PURESTREAM
MINI-CUBE
BY FRIULAIR™

WATER CHILLER
Model: MINI-CUBE QBS
Use and Maintenance Manual

Editions Record

Code	Revision	Edition	Changes
7425MUM750	05	04/2023	

Original instructions: **ITALIAN**
EN Translation of the original instructions

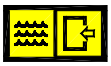
Dear Customer,
Thank you for the trust you have placed in us. Please read this manual carefully to obtain the best performance from our product.
In order to avoid incorrect operating conditions and danger for the operators, it is essential that you follow the directions meticulously as well as the current accident-prevention laws in the country of use.
Each **QBS** chiller is rigorously tested before being packed.
This verifies that there are no manufacturing defects and that the machine performs correctly the functions for which it was designed.
This manual must be kept for future reference and is an integral part of the chiller you have purchased.
Due to continuous technical development, we reserve the right to make the necessary modifications without any obligation to give advance notice.
Do not hesitate to contact us if you have any problems or need more information.
The product identification plate, located on the side of the chiller, contains all essential information about the machine.
You will have to give this data to the manufacturer, or reseller, whenever you request information, replacement parts, etc., during the warranty period.
Removing or tampering with the identification plate will void the warranty.

Warranty conditions:
The warranty is valid for 12 months from the machine being powered-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 replaced free of charge. This does not include transport costs, travel, labour, room 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.

CONTENTS

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.
NOTE	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;
- The chiller and its packing materials are recyclable.

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 MINI-CUBE QBS chillers contain R134A refrigerant.
Operations on the cooling circuit must only be performed by specialist personnel with suitable equipment.

Any modifications to the machine or related operating parameters not previously verified and authorized 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

MINI-CUBE QBS units are packaged air-cooled 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 7). 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 chapters that follow.

1.4 INSTRUCTIONS FOR USING 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 subjected 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.

2

OPERATION AND MAIN COMPONENTS

2.1 REFRIGERANT CIRCUIT

MINI-CUBE QBS chillers use a vapour-compression cycle in a refrigerant circuit that essentially consists of the following components: evaporator, compressor, condenser, lamination device (capillary tube).

Evaporator: heat exchanger (tube and fins) 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: tube and fins exchanger to enable heat exchange between the refrigerant and the air; it creates refrigerant gas condensation 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.

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.

2.2 WATER CIRCUIT

The water circuit mainly consists of a pump, evaporator, tank.
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 (see ***Water diagram*** section 11).
All **MINI-CUBE QBS** units have an open circuit with a tank at atmospheric pressure.
See chapter ***11 Water diagram***.

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.
MINI-CUBE QBS chillers are equipped with axial fans and have internal heat protection for the motor windings.

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.

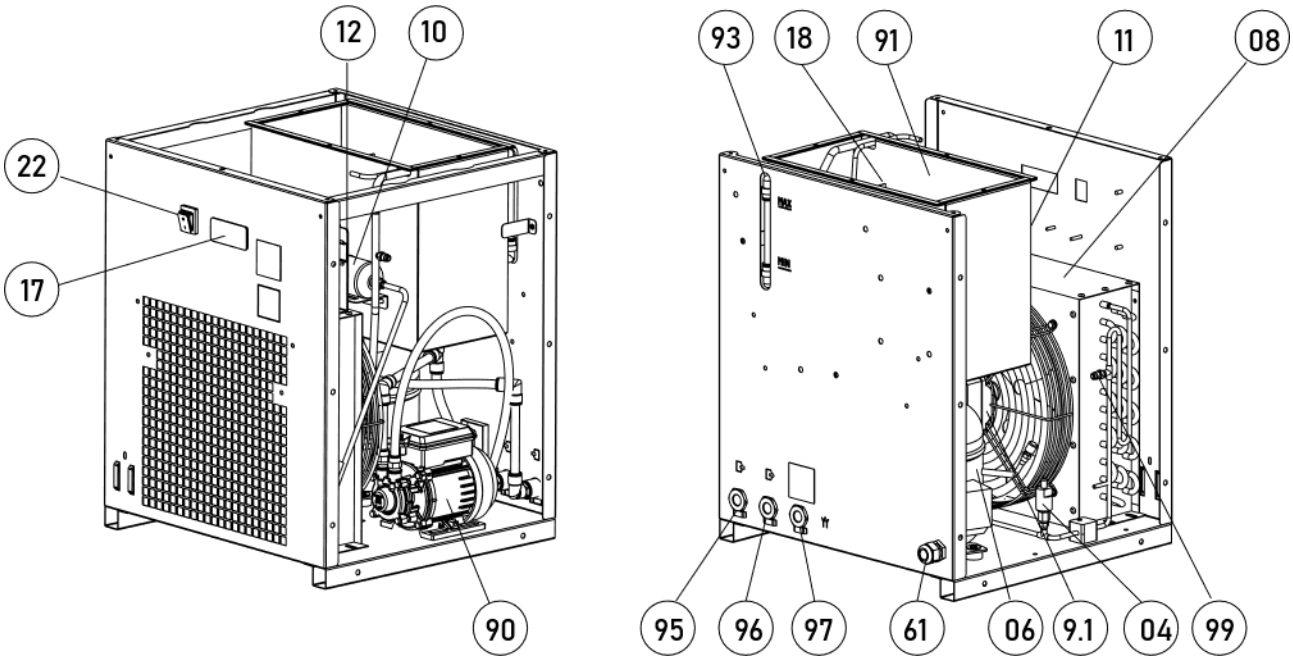
2.5 CONTROL OF THE WATER TEMPERATURE

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 5.3).

2.6 PROTECTING 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 ***6 Safety Devices***).

2.7 MINI-CUBE QBS UNITS: IDENTIFICATION OF THE MAIN COMPONENTS



04 High pressure switch
06 Compressor
08 Condenser
9.1 Fan
10 Refrigerant filter
11 Capillary tube
12 Temperature probe
17 Electronic controller
18 Evaporator
22 Disconnector switch
61 Power input
90 Pump
91 Tank
93 Level indicator
95 Water input
96 Water output
97 Drain
99 Pressure plug

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	PART QUANTITY FOR QBS MODEL			
		001 STANDARD	002 STANDARD	001 EAA OPTION	002 EAA OPTION
4	HIGH PRESSURE SWITCH	1	1	1	1
6	COMPRESSOR	1	1	1	1
8	CONDENSER	1	1	1	1
9.1	FAN MOTOR	1	1	1	1
9.2	FAN BLADE	1	1	1	1
9.3	FAN GRID	1	1	1	1
10	REFRIGERANT FILTER	1	1	1	1
12	TEMPERATURE PROBE	2	2	2	2
17	COMPLETE ELECTRONIC CONTROLLER	1	1	1	1
18	EVAPORATOR	1	1	1	1
22	DISCONNECTOR SWITCH	1	1	1	1
90	WATER PUMP	1	1	1	1
91	WATER TANK	1	1	1	1

