Ferroli

RGW

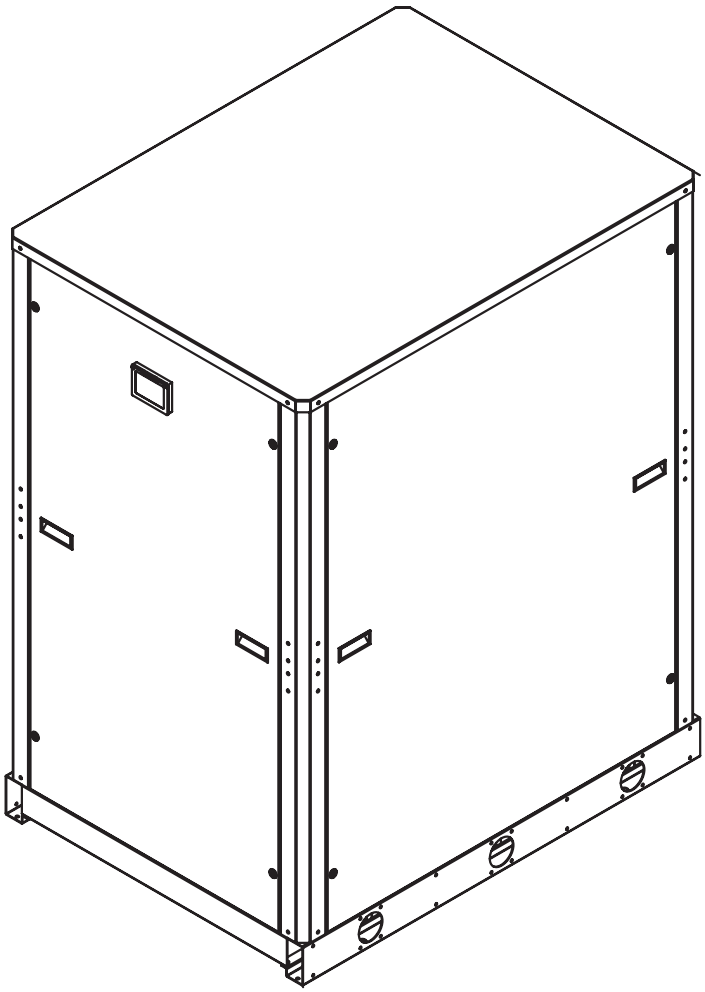
WATER-COOLED, WATER CHILLERS AND HEAT PUMPS

70 ÷ 240 kW in cooling mode

78 ÷ 268 kW in heating mode

ECO-FRIENDLY R410A REFRIGERANT GAS

EUROVENT CERTIFIED PERFORMANCE www.eurovent-certification.com



CE

INSTALLATION AND USER MANUAL

Dear Customer,
Thank you for having purchased a FERROLI Idustrial coolers. It is the result of many years experience, particular research and has been made with top quality materials and higlly advanced technologies.The CE mark guaranteed thats the appliances meets European Machine Directive requirements regarding safety.
The qualitative level is kept under constant surveillance. FERROLI products therefore offer SAFETY, QUALITY and RELIABILITY.
Due to the continuous improvements in technologies and materials, the product specification as well as performances are subject to variations without prior notice.

Thank you once again for your preference.
FERROLI S.p.A

THIS MANUAL IS DIVIDED INTO SECTIONS. THEIR NAMES APPEAR IN THE HEADING OF EACH PAGE.

GENERAL SPECIFICATIONS

CONTAINS FLUORINATED GREENHOUSE GASES COVERED BY THE KYOTO PROTOCOL:
- R410A (GLOBAL WARMING POTENTIAL GWP = 2088)

General specifications

• This manual and the wiring diagram supplied with the unit must be kept in a dry place and ready to hand for future consultation when required.

• This manual has been compiled to ensure that the unit is installed in the correct way and to supply comprehensive information about how to correctly use and service the appliance. **Before proceeding with the installation phase, please carefully read all the information in this manual, which describes the procedures required to correctly install and use the unit.**

• Strictly comply with the instructions in this manual and conform to the current safety standards.

• The appliance must be installed in accordance with the laws in force in the country in which the unit is installed.

• Unauthorized tampering with the electrical and mechanical equipment will **VOID THE WARRANTY.**

• Check the electrical specifications on the identification plate before making the electrical connections. Read the instructions in the specific section where the electrical connections are described.

• If the unit must be repaired for any reason, this must only be done by a specialized assistance center recognized by the manufacturer and using geuine spare parts.

• The manufacturer also declines all liability for any damage to persons or property deriving from failure of the information in this manual to correspond to the actual machine in your possession.

• Proper uses: this series of chillers is designed to produce cold or hot water for use in hydronic systems for conditioning/ heating purposes. The units are not suitable for the production of domestic hot water.

Any use differing from this proper use or beyond the operating limits indicated in this manual is forbidden unless previously agreed with the manufacturer.

• The prevention of the risk of fire at the installation site is the responsiblity of the end user.

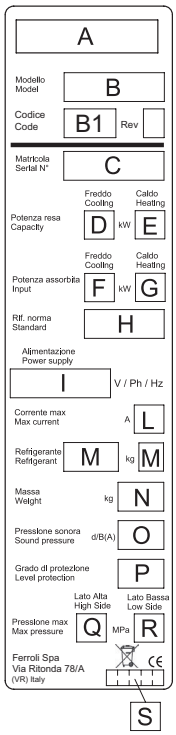
European Directives

The company hereby declares that the machine in question complies with the matters prescribed by the following Directives:

•	Machine Directive	**2006/42/CE**
•	Directive governing pressurized vessels (PED)	**97/23/CE**
•	Electromagnetic compatibility Directive (EMC)	**2004/108/CE**
•	Low voltage Directive (LVD)	**2006/95/CE**

Any other Directives have to be considered not applicable.

Identification plate of the Unit



The figure on the left depicts the identification plate of the unit, affixed to the outer left-hand side of the Electric Panel.
A description of the data is given below:

Standard versions

A - Trademark
B - Model
B1- Code
C - Serial number
D - Cooling Capacity
E - Heating Capacity
F - Power input in COOLING mode
G - Power input in HEATING mode
H - Reference standard
I - Electric power supply
L - Maximum load current
M - Type of refrigerant and charge
N - Shipping weight of the unit
O - Sound pressure level at 1m
P - IP Level Protection
Q - Maximum pressure - High Side
R - Maximum pressure - Low Side
S - PED certification authority

GENERAL SPECIFICATIONS

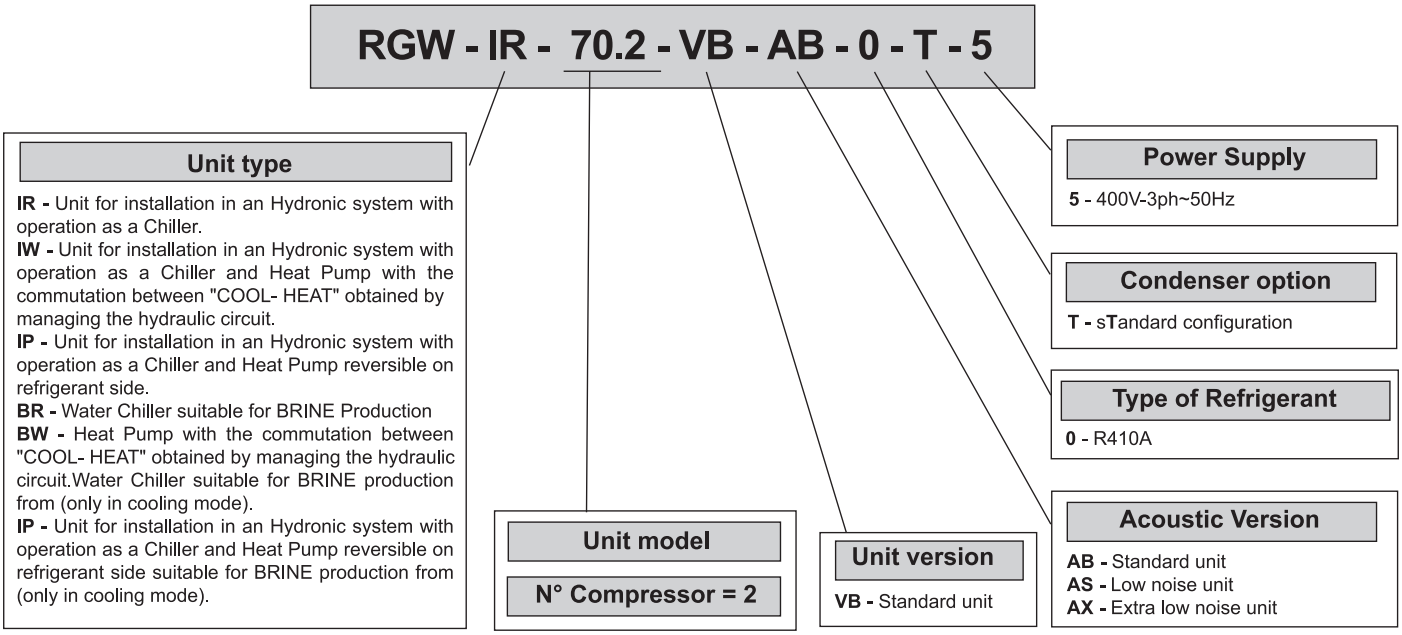
Presentation of the unit

This new series of industrial chillers and heat pumps has been designed to meet the demands of global markets in the small medium power industrial and commercial plants. Units are compact and highly configurable, built to fit different types of plants so to meet the needs of highly qualified engineers. Units are water chillers (IR) and heat pumps (IW, IP) water cooled, suitable for indoor installation; if equipped with painted structure and panels (option) they are suitable for outdoor installation too. This series is composed of 11 models and two sizes with nominal cooling capacity from **70** to **240 kW** and thermal capacity from **78** to **268 kW**.
The heat pump units can be supplied for commutation between "COOL- HEAT" obtained by managing the hydraulic circuit (IW units) or reversible on refrigerant side (IP units): the IP unit, compared with the IW unit, allows a reduction of installation space, a simplification of the hydraulic circuit so achieving a cheaper and quicker installation. The units produce cold water from 5 to 20°C (in cooling mode) and hot water from 25 to 55°C (in heating mode).
The units can be supplied for brine production (BR, BW, BP) that allow brine production from -10 to 5°C.
The development of the unit has mainly based on the selection of heat exchanger to obtain high efficiency at full and partial load. To increase the seasonal efficiency index (ESEER) and so further containing power input and operation cost the units can be supplied with electronic expansion valve (as standard for IP and BP units).
These features allow a compressors working with low compression ratios so increasing the reliability level and the operation life. Great attention has been dedicated to achieve low sound levels in order to meet the increasingly restrictive laws in terms of noise: upon request, you can choose for a Standard Unit (AB) or Low noise unit (AS) or Extra low noise unit (AX). The basic unit (AB) is an essential structure made by sheet metal with anti-corrosion treatment (not painted) and without any closing panels so suitable ONLY for indoor installation, the low noise unit (AS) provides sound attenuation thanks to panels with sound absorbing insulation. The extra low noise unit (AX) provides a further sound attenuation thanks to panels with sound absorbing and acoustic jackets for compressors.
All the units are equipped with 2 scroll compressors arranged in pairs (tandem) on 1 circuit operating with **environmental friendly R410A gas**, brazed plate heat exchangers (depending on unit type completely insulated and protected on water side with a differential pressure control), electrical panel complete with electronic controller and display, phase presence and sequence control device (as standard).
As option the unit can be selected with painted structure (epoxy powders RAL 7035). For low noise (AS) and extra low noise (AX) units, the painting is extended to all closing panels, so ensuring for the electrical panel a protection degree IP54 and the maximum protection against adverse weather conditions: with this features the unit is suitable for outdoor installation (to agree with sails support department).
A variety of other accessories are available to extend the capabilities of the units. Among various the unit can be equipped with Pumping Module (MP) with 1 or 2 pumps with Standard (STD), High (HP1) and very High (HP2) available head.
This module- full integrated inside the unit- can be asked for the water circulation on the plant exchanger, and/or for the water circulation on the source exchanger. So it is possible to order units equipped with maximum 4 pumps: max 2 for plant side, max 2 for source side.
The modules are equipped with all components necessary for a correct and easy installation so reducing the installation, space and cost for hydraulic connections.
Note that with this accessory the total length of the unit increases (see the section “dimensional data”).
The electronic controller is able to manage different condensing control systems as modulating valves (2 or 3 way, available as accessory too) or pumps driven by inverter.
Note that IW/BW units can be equipped with pumping module complete of electrical panel, but the controller is not able to manage the pumps for the 2 operation modes (cooling and heating).
The units can be coupled with dry coolers, cooling towers, geothermal probes, or uses as cooling water city water, well-water, lake-water, etc.
All units are accurately build in compliance with the existing standards and are individually tested in factory. Only electrical and hydraulic connections are required for installation.

GENERAL SPECIFICATIONS

Identification code of the unit

The codes that identify the units are listed below and include the sequences of letters that determine the meanings for the various versions and set-ups.



The available special versions are described below:

AB Standard unit. The compressors are installed on rubber vibration dampers.
The unit has composed by basement and framework made by sheet metal with anticorrosion treatment without any closing panels.

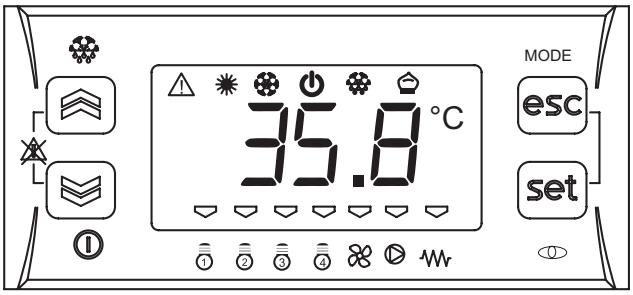
AS Low noise unit. Allows a noise reduction of 4-5 dB.
The compressors are installed on rubber vibration dampers and the unit is closed with panels made by sheet metal with anticorrosion treatment and coated with sound absorbing insulation.
The AS unit reaches IP54 (protection degree) so it can be installed outdoor.

AX Extra low noise unit. Allows a noise reduction of 7-8 dB.
The compressors are installed on rubber vibration dampers and insulated with acoustic jackets; the unit is closed with panels made by sheet metal with anticorrosion treatment and coated with sound absorbing insulation.
The AX unit reaches IP54 (protection degree) so it can be installed outdoor.

Description of the components

Componenti principali:
1. Electric control and monitoring panel. This is housed in a metal casing in which the various electrical components are positioned on one metal plate.
1a. The power section includes:
• Main door-locking circuit-breaker.
• Fuse-holder that can be isolated with protection fuse triad for each compressor.
• Fuse-holder that can be isolated with protection fuse for compressor oil heaters and antifreeze (if installed).
• Control contactor for each compressor.
• Contactor and magnetothermic switch to protect the pump (if installed).
• Phase presence and sequence monitoring device on power supply
1b. The auxiliary section includes:
• Fuses on the auxiliary transformer.
• Electromagnetic noise filter
• Insulating and safety transformer to power the auxiliary circuit.

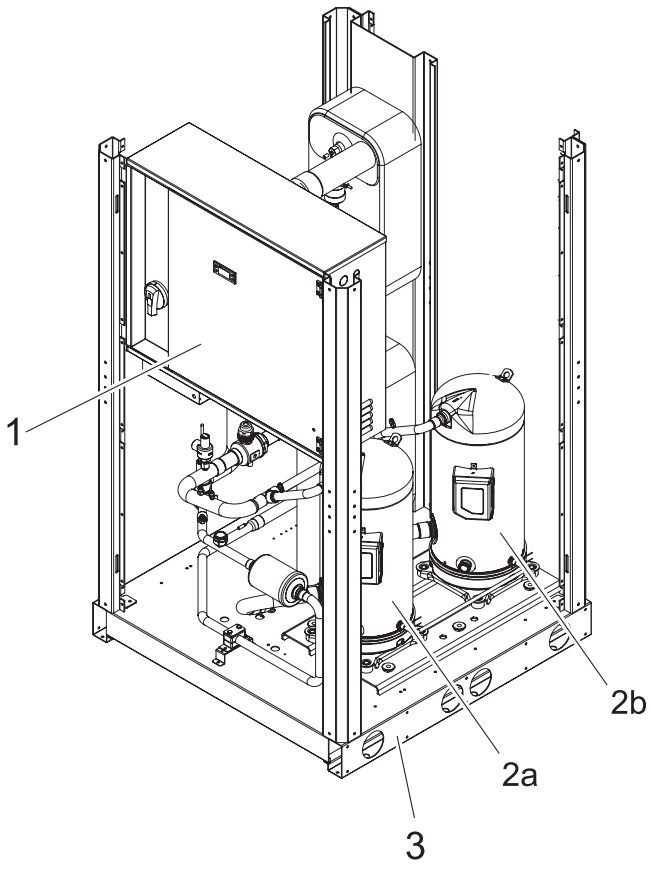
1c. The microprocessor monitoring section includes:
- User interfacing terminal with display.
- On-off key.
- Operating mode selector key.
- Compressor on-off display **LED**.
- Operational mode **LED**
- Antifreeze heaters activated indicator **LED**.
- Source Pump/s on-off display **LED**
- Plant Pumps on-off display **LED**
- Check-control with fault code display
- ON / Stand-by remote - Summer/Winter (E/I) remote selection (IW, IP. BW, BP units only).



Control system main functions:
temperature control of the water produced by the unit, compressor and pump operating hour counter, timing and cycling of start-ups, input parameters by keyboard, alarms management, operating mode change (IW, IP. BW, BP units only), dynamic set-point (climatic control), scheduling and integrative heaters control.
If installed the hydronic kit these functions are enabled: antifreeze with pump, start-up cycle after prolonged inactivity (antisticking), if the hydronic kit installed has 2 pumps there is a cycling between each pump to ensure an equivalent lifetime,
Digital input functions: low pressure, high pressure, high temperature on compressor supply, phase presence and sequence monitoring device on power supply, differential water pressure control, compressors thermal protection, pumps thermal protection, ON / Stand-by remote and remote operating mode change, demand limit and Economy function,
Digital output functions: compressor start-up, pump start-up, plate heat exchanger electrical heater,
remote general alarm, 4-way valve (only IP,BP unit), integrative heaters.
Analogic input functions: in and out water temperature for palnt and source sides, external air temperature probe (if present).
Analogic output functions: continuous control (0-10V) for 2 or 3 way valves (supplied as accessory too) or for inverter pumps for condensing control.

2. Compressors. They are the **SCROLL** type with orbiting coil equipped with built-in thermal protection. The AX unit includes: an acoustic jacket for the compressors. All units are equipped with two compressors connected in pairs (1 single refrigerant circuit) which can operate at the same time (**100% cooling capacity**) or individually (**50% of the cooling capacity**), thus adapting to the different thermal loads of the system.

3. Frame structure made of sheet metal with anticorrosion treatment and– as option- coated with epoxy powders (RAL 7035 to ensure maximun protection against adverse weather conditions.



The image refer to IR unit Mod. 90.2

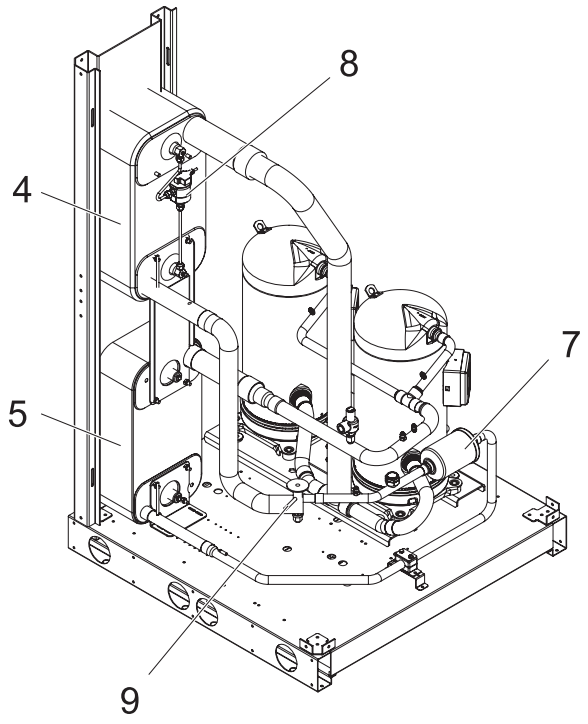
4. Plant Exchanger made of brazed stainless steel plates (**AISI 316**). It is installed in a shell of heat-insulating material to prevent the formation of condensation and heat exchanges towards the outside. Standard supply also includes a differential pressure switch on the water circuit to avoid the risk of freezing if the water flow is shut off for some reason.
It can be equipped with antifreeze heater.

5 Unit IR and BR Source Exchanger made of brazed stainless steel plates (**AISI 316**).
It can be equipped with antifreeze heater.
Unit IW and BW Source Exchanger made of brazed stainless steel plates (**AISI 316**). It is installed in a shell of heat-insulating material to prevent the formation of condensation and heat exchanges towards the outside.
It can be equipped with antifreeze heater.
Unit IP and BP Source Exchanger made of brazed stainless steel plates (**AISI 316**). It is installed in a shell of heat-insulating material to prevent the formation of condensation and heat exchanges towards the outside. Standard supply also includes a differential pressure switch on the water circuit to avoid the risk of freezing if the water flow is shut off for some reason.
It can be equipped with antifreeze heater.

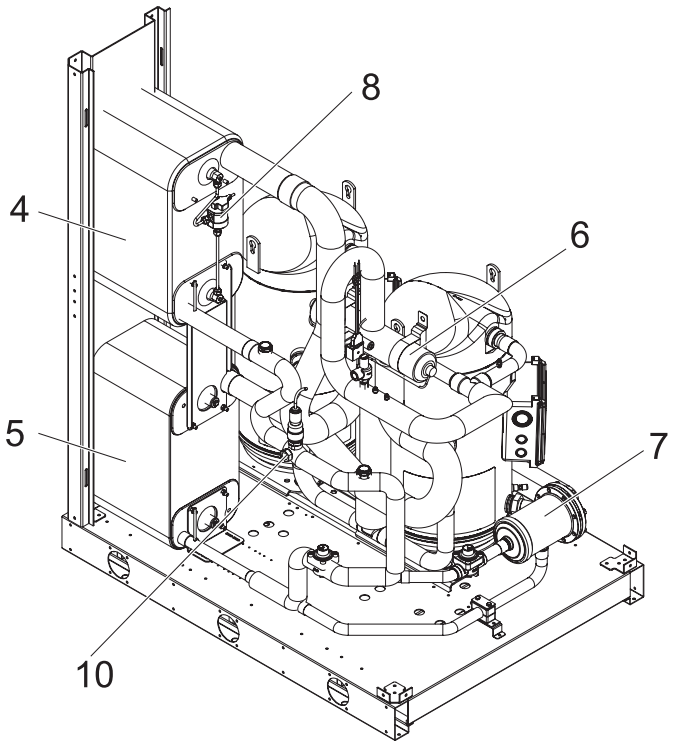
6. Four Way Reversing valve (IP and BP units), reverses the flow direction of the refrigerant depending on operation mode (cool/heat).

Covering panels (for AS and AX units, or as accessory for AB unit**)**, made of galvanized sheet metal, if painting option (VER) is selected the panels are provided coated with epoxidic powder paint (RAL 7035) to ensure maximun protection against adverse weather conditions.

One-way valves (IP and BP units), allowing the refrigerant to pass into the appropriate exchangers, depending on the operation mode (cool/heat).



The image refer to IR unit Mod. 90.2



The image refer to IP unit Mod. 190.2

Hydraulic and chilling circuit components

7. Dehydrator filter. Mechanical type. Retains impurities and traces of moisture in the circuit. **Hermetic** type for models **70÷90**; **cartridge** type for models **105÷240**.

8. Water differential pressure switch. It is installed on the connections between the water inlet and outlet of the exchanger. It stops the unit if it activates.

9. Thermostatic expansion valve. With external equalizer, this feeds the evaporator correctly, keeping the selected superheat degree at a steady level.

10. Electronic Expansion valve (standard for IP and BP units), feeds the evaporator correctly, keeping the selected superheat degree at a steady level; it guarantees an effective and quick response to the load modifications so increasing the efficiency at partial load.

Refrigerant Safety valve. Installed on the discharge pipe of the compressors, this operates if extreme faults should occur in the system.

Liquid and moisture indicator. Signals if refrigerant is in liquid state so indicating that the refrigerant charge is correct.
The indicator light also indicates the amount of moisture in the refrigerant by changing colour.

Low pressure switch. With fixed setting. It is installed on the suction pipe and blocks the compressors if the operating pressures drop below the tolerated values. Automatically resets as the pressure increases. If it activates frequently, the unit will block and can only be restarted by resetting via the user interface terminal.

High pressure switch (n°2). With fixed setting. Are installed on the discharge pipe and blocks the compressors if the operating pressure exceeds the tolerated values. If it activates, the unit will block and can only be restarted by resetting via the user interface terminal.

Pressure taps: 5/16 " SAE. Allow the operating pressure of the system to be measured:compressor discharge, expansion valve inlet, compressor suction.

Pressure taps: 1/4 " SAE (7/16" UNF) type with schraeder pin. Allow the charge/discharge of the refrigerant gas from the system.

ACCESSORIES AND OPTIONAL EQUIPMENT

PAN - Covering panels (M) (accessory only for AB unit), made of galvanized sheet metal, if painting option (VER) is selected the panels are provided coated with epoxidic powder paint (RAL 7035) to ensure maximun protection against adverse weather conditions.

AVG - Rubber vibration dampers (F). Consisting of 4 rubber vibration dampers to fit under the unit. Reduce the transmission of the mechanical vibrations generated by the compressors and pumps during normal operation to the basement of the unit. The insulating degree of the vibration dampers is about 85-90%.

GM - Pressure gauge unit (M). Consisting of 2 pressure gauges that display the pressure values of the refrigerant on the suction and discharge of the compressors.

AV – Victaulic Connections (F) Consisting of 2 Victaulic-brackets and 2 pipe Victaulic-Welding.

CV – Victaulic Elbows (F) Consisting of 2 brackets and 2 elbows Victaulic-Victaulic.

VA – Water valves (F) Consisting of 2 brackets and 2 water valves Victaulic to shut-off the unit from the plant or from the source.

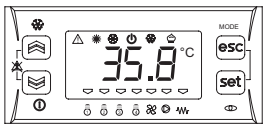
F – Victaulic Water Filter Y (F). Consisting of 1 bracket and 1 Victaulic water filter of "Y" shape. Can be turned on and off and inspected. It prevents that machining residues (dust, swarf, etc.) in the water pipes can enter into the plate-type heat exchanger.

FLS - Flow switch (F). Paddle flow switch on the water circuit to avoid the risk of freezing if the water flow is shut off for any reason. For a quick connection to the unit the accessory is completed with grooved pipe (on wich install the flow switch) and victaulic bracket.

VDV 2 way valve (F). Equipped with spring return actuator managed by the unit controller (0-10V) as condensing control device for units cooled by city-water or well-water.

VTV 3 way valve (F). Equipped with actuator managed by the unit controller (0-10V) as condensing control device for units cooled by dry-cooler or geothermal probe.

CR - Remote control (F). This can be used to select all the monitoring and display functions of the control unit on the machine at a maximum distance of 100 meters away. It must be installed by using a cable with three strands or three wires in **PVC** of the **N07-VK** type with a 1mm2 section. The transmission line must be installed in a raceway separate from any electric powering wires (**230/400 V**). The control unit has the following buttons:



MODE key : used to select the operating mode
ON/OFF key : used to turn the unit ON/OFF and to reset the alarms
Mode + ON/OFF keys : used to access and quit the various menu levels
UP key: scrolls forwards through the menu items or increases the value of a parameter
Tasto DOWN: scrolls backwards through the menu items or decreases the value of a parameter.

KOP - Programmer clock (F). Allows the unit to be turned on and off depending on the programmed time setting (up to 14 switching actions can be programmed as required throughout the 7 days of the week).

TAT- High Temperature Thermostat (M). Two thermostats in series on compressors discharge pipes preserve operation not allowing temperature to rise up than a specified fixed value.

SND Outdoor Air Temperature Probe (F). It allows the climatic variation of setpoint depending on the outdoor air temperature.

INT - Serial interface (M/F). Allows serial communication on RS485 via MODBUS protocol

CSF - Voltage monitor and sequence meter (M). The device enables control of the correct sequence of power phases and the lack of any phase. It also ensures that the unit works within ± 10% the rated voltage (MIN=360 V - RATED=400V - MAX=440V). It blocks the unit if the voltage is outside the limits provided for.

KBT – Low temperature Kit (M). Consisting of antifreeze electrical heaters for plate heat exchangers and oil crankcase heaters for compressors. It is particularly suggested for outdoor installation or indoor installation in rooms that during winter can reach very low ambient temperature

RAM – Compressors Suction and Discharge Ball Valves (M). (not available for IP and BP units) Consisting of 2 ball valves installed on suction and discharge of the compressors: they allow an easy and quick replacement of the compressors in case of fault.

NOTES: (M): only installed in the factory. **(F):** supplied for installation by the customer.

ACCESSORIES AND OPTIONAL EQUIPMENT

MP - Pumping Module (M). Consists of minimum 1 pump up to maximum 4 pumps.
The water pumps are available on 3 levels for available pressure head: Standard (STD), High Pressure (HP1), very high pressure (HP2).

The MP is copmposed by:

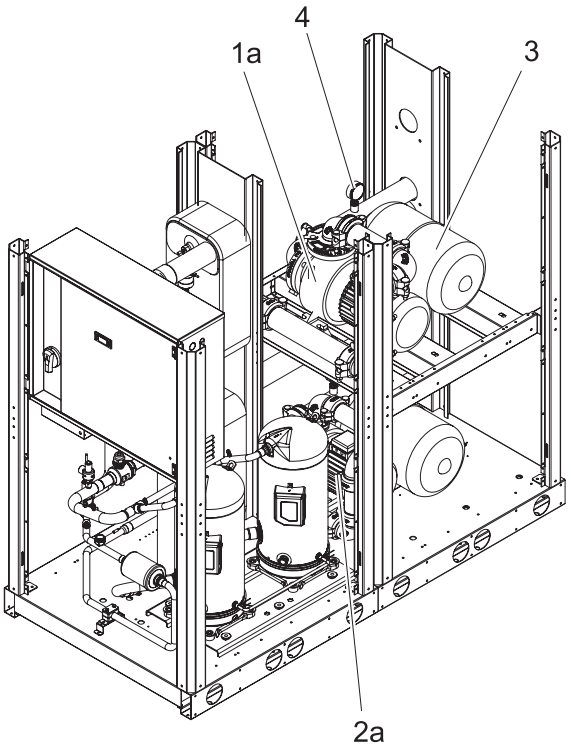
1. Plant Side Pump: minimum 1 pump, maximum 2 pumps (the second pump is activated in case of failure of the first one). The pump/s is protected by magnetothermic switch installed on the unit electrical panel.

2. Source Side : minimum 1 pump, maximum 2 pumps (the second pump is activated in case of failure of the first one). The pump/s is protected by magnetothermal switch installed on the unit electrical panel.

3. Expansion tank: This is a closed, diaphragm type chamber. It absorbs the variations in the volumes of water in the system caused by temperature variations.

4 Water pressure gauge. Connected to the water fill pipe. Displays the pressure of the water in the system.

- Water safety valve, It acts whenever faulty service leads to an operating pressure in the hydraulic (set =6 bar).
- Water drain valves.
- Air vent.



**The image refer to IR unit Mod. 190.2
with MP 1P plant side and 1P source side.**

VER Framework and panels (if present) made by sheet metal with anticorrosion treatment painted RAL7035 with epoxy powders to ensure the maximum resistance to adverse weather conditions.

EEV (M) Electronic Expansion valve (standard for IP and BP units), feeds the evaporator correctly, keeping the selected superheat degree at a steady level; it guarantees an effective and quick response to the load modifications so increasing the efficiency at partial load.

SS - Soft Starter (M). Soft starter for compressors, allows a reduction around 30/40% for the inrush current and of the vibrations transmitted to the refrigerant pipes during the start-up phase.

RIF - Capacitors for power factor corrections (M). Capacitors for power factor corrections increase power factor cos φ (>0.91)

MTC - Magnetothermic switch (M). Magnetothermic switch on all loads in place of fuses.

Other power source voltage rating (contact our technical department).

GENERAL TECHNICAL SPECIFICATION

General technical specifications

MODELS	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Power supply	400-3-50											V-ph-Hz
Refrigerant type	R410A											-
Compressor specifications												
Type / capacity control	SCROLL (ON-OFF)											-
Starting	Direct											-
Quantity	2											N°
Plant Exchanger												
Type	stainless steel brazed plates											-
PS max. operating pressure	1000											kPa
Quantity	1											N°
Victaulic hydraulic connection	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN
Total water capacity	3.9	4.2	4.8	5.5	5.9	6.9	7.5	8.7	9.7	11.2	12.8	l
Source Exchanger												
Type	stainless steel brazed plates											-
PS max. operating pressure	1000											kPa
Quantity	1											N°
Victaulic hydraulic connection	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN
Total water capacity	3.9	4.2	4.8	5.5	5.9	6.9	7.5	8.7	9.7	11.2	12.8	l
Pumping module MP												
Safety valve setting	600											kPa
Volume sourge chamber	24											l
Default pressure sourge chamber	150											kPa
Max. operating pressure sourge chamber	800											kPa

Electrical specifications

Units without pumping module

MODELS	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Total maximum load current [FLA]	45	51	62	68	74	82	90	105	120	142	164	A
Total maximum power input [FLI]	26	29	34	40	45	50	55	63	72	83	93	kW
Total maximum starting current [MIC]	141	166	204	256	262	309	317	355	370	454	476	A

GENERAL TECHNICAL SPECIFICATION

NET NOMINAL performances - Standard plants - Data certified by EUROVENT

IR unit - Chiller

MODELS			70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
IR	**Cooling mode W30W7** (source: water in 30°C out 35°C / plant: water in 12°C out 7°C)													
	Cooling capacity		69.5	78.5	91.4	104.3	117.2	132.1	146.9	168.8	190.5	214.3	238.1	kW
	Total power input		16.4	18.1	21.9	25.2	28.6	32.3	36.3	41.3	46.4	53.0	59.7	kW
	EER		4.23	4.34	4.17	4.14	4.10	4.09	4.05	4.09	4.11	4.04	3.99	W/W
	Plant side	Water flow rate	3.3	3.8	4.4	5.0	5.6	6.4	7.1	8.1	9.2	10.3	11.5	l/s
		Water pressure drop	47	38	40	41	44	42	45	46	48	48	49	kPa
	Source side	Water flow rate	4.0	4.5	5.3	6.1	6.8	7.7	8.6	9.8	11.1	12.5	13.9	l/s
		Water pressure drop	68	55	59	60	65	62	66	67	70	71	72	kPa

Data declared according to **EN 14511**. The values are referred to units without options and accessories.

IW unit - Chiller and Heat Pump with the commutation between "COOL- HEAT"

MODELS			70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
IR	**Cooling mode W30W7** (source: water in 30°C out 35°C / plant: water in 12°C out 7°C)													
	Cooling capacity		69.5	78.5	91.4	104.3	117.2	132.1	146.9	168.8	190.5	214.3	238.1	kW
	Total power input		16.4	18.1	21.9	25.2	28.6	32.3	36.3	41.3	46.4	53.0	59.7	kW
	EER		4.23	4.34	4.17	4.14	4.10	4.09	4.05	4.09	4.11	4.04	3.99	W/W
	Plant side	Water flow rate	3.3	3.8	4.4	5.0	5.6	6.4	7.1	8.1	9.2	10.3	11.5	l/s
		Water pressure drop	47	38	40	41	44	42	45	46	48	48	49	kPa
	Source side	Water flow rate	4.0	4.5	5.3	6.1	6.8	7.7	8.6	9.8	11.1	12.5	13.9	l/s
		Water pressure drop	68	55	59	60	65	62	66	67	70	71	72	kPa
IP	**Heating mode W10W45** (source: water in 10°C / plant: water in 40°C out 45°C)													
	Heating capacity		78.7	87.6	103.8	117.9	132.1	149.2	166.5	190.7	215.0	242.3	270.6	kW
	Total power input		20.6	22.5	27.1	30.9	34.8	39.2	44.1	50.2	56.5	63.8	71.4	kW
	COP		3.81	3.90	3.84	3.82	3.80	3.81	3.78	3.80	3.81	3.80	3.79	W/W
	Plant side	Water flow rate	3.7	4.2	4.9	5.6	6.3	7.1	7.9	9.0	10.2	11.5	12.8	l/s
		Water pressure drop	58	46	50	51	54	52	56	57	59	59	61	kPa
	Source side	Water flow rate	4.0	4.5	5.3	6.1	6.8	7.7	8.6	9.8	11.1	12.5	13.9	l/s
		Water pressure drop	68	55	59	60	65	62	66	67	70	71	72	kPa

Data declared according to **EN 14511**. The values are referred to units without options and accessories.

IP unit - Chiller and Heat Pump reversible on refrigerant side

MODELS			70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
IR	**Cooling mode W30W7** (source: water in 30°C out 35°C / plant: water in 12°C out 7°C)													
	Cooling capacity		68.1	77.0	89.6	102.3	114.9	129.5	144.0	165.4	186.8	210.1	233.4	kW
	Total power input		16.2	17.9	21.6	24.9	28.2	31.8	35.8	40.7	45.7	52.3	58.9	kW
	EER		4.20	4.31	4.14	4.11	4.07	4.07	4.03	4.07	4.09	4.02	3.96	W/W
	Plant side	Water flow rate	3.3	3.7	4.3	4.9	5.5	6.2	6.9	8.0	9.0	10.1	11.2	l/s
		Water pressure drop	45	36	38	39	42	40	43	44	46	46	47	kPa
	Source side	Water flow rate	4.0	4.5	5.2	6.0	6.7	7.6	8.4	9.7	10.9	12.3	13.7	l/s
		Water pressure drop	66	53	56	58	62	60	64	65	68	68	70	kPa
IP	**Heating mode W10W45** (source: water in 10°C / plant: water in 40°C out 45°C)													
	Heating capacity		77.7	86.6	102.8	116.8	130.8	147.7	165.4	188.8	212.8	239.8	267.9	kW
	Total power input		20.7	22.5	27.1	31.0	34.9	39.3	44.2	50.3	56.4	64.0	71.6	kW
	COP		3.76	3.85	3.80	3.77	3.75	3.76	3.74	3.76	3.77	3.75	3.74	W/W
	Plant side	Water flow rate	3.7	4.1	4.9	5.5	6.2	7.0	7.8	8.9	10.1	11.4	12.7	l/s
		Water pressure drop	57	45	49	50	53	51	55	56	58	58	60	kPa
	Source side	Water flow rate	4.0	4.5	5.2	6.0	6.7	7.6	8.4	9.7	10.9	12.3	13.7	l/s
		Water pressure drop	66	53	56	58	62	60	64	65	68	68	70	kPa

Data declared according to **EN 14511**. The values are referred to units without options and accessories.

GENERAL TECHNICAL SPECIFICATION

GROSS NOMINAL performances - Standard plants - EUROVENT certified data

IR unit - Chiller

	MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
IR	**Cooling mode W30W7** (source: water in 30°C out 35°C / plant: water in 12°C out 7°C)													
	Cooling capacity		70	79	92	105	118	133	148	170	192	216	240	kW
	Total power input		15.0	16.8	20.3	23.3	26.3	29.8	33.3	37.8	42.3	48.4	54.5	kW
	EER		4.67	4.70	4.53	4.51	4.49	4.46	4.44	4.50	4.54	4.46	4.40	W/W
	ESEER		6.07	6.16	6.00	5.87	5.94	5.81	5.86	5.95	5.90	5.91	5.74	-
	Plant side	Water flow rate	3.3	3.8	4.4	5.0	5.6	6.4	7.1	8.1	9.2	10.3	11.5	l/s
		Water pressure drop	47	38	40	41	44	42	45	46	48	48	49	kPa
	Source side	Water flow rate	4.0	4.5	5.3	6.1	6.8	7.7	8.6	9.8	11.1	12.5	13.9	l/s
		Water pressure drop	68	55	59	60	65	62	66	67	70	71	72	kPa

IW unit - Chiller and Heat Pump with the commutation between "COOL- HEAT"

	MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
IR	**Cooling mode W30W7** (source: water in 30°C out 35°C / plant: water in 12°C out 7°C)													
	Cooling capacity		70	79	92	105	118	133	148	170	192	216	240	kW
	Total power input		15.0	16.8	20.3	23.3	26.3	29.8	33.3	37.8	42.3	48.4	54.5	kW
	EER		4.67	4.70	4.53	4.51	4.49	4.46	4.44	4.50	4.54	4.46	4.40	W/W
	ESEER		6.07	6.16	6.00	5.87	5.94	5.81	5.86	5.95	5.90	5.91	5.74	-
	Plant side	Water flow rate	3.3	3.8	4.4	5.0	5.6	6.4	7.1	8.1	9.2	10.3	11.5	l/s
		Water pressure drop	47	38	40	41	44	42	45	46	48	48	49	kPa
	Source side	Water flow rate	4.0	4.5	5.3	6.1	6.8	7.7	8.6	9.8	11.1	12.5	13.9	l/s
		Water pressure drop	68	55	59	60	65	62	66	67	70	71	72	kPa

IP	**Heating mode W10W45** (source: water in 10°C / plant: water in 40°C out 45°C)													
	Heating capacity		78	87	103	117	131	148	165	189	213	240	268	kW
	Total power input		19.0	21.0	25.2	28.7	32.2	36.4	40.7	46.3	51.9	58.6	65.4	kW
	COP		4.11	4.14	4.09	4.08	4.07	4.07	4.05	4.08	4.10	4.10	4.10	W/W
	Plant side	Water flow rate	3.7	4.2	4.9	5.6	6.3	7.1	7.9	9.0	10.2	11.5	12.8	l/s
		Water pressure drop	58	46	50	51	54	52	56	57	59	59	61	kPa
	Source side	Water flow rate	4.0	4.5	5.3	6.1	6.8	7.7	8.6	9.8	11.1	12.5	13.9	l/s
		Water pressure drop	68	55	59	60	65	62	66	67	70	71	72	kPa

IP unit - Chiller and Heat Pump reversible on refrigerant side

	MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
IR	**Cooling mode W30W7** (source: water in 30°C out 35°C / plant: water in 12°C out 7°C)													
	Cooling capacity		68.6	77.4	90.2	103	116	130	145	167	188	212	235	kW
	Total power input		14.9	16.6	20.1	23.1	26.0	29.5	33.0	37.4	41.9	47.9	54.0	kW
	EER		4.62	4.65	4.49	4.46	4.44	4.42	4.40	4.45	4.49	4.42	4.36	W/W
	ESEER		6.01	6.10	5.94	5.81	5.88	5.75	5.80	5.89	5.84	5.85	5.68	-
	Plant side	Water flow rate	3.3	3.7	4.3	4.9	5.5	6.2	6.9	8.0	9.0	10.1	11.2	l/s
		Water pressure drop	45	36	38	39	42	40	43	44	46	46	47	kPa
	Source side	Water flow rate	4.0	4.5	5.2	6.0	6.7	7.6	8.4	9.7	10.9	12.3	13.7	l/s
		Water pressure drop	66	53	56	58	62	60	64	65	68	68	70	kPa

IP	**Heating mode W10W45** (source: water in 10°C / plant: water in 40°C out 45°C)													
	Heating capacity		77	86	102	116	130	147	164	187	211	238	265	kW
	Total power input		19.1	21.1	25.3	28.9	32.4	36.6	41.0	46.5	52.0	59.0	65.9	kW
	COP		4.03	4.08	4.03	4.01	4.00	4.00	4.00	4.02	4.06	4.03	4.03	W/W
	Plant side	Water flow rate	3.7	4.1	4.9	5.5	6.2	7.0	7.8	8.9	10.1	11.4	12.7	l/s
		Water pressure drop	57	45	49	50	53	51	55	56	58	58	60	kPa
	Source side	Water flow rate	4.0	4.5	5.2	6.0	6.7	7.6	8.4	9.7	10.9	12.3	13.7	l/s
		Water pressure drop	66	53	56	58	62	60	64	65	68	68	70	kPa

NET NOMINAL performances - Radiant plants

IW unit - Chiller and Heat Pump with the commutation between "COOL- HEAT"

	MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
IR	**Cooling mode W30W18** (source: water in 30°C out 35°C / plant: water in 23°C out 18°C)													
	Cooling capacity		94.0	105.2	121.2	140.0	158.7	178.4	197.6	227.0	257.2	288.8	321.4	kW
	Total power input		18.8	20.3	24.5	28.4	32.6	36.6	41.3	47.1	53.2	60.7	68.6	kW
	EER		5.01	5.19	4.95	4.94	4.86	4.88	4.79	4.82	4.83	4.76	4.69	W/W
	Plant side	Water flow rate	4.55	5.08	5.86	6.77	7.68	8.63	9.56	10.99	12.46	13.99	15.58	l/s
		Water pressure drop	87	69	71	75	82	78	82	84	89	88	90	kPa
	Source side	Water flow rate	5.25	5.87	6.80	7.86	8.92	10.03	11.13	12.77	14.45	16.27	18.14	l/s
		Water pressure drop	116	92	96	101	110	105	111	114	119	119	123	kPa
IP	**Heating mode W10W35** (source: water in 10°C / plant: water in 30°C out 35°C)													
	Heating capacity		85.2	95.8	112.3	128.3	144.5	162.9	181.5	208.1	234.8	264.9	295.2	kW
	Total power input		17.9	19.4	23.5	27.2	31.0	34.9	39.3	44.9	50.6	57.8	65.3	kW
	COP		4.75	4.93	4.78	4.73	4.65	4.67	4.61	4.64	4.64	4.58	4.52	W/W
	Plant side	Water flow rate	4.03	4.54	5.32	6.07	6.83	7.71	8.58	9.84	11.09	12.52	13.94	l/s
		Water pressure drop	68	55	59	60	65	62	66	67	70	71	72	kPa
	Source side	Water flow rate	5.25	5.87	6.80	7.86	8.92	10.03	11.13	12.77	14.45	16.27	18.14	l/s
		Water pressure drop	116	92	96	101	110	105	111	114	119	119	123	kPa

Data declared according to **EN 14511**. The values are referred to units without options and accessories.

