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Air conditioning system

The air conditioning system provided with the vehicle holds the temperature and air flow in the passenger compartment to the values set by the driver through a special push-button panel.

The air conditioning system has the following features:

- automatic temperature-ventilation-air distribution control functions;
- with recirculation function;
- with air flow distribution function.

The system operation is controlled by a special control unit through the driver's commands set on a push-button panel fitted on the tunnel.

Air conditioning push-button panel (Fig.1)

A.	TEMP + button
B.	TEMP – button
C.	AIR + button
D.	AIR – button
E.	VENT button
F.	BI-LEVEL button
G.	HEAT button
H.	DEFROST button
I.	TEXT button
L.	AUTO button
M.	RECIRCULATION button
N.	Display



Fig.1



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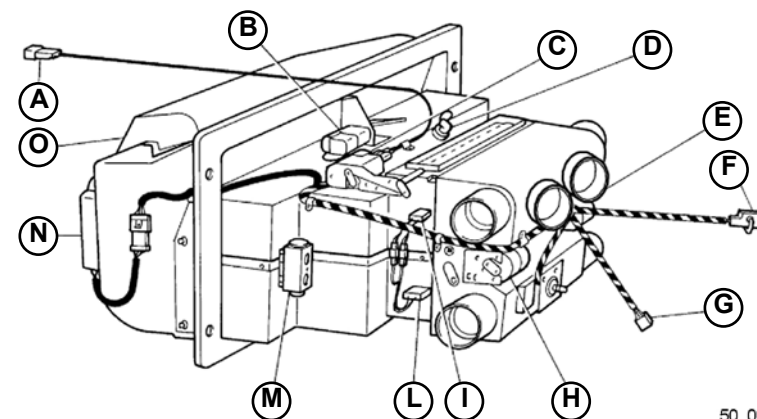
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The air conditioning unit, fitted under the dashboard is equipped with:

- a heating radiator connected to the engine cooling system;
- a conditioning evaporator connected to the car conditioning system;
- motor fans and flaps for ventilation and air distribution control;
- internal and outside temperature sensor and solar irradiation sensor for temperature control.

Air conditioning unit (Fig.2)

A.	Solar irradiation sensor (IRR)
B.	Recirculation function actuator
C.	Defrost function actuator
D.	Frost sensor temperature sensor (TSAB)
E.	Upper vent actuator
F.	Outside temperature sensor (TE)
G.	Passenger compartment temperature sensor (TA)
H.	Lower vent actuator
I.	Temperature sensor at upper vents (TT1)
L.	Temperature sensor at lower vents (TT2)
M.	Expansion valve
N.	Motor fan regulator
O.	Motor fan



50_02
Fig.2



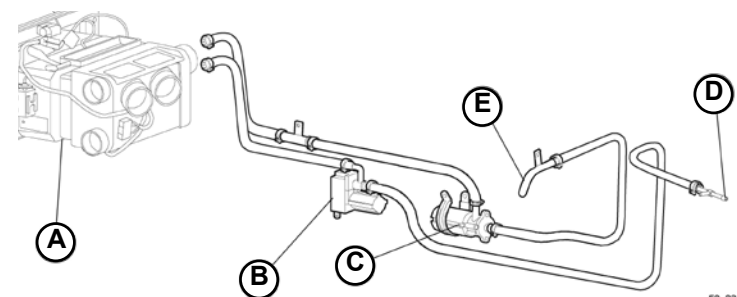
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The heating radiator is supplied by the engine coolant taken from cylinder head outlet through a special solenoid valve proportioning its flow rate. The minimum flow rate through the radiator is guaranteed by a special minimum pump fitted on the radiator expansion tank return line.

Heating system (Fig.3)

- | | |
|----|---------------------------------|
| A. | Air conditioning unit |
| B. | Heating solenoid valve |
| C. | Minimum flow rate pump |
| D. | Line to radiator expansion tank |
| E. | Head water outlet line |



50_03
Fig.3



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The air conditioning built-in evaporator is supplied by a compressor fitted behind the engine. The system condenser is installed in front of the left rear radiator of the engine cooling system.

The coolant used by the air conditioning system is R134a.

Air conditioning system (Fig.4)

- | | |
|----|--------------------------------|
| A. | Air conditioning unit |
| B. | Compressor |
| C. | Condenser |
| D. | Receiver-drier |
| E. | Coolant filling/draining valve |

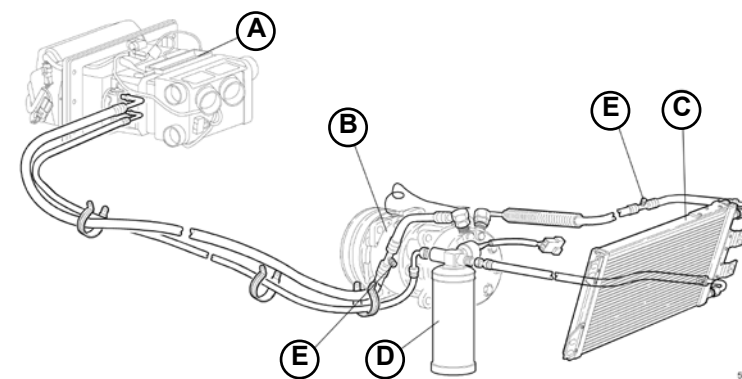


Fig.4



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The air is distributed in the passenger compartment via a set of vents that guarantee proper air recirculation, heating and conditioning (**Fig.5**).



