

## Operating Instructions



## Centauro air coolers

Keep for future use!

CEN.11.B01

*QUIRON*  
by **centauro**



**Revision**

Date	Chapter(s)	Reason	Person responsible
30.04.2011	All	Update	P. Pereira

We have prepared these operating instructions to the best of our belief. Even so, do let us know should errors or unclear points come to light. We would also be pleased to receive any pointers or suggestions on these instructions.

**Operating instructions for air coolers****These operating instructions belong to:**

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Castelo Branco, 30 April 2011

Operating instructions version: CEN.11.B01

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# 1. General

## 1.1. *Introduction*

These operating instructions contain important information on safely handling the Centauro heat exchanger.

These operating instructions are for the experienced refrigerating plant installers. It is essential for technical personnel to thoroughly read and understand these operating instructions before any work is undertaken on or with the product described!

Do turn directly to Centauro (for address see page 1) for more information on the heat exchanger which goes beyond the extent of these operating instructions.

## 1.2. *Scope of supply*

The Centauro product series comprises the following:

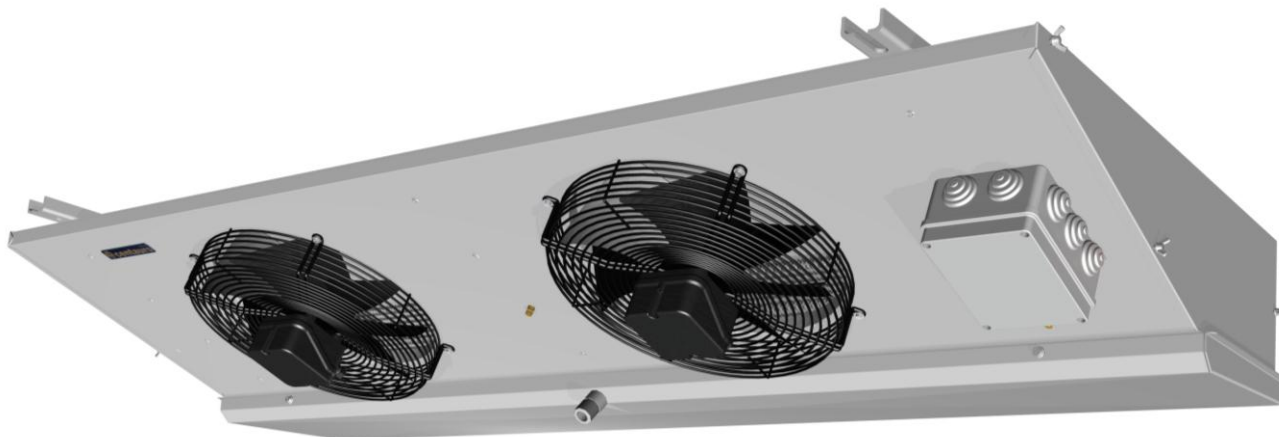
Pipelines protected by a casing and enclosed in fins with a drip tray and fan(s) mounted in the casing.

Additionally, the Centauro heat exchanger is also fitted with various components for the standard version and, if so, the optional components listed below.

### **Type designation:**

The designation on the heat exchanger nameplate provides precise details on the respective product version and includes the following information:

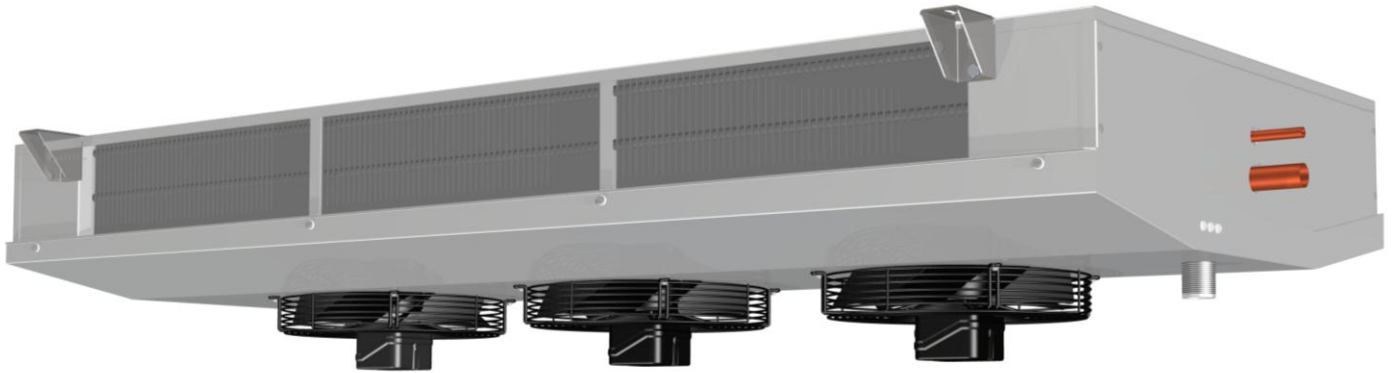
**Centauro wedge air coolers (TA / TAL, RWK / BWK)**



**Centauro cubic air coolers (MT / DD / BXN / BXL / MTA / MTB / DDC / DDL /  
DXL / BSU)**



**Centauro dual flow air coolers (CB, DF / DFL)**





The Centauro heat exchanger is completely assembled prior to delivery. It consists of the following components:

**Basic version:**

- 1 casing consisting of:
  - Smooth, hygienic aluminium and magnesium casing, white powder coated or null finish
  - Hinged or demountable condensate tray (depending on the model)
  - Fan partition plate(s)
  - Condensate drain (Dual flow air coolers):
    - up to fan diameter 300 mm with common central drain for both trays
    - bigger diameters: one drain each tray
  - Variable options for refrigerant pipe connections
  - Baffle plate at the air discharge side (depending on the model)
  - Wedge and cubic air coolers: 1 heat exchanger coil or, respectively, dual flow air coolers: 2 heat exchanger coils:
    - Corrugated aluminium fins
    - Copper core tube
    - Tube bends
    - Tubing: Capilar or venturi distributor, header
    - Schrader valve at outlet
  - 1, 2, 3, 4 and 5 axial fan(s):
    - Electric motor
    - Fan blades
    - Fan guard

**Optional accessories (available depending on the model):**

- Electrical defrost heaters coil and tray
- Hot gas defrosting coil and tray
- Double drip tray with 20mm insulation
- Epoxy coated aluminium fins
- Cutting edges and bends additionally powder coated
- Stainless steel casing
- Stainless steel core tubes
- Fan ring heater
- Reheating coil (electrical, hot gas, warm water)
- Hinged or demountable drip tray
- Hinged fan plate
- Refrigerant connections inside to the top
- Air sock adapter
- Streamer
- Insulated suction hood
- Shut-up

### 1.3. *Liability and warranty*

The stipulated warranty period holds good for the Centauro heat exchanger. Warranty is only taken on when the following conditions are fulfilled:

- The heat exchanger has only been used under the conditions defined in Chapt. 2.1, "Intended use", p. 11
- The entire work on or with the heat exchanger has been solely undertaken by authorized technical personnel.
- Only genuine replacement parts have been used.
- The technical critical values have been adhered to (see Chapt. 3.1, "Conditions of operation", p. 19).

### 1.4. *Applicable documents*

The Centauro heat exchanger is delivered including the complete documentation. It consists of the following documents:

- Operating instructions for the Centauro heat exchanger ordered
- Required certificates

## 2. Safety

### 2.1. *Intended use*

The Whiteline heat exchanger in its standard version is intended for the installation in compression refrigerating cycles only. It is for exchanging heat energy between the ambient air and the refrigerants stated below and is intended to be used in one of the following three areas of application:

- Air conditioning (K)
- Medium temperature (N)
- Low temperature (T)

The intended use is a decisive factor in the selection of heat exchanger.

The plants in which the Whiteline heat exchanger is installed must comply with the requirements of the European Machinery Directive 2006/42/EC and the European Pressure Equipment Directive 97/23/EC. The whole plant must conform to the appropriate legal regulations.

With allowance made for the regulations in force, the Whiteline evaporator is intended for refrigeration and is for use in enclosed rooms to be cooled solely. Use of the Whiteline heat exchanger is only permitted with the following refrigerants:

- Refrigerant Fluid Group 2 of the Pressure Equipment Directive 97/23/EC
  - Single substance refrigerants
  - Zeotropic refrigerant mixture
  - Azeotropic refrigerant mixture
  - Inorganic compounds

The liquid refrigerant is injected into the evaporator. In doing so, it extracts through the fins and tubes heat from the ambient air.

The instructions in these operating instructions and **those limiting values stipulated** in Chapt. 3.1, "Conditions of operation", p. 19, must be **strictly** adhered to.

#### **São proibidos:**

The use of the Centauro heat exchanger for a purpose other than that specified above (e.g. for cooling another fluid).

The use of non-authorized operating fluids (different to the above refrigerants).

Incorrect equipment setup or fitting in systems other than the above ones.

Unauthorized modifications (e.g. function, working point, fan capacity or air quantity) without the manufacturer's written approval.