IP unit - Chiller and Heat Pump reversible on refrigerant side

	MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
IR	**Cooling mode W30W18** (source: water in 30°C out 35°C / plant: water in 23°C out 18°C)													
	Cooling capacity		90.8	101.0	117.0	135.0	153.0	172.0	190.6	218.6	247.5	278.4	309.5	kW
	Total power input		19.0	20.1	24.1	28.1	32.3	36.1	41.0	46.7	52.5	59.5	66.6	kW
	EER		4.79	5.01	4.85	4.80	4.74	4.77	4.65	4.69	4.72	4.68	4.65	W/W
	Plant side	Water flow rate	4.40	4.87	5.65	6.52	7.40	8.31	9.22	10.58	11.98	13.48	14.99	l/s
		Water pressure drop	81	63	66	69	76	72	77	78	82	82	84	kPa
	Source side	Water flow rate	5.12	5.67	6.60	7.62	8.64	9.72	10.81	12.37	13.98	15.75	17.52	l/s
		Water pressure drop	110	86	90	95	103	98	105	107	111	112	114	kPa
IP	**Heating mode W10W35** (source: water in 10°C / plant: water in 30°C out 35°C)													
	Heating capacity		83.7	94.0	110.3	126.1	142.1	159.5	178.2	204.6	230.3	260.3	289.5	kW
	Total power input		17.6	19.0	23.1	26.7	30.4	34.2	38.6	43.9	49.5	56.6	63.9	kW
	COP		4.74	4.95	4.78	4.73	4.68	4.67	4.62	4.66	4.65	4.60	4.53	W/W
	Plant side	Water flow rate	3.96	4.45	5.22	5.97	6.72	7.55	8.43	9.68	10.88	12.30	13.68	l/s
		Water pressure drop	66	53	56	58	63	59	64	65	68	68	70	kPa
	Source side	Water flow rate	5.12	5.67	6.60	7.62	8.64	9.72	10.81	12.37	13.98	15.75	17.52	l/s
		Water pressure drop	110	86	90	95	103	98	105	107	111	112	114	kPa

Data declared according to **EN 14511**. The values are referred to units without options and accessories.

IR-IW UNIT PERFORMANCE

Mod. 70.2 ÷ 105.2

MOD.	TWE	TWC																	
		30			35			40			45			50			55		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
70.2	5	67.4	13.8	80.5	64.1	15.3	78.6	60.8	17.0	77.0	56.9	19.0	74.9	52.6	21.1	72.6	47.7	23.4	69.9
	6	69.7	13.9	82.9	66.4	15.3	80.9	63.0	17.0	79.2	58.9	19.0	77.0	54.5	21.1	74.5	49.4	23.4	71.6
	7	72.0	13.9	85.2	**70.0**	**15.0**	**84.3**	65.2	17.1	81.4	60.9	19.1	79.0	56.4	21.2	76.5	51.1	23.4	73.3
	8	74.4	13.9	87.6	71.0	15.4	85.6	67.3	17.1	83.6	63.0	19.1	81.1	58.2	21.2	78.4	-	-	-
	9	76.7	14.0	90.0	73.2	15.4	87.9	69.5	17.1	85.8	65.0	19.1	83.2	60.1	21.2	80.3	-	-	-
	10	79.0	14.0	92.4	75.5	15.5	90.2	71.7	17.2	88.0	67.0	19.2	85.2	62.0	21.2	82.2	-	-	-
	11	81.4	14.1	94.7	77.8	15.5	92.6	73.8	17.2	90.2	69.1	19.2	87.3	63.9	21.3	84.1	-	-	-
	12	83.7	14.1	97.1	80.1	15.5	94.9	76.0	17.2	92.4	71.1	19.2	89.4	65.8	21.3	86.0	-	-	-
	13	86.0	14.1	99.5	82.4	15.6	97.2	78.2	17.3	94.6	73.1	19.3	91.4	67.7	21.3	87.9	-	-	-
	14	88.3	14.2	101.8	84.7	15.6	99.5	80.4	17.3	96.8	75.2	19.3	93.5	69.5	21.4	89.8	-	-	-
	15	90.7	14.2	104.2	87.0	15.7	101.9	82.5	17.4	99.0	77.2	19.3	95.6	71.4	21.4	91.7	-	-	-
	16	93.0	14.3	106.6	89.3	15.7	104.2	84.7	17.4	101.2	79.2	19.4	97.6	73.3	21.4	93.7	-	-	-
	17	95.3	14.3	108.9	91.5	15.7	106.5	86.9	17.4	103.4	81.3	19.4	99.7	75.2	21.4	95.6	-	-	-
	18	97.7	14.4	111.3	93.8	15.8	108.8	89.0	17.5	105.6	83.3	19.4	101.7	77.1	21.5	97.5	-	-	-
80.2	5	75.0	15.1	89.4	71.4	16.8	87.4	67.8	18.7	85.6	63.5	21.0	83.5	58.9	23.4	81.1	53.5	25.9	78.1
	6	77.5	15.2	91.9	73.9	16.8	89.9	70.3	18.8	88.1	65.9	21.0	85.8	61.1	23.4	83.3	55.6	26.0	80.2
	7	80.0	15.2	94.5	**79.0**	**16.8**	**95.0**	72.7	18.8	90.5	68.2	21.1	88.2	63.3	23.4	85.6	57.7	26.0	82.4
	8	82.5	15.3	97.0	78.9	16.9	95.0	75.1	18.9	93.0	70.5	21.1	90.5	65.5	23.5	87.8	-	-	-
	9	85.0	15.3	99.6	81.4	17.0	97.5	77.5	18.9	95.4	72.8	21.1	92.9	67.7	23.5	90.0	-	-	-
	10	87.5	15.4	102.1	83.9	17.0	100.0	79.9	18.9	97.9	75.1	21.2	95.2	69.9	23.5	92.3	-	-	-
	11	90.0	15.4	104.6	86.4	17.1	102.6	82.3	19.0	100.3	77.4	21.2	97.6	72.1	23.6	94.5	-	-	-
	12	92.5	15.5	107.2	88.9	17.1	105.1	84.7	19.0	102.8	79.7	21.3	99.9	74.3	23.6	96.8	-	-	-
	13	95.0	15.5	109.7	91.3	17.1	107.6	87.1	19.1	105.2	82.0	21.3	102.3	76.5	23.7	99.0	-	-	-
	14	97.5	15.5	112.3	93.8	17.2	110.2	89.5	19.1	107.7	84.4	21.3	104.6	78.7	23.7	101.3	-	-	-
	15	100.0	15.6	114.8	96.3	17.2	112.7	91.9	19.1	110.1	86.7	21.4	107.0	81.0	23.7	103.5	-	-	-
	16	102.5	15.6	117.4	98.8	17.3	115.2	94.3	19.2	112.6	89.0	21.4	109.3	83.2	23.8	105.7	-	-	-
	17	105.0	15.7	119.9	101.3	17.3	117.8	96.8	19.2	115.0	91.3	21.5	111.7	85.4	23.8	108.0	-	-	-
	18	107.5	15.7	122.4	103.8	17.4	120.3	99.2	19.3	117.5	93.6	21.5	114.0	87.6	23.8	110.2	-	-	-
90.2	5	87.9	18.0	105.0	83.9	20.0	102.9	79.8	22.4	101.1	75.0	25.1	98.9	69.8	28.0	96.4	63.7	31.1	93.3
	6	90.7	18.0	107.8	86.7	20.0	105.7	82.6	22.4	103.9	77.7	25.2	101.6	72.4	28.1	99.1	66.3	31.2	95.9
	7	93.4	18.1	110.6	**92.0**	**20.3**	**111.3**	85.4	22.5	106.7	80.4	25.2	104.4	75.1	28.1	101.8	68.9	31.2	98.6
	8	96.2	18.1	113.4	92.3	20.2	111.4	88.1	22.5	109.5	83.1	25.3	107.1	77.8	28.2	104.5	-	-	-
	9	98.9	18.2	116.2	95.0	20.2	114.2	90.9	22.6	112.3	85.9	25.3	109.9	80.4	28.2	107.2	-	-	-
	10	101.7	18.3	119.0	97.8	20.3	117.1	93.6	22.6	115.1	88.6	25.4	112.7	83.1	28.3	109.9	-	-	-
	11	104.5	18.3	121.9	100.6	20.3	119.9	96.4	22.7	117.9	91.3	25.4	115.4	85.8	28.3	112.6	-	-	-
	12	107.2	18.4	124.7	103.4	20.4	122.8	99.1	22.7	120.7	94.0	25.5	118.2	88.4	28.3	115.4	-	-	-
	13	110.0	18.4	127.5	106.2	20.4	125.6	101.9	22.8	123.5	96.7	25.5	121.0	91.1	28.4	118.1	-	-	-
	14	112.7	18.5	130.3	109.0	20.5	128.5	104.6	22.8	126.3	99.4	25.6	123.7	93.8	28.4	120.8	-	-	-
	15	115.5	18.5	133.1	111.8	20.5	131.3	107.4	22.9	129.1	102.1	25.6	126.5	96.4	28.5	123.5	-	-	-
	16	118.3	18.6	135.9	114.6	20.6	134.1	110.2	22.9	131.9	104.8	25.7	129.2	99.1	28.5	126.2	-	-	-
	17	121.0	18.6	138.7	117.4	20.6	137.0	112.9	23.0	134.8	107.6	25.7	132.0	101.8	28.6	128.9	-	-	-
	18	123.8	18.7	141.5	120.2	20.7	139.8	115.7	23.0	137.6	110.3	25.8	134.8	104.4	28.6	131.6	-	-	-
105.2	5	99.9	20.9	119.7	95.2	23.0	117.1	90.5	25.6	114.8	84.8	28.6	112.0	78.7	31.8	108.9	71.7	35.2	105.1
	6	103.2	20.9	123.1	98.5	23.1	120.5	93.8	25.7	118.2	88.1	28.7	115.3	81.9	31.8	112.1	74.7	35.2	108.2
	7	106.5	21.0	126.5	**105.0**	**23.3**	**127.1**	97.1	25.8	121.5	91.3	28.8	118.6	85.0	31.9	115.3	77.8	35.3	111.3
	8	109.8	21.1	129.9	105.2	23.3	127.3	100.3	25.8	124.9	94.5	28.8	121.9	88.1	32.0	118.5	-	-	-
	9	113.2	21.1	133.2	108.6	23.3	130.7	103.6	25.9	128.2	97.7	28.9	125.2	91.3	32.1	121.7	-	-	-
	10	116.5	21.2	136.6	111.9	23.4	134.1	106.9	26.0	131.6	100.9	29.0	128.4	94.4	32.1	125.0	-	-	-
	11	119.8	21.3	140.0	115.2	23.5	137.5	110.2	26.1	134.9	104.1	29.1	131.7	97.6	32.2	128.2	-	-	-
	12	123.1	21.4	143.4	118.6	23.6	140.9	113.5	26.1	138.3	107.3	29.1	135.0	100.7	32.3	131.4	-	-	-
	13	126.4	21.4	146.8	121.9	23.6	144.3	116.7	26.2	141.6	110.6	29.2	138.3	103.8	32.3	134.6	-	-	-
	14	129.7	21.5	150.1	125.2	23.7	147.8	120.0	26.3	145.0	113.8	29.3	141.6	107.0	32.4	137.8	-	-	-
	15	133.0	21.6	153.5	128.6	23.8	151.2	123.3	26.3	148.3	117.0	29.3	144.9	110.1	32.5	141.0	-	-	-
	16	136.3	21.7	156.9	131.9	23.8	154.6	126.6	26.4	151.7	120.2	29.4	148.1	113.3	32.6	144.2	-	-	-
	17	139.6	21.7	160.3	135.2	23.9	158.0	129.9	26.5	155.0	123.4	29.5	151.4	116.4	32.6	147.4	-	-	-
	18	142.9	21.8	163.6	138.6	24.0	161.4	133.1	26.6	158.4	126.6	29.6	154.7	119.6	32.7	150.6	-	-	-

TWE= OUTLET PLANT water temperature (cooling mode). OUTLET SOURCE water temperature (heating mode) (°C)
TWC= OUTLET SOURCE water temperature (cooling mode). OUTLET PLANT water temperature (heating mode) (°C)
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).
The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchangers. Has also been considered A 0.44 x 10^{-4} m^2 K/W fouling factor.
The performances are declared no considering any correction due to water flow rate and water side pressure drop (gross performance).

IR-IW UNIT PERFORMANCE

Mod. 120.2 ÷ 170.2

MOD.	TWE	TWC																	
		30			35			40			45			50			55		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
120.2	5	112.0	23.7	134.5	106.6	26.1	131.4	101.3	28.9	128.7	94.8	32.1	125.3	87.9	35.5	121.6	79.9	39.2	117.1
	6	115.8	23.8	138.4	110.5	26.1	135.3	105.1	28.9	132.5	98.5	32.2	129.1	91.5	35.6	125.3	83.3	39.3	120.6
	7	119.7	23.9	142.4	**118.0**	**26.3**	**143.0**	108.8	29.0	136.4	102.2	32.3	132.9	95.0	35.7	128.9	86.7	39.4	124.1
	8	123.6	23.9	146.3	118.2	26.3	143.2	112.6	29.1	140.3	105.9	32.4	136.6	98.6	35.8	132.6	-	-	-
	9	127.4	24.0	150.2	122.1	26.4	147.2	116.4	29.2	144.2	109.6	32.5	140.4	102.2	35.9	136.2	-	-	-
	10	131.3	24.1	154.2	126.0	26.5	151.2	120.2	29.3	148.0	113.3	32.5	144.2	105.7	36.0	139.9	-	-	-
	11	135.2	24.2	158.1	129.9	26.6	155.1	124.0	29.4	151.9	116.9	32.6	147.9	109.3	36.1	143.6	-	-	-
	12	139.0	24.3	162.1	133.8	26.6	159.1	127.8	29.5	155.8	120.6	32.7	151.7	112.9	36.2	147.2	-	-	-
	13	142.9	24.3	166.0	137.6	26.7	163.0	131.6	29.5	159.6	124.3	32.8	155.5	116.4	36.3	150.9	-	-	-
	14	146.8	24.4	170.0	141.5	26.8	167.0	135.4	29.6	163.5	128.0	32.9	159.2	120.0	36.3	154.5	-	-	-
	15	150.6	24.5	173.9	145.4	26.9	170.9	139.2	29.7	167.4	131.7	33.0	163.0	123.6	36.4	158.2	-	-	-
	16	154.5	24.6	177.8	149.3	27.0	174.9	142.9	29.8	171.3	135.4	33.1	166.8	127.1	36.5	161.8	-	-	-
	17	158.4	24.7	181.8	153.1	27.1	178.9	146.7	29.9	175.1	139.0	33.2	170.6	130.7	36.6	165.5	-	-	-
	18	162.2	24.7	185.7	157.0	27.1	182.8	150.5	30.0	179.0	142.7	33.3	174.3	134.3	36.7	169.2	-	-	-
135.2	5	126.3	26.8	151.8	120.4	29.5	148.4	114.5	32.6	145.5	107.3	36.3	141.8	99.6	40.1	137.7	90.7	44.2	132.7
	6	130.7	26.9	156.2	124.7	29.6	152.8	118.6	32.7	149.7	111.3	36.4	145.9	103.4	40.2	141.6	94.3	44.3	136.4
	7	135.0	27.0	160.7	**133.0**	**29.8**	**161.3**	122.8	32.8	154.0	115.3	36.4	150.0	107.3	40.3	145.5	97.9	44.4	140.1
	8	139.4	27.1	165.1	133.4	29.8	161.6	127.0	32.9	158.2	119.4	36.5	154.1	111.1	40.4	149.4	-	-	-
	9	143.7	27.2	169.5	137.7	29.8	166.0	131.2	33.0	162.5	123.4	36.6	158.1	114.9	40.5	153.3	-	-	-
	10	148.0	27.3	173.9	142.0	29.9	170.4	135.3	33.1	166.8	127.4	36.7	162.2	118.7	40.5	157.2	-	-	-
	11	152.4	27.3	178.4	146.3	30.0	174.8	139.5	33.2	171.0	131.4	36.8	166.3	122.5	40.6	161.1	-	-	-
	12	156.7	27.4	182.8	150.6	30.1	179.2	143.7	33.2	175.3	135.4	36.9	170.4	126.3	40.7	165.0	-	-	-
	13	161.1	27.5	187.2	155.0	30.2	183.6	147.9	33.3	179.5	139.4	37.0	174.5	130.2	40.8	168.9	-	-	-
	14	165.4	27.6	191.7	159.3	30.3	188.0	152.0	33.4	183.8	143.4	37.1	178.6	134.0	40.9	172.8	-	-	-
	15	169.8	27.7	196.1	163.6	30.4	192.4	156.2	33.5	188.1	147.4	37.1	182.7	137.8	41.0	176.7	-	-	-
	16	174.1	27.8	200.5	167.9	30.5	196.8	160.4	33.6	192.3	151.4	37.2	186.8	141.6	41.1	180.6	-	-	-
	17	178.4	27.9	204.9	172.2	30.5	201.2	164.6	33.7	196.6	155.4	37.3	190.9	145.4	41.2	184.5	-	-	-
	18	182.8	28.0	209.4	176.6	30.6	205.7	168.8	33.8	200.8	159.4	37.4	194.9	149.3	41.2	188.4	-	-	-
150.2	5	140.8	30.2	169.5	134.3	33.1	165.7	127.7	36.6	162.5	119.8	40.6	158.4	111.3	44.8	153.9	101.5	49.4	148.4
	6	145.6	30.3	174.4	139.0	33.2	170.6	132.3	36.7	167.1	124.2	40.7	162.8	115.4	44.9	158.1	105.3	49.4	152.3
	7	150.4	30.4	179.3	**148.0**	**33.3**	**179.6**	136.8	36.8	171.8	128.5	40.8	167.2	119.5	45.0	162.2	109.1	49.5	156.1
	8	155.2	30.5	184.2	148.5	33.4	180.2	141.3	36.9	176.4	132.8	40.9	171.6	123.6	45.1	166.4	-	-	-
	9	159.9	30.6	189.0	153.2	33.6	185.1	145.9	37.0	181.0	137.1	41.0	176.1	127.6	45.2	170.6	-	-	-
	10	164.7	30.7	193.9	157.9	33.7	189.9	150.4	37.1	185.7	141.4	41.1	180.5	131.7	45.3	174.7	-	-	-
	11	169.5	30.9	198.8	162.6	33.8	194.7	155.0	37.2	190.3	145.8	41.2	184.9	135.8	45.4	178.9	-	-	-
	12	174.3	31.0	203.7	167.4	33.9	199.6	159.5	37.3	195.0	150.1	41.3	189.3	139.9	45.4	183.0	-	-	-
	13	179.0	31.1	208.6	172.1	34.0	204.4	164.1	37.4	199.6	154.4	41.4	193.7	143.9	45.5	187.2	-	-	-
	14	183.8	31.2	213.5	176.8	34.1	209.2	168.6	37.5	204.2	158.7	41.5	198.1	148.0	45.6	191.4	-	-	-
	15	188.6	31.3	218.3	181.6	34.2	214.1	173.1	37.6	208.9	163.0	41.6	202.5	152.1	45.7	195.5	-	-	-
	16	193.4	31.4	223.2	186.3	34.3	218.9	177.7	37.7	213.5	167.4	41.7	206.9	156.2	45.8	199.7	-	-	-
	17	198.1	31.5	228.1	191.0	34.4	223.7	182.2	37.8	218.2	171.7	41.8	211.4	160.3	45.9	203.9	-	-	-
	18	202.9	31.6	233.0	195.7	34.5	228.5	186.8	37.9	222.8	176.0	41.8	215.8	164.3	46.0	208.0	-	-	-
170.2	5	161.4	34.3	194.1	154.0	37.7	189.8	146.5	41.6	186.0	137.6	46.2	181.4	127.8	50.9	176.2	116.7	56.1	170.0
	6	167.0	34.5	199.7	159.4	37.8	195.3	151.8	41.7	191.4	142.6	46.3	186.5	132.6	51.1	181.1	121.1	56.2	174.5
	7	172.5	34.6	205.3	**170.0**	**37.8**	**205.9**	157.0	41.8	196.8	147.6	46.4	191.6	137.3	51.2	185.9	125.5	56.3	179.0
	8	178.0	34.7	210.9	170.4	38.0	206.5	162.3	41.9	202.1	152.6	46.5	196.7	142.0	51.3	190.8	-	-	-
	9	183.5	34.8	216.6	175.8	38.1	212.1	167.5	42.1	207.5	157.6	46.6	201.9	146.8	51.4	195.6	-	-	-
	10	189.0	34.9	222.2	181.3	38.3	217.6	172.8	42.2	212.9	162.6	46.7	207.0	151.5	51.5	200.4	-	-	-
	11	194.5	35.1	227.8	186.8	38.4	223.2	178.0	42.3	218.2	167.6	46.8	212.1	156.2	51.6	205.3	-	-	-
	12	200.1	35.2	233.5	192.2	38.5	228.8	183.3	42.4	223.6	172.6	47.0	217.2	161.0	51.7	210.1	-	-	-
	13	205.6	35.3	239.1	197.7	38.6	234.4	188.5	42.5	229.0	177.6	47.1	222.3	165.7	51.9	215.0	-	-	-
	14	211.1	35.4	244.7	203.1	38.7	240.0	193.8	42.7	234.3	182.6	47.2	227.4	170.4	52.0	219.8	-	-	-
	15	216.6	35.5	250.4	208.6	38.9	245.5	199.1	42.8	239.7	187.6	47.3	232.5	175.2	52.1	224.6	-	-	-
	16	222.1	35.7	256.0	214.1	39.0	251.1	204.3	42.9	245.1	192.6	47.4	237.6	179.9	52.2	229.5	-	-	-
	17	227.6	35.8	261.6	219.5	39.1	256.7	209.6	43.0	250.4	197.6	47.5	242.8	184.6	52.3	234.3	-	-	-
	18	233.2	35.9	267.3	225.0	39.2	262.3	214.8	43.1	255.8	202.6	47.7	247.9	189.4	52.4	239.2	-	-	-

TWE= OUTLET PLANT water temperature (cooling mode). OUTLET SOURCE water temperature (heating mode) (°C)
TWC= OUTLET SOURCE water temperature (cooling mode). OUTLET PLANT water temperature (heating mode) (°C)
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).

The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchangers. Has also been considered A 0.44 x 10^{-4} m^2 K/W fouling factor.

The performances are declared no considering any correction due to water flow rate and water side pressure drop (gross performance).

IR-IW UNIT PERFORMANCE

Mod. 190.2 ÷ 240.2

MOD.	TWE	TWC																	
		30			35			40			45			50			55		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
190.2	5	181.9	38.4	218.3	173.5	42.1	213.5	165.1	46.6	209.3	155.0	51.7	204.1	144.1	57.1	198.3	131.5	62.9	191.3
	6	188.2	38.5	224.8	179.7	42.3	219.9	171.1	46.7	215.5	160.7	51.8	210.0	149.5	57.2	203.9	136.6	63.0	196.4
	7	194.5	38.6	231.2	**192.0**	**42.3**	**232.2**	177.1	46.8	221.6	166.5	52.0	215.8	154.9	57.3	209.4	141.6	63.2	201.6
	8	200.8	38.8	237.7	192.2	42.5	232.6	183.1	47.0	227.7	172.2	52.1	221.6	160.3	57.5	214.9	-	-	-
	9	207.1	38.9	244.1	198.5	42.7	239.0	189.1	47.1	233.8	177.9	52.2	227.5	165.7	57.6	220.4	-	-	-
	10	213.4	39.0	250.5	204.7	42.8	245.4	195.1	47.2	240.0	183.6	52.4	233.3	171.1	57.8	226.0	-	-	-
	11	219.8	39.2	257.0	211.0	42.9	251.8	201.1	47.4	246.1	189.3	52.5	239.2	176.5	57.9	231.5	-	-	-
	12	226.1	39.3	263.4	217.2	43.1	258.1	207.1	47.5	252.2	195.0	52.6	245.0	181.9	58.0	237.0	-	-	-
	13	232.4	39.4	269.8	223.5	43.2	264.5	213.1	47.6	258.4	200.7	52.8	250.8	187.3	58.2	242.5	-	-	-
	14	238.7	39.6	276.3	229.7	43.3	270.9	219.1	47.8	264.5	206.4	52.9	256.7	192.7	58.3	248.1	-	-	-
	15	245.0	39.7	282.7	236.0	43.5	277.2	225.1	47.9	270.6	212.1	53.0	262.5	198.1	58.4	253.6	-	-	-
	16	251.3	39.8	289.2	242.2	43.6	283.6	231.1	48.0	276.7	217.8	53.2	268.4	203.4	58.6	259.1	-	-	-
	17	257.6	39.9	295.6	248.5	43.7	290.0	237.1	48.2	282.9	223.6	53.3	274.2	208.8	58.7	264.6	-	-	-
	18	264.0	40.1	302.0	254.7	43.8	296.4	243.1	48.3	289.0	229.3	53.4	280.0	214.2	58.9	270.1	-	-	-
215.2	5	204.9	43.2	245.9	195.4	47.5	240.6	185.9	52.6	235.9	174.6	58.4	230.1	162.3	64.6	223.6	148.1	71.2	215.7
	6	211.9	43.4	253.1	202.4	47.7	247.7	192.7	52.7	242.7	181.0	58.6	236.6	168.3	64.7	229.8	153.7	71.3	221.5
	7	219.0	43.5	260.3	**216.0**	**48.4**	**262.0**	199.4	52.9	249.6	187.4	58.7	243.2	174.4	64.9	236.0	159.4	71.5	227.3
	8	226.0	43.7	267.5	216.4	48.0	261.9	206.1	53.0	256.5	193.8	58.9	249.7	180.4	65.0	242.2	-	-	-
	9	233.1	43.8	274.7	223.3	48.1	269.1	212.8	53.2	263.3	200.2	59.0	256.2	186.4	65.2	248.4	-	-	-
	10	240.1	44.0	281.9	230.3	48.3	276.2	219.5	53.3	270.2	206.5	59.2	262.8	192.5	65.3	254.5	-	-	-
	11	247.2	44.2	289.1	237.3	48.4	283.3	226.2	53.5	277.0	212.9	59.3	269.3	198.5	65.5	260.7	-	-	-
	12	254.3	44.3	296.3	244.3	48.6	290.5	232.9	53.6	283.9	219.3	59.5	275.8	204.6	65.6	266.9	-	-	-
	13	261.3	44.5	303.5	251.3	48.7	297.6	239.7	53.8	290.7	225.7	59.6	282.4	210.6	65.8	273.1	-	-	-
	14	268.4	44.6	310.7	258.3	48.9	304.7	246.4	53.9	297.6	232.1	59.8	288.9	216.6	65.9	279.3	-	-	-
	15	275.4	44.8	317.9	265.3	49.0	311.8	253.1	54.1	304.5	238.5	59.9	295.4	222.7	66.1	285.5	-	-	-
	16	282.5	44.9	325.1	272.2	49.2	319.0	259.8	54.2	311.3	244.9	60.1	302.0	228.7	66.2	291.6	-	-	-
	17	289.5	45.1	332.3	279.2	49.3	326.1	266.5	54.4	318.2	251.3	60.2	308.5	234.8	66.4	297.8	-	-	-
	18	296.6	45.2	339.5	286.2	49.5	333.2	273.2	54.5	325.0	257.7	60.4	315.0	240.8	66.5	304.0	-	-	-
240.2	5	228.5	48.0	274.2	218.1	52.9	268.3	207.6	58.6	263.2	195.0	65.2	256.9	181.4	72.1	249.9	165.6	79.6	241.3
	6	236.4	48.2	282.2	225.9	53.0	276.3	215.1	58.7	270.9	202.1	65.3	264.2	188.1	72.3	256.8	171.9	79.8	247.7
	7	244.3	48.4	290.3	**240.0**	**54.5**	**291.8**	222.6	58.9	278.5	209.3	65.5	271.5	194.8	72.5	263.7	178.2	80.0	254.2
	8	252.2	48.5	298.3	241.5	53.4	292.2	230.1	59.1	286.2	216.4	65.7	278.8	201.6	72.6	270.6	-	-	-
	9	260.1	48.7	306.4	249.3	53.6	300.2	237.6	59.2	293.9	223.5	65.9	286.1	208.3	72.8	277.5	-	-	-
	10	268.0	48.9	314.4	257.1	53.7	308.1	245.1	59.4	301.5	230.7	66.0	293.4	215.1	73.0	284.4	-	-	-
	11	275.9	49.0	322.5	264.9	53.9	316.1	252.6	59.6	309.2	237.8	66.2	300.7	221.8	73.2	291.3	-	-	-
	12	283.8	49.2	330.5	272.7	54.1	324.1	260.1	59.8	316.9	245.0	66.4	308.0	228.5	73.4	298.2	-	-	-
	13	291.7	49.4	338.6	280.5	54.2	332.1	267.6	59.9	324.5	252.1	66.6	315.3	235.3	73.5	305.1	-	-	-
	14	299.6	49.6	346.6	288.3	54.4	340.0	275.1	60.1	332.2	259.2	66.7	322.6	242.0	73.7	312.0	-	-	-
	15	307.5	49.7	354.7	296.1	54.6	348.0	282.6	60.3	339.9	266.4	66.9	329.9	248.8	73.9	319.0	-	-	-
	16	315.4	49.9	362.7	304.0	54.7	356.0	290.1	60.5	347.5	273.5	67.1	337.2	255.5	74.1	325.9	-	-	-
	17	323.2	50.1	370.8	311.8	54.9	363.9	297.6	60.6	355.2	280.6	67.3	344.5	262.2	74.2	332.8	-	-	-
	18	331.1	50.2	378.8	319.6	55.1	371.9	305.1	60.8	362.9	287.8	67.4	351.8	269.0	74.4	339.7	-	-	-

TWE= OUTLET PLANT water temperature (cooling mode). OUTLET SOURCE water temperature (heating mode) (°C)
TWC= OUTLET SOURCE water temperature (cooling mode). OUTLET PLANT water temperature (heating mode) (°C)
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).

The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchangers. Has also been considered A 0.44 x 10^{-4} m^2 K/W fouling factor.

The performances are declared no considering any correction due to water flow rate and water side pressure drop (gross performance).

IP UNIT PERFORMANCE

Mod. 70.2 ÷ 105.2

MOD.	TWE	TWC																	
		30			35			40			45			50			55		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
70.2	5	66.1	13.9	79.4	62.9	15.4	77.5	59.7	17.1	75.9	55.8	19.1	73.9	51.6	21.2	71.7	46.8	23.4	69.0
	6	68.4	14.0	81.7	65.1	15.4	79.8	61.8	17.1	78.1	57.8	19.1	76.0	53.5	21.2	73.6	48.4	23.5	70.7
	7	70.7	14.0	84.0	**68.6**	**14.9**	**82.8**	63.9	17.2	80.2	59.8	19.2	78.0	55.3	21.2	75.5	50.1	23.5	72.4
	8	73.0	14.1	86.3	69.6	15.5	84.4	66.1	17.2	82.4	61.8	19.2	80.0	57.1	21.3	77.4	-	-	-
	9	75.2	14.1	88.6	71.9	15.6	86.6	68.2	17.3	84.6	63.8	19.2	82.0	59.0	21.3	79.2	-	-	-
	10	77.5	14.2	91.0	74.1	15.6	88.9	70.3	17.3	86.7	65.8	19.3	84.1	60.8	21.3	81.1	-	-	-
	11	79.8	14.2	93.3	76.3	15.6	91.2	72.4	17.3	88.9	67.8	19.3	86.1	62.7	21.4	83.0	-	-	-
	12	82.1	14.2	95.6	78.6	15.7	93.5	74.6	17.4	91.1	69.7	19.3	88.1	64.5	21.4	84.8	-	-	-
	13	84.4	14.3	97.9	80.8	15.7	95.7	76.7	17.4	93.2	71.7	19.3	90.1	66.4	21.4	86.7	-	-	-
	14	86.6	14.3	100.2	83.1	15.7	98.0	78.8	17.4	95.4	73.7	19.4	92.1	68.2	21.4	88.6	-	-	-
	15	88.9	14.4	102.6	85.3	15.8	100.3	80.9	17.5	97.5	75.7	19.4	94.2	70.1	21.5	90.5	-	-	-
	16	91.2	14.4	104.9	87.5	15.8	102.6	83.1	17.5	99.7	77.7	19.4	96.2	71.9	21.5	92.3	-	-	-
	17	93.5	14.4	107.2	89.8	15.9	104.9	85.2	17.5	101.9	79.7	19.5	98.2	73.8	21.5	94.2	-	-	-
	18	95.8	14.5	109.5	92.0	15.9	107.1	87.3	17.6	104.0	81.7	19.5	100.2	75.6	21.5	96.1	-	-	-
80.2	5	73.8	15.3	88.3	70.3	16.9	86.4	66.8	18.8	84.7	62.6	21.1	82.6	58.0	23.4	80.2	52.7	25.9	77.4
	6	76.3	15.3	90.8	72.7	17.0	88.8	69.1	18.9	87.1	64.8	21.1	84.9	60.2	23.5	82.4	54.8	26.0	79.5
	7	78.7	15.4	93.3	**77.4**	**16.6**	**93.2**	71.5	18.9	89.5	67.1	21.1	87.2	62.3	23.5	84.6	56.8	26.0	81.5
	8	81.2	15.4	95.8	77.6	17.0	93.8	73.9	19.0	91.9	69.4	21.2	89.5	64.5	23.5	86.8	-	-	-
	9	83.6	15.5	98.3	80.1	17.1	96.3	76.2	19.0	94.3	71.6	21.2	91.8	66.6	23.6	89.0	-	-	-
	10	86.0	15.5	100.8	82.5	17.1	98.8	78.6	19.0	96.7	73.9	21.3	94.1	68.8	23.6	91.2	-	-	-
	11	88.5	15.6	103.3	84.9	17.2	101.2	80.9	19.1	99.1	76.2	21.3	96.4	71.0	23.6	93.4	-	-	-
	12	90.9	15.6	105.8	87.4	17.2	103.7	83.3	19.1	101.5	78.4	21.3	98.7	73.1	23.7	95.6	-	-	-
	13	93.4	15.6	108.3	89.8	17.3	106.2	85.7	19.2	103.9	80.7	21.4	101.0	75.3	23.7	97.8	-	-	-
	14	95.8	15.7	110.8	92.2	17.3	108.7	88.0	19.2	106.3	83.0	21.4	103.3	77.5	23.7	100.0	-	-	-
	15	98.3	15.7	113.2	94.7	17.4	111.2	90.4	19.3	108.7	85.2	21.5	105.6	79.6	23.8	102.2	-	-	-
	16	100.7	15.8	115.7	97.1	17.4	113.6	92.7	19.3	111.1	87.5	21.5	107.9	81.8	23.8	104.4	-	-	-
	17	103.2	15.8	118.2	99.6	17.4	116.1	95.1	19.3	113.5	89.7	21.5	110.2	84.0	23.8	106.6	-	-	-
	18	105.6	15.9	120.7	102.0	17.5	118.6	97.5	19.4	115.9	92.0	21.6	112.5	86.1	23.9	108.8	-	-	-
90.2	5	86.6	18.2	103.8	82.6	20.2	101.8	78.6	22.5	100.1	73.9	25.3	97.9	68.8	28.1	95.5	62.8	31.2	92.5
	6	89.3	18.3	106.6	85.3	20.3	104.6	81.3	22.6	102.8	76.6	25.3	100.6	71.4	28.2	98.2	65.4	31.3	95.1
	7	92.0	18.3	109.4	**90.2**	**20.1**	**109.3**	84.0	22.6	105.6	79.2	25.4	103.3	74.0	28.2	100.8	68.0	31.3	97.7
	8	94.7	18.4	112.1	90.8	20.4	110.1	86.7	22.7	108.3	81.9	25.4	106.0	76.6	28.3	103.5	-	-	-
	9	97.4	18.4	114.9	93.5	20.4	112.9	89.5	22.8	111.1	84.5	25.5	108.7	79.2	28.3	106.1	-	-	-
	10	100.1	18.5	117.6	96.3	20.5	115.7	92.2	22.8	113.8	87.2	25.5	111.4	81.8	28.4	108.8	-	-	-
	11	102.8	18.5	120.4	99.0	20.5	118.5	94.9	22.9	116.6	89.9	25.6	114.1	84.4	28.4	111.4	-	-	-
	12	105.5	18.6	123.1	101.8	20.6	121.3	97.6	22.9	119.3	92.5	25.6	116.9	87.1	28.5	114.1	-	-	-
	13	108.2	18.6	125.9	104.5	20.6	124.1	100.3	23.0	122.1	95.2	25.7	119.6	89.7	28.5	116.8	-	-	-
	14	110.9	18.7	128.7	107.2	20.7	126.9	103.0	23.0	124.8	97.8	25.7	122.3	92.3	28.6	119.4	-	-	-
	15	113.6	18.8	131.4	110.0	20.7	129.7	105.7	23.1	127.6	100.5	25.8	125.0	94.9	28.6	122.1	-	-	-
	16	116.3	18.8	134.2	112.7	20.8	132.4	108.4	23.1	130.3	103.2	25.8	127.7	97.5	28.7	124.7	-	-	-
	17	119.0	18.9	136.9	115.4	20.8	135.2	111.1	23.2	133.1	105.8	25.9	130.4	100.1	28.7	127.4	-	-	-
	18	121.7	18.9	139.7	118.2	20.9	138.0	113.8	23.2	135.8	108.5	25.9	133.1	102.7	28.8	130.1	-	-	-
105.2	5	98.5	21.1	118.5	93.9	23.2	116.0	89.3	25.8	113.8	83.7	28.8	111.1	77.7	31.9	108.0	70.8	35.3	104.3
	6	101.8	21.1	121.9	97.2	23.3	119.3	92.5	25.9	117.1	86.9	28.8	114.3	80.8	32.0	111.2	73.8	35.3	107.4
	7	105.0	21.2	125.2	**103.0**	**23.1**	**124.9**	95.7	25.9	120.4	90.0	28.9	117.5	83.9	32.0	114.3	76.8	35.4	110.4
	8	108.3	21.3	128.5	103.7	23.5	126.0	98.9	26.0	123.7	93.2	29.0	120.7	87.0	32.1	117.5	-	-	-
	9	111.5	21.4	131.8	107.0	23.5	129.4	102.2	26.1	126.9	96.4	29.1	124.0	90.1	32.2	120.6	-	-	-
	10	114.8	21.4	135.1	110.3	23.6	132.7	105.4	26.2	130.2	99.5	29.1	127.2	93.1	32.2	123.8	-	-	-
	11	118.0	21.5	138.4	113.5	23.7	136.0	108.6	26.2	133.5	102.7	29.2	130.4	96.2	32.3	126.9	-	-	-
	12	121.2	21.6	141.7	116.8	23.7	139.4	111.8	26.3	136.8	105.8	29.3	133.6	99.3	32.4	130.1	-	-	-
	13	124.5	21.6	145.1	120.1	23.8	142.7	115.0	26.4	140.1	109.0	29.3	136.8	102.4	32.5	133.2	-	-	-
	14	127.7	21.7	148.4	123.4	23.9	146.1	118.3	26.4	143.4	112.1	29.4	140.1	105.5	32.5	136.4	-	-	-
	15	131.0	21.8	151.7	126.6	24.0	149.4	121.5	26.5	146.7	115.3	29.5	143.3	108.5	32.6	139.5	-	-	-
	16	134.2	21.9	155.0	129.9	24.0	152.7	124.7	26.6	149.9	118.4	29.6	146.5	111.6	32.7	142.7	-	-	-
	17	137.5	21.9	158.3	133.2	24.1	156.1	127.9	26.7	153.2	121.6	29.6	149.7	114.7	32.8	145.8	-	-	-
	18	140.7	22.0	161.6	136.5	24.2	159.4	131.1	26.7	156.5	124.7	29.7	152.9	117.8	32.8	149.0	-	-	-

TWE= OUTLET PLANT water temperature (cooling mode). OUTLET SOURCE water temperature (heating mode) (°C)
TWC= OUTLET SOURCE water temperature (cooling mode). OUTLET PLANT water temperature (heating mode) (°C)
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).

The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchangers. Has also been considered A 0.44 x 10^{-4} m^2 K/W fouling factor.

The performances are declared no considering any correction due to water flow rate and water side pressure drop (gross performance).

IP UNIT PERFORMANCE

Mod. 120.2 ÷ 170.2

MOD.	TWE	TWC																	
		30			35			40			45			50			55		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
120.2	5	110.6	23.9	133.4	105.4	26.3	130.4	100.1	29.0	127.7	93.8	32.2	124.4	87.0	35.6	120.8	79.1	39.2	116.4
	6	114.4	24.0	137.3	109.2	26.4	134.2	103.9	29.1	131.5	97.4	32.3	128.2	90.5	35.7	124.4	82.5	39.3	119.8
	7	118.2	24.1	141.1	**116.0**	**26.0**	**140.7**	107.6	29.2	135.3	101.1	32.4	131.9	94.0	35.8	128.0	85.8	39.4	123.3
	8	122.0	24.2	145.0	116.8	26.5	142.0	111.3	29.3	139.1	104.7	32.5	135.6	97.5	35.9	131.6	-	-	-
	9	125.8	24.3	148.9	120.6	26.6	145.9	115.0	29.4	142.9	108.3	32.6	139.3	101.0	36.0	135.2	-	-	-
	10	129.6	24.3	152.8	124.4	26.7	149.8	118.7	29.5	146.7	111.9	32.7	143.0	104.5	36.1	138.8	-	-	-
	11	133.4	24.4	156.6	128.3	26.8	153.7	122.5	29.6	150.6	115.5	32.8	146.7	108.0	36.2	142.4	-	-	-
	12	137.2	24.5	160.5	132.1	26.9	157.6	126.2	29.6	154.4	119.2	32.9	150.4	111.5	36.3	146.0	-	-	-
	13	141.0	24.6	164.4	135.9	26.9	161.5	129.9	29.7	158.2	122.8	33.0	154.1	115.0	36.4	149.6	-	-	-
	14	144.8	24.7	168.3	139.7	27.0	165.4	133.6	29.8	162.0	126.4	33.0	157.8	118.5	36.5	153.2	-	-	-
	15	148.7	24.7	172.2	143.5	27.1	169.3	137.4	29.9	165.8	130.0	33.1	161.5	122.0	36.5	156.8	-	-	-
	16	152.5	24.8	176.0	147.3	27.2	173.1	141.1	30.0	169.6	133.6	33.2	165.2	125.6	36.6	160.4	-	-	-
	17	156.3	24.9	179.9	151.1	27.3	177.0	144.8	30.1	173.4	137.3	33.3	168.9	129.1	36.7	164.0	-	-	-
	18	160.1	25.0	183.8	154.9	27.4	180.9	148.5	30.2	177.2	140.9	33.4	172.6	132.6	36.8	167.6	-	-	-
135.2	5	124.9	27.1	150.7	119.1	29.8	147.4	113.3	32.9	144.5	106.4	36.5	141.0	98.8	40.3	137.1	90.1	44.3	132.2
	6	129.2	27.2	155.0	123.3	29.8	151.7	117.4	32.9	148.7	110.3	36.6	145.0	102.5	40.3	140.9	93.6	44.4	135.8
	7	133.4	27.3	159.3	**130.0**	**29.5**	**158.0**	121.5	33.0	152.9	114.2	36.6	149.0	106.3	40.4	144.7	97.2	44.5	139.5
	8	137.7	27.4	163.7	131.8	30.0	160.3	125.6	33.1	157.0	118.1	36.7	153.0	110.0	40.5	148.5	-	-	-
	9	141.9	27.5	168.0	136.0	30.1	164.6	129.7	33.2	161.2	122.0	36.8	157.0	113.7	40.6	152.3	-	-	-
	10	146.2	27.5	172.3	140.2	30.2	168.9	133.7	33.3	165.4	125.9	36.9	161.0	117.5	40.7	156.1	-	-	-
	11	150.4	27.6	176.6	144.5	30.3	173.2	137.8	33.4	169.5	129.8	37.0	165.0	121.2	40.8	160.0	-	-	-
	12	154.6	27.7	181.0	148.7	30.4	177.5	141.9	33.5	173.7	133.8	37.1	169.0	124.9	40.9	163.8	-	-	-
	13	158.9	27.8	185.3	152.9	30.4	181.8	146.0	33.6	177.9	137.7	37.2	173.0	128.7	41.0	167.6	-	-	-
	14	163.1	27.9	189.6	157.1	30.5	186.1	150.1	33.6	182.0	141.6	37.2	177.0	132.4	41.0	171.4	-	-	-
	15	167.4	28.0	194.0	161.3	30.6	190.4	154.1	33.7	186.2	145.5	37.3	181.0	136.1	41.1	175.2	-	-	-
	16	171.6	28.1	198.3	165.6	30.7	194.7	158.2	33.8	190.3	149.4	37.4	185.0	139.9	41.2	179.0	-	-	-
	17	175.9	28.2	202.6	169.8	30.8	199.0	162.3	33.9	194.5	153.3	37.5	189.0	143.6	41.3	182.8	-	-	-
	18	180.1	28.2	206.9	174.0	30.9	203.4	166.4	34.0	198.7	157.2	37.6	193.0	147.3	41.4	186.7	-	-	-
150.2	5	139.2	30.6	168.3	132.8	33.5	164.6	126.4	36.9	161.4	118.7	40.9	157.5	110.3	45.1	153.1	100.7	49.6	147.8
	6	143.9	30.7	173.0	137.4	33.6	169.3	130.8	37.0	166.0	122.9	41.0	161.8	114.3	45.2	157.2	104.4	49.7	151.6
	7	148.6	30.8	177.8	**145.0**	**33.0**	**176.4**	135.3	37.1	170.5	127.1	41.1	166.1	118.3	45.3	161.3	108.1	49.7	155.4
	8	153.3	30.9	182.6	146.7	33.8	178.8	139.7	37.2	175.1	131.3	41.2	170.5	122.3	45.3	165.4	-	-	-
	9	157.9	31.0	187.4	151.3	33.9	183.5	144.2	37.3	179.6	135.6	41.3	174.8	126.3	45.4	169.4	-	-	-
	10	162.6	31.1	192.2	156.0	34.0	188.3	148.6	37.4	184.2	139.8	41.4	179.1	130.3	45.5	173.5	-	-	-
	11	167.3	31.2	197.0	160.6	34.1	193.0	153.1	37.5	188.7	144.0	41.5	183.4	134.3	45.6	177.6	-	-	-
	12	172.0	31.4	201.8	165.2	34.2	197.7	157.5	37.6	193.3	148.3	41.6	187.8	138.3	45.7	181.7	-	-	-
	13	176.6	31.5	206.5	169.8	34.3	202.5	162.0	37.7	197.8	152.5	41.7	192.1	142.3	45.8	185.8	-	-	-
	14	181.3	31.6	211.3	174.5	34.4	207.2	166.4	37.8	202.4	156.7	41.7	196.4	146.3	45.9	189.8	-	-	-
	15	186.0	31.7	216.1	179.1	34.6	211.9	170.9	37.9	206.9	161.0	41.8	200.7	150.3	46.0	193.9	-	-	-
	16	190.7	31.8	220.9	183.7	34.7	216.7	175.3	38.0	211.4	165.2	41.9	205.1	154.3	46.1	198.0	-	-	-
	17	195.4	31.9	225.7	188.4	34.8	221.4	179.8	38.1	216.0	169.4	42.0	209.4	158.2	46.1	202.1	-	-	-
	18	200.0	32.0	230.5	193.0	34.9	226.1	184.2	38.2	220.5	173.7	42.1	213.7	162.2	46.2	206.2	-	-	-
170.2	5	158.9	34.6	191.8	151.6	37.9	187.6	144.3	41.8	184.0	135.5	46.3	179.5	125.9	51.1	174.5	114.9	56.2	168.3
	6	164.3	34.8	197.4	157.0	38.1	193.1	149.4	41.9	189.3	140.4	46.5	184.5	130.6	51.2	179.2	119.3	56.3	172.8
	7	169.8	34.9	202.9	**167.0**	**37.4**	**202.5**	154.6	42.1	194.5	145.3	46.6	189.5	135.2	51.3	184.0	123.6	56.4	177.2
	8	175.2	35.0	208.4	167.7	38.3	204.1	159.7	42.2	199.8	150.2	46.7	194.6	139.9	51.4	188.7	-	-	-
	9	180.6	35.1	214.0	173.1	38.4	209.6	164.9	42.3	205.1	155.1	46.8	199.6	144.5	51.5	193.5	-	-	-
	10	186.0	35.2	219.5	178.4	38.5	215.0	170.1	42.4	210.4	160.0	46.9	204.6	149.2	51.6	198.2	-	-	-
	11	191.4	35.4	225.0	183.8	38.7	220.5	175.2	42.5	215.6	164.9	47.0	209.6	153.8	51.8	203.0	-	-	-
	12	196.9	35.5	230.6	189.2	38.8	226.0	180.4	42.6	220.9	169.9	47.1	214.6	158.5	51.9	207.7	-	-	-
	13	202.3	35.6	236.1	194.5	38.9	231.5	185.6	42.8	226.2	174.8	47.3	219.7	163.1	52.0	212.5	-	-	-
	14	207.7	35.7	241.6	199.9	39.0	237.0	190.7	42.9	231.4	179.7	47.4	224.7	167.8	52.1	217.2	-	-	-
	15	213.1	35.8	247.2	205.3	39.1	242.4	195.9	43.0	236.7	184.6	47.5	229.7	172.4	52.2	222.0	-	-	-
	16	218.5	36.0	252.7	210.6	39.2	247.9	201.0	43.1	242.0	189.5	47.6	234.7	177.1	52.3	226.8	-	-	-
	17	224.0	36.1	258.2	216.0	39.4	253.4	206.2	43.2	247.3	194.4	47.7	239.8	181.7	52.4	231.5	-	-	-
	18	229.4	36.2	263.8	221.4	39.5	258.9	211.4	43.3	252.5	199.4	47.8	244.8	186.3	52.5	236.3	-	-	-

TWE= OUTLET PLANT water temperature (cooling mode). OUTLET SOURCE water temperature (heating mode) (°C)
TWC= OUTLET SOURCE water temperature (cooling mode). OUTLET PLANT water temperature (heating mode) (°C)
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).

