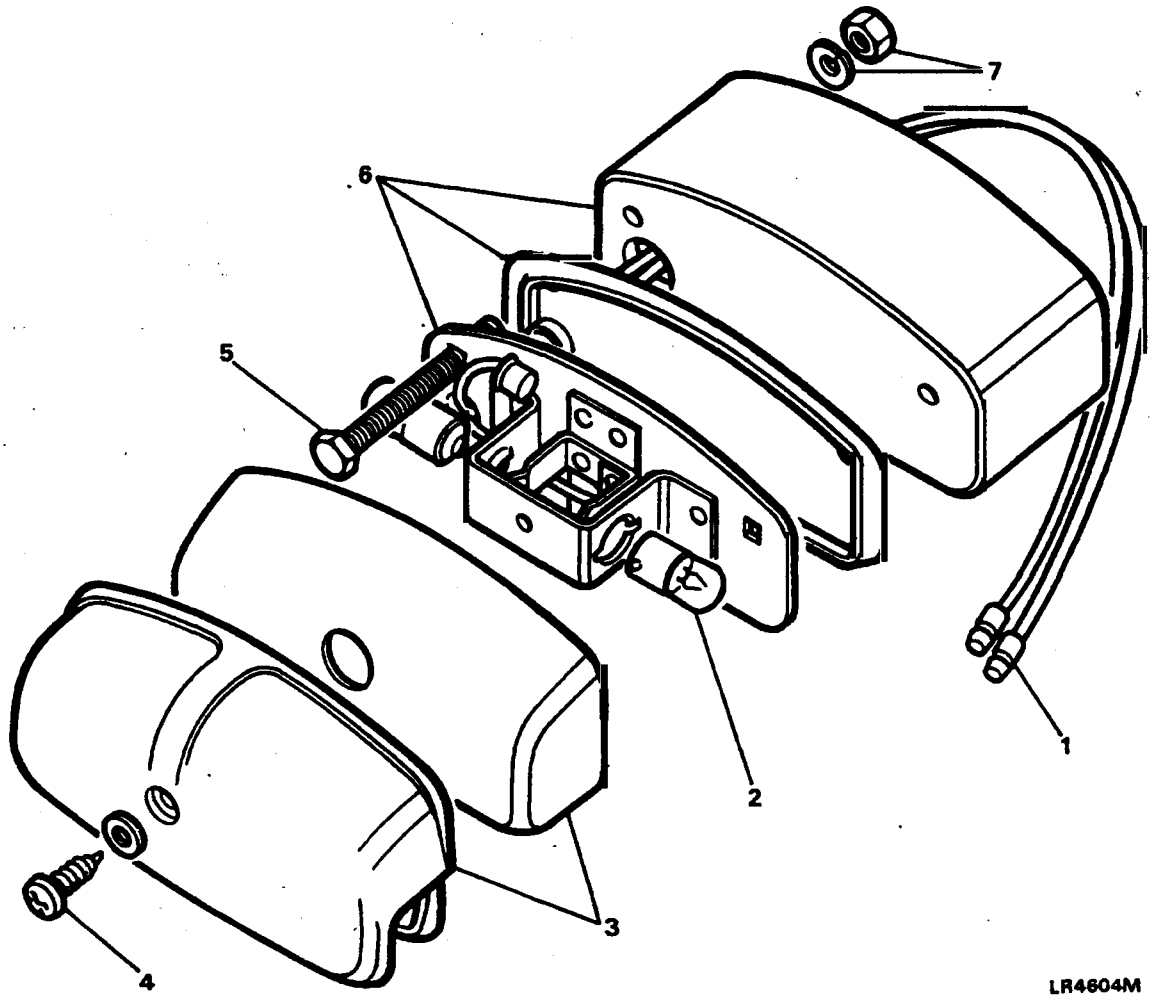
REAR NUMBER PLATE LIGHT

Removal

58 Disconnect the earth lead from the vehicle battery.

59 Undo the screw (Fig 6 (4)) holding the lens cover and lens (3) and remove.

Note ...



1	Socket connectors	5	Bolt
2	Bulb	6	Adaptor and bulbholder
3	Lens and lens cover	7	Nut and washer
4	Screw		

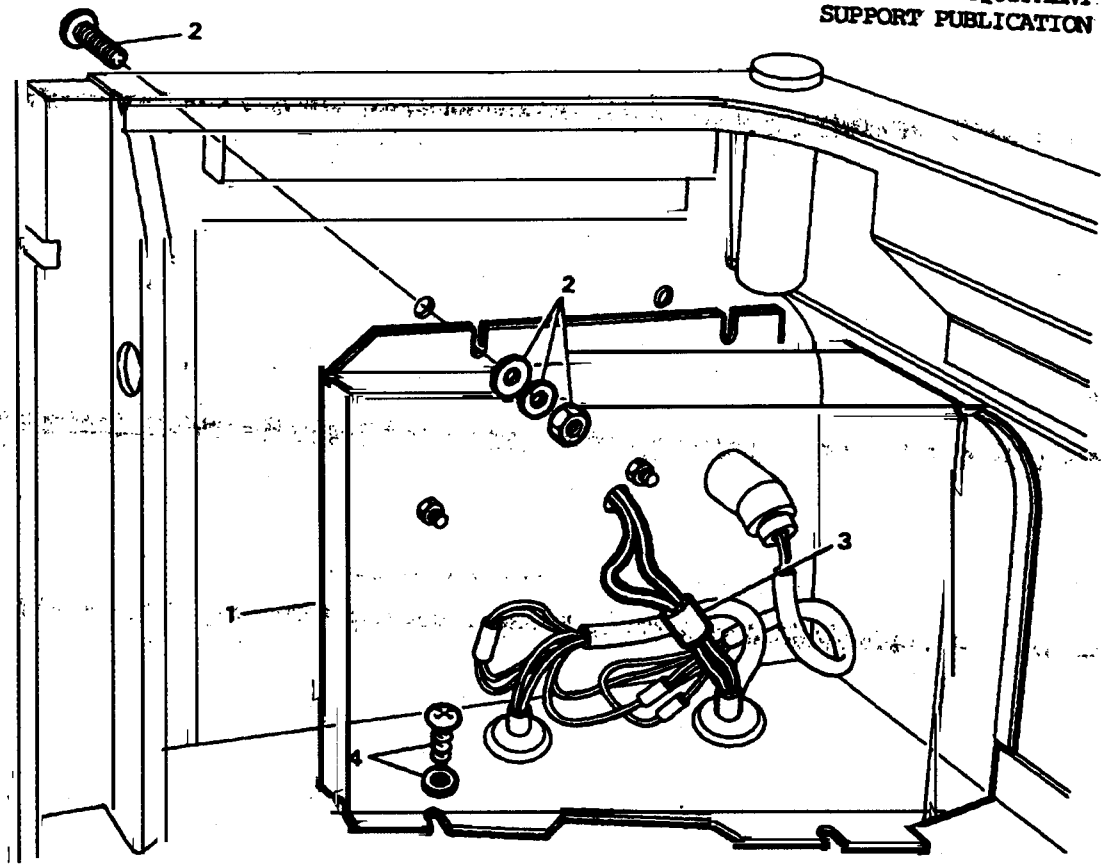
Fig 6 Number plate light

60 From inside the vehicle undo the two screws (Fig 7 (2)(4)) and remove the cover (1).

61 Disconnect the connecting leads (Fig 6 (1))(Fig 7 (3)) to the light unit.

62 Undo the two nuts (Fig 6 (7)) and bolts retaining (5) the mounting block.

63 Remove the mounting block, seal and bulb hold r (6).



1	Cover fixing	3	Tail lamp
2	Cover	4	Cover fixings

Fig 7 Removing the cover

Refitting

64 Refit the light by reversing the order of removal.

CONVOY LIGHT

65 The convoy light is located beneath the vehicle to illuminate an area of ground behind the rear axle. The front cover is fitted with a spring loaded light shi ld which may be rotated on the cover, to give full illumination or restricted illumination for use in black-out conditions.

Removal and dismantling

66 Disconnect the negative earth lead from the battery.

67 Disconnect cable at terminal.

68 Remove mounting bracket and light assembly (5) from chassis.

69 Unscrew locking ring (1) and withdraw rear case and lampholder assembly (2).

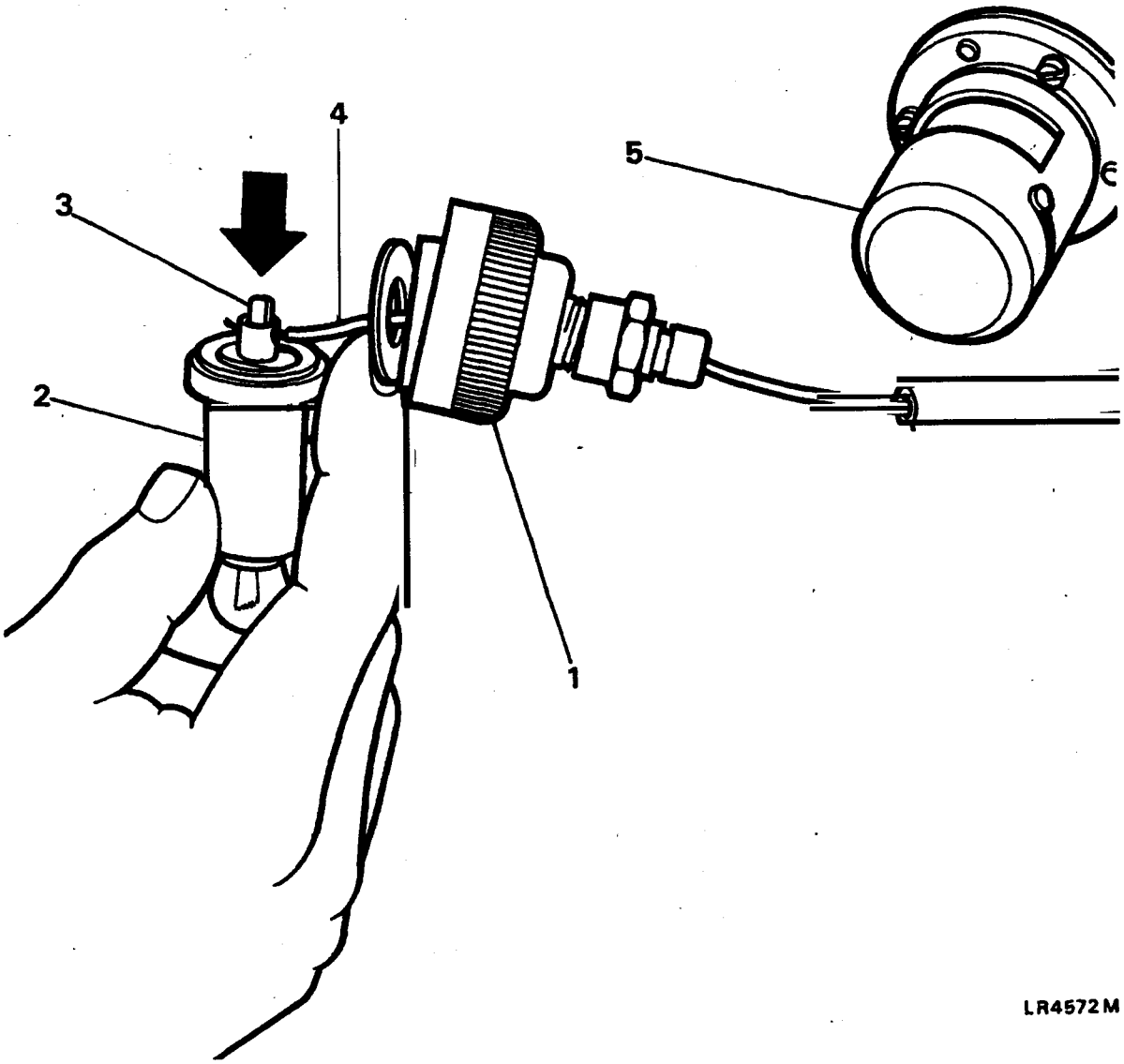
70 Release connection (3) from lampholder and withdraw cable (4).

71 Remove bracket from backplate.

72 Remove front cover from backplate.

Assembly and refitting

73 Assemble and refit the light in reverse order of removal and dismantling.



1	Locking cap	4	Lead
2	Lampholder	5	Lamp cover
3	Connector		

Fig 8 Convoy light

MAP READING LIGHT

74 The map reading light, mounted on the fascia in front of the passenger seat, is automatically illuminated when the inner flanged cover is raised. Closing the cover extinguish s the light.

Removal

75 Disconnect the earth lead from the vehicle battery.

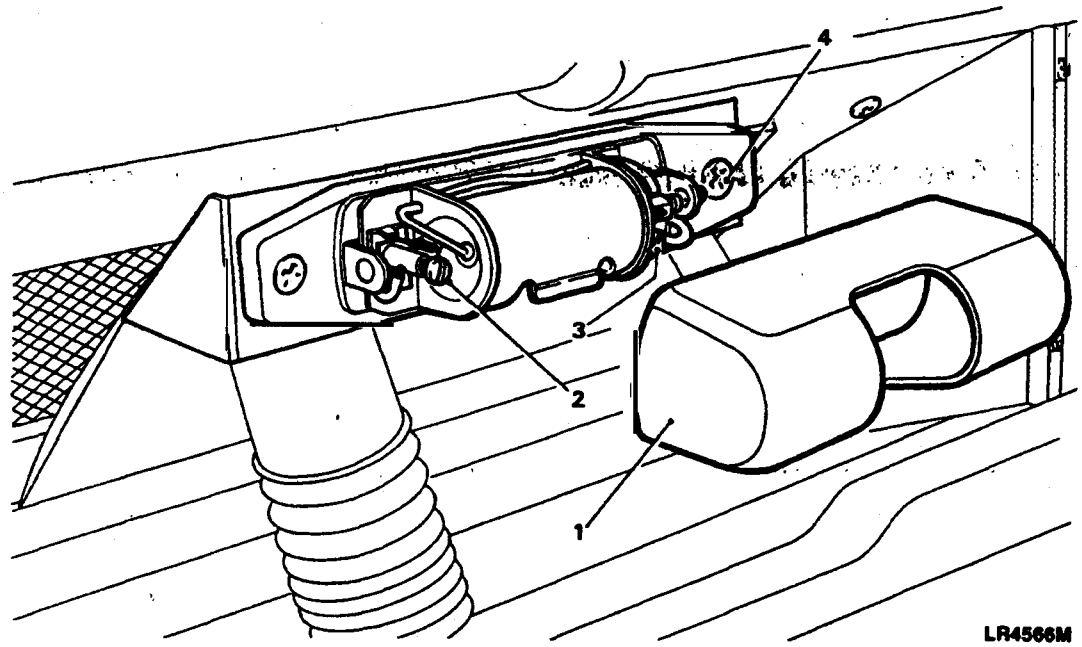
76 Raise the inner flanged cover to the "ON" position.

77 Pull off the outer cover (1).

78 If necessary pull out the rubber mounted lampholder (3), with its short lead attached.

79 Remov the screws (4) securing the body to the vehicle.

80 Slacken the terminal screw (2), on the left of the light, sufficiently to release the lead and remove the light.



1	Cover	3	Bulb holder
2	Connector	4	Fixing screw

Fig 9 Map reading light

Refitting

81 Assemble and refit the light in reverse order of removal.

Note ...

Ensure that the flanged inner cover is raised before fitting the outer cover. The outer cover is fitted with the manufacturer's name uppermost.

TRAILER SOCKET

82 The trailer socket is situated on the right of the towing hook secured to the rear chassis cross member. When not in use the socket is protected by a spring loaded cover. To use the socket, lift the cover and insert the trailer plug ensuring engagement between the lip at the end of the cover and the slot in the plug casing.

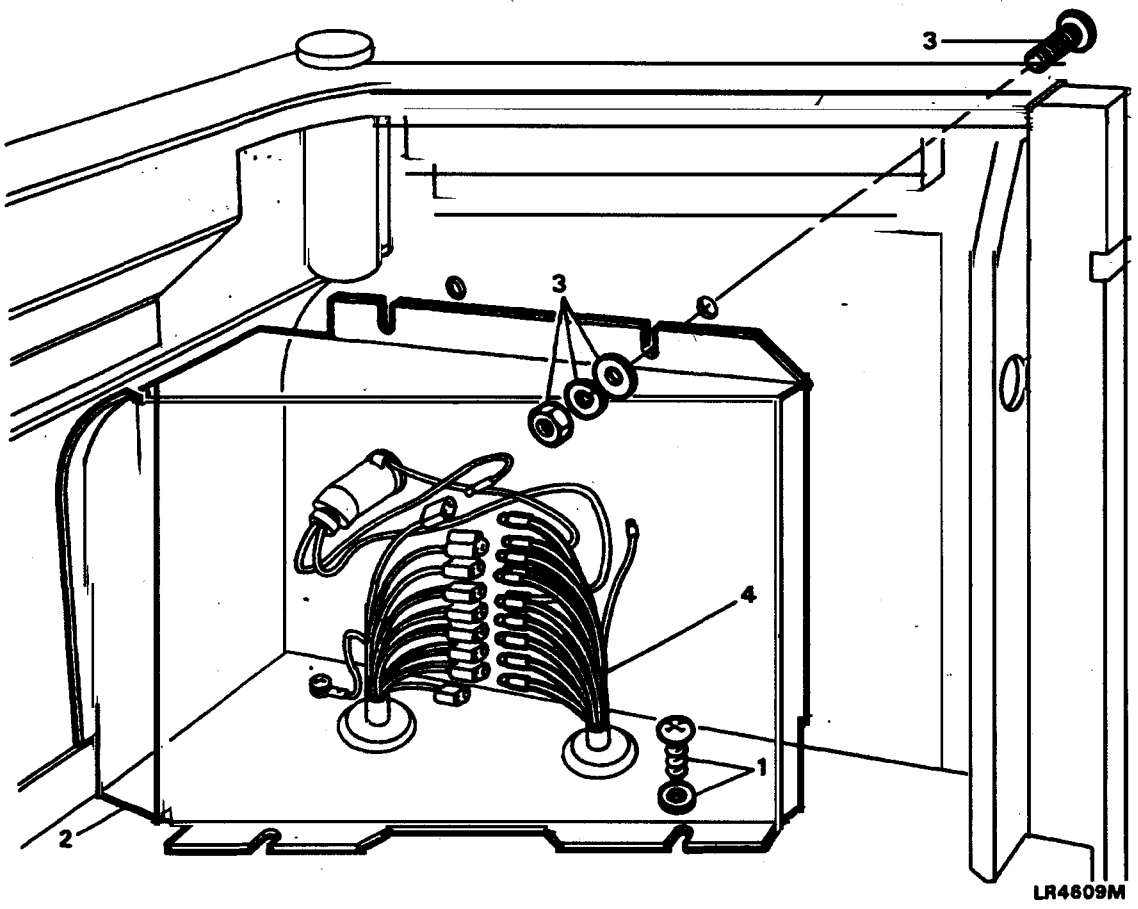
Removal

83 Disconnect the earth lead from the vehicle battery.

84 From inside the rear of the vehicle undo the two screws (1)(3) and remove the access panel (2).

85 Disconnect the snap connectors (4) from the rear lighting circuit to the trailer socket.

86 From outside of the vehicle remove the four bolts (Fig 11 (3)), spring washers (4) and nuts (5) securing the socket (1) and withdraw complete with leads.

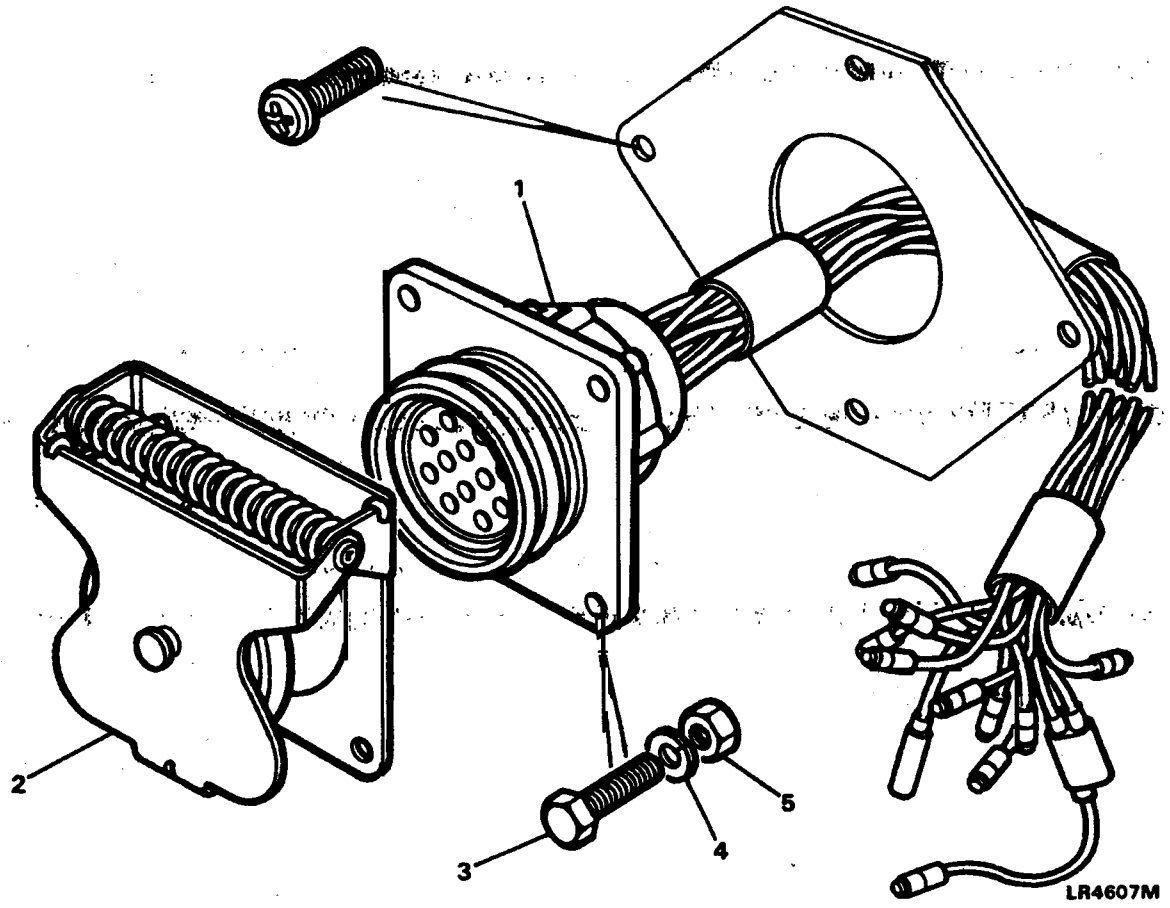


1	Cover fixings	3	Cover fixings
2	Cover	4	Trailer connectors

Fig 10 Removing the cover

Refitting

87 Refit in reverse order of removal connecting leads in accordance with the circuit diagram (Catagory 302).



1	Trailer socket	4	Washer
2	Spring cover	5	Nut
3	Bolt		

Fig 11 Trailer socket

DIRECTION SIDE REPEATER LIGHTS

Removal (Early version)

88 Disconnect the negative earth lead from the vehicle battery.

89 Undo the screw (1) retaining the lens (2) and gasket (3) and remove.

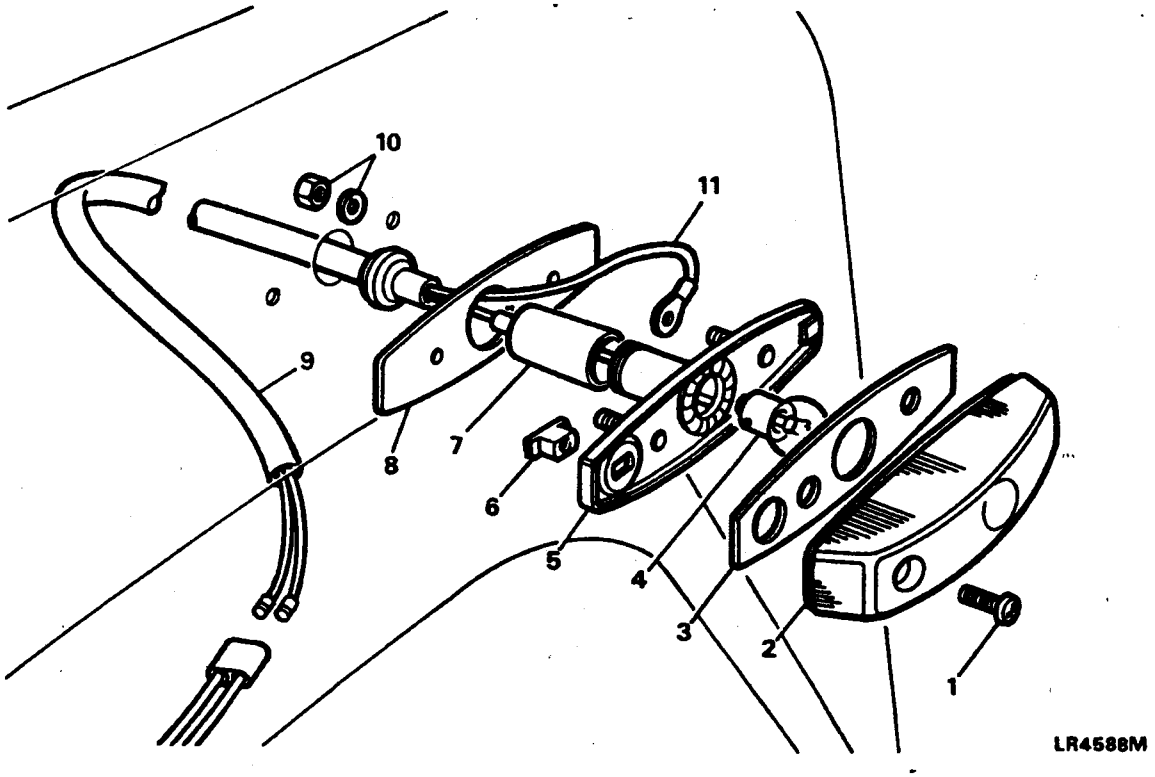
90 Remov the bulb (4) from the holder (5).

91 From inside of the wing, disconnect lead (9) via the two snap connectors and undo the two nuts and washers (10).

92 R move the lamp holder (5) and gasket (8) from the body.

Refitting

93 Refit the light in reverse order of removal.



1	Screw	7	Sleeve
2	Lens	8	Gasket
3	Gasket	9	Sleeve
4	Bulb	10	Nut and washer
5	Bulb holder	11	Lead
6	Nut		

Fig 12 Direction side repeater light (Early version)

DIRECTION SIDE REPEATER LIGHTS

Removal (Later version)

94 Disconnect the negative earth lead from the vehicle battery.

95 Ease the light unit away from the body.

96 Disconnect the two snap connectors and remove the light unit.

Refitting

97 Refit the light in reverse order of removal.

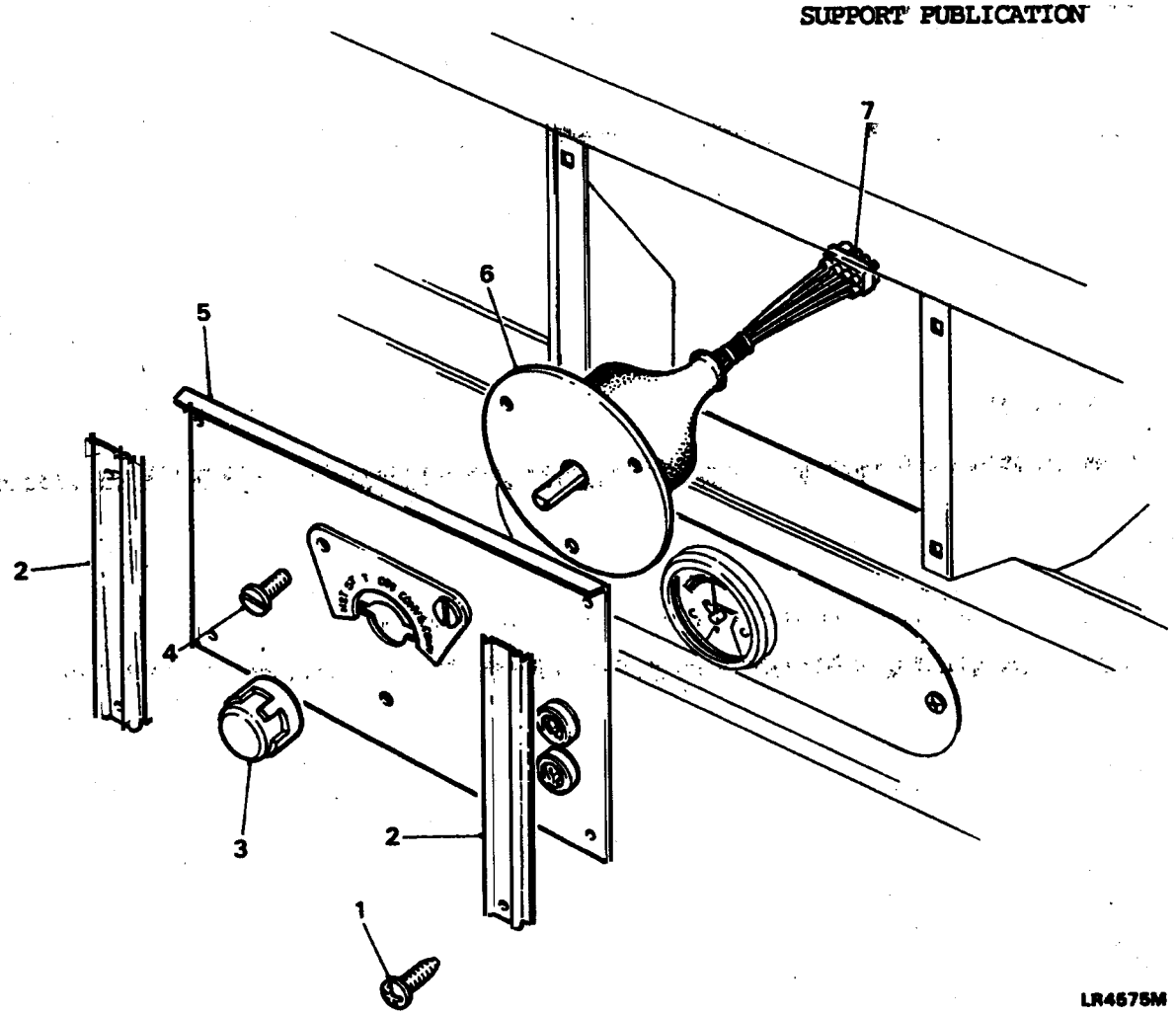
MAIN LIGHTING SWITCH

98 The main lighting switch is situated on a removable panel located in the centre of the fascia.

Removal

99 Disconnect the negative earth lead from the vehicle battery.

100 Undo th retaining screw and remove the control knob (3) from switch.



1	Screw	5	Adaptor plate
2	Retaining straps	6	Main lighting switch
3	Knob	7	Connector
4	Screw		

Fig 13 Main lighting switch.

101 Undo the four screws (1) from the retaining brackets (2) and remove the mounting panel (5) from the fascia.

102 Disconnect cables (7) at connector block.

103 Remove screws (4) securing switch assembly and indicator plate to panel and withdraw switch (6) and plate.

R fitting

104 Refit the lighting switch in reverse order of the removal.

INSPECTION SOCKETS

Removal

105 Disconnect the negative earth lead from the vehicle battery.

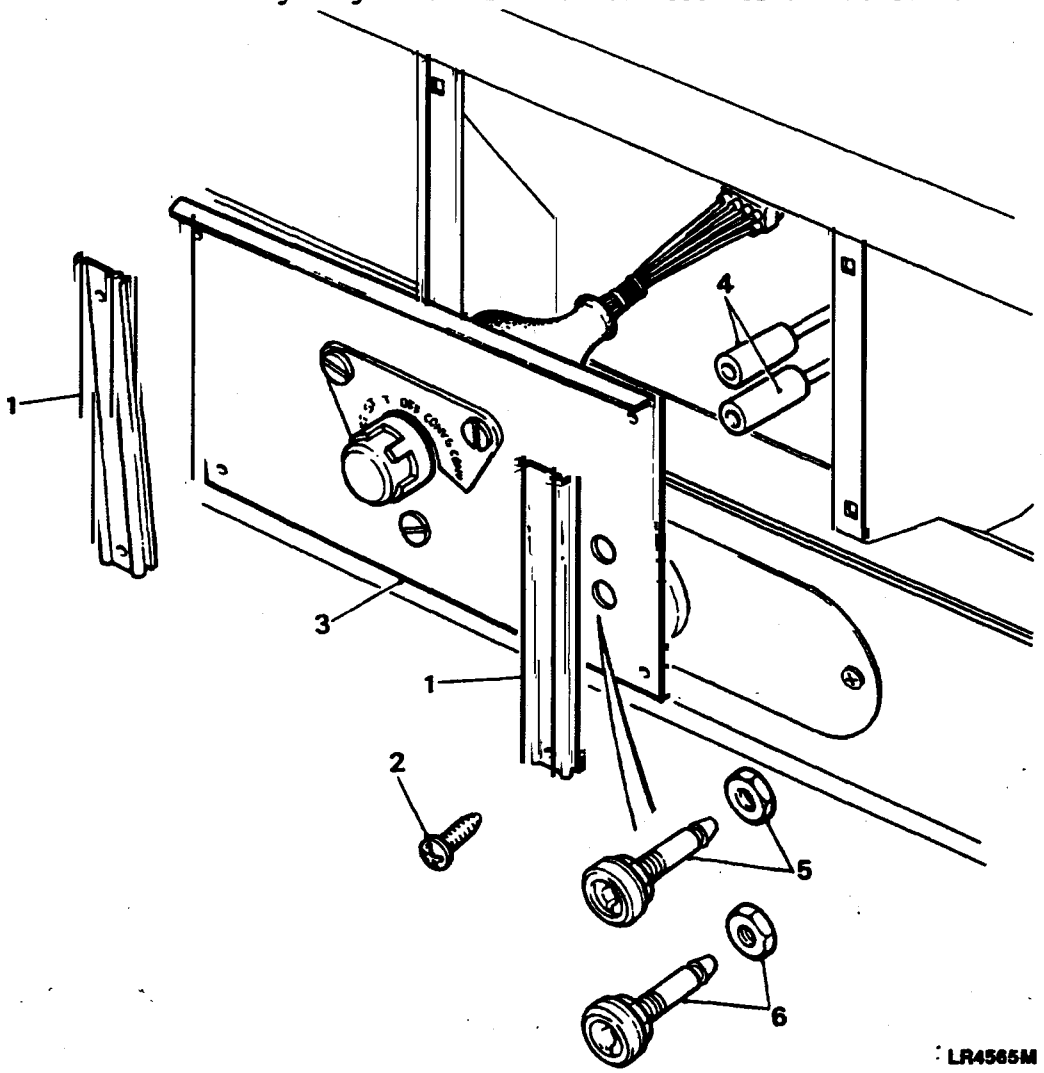
106 Undo th four screws (2) from the retaining brackets (1) and remove the mounting panel (3) from the fascia.

107 Disconnect cables (4) from snap connectors.

108 Undo the nuts from the back of the panel securing the sockets (5)(6) to the panel and withdraw sockets.

Refitting

109 Refit the lighting switch in reverse order of the removal.



1	Retaining strap	4	Connectors
2	Screw	5	Inspection socket assembly
3	Adaptor plate	6	Inspection socket assembly

Fig 14 Inspection sockets

WARNING LIGHTS PANEL

Removal

110 Disconnect the negative earth lead from the vehicle battery.

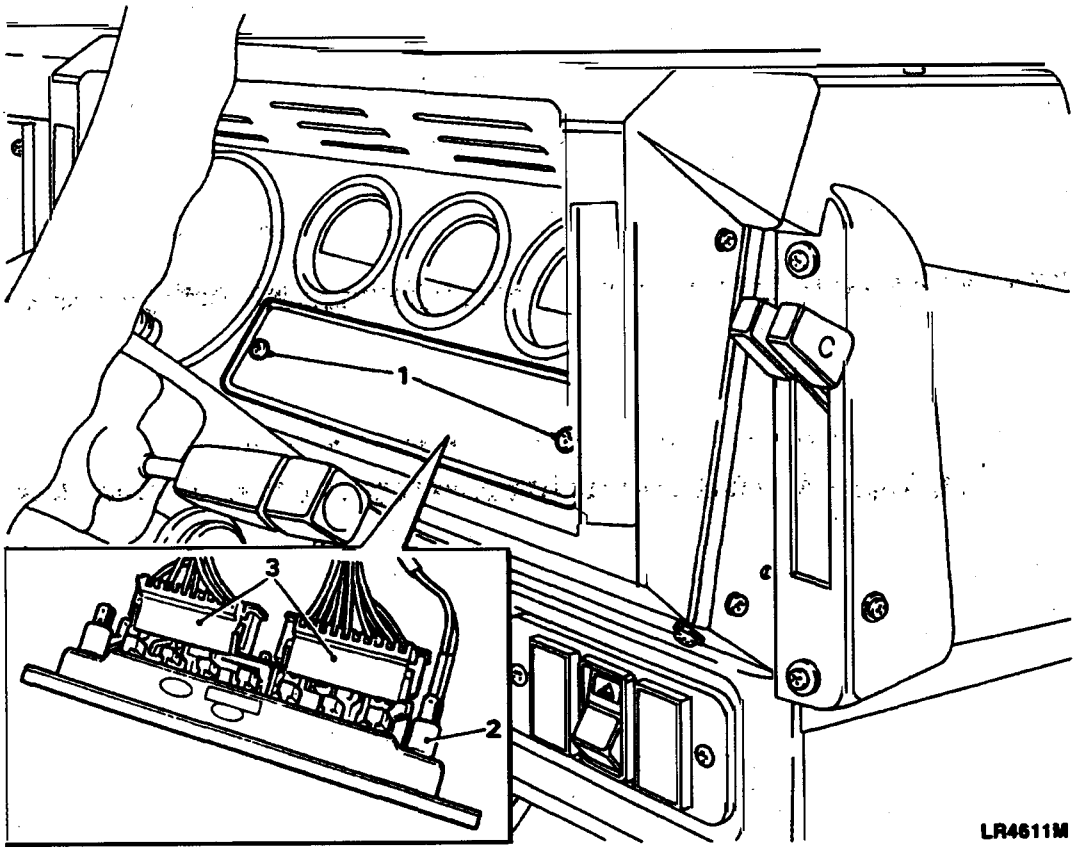
111 Undo the two screws (1) and ease the warning lights panel from the instrument panel.

112 Disconn ct the two connector blocks (3).

113 Disconnect the remaining bulb holders (2) and remove the panel.

Refitting

114 Refit the warning light panel in reverse order of the removal.



1 Fixing screws 2 Bulb lead 3 Plug connectors

Fig 15 Warning lights panel

INSTRUMENT PANEL

Removal

115 Disconnect the negative earth lead from the vehicle battery.

116 Undo the four screws (Fig 16 (1)) and ease the instrument panel forward to gain access to the rear of the panel.

117 Disconnect the plug connector (Fig 17 (2)(4)), warning light connectors (5), leads to the instruments, also the speedometer cable (3).

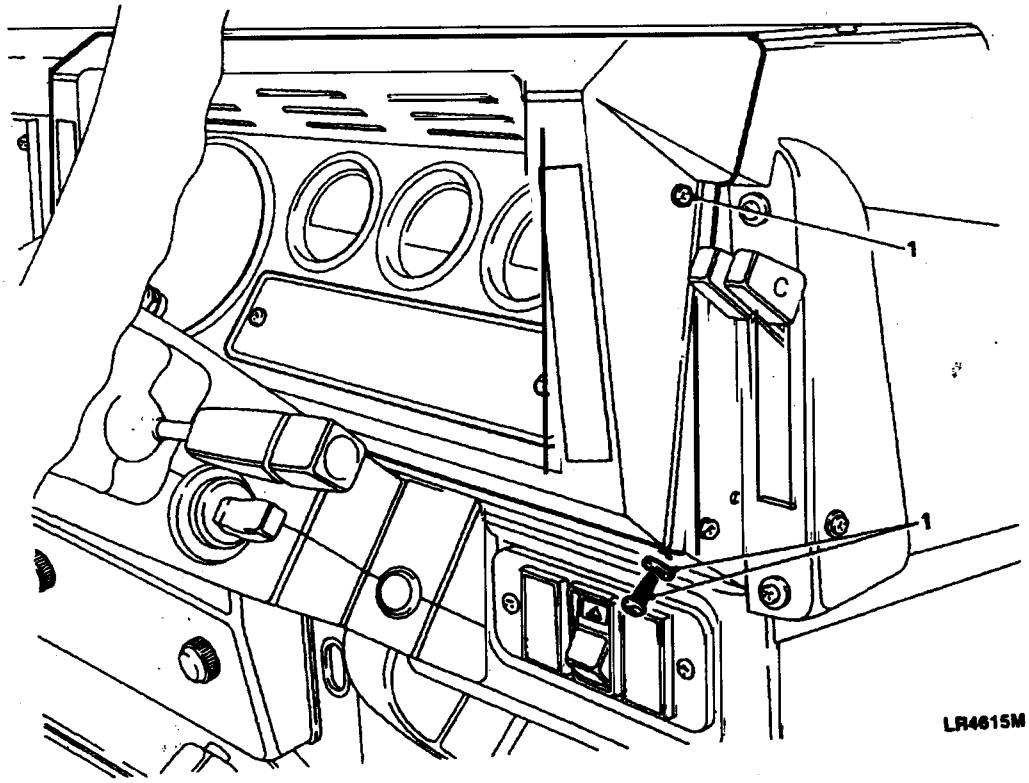
118 The panel (1) can now be removed complete with the instruments.

Instrument removal

119 Undo the retaining screw(s) (Fig 18 (4)(6)(7)) from the instruments and remove the connector(s) (3)(5)(8).

120 Unplug the rest of the connector(s) (1).

121 Remove the light bulb holder(s) (2) from the instruments.



1 Fixing screws

Fig 16 Instrument panel fixings

122 Undo the one (Fig 19 (3)) or two (5), dependant on the instrument, retaining screws and remove the bracket(s) (2)(4) holding the instrument(s) (1)(6) and remove.

123 From the front, ease the instrument(s) from the panel.

Refitting

124 Refit the instruments and panel in reverse order of the removal.

HAZARD WARNING SWITCH

Removal

125 Disconnect the negative earth lead from the vehicle battery.

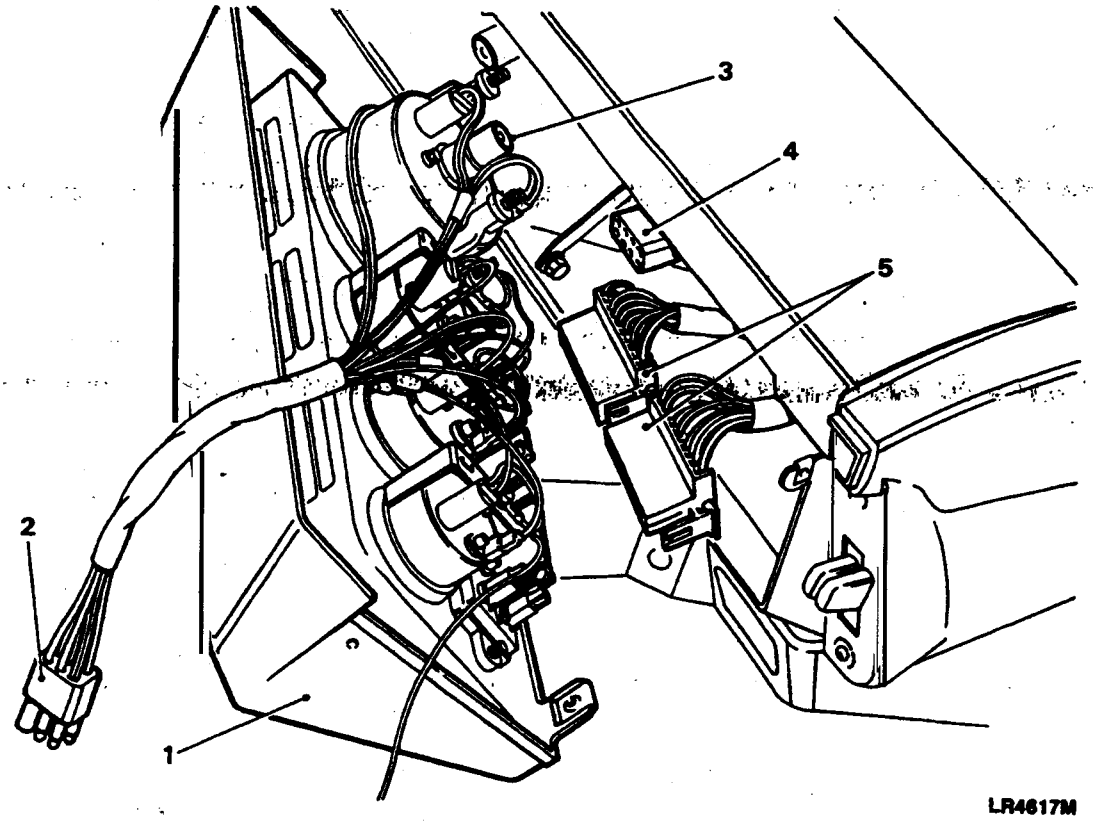
126 Undo the two screws and ease the panel forward.

127 Disconnect the plug connector (3) from the hazard unit.

128 Press the spring loaded clips inwards then ease the hazard unit (1)(2) out of the panel with the aid of a screwdriver.

