Product Manual

803 B – 04/11 D

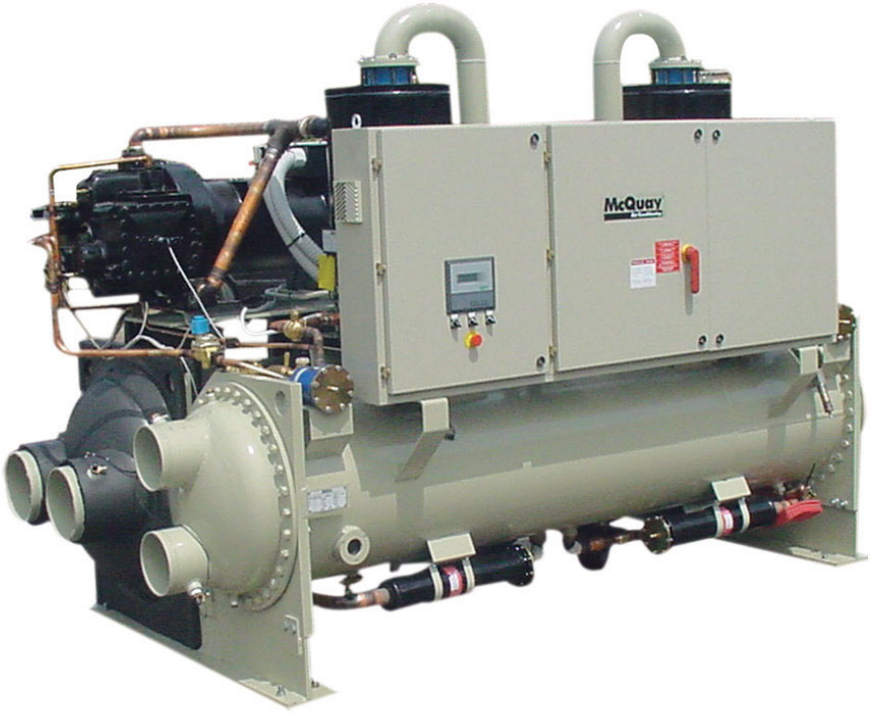
Data: **November 2004**

Supersedes: **803 B-02/09 C**

Water cooled screw chillers

PFS "B" 103.1 ÷ 296.2
Cooling capacity from 370 to 1050 kW
50Hz – Refrigerant: HFC 134a

ECOLOGICAL HFC 134a REFRIGERANT



EUROVENT CERTIFIED PERFORMANCE

McQuay is participating in the Eurovent Certification Programme. Product are as listed in the Eurovent Directory of Certified Products and on the web site www.eurovent-certification.com

CE

Member of CISQ Federation RINA ISO 9001:2000 Certified Quality System

McQuay® Air Conditioning

New water cooled screw chillers McQuay PFS “B”

McQuay International introduces their newest water cooled screw chillers equipped with new single screw compressors.
McQuay water cooled PFS chillers equipped with 1 or 2 McQuay screw compressors are a new range of the unit using the StarGate™ single screw compressors. They are manufactured by McQuay to satisfy the requirements of the consultants and the end user. McQuay PFS units are designed to minimise energy costs while maximising the refrigeration capacities. Once again McQuay has developed a line of chillers unsurpassed in performance and quality that will meet the most stringent requirements of comfort cooling, ice storage and process applications.
McQuay’s chiller design experience, combined with outstanding features makes the PFS chiller unmatched in the industry.

Customer benefits

Design for every kind of requirement

Compared with competitors, PFS water cooled chiller offers surprising performance. PFS dual compressor unit (with a single refrigerant circuit) takes full advantage of the total heat transfer surface over the use of two separate refrigerant circuits when only one compressor is required to satisfy the thermal load.
McQuay has answered the challenge to create a reliable, energy efficient, environmentally safe with the introduction of the new PFS screw compressor water-cooled chiller.

Lower noise – higher flexibility

The McQuay original compressor design with a single screw and twin rotors allows a constant gas flow. This compression process completely eliminates gas pulsations. The oil injection also results in significant mechanical noise reduction.
The twin gas compressor discharge chambers are designed to act as attenuators, based on the harmonic wave principle with destructive interference, thus always resulting equal to zero. The extremely low noise compressor performance affords the use of PFS chiller for all applications.
The reduced number of vibrations produced from the PFS chillers offers a surprisingly quiet operation eliminating the noise transmission through the structure and the chilled water piping system.

Infinitely variable capacity control

Cooling capacity control is infinitely variable by means of a capacity slide controlled by microprocessor system. Each unit has infinitely variable capacity control down to 12.5% (two compressors units), to 25% (one compressor units). This modulation allows the compressor capacity to exactly match the building cooling load. The result is a decrease in chiller energy costs, particularly at the part-load conditions at which the chiller operates most of the time. In order to optimize control sequence, each compressor load (and unload) from 95 to 100 % of its capacity by one step.

Unmatched serviceability

Field serviceability has not been sacrificed. Inspection covers allows visual inspection of the main screw and gaterotors. Suction valves allow easy isolation and field servicing of this unit.