Fig.5



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General Overview

This is the most common operating condition. Temperature settings are made automatically to ensure maximum comfort for occupants.

Under this condition the display shows (Fig.6):

requested temperature

recirculation status

air distribution status

ventilation status

AUTO message next to ventilation and air distribution.

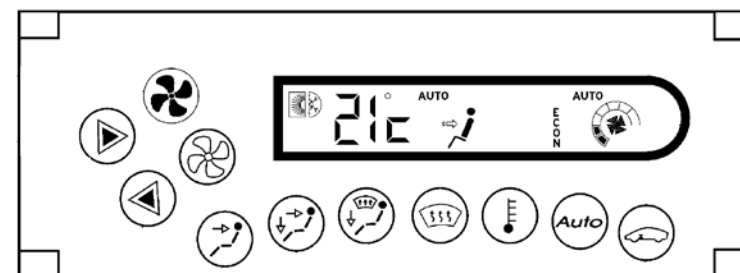


Fig.6



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Start-up transient strategy (cold engine)

The start-up transient strategy is a special operating method designed to ensure comfort to occupants also when the passenger compartment heating system is not able to work.

This is because at cold starting the system does not have an adequate source of heat. Starting the climate control under such conditions would entail letting in the passenger compartment a considerable amount of cold air which may annoy occupants.

In such condition the system automatically sets to:

- maximum heat;
- minimum ventilation;
- DEF air flow distribution;
- recirculation open;
- compressor on.

The system holds these settings until the engine water temperature reaches a value which is sufficient for automatic climate control.



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Temperature

The system adjusts the temperature at the vents to reach the required value (set on the display) according to the following parameters:

- passenger compartment temperature (TA);
- requested temperature (TR);
- outside temperature (TE);
- fan speed (Q);
- solar irradiation (IRR).

The temperature is computed by means of thermal balance equations in the passenger compartment by using suitable mathematical algorithms.

The adjustment range goes from 16°C (LO) to 31°C (HI).



System operation also depends on the outside temperature.

Actually, with outside temperatures below 16°C, even if the LO value is selected, the system delivers air warmer than the outside one.

Likewise, with outside temperatures over 31°C, even if the HI value is selected, the system delivers air colder than the outside one

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Ventilation

The fan speed is computed according to the following parameters:

- Passenger compartment temperature;
- Requested temperature;
- Outside temperature;
- Solar irradiation.

The fan speed can be set to eight levels, each of which is a 10% increase of the maximum flow rate, starting from 30%.

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Air distribution

For computing air distribution, the automatic climate control system considers the air temperature at vent outlet, given the general rule that in order to ensure comfort air should come out from the “lower” vents as the temperature increases.

In particular:

- with warm air ($TT > 50^{\circ}\text{C}$), the air flow should reach the passenger from the upper and lower vents (HEAT);
- with cool air ($TT < 30^{\circ}\text{C}$), the air flow should be frontal (VENT);
- at intermediate temperatures, a “foot/face” air flow pattern is adopted (BI-LEVEL).

The air flow distribution pattern is adjusted on the basis of a hysteresis threshold to ensure greater stability in the system.

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Recirculation

The system automatically activates the recirculation function when the following conditions are present at the same time:

- outside temperature $\geq 28^{\circ}\text{C}$;
- inside temperature $<$ outside temperature;
- compressor on.

The system opens the recirculation flap to let in outside air when the outside temperature drops below 26°C .

The recirculation flap will be opened in any case after thirty consecutive minutes for two minutes and then closed again to let fresh air into the passenger compartment. The recirculation function symbol on the display will flash when this occurs.

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In HI mode, the system provides the maximum possible heat output.

In particular, the system sets to the following conditions:

- maximum air temperature at vents allowed by the system;
- maximum ventilation;
- compressor off;
- recirculation open;
- HEAT air flow distribution.

The system will remain in HI mode until a new command is received from the user. In this case, manual settings (fan speed, air flow and recirculation) will be allowed and will have priority over the automatic settings.

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In LO mode, the system provides the maximum heat output available for cooling.

In particular, the system sets to the following conditions:

- minimum air temperature at vents allowed by the system;
- maximum ventilation;
- compressor on;
- automatic recirculation;
- VENT air flow distribution.

The system will remain in LO mode until a new command is received by the user. In this case, manual settings (fan speed, air flow and recirculation) will be allowed and will have priority over the automatic settings.

The recirculation control will always be automatic.

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Compressor

The compressor is switched off by the system when the temperature inside the evaporator reaches values which may lead to the formation of ice since this could affect the proper operation of the system.

The compressor switch-off threshold is fixed at 2 °C. The compressor will be switched on again once a temperature of 4 °C is reached.

