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

Technical Bulletin
FR-Z 0751 - 1801_201804_EN HFC R134a
ELCA_Engine ver.1.0.0.6

COOLING

NEW!

FR-Z 0751 - 1801

140-396 kW

Chiller, air source for outdoor installation

R HFC R-134a
SCREW
T SHELL & TUBES
EUROVENT CERTIFIED PERFORMANCE www.eurovent-certification.com
VPF VARIABLE PRIMARY FLOW
GREEN CERTIFICATION RELEVANT

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

- HIGH EFFICIENCY
- COMPACTNESS
- EXTREMELY SILENT OPERATION
- FLEXIBILITY
- WIDE OPERATING RANGE
- ALUMINIUM MICRO-CHANNEL HEAT EXCHANGERS
- INTEGRATED HYDRONIC GROUP

CERTIFICATIONS

Product certifications

Voluntary product certifications

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

System certifications

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

Quality System complying with the requirements of UNI EN ISO 9001:2008 regulation
Environmental Management System complying with the requirements of UNI EN ISO 14001:2004 regulation
Occupational Health and Safety Management System complying with the requirements of BS OHSAS 18001:2007

INDEX **FR-Z 0751 - 1801**

The units highlighted in this publication contain HFC R134a [GWP_{100} 1430] fluorinated greenhouse gases.

Functions

COOLING — Cooling

Refrigerant

R HFC R-134a — R-134a

Compressors

SCREW — Screw compressor

Fan

AXIAL — Axial fan

Exchangers

T SHELL & TUBES — Shell & Tubes

Other features

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

VPF VARIABLE PRIMARY FLOW — VPF

GREEN CERTIFICATION RELEVANT — GREEN Certification relevant

GREEN CERTIFICATION RELEVANT

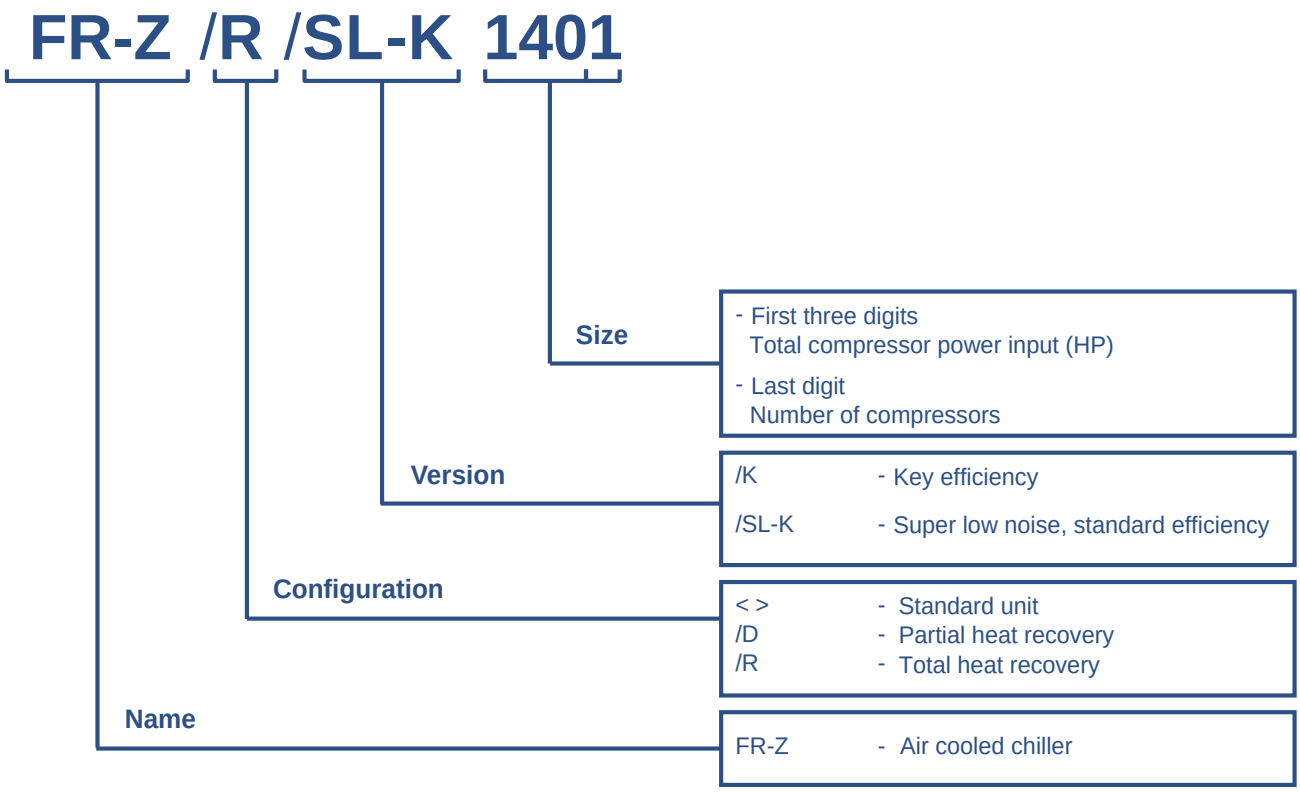
Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A., as a major player in the world HVAC market and a leading manufacturer of energy efficient, sustainable HVAC solutions, recognizes and supports the diffusion of green certification systems, as an effective way to deliver high performance buildings 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/GLOBAL/Company/Green-Certifications/QR%20code/

INCIPIT


FR-Z /R /SL-K 1401
Size
- First three digits
Total compressor power input (HP)
- Last digit
Number of compressors
Version
/K - Key efficiency
/SL-K - Super low noise, standard efficiency
Configuration
< > - Standard unit
/D - Partial heat recovery
/R - Total heat recovery
Name
FR-Z - Air cooled chiller

Outdoor unit for the production of chilled water with semi-hermetic screw compressor optimized for R134a, axial-flow fans, micro-channel full-aluminum condensing coils, single-pass shell and tubes evaporator designed by Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A. (brazed plate evaporator for sizes 0751 and 0851) and electronic expansion valve.
Base and supporting structure and panels are of galvanized epoxy powder coated steel with increased thickness. Eurovent certification.
Flexible and reliable unit; it easily adapts itself to different thermal load conditions thanks to the precise thermoregulation and the accurate sizing of all internal components. The compressors feature an enhanced lubrication system, an innovative internal geometry and a different control of capacity steps. Innovations that grant a remarkable performance improvement especially at partial loads.

1.3 HIGH EFFICIENCY
Very high efficiency at full and partial load, at the highest market levels, thanks to the adopted technological solutions. These units ensure low operating costs and therefore a quick payback time.

1.4 COMPACTNESS
Compactness in terms of overall size and weight, helping installation and working on site

1.5 EXTREMELY SILENT OPERATION
As the result of a systematic design oriented to minimize the noise level, the silenced version units give the best combination of quietness and efficiency on the market.

1.6 FLEXIBILITY
Flexibility in the applications thanks to the many configurations and versions available.

1.7 WIDE OPERATING RANGE
The accurate condensation control (variable fan speed regulation as per standard on every model) and devoted kits allow unit's operation from -10°C (-20°C with accessories) to 46°C (50°C with accessories) of outdoor air temperature and from -8°C to 18°C (20°C with accessories) of evaporator leaving water temperature.

1.8 ALUMINIUM MICRO-CHANNEL HEAT EXCHANGERS
The full aluminium micro-channel condenser coils deliver high efficiency whilst ensuring a reduced refrigerant volume and a lower unit weight. The e-coating protection (optional) grants the highest level of resistance to corrosion in any condition, even in the most aggressive environments.

1.9 INTEGRATED HYDRONIC GROUP
The built-in hydronic group (optional) includes the main water circuit components. It is available with 1 or 2 pumps, fixed or variable speed, high or low head to satisfy all the different industrial and comfort application requirements.

2.2 Chiller, air source for outdoor installation
Outdoor unit for the production of chilled water with semi-hermetic screw compressor optimized for R134a, axial-flow fans, micro-channel full-aluminum condensing coils, single-pass shell and tubes evaporator designed by Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A. (brazed plate evaporator for sizes 0751 and 0851) and electronic expansion valve.
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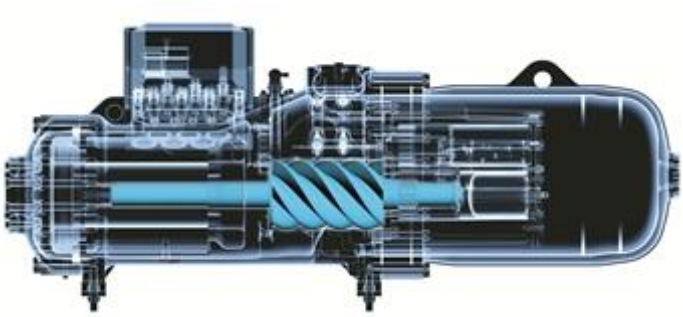
2.3 Installation note
The unit is supplied fully refrigerant charged and factory tested. On site installation only requires power and hydraulic connection.

2.4 Structure
Structure specifically designed for outdoor installation. Base and frame in hot-galvanised steel sheet of suitable thickness. All parts polyester-powder painted to assure total weather resistance. Painting: RAL 7035 textured finish.

2.5 Refrigerant circuit
Unit designed with one refrigerant circuit and one compressor. In addition to the main components described in the following sections, the refrigerant circuit is fitted as standard with:
- electronic expansion valve
- high and low pressure transducers
- visualization of the pressure´s level directly from the controller´s interface
- safety switching device for limiting the pressure
- high and low pressure safety valve
- liquid line shut-off device (function performed by electronic expansion valve with ultracap)
- non -return valve in compressor´s discharge line integrated in the compressor
- compressor's discharge valve
- liquid line shut-off valve
- refrigerant line sight glass with humidity indicator
- drier filter with replaceable cartridge
- economizer on the following models:
  0961 (K, SL-K); 1421 (K; SL-K); 1431 (K; SL-K)

2.6 Compressor
CSC screw-compressors designed according to Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A. specifications and for its exclusive use.
Semi-hermetic screw compressors with 2 five- and six-lobe rotors: the five-lobe rotor is splined directly onto the motor (nominal speed 2950 rpm) without the use of interposed gears.
The bearings provided along the rotor axis are housed in a separate chamber, isolated from the compression chamber. Made of carbon steel, the bearings are granted for a lifetime of 150.000 hours.
Each compressor is provided with an inlet for refrigerant injection (for the extension of operating limits) and the use of the economizer (for the output capacity and efficiency's increase).
Optimized lubrication guarantees oil´s distribution between mechanical parts, without using an oil pump. The innovative oil management valve greatly enhances the lubrication system by reducing the oil quantity and allowing a remarkable increase of the compressor efficiency at partial load. The built-in oil separator has 3 stages of separation, and a 10 mm stainless steel mesh filter ensures the constant presence of oil inside.
Innovative mechanic design with inner slider, managed according to specific proprietary parameters, for the variation of Vi depending on the different operating conditions. This allows to adjust the cooling capacity of the compressor from 100% to 40% (data referred to the operating conditions: 7°C of leaving water temperature, 35°C of outdoor air temperature) always achieving maximum efficiency, even in case of considerable load partialization.
The two pole motors are fitted as standard with electric devices to limit the absorbed current during compressor start-up, and with empty start-up. Each compressor is fitted with manual-reset motor thermal protection, delivery gas temperature and oil level controls and an electric resistance for the carter´s heating while the compressor is stopped. A check valve fitted on the refrigerant delivery line prevents the rotors from reversing after stopping. On-off cocks on the delivery line of each compressor to isolate the refrigerant charge in the heat exchanger when required.



2.7 Plant side heat exchanger
Sizes: 0751; 0851
Braze welded AISI 316 steel plate heat exchanger.
Sizes: 0951; 0961; 1101; 1301; 1401; 1421; 1431; 1801
Dry expansion type shell and tube heat exchanger; it acts as an evaporator with refrigerant flow inside the pipes and water flow on the shell side. Fully developed and manufactured by Mitsubishi Electric Hydronics & IT Cooling Systems S.p.A., the heat exchanger is a single pass type to provide almost perfect countercurrent heat exchange. The water flow on the shell side is fitted with baffles to increase turbulence and therefore the efficiency of exchange. The shell is made of steel, the tube nest is manufactured using copper tubes with internal grooves to improve heat exchange and each pipe is mechanically expanded onto the tube plates.
External insulation: the lining is made of flexible closed cells elastomeric foam (thermal conductivity 0.033W/mK at 0°C) coupled with 3 mm layer of crosslinked PE foam with a surface film of embossed PE for a total thickness of 9 mm.
Antifreeze control: the heat exchanger is fitted with a differential pressure switch which controls the presence of a sufficient water flow when the unit is working, in this way preventing the formation of ice inside; when pumps stop, the antifreeze control is up to an electrical resistance.
Certifications: the heat exchanger is compliant with PED requisites, for pressure equipment. Upon request, the heat exchanger can be supplied AS1210 compliant or with the SafeWork NSW certificate, depending on the size.

2.8 Source side heat exchanger
Microchannel coils ideally positioned on a "V" block structure to optimize airflow and heat transfer. Made entirely in aluminum, the coils are not subjected to galvanic corrosion.
Fins and manifolds are made of aluminum AA3003 while the channels are made of a new aluminum alloy so defined Long Life Alloy (LLA). LLA alloy has a very fine grain microstructure that guarantees higher mechanical properties and a higher resistance to the inter-granular corrosion.
Channel small section favor refrigerant fluid turbulence, which enhances the heat exchange. Tube geometry maximize the surface touched by the air, thus allowing compact dimension and refrigerant charge reduction.

2.9 Fan section source side
Axial electric fans, protected to IP 54 and with insulation class ´F´, featuring an external rotor and profiled blades. Housed in an aerodynamic hood complete with safety guard. The fan + outlet set satisfies the efficiency requirements provided for by EcoDesign directive 327/11.
6-pole electric motor with built-in thermal protection. Variable Speed Device (DVVF) for controlling condensation by adjusting the speed of rotation with voltage steps (auto-transformer), fitted with a ventilation distribution system in case of external air low temperature. In conformity with the adjustment logic, each condenser circuit has a totally independent ventilation system.

2.10 Super Low noise version features
The Super Low noise units (version SL-K) feature:
- Condensing section larger than the corresponding standard version's one (only some sizes)
- Reduced fan speed (the speed is automatically increased in case of particularly tough environmental conditions).
- Compressor enclosure with a special soundproofing insulation (multilayer lining of polyurethane foam and sound-insulating gaiter, total thickness 30 mm)
- Covering of the exposed pipes between the V-blocks with painted metal sheets with a special soundproofing insulation (multilayer lining of polyurethane foam and sound-insulating gaiter, total thickness 30 mm)
- If the hydronic is present, the pump enclosure is acoustically insulated by a 30 mm thick lining of polyester fibres (Fiberform)

2.11 Electrical and control panel
Electrical and control panel built to EN60204-1 and EC204-1 standards, complete with:
- general door lock isolator
- control circuit transformer
- IP44 XW protection
- power circuit with electric bus bar distribution system
- spring-type control circuit terminal board
- forced ventilation of the electrical board
- phases sequence control
- relays for voltage monitoring
- fuses and contactors for compressors and fans
- compressors protection with internal thermal overload
- electronic controller
- remote ON/OFF terminals
- terminals for cumulative alarm block
- Power supply 400V/3ph/50Hz
- Part-winding compressor start-up for sizes from 0751 to 0961 versions K, SL-K. Star-delta start-up for all other sizes.

2.12 Certification and applicable directives
The unit complies with the following directives and relative amendments:
- EUROVENT Certification program
- CE Declaration of conformity certificate for the European Union
- EAC Product quality certificate for Russian Federation
- M&I Product quality certificate for Australia and New Zealand
- Machine directive 2006/42/EC
- PED Directive 2014/68/EC
- Low Voltage directive 2006/95/EC
- ElectroMagnetic compatibility directive 2004/108/EC
- ErP Directive 2009/125/EC
- ISO 9001 Company´s Quality Management System certification
- ISO 14001 Company´s Environmental Management System certification

2.13 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.

2.14 Electronic control W3000 TE
The W3000TE controller offers advanced functions and algorithms.
KIPlink - Keyboard In Your Pocket - is the innovative user interface based on WiFi technology that 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. In addition to or as an alternative, the Touch interface, with a 7" WVGA colour display and a front USB port, or the Large keyboard, with a wide LCD display and led icons, are available. The temperature control is characterized by the continuous capacity modulation, based on PID algorithms with dynamic neutral zone related to the leaving water temperature. The diagnostics comprises a complete alarm management system, with the "black-box" (via PC) and the alarm history display (via user interface or also PC) for enhanced analysis of the unit operation.
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. Supervision can be easily developed via proprietary devices or the integration in third party systems by means of the most common protocols as ModBus, Bacnet, Bacnet-over-IP, LonWorks. Compatibility with the remote keyboard (up to 8 units). The programmable timer manages a weekly schedule organized into time bands to optimise unit performance by minimising power consumption during periods of inactivity. Up to 10 daily time bands can be associated with different operating set points. As an option (VPF package), the modulation of capacity is integrated with the modulation of the water flow, by means of inverter and dedicated resources for the hydraulic circuit.