The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchangers. Has also been considered A 0.44 x 10^{-4} m^2 K/W fouling factor.

The performances are declared no considering any correction due to water flow rate and water side pressure drop (gross performance).

IP UNIT PERFORMANCE

Mod. 190.2 ÷ 240.2

MOD.	TWE	TWC																	
		30			35			40			45			50			55		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
190.2	5	179.5	38.6	216.2	171.3	42.3	211.5	163.1	46.7	207.4	153.2	51.8	202.4	142.5	57.1	196.8	130.2	62.9	189.9
	6	185.7	38.7	222.5	177.4	42.5	217.7	168.9	46.8	213.4	158.8	51.9	208.1	147.8	57.3	202.2	135.1	63.0	195.0
	7	191.9	38.9	228.8	**188.0**	**41.9**	**227.8**	174.8	47.0	219.4	164.4	52.0	213.8	153.1	57.4	207.6	140.1	63.2	200.0
	8	198.0	39.0	235.1	189.6	42.7	230.2	180.7	47.1	225.4	170.0	52.2	219.6	158.4	57.5	213.0	-	-	-
	9	204.2	39.1	241.4	195.8	42.8	236.5	186.6	47.2	231.4	175.6	52.3	225.3	163.7	57.7	218.4	-	-	-
	10	210.4	39.3	247.7	201.9	43.0	242.7	192.5	47.4	237.4	181.2	52.4	231.0	168.9	57.8	223.8	-	-	-
	11	216.6	39.4	254.0	208.0	43.1	248.9	198.3	47.5	243.5	186.8	52.6	236.7	174.2	57.9	229.3	-	-	-
	12	222.8	39.5	260.3	214.1	43.2	255.2	204.2	47.6	249.5	192.3	52.7	242.4	179.5	58.1	234.7	-	-	-
	13	229.0	39.6	266.6	220.2	43.4	261.4	210.1	47.8	255.5	197.9	52.9	248.1	184.8	58.2	240.1	-	-	-
	14	235.1	39.8	272.9	226.3	43.5	267.7	216.0	47.9	261.5	203.5	53.0	253.9	190.1	58.3	245.5	-	-	-
	15	241.3	39.9	279.2	232.5	43.6	273.9	221.8	48.0	267.5	209.1	53.1	259.6	195.3	58.5	250.9	-	-	-
	16	247.5	40.0	285.5	238.6	43.8	280.1	227.7	48.2	273.5	214.7	53.3	265.3	200.6	58.6	256.3	-	-	-
	17	253.7	40.2	291.8	244.7	43.9	286.4	233.6	48.3	279.5	220.3	53.4	271.0	205.9	58.8	261.7	-	-	-
	18	259.9	40.3	298.1	250.8	44.0	292.6	239.5	48.4	285.5	225.9	53.5	276.7	211.2	58.9	267.1	-	-	-
215.2	5	202.2	43.8	243.8	193.0	48.0	238.6	183.7	53.0	234.0	172.5	58.8	228.4	160.5	64.9	222.1	146.5	71.5	214.4
	6	209.2	44.0	250.9	199.8	48.2	245.6	190.3	53.2	240.8	178.8	59.0	234.8	166.4	65.1	228.2	152.1	71.6	220.1
	7	216.1	44.1	258.0	**212.0**	**47.9**	**257.5**	196.8	53.3	247.5	185.1	59.1	241.2	172.3	65.2	234.3	157.6	71.8	225.8
	8	223.0	44.3	265.1	213.5	48.5	259.6	203.4	53.5	254.2	191.3	59.3	247.6	178.2	65.4	240.3	-	-	-
	9	229.9	44.4	272.1	220.4	48.6	266.6	210.0	53.6	261.0	197.6	59.4	254.1	184.2	65.5	246.4	-	-	-
	10	236.9	44.6	279.2	227.2	48.8	273.6	216.6	53.8	267.7	203.9	59.6	260.5	190.1	65.7	252.5	-	-	-
	11	243.8	44.7	286.3	234.1	48.9	280.6	223.2	53.9	274.4	210.2	59.7	266.9	196.0	65.8	258.5	-	-	-
	12	250.7	44.9	293.3	240.9	49.1	287.6	229.8	54.1	281.2	216.4	59.9	273.3	201.9	66.0	264.6	-	-	-
	13	257.6	45.0	300.4	247.8	49.2	294.6	236.4	54.2	287.9	222.7	60.0	279.7	207.9	66.1	270.7	-	-	-
	14	264.6	45.2	307.5	254.7	49.4	301.6	243.0	54.4	294.6	229.0	60.2	286.1	213.8	66.3	276.7	-	-	-
	15	271.5	45.3	314.5	261.5	49.5	308.6	249.6	54.5	301.4	235.2	60.3	292.5	219.7	66.4	282.8	-	-	-
	16	278.4	45.5	321.6	268.4	49.7	315.6	256.2	54.7	308.1	241.5	60.5	299.0	225.7	66.6	288.9	-	-	-
	17	285.3	45.6	328.7	275.2	49.8	322.6	262.8	54.8	314.8	247.8	60.6	305.4	231.6	66.7	294.9	-	-	-
	18	292.3	45.8	335.7	282.1	50.0	329.6	269.3	55.0	321.6	254.1	60.8	311.8	237.5	66.9	301.0	-	-	-
240.2	5	224.6	48.7	270.9	214.3	53.5	265.2	204.1	59.1	260.3	191.8	65.7	254.2	178.4	72.6	247.3	163.0	80.0	239.0
	6	232.3	48.9	278.8	222.0	53.7	273.0	211.4	59.3	267.8	198.7	65.9	261.3	185.0	72.7	254.1	169.2	80.2	245.3
	7	240.1	49.0	286.7	**235.0**	**54.0**	**286.3**	218.8	59.5	275.3	205.7	66.0	268.5	191.6	72.9	260.9	175.3	80.3	251.6
	8	247.8	49.2	294.5	237.3	54.0	288.6	226.1	59.6	282.8	212.7	66.2	275.6	198.2	73.1	267.6	-	-	-
	9	255.5	49.4	302.4	244.9	54.2	296.4	233.5	59.8	290.3	219.7	66.4	282.8	204.8	73.3	274.4	-	-	-
	10	263.2	49.5	310.3	252.6	54.3	304.2	240.8	60.0	297.8	226.7	66.5	289.9	211.4	73.4	281.2	-	-	-
	11	271.0	49.7	318.2	260.2	54.5	312.0	248.2	60.2	305.3	233.7	66.7	297.1	218.0	73.6	287.9	-	-	-
	12	278.7	49.9	326.1	267.9	54.7	319.8	255.5	60.3	312.8	240.7	66.9	304.2	224.6	73.8	294.7	-	-	-
	13	286.4	50.0	334.0	275.5	54.8	327.6	262.9	60.5	320.3	247.7	67.1	311.4	231.2	74.0	301.5	-	-	-
	14	294.2	50.2	341.9	283.2	55.0	335.4	270.2	60.7	327.8	254.6	67.2	318.5	237.8	74.1	308.2	-	-	-
	15	301.9	50.4	349.7	290.8	55.2	343.2	277.5	60.8	335.3	261.6	67.4	325.7	244.4	74.3	315.0	-	-	-
	16	309.6	50.5	357.6	298.4	55.4	351.0	284.9	61.0	342.8	268.6	67.6	332.8	251.0	74.5	321.8	-	-	-
	17	317.3	50.7	365.5	306.1	55.5	358.8	292.2	61.2	350.4	275.6	67.8	340.0	257.6	74.7	328.5	-	-	-
	18	325.1	50.9	373.4	313.7	55.7	366.6	299.6	61.3	357.9	282.6	67.9	347.1	264.2	74.8	335.3	-	-	-

TWE= OUTLET PLANT water temperature (cooling mode). OUTLET SOURCE water temperature (heating mode) (°C)
TWC= OUTLET SOURCE water temperature (cooling mode). OUTLET PLANT water temperature (heating mode) (°C)
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).

The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchangers. Has also been considered A 0.44 x 10^{-4} m^2 K/W fouling factor.

The performances are declared no considering any correction due to water flow rate and water side pressure drop (gross performance).

CORRECTION FACTOR

Correction factor for the use city water

For use of city water for condenser apply the correction factors reported on the following table.

∆t condenser water [°C]	5	10	15	20
Cooling capacity CCPF	1.000	1.025	1.030	1.035
Power input CCPA	1.000	0.960	0.955	0.950

Basing on design temperatures (TWE TWC) from the table “performances” extract Cooling Capacity (kWf) and Compressors Power Input (kWa).Based on ∆Tcond equal to the difference outlet-inlet source side exchanger (condenser) water temperature you extract CCPF and CCPA so you can calculate

Pf = kWf x CCPF

Pass_CP = kWa x CCPA

Then you calculate the thermal power to be cooled by the source side exchanger (condenser):

Pt = Pf+Pass_CP

Then you calculate the plant side exchanger (evaporator) and source side exchanger (condenser) water flow rate :

*Q_evap [l/s]=(Pf [kW]*0.86/ ∆Tevap)/3.6:*

*Q_cond [l/s]=(Pt [kW]*0.86/ ∆Tcond)/3.6:*

With Q_evap you can enter on abscissa on water pressure drop graph of the plant side exchanger (evaporator) and extract pressure drop.

With Q_cond you can enter on abscissa on water pressure drop graph of the source side exchanger (condenser) city water and extract pressure drop.

Fouling factors

The performances supplied with the tables are referred to a fouling factory = 0.44×10^{-4} m² K/W . For different values of the fouling factory, use the reduction coefficients reported in the following table.

Fouling factory		Evaporator	
		F.c. PF	F.c. PA
(m² K / W)	**0.44×10^{-4}**	**1**	**1**
(m² K / W)	0.86×10^{-4}	0.98	0.99
(m² K / W)	1.72×10^{-4}	0.93	0.98

F.c. PF: Correction Factor for Cooling capacity

F.c. PA: Correction Factor for compressor power Input

CORRECTION FACTOR

Correction factor for the use of glycol in heating mode

ETHYLENE GLYCOL with water produced between 30 ÷ 55 ° C.

Percentage Of glycol in mass / volume	0 / 0	10 / 8.9	20 / 18.1	30 / 27.7	40 / 37.5
Freezing point [°C]	0	-3.2	-8	-14	-22
CCPF - Thermal capacity correction factor	1.000	0.995	0.985	0.975	0.970
CCQA - Water flow rate correction factor	1.000	1.038	1.062	1.091	1.127
CCDP - Water pressure drop correction factor	1.000	1.026	1.051	1.077	1.103

PROPYLENE GLYCOL with water produced between 30 ÷ 55ºC.

Percentage Of glycol in mass / volume	0 / 0	10 / 9.6	20 / 19.4	30 / 29.4	40 / 39.6
Freezing point [°C]	0	-3.3	-7	-13	-21
CCPF - Thermal capacity correction factor	1	0.99	0.975	0.965	0.955
CCQA - Water flow rate correction factor	1	1.018	1.032	1.053	1.082
CCDP - Water pressure drop correction factor	1	1.026	1.051	1.077	1.103

Basing on design temperatures (TWE TWC), from the performance tables extract the thermal capacity (kWt_r)
Based on type and percentage of glycol extract CCPT, CCQA, CCDP.
Then calculate.

Pt_brine = kWt_r x CCPT

Then calculate brine flow rate to the heat exchanger:

*Q_brine [l/s]=CCQA x (Pt_brine [kW]*0.86/∆T_brine)/3.6*

where ∆T_brine is the temperature difference outlet-intlet heat exchanger:

∆T_brine=Twout_brine-Twin_brine

With this brine flow rate enter in abscissa on the water pressure drop of the heat exchanger then you have Dp_app.
Finally you can calculate the actual pressure drop of the brine on heat exchanger:

Dp_brine =CCDP x Dp_app

Correction factor for the use of glycol in cooling mode

ETHYLENE GLYCOL with water produced between 5 ÷ 20 ° C.

Percentage Of glycol in mass / volume [%]	0 / 0	10 / 8.9	20 / 18.1	30 / 27.7	40 / 37.5
Freezing point [°C]	0	-3.2	-8	-14	-22
CCPF - Cooling capacity correction factor	1	0.99	0.98	0.97	0.95
CCPA - Power input correction factor	1	1	0.99	0.99	0.98
CCQA - Water flow rate correction factor	1	1.04	1.08	1.12	1.16
CCDP - Water pressure drop correction factor	1	1.08	1.16	1.25	1.35

PROPYLENE GLYCOL with water produced between 5 ÷ 20 ° C.

Percentage Of glycol in mass / volume [%]	0 / 0	10 / 9.6	20 / 19.4	30 / 29.4	40 / 39.6
Freezing point [°C]	0	-3.3	-7	-13	-21
CCPF - Cooling capacity correction factor	1	0.98	0.96	0.94	0.92
CCPA - Power input correction factor	1	0.99	0.98	0.95	0.93
CCQA - Water flow rate correction factor	1	1.01	1.03	1.06	1.09
CCDP - Water pressure drop correction factor	1	1.05	1.11	1.22	1.38

Basing on design temperatures (TWE TWC) and leaving water temperature of the evaporator (DESIGN CONDITIONS) from the table “performances” extract Cooling Capacity (kWf) and Compressors Power Input (kWa).
Based on type and percentage of glycol extract CCPF, CCPA, CCQA, CCDP.
Then calculate.

Pf_brine = kWf x CCPF
Pass_CP_brine = kWa x CCPA

Then calculate brine flow rate of the evaporator:

*Q_brine [l/s]=CCQA x (Pf_brine [kW]*0.86/∆T_brine)/3.6*

where ∆T_brine is the difference inlet-outlet heat exchanger water temperature:

∆T_brine=Twin_brine-Twout_brine

With this brine flow rate enter in abscissa on the water pressure drop of the heat exchanger then you have Dp_app.
Finally you can calculate the actual pressure drop of the brine on heat exchanger side:

Dp_brine =CCDP x Dp_app

Brine Unit (BR)

Correction factors to apply to the basic version data

ETHYLENE GLYCOL

Percentage Of glycol in mass / volume [%]	20 / 18.1						
Freezing point [°C]	-8						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.912	0.855	0.798	0.738	0.683	-	-
CCPA - Compressor power input correction factor	0.967	0.957	0.947	0.927	0.897	-	-
CCQA - Water flow rate correction factor	1.071	1.072	1.073	1.075	1.076	-	-
CCDP - Water pressure drop correction factor	1.090	1.095	1.100	1.110	1.120	-	-

Percentage Of glycol in mass / volume [%]	30 / 27.7						
Freezing point [°C]	-14						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.899	0.842	0.785	0.725	0.670	0.613	0.562
CCPA - Compressor power input correction factor	0.960	0.950	0.940	0.920	0.890	0.870	0.840
CCQA - Water flow rate correction factor	1.106	1.107	1.108	1.109	1.110	1.111	1.112
CCDP - Water pressure drop correction factor	1.140	1.145	1.150	1.155	1.160	1.175	1.190

Percentage Of glycol in mass / volume [%]	40 / 37.5						
Freezing point [°C]	-22						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.884	0.827	0.770	0.710	0.655	0.598	0.547
CCPA - Compressor power input correction factor	0.880	0.870	0.860	0.840	0.810	0.790	0.760
CCQA - Water flow rate correction factor	1.150	1.151	1.153	1.154	1.155	1.157	1.158
CCDP - Water pressure drop correction factor	1.190	1.195	1.200	1.210	1.220	1.235	1.250

PROPYLENE GLYCOL

Percentage Of glycol in mass / volume [%]	20 / 19.4						
Freezing point [°C]	-8						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.874	0.807	0.740	0.690	0.641	-	-
CCPA - Compressor power input correction factor	0.945	0.935	0.925	0.900	0.875	-	-
CCQA - Water flow rate correction factor	1.037	1.038	1.039	1.039	1.040	-	-
CCDP - Water pressure drop correction factor	1.110	1.115	1.120	1.130	1.140	-	-

Percentage Of glycol in mass / volume [%]	30 / 29.4						
Freezing point [°C]	-14						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.869	0.799	0.729	0.680	0.630	0.583	0.536
CCPA - Compressor power input correction factor	0.935	0.923	0.910	0.888	0.865	0.838	0.810
CCQA - Water flow rate correction factor	1.072	1.071	1.070	1.069	1.069	1.068	1.067
CCDP - Water pressure drop correction factor	1.160	1.175	1.190	1.200	1.210	1.255	1.300

Percentage Of glycol in mass / volume [%]	40 / 39.6						
Freezing point [°C]	-22						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.848	0.784	0.719	0.670	0.620	0.570	0.520
CCPA - Compressor power input correction factor	0.865	0.855	0.845	0.820	0.795	0.773	0.750
CCQA - Water flow rate correction factor	1.116	1.114	1.112	1.110	1.108	1.107	1.105
CCDP - Water pressure drop correction factor	1.230	1.275	1.320	1.375	1.430	1.500	1.570

Basing on design temperature TWC and TWE = 7°C from the table “performances” extract Cooling Capacity (kWf) and Compressors Power Input (kWa).
Based on type and percentage of glycol extract CCPF, CCPA, CCQA, CCDP.
Then calculate.

Pf_brine = kWf x CCPF

Pass_CP_brine = kWa x CCPA

Then calculate brine flow rate:

*Q_brine [l/s]=CCQA x (Pf_brine [kW]*0.86/∆T_brine)/3.6*

where ∆T_brine is the difference between inlet-outlet heat exchanger water temperature:

∆T_brine=Twin_brine-Twout_brine

With this brine flow rate enter in abscissa on the water pressure drop of the heat exchanger then you have Dp_app.
Finally you can calculate the actual pressure drop of the brine on heat exchanger side:

Dp_brine =CCDP x Dp_app

TECHNICAL DATA - DESUPERHEATER VERSION (VD)

Heat exchanger specifications

MODEL	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Type of recovery exchanger	Brazed plates											-
Quantity	1											N°
Max. operating pressure on wet side	600											kPa
Total water content of recovery exchangers	0,55	0,55	0,55	0,75	0,75	0,75	1,20	1,20	1,20	1,50	1,50	l

NET NOMINAL performances - Standard plants

IR / IW unit - Chiller

MODEL		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Cooling mode W30W7-45 (source: water in 30°C out 35°C / plant: water in 12°C out 7°C / recovery : water in 40°C out 45°C)													
Cooling capacity VD		70,8	80,1	93,2	106	119	135	150	172	194	219	243	kW
Total power input VD		18,3	19,8	24,1	27,8	31,8	35,7	40,4	46,1	52,0	59,5	67,3	kW
EER VD		3,86	4,05	3,87	3,83	3,76	3,77	3,71	3,74	3,74	3,67	3,61	W/W
HRE VD		4,58	4,80	4,61	4,57	4,49	4,51	4,43	4,46	4,46	4,39	4,32	W/W
Plant side	Water flow rate	3,41	3,85	4,48	5,12	5,75	6,48	7,21	8,28	9,36	10,53	11,70	l/s
	Water pressure drop	49	40	42	43	46	44	47	48	50	50	51	kPa
Source side	Water flow rate	4,08	4,60	5,39	6,15	6,92	7,81	8,69	9,97	11,24	12,68	14,12	l/s
	Water pressure drop	70	56	60	62	66	63	68	69	72	72	74	kPa
Recovered heating capacity		13,2	14,8	17,9	20,6	23,2	26,3	29,4	33,3	37,3	42,7	48,1	kW
Recovered water flow rate		0,63	0,71	0,86	1,00	1,10	1,30	1,40	1,60	1,80	2,00	2,30	l/s
Recovered water pressure drop		6	8	11	9	10	7	8	10	13	10	13	kPa

IP unit - Chiller

MODEL		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Cooling mode W30W7-45 (source: water in 30°C out 35°C / plant: water in 12°C out 7°C / recovery : water in 40°C out 45°C)													
Cooling capacity VD		69,0	78,0	91,0	104	117	132	147	169	190	214	238	kW
Total power input VD		18,0	19,4	23,7	27,3	31,2	35,1	39,7	45,3	51,1	58,4	66,1	kW
EER VD		3,86	4,04	3,86	3,82	3,75	3,76	3,70	3,73	3,73	3,67	3,60	W/W
HRE VD		4,58	4,79	4,60	4,56	4,49	4,50	4,43	4,46	4,45	4,39	4,32	W/W
Plant side	Water flow rate	3,34	3,77	4,39	5,01	5,64	6,35	7,07	8,12	9,17	10,32	11,46	l/s
	Water pressure drop	47	38	40	41	44	42	45	46	48	48	49	kPa
Source side	Water flow rate	4,00	4,51	5,29	6,04	6,79	7,66	8,53	9,78	11,03	12,45	13,86	l/s
	Water pressure drop	67	54	58	59	64	61	66	67	69	70	72	kPa
Recovered heating capacity		13,1	14,7	17,7	20,3	23,0	26,0	29,1	33,0	36,9	42,3	47,6	kW
Recovered water flow rate		0,63	0,70	0,85	0,97	1,10	1,24	1,39	1,58	1,76	2,02	2,27	l/s
Recovered water pressure drop		6	7	11	8	10	6	8	10	12	10	13	kPa

Data declared according to **EN 14511**. The values are referred to units without options and accessories.

NOTE : THE HEATING CAPACITY RECOVERED BY THE DESUPERHEATER EXCLUSIVELY REFERS TO UNITS OPERATING IN THE COOLING MODE.

GROSS NOMINAL performances - Standard plants

IR / IW unit - Chiller

MODELLO	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Cooling mode W30W7-45 (source: water in 30°C out 35°C / plant: water in 12°C out 7°C / recovery : water in 40°C out 45°C)												
Cooling capacity VD	71,4	80,6	93,8	107	120	136	151	173	196	220	245	kW
Power input compressor VD VD	14,7	16,5	19,9	22,8	25,8	29,2	32,6	37,0	41,5	47,4	53,4	kW
Total power input VD	14,7	16,5	19,9	22,8	25,8	29,2	32,6	37,0	41,5	47,4	53,4	kW
EER VD	4,83	4,91	4,72	4,69	4,65	4,66	4,63	4,68	4,72	4,64	4,59	W/W
HRE VD	5,76	5,79	5,62	5,59	5,57	5,55	5,53	5,58	5,62	5,54	5,48	W/W

IP unit - Chiller

MODELLO	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Cooling mode W30W7-45 (source: water in 30°C out 35°C / plant: water in 12°C out 7°C / recovery : water in 40°C out 45°C)												
Cooling capacity VD	70,0	79,0	92,0	105	118	133	148	170	192	216	240	kW
Power input compressor VD VD	14,6	16,3	19,7	22,6	25,5	28,9	32,3	36,7	41,0	47,0	52,9	kW
Total power input VD	14,6	16,3	19,7	22,6	25,5	28,9	32,3	36,7	41,0	47,0	52,9	kW
EER VD	4,79	4,85	4,67	4,65	4,63	4,60	4,63	4,59	4,68	4,60	4,53	W/W
HRE VD	5,71	5,74	5,57	5,54	5,52	5,50	5,48	5,53	5,58	5,50	5,44	W/W

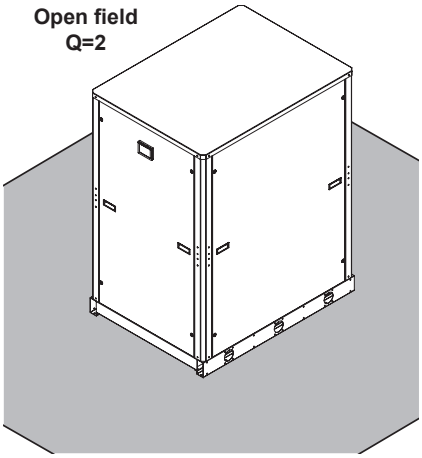
NOTE : THE HEATING CAPACITY RECOVERED BY THE DESUPERHEATER EXCLUSIVELY REFERS TO UNITS OPERATING IN THE COOLING MODE.

NOISE LEVEL

The noise levels refer to units operating in the nominal conditions (water temperature: inlet: 12°C - outlet: 7°C, Condenser water temperature: inlet: 30°C - outlet: 35°C).
The acoustic pressure levels are measured 1/ 5 / 10 meters away from the outer surface of the unit operating in the free field and resting on a reflecting surface (directional factor of 2).

SWL = Sound power levels, with reference to $1x10^{-12}$ W.
The Total sound power level in dB(A) measured in compliance with ISO 9614 standards, which is therefore the only binding acoustic specification (the values of the Octave bands in the table are indicative).

SPL = Sound pressure levels, with reference to $2x10^{-5}$ Pa.
The sound pressure levels are values calculated by applying the **ISO-3744 relation (Eurovent 8/1)** and refer to a distance of 1 meter away from the external surface of units operating in the open field with directivity factor 2 (Q=2) and the units operating in nominal conditions in the cooling mode.



AB Standard unit

MOD.	SWL (dB)										SPL [dB(A)		
	Octave bands (Hz)								Total				
	63	125	250	500	1000	2000	4000	8000	dB	dB(A)	1	5	10
70.2	76	74	71	72	72	65	61	55	80.6	**75**	59	49	44
80.2	76	74	75	74	70	68	64	53	81.5	**76**	60	50	45
90.2	77	75	76	75	71	69	65	54	82.5	**77**	61	51	46
105.2	77	75	76	75	71	69	65	54	82.5	**77**	61	51	46
120.2	77	75	76	75	71	69	65	54	82.5	**77**	61	51	46
135.2	78	76	77	76	72	70	66	55	83.5	**78**	62	52	47
150.2	78	76	77	76	72	70	66	55	83.5	**78**	62	52	47
170.2	79	77	78	77	73	71	67	56	84.5	**79**	63	53	48
190.2	79	77	78	77	73	71	67	56	84.5	**79**	63	53	48
215.2	80	78	79	78	74	72	68	57	85.5	**80**	64	54	49
240.2	80	78	79	78	74	72	68	57	85.5	**80**	64	54	49

AS Low noise unit

MOD.	**SWL (dB)**										**SPL [dB(A)**		
	Octave bands (Hz)								**Total**				
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB**	**dB(A)**	**1**	**5**	**10**
70.2	72	70	67	68	68	61	57	51	76.6	**71**	55	45	40
80.2	72	70	71	70	66	64	60	49	77.5	**72**	56	46	41
90.2	73	71	72	71	67	65	61	50	78.5	**73**	57	47	42
105.2	73	71	72	71	67	65	61	50	78.5	**73**	57	47	42
120.2	73	71	72	71	67	65	61	50	78.5	**73**	57	47	42
135.2	74	72	73	72	68	66	62	51	79.5	**74**	58	48	43
150.2	74	72	73	72	68	66	62	51	79.5	**74**	58	48	43
170.2	75	73	74	73	69	67	63	52	80.5	**75**	59	49	44
190.2	75	73	74	73	69	67	63	52	80.5	**75**	59	49	44
215.2	76	74	75	74	70	68	64	53	81.5	**76**	60	50	45
240.2	76	74	75	74	70	68	64	53	81.5	**76**	60	50	45

AX Extra low noise unit

MOD.	**SWL (dB)**										**SPL [dB(A)**		
	Octave bands (Hz)								**Total**				
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dB**	**dB(A)**	**1**	**5**	**10**
70.2	68	66	63	64	64	57	53	47	72.6	**67**	51	41	36
80.2	68	66	67	66	62	60	56	45	73.5	**68**	52	42	37
90.2	69	67	68	67	63	61	57	46	74.5	**69**	53	43	38
105.2	69	67	68	67	63	61	57	46	74.5	**69**	53	43	38
120.2	69	67	68	67	63	61	57	46	74.5	**69**	53	43	38
135.2	70	68	69	68	64	62	58	47	75.5	**70**	54	44	39
150.2	70	68	69	68	64	62	58	47	75.5	**70**	54	44	39
170.2	71	69	70	69	65	63	59	48	76.5	**71**	55	45	40
190.2	71	69	70	69	65	63	59	48	76.5	**71**	55	45	40
215.2	72	70	71	70	66	64	60	49	77.5	**72**	56	46	41
240.2	72	70	71	70	66	64	60	49	77.5	**72**	56	46	41

(E): Dati dichiarati secondo il programma di certificazione **EUROVENT LCP**. I valori si riferiscono ad unità prive di opzioni ed accessori.

OPERATING RANGE

Operating range

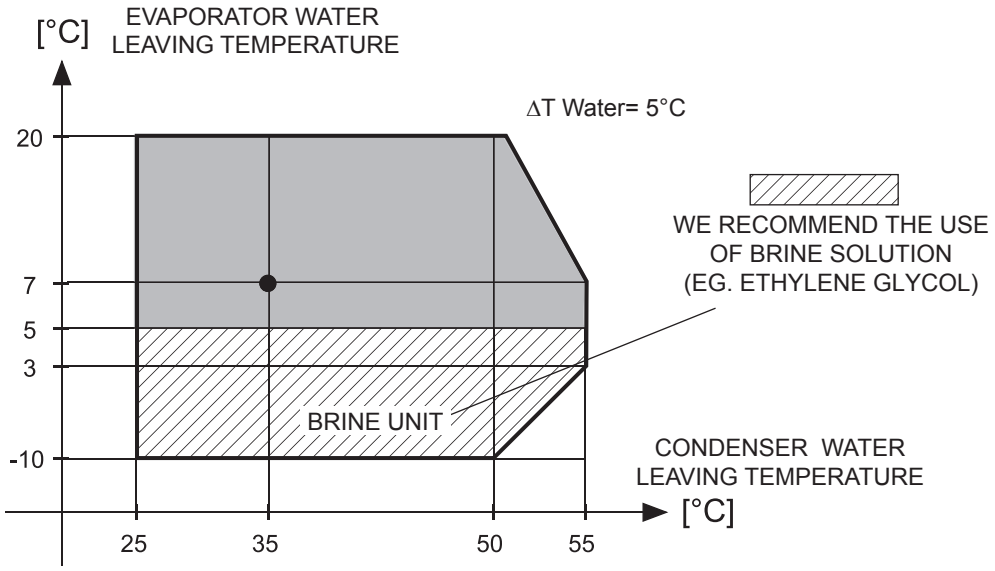
The graph indicates the admissible working envelope of the unit.
The use of the unit in conditions outside the envelope will avoid the warranty.
Here under are reported the limits of water differential temperature for the heat exchangers of the unit.

Operating range standard unit AB

Water thermal gradient		Limit value		
		Plant exchanger	Source exchanger (1)	Source exchanger (2)
Minimum	°C	3	3	10
Maximum	°C	10	10	20
		Verify that water flow rate is inside the admissible limits.		

(1) : for applications with cooling tower, geothermal probe, dry cooler.
(2) : for applications with city water, well water.

NOTE: the admissible limits for water flow rate on heat exchangers are indicated under the related pressure drop graph (see section "water pressure drop"). If the unit is equipped with pumping module the admissible limits are indicated under the related working head graph (see section "working head").



WATER PRESSURE DROP

Applications with city water, well water

Note for the calculation of pressure drop for the Source heat exchanger using city water or well water

Unit IR

Cooling Mode

The water entering to the Source heat exchanger is at a temperature usually in the range 10.15°C. The water entering to the exchanger is controlled by a 2 way valve /ex accessory VDV) or a pump driven by inverter to have a leaving water temperature in the range 30:40°C (ΔT water in the range 15 : 20°C) : so the water flow rate is roughly 1/3 ¼ of the source water flow rate in nominal condition.

To get the pressure drop of the source heat exchanger use the diagram of this section (Source Heat Exchanger with well water)

Unità IW:

Cooling Mode

The water entering to the Source heat exchanger is at a temperature usually in the range 10.15°C. The water entering to the exchanger is controlled by a 2 way valve /ex accessory VDV) or a pump driven by inverter to have a leaving water temperature in the range 30:40°C (ΔT water in the range 15 : 20°C): so the water flow rate is roughly 1/3 ¼ of the source water flow rate in nominal condition.

To get the pressure drop of the source heat exchanger use the diagram of this section (Source Heat Exchanger with well water)

Heating Mode

The water entering to the Source heat exchanger is at a temperature usually in the range 8.15°C. In this case to achieve water leaving temperature between 4 and 10°C (not dangerous for exchanger freezing) the water flow rate has to ensure a DT between 4 and 8°C: so the water flow rate is roughly the same as in nominal condition.

To get the pressure drop of the source heat exchanger use the diagram Source Heat Exchanger with Tower Water

Unità IP:

Cooling Mode

The water entering to the Source heat exchanger is at a temperature usually in the range 10.15°C. The water entering to the exchanger is controlled by a 2 way valve /ex accessory VDV) or a pump driven by inverter to have a leaving water temperature in the range 30:40°C (ΔT water in the range 15 : 20°C): so the water flow rate is roughly 1/3 ¼ of the source water flow rate in nominal condition.

To get the pressure drop of the source heat exchanger use the diagram of this section (Source Heat Exchanger with well water)

Heating Mode

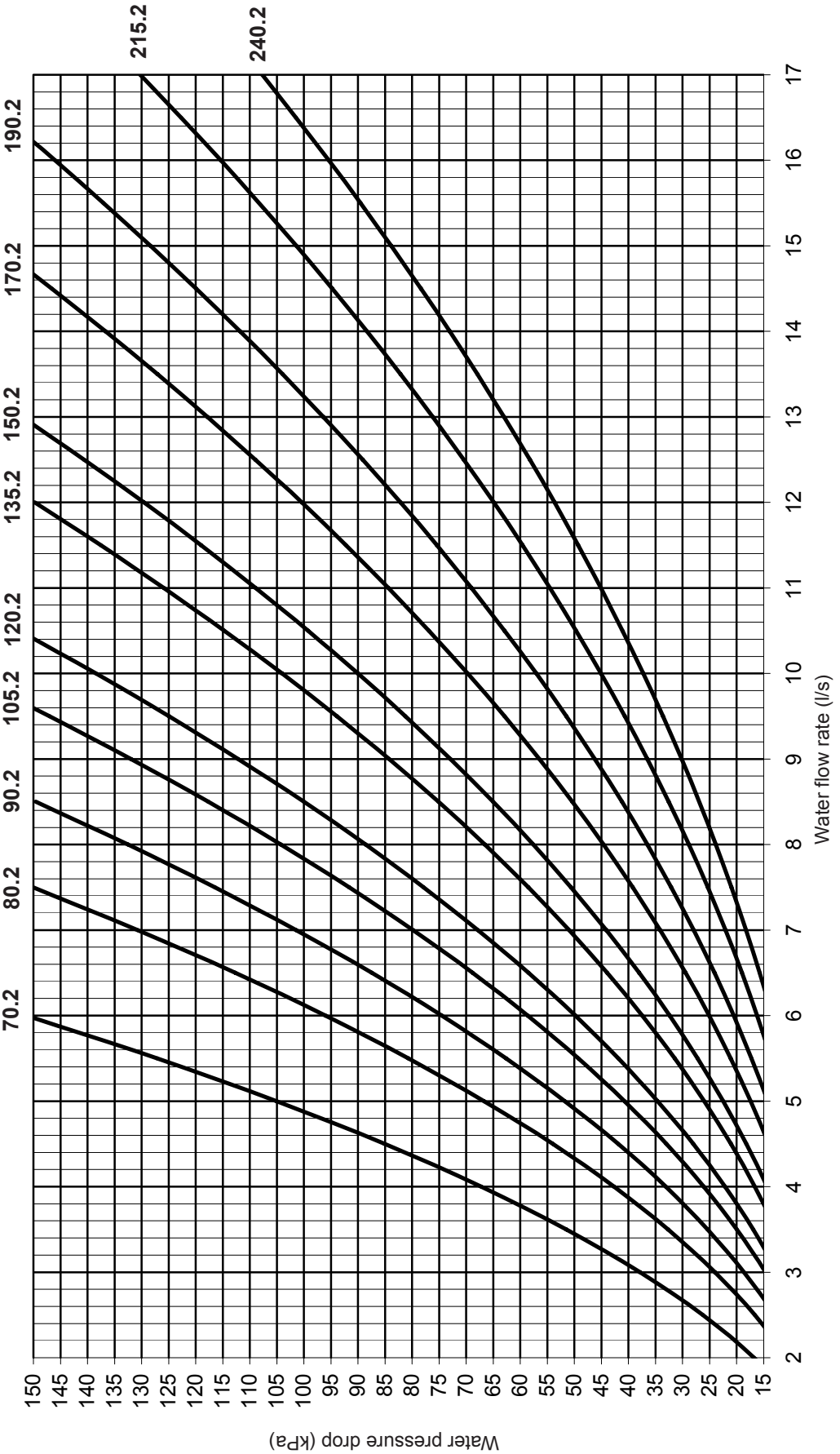
The water entering to the Source heat exchanger is at a temperature usually in the range 8.15°C. In this case to achieve water leaving temperature between 4 and 10°C (not dangerous for exchanger freezing) the water flow rate has to ensure a DT between 4 and 8°C: so the water flow rate is roughly the same as in nominal condition.

To get the pressure drop of the source heat exchanger use the diagram Source Heat Exchanger with Tower Water

WATER PRESSURE DROP

Plant exchanger

The graph below illustrates for the plant exchanger the water pressure drop values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.

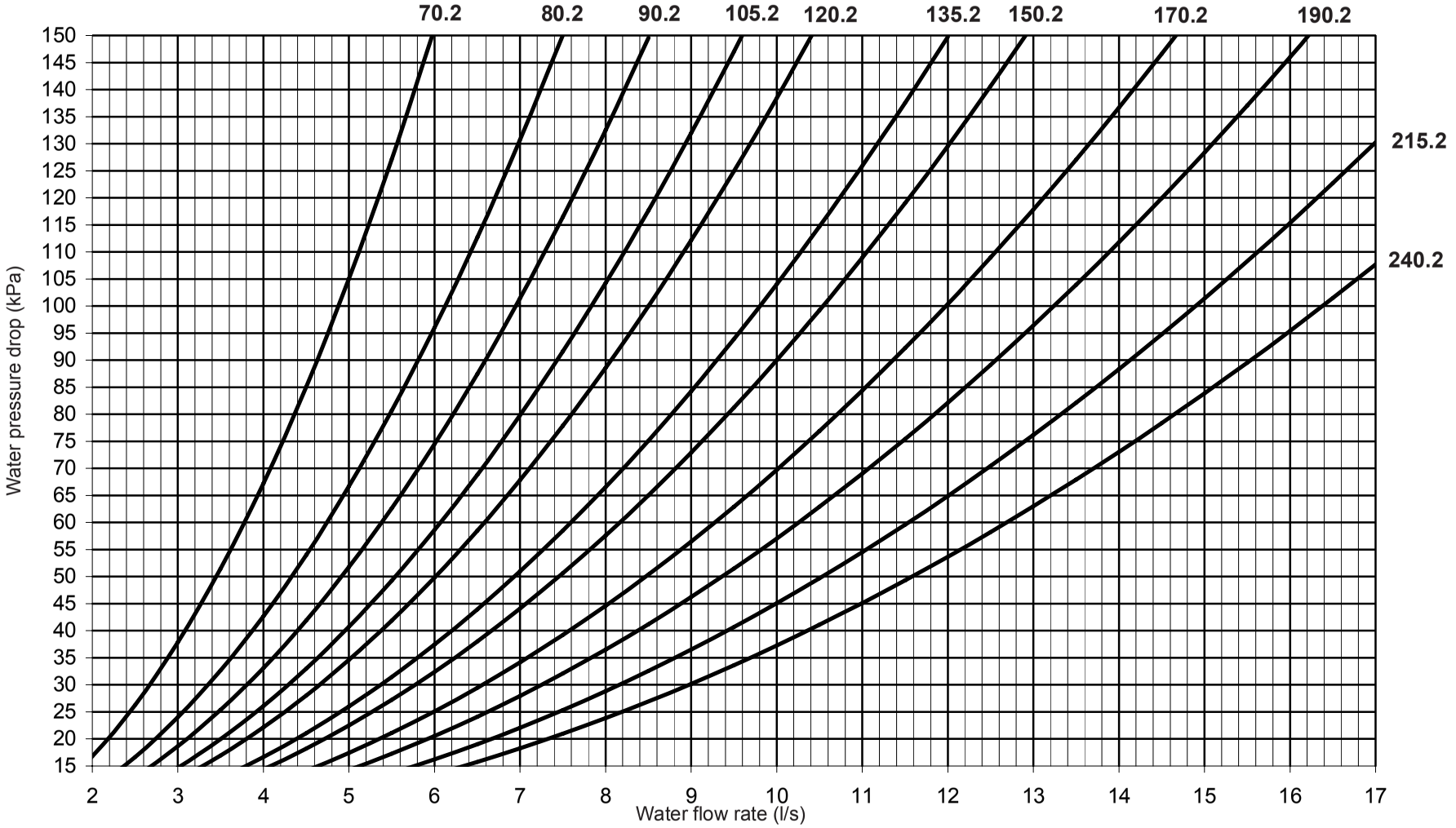


Operating range

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM	NOTES
Lower limit value	Q	2.00	2.37	2.69	3.03	3.29	3.80	4.08	4.64	5.13	5.77	6.34	Q	Q=Water flow rate
Upper limit value	Q	5.97	7.50	8.51	9.60	10.41	12.01	12.91	14.67	16.22	17.00	17.00	Q	

Sourge exchanger with cooling tower, geothermal probe, dry cooler

The graph below illustrates for the plant exchanger the water pressure drop values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.

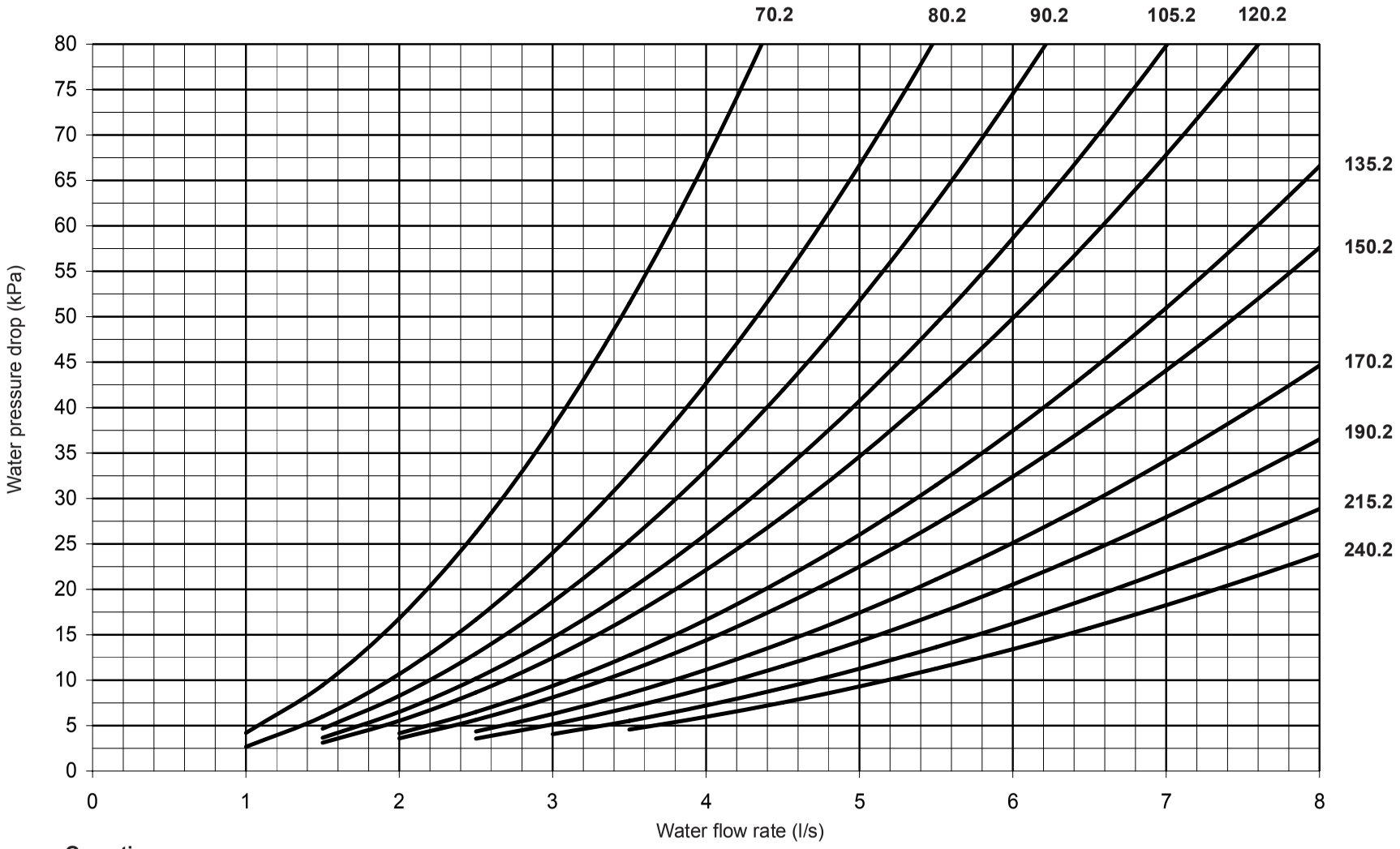


Operating range

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM	NOTES
Lower limit value	Q	2.00	2.37	2.69	3.03	3.29	3.80	4.08	4.64	5.13	5.77	6.34	Q	Q=Water flow rate
Upper limit value	Q	5.97	7.50	8.51	9.60	10.41	12.01	12.91	14.67	16.22	17.00	17.00	Q	

Sourge exchanger with city water and well water

The graph below illustrates for the plant exchanger the water pressure drop values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.



