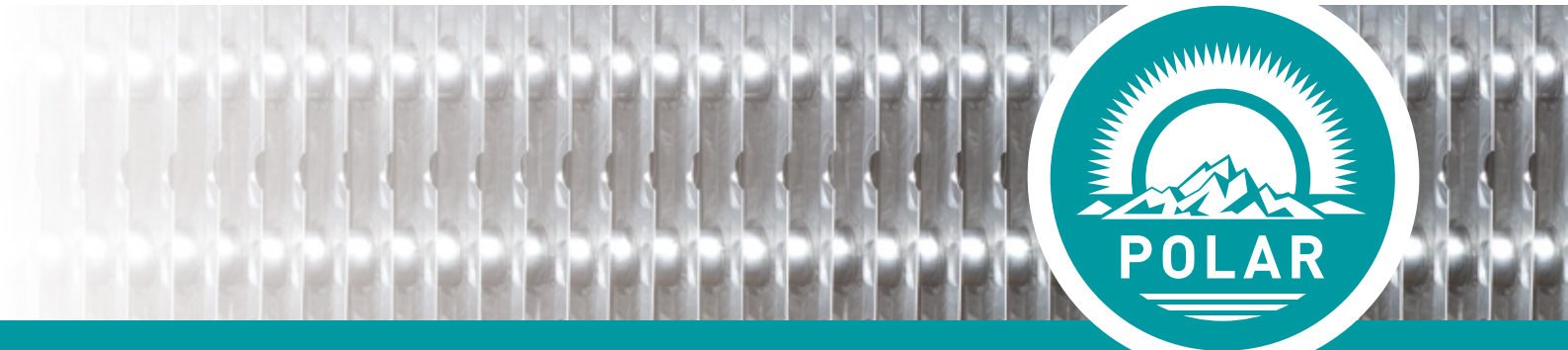
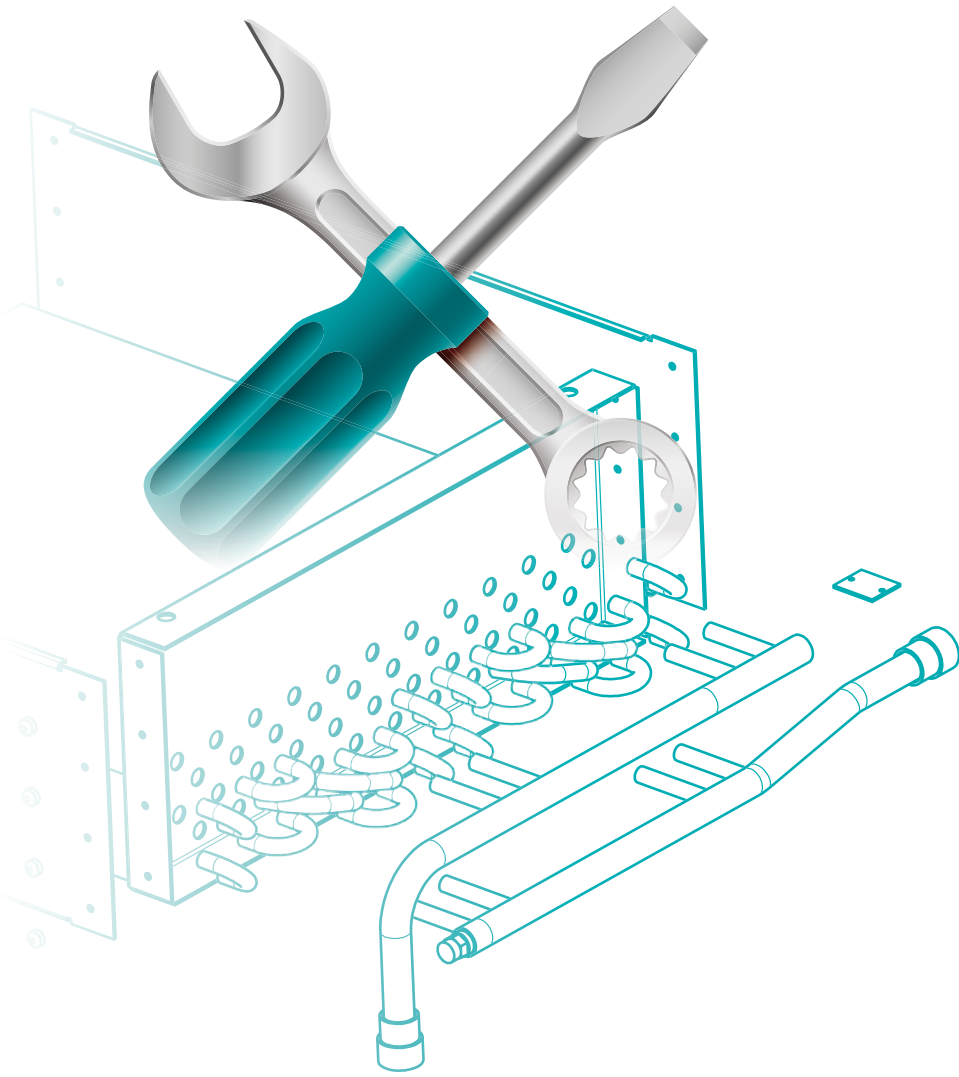


