MITSUBISHI ELECTRIC
HYDRONICS & IT COOLING SYSTEMS S.p.A.

Data Book

i-FR2-W-G04-Z 0402 - 1242_202108_EN R1234ze
ELCA_Engine ver.4.5.5.5

COOLING

i-FR2-W-G04-Z 0402 - 1242

613-1894 kW
High efficiency water cooled chiller

R HFO1234ze

SCREW

HYBRID

(The photo of the unit is indicative and may vary depending on the model)

- HFO REFRIGERANT
- HYBRID FLOODED/FALLING FILM HEAT EXCHANGER
- 2 REFRIGERANT CIRCUITS COMPLETELY INDIPENDENT
- HIGH DELTA T EVAPORATOR
- WIDE OPERATING RANGE
- SILENT OPERATION
- HIGH EFFICIENCY AT PARTIAL LOAD

INDEX

The units highlighted in this publication contain R1234ze [GWP_{100} 1] fluorinated greenhouse gases.

LEGEND

Functions

COOLING — Cooling

Refrigerant

R HFO1234ze — HFO-1234ze

Compressors

SCREW — Screw compressor

Exchangers

HYBRID — Hybrid evaporator

Other features

EUROVENT CERTIFIED PERFORMANCE www.eurovent-certification.com — Eurovent

INVERTER DRIVEN COMPRESSOR — Inverter Driven Compressor

VPF VARIABLE PRIMARY FLOW — VPF

GREEN CERTIFICATION RELEVANT — GREEN Certification relevant

HPC Hydronic Plant Connect — HPC control

1.1 Product certifications

1.2 Voluntary product certifications

Check ongoing validity of certificate:
www.eurovent-certification.com
or
www.certifl ash.com

1.3 System certifications

Quality System complying with the requirements of UNI EN ISO9001:2008 regulation

Environmental Management System complying with the requirements of UNI EN ISO14001:2004 regulation

Occupational Health and Safety Management System complying with the requirements of BS OHSAS 18001:2007

2.1 PRODUCT FEATURES

The highest efficiency in every load condition

New units are equipped with the best-in-class technology available on the market, such as the use of R1234ze refrigerant and VSD compressors.

The unique and advanced control logic maximizes its peculiarities and benefits: the result is a unit that favors efficiency in all load conditions, making the most of the benefit of using variable speed compressors. The new unit therefore consists of two completely independent circuits, each equipped with a variable speed compressor, to ensure maximum reliability, a perfect balance of the cooling capacity generated and high levels of efficiency, especially at partial loads.

Innovative design of the heat exchangers

The new design of the flooded/falling film hybrid evaporator, of exclusive MEHITS patent, and the use of the shell and tube condenser, both designed and manufactured by MEHITS, maximizes the cooling power of the unit and optimizes the compressors operation thanks to the high heat exchange coefficients.

In the evaporator the presence of the refrigerant in the shell side and of the water inside the tubes allows to:
- have low refrigerant charge
- minimize the pressure drops
- gain a perfect temperature uniformity as well as the complete evaporation of the refrigerant
- cancel any necessity to have heat surfaces dedicated to desuperheating
- facilitate cleaning operations

Specifically designed for IT Cooling applications

The new units have been designed according to specifications suitable for IT Cooling applications. As standard the unit is equipped with:
- double independent refrigerant circuits in each size;
- ITC specific operating map;
- evaporator suitable for high ΔT up to 12K;
- numbered wirings on electrical board;
- compressors suction and discharge valves;
- increased thermal insulation on both evaporator and condenser (19mm);
- temperature probes on condenser;
- internal leak detection control.

Sound level

This variability, further increased by a full range of accessories, makes the range able to fit the needs of any installation with tailored performance levels and technical feature, also in terms of sound level.
Sound configurations available are:

- Compressors acoustical enclosure: an acoustical enclosure is provided to enclose the compressors, for -6 dB(A) sound power reduction compared to the standard unit;
- Integral acoustical enclosure: a complete acoustical enclosure is provided to enclose the entire unit, for -16 dB(A) sound power reduction compared to the standard unit reaching best-in-class sound power performances.

3.1 Green certification relevant

FOCUS ON GREEN CERTIFICATION RELEVANT

Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A., as a major player in the world HVAC market and a leading manufacturer of energy efficient, sustainable HVAC solutions, recognizes and supports the diffusion of green certification systems, as an effective way to deliver high performance buildings and improve the quality and the sustainability of the built environment.

Since the first certification system was introduced at the beginning of the 1990s, the demand for certified buildings has grown considerably, as well as the number of standards, rating and certification programs. Operating worldwide Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A., has extensive experience with many of them and is active member of Green Building Council Italy.

Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A., commitment to develop responsible and sustainable HVAC solutions, is reflected by a full range of premium efficiency products and systems, designed with special care to improve building energy performance ratings, according to major certification protocols, including LEED, BREAM, GREENSTAR, BCA, NABERS, DNGB, HQE and BEAM.

To find out more about how our products contribute to enhanced green certification rating and energy performance of a building, please refer to:
https://www.melcohit.com/EN/Environment/green_certifications/

3.2 Unit Description

Indoor unit for the production of chilled water, with high efficiency variable speed (Inverter Driven) screw compressors optimized for low compression ratios and specifically designed for near zero GWP HFO R1234ze refrigerant. All the sizes are designed with two completely indipendent refrigerant circuits, electronic expansion valves, high performing shell and tube condenser and shell and tube hybrid (flooded/falling film) evaporator with low refrigerant charge technology and high heat transfer coefficiecents, both designed and manufactured by Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A. These advanced solutions allows the unit to achieve high efficiencies with low refrigerant charge.

3.3 Key Features

HFO REFRIGERANT

4th generation refrigerant HFO 1234ze, with negligible greenhouse effect in comparison with traditional HFC refrigerants (Global Warming Potential GWP of HFO 1234ze < 1, GWP of R134a = 1300 as per IPCC rev. 5th) and zero impact on the ozone layer.

HYBRID FLOODED/FALLING FILM HEAT EXCHANGER

The hybrid flooded/falling film evaporator, designed and manufactured by Mitsubishi Electric Hydronics and TI Cooling Systems, enables low refrigerant charge and high heat transfer coefficients.

2 REFRIGERANT CIRCUITS COMPLETELY INDIPENDENT

2 completely indipendent refrigerant circuits each equipped with a VSD screw compressor to ensure a perfect balance of the cooling capacity produced

HIGH DELTA T EVAPORATOR

Hybrid type, flooded/falling film evaporator, designed for the production of chilled water with high temperature and high delta T. This unit is the ideal solution for the modern IT Cooling systems, where this optimization allows great energy savings.

WIDE OPERATING RANGE

VSD compressors and kit HWT allow unit to reach high condenser temperatures. Standard unit can produce leaving water temperature up to 20°C on the evaporator side and up to 52°C on the condenser side, while exploiting HWT kit it is possible to reach condenser water temperature up to 72°C.

SILENT OPERATION

Extremely silent operation thanks to the unit's accurate design. Optional integral acoustic enclosure, further reduces the sound level beyond the best on market

HIGH EFFICIENCY AT PARTIAL LOAD

Top-level partial load efficiency thanks to technlogical solutions at the forefront: VSD screw compressors, hybrid flooded/falling film evaporator and advanced control algorithms.

GROUP CONTROLS WITH DYNAMIC MASTER

Load sharing, sequencing, active redundancy, priority of resource activation, alarm management, theese are only some of the LAN functions that the unit is able to manage when connected to a group of chillers. Besides, the system's stability is ensured even in case of alarm or malfunctioning thanks to the Dynamic Master logic.

VARIABLE PRIMARY FLOW

Energy savings due to variable pump speed management based on load demand and the variable flow ensures the units also function in critical working conditions.

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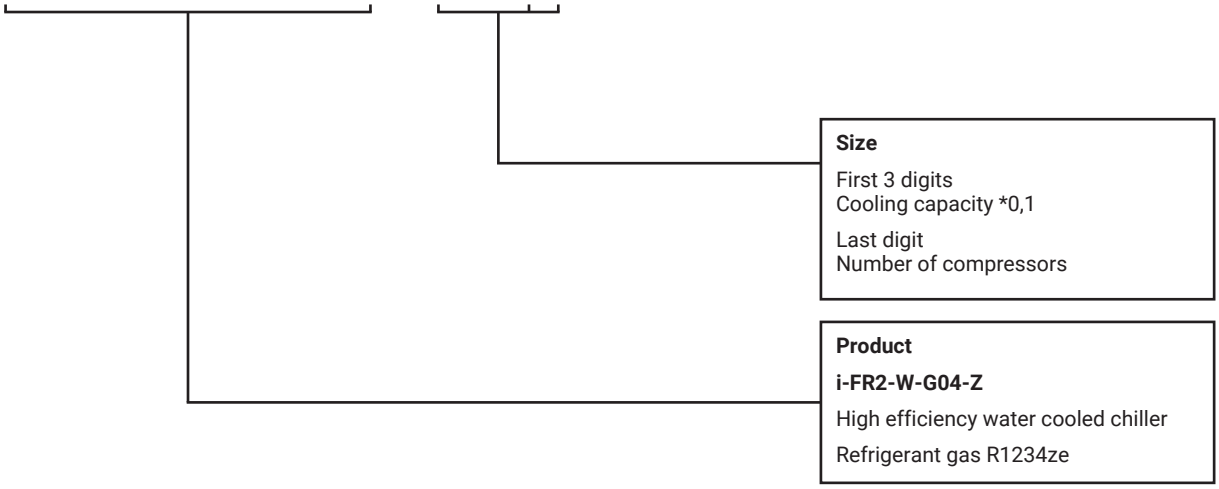
HPC

This function connects the indoor units (close control) with the external group of chillers. An advanced algorithm instantaneously detects the actual indoor thermal load and conveys this information to the chillers, thus optimizing the operation of the whole system.

i-FR2-W-G04-Z / 1242



5.1 Standard unit composition

High efficiency water cooled chiller

Indoor unit for the production of chilled water, with high efficiency variable speed (Inverter Driven) screw compressors optimized for low compression ratios and specifically designed for near zero GWP HFO R1234ze refrigerant. All the sizes are designed with two completely indipendent refrigerant circuits, electronic expansion valves, high performing shell and tube condenser and shell and tube hybrid (flooded/falling film) evaporator with low refrigerant charge technology and high heat transfer coefficiecents, both designed and manufactured by Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A. These advanced solutions allows the unit to achieve high efficiencies with low refrigerant charge.

Installation note

The unit is supplied fully refrigerant charged and factory tested. On site installation only requires power and hydraulic connection.

Refrigerant circuit

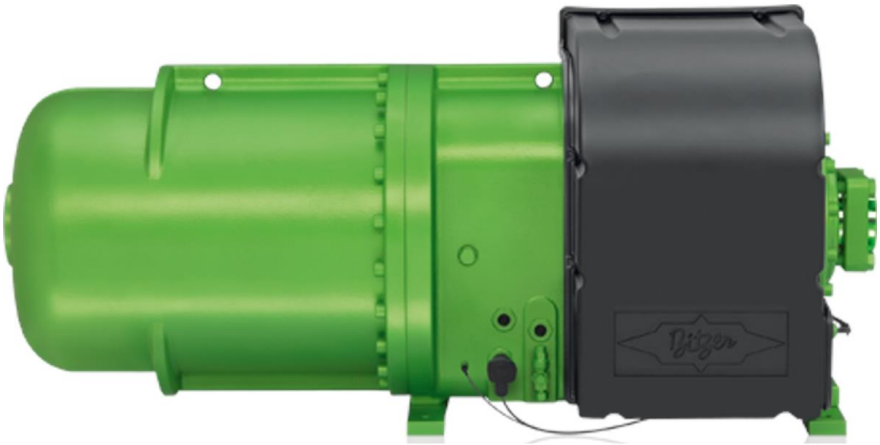
Unit fitted with 2 independent refrigerant circuits; each of them is equipped with an inverter-driven screw compressor
Circuits standard equipment:

- check valve on compressor gas discharge line
- liquid line shut-off device (function performed by electronic expansion valve with ultracap)
- compressor's discharge valve
- drier filter with replaceable cartridge
- refrigerant line sight glass with humidity indicator
- electronic expansion valve
- High and low pressure safety valve
- HP/LP dual relief valve with switch
- High pressure switches
- high and low pressure transducers
- modulating signale 0-10V for condensing pressure control (max 30m)
- high and low pressure gauges
- differential pressure switch, water side
- compressor oil level check
- crankcase heater on each compressor

VSD compressor

New semi-hermetic screw compressors designed for high efficiency in low condensing temperature applications equipped with integrated frequency converter. Extremely compact compressors, with oil separator and frequency modulation inverter with cooling system integrated in a single casing.

Semi-hermetic screw compressors with 2 five- and six-lobe rotors: the five-lobe rotor is splined directly onto the motor without the use of interposed gears. The motor drives the male screw with a variable speed range between 1: 6 thanks to the coupling with the dedicated inverter. The cooling of the inverter is achieved by an integrated plate, crossed by refrigerant regulated by special valves; the presence of additional exchangers is not required, only a connection with the liquid line.
The bearings arranged on the rotor axis in a separate chamber isolated from the compression chamber, are made of carbon steel for maximum strength and to ensure long life (> 150,000 h) in all speed conditions. The built-in oil separator has 3 stages of separation, and a 10 µm stainless steel mesh filter ensures the constant presence of oil inside the compressor.
Innovative mechanical design with internal slider, managed by specific proprietary parameters, for the variation of the Vi according to the different operating conditions to achieve the highest efficiency even in conditions of high load partialization.
Great reliability achieved by the continuous control of the operating parameters and by automatic intervention functions that bring the compressor back into the envelope in case of excessive approach to the operating limit values.
Each compressor is equipped with motor thermal protection with manual reset, discharge temperature and oil level control and an electric resistance for heating the crankcase when compressor is stopped.
The inverter power circuit is equipped with a line reactor for controlling the emissions on the power supply line, ensuring compliance with the EN 61000-6-4 standard for industrial environments.
Non-return valve located on the refrigerant delivery pipe to prevent rotors reverse rotation after stopping.
Shut-off valve on each compressor delivery pipe to isolate, if required, the refrigerant charge in the exchangers.
Compressors start-up with soft start function with continuous current increase without peaks.



Plant side heat exchanger

Shell and tube heat exchanger, fully designed and manufactured by MEHITS, working as flooded/falling film hybrid type evaporator, low refrigerant charge technology, high heat transfer coefficients and water flowing inside the pipes and refrigerant flowing in the shell side. The steel shell is insulated with a foamed polyethylene closed-cell mat of 19 mm thickness. The copper pipes are internally and externally grooved in order to improve the heat exchange and mechanically expanded to the tube plates. A differential pressure switch is fitted in order to control the water flow while the unit is working, avoiding the risk of ice generation.

Source side heat exchanger

Shell and tube heat exchanger, fully designed and manufactured by Mitsubishi Electric Hydronics and IT Cooling Systems, working as condenser, with water flowing inside and refrigerant flowing outside the pipes. Steel shell is insultated with a foamed polyethylene closed-cell matof 19 mm thickness and copper pipes are internally and externally grooved to improve heat exchange and mechanically expanded to the tube plates. Heads can be removed to inspect the pipes.

Electrical and control panel

Electrical and control panel built to EN60204-1 and EC204-1 standards, complete with:

- numbered cables
- Phases sequence control
- relays for voltage monitoring
- general door lock isolator
- power circuit with electric bus bar distribution system
- control circuit transformer
- remote ON/OFF terminals
- sectionable extra-rapid fuses to protect compressors
- terminals for cumulative alarm block
- compressors protection with internal thermal overload
- spring-type control circuit terminal board
- compressors' operation signal
- Electronic control W3000+
- cables' entrance from the top

Certification and applicable directives

The unit complies with the following directives and relative amendments:

- CE - Declaration of conformity certificate for the European Union
- 2014/35/EC Low Voltage Directive
- 2014/30/EC EMC Directive
- ErP Directive 2009/125/EC
- Machine directive 2006/42/EC
- PED Directive 2014/68/EC
- ISO 14001 - Company Environmental Management System certification
- ISO 9001 - Company Quality Management System certification

Tests

Tests performed throughout the production process, as indicated in ISO9001.
Performance or noise tests can be performed by highly qualified staff in the presence of customers.
Performance tests comprise the measurement of:
- electrical data
- water flow rates
- working temperatures
- power input
- power output
- pressure drops on the water-side exchanger both at full load (at the conditions of selection and at the most critical conditions for the condenser) and at part load conditions.

During performance testing it is also possible to simulate the main alarm states.
Noise tests are performed to check noise emissions according to ISO9614.

5.2 Electronic controller

Electronic control W3000+

W3000+ control is available with the new KIPlink (Keyboard In your Pocket) user interface. Based on WiFi technology, it allows one to operate on the unit directly from the smartphone or tablet.Using KIPlink, it is possible to turn the unit on and off, adjust the set-point, plot the main operating variables, monitor in detail the status of the refrigerant circuits, the compressors, the fans and the pumps (if present) and display and reset the possible alarms. The regulation features the continuous modulation of capacity, based on sequential adjustment + DIP referring to the leaving water temperature. Diagnostics include complete alarm management, with “blackbox” functions (via PC) and alarm log (display or PC) for best analysis of unit behaviour. The built-in clock can be used to create an operating profile containing up to 4 typical days and 10 time bands, essential for efficient programming of energy production. Optional proprietary devices can perform the adjustment of the resources in systems made of several units. Consumption metering and performance measurement are possible as well. The variable primary flow control is always available as per standard (VPF.E function). Supervision is available with different options, using proprietary devices or by integration into third party systems using ModBus, BACnet, BACnet-over-IP, LonWorks, Konnex, SNMP protocols. A dedicated wall-mounted keypad can be used for remote control of all the functions. Variable hydraulic flow control is standard (VPF.E function).

