WORKSHOP MANUAL

This workshop manual is valid for the following Eberspächer Sütrak AC systems:

V188

AC136 / AC136 AE / AC136 AE HP

AC353 G4 / AC353-5XX

A WORLD OF COMFORT

Eberspächer

Imprint

Version:
88-50-40-00573-00 Rev.A

Eberspächer Sütrak GmbH & Co. KG
Heinkelstraße 5
71272 Renningen

Phone:
+49 7159 923-0

E-mail:
info.suetrak@eberspaecher.com

Internet:
www.eberspaecher.com

The latest amended version of this workshop manual can be found on the Eberspächer Sütrak website at
www.eberspaecher.com/en/products/air-conditioning/bus-ac-solutions/about-eberspaecher-suetrak.html

Disclaimer

This document has been put together with all due care and attention. However, Eberspächer Sütrak does not assume any warranty for the provided information being up to date, correct, complete or of the requisite quality. Liability claims against Eberspächer Sütrak GmbH & Co. KG referring to material or immaterial damage caused by the use or non-use of the provided information or by using faulty and incomplete information is fundamentally ruled out insofar as Eberspächer Sütrak is not culpable of verifiable wilful intent or gross negligence.

Contents

1 Introduction

Please read through first

Read this workshop manual through carefully before starting maintenance and repair. It contains important information necessary for maintenance and repair.

Please keep the workshop manual in a safe place until the end of the service life of your AC system. It must be available for reference at all times.

Comply with the warning and safety instructions on page 4 to avoid any injury to persons or damage to the product. Operation of the system in other countries is also subject to the corresponding legislation, guidelines and regulations of the country concerned.

Deviations from this workshop manual are possible, depending on the version or revision status of the products.

Related documentation

Where applicable, observe also the operating instructions for the fitted climate controller from the KL01, KL02 and E-Control product families.

1.1 Styles used in this document

Differing styles are used to highlight the meaning of a text in this workshop manual.

Descriptive text is presented without a prefixed character.

- Text preceded by a dot (▪) indicates a list which is started by a heading.
  - – Text preceded by a dash (–) is subordinate to a list with a dot.

→ Indented text preceded by an arrow (→) indicates measures to prevent danger.

Underlined blue text denotes a cross-reference, which can be clicked in the PDF document. The part of the document named in the text is then displayed.

1.2 Warnings and indications

Warnings and indications can be found in each case before the operating instruction which could result in a hazard or damage to property.

Danger

The signal word refers to a danger with a high level of risk which causes death or serious injury if not avoided.

Warning

The signal word refers to a danger with a medium level of risk which can cause death or serious injury if not avoided.

Caution

The signal word refers to a danger with a low level of risk which can cause slight or moderate injury if not avoided.

Note

A note contains

- important information for preventing damage to machinery and/or
- recommendations for use, operation, installation and repairs.

1 Introduction

1.3 Spare parts and accessories

As a basic principle, only original spare parts and accessories supplied by Eberspächer Sütrak should be used.
Spare parts and accessories not supplied by Eberspächer Sütrak have not been tested and approved.
Other spare parts and accessories may be used after obtaining Eberspächer Sütrak's approval. The installation or use of products that have not been confirmed may possibly change the design attributes of the AC system.
Eberspächer Sütrak does not assume any liability for damage caused by using spare parts and accessories that have not been approved or by carrying out incorrect work to the AC system.

Note

Eberspächer Sütrak uses copper and aluminium components in its AC systems which are capable of lasting for the lifetime of the AC system under normal ambient conditions. However, corrosion to the copper and aluminium components cannot be ruled out if the AC systems are operated under aggressive ambient conditions, e.g. in air with extreme levels of salt, phosphate or ammonia. The standard copper and aluminium components fitted in the Eberspächer Sütrak systems are not suitable for these extreme operating conditions. Special applications are available for this on request.
Eberspächer Sütrak draws explicit attention to the fact that corrosion is not covered by material defect liability. Eberspächer Sütrak does not assume any liability for corrosion or damaged caused by cleaning the systems with compressed or corrosive substances.

1.4 Guarantee

Periods and preconditions

- The standard warranty for complete systems is twelve months from initial registration, but never longer than 15 months from the invoice date or 100,000 km/62,137 miles, whichever occurs first.
- Spare parts have a warranty period of twelve months from installation, but never longer than 18 months from delivery, whichever occurs first.
- Necessary preconditions for a warranty claim are:
  The AC system was correctly installed and put into operation by
  – an OEM partner,
  – a vehicle manufacturer,
  – an authorised dealer, or
  – Customer Service.
  The AC system has been demonstrably serviced at regular intervals and in accordance with the Eberspächer Sütrak maintenance plan.

Warranty claims against Eberspächer Sütrak will be voided if:

- Individual parts or parts of products are damaged by negligence, accident or other cases of misadventure,
- The owner does not perform the normal maintenance at all, or only in part, or deficiently,
- The AC system is not operated according to the written operating instructions from Eberspächer Sütrak,
- Eberspächer Sütrak parts are replaced because of normal wear,
- Parts or products were repaired or modified by non-authorised personnel unless the repair or modification was approved in writing by Eberspächer Sütrak,
- Parts fitted as spare parts in Eberspächer Sütrak AC systems are not original parts from Eberspächer Sütrak.

2 Safety instructions

2.1 General safety instructions

All instructions stated below must be read and heeded. Failure to comply fully or correctly with these instructions can result in malfunctions and/or serious physical injury or even death.

Eberspächer Sütrak recommends the use only of refrigerant R134a to ARI standard 700. It is forbidden to use additives as leak-detecting contrast agents.

AC systems from Eberspächer Sütrak are developed and built to the state-of-the-art in refrigeration and AC technology. They offer optimum safety for the operating and maintenance personnel.

During normal operation, all moving parts are protected against accidental contact. However, there may be open access to moving parts during inspections, checks and maintenance work. It is therefore important to observe sufficient clearance to these parts when the air-conditioning system is working. Removing the guards is strictly forbidden.

2.2 Demands on the personnel

The descriptions in this workshop manual are intended only for trained, qualified skilled staff with professional knowledge in vehicle air conditioning, electrical and electronic systems.

For work on all-electric (AE) systems, documented training by a specialist for work on high-voltage (HV) intrinsically safe vehicle is also necessary. Only this specialist may put the vehicle into operation again on completion of the work.

2.3 Personal safety equipment

Persons working on the AC system and in the immediate vicinity must wear the personal safety equipment at all times.
This includes:


Safety gloves


Safety goggles


Non-slip safety boots

It is also urgently recommended not to wear loose clothing or jewellery. Loose clothing and jewellery can get trapped in rotating fan wheels.

A safety harness must be used when working on the vehicle roof.


Safety harness

Working area

- Highly concentrated refrigerant vapours can cause cardiac arrhythmia and sudden death.
  - Ensure there is adequate ventilation of closed rooms.
  - Wear a respirator mask.
- The heat developed by a glowing cigarette can decompose the refrigerant with the release of highly toxic substances.
  - Smoking is strictly forbidden when working on the AC system and with the refrigerant.
- When working on the vehicle roof, there is a risk of falling off with serious injuries or death.
  - Use safety harness and ropes for a secure working position.
  - Use a safety platform with safety grille or safety net.

2.4 Electrical safety


Danger

Risk of fatal injury from electric shock.

Mains-powered compressors and heater elements work with AC voltage of up to 400 volts.

→ Switch off the vehicle ignition.
→ Observe the 5 safety rules:
  – Disconnect,
  – Secure against reconnection,
  – Verify that the power is off,
  – Earth and short-circuit the system,
  – Cover or cordon off any live neighbouring parts.
→ Do not touch unprotected cables.
→ Have unprotected cables repaired by a qualified electrician.

During work on high-voltage (HV) vehicles


If it is necessary to open HV components to establish that they are no longer live, special gloves must be worn as protection against high voltages.

2 Safety instructions

2.5 Safety during installation, operation and maintenance

Refrigerants can cause frostbite on contact with the skin or eyes.

- Wear personal safety equipment (safety gloves, safety goggles, safety boots), see chapter 2.3 Personal safety equipment.
- If refrigerant is spilled on the skin, rinse the affected area with warm water. Seek medical advice immediately.
- If refrigerant is spilled in the eyes, rinse for at least 10 minutes with clean water or preferably an eyewash. Seek medical advice immediately.

Pressure lines can heat up considerably during operation of the system and cause burns.

- Wear personal safety equipment (safety gloves, safety goggles, safety boots), see chapter 2.3 Personal safety equipment.

Thin fins with sharp edges on the evaporator and condenser can cut your hands.

- Wear personal safety equipment (safety gloves, safety goggles, safety boots), see chapter 2.3 Personal safety equipment.

The impeller wheels of the ventilators and fans can cause crushing injuries and may even result in severed limbs.

- Do not remove any guards as long as the system is in operation.
- Do not carry out any work on the AC system while it is in operation.
- Only proceed with work on the AC system when the ventilators and fans are switched off and at a standstill.

When there is an increase in temperature, overfull refrigerant bottles can burst because of the generated overpressure.

- Fill refrigerant bottles only up to the stipulated level.

AC systems operate under high pressure. Uncontrolled refrigerant leaks may cause serious injuries and permanent damage to health.

- Do not exceed the maximum pressure and level in the AC system.

During soldering work on the refrigerant circuit, residual refrigerant may release highly toxic decomposition products.

- Drain the refrigerant circuit completely before starting work.
- Purge the refrigerant circuit with forming gas 95/5 (H2N2) or dried nitrogen (quality 4.6 or 5.0).

2.6 Accident prevention

The general and specific national accident prevention regulations and the corresponding workshop and operating safety instructions must be observed at all times.

2.7 Safety for the environment

The refrigerant must not be allowed to drain into the environment and certainly not discharged in the local sewage system.

- Dispose of refrigerants in accordance with the local environmental protection regulations.

2.8 Liability and warranty

The manufacturer is not liable for damage caused by unintended use or incorrect operation.
Failure to comply with the safety instructions renders the warranty null and void and precludes any liability on the part of Eberspächer Climate Control Systems GmbH & Co. KG and Eberspächer Sütrak GmbH & Co. KG.

3 Maintenance and Repair

3.1 Introduction

Regular maintenance work and thorough function checks and visual inspections are necessary to ensure proper operation of the AC system.

3.2 Maintenance intervals

Regular maintenance in accordance with the maintenance plan increases the service life and operational safety and effectively prevent malfunctions. The maintenance intervals may have to be shortened in extremely dusty environments.
An overview of the regular maintenance work to be carried out and the maintenance intervals can be found in the maintenance plan (88-50-40-00262-00).

3.3 Specialist know-how

Refrigeration and AC systems are closed-centre systems that are under high pressure. Maintenance and repair work on Eberspächer Sütrak AC systems may therefore only be carried out by trained and qualified personnel. For work on electrically operated AC systems, additional training for work on high-voltage systems is also necessary.

When replacing individual components or during repairs, great attention must be paid to absolute cleanliness in order to avoid damage due to contamination. Work on the open system must be performed swiftly to prevent moisture from entering the AC system. This applies in particular to all-electric(AE) AC systems, as excessive moisture promotes the formation of acids. These attack the windings of the compressor and result in short-circuits and serious damage there.

The following instructions should be followed closely during maintenance and repair work:

- All components should be at room temperature before the fastener studs are removed. This prevents condensation that would occur if the components were too cold.
- Remove protective and sealing caps on all spare parts and lines only shortly before installation.
- Seal components and hoses immediately after removal to prevent moisture or dirt entering the system.
- Check the condition of the connections and pipes before installation. Even dirt or minor damage can result in leaks at the high pressures prevailing in the system.
- Clean soiled connectors only with a cloth soaked with alcohol.
- Always use refrigerant oil when installing screw fitting on pipe and hose connections.
- Keep refrigerant oil clean and in closed containers to prevent the absorption of moisture.
- When tightening connections, always counterhold with a second wrench to prevent twisting and deformation.
- Before tightening screw fittings, ensure that the hoses are not twisted, kinked or pinched. Later correction is generally not possible.
- Check the correct connection of hoses and lines and the tightness of clamps and clips.
- Do not hold components or parts at the connecting pipes, hoses or capillary tubes.
- When working on the condenser and evaporator packs, take care that their cooling fins are not damaged. Remedy any damage using fin combs.
- After repairs in the refrigerant circuit or if AC systems are open for a longer period, always replace the filter drier.

3.4 Preparatory work

3.4.1 Connect the fitting at the quick-couplers

In newer AC systems, quick-couplers with Schrader valve are installed on the UNF 7/16” connections of the compressor for maintenance work. The Schrader valve can be opened using a special fitting.

1 Connection on quick-coupler
2 Opening wheel
3 Service port for manifold gauge / filling station

3 Maintenance and Repair

1. Press the fitting with the quick-coupler mating piece [1] onto the connection. The locking must engage audibly.
2. Open the Schrader valve by turning the opening wheel [2].

▸ The connection between compressor and service port has been made.

3.4.2 Install digital manifold gauge

For maintenance and inspection work, a digital manifold gauge / filling station with the connected blue and red working hoses is installed on the service ports of the high-pressure and low-pressure shut-off valves of the compressor.

It allows various measurements and work on the refrigerant circuit to be carried out, e.g.:

- Leak test,
- Pressure and temperature measurements**,**
- Evacuation of the AC system,
- Filling and emptying the AC system.

1	Display	5	Refrigerant bottle connection
2	High-pressure valve actuator	6	Low-pressure connection
3	High-pressure connection	7	Low-pressure valve actuator
4	Vacuum pump connection		

Preparing measurements / work

Preconditions

- All connections are depressurised.
- Shut-off valves on digital manifold gauge are closed.

1. Switch on the digital manifold gauge. Zero pressure sensors, if necessary.
2. Inspect the condition of manifold gauge, working hoses, seals and screw fittings.
3. Connect the blue working hose to low-pressure connection [6] and the red working hose to high-pressure connection [3] of the digital manifold gauge.
4. Clean shut-off valves and service ports of the compressor.
5. Unscrew the cover nut on the service port of the **high-pressure** shut-off valve and connect the **red** working hose.
6. Unscrew the cover nut on the service port of the **low-pressure** shut-off valve and connect the **blue** working hose.
7. Check that the working hoses are securely connected to the manifold gauge.
8. Open low-pressure [7] and high-pressure [2] shut-off valves with 1.5 turns in anti-clockwise direction.
9. Close both shut-off valves on the digital manifold gauge by turning in clockwise direction.
10. Open the high-pressure shut-off valve on the compressor with two turns in anti-clockwise direction. At the same time, briefly loosen the screw fitting on the pressure gauge set to bleed the red working hose.
11. Open the low-pressure shut-off valve on the compressor with two turns in anti-clockwise direction. At the same time, briefly loosen the screw fitting on the pressure gauge set to bleed the blue working hose.

▸ The desired measurements / work can now be carried out.

3.4.3 Disconnect digital manifold gauge

1. Close pressure and suction shut-off valves on the compressor by turning in clockwise direction.
2. Open the low-pressure valve actuator on the manifold gauge and relieve the pressure in the blue working hose via the yellow working hose.
3. Then slowly open the high-pressure valve actuator and relieve the pressure in the red working hose via the yellow working hose.

3 Maintenance and Repair

4. Unscrew the working hoses from the service ports of the compressor shut-off valves.
5. Fit and tighten the cover nuts on the service ports.
6. Switch off the digital manifold gauge.
7. Unscrew the working hoses from the manifold gauge.
8. Leave the valve actuators on the manifold gauge open to relieve the seals and avoid premature wear.
9. Store manifold gauge and working hoses clean and in a safe place.

3.5 Working with the digital manifold gauge

Every AC system must be checked for leaks on completion of any installation or repair. Leaking connections result in refrigerant losses and hence reduced cooling performance. In addition, moisture can enter the refrigerant circuit at leaks and cause malfunctions.
On new systems or after major repairs, a pressure test must also be carried out. Dried nitrogen 4.6 or 5.0 with 20 to max. 25 bar is used for the pressure test. This allows major leaks or loose screw fittings to be detected without the loss of costly refrigerant. Furthermore, the use of nitrogen also allows the AC system to be flushed and dried during the pressure test.

3.5.1 Checking leak tightness of the AC system

Preconditions

- All shut-off and solenoid valves of the refrigerant circuit are open.
- Digital manifold gauge is ready for use, see chapter 3.4.2 Install digital manifold gauge.
- Low-pressure [7] and high-pressure [2] valve actuators are closed.
- Nitrogen bottle (N2) with pressure reducer is functional.

Checking leak tightness

1. First connect the yellow working hose to the refrigerant bottle connection on the manifold gauge, then to the pressure reducer of the nitrogen bottle. Ensure that the connections are tight and the pressure reducer is not under pressure (0 bar).