General installation and operating instructions

Lamellar heat exchangers



POLAR KÄLTETECHNIK

Contents

These instructions contain everything necessary for the correct and safe installation and operation of heat exchangers manufactured by Polar Kältetechnik GmbH.

Contents:

1. Appropriate use / areas of application
2. Product description
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5. Installation
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7. Equipment elements, safety devices
8. Initial commissioning and operation
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10. Corrosion
11. Maintenance / Servicing / Temporary decommissioning
12. Dismantling and disposal
13. Test table for routine checks to be made on heat exchangers

Important instructions – please read first!



SAFETY NOTE

All the safety texts and notes are shown with a safety symbol and are printed in italicised bold text. This sign indicates that there may be a risk to life and limb. Pay attention to this note and take special care in this case. In addition, always comply with the general safety and accident prevention regulations.



WARNING!

We draw your attention to the special notes so that you comply with the relevant directives / guidelines / regulations and the correct working sequences. This will avoid possible injury and prevent damage or even destruction.



IMPORTANT!

Read the instructions before starting to install the device! These instructions must be handed over to the owner operator after installation has been completed and must always be kept ready for future reference.



1. Appropriate use | areas of application

Polar lamellar heat exchangers are designed to cool or heat gaseous media in heating, ventilation and heat recovery systems, in heat pumps and refrigerating and air conditioning systems in accordance with EN 378. R-type safety refrigerants or suitable cooling saline solutions and water can be used as cooling or heating transfer media. The gas or air whose temperature is to be adjusted must not contain any solid materials which may damage, soil or have a corrosive effect on the surface of the heat exchanger because this may interfere with the correct functioning of the heat exchanger. Heat exchangers must only be used where materials cannot be affected by the ambient atmosphere or the cooling/heating transfer media. Any form of use differing from or going beyond this shall be deemed inappropriate.



WARNING!

The manufacturer is not liable for damage of any kind resulting from improper use. The user bears sole responsibility!


Limits on use, if not otherwise specified on the type plate:

Heat exchanger refrigerant: perm. operating pressure: max. 25 bar / perm. temperatures: -35°C to +100°C

Heat exchanger water/saline: perm. operating pressure: max. 16 bar / perm. temperatures: -35°C to +110°C

Note the following information on the type plate:

- Part number and type designation
- Order number and production date
- Pipe volume
- Max. operating pressure PS and max. operating temperature TS

Polar Kältetechnik GmbH D-58730 Fröndenberg	
	Type: <input type="text"/>
	No: <input type="text"/>
	Volume: <input type="text"/>
Max. operating pressure 25bar Max. temperature 100°C	