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
1020 REGULATIONS			
1015 HEAT EXCHANGERS NSW CERTIFIED	Heat exchangers with SafeWork NSW certificate		ALL
1560 POWER SUPPLY CONFIGURATION			
1561 DOUBLE POWER SUPPLY (ATS)	An ATS (Automatic Transfer Switch) is installed within the electrical board. The device automatically switches the electrical load between a principal power supply (i.e. mains) and an auxuliary power supply (i.e. backup generator). The ATS automatically senses if one of the sources has lost or gained power. When an outage occurs in the principal power supply, the switch autonomously switches over to the secondary line. When the main line becomes available again the supply is restored to this line. It is possible to set the line priority and frequency of checking.	It enhances system's redundancy and reliability. Reduces unit's downtime in case of mains power outage.	ALL
4500 FAST RESTART (UPS EXCLUDED)			
4501 FAST RESTART (UPS EXCLUDED)	Unit fast restart management after power failure	The management of the fast restart allows to minimize downtimes in case of power failure, keeping all the necessary unit safeties. This optiont requires an external 203V AC 300VA UPS power supply, by customer.	ALL
4502 FAST RESTART (UPS INCLUDED)	Unit fast restart management after power failure	The management of the fast restart allows to minimize downtimes in case of power failure, keeping all the necessary unit safeties. This option includes an electric device capable of keeping the controller power supply uninterrupted during a power failure. For duration of the UPS longer then 30 mininutes, please contact our sales department.	ALL
1660 REMOVABLE ELECTRICAL PANEL			
1661 REMOVABLE ELECTRICAL PANEL	Electrical panel removable from the unit	It allows to decrease the width of the unit for easier access through existing doors/openings.	ALL
380 NUMBERED WIRING			
381 NUMBERED WIRING ON EL. BOARD	Electrical board wires are identified by numbered labels. The reference numbers are indicated in the unit's wiring scheme.	Facilitate maintainance interventions to the electrical board connections.	ALL
383 NUMBERED WIRINGS+UK REQUESTS	Electrical board wires are identified by numbered labels. The reference numbers are indicated in the unit's wiring scheme.	Facilitate maintainance interventions to the electrical board connections.	ALL
3600 COMPRESSOR RUN STATUS SIGNAL			
3601 COMPRESSOR OPERATION SIGNAL	Auxiliary contacts providing a voltage-free signal.	Allows remote signalling of compressor's activation or remote control of any auxiliary loads.	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
6160 **AUXILIARY INPUT**			
6161 AUXILIARY SIGNAL 4-20mA	4-20 mA analog input	Allows to change the operating set-point according to the value of current applied to the analogue input.	ALL
6162 REMOTE SIGNAL DOUBLE SP	Allows to activate the Energy Saving set-point.	Allows to change the operating set-point according to a remote switch	ALL
6170 **DEMAND LIMIT**			
6171 INPUT REMOTE DEMAND LIMIT	Digital input (voltage free)	It permits to limit the unit's power absorption for safety reasons or in temporary situation.	ALL
6172 SIGNAL EXTERNAL CAPACITY CAP	Limits the unit cooling capacity to a specific % value, by acting on active resources and their operating frequencies. The unit can exceed this limit in specific conditions (e.g. start-up phase, oil recovery procedures).		ALL
1440 **USER INTERFACE**			
1442 KIPlink +7 INCH TOUCH SCREEN	In addition to KIPlink, the innovative user interface based on WiFi technology, the unit is equipped with the Touch interface, with a 7” WVGA colour display and a front USB port (WARNING: with outdoor temperature below 0°C the display response time may visibly increase).		ALL
1444 KIPlink + LARGE KEYBOARD	The unit is equipped with KIPlink, the innovative user interface based on WiFi technology, and, in addition, the physical LCD keyboard.		ALL
6194 LARGE KEYBOARD	The unit is equipped with the Large keyboard with a wide LCD display and led icons.		ALL
6195 7 INCH TOUCH SCREEN	The unit is equipped with the Touch interface, with a 7” WVGA colour display and a front USB port (WARNING: with outdoor temperature below 0°C the display response time may visibly increase).	The touch-screen's technology is characterized by an easy-to-access data, and it allows an effective graphical representation of the main figures protecting the access through 3 privilege levels.	ALL
6196 KIPlink	The unit is equipped with KIPlink, the innovative user interface based on WiFi technology		ALL
4180 **REMOTE CONNECTION ARRANGEMENT**			
4181 SERIAL CARD MODBUS	Interface module for ModBUS protocols.	Allows integration with BMS operating with ModBUS protocol.	ALL
4184 SERIAL CARD BACNET MS/TP RS485	Interface module for BACnet protocols.	Allows integration with BMS operating with BACnet protocol.	ALL
4185 SERIAL CARD FOR BACNET OVER IP	Interface module for BACnet OVER-IP protocols.	Allows to interconnect BACnet devices over Internet Protocol within wide-area networks.	ALL
4186 SERIAL CARD FOR KONNEX	Protocol for KNX system	Allows integration with BMS operating with KNX protocol	ALL
4187 M-Net W3000 INTERFACE KIT	Interface kit for M-Net protocol.	Interface module to allow the integration of the unit with Mitsubishi Electric proprietary communication protocol M-Net.	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
4188 SERIAL CARD MODBUS TCP/IP	Interface module for ModBus TCP/IP protocol	Allows integration with BMS operating with ModBus TCP/IP protocol.	ALL
4189 SERIAL CARD SNMP	Interface module for SNMP protocol	Allows integration with BMS operating with SNMP protocol.	ALL
3420 **LIGHTS ON ELECTRIC BOARD**			
3422 LIGHTS EL. BOARD+POWER SOCKET	230V power socket in the electrical board, CEE 7/3 type (Schuko). The maximum power available is 500VA. Electrical board equipped with lights.	It allows to power small electrical/electronic devices (lights, notebooks, tablets, etc.) during maintenance operations. The interior lighting simplifies maintenance and operations to the electrical panel.	ALL
1470 **MULTIFUNCTION CARD**			
1431 NIGHT MODE	The option includes a related controller expansion board and dedicated terminal block.	Night mode is a system setting to limit maximum noise level of the unit. Noise level is reduced limiting maximum compressor frequency and fan speed.	ALL
1477 4962 + 4951 + 1431	The option includes a related controller expansion board and dedicated terminal block (it is necessary to install a 3 way valve).	Enables the functions corresponding to the indicated accessory codes.	ALL
4951 WITH HYDRAULIC DECOUPLER PROBE	Water temperature probe on hydraulic decoupler.	The pump activation can be set by parameter according to the water temperature on buffer tank measuring by the sensor (in the systems with the primary and secondary circuits separated by a hydraulic decoupler), thus bringing significant pump consumption reduction during unit's stand-by.	ALL
4962 U.L.C.F. - WITH VARIABLE WATER FLOW	Option to be selected with the unit with variable speed pump/s (4713,4714,4717,4718,4722,4723). The option includes a related controller expansion board and dedicated terminal block.	Guaranteed the start-up of the units with the option U.L.C. even when the critical working condition could generate an alarm. The W3000+ controller can manage a 3 way mixing valve (not provided from MEHITS) by 0-10V signal for ensuring a dynamic control of the water temperature on user heat exchanger according to the operating limits allowed. This ensures the start-up and correct functioning of the unit into the envelope, also even critical whether condition.	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
1540 **ON BOARD MULTI MANAGER**			
1541 MM PRIORITY MASTER MM_PR	Multi Manager - Priority Master: integrated control of a group of chillers and chillers with free-cooling with up to 8 units with LAN logics and dynamic master. The unit is identified and parameterized as a Priority Master; therefore it is given preference in case of election of a new Master (in case of a failure of the current Master). At least one Priority Master must be present in the group. The maximum number of Priority Master units coincides with the number of connected units (up to 8). If you want to equip the group of chiller with auxiliary functions (e.g. 4-20 mA set point variation, pressure transducer for VPF system), each Priority Master requires auxiliary input signals. Consequently, for each Priority Master it is necessary to select these accessories from the price list and proceed with their wiring onsite. More details can be found in the data book and in the controls technical documentation.	It allows the management of a group of chillers and chillers with free-cooling (up to 8 units) via LAN with master/slave operating logic with dynamic master which always guarantees a back-up function to the network. The system makes other functions available such as load and stand-by unit management, resource use priority, unit start-up in sequence and group fast restart (when Fast Restart option is available). For more details refer to the dedicated section of the data book.	ALL
1542 MM NON PRIORITY MASTER MM_N-PR	Multi Manager - Non Priority Master: integrated control of a group of chillers and chillers with free-cooling with up to 8 units with LAN logics and dynamic master. The unit is identified and parameterized as a Non-Priority Master. Non-Priority Master units can become Masters (in case of a failure of the current Master) if there are no more Priority Master units available. In this case, the functions provided by the auxiliary signals are suspended (e.g. 4-20 mA set point variation, VPF); these signals can only be processed by Priority Master units. More details can be found in the data book and in the controls technical documentation.	It allows the management of a group of chillers and chillers with free-cooling (up to 8 units) via LAN with master/slave operating logic with dynamic master which always guarantees a back-up function to the network. The system makes other functions available such as load and stand-by unit management, resource use priority, unit start-up in sequence and group fast restart (when Fast Restart option is available). For more details refer to the dedicated section of the data book.	ALL
6460 **HPC SYSTEM ENABLING**			
6461 HPC SOFTWARE ENABLING	MEHITS proprietary operating logics, which allows the optimization of a chilled water system for applications related to the world of data centers. It allows communication and perfect synergy in operation between water-cooled indoor units and chillers outdoor units. The patent pending logics guarantees optimal functioning of the chillers + CRAHs system, always guaranteeing maximum safety and reliability for the correct functioning of the servers. The algorithm guarantees significant energy savings thanks to the proprietary operating logics that optimizes the operation of the entire system.	It allows to optimize a chilled water system, for data center applications, consisting of indoor units and chillers.	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
5920 **MANAGEMENT & CONTROL SYSTEMS**			
5922 ClimaPRO ModBUS RS485 - MID	This option includes the following devices on-board the unit panel: - MID certified network analyzer operating on ModBUS over RS-485 - Current transformers - Software release LA09 or later version.	This accessory allows to acquire the electrical data and the power absorbed by the unit and communicate with ClimaPRO via high level communication interface based on ModBUS over EIA RS-485. More specifically, the data collected are: power supply, current, frequency, power factor (cos), electrical power consumption, energy consumption. This specific energy meter model is MID certified and can therefore be used for billing applications. This option also ensures the compatibility between the units and ClimaPRO, thus allowing ClimaPRO to acquire all the main unit's operating variables and status by means of a high level communication interface to the controller installed onboard the unit panel.	ALL
5923 ClimaPRO BacNET over IP	This option includes the following devices on-board the unit panel: - network analyzer operating on BACnet over IP - Current transformers - Software release LA09 or later version.	This accessory allows to acquire the electrical data and the power absorbed by the unit and communicate with ClimaPRO via high level communication interface based on BACnet over IP. More specifically, the data collected are: power supply, current, frequency, power factor (cos), electrical power consumption, energy consumption. This network analyzer is not MID certified and cannot therefore be used for billing applications. This option also ensures the compatibility between the units and ClimaPRO, thus allowing ClimaPRO to acquire all the main unit's operating variables and status by means of a high level communication interface to the controller installed onboard the unit panel.	ALL
5924 ENERGY METER FOR BMS	This option includes the following devices on-board the unit panel: - network analyzer with display operating on ModBUS protocol over RS-485 (without certification MID) - current transformers.	This accesory allows to acquire the electrical data and the power absorbed by the unit and send them via RS-485 bus to the BMS for energy metering.	ALL
5925 ENERGY METER FOR W3000	This option includes all following devices on-board the unit panel: - network analyzer with display, already cabled to unit's controller - current transformers.	This option allows to acquire the electrical data and the power absorbed by the unit. The figures are accessible through the unit's W3000 interface, and be sent to the BMS via several protocols by selecting the dedicated serial card in the option list.	ALL
3430 **REFRIGERANT LEAK DETECTOR**			
3431 REFRIG. LEAK DETECTOR	Refrigerant leak detection system, supplied factory mounted and wired in the electrical board. In case of leak detection it will raise an alarm.	It promptly detects gas leakages	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
3432 REFRIG. LEAK DETECTOR+MIGR.	Refrigerant leak detection and migration system. In case the device detects a leakage the unit stops and stores the remaining refrigerant inside the evaporator, waiting for the intervention of a technician.	It promptly detects gas leakages, stops the unit and stores the remaining refrigerant.	ALL
3433 GAS LEAK CONTACT + COMPR. OFF	Refrigerant leak detection system, supplied factory mountedand wired in the electrical board. In case of leak detection it will raise an alarm and stop the unit.	It promptly detects gas leakages and stops the unit	ALL
3480 **FUNCTION CONTROL REFRIGERANT**			
3481 WITH INTERNAL LEAK DETECTOR	Proprietary control logic that is able to detect a refrigerant leak, without needing external devices, by reading and interpretation of internal cycle parameters.		ALL
4700 **EV - HYDRONIC MODULE**			
4713 EV - RELAY 1 PUMP + 0-10V SIG	Evaporator hydronic module, compatible with constant or variable flow control. The unit is provided with 1 relay and a 0-10V signal terminal to control the activation and the speed of 1 external variable speed pump.	The hydronic module controls the external pumps with the unit controller logic.	ALL
4714 EV - RELAY 2 PUMPS + 0-10V SIG	Evaporator hydronic module, compatible with constant or variable flow control. The unit is provided with 2 relays and a 0-10V signal terminal to control the activation and the speed of 2 external variable speed pump. The pumps are controlled in duty/standby, with running hours equalization and changeover on device failure.	The hydronic module controls the external pumps with the unit controller logic.	ALL
4860 **EV - PRIMARY FLOW CONTROL**			
4862 EV - CONSTANT FLOW (PARAMETER)	Evaporator water flow control (plant primary circuit): constant flow (parameter set). Compatible with hydronic modules with modulating regulation devices (0-10V signal) or with variable speed pumps (codes: 4713, 4714, 4715, 4716, 4717, 4718, 4719, 4721, 4722, 4723 - hydronic modules availability depends on unit model).	The unit is set up to operate with a constant water flow in the heat exchanger (plant primary circuit). The unit controller manages the pump activation to reduce pump consumption. The pump speed is adjusted via 0-10V signal. The option provides the possibility to set the pump speed with a controller parameter. Once set, the speed pump remains constant until the next parameter adjustment. The parameter set constant flow control is useful during the unit installation and commissioning, to adjust water flow and pressure head according to the real plant characteristics.	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
4864 EV – VPF (w/o DP)(SU, MM_PR)	Evaporator water flow control (plant primary circuit): variable flow (delta P control). Only for single unit systems or unit with option 1541 (Multi Manager - Priority Master) if available. Compatible with hydronic modules with modulating regulation devices (0-10V signal) or with variable speed pumps (codes: 4713, 4714, 4715, 4716, 4717, 4718, 4719, 4721, 4722, 4723 - hydronic modules availability depends on unit model). The option includes: differential pressure transducer on the unit's heat exchanger and related controller expansion board, controller expansion board to read the plant side differential pressure transducer (4-20mA signal) and manage the hydraulic by-pass valve opening (0-10V signal). Compulsory equipment, supplied by others: plant side differential pressure transducer, plant side hydraulic by-pass valve.	The unit is set up to operate with a variable water flow in the heat exchanger (plant primary circuit). The unit controller manages the pump activation to reduce pump consumption. The pump speed is adjusted via 0-10V signal. The option provides a pump speed management based on the VPF (Variable Primary Flow) function. It keeps the delta P constant on the plant side (primary circuit), thus bringing significant pump consumption reduction during part load operation. The VPF function is applicable in systems with only the primary circuit. Further information available in the dedicated bulletin section.	ALL
4865 EV – VPF (w DP)(SU, MM_PR)	Evaporator water flow control (plant primary circuit): variable flow (delta P control). Only for single unit systems or unit with option 1541 (Multi Manager - Priority Master) if available. Compatible with hydronic modules with modulating regulation devices (0-10V signal) or with variable speed pumps (codes: 4713, 4714, 4715, 4716, 4717, 4718, 4719, 4721, 4722, 4723 - hydronic modules availability depends on unit model). The option includes: differential pressure transducer on the unit's heat exchanger and related controller expansion board, plant side differential pressure transducer (installation by others), controller expansion board to read the plant side differential pressure transducer (4-20mA signal) and manage the hydraulic by-pass valve opening (0-10V signal). Compulsory equipment, supplied by others: plant side hydraulic by-pass valve.	The unit is set up to operate with a variable water flow in the heat exchanger (plant primary circuit). The unit controller manages the pump activation to reduce pump consumption. The pump speed is adjusted via 0-10V signal. The option provides a pump speed management based on the VPF (Variable Primary Flow) function. It keeps the delta P constant on the plant side (primary circuit), thus bringing significant pump consumption reduction during part load operation. The VPF function is applicable in systems with only the primary circuit. Further information available in the dedicated bulletin section.	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
4866 EV – VPF (M3000, CPRO, MM_N-PR)	Evaporator water flow control (plant primary circuit): variable flow (delta P control). Only for multi-unit systems with external controller (Manager3000 or ClimaPRO) or unit with option 1542 (Multi Manager - Non Priority Master) if available. Compatible with hydronic modules with modulating regulation devices (0-10V signal) or with variable speed pumps (codes: 4713, 4714, 4715, 4716, 4717, 4718, 4719, 4721, 4722, 4723 - hydronic modules availability depends on unit model). The option includes: differential pressure transducer on the unit's heat exchanger and related controller expansion board. It shall be the customer responsibility to configure the multi-unit control system (Manager3000, ClimaPRO or Multi Manager Priority Master) with option VPF.	The unit is set up to operate with a variable water flow in the heat exchanger (plant primary circuit). The unit controller manages the pump activation to reduce pump consumption. The pump speed is adjusted via 0-10V signal. The option provides a pump speed management based on the VPF (Variable Primary Flow) function. It keeps the delta P constant on the plant side (primary circuit), thus bringing significant pump consumption reduction during part load operation. The VPF function is applicable in systems with only the primary circuit. Further information available in the dedicated bulletin section.	ALL
4867 EV - VPF.D (SU, MM_PR)	Evaporator water flow control (plant primary circuit): variable flow (delta T control). Only for single unit systems or unit with option 1541 (Multi Manager - Priority Master) if available. Compatible with hydronic modules with modulating regulation devices (0-10V signal) or with variable speed pumps (codes: 4713, 4714, 4715, 4716, 4717, 4718, 4719, 4721, 4722, 4723 - hydronic modules availability depends on unit model). The option includes: 2 plant side NTC temperature sensors (installation by others).	The unit is set up to operate with a variable water flow in the heat exchanger (plant primary circuit). The unit controller manages the pump activation to reduce pump consumption. The pump speed is adjusted via 0-10V signal. The option provides a pump speed management based on the VPF.D (Variable Primary Flow with Decoupler) function. It keeps the delta T constant on the plant side (primary circuit), thus bringing significant pump consumption reduction during part load operation. The VPF.D function is applicable in systems with the primary and secondary circuits separated by a hydraulic decoupler. Further information available in the dedicated bulletin section.	ALL
4868 EV - VPF.D(M3000, CPRO, MM_N-PR)	Evaporator water flow control (plant primary circuit): variable flow (delta T control). Only for multi-unit systems with external controller (Manager3000 or ClimaPRO) or unit with option 1542 (Multi Manager - Non Priority Master) if available. Compatible with hydronic modules with modulating regulation devices (0-10V signal) or with variable speed pumps (codes: 4713, 4714, 4715, 4716, 4717, 4718, 4719, 4721, 4722, 4723 - hydronic modules availability depends on unit model). It shall be the customer responsibility to configure the multi-unit control system (Manager3000, ClimaPRO or Multi Manager - Priority Master) with option VPF.D.	The unit is set up to operate with a variable water flow in the heat exchanger (plant primary circuit). The unit controller manages the pump activation to reduce pump consumption. The pump speed is adjusted via 0-10V signal. The option provides a pump speed management based on the VPF.D (Variable Primary Flow with Decoupler) function. It keeps the delta T constant on the plant side (primary circuit), thus bringing significant pump consumption reduction during part load operation. The VPF.D function is applicable in systems with the primary and secondary circuits separated by a hydraulic decoupler. Further information available in the dedicated bulletin section.	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
4869 EV - VPF.E	Evaporator water flow control (plant primary circuit): variable flow (delta T control). Compatible with hydronic modules with modulating regulation devices (0-10V signal) or with variable speed pumps (codes: 4713, 4714, 4715, 4716, 4717, 4718, 4719, 4721, 4722, 4723 - hydronic modules availability depends on unit model).	The unit is set up to operate with a variable water flow in the heat exchanger (plant primary circuit). The unit controller manages the pump activation to reduce pump consumption. The pump speed is adjusted via 0-10V signal. The option provides a pump speed management based on the VPF.E function. It keeps the delta T constant on the plant side (primary circuit), thus bringing significant pump consumption reduction during part load operation. The VPF.E function is applicable in systems with only the primary circuit and with the hydraulic terminals equipped 3 way valve (by-pass). Further information available in the dedicated bulletin section.	ALL
2660 **HEAT-EXCHANGER INSULATION**			
2641 EXTRA INSULATATION ON EXCHANGERS	Increased thermal insulation on the heat exchanger: 20 mm thick closed-cell expanded polyurethane.	Reduces heat losses and prevent from condensate problems.	ALL
2720 **FLUID PRESSURE, EVAPORATOR**			
2721 FLUID PRESSURE, EVAP. 16bar	Exchanger with higher water-side pressure (16 bar) for high water column applications.		ALL
4760 **CD - HYDRONIC MODULE**			
4762 CD - RELAY 1 PUMP (ON/OFF)	Condenser hydronic module, compatible with constant flow control. The unit is provided with 1 relay to control the activation of 1 external pump via single ON/OFF signal.	The hydronic module controls the external pumps with the unit controller logic.	ALL
4763 CD - RELAY 2 PUMPS (ON/OFF)	Condenser hydronic module, compatible with constant flow control. The unit is provided with 2 relays to control the activation of 2 external pumps via double ON/OFF signal. The pumps are controlled in duty/standby, with running hours equalization and changeover on device failure.	The hydronic module controls the external pumps with the unit controller logic.	ALL
4773 CD - RELAY 1 PUMP + 0-10V SIG	Condenser hydronic module, compatible with constant or variable flow control. The unit is provided with 1 relay and a 0-10V signal terminal to control the activation and the speed of 1 external variable speed pump.	The hydronic module allows to control the external pumps with the unit controller logic. In case of water cooled chiller, the 0-10V signal, it allows to manage several condensing devices in order to maintain the condensing pressure in a pre-defined range in every applications: - for well water application to manage a 2 way modulating valve; - for cooling tower application to manage a 3 way modulation valve; - for dry-cooler or cooling tower application to modulate the fans' speed.	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
4774 CD - RELAY 2 PUMPS + 0-10V SIG	Condenser hydronic module, compatible with constant or variable flow control. The unit is provided with 2 relays and a 0-10V signal terminal to control the activation and the speed of 2 external variable speed pump. The pumps are controlled in duty/standby, with running hours equalization and changeover on device failure.	The hydronic module allows to control the external pumps with the unit controller logic. In case of water cooled chiller, the 0-10V signal, it allows to manage several condensing devices in order to maintain the condensing pressure in a pre-defined range in every applications: - for well water application to manage a 2 way modulating valve; - for cooling tower application to manage a 3 way modulation valve; - for dry-cooler or cooling tower application to modulate the fans' speed.	ALL
1280 **CONDENSER CONFIGURATION**			
1283 4 PASS CONDENSER	Water realizes 4 tube side passes	Compatible with water with high delta temperature	ALL
2710 **CONDENSER INSULATION**			
2711 CONDENSER INSULATION			ALL
2730 **FLUID PRESSURE, CONDENSER**			
2731 FLUID PRESSURE, COND. 16bar	Exchanger with higher water-side pressure (16 bar) for high water column applications.		ALL
4900 **CD - COND. WATER FLOW CONTROL.**			
4904 CD - 2 WAY MODULATING VALVE B	Two way servo-motorized valve with steel body.	It's recommended in case of inverter pumps and water flow modulation.	ALL
4905 CD - 2 WAY MODULATING VALVE C	Two way servo-motorized valve with steel body.	It's recommended in case of inverter pumps and water flow modulation.	ALL
4906 CD - 2 WAY MODULATING VALVE D	Two way servo-motorized valve with steel body.	It's recommended in case of inverter pumps and water flow modulation.	ALL
4907 CD - 2 WAY MODULATING VALVE E	Two way servo-motorized valve with steel body.	It's recommended in case of inverter pumps and water flow modulation.	ALL
4908 CD - 2 WAY MODULATING VALVE F	Two way servo-motorized valve with steel body.	It's recommended in case of inverter pumps and water flow modulation.	ALL
4909 CD - 2 WAY MODULATING VALVE G	Two way servo-motorized valve with steel body.	It's recommended in case of inverter pumps and water flow modulation.	ALL
4911 CD - 2 WAY MODULATING VALVE H	Two way servo-motorized valve with steel body.	It's recommended in case of inverter pumps and water flow modulation.	ALL
4914 CD - 3 WAY MODULATING VALVE B	Three way servo-motorized valve with steel body.	It's recommended for applications with geothermal probes, in which the water flow is required to be constant.	ALL
4915 CD - 3 WAY MODULATING VALVE C	Three way servo-motorized valve with steel body.	It's recommended for applications with geothermal probes, in which the water flow is required to be constant.	ALL
4916 CD - 3 WAY MODULATING VALVE D	Three way servo-motorized valve with steel body.	It's recommended for applications with geothermal probes, in which the water flow is required to be constant.	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
4917 CD - 3 WAY MODULATING VALVE E	Three way servo-motorized valve with steel body.	It's recommended for applications with geothermal probes, in which the water flow is required to be constant.	ALL
491D CD - 0-10V SIGN. (x 2 WAY MOD)	0-10V signal on terminal board to control the 2-way valve		ALL
491E CD - 0-10V SIGN. (x 3 WAY MOD)	0-10V signal on terminal board to control the 3-way valve.		ALL
2680 **WATER CONNECTIONS ORIENTATION**			
2681 EVAP. RIGHT - COND. RIGHT CONN.	Looking at the unit from the electrical panel side, evaporator and condenser water connections are on the right side of the unit,	Adaptability of the water layout to different system configurations.	ALL
2682 EVAP. LEFT - COND. RIGHT CONN.	Looking at the unit from the electrical panel side, evaporator water connections are on the left side while condenser water connections are on the right side of the unit,	Adaptability of the water layout to different system configurations.	ALL
2683 EVAP. RIGHT - COND. LEFT CONN.	Looking at the unit from the electrical panel side, evaporator water connections are on right side while condenser water connections are on the left side of the unit.	Adaptability of the water layout to different system configurations.	ALL
2684 EVAP. LEFT - COND. LEFT.CONN.	Looking at the unit from the electrical panel side, evaporator and condenser water connections are on the left side of the unit.	Adaptability of the water layout to different system configurations.	ALL
2910 **HYDRAULIC CONNECTIONS**			
2911 FLANGED HYDRAULIC CONNECTIONS	Grooved coupling with flanged counter-pipe user/source side.		ALL
1900 **COMPRESSOR SUCTION VALVE**			
1901 COMPRESSOR SUCTION VALVE	Shut-off valve on compressor's suction circuit.	Simplifies maintenance activities	ALL
1910 **COMPRESSOR DISCHARGE VALVE**			
1911 COMPR. DISCHARGE LINE VALVE	Shut-off solenoid valve on compressor discharge circuit	Simplifies maintenance activities	ALL
1950 **HIGH TEMPERATURE DEVICE**			
1953 KIT HWT	Kit for increased condenser leaving water temperature. To ensure control of the condenser leaving water temperature, this option must be fitted for /H function. NOTE: the adoption of "kit HWT" modifies the unit's performance in all the operating range; refer to the selection software to have the correct technical data.	The accessory is required for applications with high condensing temperature (heat pump, high level heat reclaim or dry cooler applications).	ALL
1960 **PRESSURE RELIEF VALVES**			
1961 DUAL RELIEF VALVES WITH SWITCH	Dual relief valve with switch	Allows to unselect a relief valve in order to service the unit avoiding medium or long inoperative periods	ALL