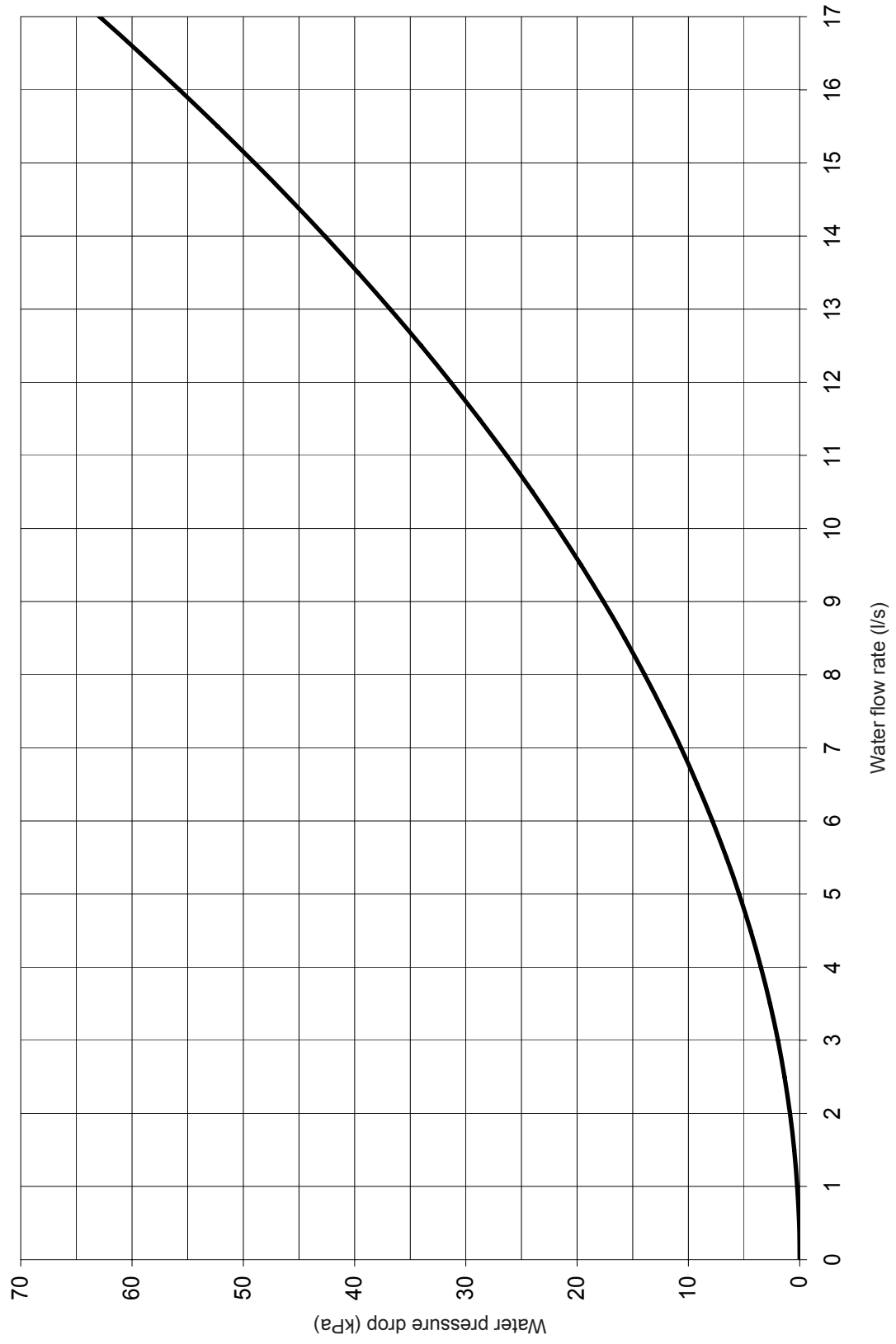
Operating range

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM	NOTES
Lower limit value	Q	1.00	1.00	1.00	1.50	1.50	1.50	2.00	2.00	2.50	3.00	3.00	Q	Q=Water flow rate
Upper limit value	Q	5.97	7.50	8.51	9.60	10.41	12.01	12.91	14.67	16.22	17.00	17.00	Q	

WATER PRESSURE DROP

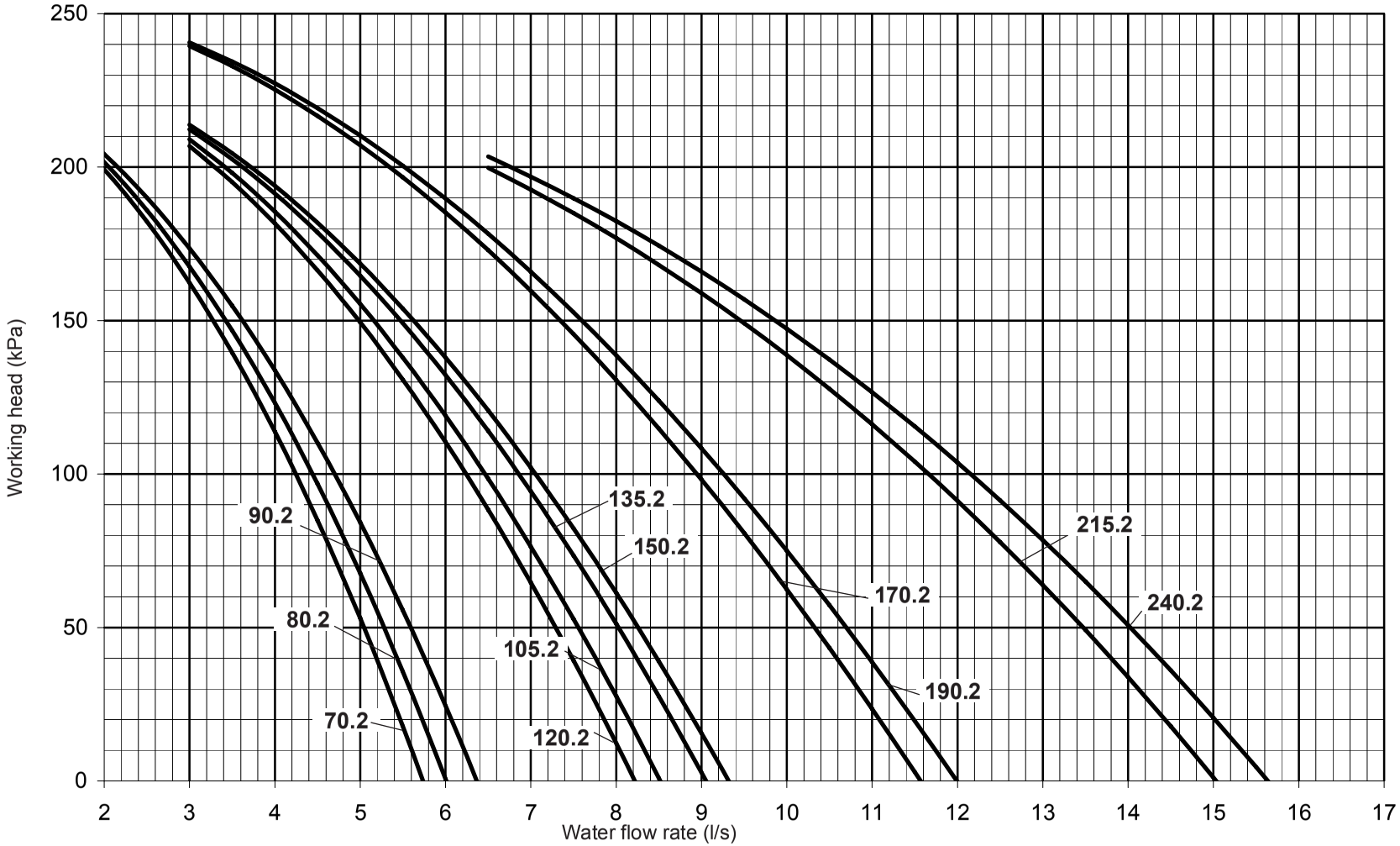
Water filter

The following graph shows the water filter pressure drop values in kPa as a function of flow rate in litres/second.



STD plant

Working head is that at the pumping module outlet reduced by all pressure losses inside the unit.
The graph below illustrates for the evaporator the working head values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.

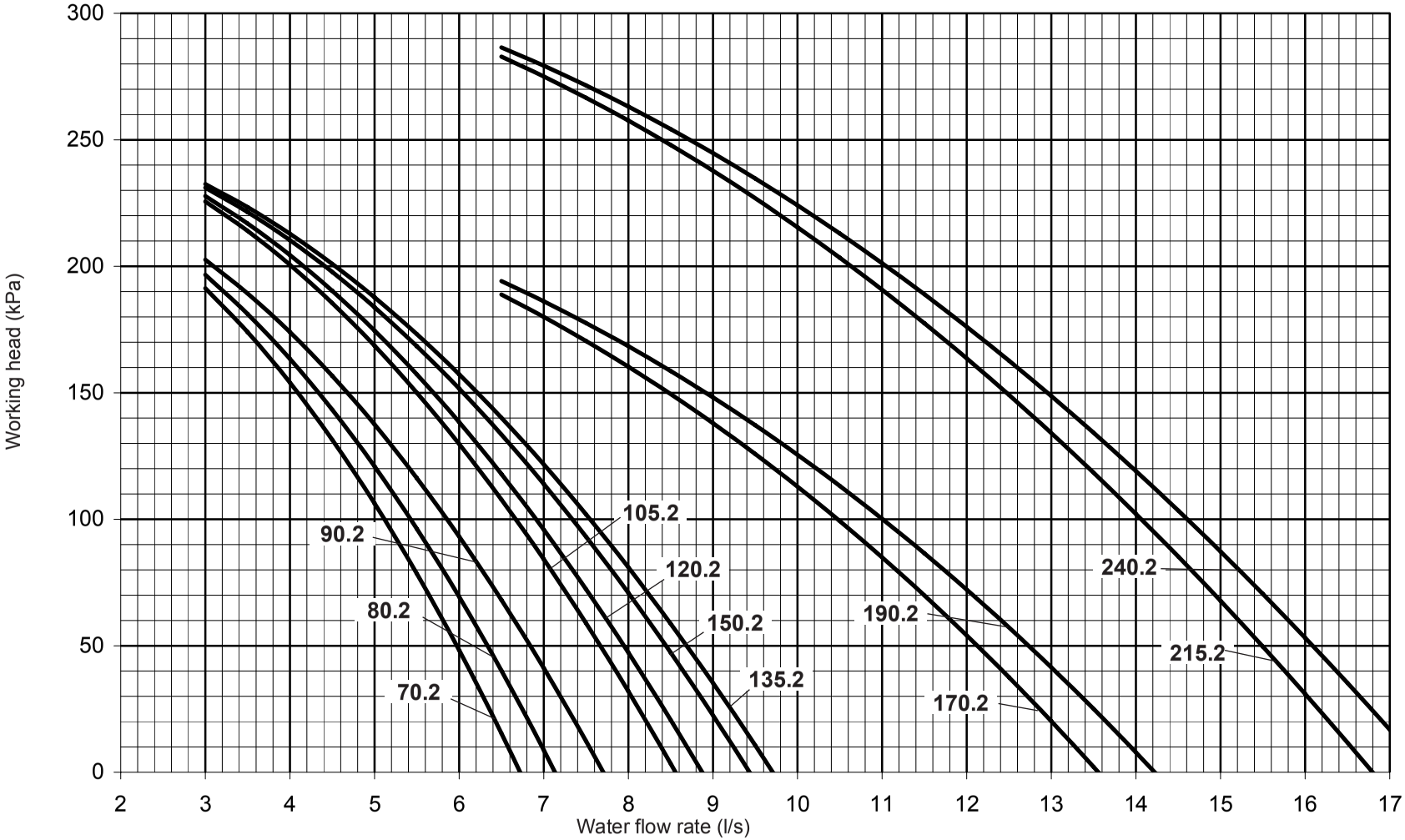


Operating range

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM	NOTES
Lower limit value	**Q**	1.5			3						6.5		l/s	Q=Water flow rate
Upper limit value	**Q**	5.75	6.0	6.4	8.2	8.5	9.0	9.3	11.6	12.0	15.0	15.6	kPa	

HP1 plant

Working head is that at the pumping module outlet reduced by all pressure losses inside the unit.
The graph below illustrates for the evaporator the working head values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.

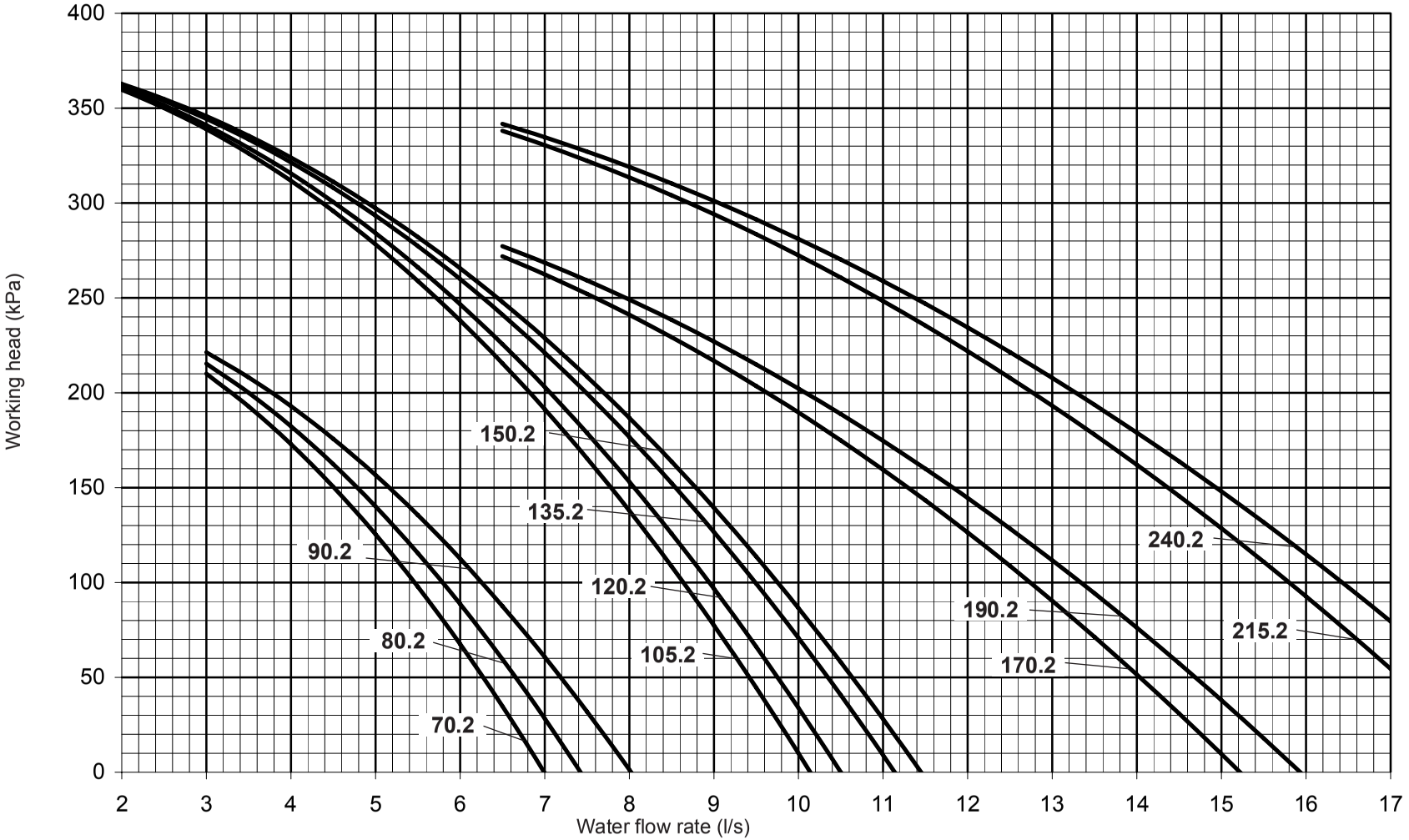


Operating range

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM	NOTES
Lower limit value	**Q**	3							6.5				l/s	Q=Water flow rate
Upper limit value	**Q**	6.7	7.1	7.7	8.6	8.9	9.4	9.7	13.6	14.2	16.8	17.0	kPa	

HP2 plant

Working head is that at the pumping module outlet reduced by all pressure losses inside the unit.
The graph below illustrates for the evaporator the working head values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.

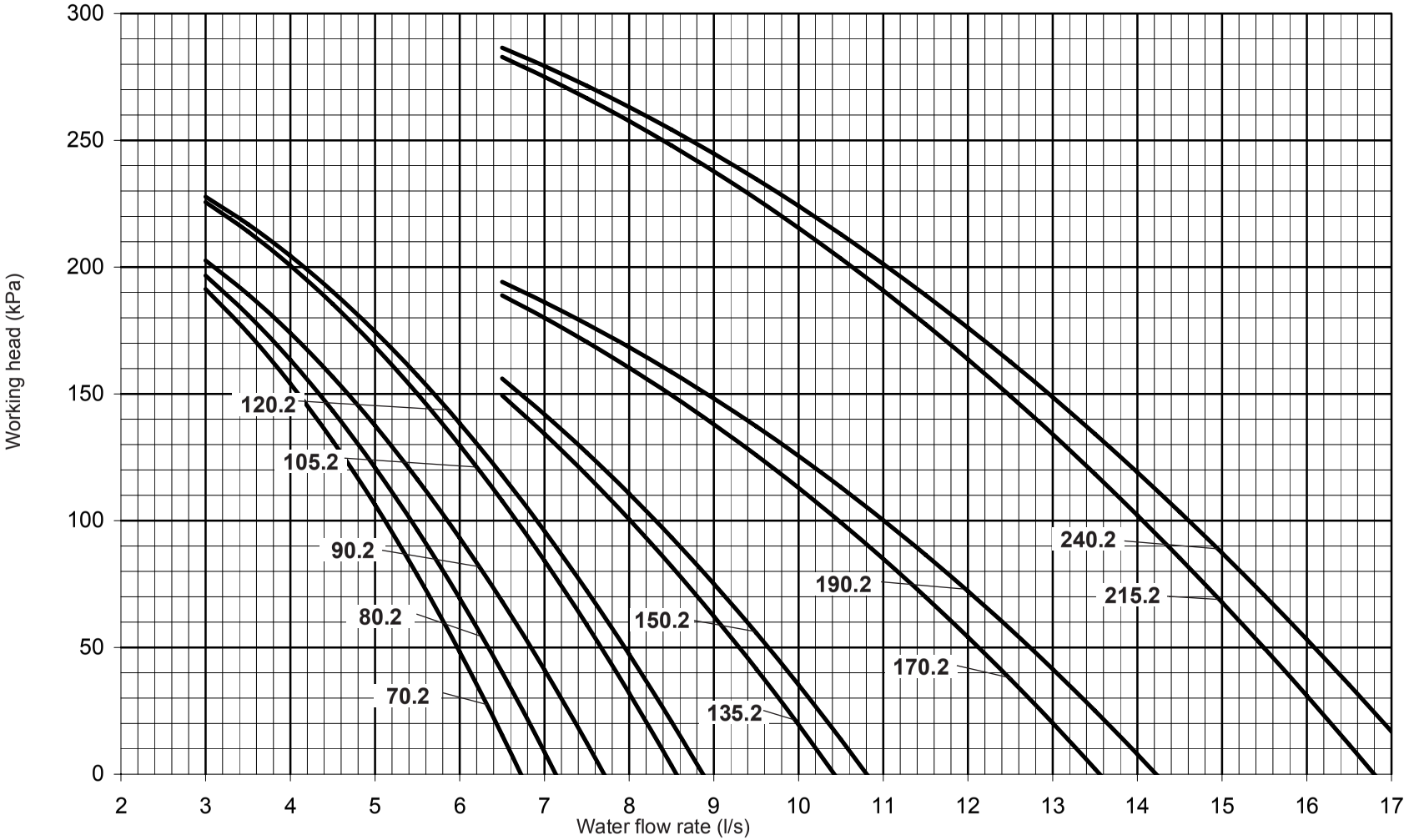


Operating range

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM	NOTES
Lower limit value	**Q**	3			0				6.5				l/s	Q=Water flow rate
Upper limit value	**Q**	7.0	7.4	8.0	10.2	10.5	11.2	11.4	15.2	16.0	17.0	17.0	kPa	

STD source

Working head is that at the pumping module outlet reduced by all pressure losses inside the unit.
The graph below illustrates for the evaporator the working head values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.

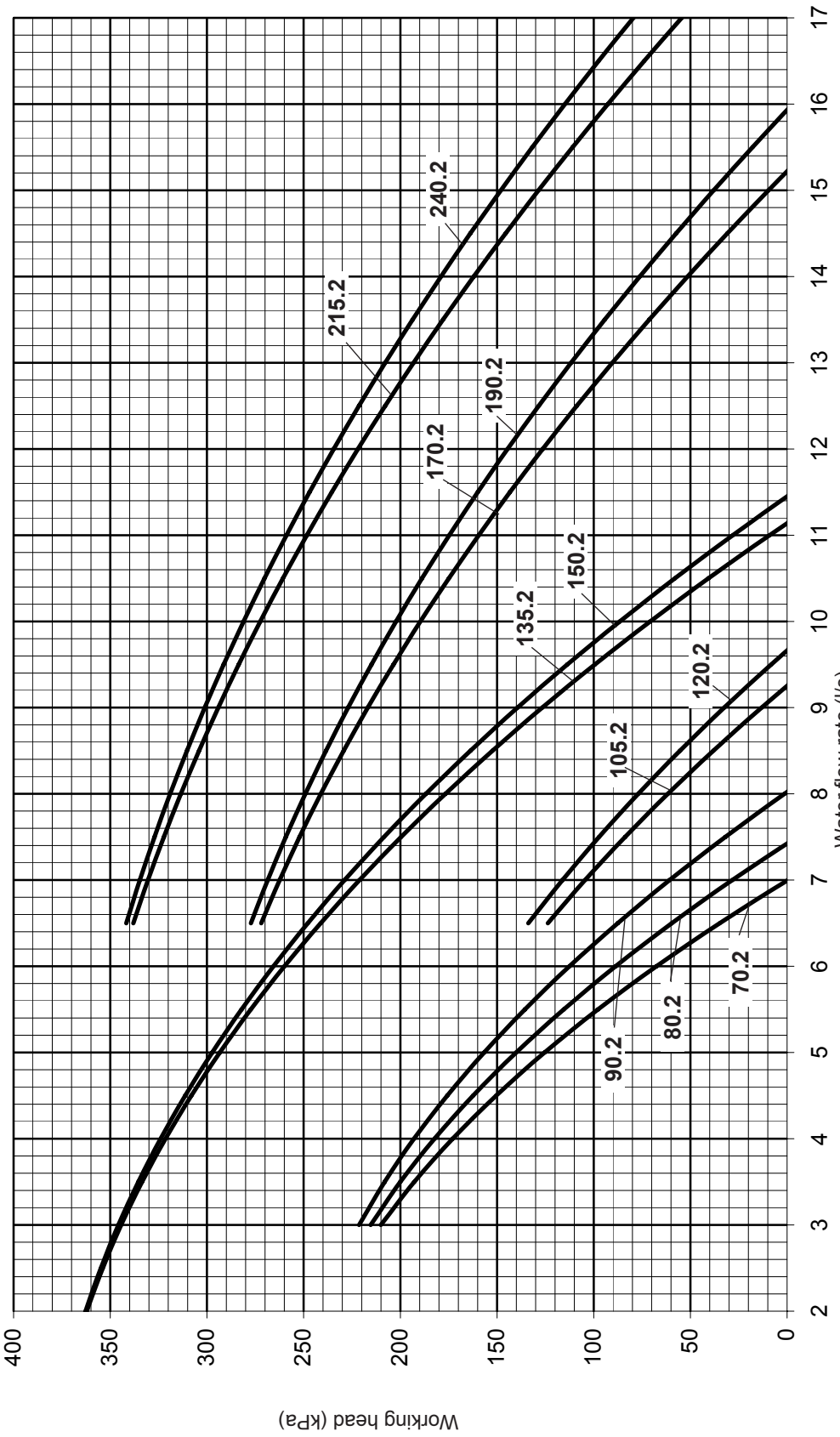


Operating range

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM	NOTES
Lower limit value	**Q**	3					6.5						l/s	Q=Water flow rate
Upper limit value	**Q**	6.7	7.2	7.8	8.6	8.9	10.4	10.8	13.6	14.2	16.8	17.0	kPa	

HP1 source

Working head is that at the pumping module outlet reduced by all pressure losses inside the unit.
The graph below illustrates for the evaporator the working head values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.

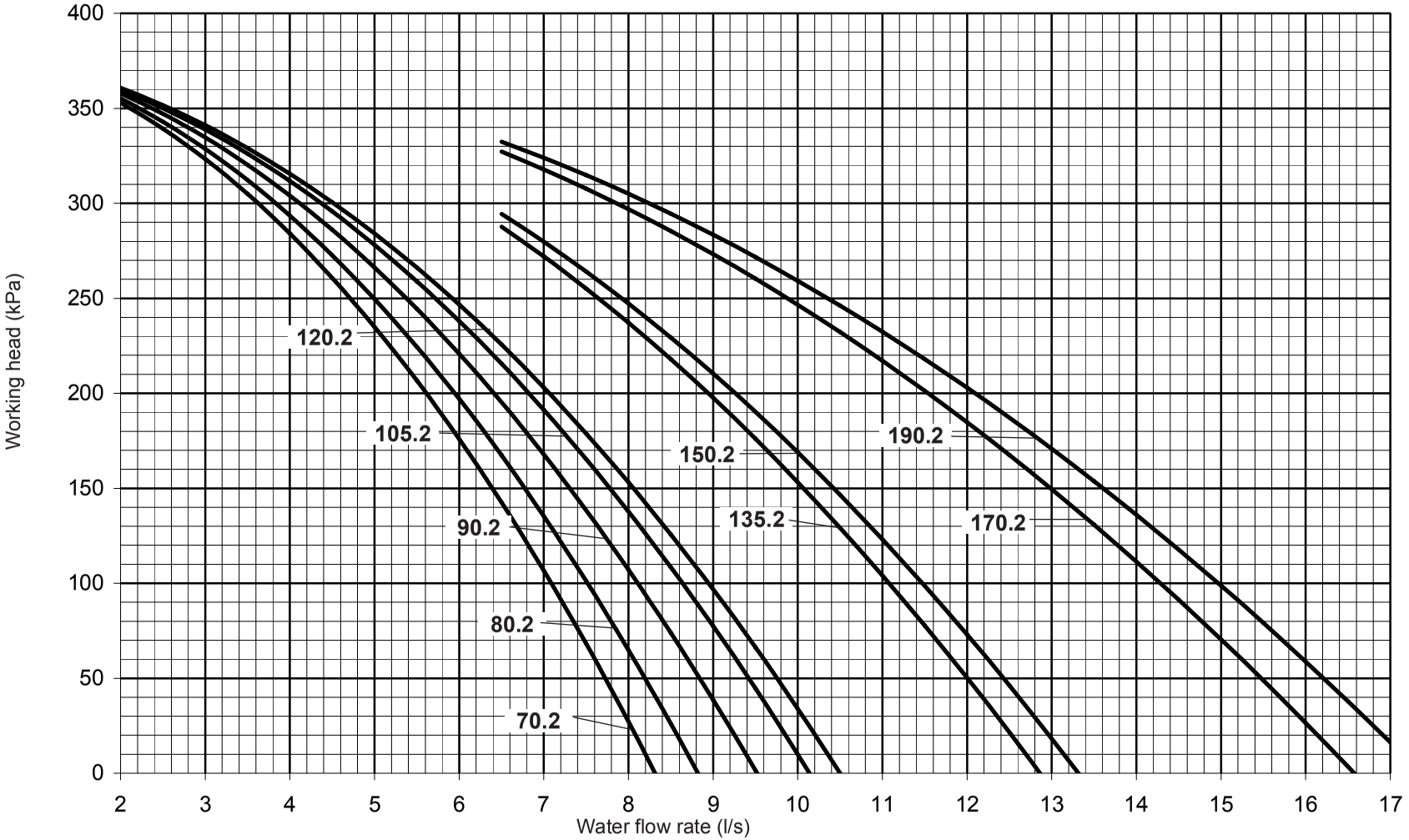


Operating range

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM	NOTES
Lower limit value	Q	3			6.5		0			6.5			l/s	Q=Water flow rate
Upper limit value	Q	7.0	7.4	8.0	9.2	9.7	11.2	11.4	15.2	15.9	17.0	17.0	kPa	

HP2 source

Working head is that at the pumping module outlet reduced by all pressure losses inside the unit.
The graph below illustrates for the evaporator the working head values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.



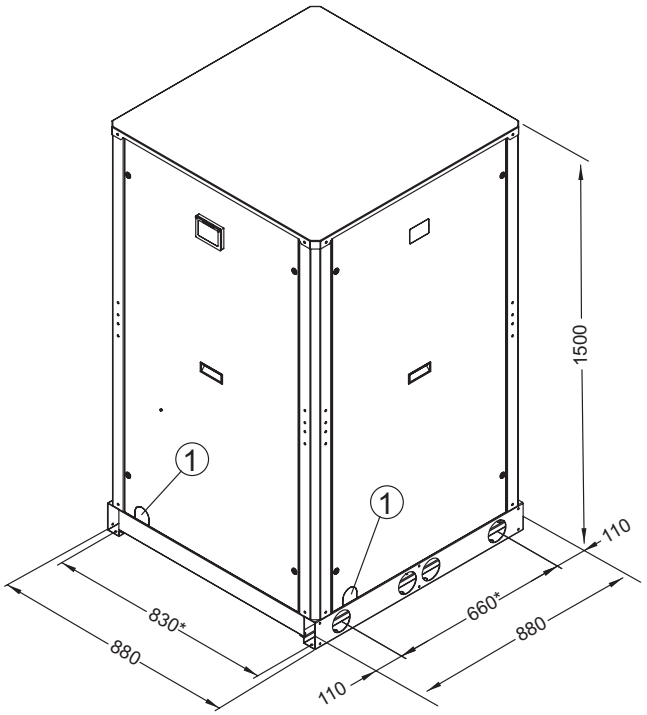
Operating range

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM	NOTES
Lower limit value	**Q**	0					6.5				ND	ND	l/s	Q=Water flow rate
Upper limit value	**Q**	8.3	8.8	9.5	10.2	10.5	12.9	13.3	16.6	17.0	ND	ND	kPa	

DIMENSIONAL DATA

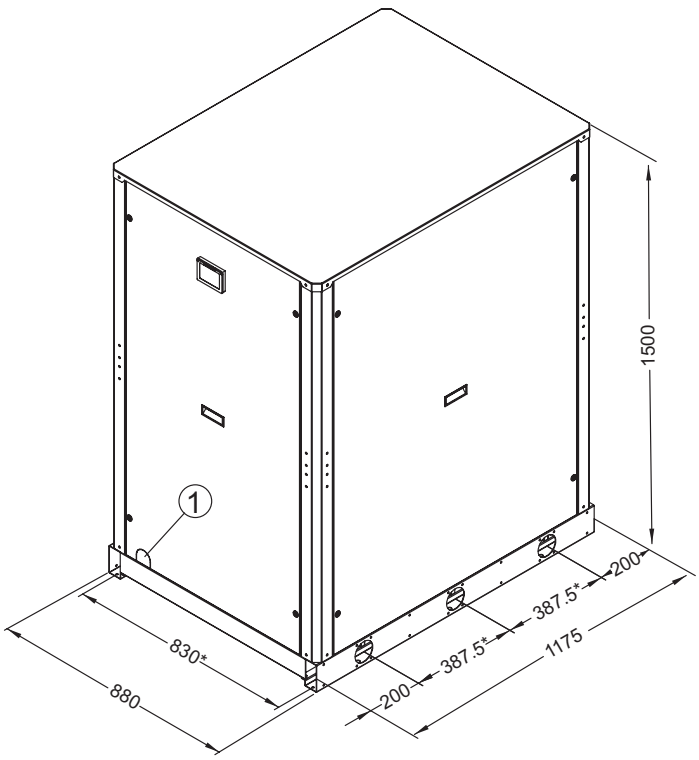
Standard unit overall dimension

F1
(Mod. 70.2 ÷ 90.2)



*** :** Center distance of vibration damper holes and lifting holes
ø 14 mm Vibration damper fixing holes
ø 75 mm lifting holes
1- Power supplie

F2
(Mod. 105.2 ÷ 240.2)



*** :** Center distance of vibration damper holes and lifting holes
ø 14 mm Vibration damper fixing holes
ø 75 mm lifting holes
1- Power supplie

Standard unit shipping weight

IR / BR / IW / BW Cooling mode

Mod.	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
AB Standard unit (1)	315	327	336	437	518	549	576	618	647	684	713	kg
AB Standard unit (2)	365	377	386	499	580	611	638	680	709	746	775	kg
AS Low noise unit (2)	365	377	386	499	580	611	638	680	709	746	775	kg
AX Extra low noise unit (2)	389	401	410	529	610	641	668	710	739	776	805	kg

IP / BP Heating mode

Mod.	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
AB Standard unit (1)	322	334	343	445	531	562	589	631	660	697	727	kg
AB Standard unit (2)	372	384	393	507	593	624	651	693	722	759	789	kg
AS Low noise unit (2)	372	384	393	507	593	624	651	693	722	759	789	kg
AX Extra low noise unit (2)	396	408	417	537	623	654	681	723	752	789	819	kg

1) Unit without cover panels
2) Unit with cover panels

Standard unit operation weight

IR / BR / IW / BW Cooling mode

Mod.	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
AB Standard unit (1)	323	335	346	447	530	563	591	636	666	706	739	kg
AB Standard unit (2)	373	385	396	510	592	625	653	698	728	768	801	kg
AS Low noise unit (2)	373	385	396	510	592	625	653	698	728	768	801	kg
AX Extra low noise unit (2)	397	409	420	540	622	655	683	728	758	798	831	kg

IP / BP Heating mode

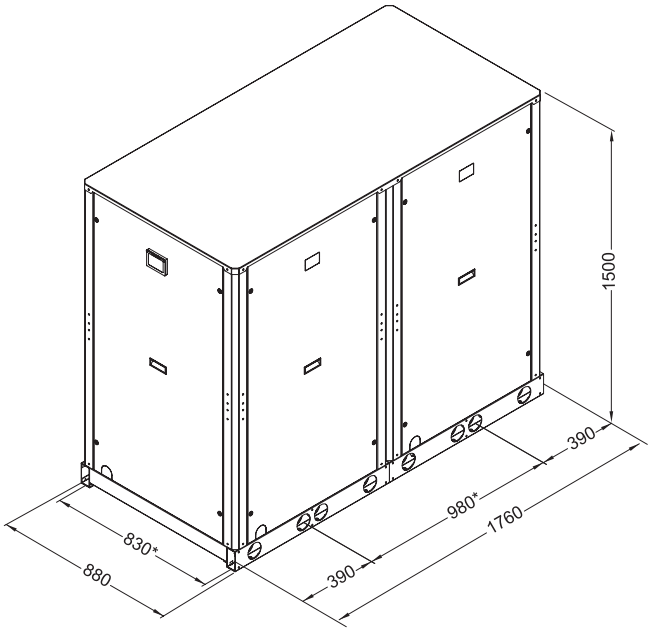
Mod.	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
AB Standard unit (1)	330	342	353	455	543	575	604	648	679	719	752	kg
AB Standard unit (2)	380	392	403	518	605	638	666	711	741	782	814	kg
AS Low noise unit (2)	380	392	403	518	605	638	666	711	741	782	814	kg
AX Extra low noise unit (2)	404	416	427	548	635	668	696	741	771	812	844	kg

1) Unit without cover panels
2) Unit with cover panels

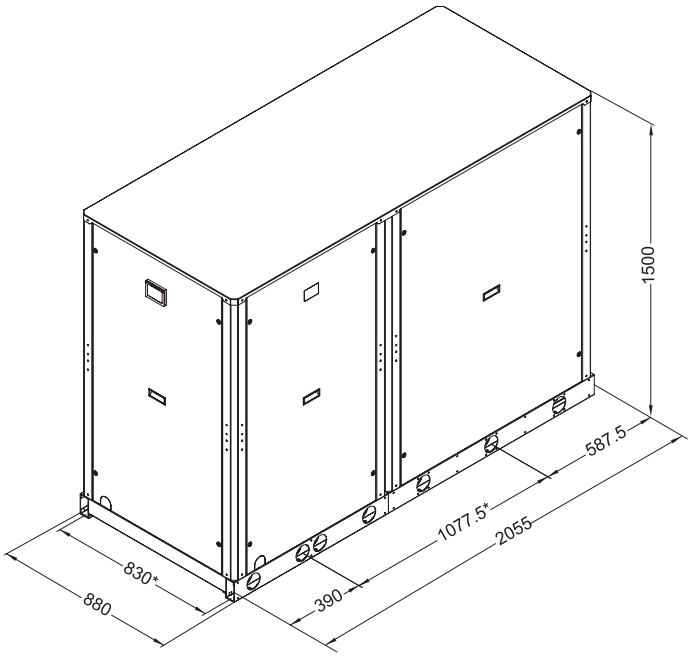
DIMENSIONAL DATA

Overall dimension Standard unit + Pumping module MP

F1 + F1



F1 + F2

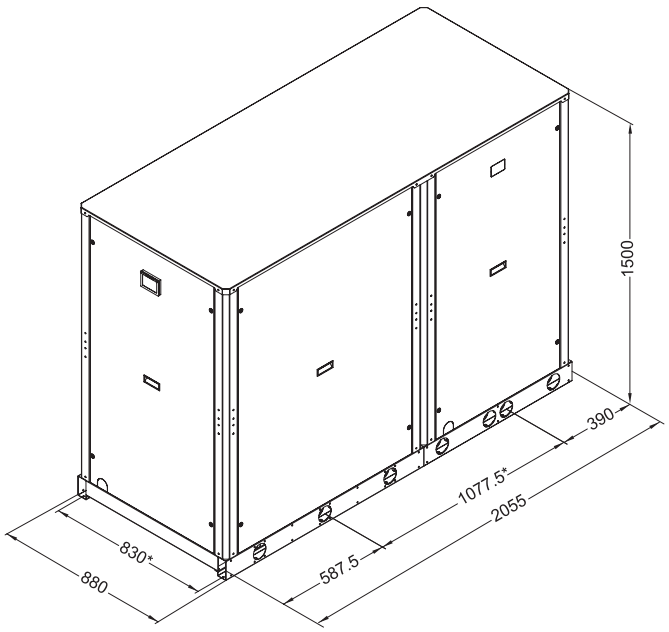


*** :** Center distance of vibration damper holes and lifting holes
ø 14 mm Vibration damper fixing holes
ø 75 mm lifting holes

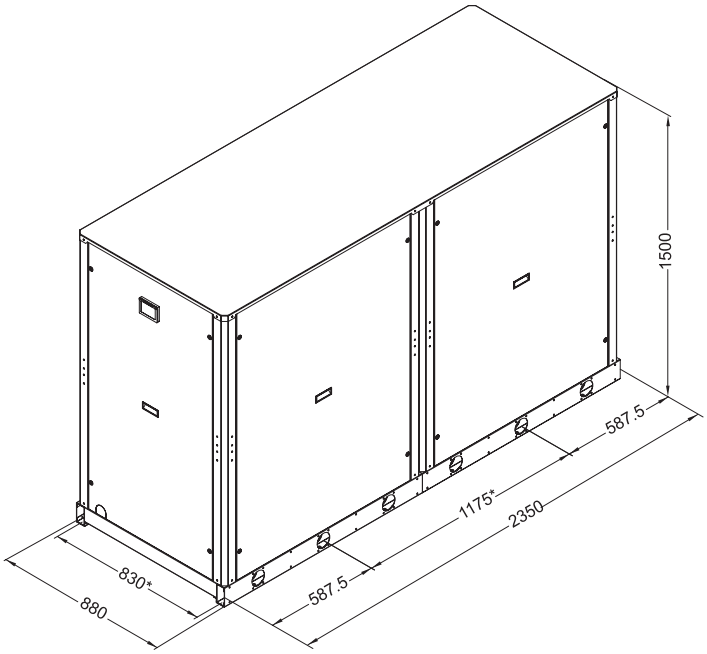
Mod. 70.2 - 80.2 - 90.2			PLANT						
	PUMPS		0	STD		HP1		HP2	
	TYPE	N°	0	1	2	1	2	1	2
SOURCE	0	0	Standard unit	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1
	STD	1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1
		2	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1
	HP1	1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1
		2	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1
	HP2	1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1	F1 + F1
		2	*F1 + F2*	*F1 + F2*	*F1 + F2*	*F1 + F2*	*F1 + F2*	*F1 + F2*	*F1 + F2*

DIMENSIONAL DATA

F2 + F1



F2 + F2



*** :** Center distance of vibration damper holes and lifting holes
ø 14 mm Vibration damper fixing holes
ø 75 mm lifting holes

Mod. 105.2 - 120.2

	PUMPS		PLANT						
			0	STD		HP1		HP2	
	TYPE	N°	0	1	2	1	2	1	2
SOURCE	0	0	Standard unit	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
	STD	1	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
		2	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
	HP1	1	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
		2	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
	HP2	1	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
		2	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**

Mod. 135.2 - 150.2

SOURCE	0	0	Standard unit	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
	STD	1	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
		2	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
	HP1	1	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
		2	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**
	HP2	1	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**
		2	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**

Mod. 170.2 - 190.2

SOURCE	0	0	Standard unit	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**
	STD	1	F2 + F1	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**
		2	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**
	HP1	1	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**
		2	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**
	HP2	1	*F2 + F1*	*F2 + F1*	*F2 + F1*	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**
		2	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**

Mod. 215.2 - 240.2

SOURCE	0	0	Standard unit	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**
	STD	1	F2 + F1	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**
		2	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**
	HP1	1	*F2 + F1*	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**
		2	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**
	HP2	1	*F2 + F1*	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**	*F2 + F1*	**F2 + F2**
		2	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**	**F2 + F2**

DIMENSIONAL DATA

MP Pumping module shipping weight

The pumping module is fully integrated with the basic unit in a single frame. For the calculation of the weight of the unit + pumping module the weights reported have to be added to the weight of the basic unit.

Esempio:
RGW IP 150.2 VB AX 0M5 + n°2 pumps HP1 Plant + n°1 pump HP2 Source
Unit weight 681 kg + pumping module weight 320 kg = **total 1001 kg**

Mod. 70.2 - 80.2 - 90.2			PLANT						
	PUMPS		0	STD		HP1		HP2	
	TYPE	N°	0	1	2	1	2	1	2
SOURCE	0	0	Unità Base	153	195	156	200	158	206
	STD	1	156	196	238	199	244	202	249
		2	200	241	283	244	288	246	294
	HP1	1	158	199	241	202	246	205	252
		2	206	246	288	249	294	252	300
	HP2	1	203	243	285	246	291	249	297
		2	301	336	368	339	374	342	379
Mod. 105.2 - 120.2									
SOURCE	0	0	Unità Base	156	200	158	206	203	301
	STD	1	158	202	246	205	252	249	348
		2	206	249	294	252	300	297	395
	HP1	1	199	243	287	246	293	290	389
		2	295	332	367	335	373	379	468
	HP2	1	203	246	291	249	297	293	392
		2	301	339	374	342	379	386	475
Mod. 135.2 - 150.2									
SOURCE	0	0	Unità Base	156	200	158	206	203	301
	STD	1	199	243	287	246	293	290	389
		2	295	332	367	335	373	379	468
	HP1	1	203	246	291	249	297	293	392
		2	301	339	374	342	379	386	475
	HP2	1	226	269	314	272	320	316	415
		2	347	385	420	388	425	432	521
Mod. 170.2 - 190.2									
SOURCE	0	0	Unità Base	158	206	199	295	214	324
	STD	1	199	246	293	287	382	301	412
		2	295	335	373	376	461	391	491
	HP1	1	214	260	308	301	397	316	426
		2	324	365	402	406	491	421	521
	HP2	1	226	272	320	313	408	328	438
		2	347	388	425	429	514	444	544
Mod. 215.2 - 240.2									
SOURCE	0	0	Unità Base	199	295	214	324	226	347
	STD	1	214	301	397	316	426	328	449
		2	324	406	491	421	521	432	544
	HP1	1	226	313	408	328	438	339	461
		2	347	429	514	444	544	455	567
	HP2	1	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D
		2	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D

DIMENSIONAL DATA

MP Pumping module operating weight

The pumping module is fully integrated with the basic unit in a single frame. For the calculation of the weight of the unit + pumping module the weights reported have to be added to the weight of the basic unit.