## 2.2. Safety marking

Special attention is drawn to dangers and vital information in the operating instructions by the use of signaling words (**DANGER!**, **WARNING!**, **CAUTION!**, **ATTENTION**, **NOTE**) and symbols. The following applies:



**DANGER!** *Danger of personal injury.*  
*Death or serious injuries WILL arise unless the appropriate steps are taken.*



**WARNING!** *Danger of personal injury.*  
*Death or serious injuries MIGHT arise unless the appropriate steps are taken.*



**CAUTION!** *Danger of personal injury.*  
*Minor injuries might arise unless the appropriate steps are taken.*



**ATTENTION** *Danger of material damage.*



**NOTE** *Particular feature is on hand.*

## 2.3. Safety instructions



**AVISO!** *Inappropriate handling of the heat exchanger can have serious, if not lethal consequences!*

*These operating instructions*

- *must have been thoroughly read and understood before any work with or on the heat exchanger,*
- *must be strictly adhered to,*
- *must always be available where the heat exchanger is set up.*

**WARNING!**

*Danger of personal injury.*

*The entire work on or with the heat exchanger is only to be undertaken by authorized specialized personnel with profound knowledge of refrigeration systems.*

**WARNING!**

*Danger from falling loads.*

*Note weight of the heat exchanger!*

*Only use suitable hoisting and handling equipment!*

*DO NOT walk under the suspended load!*

**WARNING!**

*Danger of cuts through to limbs being amputated.*

*In instances of handling, installation, maintenance, dismantling and taking out of service, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!*

**WARNING!**

*Danger due to rotating fans.*

*The heat exchanger may only be commissioned and operated with mounted fan guards!*

*Do not disassemble the fan guards!*

*Electrical parts must be isolated from M.P.S (main power supply) during maintenance.*

**WARNING!**

*Danger of severe injuries and even strangling if hair or clothes are drawn in by mobile parts.*

*Observe the following when carrying out work on the heat exchanger:*

- *Wear tight-fitting clothes!*
- *Cover long hair with a hairnet!*
- *Do not wear jewellery!*

**WARNING!**

*Danger of injuries to the skin and to the eyes due to parts being thrown out.*

*Wear protective goggles when carrying out work on or with the heat exchanger (especially during startup, operation and maintenance)!*

*Select the installation site such that parts being thrown out from the fans cannot hit people if the wheel breaks.*



**DANGER!**

*Danger for the environment.*

*Refrigerants and lubricants must be prevented from leaking.*

*Make suitable provisions to this end!*



**DANGER!**

*Danger due to electricity.*

*Only electricians may carry out work on electrical equipment!*

*Take the following precautions prior to carrying out any work on electrical equipment:*

- *Switch off the main switch and protect it against reactivation.*
- *Make sure the unit is off-circuit.*
- *Ground and short-circuit.*
- *Cover or fence off parts under voltage.*

*Observe the local safety regulations!*

*Regularly check the state of the cables!*



**CAUTION!**

*Danger of frostbite when touching cold surfaces.*

*Do not touch the surface of the heat exchanger during operation!*

*Leave surfaces to warm up first after shutdown!*

*Wear personal protective equipment (protective goggles, protective gloves, safety shoes) when carrying out work on or with the heat exchanger!*



**CAUTION!**

*Danger of burns when touching hot surfaces.*

*During defrost operations do not touch the heat exchanger surface!*

*Let the surface firstly cool down after taking out of service!*

*When working on or with the heat exchanger, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!*

**CAUTION!**

*Danger of stumbling from incorrect installation.*

*Danger of slipping from water, refrigerant or oil escaping.*

*Configure the place of installation so that there is no stumbling or slipping risk.*

*Regularly check on connections as to seal-tightness!*

**CAUTION!**

*Danger of frostbite to the limbs when touching the line at the heat exchanger outlet and its components.*

*The refrigerant causes the piping at the heat exchanger outlet to become extremely cold during operation. This is why thermal insulation is to be fitted at the piping running from the heat exchanger.*

*Startup and operations only with fitted insulation!*

*Regularly check the thermal insulation as to condition and replace, if necessary!*

*When working on or with the heat exchanger, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!*

**DANGER!**

*Danger of frostbite and injuries to both skin and eyes from coming into contact with refrigerants.*

*Only instructed specialized personnel are to work on the refrigeration circuit!*

*Wear personal protective gear (in particular protective gloves and protective goggles).*

*Undertake the following steps prior to maintenance, retrofitting and dismantling:*

- *Shut down the systems.*
- *Wait for a minimum 5 minutes until the refrigerant circuit has come to a standstill.*
- *Disconnect the heat exchanger from the rest of the system.*  
*For this, make use of the envisaged shutoff valves.*
- *Lower the pressure. Extract the refrigerant from the refrigeration system with a special recovery machine.*

*Regularly check on connections, lines and vessels as to seal-tightness and condition!*



**DANGER!**

*Danger of injuries to skin and eyes from squirting oil and from gaseous refrigerant under high pressure.*

*Undertake the following steps prior to maintenance, retrofitting and dismantling:*

- *Wear personal protective gear (in particular protective gloves and protective goggles).*
- *Shut down the system.*
- *Wait for a minimum 5 minutes until the refrigerant and oil circulation has come to a standstill.*
- *Disconnect the heat exchanger from the rest of the system.*  
*For this, make use of the envisaged shutoff valves.*
- *Lower the pressure. Extract the refrigerant from the refrigeration system with a special recovery machine.*

*Undertake the following steps at the startup, operation and maintenance stages:*

- *Regularly check on connections, lines and vessels as to seal-tightness and condition!*



**DANGER!**

*Danger of suffocation from inhaling refrigerant vapours.*

*Danger of poisoning from toxic substances set free.*

*Only instructed technical personnel are to work on the refrigeration circuit!*

*Wear personal protective gear (in particular protective gloves and protective goggles).*

*It is prohibited to work with a naked flame or with extremely high temperatures!*

*Regularly check on connections, lines and vessels as to seal-tightness and condition!*

*Ensure that the place where the heat exchanger is installed is well ventilated!*



## 2.4. Remaining risks



**CAUTION!**

**Location of hazard:** Hot surface.

**Hazard:** Burns.

**Protective steps:**

- Warn personnel of risks.
- Do not touch!
- Wear safety gloves!
- Attach the "CAUTION! High temperatures. Danger of burns." sign to a place on the heat exchanger where it can be readily seen.



**CAUTION!**

**Location of hazard:** Cold surface.

**Hazard:** Frostbite.

**Protective steps:**

- Warn personnel of risks.
- Do not touch!
- Wear safety gloves!
- Attach the "CAUTION! Cold temperatures. Danger of frostbite." Sign to a place on the heat exchanger where it can be readily seen..

## 2.5. Installer's and system operator's obligations

**The installer is responsible for:**

- Instructing the assembly and repair personnel
- Keeping to regulations when carrying out installation, retrofitting, repair and dismantling work

**The system operator is responsible for:**

- Instructing the specialized technical personnel (operators and maintenance staff)
- Arranging for regular maintenance (e.g. cleaning) and ensuring the system's operating safety
- Adhering to workplace regulations

Furthermore, the operator is also to ensure that no third parties access the system!

## 2.6. *Requirements placed on the personnel, duty of care*

Work on or with the heat exchanger is only to be taken on by specialized technical personnel who are trained and authorized to do so.

Thorough knowledge of refrigeration technology is prescribed especially for assembly and startup work as well as for taking-out-of-service.

### 3. Technical data

#### 3.1. Conditions of operation



**ATTENTION** When arranging and determining the operating limits of heat exchangers, take into consideration that all specifications refer to standard conditions SC1, SC2, SC3 and SC4 according to EN 328.

*In the case of different operating conditions, observe the heat exchangers operating limits given by the manufacturer!*

#### Pressure of heat exchangers with copper piping

Max. allowable pressure (bar g)	Pressure tested at (bar g)
28	31

Higher maximal allowable operating pressures (40/51 bar) are available on request (special equipment). However, the maximal allowable pressure indicated on the appliance's nameplate is applicable.

#### Heat exchanger temperature application ranges

Min. allowable temperature	Max. allowable temperature
-50 °C	+120 °C

#### Fan temperature application ranges

##### *Centauro wedge air coolers*

Model ranges TA/TAL	
Min. allowable temperature	Max. allowable temperature
- 30 °C	+ 40 °C
Model ranges RWK / BWK	
Min. allowable temperature	Max. allowable temperature
- 40 °C	+ 40 °C

***Centauro cubic air coolers***

<b>Model ranges BXN / BXL with ESM-fan</b>	
<b>Min. allowable temperature</b>	<b>Max. allowable temperature</b>
- 25 °C	+ 50 °C
<b>Model ranges BXN / BXL with Q-motor</b>	
<b>Min. allowable temperature</b>	<b>Max. allowable temperature</b>
- 30 °C	+ 40 °C
<b>Model ranges MT / DD / MTA / MTB / DDC / DDL / DXL / BSU</b>	
<b>Min. allowable temperature</b>	<b>Max. allowable temperature</b>
- 40 °C	+ 40 °C

***Centauro dual flow coolers***

<b>Model ranges DF / DFL</b>	
<b>Min. allowable temperature</b>	<b>Max. allowable temperature</b>
- 30 °C	+ 40 °C
<b>Model ranges CB / CBL / CBN / CBK</b>	
<b>Min. allowable temperature</b>	<b>Max. allowable temperature</b>
- 30 °C	+ 40 °C

### 3.2. *Heat exchanger specifications*

The specifications for the Centauro air cooler such as dimensions, weight, diameter and number of fans, connection size, fin spacing, surface, pipe capacity, air flow rate, noise level, air throw, noise level, electrical data of the fans and defroster heaters as well as refrigeration capacity can be taken from the Centauro catalogues, which are on view in the Internet. These operating instructions should be read in conjunction with the catalogue concerned.

The specifications in the catalogues refer to the standard heat exchanger with its basic equipment. Other heat exchanger designs and options possibly selected (refer here to Chapter 1.2, "Scope of supply", page 5) may result in changes to figures which need to be inquired into from our technical department (for address see page 2). Bear in mind that the power input of the fans under different temperatures and air resistances varies as against the standard input.

### 3.3. *Fan data*

The Centauro air coolers are fitted out with AC motors (230V/1Ph/50Hz) with one speed. Above a certain capacity of the cubic and dual flow air coolers, 3-phase AC motors (400V/3Ph/50Hz) with two speeds (star/delta) are used. By using the star/delta changeover, the 400V fan motors can be run at two speeds. The direction of rotation must be checked on here. An incorrect direction of rotation would mean having to exchange two phases.

For electrical connection of the heat exchanger, reference is to be made to the terminal connection plans in the caps of the terminal boxes of the fans and defroster heaters as well as possibly to the electrical circuit diagrams of the control cabinet (if present). If needed, please get in touch with our technical department (for address see page 2).

In addition, some model ranges of the Centauro wedge and cubic air coolers are equipped with energy-saving motors (ESM/EC) as an option. The ESM motors have two speeds ( $n_{\min}$  and  $n_{\max}$ ). EC fans have full speed control.



