SÜTRAK
Workshop - Manual

Usage for Eberspächer Air Conditioning

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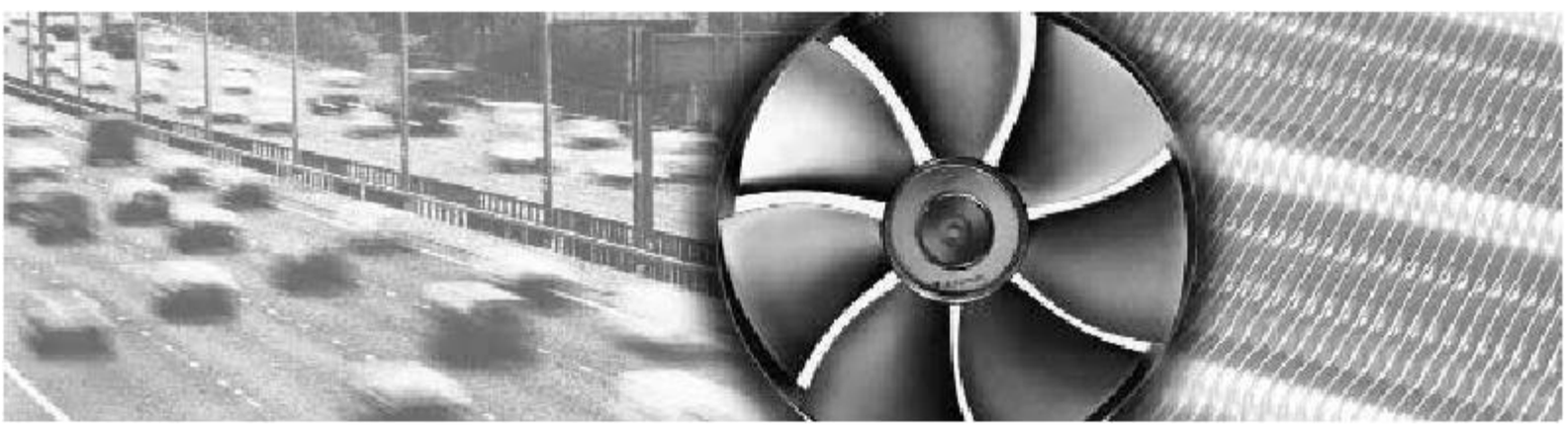


DRIVING THE MOBILITY OF TOMORROW

Eberspächer

1 General

This manual is intended for maintenance, service and operating personnel and describes important features of the air conditioning plant; it provides an overview of the structure, operation, function and maintenance of the system.

Regular maintenance in accordance with the maintenance schedule prevents problems arising with the air conditioning plant. Maintenance also helps to reduce operating costs, increase the service life of the plant and ensure it is always operating at maximum efficiency.

1.1 Revision status

Eberspächer Sütrak is always improving the quality of its products. The information in this manual may therefore be changed at any time without notice.

To prevent confusion as the result of revisions to documentation, the revision status is linked to the date of publication.

This date can be found in the black box in the bottom left of the title page.

1.2 Rating plate

Each air conditioning system can be identified by its attached rating plate.

If problems arise with the plant or any of its components, make a note of the type and serial number of the system (*see* rating plate) before contacting us to call out an engineer. Eberspächer Sütrak requires this data for the Customer Service department.

2 Safety

The following safety instructions are designed to protect the operator and the plant. They must be observed at all times.

2.1 Certification

Quality assurance is implemented in accordance with DIN ISO 9001.

The CE mark can be requested from Eberspächer Sütrak.

2.2 EU Certificate of Conformity

The EU Certificate of Conformity can be requested from Eberspächer Sütrak.

The removal of safety guards while the plant is in operation is forbidden.
Disabling of the safety features is strictly prohibited.

2.3 Safety

Safety of operating personnel is at the forefront of the design of your Eberspächer Sütrak air conditioning plant. During normal operation, all moving parts are guarded to prevent accidents. When carrying out checks before starting commissioning work, during daily inspections and maintenance work, moving parts may be exposed. An adequate distance from these parts must be maintained when the air condition plant is in operation and the main switch is in the „On“ position.

Thin metal sheets have been applied to the evaporator and condenser piping; these can cause cuts if touched with the hand. We recommend that protective gloves are worn at all times when working on the air conditioning plant.

Work on cooling plant and air conditioning installations may only be carried out by personnel with the appropriate levels of experience and training. Only those in possession of the appropriate certificates may work on air conditioning installations.

2.4 Safe handling of coolants

The coolant used in the cooling circuits of air conditioning plant can freeze on contact with skin and cause severe burns. It can cause blindness if it gets into the eyes. Should liquid coolant get into the eyes, immediately rinse with copious amounts of water and call a doctor.

The coolant used by Eberspächer Sütrak is R 134a

Follow the safety instructions:

- Do not breath in coolant vapours. Coolant in the form of vapour is heavier than air and can gather in low-lying places. In large quantities, coolant will completely displace air.
- Protective gloves and safety goggles must be worn at all times when working on the air conditioning plant.
- Air conditioning plant and coolant vessels must never be overfilled. When the temperature increases, the increased pressure may cause the vessels to burst.
- The system must be evacuated before performing any soldering work. Purge the system with dry nitrogen or forming gas while this work is being carried out.

2.4.1 First Aid in the event of coolant accidents

Freezing:

Warm the affected area to body temperature.

Eyes:

If coolant gets in the eyes, rinse with copious amounts of water. Consult a doctor without fail.

2.4.2 Disposal of coolant

Observe the legal requirements regarding the disposal of coolant: In Germany, use the white recycling bottles.

2.5 Installing spare parts and consumables

Spare parts and accessories not supplied by Eberspächer Sütrak have not been inspected and approved.

Other spare parts and accessories can be used if approved by Eberspächer Sütrak. The installation or use of non-approved product may under certain circumstances adversely affect the specified design characteristics of the plant.

Eberspächer Sütrak will not accept any liability for damages arising from the use of non-approved spare parts and accessories.

2.5.1 Inspection prior to despatch

Before despatch, each device is inspected with regard to:

- Condition
- Setting the safety features and the various control devices
- Sealing of the coolant circulation (if present, water and fuel circulation as well)
- Function

checked.

3 Care and Maintenance

To ensure the proper functioning of the air conditioning plant, regular maintenance and inspections are essential. A careful visual inspection and testing of the plant will save a lot of time as minor faults can lead to major repairs.

Regular maintenance in accordance with the maintenance schedule increases service life and operational safety and can prevent problems arising. In very dusty environments the maintenance intervals must be adjusted accordingly.

At cooler times of the year, when the compressor is not running, the air conditioning plant should be started up for about 30 minutes at least once a month to prevent compressor seals and bearings drying out. The compressor is only lubricated by the oil pump when the plant is running.

Note

The function of the mechanical-shaft seal is to make a seal and lubricate with oil. A certain amount of oil leakage (in the form of drops) is normal. This applies particularly during the running-in phase of the compressor (the first 200-300 hours of operation).