2. Product description

Polar heat exchangers are manufactured of round copper, aluminium or stainless steel pipes with pressed-on aluminium or copper lamellae. All pipe connections are hard soldered (copper and aluminium) or welded (stainless steel). Depending on the requirements, the frame and panelling parts are made of aluminium, galvanised sheet steel, copper or stainless steel. The feed lines, distributors and collectors are sized according to the flow rate of the cooling/heating transfer media; normally, in the case of cooling media they are carried out with brazed connections or with threaded nipples. Depending on the type of cooling/heating transfer media in the pipes, a distinction is made between heat exchangers used as evaporators and condensers (in the case of refrigerant operation), and coolers and heaters (water/saline solution operation). The equipment is designed to operate in defined power ranges and under defined operating conditions. Perfect functioning cannot be guaranteed if the actual operating conditions differ significantly, e.g. if the planned air volumes differ in the case of external fans, changes to the refrigerants/saline solutions, to the difference between the evaporating and the supply air temperatures, a change to the installation position, etc.

3. Safety and handling

- Polar heat exchangers are built to the current state of the art of technology and are safe in operation.
- When handling the heat exchangers always comply with the generally applicable safety and accident prevention regulations. Installation, operation and servicing are to be carried out only by suitably qualified persons and in an appropriate way. Personal protection equipment which is required by operating, servicing and repair staff must be provided by the operator, and also used. The appropriate staff must know and understand the operating instructions and also follow them.
- The limits of use stated on the type plate must not be exceeded. If the type plate is illegible or missing, please request a replacement.
- Be careful when hot surfaces are involved, e.g. air heater feed lines with a high inlet temperature, or electrical heating elements used to de-ice coolers – danger of burning! Any such surfaces must be insulated or protected against contact if common sense says that there is a risk of injury.
- Heat exchangers made of copper / aluminium are very delicate due to their structure and the material that they are made of. Consequently, they require careful handling. The lamellae can easily be bent and the pipes damaged by careless or inappropriate handling.

! WARNING!

Only lift heat exchangers by the end plates, never by the distributors, collectors or connecting pipes. Never twist or bend the connecting pipes. Danger of breakage! The brazed areas could break or the core tube be damaged, which would lead to leaks in the circuit.

! SAFETY NOTE

The lamellae have sharp edges as a result of the manufacturing process. Wear gloves to avoid injuries and cuts.

- No changes or additions are permitted which would affect the safety and proper functioning of the heat exchanger. Equipment which is filled with refrigerant must not be brazed or welded!

4. Packaging, transport and storage

Always ensure suitable and careful transporting, lifting and positioning.

! WARNING!

Lower the heat exchanger gently. Do not use any of the pipes or connecting parts to pull, lift, attach or climb on – this could cause leaks

- Store heat exchangers in a dry and protected environment to avoid dirt, damage and corrosion.
- The packaging can only be stacked if it has been specifically marked as such. If it is stackable, the stacking height must be specified on the packaging. Always ensure that only containers/packaging of the same size are stacked on top of one another.
- **Check the contents of the packaging for completeness on receipt. Any damage caused during transport and/or details of missing parts must be reported at once in writing to Polar Kältetechnik GmbH.**

5. Installation

- Always comply with the relevant currently applicable safety and accident prevention regulations when installing the heat exchanger. Installation must only be carried out by suitably qualified persons.
- As a rule, when the device is delivered it is under a residual amount of the test pressure in order to prevent moisture penetration and to permit an additional leakage check (marking on the attached label). If these heat exchangers are depressurized, there is the danger of a leak, and a leakage check must be carried out.

! SAFETY NOTE

It is essential to release the test pressure before cutting off the pipe ends! Danger of injury!

- Do not remove any of the type plates and labels – these ensure that the device can be identified in the event of a problem.

! WARNING!

