



## WATER CHILLER

### Model: **CHILL-CUBE QBE VBM/VBE**

#### User and Maintenance Manual

## Editions Record

Code	Revision	Edition	Note
7425MUM748	11C	09/2023	

Original instructions: **ITALIAN**

**EN** Translation of the original instructions

Dear valued Customer,

thank you for placing your trust in our Company. Please read this manual carefully before using to improve product performance.

In order to avoid inadequate working conditions and any danger for the operators, it is essential to follow the guidelines meticulously as well as the current safety and accident prevention regulations of the Country where the product is used.

Each **CHILL-CUBE QBE** chiller is rigorously tested before being approved for shipping.

Testing procedures check for any manufacturing defect and for a correct performance of all functions for which the product has been designed.

This manual must be retained for future reference and is an integral part of the article purchased. Due to continuous technical development, we reserve the right to make the necessary modifications without any obligation to give advance notice.

The nameplate stucked on the equipment contains all the essential information about the product itself.

If you experience any issues or need more information, do not hesitate to contact us.

**Warranty conditions:**

The warranty is valid for 12 months from the machine being started-up and no longer than 14 months from the delivery date. Any part which is recognised as being faulty at source shall be repaired or supplied free of charge. This does not include transport costs, travel, room, labour and board for technicians. The warranty excludes any liability for direct or indirect damage to persons, animals and/or property that are caused by incorrect use or inadequate maintenance and is exclusively limited to manufacturing defects.

Repair under warranty is subject to compliance with the installation, use and maintenance instructions contained in the "User manual and maintenance."

The warranty is considered void if the product is modified or tampered with in any way. When making a warranty request, please supply the information available in the product identification label.

# SUMMARY












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## SAFETY RULES

### 1.1 DEFINITIONS OF THE SYMBOLS USED

	Read this use and maintenance manual carefully before performing any repairs on the chiller.
	Warnings of a general character; risk of danger or possibility of damaging the machine, pay particular attention to the phrase following this symbol.
	Risk of electrical danger; the phrase highlights conditions that could be fatal. Follow the instructions provided meticulously.
	Risk of danger; component or system under pressure.
	Risk of danger; component or system that can reach high temperatures during operation.
	Risk of danger; it is absolutely forbidden to use water to extinguish fires near or on the chiller.
	Risk of danger; it is absolutely forbidden to operate the machine with the panel open.
	Service that can be performed by the machine's operator, if qualified (1).
	Water input connection point.
	Water output connection point.
	Dispose of each type of material in accordance with the requirements of the country of use.
<b>NOTE</b>	Phrases to be emphasized that do not contain safety rules.



This chiller has been carefully designed and constructed to be environmentally friendly:

- Refrigerants without CFC;
- Expanded foam insulation without CFC;
- Energy-saving techniques;
- Reduced noise;
- Recyclable chiller and its packing materials.

In order not to hinder our efforts, the user is required to obey the simple ecological warnings indicated by this symbol.

(1) These are persons with the experience, technical preparation and knowledge of standards and regulations who are qualified to perform the necessary actions and able to recognize and avoid possible dangers while handling, installing, using and maintaining the machine.

## 1.2 WARNINGS



Only qualified persons may use and maintain electrically-powered equipment. Before commencing maintenance operations ensure no parts of the machine are live and it cannot be re-connected to the electrical power supply.



The **CHILL-CUBE QBE** chillers contain R407C refrigerant. Operations on the refrigerating circuit must only be performed by specialist personnel with suitable equipment.



Any modification to the machine or related operating parameters not previously verified and authorised by the Manufacturer may be hazardous and will invalidate the guarantee.



Do not use water to extinguish fires near or on the chiller.

## 1.3 PROPER USE OF THE CHILLER

**CHILL-CUBE QBE** units are packaged aircooled water chillers.

They are intended for use in industrial process or air-conditioning systems requiring chilled water. Any other use is considered as incorrect.

The manufacturer is not liable for damage resulting from inappropriate use; in all cases, the user is liable for any resulting hazards.



Proper use requires conforming to the installation conditions and limits of operation (see sections 3.5 and 8). In particular:

- Power voltage and frequency;
- Pressure, temperature of incoming water;
- Water flow rate;
- Surrounding temperature.

The chiller has been tested and completely assembled. The user must only make the connections to other systems, as described in the following chapters.

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## **1.4 INSTRUCTIONS FOR USING THE EQUIPMENT UNDER PRESSURE CONFORMING TO PED DIRECTIVE 2014/68/EU**

The proper use of equipment under pressure is an essential prerequisite for ensuring safety. To this end, the user must proceed as follows:

- Use the equipment properly within the temperature limits shown in the operating limits stated on the manufacturer's name/data plate;
- Do not solder on the exchangers or refrigerant fluid pipes;
- Do not install the equipment in insufficiently ventilated rooms, areas exposed to sources of heat or near inflammable substances;
- During operation, the equipment must not be subject to vibrations that could cause fatigue failures;
- Keep the documentation attached to the equipment (user manual, declaration of conformity, etc.) for future reference;
- The maximum working pressure stated on the manufacturer's data plate must not be exceeded. Prior to use, the user must fit safety/pressure relief devices.



## OPERATION AND MAIN COMPONENTS

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### 2.1 REFRIGERATING CIRCUIT

**CHILL-CUBE QBE** chillers use a vapour-compression cycle in a refrigeration circuit that essentially consists of the following components: evaporator, compressor, condenser, lamination device (thermostatic expansion valve) and the hot gas bypass valve.

**Evaporator:** heat exchanger (co-axial or brazed-plates) to enable heat exchange between the water and the refrigerant liquid without them coming into contact with each other. The water is cooled when it passes through the evaporator.

**Compressor:** compresses the steam from the evaporator to send it to the condenser at a higher pressure.

**Condenser:** microchannel exchanger to enable heat exchange between the refrigerant and the air; it creates refrigerant gas condensation (which flows inside the microchannel) transferring the gas refrigerant condensation heat to the air (which flows externally); high pressure refrigerant liquid is thus produced.

**Lamination device:** reduces the pressure of the liquid refrigerant coming from the condenser, which is then sent to the evaporator. In particular, the thermostatic valve can modulate refrigerant flow such as to maintain continuous heating of the gas exiting the evaporator, during various operating conditions and therefore guaranteeing gas flow without liquid parts inside the compressor.

**Hot gas bypass valve:** the valve provides an artificial load on the evaporator by introducing a portion of high pressure, high temperature gas. The hot gas bypass valve monitors the outlet pressure of the evaporator and will begin to modulate open as the load on the unit decreases to the point where the evaporator temperature is at the setpoint of the bypass valve. This means that the compressor can be operated continuously and the minimum evaporator temperature will be maintained constant.

Thanks to these components, **the vapour-compression cycle** works as follows: the refrigerant liquid evaporates in the evaporator, chilling the water; the refrigerant vapours are then aspirated from the compressor, which compresses them and sends them to the condenser under high pressure; here, thanks to a flow of forced air from the fans, the high-pressure refrigerant gas is cooled, making it condensed and undercooled. The flow of refrigerant liquid then passes through the lamination valve (thermostatic expansion valve), which drastically reduces its pressure: the refrigerant liquid returns to the evaporator at a reduced pressure where it again evaporates, taking heat from the water.

The refrigerant circuit also includes a **water pump**, which ensures the flow of water to be chilled by evaporation, and the **fan** which ensures the condenser is cooled.

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### 2.2 HYDRAULIC CIRCUIT

The water circuit mainly consists of a pump, evaporator, tank, bypass calibrated between the pump discharge and the system backflow, pressure gauge on the pump discharge, and level sensor (standard). The water flows into the evaporator first where it is cooled, then into the tank, and is then suctioned by the pump which sends it to the system.

All **CHILL-CUBE QBE** units have an open circuit with a tank at atmospheric pressure. The closed circuit with a pressurized tank is optional for all models; these models are also equipped with a differential pressure switch to protect the evaporator, automatic air bleeder valve, safety valve and expansion tank. For **CHILL-CUBE QBE** 003÷007 units, if there are equipped with pressurized tank, the evaporator is a brazed plate heat exchanger.

All **CHILL-CUBE QBE** units have a regulable water by-pass valve: it is used in systems with a fixed speed circulating pump. This valve ensures that the head pressure of the pump is according to the real needs of the user. It will by-pass the differential pressure created by the pump, eliminating water hammer noise.

Installation and maintenance fast, easy and efficient. It provides a perfect leak proof seal when completely pressed.

See chapter **12 Water diagram**.

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## **2.3 FAN**

The fan forces air through the condenser fins to remove the refrigerant gas condensation heat, therefore limiting the pressure inside the condenser.

**CHILL-CUBE QBE** chillers are equipped with axial fans and have internal heat protection for the motor windings.

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## **2.4 CONDENSATION CONTROL**

When the ambient air temperature decreases, air flow cooling capacity increases slightly, causing a reduction in pressure inside the condenser; to limit this decrease in condensation pressure from falling below acceptable limits for good cooling circuit operation the fan stops temporarily.

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## **2.5 WATER TEMPERATURE CONTROL**

The purpose of the chiller is to maintain the temperature of the water produced within a desired interval as the load on the system varies; this is handled by an electronic controller and a temperature probe that turn the compressors on and off appropriately (see also sections 5.1.3 and 5.2.5).

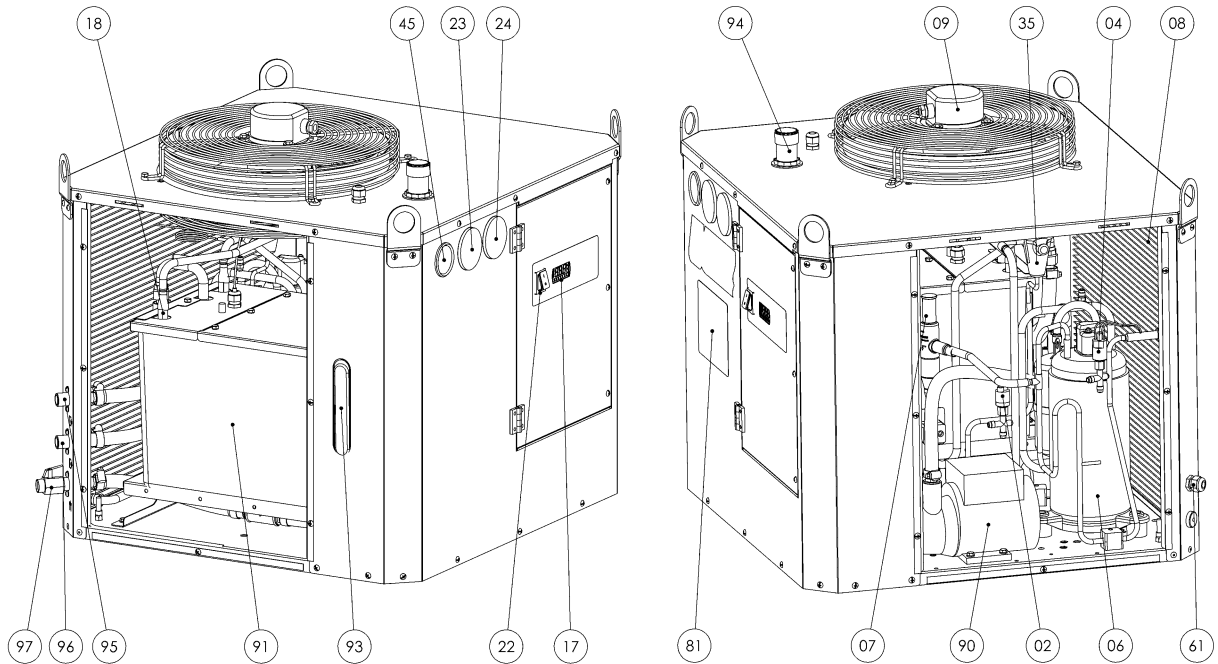
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## **2.6 PROTECTION OF THE INTEGRITY OF THE MACHINE**

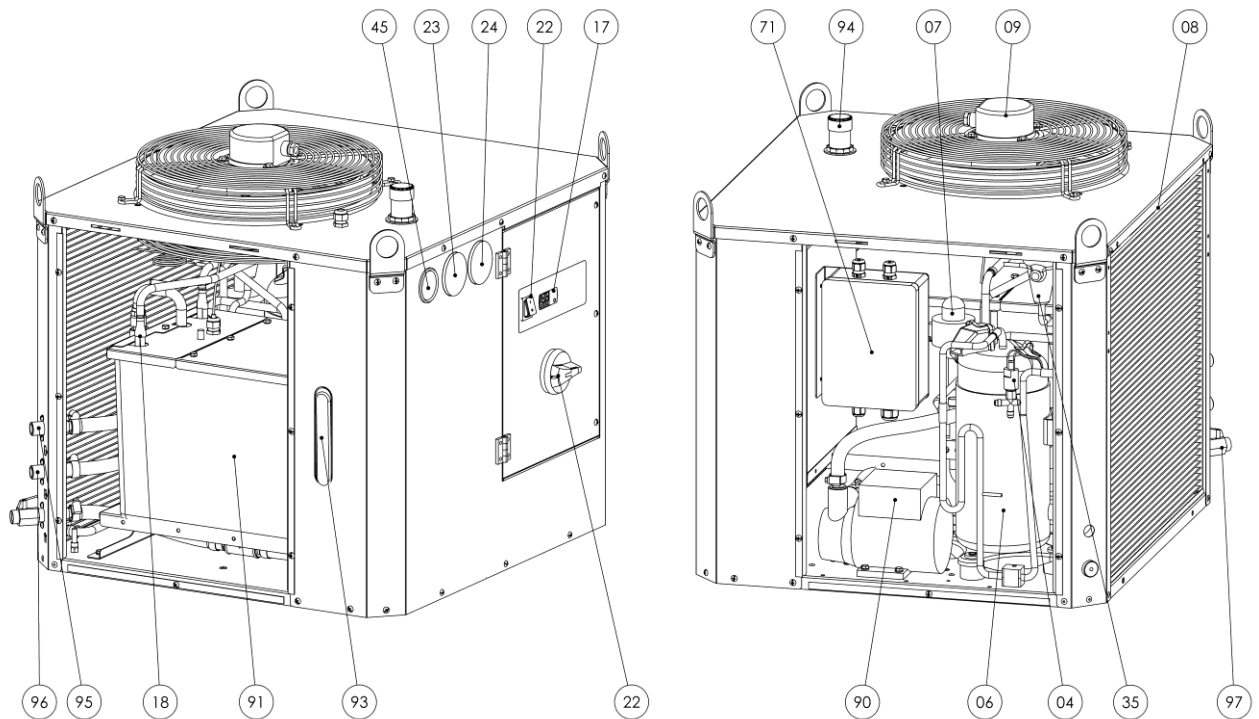
In addition to controlling the temperature, the electronic controller uses pressure switches, thermostats and timers to prevent and handle situations that could compromise the integrity of the machine (also see Chapter **7 Safety Devices**).

## 2.7 CHILL-CUBE QBE UNITS: IDENTIFICATION OF THE MAIN COMPONENTS

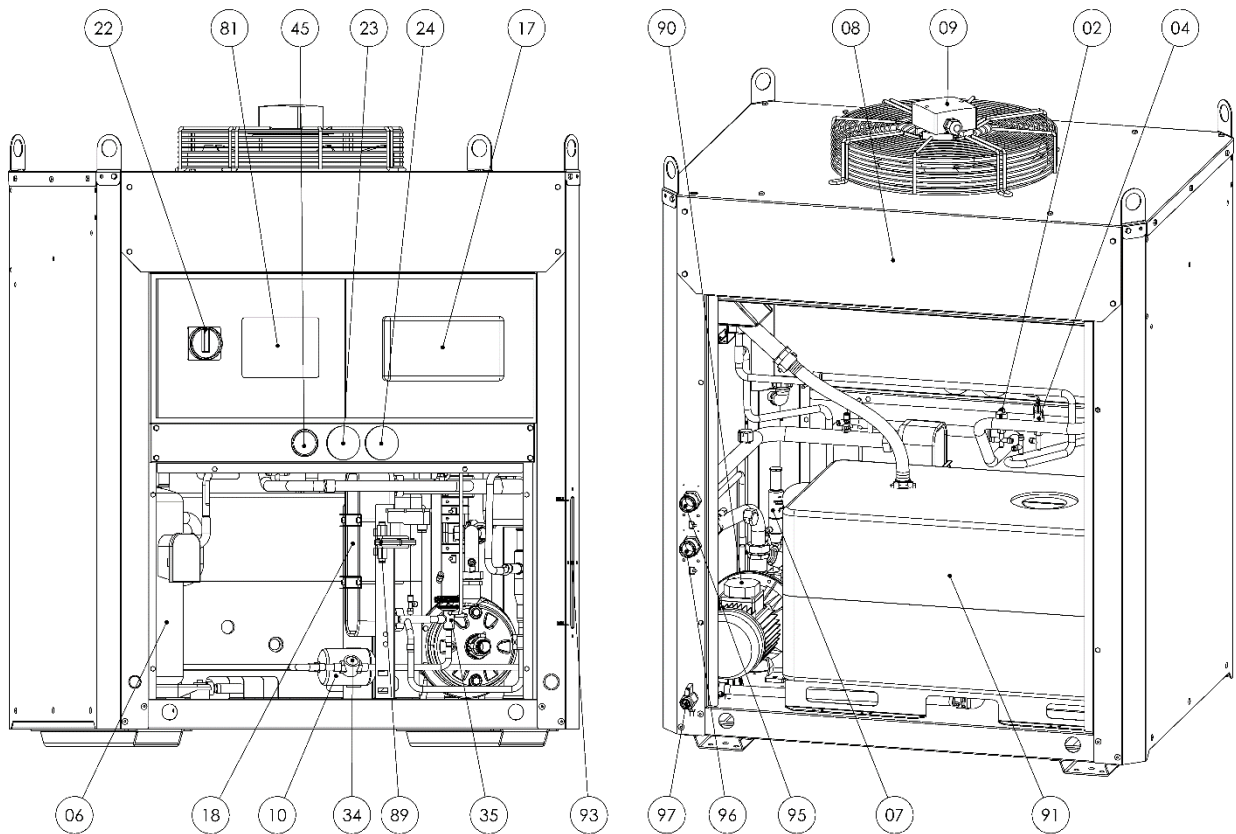
### 2.7.1 CHILL-CUBE QBE 003÷007 VBM – Mechanical hot gas bypass valve



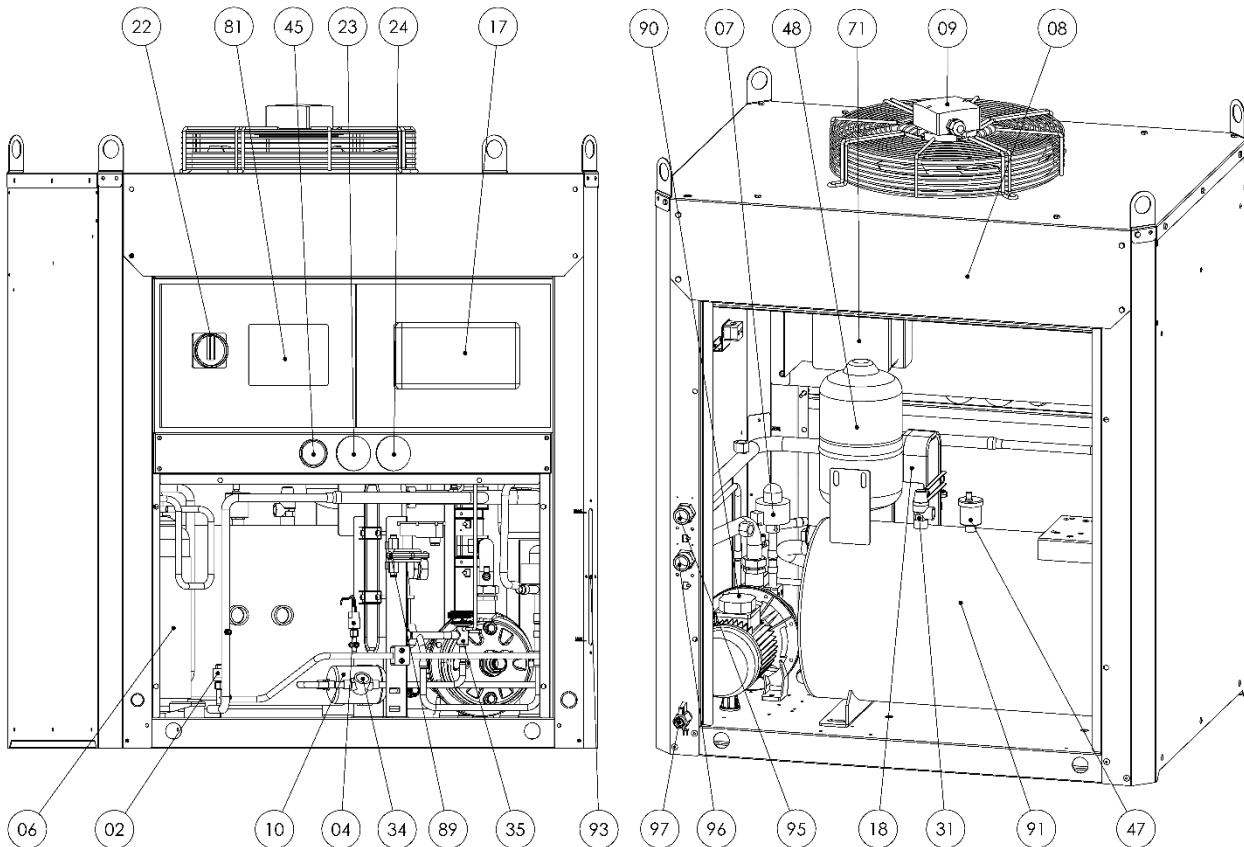
### 2.7.2 CHILL-CUBE QBE 003÷007 VBE – Electronic hot gas bypass valve



**2.7.3 CHILL-CUBE QBE 008÷025 VBM – Mechanical hot gas bypass valve**



**2.7.4 CHILL-CUBE QBE 008÷025 VBE TP – Electronic hot gas bypass valve with pressurized water circuit**



02	Low pressure switch	47	Relief valve
04	High pressure switch	48	Expansion vessel
06	Compressor	49	Automatic water bypass valve
07	Hot gas bypass valve	61	Power input
08	Condenser	71	Hot gas bypass valve driver
09	Fan	78	Flow switch
10	Refrigerant filter	81	Refrigerant diagram
17	Electronic controller	89	Differential pressure switch
18	Evaporator	90	Pump
22	Disconnect switch	91	Tank
23	High pressure manometer	93	Level indicator
24	Low pressure manometer	94	Water filler
31	Safety valve	95	Water inlet
34	Sight glass	96	Water outlet
35	Thermostatic valve	97	Drain
45	Water manometer		

## 2.8 SPARE PARTS

Spare parts list is printed on a dedicated sticker applied inside the chiller. On this sticker each spare part is identified with its ID Number and related Spare Part Number. Here below the cross reference table between ID Number and exploded drawings Ref. With their description and quantity installed inside chillers.