The compressor will always be switched on in MAX-DEF mode and will automatically be switched off during normal operation under the following conditions:

- fan off;
- HI system status.

An error concerning the frost sensor (short circuit or open circuit) will cause the compressor coupling disconnection.

The compressor will be automatically restarted by the system when normal conditions are restored.

The compressor will be activated for a few seconds every 30 minutes to ensure lubrication also when it is off.



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In manual ventilation or distribution operation, the message MANUAL will appear on the display next to the corresponding section. The meaning of the remaining information will be the same as in automatic operation. The manual recirculation selection is shown by the corresponding status indication.

In manual settings it is important to remember that:

- **Manual ventilation** selection will always have priority over automatic operation. The message MANUAL will appear on the display over the air distribution indication.
- **Recirculation** will be switched on whenever the user presses the related button. In any case, the recirculation flap will be opened for two minutes after it has been closed for thirty consecutive minutes and then it will be closed again to let fresh air into the passenger compartment.
- **The compressor** will be switched off when the AUTO button is pressed. In this case, the message ECON will appear on the display. This message will flash if the temperature at the vents required for reaching the requested temperature (set on the display) is lower than the temperature of the air at climate control module intake, indicating that the requested temperature cannot be reached while the compressor is off. The ECON message will appear fixed if, on the other hand, compressor operation is not needed to reach the required temperature. The ECON message will disappear when the AUTO button is pressed again to indicate that the compressor is operating automatically. The compressor will be operated in any case for a few seconds every 30 minutes to ensure lubrication also when it is off.
- The **MAX-DEF** mode, switched on by holding the DEF button pressed for two seconds, is used to demist the windscreen. The following conditions are established when the function is on:
 - compressor on;
 - DEF air flow distribution;
 - recirculation open;
 - maximum fan speed.

The air temperature at the vents is set to the maximum if the outside temperature is lower than 15 °C.

The system will stay in MAX-DEF mode for five minutes and then it will return to the previous settings.

The transition to the initial status can be controlled by pressing either the TEMP +/-, AIR +/- or air flow distribution buttons.

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In normal conditions, the temperatures (outside and requested) are shown in Celsius degrees.

The display can be switched to Fahrenheit degrees at any time as follows:

- Hold the outside temperature display request button pressed for approximately six seconds. After this time, the requested temperature will be displayed in Fahrenheit degrees and the temperature measurement unit will be switched to "F".
- Power down the system by turning the ignition key to OFF;
- Power up the system by turning the ignition key to ON.

The control unit will display the (outside and requested) temperatures in Fahrenheit.

The reverse procedure is possible at any time according to the same method.

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Air conditioning system check

Check the following fundamental aspects to prevent malfunctioning and ensure the correct system operation:

- Keep the climate control system control unit away from sources of high heat, e.g. in a painting oven (remember that it is good practice to remove all electronic control units from the vehicle in this case);
- Remember to disconnect the negative battery terminal and all the electronic modules before performing electrical welding operations on the vehicle (injection-ignition control unit, coil power modules, climate control / air conditioning system control unit, etc.);
- Do not apply voltage higher than or different from the vehicle battery voltage, e.g. when jump starting using an auxiliary battery make sure that the voltage is the same and the connection polarity is correct;
- Always ensure the utmost cleanliness during coolant circuit maintenance operations. This is because particles of dirt could obstruct the coolant passage through the expansion valve and cause poor system operation;
- Store receiver-driers in a dry place to ensure long life;
- Regularly check the conditions, alignment and tension of the compressor drive belt. Furthermore, check the compressor oil level;
- Make sure that there are no leaks from the heating or air conditioning system;
- Check that the system is charged with at least 850/900 grams of specified fluid;
- Check that the electrical connections of the various components and the system wiring are in good condition (sensors, climate control unit, compressor, etc.);
- Always make sure that the coolant has been drained and collected in a suitable device before disconnecting any line.



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The present section contains the following disassembly sequences:

- A. air conditioner disassembly
- B. air conditioner filter disassembly



A. air conditioner disassembly

Preliminary operations

- Disassemble the silencer safety grid (025103).

Air conditioner disassembly

1. Drain the Freon from the air conditioning system and disconnect the delivery and intake hoses from the compressor.
2. Remove the delivery (A-Fig.1) and intake pipe mounting clamps on the water pump and remove the pipes (B-Fig.1).



NOTE

Position a container under the vehicle to collect the coolant.