OPTIONS	DESCRIPTIONS	BENEFITS	AVAILABLE FOR MODELS
2340 **UNIT ENCLOSURE**			
2301 COMPRESS .ACOUSTICAL ENCLOSURE	Enclosure made from hot galvanised metal plate and painted with epoxy powder coat. The acoustic insulation availability depends on unit model, see the dedicated description in "Accessories notes".	It reduces the noise emissions and improves aesthetics.	ALL
2314 INTEGRAL ACOUST.ENCL.PLUS	Enclosure made from hot galvanised metal plate and painted with epoxy powder coat with a special acoustic insulation, see the dedicated description in "Accessories notes".	The enclosure allows to reduce the sound level of the unit, see the dedicated description in "Accessories Notes".	ALL
9960 **PACKING**			
9966 NYLON PACKING	Unit covered with nylon		ALL
9979 CONTAINER PACKING	Unit provided with container slides and covered with nylon		ALL
1800 **EVAPORATOR WATER FLOW SWITCH**			
1801 EVAPORATOR WATER FLOW SWITCH	Flow switch with stainless scoop AISI 316L and IP65 protection suitable for installation in industrial plant pipes. It should be installed in a straight pipe without filters, valves, etc., long at least 5 times its diameter, both upstream and downstream.	Signaling of lack of or excessive reduction of flow, it generates an alarm that is in automatic or manual reset depending on n ° alarms per hour and the maximum time of operation of the pump under conditions of low flow rate.	ALL
2100 **ANTIVIBRATION MOUNTING**			
2101 RUBBER TYPE ANTIVIBR.MOUNTING			ALL

6.2 Options - Additional information

1015 - Heat exchangers NSW certified
2721 – Fluid pressure, evap. 16 bar
2731 – Fluid pressure, cond. 16 bar

The NSW certification is not available for both 16 bar evaporator and condenser. If the certification is required for these options, please contact our sales department.

2301 – Compressor acoustical enclosure
2314 – Integral acoustic enclosure plus

These options lead to a noise reduction of -6 dB(A) and -16 dB(A) respectively.
Unit equipped with one of these two options may increase its dimensions: please refer to the tables below.

1661 – Removable electrical panel

This option allows the easy removal of the electrical panel of the unit, significantly reducing the width and height of the unit itself for easier handling. By selecting this option, the unit is equipped with a particular electrical panel, in which specific quick release electrical connectors are installed for all signals and auxiliary electrical connections. The power cables of the compressors will be removed directly from the EMC filters. For handling the panel, suitable lifting brackets will be provided.

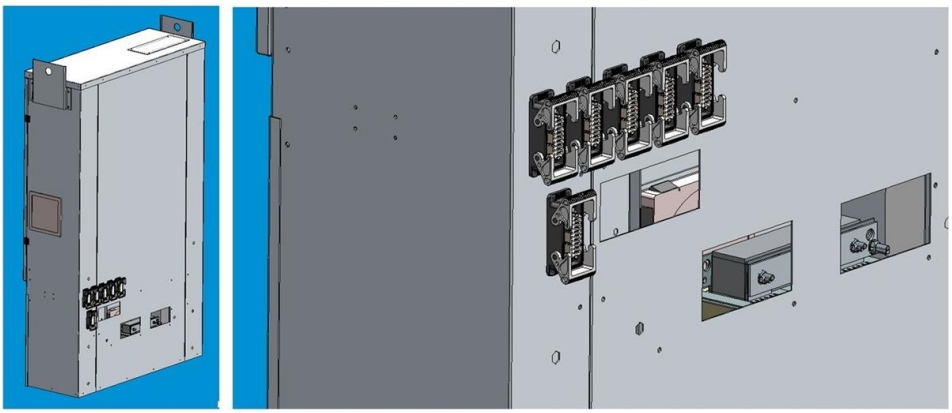


Image and detail of the removable electrical panel equipped with quick release electrical connectors.

6161 – Auxiliary signal 4-20mA
6162 – Remote signal double set point

These accessories provide for a maximum temperature difference of 8°C between the two set points, conditions being equal on the condenser side.

2911 – Flanged hydraulic connections

The option provides flanged water connections for both the evaporator and the condenser.

4914 – CD - 3 WAY MODULATING VALVE B
4915 – CD - 3 WAY MODULATING VALVE C
4916 – CD - 3 WAY MODULATING VALVE D
4917 – CD - 3 WAY MODULATING VALVE E

These options include a water connection kit, both supplied separately.
These options lead to an extension of the lead time. For further information, please contact our sales department.

2731 – Fluid pressure, cond. 16 bar

There is a mutual exclusion rule between this option and the following ones:
4914 – CD - 3 WAY MODULATING VALVE B
4915 – CD - 3 WAY MODULATING VALVE C
4916 – CD - 3 WAY MODULATING VALVE D
4917 – CD - 3 WAY MODULATING VALVE E

2721 – Fluid pressure, evap. 16 bar
2731 – Fluid pressure, cond. 16 bar
1283 – 4 pass condenser

These options lead to an extension of the lead time. For further information, please contact our sales department.

3431 – Refrigerant leak detector
3432 – Refrigerant leak detector + migration
3433 – Gas leak contact + compressors off

For the proper functioning of these options, it is recommended to equip the unit with one of the following two options:
2301 – Compressor acoustical enclosure
2314 – Integral acoustic enclosure plus

3481 – With internal leak detector

This accessory, in case of gas leaks, has a sensitivity equal to 27% of the total charge present in a single circuit, at nominal conditions and full load.

1541 – Multi Manager – Priority Master
1542 – Multi Manager – Non-Priority Master

These options are not compatible with options:
5922 - ClimaPRO ModBUS RS485 – MID
5923 - ClimaPRO BacNET over IP.

1541 – Multi Manager – Priority Master

This option is not compatible with options:
4866 – EV-VPF (M3000, CPRO, MM N-PR) (VPF option for plants with Manager3000, ClimaPro and Non-Priority Master)
4868 – EV-VPF.D(M3000, CPRO, MM N-PR) (VPF option for plants with Manager3000, ClimaPro and Non-Priority Master).

1542 – Multi Manager – Non-Priority Master

This option is not compatible with options:
4864 – EV-VPF (w/o DP)(SU, MM PR) (VPF option for plants with a Single Unit or for Priority Master units – plant side differential pressure transducer excluded).
4865 – EV-VPF (w DP)(SU, MM PR) (VPF option for plants with a Single Unit or for Priority Master units – plant side differential pressure transducer included).
4867 – EV-VPF.D (SU, MM PR) (VPF.D option for plants with a Single Unit or for Priority Master units).

4501 – Fast restart (UPS excluded)
4502 – Fast restart (UPS included)

The following tables show the first compressor start-up time and ramp-up time for 100% cooling capacity.
The time frames shown in Notes 1 and 2 are defined by the power restoration.

With the fast restart, each compressor can only start after 5’ from its previous start-up and 1’ 30’’ of off-time.

The fast restart can be activated only 2 times every 24 hours. It is possible to request the fast restart activation for 4 times every 24 hours (in this case the minimum off-time of each compressor will increase from 1’ 30’’ to 2’ 30’’).
For further information, please contact our sales department.

When the maximum number of fast restarts in a single 24 hour period is reached, the fast restart function is disabled and other potential restarts will follow the standard timing.
Once the 24 hours have passed, the fast restart function is automatically enabled again.

Note 1 - First compressor start-up time
Unit with fast restart (1) = 65”

Note 2 - Ramp-up time for 100% cooling capacity
Unit with fast restart (2)(3) = 5’10”

(1) Minimum time from its previous start-up and minimum off-time need to be fulfilled to start the compressor
(2) Reference conditions: plant (side) cooling exchanger water (in/out) 12°C/7°C; Source (side) heat exchanger water (in/out) 30°C/35°C
(3) Minimum time from their previous start-up and minimum off-time need to be fulfilled to start the compressors.

1561 – Double power supply (ATS)

In some units, the transfer switch may require an enlarged electrical board. This could entail a unit width increase. For further information, please contact our sales department.
The option may lead to an extension of the lead time, contact our sales department for information.

1801 - Evaporator water flow switch

The accessory is supplied loose.

6461 - HPC

This option requires the accessories Multi Manager (options 1541 or 1542) and KIPlink (options 6196 or 1441* or 1442* or 1443* or 1444*)
(*if available)

1540 - LAN Multi Manager

Up to 8 units (chillers or free-cooling chillers, with the same firmware version) can communicate via serial connection.
All the group functions are implemented with master/slave logic, with dynamic master.
Hereunder is a brief description of the main group functions, further details are available in the dedicated user manual.