2.15 Versions
/K - Key efficiency
Key efficiency units that grant the best cooling capacity/footprint ratio.

/SL-K - Super low noise, standard efficiency
Key efficiency units that grant the best cooling capacity/footprint ratio.
This version features a special soundproofing for the compressor compartment and the pumps (if present), a reduced fan speed and an oversized condensing section.
The fan speed is automatically increased in case of particularly tough environmental conditions.

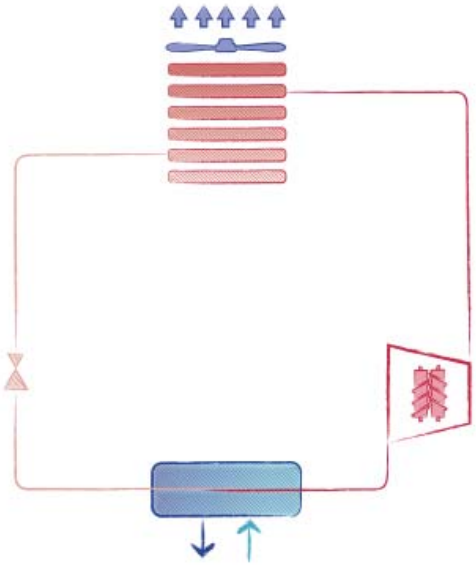
2.16 Configurations
- , standard unit
Standard unit for production of chilled water

/D, unit with partial heat recovery
Unit for the production of chilled water, equipped with an auxiliary heat exchanger (desuperheater) on the compressor discharge for superheat recovery. The recovered heat is approximately the 20% of the total cooling capacity and can be used for domestic hot water production or other secondary uses, such as the integration of an existing boiler.

/R, unit with total heat recovery
Unit for the production of chilled water, with a dedicated heat exchanger refrigerant/water for the condensation heat reclaim. The heat reclaim is managed to reach the set-point. This function is used for air treatment in applications with AHU or for domestic hot water production together with an auxiliary boiler.

CONFIGURATIONS

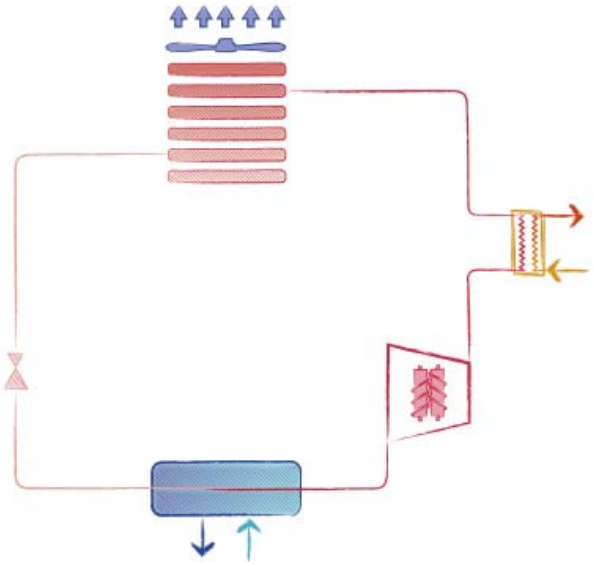
- , standard unit



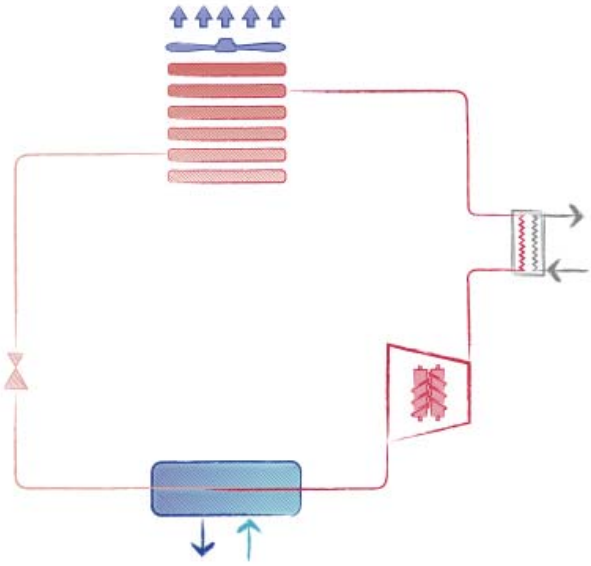
No heat recovery is possible.

/D, unit with partial heat recovery

Heat recovery: ON



Heat recovery: OFF (water flow stopped)



Each refrigerant circuit is fitted with a desupeheater.
The superheating heat recovery is only possible when the temperature of the hot water circuit is lower than the compressor discharge temperature.
The heat recovery and its amount dipends on the unit's operating conditions, in particular the outdoor air temperature and the load percentage.
It is advised to interrupt the water flow to the desuperheater when the conditions for an actual heat recovery are not met.

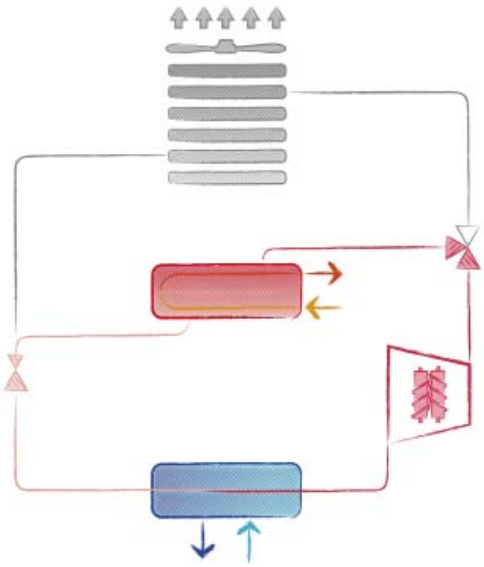
The smart management of the desuperheater pump(s) is possible with the option 3371 D - RELAY 1 PUMP (ON/OFF), further information is available in the bulletin section dedicated to accessories.

Partial heat recovery operating limits:

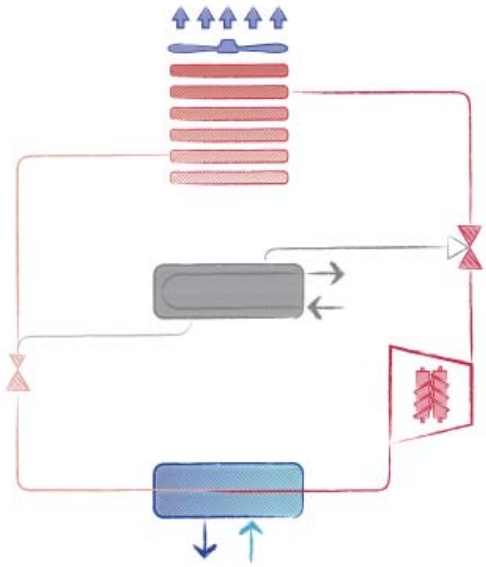
	MIN temperature	MAX temperature
Inlet water	25°C (77°F)	56°C (132,8°F)
Outlet water	30°C (86°F)	60°C (140°F)

/R, unit with total heat recovery

Heat recovery: ON



Heat recovery: OFF



Each refrigerant circuit is fitted with a total heat recovery exchanger.
The heat recovery mode is managed according to the hot water temperature set-point.
When the heat recovery mode is active, the condensation takes place in the devoted refrigerant/water heat exchanger instead of in the finned coils.

The available hydronic modules and primary flow control options for the total heat recovery exchanger are listed in the bulletin section dedicated to accessories.

Total heat recovery operating limits:

	MIN temperature	MAX temperature
Inlet water	18°C (64,4°F)	51°C (123,8°F) With Kit HT*: 56°C (132,8°F)
Outlet water	26°C (78,8°F)	55°C (131°F) With Kit HT*: 60°C (140°F)

* Option Kit HT, code 1955.

4.1 GENERAL TECHNICAL DATA FR-Z /K

[SI System]

FR-Z /K			0751	0851	0951	0961	1101	1301	1401	1421	1431	1801
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	400/3/50	400/3/50
PERFORMANCE												
COOLING ONLY (GROSS VALUE)												
Cooling capacity	(1)	**kW**	**145**	**160**	**203**	**222**	**238**	**275**	**299**	**329**	**348**	**396**
Total power input	(1)	kW	50,0	58,6	63,7	73,3	85,2	88,0	103	119	112	135
EER	(1)	kW/kW	2,91	2,73	3,18	3,03	2,79	3,12	2,92	2,77	3,12	2,93
ESEER	(1)	kW/kW	4,00	4,00	4,04	4,07	4,09	4,07	4,05	4,08	4,00	4,05
COOLING ONLY (EN14511 VALUE)												
Cooling capacity	(1)(2)	**kW**	**145**	**160**	**202**	**221**	**237**	**274**	**298**	**328**	**347**	**394**
EER	(1)(2)	kW/kW	2,88	2,70	3,14	2,98	2,75	3,07	2,87	2,73	3,08	2,89
ESEER	(1)(2)	kW/kW	3,90	3,92	3,92	3,93	3,95	3,94	3,90	3,93	3,90	3,93
Cooling energy class			C	C	A	B	C	B	C	C	B	C
COOLING WITH PARTIAL RECOVERY												
Cooling capacity	(3)	kW	151	166	210	230	247	285	310	341	361	411
Total power input	(3)	kW	48,4	56,7	61,6	71,0	82,4	85,2	99,3	115	108	131
Desuperheater heating capacity	(3)	**kW**	**41,3**	**48,9**	**51,7**	**60,4**	**70,9**	**71,8**	**84,8**	**99,2**	**91,1**	**112**
EXCHANGERS												
HEAT EXCHANGER USER SIDE IN REFRIGERATION												
Water flow	(1)	l/s	6,96	7,65	9,70	10,61	11,38	13,14	14,30	15,73	16,63	18,92
Pressure drop	(1)	kPa	20,6	20,1	30,2	36,2	41,6	42,5	50,4	44,9	29,5	38,2
PARTIAL RECOVERY USER SIDE IN REFRIGERATION												
Water flow	(3)	l/s	1,99	2,36	2,50	2,91	3,42	3,46	4,09	4,79	4,40	5,42
Pressure drop	(3)	kPa	30,3	42,5	47,5	32,1	44,4	45,4	31,3	42,8	36,1	31,9
REFRIGERANT CIRCUIT												
Compressors nr.		N°	1	1	1	1	1	1	1	1	1	1
Number of capacity steps		N°	0	0	0	0	0	0	0	0	0	0
No. Circuits		N°	1	1	1	1	1	1	1	1	1	1
Regulation			STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS
Min. capacity step		%	40	40	40	40	40	40	40	40	40	40
Refrigerant			R134a	R134a	R134a	R134a	R134a	R134a	R134a	R134a	R134a	R134a
Refrigerant charge		kg	20,0	22,0	28,0	31,0	33,0	38,0	42,0	46,0	49,0	55,0
Oil charge		kg	15,0	15,0	15,0	15,0	22,0	19,0	19,0	19,0	19,0	30,0
Rc (ASHRAE)	(4)	kg/kW	0,14	0,14	0,14	0,14	0,14	0,14	0,14	0,14	0,14	0,14
FANS												
Quantity		N°	2	2	3	3	3	4	4	4	5	5
Air flow		m³/s	10,52	10,52	15,79	15,79	15,79	21,05	21,05	21,05	26,31	26,31
Fans power input		kW	1,90	1,90	1,90	1,90	1,90	1,90	1,90	1,90	1,90	1,90
NOISE LEVEL												
Sound Pressure	(5)	dB(A)	62	62	62	62	64	64	65	66	66	66
Sound power level in cooling	(6)(7)	dB(A)	94	94	94	94	96	96	97	98	98	98
SIZE AND WEIGHT												
A	(8)	mm	1500	1500	2750	2750	2750	2750	2750	2750	4000	4000
B	(8)	mm	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260
H	(8)	mm	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Operating weight	(8)	kg	1480	1510	2100	2130	2460	2510	2540	2580	3110	3540

Notes:
1 Plant (side) cooling exchanger water (in/out) 12,0°C/7,0°C; Source (side) heat exchanger air (in) 35,0°C.
2 Values in compliance with EN14511-3:2013.
3 Plant (side) cooling exchanger water (in/out) 12,0°C/7,0°C; Source (side) heat exchanger air (in) 35,0°C; Plant (side) heat exchanger recovery water (in/out) 40,0°C/45,0°C.
4 Rated in accordance with AHRI Standard 550/590 (2011 with addendum 1).
5 Average sound pressure level at 10m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.
6 Sound power on the basis of measurements made in compliance with ISO 9614.
7 Sound power level in cooling, outdoors.
8 Unit in standard configuration/execution, without optional accessories.
- Not available
Certified data in EUROVENT

GENERAL TECHNICAL DATA FR-Z /SL-K

[SI System]

FR-Z /SL-K			0751	0851	0951	0961	1101	1301	1401	1421	1431	1801
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	400/3/50	400/3/50
PERFORMANCE												
COOLING ONLY (GROSS VALUE)												
Cooling capacity	(1)	**kW**	**140**	**170**	**196**	**215**	**246**	**265**	**288**	**332**	**346**	**395**
Total power input	(1)	kW	50,4	53,9	64,3	74,8	80,1	89,1	105	113	108	130
EER	(1)	kW/kW	2,78	3,14	3,04	2,87	3,07	2,97	2,75	2,95	3,21	3,04
ESEER	(1)	kW/kW	3,97	4,21	4,02	4,05	4,14	4,05	4,02	4,26	4,37	4,10
COOLING ONLY (EN14511 VALUE)												
Cooling capacity	(1)(2)	**kW**	**140**	**169**	**195**	**214**	**245**	**264**	**287**	**330**	**346**	**394**
EER	(1)(2)	kW/kW	2,75	3,11	3,00	2,83	3,02	2,93	2,71	2,90	3,18	3,00
ESEER	(1)(2)	kW/kW	3,88	4,10	3,91	3,93	3,99	3,93	3,87	4,11	4,26	3,98
Cooling energy class			C	A	B	C	B	B	C	B	A	B
COOLING WITH PARTIAL RECOVERY												
Cooling capacity	(3)	kW	145	176	203	223	255	275	299	344	359	410
Total power input	(3)	kW	48,7	52,1	62,2	72,4	77,5	86,1	101	109	104	126
Desuperheater heating capacity	(3)	**kW**	**42,5**	**44,3**	**53,6**	**63,1**	**66,5**	**74,5**	**88,3**	**94,2**	**88,7**	**109**
EXCHANGERS												
HEAT EXCHANGER USER SIDE IN REFRIGERATION												
Water flow	(1)	l/s	6,70	8,11	9,35	10,27	11,76	12,67	13,76	15,86	16,57	18,89
Pressure drop	(1)	kPa	19,1	22,6	28,1	33,9	44,4	39,5	46,6	45,7	29,3	38,1
PARTIAL RECOVERY USER SIDE IN REFRIGERATION												
Water flow	(3)	l/s	2,05	2,14	2,59	3,04	3,21	3,60	4,26	4,55	4,28	5,24
Pressure drop	(3)	kPa	32,0	34,9	51,0	35,1	39,0	49,0	33,9	38,6	34,2	29,9
REFRIGERANT CIRCUIT												
Compressors nr.		N°	1	1	1	1	1	1	1	1	1	1
Number of capacity steps		N°	0	0	0	0	0	0	0	0	0	0
No. Circuits		N°	1	1	1	1	1	1	1	1	1	1
Regulation			STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS	STEPLESS
Min. capacity step		%	40	40	40	40	40	40	40	40	40	40
Refrigerant			R134a	R134a	R134a	R134a	R134a	R134a	R134a	R134a	R134a	R134a
Refrigerant charge		kg	21,0	25,0	29,0	32,0	37,0	40,0	43,0	50,0	52,0	59,0
Oil charge		kg	15,0	15,0	15,0	15,0	22,0	19,0	19,0	19,0	19,0	30,0
Rc (ASHRAE)	(4)	kg/kW	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
FANS												
Quantity		N°	2	3	3	3	4	4	4	5	6	6
Air flow		m³/s	9,50	14,25	14,25	14,25	19,00	19,00	19,00	23,75	28,50	28,50
Fans power input		kW	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40
NOISE LEVEL												
Sound Pressure	(5)	dB(A)	52	52	53	53	55	55	56	57	57	57
Sound power level in cooling	(6)(7)	dB(A)	84	84	85	85	87	87	88	89	89	89
SIZE AND WEIGHT												
A	(8)	mm	1500	2750	2750	2750	2750	2750	2750	4000	4000	4000
B	(8)	mm	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260
H	(8)	mm	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
Operating weight	(8)	kg	1640	2050	2270	2290	2770	2770	2790	3250	3410	3880

