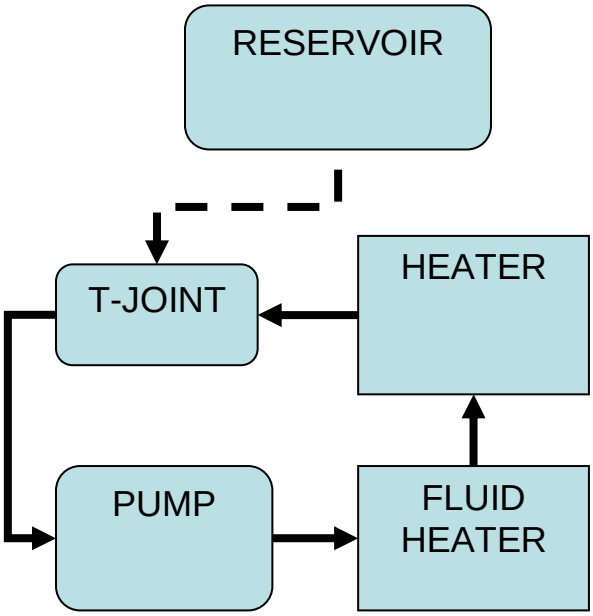
Chapter F

Heating, ventilation and AC



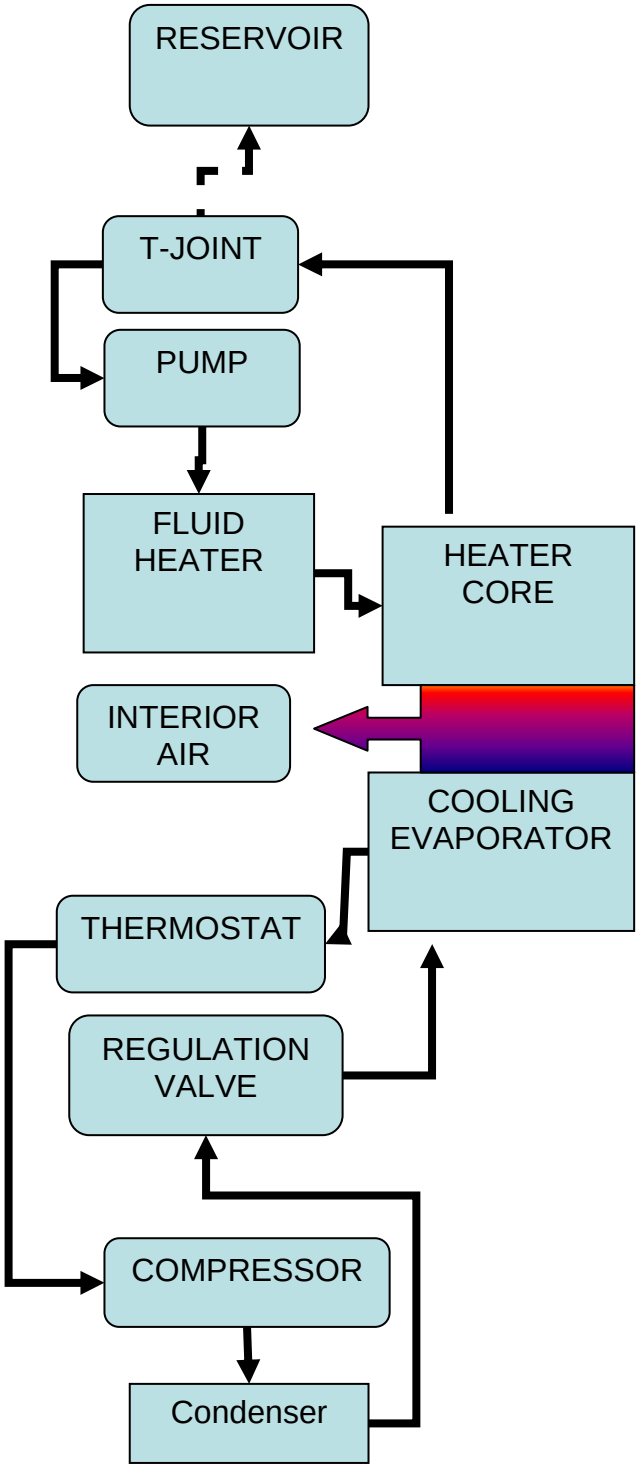
F.1 Air Condition

Generally

Turn off the ignition, make sure that the traction battery is not charging and disconnect the 12V battery before start working on the heating circuit.

F.1.1 Heating without air condition (AC)

The heating circuit shares the reservoir with the cooling circuit. Other than this there is no connection between the two circuits.



F.1.2 Heating With AC

Climate control system is equipped with a blend air type heater. Fresh air enters the heater through the cowl grille and passes through a plenum chamber with heater core and cooling evaporator. The fluid heater and AC hardware is located in the engine compartment.
The heating circuit shares the reservoir with the cooling circuit for PCU (Power Control Unit). Other than this there is no connection between the two circuits.