In order for the compressor to start during the winter months, the temperature inside the vehicle must be higher than the thermostat shut-off point. This means you may have to heat up the inside of the vehicle or switch the climate control to permanent cooling mode. In some systems, the outside temperature sensor must register more than 10 ° C.

Professional working standards are essential as the air condition and cooling systems are closed systems. When replacing individual components and performing repairs, absolute cleanliness is vital. As a rule, damage resulting from unclean conditions does not manifest itself straight away.

Work on open systems must be carried out as speedily as possible to prevent moisture entering the air conditioning system.

3.1 Maintenance schedule

3.1.1 Maintenance work to be performed weekly or every 50 hours

- Clean air filters on the return air intake and the evaporator. Remove the filter and clean it off against the exhaust direction. Replace damaged filters.
- Check the operation of the blower on the evaporators and the fans on the condenser (note direction of rotation).
- Check the tension of the V-belt on the compressor drive and adjust if necessary. Replace any defective V-belts in pairs.
- Check the coolant level through the sight glass. The level should be checked when the air conditioning system is running at a speed of at least 1500 rpm after being in operation for about 10 minutes. If the sight glass can only be accessed from the outside, the cover should only be removed for a short time to ensure that the evaporator fans draw air in over the evaporator package and not from outside. No bubbles should be evident on the sight glass.
- Check the oil level in the compressor. Let the air conditioning system run for about five minutes before checking the oil level.

3.1.2 Maintenance work to be performed monthly or every 200 hours

- Check the condenser and clean it if necessary. Straighten up any bent sheeting. If not particularly dirty, clean off the condenser against the exhaust direction using compressed air. If very dirty or greasy, clean using a non-aggressive copper and aluminium cleaner.
- Check that the condensate pipework and rainwater outlets within the condenser are not blocked.
- Inspect hoses, pipework and cables for leaks, abrasion, fractures and loose connections. Prevent contact with sharp edges or sources of heat. Check electrical connections for corrosion.
- Check fixing screws and compressor fittings. If necessary, tighten screws and replace defective or worn parts. Grease V-belt tension rollers or guide rollers.
- Check collecting flask for corrosion.

3.1.3 Maintenance work to be performed annually or every 1,000 hours

These maintenance activities must be carried out by a coolant specialist.

Professional working standards are essential as these are closed systems.

Work to be performed

- Check cooling system for leaks
- Check coolant pipework and screw couplings for anchorage, leaks and correct positioning
- Replace contaminated refrigerator oil
- Replace filter block dryer
- Check high and low pressure pressostats are working properly
- Check condenser controller pressure monitor is working properly (if present)
- Check compressor for leaks, anchorage and that it is working properly
- Check oil level
- Check compressor output regulator is working properly (if present)
- Check electromagnetic clutch for bearing noise and that it is working properly
- Check seals, locks and overall condition of system housing

  Checking the air conditioning system:
  - cool: set permanent operation on the climate control
  - heat: set permanent operation on the climate control. Start the test program.
  - ventilate
  - return air mode
- Check condition of electrical system and that it is working properly
- Check thermostat and controller
- Check fresh air vents are working properly
- Change the pollen filter every year or after 135,000 km

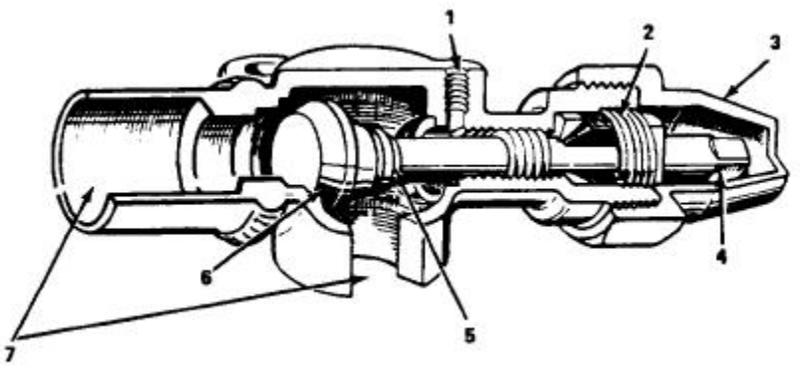
4 Professional practice - General

- The protective covers of all spare parts and pipework must remain in place until just before they are installed.
- A second spanner as a counter-hold will always be required when tightening connections. This will prevent distortion and warping.
- Parts and components should not come into contact with connecting pipes, hoses or capillary tubes.
- Make sure that the cooling fins on the evaporator and condenser packages are not damaged. Any damage that occurs can be made good with lamellar combs.
- Always use cold oil when fixing screw couplings to tubes and hoses.
- Cold oil must always be kept clean and in a closed container. This prevents the moisture from being absorbed.
- The condition of connections and tubes must be inspected prior to assembly. Dirt or even minor damage can result in leaks when exposed to the high pressure conditions that exist in the system.
- Dirty connectors may only be cleaned using a cloth soaked in alcohol.
- All components should be at room temperature before the locking pins are removed. This prevents the condensation that would occur if the components are too cold.
- Before the screw couplings are tightened, make sure that the hoses are not twisted, kinked or trapped anywhere, as it will be almost impossible to correct them later.
- Check that the hoses and pipework are connected correctly and secured using brackets and clamps.
- Components and hoses must be capped as soon as they are removed to prevent the ingress of dirt or moisture.
- The dryer must always be replaced following a repair and if the system has been open for a long time.

5 Service connections

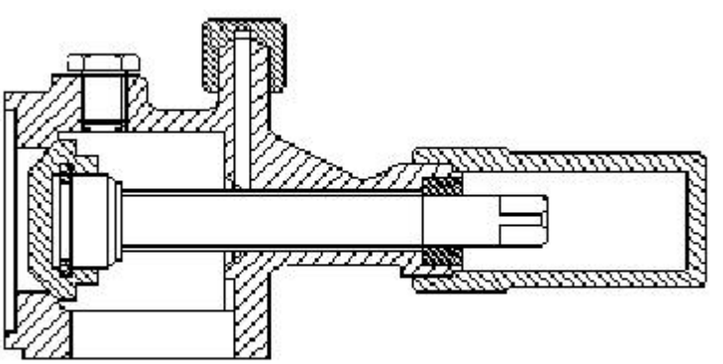
5.1 Shut-off valves

There is a service valve at both the high and low-pressure ends of the compressor. The valve can be connected to the manometer battery.