Notes:
1 Plant (side) cooling exchanger water (in/out) 12,0°C/7,0°C; Source (side) heat exchanger air (in) 35,0°C.
2 Values in compliance with EN14511-3:2013.
3 Plant (side) cooling exchanger water (in/out) 12,0°C/7,0°C; Source (side) heat exchanger air (in) 35,0°C; Plant (side) heat exchanger recovery water (in/out) 40,0°C/45,0°C.
4 Rated in accordance with AHRI Standard 550/590 (2011 with addendum 1).
5 Average sound pressure level at 10m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.
6 Sound power on the basis of measurements made in compliance with ISO 9614.
7 Sound power level in cooling, outdoors.
8 Unit in standard configuration/execution, without optional accessories.
- Not available
Certified data in EUROVENT

GENERAL TECHNICAL DATA

ENERGY EFFICIENCY

SEASONAL EFFICIENCY IN COOLING (Reg. EU 2016/2281)
Process refrigeration at high temperature

FR-Z /K			0751	0851	0951	0961	1101	1301	1401	1421	1431	1801
Prated,c	(1)	kW	145,1	159,7	202,1	221,1	237,1	273,7	297,8	327,7	346,8	394,4
SEPR	(1) (2)	-	5,10	5,40	5,11	5,00	5,41	5,03	5,17	5,10	5,02	5,29
FR-Z /SL-K			**0751**	**0851**	**0951**	**0961**	**1101**	**1301**	**1401**	**1421**	**1431**	**1801**
Prated,c	(1)	kW	139,7	169,0	194,9	214,0	244,9	264,1	286,6	330,5	345,6	393,7
SEPR	(1) (2)	-	5,09	5,84	5,14	5,04	5,57	5,02	5,19	5,35	5,55	5,38

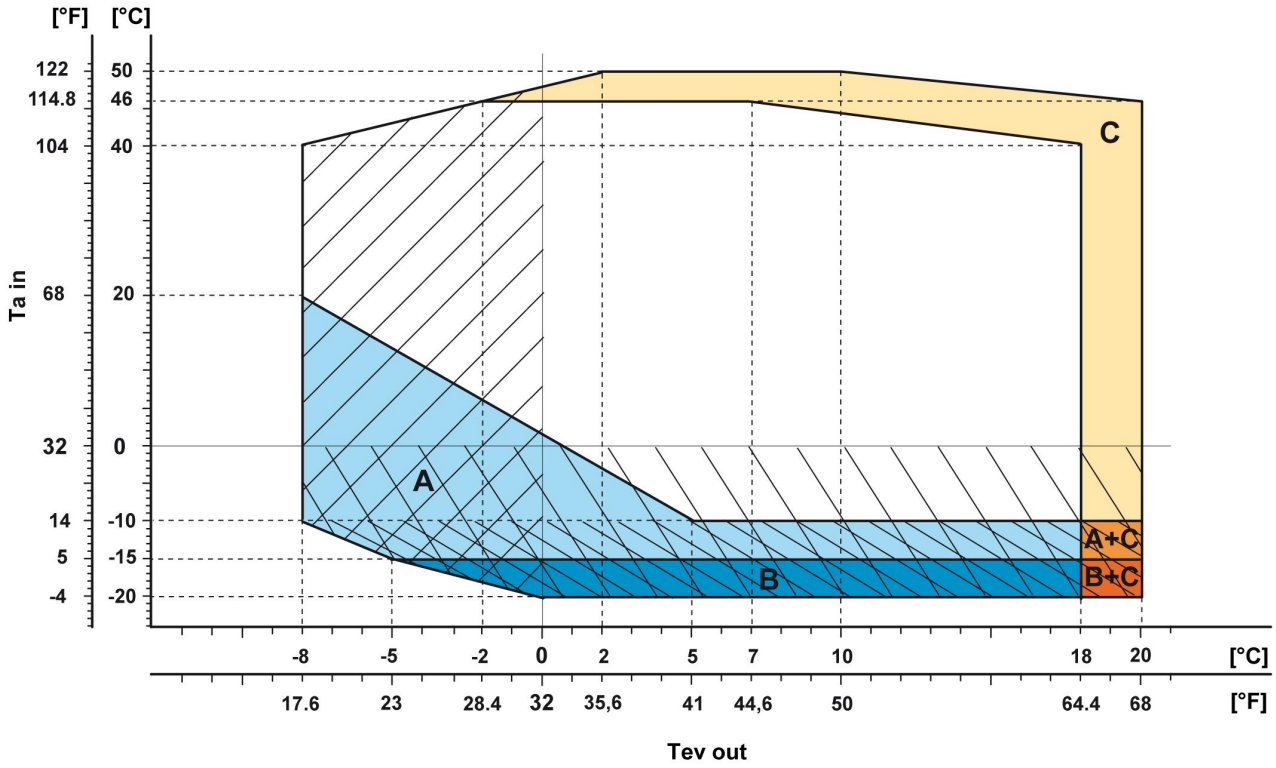
Notes:

(1) Seasonal energy efficiency of high temperature process cooling [REGULATION (EU) N. 2016/2281]
(2) Seasonal process cooling energy index

Certified data in EUROVENT

5.1 OPERATING LIMITS

/K 0751 - 1801
/SL-K 0751 - 1801



Ta in Air temperature

Tev out Evaporator leaving water temperature

Standard units

A Required: EC fans (code 808)*

B Required: EC fans (code 808)*
Low temperature device DBA (code 813)

C Required: Kit HT (code 1955)

A+C Required: EC fans (code 808)*
Kit HT (code 1955)

B+C Required: EC fans (code 808)*
Low temperature device DBA (code 813)
Kit HT (code 1955)

Required: Antifreeze piping and pumps (code 2432)
if hydronic kit is present

Required: Double insultaion on heat exchangers (code 2631)
or Double insulation on heat exchangers, pipes and pumps (code 2633) if hydronic kit is present

Required: Negative fluid temperature (code 871)

The diagram shows the temperature limits of full load operation.
In case of higher outdoor air temperature, automatically partialized its resources to ensure uninterrupted operation.
Operating limits when working partialized (water */7°C - */44,6°F):
/K, /SL-K: 53°C - 131°F
/kit HT (all versions): 57°C - 134,6°F

In case of outdoor air temperature higher than 53°C - 127,4°F, some additional cooling equipment for the electrical panel could be necessary. Please refer to our sales department for assessment and quotation.

Units with heat recovery: /D, /R
For the units with heat recovery, the maximum outdoor temperature allowed are 1,5°C - 2,7°F lower than the ones of the corresponding model without heat recovery.

* EC fans are suitable to operate up to 46°C - 114,8°F of outdoor temperature. In case of higher temperatures, fans with oversized motors must be used. For the quotation of these components, please contact our sales department.

For the specific temperature limits of each model please refer to the selection software ElcaStudio.

SIZE
FR-Z /K /0751
FR-Z /K /0851
FR-Z /K /0951
FR-Z /K /0961
FR-Z /K /1101
FR-Z /K /1301
FR-Z /K /1401
FR-Z /K /1421
FR-Z /K /1431
FR-Z /K /1801
FR-Z /D /K /0751
FR-Z /D /K /0851
FR-Z /D /K /0951
FR-Z /D /K /0961
FR-Z /D /K /1101
FR-Z /D /K /1301
FR-Z /D /K /1401
FR-Z /D /K /1421
FR-Z /D /K /1431
FR-Z /D /K /1801
FR-Z /SL-K /0751
FR-Z /SL-K /0851
FR-Z /SL-K /0951
FR-Z /SL-K /0961
FR-Z /SL-K /1101
FR-Z /SL-K /1301
FR-Z /SL-K /1401
FR-Z /SL-K /1421
FR-Z /SL-K /1431
FR-Z /SL-K /1801
FR-Z /D /SL-K /0751
FR-Z /D /SL-K /0851
FR-Z /D /SL-K /0951
FR-Z /D /SL-K /0961
FR-Z /D /SL-K /1101
FR-Z /D /SL-K /1301
FR-Z /D /SL-K /1401
FR-Z /D /SL-K /1421
FR-Z /D /SL-K /1431
FR-Z /D /SL-K /1801

5.2 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.

5.3 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.

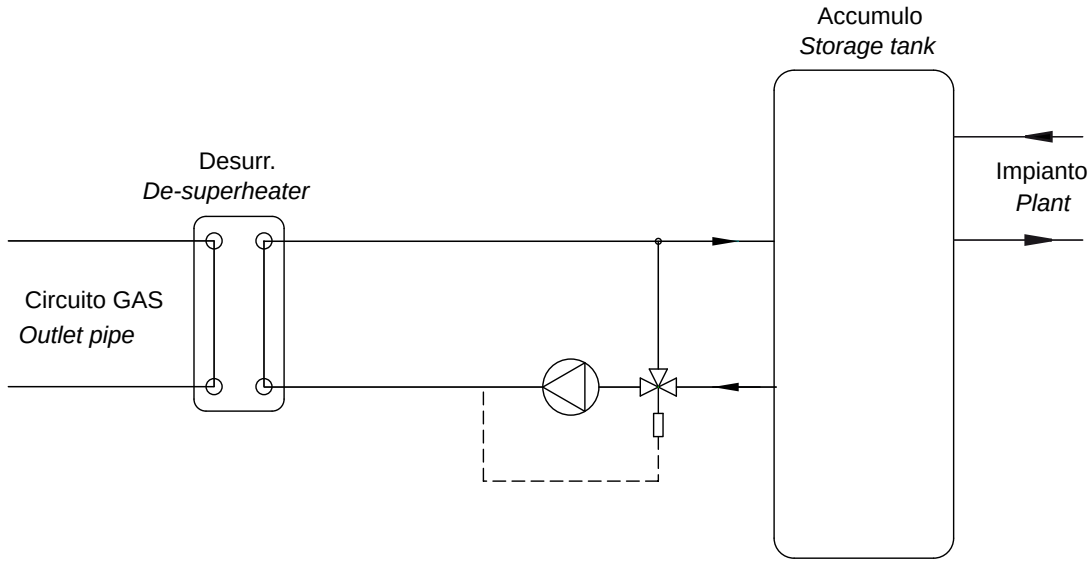
SERIES	FOULING FACTORS	EVAPORATOR			CONDENSER/RECOVERY			DESUPERHEATER
	ff (m² °CW)	F1	FK1	KE [°C]	F2	FK2	KC [°C]	R3
VARIOUS	0	1,000	1,000	0,0	1,000	1,000	0,0	1,000
VARIOUS	$1{,}80 \times 10^{-5}$	1,000	1,000	0,0	1,000	1,000	0,0	1,000
VARIOUS	$4{,}40 \times 10^{-5}$	1,000	1,000	0,0	0,990	1,030	1,0	0,990
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

OPERATION LIMITS OF DE-SUPERHEATERS

If it isn't possible to guarantee the indicated minimum temperatures, it is wise to install a dedicated kit for protection of de-superheater (device subject to RFQ - request feasibility and quotation) (see figure).

De-superheater minimum inlet temperature = 25°C
De-superheater minimum outlet temperature = 30°C



6.1 HYDRAULIC DATA

[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 RECOVERY EX. USER SIDE			
		K	Q min l/s	Q max l/s	C.A.S. l	C.a. min l	K	Q min l/s	Q max l/s	C.A.S. l
FR-Z /K /0751	400/3/50	32,8	1,53	23,06	20,1	700	-	-	-	-
FR-Z /K /0851	400/3/50	26,5	1,83	23,06	24,6	800	-	-	-	-
FR-Z /K /0951	400/3/50	24,8	1,53	23,06	90,0	1000	-	-	-	-
FR-Z /K /0961	400/3/50	24,8	1,83	23,06	90,0	1100	-	-	-	-
FR-Z /K /1101	400/3/50	24,8	6,39	14,72	90,0	1200	-	-	-	-
FR-Z /K /1301	400/3/50	19,0	6,39	14,72	85,0	1400	-	-	-	-
FR-Z /K /1401	400/3/50	19,0	6,39	14,72	85,0	1500	-	-	-	-
FR-Z /K /1421	400/3/50	14,0	7,22	16,67	80,0	1600	-	-	-	-
FR-Z /K /1431	400/3/50	8,23	7,22	16,67	116	1700	-	-	-	-
FR-Z /K /1801	400/3/50	8,23	8,33	19,44	116	2000	-	-	-	-
FR-Z /D /K /0751	400/3/50	32,8	1,53	23,06	20,1	700	588	-	2,28	1,60
FR-Z /D /K /0851	400/3/50	26,5	1,83	23,06	24,6	800	588	-	2,69	1,60
FR-Z /D /K /0951	400/3/50	24,8	6,39	14,72	90,0	1000	588	-	2,83	1,60
FR-Z /D /K /0961	400/3/50	24,8	6,39	14,72	90,0	1100	292	-	3,31	2,20
FR-Z /D /K /1101	400/3/50	24,8	6,39	14,72	90,0	1200	292	-	3,89	2,20
FR-Z /D /K /1301	400/3/50	19,0	7,22	16,67	85,0	1400	292	-	3,94	2,20
FR-Z /D /K /1401	400/3/50	19,0	7,22	16,67	85,0	1500	144	-	4,67	2,90
FR-Z /D /K /1421	400/3/50	14,0	8,33	19,44	80,0	1600	144	-	5,44	2,90
FR-Z /D /K /1431	400/3/50	8,23	9,17	26,94	116	1700	144	-	5,00	2,90
FR-Z /D /K /1801	400/3/50	8,23	9,17	26,94	116	2000	84,0	-	6,17	4,50
FR-Z /SL-K /0751	400/3/50	32,8	1,53	23,06	20,1	700	-	-	-	-
FR-Z /SL-K /0851	400/3/50	26,5	1,83	23,06	24,6	800	-	-	-	-
FR-Z /SL-K /0951	400/3/50	24,8	6,39	14,72	90,0	1000	-	-	-	-
FR-Z /SL-K /0961	400/3/50	24,8	6,39	14,72	90,0	1100	-	-	-	-
FR-Z /SL-K /1101	400/3/50	24,8	6,39	14,72	90,0	1200	-	-	-	-
FR-Z /SL-K /1301	400/3/50	19,0	7,22	16,67	85,0	1400	-	-	-	-
FR-Z /SL-K /1401	400/3/50	19,0	7,22	16,67	85,0	1500	-	-	-	-
FR-Z /SL-K /1421	400/3/50	14,0	8,33	19,44	80,0	1600	-	-	-	-
FR-Z /SL-K /1431	400/3/50	8,23	9,17	26,94	116	1700	-	-	-	-
FR-Z /SL-K /1801	400/3/50	8,23	9,17	26,94	116	2000	-	-	-	-
FR-Z /D /SL-K /0751	400/3/50	32,8	1,53	23,06	20,1	700	588	-	2,33	1,60
FR-Z /D /SL-K /0851	400/3/50	26,5	1,83	23,06	24,6	800	588	-	2,44	1,60
FR-Z /D /SL-K /0951	400/3/50	24,8	6,39	14,72	90,0	1000	588	-	2,94	1,60
FR-Z /D /SL-K /0961	400/3/50	24,8	6,39	14,72	90,0	1100	292	-	3,47	2,20
FR-Z /D /SL-K /1101	400/3/50	24,8	6,39	14,72	90,0	1200	292	-	3,67	2,20
FR-Z /D /SL-K /1301	400/3/50	19,0	7,22	16,67	85,0	1400	292	-	4,08	2,20
FR-Z /D /SL-K /1401	400/3/50	19,0	7,22	16,67	85,0	1500	144	-	4,86	2,90
FR-Z /D /SL-K /1421	400/3/50	14,0	8,33	19,44	80,0	1600	144	-	5,17	2,90
FR-Z /D /SL-K /1431	400/3/50	8,23	9,17	26,94	116	1700	144	-	4,86	2,90
FR-Z /D /SL-K /1801	400/3/50	8,23	9,17	26,94	116	2000	84,0	-	6,06	4,50

Q min: 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

7.1 ELECTRICAL DATA FR-Z /K

[SI System]

SIZE	Power supply V/ph/Hz	Maximum values								
		Compressor				Fans (1)		Total (1)(2)		
		n	F.L.I. [kW]	F.L.A. [A]	L.R.A. [A]	F.L.I. [kW]	F.L.A. [A]	F.L.I. [kW]	F.L.A. [A]	S.A. [A]
0751	400/3/50	1	62,7	102,3	303	2,00	4	110	67	311
0851	400/3/50	1	71,1	116,2	350	2,00	4	124	75	358
0951	400/3/50	1	80,9	129,8	423	2,00	4	141	87	434
0961	400/3/50	1	80,9	129,8	423	2,00	4	141	87	434
1101	400/3/50	1	99,9	163,4	300	2,00	4	175	106	311
1301	400/3/50	1	112,3	184,7	360	2,00	4	200	120	375
1401	400/3/50	1	127,8	209	404	2,00	4	224	136	419
1421	400/3/50	1	127,8	209	404	2,00	4	224	136	419
1431	400/3/50	1	127,8	209	404	2,00	4	228	138	423
1801	400/3/50	1	161,7	258	465	2,00	4	277	172	484

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) Values calculated referring to the version with the maximum number of fans working at the max absorbed current
(1)(2) Safety values to be considered when cabling the unit for power supply and line-protections

Data valid for standard units without any additional option.