   Warning

   Serious eye injuries can be caused by flying objects!

   → Wear safety goggles when working on the refrigerant circuit.

2. Carefully open the nitrogen bottle and set the pressure reducer to 15 to 20 bar/217-290 psi.
3. Open the high-pressure valve actuator on the manifold gauge.
4. Monitor high and low pressure on the display [1]. When a low pressure of approx. 2-5 bar/29-72 psi is reached, open the low-pressure valve actuator on the manifold gauge, too.
5. When the set pressure of 15 to 20/217-290 psi. bar is reached, close high-pressure and low-pressure valve actuators on the manifold gauge.
6. Unscrew the yellow working hose from the pressure reducer.
7. Unscrew the pressure reducer from the nitrogen bottle and store in a safe place together with the nitrogen bottle.
8. Monitor the pressure in the refrigerant circuit.
   – If the pressure in the AC system drops by more than approx. 0.5 – 2.0 bar within approx. 15 minutes, the system has a leak. Localise the leak using soapy water and repair. Then repeat the pressure test.
   – If the pressure has not risen or fallen within 1 hour, the AC system is leak-tight.
9. Slowly open the low-pressure valve actuator on the manifold gauge and release the nitrogen into the atmosphere via the yellow working hose. When a high pressure of approx. 2-5 bar is reached, carefully open the high-pressure valve actuator on the manifold gauge, too.

▸ The leak tighness check is now completed. Then evacuate the AC system.

Note

If, after the leak tightness check, the nitrogen is first released on the low-pressure side and then on the high-pressure side, this removes particles and foreign gases from the refrigerant circuit. Furthermore, any moisture that may have entered the system can be absorbed by the filter drier.

3.5.2 Evacuate the AC system

Water (humidity from the air) is very harmful in an AC system as it causes the refrigerant, refrigerant oil and seal materials to disintegrate due to the formation of acids, and can lead to short-circuits at the compressor or to icing of the expansion valve. For this reason, moisture must be removed from the refrigerant circuit before start-up or after maintenance work on individual components, and the system must be checked for absolute leak-tightness. Evacuation causes the water to evaporate in the vacuum. On an empty AC

3 Maintenance and Repair

system, evacuation takes six to eight hours, for maintenance work on a still filled AC system the process can be shortened to four to six hours.

Preconditions

- Refrigerant circuit has been tested for leaks.
- All shut-off and solenoid valves of the refrigerant circuit are open.
- Vacuum pump is set to 1 mbar.
- Digital manifold gauge is ready for use, see chapter 3.4.2 Install digital manifold gauge.

Evacuating the AC system

1. Connect the yellow working hose first to vacuum pump port [4] of the manifold gauge, then to the vacuum pump. Pay attention that the connections are tight.
2. Switch on the vacuum pump.

1 Venting valve

Note

If a two-stage pump is used, be sure to vent the pump for approx. 1 minute at valve [1] as otherwise the service life of the pump will be shortened!

3. Completely open the low-pressure valve actuator on the manifold gauge.
4. Monitor the pressure on the display. When a low pressure of approx. 166 mbar is reached, open the high-pressure valve actuator on the manifold gauge, too.
5. After the time specified above and reaching a vacuum level of 166 mbar, close the high-pressure and low-pressure valve actuators on the manifold gauge.
6. Monitor the pressure on the display.
   – If the pressure rises again, moisture is still being evaporated. In this case, repeat work steps 2-5 or purge the refrigerant circuit with nitrogen.
   – If the pressure remains constant, the refrigerant circuit has been evacuated.
7. Switch off the vacuum pump and unscrew the yellow working hose from the vacuum pump.

▸ The AC system is ready to be filled.

3.5.3 Filling the AC system

The filling capacity can vary, depending on the size of the system. If the filling capacity is exactly known, we recommend filling only by weight. With small AC systems and large refrigerant bottles, fill slowly to avoid over-filling the AC system. A table with the refrigerant filling capacities can be requested by e-mail from Eberspächer Sütrak: parts.suetrak@eberspaecher.com

Preconditions

- All shut-off and solenoid valves of the refrigerant circuit are open.
- The AC system has been checked for leak tightness and evacuated.
- The ambient temperature is approx. 30°C/86°F, the temperature in the passenger compartment at least 25°C/77°F.
- The AC system is switched off.
- Digital manifold gauge / filling station is ready for use, install see chapter 3.4.2 Install digital manifold gauge.

Note

- Be sure to observe the temperature specifications! If the AC system is filled according to the sight glass at too low ambient temperature, it may be over-full at higher ambient temperatures due to the expansion of the refrigerant.
- In order to avoid damage to the AC system, fill with liquid refrigerant only with the compressor at standstill!

Filling the AC system

1. Connect the yellow working hose first to the connection for the refrigerant bottle of the manifold gauge, then to the refrigerant bottle.
2. Completely open the shut-off valve of the refrigerant bottle.
3. Bleed the yellow working hose by briefly opening the screw fitting of the manifold gauge.
4. Set the refrigerant bottle to “liquid”:
   – On large tanks with immersion tube: Close the gas valve and open the liquid valve.
   – On small tanks without immersion tube: Stand the bottle upside down.

3 Maintenance and Repair

5. Fill the refrigerant circuit on the pressure side with liquid refrigerant.
6. Open the high-pressure valve actuator on the manifold gauge and fill the system with liquid refrigerant until the pressure on the high-pressure and low-pressure sides according to the display are balanced.
7. Close the high-pressure valve actuator on the manifold gauge.

Note

In order to ensure that there is no liquid refrigerant in the compressor, turn the compressor manually once or twice before starting.

8. Start the engine and keep the engine speed at 1,000 to 1,500 rpm.

Note

On AC systems with MCHX condenser coil: Be sure to fill according to the sight glass to avoid over-filling.
On AC systems with conventional condenser: Check at the sight glass whether bubbles are still to be seen. Observe the high and low pressure in the refrigerant circuit.

9. Switch the refrigerant bottle to gaseous refrigerant delivery.
   – If bubbles are still to be seen at the sight glass of the liquid line, open the low-pressure valve actuator on the manifold gauge and fill the refrigerant circuit with gaseous refrigerant.
   – When bubbles are no longer to be seen at the sight glass, immediately close the low-pressure valve actuator on the manifold gauge.
10. Continue to observe the sight glass.
   – If bubbles appear again at the sight glass, repeat work step 9.
   – If there are no longer bubbles at the sight glass, the system has been filled correctly.
11. Check the high and low pressure at the manifold gauge.
12. Check the oil level at the sight glass of the compressor, see chapter 3.10.4 Checking oil level in the compressor.
13. Check whether high-pressure and low-pressure switches are functioning correctly, see chapter 3.9.1 Low-pressure switch function test and and chapter 3.9.2 High-pressure switch function test.

▶ Filling of the refrigerant circuit has been completed. The AC system is ready for operation.
Remove the manifold gauge, see chapter 3.4.3 Disconnect digital manifold gauge.

3.6 Working with electronic filling station

3.6.1 Evacuating the AC system

The evacuation time can vary, depending on the size of the system. It must be at least 10 minutes, however, so that the electronic filling station can also check for leaks.

1. Connect the red and blue working hoses of the electronic filling station to the high-pressure and low-pressure shut-off valves of the compressor.

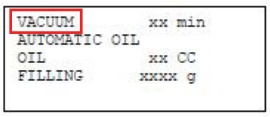
Electronic filling station

1 High-pressure connection
2 Low-pressure connection

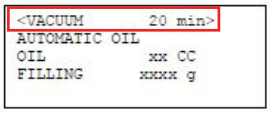
2. Switch on the electronic filling station.
3. In the main menu, select “Assisted procedure” using the arrow keys and confirm with “Enter”.

3 Maintenance and Repair

4. In submenu “Assisted procedure”, select “Vacuum” using the arrow keys and confirm with “Enter”.



5. Enter the evacuation time in minutes via the numeric keypad.

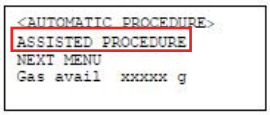


6. Open the HP and LP valves of the electronic filling station and press “Start”.

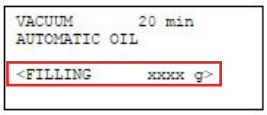
3.6.2 Filling the AC system

The filling capacity can vary, depending on the size of the system. If the filling capacity is exactly known, we recommend filling only by weight. As the AC system is only filled via the high-pressure side, the filling volume must be 100 g/3.5 oz. more than required. These 100 g/3.5 oz. are recovered from the hose again after the end of the filling process.

1. In the main menu, select “Assisted procedure” using the arrow keys and confirm with “Enter”.



2. In submenu “Assisted procedure”, select “Filling” using the arrow keys and confirm with “Enter”.



3. Enter the filling volume in gram via the numeric keypad and confirm with “Enter”.

3 Maintenance and Repair

4. After entering the filling volume, open the HP valve and start the filling process with “Start”.

5. For draining the hoses, follow the instructions under “Draining lines”.

Note

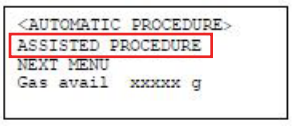
After every filling process, the working hoses of the electronic filling station have to be drained as otherwise the next AC system cannot be evacuated.

3.6.3 Draining hoses with filling station

1. Disconnect the red and blue working hoses of the electronic filling station from the high-pressure and low-pressure shut-off valves of the compressor.

1 High-pressure connection
2 Low-pressure connection

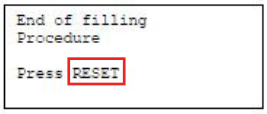
2. In the main menu, select “Assisted procedure” using the arrow keys and confirm with “Enter”.



3. In submenu “Assisted procedure”, select “Recovery/ Recycling” using the arrow keys and confirm with “Enter”.

4. Follow the instructions on the display, open the HP and LP valves of the filling station and press “Start”.

5. At the end of the recovery, press “Reset” to terminate the operation.



3 Maintenance and Repair

3.7 Checking refrigerant filling level

AC systems from Eberspächer Sütrak are filled with gaseous refrigerant. The refrigerant volume depends either on the weight indicated on the type plate or on the filling level at the receiver (one sight glass / two sight glasses) or at the sight glass of the liquid line (upline of the expansion valve). This is particularly important for AC systems in which an MCHX condenser coil is installed. With these systems, the required refrigerant volume is far lower due to the more compact design of the condenser.

Depending on the system type and installed condenser, there are three ways of checking the correct refrigerant filling level:

1 At the receiver with one sight glass,
2 At the receiver with two sight glasses,
3 At the sight glass of the liquid line.

3.7.1 At the receiver with one sight glass

If an MCHX condenser without supercooling section is used in the AC system, bubbles may appear for a short time in the sight glass of the liquid line even when the system is filled correctly. Use the sight glass on the right-hand side of the receiver to determine the correct refrigerant filling volume. The receiver is located in the rear part of the condenser.

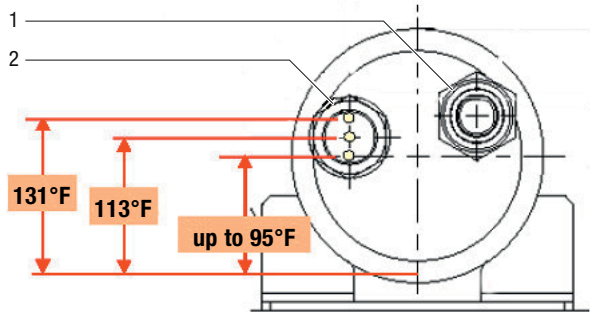
1. Remove the condenser cover.

   Note
   The evaporator cover must remain closed during the testing procedure.

2. Set the nominal temperature of the AC system to 18°C/64°F air temperature at the climate controller.
3. Start the engine and keep the engine speed at 1,000 to 1,500 rpm.
4. Operate the AC system for 10-15 minutes in cooling mode.
5. Check the high pressure (minimum approx. 14 bar / 200 psig).

   Note
   If the pressure is not reached, switch off the condenser fan or cover the air intake openings on the condenser.

6. Check the filling level at the sight glass:
   – Ambient temperature up to 35°C/95°F: Indicator ball should be floating at the bottom of the sight glass.
   – Ambient temperature 45°C/113°F: Indicator ball should be floating in the middle of the sight glass.
   – Ambient temperature 55°C/131°F: Indicator ball should be floating in the middle of the sight glass.
7. If the position of the indicator ball deviates from the nominal display for the temperature range, there is too little or too much refrigerant in the AC system.
   – Top up or drain refrigerant.
8. Check the refrigerant oil filling level at the sight glass of the compressor.
9. Fit the condenser cover again.



1 Refrigerant supply
2 Sight glass with ball for filling level indication

3.7.2 At the receiver with two sight glasses

In larger AC systems, two MCHX condensers without supercooling section are used. In these systems, bubbles may appear for a short time in the sight glass of the liquid line even when the system is filled correctly. Use the sight glasses on the front of the receiver to determine the correct refrigerant filling volume. The receiver is located in the front part of the condenser.

Note
The evaporator and condenser cover must remain closed during the testing procedure.

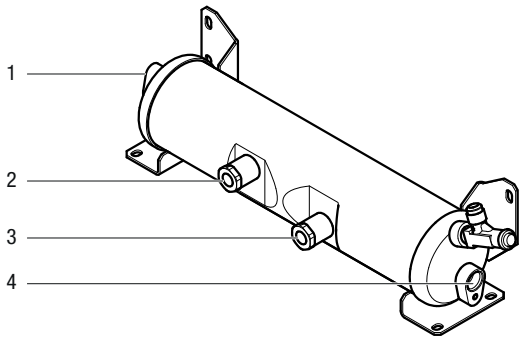
1. Remove both membrane grommets on the front side of the left-hand condenser cover in order to be able to see the sight glasses.
2. Set the nominal temperature of the AC system to 18°C/64°F air temperature at the climate controller.
3. Start the engine and keep the engine speed at 1,000 to 1,500 rpm.
4. Operate the AC system for 10-15 minutes in cooling mode.
5. Check the refrigerant filling level at the sight glasses through the openings in the condenser cover.
   – Indicator ball in the upper sight glass is moving at the bottom and the indicator ball in the lower sight glass is floating at

3 Maintenance and Repair

the top = AC system is filled correctly.

– If the position of the indicator balls deviates from the nominal display, there is too little or too much refrigerant in the AC system = Top up or drain refrigerant.

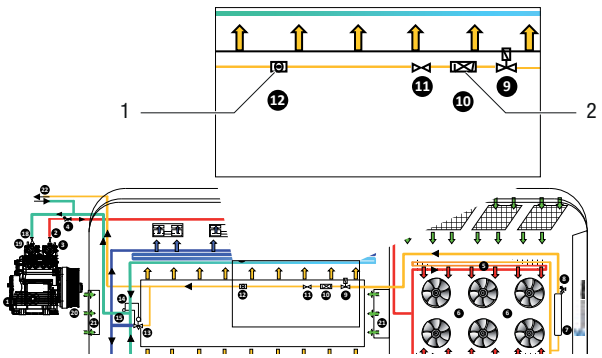
6. Check the oil level at the sight glass of the compressor.
7. After completing the work, insert the two membrane grommets in the condenser cover again.



1 Refrigerant inlet
2 Upper sight glass = empty (indicator ball at the bottom)
3 Lower sight glass = full (indicator ball at the top)
4 Refrigerant outlet

3.7.3 At the sight glass of the liquid line

In AC353-535/540/545 AC systems with MCHX condenser with supercooling section and on older models of roof-mounted and split AC systems with conventional condenser (without MCHX), the refrigerant filling volume must be checked at the sight glass of the liquid line.
This can be done easily from the inside of the bus after removing the return air grille of the middle trim.



1 Sight glass
2 Filter drier

Note

Evaporator and condenser covers must remain closed during the testing procedure.

1. Remove the return air grille and identify sight glass [1]. It is located in the rear part of the AC system near the filter drier [2].
2. Set the nominal temperature of the AC system to 18°C/64°F air temperature at the climate controller.
3. Start the engine and keep the engine speed at 1,000 to 1,500 rpm.
4. Operate the AC system for 10-15 minutes in cooling mode.
5. Check the high pressure (minimum approx. 14 bar / 200 psig).

Note

If the pressure is not reached, switch off the condenser fan or cover the air intake openings on the condenser.

6. Check the refrigerant level at the sight glass in the liquid line.
   – No bubbles = filling level OK.
   – If bubbles are seen: Add 0.25 kg / 0.5 lb of refrigerant and wait approx. 5 minutes for the system to stabilise. Gradually add further refrigerant until the sight glass is clear.

