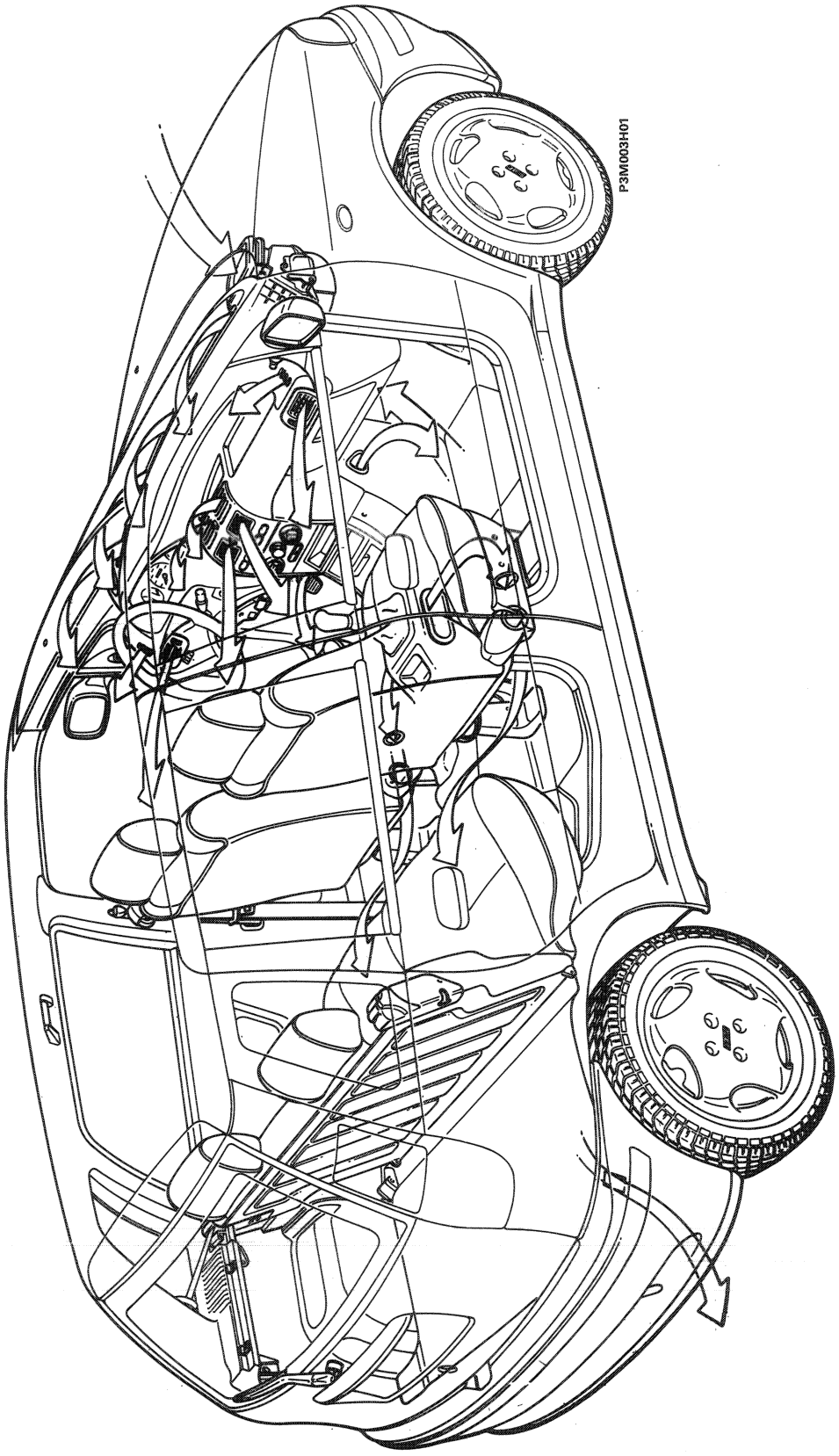
DIAGRAM SHOWING PASSENGER COMPARTMENT VENTILATION



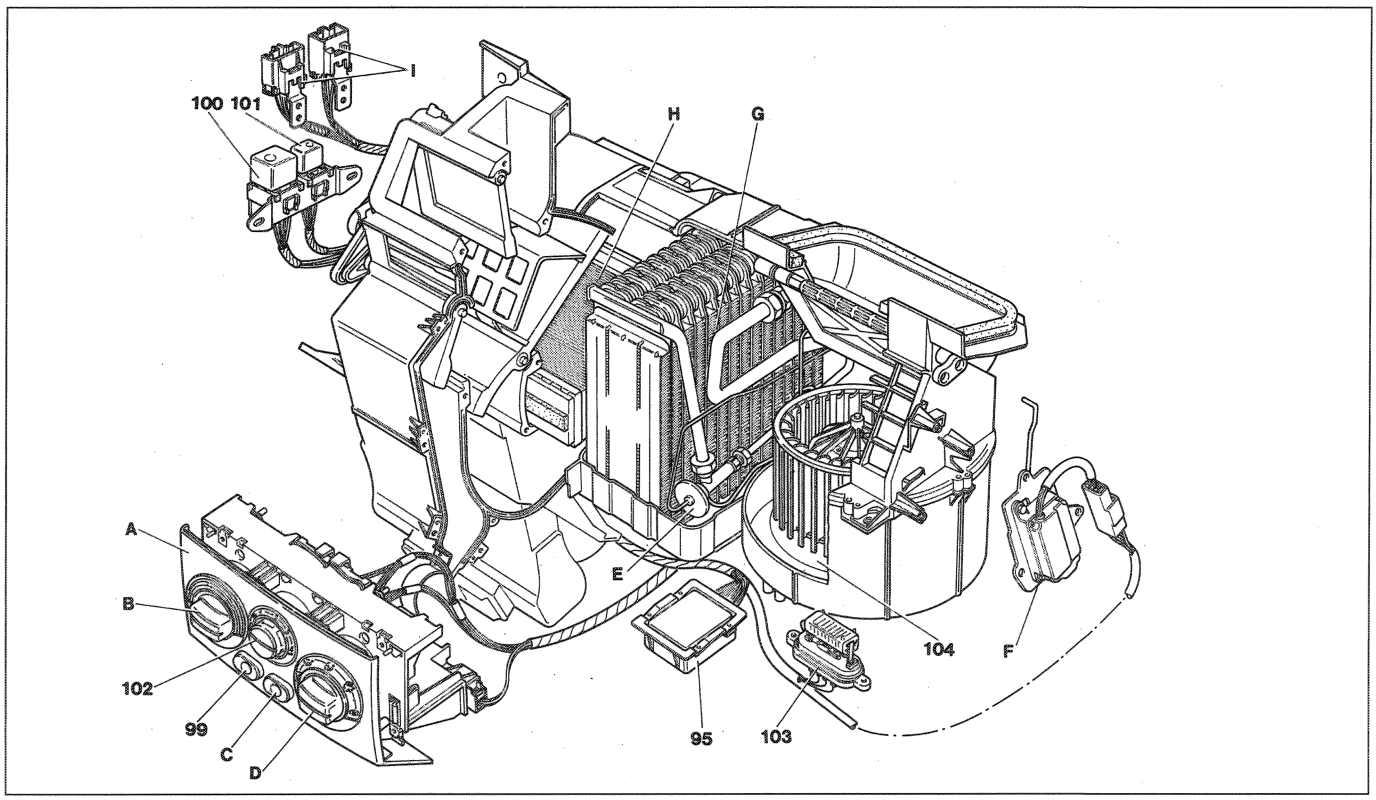
HEATER/AIR CONDITIONER WITH MANUAL CONTROLS

The heater unit for the air conditioning system with manual controls is shown in the figure.
Air mixing and distribution functions are achieved using conventional knob controls on central panel (A). These are as follows:

B: air mixing knob.
102: fan speed switch knob.
D: air distribution knob.

The knobs act via cables directly on mixer and distribution flaps whereas switch (102) regulates fan speed via resistance divider (103) located in air duct.
Two buttons, (99) and (C) on the panel activate air conditioner and recycle function respectively.

The recirculation flap is controlled by actuator (F) that incorporates a timer to limit actuator motor activation time.
A compartment in the air duct between fan and assembly case contains evaporator (6). A self-regulating expansion valve (E) is installed on the evaporator inlet pipe.



P3M003H01

Heater/air conditioner with manual controls

A Heater/air conditioner control panel
B Air mixer knob
C Recirculation activation button
D Air distribution selection knob
E Expansion valve (NIPPONDENSO)
F Recirculation flap control timer actuator
G Evaporator (NIPPONDENSO)
H Heater radiator
I Connectors
95 Compressor ECU
99 Air conditioner activation button
100 Fan circuit supply relay
101 Relay for fan first speed activation upon air conditioner activation
102 Fan speed selection switch (104)
103 Resistance divider for fan speed regulation (104)
104 Electric fan

The system is fitted with a NIPPONDENSO vane compressor with automatic regulation of compressed gas flow via electronic control unit (95). The unit is fastened under the heater.

The system acts on a fan in the compressor by measuring the temperature of evaporator (G) by means of an N.T.C. temperature sensor (not shown in figure).
System operation is described in detail in the following chapters.
Two connectors (I) fastened on a bracket on the left hand wall of the heater unit are used to connect the unit electrical system to the other air conditioner devices, located in the engine bay, and to the vehicle electrical system.
Two relays are located in the left hand part of the unit: relay (100) is used to supply the fan circuit. Relay (101) activates fan first speed when the air conditioner is turned on using button (99).

R134a gas for air conditioning system

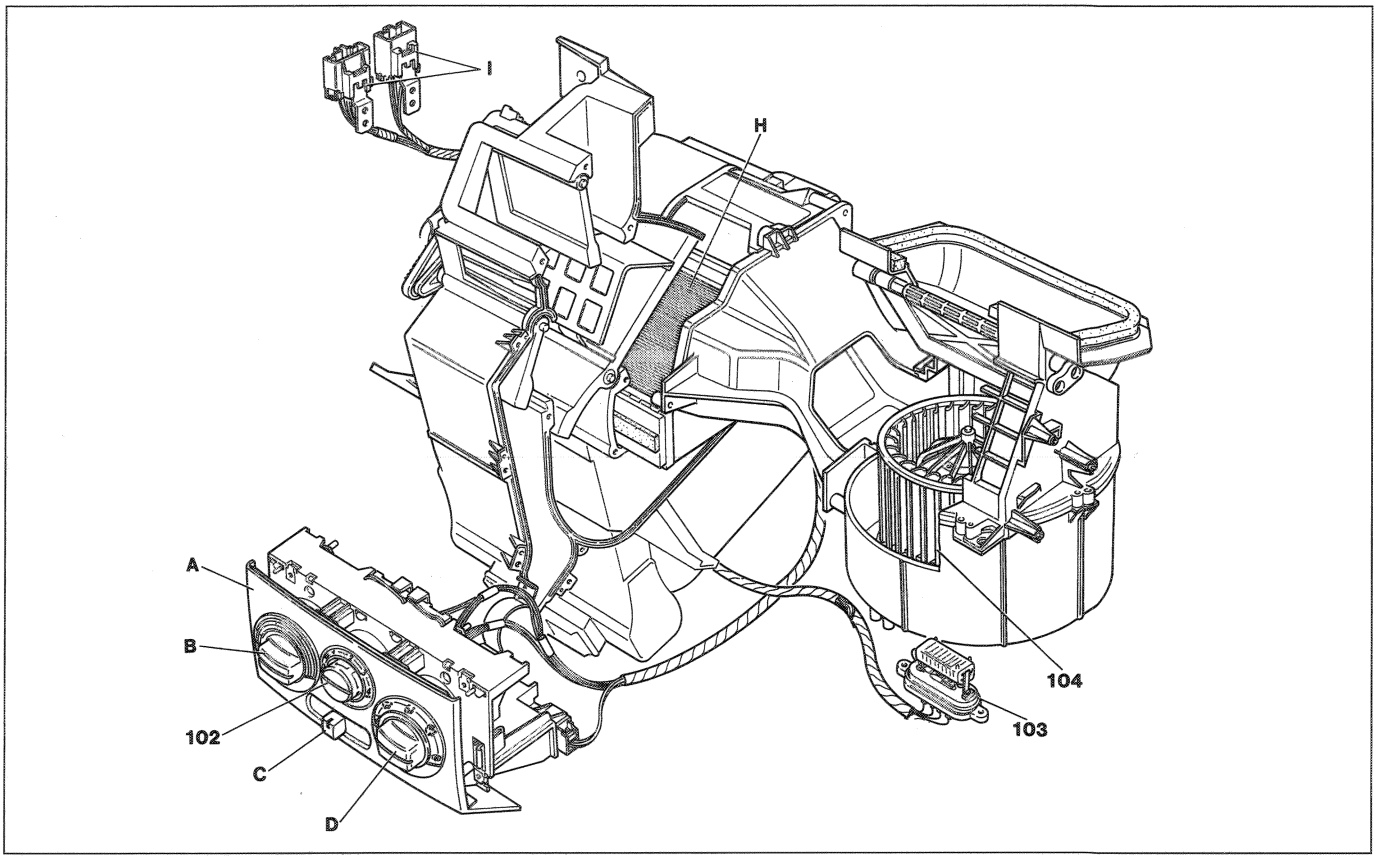
The gas used in this system is R134a (tetrafluoroethane), considered environmentally sound according to EEC law.
R134a gas cannot be used in systems designed for Freon. This is because its different molecular structure makes some components permeable (e.g. seals, hoses etc.). For this reason, components of systems that use the new gas are NOT INTERCHANGEABLE UNDER ANY CIRCUMSTANCES with components designed for Freon.
For this reason, the system must be charged/discharged using only specially-designed equipment (cleaner 134 produced by ICF) as described in the relevant chapter.

The amount of R134a gas required for this system is: ***650 ± 25 cc***

HEATER WITH MANUAL CONTROLS

The operation of the heater with manual controls is practically the same as for the air conditioner - apart from the following details:
- The unit lacks an evaporator housing compartment
- The recirculation flap is controlled by a flexible cable instead of an electric actuator

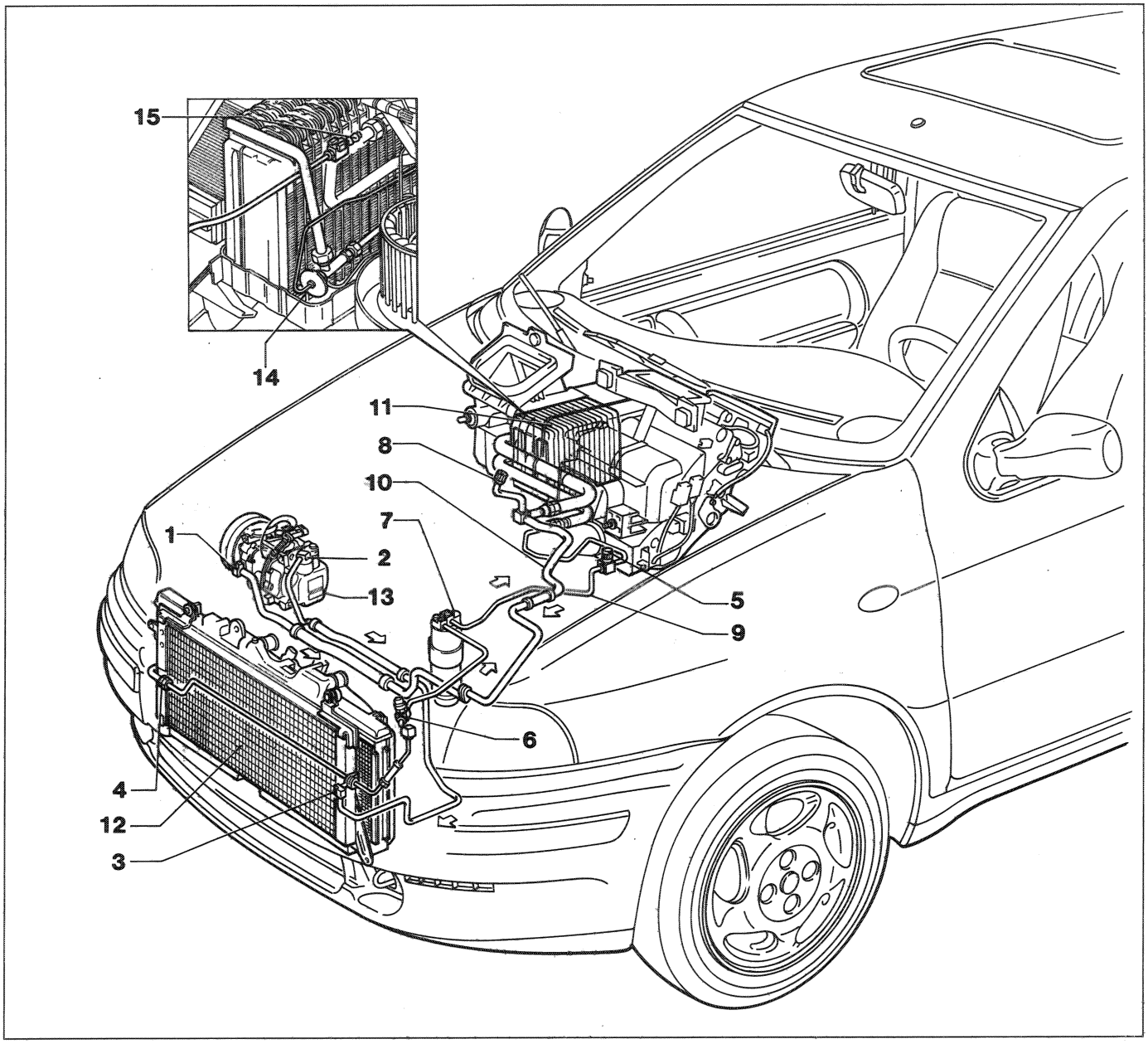
NOTE *An antipollen filter may be fitted on the outside air intake fitting as an option on both systems*