Outstanding reliability features

Full factory testing of all the units ensures a trouble free start-up. Extensive test makes certain that each safety and operating control is properly adjusted, and operates correctly.

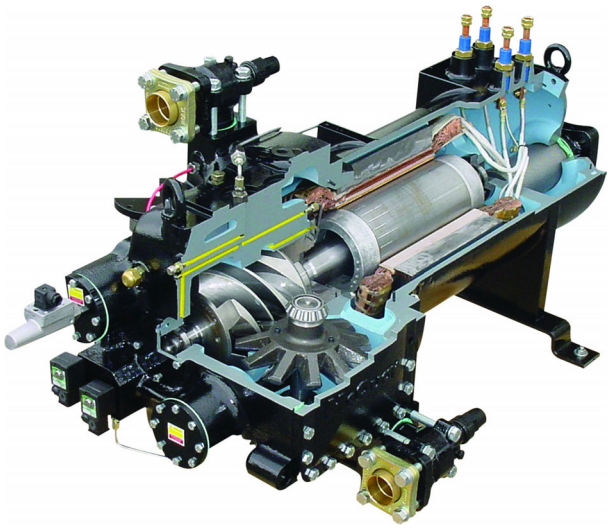
General characteristics

Ecological HCF 134a refrigerant

McQuay has designed and optimized Stargate™ compressors to operate with HFC 134a, ecological refrigerant with zero ODP (Ozone Depletion Potential) and very low GWP (Global Warming Potential) that means low value of the "direct effect" in the formula of TEWI (Total Equivalent Warming Impact).

Screw compressors

The newest Stargate™ single-screw compressor has a well balanced compression mechanism which cancels the screw rotor load in both the radial and axial directions. Inherent to the basic single-screw compressor design is the virtually load-free operation, that gives main bearing design life of 3-4 times greater than twin-screws, and eliminates expensive and complicated thrust balancing schemes. The two exactly opposed gaterotors create two exactly opposed compression cycles. Compression is made at the lower and upper parts of the screw rotor at the same time, thus cancelling the radial loads. Also, both ends of the screw rotor are subjected to suction pressure only, which cancels the axial loads and eliminates the huge thrust loads inherent in twin-screw compressors.



Oil injection is used for these compressors in order to get high COP at high condensing pressure. PFS units are provided with an high efficiency oil separator to maximise oil extraction.

Compressors have a infinitely variable capacity control down to 25% of its total capacity. This control is made by means of capacity slides controlled by microprocessors.

Standard start is star-delta type; Soft start type is available (as option) in order to have lower inrush current.

Evaporator

Flooded shell-and-tube evaporator operating with refrigerant in shell and water in tubes. Replaceable water tubes are fabricated from integral finned copper and mechanically bonded to steel tube sheets. The evaporator is PED designed, constructed, inspected and stamped. Water side working pressure is designed for 10,5 bar. Vessels include 1" FPT spring loaded pressure relief valves. Shell and non-connection water heads are insulated with 3/4" thick closed cell insulation. Standard configuration on water connections side is 2 passes.

Condenser

Shell-and-tube type operating with refrigerant in shell and water in tubes. Replaceable water tubes are fabricated from integral finned copper and mechanically bonded to steel tube sheets. Condenser is designed to conform PED. Water side working pressure is designed for 10.5 bar. Standard configuration on water connections side is 2 passes.

Operative efficiency

The majority of comfort cooling systems operate at 60% or less of building design kW for most of the year. A great number of those operating hours occur between 50% and 60% design cooling capacity. For that reason, PFS chiller was designed to obtain excellent part load performance. This is achieved by a combination of individual component features that include compressor design, operating control, double heat transfer surface with only one compressor running (dual compressors unit), refrigerant flow control.

Servo Controlled modulating liquid level regulators

PFS are equipped with a modulating servo-controlled main expansion valve type controlled by a pilot float valve type to perfectly modulate refrigerant flow to the evaporator, proportionally to the required capacity. This ensures a stable regulation and economic operation, because pressure and temperature variations are strongly reduced.

Electrical panel

Power and control are located into two sections of the main panel that is manufactured to insure protection for all weather conditions.

The power panel is fitted with a interlocked door main isolator to prevent access while power supply is on. Electrical panel is IP43.

Power section includes - The power section includes contactors, all compressors fuses, and control circuit transformer. Additional space is provided for an easy installation of the various optional accessories provided to enhance the PFS units capabilities.

Certifications

All the PFS units are CE marked (89/392). McQuay Italia obtained ISO 9001:2000.

Water content in cooling circuits

The cooled water distribution circuits should have a minimum water content to avoid excessive compressors start and stop.

In fact, each time the compressor starts up, an excessive quantity of oil goes from the compressor sump and simultaneously there is a rise in the temperature of the compressor motor's stator due to the inrush current during the start-up. To prevent damage to the compressors, McQuay has envisaged the application of a device to limit frequent stops and restarts.

