Heat Exchangers
Rigging And Handling

evapco

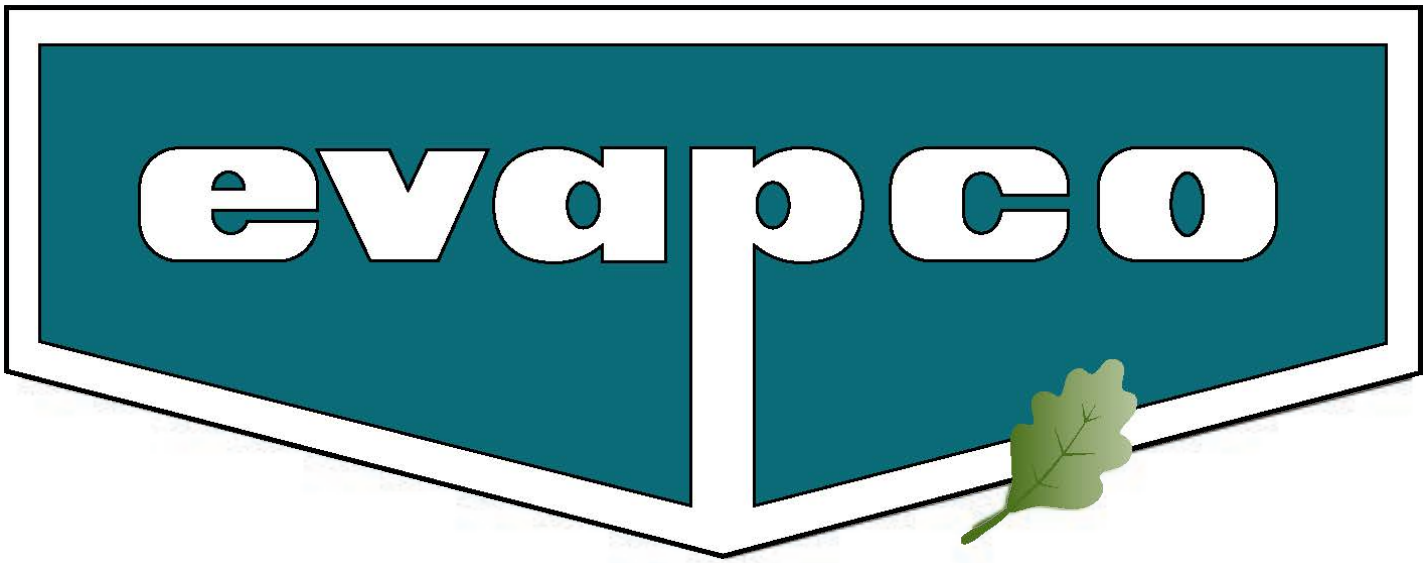
Table of Contents

Important basic information

Off-loading of the equipment

Assembling manual

Maintenance Manual



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Important basic information

Always keep the operating instructions in the immediate vicinity of the unit.

Make sure that the operating instructions are always accessible to all personnel that have to work with the product in any way.

Make sure that the operating instructions are read and understood by all persons, which have to work with the product in any way.

Importance of the EN 378 standards

(Refrigerating systems and heat pumps - Safety and environmental requirements)

The EN 378 deals with safety and environmental requirements for design, construction, manufacturing, installation, operation, maintenance and disposal of refrigeration systems and cooling equipment.

EN 378 is oriented towards manufacturers, installers and operators of refrigeration systems and cooling equipment.

The purpose of the EN 378 is to minimize the potential hazards to people, property and environment due to the cooling system, refrigeration equipment, working fluids (refrigerants and coolants).
Insufficient safety measures or non-compliance with safety-related requirements can lead to:

- Breaks or ruptures on parts with the risk materials disappearing (this can be caused by too low temperatures, too high pressures, incorrect usage of the fluid, moving machine parts).
- Leaking working fluid after a rupture/break caused by defective design, improper operation, insufficient maintenance, repairs, refilling and disposal (hazards caused by flammability, explosion hazard, disturbance of the nervous system, suffocation, panic).

Responsibilities

Manufacturer

The guidelines in these operating instructions on secure maintenance of the unit to avoid possible hazards during transportation, installation and assembly, commissioning, operation and maintenance (cleaning, maintenance and repair) refer exclusively to the unit.

The manufacturer’s liability is documented in the offer and order (design, manufacture and testing) and in accordance with EN 378-2.

The construction is designed to withstand the foreseeable mechanical, thermal and chemical stresses and resistant to the working fluid used.