P3M003H02

Heater with manual controls

A Heater/air conditioner control panel
B Air mixer knob
C Recirculation activation button
D Air distribution selection knob
H Heater radiator
I Connectors
102 Fan speed selection switch (104)
103 Resistance divider for fan speed regulation (104)
104 Electric fan



P3M005H01

Diagram of heating/ventilation system components, fitted to vehicle

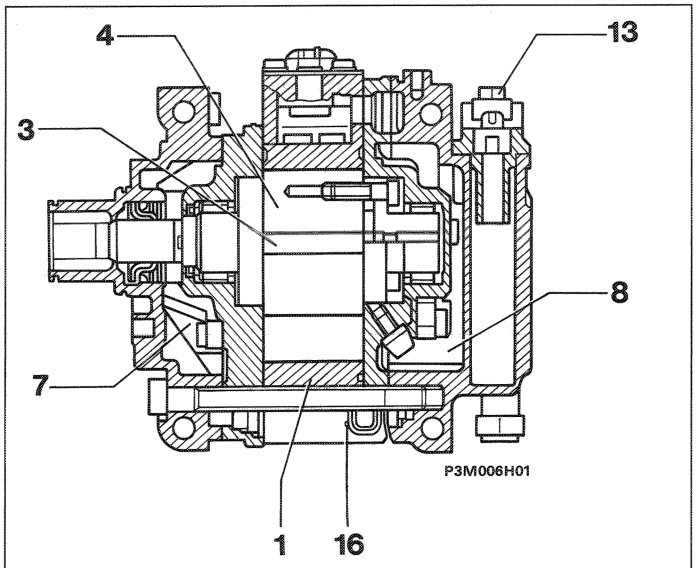
1. Gas INTAKE fitting (low pressure)
2. Gas OUTLET fitting (high pressure)
3. Condenser intake fitting
4. Condenser outlet fitting
5. HIGH PRESSURE fitting for connecting re-charging device
6. Three stage pressure switch
7. Dehydrating filter (Nippondenso)
8. LOW PRESSURE fitting for connecting re-charging device
9. High pressure pipe
10. Low pressure pipe
11. Evaporator
12. Condenser
13. Compressor (Nippondenso)
14. Expansion valve
15. Temperature sensor

Expansion valve (14) is fitted directly on evaporator intake fitting. If replaced, the heater unit must be removed from the vehicle.
The N.T.C. temperature sensor (15) is installed on the evaporator outlet duct.

COMPRESSOR

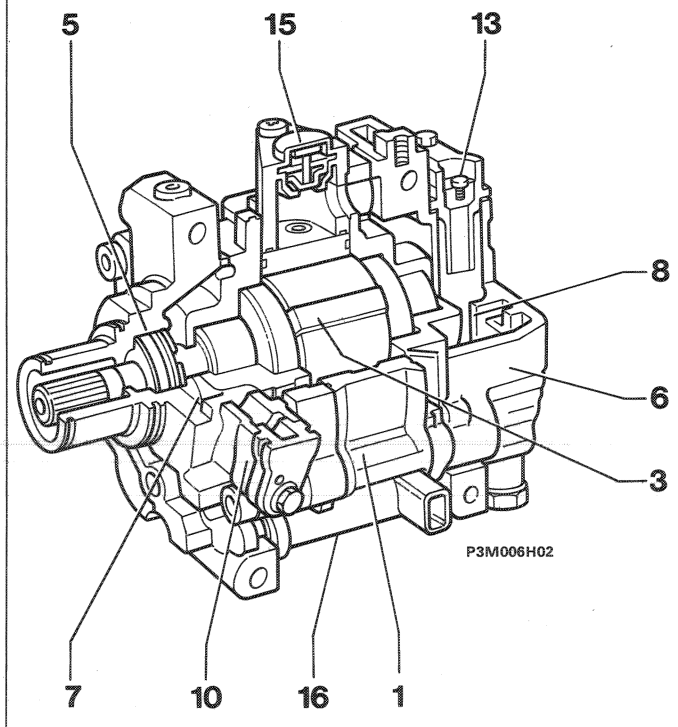
The Nippodenso compressor is vane type and equipped with a system that adjusts flow when evaporator temperature reaches values when freezing could occur.

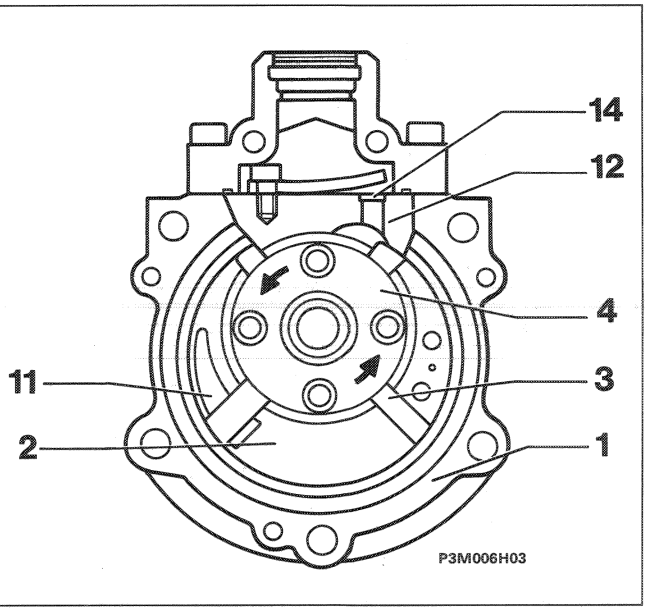
It consists of case (1) that contains chamber (2). Four vanes (3) turning inside the chamber are driven by hub (4) whose axis of rotation does not coincide with the theoretical chamber axis. The geometrical configuration of the chamber ensures that the rotating vanes are always in contact with the inside surface of the chamber.
The assembly thus allows the volume of compartments between one vane and another during rotation to be altered.
Two covers are secured to case (1), one at the front (5) and one at the rear (6). These contain an inlet or low pressure chamber (7) and a high pressure chamber (8). Gas is taken in through intake (10) on cover (5) and passes through low pressure chamber (7) and slot (11) on case (1).

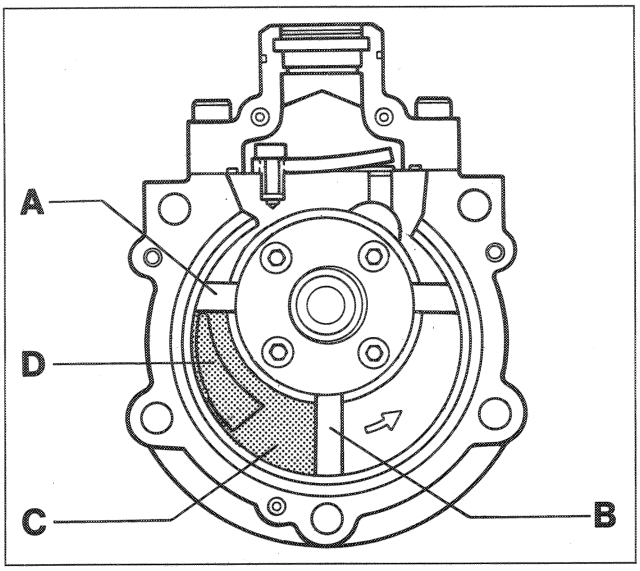


Compressed gas is expelled through duct (12) in high pressure chamber and admitted through fitting (13). Strip valve (14) prevents high pressure gas from flowing back into the compressor when it stops.

A thermal contact (15) on the top of the case is connected in line with the electromagnetic coupling. When the temperature reaches dangerous levels at about 180 °C, thermal contact (15) deactivates the electromagnetic coupling.
Fan (16) in the bottom of the compressor is used to regulate compressor output (as described in the following chapters).





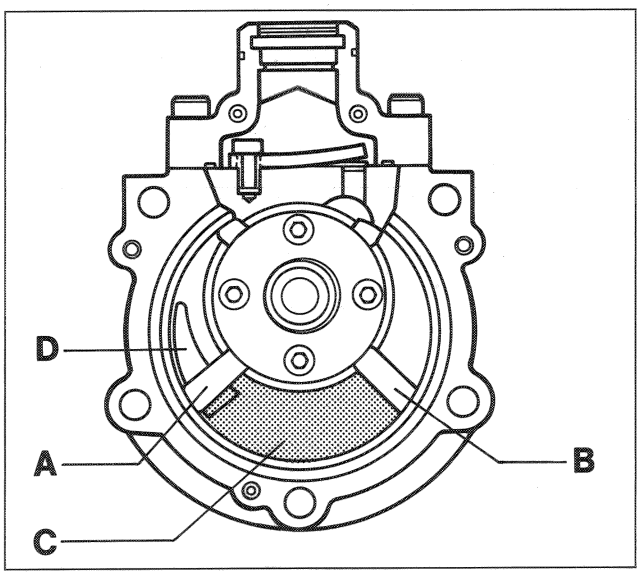


P3M007H01

OPERATION

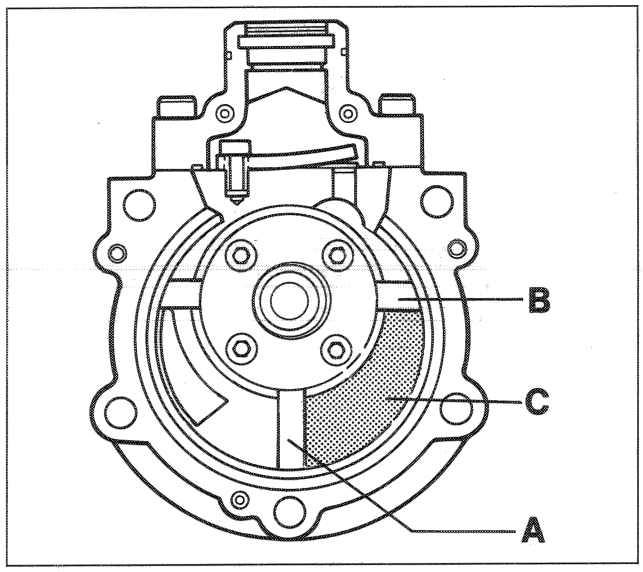
Inlet

Gas is taken in through slot (D) and then expands in compartment (C), which is delimited by vanes (A) and (B): this marks the beginning of the intake stage.



P3M007H02

The new position of vanes (A) and (B) ensures that compartment (C) is at maximum volume. In particular, vane (A) cuts off communication between compartment (C) and slot (D) to complete the intake stage.



P3M007H03

Compression

Compartment (C) reduces in volume and gas pressure increases: the compression stage thus begins.

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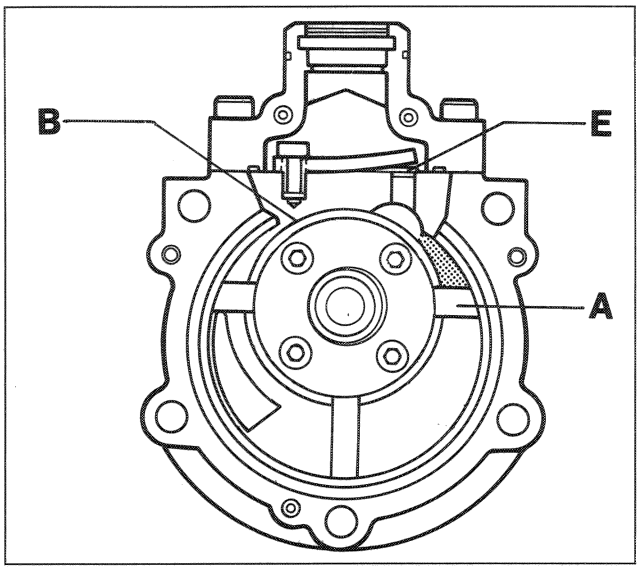
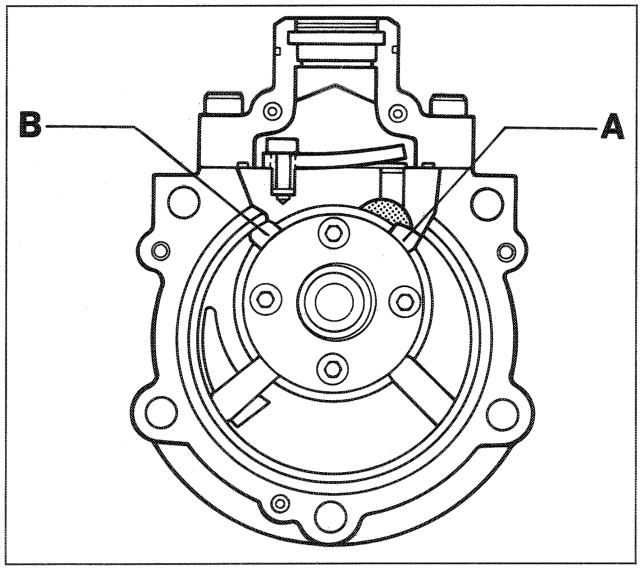


P3M008H01



P3M008H02

Exhaust

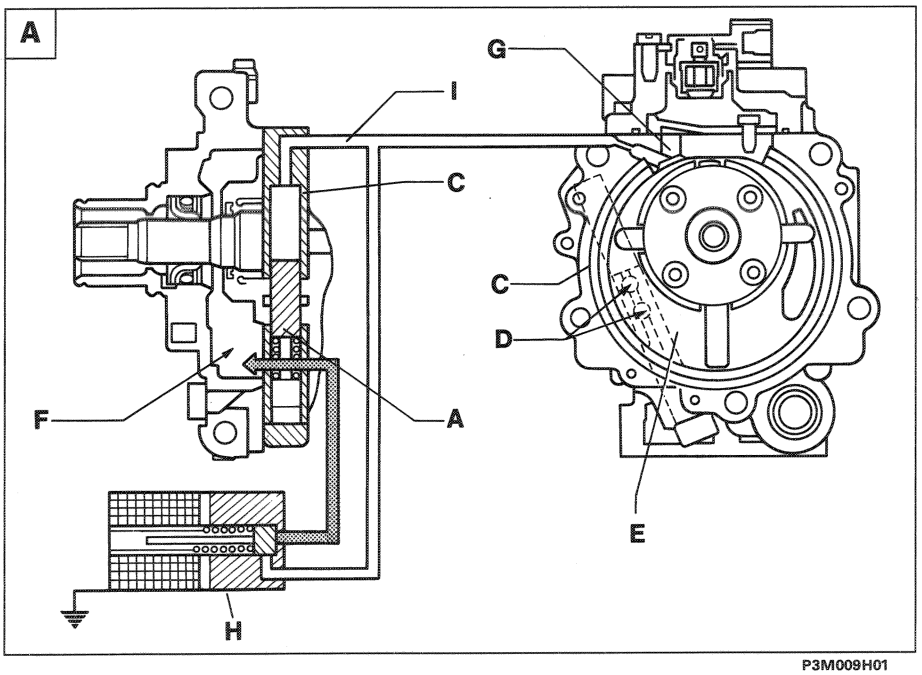
Gas pressure increases further until strip valve (E) opens: at this moment the compression stage ends and the exhaust stage begins.

When vanes (A) and (B) take up the position shown in the figure, the exhaust stage is complete.

Flow control

Flow control is achieved via an electropneumatic mechanism built into the compressor. This by-passes part of the gas in the compression stage to the intake, i.e. the low pressure chamber.

When activated, this system **allows compressor output to be reduced to about 17% of the total with the engine at 1000/min**.
The mechanism consists of a piston (A) that slides through cylinder (C) countered by spring (B).
When the piston is positioned as shown in fig. A it blocks holes (D) that bring compartment (E; in which gas compression begins) into communication with low pressure chamber (F). Viceversa, when piston (C) is in the position in fig. B, holes (D) are in communication.
The piston is operated by a small proportion of the gas under pressure, taken up by duct (I) that communicates with calibrated holes (G).
When solenoid (H) is closed, gas pressure acts on piston (A) to move it to the position in fig. A.



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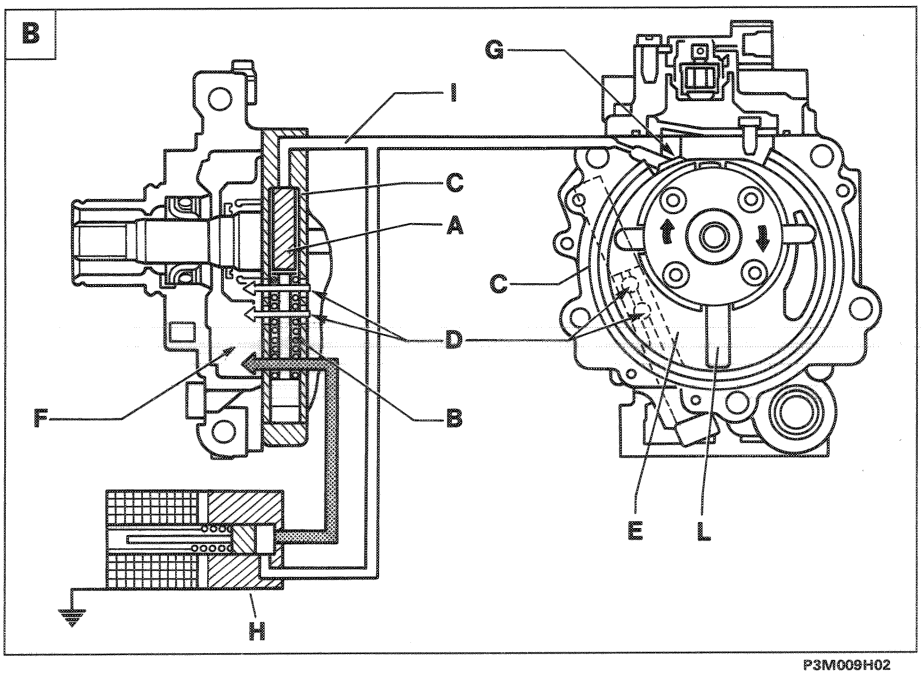

P3M009H02

Holes (D) are cut off and gas compression begins in chamber (E) as described in the previous pages.