The setting-up conditions and the connection and protection of the heat exchanger stated in standard DIN EN 378 and in the relevant national regulations must be taken into consideration. Ensure during spatial planning that there is sufficient space available around the heat exchanger so as not to adversely affect installation, functioning, maintenance and servicing work. If necessary, plan to incorporate sufficient additional space to permit the replacement of tubular heating elements.

- The customer is responsible for checking that the suspension mounting (provided) has sufficient weight-bearing capacity. Test the operating pressure at which the heat exchanger will be used. The installing technician is responsible for ensuring that all suspension points and the bolts and screws can withstand the load.

! IMPORTANT!

Do not exceed the operating pressure and temperature specified in the data on the type plate.

! SAFETY NOTE

Completely disconnect the electrical power supply before carrying out any installation, repair or maintenance work.

- Changes in temperature can result in changes to the lengths of the heat exchanger pipes – this is normal. If necessary, ensure that the connection pipes can move.
- When fitting the heat exchanger, ensure that no dirt, swarf etc. can get into the pipelines. Do not allow moisture to get into the pipelines of equipment used for refrigerant operation.
- When brazing the connecting pipes, ensure that the existing brazed points in the heat exchanger are not damaged by overheating.
- When screwing on threaded flanges or couplings to the threaded nozzles of the heat exchanger, hold them together to prevent any distortion of the heat exchanger pipes.
- The cleanness and dryness of the heat exchanger are provided for in accordance with standard DIN 8964, depending on the maker. It is very important to ensure that no contamination gets into the unit during installation.

6. Installation positions | connection | regulation

General information:

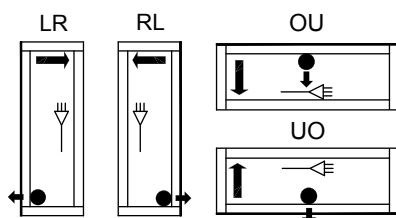
Take into consideration the stated installation position of the heat exchanger. As a rule, equipment designed for horizontal air flow cannot be used for vertical air flow, and vice versa.

If the heat exchanger is to be operated with fans that have been set up or attached by the customer, ensure that there is an even flow of air over the lamella package. Zones with poor air flow reduce the transfer performance! Prevent by-passes on the air side by using suitable baffle plates.

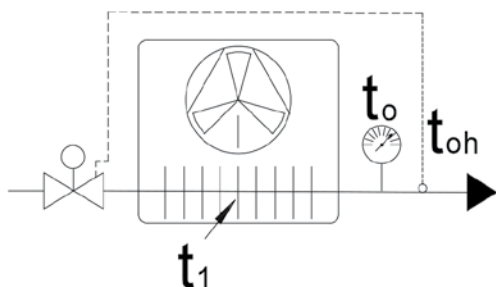
Depending on the operating conditions, condensation may occur with evaporators and coolers. The customer must arrange for any such condensate to be collected and led away if the heat exchanger is not equipped with suitable components. With air speeds of >2.5m/s, condensate may be transported in the air flow from the edge of the lamellae. In such cases, we recommend fitting a droplet separator.

Evaporator

- During evaporation (direct expansion), the overheating zone (inlet nozzle) must be at the air inlet (see below). If this is not the case, the evaporator will not achieve its maximum performance because the heat exchanger is not filled with sufficient refrigerant.



- Note the installation position shown (oil return flow).
- When Venturi distributors are used, then in order to ensure even distribution of the coolant, the minimum straight length of the pipe – without any changes to the diameter or installations upstream from the distributor – must be 10 times its diameter. As far as possible, the distributor must be set up vertically. Venturi distributors are always set up for a specific coolant mass flow and proportion of flashgas. If the operating conditions are very different, distribution will be uneven, or there will be very high pressure losses via the distributor.
- During commissioning, check for overheating and adjust if necessary. If the customer's individual operating conditions require installation of the regulating valve sensor in the air flow, insulate the sensor against the air flow.