Cooling circuit consists of:

- Switch for enabling AC
- Compressor
- Evaporator (cooling surface)
- Accumulator and dryer
- Condenser Assembling
- Thermostatic expansion valve (TXV)
- Evaporator temperature sensor (evaporator temperature control)
- A/C pressure transducer (monitoring the pressure in the high side of the refrigerant system)
- Cooling fan (cooling of condenser process)
- Control unit with relays and fuses

Generally:
Turn off the ignition, make sure the traction battery is not charging and disconnect the 12 V battery before starting work on the heating circuit.
Use approved personal protective equipment when working on the cooling circuit

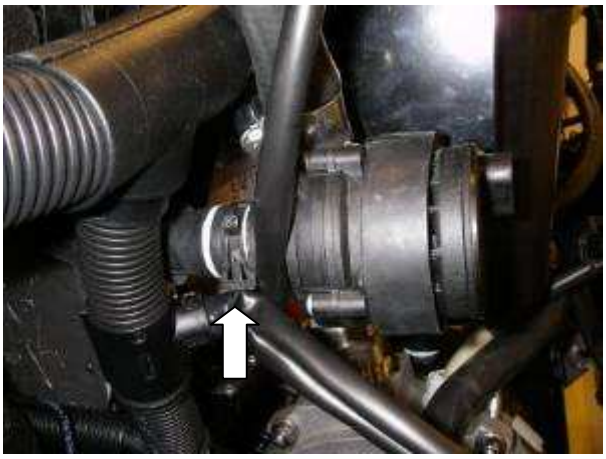
WARNING
Beware of danger when working with R-134a refrigerant!
Rapid evaporation of the liquid may cause frostbite.
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing

F.1.3 OPERATION - REFRIGERANT CIRCUIT

CAUTION:

Liquid refrigerant is corrosive to metal surfaces. Follow the operating instructions supplied with the service equipment being used.

- The refrigerant system must always be evacuated before charging.
- Do not open the refrigerant system or uncap a replacement component until you are ready to service the system. This will prevent contamination in the system.
- Before connecting an open refrigerant fitting, always install a new seal or gasket. Coat the fitting and seal with clean refrigerant oil before connecting. Do not remove the sealing caps from a replacement component until it is to be installed.
- When installing a refrigerant hose, avoid sharp bends that may restrict refrigerant flow.
- Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open a container of refrigerant oil until you are ready to use it. Replace the cap on the oil container immediately after using.
- Store refrigerant oil only in a clean, airtight, and moisture-free container.
- Keep service tools and the work area clean. Contamination of the refrigerant system through careless work habits must be avoided.
- Refrigerant in vapor form will in combination with fire be dangerous to breath. Do not smoke!



F.2 Heating

F.2.1 Draining

- Loosen the hose from the T-joint to the pump, and let the coolant drain in a suitable container.

NOTE: There will be some coolant left in the system that may need to be drained when the components have been removed out of the car.

Draining of the heating circuit is mainly relevant when replacing hoses.

F.2.2 Filling

- Fill coolant to the MAX label on the reservoir and leave the cap off.
- Turn the ignition on so you hear the pumps in the cooling circuit are running.
- Start the pump in the heating circuit by turning the heater on (red area) and the fan to position 1.
- Refill coolant in the reservoir gradually as the level decreases.
- The heating circuit probably needs bleeding after filling coolant (see below).

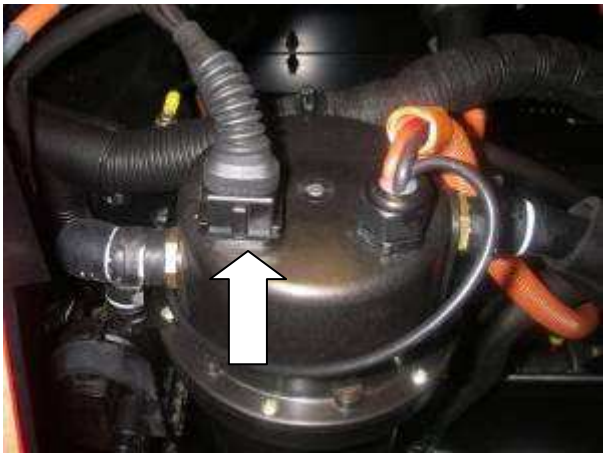
F.2.3 Bleeding

Due to small level differences in the system it can be difficult to bleed the heating circuit properly.

With ignition on set the fan to position 1
Check that the pump starts. Check coolant level in the reservoir.
A small amount of air bobbles in the system is allowed. Listen to the sound of the pump. If running smoothly and evenly the system has been properly bleeded.

If this is not sufficient do the following:

- Remove the air duct above the fluid heater for easier access to the fluid heater and the coolant hoses. The air duct is fastened with one fastener.



- Disconnect the connector on the fluid heater.

IMPORTANT: This is important because if it is connected during the bleeding process and the level is low the fluid heater can be damaged.

Warning PCU Gen2!
Never disconnect cable for heater box when the system is powered. This will cause EPO(Emergency Power Off) The condition will harm the PCU.

- Fill coolant to the MAX level on the reservoir and leave the cap off.

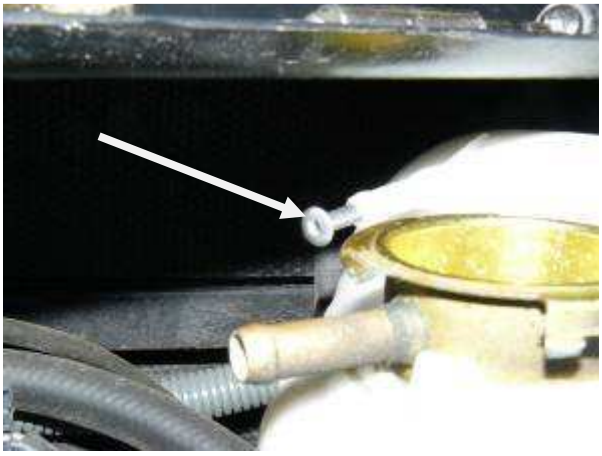
Attach the bleeding tool as shown in the picture.

- Turn the ignition on (drive position), heater on max and fan to position 1 so you hear the pump in the cooling circuit is running.
- Check reservoir level and fill coolant if necessary.
- Let the pump run until you hear it running smoothly without any air left in the system.

TIP: When replacing the fluid heater it is necessary to fill the new fluid heater with coolant before installing it. This will make the bleeding process easier and faster.