The fluid-carrying parts of the unit (tubes, distributor and header) are designed to for the expected mechanical, thermal and chemical stresses, and withstand the maximum operating pressure.
Material, wall thickness, tensile strength, corrosion resistance, shaping process and testing are suitable for the fluid used and chosen to withstand the expected pressures and stresses.

All responsibilities regarding the equipment, in which the unit is integrated, are the exclusive responsibility only to the respective personnel to the individual equipment items involved.

Important basic information

Installer

The responsibilities of the system installer including the brine circuit are according to the design calculation of unit and EN 378-2.

Component supplier - installer interface: Notify EVAPCO Europe a/s if faults occur:
Notify EVAPCO Europe a/s immediately, if faults occur during the installation, commissioning and operation.

The responsibilities of the system installer in particular include:
Planning and preparing emergency measures:

- To avoid significant damage caused by operational disruptions, a warning system must be installed on-site, which signals all faults without delay. Emergency measures must be prepared which prevent subsequent damage to people and/or property, should such faults occur.
- Install emergency stop switches, which can be actuated without danger
- Make maintenance and check intervals and adhere to these. This also include the brine circuit and should be according to EN 378-4

When connecting the unit to the heat transfer circuit of the refrigeration system, this must no deviate from the order-related offer documents and information.
The installer of the system must ensure that the personnel using the system are aware and reconnaissance of the brine used in the heat transfer circuit is based on the relevant safety instructions from the supplier of the brine.

It is recommended that the future customer staff is present - if possible - during the installation and assembly, including with the tightness test and cleaning, with the filling with brine and setting of the system.

Operator

The responsibility of the owner or operator is documented in the operation, maintenance and service of the system according to EN 378-4.

The owner or operator must ensure that the personnel is adequately trained for operating, monitoring and the maintenance of the facility including knowledge of the properties of the brine in question.

Before start-up of the system, the owner or operator must ensure that the operating personnel are well- versed with all relevant parts of the system, which includes the construction, monitoring, operating and maintenance as well as the safety precautions and measures needed due the system and the brine.

Emergency measures: To avoid possible damages to personnel or system, a warning system must be installed on site, which immediately reports operational faults.

The responsibility remains with the owner or operator of the facility, including for the brine except in case of a specific agreement on shared accountability.

Legal Notice

The unit warranty is void if:

- Faults or damages occur, which can be attributed to non-compliance with the specific operating instructions.
- Use of non-original spare-parts or non-approved by EVAPCO substitutes for these.
- Changes to the unit in comparison to the order-related parameters, such as fluid media, pressure, function, working conditions, without prior consent.

Important basic information

This manual concerns all types of Heat Exchangers from EVAPCO Europe A/S.
- The exact type of your unit will be apparent in the order-related documents.

Set-up and other applicable documents

The operating instructions for the unit include the following components
- These instructions
- Order-related documents.

Related offer documents to these instructions are:
- The order-related technical data
- The order-related drawings specifying customer, project number and order number.
- Motor connection wiring diagram in the terminal box.
- Wiring diagram for control if applicable.

This manual is part of owner's operating instructions manual of the system, which must also include the fluid media properties and safety precautions.

Warning signs used by EVAPCO and onsite by the owner

EVAPCO Europe a/s will apply the unit applicable warning signs to the unit. It will be the owner's responsibility to apply and install ALL relevant signs on-site, which are not directly attached on the unit by EVAPCO.

These warning signs can be:

Important basic information

Your EVAPCO dry cooler/air cooled condenser is manufactured with great care from the most appropriate materials and should arrive in perfect condition. Please read and follow these instructions and you will ensure long and trouble-free operation of your new equipment.

General Inspection

Prior to off-loading from the vehicle and before signing the Consignment Note, verify that the product and packaging are free of any damage.

If the equipment is damaged:

- Detail the extent of any damage on the Consignment Note before signing and accepting the goods. This is very important if subsequent claims are to be lodged with either the haulier or Insurers. Failure to do so assumes that the product has been received and accepted undamaged.
- Whenever possible photograph the equipment/damaged area(s); preferably while still on the vehicle; otherwise it may prove difficult to assign responsibility to the haulier if the damage is not noticed until after off-loading from the vehicle.
- Immediately or at the very least within 5 days, inform your local EVAPCO representative or the factory in Aabybro, Denmark so that EVAPCO Air Solutions is able to register a transport damage claim, which must be logged within 7 days of shipment of the goods. Failure to comply with the above will result in a disputed claim and any repairs will be at the cost of the Client. Furthermore, as soon as is practical provide on your Company letterhead, details of the damage accompanied by a copy of the signed Consignment Note and any photographs.