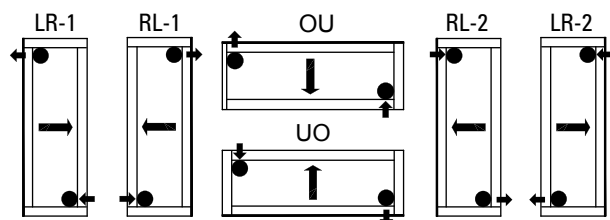
$$\Delta t_{oh} = 0,65 \cdot \Delta t_1$$

$$\Delta t_1 = t_1 - t_0$$

t_0 = evaporation temperature
 t_1 = air inlet temperature
 Δt_{oh} = super heat

Air coolers for cars | air heaters for caravans

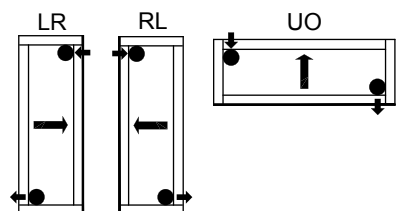
- Ensure that feed and return lines have been connected correctly (see below). Air coolers and air heaters for use with water/saline solutions are always designed for cross-current flow operation unless anything to the contrary has been specified. If the feed and return lines are reversed in connection, the specified performance will be not achieved!



- Do not vertically install coolers / heaters intended for horizontal installation or vice versa, otherwise complete bleeding/draining is not possible.
- Mixing regulation is preferable to quantity regulation when using air heaters operated with hot water. Mixing regulation achieves very consistent operational and regulating performance, while quantity regulation can lead to very large local temperature differences in the heater exchanger for inlet temperatures $>100^{\circ}\text{C}$ and consequently to stresses and tension and possible pipe damage.
- Dirty water prevents the formation of the natural protective layer on copper pipes by immediately forming a film of dirt. Frequent variations in the water speed also have an adverse effect on the protective layer. **Danger of corrosion!**
- Flow speeds of $v_S > 1.5\text{m/s}$ in the exchanger and of $v_S > 2.5\text{m/s}$ in the feed pipes must be avoided. **Danger of erosion!**
- **Closed water circuit:** use clean, oxygen-free water with a pH value of 7-10.
- **Open water circuit:** take suitable measures to protect against corrosion in accordance with the particular situation. **Danger of corrosion!**

Condenser

- The liquid nozzle must be located at the air inlet (see below).



- Do not install vertically a condenser intended for horizontal operation or vice versa (due to the flow of oil and condensate).

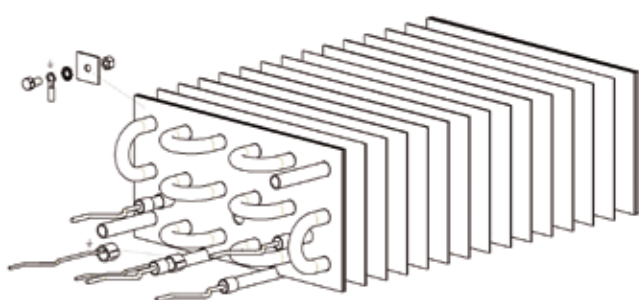
7. Equipment elements / Safety devices

- If it is not possible to ensure that the stated limits of use are not exceeded, the customer must install suitable safety equipment (e.g. overpressure protection). This is not normally included in the scope of delivery.
- In the case of heat exchangers with pre-mounted equipment elements, e.g. safety and control valves, fans, etc., always follow the special installation and operating instructions for these elements.

- Before installing the heat exchanger, check pre-mounted fittings for conformity with the cooling/heat transfer media which are used (e.g. refrigerants in the case of expansion valves). In the case of pre-mounted, screwed-on fittings, re-check that they are screwed tight after the heat exchanger has been installed, because they may loosen during transport or handling.
- When electrical resistance heating units are used to thaw out evaporators and coolers, overtemperature protection according to EN 60204-1 is required, and this is not normally included in the scope of delivery.

! IMPORTANT!