**NOTE** To order the suggested spare parts or any other part, it is necessary to quote the data reported on the identification plate.

ID N.	DESCRIPTION	NOTE	PART QUANTITY FOR QBE VBM/VBE MODEL														
			1 Phase					3 Phase									
			003	004	005	006	007	009	012	005	006	007	008	009	012	014	020
1	EVAPORATOR GROUP		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	LOW PRESSURE SWITCH		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	HIGH PRESSURE SWITCH		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	COMPRESSOR		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	HOT GAS BYPASS VALVE		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	CONDENSER		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	FAN		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9.3	FAN GRID		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	REFRIGERANT FILTER		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	TEMPERATURE PROBE		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
17	COMPLETE ELECTRONIC CONTROLLER		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	EVAPORATOR		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
22	DISCONNECTOR SWITCH		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
23	HIGH PRESSURE GAUGE		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
24	LOW PRESSURE GAUGE		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
25	COMPRESSOR CRANKCASE HEATER	[A]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
35	THERMOSTATIC EXPANSION VALVE		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
89	DIFFERENTIAL PRESSURE SWITCH	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]	[B]
90	WATER PUMP		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
91	WATER TANK		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
92	WATER LEVEL SENSOR	[C]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

[A]	Optional.
[B]	Equipped with TP EXP option.
[C]	Only for open circuit version.

## INSTALLATION

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### 3.1 TRANSPORT

The units are supplied packed in a cardboard box on a wooden pallet. After checking that the packing is undamaged, position the unit near the installation site and unpack it.



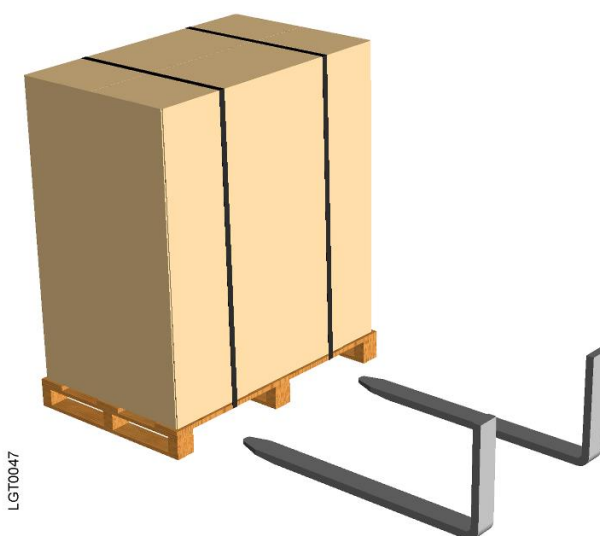
Always keep the chiller vertical: turning it upside down can irreparably damage several parts of the unit.



Handle with care. Violent falls can cause irreparable damage.



The centre of the machine is approximately its centre of gravity. In any case, when handling the machine with a forklift truck or pallet jack, always check its stability before lifting.



### 3.2 STORAGE

Protect the machine from bad weather, even if packed. Always keep the chiller vertical, even when in storage. Turning it upside down can irreparably damage several parts of the unit. If not used, the chiller can be stored packed in an enclosed place, free of dust, with a maximum temperature of 50 °C//122°F and specific humidity of not higher than 90%.



The packing material is recyclable. Dispose of each type of material in accordance with the requirements in the country of use.

### 3.3 PLACE OF INSTALLATION



**Warning!** The **CHILL-CUBE QBE 003÷007** models are suitable for indoor installation only. Optionally, version IP44 is available. All other **CHILL-CUBE QBE** units can be installed indoors or outdoors.



**Warning!** Check that the support surface is suitable to support the weight of the unit and that it is perfectly horizontally levelled.

To determine the best place to install the unit, it is important to consider the following aspects:

- The dimensions and source of the water pipes;
- The location of the power supply;
- Avoid any obstacles to the flow of the fan which could cause the recirculation of air to the condenser;
- Avoid the possible reflection of sound waves: (do not install in narrow or tight spaces);
- Provide access for maintenance or repair (see paragraph **3.3.1 Installation spaces**);
- Average air temperature in the chosen installation area (see Section **8 Operating limits**).



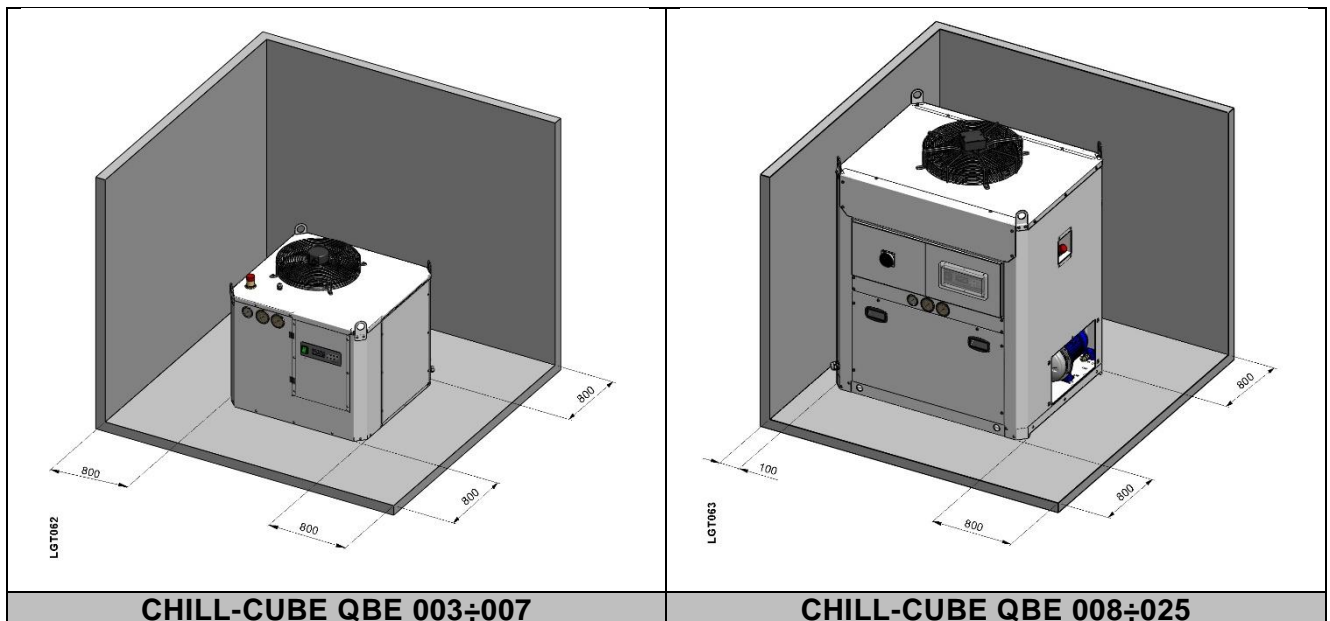
**Attention!** If the machine is installed outside, it could find itself at a temperature lower than 0°C//32°F, when stopped; the formation of ice could damage the evaporator. If you do not intend to drain the machine during the winter, you must add **anti-freeze to the water circuit** (see paragraph **3.4.4 Use of ethylene glycol as anti-freeze**).

#### 3.3.1 Installation clearances

To ensure the good functioning of the unit and access for maintenance, you must respect the minimum installation clearances shown in the figure in this paragraph.

The exit of air from the fan must not be obstructed.

In any case, avoid all situations in which hot air can circulate between the output of the fan and the intake of the machine. Contact our office to verify feasibility in all cases where one of the preceding conditions cannot be met.



- 800 mm / 31 inches on each side

- 100 mm / 4 inches on left side
- 800 mm / 31 inches on the other sides



### 3.4 WATER CONNECTIONS

Connect the machine to the water pipes following the instructions located near its water fittings (see figures).

The installation of outlet and inlet taps on the machine is recommended, which will enable machine maintenance without emptying the entire system, and emptying of the machine only during winter downtime.



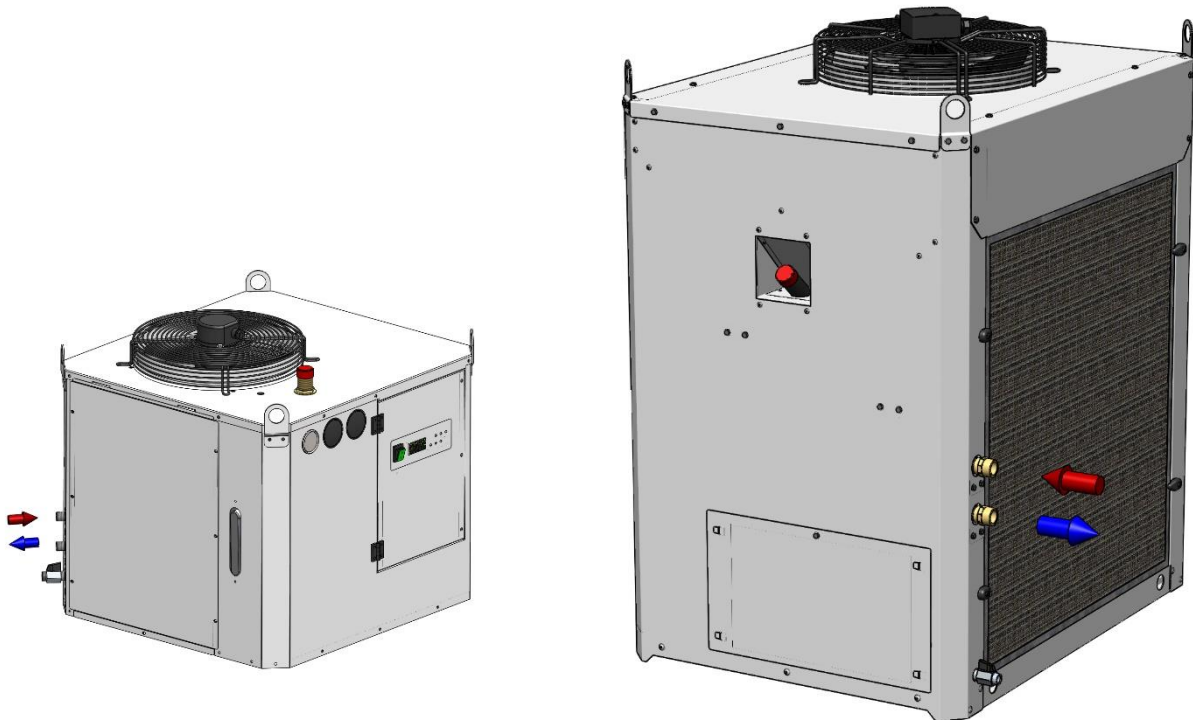
**Important!** Install the mechanical water strainer supplied with the unit on its input: scum and impurities can seriously damage the evaporator.



We recommend an extraordinary cleaning of the mechanical water strainer after the machine has been running for the first week (also see Chapter **9 Maintenance, inspections and periodic checks**).

**CHILL-CUBE QBE 003÷007**

**CHILL-CUBE QBE 008÷025**



**Warning!** No naked flames should be used during water connection operations, in the vicinity of or inside the unit.

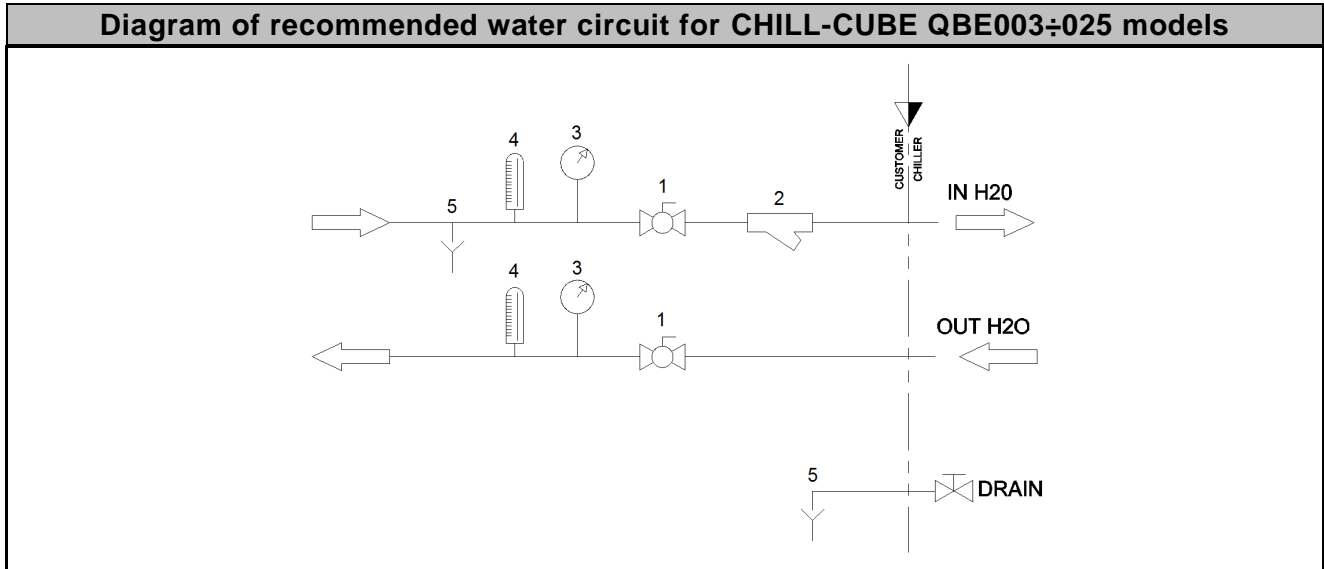
**NOTE** It is a good rule that the diameters of the arriving and departing pipes be not less than the water fittings.

CHILL-CUBE QBE Models 60Hz	003÷007	009÷025
Diameter of the in/out water fittings	1/2" NPT FF	1" NPT FF

### 3.4.1 Recommended water system for CHILL-CUBE QBE 002÷025

CHILL-CUBE QBE 003÷025 units come as standard with a mechanical water strainer, a tank at atmospheric pressure, pump and bypass; it is advisable to also provide the water circuit with:

- Machine inlet and outlet taps;
- Inlet and outlet pressure gauges and thermometers for water from the machine, to control its operation.



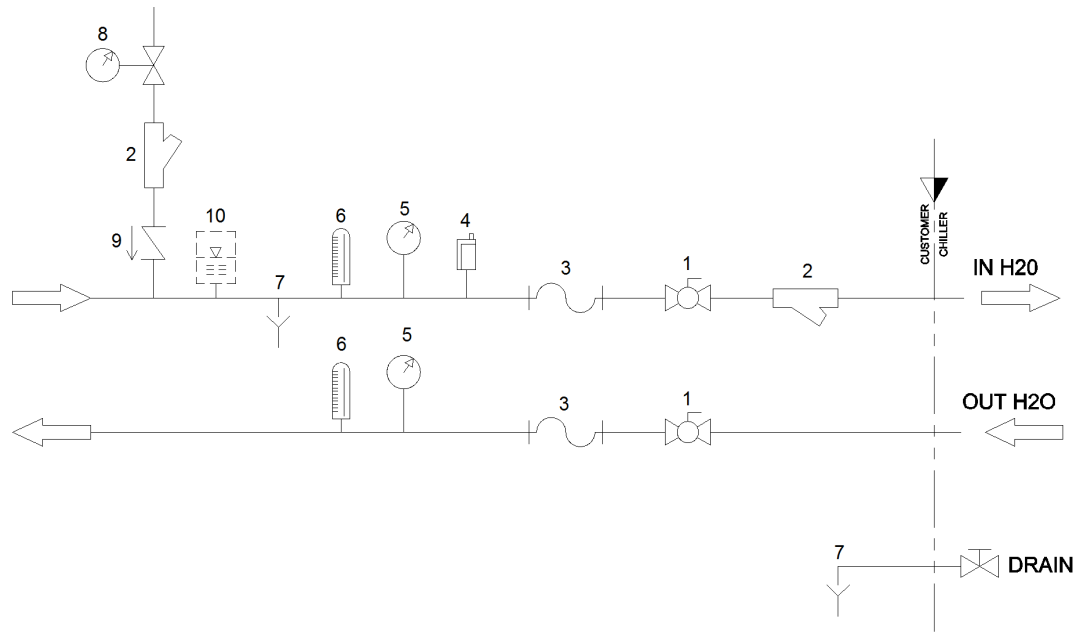
Key			
1	Tap	4	Thermometer
2	Water strainer (supplied with the unit)	5	System/unit discharge
3	Pressure gauge		

### 3.4.2 Recommended water system for QBE 003÷025 with pressurized tank

CHILL-CUBE QBE 003÷025 units can be equipped with pressurized water tank, pump, expansion vessel, automatic air bleeder valve, safety valve. Also in this case the water strainer is supplied with the machine. It is however advisable to also provide the water circuit with:

- Machine inlet and outlet taps;
- A mechanical filter and a backflow valve on the filling line, upstream of the feed tap;
- An air bleeder at the highest point of the system;
- A discharge tap at the lowest point of the system;
- Inlet and outlet pressure gauges and thermometers for water from the machine, to control its operation;
- Anti-vibration pipe joints to prevent vibrations from being transmitted to the system;
- In the case of water circuits of considerable capacity it is advisable to check if it is necessary to combine the existing expansion tank on the unit with an additional tank. The capacity of the expansion tank provided with the **CHILL-CUBE QBE 003÷007** models is 3 l/0.8 gallons, however for **CHILL-CUBE QBE 008÷025** models are equipped with a 5 l/1.32 gallons expansion vessel.