In the case of significant damage:

- If significant damage is sustained to the goods, in particular to the tubes and/or headers, the shipment should not be accepted.
- Detail the extent of the damage on the Consignment Note and sign ‘goods not accepted’.
- Return the Consignment Note to the carrier with instructions to return the shipment to the factory.
- The details of the damage must be noted on the Consignment Note!
- Photographs are also helpful in quantifying the extent of the damage.
- In case of further onward transportation:
  - As a minimum, always use the EVAPCO provided packaging/crating for further onward transportation.

Unpacking the heat exchanger

Remove the straps, holding the bottom palette, the side timber slats and the unit together, if applicable.

In some instances, the headers are protected during transport with a frame around them affixed to the bottom palette. Remove this.

Check the unit for damages to ensure no transport damage has occurred. If it is found to be the case, immediately note the damage on the transport papers and report these to EVAPCO in writing.
Some units will be delivered with pressurized air. For such units, please check that this pressure is still present. This can be done by opening the small valve on the header and listening for the escaped air.

Off-loading of the equipment

For shipments where a forklift truck or crane is necessary

- Ensure that the crane operator and/or the truck driver lift the unit securely. Always consider the weight of the heat exchanger with regard to crane, forklift, etc.
- Tubes and return bends are never to be used for lifting and you should always be careful when moving the heat exchanger.
- Remove the packing and verify that no damage, previously hidden, has occurred. Here can be added that slightly dented fins normally can be repaired easily. You can, as habitual costumer, have advantage of buying a fin straighten tool, which is a useful tool for your fitter.
- Dented or slightly damaged tubes are only to be repaired by a qualified fitter. If the damage of the tubes cannot be repaired by your fitter contact your local EVAPCO representative about returning the shipment to EAS.
- Be aware that you according to insurance procedures only have 1 working week to forward your damage complaint, if the damage has not been marked in the consign-ment note.

Assembling manual

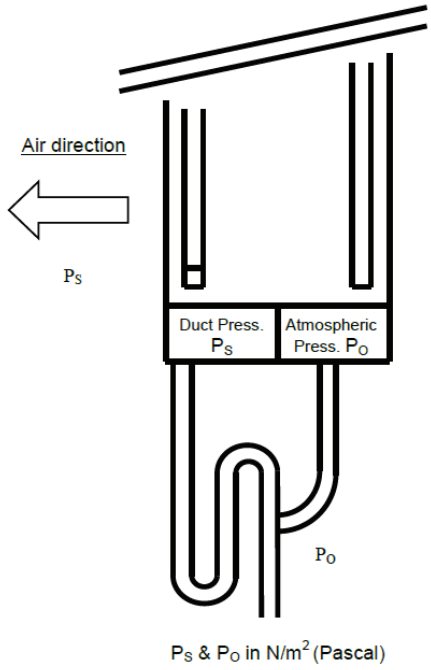
Take care to protect all parts of the unit, including the tube connections, and avoid denting the fins, when moving the heat exchanger. If care is not taken, there is a risk of damages not immediately noticeable, which as a result do not come to your knowledge until after installation.
The heat exchanger must be placed with the heat exchanger tubes completely horizontal to ensure the best possible operation.
The heat exchanger should be placed in such way that free access and discharge of airflow are possible at all times.

Connecting the Liquid/Air Heat exchanger to the Pipe Work

Each unit is marked with arrows to show inlet and outlet. When connecting the heat exchanger to the pipe work the following is to be considered.

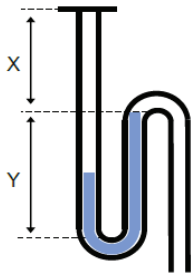
- Take care to avoid tension when connecting pipe work. Vibrations and pulses can damage the heat exchanger.
- The inlet and outlet tubes of the heat exchanger must not carry the rest of the pipe work.
- If necessary use flexible connectors. When tightening the threaded headers, always use torque wrenched opposite the tightening direction, to avoid damage to the tubes.
- If possible the system is filled, from the bottom, as this allows for better air vent.
- Take care that the system is completely emptied for air. If air bubbles occur in the system, the heat transfer is not optimum.
- If the headers have plugs for air vent and drainage valves, do not use these plugs for air venting or draining the system, as leaks might occur, when retightening the plugs. Use valves designed for air venting and drainage.
- Be particularly aware of temperatures around zero and below, as these temperatures could mean danger of breakage due to frost in the tubes of the heat exchanger. Always consider the temperature when choosing a brine mixture. To avoid damages the heat exchanger should be emptied completely for fluid. To ensure the complete emptying of the heat exchanger, compressed air should be used, through the air ventilation connection until the heat exchanger is empty.
- If the duct mounted heat exchanger has a drip tray, please follow the instructions to dimensio the water trap.