**DANGER!**

*Danger due to electricity.*

*Only electricians may carry out work on electrical equipment!*

*Take the following precautions prior to carrying out any work on electrical equipment:*

- *Switch off the main switch and protect it against reactivation.*
- *Make sure the unit is off-circuit.*
- *Ground and short-circuit.*
- *Cover or fence off parts under voltage.*

*Observe the local safety regulations!*

*Regularly check the state of the cables!*

## 4. Heat exchanger description

### 4.1. Construction

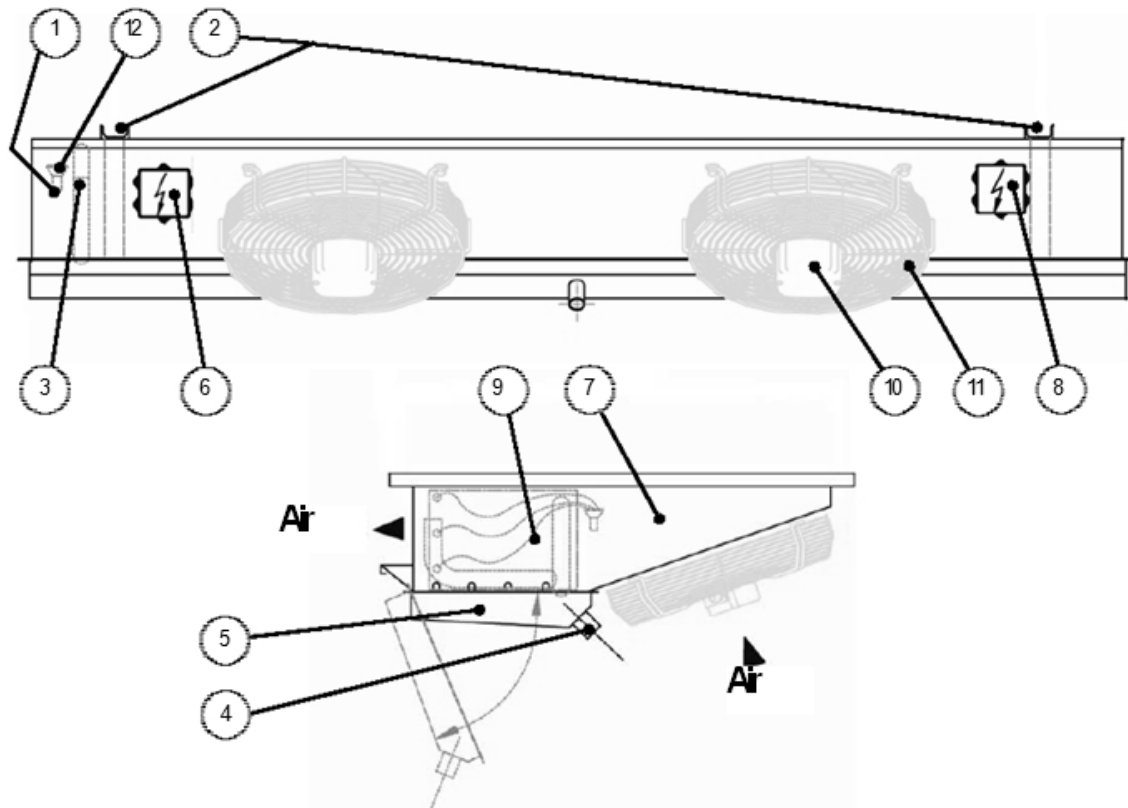


Fig. 1: Example: Wedge air cooler RWK / BWK.

#### Legend

- |                                    |  |
|------------------------------------|--|
| 1 Connection heat exchanger inlet  | 7 Casing   |
| 2 Mounting point                   | 8 Terminal box defrost heaters                   |
| 3 Connection heat exchanger outlet | 9 Heat exchanger coil                            |
| 4 Connection condensate drain      | 10 Fan   |
| 5 Drip tray (here hinged)          | 11 Fan guard                                     |
| 6 Terminal box fans                | 12 Refrigerant distributor (Venturi distributor) |

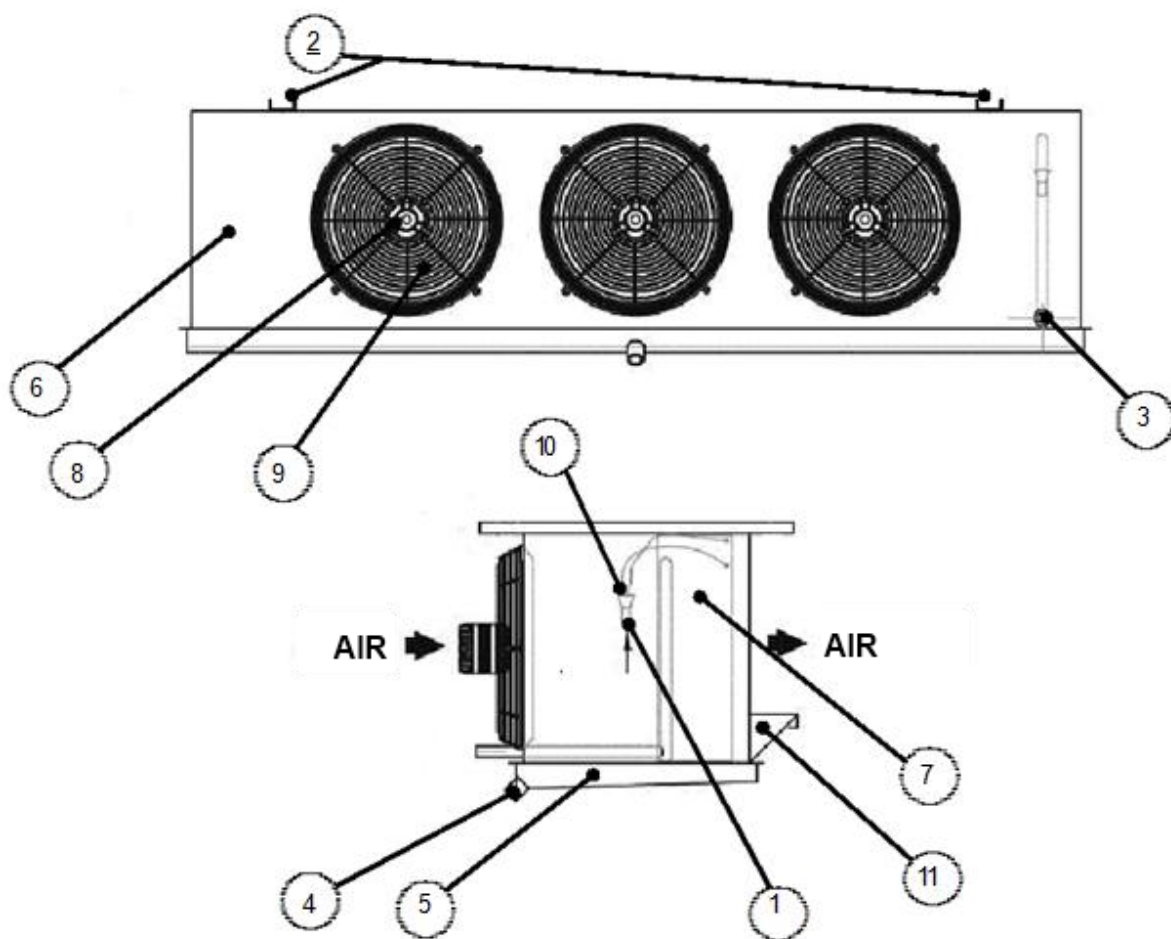


Fig. 2: Example: Cubic air cooler BXN/BXL.

**Legend**

- |                                    |  |
|------------------------------------|--|
| 1 Connection heat exchanger inlet  | 7 Heat exchanger coil                            |
| 2 Mounting points                  | 8 Fan  |
| 3 Connection heat exchanger outlet | 9 Fan guard                                      |
| 4 Connection condensate drain      | 10 Refrigerant distributor (Venturi distributor) |
| 5 Drip tray                        | 11 Air baffle plate (blow through versions only) |
| 6 Casing                           |  |



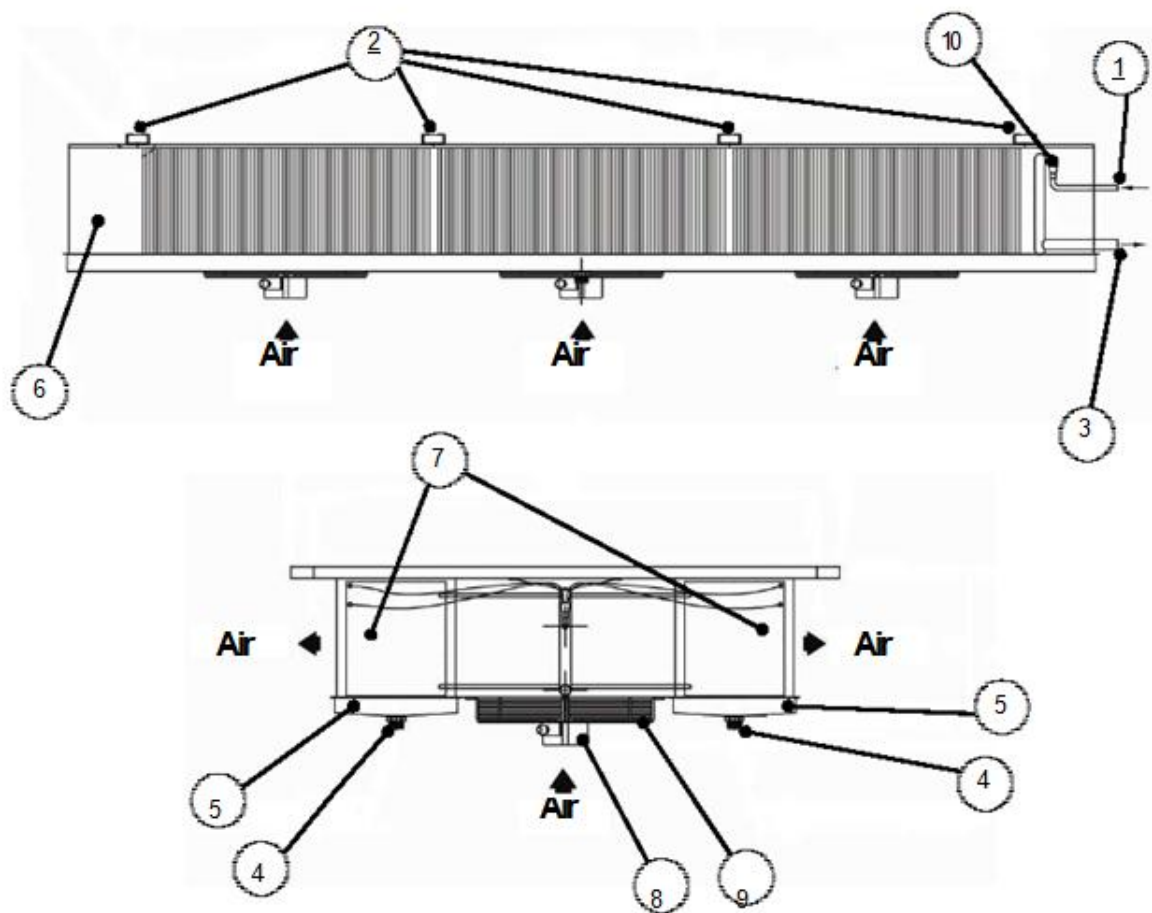


Fig. 3: Example: Dual flow air cooler CB (Ø500).

