In a house, for our comfort we ensure:
- a certain temperature
- a certain level of humidity in the air.

In a car, we usually have:
- heating
- and ventilation.

We could also have AIR CONDITIONING.

The purpose of air conditioning is to produce cold in the passenger compartment in order to obtain a temperature less than the external temperature.

The humidity level is also lowered.

In order to give an acceptable level of comfort, we try to produce a difference in temperature between the interior and exterior of the vehicle of about 20 degrees maximum.

If the difference in temperature is too high, the occupants may become uncomfortable.

To obtain the maximum efficiency from an air conditioning system in a vehicle, it must operate with the windows closed.

USE

The temperature inside a closed vehicle which has been left parked in the sun may be greater than 60°C.

We cannot begin to talk in terms of comfort until the passenger compartment has had the time to cool down.

After the heat stored in the vehicle has evaporated, close the windows, turn on the air conditioning and set the system to recycled air for a short while to give the best efficiency.

IMPORTANT : if the difference in temperature between the interior and exterior is greater than 20°C the occupants may become uncomfortable.

When the air conditioning system is operating, all the windows should be closed to ensure the system operates efficiently.

In very humid weather, when the external temperature is greater than 4°C, to avoid condensation forming on the windows, it is advisable to run the air conditioning to draw humidity into the evaporator, thus feeding the passenger compartment with dry air.

This air may then be heated to give the required level of comfort.

Ignore any water which may collect under the vehicle. It comes from the drain pipes for the condensation extracted from the air by the evaporator unit.

IMPORTANT : in winter, the system is not used so much as in summer. Turn the system on from time to time to keep the compressor and other components in the system in good working order.

MAINTENANCE

On a vehicle fitted with air conditioning, the engine may tend to become hotter than that of another vehicle. We recommend that the engine coolant level be checked more frequently.

Every year, we recommend that you:

- check the refrigerant fluid in the air conditioning circuit,
- clean and blow out the condenser and the engine cooling radiator,
- ensure that the condensation drain pipe for the cold air fan is not blocked.

When repairing major leaks, each time a component is replaced (compressor, condenser, etc...) or **if water is thought to be present in the air conditioning circuit, replace the dehydration canister and carry out a vacuum suction operation. Also do this if the air conditioning circuit has been left open for more than 10 minutes without being plugged (see "Precautions" section).**

NOTE : each time the compressor operates it is normal to see bubbles in the inspection window for the dehydration canister for a few minutes, for cold circuits using R12. For R134a, there will always be bubbles present, which is why the inspection window is not used on the dehydration canister for R134a.

All types of refrigerants

Observe the following safety advice:

1 Always wear gloves and protective goggles (if possible wear glasses with side protection) when handling refrigerant fluids.

Advice : keep an eye bath at hand; if refrigerant fluid enters the eye, rinse with copious amounts of cold water for 15 minutes.

Consult a doctor immediately, even if there is no pain. Inform the doctor that the coagulation is due to refrigerant fluid R134a or R12.

If other body parts come into contact with the refrigerant (despite observation of the precautions), rinse with copious amounts of cold water for 15 minutes.

2 Any operation carried out on the refrigerating circuit must be done in a well ventilated area. Do not store the refrigerant in pits, trenches, air chimneys etc....

Reason: Refrigerant fluids are colourless and odourless. Their specific gravity is higher than that of air. The refrigerant fluid will take the place of air, creating a danger of asphyxiation in poorly ventilated areas or pits.

Solution: When working on the air conditioning system, check there are no pits, trenches or air chimneys etc within 5 metres.
Ensure the gas extraction systems are operating.

3 Welding and brazing work on the air conditioning system components is strictly forbidden.

This includes welding or brazing work on the vehicle which may cause an increase in temperature of the air conditioning components.
The vehicle may be baked after paintwork operations or adjacent work may be carried out if the temperature does not exceed 80°c.

Faulty or leaking components of the air conditioning system may not be repaired by welding or brazing. They must be renewed.

Ensure the refrigerant fluid pipes are well secured and cannot come into contact with metal parts.

4 Refrigerant fluid R12 produces toxic phosgene in the presence of a flame: do not breathe in.

5 Never smoke near to a refrigerant fluid circuit.

Never mix refrigerant fluids R12 and R134a in the same circuit.

The installation comprises a series of components through which a refrigerant fluid R12 or R134a circulates.

Special pipes ensure the connections between the various components and carry the refrigerant fluid.

Operation is ensured by two levels of pressure which are established and maintained by the circulation of the fluid within the circuit.

The two pressure levels are established by the COMPRESSOR (1) on the one hand and by the PRESSURE RELEASE VALVE (2)on the other.

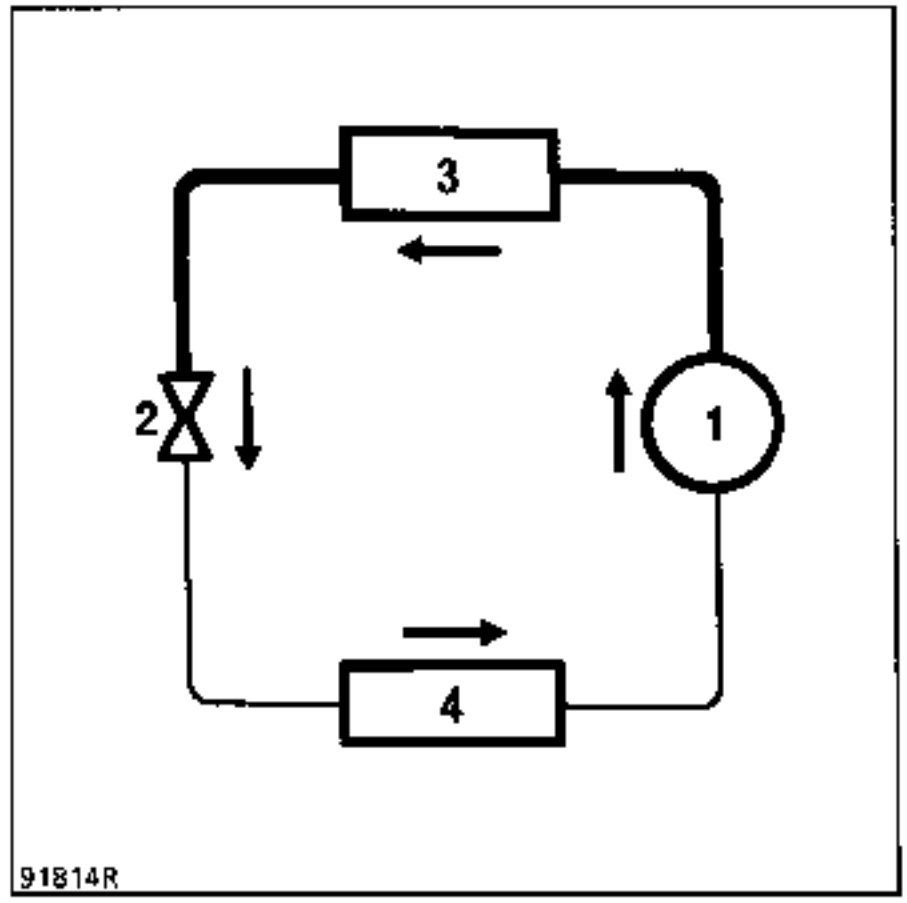
The heat exchanger, known as the CONDENSER (3) passes the heat from the refrigerant fluid to the outside, while the heat exchanger known as the EVAPORATOR (4) absorbs the heat from the air which enters the passenger compartment.

This process ensures:

- reduction of the temperature of the air which enters the passenger compartment,

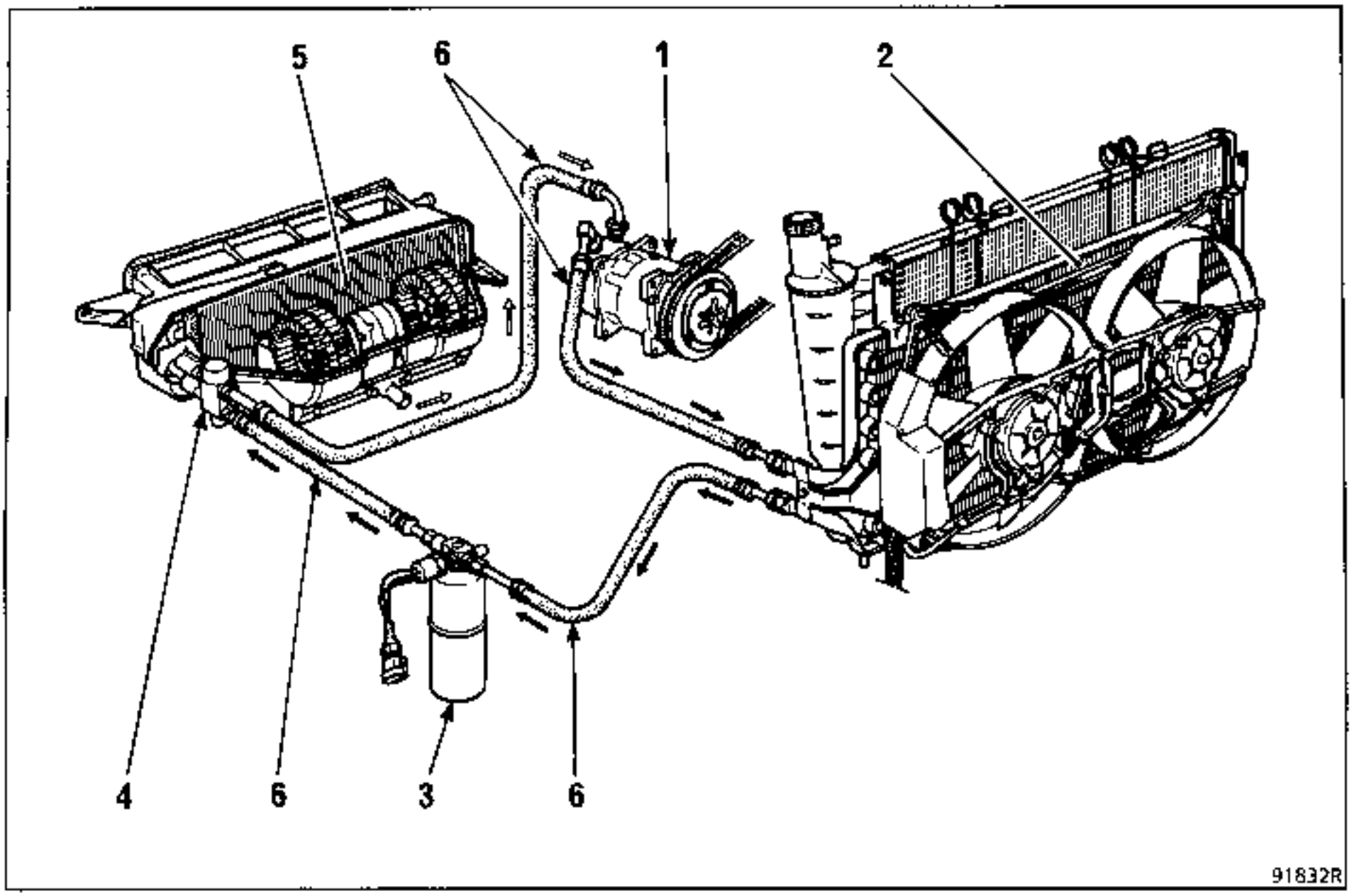
- reduction in the relative humidity of the air.

In a conventional installation, components(1), (2), (3) are located in the engine compartment, while component (4) is located in the dashboard or the scuttle panel.