When required, (Fig. B) solenoid (H) opens to allow gas under pressure in duct (I) and cylinder (C) to flow into low pressure chamber (F) . Piston (A) is therefore pushed into rest position by spring (B) to open up by-pass holes (D).

In this way, part of the gas in chamber (E - at the compression stage) is able to flow into the low pressure chamber (F), until vane (L), has passed holes (D).

By reducing the quantity of gas in chamber (E), compressor output can also be reduced to about 17%.

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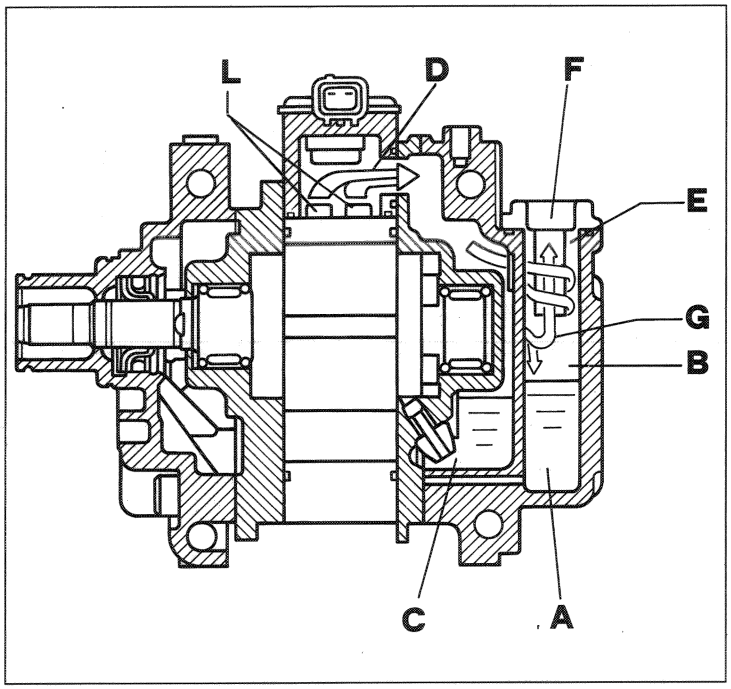
Lubrificazione

Lubrication oil (A) is contained in the high pressure chamber (B). When the compressor is working, the high pressure in chamber (B) forces oil through calibrated hole (C) to the moving parts inside.

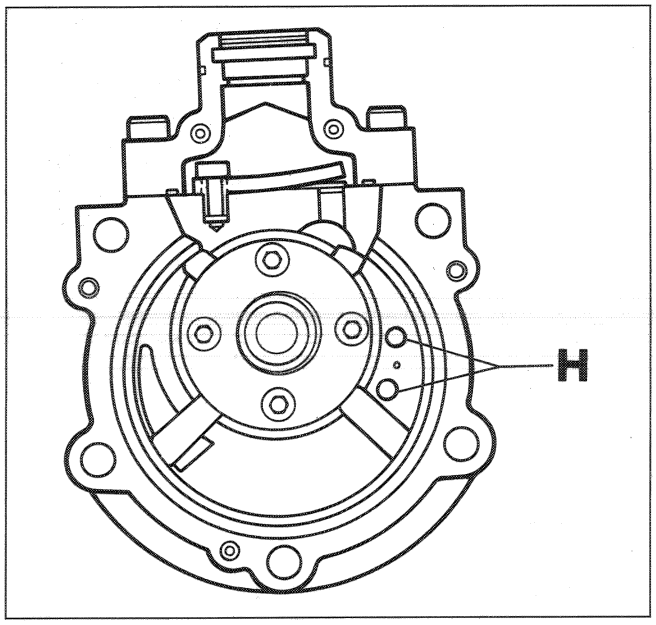
Oil mixed with gas (D) is expelled through strip valve (L) to the high pressure chamber.
A separator device (E) installed in gas outlet fitting (F) separates the gas from the oil that falls under the force of gravity to the bottom of chamber (B) while the gas emerges from fitting (F).
This device minimises the amount of oil entering the system and thus increases thermal efficiency.

The compressor is also fitted with two safety valves (H) that discharge any excess pressure in compression chambers (I).
The valves open when the pressure difference between chamber (I) and chamber (B) exceeds 4 bar.

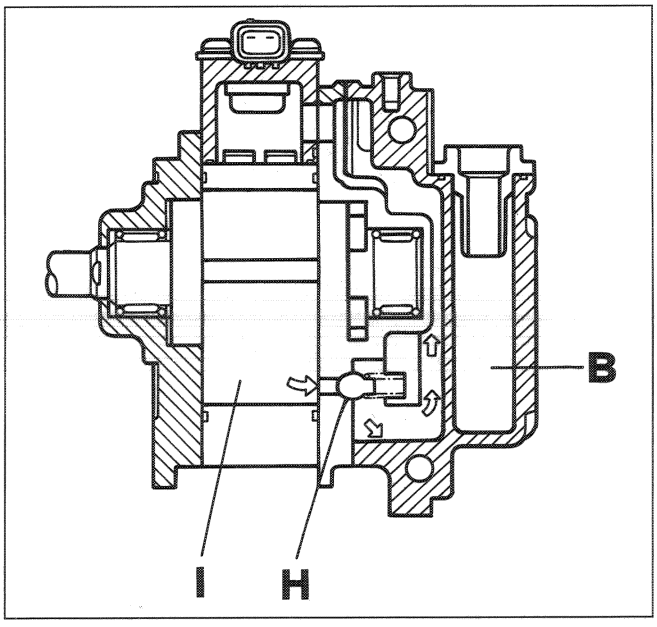


P3M010H01

To prevent the oil in the compressor from flowing into the compression chamber or the upper part of the chamber and a possible momentary loss of lubrication to the moving parts, it is essential that the compressor is positioned as shown in the figure when not installed.



P3M010H02



P3M010H03

MAINTENANCE AND SERVICE OPERATIONS

Lubricant oil

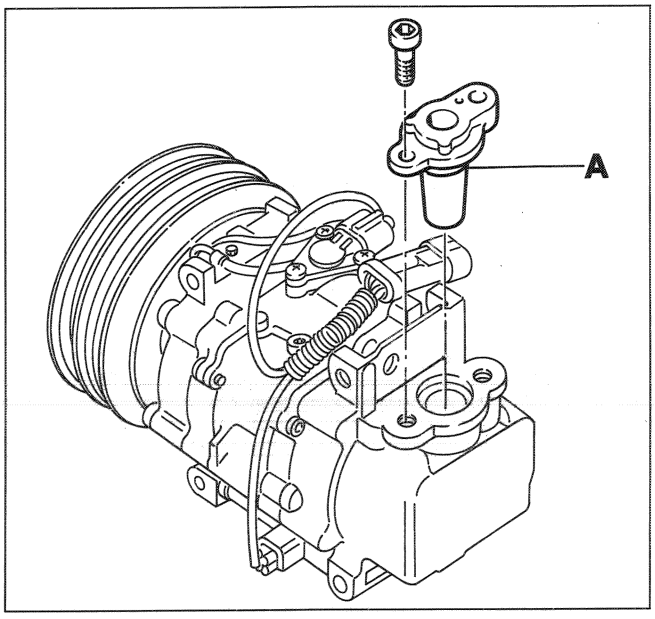
The compressor is lubricated with about 150 ± 20 cc of oil type ND9. Use only oil type ND9 for topping up or changes.

In the case of service operations that involve the replacement of certain system components such as the condenser or evaporator, add 40 cc of oil for each part replaced.
If the compressor is replaced, new compressors are supplied with the required amount of oil. For this reason, prior to installation on the vehicle, remove a quantity of oil corresponding to the amount remaining in the system. To do this:

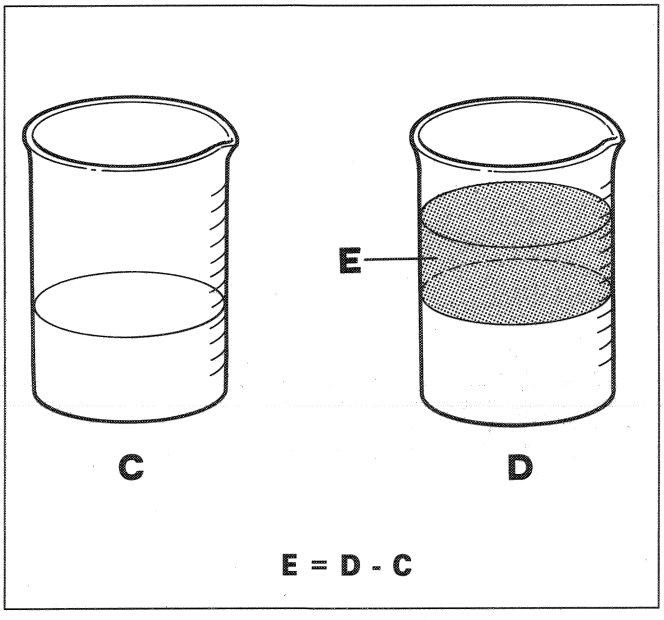
New compressors are supplied pressurised with nitrogen to prevent the entrance of moisture and impurities. When fitting, therefore, remove the inlet and outlet fitting plugs slowly and with the compressor positioned exactly as shown in the figure below (with the cover facing upward).

1. Remove the oil separator device (A) secured close to the compressor outlet fitting, which must be replaced.
2. Pour the quantity of oil in the compressor into graduated burette (C) taking care to drain the contents well.
3. Remove the oil separator device (A) from the new compressor and pour the quantity of oil contained into a graduated burette (D), taking care to drain the contents properly.
4. Remove the excess quantity of oil (E) corresponding to the difference between the quantity of oil in burette (C) and burette (D) (E=D-C).

The oil is highly hygroscopic: avoid leaving the tins open.
Avoid leaving the compressor or any other part detached from the system for longer than necessary.
Do not overturn or tilt the compressor when the oil separator device (A) is not fitted.



P3M011H01

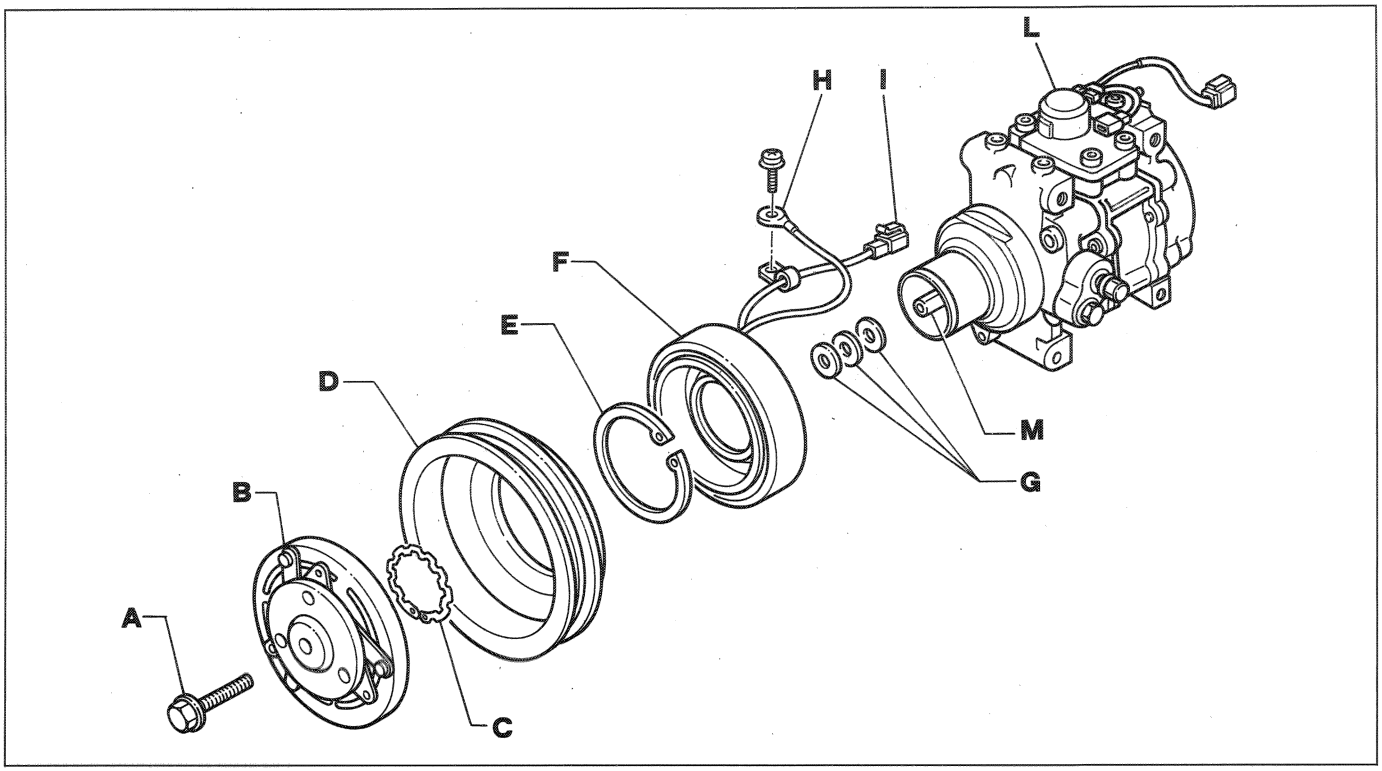


P3M011H02

Calculating the quantity of lubricant oil to be added to compressor.

50.

Electromagnetic clutch



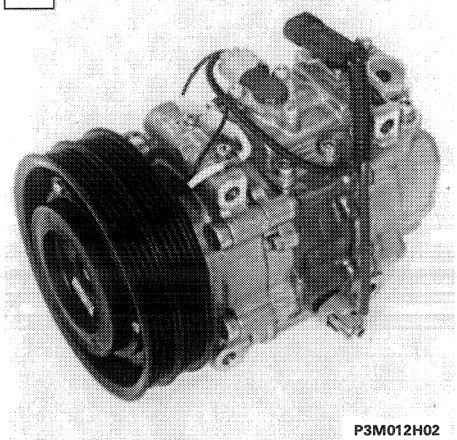
P3M012H01

Electromagnetic clutch components

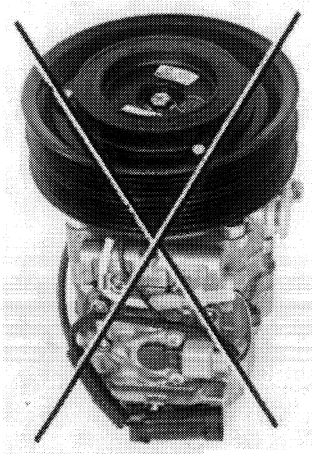
A - Bolt retaining clutch assembly to compressor shaft (M)
B - Hub with rubber coupling
C - Pulley retaining ring
D - Pulley for polyv cylinder
E - Solenoid retaining ring
F - Solenoids
G - Clutch clearance adjustment shims
H - Solenoid earth lead
I - Lead connected in line to safety thermal contact
L - Safety thermal contact

NOTE *Safety thermal contact (L) opens when compressor temperature reaches a level of about 180 °C and closes when it reaches a value of about 120 °C.*

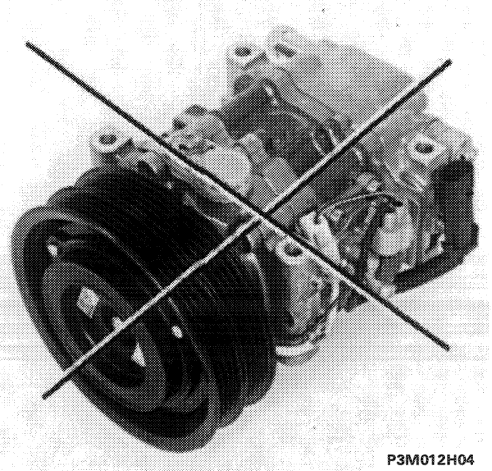
1



P3M012H02

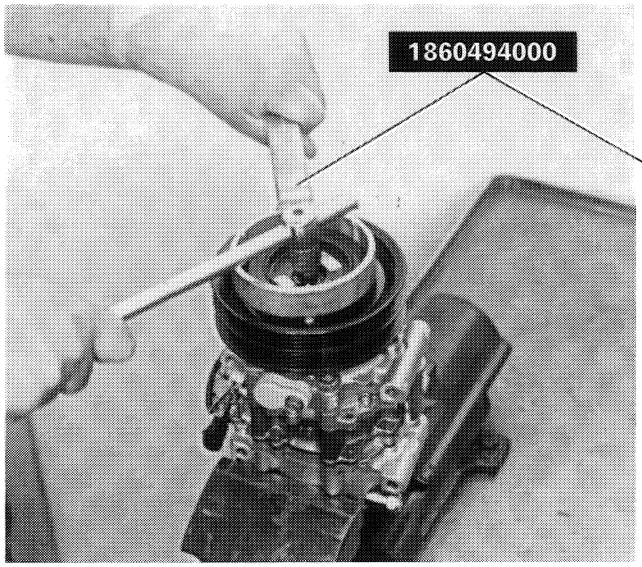


P3M012H03



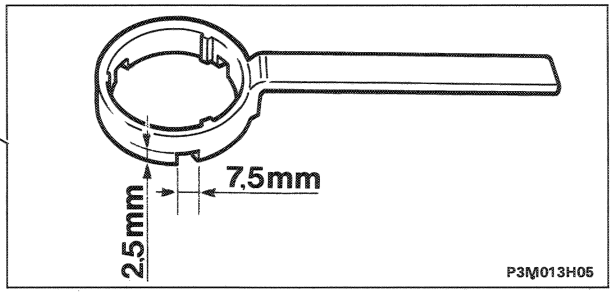
P3M012H04

Whenever the compressor is removed or handled, it should be positioned with the cover facing upward as shown in figure 1 to avoid oil leaks and the compressor becoming soiled.