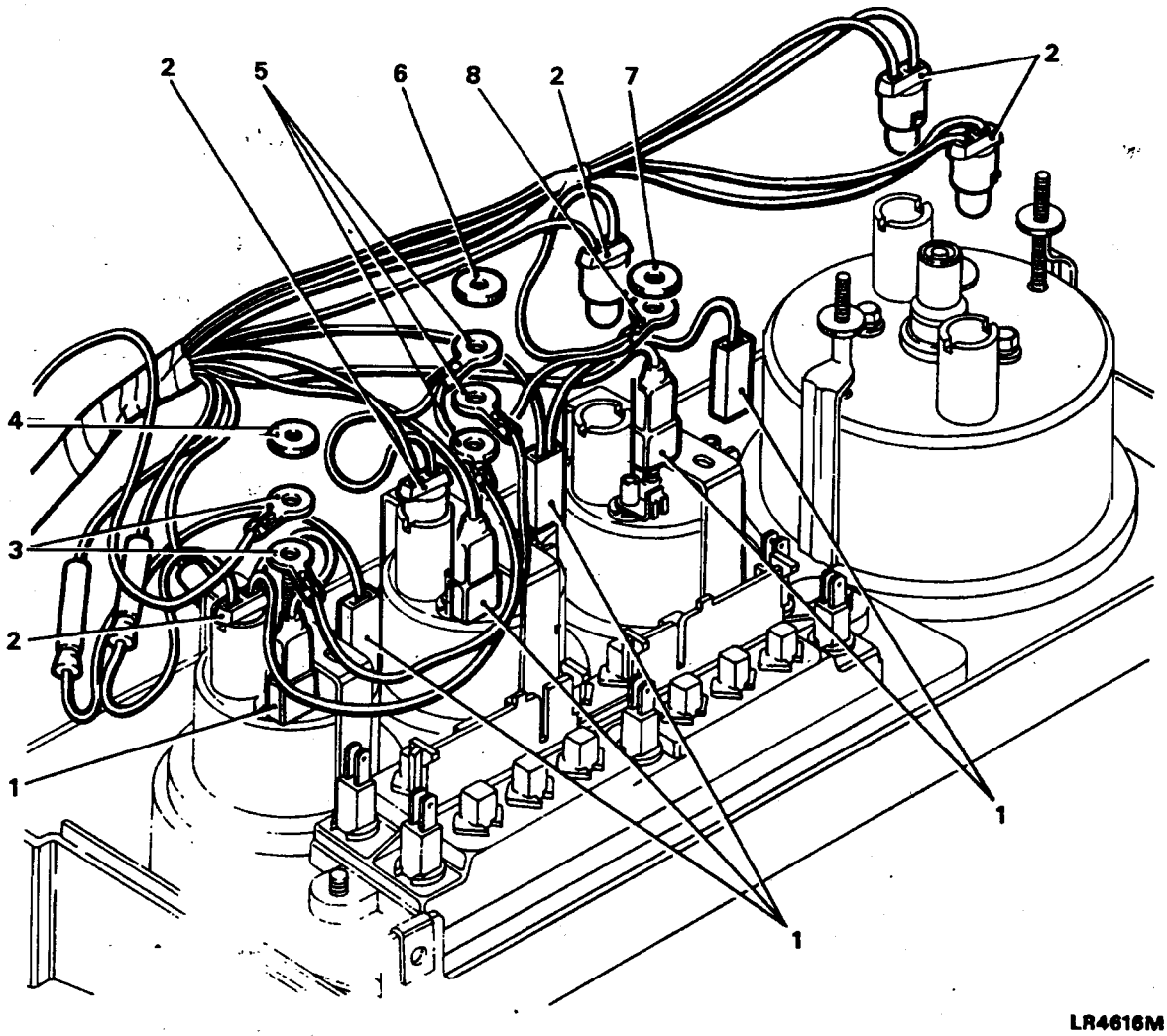
Refitting

129 Refit the hazard warning switch in reverse order of the removal.



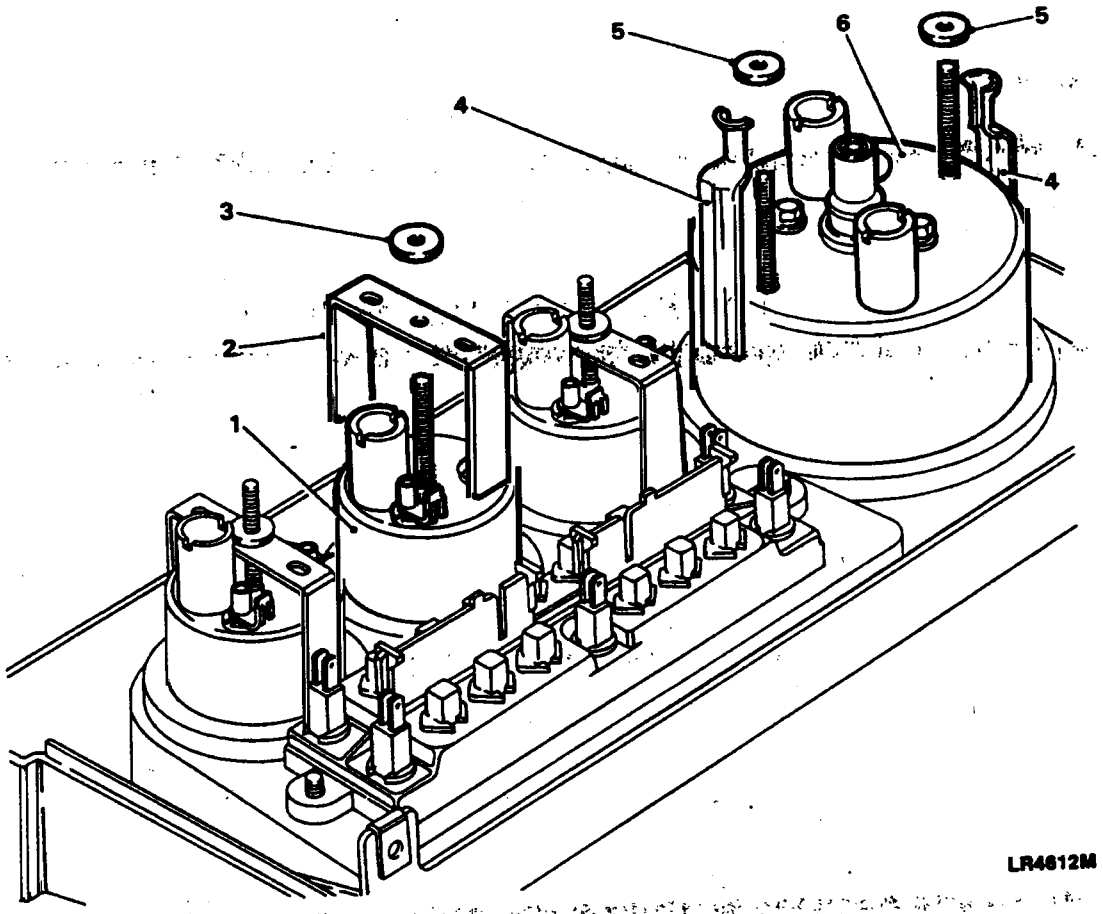
1	Instrument panel	4	Connector
2	Instrument connector	5	Warning lights connectors
3	Speedo cable connection		

Fig 17 Removing the plug connectors



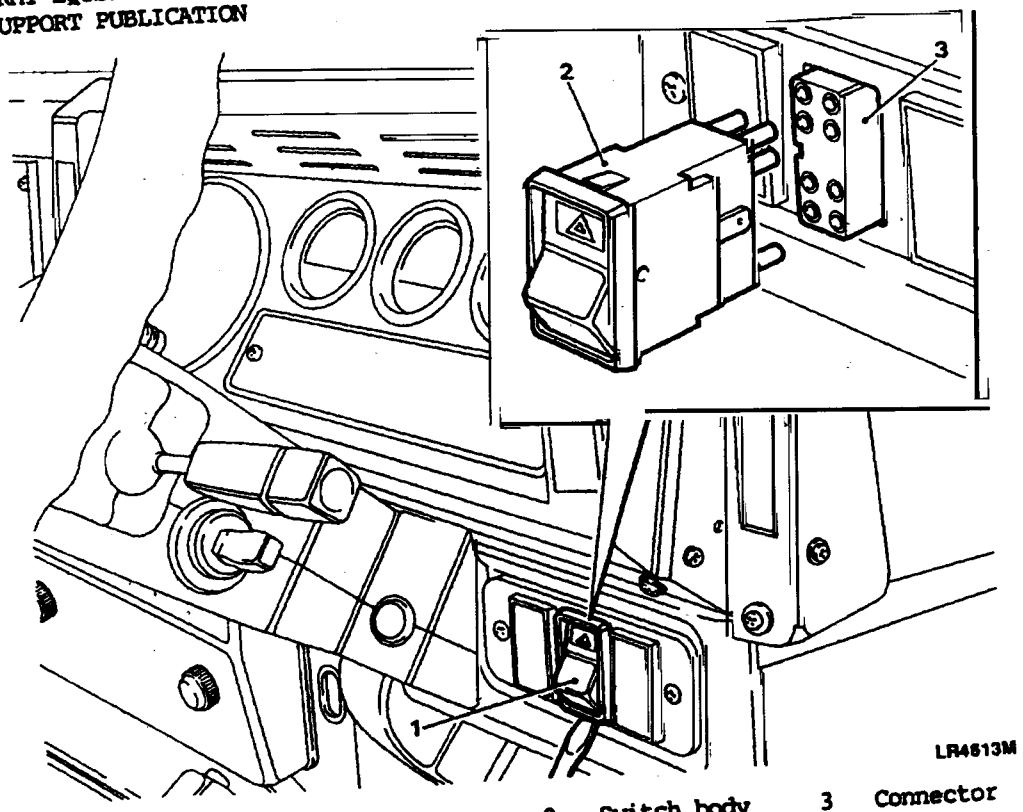
1	Instrument connections	5	Electrical connections
2	Bulb holders	6	Knurled nuts
3	Electrical connections	7	Knurled nuts
4	Knurled nuts	8	Electrical connections

Fig 18 Removing the leads and bulbs



1	Instrument	4	Bracket
2	Bracket	5	Knurled nut
3	Knurled nut	6	Speedometer

Fig 19 removing the instruments



1 Hazard rocker switch 2 Switch body 3 Connector

Fig 20 Hazard warning switch

COLUMN SWITCHES AND IGNITION SWITCH

Removal

130 To remove the steering wheel, instrument panel, steering column and column heater/start switches see Catagory 522 Chapter 7 paragraphs 3 to 6.

131 Disconnect the three plug connectors (1) from the main harness.

132 Undo the screw (2) retaining the switch panel (6) to the column.

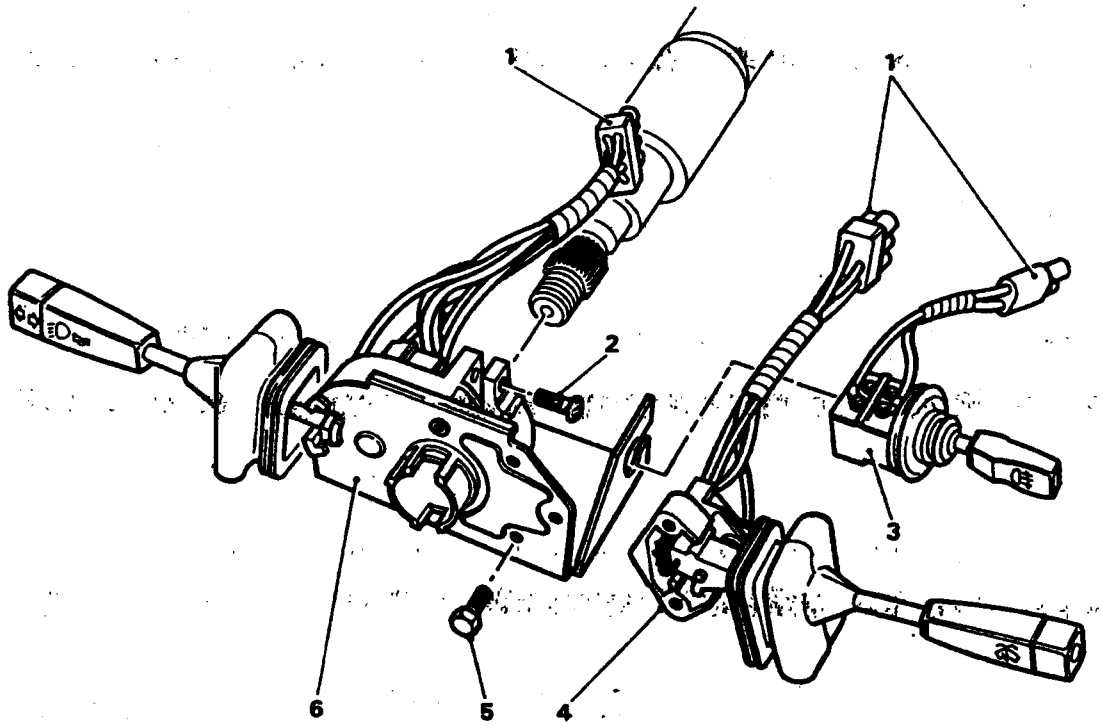
133 Undo the bolts (5) retaining the wash\wipe switch (4) and remove.

134 Remove the rear fog switch (3) from the switch panel.

Refitting

135 Refit the column switches in reverse order of the removal.

136 To refit the steering wheel, instrument panel, steering column and column heater/start switches see Catagory 522 Chapter 7 paragraphs 13 to 16.



1	Connectors	4	Wash/wipe switch
2	Screw	5	Bolt
3	Rear fog guard switch	6	Switch assembly

Fig 21 Column switches

Chapter 13-2

12/24 VOLT FFR ELECTRICAL SERVICE

CONTENTS

INTRODUCTION

1 This Chapter gives Unit and Field repairs for the 12/24 volt FFR electrical system fitted to Land Rover 90 and 110 vehicles having 2.5 litre diesel engines. The information given is applicable to both left and right hand vehicles.

AMMETER

2 The ammeter is situated in a panel below the six-way lighting switch.

Removal

3 Disconnect the vehicle battery earth leads and radio batteries.

4 Undo the two screws (Fig 1 (2)) retaining the auxiliary panel (1) and ease forward.

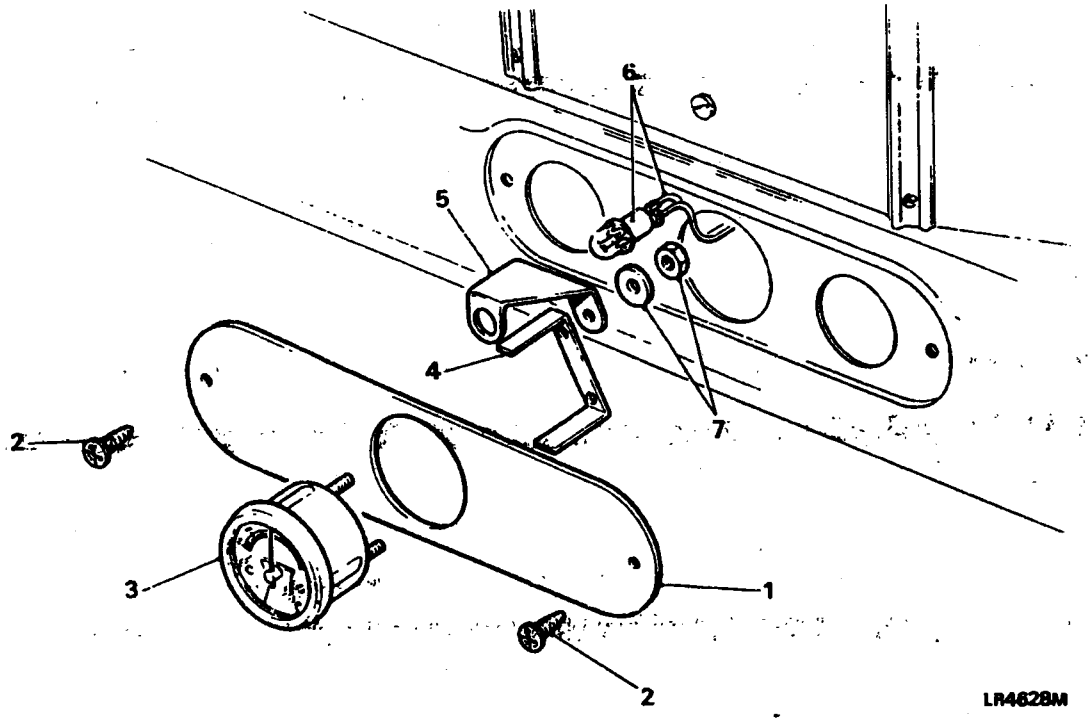
5 Undo the nut and washer (7) and remove lampholder and lamp (6) from the bracket (4).

6 Detach leads from ammeter terminals.

7 Remove lampholder bracket and bracket securing ammeter (3), withdraw instrument through front of panel.

Refitting

8 Insert ammeter through front of panel.



1	Auxiliary panel	5	Light bulb holder bracket
2	Screw	6	Light bulb and holder
3	Ammeter	7	Nut and washer
4	Ammeter bracket		

Fig 1 Ammeter

9 Fit securing bracket and lampholder bracket.

10 Connect leads to their respective terminals.

11 Fit lampholder and lamp to bracket.

12 Refit auxiliary panel to dash.

13 Connect vehicle battery earth leads and radio batteries, start engine and check that the instrument is functioning.

FAST FUSE

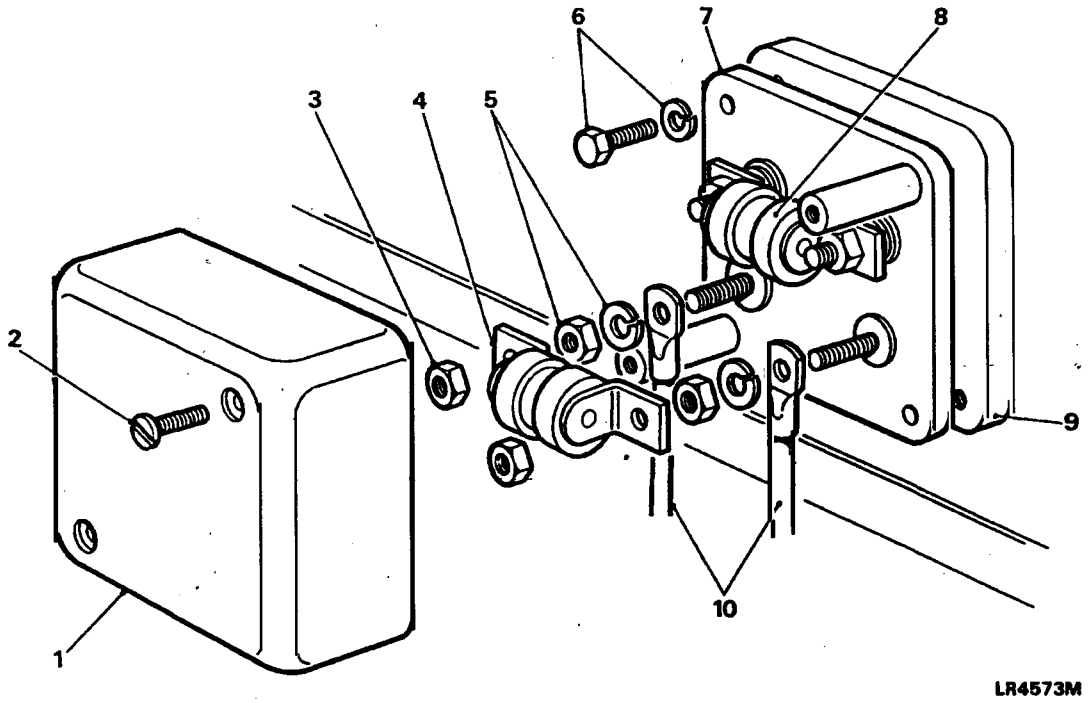
14 Vehicles fitted for radio have an additional fuse box fitted to the bulkhead behind the front seats. The box contains a 50 amp fast fuse which protects the 90 amp alternator circuits in the event of accidental reversal of polarity when connecting the radio batteries. A spare fuse is also contained within the box, should this spare fuse be used a replacement must be obtained at the earliest opportunity.

Removal

15 Disconnect the vehicle battery earth leads and radio batteries.

16 Undo the two screws (Fig 2 (2)) securing the cover and remove the cover (1).

17 Undo the two nuts (3) and remove the fuse (4).



1	Fast fuse cover	6	Fixing screw and washer
2	Screw	7	Base plate
3	Nuts	8	Fast fuse (spare)
4	Fast fuse	9	Mounting plate
5	Nut and spring washer	10	Feed wires

Fig 2 fast fuse

18 Undo the two nuts and spring washers (5) and disconnect the two leads (10) from the terminals.

19 Undo the two bolts and washers (6) and remove the base plate (7) from the mounting plate (9).

Refitting

20 The refitting of the fast fuse is the reverse of the removal.

AUXILIARY TERMINAL BOX

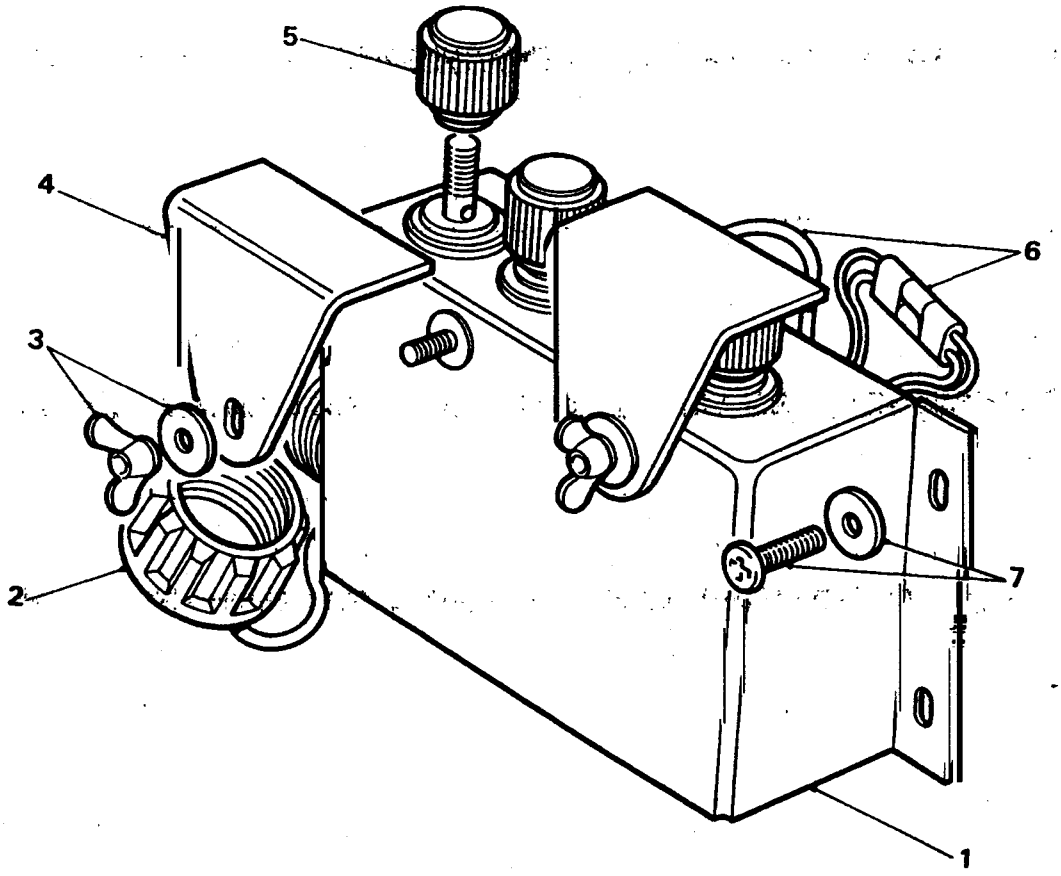
21 The auxiliary terminal box is mounted on the bulkhead at the rear of the left hand seat. A socket is provided on the side of the box for connection of the radio batteries and four terminals situated on the top of the box provide the means of operating 24V equipment.

Removal

22 Disconnect the vehicle battery earth leads and radio batteries also.

23 Unscrew the radio batteries feed from the side of the terminal box (1) if fitted and fit the protective cap (2).

24 Undo the wing nut (3) and turn the cover (4) to gain access to any auxiliary terminals which may be connected.



1	Terminal box	5	Terminal
2	Protection cap	6	Ammeter and feed connection
3	Wingnut and washer	7	Screw and washer
4	Cover		

Fig 3 Terminal box

25 Undo the terminals (5) and remove the connections (if fitted).

26 Undo the retaining screws and washers (7) and ease forward.

27 Disconnect the ammeter and feed wires (6) from the terminal box.

Refitting

28 The refitting of the terminal box is the reverse of the removal.

RADIO TABLE

29 The radio table is situated behind the rear bulkhead and sits on the floor. The table is supported by the battery box which holds four radio batteries in two trays.

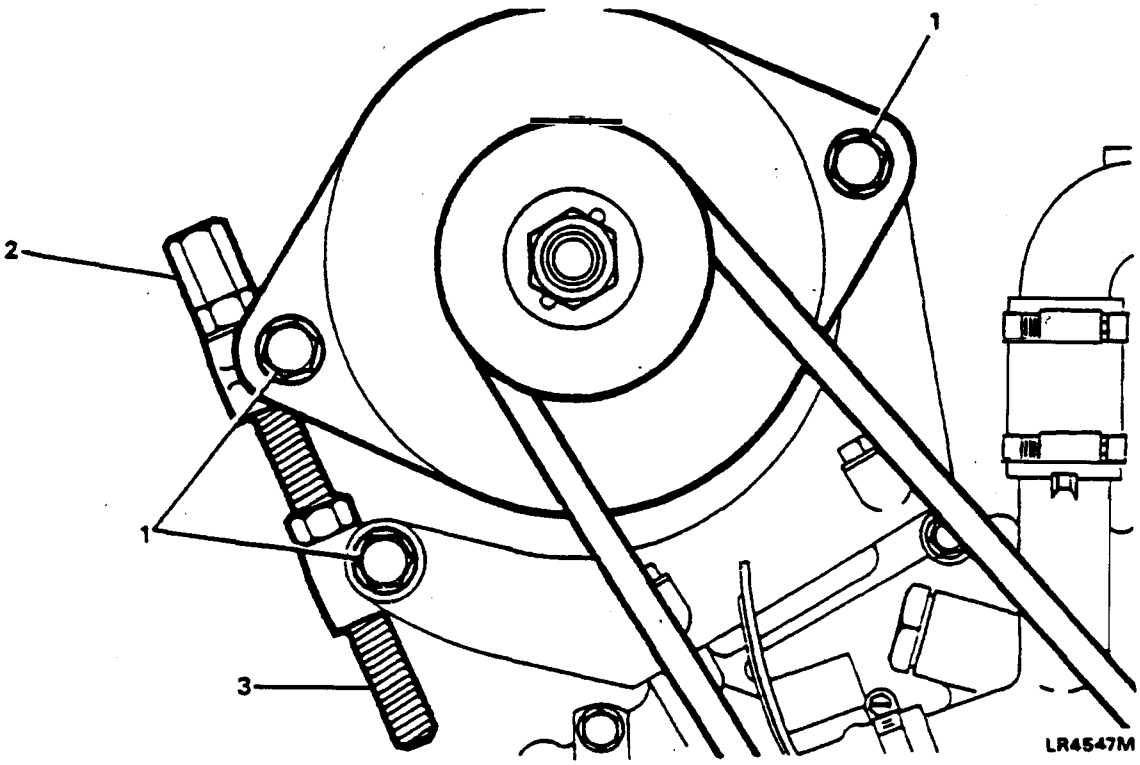
Removal

30 Undo the earth straps from the table.

31 Undo the fixing screws attaching the table to the battery box and remove.

Refitting

32 The refitting of the radio table is the reverse of the removal.



1 Pivot bolts 2 Top nut 3 Adjustment rod

Fig 4 Alternator

ALTERNATOR

33 The 90 amp brushless alternator is a fully wadeable machine and is finished to military specifications. It is fitted to the right hand side of the engine.

Removal

34 Disconnect the vehicle battery earth leads and radio batteries too.

35 Disconnect the leads from the rear of the alternator noting their locations for refitting.

36 Slacken the two alternator pivot bolts (1) and the adjustment rod pivot bolt (1).

37 Remove the top nut (2) on the adjustment rod.

38 Slacken the adjustment rod (3) sufficiently to allow removal of the drive belt.

39 Using a suitable sling and hoist, take the weight of the alternator.

40 Remove the adjusting rod top fixing bolt and nut and move the adjusting rod aside.

41 Remove the pivot bolt and nut and lift the alternator clear of the vehicle.

Refitting

42 Refit the alternator by reversing the removal procedure, but do not tighten the pivot and adjustment rod nuts and bolts.

43 After fitting the drive belt adjust the tension to give 10 mm (0.4 in.) deflection when thumb pressure is applied, at the mid-point between the crankshaft and alternator pulleys. Tighten the locknut.

44 Tighten the three pivot bolts to a torque of 81 to 90 Nm (60 to 66 lbf ft).

Chapter 13-3

12 VOLT 3.5 L PETROL ELECTRICAL SYSTEM

UNIT AND FIELD REPAIRS

CONTENTS

INTRODUCTION

1 This Chapter details Unit and Field repairs procedures for the 12 volt electrical system fitted to Land Rover 3.5 litre petrol engines. For other 12 volt components refer to Cat 522 Chap 13-1.

Alternator

Removal

2 To remove the alternator proceed as follows:

2.1 Disconnect the leads from the vehicle battery.

2.2 Disconnect the leads from the rear of the alternator, noting their position.

2.3 Slacken the pivot bolt (Fig 1 (2)) and the adjustment bracket bolt (5) from the engine block.

2.4 Slacken the adjustment bolt (4) securing the adjustment link to the alternator, and pivot the alternator inwards to enable removal of the belt from the pulley (3).

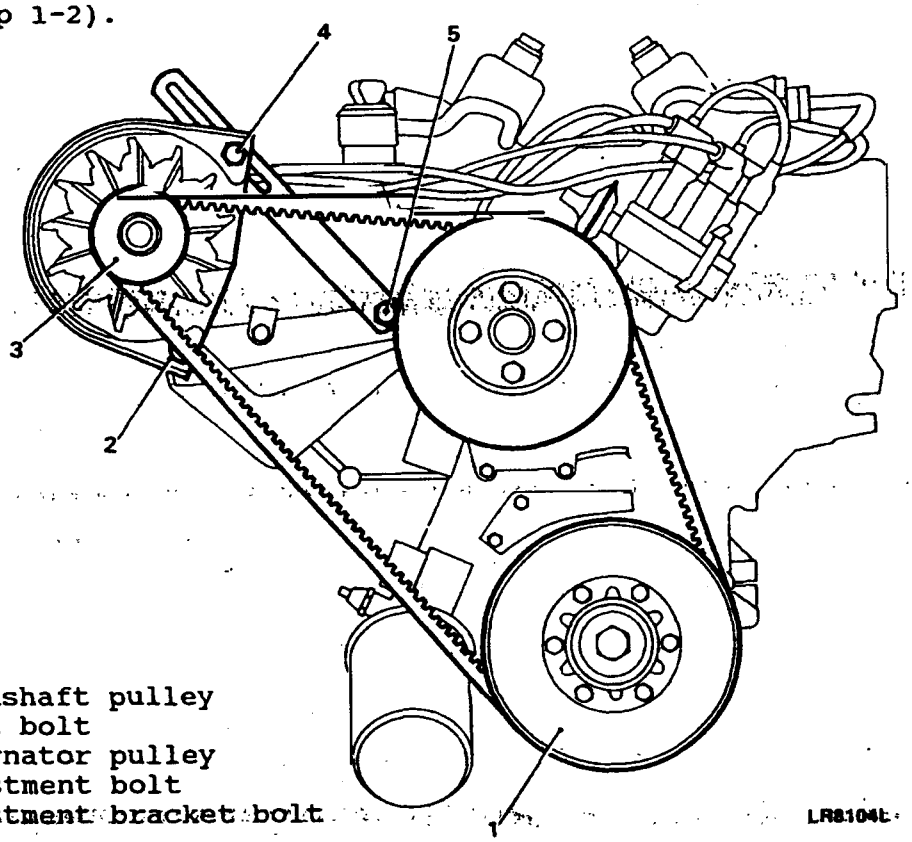
2.5 Remove the pivot bolt (2), adjustment bolt (4), and lift the alternator clear from the engine.

Refitting

3 To refit the alternator proceed as follows:

3.1 Reverse the removal procedures (Para 2), but do not tighten the adjustment and pivot bolts.

3.2 Fit the drive belt and adjust to the correct tension (Cat 522 Chap 1-2).



1 Crankshaft pulley
2 Pivot bolt
3 Alternator pulley
4 Adjustment bolt
5 Adjustment bracket bolt

Fig 1 Alternator mounting

Regulator/brush box assembly

Removal

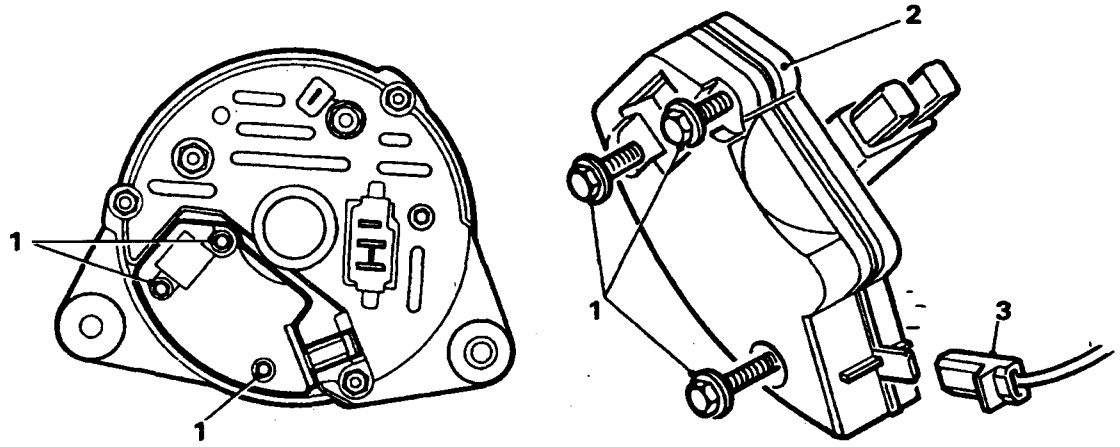
4 For removal of the regulator/brush box assembly proceed as follows:

4.1 Remove the three screws (Fig 2 (1)) retaining the regulator.

4.2 Remove the regulator/brush box assembly (2) from the alternator, at the same time disconnect the connector (3).

Refitting

5 Refit the regulator/brush box assembly by reversing the removal procedure.



1 Screws
2 Regulator/brush box assembly
3 Connector

Fig 2 Removing the regulator/brush box assembly

Starter motor

Removal

6 To remove the starter motor proceed as follows:

6.1 Disconnect the leads from the vehicle battery.

6.2 Disconnect the leads from the solenoid and starter motor and remove the exhaust heat shield.

6.3 Remove the two bolts securing the starter motor to the flywheel housing.

6.4 Remove the starter motor from the underside of the vehicle.

Refitting

7 Refit the starter motor by reversing the removal procedure.

Starter motor solenoid

Removal

8 To remove the starter motor solenoid proceed as follows:

8.1 Remove the starter motor from the vehicle (Para 6).

8.2 Remove the two bolts securing the solenoid to the starter motor.

8.3 Withdraw the solenoid from the solenoid housing.

Refitting

9 Refit the solenoid to the starter motor by reversing the removal procedure.

Distributor

Removal

10 To remove the distributor proceed as follows:

10.1 Disconnect the vehicle battery leads.

10.2 Disconnect the vacuum pipe.

10.3 Remove the distributor cap.

10.4 Disconnect the low tension lead from the coil.

10.5 Mark the distributor body in relation to the centre line of the rotor arm (Fig 3).

10.6 Add alignment marks to the distributor and front cover (Fig 4).

10.7 Release the distributor clamp and remove the distributor.

Note ...

Marking the distributor enables refitting in the exact original position, but if the engine is turned after the distributor is removed, a complete ignition timing procedure must be performed.

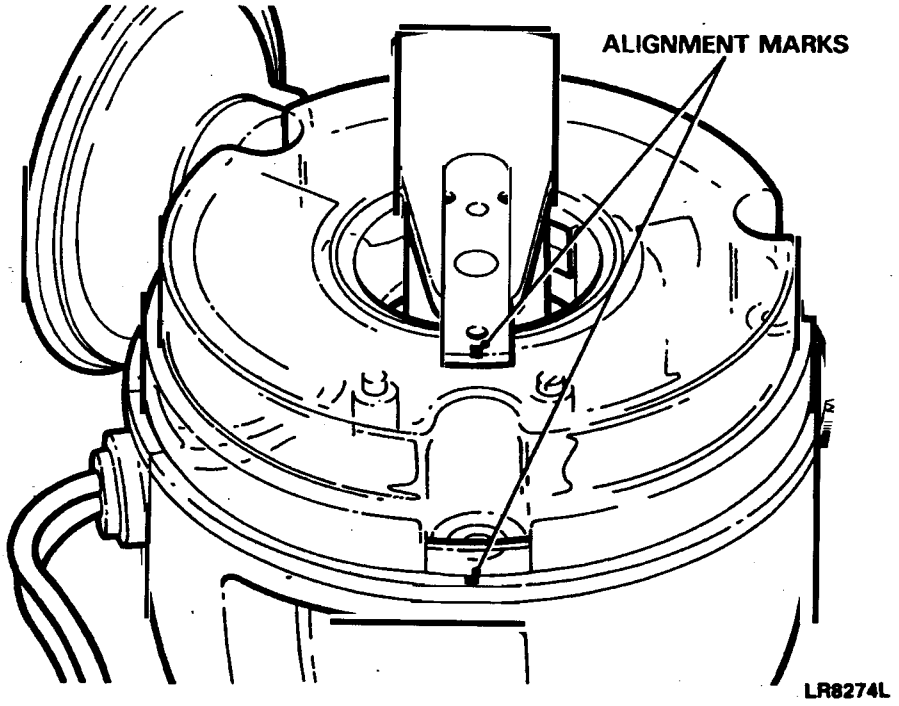


Fig 3 Marking distributor body prior to removal

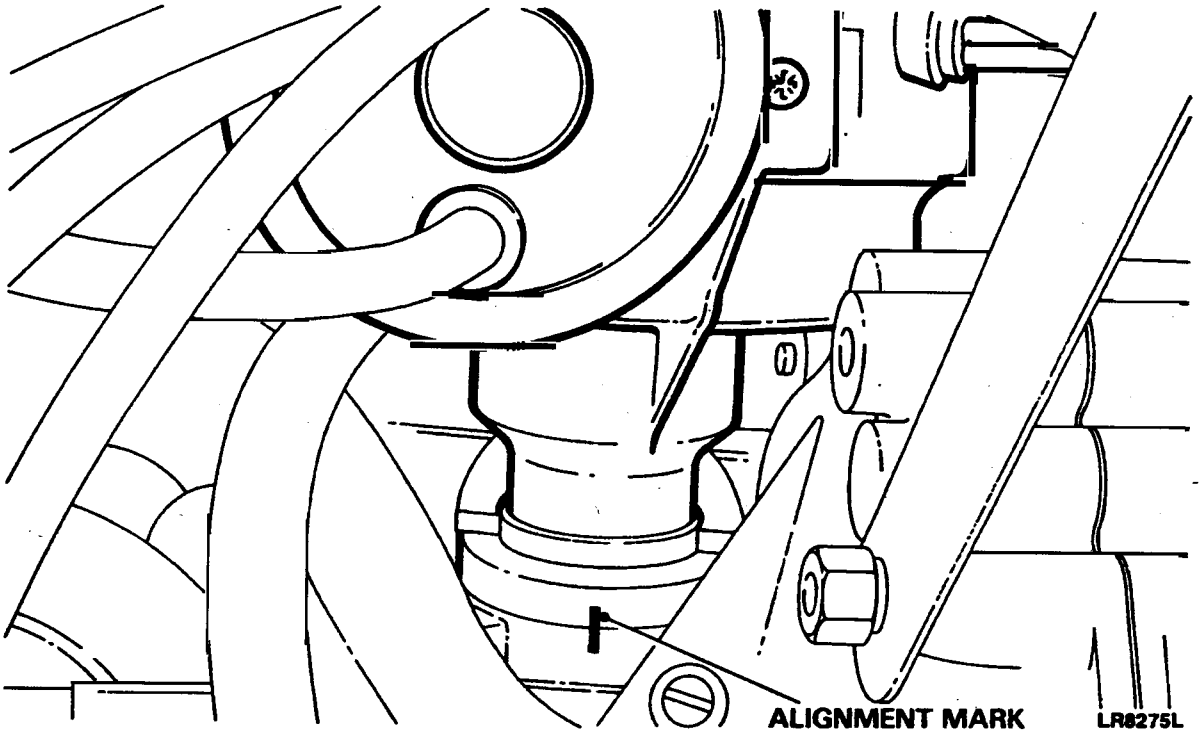


Fig 4 Marking front cover prior to distributor removal

Refitting

11 To refit the distributor proceed as follows:

Note...

If a new distributor is being fitted, mark the body in the same relative position as the previous distributor.

11.1 Engine static. If the engine has been turned whilst the distributor has been removed refer to Para 11.2. If the engine has remained static proceed as follows:

11.1.1 Fit a new 'O' ring seal to the distributor housing.

11.1.2 Turn the distributor drive until the centre line of the rotor arm is 30° anti-clockwise from the mark made on the top edge of the distributor body.

11.1.3 Fit the distributor in accordance with alignment markings.

Note ...

It may be necessary to align the oil pump drive shaft to enable the distributor drive shaft engagement.

11.1.4 Fit the clamp and bolt.

11.1.5 Connect the vacuum pipe to the distributor and the low tension lead to the coil. Fit the distributor cap and connect the leads exactly in accordance with Fig 5.

11.1.6 Reconnect the vehicle battery leads.

11.1.7 Using suitable electronic equipment, set the ignition timing (Para 14).

11.2 Engine turned. If the engine has been turned whilst the distributor has been removed proceed as follows:

11.2.1 Set the engine - No. 1 piston to static ignition timing figure on the compression stroke.

11.2.2 Turn the distributor drive until the rotor arm is approximately 30° anti-clockwise from No. 1 sparking plug lead position on the cap.

11.2.3 Fit the distributor to the engine.

11.2.4 Check that the centre line of the rotor arm is now in line with No. 1 sparking lead on the cap. Reposition the distributor if necessary.

11.2.5 If the distributor does not seat correctly in the front cover, the oil pump drive is not engaged. Engage by lightly pressing down the distributor while turning the engine.

11.2.6 Loosely fit the clamp and bolt.

11.2.7 Set the ignition timing statically to within 2°-3° of T.D.C.

11.2.8 Fit the low tension lead to the coil.

11.2.9 Fit the distributor cap and reconnect the vehicle battery.

11.2.10 Using suitable electronic equipment, set the ignition timing (Para 14).

11.2.11 Connect the vacuum pipe to the distributor.

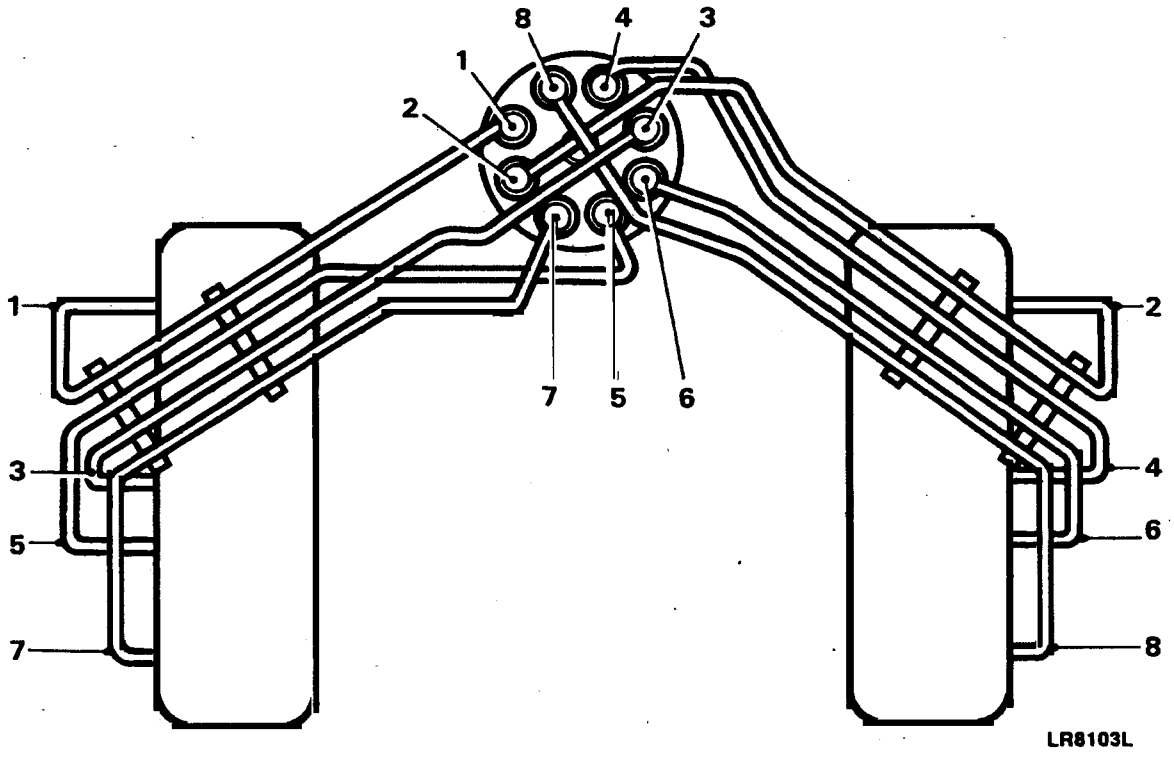


Fig 5 Distributor lead connections

Coil

Removal

12 To remove the coil proceed as follows:

12.1 Disconnect the vehicle battery.

12.2 Disconnect the electrical leads from the coil.

12.3 Remove the two retaining nuts and washers securing the coil to the inner wing mounting bracket.

12.4 Remove the coil from the vehicle.

Refitting

13 Refit the coil to the vehicle by reversing the removal procedure.

Ignition system

Timing

14 To adjust the ignition timing proceed as follows:

CAUTION ...

Incorrect timing can lead to serious engine damage. If the distributor has been disturbed for any reason, the ignition timing must be set statically to 6° B.T.D.C. This procedure is only to give an approximation in order that the engine may be started, before accurate timing can commence. On no account must the engine be started before preliminary static timing is performed.

Note ...

A calibrated tachometer and a stroboscopic lamp will be required for accurate ignition timing.

14.1 Couple the stroboscopic timing lamp and tachometer to the engine, following the manufacturers instructions.

14.2 Disconnect the vacuum pipe from the distributor.

14.3 Start the engine and without load, increase engine speed to a maximum of 3000 rev/min until normal operating temperature is reached.

14.4 Reduce the engine speed to idle and check the normal idling speed falls within the tolerance specified.

Note ...

Idle speed for timing purposes must not exceed 750 rev/min, and can be achieved by removing a breather hose. Do not adjust the idle setting screws.

14.5 Slacken the distributor clamping bolt and turn the distributor until the timing flash coincides with the timing pointer and the correct timing mark on the rim of the torsional vibration damper.

14.6 Retighten the distributor clamping bolt securely and recheck timing. Tightening the clamping bolt can sometimes disturb the distributor position.

14.7 Disconnect the stroboscopic timing lamp and tachometer from the engine and refit the vacuum pipes.

System checking procedures

15 Prior to commencing the system checking procedures instructed in Para 16 to 23 the following preliminary checks should be performed:

15.1 Inspect the battery cables and connections to ensure they are clean and tight.

15.2 Check the battery state of charge if in doubt as to its condition.

15.3 Inspect all low tension connections to ensure they are clean and tight.

15.4 Check the high tension leads are correctly positioned and not shorting to earth against any engine components. The wiring harness and individual cables should be firmly fastened to prevent chafing.

16 Pick-up air gap. Check the air gap with a non-ferrous feeler gauge.

Note ...

The air gap is set initially at the factory and will only require adjusting if tampered with or when the pick-up module is replaced.

17 High tension sparking. To check the HT sparking proceed as follows:

17.1 Remove the coil/distributor HT lead from the distributor cover and hold approximately 6 mm (0.25 in) from the engine block (Fig 6).

17.2 Switch on the ignition and operate the starter.

17.3 If regular sparking occurs, proceed to Para 22. If no sparking occurs, proceed to Para 18.

18 Low tension voltage. To check the LT voltage proceed as follows:

18.1 Switch on the ignition.

18.2 Connect a voltmeter to the points indicated by the arrow heads in Fig 7 and make a note of the voltage readings.

18.3 Compare the voltages obtained with the specified values listed as follows:

18.3.1 V1 More than 11.5 volts.
V2 1 volt maximum below volts at point V1.
V3 1 volt maximum below volts at point V1.
V4 0 volt -0.1 volt.