1	COMPRESSOR
2	PRESSURE RELEASE VALVE
3	CONDENSER
4	EVAPORATOR
▬▬	HIGH PRESSURE
———	LOW PRESSURE

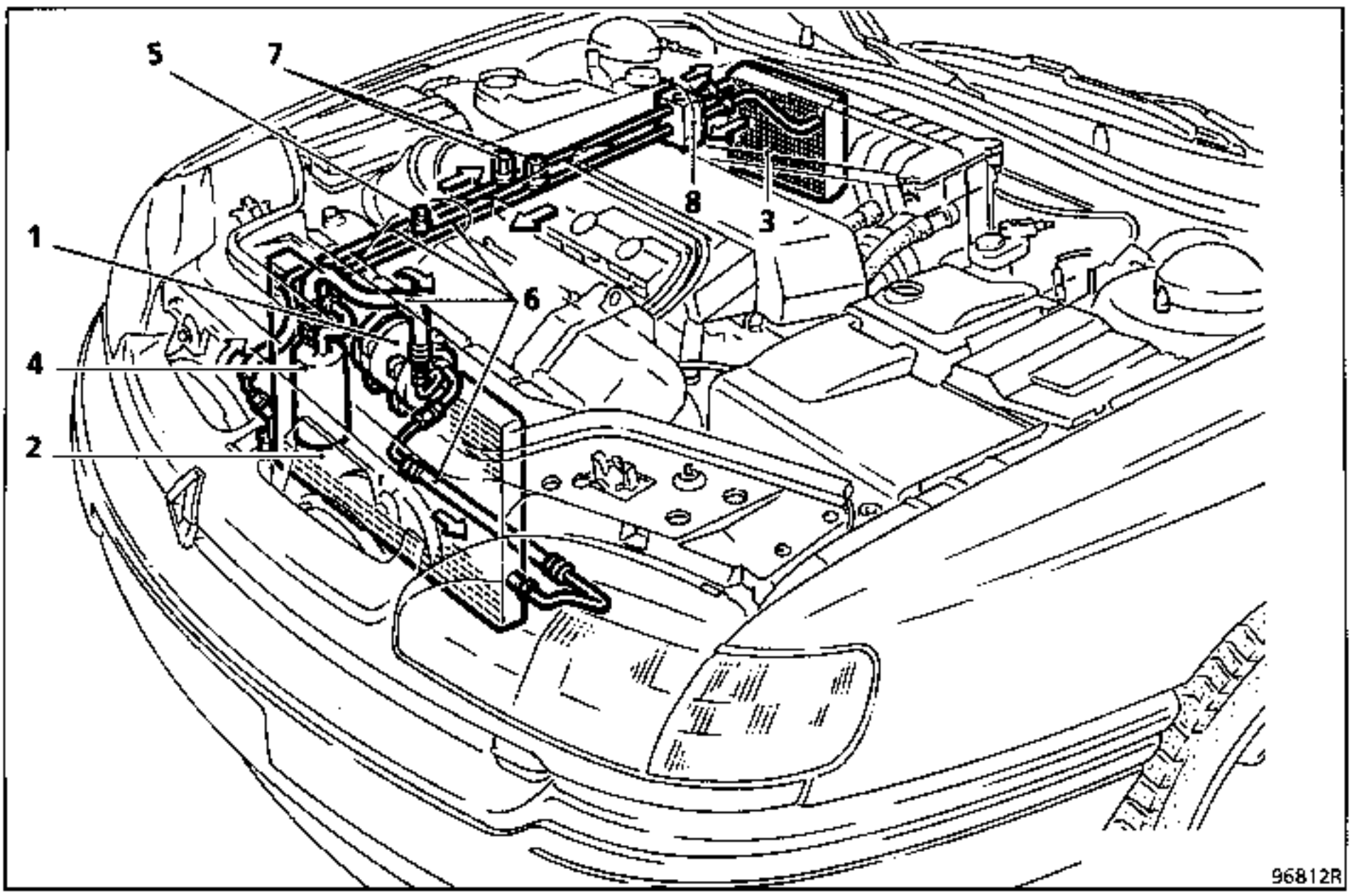
The assembly 1, 2, 3, 4 and the connecting pipes are known as the cold circuit.



Low pressure

High pressure

1 Compressor
2 Condenser
3 Dehydration canister
4 Pressure release valve
5 Evaporator
6 Connecting pipes



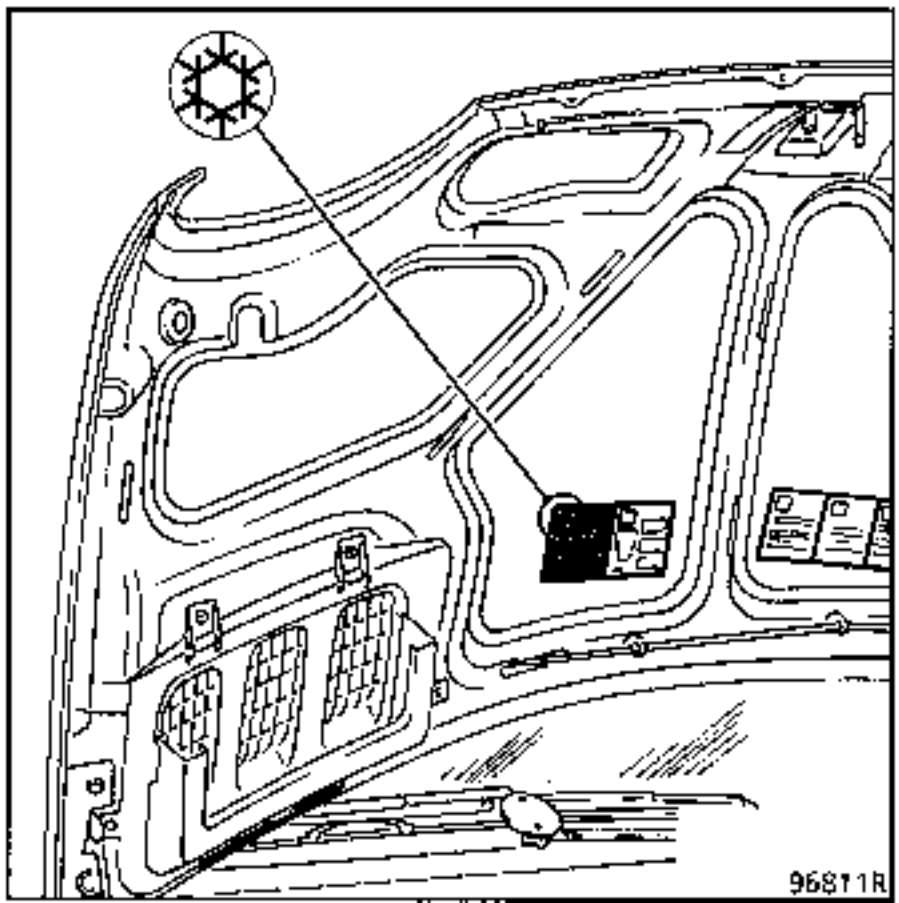
The new refrigerant used in the air conditioning systems protects the ozone layer and is called R 134a.

The components of the air conditioning system have been specially adapted to operate with this refrigerant. The main components are :

1 Compressor
2 Condenser
3 Evaporator
4 Dehydration canister
5 Pressostat
6 Connecting pipes
7 Filling valves
8 Pressure release valve

IMPORTANT : Refrigerant R134a cannot be mixed with refrigerant R12; one may not be used in place of the other, except for the special adaptation operation from R12 to R134a, see Technical Note n° 2422A.

Since refrigerant R134a is not compatible with refrigerant R12, a label in the engine compartment warns when refrigerant R134a is to be used.
Example : TWINGO



GENERAL METHOD FOR REPLACING A COMPONENT

If the replacement of a component requires the circuit to be opened, it is vital that the new component and the special compressor oil are immediately available.

REMOVAL

Run the air conditioning system for at least 10 minutes (if the system will allow).

Drain the circuit using the filling station.

Measure the amount of oil and refrigerant fluid retained.

Ensure access to the component to be replaced is clear.

Disconnect the union.

Fit plugs to the open union on the cold circuit to prevent humidity entering the circuit.

Remove the component.

REFITTING

Apply special compressor oil to the threads of the new component and to the seals.

IMPORTANT: small plugs may be fitted inside new components - remove them.

Connect the new component to the free union and hand tighten.

Position the component correctly.

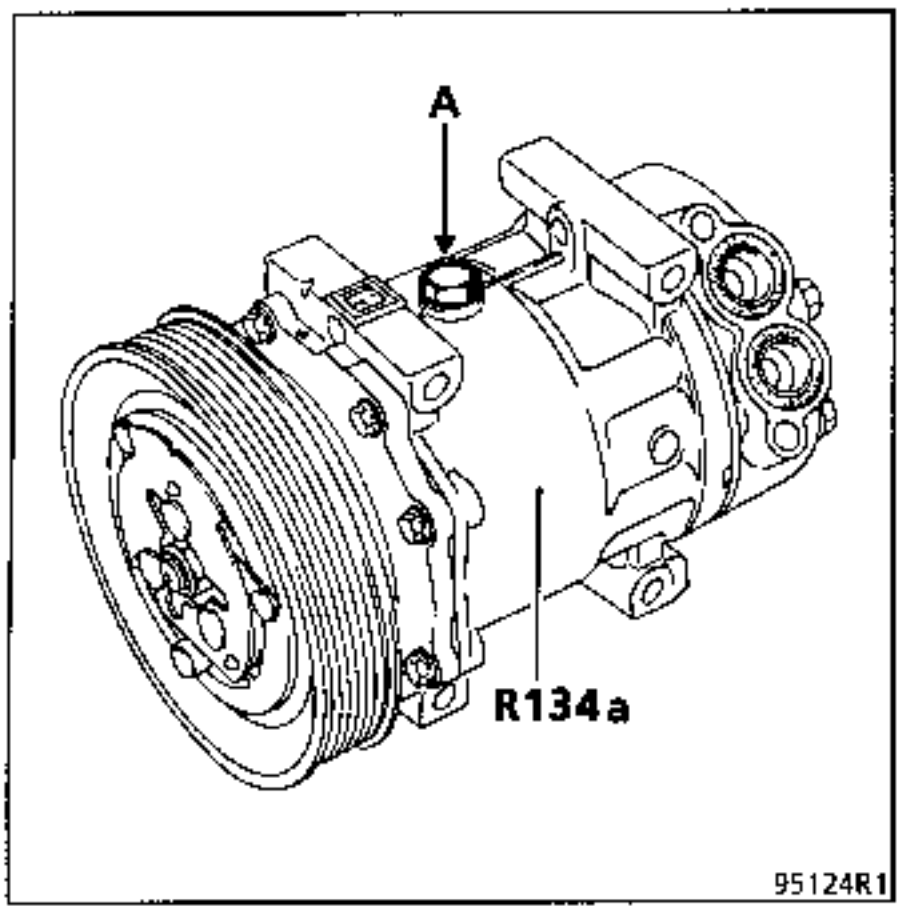
Torque tighten.

Apply vacuum suction.

Fill the circuit with refrigerant fluid, using the required amount of oil.

Note : if a large amount of oil has to be added (if a pipe has burst or if you are carrying out the R12 to R134a adaptation), add the oil via the compressor.

IMPORTANT : if humidity is suspected to be present in the air conditioning circuit, replace the dehydration canister and carry out a vacuum suction operation.

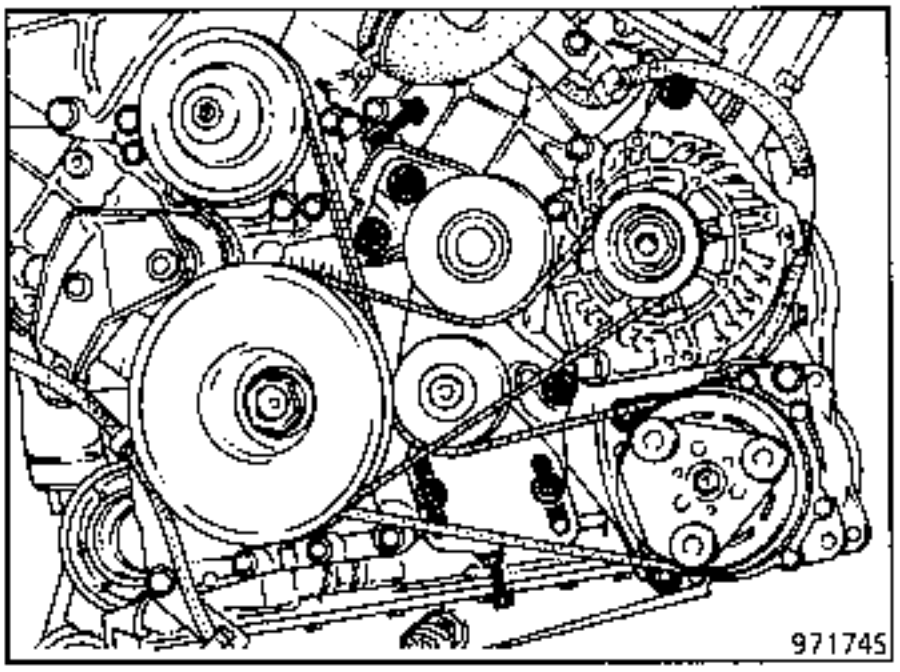


An electromagnetic coupler on the compressor ensures the transfer of forces between the pulley and the plate driving the compressor pistons when the air conditioning is operational.