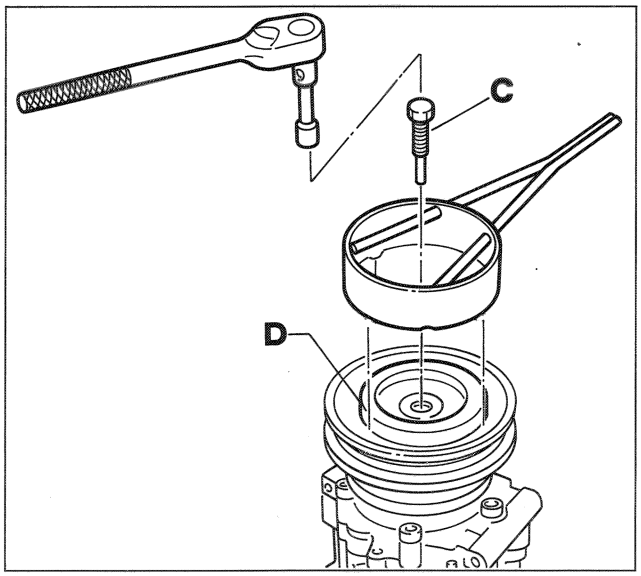
P3M013H04

Removing-refitting electromagnetic clutch components



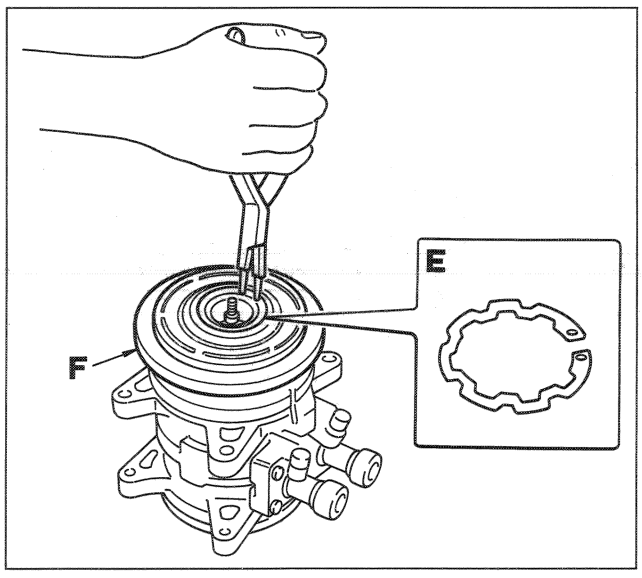
P3M013H05

Make three equidistant millings at the distances shown in the figure on tool 1860494000.
Secure hub with tool 1860494000 and remove the retaining nut.



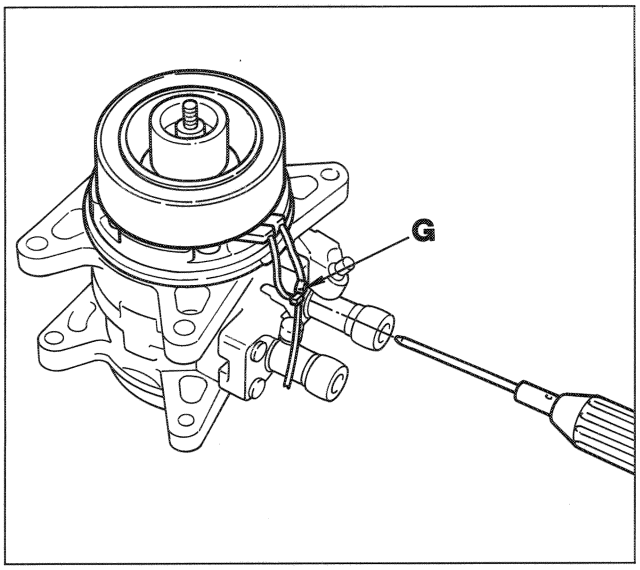
P3M013H02

Fit extractor (C) and remove (D).



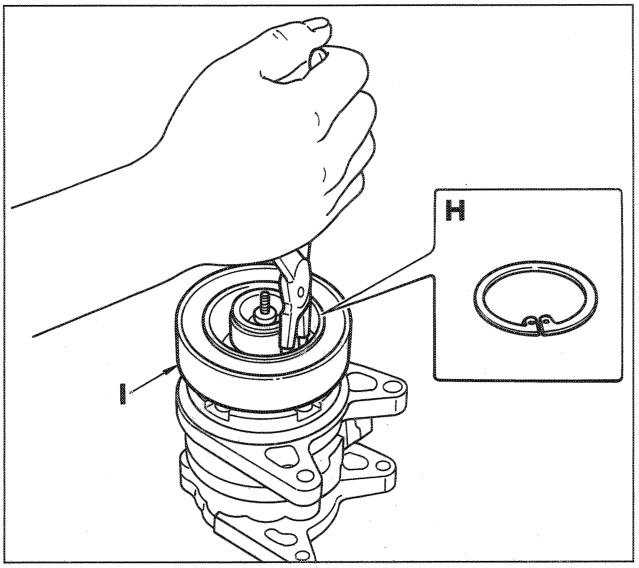
P3M013H03

Remove pulley retaining ring (E) and pulley (F).



P3M014H01

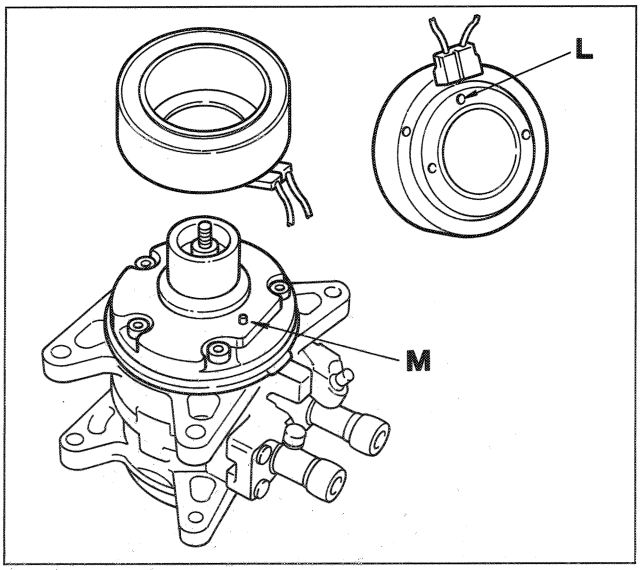
Remove solenoid lead retaining screw (G).



P3M014H02

Remove ring (H) retaining solenoid and solenoid (I)

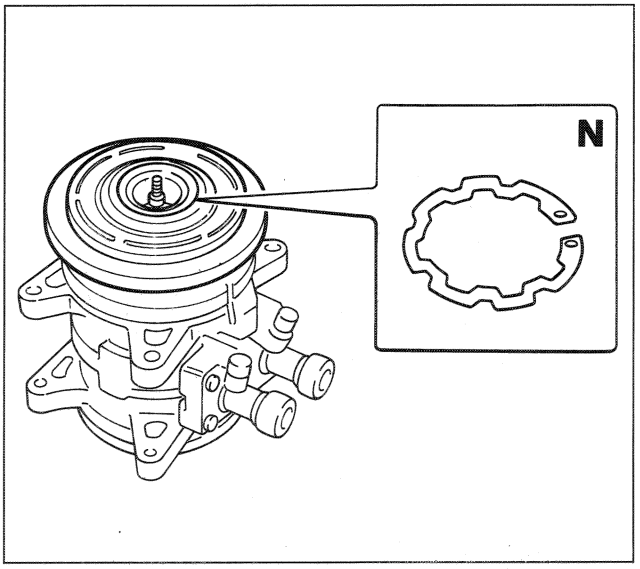
Refitting



P3M014H03

Reassemble the components by reversing order of operations described for disassembly with particular attention to the following details:

Refit solenoid taking care to insert pin (M) properly in seat (L)



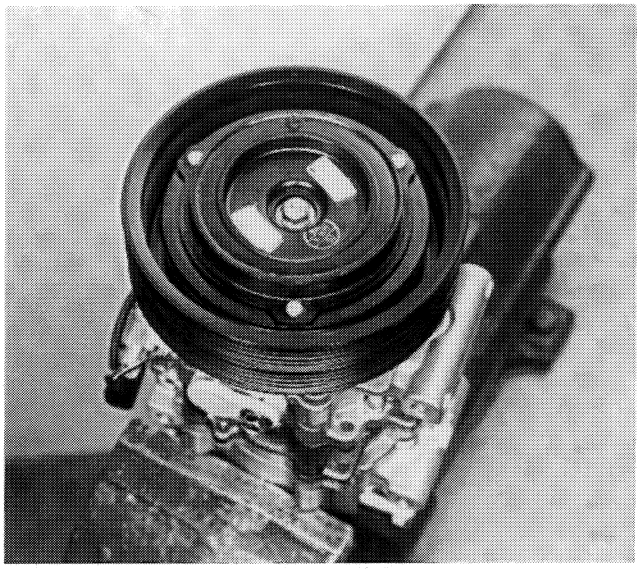
P3M014H04

Refit ring (N) retaining pulley with convex part facing upward

When fitting, replace all retaining rings removed previously

Adjusting clutch clearance

The specified clearance between hub and pulley should be 0.5 ± 0.15 mm.
Proceed as follows to check clutch clearance.



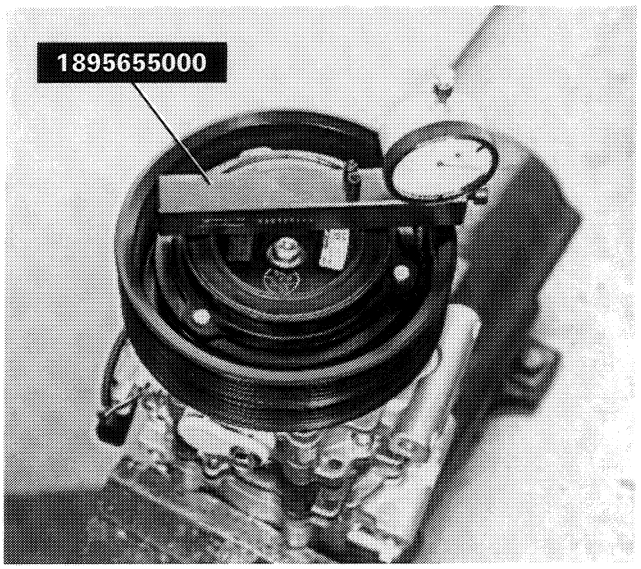
P3M015H03

Rest plate 1895655000 on hub surface.

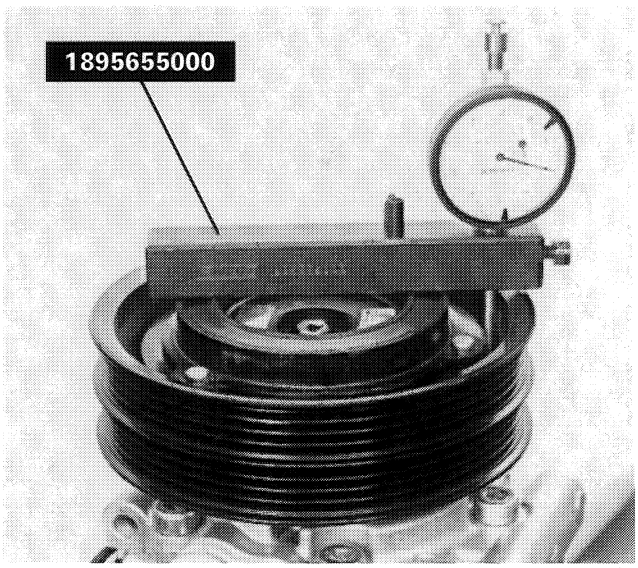
Use a gauge to measure the gap between the plate and the lower part of the clutch (gap X).

Excite solenoid with a voltage of 12V and use gauge to measure the gap between the plate and the bottom part of the clutch (gap Y).

Clutch clearance is equal to: X – Y.



P3M015H04



P3M015H05

If the measurement obtained is not as specified, add or remove shims between hub and compressor shaft.

For this purpose, shims are available in the following thicknesses: 0.10 - 0.30 - 0.50 mm.

After adjusting the clutch clearance, tighten the bolt retaining the assembly to the compressor shaft to a torque of: 10.8 - 16.2 Nm

OPERATION OF COMPRESSOR ECU FOR VEHICLES WITH PETROL ENGINES.

The gas outlet control system is governed by an ECU. This acts on the compressor solenoid according to evaporator temperature, which is recorded using an NTC cursor (96 - see figure on next page).

When button (99) is pressed to activate the air conditioner, the ECU is supplied with 12V positive voltage to terminal (1). Under these conditions, the ECU activates the gas flow control solenoid (94B) so that the compressor is set to operate with an output of 17%.

Simultaneously, a positive signal is sent to terminal (8) of fuel injection control unit (85), which adjusts engine idle speed. After a delay of several milliseconds, relay (E) for activation of compressor coupling (94A) is excited.
During air conditioner operation, if evaporator temperature exceeds 5 °C, the ECU sets the compressor to maximum output (100 %).
If evaporation temperature reaches a level of between 3 - 4 °C, the ECU excites the flow control solenoid (94B) and output is reduced to 17% of the total.

The amount of gas entering the evaporator is therefore reduced and the cooling effect consequently falls.
If evaporator temperature reaches values of less than 3 °C, the ECU releases relay (E) and thus consequently the compressor coupling.
The compressor coupling is released when the accelerator pedal is pushed to the floor and when the engine temperature reaches 107°C to avoid further overheating. These operations are carried out by the electronic injection ECU (85).

The ECU always sets the compressor to operate at 17% of the total output whenever it is activated in order to reduce engine load. This situation is maintained for a minimum of 4 seconds. After this, ECU (95) decides whether to set the compressor to maximum output or not, as described previously, on the basis of evaporator temperature. The compressor ECU (95) is informed that the air conditioner has been activated via a 12 V signal to terminal (1).
When the compressor is activated by the fuel injection control unit, the ECU is informed via terminal (2) which is connected in parallel to the coupling via auxiliary control unit (91).

NOTE *The connections of electronic injection ECU (85) shown in the diagram refer to the version 1242 SPI and MPI.*

Evaporator temperature sensor

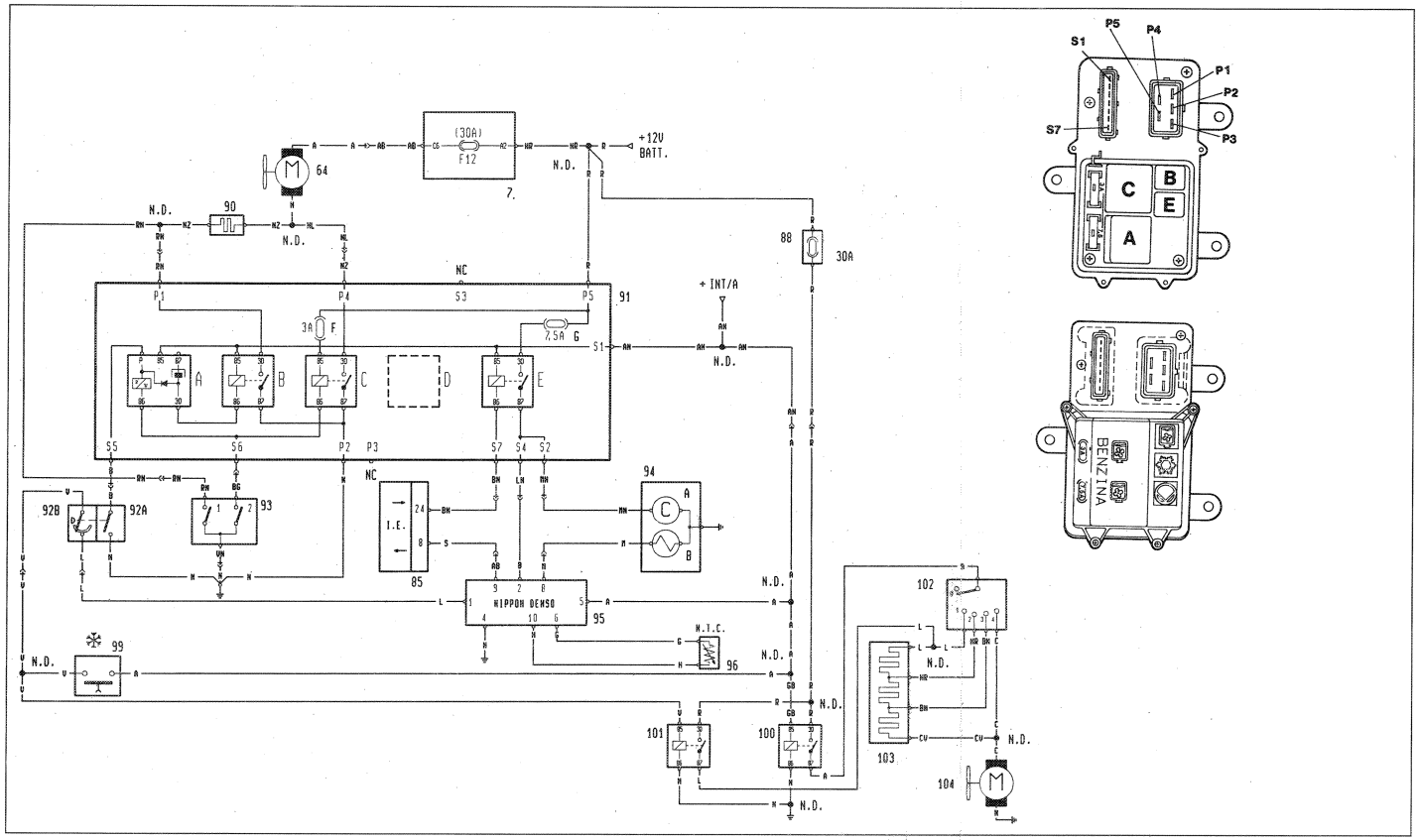
Temperature sensor (96) is an NTC resistor and positioned close to the evaporator outlet pipe. It is not accessible from the outside.