When the pump is running smoothly and all air is out of the system the bleeding tool can be disconnected in followed steps:

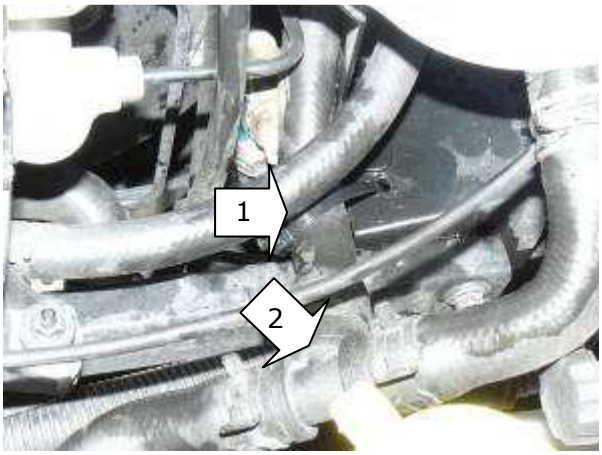
- Turn the ignition off (make sure the pump is not running).
- Attach clamp pliers or other suitable tool.
- Disconnect the bleeding tool and connect the coolant hose. Avoid without spilling coolant as far as possible.
- Connect the signal connectors on the fluid heater.
- Test the fluid heater and listen to the pump if there is any air left in the system.
- Check the coolant level.



F.2.4 Reduction valve

The main reason for air in the heating circuit is caused by too high pressure in the return hose to the reservoir. The results are air bubbles in the coolant entering the cooling circuit. The solution is to install a reduction valve and to re-route a coolant hose.

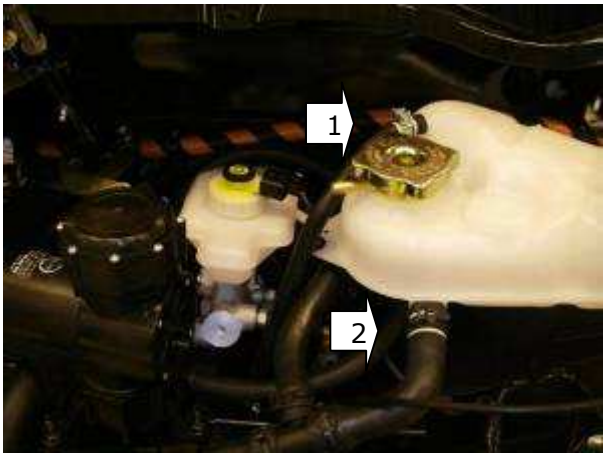
- Turn the ignition off.
- Remove the return hose.
- Check if a reduction valve is already installed in the hose.
- Install the reduction valve.
- Assemble in reverse order.



F.2.5 Fasten the coolant hose

Pull the coolant hose located at the middle of the T-joint and to the heating circuit. Fasten it with a plastic strip to the bracket supporting the reservoir as shown in the picture (1).

IMPORTANT: The branch of the T-joint should point downwards.



F.3 Reservoir

F.3.1 Disassembling

Before the work is started, Make sure the charge cable is disconnected and the ignition is in off position

- Open the hood.
- Squeeze the hose and loosen the clamp on the return hose (1) and disconnect.
- First clinch the hose and then loosen the clamp on the hose (2) and disconnect. Collect the draining coolant.
- Loosen screws and clips, three of each. It may be practical to remove the headlamp for access to one of the fasteners.

F.3.2 Assembling

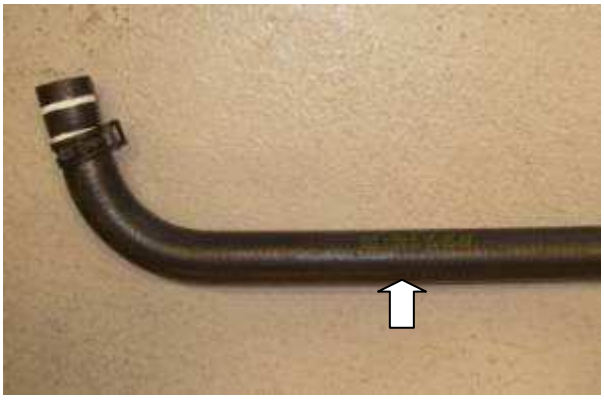
- Assembling in reverse order.
- Fill coolant.
- See section F1.3 regarding bleeding of the system.

F.4 Hoses

F.4.1 Disassembling

- First drain the heating circuit for coolant.
- Loosen the clamps and push it back.
- Remove the hose.

TIP: To collect the coolant spilling out, place a drain container with a large opening under the vehicle.
You can also drain the cooling circuit before hoses are disconnected. See section F.1.1.

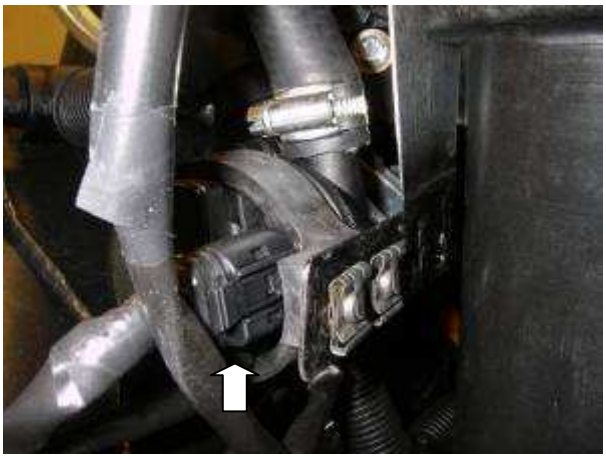


F.4.2 Replacing hoses

Drain the heating circuit for coolant as described in section F.1.2 before any defect hoses are replaced.

F.4.3 Assembling

- Attach the new hose. NOTE! Check date code (se picture marked with arrow).
- Fasten the hose with the clamp.
- Fill coolant.
- Bleed the system. See section F.1.3.