- Load management
There are two possible load management logics: load sharing and sequencing.
- Load sharing: the load is distributed equally among the active units of the group.
- Sequencing: the units are activated one after the other. When the first unit is saturated (all the available resources are used), the second unit is activated, and so forth unit the load is fully covered.

- Dynamic master
In case of disconnection of the master unit, a new master is automatically elected among the other units, and the group functions remain active. The dynamic master function grants a backup solution to the net, overcoming the single point of failure typical of the static master architecture. Besides, it is possible to set the "master succession priority": in case of the master unit disconnection, the new master is elected among the units set as priority.

- Stand-by unit management
It is possible to set the number of unit that remain in stand-by, the load will be managed (with load sharing or sequencing) among the other units of the group. The stand-by unit rotation is automatic, according to the running hours equalization. A stand-by unit is immediately activated in case of total failure or disconnection of one of the active units of the group, or in case the water temperature exceeds the safety threshold.

- Restart in sequence
After a power black-out, this group function coordinates the compressor activation time of the different units and prevents from dangerous current picks due to simultaneous start-ups. Besides, it is possible to set the activation sequence of the units.

- Resource priority management
To make the most of the available cooling resources, it is possible to set the usage priority of each unit. The load management function will be adjusted accordingly. When available, the free-cooling is always given priority and is fully exploited before activating any compressor. Then the activation of the compressors follows the priority level assigned to the units.

- Auxiliary input
The auxiliary inputs are applied at a group level:
- 4-20 mA: remote set-point adjustments (analog input).
- Double set-point: remote switch between 2 set-points (digital input).
- Demand limit: remote signal to limit the unit's activable resources (digital input).

6461 – HPC

HPC is the new advanced and fully integrated control function designed by MEHITS for hydronic plant optimization. It connects MEHITS chillers and indoor CRAH units without any external devices.

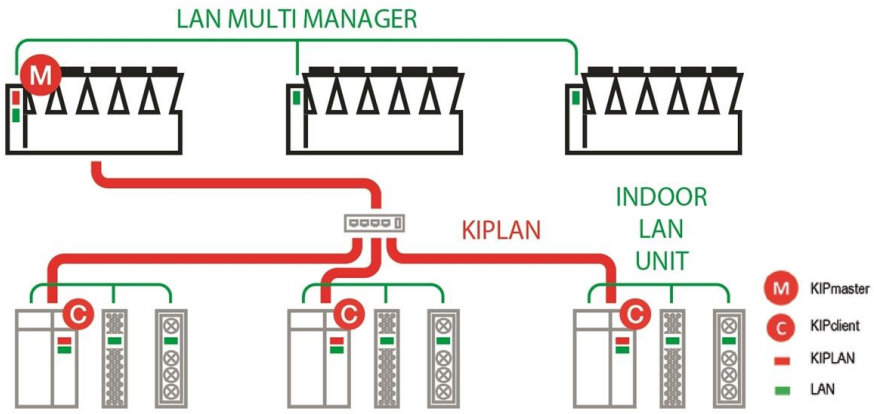
INFRASTRUCTURE

The HPC function is based on LAN groups and the KIPlink network (KIPLAN).

• Every indoor and outdoor unit must be equipped with KIPlink.
• Every outdoor unit must be equipped with Multi Manager.
• HPC supports up to 20 LAN groups of indoor air conditioners (max 15 units per group) and 1 LAN group of outdoor chillers (max 8 units).
• HPC requires a KIPLAN (KIPlink network) made up of one unit per each LAN group.
The result is a KIPLAN made of 1 chiller unit (KIP Master), and up to 20 indoor units (KIP Clients).
• KIPLAN network allows HPC data communication between the different LAN groups (indoor and outdoor).

KIPlink allows direct access to all HPC variables and parameters with devoted menus and pages.
The most important parameters are also available on the Compact/Large Keyboard.

Further information is available in the dedicated Manuals (W3000+, Evolution+, KIPlink).



WORKING LOGICS

The HPC control logics enhance the system efficiency leveraging on partial loads, redundant units, and favourable ambient conditions.
HPC acts on time intervals. The time lapse between each HPC action can be set from 1 to 500 minutes. The time left until the next action is visible in the KIPlink group interface section.
According to the instantaneous operating conditions detected in the chilled water system, HPC regulates: the chillers' set-point, the pumps' speed, and the indoor air conditioners' valves and fans.

The main variables taken into consideration are:
- Cooling demand of each indoor unit group (room temperature, fans' speed, valve opening),
- Chilled water temperature,
- Pumps' speed,
- Chillers' group operating status (outdoor air temperature, FC availability)

The highest benefits are achieved in systems with VSD pumps and free-cooling chillers.

IT cooling load satisfaction is paramount. HPC always gives priority to room cooling dependability. Therefore, actions are taken on the basis of the indoor unit groups' status.

There are 4 operating modes, in order of priority:

1. Reset
When the cooling demand of at least one group of indoor units suddenly increases.
HPC contribution is reset and suspended until the Reset message is active.
The system immediately increases the cooling capacity.

2. Reduce
When the cooling demand of at least one group of indoor units slightly increases.
HPC contribution is reduced. The system increases the cooling capacity.

3. Optimization On
When the cooling demand of all groups of indoor units remains stable or decreases.
HPC optimizes the system by increasing its contribution.

4. No Action
When the cooling demand of all groups of indoor units remains stable or decreases, but HPC has already pushed the system to the best performance achievable in the current conditions.
No further action is taken.

Further information is available in the dedicated Manuals (W3000+, Evolution+).

PLUS:
- Fully in house developed and patent pending
- Completely integrated, no need for any external devices
- Based on proprietary logics and devices (Multi Manager, KIPlink)
- Energy simulations, comparisons, and payback analysis available on ELCA software
- Ideal to complete the package of a MEHITS chilled water system (chillers and CRAHs)

Chiller Plant Control with Active Optimization System

ClimaPRO System Manager

ClimaPRO System Manager represents the state-of-the-art platform for chiller plant management and control.
ClimaPRO ensures to actively optimize the entire chiller plant by managing and adjusting each component directly involved in the production and the distribution of the heating and the cooling energies, therefore involving chillers and heat pumps, pumping groups as well as the source-side devices like, for example, the cooling towers.

In particular, ClimaPRO measures in real-time all the operating variables from the field, for each individual device and each of the main system branche, by using serial communication lines as well as dedicated analogue signals.

The acquired data are then compared with the design data of each single unit at any different working conditions, thus allowing to implement control strategies based on dynamic algorithms which take into account the real operating conditions.

On the basis of these values, an advanced diagnostic module also allows to assess the level of efficiency for each individual unit, translating data into easy-to-read information in order to simplify and optimize the maintenance activities.

The “Chart Builder” software module allows to display the trends of the main operating variables. The “Reporting” module allows to send reports to selected users, including data and system’s status of the main devices as well as to perform calculation of the energy indexes for each single unit and for the entire chiller plant.

The accessibility to ClimaPRO System Manager is ensured by an integrated web server that makes it visible from any computer equipped with a web browser, either locally or remotely.

[SI System]

i-FR2-W-G04-Z			0402	0502	0572	0702	0852	0942	1042	1242
Power supply		V/ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
PERFORMANCE										
COOLING ONLY (GROSS VALUE)										
Cooling capacity	(1)	**kW**	**618,7**	**777,6**	**872,6**	**1080**	**1313**	**1447**	**1572**	**1910**
EER	(1)	kW/kW	8,395	8,379	8,155	7,600	8,326	8,236	7,825	7,341
COOLING ONLY (GROSS VALUE)										
16°C/10°C										
Cooling capacity	(2)	kW	447,5	564,2	634,5	786,5	954,4	1051	1159	1389
EER	(2)	kW/kW	5,752	5,816	5,716	5,398	5,917	5,898	5,758	5,422
EXCHANGERS										
HEAT EXCHANGER USER SIDE IN COOLING										
Water flow	(1)	l/s	18,56	23,33	26,17	32,41	39,40	43,40	47,14	57,30
Pressure drop at the heat exchanger	(1)	kPa	28,5	28,6	29,0	32,4	32,2	32,0	31,7	33,2
HEAT EXCHANGER SOURCE SIDE IN REFRIGERATION										
Water flow	(1)	l/s	33,10	41,61	46,82	58,41	70,33	77,55	84,71	103,7
Pressure drop at the heat exchanger	(1)	kPa	64,9	62,6	68,8	66,3	73,1	69,4	67,0	68,2
REFRIGERANT CIRCUIT										
Compressors nr.		N°	2	2	2	2	2	2	2	2
Number of capacity steps		N°	0	0	0	0	0	0	0	0
No. Circuits		N°	2	2	2	2	2	2	2	2
Regulation			2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS
Min. capacity step		%	-	-	-	-	-	-	-	-
Refrigerant			R1234ze	R1234ze	R1234ze	R1234ze	R1234ze	R1234ze	R1234ze	R1234ze
Theoretical refrigerant charge		kg	118	142	142	223	246	258	271	299
Oil charge		kg	36,0	36,0	36,0	36,0	70,0	70,0	70,0	70,0
Rc (ASHRAE)	(3)	kg/kW	0,30	0,28	0,25	0,32	0,29	0,28	0,26	0,24
NOISE LEVEL										
Total sound Pressure	(4)	dB(A)	81	83	83	84	79	82	82	83
Total sound power level in cooling	(5)(6)	dB(A)	100	102	102	104	99	102	102	103
SIZE AND WEIGHT										
A	(7)	mm	3540	3540	3580	4730	4730	4730	4730	4800
B	(7)	mm	1520	1520	1595	1630	1710	1710	1710	1810
H	(7)	mm	2140	2140	2140	2140	2200	2200	2200	2450
Operating weight	(7)	kg	4750	5030	5090	6280	7590	7890	8300	9400

Notes:
1 Plant (side) cooling exchanger water (in/out) 28,00°C/20,00°C; Source (side) heat exchanger water (in/out) 30,00°C/35,00°C.
2 User side heat exchanger water temperature (in/out) 16°C/10°C; source side heat exchanger water temperature (in/out) 30°C/35°C.
3 Rated in accordance with AHRI Standard 550/590
4 Average sound pressure level at 1m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.
5 Sound power on the basis of measurements taken in compliance with ISO 9614.
6 Sound power level in cooling, indoors.
7 Unit in standard configuration, without optional accessories.
- Not available

[SI System]

i-FR2-W-G04-Z + HWT kit			0402	0502	0702	0852	0942	1042	1242
Power supply		V/ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
PERFORMANCE									
COOLING ONLY (GROSS VALUE)									
Cooling capacity	(1)	**kW**	**638,3**	**775,3**	**1092**	**1324**	**1451**	**1603**	**1924**
EER	(1)	kW/kW	8,039	7,855	7,050	7,531	7,291	6,895	6,327
COOLING ONLY (GROSS VALUE)									
16°C/10°C									
Cooling capacity	(2)	kW	463,0	562,0	786,8	962,9	1055	1167	1404
EER	(2)	kW/kW	5,809	5,729	5,252	5,715	5,579	5,343	5,005
EXCHANGERS									
HEAT EXCHANGER USER SIDE IN COOLING									
Water flow	(1)	l/s	19,15	23,26	32,77	39,71	43,52	48,07	57,71
Pressure drop at the heat exchanger	(1)	kPa	30,4	28,4	33,1	32,7	32,2	32,9	33,7
HEAT EXCHANGER SOURCE SIDE IN REFRIGERATION									
Water flow	(1)	l/s	34,30	41,76	59,56	71,64	78,81	87,62	106,3
Pressure drop at the heat exchanger	(1)	kPa	69,7	63,1	69,0	75,8	71,6	71,6	71,8
REFRIGERANT CIRCUIT									
Compressors nr.		N°	2	2	2	2	2	2	2
Number of capacity steps		N°	0	0	0	0	0	0	0
No. Circuits		N°	2	2	2	2	2	2	2
Regulation			2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS	2xSTEPSLESS
Min. capacity step		%	-	-	-	-	-	-	-
Refrigerant			R1234ze	R1234ze	R1234ze	R1234ze	R1234ze	R1234ze	R1234ze
Theoretical refrigerant charge		kg	118	142	223	246	258	271	299
Oil charge		kg	36,0	36,0	36,0	70,0	70,0	70,0	70,0
Rc (ASHRAE)	(3)	kg/kW	0,29	0,28	0,32	0,29	0,27	0,26	0,24
NOISE LEVEL									
Total sound Pressure	(4)	dB(A)	81	83	84	79	82	82	83
Total sound power level in cooling	(5)(6)	dB(A)	100	102	104	99	102	102	103
SIZE AND WEIGHT									
A	(7)	mm	3540	3540	4730	4730	4730	4730	4800
B	(7)	mm	1520	1520	1630	1710	1710	1710	1810
H	(7)	mm	2140	2140	2140	2200	2200	2200	2450
Operating weight	(7)	kg	4750	5030	6280	7590	7890	8300	9400

Notes:
1 Plant (side) cooling exchanger water (in/out) 28,00°C/20,00°C; Source (side) heat exchanger water (in/out) 30,00°C/35,00°C.
2 User side heat exchanger water temperature (in/out) 16°C/10°C; source side heat exchanger water temperature (in/out) 30°C/35°C.
3 Rated in accordance with AHRI Standard 550/590
4 Average sound pressure level at 1m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.
5 Sound power on the basis of measurements taken in compliance with ISO 9614.
6 Sound power level in cooling, indoors.
7 Unit in standard configuration, without optional accessories.
- Not available

[SI System]

ENERGY EFFICIENCY

SEASONAL EFFICIENCY IN COOLING (Reg. EU 2016/2281)
High temperature process cooling

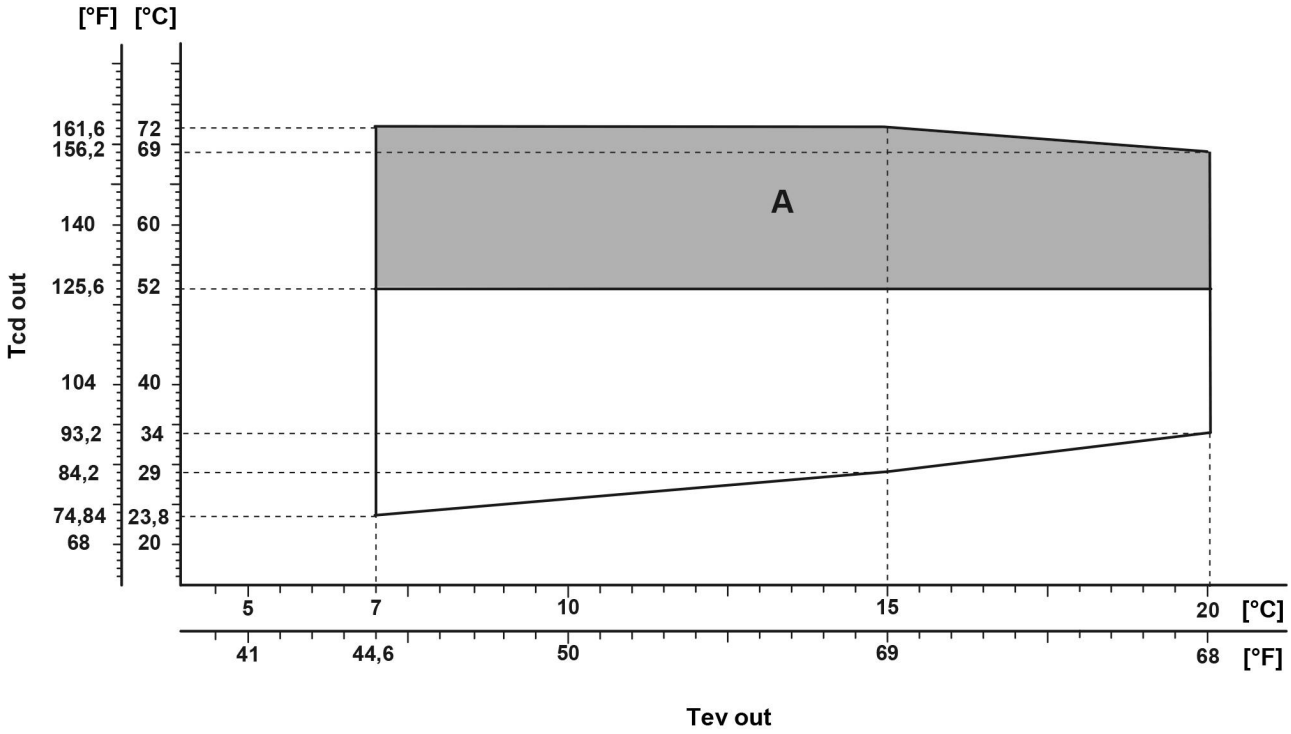
i-FR2-W-G04-Z			0402	0502	0572	0702	0852	0942	1042	1242
Prated,c	(1)	kW	399,88	504,70	568,09	704,19	854,18	941,19	1041,90	1244,00
SEPR HT	(1) (3)	-	9,14	9,21	9,14	8,96	9,40	9,33	9,20	8,97

i-FR2-W-G04-Z + HWT kit			0402	0502	0702	0852	0942	1042	1242
Prated,c	(1)	kW	414,10	502,69	702,10	862,26	945,16	1045,87	1258,00
SEPR HT	(1) (3)	-	9,07	9,06	8,46	8,60	8,49	8,28	8,03

SEASONAL EFFICIENCY IN COOLING (Reg. EU 2015/1095)
Process refrigeration at medium temperature

Notes:
(1) Seasonal energy efficiency of high temperature process cooling [REGULATION (EU) N. 2016/2281]
(2) Seasonal Energy Efficiency of Process Cooling at Medium Temperature [REGULATION (EU) N. 2015/1095]
(3) Seasonal energy efficiency ratio
The units highlighted in this publication contain R1234ze [GWP_{100} 1] fluorinated greenhouse gases.
Data certified in EUROVENT

9.1 Operating limits - Graphs



Tev out Evaporator leaving water temperature

Tcd out Condenser leaving water temperature

A Required: Kit HWT (code 1953)

It is possible to use a mixture of water and glycol on the evaporator side.
Only ethylene glycol is available and can be used in a maximum percentage up to 35%.