Plant (side) cooling exchanger water (in/out) 12,0°C/7,0°C; Source (side) heat exchanger air (in) 35,0°C.

Voltage tolerance: 10%
Maximum voltage unbalance: 3%

Give the typical operating conditions of units designed for outdoor installation, which can be associated (according to reference document IEC 60721) to the following classes:
- climatic conditions class 4K4H: air temperature range from -20 up to 55°C (*), relative humidity range from 4 up to 100%, with possible precipitations, at air pressure from 70 and 106 kPa and a maximum solar radiation of 1120 W/m2
- special climatic conditions negligible
- biological conditions class 4B1 and 4C2: locations in a generic urban area
- mechanically active substances class 4S2: locations in areas with sand or dust representative of urban areas
- mechanical conditions class 4M1: locations protected from significant vibrations or shocks

The required protection level for safe operation, according to reference document IEC 60529, is IP43XW (protection against access, to the most critical unit's parts, of external devices with diameter larger than 1 mm and rain).
The unit can be considered IP44XW protected, i.e. protected against access of external devices (with diameter larger than 1 mm) and water in general.

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

ELECTRICAL DATA FR-Z /SL-K

[SI System]

SIZE	Power supply V/ph/Hz	Maximum values								
		Compressor				Fans (1)		Total (1)(2)		
		n	F.L.I. [kW]	F.L.A. [A]	L.R.A. [A]	F.L.I. [kW]	F.L.A. [A]	F.L.I. [kW]	F.L.A. [A]	S.A. [A]
0751	400/3/50	1	62,7	102,3	303	2,00	4	110	67	311
0851	400/3/50	1	71,1	116,2	350	2,00	4	128	77	361
0951	400/3/50	1	80,9	129,8	423	2,00	4	141	87	434
0961	400/3/50	1	80,9	129,8	423	2,00	4	141	87	434
1101	400/3/50	1	99,9	163,4	300	2,00	4	179	108	315
1301	400/3/50	1	112,3	184,7	360	2,00	4	200	120	375
1401	400/3/50	1	127,8	209	404	2,00	4	224	136	419
1421	400/3/50	1	127,8	209	404	2,00	4	228	138	423
1431	400/3/50	1	127,8	209	404	2,00	4	232	140	427
1801	400/3/50	1	161,7	258	465	2,00	4	281	174	488

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) Values calculated referring to the version with the maximum number of fans working at the max absorbed current
(1)(2) Safety values to be considered when cabling the unit for power supply and line-protections

Data valid for standard units without any additional option.

Plant (side) cooling exchanger water (in/out) 12,0°C/7,0°C; Source (side) heat exchanger air (in) 35,0°C.

Voltage tolerance: 10%
Maximum voltage unbalance: 3%

Give the typical operating conditions of units designed for outdoor installation, which can be associated (according to reference document IEC 60721) to the following classes:
- climatic conditions class 4K4H: air temperature range from -20 up to 55°C (*), relative humidity range from 4 up to 100%, with possible precipitations, at air pressure from 70 and 106 kPa and a maximum solar radiation of 1120 W/m2
- special climatic conditions negligible
- biological conditions class 4B1 and 4C2: locations in a generic urban area
- mechanically active substances class 4S2: locations in areas with sand or dust representative of urban areas
- mechanical conditions class 4M1: locations protected from significant vibrations or shocks

The required protection level for safe operation, according to reference document IEC 60529, is IP43XW (protection against access, to the most critical unit's parts, of external devices with diameter larger than 1 mm and rain).
The unit can be considered IP44XW protected, i.e. protected against access of external devices (with diameter larger than 1 mm) and water in general.

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

ELECTRICAL DATA

MAXIMUM CABLES/BARS SECTION CONNECTED TO MAIN SWITCH AND SHORT TIME CURRENT STANDARD UNITS

Unit size (all versions)	Main switch type (category AC-23A/B)	Cable section	Bar dimensions	Maximum back-up fuse rating	ICW (0,25s) Short time current rms	Further technical data
		∅ [mm²]	□ [mm]	[A]	[kA]	
751	VC2P 250A	120	20 x 5	250	15	http://www.technoelectric.it/ing/VCP_tab_dati_ing.html
851						
951						
961						
1101						
1301						
1401	VC3P 400A	240	2 x 25 x 5	400	25	
1421						
1431						
1801						
1502						
1702						
1902						
1922						
2202	VC4P 630A	2 x 185	2 x 32 x 6	630		
2602						
2652						
2702						
2722						
3152						
3602	SIRCO 800A	min 2 x 185 max 2 x 300	min 2 x 40 x 5 max 2 x 63 x 5	800		https://www.socomec.com/files/live/sites/systemsite/files/SCP/pdf_catalogue/GB/cat_sircosirco-ac_en.pdf
3902						
4202	SIRCO 1000A	min 2 x 240 max 4 x 185	min 2 x 50 x 5 max 2 x 63 x 5	1000		
4502						
4802						
4812						
4822						
5412	SIRCO 1250A CD	4 x 185	min 2 x 60 x 5 max 2 x 63 x 5	1250	27	
6002						
6022						
5703						
6303						
6603						
6903	VC5P 1600A 50KA	-	3 x 50 x 8	1600	50	http://www.technoelectric.it/ing/VCP_tab_dati_ing.html
7203						
7213						
7223						

Electrical data valid for standard units without any additional option

Voltage tolerance: 10%
Maximum voltage unbalance: 3%

ELECTRICAL DATA

MAXIMUM CABLES/BARS SECTION CONNECTED TO MAIN SWITCH AND SHORT TIME CURRENT UNITS WITH Kit HT (Code 1955)

Unit size (all versions)	Main switch type (category AC-23A/B)	Cable section	Bar dimensions	Maximum back-up fuse rating	ICW (0,25s) Short time current rms	Further technical data
		∅ [mm²]	□ [mm]	[A]	[kA]	
751	VC2P 250A	120	20 x 5	250	15	
851						
951						
961						
1101	VC3P 400A	240	2 x 25 x 5	400		http://www.technoelectric.it/ing/VCP_tab_dati_ing.html
1301						
1401						
1421						
1431						
1801						
1502						
1702						
1902	VC4P 630A	2 x 185	2 x 32 x 6	630	25	
1922						
2202						
2602						
2652						
2702	SIRCO 800A	min 2 x 185 max 2 x 300	min 2 x 40 x 5 max 2 x 63 x 5	800		https://www.socomec.com/files/live/sites/systemsite/files/SCP/pdf_catalogue/GB/cat_sircosirco-ac_en.pdf
2722						
3152						
3602	SIRCO 1000A	min 2 x 240 max 4 x 185	min 2 x 50 x 5 max 2 x 63 x 5	1000		
3902						
4202						
4502	SIRCO 1250A CD	4 x 185	min 2 x 60 x 5 max 2 x 63 x 5	1250	27	
4802						
4812						
4822						
5703	VC5P 1600A 50KA	-	3 x 50 x 8	1600	50	http://www.technoelectric.it/ing/VCP_tab_dati_ing.html
6303						
6603						
6903						
7203						
7213						
7223						

Electrical data valid for standard units without any additional option

Voltage tolerance: 10%
Maximum voltage unbalance: 3%

8.1 FULL LOAD SOUND LEVEL FR-Z /K

SOUND POWER									
SIZE	Octave band [Hz]								Total sound level dB(A)
	63	125	250	500	1000	2000	4000	8000	
	Sound power level dB								
0751	88	94	94	90	91	83	81	72	**94**
0851	88	94	94	90	91	83	81	72	**94**
0951	88	94	94	90	91	83	81	72	**94**
0961	88	94	94	90	91	83	81	72	**94**
1101	90	96	96	92	93	85	83	74	**96**
1301	90	96	96	92	93	85	83	74	**96**
1401	91	97	97	93	94	86	84	75	**97**
1421	92	98	98	94	95	87	85	76	**98**
1431	92	98	98	94	95	87	85	76	**98**
1801	92	98	98	94	95	87	85	76	**98**

Working conditions

Plant (side) cooling exchanger water (in/out) 12,0°C/7,0°C; Source (side) heat exchanger air (in) 35,0°C.

Sound power on the basis of measurements made 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, outdoors.

SOUND PRESSURE LEVEL									
SIZE	Octave band [Hz]								Total sound level dB(A)
	63	125	250	500	1000	2000	4000	8000	
	Sound pressure level dB								
0751	56	62	62	58	59	51	49	40	**62**
0851	56	62	62	58	59	51	49	40	**62**
0951	56	62	62	58	59	51	49	40	**62**
0961	56	62	62	58	59	51	49	40	**62**
1101	58	64	64	60	61	53	51	42	**64**
1301	58	64	64	60	61	53	51	42	**64**
1401	59	65	65	61	62	54	52	43	**65**
1421	60	66	66	62	63	55	53	44	**66**
1431	60	66	66	62	63	55	53	44	**66**
1801	60	66	66	62	63	55	53	44	**66**

Working conditions

Plant (side) cooling exchanger water (in/out) 12,0°C/7,0°C; Source (side) heat exchanger air (in) 35,0°C.

Average sound pressure level at 10m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.

FULL LOAD SOUND LEVEL FR-Z /SL-K

SOUND POWER									
SIZE	Octave band [Hz]								Total sound level dB(A)
	63	125	250	500	1000	2000	4000	8000	
	Sound power level dB								
0751	88	85	88	82	76	72	70	62	**84**
0851	88	85	88	82	76	72	70	62	**84**
0951	89	86	89	83	77	73	71	63	**85**
0961	89	86	89	83	77	73	71	63	**85**
1101	91	88	91	85	79	75	73	65	**87**
1301	91	88	91	85	79	75	73	65	**87**
1401	92	89	92	86	80	76	74	66	**88**
1421	93	90	93	87	81	77	75	67	**89**
1431	93	90	93	87	81	77	75	67	**89**
1801	93	90	93	87	81	77	75	67	**89**

Working conditions

Plant (side) cooling exchanger water (in/out) 12,0°C/7,0°C; Source (side) heat exchanger air (in) 35,0°C.

Sound power on the basis of measurements made 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.

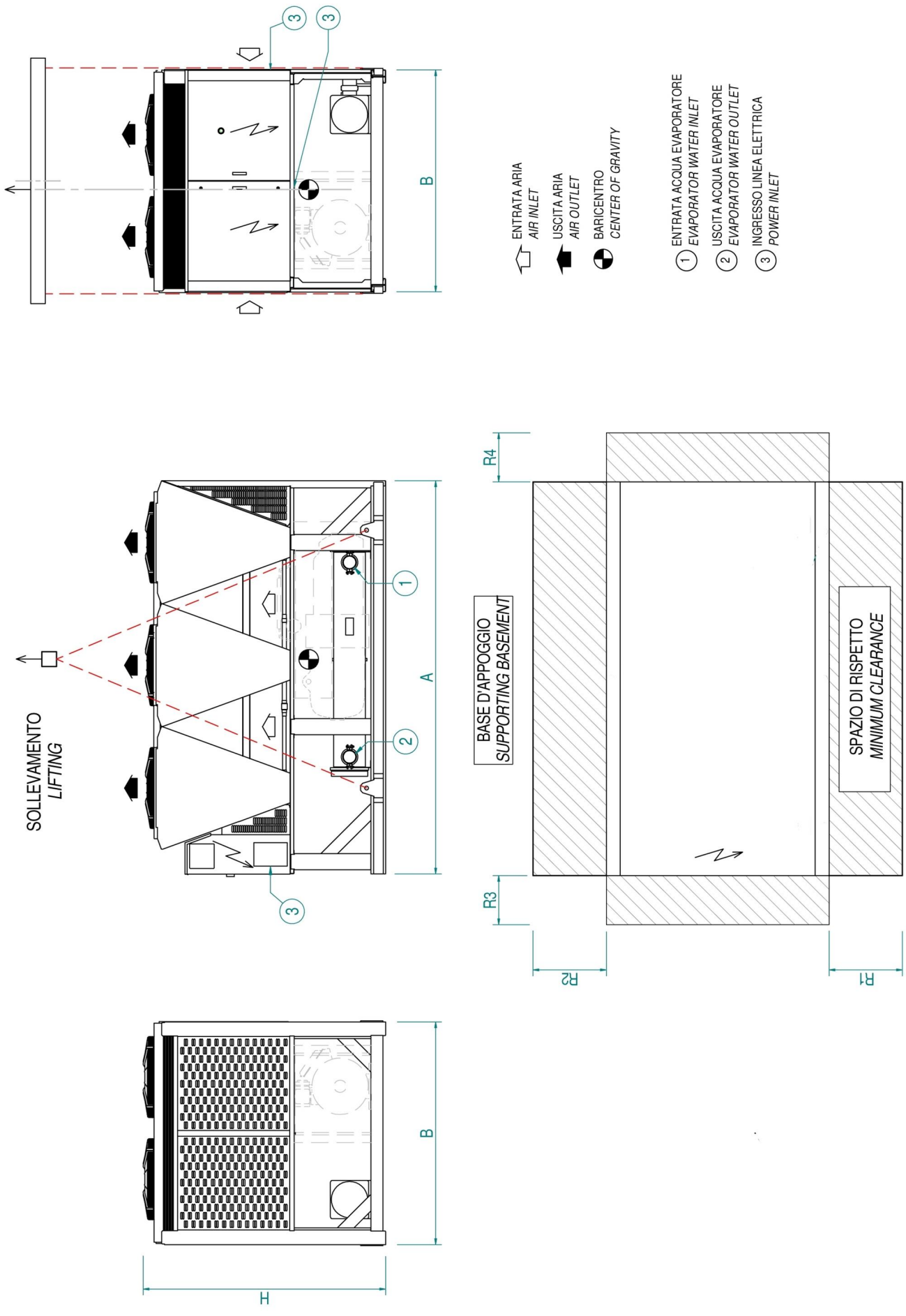
Sound power level in cooling, outdoors.

SOUND PRESSURE LEVEL									
SIZE	Octave band [Hz]								Total sound level dB(A)
	63	125	250	500	1000	2000	4000	8000	
	Sound pressure level dB								
0751	56	53	56	50	44	40	38	30	**52**
0851	56	53	56	50	44	40	38	30	**52**
0951	57	54	57	51	45	41	39	31	**53**
0961	57	54	57	51	45	41	39	31	**53**
1101	59	56	59	53	47	43	41	33	**55**
1301	59	56	59	53	47	43	41	33	**55**
1401	60	57	60	54	48	44	42	34	**56**
1421	61	58	61	55	49	45	43	35	**57**
1431	61	58	61	55	49	45	43	35	**57**
1801	61	58	61	55	49	45	43	35	**57**

Working conditions

Plant (side) cooling exchanger water (in/out) 12,0°C/7,0°C; Source (side) heat exchanger air (in) 35,0°C.

Average sound pressure level at 10m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.



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.