During the span of one hour there will be no more than 6 starts of the compressor. The plant side should therefore ensure that the overall water content allows a more constant functioning of the unit and consequently greater environmental comfort. The minimum installation water content envisaged should be calculated with a certain approximation using this simplified formula:

(1) $$Q = 35{,}83 \times \frac{P\,(kW)}{\Delta T(°C)} \times \frac{1}{N}$$

where:

Q = Minimum content of the plant expressed in litres
P = Cooling capacity of the plant expressed in kW
ΔT = Entering/leaving water temperature difference of the evaporator expressed in °C
N = Number of compressors.

For a more accurate determination of the quantity of water, it is advisable to contact the designer of the plant.

Microtech II Plus controller

Microtech II Plus device is installed as standard on all the units; it can be used to alter unit set points and control commands. A display illustrates the machine's operating status and programable parameters (setpoints) e.g. temperatures and pressures of fluids (water, refrigerant). Device controls maximise the McQuay chillers energy efficiency and reliability characteristics. It uses sophisticated software with predictive logic to select the most energy efficient combination of compressor. The compressors are automatically rotated to ensure equal operating hours. Microprocessor device protects critical components in response to external signals from its system sensors measuring: motor temperatures, refrigerant gas and oil pressures, electrical supply and evaporator.

Control section - main features:

- Management of the compressor capacity slide according to the distributed multiprocessor logic system
- Chillers enabled to work in partial failure condition thanks to the distributed multiprocessor logic system
- Full routine operation at condition of:
  - High thermal load
  - High evaporator entering water temperature (start-up)
- Display of evaporator entering/leaving water temperature
- Display of condensing-evaporating temperature and pressure, superheat temperature for each circuit
- Leaving water cooled temperature regulation (also available entering water regulation). Temperature tolerance=0,2°C
- Compressors and evaporator/condenser pumps hours counter
- Display of Status Safety Devices
- Start up numbers and compressors working hours equalization
- Excellent management of compressors load
- Automatic re-start in case of power supply interruption
- External signal demand limit 0÷100%
- Soft load: starting load limitation (25÷100%) time based
- External air reset
- Current limitor
- High evaporator temperature start

Safety for each refrigerant circuit

High pressure (pressure switch)

Low pressure (pressure switch)

Compressor thermal

High Discharge Temperature on the compressor

Phase Monitor

Star / Delta Transition Failed

Low Delta Pressure between Suction and Discharge

System security

A serious alarm input (stops the unit)

A flow controller input (stops the unit)

A pump thermal input (stops the unit)

Remote on/off input without alarm signaling

Regulation type

Stabilized PID Proportional - Integral – Derivative regulation on the evaporator input probe for a perfect water regulation (max $\Delta T = \pm 0,2°C$)

Microtech II Plus terminal

The Microtech II Plus terminal has following features:

- 4-lines by 20-character liquid crystal display
- Removable and remote key-pad
- Key-pad consisting of 15 keys “ clear language display ”
- Memory to protect the data
- General faults alarm led
- 4-level password access to modify the setting
- Service report dislaying all working hours and general conditions

MicroPlant™:

Solution for: tele-maintenance and supervisory systems

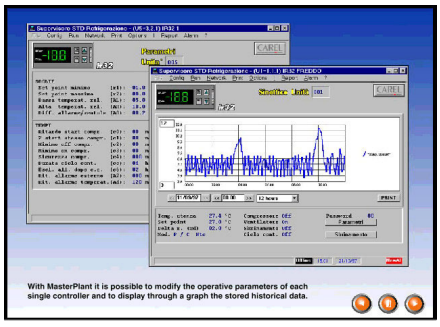
Microtech II Plus can be monitored locally or via modem by MicroPlant supervision program, that runs on PC systems under Windows ’95 – ’98.

MicroPlant is the best solution:

- To centralise all the information in just one local and/or remote PC
- To check all the parameters for each unit connected
- To be informed immediately and automatically of any alarm situation via modem - printouts
- Automatic printouts of alarms, parameters and graphs
- To control several plants located in different geographical areas from a central station
- To manage the Service centers

MicroPlant allows:

- Visualization and modification of all the parameters for each controller
- Protection of the main parameters against incidental modifications (different levels of passwords)
- Memorization of the detected values and visualization of their graphics
- Display, print-out and chronological memorization of the detected alarms
- Connection between local and remote computer via telephone line (Modem)

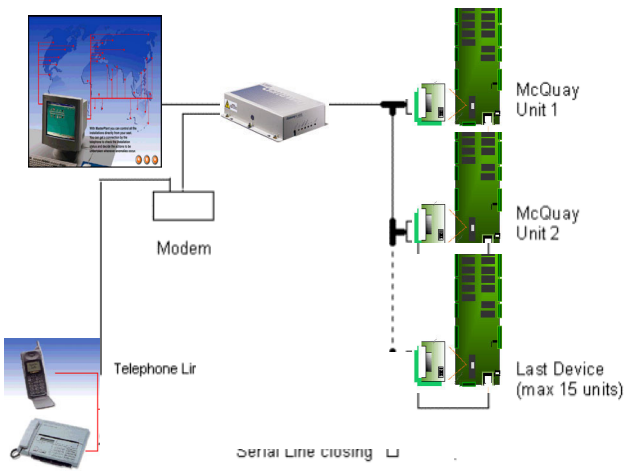


Microtech II Plus remote control

Compatibility with supervisory systems is becoming increasingly important in HVAC. Microtech II Plus allows easy interfacing with BMS (Building Management Systems), the external world that can be:

Landis & Staefa, Siemens, Johnson, Honeywell, Satchwell, Trend.