For the limits of single size and version refer to software Elca World

9.2 ETHYLENE GLYCOL MIXTURE

Ethylene glycol and water mixture, used as a heat-conveying fluid, cause a variation in unit performance. For correct data, use the factors indicated in the following tabel.

	Freezing point (°C)							
	0	-5	-10	-15	-20	-25	-30	-35
	Ethylene glycol percentage by weight							
	0%	12%	20%	30%	35%	40%	45%	50%
cPf	1	0,985	0,98	0,974	0,97	0,965	0,964	0,96
cQ	1	1,02	1,04	1,075	1,11	1,14	1,17	1,2
cdp	1	1,07	1,11	1,18	1,22	1,24	1,27	1,3

cPf: cooling power correction factor
cQ: flow correction factor
cdp: pressure drop correction factor

For data concerning other kind of anti-freeze solutions (e,g, propylene glycol) please contact our Sale Department.

9.3 FOULING FACTORS

Performances are based on clean condition of tubes (fouling factor = 1). For different fouling values, performance should be adjusted using the correction factors shown in the following table.

SERIES	FOULING FACTORS	EVAPORATOR			CONDENSER/RECOVERY			DESUPERHEATER
	ff (m² °CW)	F1	FK1	KE [°C]	F2	FK2	KC [°C]	R3
VARIOUS	0	1,000	1,000	0,0	1,000	1,000	0,0	1,000
VARIOUS	$1{,}80 \times 10^{-5}$	1,000	1,000	0,0	1,000	1,000	0,0	1,000
VARIOUS	$4{,}40 \times 10^{-5}$	1,000	1,000	0,0	0,990	1,030	1,0	0,990
VARIOUS	$8{,}80 \times 10^{-5}$	0,960	0,990	0,7	0,980	1,040	1,5	0,980
VARIOUS	$13{,}20 \times 10^{-5}$	0,944	0,985	1,0	0,964	1,050	2,3	0,964
VARIOUS	$17{,}20 \times 10^{-5}$	0,930	0,980	1,5	0,950	1,060	3,0	0,950

ff: fouling factors
F1 - F2: potential correction factors
FK1 - FK2: compressor power input correction factors
R3: capacity correction factors
KE: minimum evaporator outlet temperature increase
KC: maximum condenser outlet temperature decrease

[SI System]

Water flow and pressure drop

Water flow in the plant (side) exchanger is given by:
Q=P/(4,186 x Dt)
Q: water flow (l/s)
Dt: difference between inlet and outlet water temp. (°C)
P: heat exchanger capacity (kW)

Pressure drop is given by:
Dp= K x (3,6 x Q)^2/1000
Q: water flow (l/s)
Dp: pressure drop (kPa)
K: unit size ratio

SIZE	Power supply V/ph/Hz	HEAT EXCHANGER USER SIDE					HEAT EXCHANGER SOURCE SIDE			
		K	Q min l/s	Q max l/s	C.A.S. l	C.a. min l	K [1]	Q min [2] l/s	Q max l/s	C.A.S. l
i-FR2-W-G04-Z /0402	400/3/50	6,39	11,81	29,17	89,0	1390	4,57	14,17	34,72	94,0
i-FR2-W-G04-Z /0502	400/3/50	4,05	14,72	36,11	104	1760	2,79	18,06	44,44	119
i-FR2-W-G04-Z /0572	400/3/50	3,27	16,11	40,00	125	1980	2,42	18,89	46,94	124
i-FR2-W-G04-Z /0702	400/3/50	2,38	20,56	51,39	205	2460	1,50	25,56	63,06	242
i-FR2-W-G04-Z /0852	400/3/50	1,60	25,00	62,22	250	2970	1,14	29,17	71,67	279
i-FR2-W-G04-Z /0942	400/3/50	1,31	27,50	68,89	272	3280	0,89	32,78	81,11	310
i-FR2-W-G04-Z /1042	400/3/50	1,10	30,00	75,28	312	3640	0,72	36,39	89,72	357
i-FR2-W-G04-Z /1242	400/3/50	0,78	35,83	89,17	397	4350	0,49	44,44	109,7	463
i-FR2-W-G04-Z /0402 /HWT	400/3/50	6,39	11,81	29,17	89,0	1390	4,57	14,17	34,72	94,0
i-FR2-W-G04-Z /0502 /HWT	400/3/50	4,05	14,72	36,11	104	1760	2,79	18,06	44,44	119
i-FR2-W-G04-Z /0702 /HWT	400/3/50	2,38	20,56	51,39	205	2460	1,50	25,56	63,06	242
i-FR2-W-G04-Z /0852 /HWT	400/3/50	1,60	25,00	62,22	250	2970	1,14	29,17	71,67	279
i-FR2-W-G04-Z /0942 /HWT	400/3/50	1,31	27,50	68,89	272	3280	0,89	32,78	81,11	310
i-FR2-W-G04-Z /1042 /HWT	400/3/50	1,10	30,00	75,28	312	3640	0,72	36,39	89,72	357
i-FR2-W-G04-Z /1242 /HWT	400/3/50	0,78	35,83	89,17	397	4350	0,49	44,44	109,7	463

The coefficient "K" on the source side heat exchanger is referred to its standart selection. When it's required to move to an higher number of steps water side (with delta T >=10°C), "K" coefficient as to be multiplied for 8,5 (Knew = K x 8,5)

Q min: minimum water flow admitted to the heat exchanger

Q min [2]: minimum water flow admitted to the heat exchanger

Q max: maximum water flow admitted to the heat exchanger

C.a. min: minimum water content admitted in the plant

C.A.S.: Exchanger water content

11.1 ELECTRIC DATA

[SI System]

i-FR2-W-G04-Z

SIZE	Power supply V/ph/Hz	Maximum values						
		Compressor				Total (1)		
		n	F.L.I. [kW]	F.L.A. [A]	L.R.A. [A]	F.L.I. [kW]	F.L.A. [A]	S.A. [A]
0402	400/3/50	2	2x67.9	2x115.3	2x20	135,8	231	-
0502	400/3/50	2	2x84	2x140.7	2x20	168,1	281	-
0572	400/3/50	2	2x94.5	2x157.2	2x20	188,9	314	-
0702	400/3/50	2	2x119	2x196	2x20	237,9	392	-
0852	400/3/50	2	2x127.5	2x211	2x20	255,0	422	-
0942	400/3/50	2	2x141.9	2x233	2x20	283,8	466	-
1042	400/3/50	2	2x161.6	2x264	2x20	323,2	528	-
1242	400/3/50	2	2x200	2x327	2x20	400,0	654	-

F.L.I.: Full load power
F.L.A.: Full load current
L.R.A.: Locked rotor amperes for single compressor
S.A.: Inrush current

(1) Safety values to be considered when cabling the unit for power supply and line-protections

Data valid for standard units without any additional option.

Voltage tolerance: 10%
Maximum voltage unbalance: 2%

Given the typical operating conditions of units designed for indoor installation, which can be associated (according to reference document IEC 60721) to the following classes:
- climatic conditions class AA4: air temperature range from 5 up to 42°C (*)
- special climatic conditions negligible
- presence of water class AD2: possibility of water dripping inside the technical room
- biological conditions class 4B1 and 4C2: negligible presence of corrosive and polluting substances
- mechanically active substances class 4S2: locations in areas with sand or dust sources

The required protection level for safe operation, according to reference document IEC 60529, is IP21 BW (protection against access of external devices with diameter larger than 12 mm and water falling vertically).
The unit can be considered IP21 CW protected, thus fulfilling the above operating conditions.

(*) for the unit's operating limits, see "selection limits" section

[SI System]

i-FR2-W-G04-Z + HWT kit

SIZE	Power supply V/ph/Hz	Maximum values						
		Compressor				Total (1)		
		n	F.L.I. [kW]	F.L.A. [A]	L.R.A. [A]	F.L.I. [kW]	F.L.A. [A]	S.A. [A]
0402	400/3/50	2	2x87.5	2x144.6	2x20	175,0	289	-
0502	400/3/50	2	2x107	2x174.3	2x20	214,0	349	-
0702	400/3/50	2	2x164	2x261	2x20	328,0	522	-
0852	400/3/50	2	2x193.5	2x313	2x20	387,0	626	-
0942	400/3/50	2	2x216	2x348	2x20	432,0	696	-
1042	400/3/50	2	2x244	2x391	2x20	488,0	782	-
1242	400/3/50	2	2x285	2x459	2x20	570,0	918	-

F.L.I.: Full load power
F.L.A.: Full load current
L.R.A.: Locked rotor amperes for single compressor
S.A.: Inrush current

(1) Safety values to be considered when cabling the unit for power supply and line-protections

Data valid for standard units without any additional option.

Voltage tolerance: 10%
Maximum voltage unbalance: 2%

Given the typical operating conditions of units designed for indoor installation, which can be associated (according to reference document IEC 60721) to the following classes:
- climatic conditions class AA4: air temperature range from 5 up to 42°C (*)
- special climatic conditions negligible
- presence of water class AD2: possibility of water dripping inside the technical room
- biological conditions class 4B1 and 4C2: negligible presence of corrosive and polluting substances
- mechanically active substances class 4S2: locations in areas with sand or dust sources

The required protection level for safe operation, according to reference document IEC 60529, is IP21 BW (protection against access of external devices with diameter larger than 12 mm and water falling vertically).
The unit can be considered IP21 CW protected, thus fulfilling the above operating conditions.

(*) for the unit's operating limits, see "selection limits" section

11.2 Dimensions of the electrical connections to the main switch

Maximum cables/bars section connected to main switch and short time current

<table>
<tr><th>SIZE</th><th>STD</th><th>HT</th><th>ICW (0,3s) Short time current rms (STD) [kA]</th><th>ICW (0,3s) Short time current rms (HT) [kA]</th><th>Cable section (STD) ∅ [mm²]</th><th>Bar dimensions (STD) ☐ [mm]</th><th>Cable section (HT) ∅ [mm²]</th><th>Bar dimensions (HT) ☐ [mm]</th><th>Additional technical information</th></tr>
<tr><td>0402</td><td rowspan="2">SIRCO B5 3X400A</td><td>SIRCO B5 3X400A</td><td rowspan="5">25</td><td rowspan="3">25</td><td rowspan="2">min 185 max 240</td><td rowspan="2"></td><td>min 185 max 240</td><td></td><td rowspan="11">https://www.socomec.com/files/live/sites/systemsite/files/DOCUMENTATION/SCP_hors_cata/dcg_145023uk.pdf</td></tr>
<tr><td>0452</td><td rowspan="2">SIRCO B5 3X630A</td><td rowspan="2">min 2x150 max 2x300</td><td rowspan="2">min 2x30x5 max 2x50x5</td></tr>
<tr><td>0502</td><td rowspan="2">SIRCO B5 3X630A</td></tr>
<tr><td>0572</td><td rowspan="3">SIRCO B5 3X630A</td><td rowspan="3">min 2x150 max 2x300</td><td rowspan="3">min 2x30x5 max 2x50x5</td></tr>
<tr><td>0632</td><td rowspan="3">SIRCO B6 3X800A</td><td rowspan="3">50</td></tr>
<tr><td>0702</td></tr>
<tr><td>0762</td><td rowspan="3">min 2x185 max 2x300</td><td rowspan="3">min 2x40x5 max 2x63x5</td></tr>
<tr><td>0852</td><td rowspan="4">50</td><td rowspan="4">50</td></tr>
<tr><td>0942</td><td rowspan="4">min 2x185 max 2x300</td><td rowspan="4">min 2x40x5 max 2x63x5</td></tr>
<tr><td>1042</td><td rowspan="3">SIRCO B6 3X800A</td></tr>
<tr><td>1122</td><td>SIRCO B6 3X1000A</td><td>min 2x240 max 4x185</td><td>min 2x50x5 max 2x63x5</td></tr>
<tr><td>1242</td><td>SIRCO B6 3X1250A</td><td>max 4x185</td><td>min 2x60x5 max 2x63x5</td></tr>
</table>

i-FR2-W-G04-Z

SOUND POWER LEVEL IN COOLING									
SIZE	Octave band [Hz]								Total sound level dB(A)
	63	125	250	500	1000	2000	4000	8000	
	Sound power level dB								
0402	65	78	81	95	97	92	88	81	**100**
0502	67	80	83	97	99	94	90	83	**102**
0572	67	80	83	97	99	94	90	83	**102**
0702	69	82	85	99	101	96	92	85	**104**
0852	86	85	86	96	95	91	88	78	**99**
0942	89	88	89	99	98	94	91	81	**102**
1042	89	88	89	99	98	94	91	81	**102**
1242	90	89	90	100	99	95	92	82	**103**

Working conditions
Plant (side) cooling exchanger water (in/out) 28,00°C/20,00°C; Source (side) heat exchanger water (in/out) 30,00°C/35,00°C.
Sound power on the basis of measurements taken in compliance with ISO 9614.
Such certification refers specifically to the sound Power Level in dB(A). This is therefore the only acoustic data to be considered as binding.
Sound power level in cooling, indoors.

i-FR2-W-G04-Z

SOUND PRESSURE LEVEL									
SIZE	Octave band [Hz]								Total sound level dB(A)
	63	125	250	500	1000	2000	4000	8000	
	Sound pressure level dB								
0402	46	59	62	76	78	73	69	62	**81**
0502	48	61	64	78	80	75	71	64	**83**
0572	48	61	64	78	80	75	71	64	**83**
0702	49	62	65	79	81	76	72	65	**84**
0852	66	65	66	76	75	71	68	58	**79**
0942	69	68	69	79	78	74	71	61	**82**
1042	69	68	69	79	78	74	71	61	**82**
1242	70	69	70	80	79	75	72	62	**83**

Working conditions
Plant (side) cooling exchanger water (in/out) 28,00°C/20,00°C; Source (side) heat exchanger water (in/out) 30,00°C/35,00°C.
Average sound pressure level at 1m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.

i-FR2-W-G04-Z + HWT kit

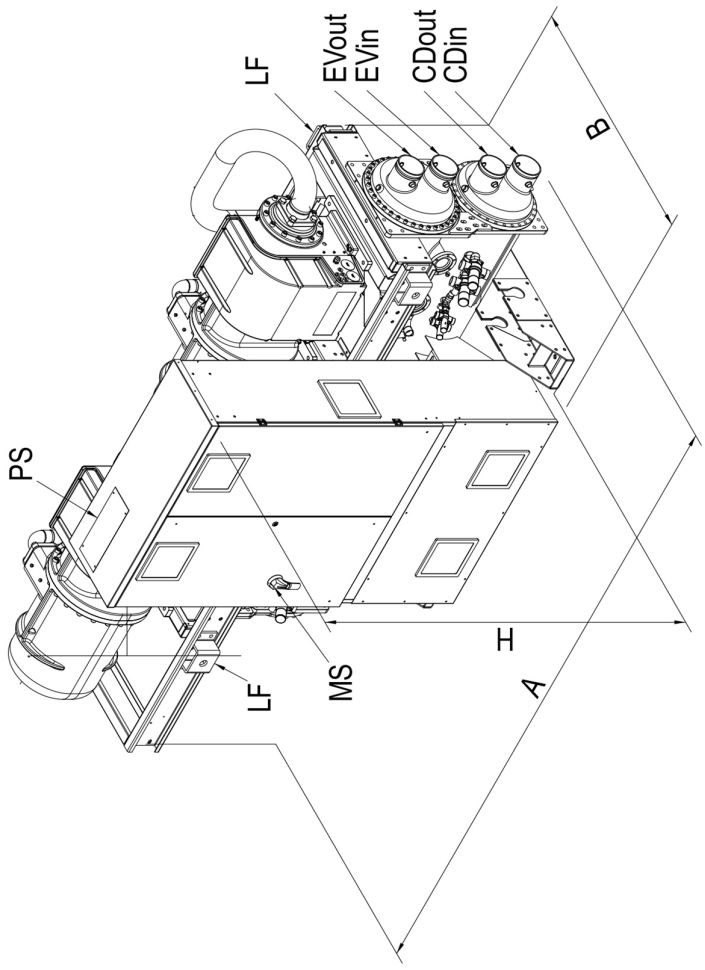
SOUND POWER LEVEL IN COOLING									
SIZE	Octave band [Hz]								Total sound level dB(A)
	63	125	250	500	1000	2000	4000	8000	
	Sound power level dB								
0402	65	78	81	95	97	92	88	81	**100**
0502	67	80	83	97	99	94	90	83	**102**
0702	69	82	85	99	101	96	92	85	**104**
0852	86	85	86	96	95	91	88	78	**99**
0942	89	88	89	99	98	94	91	81	**102**
1042	89	88	89	99	98	94	91	81	**102**
1242	90	89	90	100	99	95	92	82	**103**

Working conditions
Plant (side) cooling exchanger water (in/out) 28,00°C/20,00°C; Source (side) heat exchanger water (in/out) 30,00°C/35,00°C.
Sound power on the basis of measurements taken in compliance with ISO 9614.
Such certification refers specifically to the sound Power Level in dB(A). This is therefore the only acoustic data to be considered as binding.
Sound power level in cooling, indoors.

i-FR2-W-G04-Z + HWT kit

SOUND PRESSURE LEVEL									
SIZE	Octave band [Hz]								Total sound level dB(A)
	63	125	250	500	1000	2000	4000	8000	
	Sound pressure level dB								
0402	46	59	62	76	78	73	69	62	**81**
0502	48	61	64	78	80	75	71	64	**83**
0702	49	62	65	79	81	76	72	65	**84**
0852	66	65	66	76	75	71	68	58	**79**
0942	69	68	69	79	78	74	71	61	**82**
1042	69	68	69	79	78	74	71	61	**82**
1242	70	69	70	80	79	75	72	62	**83**

Working conditions
Plant (side) cooling exchanger water (in/out) 28,00°C/20,00°C; Source (side) heat exchanger water (in/out) 30,00°C/35,00°C.
Average sound pressure level at 1m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.