The electromagnetic clutch - compressor assembly cannot be repaired.

The compressor contains a special oil for the refrigerant circuit. Do not mix oils. A label on the bonnet shows if the cold circuit has R134a. A special R134a label is also applied to the compressor.

The compressor is driven by the accessories belt.



GENERAL METHOD FOR REPLACING COMPRESSORS

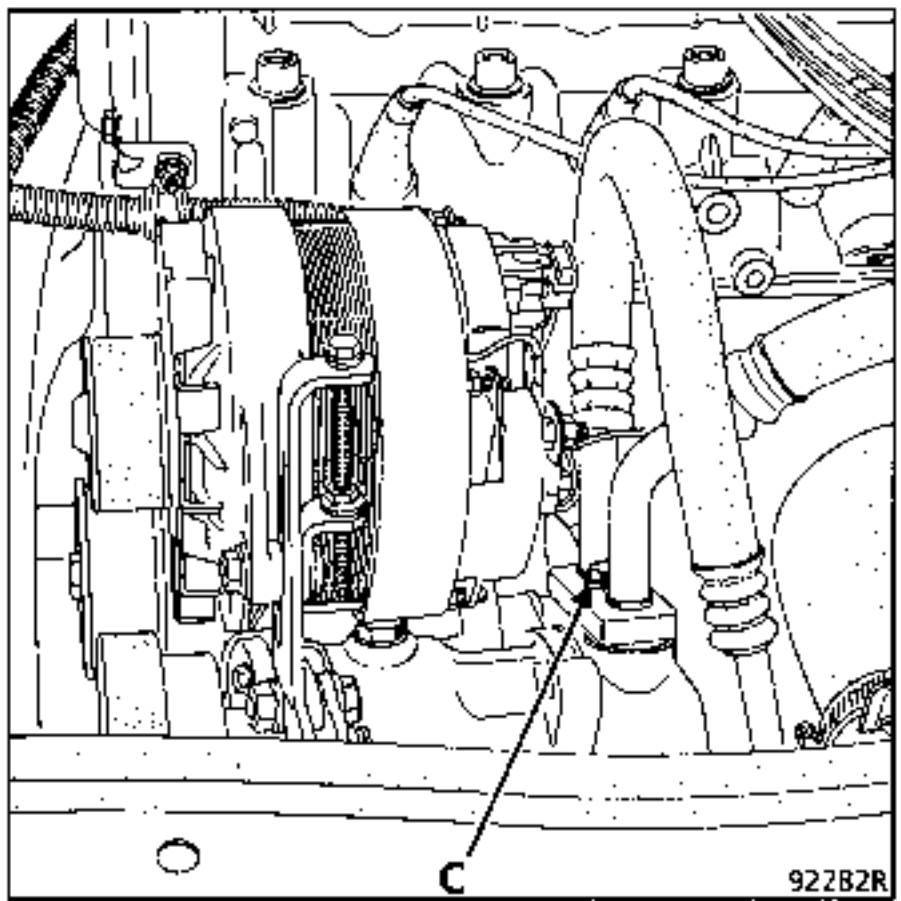
Disconnect the battery.

Remove the belt connected to the compressor.

Drain the refrigerant circuit using the filling station.

Remove as much oil as possible using the filling station.

Remove the mounting bolt (C) securing the pipes on the compressor.



Fit plugs to the pipes or apply adhesive tape to their ends to prevent humidity entering the circuit.

Disconnect the – 12 Volts clutch feed.

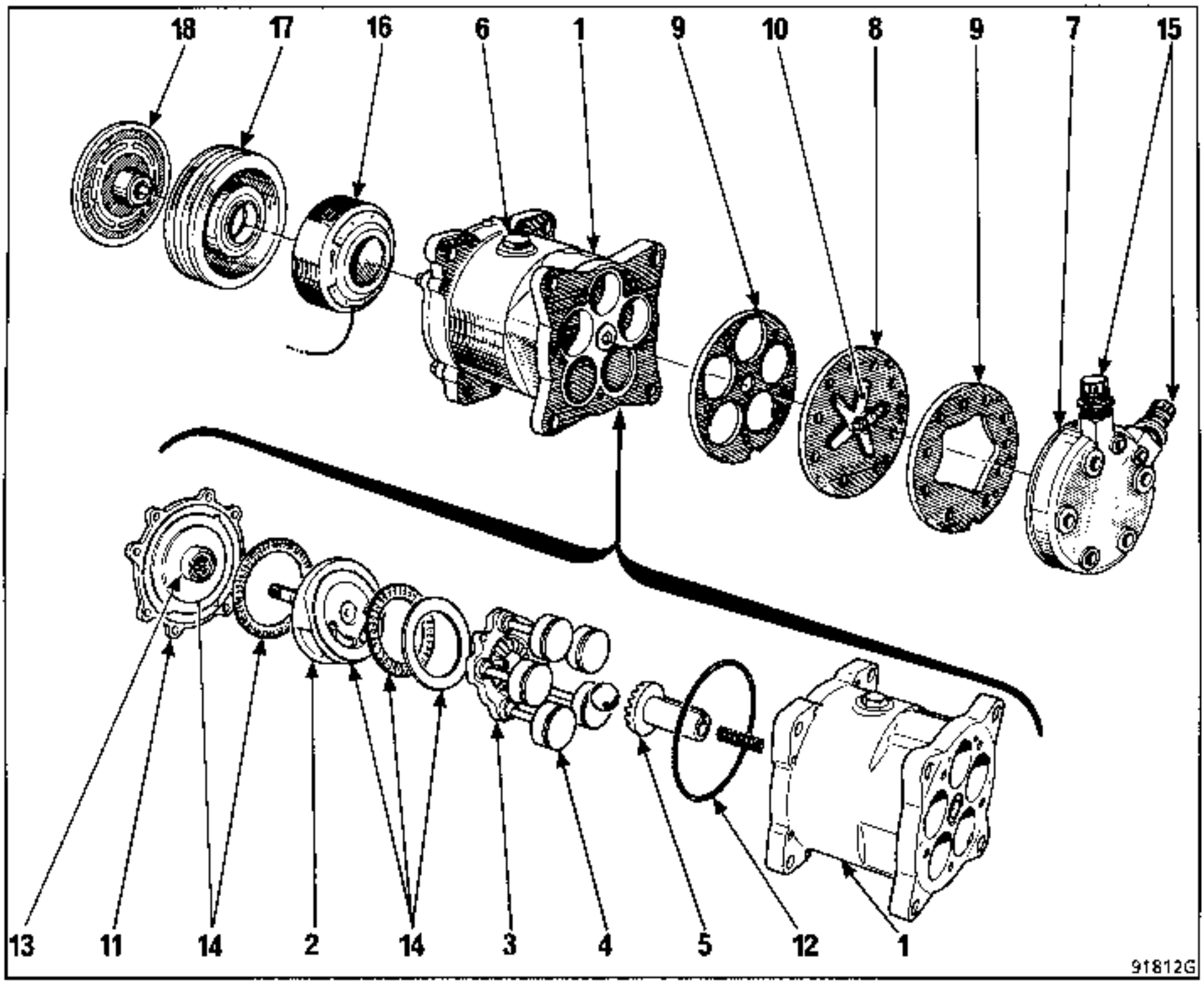
Remove the compressor.

REFITTING

Fit the new compressor full of oil , after lubricating the seals.

Fill the circuit with refrigerant fluid using the filling station.

NOTE: when replacing the compressor, take the utmost care when draining the circuit to retain as much oil as possible using the station.



ALTERNATING AXIAL COMPRESSOR (SANKYO)

1 Compressor body in aluminium alloy
2 Balanced cam rotor
3 Piston and rod control plate
4 Piston with one sealing ring
5 Guide gear
6 Plug for filling with oil and checking level
7 Aluminium head
8 Seat for inlet and return valves
9 Head gasket
10 Intake/ return valves
11 Compressor cover with integral control shaft bearing
12 Seal between cover and compressor body
13 Front sealing ring
14 Bearing race
15 Compressor inlet / outlet connection unions
16 Electromagnetic clutch control coil
17 Drive pulley
18 Connecting plate

ROLE

The compressor pumps refrigerant fluid in the installation; the fluid is taken up in the form of a vapour at low pressure and low temperature. It is compressed and returned to the installation in the form of a vapour at high pressure and high temperature.

SPECIFICATIONS

Alternating axial compressors manufactured in Japan and used on our vehicles have 5 or 7 pistons and the following specifications:

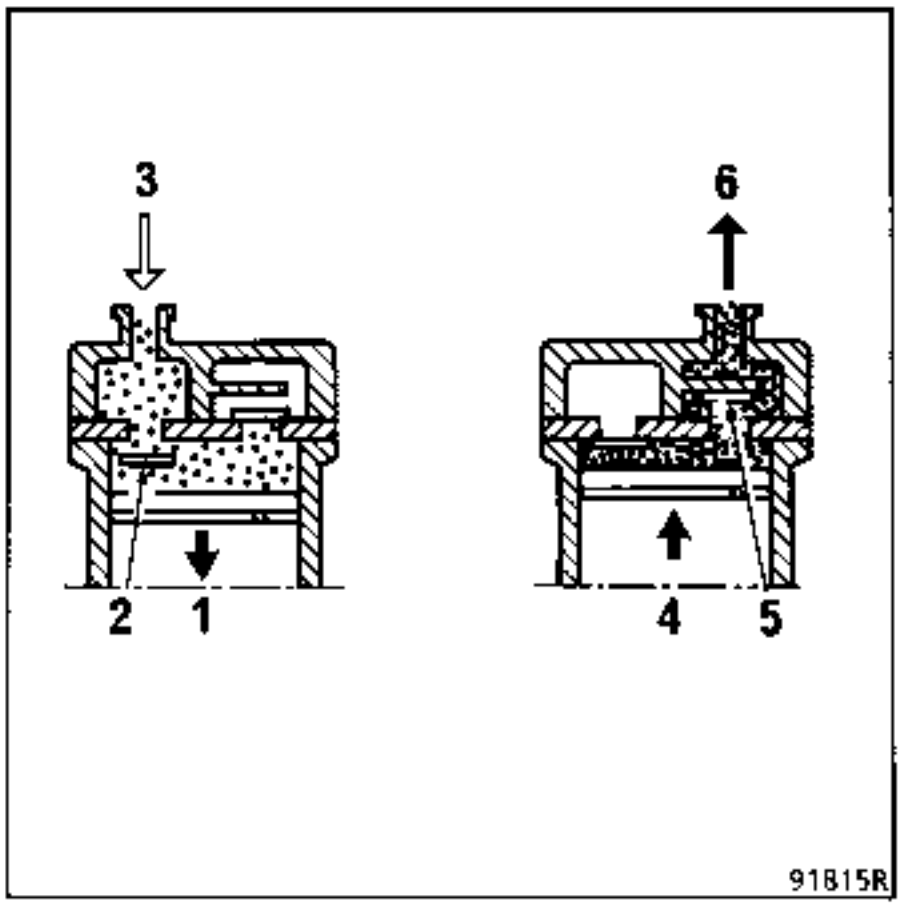
- compact and light,
- low power requirements,
- regular operation,
- silent operation,
- horizontal fitting with many alignment possibilities,
- rotation direction is unimportant,
- lubricating system by differential pressure.

OPERATING PRINCIPLE

The compressor mechanism is lubricated by a special oil which is put into the compressor when it is manufactured. Some of this lubricant is carried in the installation by the refrigerant fluid.

The compressor operates at the same time with both high and low pressures.

SIMPLIFIED DIAGRAM



1 Intake
2 Intake valve open
3 Refrigerant fluid taken up at low pressure
4 Compression
5 Return valve open
6 Refrigerant fluid returned at high pressure

The mechanical operation of the compressor may be described thus:

the control plate (3) is driven by the cam rotor (2). During this rotation, the rods mounted on the control plate with crimped ball joints, transfer the movement caused by the cam rotor to the pistons (4). In this way an alternating axial movement is obtained for each piston.

The gear (5) ensures that the control plate is kept rotating and acts as a ball joint.

In the head, a set of reed valves (10) ensures the intake/return cycle for the refrigerant fluid in each of the compressor's cylinders.