3

INSTALLATION

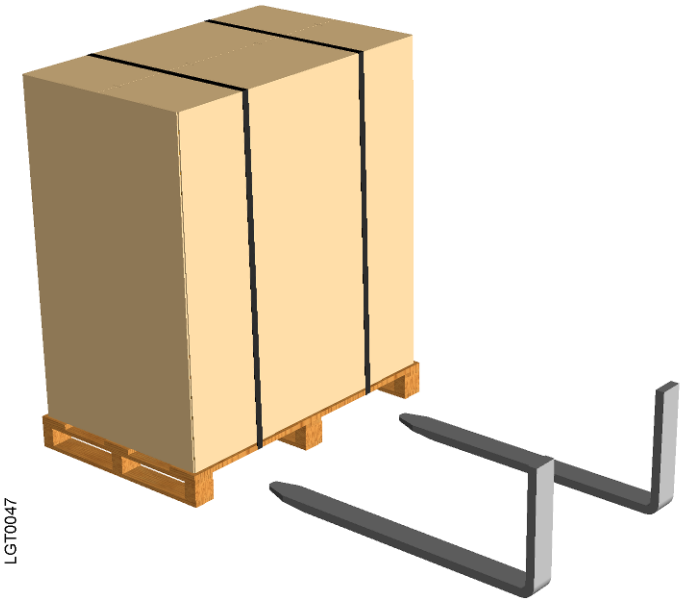
3.1 TRANSPORT

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 **MINI-CUBE QBS 001÷002** models are suitable for indoor installation only.

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

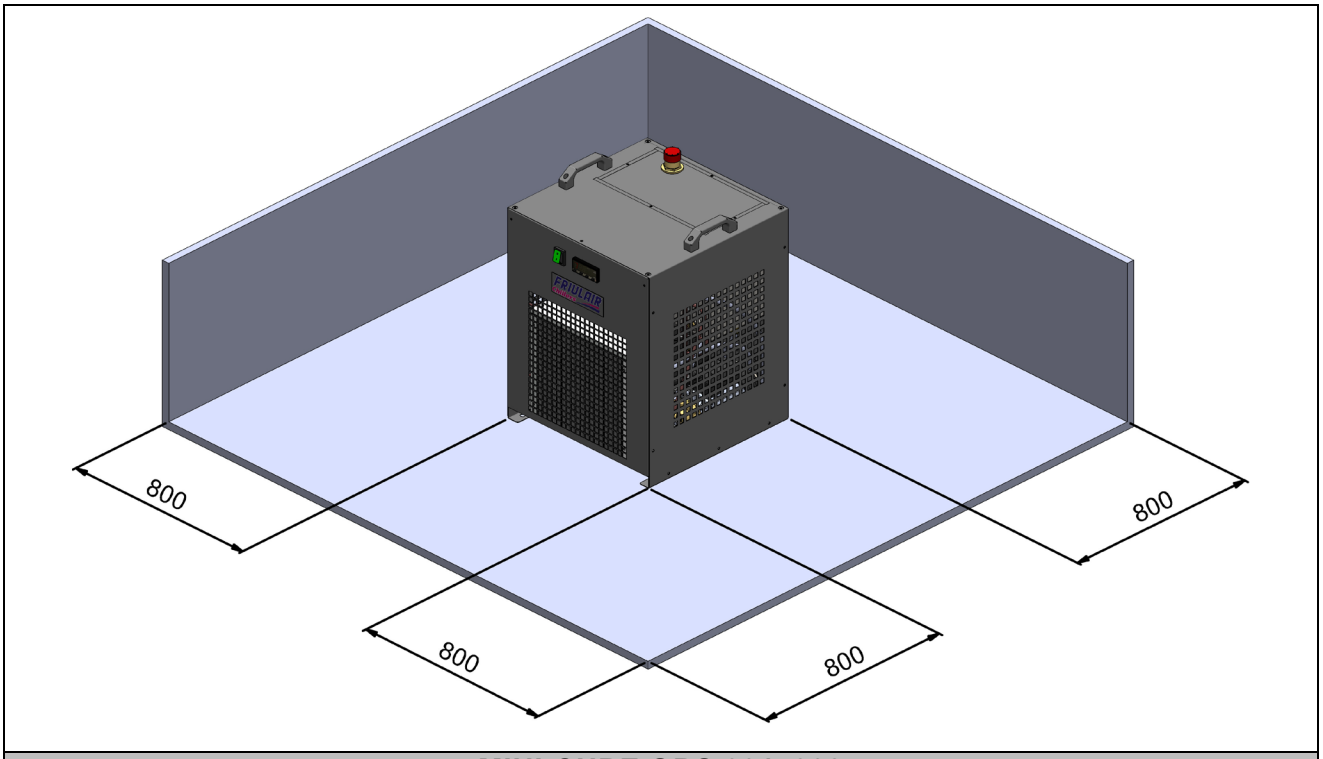
To determine the best place to install the unit, it is important to consider the following aspects:

- 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 ***7 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 ***3.4.3 Use of ethylene glycol as a winter anti-freeze***).

3.3.1 Installation

To ensure the good functioning of the unit and access for maintenance, you must respect the minimum installation clearancies 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.



MINI-CUBE QBS 001÷002

- 800mm / 31 inches on each side

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 filter on its input: scum and impurities can seriously damage the evaporator.

We recommend an extraordinary cleaning of the mechanical water filter after the machine has been running for the first week (also see Chapter ***8 Maintenance, inspections and periodic checks***).

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.

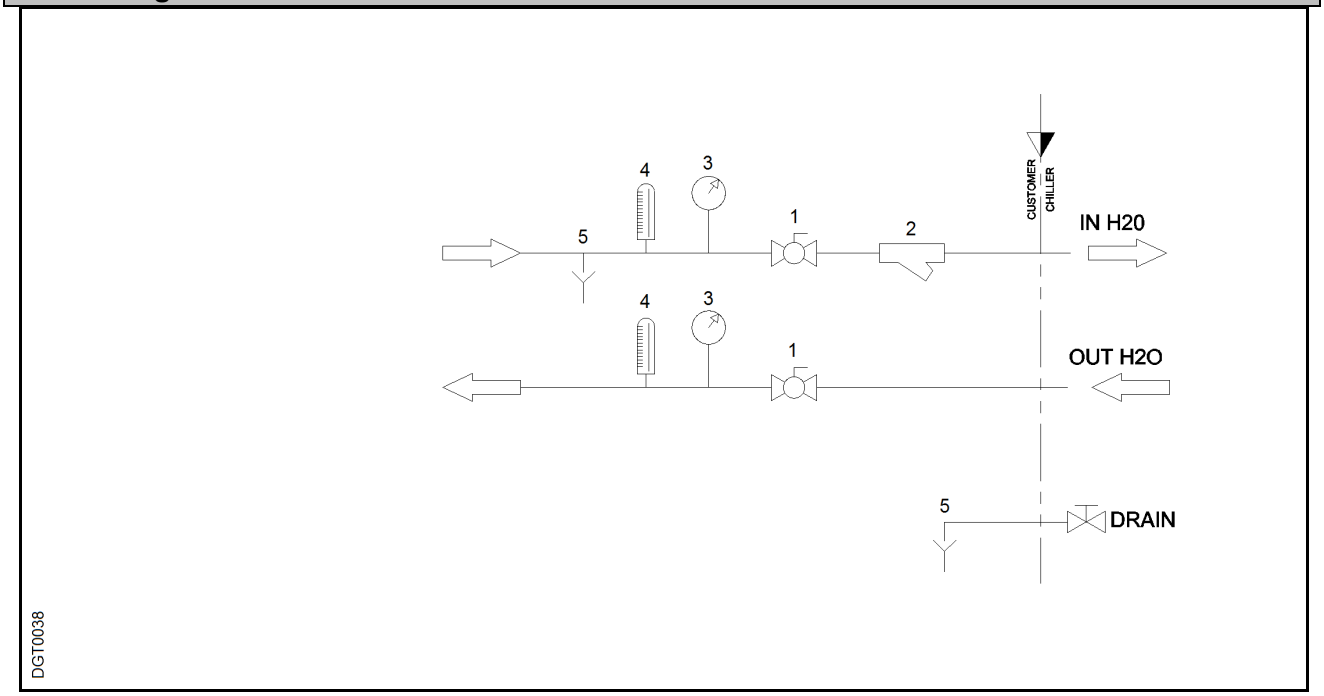
MINI-CUBE QBS 001÷002	60 Hz
Diameter of the in/out water fittings	3/8” NPT FF