**Diagram of the recommended water circuit for the CHILL-CUBE QBE 003÷025 with pressurized tank**



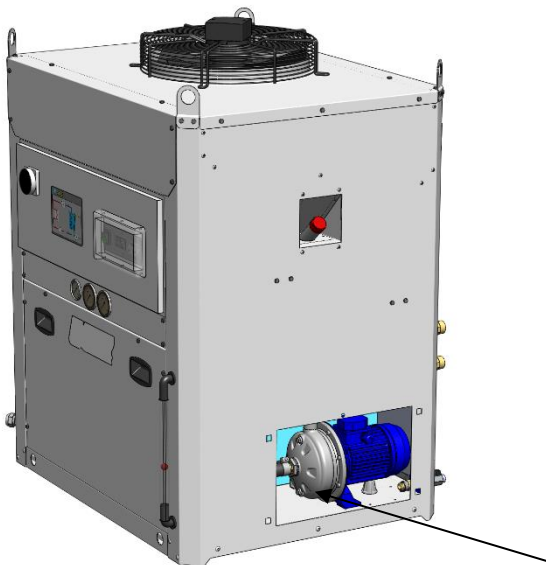
DGT0039

Key			
1	Tap	6	Thermometer
2	Water strainer (supplied with the unit)	7	Drain
3	Anti-vibration joints	8	Filling unit
4	Bleeder valve	9	Check valve
5	Pressure gauge	10	Expansion vessel (if required)



**Important!** During winter downtime empty the system (or just the refrigerator) to prevent damage from the cold.

Any residual water inside the pump (**CHILL-CUBE QBE 008÷025**) must be discharged using the proper screw on the lower part of the pump (see diagram).



**Pump Drain screw**

LOT061

### 3.4.3 Water quality

For unit safe and durable operation, the quality of the process water in the system must comply with the parameters in the table below. If this is not the case, it is recommended to use suitable chemicals or additives such as corrosion inhibitors, hardness stabilisers and anti-algae<sup>1</sup>.

Total hardness	6.0...15 dH°	Cl <sup>-</sup>	<5 mg/l
PH	7.5...9.0	Cl <sub>2</sub>	0.5 mg/l
Conductivity	10...500 µS/cm	H <sub>2</sub> S	<0.05 mg/l
Residual solid particles	<30 mg/l	NO <sub>2</sub> <sup>-</sup>	<5 mg/l
Saturation Index SI	-0.2 < 0 < 0.2	NO <sub>3</sub> <sup>-</sup>	<100 mg/l
HCO <sub>3</sub>	<300 mg/l	Fe	<0.2 mg/l
SO <sub>4</sub> <sup>2-</sup>	<100 mg/l	Al	<0.2 mg/l
Aggressive free carbonic acid	<20 mg/l	Mn	<0.1 mg/l
Free chlorine	<0.5 mg/l	NH <sub>4</sub> <sup>+</sup>	<2 mg/l
PO <sub>4</sub> <sup>3-</sup>	<2 mg/l	Oxygen content	<0.1 mg/l
HCO <sub>3</sub> / SO <sub>4</sub>	>1.0 mg/l	S <sup>2-</sup>	<1 mg/l
NH <sub>3</sub>	<0.5 mg/l		



The use of demineralized water with the addition of anticorrosive liquids is mandatory.



Any damage caused by failure to comply with the water requirements is excluded from the warranty.

<sup>1</sup> Please get in touch with the company for product recommendations..

### 3.4.4 Use of glycol as anti-freeze

3.4.4.1 In environments where the outside air temperature is close to zero, if the system is not drained during the winter shutdown, the water system must be loaded with a mixture of water and glycol, using the percentages shown in the table below:

Percentages of glycol required as a function of the expected temperature of the outside air.		
Outside air temperature [°C]	0	-3
Outside air temperature [°F]	32	26,6
Percentage of ethylene glycol by volume [%]	10	15
Percentage of propylene glycol by volume [%]	10	15

3.4.4.2 Based on the desired outlet water temperature, the water system must be loaded with a mixture of water and glycol, based on the percentages shown in the table below:

Recommended glycol percentages based on the desired water temperature				
Desired water temperature [°C]	-3	0	+3	+5
Desired water temperature [°F]	26.6	32	37.4	41
Percentage of ethylene glycol by volume [%]	25	20	15	15
Percentage of propylene glycol by volume [%]	30	25	20	15



**Attention!** Maximum concentration of ethylene glycol allowed: **40%**

For higher glycol concentrations contact our company's sales offices to make sure that the mechanical seal and the pump motor are suitable for the type and concentration of fluid loaded in the hydraulic system



**Important!** We do not recommend using automotive glycols, as they may contain incompatible substances or be aggressive for the mechanical seals of the hydraulic pumps.



Any damage caused by failure to comply with the water/glycol percentage is excluded from the warranty.

### 3.4.5 Charging the hydraulic circuit CHILL-CUBE QBE 003÷025

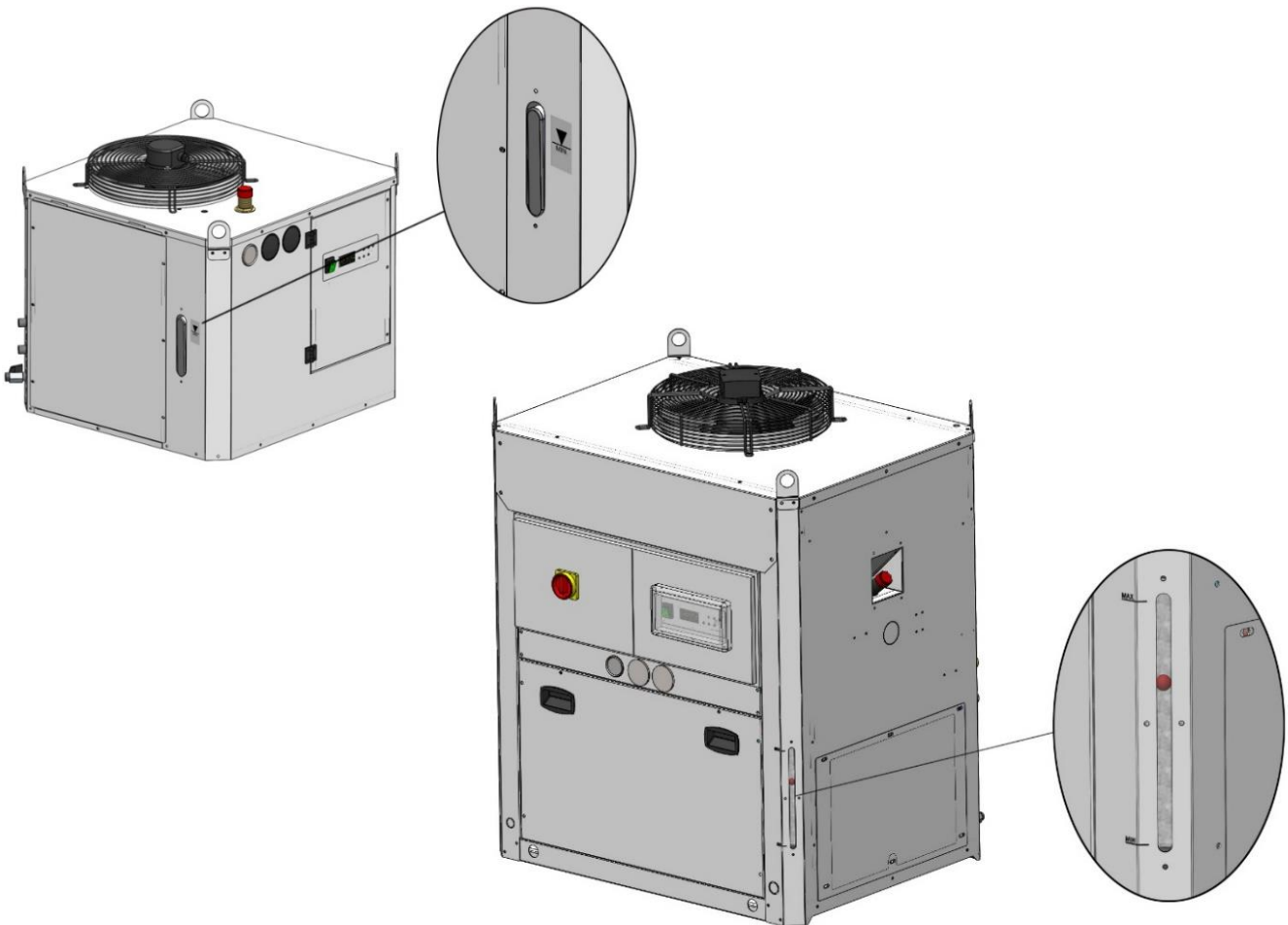
#### 3.4.5.1 Preliminary operations

- Check that the drain taps are turned off;
- Open all the vent valves of the system;
- Open the system interception devices;

#### 3.4.5.2 Subsequent operations based on the hydraulic circuit

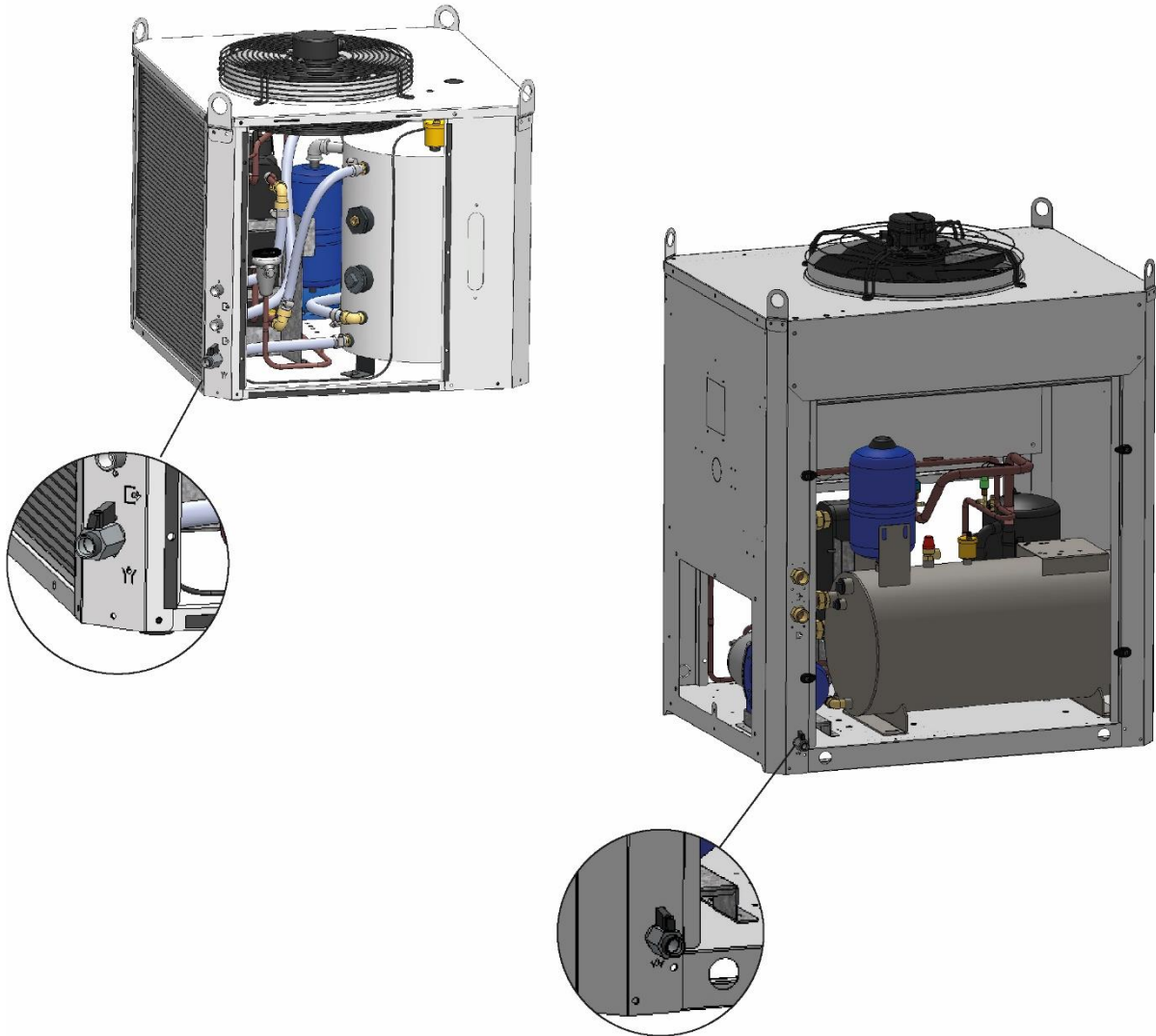
##### For hydraulic circuits with open vessel systems:

Feed the water from the filling inlet above the machine until the water reaches the required level near the transparent level indicator (see picture below). When the pump starts check the level again and top up if necessary;



### **For hydraulic circuits with pressurized systems:**

Start filling by slowly opening the water drain / refill tap available on the unit (see picture below):



If it is necessary to load glycol into the circuit (see **paragraph 3.4.4**), prepare the water / glycol mixture gradually in an external container. Transfer it to the inside of the cooler tank with the help of a small external pump.

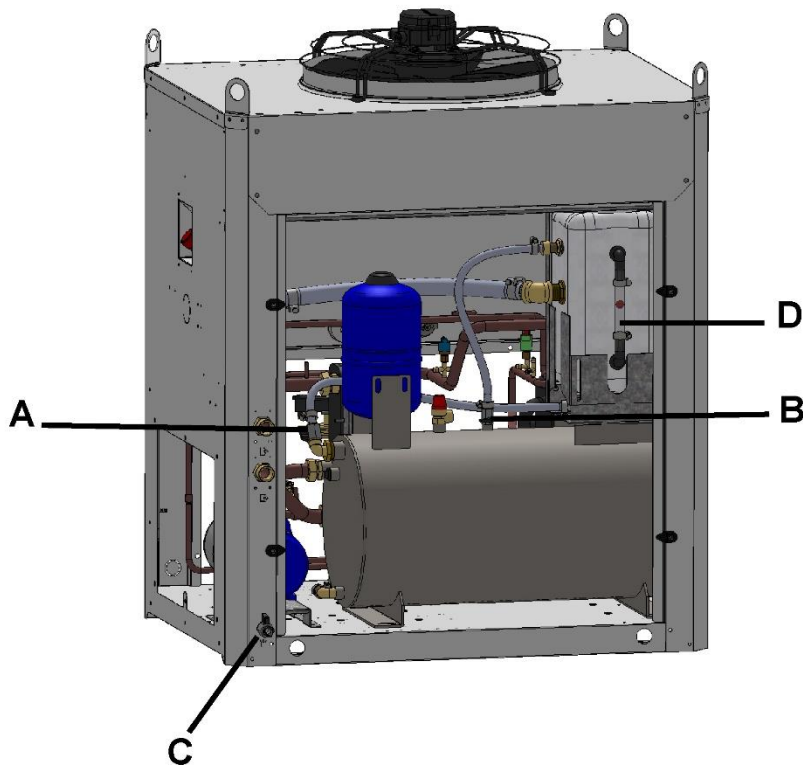
Continue filling until the value of at least 1 bar is read on the pressure gauge, check that no more air comes out of the automatic air vent valves.

Close the tap and start the pump for a few minutes to vent the pipes, if when the pump stops the circuit pressure is less than 1 bar, open the filling valve again and restore the circuit pressure (repeat the operation until the pressure remains stable at 1 bar).

If there is an automatic filling unit (WF option), calibrate the unit to maintain the pressure at 1 bar and leave the filling cock open.

### **For hydraulic circuits with additional atmospheric tank (opt. TA)**

Open the taps (**A** and **B**) for filling and venting the additional atmospheric tank.



Make sure that the drain cock (**C**) is closed.

If it is necessary to load glycol into the circuit (see **paragraph 3.4.4**), prepare the water / glycol mixture gradually in an external container.

Fill the additional tank by checking the level (**D**), the circuit will fill by gravity emptying the additional tank, continue to fill the additional tank until the level stops dropping. Start the pump by checking the level of the additional tank and fill it if necessary.

When the level of the additional tank remains constant, close the fill and vent cocks (**A** and **B**) of the same while the pump is running. (It is advisable to periodically check the filling of the circuit by opening the taps and checking if the tank level drops).

#### **3.4.5.3 Concluding operations**

- Recheck the filling of the system;
- Check for any leaks by checking the pressure gauge and inspecting the circuit.



## 3.5 ELECTRICAL CONNECTIONS



The machine must be connected to the electricity following the electrical diagram and conforming to the current laws and regulations in the place of installation.

- The voltage, frequency and number of phases must conform to the data shown on the machine's identification plate;
- The power supply voltage must not vary by more than  $\pm 10\%$  from its nominal value;
- The frequency must not vary by more than  $\pm 1\%$  from its nominal value ( $\pm 2\%$  for brief periods);
- The imbalance between power phases must be  $< 2\%$ ;
- Upstream from the electrical panel, install a differential switch (IDn=0.03A) (main power switch) and slow-blow fuses with the specifications shown on the electrical diagram;
- Use wires of the section shown on the electrical diagram and in the following table.



**Attention!** Never change the internal electrical connections, as the warranty will be immediately voided.



**Important!** Screw the wires solidly to the terminal strip of the cut-off switch and lock the wire with a cable-gland.



**Important!** Make the cable entering the machine enters the cable-gland from below: this prevents rain from dripping inside the machine.



**Important!** The earth connection is mandatory: connect the earth wire to the terminal provided in the electrical panel. The ground wire must be longer than the other wires so that it will be the last one to be pulled if the device holding the cable loosens.



**Attention!** The RS485 port is not galvanically isolated

### 3.5.1 Connecting a remote on/off switch and a remote alert warning indicator

A remote ON/OFF switch can be installed using the terminal clamps on the switchboard terminal board.



Consult the electrical diagram.

A remote alert warning indicator can be installed using the terminal clamps in the switchboard cabinet

#### NOTE

For all **CHILL-CUBE QBE** units, any remote switch installed must be enabled on the electronic controller setting the “**L8**” parameter to value 1 (see par. 5.2.2).



Consult the electrical diagram.

## PRELIMINARY CHECKS AND START-UP

### 4.1 PRELIMINARY CHECKS AND PREPARATION FOR THE START-UP

Before starting up the unit, it is a good idea to do the following:

- Check that the water shut-off valves are open;
- Verify the regular water level in the tank;
- Check that the surrounding temperature is in the range for the machine to function (see Chapter **8 Operating Limits**);
- Check the cut-off switch on the machine switchboard is open;
- Check that the mains voltage matches the voltage on the machine's identification plate with a tolerance of  $\pm 10\%$ ;
- Close the main power supply switch;
- Close the cut-off switch on the machine's electrical panel.




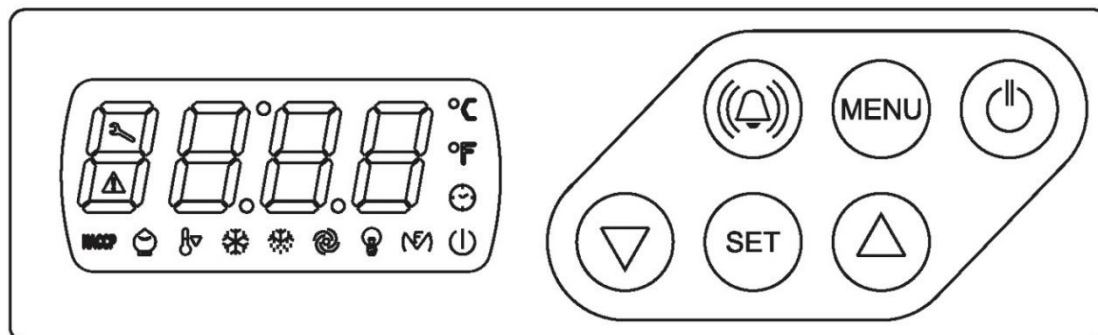
**Warning!** Produced water temperatures less than 5°C//41°F require the use of glycolate mixtures and the setting of suitable electronic controller parameters. Contact the company (*see section 5.16*).