Note

If more than 1 kg / 2.2 lb of refrigerant has to be added, there is probably a fault in the system. Be sure to remedy the fault, for example clogging or leakage, and start the filling process again, if necessary.

7. Check the oil level at the sight glass of the compressor.

3 Maintenance and Repair

3.8 Pressure check in the refrigerant circuit

Pressure switches are installed on the high-pressure and low-pressure sides to monitor the pressures in the refrigerant circuit. In the event of inadmissible pressures, the pressure switches switch off the compressor via the electromagnetic clutch to protect the AC system.
Under normal conditions, the pressure on the high-pressure side is 13.2 to 20.2 bar (pressure gauge shows 12.2 - 19.2 bar), and on the low-pressure side approx. 2.9 bar (pressure gauge shows 1.9 bar).

The system pressures and temperatures depend on various factors:

- Temperature in the passenger compartment,
- Outside temperature, direct sunlight,
- Relative humidity,
- Number of passengers, door openings,
- Compressor speed.

The pressure is higher in the case of a high heat burden, high compressor speed, soiling of the condenser or poor air circulation. The pressure is lower in the case of a lower heat burden or low compressor speed.

3.8.1 Carrying out the pressure check

- Run the AC system for 10 minutes.

The following pressures and temperatures should be measured at the condensers and evaporator:

High-pressure side
Operating pressures with different outside temperatures (for refrigerant R 134a)

Outside temperature	Condenser temperature	Pressure gauge display
25°C	40 – 50°C	9.2 – 12.2 bar
77°F	104 – 122°F	133.4 – 176.9 psi
30°C	45 – 55°C	10.6 – 13.9 bar
86°F	113 – 131°F	153.7 – 201.7 psi
35°C	50 – 60°C	12.2 – 15.8 bar
95°F	122 – 140°F	176.6 – 229.2 psi
40°C	55 – 65°C	13.9 – 17.9 bar
104°F	131 – 149°F	201.7 – 259.4 psi
45°C	60 – 70°C	15.8 – 20.26 bar
113°F	140 – 158°F	229.2 – 292.3 psi

Low-pressure side
Operating pressures with different inside temperatures (for refrigerant R 134a)

Inside temperature	Evaporation temperature	Pressure gauge display
20°C	-5 – 5°C	1.4 – 2.5 bar
68°F	23 – 41°F	20.8 – 36.2 psi
25°C	0 – 10°C	1.9 – 3.1 bar
77°F	32 – 50°F	28.0 – 45.6 psi
30°C	5 – 15°C	2.5 – 3.9 bar
86°F	41 – 59°F	36.2 – 56.3 psi
35°C	5 – 15°C	2.5 – 3.9 bar
95°F	41 – 59°F	36.2 – 56.3 psi

Note

If the AC system is operated outside the normal operating conditions, this will result in

- High pressure in the evaporator,
- High pressure and high temperatures after compressing,
- Repeated switching of the clutch until the inside temperature drops again.

3 Maintenance and Repair

3.9 Pressure switches

3.9.1 Low-pressure switch function test

The low-pressure switch switches off the system as soon as the pressure drops below approx. 0.35 bar/5 psi. The starting pressure lies 1.75 bar/25.4 psi above the cut-out pressure so that the AC system only starts again at a pressure of at least 2.1 bar/30.4 psi.

1. Connect manifold gauge / filling station, see chapter 3.4.2 Install digital manifold gauge.
2. Start the engine and switch on the compressor.
3. Slowly close the low-pressure shut-off valve on the compressor until the pressure drops and the low-pressure switch switches off the electromagnetic clutch and hence the compressor (at approx. 0.35 bar/5 psi).
4. Slowly open the low-pressure shut-off valve on the compressor. Wait until the pressure rises again and the electromagnetic clutch switches on the compressor again (at approx. 2.1 bar/30.4 psi).
   - If the low-pressure switch does not trip at the indicated pressures, replace the pressure switch.
   - If the low-pressure switch does not trip at all, switch off the engine at approx. 0.2 bar/2.9 psi and replace the pressure switch, see chapter 3.9.3 Replacing pressure switches.

3.9.2 High-pressure switch function test

The components of the AC system are designed for a maximum pressure. The high-pressure switch protects them from excessive pressures. It switches off the system as soon as the pressure exceeds approx. 23.5 bar/340.8 psi. The starting pressure lies approx. 6.9 bar/100 psi below the cut-out pressure so that the AC system only starts again at a maximum pressure of approx. 16.6 bar/240.7 psi.

Danger

Risk of fatal injury from electric shock!

Risk of electric shock when the ignition is switched on and with high voltage in the electrical components of the AC system.

- Switch off the ignition.
- Secure the system to prevent it from being switched on again.
- Determine lack of voltage.
- Earth and short-circuit.
- Cover or cordon off any live neighbouring parts.

1. Remove the fuse or relay of the condenser fan or remove the power supply plug at the motor to interrupt the power supply to the condenser fan. With CAN bus control, cover the air intake opening of the condenser so that no air can flow through.
2. Connect the manifold gauge, see chapter 3.4.2 Install digital manifold gauge.
3. Start the engine and switch on the compressor.
4. Slowly close the high-pressure shut-off valve on the compressor until the pressure drops and the high-pressure switch switches off the electromagnetic clutch and hence the compressor at approx. 23,5 bar/340.8 psi.

Caution

Risk of injury from flying parts!

High pressure in the AC system can cause components to burst and flying fragments can result in injuries.

→ Wear personal protective equipment.

→ Switch off the motor manually at 24.5 bar/355.3 psi.

5. Slowly open the high-pressure shut-off valve. Wait until the pressure drops again and the electromagnetic clutch switches on the compressor again (at approx. 16.6 bar/240.7 psi).
   - If the high-pressure switch does not trip at the indicated pressures, replace the pressure switch, see chapter 3.9.3 Replacing pressure switches.

3.9.3 Replacing pressure switches

1. Connect manifold gauge / filling station, see chapter 3.4.2 Install digital manifold gauge.
2. Start the engine and switch on the AC system.
3. Slowly close the low-pressure shut-off valve on the compressor until the intake pressure drops.
4. Switch off the AC system.
5. Close the high-pressure and low-pressure shut-off valves on the compressor.
6. Drain the refrigerant in the compressor via the UNF 7/16” fitting.
7. Replace the pressure switch.
8. Evacuate the compressor.
9. Completely open the shut-off valves again.
10. Switch on the AC system again and check the refrigerant filling at the sight glass.

▶ Replacement of the pressure switch has been completed.

3 Maintenance and Repair

3.10 Compressor

The compressor is lubricated by the oil pump only when the AC system is running. The AC system must therefore be switched on for approx. 30 minutes at least once a month even during the cold season in order to prevent seals and bearings from drying out.

In order to be able to start the compressor in the cold season, the vehicle inside temperature must be above the thermostat cut-off point. If necessary, heat the interior of the vehicle first or switch to continuous cooling at the AC controller. With some systems, the outside temperature sensor must show more than 10°C.

Before starting any work on the compressor:

- Switch off the compressor and secure to prevent it being switched on again.
- Relieve the system pressure in the compressor.
- Completely drain the AC system.
- Prevent air and moisture from entering the AC system.

After completing maintenance:

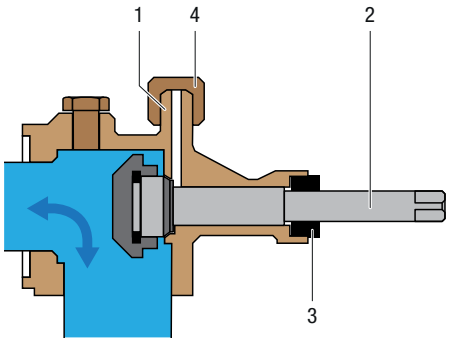
- Connect the safety switch.
- Evacuate the compressor.
- Deactivate the start inhibitor.

3.10.1 Pressure test via the shut-off valves

The compressor has basically two shut-off valves, one for the high-pressure side and one for the low-pressure side. The shut-off valves have a service port to which a digital manifold gauge / filling station can be connected for testing purposes.

Precondition

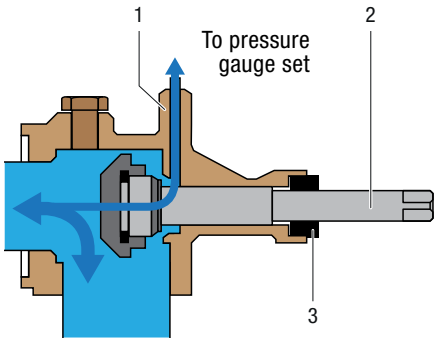
- The shut-off valves are in working position. Service port [1] is closed.



Shut-off valve in working position

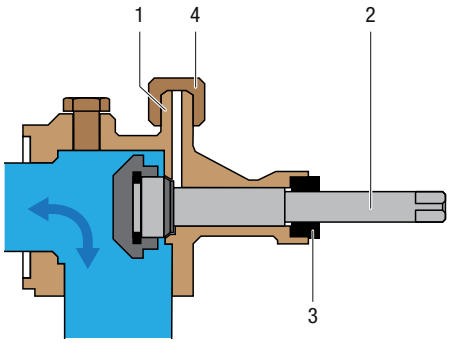
Testing the pressure

1. Remove protective cap [4] of the service port.
2. Connect digital manifold gauge / filling station to the service port, see chapter 3.4.2 Install digital manifold gauge.
3. Loosen valve spindle seal [3] by turning ¼ turn in anti-clockwise direction.
4. Screw in valve spindle [2] in the shut-off valve by 1.5 turns in clockwise direction.
   - The shut-off valve is half open and is now in service position. There is now a connection between refrigerant circuit and digital manifold gauge.



Shut-off valve in service position

5. Carry out pressure test.
6. After completing the pressure test, be sure to **completely** unscrew valve spindle [2] in anti-clockwise direction.
7. Tighten valve spindle seal [3] again by turning ¼ turn in clockwise direction.
   - The shut-off valve is completely open again and is in working position. The refrigerant circuit is open.



Shut-off valve in working position

Note

An incompletely unscrewed valve spindle or inadequately tightened valve spindle seal will result in leaks in the refrigerant circuit.

3 Maintenance and Repair

8. Disconnect the digital manifold gauge, see chapter 3.4.3 Disconnect digital manifold gauge.
9. Fit protective cap [4] again and tighten.

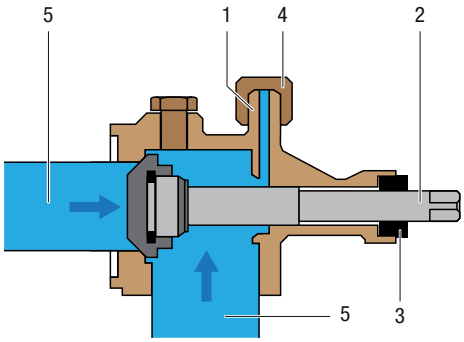
▶ The pressure test via the shut-off valves has been completed.

3.10.2 Valve position during compressor replacement

Note

If the compressor is to be replaced, the whole refrigerant circuit must first be drained.

1. Loosen valve spindle seal [3] on both valves by turning ¼ turn in anti-clockwise direction.
2. **Completely** screw in valve spindle [2] in both shut-off valves by turning in clockwise direction. The plunger must be tight against the valve seat in the housing and interrupt the refrigerant circuit [5].



Shut-off valve closed, refrigerant circuit interrupted.

3. Repair or remove the compressor. Protect the open hose ends of the refrigerant circuit with masking tape to prevent the ingress of dirt.
4. Install a new compressor.
5. **Completely** unscrew the valve spindle in both shut-off valves by turning in anti-clockwise direction.
6. Tighten valve spindle seal again by turning ¼ turn in clockwise direction.

Note

An incompletely unscrewed valve spindle or inadequately tightened valve spindle seal will result in leaks in the refrigerant circuit.

▶ The shut-off valves are now completely open again and in working position. The refrigerant circuit is open.

3.10.3 Oil in the compressor / refrigerant circuit

Normally, no oil is consumed during operation of the refrigerant circuit. Oil only has to be topped up in the event of a major leak or after replacement of a larger component. The refrigerant circuit must not, however, be overfilled with oil. Excessive oil can cause serious damage and has a negative impact on the cooling capacity. The oil level can be checked via the sight glass in the compressor housing.

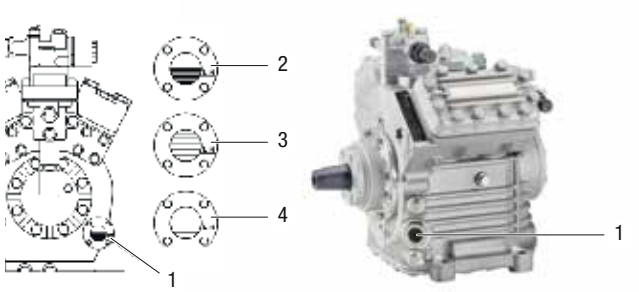
Searching for oil leaks

1. Inspect fittings, flexible hoses and crankshaft for oily marks.
2. Clean oily points to allow the oil leak to be localised.
3. Check oil level in the compressor.

3.10.4 Checking oil level in the compressor

Preconditions

- Interior temperature is between 22°C/71°F and 30°C/86°F,
- Outside temperature is between 20°C/68°F and 40°C/104°F,
- Compressor is in as horizontal a position as possible.



Checking the oil level in the sight glass

1	Sight glass	3	Oil level too high
2	Optimum oil level	4	Oil level too low

Checking oil level

1. Mark the oil level in the sight glass [1] with the engine switched off.
2. Start the engine and run at 2/3 of its maximum speed for approx. 10-15 minutes.
3. Observe the oil level in the sight glass [1] with the engine running.
   – If the oil level is in the middle of the sight glass [2], the oil level is OK.
   – If the oil level is too high [3], switch off the engine, drain some oil, see chapter 3.10.5 Drain oil from the compressor, then start again at work step 2.
   – If the oil level is too low [4], switch off the engine, add some

3 Maintenance and Repair

oil, see chapter 3.10.6 Topping up oil at the compressor, then start again at work step 2.

Note

Should the oil level still be too low after checking again, a shift of oil in the refrigerant circuit is to be suspected. This must be prevented, as oil hammer can result in serious damage to the compressor. In this case, immediately contact the Eberspächer Sütrak service staff.

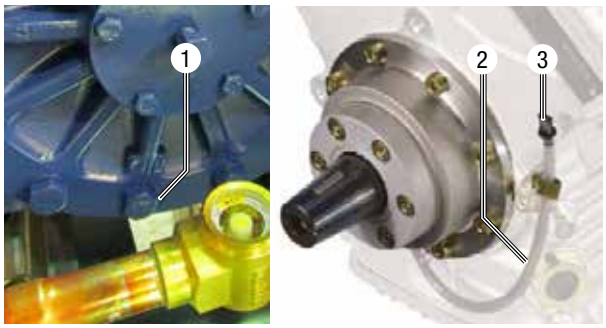
3.10.5 Drain oil from the compressor

Precondition

- The shut-off valves are in working position. The service port is closed.

Draining oil

1. Connect the recovery unit to the service port of the low-pressure valve.
2. Close low-pressure and high-pressure shut-off valves in clockwise direction. Completely screw in the valve spindle in clockwise direction so that the refrigerant circuit is interrupted.
3. Draw off refrigerant still in the compressor using the recovery unit.



1 Oil drain screw on compressor
2 Oil drain hose
3 Plug

4. Unscrew oil drain screw [1] until oil runs out, but do not remove the screw, or remove plug [3] of oil drain hose [2].
5. Drain the corresponding amount of oil and collect in a suitable vessel.

Note

Dispose of the oil in accordance with the applicable environmental protection regulations!

6. Tighten oil drain screw again or insert the plug into the oil drain hose again.
7. Evacuate the compressor.
8. Unscrew the low-pressure and high-pressure shut-off valves in anti-clockwise direction so that the refrigerant circuit is completely open again.
9. Switch on the AC system and check for proper function.

3.10.6 Topping up oil at the compressor

Precondition

- Close low-pressure and high-pressure shut-off valves in clockwise direction. Completely screw in the valve spindle so that the refrigerant circuit is interrupted.

Topping up oil

1. Connect the recovery unit and draw off the remaining refrigerant from the compressor.
2. Connect the hose to the oil filler plug on the low-pressure side and hang the end in a container filled with fresh oil.

Note

To avoid damage to the compressor, use only new oil suitable for use with the refrigerant.

3. Screw vacuum pump to the service port of the high-pressure shut-off valve.
4. Evacuate the compressor so that the oil in the compressor is drawn off.
5. Completely open the low-pressure and high-pressure shut-off valves in anti-clockwise direction.
6. Check the oil level in the compressor as described above. If necessary, repeat work steps 1-6.