3.4.1 Recommended water system

MINI-CUBE QBS 001÷002 units come as standard with a tank at atmospheric pressure, pump and bypass; it is advisable to also provide the water circuit with:

- A mechanical filter for water in the machine inlet pipes, with mesh no greater than 1mm;
- Machine inlet and outlet taps;
- Inlet and outlet pressure gauges and thermometers for water from the machine, to control its operation.

Diagram of recommended water circuit for MINI-CUBE QBS 001÷002 models



Key			
1	Tap	4	Thermometer
2	Mechanical filter	5	System/unit discharge
3	Pressure gauge		

3.4.2 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[1].

Total hardness	6.0…15 dH°	Cl^-	<5 mg/l - ppm
PH	7.5…9.0	Cl_2	0.5 mg/l - ppm
Conductivity	10…500 µS/cm	H_2S	<0.05 mg/l - ppm
Residual solid particles	<30 mg/l - ppm	NO_2^-	<5 mg/l - ppm
Saturation Index SI	-0.2 < 0 < 0.2	NO_3^-	<100 mg/l - ppm
HCO_3	<300 mg/l - ppm	Fe	<0.2 mg/l - ppm
SO_4^{2-}	<100 mg/l - ppm	Al	<0.2 mg/l - ppm
Aggressive free carbonic acid	<20 mg/l - ppm	Mn	<0.1 mg/l - ppm
Free chlorine	<0.5 mg/l - ppm	NH_4^+	<2 mg/l - ppm
PO_4^{3-}	<2 mg/l - ppm	Oxygen content	<0.1 mg/l - ppm
HCO_3 / SO_4	>1.0 mg/l - ppm	S^{2-}	<1 mg/l - ppm
NH_3	<0.5 mg/l - ppm		

The use of demineralised water is allowed only with the addition of anticorrosive liquids.

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

[1] Please get in touch with the company for product recommendations..

3.4.3 Use of glycol as anti-freeze

3.4.3.1 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

3.4.2.2 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:

Required glycol percentages based on the desired water temperature	
Desired water temperature [°C]	+5
Desired water temperature [°F]	41
Percentage of ethylene glycol by volume [%]	15
Percentage of propylene glycol by volume [%]	15

Attention! Maximum concentration of ethylene glycol allowed: **20%.** For glycol concentrations higher than 20%, 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.

3.4.3 Charging the water circuit

- Check that the drain taps are turned off;
- Open the system interception devices;

Attention! Make sure that the tube that draws the inlet water to the pump is almost always fluid-filled. It is also recommend, at least in the very early re-start phase, to close the liquid outlet port of the chiller to increase the pump's prevalence.
This will avoid premature failure of the impeller and will extend the life of mechanical seal. Also, the engine will not overheat.

- Feed the water from the filling inlet above the machine until the water reaches the required level (near the transparent level indicator – see diagram). When the pump starts check the level again and top up if necessary;
- Check for any leaks by examining the circuit.

Water level indicator

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 ±10% from its nominal value;
- The frequency must not vary by more than ±1% from its nominal value (±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.

4

PRELIMINARY CHECKS AND START-UP

4.1 PRELIMINARY CHECKS AND PREPARATION FOR THE FIRST 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;

Attention! Make sure that the tube that draws the inlet water to the pump is almost always fluid-filled. It is also recommend, at least in the very early re-start phase, to close the liquid outlet port of the chiller to increase the pump's prevalence.
This will avoid premature failure of the impeller and will extend the life of mechanical seal. Also, the engine will not overheat.

- 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 ±10%;
- Close the main power supply switch;
- Close the cut-off switch on the machine's electrical panel.

4.2 STARTUP

Connect the device power supply. Touch the ⏻ for 4 seconds. The led ⏻ will flash and turn off, the chiller will switch on.
The controller will display the temperature of the water inside the tank - if it is higher than the set value the compressor will start up.

To disable, touch the ⏻ for 4 seconds. The led ⏻ will flash and turn on, the chiller will switch off.

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.

5

ELECTRONIC CONTROLLER – MINI-CUBE QBS STANDARD

The **MINI-CUBE QBS** 001÷002 electronic controller:

- Displays the temperature of the water exiting the water chiller;
- Enables the required temperature of the chilled water to be set (set point);
- Enables compressor activation and deactivation (standby);
- Controls on/off compressor operation depending on the temperature of the water measured with the set point and upper differential (3°C//3K//5,4°F);
- Guarantees minimum compressor on/off times to maintain its integrity;
- Signals any faults in the temperature probe.

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

Button	Function
	On/off button Exit procedure
SET	Setting setpoint Access the menu
	Down key
	Up key

Display/Led	Function
	Indicates the state of compressor: On: compressor ON Off: compressor OFF Flashing: setting setpoint mode or compressor protection
	Indicates the state of the fans: On: fan ON Off: fan OFF Flashing: fan stopping
AUX	Auxliary led
	Energy saving on
°C	°Celsius unit
°F	°Fahrenheit unit
	Indicates the state of the chiller: On: chiller OFF Off: chiller ON

The display shows alarms like in the following table.

Sign	Description	Type of rearm
iA	Multifunction input alarm Pressure switch alarm	Manual
Pr1	Probe AI1 failure	Automatic
Pr2	Probe AI2 failure	Automatic
AL	Minimum temperature AI1 probe - Antifreeze	Automatic
AH	Maximum temperature AI1 probe	Automatic
COH	Superheated condenser	Automatic
CSd	Blocked condenser	Automatic

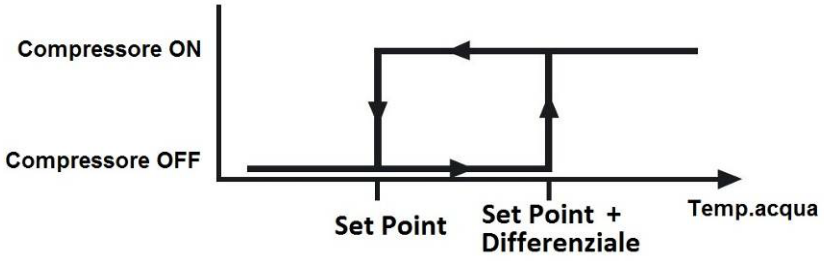
5.2 TURNING ON AND OFF

Connect the device power supply. Touch the ⏻ for 4 seconds. The led ⏻ will flash and turn off, the chiller will switch on.