### 4.2 STARTUP

#### 4.2.1 CHILL-CUBE QBE 003÷007 Startup

On closing the cut-off switch the electronic controller will light the led . To proceed with startup:



- Turn on the unit by pressing  key on the electronic controller for more than 2 seconds;



- Check pump startup (light );
- The display will show the temperature detected by the temperature probe; if it is higher than the set value the compressor will start up.



**Attention!** At start-up after couple of days, you must adjust date and time (see paragraph **5.7 Setting the date and time**).

Turn off the unit by holding the  key on the electronic controller for more than 1 second; the led  will light to signal the status of OFF. The electronic controller will first switch off the compressor then shortly after the pump.







**Attention!** It is important not to turn off the unit using the main power switch or cut-off switch on the machine switchboard because this would not provide for the delayed power-off of the pump regarding the power-off of the compressors, with the risk of damaging the evaporator; in addition, it would prevent the functioning of the heating element in the compressor housing.



**Attention!** Check the correct direction of rotation of the pump and fan.

#### 4.2.2 CHILL-CUBE QBE 008÷025 Startup

On closing the cut-off switch the electronic controller will light the led .  
To proceed with startup:

- Turn on the unit by pressing  key on the electronic controller for more than 2 seconds;
- Check the alert symbol  does not appear on the electronic controller; if it does appear press  key to see which type of alert has been flagged.

**Attention!** On first starting up an alert could occur in relation to an error sequence in the R/S/T phases, shown by the code **HPLP**.



This safety system safeguards the compressor from the possibility of turning in the wrong direction.

**Note: the phase sequence relay located inside the electrical panel must have both LEDs lit to confirm the correct phase sequence.**




Should this occur close the main power switch upstream of the machine, and invert two phases between them immediately downstream of the main switch itself.





**Attention!** Do not interfere with cabling downstream of the unit switchboard cut-off switch at any time, as doing so could compromise the correct sequence of other devices, such as the pump or fans.

Repeat operations from the beginning.

- Check the pump has started (light ); possibly by checking the pressure of the water upstream and downstream of the machine on the previously installed pressure gauges;
- Wait for the electronic controller to verify continuity of water flow via the signal of the differential pressure switch; if the differential pressure switch intervenes (alarm code **FL**), vent the system, check the shut-off valves are open and pump operation (see *par. 5.2.12* for alarm's rearm);
- The display will show the temperature detected by the probe; if it is higher than the set value the compressor will start up.



**Attention!** At start-up after couple of days, you must adjust date and time (see paragraph **5.7 Setting the date and time**).

Turn off the unit by holding the  key on the electronic controller for more than 1 second; the led  will light to signal the status of OFF. The electronic controller will first switch off the compressor then shortly after the pump.



**Attention!** It is important not to turn off the unit using the main power switch or cut-off switch on the machine switchboard as this could cause a delayed switch-off of the pump with respect to the compressor, which could damage the evaporator.

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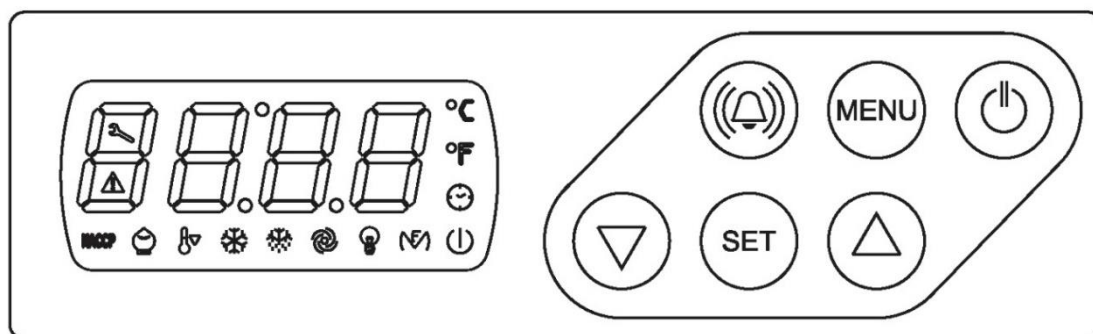
### 4.3 START-UP UNDER CRITICAL CONDITIONS

The consequence of starting up under critical conditions could be the intervention of the high-pressure pressure switch (to rearm the high-pressure pressure switch, see paragraph **7.2 *Rearming the high-pressure pressure switch***).

To overcome this problem, you will have to reduce the thermal load on the machine by shutting off some of the uses or, if this is not possible, by reducing the flow of water into the evaporator: partially close the output tap from the chiller and restart the machine.

Operate the chiller under these conditions until the water temperature gradually returns within operating limits; then, you can turn on the tap completely.

## ELECTRONIC CONTROLLER



The electronic controller has a 4 number display, 14 integrated signaling leds and 6 function buttons.

It manages:

- Compressor operation to ensure temperature control of the chilled water;
- Pump operation;
- Fan operation;
- Alarms.

### 5.1 MAIN FUNCTIONS OF THE ELECTRONIC CONTROLLER BUTTONS AND MEANINGS OF THE ICONS

The following tables resume all the buttons and icons display on the electronic controller.

Button	Function
	Alarm menù
	Access the menù
	On/Off (pressed for more than 1 second) Returns to the previous menu level (pressed once)
	Down key
	Setting setpoint Confirms value entered for a parameter Alarm reset (pressed for 2 seconds)
	Up key

Display/Led	Function
	Water temperature and other contents available in the menu
	°Celsius unit
	°Fahrenheit unit
	Indicates the date, hour and clock alarm
	Indicates that the machine is off
	Indicates the state of the pump: On: pump ON Off: pump OFF Slow flashing: with compressor off, the pump verifies the state of the water temperature Fast flashing: pump about to turn off
	Not used
	Indicates the state of the fan: On: fan ON Off: fan OFF
	Not used
	Indicates the state of the compressor: On: compressor ON Off: compressor OFF Slow flashing: compressor about to turn on Fast flashing: compressor about to turn off
	Indicates the setpoint setting (flashing)
	Energy saving on
	Not used
	Indicates the presence of one or more active alarms
	Indicates the request of maintenance

## 5.2 TURNING ON AND OFF



**Attention!** At start-up after couple of days, you must adjust date and time (see paragraph **5.7 Setting the date and time**).

Turn on the unit by pressing key on the electronic controller for more than 2 seconds. The display will show the temperature detected by the probe.

Turn off the unit by pressing key on the electronic controller for more than 2 seconds. The led will light to signal the status of OFF.

The electronic controller can be turn on/off using the keypad or by remote operation, the choice of this modes is done via “L8” parameter (refers to par. **5.8 Parameters changing**).

If “L8” = 0, the chiller can be switched on/off only with key.

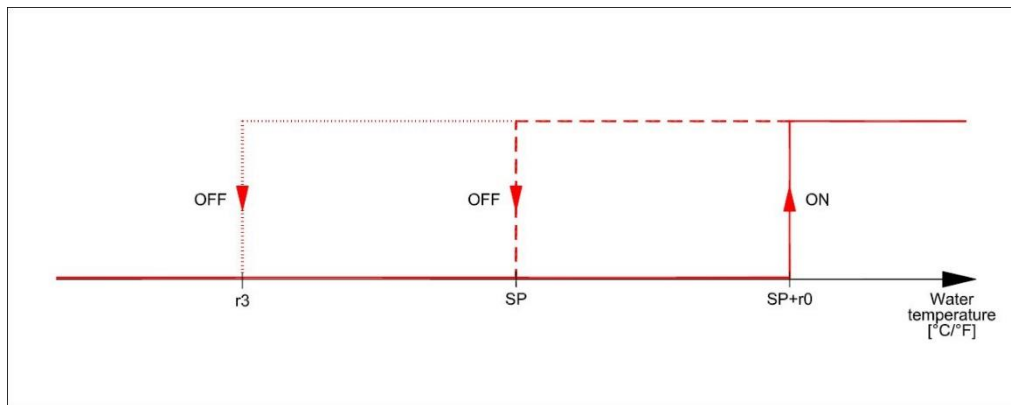
If “L8” = 1, the chiller can be switched on/off only through the digital input available on the terminals in the electric board (refers to par. **3.5.1 Connecting a remote on/off switch**).

The choice of one mode excludes the other mode.

### 5.3 WATER TEMPERATURE CONTROL

The **CHILL-CUBE QBE 003+025**'s electronic controller regulates the water temperature with a proportional logic.

This type of control is based on setpoint value "**SP**" and on a temperature differential "**r0**" above it: the compressor is switched off when water temperature go under the set point "**SP**". Due to a low thermal load and/or a low water flow rate, set point could be reached when compressor has not yet reached the minimum ON time ("**C3**" parameter). In this case, water temperature can decreases under the set point. If minimum value ("**r3**" parameter) is reached, the compressor will be switched off apart from its protection times.



The two temperature probes act as follow:

- **A12** takes the outlet water temperature (evaporator exit → antifreeze function);
- **A11** takes the condensing temperature (fan regulation).






### 5.4 CHANGING THE CHILLER SETPOINT




**Warning!** Setting the chiller setpoint at least  $-2^{\circ}\text{C} // -2\text{K} // -3,6^{\circ}\text{F}$  from the hot gas bypass valve setpoint (see par. **5.17.2 Regulation and changing setpoint of the hot gas bypass valve**).



**Attention!** If it was not specified during the proposal phase that the unit is required to produce water at temperatures near to  $0^{\circ}\text{C} // 32^{\circ}\text{F}$  or below contact the company (see section **5.16 Low water temperatures**).




- Press  key; the living set point value will be shown and the yellow icon  will flash.
- Use  and  keys to set desired value and press  key to confirm.

**Attention!** The new value will be saved after 15 seconds, even if the  key has't been pressed.




**NOTE** The setpoint value can be changed also when the keyboard is locked.

### 5.5 QUICK MENU

At the unit switches on, the display will show the outlet water temperature, but quickly it is possible to access to the following parameters.



- Press  key one time to access to the quick menu;
- Using  and  keys it is possible to access to the following parameters:

Parameter	Function/Value
<b>Pb2</b>	Temperature of the AI1 probe
<b>bU</b>	Buzzer activation/disactivation
<b>rtC</b>	Setting time and date (see par. 5.2.7)
<b>PH</b>	Pump operating time
<b>CH</b>	Compressor operating time






- Press  key for see the set or the current value of the selected parameter;
- Press  key for return to the quick menu;
- Press  key for exit.

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## 5.6 LOCK AND UNLOCK THE KEYBOARD





















To lock the keyboard press at the same time  and  keys for 2 seconds. The display will show text **“Loc”** for one second to confirm the keyboard locking. When the keyboard is locked, if you press any keys, text **“Loc”** will appear. When the keyboard is locked, it's not allow to:

- Turn on and turn off the chiller from the controller;
- Show the temperature of AI2 probe;
- Show information about alarms;
- Show compressor working hours;
- Show pump working hours.

When the keyboard is locked, the changing setpoint is allowed pressing  key and after  and  keys. For unlock the keyboard press at the same time  and  keys for 2 seconds. The display will show text **“UnL”** for one second, to confirm the keyboard unlocking.

---

## 5.7 SETTING THE DATE AND TIME












- Push the button ;
- Use  and  in order to see **“rtC”**;
- Push the button , the led  flashes, the display will show “yy”, followed by the last two digits of the year. (i.e. “yy15”). Use  and  to modify the value;
- Push the button  to continue to the month's adjustment; then the display shows “MM”, followed by the last two digits of the month. (i.e. “MM08”). Use  and  to modify the value;
- Push the button  to continue to the day's adjustment; then the display shows “dd”, followed by the last two digits of the day. (i.e. “dd04”). Use  and  to modify the value;
- Push the button  to continue to the time's adjustment; then the display shows “hh”, followed by the last two digits of the time in hours, considered in the 24h format. (i.e. “hh15”). Use  and  to modify the value;
- Push the button  to continue to the minute's adjustment; then the display shows “nn”, followed by the last two digits of the minutes. (i.e. “nn19”). Use  and  to modify the value;
- Push the button  to return to the main menu.



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## 5.8 PARAMETERS CHANGING

The electronic control can be personalized to adapt at different use of the chiller, through parameters setting, using a password.

- Press  key for 4 seconds;
- The display will show “**PA**” text;
- Press  key;
- Use  key to insert the password<sup>2</sup>;
- Press  key. Appear the first parameter;
- Press  and  keys for scroll down the list;
- Press  key for see the current value of the selected parameter;
- Press  and  keys to change the value;
- Press  key to confirm the new value and return to parameters menu or wait for 15 seconds without touch the keyboard;
- Press  key to exit from parameters menu or wait for 60 seconds without touching the keyboard.












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## 5.9 CHANGING THE TYPE OF RESTART AFTER A POWER FAILURE

In the case of a power failure, the chiller can behave in three different ways when power is restored:

- Stay off;
- Start;
- Return to the same condition it was in when the power failed.

To select one of these options, proceed as follows:

- Press  key for 4 seconds;
- The display will show “**PA**” text;
- Press  key;
- Use  key to insert the password<sup>3</sup>;
- Press  key. Appear the first parameter;
- Press  and  keys for scroll down the list until reach “**r7**” parameter;
- Press  key to set the parameter;
- Press  and  keys to change the value:
  - a) 0 when the power returns, the machine will stay off;
  - b) 1 when the power returns, the machine will start;
  - c) 2 when the power returns, the machine will work in the same way as before the power failed;
- Press  key to confirm the new value and return to parameters menu or wait for 15 seconds without touch the keyboard;
- Press  key to exit from parameters menu or wait for 60 seconds without touching the keyboard.



**Attention!** If remote control is active ( **L8=1**), the parameter **r7** must be set as 2.

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<sup>2</sup> Contact our company

<sup>3</sup> Contact our company

---


## 5.10 DISPLAYING THE FIRMWARE RELEASE VERSION OF THE ELECTRONIC CONTROLLER

It is possible to display the software release version only in startup phase. Follow this instructions:

- Connect the device power supply;
- While the display is flashing, press and hold  key;
- On the display will appear 3 values sequentially:
  - The first value is the firmware's number;
  - The second value is the firmware's release;
  - The third value is a not used parameter.

---


## 5.11 ALARMS





An alarm is displaying with its code and the led  lights up. There are 3 type of rearm:

- **Manual rearm:** these alarms must be reset, this can only be done when the alarm condition no longer exists; at that point the unit is enabled to run;
- **Automatic rearm:** the alarm is automatically deactivated as soon as the alarm condition ceases and the machine restarts by itself;
- **Semi-automatic rearm:** semi-automatic alarms behave like automatic alarms; but if the same semiautomatic alarm occurs 5 times in 60 minutes, that alarm becomes a manual one; therefore to restart the machine, you will have to remove the cause of the alarm and reset it.

---

## 5.12 DISPLAYING ALARM

The led  indicates the presence of an alarm. Alternately the display shows the occurred alarm code (or the most important alarm code, if there are many) and the water temperature value. In case of multiple alarms intervention, it is possible to display the alarm history in this way:

- Press  key;
- Use  and  key to display active alarms;
- Press  key to return to main menu.

The last 20 active alarms are saved; further new alarms will overwrite the oldest ones.

## 5.13 ALARM CODES TABLE

Code	Description	Type of rearm	Compressor's effect	Pump's effect	Fan's effect
<b>FL</b>	Level sensor/Flow switch	Manual	OFF	NO ACTION*	OFF
<b>HPLP (HL**)</b>	<i>For QBE VBE/VBM 003÷007</i> High/Low pressure	Manual	OFF	NO ACTION	NO ACTION
	<i>For QBE VBE/VBM 008÷025</i> High/Low pressure Compressor protection Pump protection Fan protection Wrong phase sequence				
<b>Pr1</b>	AI2 temp. probe failure	Automatic	OFF	NO ACTION	OFF
<b>Pr2</b>	AI1 temp. probe failure	Automatic	OFF	NO ACTION	OFF
<b>AL</b>	Min. temp. Probe AI2 (if P3=1) / probe AI1 (if P3=2)	Semi-Auto	OFF	ON	OFF
<b>AH</b>	Max. temp. AI2 probe	Semi-Auto	OFF	NO ACTION	OFF
<b>COH</b>	Superheated condenser	Semi-Auto	NO ACTION	NO ACTION	NO ACTION
<b>CSD</b>	Blocked condenser	Manual	OFF	NO ACTION	OFF

\* Pump's effect in case of FL alarm is a programmable parameter : **Lb**=0 OFF, **Lb** =1 ON, **Lb** =2 NO ACTION

\*\* in the alarm log, **HPLP** can appear with the abbreviation **HL**.

## 5.14 RESETTING ALARM



To reset an alarm, the condition that caused it must no longer exist. For example, if the low-pressure switch has occurred, the alarm can only be reset when the pressure has risen beyond the reset value (see paragraph **7.1 Calibration of the safety devices and type of rearm**).






Proceed at manual rearm in this way:

- Press key;
- Use and key to select the alarm to reset (a manual rearm's alarm lights up and leds);
- Press key will appear code "**dEL**";
- Press for 1 second key to cancel the memory;
- Press key for return to upper level menu.











## 5.15 DISPLAYING AND RESETTING ALARM HISTORY

Make sure that the keyboards is not locked and that no procedure is in progress.

- Press key;
- Use and keys to select "**LS**" label;
- Press key to exit the procedure or key to access the alarm history;

- Il display visualizzerà l'indicazione dell'allarme più recente nella seguente forma **"1.AL"**
- Use  and  keys to select desired alarm;
- Press  to return to **"LS"** label or press  key.  
The display will show in sequence the information in the following form:  
**StA (StArt), by15, bM03, bd17,bh14, bn20, Sto (Stop), Ey15, EM03, Ed17, Eh14, En45**  
they provide information about the date, starting and ending time alarm;
- If the alarm is still active, the display will show for 1 second:  
**StA (StArt), by15, bM03, bd17,bh14, bn20;**
- Press  key to exit.

To reset alarm history:

- Press  key for 4 seconds;
- The display will show **"PA"** text;
- Press  key;
- Use  key to insert the password<sup>4</sup>;
- Press  key. The first parameter appears;
- Press  and  key to scroll down the list until **"rLS"** parameter is reached;
- Press  key and use  key to set **"149"** value;
- Press  key, the display will flash "----" for 4 seconds after the device will exit the procedure;
- Press  key to return at main screen.

**NOTE** It is recommended to clear the alarm history when you change the parameters.

---

<sup>4</sup> Contact our company

## 5.16 LOW WATER TEMPERATURE



If it was not anticipated that the chiller unit offered was to produce water at temperatures close to 0°C//32°F, or below, you should contact our company.



To achieve temperatures that are negative, or near zero, it is necessary to use anti-freeze (ethylene glycol) in percentages that depend on the desired temperature; it is also necessary to change the calibration of the anti-freeze thermostat.



In case of RH and/or RA1 / RA2 / RA3 (HEATING or ANTI-FREEZE RESISTORS) option installed on the machine, check that the Chiller setpoint does not conflict with the one chosen for this option. Contact our Service Assistance to request instructions.

### 5.16.1 Changing the setting of the anti-freeze thermostat



**Warning!** Setting the chiller setpoint at least -2°C// -2K// -3,6°F from hot gas bypass valve setpoint (see par. **5.17.2 Regulation and changing setpoint of the hot gas bypass valve**).



**Attention!** Verify the minimum working temperature for each model (see chapter **7 Operating limits**). The working limits differ depending on the model.

For operating with low water temperature (under 5°C//41°F), it is recommended to set the electronic controller parameters as per the following table, in function of desired outlet water temperature.

