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Climate control or the variation of the temperature and the humidity of the air in the passenger compartment can be achieved by one of the following two systems:

- manually operated heater which comes as standard on the vehicle;
- manually operated climate control which is available on request in place of the first system.

Both systems are basically made up of the assembly illustrated below which houses the following components:

- electric fan (see ideogram);
- mixture flaps (B);
- heater (C);
- distribution flaps (D);
- lower flap for adjusting footwell air flow (E);
- air intake flap (F).

The above assembly is located on the centre section of the bulkhead (metal partition dividing the engine compartment and the passenger compartment) and it is composed of two distinctly separate parts which are joined together.

The first part is positioned transversely in the compartment under the windscreen and it is basically made up of a casing (see illustration at the top of the next page) housing the electric fan (A), the mixture flaps (B), the heater (C) and the air intake flap (E).

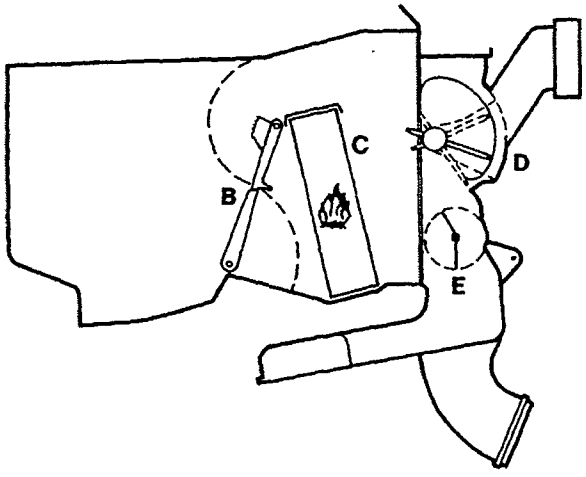
The second part is located in the front centre section of the passenger compartment under the dashboard and it is composed of a suitably shaped duct to which the connection pipes for the various vents are fitted and which houses the distribution flaps (D) and the flap which adjusts the flow of air to the footwell vents (E).

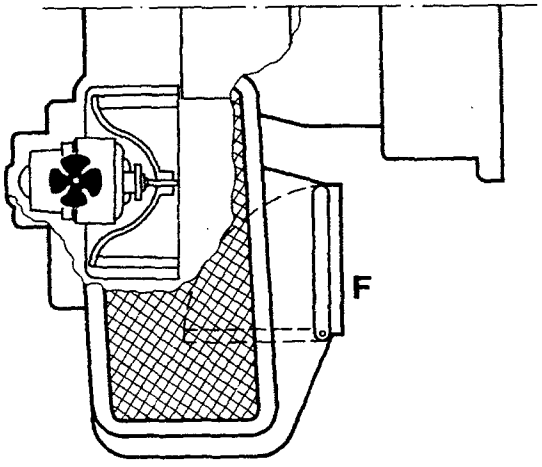
In both systems, the mixture flaps (B) and consequently also the control lever for the tap on the heater duct are adjusted by a shaft with two universal joints operated by a knob with the help of a conical toothed wheel and a toothed sector.

The distribution flaps (D) and the flap (E) which adjusts the flow of air to the footwell vents are positioned by a shaft with two universal joints operated by a knob with the help of a pair of conical toothed wheels, a cylindrical toothed wheel and a rack.

In both systems the air intake flap (F) is operated by a pneumatic actuator which is controlled by a vacuum switch which is operated, according to the system, by either a knob or a switch.

In both systems the electric fan receives three different voltages via a resistor which can be selected by means of a switch operated by a knob.





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Diagrammatic sections showing heater and distributor duct

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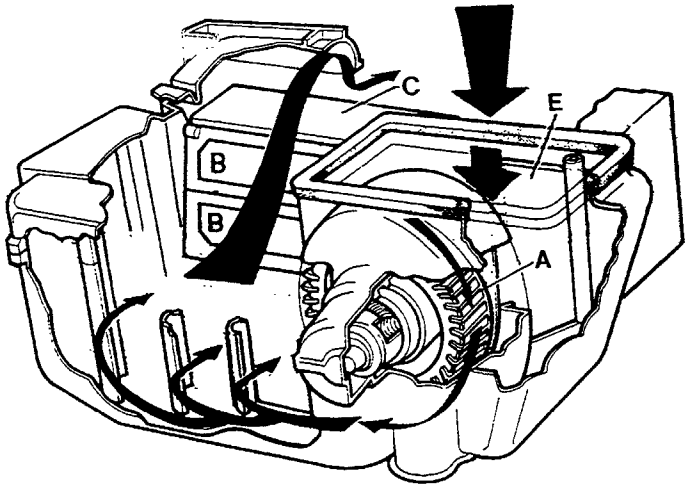

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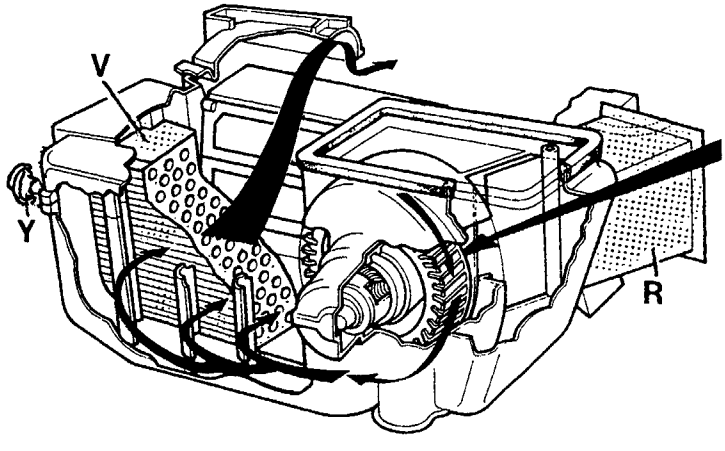
View of heater assembly for first system

A. Electric fan
B. Mixture flaps
C. Heater
E. Air intake flap

The arrows show the route of the outside air inside the heater assembly when the mixture flaps are closed



P1L002H02

View of evaporator/heater assembly for the second system

R. Recirculation air duct
V. Evaporator
Y. Expansion valve

The components which are shaded are the additional ones compared with the first system.

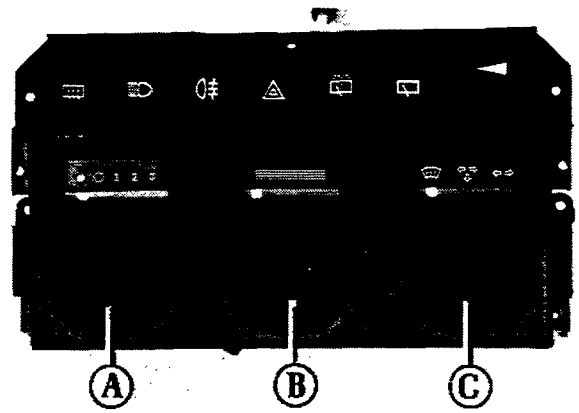
The manually operated climate control system differs from the heating system through the addition of certain components, namely:
- a compressor which is located in the right rear section of the engine compartment on the power assisted steering pump;
- a condenser which is a heat exchanger and is located at the front in front of the engine coolant radiator;
- a drier filter which is positioned at the front on the left side of the above mentioned condenser;
- an expansion valve (Y) which is bolted onto the evaporator inlet duct;
- an evaporator (V) which is housed in the casing which makes up the heater assembly;
- a three stage pressure switch which is bolted onto the pipe which connects the condenser to the drier filter
- an anti-frost thermostat which is located on the upper surface of the heater assembly.
- different pipes which connect the various components which make up the system.

The evaporator/heater unit for the air conditioning system (shown in the second diagram) differs from the one for the heater for the first system (shown in the top diagram) through the following features:

- opening in the left rear wall by the air intake flap;
- there is a duct (R) fitted on the above mentioned opening which is in contact with an opening in the bulkhead (partition dividing the passenger compartment and the engine compartment);
- inside in front of the heater there is an evaporator (V) and between the evaporator fins there is a sensitive bulb for the anti-frost thermostat which is fixed on the outside to the surface of the cover for the casing which makes up the assembly.

Control panel for manually operated heater

A. Knob for introducing and adjusting flow of air into the passenger compartment
B. Knob for adjusting the temperature of the air introduced into the passenger compartment
C. Knob for selecting the air distribution to the various vents



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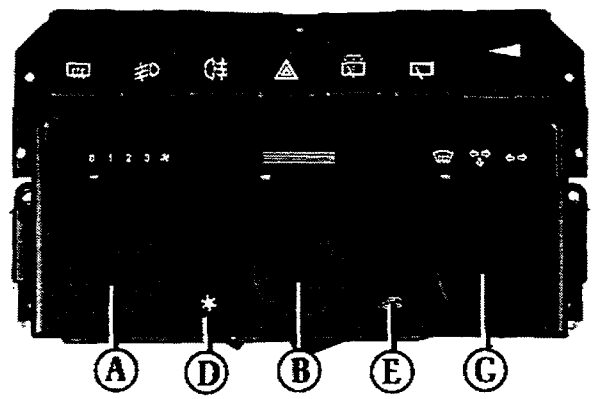
Control panel for manually operated climate control

A. Knob for adjusting flow rate of air introduced into the passenger compartment
B. Knob for adjusting the temperature of the air introduced into the passenger compartment
C. Knob for selecting the distribution of air to the various vents
D. Switch controlling energizing of compressor pulley electro-magnet coupling
E. Push button for activating recirculation of air inside the passenger compartment



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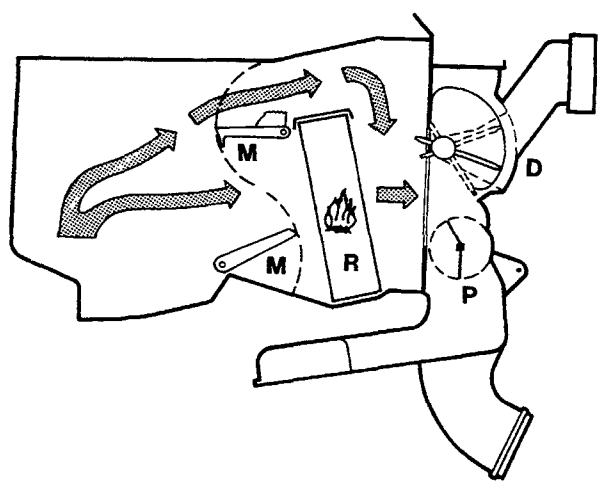
As can be seen from the illustrations the control panel for the climate control differs from the one for the first system through the addition of two cylindrical switches (D and E).
The first switch (D) identifiable by the ideogram of a snowflake operates a switch which can either activate the supply circuit for the compressor pulley electro-magnet coupling or not.
The second switch (E) identifiable by the ideogram of the passenger compartment activates a pneumatic (vacuum) switch which is connected by a small pipe to the (pneumatic) actuator which operates the air intake flap which either allows the air in the passenger compartment (recirculation) to enter the evaporator/heater unit or not.
The flow of air which circulates inside the heater assembly and then in the distribution duct connected to it is represented diagrammatically in the illustration at the side and is described in the text which follows.
Depending on the desired temperature of the air inside the passenger compartment and that of the atmosphere outside of the vehicle it is necessary for the two mixture flaps (M) to be manually placed in a certain position which either allows some or all of the flow of air drawn in by the electric fan to pass through the heater (R).
The total flow of air heated to a certain temperature reaches the distribution flaps (D).
These flaps, together with (P) which adjusts the flow of air to the footwell vents, can assume three different positions which correspond to three different distributions of air to the vents (see overleaf).



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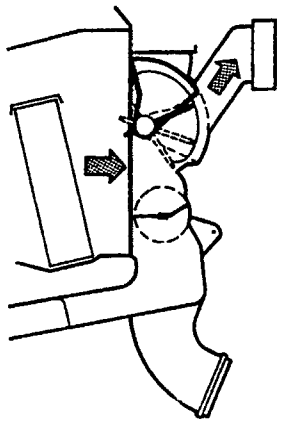
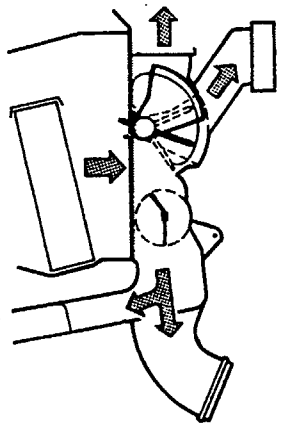
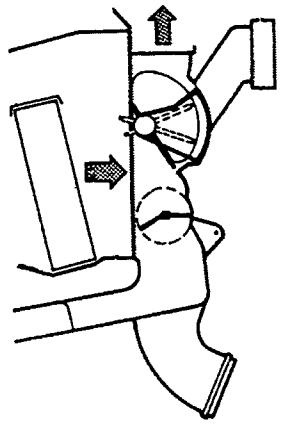
The table below illustrates for both systems possible positions of the distribution flaps and the flaps adjusting the flow of air to the footwell vents the the corresponding distributions of air and conditions are described.

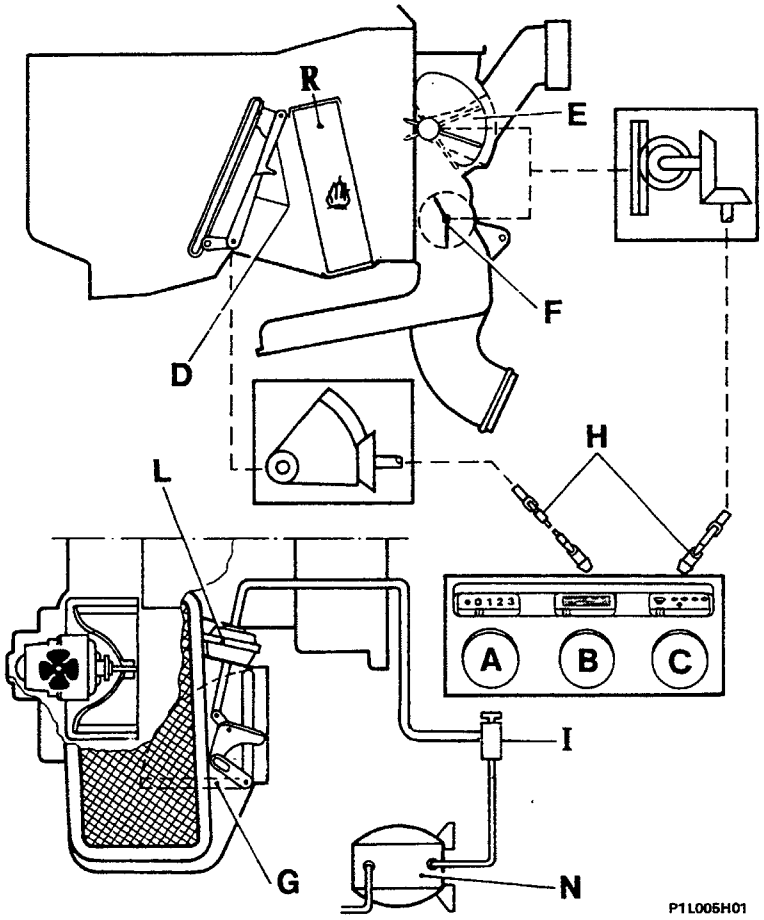
SLIGHT KNOB POSITIONS	REPRESENTATION OF DISTRIBUTION FLAP POSITIONS AND ROUTE OF THE AIR	VENTS OUT OF WHICH AIR COMES INTO THE PASSENGER COMPART.	PREVALENT USAGE CONDITIONS
⇦ ⇨		Distribution flaps upwards Air conveyed to the centre and side vents	With air adjusted to ambient temperature or minimum for summer ventilation
⇧ ⇦ ⇨		Distribution flaps in middle position Air conveyed to all the vents, mainly to the footwell vents	Condition with temperature adjusted to maximum with considerable heating suitable for wintertime
		Distribution flaps downwards Air distributed to windscreen vents	Used when front windows need de-misting or de-frosting rapidly

P1L004H01

DIGRAM SHOWING OPERATION OF MANUALLY OPERATED HEATING SYSTEM

Diagram showing manually operated heating system

A. Knob controlling intake and adjustment of air flow rate.
B. Temperature adjustment knob.
C. Distribution selector knob.
D. Mixture flaps.
E. Distribution flaps.
F. Footwell air vents adjustment flap.
G. Air intake flap.
H. Shafts with universal joints.
I. Vacuum switch.
L. Air intake flap (G) contol actuator.
N. Vacuum reservoir.
R. Heater



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KNOB (A)	POSITIONS KNOB	●	○	1	2	3
	AIR INTAKE FLAP (G) POSITIONS	air drawn in nil	outisde intake air	outside intake air	outside intake air	outside intake air
	ELECTRIC FAN SPEEDS	nil	nil	1st speed (low)	2nd speed (average)	3rd speed (high)

KNOB (B)		INTAKE OF HOT WATER INTO HEATER	MIXTURE FLAP (D) EXTREME POSITIONS
	By turning the knob in a clockwise direction the pointer moves from the blue zone to the red zone	From nil to maximum flow rate	From closed to completely open

P1L005H04

KNOB (C)	KNOB POSITIONS			
	DISTRIBUTION FLAP (E) POSITION	see page 4	see page 4	see page 4
	FOOTWELL AIR VENT FLAP (F) POSITION ADJUST.	see page 4	see page 4	see page 4

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DIAGRAM SHOWING OPERATION OF MANUALLY OPERATED CLIMATE CONTROL SYSTEM

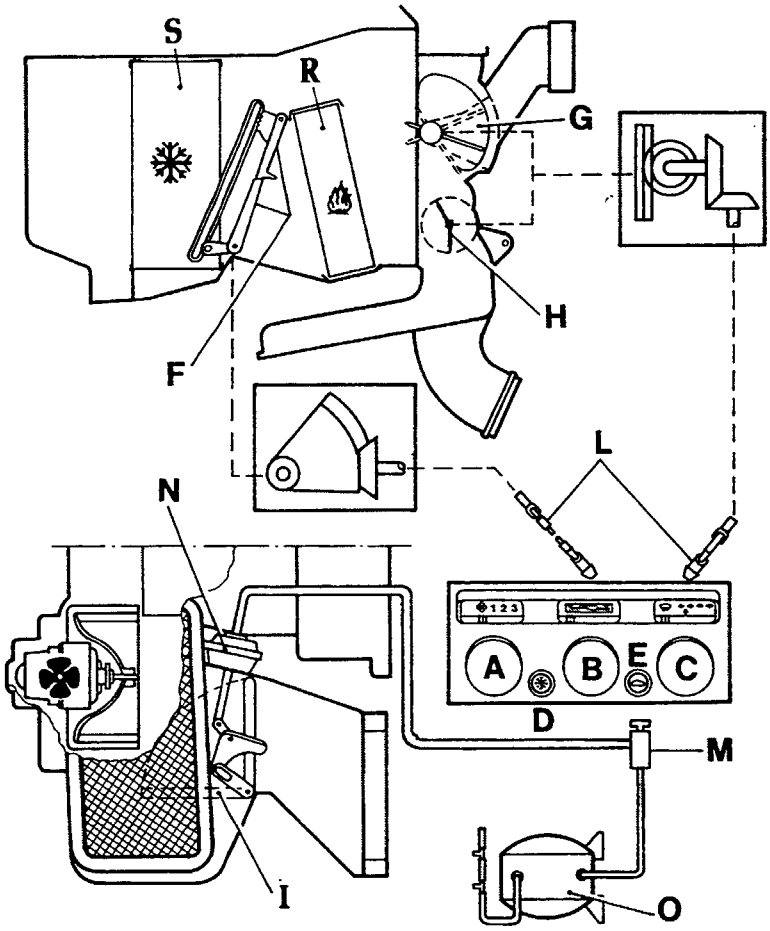


Diagram showing manually operated climate control system

A. Air flow rate adjustment knob.
B. Temperature adjustment knob.
C. Air distribution selector knob.
D. Switch controlling energizing of compressor pulley electro-magnet coupling.
E. Vacuum switch (M) knob.
F. Mixture flaps.
G. Distribution flaps.
H. Footwell air vents adjustment flap.
I. Air intake flap.
L. Shafts with universal joints.
M. Vacuum switch.
N. Air intake flap (I) control actuator.
O. Vacuum reservoir.
R. Heater
S. Evaporator

KNOB	POSITIONS KNOB	○	1	2	3
A	ELECTRIC FAN SPEEDS	nil 1st speed if switch D is pressed	1st speed (low)	2nd speed (average)	3rd speed (high)

KNOB	
B	By turning the knob in a clockwise direction the pointer moves from the blue zone to the red zone. The intake of hot water into the heater varies from nil to maximum, whilst the position of the mixture flaps varies from completely closed to completely open (see the same knob on the previous page)

KNOB	
C	The knob positions and the corresponding positions for the distribution flaps and the footwell air vent adjustment flaps are the same as those listed in the diagram on the previous page for the same knob

SWITCH	SWITCH CON.	SWITCH	PULLEY ELECTRO-MAGNET COUPLING	COMPRESSOR
D	Pressed	Closed	Energized	Working
	Not pressed	Open	De-energized	Not working

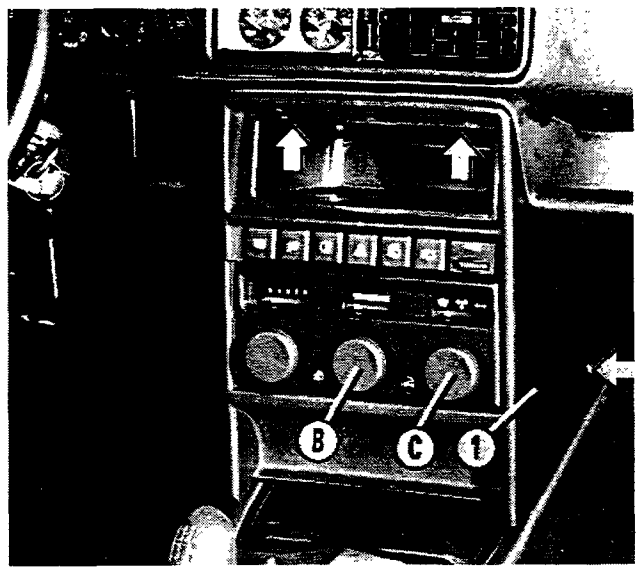
SWITCH	SWITCH CON.	AIR INTAKE FLAP (I) POSITIONS	AIR INTAKE
E	Not pressed	Transverse ▯	Outside air
	Pressed	Longitudinal ▭	Recirculation air

CONTROLS

Removing

In order to remove the controls for one of the two systems (heater or climate control - both manually operated) carry out the following operations:

- turn knobs B and C as far as possible in an anti-clockwise direction so that the pointers are in the extreme blue positions (max cold) and corresponding to the distribution of air to the windscreen vents;
- undo the bolts shown by the arrows which fix the front cover (1) for the centre console to the dashboard at the top and at the side;



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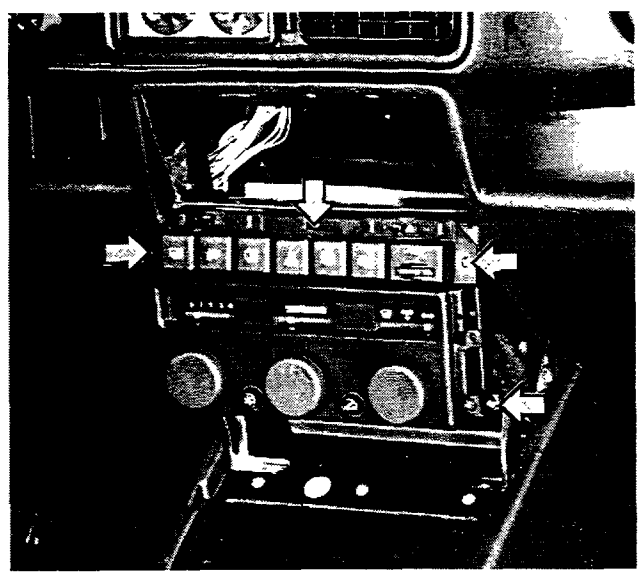
- remove the above mentioned front cover (complete with radio console cover) from its housing;
- undo the bolts shown by the arrows which fix the controls to the centre console;
- partly remove the controls (shown in the diagram below) from their housing (by moving them forwards a few centimetres) and release the end section of the two rods (2 and 3 in the diagram below) from the joints for the shafts for the mixture and distribution flap drive gears;



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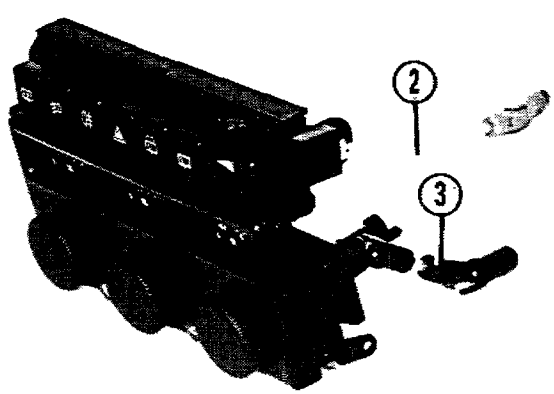
- make a note of the colour of the connectors and the cables which are attached at the terminals for each individual switch for the controls;
- release the connectors and the terminals for the cables which are connected to the terminals for the various switches for the controls;
- (after having made a note of their position) detach the two pipes from the vacuum switch (F or G depending on the system) illustrated in the centre diagrams overleaf and lastly release the bulb holder and bulb from its housing (4) with the fibre optic lights for the ideograms.



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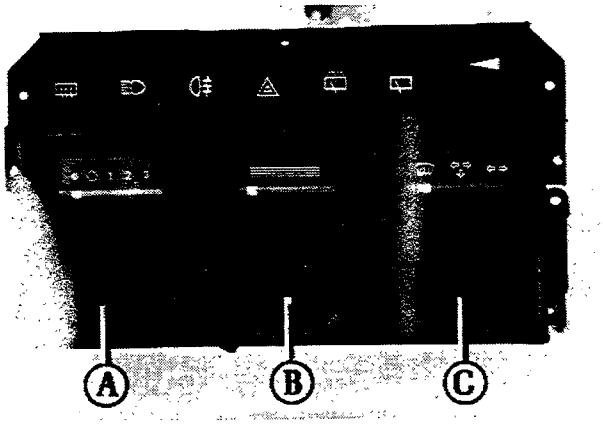

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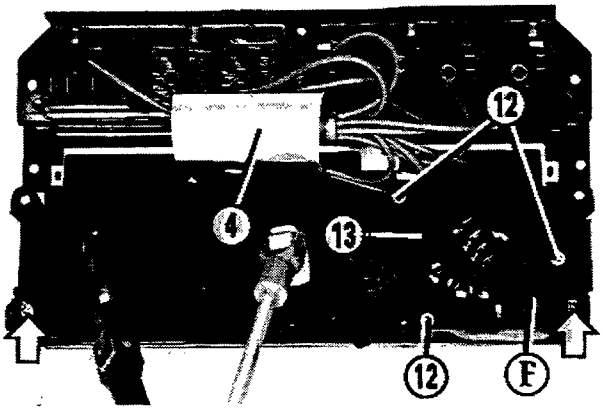
Dismantling

- remove the knobs (A B C) from the controls which are a press fit;

Front view of controls for manually operated climate control system



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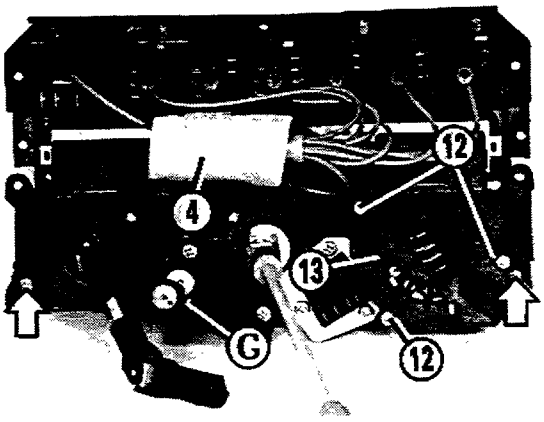
Rear view of controls for manually operated heating system

F. Vacuum switch controlling actuator which operates air intake flap



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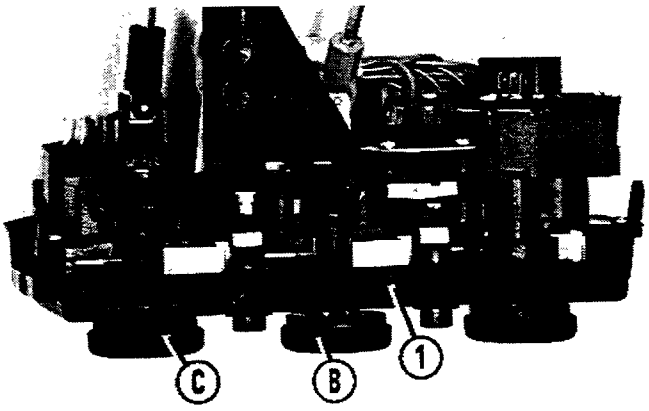
Rear view of controls for manually operated climate control system

G. Vacuum switch controlling actuator which operates air intake flap

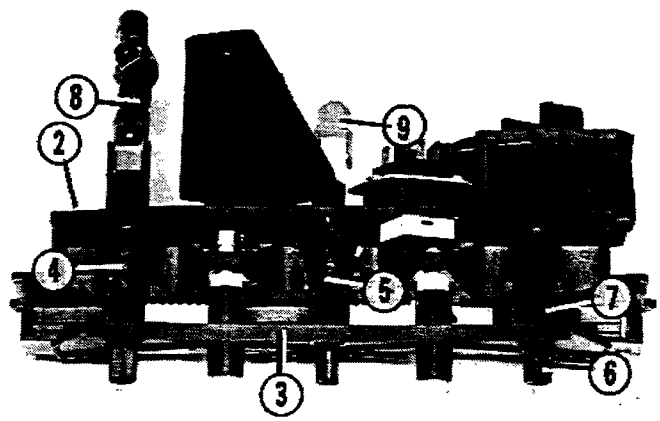


P1L008H03

- undo the bolts (shown by the arrows in the two centre diagrams) which fix the controls to the front cowling (1) (shown in the diagrams at the top of the next page).

Controls for climate control system (view from underneath)

The controls are made up of two plate (2 and 3) welded parallel to each other which have three shafts going accross; two of them (4 and 5) have a tooth in the centre (between the two plates) whilst the third (6) has a toothed sector (7).
On the outside of the internal plate (2) the ends of the two shafts (4 and 5) opposite those where the two knobs (B - C in the diagrams on the previous page) are fitted the end sections of the two rods with universal joints (8 and 9) are fitted.
Inside the above mentioned two plates, meshing with the teeth of the two shafts (4 and 5) and the toothed sector (7) there are three rackes which form an integral part of the pointers (10).



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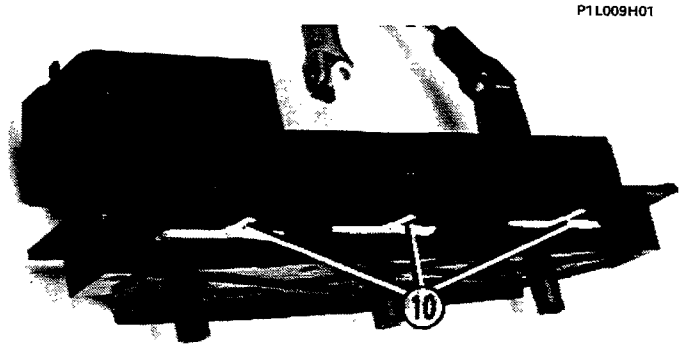
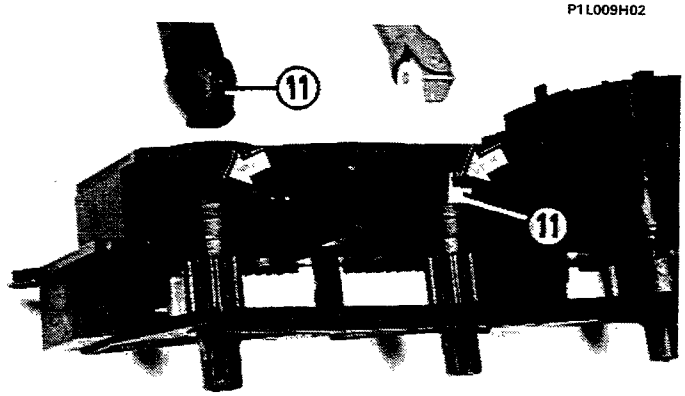


P1L009H02

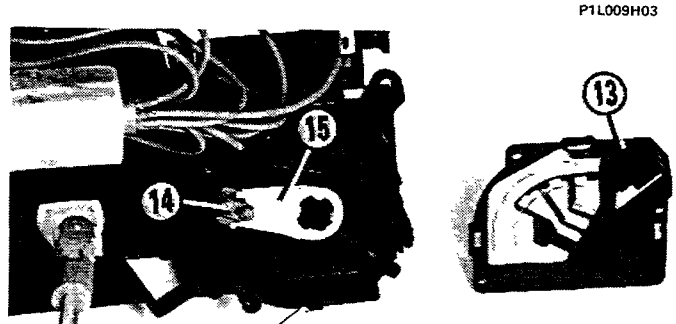
View of controls for the two systems detached from the cowling

- taking great care not to break them, slightly raise the tabs shown by the arrows which keep the two projections (11) at the ends of the rods with the joints in position so that they can be released from the controls;



P1L009H03

- undo the bolts (12 in the diagrams at the centre of the previous page), remove the cover (13) sliding contacts and take care not to lose the plate with contacts (14) which is resing on the rotor arm (15);



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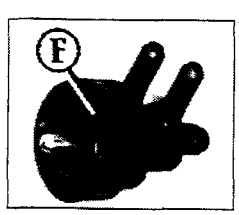
- for the controls for the heating system only, after the previous operation, remove the vacuum switch (F) from its housing.



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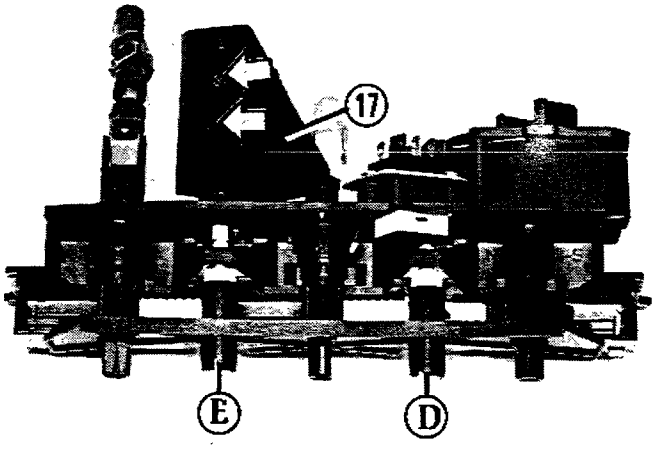
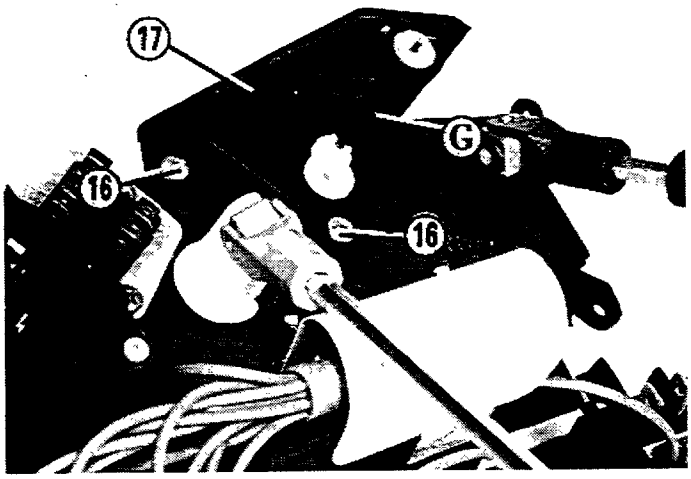


P1L010H01

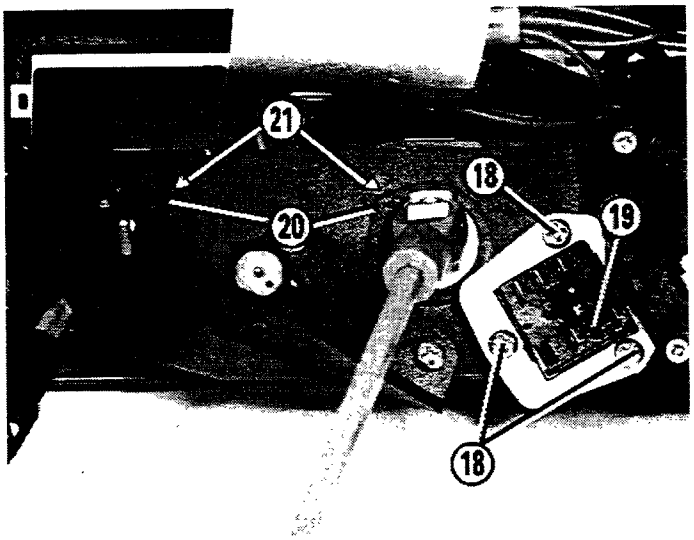
The operations described and illustrated which follow apply only to the controls for the climate control system.