When the customer carries out the wiring of the heating elements on his own premises, ensure correct earthing of the heating system! Heating cartridges with 3-wire cabling can be earthed directly via the earth wire. Heating elements with 2-wire cabling must be earthed by pressing an earthing loop, or, if there is sufficient contact, via an earthing screw in the end metal sheet of the heat exchanger. Heating elements must be mechanically secured against expansion-related movement (e.g. retention clamps).



! SAFETY NOTE

In operation, the surface of electrical heating elements can reach a temperature of >100°C. Danger of burning!

8. Commissioning and operation

! WARNING!

Always comply with the relevant currently applicable safety and accident prevention regulations when installing the heat exchanger. Initial commissioning must only be carried out by suitably qualified persons after testing the heat exchanger for safety and for leaks.

- Before commissioning, ensure that the entire pipeline system is clean – this will prevent dirtying or even blocking of the heat exchanger, which could affect the performance of the unit and/or damage it.

! IMPORTANT!

After the test running of fan heat exchangers, it is essential that the amount of current drawn is checked against the details on the type plate. In addition, check the direction of rotation of the fan.

- Check the regulating devices that have been connected function properly, and also check the switching on and off points of the safety devices.
- Completely ventilate the water/saline solution circuits!
- In the case of coolers and heaters with cooling saline solutions or water in the internal circuit, the minimum operating temperature anywhere in or on the heat exchanger must be higher than the freezing temperature of the liquid. Liquid freezing in the pipelines can damage the heat exchanger. In the case of water which contains antifreeze protection (saline solution): in winter, ensure that there is sufficient antifreeze protection. In the case of water without antifreeze protection: completely empty the air cooler in winter / do not allow the air heater return line temperature (when using outside air) to fall below 8°C.
- After commissioning, check all flange and screw connections for tightness.
- The heat exchanger is a component within a system, so shutting down and restarting the system must be carried out according to the system maker's operating instructions.
- Routine checks must be carried out **only by suitably qualified persons** at intervals based on the experience of the owner operator. The appendix includes a list of recommended tests for routine checking.

9. Faults

Action to be taken in the event of faults (safety instructions for evaporators and condensers):



SAFETY NOTE

- **Use personal safety equipment if the refrigerant escapes!**
- **Avoid any contact with the refrigerant!**
- **If liquid refrigerant gets into the eyes, seek medical attention immediately!**

Action in the event of faults (heaters):

- In the case of faults in the hot water supply to heaters (e.g. failure of the heating system or pump) in which the heat exchanger is exposed to temperatures of $<0^{\circ}\text{C}$ (caused by supply air and/or ambience), disconnect the heater from the mains supply and empty it completely in order to prevent the exchanger pipes from freezing.

Possible faults, causes and solutions:

Evaporator

Fault	Possible causes	Solution
Uneven frosting, uneven air outlet temperature	<ul style="list-style-type: none"> • Uneven air inflow • Uneven distribution of refrigerant via Venturi distributors 	<ul style="list-style-type: none"> • Fit air-side baffle plate, air deflection, increase in volume of air • See para. 6 Information on the distributor
Air outlet temperature is too high	<ul style="list-style-type: none"> • Overheating zone/inlet nozzle is at the air outlet • Insufficient filling level caused by faulty regulator • Evaporating temperature is too high • Volume of air is too high 	<ul style="list-style-type: none"> • Change installation position or manufacture superheating coil at the air inlet • Check for overheating and regulating behaviour, check fitting of sensor, replace regulator if necessary • Check compressor/suction pressure regulator • Reduce volume of air
Suction gas overheating	<ul style="list-style-type: none"> • Nozzle in regulator is blocked or too small • Condensation pressure is too low 	<ul style="list-style-type: none"> • Check for overheating and regulating behaviour, check fitting of sensor, replace regulator if necessary • Reduce volume of air
Air flow rate is too low	<ul style="list-style-type: none"> • Lamella package is dirty • Lamella package has iced up 	<ul style="list-style-type: none"> • Clean lamella package • Thaw out lamella package
Noisy fan	<ul style="list-style-type: none"> • Ice formation on fan wheel / inlet nozzle 	<ul style="list-style-type: none"> • Switch off unit and remove ice
Flow noise in the distributor	<ul style="list-style-type: none"> • Proportion of gas in the distributor is too high • Rate of refrigerant flow is too high • Diameter is too small, or the feed line was not laid correctly 	<ul style="list-style-type: none"> • Check condensation pressure and undercooling • Check layout of equipment • See para. 6 Information on the distributor