Outlet water temperature [°C] Outlet water temperature [°F]		Unit	-3 [26,6]	0 [32]	2 [35,6]	5 [41]	7 [44,6]
<b>SP</b>	Chiller Setpoint	°C [°F]	-3 [26,6]	0 [32]	2 [35,6]	5 [41]	7 [44,6]
<b>r0</b>	Cooling temperature differential	°C [°F]	2 [3,6]	2 [3,6]	2 [3,6]	2 [3,6]	2 [3,6]
<b>r1</b>	Setpoint minimum limit	°C [°F]	-4 [24,8]	-1 [30,2]	1 [33,8]	4 [39,2]	6 [42,8]
<b>r3</b>	Minimum temperature compressor OFF	°C [°F]	-5 [23]	-2 [28,4]	0 [32]	3 [37,4]	5 [41]
<b>A1</b>	Ice alarm setpoint	°C [°F]	-7 [19,4]	-4 [24,8]	-2 [28,4]	0 [32]	4 [39,2]
	Percentage of ethylene glycol	%	25	20	15	15	0

\* Recommended choice

## 5.17 MECHANICAL HOT GAS BYPASS VALVE – VBM

### 5.17.1 Working mode – VBM

The mechanical valve of the hot gas bypass is used to adapt the evaporator capacity to the heat load. It is installed between the high and low pressure line of the refrigerant circuit and is designed to bring the hot refrigerant gas directly to the evaporator inlet port.

The mechanical bypass valve keeps constant the evaporation pressure and consequently, in an indirect way, regulates and stabilizes the water outlet temperature.

The factory setting of the bypass valve is such as to ensure a 15°C//59°F outlet water temperature at nominal working conditions, corresponding to an evaporation temperature of 10°C//50°C. Any other setting is customizable (see section **4.3.2 Regulation**).

### 5.17.2 Regulation – VBM

If you want to change the outlet water temperature from the refrigerator, you need to act on the screw present on the bypass valve head (use an 8 mm hex wrench).

To decrease the water temperature, counterclockwise rotate the valve screw, vice versa to increase the temperature. The table below shows the correspondence between the values of the desired outlet water temperature and numbers of spin respect to the factory setting.

Desired outlet water temperature	[°C//°F]	5//41	10//50	15//59	20//68
Corresponding evaporating temperature	[°C//°F]	0//32	5//41	10//50	15//59
Numbers of spin	[#]	4	2	0	2
Rotation direction		Counterclockwise		Clockwise	



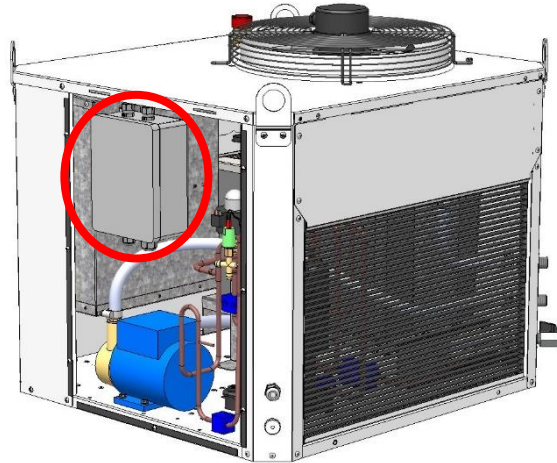
**Attention!** For each of the valve control variation, observe the trend of the temperature for a significant working time (for example a complete processing cycle of the system).



Note all changes made from the factory configuration, so they can be restored in case of need.

## 5.18 ELECTRONIC HOT GAS BYPASS VALVE – VBE

The electronic hot gas bypass valve is regulated by a stand-alone driver (see picture below).

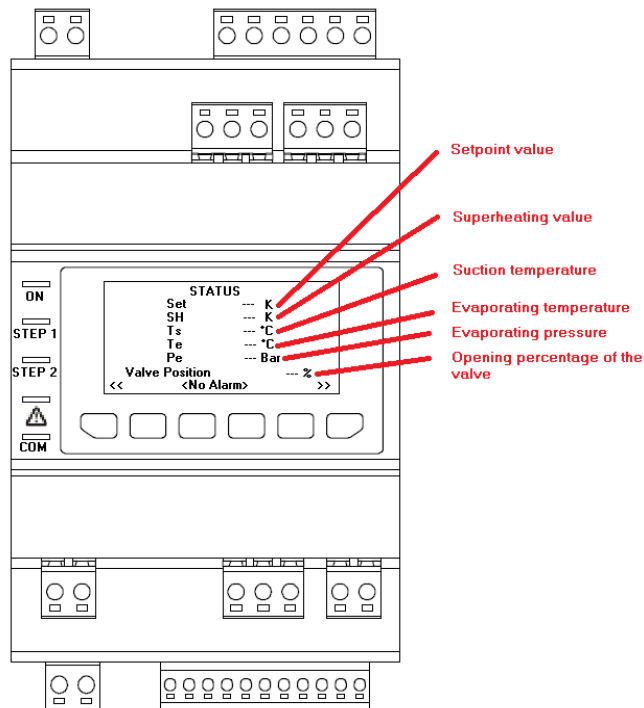


In case of valve and/or driver failure, the chiller continues to normally work.

### 5.18.1 Working mode – VBE

The electronic hot gas bypass valve regulates the refrigeration power of bypassing a suitable amount of heat directly to the evaporator refrigerant gas.

A temperature sensor on the water line in the output controls the hot gas bypass valve through the electronic controller and the valve driver.

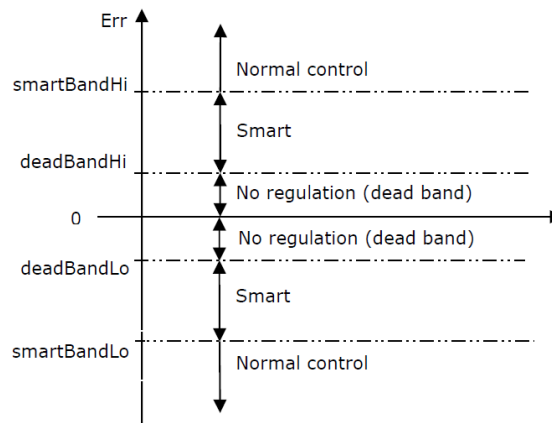


### 5.18.2 Regulation and changing setpoint – VBE

The electronic hot gas bypass valve is automatically adjusted by the driver as a function of the desired outlet water temperature.










The algorithm activates different type of regulation mode as a function of the working point:

- Positive error:
  - If the error is greater or equal to zero but lower than *deadBandHi*, there is no regulation;
  - If the error is greater of *deadBandHi* but lower than *smartBandHi*, the “Smart” algorithm is active;
  - On the other cases, the “Normal” control is active;
- Negative error:
  - If the error is lower than zero but greater than *deadBandLo*, there is no regulation;
  - If the error is lower than *deadBandLo* but grater than *smartBandLo*, the “Smart” algorithm is active;
  - On the other cases, the “Normal” control is active;




**Warning!** Setting the hot gas bypass valve setpoint at least +2°C//2K//3,6°F from chiller setpoint (see par. **5.4 Changing the chiller setpoint**).

If you wish to change the valve setpoint, use the following procedure:

- From the main screen press  for 3 seconds;
- Press  at **User** menu;
- Use  and  to reach the parameter **PB01**;
- Press  to select the value and use  and  to change the value;
- Press  to confirm the value;
- Press  to exit from the procedure.

### 5.18.3 Alarms and alarm history – VBE

It is possible to display the alarm history in this way:

- From the main screen press  one time;
- Choose the menu **“Alar”** or **“HiSt”** for display the active alarms or the alarm history respectively.

The last 100 active alarms are saved on the alarm history; further new alarms will overwrite the oldest ones.



The table below show the possible alarms:

Alarm	Description
<b>AL01</b>	Temperature probe
<b>AL02</b>	Pressure transducer
<b>AL03</b>	Discharge temperature probe
<b>AL04</b>	Superheat low
<b>AL05</b>	Superheat high
<b>AL06</b>	Low operating pressure
<b>AL07</b>	High operating pressure
<b>AL08</b>	Low pressure
<b>AL09</b>	High discharge pressure alarm

















The rearm is automatic so the alarm is automatically deactivated as soon as the alarm condition ceases and the driver restarts by itself.

#### 5.18.4 Changing the factory setting of the valve regulation – VBE

The factory setting of the regulation parameter of the hot gas bypass valve are:

Parameter	Description	Factory Setting
<b>PB02</b>	PID – Proportional band	5°C//9°F
<b>PB03</b>	PID – Integral time	120 s
<b>PB10</b>	Dead zone	0,2°C//0,3°F
<b>PB11</b>	Smart band	0,5°C//0,9°F

Follow this procedure for changing the parameters:

- From the main screen press  for 3 seconds;
- Press  at **Inst** menu;
- Press  at **IS-V** menu;
- Use  and  to reach the parameter **PSd3**;
- Press  to select the parameter and use  and  to insert the password<sup>5</sup>;
- Press  to confirm the value;
- Use  and  to scroll the parameter list and find the value on the table;
- Press  to select the parameter and use  and  to change the value
- Press  to confirm the value;
- Press  to exit from the procedure.

<sup>5</sup> Contact our company.

## SAFETY DEVICES

**CHILL-CUBE QBE** chillers have a series of safety devices that limit the machine's temperature and pressure values to ensure that it operates within the expected limits and to avoid dangerous situations.

Here is a list of dangerous situations, including the relative safety device and its location.

Dangerous situation	Safety device	Location	QBE 003÷007	QBE 008÷025
High condensation pressure	High-pressure switch	Compressor output pipe	✓	✓
Low evaporation pressure	Low-pressure switch	Compressor intake pipe	✓	✓
Low water flow-capacity	Water differential pressure switch	Plate evaporator	Opt.	✓
Low water temperature	Anti-freeze thermostat	Water exit from the evaporator	✓	✓
Frequent compressor start-ups	Anti-circulation timer	Electronic controller	✓	✓
Low water level in the tank	Water-level sensor	Tank	✓	✓

Legend: Opt.: optional

When they reach their calibration value, most of the security devices trigger an alarm managed by the electronic controller.



For some safety devices, once the cause of the alarm times out, the machine resumes operation automatically as soon as the reset value is reached. Others must be manually reset to restart the machine (also see paragraph 5.2.14). The following paragraph lists the characteristics of each safety device.

### 6.1 CALIBRATION OF THE SAFETY DEVICES AND REARM TYPE

Safety device	Intervention value	Reset value	Type of rearm	QBE 003÷007	QBE 008÷025
High-pressure gauge	30 barg//435 psi	23 barg//334 psi	Manual	✓	✓
Low-pressure gauge	2,5 barg//36 psi	4,2 barg//61 psi	Manual	✓	✓
Water differential pressure switch	85mbar//1,23psi	105mbar//1,53psi	Manual	Opt.	✓
Anti-freeze thermostat	4°C//39,2°F	8°C//46,4°F	Semiautom.	✓	✓
Water-level sensor	--	--	Semiautom.	✓	✓
Anti-circulation timer*	5 min.	--	--	✓	✓

\* This is a function of the electronic controller that prevents the same compressor from stopping and starting too frequently: at least 5 minutes must elapse between one compressor's power up and the next.

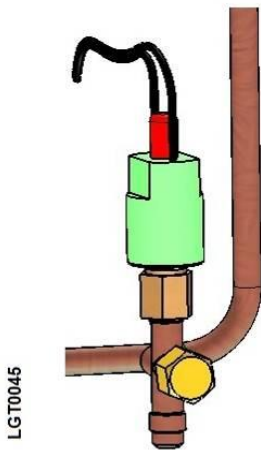
## 6.2 REARMING THE HIGH-PRESSURE SWITCH

The intervention of the high-pressure switch is the only case in which, in addition to manually rearming the electronic controller, it is also necessary to reset the pressure switch itself. The high-pressure pressure switch is located in the compressor compartment on the uninsulated copper pipe that goes from the compressors to the condensation coil; there is a manual-reset button on top of it.



**Warning!** The upper part of the compressor casing and discharge pipe are at a high temperature.  
Be especially careful when working in their vicinity.

This can only be rearmed when the pressure in the circuit has fallen below the reset value (see table **Calibration of the safety devices and type of rearm** in paragraph 7.1).



For this reason, when dealing with an intervention of the high-pressure switch, it is necessary to:

- A) Identify the cause of the rise in pressure (fan not working, condensation coil dirty or obstructed, obstacles to the flow of exiting air, operating temperature outside operating limits, etc. (also see Chapter **10 Troubleshooting**) and remove the cause, if possible;
- B) Wait until the high-pressure manometer falls below the reset value (see the table, "**Calibration of the safety devices and type of rearm**" in paragraph 7.1);
- C) Rearm the pressure switch by pressing the red button: if you do not hear a click, it is not rearmed;
- D) Then rearm the electronic controller (see paragraph **5.14 Resetting alarm**).

### **High pressure switch**



**Attention!** The high-pressure gauge stops the compressor while it keeps the condenser fan running to lower the pressure in the condenser.

## OPERATING LIMITS

### 7.1 OPERATING TEMPERATURES

The various units in the **CHILL-CUBE QBE** line guarantee several operating limits depending on the model and accessories provided. The graphs show the limits for continuous operation of the **CHILL-CUBE QBE** units, in relation to the temperature of the water exiting the machine and the temperature of the external air.



**Warning!** Without the crankcase heating resistor (RC) and a condensation control (CA / CE for **CHILL-CUBE 008÷025**) the minimum working ambient temperature is +10°C.



**Warning!** If the unit is equipped with RC option (crankcase heating resistor) make sure that the unit is powered at least 24H before every start-up, in order to ensure that compressor lubricant is heated.



**Warning!** In order not to reduce the condenser performances, the wind baffle kit (FWB) must be removed when the ambient temperature is  $\geq + 10^\circ\text{C}$

#### Legend



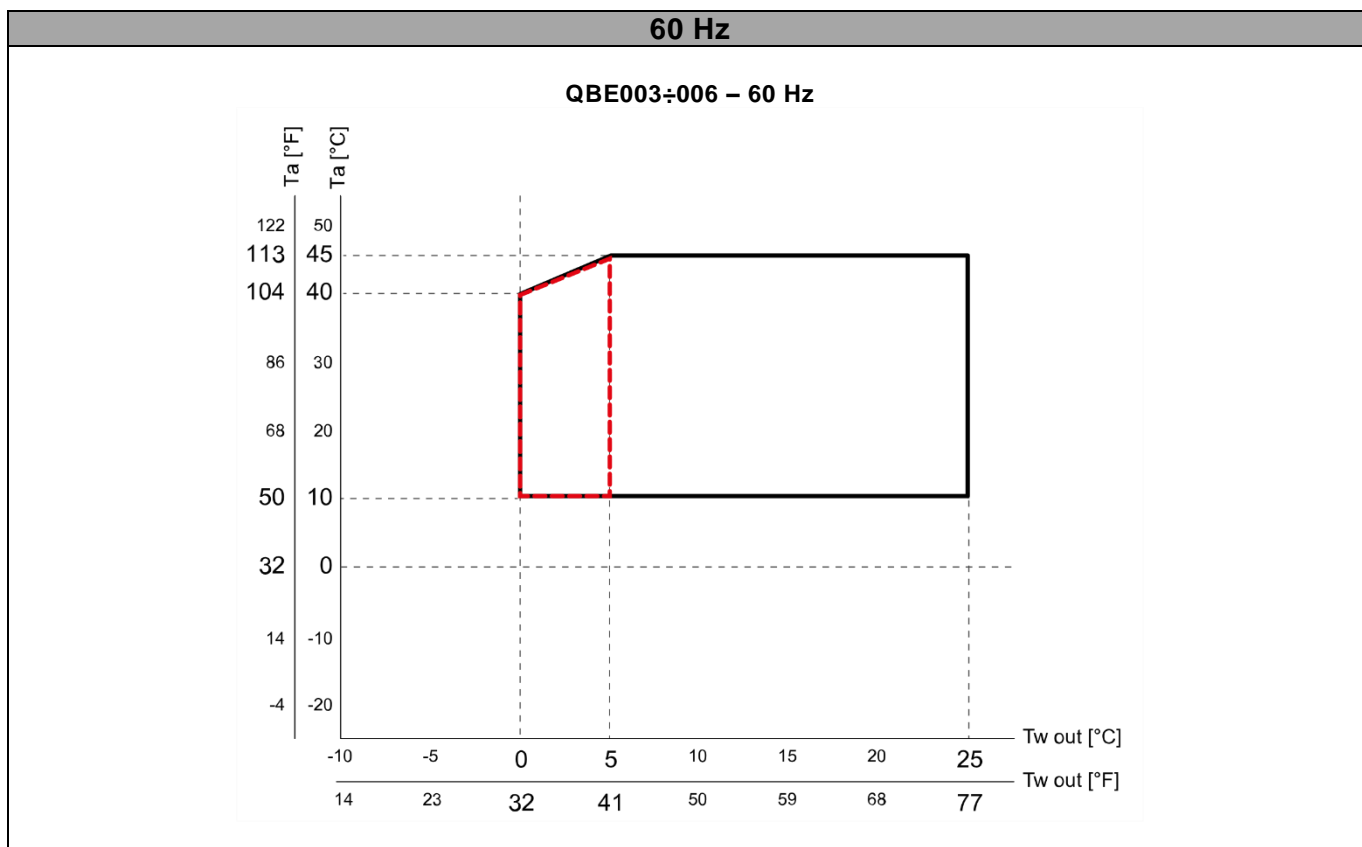
**Mandatory** ethylene glycol - please contact our company