To disable, touch the ⏻ for 4 seconds. The led ⏻ will flash and turn on, the chiller will switch off.

5.3 CONTROLLING WATER TEMPERATURE

The **MINI-CUBE QBS**'s electronic controller regulates the outlet water temperature on the basis of a set point value and an upper differential of 3°C//3K//5,4°F according to the following diagram:



5.4 CHANGING THE SET POINT

Touch the SET : the flashing led ❄ indicates that the setpoint can be changed. Use ∧ and ∨ keys within 15 seconds to change the temperature setpoint. Touch SET key or do not operate for 15 seconds to confirm the value. Otherwise, touch ⏻ key, but any changes will not be saved. The led ❄ will switch off and the device will exit the procedure.

5.5 TEMPERATURE DISPLAY AS DETECTED BY THE PROBES

- Make sure that the keyboard is not locked and that no procedure is in progress;
- Touch the ∨ key for 4 seconds: the display will show the first label available;
- Touch the ∧ or ∨ key to select a label **Pb1/ Pb2**;
- Touch the SET key to display the corresponding temperature;
- To exit the procedure, touch SET key or do not operate for 60 seconds;
- Touch the ⏻ key.

5.6 LOCKING AND UNLOCKING THE KEYBOARD

To lock the keyboard proceed as follow:

- Make sure that the keyboard is not locked and that no procedure is in progress;
- Do not operate for 60 seconds: the display will show the message **"Loc"** for 1 second and the keyboard shall lock automatically.

To unlock the keyboard:

- Touch a key for 1 second: the display will show the message **"UnL"** for 1 second.

5.7 COMPRESSOR OPERATION HOURS

To shoe the compressor operation hours:

- Make sure the keyboard is not locked and that no procedure is in progress;
- Touch the ∨ key for 4 seconds: the display will show the first label available;
- Touch the ∧ or ∨ key to select the label **CH**;
- Touch the SET key to display the corresponding compressor's running hours.

To cancel the compressor operation hours:

- Make sure the keyboard is not locked and that no procedure is in progress;
- Touch the ∨ key for 4 seconds: the display will show the first label available;
- Touch the ∧ or ∨ key to select the label r**CH**;
- Touch the SET key;
- Touch the ∧ or ∨ key within 15 seconds to set a password[2];
- Touch the SET key or do not operate for 15 seconds: the display will show a flashing **"----"** for 4 seconds, after which the device will exit the procedure.

5.8 SETTING THE CONFIGURATION PARAMETERS

To access the procedure:

- Make sure no procedure is in progress;
- Touch the SET key for 4 seconds: the display will show **"PA"**;
- Touch the SET key;
- Touch the ∧ or ∨ key within 15 seconds to set a password[3];
- Touch the SET key or do not operate for 15 seconds: the display will show **"SP"**.

To select a parameter:

- Touch the ∧ or ∨ key;

To set a parameter:

- Touch the SET key;
- Touch the ∧ or ∨ key within 15 seconds to set the value as desired;
- Touch the SET key or do not operate for 15 seconds.

To exit the procedure:

- Touch the SET key for 4 seconds or do not operate for 60 seconds (any changes will be saved).

After setting the parameter, suspend power supply flow to the device.

[2] Contact our company.
[3] Contact our company.

6

AUTOADAPTIVE CONTROLLER – MINI-CUBE QBS WITH EAA OPTION*

*EAA Option is available only for 230/1/60 power supply.

The **MINI-CUBE QBS** 001÷002 autoadaptive controller:

- Displays the temperature of the water exiting the water cooler;
- Enables the required temperature of the chilled water to be set (set point);
- Signals any faults in the temperature probe.

6.1 MAIN FUNCTIONS OF THE ELECTRONIC CONTROLLER BUTTONS AND MEANINGS OF THE ICONS

Button	Function
set	Setting setpoint
▼	Down key Access the menu
▲ ❄	Up key

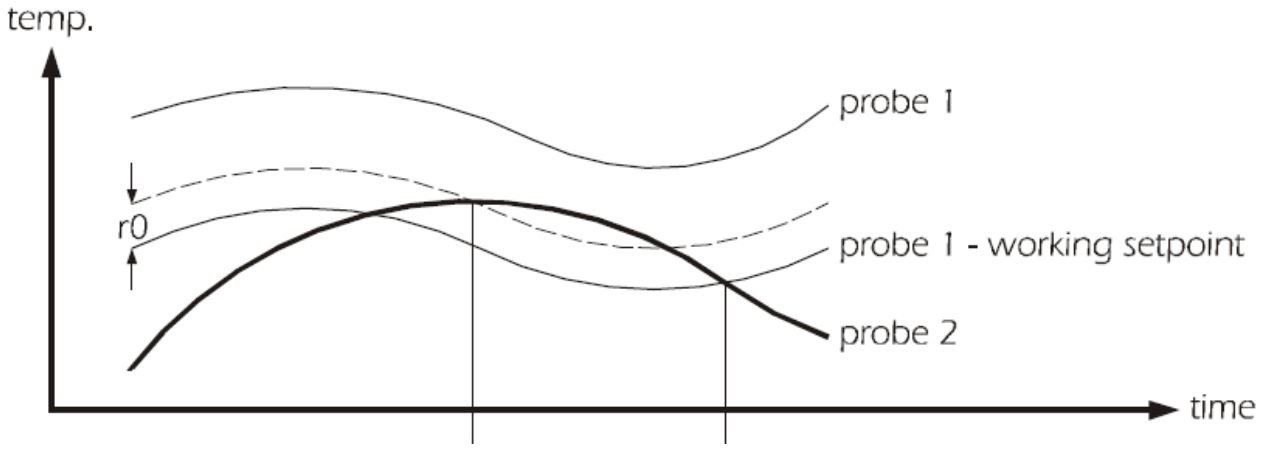
Display/Led	Function
❄	Indicates the state of the fans: On: fan ON Off: fan OFF Flashing: fan stopping
°C	°Celsius unit
°F	°Fahrenheit unit
⚠	Indicates the presence of alarms

6.2 TURNING ON AND OFF

Connect the device power supply. To turn on the instrument you have to supply it by the cut-off switch. To turn it off it is enough to cut off the power supply by closing the cut-off switch. The display will shows the outlet water temperature.

6.3 CONTROLLING WATER TEMPERATURE – STANDARD SETTING

The **MINI-CUBE QBS**'s electronic controller regulates the outlet water temperature in function of the ambient temperature. The working setpoint will be relative to the temperature read by probe or temperature read by probe 1 – working setpoint (without sign).



6.4 CHANGING THE SET POINT

Make sure the keyboard is not locked and no procedure is running.
To gain access the procedure:

- Press ▲❄ and ▼ 4 seconds and the display will show **"PA"**;
- Press set;
- Press ▲❄ or ▼ in 15 seconds to set the password[4];
- Press set or do not operate 15 seconds;
- Press ▲❄ and ▼ 4 seconds and the display will show **"SP"**, the first available parameter.
- Press ▲❄ or ▼ to scroll the parameter list until you reach **"r0"**;
- To select the parameter, press set and use ▲❄ or ▼ in 15 seconds to modify the setting value;
- Press set to confirm the value or do not operate 15 seconds.