In the case of Service operations that involve evaporator removal/refitting, it is important NOT TO MOVE THE SENSOR FROM ITS ORIGINAL POSITION, because the different temperature levels read by a differently positioned sensor could lead to incorrect compressor output control.

Sensor reference values are:

at 0 °C = 4852 Ω ± 243 Ω
at 15 °C = 2341 Ω ± 234 Ω
at 25 °C = 1500 Ω

AIR CONDITIONER WIRING DIAGRAM (FOR PETROL ENGINES)



P3M017H01

7. Junction unit (under facia on left hand side)
64. Condenser and radiator cooling fan
85. Weber electronic injection ECU (SPI and MPI)
88. Fuse (30A) protecting ventilation fan circuit (in engine bay)
90. Resistor for first fan speed (64)
91. Auxiliary control unit for air conditioner (on left front wheel arch)
    A. Timer delaying activation of 2nd speed of condenser and ventilation fan (64)
    B. Relay for activation of first speed of fan (64))
    C. Relay for activation of second speed of fan (64))
    D. Connection available
    E. Compressor coupling activation relay
    F. Fuse (3A) protecting excitation circuit of relay (C))
    G. Fuse (7.5) protecting circuit of compressor coupling (94A)
92. Three stage pressure switch (trinary)
    A. Section MIN/MAX
    B. Second level section (closed at about 15 bar)
93. 2-level thermal contact on radiator for activating radiator/condenser fan (64) (1st level closed at about 88 °C; 2nd level closed at about 92 °C)
94. Air conditioner compressor
    A. Coupling
    B. Flow control solenoid
95. Nippodenso compressor control unit (under heater unit)
96. Evaporator temperature sensor (in evaporator)
100. Ventilation fan circuit supply relay
101. Relay for activating ventilation fan 1st speed upon air conditioner activation
102. Ventilation fan speed selection switch
103. Resistance separator for ventilation fan speed
104. Ventilation fan

50.

OPERATION OF COMPRESSOR ECU FOR VEHICLES WITH DIESEL ENGINES.

Compressor coupling control circuits differ from petrol engine vehicle circuits because they lack a fuel injection control unit but are fitted with a Bitron electronic unit (98) for disconnection of the compressor during acceleration.

When button (99) is pressed to activate the air conditioner, terminal (1) of ECU (95) is supplied with a voltage of 12 V through the closed contacts of section (B) of three stage pressure switch (92).

Under these conditions, the ECU supplies compressor output control solenoid (94B) so that it operates with an output of 17%.

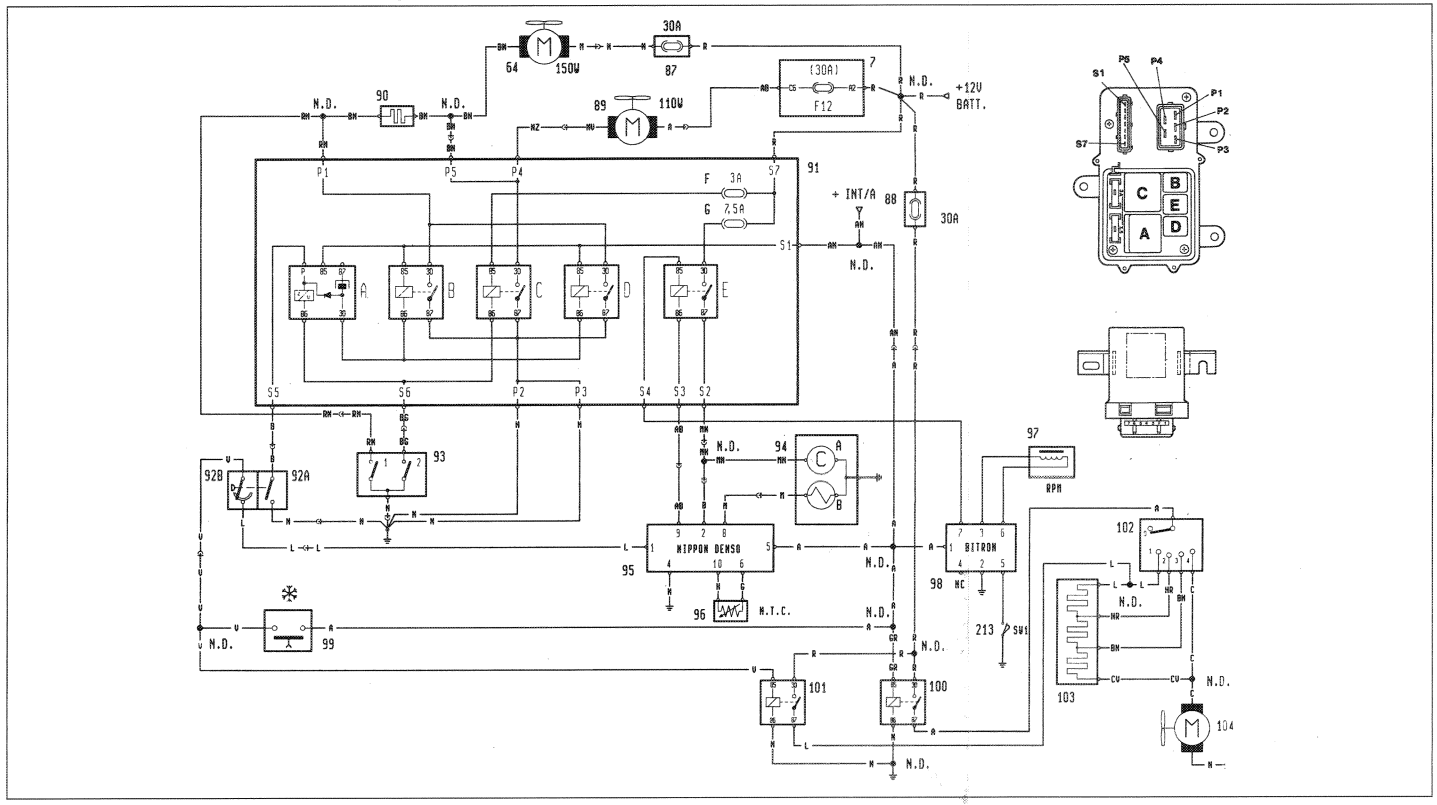
It simultaneosly supplies terminal (85) of relay (E) with a voltage of 12 V to activate compressor coupling (94A). The other terminal of coil (86) of relay (E) is earthed through terminal (7) of Bitron air conditioner deactivation ECU (98).

The system for controlling compressor output according to evaporator temperature is as described for the petrol versions.

ECU (98) deactivates relay (E) and consequently uncouples the compressor when the accelerator pedal is pushed to the floor. This operation leads to closure of microswitch (SW1) installed on the injection pump. When a full load situation has been identified in this way, the ECU reacts as follows:

- If engine rpm is $\leqslant$ to 2000 rpm, the compressor is uncoupled for the entire period microswitch (SW1) is closed.
- If engine rpm exceeds 2000 rpm, the compressor is deactivated for about 8 seconds from the moment switch (SW1) is closed.

AIR CONDITIONER WIRING DIAGRAM (FOR DIESEL ENGINES)



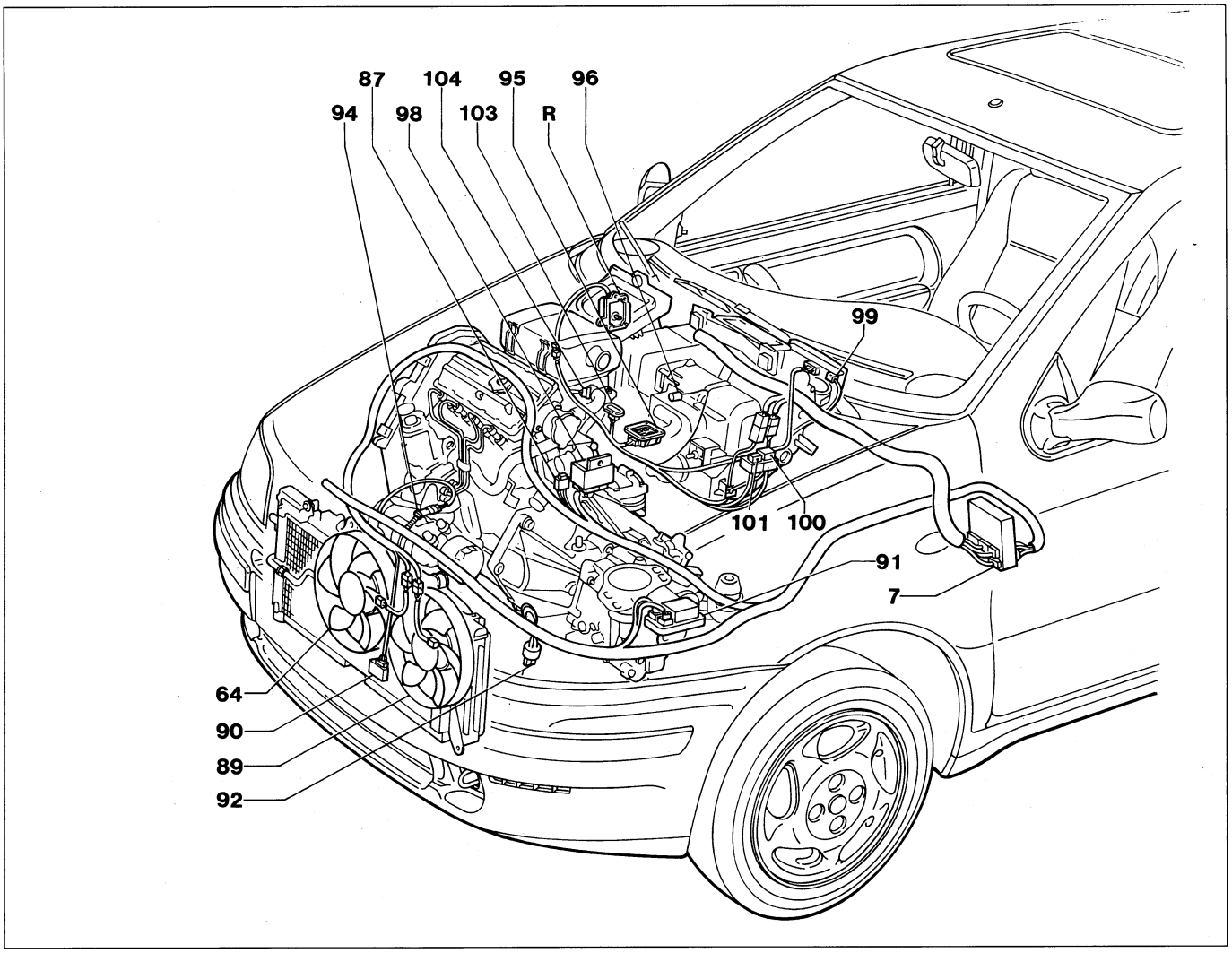
P3M19H022

7. Junction unit (under facia on left hand side)
64. Radiator/condenser cooling fan
88. Fuse (30A) protecting ventilation fan circuit (in engine bay)
89. Radiator/condenser cooling fan
90. Resistor for fan 1st speed (64)
91. Auxiliary control unit for air conditioner (on left front wheel arch)
    - A. Timer for delaying activation of 2nd speed of radiator and condenser fan (64)
    - B. Fan 1st speed activation relay (64)
    - C. Relay (50A) for activation 2nd speed of fan (64)
    - D. Auxiliary relay for activating 1st speed of fan (64)
    - E. Compressor coupling activation relay
    - F. Fuse (3A) protecting relay excitation circuit (C)
    - G. Fuse (7.5) protecting compressor coupling circuit (94A)
92. Three stage pressure switch (trinary)
    - A. MIN/MAX section
    - B. 2nd level section (closes at about 15 bar)
93. 2-level thermal contact on radiator for activating radiator/condenser fan (64) (1st level closed at about 88 °C; 2nd level at about 92 °C)
94. Air conditioner compressor
    - A. Coupling
    - B. Flow control solenoid
95. Nippodenso compressor control unit (under heater unit)
96. Evaporator temperature sensor (in evaporator)
97. Rpm sensor
98. Electronic control unit (BITRON) for disconnecting air conditioner
100. Ventilation fan circuit supply relay
101. Relay for activating ventilation fan 1st speed upon air conditioner activation
102. Ventilation fan speed selection switch
103. Resistance separator for ventilation fan speed
104. Ventilation fan
213. Full-load switch for air conditioner

50.

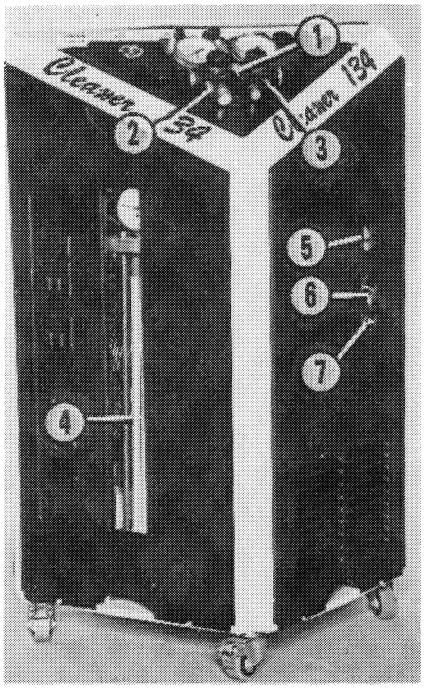
LOCATION OF AIR CONDITIONER ELECTRICAL COMPONENTS

The vehicle shown in the diagram is a Punto 1698 turbo Diesel

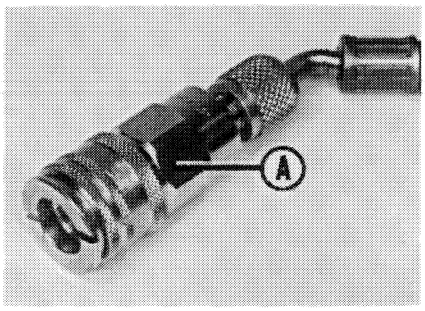


P3M020H01

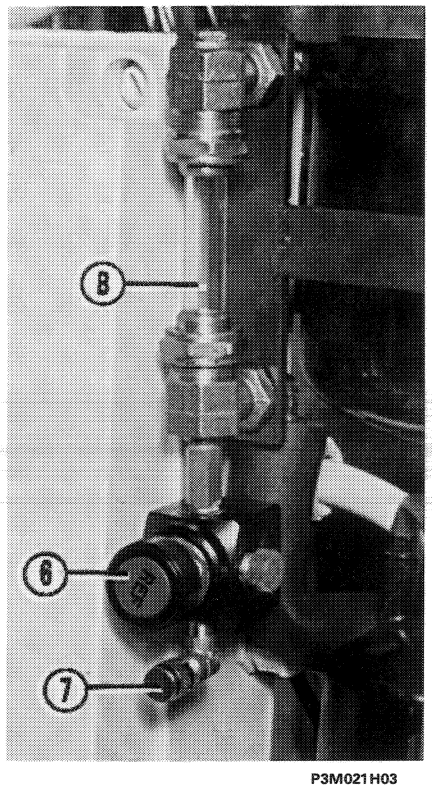
7. Main junction unit
64. 150 W radiator/condenser cooling fan
87. Fuse (30A) protecting 150 W fan (64)
89. 110 W radiator/condenser cooling fan
90. Resistor for first speed of 150 W fan (64)
91. Auxiliary relay carrier control unit for air conditioner
92. Three stage pressure switch
94. Air conditioner compressor
95. Compressor control unit (NIPPODENSO)
96. Evaporator temperature sensor (NTC)
98. Control unit (BITRON) for disconnecting compressor
99. Heater/air conditioner control panel
100. Ventilation fan circuit supply relay
101. Relay for activation of fan 1st speed upon air conditioner activation
103. Resistance separator for ventilation fan speed
104. Ventilation fan
R. Air intake flap electrical actuator (recirculation)



P3M021H01



P3M021H02



P3M021H03

CLEANER 134

MAIN COMPONENTS

The Cleaner 34 (figure alongside) consists of a console with two triangular plastic panels at the top: one flat tray that acts as a collector and one tilted panel along which are arranged various electrical components in a line at the top (on the horizontal diagonal). At the front, toward the front corner in horizontal position, is a pressure gauge assembly (1).

