

82 - AIR CONDITIONING

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AIR CONDITIONING - REFRIGERANT SYSTEM

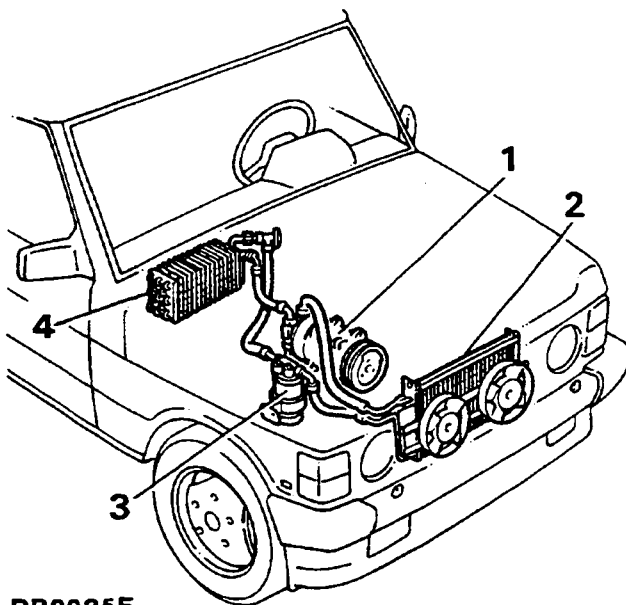
Description

For air conditioning air distribution system. See **HEATING AND VENTILATION, Description and operation, Air conditioning system (where applicable)**

The air conditioning system comprises four major units:

1. An engine-mounted compressor.
2. A condenser mounted in front of the radiator.
3. A receiver/drier unit located in the engine compartment.
4. An evaporator unit mounted behind the dashboard.

The four units are interconnected by hoses carrying refrigerant, and the evaporator is linked into the vehicle ventilation system.



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Refrigeration cycle

The function of the refrigeration circuit is to cool the evaporator.

1. Compressor

The compressor draws vaporized refrigerant from the evaporator. It is compressed, and thus heated, and passed on to the condenser as a hot, high pressure vapour.

2. Condenser

The condenser is mounted directly in front of the vehicle radiator. It consists of a refrigerant coil mounted in a series of thin cooling fins to provide the maximum heat transfer in a minimum amount of space. Airflow across condenser is induced by vehicle movement and is assisted by two electric condenser fans. The refrigerant enters the inlet at the top of the condenser as a heat laden high pressure vapour.

As this vapour passes down through the condenser coils, heat will follow its natural tendency and flow from the hot refrigerant vapour into the cooler air flowing across the condenser coils and fins.

When the refrigerant vapour reaches the temperature and pressure that will induce a change of state, a large quantity of latent heat will be transferred to the outside air. The refrigerant will change from a high pressure **HOT VAPOUR** to a high pressure **WARM LIQUID**.

3. Receiver drier

This unit filters, removes moisture, and acts as a reservoir for the liquid. To prevent icing inside the system, extreme precautions are taken during servicing to exclude moisture. The receiver drier should be considered as a second stage insurance to prevent the serious consequences of ice obstructing the flow.



NOTE: A sight glass provided in the unit top enables a visual check to be made of the high pressure liquid flow.



WARNING: Under no circumstances should refrigerant hoses be disconnected without first discharging the system

4. Expansion valve and evaporator

High pressure liquid refrigerant is delivered to the expansion valve. A severe pressure drop occurs across the valve and as the refrigerant enters the evaporator space at a temperature of approximately -6°C it boils and vaporizes. As this change of state occurs, a large amount of latent heat is absorbed. The evaporator is therefore cooled and as a result heat is extracted from the air flowing across the evaporator. The air flow is controlled by two evaporator fans regulated by the air conditioner fan control.

Second cycle

Low pressure vaporized refrigerant is drawn from the evaporator by the compressor and a second cycle commences.



**AIR CONDITIONING - ELECTRICAL -
MECHANICAL FAULTS**

FAULT	CAUSE	REMEDY
<p>A. MOTOR INOPERATIVE OR SLOW RUNNING</p>	<ol style="list-style-type: none"> 1. Incorrect voltage. 2. Open or defective fuse or relay. 3. Loose wire connection including ground. 4. Switch open or defective. 5. Tight, worn, or burnt motor bearings. 6. Open rotor windings. 7. Worn motor brushes. 8. Shaft binding-blade misaligned. 9. Defective resistors 	<ol style="list-style-type: none"> 1. Check voltage. 2. Check and replace as necessary. 3. Check system wires; tighten all connections. 4. Replace switch. 5. Replace motor. 6. Replace motor. 7. Replace motor. 8. Check alignment. Repair or replace as necessary. 9. Rectify or replace.
<p>B. CLUTCH INOPERATIVE</p>	<ol style="list-style-type: none"> 1. Incorrect voltage. 2. Open or defective fuse or relay. 3. Defective thermostat control or pressure switch. 4. Shorted or open field coil. 5. Bearing seized (clutch will not disengage). 6. Refrigeration circuit problem causing heavy load and excessive drive torque. 	<ol style="list-style-type: none"> 1. Check voltage. 2. Check and replace as necessary. 3. Replace thermostat or pressure switch. 4. Replace coil. 5. Replace bearing. 6. Check and rectify.
<p>C. CLUTCH NOISY</p>	<ol style="list-style-type: none"> 1. Incorrect alignment. 2. Loose belt. 3. Compressor not mounted securely. 4. Bearing in clutch-pulley assembly not pressed in. 5. Low voltage to clutch. 6. Clutch will not spin freely. 7. Oil on clutch face. 8. Slipping clutch. 9. Overloaded or locked compressor. 10. Icing. 	<ol style="list-style-type: none"> 1. Check alignment; repair as necessary. 2. Adjust to proper tension. 3. Repair as necessary. 4. Remove clutch and replace bearing. 5. Check connections and voltage. 6. Refer to B5 above. 7. Check compressor seals for leaks. 8. Refer to C5 above. 9. Repair or replace compressor. 10. Check for suction line frosting. Replace expansion valve if necessary. Replace receiver/drier if necessary.
<p>D. CONDENSER AND/OR EVAPORATOR VIBRATION</p>	<ol style="list-style-type: none"> 1. Motor and/or blades improperly mounted. 2. Foreign matter build-up on blades. 3. Excessive wear of motor bearings. 	<ol style="list-style-type: none"> 1. Check mountings, adjust as necessary. 2. Clean blades with a suitable non-inflammable cleaner. 3. Replace motor.

REFRIGERATION SYSTEM FAULTS

For any refrigeration system to function properly all components must be in good working order. The unit cooling cycle and the relationship between air discharge temperature and ambient temperature and the pressures at the compressor can help to determine proper operation of the system.

The length of any cooling cycle is determined by such factors as ambient temperature and humidity, thermostat setting, compressor speed and air leakage into the cooled area, etc. With these factors constant, any sudden increase in the length of the cooling cycle would be indicative of abnormal operation of the air conditioner.

The low and high side pressures at the compressor will vary with changing ambient temperature, humidity, in-car temperature and altitude.

The following items should be checked before operating the system:

1. Compressor drive belt tension.
2. Compressor magnetic clutch operation.
3. Condenser fan operation.
4. Condenser fins, dirt will cause poor cooling and higher operating temperatures.

The following conditions should be checked after operating the system for several minutes:

1. All high pressure lines and components should be hot to the touch.
2. All low pressure lines should be cool to the touch.
3. Inlet and outlet temperatures at the receiver/drier should be at the same temperature (warm). Any very noticeable temperature difference indicates a blocked receiver/drier.
4. Heavy frost on the inlet to the expansion valve may indicate a defective valve or moisture in the system.
5. With ambient humidity between 30% and 60%, compressor pressures and evaporator air discharge temperature should fall within the general limits given in the table below.

Type of Weather	Evaporator Air Temp °F (°C)	Low Side Pressure p.s.i. (bar)	High Side Pressure p.s.i. (bar)
70-80°F (21-27°C)	35-45°F (1.7-7.2°C)	15-20 (1.1-1.4)	160-200 (11.2-14)
80-90°F (27-32°C)	40-50°F (4.4-10°C)	20-25 (1.4-1.8)	190-240 (13.4-16.9)
Over 90°F (Over 32°C)	45-60°F (7.2-15.6°C)	25-30 (1.8-2.1)	220-270 (15.5-19)

1. Low and high side pressures are guides not specific limits.
2. Evaporator air temperatures will be lower on dry days, higher on humid days.