- remove the two cylindrical switches (D and e) for the switch controlling the energizing of the compressor pulley electro--magnet coupling and the vacuum switch controlling the pneumatic actuator operating the air intake flap which are fitted in the controls;



P1L010H02

- undo the two bolts (16) which fix the support (17) to which the vacuum switch (G) is fixed by clips (shown by the arrows in the diagram above) to the internal plate for the controls;
- undo the bolts (18) which fix the switch (19) which controls the energizing of the compressor pulley electro-magnet coupling to the internal plate for the controls.



P1L010H03

Reassembly and refitting

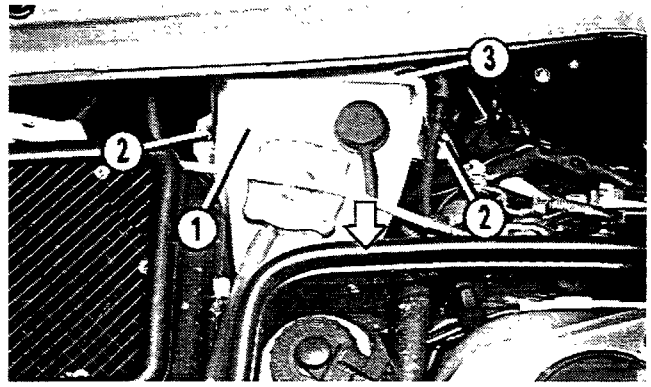
Reverse the order of the operations described and illustrated for the dismantling and removal bearing in mind that before commencing the refitting operations the knobs must be rotated so that the pointers (20) which are an integral part of the housings for the end sections of the two rods with the joings are aligned with the two arrows (21) on the internal plate for the controls.

HEATER UNIT OR EVAPORATOR/HEATER UNIT

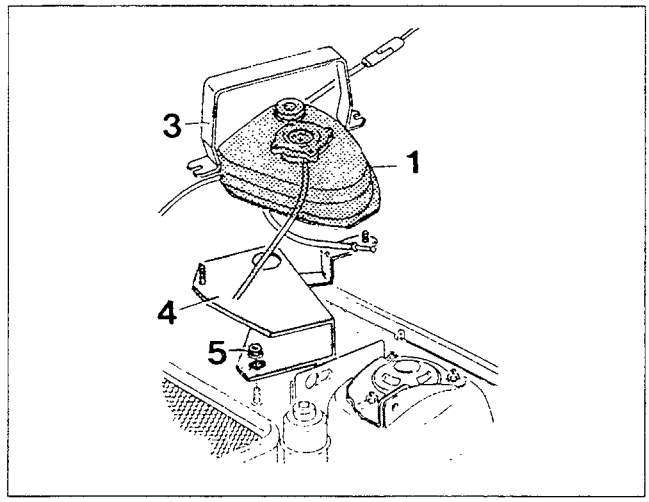
Removing

For vehicles which have climate control systems, carry out the following operations:

- remove the engine coolant expansion tank (1) after having undone the nuts (2) which fix the retaining bracket (3) to the mounting bracket (4) underneath and remove the latter from the engine compartment after having undone the nut (5) which fixes it at the bottom to the bodyshell;



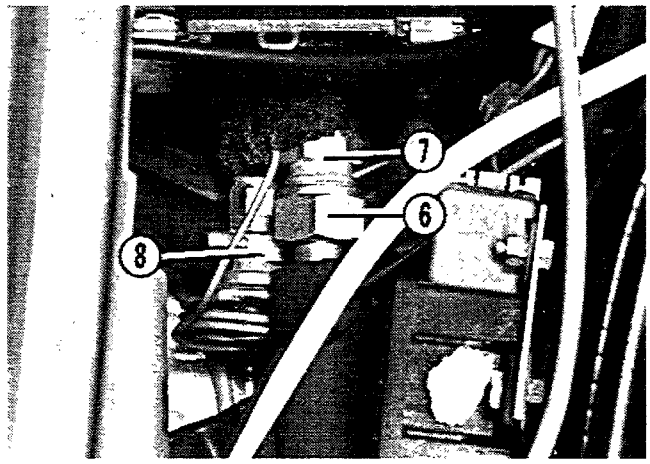
P1L011H01



View of mounting bracket for engine coolant expansion tank

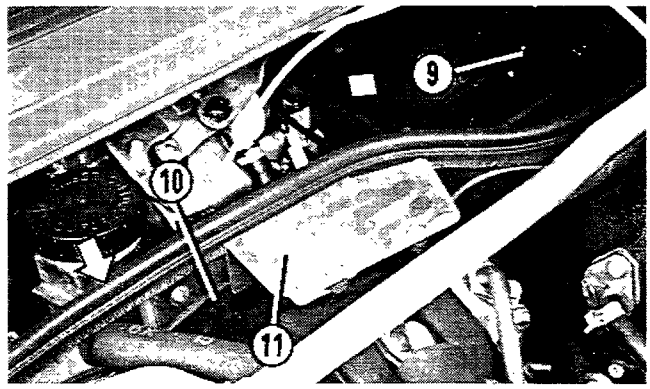
P1L011H02

- **drain the air conditioning system** (as far as the operations are concerned see the description and illustration on page 23);
- undo the union (6) and the one below (not visible in the diagram) for the pipes which are connectedto the outlet duct (7) for the evaporator and to the expansion valve (8);



P1L011H03

- disconnect the electrical connection for the cables at the anti-frost thermostat (9);
- undo the nuts fixing the supporting bracket (11) for the pressure transducers to the bulkhead (10).



P1L011H04

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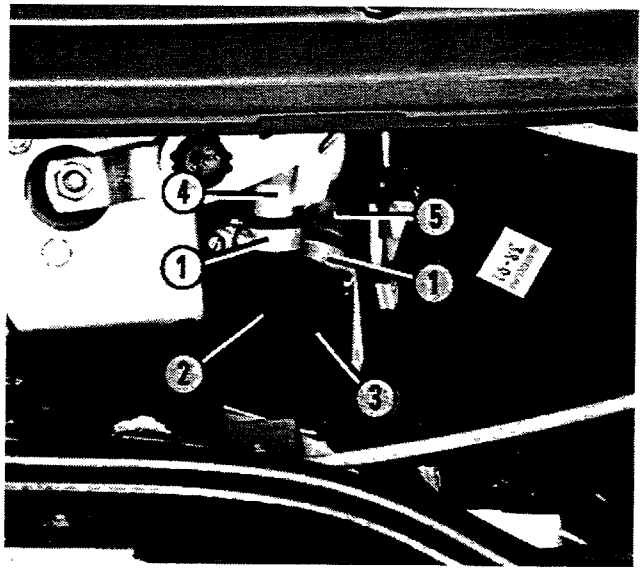
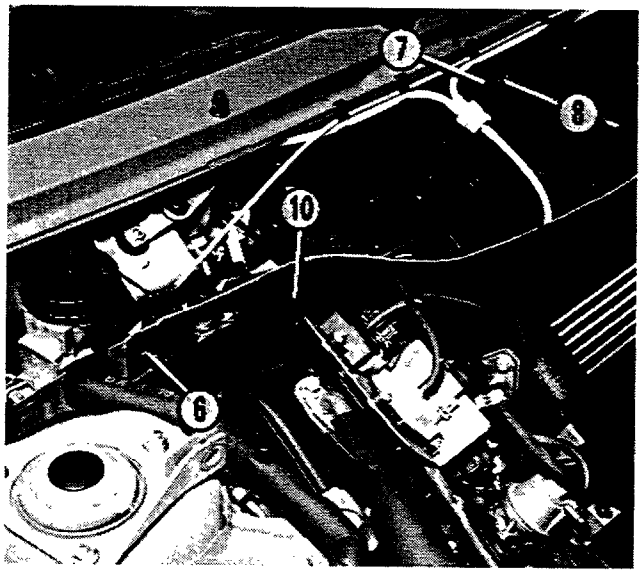


P1L012H01

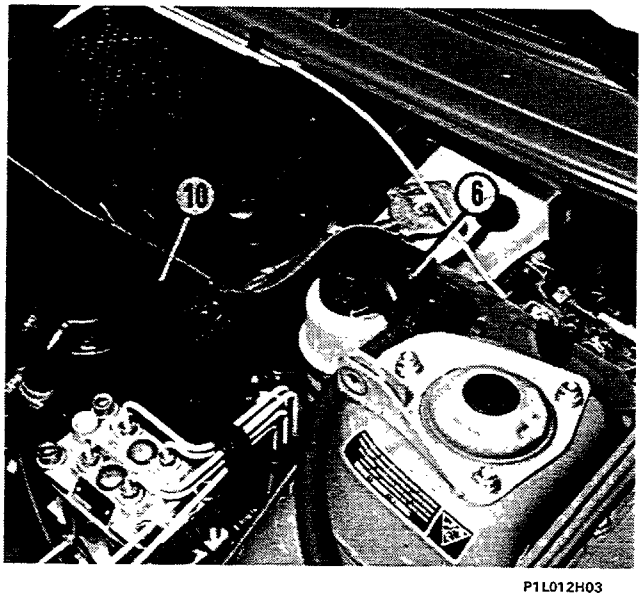
For vehicles with one of the two heating or climate control systems, carry out the following operations:

- drain the engine cooling system;
- loosen the bands (1) and release the two pipes (2 and 3) from the inlet ducts for the tap (4) and the outlet ducts (5) for the heater radiator;



P1L012H02

- remove the profiles (shown by the arrows in the first and fourth diagrams on the previous page) which are a press fit at the top of the bulkhead (10);
- remove the bulkhead (10) between the engine compartment and the heater unit after having undone the bolts (6) which fix it to the bodyshell;
- release the pipe (7) from the pneumatic actuator (8) which operates the air intake flap and, for the heating system only, release the pipe (which goes above the heater unit) from the vacuum reservoir which is located at the (left) side of the above mentioned unit;

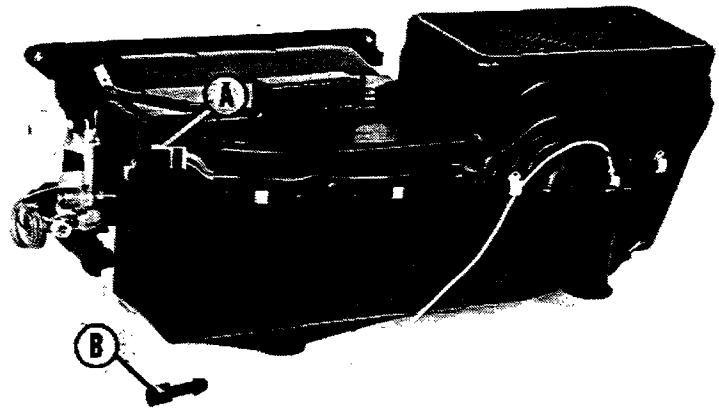


P1L012H03

- disconnect the electrical connections (shown by the letters A and B in the first diagram overleaf) for the supply cables for the resistor for the various electric fan speeds and supply;
- remove the controls following the description and illustration on page 7;
- carry out the operations described for the air distributor duct given on page 18;
- working appropriately, remove the heater/distributor assembly or evaporator - heater - distributor from its housing.

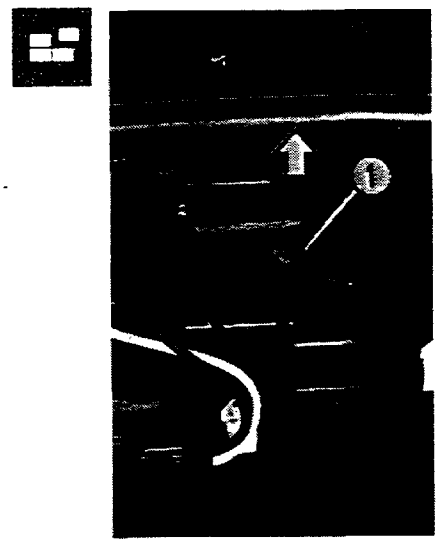
Dismantling

NOTE *The evaporator/heater unit for the manually operated climate control system only differs from the one for the other system through the addition of the evaporator with the expansion valve, the anti-frost pressure switch and the recirculation duct; for reasons of brevity the text and the diagrams which follow only contain descriptions and illustrations of the dismantling of the first unit mentioned above and illustrated at the side.*

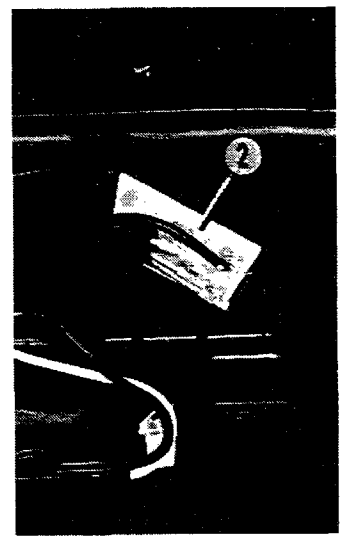


P1L013H01

- remove the cover (1) sliding it in the direction shown by the arrows on the guides on the group;
- release the plate with the resistances (2) from the housing in the cover for the heater unit casing;

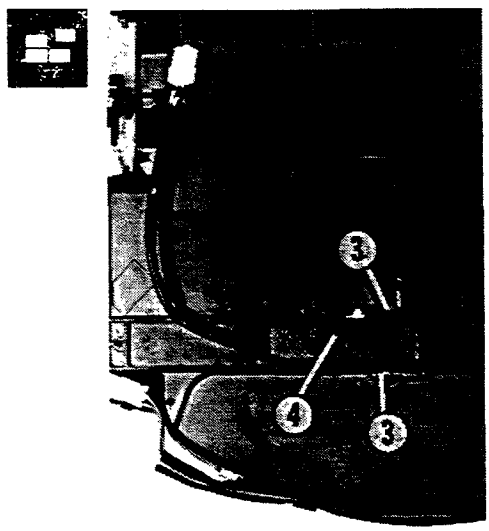


P1L013H02

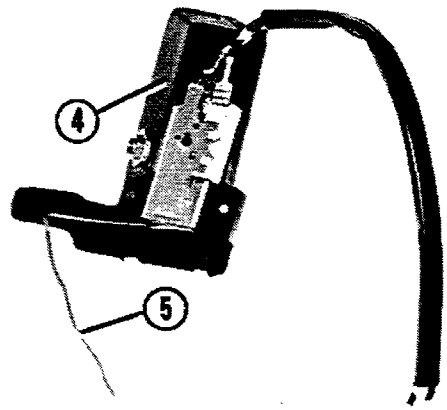


P1L013H03

- undo the bolts (3) which fix the anti-forst pressure switch (4) to the upper surface of the heater unit;
- raise the anti-frost pressure switch (4) in a vertical line until the sensitive bulb (5) is completely removed from the unit;



P1L013H04



P1L013H05

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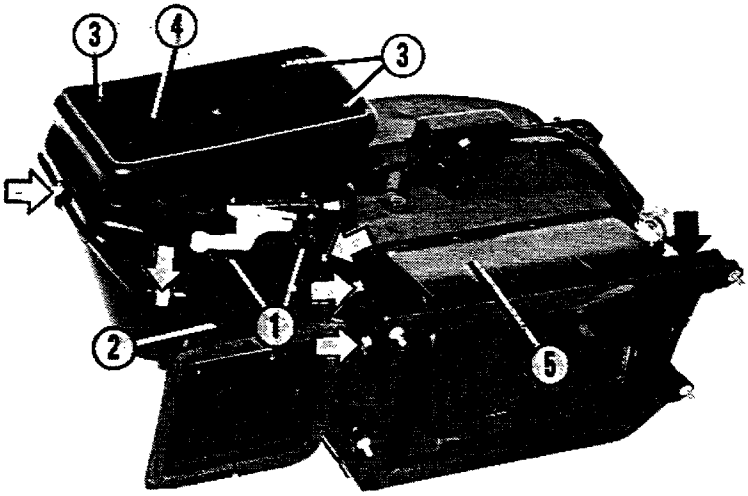
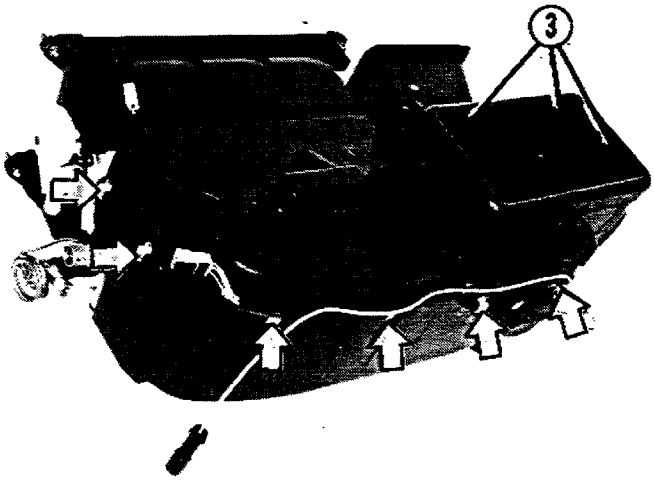


P1L014H01



P1L014H02

- for the evaporator/heater unit only, undo the bolts (1) and the opposite lower parallel ones which fix the recirculation duct (2) to the casing which makes up the assembly;

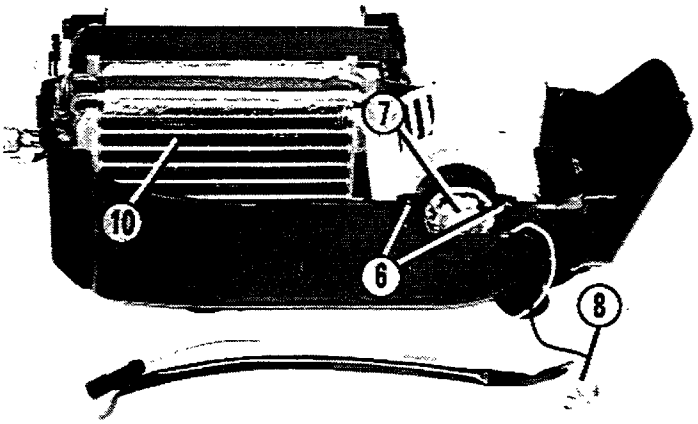
- undo the bolts (3) which fix the grille (4) to the cover for the casing which makes up one of the two units;

- after having removed the grille (4) undo the bolt located at the bottom of the rib shown by the black arrow and remove the various white clips shown by the arrows and the internal one (accessible through the opening freed by the grille) which fix the upper cover (5) along its perimeter to the casing containing the heater and the other components;

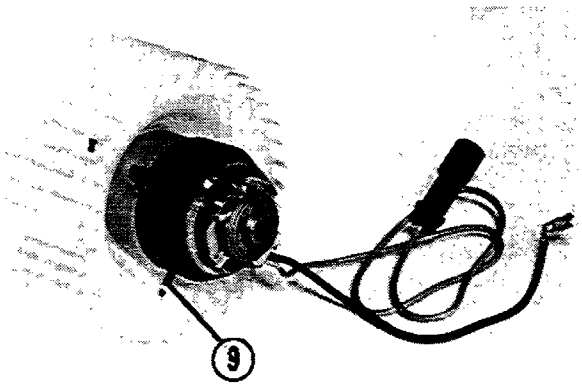
- after having removed the cover (5) undo the two bolts (6) which fix the fan (7) to the casing;

- disconnect the terminal for the black supply cable for the electric fan from the resistor plate (8).

There is a pin (9), in the lower part of the support fitted to the front section of the electric fan, which is used for centering it on the casing.



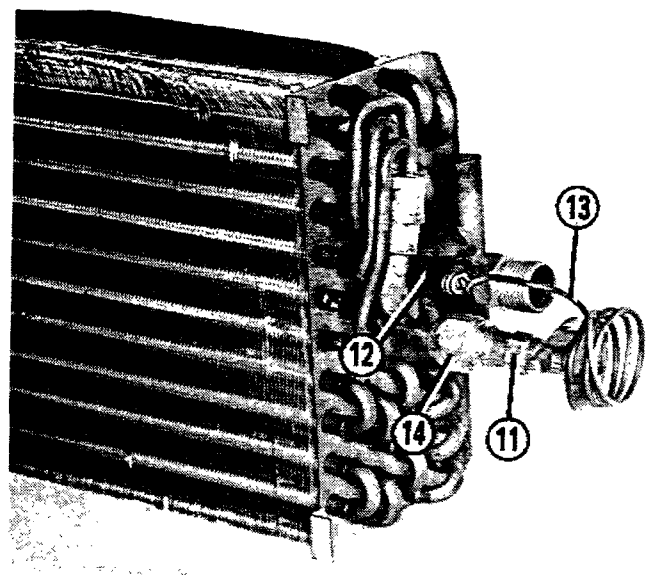
P1L014H03



P1L014H04

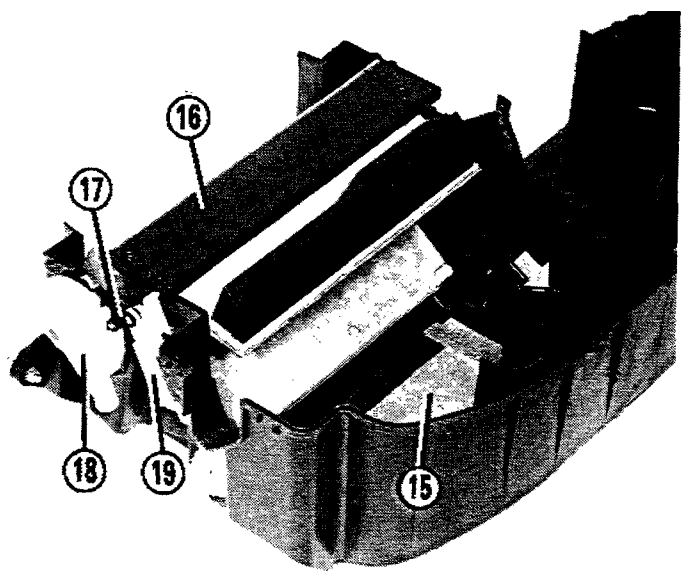
- remove the evaporator (10 in the diagram at the foot of the previous page) from its housing in the casing and if this operation proves difficult adjust the tab which is fitted by the rib at the point shown by the arro in the second diagram at the side.

In order to release the expansion valve (11) from the evaporator simply remove the black anti-condensation adhesive (prestite) which partly covers it, then remove the clip (12) which keeps the sensitive bulb (13) in contact with the outlet duct for the evaporator and lastly undo the union (14) which joins it to the inlet duct.



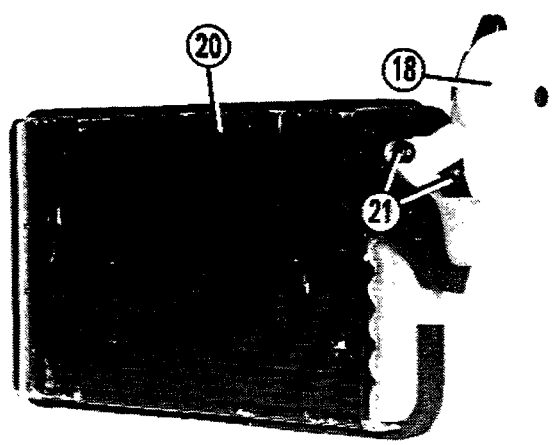
P1L015H01

- remove the lower plate (15) supporting the evaporator;
- remove the shield (16) (positioned above the heater) whose lower projections fit in the openings in the casing (shown by the arrows in the diagram at the top of the next page);
- stretch the end section of the tap (18) control lever (17) to release it from the operating rod (19);
- remove the heater (20) from its housing in the casing.



P1L015H02

In order to release the tap (18) complete with inlet duct from the heater simply undo the nuts (21) which join the two components.



P1L015H03

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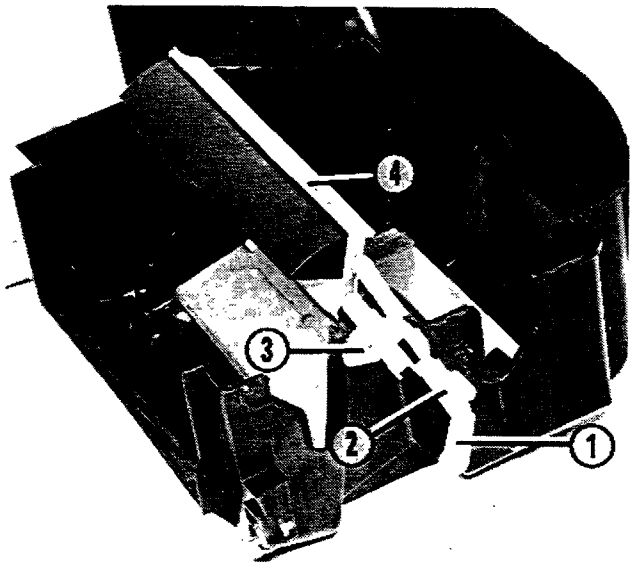
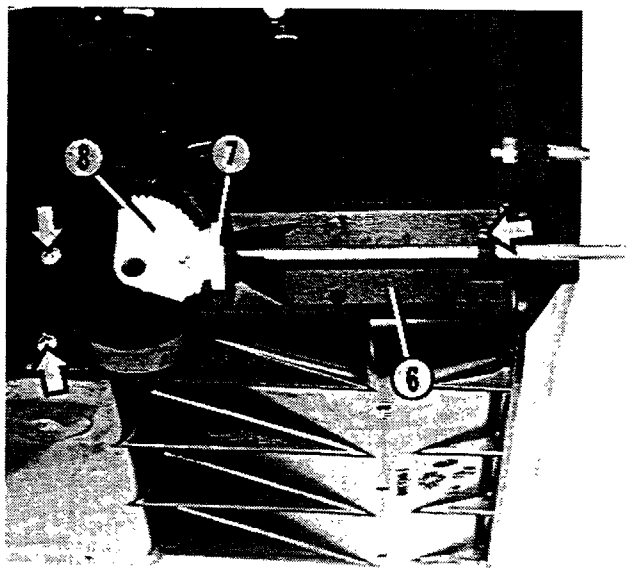


P1L016H01

- suitably stretch the end section of the lower mixture flap control lever (1) to release it from the rack operating rod (2);

- through the opening in the casing by the lower part of the housing where the shaft for the toothed sector (3) is fitted, adjust the projection (shown by the arrow in the lower diagram) to allow it to be removed which should take place together with the release of the rack rod (2);

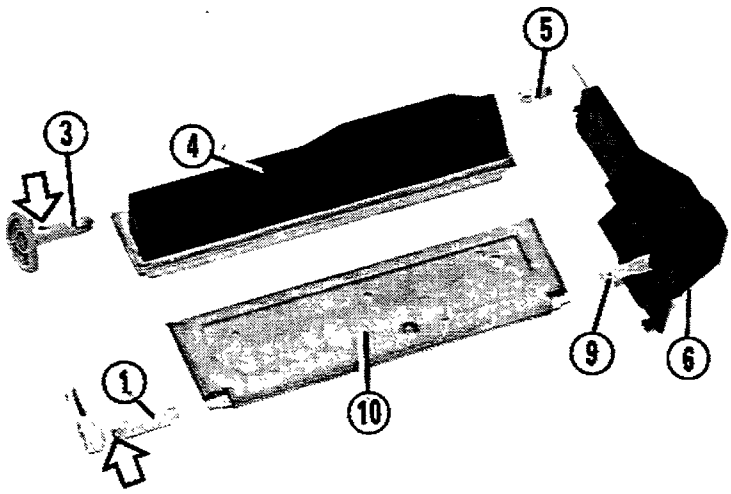
- suitably expand the left wall of the casing in order to release the upper mixture flap (4) and plastic bush (5) on which it is hinged;



P1L016H02

- undo the bolts shown by the arrows which fix the support (6) with the toothed wheel (7) and sector (8) which control the mixture flaps to the left side of the casing;

- working appropriately, release the end section (9) which makes up the toothed sector pin (8) from the lower mixture flap pin (10);

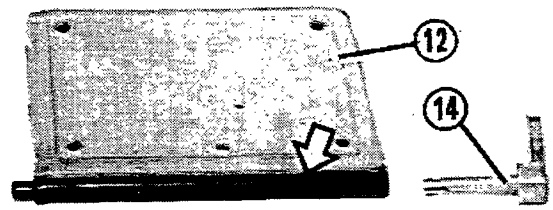


- through the opeing in the casing by the lower part of the housing where the shaft for the lever (1) is fitted, adjust the projection (shown by the arrow in the lower diagram) in order to be able to extract it and then remove the lower mixture flap (11) from the casing;

View of mixture flap hinge components

P1L016H03

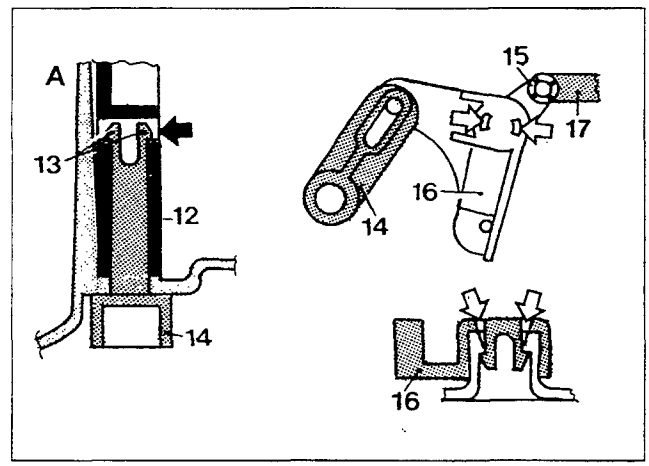
- through the notch (shown by the arrows in the diagram at the side and detail A in the second diagram) in the air intake flap (12) act on the tabs (13) for the end section of the pin for the control lever (14) to allow its removal and the subsequent release of the air intake flap (12) from the casing cover;



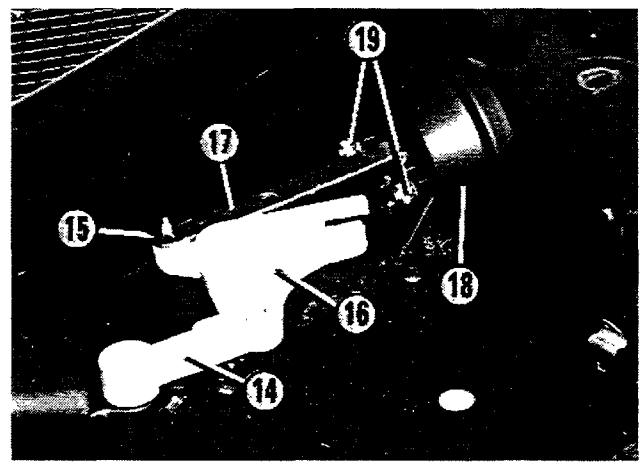
P1L017H01

- remove the clip (15) and release the rod (17) for the pneumatic actuator (18) which can be released from the casing cover after having loosened the nuts (19) from the plate (16);

- work appropriately through the slots (shown by the arrows in the details on the right in the diagram at the side) in the plate (16) to release the internal tabs from the projection in the casing cover.



P1L017H02



P1L017H03

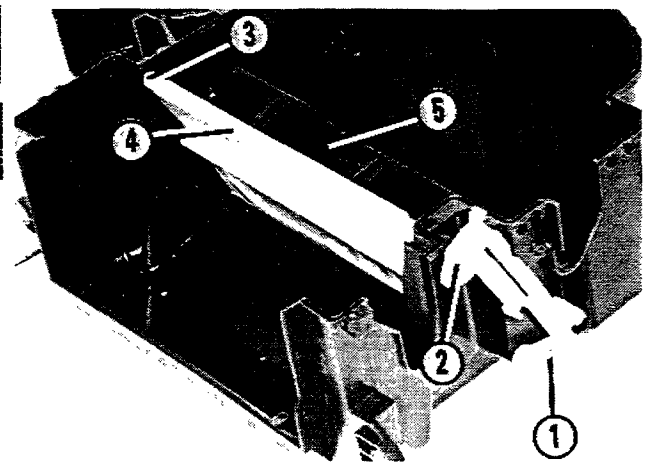
Reassembly and refitting

Reverse the order of the operations described for the dismantling and removal bearing the following points in mind.

Before fitting the lever (1) and the toothed sector (2) (controlling the mixture flaps) on the casing, grease the external surfaces which are in contact with the casing and the bush (3) with MR3 Fiat grease.

The upper mixture flap (4) has a deflector (5) which should be facing the evaporator during fitting.

When the two mixture flaps are aligned (closed) the toothed sector (2) and the lever (1) should be positioned as shown in the diagram at the side whilst the triangular projections for the wheel and the toothed sector on the support located on the left side of the casing should coincide (see illustration at the top of the next page).



P1L017H04

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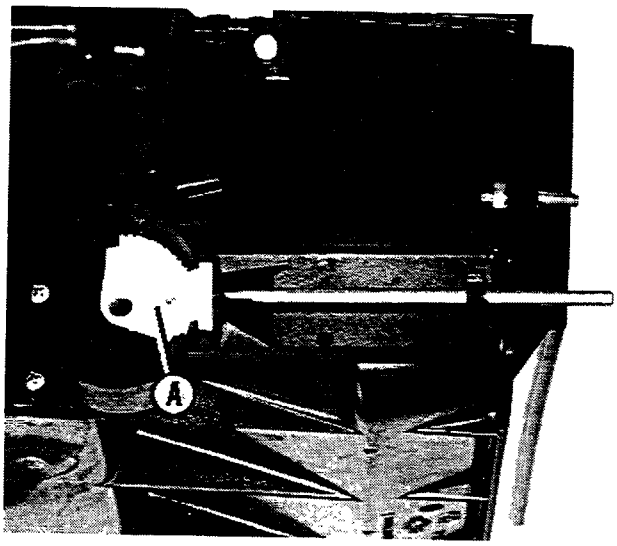
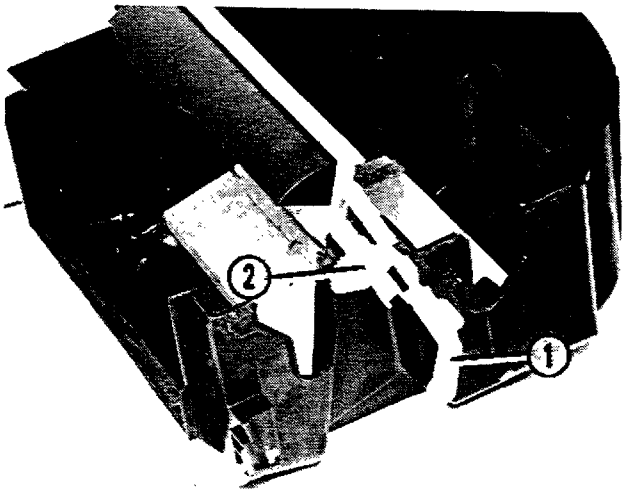


P1L018H01

Before fitting the end section of the toothed sector (A) for the above mentioned support in its housing in the casing, lubricate the outer surface with vaseline.

Grease the toothed surface of the sector and the wheel for the above mentioned support with grassofiat MR3.

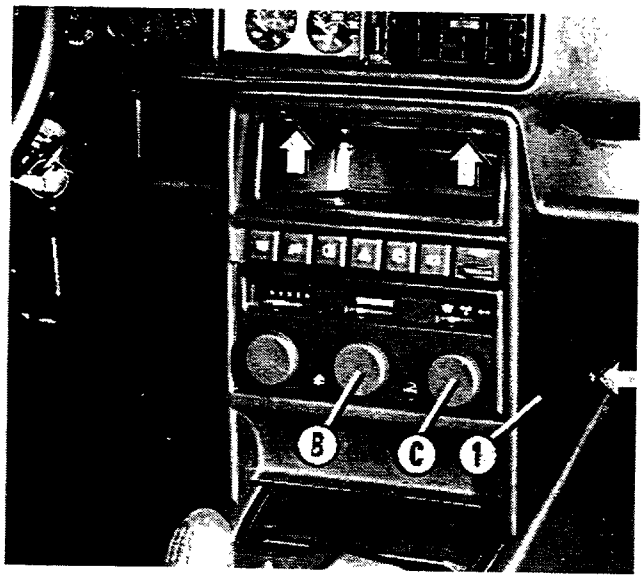


P1L018H02

When the two mixture flaps are in a totally open position the toothed sector (2) and the lever (1) should be in the position illustrated in the diagram at the side.