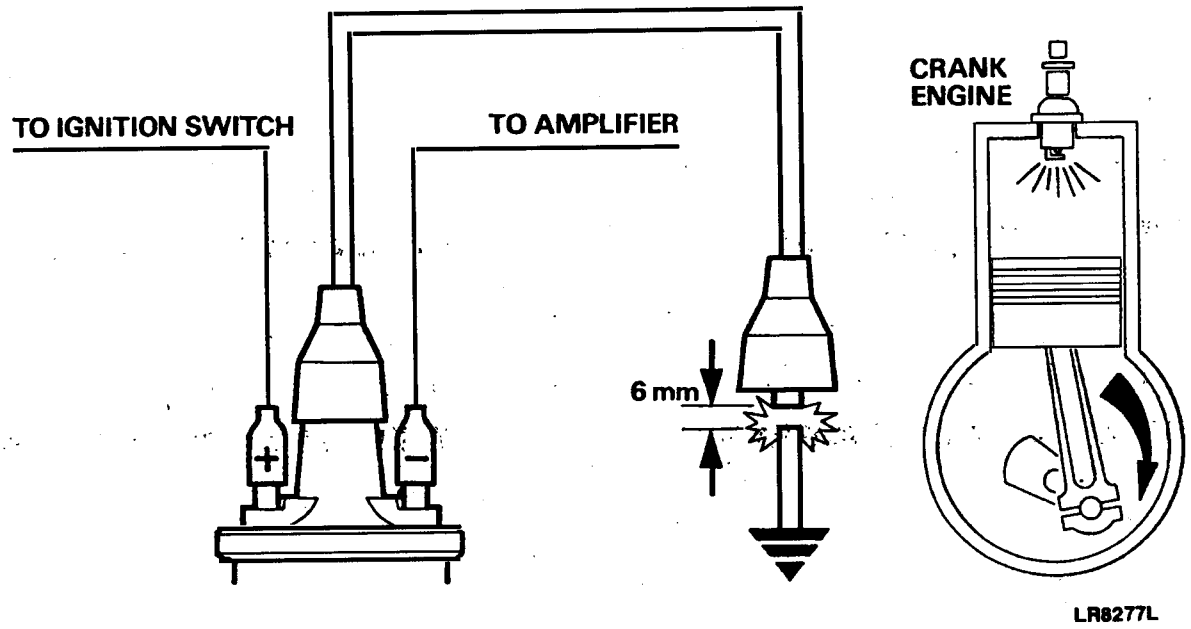


Fig 6 Checking high tension sparking

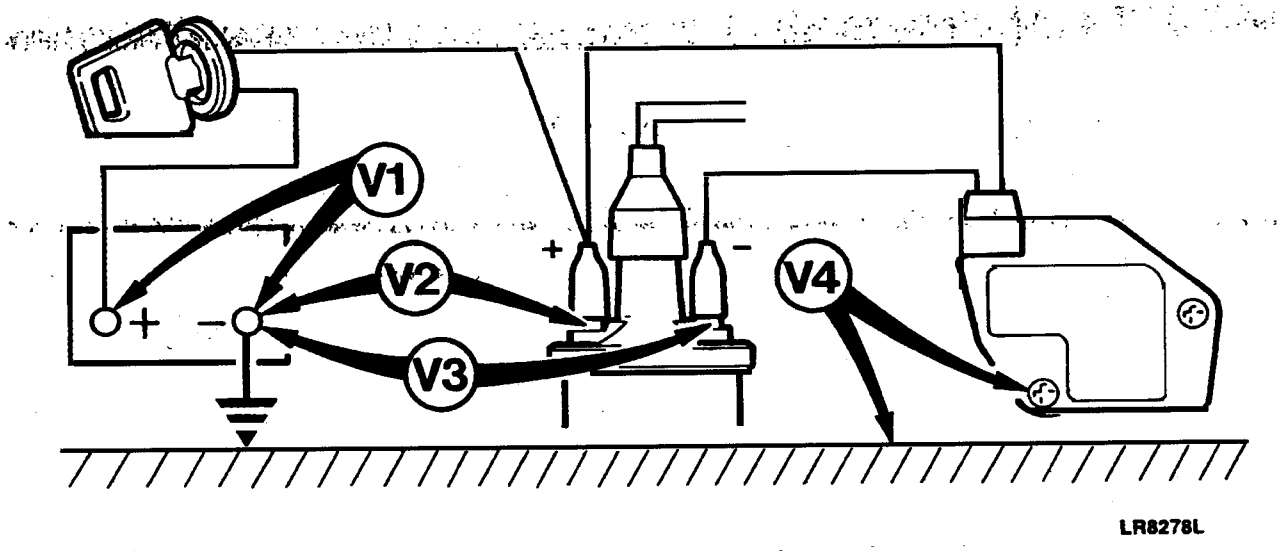


Fig 7 Checking low tension voltage

18.4 If all the readings are correct proceed to Para 19.

18.5 Check the incorrect reading(s) with TABLE 1 to identify area of possible faults, i.e. faults listed under the heading 'suspect'.

18.6 If the coil or amplifier is suspected, disconnect the LT lead at the coil and repeat voltage check V3. If voltage is still incorrect, fit a new coil. If the voltage is correct, check the LT lead and if satisfactory fit a new amplifier.

18.7 If the engine will not start proceed to Para 19.

19 Amplifier switching. To check the amplifier switching proceed as follows:

19.1 Connect a voltmeter between the battery positive terminal and the HT coil negative terminal (Fig 8). The voltmeter should register zero volts.

19.2 Switch on the ignition and crank the engine. The voltmeter reading should increase just above zero, in which case proceed to Para 21. If there is no increase in voltage during cranking, proceed to Para 20.

TABLE 1 LOW TENSION VOLTAGE CHECK

Voltage test				SUSPECT
V1	V2	V3	V4	
(1)	(2)	(3)	(4)	(5)
L	E	E	E	Discharged battery
E	L	L	E	Ignition switch and or wiring
E	E	L	E	Coil or amplifier
E	E	E	H	Amplifier earth

Key

E Expected voltage
H Voltage higher than expected
L Voltage lower than expected

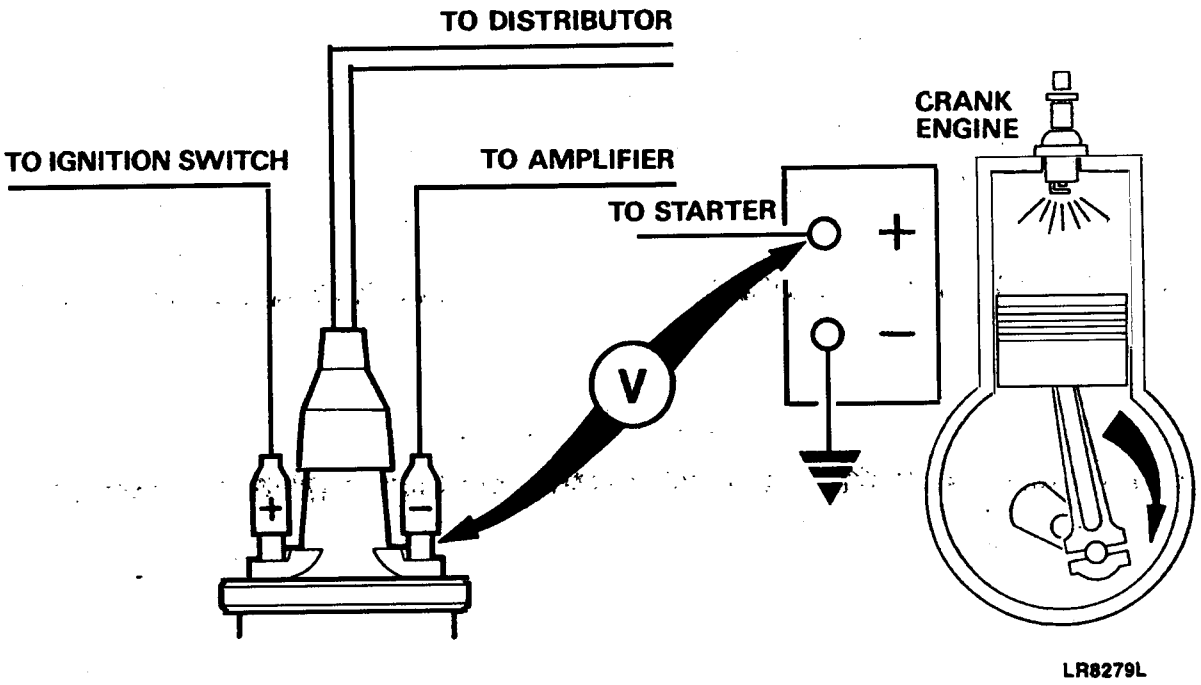


Fig 8 Checking amplifier switching

20 Pick-up coil resistance. To check the pick-up coil resistance proceed as follows:

20.1 Disconnect the pick-up leads at the harness connector.

20.2 Connect the leads of an ohmmeter to the two pick-up leads in the plug (Fig 9).

20.3 The ohmmeter should register between 2k and 5k ohms if the pick-up is satisfactory. If the ohmmeter reading is correct, check all connections between the pick-up and amplifier and if satisfactory, fit a new amplifier.

20.4 If the engine does not start, proceed to Para 21.

20.5 Change the pick-up if the ohmmeter reading is incorrect. If the engine does not start, proceed to Para 21.

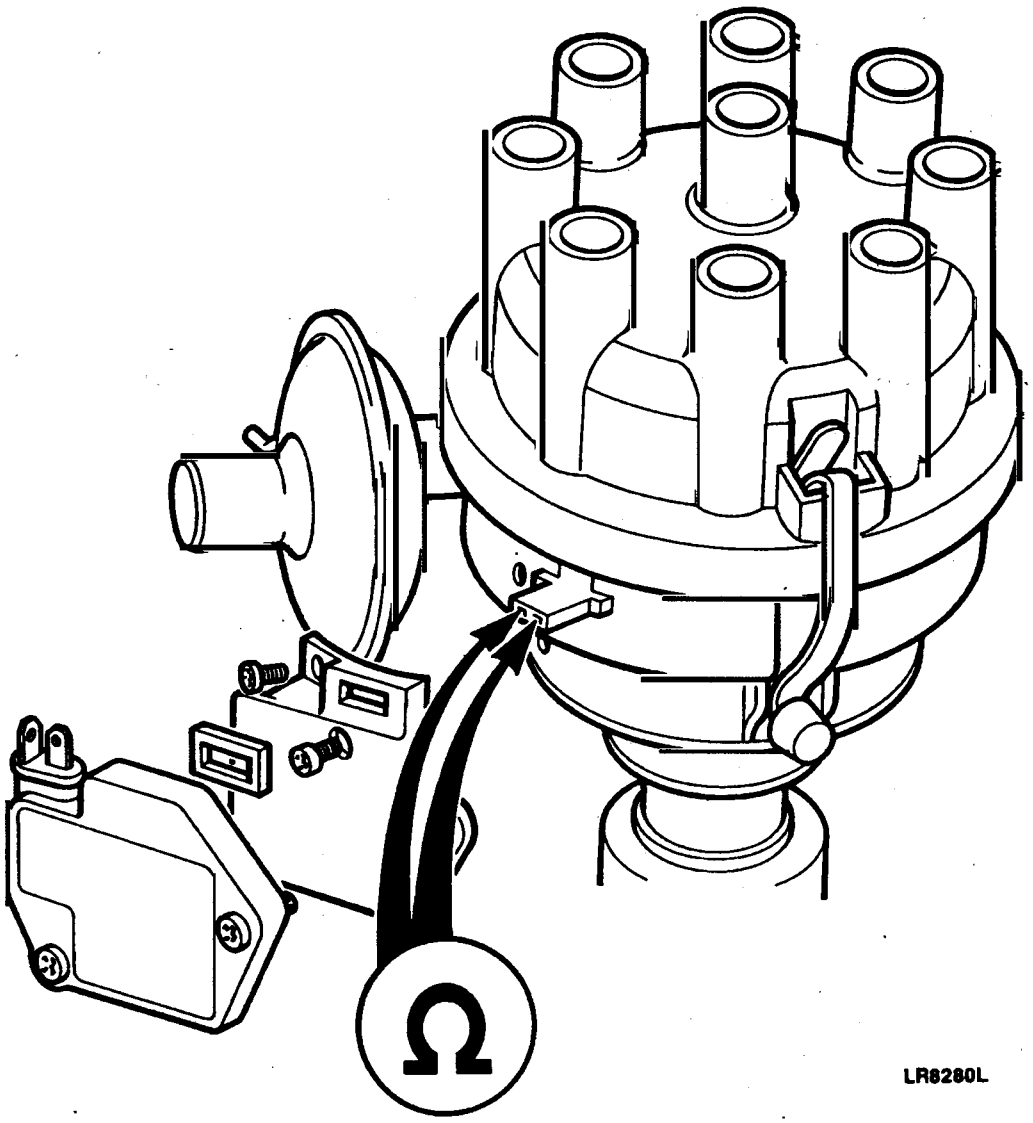


Fig 9 Checking pick-up coil resistance

21 Coil high tension sparking. To check the coil HT sparking proceed as follows:

21.1 Remove the existing coil/distributor HT lead and fit test Ht lead to coil tower (Fig 10).

21.2 Using suitable insulated pliers, hold the free end approximately 6 mm (0.25 in) from the engine block and crank the engine. There should be a good HT spark.

21.3 If there is a weak or no spark, fit a new coil and repeat procedure instructed in Para 21.2.

21.4 If the HT spark is good, repeat the procedure instructed in Para 21.2 with the original HT lead. If the spark is good, proceed to Para 22.

21.5 If there is a weak or no spark, fit a new HT lead. If engine will not start proceed to Para 22.

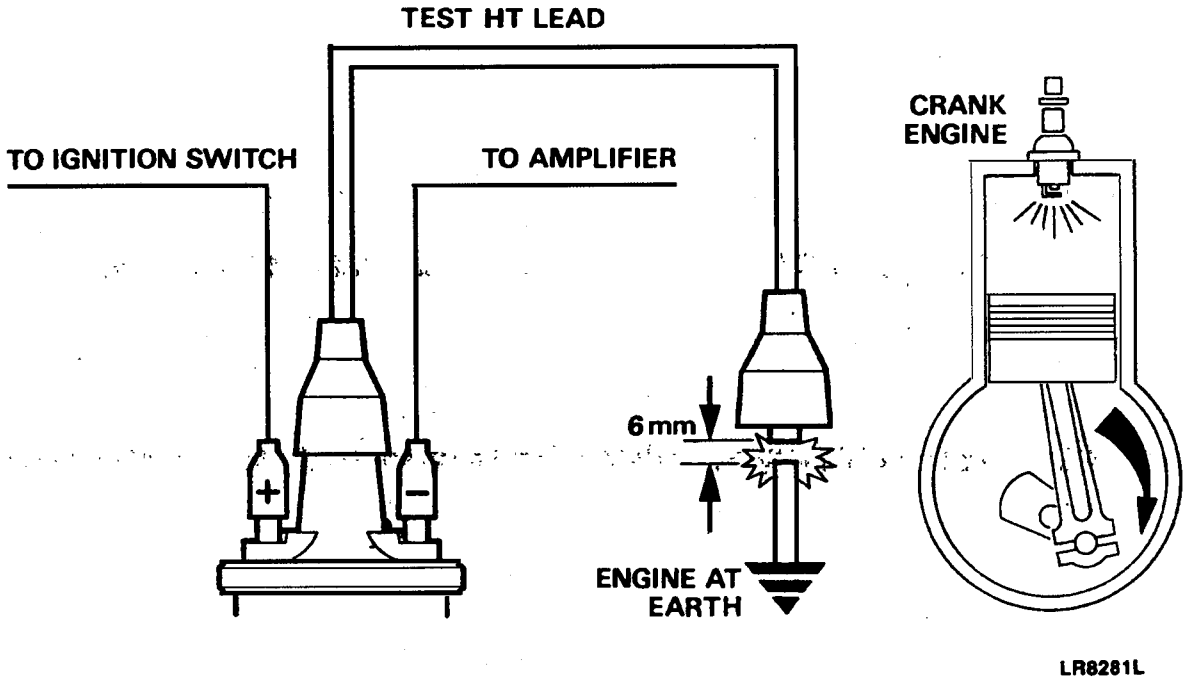


Fig 10 Checking coil high tension sparking

22 Rotor arm. To check the rotor arm proceed as follows:

22.1 Remove the distributor cover.

22.2 Disconnect the coil HT lead from the cover and using insulated pliers, hold approximately 3 mm (0.13 in) above rotor arm electrode (Fig 11) and crank the engine.

22.3 There should be no HT sparking between the rotor and HT lead. If satisfactory, proceed to Para 23.

22.4 If HT sparking occurs, an earth fault on the rotor arm is indicated. Fit a new rotor arm.

22.5 If engine will not start, proceed to Para 23.

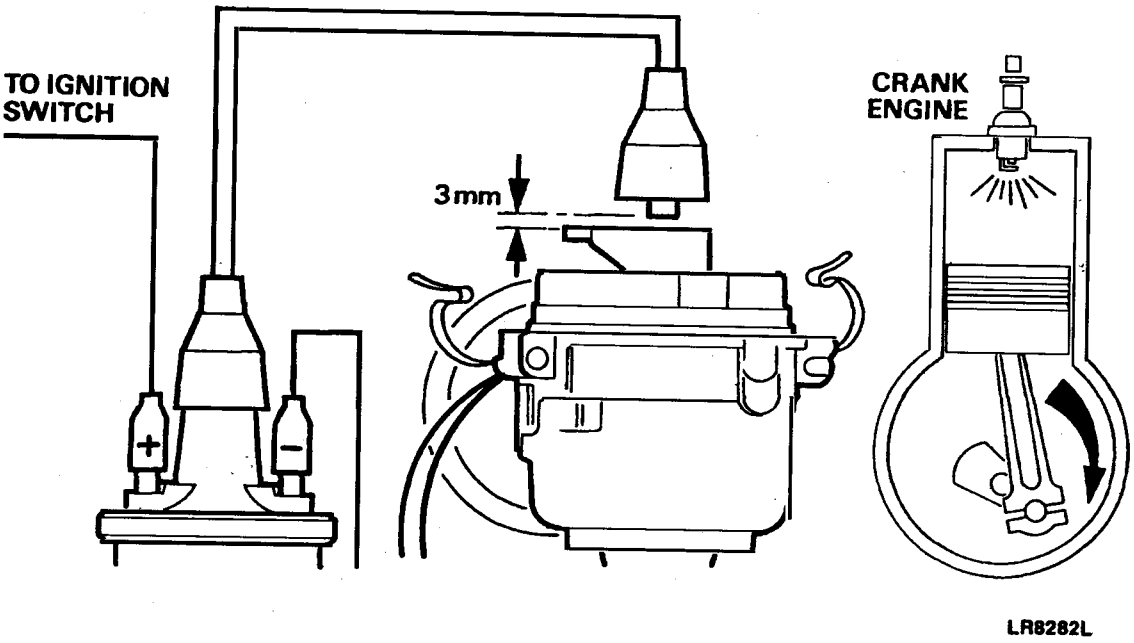


Fig 11 Checking rotor arm

23 Visual and high tension cables. To visually check the ignition system and HT cables proceed as follows:

23.1 Examine the distributor cover. It should be in a clean and dry condition, without evidence of tracking marks.

23.2 Examine the coil top. It should be in a clean and dry condition, without evidence of tracking marks.

23.3 Examine the high tension cable insulation. There should be no evidence of cracking, chafing or perishing.

23.4 Examine the high tension cable continuity. It must not be an open circuit.

23.5 Examine the sparking plugs. They should clean, dry and set to the correct gap.

23.6 Examine the rotor and flash shield. There should be no evidence of cracks or tracking marks.

23.7 The reluctor must not foul the pick-up or leads.

Chapter 13-4

12/24 VOLT 3.5 L PETROL ELECTRICAL SYSTEM

UNIT AND FIELD REPAIRS

CONTENTS

INTRODUCTION

1 This Chapter details the 12/24 volt electrical system fitted to Land Rover 3.5 litre petrol engine 127 vehicles.

Ammeter

2 For removal/refitting instructions of the ammeter refer to Cat 522 Chap 13-2.

Fast fuse

3 For details of the fast fuse refer to Cat 522 Chap 13-2.

Auxiliary terminal box

4 For details of the auxiliary terminal box refer to Cat 522 Chap 13-2.

90 amp alternator

Removal

5 For removal of the 90 amp alternator proceed as follows:

5.1 Disconnect the leads from the batteries.

5.2 Disconnect the leads from the rear of the alternator noting their locations for refitting.

5.3 Slacken the tensioner fixing bolt (Fig 1 (8)).

5.4 Release the locknut (6) from the tensioner screw (7).

5.5 Slacken the tensioner pivot bolt (9).

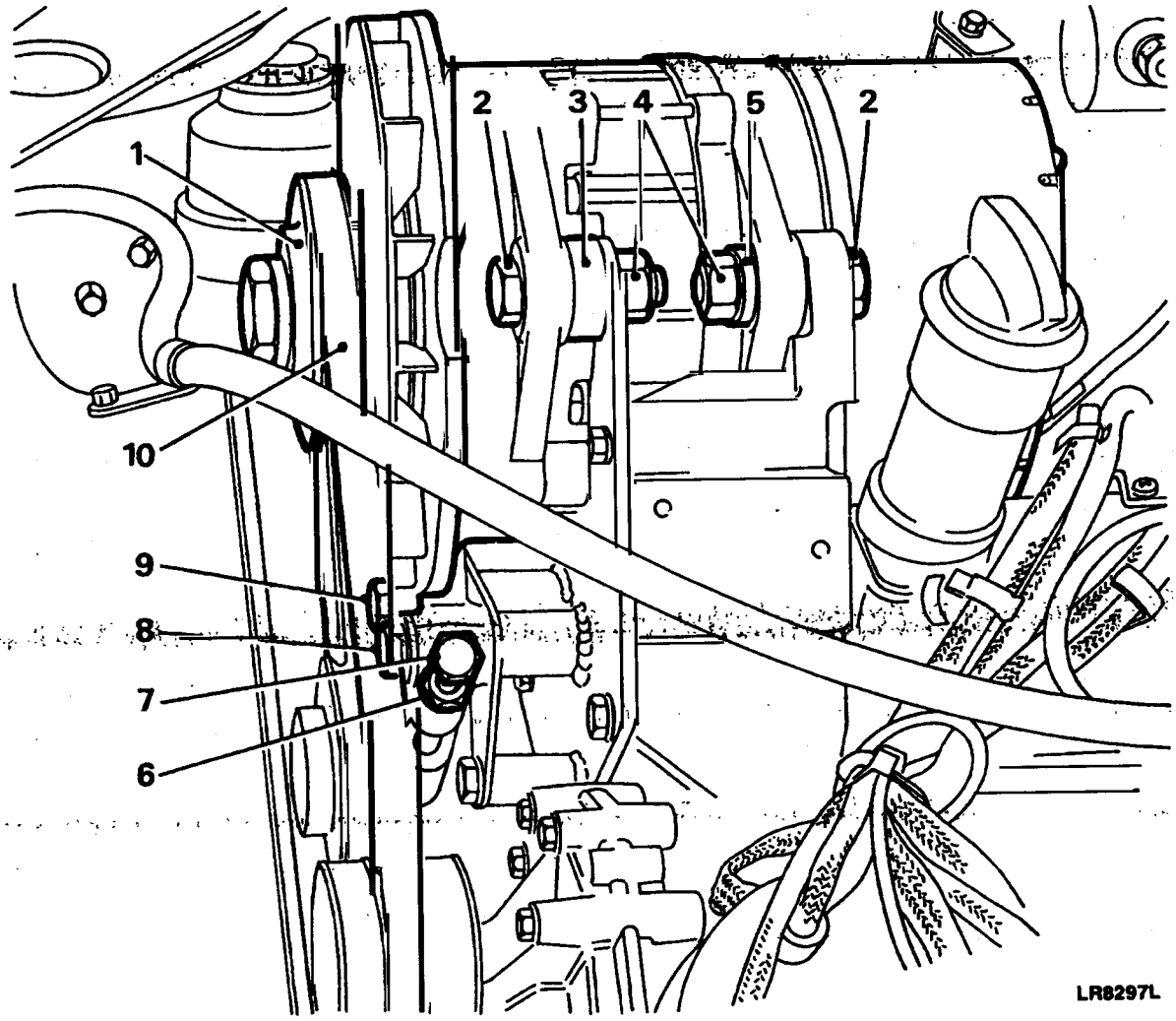
5.6 Turn the tensioner screw anti-clockwise to reduce the belt tension.

5.7 Remove the belt (10) from the alternator pulley (1).

5.8 Select a suitable sling and hoist. Fit the sling around the alternator and increase the tension to support the alternator weight during removal.

5.9 Remove the four alternator fixing nuts (4) and two washers (5), and withdraw the four bolts (2) and two spacers (3).

5.10 Using the hoist as assistance, carefully manoeuvre the alternator from the vehicle.



1 Alternator pulley
2 Bolts
3 Spacers
4 Nuts
5 Washers
6 Tensioner locknut
7 Tensioner screw
8 Tensioner fixing bolt
9 Tensioner pivot bolt
10 Belt

Fig 1 90 amp alternator mounting

Refitting

6 To refit the 90 amp alternator proceed as follows:

6.1 Using a suitable hoist and sling, lower the alternator into position.

6.2 Fit and secure the spacers (Fig 1 (3)), bolts (2), nuts (4) and washers (5) to the alternator and its mounting.

6.3 Fit the belt (10) to the alternator pulley (1).

6.4 Adjust the tension of the alternator belt (Cat 522 Chap 1-2 Para 53).

6.5 Connect the leads to the rear of the alternator.

6.6 Connect the battery leads.

6.7 Run the engine for three to five minutes at fast idle, switch off and re-check the belt tension.

Chapter 13-5

12 VOLT 2.5 L DIESEL WINTERISED ELECTRICAL SYSTEM

UNIT AND FIELD REPAIRS

CONTENTS

INTRODUCTION

1 This Chapter details the Unit and Field repair procedures for the 12 volt winterised electrical system fitted to Land Rover 2.5 litre diesel winterised 90 and 110 vehicles. The information detailed is applicable to both left and right hand vehicles.

Alternator (A127-65)

2 The A127-65 alternator is mounted to the engine in an identical manner to the alternator fitted to Land Rover non-winterised 2.5 litre diesel vehicles.

Removal

3 For removal of the alternator refer to Cat 522 Chap 13-1.

Refitting

4 For refitting the alternator refer to Cat 522 Chap 13-1.

Rear windscreen wiper motor

Removal

5 To remove the rear windscreen wiper motor from the vehicle proceed as follows:

5.1 Disconnect the negative battery lead.

5.2 Remove the two screws (Fig 1 (7)) securing the wiper motor cover (8) to the rear door interior trim panel and remove the cover from the wiper motor.

5.3 Remove the nut (1) and withdraw the wiper arm (2) from the motor spindle.

5.4 Remove the protective sleeve (3) and loosen the nut (4) securing the wiper motor to the outside of the rear door. Do not remove at this stage.

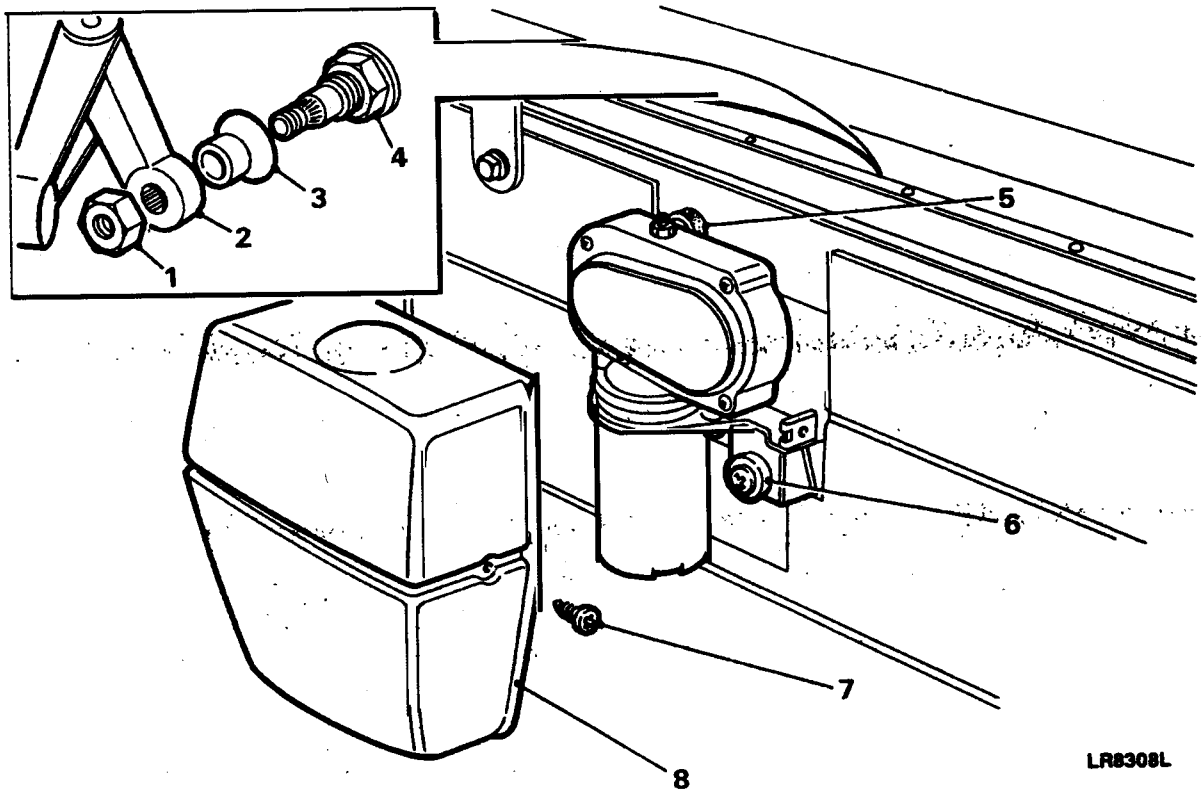
5.5 Disconnect the electrical leads.

5.6 Remove the cross head screw (6) securing the wiper motor to the inside of the rear door.

5.7 Support the wiper motor and remove the nut loosened in Para 5.4. Simultaneously withdraw the wiper motor and seal (5) from the inside of the rear door.

Refitting

6 To refit the rear windscreen wiper motor to the vehicle, reverse the procedures instructed in Para 5.



1 Nut
2 Wiper arm
3 Protective sleeve
4 Nut
5 Seal
6 Screw
7 Screw
8 Cover

Fig 1 Rear windscreen wiper motor

Rear windscreen washer jet

Removal

7 To remove the rear windscreen washer jet from the vehicle proceed as follows:

7.1 Remove the interior trim panel located above the rear door (Cat 522 Chap 16-2).

7.2 Withdraw the plastic tube from the washer jet inlet.

7.3 Remove the brass nut and washer retaining the washer jet to the upper rear panel.

7.4 Remove the washer jet from the outside of the vehicle.

Refitting

8 To refit the rear windscreen washer jet to the vehicle reverse the procedures instructed in Para 7.

Chapter 15-1

CHASSIS 90/110

CONTENTS

INTRODUCTION

1 This Chapter covers the unit and field repairs to the chassis for Land Rover 90 and 110 vehicles.

GENERAL

2 The chassis frame comprises two boxed section side members and four cross members, on Land Rover 90 vehicles, and six cross members on Land Rov r 110 vehicles. On both vehicle types all of the cross members are welded to the side members, except for the inner member situated beneath the bell housing which is bolted to the side members to allow removal of the cross member when carrying out gearbox removal. Additional supports for road springs, fuel tanks and body retention are welded to the side members.

Frame alignment

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

3.1 Place the vehicle on a level floor.

3.2 Mark measuring points at approximately the locations shown in Fig 3 ensuring that the marks are exactly opposite on each side of the chassis frame.

3.3 Hold a plumb line against each of the measuring points in turn and mark the floor directly beneath the plumb-bob.

3.4 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 (0.375 in).

3.4 Chassis frame dimensional checks can be made, with the vehicle upper structure removed, referring to the applicable illustration and associated key.

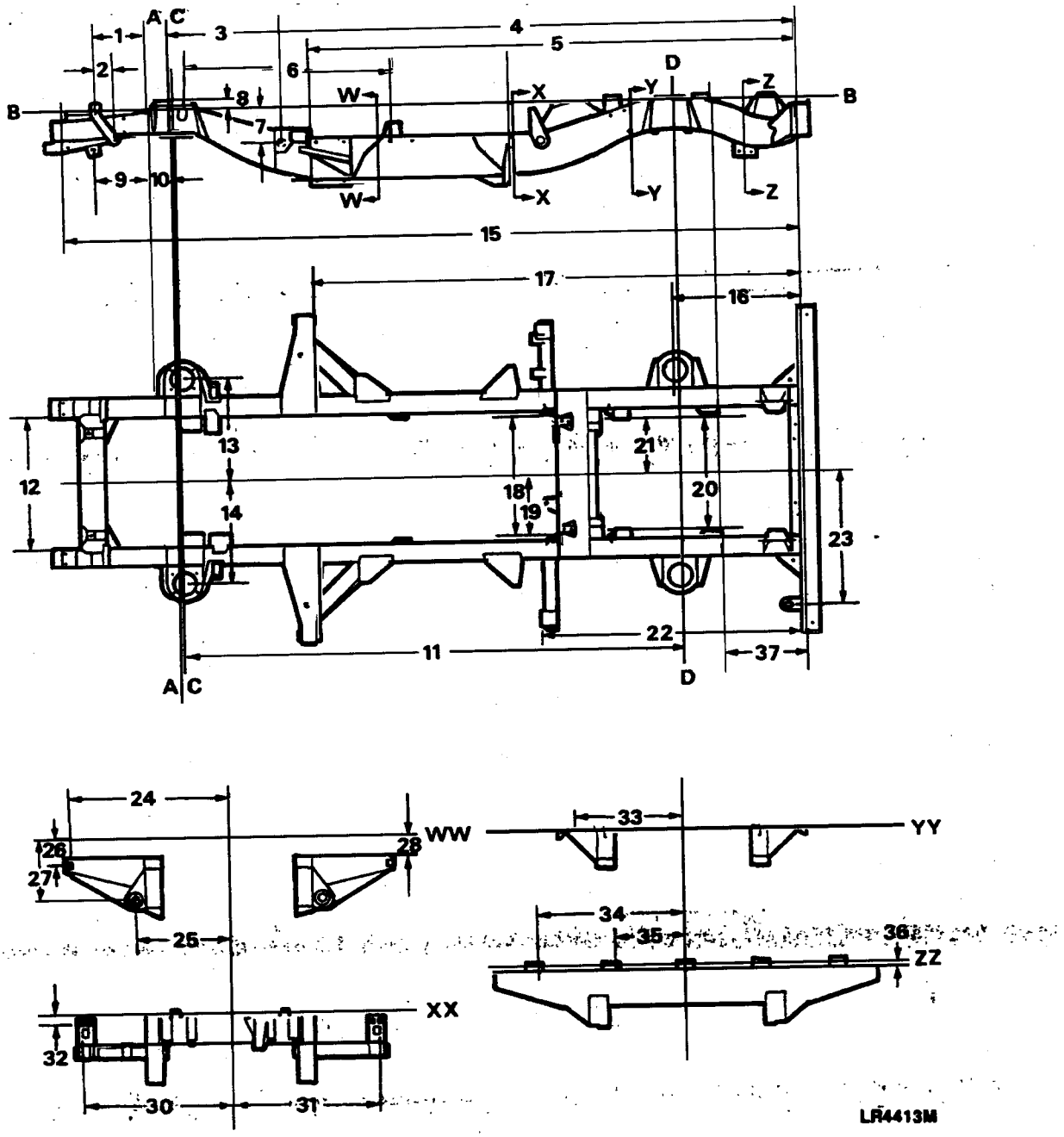


Fig 1 Land Rover 90 Chassis alignment dimensions

Key to Fig 1

A	Front datum	C	Front axle centre line
B	Chassis datum	D	Rear axle centre line
1	239,00 - 236,50 mm	20	519,60 - 517,00 mm
2	82,00 - 79,50 mm	21	259,80 - 258,50 mm
3	633,00 mm	22	1242,60 - 1240,6 mm
4	2420,60 - 2418,60 mm	23	642,50 - 639,50 mm
5	2306,40 - 2305,40 mm	24	750,90 mm
6	981,20 - 978,70 mm	25	439,50 - 436,50 mm
7	182,70 mm	26	136,50 mm
8	41,50 - 37,00 mm	27	299,50 - 295,50 mm
9	252, 00 - 250,00 mm	28	103,00 - 100,00 mm
10	110,00 mm	29	131,50 - 126,50 mm
11	2360,00 mm Wheelbase	30	705,50 - 704,50 mm
12	636,00 - 654,00 mm	31	705,50 - 704,50 mm
13	488,00 - 483,00 mm	32	42,20 - 40,20 mm
14	488,00 - 483,00 mm	33	491,00 - 486,00 mm
15	3431,10 - 3426,10 mm	34	594,20 - 593,40 mm
16	588,30 - 586,30 mm	35	283,00 - 282,20 mm
17	2313,80 - 2311,80 mm	36	32,25 - 31,25 mm
18	590,50 mm	37	397,00 - 395,00 mm
19	295,25 mm		

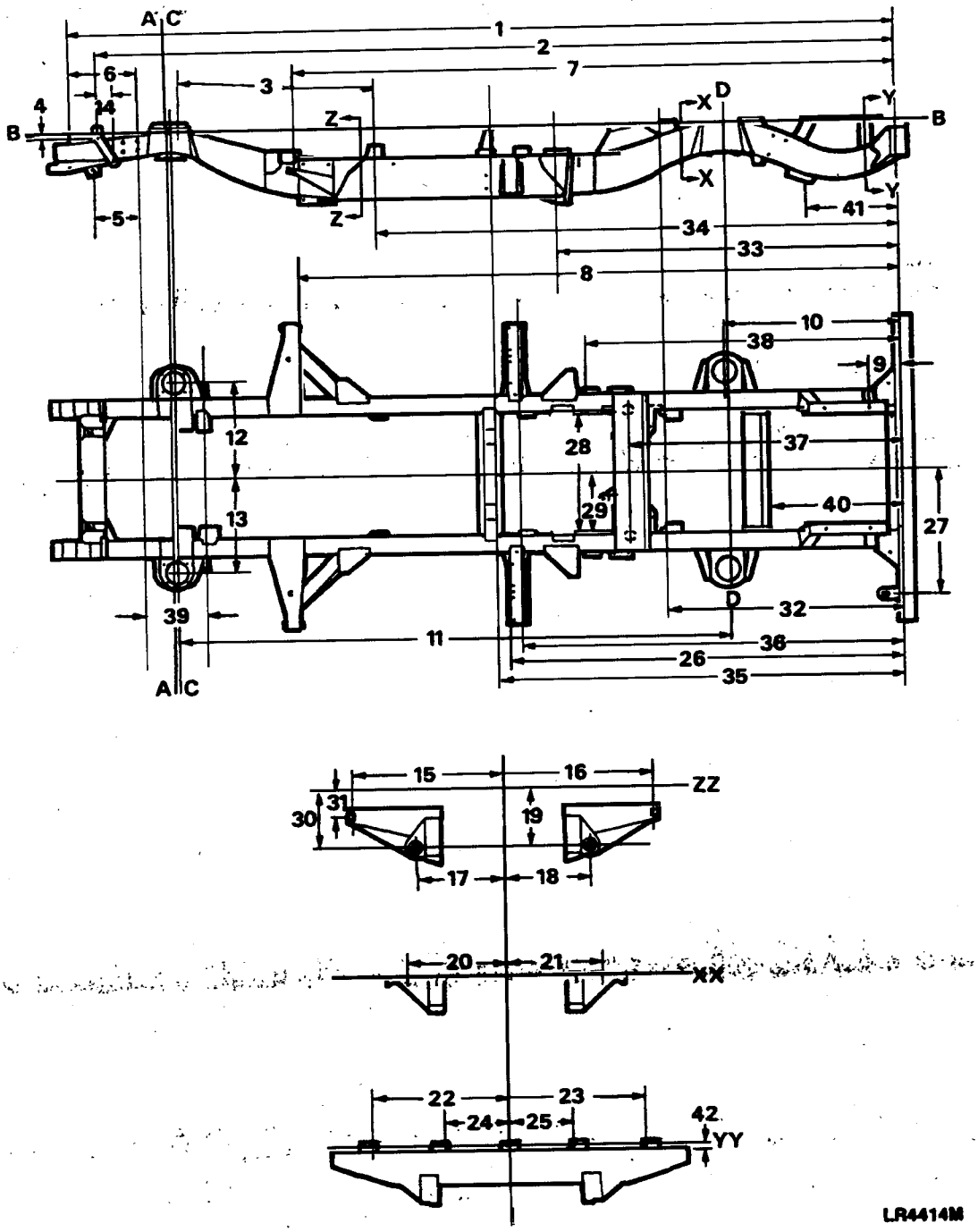
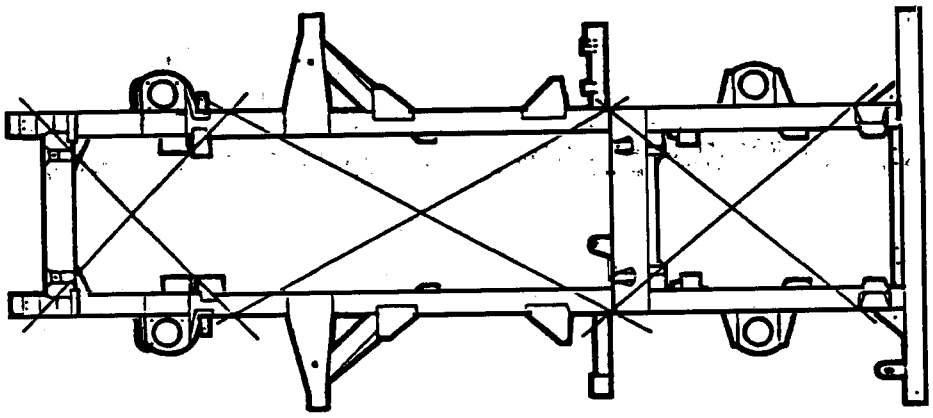


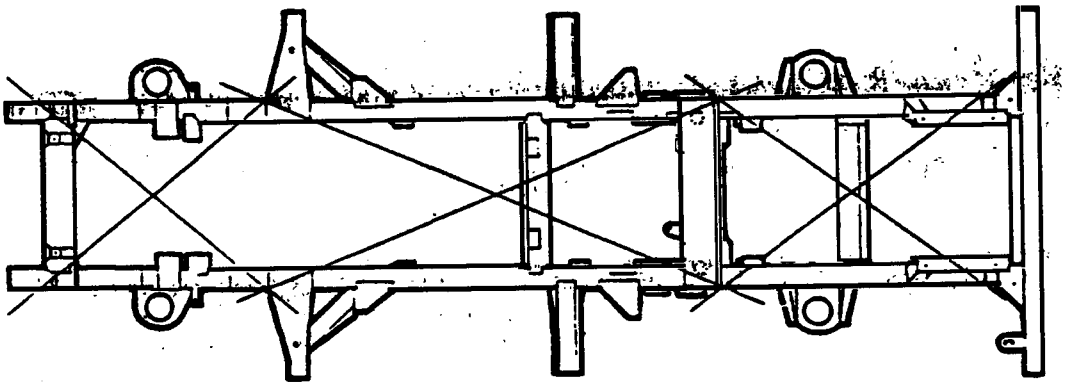
Fig 2 Land Rover 110 Chassis alignment dimensions

Key to Fig 2

A	Front datum	B	Chassis datum
C	Front axle centre line	D	Rear axle centre line
1	4148,00 - 4143,00 mm	22	594,20 - 593,40 mm
2	4009,50 - 4005,00 mm	23	594,20 - 593,40 mm
3	981,20 - 978,70 mm	24	283,00 - 282,20 mm
4	22,00 - 20,00 mm	25	283,00 - 282,20 mm
5	252,00 - 250,00 mm	26	1970,00 - 1968,00 mm
6	239,00 - 236,50 mm	27	642,90 - 639,50 mm
7	3023,30 - 3022,30 mm	28	590,50 mm
8	3030,70 - 3028,70 mm	29	295,25 mm
9	155,00 - 153,00 mm	30	299,50 - 295,50 mm
10	871,20 - 869,20 mm	31	103,00 - 100,00 mm
11	2794,00 - Wheelbase	32	1177,50 - 1175,50 mm
12	488,00 - 483,00 mm	33	1692,59 - 1689,50 mm
13	488,00 - 483,00 mm	34	2610,00 - 2606 mm
14	82,00 - 79,50 mm	35	2040,50 - 2037,50 mm
15	750,90 mm	36	1912,50 - 1909,50 mm
16	750,90 mm	37	1359,00 - 1357,00 mm
17	439,50 - 436,50 mm	38	1573,00 - 1571,00 mm
18	439,50 - 436,50 mm	39	270,00 - 268,00 mm
19	299,50 - 295,50 mm	40	665,50 - 663,50 mm
20	500,00 - 495,00 mm	41	440,00 - 438,00 mm
21	500,00 - 495,00 mm	42	32,25 - 31,25 mm



LAND ROVER 90



LAND ROVER 110 LR4412M

Fig 3 Chassis frame diagonal measurements

Chapter 15-2

CHASSIS

CONTENTS

INTRODUCTION

1 This Chapter covers the unit and field repairs to the chassis for Land Rover 127 vehicles.

GENERAL

2 The chassis frame comprises two boxed section side members and seven cross members, on Land Rover 127 vehicles. All of the cross members are welded to the side members, except for the inner member situated beneath the bell housing which is bolted to the side members to allow removal of the cross member when carrying out gearbox removal. Additional supports for road springs, fuel tanks and body retention are welded to the side members.

Frame alignment

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

3.1 Place the vehicle on a level floor.

3.2 Mark measuring points at approximately the locations shown in Fig 2 ensuring that the marks are exactly opposite on each side of the chassis frame.

3.3 Hold a plumb line against each of the measuring points in turn and mark the floor directly beneath the plumb-bob.

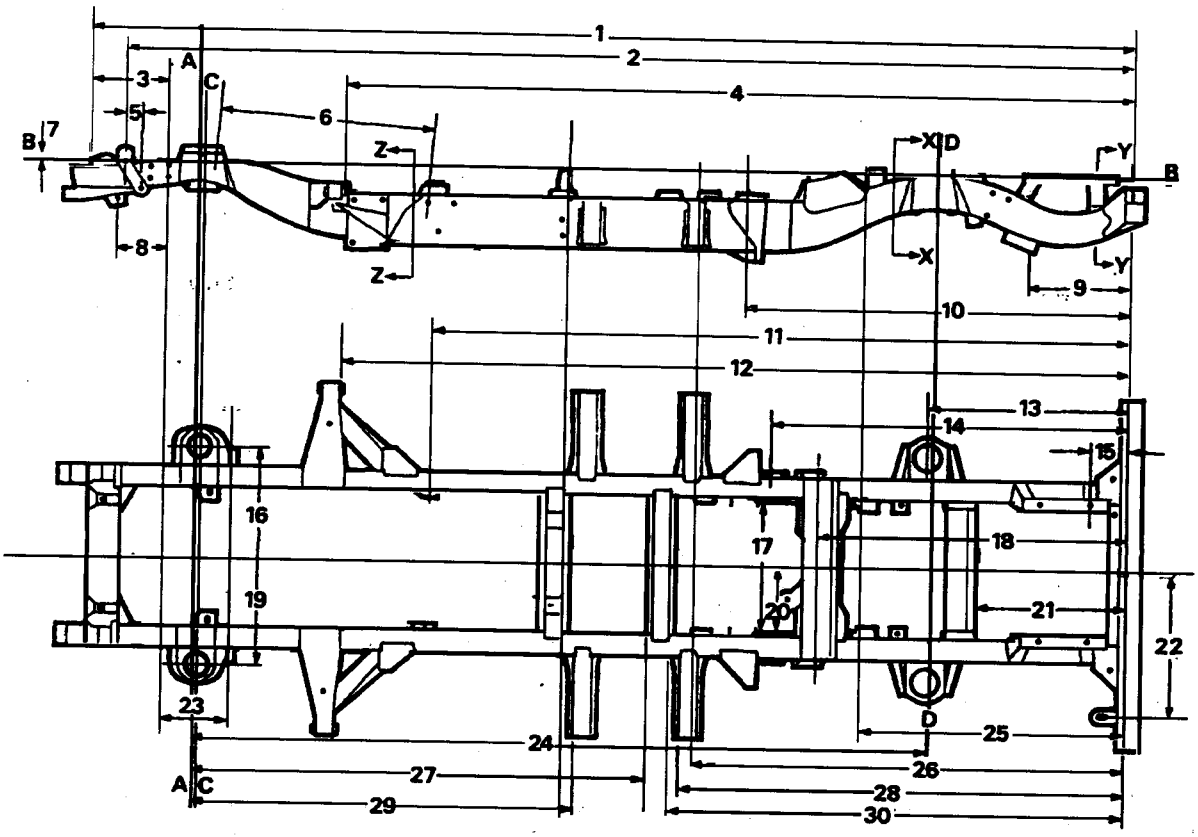
3.4 Move the vehicle and measure diagonally between the marks made on the floor, if the chassis is square the diagonals between the related measuring points should agree within 9,50 mm (0.375 in).