F.5 Pump

F.5.1 Disassembling

Before the work is started, Make sure the charge cable is disconnected and the ignition is in off position

- Disconnect the 12V battery.
- Loosen the contact (see picture).
- Push the pump out of its rubber sleeve.

- Squeeze the hoses and disconnect them.

F.5.2 Assembling

Assembling in reverse order.

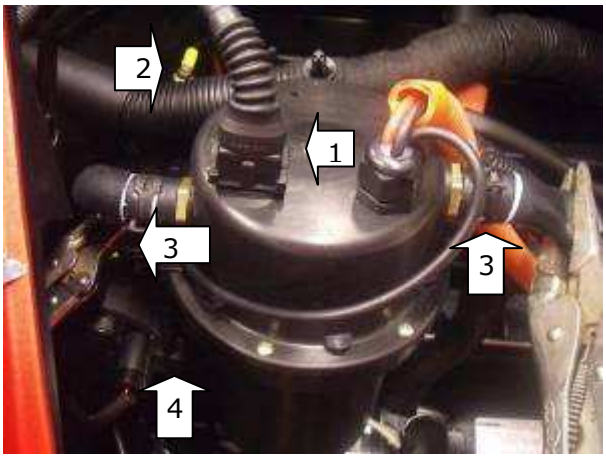
Refill coolant if necessary and bleed the heating circuit (see section F.1.3).

F.6 Fluid heater

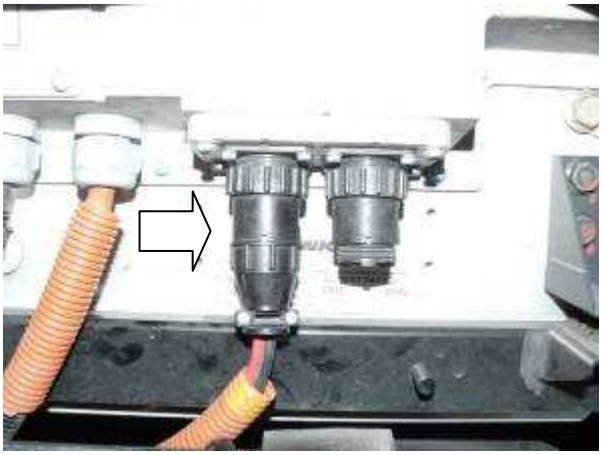
F.6.1 Disassembling

Before the work is started, Make sure the charge cable is disconnected and the ignition is in off position

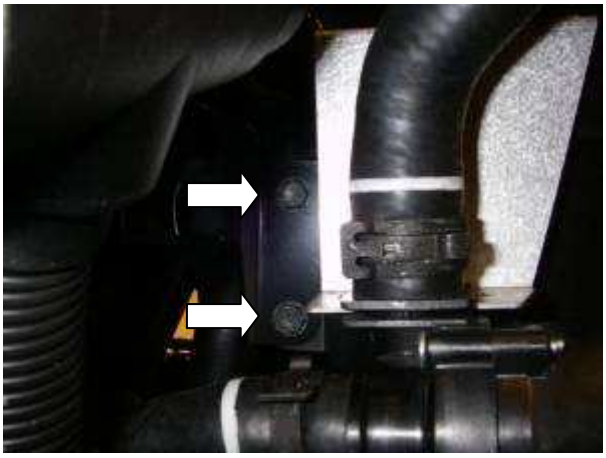
- Open the hood.
- Disconnect the 12V battery.
- **Disconnect the traction battery (see chapter C).**
- Remove the air duct above the fluid heater. The air duct is fastened with one fastener.



- Disconnect the connector (1) and grounding cable (2).
- Squeeze the hoses suitable pliers and loosen the clamps (3). Collect the draining coolant.
- Loosen the pump with rubber sleeve from the bracket (4).



- Disconnect the connector to the fluid heater.



- Loosen the fluid heater bracket and remove it.

F.6.2 Assembling

Assemble in reverse order.

Fill coolant and bleed the heating circuit if necessary.

Tightening torques:
Fluid heater to bracket = 7 Nm

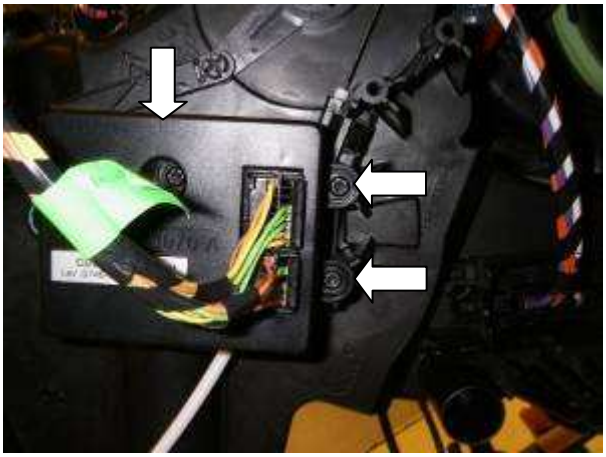
F.7 Fresh air intake filter

F.7.1 Intake filter replacement

- Remove the air duct which is fastened with one fastener.

- Remove the old Fresh air filter and install a new one.

Make sure the new filter is correctly installed and the air duct fits tightly.



F.8 CDCM

Climate and Defrost Control Module controlling heating, ventilation and AC (option). The unit is located on passenger's side of the heater and is fastened with 3 screws.

F.8.1 Disassembling

Make sure the charge cable is disconnected the ignition is off before the work is started.

- Disconnect the 12V battery.
- Disconnect contact on CDCM.
- Loosen the three fasteners.

F.8.2 Assembling

Assemble in reverse order.