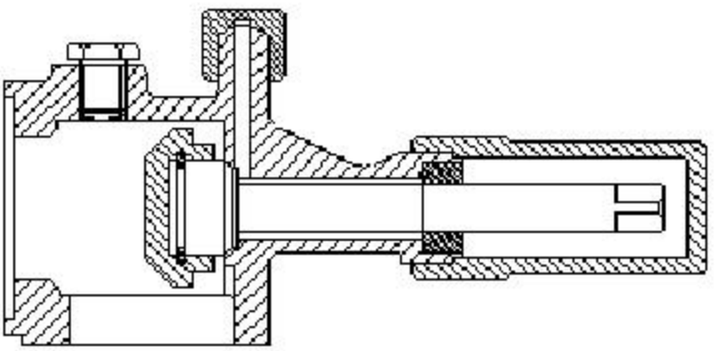
The service valve is a 3-position valve: pin in, pin out, pin halfway in

Valve spindle on inner seat (closed)



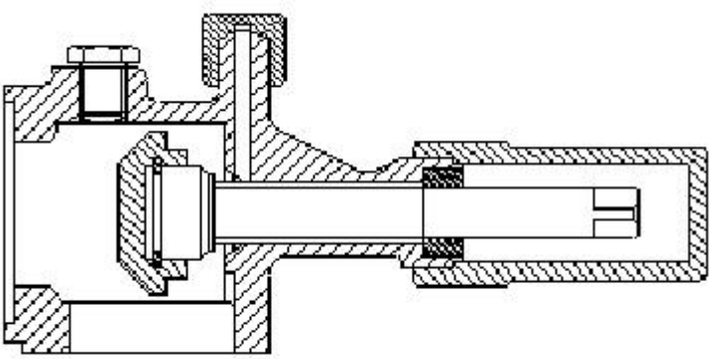
In this position, the flow of coolant is interrupted. The compressor can be replaced; evacuation can be carried out through the UNF 7/16" connection, which is in contact with the compressor.

Valve spindle on outer seat (open)



This is the normal operating position. In this position, the flow of coolant is not interrupted. The connection to the manometer battery is broken.

Valve spindle out halfway



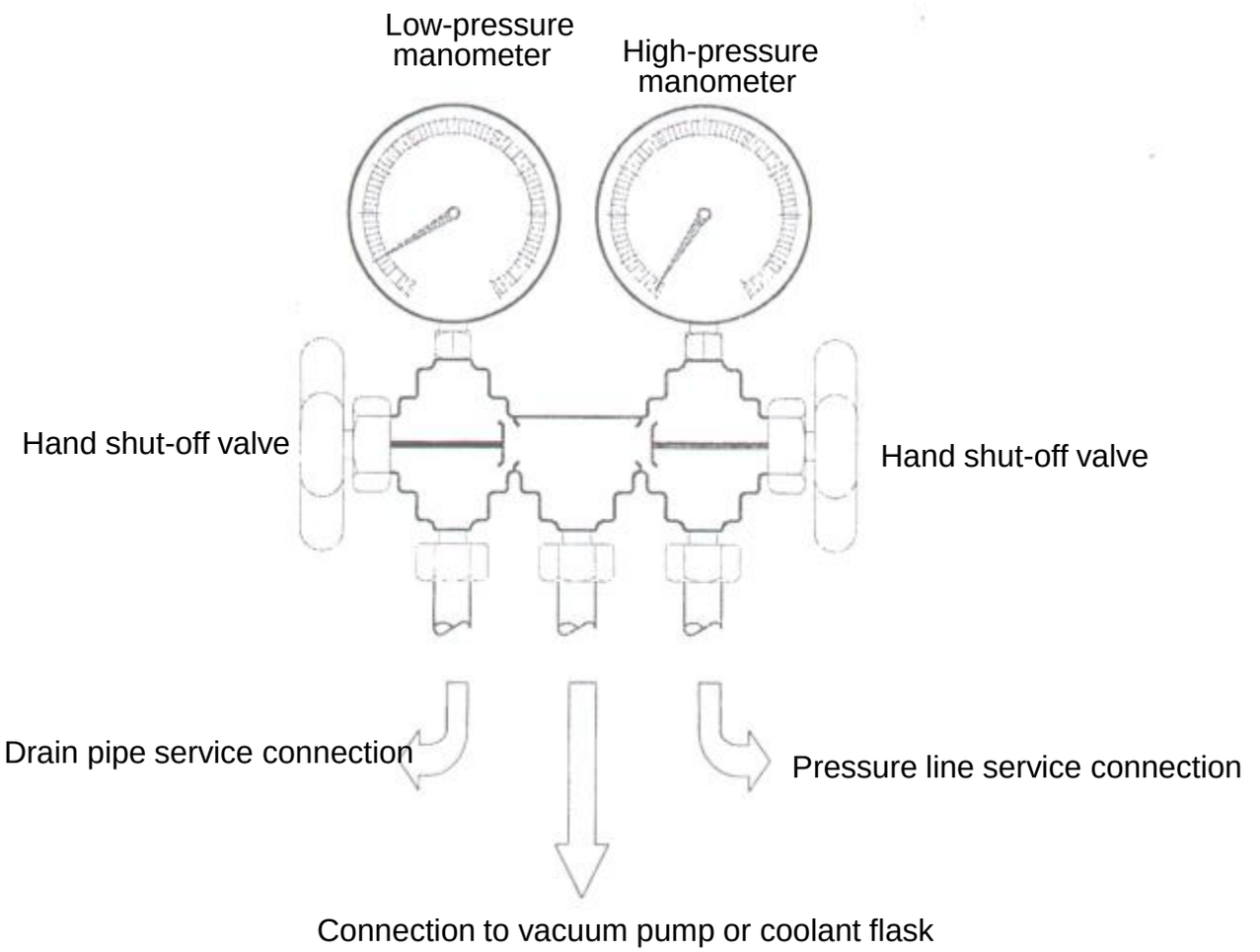
This position can be seen as the service position. There is a connection between the manometer battery and the coolant circuit.

5.2 Quick-release connections

Most new systems have a quick-release connection fitted to the UNF 7/16" connections. This has a Schrader valve that can be opened using a special fitting (see photo).

The fitting is pushed onto the quick-release connection. The connection from the compressor to the service connection (orifice of the Schrader valve) is made by turning the wheel.

6 Manometer battery



6.1 Connecting the manometer battery

1. Clean the service connections before removing the covers.
2. Check manometer battery, filling hoses, seals and connections for good condition. Connect the red hose on the high-pressure side, the blue hose on the low-pressure side and the yellow hose to the central service connection.
3. Remove the covering nuts on the compressor shut-off valves.
4. Check the position of the shut-off valve, both valves on rear stop.
5. Remove the covering nuts on the service connections of the compressor shut-off valves.
6. Connect the red hose to the service connection of the pressure shut-off valve.
7. Connect the blue hose to the service connection of the suction shut-off valve.
8. Check that the hoses are securely connected to the manometer battery, close both shut-off valves on the manometer battery.
9. Open by two turns the pressure shut-off valve on the compressor. Slightly loosen the screw cap on the manometer battery in order to vent the red hose.
10. Open by two turns the suction shut-off valve on the compressor. Slightly loosen the screw cap on the manometer battery in order to vent the blue hose.

6.2 Disconnecting the manometer battery

1. Turn the pressure shut-off valve on the compressor into the "normal operating position", valve on rear stop.
2. Open the pressure and suction shut-off valves on the manometer battery to reduce the pressure in the hoses.
3. Turn the suction shut-off valve on the compressor into the "normal operating position", valves on rear stop.
4. Fit and tighten the covering nuts on the compressor shut-off valves.
5. Open the shut-off valves on the manometer battery to relieve the pressure in the hoses.
6. Remove the hoses from the service connections on the compressor shut-off valves.
7. Fit and tighten the covering nuts on the service connections of the compressor shut-off valves.
8. Keep the manometer battery and hoses clean and in a safe place. Slightly open the working valves on the manometer battery to prevent premature wear of the seals.