DIMENSIONAL DRAWINGS

FR-Z 0751 - 1801

[SI System]

SIZE	DIMENSIONS AND WEIGHTS				CLEARANCE				HEAT EXCHANGER USER SIDE		HEAT RECOVERY EX. USER SIDE	
	A	B	H	VEIGH	R1	R2	R3	R4	IN/OUT		IN/OUT	
	[mm]	[mm]	[mm]	[kg]	[mm]	[mm]	[mm]	[mm]	TYPE	Ø	TYPE	Ø
FR-Z /K /0751	1500	2260	2500	1480	2000	2300	1500	1500	H	3"	-	-
FR-Z /K /0851	1500	2260	2500	1510	2000	2300	1500	1500	H	3"	-	-
FR-Z /K /0951	2750	2260	2500	2100	2000	2300	1500	1500	H	4"	-	-
FR-Z /K /0961	2750	2260	2500	2130	2000	2300	1500	1500	H	4"	-	-
FR-Z /K /1101	2750	2260	2500	2460	2000	2300	1500	1500	H	4"	-	-
FR-Z /K /1301	2750	2260	2500	2510	2000	2300	1500	1500	H	4"	-	-
FR-Z /K /1401	2750	2260	2500	2540	2000	2300	1500	1500	H	4"	-	-
FR-Z /K /1421	2750	2260	2500	2580	2000	2300	1500	1500	H	4"	-	-
FR-Z /K /1431	4000	2260	2500	3110	2000	2300	1500	1500	H	5"	-	-
FR-Z /K /1801	4000	2260	2500	3540	2000	2300	1500	1500	H	5"	-	-
FR-Z /D /K /0751	1500	2260	2500	1524	2000	2300	1500	1500	H	3"	F	2"
FR-Z /D /K /0851	1500	2260	2500	1555	2000	2300	1500	1500	H	3"	F	2"
FR-Z /D /K /0951	2750	2260	2500	2163	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /K /0961	2750	2260	2500	2194	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /K /1101	2750	2260	2500	2534	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /K /1301	2750	2260	2500	2585	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /K /1401	2750	2260	2500	2616	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /K /1421	2750	2260	2500	2657	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /K /1431	4000	2260	2500	3203	2000	2300	1500	1500	H	5"	F	2"
FR-Z /D /K /1801	4000	2260	2500	3646	2000	2300	1500	1500	H	5"	F	2 1/2"
FR-Z /SL-K /0751	1500	2260	2500	1640	2000	2300	1500	1500	H	3"	-	-
FR-Z /SL-K /0851	2750	2260	2500	2050	2000	2300	1500	1500	H	3"	-	-
FR-Z /SL-K /0951	2750	2260	2500	2270	2000	2300	1500	1500	H	4"	-	-
FR-Z /SL-K /0961	2750	2260	2500	2290	2000	2300	1500	1500	H	4"	-	-
FR-Z /SL-K /1101	2750	2260	2500	2770	2000	2300	1500	1500	H	4"	-	-
FR-Z /SL-K /1301	2750	2260	2500	2770	2000	2300	1500	1500	H	4"	-	-
FR-Z /SL-K /1401	2750	2260	2500	2790	2000	2300	1500	1500	H	4"	-	-
FR-Z /SL-K /1421	4000	2260	2500	3250	2000	2300	1500	1500	H	4"	-	-
FR-Z /SL-K /1431	4000	2260	2500	3410	2000	2300	1500	1500	H	5"	-	-
FR-Z /SL-K /1801	4000	2260	2500	3880	2000	2300	1500	1500	H	5"	-	-
FR-Z /D /SL-K /0751	1500	2260	2500	1689	2000	2300	1500	1500	H	3"	F	2"
FR-Z /D /SL-K /0851	2750	2260	2500	2112	2000	2300	1500	1500	H	3"	F	2"
FR-Z /D /SL-K /0951	2750	2260	2500	2338	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /SL-K /0961	2750	2260	2500	2359	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /SL-K /1101	2750	2260	2500	2853	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /SL-K /1301	2750	2260	2500	2853	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /SL-K /1401	2750	2260	2500	2874	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /SL-K /1421	4000	2260	2500	3348	2000	2300	1500	1500	H	4"	F	2"
FR-Z /D /SL-K /1431	4000	2260	2500	3512	2000	2300	1500	1500	H	5"	F	2"
FR-Z /D /SL-K /1801	4000	2260	2500	3996	2000	2300	1500	1500	H	5"	F	2 1/2"

DIMENSIONAL DRAWINGS

LEGEND OF PIPE CONNECTIONS

TYPE = F
Grooved coupling with male threaded counter-pipe user side

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

NOMINAL PIPE SIZE	PIPE OUTSIDE DIAMETER
ø inches	ø mm
¾	26,7
1	33,7
1 ¼	42,4
1 ½	48,3
2	60,3
2 ½	76,1
3	88,9
3 ½	101,6

NOMINAL PIPE SIZE	PIPE OUTSIDE DIAMETER
ø inches	ø mm
4	114,3
4 ½	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

DESIGNATION	DESCRIPTION
UNI EN 10226-1 - Rp 1 1/2	Internal cylindrical threads where pressure-tight joints are made on the threads, defined by standard UNI ISO 7/1 Conventional ø 1 1/2”
UNI EN 10226-1 - Rp 2 1/2	Internal cylindrical threads where pressure-tight joints are made on the threads, defined by standard UNI ISO 7/1 Conventional ø 2 1/2”
UNI EN 10226-1 - Rp 3	Internal cylindrical threads where pressure-tight joints are made on the threads, defined by standard UNI ISO 7/1 Conventional ø 3”
UNI EN 10226-1 - R 3	External conical threads where pressure-tight joints are made on the threads, defined by standard UNI ISO 7/1 Conventional ø 3”
UNI ISO 228/1 - G 4 B	Internal cylindrical threads where pressure-tight joints are not made on the threads, defined by standard UNI ISO 228/1 Tolerance class B for external thread Conventional ø 4”
DN 80 PN 16	Flange Nominal Diameter: 80 mm Nominal Pressure: 16 bar

NOTE:
Conventional diameter value [in inches] identifies short thread designation, based upon the relative standard.
All relative values are defined by standards.
As example, here below some values:

	UNI EN 10226-1	UNI ISO 228/1
Conventional ø	1”	1”
Pitch	2.309 mm	2.309 mm
External ø	33.249 mm	33.249 mm
Core ø	30.291 mm	30.291 mm
Thread height	1.479 mm	1.479 mm

10.1 HYDRONIC MODULE

The units can be fitted with the following types hydronic module:

- Only terminals (ON/OFF or modulating)

The hydronic module allows to control the external pumps with the unit controller logic.

- Pumps (fixed or variable speed)

The hydronic module includes the pumps and the main water circuit components, thus optimizing hydraulic and electrical installation space, time and costs.

The complete list of the options available is present in the accessory section of the bulletin.

For the hydronic modules with only terminals, the factory-mounted components are:

- Terminals for external pumps control (only relays or relays + 0-10V signal)
- Differential pressure switch (on heat exchanger)
- Drain valve (on heat exchanger)

For the hydronic modules with pumps, the factory-mounted components are:

- 1 or 2 pumps, 2 poles, low or high head, fixed speed or variable speed (inverter)
- Pump suction and discharge valves
- One-way valve (Clapet type for in-line pumps)
- Purge valve
- Drain plug
- Differential pressure switch (on heat exchanger)
- Drain valve (on heat exchanger)

In the modules with 2 pumps, they are controlled in duty/standby, with running hours equalization and changeover on device failure.
The electrical panel of the unit is protected with fuses and contactors with thermals cut-out.

Suction, volute and discharge of each pump and all the water pipes are covered with an insulation lining in closed-cell reticulated foam in PE of 15 mm.
The hydronic group is protected by a self-ventilated enclosure. In silenced units (/SL versions and units with Noise Reducer (code 2315)), the enclosure is acoustically insulated by a 30 mm thick lining of polyester fibers (Fiberform).
Note: the use of 2 pole pumps in super low noise units (/SL versions) increases the sound power by 1 dB(A).

The choice between in-line and end-suction pumps has been made keeping in consideration the best configuration in terms of dimensions and performances.

10.1 IN-LINE PUMPS

Low or high head pumps

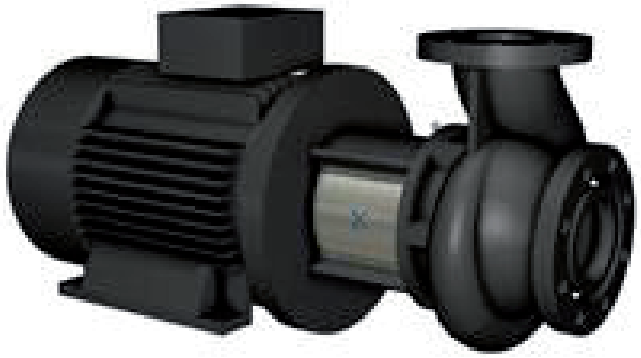
Grundfos single-stage, close-coupled, volute twin-head pump with in-line suction and discharge ports. The pump housing and the impeller are made of cast iron, with optimized design to improve the efficiency. The twin-head pumps are designed with two parallel power heads. Each power head is fitted with a fan-cooled asynchronous motor of identical size. Motor and pump shafts are connected via a rigid two-part coupling. The pumps are of the top-pull-out design, i.e. you can remove the power head (motor, pump head and impeller) for maintenance or service while the pump housing remains in the pipework.
Pump housing and pump head are electrocoated to improve the corrosion resistance. The flanges have tappings for mounting of pressure gauges. The central part of the motor stool is provided with guards for protection against the shaft and coupling.
The shaft seal is in accordance with EN 12756. Pipework connection is via PN 16 DIN flanges (EN 1092-2 and ISO 7005-2).
The pump is fitted with an unbalanced rubber bellows seal with torque transmission across the spring and around the bellows. Due to the bellows, the seal does not wear the shaft, and the axial movement is not prevented by deposits on the shaft.
Primary seal:

- Rotating seal ring material: Silicon carbide (SiC)
- Stationary seat material: Silicon carbide (SiC)

This material pairing is used where higher corrosion resistance is required. The high hardness of this material pairing offers good resistance against abrasive particles.
Secondary seal material: EPDM (ethylene-propylene rubber). EPDM has excellent resistance to hot water.
A circulation of liquid through the duct of the air vent screw ensures lubrication and cooling of the shaft seal.
The twin-head pumps are connected in parallel. A non-return flap valve in the common outlet port is opened by the flow of the pumped liquid and prevents backflow of liquid into the idle pump head. The pump housing is provided with a replaceable bronze neck ring to reduce the amount of liquid running from the discharge side of the impeller to the suction side.
The pumps are fitted with high efficiency motors classified as IE3 in accordance with IEC 60034-30. The fan-cooled motors are totally enclosed, with main dimensions to IEC and DIN standards. Electrical tolerances comply with IEC 60034. Insulation class F (IEC 85). These motors show high efficiency, thus minimizing the energy consumption. The motor can be drived via a variable frequency drive for variable speed operation.

10.2 END-SUCTION PUMPS
Low or high head pumps
Non-self-priming, single-stage, centrifugal volute end-suction pumps with axial inlet port, radial outlet port and horizontal shaft, designed according to ISO 5199 with dimensions and rated performance according to EN 733 (10 bar). Flanges are PN 16 with dimensions according to EN 1092-2.
The pump is close-coupled to a fan-cooled asynchronous motor. Pump housing and impeller are made of cast iron, while the wear ring is made of bronze. The back pull-out design enables removal of the motor, motor stool and impeller without disturbing the pump housing or pipework. Cast-iron parts have an epoxy-based coating made in a cathodic electro-deposition (CED) process.
The pump housing has both a priming and a drain hole closed by plugs.
The impeller is a closed impeller with double-curved blades with smooth surfaces. The impeller is statically balanced according to ISO 1940-1 class G6.3 and hydraulically balanced to compensate for axial thrust. Wear rings used in pump housing and for impeller are made of bronze.
Motor stool and pump cover are made of cast iron. Coupling guards are fitted to the motor stool. The pump cover is provided with a manual air vent screw for venting of the pump housing and the shaft seal chamber. An O-ring forms the seal between cover and pump housing.
The pump is fitted with an unbalanced rubber bellows seal with torque transmission across the spring and around the bellows. Due to the bellows, the seal does not wear the shaft, and the axial movement is not prevented by deposits on the shaft.
Primary seal:
- Rotating seal ring material: Silicon carbide (SiC)
- Stationary seat material: Silicon carbide (SiC)

This material pairing is used where higher corrosion resistance is required. The high hardness of this material pairing offers good resistance against abrasive particles.
Secondary seal material: EPDM (ethylene-propylene rubber). EPDM has excellent resistance to hot water.
The pumps are fitted with high efficiency motors classified as IE3 in accordance with IEC 60034-30. The fan-cooled motors are totally enclosed, with main dimensions to IEC and DIN standards. Electrical tolerances comply with IEC 60034. Insulation class F (IEC 85). These motors show high efficiency, thus minimizing the energy consumption. The motor can be drived via a variable frequency drive for variable speed operation.



10.3 VARIABLE FREQUENCY DRIVE
For pump speed control
Mitsubishi Electric frequency converters, with IP55 protection rating for rough environment. The drives, one for each pump, are cooled by built-in fans and installed with a dedicated enclosure.
The fast-response speed control combined with the advanced auto-tuning function ensures safe and accurate operation in any condition.
Optimum control of the excitation current maximizes motor efficiency for additional energy savings.
The drive features built-in EMC filter (EN 61800-3, 1st Environment, Category C2) and DC link choke to significantly reduce electromagnetic noise and current harmonic distortion THDi.

10.3 OTHER COMPONENTS
The following components are excluded from the hydronic kit supply, but their use is mandatory for the correct unit and system operation.
These components are available as accessories and supplied loose, it shall be the customer responsability to install them.
- Unit inlet water filter
- Unit outlet flow-switch

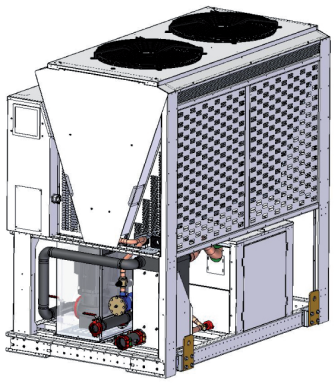
It is also recommended the use of the following components:
- Unit inlet and outlet pressure gauges
- Shut-off valves
- Flexible joints on piping

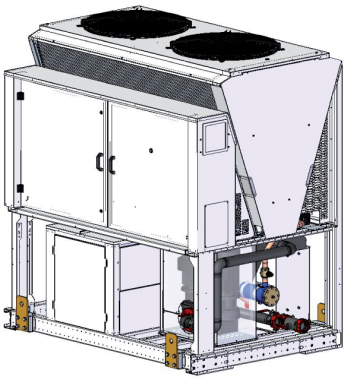
Possible configurations

PUMP GROUP	Versions	
	K	SL-K
HYDRONIC KIT 1 PUMP 2 POLES LH(4706)	X	X
HYDRONIC KIT 1 PUMP 2 POLES HH(4707)	X	X
HYDRONIC KIT 2 PUMPS 2 POLES LH(4711)	X	X
HYDRONIC KIT 2 PUMPS 2 POLES HH(4712)	X	X

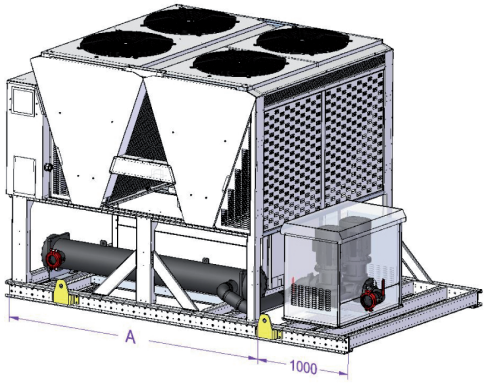
UNITA' CON KIT IDRONICO
UNITS WITH HYDRONIC GROUP

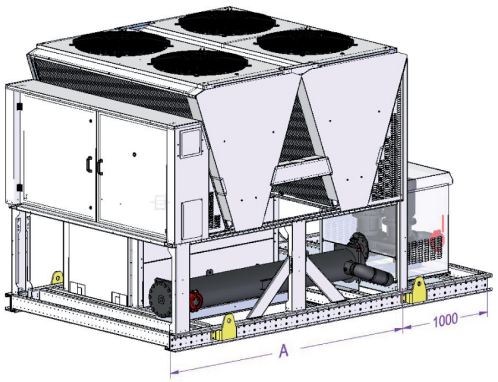
KIT IDRONICO INTERNO - POMPE IN-LINE
INTERNAL HYDRONIC KIT - IN-LINE PUMPS



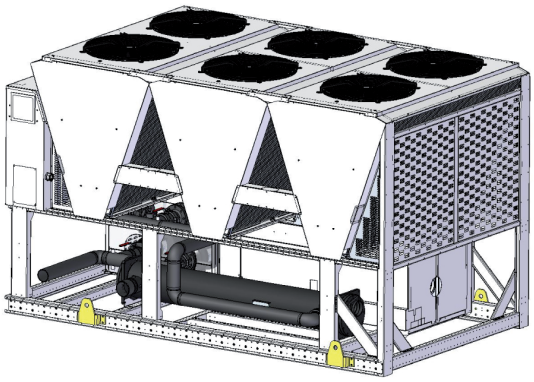


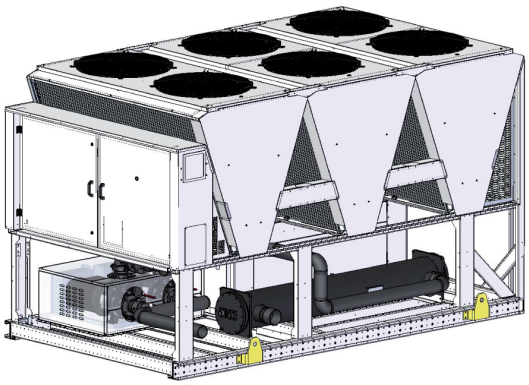
KIT IDRONICO SU PROLUNGAMENTO STRUTTURA - POMPE IN-LINE
HYDRONIC KIT ON FRAME EXTENSION - IN-LINE PUMPS