#### Legend

- |                                    |  |
|------------------------------------|--|
| 1 Connection heat exchanger inlet  | 6 Casing   |
| 2 Mounting points                  | 7 Heat exchanger coils                           |
| 3 Connection heat exchanger outlet | 8 Fan  |
| 4 Connection condensate drain      | 9 Fan guard                                      |
| 5 Drip tray                        | 10 Refrigerant distributor (Venturi distributor) |

#### 4.1.1. Basic version

In the basic version, the heat exchanger consists of the following main components linked to each other. Each of these components fulfills certain functions and reveals certain design features which must be taken note of.

##### **Casing**

Each of the heat exchanger components are pre-assembled into a unit in the form of a stable casing and are also ready-for-connection. The casing is made of hygienic, smooth and canted aluminium-magnesium-sheets which can be powder-coated or painted versions "P".  
A ground terminal point is provided in the casing for earthing the heat exchanger after installation in an overall refrigerating plant.

##### **Heat exchanger coil**

The Centauro wedge and cubic air coolers both have one heat exchanger coil. In contrast, the dual flow heat exchangers are equipped with two heat exchanger coils (Pos. 7 in Fig. 3, page 25) through which the air from the fan is blown through to two sides and discharged.

The standard Centauro heat exchanger coil consists of corrugated aluminium fins pressed onto a copper pipe coil. The refrigerant is directed through the copper pipe where it evaporates. It does this by absorbing the ambient heat of the room to be cooled by means of the fins. To avoid an excessive drop in pressure, a capilar Venturi or capilar distributor sprays the refrigerant into a number of pipe runs.

The pipe has both an inlet and outlet for the refrigerant. Some models also have a service connection (Schrader valve) at the outlet.

##### **Fan**

The number, diameter and speed of the fans vary in keeping with the field of application and use of the heat exchanger in question.

Axial fans are the fans used. They consist of:

- Drive motor (incl. electrical terminal box)
- Fan blades
- Fan safety guard

The fans of the Centauro wedge and cubic air coolers are wired to the interior terminal boxes, when delivered. The Centauro dual flow air cooler terminal boxes onto which the fans are pre-wired are positioned outside at the front of the casing.

The fans work in parallel onto the joint heat exchanger. They draw/blow through the cooling ambient air across the fins of the heat exchanger's external surface.

Air routing of the Centauro wedge and dual flow air coolers is basically of the blow-through type. The BXN and BXL model ranges of the Centauro cubic evaporators have a blow-through form of air routing. The rest of the cubic model ranges are of a draw-through design.

In the case of the **blow-through type**, the air enters on the fan side and is blown-through across the heat exchanger coil and discharged. The fins act as flow streamers leading to even speed and distribution of air in the room to be cooled. The Centauro air coolers of the blow-through type are additionally equipped with an air baffle (e.g. Pos. 11 in Fig. 2, page 24). It lends support to the "Coanda effect": The cold air emerging is directed to the ceiling where it combines with the warmer rising ambient air. This air mixture is then led over the product to ensure cooling.

In the **draw-through type** the air is taken in by the fans across the fin unit and then discharged. This results in greater air velocities, thus making possible a greater air throw in certain conditions.

To stop humid air or water droplets getting into the cooling chamber, fan startup is to be delayed somewhat following defrosting



**CAUTION** *Following defrosting, the fans are only to be turned  
No more than 90 s at the earliest after switching on the  
heat exchanger, solenoid valve!*

*Guarantee by all means a complete defrost!*



**WARNING!** *Danger due to rotating fans.*

*The heat exchanger may only be commissioned and  
operated with mounted fan guards!*

*Do not disassemble the fan guards!*

*Disconnect main power supply (M.P.S.)!*

*Electrical parts must be isolated from M.P.S (main power supply)  
during maintenance.*

#### 4.1.2. Optional accessories (available depending on the model)

- Electrical defrost heaters, coil and tray
- Hot gas defrosting, coil and tray
- Double drip tray with 20mm insulation
- Epoxy coated aluminium fins
- Cutting edges and bends additionally white powder coated
- Stainless steel casing
- Stainless steel core tubes
- Reheating coil (electrical, hot gas, warm water)
- Fan ring heater
- Air sock adapter
- Streamer

## Defrosting

In order to ensure the optimal operation of the heat exchanger and to avoid unacceptably strong frosting and/or permanent icing, which may lead to shutdown and malfunction, the coil block and if necessary the drip tray require defrosting in good time.

At ambient temperatures above +2°C, air recirculation defrost can be used to defrost the heat exchanger coil. Only entry of the refrigerant needs to be shut off here - the fan continue(s) to operate. In this way, the warm ambient air is led over the heat exchanger coil, which then defrosts

At ambient temperatures under +2°C, defrosting has to be either of the electrical heating or of the hot gas type.

It is to be ensured when defrosting with hot gas that sufficient other users are in refrigeration operations so that a sufficient amount of hot gas is available.



**ATTENTION** *Ending the defrosting phase must be secured two-fold (time/temperature or temperature/temperature)!*



**ATTENTION** *At ambient temperatures under 0°C, it is to be ensured that a flow-off trace heater is installed on site. It makes sure that during defrosting the condensate drain contains no ice that the condensate can freely flow off.*

Defrosting must be continued until all hoar frost has thawed. Otherwise ice points will develop at any residual hoar frost once operations are resumed.

Our recommendation at the end of defrosting and after heat exchanger switch-on is for a non-active period in which the thawed water can drip from the heat exchanger coil and flow off through the drip water tray drain.



**NOTE** *Our recommendation is for a 5-minute non-active period between termination of defrosting phase and turning on the heat exchanger.*

## Double drip tray with 20mm insulation

The recommended uses of the insulated drip tray are as follows:

- At room temperatures over 0°C it prevents the condensation of humidity on the exterior of the drip tray and consequently prevents water dripping down into the room. Without insulation condensate dripping would inevitably form due to the temperature difference between the air cooler and the room).
- In cold rooms with room temperatures from -15°C it prevents the ambient air heating up during the defrosting process due to the large tray surface and so increases the level of defrosting effectiveness in the drip tray.

**NOTE**

*In the case of air coolers with hot gas defrosting the double drip tray is provided as standard equipment.*

**Epoxy coating, powder-coating, stainless steel finishing**

Epoxy resin-coated aluminium fins are protected from especially corrosive cooling ambient air and/or cleaning agents, which could damage their surfaces.

Added protection in the case of especially corrosive fluids and where hygiene and optical cleanliness are of the essence comes from powder coating the cutting edges and pipe bends and constructing the casing and/or core pipes in stainless steel.

**Reheating coil**

A reheating coil is for de-humidifying the air and makes it possible to set up optimum interior air conditioning (temperature/relative humidity) in one operation.

The reheating coil (air heater) is positioned at the air outlet directly downstream of the air cooler where no direct effect comes from the two heat exchangers. The air is cooled to under the desired air outlet temperature. It is heated by the reheating coil to the desired ambient temperature. The result is that drier air is then obtained at the prescribed air outlet temperature. The reheating coil can be run electrically or with hot gas and hot water..

**Fan ring heater**

Fig. 4: Fan ring heater

The fan ring heater is used in low-temperature cooling at ambient temperatures of under -15°C and with horizontal air routing.

The fan ring heater stops condensate drops freezing solidly at a horizontal fan nozzle once the heat exchanger coil has de-frosted. It thus stops these ice droplets blocking the fan blades once the fan is switched on.

A smooth fan startup not only protects the fan blades from breaking but also raises the service life of the motor.

**Air sock adapter**

Fig. 5: Air sock adapter

This option is only available for Centauro cubic air coolers of the draw-through type. An air sock can be rapidly fitted and dismantled at this connection. This is recommended where it is vital to have draught-free working conditions and an even distribution of air in all rooms.

The adapter can also be used for the shut-ups which are used some to the time in support of defrosting.

**Streamer**

Fig. 6: Streamer

This option is available only for Centauro cubic air coolers of the draw-through type, but not for all fan types.

Fitting a streamer considerably raises the air throw of the air cooler brought about by streaming and bundling the air. Fitting and dismantling are quick and necessitate no fan change and, as such, there is no difficulty in retrofitting this accessory.

## 4.2. Functional principle

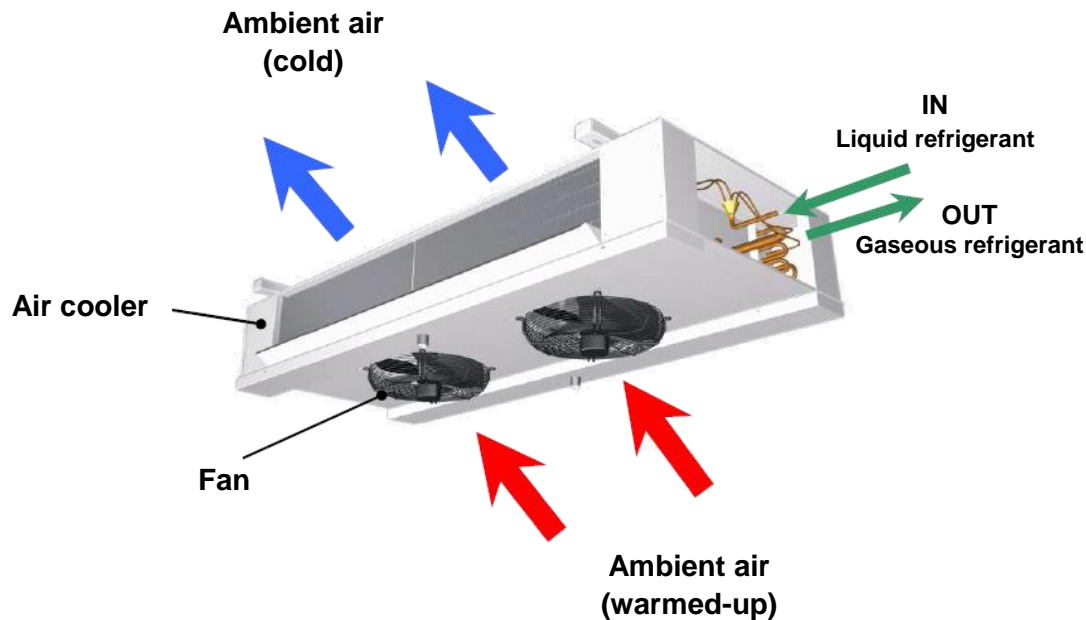


Fig. 7: Functional principle air cooler.