Four diagrams are attached to the outer surface of the metal moulding that divides the two surfaces above. These describe the operations to be carried out as part of the different functions.

Two hoses (blue and red) for connection to the vehicle heating/ventilation system can be connected to the pressure gauge assembly via two fittings (2 and 3).

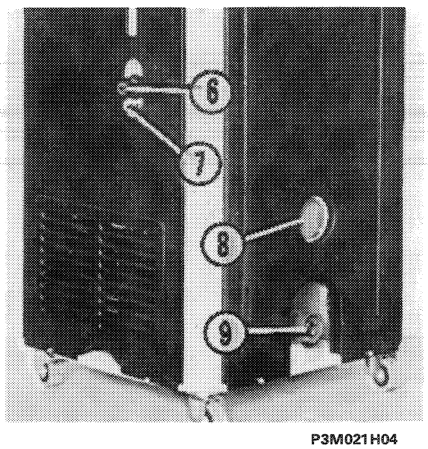
A quick-release fitting (A) is fitted to the free end of each hose

An opening that provides access to dispensing cylinder (4) is located in the panel that forms the left top outer cover to the device.

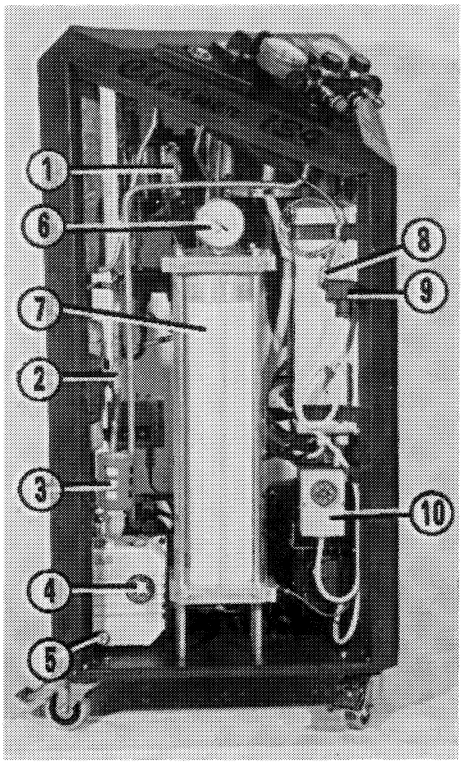
Two openings located vertically one above the other are arranged in the middle part of the panel that forms the right front outer cover to the device; the top opening (5) provides a view of the quantity of oil (separated from coolant) that has built up in column (B). This may be drained through fitting (7) by opening the cock (6) that emerges from the second opening (lower).

Two openings are located in the lower middle part of the panel that forms the right lower outer cover of the device. The knob of the master switch can be turned through the round upper opening (8), while the lower opening (concealed by a cover) provides access to the supply lead socket (9).

The parts listed and described on the following pages are housed inside the device case and connected by electrical wires or hoses.



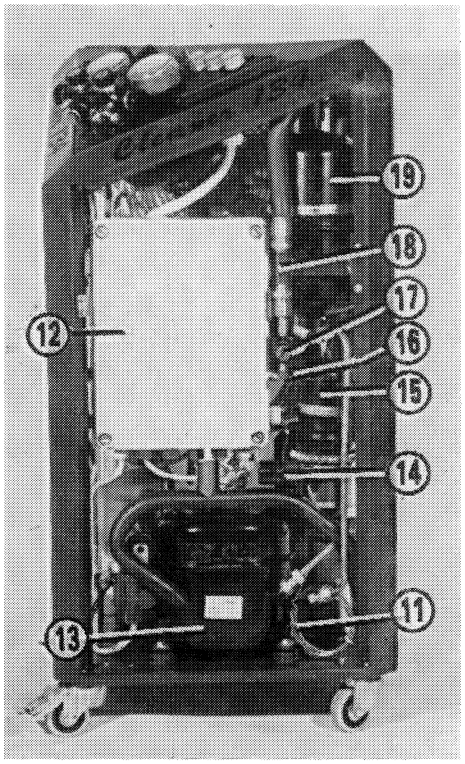
P3M021H04



P3M022H01

1. Condenser cooling fan
2. One-way check valve
3. Vacuum pump oil vapour vent absorption filter
4. Vacuum pump oil level inspection glass.
5. Vacuum pump oil drain plug
6. Dispensing cylinder pressure gauge
7. Dispensing cylinder with electric heater and clear front protective cover
8. Fitting for connecting electronic vacuum gauge
9. Electric socket for electronic vacuum gauge

Part (15) is used to separate oil from coolant leaving the compressor.

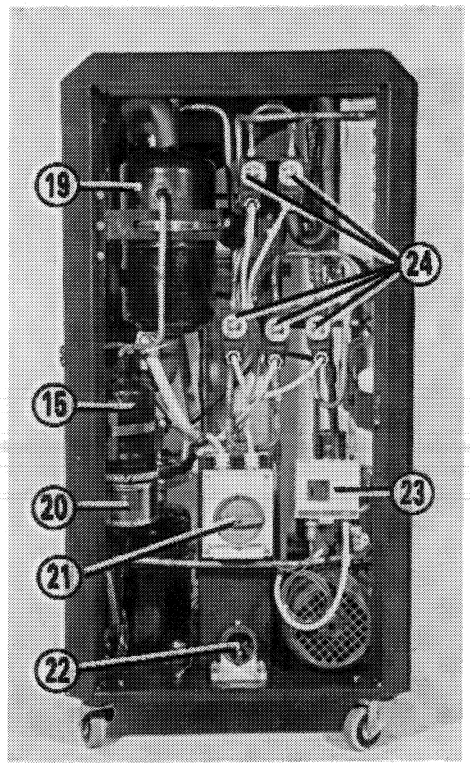


P3M022H02

Pressure switch (14) cuts out compressor operation when output pressure exceeds 15 bar.

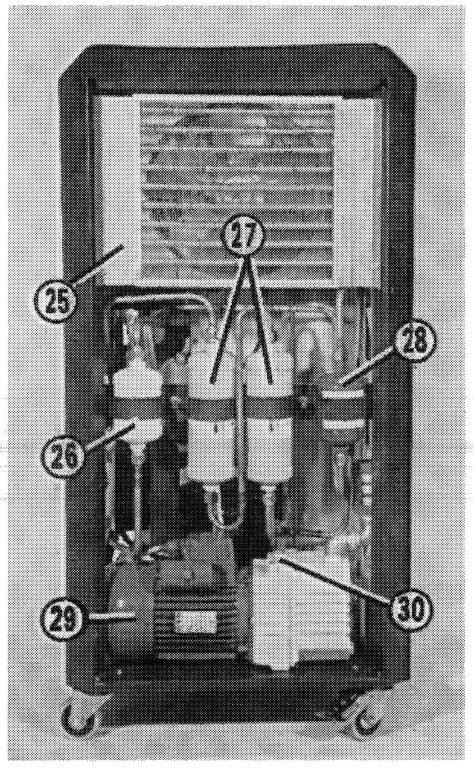
Gauge (18) shows amount of oil that separates from coolant entering part (19) during absorption and which can be drained through fitting (16) afer opening cock (17).

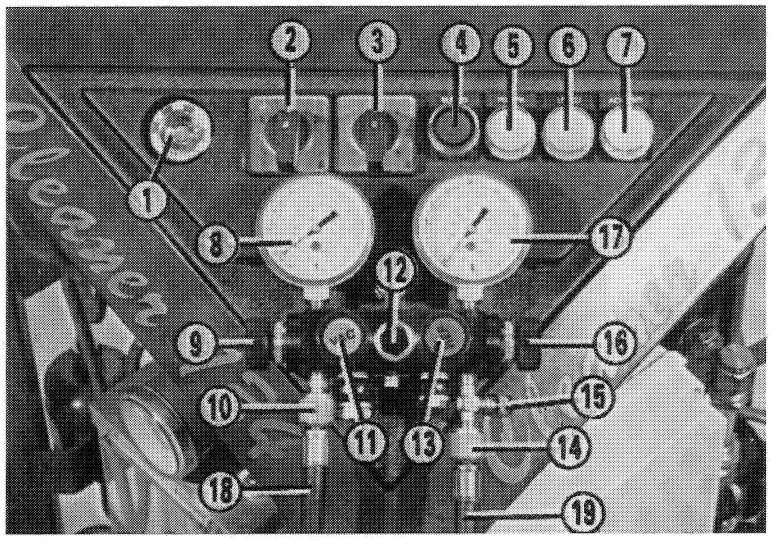
10. Thermostat for regulating coolant temperature in dispensing cylinder
11. Capillary return line for oil separated from coolant leaving compressor



P3M022H03

12. Junction box
13. Compressor
14. Maximum pressure switch
15. Oil separator with heater
16. Oil drain fitting
17. Oil drain cock
18. Level gauge for oil separated from coolant
19. Oil separator
20. Band heater for coolant in separator (15)
21. Master switch
22. Power socket
23. Minimum pressure switch
24. Solenoid
25. Condenser
26. Anti-acid filter
27. Main filters (two)
28. Safety filter
29. Vacuum pump
30. Ballast





P3M023H01

Detail of top inclined panel

1. Moisture indicator
2. Function selector
3. Function switch
4. Compressor forcing button and "LOCK" warning light"
5. "PUMP" warning light"
6. "LEVELS" warning light"
7. Device activated "ON" warning light"
8. Low pressure end pressure gauge
9. Low pressure cock"
10. Fitting for low pressure end hose
11. "VAC" cock"
12. Liquid gauge
13. "REF" cock"
14. High pressure end hose fitting
15. Fitting for connecting vehicle system oil filling device
16. High pressure cock"
17. High pressure end pressure gauge.
18. Low pressure end hose
19. High pressure end hose

The semi-automatic Cleaner 134 device is equipped with 4 filters; one anti-acid and the other dehydrating, including a safety filter.
The absorption capacity of the first filtering station (filter F1) at 25°C is about 27 grams whereas the capacity of the second station (filters F2 and F3) is about 105 grams.
The dispensing cylinder has a capacity of 4Kg and is heated by a coil, connected in turn to a device for automatic temperature control (thermostat).
A safety valve on the top part of the dispensing cylinder behind the pressure gauge is used to drain off uncondensed gas.
Indicator (1) changes colour to show the level of moisture present in the liquid coolant after flowing through the first three filters.
Percentage moisture levels as a function of temperature corresponding to the three different colours are indicated in the table given on the following page.

INNER DISC COLOUR	SYMBOL	MOISTURE CONTENT (in parts per million)		
		24° C	38° C	52° C
LIGHT BLUE	DRY	Less than 5	Less than 10	Less than 20
BLUE-PURPLE	CAUTION	5 - 10	10 - 30	20 - 50
RED	WET	Greater than 15	Greater than 30	Greater than 50

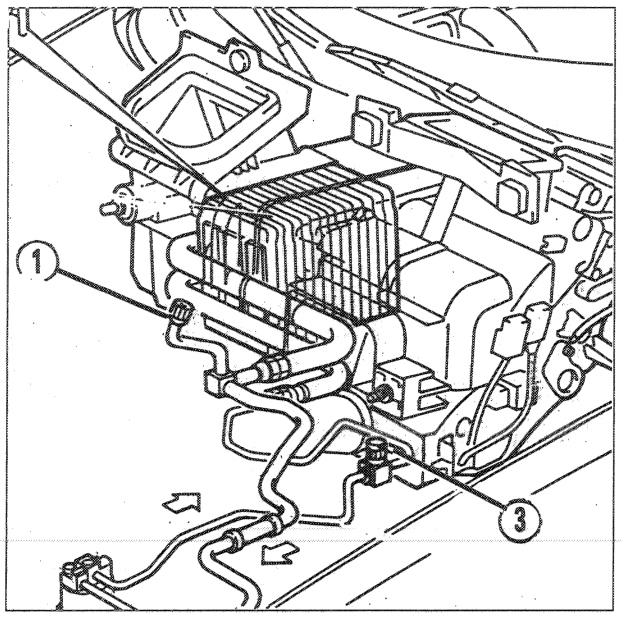
Sensation of cold	Use colour column corresponding to 24°C
Sensation of heat	Use colour column corresponding to 52°C
No sensation	Use colour column corresponding to 38°C

The maximum acceptable moisture level in the coolant is 15 parts per million.

RECOVERY AND RECYCLING OF COOLANT FROM VEHICLE SYSTEM

To recover and then recycle the coolant in a vehicle heating/ventilation system, proceed as follows:

- turn on vehicle engine and run for about fifteen minutes. Activate the heating/ventilation system simultaneously;

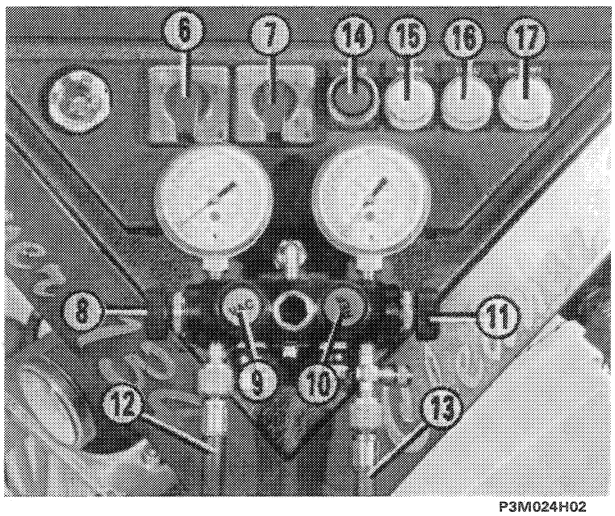


P3M024H01

- check that the device cocks are closed and knobs of selector (6) and switch (7) are in position 0 (off);

- fit quick-release fitting of blue hose (low pressure side) into valve (1) welded to the pipe connected to the evaporator outlet duct;

- fit quick-release fitting of red hose (high pressure side) to valve (3) welded to end of pipe which is connected in turn to the dehydrating filter of the vehicle system

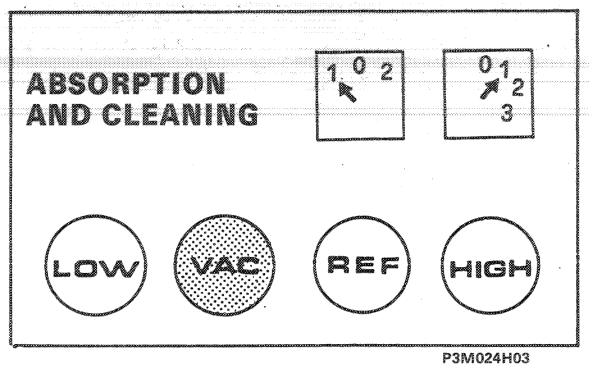


P3M024H02

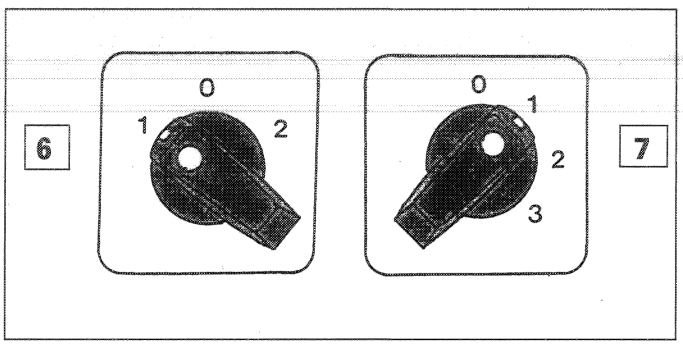
NOTE *Before connecting the quick-release fittings (A) on the vehicle system valves, move arrowed ring-nut fully upward.*

- plug device into a 220 V / 50 HZ current socket and turn the knob of master switch (21 lower left hand figure on page 12) to ON position (device activated and indicator 17 lit);

- open cocks HIGH (11) - LOW (8) - REF (10);
- check that VAT cock (9) is closed;
- turn knob of switch (7) to position 1 and then knob of selector (6) to position 1.



P3M024H03



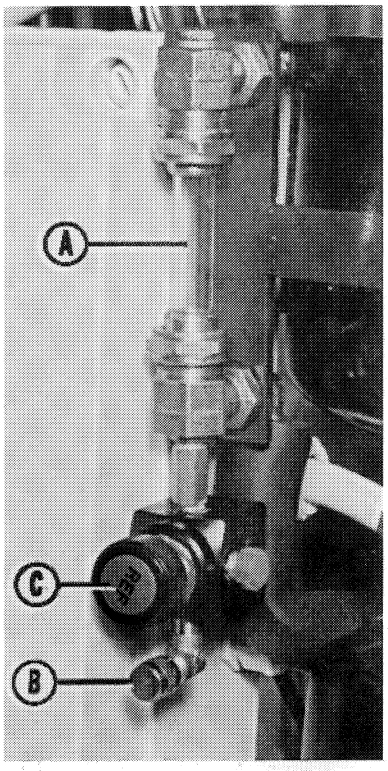
P3M024H04

The device automatically begins absorbing gaseous coolant, which accumulates in the dispensing cylinder after flowing through its parts.

The operation may be monitored by watching the oil separator level gauge, the moisture indicator and the level gauge built into the dispensing cylinder.