FAULT	CAUSE	REMEDY
<p>A. HIGH HEAD PRESSURE</p>	<ol style="list-style-type: none"> 1. Overcharge of refrigerant. 2. Air in system. 3. Condenser air passage clogged with dirt or other foreign matter. 4. Condenser fan motor defective. 	<ol style="list-style-type: none"> 1. Discharge, evacuate and charge system. 2. Discharge system, fit new drier, evacuate and charge system. 3. Clean condenser of debris. 4. Replace motor.
<p>B. LOW HEAD PRESSURE</p>	<ol style="list-style-type: none"> 1. Undercharge of refrigerant; evident by bubbles in sight glass while system is operating 2. Split compressor gasket or leaking valves. 3. Defective compressor. 	<ol style="list-style-type: none"> 1. Evacuate and charge system. Check for leakage. 2. Replace gasket and/or reed valve. Fit new drier, evacuate and charge system. 3. Repair or replace compressor.
<p>C. HIGH SUCTION PRESSURE</p>	<ol style="list-style-type: none"> 1. Loose compressor belt 2. Refrigerant flooding through evaporator into suction line; evident by ice on suction line and suction service valve. 3. Expansion valve stuck open. 4. Compressor suction valve strainer restricted. 5. Leaking compressor valves, valve gaskets and/or service valves. 6. Receiver/drier stopped; evident by temperature difference between input and output lines. 	<ol style="list-style-type: none"> 1. Adjust belt tension. 2. Check thermobulb. Bulb should be securely clamped to clean horizontal section of copper suction pipe. 3. Replace expansion valve. 4. Remove and clean or replace strainer. 5. Replace valves and/or gaskets. Fit new drier evacuate and charge system. 6. Fit new drier, evacuate and charge system.
<p>D. LOW SUCTION</p>	<ol style="list-style-type: none"> 1. Expansion valve thermobulb not operating. 2. Expansion valve sticking closed. 3. Moisture freezing in expansion valve orifice. Valve outlet tube will frost while inlet hose tube will have little or no frost. System operates periodically. 4. Dust, paper scraps, or other debris restricting evaporator blower grille 5. Defective evaporator blower motor, wiring, or blower switch. 	<ol style="list-style-type: none"> 1. Warm thermobulb with hand. Suction should rise rapidly to 20 lb or more. If not replace expansion valve. 2. Check inlet side screen. Clean if clogged. Refer to C-2 and C-3. 3. Fit new drier, evacuate and charge system. 4. Clean grilles as required. 5. Refer to Fault Diagnosis Chart for blower motor.

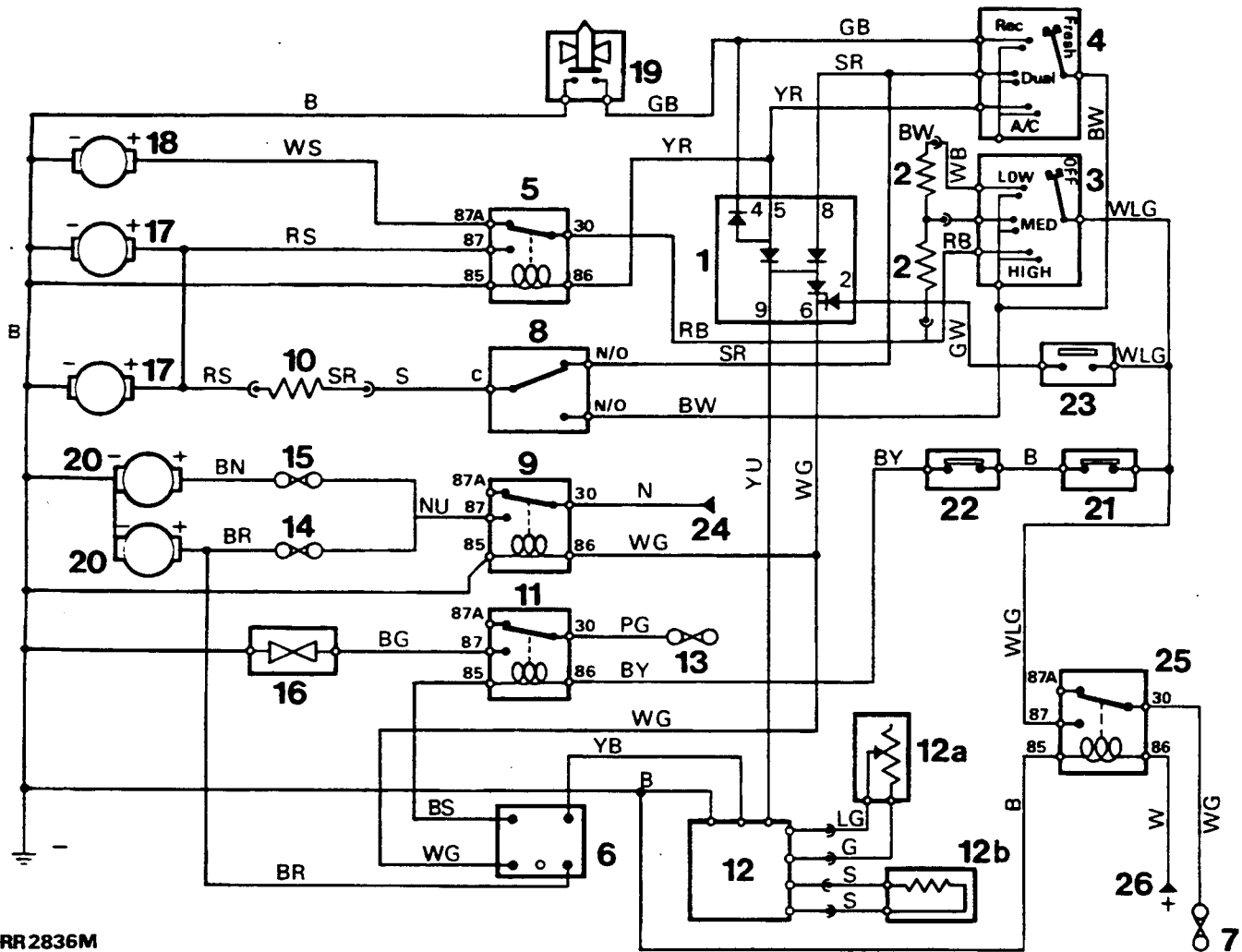
FAULT	CAUSE	REMEDY
E. NOISY EXPANSION VALVE (steady hissing)	1. Low refrigerant charge; evident by bubbles in sight glass.	1. Leak test. Repair or replace components as required.
F. INSUFFICIENT COOLING	1. Expansion valve not operating properly. 2. Low refrigerant charge-evident by bubbles in sight glass. 3. Compressor not pumping.	1. Refer to C-2, C-3, D-1 and E. 2. Refer to B-1 and E. 3. Refer to B-2 and B-3
G. COMPRESSOR BELT SLIPPING	1. Belt tension. 2. Excessive head pressure. 3. Incorrect alignment of pulleys or worn belt not riding properly. 4. Nicked or broken pulley. 5. Seized compressor.	1. Adjust belt tension. 2. Refer to A-1 through A-4 and C-6. 3. Repair as needed. 4. Replace as needed. 5. Replace compressor.
H. ENGINE NOISE AND/OR VIBRATION	1. Loose or missing mounting bolts. 2. Broken mounting bracket. 3. Loose flywheel or clutch retaining bolt. 4. Rough idler pulley bearing. 5. Bent, loose, or improperly mounted engine drive pulley. 6. Defective compressor bearing. 7. Insecure mountings of accessories; generator, power steering, air filter, etc. 8. Excessive head pressure. 9. Incorrect compressor oil level.	1. Repair as necessary. 2. Replace bracket. 3. Repair as necessary. 4. Replace bearing. 5. Repair as necessary. 6. Replace bearing. 7. Repair as necessary. 8. Refer to A-1, A-2, A-3 A-4 and C-6. 9. Refer to compressor Oil Level Check.

HEATER AND AIR CONDITIONING - CIRCUIT DIAGRAM ON 1992 MODEL YEAR

1. For details of heating and air conditioning electrics, for 1992 Models on, see separate publication Range Rover Electrical Trouble Shooting Manual.



HEATER AND AIR CONDITIONING - CIRCUIT DIAGRAM 1990 MODEL YEAR



RR2836M

- | | |
|---|---|
| 1. Diode pack. | 14. Fuse B8. |
| 2. Resistors. | 15. Fuse B9. |
| 3. Fan speed switch. | 16. Compressor clutch. |
| 4. Air conditioning/re-circ/fresh air switch. | 17. Air conditioning motors (2) - dashboard unit. |
| 5. Heater/air conditioning relay. | 18. Heater motor. |
| 6. Cable connection to ECU (EFI). | 19. Fresh air solenoid. |
| 7. Fuse C9 - main fuse panel. | 20. Condenser fan motors. |
| 8. Face vent switch. | 21. High pressure switch. |
| 9. Condenser fan relay. | 22. Low pressure switch. |
| 10. Two level resistor. | 23. Engine coolant temperature switch. |
| 11. Compressor clutch relay. | 24. 12V from terminal post. |
| 12. Thermostat. | 25. Heater/air con load relay |
| 13. Fuse B7. | 26. 12V from ignition load relay |