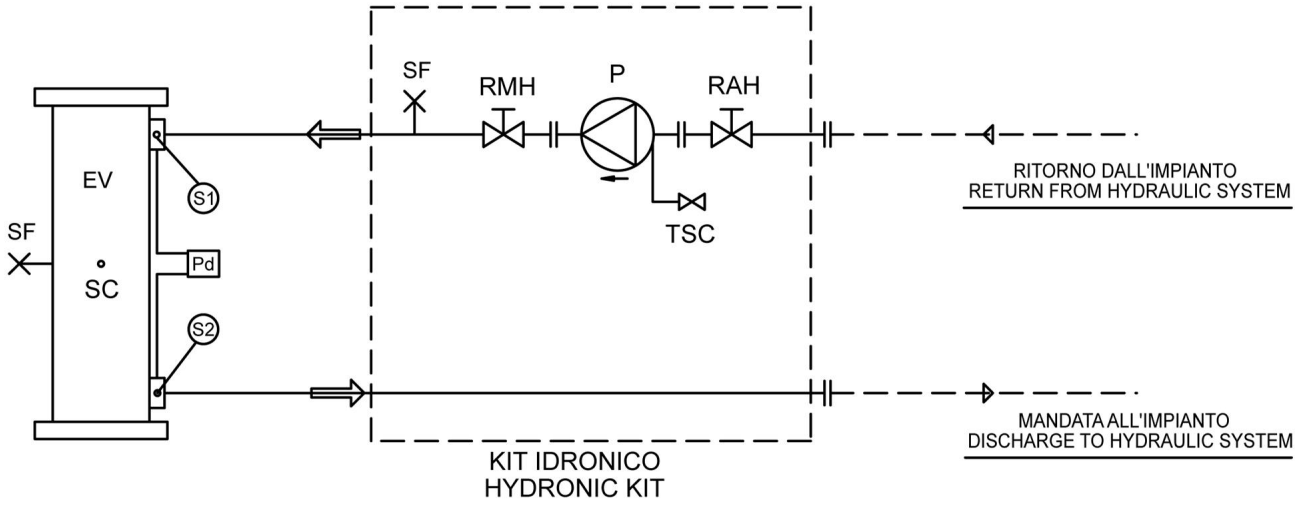


KIT IDRONICO INTERNO - POMPE ORTOGONALI
INTERNAL HYDRONIC KIT - END-SUCTION PUMPS



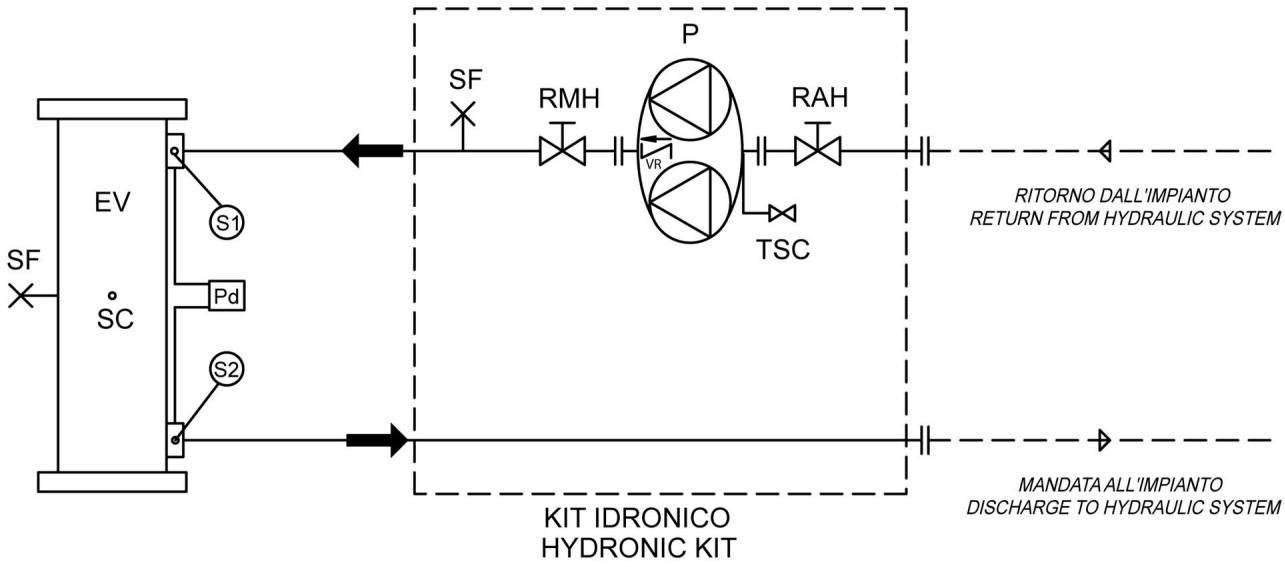


Schema idraulico 1 POMPA IN-LINE o 1 POMPA ORTOGOLALE - configurazione STD
Hydraulic diagram 1 IN-LINE water PUMP or 1 END-SUCTION water PUMP - STD configuration



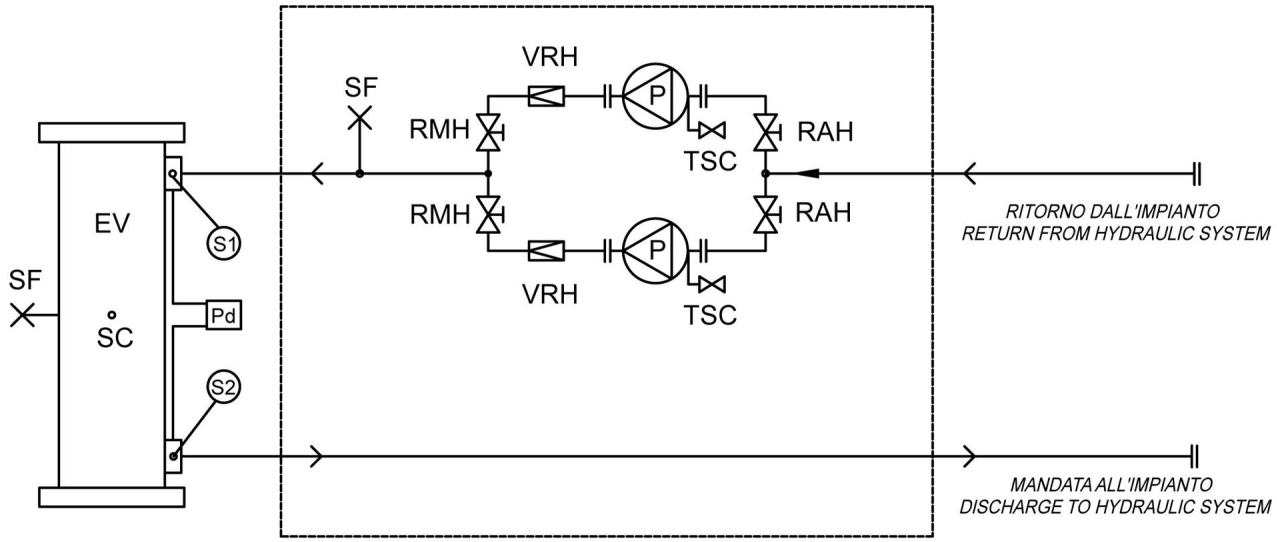
LEGENDA - LEGEND	
COMPONENTI DEL KIT IDRONICO *COMPONENTS OF THE HYDRONIC KIT*	
EV	Evaporatore (scambiatore a fascio tubiero) Evaporator (tube exchanger)
P	Pompa gemellare Twin rotor pump
Pd	Pressostato differenziale lato acqua Water Differential pressure switch
RAH	Rubinetto aspirazione Pump suction valve
RMH	Rubinetto mandata Pump discharge valve
SC	Valvola di scarico Drain valve
TSC	Tappo di scarico Drain plug
SF	Valvola di sfiato Purge valve
S1	Sonda ingresso acqua scambiatore Exchanger water inlet probe
S2	Sonda uscita acqua scambiatore Exchanger water outlet probe
VR	Valvola di non ritorno (interna alla pompa) One way valve (pump inside)

Schema idraulico 2 POMPE IN-LINE - configurazione STD
Hydraulic diagram 2 IN-LINE water PUMPS - STD configuration



LEGENDA - LEGEND	
COMPONENTI DEL KIT IDRONICO *COMPONENTS OF THE HYDRONIC KIT*	
EV	Evaporatore (scambiatore a fascio tubiero) Evaporator (tube exchanger)
P	Pompa gemellare Twin rotor pump
Pd	Pressostato differenziale lato acqua Water Differential pressure switch
RAH	Rubinetto aspirazione Pump suction valve
RMH	Rubinetto mandata Pump discharge valve
SC	Valvola di scarico Drain valve
TSC	Tappo di scarico Drain plug
SF	Valvola di sfiato Purge valve
S1	Sonda ingresso acqua scambiatore Exchanger water inlet probe
S2	Sonda uscita acqua scambiatore Exchanger water outlet probe
VR	Valvola di non ritorno (interna alla pompa) One way valve (pump inside)

Schema idraulico 2 POMPE ORTOGOLALI - configurazione STD
Hydraulic diagram 2 END-SUCTION water PUMPS - STD configuration



KIT IDRONICO
HYDRONIC KIT

LEGENDA - LEGEND	
COMPONENTI DEL KIT IDRONICO *COMPONENTS OF THE HYDRONIC KIT*	
EV	Evaporatore (scambiatore a fascio tubiero) Evaporator (tube exchanger)
P	Pompa Water pump
Pd	Pressostato differenziale lato acqua Water Differential pressure switch
RAH	Rubinetto aspirazione Pump suction valve
RMH	Rubinetto mandata Pump discharge valve
SC	Valvola di scarico Drain valve
TSC	Tappo di scarico Drain plug
SF	Valvola di sfiato Purge valve
S1	Sonda ingresso acqua scambiatore Exchanger water inlet probe
S2	Sonda uscita acqua scambiatore Exchanger water outlet probe
VRH	Valvola di non ritorno One way valve

HYDRONIC GROUP

Hydronic kit positioning

	Version	HYDRONIC KIT 1 PUMP 2 POLES LH (4706)				HYDRONIC KIT 1 PUMP 2 POLES HH (4707)				HYDRONIC KIT 2 PUMPS 2 POLES LH (4711)				HYDRONIC KIT 2 PUMPS 2 POLES HH (4712)			
		extra L [mm]	extra W [mm]	extra H [mm]	extra WGT [kg]	extra L [mm]	extra W [mm]	extra H [mm]	extra WGT [kg]	extra L [mm]	extra W [mm]	extra H [mm]	extra WGT [kg]	extra L [mm]	extra W [mm]	extra H [mm]	extra WGT [kg]
0751	K	/	/	/	-	/	/	/	-	/	/	/	-	/	/	/	-
	SL-K	/	/	/	-	/	/	/	-	/	/	/	-	/	/	/	-
0851	K	/	/	/	-	/	/	/	-	/	/	/	-	/	/	/	-
	SL-K	1000	/	/	-	/	/	/	-	1000	/	/	-	/	/	/	-
0951	K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
	SL-K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
0961	K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
	SL-K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
1101	K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
	SL-K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
1301	K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
	SL-K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
1401	K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
	SL-K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
1421	K	1000	/	/	-	1000	/	/	-	1000	/	/	-	1000	/	/	-
	SL-K	/	/	/	-	/	/	/	-	/	/	/	-	/	/	/	-
1431	K	/	/	/	-	/	/	/	-	/	/	/	-	/	/	/	-
	SL-K	/	/	/	-	/	/	/	-	/	/	/	-	/	/	/	-
1801	K	/	/	/	-	/	/	/	-	/	/	/	-	/	/	/	-
	SL-K	/	/	/	-	/	/	/	-	/	/	/	-	/	/	/	-

extra L	Unit's extra length
extra W	Unit's extra operating width (NOT to be considered for transport)
extra H	Unit's extra height
extra H	Unit's extra weight (pumps and piping)
HYDRONIC KIT 1 PUMP 2 POLES LH	HYDRONIC KIT 1 PUMP 2 POLES LH
HYDRONIC KIT 1 PUMP 2 POLES HH	HYDRONIC KIT 1 PUMP 2 POLES HH
HYDRONIC KIT 2 PUMPS 2 POLES LH	HYDRONIC KIT 2 PUMPS 2 POLES LH
HYDRONIC KIT 2 PUMPS 2 POLES HH	HYDRONIC KIT 2 PUMPS 2 POLES HH
-	Not available

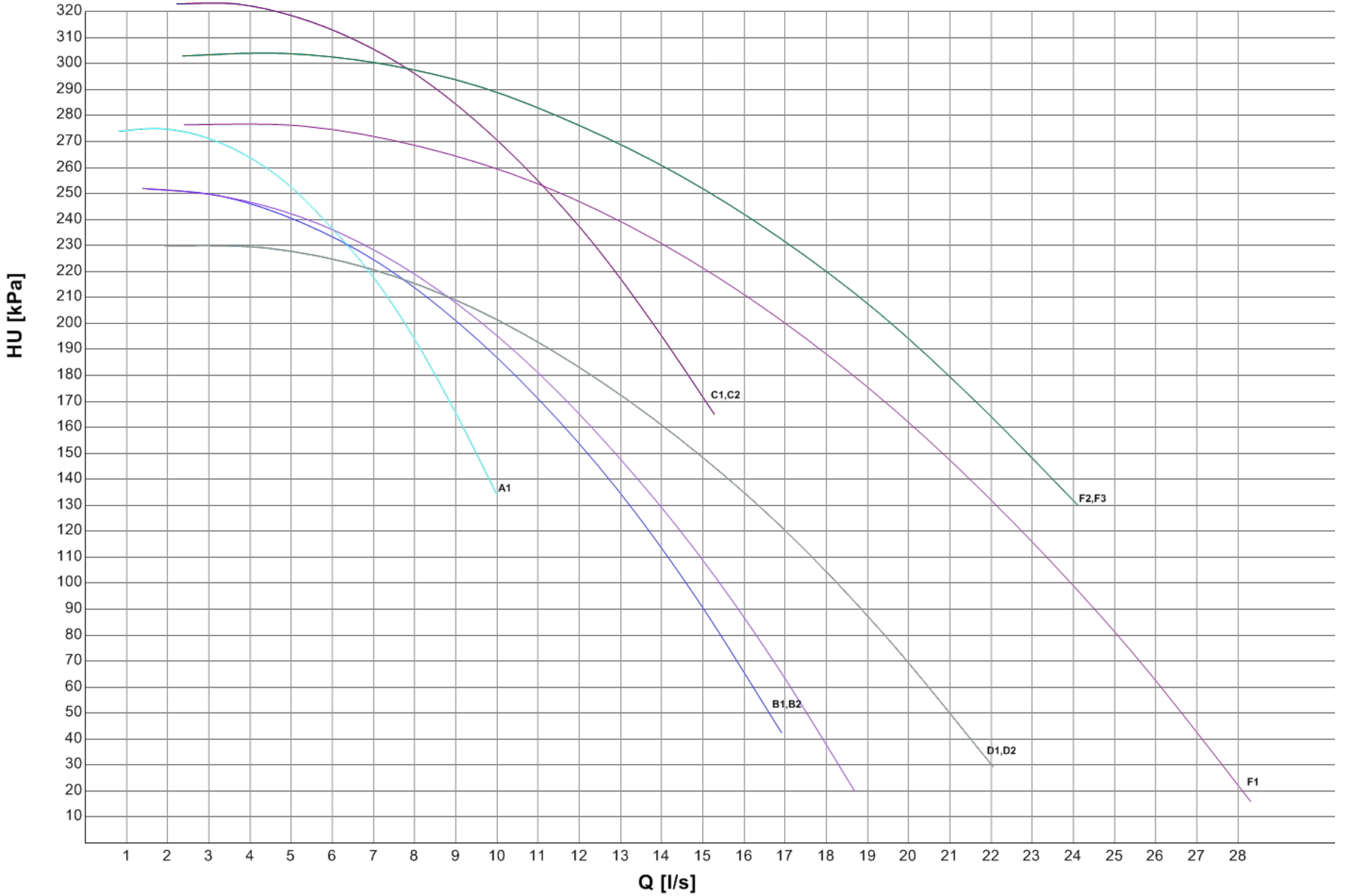
HYDRONIC GROUP

HEAT EXCHANGER USER SIDE - HYDRONIC KIT 1 PUMP 2 POLES HH

SIZE		CH		PUMP					CH
		Pfgross	Qfgross	Rif.	Model	N.	F.L.A.	F.L.I.	HU
		[kW] (1)	[l/s] (1)			Pole	[A]	[kW]	[kPa]
0751	K	145	6,96	A1	TP 50-290/2	2	6	3,00	218
	SL-K	140	6,70						224
0851	K	160	7,65	B1	TP 65-250/2	2	8	4,00	217
	SL-K	170	8,11						212
0951	K	203	9,70	B2					199
	SL-K	196	9,35						203
0961	K	222	10,61	C1	TP 65-340/2 IE3	2	11	5,50	261
	SL-K	215	10,27						266
1101	K	238	11,38	C2					248
	SL-K	246	11,76						242
1301	K	275	13,14	D1	TP 80-240/2	2	11	5,50	171
	SL-K	265	12,67						176
1401	K	299	14,30	D2					158
	SL-K	288	13,76						164
1421	K	329	15,73	F1	TP 80-250/2	2	14	7,50	198
	SL-K	332	15,86		NB 50-160/150 IE3				225
1431	K	348	16,63	F2					236
	SL-K	346	16,57						236
1801	K	396	18,92	F3					208
	SL-K	395	18,89						209