3.5 Chassis frame dimensional checks can be made, with the vehicle upper structure removed, referring to the illustration and associated key.

Key to fig 1

A	Front datum
B	Chassis datum
C	Front axle centre line
D	Rear axle centre line

1	4579,8 - 4574,8 mm
2	4441,3 - 4436,8 mm
3	377,5 - 374,5 mm
4	3455,1 - 3454,1 mm
5	82 - 79,5 mm
6	978,7 - 981,2 mm
7	22 - 20 mm
8	252 - 250 mm
9	440 - 438 mm
10	1692,5 - 1689,5 mm
11	3041,8- 3037,8 mm
12	3462,5 - 3460,5 mm
13	871,2 - 869,2 mm
14	1573 - 1571 mm
15	155 - 153 mm
16	488 - 483 mm
17	590,5 mm
18	1359 - 1357 mm
19	488 - 483 mm
20	295,25 mm
21	665,5 - 633,5 mm
22	642,5 - 639,5 mm
23	270 - 268 mm
24	3225,8 mm - Wheel base
25	1177,5 - 1175,5 mm
26	1912,5 - 1909,5 mm
27	1974 - 1972 mm
28	1970 - 1968 mm
29	1691,5 - 1689,5 mm
30	2040,5 - 2037,5 mm
31	750,9 mm
32	750,9 mm
33	136,5 mm
34	299,5 - 295,5 mm
35	299.5 - 295,5 mm
36	439,5 - 436,5 mm
37	439,5 - 436,5 mm
38	500 - 495 mm
39	500 - 495 mm
40	594,2 - 593,4 mm
41	594,2 - 593,4 mm
42	283 - 282,2 mm
43	283 - 282,2 mm
44	32,25 - 31,25 mm



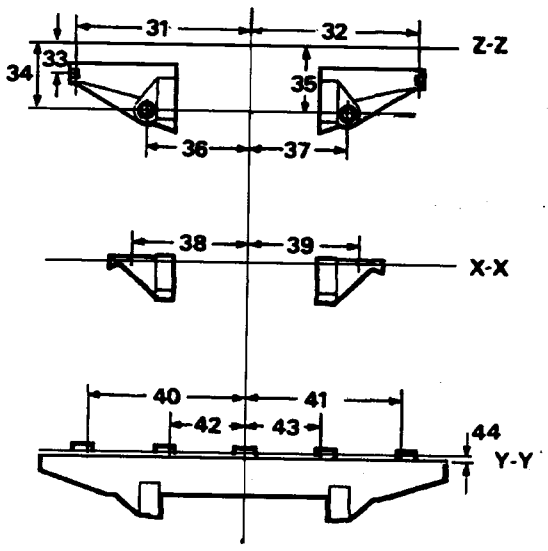


Fig 1 Land Rover 127 Chassis alignment dimensions

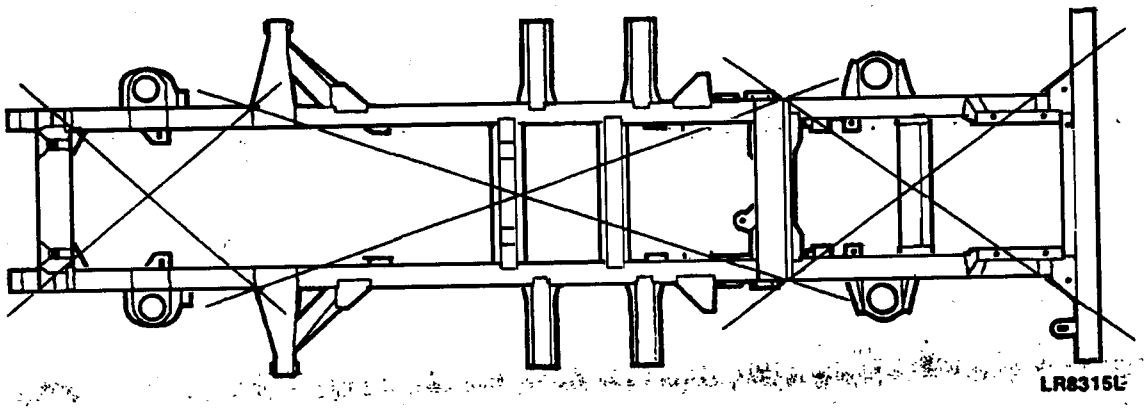


Fig 2 Chassis frame diagonal measurements

Chapter 16-1

BODY CAB AND FITTINGS 90/110

CONTENTS

INTRODUCTION

1 This Chapter covers the Unit and Field repairs for Land Rover 90 and 110 vehicles.

GENERAL

Body panels

2 Land Rover body panels are manufactured from a special aluminium-alloy known as "birmabright".

3 "Birmabright" melts at a slightly lower temperature than pure aluminium and will not rust or corrode under normal circumstances. It is work hardening, but is easily annealed. Exposed to atmosphere, a hard oxide skin forms on the surfac .

Panel beating

4 "Birmabright" panels and wings can be beaten out after accidental damage then must be annealed, by the application of heat, followed by slow air-cooling; as the melting point is low, heat must be applied slowly and carefully. A practical temperature control is to apply oil to the cleaned surface to be annealed. Play the welding torch on the underside of the clean d surface and watch for the oil to clear, leaving the surface clean and unmark d; then allow to cool naturally in the air, when the area so treated will again be soft and workable. Do not quench with oil or water. An alternative method is to clean the surface to be annealed and then rub it with a piece of soap. Apply heat beneath the area, as described above, and watch for the soap stain to clear. Then allow to cool as for the oil method. To avoid any risk of locally melting the metal, when applying the heat for annealing, hold the torch some little distance from the metal and keep it moving about.

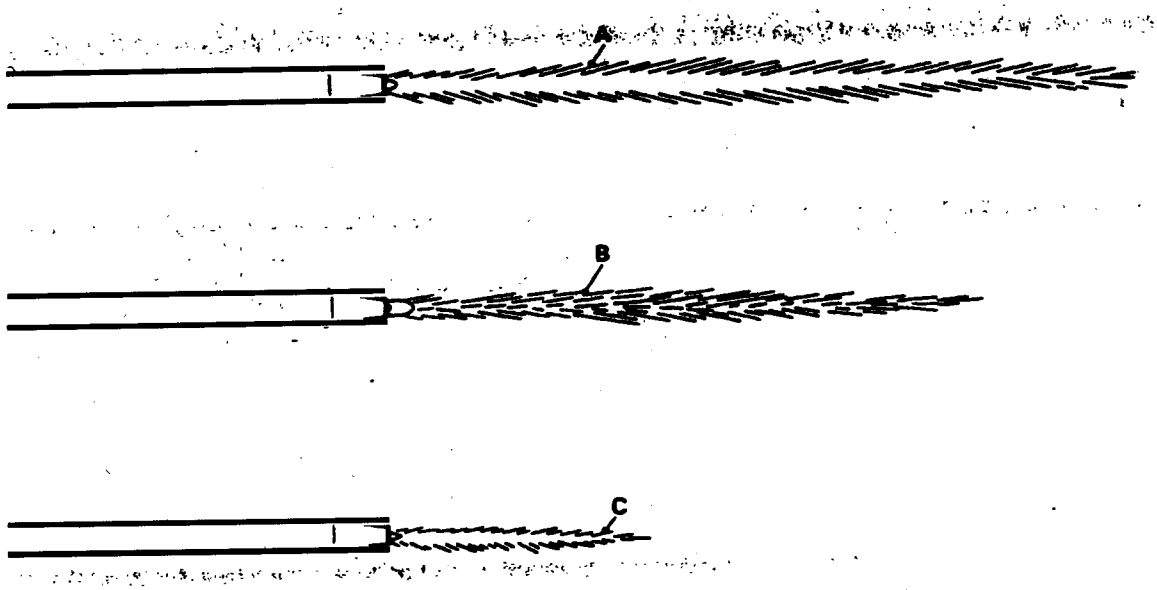


Fig 1 Welding flame j ts

Gas welding

5 When carrying out gas welding a small jet must be used, one or two sizes smaller than would be used for welding sheet steel of comparable thickness. For example , use a No 2 nozzle for welding 18 swg (0.048 in) sheet, and a No 3 for 16 swg (0.064 in) sheet.

6 The flame should be smooth, quiet and neutral and have a brilliant inner core with a well defined, rounded end. The hottest point of the flame is close to the jet and the flame should have a blue to orange envelope becoming nearly colourless at the end (Fig 1 (A)).

7 A slightly reducing flame may also be used, that is, there may be a slight excess of acetylene. Such a flame will have a brilliant inner core with a feathery white flame and a blue to orange envelope (Fig 1 (B)).

8 Do not use an oxidising flame, which has a short pointed inner core bluish white in colour with a bluish envelope (Fig 1 (C)).

9 To carry out repairs use only 5 per cent magnesium/aluminium welding rod (Fig 2 (1)) (5 Mg/A), (Sifalumin No 27 (MG 5 Alloy))or an off-cut of "Birmabright" sheet with Sifbronze Special Acid Flux. If using an off-cut, do not use too wide or thick an off-cut or trouble may be experienced in making it melt before the material being welded melts.

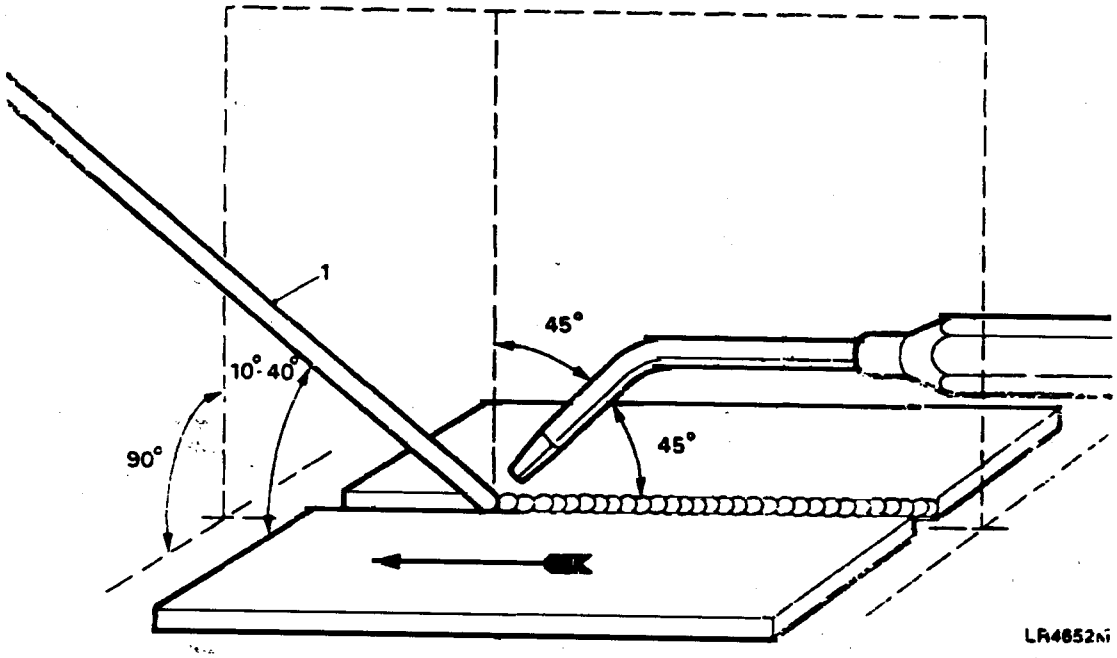


Fig 2 Welding techniques

10 Prior to welding clean off all grease and paint, dry thoroughly 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. Also clean the welding rod or off-cut strip with wire wool. Cleanliness is essential to achieve a satisfactory weld.

11 It should be remembered that aluminium and its alloys do not show "red-not" before melting, so there is nothing about the appearance of the metal to indicate that it has reached welding temperature. A little experience will enable the operator to gauge this point, a useful guide is to sprinkle a

few particles of sawdust over the work; this will sparkle and char when th right temperature is approached, alternatively a piece of dry wood rubbed over the hot metal will sparkle at the point of contact if the temperature is correct. If the operator is not experienced in welding aluminium, it is recommended that a few practice welds are made with scrap aluminium before the actual repair is commenced.

12 The Sifbronze special flux should be used in accordance with the manufacturers instructions, as this flux is highly acid, it is essential to wash it off immediately after the weld has cooled. Very hot soapy water should be used with wire wool or a scratch brush, the alkaline nature of the soap will t nd to neutralise the acid.

13 The heat of welding will have softened the metal in the area of the repair, it may be hardened again by peening with a light hammer. Many light blows are pref rable to fewer heavy ones. To avoid denting and deformation, and to make the peening more effective, use a dolly or an anvil behind the work. Filing surplus metal from the weld will also help to harden the work again.

Welding tears and patches

14 If a tear extends to the edge of a panel drill a small hole at the end away from the edge to prevent the crack from spreading. Start the weld where the hol has been drilled and work towards the edge.

15 When welding a long tear, or making a long welded joint, tack the edges to be welded at intervals of from 50,00 to 100,00 mm (2.00 to 4.00 in) with spots. This is done by melting the metal at the starting end and fusing into it a small amount of filler rod, repeating the process at the suggested intervals. After tacking, weld continuously along the joint from right to left, increasing the speed of the weld as the material heats up.

16 Wh n the work has cooled, wash off all traces of flux as described previously, and file off any excess build-up of metal.

17 Wh n patching, cut the patch to the correct shape for the hole to be filled, but of such size as to leave a gap of 0,80mm (0.030 in) between the patch and the panel, then weld as described above. A repair must never be made by applying an overlay patch.

Electric welding

CAUTION ...

Before commencing electric welding the battery earth lead must be disconnected otherwise damage to the alternator will occur.

18 During vehicle manufacture the "Argon-Arc" process is used, all atmospheric oxygen being excluded from the weld by the Argon gas shield. For all body r pair work carried out at Unit and Field level, the gas welding method is sufficient and quite satisfactory.

Riv ting

19 Where both sides of the material are accessible and it is possible to use an anvil or "dolly", solid aluminum rivets may be used, with a suitable punch or "pop" to ensure clean rounded heads on the work. For riveting blind holes, "pop-rivets" must be used.

Painting

20 The area to be painted must be flatted to remove the hard oxide skin which forms on the surface of the alloy when exposed to the atmosphere. Degrease and dry the area, then apply a suitable etch-primer. Unless an etch-primer is used, paint is liable to come away as it cannot "key" into the hard oxide of an untreated alloy surface and the use of ICI Etching Primer P565-5002 is recommended. It is quick and easy to apply and it prolongs the life of the paint film by ensuring excellent adhesion.

Application

21 The activated Etching Primer has a limited pot life of approximately 8 hours at normal temperatures and should not be used after this time, as it may have inferior adhesion and corrosion resistance. Any Etching Primer that has been mixed for more than 8 hours must be thrown away and not returned to the can.

22 Apply Etching Primer as soon as possible after cleaning, and paint as soon as the pre-treatment is completed. Undue delay may cause the surface to be contaminated again and thus nullify the treatment. Do not leave pre-treated work overnight before it is painted.

24 Etching primer, when followed by a suitable paint system, gives a film which is very resistant to moisture, but the Etching Primer itself is water sensitive. It should therefore be coated with paint as soon as possible when it is dry.

25 Mix and apply the Etching Primer and paint as follows:

25.1 Activate the Etching Primer by mixing with an equal volume of Activator P273-5021 and allow to stand for 10 minutes.

25.2 Adjust the spraying viscosity of the mixture if necessary to 22-25 sec BSB4 Cup by adding small quantities of Thinner 851-565; never add more Activator.

25.3 Apply by spray to a clean dry surface in a thin uniform coat, rather than a thick heavy one, which may impair adhesion.

25.4 Air dry for at least 15 minutes before applying undercoat by spray or for 2 hours for brush application. If required these times can be shortened by force drying, this also gives increased hardness to the film.

25.5 Subsequent painting should follow normal paintshop practice.

25.6 When wet flatting the subsequent paint layers take care not to rub through to the Etching Primer. If this does occur allow to dry out thoroughly, dry flat the area and spot in with Etching Primer.

Bodywork

26 The following body illustrations show the make up of the 90 and 110 Land Rover vehicles. They are divided into eighteen separate drawings for ease of reference and understanding.

1. Bonnet assembly
2. Plate fixings
3. Plate
4. Bonnet stop buffer
5. Bonnet stop buffer fixings
6. Buffer reinforcement fixings
7. Buffer reinforcement
8. Clamping plate
9. Grille top panel fixings
10. Crossbrace tube fixings
11. Crossbrace tubes
12. Seal
13. Radiator grille panel
14. Radiator grille panel fixings
15. Crossbrace tube to grille top panel fixings
16. Radiator grille
17. Radiator grille fixings
18. Bonnet catch
19. Grille panel to top panel fixings
20. Washer plate and grille top panel assembly
21. Bonnet prop pivot fixings
22. Bonnet prop pivot pin assembly
23. Bonnet prop pivot assembly
24. Bonnet fastener fixings (Wing)
25. Bonnet fastener assembly
26. Bonnet fastener fixings (Bonnet)
27. Spare wheel retainer
28. Spare wheel retainer fixing
29. Buffer
30. Hinge fixings
31. Hinge assembly

Fig 3 Bonnet assembly (Early version)

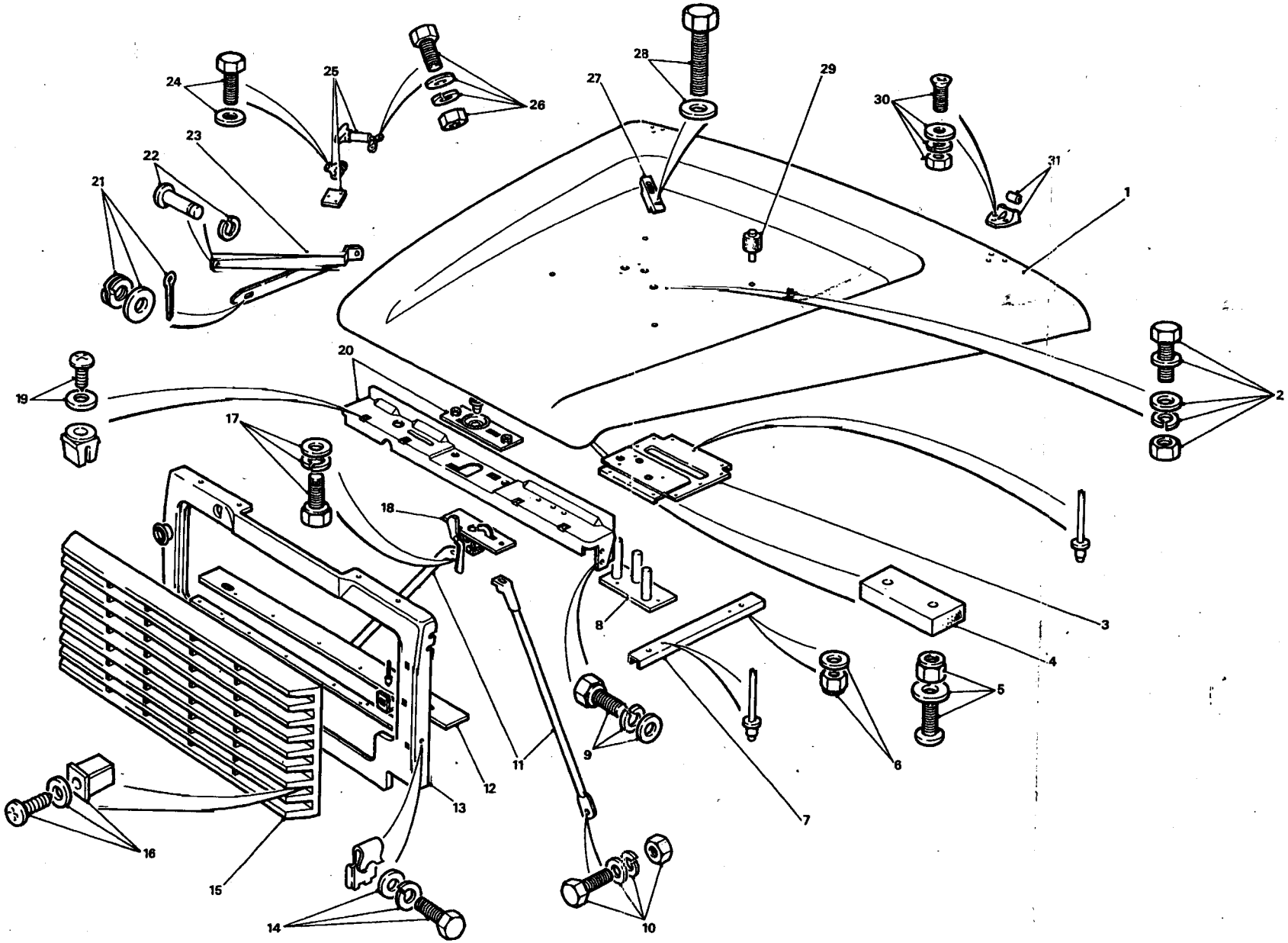


Fig 3 Bonnet assembly (Early version)

1. Bonnet
2. Plate fixings
3. Plate
4. Bonnet stop buffer
5. Buffer reinforcement fixings
6. Buffer reinforcement
7. Clamping plate
8. Top panel to wings fixings
9. Adjustment plate fixings
10. Crossbrace tube fixings
11. Crossbrace tubes
12. Crossbrace tubes to grille top panel fixings
13. Seal (When oil cooler is fitted)
14. Radiator grille panel fixings
15. Radiator grille panel
16. Radiator grille
17. Radiator grille fixings
18. Bonnet catch
19. Bonnet release cable retainer assembly
20. Grille top panel
21. Grille top panel fixings
22. Bonnet prop pivot fixings
23. Bonnet prop
24. Stowage clip fixings
25. Bonnet prop stowage clip
26. Washer plate
27. Bonnet safety catch
28. Bonnet release mechanism assembly
29. Bonnet fastener fixings (Wings)
30. Bonnet fastener
31. Bonnet fastener fixings (Bonnet)
32. Bonnet release cable fixings
33. Bonnet safety catch fixings
34. Spare wheel clamp fixings
35. Spare wheel clamp
36. Buffer
37. Hinge fixings
38. Hinge assembly

Fig 4 Bonnet assembly (Later version)

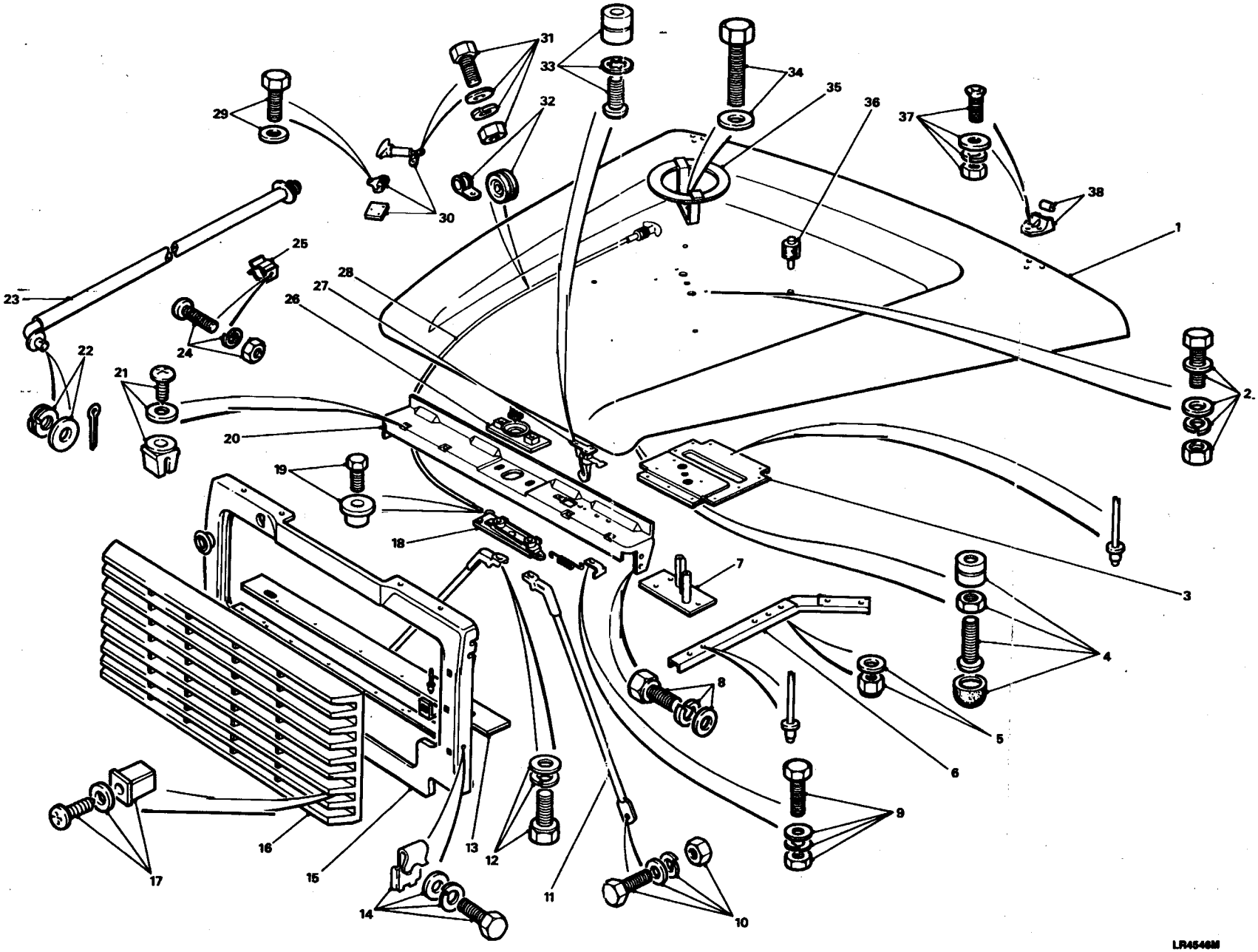


Fig 4 Bonnet assembly (Later version)

1. Spire nut - Wheelarch to stay
2. Rivet
3. Eyebrow
4. Wheelarch fixings
5. Wheelarch
6. Front suspension cover
7. Front suspension cover to wheelarch fixings
8. Nose panel fixings
9. Nose panel
10. Fixing
11. Bonnet fastener plate
12. Staple
13. Fastener plate to staple fixings
14. Wing top
15. Bracket
16. Rivet - Wing top to bracket
17. Air intake grille
18. Air intake grille to wing top fixings
19. Wing top to bracket fixings
20. Fixing bracket
21. Fixing plate
22. Plate to bracket fixings
23. Rivet - Headlight mounting panel
24. Headlight mounting panel
25. Outer panel
26. Outer panel to scuttle fixings
27. Side indicator repeater light assembly
28. Side indicator repeater assembly to outer panel fixings
29. Stay
30. Stay to wheelarch fixings
31. Wheelarch to scuttle

Fig. 5 Front wing 12 volt vehicles

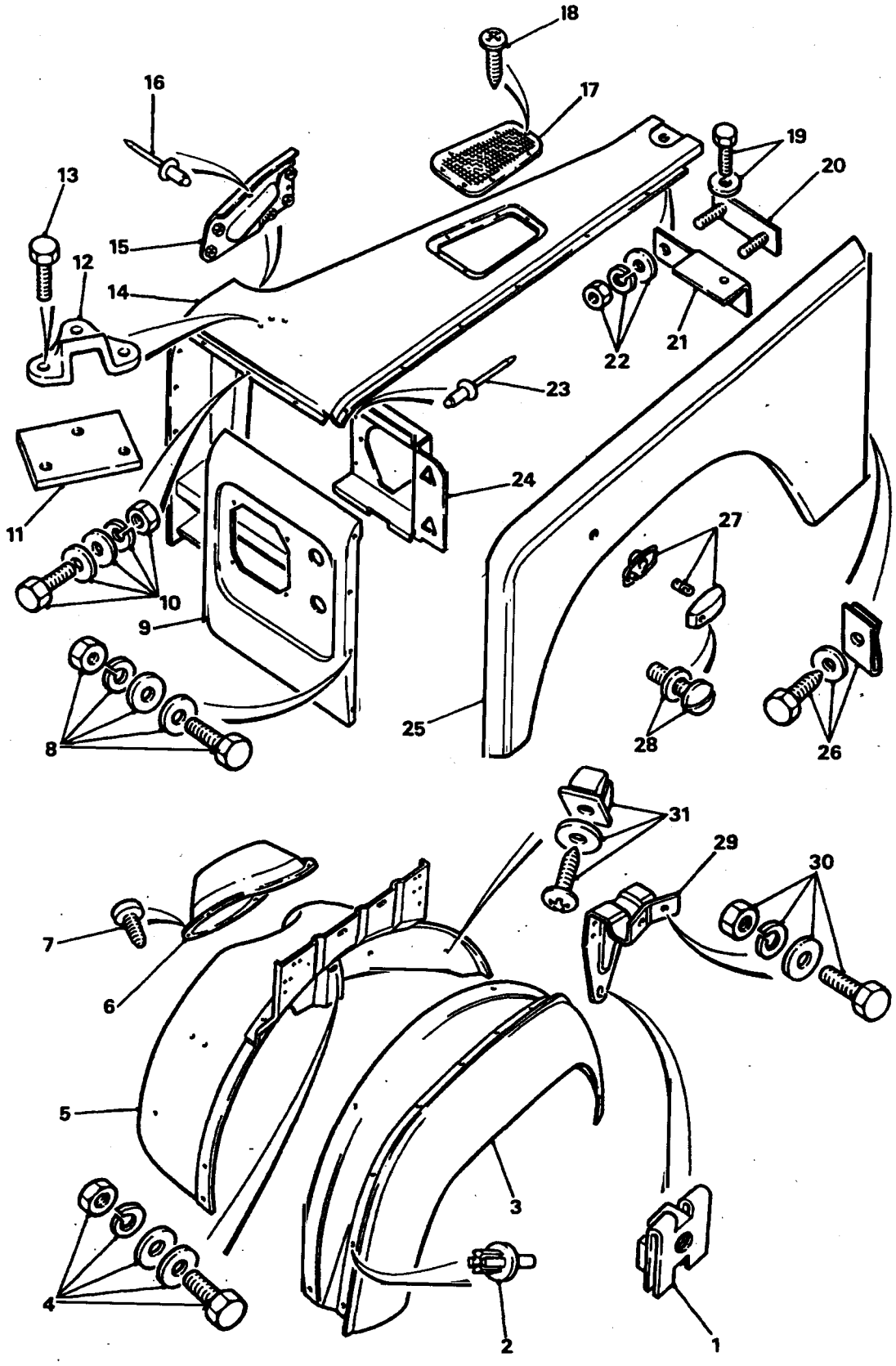


Fig 5 Front wing assembly 12 volt vehicles

1. Rivet
2. Eyebrow
3. Wheelarch fixings
4. Wheelarch
5. Front suspension cover
6. Fixings
7. Radio aerial bracket support
8. Fixings
9. Front wing rear fixing
10. Side indicator repeater light assembly
11. Fixings
12. Outer panel
13. Nose panel
14. Headlight mounting panel
15. Rivet
16. Fixing plate fixings
17. Fixing bracket
18. Fixing plate
19. Wing top to bracket fixings
20. Wing top
21. Fixings
22. Air intake grille
23. Grommet
24. A.T.U. mounting bracket
25. Mounting bracket fixings
26. Tie plate
27. Rivet
28. Front wing to Nose panel fixings
29. Wing top to nose panel
30. Bonnet fastener plate
31. Staple
32. Staple to plate fixings
33. Windscreen clamp assembly fixings
34. Windscreen clamp assembly
35. Lower gasket
36. Windscreen hinge
37. Upper gasket
38. Upper windscreen hinge fixings
39. Laminated clear glass
40. Glazing rubber
41. Windscreen frame
42. Scuttle to steering
43. Grommet
44. Grommet plate
45. Grommet plate to scuttle fixings
46. Drain channel seal
47. Finishing strip
48. Finishing strip fixing
49. Plug
50. Plug
51. Scuttle to chassis fixings
52. Bonnet buffers
53. Scuttle
54. Front plate
55. Rivet
56. Air flow divider panel
57. Ventilator control
58. Front plate fixings
59. Front plate fixings
60. Front plate to scuttle fixings
61. Front plate to scuttle fixings
62. Rivet
63. Flyscreen
64. Rivet
65. Splash panel
66. Ventilator lid
67. Hinge pin
68. Stay
69. Stay to wheelarch fixings
70. Wheelarch to scuttle and wing fixings
71. Spire nut - Wheelarch to stay

Fig 6 Front wing and scuttle assembly 12/24 volt vehicles

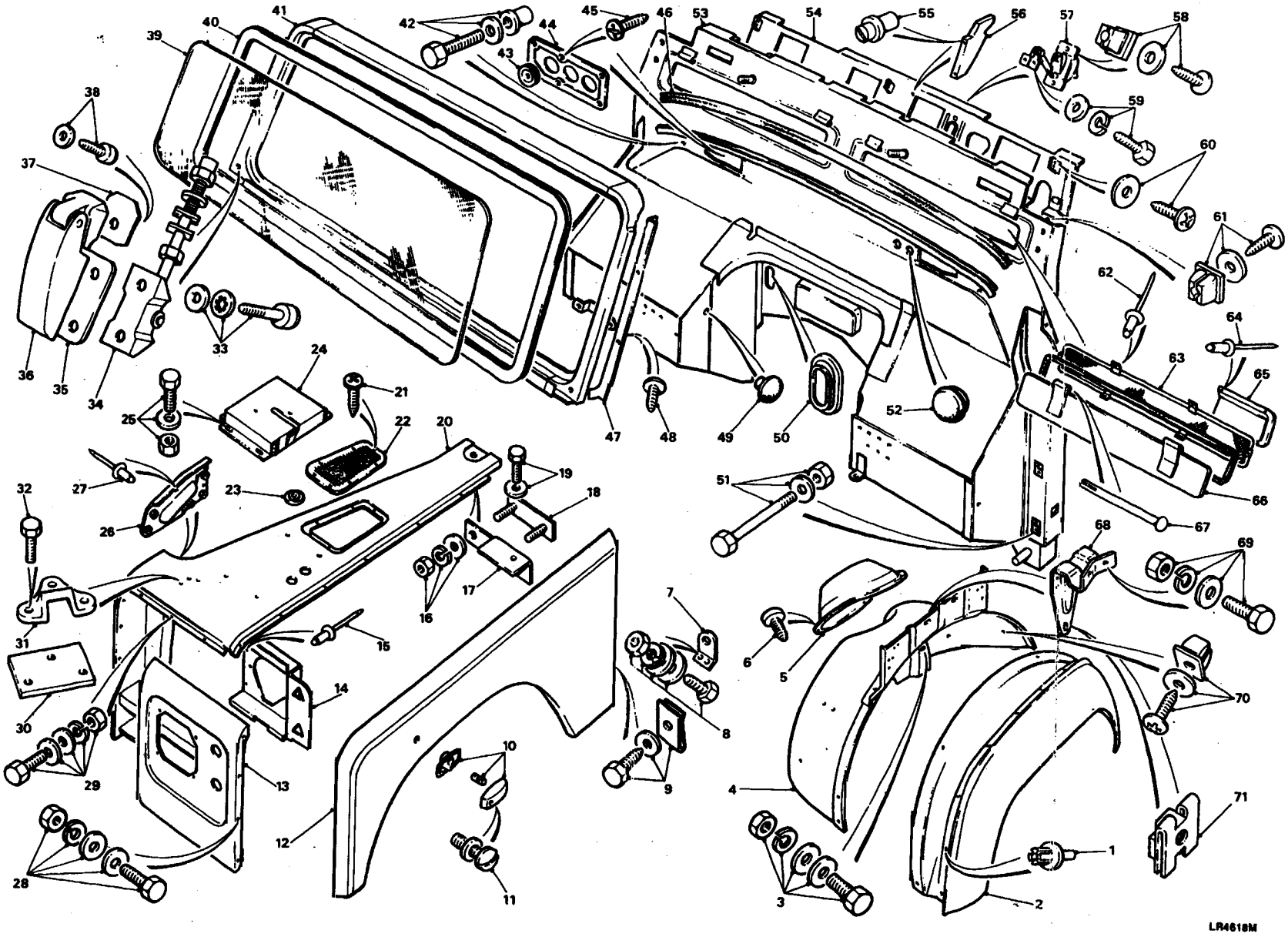


Fig 6 Front wing and scuttle assembly 12/24 volt vehicles

1. Heater duct assembly
2. Switch panel to duct fixings
3. Switch panel
4. Switch panel to duct fixings
5. Blank - Switch panel
6. Fuse box cover
7. Fuse box cover fixing
8. Heater duct fixing
9. Heater duct and wiper motor cover to dash fixings
10. Wiper motor cover
11. Finisher
12. Closing panel and insulation pad assembly
13. Parcel tray
14. Parcel tray to dash fixing
15. Trim finisher
16. Wiper motor drive cover
17. Front auxiliary swwitch panel
18. Left hand auxiliary switch panel
19. Grab handle
20. Grab handle to crash pad fixings
21. Grab handle to heater duct fixings
22. Crash pad to dash fixings
23. Upper crash pad
24. Demister outlet to crash pad fixing
25. Demister outlet
26. End closing panel to crash pad fixings
27. End closing panel
28. Right hand auxiliary switch panel
29. Crash pad to front plate fixing
30. Auxiliary side to plate fixings
31. End closing panel to dash fixings
32. Closing pad and insulation pad assembly
33. Finisher to heater duct fixings

Fig 7 Dash trim assembly

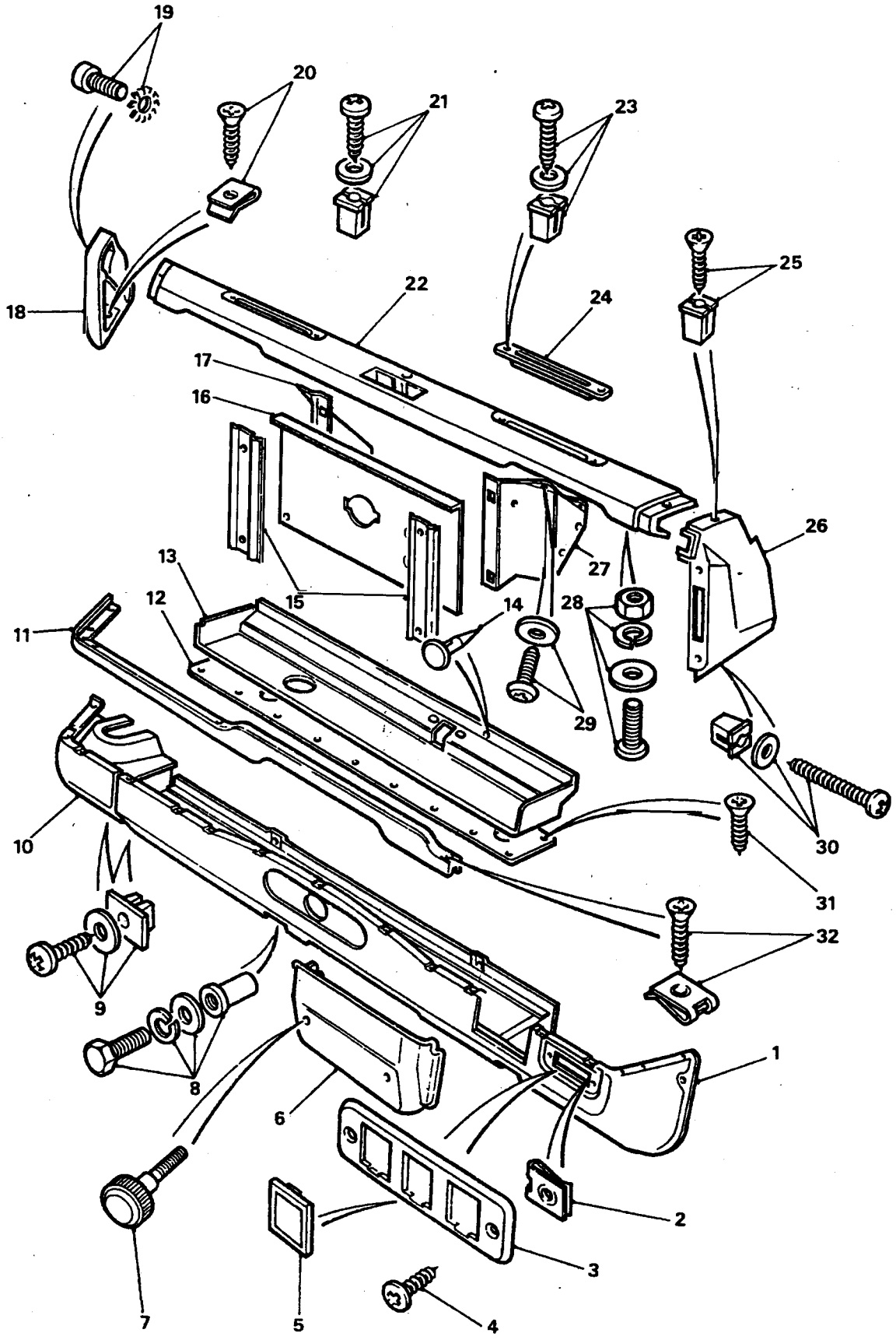


Fig 7 Dash trim assembly

1. Bracket to sill channel fixings
2. Bracket
3. Sill panel to bracket fixings
4. Front stay fixings
5. Front stay
6. Front sill panel
7. Front sill panel to wing outer panel
8. Sill channel
9. Bolt plate - Sill channel to scuttle
10. Bolt plate fixings
11. Heelboard to floorplate seal
12. Sill to toebox seal
13. Front floor plate
14. Floor plate fixings
15. Battery tray
16. Overcentre catch
17. Rivet - Overcentre catch
18. Cover plate
19. Rivet - Cover plate
20. Rear tunnel seal
21. Tunnel panel
22. Side tunnel panel
23. Front tunnel panel
24. Diaphragm panel
25. Diaphragm panel to scuttle
26. Diaphragm panel to scuttle fixings
27. Tunnel panel to diaphragm panel fixings
28. Sill to toebox seal
29. Front floor plate
30. Healboard to floorplate seal
31. Floorplates to heelboard fixings
32. Gearshaft gaiter
33. Insulation pad
34. Tie strap
35. Tool locker (110)
36. Extension panel
37. Rivet - Extension panel
38. Tool locker cover (110) or Seatbase cover (90)
39. Centre cover
40. Centre cover fixings
41. Seatbase seal
42. Battery cover (110) or Battery/Toolbox cover (90 only)
43. Rivet - Battery and tool lockers
44. Protective capping
45. Front cushion
46. Front squab
47. Trim clip
48. Plastic spacer
49. Squab to seat frame fixings
50. Seat slide - plain
51. Seatbase to stiffener fixings
52. Adjustable seat frame
53. Seat slide - with control
54. Seat slide to frame fixings
55. Cover locating angle
56. Extension panel
57. Seatbase to BC post fixings
58. Seatbase to chassis fixings
59. Seatbase to sill channel fixings

Fig 8 Gearbox tunnel and seatbase assembly

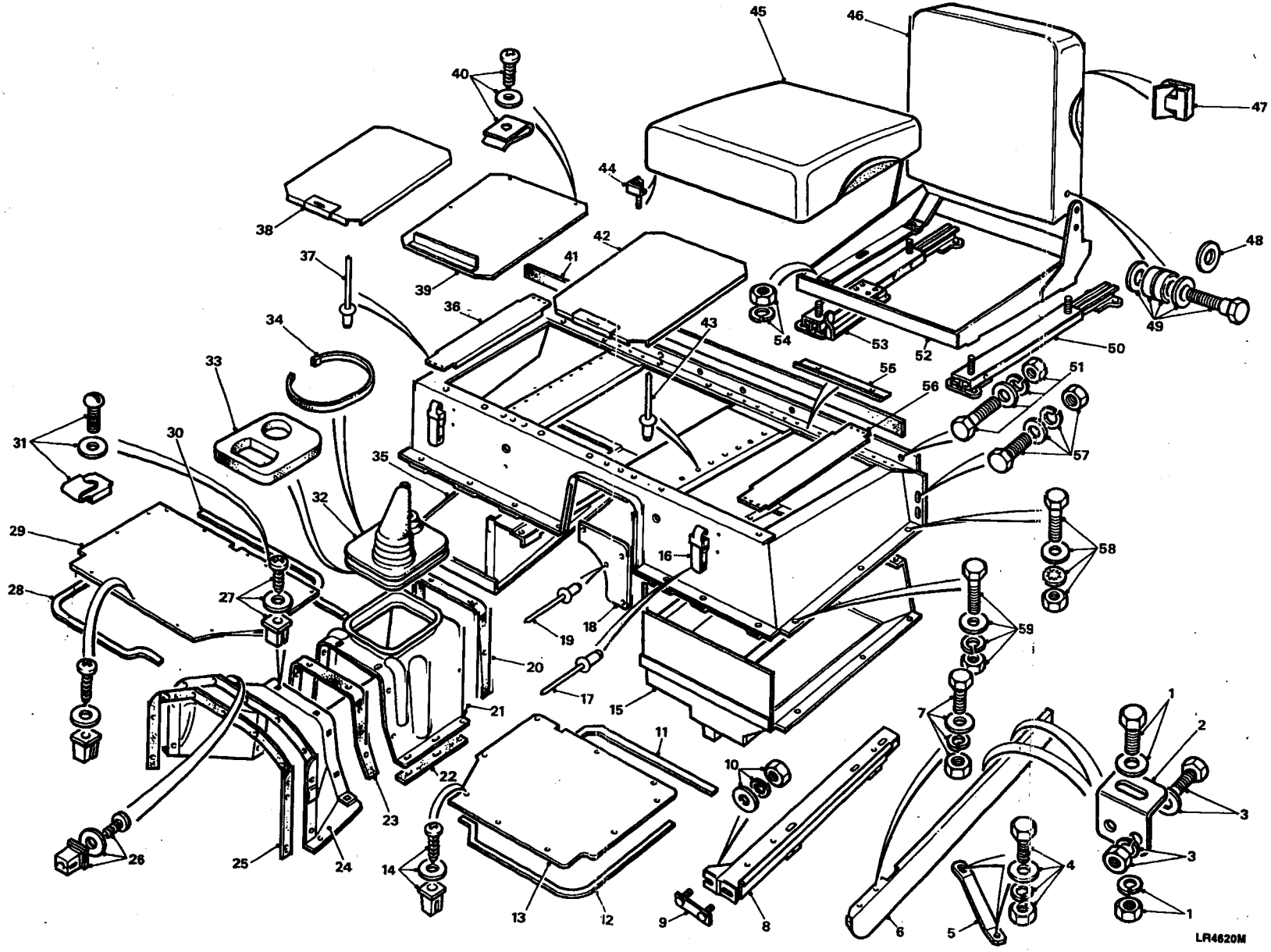


Fig 8 Gearbox tunnel and seatbase assembly

1. Striker assembly } Early version
2. Striker assembly fixings
3. Door lock assembly
4. Door lock assembly fixings
5. Exterior mirror
6. Mirror arm and hinge
7. Bottom hinge fixings
8. Bottom hinge assembly
9. Top hinge and mirror fixings
10. Side door assembly
11. Pivot fixings
12. Buffer
13. Restraining strap
14. Restraining strap bracket
15. Bracket fixings
16. Retainer bracket
17. Retainer bracket fixings
18. Sliding window catch assembly
19. Rivet - Sill seal
20. Sill seal
21. Side door seal
22. Glazing felt
23. Draught rail assembly
24. Inner and outer finger pull
25. Front glazing panel assembly
26. Rear glazing panel assembly
27. Slide rail assembly
28. Removeable rail fixing
29. Removeable rail
30. Side screen assembly
31. Side screen assembly and capping strip
32. Side screen to door fixings
33. Striker support assembly
34. Striker support assembly fixings
35. Shroud
36. Striker plate fixings } Later versions
37. Striker plate assembly
38. Door key
39. Door lock assembly
40. Door lock assembly fixings
41. Door striker assembly fixings