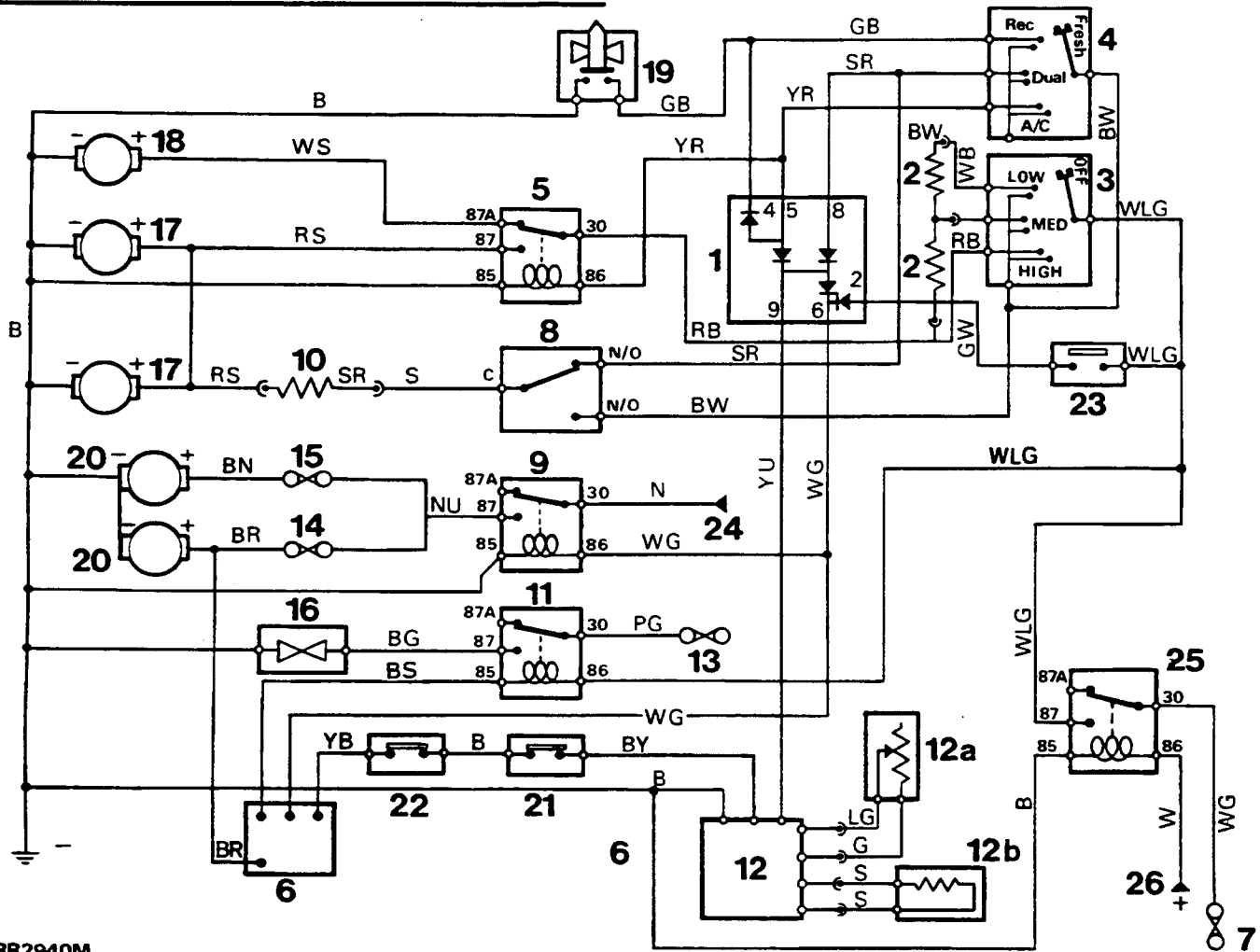
NOTE: For details of air conditioning inputs to ECU. See *FUEL SYSTEM, Fault diagnosis, Fuel injection - circuit diagram - 1990 - 1991*

Cable colour code

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

The last letter of a colour denotes the tracer colour.

HEATER AND AIR CONDITIONING - CIRCUIT DIAGRAM 1991 MODEL YEAR



RR2940M

- 1. Diode pack.
- 2. Resistors.
- 3. Fan speed switch.
- 4. Air conditioning/re-circ/fresh air switch.
- 5. Heater/air conditioning relay.
- 6. Cable connection to ECU (EFI).
- 7. Fuse C9 - main fuse panel.
- 8. Face vent switch.
- 9. Condenser fan relay.
- 10. Two level resistor.
- 11. Compressor clutch relay.
- 12. Thermostat.
- 12a. Temperature control potentiometer.
- 12b. Evaporator temperature sensor.
- 13. Fuse B7.
- 14. Fuse B8.
- 15. Fuse B9.
- 16. Compressor clutch.
- 17. Air conditioning motors (2) - dashboard unit.
- 18. Heater motor.
- 19. Fresh air solenoid.
- 20. Condenser fan motors.
- 21. High pressure switch.
- 22. Low pressure switch.
- 23. Engine coolant temperature switch.
- 24. 12V from terminal post.
- 25. Heater/air con load relay.
- 26. 12V from ignition load relay.

NOTE: For details of air conditioning inputs to ECU. See *FUEL SYSTEM, Fault diagnosis, Fuel injection - circuit diagram - 1990 - 1991*

Cable colour code

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

The last letter of a colour denotes the tracer colour.

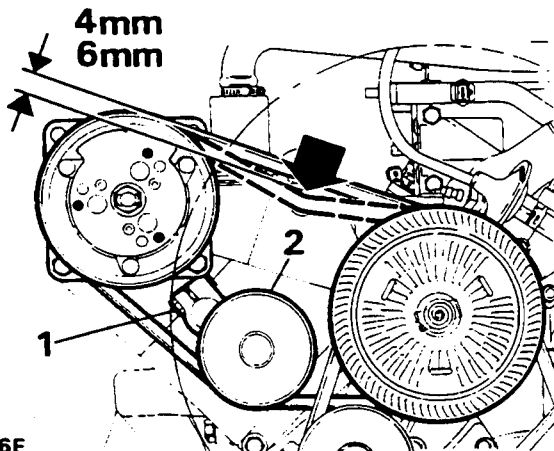


COMPRESSOR DRIVE BELT

Service repair no - 82.10.01.

Adjust

1. Slacken idler pulley securing bolt.



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2. Adjust position of idler pulley until correct tension is obtained. The belt must be tight with 4 to 6 mm total deflection when checked by hand midway between pulleys on the longest run.
3. Tighten securing bolt and recheck tension.



GENERAL SERVICE INFORMATION

INTRODUCTION

Before any component of the air conditioning system is removed, the system must be discharged. When the component is replaced, the system must be evacuated to remove all traces of old refrigerant and moisture. The system must then be recharged with refrigerant.



WARNING: All work involving the handling of refrigerant requires special equipment, a knowledge of its proper use and attention to safety measures.

SERVICING EQUIPMENT

The following equipment is required for full servicing of the air conditioning system.

Charging station
Leak detector
Safety goggles and gloves
Refrigerant charging line seals
Thermometer +20°C to -60°C
Compressor dipstick
Recovery and recycling equipment

SERVICING MATERIALS

Refrigerant: Refrigerant 12, which includes Freon 12 or Arcton 12.



CAUTION: Methychloride refrigerants must not be used.

Compressor oil: *See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended lubricants and fluids*

PRECAUTIONS IN HANDLING REFRIGERANT

Refrigerant 12 is transparent and colourless in both the gaseous and liquid state. It has a boiling point of -29.8°C at atmospheric pressure and at all normal pressures and temperatures it becomes a vapour. The vapour is heavier than air, non-flammable, and non-explosive. It is non-poisonous except when in contact with an open flame, and non-corrosive until it comes in contact with water.

FIRST AID: If refrigerant should contact the eyes or skin, splash the eyes or affected area with cold water for several minutes. Do not rub. As soon as possible thereafter, obtain treatment from a doctor or eye specialist.

The following precautions in handling Refrigerant 12 should be observed at all times.

DO NOT:

- Leave refrigerant container open to atmosphere.
- Carry refrigerant container inside a vehicle.
- Subject refrigerant containers to high temperature.
- Weld or steam clean near an air conditioning system.
- Expose eyes or skin to liquid refrigerant.
- Discharge refrigerant vapour into an area with an exposed flame or into an engine intake. Heavy concentrations of refrigerant in contact with naked flame produce a toxic gas, phosgene.
- Allow liquid refrigerant to contact bright metal, it will tarnish metal and chrome surfaces, and combined with moisture can seriously corrode all metal surfaces.

PRECAUTIONS IN HANDLING REFRIGERANT LINES

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

1. When disconnecting any hose or flexible connection the system must be discharged of all pressure. Proceed cautiously, regardless of gauge readings. Open connections slowly, keeping hands and face well clear, so that no injury occurs if there is liquid in the line. If pressure is noticed, allow it to bleed off slowly.
2. Lines, flexible end connections and components must be capped immediately they are opened to prevent the entrance of moisture and dirt.
3. Any dirt or grease on fittings must be wiped off with a clean alcohol dampened cloth. Do not use chlorinated solvents such as trichloroethylene. If dirt, grease or moisture cannot be removed from inside the hoses, they must be replaced with new hoses.
4. All replacement components and flexible end connections must be sealed, and only opened immediately prior to making the connection.
5. Ensure the components are at room temperature before uncapping, to prevent condensation of moisture from the air that enters.
6. Components must not remain uncapped for longer than fifteen minutes. In the event of delay, the caps must be fitted.
7. Receiver/driers must never be left uncapped as they contain Silica Gel crystals which will absorb moisture from the atmosphere. A receiver/ drier left uncapped must not be used, fit a new unit.
8. The compressor shaft must not be rotated until the system is entirely assembled and contains a charge of refrigerant.
9. A new compressor contains an initial charge of 135 ml of oil when received, part of which is distributed throughout the system when it has been run. The compressor contains a holding charge of gas when received which should be retained until the hoses are connected.
10. The receiver/drier should be the last component connected to the system to ensure optimum dehydration and maximum moisture protection of the system.
11. All precautions must be taken to prevent damage to fittings and connections. Slight damage could cause a leak with the high pressures used in the system.
12. Always use two wrenches of the correct size, one on each fitting when releasing and tightening refrigeration unions.
13. Joints and 'O' rings should be coated with refrigeration oil to aid correct seating. Fittings which are not lubricated with refrigerant oil are almost certain to leak.
14. All lines must be free of kinks. The efficiency of the system is reduced by a single kink or restriction.
15. Flexible hoses should not be bent to a radius less than ten times the diameter of the hoses.
16. Flexible connections should not be within 50mm of the exhaust manifold.
17. Completed assemblies must be checked for refrigeration lines touching metal panels. Any direct contact of lines and panels transmits noise and must be eliminated.