McQuay Chiller System Controller (CSC) is available as option.



Standard Accessories (furnished on basic unit)

Modulating condenser water flow valve – Factory mounted on condenser outlet water connection, in order to allow fast and safe unit starting. It is not supplied for condensers with water side pressures higher than 10 bar.

Discharge line check valve – Ensures compressors maintainence operations without any refrigerant loss.

Star Delta Compressors starter – For low inrush current and reduced starting torque.

Phase monitor – The phase monitor controls the voltage values on the supply line stopping the unit when the calibration threshold is reached (± 10%). This safety device is automatically reset.

Evaporator connection water side Victaulic – Hydraulic joint with gasket for an easy and quick water connection.

Insulation around the evaporator – Insulation 20 mm thickness to protect the evaporator against freezing.

Hour run meter – Digital compressors hour run meter.

General fault contactor – Contactor for the alarm warning.

Options (on request)

Brine double set point version (CB) - Dual leaving glycol mixture temperature setpoints. The lower setpoint can go down to -8°C.

Compressor thermal overload relays - Safety devices against compressor motor overloading in addition to the normal protection envisaged by the electrical windings.

Ammeter and voltmeter - Digital meters of unit drawn amperes and voltage values, installed on the electrical control panel.

Condenser power factor correction - Installed on the electrical control panel to ensure it conforms to the plant rules. (McQuay advices maximum 0,9).

Suction line shut off valve – Suction shut-off valve installed on the suction port of the compressor to facilitate maintenance operation.

Flanged connections – Evaporator and condenser flanged connections (150 psig) are available instead of the standard victaulic connections.

Marine water boxes – Evaporator and condenser can be furnished with marine water boxes with victaulic or flanged connections (on request). To save time and work marine water boxes cover can be easily removed to clean internal tubes without the disconnection of water pipes.

Double water pressure differential switch – Factory mounted differential switch is available as option to detect evaporator and condenser loss of flow .

Flow switch - Supplied separately to be wired and installed on the evaporator water piping (by the customer).

Cu-Ni 90-10 condenser – To work with sea water the heat exchangers are fitted with Cu-Ni tubes and special protection inside the end covers.

Rubber type antivibration mounts (Pads) - Supplied separately, must be positioned under the base of the unit.

Sound proof cabinet - Made of sheet metal and internally insulated, the cabinet is "integral kind" (around the whole chiller, not only around the compressors) to reach the best performance in noise reduction.

Note: to realize the baseframe consider that the dimensions of the sound proof cabinet are 300 mm longer, 300 mm wider and 200 mm higher than the standard unit. The cabinet is supplied in a separated non assembled kit.

Witness tests - The units are normally tested at the test bench prior to the shipment. On request, a second test can be carried out, at customer's presence, in accordance with the procedures indicated on the test form. (Not available for units with Glycol mixtures).

Soft start – Electronic starting device to reduce inrush current.

Installation notes

Warning

Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations, and who are experienced with this type of equipment. Must be avoided the unit installation in places that could be considered dangerous for all the maintenance operations.

Handling

The chiller is mounted on heavy wooden skids to protect the unit from accidental damage and to permit easy handling and moving. It is recommended that all moving and handling be performed with the skids under the unit when possible and that the skids not be removed until the unit is in the final location.
If the unit must be hoisted, it is necessary to lift the unit by attaching cables or chains at the lifting holes in the evaporator tube sheets. Spreader bars must be used to protect the control cabinet and the other areas of the chiller.