3 Maintenance and Repair

3.10.7 Oil change

For an oil change, the compressor has to be removed. Only in this way can the oil in the compressor be completely changed. In order to avoid over-filling, the volume of fresh oil added should not be more than the volume of old oil drained.

Precondition

- The shut-off valves are in working position. The service port is closed.

Carrying out oil change

1. Unscrew the protective cap on the service port of the low-pressure shut-off valve and connect the recovery unit.
2. Close the low-pressure and high-pressure shut-off valves and draw off the remaining refrigerant from the compressor.
3. Remove the compressor, see chapter 3.10.9 Replacing the compressor.
4. Drain the old oil. Collect the volume of drained oil in a measuring beaker.
5. Pour in fresh oil, see chapter 3.10.6 Topping up oil at the compressor.

   Note

   The volume of fresh oil corresponds to the previously drained volume of old oil. Dispose of the old oil in accordance with the applicable environmental protection regulations!

6. Install the compressor and evacuate.
7. Completely open the low-pressure and high-pressure shut-off valves in anti-clockwise direction.
8. Check the oil level in the compressor and correct the volume of oil, if necessary see chapter 3.10.4 Checking oil level in the compressor.
9. Switch on the AC system and check the function of the compressor.

▸ The oil change has been completed.

3.10.8 Checking the acid content of the compressor oil

An excessive acid content in the compressor oil will attack the windings of the compressor motor and can result in short-circuits. The acid content should therefore be checked at least once a year, particularly after damage to the compressor or compressor motor. This applies in particular to high-voltage compressors in AE systems.

Precondition

- A prepared oil test bottle for 20 ml of compressor oil is ready. Observe the manufacturer's instructions.
- 100 ml measuring beaker.

Note

Open the oil test bottle only immediately before use.

Checking the acid content

1. For the test, drain 20 ml at the oil drain screw or oil drain hose into the measuring beaker, see chapter 3.10.5 Drain oil from the compressor.
2. Pour the oil sample into the oil test bottle.
3. Shake the oil test bottle and wait for approx. 10 seconds until the colour has stabilised.
   - Violet colour: Acid content is OK.
   - Yellow colour: Acid content is too high. Carry out several oil changes within the next few weeks until the acid content is OK.

3.10.9 Replacing the compressor

Depending on the system concept, the compressor for the AC system can be at various points in the bus:

- On the roof of the bus directly next to the AC system,
- In the rear of the bus,
- In the driver's area at the front of the bus.

Removal and installation of the compressor depends on the installation position in the bus.

The replacement of electric compressors in all-electric (AE) AC systems is described in a separate chapter, see chapter 3.10.10 Replacing compressors in AE systems.

Removal

1. Switch off the AC system and secure to prevent it being switched on again.
2. Close the shut-off and solenoid valves on the compressor.
3. Draw off the refrigerant from the compressor.

   Warning

   The pressurised compressor can result in serious eye injuries!

   → Wear safety goggles.

4. Disconnect and insulate the electrical connections at the compressor.

3 Maintenance and Repair

Note

Mark the cable ends, if necessary.
That will simplify the later reconnection of the cables.

5. Relieve the drive belt and remove.
6. If possible, remove the electromagnetic clutch.

Note

Depending on the installation situation, it may be necessary to first remove the compressor and then the electromagnetic clutch.
If the ball bearing of the electromagnetic clutch is still OK, it can continue to be used.

7. Loosen and remove the screw fittings and flanges from the suction and pressure connections.
8. Loosen the mechanical brackets of the compressor.
9. Lift out the compressor using a hoist.
10. Drain the old oil from the compressor and collect in a measuring beaker.

Note

The volume of oil collected may give an indication of the cause of the damage.

11. Repair the compressor or dispose of in an eco-friendly manner. If necessary, remove the high-pressure and low-pressure switches.

▶ Removal of the compressor has been completed.

Installation

1. If necessary, install the electromagnetic clutch on the new compressor and high-pressure and low-pressure switches.
2. Lift in the compressor using a hoist and fasten to the mechanical brackets. Ensure that the electromagnetic clutch and pulley of the drive motor are aligned.
3. Clean the flange connection surfaces of the high-pressure and low-pressure valves and on the compressor.
4. Lubricate the new seals slightly with oil and fit to the connecting flanges of the high-pressure and low-pressure valves. Then secure the shut-off valves using M8 Allen screws.
5. Make the electrical connection to the high-pressure and low-pressure switches.
6. Connect the cable harness to the compressor.
7. If not already installed, install the electromagnetic clutch.
8. Fit the drive belt, tension and check the alignment.
9. Replace the filter drier.
10. Open the shut-off and solenoid valves.
11. Check the AC system for leaks using nitrogen at 15-20 bar.

Warning

The pressurised compressor can result in serious eye injuries!

→ Wear safety goggles.

12. Evacuate the AC system, see chapter 3.5.2 Evacuate the AC system.
13. Break the vacuum and purge the AC system using nitrogen. Repeat the procedure, if necessary, until all remaining moisture has been removed from the AC system.
14. Refill the system with refrigerant, see chapter 3.5.3 Filling the AC system.
15. Switch on the AC system and check the function of the compressor, monitoring the oil level during operation, running noises, pressures, temperatures, function of the options, e.g. power controller.

Note

After the replacement of a compressor, there is already oil in the refrigerant circuit. It may therefore be necessary to drain part of the oil filling. With larger volumes of oil in the refrigerant circuit, e.g. caused by previous compressor damage, there is also a risk of liquid hammer during starting.

▶ Installation of the compressor has been completed.

3 Maintenance and Repair

3.10.10 Replacing compressors in AE systems

In all-electric (AE) systems, DC voltages of up to 400 V may exist, at the inverter even as high as 800 V. Before working on AE systems, a specialist for work on high-voltage intrinsically safe vehicles should therefore establish that they are no longer live. Only this specialist may put the vehicle into operation again on completion of the work.

Removal

Precondition

- The shut-off valves are in working position. The service port is closed.

1. Disconnect the electrical connections in the terminal box and remove the connecting leads.

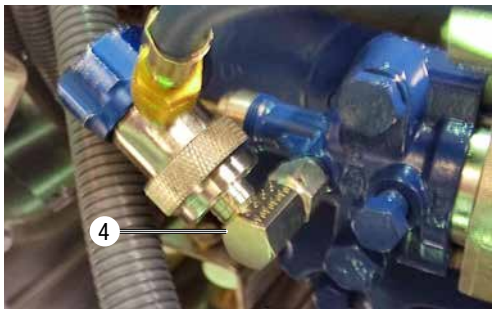
   Danger

   Risk of fatal injury from electric shock!

   Risk of electric shock when the ignition is switched on and with high voltage in the electrical components of the AC system.

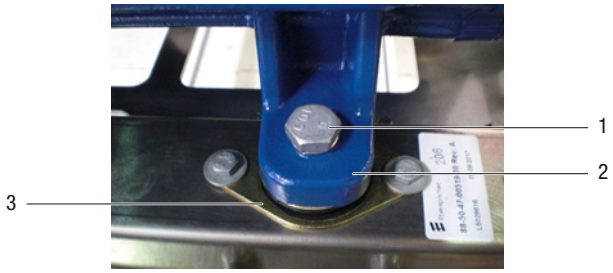
   → Switch off the ignition.
   → Secure the system to prevent it from being switched on again.
   → Determine lack of voltage.
   → Earth and short-circuit.
   → Cover or cordon off any live neighbouring parts.

2. Disconnect the electric connecting leads of the low-pressure and high-pressure switches at the plug connector.
3. Unscrew protective cap on the service port of the low-pressure shut-off valve and connect the recovery unit.



4 Service port of low-pressure shut-off valve

4. Close low-pressure and high-pressure shut-off valves.
5. Draw off refrigerant still in the compressor into a vessel suitable for the refrigerant.
6. Unscrew M8 Allen screws at the connecting flange [4] of the high-pressure shut-off valve and remove the refrigerant line with shut-off valve.
7. Unscrew the hex. head bolts at the connecting flange of the low-pressure shut-off valve and remove the refrigerant line with shut-off valve.
8. Attach suitable lifting equipment to the ring bolt of the compressor.
9. Unscrew the M8 hex. head bolts [1] at the support legs [2] of the compressor.



1 Hex head screw M8
2 Compressor support leg
3 Dome mount

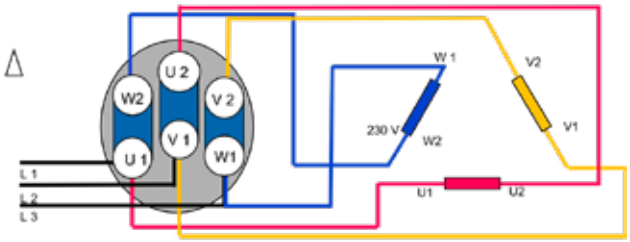
10. Lift the compressor out of the vehicle using a hoist and place safely to one side.

▸ Removal of the compressor has been completed.

Installation

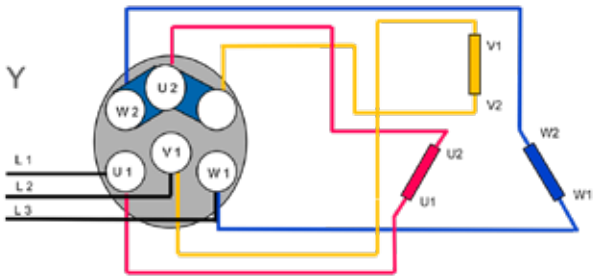
In AE systems there are basically two different circuits to which the compressor can be connected electrically.

With a supply voltage of 230 V, the connection is made via a delta connection, with a supply voltage of 400 V the compressor is connected via a star connection (see circuit diagram).



230 Volt delta connection

3 Maintenance and Repair



400 Volt star connection

Information on the supply voltage can be found on the type plate of the compressor.

Compressor type plate

Preparing the electrical connection

Note

If there was no MP10 motor protection device in the terminal box in the removed compressor, the motor protection switch supplied with the new compressor must also be removed.

1. Open the terminal box and unscrew the earthing conductor in the terminal box.

   Danger

   Risk of fatal injury from electric shock!

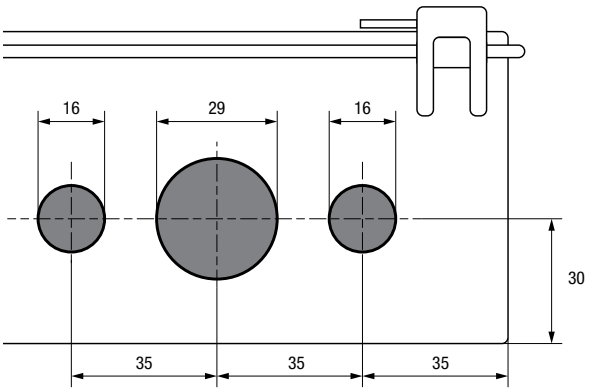
   Risk of electric shock when the ignition is switched on and with high voltage in the electrical components of the AC system.

   → Switch of the ignition.
   → Secure the system to prevent it from being switched on again.
   → Determine lack of voltage.
   → Earth and short-circuit.
   → Cover or cordon off any live neighbouring parts.

2. Remove the terminal box cover.
3. Remove MP10 motor protection device, bracket and terminal strip.
4. Unscrew the four hex. head bolts in the terminal box and remove the terminal box.

1 Hex. head bolt

5. On the hinge side of the terminal box, drill three holes as shown in the drilling template and deburr the holes for the electrical connection of the compressor.



Terminal box drilling template

6. Attach the terminal box to the compressor again using the four hex. head bolts, tightening torque 7 Nm.

Installing pressure switches

1. Remove the sealing plugs for the pressure switches on the compressor.

Removing sealing plugs

3 Maintenance and Repair

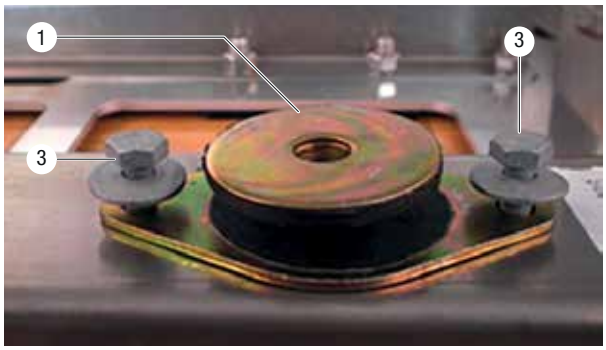
2. Preassemble the pressure switches with sealing washer on the screw adapters, lubricate sealing surface with oil.
3. Wrap the thread of the screw adapter with Teflon tape and screw the adapter onto the compressor.

Pressure switch screw adapter installed on compressor

4. Secure the pressure switches using a torque wrench, paying attention to the correct connections, tightening torque 10 Nm.

Preparing the installation location

1. Unscrew the two M6 combination screws [2] from the used dome mounts [1] using an angle-drive screwdriver. Dispose of the dome mounts and screws.



1 Dome mount
3 M6 combination screw

2. Install new dome mounts [2] on the compressor bracket [1] and secure with M6 combination screws [3], tightening torque 7 Nm.

1 Dome mount
2 Compressor bracket
3 M6 combination screw

3. Lift the preassembled compressor into the vehicle using a suitable hoist and fasten to the dome mounts using M6 screws from the installation kit, tightening torque 25 Nm.
4. Remove and scrap the high-pressure shut-off valve from the existing refrigerant line. Connect the refrigerant line to the high-pressure shut-off valve of the compressor, tightening torque 37 Nm. Also replace the seals.

Note

In some systems, the refrigerant line is brazed to the shut-off valve. In this case either the refrigerant line also has to be replaced, or the shut-off valve supplied with the compressor has to be removed.

5. Remove and scrap the low-pressure shut-off valve from the existing refrigerant line. Connect the refrigerant line to the low-pressure shut-off valve of the compressor, tightening torque 37 Nm. Also replace the seals.

Note

In some systems, the refrigerant line is brazed to the shut-off valve. In this case either the refrigerant line also has to be replaced, or the shut-off valve supplied with the compressor is removed. Fasten the cable gland to the terminal box and connect the earthing cable of the terminal box cover again.

6. Fasten the cable gland to the terminal box and connect the minus cable of the terminal box cover again.

3 Maintenance and Repair

Terminal box with connections

7. Connect the cable harness to the terminal box and connect the three cables as shown in the circuit diagram.

Example of a delta circuit

8. Connect the cables of the low-pressure and high-pressure switches.
9. Evacuate the compressor, see chapter 3.5.2 Evacuate the AC system.
10. Refill the system with refrigerant, see chapter 3.5.3 Filling the AC system.

▶ Installation of the new compressor has been completed.

3.11 Shaft seal

Open reciprocating compressors for vehicle applications have a high-quality shaft seal on the shaft leadthrough. It consists of a rotating unit and a static unit. The rotating seal surfaces must be lubricated with oil, also to prevent refrigerant losses.

Droplets of oil may form on the outside of the compressor during the running-in phase (approx. 200-300 operating hours). This is not an indication of leaks.

During prolonged standstills of the AC system, e.g. in the winter, sticking of the seal surfaces is possible. For this reason, the AC system should be switched on for approx. 10 minutes every four weeks during the cold season.

As an intervention in the refrigerant circuit is necessary for replacement of the shaft seal, it should only be replaced in the event of refrigerant losses. Always replace the complete shaft seal with all the parts.

Multiple replacement of a shaft seal on the same compressor

If the shaft seal on a compressor has to be replaced several times in succession - without success and without visible damage to the shaft seal, it is necessary to replace the whole compressor. In such a case it can be assumed that the drive is damaged (worn main bearing, damage to the O-ring sealing surface of the crankshaft).

3.11.1 Replacing the shaft seal

Tools and equipment

- Torque wrench
- Allen key (6 mm)
- Disposable centering sleeve
- Brush

Removal

Preparatory work

- Connect the recovery unit to the service port of the shut-off valves.
- Close the low-pressure and high-pressure shut-off valves.
- Draw off the refrigerant still in the compressor.

3 Maintenance and Repair

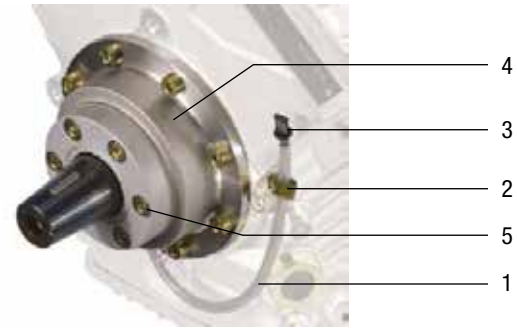
Warning

Serious injury possible if the work is not performed correctly!

→ Depressurise the compressor.