PERIODIC MAINTENANCE

Routine servicing, apart from visual checks, is not necessary. The visual inspections are as follows:

Condenser

With a garden hose or air line, clean the fins of the condenser to remove flies, leaves, etc. Check the hose connection for signs of oil leakage.

Compressor

Check hose connections for signs of oil leakage. Check flexible hoses for swelling. Examine the compressor belt for tightness and condition. Checking the compressor oil level and topping-up is only necessary after charging the system or in the event of a malfunction of the system.

Receiver/Drier

Examine the sight glass for bubbles with the system operating. Check connections for leakage.

Evaporator

Examine the refrigeration connections at the unit. If the system should develop a fault, or if erratic operation is noticed, refer to the fault diagnosis chart.

SERVICE VALVES

These are secured to the head of the compressor, and the suction and discharge flexible end connections are secured to them by unions.

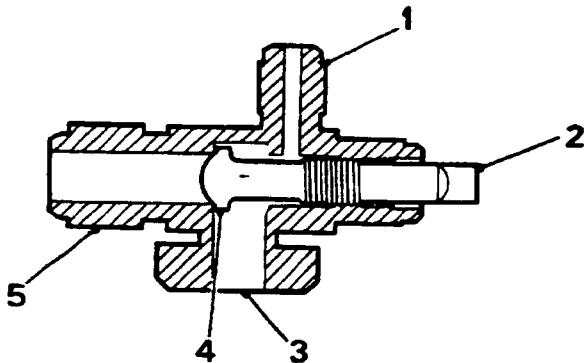
The service valves are identified as suction or low pressure, and discharge or high pressure. Whilst they are identical in operation they are not interchangeable, as the connections are of different sizes.

The valve with the larger connections fits the suction side. As the name suggests, these valves are for service purposes, providing connections to external pressure/vacuum gauges for test purposes. In combination with charging and testing equipment they are used to charge the system with refrigerant.

Stem type

Stem type service valves allow for the isolation of the compressor from other parts of the system. When these valves are used in conjunction with the liquid line quick-disconnect fittings, the three major assemblies of the system can be removed from the vehicle with a minimal loss of refrigerant. In addition, it is possible to remove major assemblies for repair of components which are not part of the refrigeration system, or provide access to parts of the vehicle which are obstructed by the air conditioning system, without fully discharging the system.

WARNING: A thorough understanding of the stem type service valve is necessary before undertaking servicing or repair involving the air conditioning system.

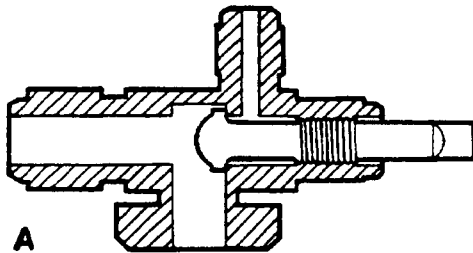


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Service valve key

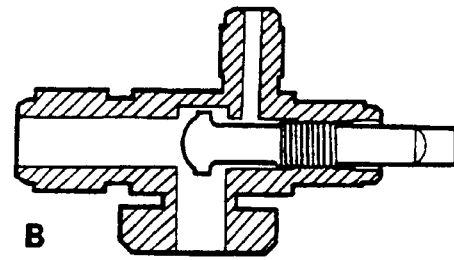
1. Service port.
2. Valve stem.
3. Compressor port.
4. Valve seat.
5. Hose connector.

Service valve positions



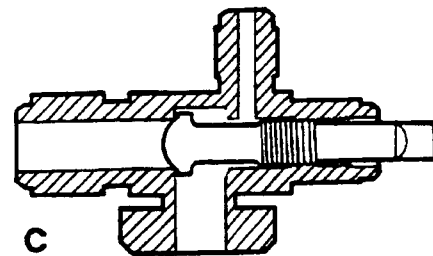
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- A. ON: FULLY COUNTER-CLOCKWISE** - Normal operating position, and the position which is used for connecting and disconnecting the manifold gauge set, is the 'on' position. The stem is turned fully counter-clockwise. This seals the service gauge port from receiving any refrigerant flow.



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- B. MID (Test) POSITION** - After the service gauge manifold has been installed (the valve stem is in the on position), turn the valve stem the required number of turns clockwise. This will put the valve stem seat midway in the service valve and allow full system operation while permitting refrigerant pressure to reach the gauges.



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- C. OFF: FULLY CLOCKWISE** - With the service valve stem turned fully clockwise, the valve will block passage of refrigerant flow through the system. As illustrated, the refrigerant flow to or from the compressor (depending on whether it is high side or low side) is blocked.



WARNING: NEVER operate the air conditioning system with the service valves in the OFF POSITION, it will cause severe damage to the compressor.



CHARGING AND TESTING EQUIPMENT

Service repair no - 82. 30. 02/01

This is standard equipment for the servicing of automotive air conditioning systems, and is used for all testing, trouble shooting, evacuating and charging operations.

It is recommended that the operator adheres to the appropriate manufacturers' instructions for the equipment in use.



WARNING: The air conditioning system is charged with a high pressure, potentially toxic refrigerant. Repairs or servicing must only be carried out by an operator familiar with both the vehicle system and the charging and testing equipment.

All operations must be carried out in a well-ventilated area away from open flame and heat sources.

Always wear safety goggles and gloves when opening refrigerant connections.

Connecting

1. Check both service valves are fully open.
2. Remove dust caps from gauge connections on service ports.
3. Coat threads and flares with compressor oil.
4. Connect the charging and testing equipment referring to manufacturer's instructions.

Remove

5. Engine must be stopped prior to disconnecting equipment.
6. Close both service ports.
7. Disconnect charging lines.
8. Refit dust caps to compressor valve stems, service ports and charging lines.

DISCHARGING SYSTEM



NOTE: Before discharging, see General service information. Always use refrigerant recovery and recycling equipment where available following manufacturers instructions.



WARNING: Wear eye and hand safety protection. Open connections slowly in case liquid or pressure is present. Allow to bleed off slowly.

Discharging

1. Connect manifold gauge set according to manufacturer's instructions.
2. Connect recycling and recovery of refrigerant equipment.
3. Slowly open high side valve until refrigerant flow stops, open low side valve to remove any residual pressure.
4. When discharging refrigerant, maintain a gentle flow.
5. Measure the amount of oil discharged from the system. Add an equal amount of new oil to system during charging operation.



CAUTION: When disconnecting compressor hoses, the compressor should be sealed by closing relevant service valve. It is essential to ensure that both service valves are open before operating compressor.

EVACUATE SYSTEM

If air conditioning system is opened to atmosphere it must be evacuated to remove all air and moisture. Evacuating is necessary before charging system and also provides a system check for leaks.

Evacuating

1. Discharge system. *See Discharging system*
2. Connect charging and testing equipment referring to manufacturer's instructions.
3. Slowly open vacuum control valve to avoid removing residual oil in system.
4. Low side gauge should indicate a vacuum of 660mm Hg in five minutes.
5. If this is not achieved it shows system leaks or vacuum pump is defective.
6. Check vacuum pump, if working properly, then leak test air conditioning system.
7. Continue evacuating for 30 minutes to ensure removal of all moisture.
8. Stop vacuum pump and check vacuum holds for few minutes. Any pressure rise denotes a leak or moisture remaining in system. Remedy as necessary.
9. Once system is evacuated, it is ready for charging.

QUICK FLUSHING



NOTE: This operation is in addition to evacuating, and removes excess moisture content from systems left open to atmosphere.

1. Fit a new receiver drier. *See Receiver drier*
2. Connect charging and testing equipment and follow the equipment manufacturer's instructions for quick flushing.
3. Evacuate system.
4. Charge system with about 0.35 Kg of refrigerant.
5. Allow refrigerant introduced to remain for ten minutes.
6. Evacuate system. *See Evacuate system*



CHARGING SYSTEM



CAUTION: Do not charge liquid refrigerant into compressor. Liquid cannot be compressed. If liquid refrigerant enters compressor inlet valve, severe damage is possible. Also compressor oil may be absorbed into refrigerant, causing damage when compressor is operated.

Charging

1. Evacuate system. *See Evacuate system*
2. Follow manufacturer's instructions for charging system with refrigerant.
3. Ensure that full charge of refrigerant: 1.19 kg is drawn into system.
4. Check system operates satisfactorily with a pressure test. *See Pressure test system*



CAUTION: Overcharging air conditioning system will cause excessive head pressure.

LEAK TEST SYSTEM

The following instructions refer to an electronic type refrigerant leak detector which is the safest, most sensitive and widely used.