Duct mounted heat exchangers



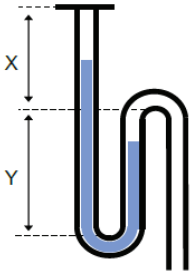
P_S & P_O in N/m^2 (Pascal)

Positive air pressure



$Y = P_S / 10 + 50$ mm
$X = 50$ mm (Minimum)

Negative air pressure



$X = P_S / 10 + 50$ mm
$Y = X / 2$ mm (Minimum)

Assembling manual

Connecting the Liquid/Hot Gas Heat exchanger to the Pipe Work

When connecting liquid and hot gas lines to the heat exchanger, the following should be considered.

- Take care to avoid tension when connecting gas and liquid lines. Vibrations and pulses can damage the heat exchanger. The inlet and outlet tubes of the heat exchanger must not carry the rest of the pipe work. If necessary use flexible connectors.
- Before assembly, the protective gas in the heat exchanger (overpressure of approx. 1 Bar) has to be let out. When no more outlet of gas can be heard, the header/bottom caps can be removed from the tubes. Use a tube cutter and never a saw.
- Never braze or weld on the heat exchanger, as long as pressure still exists in the connecting system and the heat exchanger contains gas. Ensure that the heat exchanger is disconnected from the rest of the system and evacuate the heat exchanger before working on it.
- If the cooling heat exchanger has a drip tray follow the same instructions as for the Liquid/Air heat exchanger. (According drawings above).

Connecting a steam heat exchanger to the Pipe Work

When installing a steam heat exchanger into a piping system, the following should be considered.

- When installing a steam heat exchanger into a piping system, ensure that condensate can be drained and always use steam traps on each condensate connection.
- Always ensure that the steam is dry, as humid steam can cause water hammering. To help avoiding this, insulation of the steam pipes may be advisable.
- Vibrations and pulses can damage the heat exchanger and it may therefore be advisable to install vibration dampers in the piping system which can absorb a large majority of these vibrations.
- It is highly recommended that steam heat exchangers are installed with heat exchanger tubes in a vertical position. If this is not possible heat exchangers must be installed in a way which allows condensate to be drained away from the heat exchanger to steam traps.
- The inlet- and outlet tubes (manifolds) of the heat exchanger must not carry the connecting piping system which must be carried by supports or similar devises.
- Due to high temperatures it is very important that heat exchanger tubes can expand freely during operation. This means that manifolds under no circumstances must be fixated. If this happens it is very likely that the heat exchanger will break down.
- When starting the steam system, steam valve has to be opened slowly to warm up the hole system before being taken in operation, to avoid stress tension and water hammering.

Frost & draining

EVAPCO Europe is not responsibility for ensuring that the product is adequately protected against frost damage. If the product has occasion to operate in close-to or sub-zero temperatures then either the circulating fluid should be dosed with an adequate anti-freeze additive or provision has to be made to either manually or automatically drain the fluid from the heat exchanger. Note : Opening the air vent and drain connections as a means to fully drain the fluid from the heat exchanger is not sufficient to drain all the fluid and thus prevent frost damage. To ensure full drainage, air pressure assisted draining is recommended.

If you have any doubts, please contact your local EVAPCO representative or the factory for advice.

Users manual

Start up

- After secure placement and connection of pipe work, please verify that the rest of the pipe work/the pumps do not transfer any pulses and vibrations to the heat exchanger.
- Check for leaks!
- If possible, measure for control the performance of the heat exchanger and file these measurements. These measurements can be used to control the performance reduction due to fouling of fins and the cleaning frequency can be planned.

Maintenance Manual

During normal maintenance, all relevant national and company safety regulations should be observed, as well as the appropriate guidelines imposed by the suppliers of relevant medias, such as cooling media.

It is recommended to implement an inspection and maintenance plan for the unit.

Inspection and maintenance plan

EVAPCO recommends at least the following points get checked at appropriate intervals. It is up to the owner to adjust the inspection and maintenance plan according to the requirements of the specific site. However, it is not recommended to enlarge the intervals.