→ Relieve and remove the drive belt.

1. Remove the electromagnetic clutch, (see chapter 3.12 Electro-magnetic clutches).



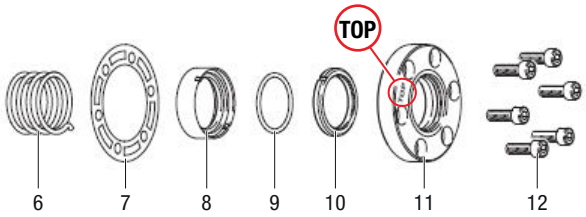
1 Oil drain hose
2 Mounting plate
3 Plug
4 Sliding ring lid
5 Screws

2. Pull oil drain hose [1] out of mounting plate [2].
3. Remove plug [3] from the oil drain hose and completely empty oil collecting pan.
4. Close the oil drain hose with the plug and fit in the mounting plate again.
5. Loosen screws [5] of the sliding ring lid using the Allen key.
6. Pull the sliding ring slid and all the parts of the slip-ring seal from the shaft by hand. Collect the oil still in the oil collecting pan.
7. Dispose of the removed slip-ring seal in accordance with the applicable environmental protection regulations.

Installation

Preconditions

- Sliding and sealing surfaces are clean and have been inspected for damage.
- Deposits on the shaft have been removed using an oil-soaked polishing cloth or emery cloth grain 280 or finer.



6 Compression spring
7 Seal
8 Guide ring
9 O-ring
10 Slidin ring
11 Sliding ring lid
12 Screws

1. Push compression spring [6] onto the shaft with the marked end first until it engages audibly in the groove of the shaft.
2. Assemble sliding ring [10], O-ring [9] and guide ring [8], then push onto the shaft until they engage with an audible click. Ensure that the strong chamfer of the sliding ring is facing towards sliding ring lid [11].
3. Lubricate seal [7] of the sliding ring lid slightly with oil and fit.
4. Grease the contact surface of the sliding ring lid using a brush.
5. Install the sliding ring lid on the shaft using the disposable centering sleeve. Pay attention that the designation “TOP” is at the top and the sliding ring lid is not tilted.
6. Tighten the opposite bolts [12] in pairs to a final torque of 37 Nm. Start with the bolt to the left of “TOP” and work in anti-clockwise direction.
7. Pull off and dispose of the disposable centering sleeve.
8. Install O-ring [13] in the groove of the end cover.

13 1. O-ring
14 2. O-ring in oil collecting pan

9. Place the second O-ring [14] into the oil collecting pan and then push the pan onto the end cover, paying attention to the correct position of the oil drain hose.
10. Fit the oil collecting pan and secure with the 3 M5 bolts, tight-

3 Maintenance and Repair

ening torque 4 Nm.

11. Close the oil drain hose with the plug and fit in the mounting plate.
12. Turn the compressor shaft a few rotations by hand.
13. Evacuate the compressor.
14. Open the shut-off valves.
15. Inspect the compressor for leaks.
16. Fit the drive belt, tension and if necessary align.
17. Put the AC system into operation again. Top up with refrigerant, if necessary.
18. Inspect the AC system for leaks.
19. Check the operating data of the AC system at different compressor speed and record the following key values:
    - Compressor speed,
    - Evaporation pressure and temperature,
    - Suction gas superheating,
    - Condensation pressure and temperature,
    - Oil temperature at the oil drain plug,
    - Oil level in the sight glass.

▶ Replacement of the shaft seal has been completed.

3.12 Electromagnetic clutches

The electromagnetic clutch forms the connection between the V-belt pulley that is driven by the vehicle engine and the drive crankshaft of the compressor. When the AC system is not in operation, the V-belt pulley runs in freewheel. When the AC system is switched on, the solenoid coil is energised and a magnetic field is generated that attracts the spring plate on the V-belt pulley. As the spring plate is mounted directly on the crankshaft of the compressor, the compressor is now driven.

3.12.1 KK 73 clutch

The KK73 clutch is maintenance-free during operation. During cleaning and repair work on the compressor, cover the clutch so that no greasy liquids, greases or dirt particles get into the working gap of the clutch. Do not clean the clutch using a high-pressure cleaner.

Recommended tools

- Allen key for M8 screws
- Circlip pliers for fitting the circlips
- Torque wrench with 17 mm socket for M10 and/or M12 bolt
- 41 mm open-jaw wrench
- Feeler gauge for checking the air gap
- M16 bolt for removing the clutch and corresponding wrench for this bolt
- Suitable fluid for degreasing the friction surface, e.g. alcohol
- High-temperature assembly paste for greasing the shaft end, e.g. Molykote G-rapid-plus or Molykote P40

Removal

1. Loosen and remove M12 bolt [3], counterholding with the WAF 41 open-jaw wrench at the rotor.
2. Screw an M16 bolt into tensioner pulley [4] as puller bolt and pull rotor [2] off shaft end [7] of the compressor by tightening the bolt.
3. Loosen the M8 bolts [5] on the solenoid coil and remove the solenoid coil from mounting [6].

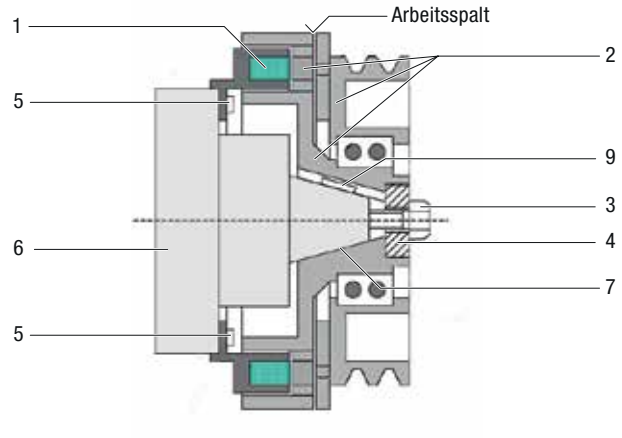
Note

In order to avoid damage to the clutch components, do not place a puller or similar tool against the V-belt pulley to remove the solenoid coil.

3 Maintenance and Repair

Installation

- Compressor flange [6] and shaft end [7] are dirt-free.



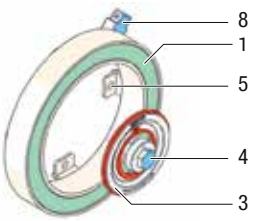
1 Solenoid coil
2 Rotor
3 M12 bolt
4 Tensioner pulley
5 4 M8 bolts
6 Compressor flange
7 Shaft end
8 Anti-surge diode
9 Parallel key

1. Grease the shaft end lightly with high temperature-resistant assembly paste.

Note

Greasing simplifies the later removal of the clutch.

2. Install solenoid coil [1] on the mounting on the compressor flange and secure with 4x M8 bolts [5], tightening torque Bock compressor 34 Nm, Bitzer compressor 25 Nm. Take care that the coil cable does not come into contact with hot parts (t_{max} = 125°C / 257°F) and that the connection for anti-surge diode [8] is open on the underside so that no water can enter.



1 Magnetic coil
2 Rotor
3 M12 bolt
4 Tensioner pulley
5 M8 bolts (4 bolts)
6 Recess
7 Shaft end
8 Anti-surge diode
9 Parallel key

Note

In order to avoid damage to the KK 73 clutch, pay attention to correct voltage and exact mounting when connecting the solenoid coil. On no account use a hammer to install the solenoid coil!

3. Push rotor [2] carefully by hand onto the shaft end up to the stop against the compressor, paying attention to the alignment of parallel key [9] on the shaft end and the groove in the mounting bore of the rotor.

Note

On no account use a hammer to push on.

4. counterholding with the WAF 41 open-jaw wrench.
5. Turn the rotor by hand, paying attention to free movement and noise. If grinding noises are heard or the KK 73 clutch binds, remove the clutch again and inspect. If necessary, degrease the friction surface of the rotor with a suitable fluid.

Adjusting the working gap

Working gap (distance between the friction partners): 0.6 – 0.9 mm

- Measure the working gap using a feeler gauge.
  – If the working gap is too large, replace the clutch.

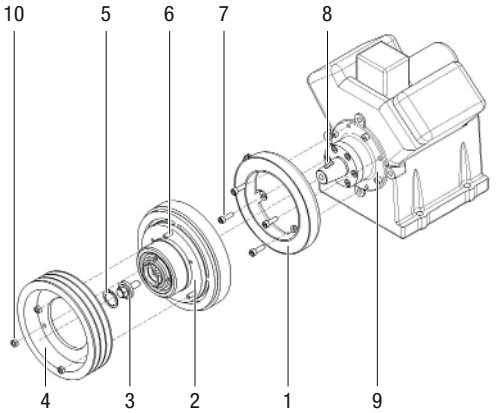
3 Maintenance and Repair

3.12.2 LA16 and LA25 clutches

Removal and installation of electromagnetic clutches of the LA16 and LA 25 Series are described below. The solenoid coil should also be replaced when the clutch is replaced.

Recommended tools

- Torque wrench
- Feeler gauge
- Circlip pliers



1 Solenoid coil
2 Rotor assembly
3 M12 clamping bolt
4 V-belt pulley
5 Seeger K-Circlip
6 Grub screw
7 4 M8 bolts
8 Parallel key
9 Compressor flange
10 4 M8 nuts

Removal

1. Disconnect the cable or plug from the anti-surge diode.
2. On LA16 clutch with bolted V-belt pulley [4] only: Loosen M8 nuts [10] and remove V-belt pulley.
3. Remove Seeger K-circlip [5] using circlip pliers and turn M12 clamping bolt [3] to the left to loosen, counterholding with a WAF 41 open-jaw wrench or ring spanner at the flats on the rotor.
4. Press rotor assembly [2] off the end of the shaft.

   Note

   On no account use a hammer or similar tool for removal!

5. Loosen four M8 bolts [7] and remove solenoid coil [1].

▸ Removal of the LA16 or LA25 clutch has been completed.

Installation

If stored at moderate temperatures, clutches can be stored for three years, otherwise for only two years. Do not use ball bearings that have fallen on the floor!

1. Grease the shaft end lightly with high temperature-resistant assembly paste.

   Note

   Greasing simplifies the later removal of the clutch.

2. Install solenoid coil [1] on the mounting on compressor flange [9] and secure with four M8 bolts [7] (tightening torque Bock 34 Nm, Bitzer 25 Nm). Take care that the cable does not come into contact with hot parts (t_{max} = 125°C / 257°F) and that the opening of the connection for the anti-surge diode is facing downwards so that no water can enter.
3. Take Seeger K-circlip [5] and M12 clamping bolt [3] from the new rotor assembly [2].
4. Push the rotor assembly carefully by hand onto the shaft end up to the stop against the compressor, paying attention to the alignment of parallel key [8] on the shaft end and the groove in the mounting bore of the rotor.

   Note

   On no account use a hammer to push on.

5. Turn the rotor by hand, paying attention to free movement and noise. If grinding noises are heard or the clutch binds, remove the clutch again and inspect. If necessary, degrease the friction surface of the rotor with a suitable fluid. Observe the control crack!
6. Insert M12 clamping bolt and tighten to 85 Nm using a torque wrench, counterholding with a WAF 41 open-jaw wrench at the flats on the rotor.
7. Fit Seeger K-circlip using circlip pliers, paying attention to the correct installation position (concave side towards sealing washer)!
8. On LA16 clutch with bolted V-belt pulley only: Push V-belt pulley [4] onto stud bolts [6] and secure with M8 nuts [10], tightening torque 25 Nm.
9. Connect the cable or plug of the anti-surge diode.

3 Maintenance and Repair

Note

The connection is polarity-independent.

Permissible operating voltage:

10.8 – 16 V DC with 12 V DC nominal voltage.

21 – 32 V DC with 24 V DC nominal voltage.

▸ Installation of the LA16 and LA25 clutch has been completed.

3.13 Condenser

The condenser dissipates the heat absorbed from evaporator and condenser to the atmosphere and condenses the refrigerant. It consists of the condenser pack and the condenser fans.

3.13.1 Cleaning the condenser pack

The pipes and fins of the condenser pack are firmly connected. It must be dirt-free and the fins must not be distorted or compressed.

1. Remove the condenser cover.
2. Cover the condenser fan to protect it from splash water.
3. Clean the condenser coil with compressed air or steam at a temperature of max. 40°C.
4. If detergents are used, be sure to rinse off with clean water.

   Note

   In order to avoid damage to the coating of the condenser, use only mild and biologically degradable detergents.

5. Align fins using a fin comb.
6. Remove the splash water protection.
7. Install the condenser cover.

▸ Cleaning of the condenser coil has been completed.

3.13.2 Replacing MCHX condenser

MicroChannelExchange (MCHX) condensers are employed in AC353 and AC136 Series AC systems. Replacement of the MCHX condenser for the AC353-535 / 540 / 545 is described below as an example.

Note

Replacement of the MCHX condenser involves the lifting of heavy loads. We therefore recommend that you work in pairs.

Recommended tools

- Torque wrench
- Open-jaw wrench
- Cordless screwdriver
- Side cutters
- Cable tie pliers

Removal

1. Switch off the AC system.

3 Maintenance and Repair

Warning

Risk of injury from flying parts!

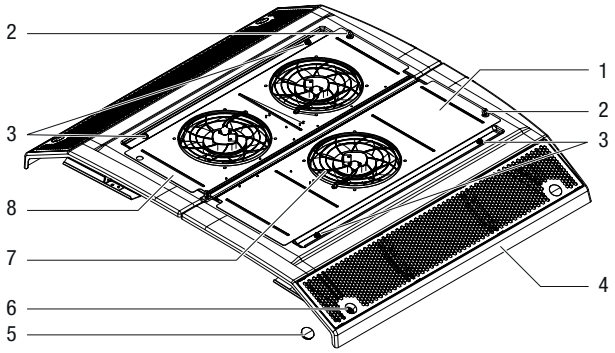
→ Secure the AC system to prevent it from being switched on again.

2. Open the liquid solenoid valve.
3. Draw off the refrigerant from the whole system.

Danger

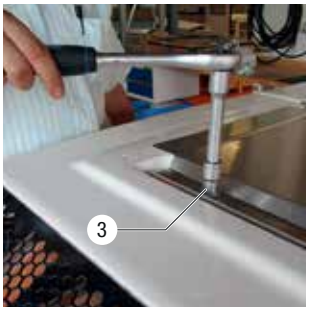
Risk of serious injury or death from falling

→ Use a safety harness when working on the vehicle roof. On no account may the safety harness be fastened to the eyebolts of the AC system.

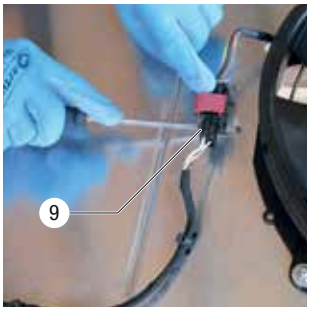


1 Fan plate right
2 Eyebolt
3 Fan plate fastener stud
4 Condenser cover
5 Cap for condenser cover fastener stud
6 Condenser cover fastener stud
7 Fan
8 Fan plate left

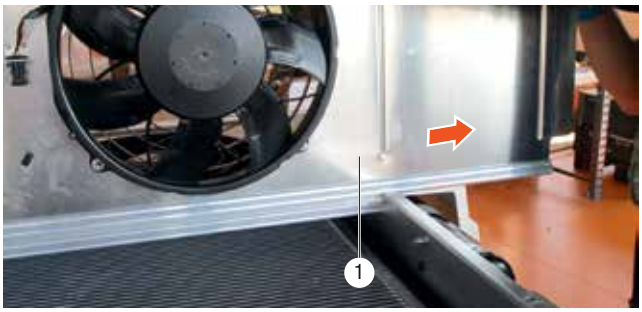
4. Loosen fastener studs [3] and eyebolts [2] on both fan plates [1] and [8].
5. Lift right-hand fan plate [1].



6. Remove caps [5] for fastener studs [6] on the condenser cover, loosen the fastener studs and remove the condenser cover.
7. Disconnect electrical connection [9] of the fan from the cable harness. Cut the three cable ties [10] on the cable harness using side cutters and lay the cable harness to the side.



8. If possible, pull out right-hand fan plate [1] carefully at a 45° angle in the direction of the arrow and place to one side.



9. Loosen M6 screw [11] on the refrigerant hose to the evaporator and remove the refrigerant hose.
10. Loosen the two M10 screws [12] at the flange and remove the pressure line to the compressor.