3. Remove the rear cross member, unscrewing the 4 screws (C-Fig.2) of the two inner sides.

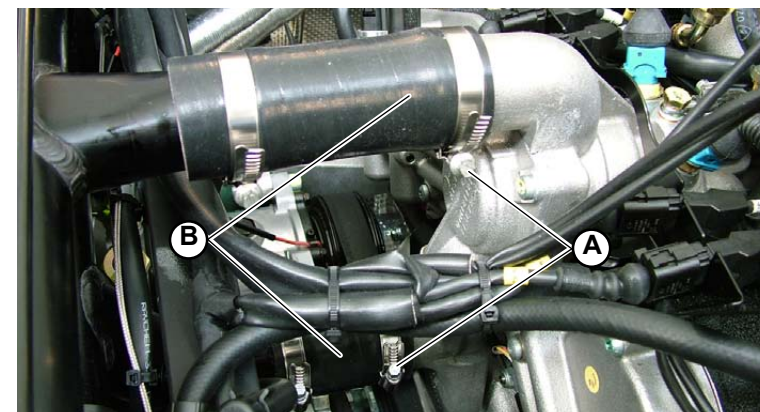


Fig.1

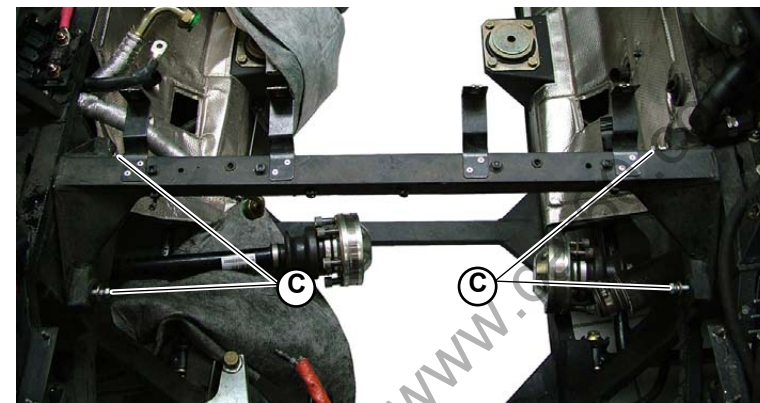


Fig.2



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4. Remove the auxiliary belt (010103).
5. Remove the three screws (D-Fig.3) that secure the heat-proof screen (E-Fig.3) to the lower support.

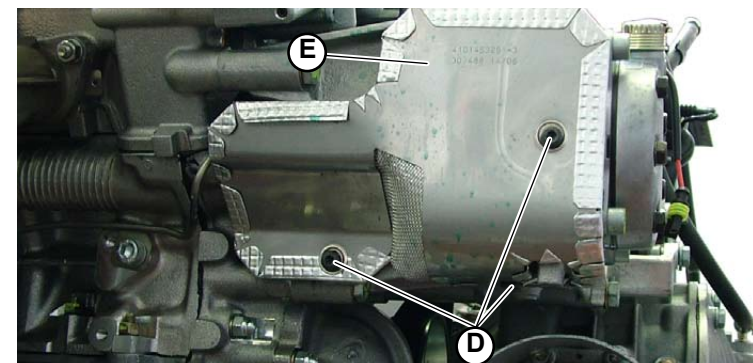


Fig.3

6. Remove the 4 screws (F-Fig.4) securing the power steering pump frame, air conditioning system compressor and alternator (G-Fig.4); remove the frame without damaging the pipes.

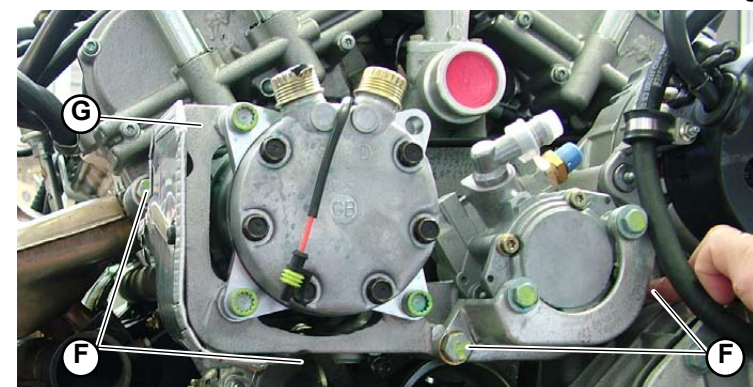


Fig.4

7. Remove the 6 screws (H-Fig.5) that secure the compressor (I-Fig.5) to the support; then remove the compressor and the pulley.

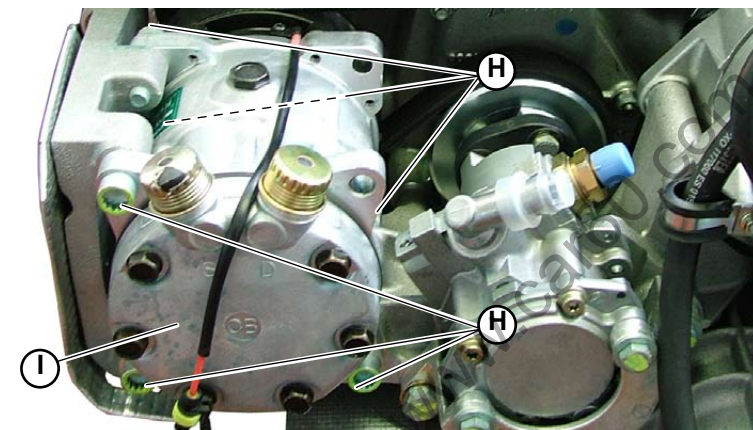


Fig.5



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B. air conditioner filter disassembly

- Open the front bonnet.
- Manually remove the safety grids (**A-Fig.6**) on either side of the luggage compartment.
- Unscrew the fixing screws (**B-Fig.6**) to access the filters.
- Remove the air conditioner dustproof filters.