1. Place the vehicle in a well ventilated area but free from draughts, as leakage from the system could be dissipated without detection.
2. Follow the instructions issued by the manufacturer of the particular leak detector being used.
3. Commence searching for leaks by passing the detector probe around all joints and components, refrigerant gas is heavier than air.
4. Insert the probe into an air outlet of the evaporator or into the evaporator drain tube. Switch the air conditioning blower on and off at intervals of ten seconds. Any leaking refrigerant will be gathered in by the blower and detected.
5. Insert the probe between the magnetic clutch and compressor to check the shaft seal for leaks.
6. Check all service valve connections, valve plate, head and base plate joints and back seal plate.
7. Check the condenser for leaks at the hose connections.
8. If any leaks are found, the system must be discharged before rectification.
9. Rectify any leaks and recheck for leaks during evacuation prior to charging.

PRESSURE TEST SYSTEM

1. Fit charging and test equipment.
2. Start engine.
3. Run engine at 1,000 to 1,200 rev/min. Adjust heat controls: Set to cold, close air supply to dash vents, slide levers to air conditioning 'ON' and fan speed to maximum.
4. Note ambient temperature in immediate test area check high pressure gauge readings. Discharge side - against Table 1.
5. If pressure readings are outside limits quoted, refer to fault diagnosis. *See Fault diagnosis, Air conditioning - electrical - mechanical faults*
6. Stop engine.
7. Close both service ports and close all valves on charging and test equipment. Disconnect charging lines from compressor. Refit dust caps to compressor valve stems, port connections and charging lines.

Pressure gauge readings will vary within range quoted with rate of flow of air over condenser, higher readings resulting from a low air flow. A blower fan is recommended for additional air flow over condenser if temperatures are over 27°C, so consistent analysis can be made of readings.

Table 1

Ambient Temperature		Compound Gauge Readings		High Pressure Gauge Readings	
°C	°F	bar	p.s.i.	bar	p.s.i.
16	60	1,03-1,4	15-20	6,9-10,3	100-150
26,7	80	1,4-1,72	20-25	9,6-13,1	140-190
38	100	1,72-2,1	25-30	12,4-15,5	180-225
43,5	110	2,1-2,4	30-35	14,8-17,2	215-250



SYSTEM TEST

1. Place the vehicle in a ventilated, shaded area free from excessive draught, with the doors and windows open.
2. Check that the surface of the condenser is not restricted with dirt, leaves, flies, etc. Do not neglect to check the surface between the condenser and the radiator. Clean as necessary.
3. Switch on the ignition and the air conditioner air flow control. Check that the blower is operating efficiently at low, medium and high speeds. Switch off the blower and the ignition.
4. Check that the evaporator condensate drains are open and clear.
5. Check the tension of the compressor driving belt, and adjust if necessary.
6. Inspect all connections for the presence of refrigerant oil. If oil is evident, check for leaks, and repair as necessary.
7. Start the engine.
8. Set the temperature control switch to maximum cooling and switch the air conditioner blower control on and off several times, checking that the magnetic clutch on the compressor engages and releases each time.
9. With the temperature control at maximum cooling and the blower control at high speed, warm up the engine and fast idle at 1,000 rev/min. Check the sight glass for bubbles or foam. The sight glass should be generally clear after five minutes running, occasional bubbles being acceptable. Continuous bubbles may appear in a serviceable system on a cool day, or if there is insufficient air flow over the condenser at a high ambient temperature.
10. Repeat at 1,800 rev/min.
11. Gradually increase the engine speed to the high range, and check the sight glass at intervals.
12. Check for frosting on the service valves and evaporator fins.
13. Check the high pressure hoses and connections by hand for varying temperature. Low temperature indicates a restriction or blockage at that point.
14. Switch off the air conditioning blower and stop the engine.
15. If the air conditioning equipment is still not satisfactory, proceed with the pressure test as previously described in this section.



NOTE: The compressor oil is soluble in Refrigerant 12 and is deposited when the refrigerant evaporates from a leak.

COMPRESSOR

Service repair no - 82.10.20.

Remove and refit

Remove

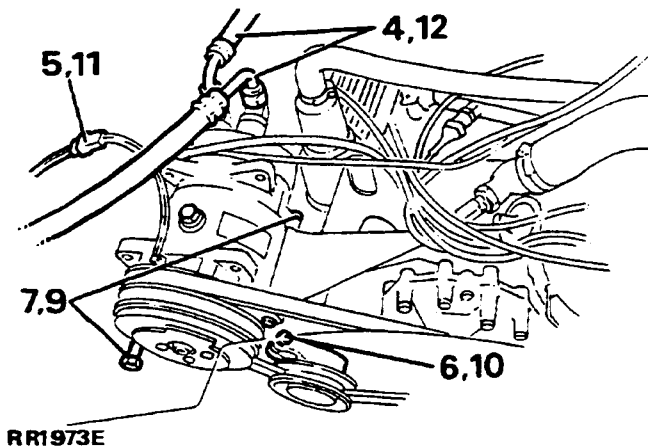
1. Site vehicle in a ventilated area.
2. Disconnect the battery negative lead.
3. Discharge the air conditioning system. **See *Discharging system***

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

4. Disconnect suction and discharge unions from compressor.
5. Disconnect electrical lead to compressor clutch.
6. Slacken idler pulley and release drive belt.
7. Remove the two compressor mounting bolts and lift compressor clear.

Refit

8. If a new compressor is being fitted, drain oil from new compressor. Drain and measure oil from old compressor. Measure new oil equal to amount drained from old compressor. Add 30 ml of new oil to this amount and refill new compressor.
9. Locate compressor in position, fit and tighten mounting bolts.
10. Fit compressor drive belt. **See *Adjustment, Compressor drive belt***
11. Connect electrical lead to compressor clutch at the connector.
12. Evacuate air conditioning system. **See *Evacuate system***
13. Charge air conditioning system. **See *Charging system***





COMPRESSOR OIL LEVEL

Type: Sanden 709

Check

It is **not** necessary to check compressor oil level as part of routine maintenance.

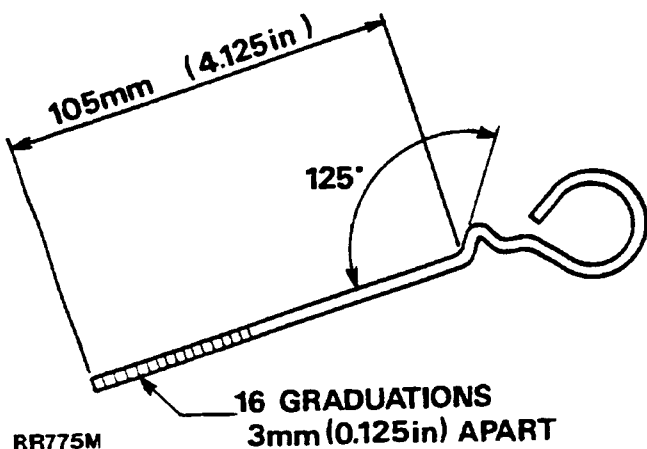


NOTE: The compressor oil level should be checked whenever any components, are removed and refitted, or when a pipe or hose has been removed and reconnected or, if a refrigerant leak is suspected.

All compressors are factory charged with 135 ± 15 ml of oil. When air conditioning equipment is operated some of the oil circulates throughout the system with the refrigerant, the amount varying with engine speed. When the system is switched off oil remains in the pipe lines and components, so the level of oil in compressor is reduced, by approximately 30 ml.

The compressor oil level must finally be checked after the system has been fully charged with refrigerant and operated to obtain a refrigerated temperature of the car interior. This ensures correct oil balance throughout the system.

The compressor is not fitted with an oil level dipstick, and a suitable dipstick must be made locally from 3mm diameter soft wire in accordance with accompanying illustration. After shaping, mark the end of dipstick with sixteen graduations 3mm apart.



Procedure

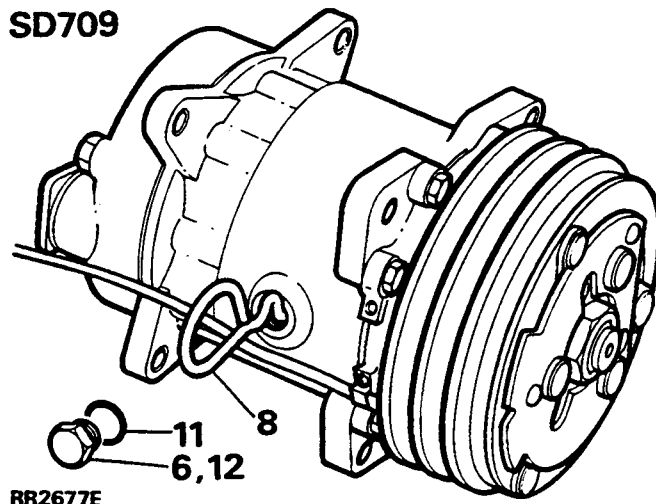
1. Open the bonnet.
2. Fit charging and testing equipment.
3. Start engine and turn temperature control to maximum cooling position, and the air flow control to **HIGH** speed. Operate system for ten minutes at engine idle speed.



CAUTION: Open valve slowly to avoid sudden pressure reduction in compressor crankcase that could cause oil to leave the compressor.

4. Reduce engine speed to idling, and **SLOWLY** open suction side valve on the test equipment until the compound gauge reads 0 or below.
5. Stop engine at this point and quickly open suction valve and discharge valve.