7 Commissioning the air conditioning system

7.1 General comments regarding commissioning of the air condition system

Absolute cleanliness must be ensured when installing or repairing an air conditioning system, as practically all the faults that arise can be traced back to the presence of dirt. As the cooling system is a closed system, any foreign bodies remain in the system until they cause a problem or even serious damage, which can then usually only be repaired at a great deal of trouble and expense. The system may nevertheless appear to start up and work perfectly normally.Damage caused by foreign bodies and dirt may not manifest itself for many months.

The continued proper functioning of the system depends on thorough and professional standards of work right from the outset. This entails proper storage and keeping all components closed and/or covered, through professional installation and assembly, in repair situations as well, right up to the scrupulous checking for leaks, cleaning, filling and commissioning of the system.

Professional and careful handling of tools, vacuum pumps, manometer battery, etc. will provide many years of reliable system operation.

7.2 Checking for leaks

Following commissioning and repair work, every air conditioning or cooling system must be checked for leaks. Leaks not only means loss of coolant and hence reduced cooling capacity, they can also result in the ingress of moisture, which will eventually cause problems in the system.

A pressure test must first be performed following repair work and when a new system has been installed. Dry nitrogen 4.6 or 5.0 at 20 to (max.) 25 bar is used for the pressure test. This has the advantage that serious leaks or loose connections can be detected without the loss of any expensive coolant. In addition, the use of nitrogen purges (and hence cleans) the system as part of the pressure test. If the pressure in a closed system does not fall, it can be assumed that there is no leakage in the system.

A pressure test using nitrogen alone needs a long time (8-12 hours) in order to detect minor leaks as well.

If any leaks are present, nitrogen cannot be detected using leakage detectors, so soapsuds have to be used to establish the precise location of the leak. If a drop in pressure indicates a leak that cannot be detected using soapsuds, R 134a must be used in conjunction with the appropriate electronic detection equipment. Make sure that the leakage detector is approved for use with R 134a.

If the leakage necessitates a rework or a repair, the leakage test must be repeated on completion of the work.

7.3 Evacuate

Evacuating the air conditioning or cooling system has the following purposes:

- to remove air,
- to remove moisture,
- to remove extraneous gases.

To evacuate a system, a vacuum pump powerful enough to maintain an absolute level of 0.4 mbar is required. A high vacuum level is required in order to be certain that air and extraneous gas is drawn off all the time. Dropping the pressure to 0.4 to 1 mbar (1000 microns) also ensures that the boiling point of water falls to about 0 ° C, causing any moisture in the system to condense out and the water vapour to be drawn off with the air and extraneous gas.

The answers to the following questions show why careful evacuation is necessary:

Why does moisture have to be removed?

- Because coolants can only absorb very small amounts of moisture and high levels lead to faults.
- To prevent ice blocking the expansion valve.
- To prevent decomposition of the coolant, the cooling oil and the sealing material.
  Water absorption capacity of filter dryer 70g (for comparison purposes: 1 drop of water weighs 150mg)

Why do air and extraneous gases have to be removed?

Because large amounts in the coolant circuit leads to faults.

Air and extraneous gases do not condense out and therefore do not combine with the coolant. This can result in the following faults:

- Increased condensation pressure in the condenser
- Oxidisation and corrosion
- Oxidisation of cooling oils
- Overheating of compressors.

7.4 The evacuation sequence

Make certain that the cooling circuit is "open" (all shut-off valves open). Built-in solenoid valves must be opened by a magnet on the armature or by a separate excitation mechanism on the coil.

- ð Connect manometer battery.
- ð Check the vacuum pump (oil level, proper operation).
- ð Connect the yellow hose to the manometer battery and the vacuum pump and check the connections for leaks.
- ð Turn on the vacuum pump.
- ð Open both manometer battery valves fully.
- ð Monitor the pressure on the manometer indicator; when the vacuum level reaches 0.75 Torr or 1 mbar, evacuate the system for at least eight hours.
- ð Close both manometer battery valves after a minimum of eight hours.
- ð Monitor the pressure. If the pressure does not start to increase again, switch the vacuum pump off. An increase in pressure indicates that moisture is still condensing out. In this case evacuation must be continued or the system rinsed with coolant. In either case, the last four positions must be repeated.
- ð Disconnect the yellow hose from the vacuum pump. The system can now be filled.

7.5 Vacuum test

Make sure that the vacuum gauge is not installed on the vacuum pump but as far away from the system as possible, for example on the collecting flask.

If the vacuum increases to 3000 to 4000 microns (3-4 mbar or 2.25 to 3 Torr) five minutes after the vacuum pump is switched off, there is still water in the system and the vacuum process will have to continue. If the vacuum remains between 2000 and 3000 microns (2 to 3 mbar or 1.5 to 2.25 Torr) after five to ten minutes, there is no more water in the system; it is sealed.

7.6 Filling the system with coolant

The procedure described below assumes that the system has already been checked for leaks and has been evacuated. There are two ways of filling an air conditioning or cooling system with coolant:

– Adding coolant in liquid form.

Only fill with liquid coolant if the air conditioning system is not in operation !

– Filling with coolant in the form of vapour from the suction end with the compressor running.

There are also two ways of determining the amount of coolant required:

– If the precise amount is known, it should be added by weight according to the rating plate.

– If the amount is not known, add coolant using the sight glass. In this case the ambient temperature should be about 30 ° C and the temperature in the car interior must be at least 25 ° C.

If the sight glass is used to fill the system and the outside temperature is too low, reaching a higher temperature may cause the system to overflow as a result of expansion of the coolant.

7.6.1 Filling an evacuated system

ð Connect the yellow hose to the manometer battery and the coolant container.

Check that the connections are clean.

ð Open the shut-off valve on the coolant container fully (vaporous).

ð Loosen the screw coupling on the yellow hose on the manometer battery until coolant starts to flow out, indicating that the hose has been vented.

ð Fully tighten the screw couplings on the yellow hose.

ð Change the coolant container over to "liquid". Open the shut-off valve on the coolant container fully.

– In the case of large containers with an immersion tube by closing the "vapour" valve and opening the "liquid" valve.

– In the case of small containers with no immersion tube: turn small flasks upside down.

ð Start filling the system from the pressure end with liquid coolant. With the compressor stationery, open the red, high-pressure valve on the manometer battery and allow liquid coolant into the system until the pressure is the same on both the low-pressure and high-pressure indicators on the manometer battery.

– Fill with liquid (only with compressor stationery)

– Top up: gaseous from the suction end.

Fill small air conditioning and cooling systems with large coolant containers slowly, as otherwise the system will overflow during the preliminary filling.

If the precise amount of coolant is known, place coolant container on a balance and monitor how much is required.

ð Close the valve on the high-pressure side of the manometer battery.

ð Start the compressor. Set the compressor speed to approx. 1000 to 1500 rpm. To be certain there is no liquid coolant in the compressor, turn by hand 1 or 2 times before starting.