Possible faults, causes and solutions:

Evaporator

Fault	Possible causes	Solution
Ice block formation at the evaporator	<ul style="list-style-type: none"> Faulty pipe heater Thawing time too short Thawing safety thermostat is blocking the thawing process 	<ul style="list-style-type: none"> Check the function of the heating elements Reduce thawing time; if necessary, change thawing interval Check the function and the switch point of the thawing safety thermostat
Icing forms on the ceiling	<ul style="list-style-type: none"> Thawing time is too long 	<ul style="list-style-type: none"> Reduce thawing time; if necessary, change thawing interval

Cooler (water/saline)

Fault	Possible causes	Solution
Uneven frosting, uneven air outlet temperature	<ul style="list-style-type: none"> Uneven air inflow 	<ul style="list-style-type: none"> Fit air-side baffle plate, air deflection, increase in volume of air
Air outlet temperature is too high	<ul style="list-style-type: none"> Feed and return have been interchanged Refrigerant mass flow is too low Inlet temperature is too high Volume of air is too high 	<ul style="list-style-type: none"> Check feedlines; adjust if necessary Check mass flow, inlet and return line temperature; re-adjust if necessary Check equipment Reduce volume of air
Air flow rate is too low	<ul style="list-style-type: none"> Lamella package is dirty Lamella package has iced up 	<ul style="list-style-type: none"> Clean lamella package Thaw out lamella package
Noisy fan	<ul style="list-style-type: none"> Ice formation on fan wheel/inlet nozzle 	<ul style="list-style-type: none"> Switch off unit and remove ice
Flow noise in the equipment	<ul style="list-style-type: none"> Refrigerant mass flow is too high 	<ul style="list-style-type: none"> Check and adjust the mass flow
Ice block formation at the evaporator	<ul style="list-style-type: none"> Faulty pipe heater Thawing time too short Thawing safety thermostat is blocking the thawing process 	<ul style="list-style-type: none"> Check the function of the heating elements Check the thawing interval and time; reset if necessary Check the function and switch point of the thawing safety thermostat
Icing forms on the ceiling	<ul style="list-style-type: none"> Thawing time is too long 	<ul style="list-style-type: none"> Reduce thawing time; if necessary, change thawing interval

Possible faults, causes and solutions:

Heater (water/saline)

Fault	Possible causes	Solution
Air flow rate too low	<ul style="list-style-type: none"> Lamella package is dirty 	<ul style="list-style-type: none"> Clean the lamella package
Uneven air outlet temperature	<ul style="list-style-type: none"> Uneven air inflow 	<ul style="list-style-type: none"> Increase the volume flow and adjust the inlet temperature
Air outlet temperature is too low	<ul style="list-style-type: none"> Air inlet temperature too low Inlet temperature too low Volume of air too high 	<ul style="list-style-type: none"> Increase the inlet temperature and/or reduce the volume of air
Flow noise in the device	<ul style="list-style-type: none"> Rate of refrigerant flow is too high 	<ul style="list-style-type: none"> Check and adjust mass flow

10. Corrosion

Acidic food items (e.g. fruit acids, salads, etc.) or other aggressive substances (e.g. cleaners, see below) can damage the heat exchanger. Pitting corrosion in the copper pipes or oxidation of the aluminium lamellae are frequent causes of failures in these cases. If the heat exchanger comes into direct contact with food items or substances of this type, for example, through accidental spillage, then thorough cleaning must take place immediately (see section 11).