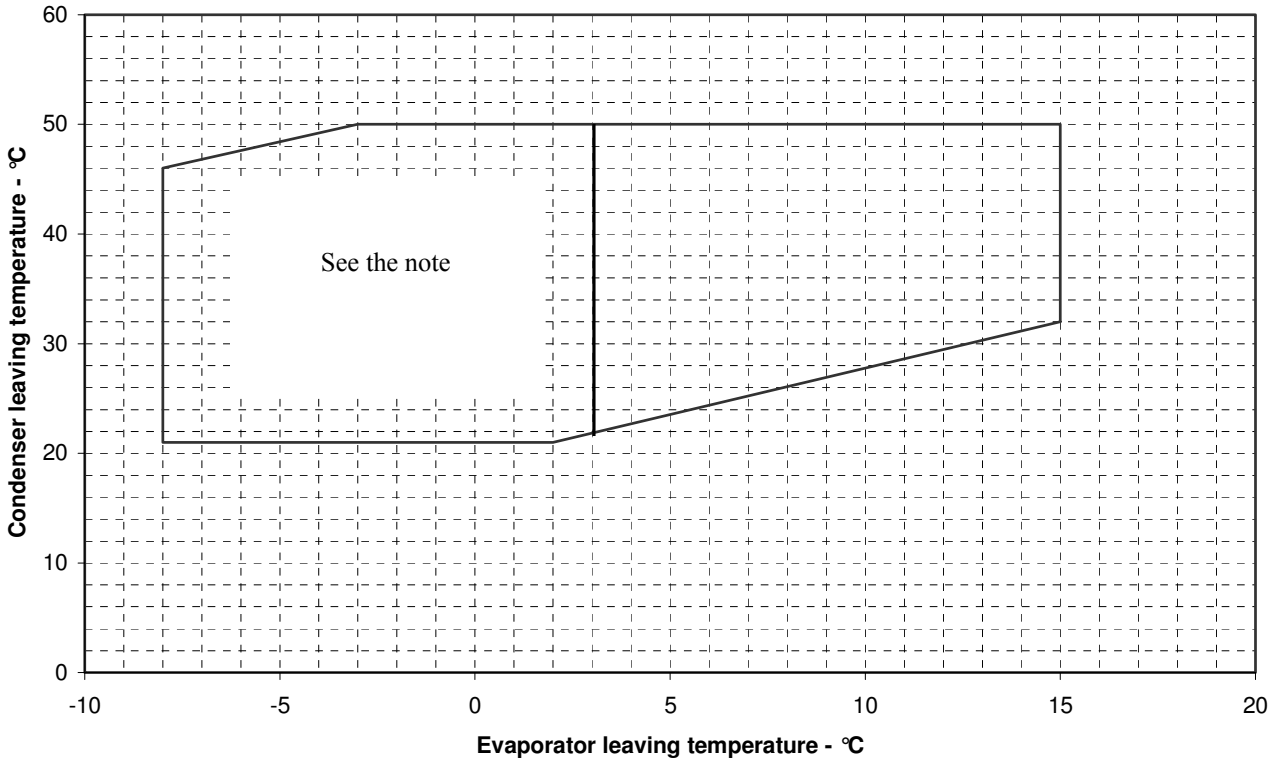
Location

A levelled and sufficiently strong floor is required.
Rubber-in-shear isolators can be furnished and field placed under each corner of the package. A rubber anti–skid pad should be used under isolators if hold-down bolts are not used.
Vibration isolator in all water piping connected to the chiller are recommended to avoid straining the piping and transmitting vibration and noise.

Evaporator and Condenser water flow and Delta T

Standard configuration on water side connections is 2 passes for both evaporator and condenser. Use pressure drop curves to check if it's the best solution.
In order to optimize performances with higher delta T (lower water flow), 3 passes evaporator and 3 or 4 passes condenser configurations are available on request.

Operating Range



Note: the use of glycol is necessary for evaporator leaving water temperature below +3°C.

Table 1 – Operating limits

PFS 103.1÷296.2		HFC 134a
Max evaporator leaving water temperature	°C	15
Min evaporator leaving water temperature (without glycol)	°C	3
Min evaporator leaving water temperature (with glycol)	°C	-8
Max condenser leaving water temperature	°C	50

Table 2 – Evaporator fouling factors

Fouling factors $m^2°C$ / kW	Cooling capacity correction factor	Power input corretion factor	COP correction factor
0,0176	1,000	1,000	1,000
0,0440	0,978	0,986	0,992
0,0880	0,957	0,974	0,983
0,1320	0,938	0,962	0,975

Table 3 – Condenser fouling factors

Fouling factors $m^2°C$ / kW	Cooling capacity correction factor	Power input corretion factor	COP correction factor
0,044	1,000	1,000	1,000
0,088	0,990	1,018	0,973
0,132	0,981	1,036	0,945

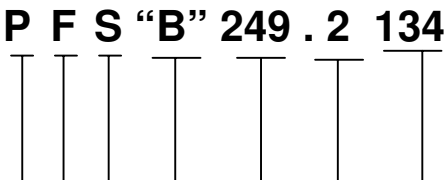
Table 4 – Ethylene glycol and low ambient temperature correction factors

Air ambient temperature °C	-3	-8	-15	-23	-35
% of ethylene glycol by weight	10	20	30	40	50
Cooling capacity correction factor	0,991	0,982	0,972	0,961	0,946
Power input correction factor	0,996	0,992	0,986	0,976	0,966
COP correction factor	0,995	0,990	0,986	0,985	0,979
Flow rate correction factor	1,013	1,040	1,074	1,121	1,178
Water pressure drops correction factor	1,070	1,129	1,181	1,263	1,308

Table 5 – Low temperature operation performance factors

Ethylene glycol/water leaving temperature °C	2	0	-2	-4	-6	-8
Min. % of ethylene glycol	10	20	20	30	30	30
Cooling capacity correction factor	0,842	0,785	0,725	0,670	0,613	0,562
Power input compressors correction factor	0,95	0,94	0,92	0,89	0,87	0,84

Nomenclature



P	Water cooled
F	Flooded
S	Screw compressor
"B"	Release
103÷296	Unit size
1 **2**	N° of compressors
134	Refrigerant HFC 134a

Physical data PFS “B”