Grease the side surfaces of the casing which come into contact with the mixture flaps during rotation with Rhodorsil Silicones PATE4.

Grease the toothed surface of the sector (2) and the sliding and toothed surfaces of the rack (3) with grassofiat MR3.



P1L007H01

AIR DISTRIBUTION DUCT

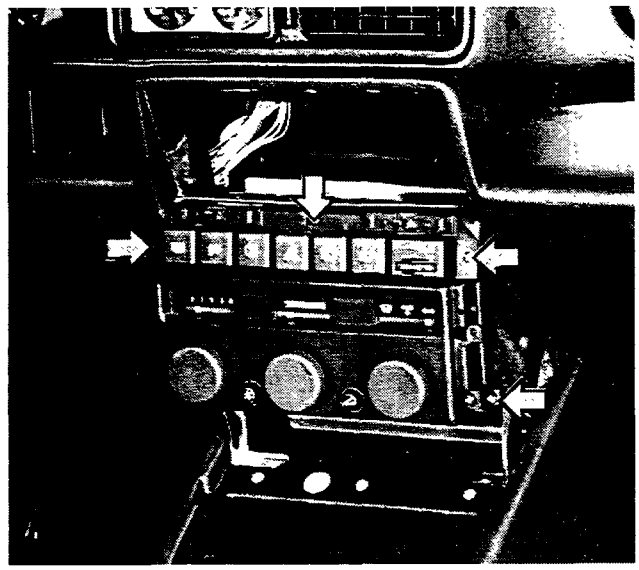
Removing

The air distribution duct assembly located under the dashboard is the same in both systems.

The operations for its removal are listed below and the order is not critical:

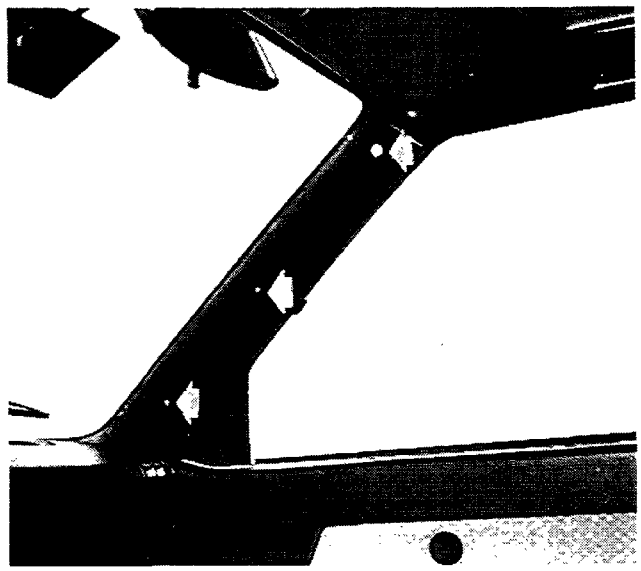
- completely rotate knobs B and C in an anti--clockwise direction;
- undo the bolts shown by the arrows which fix the front cover (1) for the centre console to the dashboard at the top and at the side;

- remove the front cover mentioned above from its housing and undo the bolts shown by the arrows which fix the controls to the centre console;
- move the controls a few centimetres forward and release the end section of the two rods with joints from the shafts for the drive gears for the mixture and distribution flaps;
- after having made a note of the colour and the position, release the connectors, the terminals for the cables and the pipes from the switchs and the vacuum switch for the controls and also release the bulb holder and bulb from the housing with the ideogram fibre optic lights;
- open the cover located at the front of the upper cover for the tunnel which conceals the cigar lighter and the ashtray housing and remove the latter and undo the bolts (1) underneath and the bolt at the rear which fix the above mentioned cover to the floor;
- undo the knobs which fix the side shields fro the front section of the tunnel to the bracket fitted on the latter;
- undo the bolts which fix the two shields to the steering upper control shaft;
- remove the shield for the junction unit and release the latter from the dashboard after having undone the bolts which fix the two components;
- remove the instrument panel (see operations in section 55);
- undo the bolts which fix the dashboard to the bodyshell at the bottom;
- remove the small caps and the bolts underneath (shown by the arrows) which fix the interior fittings for the front side pillars to the bodyshell;
- working in the area underneath the windscreen in the engine compartment undo the nuts which fix the dashboard to the bodyshell at the top;
- remove the dashboard from its housing and place it on the floor of the vehicle;
- undo the bolts which fix the air distribution duct to the dashboard at the top.



P1L007H02

P1L019H01



P1L019H02

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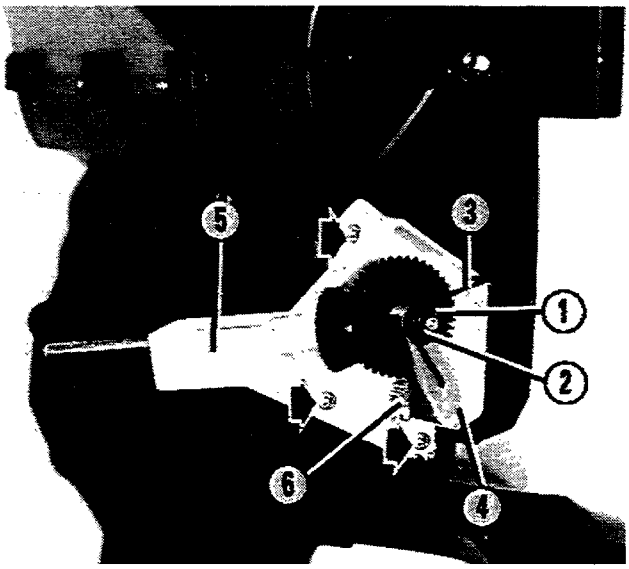


P1L020H01

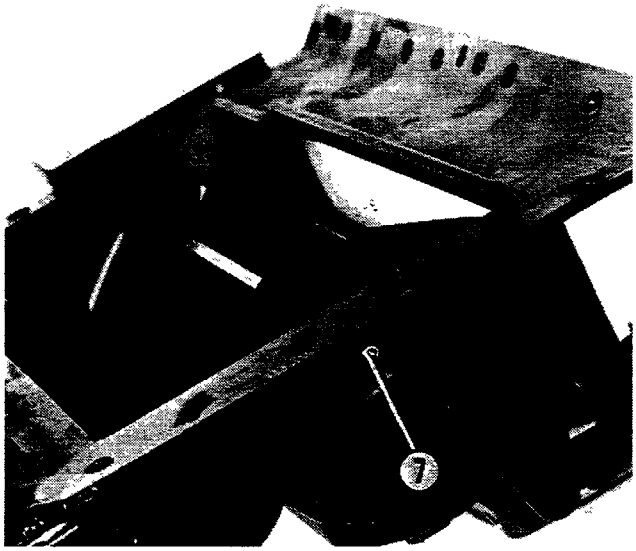
Dismantling

Remove the clip (1) and remove the washer (2) underneath the shaft.

Remove the spring (3) and remove the lever (4).

Undo the bolts (shown by the arrows) which fix the flap control device (5) to the air distribution duct.

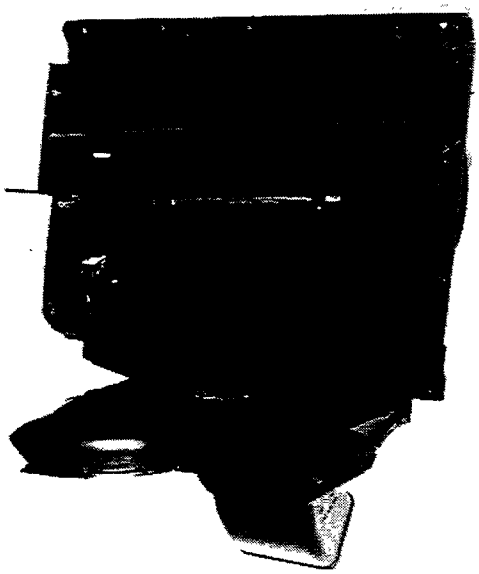
Remove the above mentioned device after having released it from the flap control rack (6).



P1L020H02

Release the rack from the flaps (see diagram overleaf).

Remove the clips (7) which keep the hinged shaft for the upper flaps in place on the air distribution duct.

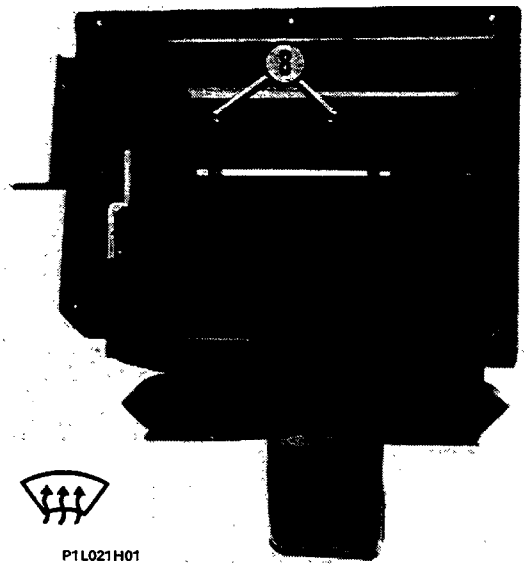


P1L020H03

Release the upper flaps from the air distribution duct (see diagram above).

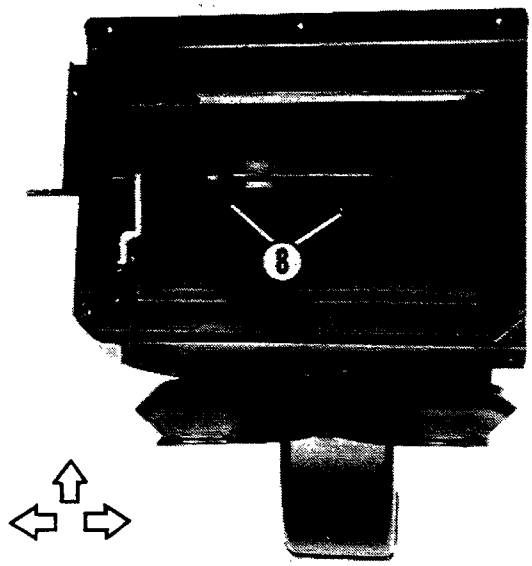
In the same way release the lower flap from the above mentioned duct.

Undo the bolts (8 in the diagrams overleaf) which fix the centre vent air ducts to the distribution duct assembly.

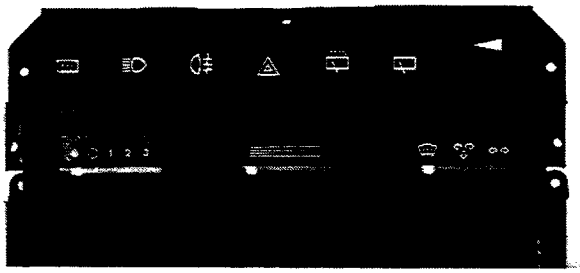


P1L021H01

P1L021H02



P1L021H04



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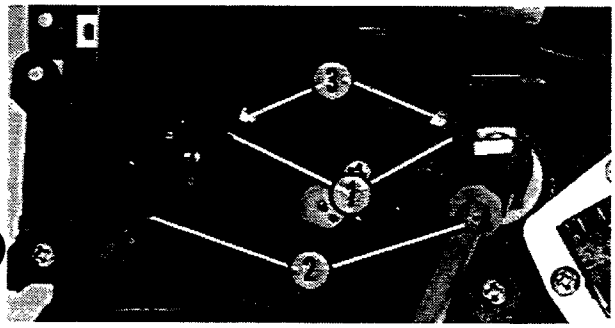

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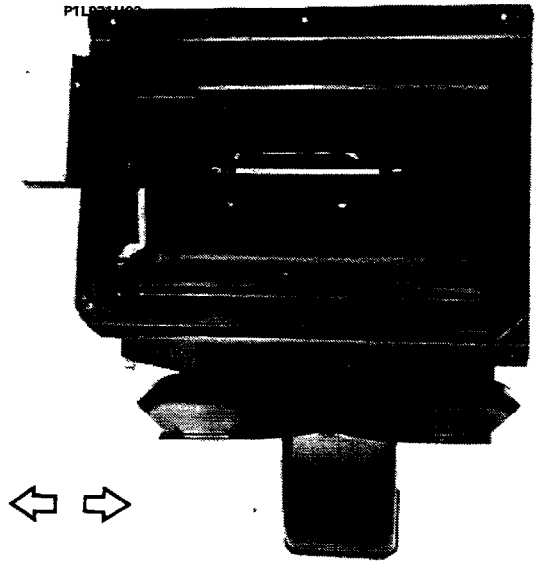


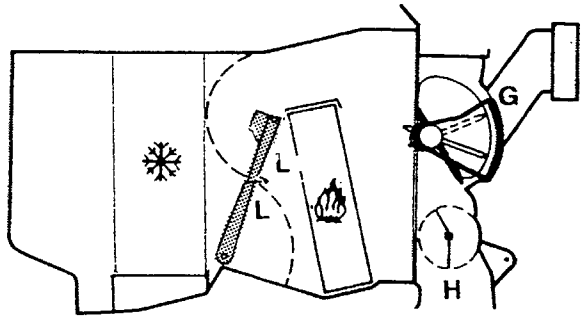
P1L021H08

P1L021H07

Reassembly and refitting

Reverse the order of the operations described for the dismantling and removal.

It should be remembered that the references (1) for the housings for the rods with joints (2) in the rear part of the assembly should be aligned with the reference arrows (3) and the mixture flaps (L) and the distribution flaps (G) should be in the positions shown in the diagram at the side, i.e. the former should be closed and aligned and the latter should be in the position illustrated in the top left diagram.



P1L021H09

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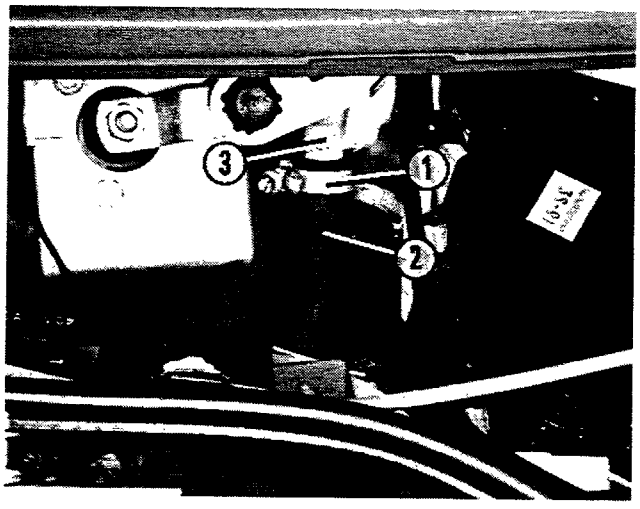
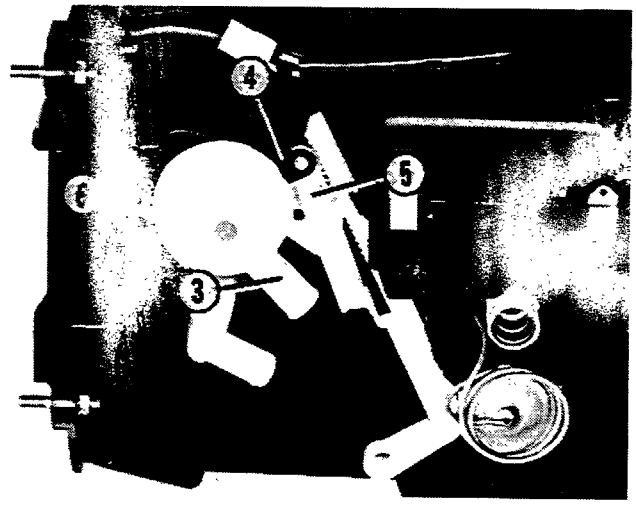
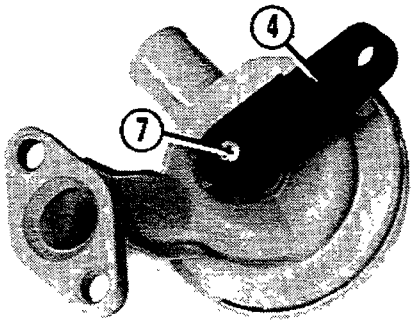


P1L022H01



P1L022H02

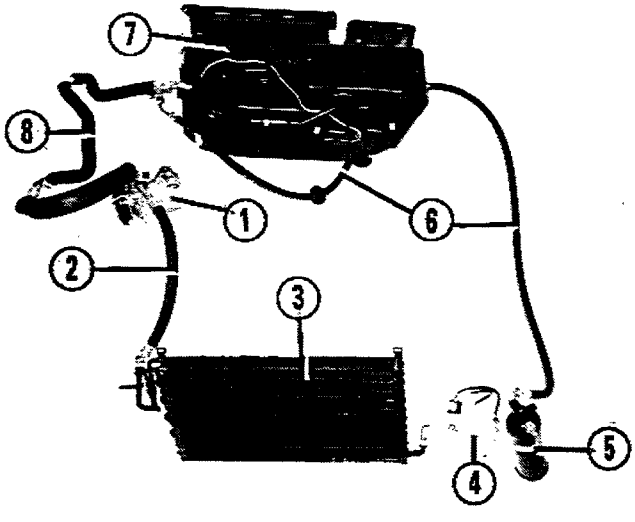
TAP FOR ADJUSTING INLET OF WATER INTO THE HEATER



P1L022H03

Removing

- after having drained the engine cooling system loosen the band (1) and detach the pipe (2) from the tap (3) inlet duct;
- suitably expand the end section of the lever (4) so that it can be released from the rack rod (5);
- undo the nuts (6) which fix the tap (3) to the heater and undo the bolt (7) which fixes the lever (4) in position on the shaft.



P1L022H04

Air conditioning system components

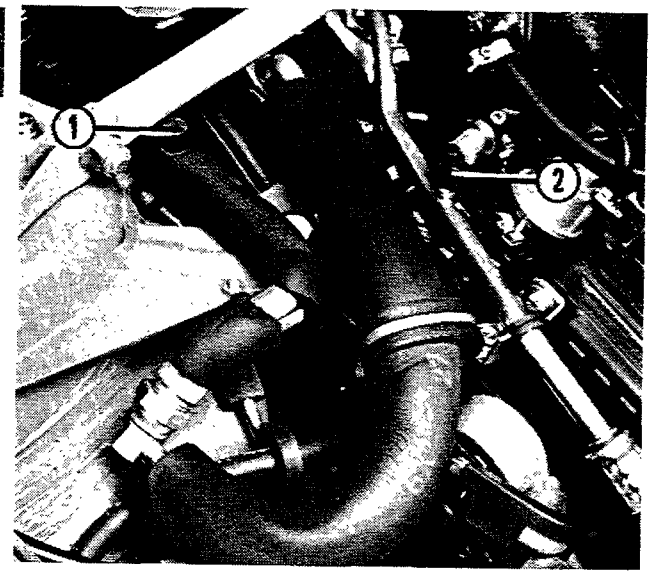
1. Compressor
2. Connecting pipe between compressor and condenser
3. Condenser
4. Connecting pipe between condenser and drier filter with three stage pressure switch
5. Drier filter
6. Connecting pipe between filter (5) and assembly (7)
7. Evaporator/heater/distributor unit
8. Connecting pipes between assembly (7) and compressor

DRAINING THE AIR CONDITIONING SYSTEM

Before carrying out any operations which may cause the escape of coolant fluid the air conditioning system must be drained.

During this operation **gloves and goggles** must be worn as protection against **dangerous contact with jets of coolant fluid.**

To drain the system undo the covers (1 and 2) for the needle valves, welded on the pipes which connect the compressor to the condenser and to the evaporator and tighten the uions for the flexible pipes for the equipment for checking, draining, re-pressurizing and recovering the coolant fluid as illustrated in the text which follows.



P1L023H01

Only if the vital recovery equipment (in terms of pollution) is not available, place the free ends of the two pipes connected to the needle valves in contact with the workshop intake system or if there is none place them through the engine compartment on the floor underneath the vehicle facing the opposite direction to the operator.

To recover the coolant fluid from the system have the appropriate equipment ready and carry out the following operations:

- start up the engine and let it run for about ten minutes together with the climate control system;
- check that all the taps for the equipment pressure gauge assembly for checking, draining and recovering the coolant fluid are closed, the general switch is off and the function switches are off or in position 0;
- tighten the union at the free end of the light blue coloured low pressure side flexible pipe to the needle valve (1) welded on the pipe which connects the evaporator to the compressor inlet duct;
- tighten the union on the free end of the red coloured high pressure side flexible pipe to the needle valve (2) welded to the pipe which connects the compressor supply duct to the condenser;
- open the taps (where fitted) on the above mentioned flexible pipes;
- connect the supply cable for the equipment to a 220V/50HZ electrical socket and after having switched on the general switch open the taps and switch on the function switches as described on pages 70 and 71 for the recovery and recycling of the coolant fluid carried out with the two types of equipment considered;
- the equipment will automatically start the recovery operation and will stop when the operation is completed;
- wait for ten minutes to allow any pockets of coolant fluid at low pressure which remain in the system to absorb heat, increase in pressure be recovered, then close the taps for the equipment pressure gauge unit and switch off the function switch(es);
- close the taps fitted on the above mentioned flexible pipes (naturally if they are fitted) and undo the union at the end from the vehicle system needle valves (1 and 2).

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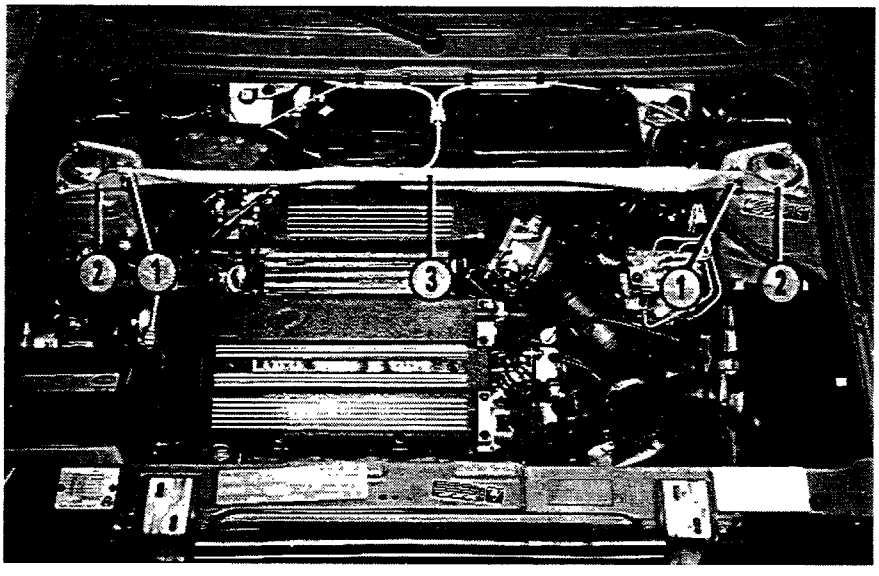
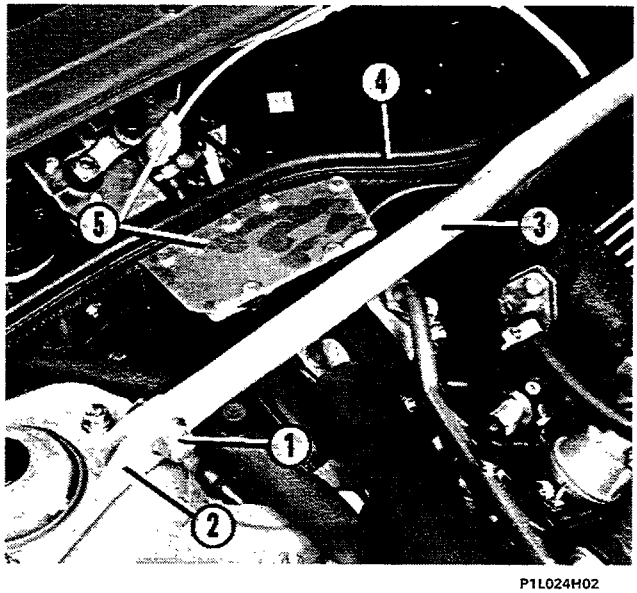


P1L024H01

COMPRESSOR

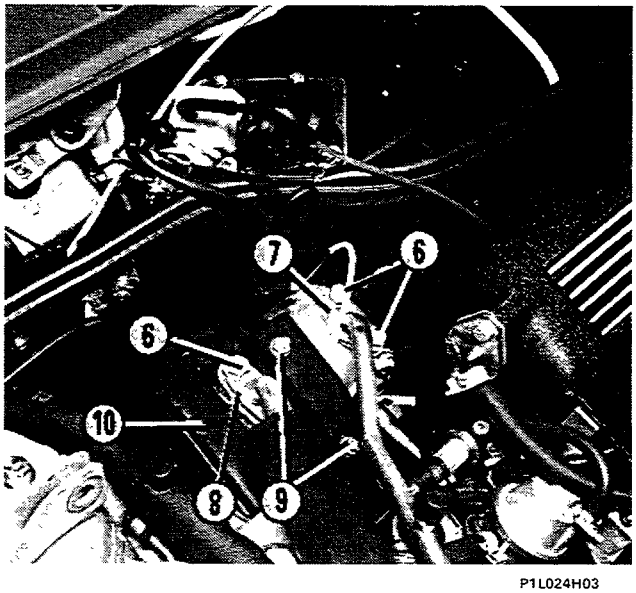
Removing

- release the terminal from the negative battery pole;
- **drain the air conditioning system** (see previous page);



P1L024H02

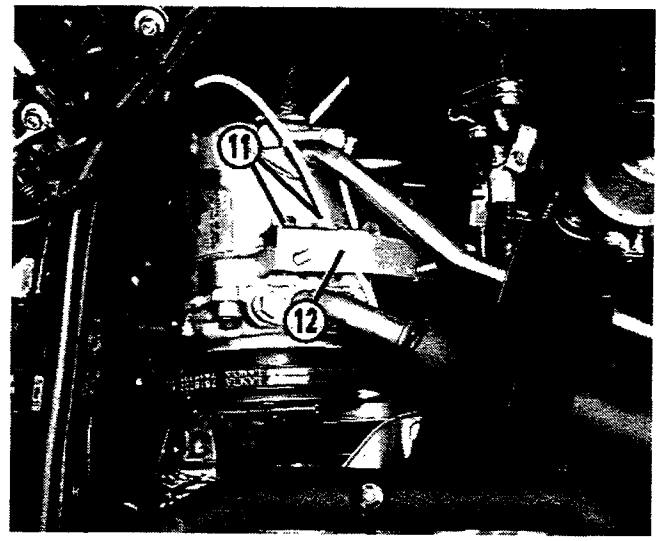
- undo the nuts (1) and remove the bolts fixing the transverse bar (3) to the brackets (2) anchored to the supports for the upper attachments for the front shock absorbers;
- after having removed the bar (3) undo the nuts which fix the bracket (5) supporting the pressure transducers to the bulkhead (4) and place the bracket as illustrated in the third diagram beyond the edge of the bulkhead (4);



P1L024H03

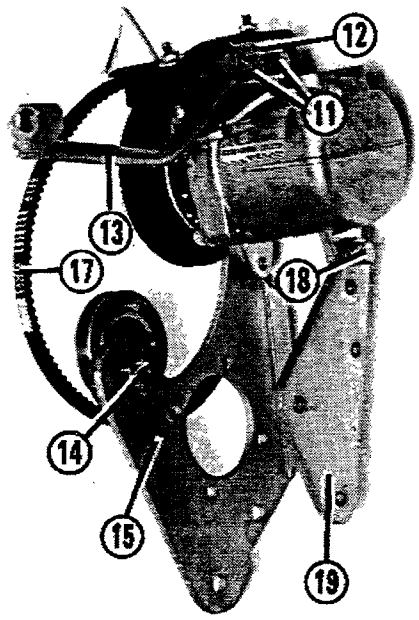
- undo the bolts (6) which fix the plates (7 and 8) for the end sections of the pipes connected to the condenser and the evaporator to the compressor inlet and supply manifolds;
- undo the nuts (9) which fix the shield for the belt (10) to the compressor and release the belt from the compressor;

- undo the bolts (11) which fix the plate (12), supporting the shield (10) and the connecting bar (13) to the compressor at the top and undo the fixing bolt;
- loosen the bolt (14) which fixes belt tensioner support (16) to the front bracket (15) mounted on the power assisted steering pump;
- suitably position the belt tensioner (16) and release the belt (17) which transmits the power from the power assisted steering pump to the compressor from the appropriate pullies;
- disconnect the electrical connection for the supply cable for the compressor pulley electro-magnet coupling;
- undo the bolts (18) which fix the compressor at the bottom to the mounting brackets (15 and 19) anchored to the power assisted steering pump.



P1L025H01

View of fixing of compressor to power assisted steering pump brackets



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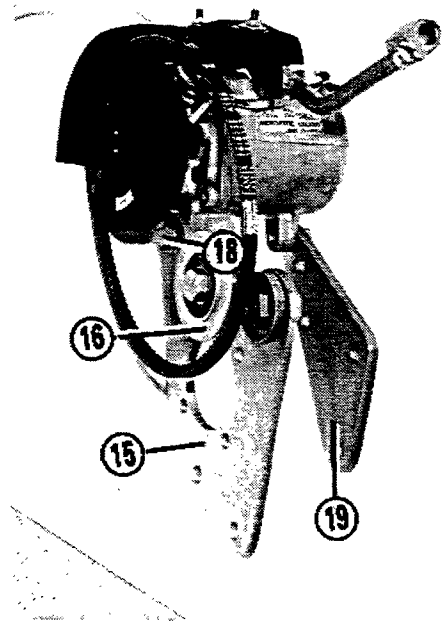
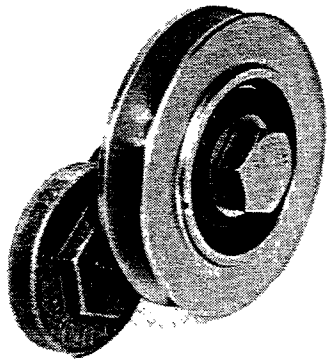


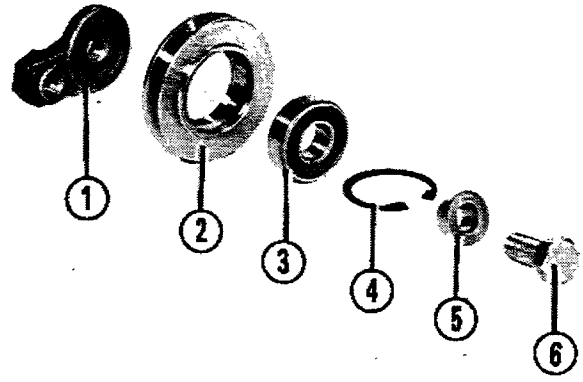
P1L025H03

Belt tensioner components

1. Support
2. Pulley
3. Bearing
4. Circlip
5. Bush
6. Bolt



P1L025H04



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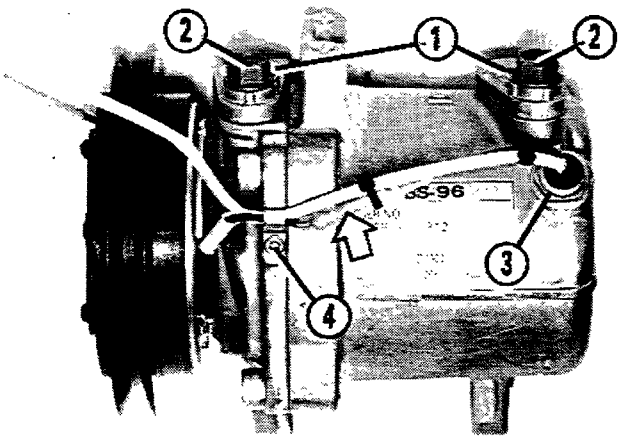
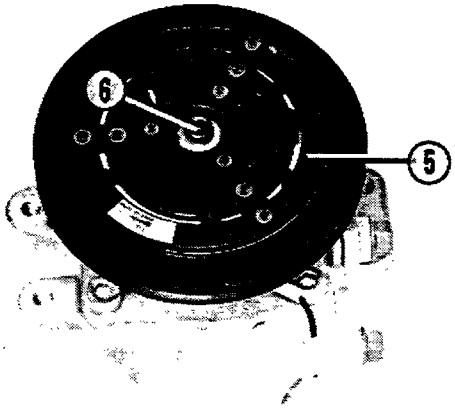


P1L026H01

NOTE *Spare compressors are available with the exhaust and supply ducts sealed by special plugs (1) fixed by bolts (2).*

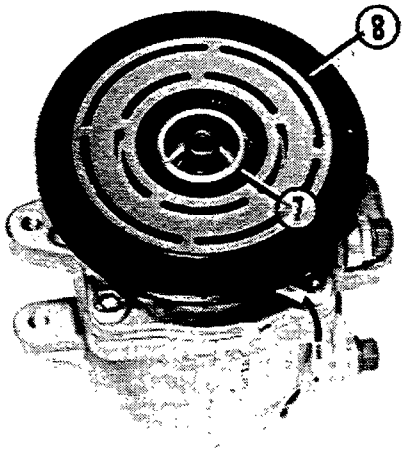
Dismantling

- disconnect the electrical connection (shown by the arrow) which joins the supply cable for the pulley electro-magnet coupling and the cable for the thermal switch (3);
- undo the bolt (4) which fixes the retaining bracket for the cables for the electro-magnet coupling and the switch (3) to the compressor and undo the switch from the housing in the compressor outer casing;



P1L026H02

- mark the position of each individual component before removing it;
- working appropriately, keep the front disc (5) still and undo the bolt (6) which fixes it to the compressor shaft;
- release the disc (5) from the splinining in the end section of the compressor shaft;
- remove the bush and the metal rings from the compressor shaft;



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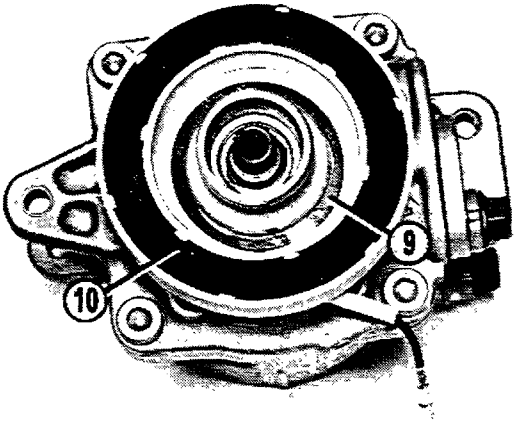
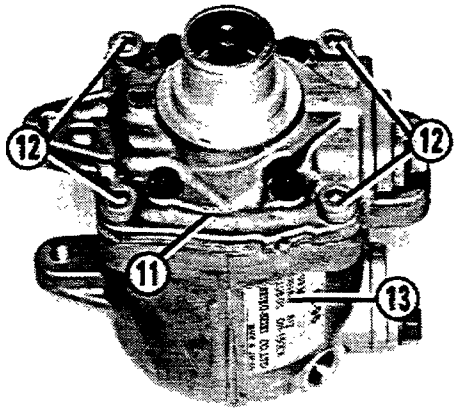


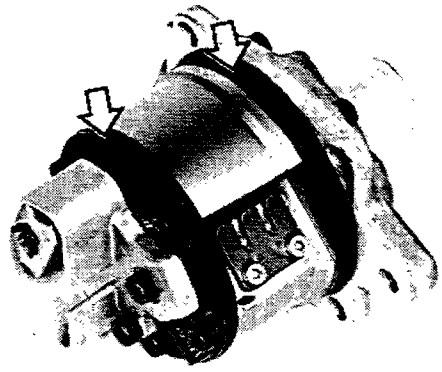
P1L026H04

- with an appropriate pair of pliers, remove the circlip (7) from its housing and, using the press or a suitable drift, remove the pulley (8) complete with internal bush from its housing;
- if the above mentioned bearing has to be replaced it can be removed from the pulley (8) using the press and an appropriate drift;
- using an appropriate pair of pliers, remove the electro-magnet (10) circlip (9) which can be easily released from the compressor front support;