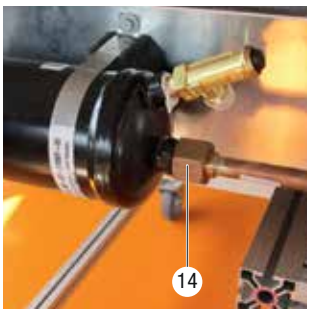
11. Loosen M6 bolts [13] on the refrigerant lines between receiver and condenser.
12. Loosen screw fittings [14] between refrigerant line and receiver inlet port and receiver outlet port and refrigerant line, counter-holding at the inlet and outlet ports with an open-jaw wrench.
13. Remove the refrigerant lines carefully.
14. Lift left-hand fan plate.

3 Maintenance and Repair

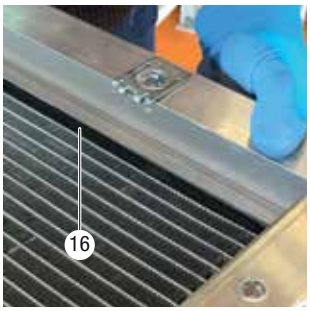
Caution

Risk of injury from sharp-edged components.

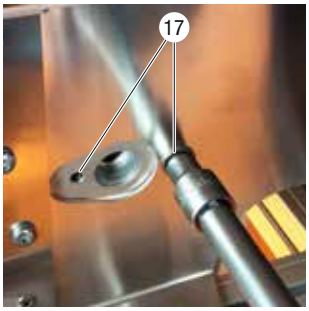
→ Secure the fan plate to prevent it from dropping down.

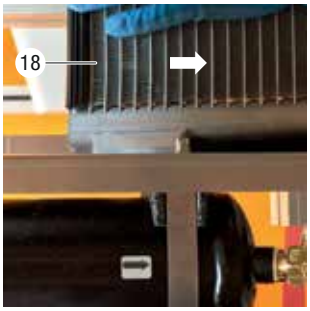


15. Loosen and remove the three M6 Torx screws [15] at the front and rear housing segments.
16. Remove mounting strip and C-profile [16].



17. Loosen and remove the two M6 combination screws [17] at the MCHX condenser.
18. Lift out MCHX condenser [18] to the side with a second person.



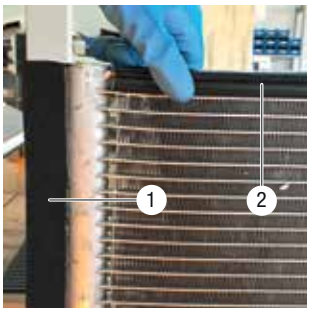


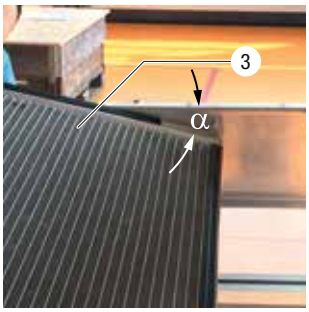
▸ Removal of the MCHX condenser has been completed.

Installation

Various additional parts and the filter drier also have to be replaced when the MCHX condenser is replaced. Eberspächer Sütrak therefore offers a kit with all the necessary spare parts for replacement of the MCHX condenser.

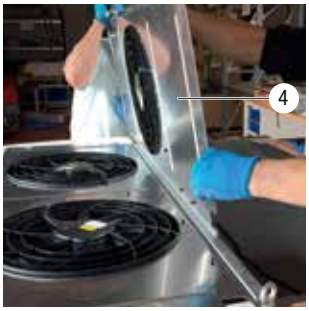
1. Attach new sealing tape [1] and new C-profile [2] to the new MCHX condenser.

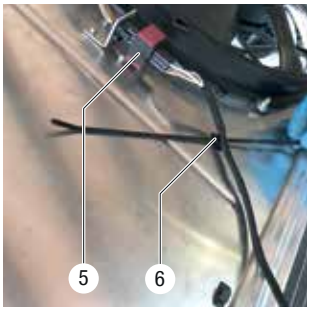




2. Carefully lift in MCHX condenser [3] at an angle of 30° [α], taking care that it is not damaged by either the bolts of the receiver mounting or by the rear housing segment.
3. Push in the MCHX condenser up to the stop, paying attention to the correct position in the mounting strip.
4. Slightly tighten the two M6 combination screws on the condenser.
5. On the open side of the MCHX condenser, also fit a new C-profile. Then install mounting strip and tighten the six Torx screws slightly.
6. Replace the O-rings on the refrigerant lines.
7. Connect the refrigerant lines to MCHX condenser and receiver, tighten the bolts on the MCHX condenser slightly and the bolts on the receiver to 40 Nm, counterholding at the receiver with an open-jaw wrench.
8. Connect the refrigerant hose of the condenser again and tighten the M6 bolt slightly.
9. Connect the pressure line of the compressor again and tighten the M10 bolts slightly.
10. Replace the filter drier, see chapter 3.16 Filter drier.
11. Tighten all M6 bolts to 7 Nm and all M10 bolts to 45 Nm.
12. Inspect for leaks, see chapter 3.5.1 Checking leak tightness of the AC system, then evacuate the AC system, see chapter 3.5.2 Evacuate the AC system.
13. Install right-hand fan plate [4] again.

3 Maintenance and Repair





14. Connect cable harness [5] to the fan and secure to the fan plate again with cable ties [6]. Cut off protruding ends with cable tie pliers.
15. Fill the AC system with refrigerant, see chapter 3.5.3 Filling the AC system.
16. Install condenser cover again and secure with the fastener studs. Then fit new caps to the fastener studs.
17. Lower the fan plates and secure with eyebolts and fastener studs.
18. Test the AC system.

▸ Installation of the MCHX condenser has been completed.

3.14 Receiver bottle

The receiver bottle serves as a storage vessel for the refrigerant. It compensates the constantly changing refrigerant demand of the expansion valve. This results from the different operating conditions, such as start-up and operating phase and shutdown cycles.

1. Close the manual shut-off valve at the receiver outlet.
2. Allow the AC system to run until the low-pressure switch trips.
3. Switch off the AC system.

Warning

Risk of injury from flying parts!

→ Secure the AC system to prevent it from being switched on again.

4. Draw off the refrigerant from the whole system.
5. Replace the receiver bottle.
6. Evacuate the AC system.
7. Fill the AC system with refrigerant, see chapter 3.5.3 Filling the AC system.

▸ Replacement of the receiver bottle has been completed.

3.15 Solenoid valve

In order to prevent liquid refrigerant running back from the evaporator to the compressor when the system is at standstill, a solenoid valve is installed on the low-pressure side of the refrigerant circuit.

3.15.1 Replacing solenoid valve

1. Close the manual shut-off valve at the receiver outlet.
2. Allow the AC system to run until the low-pressure switch trips.
3. Switch off the AC system.

Warning

Risk of injury from flying parts!

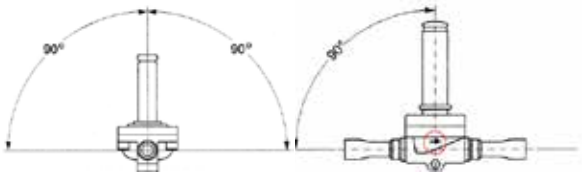
→ Secure the AC system to prevent it from being switched on again.

4. Close the low-pressure shut-off valve on the compressor and, if necessary, the manual shut-off valve downline of the solenoid valve.
5. Draw off the refrigerant trapped between the two shut-off valves.
6. Remove the solenoid valve.

Note

Carefully remove the blue solenoid coil with click fitting using a screwdriver. On no account should a wrench be used!

7. Replace the solenoid valve, paying attention to the correct installation position.



Installation position and flow direction of the solenoid valve

Note

The solenoid valve is normally installed horizontally. The solenoid coil may thereby be oriented by max. 90° to the right or left, but never facing downwards. In special applications and after prior consultation with Eberspächer Sütrak, vertical installation – with flow direction upwards – is also possible. The flow direction must correspond to the arrow on the valve body.

3 Maintenance and Repair

8. Evacuate the line section.
9. Open the shut-off valves again.
10. Top up with refrigerant, if necessary.

▸ Replacement of the solenoid valve has been completed.

3.16 Filter drier

The filter drier absorbs moisture, acid and dirt from the refrigerant circuit to prevent damage such as corrosion. It should therefore be replaced once a year (in AE systems only every two years). If it is clogged with dirt particles and moisture, the inlet port of the filter drier heats up. This is an indication that the filter drier has to be replaced. The filter drier should generally also be replaced after work on the refrigerant circuit and when replacing individual components in the refrigerant circuit.

There are two different versions of filter drier:

Version 1

with thread on inlet and outlet port

1 Outlet port
2 Inlet port

Version 2

with swivel nut at outlet port [1] and thread on inlet port [2].

1 Outlet port
2 Inlet port

3.16.1 Replacing the filter drier

Replacement of the filter drier is described below for version 2. Particular attention must be paid to correct counterholding when loosening the screw fittings.

Recommended tools

- Torque wrench

Preconditions

- Return air filter is covered.

Danger

Risk of fire from easily inflammable materials!

→ No naked flames.

→ Cover the return air filter to protect it from oil droplets.

- Manual valve is closed.

Removal

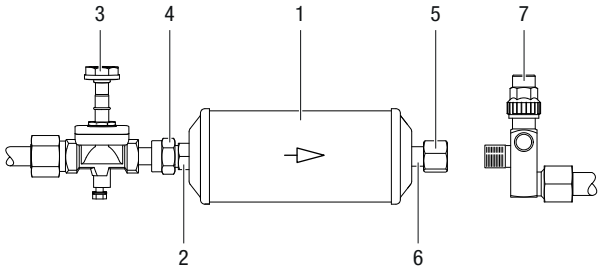
1. Switch off the AC system.

Warning

Risk of injury from flying parts!

→ Secure the AC system to prevent it from being switched on again.

2. Draw off the refrigerant from the whole system.
3. Loosen screw fitting [4] between solenoid valve [3] and inlet port [2] of filter drier [1], counterholding at inlet port [2].



1 Filter drier
2 Inlet port
3 Solenoid valve
4 Screw fitting
5 Screw fitting
6 Outlet port
7 Manual valve

4. Loosen screw fitting [5] between outlet port [6] and manual valve [7], counterholding at the manual valve with an open-jaw

3 Maintenance and Repair

wrench.

5. Remove the filter drier.

▶ Removal of the filter drier has been completed.

Installation

Precondition

- All connections are free from dirt.

1. Oil O-rings [8] lightly with POE oil (SE55/68) and place correctly into the groove on the ports of the filter drier.

8 O-ring

2. Install filter drier according to the flow direction marked on the housing (arrow).
3. Tighten outlet port [6] of the filter drier using a torque wrench, tightening torque 50-60 Nm, counterholding at the manual valve with an open-jaw wrench so that pipework and filter drier cannot move during installation.
4. Tighten solenoid valve [3] at inlet port [2] of the filter drier to 50-60 Nm also using a torque wrench, counterholding at the inlet port with an open-jaw wrench so that pipework and filter drier cannot move during installation.
5. Open the manual valve.
6. Inspect for leaks, see chapter 3.5.1 Checking leak tightness of the AC system, and evacuate the AC system, see chapter 3.5.2 Evacuate the AC system.
7. Fill the AC system with refrigerant, see chapter 3.5.3 Filling the AC system.
8. Check the function of the AC system.

▶ The AC system can be put into operation.

3.16.2 Filter drier in special regions

In hot countries, in tropical countries and in regions where the AC system runs all year round, the filter drier should be replaced twice a year. In this case it is sufficient for the complete AC system to be evacuated once a year and the second time only the filter drier.

Removal

Preconditions

- Return air filter is covered.

Danger

Risk of fire from easily inflammable materials!

→ No naked flames.

→ Cover the return air filter to protect it from oil droplets.

- Manual valve is closed.

1. Switch off the AC system.

Warning

Risk of injury from flying parts!

→ Secure the AC system to prevent it from being switched on again.

2. Completely close both shut-off valves upline and downline of the filter drier.
3. Draw off the refrigerant trapped between the two shut-off valves.
4. Loosen the screw fitting between solenoid valve [3] and inlet port [1] of filter drier, counterholding at the inlet port.
5. Loosen the screw fitting between outlet port [2] and manual valve [4], counterholding at the manual valve.
6. Remove the filter drier.

▶ Removal of the filter drier has been completed.

Installation

Precondition

- All connections are free from dirt.

1. Oil O-rings [8] lightly with POE oil (SE55/68) and place correctly into the groove on the ports of the filter drier.

8 O-ring

3 Maintenance and Repair

2. Install filter drier according to the flow direction marked on the housing (arrow).
3. Tighten outlet port [6] of the filter drier using a torque wrench, tightening torque 50-60 Nm, counterholding at the manual valve with an open-jaw wrench so that pipework and filter drier cannot move during installation.
4. Tighten solenoid valve [3] at inlet port [2] of the filter drier to 50-60 Nm also using a torque wrench, counterholding at the inlet port with an open-jaw wrench so that pipework and filter drier cannot move during installation.
5. Evacuate the filter drier.
6. Completely open the two shut-off valves again and top up refrigerant, if necessary.
7. Check the function of the AC system.

▸ Installation of the filter drier has been completed.

3.17 Sight glass

The sight glass is installed in the liquid line immediately upline of the expansion valve. It allows you to check whether only liquid refrigerant is flowing through the expansion valve and whether it is flowing freely.

If extreme bubbling is observed, this is an indication that gaseous refrigerant is flowing through the expansion valve. This results in a significant reduction in the cooling capacity. In most cases, the cause of the bubbling is insufficient refrigerant filling.

Different sight glasses

3.17.1 Replacing sight glass

1. Close the manual shut-off valve at the receiver outlet.
2. Allow the AC system to run until the low-pressure switch trips.
3. Switch off the AC system.

1.

Warning

Risk of injury from flying parts!

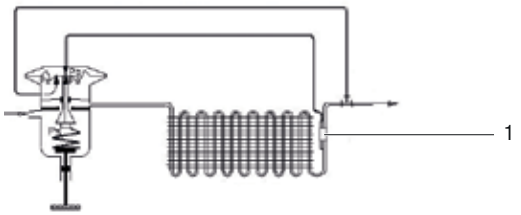
→ Secure the AC system to prevent it from being switched on again.

2. Close the low-pressure shut-off valve on the compressor and if necessary, the manual valve downline of the sight glass.
3. Draw off the refrigerant trapped between the two shut-off-valves.
4. Replace the sight glass.
5. Evacuate the line section.
6. Open the shut-off valves again.
7. Top up with refrigerant, if necessary.

▸ Replacement of the sight glass has been completed.

3.18 Expansion valve

The expansion valve serves to reduce the pressure of the refrigerant coming from the condenser at high pressure. The reduction in pressure causes the refrigerant to start to evaporate. Furthermore, the expansion valve regulates the amount of refrigerant flowing into the evaporator to ensure an optimum supply of refrigerant. Thermostatic expansion valves (TEV) with external pressure compensation are installed in Eberspächer Sütrak bus AC systems.



Inspection of the expansion valve

- Check the function of the nozzle.
- Inspect the capillary for damage.

3.18.1 Replacing the expansion valve

1. Close the manual shut-off valve at the receiver outlet.
2. Allow the AC system to run until the low-pressure switch trips.
3. Switch off the AC system.

Warning

Risk of injury from flying parts!

→ Secure the AC system to prevent it from being switched on

3 Maintenance and Repair

again.

4. Close the low-pressure shut-off valve on the compressor and if necessary, the manual shut-off valve downline of the expansion valve.
5. Draw off the refrigerant trapped between the two shut-off valves.
6. Replace the expansion valve and carefully screw on the pipelines.

Note

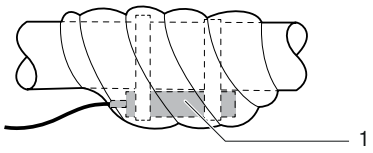
The capillary must not be installed on hot components or in the vicinity of fans.

7. Connect the external pressure compensation to the suction line facing upwards.
8. Install sensor [1] of the expansion valve on the evaporator outlet port and in flow direction upline of the pressure compensation line. Clean the surface of the pipe with emery cloth, if necessary.

Note

Install the sensor on a horizontal pipe, if possible.

9. Be sure to insulate sensor [1] in order to avoid damage to the AC system.



1 Insulated sensor on horizontal intake pipe

10. Evacuate the line section.
11. Open the shut-off valves again.
12. Top up with refrigerant, if necessary.

▶ Replacement of the expansion valve has been completed.