- ð Check whether there any bubbles are still visible in the sight glass. Monitor the high and low-pressure levels in the system.

- ð Get ready to release vaporous coolant from the coolant container.

- ð If there are still bubbles in the sight glass, open the blue valve (suction gas end) on the manometer battery and feed vaporous coolant to the system.

- ð Check the sight glass and when no more bubbles can be seen, immediately connect the blue valve (suction end) to the manometer battery.

- ð Continue to monitor the sight glass. If no more bubbles appear the system is full. If bubbles reappear, gaseous coolant must be fed to the system again.

- ð Check working pressures, high and low-pressure.

- ð Check the oil level in the compressor.

- ð Check high and low pressure pressostats are working properly.

- ð When all the above points have been properly carried out, the air conditioning system is full and can be put into operation.

- ð Disconnect the manometer battery.

7.7 Checking the pressure switch

The high and low-pressure switches monitor and limit the pressures and trip via the electromagnetic clutch of the compressor. You must protect the compressor and the system from both overpressure and underpressure.

7.7.1 Low-pressure switch

The low-pressure switch is extremely important. The low-pressure switch must open when the pressure falls to the specified level otherwise the air conditioning system will not function properly.
Test the air conditioning system with a reliable manometer (with pressure and vacuum indicators):

- ð Connect the manometer battery to the compressor.
- ð Start the motor and operate the compressor.
- ð Slowly close the shut-off valve on the compressor until the pressure falls. Monitor the pressure indicator on the suction manometer, as the low-pressure switch turns off the clutch and the compressor. The low-pressure switch turns the compressor off at 0.35 bar.
- ð Wait until the pressure starts to rise and the clutch switches the compressor on again. The low-pressure switch switches the compressor on at 2.1 bar.
- ð If the low-pressure switch does not trip at the specified pressure, it will have to be replaced.

If the low-pressure switch does not trip, the system and the compressor will have to be stopped manually at 0.3 bar. Replace the low-pressure switch.

7.7.2 High-pressure switch

The high-pressure switch is very important as the components in the air conditioning system are designed for a maximum pressure. If the pressure is too high, the components may be damaged.
The high-pressure switch turns the compressor off at 23.5 bar.

- ð Connect the manometer battery to the compressor.
- ð Start the motor and operate the compressor.

ð Turning the condenser fans off or covering the condenser intake increases the pressure in the system. Monitor the manometer indicator. The system must switch off at 23.5 bar.

If the high-pressure switch does not trip, the system and the compressor will have to be stopped manually at 25 bar. Replace the high-pressure switch.

ð Wait until the pressure starts to fall and the clutch switches the compressor on again. Switch-on pressure 16,6 bar.

8 Pressure monitoring

Under normal conditions, there should be a pressure of 13.2 to 20.2 bar (manometer indicator: 12.2 to 19.2 bar) on the high-pressure side.

The pressure will be higher when there is a more thermal loading (passengers, sunshine, etc.), at high compressor speeds, when the condenser is dirty or when there is an insufficient airflow through the condenser. The pressure will be lower when there is lower thermal loading and at lower compressor speeds.

Under normal conditions, there should be a pressure of 2.9 bar (manometer indicator: 1.9 bar) on the low-pressure side.

The pressure will be lower when there is less thermal loading (passengers, sunshine, etc.), at high compressor speeds, or when there is an insufficient airflow through the evaporator. The pressure will be higher when there is more thermal loading (passengers, sunshine, etc.) and at low compressor speeds.

Pressure figures at various outside and inside temperatures (for R 134a coolant)

Outsidetemperaturein ° C	Liquifiertemperature	Manometerindicator
25	45-55	10,6-13,9
30	50-60	12,2-15,8
35	55-65	13,9-17,9
40	60-70	15,8-20,2
45	65-75	17,9-22,6

Table 8-1:

Insidetemperaturein ° C	Volatilisationtemperature	Manometerindicator
20	-10-0	1.0-1.9
25	-5-5	1.4-2.5
30	0-10	1.9-3.1
35	5-15	2.5-3.9

Table 8-2:

9 Maintenance work on the compressor

9.1 Oil

The oil level in the compressor can be checked through the oil sight glass in the lower part of the compressor housing. Normally, no oil is consumed in the coolant circuit. The oil will only need to be topped up if there is a large-scale leak or when some is lost when a larger component is replaced (condenser, evaporator).

Only use oil that is suitable for the coolant being used.

Under no circumstances should used oil for topping-up purposes.

Do not overfill the coolant circuit with oil. Too high a proportion of oil can cause serious damage and has a negative effect on the cooling output.

9.1.1 Finding oil leaks

The first thing to do is to carry out a visual examination to see whether any oil is leaking from around the fittings, the flexible hoses or the crankshaft. If oily marks are found around these components, clean away the oil. If there is again evidence of oil after the system has been in operation for a while, this is a clear indication that there is a leak.

9.1.2 Check the oil level in the compressor

While the system is in operation, the oil level should be in the middle of the sight glass.

The oil check is carried out under the following conditions.

- the compressor should have been running for 20 minutes

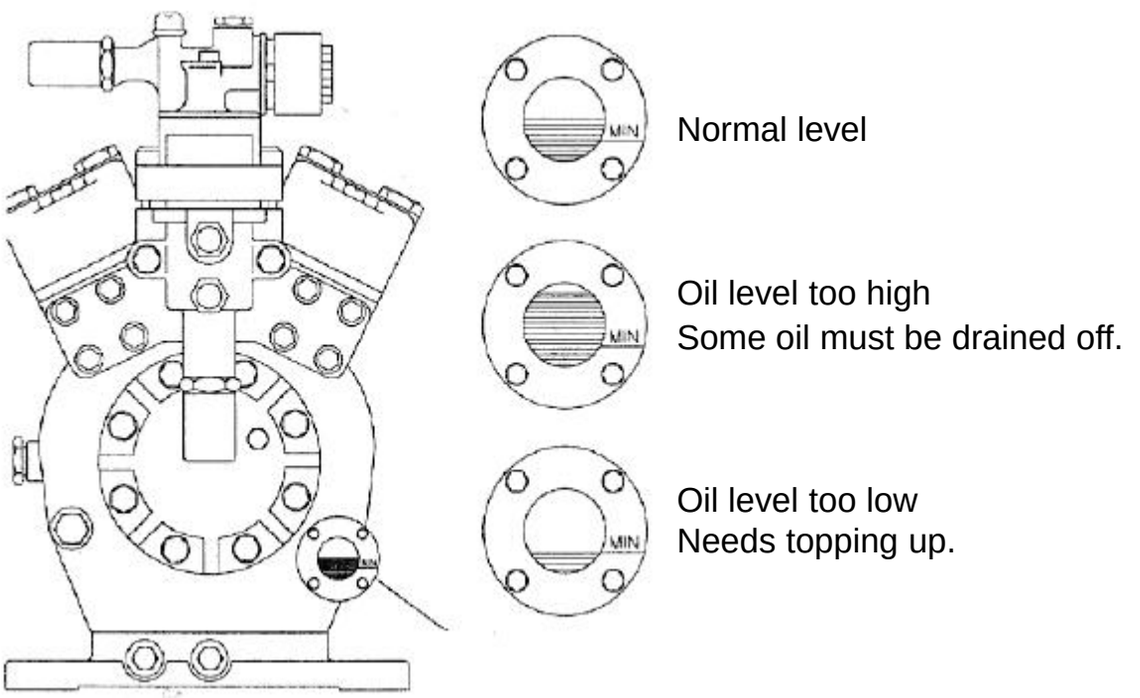
- bring the motor up to 2/3 of its maximum speed

- the room temperature should be between 20 and 40 ° C

The oil sight glass is checked in these conditions.