A fan-ventilated air cooler is a component of a compression refrigeration circuit, which absorbs the heat from the air and releases it into the refrigerant.

The air cooler is the heat exchanger, in which the refrigerant is evaporated through the absorption of heat from the air (the medium being cooled). The air is guided mechanically through built-in fans over the heat transfer area of the heat exchanger, i.e. the entire exterior surface of the air cooler.

In direct expansion systems the heat exchanger works according to the principle of "dry evaporation". The refrigerant supplied to the air cooler is completely evaporated and overheated to protect the refrigeration plant's compressor(s) from liquid locks. Flooded operation of the Whiteline air cooler is, however, also possible (special version).



**ATTENTION** Tubes and individual components of the heat exchanger are designed for certain operating conditions. Continuous operations not respecting these conditions (see chapter 3, "Conditions of operation", page 19) are not permitted.

### 4.3. *Monitoring and safety devices*

#### 4.3.1. Electrical defrosting

In order to exclude the risk of the equipment overheating, monitoring must be carried out by the customer with a safety device (temperature limiter, must be provided when installing the plant) according to Directive EN 60519-2; VDE 0721; T. 411. Operating without temperature monitoring is prohibited!



**ATTENTION** *Ending the defrosting phase must be secured  
twofold (time/temperature or temperature/temperature)!*



## 5. Transport and storage prior to startup

### 5.1. Transport

For transportation, the heat exchanger is packed in cardboard boxes or covered with foil and fitted into a wooden crate.

For safety reasons, the heat exchanger may only be transported using permissible and suitable means of load suspension (e.g. lift trucks) that have a sufficient load capacity (for information on this, see weight specifications in the Centauro catalogues, which are on view in the Internet.

Take special care in the process!

The forks of the forklift or hand pallet truck have to be driven fully under the heat exchanger or, respectively, the crate/palette.

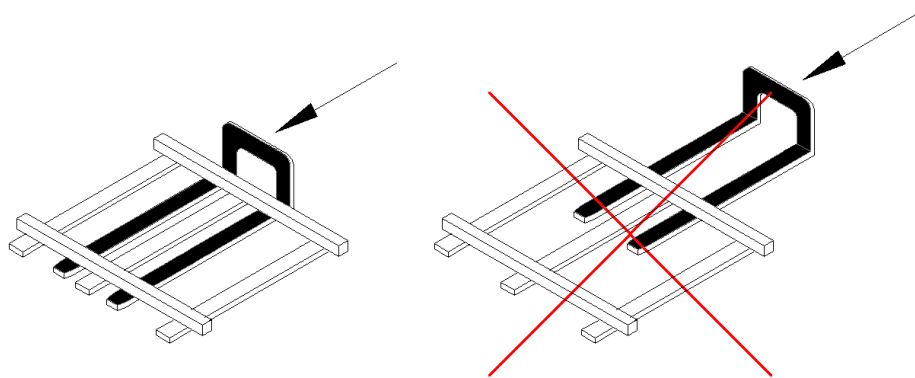


Fig. 8: Load suspension means



**WARNING! Danger from falling loads.**

**Note weight of the heat exchanger!**

**Refer on this to the weight specifications in the Centauro catalogues, which are on view in the Internet.**

**Only use suitable hoists and handling equipment!**

**DO NOT walk under the suspended load!**

Secure the heat exchanger so that it can neither topple over nor slip! Ensure prior to transport that there are no people where the handling equipment is!



**ATTENTION Do not stack more than 2 heat exchangers for transport!**

**Forbidden are:** Lifting and transfer undertaken at piping or other components. This could lead to equipment damage and non-justifiable accident risks.



**NOTE** *The warranty becomes null and void on damage arising from non-adherence to the transport conditions and safety steps!*

## 5.2. *Examination of the delivery*

Check whether the heat exchanger has been delivered in a damage-free condition and whether you have received the full scope of delivery. Let Centauro (for contact address see page 2) know immediately about any damage and record to this effect on the delivery note.

## 5.3. *Storage prior to startup*

If needed, the heat exchanger can be stored before installation into the overall refrigerating plant. Only store the heat exchanger in an enclosed space with protection from dust, contamination, moisture, damage and other damaging effects.

In view of the corrosion and contamination risk, the heat exchanger is not to be left standing around with open inlet and outlet piping, thus allowing moisture and dirt to penetrate.

## 6. Installation

### 6.1. Preliminary notes

#### 6.1.1. Preparation prior to assembly



**WARNING!** *Danger of cuts from contact with the edges and fins of the heat exchanger.*

*In instances of handling, installation, maintenance, dismantling and taking-out-of-service, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!*



**ATTENTION** *Danger of damage to the heat exchanger.*

*The individual fins must not be bent so as to guarantee the continued functioning of the heat exchanger.*

Carefully remove the outer packaging as well as all insulating and packaging material from the heat exchanger so that the fastening screws of the detachable covering can be got at.

Before assembly, remove the detachable transportation protective film from the heat exchanger.

Prior to delivery, the heat exchanger is subject to a tightness test (see test seal) and filled with inert gas (dried nitrogen min. 5.0) of 1 bar gauge pressure at 20°C. Should the pressure at the Schrader valve be considerably under this figure on receiving the heat exchanger, then in all probability this points to a lack of tightness.

In this case, the heat exchanger piping is to be examined for tightness! Please then get directly in touch with Centauro (for contact address see page 2).



**DANGER!**

*Danger from excess pressure.*

*The heat exchanger is delivered with a 1 bar gauge pressure of the nitrogen inert gas fill.*

*Always firstly discharge the inert gas fill when opening a part of the heat exchanger!*

*Wear personal protective gear (in particular protective gloves and protective goggles).*



**NOTE**

*Penetration of air and/or humidity into the heat exchanger is to be avoided.*



**CAUTION**

*Danger of injury from incorrect assembly.*

*Make a note of the rating plate particulars before mounting the heat exchanger!*

## 6.2. Place of installation

The Centauro air coolers are designed for ceiling suspension in the room to be cooled. As the large Centauro cubic air coolers with fan diameters of 710 mm and 800 mm are provided with bases, they can also be put up in the cold room.



**DANGER!**

*Danger of suffocation from inhaling refrigerant vapours.*

*Danger of poisoning from toxic substances set free.*

*Ensure that the place where the heat exchangers are installed is well ventilated!*



**WARNING!**

*Danger for the environment.*

*Refrigerants and lubricants must be prevented from leaking.*

*Make suitable provisions to this end!*



**WARNING!**

*Danger of injuries to the skin and to the eyes due to parts being thrown out.*

*Select the installation site such that parts being thrown out from the fans cannot hit people if the wheel breaks.*



**CAUTION!**

*Danger of stumbling from incorrect installation.*

*Danger of slipping from water, refrigerant or oil escaping.*

*Configure the place of installation so that there is no risk of stumbling or slipping.*

*Regularly check on connections as to seal-tightness!*

The installation surface is to be:

- Firm
- Level
- Horizontal

We recommend the use of suitable load suspension means (fork-lift trucks or lifting platforms) to install or move the heat exchangers. Regulations on operational safety prescribe the use of chain hoists if loads are over 25 kg.



**ATTENTION** *Danger of damage to property*

*Before installing the heat exchanger check that the permitted load capacity of the floor is not being exceeded by the use of the lifting platform.*

The air coolers are to be fixed to the ceiling at their mounting points with screws which correspond to their weight. The company operator or installation firm is responsible for secure fastening of the screwed connections.

As the Centauro cubic air cooler models with fan diameters of 710 mm and 800 mm are provided with both mounting points for ceiling suspension and bases for floor installation, the type of installation can be selected.

The following are to be noted when fixing the appliances:

- Choose a place for installation with an effective circulation of air
- The total weight during the operation is to be noted when fixing the heat exchanger. The fastening screws must be accordingly adjusted.
- A suitable bolt locking device is to be used to stop the fastening screwed connection from becoming undone
- The fastening screwed connection must not be over-tightened.
- For a preferably even distribution of load, all the fastening screwed connections are to be evenly tightened.
- The fastening screwed connection must be checked as to functional reliability as part of interval-based maintenance (refer here to Chapter 9, "Service and Maintenance", page 51).

The heat exchanger is to be fastened and/or installed so that it is not damaged by possible surrounding hazards (production, materials handling and other operations in the installation area) and/or is not impaired in its function from the operations of non-authorized persons.



**NOTE**

*The heat exchanger must be mounted or installed with an adequate gradient for dripping water towards the drain.*



**NOTE**

*All mounting points must constantly maintain the spacing to the fastening surface under load so that no stress develops in the heat exchanger. The heat exchangers are to be fixed in their fastening position to stop appliances shifting.*



**ATTENTION**

*Mount or install the heat exchanger so that the air inlet and outlet area can be kept largely free and there will never be an air short circuit.*



**NOTE**

*Mount or install the heat exchanger so that there is sufficient free space to replace the electric heating elements unhindered.*

### 6.3. Connecting to the piping



**WARNING!**

*Danger of injuries from lines or vessels bursting and given leakages.*

*Ensure that joints are seal-tight when connecting the piping!*

*Only make use of lines, vessels and components of an adequate strength!*

Unscrew the fastening screws of the detachable covering. Slightly tilt the covering and remove so as to get to the piping connections and terminal boxes (if on the inside).