**Mandatory** continuous fan(s) speed control - phase cut type (CA)

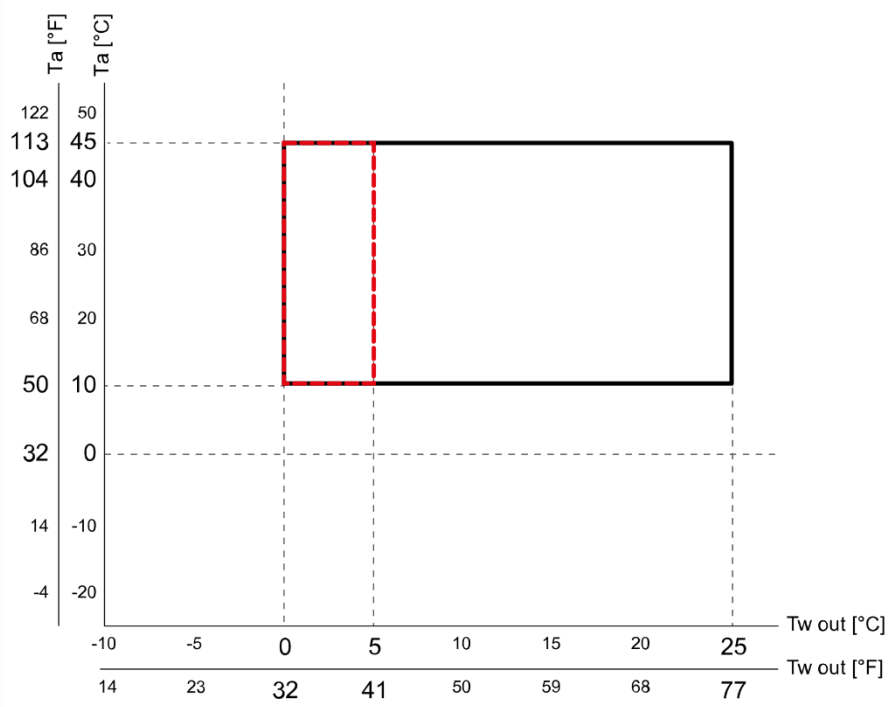


**Mandatory** continuous fan(s) speed control - electronic fan(s) (CE)

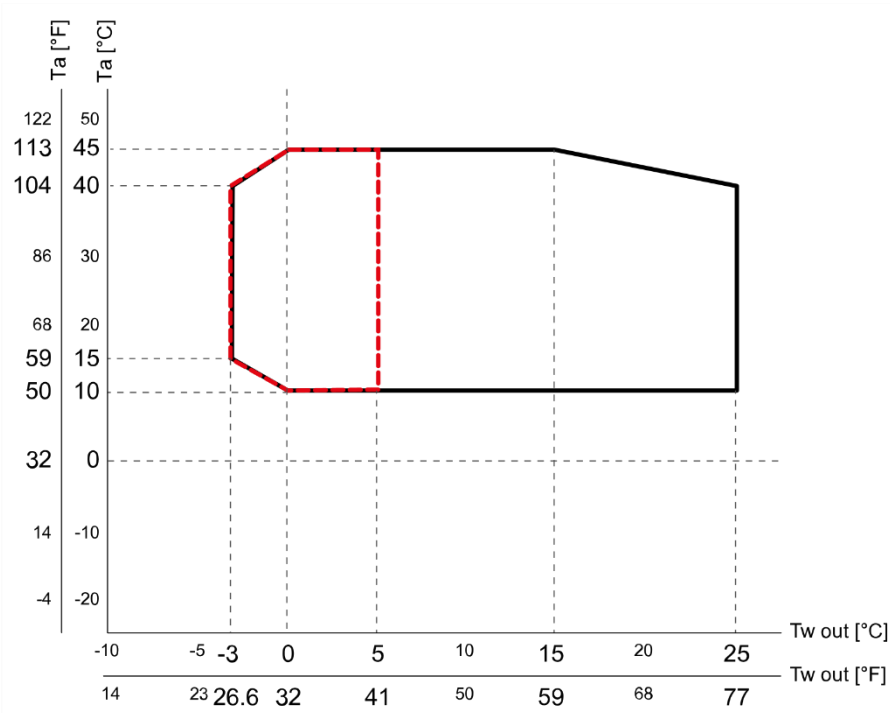


60 Hz

QBE 007 – 60 Hz

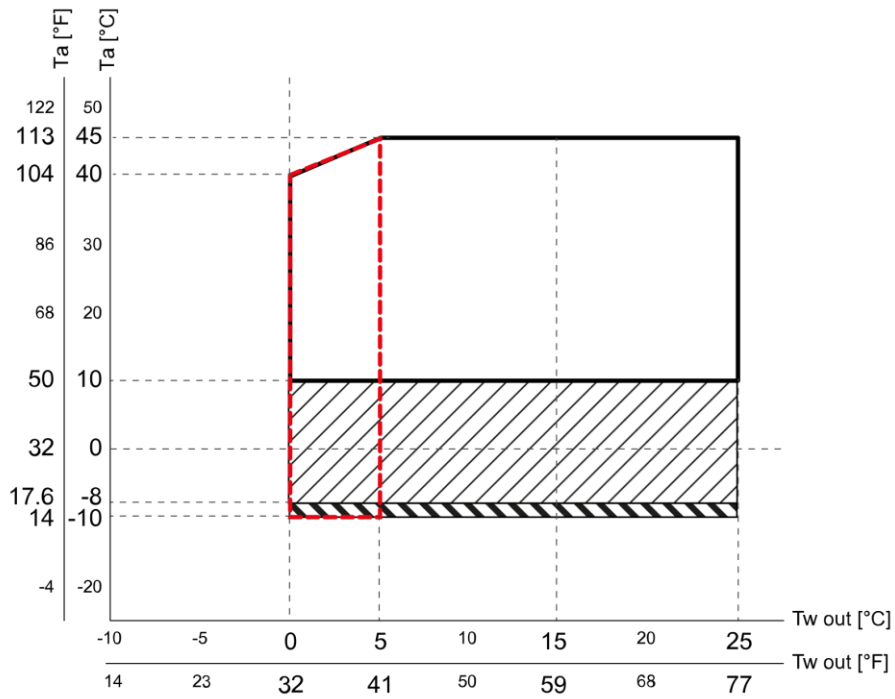


QBE 005÷007 3 PH – 60 Hz

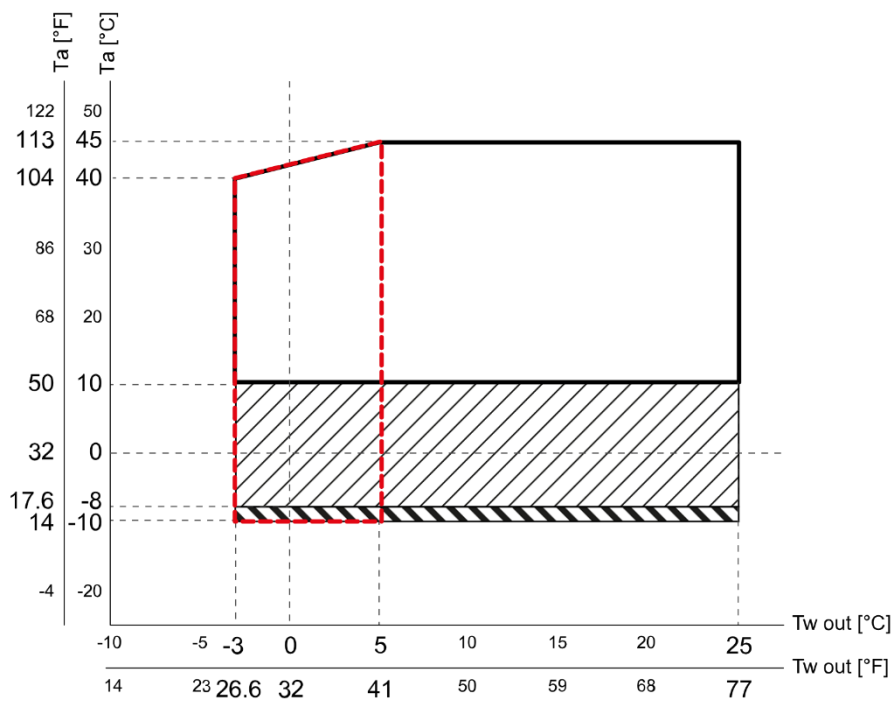


60 Hz

QBE 009÷012 – 60Hz



QBE 014÷025 – 60Hz



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## 7.2 MINIMUM WATER FLOW RATE


Operation with water flow rates lower than minimum limits could cause the anti-freeze thermostat to intervention and make it difficult to regulate water temperature.

CHILL-CUBE Model	Unit	QBE 003	QBE 004	QBE 005	QBE 006	QBE 007	QBE 008	QBE 009	QBE 012	QBE 014	QBE 020	QBE 025
Minimum water flow rate	[l/h]	200	300	350	450	500	600	600	1000	1000	1200	1200

## MAINTENANCE, INSPECTIONS AND PERIODIC CHECKS



To keep the machine running properly and providing the guaranteed performance required, it is necessary to make some periodic checks.

Operation	Frequency	Execution
Check that the temperature of the water produced is in the required interval	Daily	User
Check tank water level using level indicator – see section 3.4.2 - (only units with open water circuit)	Daily	
Check for the presence of any alarm signals	Daily	
Check the functioning of the fans	Monthly	
Check the pressure of the water circuit with the pump stopped (verify that it is about 1bar//15psi) [ONLY FOR PRESSURIZED WATER CIRCUIT OPTION]	Monthly	
Check that the temperature of the air is compatible with the operating limits of the machine	Monthly	
Check for any dirt on the exchanger plates inside (only QBE 008÷025) (see <b>paragraph 8.1</b> )	Yearly (1)	
Clean the air filters (only QBE 008÷025)	Monthly(1)	
Clean the condensing coil with a jet of compressed air	Annual (1)	
Clean the water filter	Monthly(2)	
Check that the refrigerant liquid sight glass is clear or, at most, with a few bubbles (check with the compressor running – only QBE 008÷025)	Every 6 months	Specialized personnel 
Check that the subcooling and superheating values are, respectively between 3÷5K//5,4÷9°F and 5÷7K//9÷12,6°F	Every 6 months	
Check for traces of oil on the pipes of the refrigerant circuit (symptom of refrigerant leaks)	Every 6 months	
Carry out the correct maintenance of the fluid loaded in the system (see <b>par.9.2</b> )	Yearly	
Check the tightness of the electrical terminals both inside the electrical panel and on the terminal strips of the compressors	Yearly	
Check the contacts of the contactors; if they show signs of deterioration, replace them	Yearly	
Check that the current absorbed by the machine is within the values on the identification plate	Every 6 months	

- (1) It may be necessary to carry this out more frequently in the case of particularly dirty environments.
- (2) We recommend an extraordinary cleaning of the filter after the machine has been operating for the first week.
- (3) It is not necessary to do this if the system has been charged with an anti-freeze solution (water and a suitable percentage of glycol) (see paragraph **3.4.4 Use of ethylene glycol as anti-freeze**).



**Attention!** Before carrying out any maintenance on the unit or accessing internal parts, make sure you have cut-off the electricity.



**Attention!** The upper part of the compressor housing and the output pipe are hot. Be especially careful when working near them.



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## 9.1 CLEANING THE PLATE EXCHANGER

The plate exchangers' mobility in the range **QBE 008-025** creates a self-cleaning effect. Dirt on the heat exchange surfaces is considerably reduced compared to traditional heat exchangers. This means that the plate heat exchanger can remain in operation for longer between cleaning.

It is advisable to **check for hydraulic pressure drops at least once a year**, comparing the previously recorded with the current value, to establish if the plate needs cleaning.

Recommendations for plate cleaning:

- Use high head centrifugal pumps with a maximum fluid temperature of 50°C;
- To remove biological material, grease, oil and other organic deposits from heat exchangers and connected equipment, use a strong caustic soda-based alkaline cleaning solution.



The cleaning liquid must comply with environmental regulations and be readily biodegradable. It must ensure that plates, gaskets or adhesives are undamaged. It can be used in combination with other additives to reduce foaming during the cleaning process.

The recommended basic concentration is one part cleaning solution to nine parts water. Start by adding water first and then the cleaner.

The pH level should never be less than 12 during the cleaning process. Add more cleaner to increase the pH level.

Questa procedura di pulizia è solo per lo scambiatore di calore. La pompa e gli altri componenti del circuito del fluido non sono compatibili con la soluzione detergente.

Estimated time for cleaning: 2 - 6 hours, depending on the deposits in the heat exchanger, size of the heat exchanger, cleaning temperature and cleaning liquid concentration.

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## 9.2 MAINTENANCE OF THE FLUID LOADED IN THE SYSTEM








For water circuits with non-pressurized (atmospheric or open) tank:


it is advisable to **annually replace the fluid** loaded in the system (water, glycol, chemical products or additives) and restore the parameters shown in the table in paragraphs **3.4.3 Water quality** and **3.4.4 Use of glycol as anti-freeze**.

For water circuits with pressurized tank:

it is advisable to **annually check** the properties of the fluid loaded in the system. The fluid must meet the parameters in table **3.4.3 Water quality** and **3.4.4 Use of glycol as anti-freeze**.




## TROUBLESHOOTING

Cause	Alarm or symptom	Solution	Execution
<b>1. The unit does not start</b>			
Contacts of the main differential switch are open	Electronic controller off	Close the contacts	User 
Unit's electrical panel cut-off switch is open	Electronic controller off	Close the contacts	User 
No consent from the water differential switch (only QBE VBM/VBE 003÷025)	<b>FL</b>	Check the functioning of the pump, bleed the system	User
Compressor timer active	The compressor icon on the display of the electronic controller is flashing	Wait (5 mins at the most)	User
No consent from the service thermostat	System water at temperature (see display)	Apply a thermal load to the machine or lower the set point	User
No consent from the antifreeze thermostat	<b>AL</b>	Reset a temperature of the water (set point) compatible with the calibration of the antifreeze thermostat (see par. 5.2.15)	User
Service and anti-freeze probe defective	<b>Pr1/Pr2</b>	Check contacts and replace, if necessary	Specialized personnel 
Intervention of the main differential switch	Electronic controller off	Look for current leakage inside the machine	Specialized personnel 
<b>2. The compressor does not start</b>			
Intervention of the thermal protection inside the compressor	The contactor of the compressor is on but the compressor is stopped	Wait for cooling: check that the compressor is working under normal conditions. Check for insufficient refrigerant in the circuit (see point 6).	Specialized personnel 
Contactor of the compressor off (only QBE VBM/VBE 003÷025)	The compressor icon is on but the compressor is stopped	Check the voltage at the coil of the contactor of the compressor and the continuity of the coil itself	Specialized personnel 
Intervention of the phase sequence relay (only QBE VBM/VBE 008÷025 three phase power input models)	<b>HPLP</b>	Reverse the two phases upstream from the cut-off switch of the unit's electrical panel (see par. 4.2.3)	Specialized personnel 



Cause	Alarm or symptom	Solution	Execution
Intervention of the thermal protection inside the compressor OR magnetothermic protection of the compressor open (QC1)	<b>HPLP</b>	Look for short circuits in the motor windings of the compressors. Check for possible over-absorption of current due to too low voltage; near the limit conditions: check the power supply voltage and operating conditions.	Specialized personnel 

Cause	Alarm or symptom	Solution	Execution
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### 3. Intervention of the high pressure switch







Condenser obstructed or insufficient air flow-capacity	<b>HPLP</b>	Remove dirt from the condenser and any obstacles to the flow of air. Wait for the pressure to drop below the reset value, then rearm the high-pressure pressure switch by pressing the button on top of it (see figure in paragraph 7.2).	User
The unit has operated outside its operating limits (such as air or water too hot)	<b>HPLP</b>	If possible, restore conditions that are compatible with the operating limits. Reset the high pressure switch (paragraph 7.2).	User
Fan not working	<b>HPLP</b>	See point 7	
Excessive refrigerant charge	High subcooling (greater than 10K/18°F)	Drain excess refrigerant	Specialized personnel 
Presence of air or incondensable gas in the refrigerant circuit	Presence of bubbles on the flow peep hole, also with subcooling values greater than 5K/9°F	Drain the circuit, create vacuum and recharge	Specialized personnel 
Refrigerant filter clogged or thermostatic valve stuck	Pipe downstream from the component covered with frost	Check and replace	Specialized personnel 

### 4. Intervention of the water differential pressure switch

Water circulation pump blocked or defective (QBE 003÷025)	<b>FL</b>	Unlock or replace the pump	Specialized personnel 
Circulation pump stopped	<b>FL</b>	Check the voltage at the coil of the contactor of the pump and the continuity of the coil itself	Specialized personnel 

### 5. Intervention of the low pressure switch

Refrigerant filter clogged or thermostatic valve stuck	Pipe downstream from the component covered with frost <b>HPLP</b>	Check and replace	Specialized personnel 
Insufficient refrigerant charge	<b>HPLP</b>	See point 8	

Cause	Alarm or symptom	Solution	Execution
<b>6. Compressor intake pipe covered with frost</b>			
No refrigerant	High overheating, low undercooling and high output temperature of the compressor. Traces of oil on the refrigerant circuit.	Check the chiller circuit with a leak detector. Repair any ruptures and recharge the circuit.	Specialized personnel 
<b>7. Fan does not start</b>			
Very low outside air temperatures and consequent intervention of the condensation control	Fan icon off. Condensation pressure normal	The machine can working anyway	
No voltage output from the fan-speed regulator (only QBE VBM/VBE 008-025 with optional condensation control)	Fan icon on and fans stopped	Check the voltage output from the regulator and replace, if necessary	Specialized personnel 
Electrical connections of the fan loose	Fan icon on and fans stopped (only QBE008-025)	Check and tighten	Specialized personnel 
Intervention of the thermal protection inside the fan OR magnetothermic protection of the fan open (QV1 )	<b>HPLP</b>	Check that the working conditions of the machine (outside air temperature) are compatible with the operating limits. Wait for the fan motor to cool	User
<b>8. The unit is working without ever stopping</b>			
Excessive thermal load		Reduce the thermal load. Reduce the temperature of the incoming water and/or the flow-capacity of the exit tap of the unit a little.	User
No refrigerant		See point 6	
<b>9. The pump doesn't start. Magnetothermic protection of the pump open.</b>			
Excessive water flow capacity; the pump is absorbing too much current. Intervention of the thermal protection inside the fan OR magnetothermic protection of the fan open (QP1)	<b>HPLP</b>	Reduce the flow capacity of the water by closing the output tap of the pump a little bit. Rearm the thermomagnetic protection of pump QP1.	User 
Short circuit or overcurrent	<b>HPLP</b>	Look for a short circuit in the winding of the pump motor. Check for possible over-absorption of current due to too low voltage; check the power supply voltage.	Specialized personnel 
<b>10. The unit stops and starts repeatedly; water temperature changes suddenly</b>			
Insufficient water flow rate		Check water flow rate (see section 8.2). Open the system tap fully. If possible reduce system feed leaks. If possible add a pump in series with suitable head.	Specialized personnel 

## DISMANTLING THE CHILLER



If the chiller is being dismantled, you must separate it into parts of homogeneous material.

The following table lists the main materials of the various components of the machine.

Part	Material
Refrigerant fluid	R407C, Oil
Panelling and supports	Carbon steel, epoxy paint
Chiller compressor	Steel, Copper, Aluminium, Oil
Plate exchanger (evaporator QBE008÷025)	Steel, Copper
Coaxial exchanger (evaporator QBE002÷007)	Copper
Condenser	Aluminium, Carbon Steel
Pipes	Copper
Fan	Aluminium, Copper, Steel
Valves	Steel, Bronze
Insulation	Synthetic rubber without CFC, EPS, Polyurethane
Pump	Steel, Copper
Tank	ABS, PVC
Electrical wires	Copper, PVC
Electrical parts	PVC, Copper, Bronze

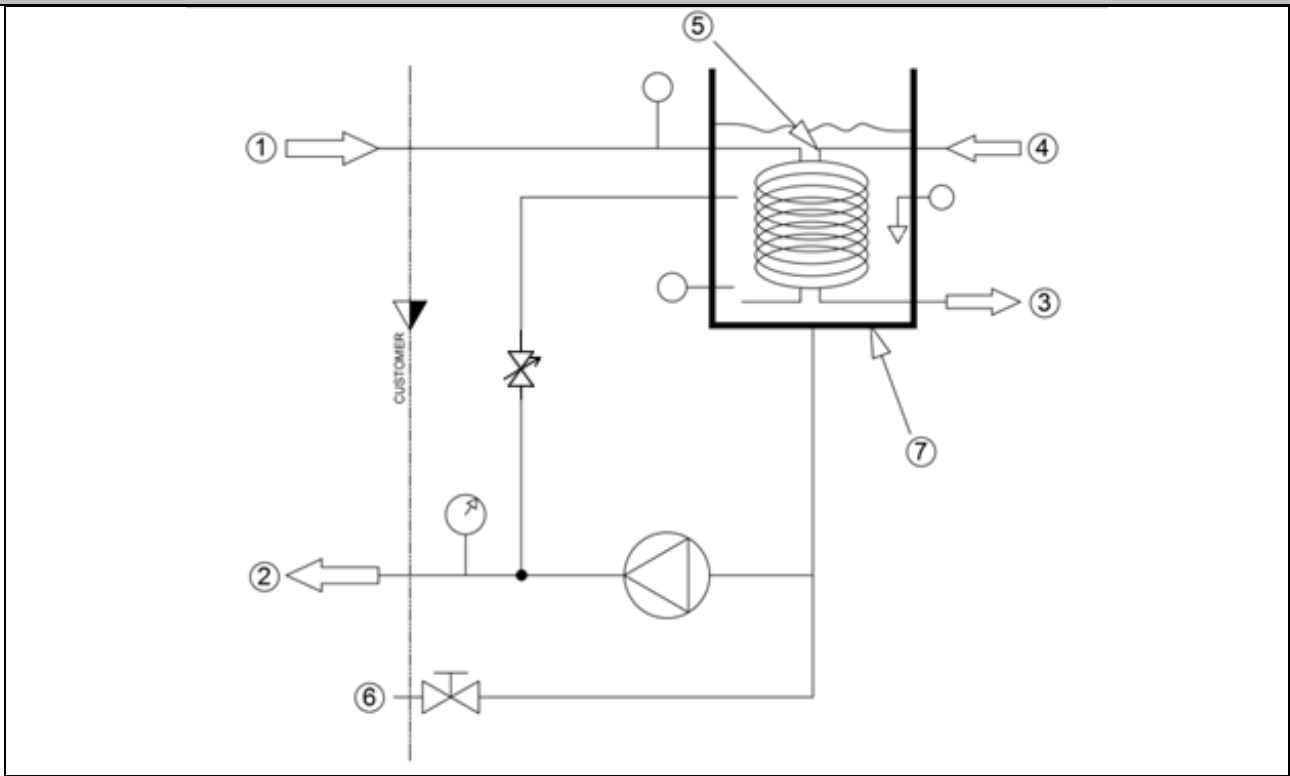
We recommend that you follow current safety norms for the disposal of each single material. The refrigerant contains particles of lubrication oil from the chiller compressor.