Job	Weekly	Monthly	Half yearly	Yearly
Check unit for dirt build-up	x			
Check unit for damages	x			
Check performance data		x		
Check unit for leaks			x	
Check connections for tightness				x
Check cooling media pressure		x		
Check unit for corrosion			x	
Cleaning the coil			x	

Cleaning

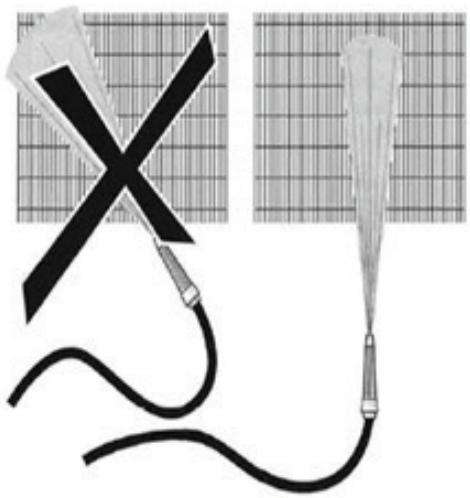
It is essential to understand that fouled or dirty fins reduce the heat transfer substantially.

- It is essential to understand that fouled or dirty fins can substantially reduce the thermal performance of a dry cooler or air cooled condenser.
- Regular visual inspections of the product and in particular the heat exchanger is recommended.
- Check for fouling of the fins by using a flash light to shine between the fins to establish the accumulation of dust, dirt or debris. If it is concluded that such fouling has impacted upon the airflow, performance or resulted in the motors drawing a higher than normal running current (Amps), the heat exchanger surface should be cleaned.
- Accumulation of dry dust or sand, usually on the air inlet face of the heat exchanger, can simply be removed by one of the following methods …
  - Low pressure compressed air jet applied against the normal air direction of dry cooler.
  - A suitable industrial vacuum cleaner.
  - A soft hand brush. Sweep along the fins and under no circumstances across the fins.
- Moist, sticky accumulations or grease should be removed by means of hot water or a steam jet cleaning appliance applied against the normal air flow direction. Note: Ensure the jet of the cleaning appliance is kept at an angle of no more than 15° from vertical position, to avoid deforming the edges of the fins.
- Under no circumstances use organic solvents and cleaning products.
- If in doubt contact the manufacturer of the proposed cleaning products to confirm which cleaning agents are suitable for the product's tube, fin and casework material. If in doubt, contact your local EVAPCO representative or the factory.
- Avoid mechanical cleaning with any hard objects, which might damage the tubes or fins resulting in a capacity issue or perhaps even leaks.

Maintenance Manual

Cleaning

Cleaning hydraulically



When cleaning the coil hydraulically, with water under pressure, ensures that the water spray used has maximum 50 Bar.

Always clean in the vertical direction. Never across the fins, as this will damage the fins. And always from the top down to avoid the water spray entering the fans (this can short circuit the fans).

For oily or otherwise difficult to remove dirt, it is possible to add a chemical cleaning agent to the water used in the hydraulic compressor. Ensure that the cleaning agent is compatible with the materials used in the unit and that it is an environmentally friend agent.

Cleaning with compressed air

If cleaning the unit with compressed air (max. 80 Bar pressure) for the purpose of removing dirt and other things, please ensure that the air stream is COMPLETELY VERTICAL to the fins as the air stream can otherwise damage the fins.

Cleaning with brushes

Dry dust and some dirt can be removed with brushes, possibly in conjunction with compressed air (the last keep in mind the previously mentioned guidelines and a minimum distance to the fins of 200 mm) or an industrial vacuum cleaner.

However, ensure that soft brushes are used and when possible all cleaning should be from the top down. ALWAYS brush along the fins. NEVER across the fins, as this will damage the fins.

Maintenance Manual

Wear and tear

- Generally, heat exchangers are a low maintenance product, but when the product is exposed to an aggressive or corrosive environment. In such a case the tube, fin and casework materials may suffer from various forms of corrosion. However, if correctly specified, the materials of manufacture should be suitable for the operational environment.

Safety Precautions

The following Health and Safety legislation and codes of practise etc. should be acknowledged …

- Only use the coolant/refrigerant specified for the design of the heat exchanger. Failure to do so may damage the tubes of the heat exchanger resulting in leaking tubes. If in doubt consult EVAPCO.
- All products are designed in accordance with the PED and categorized in-line with the specified design pressure. Therefore ensure that this design pressure is not exceeded. Failure to comply may result in damage to the unit and could result in injury.
- Care should be taken when in close proximity to the heat exchanger finned surface, which comprises sharp edges and can inflict injury. Use of gloves is recommended.