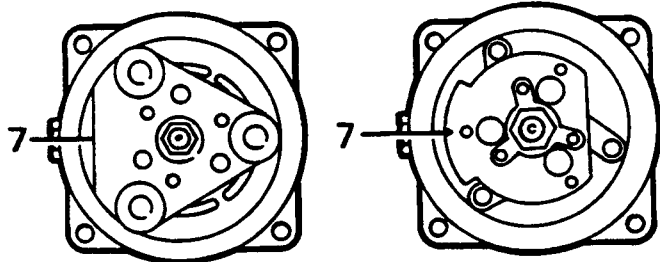
SD709



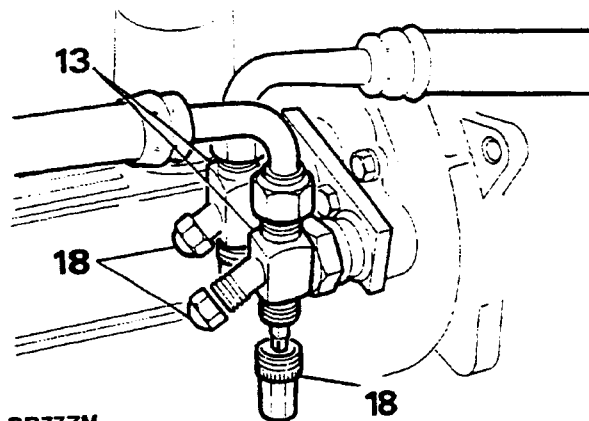
6. Slacken oil filler plug and unscrew it slowly by five turns to bleed off crankcase pressure.



NOTE: The oil filler plug on compressors fitted to Diesel engines is opposite side to that shown. Oil check procedure is the same.



RR3786M



RR777M

7. Remove oil filler plug. Align counterweight to position shown to enable dipstick to be inserted to its full length.
8. Wipe dipstick and insert to its stop position, ensuring the angle of dipstick is flush with the surface of filler orifice.
9. Withdraw dipstick and count the number of graduations to determine depth of oil.
10. **Oil level - SD 709:** fifteen to sixteen graduations. Add or remove oil as necessary until the mid-range figure is obtained. It is recommended that a syringe is used for adding or removing oil. Use only the correct compressor oil. **See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended lubricants and fluids**
11. Lubricate new 'O' ring with compressor oil, fit to level plug and install loosely.
12. Evacuate air from compressor. Tighten filler plug to **10 Nm**. **See Evacuate system**
13. Close suction and discharge valves.
14. Run the engine at 1,200 rev/min and check for leaks at the compressor level plug. Do not overtighten to correct a leak. In the event of a leak isolate compressor as described in instructions 4 to 6. Check 'O' ring seals for dirt, etc.
15. Stop engine.
16. Close all valves on charging and testing equipment.
17. Disconnect charging lines from compressor.
18. Refit dust caps to compressor valve stems and gauge connections, and to the charging lines.



CONDENSER

Service repair no - 82.15.07.

Remove and refit

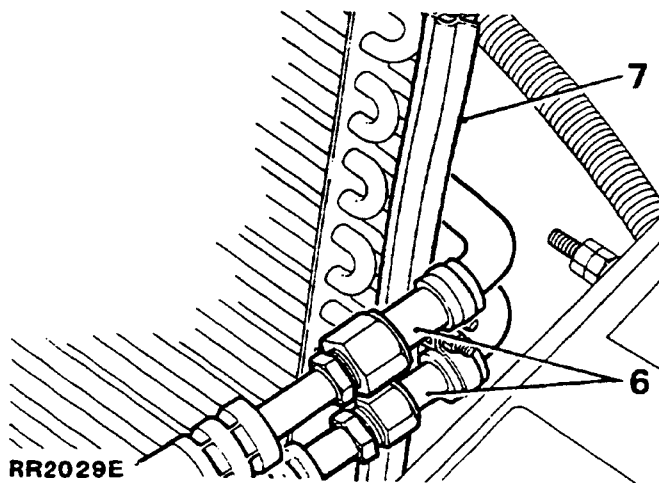
Remove

1. Disconnect the battery negative lead.



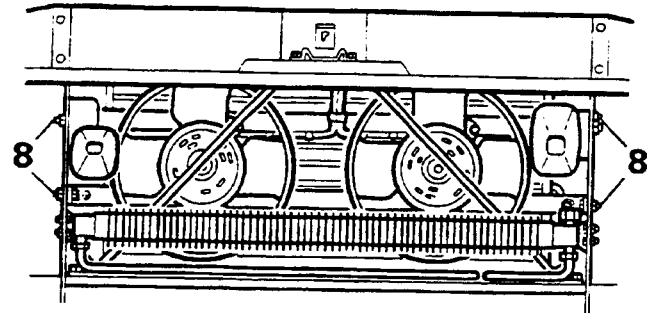
WARNING: Wear eye and hand protection when disconnecting components containing refrigerant. Plug all exposed connections immediately.

2. Discharge air conditioning system. *See Discharging system*
3. Remove front grille panel.
4. Remove radiator. *See COOLING SYSTEM, Repair, Radiator/oil coolers - RR2591E*
5. Disconnect two fan motor wiring connections.



RR2029E

6. Disconnect hoses at condenser end.
7. Remove each vertical radiator seal.



RR1859E

8. Remove four bolts securing condenser, remove condenser and fan motor assembly.

Refit

9. Reverse removal procedure. 3 to 8 above.
10. Add 30 ml of oil to compressor to compensate for oil loss if a new condenser is fitted.
11. Evacuate air conditioning system. *See Evacuate system*
12. Charge the system. *See Charging system*
13. Carry out leak test on disturbed joints. *See Leak test system*
14. Check air conditioning operation by carrying out a System Test. *See System test*

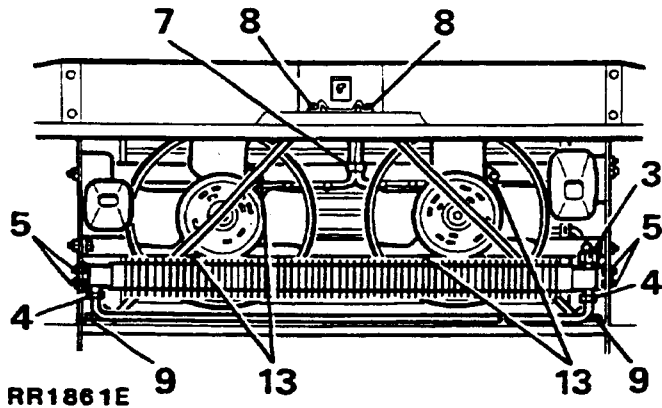
CONDENSER FANS AND MOTORS

Service repair no - 82.15.01.

Remove and refit

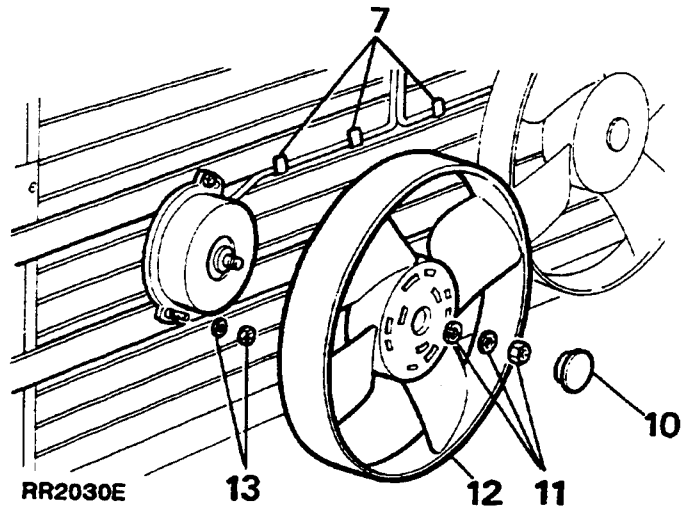
Remove

1. Disconnect the battery negative lead.
2. Remove grille panel.
3. Disconnect wiring connectors to transmission oil cooler.
4. Loosen fittings and detach oil cooler hoses.
5. Remove two mounting bolts from each side and withdraw transmission oil cooler.



RR1861E

6. Disconnect two fan motor wiring connectors.
7. Release wiring securing clips.
8. Loosen two bolts securing upper striker support stays.
9. Remove bolts securing lower ends of support stays and pivot both stays forward.
10. Remove dust caps from fan centres.



RR2030E

11. Remove securing nut and washers.
12. Withdraw fan blade from motor shaft.
13. Remove nuts and washers securing each motor and withdraw fan motor assemblies.

Refit

14. Reverse removal procedure. Ensuring that wiring is clipped and no fouling of fan blades occurs.
15. Check gearbox fluid level, refill if necessary.



EVAPORATOR ASSEMBLY

Service repair no - 86.25.00.

Remove and refit



WARNING: All work involving the service and maintenance of air conditioning requires special equipment, knowledge, experience and a full awareness and adhesion to the safety precautions.

Expansion valve

To remove expansion valve follow instructions 1 to 21 and to refit follow instructions 31 to 49.

Hose-Compressor to evaporator

To remove hose - compressor to evaporator follow instructions 1 to 19 and to refit follow instructions 35 to 49.

Hose-receiver drier to evaporator

To remove hose - receiver drier to evaporator follow instructions 1 to 19 and to refit follow instructions 35 to 49.

Blower assembly

To remove blower assembly follow instructions 1 to 22 and to refit follow instructions 30 to 49.