If the oil level is too low, the amount of coolant circulating has to be checked. A coolant leak would result in a low oil level. The system must be topped up if there is not enough coolant in the system; the oil level is then checked again.

If the oil level is still too low, displacement of oil in the circuit is to be suspected. In this case, contact your Eberspächer Sütrak agent immediately.



9.1.3 Draining oil

1. The manometer battery is connected
2. The service valves on the suction and pressure ends are moved onto the inner seat (closed).
3. The suction station is connected and the coolant still in the compressor is sucked out.
4. The oil drain screw is opened slightly. The screw must not be removed. As much oil as necessary is drained off.
5. The oil drain screw is tightened again.
6. The compressor is evacuated.
7. The service valves on the suction and pressure ends are moved onto the outer seat (opened).
8. The air conditioning system is turned on and checked again under the conditions described above.

Note: If the oil cannot flow freely into a container (not enough space), the compressor must be dismantled. In this case, the regulations governing the replacement of a compressor shall apply.

9.1.4 Top up the oil in the compressor

1. The manometer battery is connected.
2. The service valves on the suction and pressure ends are moved onto the inner seat (closed).
3. The suction station is connected and the coolant still in the compressor is sucked out.
4. One end of a hose is connected to the service connection on the suction end and the other dipped into the oil container.
5. A vacuum pump is connected to the service connection on the pressure end. The compressor is evacuated and oil is then sucked into it.
6. If there is sufficient oil in the compressor, the service valves are moved out to the outer seat again (opened).

9.1.5 Oil change

The compressor must be dismantled when changing the oil. This is the only way of replacing all the oil in the compressor.

1. The manometer battery is connected.
2. The service valves on the suction and pressure lines are moved onto the inner seat (closed).
3. The suction station is connected and the coolant still in the compressor is sucked out.
4. The compressor can now be dismantled. The oil is replaced.
5. The compressor is reconnected.
6. The compressor is evacuated.
7. The service valves on the suction and pressure ends are moved onto the outer seat (opened).
8. The air conditioning system is turned on and checked.

9.2 Recommended service intervals for FK compressors

It has to be emphasised that these service intervals are only approximate guidelines, as they depend very heavily on unknown external factors, such as operating conditions, operating time, type of drive, etc. They should be treated with a degree of flexibility and seen as average service periods.

Weekly maintenance (approx. every 100 operating hours)

- Check oil level on compressor sight glass under constant operating conditions.
- Visual inspection of seals and mechanical-shaft seal for leaks.
- Check V-belt tension.

Annual maintenance (approx. every 5,000 operating hours)

- Change oil and clean oil filter.
- Visual inspection of mechanical-shaft seal, shut-off valves, drain plugs and seals for leaks.
- Check operating conditions (compressor operating within permitted application limits).
- Check V-belt tension.
- Check safety features and whether they are working properly.
- Check that any extra features, e.g. output regulator, are working properly.

Biannual maintenance (approx. every 10,000 operating hours)

- as above, plus
- Change the mechanical-shaft seal

After 5 years of operation (approx. 25,000 operating hours)

- Service and if necessary overhaul of the compressor: replace parts according to their function and degree of wear.
- Replace valve plates and seals.

9.3 Mechanical-shaft seals

Fundamentals

- The shaft is sealed by a mechanical-shaft seal (stuffing box).
- Friction occurs on the contact surfaces.
- The rotating contact surfaces must therefore be lubricated with oil.
- The oil forms a wafer-thin lubricating and sealing film that also prevents coolant from escaping.

Running-in phase

Some oil may escape during the running-in phase and form drops on the compressor casing. This does not mean that the mechanical-shaft seal is leaking and needs to be replaced. The seal will function normally after the running-in phase (about 200-300 operating hours). Up to 0.05 cm^3 of oil leakage per operating hour is within the permitted tolerance.

Damage to the mechanical-shaft seal

The mechanical-shaft seal can be damaged through any of the following reasons:

- Thermal overloading: the compressor runs too hot for an extended period (damage to the O-rings and the contact surfaces).
- Frequent switching: the system trips too often and at very short intervals.
- Long standstill periods: damage can occur when the system is started as the result of rotating sealing elements sticking together.
- Particles of dirt in the oil: the smallest contamination (e.g. copper swarf) can destroy the high-precision contact surfaces.
- Copper plating: as the result of moisture in the cooling circuit.

Replacing the mechanical-shaft seal

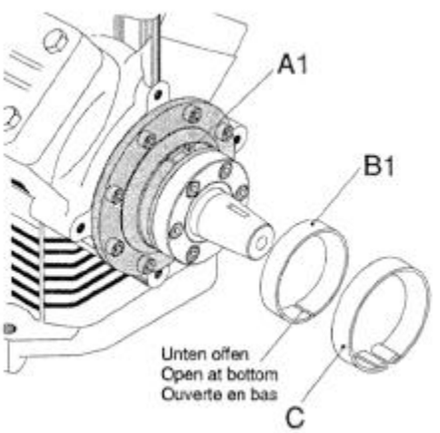
- The utmost cleanliness is necessary.
- Always replace the set as a whole.
- Clean all contact surfaces.
- Oil the O-rings and contact surfaces.
- Centre the seal cover using a guide sleeve.
- Tighten the screws evenly (note tightening torque).

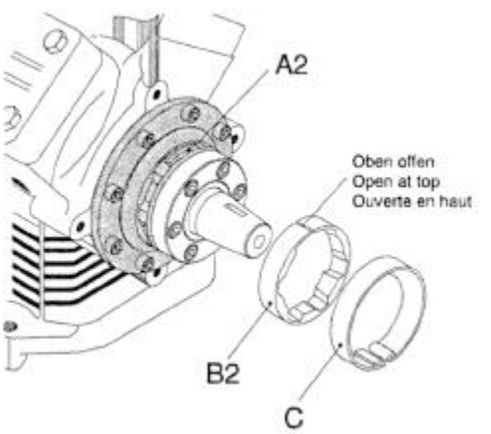
Repeated replacement of a mechanical-shaft seal on the same compressor

If the mechanical-shaft seal on a particular compressor is replaced several times without success and without showing any signs of visible damage to the seal, the complete compressor will have to be replaced. In such cases, it is to be assumed that the power plant is damaged (worn main bearing, damage to O-ring seals on crankshaft).