Tightening torque = 1,9 Nm

F.9 Heater

F.9.1 Disassembling of the control panel

Remove the radio and disconnect connectors and antenna.

Remove the frame with indicator lights. The frame is fastened with clips.

- Pull the frame in the middle below the control panel loosening the two barbs at the bottom.
- Pull the horizontal part of the frame below the radio by loosening the fasteners loosening the fasteners at both sides of the radio.
- Pull the upper part of the frame to loosen the upper fasteners.

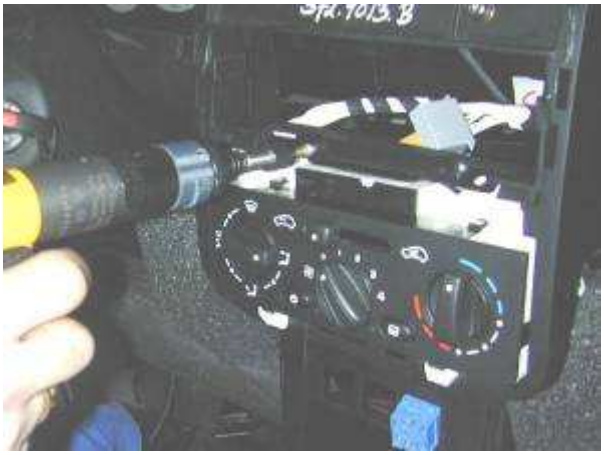
Make sure the frame is pulled straight out.

Loosen the connector and pull it sideways through the opening between the center vents and the inner frame.

Loosen the center panel.

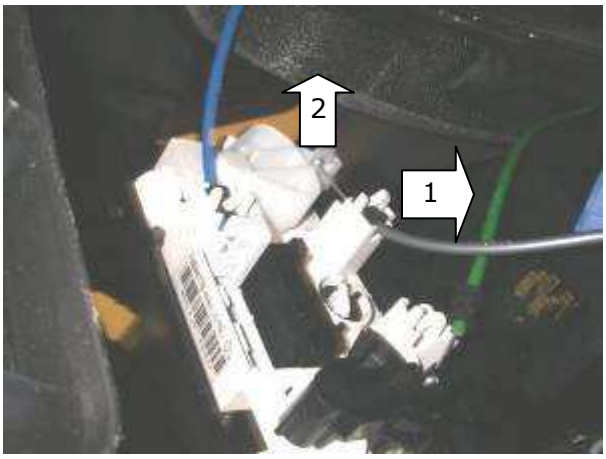
This is fastened with two fasteners at the top as shown in the picture.

Loosen two fasteners at the bottom; one on each side of the center stack (one side shown in the picture).
Pull both sides of the frame to loosen clips along the edge.



The control panel with buttons for heating and ventilation can either be taken out individually or together with the frame.

The control panel is fastened to the frame with 2 screws. Loosen the fasteners, press the white clips down and flip the panel outwards.



The picture is showing the wire for heating and ventilation connected to the back of the control panel. Electrical contact is here already disconnected.

To disconnect the wire pull the anchorage to one side (1) releasing the wire from the slot. Then pull the plate locking the knob (2) at the end of the wire.

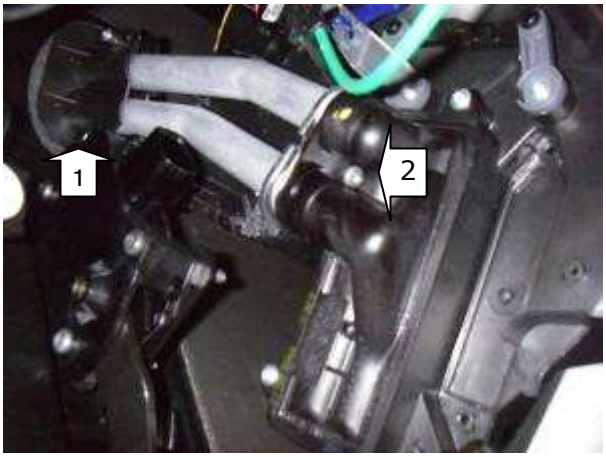
F.9.2 Assembling

Assemble in reverse order.

F.9.3 Disassembling – tube Assembly

Intake tubes to the heater run from the motor compartment to the heater on the driver's side of the car.

- Open the hood, squeeze the coolant hoses, loosen the clamps and remove the hoses.
- Loosen metal plate and pull it off together with the seal.



- Loosen fastener (1).
- Loosen fastener (2).

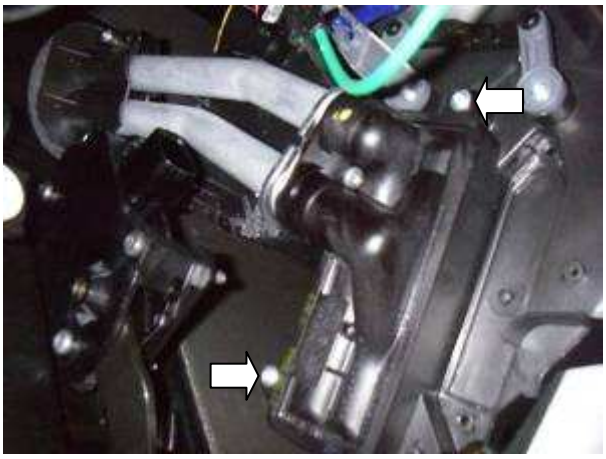
Place a collector or a towel below the tubes to avoid coolant running into the interior.

- Push the tubes upwards/against the motor compartment releasing them at the bottom.

The pipes can now be pull slightly to the side and then down and out.

F.9.4 Assembling

Assemble in reverse order.