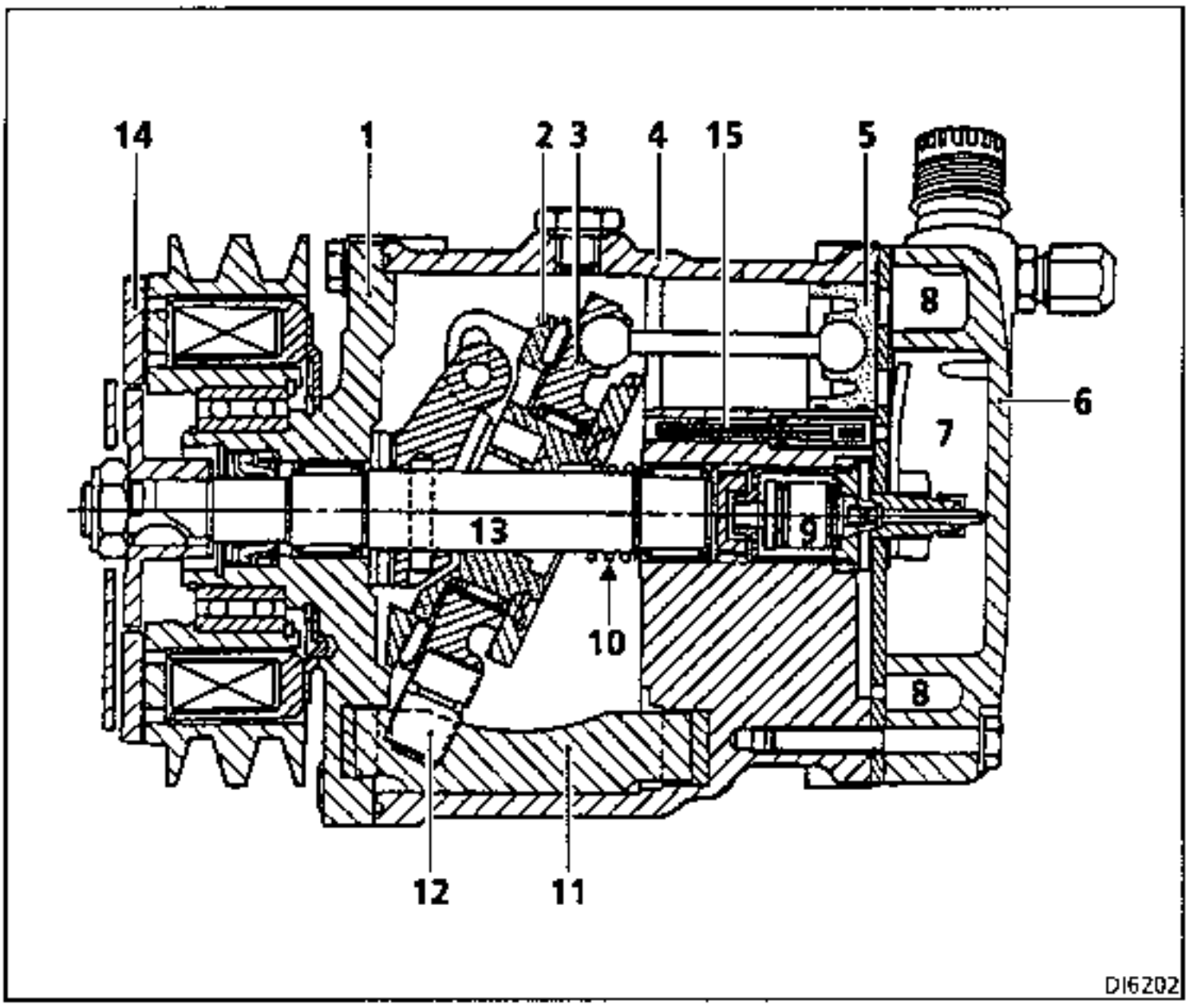
The compressor is driven by an electromagnetic clutch.

SPECIAL NOTES FOR THE SANDEN VARIABLE DISPLACEMENT COMPRESSOR

The compressor adapts to cooling requirements by continuously varying its displacement. The aim of this function is to maintain a constant temperature at the evaporator in order to improve user comfort.

The major difference between a variable displacement compressor and a fixed displacement compressor is at the oscillating plate (causes the alternating movement of the pistons).

The incline of the plate may vary, thus modifying the piston stroke.



1 Compressor cover
2 Cam plate with variable angle
3 Oscillating plate
4 Compressor body
5 Piston
6 Head
7 Discharge chamber
8 Intake chamber
9 Internal control valve
10 Spring
11 Guide rail
12 Runner
13 Main shaft
14 Electromagnetic clutch
15 Calibrated connection between high pressure and housing pressure

Compressor	Oil volume cm³	Drain volume cm³	Oil
SD 506	207 ± 30	177 ± 30	ELF RIMA 100
SD 507	150 ± 30	120 ± 30	ELF RIMA 100
SD 508	175 ± 15	145 ± 15	ELF RIMA 100
SD 509	135 ± 15	105 ± 15	ELF RIMA 100
SD 510	135 ± 15	105 ± 15	ELF RIMA 100
SD 709	135 ± 15	105 ± 15	ELF RIMA 100
SD 7H	135 ± 15	105 ± 15	PAG SP 20
SD 7V	135 ± 15	105 ± 15	PAG SP 10

This table gives information on the oil content of the compressors. In general, 30 ml of oil remains in the compressor after draining.

Existing methods for checking the compressor oil level using a dipstick are difficult to apply. In many cases the compressor filling plug is not accessible and with 7 piston compressors the dipstick will no longer fit.

The compressor contains a known volume of oil at the start. It is assumed that under normal circumstances, no oil is consumed. Loss of oil can only result from leaks (component bursts) or if a component is replaced in the cold circuit.

It is however acknowledged that the cold circuit may lose charge or have a slow leak (approximately 100 to 150 g/year of refrigerant fluid maximum). In this case there is no oil loss.

Consequently, the oil level must be checked when there is doubt (abnormal compressor noise). The only valid method is to remove the compressor and check for oil. If there is no oil and no trace of oil on the walls, add 100 ml.

METHOD FOR ADDING OIL

Example : Replacing the condenser = Oil retained after draining +30ml

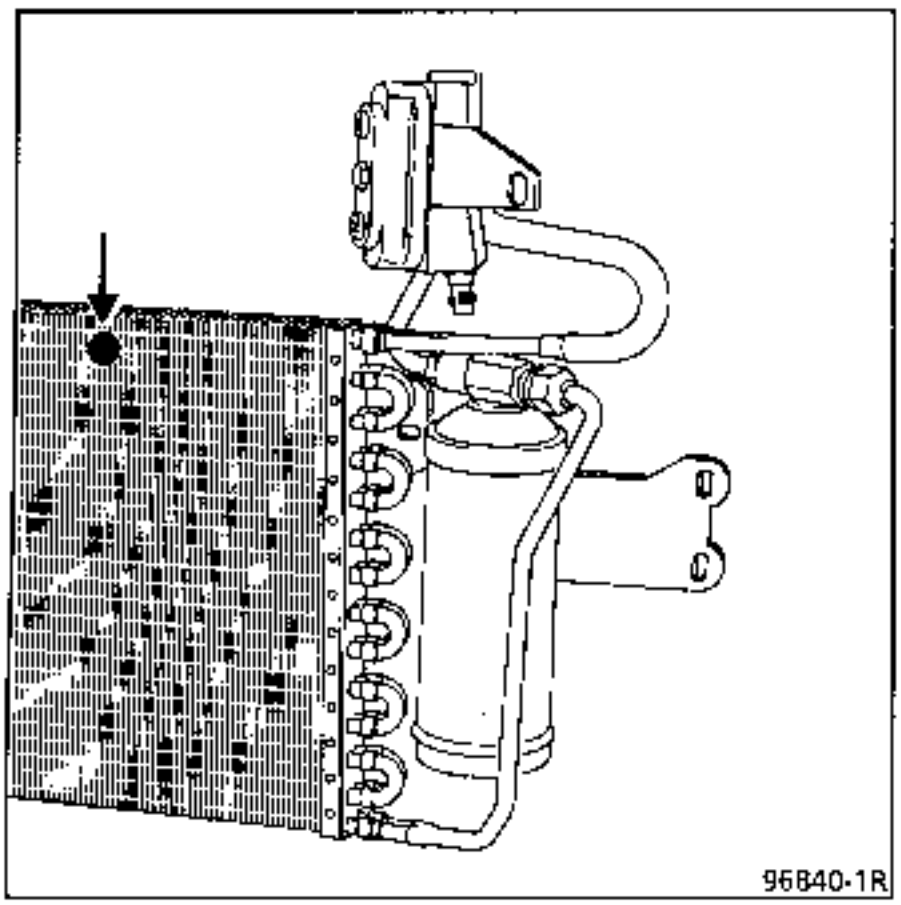
Oil is added by intake into the vehicle's air conditioning circuit (except when adding 100 ml which should preferably be injected into the compressor).

Cold circuits using SP 20 oil

- for small volumes ≤ 30 ml, add the SP 10 oil using the filling station,
- for large volumes (100 ml) add the oil directly into the compressor **using SP 20 oil only**.

REPLACEMENT OR BREAKAGE OF A COMPONENT

OPERATION ON AC CIRCUIT	VOLUME OF OIL WHICH MUST BE ADDED
Draining the air conditioning circuit	Measure the amount of oil retained and add a similar volume of new oil
Pipe burst or other major leak	100 ml
Replacing the condenser	30 ml
Replacing the evaporator	30 ml
Replacing the dehydration canister	15 ml
Replacing a pipe	10 ml



The condenser passes the heat from the compressed gaseous refrigerant into the ambient air. The gaseous refrigerant then condenses and changes into a liquid form in the condenser.

The condenser (M) is a type of "radiator" located against the engine cooling radiator.

GENERAL METHOD FOR REPLACING A CONDENSER

Disconnect the battery.

Drain the refrigerant circuit using the filling station.

Remove the pipes connected to the condenser.

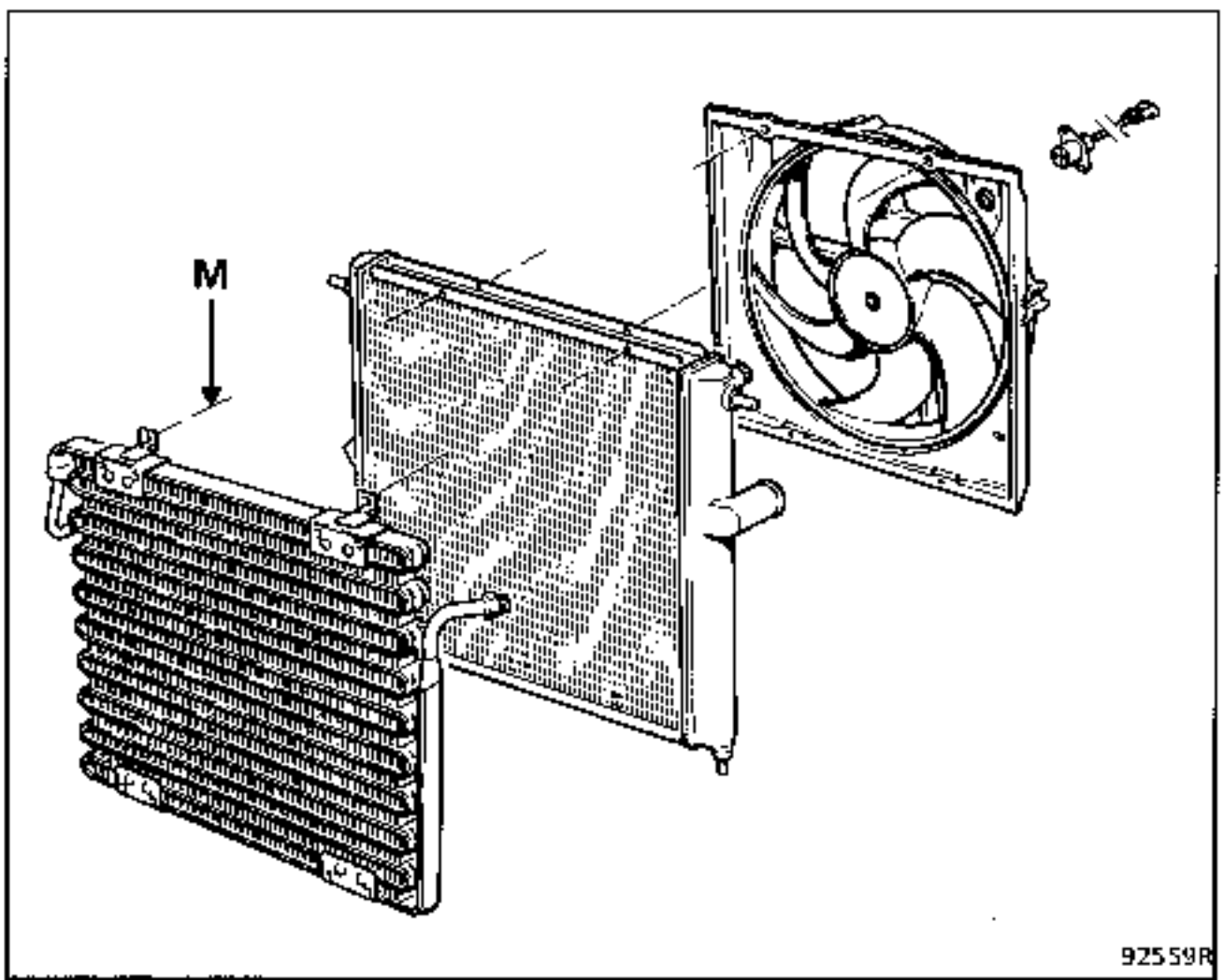
Fit plugs to the pipes or apply adhesive tape to their ends.