P1L027H01

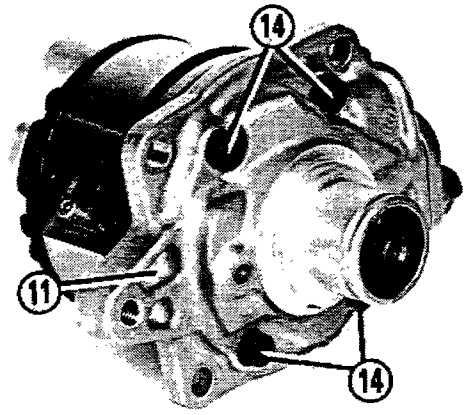
View of compressor with pulley and electro-magnet removed



P1L027H02

Front support components with compressor internal components

- place the compressor assembly in a vertical position with the front support (11) at the top and undo the four bolts (12) which fix the latter to the outer casing (13);
- using two screwdrivers move the support (11) away from the outer casing (13) and extract the compressor internal components from the outer casing;
- drain the ant-freeze from the outer casing into a graduated container whose weight is known;
- release the two seals (shown by the arrows) from the compressor internal components;
- undo the bolts (14) which fix the front support (11) to the compressor internal components;
- using an appropriate pair of pliers, remove the circlip (15) for the seal (16) and using an appropriate drift release the latter from the support (11);



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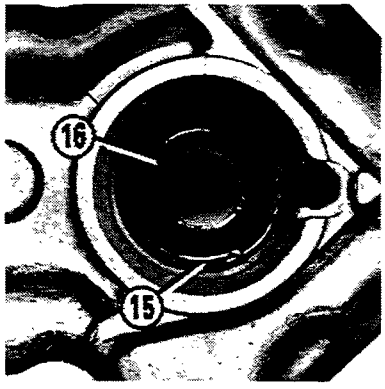
Front support components with compressor internal components



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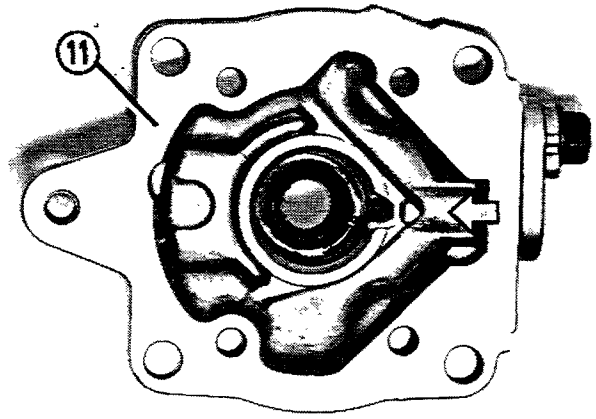

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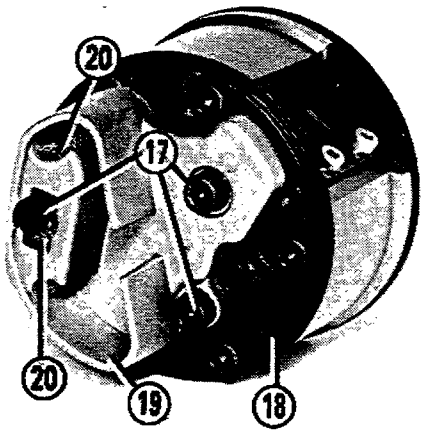

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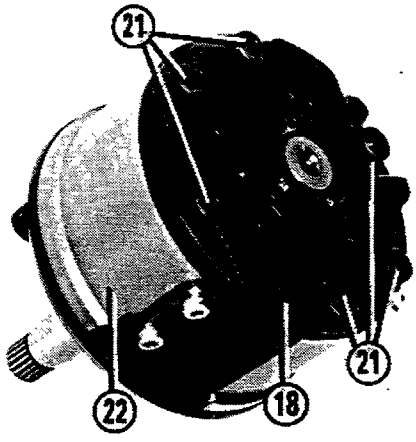

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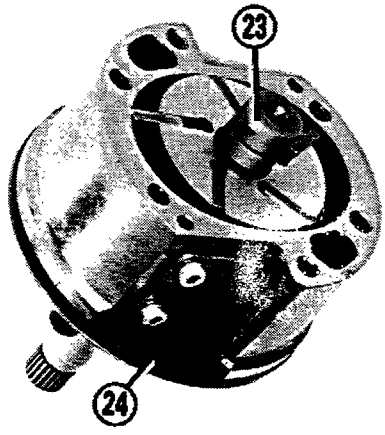

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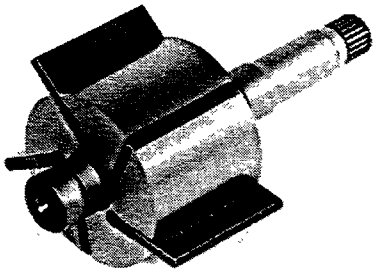
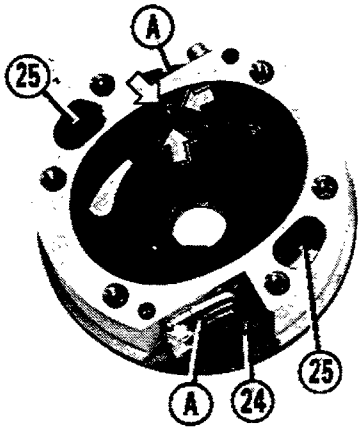


P1L028H04

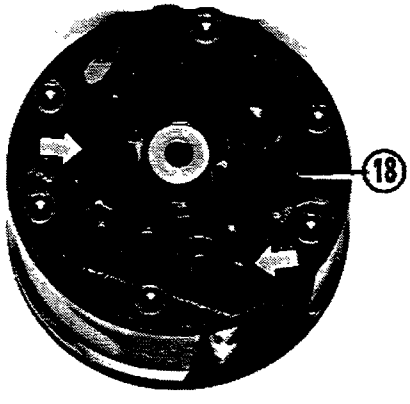
- undo the bolts (17) fixing the plate (19), with the gauze filters (20) which convey the coolant fluid to the supply duct in the compressor outer casing, to the rear flange (18);
- undo the bolts (21) which fix the rear flange (18) to the compressor casing (22);
- release the rear flange (18) from the rear part of the rotor shaft (23) and remove the latter with vanes taking care that they do not come out of their housings;
- undo the two bolts which fix the front flange (24) to the compressor casing which can be released using two screwdrivers for the centering pins.



P1L028H05

Reassembly and refitting

Reverse the order of the operations described for the dismantling and removal bearing in mind that the shims and seals should be intact and not distorted.



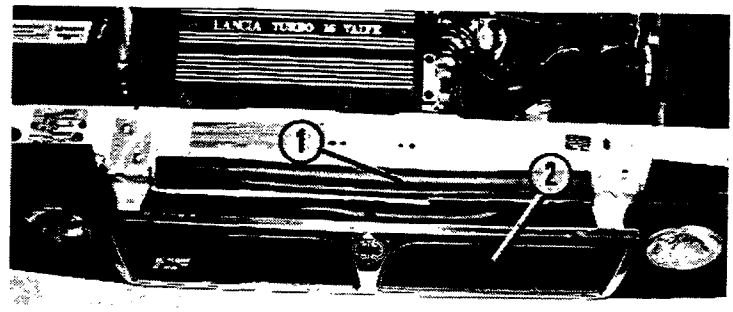
P1L028H06

The coolant fluid (FREON 12) at low pressure coming from the evaporator enters through the duct shown by the arrow in the diagram at the foot of the previous page and through the front flange (24) and the ducts (25) it flows to the centre part of the casing where it is compressed to activate the rotor (23) with extending vanes and through the openings shown by the arrows in the diagram on the bottom left it reaches the supply valves (A) and through the ducts (shown by the arrows in the diagram on the bottom right) it reaches the rear flange (18) and the plate (19) and then the supply duct in the compressor outer casing.

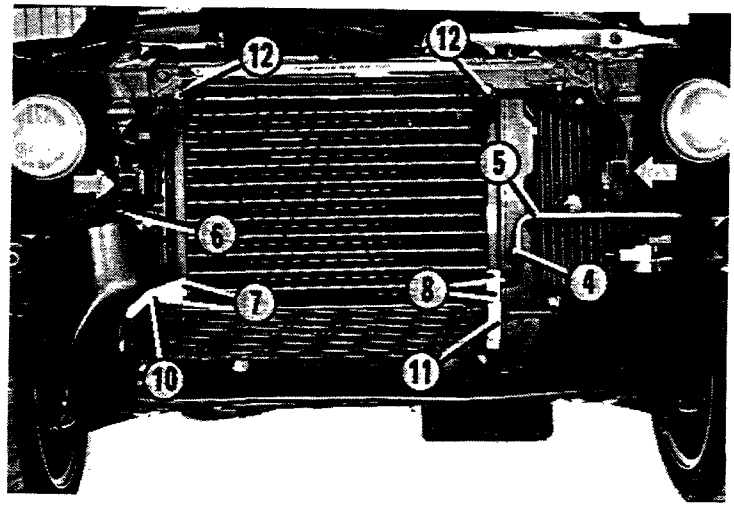
CONDENSER

Removing

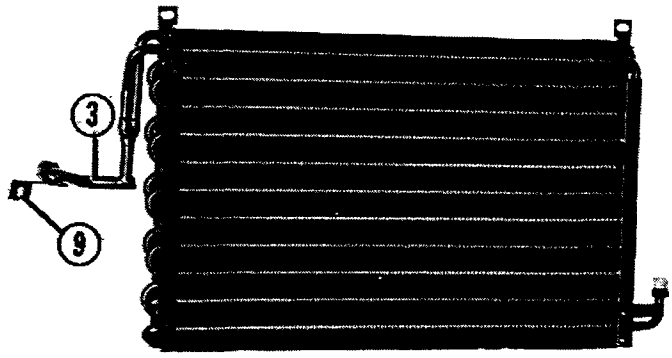
- **drain the air conditioning system** (see page 23 for the operations);
- remove the rubber profile (1) stuck by a strip of double-sided adhesive tape to the top part of the front grille (2) and undo the bolts underneath which fix the grille at the top to the upper front cross member;
- remove the front grille (2) after having released the side projections in the lower part from the housings in the bodyshell (shown by the arrows);
- remove the front half shields from the front wheel arches;
- remove the two rectangular grilles on the front bumpers under the head-lamps after having adjusted the fixing springs along the perimeter;
- working inside the front wheel arches and through the openings in which the above mentioned grilles were fitted, undo the bolts fixing the front bumper to the bodyshell;
- undo th union for the pipe which is connected to the inlet duct (3) for the condenser and the one (4) for the pipe (5) which connects the latter to the drier filter;
- undo the bolts (6 - 7 - 8) which fix the bracket (9) welded to the inlet duct (3) for the condenser to the bodyshell and the brackets (10 and 11) to the condenser;
- remove the condenser from its housing after having undone the bolts (12) which fix it at the top to the front cross member.



P1L029H01



P1L029H02



P1L029H03

Refitting

Reverse the order of the operations described and illustrated for the removal bearing in mind that the finned surface of the condenser should not be blocked with dirt and the actual fins should be in good condition. Straighten any distorted fins using a pair of pliers or two screwdrivers and remove any dirt which may be clogging them without distorting them.
In addition, if for various reasons the condenser pipes may be disconncted from the system for several hours, seal the inlet and outlet ducts so that not too much humidity can penetrate.

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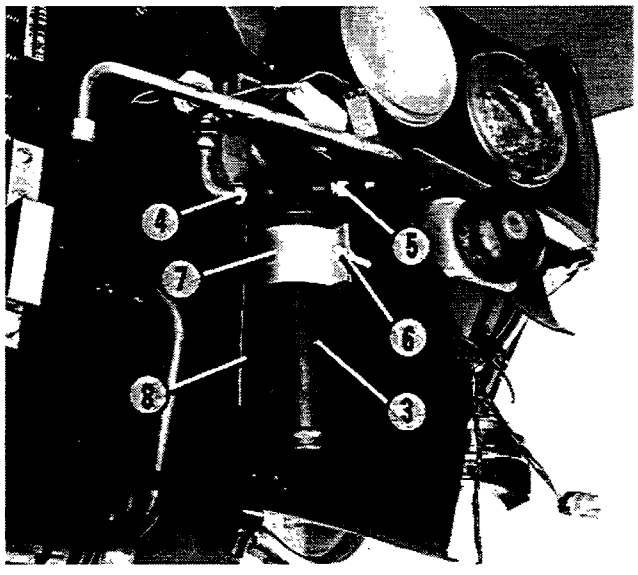
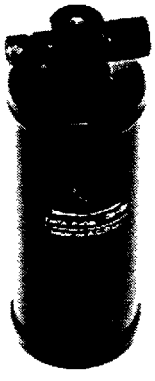


P1L030H01



P1L030H02

DRIER FILTER

Removing

- **drain the air conditioning system** (see page 23 for the operations);
- detach the rubber profile (1 in the diagram at the top of the previous page) fitted by a band of double-sided adhesive tape on the upper part of the front grille (2) and undo the bolts underneath which fix the latter at the top to the upper front cross member;
- remove the front grille (2 in the diagram at the top of the previous page) after having released side projections on the lower part from the housings in the bodyshell (shown by the arrows in the second diagram on the previous page);
- remove the front half shields for the front wheel arches and two rectangular grilles under the headlamps in the front bumper;
- working inside the front wheel arches and through the openings created by the above mentioned grilles, undo the bolts fixing the front bumper to the bodyshell;
- undo the unions (4 and 5) from the ends of the pipes which connect the drier filter (3) to the expansion valve and to the condenser;
- loosen the bolt (6) which tightens the band (7) for the special support bracket (8) around the drier filter (3) and undo the bolts which fix the bracket to the bodyshell (accessible by lifting and lowering the filter inside the band);
- remove the drier filter and mounting bracket from the vehicle and release the first component from the second.

Refitting

Reverse the order of the operations described for the removal.

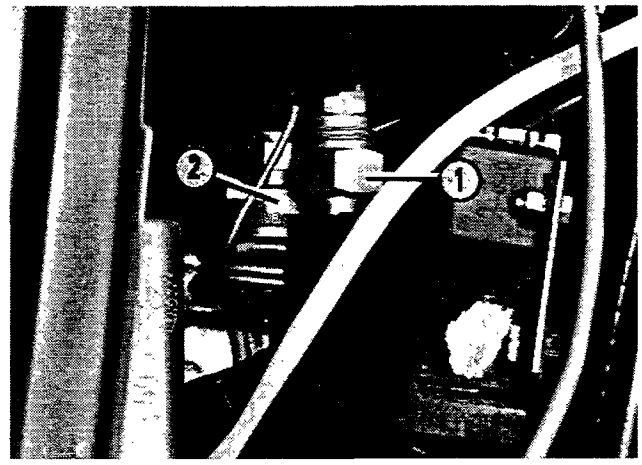
NOTE *To prevent the drier filter from absorbing too much humidity from the atmosphere, which would adversely affect its operation, it is advisable that no more than 15 minutes should elapse when it is connected to the system; if the system should remain open for more than this length of time for any reason, seal the filter or the pipes connected to it using plugs.*

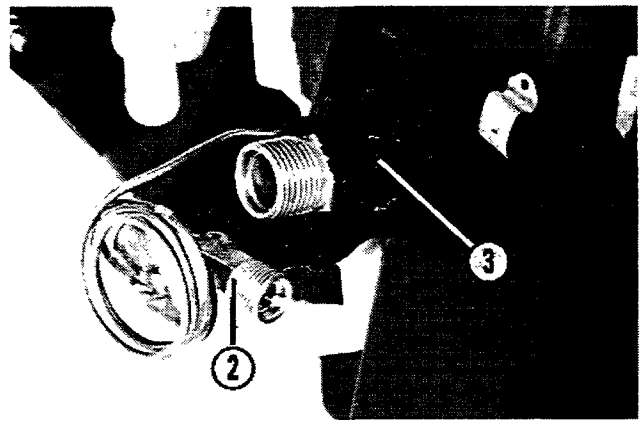
EXPANSION VALVE

Removing

After having drained the air conditioning system, carry out the following operations:

- working on the right side of the evaporator/heater unit located in the centre of the rear part of the engine compartment in the area under the windscreen, undo the union (1) for the pipe which connects the evaporator outlet duct to the compressor;
- remove the above mentioned pipe and undo the union underneath for the pipe which connects the drier filter to the expansion valve (2);



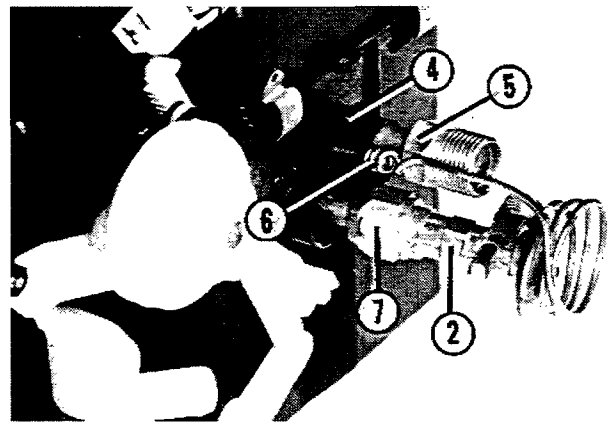


P1L031H02

- remove the anti-condensation insulating adhesive tape (3) covering the evaporator inlet and outlet ducts and part of the expansion valve (2);

- remove the clip (4) which keeps the sensitive bulb (6) for the expansion valve (2) in contact with the evaporator outlet duct;

- undo the union (7) for the evaporator outlet duct which joins the evaporator to the expansion valve (2).



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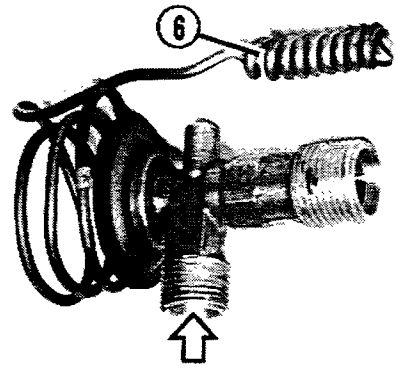
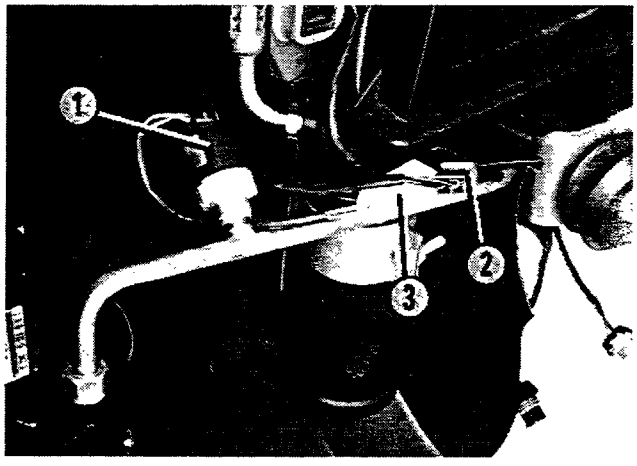


P1L031H04

View of expansion valve

There is a conical shaped gauze filter inside the duct shown by the arrow



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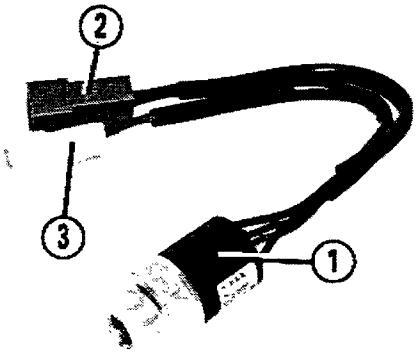


P1L032H02

THREE STAGE PRESSURE SWITCH

Removing

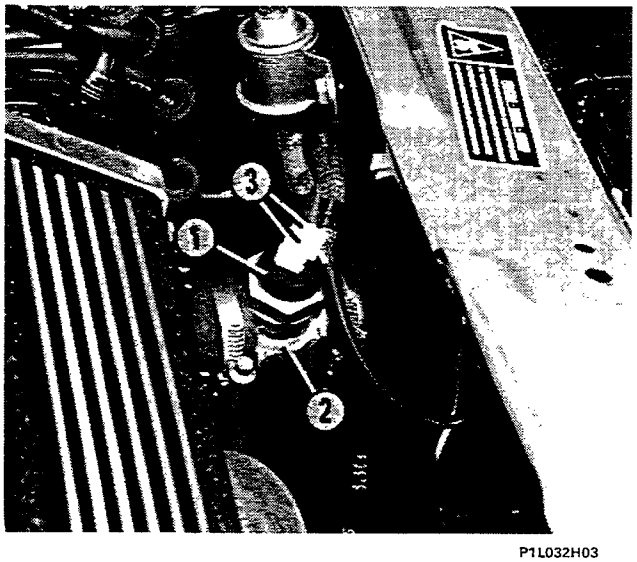
The air conditioning system does not have to be drained in order to remove the three stage pressure switch (1), simply undo it from the pipe which connects the condenser to the drier filter after having disconnected the two electrical connections (2 and 3) for the cables.

The three stage pressure switch has the task of activating the supply circuit for the electric fan for cooling the engine coolant condenser and radiator when the vehicle is stationary or in slow moving traffic and the flow of air created when the vehicle moves forwards starts to fail and the condensation of the coolant fluid is required through ventilation.
In addition the three stage pressure switch has the function of interrupting the supply circuit for the compressor pulley electro-magnet coupling when the pressure of the coolant fluid (high pressure side) reaches dangerous limits in spite of the action of the electric fan or because of its failure to operate or when on account of a leak or because the outside temperature is below 10°C (thermal conditions insufficient to cause the evaporation of the coolant fluid) the pressure of the coolant fluid reaches a value below 1.96 bar.

THEMOSTATIC SWITCH FOR COMPRESSOR SUPPLY CIRCUIT

The thermal switch (1) is bolted onto a union (2) which is located between the two hoses which join the engine to the upper part of the cooling radiator.

To replace the switch, which is available as spares with the union onto which it is bolted and the two hoses, simply release the switch from the engine and radiator ducts after having loosened the retaining bands and released the two connectors (3) for the supply cables from the upper terminals.



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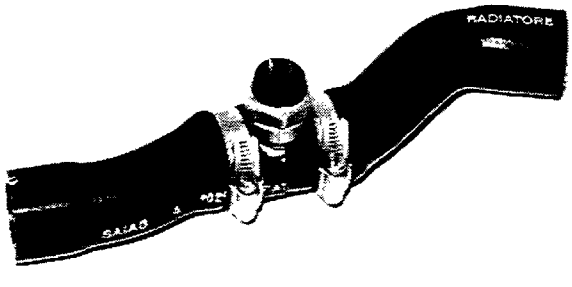
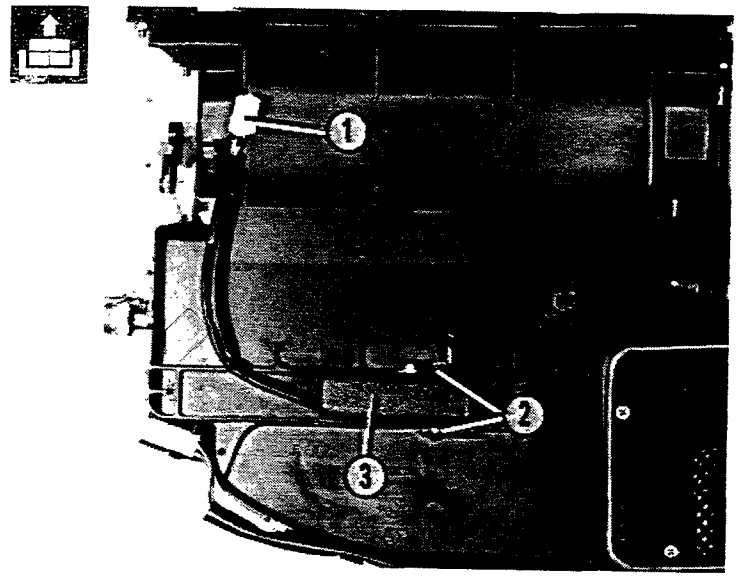


P1L032H04

ANTI-FROST THERMOSTAT



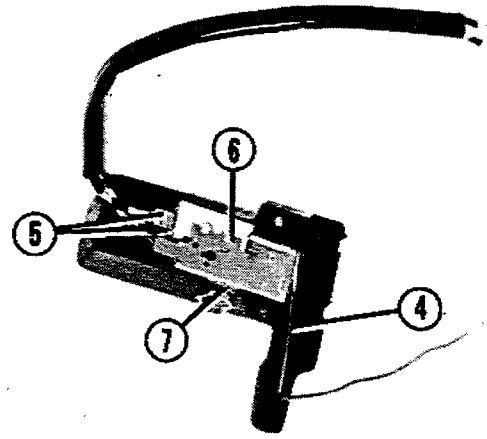
P1L033H01

Removing

- disconnect the electrical connection (1) for the cables connected to the anti-frost thermostat;
- undo the bolts (2) which fix the anti-frost thermostat (3) to the upper surface of the casing containing the evaporator and the heater;
- vertically raise the anti-frost thermostat (3) until the sensitive bult (4) is completely removed from the casing.

Dismantling

Detach the two terminals (5) for the cables which are fitted to the terminals for the anti-frost thermostat (6) and loosen the nut (7) fixing the latter to the shield.

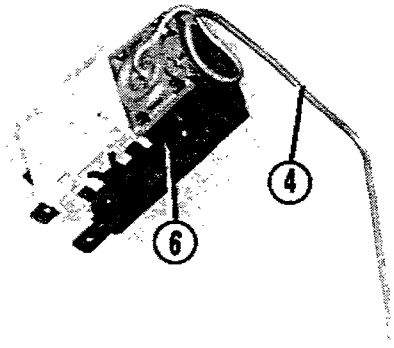


P1L033H02

Refitting

Reverse the order of the operations described for the removal bearing in mind that the sensitive bulb (4) should be slowly introduced into the special opening in the cover of the above mentioned casing making sure that it is not inserted between the tabs of the evaporator in the casing.

The anti-frost thermostat has the task of interrupting the supply circuit for the compressor pulley electro-magnet coupling when the evaporation temperature decreases in order to prevent the condensation water which forms on the surfaces of the evaporator fins from freezing.



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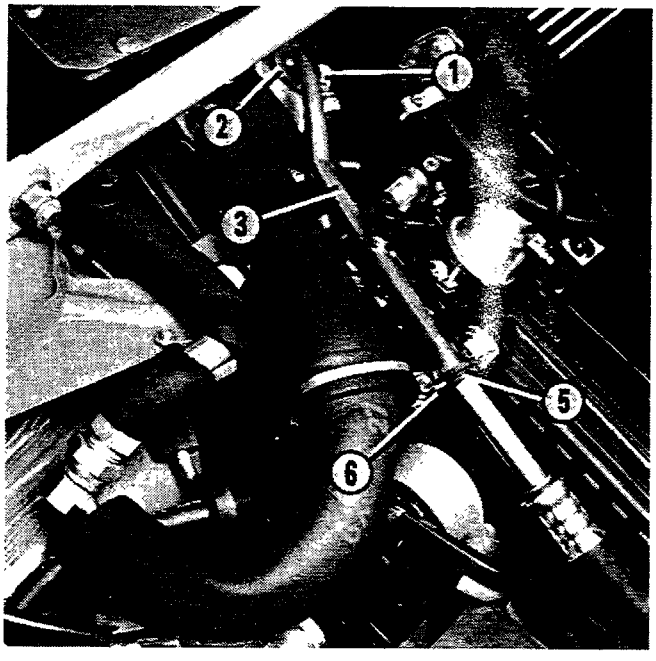


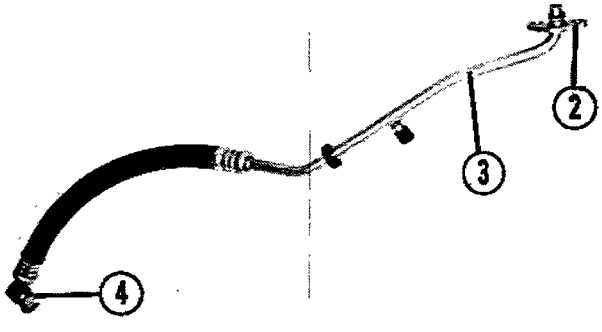
P1L034H01

CONNECTING PIPE BETWEEN COMPRESSOR AND CONDENSER

Removing

In order to remove the pipe carry out the following operations after having drained the air conditioning system:

- undo the two bolts (1) which fix the plate (2), which keeps one end of the pipe (3) in the supply duct, to the compressor;
- undo the union (4) at the other end of the pipe (3) which connects it to the condenser;
- release the rubber ring (5) fitted on the pipe from the mounting bracket (6).

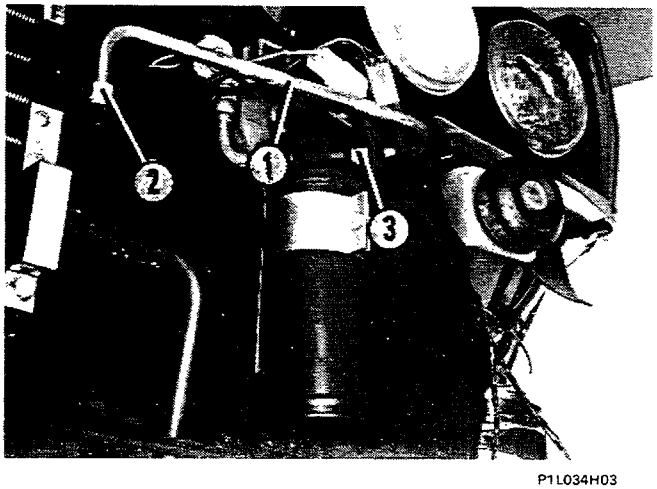


P1L034H02

View of pipe which connects the compressor to the condenser

CONNECTING PIPE BETWEEN CONDENSER AND DRIER FILTER

In order to remove the pipe (1), after draining the air conditioning system, simply undo the unions (2 and 3) which connect it to the condenser and the drier filter.



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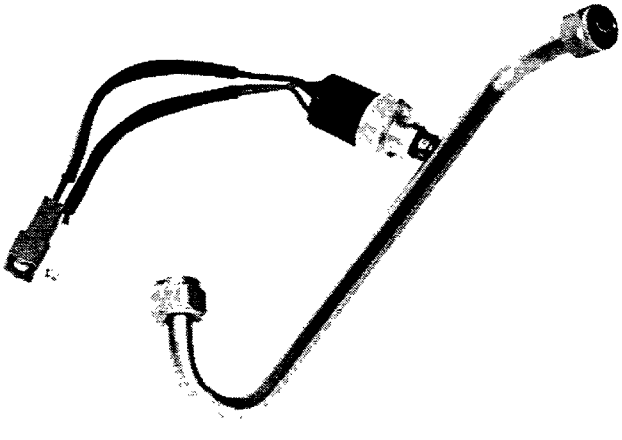
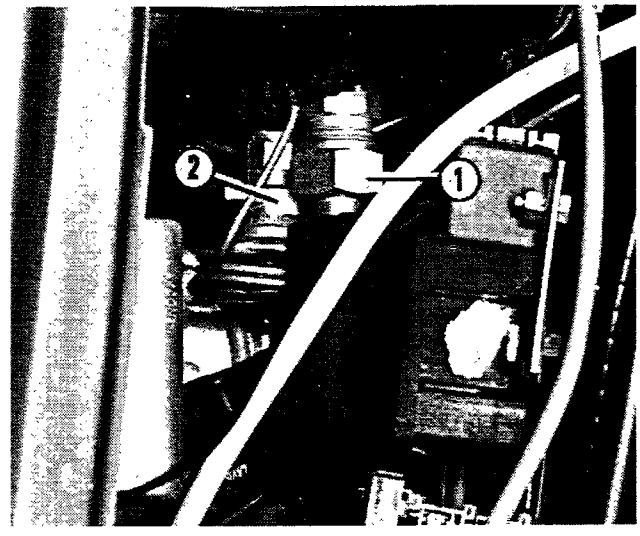


P1L034H04

CONNECTING PIPE BETWEEN DRIER FILTER AND EXPANSION VALVE

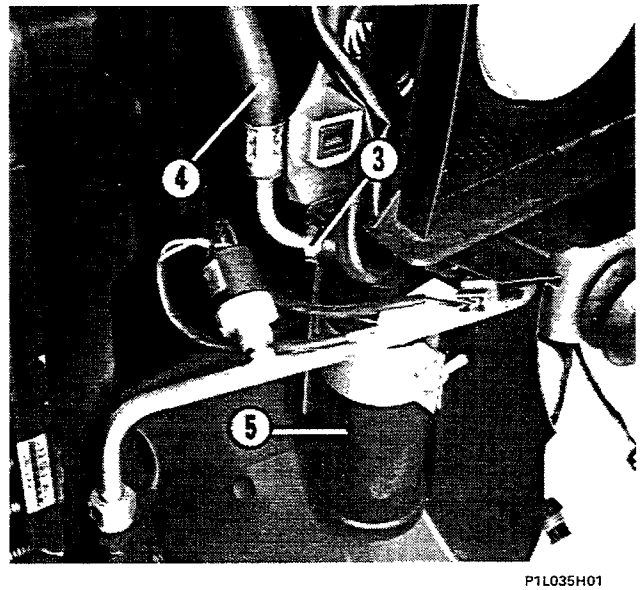


P1L031H01

Removing

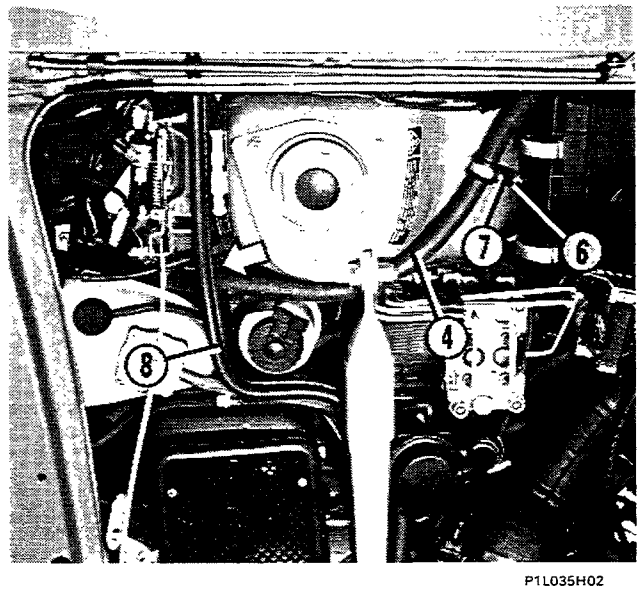
Carry out the following operations after having drained the air conditioning system:

- undo the union (1) for the pipe connected to the evaporator outlet duct and undo the union for the pipe underneath which is bolted onto the expansion valve (2);



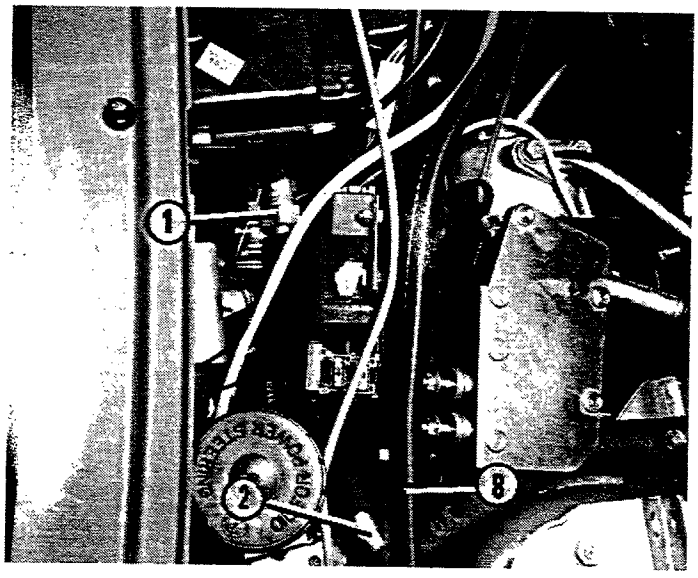
P1L035H01

- undo the union (3) for the pipe (4) which is fitted on the drier filter (5) outlet duct;
- working in the left front part of the engine compartment, remove the pipe (4) from the rubber ring fitted in the opening in the duct conveying air to the radiator for cooling the air;



P1L035H02

- undo the bolt (6) which fixes the pipe (4) retaining plate (7) to the bodyshell;
- working appropriately, release the pipe (4) from the area under the windscreen where the evaporator/heater unit is located and remove it from the rubber ring (shown by the arrow) which is fitted on the opening in the left metal support for the bulkhead (8) which divides the engine compartment from the area under the windscreen.