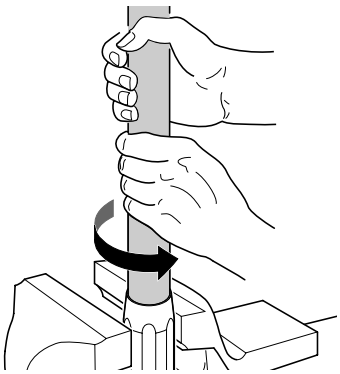
3.19 Flexible hoses

3.19.1 Installing hoses

1. Cut off the hose at right-angles using a sharp saw and carefully clean of cutting waste.
2. Mark a line with chalk or marking pen shortly before the end of the lantern piece to ensure that the hose is not pulled out during assembly.
3. Screw the hose into the lantern piece in anti-clockwise direction until it is fully inn contact, then back off by ¼ turn.

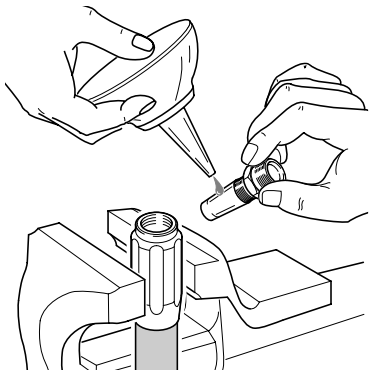
Note

With very long hoses it may be expedient to screw the lantern piece onto the hose in clockwise direction.



Screwing hose into lantern piece

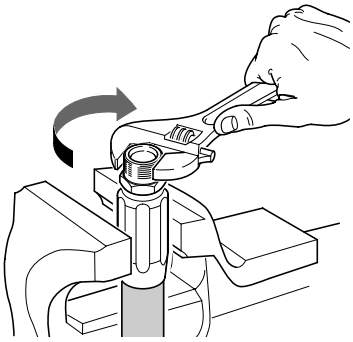
4. Lubricate the thread and cone with the same oil as used in the AC system.



Lubricating thread and cone

5. Push the cone into the hose, press in slightly by hand and screw in by one turn in clockwise direction.
6. Screw further in a smooth movement using a suitable wrench until the nut is just in contact with the lantern piece.

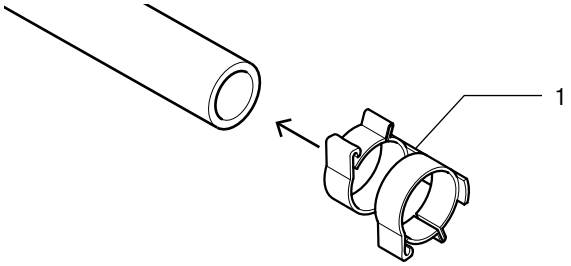
3 Maintenance and Repair



Screwing in cone

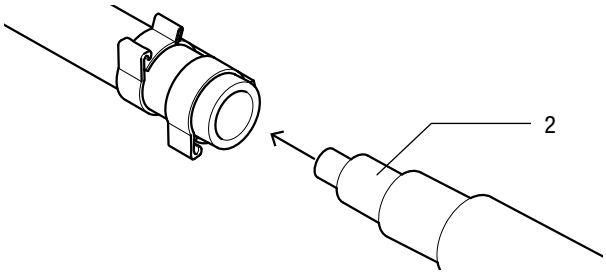
3.19.2 Installing crimp connectors with a double clamp

1. Cut off the hose end with hose cutting pliers.
2. Push hose connector [1] over the hose until the angled stop contacts the end of the hose.



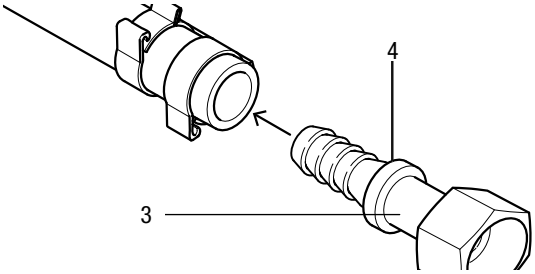
1 Hose connector

3. Flare the hose with flaring kit [2] until the O-rings of the connector no longer move when the connector is inserted.



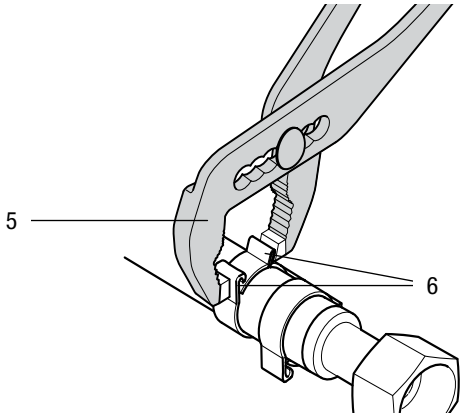
2 Flaring kit

4. Lubricate connector [3] with a drop of refrigerant oil and push into the hose up to stop [4].



3 Connector
4 Stop

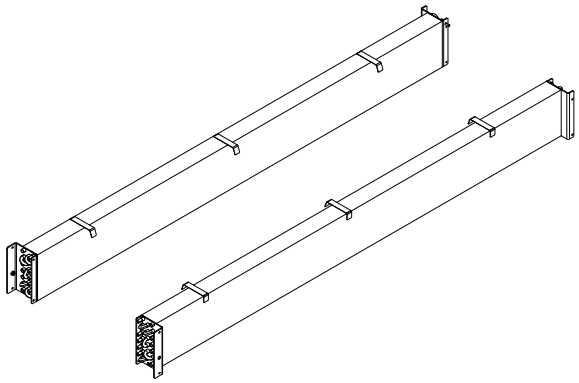
5. Lock the tabs of hose connector [6] using special pliers [5].



5 Special pliers
6 Tabs of hose connector

3.20 Evaporator

The evaporator is responsible for removing the heat. It absorbs the heat and dissipates it to the refrigerant. The previously liquid refrigerant thereby evaporates. In order to ensure that no liquid refrigerant enters the compressor, the refrigerant is superheated by five to nine Kelvin after complete evaporation.



Evaporator

3 Maintenance and Repair

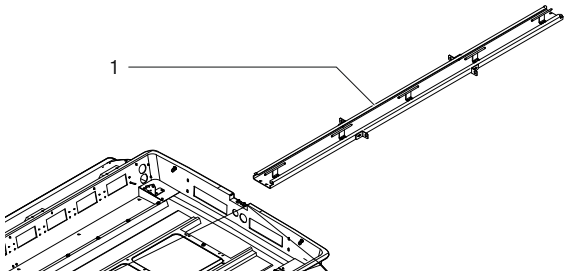
3.20.1 Replacing the evaporator

Various additional parts also have to be removed from the housing, e.g. the hinge strip, in order to be able to replace the evaporator. It is therefore important that their seals and sealing tapes are also replaced so that no moisture can enter the AC system.

1. Close the manual shut-off valve at the receiver outlet.
2. Allow the AC system to run until the low-pressure switch trips.
3. Switch off the AC system.

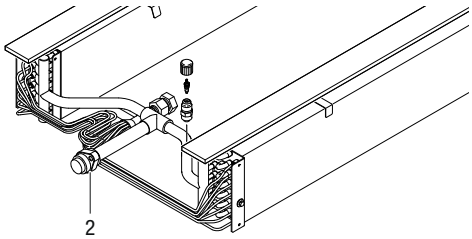
Warning
Risk of injury from flying parts!
→ Secure the AC system to prevent it from being switched on again.

4. Close the low-pressure shut-off valve on the compressor and, if necessary, the manual valve downline of the evaporator.
5. Draw off the refrigerant trapped between the two valves.
6. Remove hinge strip [1].



1 Hinge strip

7. Loosen flange connection [2] at the evaporator and remove the refrigerant line.



2 Flange connection

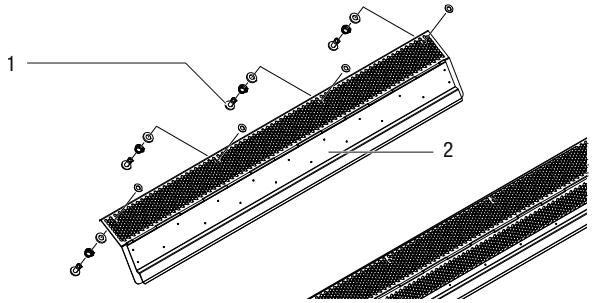
8. Replace the evaporator coil.
9. Connect the refrigerant line to the evaporator again at the flange.
10. Install the hinge strip again, replacing the sealing tape on the hinge strip, if necessary.
11. Evacuate the line section.
12. Open the valves again and top up with refrigerant, if necessary.
13. Check the function of the AC system.

▶ Replacement of the evaporator has been completed.

3.20.2 Cleaning and replacing filters

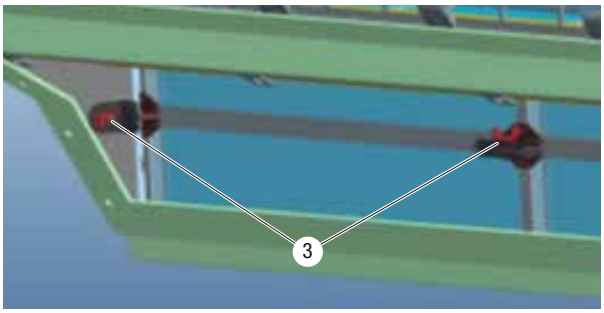
The filters are intended to keep leaves, splashes of water and dirt away from the AC system, thus preventing premature clogging of the air filters. They should therefore be replaced at least once a year.
Three different filters are used in Eberspächer Sütrak AC systems: PU foam filter, metal filter and pleats filter.

1. Open the four fastener studs [1] with a ¼ turn from the inside of the vehicle.
2. Remove return air grille [2].



1 Fastener stud
2 Return air grille

3. Loosen wing nuts [3] and remove metal filter with housing segment.

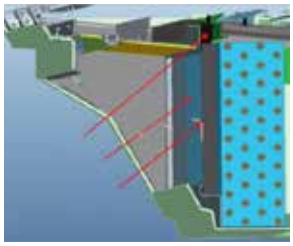


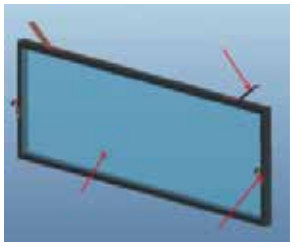
3 Wing nut

4. Remove metal filter from housing segment.
5. Clean metal filter with compressed air or replace.

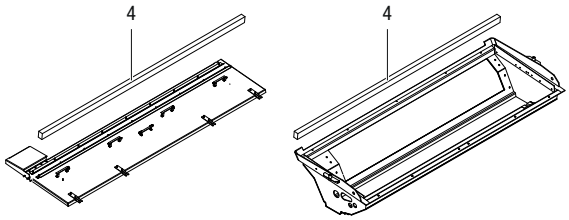
Note
Pleats filters and PU foam filters must always be replaced as they cannot be cleaned.

3 Maintenance and Repair





6. Also clean or replace filter mats [4] on the internal cover in the evaporator housing.



7. Install new or cleaned metal filters in the housing segment again.
8. Install housing segment again and secure with the wing nuts.
9. Install return air grille again and secure with the four fastener studs.
10. Cleaning of the air filters has been completed.

3.20.3 Cleaning the evaporator

Dust, dirt or residues of refrigerant oil increase the fire risk in the evaporator. This applies in particular to AE systems, as the heater rods there reach temperatures of up to 750°C/1382°F. The evaporator must therefore be cleaned at regular intervals.

Precondition

- The ignition is switched off and secured to prevent it being switched on again.

Cleaning the evaporator

1. Disconnect plugs for heater, compressor and battery from the inside of the vehicle or disconnect the wiring.
2. Open the cover of the evaporator.

Warning
Risk of burns on hot surfaces!
→ Do not touch the heater rods.

3. Remove dirt and dust using a vacuum cleaner.
4. On AE systems, inspect the heater rods for residues of refrigerant oil and discolouration.

Warning!
Risk of fires due to inflammable substances!
→ Be sure to remove any residues of refrigerant oil.
→ Replace the heater in the event of extreme discolouration or matt surface.
→ Inspect all components in the evaporator for fusing and replace, if necessary.

5. Check the connections to the heater rod and retighten, if necessary.
6. Close the cover of the evaporator.
7. Reconnect the connecting plugs or wiring.

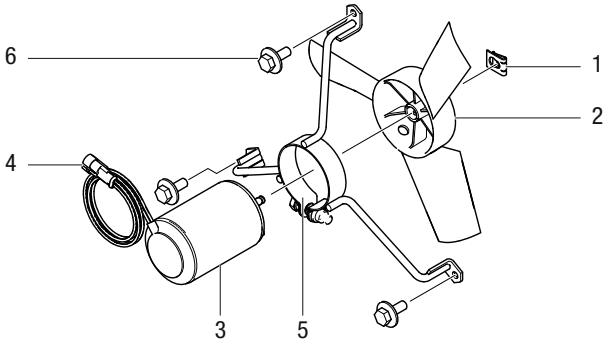
▸ Cleaning of the evaporator has been completed.

3.21 Fans and blowers

Fans and blowers are required for the air circulation in a bus so that the cooling capacity of the AC system can be assured. The condenser fan transports the air uniformly out of the bus, the evaporator fan transports the air into the air manifold/air duct.

3.21.1 Replacing the condenser fan

Condenser fan with brush motor



1	Clamp	4	Connecting plug
2	Fan blade	5	Motor bracket
3	Fan motor	6	Combination screw

Precondition

- The ignition is switched off and secured to prevent it being switched on again.

3 Maintenance and Repair

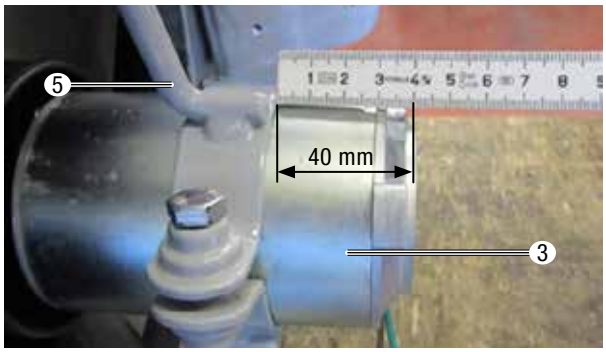
Removal

1. Open or remove the cover of the AC system.
2. Disconnect plug [4] of the fan motor [3] and secure with a cable tie so that the plug does not drop onto the floor.
3. Loosen the three combination screws [6] of motor bracket [5] and remove the fan.
4. Remove clamp [1] from the motor shaft using pliers and pull fan blade [2] off the motor shaft.
5. Loosen the clamping bolt of motor bracket [5] and remove fan motor [3].

▸ Fan blade and fan motor can now be replaced.

Installation

1. Install new fan motor [3] in motor bracket and fix temporarily with the clamping bolt. Grease the motor shaft with lubricant paste.
2. Push new fan blade [2] onto the motor shaft and secure with a new clamp [1].
3. Secure motor bracket [5] to the frame with the three combination screws [6], tightening torque 10 Nm.
4. Align fan motor and fan blade.
   Adjust clearance of 40 mm between fan motor [3] and motor bracket [5] and tighten the clamping bolt.



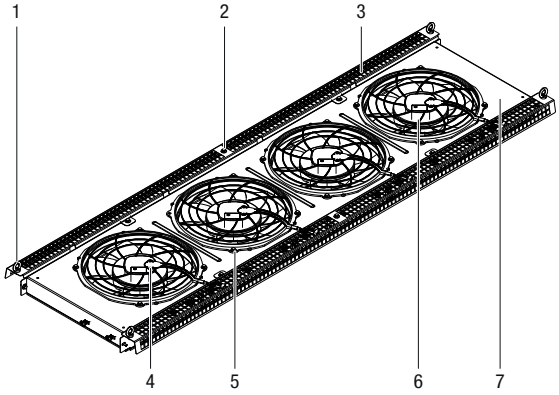
3 Fan motor
5 Motor bracket with clamping bolt

5. Check manually that the fan vanes do not contact adjacent components. Adjust the clearance, if necessary.
6. Connect plug [4] of the fan motor again.
7. Close or fit the cover of the AC system.

▸ Installation of the condenser fan has been completed.

Condenser fan with brushless motor

In the case of condenser fans with brushless motors, the whole assembly with fan wheel and motor always has to be replaced.



1 Eyebolt
2 Hex. head bolt
3 Cover
4 Electrical connection
5 Screw
6 Condenser fan
7 Housing cover

Precondition

- The ignition is switched off and secured to prevent it being switched on again.

Removal

1. Loosen the four eyebolts [1] and the two hex. head bolts [2] on the two side covers [3] and remove the covers.
2. Disconnect electrical connection [4] of the condenser fan in question.
3. Loosen the four screws [5] of the condenser fan and remove condenser fan [6].

▸ The condenser fan can now be replaced.