Improvements to the oil leak collection system on FKX-40 compressors

As part of a range of improvements to the mechanical-shaft seal oil leak collection system, the oil collection ring and bearing flange on all FK-40 compressors has been modified.





The new version bears the factory serial number of the compressor.

Old version: _ _ _ _ _ 001

New version: _ _ _ _ _ 007

A1 Bearing flange with one oil well
B1 Flat oil felt (placed on bearing flange A1)

A2 Bearing flange with 6 oil wells
B1 Profiled oil felt (placed on bearing flange A2)

In both instances the oil felt is secured by the collecting ring C.

In an emergency, the felt ring B1 can also be used for the new bearing flange A2, but not the other way round (B2 on A1).

9.4 Pressostats

9.4.1 Checking the high-pressure pressostat

See section 7.7.2

9.4.2 Checking the low-pressure pressostat

See section 7.7.1

9.4.3 Replacing the pressostats

- Connect the manometer battery to the compressor
- Start up the air conditioning system.
- Slowly close the the service valve (LP) until the suction pressure falls.
- Turn off the air conditioning system
- Position the service valves on the high and low-pressure ends on the inner seat (closed).
- The coolant in the compressor can now be drained off through the UNF 7/16" connection.
- The compressor is now depressurised and the defective pressostat can be replaced.
- Evacuate the compressor.
- Bring the service valves into the operating position (open).
- Turn on the air conditioning system and check the coolant level in the sight glass.

10 Maintenance and repair of refrigeration components

10.1 Condenser

The condenser must be cleaned in accordance with the maintenance schedule.

The condenser must be clean and the metal sheets should not be warped or pressed together.

Cleaning the condenser

The condenser is cleaned using compressed air or water vapour at a temperature of less than 40 ° C.

- Remove the condenser cover
- Do not splash the condenser fan
- Clean the condenser package Straighten any warped metal sheets using a lamellar comb.
- Remove splash water guard
- Fit condenser cover

Note

The condenser must not be cleaned using steam or hot water at a temperature above 40 ° C. If a cleaning agent is used, it must be rinsed thoroughly afterwards with fresh water.

Important: The condenser must not be sprayed directly with pressure water!

Environmental note

The use of aggressive chemical and non-biodegradable agents should be avoided.

Replacing the condenser

To replace the condenser, the coolant already in the system must first be drained off.

10.2 Collecting flask

If the collecting flask is to be replaced, all the coolant in the system must be drained off. After replacing the flask, the system must be evacuated again and refilled.

10.3 Replacing the solenoid valve

- Close the hand shut-off valve on the collector output.
- Let the system run until the low-pressure pressostat trips.
- Close the suction shut-off valve (if necessary close the hand shut-off valve following the solenoid valve).
- Drain off the coolant between the two shut-off valves (through the Schrader valve if necessary).
- Replace the solenoid valve.
- Evacuate the lines (through the Schrader valve if necessary).
- Open the shut-off valves again.
- If necessary, top up with coolant.

10.4 Replacing the filter dryer

- Close the hand shut-off valve on the collector output.
- Let the system run until the low-pressure pressostat trips.
- Close the suction shut-off valve of the compressor (if necessary close the hand shut-off valve following the solenoid valve).
- Drain off the coolant between the two shut-off valves (through the Schrader valve if necessary).
- Replace the filter dryer.
- Evacuate the lines (through the Schrader valve if necessary).
- Open the shut-off valves again.
- If necessary, top up with coolant.

10.5 Replacing the sight glass

- Close the hand shut-off valve on the collector output.
- Let the system run until the low-pressure pressostat trips.
- Close the suction shut-off valve (if necessary the hand shut-off valve following the sight glass).
- Drain off the coolant between the two shut-off valves (through the Schrader valve if necessary).
- Replace the sight glass.
- Evacuate the lines (through the Schrader valve if necessary).
- Open the shut-off valves again.
- If necessary, top up with coolant.

10.6 Thermostatic expansion valve (TEV)

Checking the TEV components

Check that the nozzle is still working properly.

Check that the capillary is undamaged.

When fitting the valve, the pipework has to be screwed on very carefully. Screw connections are often the source of leaks.

External pressure compensation

Make certain that the connection for the externalpressure compensation is pointing upwards when fitted onto the drain pipe.

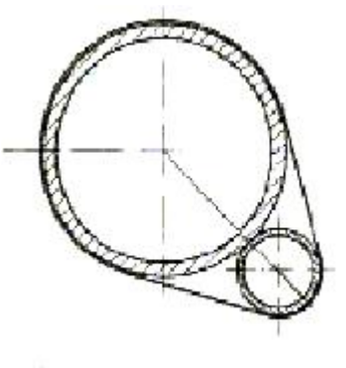
Sensor

The sensor must be fitted between the compensation line and the evaporator outlet. When seen from the direction of flow, it should always be fitted before the connection of the external pressure compensation line.

The surface of the pipe on which the sensor is mounted must be clean (it should ideally be cleaned using a lubricated paper).

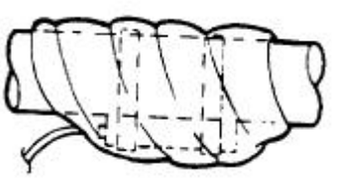
The sensor is fastened to the horizontal suction pipe using sensor clamps or clips.

Above a diameter of 22 mm (suction pipe), we recommend that the sensor is attached to the side (4 o'clock position).



Mounting of the sensor on vertical pipework should be avoided if possible.

The sensor must be insulated in all cases. An uninsulated sensor would cause considerable damage.



The capillaries mustnot come into contact with warm components. They should also not be placed close to fans (effect of air).

Replacing the electrical valve

Same procedure as with sight glass

10.7 Replacing the evaporator

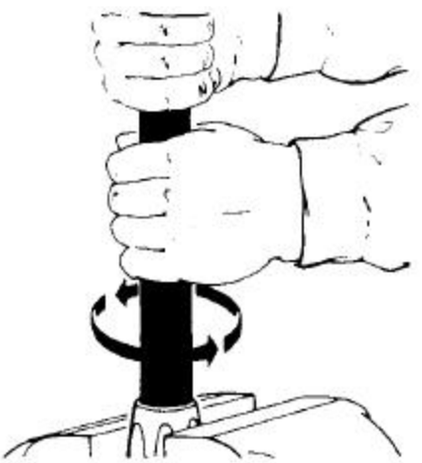
Same procedure as with sight glass

11 Installation instructions for flexible hoses

Cut the hose at right-angles without scratching it. Use a sharp saw (DO NOT USE SANDPAPER).

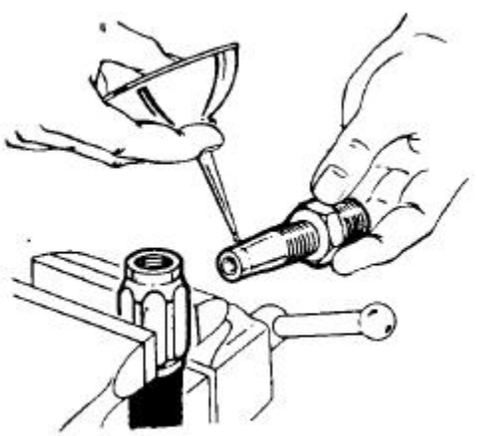
Carefully remove any trimmings from the hose.