(1) Values refer to nominal conditions
CH Cooling mode
Pf Cooling capacity unit (Cooling mode)
Pt Heating capacity unit (Heating mode)
Q Plant (side) exchanger water flow
F.L.I. Pump power input
F.L.A. Pump running current
HU Pump residual pressure head (Units with hydronic group without mains filter)

HEAT EXCHANGER USER SIDE - HYDRONIC KIT 1 PUMP 2 POLES HH



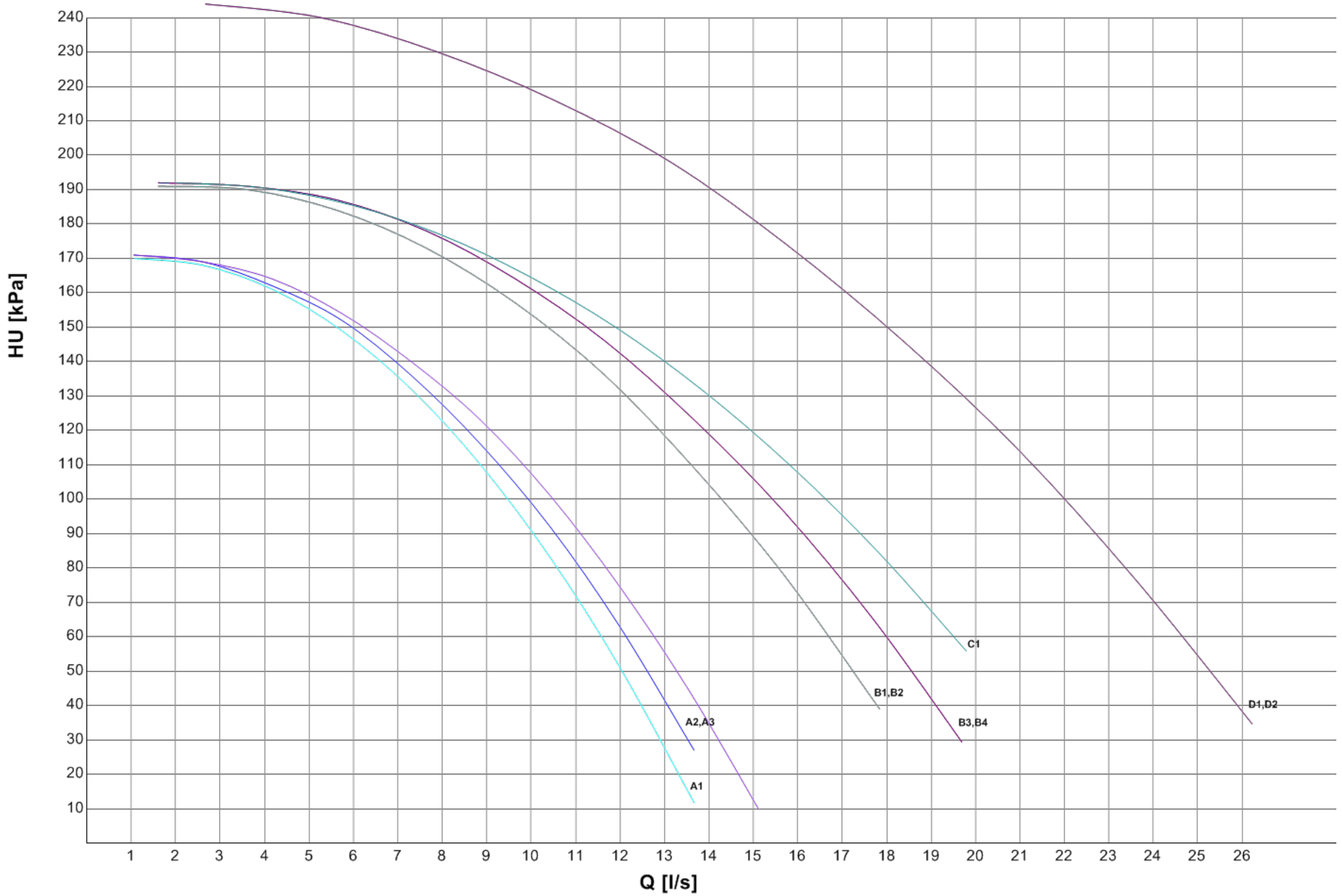
HYDRONIC GROUP

HEAT EXCHANGER USER SIDE - HYDRONIC KIT 1 PUMP 2 POLES LH

SIZE		CH		PUMP					CH
		Pfgross	Qfgross	Rif.	Model	N.	F.L.A.	F.L.I.	HU
		[kW] (1)	[l/s] (1)			Pole	[A]	[kW]	[kPa]
0751	K	145	6,96	A1	TP 65-170/2	2	4	2,20	136
	SL-K	140	6,70						139
0851	K	160	7,65	A2					132
	SL-K	170	8,11						127
0951	K	203	9,70	A3					111
	SL-K	196	9,35						116
0961	K	222	10,61	B1	TP 80-210/2	2	8	4,00	147
	SL-K	215	10,27						151
1101	K	238	11,38	B2					139
	SL-K	246	11,76						135
1301	K	275	13,14	B3					130
	SL-K	265	12,67						135
1401	K	299	14,30	B4					115
	SL-K	288	13,76						122
1421	K	329	15,73	C1					120
	SL-K	332	15,86		NB 50-125/121	2	8	4,00	101
1431	K	348	16,63	D1	NB 50-125/135	2	11	5,50	165
	SL-K	346	16,57						166
1801	K	396	18,92	D2					140
	SL-K	395	18,89						140

(1) Values refer to nominal conditions
CH Cooling mode
Pf Cooling capacity unit (Cooling mode)
Pt Heating capacity unit (Heating mode)
Q Plant (side) exchanger water flow
F.L.I. Pump power input
F.L.A. Pump running current
HU Pump residual pressure head (Units with hydronic group without mains filter)

HEAT EXCHANGER USER SIDE - HYDRONIC KIT 1 PUMP 2 POLES LH



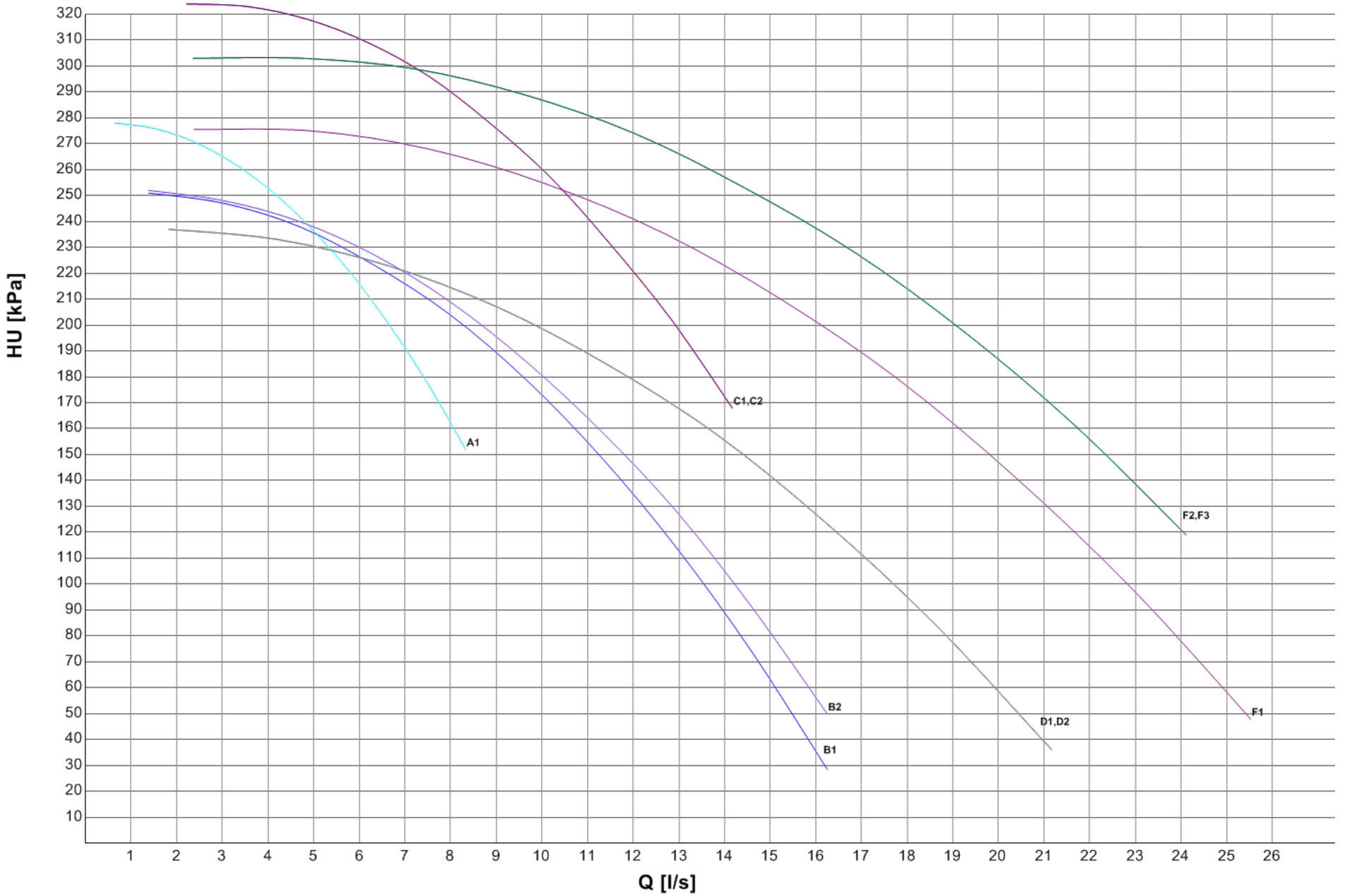
HYDRONIC GROUP

HEAT EXCHANGER USER SIDE - HYDRONIC KIT 2 PUMPS 2 POLES HH

SIZE		CH		PUMP					CH
		Pfgross	Qfgross	Rif.	Model	N.	F.L.A.	F.L.I.	HU
		[kW] (1)	[l/s] (1)			Pole	[A]	[kW]	[kPa]
0751	K	145	6,96	A1	TPD 50-290/2	2	6	3,00	193
	SL-K	140	6,70						199
0851	K	160	7,65	B1	TPD 65-250/2	2	8	4,00	208
	SL-K	170	8,11						202
0951	K	203	9,70	B2					186
	SL-K	196	9,35						191
0961	K	222	10,61	C1	TPD 65-340/2 IE3	2	11	5,50	249
	SL-K	215	10,27						255
1101	K	238	11,38	C2					234
	SL-K	246	11,76						226
1301	K	275	13,14	D1	TPD 80-240/2	2	11	5,50	166
	SL-K	265	12,67						172
1401	K	299	14,30	D2					151
	SL-K	288	13,76						158
1421	K	329	15,73	F1	TPD 80-250/2 IE3	2	14	7,50	185
	SL-K	332	15,86		NB 50-160/150 IE3				220
1431	K	348	16,63	F2					230
	SL-K	346	16,57						231
1801	K	396	18,92	F3					202
	SL-K	395	18,89						202

(1) Values refer to nominal conditions
CH Cooling mode
Pf Cooling capacity unit (Cooling mode)
Pt Heating capacity unit (Heating mode)
Q Plant (side) exchanger water flow
F.L.I. Pump power input
F.L.A. Pump running current
HU Pump residual pressure head (Units with hydronic group without mains filter)

HEAT EXCHANGER USER SIDE - HYDRONIC KIT 2 PUMPS 2 POLES HH



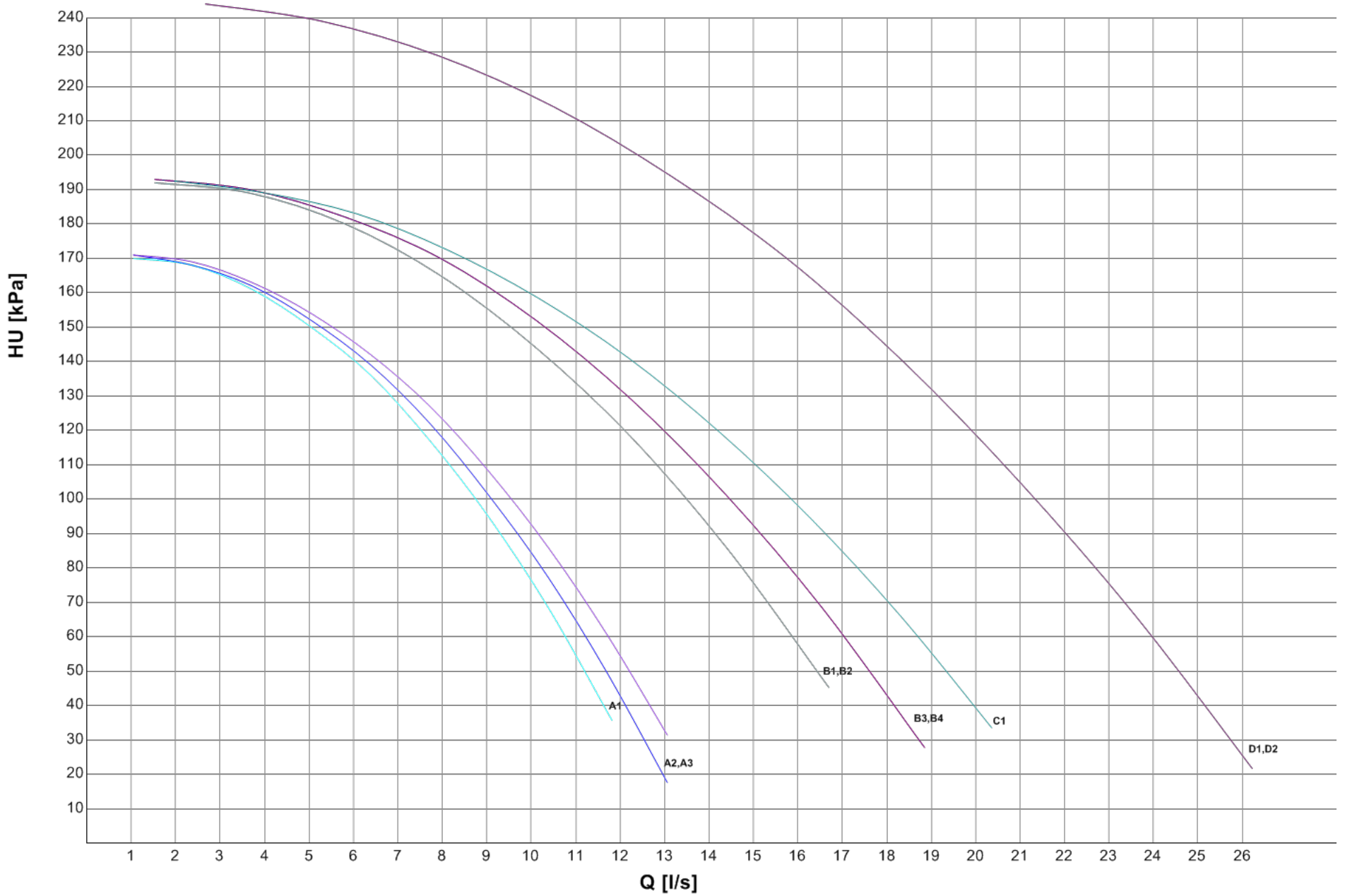
HYDRONIC GROUP

HEAT EXCHANGER USER SIDE - HYDRONIC KIT 2 PUMPS 2 POLES LH

SIZE		CH		PUMP					CH
		Pfgross	Qfgross	Rif.	Model	N.	F.L.A.	F.L.I.	HU
		[kW] (1)	[l/s] (1)			Pole	[A]	[kW]	[kPa]
0751	K	145	6,96	A1	TPD 65-170/2	2	21	10,2	128
	SL-K	140	6,70						132
0851	K	160	7,65	A2					123
	SL-K	170	8,11						116
0951	K	203	9,70	A3					97,7
	SL-K	196	9,35						103
0961	K	222	10,61	B1	TPD 80-210/2 IE3	2	8	4,00	139
	SL-K	215	10,27						142
1101	K	238	11,38	B2					129
	SL-K	246	11,76						124
1301	K	275	13,14	B3					118
	SL-K	265	12,67						124
1401	K	299	14,30	B4					103
	SL-K	288	13,76						110
1421	K	329	15,73	C1					105
	SL-K	332	15,86		NB 50-125/121	2	8	4,00	96,2
1431	K	348	16,63	D1	NB 50-125/135	2	11	5,50	160
	SL-K	346	16,57						161
1801	K	396	18,92	D2					133
	SL-K	395	18,89						134

(1) Values refer to nominal conditions
CH Cooling mode
Pf Cooling capacity unit (Cooling mode)
Pt Heating capacity unit (Heating mode)
Q Plant (side) exchanger water flow
F.L.I. Pump power input
F.L.A. Pump running current
HU Pump residual pressure head (Units with hydronic group without mains filter)

HEAT EXCHANGER USER SIDE - HYDRONIC KIT 2 PUMPS 2 POLES LH



HYDRONIC GROUP

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.
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.