Esempio:
RGW IP 150.2 VB AX 0M5 + n°2 pumps HP1 Plant + n°1 pump HP2 Source
Unit weight 696 kg + pumping module weight 341 kg = **total 1037 kg**

Mod. 70.2 - 80.2 - 90.2			PLANT						
	PUMPS		0	STD		HP1		HP2	
	TYPE	N°	0	1	2	1	2	1	2
SOURCE	0	0	Unità Base	164	210	167	215	169	221
	STD	1	167	208	254	211	260	214	265
		2	215	257	303	260	308	262	314
	HP1	1	169	211	257	214	262	217	268
		2	221	262	308	265	314	268	320
	HP2	1	219	261	307	264	312	266	318
		2	326	358	394	361	400	364	405
Mod. 105.2 - 120.2									
SOURCE	0	0	Unità Base	167	215	169	221	219	326
	STD	1	169	214	262	217	268	266	374
		2	221	265	314	268	320	318	425
	HP1	1	216	260	309	263	315	313	420
		2	320	354	393	357	399	407	504
	HP2	1	219	264	312	266	318	316	423
		2	326	361	400	364	405	414	511
Mod. 135.2 - 150.2									
SOURCE	0	0	Unità Base	167	215	169	221	219	326
	STD	1	216	260	309	263	315	313	420
		2	320	354	393	357	399	407	504
	HP1	1	219	264	312	266	318	316	423
		2	326	361	400	364	405	414	511
	HP2	1	242	287	335	289	341	339	446
		2	372	407	446	410	451	460	557
Mod. 170.2 - 190.2									
SOURCE	0	0	Unità Base	169	221	216	320	231	349
	STD	1	216	263	315	310	413	324	443
		2	320	357	399	403	497	418	527
	HP1	1	231	278	330	324	428	339	458
		2	349	387	428	433	527	448	557
	HP2	1	242	289	341	336	440	351	469
		2	372	410	451	456	550	471	580
Mod. 215.2 - 240.2									
SOURCE	0	0	Unità Base	216	320	231	349	242	372
	STD	1	231	324	428	339	458	351	481
		2	349	433	527	448	557	460	580
	HP1	1	242	336	440	351	469	362	492
		2	372	456	550	471	580	483	603
	HP2	1	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D
		2	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D	#N/D

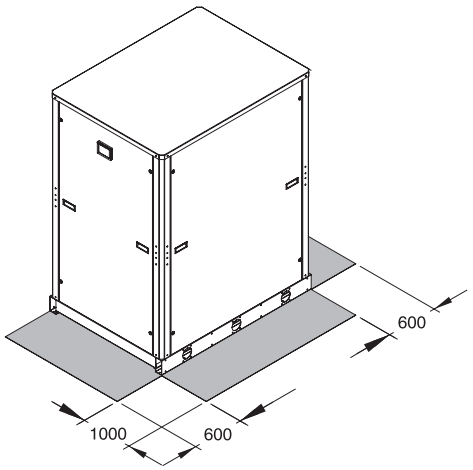
DIMENSIONAL DATA

Minimum space for operation

Refer to the figure alongside for the dimensions of the unit.
To correctly install the unit, comply with the measurements for the free area that must be left around the machine, as shown in the figure. The distances must be doubled if the unit is to be installed in a pit.

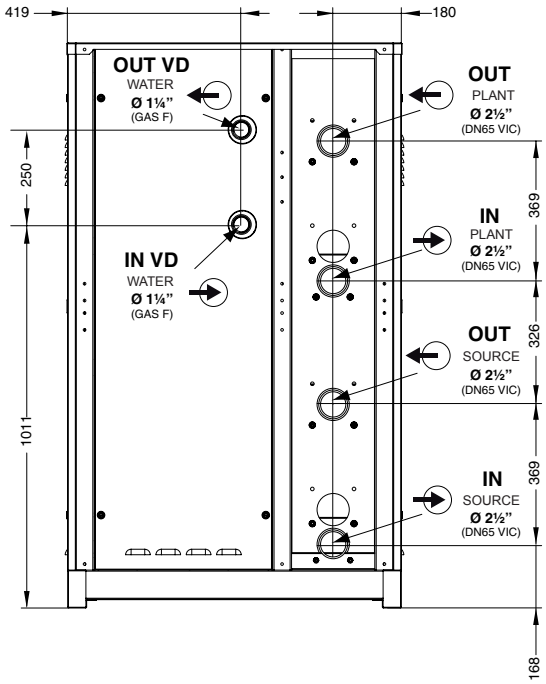
NOTE: Allow for a clear area of not less than 0.5 meters above unit.

The areas installation must be doubled if multiple units are installed.

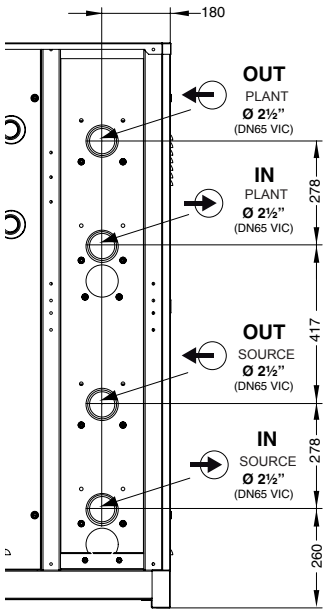


Hydraulic connections

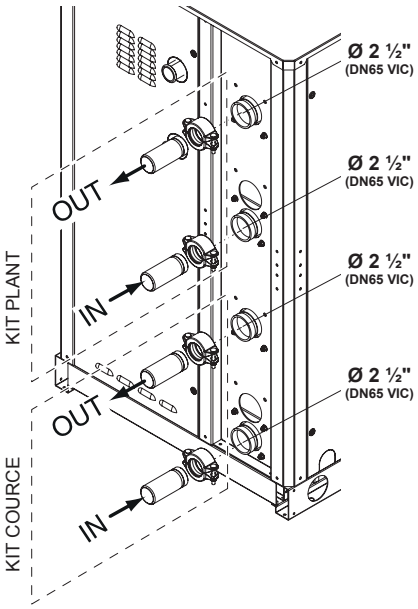
STANDARD UNIT VB + DESUPERHEATER VD



STANDARD UNIT VB + PUMPING MODULE MP



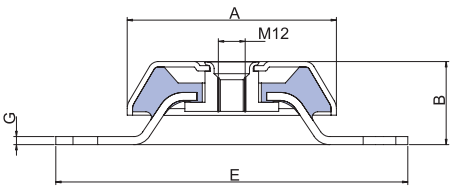
UNIT WITH N°2 ACCESSORIES VICTAULIC CONNECTION

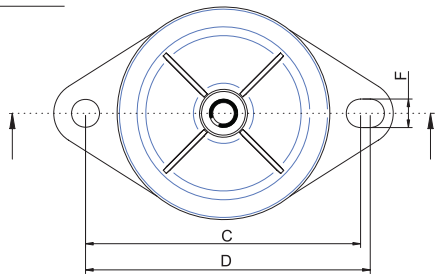


NB.: The measures are in mm.

Vibration-damper installation

To prevent the operating unit from transmitting vibrations to the bearing structure, vibration dampening materials should be inserted under the bearing points.
The unit can be supplied with the rubber or spring vibration dampening accessory. This must be mounted by the installer.





Unit	Mod.	A	B	C	D	E	G	F	UM
Unit without pumping module MP	70.2 ÷ 240.2	95	35	122	124	150	3	10	mm
Unit with pumping module MP	70.2 ÷ 90.2	95	35	122	124	150	3	10	mm
	105.2 ÷ 240.2	106	37	136	150	170	3.5	12.5	mm

RECEPTION AND POSITIONING

Inspections on arrival

As soon as the unit is consigned, it is essential to make sure that all the ordered items have been received and that the dispatch is complete. Carefully check that the load has not been damaged. If visible damage is discovered, immediately inform the haulage contractor and write "Collected with reserves owing to evident damage" on the consignment note. Delivery at the plant means that any damages will be reimbursed by the insurance company as established by law.

Safety prescriptions

Comply with the current safety provisions in relation to the equipment used to handle the unit and the ways in which these operations are carried out. Use single protection devices as goggles, gloves, helmets… when handling the unit to avoid risk of injuries.

Handling

Before moving the unit, check its weight on the data plate with the general specifications of the appliance and consult the **Dimensional data** section of this manual. Make sure that the unit is handled with care, that it is not jolted in any way and that none of its functional parts is damaged.
Comply with the following instructions when lifting and positioning the unit:

• Handling with a lift truck or similar

The unit has four wooden bases so that it can be transported in a longitudinal and sideways direction.
Do not allow the unit or any of its parts to drop on to the ground. Remember that the heaviest part is the one where the compressor is installed (electric panel side Fig.1). Refer to the data plates (Part.3 Fig.1) that identify the center of gravity position, applied to the 4 sides of the base.

Fig. 1

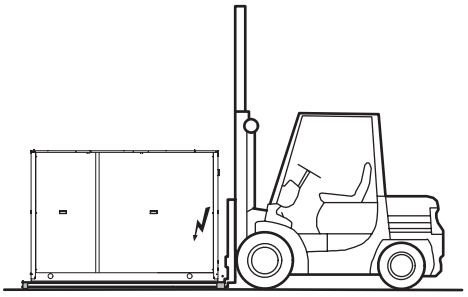


Fig. 2

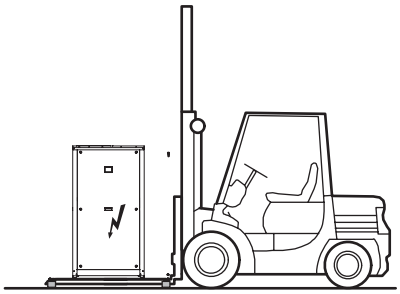
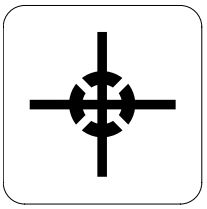
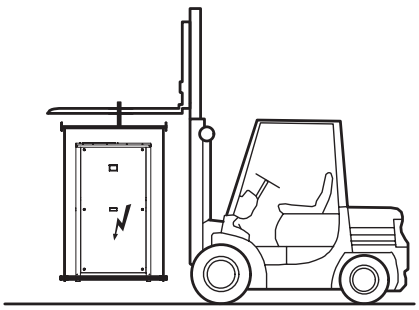


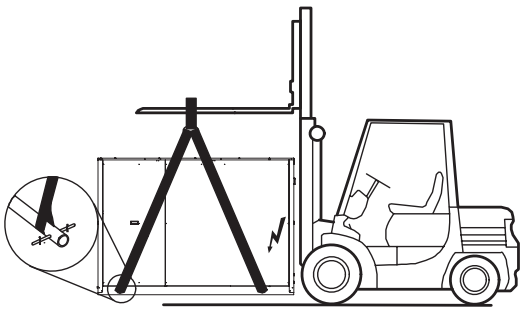
Fig. 3



• Lifting and handling with a crane or similar

- Position metal tubes of an adequate thickness in the holes on the base of the unit in order to lift it.
- The ends of the tubes must project to an adequate extent to allow safety components to be inserted and the lifting belts to be fitted.
- Consult the tables in the section "Dimensional data" when the appliance arrives section for the venter of gravity position.
- Use spacer bars in the top part of the unit to prevent the plastic parts covering the unit from being crushed and damaged.





WARNING:
Before proceeding with the handling operations, read the information on the wrapping to ensure the safety of persons and property. Also be sure to:

- Handle the load with care
- Avoid stacking other objects on top of the unit

RECEPTION AND POSITIONING

Storage

The units must be stored in a dry place sheltered from the run, rain, sand and wind.
The storage conditions are:
- Do not stack the units
- Maximum temperature = 60°C
- Minimum temperature = -10°C
- Humidity = 90%

Packing removing

Recycle and dispose of packing material in conformity with local regulations, be extremely careful not to damage the unit.

Positioning

Before positioning please consider the overall dimensions and the technical requirements of the system and the unit, electric and hydraulic connections and any air pipes/ducts or free passages.
Neglecting these aspects may decrease performance and operational life of the unit and therefore increase the operating costs and maintenance.
Units are designed to be installed **INSIDE** and in fixed positions.

Before placing the unit be sure that:

- the location is in a safe accessible place
- the framework or the floor is adequate to support the weight of the unit **WORKING** (tank filled with water, etc…), please refer to weight paragraph
- support points are leveled and aligned
- the place can not be subject to flooding

To guarantee a correct cooling of the electrical panel it is necessary to provide a minimum air circulation around the unit.
If these suggestions are not attended serious damages can be caused to electrical and electronic components with a possible consequent unit block.

HYDRAULIC CONNECTIONS

General rules

A mesh filter (hole Ø<1mm for plates heat exchanger Ø<1.5mm for shell and tubes heat exchanger) must be installed on the unit's water inlet otherwise warranty is immediately forfeited. The filter
The filter performs the function of blocking any foreign matter in the system's plumbing circuit (shavings, machining debris, etc.) limiting or avoiding possible problems of fouling (that decreases the heat exchange coefficient), erosion, and clogging
The clogging and fouling of the exchanger can lead to a reduction of the water flow rate and. In the case that the exchanger works as evaporator- of the evaporation temperature: these 2 factors can cause the icing of the exchanger
The icing event leads to the bursting of the exchanger, the inlet of water into the refrigerant circuit and so the necessity of a replacement of the main components (compressors, filters, expansion valves,. Etc.) and an accurate washing of components as refrigerant pipes, coils, etc., practically the rebuilding nearly complete of the refrigerant circuit.

The filter must be maintained clean: this is so necessary verify the cleanness after the unit installation and checking periodically the state.

Protection devices

Standard supply includes a differential pressure switch situated between the water inlet and outlet of the heat exchanger to avoid freezing if the water flow stops for any reason.
Activation is calibrated for a 80 mbar ±5 Δp, while resetting occurs with a Δp of 105 mbar ±5.
The differential pressure switch opens the contact and shuts down the compressors when the water flow ratey decreases and $\Delta p \leq$ 80 mbar ±5.
The differential pressure switch closes and therefore the unit can restart when the water flow rate increases and $\Delta p \geq$ 105 mbar ±5.
• Standard supply includes an antifreeze heater placed between the external thermal insulation and the shell of the exchanger and controlled by the main electronic controller of the unit in order to protect the evaporator full of water (but not the pipes) from the winter icing when the unit is in stand-by mode. The exchanger is protected down to an outdoor air temperature of -20°C.
NOTE the antifreeze protection only worlk if the unit is electrically connected the standby period.
It is recommended to install a water paddle flow switch at the water inlet of the unit (it can be supplied as accessory or option): the water paddle flow switch has to be electrically wired in series with the differential pressure switch.
It is mandatory to calibrate the trip out of the water paddle flow switch at a water flow rate value higher than the minimum water flow rate admissible for the exchanger (re. section Pressure Drop).

Tips for a successful installation

For a correct design and installation of the hydraulic plant comply the local laws governing safety matters and sound…
The following information is suggestion for a correct installation of the unit:
• Before connecting the unit to the system wash adequately the pipes using clean water, filling and emptying and cleaning the filters. Only after that proceed connecting the unit to the system; this operation is crucial to ensure proper start-up without the need to have repeated stops to clean the filter, with the possible risk of damage to heat exchangers and other components.
• Check by qualified personnel the quality of the water or of the mixture used; avoid the presence of inorganic salts, biological load (seaweeds, etc.) suspended solids, dissolved oxygen and the pH. Water with inadequate characteristics can cause a pressure drop increase due to a rapid fouling of the filter, energy efficiency decrease and corrosive symptom increase that can damage the unit.
• The pipes must have the least possible number of bends to minimize load losses and must be adequately supported in order to prevent the connections of the unit from being excessively stressed.
• Install on-off valves near components that need to be serviced to isolate them when maintenance work needs to be done and to allow them to be replaced without having to discharge the system.
• Before isolating the pipes and charging the system, carry out preliminary inspections to make sure that there are no leaks.
• Isolate all the chilled water pipes to prevent condensation from forming along the pipes themselves. Make sure that the material used is the steam barrier type, failing this, cover the insulation with an appropriate protection. Also make sure that the air venting valves can be accessed through the insulation.
• Do not forget to install or at least allow for the installation of pressure and temperature reading instruments on the inlet and outlet parts of the hydraulic circuit. These instruments will allow you to monitor the operation of the system.
• The circuit can be kept under pressure by means of an expansion tank and a pressure reducer. A plant filling unit can also be used in order to automatically charge the system and keep it at the desired pressure if it drops below a certain pressure value. Install manual or automatic values in the highest point of the system to eliminate air from the circuit.
Fit manual or automatic valves at the highest point in the circuit in order to vent air from the circuit.
• the water connections are Victaulic-type joints for hooking up to the unit.
The joints allow the pipes to expand due to changes in temperature and in addition the elastomer gasket and the specified play help insulate and absorb noise and vibration.
• If vibrations dampers are installed under the unit, it is recommended to use flexible couplings before and after the water circulation pump and near the unit.
• Install on the outlet of the unit a suitable valve able to regulate the water flow.
• Avoid that the weight of the connection pipes pushes on the hydraulic connections of the unit using approved supports.

Check that plant components are suitable to bear the maximum static pressure (it depends on the height of the building).

HYDRAULIC CONNECTIONS

Water component for corrosion limit

To avoid corrosion problems in water exchangers make sure that the water used in the plant meets the requirements listed in the table.

pH	7.5 ÷ 9.0	-
SO4 --	< 100	ppm
HCO3 -/ SO4 --	>1.0	
Total hardness	8.0 ÷ 15.2	°F
Cl-	< 50	ppm
PO4 3-	< 2.0	ppm
NH3	< 0.5	ppm

Free Chlorine	< 0.5	ppm
Fe3+	< 0.5	ppm
Mn++	< 0.05	ppm
CO2	< 50	ppm
H2S	< 50	ppb
Temperature	< 65	°C
Oxygen content	< 0.1	ppm

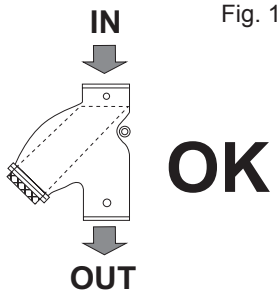
Precautions for the Winter

The water could freeze and damage the exchanger of the unit and other parts of the system during the winter period, if the system was to remain at a standstill. This problem can be obviated in 3 different ways:
1. Drain the system completely, taking care to drain the plate exchanger (in order to drain the unit's piping system completely, open the water drain ball valves and the air vent valves, open any valves closed).
2. Operate with glycol water taking account, depending on the % of glycol, of the factor of correction of the refrigerating capacity, power input, water flow rate and losses of head (see table on following page)
3. If it is certain that the unit will always be powered throughout the winter, the unit is able to protect itself from freezing, down to a temperature of -20°C: this is possible thanks to an antifreeze electric heating element installed on the plate exchanger and intelligent control of the water pump that must be governed by the microprocessor board (see the "Electric Connections" section).
If the unit is fitted with a Storage tank, solution no. 3 requires installing the tank antifreeze heating element accessor.

Filter cleaning

After the filter cleaning pay attention to reinstall in the correct position the filtering mesh (fig.1).

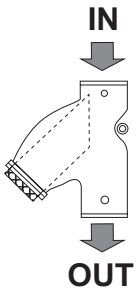
Fig. 1



OK

FILTER MESH
CORRECTLY INSTALLED

Fig. 2



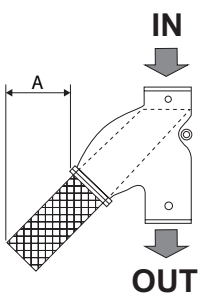
NO

FILTER MESH
NOT CORRECTLY INSTALLED

Fig. 3

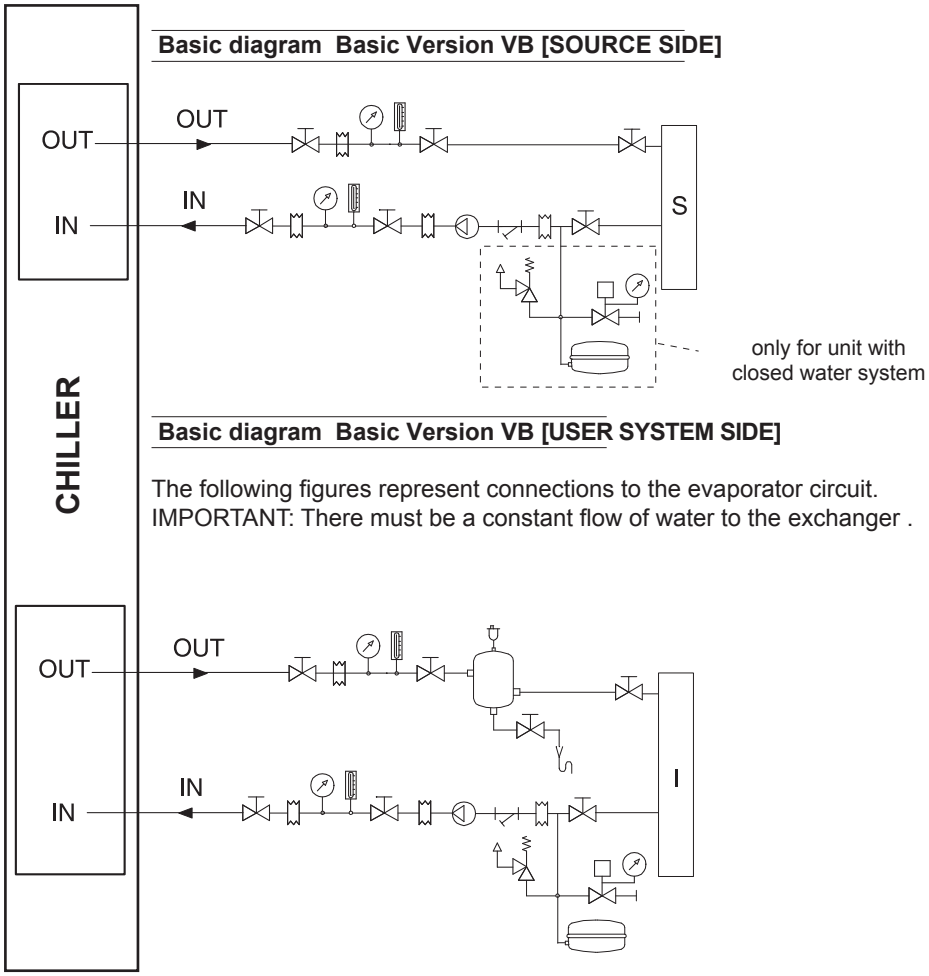
Minimum space for mesh extraction

Filter size	A (mm)
DN 50	116
DN 65	122
DN 80	129
DN 100	168
DN 125	258
DN 150	219
DN 200	284



HYDRAULIC CONNECTIONS

Basic diagram Basic Version VB [SOURCE SIDE]



Basic diagram Basic Version VB [USER SYSTEM SIDE]

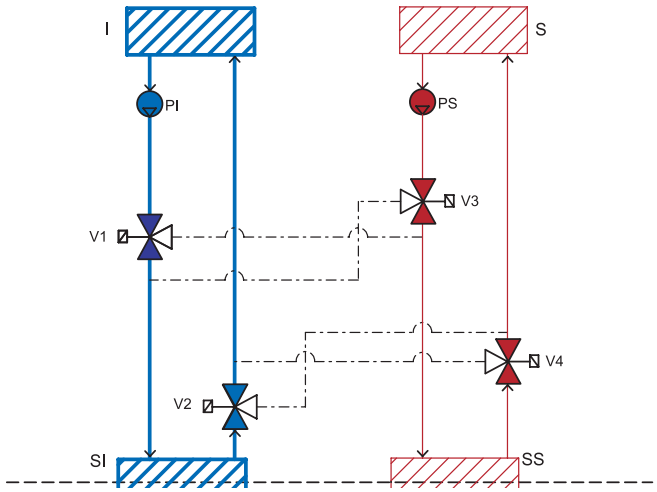
The following figures represent connections to the evaporator circuit.
IMPORTANT: There must be a constant flow of water to the exchanger .

I = User system
S = Source

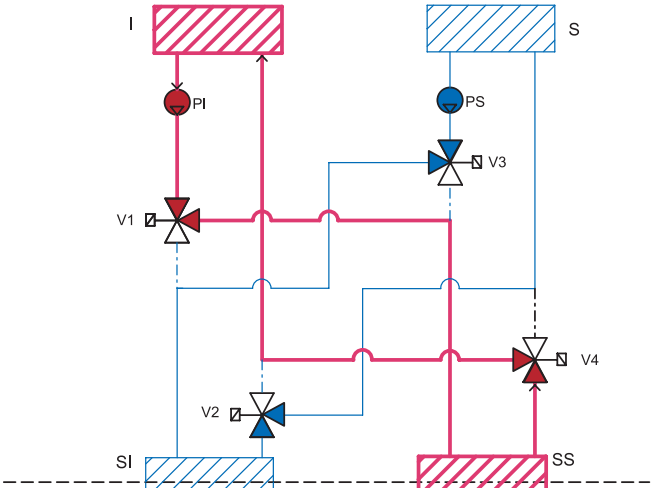
- Pressure gauge
- Thermometer
- On-off and/or water flow rate regulating valve
- Monitoring electronics (governor)
- Pump
- Filter
- Tank
- Expansion tank
- Air vent valve
- Safety valve
- Coupling
- Water filling unit
- Three-way driven valve
- Recovery water flow inlet probe

Hydraulic circuit for heat pump reversible water side IW-BW

Cooling mode



Heating mode



	DESCRIPTION		DESCRIPTION
SI	Plant exchanger	S	Source
SS	Source exchanger	V1	Expansion three way valve
I	System	V2	Expansion three way valve
PI	System pump	V3	Expansion three way valve
PS	Source pump	V4	Expansion three way valve

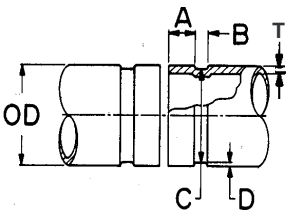
PLANT
SOURCE
NOT USED

HYDRAULIC CONNECTIONS

ISO-G	DN(mm)	EXTERNAL DIAMETER OD(mm)	A	B	O	D	T
1”	25	33.7	15.875	7.137	30.226	1.600	1.651
11/4”	32	42.4	15.875	7.137	38.989	1.600	1.651
11/2”	40	48.3	15.875	7.137	45.085	1.600	1.651
2”	50	60.3	15.875	8.738	57.150	1.600	1.651
21/2”	65	76.1	15.875	8.738	72.260	1.981	2.108
3”	80	88.9	15.875	8.738	84.938	1.981	2.108
4”	100	114.3	15.875	8.738	110.084	2.108	2.108
5”	125	139.7	15.875	8.738	135.500	2.134	2.769
6”	150	168.3	15.875	8.738	163.957	2.159	2.769
8”	200	219.1	19.050	11.913	214.401	2.337	2.769

1) Pipe groove inspections

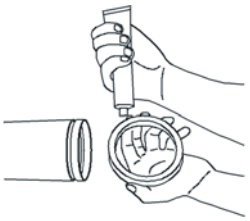
Check the depth and diameter of the grooves and their distance from the pipe ends. Make sure that the work has been carried out with care and that the end surface of the pipes is smooth and not ovalized. Make sure that there are no notches, burrs or other imperfections that could impair the tightness. Groove dimensions in mm A=16-B=8-C=57.2-D=1.6



2) Checking the seal and relative lubrication

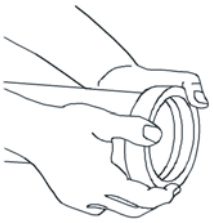
Make sure that the type of seal used is compatible with the nature and temperature of the fluid. Signal green **EPDM** seals are used.

Apply a film of grease to the seal: on the back, on the side flanks and on the inner lips that contact the pipe. Work in conditions of the utmost cleanliness as particles of dirt could damage the seal. Always and only use synthetic grease. Greasing makes it easier to fit the seal on the pipe and improves the tightness. It also allows the seal to slide within the connection, avoiding tensions and projections near the bolts.



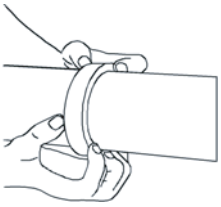
3) How to fit the seal

Fully insert the seal into the end of a pipe. Make sure that the seal lips adhere to the pipe itself.



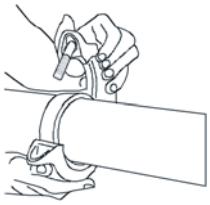
4) Alignment

Align the pipes and move their ends near to each other. Now push the seal, centering it on the two pipe ends. The seal must remain inside the grooves.



5) Joint assembly

Remove one bolt and loosen (without removing) the other one. Seat part of the body of the joint at the bottom, between the pipe ends, inserting and edges of the grooves. Now seat the other part of the body at the top, on the two ends, and close the joint. Make sure that the parts of the body of the joint touch each other.

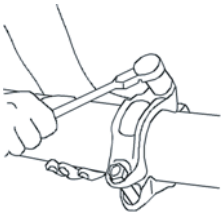


6) Nut torquing

Fit the previously removed bolt back in place and tighten both nuts by hand. Now torque them with the relative wrench, tightening them alternately a few turns.

WARNING:

If one nut is fully tightened at a time, the seal could slip between the jaws of the opposite side of the joint.



ELECTRICAL CONNECTIONS

General rules

The appliance must be wired in compliance with the laws in force in the country in which it is installed. The units are supplied fully wired in the factory and pre-engineered for connection to the electricity main. The electric panel is made in compliance with the technical standards in force in the European Union.

Structure of the electric panel

All the electrical components are contained in a closed casing protected against the atmospheric agents and inspectionable by opening the front door after removing the front panel (if present). The door for accessing the power section is locked by the mechanism. Access for the supply cables and earth cable (PE) is permitted through the opening on the botton of the electric panel.

Composition of the system

The system comprises an electromechanical part consisting of the power circuit, with disconnecting device, contactors, fuses or thermal cutouts, transformer, and another part comprising the Microprocessor control system.

NOTES: Refer to the wiring diagram supplied with the unit for the layout of the electric panel.

Electrical connections

All electrical connections must be carried out by qualified personnel in the absence of electric power. The table below gives the electrical specifications of the different constructional configurations of the units.

Standard unit

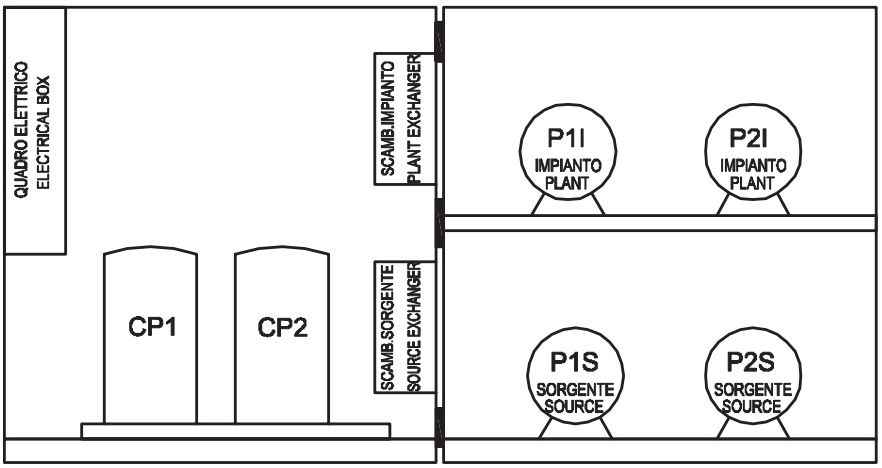
UNIT	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Power supply	400 - 3 - 50											V-ph-Hz
TOTAL FLA	45	51	62	68	74	82	90	105	120	142	164	A
TOTAL FLI	26	29	34	40	45	50	55	63	72	83	93	kW
TOTAL MIC	141	166	204	256	262	309	317	355	370	454	476	A

NOTES:
Values relative to a 400V-3-50Hz power supply voltage rating
FLA= Power draw at maximum tolerated conditions
LRA= Locked Rotor Amps
FLI= Electric power draw at maximum tolerated conditions
MIC= Maximum surge current of the unit

Compressor specification

UNIT		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Power supply		400 - 3 - 50											V-ph-Hz
FLA	CP 1	22.6	25.6	31.0	31.0	37.0	37.0	45.0	45.0	60.0	60.0	82.0	A
	CP 2	22.6	25.6	31.0	37.0	37.0	45.0	45.0	60.0	60.0	82.0	82.0	
FLI	CP 1	13.2	14.7	17.0	17.0	22.6	22.6	27.3	27.3	36.1	36.1	46.7	kW
	CP 2	13.2	14.7	17.0	22.6	22.6	27.3	27.3	36.1	36.1	46.7	46.7	
LRA	CP 1	118	140	173	173	225	225	272	272	310	310	394	A
	CP 2	118	140	173	225	225	272	272	310	310	394	394	

Unit layout



ELECTRICAL CONNECTIONS

Pumping module MP specifications

Pump mod.	300/1.5	500/2.2	50-125/4.0	500/3.0	40-160/4.0	50-160/5.5	50-160/7.5	UM
FLA	3.2	4.8	8.9	5.6	9.8	11.8	15	A
FLI	1.8	2.9	4.9	3.3	5.3	6.7	8.8	kW
LRA	20.6	37.3	71	57.6	71	95	124	A

NOTES:
FLA= Power draw at maximum tolerated conditions
LRA= Locked Rotor Amps
FLI= Electric power draw at maximum tolerated conditions
MIC= Maximum surge current of the unit
Values relative to a 400V-3-50Hz power supply voltage rating

Pumps used

Plant

Unit	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2
STD	300/1.5	300/1.5	300/1.5	500/2.2	500/2.2	500/2.2	500/2.2	500/3.0	500/3.0	50-125/4.0	50-125/4.0
HP1	500/2.2	500/2.2	500/2.2	500/3.0	500/3.0	500/3.0	500/3.0	50-125/4.0	50-125/4.0	50-160/5.5	50-160/5.5
HP2	500/3.0	500/3.0	500/3.0	40-160/4.0	40-160/4.0	40-160/4.0	40-160/4.0	50-160/5.5	50-160/5.5	50-160/7.5	50-160/7.5

Source

Unit	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2
STD	500/2.2	500/2.2	500/2.2	500/3.0	500/3.0	50-125/4.0	50-125/4.0	50-125/4.0	50-125/4.0	50-160/5.5	50-160/5.5
HP1	500/3.0	500/3.0	500/3.0	50-125/4.0	50-125/4.0	40-160/4.0	40-160/4.0	50-160/5.5	50-160/5.5	50-160/7.5	50-160/7.5
HP2	40-160/4.0	40-160/4.0	40-160/4.0	40-160/4.0	40-160/4.0	50-160/7.5	50-160/7.5	50-160/7.5	50-160/7.5	nd	nd

For the calculation of the electrical data for units with pumping module you have to add to the values of the basic unit the electrical data of the selected pumping module.

Example:
RGW IP 150.2 VB AX 0M5 + n°2 pumps HP! Plant + n°1 pump HP2 Source

UB:	**RGW IP 150.2 VB AX 0M5**	FLA =90 A	FLI = 55 kW	MIC = 317 A
PI:	n°2 pumps HP1 Plant **(mod. 500/3.0)**	FLA =5.6 A	FLI = 5.3 kW	LRA = 71 A
PS:	n°1 pump HP2 Source **(mod. 50-160/7.5)**	FLA = 15 A	FLI = 88 kW	LRA = 124 A

n°1 pump HP2 Source

$FLA_{TOT} = FLA_{UB} + FLA_{PI} + FLA_{PS}$
$= 90 + 5.6 + 15 = 110.6$ A

$FLI_{TOT} = FLI_{UB} + FLI_{PI} + FLI_{PS}$
$= 55 + 5.3 + 8.8 = 69.1$ A

$MIC_{TOT} = MIC_{UB} + FLA_{PI} + FLA_{PS}$
$= 317 + 5.6 + 15 = 337.6$ A

Note: For modules with 2 pumps for the calculation of FLA and FLI you have to consider that only 1 pump per time can work.
For the calculation of MIC you have to consider that the pumps are already working so you have only to add to the MIC of the basic unit the FLA of the Plant pump and the FLA of the Source pump.

ELECTRICAL CONNECTIONS

1) Connection to the electricity main

• Power supply line;
The machine's power supply line must be laid by following a clearly defined route in order to make it as correct as possible any without any breaks. Pass the line through the opening on the button of the electrical panel. Secure the line integral with the structure of the machine. Then continue inside the panel and connect the conductors directly to the input terminals of the main disconnecting device of the machine.
• Power supply system;
The power cables of the machine's supply line must be taken from a system of symmetrical three-phase voltages and of a separate protection conductor.

V= 380÷415V
f= 50 Hz

• Protection on supply side:
An automatic switch must be installed on the supply side of the side in order to protect against any overcurrents and indirect contacts that could occur when the machine is operating.
It is advisable to install an automatic current limiter switch in order to limit the effective short-circuit current in the connecting point of the machine. This allows a protection device with a lower breaking capacity than that required in the connection point to be sized like the main circuit-breaker of the machine.
The line and switch must be coordinated in compliance with the current laws governing electrical safety matters, regarding the type of installation and environmental conditions in which the machine must operate.
• Protection conductor (ground wire):
The protection conductor from the feeder line must be connected straight to the ground screw identified by code **"PE",** which ensures the equipotential connection of all metal grounding points and structural parts of the machine.

2) Electric panel

• Protection degree:
The electric panel casing is made from sheet metal and has IP22 protection rating at the doors directly accessible from the outside. The other parts of the casing guarantee a protection degree that is at least equivalent to **IP22**, as established by the current laws in force: this has been achieved since the panel has further protection against the penetration of solid foreign bodies and atmospheric agents thanks to the machine structure in which it is housed. If the unit is equipped with panels the protection degree for the electrical panel becomes IP54.
• Starting and stopping function:
The red handle on the panel door directly acts on the main circuit-breaker. The handle also acts as a door lock since it ensures that the machine is only powered when the door is shut. The stopping function carried out by the main circuit-breaker is classified as type "0" since the machine is stopped by immediately cutting off the power supply.

3) Reference standards

• The provisions established by the following Directives have been complied with to ensure the safety of the electrical products placed on the European Union market:
- Low Voltage Directive **2006/95 EEC** which also includes the following harmonized standards:
CEI EN 60335-1 and 60335-2-40.
Classification:**CEI EN 60204-1.** Safety of machinery. Electrical equipment of machines. Part 1: General rules.
- Directive **2004/108/EEC** concerning **"Electromagnetic compatibility".**

4) User connection
In the electrical board are available on terminals:
a) command for water circulation pump (available one relè free contact) and relative thermal protection
b) digital input for remote ON/Stand by of the unit
c) free voltage contact for general alarm (NO)
d) digital input for remote switch working mode (Cool/Heat) of the unit
e) 0÷10V signal for control of source inverter pumps or 2 or 3 way valves (supplied as accessory too)
f) for IW/BW and IP/BP units relay (230V) control of the pumps group of the Source exchanger and related safety devices

For more details refer to the wiring diagram of the unit.

R410A PROTECTION DEVICES

Protection devices HIGH PRESSURE

The unit is protected against risk of overpressure by means of 3 levels protection chain.

Each circuit is equipped with:
1) high pressure automatic switch connected to electronic controller
2) high pressure manual switch connected to compressor contactor command and to electronic controller
3) high pressure safety valve

Protection devices technical data

LEVEL	1	2	3
Device	High pressure automatic switch	High pressure manual switch	High pressure safety valve
Trip out (barg)	41.0	43.0	45.0
Trip in (barg)	29.5	31.0	41.0
connected to	electronic controller	compressor contactor command	discharge pipe compressor
effect	stop the compressors	stop the compressors	Discharge the refrigerant to atmosphere to reduce the system pressure
reset *	By keyboard if the high pressure switch has trip-in and after the solution of the problem that generates the alarm	Press the button present on the manual pressure switch **CAUTION**	Not necessary

CAUTION

IN CASE OF COMPRESSORS TRIP-OUT BY MANUAL RESET HIGH PRESSURE SWITCH THERE ARE NO EVIDENCES ON THE DISPLAY, DO NOT RESET THE PRESSURE SWITCH BEFORE YOU HAVE DONE THE FOLLOWING STEPS:
1) SHUT DOWN THE UNIT
2) THEN RESET THE HIGH PRESSURE SWITCH

*: For more details refers to section monitoring basic system.

Protection devices LOW PRESSURE

LEVEL	1
Device	Low pressure automatic switch
Trip out (barg)	4 bar Standard Version IR 2 bar Brine Version BR
Trip in (barg)	6 bar Versione Standard IR 4 bar Versione Brine BR
connected to	electronic controller
effect	stop the compressors and pumps of the source side exchanger (if manager by the unit controller)
reset*	YES by keyboard if the low pressure switch has trip-in and after the solution of the problem that generates the alarm

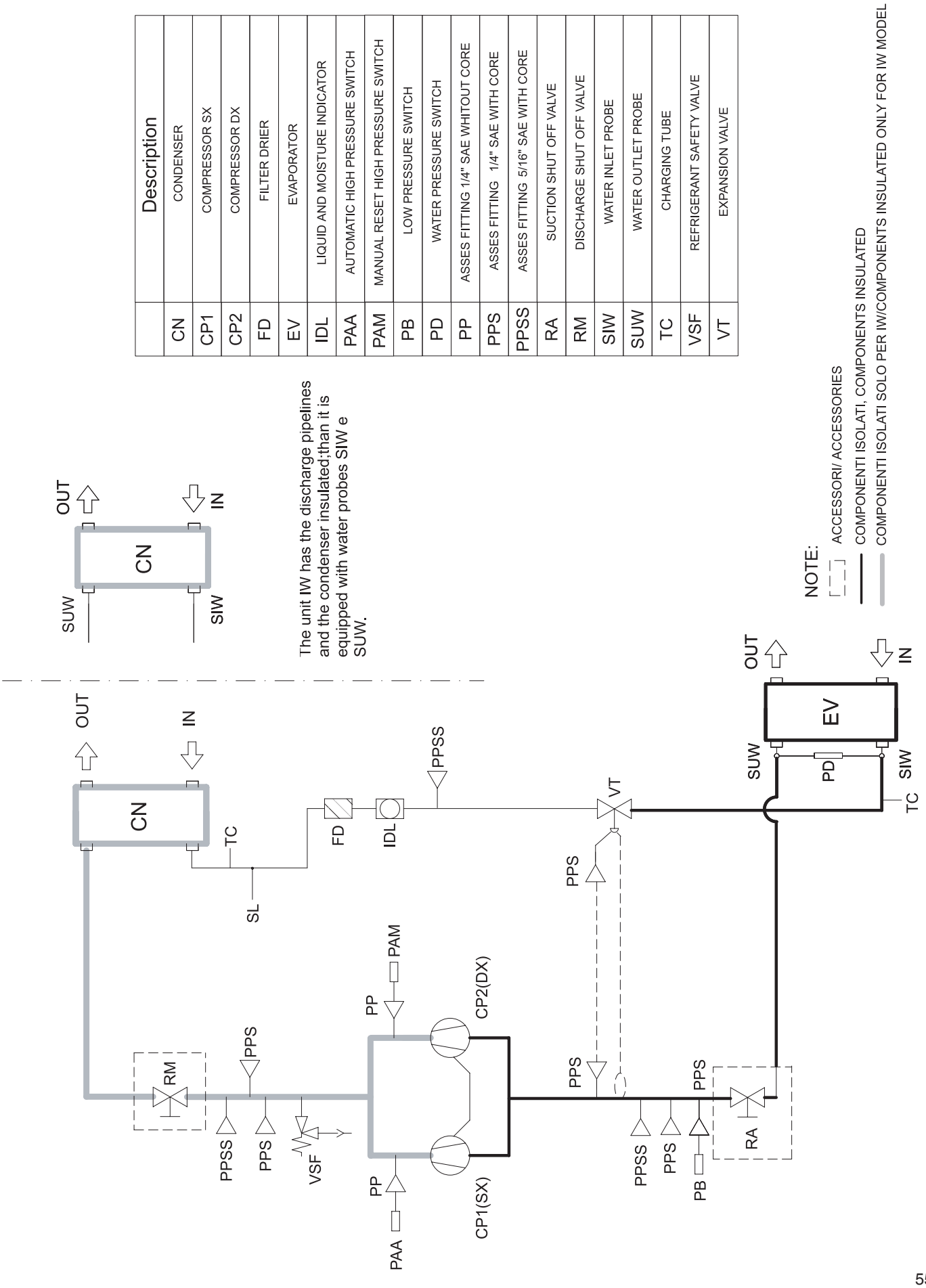
Protection devices DISCHARGE TEMPERATURE (if installed)

LEVEL	1
Device	High Temperature Thermostat
Trip out	135°C
Trip in	120°C
connected to	electronic controller
effect	stop the single compressor.
reset*	YES by keyboard after the solution of the problem that generates the alarm

REFRIGERANT FLOW DIAGRAM - STANDARD UNIT VB

Refrigerant flow diagram IR / IW / BR / BW - Standard unit VB

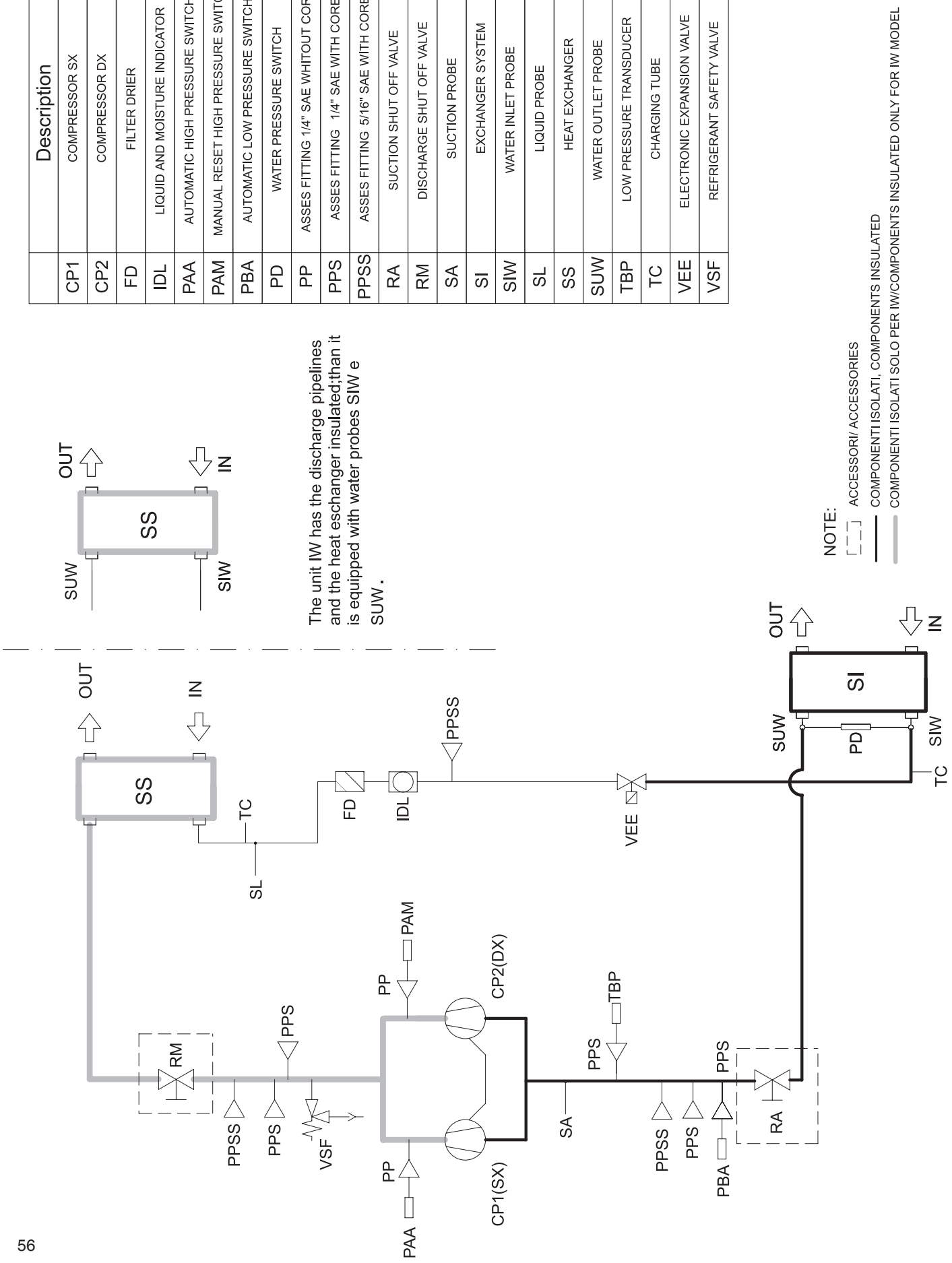
	Description
CN	CONDENSER
CP1	COMPRESSOR SX
CP2	COMPRESSOR DX
FD	FILTER DRIER
EV	EVAPORATOR
IDL	LIQUID AND MOISTURE INDICATOR
PAA	AUTOMATIC HIGH PRESSURE SWITCH
PAM	MANUAL RESET HIGH PRESSURE SWITCH
PB	LOW PRESSURE SWITCH
PD	WATER PRESSURE SWITCH
PP	ASSES FITTING 1/4" SAE WHITOUT CORE
PPS	ASSES FITTING 1/4" SAE WITH CORE
PPSS	ASSES FITTING 5/16" SAE WITH CORE
RA	SUCTION SHUT OFF VALVE
RM	DISCHARGE SHUT OFF VALVE
SIW	WATER INLET PROBE
SUW	WATER OUTLET PROBE
TC	CHARGING TUBE
VSF	REFRIGERANT SAFETY VALVE
VT	EXPANSION VALVE