Fig 9 Side door assembly

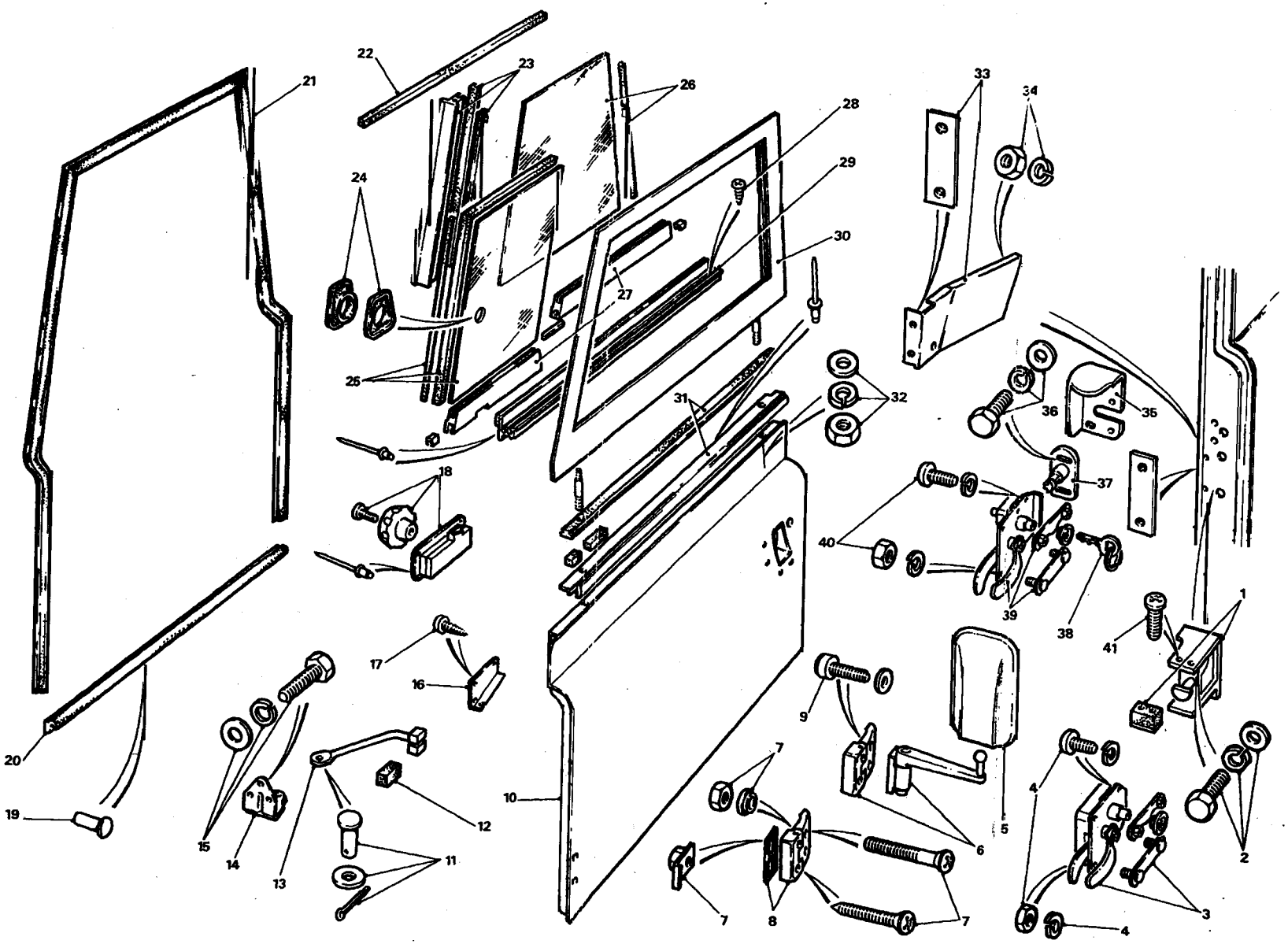


Fig 9 Side door assembly

1. Left hand bodyside Panel assembly
2. Rear sill panel
3. Floor plate
4. Stiffener bracket
5. Front panel assembly
6. Reinforcement bracket to mounting bracket fixings
7. Squab buffer bracket
8. Reinforcement angle bracket
9. Small arms clip to bracket fixings
10. Small arms clip
11. Reinforcement plate
12. Plate and angle bracket to front panel assembly
13. Reinforcement bracket
14. Mounting bracket
15. Mounting bracket to top capping fixing
16. Small arms clip to mounting bracket fixings
17. Small arms clip
18. Reinforcement plate and bracket to bulkhead fixings
19. Seat strap
20. Seat strap to backrest assembly fixings
21. Seat base protection strip
22. Seat base assembly
23. Backrest protection strip
24. Backrest assembly
25. Clip to frame fixings
26. Bracket securing clip
27. Backrest to fixing seat fixings
28. Rubber buffer to backrest fixing
29. Rubber buffer
30. Retaining pad
31. Backrest assembly
32. Backrest panel
33. Seat frame to wheelarch fixings
34. Cushion assembly
35. Front panel capping
36. Right hand top capping
37. Right hand bodyside panel
38. Right hand protection angle
39. Right hand rear corner capping
40. Right hand rear end panel
41. Right hand rear corner bracket
42. Rear mounting bracket
43. Rear protection plate assembly
44. Protection plate to floor fixings
45. Left hand rear corner bracket
46. Left hand rear corner capping
47. Left hand protection angle
48. Left hand top capping
49. All cappings and protection angles fixings

Fig 10 Lower rear body assembly I (90)

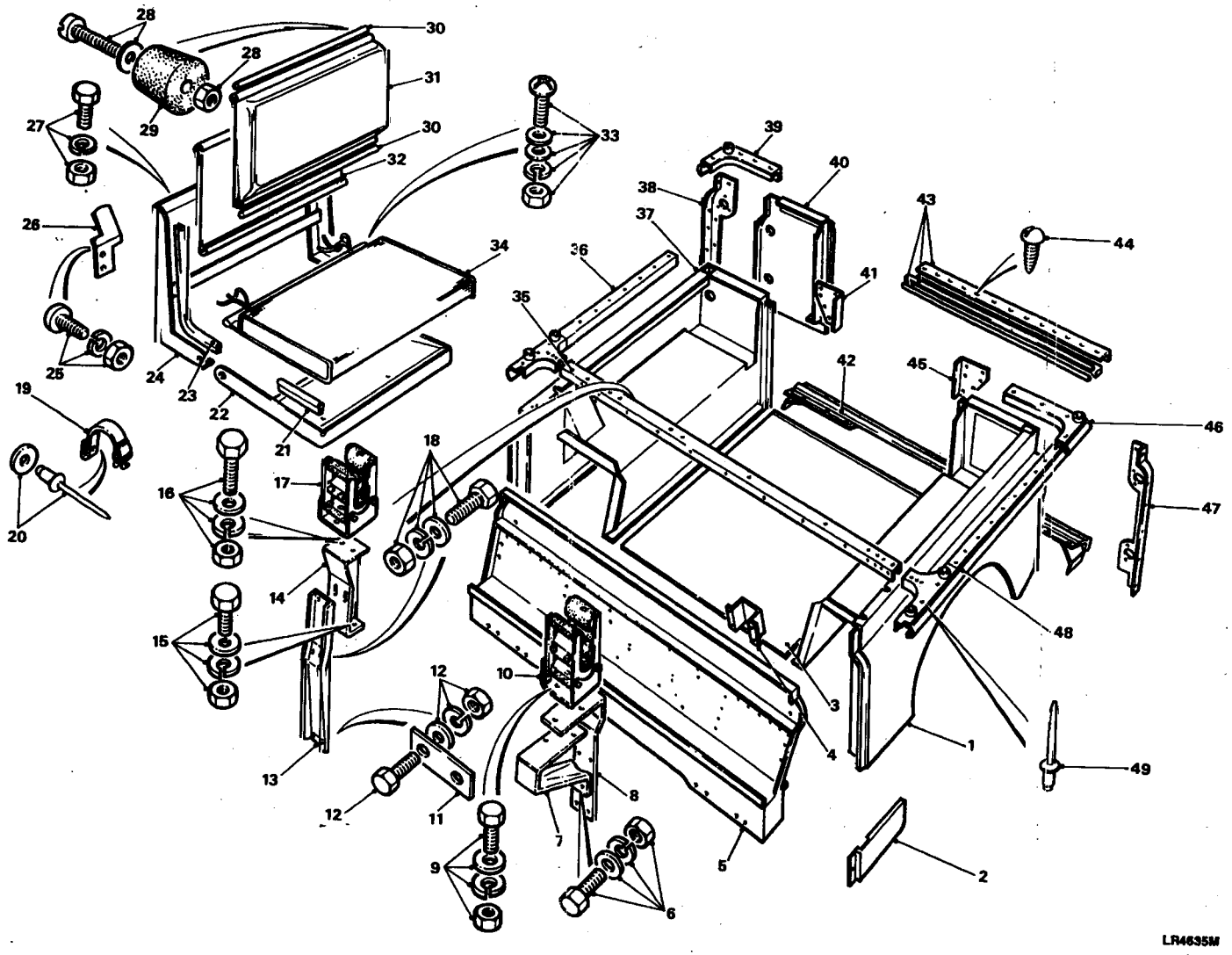


Fig 10 Lower rear body assembly I (90)

1. Plastic rivet - Rear eyebrow to rear wing
2. Rear eyebrow
3. Rear body assembly
4. Crossmember to floor fixings
5. Crossmember assembly
6. Rivet - Mounting pad to crossmember
7. Mounting pad
8. Crossmember
9. Mounting bracket front panel to chassis
10. Fixings - Front panel to Bracket
11. Rivet - nut plate to Front panel
12. Nut plate
13. Grommet
14. Vertical tread plate
15. Rivet - tread plate to Front panel
16. Wheelarch stiffener
17. Stiffener
18. Fixings - Stiffener to body
19. Distance tube
20. Fixing - lashing cleat to body
21. Angle plate
22. Lashing cleat
23. Cover panel, rear lamp
24. Fixings - cover panel to rear body
25. Fixings - cover panel to body floor
26. Fixings - Channel to mudshield
27. Spire nut - Channel to mudshield
28. Mudshield - rear lamp
29. Mudshield channel
30. Rivet - tread plates to rear body
31. Drive screw
32. Fixings - Body to rear chassis
33. Nutplate
34. Rivet - nutplate to rear mounting panel
35. Fixings - Stay to floor
36. Stay bodyside to floor
37. Fixings - stay to wing

Fig 11 Lower rear body assembly II (90)

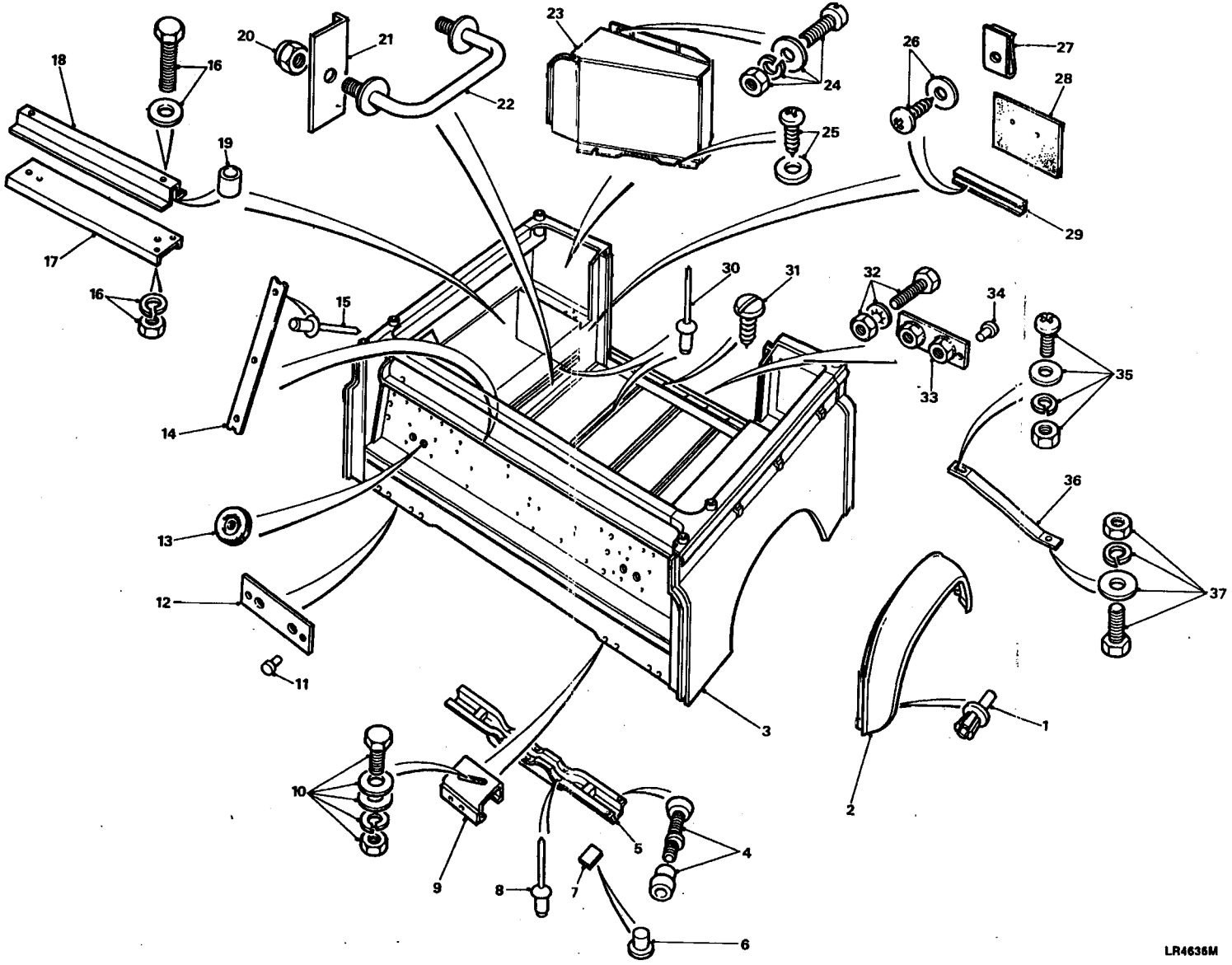


Fig 11 Lower rear body assembly II (90)

1. Support bracket assy
2. Support bracket fixings
3. Securing plate fixings
4. Door panel assy and fixings
5. Door catch
6. Outer support frame fixings
7. Sill panel
8. Outer support frame
9. Outer support frame to rear frame fixings
10. Front support bracket and floor
11. Front support bracket, floor and cross member fixings
12. Front panel assy
13. Squab buffer bracket to reinforcement bracket
14. Squab buffer bracket and reinforcement angle bracket
15. Small arms clip to Mounting bracket fixings
16. Reinforcement plate and fixings
17. Small arms clip
18. Reinforcement bracket
19. Mounting bracket
20. Mounting bracket to top capping fixing
21. Small arms clip to mounting bracket fixings
22. Seat strap and fixings
23. Reinforcement bracket to bulkhead fixings
24. Backrest securing clip and fixings
25. Edging strips
26. Backrest fixings
27. Rubber buffer and fixings
28. Backrest assembly
29. Panel backrest
30. Rear cushion frame assy
31. Pad seat cushion
32. Seat frame to wheelarch fixings
33. Rear seat frame assy
34. Bodyside panel assy
35. Front panel capping and fixings
36. Right hand top capping and fixings
37. Right hand rear corner capping and fixings
38. Right hand rear protection angle and fixings
39. Rear end panel
40. Rear mounting angle
41. Protection strip and seals
42. Protection strip fixings
43. Corner bracket and fixings
44. Left hand corner capping and fixings
45. Left hand protection angle and fixings
46. Left hand top capping and fixings
47. Crossmember
48. Mud shield
49. Mud shield to bodyside fixings.

Fig 12 Lower rear body assembly I (110)

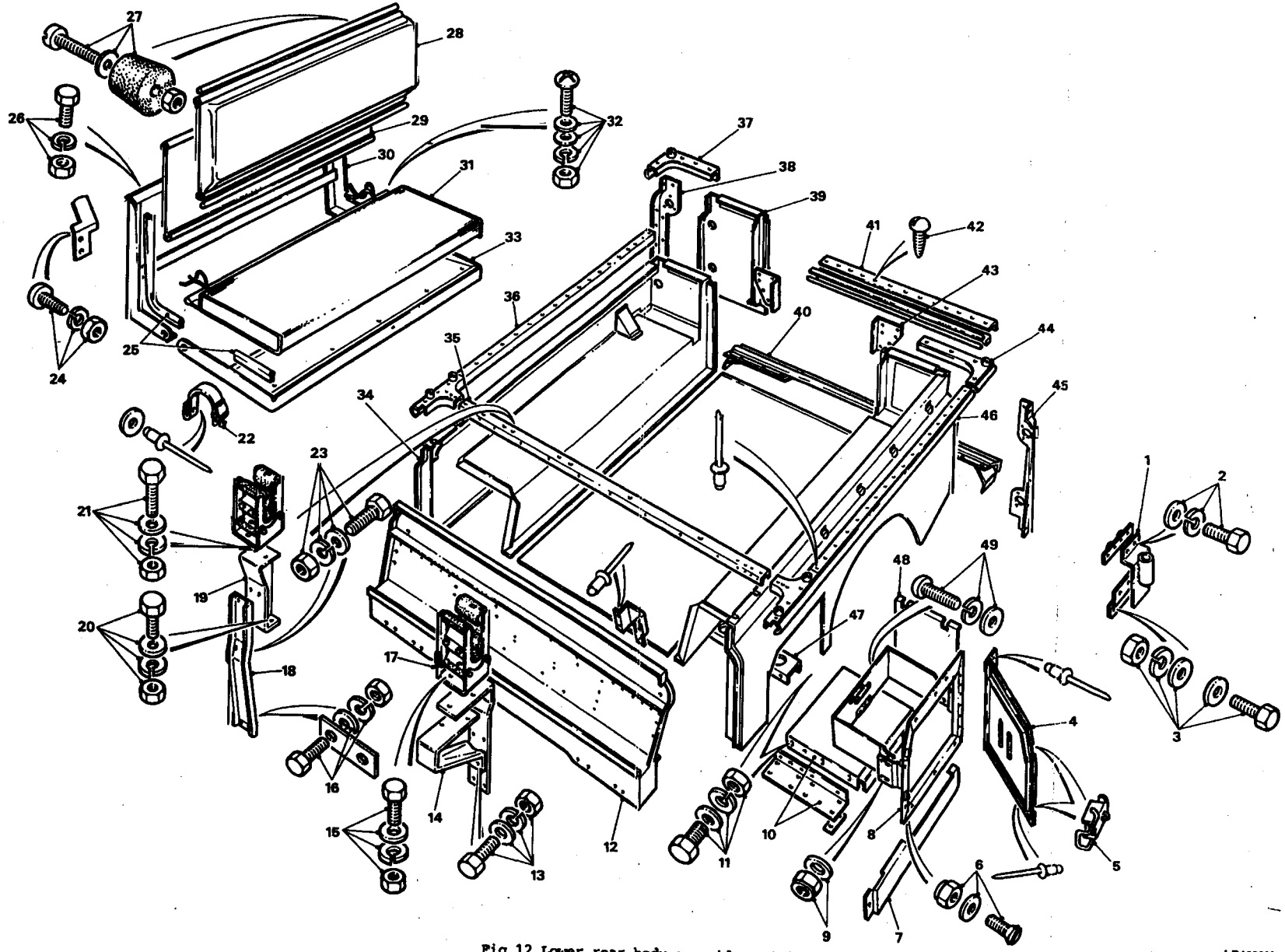


Fig 12 Lower rear body assembly I (110)

LR4633M

1. Wheelarch stiffener
2. Rivet - stiffener to body
3. Pin and collar, crossmember to body fixings
4. Mounting pad and fixings
5. Crossmember assembly
6. Rivet - Crossmember to floor
7. Front panel mounting bracket to chassis
8. Front panel to bracket fixings
9. Rivet - Nutplate to front panel
10. Nutplate
11. Grommet
12. Stowage box
13. Rivet - Stowage box to rear body
14. Front panel vertical treadplate
15. Rivet - front panel vertical treadplate
16. Stiffener to rear body fixings
17. Wing mounted radio seat stiffener
18. Wheelarch box stiffener
19. Stiffener to rear body fixings
20. Distance tube
21. Cargo lashing cleat
22. Angle plate
23. Lashing cleat to body side fixing
24. Channel to mudshield fixing
25. Mudshield
26. Channel
27. Treadplates
28. Treadplates to rear body fixings
29. Protection strip
30. Protection strip to rear body fixing
31. Rear body to chassis fixing
32. Cover panel
33. Cover panel to body fixings
34. Cover panel to body fixings
35. Rivet - Nutplate to rear body
36. Stay to bodyside floor fixing
37. Bodyside stay
38. Bodyside stay to wing fixings
39. Eyebrow
40. Rivet - Eyebrow to body
41. Rear body assembly

Fig 13 Lower rear body assembly II (110)

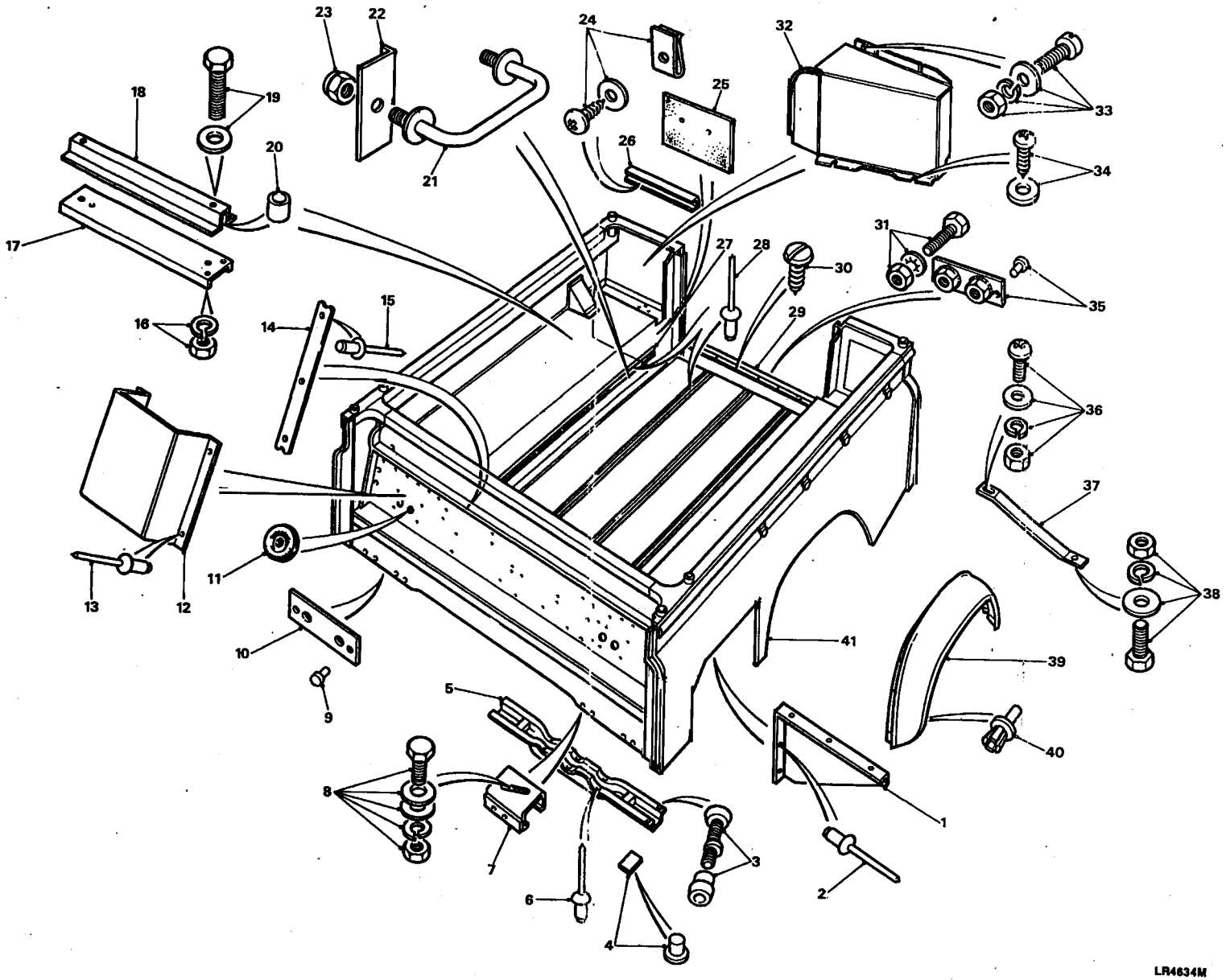


Fig 13 Lower rear body assembly II (110)

1. Right hand tailgate hinge fixings
2. Right hand tailgate hinge
3. Right hand tailgate to hinge fixing
4. Shovel and strap assembly
5. Tailgate
6. Pick helve strap assembly
7. Pad
8. Pick head support assembly
9. Pick head support assembly
10. Shovel strap assembly
11. Pick helve strap assembly
12. Left hand tailgate hinge
13. Shovel support and bracket
14. Locking plate
15. Left hand locking plate/bracket fixings
16. Left hand bracket
17. Tailgate cable
18. Tailgate cable bracket
19. Tailgate cable bracket fixings
20. Tailgate cable fixings
21. Pick head support fixings
22. Right hand locking plate/bracket fixings
23. Right hand locking plate
24. Right hand bracket
25. Tailgate buffer fixings
26. Tailgate buffer
27. Right hand seal
28. Pick helve stop bracket

Fig 14 Tailgate assembly (Soft top only)

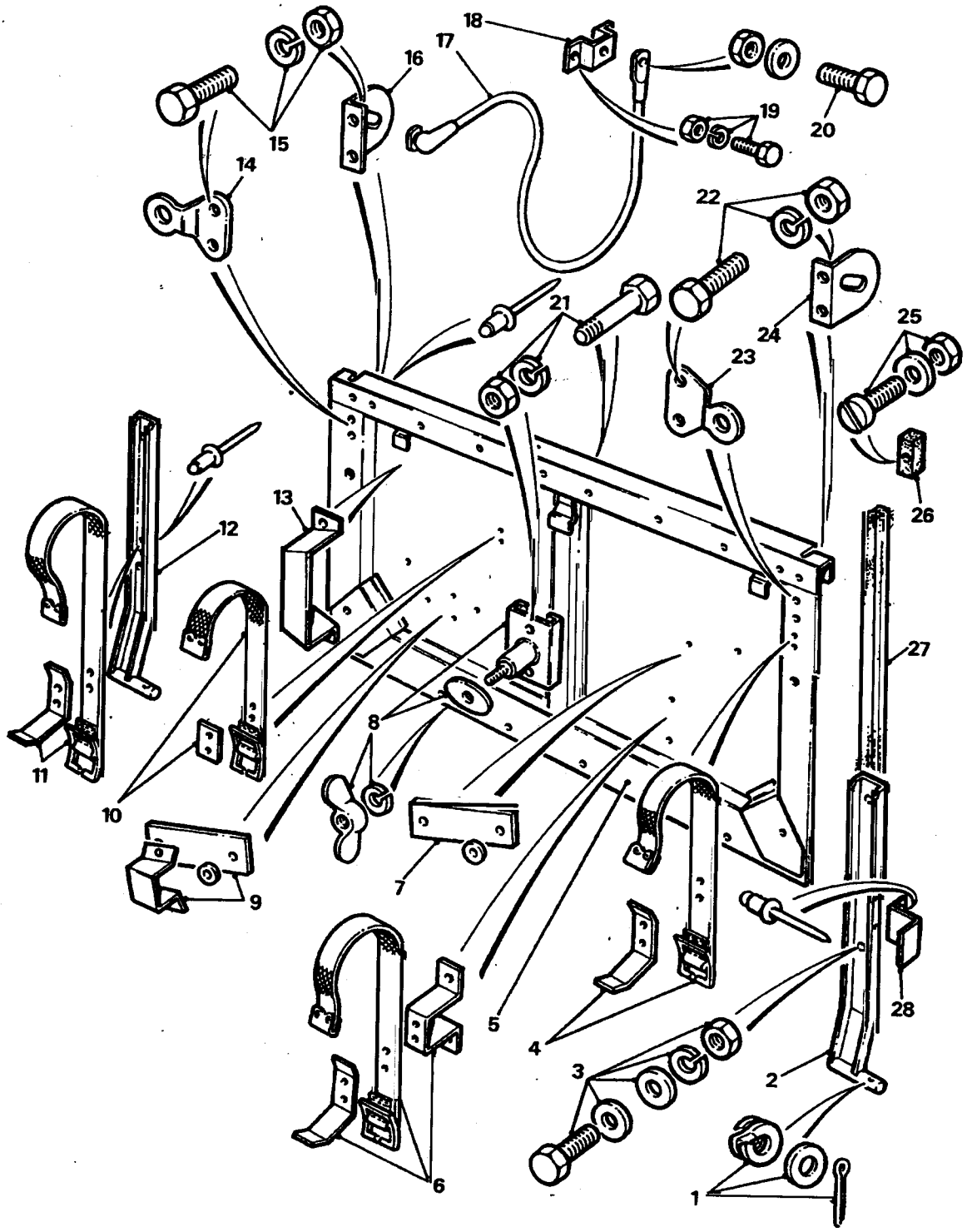


Fig 14 Tailgate assembly (Soft top only)

1. Bracket to bodyside fixings
2. Nutplate
3. Hoodsticks to body fixings
4. Rollover bar
5. Front hoodstick
6. Bracket to body fixing
7. Support bracket
8. Bracket to body fixings
9. Rivet - Rope hook to body
10. Rope hook
11. Side drain channel
12. Top drain channel
13. Fixings
14. Handle
15. Spring pin
16. Spindle
17. Spring
18. Spindle fixings
19. Header rail seal
20. Header rail
21. Top drain channel fixings
22. Sail and ring eyelets
23. Hood assembly
24. Buckle
25. Eyelet
26. End cap
27. Side drain channel
28. Front hook fixings
29. Front hook
30. Front tie tube
31. Intermediate hoodsticks
32. Tie tube - Rear and top
33. Rear hoodsticks
34. Washer plate - Hood sticks
35. Rope hook
36. Rivet - Washer plate to rope hook
37. Hoodsticks fixings
38. Rope hook
39. Rivet - Hook to body
40. Hoodsticks fixings
41. Arm clamp
42. Front and rear hoodsticks to body fixings
43. Intermediate hoodsticks to body fixings
44. Nut plate
45. Rear stay fixings
46. Rear stay
47. Stay bracket
48. Rollover bar to body fixings

Fig 15 Soft top assembly (110)

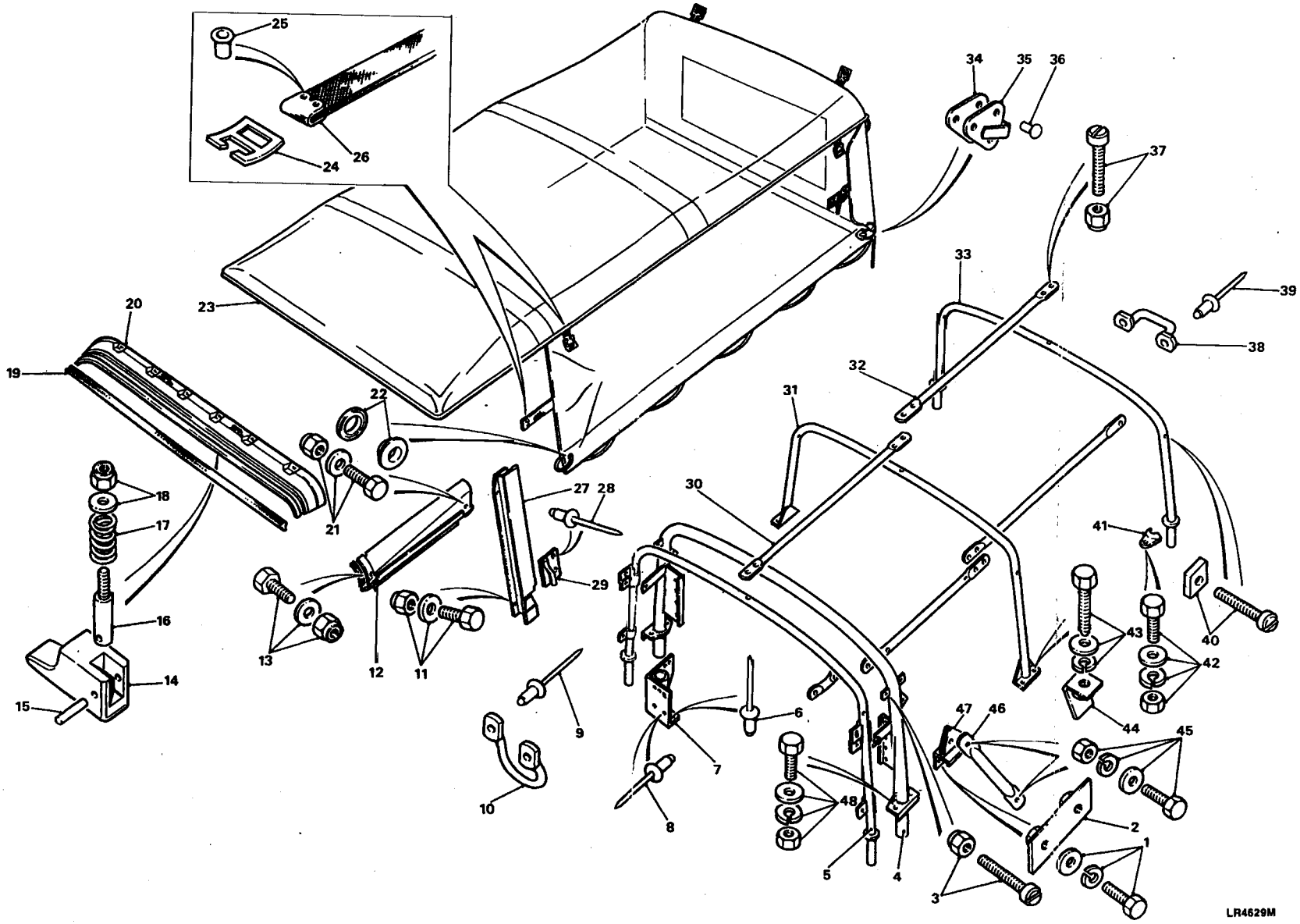


Fig 15 Soft top assembly (110)

1. Mounting upper body to lower bodyside fixings
2. Support bracket bodyside
3. Support bracket to bodyside lower fixings
4. Support bracket to bodyside lower fixings
5. Nutplate
6. Mounting upper body to lower bodyside fixings
7. Front Pillar mounting angle
8. Mounting angle to bodyside fixing
9. Rivet - Bracket to bodyside
10. Upper door pillar seal
11. Retainer to pillar fixings
12. Lower bodyside seal
13. Front pillow stud plate
14. Rivet - Bodyside panel to stiffeners
15. Bodyside panel assembly
16. Bracket stiffener
17. Rivet - Stiffening brackets to bodyside
18. Rivet - Bodyside panel to stiffening plate
19. Bodyside panel stiffener
20. Fixings - Nutplate to bodyside
21. Stiffening plate
22. Upper door pillar seal
23. Seat belt bracket
24. Fixings - Roof cantrail to windscreen
25. Upper bodyside seal
26. Seat belt bracket to bodyside fixings
27. Stiffening plate to bodyside fixings
28. Roof to windscreen outer seal
29. Roof to windscreen inner seal
30. Roof header to windscreen fixings
31. Roof Assembly
32. Pickaxe handle support bracket
33. Bracket/strap assembly to roof assembly fixings
34. Pickaxe handle support bracket
35. Strap and handle support
36. Upper body to lower body fixings
37. Seal retainer
38. Retainer to roof fixings
39. Roof to upper body fixings
40. Rear end door seal
41. Filler strip
42. Glazing strip
43. Rear end window glass
44. Support bracket
45. Lower body to bracket fixings
46. Bodyside to bracket fixings

Fig 16 Upper Body Hard Top (90)

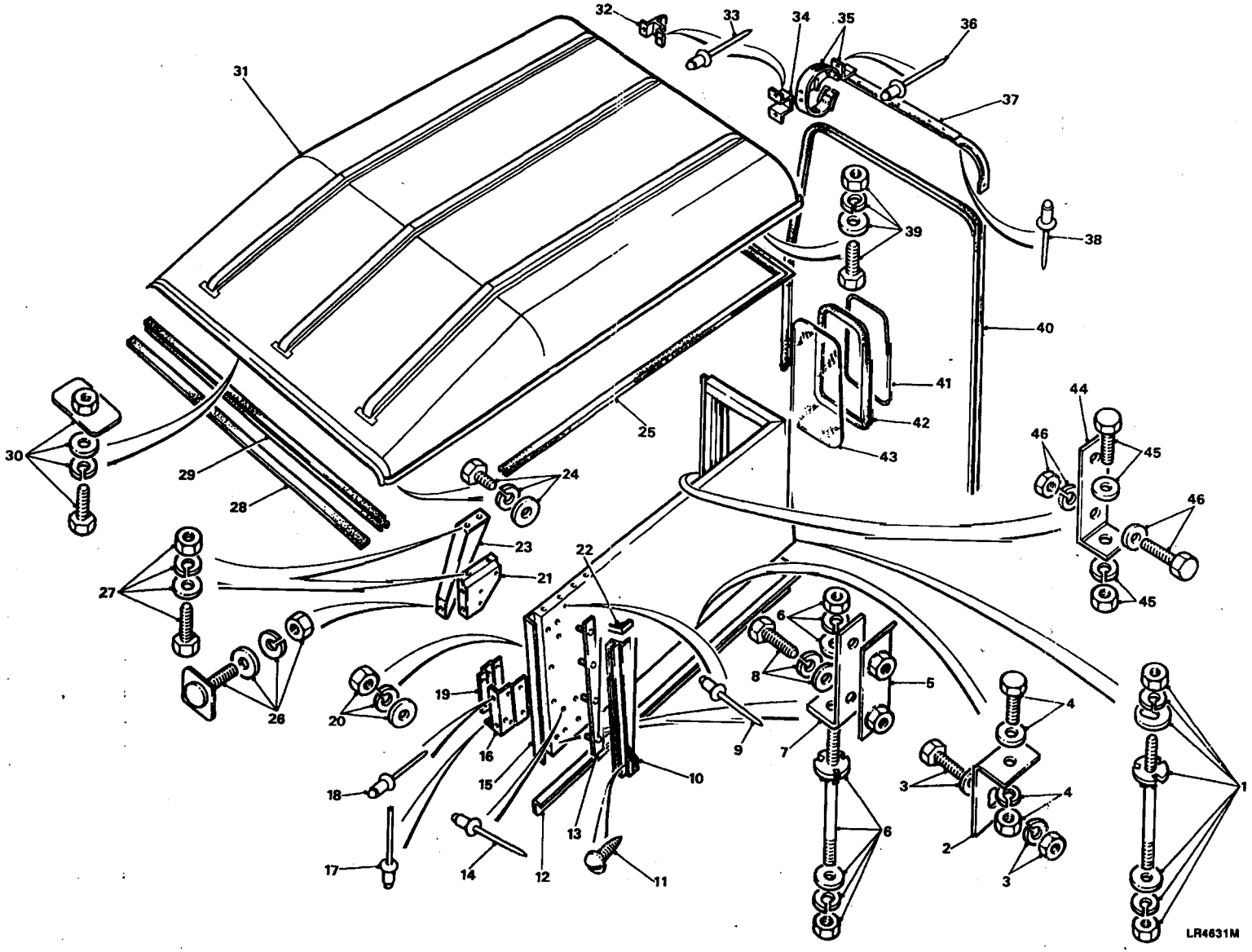


Fig 16 Upper body hard top (90)

1. Glazing
2. Rivet
3. Glazing strip
4. Filler strip
5. Upper door pillar seal
6. Seal retainer and finisher
7. Retainer to pillar fixing
8. Front pillar stud plate
9. Bodyside lower seal
10. Rivet - Bodyside panel to stiffener fixings
11. Bracket stiffener
12. Rivet - Stiffening bracket to bodyside
13. Rivet - Bodyside panel to stiffening plate
14. Stud plate to bodyside fixings
15. Bodyside panel stiffener
16. Stiffening plate
17. Roof contrain to windscreen fixings
18. Seat belt bracket
19. Seat belt to body fixings
20. Roof to upper body fixings
21. Roof to windscreen inner seal
22. Roof to windscreen outer seal
23. Roof assembley
24. Bodyside upper seal
25. Upper bodyside panel

Fig 17 Upper body hard top with fixed windows (90)

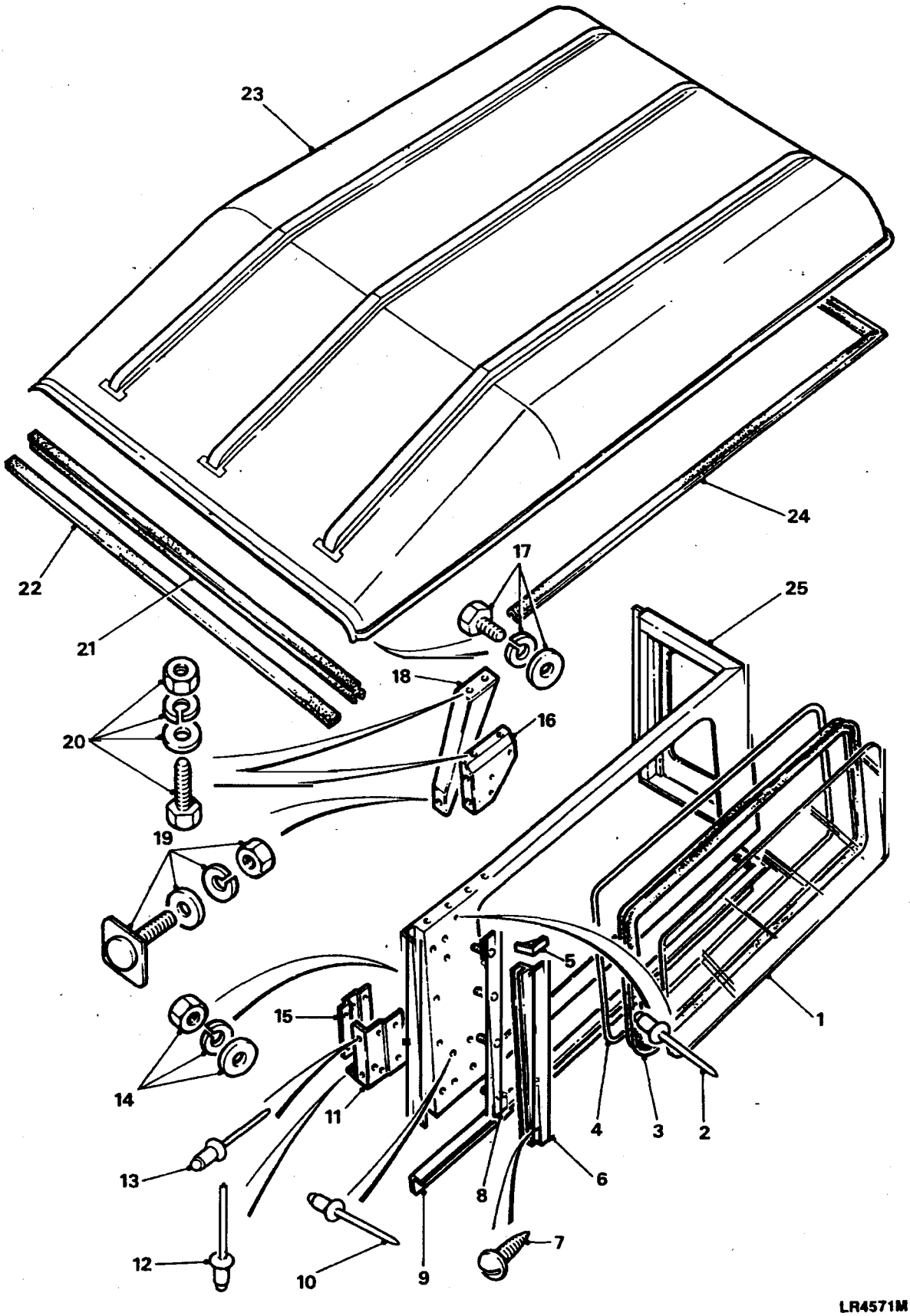


Fig 17 Upper body hard top with fixed windows (90)

1. Mounting upper body to lower bodyside fixings
2. Support bracket bodyside
3. Support bracket to bodyside lower fixings
4. Support bracket to bodyside lower fixings
5. Nutplate
6. Mounting upper body to lower bodyside fixings
7. Front Pillar mounting angle
8. Mounting angle to bodyside fixing
9. Rivet - Bracket to bodyside
10. Upper door pillar seal
11. Retainer to pillar fixings
12. Lower bodyside seal
13. Front pillow stud plate
14. Rivet - Bodyside panel to stiffeners
15. Bodyside panel assembly
16. Bracket stiffener
17. Rivet - Stiffening brackets to bodyside
18. Rivet - Bodyside panel to stiffening plate
19. Bodyside panel stiffener
20. Nutplate to bodyside fixings
21. Stiffening plate
22. Upper door pillar seal
23. Grommet
24. Grommet cover
25. Grommet cover to bodyside fixings
26. Roof cantrail to windscreen fixings
27. Seat belt bracket
28. Seat belt bracket to bodyside fixings
29. Stiffening plate to bodyside fixings
30. Roof to windscreen outer seal
31. Roof to windscreen inner seal
32. Roof header to windscreen fixings
33. Roof Assembly
34. Pickaxe helve support bracket
35. Rivet - Bracket/strap assembly to roof assembly
36. Pickaxe handle support bracket
37. Strap and handle support
38. Rivet - Upper body to lower body
39. Seal retainer
40. Retainer to roof fixings
41. Rivet - Roof to upper body
42. Filler strip
43. Glazing strip
44. Rear end window glass
45. Rear end door seal
46. Support bracket
47. Lower body to bracket fixings
48. Bodyside to bracket fixings