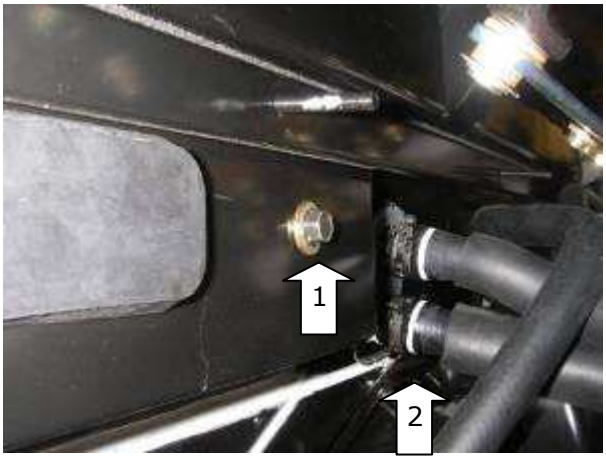
F.9.5 Disassembling– heater element

Before the heater element is removed the tubes must be loosened (see section about).

- Loosen heater element fasteners.
- Pull the element out.

F.9.6 Assembling

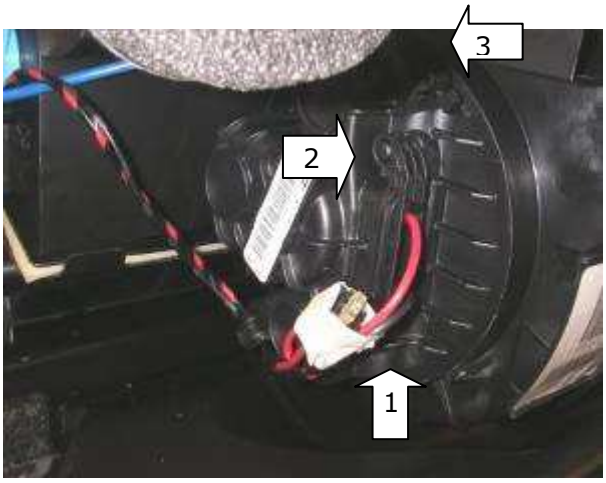
Assemble in reverse order.
Remember to connect the tubes afterwards.



F.9.7 Disassembling– blower

To be able to replace the heater blower the following must be removed:

- Indicator bar and the frame around the control panel.
- Gear console cover and both closure panels.
  CAUTION! Be careful when removing the closure panel not damaging the pins.
- Knee bolster and hood release handle.
- Striker in the motor compartment (1).
- Bracket around the pipes in the motor compartment (2).

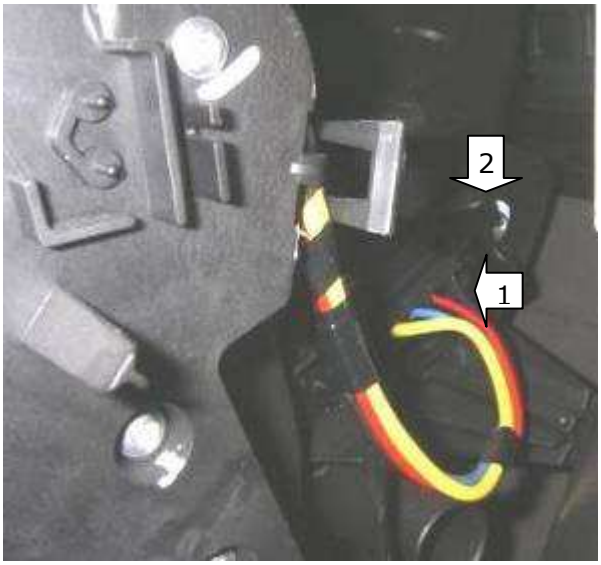


It is now possible to access the blower and loosen it. It is also probably possible to wriggle the blower down between the steering column and the heater. To do this the heater must be moved slightly to the right. If this is not possible the complete dashboard must be removed before the blower is removed.

- Loosen the contact. Pull it loose at the bottom (1), rotate it around the axle at the top (2) and lift the axle off.
- Lift the latch up and out (3) making it possible to loosen the blower house.
- Remove the complete blower.

F.9.8 Assembling

Assemble in reverse order.



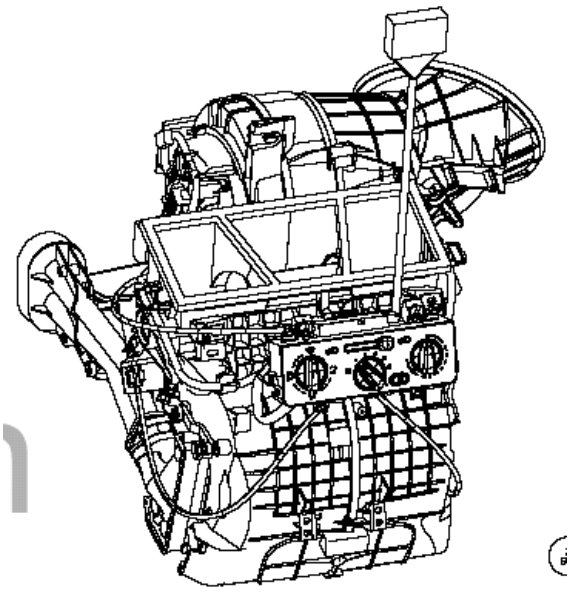
F.9.9 Disassembling – blower resistor

The blower resistor is located on the passenger's side of the heater.

- Push the sides of the connector (1) and pull it out.
- Loosen the fastener (2).
- Pull the blower resistor out.