PFS Unit size		103.1	124.1	147.1	208.2	229.2	249.2	272.2	296.2
Cooling capacity (1)	kW	369	445	521	734	816	895	976	1050
Power input (1)	kW	65	78	90	130	143	155	168	180
COP (1)		5.7	5.7	5.8	5.7	5.7	5.8	5.8	5.8
McQuay Screw compressors	No.	1	1	1	2	2	2	2	2
Refrigerant circuits	No.	1	1	1	1	1	1	1	1
Min % of capacity reduction	%	25,0	25,0	25,0	12,5	12,5	12,5	12,5	12,5
Refrigerant charge HFC 134a	kg	130	165	180	200	215	230	274	290
Oil charge	l	30	30	30	60	60	60	60	60
Evaporator									
Evaporators / water volume	No./l	1/78	1/107	1/134	1/184	1/210	1/210	1/281	1/302
Max water operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5
Condenser									
Condensers / water volume	No./l	1/83	1/111	1/133	1/181	1/199	1/243	1/243	1/263
Max water operating pressure	bar	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5
Weight and dimensions									
Shipping weight	kg	3089	3370	3603	5546	5636	6007	6448	6598
Operating weight	kg	3250	3588	3870	5911	6045	6460	6972	7163
Unit length (2)	mm	3625	3860	3860	4145	4145	4145	4145	4145
Unit width	mm	1551	1551	1551	1743	1743	1808	1910	1910
Unit height	mm	2250	2250	2250	2300	2300	2300	2300	2300

Note: **(1)** Nominal cooling capacity and power input are based on: 12/7 °C entering/leaving evaporator water temperature; 30/35 °C entering/leaving condenser water temperature.
(2) Length includes modulating condenser water flow valve.

Electrical data PFS “B”

PFS unit size		103.1	124.1	147.1	208.2	229.2	249.2	272.2	296.2
Standard voltage (1)		400 V – 3Ph – 50 Hz							
Nominal unit current (2)	A	112	129	148	224	244	258	277	295
Max unit current (3)	A	137	178	205	302	331	357	385	410
Max unit inrush current (4)	A	367	367	367	535	550	561	575	588
Max unit current for wires sizing (5)	A	142	183	210	307	336	362	390	415
Max short circuit holding current	kA	25	25	25	25	25	25	25	25

Notes: **(1)** Allowed voltage tolerance ± 10%. Voltage unbalance between phases must be within ± 3%.
(2) Absorbed current referred to nominal condition: 12/7 °C entering/leaving evaporator water temperature; 30/35 °C entering/leaving condenser water temperature.
(3) Absorbed current referred to the following conditions: 15/10 °C entering/leaving evaporator water temperature; 45/50 °C entering/leaving condenser water temperature.
(4) Absorbed current of compressor n°1 at 75% + inrush current of the other compressor.
(5) Compressors FLA (Full Load Ampere).

Sound pressure level PFS “B”

PFS Unit size	Sound pressure level at 1 m from the unit in free field (rif. 2 x 10^{-5})								
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	dBA
103.1	63,5	70,5	80,0	74,5	74,0	68,5	60,5	50,5	**78,0**
124.1	64,5	71,5	81,0	75,5	75,0	69,5	61,5	51,5	**79,0**
147.1	65,5	72,5	82,0	76,5	76,0	70,5	62,5	52,5	**80,0**
208.2	66,5	73,5	83,0	77,5	77,0	71,5	63,5	53,5	**81,0**
229.2	67,0	74,0	83,5	78,0	77,5	72,0	64,0	54,0	**81,5**
249.2	67,5	74,5	84,0	78,5	78,0	72,5	64,5	54,5	**82,0**
272.2	68,0	75,0	84,5	79,0	78,5	73,0	65,0	55,0	**82,5**
296.2	68,5	75,5	85,0	79,5	79,0	73,5	65,5	55,5	**83,0**

Note: Average sound pressure level rated in accordance to ISO 3744, free field semispheric conditions.

Sound pressure level PFS “B” with sound proof cabinet

PFS Unit size	Sound pressure level at 1 m from the unit in free field (rif. 2 x 10^{-5})								
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	dBA
103.1	58,3	63,5	70,1	62,8	60,6	54,5	47,1	37,1	**66,0**
124.1	59,3	64,5	71,1	63,8	61,6	55,5	48,1	38,1	**67,0**
147.1	60,3	65,5	72,1	64,8	62,6	56,5	49,1	39,1	**68,0**
208.2	61,3	66,5	73,1	65,8	63,6	57,5	50,1	40,1	**69,0**
229.2	61,8	67,0	73,6	66,3	64,1	58,0	50,6	40,6	**69,5**
249.2	62,3	67,5	74,1	66,8	64,6	58,5	51,1	41,1	**70,0**
272.2	62,8	68,0	74,6	67,3	65,1	59,0	51,6	41,6	**70,5**
296.2	63,3	68,5	75,1	67,8	65,6	59,5	52,1	42,1	**71,0**

Note: Average sound pressure level rated in accordance to ISO 3744, free field semispheric conditions.