REFRIGERANT FLOW DIAGRAM - STANDARD UNIT VB

Refrigerant flow diagram IR / IW / BR / BW with electronic valve - Standard unit VB

	Description
CP1	COMPRESSOR SX
CP2	COMPRESSOR DX
FD	FILTER DRIER
IDL	LIQUID AND MOISTURE INDICATOR
PAA	AUTOMATIC HIGH PRESSURE SWITCH
PAM	MANUAL RESET HIGH PRESSURE SWITCH
PBA	AUTOMATIC LOW PRESSURE SWITCH
PD	WATER PRESSURE SWITCH
PP	ASSES FITTING 1/4" SAE WHITOUT CORE
PPS	ASSES FITTING 1/4" SAE WITH CORE
PPSS	ASSES FITTING 5/16" SAE WITH CORE
RA	SUCTION SHUT OFF VALVE
RM	DISCHARGE SHUT OFF VALVE
SA	SUCTION PROBE
SI	EXCHANGER SYSTEM
SIW	WATER INLET PROBE
SL	LIQUID PROBE
SS	HEAT EXCHANGER
SUW	WATER OUTLET PROBE
TBP	LOW PRESSURE TRANSDUCER
TC	CHARGING TUBE
VEE	ELECTRONIC EXPANSION VALVE
VSF	REFRIGERANT SAFETY VALVE

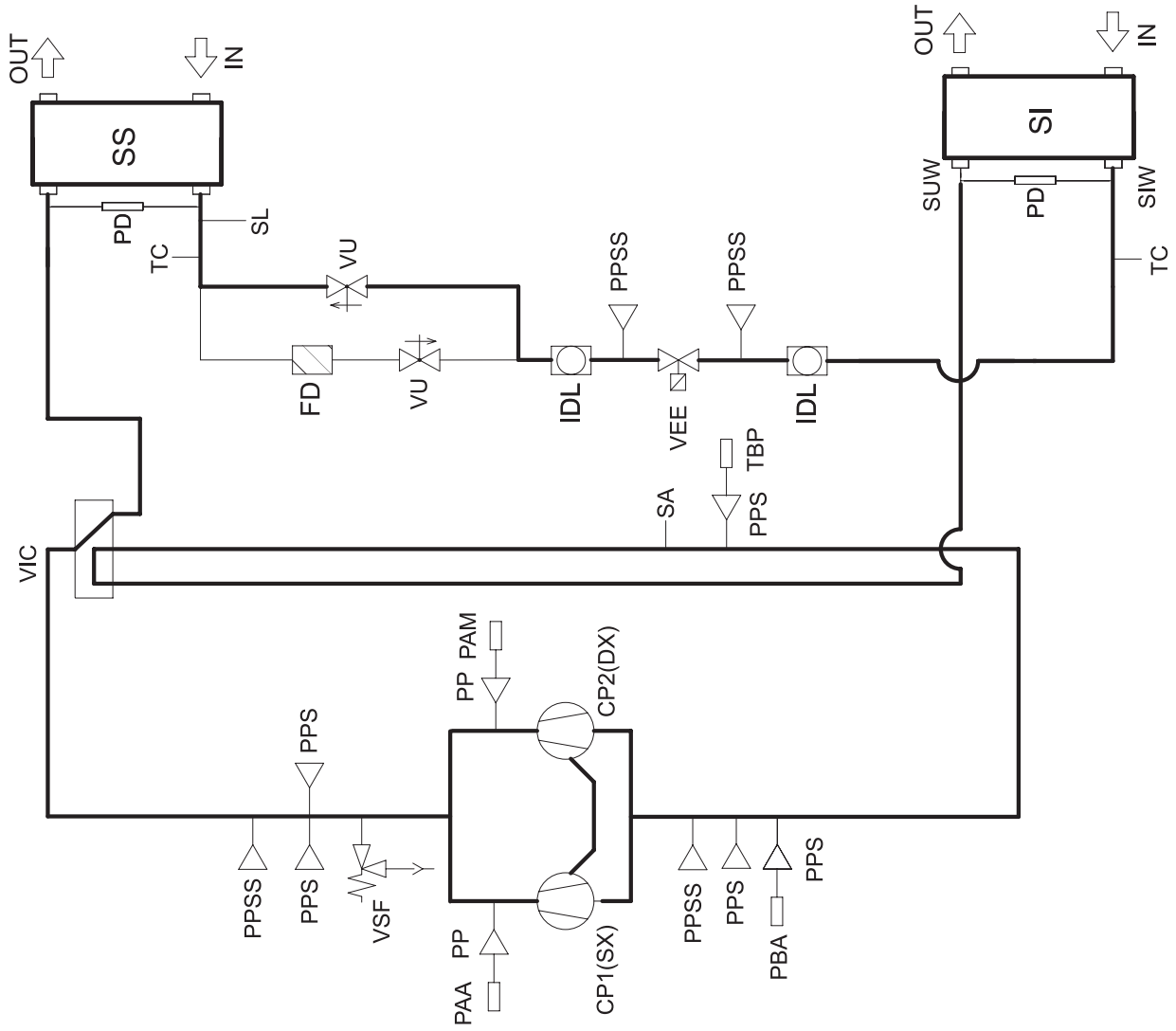


REFRIGERANT FLOW DIAGRAM - STANDARD UNIT VB

Refrigerant flow diagram in heating mode IP / BP with electronic valve - Standard unit VB

	Description
CP1	COMPRESSOR SX
CP2	COMPRESSOR DX
FD	FILTER DRIER
IDL	LIQUID AND MOISTURE INDICATOR
PAA	AUTOMATIC HIGH PRESSURE SWITCH
PAM	AUTOMATIC HIGH PRESSURE SWITCH
PBA	AUTOMATIC LOW PRESSURE SWITCH
PD	WATER PRESSURE SWITCH
PP	ASSES FITTING 1/4" SAE WHITOUT CORE
PPS	ASSES FITTING 1/4" SAE WITH CORE
PPSS	ASSES FITTING 5/16" SAE WITH CORE
RA	SUCTION SHUT OFF VALVE
RM	DISCHARGE SHUT OFF VALVE
SA	SUCTION PROBE
SI	PLANT HEAT EXCHANGER
SIW	WATER INLET PROBE
SL	LIQUID PROBE
SS	SOURCE HEAT EXCHANGER
SUW	WATER OUTLET PROBE
TBP	LOW PRESSURE TRANSDUCER
TC	CHARGING TUBE
VEE	EXPANSION ELECTRONIC VALVE
VIC	FOUR WAY VALVE
VSF	REFRIGERANT SAFETY VALVE
VU	CHECK VALVE

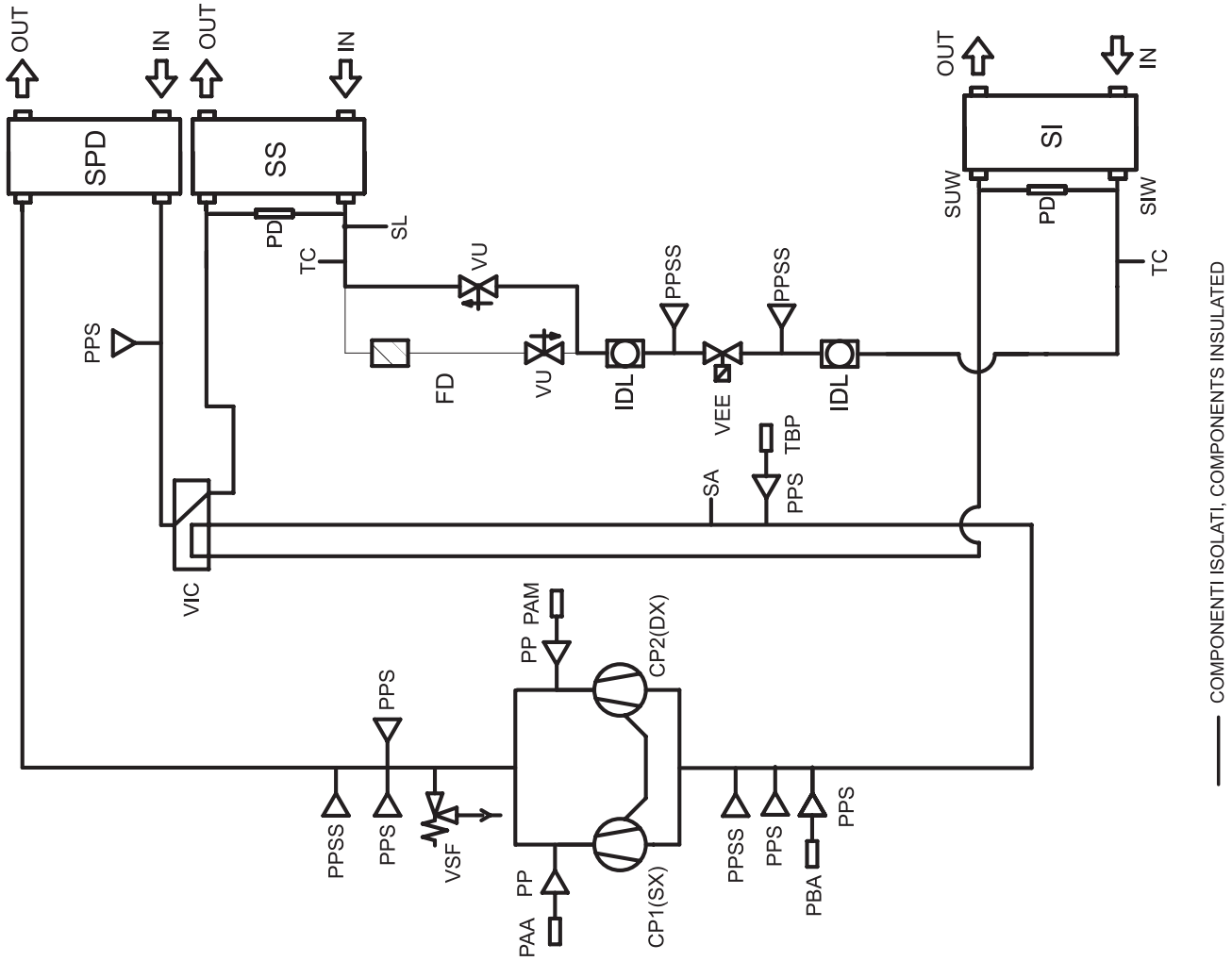
COMPONENTI ISOLATI, COMPONENTS INSULATED



REFRIGERANT FLOW DIAGRAM - DESUPERHEATER UNIT VD

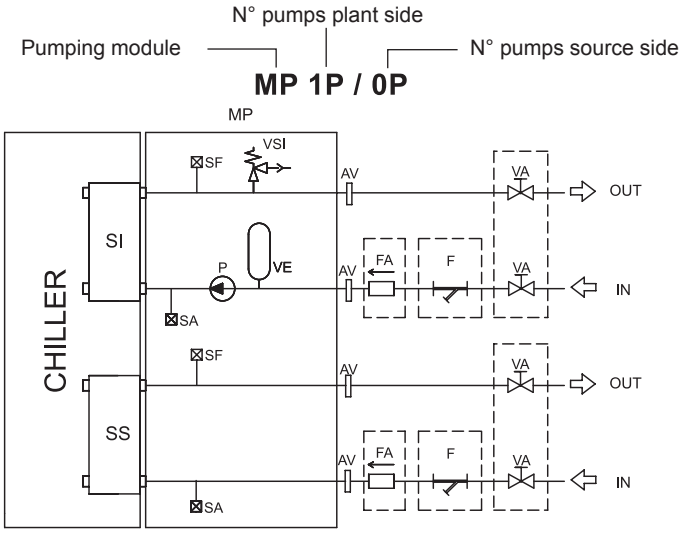
Refrigerant flow diagram IP / BP with electronic valve - Desuperheater unit VD

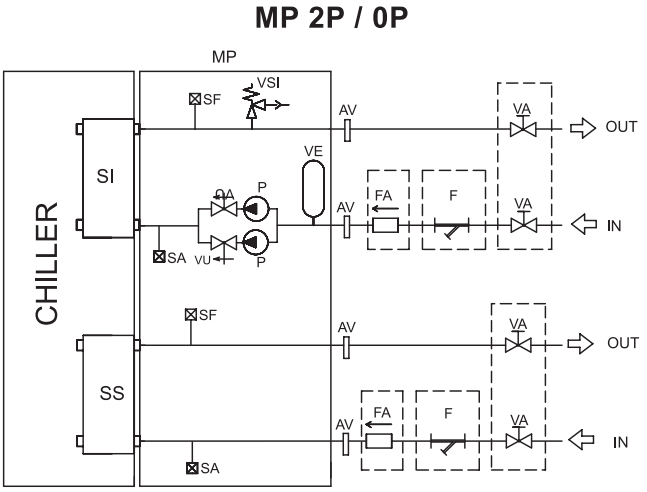
	Description
CP1	COMPRESSOR SX
CP2	COMPRESSOR DX
FD	FILTER DRIER
IDL	LIQUID AND MOISTURE INDICATOR
PAA	AUTOMATIC HIGH PRESSURE SWITCH
PAM	AUTOMATIC HIGH PRESSURE SWITCH
PBA	AUTOMATIC LOW PRESSURE SWITCH
PD	WATER PRESSURE SWITCH
PP	ASSES FITTING 1/4" SAE WHITOUT CORE
PPS	ASSES FITTING 1/4" SAE WITH CORE
PPSS	ASSES FITTING 5/16" SAE WITH CORE
RA	SUCTION SHUT OFF VALVE
RM	DISCHARGE SHUT OFF VALVE
SA	SUCTION PROBE
SI	PLANT HEAT EXCHANGER
SIW	WATER INLET PROBE
SL	LIQUID PROBE
SS	SOURCE HEAT EXCHANGER
SUW	WATER OUTLET PROBE
TBP	LOW PRESSURE TRANSDUCER
TC	CHARGING TUBE
VEE	EXPANSION ELECTRONIC VALVE
VIC	FOUR WAY VALVE
VSF	REFRIGERANT SAFETY VALVE
VU	CHECK VALVE
SPD	DESUPERHEATER PLATE HEAT EXCHANGER

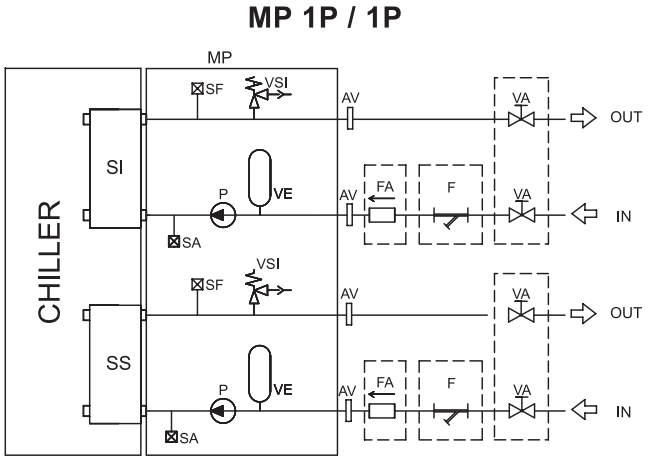


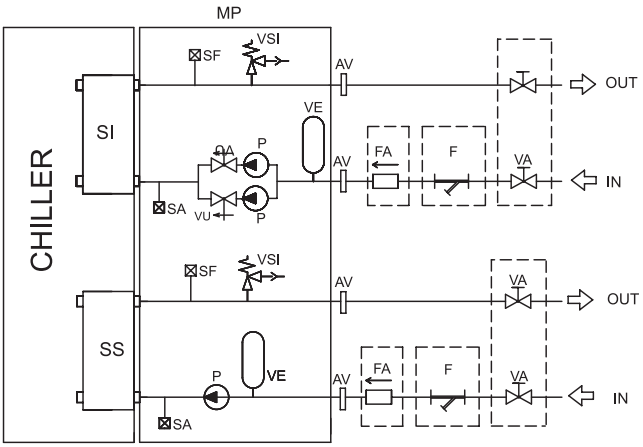
HYDRAULIC DIAGRAM

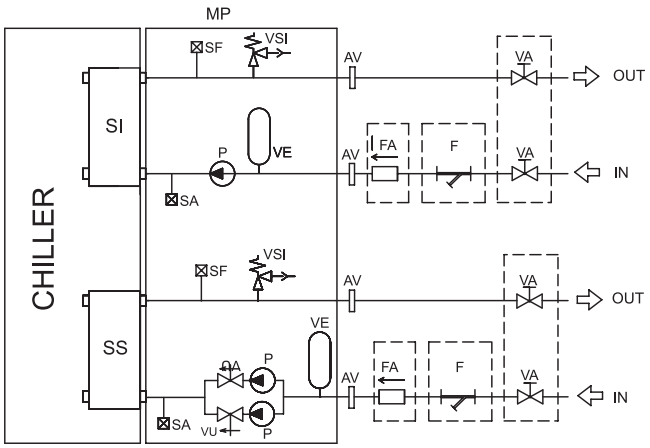
Hydraulic diagram unit + pumping module









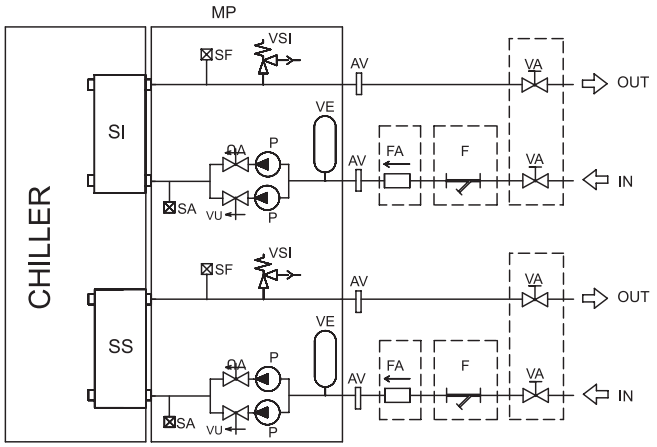


	Descriptions
AV	VICTAULIC CONNECTIONS
F	FILTER
FA	WATER FLOW PADDLE SWITCH
MP	PUMPING MODULE
P	PUMP
SA	DRAIN WATER VALVE
SF	AIR VENT VALVE
SI	PLANT EXCHANGER
SS	SOURCE EXCHANGER
VA	SHUT-OFF WATER VALVE
VE	EXPANSION TANK
VSI	WATER SAFETY VALVE
VU	CHECK VALVE

LEGEND:
Accessory - - - - - - -

HYDRAULIC DIAGRAM

MP 2P / 2P



MP 0P / 1P

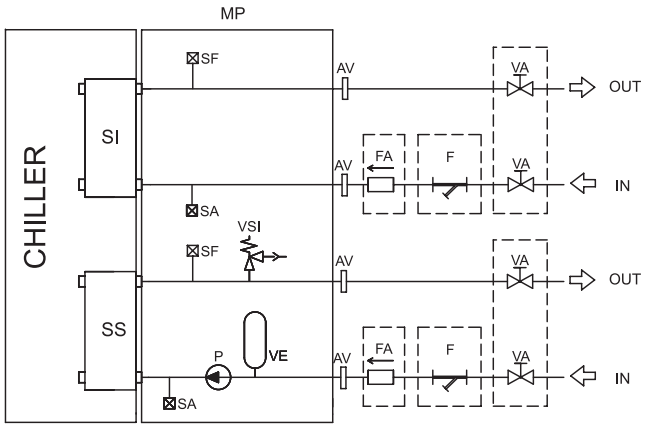
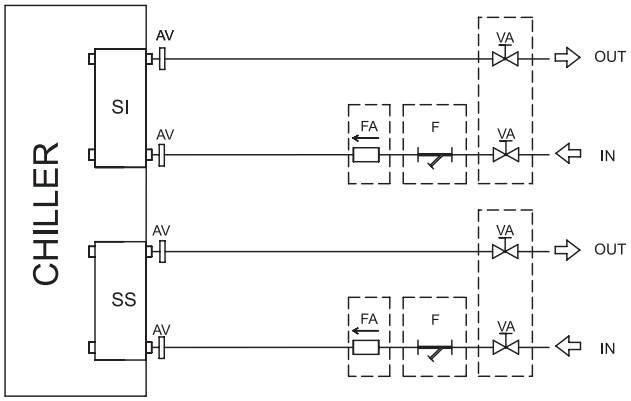
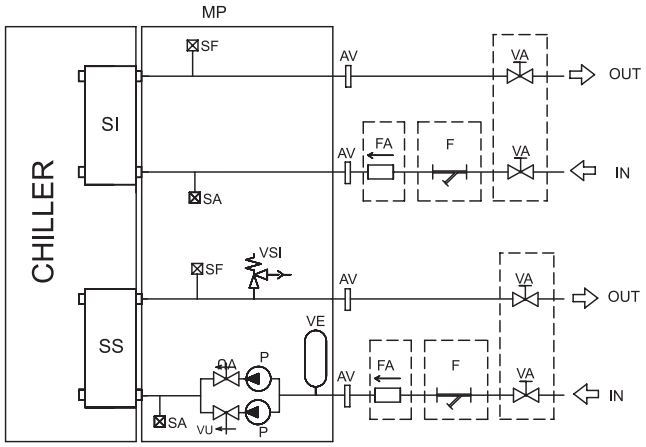


DIAGRAM WITHOUT PUMPING MODULE



MP 0P / 2P



	Descriptions
AV	VICTAULIC CONNECTIONS
F	FILTER
FA	WATER FLOW PADDLE SWITCH
MP	PUMPING MODULE
P	PUMP
SA	DRAIN WATER VALVE
SF	AIR VENT VALVE
SI	PLANT EXCHANGER
SS	SOURCE EXCHANGER
VA	SHUT-OFF WATER VALVE
VE	EXPANSION TANK
VSI	WATER SAFETY VALVE
VU	CHECK VALVE

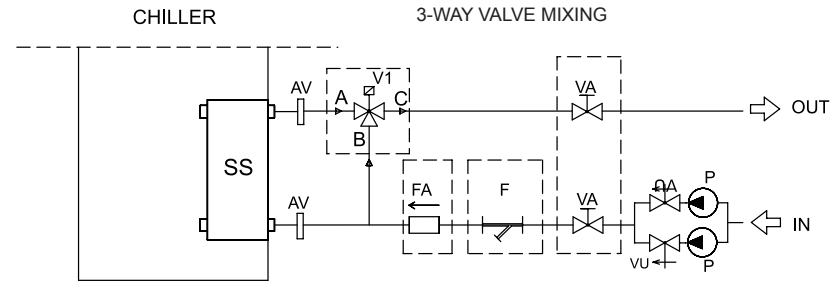
LEGEND:
Accessory - - - - - - -

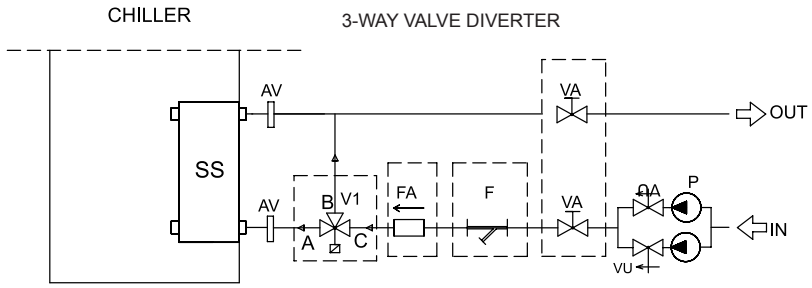
HYDRAULIC DIAGRAM

Hydraulic diagram unit + 2 and 3 vie valve accessory

SOURCE: DRY COOLER OR GEOTHERMAL PROBE

Unit without pumping module

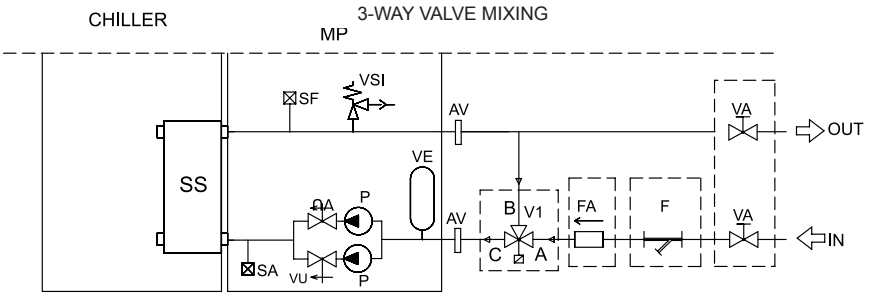


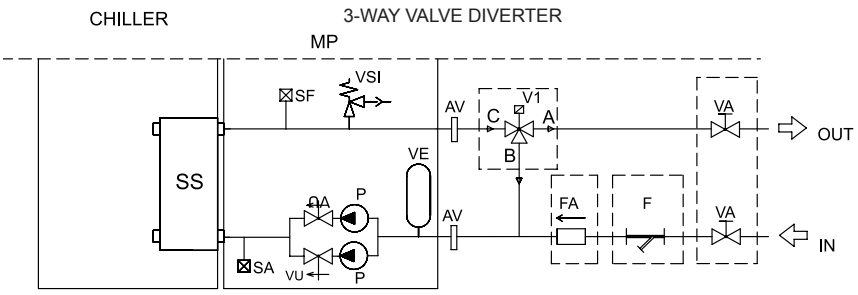


	Descriptions
AV	VICTAULIC CONNECTIONS
F	FILTER
FA	WATER FLOW SWITCH
MP	PUMPING MODULE
P	PUMPING
SA	DRAIN WATER VALVE
SF	AIR VENT VALVE
SS	SOURCE EXCHANGER
VA	SHUT-OFF WATER VALVE
VE	EXPANSION TANK
VSI	WATER SAFETY VALVE
VU	CHECK VALVE
V1	THREE WAY VALVE (A-B-C VALVE CONNECTIONS)
V2	TWO WAY VALVE
V3	BY PASS VALVE

LEGEND:
Accessory - - - - - - -

Unit with pumping module

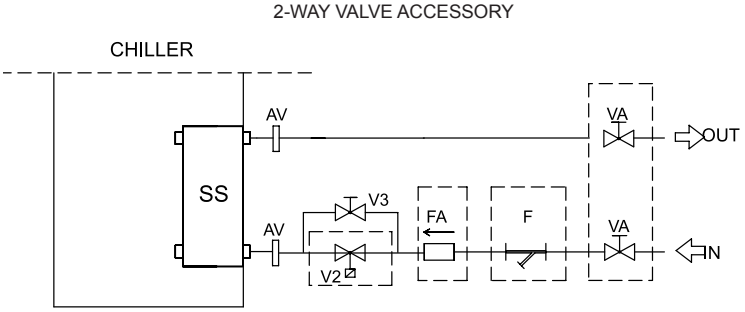




	Descriptions
AV	VICTAULIC CONNECTIONS
F	FILTER
FA	WATER FLOW SWITCH
MP	PUMPING MODULE
P	PUMPING
SA	DRAIN WATER VALVE
SF	AIR VENT VALVE
SS	SOURCE EXCHANGER
VA	SHUT-OFF WATER VALVE
VE	EXPANSION TANK
VSI	WATER SAFETY VALVE
VU	CHECK VALVE
V1	THREE WAY VALVE (A-B-C VALVE CONNECTIONS)
V2	TWO WAY VALVE
V3	BY PASS VALVE

LEGEND:
Accessory - - - - - - -

SOURCE: WELL OR CITY WATER



LEGEND:
Accessory - - - - - - -

	Descriptions
AV	VICTAULIC CONNECTIONS
F	FILTER
FA	WATER FLOW SWITCH
MP	PUMPING MODULE
P	PUMPING
SA	DRAIN WATER VALVE
SF	AIR VENT VALVE
SS	SOURCE EXCHANGER
VA	SHUT-OFF WATER VALVE
VE	EXPANSION TANK
VSI	WATER SAFETY VALVE
VU	CHECK VALVE
V1	THREE WAY VALVE (A-B-C VALVE CONNECTIONS)
V2	TWO WAY VALVE
V3	BY PASS VALVE

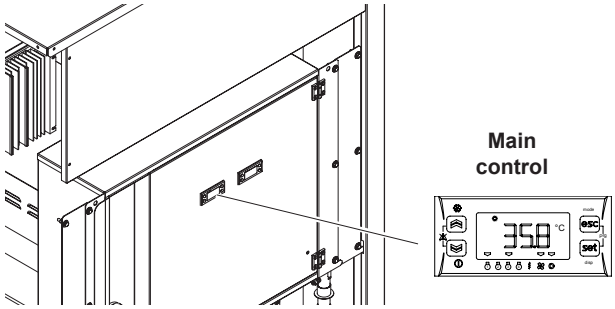
MAIN CONTROLLER

UNIT \ COMP.	SB655	SE655	XVD420
IR / BR	x	(x)	O
IW / BW	x	x	O
IP / BP	x	x	x

x = Present
(x) = Present with source pumps
O = Optional

SB655 - main electronic controller of the unit
SE655 - expansion electronic board of the unit
XVD420 - controller for electronic valve EEV (settable by service only)
IR - Unit for installation in an Hydronic system with operation as a Chiller.
IW - Unit for installation in an Hydronic system with operation as a Chiller and Heat Pump with the commutation between “COOL- HEAT” obtained by managing the hydraulic circuit.
IP - Unit for installation in an Hydronic system with operation as a Chiller and Heat Pump reversible on refrigerant side.
BR - Water Chiller suitable for BRINE Production
BW - Heat Pump with the commutation between “COOL- HEAT” obtained by managing the hydraulic circuit.Water Chiller suitable for BRINE production from (only in cooling mode).
IP - Unit for installation in an Hydronic system with operation as a Chiller and Heat Pump reversible on refrigerant side suitable for BRINE production from (only in cooling mode).

The unit is managed by a **microprocessor controller** to which all the loads and control devices are connected by means of a terminal block. The user interface comprises a display and four buttons with which it is possible to show and possibly modify all the unit’s operation parameters. The interface, located in the front part of the unit and accessible from the outside, is protected by a transparent plastic door. A remote control having all the same functions as the interface fitted on the unit is available as an accessory.



Every button provides for :
- **a direct function :** indicated on the button itself and obtained by pressing the button
- **an associated function** : indicated on the front of the instrument at the corresponding button and obtained by prolonged pressing (3 seconds) of the button
- **a combined function :** obtained by pressing 2 buttons at the same time

ON/OFF - STAND-BY OF THE UNIT: see paragrah “Functions available for the user - ST-BY of the unit”.

Inputs and outputs

Analog input

Analog inputs MAIN CONTROLLER (SB655)			
DESCRIPTION			CHARACTERISTICS
AI1	SIW	water inlet probe	NTC (-50°C ÷ 99°C)
AI2	SUW	water outlet probe	NTC (-50°C ÷ 99°C)
AI3	SL	liquid probe / Liquid pressure transducer*	NTC (-50°C ÷ 99°C) / (4-20mA / 0-50 BAR)
AI4	STAE / IN CF1	outside air probe / remote ST-BY - S/W.- demand limit-economy	NTC (-50°C ÷ 99°C) / digital input
AI5	IN CF2	see AI5 on “digital inputs”	configured as digital input

- Input AI4 is factory-set as not enabled. Its configuration for specific use must be carried out at the time of installation according to the needs of the moment, modifying the configuration by parameter.
- Input AI5 is factory-set as neutral and its configuration for specific use must be carried out at the time of installation according to the needs of the moment, modifying theconfiguration by parameter.
* : Transducer is not available on units IW.
Modification and parameter configuration operations must only be carried out by an authorised service centre or by competent personnel.

Analog inputs EXPANSION BOARD (SE655)			
DESCRIPTION			CHARACTERISTICS
AI1 E	SIW SOURCE	Water inlet probe SOURCE	NTC temperature (-50°C 99°C)
AI2 E	SUW SOURCE	Water oulet probe SOURCE	NTC temperature (-50°C 99°C)
AI3 E	-	Not used	-
AI4 E	-	Not used	-
AI5 E	-	Not used	-

MAIN CONTROL

Digital input

Digital inputs MAIN CONTROLLER (SB655)			
DESCRIPTION			CHARACTERISTICS
DI1	TC1*	Thermal switch compressor 1 – discharge thermal switch compressor 1 –high pressure switch	Digital input with voltage-free contact
DI2	TC2*	Thermal switch compressor 2 –discharge thermal switch compressor 2 – high pressure switch	Digital input with voltage-free contact
DI3	PB +SEQ + TV	Low pressure switch + sequence meter + EEV driver alarm	Digital input with voltage-free contact
DI4	TP1	Thermal switch pump 1	Digital input with voltage-free contact
DI5	TP2	Thermal switch pump 2	Digital input with voltage-free contact
DI6	P.diff.	Differential pressure switch	Digital input with voltage-free contact
AI5-IN DIG	Multiconf.	Remote ST-BY - S/W.-demand limit-economy	Analog input configured as digital

Note for input ID5 thermal switch pump 2.
If only one pump is used and only one thermal switch is required, ID5 can be used as an additional multiconf. input for Remote ST-BY - S/W.-demand limit-economy.
In this way it is possible to have both the
- remote ST-BY, and
- S/W - demand limit – economy
- External probe

ID5 is factory-configured as pump 2 thermal switch. To modify the configuration, refer to the section “configurable inputs setting”.

Digital inputs EXPANSION BOARD (SE655)		
DESCRIZIONE		CARATTERISTICHE
DI1 E	Not used	-
DI2 E	Not used	-
DI3 E	Not used	-
DI4 E	Thermal source pump 1	Digital input with voltage-free contact
DI5 E	Thermal source pump 2	Digital input with voltage-free contact
DI6 E	Source differential pressure switch.	Digital input with voltage-free contact

Analog output

Analog outputs MAIN CONTROLLER (SB655)		
DESCRIPTION		CHARACTERISTICS
AO1	See digital output	-
AO2	See digital output	-
AO3	Modulating pump 1 source	signal 0-10V
AO4	Modulating pump 2 source	signal 0-10V
AO5	Not used	-

Analog outputs EXPANSION BOARD (SE655)		
DESCRIPTION		CHARACTERISTICS
AO1 E	Not used	-
AO2 E	Not used	-
AO3 E	Not used	-
AO4 E	Not used	-
AO5 E	Not used	-

Digital output

Digital outputs **MAIN CONTROLLER (SB655)**		
DESCRIPTION		**CHARACTERISTICS**
DO1	Compressor 1	2A resistive relays - 230Vac
DO2	Compressor 2	2A resistive relays - 230Vac
DO3	Reverse cycle valve	2A resistive relays - 230Vac
DO4	Antifreeze resistance – support 1st step	2A resistive relays - 230Vac
DO5	Resistance support 2nd step	Open collector - 12Vcc max 35mA
DO6	Alarm relay	2A resistive relays - 230Vac
AO1	Relay plant pump 1 (using 12Vdc external relay)	Open collector - 12Vcc max 35mA
AO2	Relay plant pump 2 (using 12Vdc external relay)	0 - 10Vdc output - max 28mA
Note: AO1-2 are analog outputs configured as digital		

Digital outputs EXPANSION BOARD (SE655)		
DESCRIPTION		**CHARACTERISTICS**
DO1 E	Not used	-
DO2 E	Not used	-
DO3 E	Not used	-
DO4 E	Pump 1 SOURCE	2A resistive relays - 230Vac
DO5 E	Not used	-
DO6 E	Pump 2 SOURCE	2A resistive relays - 230Vac

Technical data

Main controller SB655 technical data

Description	Typical	Minimum	Maximum
Power supply voltage	12-24 V~	10,8-21,6 V~	13,2-26,4 V~
Power supply frequency	50 Hz / 60 Hz	-	-
Power	6 VA	-	-
Insulation class	2	-	-
Protection rating	Frontal IP65	-	-
Ambient operating temperature	25 °C	-10 °C	60 °C
Ambient operating humidity (non-condensing)	30 %	10 %	90 %
Ambient storage temperature	25 °C	-20 °C	85 °C
Ambient storage humidity (non-condensing)	30 %	10 %	90 %

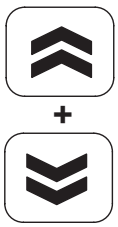
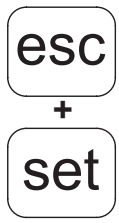
Expansion board SE655 technical data

Description	Typical	Minimum	Maximum
Power supply voltage	12-24 V~	10,8-21,6 V~	13,2-26,4 V~
Power supply frequency	50 Hz / 60 Hz	-	-
Power	5 VA	-	-
Insulation class	2	-	-
Protection rating	Frontal IP0	-	-
Ambient operating temperature	25 °C	-10 °C	60 °C
Ambient operating humidity (non-condensing)	30 %	10 %	90 %
Ambient storage temperature	25 °C	-20 °C	85 °C
Ambient storage humidity (non-condensing)	30 %	10 %	90 %

MAIN CONTROL

User interface

Button		Direct function	Associated function	
	UP	Increase value of selected parameter Scroll menu up		Manual defrost
	DOWN	Decrease value of selected parameter Scroll menu down	-	-
	ESC	Go to menu higher level without saving the modification	mode	Access the “Operation mode” menu (1)
	SET	Go to menu higher level and save the modification Go to menu lower level Access the “Status” menu	disp	Changing the display value
	TUTTI	Alarm deactivation	-	-

Button		Combined function	
	UP + DOWN		Manual reset
	ESC + SET		Access the “Programming” menu

NOTA:
1): key for unit on/off with mode selection (see paragrah “Functions available for the user - ST-BY of the unit”).

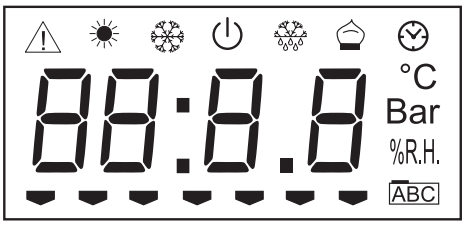
MAIN CONTROL

Display

The following are shown in normal display :

• adjustment temperature, or unit outlet water temperature (in degrees Celsius with decimal point)

• alarm code, if at least one is activated (in case of several alarms the code of the first according to the Table of Alarms is displayed)

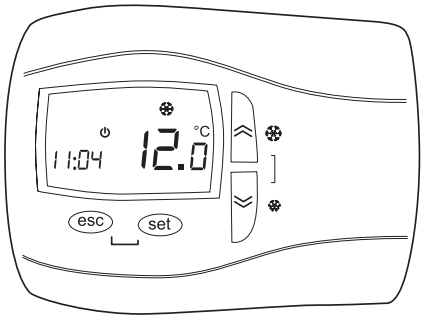


In menu mode the display depends on its position (see menu structure).

	Icon	Description	Colour	On fixed	On flashing
Operation status and modes		Allarm	Red	Alarm in progress	Alarm deactivated
		Heating	Green	Heating mode from keyboard	Heating mode from remote
		Cooling	Green	Cooling mode from keyboard	Cooling mode from remote
		Stand by	Green	Standby from keyboard	Standby from remote
		Defrost	Green	Defrost in progress	-
		Economy	Verde	non utilizzato not used	-
Unit of measure		Clock	Red	Time display format 24.00	Time setting format 24.00
	°C	Centigrade degrees	Red	Unit of measure of selected parameter	-
	Bar	Bar	Red	not used	-
	%R.H.	Relative humidity	Red	not used	-
	ABC	Menù	Red	Menu browsing	-
Users		Compressor 1	Amber	User activated	Safety timing
		Compressor 2	Amber	User activated	Safety timing
		not used	-	-	-
		not used	-	-	-
		Antifreeze heater Supplementary heating element 1st step	Amber	User activated	Safety timing
		Source pumps	Amber	User activated	Safety timing
		Plant pumps	Amber	User activated	Safety timing

Remote control

Suitable for wall mounting, it has all the functions of the standard interface fitted on the unit.
The buttons, functions associated with the buttons and the display indications are the same as those provided for the standard interface.
All configuration and control operations are further facilitated by the double display which allows the name and value of the selected parameter to be shown at the same time.



Refer to the enclosed manual for the installation and connection procedures and operating instructions.

MAIN CONTROL

Menu structure

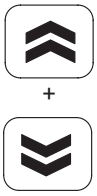
The control system is basedd on three menu with tree structure.

Menu	Access procedure	Submenu	Available functions
Operation mode	Press (prolonged) esc (ESC button associated function)	StbY	Change operation mode
		HEAt	
		COOL	
UP button	Press (UP button direct function)	-	Value increases, the next label
DOWN button	Press (DOWN button direct function)	-	Value decreases, the next label
Main view (disp)	Press (prolonged) set (SET button direct function)	A i	Analogue input display
		rtC	Clock display
		SEtP	Set point (set by customer) display
		SEtr	Set point (actual set point) display

Menu	Access procedure	Submenu	USER	SERVICE	Available functions
Status	Pres set (SET button direct function)	A i	√	√	Analogue input display
		d i	√	√	Digital input display
		AO	√	√	Analogue output display
		dO	√	√	Digital output display
		CL	√	√	Date and hour adjustment
		SP	√	√	HEAt setpoint display
			√	√	COOL setpoint display
		Sr	√	√	HEAt actual setpoint display
			√	√	COOL actual setpoint display
		Hr	√	√	Compressors and pumps working hours display

Menu	Access procedure	Submenu		USER	SERVICE	Available functions
procedure	Pressione contemporanea tasti esc + set (funzione combinata tasti ESC + SET)	PAr	CL	√	√	Electronic controller configuration parameters (base controller)
			Cr	√	√	Electronic controller configuration parameters (remote controller)
			CE	√	√	Electronic controller configuration parameters (expansion controller)
			CF	√	√	Electronic controller configuration parameters
			U i	√	√	LED Electronic controller configuration parameters (base + remote)
			tr	√	√	Temperature control parameters
			St	√	√	Operating states parameters
			CP		√	Compressor parameters
			PI	√	√	Plant pump parameters
			FE		√	Fan parameters
			PE	√	√	Source pump parameters
			H i	√	√	Plant heaters (antifrezze and integration) parameters parameters
			HE	√	√	Source heaters (antifrezze and integration) parameters parameters
			dF		√	Defrost parameters
			dS		√	Dinamic Setpoint parameters
			HP		√	Heat pump block parameters (in HEAT mode)
			PL		√	Demand limit parameters
			tE	√	√	Scheduling (time bands) parameters
			AL		√	Alarms parameters
			rC		√	Heat recoveryparameters

CONTRÔLEUR PRINCIPAL

Menu	Access procedure	Sub-menu	USER	SERVICE	Available functions	SERVICE	Available functions
Programmation		FnC	dEF			√	Manual defrost
			tA			√	Silence alarms
			St	OFF		√	Change in OFF state
				On		√	Change in status ON
			CC	UL		√	Upload program parameters
				dL		√	Download the program parameters
				Fr		√	Format Multi Function Key
			EUr			√	Reset historical alarms, long press button
		PASS		-	√	√	Enter password
		EU		-	√	√	Viewing historical alarms
Tacitazione Allarmi	Pressure contemporary buttons  (combined function ESC + SET button)	-	-	-	√	√	Manual
Manual defrost	Long press button  (UP button function associated)	-	-	-	√	√	Enable manual defrost

Press SET to go from one level to that below. Press ESC to go to higher level.
Press the UP and DOWN buttons respectively to scroll the menu up and down inside the same level.

Press the UP and DOWN buttons to modify the value of the selected parameter. Press SET to confirm the modification. Press ESC to not confirm the modification.

Alarms

Alarm activation and reset
The controller can perform a complete diagnosis of the unit, detecting all operation faults and signalling a number of alarms.
Activation of an alarm involves :
• blocking of users concerned
• signalling of alarm code on the display (in case of simultaneous alarms the one with the lowest index is displayed whereas the complete list of active alarms can be shown by accessing the “Status \ AL”) menu
• recording of event in the alarms history

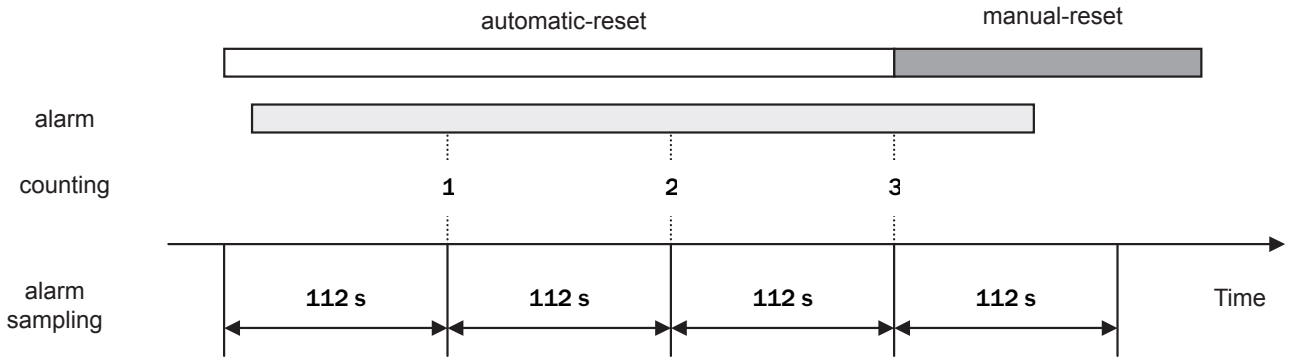
Alarms that can damage the unit or system require **manual resetting** or an action by the operator to reset the controller (pressing the UP and DOWN buttons at the same time). It is advisable to carefully check the cause of the alarm and make sure the problem is eliminated before restarting the unit. In any case the unit restarts only if the cause of the alarm has ended.