Fig 18 Upper Body Hard Top (110)

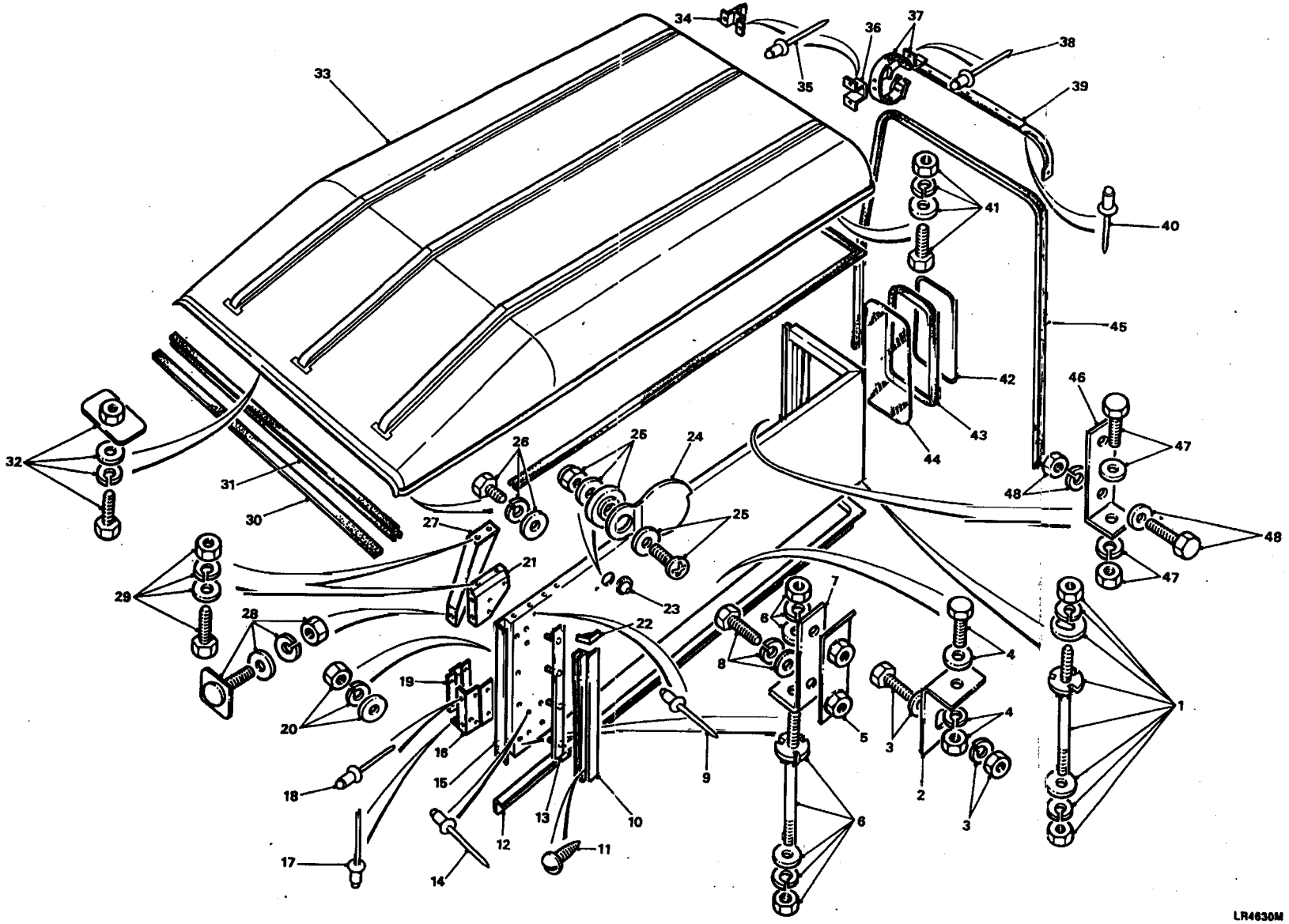


Fig 18 Upper body hard top (110)

1. Spacer to pillar fixings
2. Shim
3. Spacer
4. Female dovetail
5. Dovetail to spacer fixings
6. Male dovetail
7. Dovetail to spacer fixings
8. Buffers
9. Checkstrap
10. Release lever
11. Retaining bracket
12. Bracket to mounting bracket fixings
13. Spring
14. Retaining bracket
15. Clevis pin, washer and split pin
16. Mounting bracket
17. Mounting bracket to body fixings
18. Rear door trim
19. Rear door trim to door fixings
20. Grab handle
21. Grab handle to door fixings
22. Rear door assembly
23. Middle and lower hinge
24. Lower hinge to door fixings
25. Middle and lower hinge to body fixings
26. Bottom retainer
27. Middle and lower hinge to body nutplate
28. Outer hinge to inner hinge fixings
29. Upper hinge
30. Upper hinge to door fixing
31. Upper hinge to body fixing
32. Side retainer
33. Window
34. Top retainer
35. Corner retainer
36. Retainers to door fixings
37. Side retainer
38. Support bracket
39. Tool angle support
40. Shovel support bracket
41. Shovel support strap
42. Rivet
43. Shovel support bracket
44. Shovel support strap
45. Shovel support bracket
46. Pad
47. Rivet - Pad to door
48. Rivet - Pad and support centr to door
49. Pad
50. Pickaxe support centre
51. Retaining plate
52. Wing nut
53. Pickaxe support pad and bracket
54. Nut retainer
55. Lock assembly
56. Lock to door fixings
57. Lock to door fixings
58. Screw retainer
59. Striker to pillar fixings
60. Shroud
61. Striker

Fig 19 Rear door assembly (Hard top only)

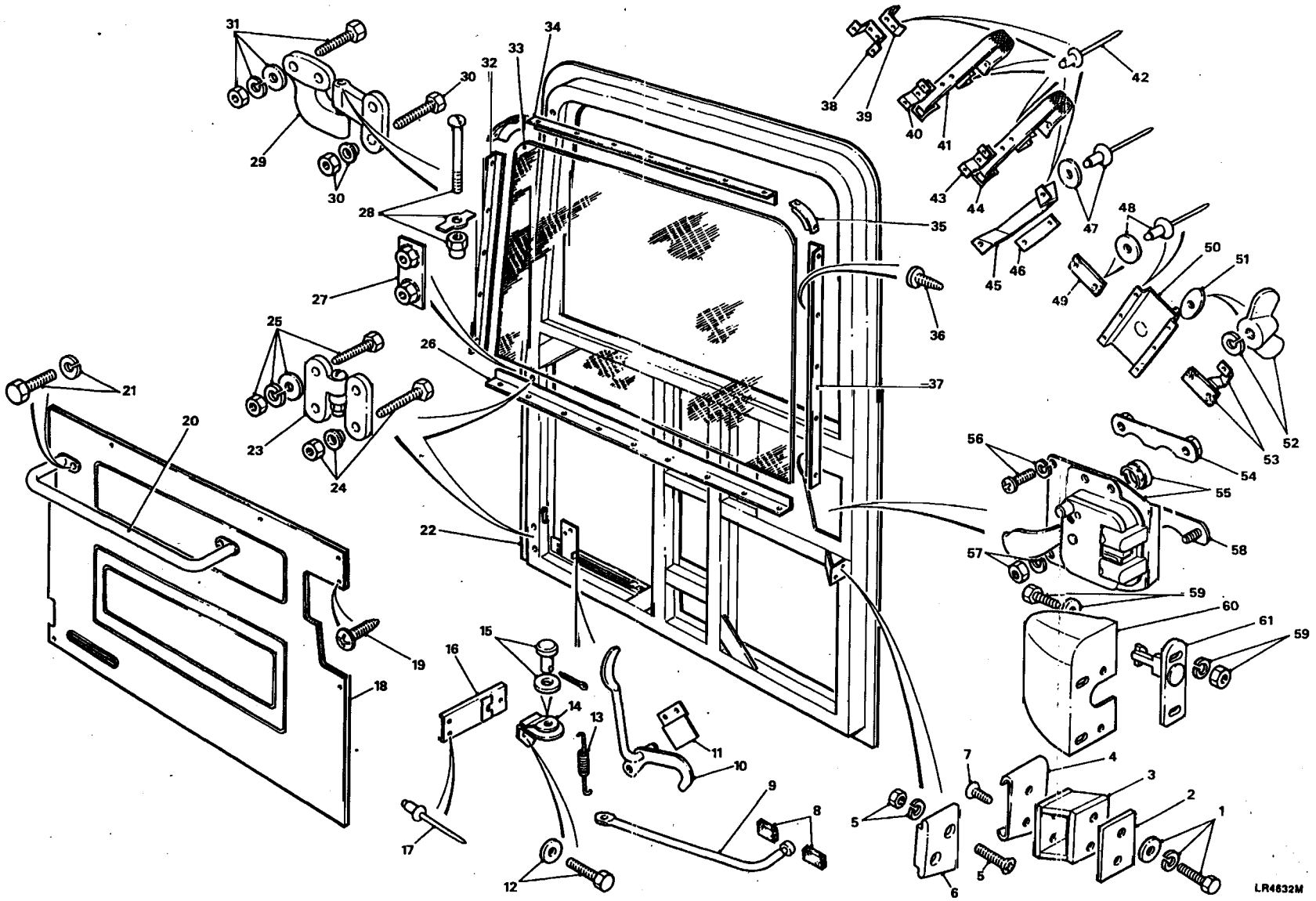


Fig 19 Rear door assembly (Hard top only)

1. Battery box door
2. Radio battery
3. Battery tray
4. Battery box door catch
5. Battery box assembly
6. Battery box to floor - front fixings
7. Nutplate
8. LH reinforcement panel battery box to radio table - front
9. Cable Assembly - Terminal box to batteries and table
10. Nutplate
11. Battery box to floor - rear fixings
12. LH reinforcement panel battery box to radio table - rear
13. Closing panel top - rear
14. Grommet
15. Radio table frame
16. Radio support upper and lower fixings
17. Radio rack support - LH
18. Earth braid
19. Fixing angle fixings
20. Equipment racking
21. Equipment racking channel
22. Channel to equipment rack fixings
23. Edge protection
24. Radio rack support - RH
25. Earth braid
26. Fixings - Earth braid
27. Location cleat
28. Location cleat to bodyside fixings
29. RH reinforcement panel battery box to radio table - rear
30. Closing panel top rear fixings
31. Wing nut - J Bolt
32. RH reinforcement panel, battery box to radio table - front
33. "J" Bolt
34. Wing stud
35. Backrest
36. Cushion
37. Seat frame
38. Retaining strap
39. Retaining strap to body fixings
40. Bollard for retaining strap fixings

Fig 20 Radio Equipment (FFR only)

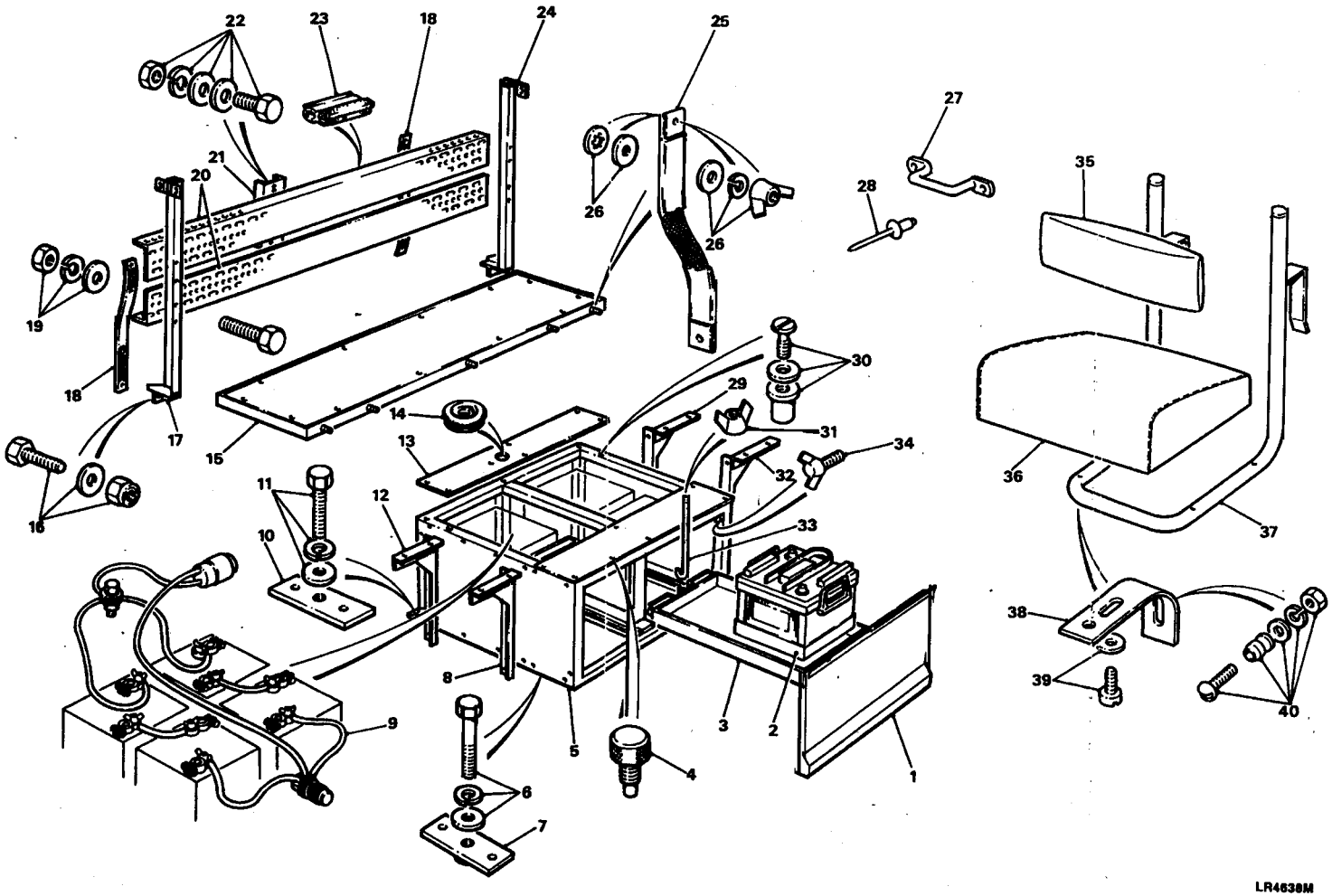


Fig 20 Radio equipment (FFR only)

Seals and sealants

27 When the Land Rover is manufactured, the vehicle requires various types of seals or sealants to prevent ingress of water, sand and debris into the compartments. The following set of illustrations are an attempt to show all the seals and sealants that should be replaced when rebuilding part of, or the whole of, the vehicle. It is necessary that these instructions be followed to achieve the most effective results using the seals or sealants.

TABLE 1 - MATERIALS

Ser	NSN/part No	Description	Remarks
(1)	(2)	(3)	(4)
1	Sikaflex 221	Seam sealant	Sika Ltd. Welwyn Garden City Herts. AL7 1BQ
2	Autamastic SR51	Rubber to glass	
3	Bostik 5925	Prestik (putty)	Bostik Ltd. Leicester England
4	Bostik 1261 MOD	Underseal	
5	RA608177	1/8 x 0.29 in long	Zinc plated mild steel rivet
6	RA610123	5/32 x 0.266 in long	Aluminium alloy rivet
7	RA610183	5/32 x 0.335 in long	Aluminium alloy rivet
8	RA612183	3/16 x 0.29 in long	Aluminium alloy rivet
9	RA612236	3/16 x 0.39 in long	Zinc plated Nickel copper alloy
10	RA612347	3/16 x 0.50 in long	Zinc plated midl steel rivet
11	RR612063	3/16 x 3/8 in long	Aluminium alloy snaphead
12	RU608123	1/8 x 0.295 in long	Aluminium alloy blind rivet
13	RU608253	1/8 x 0.42 in long	Aluminium alloy blind rivet
14	RU608313	1/8 x 0.482 in long	Aluminium alloy blind rivet
15	RU610313	5/32 x 0.497 in long	Aluminium alloy blind rivet
16	RU612373	3/16 x 0.575 in long	Aluminium alloy blind rivet

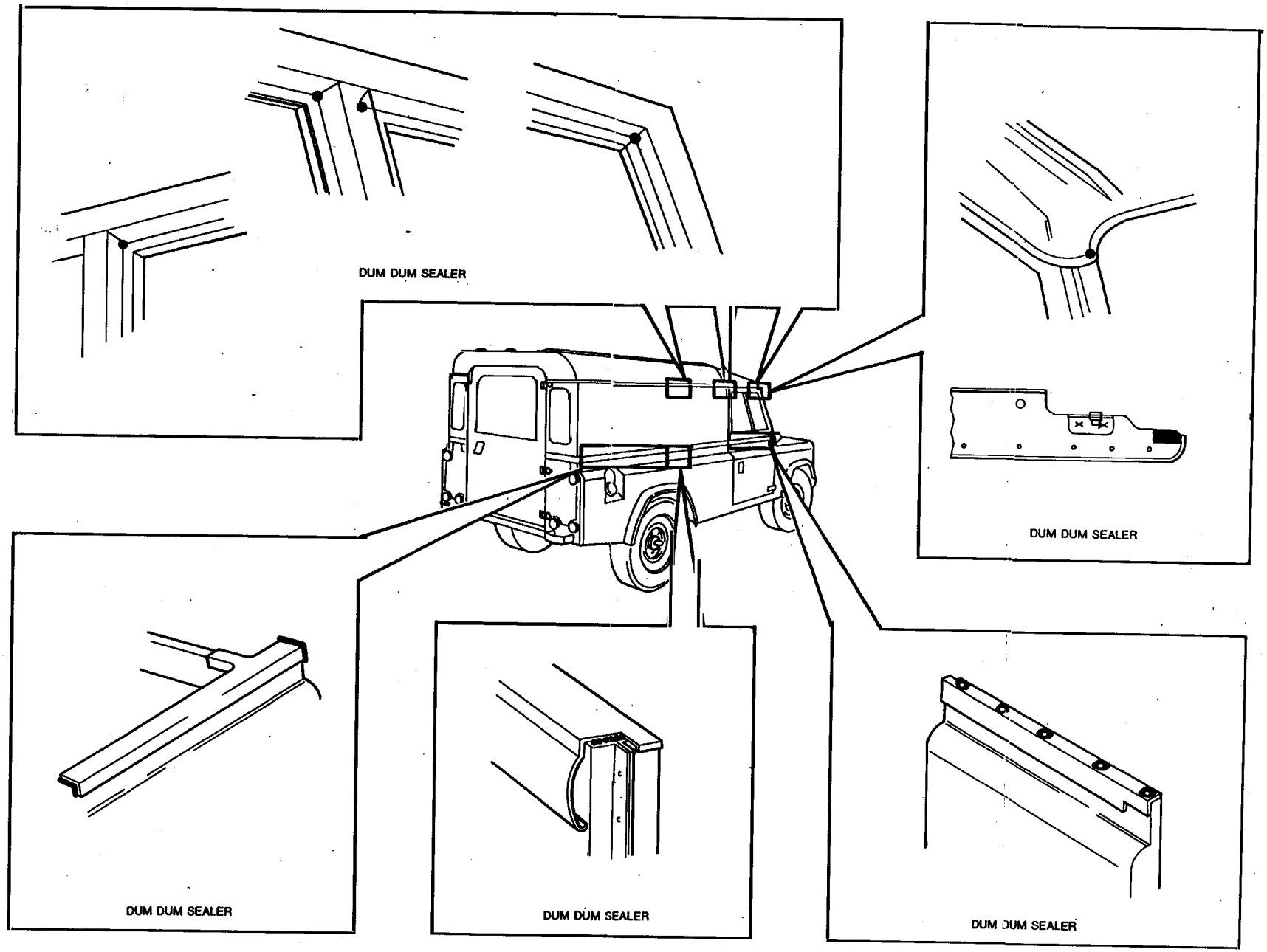


Fig 21 General arrangements of sealants I

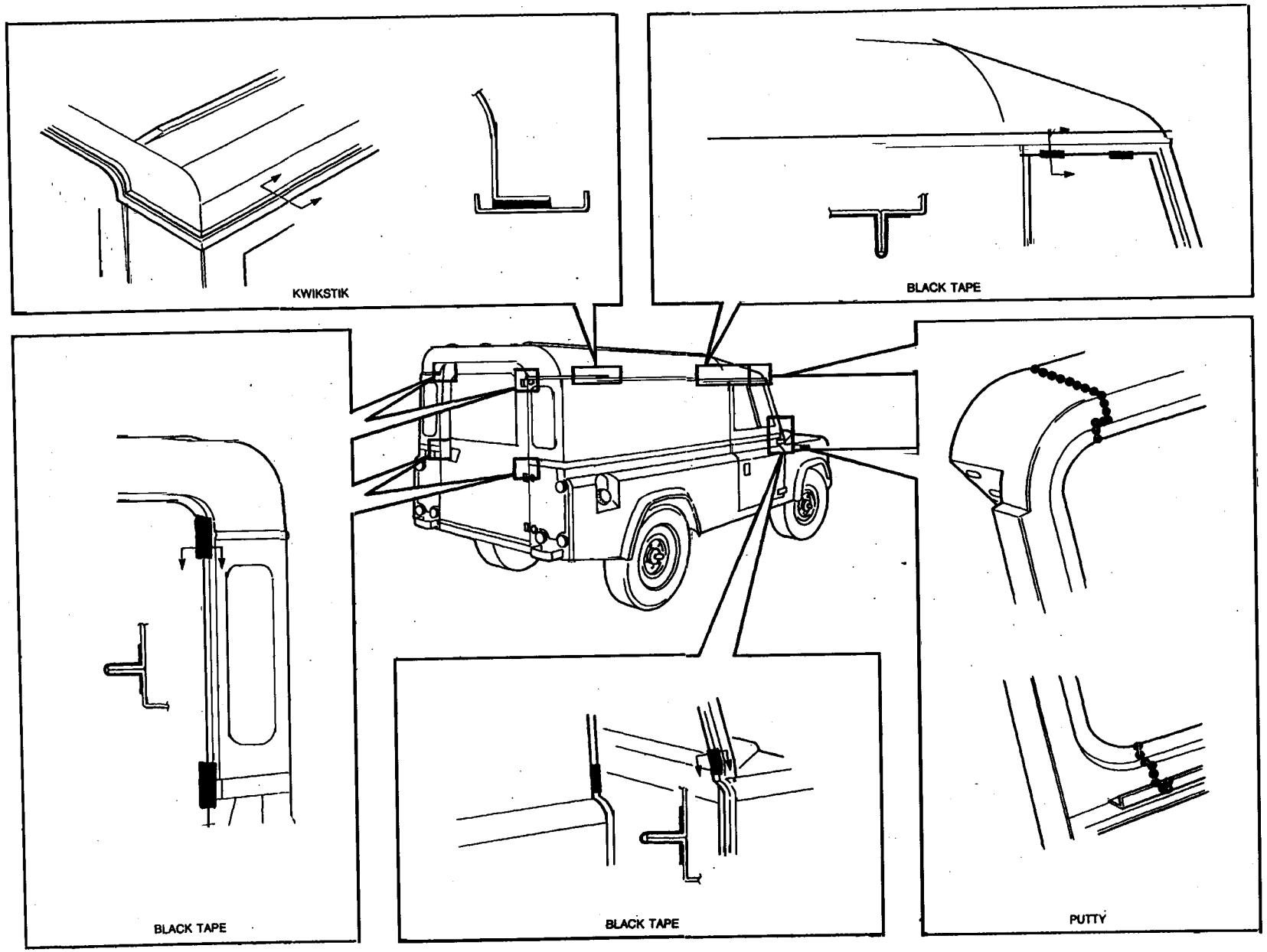


Fig 22 General arrangements of sealants II

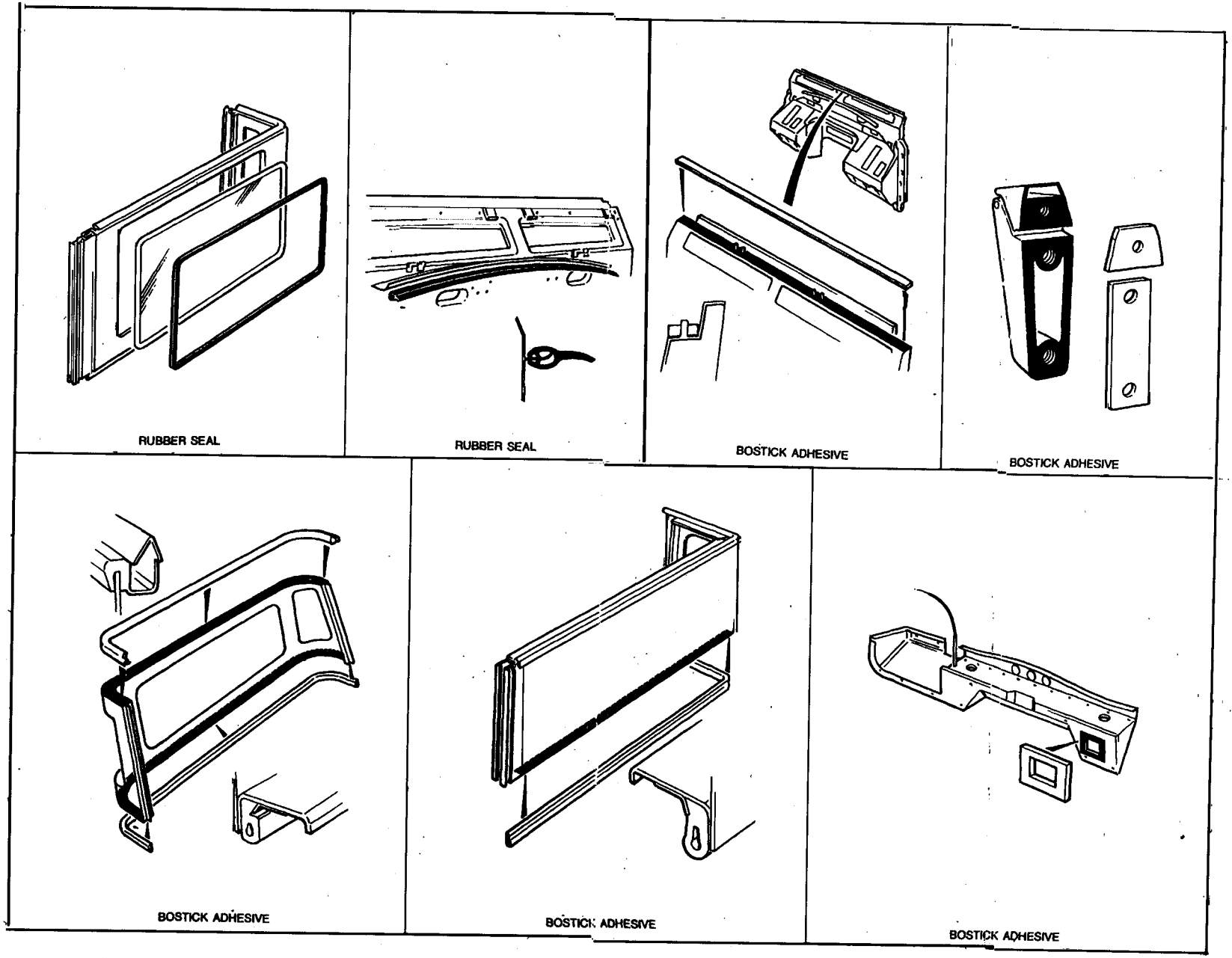


Fig 23 General arrangements of sealants III

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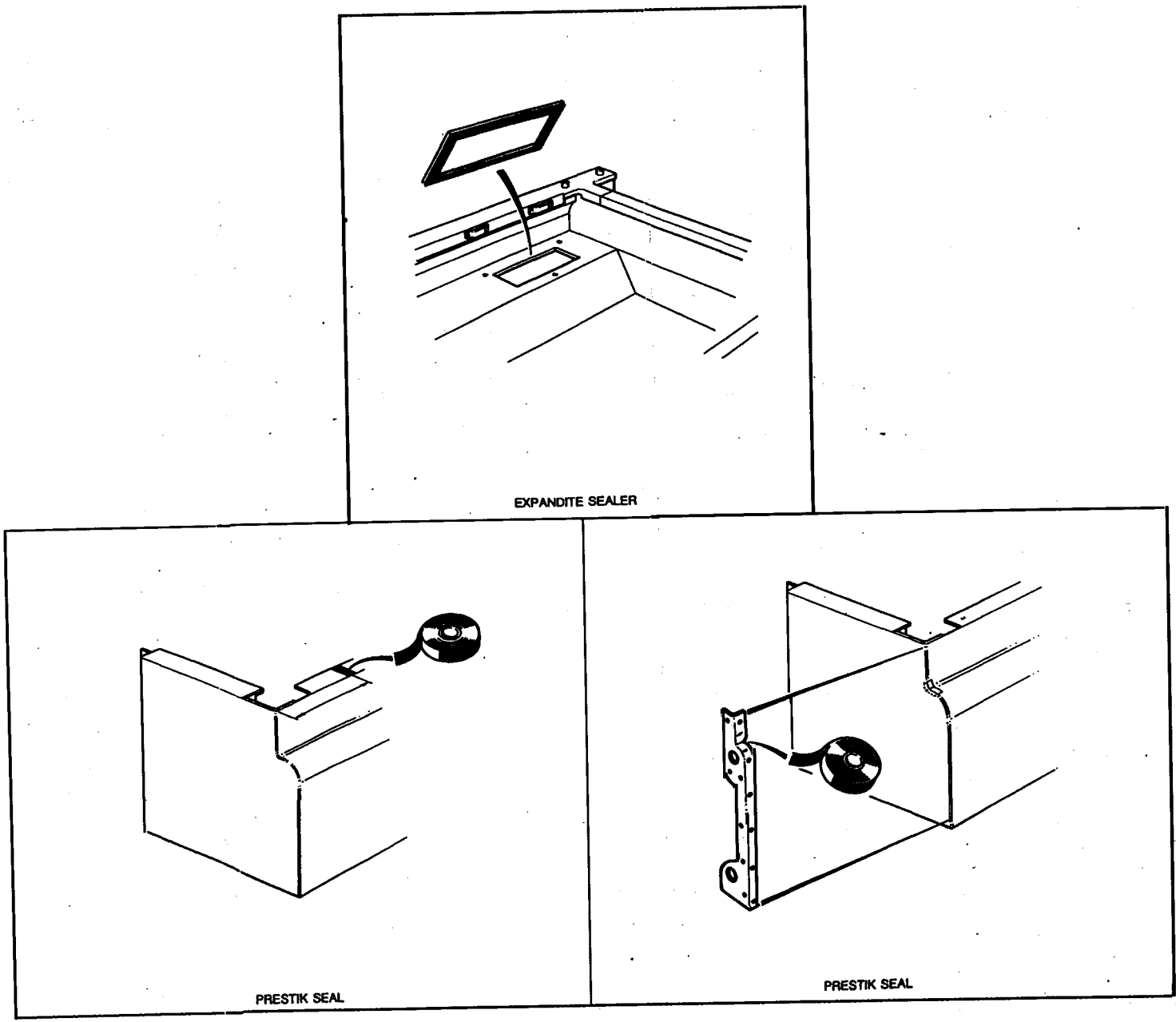


Fig 24 General arrangements of sealants IV

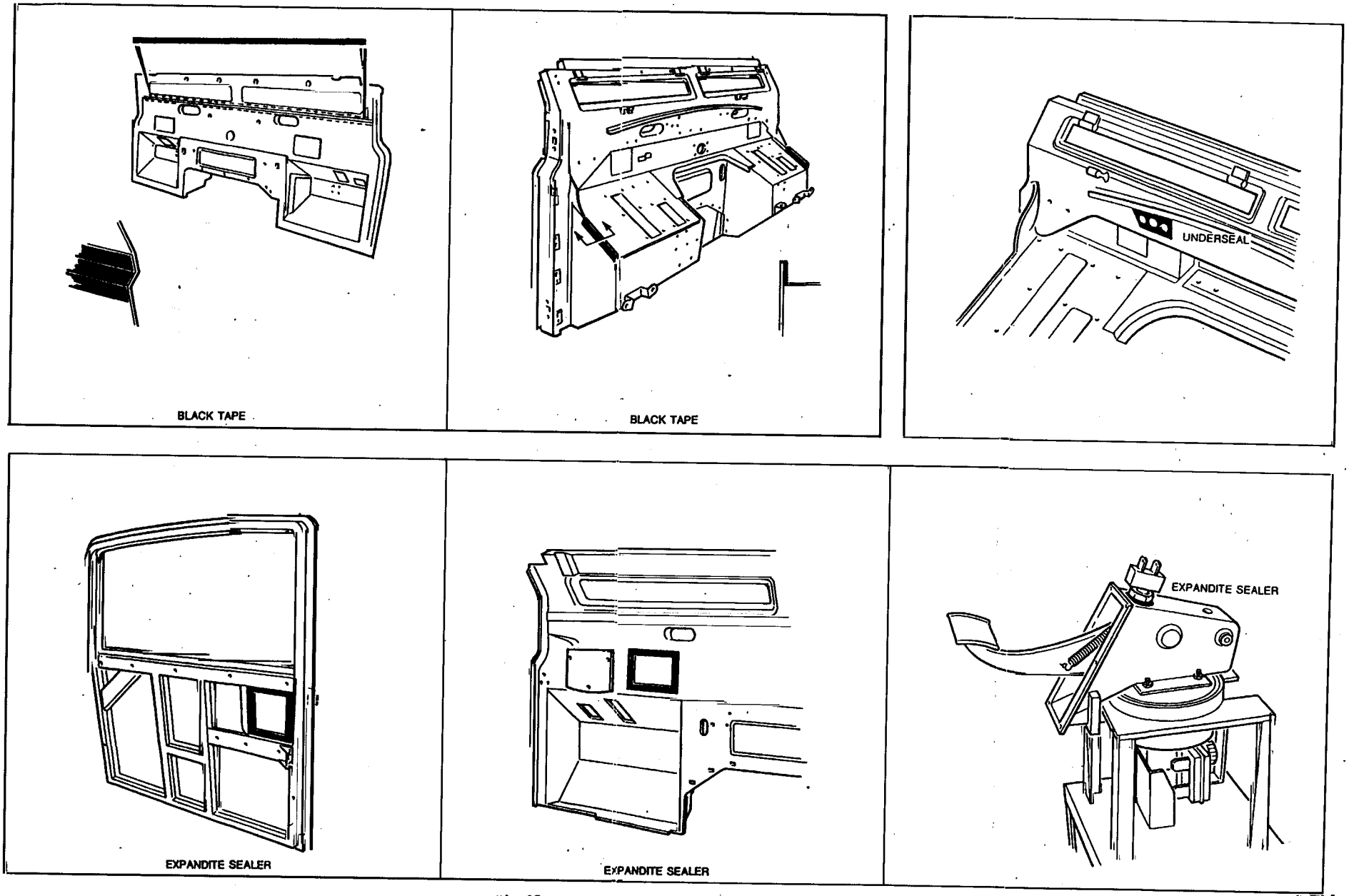


Fig 25 General arrangements of sealants V

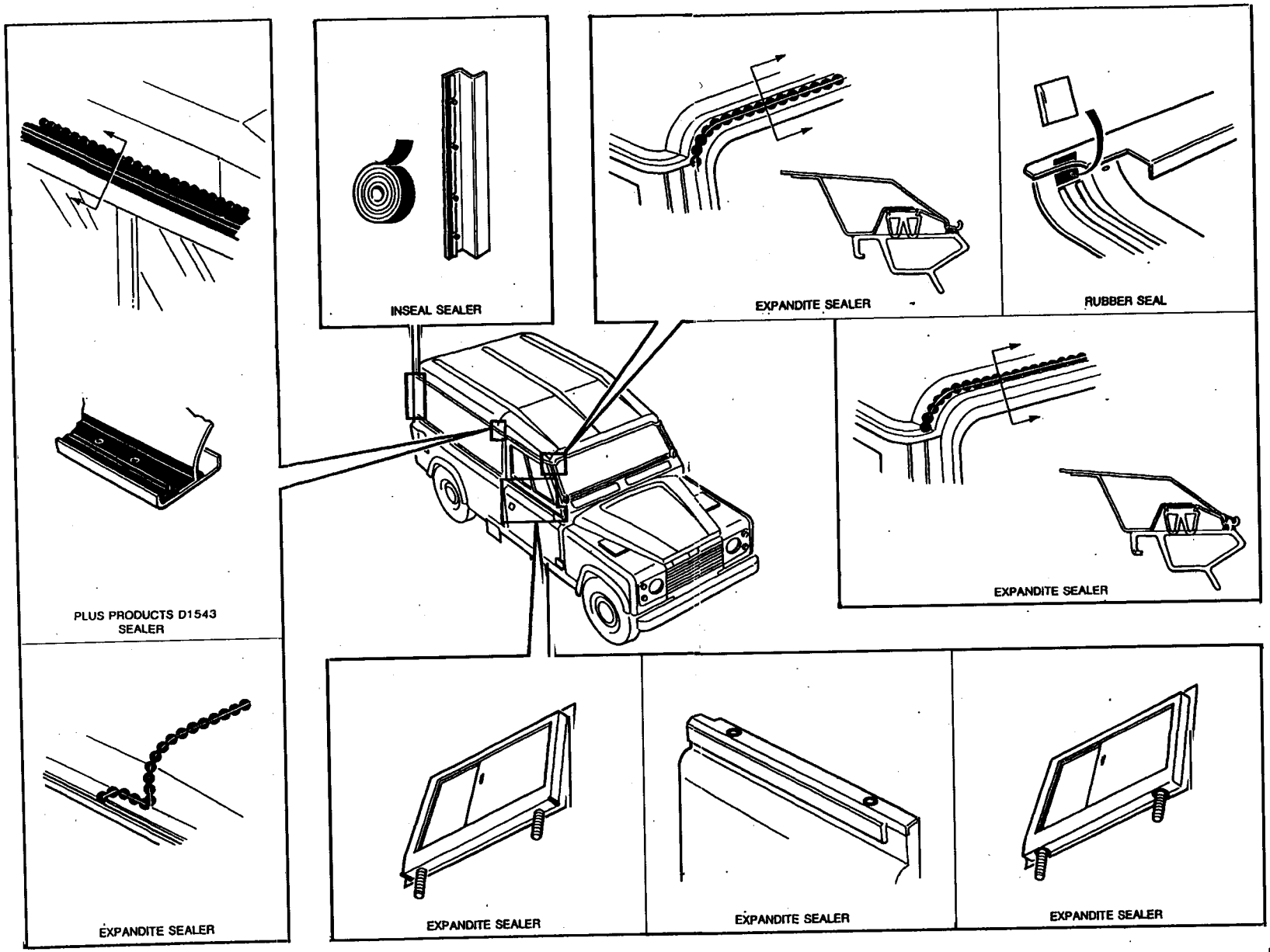


Fig 26 General arrangements of sealants VI

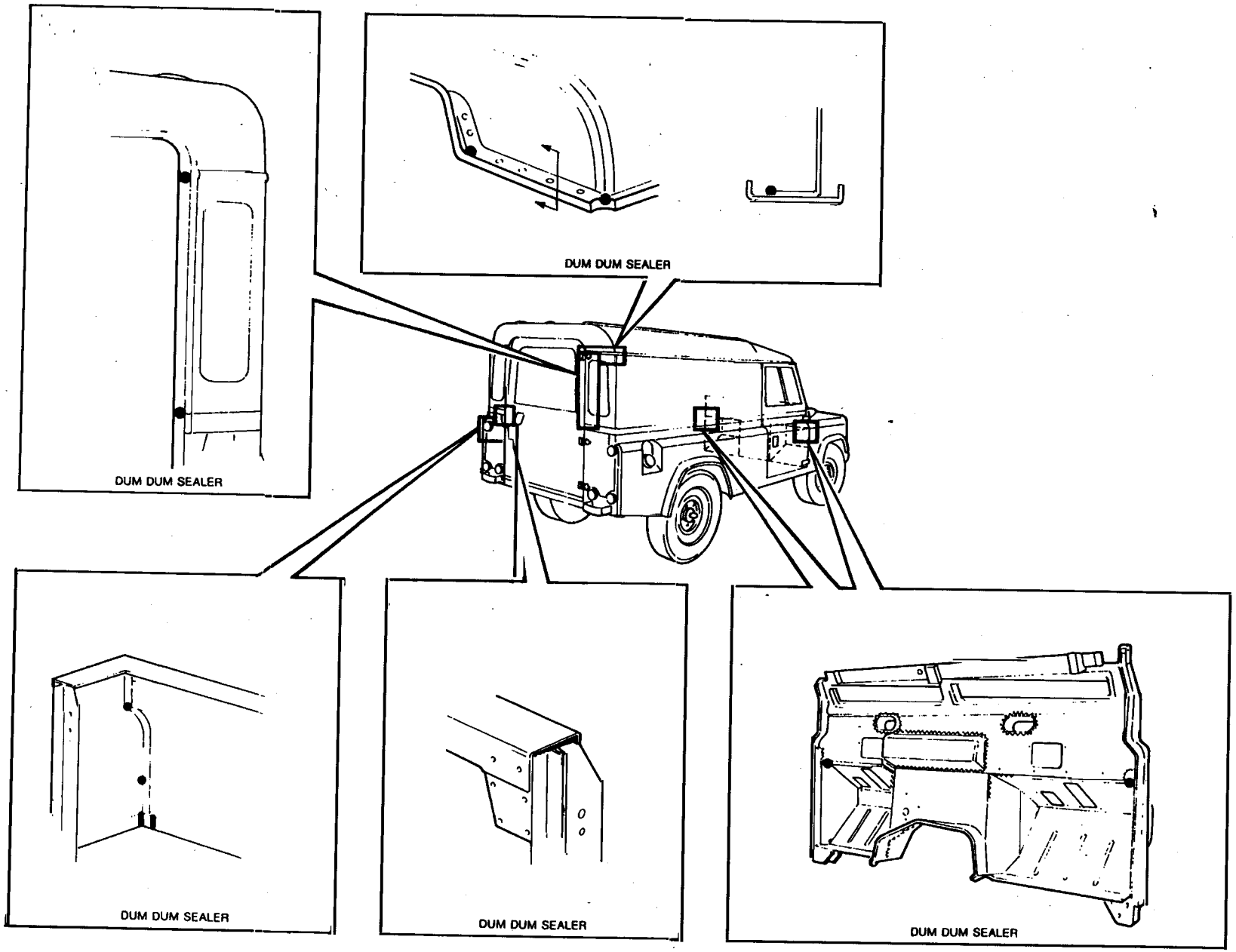
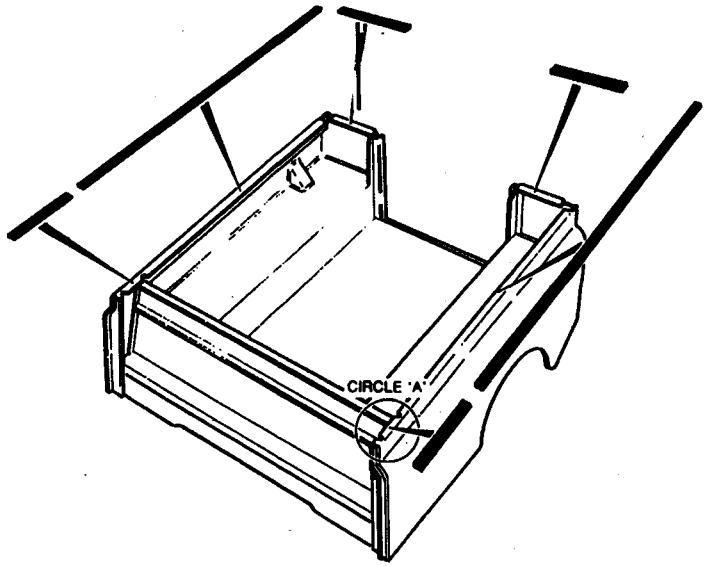