EVin Entrata acqua evaporatore
Evaporator water inlet

EVout Uscita acqua evaporatore
Evaporator water outlet

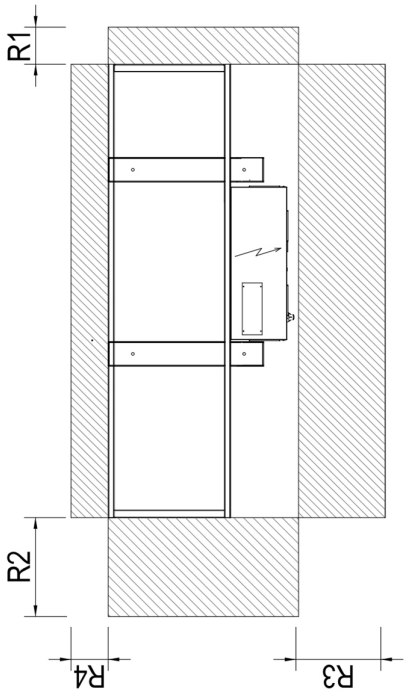
CDin Entrata acqua condensatore
Condenser water inlet

CDout Uscita acqua condensatore
Condenser water outlet

LF Punti di sollevamento
Lifting points

PS Ingresso linea elettrica
Power inlet

MS Sezionatore generale
Main isolator



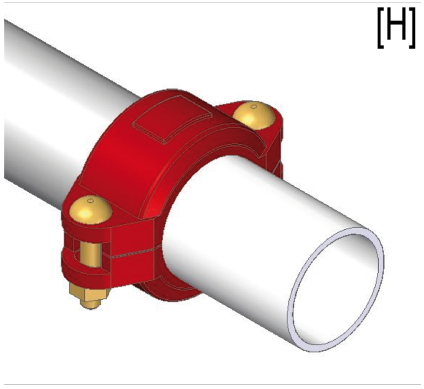
- Oltre agli spazi di rispetto specificati qui sopra, viene richiesto anche di rispettare uno spazio in altezza di 600 mm al di sopra dell'unità.
- In addition to the clearance spaces specified above, it is also required to respect a space in height of 600 mm above the unit.

REMARKS:For installation purposes, please refer to the documentation sent after the purchase-contract. This technical data should be considered as indicative. Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A. may modify them at any moment. Data valid for standard units without any additional option.

[SI System]

SIZE	DIMENSIONS AND WEIGHTS				CLEARANCE				HEAT EXCHANGER USER SIDE		HEAT EXCHANGER SOURCE SIDE	
	A	B	H	WEIGHT	R1	R2	R3	R4	IN/OUT		IN/OUT	
	[mm]	[mm]	[mm]	[kg]	[mm]	[mm]	[mm]	[mm]	TYPE	Ø	TYPE	Ø
i-FR2-W-G04-Z /0402	3540	1520	2140	4750	1000	2600	900	500	H	5"	H	5"
i-FR2-W-G04-Z /0502	3540	1520	2140	5030	1000	2600	900	500	H	5"	H	5"
i-FR2-W-G04-Z /0572	3580	1595	2140	5090	1000	2600	900	500	H	5"	H	5"
i-FR2-W-G04-Z /0702	4730	1630	2140	6280	1000	4000	900	500	H	6"	H	6"
i-FR2-W-G04-Z /0852	4730	1710	2200	7590	1000	4000	900	500	H	6"	H	6"
i-FR2-W-G04-Z /0942	4730	1710	2200	7890	1000	4000	900	500	H	6"	H	6"
i-FR2-W-G04-Z /1042	4730	1710	2200	8300	1000	4000	900	500	H	8"	H	8"
i-FR2-W-G04-Z /1242	4800	1810	2450	9400	1000	4000	900	500	H	8"	H	8"
i-FR2-W-G04-Z /0402 /HWT	3540	1520	2140	4750	1000	2600	900	500	H	5"	H	5"
i-FR2-W-G04-Z /0502 /HWT	3540	1520	2140	5030	1000	2600	900	500	H	5"	H	5"
i-FR2-W-G04-Z /0702 /HWT	4730	1630	2140	6280	1000	4000	900	500	H	6"	H	6"
i-FR2-W-G04-Z /0852 /HWT	4730	1710	2200	7590	1000	4000	900	500	H	6"	H	6"
i-FR2-W-G04-Z /0942 /HWT	4730	1710	2200	7890	1000	4000	900	500	H	6"	H	6"
i-FR2-W-G04-Z /1042 /HWT	4730	1710	2200	8300	1000	4000	900	500	H	8"	H	8"
i-FR2-W-G04-Z /1242 /HWT	4800	1810	2450	9400	1000	4000	900	500	H	8"	H	8"

13.2 Legend of pipe connections



TYPE = H
[H] - Grooved coupling with weld end counter-pipe user side

NOMINAL PIPE SIZE	PIPE OUTSIDE DIAMETER
ø inches	ø mm
3/4	26,7
1	33,7
1 1/4	42,4
1 1/2	48,3
2	60,3
2 1/2	76,1
3	88,9
3 1/2	101,6

NOMINAL PIPE SIZE	PIPE OUTSIDE DIAMETER
ø inches	ø mm
4	114,3
4 1/2	127,0
5	139,7
6	168,3
8	219,1
10	273,0
12	323,9
14	355,6

UNI ISO 228/13
Pipe threads where pressure-tight joints are not made on the threads - Designation, dimensions and tolerances
Used terminology:
G: Pipe threads where pressure-tight joints are not made on the threads
A: Close tolerance class for external pipe threads where pressure-tight joints are not made on the threads
B: Wider tolerance class for external pipe threads where pressure-tight joints are not made on the threads
Internal threads: G letter followed by thread mark (only tolerance class)
External threads: G letter followed by thread mark and by A letter for A class external threads or by B letter for B class external threads.

UNI EN 10226-1
Pipe threads where pressure-tight joints are made on the threads - Designation, dimensions and tolerances
Used terminology:
Rp: Internal cylindrical threads where pressure-tight joints are made on the threads
Rc: Internal conical threads where pressure-tight joints are made on the threads
R: External conical threads where pressure-tight joints are made on the threads
Internal cylindrical threads: R letter followed by p letter
Internal conical threads: R letter followed by c letter
External conical threads: R letter

NOTE:
Conventional diameter value [in inches] identifi es short thread designation, based upon the relative standard.
All relative values are defi ned by standards.

14.1 Variable flow control

Pump energy consumption significantly impacts plant running costs, but it can be considerably reduced thanks to the use of variable speed pumps (inverter driven pumps), capable of adjusting the water flow rate according to the actual plant thermal load.
Mitsubishi Electric Hydronics & Cooling Systems has developed the VPF control series (Variable Primary Flow), that provides different water flow regulation logics specifically devoted to various hydraulic plant solutions: only a primary circuit, primary and secondary circuits, single unit or multi-unit systems controlled with external controller (Manager 3000, ClimaPRO) or with 1541, 1542 Multi Manager options.
The VPF systems adjust the pump speeds on the basis of the plant's thermal load and optimize the unit's thermoregulation algorithm for variable flow operation, in a dynamic and simultaneous way. This ensures the highest energy savings, stable operation, and complete reliability.

VPF SYSTEM (delta P control)
For plants with only a primary circuit

VPF - Plant and unit requirements

The VPF logic provides the variable flow control for the plant's primary circuit.

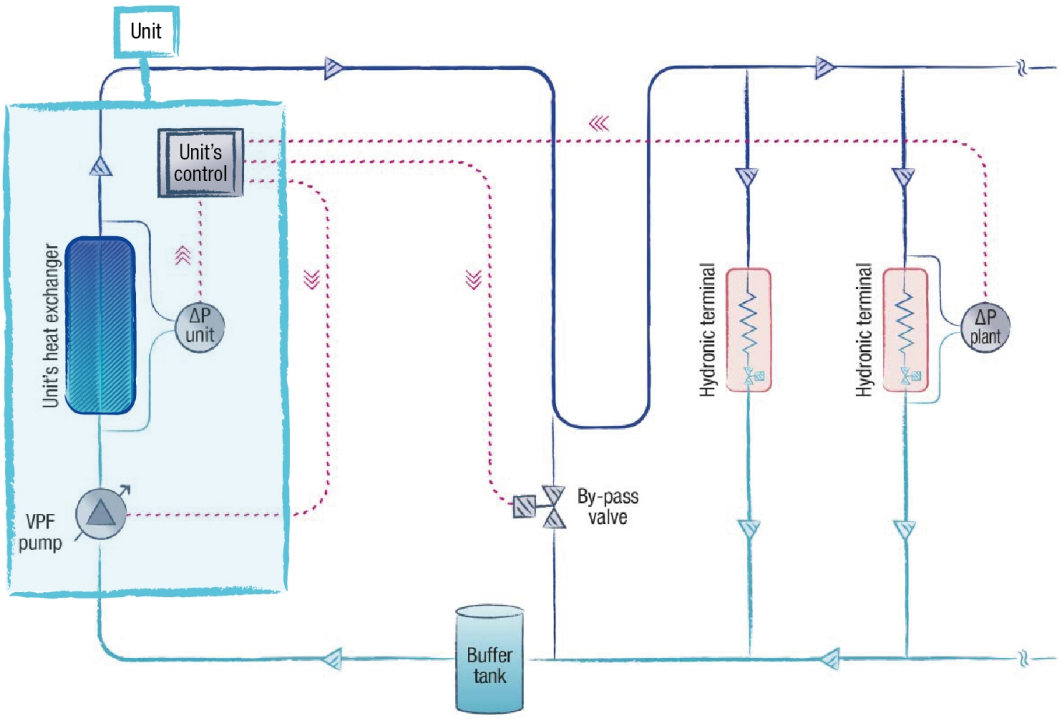
- Type of plant: primary circuit only, that feeds hydronic terminals fitted with a 2-way regulating valve

- Hydronic module: modulating regulation devices (0-10V signal) or variable speed pumps

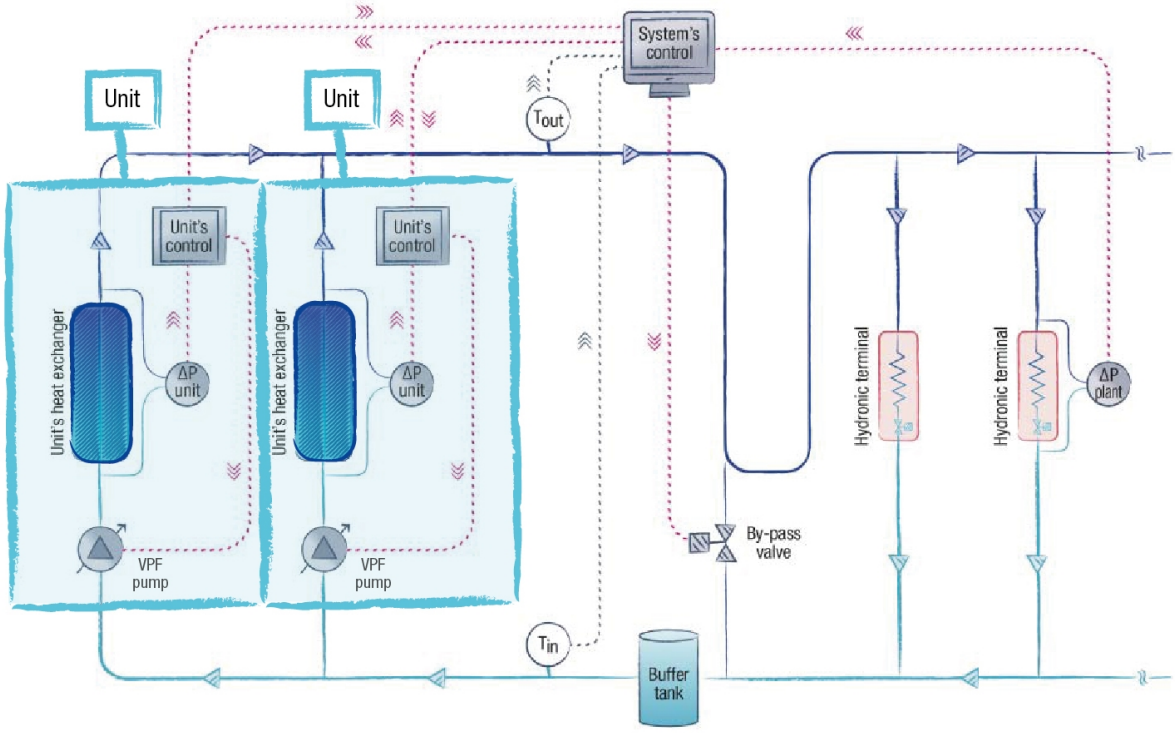
- Unit thermoregulation: control of the leaving water temperature

- Monitored parameter: delta P on relevant users' hydronic terminal

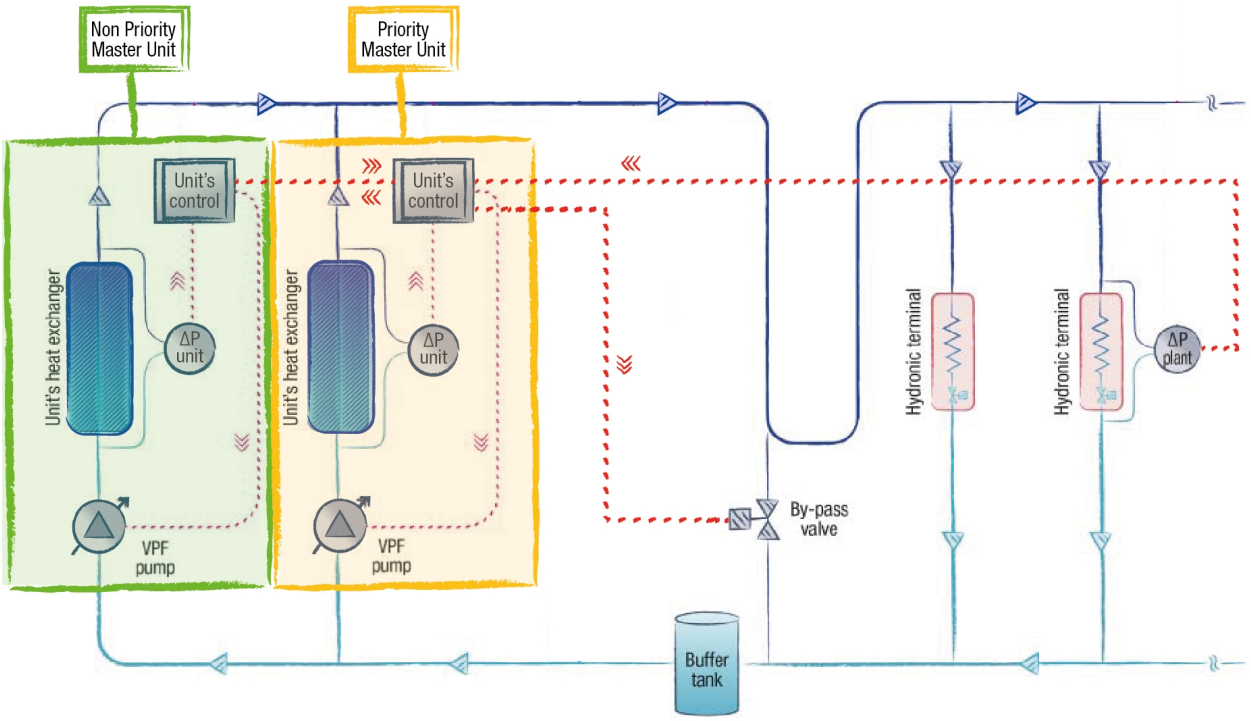
Plant diagram for single unit system



Plant diagram for multi-unit with external control system (Manager3000 or ClimaPRO)



Plant diagram for multi-unit system with Multi Manager



VPF - Operating logic

Water flow regulation

The VPF system monitors the differential pressure on the plant side (ΔP) and adjusts the pump speed in order to keep it within a defined range (ΔPmin ΔPmax).

- If ΔPmin ≤ ΔP ≤ ΔPmax
The plant water flow is appropriate to the thermal load, the pump speed is kept constant.

- If ΔP > ΔPmax
The plant water flow exceeds what is necessary to properly cover the thermal load, the pump speed is reduced to save pump energy.

- If ΔP < ΔPmin
The plant water flow is too low to ensure the proper feed to the hydronic terminals, the pump speed is increased.

With the VPF system, the water flow can be reduced to 50% of the unit nominal water flow, with regards to the selection conditions, provided that the minimum water flow required by the unit's heat exchanger is respected (the control of the heat exchanger's minimum water flow is described below).
The pump speed regulation is performed with little progressive adjustments while continuously monitoring the values of both the delta P on the plant side and the water temperature on the heat exchanger. The absence of abrupt water flow changes prevents fluctuation due to possible conflicts with the unit's thermoregulation function (compressor regulation).

Control of the unit's minimum water flow

Under no circumstances can the primary circuit water flow be reduced below the minimum water flow required by the unit's heat exchanger.
The monitoring of the unit's water flow is performed through a factory installed differential pressure transducer on the unit's heat exchanger.
If the differential pressure on the plant side requests a users' water flow lower than the unit's minimum water flow, the VPF system commands the gradual opening of the hydraulic by-pass valve (safety function). This ensures that the minimum water flow required by the unit's heat exchanger is always provided. As soon as the hydronic terminals request an increase of the water flow ($\Delta P < \Delta Pmin$), the VPF closes the by-pass valve.

Multi-unit systems

The VPF control logic is also the same for multi-unit systems.
The plant side differential pressure transducer reading and the by-pass valve opening are managed by the multi-unit control system (Manager3000, ClimaPRO, Multi Manager Master).
Each unit autonomously adjusts its pump speed on the basis of the information provided by the multi-unit control system.
When the plant load requests the activation of a stand-by unit, the multi-unit control system calculates the starting speed of its pump in order to avoid excessive water flow variation of the running units.

In case of multi-unit system with Multi Manager, at least one unit must be set as Priority Master (opt 1541). To grant redundancy to the system, more than one unit can be configured as Priority Master. All the Priority Masters must be connected to the differential pressure transducer and the by-pass valve. The Multi Manager system only takes into account the signal read and sent by the Master of the moment (a specific filtering device is part of the supply; see the table below, note (8).
The Non Priority Master cannot be connected to differential pressure transducer and by-pass valve and cannot managed the VPF function. In the event that a Non Priority Master is elected as the Master of the system, the VPF function is suspended.