F.9.10 Assembling

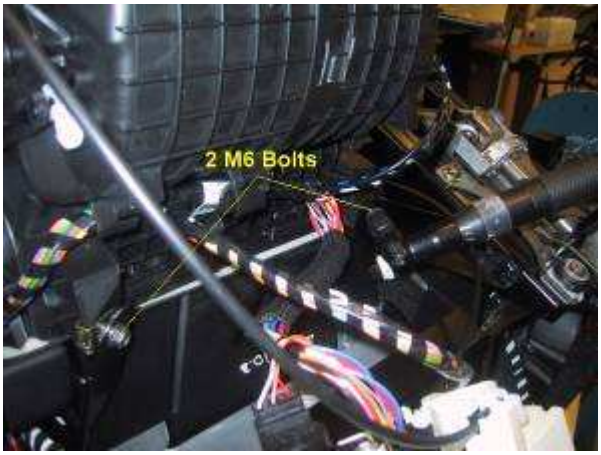
Assemble in reverse order.



F.9.11 Disassembling – complete heater

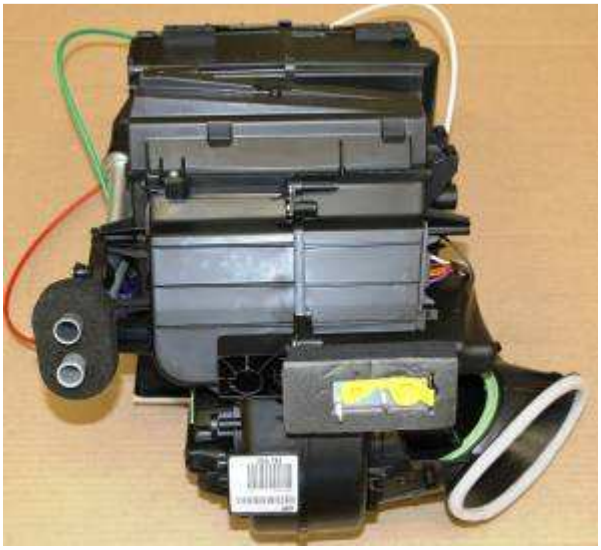
To remove the complete heater Assembling the dashboard must be removed. See separate section in chapter H interior.

- Loosen air vents.
- Loosen contact.



- Loosen fasteners.

NOTE:
The following parts on the heater can be replaced separately: Control panel, pipes, Heater core, blower, blower resistor, harness and the distributor case.



Note: AC equipped
Evaporator cannot be serviced separately. The complete unit must be replaced

F.9.12 Assembling

Assemble in reverse order.

Fill coolant if necessary and bleed the heating circuit.

Tightening torque:
Heater to the dashboard = 7 Nm

F.10 AC Air - Conditioning system

The system supplies the cabin with mixed air temperature. Condensed water will be drained from the evaporator area during operation. This is a normal condition.

F.10.1 Working on AC system

SAFETY WARNING!
It is necessary to wear suitable protection such as goggles and gloves. Contact with the refrigerant can cause blindness as well as other injuries to the operator.

- Carefully read the instruction
- Do not open in case of rain or high humidity
- Use gloves
- Use protective goggles
- **Refrigerant vapor in combination with fire will cause toxic vapor. Don't smoke when working with AC**

Use an AC service unit with two connections, for HP and LP (high pressure/low pressure)

F.10.2 Specifications

- Maximum allowed air temperature at center panel outlet: 5-10° C at 25°C ambient air temperature.
- Fuse
  a) Condenser fan: 20A
  b) Cabin / heater - fan: 25A
- Refrigerant capacity R134: 490g
- Oil content in compressor, evaporates, condenser and receiver dryer is not specified, replacement of components weighed amount of oil in each component and replaced
- Total amount of oil 130CC
- Oil type POE (Ze-GLES RB68 synthetic oil)
- Evacuation time recommended 20 min
- Normal static pressure, 5bar (25 ℃ room temperature), see the separate table
- Max pressure HP 24bar and LP ca3 bar at max cooling
- Pressure sensor on the HP side
- Temperaturdifference in/out condenser 80/90°C

F.10.3 Leak test (gas sniffer and UV/transfluid)

By use of Sniffer:

It is not necessary to fill the AC system with UV tracer before the test. The sniffer picks up traces of R134a gas when the AC is active

Move the device along the components of the facility to ascertain any possible leaks in the system. Always follow the search device product guide

By use of tracer fluid and UV light:

Alternatively, leakage searches using tracerfluid. To ensure an optimal result, the car must be driven for 3-5days with activated AC system.

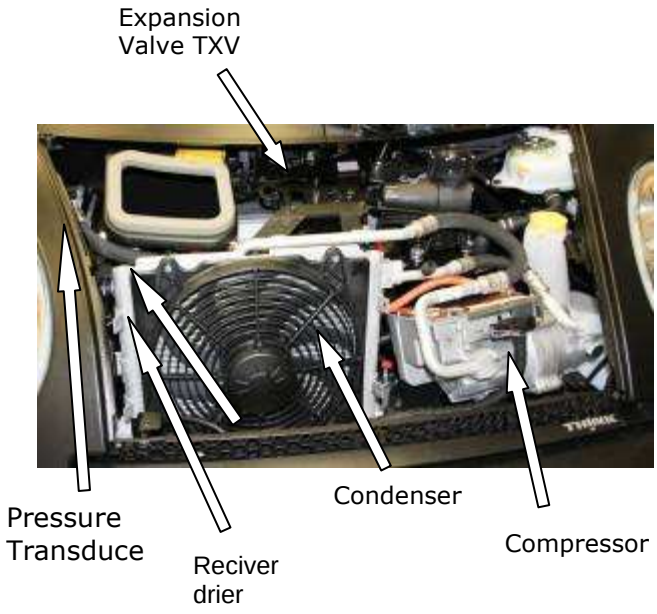
F.10.4 Leak test by use of N2 Gas

This test is based on pressurize system with N2.

Step 1 Evacuate all R134a with an AC service unit
Step 2 Pressurize the system in 3 steps up to **MAX 15 bar (evaporator may be damaged) Often the leaks are easy to find at 3-5bar**

Step 3 Listen for any leaks

Step 4 Use a soap/water solution and spray on Components, hoses and connections. Leaks will cause soap bubbles.