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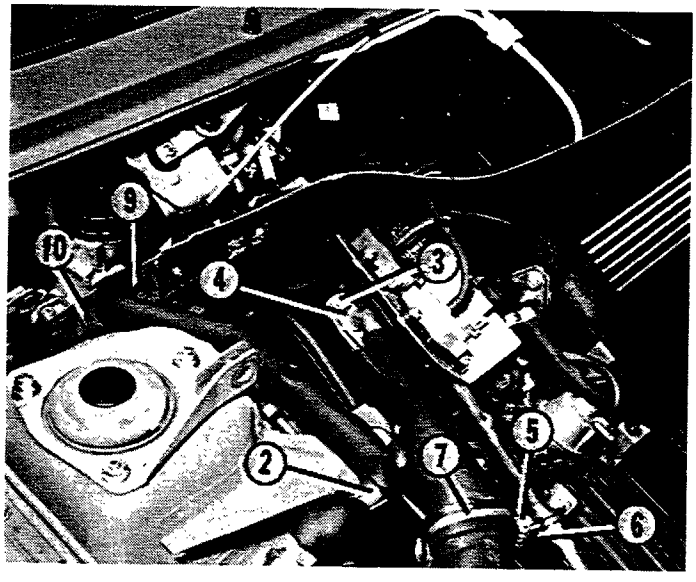


P1L036H02

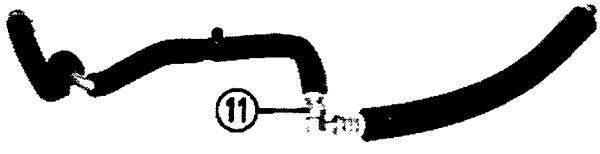
CONNECTING PIPE BETWEEN EVAPORATOR AND COMPRESSOR

Removing

Carry out the following operations after having drained the air conditioning system:

- undo the union (1) which connects one end of the pipe (2) to the evaporator outlet duct;
- undo the bolts (3) which fix the plate (4) which keeps the other end of the pipe (2) in the compressor inlet duct;
- undo the nut (5) which fixes the plate (7) supporting the pipe (2) to the mounting bracket (6) fixed to the engine;
- remove the right side part of the rubber profile (8) which is fitted on the top of the bulkhead which divides the rear part of the engine compartment from the area under the windscreen from its housing;
- Remove the pipe (2) from the engine compartment after having removed the rubber seal (9) (fitted on the pipe) from the housing in the right metal support (10) for the above mentioned bulkhead.

The connecting pipe between the evaporator and the compressor is made up of two pipes connected together by a union (11) (see diagrams below).



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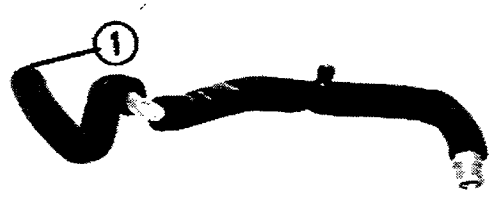
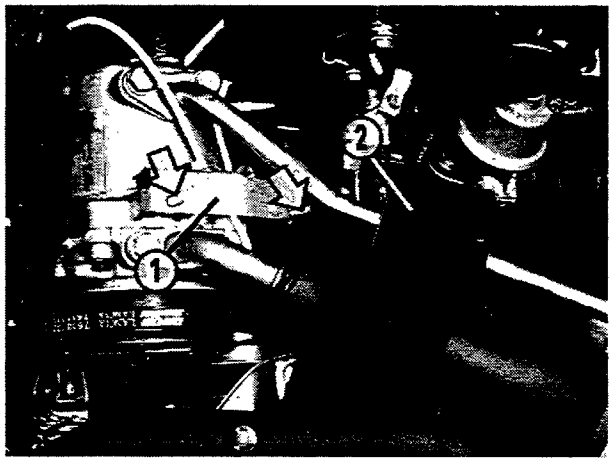


P1L036H04

P1L036H05



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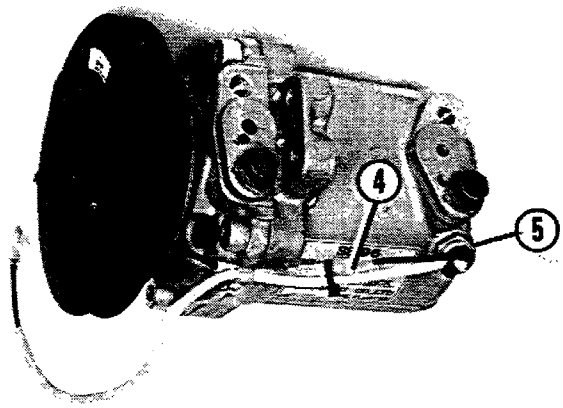
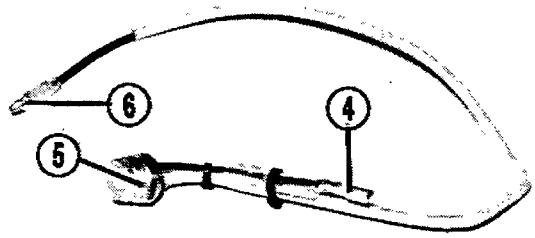


P1L037H02

THERMOSTATIC SWITCH ON COMPRESSOR

Carry out the following operations in order to remove the switch:

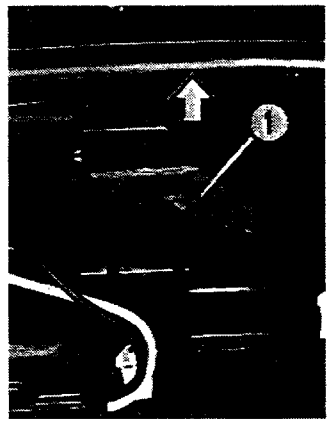
- remove the shield (2) from its housing and position it as shown in the diagram after having undone the two nuts which fix it by the two stud bolts (shown by the arrows) to the support (1) fixed to the compressor;
- disconnect the electrical connections (4 and 6) for cables for the switch which are connected to the cable for the solenoid valve for the pulley electro-magnet coupling and to the wiring for the vehicle;
- undo the switch (5) from the outer casing for the compressor.



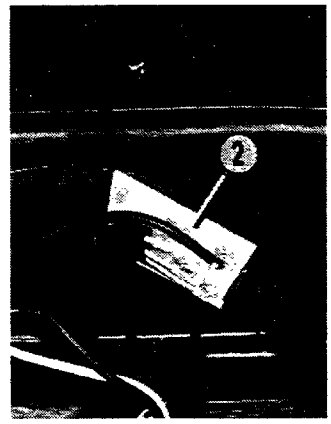
P1L037H03

RESISTOR FOR CAR INTERIOR CLIMATE CONTROL FAN SPEED

Working on the left front part of the evaporator/heater unit, slide the cover (1) upwards and release the plate with resistors (2) from its housing.



P1L013H02



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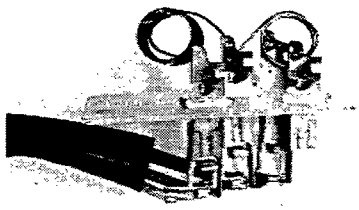

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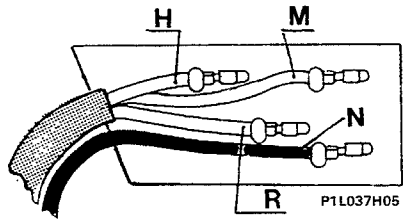

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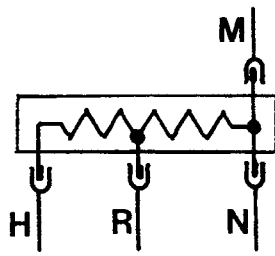

P1L037H06

Plate with resistors, colour code for cables connected to it and wiring diagram

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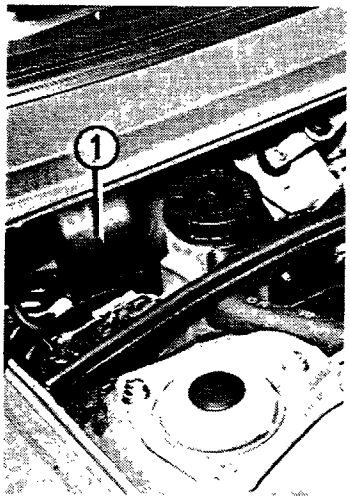
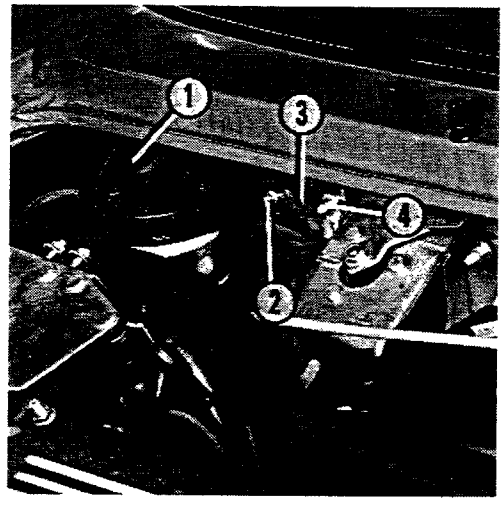


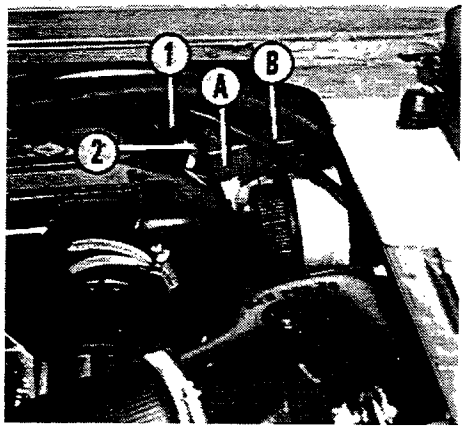
P1L038H01



P1L038H02

VACUUM RESERVOIR

The vacuum reservoir (1) is located in the right rear part of the area under the windscreen and is fixed by nuts (2) to the bracket (3) which in turn is fixed to the bodyshell by a nut (4).



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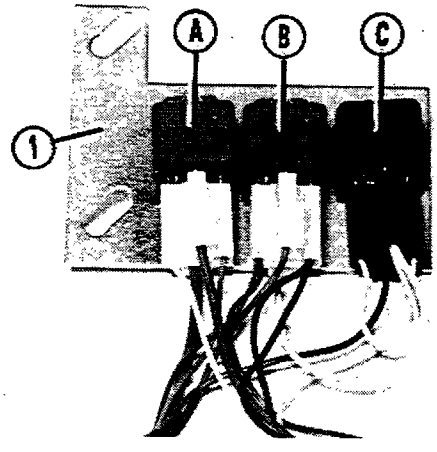


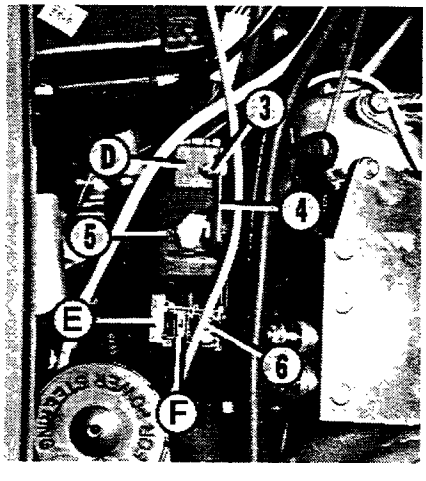
P1L038H04

RELAYS AND FUSES FOR CLIMATE CONTROL SYSTEM

Three relays (A - B - C) for the climate control system are fixed by bolts to a plate (1) which is fixed by nuts (2) to the front section of the left inner lining for the engine compartment near the headlamps.

A fourth relay (D) is fixed by a bolt (3) to a bracket (4) which is fixed together with the connector block (5) to the centre front part of the area under the windscreen.

A fuse carrier assembly and fuses, one large (E) - 40 A and one small (F) - 10 A, is fitted to the fuse holder (6) which is located at the side of the connector block (5).



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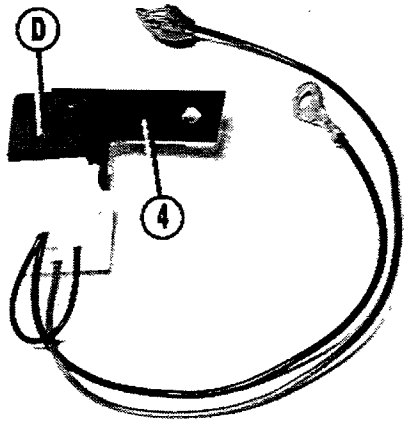
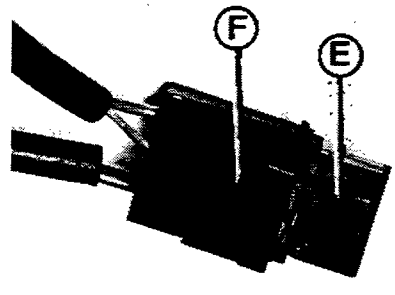
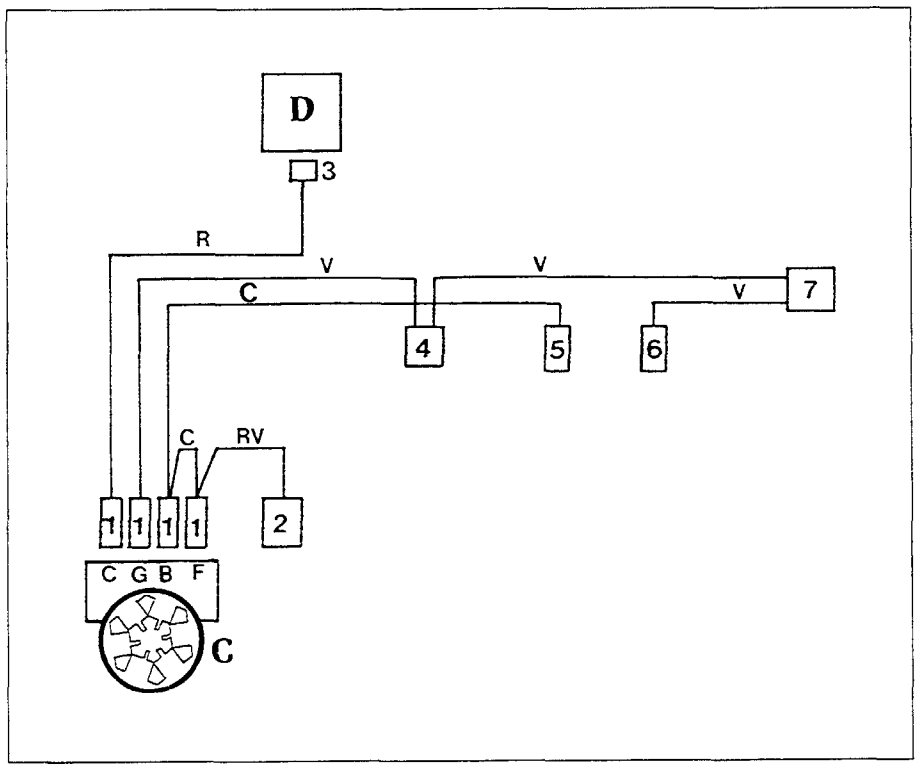


P1L038H06



P1L038H07

WIRING FOR CLIMATE CONTROL SYSTEM



P1L039H01

Wiring diagram for first cables

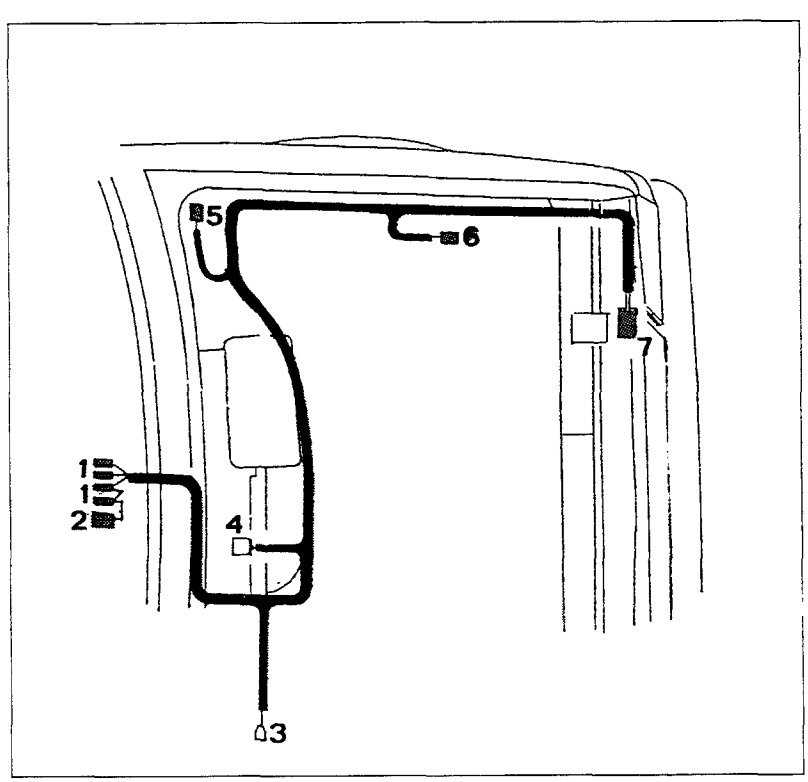
1. White coloured one way connectors to be fitted to terminals marked with letters for switch for switching on system (compressor)
2. Red coloured terminal to be connected to red/green cable for hazard warning lights control switch
3. Female terminal for socket to which relay D is fitted (see previous page) by terminal 85
4. White coloured two way connector which is connected to anti-frost thermostat cable terminals
5. White coloured one way connector which is connected to the one for the other wiring
6. Black coloured one way connector which is connected to the one for the other wiring
7. Red coloured two way connector which is connected to the red coloured one for the three stage pressure switch cable terminals

C. Climate control system on switch

D. Relay for engaging car interior climate control electric fan first speed

Cable colour code

C = Orange R = Red V = Green RV = Red/Green



P1L039H02

View of location of first wiring along left side and rear of the engine compartment

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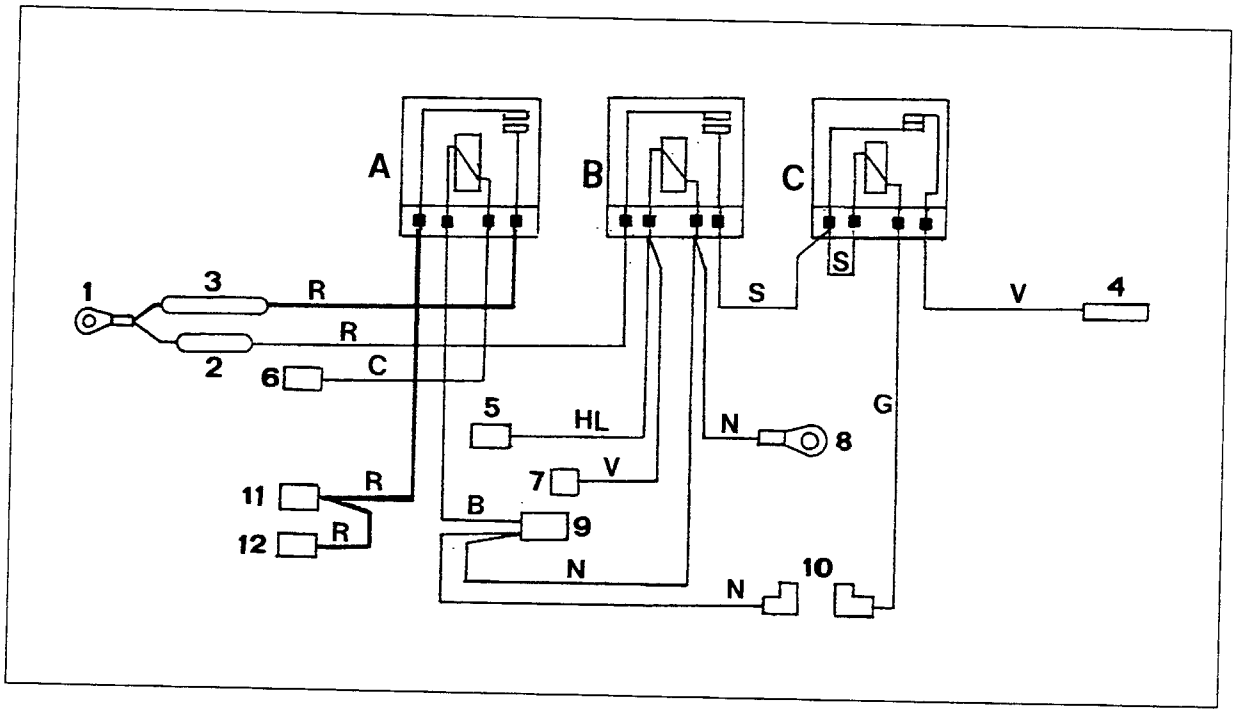
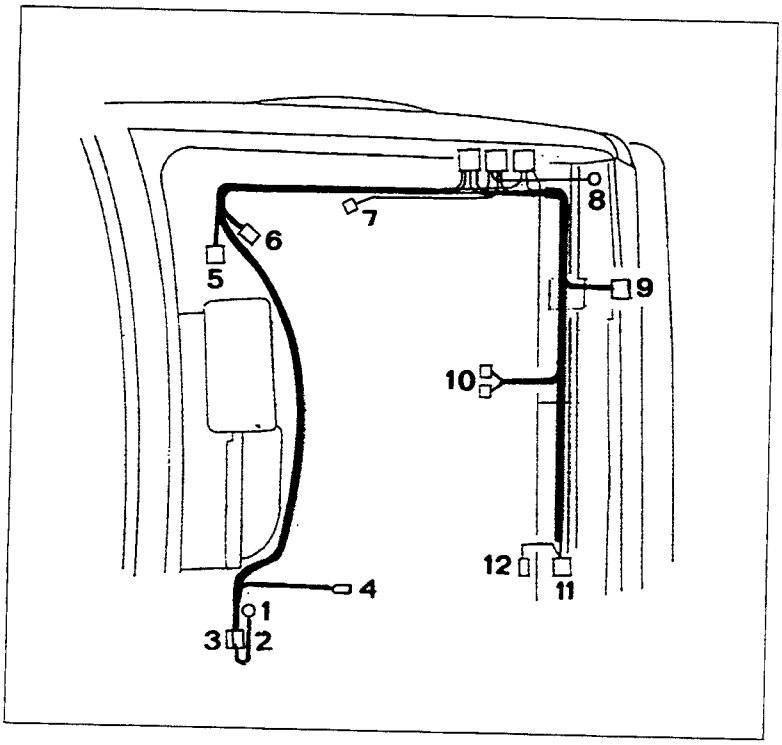


P1L040H01

Wiring diagram for second wiring with three relays

1. Terminal connected to connector block
2. Fuse holder with 10 A fuse
3. Fuse holder with large 40 A fuse
4. Cylindrical single pole connector connected to one of the terminals for the thermal switch bolted onto the compressor
5. Black three way connector connected to fast idle cable connector
6. Connettore bianco ad una via che è collegato a quello (5) dell'altro cablaggio
7. Black coloured one way connector connected to connector (6) for other wiring
8. Terminal connected to earth on left front side
9. White two way connector connected to white connector for three stage pressure switch cable terminals
10. White square connectors fitted to terminals for thermostatic switch bolted onto the union fitted on the pipe connecting the motor to the radiator
11. Black connector fitted to the terminal for the radiator and condenser cooling fan resistor
12. White connector fitted to the connector for the supply cable for the radiator and condenser cooling fan motor



P1L040H02

Cable colours

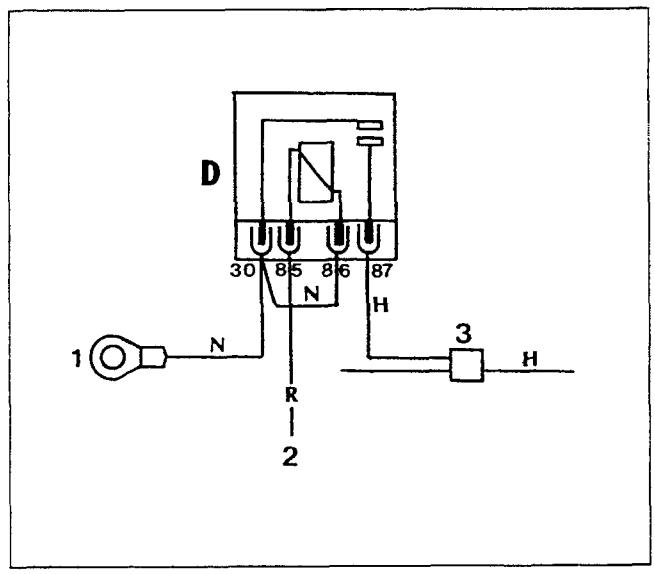
B	= White	S	= Pink
C	= Orange	V	= Green
G	= Yellow	HL	= Grey/Blue
N	= Black		

View of location of wiring along left side and rear of engine compartment

Diagram showing connection of relay located at the side of the connector block on the right side of the bulkhead which divides the engine compartment from the area below the windscreen

1. Terminal which is conneted to earth on the vacuum reservoir mounting bracket
2. Cable connected to terminal C for the climate control system on switch
3. Light blue coloured terminal which is connected to the grey coloured cable which is connected to the car interior climate control fan speed resistor

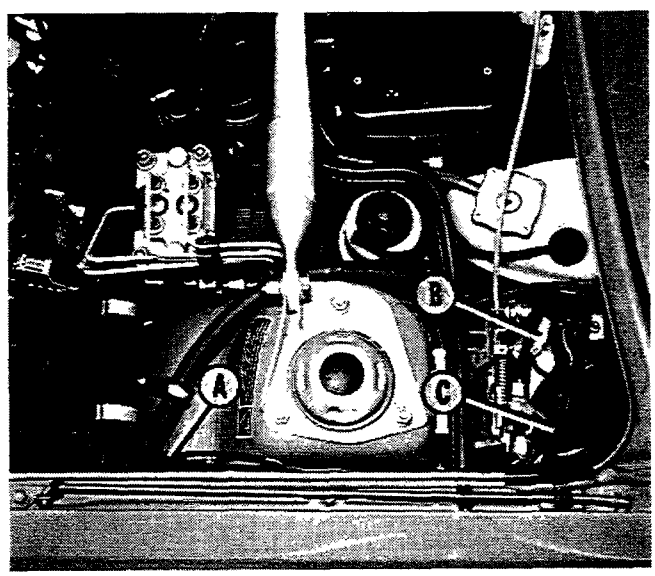
D. Relay (see first diagrams at the foot of page 38)



P1L041H01

View of location of connections between two cables and vehicle system

A. Connection between connector (6) for first cable and connector (7) for second cable
B. Connection between connector (5) for first cable and connector (6) for second cable
C. Connection between connector (5) for second cable and connector for fast idle cables



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FAULT DIAGNOSIS FOR MANUALLY OPERATED CLIMATE CONTROL SYSTEM

There are three different types of problems which can occur in the system in question:
- of a mechanical nature;
- of an electrical nature (cables or various components not working properly);
- of an operational nature which may stem from the previous problems or be intrinsic to the system components.

PROBLEMS OF A MECHANICAL NATURE		
DEFECT DISCOVERED	POSSIBLE CAUSE	REPAIR OPERATIONS
Compressor noisy	Compressor pulley not perfectly aligned with the power assisted steering pump pulley.	A
	Compressor pulley drive belt not working properly (slack, too taut) or worn.	B
	Knocking from compressor due to excessive coolant fluid or the presence of uncondensed gases in the system.	C
	Loosening of the bolts fixing the compressor to the mounting brackets and retaining bars and the bolts fixing the latter to the power assisted steering pump and the engine.	D
	Pulley with electro-magnet coupling noisy.	E
	Knocking from the compressor due to internal clearances or noisy with tendency to seize	F
Assembly under dashboard noisy	Rods with universal joints stuck and gears and racks for distribution flaps not lubricated or with worn teeth.	G
Noise inside compartment under the windscreen	Drive gears and rack for tap and mixture flaps not lubricated or with worn teeth.	H
	Noise from car interior climate control fan impeller or blades.	I

A Check the fitting and the fixing of the two pullies.

B Check the condition and tension of the belt.

C Drian, dry and re-pressurize the system.

D Check and tighten the bolts.

E If the noise persists, after having checked the torque tightening of the bolt fixing the clutch plate, remove the compressor and replace the component which is not working properly (bearing, pulley, clutch plate).

F Drain the system and replace the compressor

G Check the operation of the universal joints for the rods and the condition of the gears and the rack.

H Check the condition of the gears and the rack

I Check that the impeller does not interfere with the casing and replace the electric fan if the blades are noisy

PROBLEMS OF AN ELECTRICAL NATURE		
DEFECT DISCOVERED	POSSIBLE CAUSES	REPAIR OPERATIONS
Pulley with electro--magnet coupling not working	Protective fuse or relay not working properly Electro-magnet coupling winding broken Three stage pressure switch not working properly Thermostatic switch on compressor not working properly Thermostatic switch on connecting pipe between radiator and engine not working properly Anti-frost thermostat not working properly Electro-magnet coupling winding supply voltage too low System pressure below 1.65 bar or discharged Compressor on switch not working properly	A (page 44)
Pulley with electro--magnet coupling slipping	Electro-magnet coupling windings short circuited Supply voltage for electro-magnet coupling winding too low	B (page 47)
Radiator and condenser cooling fan not working properly	Protective fuse not working properly Relay feed not working properly Electric fan motor windings broken or short circuited Three stage pressure switch not working properly Two level thermal switch not working properly	C (page 48)
Car interior climate control electric fan not working properly	Protective fuse or relay feed not working properly Electric fan motor windings broken or short circuited Resistor for speeds not working properly Speed selection switch not working properly	D (page 49)
Engine not maintaining idle speed	Compressor on signal failure Injection electronic control unit not working properly	E (page 51)

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A

Cable colour code

G = Yellow
N = Black
R = Red
S = Pink
V = Green
RV = Red/Green

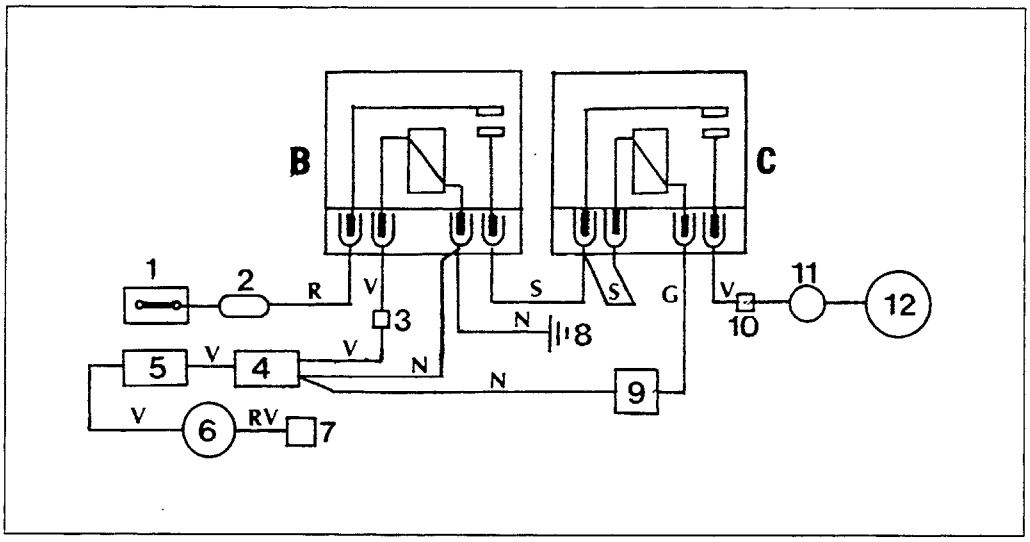
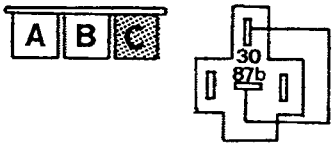
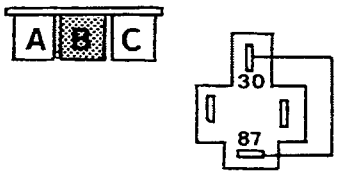


Diagram showing compressor pulley electro-magnet coupling supply circuit

1. Connector block
2. 10 A removable fuse
3. Connector
4. Three stage pressure switch
5. Anti-frost thermostat
6. Air conditioner on switch
7. Red coloured terminal
8. Left front side earth
9. Thermostatic switch on hose connecting engine and radiator
10. Connector
11. Thermostatic switch on compressor
12. Compressor

B and C. Relays (see page 38)

CHECKING OPERATIONS	RESULT	REPAIR OPERATIONS
Check the efficiency of the 10 A fuse (detail F - page 38)	Fuse not working properly	Replace the fuse
	Fuse okay	Carry out operation 2
 2 Remove relay C and using a bridge connect terminals 30 and 87b (cables S and V) for the socket and switch on the air conditioning system	Electro-magnet coupling remains de-energized	Carry out operation 3
	Electro-magnet coupling energized	Carry out operation 1 2
 3 Remove relay B and using a bridge connect terminals 30 and 87 (cables R and S) for the socket and switch on the air conditioning system	Electro-mag. coupling energized	Carry out operation 4
	Electro-magnet coupling remains de-energized	Carry out operation 1 4

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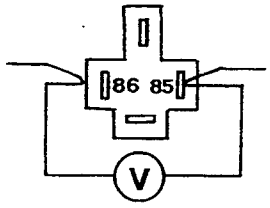
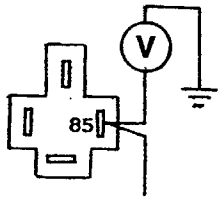
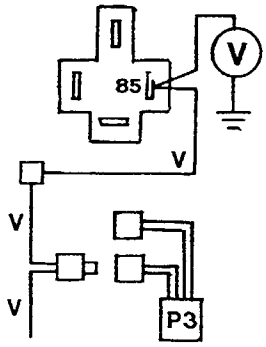
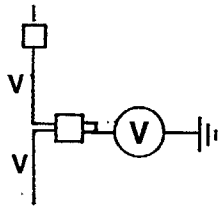
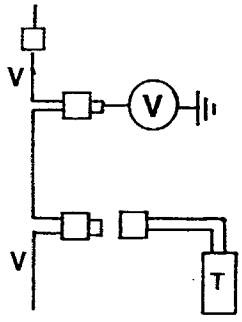
CHECKING OPERATIONS	RESULT	REPAIR OPERATIONS
 4 Connect a multimeter (voltmeter) between terminals 85 and 86 (cables V and N) for the relay (B) socket	Voltage 12 V	Replace the relay B
	Nil voltage	Carry out operation 5
 5 Connect a multimeter (voltmeter) between terminal 85 (cable V) for the relay B socket and the earth	Voltage 12 V	Replace cable N which is connected to earth
	Nil voltage	Carry out operation 6
 6 Leave the multimeter (voltmeter) connected as for the previous test and, using a bridge, connect the terminals for the V cables for the red connector disconnected from the connector for the terminals for the three stage pressure switch (P3)	Voltage 12 V	Meaure the pressure for the system and if the value is higher than the minimum calibration for the pressure switch, replace the latter
	Nil voltage	Carry out operation 7
 7 Connect a multimeter (voltmeter) between the V cables for the red connector for the above mentioned wiring (connected to the three stage pressure switch) and the earth	Voltage 12 V	Replace the broken section(s) of cable V which connects the pressure switch to relay B
	Nil voltage	Carry out operation 8
 8 Leave the multimeter (voltmeter) connected as for the previous test and, using a bridge, connect the V cables for the connector disconnected from the connector for the anti-frost thermostat (T) cables	Voltage 12 V	Replace the anti-frost thermostat after having checked that the sections of cable connected to it are not broken
	Nil voltage	Carry out operation 9