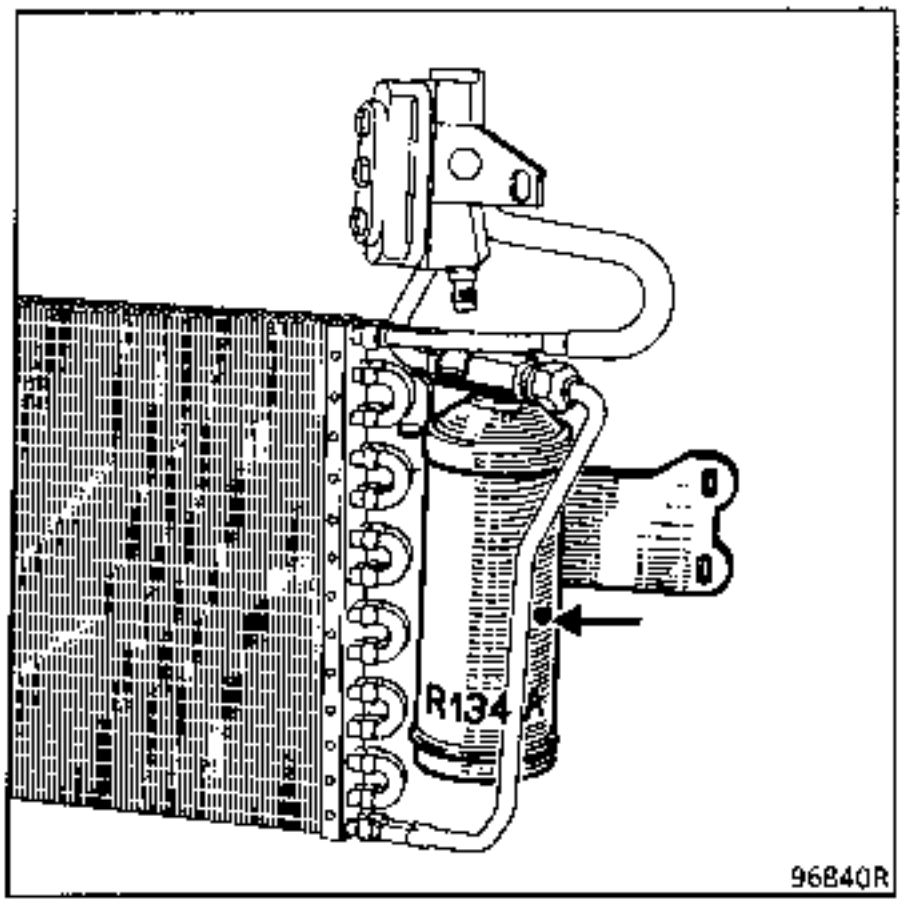
Release the condenser and separate it from the engine cooling radiator.

Take care not to damage the condenser and radiator fins during the operation.

In order to avoid the fitting of an incorrect type condenser (used for refrigerant fluid R12), condensers designed for R134a have a foolproofing device (pipes cannot be fitted) or a green coloured marker.

IMPORTANT : if the condenser is to be replaced, you must add the **volume of oil retained** when draining + **30 ml** using the filling station. Use new oil only.





The dehydration canister has three functions. :
- reservoir for refrigerant fluid.
- filter for fluid circulating in the system.
- retention of the humidity in the system.

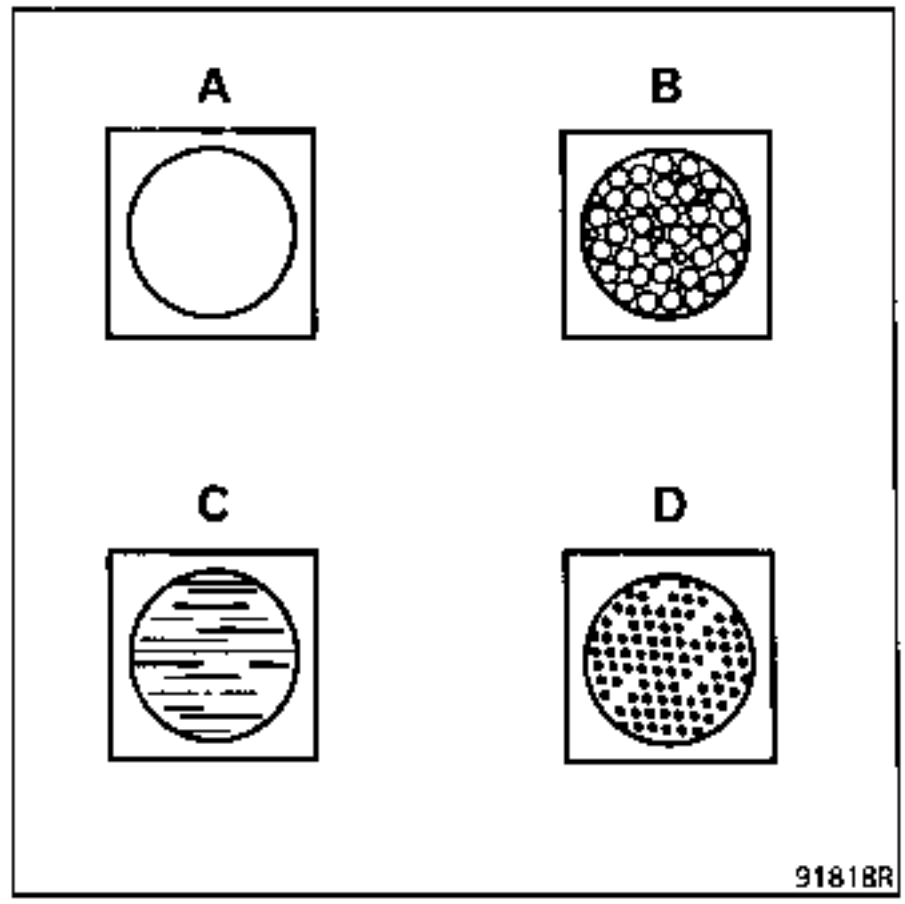
On dehydration canisters for R12 an inspection window allows the operation of the installation to be monitored when the compressor is operating.

A Inspection window clear: installation correctly filled or completely empty,

B Bubbles in inspection window: lack of refrigerant fluid in the circuit,

C Threads of oil in inspection window: compressor oil circulating in the circuit

D Striped, non-uniform fluid: desiccant circulating in the circuit - replace the dehydration canister.



NOTE : on vehicles which use the R134a refrigerant, the dehydration canister is of a special type. A label in the engine compartment warns that the new refrigerant must be used.

Dehydration canisters for R134a do not have an inspection window since the oil and refrigerant fluid are always in emulsion.

GENERAL METHOD FOR REPLACING A DEHYDRATION CANISTER

Disconnect the battery.

Drain the refrigerant circuit using the filling station.

Remove the pipes from the dehydration canister.

Fit the plugs.

SPECIAL NOTES FOR REFITTING

Refitting is the reverse of removal.

The dehydration canister is very sensitive to humidity. It must be fitted quickly and care should be taken to prevent it being left open to the air.

Apply vacuum suction to the circuit before filling with refrigerant fluid and oil.

IMPORTANT : if the dehydration canister is being replaced you must add **the volume of oil retained + 15 ml** using the filling station. Use new oil only.

ROLE

The pressure release valve reduces the pressure of the refrigerant fluid at the inlet to the evaporator to a pre-set value. The fluid circulating in the evaporator may then be taken up by the compressor in a completely gaseous state.

OPERATING PRINCIPLE

The pressure release valve receives the refrigerant fluid in liquid form under high pressure at (1).

At the outlet, the fluid has expanded to low pressure (pressure depends on the installation), creating cooling, at (2). This is the principle of creation of cooling by the expansion of a fluid.

The pressure release valve controls the fluid pressure in the evaporator by the modulating component (7).

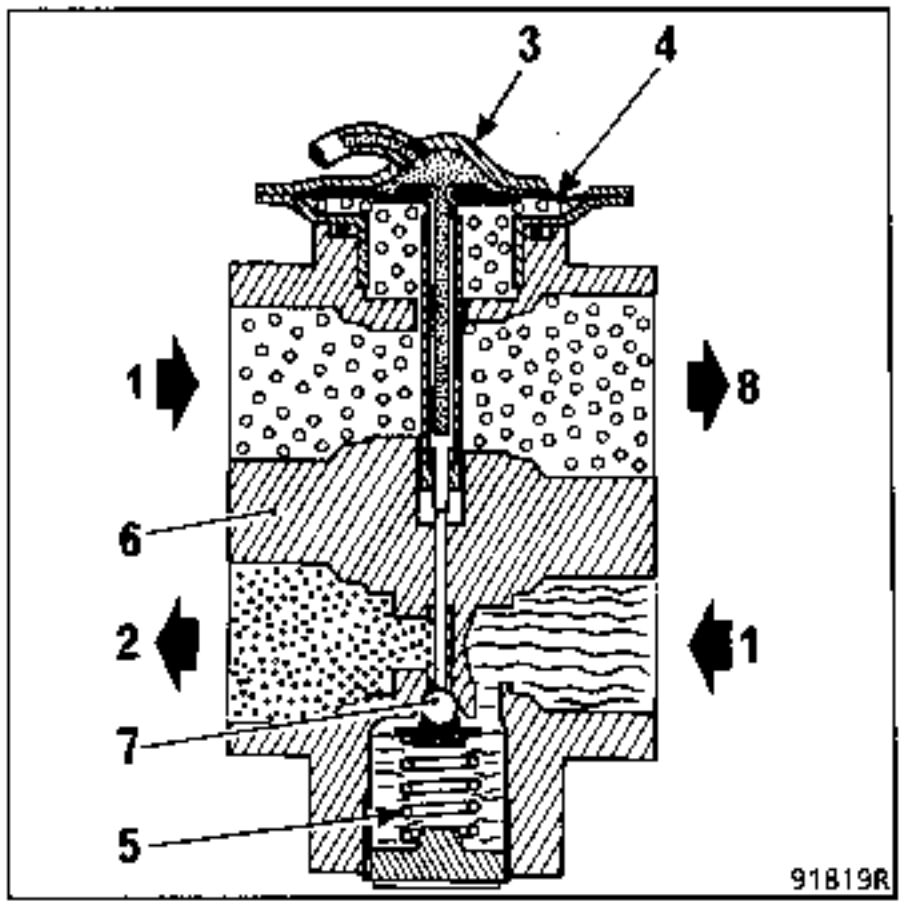
While it is circulating, the fluid heats up as it comes into contact with the air blown by the fan through the evaporator. A thermostatic sensor (3) adjusts the flow of refrigerant fluid.

In this manner a constant pressure is maintained in the evaporator, known as the circuit low pressure.

The pressure release valve reacts on a permanent basis to each variation in pressure, controlling the flow and evaporation of the refrigerant fluid in the evaporator. It should never be completely closed during operation.