Evaporator assembly

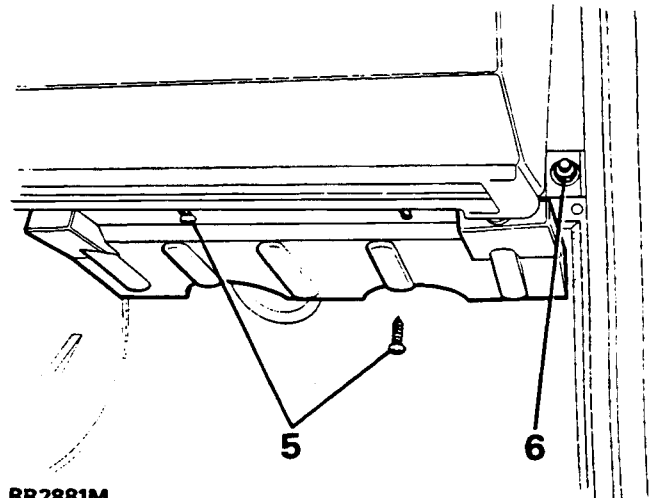
Remove

1. Open bonnet and connect gauge set.



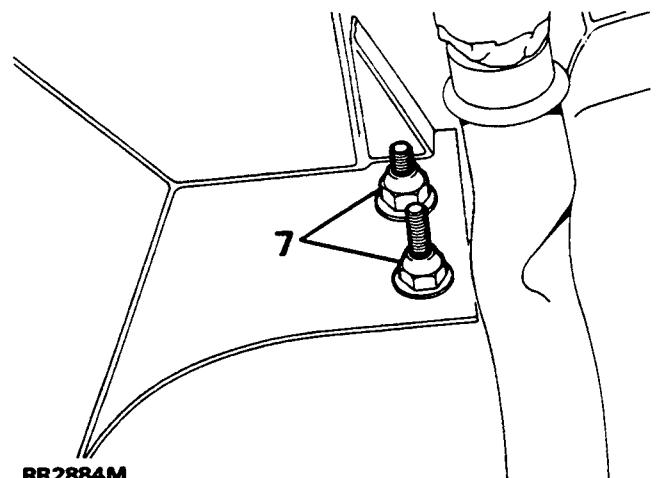
WARNING: Wear eye and hand protection when disconnecting components containing refrigerant. Plug all exposed connections immediately.

2. Discharge system. See *Discharging system*
3. Disconnect the battery negative lead.
4. Disconnect evaporator hoses from compressor and receiver drier.
5. Working underneath dash unit remove two screws securing blower closing panel. Slide panel out of two lower retaining clips.



RR2881M

6. Remove nut and washer from evaporator case mounting bracket.
7. Remove two nuts securing, both centre dash panel and evaporator case mounting bracket.



RR2884M

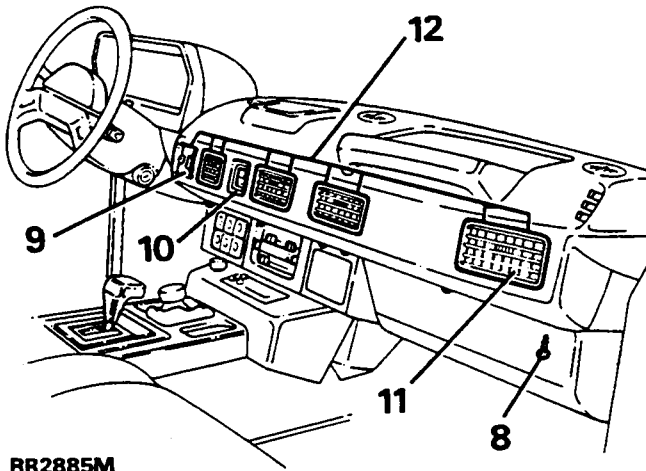
8. Remove six screws securing lower edge of louvre panel to evaporator case.



CAUTION: Dash components can easily be scratched or damaged by incorrect leverage and excessive force.

9. Pry out, using equal leverage top and bottom, mirror control switch. Disconnect the two multiplugs.
10. Repeat instruction 9 for removal of clock. Disconnect electrical leads and bulb holder.

11. Pry out, along the lower edge, four air vents.
12. Remove nine screws securing the evaporator housing and louvre panel to dash top.



RR2885M

13. Withdraw panel clear of dash top.
14. Withdraw refrigerant hoses and evaporator condensation drain tubes through bulkhead.
15. Remove air hose from the end of evaporator case upper.
16. Disconnect electric wiring to blower motor and electronic thermostat at multiplugs.
17. Remove evaporator case assembly from vehicle.

Disassemble

18. Remove insulation from evaporator and expansion valve hose connections.
19. Disconnect hoses from expansion valve and evaporator. Use a second wrench to support hose adaptors and plug connections.
20. Unclamp sensor coil from evaporator outlet pipe.
21. Unscrew expansion valve from evaporator. Plug connection.
22. Remove eight securing screws and detach blower units from evaporator case.

23. Remove screws securing upper evaporator casing to evaporator lower case.
24. Remove thermister probe and lift off upper casing.
25. Remove insulation pad and screws securing evaporator to lower casing.
26. Withdraw evaporator from casing.

Assemble

27. Secure evaporator to lower casing.
28. Fit insulation pad.
29. Screw casing together and fit thermister probe.
30. Refit and secure blower units to evaporator casing.



NOTE: Use refrigerant compressor oil on all mating surfaces. Tighten connections to correct torque.

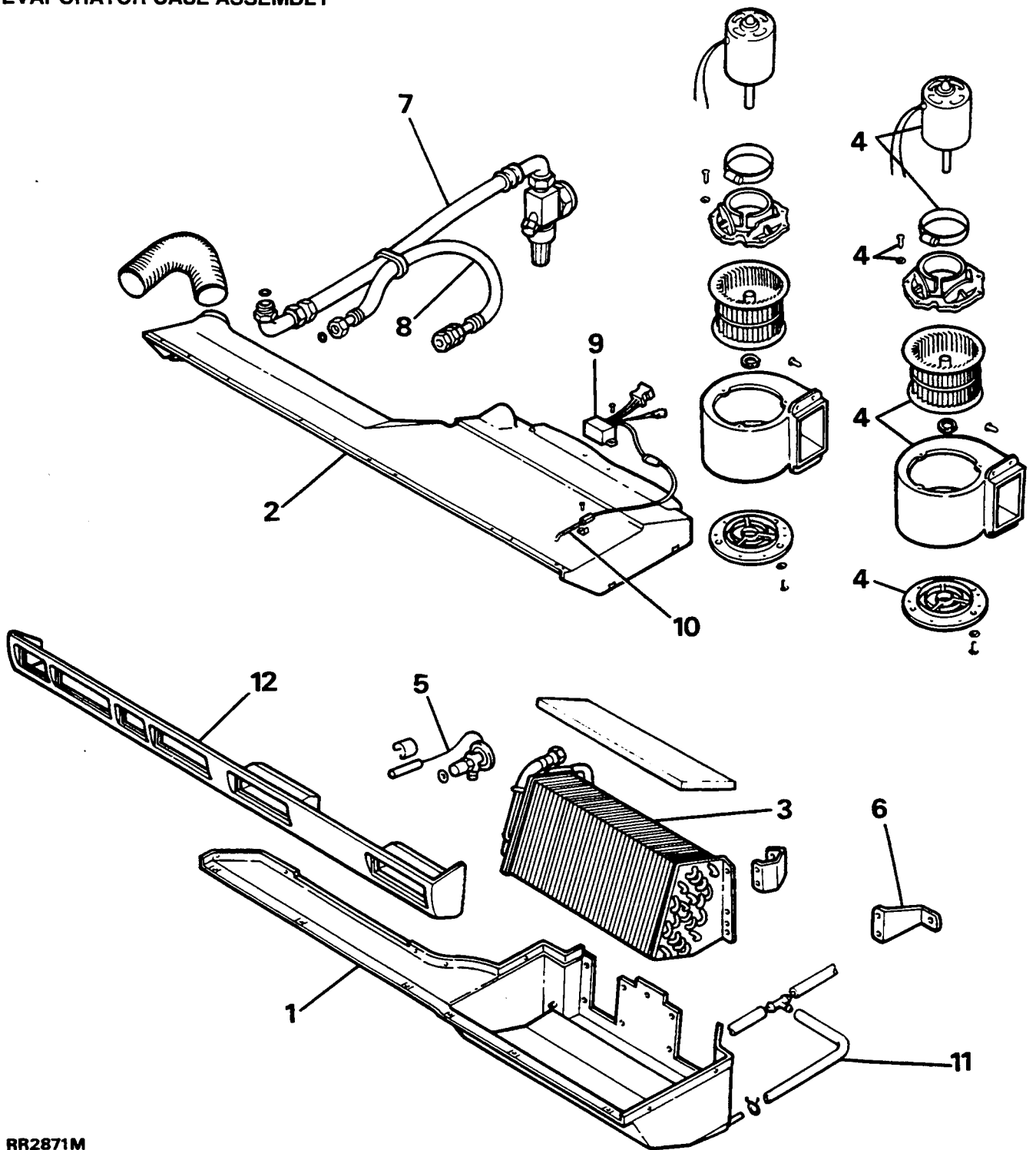
31. Assemble expansion valve to evaporator with inlet facing downwards.
32. Clamp sensor coil to evaporator outlet pipe.
33. Connect hoses to evaporator and expansion valve. Use new 'O' rings.
34. Wrap all exposed metal at hose connections with prestitute tape.