While absorbing coolant from the vehicle heating/ventilation system, various different situations may arise as follows:

CONDITIONS	INDICATION AND EFFECTS	OPERATIONS TO BE CARRIED OUT
The coolant in the dispensing cylinder reaches the maximum specified level	LEVEL warning light comes on (16) Compressor operation is stopped, and device stops working	Close REF cock (10) on pressure gauge assembly and turn knobs of selector (7) and selector (6) to position 0. Transfer sufficient coolant from the dispensing cylinder to another container and then finish the interrupted operation of recovering coolant from the vehicle system.
Any uncondensed gas that builds up in the upper part of the dispensing cylinder or inside the cylinder will set up excess pressure	The breather valve situated at the top of the dispensing cylinder opens when a pressure of 15 bars is set up	
The pressure of coolant in the device high pressure circuit reaches a value in excess of 15 bar	A pressure switch on the compressor outlet pipe turns off the compressor and then the device.	
The pressure of coolant at the device inlet and throughout the low pressure area reaches a value of - 0.2 bar	A pressure switch on the compressor inlet turns off the compressor and also the device. This situation occurs once recovery is complete and is indicated by "LOCK" warning light (14) coming on and an acoustic signal	Leave the device connected to the vehicle system and working for at least a further 10 minutes so that any remaining low pressure coolant pockets in the vehicle system can absorb heat and increase pressure in order to be recovered.



P3M026H01

To reduce the waiting time for the last operation described in the table, absorption of any coolant remaining in the system may be "forced" by pressing button (14) to activate the compressor and checking the vacuum level on the blue-coloured low pressure side pressure gauge.

When absorption is complete, i.e. after waiting about ten minutes or pressing button (14) for a period of time, turn knobs of switch (7) and selector (6) to position 0 and close "REF" cock (10).

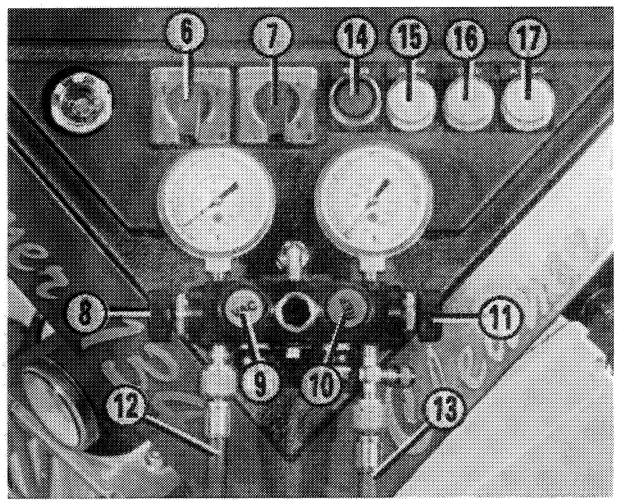
At the end of the above operation, oil separated out from the recovered coolant inside the distiller may be observed via level gauge (A) and may be drained through fitting (B) after opening cock (C).

If necessary, the same amount of clean antifreeze fluid may be added to the vehicle compressor in order to replace fluid absorbed by the device with the coolant.

DISCHARGING VEHICLE SYSTEM

Before charging, the vehicle air conditioning system must be discharged and restored to efficient operating conditions, i.e. after:

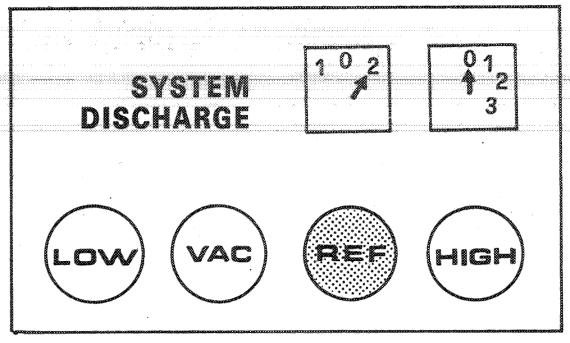
- repairing any coolant leaks;
- replacing any inefficient system parts.



P3M024H02

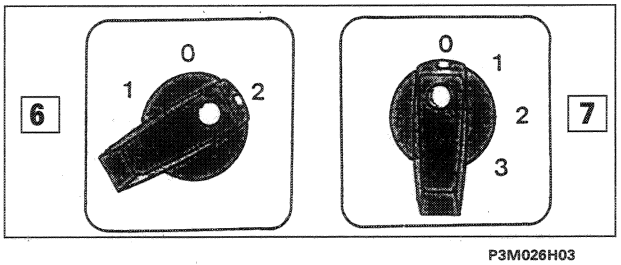
To discharge the system, first fit quick-release fittings of hoses (12 and 13) of the Cleaner 134 device to system valves and then proceed as follows:

- after ensuring that the vacuum pump contains the specified amount of oil without any impurities (see page 34) open cocks VAC (9) HIGH (11) LOW (8) and turn knob of function selector (6) to position 2;
- the vacuum pump starts up and «PUMP» warning light (15) comes on. When low pressure pressure gauge (18) shows a vacuum reading, close VAC cock (9) and turn knob of function selector (6) to position 0;
- check vehicle system seal for 5 minutes by checking that the vacuum level measured on the pressure gauge (18) does not drop;
- if leaks are not found, open cock (9) again and turn knob of function selector (6) to position 2;



P3M026H02

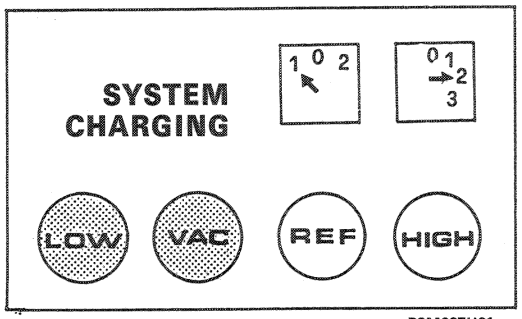
cock (REF) shown in the figure must stay closed



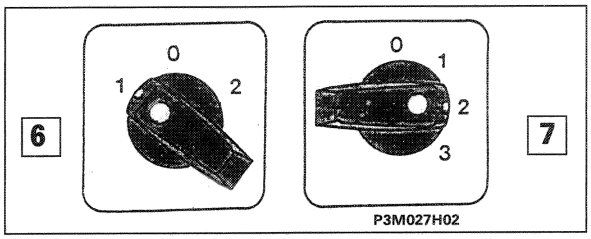
P3M026H03

- when pressure gauge (18) shows a vacuum reading of 10 mbar close cocks (8 - 9 - 11) and turn the function selector knob (6) to position 0.

After this operation, discharge the vehicle system.



Cocks (LOW-VAC) shown in figure must remain closed



CHARGING VEHICLE AIR CONDITIONING SYSTEM

To charge the vehicle air conditioning system, proceed as follows:

- keep the two device hoses connected to the vehicle system valves;
- read off coolant level in dispensing cylinder column and use scale underneath (on the cylinder itself) to obtain actual amount of fluid available (by reading values shown at the ends of the corresponding tilted line);
- check that the quantity of coolant to be added to the vehicle system is contained in the dispensing cylinder. Note the device stops automatically when the dispensing cylinder level reaches minimum;
- if the dispensing cylinder contains at least 2 - 2.5 kg of coolant, open cocks REF (10) and HIGH (11) and turn the knob of function switch (7) to position 2 and selector knob (6) to position 1 and check that cocks LOW (8) and VAC (9) are closed.

The difference between pressure inside the vehicle system lines and pressure inside the dispensing cylinder causes coolant to flow from the device through the red high pressure side hose to the vehicle system.

When the coolant level in the dispensing cylinder column reaches an established level, i.e. starting level minus amount corresponding to charge added to the vehicle system, turn knobs of switch (7) and selector (6) to position 0 and close cocks HIGH (11) and REF (10).

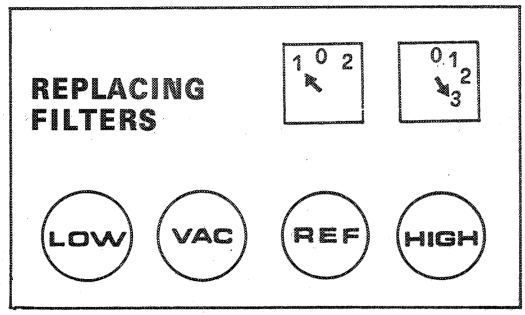
Before charging is complete, two situations may arise as follows:

CONDITIONS	OBSERVATIONS AND EFFECTS	OPERATIONS TO BE CARRIED OUT
Equalizing pressure inside vehicle system lines and inside dispensing cylinder.	The pressure balance considerably slows the flow of coolant from dispensing cylinder to vehicle system or prevents it altogether	Close cock HIGH (11), start up vehicle engine and turn on the air conditioning system (temperature LO, fan at top speed). Then slowly open cock LOW (8). When charging is complete, close cocks LOW (8) and REF (10), turn knobs of switch (7) and selector (6) to position 0 and also turn off the air conditioning system and switch off the vehicle engine
During the charging operation, the minimum dispensing cylinder level is reached inadvertently	To avoid adding uncondensable gases to the vehicle system, a device built into the dispensing cylinder cuts off the charging operation and turns on «LEVEL» indicator (16)	Use a canister of coolant R 134A to fill device dispensing cylinder partly, as described on page 20 and following pages. Finish charging vehicle system as described previously.

NOTE *The charging operation may stop if more coolant than required is inadvertently added to the vehicle system.*

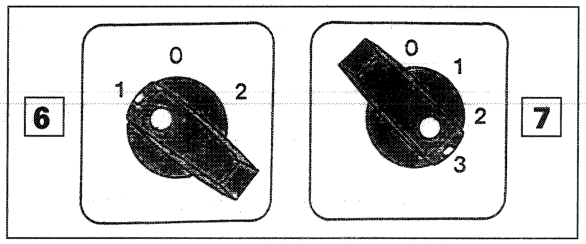
CHECKING PRESSURES IN VEHICLE SYSTEM

To check pressure levels set up in the vehicle air conditioning system during operation, after connecting the quick-release fittings of the two device hoses to the system valves (as described on page 24) simply open cocks (if present) on hoses and read off pressures shown on the two pressure gauges (blue low pressure side and red high pressure side)



P3M028H01

All cocks must remain closed

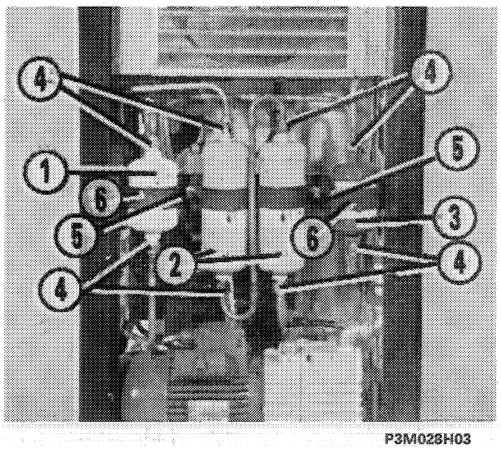


P3M028H02

CHANGING FILTERS

To change the filters (anti-acid 1, main 2 and safety 3) proceed as follows::

- connect device to a 220 V 50 HZ mains supply and turn master switch to ON;
- check that all device pressure gauge cocks are closed;
- turn knob of function switch (7 central figure on page 16) to position 3 and knob of selector (6) to position 1;
- the device automatically creates a vacuum in the part of the system connected to the filters to be changed. When a vacuum of - 0.2 bar is set up in the inlet pipe of the compressor, a pressure switch stops the compressor and simultaneously lights up «LOCK» warning light and turns on an acoustic signal;
- return knobs of switch (7) and selector (6) to position 0;
- turn knob of master switch to OFF;
- remove device rear left side panel (after unscrewing the two screws that retain it at the bottom to the frame);
- unscrew fittings (4) and nuts (5) and after removing brackets (6) replace filters (1 - 2 - 3) with new units, making sure the arrow on each one faces downward;
- before screwing fittings (4) back onto the new filters, check these contain O-rings. These must be undamaged and lubricated with vaseline or antifreeze fluid for compressors.



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NOTE *When the above filters are removed from their housings for replacement, check that they are under a slight vacuum. If not, the device could be malfunctioning. Consult page 22 in this case.*

After replacing the filters mentioned previously and securing them to the device frame, connect device to a canister of R134 A or to a vehicle air conditioning system and carry out a cycle of absorption and cleaning (in order to remove air and moisture from device);

- when the operation is complete, close the various cocks and turn switch and selector knobs to 0. Turn master switch knob to OFF;

- use an electronic leak detector to check seal of the various fittings unscrewed during filter replacement;
- replace left rear panel and secure bottom to device frame using two screws;
- check the amount of coolant in the dispensing cylinder. Top up from canister if necessary.

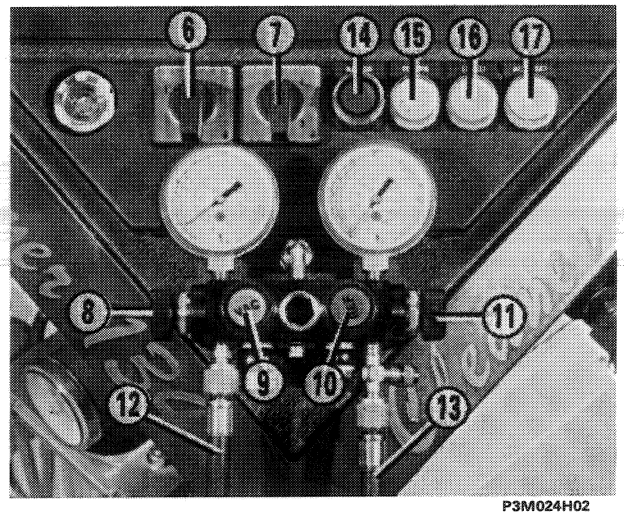
NOTE *When the filters are changed, the moisture indicator becomes red. Before it changes back to blue, it may be necessary to absorb and clean up to 2.5 Kg of coolant.*
During this period of time, the recovered fluid is quite clean even though the moisture indicator disc colour has not completely settled.

TRANSFERRING COOLANT FROM DEVICE DISPENSING CYLINDER TO A CONTAINER (CANISTER)

This operation becomes necessary when the maximum level setting of the device dispensing cylinder is reached during absorption and cleaning of coolant in a vehicle air conditioning system and the device automatically turns off, or when for any reason (preparing to carry out the above operation) clean coolant is to be transferred to a container (provided container can withstand up to 35 bar).

After ensuring that container to which the coolant is to be transferred is under a vacuum (at least - 0.1 bars), proceed as follows:

- if coolant is absorbed from a vehicle system, close cock HIGH (F) of pressure gauge assembly and disconnect red hose from vehicle system valve and connect to container service valve;
- if no operation is being carried out, connect red hose between device high pressure side fitting and container service valve;
- ensure that all device pressure gauge cocks are closed, then open cocks marked HIGH (8) and REF (10), then turn knob of switch (7) to position 2 and knob of selector (6) to position 1.
- as a result of the pressure difference set up, coolant flows from the device dispensing cylinder to the canister. When the canister has received a quantity of R134 A **that must always be less than 80% of its volume**, turn knobs of switch (7) and selector (6) to position 0 and close canister cocks and cocks HIGH (8) and REF (10) of device pressure gauge assembly;



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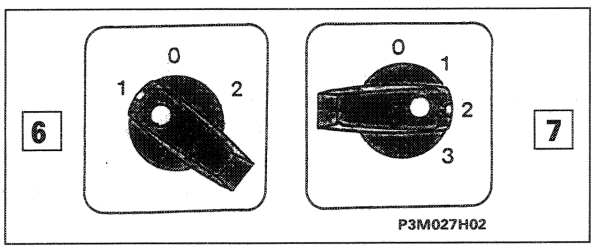
- disconnect red hose from container service valve and cover valve with a cap;
- after these operations, the operation interrupted previously may be repeated (first case described above), i.e. absorbing coolant from the vehicle system, after re-attaching quick-release fitting of the red hose to the system high pressure side valve.



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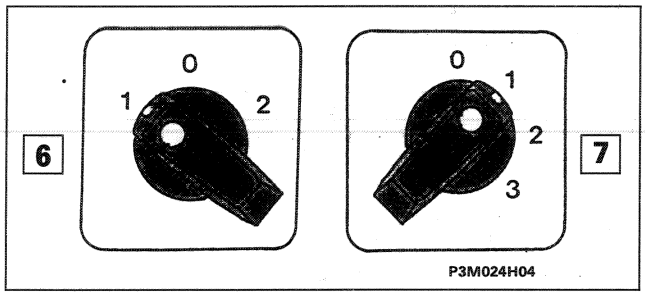
TRANSFERRING COOLANT FROM CANISTER TO DEVICE DISPENSING CYLINDER

This operation is necessary when the minimum device dispensing cylinder level is reached while charging a vehicle air conditioning system with coolant and the device stops automatically or when the device needs refilling so that it contains sufficient coolant for the charging operation.

If a vehicle air conditioning system is being charged, drain by absorbing and cleaning the coolant added previously. Then close HIGH cock of device pressure gauge assembly and disconnect the red hose of the vehicle system valve and connect to canister service valve (at least 3.5 Kg di R 134 A).