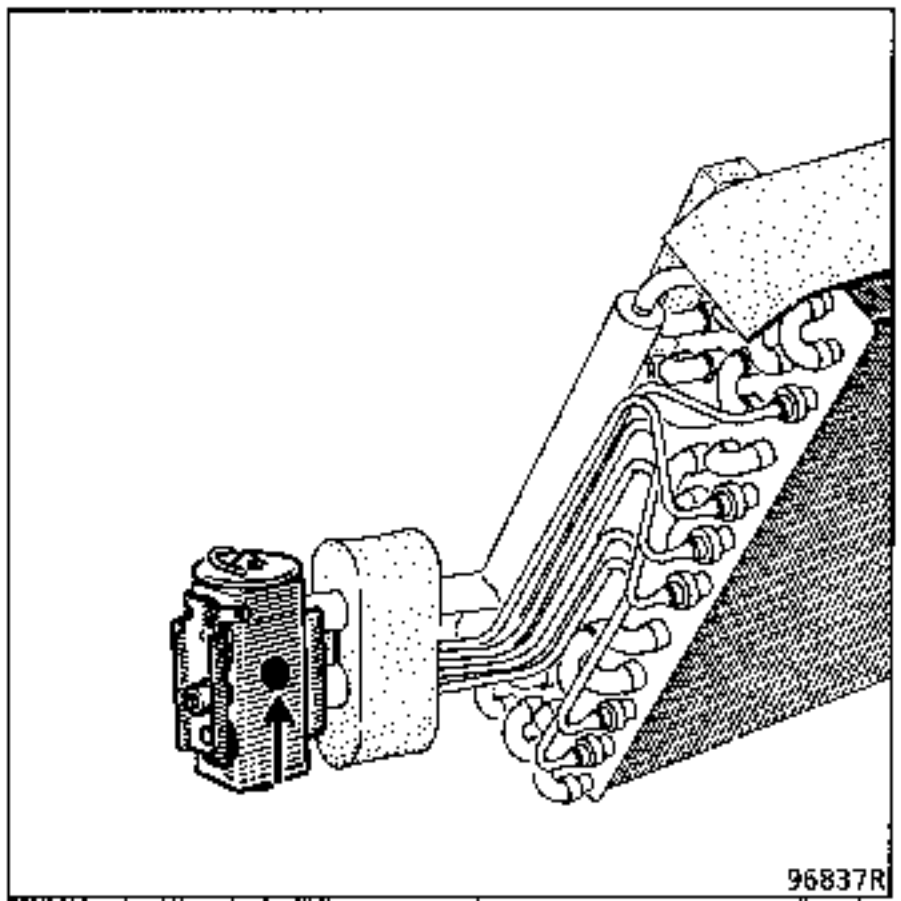
1 Refrigerant fluid inlet
2 Refrigerant fluid outlet
3 Thermostatic sensor
4 Diaphragm
5 Calibrated spring
6 Pressure release valve body
7 Modulating component
8 Return of refrigerant fluid to the compressor

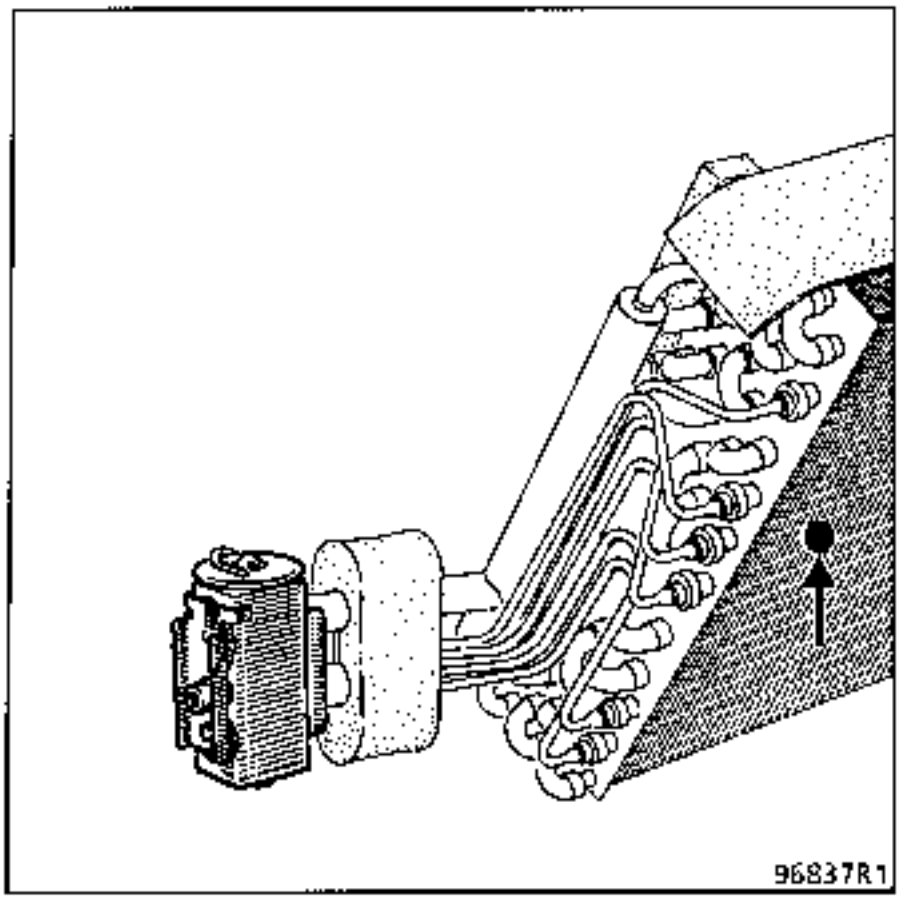
MONOBLOCK PRESSURE RELEASE VALVE (INTEGRAL THERMOSTAT)



LOCATION

The pressure release valve is located near to the evaporator. It is generally located at the front of the scuttle panel.





ROLE

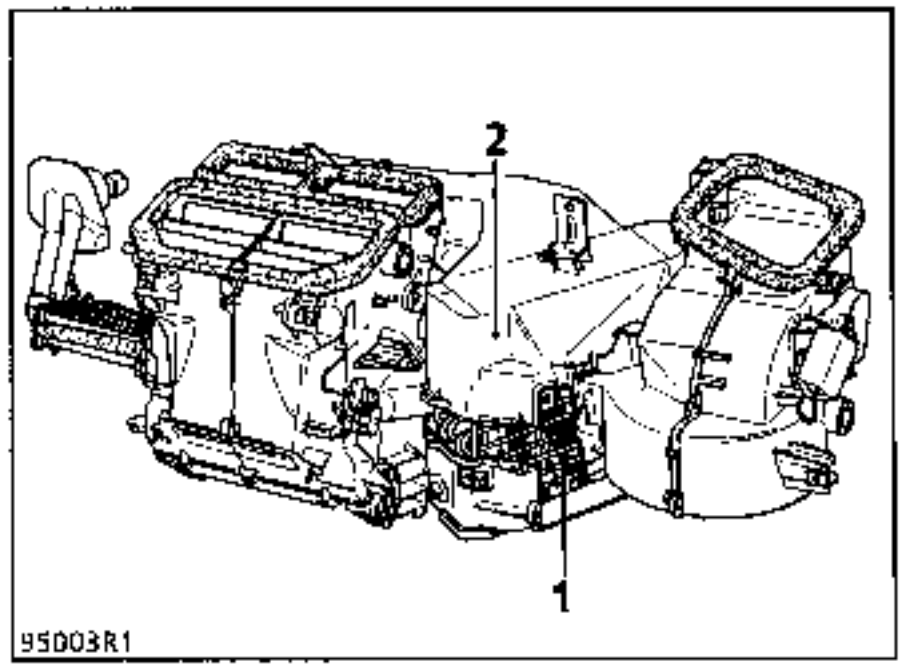
The evaporator transfers the heat from the air through which the fluid passes into the fluid itself.

The refrigerant fluid expands inside the evaporator, changing completely into a gas while cooling the external air which is directed to the passenger compartment. It also acts as a dehumidifier by condensation action on its walls, causing the formation of ice.

SPECIAL NOTES

Refrigerant fluid R134a should only be used with evaporators made completely of aluminium.

The evaporator (1) is located in a unit (2) found either in the scuttle panel or under the vehicle dashboard.



GENERAL METHOD FOR REPLACING AN EVAPORATOR

Disconnect the battery.

Drain the refrigerant circuit using the filling station.

Remove the pressure release valve.

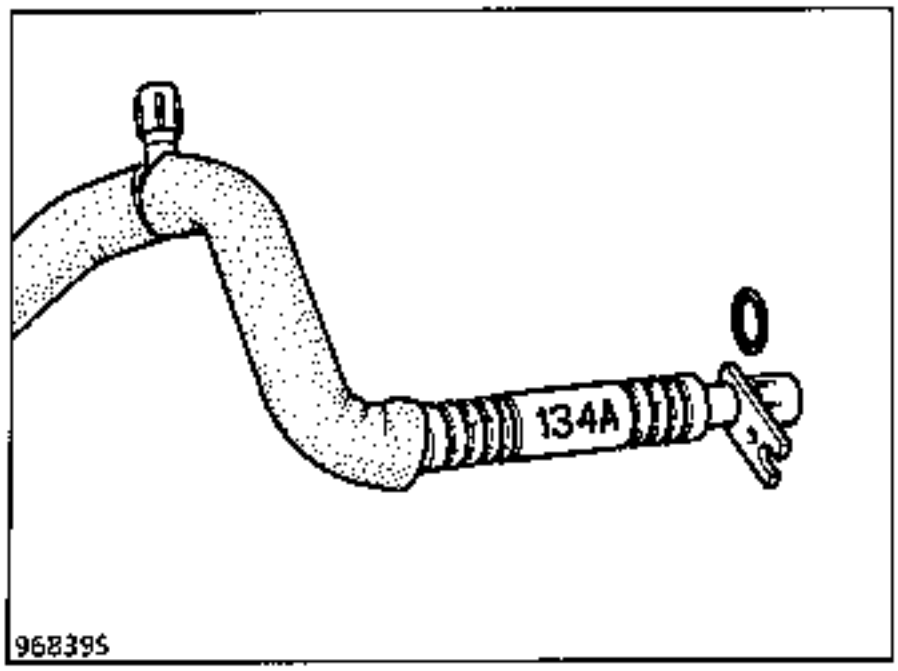
Fit plugs to avoid the entry of humidity into the cold circuit.

Remove the evaporator from its unit.

When refitting, ensure the evaporator is clean and the fins are in good condition.

In order to avoid an incorrect type evaporator being fitted (used for refrigerant fluid R12), there is a green marker on the pressure release valve.

IMPORTANT : if the evaporator is being replaced you must add **the volume of oil retained** when draining **+ 30 ml** using the filling station.



Pipes : These allow the refrigerant fluid to circulate from one component to another.

For refrigerant fluid **R134a** a thermoplastic barrier is incorporated in the flexible section of the pipe to increase its sealing.

FITTING PRECAUTIONS

Before fitting a new pipe, ensure there are no small plugs in the pipe.

When refitting, position the pipe and secure it using the clips before connecting it to the components.

Check that the pipe does not vibrate when the system is operating.

TOPPING UP THE OIL LEVEL

IMPORTANT : if a pipe is to be replaced you must add the volume of oil retained when draining + **10 ml** (use new oil).

If a pipe has burst (major leak), replace the pipe, the dehydration canister must also be replaced and apply vacuum suction, then add **100 ml** of oil directly to the compressor.

NOTE: when refitting, lubricate the unions and seals using compressor oil (specific to cold circuit for R12 or R134a).

REMINDER:

Never carry out welding work on the pipes or a component in the cold circuit.

Leave the cold circuit open for the shortest possible time to avoid the entry of humidity.

An air conditioning installation is controlled by an electrical circuit which in general is specific to each vehicle.