Fig.6

www.car60.com



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The present section contains the following assembly sequences:

- A. Air conditioner assembly
- B. Air conditioner filter assembly



A. Air conditioner assembly

1. Position the compressor (**A-Fig.1**) and secure it onto the support using the 6 screws (**B-Fig.1**).
Screw attachment: **tightening torque (000800-6c)**.
2. Position the power steering pump frame, air condition system compressor and alternator (**C-Fig.2**) and secure it using the 4 screws (**D-Fig.2**), without damaging the pipes.
Screw attachment: **tightening torque (000800-6d)**.
3. Install the auxiliary belt (**010105**).

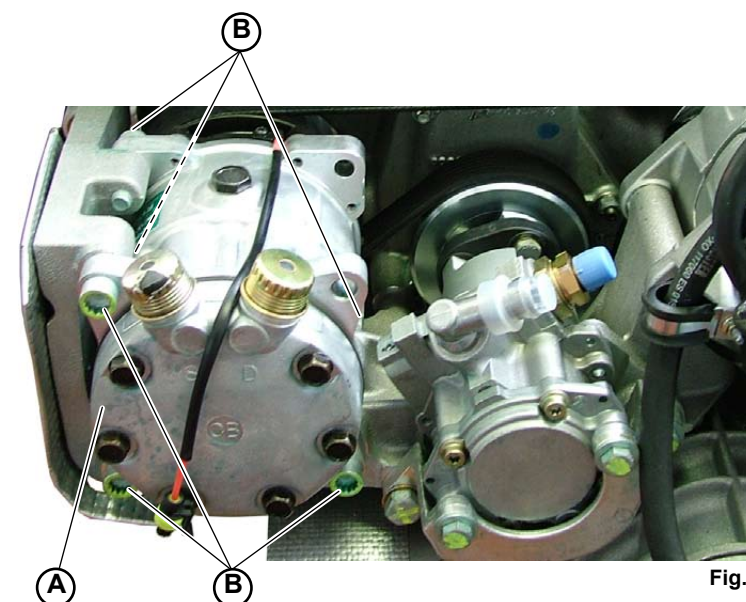


Fig.1

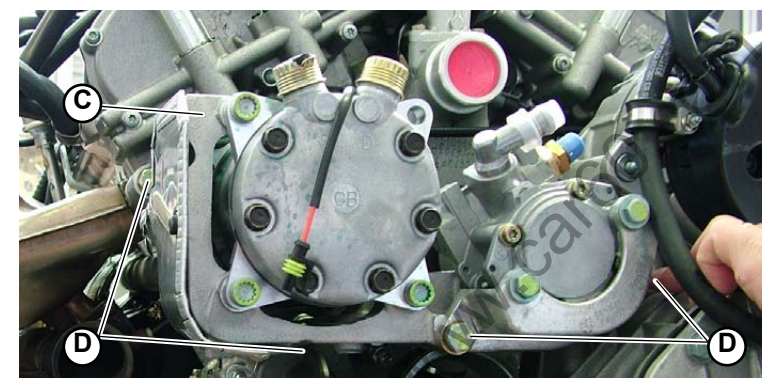


Fig.2



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4. Secure the heat-proof screen (**E-Fig.3**) to the lower support using the three screws (**F-Fig.3**).

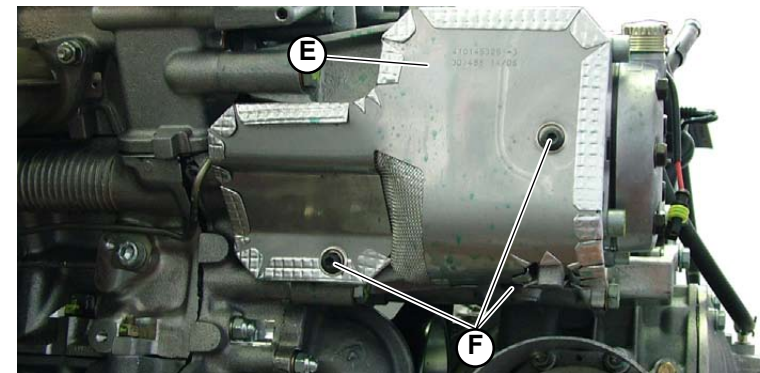


Fig.3

5. Assemble the rear cross member, tightening the 4 screws (**G-Fig.4**) onto the two inner sides.

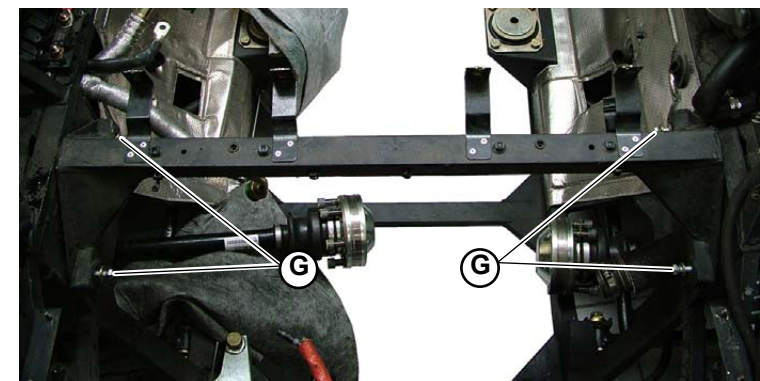


Fig.4

6. Reconnect the water pump delivery and intake pipes (**H-Fig.5**), securing them with the clamps (**I-Fig.5**).



NOTE

Top up the engine coolant (**022107**).