Refit

35. Place evaporator assembly in vehicle, reconnect two wiring connectors disconnected at instruction 16.
36. Feed hoses and evaporator condensation tubes through bulkhead. Ensure that openings and grommets are sealed against ingress of dust and moisture.
37. Fit evaporator assembly to its location and reconnect air hose at the end of evaporator casing. Ensure centre dash panel is eased over evaporator case mounting bracket on shared fixing point.



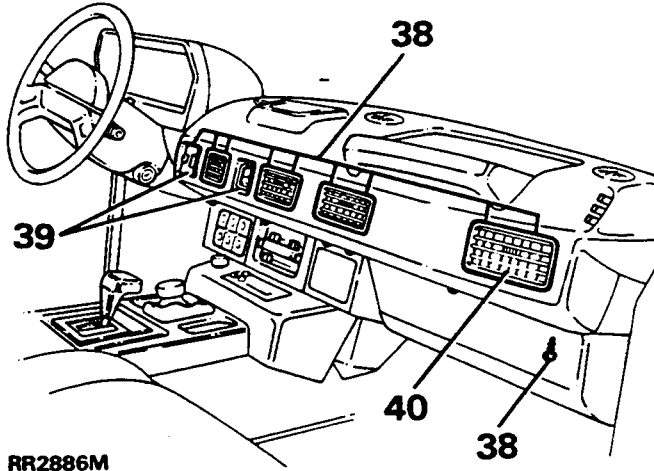
EVAPORATOR CASE ASSEMBLY



RR2871M

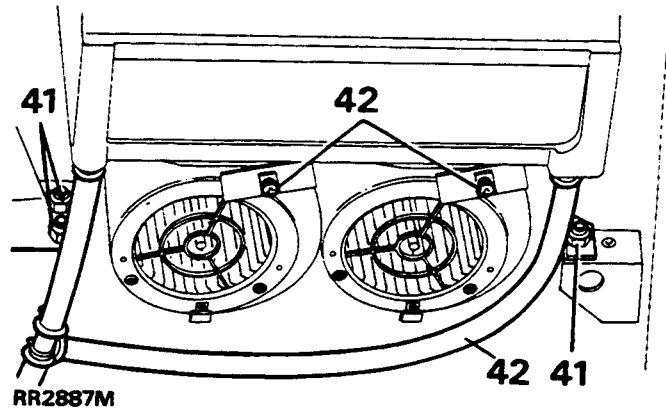
- | | | | |
|--------------------------|---------------------|----------------------|----------------------|
| 1. Evaporator case lower | 3. Evaporator | 7. Hose Assy Suction | 10. Thermister Probe |
| 2. Evaporator case upper | 4. Blower Assy | 8. Hose Assy Liquid | 11. Drain Hose Assy |
| | 5. Expansion Valve | 9. Thermostat | 12. Louvre Panel |
| | 6. Mounting Bracket | | |

38. Feed electrical connections to clock and mirror control switch through their apertures in louvre panel. Refit louvre panel.
39. Reconnect electrics to clock and mirror control switch, fit them to louvre panel.
40. Fit air vents.



RR2886M

41. Secure, using new nuts and plain washers, evaporator case mounting brackets.
42. Ensure condensation tubes are free from kinks and able to drain water. Fit blower closing panel.
43. Connect two refrigerant hoses to compressor and receiver drier. Tighten to **37 Nm**.



RR2887M

44. Evacuate system. *See Evacuate system*
45. Charge complete system. *See Charging system*
46. Leak test any disturbed joints. *See Leak test system*
47. Perform a functional check.
48. Check compressor oil level. *See Compressor oil level*
49. Disconnect gauge set.



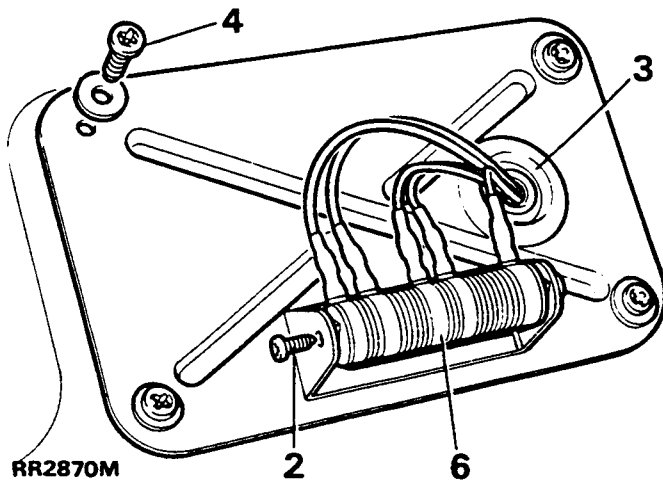
RESISTOR UNIT

Remove and refit

The resistor unit is located on front dash closing panel underneath decker panel.

Remove

1. Disconnect the battery negative lead. Remove decker panel. *See CHASSIS AND BODY, Repair, Decker panel*
2. Remove two screws securing resistor.
3. Release grommet from housing.
4. Remove four screws from front dash closing panel.
5. Disconnect resistor electrical wiring at multiplug.
6. Remove resistor complete with wiring and multiplug.



Refit

7. Reverse removal procedure.

RECEIVER DRIER

Service repair no - 82.17.01.

Remove and refit



CAUTION: Immediate blanking of receiver drier is important. Exposed life of unit is only 15 minutes.

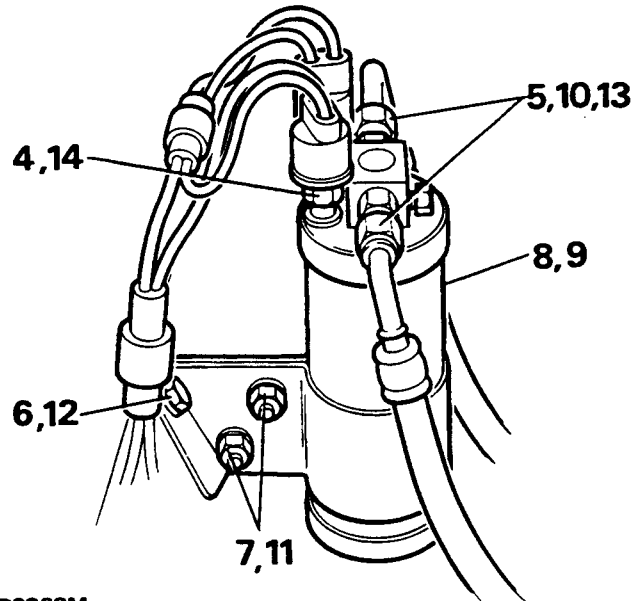
Remove

1. Connect gauge set. *See Charging and testing equipment*



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

2. Discharge system. *See Discharging system*
3. Disconnect the battery negative lead.
4. Disconnect electrical leads at two plug connectors and unscrew, at hexagon nut, the pressure switches from receiver drier.



5. Disconnect two hose connections. Use a second spanner to support hose adaptor.
6. Remove bolt, nut and washers securing mounting bracket to wing valance.
7. Remove clamp bolts, washers and nuts.
8. Withdraw receiver drier from mounting bracket.

Refit

9. Fit receiver drier into mounting bracket with inlet and outlet connections correctly fitted.
10. Connect two hose connections finger tight.



NOTE: Use refrigerant compressor oil on all mating surfaces to prevent leakage.

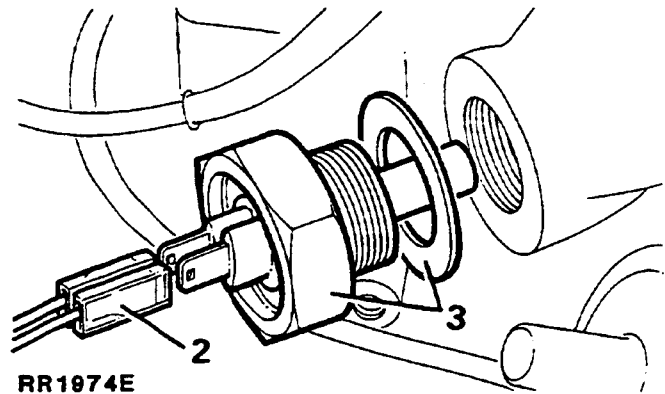
11. Fit clamp bolts, washer and nuts.
12. Secure mounting bracket to wing valance.
13. Tighten two hose connections to **18 Nm. Use a second spanner to support hose adaptor.**
14. Refit pressure switches to receiver drier. Tighten to **23 Nm.**
15. Reconnect electrical leads as shown.
16. Evacuate complete system. **See Evacuate system**
17. Charge complete system. **See Charging system**
18. Perform a leak test on any disturbed joints.
19. Carry out a functional check.
20. Check compressor oil level. **See Compressor oil level**
21. Disconnect gauge set.

COOLANT TEMPERATURE SENSOR

Remove and refit

Remove

1. Disconnect the battery negative lead.
2. Disconnect electrical leads from sensor.
3. Remove sensor from thermostat housing.



Refit

4. Reverse removal procedure. Using a **NEW** joint washer.



TORQUE VALUES



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

	Nm
AIR CONDITIONING	
Compressor hose	37
Receiver drier hose	18
Receiver drier switch	23
Compressor oil filler plug	10