Repairs

In the event that the product needs to be repaired, certain recommendations should be followed.

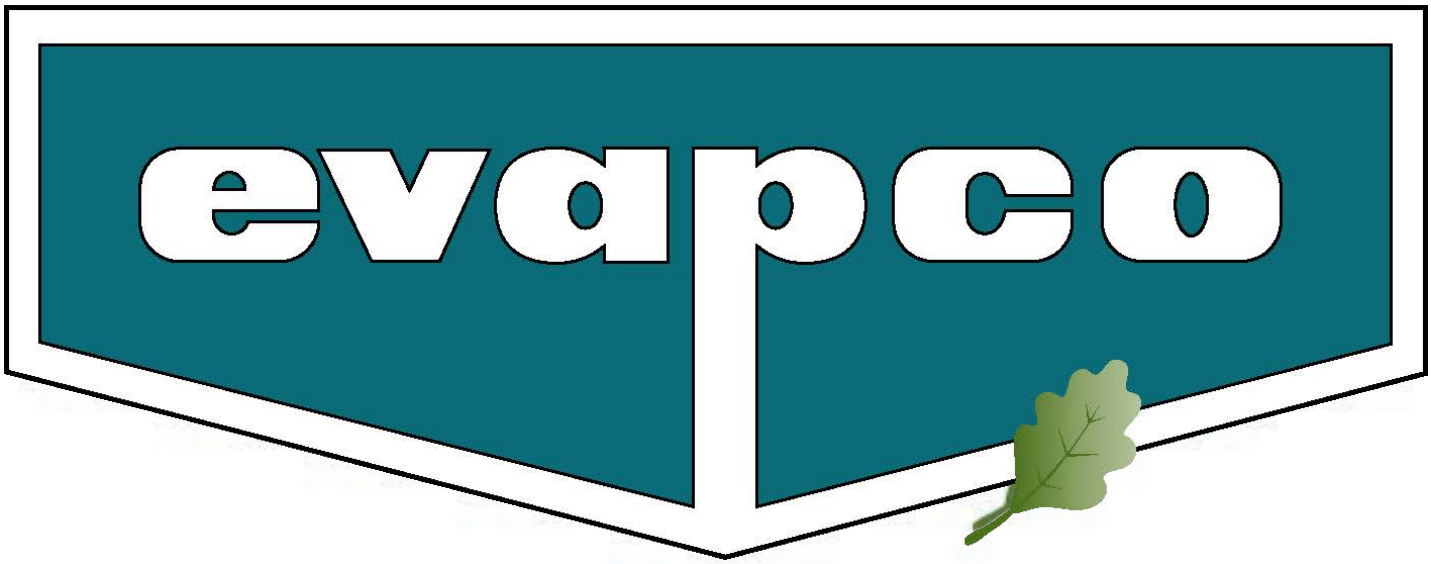
- Welding / Brazing - Ensure that the product is completely isolated and drained of coolant/refrigerant plus ensure that any fitted air vents are open prior to commencing any repair work on the heat exchanger. Failure to do so may result in the build-up of excessive internal system pressure and may result in tube/pipe failure and potential injury.

Troubleshooting

If faults or errors occur, the steps recommended in the user manual under safety are to be followed. If the faults are outside the outlined, please contact EVAPCO for clarification.

Troubleshooting table.

Fault	Potential cause	Remedy
Cooling media escaping	Coil leaking	Establish the leaking spot. Switch off cooling media and fans. Empty the unit. Close the leak or tighte- ning the packing, if this is the lea- king spot.
Capacity not reached	Coils are dirty	Clean according to maintenance manual
Capacity not reached	Insufficient fluid flow	Check pumps with regards to required values. Reset value or change faulty equipment, if pumps or valves are faulty
Capacity not reached	Cooling media concen- tration has changed	Adjust the mixture



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OUR PRODUCTS ARE MANUFACTURED WORLDWIDE.

Get to Know EVAPCO

- The global innovator in heat transfer solutions
- Serving the commercial HVAC, Industrial Refrigeration
- Power Generation, and Industrial Processing markets
- Founded in 1976
- Employee-owned
- 24 manufacturing facilities in 10 countries
- More than 170 sales offices worldwide

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