- Fill the air conditioning system.
- Install the silencer safety grid (**025105**).

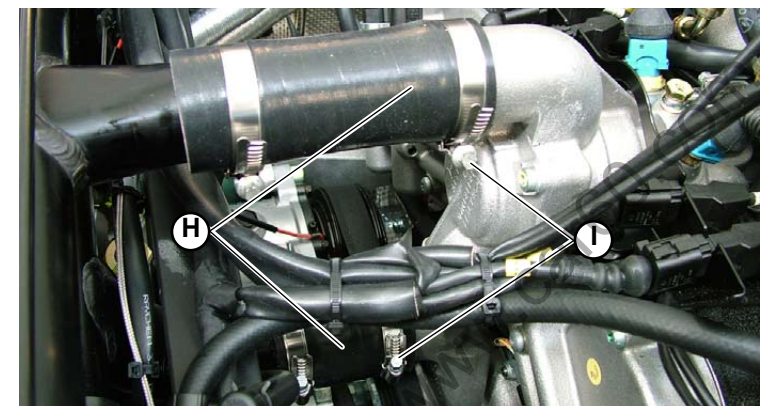


Fig.5



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B. Air conditioner filter assembly

- Reposition the air conditioner dustproof filters in their housing.
- Tighten the 4 fixing screws (**A-Fig.6**).
- Clip the safety grids (**B-Fig.6**) on either side of the luggage compartment.
- Close the front bonnet.

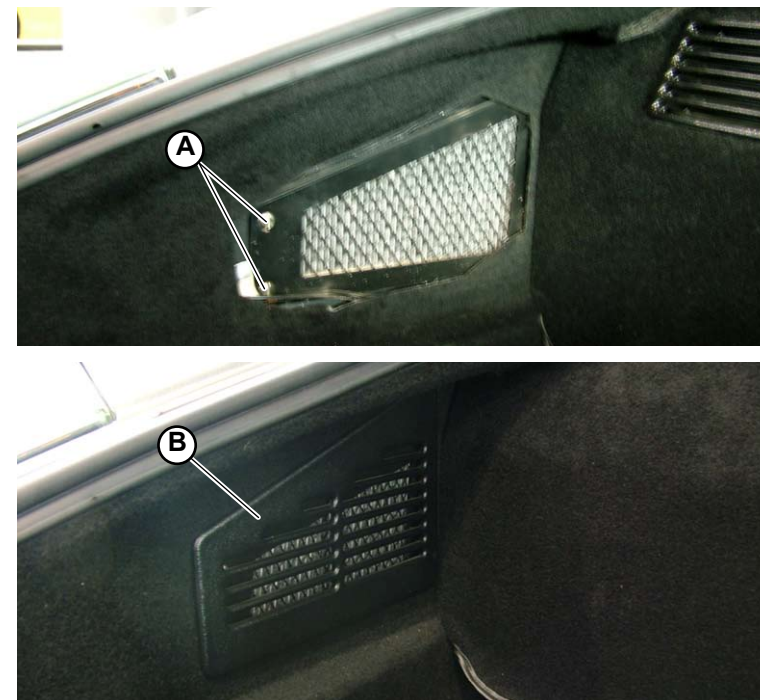


Fig.6

www.car60.com



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Air conditioning system filling



This system employs R134a coolant (tetra-fluoride-ethane) which is classified as an environmental-friendly substance by the legislation in force. Never use this coolant in systems operating with the previous R12 fluid (Freon 12).

For reasons of incompatibility between compressor oil and coolant, R12 cannot be used in systems designed to run on R134a.



Do not dispose of R134a directly into the atmosphere. Despite the fact that the ozone depletion potential of the substance is equal to zero, it does have a potential global warming factor. For this reason, collection and recycling are subject to legal controls.

Always use type-approved coolant collection/recycling devices to capture the coolant drained from the air conditioning system. Do not mix different coolants in the same device



CAUTION!

When servicing air conditioning systems or compressors, always wear protective glasses and gloves.

Carry out these operations in properly ventilated and free of naked flames areas.

Connect the special device for collecting the coolant to the port located on the compressor intake pipe, that can be accessed from the left rear wheel arch compartment.

Drain the system slowly to prevent the formation of ice inside the expansion valve and oil leakage from the compressor.

After draining the system completely, bleed the air from the coolant charging cylinder and system.

A vacuum of approximately 0.5 ÷ 0.6 bars in the system is required according to the device used.

Check system tightness for at least 15 minutes after eliminating all the air from the system.