Less critical alarms are **automatic reset.** As soon as the cause is eliminated the unit starts working again and the alarm code disappears from the display. Some of these alarms become manual reset if the number events per hour exceeds a fixed limit.

Press any button to **deactivate the alarm** : alarm signalling disappears from the display, the alarm LED starts flashing and the Alarm digital output is disabled. This operation does not affect the alarm in progress.

Number of events per hour
The counting of events per hour is provided for some alarms : if the number of events reaches a fixed limit in the last hour, the alarm goes from automatic to manual reset.
Sampling of alarms occurs every 112 seconds. If an alarm is activated several times in a sampling period (112 seconds) it is counted only once.

Example. If an number of events per hour equal to 3 is set, it must have a duration of between 2*112 seconds and 3*112 seconds so that the alarm goes from automatic to manual reset.



Alarms history
The controller enables the recording of alarms occurring during unit operation (up to a max. of 99 events). The following are memorised for each event :
• alarm code
• input time
• input date
• output time
• output date
• type of alarm (automatic or manual reset)
This information can be shown by accessing the “Programming \ EU” menu.
When the number of events memorised is more than 99, alarm Er90 is generated and the subsequent events are memorised overwriting the oldest alarms.
The alarms history can be cancelled by means of the Eur function available inside the “Programming \ FnC” menu.

Alarm table

Code	Alarm		Type of alarm	input	COMPRESSORS	EXCHANGER FANS (WITH LOSS)	PLANT CIRCUIT PUMPS	EXCHANGER RESISTANCES PLANT	AUXILIARY OUTPUT
Er05	Low pressure + sequence meter + EEV alarm (if present)		A/M (2)	ID3	OFF	OFF			
Er 10	Compressor 1 thermal protection	High pressure	M	ID1	OFF comp.1				
Er 11	Compressor 2 thermal protection		M	ID2	OFF comp.2				
Er20	Plant circuit water differential pressure switch		A/M	ID6	OFF	OFF if manual reset	OFF		
Er21	Plant circuit pump 1 thermal protection		M	ID4	OFF	OFF	OFF p.1	OFF	
Er22	Plant circuit pump 2 thermal protection		M	ID5	OFF	OFF	OFF p.2	OFF	
Er25	Source circuit water differential pressure switch		M	DIE2	OFF	OFF	ON	OFF	
Er26	Source circuit pump 1 thermal protection		M	DIE4	OFF	OFF	ON	OFF	
Er27	Source circuit pump 2 thermal protection		M	DIE5	OFF	OFF	ON	OFF	
Er30	Plant circuit antifreeze		M	AI2	OFF				
Er31	Source circuit antifreeze		M	AI2E	OFF				
Er45	Clock fault error		A						
Er46	Clock to be set error		A						
Er47	Remote keyboard communication error / expansion / lan relè		A						
Er60	Plant exchanger inlet water probe fault		A	AI1	OFF	OFF	OFF	OFF	OFF
Er61	Plant exchanger outlet water probe fault		A	AI2	OFF	OFF	OFF	OFF	OFF
Er62	Liquid temperature probe fault		A	AI3					
Er63	Source exchanger inlet water probe fault		A	AI1	OFF	OFF	OFF	OFF	OFF
Er64	Source exchanger outlet water probe fault		A	AI2	OFF	OFF	OFF	OFF	OFF
Er68	External air probe fault		A	AI4					
Er75	Liquid pressure transducer fault		A	AI3					
Er80	Configuration error		A		OFF	OFF	OFF	OFF	OFF
Er90	Recordings for alarms history exceeded signalling		M						

Notes:
(1) A = automatic reset, M = manual reset
(2) Only when the alarm becomes manual reset

Er05 **Low pressure – Sequence meter - EEV driver alarm**
The alarm becomes manual reset when the number of events per hour is more than parameter AL 12.
The alarm is bypassed for the time of parameter AL 11 from activation of the compressor or the reverse cycle valve.

Er 10 **Compressor 1 thermal protection**
The manual-reset alarm intervenes in the event of activation of the compressor 1 thermal protection or the thermostat located on the outlet of the compressor 1.

Er 11 **Compressor 2 thermal protection**
The manual-reset alarm intervenes in the event of activation of the compressor 2 thermal protection or the thermostat located on the outlet of the compressor 2.

Er 10 Er 11* **Compressor 1 thermal protection - Compressor 2 thermal protection - High pressure switch (PAA)**
The manual-reset alarm intervenes in the event of activation of the compressor 2 thermal protection or the thermostat located on the outlet of the compressor 2 and in the event of activation of the compressor 1 thermal protection or the thermostat located on the outlet of the compressor 1 and/or more likely it means the auto-reset high pressure switch (PAA) trips in.

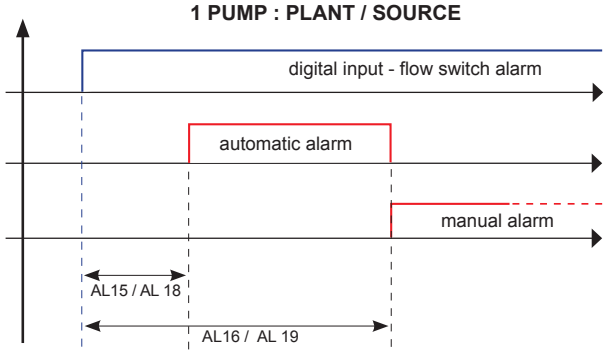
Er 21 Er22 / Er26 Er27 **Thermal protections of pumps plant / source**
If there is the intervention of a pump thermal protection the controller blocks it; if the controller manages 2 pumps the block of the first one leads to the activation of the other one. If there are the interventions of both thermal protections the controller blocks the unit.

Er20 Er25 **Flow switch / water differential pressure switch alarm**

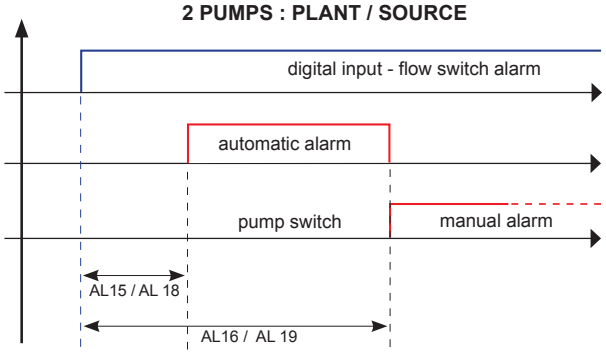
Unit with 1 pump:
The alarm s active if the input is active for at least the time AL15 (plant) / AL18 (source). It remains automatic for the time AL16 (plant) / AL19 (source): if, during this time the alarm is deactivated the unit can restart to work, instead if remains active becomes manual

Unit with 2 pumps:
The alarm s active if the input is active for at least the time AL15 (plant) / AL18 (source). It remains automatic for the time AL16 (plant) / AL19 (source): during this time the controller stops the working pump and switch on the other one, if the alarm is deactivated the unit can restart to work, instead if remains active becomes manual.

1 PUMP : PLANT / SOURCE



2 PUMPS : PLANT / SOURCE



If there is the flow switch alarm during the first startup of the unit control the cleaness of the water plant. Particularly diring the startup a lot of impurities due to the pipes installation can be present into the hydraulic plant and if the plant was not carefully washed, despite the installation of water filters with adequate mesh size impurities as sand, chips or similar could enter into the exchangers choking them and, in worst cases, lead to a serious damage or broke for freezing (if the excahanger is working as evaporator).

Er30 / Er31 **Antifreeze plant / source**
The alarm switch off the compressors, activates the heaters and the pumps (if off).
It is a very dangerous alarm: check carefully the possible cause and eliminates it before reset the alarm.

Er45 **Clock failure**
If the clock is not working it is not possible to set time bands and the record of date and hour for the alarms present in the alarm events.

Er46 **Alarm: clock to be set**
There is this alarm if the controller is not electrically supplied for several days.

Er47 **LAN communication error between electronic controller (base, remote, expansion)**
There is this alarm if there si not communication between the devices connected trough LAN.

Er60 Er61 Er63 Er64 **Failure of temperature probes (plant and source)**
This alarm stops the unit. It could be caused for short-circuit, breakage or out of range of the probe

Er62 **Failure of liquid temperature probe**
If the alarm is active the source pumps / 2 way valve / 3 way valve work only on-off on request (on when compressor is on). It could be caused for short-circuit, breakage or out of range of the probe.

Er68 **Failure of external air temperature probe**
If the alarm is active all controls based on this probe (i.e. dynamic setpoint or defrost) are disabled: the unit can continue to work. It could be caused for short-circuit, breakage or out of range of the probe.

Er68 **Outside air probe fault**
When the alarm is activated, climate adjustment in heating and dynamic defrost are unavailable.

Er75 **Liquid pressure transducer fault**
If the alarm is active the source pumps / 2 way valve / 3 way valve work only on-off on request (on when compressor is on). It could be caused for short-circuit, breakage or out of range of the probe.

Er90 **Maximum number of recordings in alarms history exceeded**
Indicates that the alarms history buffer is full. Every new alarm will be memorised, cancelling the oldest alarm.

*** Note: The manual-reset high pressure (PAM) does not have reference on the control display so you can not identify it through the internal diagnostics as it acts directly on contactors, it may happen that the control display does not signal any error but the compressors are however still, in this case switch-off the unit then rearm the manual-reset high pressure switch by pressing the button located at the top of the switch.**

ST-BY of the unit

When the unit is powered it may be in STAND BY status (the display shows the message Stby) or ON status. It is possible to switch between ON and STAND BY by pressing (prolonged) the MODE button.
When the unit is STAND BY all the users are disabled and the antifreeze function is not activated.

Operation mode selection

When the unit is ON, one of the operation modes can be selected by accessing the “Operation mode” menu.
- Cooling ❄ COOL
- Heating ☀ HEAt
- STAND BY ⏻ StdbY

Remote ST-BY ⏻

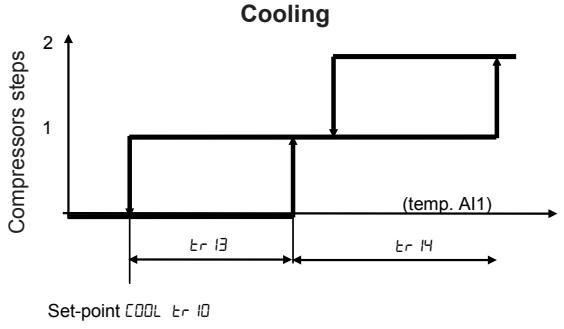
This function allows remote selection of the STANDBY mode. If the input is activated (contact open) the controller is in STANDBY mode and the operation mode cannot be modified from keyboard.
The function is available if one of the configurable inputs is configured for this, contact closed = unit ON (display SIW), contact open = STAND-BY (display StdbY).

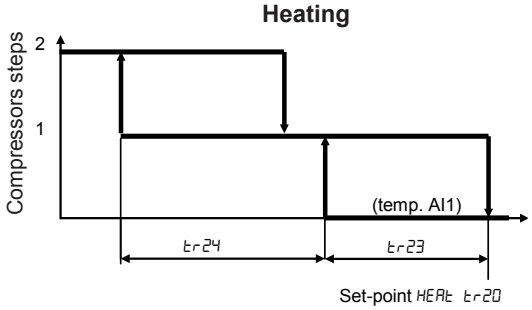
Working mode remote change-over cooling ❄ / ☀ heating

This function allows remote selection of Cooling or Heating mode. If the input is activated (contact open) the unit is in heating mode. If the input is not activated (contact closed) the unit is in cooling mode. The operation mode cannot be modified from the keyboard (but STANDBY mode can be selected).
To enable this function, follow the indications in the section “configurable inputs setting”.

Set point

The set point value in cooling (COOL) and heating (HEAt) can be set by accessing the “Status \ Sp” menu. The purpose of the controller is to keep the water temperature at the unit inlet as close as possible to the set value, by activating the compressor according to an on-off logic.

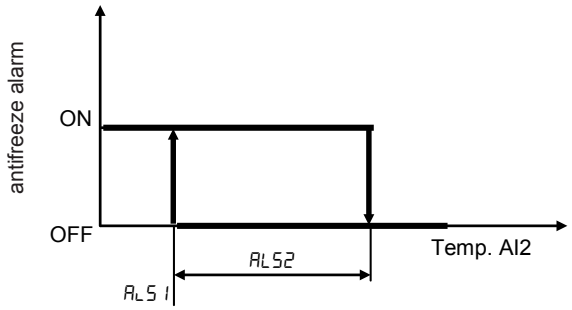




For IW / BW unit the thermoregulation in heat mode is managed by input probe of source exchanger **AIE1**

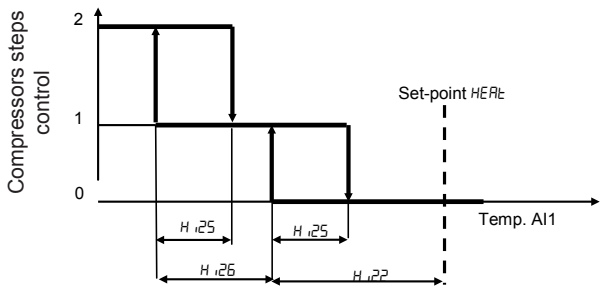
Antifreeze

The plate-type exchanger is protected by activation of an electrical heating element and activation of the antifreeze alarm, occurring in sequence when the exchanger outlet water temperature reaches dangerous values. The storage tank is protected by the antifreeze heater (accessory) activated in parallel with the plate-type exchanger heating element.



Supplementary electrical heating elements

The parameter H 102 enables operation of the electrical elements supplementing the heat pump when it assumes value 1. The heating elements are activated according to a two-step logic depending on the unit inlet water temperature. When present, the heating elements also carry out a storage tank antifreeze function.

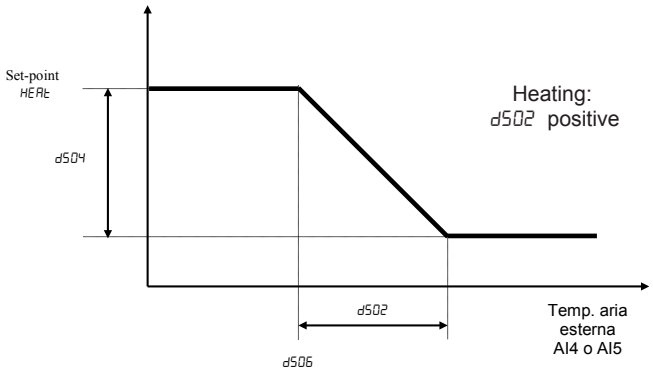


Dinamic setpoint

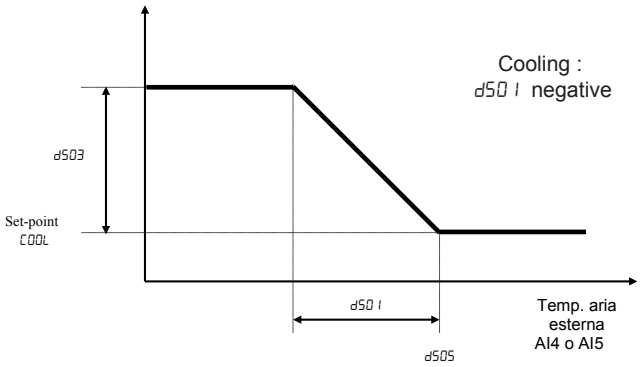
The parameter d500 allows the dynamic setpoint; if ds00=1 the setpoint is corrected as a function of external air temperature (if present). To set the external air temp follow the indications of the section “Configurable Inputs”.

The activation of the dynamic setpoint is displayed by the switch-on of the led Economy on the display (money box symbol); it is possible to display the actual setpoint by the parameterSettr.

Dinamic setpoint in heating mode
It is possible to modify setpoint (d506 in °C), the proportional band (d502 in °C), and the maximum differential (d504 in °C)



Dinamic setpoint in cooling mode
It is possible to modify setpoint (d505 in °C), the proportional band (d501 in °C), and the maximum differential (d503 in °C)



Plant pump on-off control

Pre-pumping: when the unit is switched fromn STD-BY to COOL or HEAT mode firstly the pump is activated and, if there is no alarm, after the time of parameter PI20 the first compèressor can start-up.

Post-pumping: when the unit is switched from COOL or HEAt mode to STD-BY firstly the compressors are switched-off and after the time of parameter PI21 the pump is switched off.

If the pump is ON is always working at 100%.

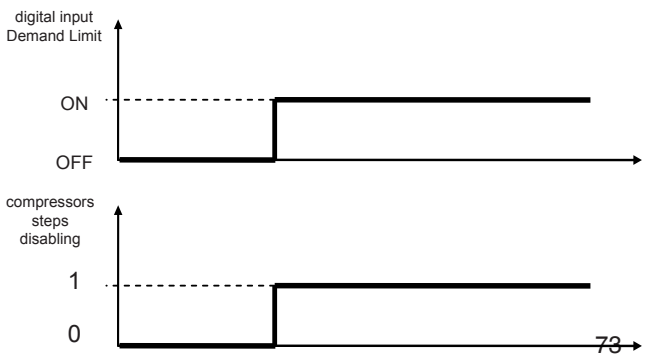
Plant pump modulating control

If the pump is driven by inverter (or similar modulating system) is possible to set the velocity between 30% and 100% of the maximum velocity modifying the parameters PI31 in cooling, PI41 in heating.
For instance with PI31=70 and PI41=75 the velocity will be 70% in cooling and 75% in heating

Note: When the compressors are off the pump works at minimum velocity.
Referring pre and post pumping the pump is managed as in on-off mode

Demand limit

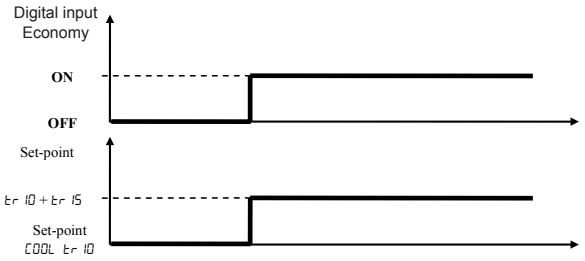
Basing on the state of a digital input, this function allows to force the unit to work with only 1 compressor, so reducing the power input demand.
To enable this function follow the indications of the section “Configurable Inputs”.



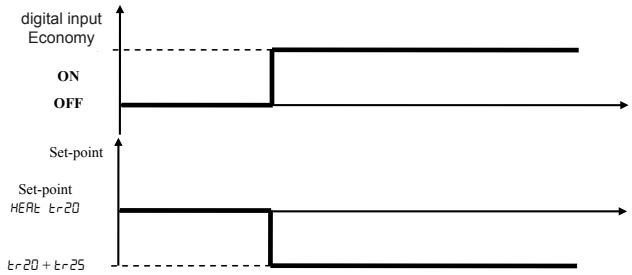
Funzione economy

Basing on the state of a digital input, this function allows to modify the setpoint.
In cooling mode the setpoint is increased of the value of the parameter tr 15 (es. tr 15 + 5 °C).
In heating mode the setpoint is decreased of the value of the parameter tr25 (es. tr25 - 6°C)
To enable this function follow the indications of the section “Configurable Inputs”.
The activation of the Economy function is displayed by the switch-on of the led Economy on the display (money box symbol); it is possible to display the actual setpoint by the parameter Settr.
The enabling of the Economy function has to be done considering .

Cooling mode COOL:
tr 15 usually positive value
tr 10 set-point COOL



Heating mode HEAt:
tr25 usually negative value
tr20 set-point HEAt



Recording hours of operation

The controller can record the hours of compressors and pumps operation. Access the “Status \ Hr” menu to show the values. The hours are reset by pressing (prolonged) the SET button, while the hours of operation are displayed.

Power failure

In case of a power failure, when the power is restored the controller will go to the status prior to the power failure. The procedure is cancelled if a defrost is in progress. All timing in progress is cancelled and reinitialised.

Clock

The controller has an internal clock for memorising the date and time of each alarm occurring during unit operation (see “Alarms history”). The clock can be set by accessing the “Status \ CL” menu.

Date and hours setting

The electronic controller is equipped with internal clock (RTC) that allows to record in the alarm events date and hour of each alarm.
To modify date and hour, starting from the main view on the display, press the SET button.
With a single pressure of the button You enter in the view of different folders.
Scroll the menu using UP and DOWN buttons until find the folder CL
Press the SET button to enter in the menu.
Now in the display you have the label HOUR. You can choose to set hour, date and year scrolling the menu using UP and DOWN buttons.
Press the SET button for 3 seconds and enter in the modification menu.
To set hour, date and year it will be enough scroll UP and DOWN until the selected value, then press SET button.
To exit from the clock adjustment menu press the ESC button until arrive to main view on the display.

Source pump on-off control in cooling and heating mode
The source pump is turned on when the controller requires the first capacity step (first compressor).

Pre-pumping: the compressors start after the delay time (parameter PE20)
Post-pumping: when the compressors are switched off the pump continues to work for a short time (parameter PE21)

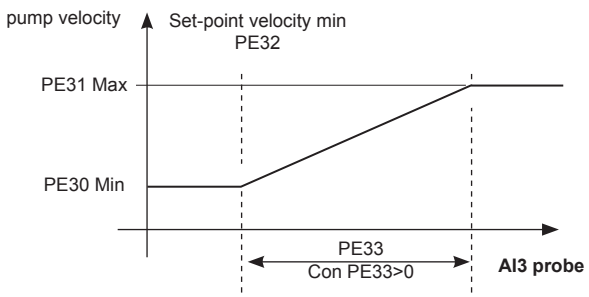
When the pump is on works always at 100%.
Note: the post-pumping is done even when the unit is swiched fron COOL o HEAT mode to STD-BY.

Source pump modulating control / 2 or 3 way valve in cooling mode
The velocity of the pump / voltage supply of the valve is controlled basing on the temperature measured by the prob (AI3)

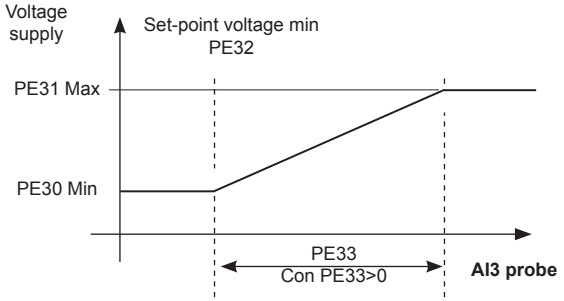
Set-Point:	Minimum speed setpoint / Minimum voltage supply parameter PE32
Band:	Proportional band parameter PE33
Mode:	Proportional

The proportional band PE33 could be positive or negative, By factory is fixed positive
The modulating control of the source pump / 2 or 3 way valve respects the same timing of pre / post pumping as the on-off control.

SOURCE PLANT



2 / 3 WAY VALVE

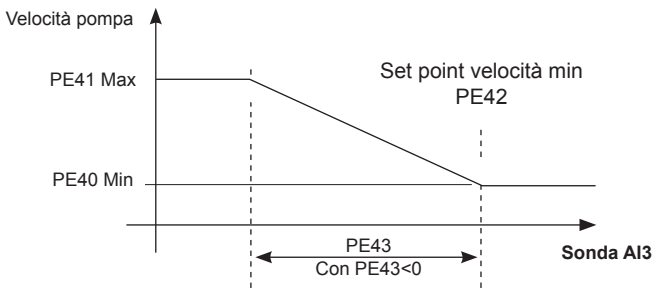


Source pump modulating control / 2 or 3 way valve in heating mode
The velocity of the pump / voltage supply of the valve is controlled basing on the temperature measured by the probe (AI3)

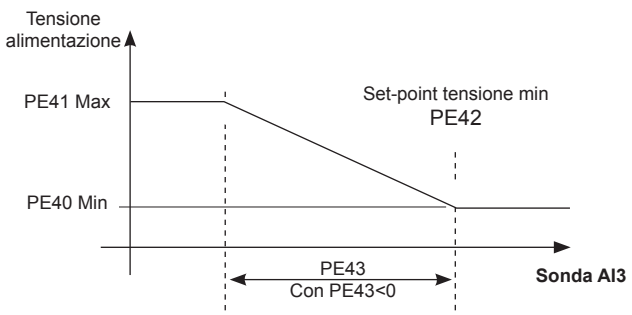
Set-Point:	Minimum speed setpoint / Minimum voltage supply parameter PE42
Band:	Proportional band parameter PE43
Mode:	Proportional

The proportional band PE43 could be positive or negative, By factory is fixed negative
The modulating control of the source pump / 2 or 3 way valve respects the same timing of pre / post pumping as the on-off control

PLANT PLANT



2 / 3 WAY VALVE



Timer scheduling

The scheduling allows to set weekly time zones to obtain a reduce in energy consumption when the cooling or heating demand is lower.

There are 3 time zones each one with 4 events per hour.

For each event, you can set hours and minutes of start and stop, an operating mode (Stand-by or ON), a cooling set point and a heating set point.

ATTENTION: you can not change the operating mode via scheduling. The operating mode (cooling or heating) will be the same adopted before the enabling of time scheduling.
To enable time scheduling you must set up the date and time into the controller

The parameters for the scheduling can be accessed in the “tE” (time event) folder.

Enabling
The function can be enabled with the parameters tE00 – Enabling scheduling

Parameters		descroptions	Value
tE00	Enabling scheduling	Scheduling disabled	0
		Scheduling enabled	1

Management time
For each day of the week you can select one of the 3 time zone available

Parameters	day	Time zone		
tE01	Monday	1	2	3
tE02	Tuesday	1	2	3
tE03	Wednesday	1	2	3
tE04	Thursday	1	2	3
tE05	Friday	1	2	3
tE06	Saturday	1	2	3
tE07	Sunday	1	2	3

For each time zone you can associate 4 events.
The parameters involved in time events are described below:

Event hour start time
It determines the hour of the start of the event [0-23]

Event minute start time
It determines the minutes of the start of the event [0-59]

Operating Mode ON/Standby
It determines the operating mode during the event
- 0 = ON
- 1 = Stand-by

Set point Cool
It determines the set point in cooling mode that will be set if the unit is in cooling mode before time scheduling

Set point Heat
It determines the set point in heating mode that will be set if the unit is in heating mode before time scheduling

Summary parameters table for time scheduling

	Descrizione	Profilo 1	Profilo 2	Profilo 3
EVENT 1		tE 10__tE 14	tE38__tE42	tE66__tE70
	Hour / minutes	tE 10__tE 11	tE38__tE39	tE66__tE67
	Mode operating ON/Standby	tE 12	tE40	tE68
	SetPoint Cool	tE 13	tE41	tE69
	SetPoint Heat	tE 14	tE42	tE70
EVENT 2		tE 17__tE21	tE45__tE49	tE73__tE77
	Hour / minutes	tE 17__tE 18	tE45__tE46	tE73__tE74
	Mode operating ON/Standby	tE 19	tE47	tE75
	SetPoint Cool	tE20	tE48	tE76
	SetPoint Heat	tE21	tE49	tE77
EVENT 3		tE24__tE28	tE52__tE56	tE80__tE84
	Hour / minutes	tE24__tE25	tE52__tE53	tE80__tE81
	Mode operating ON/Standby	tE26	tE54	tE82
	SetPoint Cool	tE27	tE55	tE83
	SetPoint Heat	tE28	tE56	tE84
EVENT 4		tE31__tE35	tE59__tE63	tE87__tE91
	Hour / minutes	tE31__tE32	tE59__tE60	tE87__tE88
	Mode operating ON/Standby	tE33	tE61	tE89
	SetPoint Cool	tE34	tE62	tE90
	SetPoint Heat	tE35	tE63	tE91

Example of timer scheduling:
You choose to set time zone 1 from Monday to Friday with the following setup:

At 07.30 you put the unit ON with a set point of 12°Cin cooling mode, and 40°C in heating mode
At 12.30 you change the set point to 14°C in cooling mode, 37°C in heating mode
At 13.30 you change the set point to 12°C in cooling mode, 40°C in heating mode
At 18.00 you put the unit in stand-by

You have to set the following parameters:

tE00**=1 enabling scheduling**

tE01, tE02, tE03, tE04, tE05**, = 1 time zone 1**

EVENT 1 – unit ON
tE 10=8 hour
tE 11=30 minutes

tE 12= 0 ON, unit is ON (pay attention: 0=ON, 1=stand-by)

tE 13= 12 set point cool 12°C
tE 14=40 set point heat 40°C

EVENT 2 – change set point
tE17=12 hour
tE18=30 minutes

tE19= 0 ON, unit is ON (pay attention: 0=ON, 1=stand-by)

tE 20= 12 set point cool 14°C
tE 21=40 set point heat 37°C

EVENT 3 – change set point
tE 24=13 hour
tE 25=30 minutes

tE 26= 0 ON, unit is ON (pay attention: 0=ON, 1=stand-by)

tE 27= 12 set point cool 12°C
tE 28=40 set point heat 40°C

EVENT 4 – unit in stand-by
tE 31=18 hour
tE 32=00 minutes

tE 33= 1 stand-by, unit is in stand-by (pay attention: 0=ON, 1=stand-by)

tE 34= 12 set point cool 12°C
tE 35=40 set point heat 40°C

The operating mode (cooling or heating) adopted is the one already active before the event happens.

For Saturday or Sunday you can choose time zone 1 or another time zone (2 or 3) and set the parameters in a similar manner as described in this example.

CONTRÔLEUR PRINCIPAL

Parameters

Description	Unit	Min	Max	default value	Protection
TR10 - Temperature controller setpoint in COOL	°C	7 [243]	22 [244]	9	3
TR13 - Temperature control hysteresis	°C	0.1	25.5	1	2
TR14 - Steps/compressors insertion differential	°C	0.1	25.5	2.5	2
TR15 - Setpoint differential in Cool from economy input	°C	-25.5	25.5	5	1
TR20 - Temperature controller setpoint	°C	28 [249]	51 [250]	43	3
TR23 - Temperature control hysteresis	°C	0.1	25.5	1	2
TR24 - Steps/compressors insertion differential	°C	0.1	25.5	2.5	2
TR25 - Setpoint differential in Heat from economy input	°C	-25.5	25.5	-5	1
dS01 - Temperature controller dynamic differential proportional band in Cool	°C	-50	99.9	-10	1
dS02 - Temperature controller dynamic differential proportional band in Heat	°C	-50	99.9	10	1
dS03 - Maximum temperature controller dynamic differential in Cool	°C	-50	99.9	5	1
dS04 - Maximum temperature controller dynamic differential in Heat	°C	-50	99.9	-5	1
dS05 - Temperature controller dynamic differential setpoint in Cool	°C	-50	99.9	30	1
dS06 - Temperature controller dynamic differential setpoint in Heat	°C	-50	99.9	10	1
PI30 - Minimum Plant circuit water pump speed in Cool	%	0	100	60	2
PI31 - Maximum Plant circuit water pump speed in Cool	%	0	100	100	3
PI40 - Minimum Plant circuit water pump speed in Heat	%	0	100	60	2
PI41 - Maximum Plant circuit water pump speed in Heat	%	0	100	100	3
HI22 - Plant exchangerheaters maximum dynamic differential in integration	°C	0	99.9	10	1
HI25 - Plant exchangerheaters regulator hysteresis in integration	°C	0.1	25.5	2	2
HI26 - Plant exchangerheater 2 switch-on setpoint differential in integration	°C	0	99.9	3	2
AL15 - Flow switch activation/deactivation time on Plant circuit automatic alarm	sec	0	255	2	2
AL16 - Enable flow switch time for Plant circuit manual alarm	Sec x 10	0	255	0	2
AL51 - Plant circuit anti-freeze regulator setpoint alarm	°C	-50	99.9	4.5	1
AL52 - Plant circuit anti-freeze regulator hysteresis alarm	°C	0.1	25.5	2	2

NOTE: The parameters may be changed at any time by the manufacturer.

Description	Unit	Min	Max	default value	Protection
PE20 - Delay Source circuit water pump on - compressor on	sec	0	255	30	1
PE21 - Delay compressor off - Source circuit water pump off	sec	0	255	30	1
PE30 - Minimum Source circuit water pump speed in Cool	%	0	100	30	1
PE31 - Maximum Source circuit water pump speed in Cool	%	0	100	100	1
PE32 - Minimum Source circuit water pump setpoint speed in Cool	°C	-50	99.9	20	3
PE33 - Proportional band Source circuit water pump in Cool	°C	-50	99.9	25	1
PE40 - Minimum Source circuit water pump speed in Heat	%	0	100	40	1
PE41 - Maximum Source circuit water pump speed in Heat	%	0	100	100	1
PE42 - Minimum Source circuit water pump setpoint speed in Heat	°C	-50	99.9	15	1
PE43 - Proportional band Source circuit water pump in Heat	°C	-50	99.9	8	1

Protection 3 = always accessible
Protection 1 = accessible by service
Protection 2 = not accessible

Configurable inputs

The configurable inputs are AI4, AI5 and ID5.
For configuration, access the parameters CL and select the required function according to the following tables.

I/O	ID	analogue / digital input	Configuration	Polarity	Offset (range) / Stato
AI4	S1	Not configured	CL03 = 0 CL33 = 0 CL53 = 0	----	----
		External probe sensor (provided with accessory SND3)	CL03 = 2 CL33 = 9 CL53 = 0	NTC probe	CL23 (-12,0... +12,0 [°C]) CL 13 = Start value scale AiL4 [°C] CL 12 = Full scale value AiL4 [°C]
		External probe air as analog input 4-20 mA	CL03 = 3 CL33 = 9 CL53 = 0	----	CL23 (-12,0... +12,0 [°C]) CL 13 = Start value scale AiL4 [°C] CL 12 = Full scale value AiL4 [°C]
		External probe air as analog input 0-10 V	CL03 = 4 CL33 = 9 CL53 = 0	----	CL23 (-12,0... +12,0 [°C]) CL 13 = Start value scale AiL4 [°C] CL 12 = Full scale value AiL4 [°C]
		External probe air as analog input 0-5 V	CL03 = 5 CL33 = 9 CL53 = 0	----	CL23 (-12,0... +12,0 [°C]) CL 13 = Start value scale AiL4 [°C] CL 12 = Full scale value AiL4 [°C]
		External probe air as analog input 0-1 V	CL03 = 6 CL33 = 9 CL53 = 0	----	CL23 (-12,0... +12,0 [°C]) CL 13 = Start value scale AiL4 [°C] CL 12 = Full scale value AiL4 [°C]
		ON/STBY remote (digital input)	CL03 = 1 CL33 = 0 CL53 = +1	input active open contact	open contact = STAND-BY close contact = ON
		Summer / Winter remote (digital input)	CL03 = 1 CL33 = 0 CL53 = +3	input active close contact	close contact = HEAT (Winter)
		Demand Limit 50% (digital input)	CL03 = 1 CL33 = 0 CL53 = +21	input active close contact	close contact = Demand Limit 50%
		Economy (digital input)	CL03 = 1 CL33 = 0 CL53 = +22	input active close contact	close contact = economy
AI5	S2	Not configured	CL04 = 0 CL34 = 0 CL54 = 0	----	----
		External probe sensor (analogic input)	CL04 = 2 CL34 = 9 CL54 = 0	NTC probe	CL24 (-12,0... +12,0 [°C])
		ON/STBY remoto (digital input)	CL04 = 1 CL34 = 0 CL54 = +1	input active open contact	open contact = STAND-BY close contact = ON
		Summer / Winter remote (digital input)	CL04 = 1 CL34 = 0 CL54 = +3	input active open contact	close contact = HEAT (Winter)
		Demand Limit 50% (digital input)	CL04 = 1 CL34 = 0 CL54 = +21	input active open contact	close contact = Demand Limit 50%
		Economy (analogic input)	CL04 = 1 CL34 = 0 CL54 = +22	input active open contact	close contact = economy
DI5		Not configured	CL44 = 0	----	----
	QF2. 2	thermal pump 2	CL44 = -48	input active open contact	open contact = thermal pump 2
		ON/STBY remote	CL44 = -1	input active open contact	open contact = STAND-BY
		Summer / Winter remote	CL44 = +3	input active close contact	close contact = HEAT (Winter)
		Demand Limit 50%	CL44 = +21	input active close contact	close contact = Demand Limit 50%
		Economy	CL44 = +22	input active close contact	close contact = economy

* If present the module of pumping two pumps can not get that DI5 must be configured CL44 = -48

The outdoor air sensor (optional SND3) is factory installed on input AI4; if it were necessary to can install it on input AI4 or AI5, as specified above. The input AI4 can also accept an input signal current (4-20mA) or voltage (0-10V ,0-5V ,0-1V) from a probe external air by the user.

Network comunication

The unit can communicate on serial line using the **Modbus** communication protocol with **RTU** coding.
The unit can be connected to an RS485 network by means of the serial interface supplied as an accessory, and respond to requests from any master device connected to the network.

Serial line settings

The serial line must be set as follows :

- baud rate : **9600**
- data bits : **8**
- stop bits : **1**
- parity : **even**

All the devices connected to the same serial line MUST use the same settings.

Device address

To communicate correctly, each device connected to the serial network must have an univocal address (“Modbus individual address”) of between 1 and 247. This address can be set by modifying the parameter CF30.

Modbus commands

The Modbus commands implemented by the controller are :

- parameter reading **3** (Hex 03 : Read Holding Registers)
- parameter writing **16** (Hex 10 : Write Multiple Registers)

Table of addresses

All the available resources are stored in the controller as WORD (2 byte) and therefore require the reading or writing of an entire Modbus register. According to the Modbus protocol, to identify a register of address X the address X-1 must appear in the message. Some registers contain more than one piece of information : in this case the bits representing the resource value are identified by means of the number of bits used (“Bit number”) and by the least significant bit (“Lsb”). In the writing operation for these registers it is necessary to read the current register value, modify the bits representing the resource concerned and rewrite the entire register.

Example.

Bit number	=	4
Lsb	=	7
Resource value	=	3

15	14	13	12	11	**10**	**9**	**8**	**7**	6	5	4	3	2	1	0
0	1	1	0	1	**0**	**0**	**1**	**1**	1	0	1	1	0	1	0

The resources can be read only (R), write only (W) or read and write (RW).

To interpret the value written in the register it is necessary to consider the value of CPL, EXP and UM :

CPL : if the register represents a number with sign (CPL = Y) carry out the following conversion :

0	=	register value	<	32767	:	resource value = register value
32768	=	register value	<	65535	:	resource value = register value – 65536

EXP : indicates the exponent of the power of 10 to be multiplied by the register value to obtain the resource value.

EXP	Multiplier	
-2	10^{-2}	0,01
-1	10^{-1}	0,1
0	10^{0}	1
1	10^{1}	10
2	10^{2}	100

MU : indicates the unit of measure of the resource

IMPORTANT. DO NOT modify any parameter not indicated in the tables provided or indicated as a read only parameter (R), otherwise the warranty will be cancelled.

Modbus address

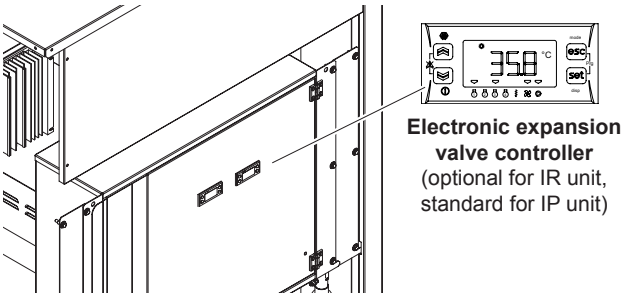
Label	Description	RW	Register address		Bit number	Lsb	CPL	EXP	UM
			Dec	Hex					
tr10	Temperature control setpoint in Cool	RW	17062	042A6	16	0	Y	-1	°C
tr20	Temperature control setpoint in Heat	RW	17074	042B2	16	0	Y	-1	°C
rC01	Recovery regulator set point (only for recovery unit)	RW	17742	0454E	WORD		Y	-1	°C
-	Operation hours compressor 1	R	979	003D3	16	0	N	0	ore
-	Operation hours compressor 2	R	981	003D5	16	0	N	0	ore
-	Operation hours plant pump 1	R	987	003DB	16	0	N	0	ore
-	Operation hours plant pump 2	R	989	003DD	16	0	N	0	ore
-	Operation hours source pump 1	R	991	003DF	16	0	N	0	ore
-	Operation hours source pump 2	R	993	003E1	16	0	N	0	ore
-	Analogue input AIL1	R	412	0019C	16	0	Y	-1	°C
-	Analogue input AIL2	R	414	0019E	16	0	Y	-1	°C
-	Analogue input AIL3	R	416	001A0	16	0	Y	-1	°C/Bar
-	Analogue input AIL4	R	418	001A2	16	0	Y	-1	°C/Bar
-	Analogue input AIL5	R	420	001A4	16	0	Y	-1	°C
-	Analogue input AIE1	R	898	00382	16	0	Y	-1	°C
-	Analogue input AIE2	R	900	00384	16	0	Y	-1	°C
-	Device in STAND BY	R	33028	08104	1 bit	2	N	0	num
-	Device in STAND BY (from digital input)	R	33028	08104	1 bit	3	N	0	num
-	Device in COOL	R	33028	08104	1 bit	4	N	0	num
-	Device in COOL (from digital input)	R	33029	08104	1 bit	5	N	0	num
-	Device in HEAT	R	33029	08104	1 bit	6	N	0	num
-	Device in HEAT (from digital input)	R	33029	08104	1 bit	7	N	0	num
COOL	Select mode COOL	W	33552	08310	1 bit	3	N	0	num
HEAt	Select mode HEAT	W	33552	08310	1 bit	4	N	0	num
StbY	Select mode STAND BY	W	33553	08310	1 bit	5	N	0	num
rC00	Select recovery mode (only for recovery unit)	RW	50508	0C54C	BYTE		N	0	num
Er00	General alarm	R	33104	08150	1 bit	0	N	0	flag
Er05	Circuit 1 digital low pressure alarm -phase sequencer-fan thermal switch	R	33105	08150	1 bit	5	N	0	flag
Er10	Compressor 1 thermal switch alarm - high pressure	R	33105	08151	1 bit	2	N	0	flag
Er11	Compressor 2 thermal switch alarm - high pressure	R	33105	08151	1 bit	3	N	0	flag
Er20	Plant circuit flow switch alarm	R	33106	08152	1 bit	4	N	0	flag
Er21	Plant circuit pump1 thermal switch alarm	R	33107	08152	1 bit	5	N	0	flag
Er22	Plant circuit pump2 thermal switch alarm	R	33107	08152	1 bit	6	N	0	flag
Er25	Source circuit flowswitch alarm	R	33107	08153	1 bit	1	N	0	flag
Er26	source circuit pump 1 thermal switch alarm	R	33107	08153	1 bit	2	N	0	flag
Er27	source circuit pump 2 thermal switch alarm	R	33107	08153	1 bit	3	N	0	flag
Er30	Plant circuit antifreeze alarm	R	33108	08153	1 bit	6	N	0	flag
Er45	Faulty clock alarm	R	33110	08155	1 bit	5	N	0	flag
Er46	Time lost alarm	R	33110	08155	1 bit	6	N	0	flag
Er47	LAN communication absent alarm	R	33110	08155	1 bit	7	N	0	flag
Er60	Plant exchanger water input probe faulty alarm	R	33111	08157	1 bit	4	N	0	flag
Er61	Plant exchanger water output probe faulty alarm	R	33112	08157	1 bit	5	N	0	flag
Er62	liquid probe faulty alarm	R	33112	08157	1 bit	6	N	0	flag
Er63	source exchanger water input probe alarm	R	33112	08157	1 bit	7	N	0	flag
Er64	Faulty exchanger water output probe alarm	R	33112	08158	1 bit	0	N	0	flag
Er68	Faulty external temperature probe alarm	R	33112	08158	1 bit	4	N	0	flag
Er75	Liquid pressure transducer alarm	R	33113,3	08159	1 bit	3	N	0	flag
Er90	Alarm history log full warning	R	33115	0815B	1 bit	2	N	0	flag

* If several operation modes are enabled by mistake:
- OFF has priority over STAND BY, HEATING, COOLING
- STAND-BY has priority over HEATING, COOLING
- HEATING has priority over COOLING

ELECTRONIC EXPANSIONE VALVE CONTROL - XVD420

The electronic expansion valve is managed by a microprocessor controller to which the electronic valve and relative control devices are connected.

The user interface comprises a display and four buttons with
which it is possible to show and possibly modify all the electronic expansion valve operation parameters.
The interface, located in the front part of the unit and accessible by removing the front panel of the unit.