The heat exchanger is to be linked to and soldered into the refrigeration plant by the following line connections:

- Connection of the heat exchanger outlet
- Connection of the expansion valve
- Connection of the heat exchanger inlet
- Additionally, when equipped with hot gas defrosting:
  - Hot gas distribution system in the tray
  - Separate hot gas connection of the heat exchanger

Additionally connect the following line:

- Connection of the condensate drain line

Extreme care and meticulous cleanliness is required when laying piping in refrigeration systems. For refrigeration plants only use appropriate pipes which inside are absolutely clean, dry and contamination-free (e.g. scale, rust and flux residues).

Possible effects of contamination:

- Obstruction of nozzles, filters and needle valves
- Contamination of solenoid valve seats
- Contamination of optical sensors (e.g. electrical regulators)
- Oil slagging
- Deposits forming on the inside of the pipe and at moving parts



**ATTENTION** *To protect the refrigeration plant from damage and component negative effects, Centauro recommends the fitting of a suction filter as well as other constructions to both lower the degree of contamination and stop dirt particles spreading through the overall plant.*

### 6.3.1. Preliminary notes

#### **Soldering and welding**

Always use inert gas (e.g. dried nitrogen) when carrying out soldering and welding work!

Make sure that the required soldering does not lead to parts (e.g. stop valves) overheating.

Proceed as follows when soldering:

- Shield damageable parts (e.g. pipe bends, distributor heads and housing of stop valves) with a protective plate and cover with a damp cloth.
- Direct the flame away from damageable parts.

#### **Selection of suitable expansion valves**

The expansion valves located in front of the heat exchanger (evaporator, air cooler) of the refrigeration plant must be able to adjust the refrigerant cycle both at full and reduced capacity. Avoid overdimensioning at full capacity.

### 6.3.2. Heat exchanger outlet connection

Connect the heat exchanger outlet connection to the suction line of the refrigeration plant. Solder both lines together.

### 6.3.3. Thermostatic expansion valve

For heat exchangers with a liquid distributor (Venturi distributor) a thermostatic expansion valve with external pressure equalisation must be used. If you have any questions, please contact Centauro (for contact address see p. 2).

For heat exchangers with no liquid distributor a thermostatic valve without external pressure equalisation is sufficient.

The following must be noted when mounting the expansion valve:

- Ensure there is a good thermal connection between sensor and heat exchanger outlet line.
- Fasten the sensor to a horizontal piece of the line, as close as possible to the heat exchanger outlet, i.e. not to the collection line or the oil riser.
- Always fasten the sensor directly behind the evaporator, even if the system is fitted with a suction gas heat exchanger.
- Do not fasten the sensor close to components of large mass, such as flanges or stop valves.
- The sensor must be located in a position that cannot be affected by external sources of heat such as air discharge ducts, fan motors or liquid lines.
- The expansion valve can be fitted with an external pressure equalisation line. This line must always be connected downstream of the sensor.
- If you have any questions on selecting the correct expansion valve, please contact your valve supplier.

**For further information on installing the valve, please consult the manufacturer's documentation on the thermostatic expansion valve.**

### 6.3.4. Heat exchanger inlet connection

Connect the heat exchanger inlet connection to the liquid line of the refrigeration plant, which runs from the receiver and via the expansion valve to the air cooler. Solder both lines together.

### 6.3.5. Hot gas line for defrosting the heat exchanger

For air coolers with hot gas defrost additionally the hot gas distribution system in the tray as well as the separate hot gas connection of the heat exchanger coil have to be linked to the hot gas line of the refrigeration plant. Solder the lines together.

It is recommended to connect the two lines in series - first the drip tray distribution system, then the coil's hot gas line -, in order to ensure that the drip tray's drain is free of ice when the coil is being defrosted.



### 6.3.6. Condensate drain line

Connect the condensate drain at the heat exchanger drip tray to the condensate drain line.

The condensate drain line for the heat exchanger must be installed according to current regulations and standards. Take note in particular of hygiene regulations for cold rooms on the storage and processing of food!

## 6.4. *Electrical connection*



**DANGER!**

***Danger due to electricity.***

***Only electricians may carry out work on electrical equipment!***

***Take the following precautions prior to carrying out any work on electrical equipment:***

- ***Switch off the main switch and protect it against reactivation.***
- ***Make sure the unit is off-circuit.***
- ***Ground and short-circuit.***
- ***Cover or fence off parts under voltage.***

***Observe the local safety regulations!***

***Regularly check the state of the cables!***

Electrically connect the following electrical components individually to the heat exchanger prior to first start-up:

- For basic equipment:
  - Fan(s)
- Accessories:
  - Electric defrosting
  - Fan ring heater

The electric installation of the heat exchanger must be carried out according to current regulations and standards. Take note in particular of the regulations of the local electricity supplier!

For the electric installation refer to the electrical data provided in the Centauro catalogues, which are on view in the Internet.

The electric installation of the heat exchanger is to be carried out according to the circuit diagram in the terminal boxes of the fan(s) and heater(s). In the case of a separate switch cabinet, the wiring diagram will also have to be taken into account.



**ATTENTION** *Danger of damages to the electrical components.*

*Prior to connecting the electrical components to the mains, observe the existing voltage and current!*

*Compare them to the motor specifications on the type plate of the electrical components!*

*Mind the rotational direction of the fan(s)!*

#### 6.4.1. Connecting a three-phase fan

Ensure the correct rotational direction during the electrical connection of the fans. Like various other types of fan, axial fans only push air in one rotational direction.

Because fans can turn in both directions, the correct rotational direction depends on the connection of phases L1, L2 and L3. If the phase allocation is not precisely known, there is a 50:50 chance, of getting the correct rotational direction. For the first start-up of the fan it is important to look out for this and ensure that the fan is rotating in the correct direction.

You will recognise this by the fact that the air draft or air pressure (velocity pressure) is ascending, when the fan is in operation.

All three-phase current models are wired identically internally. Once the correct phase sequence has been detected, it is important to keep the appropriate notes and instructions in a suitable place for servicing purposes.

All other fans can be connected similarly in this particular system or this installation and the fans will operate in the correct rotational direction.

#### 6.4.2. Connecting an ESM-fan

The following connection diagram applies to fans with energy saving motor (ESM):

– Electr. connection:

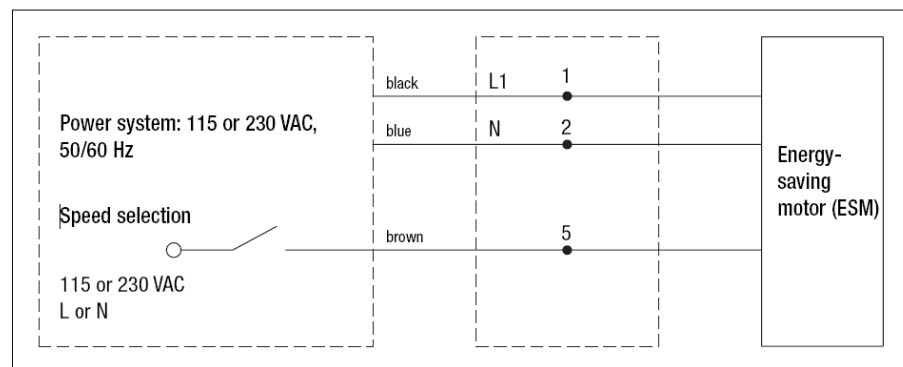


Fig. 9: Connection diagramm ESM-fan (From: ebm papst)

## 7. Startup



**ATTENTION** *The heat exchangers are designed for installation in compression refrigeration plants which satisfy the requirements of the European Machinery Directive 2006/42/EC and the European Pressure Equipment Directive 97/23/EC. They are only to be put into operation on having been installed into these systems and when the overall plant complies with the respective legal regulations.*



**ATTENTION** *To prevent malfunctions of three-phase fans, the rotational direction of the winding connections must be checked before start-up.*



**ATTENTION** *Prior to startup of the plant, a test is required on the basis of § 14 of the Workplace Safety Ordinance and/or in keeping with national regulations.*

The heat exchanger would be permanently damaged if operations are carried out at pressures greater than the **max. allowable operating pressures** (refer on this to Chapt. 3.1, „Conditions of operation“, p. 19). In the worst possible case the heat exchanger would burst.



**DANGER!**

*Danger of injury due to squirting refrigerants and oil or parts being thrown out if lines/vessels burst.*

*Carry out the following procedures for startup, operation and maintenance:*

- *Regularly check on connections, lines and vessels as to seal-tightness and condition!*
- *The max. allowable operating pressure (refer to Chapt. 3.1, “Conditions of operation”, p. 19) must not be exceeded!*

*Adhere to safety instructions when handling pressure vessels!*



**WARNING!**

*Danger due to rotating fans.*

*The heat exchanger may only be commissioned and operated with mounted fan guards! Do not disassemble the fan guards!*

*Electrical parts must be isolated from M.P.S (main power supply) during maintenance.*



**WARNING!**

*Danger for the environment.*

*Refrigerants and lubricants must be prevented from leaking. Make suitable provisions to this end!*



**WARNING!**

*Danger of severe injuries and even strangling if hair or clothes are drawn in by mobile parts.*

*Observe the following when carrying out work on the heat exchanger:*

- *Wear tight-fitting clothes!*
- *Cover long hair with a hairnet!*
- *Do not wear jewellery!*



**CAUTION!**

*Danger of frostbite to the limbs when touching the line at the heat exchanger outlet and its components.*

*The refrigerant causes the piping at the heat exchanger outlet to become extremely cold during operation. This is why thermal insulation is to be fitted at the piping running from the heat exchanger.*

*Startup and operations only with fitted insulation!*

*Regularly check the thermal insulation as to condition and replace, if necessary!*

*When working on or with the heat exchanger, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!*

## 7.1. Preparatory works prior to first startup



**ATTENTION**

*Danger of damage to components from the use of non-permitted refrigerants.*

*Only use the refrigerants specified!*

The following tests and steps are to be carried out prior to first startup of the heat exchanger.

### 7.1.1. Compression strength test

When completing the "refrigeration plant" assembly, a compression strength test as in keeping with the national regulations is to be carried out and recorded in writing.