If the system is not airtight, fill with approximately 500 grams of coolant and locate the leak.



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Add a small amount of fluorescent fluid to the coolant to facilitate leak location. The presence of the leak will appear under the light of specific leak locating lamps.



CAUTION!

Do not use naked flames to locate leaks. A particularly hazardous gas (phosgene) could be formed.

The system draining and refilling operations must be carried out with the special device connected to the points shown in the figures (**Fig.1** - Low pressure circuit valve) (**Fig.2** - High pressure circuit valve).

After checking system tightness, refill it with 850/900 grams of the prescribed coolant. To refill the system, start the engine up, select the lowest temperature on the control panel and make sure the climate control system control unit causes the compressor electromagnetic clutch to engage.

When the system is filled up, let it run for approx. 10-15 mins and check that the coolant flowing through the receiver-drier is in liquid state.

To check oil level inside the compressor, place it in horizontal position and, after removing the plug, make sure oil level matches the filling hole. Top up with the prescribed oil, if necessary.

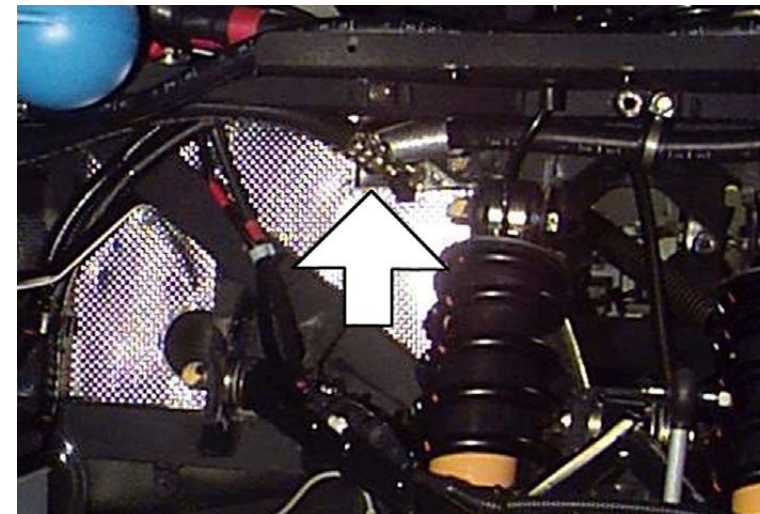


Fig.1

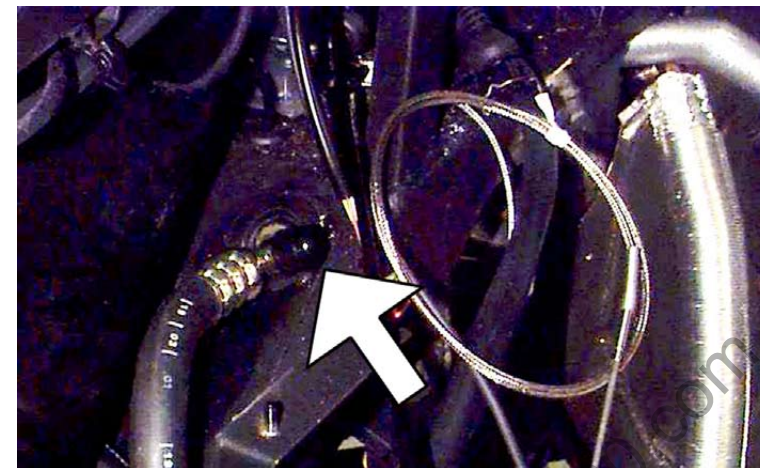


Fig.2



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The climate control system control unit will run a procedure to identify the system where it is fitted the first time it is switched on.

For this reason, the RESET procedure must be run whenever a control unit is connected to a different system from where it was first used.

To run the RESET procedure, turn the ignition switch to ON and press the AUTO button simultaneously.

Letter I will firstly appear along with the basic control symbol followed by letter B during the procedure.

At the end of the procedure, the control unit will switch to automatic operation. The temperature will be set to 23 °C.

The system will be ready to work from this point.



The control unit RESET procedure is required only if the control unit is replaced.



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Malfunctions diagnosis for “Insufficient cooling”

Below is a list of the most probable causes of defects, referring to the pressure read by the LOW or HIGH pressure gauge, which reveals the value that has changed the most.



The following “Probable causes” were listed in the order of the defect statistically most likely to occur.

(V) For variable displacement compressors only;

(F) For fixed displacement compressors only;

Probable causes

Fig.1

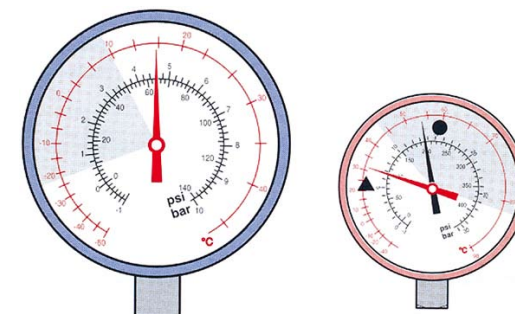
- Intake and exhaust pipes inverted on the compressor;
- The compressor’s electric clutch slips or does not completely engage;
- Expansion valve is stuck open. If the compressor has variable displacement, small but quick changes in pressure occur in the low pressure side;
- (V) The compressor’s displacement control valve is poorly calibrated or defective;
- Compressor damaged.