Electronic expansion valve controller
(optional for IR unit, standard for IP unit)

Inputs and outputs

Analog input

Analog inputs ELECTRONIC EXPANION VALVE DRIVER (XVD420)		
DESCRIPTION		**CHARACTERISTICS**
AI1	suction pression transducer	electronic transducer 4-20 mA (0 barg ÷ 30 barg)
AI3	suction temperature	NTC temperature sensor (-50°C ÷ 99°C)

Digital input

Digital inputs ELECTRONIC EXPANION VALVE DRIVER (XVD420)		
DESCRIPTION		**CHARACTERISTICS**
DI1	Enabling regolation	Digital input with voltage-free contact

Digital output

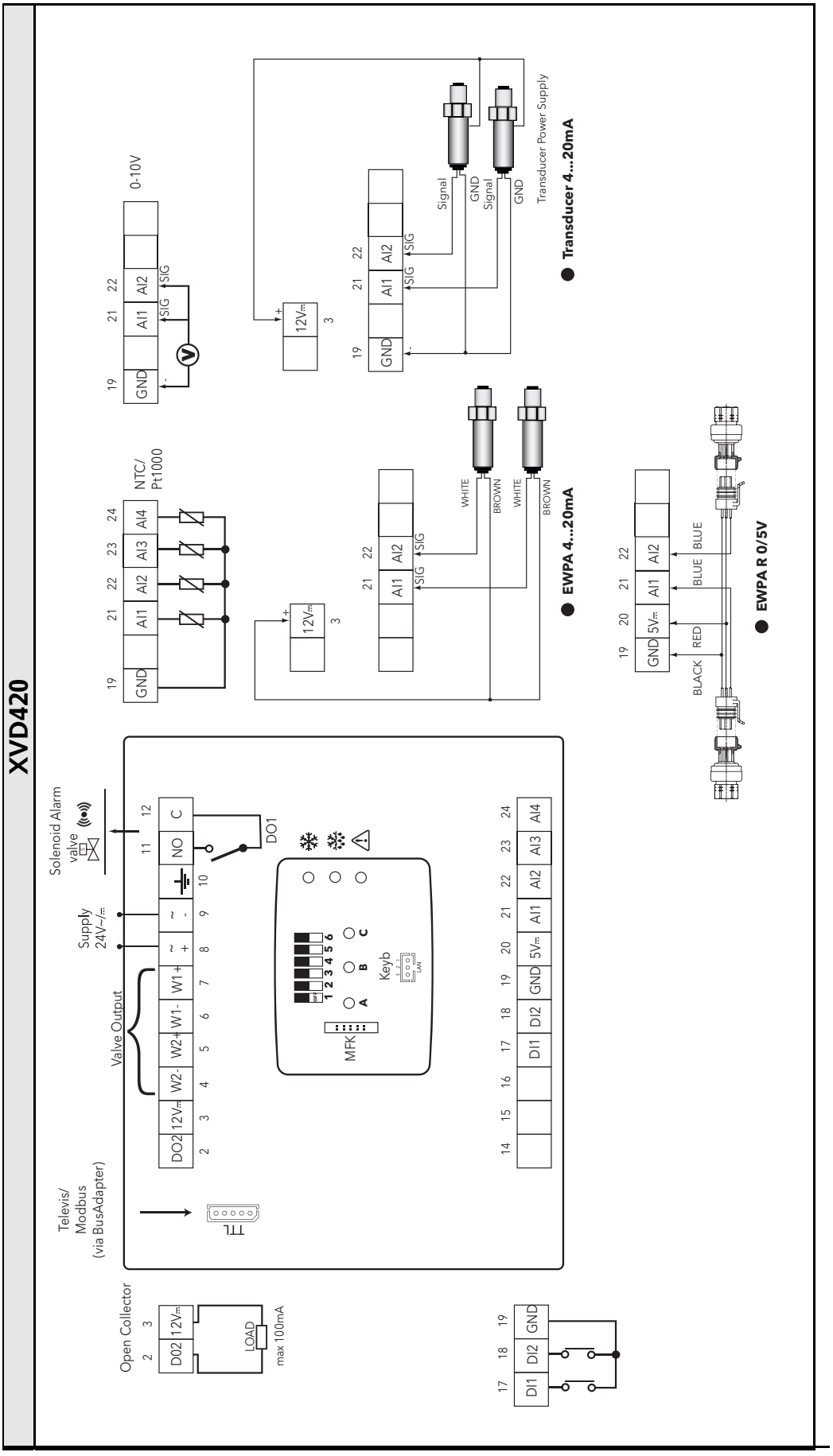
Digital outputs ELECTRONIC EXPANION VALVE DRIVER (XVD420)		
DESCRIPTION		**CHARACTERISTICS**
DO1	Alarms	5A resistive relays - 250Vac

Technical data

Electronic expansion valve driver EEV - XVD420 technical data

Description	Typical	Minimum	Maximum
Power supply voltage	24 V~ / --	-	-
Power supply frequency	50 Hz / 60 Hz	-	-
Power	30 VA - 25Watt	-	-
Protection rating	2	-	-
Ambient operating temperature	25 °C	-5 °C	55 °C
Ambient operating humidity (non-condensing)	30 %	10 %	90 %
Ambient storage temperature	25 °C	-20 °C	85 °C
Ambient storage humidity (non-condensing)	30 %	10 %	90 %

ELECTRONIC EXPANSIONE VALVE CONTROL - XVD420



User interface

The front panel of the device functions as the user interface and is used to perform all operations relating to the device.

XVD	SKP 10
	

XVD LED

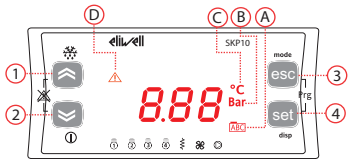
There are 3 LEDs on the front panel of the XVD driver showing the status of the valve.
There are a further 3 LEDs inside the door for uploading/downloading parameters and/or *applications* (see Multi Function Key chapter).

	LEDs	Colour	On	Blinking		Off
	**EEV**	Green	Valve regulation	Valve closed (No regulation in progress) Setpoint satisfied		NA*
	**Defrost**	Yellow	Defrost in progress Valve closed (No regulation in progress)	//	No serial connection	No defrost
	**Alarm**	Red	NA	Alarm present		No alarm
* EEV LED off means no power is reaching driver.						

SKP 10 keys

The values displayed on the remote SKP 10 terminal can have up to 4 digits or 3 digits plus a sign.

SKP 10



No.	Key	Single press (press and release)	[press and hold]
1	UP	Quick modification of overheating setpoint* Increases a value / Goes to next *label*	//
2	DOWN	Quick modification of overheating setpoint* Decreases a value / Goes to previous *label*	//
3	ESC	Exit without saving new settings Go back to previous level	//
4	set	Confirms value / exit and save new settings Go to next level (access to *folder*,sub-*folder*, parameter, value) Access to State Menu	**disp** [Main display] See paragraph on Main display
3+4	esc+set	**Prg** **Esc+set** keys pressed at the same time. Opens *Programming Menu*	
* Can also be modified from parameter dE32			

LED SKP 10

The display shows the value/resource set for the "main display".
In the event of an alarm, it will alternate with the alarm code Exx. (when more than one alarm occurs, the one with the lowest number will be shown first).

LEDs			
No.	**Colour**	**Description**	**Note**
A	Red	Menu (ABC)	
B	Red	Pressure Display (Bar)	Values are in relative bars. If the value is Psi, the symbol is not shown.
C	Red	Temperature Display (degrees centigrade)	If the value is °F the symbol is not shown.
D	Red	Alarm	

Access to folders - menu structure

Access to folders is organised into menus.
Access is determined by the keys on the front panel (see relative sections).
Access to each individual menu is explained below (or in the sections indicated).
There are 2 menus:

- *"States" menu* → See "States Menu' section
- "Programming" Menu → See '*Programming Menu*' section

There are 3 folders/submenus in the *Programming Menu*:

- Parameters Menu (PAr *folder*) → See Parameters chapter
- *MFK* menu (*folder* FnC) → See Multi Function Key chapter
- PASS Password → See Parameters chapter

Set main display

Main Display refers to the contents of the *default* display, i.e. when keys are not used.
XVD allows you to modify the main display to your own requirements. The various contents can be selected from the "disp" menu which is opened by pressing and holding the [set] key for more than 3 seconds.
The main display can be selected from:

Label	Description	Value on display	Value on display in the event of a probe error (backup)
drE1	Overheating temperature	AI3 Overheating probe	AI4 Backup overheating probe
drE2	Refrigerant saturation temperature	AI1 Saturation probe	AI2 Backup saturation probe
drE3	**Backup probe** overheating temperature	AI4	- - -
drE4	**Backup probe** refrigerant saturation temperature	AI2	- - -
drE5*	Overheating	Difference drE1-drE2	NA
drE6	Refrigerant pressure	AI1 When configuring probe as saturation probe 4..20mA or ratiometric	AI2 When configuring probe as backup saturation probe 4..20mA or ratiometric Otherwise, it shows - - -
drE7	Percentage valve opening		
* *default*			

N.B.

- *Analogue inputs* are preconfigured during manufacture.
- The probe display always shows temperatures (to see pressure values, see Input/Output Display).

Step by step instructions are provided below.

Set main display		
 ▶	 ▶	 ■
To open the [disp] menu and modify the main display setup, press and hold the set key for at least 3 seconds.	This opens the blinking menu for the previous display (in this case drE3).	To modify the display, use the "up" and "down" keys to scroll through the menu and press the set key to confirm. When you have selected the type of display (e.g. drE1), press the set key to confirm. You will be automatically returned to the main display set.

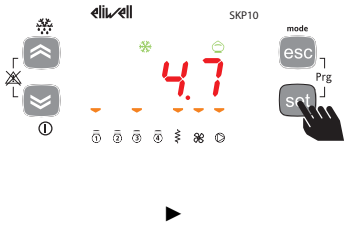
"States" menu

From the states menu you can view values for each resource.
Setpoints can be viewed and modified.
The resources may be present / not present depending on the model (e.g. dO2 is not present in XVD100).

Label					Description	Change
rE	drE1	drE2	...	drE7	Main display	NO This is a view only menu; see the relative paragraph for information on configuration.
Ai	dAi1	dAi2	dAi3	dAI4	*Analogue inputs*	NO
di	ddi1	ddi2			*Digital inputs*	NO
dO	ddO1	ddO2			*Digital outputs*	NO
AL	Er01	Er02	...	Er15	*Alarms*	NO
SP	**SP1**	**SP2**	**SP3**	SP4	Setpoint	YES (SP4 excluded)

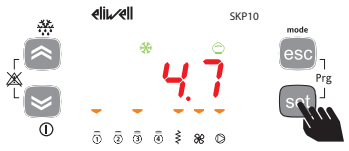
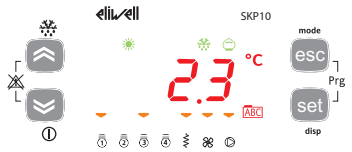
Programming the Set Point

Setpoint	Description	Settable from Parameter	Note
SP1	minimum overheating setpoint	**dE32**	If dE32 = 0 is intended as the only overheating setpoint - - - If dE30 = 1 is intended as overheating target Quick modification with UP and DOWN keys.
SP2	Maximum overheating setpoint	**dE31**	Valid if dE30=1
SP3	MOP setpoint.	**dE52**	expressed in units of temperature
SP4	Dynamic overheating temperature.	View only, not modifiable. Calculated dynamically	If dE30 = 0 then the set is defined in dE32

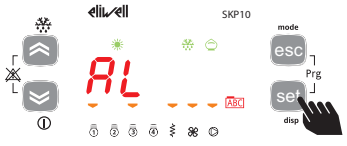
Programming the setpoint		
 ▶	 ▶	 ■
Example of SP1 configuration To access the State Menu, press and release the set key. *Label* rE will appear on the display. (Use the UP and DOWN keys to scroll the other labels until you find the SP *label* required)	Press the set key to view the *label* for the first setpoint SP1.	Press the set key again to view the value of SP1 (use the up and down keys to view other setpoints). To modify the display, press the up and down keys and then the set key to confirm. Press the set key to confirm. You will be automatically returned to the main display set.

Rapid Setpoint SP1 programming		
 ▶	 ▶	 ■
Press the up and down keys to quickly modify the setpoint.	The current setpoint value appears on the display To modify the value, press the up and down keys and then the set key to confirm.	Press the set key to confirm. You will be automatically returned to the main display set.

Inputs/Outputs display

Inputs/Outputs display		
		
Example of view for *Analogue Inputs*. The same procedure applies to all other I/Os*** To access the State Menu, press and release the set key. *Label* rE will appear on the display. (Use the UP and DOWN keys to scroll the other labels until you find the Ai *label* required)	Press the set key to view the *label* for the first analogue input (dAi1 in this case).	Press the set key again to view the value of dAi1. Note that the °C icon lights up to indicate that the value shown is in degrees centigrade --- Press the esc key to go back to the main display.
***For *digital inputs*, the value will be: - 0 = input not active (this is equivalent to input open) - 1 = input active (this is equivalent to input shortcircuited to ground)		

Alarm Display (AL)

Alarm display		
		
To access the State Menu, press and release the set key. *Label* rE will appear on the display. (Use the UP and DOWN keys to scroll the other labels until you find the AL *label* required)	Press the set key to view the *label* of the first active alarm (if it exists)	In this case, the first alarm is Er01. Use the UP and DOWN keys to scroll any other *alarms*. --- NOTE: the menu is not cyclical. For example, if the active *alarms* are Er01 and Er02, the display will show: Er01 ->Er02<Er01 NOTE: -> UP, <-DOWN Press the esc key to go back to the main display.

ELECTRONIC EXPANSIONE VALVE CONTROL - XVD420

Electrical expansion valve table alarm XVD420

Code	Driver input	Allarm	Cause	Effect	Alarm type	Alarm on main controller	Input on main controller	Troubleshooting
Er01	AI1	Probe AI1 fault	Probe fault / shortcircuit / non connected	Valve closed	Automatic	er05	DI3	Check wiring of the probe, replace probe AI1
Er03	AI3	Probe AI3 fault	Probe fault / shortcircuit / non connected	Valve closed	Automatic	er05	DI3	Check wiring of the probe, replace probe AI3
Er06	AI1 - AI3	Errore uscita saturazione	Probe AI1 AI3 fault / shortcircuit / non connected	Valve closed	Automatic	er05	DI3	Check wiring of the probe, replace probe AI1 AI3
Er07	-	MOP alarm	Saturation temperature > setpoint MOP 20°C for more than 255 s	Valve closed	Automatic	er05	DI3	Wait for saturation temperature < 20°C
Er 10	-	NO link alarm	Serial communication fault	Valve closed	Automatic	er05	DI3	Re-establish connection
Er 11	W2- W2+ W1- W1+	Motor protection alarm	Excedeed absorbed current	Valve closed	Manual *	er05	DI3	Check motor phases, motor connections
Er 12	W1- W1+	Motor protection alarm	Disconnection winding 1	Valve closed	Manual *	er05	DI3	Check winding connection 1 (terminals 6-7)
Er 13	W1- W1+	Motor protection alarm	Shortcircuit winding 1	Valve closed	Manual *	er05	DI3	Check winding connection 1 (terminals 6-7)
Er 14	W2- W2+	Motor protection alarm	Disconnection winding 2	Valve closed	Manual *	er05	DI3	Check winding connection 2 (terminals 4-5)
Er 15	W2- W2+	Motor protection alarm	Shortcircuit winding 2	Valve closed	Manual *	er05	DI3	Check winding connection 2 (terminals 4-5)

Note:
* power off and on the driver/unit to reset

Operating setting procedure

-Be sure it is present the jumper between terminals MI1 and DCM.

- Power on the inverter.

To access the Delta VFD-EL settings:

- Ensure the inverter is in STOP mode by pressing STOP RESET

- Press MODE until the message appears Frd.

- To enter int the **Frd menu** press ENTER.

- At this point, we are in the main parameters menu .

-To access and modify the parameters, choose the parameter, press ENTER, change value with the arrows keys and confirm with ENTER

- The modified parameter will be confirmed with the label End .

- At the end of the parameters settings, turn OFF and turn ON power supply, then check that the RUN light is on and the STOP light is flashing.

Alarm

Note that the intervention of the inverter alarm stops the inverter and so stops the device controlled by the inverter with the result of generating alarms on the main electronic controller: i.e. the alarm of the water pump inverter generates the water pump thermal switch alarm.

Code	Input on inverter	Alarm	Cause	Troubleshooting
oc	U-V-W	Over current	Abnormal increase in current	1. Check if motor power corresponds with the AC motor drive output power 2. Check the wiring connections to U/T1, V/T2, W/T3 for possible short circuits 3. Check the wiring connections between the AC motor drive and motor for possible short circuits, also to ground 4. Check for loose contacts between AC motor drive and motor 5. Increase the Acceleration Time 6. Check for possible excessive loading conditions at the motor 7. If there are still any abnormal conditions when operating the AC motor drive after a shortcircuit is removed and the other points above are checked, it should be sent back to manufacturer
ou	-	Over voltage	The DC bus voltage has exceeded its maximum allowable value	1. Check if the input voltage falls within the rated AC motor drive input voltage range 2. Check for possible voltage transients 3. DC-bus over-voltage may also be caused by motor regeneration. Either increase the Decel. Time or add an optional brake resistor (and brake unit) 4. Check whether the required braking power is within the specified limits

Code	Input on inverter	Alarm	Cause	Troubleshooting
oH1	-	Overheating	Heat sink temperature too high	1. Ensure that the ambient temperature falls within the specified temperature range 2. Make sure that the ventilation holes are not obstructed 3. Remove any foreign objects from the heatsinks and check for possible dirty heat sink fins 4. Check the fan and clean it 5. Provide enough spacing for adequate ventilation
oH2	-	Overheating	Heat sink temperature too high	1. Ensure that the ambient temperature falls within the specified temperature range 2. Make sure that the ventilation holes are not obstructed 3. Remove any foreign objects from the heatsinks and check for possible dirty heat sink fins 4. Check the fan and clean it 5. Provide enough spacing for adequate ventilation
LU	-	Low voltage	The AC motor drive detects the the DC bus voltage has fallen below its minimum value	1. Check whether the input voltage falls within the AC motor drive rated input voltage range 2. Check for abnormal load in motor 3. Check for correct wiring of input power to R-ST (for 3-phase models) without phase loss
oL	-	Overload	The AC motor drive detects excessive drive output current	1. Check whether the motor is overloaded 2. Reduce torque compensation setting in Pr.07.02 3. Use the next higher power AC motor drive model
oL1	-	Overload 1	Internal electronic overload trip	1. Check for possible motor overload 2. Check electronic thermal overload setting 3. Use a higher power motor 4. Reduce the current level so that the drive output current does not exceed the value set by the Motor Rated Current Pr.07.00
oL2	-	Overload 2	Motor overload	1. Reduce the motor load 2. Adjust the over-torque detection setting to an appropriate setting (Pr.06.03 to Pr.06.05)
HPF1	-	CC (Current clamp)	Internal error	Return to factory
HPF2	-	OV hardware error	Internal error	Return to factory
HPF3	-	GFF hardware error	Internal error	Return to factory
HPF4	-	OC hardware error	Internal error	Return to factory
bb	-	External base block	External base block	1. When the external input terminal (B.B) is active, the AC motor drive output will be turned off 2. Deactivate the external input terminal (B.B) to operate the AC motor drive again
ocA	-	Over-current during acceleration	Over-current during acceleration	1. Short-circuit at motor output: Check for possible poor insulation at the output lines 2. Torque boost too high: Decrease the torque compensation setting in Pr.07.02 3. Acceleration Time too short: Increase the Acceleration Time 4. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model
ocd	-	Over-current during deceleration	Over-current during deceleration	1. Short-circuit at motor output: Check for possible poor insulation at the output line 2. Deceleration Time too short: Increase the Deceleration Time 3. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model
ocn	-	Over-current during constant speed operation	Over-current during constant speed operation	1. Short-circuit at motor output: Check for possible poor insulation at the output line 2. Sudden increase in motor loading: Check for possible motor stall 3. AC motor drive output power is too small: Replace the AC motor drive with the next higher power model
EF	-	External fault	External fault	1. When multi-function input terminals (MI3-MI9) are set to external fault, the AC motor drive stops output U, V and W 2. Give RESET command after fault has been cleared

Code	Input on inverter	Alarm	Cause	Troubleshooting
cF1.0	-	Internal EEPROM can not be programmed	Internal error	Return to factory
cF1.1	-	Internal EEPROM can not be programmed	Internal error	Return to factory
cF2.0	-	Internal EEPROM can not be read	Internal error	1. Press RESET key to set all parameters to factory setting 2. Return to the factory
cF2.1	-	Internal EEPROM can not be read	Internal error	1. Press RESET key to set all parameters to factory setting 2. Return to the factory
cF3.0	-	U-phase error	Internal error	Return to factory
cF3.1	-	V-phase error	Internal error	Return to factory
cF3.2	-	W-phase error	Internal error	Return to factory
cF3.3	-	OV or LV	Internal error	Return to factory
cF3.4	-	Temperature sensor error	Internal error	Return to factory
cF3.5	-	Temperature sensor error	Internal error	Return to factory
OFF	-	Ground fault	Ground fault	When (one of) the output terminal(s) is grounded, short circuit current is more than 50% of AC motor drive rated current, the AC motor drive power module may be damaged NOTE: The short circuit protection is provided for AC motor drive protection, not for protection of the user 1. Check whether the IGBT power module is damaged 2. Check for possible poor insulation at the output line
cFA	-	Auto accel/decel failure	Auto accel/ decel failure	1. Check if the motor is suitable for operation by AC motor drive 2. Check if the regenerative energy is too large 3. Load may have changed suddenly
cE--	-	Communication error	No communication	1. Check the RS485 connection between the AC motor drive and RS485 master for loose wires and wiring to correct pins 2. Check if the communication protocol, address, transmission speed, etc. are properly set 3. Use the correct checksum calculation 4. Please refer to group 9 in the chapter 5 for detail information
codE	-	Software protection failure	Internal error	Return to factory
AErr	AVI-ACM	Analog signal error	No signal on ACI	Check the wiring of ACI
FbE	AVI-ACM	PID feedback signal error	No signal on ACI	1. Check parameter settings (Pr.10.01) and AVI/ACI wiring 2. Check for possible fault between system response time and the PID feedback signal detection time (Pr.10.08)
PHL	-	Phase loss	Loss of a input phase	Check input phase wiring for loose contacts
AUE	-	Auto tuning error	Auto tuning feature failure	1. Check cabling between drive and motor 2. Retry again
CP10	-	Communication time-out error on the control board or power board	Communication time-out	1. Press RESET key to set all parameters to factory setting 2. Return to the factory
PtC1	-	Motor overheat protection	Possible motor overheat	1. Check if the motor is overheat 2. Check Pr.07.12 to Pr.07.17 settings
PtC2	-	Motor overheat protection	Possible motor overheat	1. Check if the motor is overheat 2. Check Pr.07.12 to Pr.07.17 settings

PROBE CHARACTERISTICS

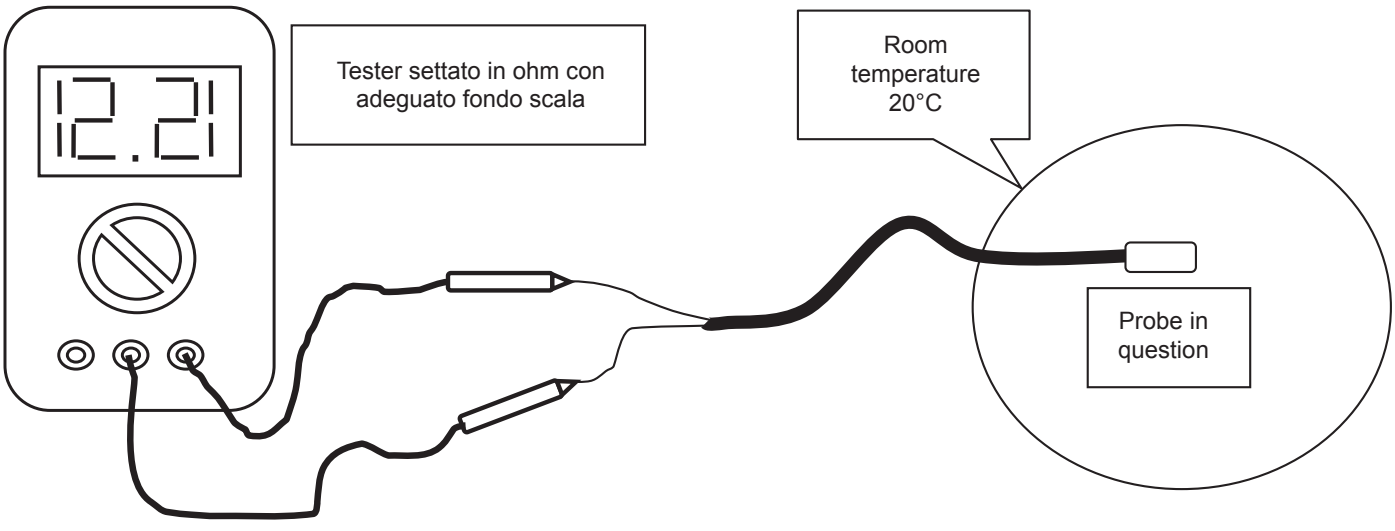
NTC10K-25°C type temperature probes are used.
When the probe bulb is at a temperature of 25°C the electrical resistance measurable at the probe ends with a multimeter is approx. 10 kW. The thermistor of these probes has a negative temperature coefficient: the electrical resistance value decreases as the temperature increases.

To find out if a temperature probe is faulty or disconnected, check the correspondence between the resistance value in kW and the bulb temperature in °C according to the following table.

Temperature [°C]	Resistance [kΩ]	Temperature [°C]	Resistance [kΩ]	Temperature [°C]	Resistance [kΩ]
0	25,7950	20	12,2110	40	5,7805
1	24,8483	21	11,7628	41	5,5683
2	23,9363	22	11,3311	42	5,3640
3	23,0578	23	10,9152	43	5,1671
4	22,2115	24	10,5146	44	4,9774
5	21,3963	25	10,1287	45	4,7948
6	20,6110	26	9,7569	46	4,6188
7	19,8546	27	9,3988	47	4,4493
8	19,1259	28	9,0539	48	4,2860
9	18,4239	29	8,7216	49	4,1287
10	17,7477	30	8,4015	50	3,9771
11	17,0963	31	8,0931	51	3,8312
12	16,4689	32	7,7961	52	3,6906
13	15,8644	33	7,5100	53	3,5551
14	15,2822	34	7,2343	54	3,4246
15	14,7213	35	6,9688	55	3,2989
16	14,1810	36	6,7131	56	3,1779
17	13,6605	37	6,4667	57	3,0612
18	13,1592	38	6,2293	58	2,9489
19	12,6762	39	6,0007	59	2,8406

For a reliable check it is not necessary to control each single value, but just several sample values. If the instrument gives an infinite resistance, this means the probe is disconnected.

Example. With a temperature of 20°C on the probe, the ohmmeter display will indicate approx. 12.21 kΩ



Start up

The following operations must be carried out only by properly trained personnel. To make the **contractual warranty** effective, start up **must be carried out by authorized service centres**.
Before calling the service centre it is advisable to make sure that all the installation steps have been completed (positioning, electrical connections, hydraulic connections).

Preliminary operation

WARNING - Before you perform the checks listed below, please read carefully the section "Safety and Maintenance"
Verify that :
- the unit has not suffered visible damages due to transport or positioning
- the unit is placed on an horizontal surface able to bear its weight
- the minimum operating area are respected
- the ambient conditions comply with the provided operating limits
- the hydraulic and electrical connections has been carried out correctly

Electrical cheks
Verify that the unit power supply line complies with the regulations in force. Check that the section of power cables are suitable to withstand the overall absorption of the unit (see electrical data), and that the unit has been properly grounded.

Check that all electrical connections are well fixed and all terminals properly tightened.
Switch on the unit by turning the switch in position ON . The display will light a few seconds after power up , check the operating status of both Std -by or off (via keyboard). A wrong sequence of the power supply phases is immediately detected by the phase sequence controller (standard on all the three phase power supply units) and reported on the display of the unit. To eliminate the error switch each other two phases of the power supply line.
Verify that:
- the voltage of the power supply line complies with the the nominal one of the unit
- for three phase power supply units, the unbalance between the phases is lower than 3% (a higher value produces an excesive current input on one or more phases causing possible damages to the electrical components of the unit)

NOTE. *Example of phase unbalance calculation*

- Read the value of the three line voltages using a voltmeter :
  line voltage between phases L_1 and L_2 : $V_{1-2} = 390$ V
  line voltage between phases L_2 and L_3 : $V_{2-3} = 397$ V
  line voltage between phases L_3 and L_1 : $V_{3-1} = 395$ V
- Calculate the difference between the maximum and minimum value of the measured line voltages :
  $\Delta V_{max} = \max(V_{1-2}; V_{2-3}; V_{3-1}) - \min(V_{1-2}; V_{2-3}; V_{3-1}) = V_{2-3} - V_{1-2} = 397 - 390 = 7$ V
- Calculate the average line voltage value :
  $\Delta_{average} = (V_{1-2} + V_{2-3} + V_{3-1}) / 3 = (390 + 397 + 395) / 3 = 394$ V
- Calculate the percentage unbalance value :
  $\Delta V_{max} / V_{average} \times 100 = 7 / 394 \times 100 = 1{,}78\ \% < 2\ \%$

Check that the connections made by the installer comply with the data reported here .
If present, check that the resistance of the compressors oil crankase are operating, by measuring the temperature rise of the oil crankase. The resistance / s must be in operation for at least 24 hours before starting the compressor , and in each case the temperature of the oil crankase must be 10 - 15 ° C higher than the ambient temperature .
WARNING - At least 24 hours prior to the operation of the unit (or at the end of each period of prolonged pause) the unit must be powered in such a way as to allow the heating elements of the compressor crankcases to evaporate the refrigerant present in the oil. Failure to do so may cause serious damage to the compressor and will void the warranty.

Hydraulic circuit checks
Check that all hydraulic connections are executed correctly: Refer to the installation manual.
Check that the hydraulic system is filled, under pressure and air free (possibly vent it).
Make sure that any shutoff valves present in the system are properly open.
Make sure that the circulation pump is running and that the water flow is sufficient to close the contact of the differential pressure and / or flow switches .
Check the correct operation of the differential pressure and / or flow switches: close the shutoff valve at the outlet of the heat exchanger, the unit display must show the alarm message, eventually reopen the valve and reset the alarm.

Turning on
ATTENTION . The operation must be agreed in advance depending on the timing of construction of the plant . Before the intervention of Service Department all works (electrical and plumbing connections , water filling and air vent of the plant) will have been completed.
Start all the plant components necessary to guarantee an adequate water flow rate on the plant hydraulic circuit.
Activate the unit in cooling or in heating mode operating on the user interface and setting a set point suitable to require the unit to work.

Refrigerant circuit checks
The vibrations during transport , may have loose connections : check for leaks of refrigerant gas especially at the refrigerant pressure taps , pressure transducers and pressure switches.
After a short period of operation, check the oil level of the compressor (if present siight oil) and the absence of bubbles in the glass of liquid indicator (if present) . The continuous passage of vapor bubbles may mean that the refrigerant charge is low or that the expansion valve is not properly adjusted. The presence of bubbles in the running for short periods , however, is possible.

Evaporation and condensation temperature
Verify that:
- the saturation temperature (dew point) corresponding to the condensing pressure is about 10-15°C higher than the outdoor air temperature in cooling and about 5°C higher than the water outlet temperature in heating
- the saturation temperature (dew point) corresponding to the evaporating pressure is about 5°C lower than the water outlet temperature in cooling and about 5-10°C lower than the outdoor air temperature in heating

Superheat
Check the superheat comparing the temperature measured with a contact thermostat fitted to the compressor suction pipe , with the temperature shown on the low pressure gauge (saturation temperature corresponding to the evaporation pressure) . The difference between these two temperatures gives the value of the superheta. The optimal values are between 4 and 8 ° C.

Subcooling
Check the subcooling comparing the temperature measured with a contact thermostat on the pipe outlet of the condenser , with the temperature shown on the pressure gauge of high pressure (saturation temperature corresponding to the condensation pressure) . The difference between these two temperatures gives the value of subcooling . The optimal values are between 4 and 5 ° C, for reversible units with subcooler in the coil the optimal values are between 10 and 20 ° C depending on the external air temperature .

Discharge temperature
If the values of subcooling and superheat are regular, the temperature measured at the outlet of the compressor discharge pipe must be:
- Units charged with R410A of 30/40 ° C higher than the condensing temperature
- Units charged with R134a of 15/20 ° C higher than the condensing temperature .

Hydraulic circuit check
- the difference between the water inlet and outlet temperature from the plate heat exchanger of the unit is inside the limits provided.

Electrical setting check
- the current absorbed by the compresor and the fans is lower than the maximum value admitted (FLA), as indicated in the section "Technical data and performances"

SAFETY AND MAINTENANCE

Basic safety rules

Recall that the use of products that use electricity and water entails the observance of some basic safety rules , such as: This appliance is not intended for use by persons (including children) with reduced physical , sensory or mental capabilities or lack of experience and knowledge, unless supervised or instructed on the use of the appliance by a person responsible for their safety . Children should be supervised to ensure that they do not play with the appliance.

It is forbidden to any technical intervention or maintenance without first disconnecting the unit from the mains supply by moving the master switch and the main control panel to “Off” .
You may not modify safety equipment or settings.
Do not pull, detach or twist the electrical cables coming from the unit even if it is disconnected from the mains supply.
It is forbidden to leave containers of flammable substances near the unit.
Do not touch the appliance when barefoot or with wet or damp parts of the body .
It is forbidden to open the doors of access to the internal parts of the unit without first ensuring that the system switch to “Off”.
Not dispose of, abandon or leave within reach of children packaging materials as it can be a potential source of danger.

IMPORTANT SAFETY INFORMATION
There is no guarantee proper operation as a result of a fire, before restarting the machine, contact an authorized service center. If equipped with safety valves refrigerant, in case of excessive pressure the safety valves can discharge high temperature refrigerant gas to the atmosphere. Wind, earthquakes and other natural phenomena of exceptional intensity were not considered. When using the unit in an aggressive atmosphere and or with aggressive water consult the factory.

Residual Risks

The machine has been designed with a view to reducing the risks to persons and the environment in which it is installed, to the minimum. To eliminate residual risks, it is therefore advisable to become as familiar as possible with the machine in order to avoid accidents that could cause injuries to persons and/or damage to property.

a. Access to the unit
Only qualified persons who are familiar with this type of machine and who are equipped with the necessary safety protections (footwear, gloves, helmet, etc.) may be allowed to access the machine. Moreover, in order to operate, these persons must have been authorized by the owner of the machine and be recognized by the actual Manufacturer.

b. Elements of risk
The machine has been designed and built so as not to create any condition of risk. However, residual risks are impossible to eliminate during the designing phase and are therefore listed in the following table along with the instructions about how to neutralize them.

Part in question	Residue hazard	Mode	Precautions
Compressor and delivery pipe	Burns	Contact with the pipes and/or compressor	Avoid contact by wearing protective gloves
Delivery pipes, heat recovery exchanger and coils	Explosion	Excessive pressure	Turn off the machine, check the high pressure switch and safety valve, the fans and condenser
Pipes in general	Ice burns	Leaking refrigerant	Do not pull on the pipes
Electrical cables, metal parts	Electrocution, serious burns	Defective cable insulation, live metal parts	Adequate electrical protection (correctly ground the unit)
Heat exchange coils	Cuts	Contact	Wear protective gloves
Fans	Cuts	Contact with the skin	Do not push the hands or objects through the fan grille

Disconnection and disposal

The machine contains lubricating oil and refrigerant gas for which, during the destruction of the unit, these fluids will be recovered and disposed of in accordance with the rules in force in the country where it is installed.
During the disconnection thus avoid spills or leaks of refrigerant gas and of the plant water if treated with additives or antifreeze substances.
The machine must not be abandoned in the process of destruction, but it can also be stored outdoors with gas, water and electrical circuits intact and closed.
For dismissing and disposal, deliver the units to specialized centres according to your national laws.

General recommendations about the R410A refrigerant used

1 SUPPLIER COMPANY AND PRODUCT IDENTIFICATION

Card No.	FRIG 8
Product	R-410A
Supplier company identification	RIVOIRA SpA

2 COMPOSITION / INFORMATION ON INGREDIENTS

Substance / Preparation	Preparation
Components / Impurities	Contains the following components : Difluoromethane (R32) 50 % in weight Pentafluoroethane (R125) 50 % in weight
EEC No.	Non-applicable for mixtures
Trade-name	/ /

3 IDENTIFICATION OF HAZARDS

Identification of hazards	Liquefied gas. The vapours are heavier than air and can cause suffocation, reducing the oxygen available for breathing. Rapid evaporation of the fluid can cause freezing. Can cause cardiac arrhythmia.

4 FIRST-AID MEASURES

Inhalation	Do not administer anything if the person has fainted. Take the person outdoors. Use oxygen or artificial respiration if necessary. Do not administer adrenaline or similar substances.
Contact with eyes	Rinse thoroughly with plenty of water for at least 15 minutes and see a doctor.
Contact with skin	Wash immediately with plenty of water. Immediately remove all contaminated garments.
Swallowing	

5 FIRE-PREVENTION MEASURES

Specific hazards	Increase in pressure.
Dangerous fumes	Halogen acids, traces of carbonyl halides.
Fire-extinguishing means usable	All the known fire-extinguishing means can be used.
Specific methods	Cool the containers/tanks with water sprays.
Special protection equipment	Use self-contained breathing apparatus in confined spaces.

6 MEASURES AGAINST ACCIDENTAL SPILLING OF THE PRODUCT

Personal protection	Evacuate personnel to safe areas. Provide for adequate ventilation. Use personal protection equipment
Protection for the environment	It evaporates.
Product removal methods	It evaporates.

7 HANDLING AND STORAGE

Handling and storage	Ensure an adequate air change and/or extraction in the workplaces. Only use well-ventilated rooms. Do not breathe vapours or aerosols. Carefully close the containers and keep them in a cool, dry and well-ventilated place. Keep in the original containers.
Incompatible products	Explosives, flammable materials, organic peroxides.

8 CONTROL OF EXPOSURE / PERSONAL PROTECTION

Personal protection	Ensure adequate ventilation, especially in closed areas.
Control parameters	Difluoromethane (R32): Recommended exposure limits: AEL (8h and 12h TWA) = 1000 ml/m3 Pentafluoroethane (R125): Recommended exposure limits: AEL (8h and 12h TWA) = 1000 ml/m3
Respiratory tract protection	For rescue and for maintenance works in tanks, use self-contained breathing apparatus. The vapours are heavier than air and can cause suffocation, reducing the oxygen available for breathing.
Eye protection	Total protection glasses.
Hand protection	Rubber gloves.
Hygiene measures	Do not smoke.

9 CHEMICAL-PHYSICAL PROPERTIES

Relative density, gas (air=1)	Heavier than air.
Solubility in water (mg/l)	Not known, but deemed very low.
Appearance	Colourless liquefied gas.
Odour	Similar to ether.
Fire point	Does not ignite.

10 STABILITY AND REACTIVITY

Stability and reactivity	No decomposition if used according to the special instructions.
Materials to be avoided	Alkali metals, alkali-earth metals, granulated metal salts, Al, Zn, Be, etc. in powder.
Hazardous products of decomposition	Halogen acids, traces of carbonyl halides.

11 TOXICOLOGICAL INFORMATION

Local effects	Concentrations substantially above the value TLV (1000 ppm) can cause narcotic effects. Inhalation of highly concentrated products of decomposition can cause respiratory insufficiency (pulmonary oedema).
Long-term toxicity	No carcinogenic, teratogenic or mutagenic effects have been recorded in experiments on animals.
Specific effects	Rapid evaporation of the fluid can cause freezing. Can cause cardiac arrhythmia.

12 ECOLOGICAL INFORMATION

Effects linked to ecotoxicity	Pentafluoroethane (R125) Potential global warming with halocarbides; HGWP (R-11 = 1) = 0.84 Potential impoverishment of the ozone; ODP (R-11 = 1) = 0

13 CONSIDERATIONS ON DISPOSAL

General	Do not dispose of where accumulation can be hazardous.
	Usable with reconditioning.
	The depressurised containers must be returned to the supplier.
	Contact the supplier if instructions for use are deemed necessary.

14 INFORMATION FOR TRANSPORT

Designation for transport	LIQUEFIED GAS N.A.S. (DIFLUOROMETHANE, PENTAFLUOROETHANE)
UN No.	3163
Class/Div	2.2
ADR /RID No.	2, 2nd A
ADR/RID hazard no.	20
ADR label	Label 2 : non-toxic non-flammable gas.
CEFIC Groupcard	20g39 - A
Other information for transport	Avoid transport on vehicles where the loading zone is not separate from the cab. Make sure the driver is informed about the potential risk of the load and knows what to do in case of accident or emergency. Before starting transport, make sure the load is properly secured and : make sure the valve of the container is closed and does not leak; make sure the blind cap of the valve (when provided) is correctly fitted; make sure the cap (when provided) is correctly fitted and that there is an adequate ventilation passage; ensure compliance with the current provisions.

15 INFORMATION ON REGULATIONS

The product must not be labelled according to Directive 1999/45/EC.
Comply with the regulations given below, and the relevant applicable updates and amendments.
Circulars no. 46/79 and 61/81 of the Ministry of Labour : Risks related to the use of products containing aromatic amines
Leg. Decree no. 133/92 : Regulations on the discharge of hazardous substances in waters
Leg. Decree no. 277/91 : Protection of workers against noise, lead and asbestos
Law 256/74, Decree 28/1/92, Leg. Decree no. 52 dated 3/2/97, Decree dated 28/4/97 as amended : Classification, packing and labelling of hazardous substances and preparations
Decree no. 175/88, as amended : Activities with significant accident risks (Seveso Law)
Decree no. 203/88 : Emissions into the atmosphere
Decree no. 303/56 : Work hygiene
Decree no. 547/55 : Regulations on accident prevention
Leg. Decree no.152 dated 11/5/99 : Protection of waters

16 OTHER INFORMATION

Recommended uses Refrigerant
Can cause suffocation in high concentration.
Keep in a well-ventilated place.
Do not breathe the gas.
The risk of suffocation is often underestimated and must be clearly explained during the training of operators.
Ensure compliance with all the national and regional regulations.
Before using this product in any new process or trial, an in-depth study on safety and compatibility of the product with the materials must be carried out.
The above information is based on our current know-how and describes the product according to the safety requirements. It does not however represent a guarantee and assurance of the qualities in a legal sense. Each person responds personally for compliance with such regulations.

First aid

• Move the victim away from the toxic source, keep him warm and allow him to rest.
• Administer oxygen if necessary.
• Proceed with artificial respiration if necessary.
• Give heart massage in the case of heart failure.
• Immediately seek medical help.

Contact with the skin:
• Immediately thaw the affected parts under running lukewarm water.
• Remove contaminated clothing (garments may stick to the skin in the case of ice burns) if they have not adhered to the skin.
• Seek medical assistance if necessary.

Contact with the eyes:
• Immediately rinse the eyes with physiologic eyewash or clean water for at least 10 minutes with the eyelids pulled open.
• Seek medical assistance if necessary.

Swallowing:
• Do not make the victim vomit. If the victim is conscious, have him rinse his mouth out with clean water and then drink 200, 300 ml of water.
• Immediately seek medical help.
• Do not administer adrenaline or sympathomimetic drugs after exposure owing to the risk of cardiac arrhythmia.
For further information about the characteristics of the refrigerant, consult the technical briefs that can be obtained from manufacturers of refrigerant products.

SAFETY AND MAINTENANCE

General Rules for Maintanance

The maintenance is extremely important for the functioning of the system and the regular working of the unit over time.
In accordance with the European Regulation EC 303/2008 , it should be noted that companies and engineers in maintenance , repair, leak testing and recovery / recycle refrigerant gases should be CERTIFIED in accordance with local regulations.
Maintenance must be performed in compliance with the safety rules and tips given in the manual supplied with the unit.
Routine maintenance helps maintain unit efficiency, reduce the rate of deterioration which each device is subject in time and gather information and data to understand the efficiency of the unit and prevent failures.
For extraordinary maintenance or in case you need service , contact only to a specialized service center approved by the manufacturer and use original spare parts.
In accordance with the European Regulation EC 1516/2007 it is necessary to prepare a “equipment record”.
Provide anyway a databook (not supplied) that allows you to keep track of interventions made on the unit; in this way it will be easier to properly program the various interventions and will facilitate a possible troubleshooting.
Bring on the databook : date, type of intervention made, description of the intervention , measurements , reported anomalies , alarms recorded in the alarm history , etc. ...

Routine maintenance

The inspections described below, to which the unit must be subjected, do not require specific technical know-how.
They merely include a few simple inspections involving certain parts of the unit.
The table below gives a recommended list of inspections which should be carried out at the indicated intervals.
Provide controls and interventions more frequently in case of heavy (continuous or intermittent high, close to operating limits, etc ...) or critical (essential service such as data centres, hospital etc ...) use.

DESCRIPTION	WEEKLY	MONTHLY	EVERY SIX MONTHS
Visual inspection of the unit			•
Inspection of hydraulic circuit		•	
Inspection of electrical system		•	
Inspection of condensing system		•	
Inspection of the water heat exchanger			•
Inspection of the water filter		•	
Inspection of the water pumps (if present)			•
Reading and adjustment of the operating parameters	•		

• Visual inspection of the structure of the unit
When checking the condition of the parts that form the structure of the unit, pay particular attention to the parts liable to rust.
If traces of rust are noted, they must be treated with rust-inhibitor paint in order to eliminate or reduce the problem.
Check to make sure that the external panels of the unit are well fixed.
Bad fixing gives rise to noise and abnormal vibrations.

• Inspection of hydraulic circuit
Check visually to make sure that there are no leaks in the hydraulic circuit. Check that water filters are clean.

• Inspection of electrical system
Make sure that power cables that supply the unit are not torn, cracked or damaged in a way that could impair its insulation.

• Inspection of the ventilated condensing/evaporating section
WARNING: The finned pack exchanger has fins made of aluminium or some other thin material, thus even accidental contact could cause cuts.

Condensing/Evaporating coils
In view of the function of this component, it is very important for the surface of the exchanger to be as free as possible from clogging caused by items that could reduce the fan’s air flow rate and, thus, the performances of the unit itself.
The following operations may be required:
- Remove all impurities (such as paper scraps, leaves, etc.) that could be clogging the surface of the bank either by hand or using a brush (comply with the above mentioned safety prescriptions).
- If the dirt has deposited on the fins and is difficult to remove by hand, use a flow of compressed air or pressurized water on the aluminium surface of the coils, remembering to direct the flow in a vertical and opposite to the standard flow direction to prevent the fins from being damaged.
- “Comb” the coils with the relative tool, using the appropriate comb spacing for the fins if some parts of them are bent or squashed.

Axial fans
Visually inspect these parts to make sure that the fans are well fixed to the bearing grille and that this latter is fixed to the structure of the unit. Check the fan bearings, and close the terminal box and cable glands. Bearings damaged and bad fixing are the source of abnormal noise and vibrations,

• Inspection of the water heat exchangers
The exchangers must ensure the maximum heat transfer possible so keep them clean and free from dirt that may reduce efficiency; make sure that the temperature difference between water outlet temperature and evaporation/condensation does not increase over time, if the difference exceeds 8 -10 ° C it is necessary to proceed cleaning the water side of the exchanger, keeping in mind the following: water circulation must be in the opposite direction than normal, the fluid velocity does not exceed 1.5 times the nominal velocity and use just water or moderately acid products but only water for final washing.

• Inspection of the water filters
Make sure to clean the filter and remove any impurities that block the proper flow of water, contributing to increase pressure drop and therefore energy consumption of the pumps. Refer to the section “Hydraulic Connections” too.

• Inspection of the water pumps
Check water leakages, the state of the bearings, the closing of the terminal box and integrity of the cable. Bearings damaged and bad fixing are the source of abnormal noise and vibrations,

• Reading and adjustment of the operating parameters
This control can be done using the pressure gauges (if installed) of the refrigerant circuits and using the pressure and temperature gauges (if installed) of the hydraulic circuits of the unit (evaporator + heat recovery - if present)

NOTE:
FOR THE PLANT WATER FILL AND DRAIN REFER TO THE SECTION HYDRAULIC CONNECTIONS

CAUTION
As a result of extraordinary maintenance on the cooling circuit with component replacement, before restarting the machine, perform the following steps:
- Pay attention to restore the refrigerant charge indicated on the name plate of the machine.
- Open all the ball valves in the refrigerant circuit.
- Correctly connect the power supply and grounding.
- Check the hydraulic connections.
- Check that the water pump is working properly.
- Clean water filters.
- Check that the finned coils are not dirty or clogged.
- Check the proper rotation of fans.

Ferroli

COD. 3QE28954

GRUPPO FERROLI

Ferroli spa ¬ 37047 San Bonifacio (Verona) Italy ¬ Via Ritonda 78/A
tel. +39.045.6139411 ¬ fax +39.045.6100933 ¬ www.ferroli.it