### 7.1.2. Tightness test

The heat exchangers are subject to a pressure tightness test before they are delivered. That is why it is not absolutely necessary for the heat exchanger and its pipe connections to be tested before startup (see Chapt. 6.1, "Preliminary notes", p. 35). However, the components and connecting lines mounted by the refrigeration system installer must be tested by a specialist for seal-tightness and pressure.

Note the following when conducting tightness and pressure tests:

- Carry out the tests in keeping with the provisions and standards in force and record in writing.
- The maximum allowable pressure at the heat exchanger inlet and outlet must not be exceeded (refer to Chapt. 3.1, "Conditions of operation", p. 19).

### 7.1.3. Evacuating and drying

Air and moisture get into the piping and components when the heat exchanger is installed.

Possible effects of air remaining in the refrigeration plant:

- Increased discharge gas temperatures
- Performance losses from non-condensable gases
- Possible failure of compressors from overloading and oil coking

Possible effects from residual moisture:

- Acid forming with failure of the compressor due to motor coil damage
- Metal corrosion
- Reduction in system service life
- Ice forming in valves, control and regulation mechanisms

Piping and components of the refrigerant circuit are therefore to be thoroughly and properly evacuated and dried. Use suitable vacuum pumps.



**ATTENTION** *Keep on evacuating the high pressure and low pressure sides until you have a vacuum final figure of at least 0.07 mbar abs. Watch out for any shutoff piping sections.*



**ATTENTION** *Plant residual moisture must not be above 100 ppm!*

#### 7.1.4. Control of the electrical connection



**DANGER!**

*Danger due to electricity.*

*Only electricians may carry out work on electrical equipment!*

*Take the following precautions prior to carrying out any work on electrical equipment:*

- *Switch off the main switch and protect it against reactivation.*
- *Make sure the unit is off-circuit.*
- *Ground and short-circuit.*
- *Cover or fence off parts under voltage.*

*Observe the local safety regulations!*

*Regularly check the state of the cables!*

Check all of the electrical connections. Make sure that the supply line is in order, i.e. the specified values (voltage, frequency, number of phases) are complied with. Only use suitable tools and measuring devices to do this.



**ATTENTION** *To prevent malfunctions of the three-phase fans, the rotational direction of the winding connections must be checked before start-up.*

The electric circuit diagram must also be checked.

### 7.1.5. Final measures

#### Verificação



**ATTENTION** *All screw connections (especially on the fans), fixings, electrical connections etc. must be checked for correctness.*



**ATTENTION** *The wiring must be checked for correctness and the electrical safety measures for function prior to start-up.*



**ATTENTION** *The power input of the fans must be checked*



**ATTENTION** *The rotational direction of the three-phase fans must be checked and changed if necessary.*



**ATTENTION** *All supply lines to the terminal boxes must be sealed according to their protection rating.*



**ATTENTION** *The supply line must always be protected according to the smallest cross-section.*



**ATTENTION** *All specified controlling equipment must be checked for correct function.*



**ATTENTION** *All safety devices must be checked to ensure that switch-off and switch-on points have been correctly set.*

#### Opening operating valves



**ATTENTION** *Open all operating valves before startup of the over-all refrigeration plant!*

## 8. Operation



**WARNING!**

*Inappropriate handling of the heat exchanger can have serious, if not lethal consequences!*

*Have you read through all the operating instructions and particularly Chapt. 2.3, "Safety instructions", p. 12? The heat exchanger is not to be operated beforehand!*

*Note the regulations and standards in force on operating refrigeration and air-conditioning systems!*



**DANGER!**

*Danger of injuries to skin and eyes from squirting oil and from gaseous refrigerant under high pressure.*

*Undertake the following steps at the startup, operation and maintenance:*

- *Regularly check on connections, lines and vessels as to seal-tightness and condition!*



**WARNING!**

*Danger for the environment.*

*Refrigerants and lubricants must be prevented from leaking. Make suitable provisions to this end!*

*Spilled oil is to be removed and properly disposed of i.e. with consideration given to the regulations in force!*



**WARNING!**

*Danger due to rotating fans.*

*The heat exchanger may only be commissioned and operated with mounted fan guards! Do not disassemble the fan guards!*

*Electrical parts must be isolated from M.P.S (main power supply) during maintenance.*



**WARNING!**

*Danger of severe injuries and even strangling if hair or clothes are drawn in by mobile parts.*

*Observe the following when carrying out work on the heat exchanger:*

- *Wear tight-fitting clothes!*
- *Cover long hair with a hairnet!*
- *Do not wear jewellery!*





**WARNING!** *Danger of injury and even blindness due to parts being thrown out.*

*Wear protective goggles when carrying out work on or with the heat exchanger (especially for start-up, operation and maintenance)!*



**CAUTION!**

*Danger of frostbite when touching cold surfaces.*

*Do not touch the surface of the heat exchanger during operation!*

*Leave surfaces to warm up first after shutdown!*

*Wear personal protective equipment (protective goggles, protective gloves, safety shoes) when carrying out work on or with the heat exchanger!*



**CAUTION!**

*Danger of burns when touching hot surfaces.*

*During defrost operations do not touch the heat exchanger surface!*

*Let the surface firstly cool down after taking out of service!*

*When working on or with the heat exchanger, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!*



**CAUTION!**

*Danger of frostbite to the limbs when touching the line at the heat exchanger outlet and its components.*

*The refrigerant causes the piping at the heat exchanger outlet to become extremely cold during operation.*

*This is why thermal insulation is to be fitted at the piping running from the heat exchanger.*

*Startup and operations only with fitted insulation!*

*Regularly check the thermal insulation as to condition and replace, if necessary!*

*When working on or with the heat exchanger, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!*

The overall refrigeration plant must be in operation for the heat exchanger to be operated.

The heat exchanger is to be switched on by opening the respective stop valves on the connection lines to the overall plant (refrigerant inlet and outlet) and by connection to the electrical system.

At the start, the heat exchanger requires a certain period of operation to get to its optimum working point. This is the case when it has complied with the conditions laid down for the specific application (refer here to the specifications and performance data in the Centauro catalogues in force (can be viewed on the Internet).

The working point is determined by the following parameters:

- Evaporating temperature ( $t_0$ )
- Air inlet temperature ( $t_{L1}$ )
- Volumetric air flow
- Relative air humidity
- Overheating ratio

Only on attaining the working point does the heat exchanger then operate under optimum conditions.

## 9. Service and maintenance



**WARNING!** *Inappropriate handling of the heat exchanger can have serious, if not lethal consequences!*

*Have you read through all the operating instructions and particularly Chapt. 2.3, "Safety instructions", p. 12? The heat exchanger is not to be operated beforehand!*

*Note the regulations and standards in force on operating refrigeration and air-conditioning systems!*



**WARNING!** *Danger of personal injury.*

*The entire work on or with the heat exchanger is only to be undertaken by authorized specialized personnel with in-depth knowledge of refrigeration systems..*



**DANGER!** *Danger of injuries to skin and eyes from squirting oil and from gaseous refrigerant under high pressure.*

*Undertake the following steps prior to maintenance, retrofitting and dismantling:*

- *Wear personal protective gear (in particular protective gloves and protective goggles).*
- *Shut down the system.*
- *Wait for a minimum 5 minutes until the refrigerant and oil circulation has come to a standstill.*
- *Disconnect the heat exchanger from the rest of the system. For this, make use of the envisaged shutoff valves.*
- *Lower the pressure. Extract the refrigerant from the refrigeration system with a special recovery machine.*

*Undertake the following steps at the startup, operation and maintenance stages:*

- *Regularly check on connections, lines and vessels as to seal-tightness and condition!*



**WARNING!** *Danger for the environment.*

*Refrigerants and lubricants must be prevented from leaking. Make suitable provisions to this end!*

*Spilled oil is to be removed and properly disposed of i.e. with consideration given to the regulations in force!*



**WARNING!** *Danger due to rotating fans.*

*The heat exchanger may only be commissioned and operated with mounted fan guards!*

*Do not disassemble the fan guards!*

*Electrical parts must be isolated from M.P.S (main power supply) during maintenance.*



**WARNING!** *Danger of severe injuries and even strangling if hair or clothes are drawn in by mobile parts.*

*Carry out the following procedures prior to maintenance, retrofitting and disassembly:*

- *Switch off the plant and protect it against reactivation.*
- *Observe the after-running time of the fan wheel!*
- *Only restart the unit after it has been completely reinstalled!*
- *Wear a hairnet as well as tight-fitting clothes!*



**WARNING!** *Danger of operational malfunctioning due to acidification and the development of toxic gases when undertaking soldering and welding on pipes with refrigerant.*

*NO soldering or welding on pipes which contain refrigerant - even if depressurized!*



**WARNING!** *Danger of injury and even blindness due to parts being thrown out.*

*Wear protective goggles when carrying out work on or with the heat exchanger (especially for start-up, operation and maintenance)!*



**CAUTION!**

*Danger of frostbite when touching cold surfaces.*

*Do not touch the surface of the heat exchanger during operation!*

*Leave surfaces to warm up first after shutdown!*

*Wear personal protective equipment (protective goggles, protective gloves, safety shoes) when carrying out work on or with the heat exchanger!*

**CAUTION!**

***Danger of burns when touching hot surfaces.***

***During defrost operations do not touch the heat exchanger surface!***

***Let the surface firstly cool down after taking out of service!***

***When working on or with the heat exchanger, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!***

**CAUTION!**

***Danger of frostbite to the limbs when touching the line at the heat exchanger outlet and its components.***

***The refrigerant causes the piping at the heat exchanger outlet to become extremely cold during operation.***

***This is why thermal insulation is to be fitted at the piping running from the heat exchanger.***

***Startup and operations only with fitted insulation!***

***Regularly check the thermal insulation as to condition and replace, if necessary!***

***When working on or with the heat exchanger, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!***

Maintenance (upkeep and repairs) and recurrent tests are to be implemented according to the specifications of the regulations and standards in force.

The operator is responsible for keeping to the deadlines for the requisite recurrent tests and for proper operation of the refrigeration plant (see the valid regulations and standards).

Only persons of competence as envisaged by the German Workplace Safety Ordinance or Technical Rules for Operational Safety (TRBS) No. 1203 and/or in accordance with the national provisions and regulations in force are to carry out maintenance work and repairs.