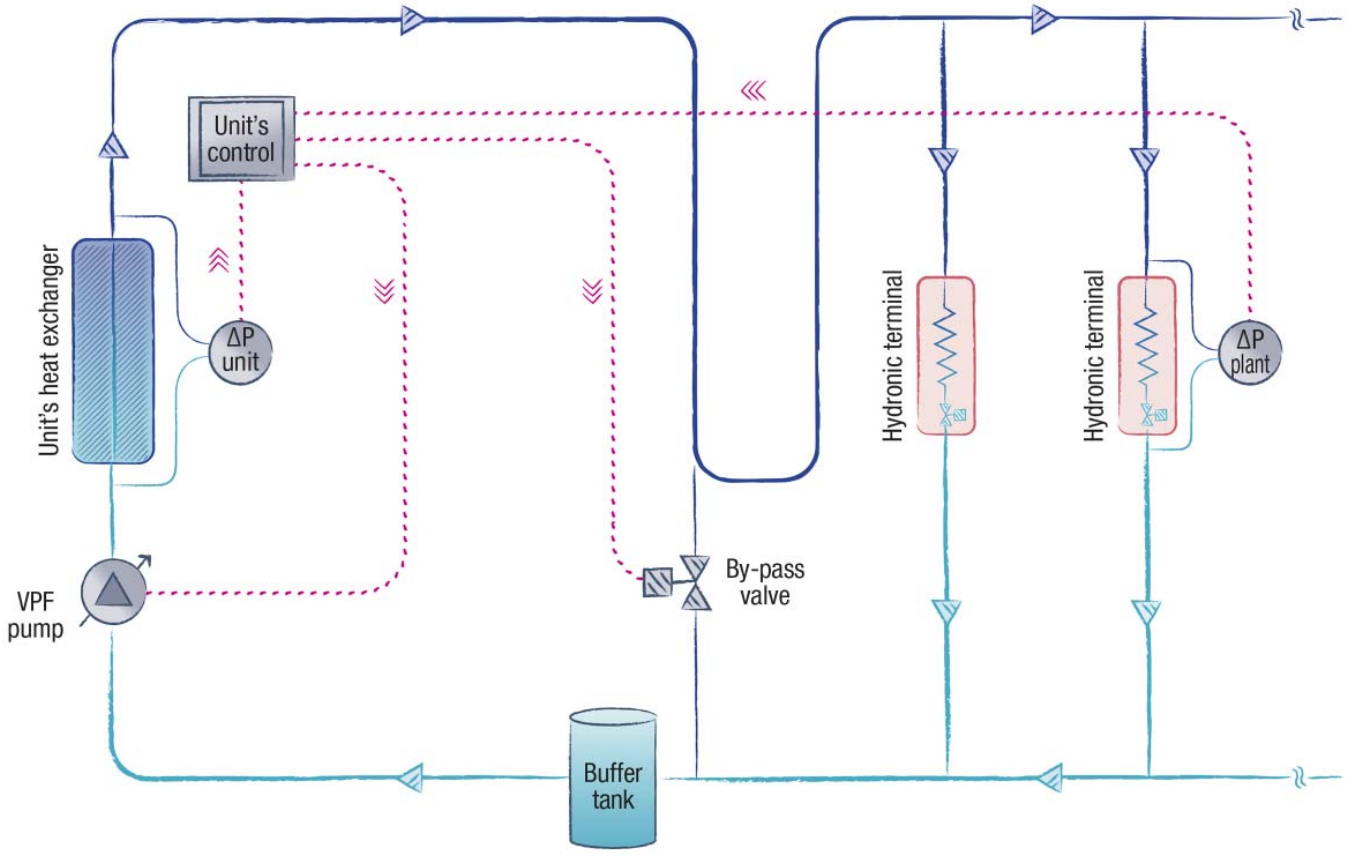
VPF SYSTEM (delta P control)
For plants with only a primary circuit

VPF - Plant and unit requirements

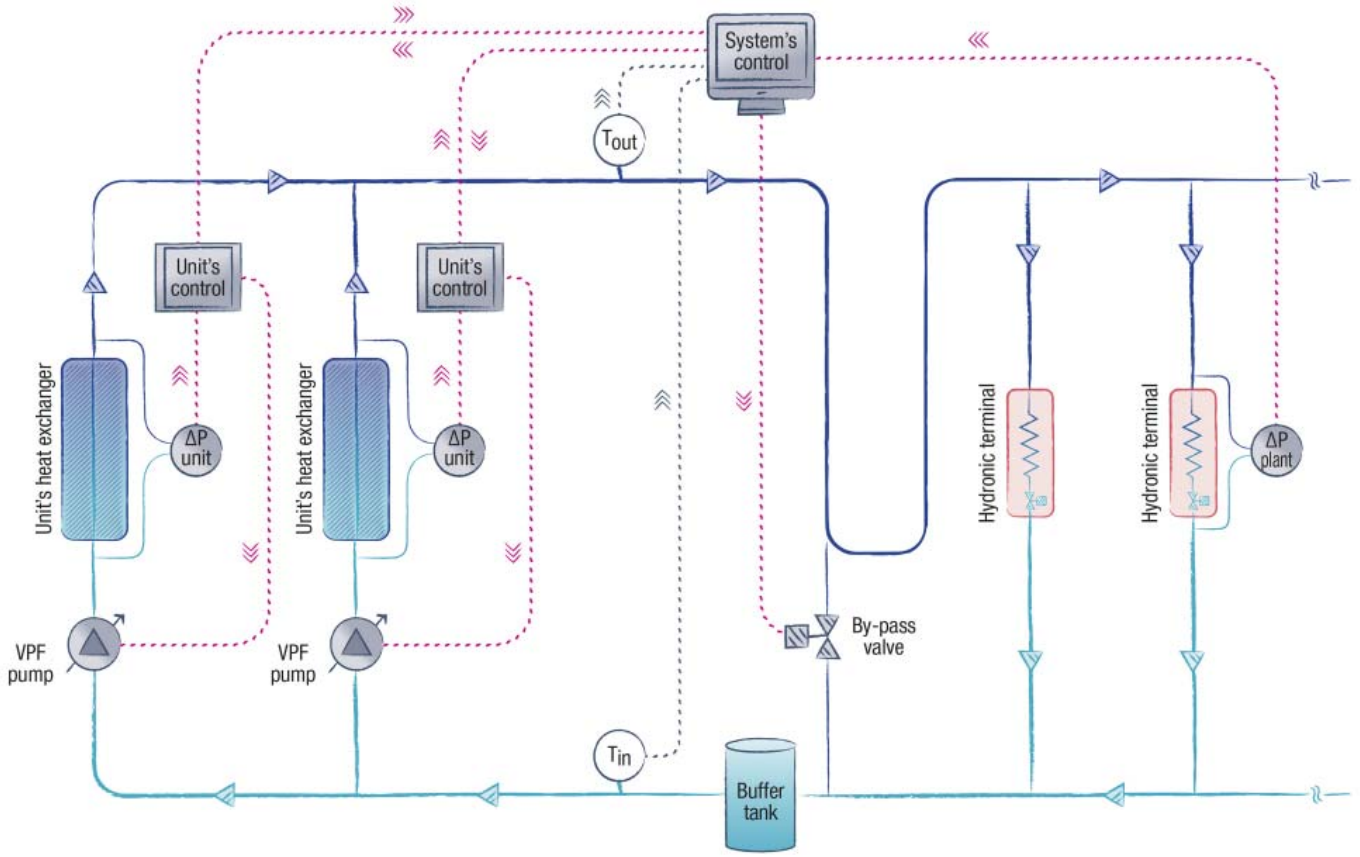
The VPF logic provides the variable flow control for the plant's primary circuit.

- 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 system



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 (ΔP < ΔPmin), 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 or ClimaPRO).
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.

VPF - Devices and installation

Device	Accessory name		
	VPF (plant DP trans excl)	VPF (plant DP trans incl)	VPF MULTI-UNIT SYSTEM
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 control system (2)
Plant side differential pressure transducer	Not included (the supply is the customer's responsibility) (1)	Factory supplied, installation is the client's responsibility (1)(2)	Factory supplied with the multi-unit control system, installation is the client's responsibility (1)(3)
Plant side hydraulic by-pass valve	Not included (the supply is the customer's responsibility) (4)	Not included (the supply is the customer's responsibility) (4)	Not included (the supply is the customer's responsibility) (4)

(1) 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.
(2) 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"
(3) It is the customer's responsibility to configure the multi-unit control system (Manager3000 or ClimaPRO) with option VPF.
(4) See attached table for information on the hydraulic by-pass design.

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.

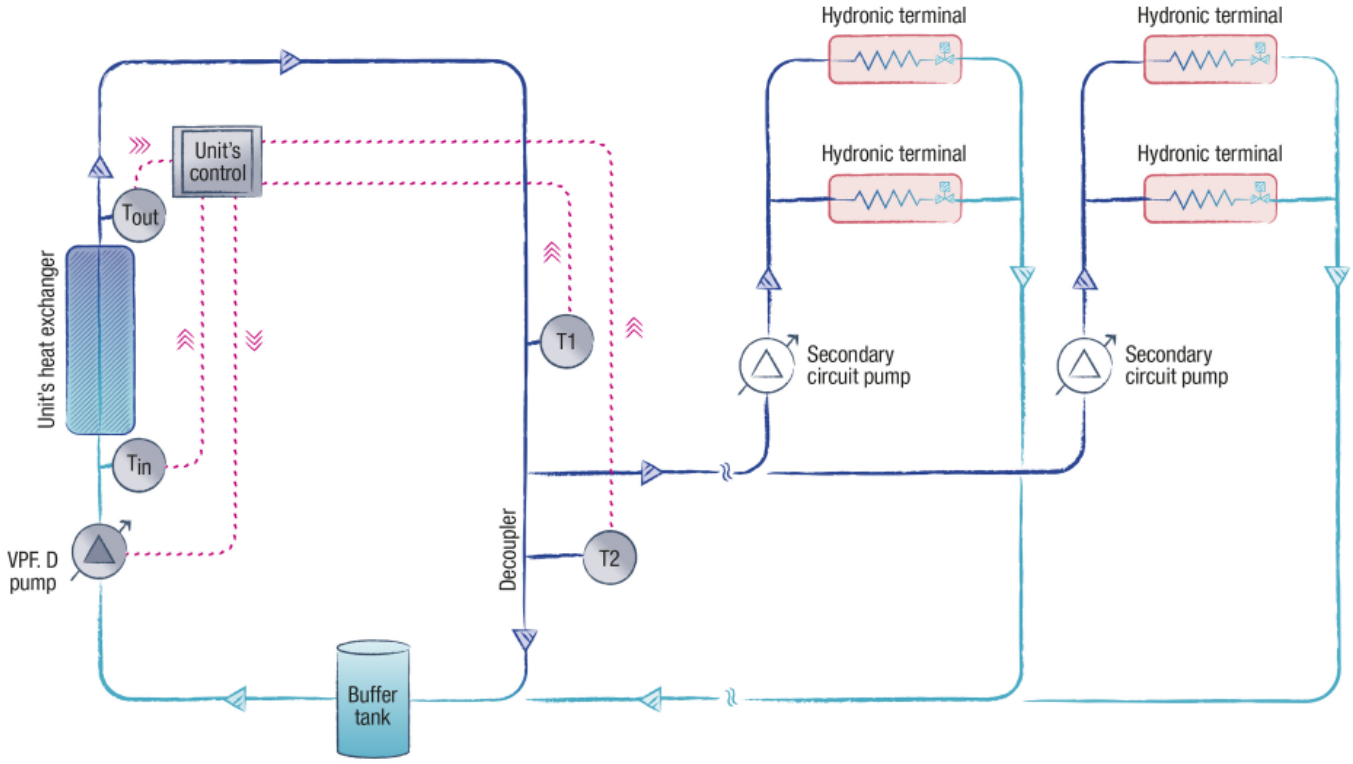
VPF.D SYSTEM (delta T control)
For plants with primary and secondary circuits separated by a hydraulic decoupler.

VPF.D - Plant and unit requirements

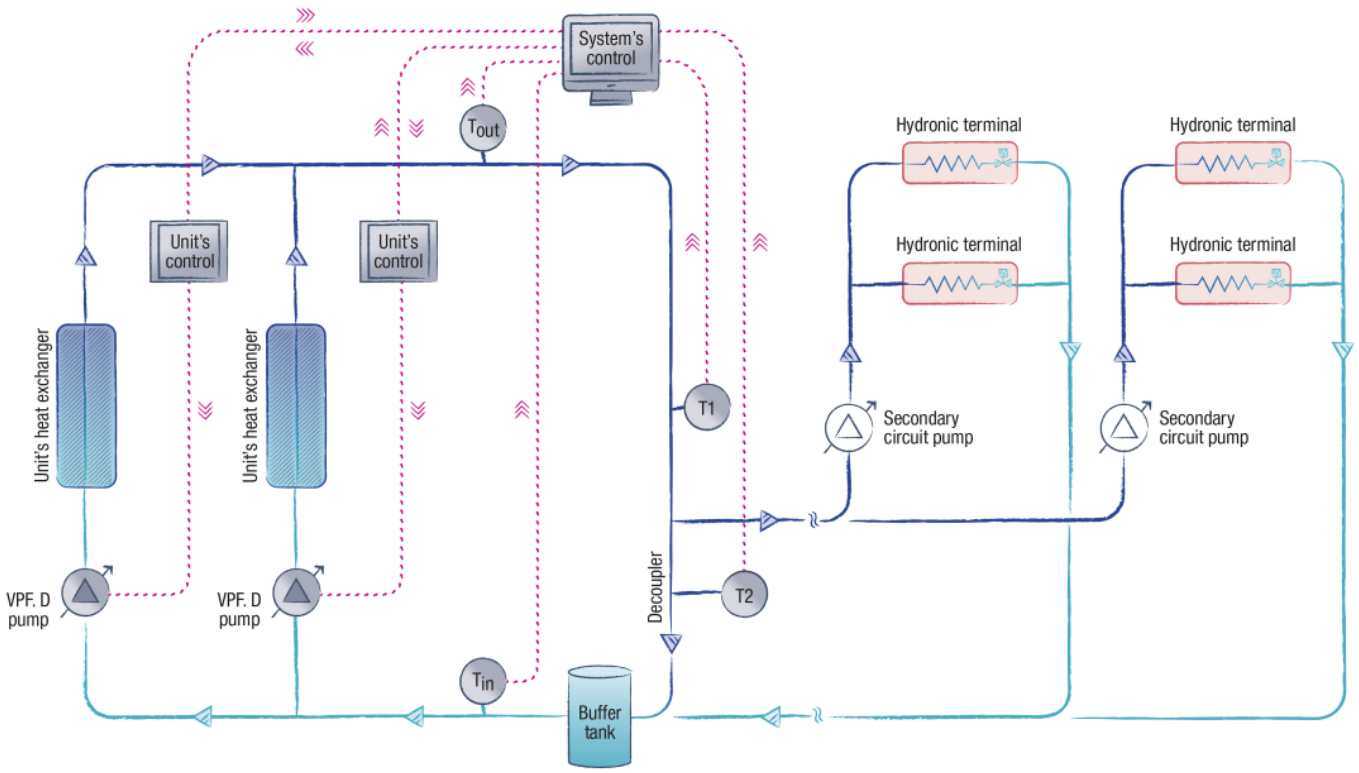
The VPF.D logic provides the variable flow control for the plant's primary circuit.

- 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 single unit system



Plant diagram for multi-unit system



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 or ClimaPRO).
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.

VPF.D - Devices and installation

Device	Accessory name	
	VPF.D	VPF.D MULTI-UNIT SYSTEM
2 plant side NTC temperature sensors and related controller expansion board	Factory supplied (probes supplied without wells), installation is the client's responsibility (1)	Factory supplied with the multi-unit control system (probes supplied without wells), installation is the client's responsibility (1)(2)

(1) 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)
(2) It is the customer's responsibility to configure the multi-unit control system (Manager3000 or ClimaPRO) with option VPF.D.

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

Heat exchanger minimum 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”)

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

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