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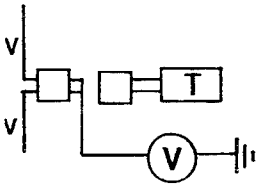
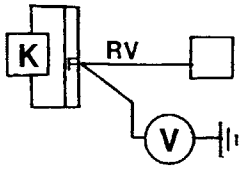
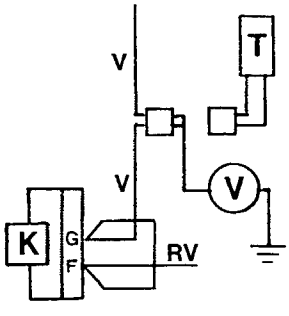
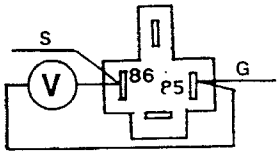
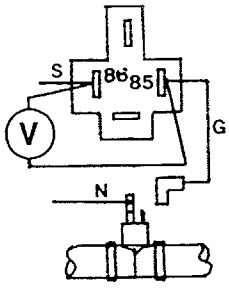
CHECKING OPERATIONS	RESULT	REPAIR OPERATIONS
 9 Connect a multimeter (voltmeter) between the earth and the V cables for the connector for the wiring which is connected to the anti-frost thermostat cables	Voltage 12 V	Replace cable V which connects the anti-frost thermostat to the three stage pressure switch
	Nil voltage	Carry out operation 10
 10 Remove the controls and connect a multimeter (voltmeter) between the earth and the terminal for the RV cable connected at terminal F for the system on switch	Nil voltage	Replace cable RV after having made sure that the terminal is correctly positioned
	Voltage 12 V	Carry out operation 11
 11 Connect a multimeter (voltmeter) between the earth and the V cables for the connector for the wiring disconnected from the anti-frost thermostat cable terminals and, using a bridge, connect the terminals for cables V and RV connected to the terminals (G and F) for the system on switch	Voltage 12 V	Replace the system on switch after having checked that the terminals for the above mentioned cables are fitted to the terminals
	Nil voltage	Replace cable V which connects the above mentioned switch to the anti-frost thermostat
 12 Connect a multimeter (voltmeter) between terminals 85 and 86 (cables S and G) for the socket for relay C	Nil voltage	Replace relay C
	Voltage 12 V	Carry out operation 13
 13 Leave the multimeter connected as for the previous test and disconnect the square connector for cable G from the thermal switch fitted on the hose connecting the engine to the radiator	Nil voltage	Replace the above mentioned thermal switch if the temperature of the engine coolant is below 100° C
	Voltage 12 V	Replace cable G between relay C and the above mentioned switch

P1L046H01

CHECKING OPERATIONS	RESULT	REPAIR OPERATIONS
1 4 Connect a multimeter (voltmeter) between the earth and terminal 30 (cable R) for the socket for relay B	Nil voltage	Replace cable R which connects the 10 A fuse to terminal 30 for the socket for relay B
	Voltage 12 V	Carry out operation 1 5
1 5 Connect a multimeter (voltmeter) between the earth and terminal 30 (cable S) for the socket for relay C	Nil voltage	Replace cable S which connects terminal 87 for the socket for relay B to terminal 30 for the socket for relay C
	Voltage 12 V	Carry out operation 1 6
1 6 Connect a multimeter (voltmeter) between cable V for the single pole connector which is fitted to the terminal for the thermal switch bolted onto the compressor and the earth	Voltage 12 V	Replace cable V which connects the relay (C) to the switch on the compressor
	Nil voltage	Carry out operation 1 8
1 7 Disconnect the second cable terminal for the above mentioned switch from the supply cable for the compressor pulley electro-magnet coupling winding. Connect a multimeter (ohmmeter) to the terminals for the above mentioned switch	Infinite resistance	Replace the thermostatic switch on the compressor if the value for the temperature is below the calibration of the switch
	Nil resistance	Drain the air conditioning system and replace the winding for the compressor pulley electro-magnet coupling
B Connect a multimeter (voltmeter) between the terminal for the compressor pulley electro-magnet coupling winding and the earth	Voltage lower than 12 V	Check the battery voltage and check the supply circuit for the electro-magnet coupling
	Voltage 12 V	Replace the winding for the electro-magnet coupling for the pulley

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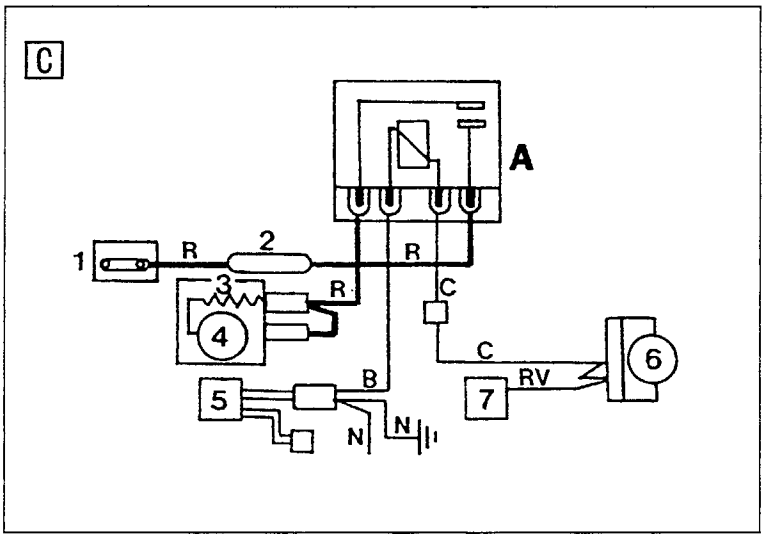


P1L048H01

Diagram showing supply circuit for condenser and radiator cooling fan

1. Connector block
2. 40 A large removable fuse
3. Resistor on electric fan (4) duct
4. Condenser and radiator cooling fan
5. Three stage pressure switch
6. Climate control (compressor) on switch
7. Red coloured terminal

A. Relay for engaging electric fan (4)

CHECKING OPERATIONS	RESULT	REPAIR OPERATIONS
Check the efficiency of the 40 A fuse (detail E page 38)	Fuse not working prop.	Replace the fuse
	Fuse working properly	Carry out operation [2]
[2] Remove relay A and, using a bridge, connect terminals 30 and 87 (red cables) for the socket	Elec. fan working	Carry out operation [3]
	Electric fan not working	Carry out operation [8]
[2] Connect a multimeter (voltmeter) between the earth and terminal 86 (cable C) for the socket for relay A	Nil voltage	Carry out operation [4]
	Voltage 12 V	Carry out operation [5]
[4] Disconnect the electrical connection for cable C (view B in the second diagram on page 41) and connect a multimeter (voltmeter) between the connector for the first cable (the one coming from the controls) and the earth	Nil voltage	Carry out operation [X]
	Voltage 12 V	Carry out operation [Y]

[X] Replace the broken section of cable C for the compressor on switch after having checked the position of the terminal (7 - diagram above) and the condition of the RV cable connected to it

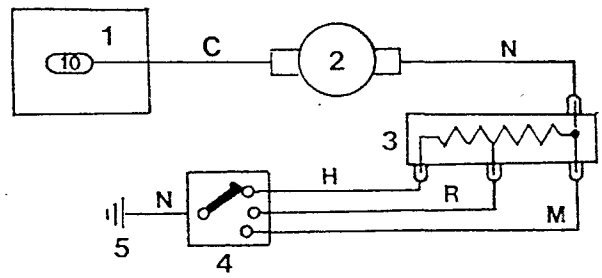
[Y] Replace cable C which connects the above mentioned connector to relay A

CHECKING OPERATIONS	RESULT	REPAIR OPERATIONS
[5] Disconnect the white coloured connector for the terminals for the three stage pressure switch and, using a bridge, connect the N cables with the B cables for the connector for the wiring and lastly connect a multimeter between terminals 85 and 86 for the socket for relay A	Nil voltage	Carry out operation [6]
	Voltage 12 V	Check the efficiency of the three stage pressure switch and if it is still not working properly, replace relay A
[6] Leave the multimeter connected as in the previous operation and connect the terminal for cable B for the white coloured connector mentioned above to earth	Nil voltage	Replace cable B which connects the three stage pressure switch to terminal 85 for relay A
	Voltage 12 V	Replace cable N which connects terminal 86 for relay B to the three stage pressure switch
[7] Connect a multimeter (voltmeter) between the earth and terminal for the red cable connected to the supply cables for the condenser and radiator cooling fan	Nil voltage	Replace the broken section(s) of cable R which connects terminals 30 and 87 for relay A to the fuse and to the electric fan
	Voltage 12 V	Replace the electric fan

[D]

Wiring diagram showing car interior climate control electric fan supply circuit

1. Junction unit
2. Car interior climate control electric fan
3. Resistor
4. Fan speed selector switch
5. Earth carrier loom underneath the dashboard

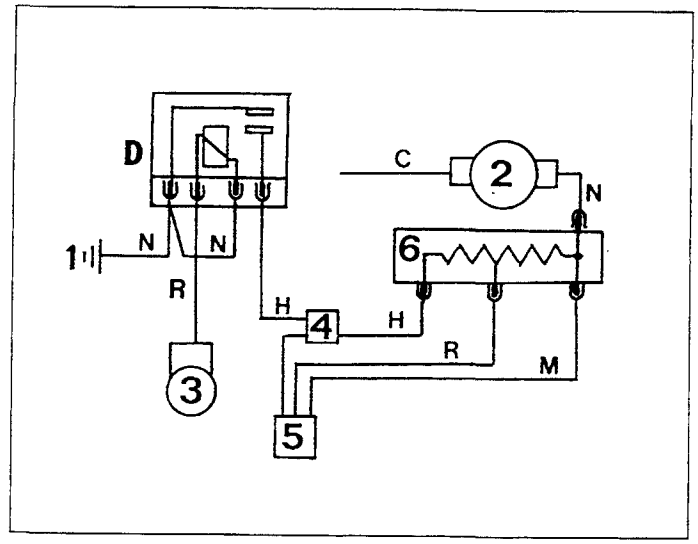


P1L049H01

CHECKING OPERATIONS	RESULT	REPAIR OPERATIONS
1 Check the effiency of the 10 A fuse for the junction unit	Fuse not working prop.	Replace the 10 A fuse
	Fuse working properly	Carry out operation 2
2 Connect a multimeter (voltmeter) between the terminals for the fan supply cables (C and N) Ignition switch in ON position and fan speed selector knob in position 3	Nil voltage	Replace the electric fan
	Voltage 12 V	Carry out operation 3
3 Connect a multimeter between the terminal for the electric fan supply cable (C) and the earth Ignition switch in ON position	Nil voltage	Replace the broken section(s) of cable (C) which connects the junction unit to the electric fan
	Voltage 12 V	Carry out operation 4
4 Disconnect the terminal for cable N from the terminal for the plate with the resistors and connect it to earth Ignition switch in ON position	Electric fan not working	Replace cable N which connects the plate with the resistors to the electric fan
	Electric fan working	Carry out operation 5
5 Reconnect the terminal for cable N to the terminal for the above mentioned plate and turn the electric fan speed selector knob firstly to position 2 and then to position 1	Electric fan working	Replace cable M which connects the speed switch to the resistor
	Electric fan not working	Carry out operation 6
6 Remove the controls and connect a multimeter (ohmmeter) between the terminal for cable N connected to the electric fan speed selector switch and the earth	Nil resistance	Replace the speed switch
	Infinite resistance	Replace cable N which connects the above mentioned switch to earth

Wiring diagram for electric fan supply when the climate control system is switched on

1. Earth on vacuum reservoir mounting bracket
2. Car interior climate control electric fan
3. Climate control system on switch
4. Light blue coloured terminal
5. Electric fan speed switch
6. Resistor
D. Relay



P1L051H01

If when the cylindrical button with the ideogram of a snowflake for switching on the climate control system (compressor) is pressed and the car interior climate control electric fan does not starting working at the first (low) speed then the following operations should be carried out

CHECKING OPERATIONS	RESULT	REPAIR OPERATIONS
1 Remove the relay (D) and, using a bridge, connect terminals 30 and 87 (cables N and H) for the socket; turn the ignition switch to the ON position and leave the climate control system on	Electric fan not working	Replace cable N and/or cable H which is broken
	Electric fan working	Carry out operation 2
2 Connect a multimeter between the earth and terminal 85 (cable R) for the socket for relay D; turn the ignition switch to the ON position and leave the climate control system on	Voltage 12 V	Replace the relay after having made sure that there is a 12 V supply between terminals 85 and 86 for the socket
	Nil voltage	Replace cable R which connects the switch (3) to terminal 85 for the socket for relay D

E If whilst the engine is idling it switches off or tends to cut out when the climate control system is activated then it is necessary to check the condition and the insulation of the sections of the HL cable which connect terminal 85 for relay B to the electronic control unit for the injection and the ignition.
If no break or short circuit is found, replace the above mentioned electronic control unit
The connector for the section of the HL cable connected to relay B is located on the left hand side of the evaporator/heater unit (see detail B in the second diagram on page 41)

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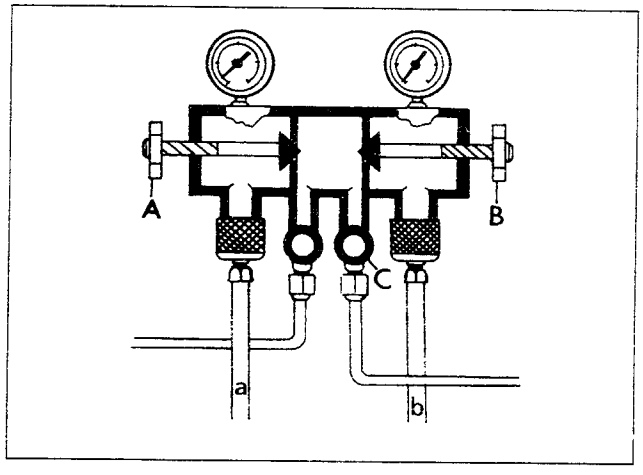

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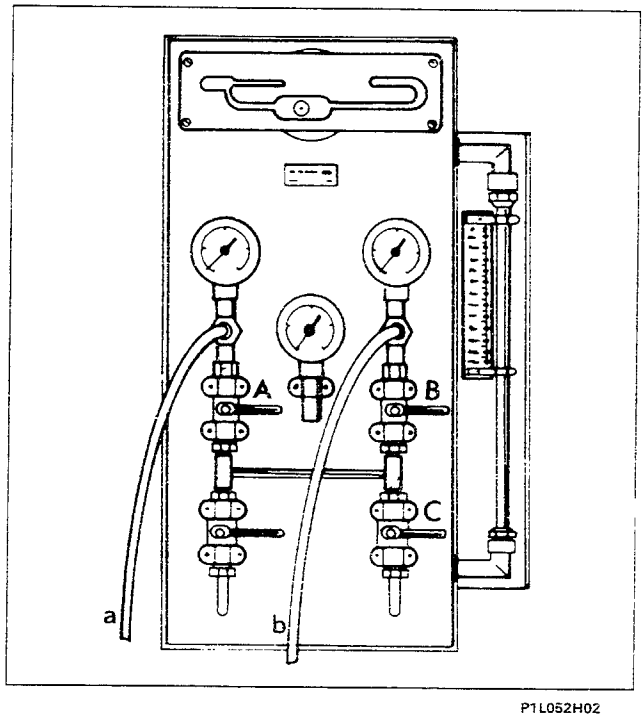

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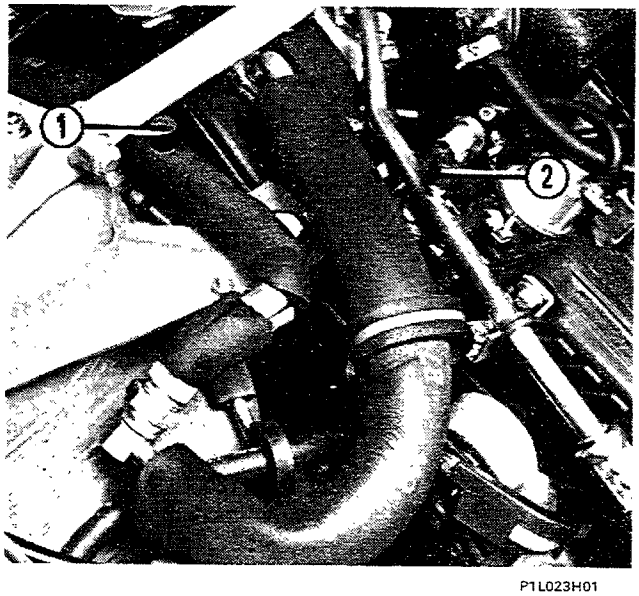

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PROBLEMS OF AN OPERATIONAL NATURE

In order to establish the possible causes of problems and the consequent repair operations the following operations have to be carried out:

- position the vehicle in question in a well ventilated part of the workshop (if this is not possible then in the area least polluted by exhaust gases and vapours in general);

Carlo EISNER equipment

- check that all the taps for the equipment for the checking, recovery, draining and re-pressurizing of the system in question are closed;
- tighten the union at the end of the light blue coloured low pressure side flexible pipe (a) to the (Bridgeport type) needle valve (1) welded to the pipe which connects the evaporator to the compressor;
- tighten the union at the end of the red coloured high pressure side flexible pipe to the needle valve (2) welded to the pipe which connects the compressor to the condenser;
- take readings from the equipment high and low pressure side gauges (for equipment with the possibility of recovery, first open the taps on the flexible pipes).

CEAST equipment

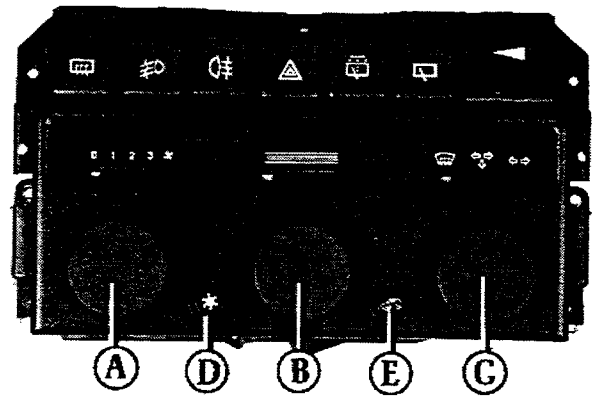
NOTE *For equipment without the possibility of recovering the coolant fluid (CEAST and CARLO EISNER) only before tightening the unions for the flexible pipes to the vehicle system needle valves, open the low pressure side tap (A) and the high pressure side tap (B) and the metering cylinder shut off tap (C) quickly to expel the air in the two flexible pipes (a and b) and then close taps A - B - C which were opened previously.*

PRESSURES MEASURED	CAUSE OF MALFUNCTION	REPAIR OPERATIONS
0 ÷ 0,7 bar	System drained (or almost) on account of leaks	Introduce 400 gr. of FREON 12 into the system and locate the leaks using a leak detector and then eliminate them
0,7 ÷ 1,65 bar	System partly drain on account of leaks	Using a leak detector, locate the leaks and eliminate them (*)
above 2.5 bar	When the climate control is switched on the compressor pulley electro-magnet coupling does not work	After having checked the compressor pulley electro-magnet coupling supply circuit, replace the 3 stage pressure switch

(*) Before intervening bear in mind that the pressure value indicated refers to an outside temperature above 10 °C.

When the outside temperature is above 10 °C start up the engine and keep it at a speed of 1000 rpm and carry out the following operations:

- turn the left knob (A) completely in a clockwise direction to the position marked by the number 3 corresponding to the maximum car interior climate control fan speed;
- turn the middle knob (B) completely in an anti-clockwise direction to the position corresponding to maximum cold (pointer in extreme blue position)
- turn the right knob (C) completely in a clockwise direction corresponding to the distribution of air to the front vents;
- press button (D) for switching on the compressor;
- press button (E) for selecting recirculation air.



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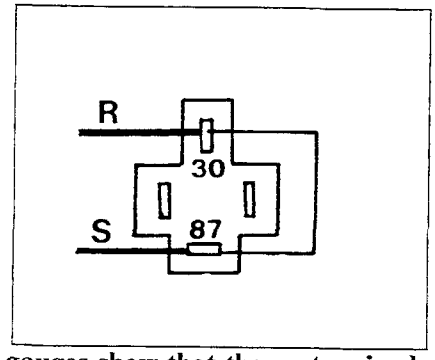

If the ambient temperature is below 10° C then the compressor electro-magnet coupling is not energized because the contacts of the three stage pressure switch are open; in this case, using a bridge, temporarily connect terminals 30 and 87 for the relay socket for a few minutes (B in the diagram at the side).

Remove the above mentioned bridge straightaway if the equipment pressure gauges show that the system is almost or completely drained (see values in table above)

If the ambient temperature is above 20° C and the radiator and condenser cooling fan does not come on, connect the terminals for cables B and N for the white connector fitted to the three stage pressure switch connector together.

Let the engine run at a speed of 1500 rpm letting the air conditioning system operate at the same time; when the latter reaches operating temperature, measure the high and low pressure values which are determined in the circuit and can be read from the equipment pressure gauges and also measure the temperture of the air coming out of the centre and side vents in the dashboard using thermal sensors connected to the digital multimeter.

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An air conditioning system which is working normally and efficiently should give the following results:

Low pressure	0,49 ÷ 2,94 bar (0,5 ÷ 3 kg/cm²)
High pressure	9,8 ÷ 19,6 bar (10 ÷ 20 kg/cm²)
Average temperature of air coming out of the front vents	After two minutes operation it should be at least 8° C lower than the ambient temperature surrounding the vehicle
High pressure circuit	Evenly hot to touch
Low pressure circuit	Evenly cold to touch

If the pressure values measured by the pressure gauges and the temperature values measured by the digital multimeter do not correspond to the values in the above table then this means that the system in question is not working efficiently because there are problems.
Using the pressure values measured and other elements it is possible to determine the fault(s) in the system being examined.
The pressure values and the symptoms, the defects which can be discovered, their probable causes and lastly the various repair operations are listed in the tables on this page and the pages which follow.

PRESSURE READINGS ON PRESSURE GAUGES		SYMPTOMS DISPLAYED	DEFECT DETECTED FROM THE SYMPTOMS	PROBABLE CAUSES	REPAIR OPERATIONS
High side	Low side				
High	High	Excessive knocking from the compressor	Excess coolant fluid	System not perfectly pressurized	A
Low	Low	Bubbles can be seen through the drier filter inspection window	Insufficient quantity of coolant fluid	Coolant leaks	B
	High	High temp. downstream of condenser Compressor switching off due to three stage pressure switch	Condensation deficiency	Condenser blocked on the outside Condenser and radiator fan not switching on	C
Vacuum		Poor or no refrigeration. Difference in temperature upstream and downstream of obstruction point	Cooling circuit blocked	Pipes restricted or obstructed. Expansion valve blocked. Purifier/drier filter blocked	D

PRESSURE READINGS ON GAUGES		SYMPTOMS DISPLAYED	DEFECT DETECTED FROM THE SYMPTOMS	PROBABLE CAUSES	REPAIR OPERATIONS
High side	Low side				
Pressures almost level		Poor air conditioner efficiency Evaporator flooded with coolant fluid which continues to evaporate along the entire section of pipe which joins the evaporator to the compressor	Abnormal operation of the expansion valve Expansion valve stuck open	Expansion valve stuck	E
Very low	Low	Poor or no refigeration according to extent to which jet is blocked	Abnormal operation of the expansion valve Expansion valve stuck closed	Expansion valve stuck	F
		The compressor does not reach or maintain sufficient pressure Loss of compressor revs	Compressor inefficient	Coolant leaks Abnormal operation of the compressor pulley electro-magnet coupling	G
Normal	Normal	Evaporator cooling insufficient or intermittent (lacking at hot times)	Coolant fluid does not condense, air or humidity present in the system	Imperfect drying Saturation of drier filter	H

REPAIR	OPERATIONS
A	With the compressor switched off, drain the excess coolant from the low pressure side needle valve until the pressure goes down to the normal values
B	Locate and eliminate the leaks and if the condenser or the evaporator is involved, replace them
C	Remove the impurities which prevent the free circulation of the air through the condenser and/or check the electric fan supply circuit

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	REAPAIR OPERATIONS
D	Try to unblock the system by blowing through with nitrogen Replace the blocked component If the blockage is due to impurities replace the drier filter and the oil in the compressor Check the level of the oil in the compressor Dry and re-pressurize the system, washing the circuit with coolant in the following way - introduce 500 grams of FREON 12 into the system; - drain the system spraying a small amount of the coolant fluid on a white cloth to check whether there are any impurities in it; if they are, completely dismantle the system and wash each component thoroughly with trichloro-ethylene.
E	Drain the system. Replace the expansion valve. Check the level of the oil in the compressor. Dry and re-pressurize the system
F	Drain the system. Replace the expansion valve. Check the level of the oil in the compressor. Dry and re-pressurize the system
G	Let the engine run at a speed of 2000 rpm with the compressor switched on and check that it is not leaking; if it is, overhaul or replace the compressor Check that the magnetic anchorage for the compressor pulley is not slipping; if it is, check that the mating surfaces of the electro-magnet coupling and the pulley are not soiled by greasy substances or other impurities
H	Completely drain the system Check the level of the oil in the compressor Replace the drier/purifier filter Thoroughly dry and re-pressurize the system

CHECKING THE OPERATION OF CERTAIN AIR CONDITIONING SYSTEM COMPONENTS

EXPANSION VALVE

To check the operation of the expansion valve, after having connected the previously mentioned equipment to the vehicle system, carry out the following operations:

- remove the anti-condensation adhesive tape (prestite) which covers the expansion valve and the sensitive bulb and move the latter away from the evaporator outlet duct (after having removed the retaining clip);
- start up the engine and let it run at a speed of 2000 rpm;
- turn the system control knobs so that the car interior climate control fan is operating at maximum speed and the temperature is at minimum (blue zone) and the air is distributed to the centre vents and lastly press the cylindrical button with the ideogram of a snowflake on it.
- carry out the tests described overleaf.

First test

Cool the sensitive bulb for the expansion valve; the latter is working properly if the reading on the low pressure side gauge decreases until there is a vacuum.
If the pointer on the pressure gauge remains in the pressure range then the expansion valve should be replaced

Second test

Disconnect the connector for the wiring from the connector for the terminals for the anti-frost thermostat and connect together the two cables.
When the sensitive bulb for the expansion valve warms up if the reading on the low pressure side gauge is higher than the normal operating value and the reading on the high pressure side gauge is lower than the normal value or there is excessive condensation on the pipe which connects the evaporator to the compressor then this means that the expansion valve is working properly; if this is not the case, replace it.

CONDENSER

If during operation the temperature downstream of the condenser is high and the compressor switches off on account of the three stage pressure switch this means that there is a condensation deficiency; carry out the following operations in the order given:

1. Check whether the three stage pressure switch is working properly (see the next chapter for the operations): if it is not, replace it.
2. If the pressure switch is working properly check that the condenser is not blocked on the outside; if it is, remove all the impurities and straighten any distorted or bent fins so that the cooling air circulates freely through the condenser.
3. If the condenser is not blocked on the outside, check that there are no leaks or that it is not partly blocked inside; if there are leaks, replace the component; if, on the other hand, it is partly blocked try to unblock it by blowing through with nitrogen.

PURIFIER/DRIER FILTER

The purifier/drier filter has to be replaced when the following problems occur:
- expansion valve blocked or corrosion inside the two heat exchangers;
- chemical compound «SILICAGEL» in the filter saturated and cannot retain any further moisture; this is caused by the prolonged absence of coolant fluid in the system which is the direct consequence of leaks;
- leaks of coolant fluid from the inspection window or from the inlet and outlet ducts;
- filter blocked; this problem can be deduced when there is a difference in temperature between the filter inlet and outlet pipes.

After having removed the drier filter the two pipes connected to it must be sealed at once and before they are reconnected to the filter the «O-Ring» seals must be lubricated with anti-freeze.

THREE STAGE PRESSURE SWITCH

To check the efficiency of the pressure switch connect the equipment to carry out the checking, drying and re-pressurizing of the system as described on page 52.
Measure the pressure at the equipment high side pressure gauge.
If on account of leaks in the system the pressure readings are nil, check if when the ignition switch is turned to the ON position and the button with the ideogram of a snowflake is pressed the compressor pulley electro--magnet coupling is energized.
If this is the case, switch off the ignition and replace the three stage pressure switch.

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If the above mentioned coupling is not energized, slowly partly re-pressurize the system and check on the high side pressure gauge at what value the coupling is energized; if it is at a value below 1.96 bar, replace the pressure switch.

If the system is pressurized and the reading is above 2.15 bar then the above mentioned electro-magnet coupling should be energized.

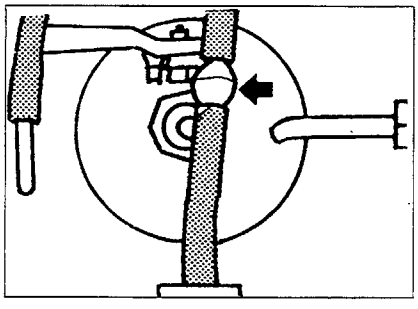
Disconnect the electrical connection for the terminals for the two level thermal switch on the engine, start up the engine and activate the air conditioning system and measure the pressure at the start of and the end of the operation of the condenser and radiator cooling fan.

Then disconnect the electrical connection for the above mentioned electric fan supply cables and take the readings of the two pressures at which the compressor pulley electro-magnet coupling is de-energized and re-energized.

If the increasing pressure exceeds 26.5 bar without the electro-magnet coupling being de-energized switch off the engine at once.

The three stage pressure switch should be replaced if at a pressure below 1.96 bar it allows the energizing of the above mentioned electro-magnet coupling with the engine switched off or if the condenser and radiator cooling fan switches on at a pressure other than 14.5 - 16.5 bar and switches off at a pressure other than 11.5 - 13.5 bar or the electro-magnet coupling is de-energized at a pressure of above 23.5 - 26.5 bar.

NOTE ***During the last operation described do not become distracted because if the three stage pressure switch is not working properly and the engine does not cut out immediately the increasing pressure in the circuit (above 26.5 bar) can cause the pipes to explode.***



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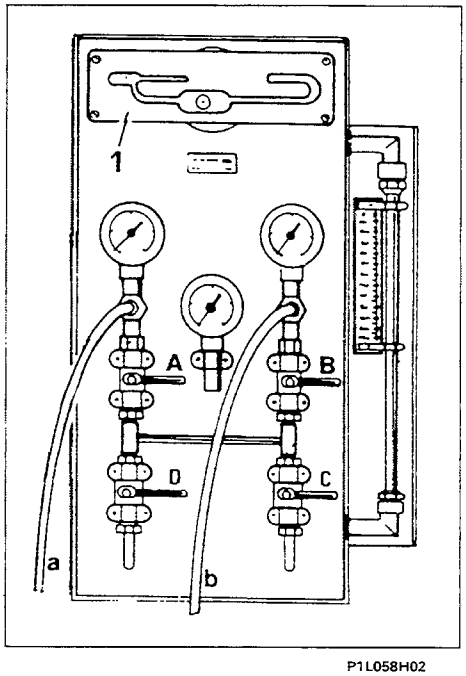

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SETTING UP EQUIPMENT FOR DRAINING AND RE--PRESSURIZING THE AIR CONDITIONING SYSTEM

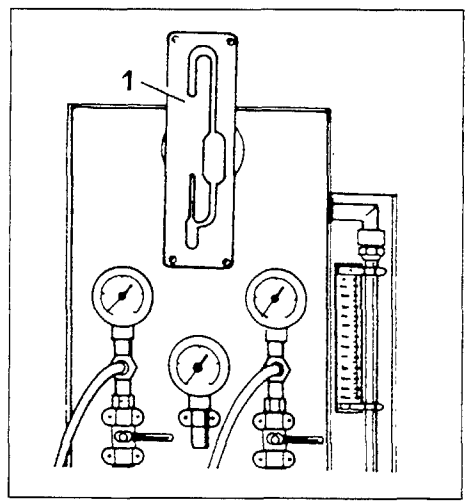
CEAST EQUIPMENT

Preparing the equipment

Carry out the following operations:

- position the equipment far away from any source of heat;
- working from the rear of the equipment, remove the two rubber plugs from the pump inlet and outlet unions (these should be kept because they can be reused if the equipment is subsequently moved);
- connect the free end of the rubber pipe to the pump inlet union and fit the oil recovery "trap" device to the drain union;
- if there are traces of mercury in the filter glass (shown by the arrow) then the equipment must be placed in a horizontal position so that the particles of mercury return to the GAEDE vacuum gauge;
- connect the supply cable for the motor which drives the vacuum pump to a single phase 220 V current socket;
- close the low pressure side and high pressure side taps (A-B);
- close the coolant inlet tap and the coolant drain tap for the metering cylinder (located at the side of and inside the upper part of the equipment);
- open the taps for excluding the metering cylinder (C) and the vacuum pump (D);
- let the vacuum pump operate by activating the switch.

Draining the metering cylinder



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Let the vacuum pump run for 20 minutes in order to dry the metering cylinder completely; check the degree of vacuum reached or more precisely the value of the residual pressure in the metering cylinder using the GAEDE vacuum gauge (1) as follows:

- place the vacuum gauge (1) in a horizontal position, with the central mercury container at the bottom (see illustration at the foot of the previous page);
- rotate the above mentioned vacuum gauge (1) in an anti-clockwise direction until it is vertical (as illustrated in the diagram at the side);
- read off the degree of vacuum (residual pressure) which is determined by the level reached by the mercury in the small graduated bulb;
- return the vacuum gauge to a horizontal position to allow the pump to complete draining in the instrument as well.

Having reached a good degree of vacuum, below 0.66 mbar (0.5 mmhg) close the taps to exclude the metering cylinder (C) and the vacuum pump (D).

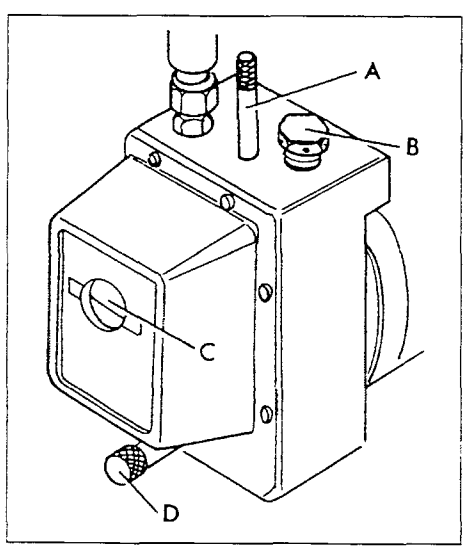
Filling the metering cylinder

In order to fill the metering cylinder, carry out the following operations:

- tighten the unions at the ends of the flexible pressurizing pipe one to the outlet union for a canister of coolant fluid and the other (without fully tightening it) to the inlet tap which is located on the left hand side of the equipment;
- slightly open the handwheel for the pressurizing cylinder to expel the air in the flexible pipe and then lock the union on the inlet tap;
- open the inlet tap and the handwheel for the pressurizing cylinder, allowing the coolant fluid to enter themetering cylinder at a stable pressure;
- slightly open the drain tap (inside the equipment above the metering cylinder): this allows the gradual filling of the metering cylinder because it keeps the pressure below that in the canister;
- check the level of the coolant fluid in the graduated rod on the side of the equipment;

Prevent the level of the coolant from exceeding the «0» on the graduated scale when it is completely at the top so that there is an allowance for the variation in volume of the fluid in relation to the ambient temperature.

To facilitate filling the metering cylinder, the pressurizing canister should be fixed upsidedown to a wall with the filler higher than the equipment inlet tap.