6.5 SHOWING THE TEMPERATURE READ BY PROBE 1 (AMBIENT TEMPERATURE)

Make sure the keyboard is not locked and no procedure is running.

- Press ▼ 2 seconds: the dispaly will show the first available label;
- Press ▲❄ or ▼ to select **"Pb1"**;
- Press set to show the setting value.

6.6 SHOWING THE TEMPERATURE READ BY PROBE 2 (OUTLET WATER TEMPERATURE)

Make sure the keyboard is not locked and no procedure is running.

- Press ▼ 2 seconds: the dispaly will show the first available label;
- Press ▲❄ or ▼ to select **"Pb2"**;

Press set to show the setting value.

[4] Contact our company.

6.7 LOCKING/UNLOCKING THE KEYBOARD

Make sure the keyboard is not locked and no procedure is running.

- Press set and ▼ 2 seconds: the display will show **"Loc"** 1 second.

If the keyboard is locked, you will not be allowed to:

- Show the temperature read by probe 1 and probe 2;
- Modify the working setpoint.

This operations provoke the visualization of the label **"Loc"** 1 second.
To unlock the keyboard:

- Press set and ▼ 2 seconds: the display will show **"UnL"** 1 second.

6.8 ALARMS

The display will show the following code of alarm.

Code	Description	Type of rearm
AL1	Minimum temperature probe 1 (ambient temperature)	Automatic
AL2	Maximum temperature probe 2 (outlet water temperature)	Automatic
Pr1	Probe 1 error	Automatic
Pr2	Probe 2 error	Automatic
Loc	Keyboard and/or setpoint are locked	---
----	The quantity to show is not available	---

6.9 SETTING CONFIGURATION PARAMETERS

To gain access the procedure:

- Press ▲❄ and ▼ 4 seconds and the display will show **"PA"**;
- Press set;
- Press ▲❄ or ▼ in 15 seconds to set the password[5];
- Press set or do not operate 15 seconds;
- Press ▲❄ and ▼ 4 seconds and the display will show **"SP"**, the first available parameter.
- Press ▲❄ or ▼ to scroll the parameter list;
- To select a parameter, press set and use ▲❄ or ▼ in 15 seconds to modify the setting value;
- Press set to confirm the value or do not operate 15 seconds.

[5] Contact our company.

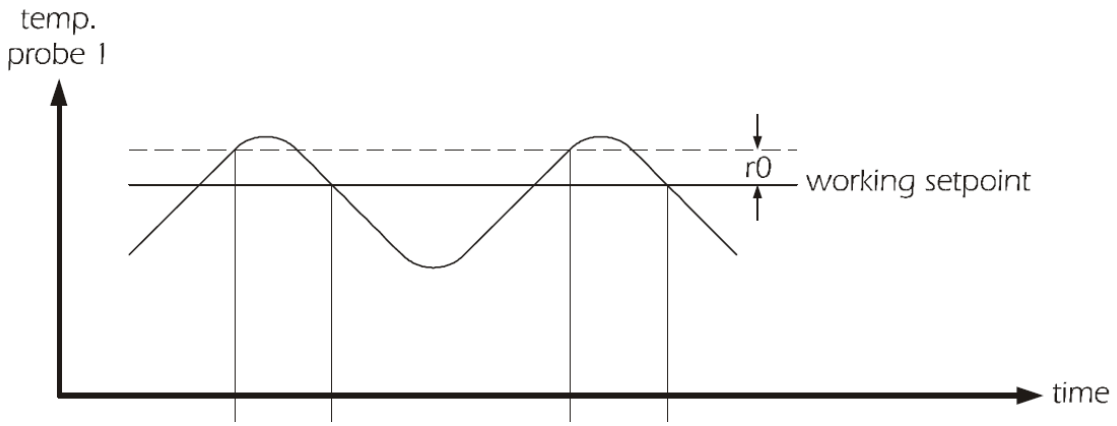
6.10 TABLE OF STANDARD PARAMETERS CONFIGURATION

Below there is a table of most important parameters and their factory setting. To modify the parameter contact our company.

Parameter	Function	Factory setting
SP	Working setpoint	0°C//32°F
r0	Working setpoint differential	5K
r1	Minimum working setpoint	0°C//32°F
r2	Maximum working setpoint	25°C//77°F
r6	Type of working setpoint: • Absolute setpoint r6=0 • Relative setpoint r6=1: temp. read by probe 1 – working setpoint	1
r7	Forced off of compressors	4°C//39,2°F
r8	Differential of parameter r7 *[At r7+r8 value the compressor could be switched on]*	2K
A1	Temperature the alarm of low temperature is activated AL1	4°C//39,2°F
A4	Temperature the alarm of high temperature is activated AL2	50°C//122°F
A10	Differential of parameter A1 *[At A1+A10 value the alarm AL1 will be deactiveted]*	2K
A11	Differential of parameter A4 *[At A4-A11 value the alarm AL2 will be deactiveted]*	5K

6.11 ALTERNATIVE METHOD OF TEMPERATURE REGULATION

The electronic controller allows to regulate the outlet working temperature with an absolute logic in function of the temperature read by probe 1.
In that way, the SP value is the absolute regulation setpoint like in the following image.



To set this kind of working mode, please set the following values in that way (see paraghaph ***5.9 Setting configuration parameters***).

Parameter	Function	Suggested value
r1	Minimum working setpoint	6°C//42,8°F
r6	Type of working setpoint: • Absolute setpoint r6=0 • Relative setpoint r6=1: temp. read by probe 1 – working setpoint	0

7

SAFETY DEVICE AUTOADAPTIVE CONTROLLER – MINI-CUBE QBS WITH EAA OPTION

MINI-CUBE QBS 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
High condensation pressure	High-pressure switch	Compressor output pipe
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

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.
The following paragraph lists the characteristics of each safety device.