Fig 28 General arrangements of sealants VIII



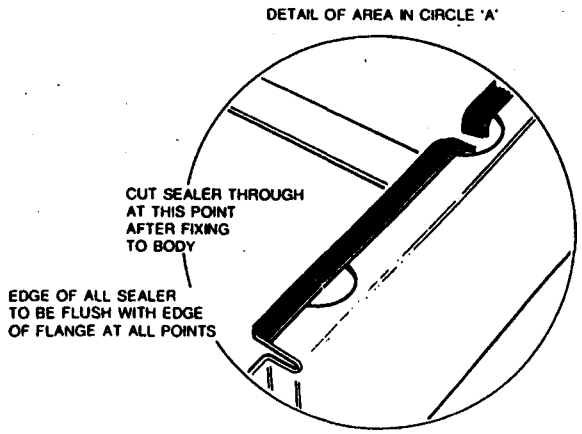


Fig 27 General arrangements of sealants VII

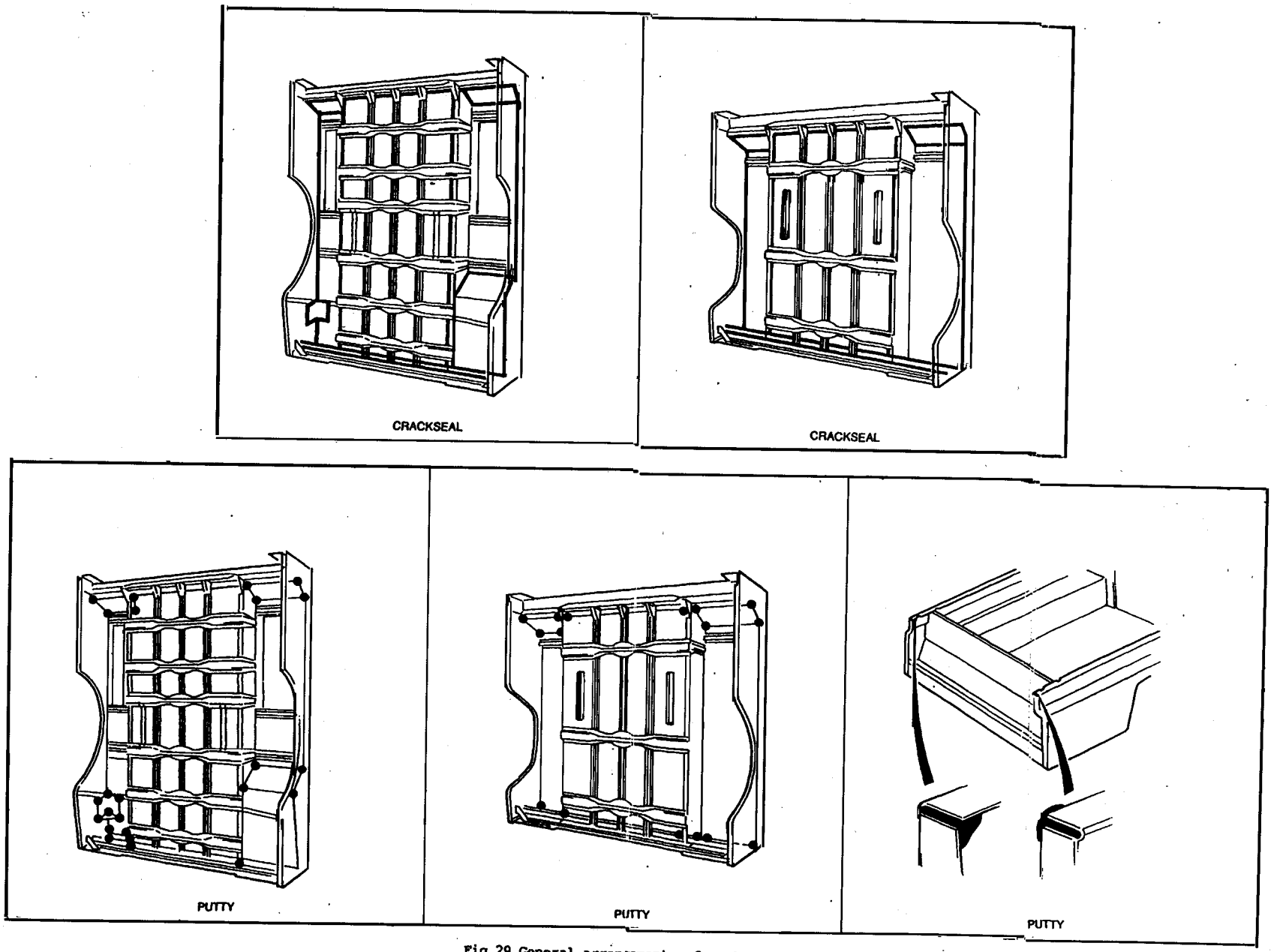


Fig 29 General arrangements of sealants XI

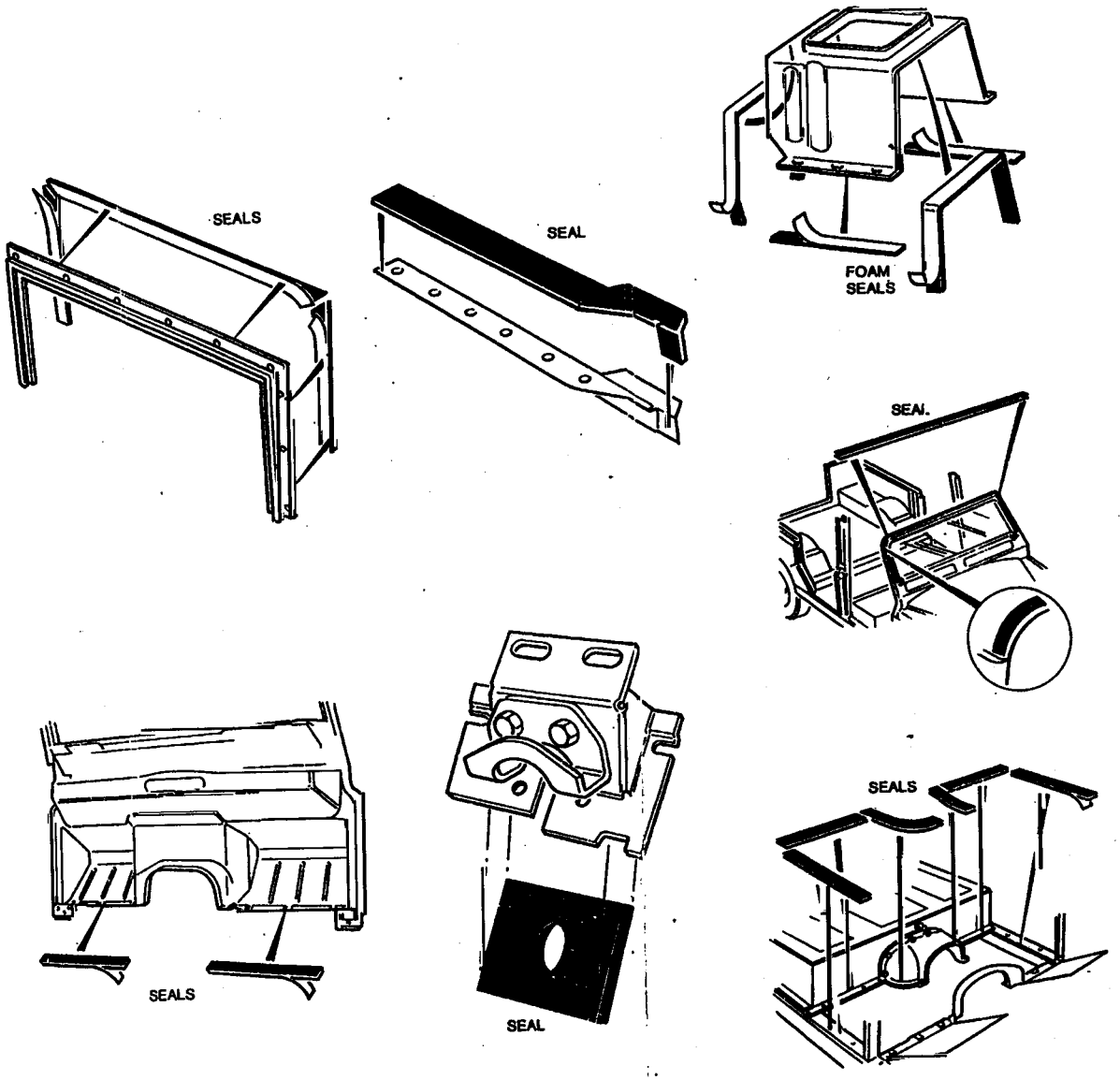
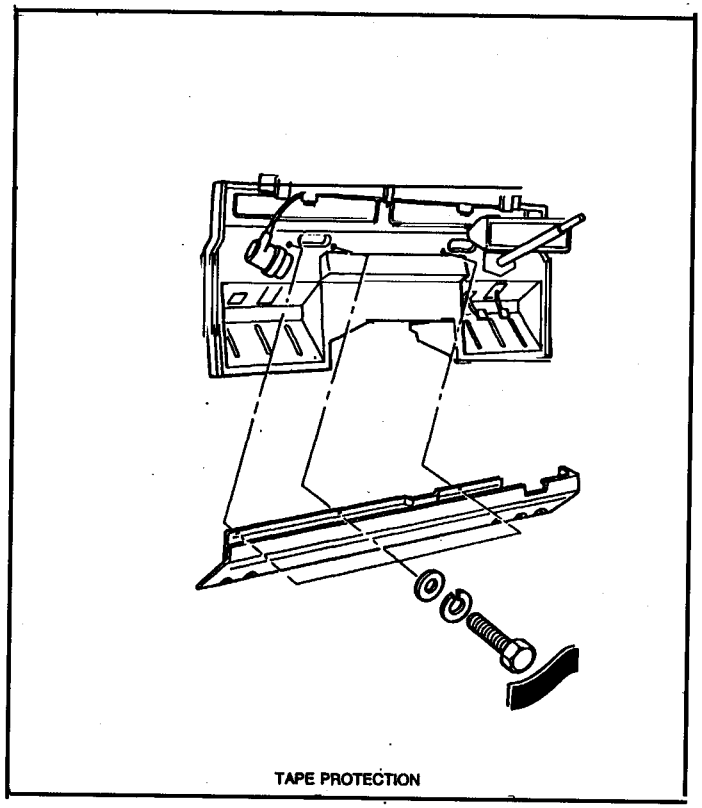


Fig 30 General arrangements of sealants X



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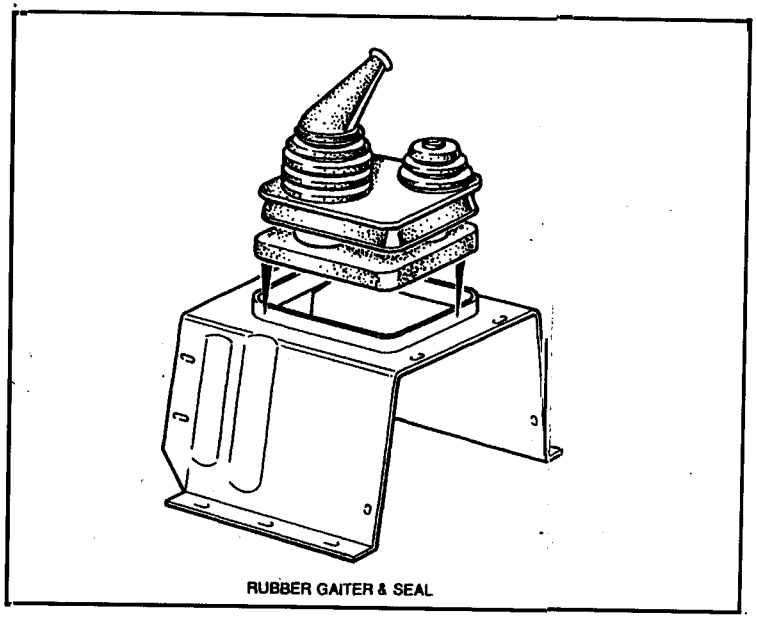
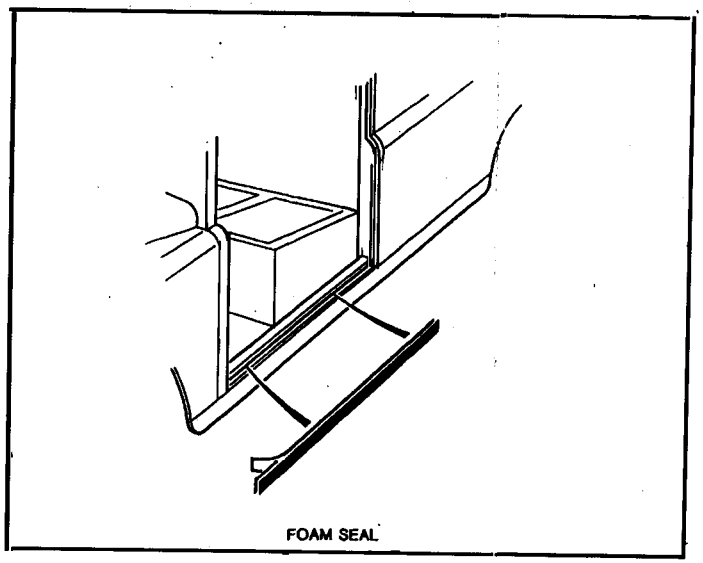


RUBBER GAITER & SEAL



FOAM SEAL

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Fig 31 General arrangements of sealants XI

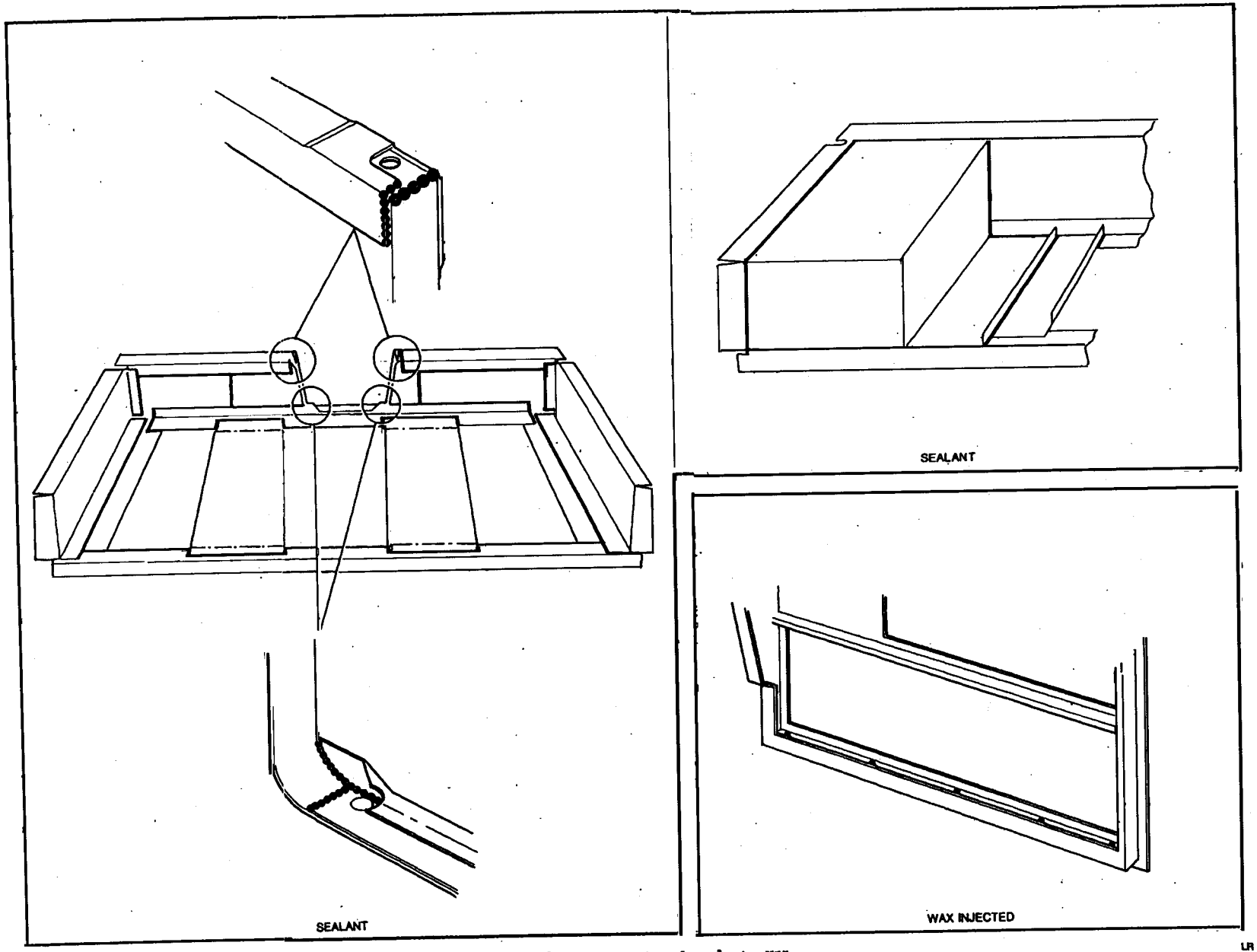


Fig 32 General arrangements of sealants XII

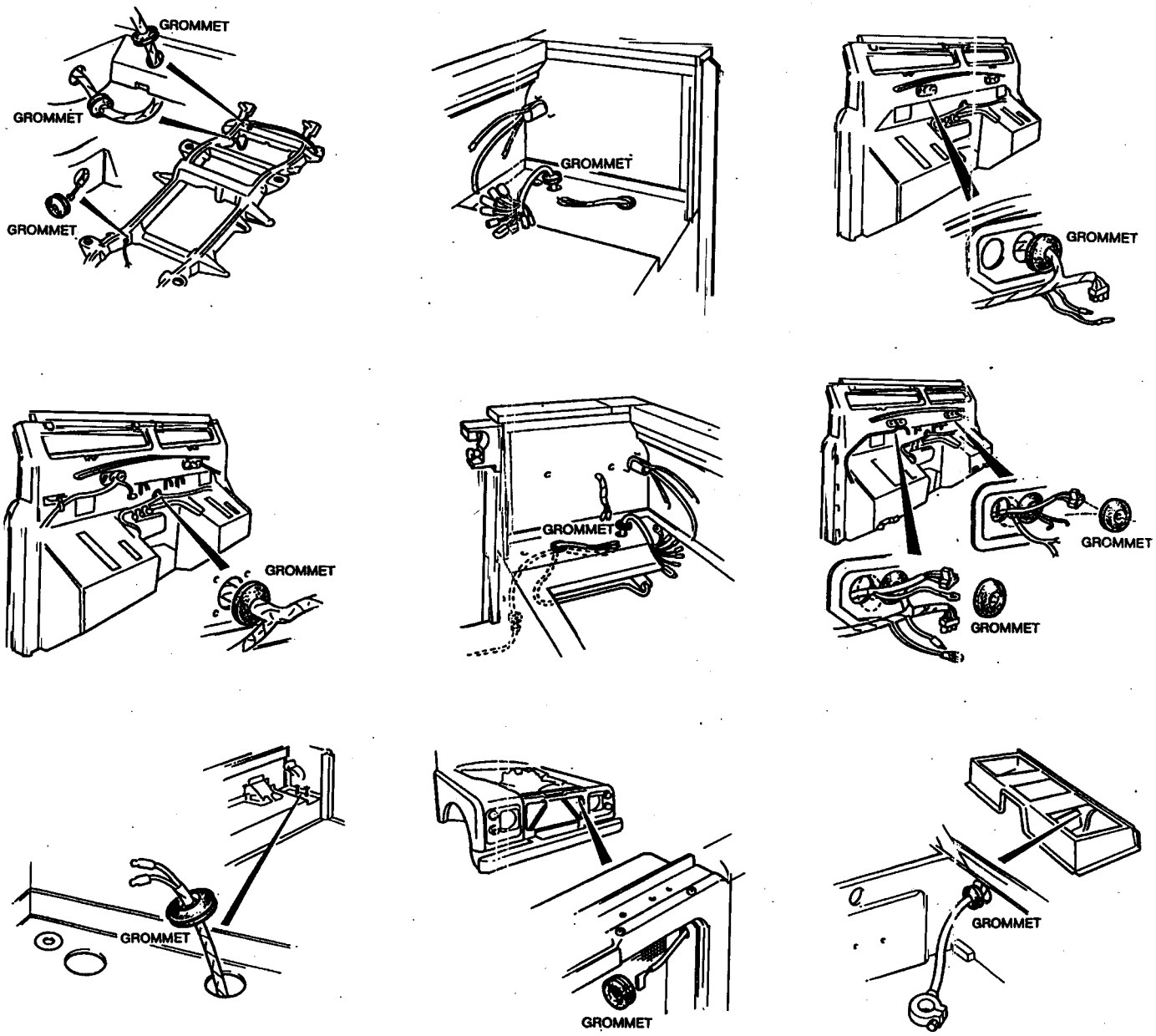


Fig 33 General arrangements of sealants XIII

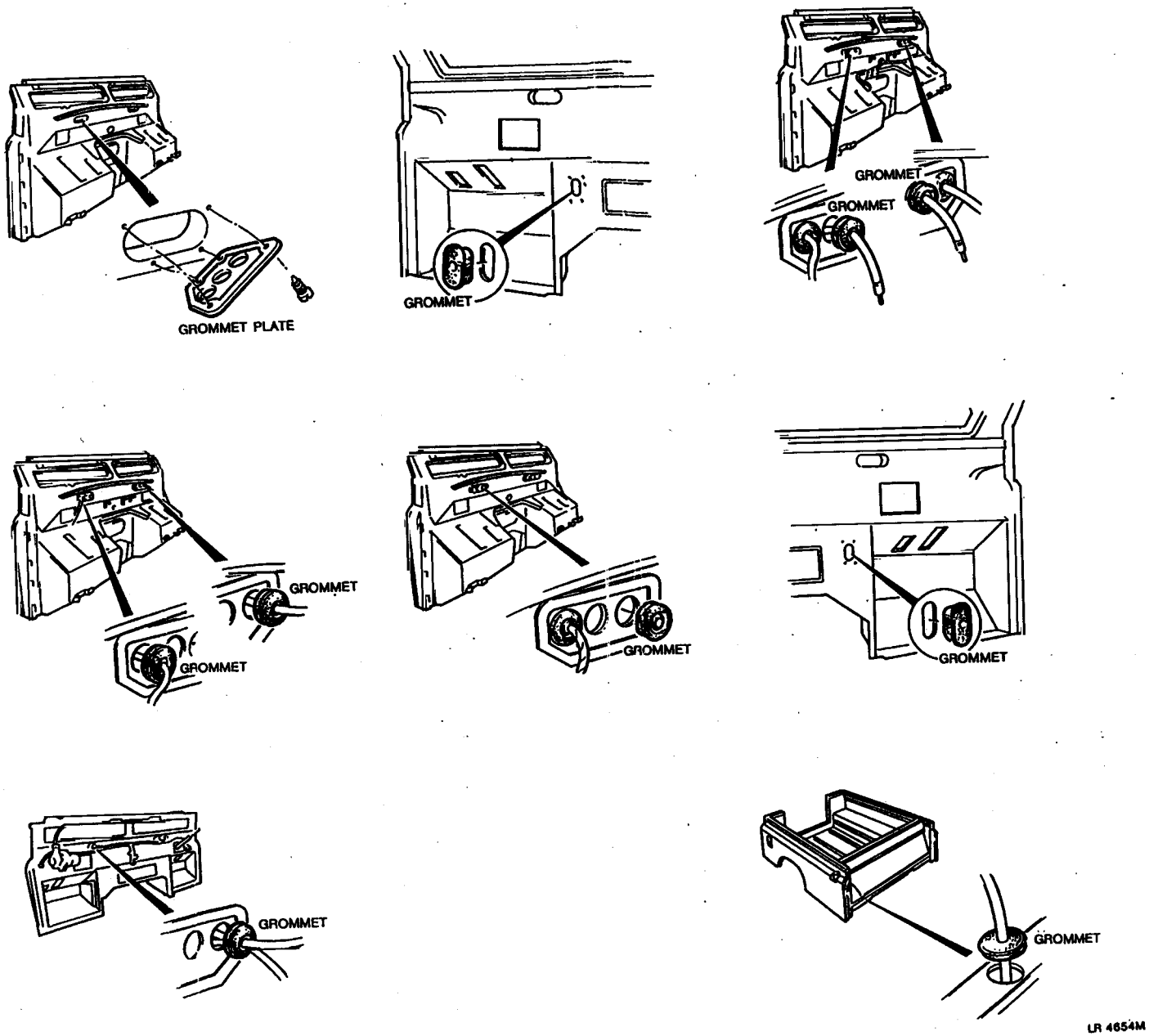


Fig 34 General arrangements of sealants XIV

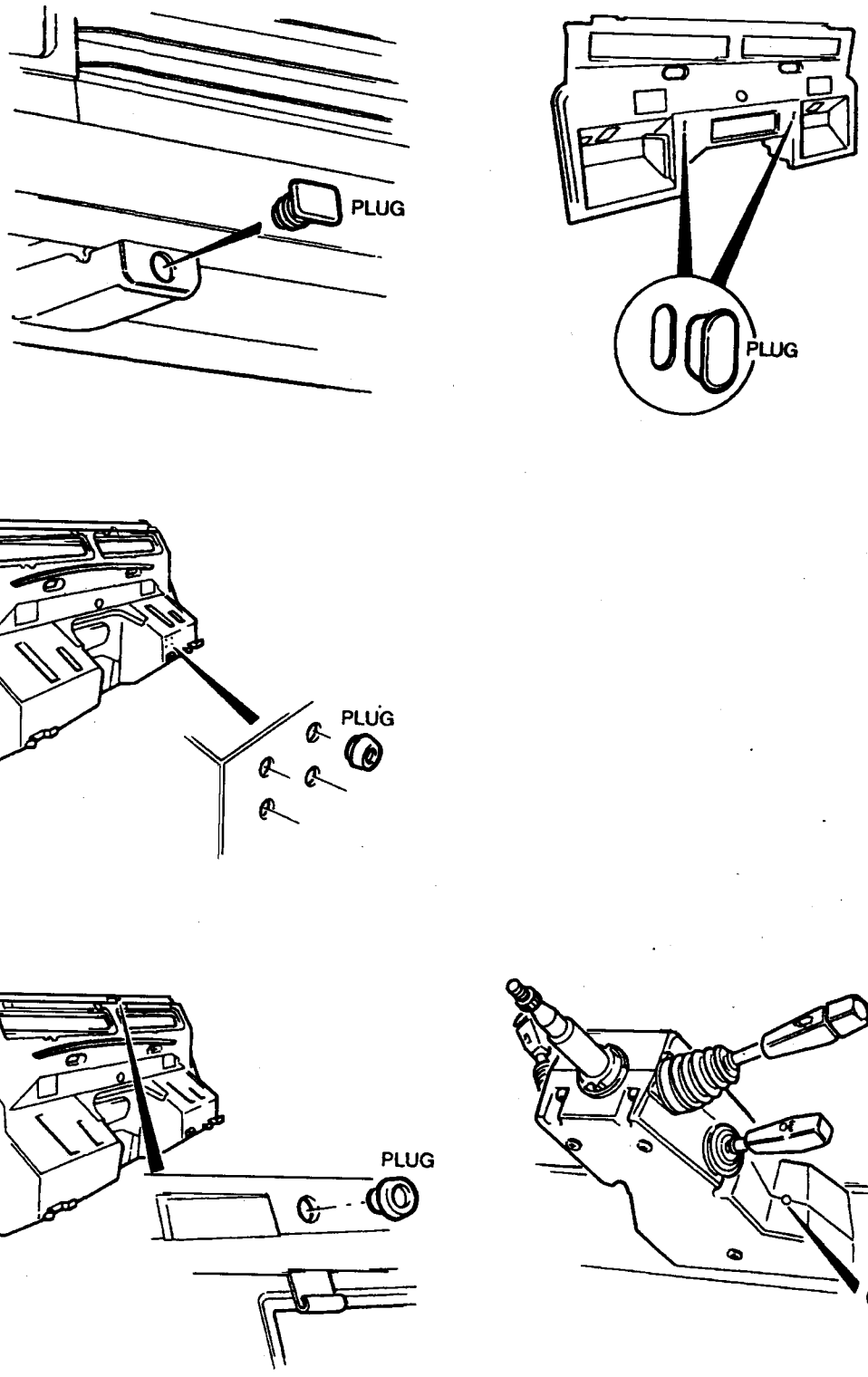


Fig 35 General arrangements of sealants XV

Chapter 16-2

WINTERISED BODY AND CAB FITTINGS

CONTENTS

INTRODUCTION

1 This Chapter contains details of the additional body and cab fittings assembled to Land Rover Winterised 90 and 110 vehicles.

GENERAL

2 Land Rover Winterised 90 and 110 vehicles have been specifically designed to operate in extreme sub-zero climatic conditions. In order to meet the required specification, a number of body and cab additions have been incorporated as an aid to protect both the vehicle and its operators.

INTERIOR TRIM ARRANGEMENT

Removal

3 To remove the internal trim proceed as follows:

Note ...

The use of a flat broad bladed instrument is advised for withdrawal of the trim retainers, prior to panel removal. Due care must be taken to avoid scarring or puncturing the trim panel surfaces.

3.1 Remove the front seat belt harness straps from the front of the vertical side trim panels (Fig 1 (8)).

3.2 Remove the rear seat cushion backs.

3.3 Withdraw the trim retainers and remove the r.h. and l.h. vertical trim panels from the vehicle.

3.4 Withdraw the trim retainers and remove the r.h. and l.h. rear side window surround trim panels (7) from the vehicle.

3.5 Withdraw the trim retainers from the centre roof trim panel (3). Support the panel sufficiently to facilitate disconnection of the interior light electrical cables. Disconnect the cables and remove the panel from the vehicle.

3.6 Remove the two rear entry/exit grab handles (5).

3.7 Withdraw the trim retainers and remove the rear vertical trim panel (6) from the vehicle.

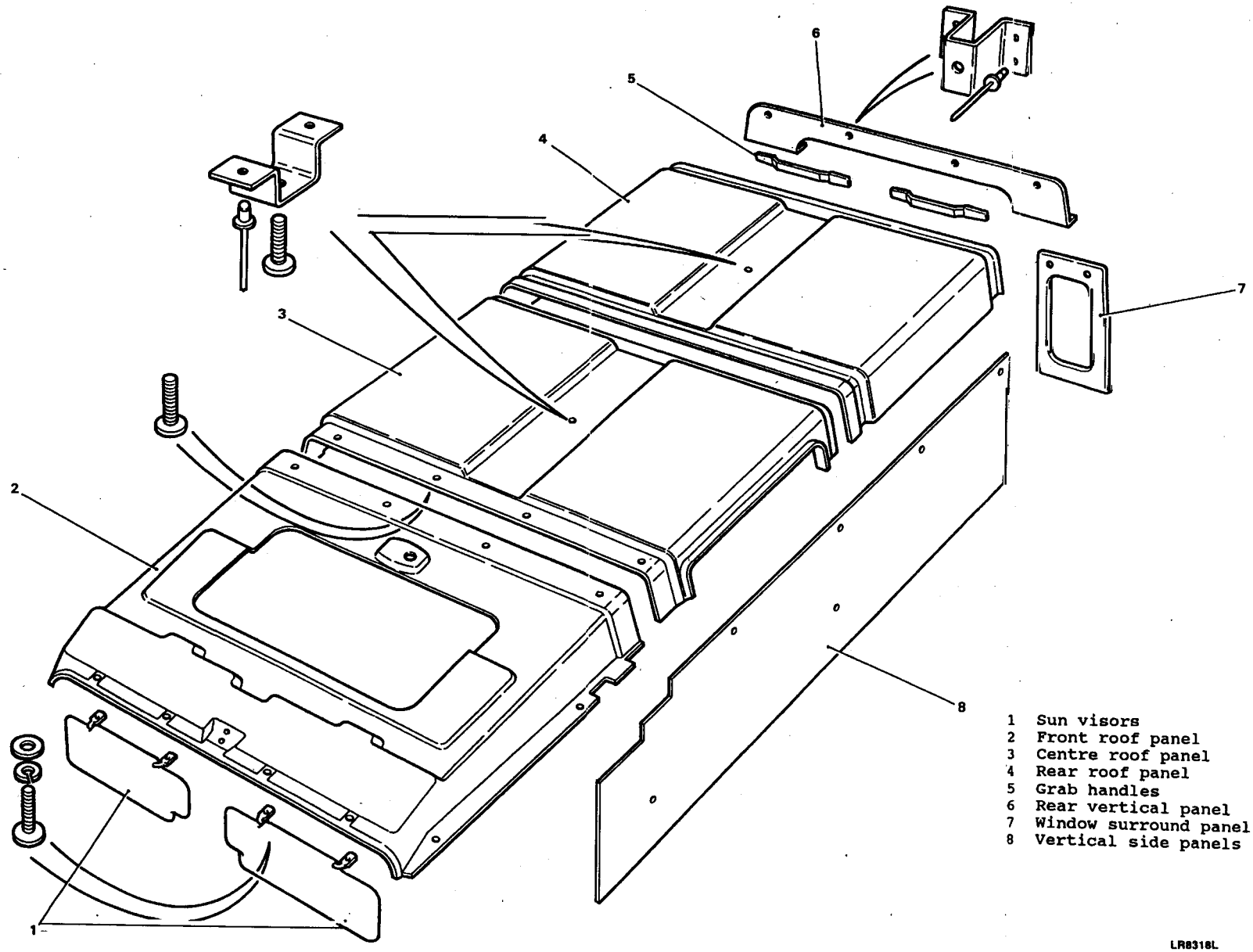
3.8 Withdraw the trim retainers and remove the rear roof trim panel (4) from the vehicle.

3.9 Remove the passenger and driver sun visors (1).

3.10 Remove the internal rear view mirror.

3.11 Remove the escape hatch roof finisher (Para 5.1 to 5.6)

3.12 Withdraw the trim retainers and remove the front roof trim panel (2) from the vehicle.



1 Sun visors
2 Front roof panel
3 Centre roof panel
4 Rear roof panel
5 Grab handles
6 Rear vertical panel
7 Window surround panel
8 Vertical side panels

Fig 1

Interior trim arrangement

Refitting

4 To fit the internal trim panels reverse the procedures instructed in Para 3.

OBSERVATION HATCH

Removal

5 To remove the observation hatch proceed as follows:

5.1 Open the hatch (Fig 2 (1)) to its fullest extent by pulling the latch handle down to the first open position.

5.2 Move the green button to the right and push the hatch up as far as the latch will allow to the fully open position.

5.3 Move the red button upwards and open the retaining hasp.

5.4 Raise up the rear of the hatch and withdraw it rearwards from the escape hatch exterior surround.

5.5 Remove the two screws and withdraw the latch finisher (6).

5.6 The observation hatch interior finisher (5) is secured by 14 dowels to the outer frame retainer (4). Carefully lever the finisher away from the retainer using a screwdriver with a broad blade.

5.7 Remove the 15 screws and withdraw the outer frame retainer (4).

5.8 Lift the outer frame (3) from the vehicle.

5.9 If necessary, remove the adhesive-backed seal from the inner edge of the frame.

5.10 To release the latch from the escape hatch panel, remove the two screws and withdraw the latch and backing plate.

Refitting

6 To refit the observation hatch proceed as follows:

6.1 If removed, fit the two centralising blocks to the outer frame and secure with adhesive.

6.2 Secure a new seal to the outer closing edge of the outer frame (Fig 2 (3)) avoiding a join along the hinge side.

6.3 Clean the area of contact on the vehicle roof and lower the outer frame into position.

6.4 From the inside of the vehicle, offer-up the retaining frame (4) and secure to the outer frame (3) with the 15 screws.

6.5 If removed, fit the latch to the hatch panel with the backing plate and two screws.

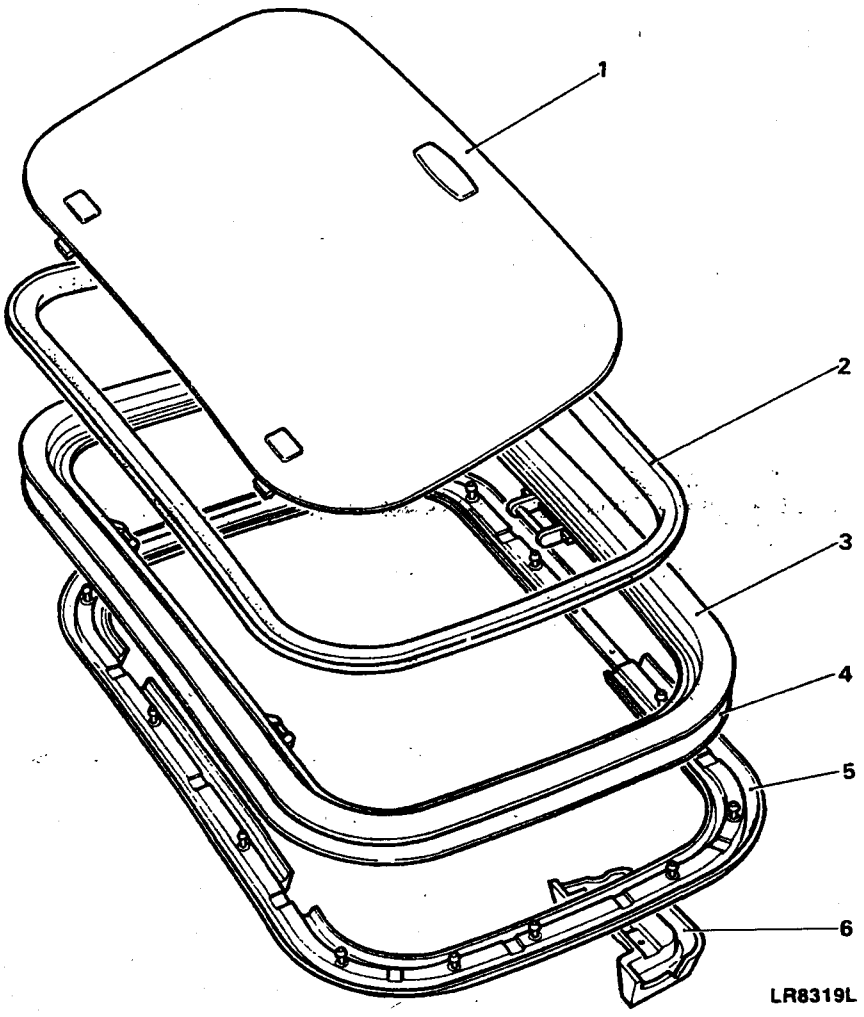
6.6 Secure the interior finisher (5) to the frame retainer (4) with the 14 dowels.

6.7 Fit and secure the latch finisher (6) with the two screws.

6.8 Fit the hatch panel (1) and latch assembly squarely to the outer frame.

6.9 Lower the latch on the pivot bar, ensuring that the bar locates in its cradle, and whilst pushing the red button upwards, close the latch hasp over the bar until it locks.

6.10 To check the operation and to close the hatch, move the green button to the right whilst pulling the latch handle downwards until it snaps into the locked position.



1 Observation hatch
2 Observation hatch surround
3 Outer frame
4 Outer frame retainer
5 Internal finisher
6 Latch finisher

Fig 2 Observation hatch

SIDE DOOR ASSEMBLY

Removal

Door trim

7 To remove the side door trim proceed as follows:

7.1 Prise off the two finishers (Fig 3 (13)) and remove the two screws (15) securing the door pull (14).

7.2 Remove the single screw (18) behind the remote control lever.

7.3 Prise off the remote control lever bezel (16).

7.4 Prise off the door locking button bezel (12).

7.5 Lever off the window regulator handle centre finisher (19), remove the retaining screw (20), withdraw the handle (21) and bezel (22).

7.6 Using a screwdriver, carefully ease the trim (11) away from the door.

Mounting panel

8 To remove the mounting panel proceed as follows:

8.1 Remove the door trim (Para 7).

8.2 Remove the four screws (Fig 3 (24) securing the window regulator (29) to the mounting panel (26).

8.3 Remove the five screws (10),(25) securing the mounting panel (26) to the door frame (7).

8.4 Release the remote control lever rod (30) from the latch mechanism (36) and from the plastic clip (40) in the mounting panel.

8.5 Slide the window regulator arm (28) from the mounting panel channel and remove the panel with the remote control lever and rod.

Door locking button

9 To remove the door locking button proceed as follows:

9.1 Remove the door trim (Para 7).

9.2 Peel back sufficient of the weather protection sheet to expose the mechanism.

9.3 Release the spring clip and disconnect the locking button control rod (34) from the latch mechanism (36).

9.4 Remove the two screws (32) and withdraw the locking button assembly (33).

Window regulator

10 To remove the window regulator proceed as follows:

10.1 Remove the door trim (Para 7).

10.2 Remove the weather protection sheet.

10.3 Temporarily fit the handle (Fig 3 (21)) and position the window (8) half open and support with a length of timber.

10.4 Remove the two lower screws (25) securing the mounting panel to the door and slacken the three upper screws (10).

10.5 Remove the four screws (24) retaining the window regulator (29) to the mounting panel and slide the operating arms (28) from the channels (9) attached to the glass and mounting panel and remove the regulator.

Remote control lever

11 To remove the remote control lever proceed as follows:

11.1 Remove the door trim (Para 7).

11.2 Peel back sufficient of the weather protection sheet to gain access to the remote control lever.

11.3 Release the spring clip and disconnect the control rod (Fig 3 (30)) from the latch mechanism (36).

11.4 Release the control rod (30) from the plastic clip (40) in the mounting panel.

11.5 Remove the two screws (23) securing the remote control lever (27) to the mounting panel and withdraw the lever and control rod.

Exterior door handle

12 To remove the exterior door handle proceed as follows:

12.1 Remove the door trim (Para 7).

12.2 To gain access to the handle mechanism, remove the mounting panel (Fig 3 (26)) and support the window with timber.

12.3 Disconnect the control rod (31) from the handle mechanism.

12.4 Disconnect the control rod (38) from the locking barrel lever.

12.5 Remove the two screws (37) and withdraw the handle assembly (3).

Door latch assembly

13 To remove the door latch assembly proceed as follows:

13.1 Remove the mounting panel (Para 7) and support the glass with timber.

13.2 Disconnect the control rod (Fig 3 (31)) from the handle operating lever.

13.3 Disconnect the control rod (38) from the locking barrel lever on the handle.

13.4 Disconnect the locking button control rod (34) from the latch mechanism (36).

13.5 Remove the two screws (37) and remove the handle assembly (3) from the door.

13.6 Remove the two self-tapping screws (2) retaining the lower end of the window glass runner.

13.7 Remove the three screws (35) securing the latch assembly to the door.

13.8 Whilst taking care not to damage the runner, ease it away from the latch and manoeuvre the latch assembly from the door.

Window glass

14 To remove the window glass proceed as follows:

14.1 Remove the mounting panel (Para 7).

14.2 Remove the window regulator (Para 10).

14.3 Push the glass up to the top of its travel and support with a suitable length of timber.

14.4 Remove the two self tapping screws (Fig 3 (2)) securing the window glass runner on the latch side of the door and the single screw (1) from the hinge side.

14.5 Taking care not to damage the paint work, prise the exterior waist weather strip (6) from the door.

14.6 Remove the timber support and lower the glass to the bottom of the door.

14.7 Ease the runner from the glass at the hinge side of the door, lift the glass over the bottom edge of the door and withdraw.

Locking barrel

15 To remove the locking barrel proceed as follows:

15.1 Remove door trim (Para 7) and weather protection sheet.

15.2 Remove the mounting panel (Fig 3 (26)).

15.3 Raise and support the glass to gain access to the latch mechanism (36).

15.4 Release the spring clip and disconnect the control rod (38) from the lock operating lever.

15.5 Remove the single screw (39) and withdraw the lock lever assembly.

15.6 Withdraw the lock barrel (4) from the exterior door handle (3), complete with the locking sleeve (5).

15.7 Depress the spring loaded button and withdraw the plastic retaining sleeve from around the barrel.

Key to fig 3

1 Screw
2 Screw
3 Exterior door handle
4 Barrel
5 Sleeve
6 External weather strip
7 Door frame
8 Window glass
9 Channel
10 Screw
11 Door trim
12 Bezel
13 Finisher
14 Door pull
15 Screw
16 Bezel
17 Trim fastener
18 Screw
19 Finisher
20 Screw
21 Window regulator handle
22 Bezel
23 Screw
24 Screw
25 Screw
26 Mounting panel
27 Remote control lever
28 Window regulator arm
29 Window regulator
30 Control rod
31 Control rod
32 Screw
33 Locking button assembly
34 Control rod
35 Screw
36 Latch assembly
37 Screw
38 Control rod
39 Screw
40 Plastic clip

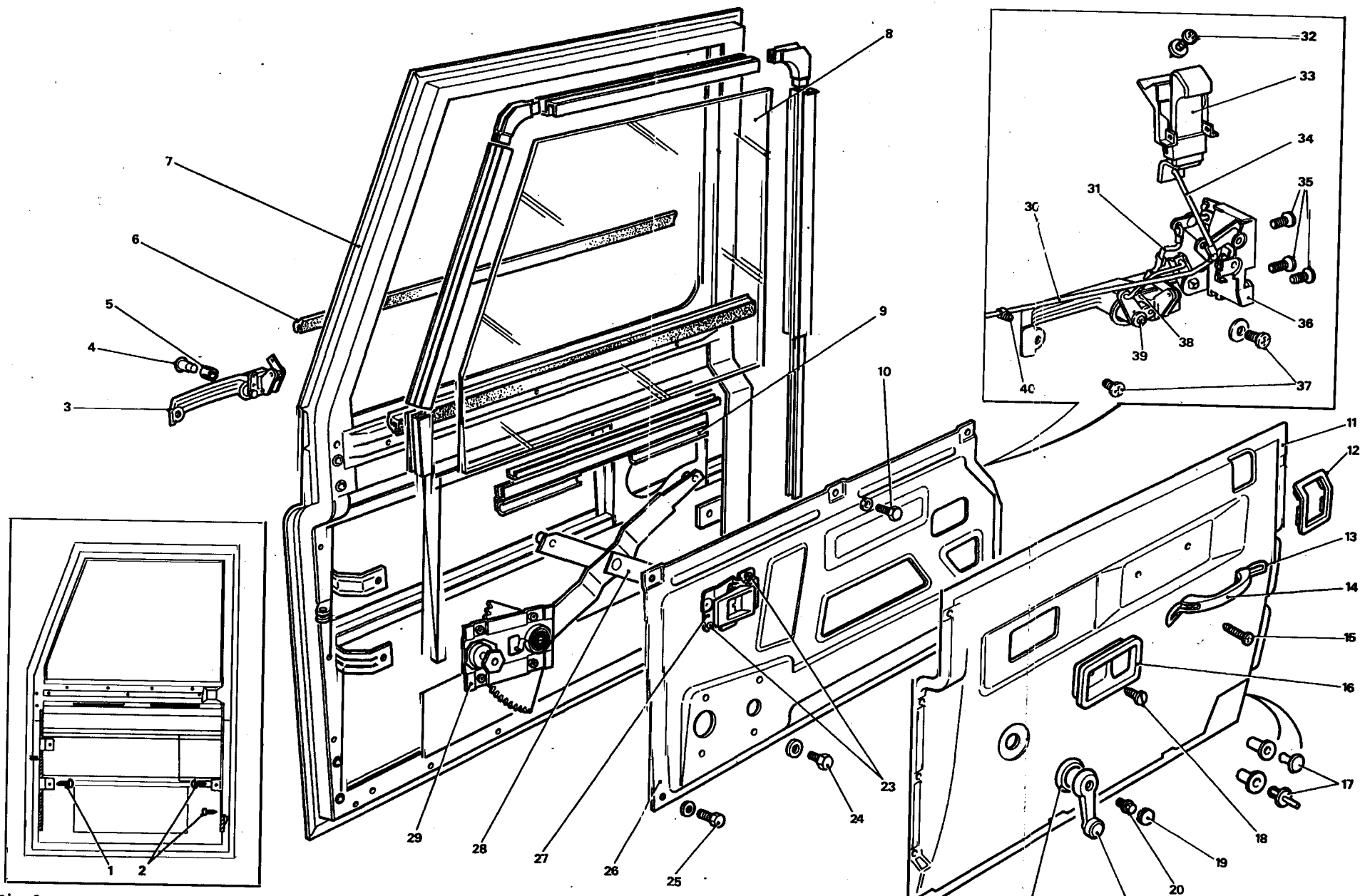


Fig 3

Side door assembly

LR8320L
Fig 3

Oct 90

Refitting

Door trim

16 To fit the door trim proceed as follows:

16.1 Remove any trim fasteners (Fig 3 (17)) held in the door panel and insert them into the back of the trim or use new ones.

16.2 Ensure the anti-vibration pads are in position and offer-up the trim (11) to the door, lining-up the fasteners with the holes in the door and push the trim into position.

16.3 Fit the bezels (12),(16) to the locking button (33) and remote control lever (27).

16.4 Fit the single screw (18) behind the remote control lever (27).

16.5 Fit the door pull (14) and secure with two screws (15) and finishers (13).

16.6 Fit the bezel (22), window regulator handle (21) and retain with the single screw (20) and finisher (19).

Mounting panel

17 To fit the mounting panel proceed as follows:

17.1 Engage the window regulator arm (Fig 3 (28)) in the mounting panel channel.

17.2 Connect the control rod (30) to the latch mechanism (36) and secure the clip.

17.3 Fit the mounting panel (26) and retain with the five screws (10),(25).

17.4 Secure the window regulator (29) to the mounting panel with the four screws (24).

17.5 Raise and lower the window to check for free movement.

17.6 Fit the weather protection sheet and door trim (Para 16).

Door locking button

18 To fit the door locking button proceed as follows:

18.1 Secure the locking button assembly to the door with the two screws (Fig 3 (32)).

18.2 Connect the control rod (34) to the latch mechanism (36) and secure with spring clip.

18.3 Reseal the weather protection sheet and fit the door trim (Para 16).

Window regulator

19 To fit the window regulator proceed as follows:

19.1 Insert the regulator window operating arms (Fig 3 (28)) into the channels (9).

19.2 Fit and tighten the mounting panel lower screws (25) and tighten the upper screws (10).

19.3 Position the holes in the regulator (29) to line up with the holes in the mounting panel and secure with the four screws (24).

19.4 Temporally fit the regulator handle (21) and check that the glass can be raised and lowered without tight spots.

19.5 Secure the weather protection sheet with adhesive.

19.6 Fit the door trim (Para 16).

Remote control lever

20 To fit the remote control lever proceed as follows:

20.1 Feed the control rod (Fig 3 (30)) into position and loosely secure the lever (27) to the mounting panel (26) with the two screws (23).

20.2 Connect the control rod (30) to the latch mechanism (36) and secure with spring clip.

20.3 Tighten the control lever retaining screws (23).

20.4 Secure the control rod (30) to the plastic clip (40) in the mounting panel.

20.5 Secure the weather protection sheet with adhesive.

20.6 Fit the door trim (Para 16).

Exterior door handle

21 To fit the exterior door handle proceed as follows:

21.1 Fit the handle (Fig 3 (3)) to the door ensuring that the two bezels are in position, flat faces towards the door, and secure with the two screws (37).