Sound pressure level correction factor for different distances

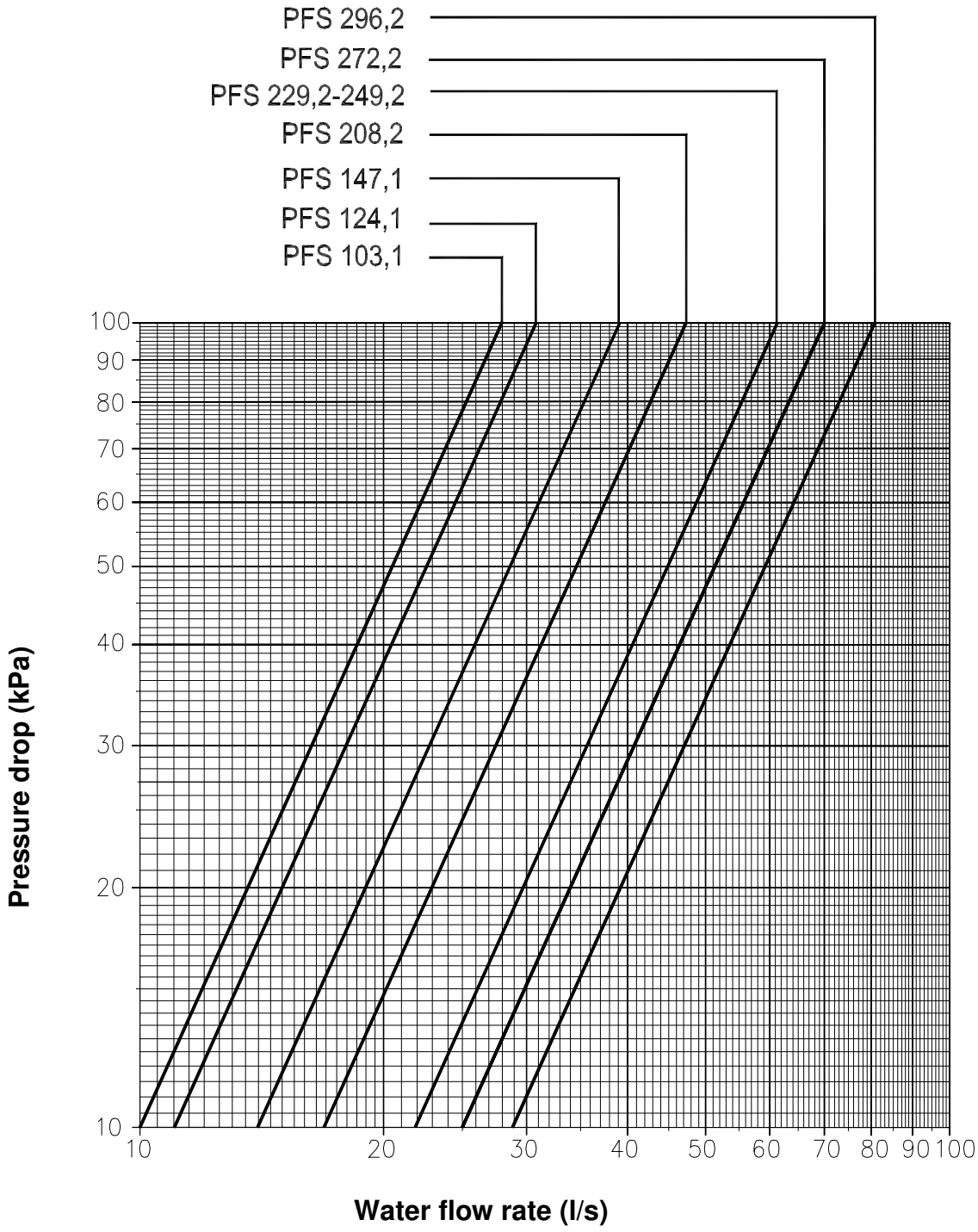
PFS Unit size	Distance (m)					
	1	5	10	15	20	25
103.1	0	-8,3	-13,2	-16,3	-18,6	-20,4
124.1	0	-8,3	-13,2	-16,3	-18,6	-20,4
147.1	0	-8,3	-13,2	-16,3	-18,6	-20,4
208.2	0	-8,1	-13,0	-16,1	-18,4	-20,2
229.2	0	-8,1	-13,0	-16,1	-18,4	-20,2
249.2	0	-8,1	-13,0	-16,1	-18,4	-20,2
272.2	0	-8,0	-12,9	-16,0	-18,3	-20,1
296.2	0	-8,0	-12,9	-16,0	-18,3	-20,1