7.1 CALIBRATION OF THE SAFETY DEVICES AND TYPE OF REARM

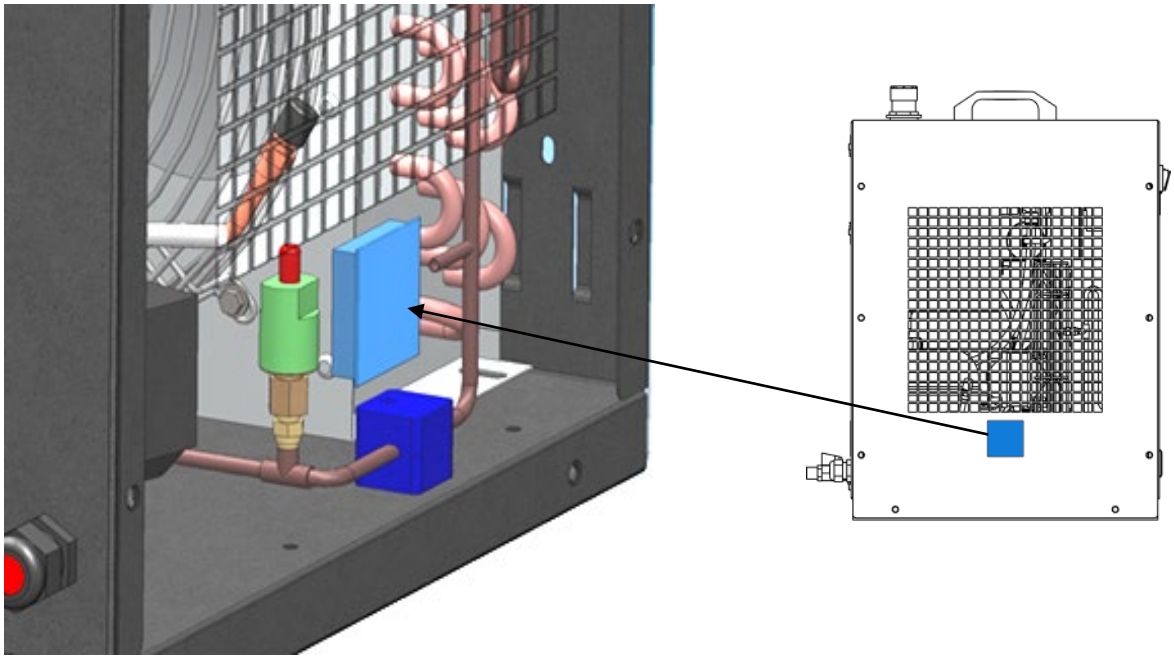
Safety device	Intervention value	Reset value	Type of rearm
High-pressure gauge	30 barg//435 psi	23 barg//334 psi	Manual
Anti-freeze thermostat	4°C//39,2°F	6°C//42,8°F	Semiautom.
Water-level sensor	--	--	Semiautom.
Anti-circulation timer*	5 min.	--	--

* 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.

7.2 REARMING THE HIGH-PRESSURE PRESSURE SWITCH

The intervention of the high-pressure 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 red 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 6.1).

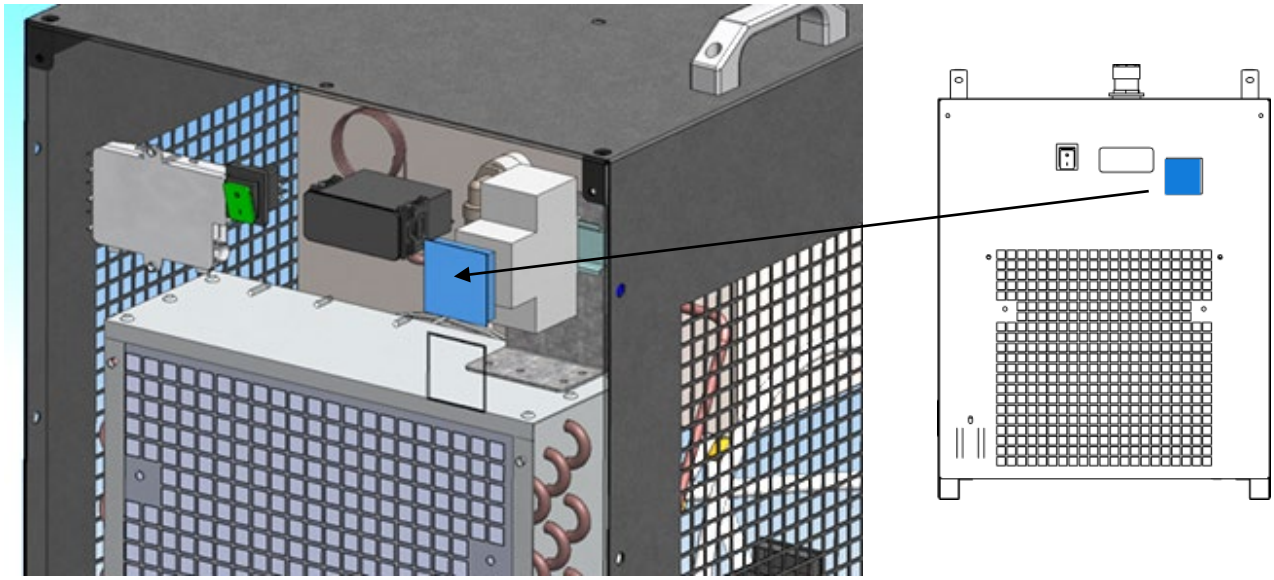
For this reason, when dealing with an intervention of the high-pressure switch, it is necessary to:

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 ***9 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 6.1);
C) Remove the outer cap and 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.

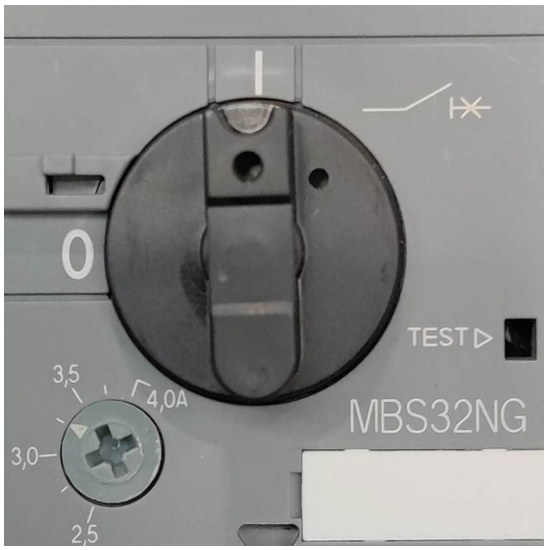
Attention! The high-pressure gauge stops the compressor while it keeps the condenser fan running to lower the pressure in the condenser.

7.3 REARMING THE PUMP THERMAL PROTECTION

The tap to access the pump thermal protection is located near to the electronic controller



Remove the tape and turn the handle from “0” to “I”.