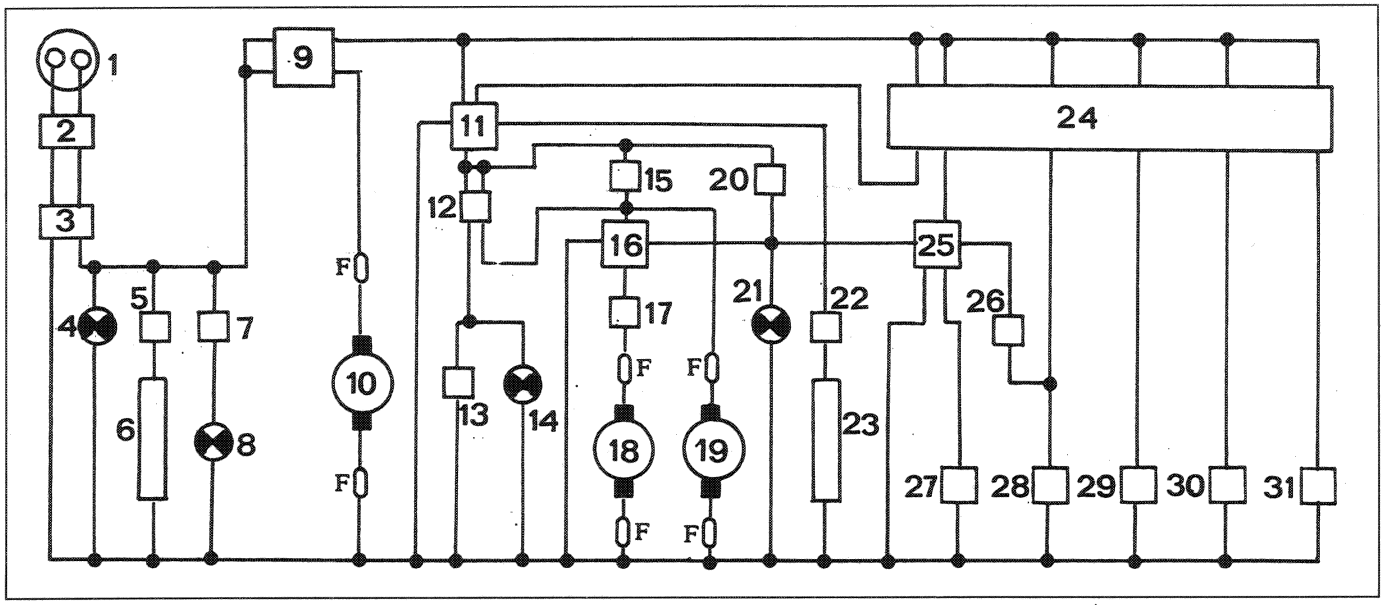
If no operation is being carried out, connect the red hose between the high pressure fitting of the device pressure gauge assembly and canister service valve. Then connect the device to the mains supply and turn master switch knob to ON.

Now proceed as follows in both cases:



- ensure that device pressure assembly cocks are closed, then open HIGH and REF cocks and canister cock;
- turn knob of switch (7) to position 1 and knob of selector (6) to position 1;
- coolant absorbed by the canister is cleaned and builds up in the dispensing cylinder after passing through the various device components. When the level is as established (read off cylinder column) turn knobs of switch (7) and selector (6) to position 0, close cock of container and HIGH and REF cocks of device pressure gauge assembly;
- disconnect quick-release fitting of red hose from container service valve and cover valve with plug;
- after these operations, resume operation interrupted previously (first case described above), i.e. charging vehicle system with coolant, after connecting quick-release fitting of red hose removed previously to the system high pressure valve;
- in the second case, turn master switch knob to OFF and disconnect supply lead from device socket.

FUNCTION SWITCH	SOLENOID EXCITED				
KNOB POSITIONS	EV1	EV2	EV3	EV4	EV5
0					
1	*	*	*		
2	*			*	
3		*		*	*



P3M031H01

Equipment wiring diagram

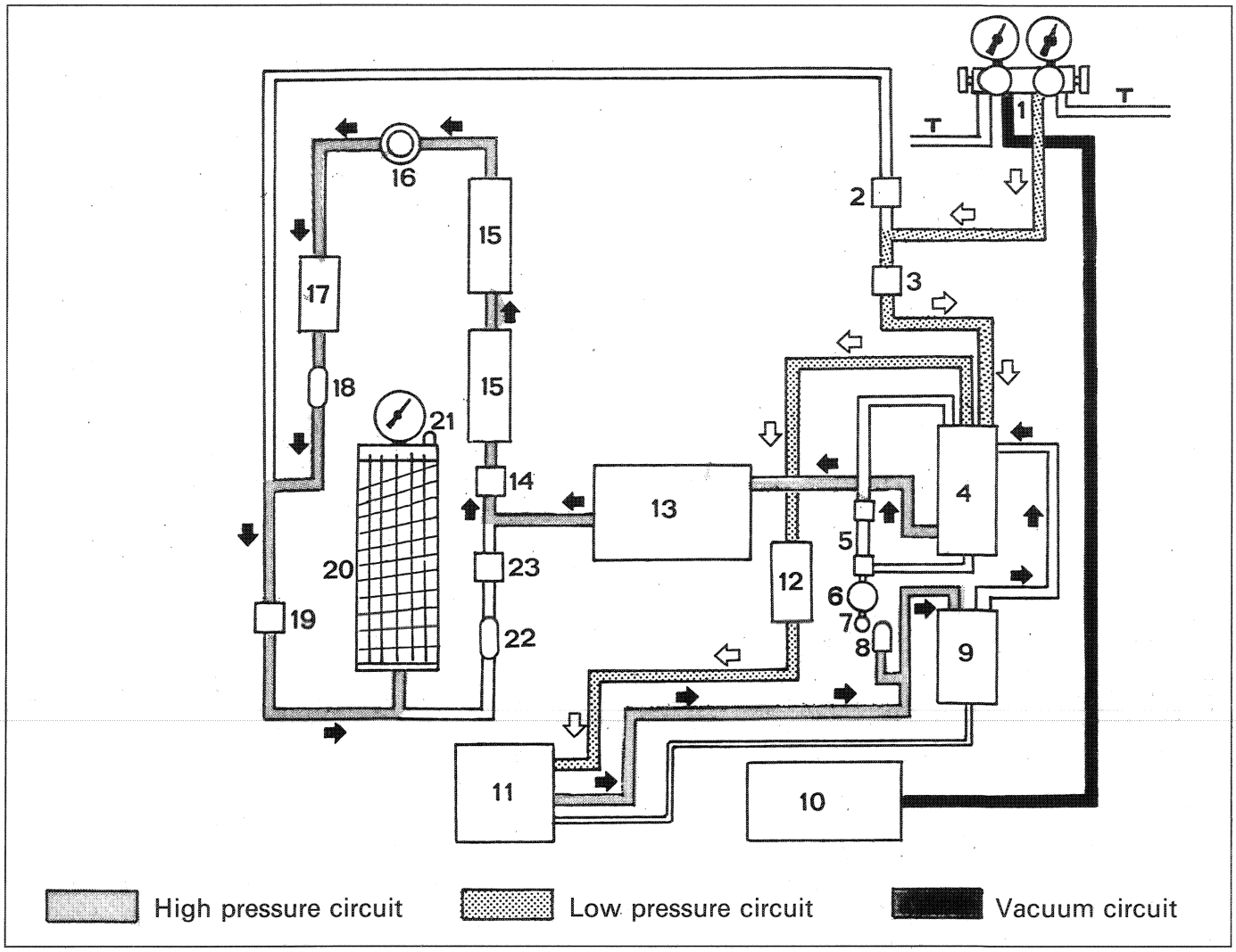
1. Supply lead socket
2. Master switch
3. Magneto-thermal switch
4. Voltage warning light
5. Heater thermostat (6)
6. Dispensing cylinder heater
7. Vacuum switch
8. Warning light "PUMP"
9. Function selector
10. Vacuum pump motor
11. Compressor control relay
12. Minimum pressure switch
13. Acoustic signal
14. Warning light "LOCK"
15. Button "ON"
16. Overfilled relay
17. Maximum pressure switch
18. Compressor
19. Condenser cooling fan
20. Maximum level sensor
21. Warning light "LEVELS"
22. Heater thermostat (23)
23. Oil separator heater
24. Function switch
25. Charge valve control relay
26. Minimum level sensor
27. Charging solenoid EV1
28. Main filter inlet solenoid EV4
29. Recovery solenoid EV2
30. Liquid charge solenoid EV3
31. Solenoid EV5

F. Fuses

The following functions correspond to the three positions of selector (6):
- 1 Recovery, charge system, change filters.
- 0 Equipment off.
- 2 Drain system.

The following functions correspond to the four positions of switch (31) in addition to the activation of certain solenoids (as indicated in table shown at the bottom of the previous page):
- 0 Off
- 1 Absorption and cleansing
- 2 Charge system
- 3 Change filters

When relay (25) is in rest position, solenoid EV1 (27) becomes excited. This is deactivated if relay coil is excited by sensor (26) during the charging operation when the coolant level in the dispensing cylinder reaches minimum level.
When excited, relay (11) allows compressor (18) to operate.
Minimum pressure switch (12) deactivates compressor (18) and condenser fan (19), and also to light warning light "LOCK"(14).
Maximum pressure switch (17) turns off compressor (18) when coolant pressure inside the circuit reaches 15 bar.



P3M032H01

Diagram showing route taken by coolant inside system

1. Pressure gauge assembly
2. Solenoid EV4
3. Solenoid EV2
4. Oil separator
5. Oil level gauge
6. Oil drain cock
7. Oil drain fitting
8. Maximum pressure switch
9. Oil separator with heater
10. Vacuum pump
11. Compressor
12. Anti-acid filter F1
13. Condenser
14. Solenoid EV3
15. Main filters F2
16. Moisture indicator
17. Safety filter F3
18. One-way check valve
19. Solenoid EV1
20. Dispensing cylinder
21. Safety valve
22. One-way check valve
23. Solenoid EV5

T. Hose for connection to vehicle system

The white arrows indicate the direction in which low pressure coolant flows inside the system before reaching the compressor.

The black arrows indicate the direction in which high pressure coolant flows inside the system before reaching the dispensing cylinder.

When relay (16) is excited by sensor (20) (if coolant reaches maximum level inside the dispensing cylinder), it deactivates compressor (18) and lights up warning light "LEVELS" (21).

MAINTENANCE

The Cleaner 134a device operates at maximum efficiency while draining a vehicle air conditioning system if its vacuum pump is efficient. For this reason, before using the device, check the level of oil in the pump and whether any impurities are present by carrying out the following operations:

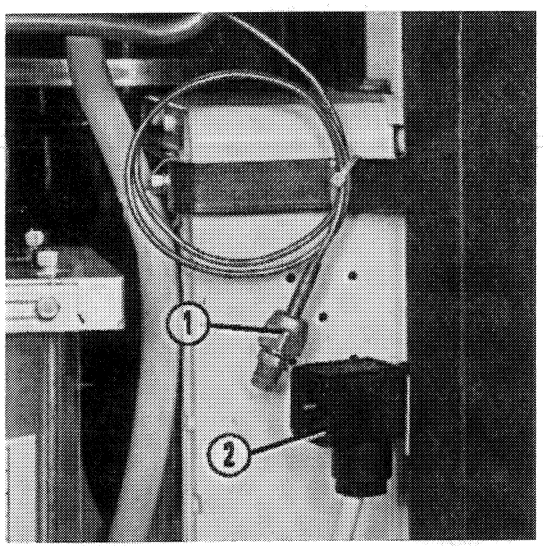
- operate the pump by turning selector lever to position 2. After checking oil level in the indicator window (1) turn ballast (2) to remove any uncondensed gases that could contaminate the oil and cause serious damage to the pump;

- after 5 minutes, check that the oil level visible through indicator window (1) is just over half way along the window and that no impurities are present on its surface;

If no particular defects are found, the equipment - or more specifically the vacuum pump - are ready for use.

Note that when the pump is hot, the oil level must be no higher or lower than the extreme levels shown on the indicator window (1) because in the first case the pump will become clogged with oil and its performance will be impaired and in the second case seizure could occur due to lack of lubrication.

Also note that oil level should be checked for a possible top up when the pump is warm.



P3M033H02

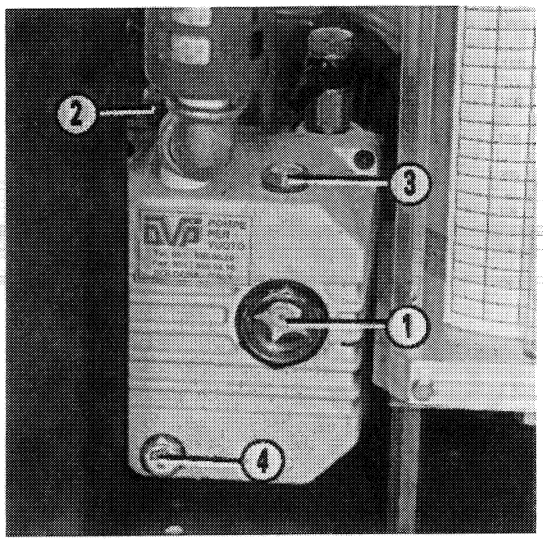
CHANGING OIL

The first vacuum pump oil change is due afer 100 hours of operation whereas subsequent oil changes must be carried out when the oil is no longer light and clear but greyish in colour.

To replace the oil with the pump hot, proceed as follows:

- unscrew filler (3) and drain (4) plugs and leave oil to drain out fairly quickly, taking all the impurities with it;

- close the drain plug (4) and add 0.45 litres of special oil (viscosity 6° Engler) through plug (3). Check oil reaches the correct level.



P3M033H01

Detail of fitting and electrical socket for connecting electronic vacuum gauge

1. Fitting
2. Electrical power point

50.

LIST OF FAULTS THAT MAY ARISE DURING THE VARIOUS STAGES OF DEVICE OPERATION, THEIR PROBABLE CAUSES AND OPERATIONS TO BE CARRIED OUT TO RECTIFY THEM

ABSORPTION AND RECYCLING OPERATION		
FAULTS	**CAUSES**	**OPERATIONS TO BE CARRIED OUT**
Compressor does not work	LOCK warning light lit	Absorption operation completed
	LOCK warning light off due to:	
	- incorrect position of switch or function selector knobs;	Position switch and function selector knobs correctly
	- interruption of compressor supply circuit or LOCK warning light	Identify where break took place and restore circuit continuity
	- lack of power or break in lead connecting electrical mains and device (revealed due to failure or "ON" warning light to come on)	Check if power cut is due to a temporary lack or a shortcoming in workshop machinery. If necessary, restore connection between equipment and mains to working order
	LEVEL warning light on due to:	Transfer part of coolant from dispensing cylinder to a canister
	- dispensing cylinder overfilled	
	- Compressor inefficient	Contact manufacturer's Service department
Compressor goes on and off frequently	Leak on inlet circuit or block in high pressure circuit	Contact manufacturer's Service dept.
Compressor noisy	Poor lubrication due to:	
	- inefficient oil separator heater band	Replace heater band
	- capillary pipes inefficient	Contact manufacturer's Service dept.
Required vacuum level not achieved during absorption	Incorrect minimum pressure switch setting	Reset minimum pressure switch
	Leaks from solenoid EV4	Clean and/or replace solenoid EV4 (see note on page 35)
	Leak in inlet circuit	Contact manufacturer's Service department

FAULTS	CAUSES	OPERATIONS TO BE CARRIED OUT
Coolant in dispensing cylinder exceeds maximum established level	Inefficient maximum level sensor	Replace sensor (*)
Level of coolant in dispensing cylinder less than minimum established	Minimum level sensor inefficient	Replace sensor (*)
Pressure in dispensing cylinder does not increase	Thermostat setting incorrect Dispensing cylinder heating element inefficient	Reset thermostat Replace heating element
Presence of moisture in recovered and recycled coolant indicated by moisture indicator	Saturation of drying agents in dehydrating filters Moisture indicator inefficient	Replace filters (*) Replace moisture indicator (*)

(*) See note on page 26

OPERATION OF DRAINING VEHICLE AIR CONDITIONING SYSTEM		
FAULTS	**CAUSES**	**OPERATIONS TO BE CARRIED OUT**
Vacuum pump will not operate	PUMP warning light off due to:	
	- incorrect positioning of switch or function selector knobs;	Position knobs of switch and function selector correctly
	- break in supply circuit of vacuum pump and/or PUMP warning light	Identify point of break and restore circuit continuity
	- lack of current or break in lead connecting electrical mains to device (revealed by failure of ON light to come on)	Check whether power failure is due to a temporary factor or a fault in the workshop equipment. If necessary, repair lead connecting equipment and mains
	Vacuum pump inefficient	Contact manufacturer's Service department

FAULTS	CAUSES	OPERATIONS TO BE CARRIED OUT
Vacuum pump works but does not achieve required level of vacuum	VAC cock closed REF cock open Pump oil contaminated	Open VAC cock Close REF cock Change pump oil

OPERATION OF CHARGING VEHICLE AIR CONDITIONING SYSTEM		
FAULTS	**CAUSES**	**OPERATIONS TO BE CARRIED OUT**
Coolant does not flow from equipment to vehicle system	LEVEL warning light comes on because coolant within dispensing cylinder is at minimum level	Transfer coolant R134a from a canister to the equipment dispensing cylinder
Coolant does not flow, or only very slowly	Pressures between equipment and system have equalized	Transfer coolant from dispensing cylinder to vehicle air conditioning system to activate air conditioner

OPERATION OF FILTER REPLACEMENT		
FAULTS	**CAUSES**	**OPERATIONS TO BE CARRIED OUT**
Required vacuum level not achieved during filter replacement	Leak from solenoid EV3 Leak in inlet circuit	Clean and/or replace solenoid EV3 Contact manufacturer's Service department

NOTE *Before carrying out any operation that involves opening the coolant circuit (except filter replacement) evacuate all traces of coolant by connecting a second recovery and recycling device to the Cleaner 134.*

In the above tables, remedial operations that involve opening the coolant circuit are marked with (*).

When the device is off, i.e. de-activated, all solenoids are in closed position, i.e. do not permit coolant to flow through.