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CARLO EISNER PORTABLE EQUIPMENT

Preparing the equipment

Place the equipment as far away as possible from any source of heat and then check, through the inspection window C, the the vacuum pump contains the recommended amount of unpolluted oil;

View of the Carlo Eisner equipment vacuum pump

C. Inspection window for checking level and condition of oil

A. Ballast control
B. Oil filler plug
D. Oil drain plug

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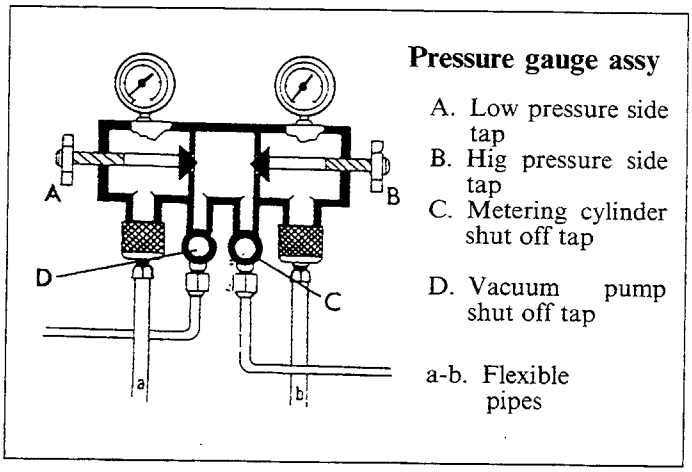

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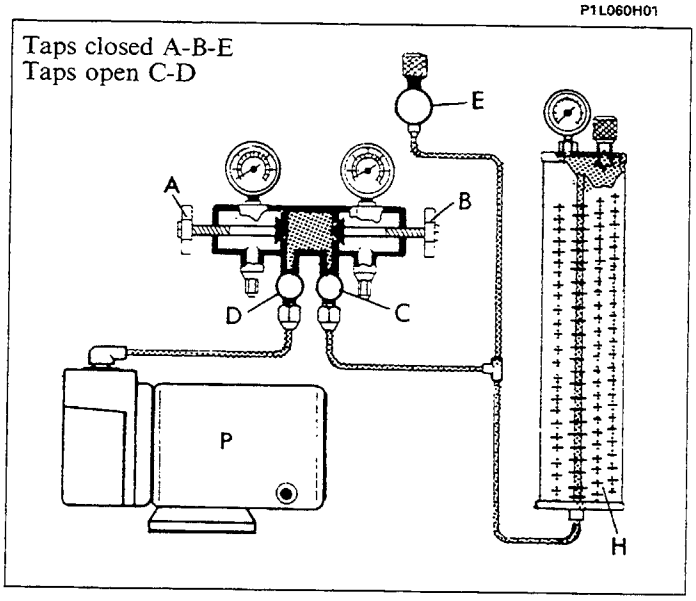

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Diagram showing metering cylinder drainage system

E. Pressurizing tap
H. Metering cylinder
P. Vacuum pump

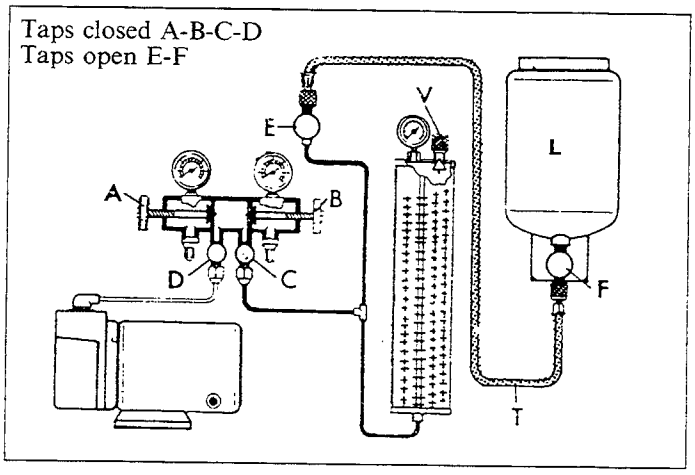

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Diagram showing metering cylinder filling system

E. Pressurizing tap
F. Canister tap
L. Pressurizing canister
T. Flexible pressurizing pipe
V. Bleed valve

After having changed the oil if it is polluted or not at the correct level, carry out the following operations:

- connect the electronic vacuum gauge sensor to the special socket on the inlet pipe for the vacuum pump and calibrate the electronic vacuum gauge (see page 88);
- connect the supply cable for the motor which drives the vacuum pump to a single phase 220 V current socket;
- close the low pressure side tap (A), the high pressure side tap (B) and the metering cylinder pressurizing tap (E);
- open the metering cylinder shut off tap (C) and the vacuum pump shut off tap (D):
- rotate the ballast control rod in an anti-clockwise direction through two or three revolutions;
- switch on the vacuum by via the switch on the supply cable; the pointer for the pressure gauge on the metering cylinder should indicate 0;
- after the vacuum pump has been working for two minutes fully tighten the ballast control rod (in a clockwise direction).

Draining the metering cylinder

Let the vacuum pump operate for about 15 minutes in order to completely dry (drain) the metering cylinder.
Check the degree of vacuum reached or more precisely the value of the residual pressure in the metering cylinder using the previously calibrated electronic vacuum gauge.
The reading should be taken from the instrument after having positioned the two switches in ON and READ.

Having reached a good degree of vacuum below 0.66 mbar (0.5 mmHg) close the shut off taps for the vacuum pump (D) before switching off the pump.

Filling the metering cylinder

In order to fill the metering cylinder, carry out the following operations:

- tighten the unions at the end of the flexible pressurizing pipe (T) one to the outlet union for a canister of coolant fluid and the other (without fully tightening it) to the pressurizing tap (E);
- slightly open the pressurizing canister handwheel to expel the air in the flexible pipe and then lock the union on the tap (E);
- open the pressurizing tap (E) and the pressurizing canister handwheel;

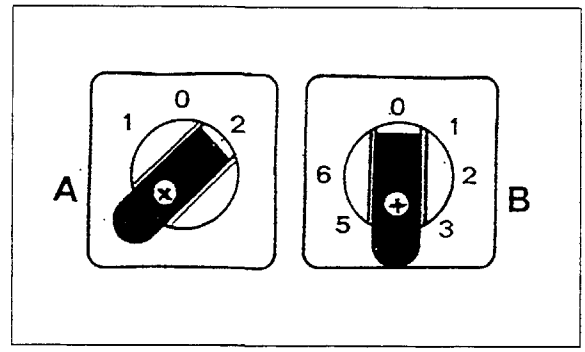
- to facilitate the operation of gradually filling the metering cylinder the coolant fluid must be bled from the needle valve at the top to keep the pressure in it lower than that of the canister;
- rotate the transparent graduated cylinder so that the scales corresponding to the coolant used (R 12) is positioned at the front;
- from the above mentioned scales select the one which has the pressure corresponding to that shown by the pressure gauge fitted on the metering cylinder at the top beyond the maximum level line and superimpose it on the level indicator (column) and read the volume of coolant fluid present in the metering cylinder.

When pressurizing avoid exceeding the line corresponding to the maximum value on the graduated scale on the transparent cylinder and then completely fill the metering cylinder to allow for a variation in volume in relation to the ambient temperature.

To facilitate filling the metering cylinder the pressurizing canister should be fixed upsidedown to a wall.

After having filled the metering cylinder, close the handwheel for the canister and the pressurizing tap (E) and then undo the unions at the end of the flexible pressurizing pipe.

ICF CLEANER 12 SEMI-AUTOMATIC COOLANT FLUID PURIFICATION EQUIPMENT



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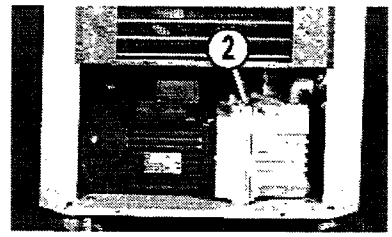
Preparing the equipment

Before using the equipment it is necessary to check the level of the oil in the vacuum pump, to check for any impurities and also there should be beween 2 and 2.5 kg of coolant fluid in the metering cylinder.

To check the level of the oil and to check for any impurities, carry out the following operations:

- connect the equipment to a 220 V electric current socket and operate the pump by rotating the selector knob (A) to position 2;
- check the level of the oil through the special inspection window (1) and partly undo the ballast (2) to release any uncondensed gases which could polllute the oil and cause serious damage to the pump;
- after 5 minutes operation check via the inspection window (1) that the surface of the oil is clear and clean (and not greyish) with no impurities and that the level comes at least halfway up the window.



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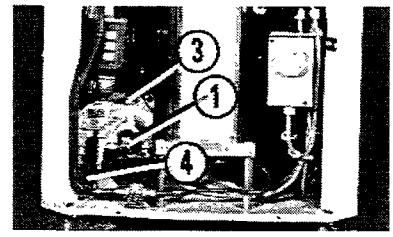
The level of the oil with the pump hot should not exceed or be lower than the extreme levels for the inspection window because in the former case the pump is blocked with oil and overheats with a decrease in performance whilst in the second case there is a deficiency in lubrication with the consequent possibility of seizing.



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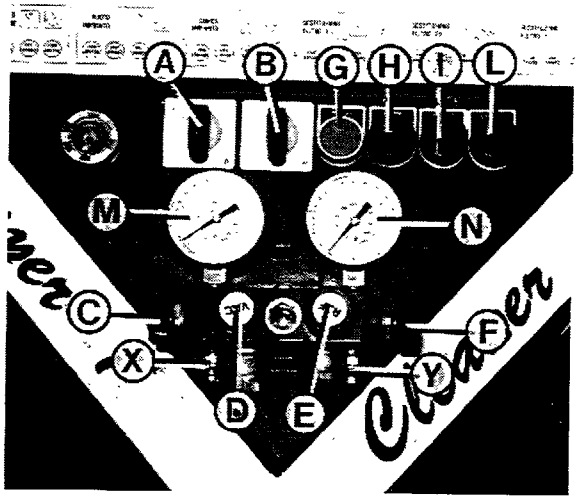
Filling the metering cylinder

To fill the metering cylinder for the Cleaner 12 equipment, carry out the following operations:

- tighten the union at one end of the red coloured flexible pipe to the service valve for a canister of coolant fluid;



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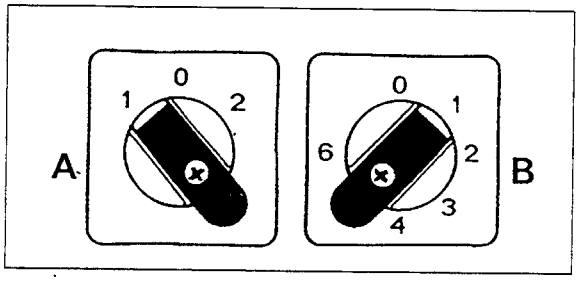

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- tighten the union for the other end of the red flexible pipe to the high pressure side union (Y) for the equipment pressure gauge and switch on the equipment by placing the general switch in the ON position;
- make sure that the taps for the equipment pressure gauges are closed then open the HIGH (F) and REF (E) taps and lastly slowly open the canister tap;
- turn the knob for the switch (B) into position 1 and the one for the selector (A) into position 1.

NOTE *During the operation of filling the metering cylinder it is advisable to let the coolant fluid flow in a gaseous state and therefore at a low speed from the canister to the equipment*

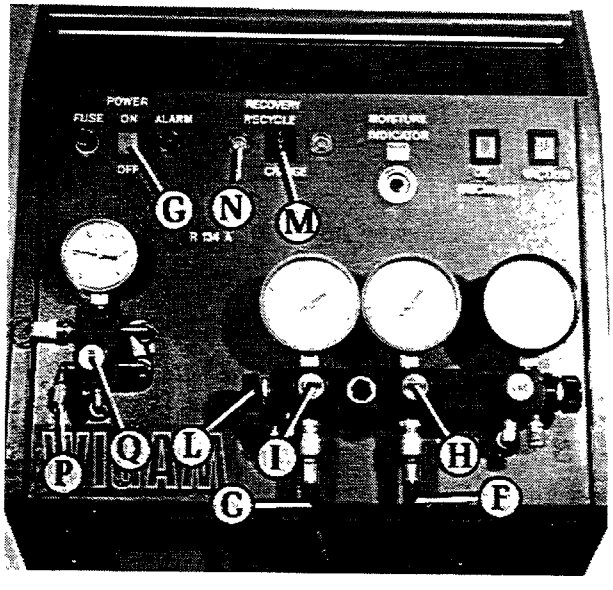
The coolant fluid passes through the equipment components and has any traces of humidity and impurities removed and a when a certain amount (which can be detected in the special column) is transferred from into the metering cylinder, turn the knobs for the switch (B) and the sector (A) into position 0 and then close the canister tap and the HIGH (F) and REF (E) taps for the equipment pressure gauges.

MURRAY EUROPE UP 12 EQUIPMENT FOR THE RECOVERY AND RECYCLING OF COOLANT FLUID

Preparing the equipment and filling the metering cylinder

Before using the equipment the level of the oil in the vacuum pump must be checked, a check must be made for any impurities in the oil and also there should be between 1.5 and 2 Kg of coolant fluid in the metering cylinder

The metering cylinder can be filled with coolant fluid in two different ways; firstly by absorbing the fluid from the canister and secondly by transferring the fluid directly from the canister to the metering cylinder.



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For the first method, carry out the following operatio

- tighten the union for the free end of the light blue flexible pipe (low pressure side) to the union for a canister of coolant fluid;
- electrically connect the UP 12 equipment to a 220 V current socket and press button (G) for the general switch into the ON position (if it lights up this means that the equipment is receiving a voltage supply);
- open the tap for the canister, the tap for the connecting pipe (if fitted) and the LOW (I) and REF (L) taps for the equipment pressure gauges and lastly press the button for switch M into position 1 (RECOVERY RECYCLE);
- close the tap for the canister when the metering cylinder contains about 0.5 kg of coolant fluid and the level in the distiller is at maximum;

- press the button for switch (M) placing it in position 0 and close taps (I - L) mentioned above.

In the second method, when introducing the coolant fluid into the metering cylinder the equipment does not have to be connected to the electrical grid, simply carry out the following operations:

- tighten the unions for the ends of a flexible service pipe to union (P) for the one way pressure gauges and to the outlet union for the coolant canister, respectively and position the latter higher than the metering cylinder;
- open the taps for the canister, the flexible service pipe (if fitted) and the REF tap (Q) for the one way pressure gauge;
- fit a thermostatic heating band to the canister if it is noticed that there are difficulties in transferring the coolant fluid to the metering cylinder and when the latter contains the desired amount of coolant fluid close the tap for the canister then the tap for the flexible service pipe and lastly the REF tap for the equipment.

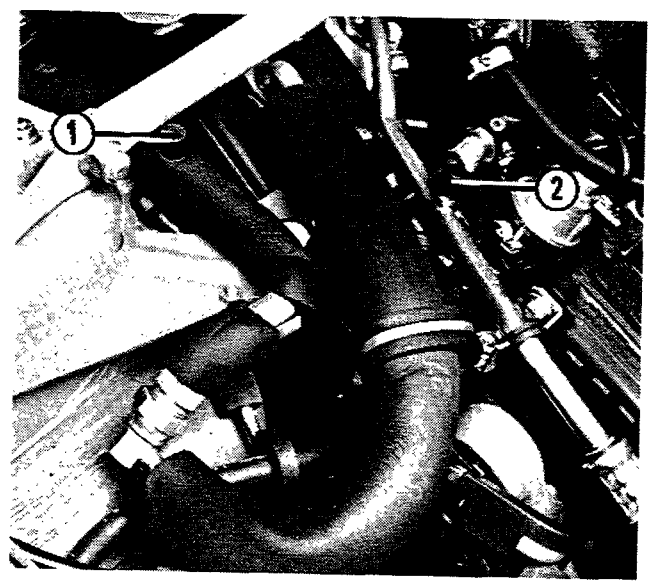
INSTRUCTIONS FOR DRYING AND PRESSURIZING THE AIR CONDITIONING SYSTEM

DRYING

Drying is designed to eliminate the uncondensed gases and the largest possible amount of humidity present inside the air conditioning system and should be carried out after having restored the system to its original operating conditions, i.e. after having eliminated any leaks of coolant fluid and replaced any components which are not working properly.

In order to dry the air conditioning system use the special equipment equipment (with or without recovery) which should be connected in the following way:

- the union for the free end of the low pressure side flexible pipe (light blue) should be tightened to the needle valve (1) welded on the pipe which connects the evaporator to the compressor;



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- the union for the free end of the high pressure side flexible pipe (red) should be tightened to the needle valve (2) welded on the pipe which connects the compressor to the condenser.

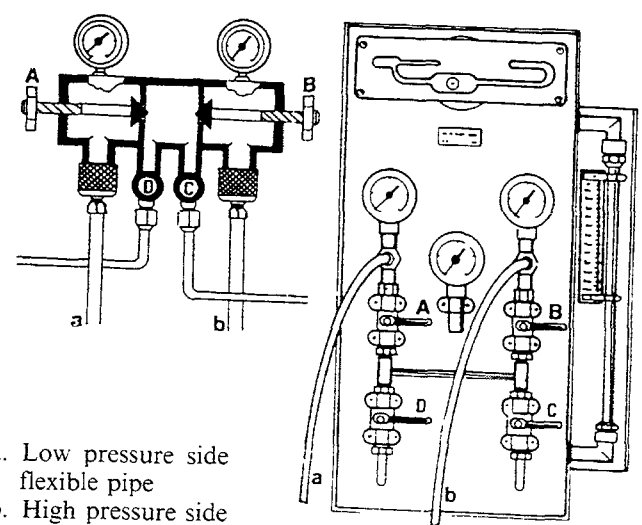
After having established these connections, according to the equipment available, carry out the following operations:

Equipment without the possibility of recycling coolant fluid (CEAST - EISNER)

- make sure that the metering cylinder shut off tap (C) is properly closed;
- start up the vacuum pump and then open the low pressure side tap (A), the high pressure side tap (B) and the vacuum pump shut off tap (D).

After these operations if there are no leaks in the air conditioning system the pointers on the pressure gauges will indicate a value below zero.

After 5 minutes close taps (A and B) and the vacuum pump shut off tap (D) and wait for another 5 minutes.



a. Low pressure side flexible pipe
b. High pressure side flexible pipe

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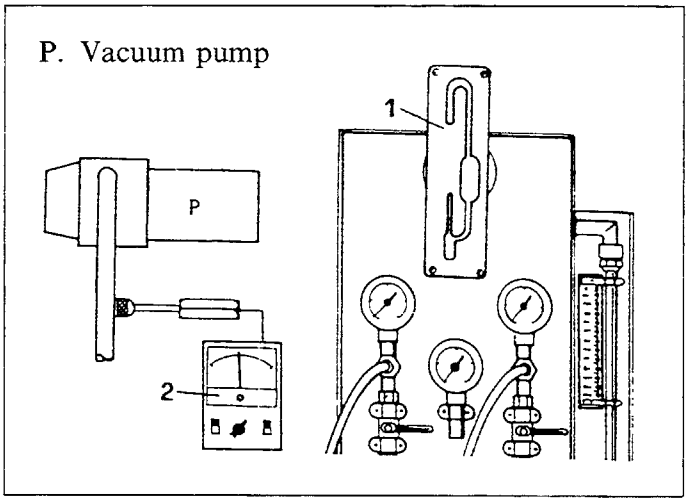


NOTE *The electronic vacuum gauge should be calibrated before use.*

Vacuum pump operating time	Vacuum values	
	mbar	mmHg
about 10 minutes	⩽2,67	⩽2
about 45 minutes	⩽0,8	⩽0,6

If during the period of time mentioned above the previous vacuum reading on the pressure gauges decreases, it is obvious that there are leaks in the system.

If the leaks are not eliminated with a further locking of the pipe unions, introduce 300 g. of coolant fluid into the system opening the high pressure side tap (B) and the metering cylinder shut off tap (C) and search for the leaks using a leak detector and eliminate them.
Repeat the operations described previously and if no further leaks are discovered, restart the vacuum pump.

The instruments which indicate with precision whether or not the system is water tight are the GAEDE vacuum gauge (1) (for CEAST equipment) and the A-14 electronic vacuum gauge (2) (for Carlo EISNER equipment) and their indications must be adhered to.

Usually after the vacuum pump has been operating for a certain length of time the vacuum values in the table should be obtained.

For the GAEDE vacuum gauge the values in the table refer to the corresponding level of mercury in the instrument in a vertical position.

Having reached a good degree of vacuum below 0.667 mbar (0.5 mmHg), which is the value necessary to start pressurizing the system, close tap D before switching off the pump.
During the operation of drying the following conditions can occur:

1. Time available limited.
2. The equipment vacuum pump is no longer working at optimum efficiency.
3. Air conditioning system has remained without coolant for a long time due to leaks.
4. Air conditioning system components have been replaced (pipes, condenser, etc.).

In these cases, after having connected the equipment flexible pipes to the system needle valves, carry out the following operations:

- let the vacuum pump run for about 15 minutes making sure that the degree of vacuum reached is at least 2.67 mbar (2 mmHg);
- introduce 500 g. of coolant fluid into the system and start up the engine;
- press the cylindrical button for switching on the air conditioning which has an ideogram of a snowflake on it;
- turn the centre knob completely in an anti-clockwise direction to the position corresponding to maximum cold (blue);
- accelerate the engine until it reaches an idle speed of 1500 rpm and keep it like this for 10 minutes;
- empty all the coolant fluid introduced into the system by loosening the union for the flexible pipe connected to the needle valve welded on the pipe which connects the drier filter to the evaporator;
- repeat the operations described previously and restart the vacuum pump and let it run for 30 minutes before final pressurizing the system.

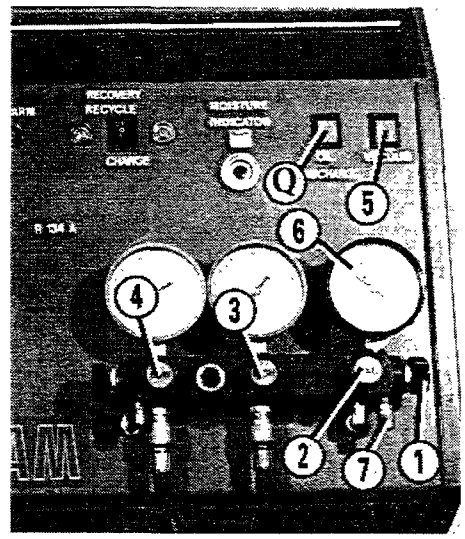
For conditions 3 and 4 mentioned above before draining the coolant fluid introduced into the system, check whether there are any leaks using the electronic leak detector and eliminate them, before letting the vacuum pump run for the recommended 30 minutes, replace the drier filter.isidratatore.

NOTES *Before switching off the vacuum pump the pump shut off tap should always be closed to prevent the system from drawing in vapours saturated with humidity and various impurities from the pumpl.*
During the operation of draining, if the CEAST equipment is used then the GAEDE vacuum gauge should be in a horizontal position.
Slightly lubricate the threads and the seals (O-Rings) for the unions for the various air conditioning system pipes using only the same anti-freeze as used to lubricate the compressor.
Never use ordinary greases or lubricants or various sealants because if even the smallest particle of foreign material managed to penetrate inside the circuit this would cause not only problems of an operating nature in the air conditioning system but also serious damage to the system components.

Equipment with the possibility of recovering and recycling coolant fluid

UP 12 EQUIPMENT

- open the VAC (1 and 2), HIGH (3) and LOW (4) taps and those for the flexible pipes connected to the vehicle system;
- press the button for the VACUUM switch (5) which operates the vacuum pump;
- after about twenty minutes close the VAC tap (2) and stop the operation of the pump by pressing the switch (5) again;
- leave things as they are for 5 minutes and during this period of time check whether the system is water tight by observing whether the value on the vacuum gauge (6) decreases;
- if there are no leaks, start up the vacuum pump again by pressing switch (5) and open the VAC tap (2);



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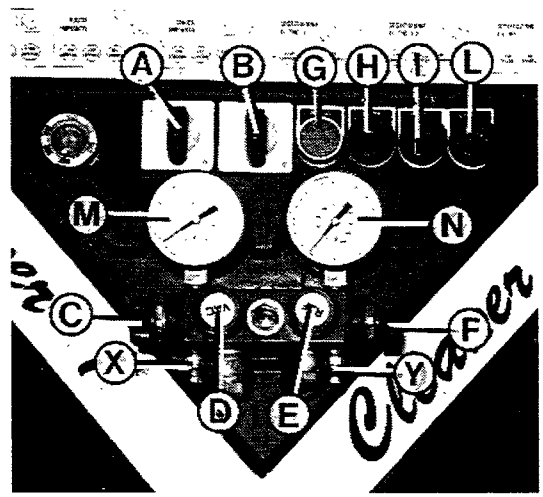
- after about twenty minutes stop the vacuum pump by pressing switch (5) again, close the VAC (1) and LOW (4) taps and then pressurize the vehicle system.

NOTE ***Remember to close the VAC tap (1) because if it remains open this can cause the vacuum gauge (6) to break (even if it is protected by the safety valve 7) when the subsequent operation of pressurizing the vehicle system is carried out.***

CLEANER 12 EQUIPMENT

- open the VAC (D), HIGH (F) and LOW (C) taps and the ones for the flexible pipes connected to the vehicle system;
- check that there are no impurities in the vacuum pump and that it contains the recommended amount of oil, then start up the pump by turning the knob for the function selector (A) into position 2 and check that the «PUMP» warning light (H) comes on;
- after about fifteen minutes check the vacuum value reached on the low pressure side gauge (M), then close the VAC tap (D) and turn the knob for the function selector (A) to position 0 and check that the previous vacuum value does not decrease over a period of five minutes;
- if there are no leaks, start up the vacuum pump again by turning the selector knob (A) to position 2 and reopen tap (D);



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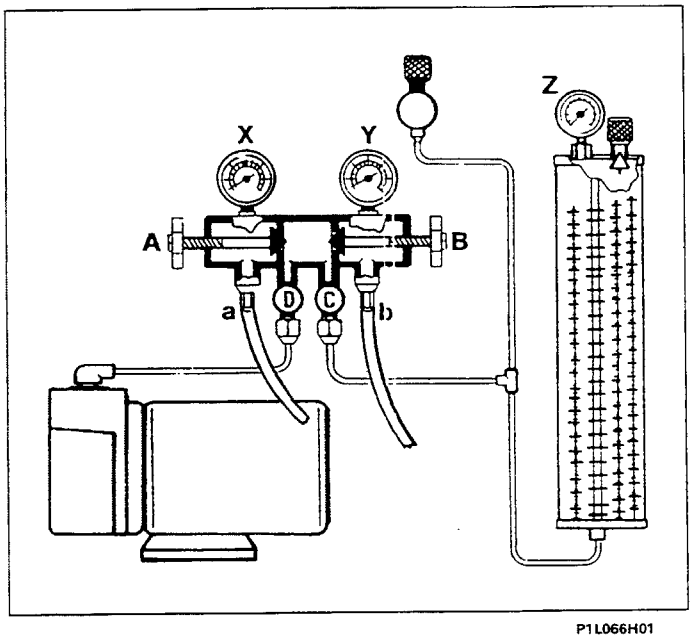
- when the reading on the vacuum gauge (M) is 10 mbar (after 20 - 25 minutes) close the taps (C - D - F) once again and turn the function selector knob (A) to position 0.

After these operations the vehicle system can be pressurized.



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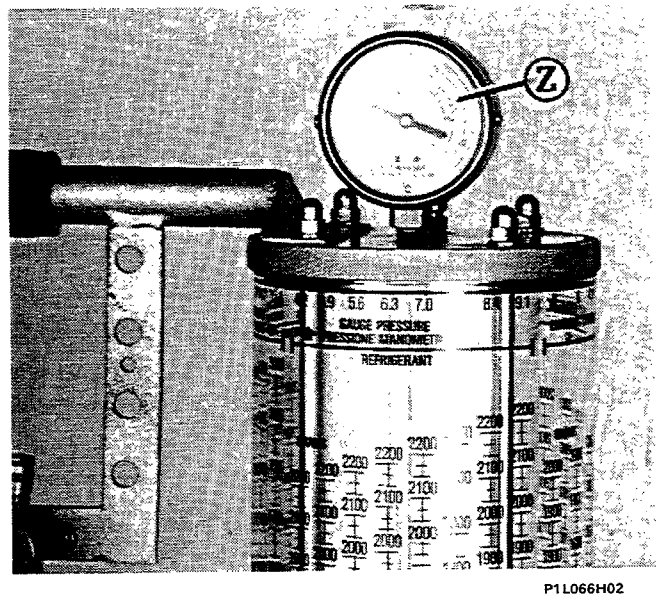
EISNER equipment



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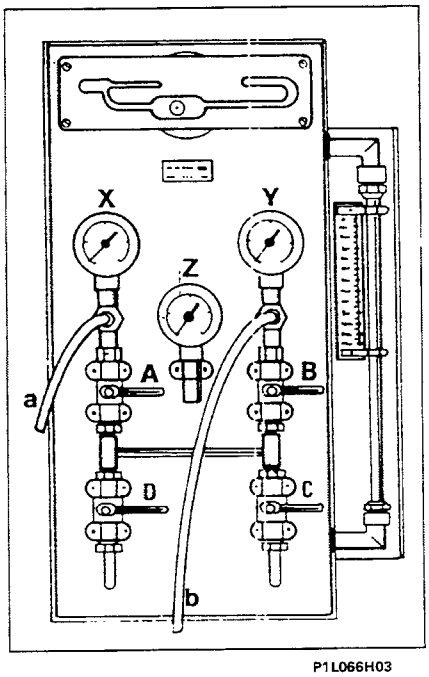
PRESSURIZING

After having dried the air conditioning system, proceed with filling (pressurizing) it by introducing the quantity of coolant fluid recommended in the table on page 90.

In order to pressurize the system using one of the types of equipment which do not have the possibility for recovering the coolant fluid, carry out the following operations:

- keep the connections for the two equipment flexible pipes (a and b) to the system needle valves unchanged and make sure that the low and high pressure side taps (A and B) and the metering cylinder and vacuum pump shut off taps (C and D) are closed;



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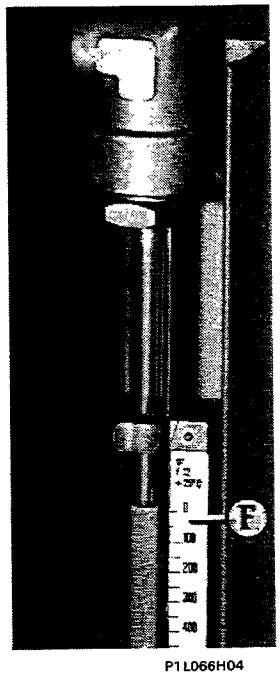

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CEAST equipment

- for the Carlo EISNER equipment display the level of the coolant fluid in the column on which the scale should be superimposed (turning the transparent graduated cylinder) corresponding to the R12 coolant fluid at the pressure shown by the pressure gauge Z;
- for the CEAST equipment align the 0 for the graduated rod (F) with the level of the coolant fluid in the side column;
- slowly open both the hig pressure side tap (B) and the metering cylinder shut off tap (C) and check that the coolant fluid gradually enters the vehicle system.

After this operation there are two possible conditions, namely:

1. The entire amount of coolant fluid required passes from the equipment metering cylinder into the vehicle system, i.e. the level of the coolant fluid inside

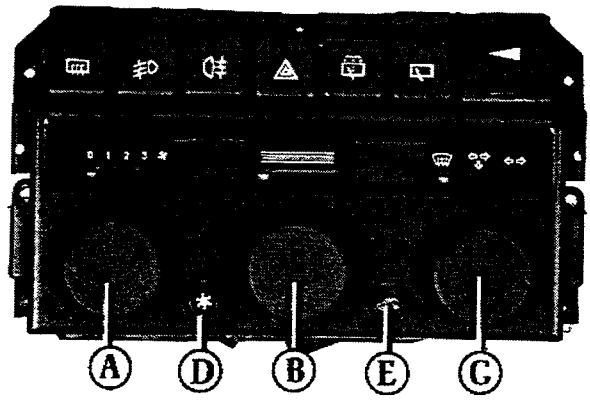
the equipment column reaches the pre-fixed level (which is the result of that measured at the outset minus that corresponding to the amount instroduced into the vehicle system).

2. Only part of the planned quantity of coolant fluid has flowed from the equipment metering cylinder to the vehicle system because the pressure in the latter and that in the first container (metering cylinder) read on the pressure gauges (Y and Z) are level.

Close the high pressure side tap (B) and the metering cylinder shut off tap (C).

When the second condition mentioned above occurs, in order to complete the filling of the system with coolant fluid, carry out the following operations:

- connect the terminals for the green coloured cables at the red coloured connector which is fitted to the corresponding terminals for the three stage pressure switch and start up the engine;
- press switch (D) for switching on the compressor;
- turn knob (B) completely in an anti-clockwise direction to the position corresponding to the Blue limit (maximum cold);
- turn knob (A) in a clockwise direction to position 3 corresponding to the maximum fan speed;
- increase the engine rotation speed to 1500 rpm;



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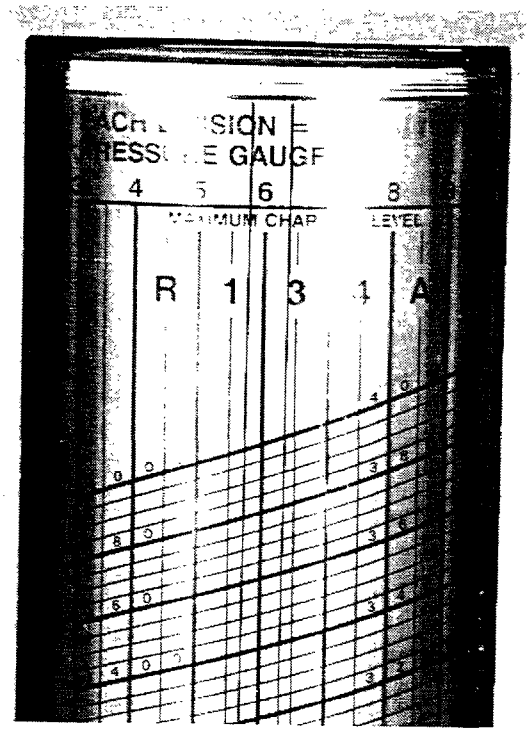
- open the low pressure side tap (A) for the equipment connected to the vehicle system;
- slowly open the metering cylinder shut off tap (C) for the equipment to allow the coolant to be drawn in by the compressor in a gaseous state.

This last operation is carried out carefully to prevent flows of coolant fluid in a liquid state from coming into contact with the compressor valves and damaging them on account of which it is necessary to check that the value on the low pressure side gauge (X) is 1 - 2 bar (about 1 - 2 kg/cm²) lower than that measured on the metering cylinder pressure gauge (Z).

When the operation of pressurizing the vehicle system is over, i.e. the recommended amount of coolant fluid has been introduced, close the metering cylinder shut off tap (C) and the low pressure side tap (A) and remove the connection between the terminals for the two cables at the red connector connected to the three stage pressure switch cable terminals.

In order to pressurize the air conditioning system using MURRAY EUROPE UP 12 equipment, carry out the following operations:

- keep the connections for the two equipment flexible pipes to the vehicle system valves unchanged;
- align the vertical line corresponding with the value for the pressure measured by the pressure gauge (2 in the diagram at the top of the next page) with the central column for the metering cylinder by rotating the external graduated cylinder (the illustration at the side shows the column with the vertical line corresponding to 6 bar superimposed);
- measure the level reached by the coolant fluid in the column and using the scale on the external graduated cylinder it is possible (by reading the values at the edges of the tilted line) to determine the quantity of fluid contained in the metering cylinder;



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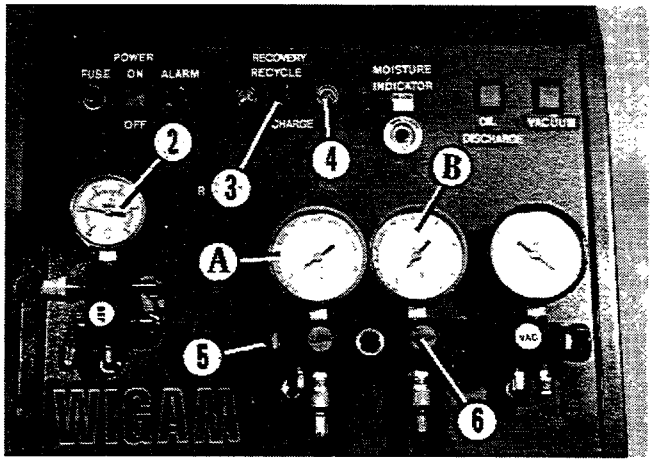

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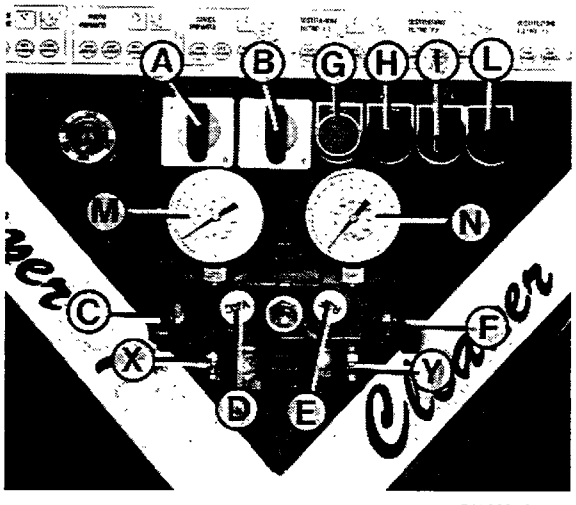
- place the CHARGE switch (3) in position 2 (shown by the white warning light 4 coming on) and open the REF (5) and HIGH (6) taps.
  The coolant fluid will flow in the high pressure side of the vehicle system preventing any jets of coolant fluid in a liquid state from coming into contact with the compressor valves and damaging them;
- slowly the level of the coolant fluid inside the metering cylinder will decrease and when it reaches the pre-fixed level in the column (that measured at the outset minus that corresponding to the amount introduced into the vehicle system) press the CHARGE switch once again returning it to position 0 and close the HIGH (6) and REF (5) taps.