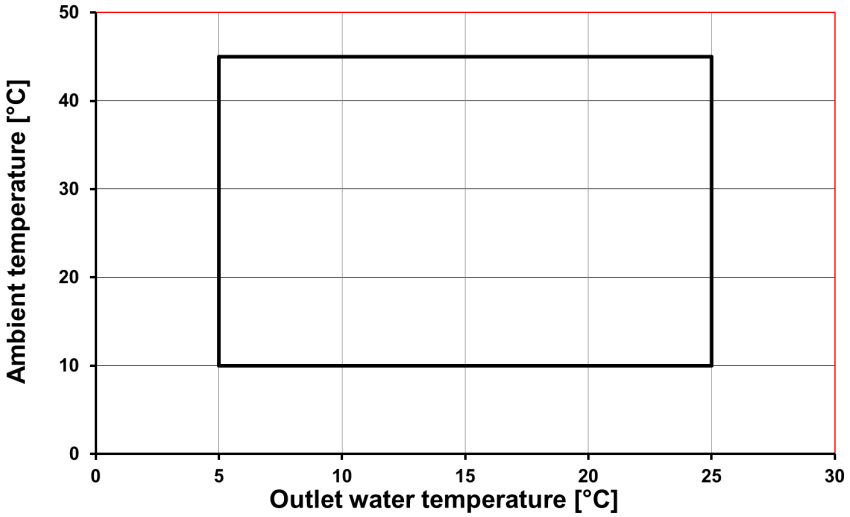


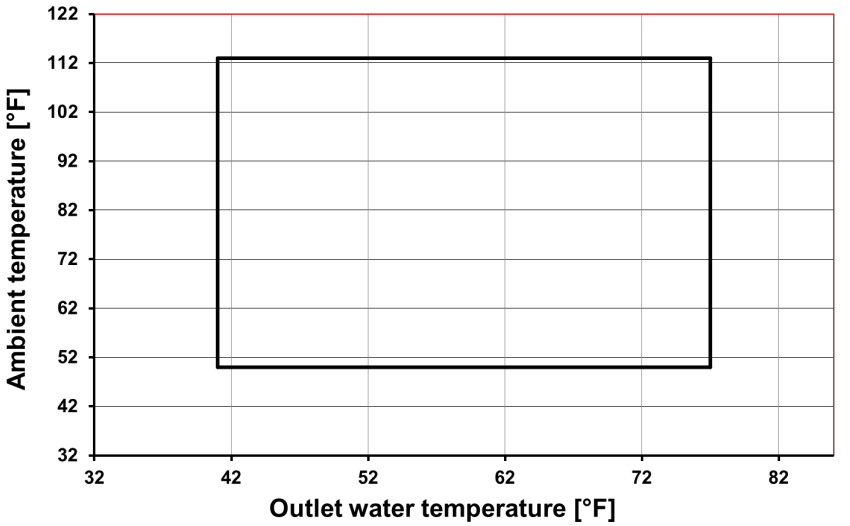
8

OPERATING LIMITS

The graphs show the limits for continuous operation of the **MINI-CUBE QBS** units, in relation to the temperature of the water exiting the machine, and the temperature of the external air.

MINI-CUBE QBS 001÷002





9

SEPR - SEASONAL ENERGY PERFORMANCE RATIO
ACCORDING TO COMMISSION REGULATION (EU) 2016/2281

Only for units at 50Hz power supply.

230V/1Ph/50Hz		
Model MINI-CUBE QBS	001	002
SEPR	4,16	4,37

10

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 3.4.3	Daily	
Check for the presence of any alarm signals	Daily	
Check the functioning of the fans	Monthly	
Check that the temperature of the air is compatible with the operating limits of the machine	Monthly	
Clean the condensing coil with a jet of compressed air	Annual (1)	Specialized personnel
Clean the water filter	Monthly(2)	
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	
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 ***3.4.3 Use of ethylene glycol as a winter 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.

TROUBLESHOOTING

Cause	Alarm or symptom	Solution	Execution
1. The unit does not start			
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 
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	**AL**	Reset a temperature of the water (setpoint) compatible with the calibration of the antifreeze thermostat	User
Service and anti-freeze probe defective	**AL**	Check contacts and replace, if necessary	Specialized personnel 
Water temperature probes defective	**Pr1/Pr2**	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 
2. The compressor does not start			
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	The compressor icon is on but the compressor is stopped	Check the voltage at the coil of the contactos of the compressor and the continuity of the coil itself	Specialized personnel 
3. The water pump does not make pressure and flow			
The suction pipe of the pump is full of air or the pressure drops on the hydraulic circuit are too high	The water pump does not work properly	Make sure that the tube that draws the inlet water to the pump is almost always fluid-filled. It is also recommend, at least in the very early re-start phase, to close the liquid outlet port of the chiller to increase the pump's prevalence (see paragraph ***3.4.3 Charging the water circuit***)	Specialized personnel 

Cause	Alarm or symptom	Solution	Execution
Intervention of the thermal pump protection	No water flow	Reset the pump thermal protection (paragraph. 7.3) and check that the thermal absorptions are within the expected ranges. Check that the pump is not mechanically blocked. Try to manually unclog or replace the pump	Specialized personnel
4. Intervention of the high pressure pressure switch			
Condenser obstructed or insufficient air flow-capacity	**iA**	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 6.2).	User
The unit has operated outside its operating limits (such as air or water too hot)	**iA**	If possible, restore conditions that are compatible with the operating limits. Reset the high pressure switch (paragraph 6.2).	User
Fan not working	**iA**	See point 4	
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
5. Fan doesn't start			
Very low outside air temperatures and consequent intervention of the condensation control	Fan icon off. Condensation pressure normal	The machine can working anyway	
6. The unit is working without ever stopping			
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	
7. Compressor intake pipe covered with frost			
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
8. The unit stops and starts repeatedly; water temperature changes suddenly			
Insufficient water flow rate		Check water flow rate. Open the system tap fully. If possible reduce system feed leaks. If possible add a pump in series with suitable head.	Specialized personnel

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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.

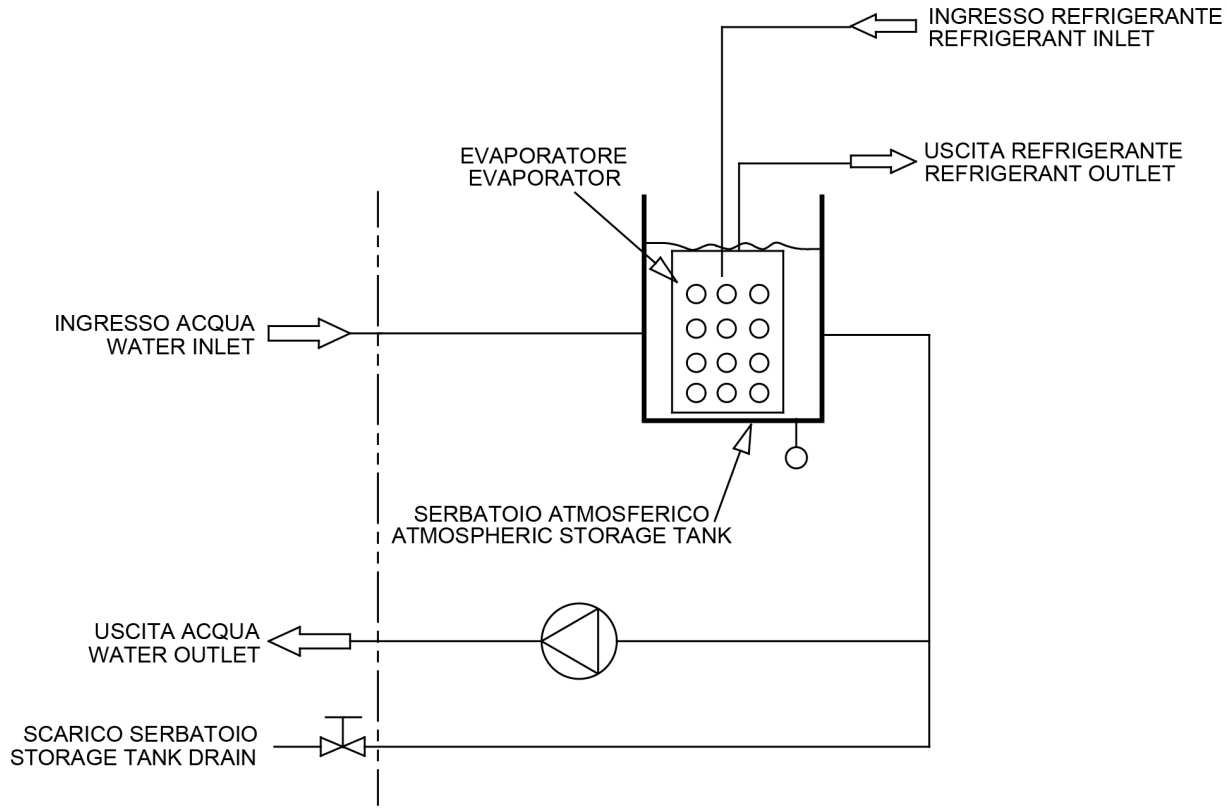
Part	Material
Refrigerant fluid	R134A, Oil
Panelling and supports	Carbon steel, epoxy paint
Chiller compressor	Steel, Copper, Aluminium, Oil
Evaporator	Copper
Condenser	Aluminium, Carbon Steel, Copper
Pipes	Copper
Fan	Aluminium, Copper, Steel
Valves	Steel, Bronze
Insulation	Synthetic rubber without CFC, EPS, Polyurethane
Pump	Steel, Copper
Tank	Stainless steel
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.