A certain number of components are found in each installation:

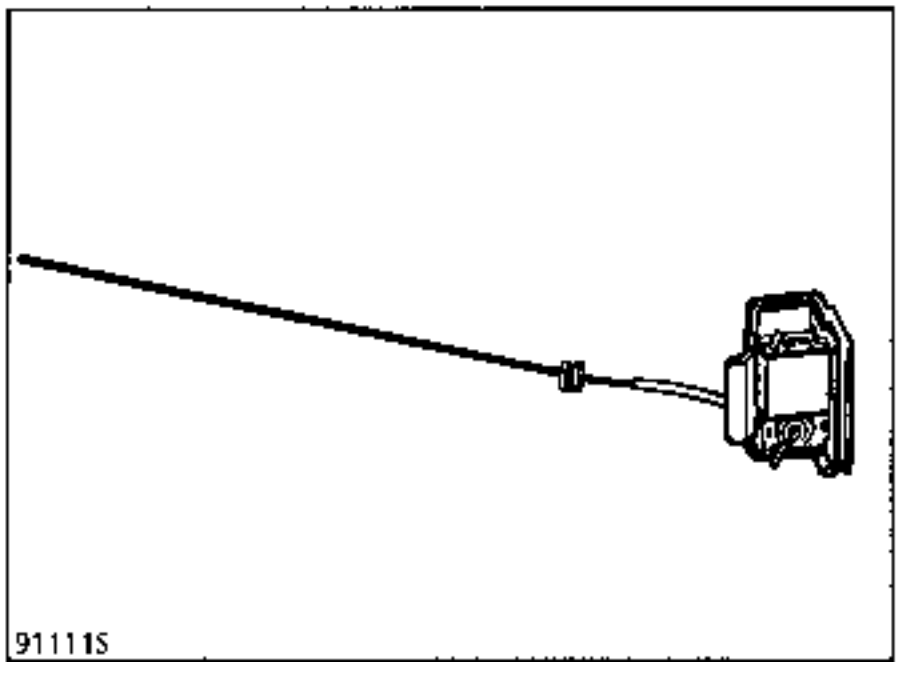
- air conditioning fan,
- air conditioning fan control rheostat,
- evaporator thermostat,
- compressor electromagnetic clutch,
- engine cooling fans thermostat,
- engine cooling fan,
- control relay,
- pressostats.

We shall only consider the air conditioning system protection components:

- evaporator thermostat,
- pressostat.

EVAPORATOR THERMOSTAT

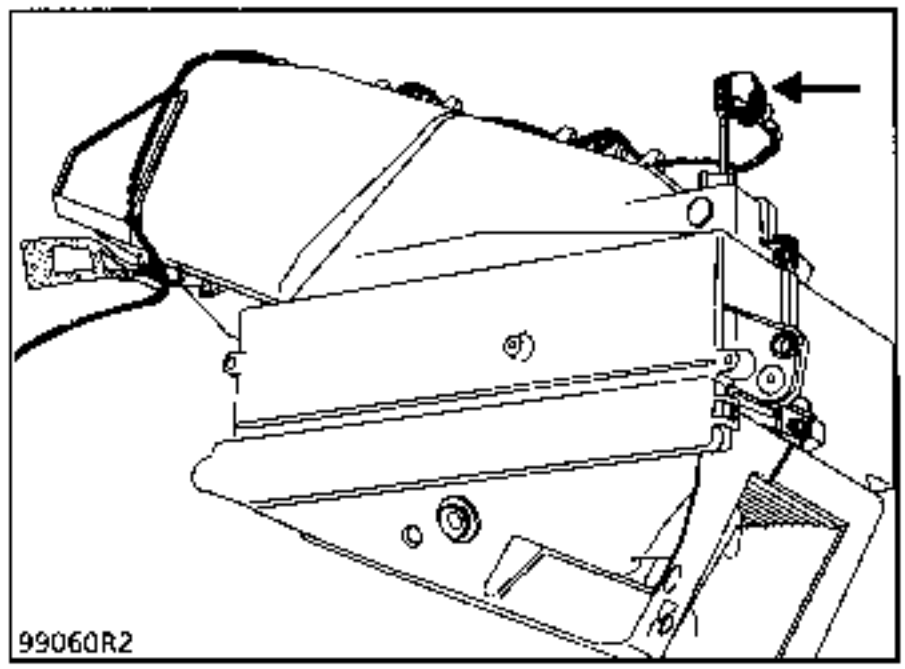
This thermostat cuts the compressor operation when the temperature of the air leaving the evaporator drops too low (≈ + 4 °C) to prevent the evaporator from icing up.



EVAPORATOR SENSOR

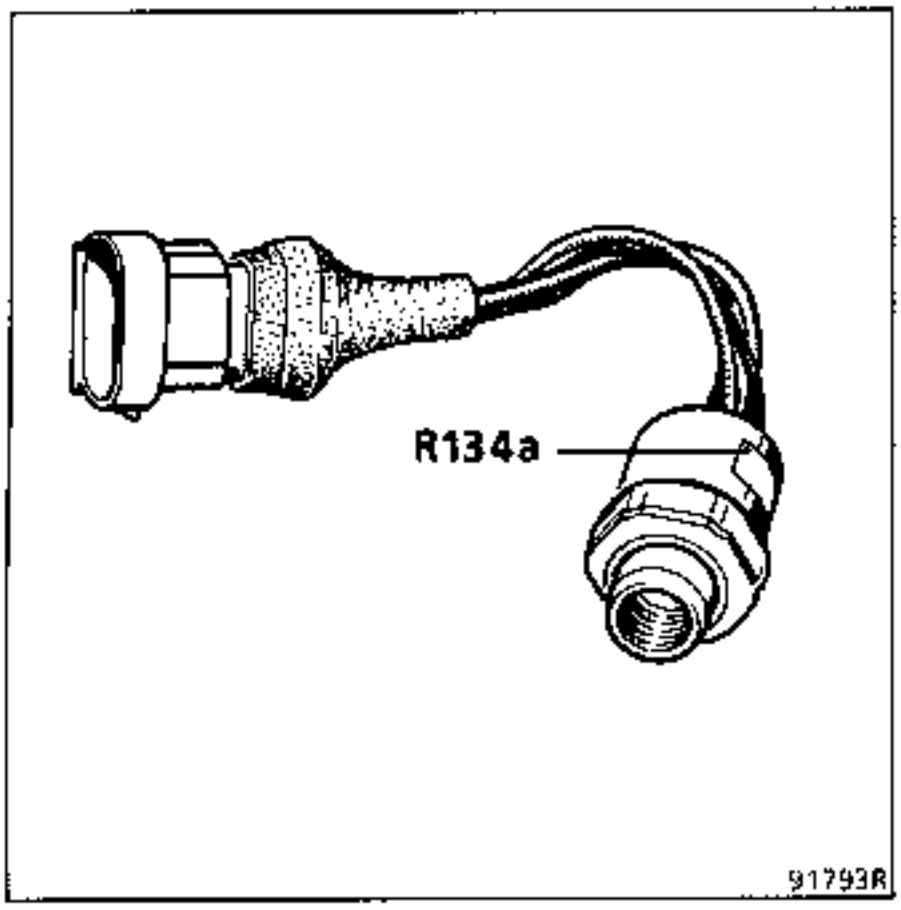
This is the "temperature sensor" for the evaporator.

It is located next to the evaporator which it crosses.



NOTE : Variable displacement compressors do not require an evaporator sensor in order to operate. The evaporator sensor has a safety function in this instance.

TRIFUNCTION PRESSOSTAT



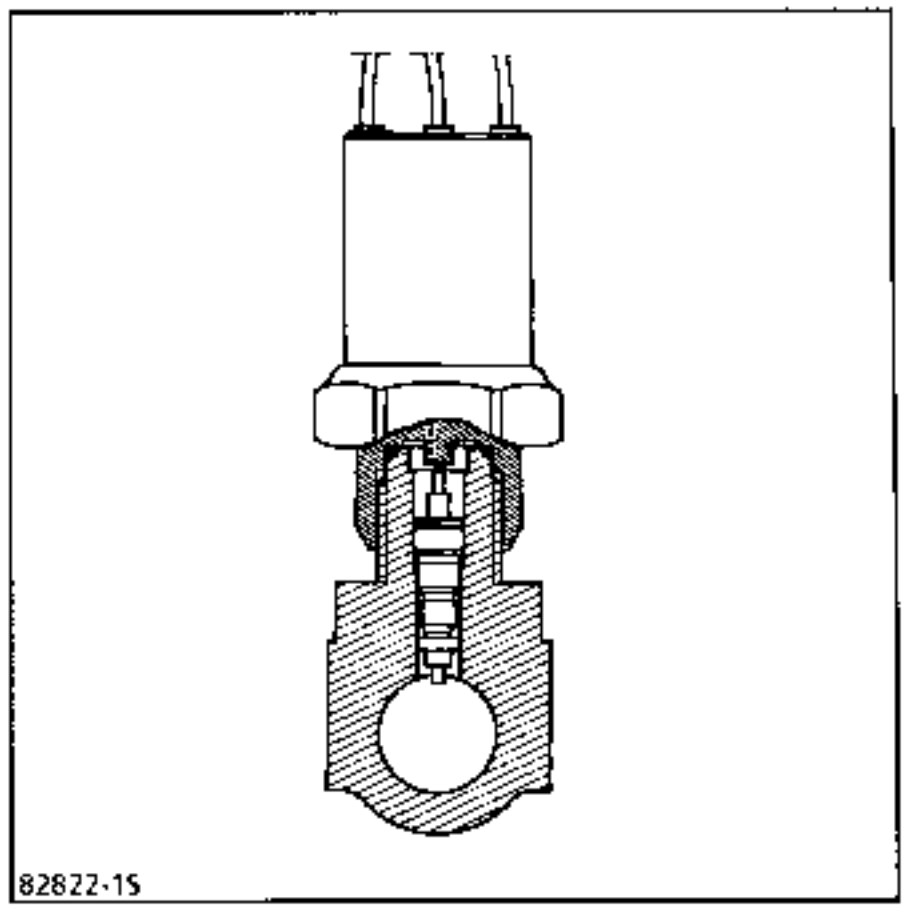
This has three functions:

Low pressure cut-out
It cuts the compressor operation as soon as the pressure in the high pressure circuit drops below 2 bars ±0.25.
The circuit is opened at **2.15 bars ± 0.35.**

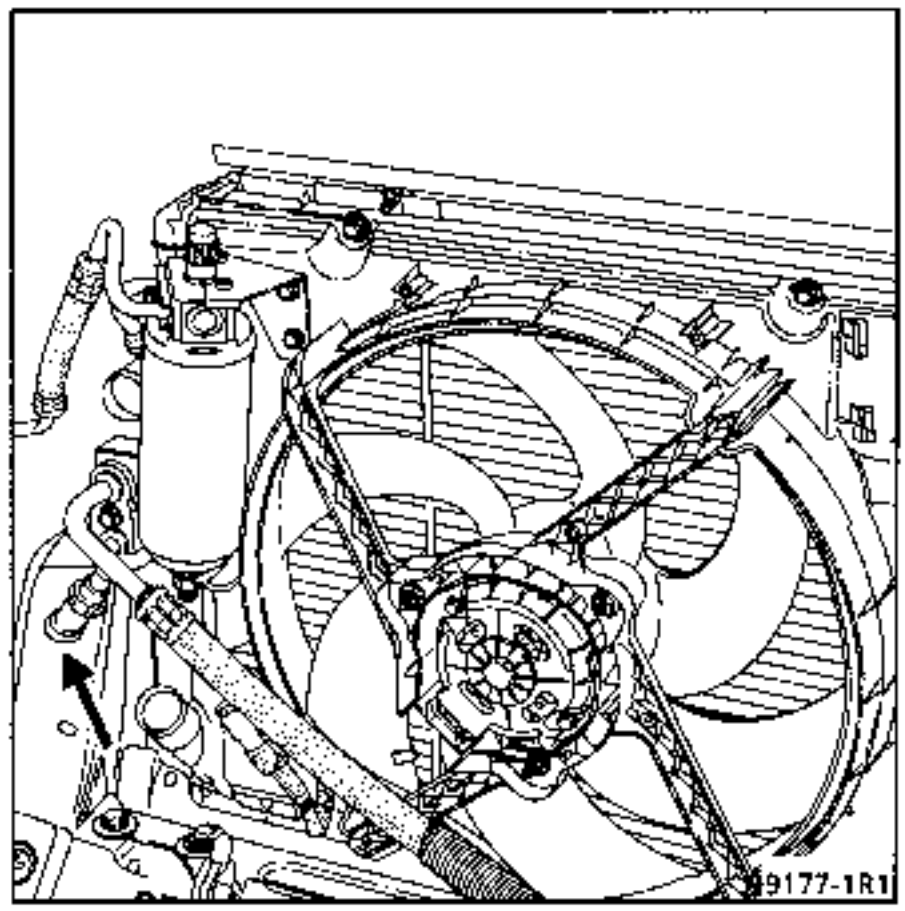
High pressure cut-out.
It cuts the compressor operation as soon as the pressure in the high pressure circuit reaches
27 bars $^{+\ 2}_{-\ 3}$.
The circuit is opened at **21 bars ±2**.