F.10.5 AC system location

The refrigeration equipment
is located in the engine compartment

F.10.6 AC Static pressure test

AC compressor not active:
Open up valves (for proper handling of the AC service unit, read the user guide)

Connect hoses to the service ports, high pressure (HP red line) and low-pressure (LT blue line).

Read the high pressure and low pressure manometer. Meters should display the same pressure value.

Pressure to conform to the following list

Ambient temperature	Static pressure
+15 Celsius	3,9 bar
+20 Celsius	4,7bar
+25 Celsius	5,6bar
+30 Celsius	6,7bar
+35 Celsius	7,8bar
+40 Celsius	9,1bar

F.11 Draining the AC system

NOTE: For proper handling of the AC service station, read the user guide

Connect to service hoses of high pressure (red line) and low-pressure pipe (blue line).

Start the evacuating of the system. For correct "vacuum" time se technical data.

Important:
Use correct time to ensure that all incondensable (R134a) and moisture are evacuated from the system.

Store the recovered R134a and oil for later use.

Extracted oil must be replaced with new oil of the same type see specifications.

Note!
If components have been replaced, oil must be aggregated for each component and added to the recovered oil during the filling process.

For total amount of oil in the system allowed, see specifications.

F.11.1 Refilling of the AC system

Before refilling with R134a, the AC system must have passed the leak test and evacuation must be done.

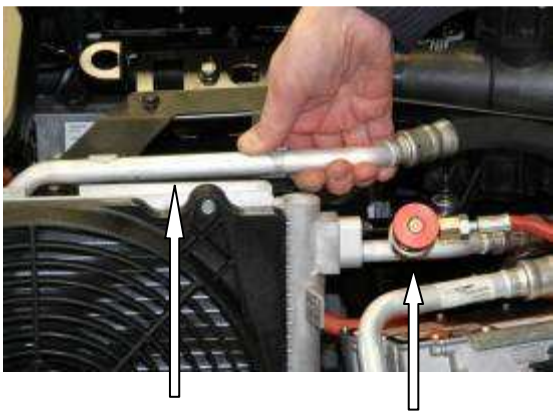
Fill With right amount of gas. **Use only specified refrigerant**.

NOTE: For proper handling of the AC service station, read the user guide

Warning!

Do not overfill, it can harm the system and cause spill to the nature.

Fill the right amount oil ref previous chapter.



F.11.2 Test of condenser function

- Start the AC system run for at least 5 minutes
- Measure the different between in / out temperature for the condenser

DANGER !
HP inlet very hot (70-100°C)

To confirm condenser performance outlet temperature should be approximately 15 °C colder than the inlet.

F.11.3 AC performance temperature test

- Close all doors and windows.
- Set the system to recirculation
- Set the temperature to the coldest level.
- Set fan to its second speed.
- Maximum allowed air temperature at center panel outlet see specification

- Set the system in normal position (fresh air) repeat the test
- Maximum allowed air temperature at center panel outlet see specification

F.12 Condenser A/C removal

Recover the refrigerant from the refrigerant system.
Disconnect fan module el. connector.

Disconnect the supply connector from the A/C compressor.

Remove the nut that secures the A/C discharge line to the compressor

Inspect seals and tubes for damage.

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system.

If refrigerant oil has been drained from the A/C compressor, the same amount of oil should be added to the refrigerant system. (See specifications for correct oil type.)

Important: Install plugs in, or tape over the opened refrigerant line fittings and compressor ports.

Disconnect the A/C discharge line from the condenser.

Replace rubber O-ring. Lubricate the rubber O–ring with clean refrigerant oil before installation.

Remove cable ties from the wiring harness.

Remove the 4 attaching bolts on the mounting bracket

Release the condenser support bracket.

Take care of rubber bushing when the support bracket is removed.

Carefully lift the condenser up and hold it.

Disconnect the discharge line from the receiver/drier.

Carefully lift condenser up, and remove it from the engine compartment.

NOTE: Inspect that the rubber bushings located under the condenser are in correct location after removal.

Important!
Use only refrigerant oil of the
type recommended for the compressor in the vehicle
Add same amount off refrigerant oil that has been removed from the refrigerant system.

F.13 Assembling of the condenser

Install the condenser in reverse steps. Replace the rubber O-ring. Lubricate the rubber O–ring with clean refrigerant oil before installation

F.14 Expansion valve removal

Recover the refrigerant from the refrigerant system.

The front "H" valve-type thermal expansion valve
(TXV) is located at the dash panel between the liquid and suction lines, and the evaporator coil.

Release wiring harness located over PCU.

Remove the bolt securing the refrigerant lines to the expansion valve (TXV).

Remove the bolt securing the expansion valve to the evaporator

Carefully remove the expansion valve from the evaporator.

Inspect rubber O-rings and tube flange for damage.

F.15 Assembling of expansion valve

Install the expansion valve in reverse steps. Replace rubber O-ring. Lubricate the rubber O–ring with clean refrigerant oil before installation.

F.16 Replace A/C compressor

Recover the refrigerant from the refrigerant system.

Disconnect the wiring harness connector at compressor.

Remove the nut securing the suction line fitting to the top of the compressor.
Disconnect the suction line fitting from the compressor suction port.
Remove the seal from the suction line fitting

Disassemble the ground cable.

Disassemble the compressor support bolts.

Carefully lift the compressor up, and remove it from the engine compartment.

Drain the compressor for refrigerant oil and measure the amount of oil. Add the same amount of oil into the refrigerant system, when installing the new compressor.

F.17 Assembling of the compressor

Install the compressor in reverse steps. Replace rubber O-ring. Lubricate the rubber O–ring with clean refrigerant oil before installation.