WATER DIAGRAMS

MINI-CUBE QBS 001÷002



VALVOLA DI SCARICO
DRAIN VALVE

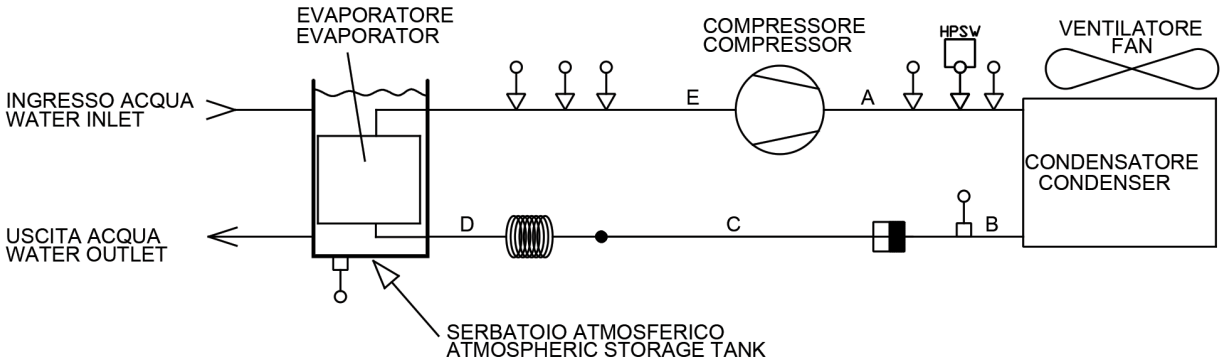
SONDA DI TEMPERATURA
TEMPERATURE PROBE

POMPA
PUMP

14

REFRIGERANT DIAGRAMS

MINI-CUBE QBS 001÷002



HPSW PRESSOSTATO DI ALTA PRESSIONE
HIGH PRESSURE SWITCH

PRESA DI PRESSIONE
OUTLET PRESSURE

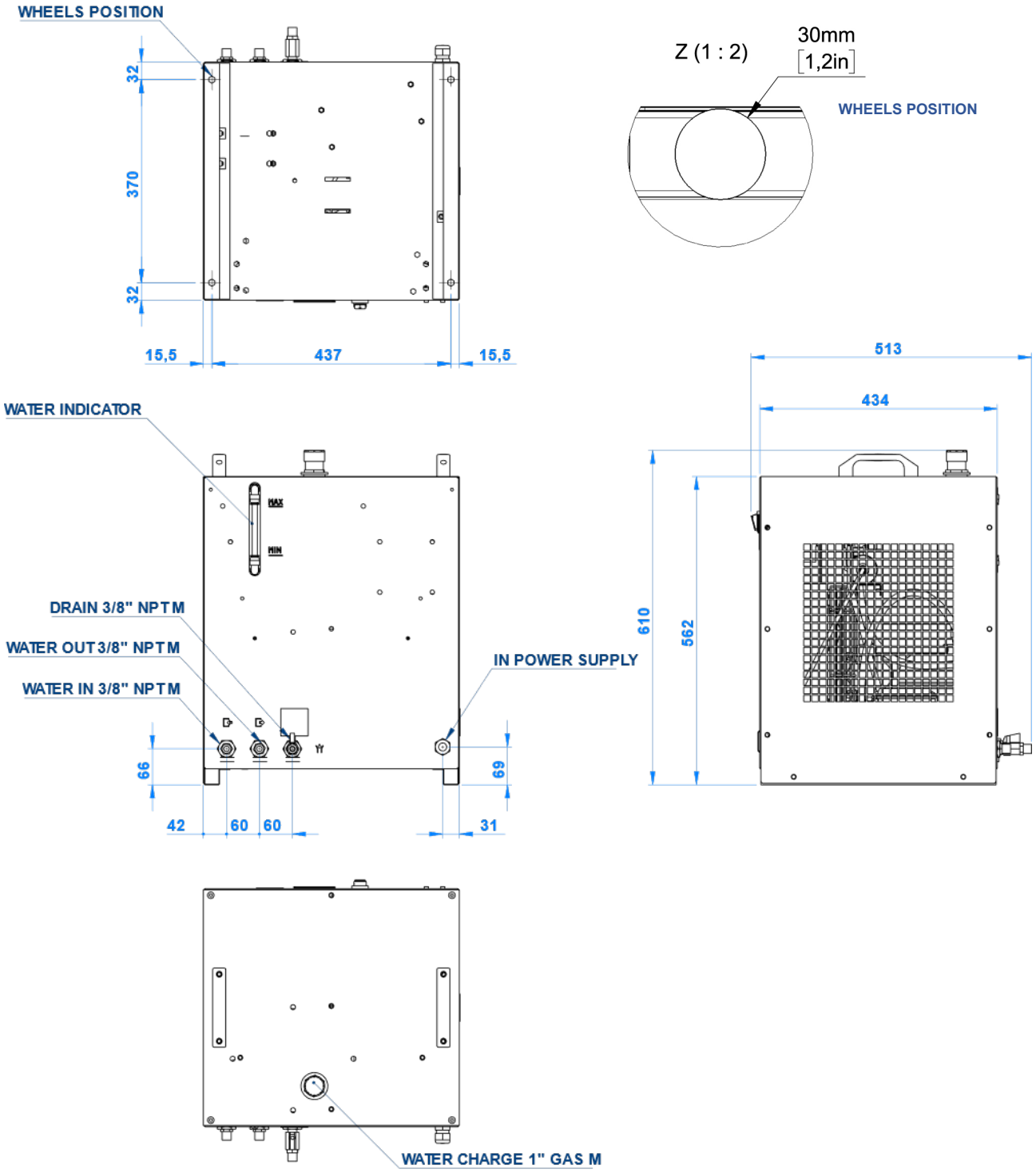
FILTRO DEIDRATATORE
FILTER DRYER

POZZETTO PER SONDA TEMPERATURA
TEMPERATURE PROBE WELL

CAPILLARE DI EQUALIZZAZIONE PRESSIONI
PRESSURE EQUALIZATION CAPILLARY

DIMENSIONAL DRAWINGS

MINI-CUBE QBS 001÷002 60Hz



Model	Mass [kg / lb]
QBS 001	40 / 88,2
QBS 002	43 / 94,8

ELECTRICAL DIAGRAM ABBREVIATIONS

List of electrical descriptions found on the wiring diagram.

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

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