Fan control
It forces the engine cooling fans to operate, as soon as the pressure exceeds **19 bars ± 1.5.**
This action stops as soon as the circuit pressure drops below **14 bars ± 1.5.**

The refrigerant circuit does not need to be drained to work on the pressostat; it is mounted using a "SCHRADER" valve.

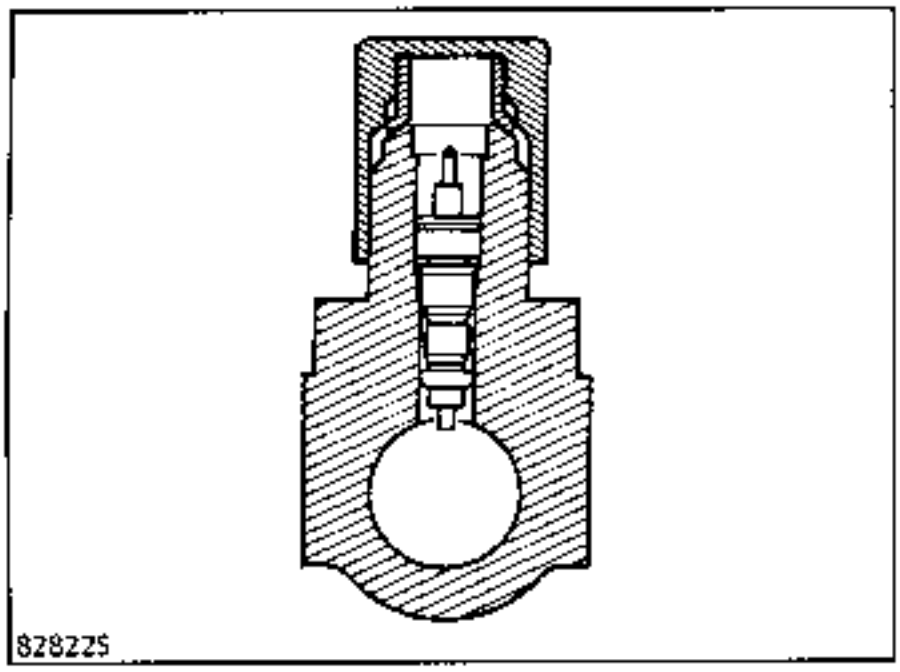


NOTE : on Renault SAFRANE, CLIO, R19, R21 vehicles using refrigerant fluid **R134a** the pressostat is specific (internal diaphragm material is different) so to avoid fitting an incorrect type pressostat (used for refrigerant fluid R12) the pressostats are marked with a green label.



USING THE FILLING STATION

The filling station is connected to the vehicle's air conditioning installation service valves using the connecting pipes with blue connections (low pressure) and red connections (high pressure).

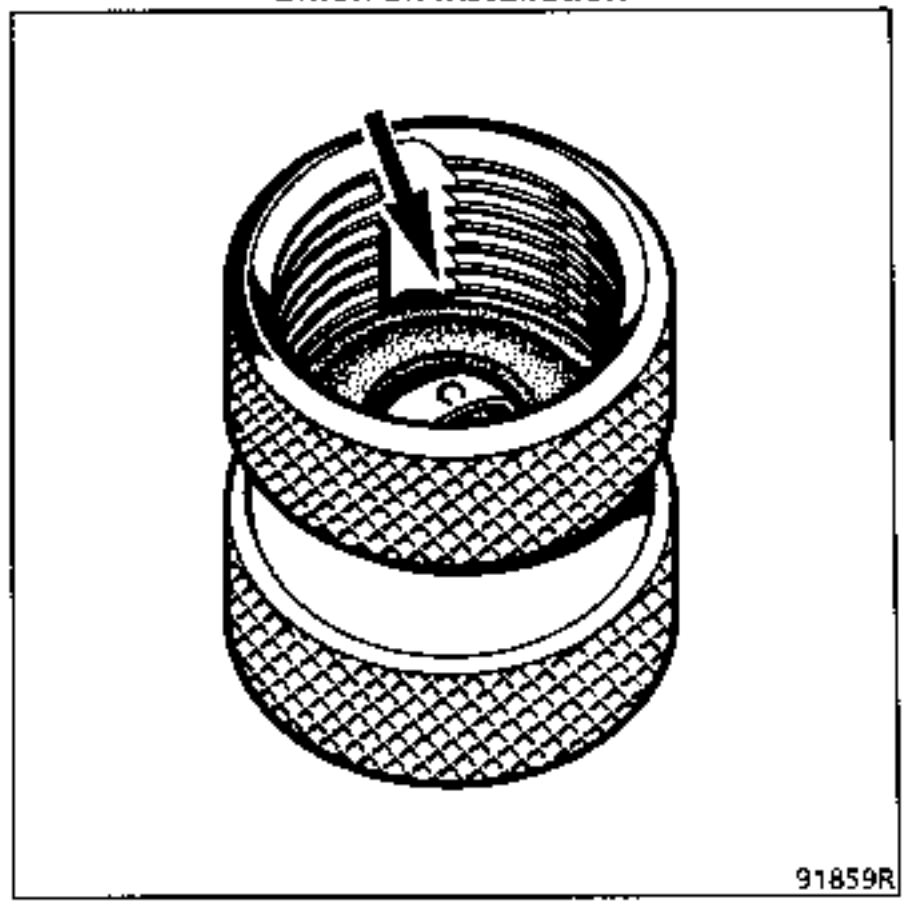


The filling station pipe unions and the unions on the installation are different and may not be incorrectly connected.

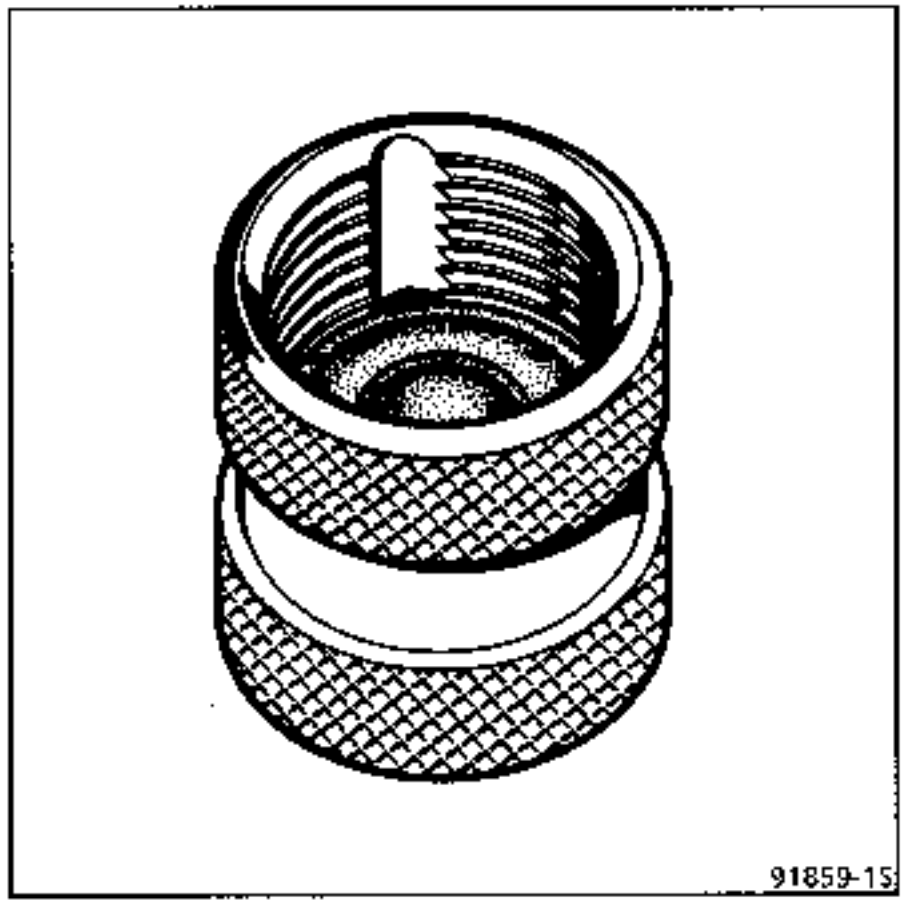
The union for the service valve on the vehicle has a service valve release pin.

When the union is connected the fluid is then able to flow.

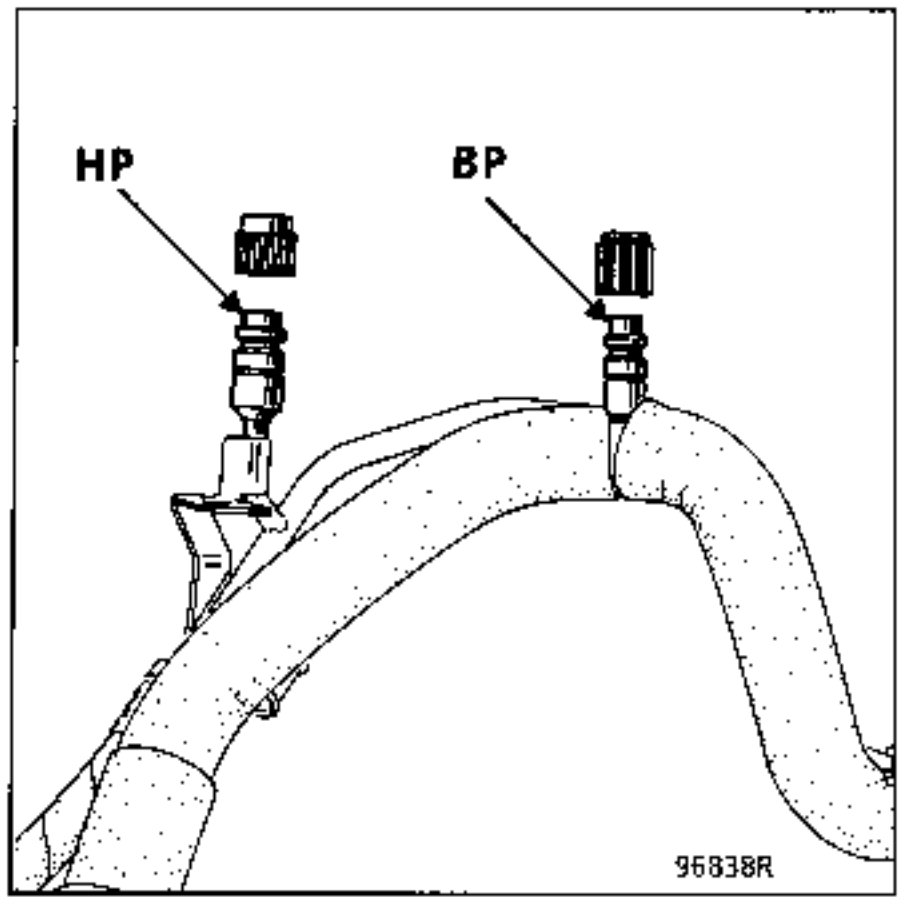
Union on installation



Union on station



Disconnecting the station from the vehicle should be carried out quickly to avoid refrigerant fluid splashing when the valves close. Gloves must be worn during this operation.



The refrigerating circuit is drained and filled via the two filling valves (BP) and (HP).

BP : Small diameter valve for low pressure circuit.
HP : Large diameter valve for high pressure circuit.

This system allows the filling equipment to be connected and disconnected quickly to avoid refrigerant fluid being splashed.

These different unions prevent incorrect filling equipment being connected (refrigerant fluid R12 filling equipment).

ADAPTATION OF THE VALVES ON THE VEHICLE

Remove the covers from the vehicle filling valves.

Remove the valve core (1) from the vehicle valves using a conventional valve core removal tool (for tyre valves).

Fit the reference labels (2) around the filling valves.

Use "LOCTITE FRENBLOC" (271 ; red) to coat the threads of the adapters (3) and (4) and screw them onto the filling valves.

High pressure	⇒	small vehicle pipe,
	⇒	adapter diameter 16 mm (3)
Low pressure	⇒	large vehicle pipe,
	→	adapter diameter 13 mm (4)

Tightening torque : 1 daN.m

Replace the vehicle valve covers with those provided with the adapters (5).