Draw a line use chalk or a marker pen just before the end of the locking ring. This is a quick and easy method of checking that the hose is not pulled out during the assembly.

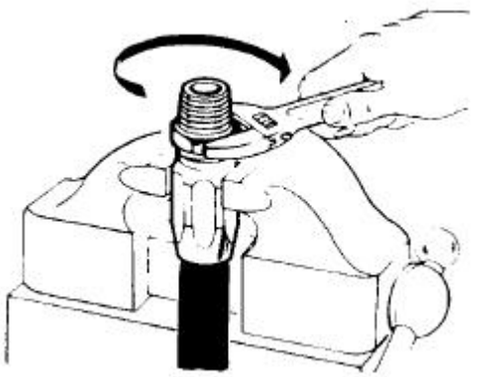


Turning the hose anti-clockwise, push it up against the locking ring and then loosenitslightly by turning it1/4 turn in a clockwise direction.

If the hose is very long, it will be easier to screw the locking ring onto the hose in an anti-clockwise direction.



Oil the thread and the tapered end with the same type of oil that is being used in the system.



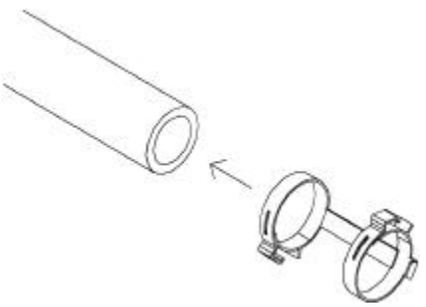
Push the tapered end into the hose pushing it in a little way with the hand and start turning the locking ring in a clockwise direction.

Using an appropriate spanner, keep turning until the nut just touches the locking ring. Do not overtighten.

Apply an even turning motion (do not interrupt).

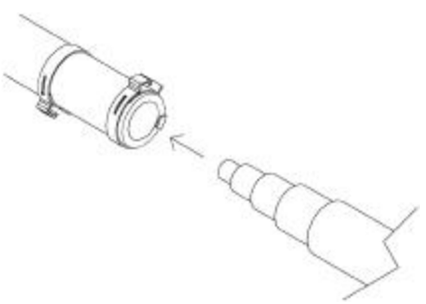
11.1 Installation instructions for clamp connections with double clamp

Cut off the end of the hose using the hose-cutter contained in the kit (Eberspächer Sütrak Article No. 22,25,34,171).



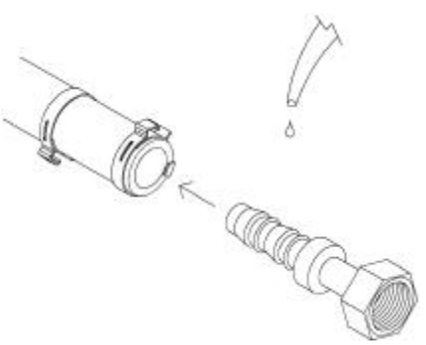
Push the hose connector over the hose until the stop comes up against the edge of the hose.

Fig. 8-10: Clamp connector, Figure 1



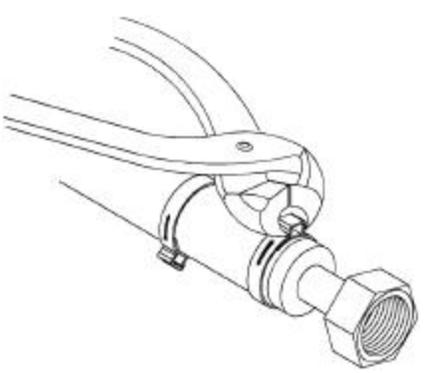
With the aid of the expanding tool contained in the kit, expand the end of the hose, to prevent displacement of the O-rings of the connector when the connector is inserted.

Fig. 8-11: Clamp connector, Figure 2



Lubricate the connection with a drop of refrigerant oil which is compatible with the refrigerant used, and push it into the hose as far as the stop.

Fig. 8-12: Clamp connector, Figure 3



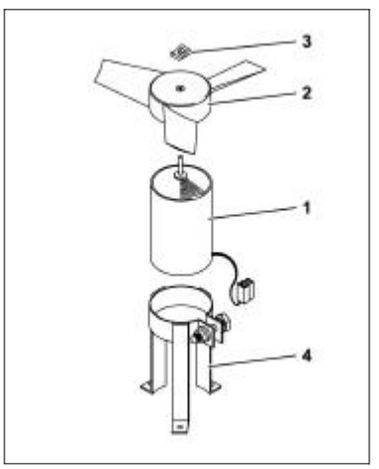
Using the pliers contained in the kit, engage the lugs of the hose connector.

Fig. 8-13: Clamp connector, Figure 4

12 Repairing electrical components

12.1 Condenser fans

Fitting and removing fans

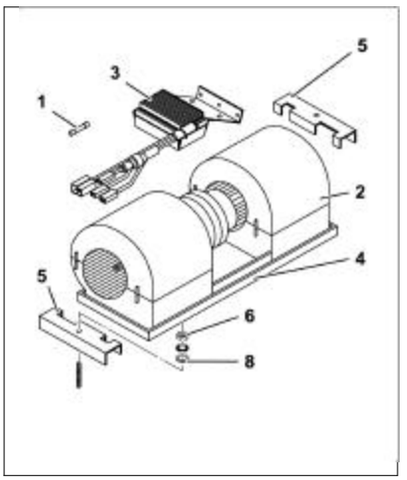


Condenser fans
1 Fan motor
2 Fan blade
3 Bayonet clip
4 Fan holder

Step	Fitting,removing	Comment
1	System cover	The system must not belive
2	Undo the fan motor connector(1)	Secure the cable with a cable tie so The connector is not lying on the floor.
3	Undo the bayonet clip (3) from the fan motor (1) driveshaft. Remove the fan blade (2)	
4	Undo the screw fastening of the fan holder(4). Remove the fan motor	
5	Undo the fan holder (4)from the chassis and remove	Three hexagonal head screws are Used to hold the fan holder (4) in place.

12.2 Evaporator blowers

Fitting and removing fans and exhaust blowers



Evaporator fans

1 Fuse
2 Dual radial blower 24V
3 Speed regulator
4 Fan chassis
5 Fan holder
6 M6 nut
7 Toothed disk 6.4
8 Washer 6.4

Exhaust blower

Same arrangement as evaporator fans but without speed regulator

Step	Fitting,removing	Comment
1	Systemcover	The system must not believe
2	Unplug the connector for the speed regulator (3) And the power supply to the motor.	Secure the cable with a cable tie so The connector is not lying on the floor Note that the black cable is the earth cable.
3	Remove the fuse (1) for the gate line("U") reg Of the speed regulator (3).	Check the fuse.
4	Remove the fan holder (5) from the chassis (4).	There is a seal underneath the fan.
5	Thespeedregulator(3)canbedetachedfrom thechassis(4)bydrillingoutthepoprivets.	

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