We recommend that you refer to the en 378 as a maintenance plan in the form of a checklist for refrigeration plants.

Regular checks and upkeep ensure trouble-free operations. The place of installation and operating conditions determine which maintenance intervals are involved. During upkeep checks particular attention should be paid to signs of contamination, frost and/or ice forming, leaks, corrosion and vibrations.

## 9.1. Heat exchanger maintenance



**WARNING!** *Danger of cuts from contact with the edges and fins of the heat exchanger.*

*In instances of handling, installation, maintenance, dismantling and taking-out-of-service, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!*



**ATTENTION** *Danger of damage to the heat exchanger.*

*The individual fins must not be bent so as to guarantee the continued functioning of the heat exchanger.*

- The heat exchanger can only perform as projected and guaranteed if the coil block is clean. Dirt and frost and/or ice forming must be removed from the fins and also from the area close to the heat exchanger.
- **Dry** dust or dirt can be removed with a brush, a broom or with pressurised air (pressure max. 50 bar; against the direction of the airflow of the heat exchanger) or a high-performance industrial vacuum cleaner.



**ATTENTION** *Danger of damage to property.*

- *Always brush lengthways along the fins!*
- *Use soft brushes!*
- *Never brush crossways to the longitudinal direction of the fins!*
- *Mechanical cleaning using hard objects, e.g. steel brushes, screwdrivers etc.) damage the heat exchanger and are prohibited.*

- **Very damp or oily contamination** must be dealt with using a high pressure water jet (pressure max. 50 bar), or steam pressure jet (pressure max. 50 bar), from a distance of at least 200 mm, and, if necessary using neutral cleaning agents, always against the direction of the airflow.



**ATTENTION** *Cleaning should be carried out from the inside to the outside and from the top to the bottom.*

*The jet of the cleaning device must never be applied at an angle to the surface of the fins, but only parallel to them (max. ±5 degree deviation), to avoid bending the fins.*

- Cleaning must be carried out until all dirt is removed.

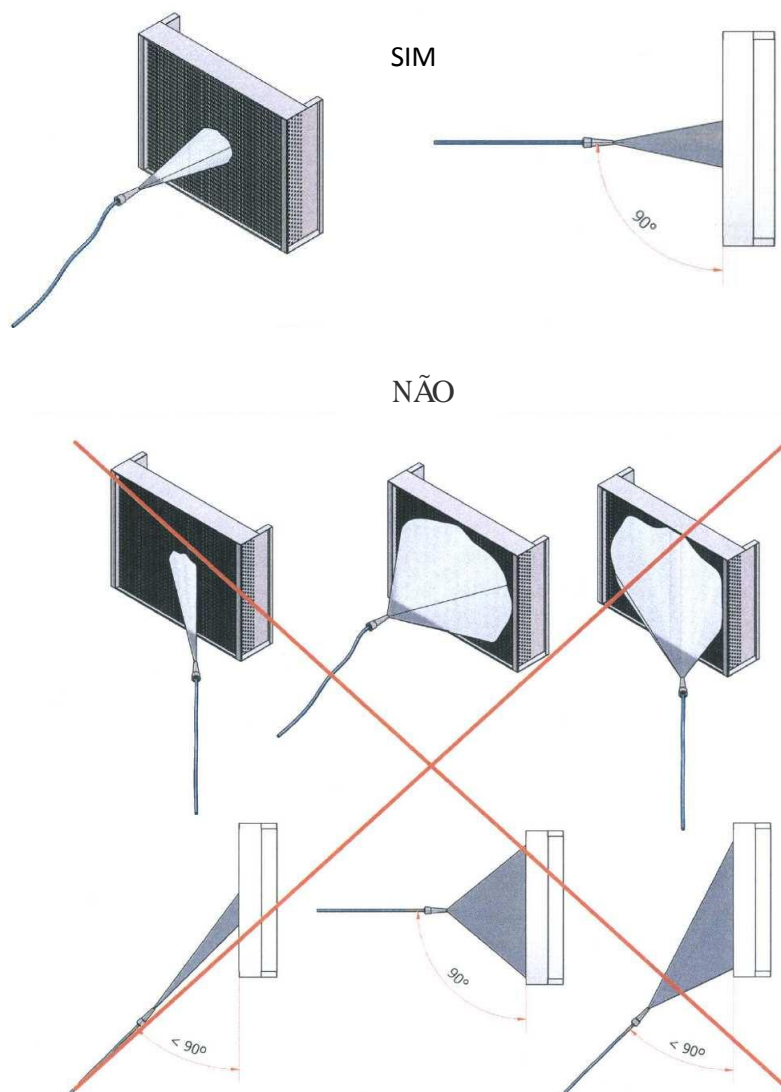


Fig. 10: Cleaning of the fins with water or pressure water jet



**DANGER!**

***Danger through electricity.***

***During the cleaning the heat exchanger MUST be switched off both at the refrigeration plant and electrically.***

***Electrical connections and motors must not come into contact with water or steam jets.***



**ATTENTION**

***Danger of damage to property.***

***When using cleaning agents in cold rooms, attention must be paid to the corrosion resistance of the heat exchanger materials to the cleaning agents used!***

***Only use cleaning agents which act neutrally towards the device materials and not aggressively or corrosively.***

- **Dirt and frost and/or ice forming** on the fans and the fans' protective guards must be removed regularly, because otherwise this will lead to imbalance to the point of destruction or to loss of performance. The fan motors themselves are maintenance-free.



**WARNING!**

***Danger due to rotating fans.***

***The heat exchanger may only be commissioned and operated with mounted fan guards!***

***Do not disassemble the fan guards!***

***Electrical parts must be isolated from M.P.S (main power supply) during maintenance.***

Attention is also to be paid to the following:

- Check the pipe system for leaks. In case of leaks moisture and air may penetrate the pipe system. Seal the system and generate a vacuum. Then recharge the system.
- Check the fins for visibly unusual ice deposits. Increased formation of ice may indicate faulty or inadequate defrost heating or incorrect attaching of the defrost sensor.
- Check whether the fans can run freely in the wall ring nozzle.
- Strange noises during the fan's operation indicate faulty bearings.



## 10. Disassembly, storage and disposal



**WARNING!** *Inappropriate handling of the heat exchanger can have serious, if not lethal consequences!*

*Have you read through all the operating instructions and particularly Chapt. 2.3, "Safety instructions", p. 12? The heat exchanger is not to be operated beforehand!*

*Note the regulations and standards in force on operating refrigeration and air-conditioning systems!*



**WARNING!** *Danger of personal injury.*

*The entire work on or with the heat exchanger is only to be undertaken by authorized specialized personnel with in-depth knowledge of refrigeration systems..*



**DANGER!**

*Danger of injuries to skin and eyes from squirting oil and from gaseous refrigerant under high pressure.*

*Undertake the following steps prior to maintenance, retrofitting and dismantling:*

- *Wear personal protective gear (in particular protective gloves and protective goggles).*
- *Shut down the system.*
- *Wait for a minimum 5 minutes until the refrigerant and oil circulation has come to a standstill.*
- *Disconnect the heat exchanger from the rest of the system. For this, make use of the envisaged shutoff valves.*
- *Lower the pressure. Extract the refrigerant from the refrigeration system with a special recovery machine.*

*Undertake the following steps at the startup, operation and maintenance stages:*

- *Regularly check on connections, lines and vessels as to seal-tightness and condition!*



**CAUTION!**

*Danger of frostbite when touching cold surfaces.*

*Do not touch the surface of the heat exchanger during operation!*

*Leave surfaces to warm up first after shutdown!*

*Wear personal protective equipment (protective goggles, protective gloves, safety shoes) when carrying out work on or with the heat exchanger!*



**CAUTION!**

***Danger of burns when touching hot surfaces.***

***During defrost operations do not touch the heat exchanger surface!***

***Let the surface firstly cool down after taking out of service!***

***When working on or with the heat exchanger, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!***



**CAUTION!**

***Danger of frostbite to the limbs when touching the line at the heat exchanger outlet and its components.***

***The refrigerant causes the piping at the heat exchanger outlet to become extremely cold during operation. This is why thermal insulation is to be fitted at the piping running from the heat exchanger.***

***Startup and operations only with fitted insulation!***

***Regularly check the thermal insulation as to condition and replace, if necessary!***

***When working on or with the heat exchanger, personal protective gear (protective goggles, protective gloves, safety shoes) is to be worn!***

## 10.1. Disassembly

Proceed as follows in dismantling the heat exchanger from the overall plant:

- After having disconnected the power supply to the switch cabinet, first of all, shut-off the electrical connections of the various heat exchanger components. For information on the individual parts, refer to the Centauro catalogues, which are on view in the Internet.
- Relieve the plant from pressure. For this purpose, withdraw refrigerant from the entire refrigeration plant using a suitable recovery machine (avoid any emission of refrigerants!). There are connections specially provided for this on the common suction and common discharge line of the refrigeration machine unit. Connect the recovery machine to them and withdraw the refrigerant.
- Refrigerant is only to be stored in approved recycling pressurized gas tanks.
- Close all the stop valves in the refrigerant circuit.
- Then disconnect the following pipe links to the overall plant:
  - Refrigerant inlet
  - Refrigerant outlet
  - Additionally, for version with hot gas defrosting: hot gas line

## 10.2. Storage after disassembly

The following steps must be carried out once the heat exchanger is dismantled and stored:

- Dry out the heat exchanger.  
Before storage ensure that no moisture is left in the complete unit.
- Hermetically seal the connections.  
Also place an end section on the end of each of the following open lines and thoroughly seal them:
  - Refrigerant inlet
  - Refrigerant outlet
  - Additionally, for version with hot gas defrosting: hot gas line



**ATTENTION** *Danger of damage to the heat exchanger.*

*On no account is any moisture to get into the pipe system during the time the heat exchanger is stored!*



**ATTENTION** *In case of longer periods of standstill operate the fans 2 to 4 hours a month.*

## 10.3. Disposal

Consideration is to be given to the relevant, valid regulations and standards (incl. waste disposal ordinance) when disposing of the heat exchanger!



**WARNING!** *Danger for the environment.*

*Spilled oil is to be removed and properly disposed of i.e. with consideration given to the regulations in force!*