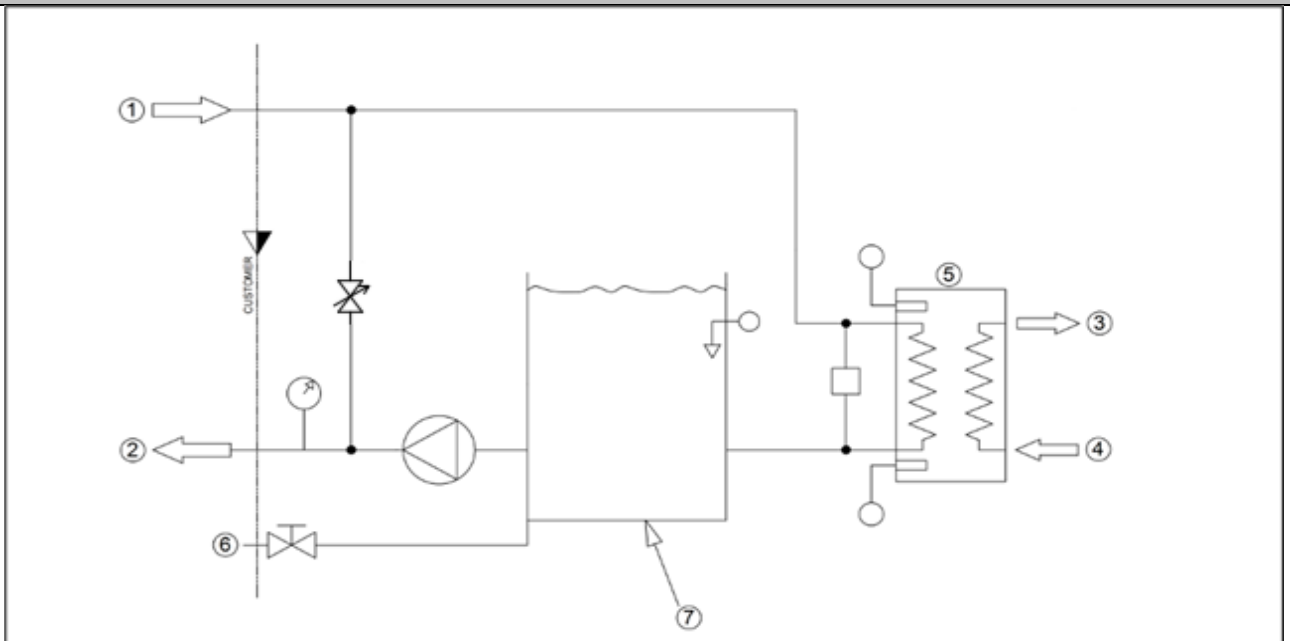
Dispose of refrigerant properly. Remove it from the chiller with suitable tools and deliver it to authorized collection centres that will treat it and make it reusable.

## HYDRAULIC CIRCUIT DIAGRAM

QBE 003÷007 STANDARD

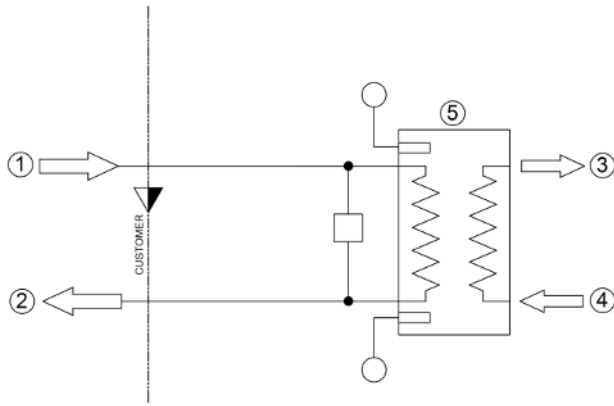


QBE 008÷025 STANDARD

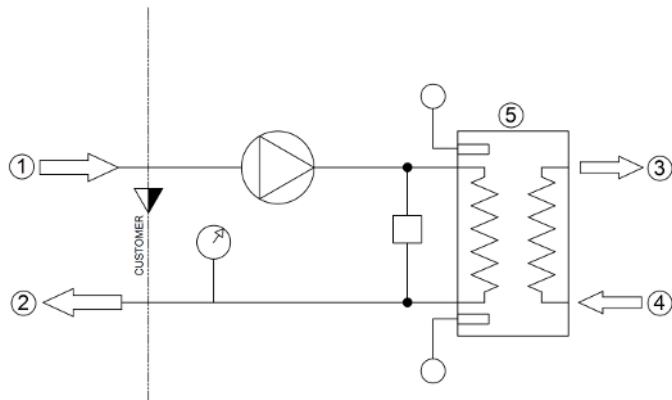


## 11.1 OPTIONAL VERSION

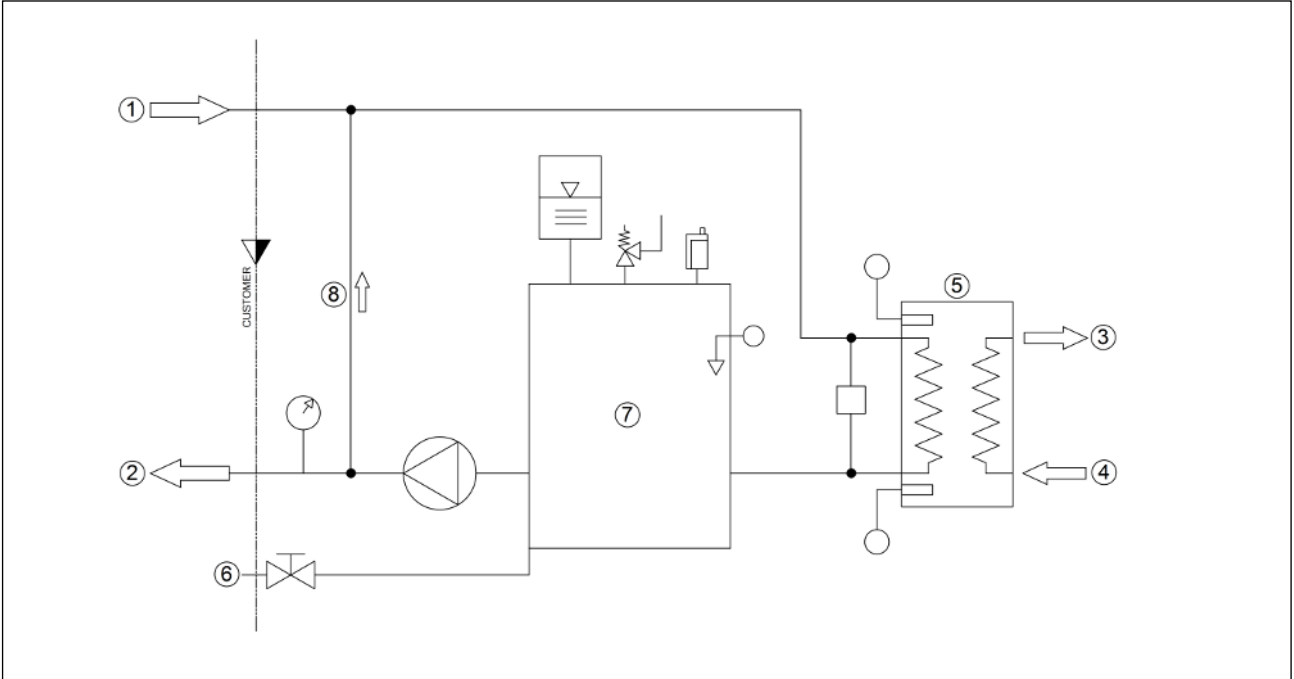
### QBE 003-025 PLATE HEAT EXCHANGER (EXP P0 T0)



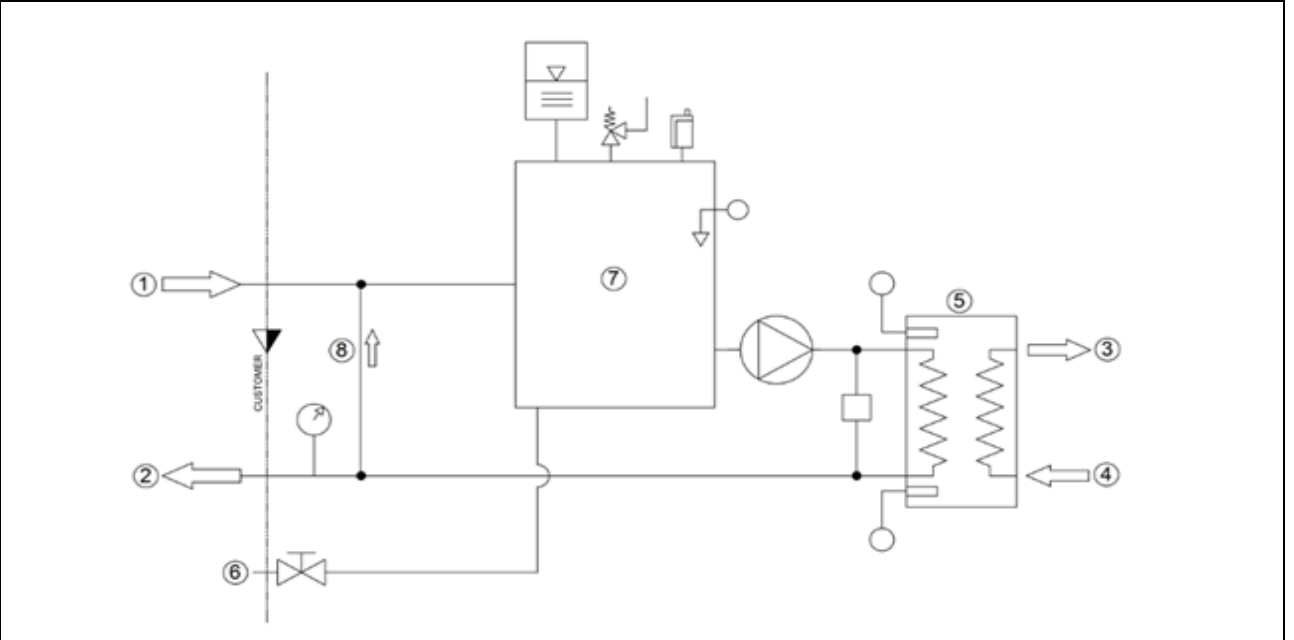
### QBE 003-025 PLATE HEAT EXCHANGER AND PUMP (T0 EXP + P2/P3/P5)