An aggressive environment, for example, due to smoke, aerosols formed by acids, chlorine, ammonia, salt, etc., can also result in damage to the heat exchanger within a short time. Regular cleaning (see section 11) is necessary.

The durability/operating life of a heat exchanger in an aggressive environment is very dependent on the type of substance and its concentration. Consequently we cannot accept any liability for premature failure of a component which results from corrosion phenomena.

11. Maintenance, servicing and temporary decommissioning

Servicing:

Check the correct function and tightness of the heat exchanger and fitted elements (safety and regulating devices, fan, etc.) at regular intervals (see test table in the appendix).

Maintenance / cleaning:



IMPORTANT!

Clean the heat exchangers regularly!

Regular cleaning and cleaning after contact with aggressive substances should take place with lukewarm water, together with a neutral cleaning agent if required. If surfaces are dry and only dusty (e.g. on a heater), cleaning with clean, dry compressed air is also possible.



IMPORTANT!

The cleaning agent must be washed off completely!

Under no circumstances use cleaners containing any of the following substances: Ammonia; bleach (chlorine); acids; acetone (organic solvents); concentrated alkalis.

Temporary decommissioning: If the cooler and heater in units with saline solution/water circuits are decommissioned for a long period of time, they should be completely emptied. We recommend blowing out the units with compressed air because this will remove any residual water from the pipelines.

12. Dismantling and disposal

Always comply with DIN EN 378 and the relevant national regulations (e.g. German Water Resources Law, German Halon Prohibition Ordinance) when dismantling the heat exchanger.

The heat exchanger is primarily manufactured from copper, aluminium, steel and stainless steel, which, even when painted, can be sent for recycling using mechanical and/or thermal separation.

Polar Kältetechnik GmbH uses untreated wood, cardboard, styrofoam / expanded polystyrene and polyethylene (PE) foil for packaging and packing. These materials can be sent for recycling.

13. Test table for routine checks to be made on heat exchangers

Routine checks are to be carried out **only by suitably qualified persons** at intervals based on the experience of the owner operator, i.e. on the basis of a hazard assessment and with regard to the operating conditions on the part of the owner operator. The following list is only a recommendation.

Test table	Device type			
	Evaporator (direct exp.)	Condenser	Cooler (cars)	Heater (caravans)
Visual checks				
Holdings and fastenings	●	●	●	●
Dirtiness of the heat exchanger	●	●	●	●
Damage to the heat exchanger and the feed lines	●	●	●	●
Icing up/formation of ice	●		●	
Amount of refrigerant and undercooling (sight glass)	●	●		
Contaminants or dirt in the refrigerant circuit (filter with sight glass)	●	●		
Control measurements				
Evaporation temperature and overheating of the refrigerant	●			
Condensation temperature and undercooling of the refrigerant		●		
Inlet/return line temperature of the refrigerant			●	●
Air inlet and outlet temperature	●	●	●	●
Power drawn and speed of rotation of the fans	●	●	●	●
Concentration of antifreeze and inhibitors			●	
Function tests				
Defrosting; defrosting safety thermostat	●		●	
Fans (running noises, imbalance)	●	●	●	●
Cut-off and regulating valves	●	●	●	●
Condensate drain	●		●	
Measures				
Cleaning of the heat exchanger	●	●	●	●
Cleaning of the drip catch pan and drain	●		●	

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Polar Kältetechnik GmbH reserves the right to make technical changes to the illustrations and details shown in these operating instructions.



POLAR KÄLTETECHNIK

Polar Kältetechnik GmbH

Werner-von-Siemens-Straße 1a · 58730 Fröndenberg · Germany

Telefon: +49 (0) 23 73-7 00 25/26 · Telefax: +49 (0) 23 73-97 20 06

E-Mail: info@polarkaeltetechnik.de · www.polarkaeltetechnik.de