NOTES *If you do not wish the compressor to draw in the coolant fluid remaining in the high pressure side flexible pipe then the value must be increased to 70 grams.*
Pay attention during pressurizing not to completely drain the metering cylinder but to leave at least 200 grams of coolant fluid to prevent uncondensed gases from entering the system.



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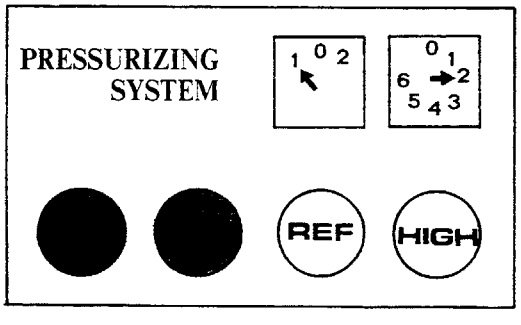
To pressurize the air conditioning system using Cleaner 12 equipment, carry out the following operations:

- keep the connections for the two equipment flexible pipes to the system valves unchanged;
- measure the level of the coolant fluid in the metering cylinder central column and using the scale underneath (on the actual cylinder) it is possible (by reading the values at the ends of the corresponding tilted line) to determine the actual quantity of fluid available;
- check that the amount of coolant fluid to be introduced into the vehicle system is contained in the equipment metering cylinder bearing in mind that the latter automatically cuts out when the minimum level is reached;
- if there is at least 2 - 2.5 kg of coolant fluid in the metering cylinder, close the REF (E) and HIGH (F) taps and tuen the knob for the function switch (B) into position 2 and that for the selector (A) into position 1 and chekc that the LOW (C) and VAC (D) taps are closed.



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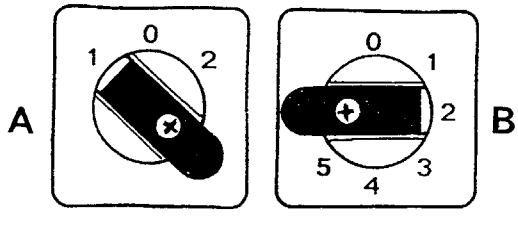
The taps shown by the shading should remain closed



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The difference between the pressure inside the vehicle system pipes and that inside the metering cylinder causes the coolant fluid to flow from the equipment through the red high pressure side flexible pipe to the vehicle system.

When the level of the coolant fluid in the metering cylinder column reaches the pre-fixed level which is the original amount minus that introduced into the vehicle system, rotate the knobs for the switch (B) and the selector (A) into position 0 and close the HIGH (F) and REF (E) taps.

Before completing the pressurizing, two conditions can occur, namely:

CONDITIONS	SYMPTOMS AND EFFECTS	OPERATIONS TO BE CARRIED OUT
Levelling of the pressure inside the vehicle system pipes with that inside the metering cylinder.	The balancing of the pressures considerably slows down or actually prevents the coolant fluid from flowing from the metering cylinder to the vehicle system.	Close the HIGH (F) tap, start up the engine and activate the cliamte control system (temperature LO, max fan speed) and slowly open the LOW tap (C). When the pressurizing is over, close the LOW (C) and REF (E) taps, turn the knobs for switch (B) and selector (A) to position 0 and also de-activate the climate control system and switch off the engine.
During the operation of pressurizing, the minimum level is inadvertently reached in the metering cylinder.	A control device incorporated in the metering cylinder to prevent the intake of uncondensed gases into the system interrupts the pressurizing operation and causes the «LEVELS» warning light (L) to come on.	Using a canister of R 134A coolant fluid, partly fill the equipment metering cylinder following the instructions given on page 20 onwards and then complete the operation of pressurizing the vehicle system as described previously.

NOTE *The pressurizing operation can also be interrupted if a larger amount of coolant fluid than that recommended is inadvertently introduced into the vehicle system.*

Having completed the operation of pressurizing the air conditioning system after having closed all the equipment pressure gauge taps (for all types of equipment) start up the engine or let it run and at the same time

After two minutes read off the value on the equipment high and low pressure side gauges for the air conditioning system then, using an appropriate thermal sensor connected to the electronic multimeter, measure the temperature of the air flowing into the passenger compartment out of the centre and side vents in the dashboard.

The system is working properly if the relationship between the temperature of the air coming out of the vents and the outside temperature is within the following values:

Ambient temperature	21°C	27°C	32°C	38°C	43°C
Temperature of air coming out of the vents	4° ÷ 7°C		6° ÷ 8°C		7° ÷ 10°C

Lastly, undo the unions for the equipment flexible pipes from the needle valves welded to the vehicle system pipes bearing in mind that for equipment where there is the possibility of recovering the

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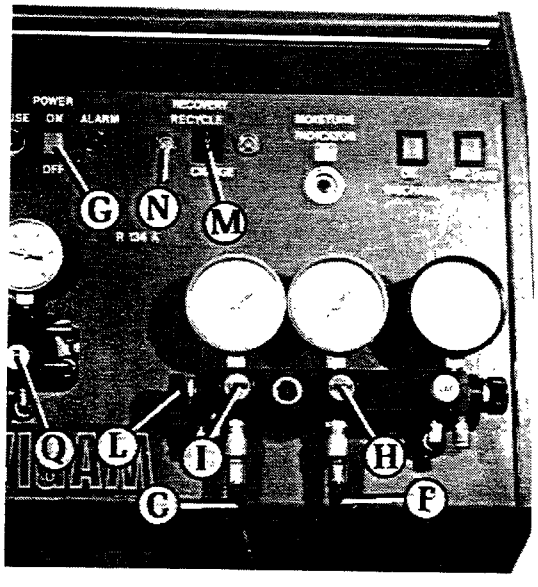
coolant fluid the taps on the flexible pipes must be closed first.

RECOVERING AND RECYCLING COOLANT FLUID

In order to recover (absorb) and then recycle the coolant fluid present in the climate control system using one of the two types of equipment in question the following operations must be carried out in the order given:

- start up the enigne and activate the climate control system;
- after 10-15 minutes de-activate the climate control system and switch off the engine;
- tighten the unions for the free ends of the equipment flexible pipes to the needle valves welded on the system pipes as described on page 23.

The operations which follow differ according to the type of equipment available.



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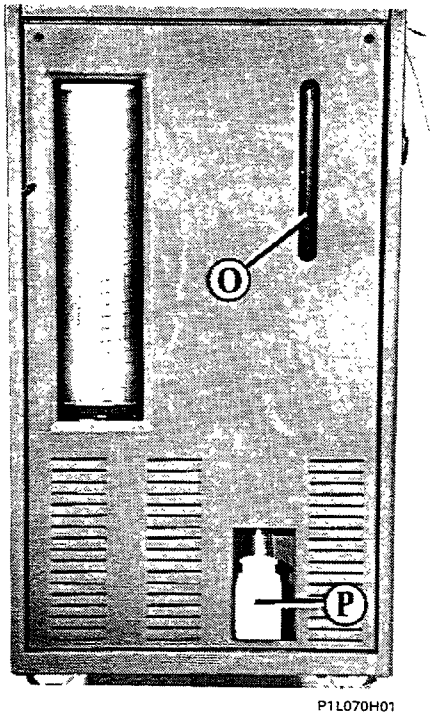
MURRAY EUROPE UP 12 EQUIPMENT

- open the taps fitted on the flexible pipes (C and F) which connect the equipment to the vehicle system;
- electrically connect the UP 12 equipment to a 220 V / 50HZ current socket and press the general switch (G); if it comes on this means that the system is receiving a voltage supply;
- open the HIGH (H) - LOW (I) - REF (L) taps and place switch (M) in position 1 (RECOVERY RECYCLE). The equipment will automatically start the operation of recovery and will stop when the operation is completed (the green warning light N coming on means that it is working properly);



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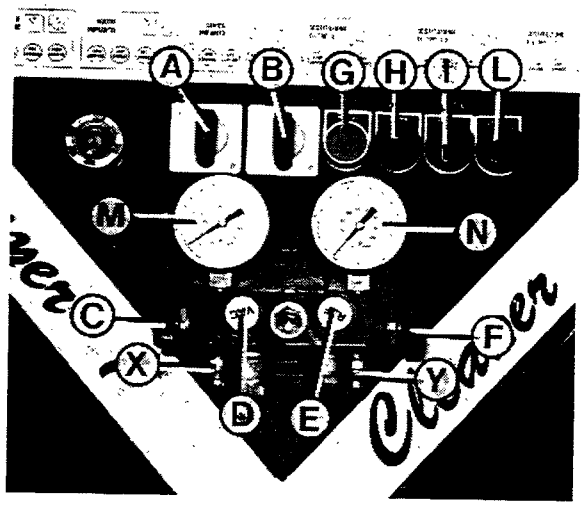
- at the end of the operation leave the equipment connected to the vehicle still for a further 10 minutes so that any pockets of coolant fluid at low pressure remaining in the system have the chance to absorb heat and increase in pressure and be recovered;
- press switch (M) placing it in the intermediate position 0 and close taps (H - I - L) mentioned above again;
- proceed with replacing the components in the system which are not working properly and, if necessary, undo the unions for the UP 12 equipment flexible pipes (C and F) from the valves after having closed the relevant taps;

At the end of the recovery operation the oil with the impurities separated from the coolant fluid can be seen in the distiller (O) column and when the OIL DISCHARGE switch (in the panel at the top right) is pressed it can be discharged into a special container (P) where it can be easily measured.

The same quantity of fresh oil, if necessary, can be introduced into the compressor to replace that absorbed by the equipment with the coolant fluid.



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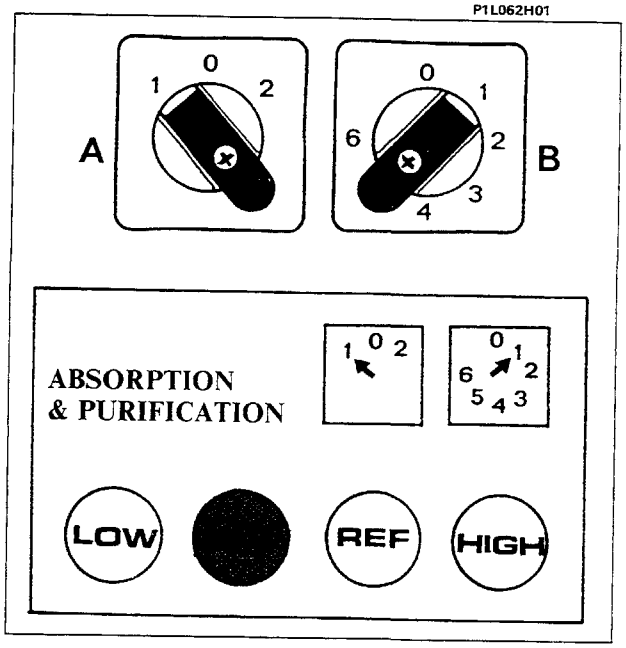

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The shaded top should remain closed.

ICF CLEANER 12 EQUIPMENT

- check that the equipment taps are closed and the knobs for the selector (A) and the switch (B) are in position 0 (off);
- electrically connect the equipment to a 220 V / 50 HZ current socket and turn the knob for the general switch (20 in the diagram in the centre of page 12) to the ON position (equipment receiving voltage supply);
- open the HIGH (F) - LOW (C) - REF (E) taps;
- check that the VAC tap (D) is closed;
- turn the knob for switch (B) to position 1 and the one for the selector (A) to position 1.

The equipment will automatically start the operation of absorbing the coolant in a gaseous state which after having circulated through the components accumulates in the metering cylinder (in a liquid state).

The regular carrying out of the operation mentioned above can be checked by observing the level of the oil separator, the humidityt indicator and the level indicator incorporated in the metering cylinder.

During the operation of absorbing the coolant fluid from the vehicle climate control system different conditions can occur, namely:

CONDITIONS	SYMPTOMS AND EFFECTS	OPERATIONS TO BE CARRIED OUT
The level of the coolant fluid in the metering cylinder reaches the maximum level.	The «LEVELS» warning light (L) comes on. The compressor and consequently the equipment stops working.	A
Any uncondensed gases accumulate in the upper part of the metering cylinder or inside creating excess pressure.	The breather valve at the top of the metering cylinder opens when the pressure reaches 15 bar.	
The pressure of the coolant fluid in the high pressure circuit reaches a value greater than 15 bar.	A pressure switch on the compressor supply pipe stops the operation of the compressor and consequently the equipment.	

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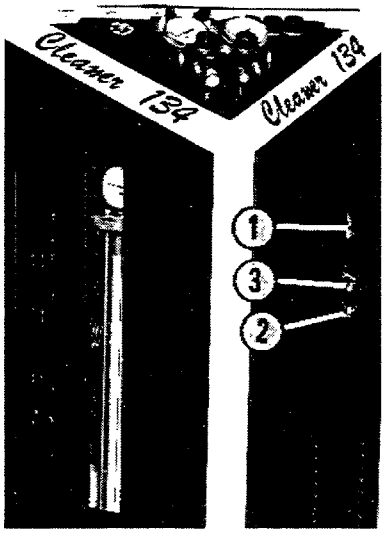
CONDITIONS	SYMPTOMS AND EFFECTS	OPERATIONS TO BE CARRIED OUT
The pressure of the coolant fluid at the equipment inlet and in the entire low pressure area reaches a value of -0.2 bar.	A pressure switch on the compressor inlet pipe stops the operation of the compressor and consequently the equipment. This condition which is what occurs at the end of the operation of absorption is signalled by the «LOCKED» warning light (I) coming on and the sounding of an alarm.	B

A Close the REF tap (E) for the pressure gauges and turn the knobs for the switch (B) and the selector (A) to position 0. Transfer a suitable amount of coolant fluid from the metering cylinder to another container and then complete the operation of absorption from the vehicle system which has been interrupted.

B Leave the equipment connected to the vehicle system to run for at least another 10 minutes so that any pockets of coolant fluid at low pressure remaining in the system have the chance to absorb heat and increase in pressure and be recovered.

To reduce the waiting time for the last operation described in the table it is possible to «force» the absorption of the coolant fluid still present in the system by pressing the "ON" button (G) which activates the operation of the compressor and checking the vacuum value reached on the light blue coloured low pressure side gauge.



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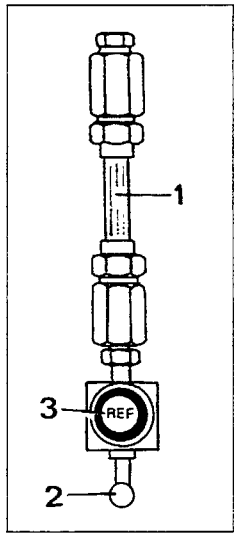

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At the end of the operation of absorbing, i.e. after having waited ten minutes or after having activated the "ON" button, turn the knobs for the switch (B) and the selector (A) to position 0 and close the "REF" tap (E).

At the end of the operation described above the oil separated inside the distiller from the coolant fluid absorbed can be seen by observing the level indicator (1) and it can be drained through the union (2) after having opened the tap (3).

If necessary, the same amount of fresh anti-freeze can be introduced into the compressor to replace that absorbed by the equipment with the coolant fluid.

CHECKING VEHICLE SYSTEM PRESSURES

In order to check the pressure of the coolant fluid during the operation of the climate control system, after having tightened the two unions for the free ends of the two equipment flexible pipes to the valves as described on page 23, simply open the taps and read off the values on the two pressure gauges, the light blue low pressure side and the red high pressure side.

DISCONNECTING THE EQUIPMENT FROM THE VEHICLE SYSTEM

The unions at the ends of the equipment flexible pipes can be simply undone from the climate control system valves after closing the taps on the pipes.

The two equipment flexible pipes disconnected from the vehicle system remain full of coolant fluid which can be accumulated in the metering cylinder by carrying out a recovery - recycling cycle (following the instructions given on page 70).

After these operations the equipment is ready to be reconnected and to carry out any operation without the danger of damaging the vacuum pump or dispersing coolant fluid into the atmosphere.

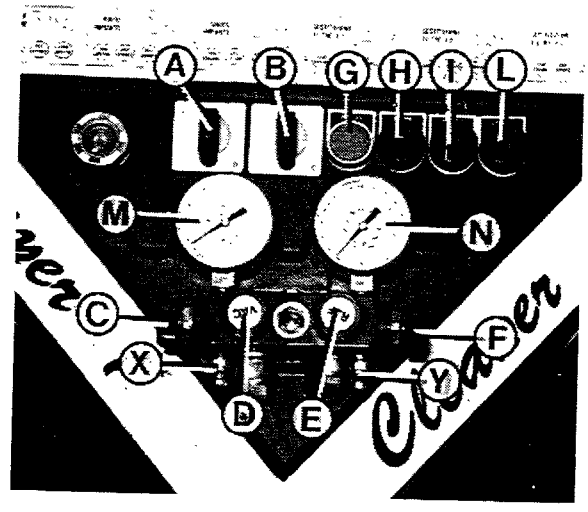
TRANSFERRING COOLANT FLUID FROM THE METERING CYLINDER TO A CONTANER (CANISTER)

This operation is necessary when during the absorption and purification of the coolant contained in the climate control system the maximum level (on the cylinder outside of the metering cylinder for the UP 12 equipment or on the metering cylinder for the Cleaner 12 equipment) is reached or when for any reason whatsoever (plan to exceed the maximum level by carrying out the previous operation) it is desired to transfer the purified coolant fluid into any container (homologated for pressures of up to 35 bar).

Using the Cleaner 12 equipment it is automatically de-activated when the level of the coolant fluid inside the metering cylinder inadvertently reaches the maximum level whilst for the other equipment mentioned above care must be taken that the level of the coolant fluid in the metering cylinder column does not exceed the maximum level line on top of the external graduated cylinder.

After making sure that a vacuum has been created in the container to which the coolant fluid is going to be transferred (a value of at least - 0.1 bar), carry out the following operations:

- if absorbing the coolant fluid from the vehicle system, close the HIGH tap (F or 6) for the equipment pressure guage and after having closed the tap fitted on the red flexible pipe undo or detach the union at the end of the pipe and tighten or fit it on the service valve for the container to be filled;
- if no operation is being carried out, tighten the union for the free end of the red flexible pipe (high pressure side) to the service valve for the container to be filled;
- make sure that the buttons or the knobs for the switches controlling the equipment being used are in position 0 and that the taps for the pressure gauges are closed, then open those marked HIGH (F or 6) and RED (E or 5);
- if the Cleaner 12 equipment is being used, turn the knob for switch (B) to position 2 and that for selector (A) to position 1;
- if the UP 12 equipment is being used, press the button for the switch (3) to position 2 CHARGE (indicated by the white warning light 4 coming on);



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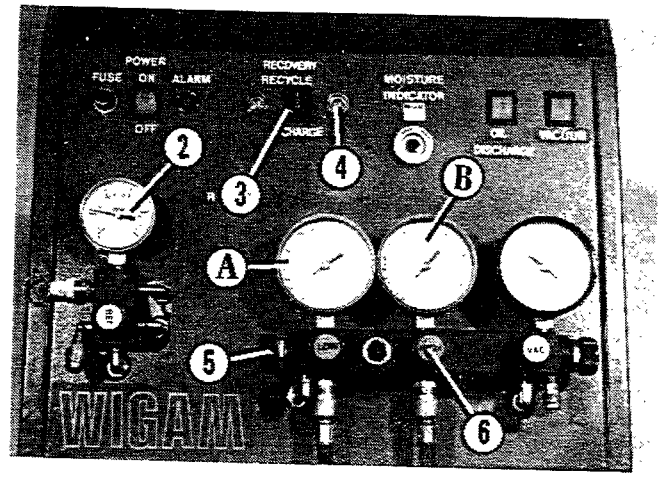

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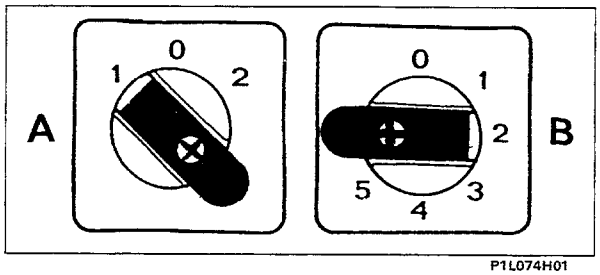

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On account of the difference in pressure the coolant fluid is transferred from the equipment metering cylinder to the container (canister) and when the amount of fluid in the latter reaches the pre-set level (equivalent to the difference between the initial level and the final level in the equipment metering cylinder column) the operations which follow should be carried out.

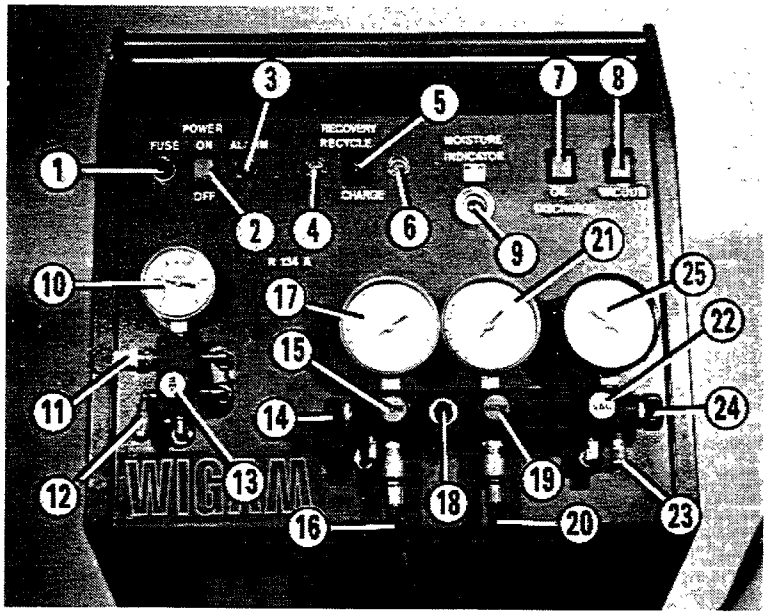
For the Cleaner 12 equipment turn the knobs for the switch (B) and the selector (A) to position 0, whereas for the UP 12 equipment press the switch (£) so that it is in the intermediate position 0, then close the tap for the container and the HIGH (F or 6) and REF (E or 5) taps for the equipment pressure gauges.

Lastly undo the union for the red flexible pipe from the container service valve and cover the latter with a special plug.

After these operations the previously interrupted operation of absorbing the coolant fluid from the vehicle system can be resumed (first case mentioned above) after having once again tightened the union for the red flexible pipe to the high pressure side valve.

NOTE ***Never introduce more coolant fluid into a container than the maximum weight capacity - always fill it to below 80% of its capacity***

UP 12 EQUIPMENT (PROCESSING UNIT)



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10. Pressure gauge for measuring pressure in the metering cylinder
11. Safety valve and valve for draining uncondensed gases
12. Attachment for tap (13) service pipe
13. «REF» tap for draining and pressurizing metering cylinder
14. «REF» tap (for coolant)
15. «LOW» low pressure side tap
16. Low pressure side flexible pipe
17. Low pressure side gauge (light blue)

View of upper tilted panel

1. 4 A fuse
2. General switch with warning light incorporated
3. «ALARM» warning light
4. Recovery - recycle function warning light
5. Three position switch for selecting recovery/recycle and pressurizing functions
6. Re-pressurizing function warning light
7. Switch for draining oil separated from coolant fluid
8. Vacuum pump on switch
9. Inspection window for coolant in liquid state with humidity indicator
18. Coolant warning light
19. «HIGH» high pressure side tap
20. High pressure side flexible pipe
21. High pressure side gauge (red)
22. Vacuum pump «VAC» tap
23. Safety valve for vacuum gauge (25)
24. Vacuum gauge «VAC» tap
25. Vacuum gauge

According to the colour of the warning light the amount of humidity present in the coolant fluid in a liquid state which has passed through the first three filtering stages can be detected and the values depending on the temperature corresponding to the three different colours are given in the table below:

SEAL COLOUR AND SYMBOLS	HUMIDITY CONTENT (in parts per million)		
	24° C	38° C	52° C
GREEN DRY (SECCO)	Less than 5	Less than 10	Less than 20
PEA GREEN CAUTION (ATTENZIONE)	5 ÷ 10	10 ÷ 30	20 ÷ 50
YELLOW WET (UMIDO)	More than 15	More than 30	More than 50

The intense green colour indicates that the coolant fluid absorbed and purified is in good condition; the pea green colour indicates that it contains a certain percentage of humidity which is still acceptable whilst yellow indicates a value which is no longer acceptable and means that the filters must be replaced at the end of the cycle.

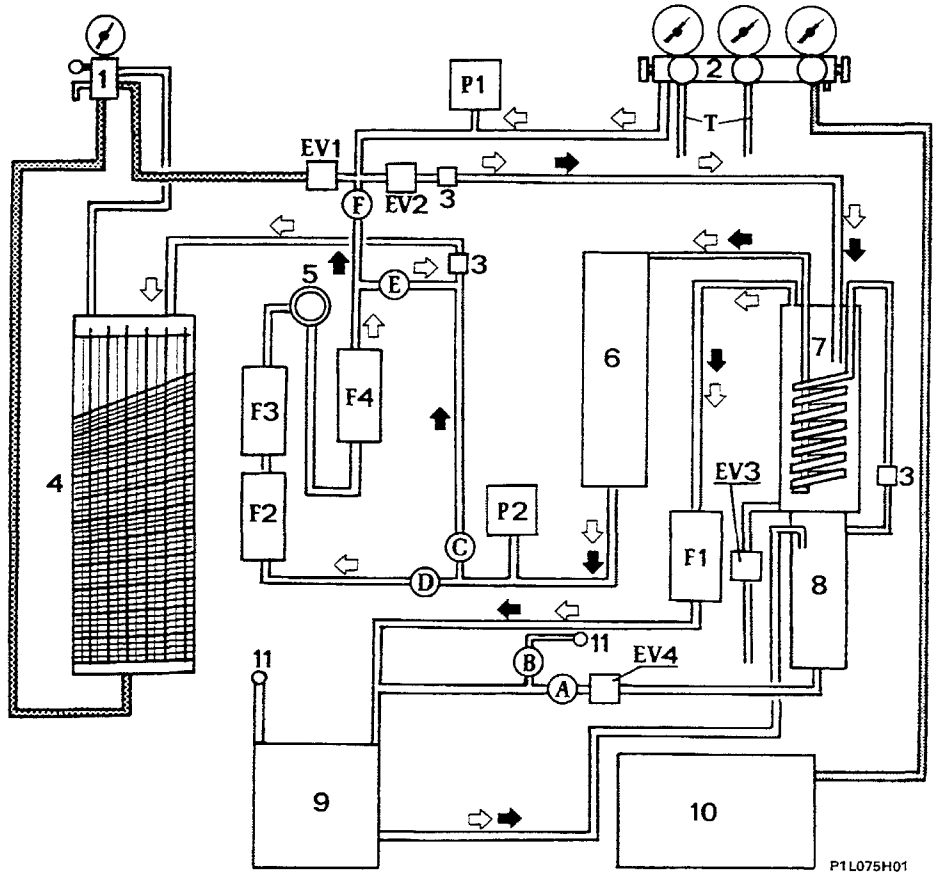

Diagram showing treatment of coolant fluid

1. One way pressure gauge
2. Five way pressure gauge
3. Single-acting (one-way) valves
4. Metering cylinder
5. Warning light with humidity indicator
6. Condenser
7. Distiller
8. Oil separator
9. Compressor
10. Vacuum pump
11. Service attachments

P1. Safety pressure switch

P2. Supply pressure switch

F1 - F2 - F3 - F4. Filters

EV1 - EV2 - EV3 -EV4. Solenoid valves

A - B - C - D - E - F. Manual valves (taps)

T. Flexible pipes connected to vehicle system

Vacuum circuit
Pressurizing circuit

The white arrows indicate the direction of the flow of coolant fluid in the recovery and recycle circuit.
The black arrows indicate the direction of the flow in the circuit for recovering the gases from the filters.

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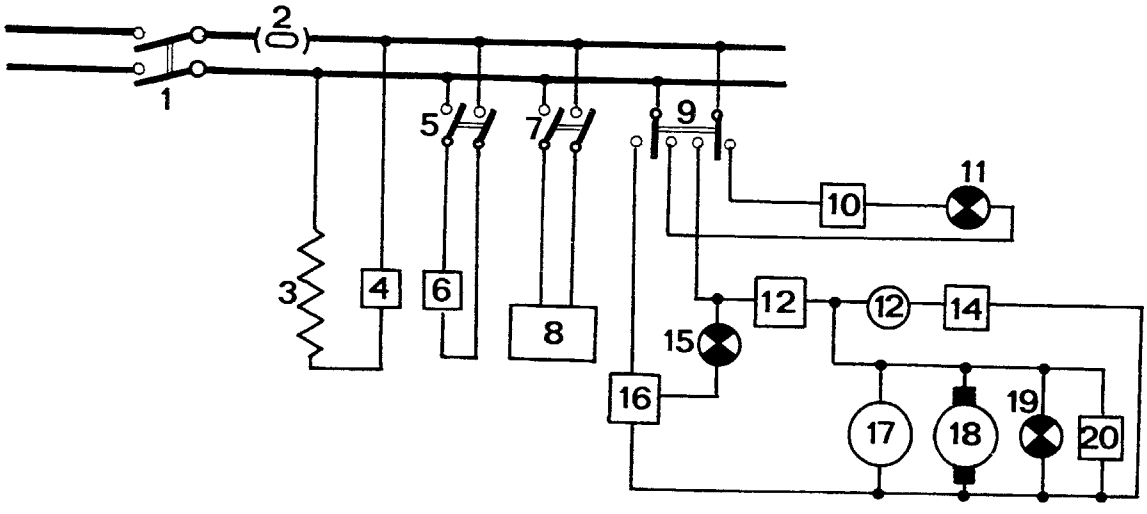

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Wiring diagram showing various controls

1. General switch with warning light incorporated
2. 4 A fuse
3. Heating resistance for metering cylinder
4. Thermostat
5. OIL DISCHARGE switch with warning light incorporated
6. Solenoid valve EV3
7. VACUUM switch with warning light incorporated
8. Vacuum pump
9. Three position switch RECOVERY RECYCLE - CHARGE
10. Solenoid valve EV1
11. White coloured warning light for activating pressurizing function
12. Supply pressure switch
13. Supply regulator
14. Solenoid valve EV2
15. Red coloured ALARm warning light
16. Safety pressure switch
17. Compressor
18. Condenser fan
19. Green coloured warning light for activating recovery - recycle function
20. Solenoid valve EV4

MAINTENANCE

Periodically check (every ten operations) the level of the oil in the vacuum pump and in the compressor. The level of the oil should reach halfway up the inspections windows and it should be checked with the equipment switched off.

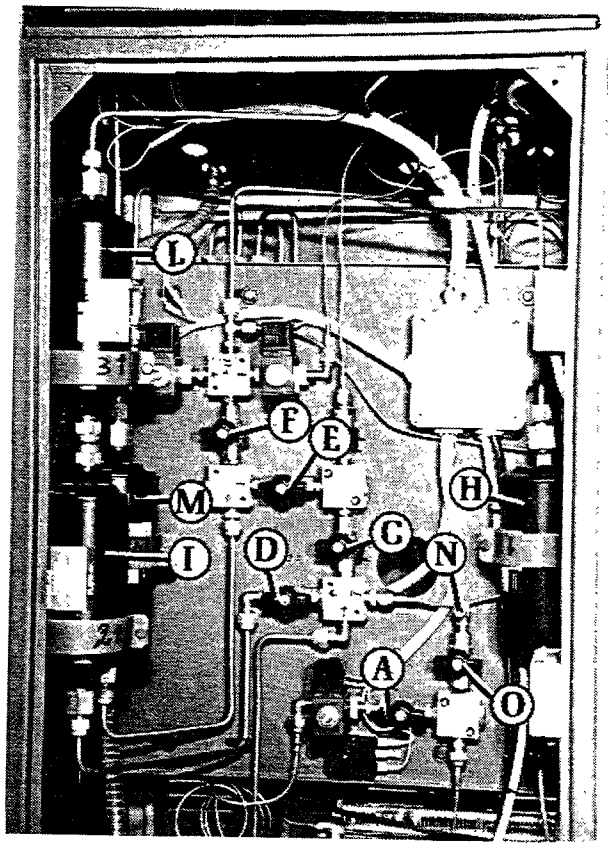
VACUUM PUMP

To top up the level of the oil or to change it, use only Wigam K1L type oil.
If the equipment is normally used daily, change the oil at least once per season after having let the vacuum pump operate for at least 10 minutes with the inlet closed.

REPLACING THE FILTERS

When the colour of the humidity indicator starts to become yellow the filters should be replaced; three F 25 type filters should be available for this operation because the safety filter (F4 in the diagram on the previous page) should be used in place of filter (F1).
Carry out the following operations to replace the filters:

- remove the rear panel for the equipment;



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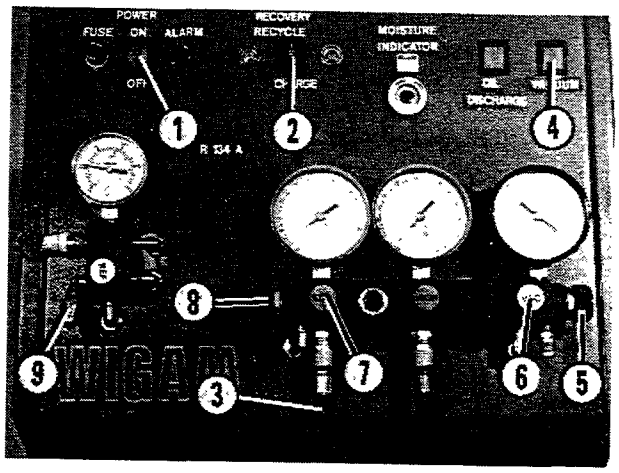

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- close the manually operated valves (A - D - E) and open valves (C and F) and make sure that all the taps on the pressure gauges are closed;
- electrically connect the UP 134/A equipment to a 220 V socket and carry out the recovery - recycle (by pressing switches 1 and 2);
- having completed the recovery operation, switch off the equipment and undo the unions which connect the filters F1 (H) - F2 (I) - F3 (L) and F4 (M);
- replace the above mentioned components with new filters F2 - F3 - F4 (I-L-M) whilst the old filter F4 (M) should be fitted in place of the first one (H);
- after having connected the above mentioned filters to the respective pipes change the oil in the compressor following the instructions given in the chapter which follows;
- electrically connect the Up 134/A equipment and connect the low pressure side flexible pipe (3) to the service attachment (N);
- switch on the vacuum pump by pressing the switch (4) and open the taps (5 - 6 - 7 - 8) for the five way pressure gauge, the tap for the rapid attachemtn union connected to the end of the flexible pipe (3) and the service valve (O);
- drain for at least 20 to 30 minutes and then check that there are no leaks as described on page 5;
- close all the taps for the five way pressure gauge and then close valves C and F and open valves A - D - E and disconnect the flexible pipe (3) after having closed the tap for the rapid attachment union and the safety valve (O).

After these operations the equipment is ready to carry out other operations.

NOTES *After replacing the filters it is advisable to carry out a recovery - recycle cycle for the coolant fluid present in the pressurizing metering cylinder. Before the humidity indicator becomes green once again it may be necessary to absorb 2 or 3 kg of coolant fluid.*

CHANGING THE OIL IN THE COMPRESSOR

Each time the filters are replaced it is also advisable to change the oil in the compressor using Est 1 type oil.

After carrying out the first four operations in the previous chapter (REPLACING THE FILTERS) carry out the following operations:

- remove the drain plug with the level inspection window and tilt the latter towards the equipment to facilitate the complete draining of the oil from the compressor;
- stop the draining of the oil by refitting the plug;
- during the seventh operation in the previous chapter, connect the service pipe with the service attachment to the compressor and draw off the amount of new oil required to reach the optimum level (halfway up the inspection window) from the appropriate container;
- disconnect the service pipe from the above mentioned attachment and then continue the evacuation operation described in the previous paragraph (operation 7).

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