Fig.2

- (F) Thermostat defective;
- (F) Expansion valve stuck closed or obstructed;
- Filter waterlogged;
- (V) The compressor’s displacement control valve is stuck at maximum displacement;
- (F) Obstruction in the low pressure side or the high pressure side between the filter and evaporator;

Fig.3

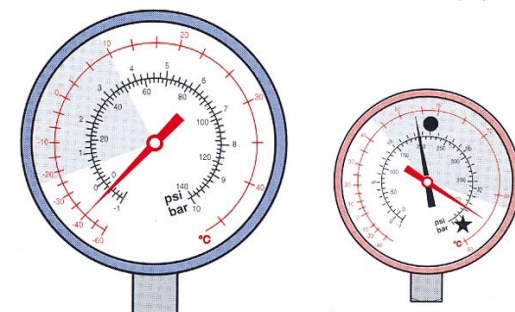
- Hot air penetrating into the evaporation unit or passenger compartment;
- Hot water seeping into the heater;
- Ice forming on the evaporating coil.



B.P. alta

A.P. normale (●)
o bassa (▲)

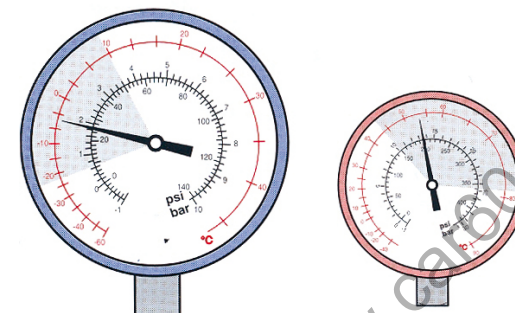
Fig.1



B.P. bassa

A.P. alta (★)
o normale (●)

Fig.2



B.P. normale

A.P. normale

Fig.3

Gray area (high pressure and low pressure area with outside temperature between 15.5 and 43°C)

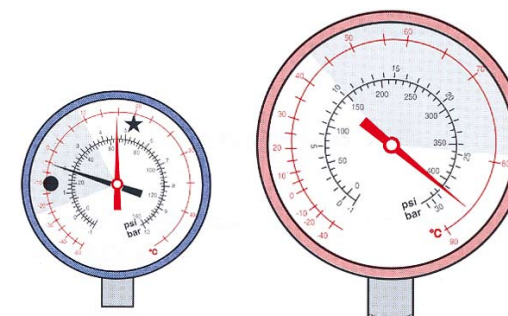


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Fig.4

- Normal situation with very high ambient temperature ($>43^{\circ}\text{C}$);
- Too much coolant, 30-35% extra;
- Condenser overheating;
- Air inside the A/C system;
- (V) The compressor's displacement control valve is defective;
- Obstruction in the high pressure side between compressor and condenser pipe-filter but after the point where the high pressure is read.



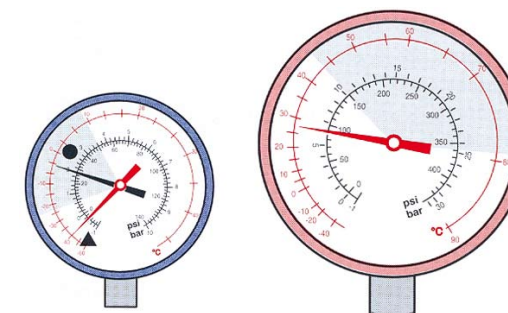
B.P. alta (★)
o normale (●)

A.P. alta

Fig.4

Fig.5

- Normal situation with very low ambient temperature ($>5^{\circ}\text{C}$);
- Too little coolant, 70-75% deficiency. Check for coolant leaks;
- (V) Expansion valve stuck closed or obstructed;
- (V) Obstruction in the low pressure side or the high pressure side between the filter and evaporator;
- Obstruction in the high pressure side between compressor and condenser pipe-filter but after the point where the high pressure is read.
- Compressor damaged.



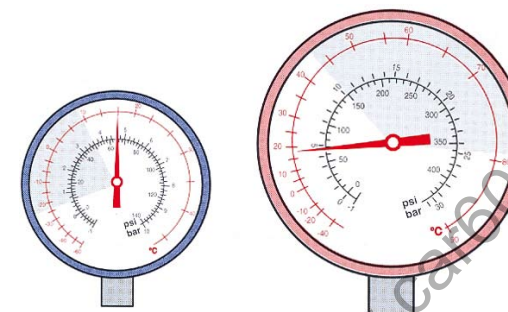
B.P. normale (●)
o bassa (▲)

A.P. bassa

Fig.5

Fig.6

- Compressor belt failure. Probable cause: pulleys not aligned;
- The compressor's electric clutch slips or does not engage;
- Compressor damaged;
- (V) The compressor's displacement control valve is defective.



B.P. circa uguale a A.P.

Fig.6