VPF - Devices and installation

Device	Accessory name		
	VPF (w/o DP)(SU, MM_PR) (1)	VPF (w DP)(SU, MM_PR) (2)	VPF (M3000, CPRO, MM_N-PR) (3)
Differential pressure transducer on the unit's heat exchanger and related controller expansion board	Factory installed	Factory installed	Factory installed
Controller expansion board to read the plant side differential pressure transducer (4-20mA signal) and manage the hydraulic by-pass valve opening (0-10V signal)	Factory installed	Factory installed	Factory installed on the multi-unit external control system (Manager3000, ClimaPRO) Not included with option 1542 (Non Priority Master unit) (5)
Plant side differential pressure transducer	Not included (the supply is the customer's responsibility) (4)	Factory supplied, installation is the client's responsibility (4)(5)	Factory supplied with the multi-unit external control system (Manager3000, ClimaPRO); installation is the client's responsibility Not included with option 1542 (Non Priority Master unit) (4)(6)
Plant side hydraulic by-pass valve	Not included (the supply is the customer's responsibility) (7)(8)	Not included (the supply is the customer's responsibility) (7)(8)	Not included (the supply is the customer's responsibility) (7)

(1) VPF for unit without plant differential pressure transducer included (for single unit plant and Priority Master unit)
(2) VPF for unit with plant differential pressure transducer included (for single unit plant and Priority Master unit)
(3) VPF for multi-unit plant with external controller (Manager3000, ClimaPRO) and Non Priority Master unit
(4) It is recommended to install the differential pressure transducer on the most hydraulically critical hydronic terminal, to ensure it has a proper water flow in any load condition.
(5) Technical features of the differential pressure transducer supplied:
Model: Huba Control 692.9 120071C1
Pressure range: 0 ... + 1 bar
Output: 4-20mA
Electrical connection: DIN EN 175301-803-A (IP 65)
Pressure connection adapters: male threaded G 1/8"
(6) It is the customer's responsibility to configure the multi-unit control system (Manager3000, ClimaPRO or Multi Manager) with option VPF.
(7) See attached table for information on the hydraulic by-pass design.
(8) In case of a multi-unit plant with more than one Master Priority unit (opt 1541) please specify it when emailing our sales. An additional device will be add to manage the multiple signals coming from unit's controller to the by-pass valve.

The following table provides the indications for a correct hydraulic by-pass design.

Heat exchanger minimum flow (m^3/h) (1)	Minimum by-pass diameter	Minimum by-pass valve diameter	Suggested valve model	Kvs	Suggested actuator model
From 19 to 30	DN50 (2")	DN50 (2")	VVG41.50	40	SKB60
Up to 37	DN65 (2" ½)	DN65 (2" ½)	VVF31.65	49	SKB60
Up to 60	DN80 (3")	DN80 (3")	VVF31.80	78	SKB60
Up to 95	DN100 (4")	DN100 (4")	VVF31.90	124	SKC60
Up to 150	DN125 (5")	DN125 (5")	VVF31.91	200	SKC60
Up to 230	DN150 (6")	DN150 (6")	VVF31.92	300	SKC60

((1) In case of a multi-unit system, the unit with the highest minimum water flow should be the reference.

VPF.D SYSTEM (delta T control)
For plants with primary and secondary circuits separated by a hydraulic decoupler.

VPF.D - Plant and unit requirements

The VPF.D logic provides the variable flow control for the plant's primary circuit.

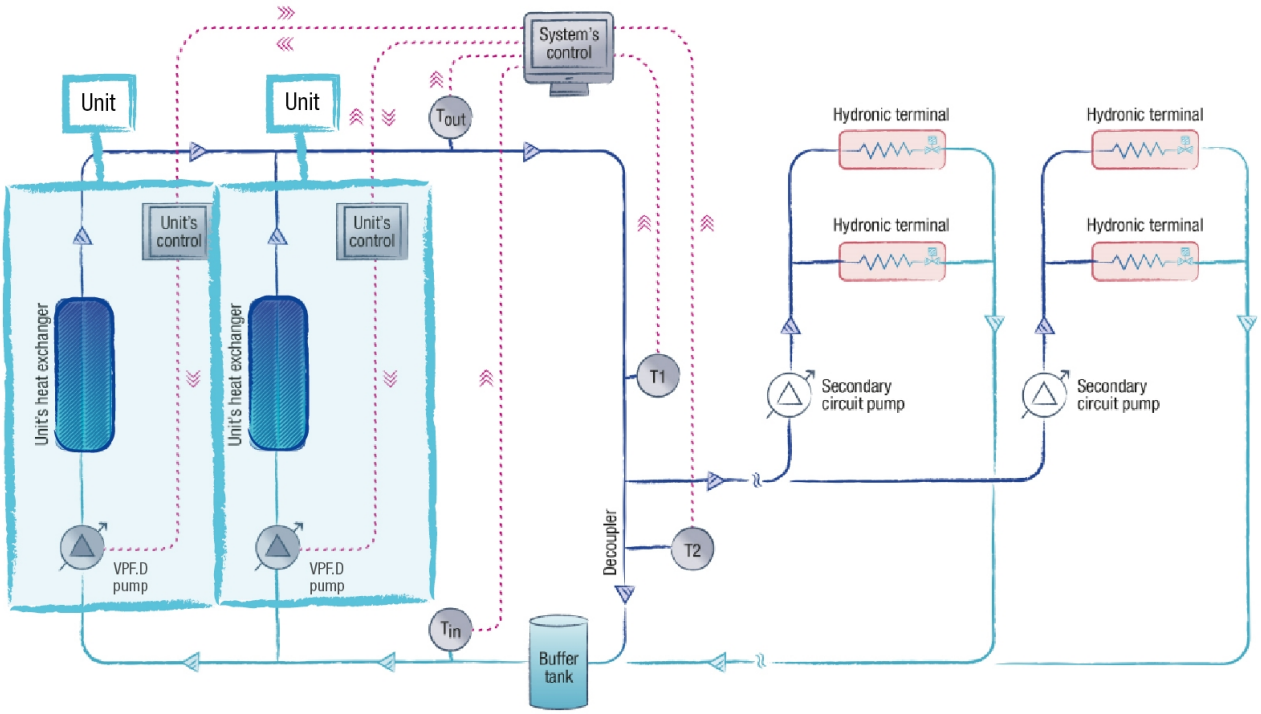
- Type of plant: primary and secondary circuits separated by a hydraulic decoupler

- Hydronic module: modulating regulation devices (0-10V signal) or variable speed pumps

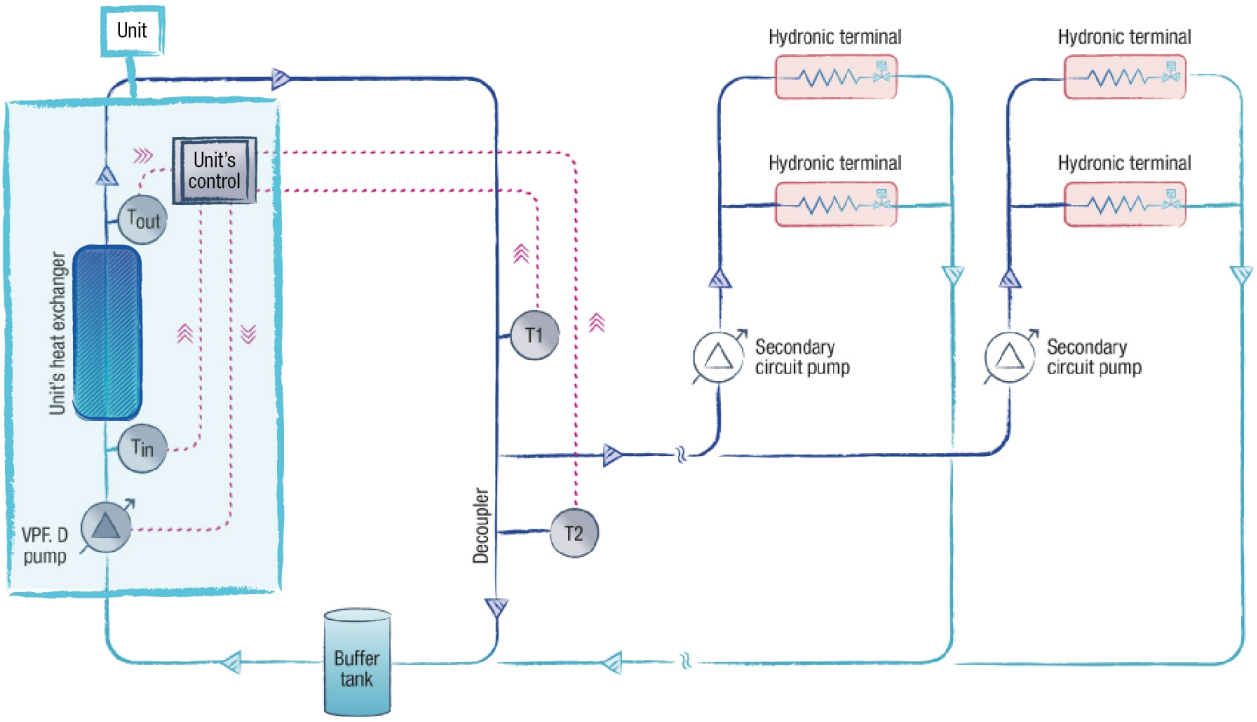
- Unit thermoregulation: control of the leaving water temperature

- Monitored parameter: delta T on primary circuit

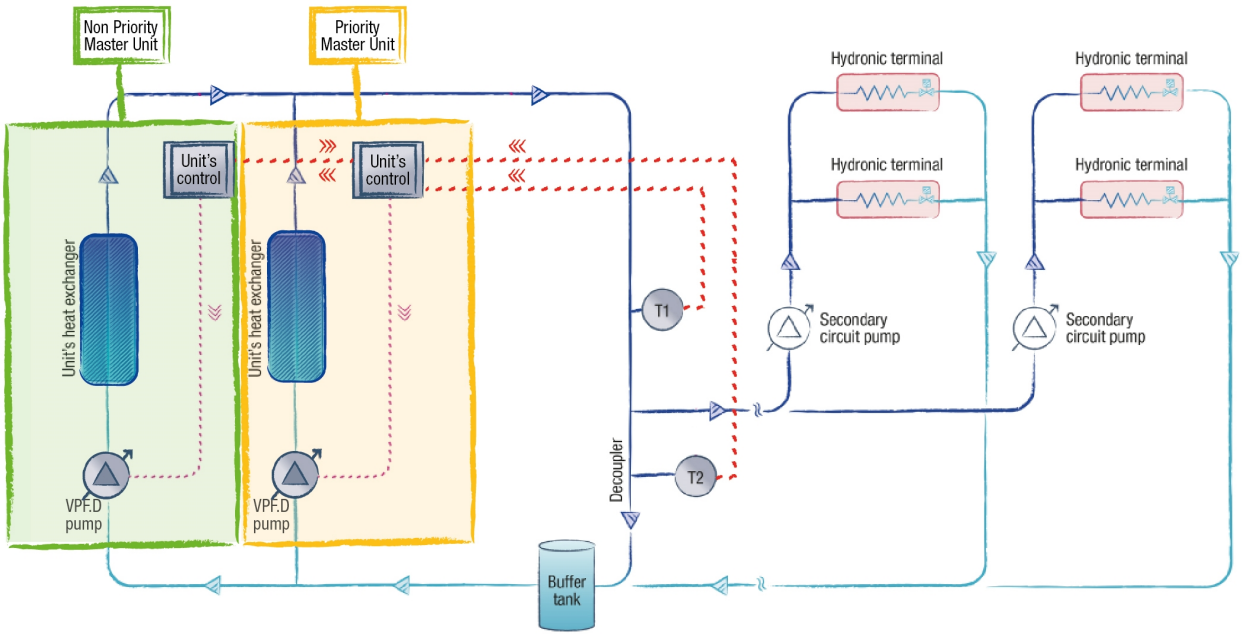
Plant diagram for multi-unit with external control system (Manager3000 or ClimaPRO)



Plant diagram for single unit system



Plant diagram for multi-unit system with Multi Manager



VPF.D - Operating logic

Water flow regulation

The VPF.D system monitors the temperature difference of the primary circuit (ΔT) (that corresponds to the temperature difference of the unit's heat exchanger in the case of a single unit system), and adjusts the primary circuit's pump speed in order to keep it within a defined range (ΔTmin ÷ ΔTmax). The secondary circuit water flow is completely independent and is to be managed by the client.

- If ΔTmin ≤ ΔT ≤ ΔTmax
The plant water flow is appropriate to the thermal load, the pump speed is kept constant.

- If ΔT < ΔTmax
The plant water flow exceeds what is necessary to properly cover the thermal load, the pump speed is reduced to save pump energy.

- If ΔT > ΔTmin
The plant water flow is too low to ensure the proper feed to the users, the pump speed is increased.

To prevent the returning water of the secondary circuit from recirculating through the decoupler and mixing with the delivery water, which would cause serious plant regulation problems, the VPF.D provides a safety function based on the temperatures, which are detected by two probes on the plant side: T1 on the unit delivery line and T2 on the hydraulic decoupler. If during the water flow regulation of the circuits, the flow direction in the decoupler reverses (detected temperatures T1 < T2), the system forces a quick increase of the primary water flow until the correct direction of the flow in the decoupler is restored (detected temperatures T1 = T2).

With the VPF.D system, the water flow can be reduced to 50% of the unit nominal water flow, with regards to the selection conditions, provided that the minimum water flow required by the unit's heat exchanger is respected (the control of the heat exchanger's minimum water flow is described below).
The pump speed regulation is performed with little progressive adjustments while continuously monitoring the values of both the temperature difference on the primary circuit and the temperatures of the probes T1 and T2. The absence of abrupt water flow changes prevents fluctuation due to possible conflicts with the unit's thermoregulation function (compressor regulation).

Control of the unit's minimum water flow

Under no circumstances can the primary circuit water flow be reduced below the minimum water flow required by the unit's heat exchanger.
The unit's minimum water flow is ensured by setting the minimum pump speed (service menu parameter).

Multi-unit systems

The VPF.D control logic is also the same for multi-unit systems.
The reading of the temperature difference on the primary circuit and the reading of the temperature probes T1 and T2 is managed by the multi-unit control system (Manager3000, ClimaPRO, Multi Manager Master).
Each unit autonomously adjusts its pump speed on the basis of the information provided by the multi-unit control system.
When the plant load requests the activation of a stand-by unit, the multi-unit control system calculates the starting speed of its pump in order to avoid excessive water flow variation of the running units.

In case of multi-unit system with Multi Manager, at least one unit must be set as Priority Master (opt 1541). To grant redundancy to the system, more than one unit can be configured as Priority Master. All the Priority Masters must be connected to the temperature probes T1 and T2. The Multi Manager system only takes into account the signal read and sent by the Master of the moment.
The Non Priority Master cannot be connected to the temperature probes T1 and T2, and cannot managed the VPF.D function. In the event that a Non Priority Master is elected as the Master of the system, the VPF.D function is suspended.

VPF.D - Devices and installation

Dispositivo	Accessory name	
	VPF.D (SU, MM_PR) (1)	VPF.D(M3000, CPRO, MM_N-PR) (2)
2 plant side NTC temperature sensors and related controller expansion board	Factory supplied (probes supplied without wells), installation is the client's responsibility (3)	Factory supplied with the multi-unit external control system, Manager3000 or ClimaPRO (probes supplied without wells); installation is the client's responsibility Not included with option 1542 (Non Priority Master unit) (3)(4)

(1) VPF.D for single unit plant and Priority Master unit
(2) VPF.D for multi-unit plant with external controller (Manager3000 or ClimaPRO) and Non Priority Master unit
(3) It is recommended to install the temperature probes as shown in the enclosed plant diagrams (T1 on the unit delivery line, T2 on the hydraulic decoupler)
(4) It is the customer's responsibility to configure the multi-unit control system (Manager3000, ClimaPRO or Multi Manager) with option VPF.D.

The following table provides the indications for a correct hydraulic decoupler design.

Heat exchanger minimun flow (m^3/h) (1)	Minimum hydraulic decoupler diameter
From 25 to 40	DN65 (2" ½)
Up to 60	DN80 (3“)
Up to 100	DN100 (4“)
Up to 150	DN125 (5“)
Up to 225	DN150 (6”)
Up to 375	DN200 (8”)

(1) In case of a multi-unit system, the unit with the highest minimum water flow should be the reference.

14.2 Condensation control devices

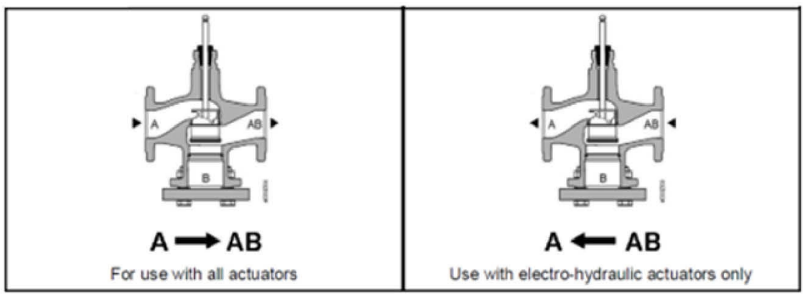
2-WAY modulating valve

Two way servo-motorized valve with steel body, recommended for well water applications, and in general for applications with variable water flow.