21.2 Connect the control rod (31) to the handle operating lever and secure with spring clip.

21.3 Connect the control rod (38) to the locking barrel lever and retain with spring clip.

21.4 Fit the mounting panel (Para 17), weather protection sheet and door trim (Para 16).

Door latch assembly

22 To fit the door latch assembly proceed as follows:

22.1 Carefully ease the window runner away, sufficiently to enable the latch (Fig 3 (36)) to be located into position.

22.2 Secure the latch to the door with the three screws (35).

22.3 Secure the window runner with the two screws (2) ensuring that the packing strip is in position and that the screw heads are below the bottom of the runner to prevent damage to the glass.

22.4 Fit the handle (3) with the two screws (37), ensuring that the bezels are in position.

22.5 Connect the control rod (31) to the handle operating lever and secure with spring clip.

22.6 Connect the control rod (38) to the locking lever and retain with spring clip.

22.7 Connect the locking button control rod (33) to the latch lever and secure with spring clip.

22.8 Fit the mounting panel (Para 17), weather protection sheet and door trim (Para 16).

Window glass

23 To fit the window glass proceed as follows:

23.1 Insert the glass into the runners at an angle.

23.2 Whilst lifting the glass, position it squarely in the runners and raise it to the top of its travel and support with a suitable timber support.

23.3 Secure the hinge side runner with the single screw (Fig 3 (1)) ensuring that the packing strip is in position.

23.4 Locate the packing strip and secure the opposite runner with the two screws (2). Ensure that all three screw heads are well below the bottom of the runners to prevent damage to the glass.

23.5 Locate the regulator (29) in the window lift channels (9).

23.6 Fit the mounting panel (Para 17), weather protection sheet and door trim (Para 16).

Locking barrel

24 To fit the locking barrel proceed as follows:

Note ...

If a new barrel is being fitted, check that the number on the barrel coincides with the number on the accompanying key.

24.1 Push the plastic retaining sleeve (Fig 3 (5)) over the barrel (4) until the spring loaded peg locks it in position.

24.2 Fit the barrel and plastic sleeve assembly to the locking sleeve and insert it into the exterior handle (3).

24.3 Assemble the lock lever components.

24.4 Fit the lock lever components to the barrel assembly from the inside of the door and secure with the single screw.

24.5 Connect the control rod (38) to the lock lever and secure with spring clip.

24.6 Fit the mounting panel (Para 17), weather protection sheet and door trim (Para 16).

SA 80 GUN CLIPS

Removal

Dash mounted clip assembly

25 To remove the dash mounted gun clip assembly proceed as follows:

25.1 Withdraw the fixings from the top of dash bracket (Fig 4 (6)).

25.2 Withdraw the fixings from the bottom of dash bracket (6) and remove the bracket from the dash panel.

25.3 Withdraw the fixings from the centre of dash bracket (6) and remove the barrel gun clip (7).

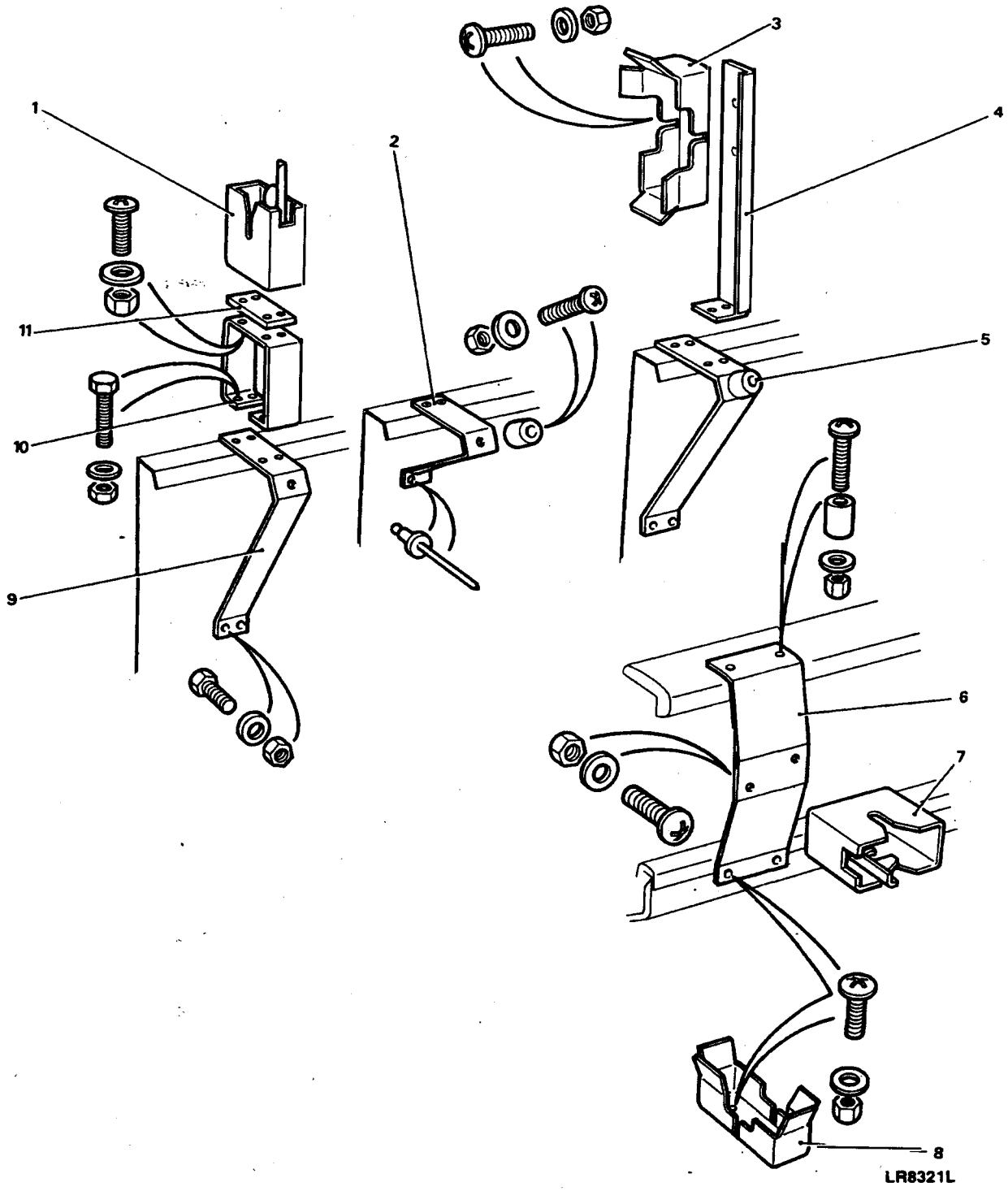
25.4 Withdraw the fixings and remove the floor plate mounted butt gun clip (8).

Rear bulkhead mounted clip assembly

26 To remove the rear bulkhead mounted gun clip assembly proceed as follows:

26.1 Withdraw the fixings securing the barrel gun clip (Fig 4 (1)) to the bracket (10).

26.2 Remove the gun clip from the bracket complete with spacer (11).



1 Barrel gun clip
2 Squab buffer bracket
3 Butt gun clip
4 Butt clip bracket
5 Cantilever bracket
6 Dash bracket
7 Barrel gun clip
8 Butt gun clip
9 Cantilever bracket
10 Barrel gun clip bracket
11 Spacer

Fig 4 SA 80 Gun clips

26.3 Withdraw the fixings and remove the barrel gun clip bracket (10) from the cantilever bracket (9).

26.4 Withdraw the remaining fixings and remove the cantilever bracket from the top of the rear bulkhead.

26.5 Withdraw the fixings and remove the butt gun clip (3) from the bracket (4).

26.6 Withdraw the fixings and remove the butt clip bracket (4) from the cantilever bracket (5).

26.7 Withdraw the remaining fixings and remove the cantilever bracket from the top of the rear bulkhead.

26.8 Withdraw the fixings and remove the squab buffer bracket (2) from the top of the rear bulkhead.

Refitting

27 To fit the gun clip assemblies reverse the procedures instructed in Para 25 and 26.

SNOW BLINDS AND FUEL FILL FLAP

28 Special non-perishable snow blinds are fitted to windscreen (Fig 5 (4)), driver (8), passenger (3), rear (1),(7) window surfaces and front radiator grille (5). The blinds are held by locating adjacent strips of velcro (9) and are secured in an operational position by rotatable stud fasteners (2). Once in situ, the blinds can be released from their securing studs, rolled horizontally or vertically and held static by further velcro strips. The radiator grille snow blind is fitted with a rectangular inset which can be rolled horizontally in a similar manner, allowing the induction of air into the cooling system. A snow cover protecting the fuel fill point (6) is also located by adjacent strips of velcro.

Key to fig 5

1 Rear door window blind
2 Stud fasteners
3 Passenger door window blind
4 Windscreen blind
5 Radiator grille cover
6 Fuel fill flap cover
7 Rear side window blinds
8 Driver door window blind
9 Velcro strip

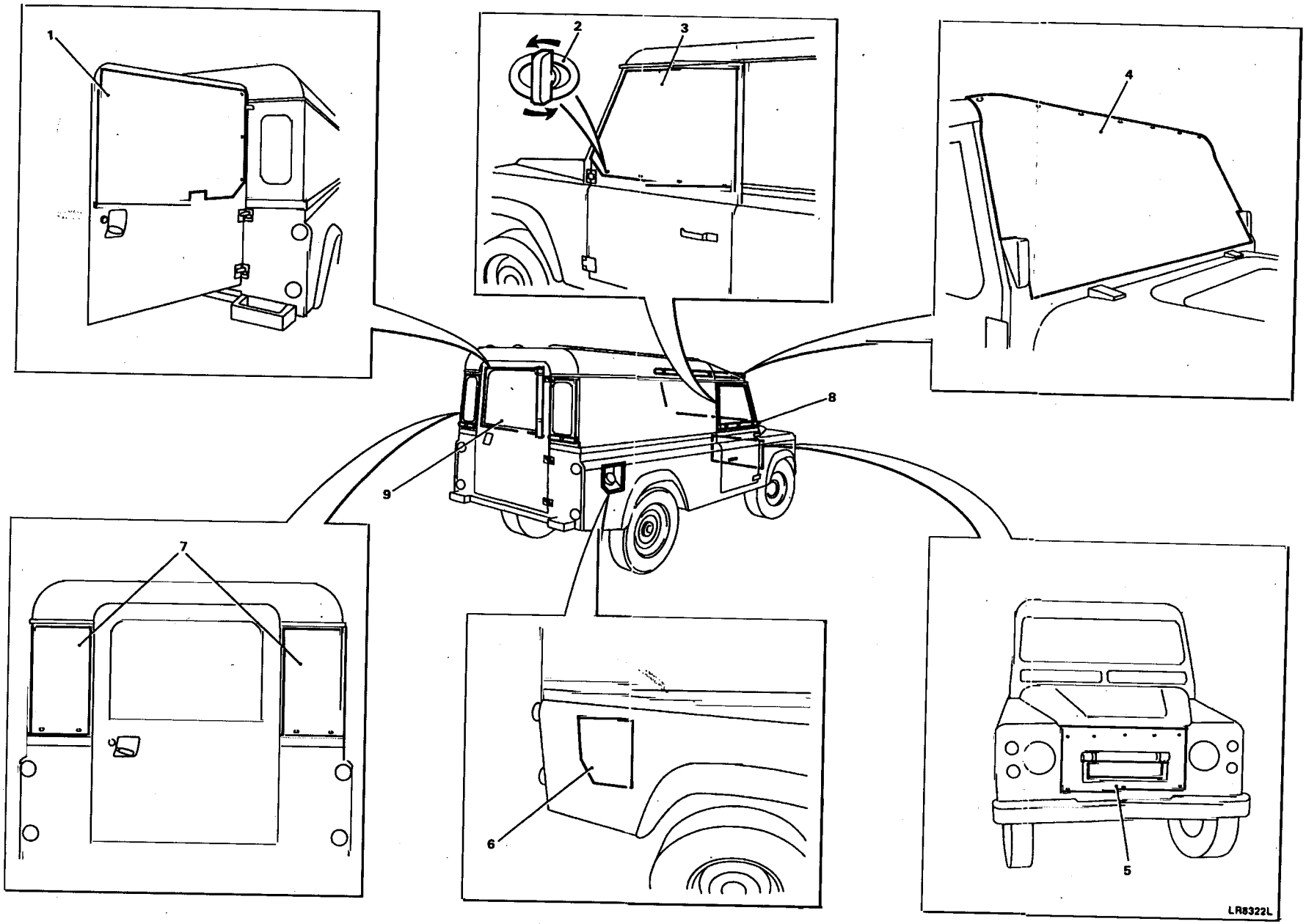


Fig 5
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Snow blinds and fuel fill flap

SKI RACK

Removal

29 To remove the ski rack proceed as follows:

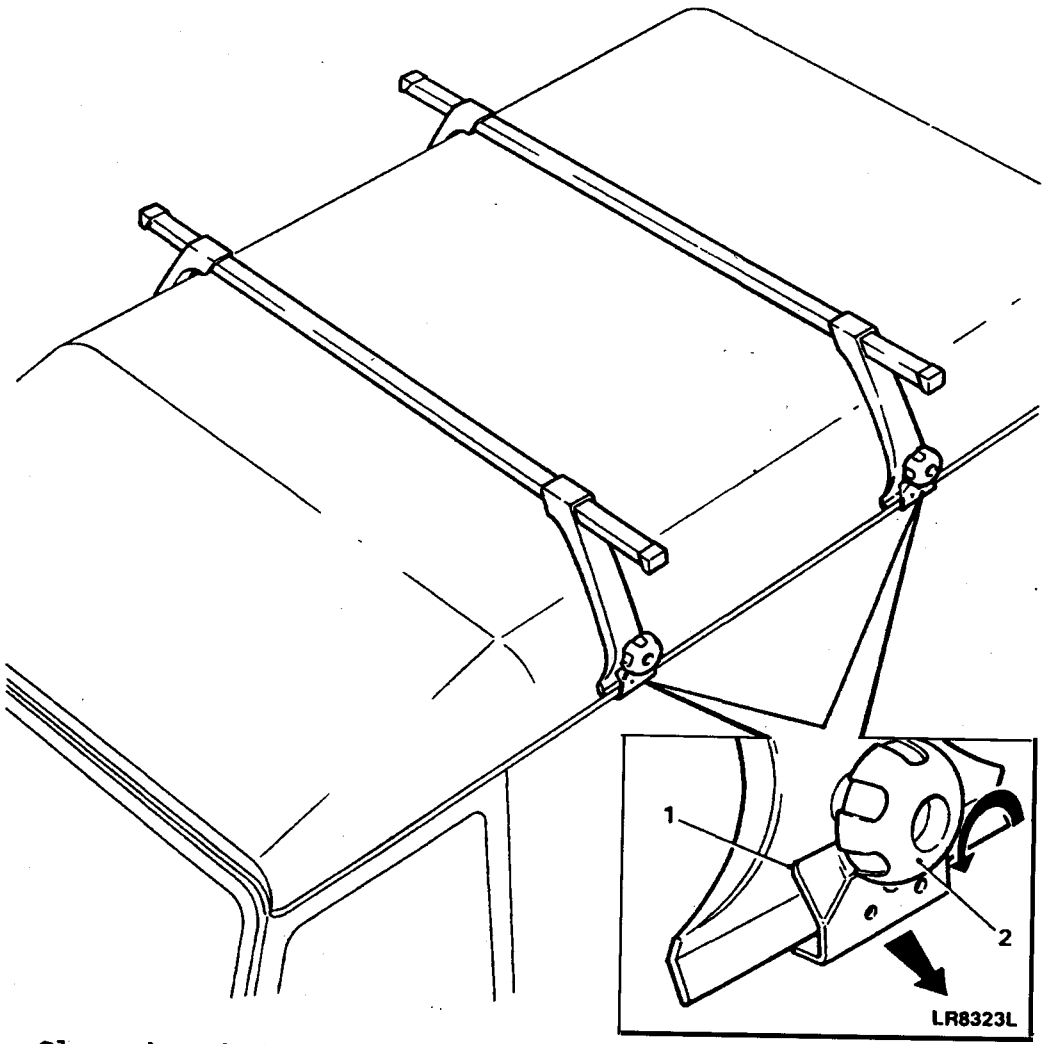
29.1 With the use of a soft marker pen note the mounting position on the vehicle roof.

29.2 Rotate the locking knob (Fig 6 (2)) anti-clockwise to release the clamp bracket (1) from the roof gutter rail.

29.3 If necessary, remove the rail end caps and release the rails from the vertical support brackets by withdrawing the screw and bracket assembly using the special key supplied.

Refitting

30 To fit the ski rack reverse the procedures instructed in Para 29 ensuring the vertical support brackets are correctly positioned.



1 Clamp bracket

2 Rotatable Knob

Fig 6 Ski rack

Chapter 17

ELECTRIC WINCH 127 VEHICLES

CONTENTS

INTRODUCTION

1 This Chapter details the Unit and Field repair procedures for the electric winch fitted to Land Rover 127 vehicles.

GENERAL

2 The electric winch is constructed as a sealed unit requiring no internal lubrication, and under normal circumstances any mechanical maintenance other than the cleaning and greasing of the wire rope.

Note ...

The brake linings, drum bushes and seals should be checked periodically for wear and replaced if necessary.

SPECIAL TOOLS

3 The special tools listed in the following table will be referred to in the text when used, by the serial number shown in the table.

TABLE 1 SPECIAL TOOLS

Ser No (1)	Manufacturers Part No (2)	Designation (3)
1	9164	Brake assembly holder
2	9167	Bush/seal locator

Key to fig 1

1 Clamp
2 Motor cable
3 Motor cable
4 Motor cable
5 Solenoid housing
6 Control box assembly
7 Capscrew
8 Upper housing
9 Bearing
10 Motor
11 Terminal gaiter
12 Negative cable
13 Cluster gear
14 Intermediate gear
15 Retaining plate
16 Bearing
17 Drum
18 'U' bolt clamp
19 Bush
20 End support
21 End cap
22 Screw
23 Wire rope assembly
24 Retaining ring
25 Retaining ring
26 Horizontal shaft
27 Bush
28 Horizontal roller
29 Hook
30 Bush
31 Retaining ring
32 Capscrew
33 Lockwasher
34 Retaining ring
35 Bush
36 Vertical roller
37 Bush
38 Fairlead cable bracket
39 Vertical shaft
40 Thrust washer
41 Seal
42 Bush
43 Square nut
44 Main gear
45 'O' ring
46 Pinion
47 Cam
48 Bush
49 Lip seal
50 Inner disc
51 Spring
52 Steel ball
53 Ratchet
54 Hub
55 Outer disc
56 Parallel key
57 Retaining ring
58 Friction lining
59 Remote control switch
60 Remote control lead
61 Capscrew
62 Washer
63 Protective cap
64 Spring
65 Grease fitting
66 Pawl
67 Square nut
68 Lower housing
69 Cluster gear shaft
70 Screw
71 Shift knob
72 Seal
73 Shifter assembly
74 Motor pinion
75 Solenoid housing
76 Solenoid
77 Fastener
78 Positive cable
79 Lockwasher
80 Adapter
81 Plate

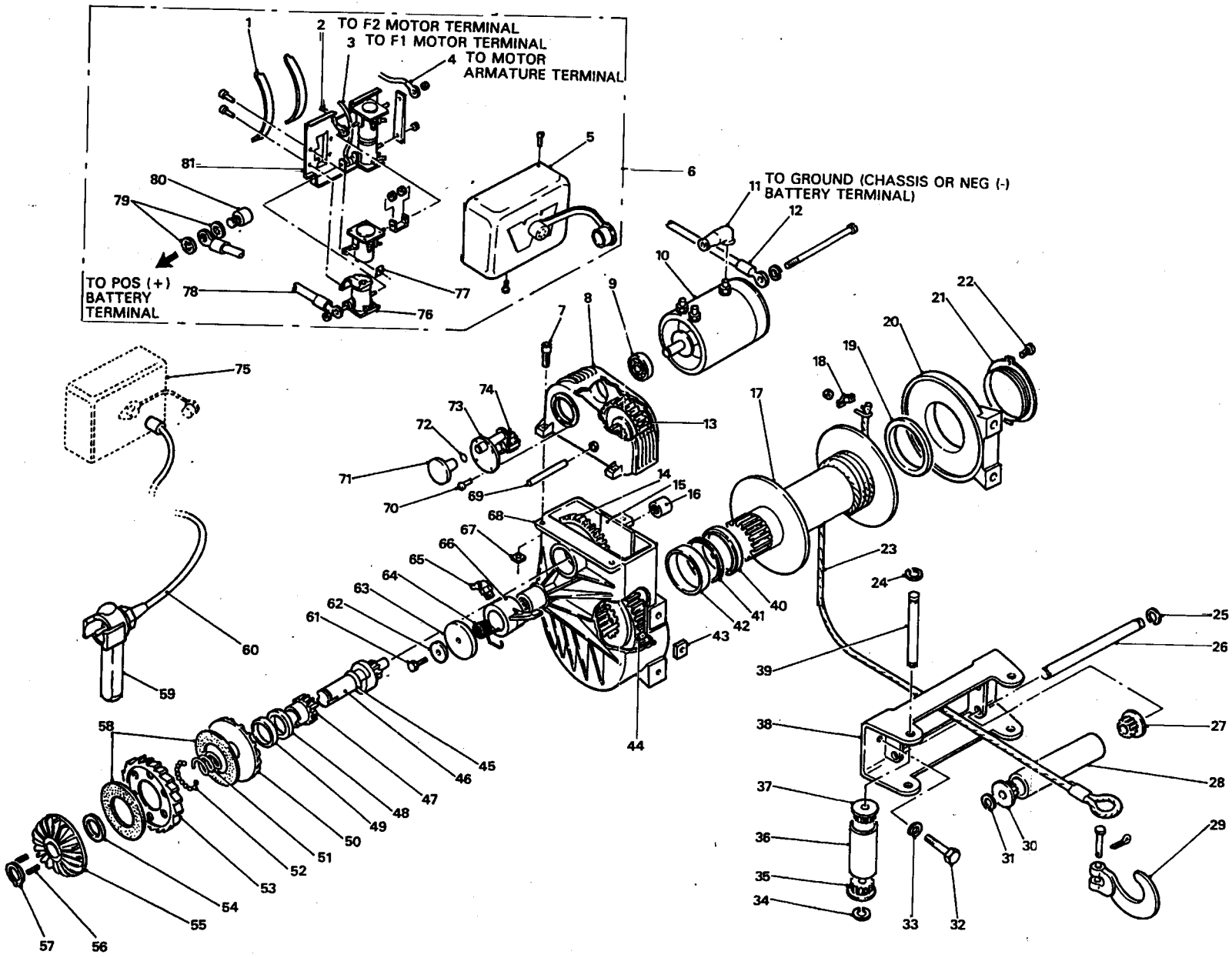


Fig 1

Electric winch assembly

REMOVAL

Electric winch assembly

4 To remove the electric winch assembly from the vehicle proceed as follows:

4.1 Disconnect the vehicle battery.

4.2 If fitted, remove the remote control lead (Fig 1 (60)) from the winch control box (5).

4.3 Disconnect the negative earth cable (12) from the winch motor.

4.4 Remove the solenoid control box housing cover (5) and disconnect the positive cable (78). Replace the cover.

4.5 Remove the two capscrews (32), lockwashers (33) and square nuts (43) securing the fairlead cable guide bracket (38) to the mounting cradle and remove the guide bracket.

4.6 Remove the two remaining top capscrews, lockwashers and nuts securing the lower housing to the cradle. With assistance remove the electric winch assembly from the mounting cradle.

Clutch

5 To remove the clutch assembly from the upper housing proceed as follows:

5.1 Disconnect the vehicle battery.

5.2 With the clutch in the engaged position, remove the four screws (Fig 1 (70)) securing the clutch assembly (73) to the upper housing (8).

5.3 Slide the clutch assembly out, just far enough to see the key on the armature shaft.

5.4 Rotate the drum to bring the key to the top of the shaft.

5.5 Remove the key and clutch assembly.

Brake linings

6 To remove the brake linings from the upper housing proceed as follows:

6.1 Disconnect the vehicle battery.

WARNING ...

BE CAREFUL WHEN REMOVING THE SPECIAL TOOL. A SPRING (51) IS COMPRESSED BETWEEN THE PLATES.

6.2 Using special tool (Serial No 1) hold the brake assembly together prior to removal.

6.3 Remove the retaining ring (Fig 1 (57)) and slide the brake assembly from the shaft.

6.4 Lay the brake assembly on a flat surface and hold down firmly while removing the special tool (Serial No 1).

6.5 Remove the brake linings (58).

Wire rope

7 To remove the wire rope from the drum proceed as follows:

WARNING ...

ALWAYS WEAR HEAVY LEATHER GLOVES WHEN HANDLING THE WIRE ROPE.

7.1 Disconnect the vehicle battery.

7.2 Remove the two setscrews (Fig 1 (22)) and unscrew the end cap (21) from the end support.

7.3 Remove the 'U' bolt clamp (18) from the end of the wire rope.

7.4 Ensure that the clutch is disengaged and hand rotate the drum withdrawing the wire rope through the fairlead guide.

DISMANTLE

Electric winch assembly

8 To dismantle the electric winch assembly proceed as follows:

8.1 Remove the electric winch assembly from the vehicle (Para 4).

8.2 Remove the motor (10) from the upper housing (8).

8.3 Remove the three capscrews (Fig 1 (7)) securing the upper housing to the lower housing (68).

8.4 Allow the oil from the lower housing to drain into a suitable container.

8.5 Remove the four screws (70) and withdraw the clutch assembly (73).

8.6 Drive the cluster gear shaft (69) out of the cluster gear (13) from the motor mount side.

Caution ...

It is essential to secure the upper housing in a support fixture in order to avoid damage to the cluster gear bearings and upper housing.

8.7 With the housing secured to a support fixture remove the brake assembly and pinion (46) using a slide hammer.

Notes ...

(1) The retaining plate (15) should be lifted approximately 18 mm (0.75 in) to allow the pinion to be withdrawn.

(2) It is not necessary to remove the brake pinion in order to remove the drum.

8.8 Using special tool (Serial No 1) to hold the brake assembly together, remove the retaining ring (57) and withdraw the pinion (46) from the brake assembly.

8.9 Position the lower housing so that the drum is vertical and pull the retaining plate out until it releases the drum shaft (17).

8.10 Lift the drum assembly from the lower case.

8.11 Remove the drum shaft bushing (40-42).

8.12 Remove the silicone sealant from the mating surfaces of the upper and lower housings.

CLEANING

9 Thoroughly clean and degrease all components using a suitable solvent.

EXAMINATION

10 To examine the components proceed as follows:

10.1 Check the wire rope for frays, kinks and breakage.

10.2 Check the brake friction linings for wear.

10.3 Check battery cables are tight at all terminals and connections.

10.4 Check the splined cam to ensure it is free on the pinion.

10.5 Check seals and bushes and generally examine all components for wear and damage.

REPAIR AND REPLACEMENT

11 Replace all worn or damaged components using the available service kits.

REASSEMBLY

Electric winch assembly

12 To reassemble the electric winch assembly proceed as follows:

12.1 The drum shaft bushing (Fig 1 (42)) in the lower housing must be seated to the correct depth in order for the seal ring (41) to seal effectively. The dimension from the machined surface of the case to the bushing must be 4.8 mm (0.19 in). If this dimension is not correct the bushing must be relocated using special tool (Serial No 2) as follows:

12.1.1 Locate the special tool (Serial No 2) over the bushing.

12.1.2 Tap lightly with a hammer until the tool seats against the case.

12.2 Place the thrust washer (40) on the drum shaft with the flat side down. The step side must face the seal (41).

Note ...

If the thrust washer is flat on both sides, it must be replaced.

12.3 Place a new seal on the shaft and lightly grease the shaft, seal, thrust washer and bushing.

Caution ...

Too much grease will create a hydraulic action causing the seal lips to roll back during installation, resulting in possible leakage.

12.4 Slide the drum shaft into the lower housing taking care not to damage the seal ring.

12.5 Slide the retaining plate (15) down to engage the groove in the drum.

12.6 Position the winch vertically and replace the drum support bracket.

12.7 Replace the 'O' ring (45) on the brake pinion.

12.8 Grease the pinion lightly and slide it into the splined cam (47).

12.9 Slide the pinion into the brake assembly.

12.10 Ensure both keys (56) are in position and fit the retaining ring (57).

12.11 Install the intermediate gear (14) into the lower casing.

12.12 Coat the housing bore with a loctite sealer and insert the brake pinion (46) through and into the retaining plate (15).

12.13 Hold the brake pawl (66) slightly to clear the brake during installation.

12.14 Fit special tool (Serial No 2) between the seal (49) and the brake disc (50).

12.15 Tap the brake shaft with a soft face hammer until the seal is seated flush with the case.

12.16 Remove the special tool (Serial No 2).

12.17 Push the brake assembly in until the retaining plate drops down and locates the pinion in place.

12.18 Add 0.2 litres of automatic transmission fluid type F or SAE 20 non-detergent oil to the lower housing.

12.19 Apply silicone sealant in the groove of the upper housing and fit to the lower housing.

12.20 Secure with the three capscrews (7).

Clutch

13 To reassemble the clutch to the upper housing reverse the removal procedures (Para 5), ensuring that the motor pinion (74) is correctly located and a bead of silicone sealant is applied to the mating face of the clutch assembly prior to fitting.

Note ...

Take special care to avoid dropping the drive key.

Brake linings

14 To reassemble the brake linings proceed as follows:

14.1 If necessary, fit new brake linings (58), otherwise alternate the existing linings so that half the shoulders are on each side of the ratchet (53).

14.2 Lubricate the brake pawl (66) and the mounting boss of the lower housing.

14.3 Fit the pawl with the arm at the three o'clock position.

14.4 Fit the spring (64) with the bent arm pointing down.

14.5 Fit the protective cap (63), washer (62) and capscrew (61).

14.6 Rotate the brake pawl clockwise one full turn for correct spring tension.

14.7 Lightly grease the brake shaft.

14.8 Hold the brake pawl (66) slightly to clear the brake during installation.

14.9 Ensure both keys (56) are in position and fit the retaining ring (57).

Wire rope

15 To install wire rope to the drum proceed as follows:

WARNING ...

ALWAYS WEAR HEAVY LEATHER GLOVES WHEN HANDLING THE WIRE ROPE.

15.1 Pass the tapered end of the wire rope through the fairlead guide bracket (Fig 1 (38)), under and over the winch drum (17) and through the hole in the winch drum.

15.2 Remove the two setscrews (22) and plastic cap (21) from the end support (20).

15.3 Pull the tapered end of the wire rope out to fit the 'U' bolt clamp (18) and secure to the end of the wire rope.

15.4 Pull the wire rope back so that the 'U' bolt clamp returns and is held firmly on the inside of the drum.

15.5 Replace the plastic cap (21) to the end support (20) and secure with the two setscrews (22).

15.6 Select 'winch in' on the remote control hand grip and reeve the rope evenly onto the drum under a tension of at least 230 Kg (500 lb), until the final loop is held neatly by the fairlead guide.

Note ...

Always ensure that the wire rope on the winch drum 'winches in' and 'winches out' from the bottom of the drum so that correct automatic brake operation can take place when the electric winch is in use.

REFITTING

Electric winch assembly

16 To refit the electric winch assembly to the vehicle proceed as follows:

16.1 Disconnect the vehicle battery earth lead.

16.2 Locate the electric winch assembly to the rear of the vertical section of the mounting cradle.

16.3 Align the upper holes in the lower housing and drum end support with the upper holes in the vertical section of the mounting cradle. Loosely secure with the two capscrews (Fig 1 (32)) and lockwashers (33).

16.4 Align the holes in the fairlead guide cable bracket (38) with the holes in the vertical section of the mounting cradle and winch. Insert the two capscrews (32) and lockwashers (33) through the fairlead guide bracket and loosely secure with the square nuts (43).

Note ...

The drum end support must be tightened first to ensure that the drum rotates freely.

16.5 Lightly tighten gear side capscrews and align with end support (20). Assure that the drum rotates freely with the clutch disengaged. If the drum binds or does not rotate freely, relocate end support and repeat process.

16.6 Tighten the capscrews to 44 Nm (33 lbf ft).

WARNING ...

ALWAYS WEAR HEAVY LEATHER GLOVES WHEN HANDLING THE WIRE ROPE.

16.7 If the wire rope is already installed, feed the wire rope through the fairlead guide bracket and attach the hook (29) securing with cotter pin and split pin.

16.8 Remove the solenoid control box housing cover (5) and connect the positive cable (78). Replace the cover.

16.9 Connect the negative earth cable (12) to the winch motor negative terminal.

16.10 Reconnect the vehicle battery earth lead.

16.11 Before initial use of the electric winch, plug in remote control lead and test for proper forward and reverse operation (Para 17), keeping hands free of the wire rope.

TEST PROCEDURE

17 After repair and/or overhaul the winch must be tested to see if it is capable of performing in accordance with the manufacturer's specifications.

18 The winch must be secured to a mounting device which is capable of withstanding the maximum rated load. If during the course of repairs a new wire rope has been fitted, it must be stretched and respooled under load (Para 15.6) prior to the load testing of the winch. For test procedure proceed as follows:

18.1 Operate the clutch free wheeling device and put in the release mode.

18.2 Pull the cable off the drum by hand for five metres to see the winch is free of drag.

18.3 Depress the free wheeling device in the engaged mode and power out the remainder of the wire rope until six wraps remain on the drum.

Note ...

During this operation there should be no excessive overheating of the motor or end plate bearings.

18.4 Load test the winch to its maximum rated capability (Fig 2). This can be done by applying a progressive increasing load by use of a load cell/spring/tensioning device. The winch must be capable of operating to its maximum stated specification only on the first layer of the wire rope on the drum.

18.5 When the load test is completed the winch braking mechanism must be tested by securing a pulley at a height higher than that of the winch mounting and passing the wire rope up and over the pulley and suspending a load (Fig 3) or maintaining the equivalent applied force for a minimum of 15 minutes with a creep of no more than 35 per cent of a drums revolution after the brake has been applied. This test must be carried out after first lowering its load from a suspended position or after reeling out with the equivalent force applied.

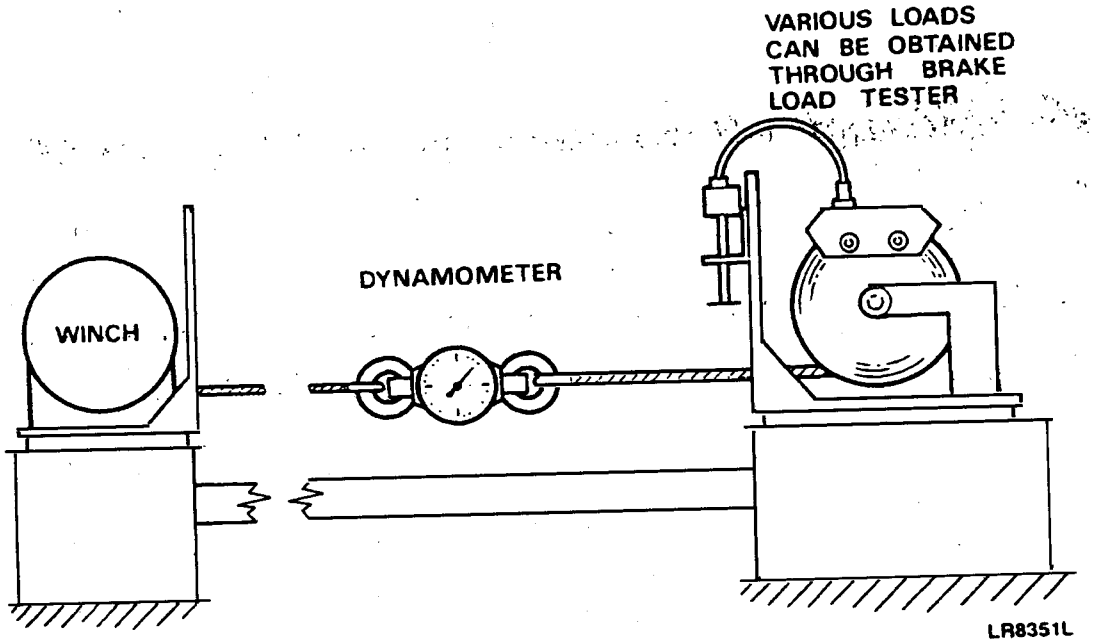


Fig 2 Dynamometer test

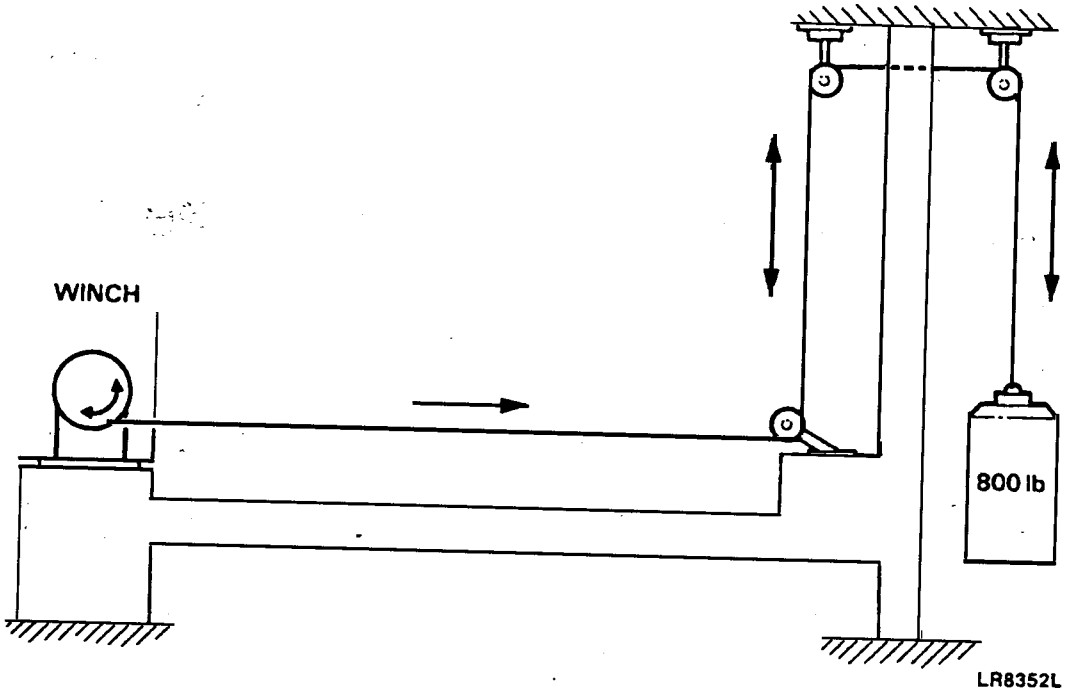


Fig 3 Brake test

Chapter 18-1

WINTERISED HEATING AND VENTILATION SYSTEM

UNIT AND FIELD REPAIRS

CONTENTS

INTRODUCTION

1 This Chapter details the Unit and Field repair procedures for the heating and ventilation system fitted to Land Rover 2.5 litre diesel winterised 90 and 110 vehicles.

GENERAL

2 Land Rover winterised 90 and 110 vehicles have been specifically designed to operate in extreme sub-zero climatic conditions. In order to meet the required specification a 'Webasto' DBW 46 water heater has been incorporated as an aid to engine cold start. The vehicle internal heater feed hose is connected into the water pre heater circuit, but only receives its hot water from the cooling system when propelled by the engine water pump after ignition. The water heater operates independently of the engine and is installed to raise coolant temperature prior to starting.

INTERIOR WATER HEATER CIRCUIT

Removal

Radiators

3 To remove the radiators from the vehicle proceed as follows:

3.1 Open the water stop tap mounted on the front face of rear bulkhead and drain the cooling system (Cat 522 Chap 12-1).

3.2 Remove the rear compartment radiators as follows:

3.2.1 Lift the rear seat cushions and support with straps in the upright position.

3.2.2 Withdraw the screws (Fig 1 (11)) and remove the plastic trim panels (12) to expose the radiator connections.

3.2.3 Release the clips (17) and remove the hoses (16) from the feed and return radiator ports.

3.2.4 Withdraw the screws (7) and washers (6) from the upper mounting blocks (8) and lift the radiator (9) clear from the lower mounting blocks.

3.2.5 If necessary, the copper tubing can be exposed by dismantling the radiator cowling.

3.3 Remove the battery box radiator as follows:

3.3.1 Disconnect and remove the vehicle batteries.

3.3.2 Release the clips (19) and remove the hoses (18) from the feed and return radiator ports.

3.3.3 Support the radiator base and from the passenger door side, withdraw the two screws (20) from the caged nuts. Remove the radiator (21) from the battery box.

3.3.4 If necessary, the copper tubing can be exposed by dismantling the radiator cowling.

Note ...

Copper connection repairs and replacements can be performed with the units removed from the vehicle by adopting standard soldering repair techniques.

Stop tap

4 To remove the stop tap from the water heater circuit proceed as follows:

4.1 Drain the cooling system (Cat 522 Chap 12-1).

4.2 Withdraw the screws (Fig 1 (13)) and remove the rear bulkhead panel (14).

4.3 Release the clips (5) and remove the hoses (1) from each end of the rear bulkhead pipes.

4.4 Release the two collar nuts (2) from each side of the tap connection (3) and withdraw the pipes from the tap.

4.5 Remove the operating handle (4) from the tap connection.

4.6 Withdraw the tap connection through the rear bulkhead grommet (15).

Refitting

Radiators

5 To fit the radiators to the vehicle proceed as follows:

5.1 Reverse the procedures instructed in Para 3.2 and 3.3.

5.2 Refill the cooling system (Cat 522 Chap 12-1).

5.3 Bleed the water heater circuit (Para 7).

Stop tap

6 To fit the stop tap to the water heater circuit proceed as follows:

6.1 Reverse the procedures instructed in Para 4.2 to 4.6 ensuring new ferrels are fitted to the tap connection pipes.

6.2 Refill the cooling system (Cat 522 Chap 12-1).

6.3 Bleed the water heater circuit (Para 7).

Bleeding the water circuit

7 To bleed the water circuit proceed as follows:

WARNINGS ...

(1) DO NOT REMOVE THE RADIATOR OR EXPANSION TANK FILLER CAPS WHEN THE ENGINE IS HOT. THE COOLING SYSTEM IS PRESSURISED AND THE RAPID RELEASE OF HOT COOLANT COULD RESULT IN PERSONAL INJURY.

(2) INADEQUATE BLEEDING COULD RESULT IN THE WATER HEATER OVERHEAT FUSE BLOWING DURING OPERATION.

7.1 Open the water heater outlet hose bleed valve (Fig 1 (22)) to allow the escape of air. Close the bleed valve when air free coolant is evident from the connection.

7.2 Open individually each of the two rear radiator bleed valves (10) to allow the escape of air. Close each bleed valve when air free coolant is evident from the connections.

7.3 If static bleeding is insufficient, operate the engine at high idle speed until the radiator thermostat opens.

7.4 Switch on the heater while the engine is running so that the circulating pump is actuated.

7.5 Repeat the procedures instructed in Para 7.1 and 7.2 adding coolant if required. After satisfactory bleeding is achieved, the water circulating pump will run almost without noise.

Key to fig 1

1 Hose
2 Collar nuts
3 Tap connection
4 Tap operating handle
5 Hose clip
6 Washer
7 Screw
8 Upper mounting block
9 Radiator
10 Radiator bleed valve
11 Screw
12 Trim panel
13 Screws
14 Rear bulkhead panel
15 Grommet
16 Hoses
17 Hose clips
18 Hose
19 Hose clip
20 Screw
21 Radiator
22 Water heater bleed valve

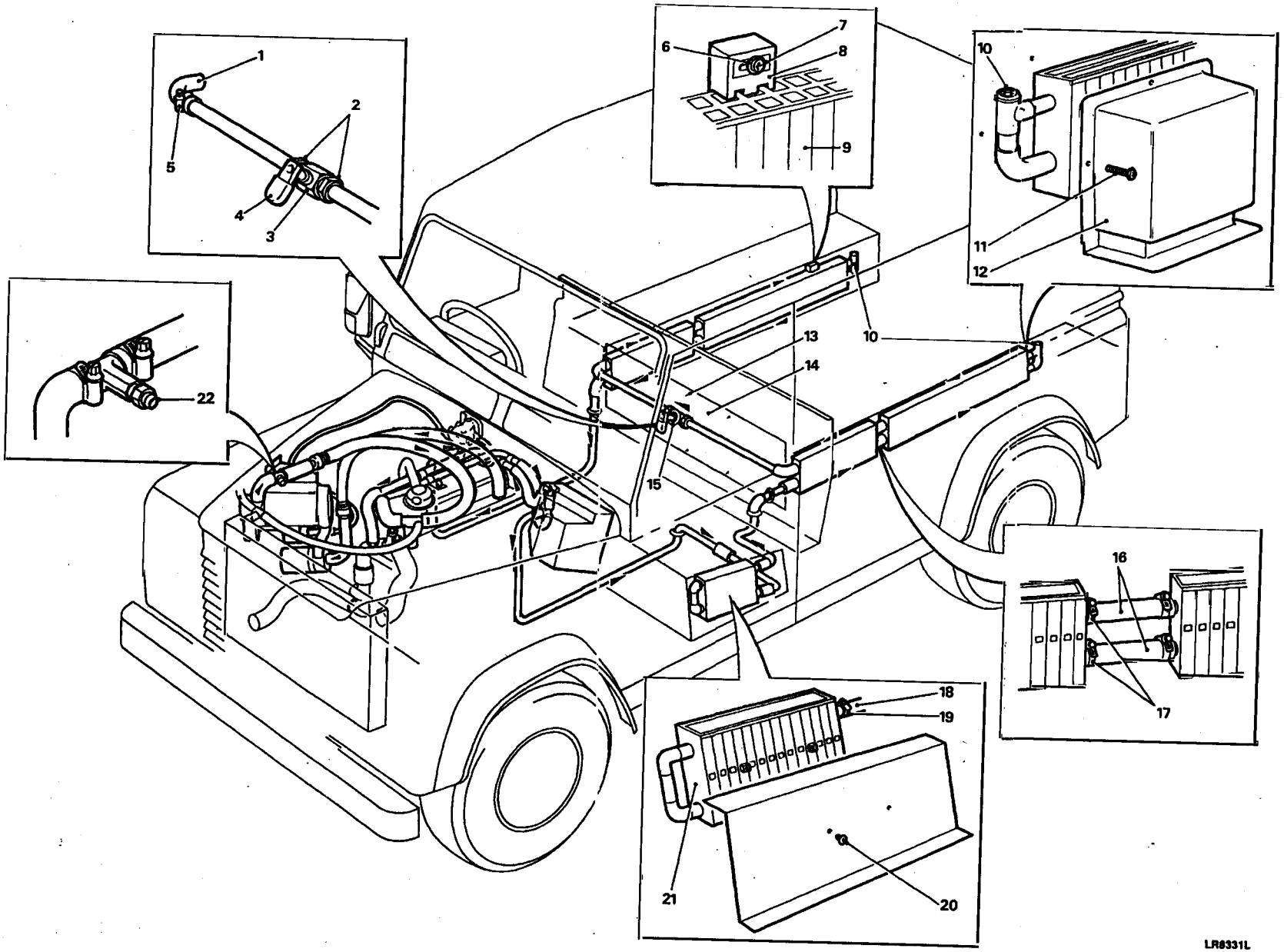


Fig 1

Water circuit radiator and tap installation

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