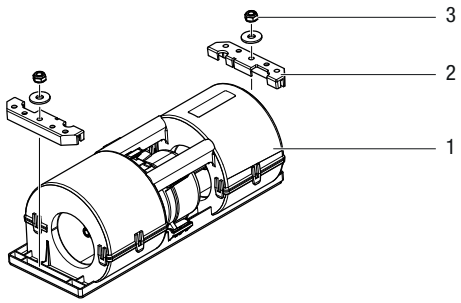
Installation

1. Place condenser fan [6] into housing cover [7] and secure with four screws, paying attention to the correct position of the electrical connection.
2. Make the electrical connection to the condenser fan.
3. Secure the cover with the two eyebolts and the two hex. head bolts.
4. Check the function of the condenser fan, paying attention to the correct direction of rotation.

▸ Installation of the condenser fan has been completed.

3 Maintenance and Repair

3.21.2 Replacing double radial blower



1 Double radial blower
2 Blower bracket
3 Nut

Precondition

- The ignition is switched off and secured to prevent it being switched on again.
- Battery main switch is turned OFF.

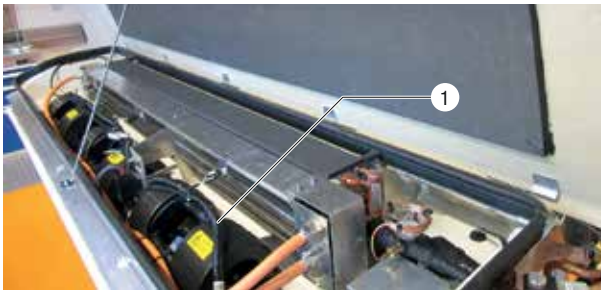
Removal

1. Loosen fastener stud on the evaporator cover with ¼ turn and open the evaporator cover.
2. Check that the connecting plug is no longer live using a measuring instrument.
3. Disconnect the plug from the power supply and speed regulator, if necessary.
4. Loosen nuts [3] and remove fan bracket [2].
5. On double radial blowers with brush motor, remove the speed regulator from the basic chassis.
6. Remove double radial blower [1].

▸ Removal of the double radial blower has been completed.

Installation

1. Install double radial blower.
2. On double radial blowers with brush motor, install the speed regulator on the basic chassis.
3. Install fan bracket with washers and nuts on the basic chassis.
4. Connect the plug to the power supply and speed regulator, if necessary. Ensure that the cable harnesses [1] are routed cleanly to avoid electromagnetic interference.



1 Electrical connection of double radial blower

5. Turn on battery main switch and ignition.
6. Check the function of the double radial blower at different speeds and for correct direction of rotation.

Warning
Severing of limbs possible at rotating fan wheels!
→ Never reach into rotating fan wheels.

7. Close the evaporator cover and lock with ¼ turn of the fastener stud.

▸ Installation of the double radial blower has been completed.

3.22 Evaporator heater in AE systems

In AE systems, the evaporator heater has either a 3 x 230 V AC voltage supply or a 290-400 V DC voltage supply. The AC voltage-powered evaporator heater is connected to the inverter, the DC voltage-powered heater to the battery of the bus.

3.22.1 Overheating protection

The evaporator heater has an overheating protection device. This trips at a temperature of 90°C / 194°F to prevent fires in the AC system. This safety device must therefore be fully functional in the event of an emergency. The cartridge of the overheating protection device must therefore be replaced after three years at the latest, or in the event of mechanical damage.

Replacing the cartridge

Precondition

- The ignition is switched off and secured to prevent it being switched on again.

1. On AC systems with DC/DC inverter, disconnect the three plugs of heater, compressor and battery from the interior of the vehicle. On AC systems with DC/AC inverter, loosen the screw connections.

3 Maintenance and Repair

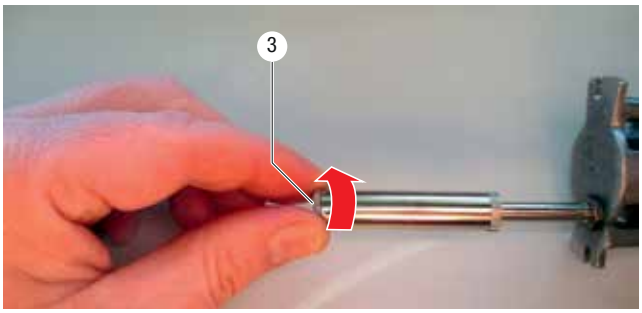
Danger!
Risk of fatal injury from electric shock!

- → Secure the system to prevent it from being switched on again.
- → Wear high-voltage protective gloves.
- → Check that the power is off.
- → Earth and short-circuit.
- → Cover live parts.
- → Have unprotected cables repaired by a qualified electrician.

2. Loosen fastener stud on the evaporator cover and open the evaporator cover.
3. Carefully remove cotter pin [1] at the end of sensor [2].

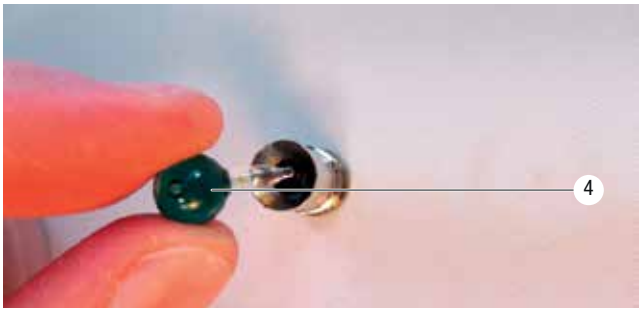
1 Cotter pin
2 Sensor

4. Unscrew cartridge holder [3] from sensor.



3 Cartridge holder

5. Remove cartridge [4].



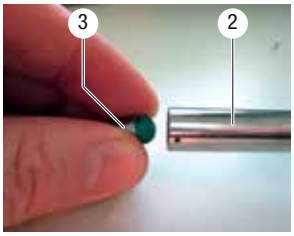
4 Cartridge

6. Clean the cartridge holder using a brush. Particular in the case of mechanical damage to the cartridge, carefully remove any glass splinters.
7. Install new cartridge in the cartridge holder, paying attention to the correct installation direction.

Warning
Risk of fires due to overheating!

- → Always replace cartridges in pairs on both sides of the AC system and document the replacement in the maintenance plan.
- → Use only OEM replacement cartridges of the correct colour.
- → Do not keep cartridges in stock as their service life is limited.

8. Screw cartridge holder [3] into sensor [2]. On heaters with DC voltage supply, tighten protective cap [5] in clockwise direction at the same time using a wrench.



2 Sensor
3 Cartridge holder

5 Protective cap

9. Insert cotter pin and secure to prevent it from falling out.
10. Check the correct position of the sensor (CC dimension). If the sensor is bent, replace the sensor.

▸ Replacement of the cartridge has been completed.

Temperature switch

The evaporator is protected against damage due to overheating by temperature switches. Three bi-metals are installed on the evaporator for this that switch off the AC system at temperatures above 50°C / 122°F.

1 Bi-metals as overheating protection on the evaporator

3 Maintenance and Repair

3.22.2 Replacing evaporator heater

The evaporator heater of AE systems consists of several heater rods. In the event of a defect in the heater rods, the complete heater should always be replaced.

Removal

Preconditions

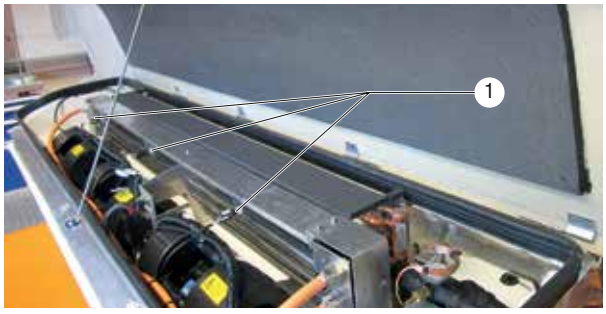
- The ignition is switched off and secured to prevent it being switched on again.
- Evaporator heater has cooled down.

Warning
Risk of burns at the heater rods of the evaporator heater.
→ Wear gloves.
→ Allow the evaporator heater to cool down before maintenance and repair work.

1. On AC systems with DC/DC inverter, disconnect the three plugs of heater, compressor and battery from the interior of the vehicle. On AC systems with DC/AC inverter, loosen the screw connections.

Danger!
Risk of fatal injury from electric shock!
→ Secure the system to prevent it from being switched on again.
→ Wear high-voltage protective gloves.
→ Check that the power is off.
→ Earth and short-circuit.
→ Cover live parts.
→ Have unprotected cables repaired by a qualified electrician.

2. Loosen fastener stud on the evaporator cover with ¼ turn and open the evaporator cover.
3. Disconnect wiring from bi-metals.



1 Bi-metals

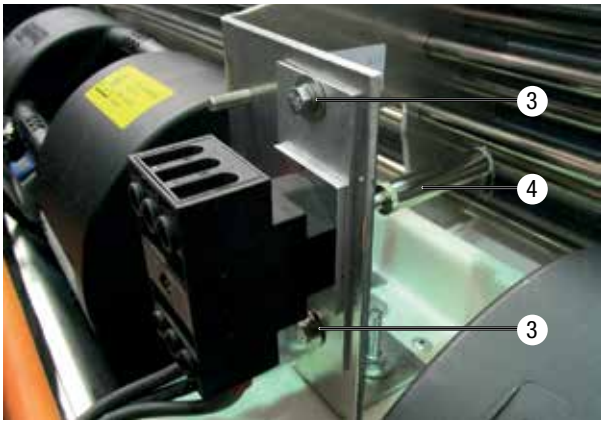
4. Loosen the two screws of the protective plate on both sides and remove the cover.
5. Disconnect the cables [1] on one side and unscrew the cable harness.

1 Cable harness connections

6. Loosen screw fittings [2] at the tubular heater.

2 Screw fitting

7. Loosen the two M5 bolts [3] of overheating protection device [4] and remove the device.



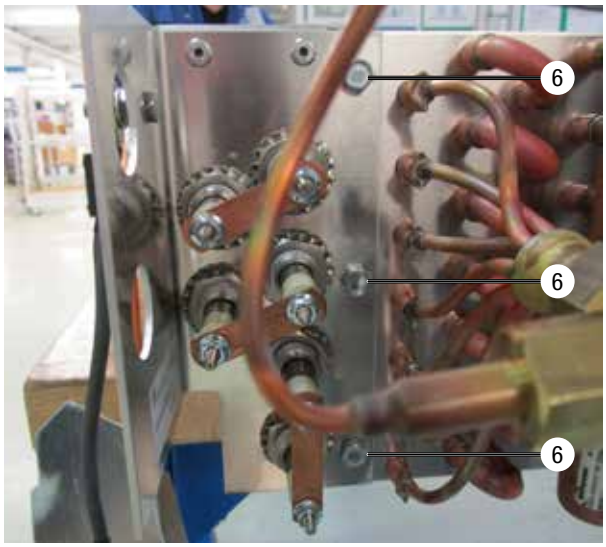
1 M5 bolt
2 Overheating protection device

8. Loosen nut [5] on the bracket for the overheating protection device from the bottom of the housing.

3 Maintenance and Repair

5 Self-locking nut

9. Loosen and remove the three screws [6] from the cable harness brackets.



6 Retaining screws

▸ The evaporator heater can now be removed.

Installation

1. Install the new evaporator heater.
2. Tighten the three screws of the cable harness brackets again.
3. Tighten the nut on the bracket for the overheating protection device on the bottom of the housing again.
4. Fasten the overheating protection device to the bracket again using the two screws.
5. Fasten the cable harnesses to the two lateral cable harness brackets again.
6. Connect the cables again according to the device-specific circuit diagram.
7. Secure the protective plates again with two screws.
8. Reconnect the bi-metals.
9. Close the evaporator cover and lock with the fastener stud.
10. Make the electrical connections to the heater, compressor and battery again.

▸ Replacement of the evaporator heater has been completed.

3.22.3 Replacing Gigavac switching devices

The evaporators in AE systems with DC/DC inverter have three Gigavac switching devices.

Removal

Precondition

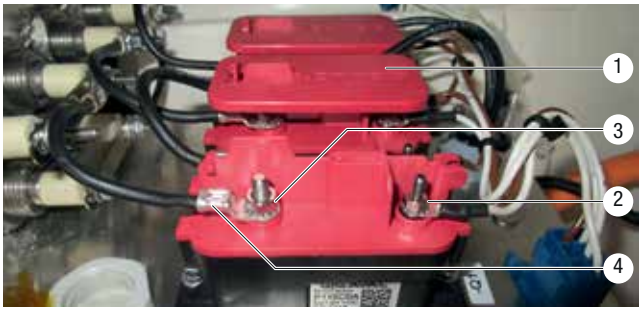
- The ignition is switched off and secured to prevent it being switched on again.

1. Disconnect the three plugs of heater, compressor and battery from the interior of the vehicle.

Danger!
Risk of fatal injury from electric shock!

→ Secure the system to prevent it from being switched on again.
→ Wear high-voltage protective gloves.
→ Check that the power is off.
→ Earth and short-circuit.
→ Cover live parts.
→ Have unprotected cables repaired by a qualified electrician.

2. Open the cover of the evaporator housing.
3. Remove red cover [1] of the Gigavac switching devices.



Removal of the Gigavac switching devices

4. Loosen the two M3 [2] and M4 nuts [3] on the Gigavac switching devices from top to bottom.
5. Remove ring cable lugs [4].
6. Replace Gigavac switching devices.
7. Install the ring cable lugs and secure from bottom to top with the M3 and M4 nuts.
8. Fit the cover of the Gigavac switching devices again.

▸ Replacement of the Gigavac switching devices has been completed.

3 Maintenance and Repair

3.23 DC/DC and DC/AC inverter

In AE systems there is an inverter that either converts the DC input voltage into a lower DC voltage (DC/DC inverter) or inverts it into an AC voltage (DC/AC inverter). The DC/AC inverter is located in an inverter box on the roof of the bus, the DC/DC inverter is housed in the rear of the bus.
The inverter box has three different voltages:

- Input voltage of the DC/AC inverter,
- Output voltage of the DC/AC inverter,
- Battery voltage.

3.23.1 General maintenance work

Danger!
Risk of fatal injury from electric shock!

→ Have work on the inverter box carried only by a specialist for work on HV intrinsically safe vehicles.
→ If it is necessary to open HV components to establish that they are no longer live, special gloves must be worn as protection against high voltages.
→ Recommissioning of the vehicle on completion of the work only by this specialist.
→ Instruct employees who do not carry out electrical maintenance work on the inverter box about:
  - Hazard sources in the vehicle,
  - Protective and
  - behavioural measures.

Precondition

- The ignition is switched off and secured to prevent it being switched on again.

1. Open the cover of the inverter box.

   Danger!
   Risk of fatal injury from electric shock!

   → Secure the system to prevent it from being switched on again.
   → Wear high-voltage protective gloves.
   → Check that the power is off.
   → Earth and short-circuit.
   → Cover live parts.
   → Have unprotected cables repaired by a qualified electrician.

2. Check tightening torques.
3. Inspect electric cables for damage and repair, if necessary.
4. Carry out a visual inspection for coolant leaks. Inspect the lines for leaks, if necessary.
5. Inspect the heat exchanger for cleanliness and clean with compressed air, if necessary.

   Warning
   Risk of injury to the eyes from flying parts and possible damage to the heat exchanger!

   → Wear safety glasses/goggles.
   → Maintain a minimum distance of approx. 10-15 cm between air gun and heat exchanger.

3.23.2 Replacing the filter mat

1. Inspect filter mat [1] in the inverter for soiling.

1 Filter mat

2. Loosen four screws and remove the cover.
3. Replace soiled filter mat.
4. Fit the cover again and secure with the four screws.

▸ Replacement of the filter mat has been completed.

3 Maintenance and Repair

3.23.3 Top up coolant

The coolant circuit of the inverter box is filled with a water-glycol mixture. There is a sensor on the receiver bottle of the coolant circuit that switches off the AC system if the coolant level is too low. The filling level should therefore be checked at regular intervals to avoid standstills of the AC system.

1. Open cap [1] of the receiver bottle and check the coolant filling level.

1 Cap of receiver bottle

2. Top up with coolant according to the bus manufacturer's instructions.
3. Close the cap of the receiver bottle again.
4. Check the lines for leaks and repair, if necessary.

▶ The inverter box can be put into operation again by the specialist for HV intrinsically safe vehicles.

Notes

Notes

Eberspächer Sütrak GmbH & Co. KG
Heinkelstraße 5
71272 Renningen
Phone: +49 7159 923-0
Fax: +49 7159 923-108
info.suetrak@eberspaecher.com
www.eberspaecher.com

Eberspächer

88-50-40-00573-00 Rev.A EN 07.2018