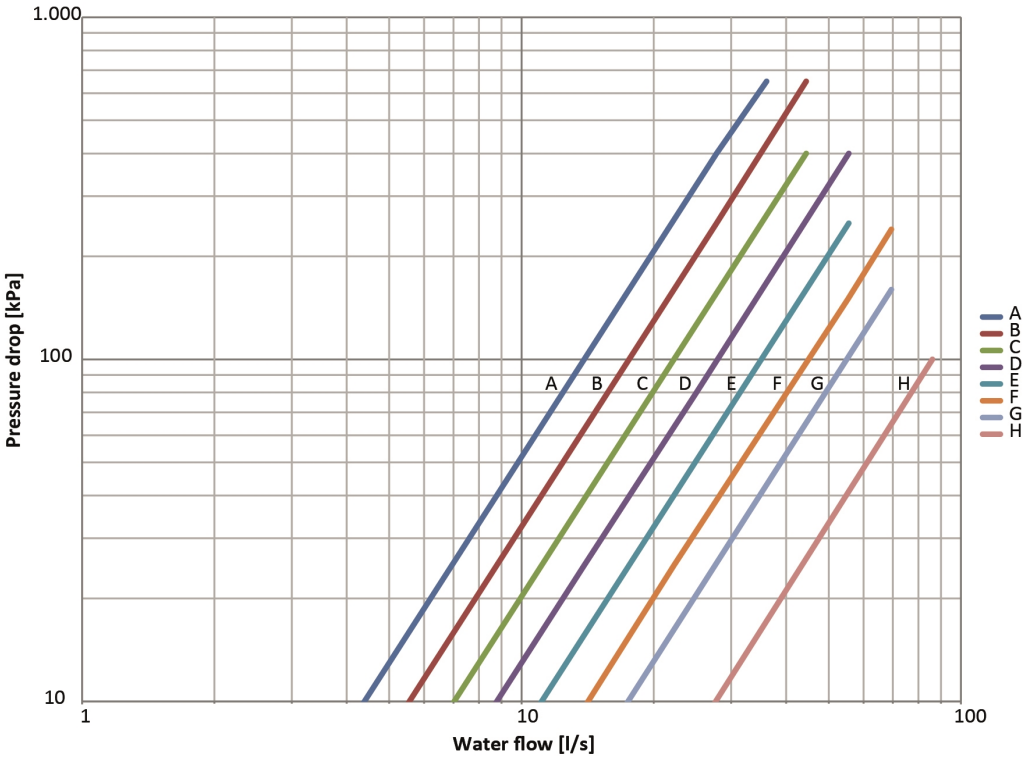
The following models are available:

Model	Valve 2 way	Connection	DN	kvs	k	Dp max	Qmin	Qmax	Actuator (0-10V)	Fluid direction
type	model	type		[m3/h]		[kPa]	[m3/h]	[m3/h]	type	
A	VVF43.65-50	Flangiato	65	50	40	300	32	50	SKC60	A → AB
B	VVF43.65-63	Flangiato	65	63	25,2	300	40	63	SKC60	A → AB
C	VVF43.80-80	Flangiato	80	80	15,6	300	51	80	SKC60	A → AB
D	VVF43.80-100	Flangiato	80	100	10	300	63	100	SKC60	A → AB
E	VVF43.100-125	Flangiato	100	125	6,4	300	80	125	SKC60	AB → A
F	VVF43.100-160	Flangiato	100	150	4,4	300	95	150	SKC60	AB → A
G	VVF43.125-200	Flangiato	125	200	2,5	300	125	200	SKC60	AB → A
H	VVF43.150-315	Flangiato	150	280	1,3	200	175	280	SKC60	AB → A

VVF43..



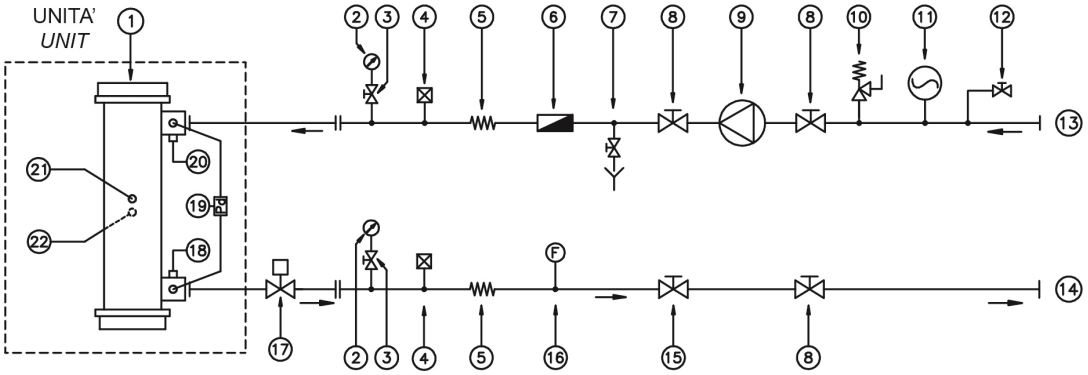
Graphic - 2-WAY modulating valve



The following valves are recommended to work at the conditions 12/7°C and 16/24°C (delta T 8°K):

2-WAY MODULATING VALVE - RECOMMENDED SELECTION - CH 12/7°C - 16/24°C												
SIZE	CD	K	Model	Valve (Siemens)	Ø valve	Dp max	Actuator (0-10V)	Kvs	K	Q cd	DP cd	DP V2V
	n°					[kPa]		[m3/h]		[m3/h]	[kPa]	[kPa]
0402	1	4,57	C	VVF43.80-80	80	300	SKC60	80	15,6	53,3	13,0	44,4
0452	1	4,57	C	VVF43.80-80	80	300	SKC60	80	15,6	60,1	16,5	56,5
0502	1	2,79	D	VVF43.80-100	80	300	SKC60	100	10,0	67,0	12,5	44,9
0572	1	2,42	D	VVF43.80-100	80	300	SKC60	100	10,0	75,2	13,7	56,5
0632	1	2,17	D	VVF43.80-100	80	300	SKC60	100	10,0	83,2	15,0	69,3
0702	1	1,50	E	VVF43.100-125	100	300	SKC60	125	6,4	93,7	13,2	56,2
0762	1	1,50	E	VVF43.100-125	100	300	SKC60	125	6,4	102,8	15,8	67,6
0852	1	1,14	E	VVF43.100-125	100	300	SKC60	125	6,4	113,4	14,6	82,2
0942	1	0,89	E	VVF43.100-125	100	300	SKC60	125	6,4	124,9	13,8	99,9
1042	1	0,72	F	VVF43.100-160	100	300	SKC60	150	4,4	136,9	13,6	83,3
1122	1	0,72	F	VVF43.100-160	100	300	SKC60	150	4,4	148,8	16,0	98,4
1242	1	0,49	G	VVF43.125-200	125	300	SKC60	200	2,5	165,6	13,4	68,6

Water scheme - 2-WAY modulating valve



LEGENDA – LEGEND			
1	Condens./Evap.	13	Ritorno dal pozzo/torre Return from well/tower
2	Manometro Water pressure gauge	14	Mandata al pozzo/torre Discharge to well/tower
3	Valvola d'intercettazione Intercept valve	15	Valvola di taratura della portata Flow control valve
4	Valvola di sfiato automatico Automatic purge valve	16	Flussostato Flow switch
5	Giunto antivibrante Vibration damper joint	17	Valvola a 2 vie 2 Way valve
6	Filtro a rete Screen filter	18	Sonda uscita scambiatore ausiliario Exchanger water outlet probe
7	Valvola di scarico Drain valve	19	Pressostato differenziale Pressure switch
8	Valvola d'intercettazione Intercept valve	20	Sonda ingresso scambiatore ausiliario Exchanger water inlet probe
9	Pompa di circolazione Available pressure pump	21	Valvola di sfiato Purge valve
10	Valvola di sicurezza Safety valve	22	Valvola di scarico Drain valve
11	Vaso di espansione Expansion tank		
12	Reintegro Water filling		

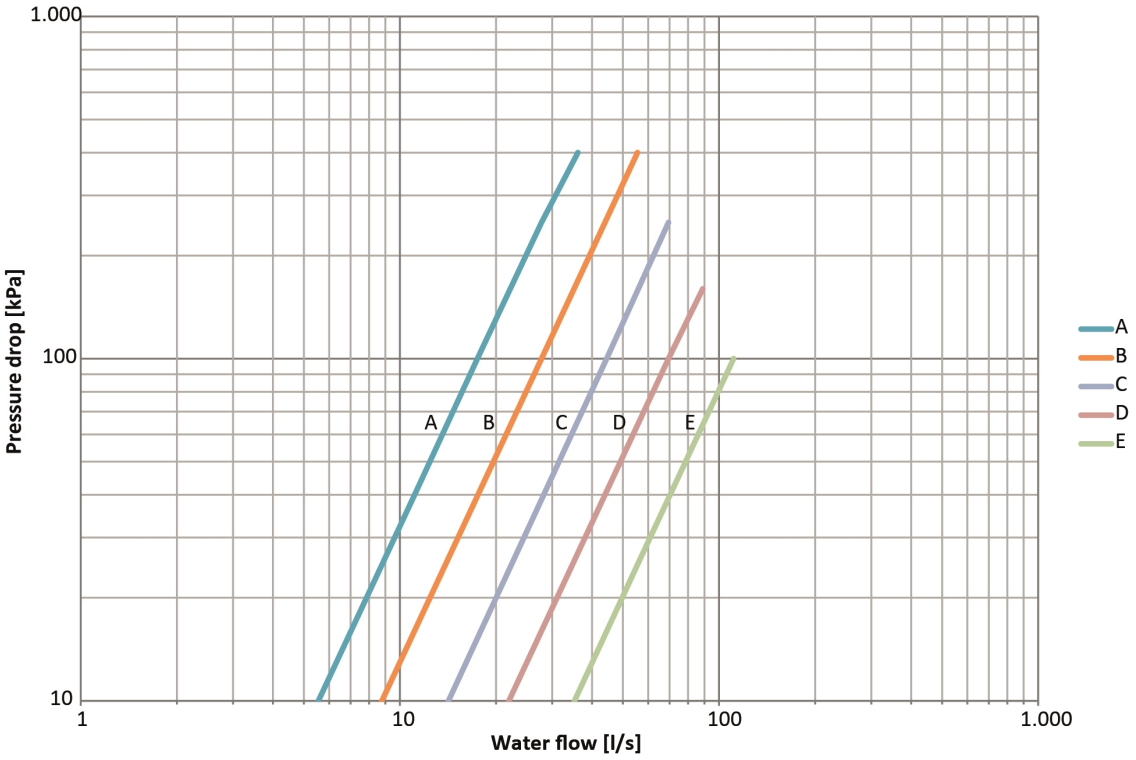
3-WAY modulating valve

Three-way servo-motorized valve with steel body, recommended for all applications with fixed water flow.

The following models are available:

Model	Valve 3 vie	Connection	DN	kvs	k	Qmin	Qmax	Actuator (0-10V)
type	model	type		[m3/h]		[m3/h]	[m3/h]	type
A	VXF32.65-63	Flanged	65	63	25,2	28	45	SKB60
B	VXF32.80-100	Flanged	80	100	10	45	72	SKB60
C	VXF32.100-160	Flanged	100	160	3,9	72	112	SKC60
D	VXF32.125-250	Flanged	125	250	1,6	112	180	SKC60
E	VXF32.150-400	Flanged	150	400	0,63	180	285	SKC60

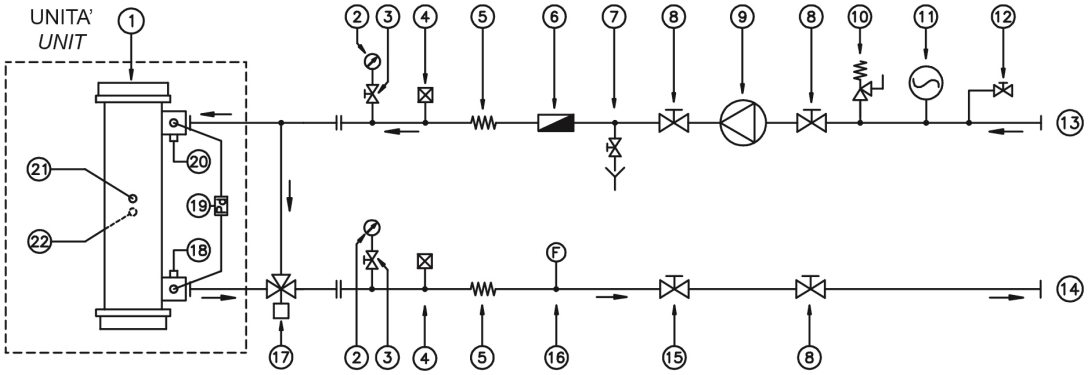
Graphic - 3-WAY modulating valve



CHILLER units
The following valves are recommended to work at the conditions 12/7°C and 30/35°C (delta T 5°K):

3-WAY MODULATING VALVE - RECOMMENDED SELECTION									CH 12/7°C - 30/35°C		
SIZE	CD	K	Model	Valve (Siemens)	Ø valve	Actuator (0-10V)	Kvs	K	Q cd	DP cd	DP V3V
	n°						[m3/h]		[m3/h]	[kPa]	[kPa]
0402	1	4,57	C	VXF32.100-160	100	SKC60	160	3,9	81,6	30,5	26,0
0452	1	4,57	C	VXF32.100-160	100	SKC60	160	3,9	92,3	38,9	33,2
0502	1	2,79	C	VXF32.100-160	100	SKC60	160	3,9	103	29,7	41,6
0572	1	2,42	C	VXF32.100-160	100	SKC60	160	3,9	116	32,6	52,7
0632	1	2,17	D	VXF32.125-250	125	SKC60	250	1,6	129	36,0	26,6
0702	1	1,50	D	VXF32.125-250	125	SKC60	250	1,6	145	31,6	33,8
0762	1	1,50	D	VXF32.125-250	125	SKC60	250	1,6	159	38,1	40,6
0852	1	1,14	D	VXF32.125-250	125	SKC60	250	1,6	173	34,3	48,1
0942	1	0,89	E	VXF32.150-400	150	SKC60	400	0,63	191	32,5	22,9
1042	1	0,72	E	VXF32.150-400	150	SKC60	400	0,63	213	32,8	28,3
1122	1	0,72	E	VXF32.150-400	150	SKC60	400	0,63	230	38,2	33,0
1242	1	0,49	E	VXF32.150-400	150	SKC60	400	0,63	256	32,0	41,1

Water scheme - 3-WAY modulating valve



LEGENDA – LEGEND			
1	Condensatore/Evaporatore Condenser/Evaporator	13	Ritorno dal pozzo/torre Return from well/tower
2	Manometro Water pressure gauge	14	Mandata al pozzo/torre Discharge to well/tower
3	Valvola d'intercettazione Intercept valve	15	Valvola di taratura della portata Flow control valve
4	Valvola di sfiato automatico Automatic purge valve	16	Flussostato Flow switch
5	Giunto antivibrante Vibration damper joint	17	Valvola a 3 vie 3 Way valve
6	Filtro a rete Screen filter	18	Sonda uscita scambiatore ausiliario Exchanger water outlet probe
7	Valvola di scarico Drain valve	19	Pressostato differenziale Pressure switch
8	Valvola d'intercettazione Intercept valve	20	Sonda ingresso scambiatore ausiliario Exchanger water inlet probe
9	Pompa di circolazione Available pressure pump	21	Valvola di sfiato Purge valve
10	Valvola di sicurezza Safety valve	22	Valvola di scarico Drain valve
11	Vaso di espansione Expansion tank		
12	Reintegro Water filling		

14.3 Compressor rephasing and electromagnetic compatibility

The harmonic distortion due to power frequency conversion

The increasing need for chillers to work with high efficiency at part loads has led to the introduction of the frequency converter (commonly called inverter) in order to drive the compressor.
The frequency converter varies the compressor's rotation speed through the regeneration of the power voltage, keeping its amplitude and frequency under control, through a conversion of the electrical power in two steps: first with a ACDC rectifier and then with a inverter DCAC inverter.
The use of the frequency converter determines an AC current characterized by a non-sine periodic wave form with given frequency f. This wave can be broken out into a sine wave called pure wave and a certain number of waves with greater frequencies (multiples of f), called harmonic waves and numbered with rising odd numbers (3°, 5°, 7°,…).

Power Factor, Displacement Power Factor and Total Harmonic Distortion

The harmonic waves do not contribute to the absorption of active power from the power source, but their presence causes:
- The presence of voltage harmonics that worsen the quality of the grid power voltage thus leading to possible malfunctions of the loads connected to this power grid.
- The worsening of the unit power factor PF, resulting in higher charges for the client from the electricity distribution company.

The Power Factor PF of a system is equal to the ratio between the active power and the apparent power and it is formulated in the following way:

$$PF = \frac{1}{\sqrt{1+THD_i^2}} DPF$$

DPF (Displacement Power Factor) is equal to the cosf of the pure current wave.
THD (Total Harmonic Distorsion) is the rate which describes the amount of the harmonic distortion. In particular THDi refers to the current wave and THDv to the voltage wave.

It is therefore clear that, whenever harmonics are present, the Power Factor PF is different from the Displacement Power Factor, and that the heavier the harmonics are, the greater the difference is.

In general, frequency converters are characterized by an intrinsic constant DPF (Displacement Power Factor) value between 0.97 and 0.99, while the Power Factor PF varies according to the load conditions, usually becoming worse when load partialization increases.

The following table displays the values of Power Factor PF and current Total Harmonic Distortion for the units:

Size	100%		MAXIMUM	
	P.F.	THDi [%]	P.F.	THDi [%]
402	0,77	72%	0,82	58%
452	0,78	69%	0,83	53%
502	0,79	65%	0,84	50%
572	0,80	68%	0,84	52%
632	0,82	64%	0,85	48%
702	0,83	67%	0,86	52%
762	0,84	62%	0,87	48%
852	0,84	56%	0,87	47%
942	0,85	54%	0,88	45%
1042	0,86	52%	0,89	43%
1122	0,86	59%	0,88	45%
1242	0,87	55%	0,88	41%

Size unit + HWT kit	100%		MAXIMUM	
	P.F.	THDi [%]	P.F.	THDi [%]
402	0,79	74%	0,87	46%
452	0,81	70%	0,88	43%
502	0,82	66%	0,89	41%
572	0,83	63%	0,89	39%
632	0,85	59%	0,90	37%
702	0,86	68%	0,91	43%
762	0,87	64%	0,91	42%
852	0,85	56%	0,89	40%
942	0,85	53%	0,90	38%
1042	0,86	51%	0,90	36%
1122	0,86	57%	0,90	34%
1242	0,87	53%	0,90	32%

MAXIMUM: Values calculated at Maximum conditions (considering toughest possible load conditions)
100%: Values calculated at 12/7 °C, 30/35 °C at the nominal cooling capacity

The data shown above refer to measurement performed with the unit powered by 3% THDv electricity grid. Grids with different characteristics can load to results that differ from those shown in the table.

For installations where the control of the THDi values is crucial, active harmonic modular filters are available: they're a device that analyzes the line current harmonics drawn by the loads and generates a compensation current at an opposite phase angle thereby neutralizing the harmonic currents, to obtain a THDi less than 5%. The harmonic current is reduced in all the working conditions of the unit.

Active harmonic modular filters are subject to RFQ (feasibility and quote request).

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