**QBE 003÷025 PLATE HEAT EXCHANGER, COLD PRESS. TANK AND PUMP  
(TP EXP + P2/P3/P5)**

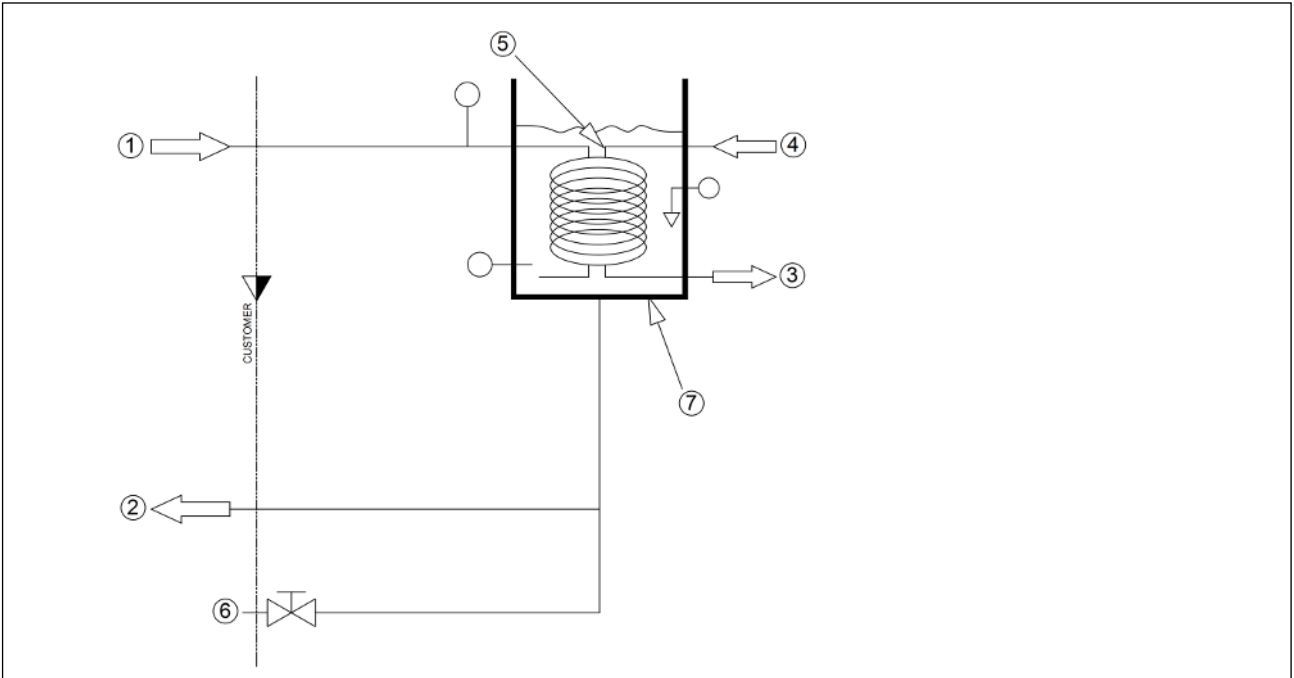


**QBE 003÷025 PLATE HEAT EXCHANGER, WARM PRESS. TANK AND PUMP  
(TP EXP + P2/P3/P5)**

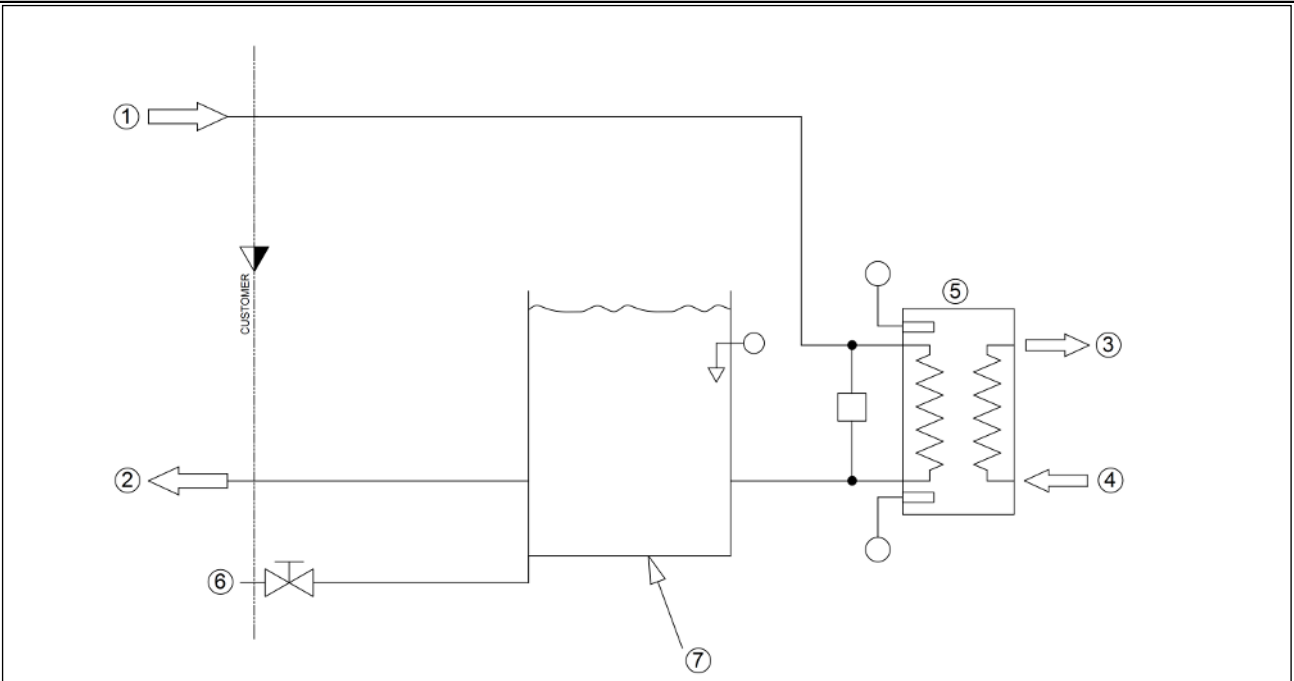




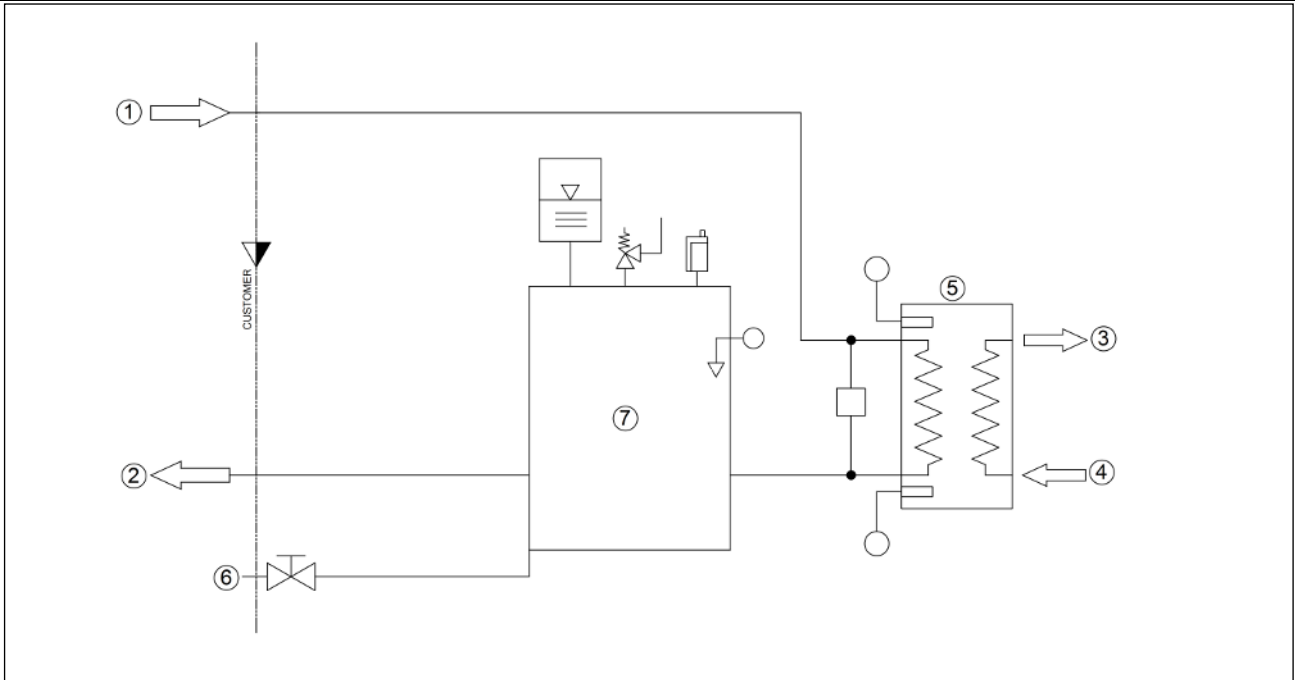
**QBE 002÷007 OPEN TANK NO PUMP (P0)**



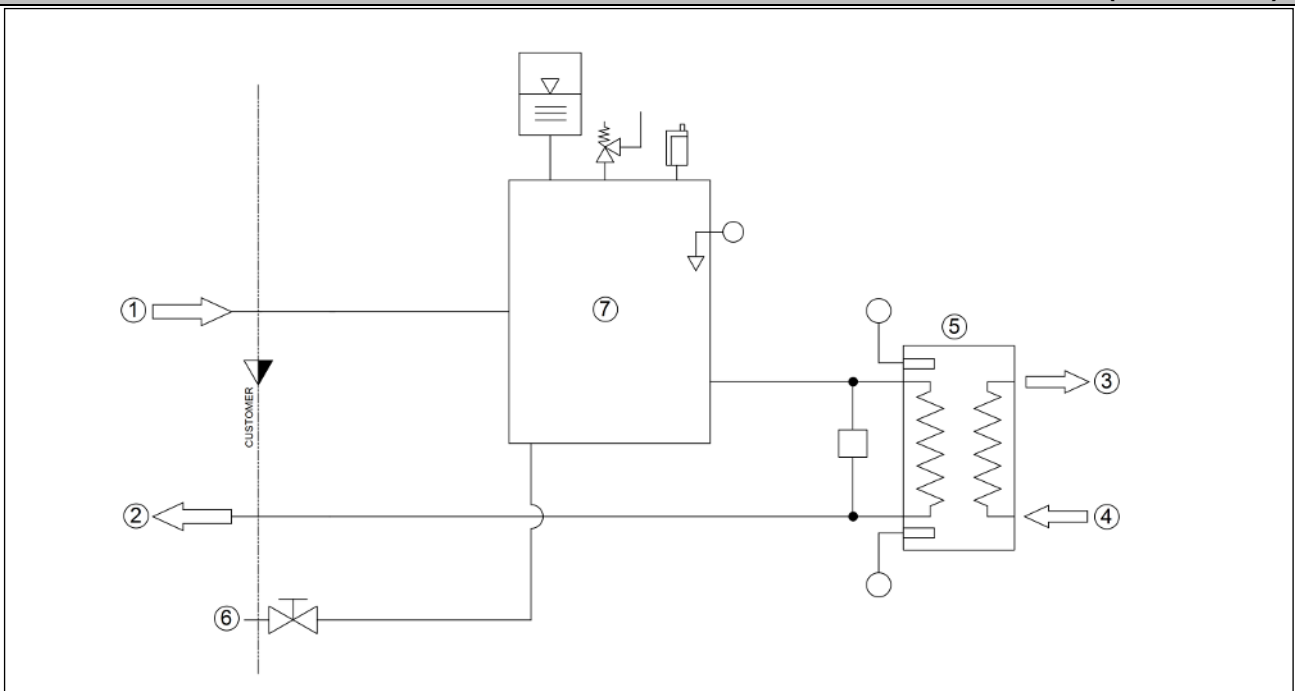
**QBE 008÷025 OPEN TANK NO PUMP (P0)**


















**QBE 003÷025 PLATE HEAT EXCHANGER, COLD PRESS. TANK, NO PUMP (TP EXP P0)**



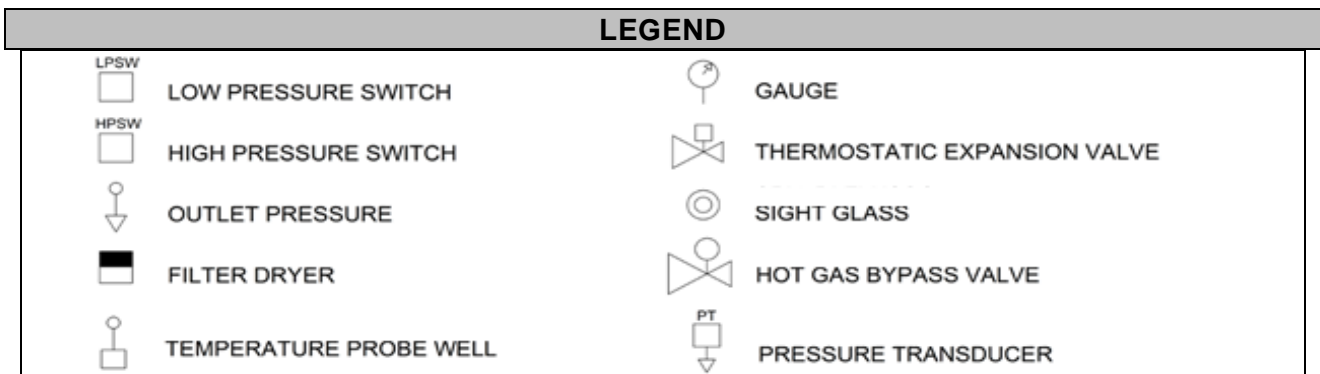
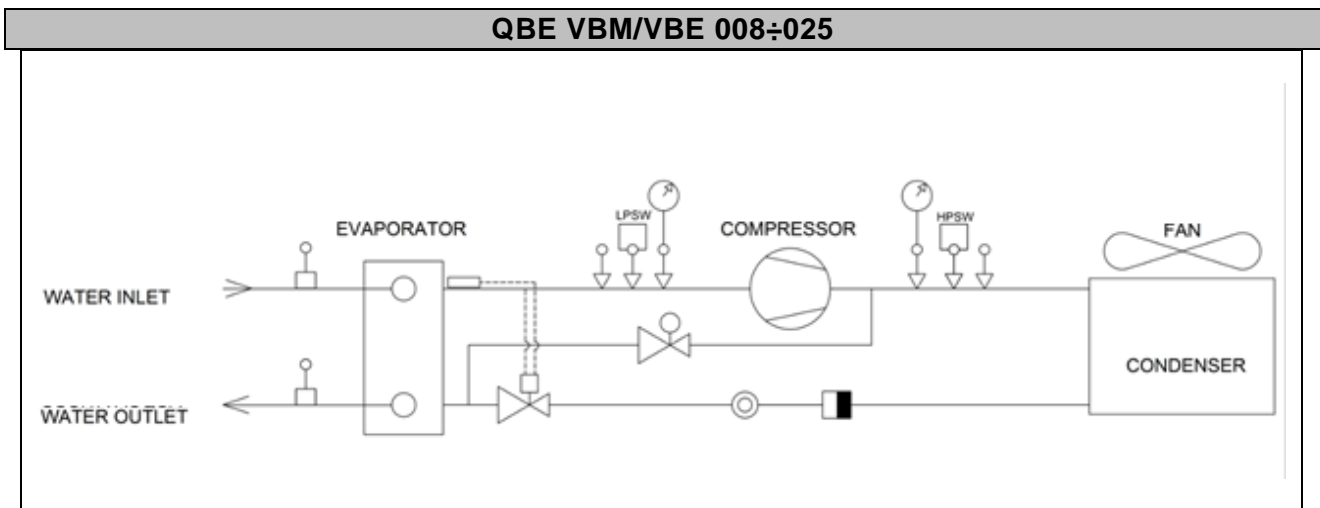
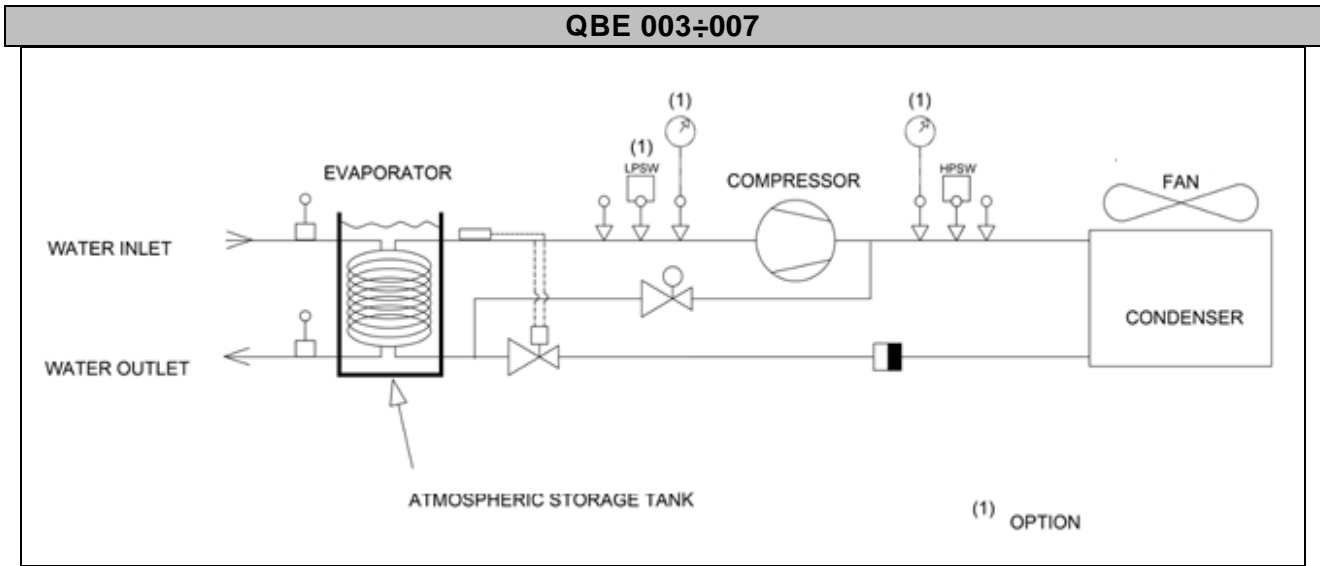
**QBE 003÷025 PLATE HEAT EXCHANGER, WARM PRESS. TANK, NO PUMP (TP EXP P0)**



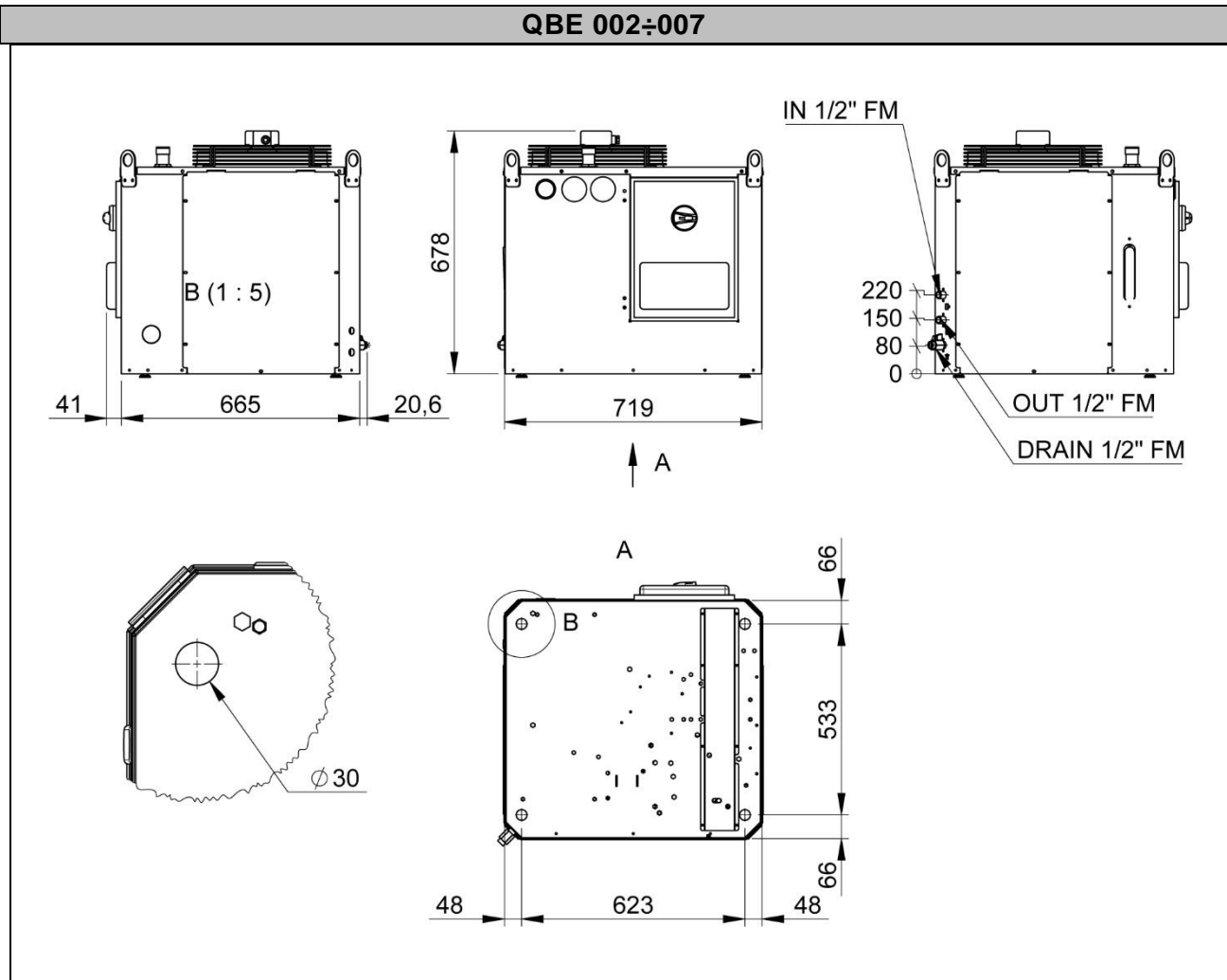
## LEGEND

	GAUGE		TEMPERATURE PROBE	①	WATER INLET
	CHECK VALVE		DIFFERENTIAL PRESSURE SWITCH	②	WATER OUTLET
	SAFETY VALVE		PUMP	③	REFRIGERANT OUTLET
	EXPANSION VESSEL		RELIEF VALVE	④	REFRIGERANT INLET
	DRAIN TAP		LEVEL SENSOR	⑤	EVAPORATOR
	SHUT OFF VALVE		THERMOMETER	⑥	DRAIN
	FILTER (SUPPLIED WITH THE UNIT)		PLANT DISCHARGE	⑦	STORAGE TANK
			REGULABLE WATER BYPASS		

## REFRIGERATION CYCLE DIAGRAM

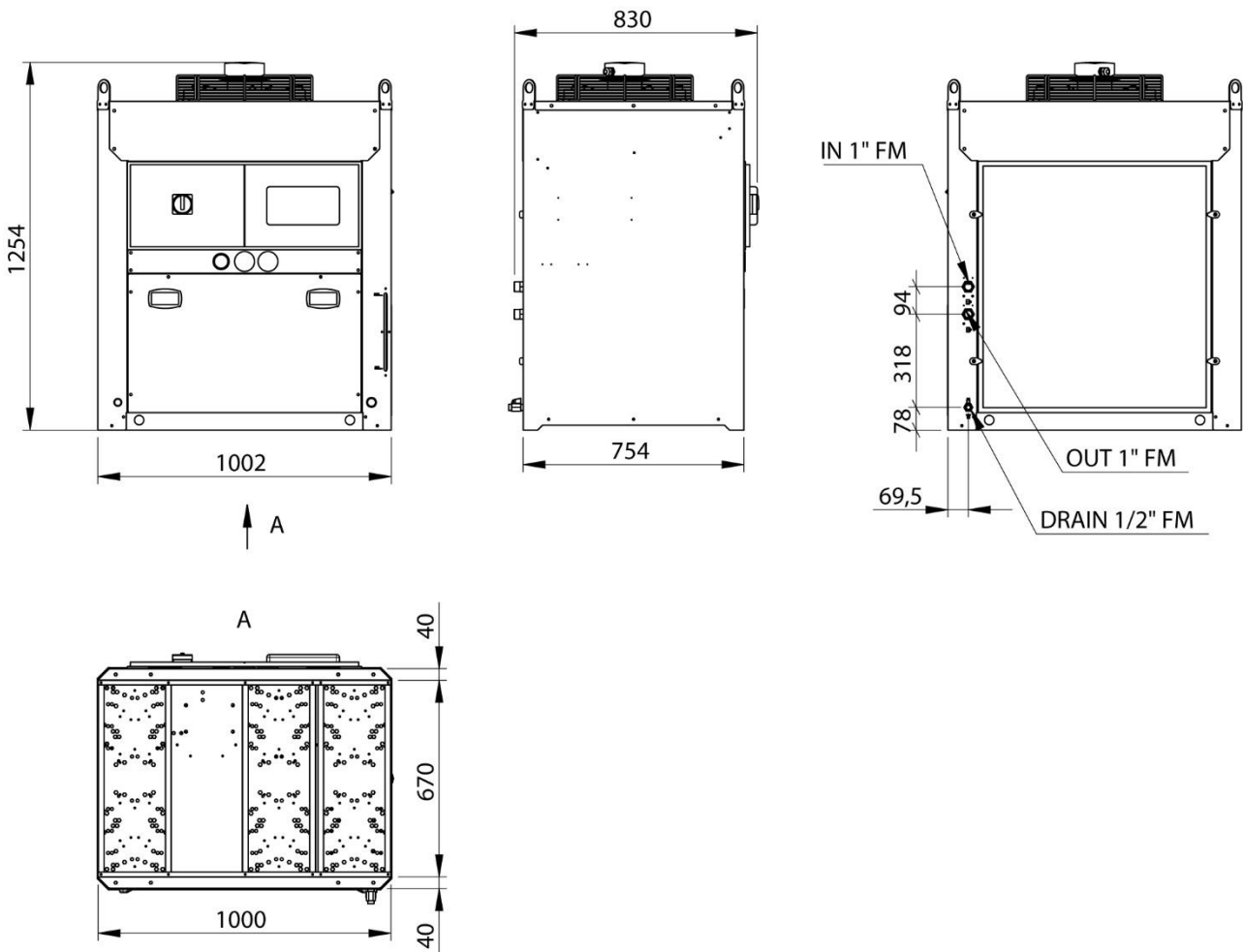


## DIMENSIONAL DRAWINGS & MASSES



Model	Mass [kg / lb]	
	STD Standard Configuration	MAX Maximum configuration
<b>QBE 002</b>	67 / 147.8	68 / 149.9
<b>QBE 003</b>	68 / 149.9	83 / 183.0
<b>QBE 004</b>	68 / 149.9	83 / 183.0
<b>QBE 005</b>	73 / 160.9	88 / 183.0
<b>QBE 006</b>	73 / 160.9	88 / 183.0
<b>QBE 007</b>	81 / 178.6	96 / 211.6
<b>QBE 005 3PH</b>	86 / 189.6	100 / 220.5
<b>QBE 006 3PH</b>	86 / 189.6	100 / 220.5
<b>QBE 007 3PH</b>	90 / 198.4	104 / 229.3

**QBE 008-025**



Model	Mass [kg / lb]	
	STD Standard Configuration	MAX Maximum configuration
QBE 008	165 / 363.8	195 / 429.9
QBE 009	168 / 370.4	198 / 436.5
QBE 012	169 / 372.6	199 / 438.7
QBE 014	181 / 399.0	205 / 452.0
QBE 020	187 / 412.3	211 / 465.2
QBE 025	187 / 412.3	211 / 465.2

**NOTES:**

- The masses refer to the standard (STD.) or maximum (MAX.) configuration of the unit.
- For QBE002-025 60 Hz version water fittings are NPT FF type.

## ELECTRICAL DIAGRAMS ABBREVIATIONS

List of electrical descriptions present into the diagrams on the unit.

Abbreviation	Description
<b>CD</b>	Condensing control - ON/OFF - Steps
<b>CA</b>	Condensing control - cut-phase regulator
<b>CE</b>	Condensing control - EC fans
<b>EBS</b>	230V socket inside electrical control panel
<b>RS</b>	Electrical control panel anticondensation heater
<b>RA1</b>	Evaporator antifreeze heater
<b>RA2</b>	Evaporator and pump antifreeze heater
<b>RA3</b>	Evaporator, pump and tank antifreeze heater
<b>RH</b>	Heating element
<b>RC</b>	Compressor crankcase heater
<b>VQ</b>	Electrical control panel forced ventilation
<b>EBC</b>	Electrical control panel cooler
<b>P2</b>	Single pump P2
<b>P3</b>	Single pump P3
<b>P5</b>	Single pump P5
<b>D2</b>	Double pump P2
<b>D3</b>	Double pump P3
<b>D5</b>	Double pump P5
<b>X2</b>	Disconnecter with P2 pump
<b>X3</b>	Disconnecter with P3 pump
<b>X5</b>	Disconnecter with P5 pump
<b>ER</b>	Remote control panel
<b>W1</b>	Double water setpoint
<b>FSC</b>	External flow switch arrangement
<b>REP</b>	External pump arrangement signal
<b>LSM</b>	Water level sensor
<b>VE</b>	Electronic thermostatic valve
<b>VBE</b>	Electronics hot gas bypass valve
<b>VL</b>	Liquid refrigerant solenoid valve
<b>ENB</b>	Netbiter Gateway
<b>SFS</b>	Compressor softstarter
<b>SFSP</b>	Pump softstarter
<b>SRP</b>	Electronic controller sun/rain protection



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