Standard ratings PFS "B" 103.1 ÷ 296.2

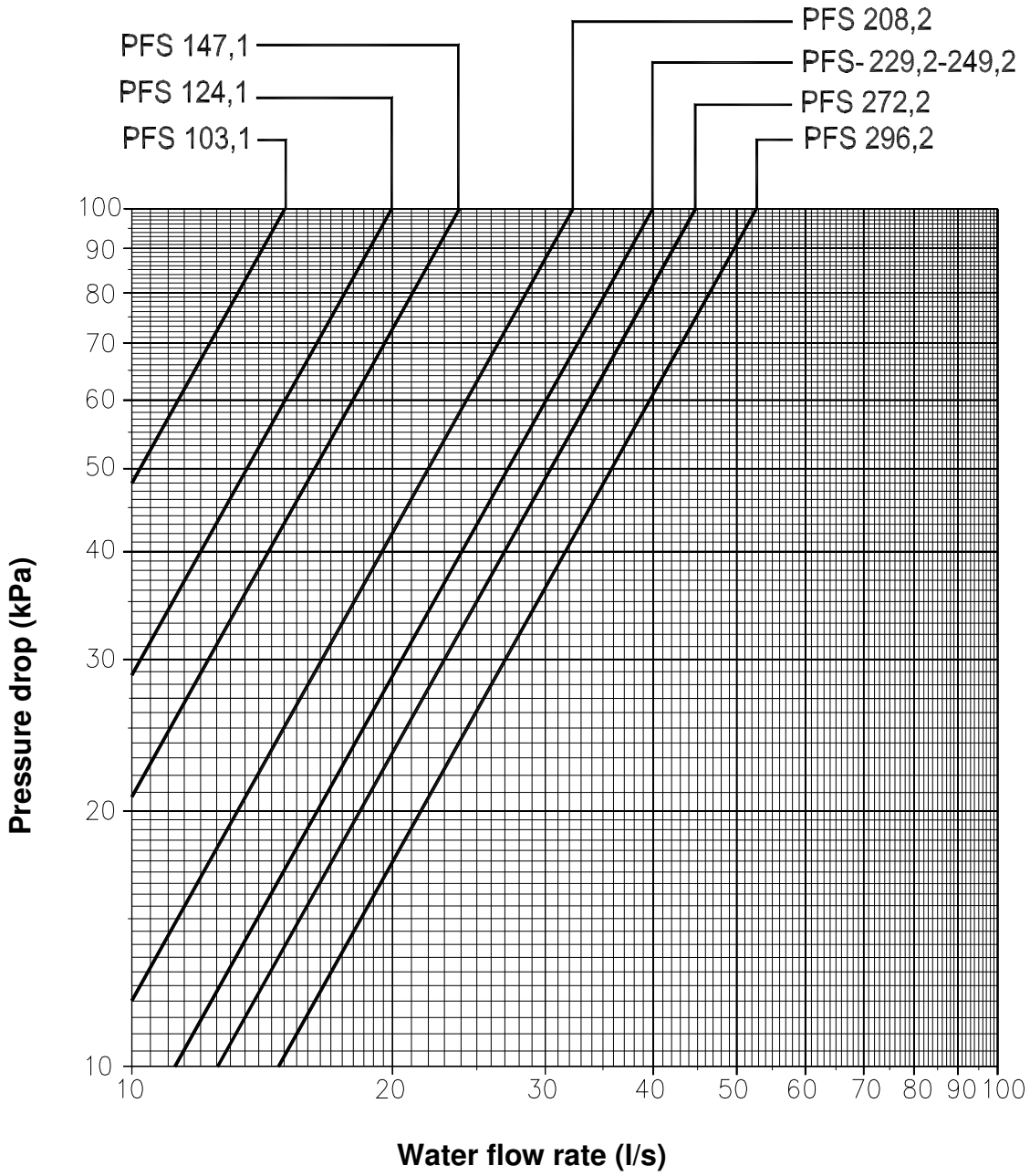
PFS Unit size	Leaving chilled water temperature °C	ENTERING CONDENSER WATER TEMPERATURE - °C														
		25			30			35			40			45		
		Cool. cap. (kW)	Pow. input (kW)	COP	Cool. cap. (kW)	Pow. input (kW)	COP	Cool. cap. (kW)	Pow. input (kW)	COP	Cool. cap. (kW)	Pow. input (kW)	COP	Cool. cap. (kW)	Pow. input (kW)	COP
103.1	4	347	56	6,2	332	64	5,2	317	72	4,4	301	81	3,7	284	91	3,1
	5	359	57	6,3	344	64	5,4	329	72	4,5	312	81	3,8	295	91	3,2
	6	372	57	6,5	357	65	5,5	340	73	4,7	324	82	4,0	306	92	3,3
	7	385	57	6,7	369	65	5,7	353	73	4,8	335	82	4,1	318	92	3,5
	8	398	58	6,9	382	65	5,9	365	73	5,0	347	82	4,2	329	92	3,6
	9	411	58	7,1	395	65	6,0	377	74	5,1	359	83	4,4	341	92	3,7
	10	425	58	7,3	408	66	6,2	390	74	5,3	372	83	4,5	353	93	3,8
124.1	4	418	67	6,3	400	76	5,2	381	86	4,4	362	97	3,7	341	109	3,1
	5	433	67	6,4	415	77	5,4	395	87	4,6	375	98	3,8	354	110	3,2
	6	449	68	6,6	429	77	5,6	410	87	4,7	389	98	4,0	368	110	3,4
	7	464	68	6,8	445	78	5,7	424	88	4,8	403	98	4,1	381	110	3,5
	8	480	68	7,0	460	78	5,9	439	88	5,0	418	99	4,2	396	110	3,6
	9	497	69	7,2	476	78	6,1	455	88	5,2	433	99	4,4	410	111	3,7
	10	513	69	7,5	492	79	6,3	470	89	5,3	448	99	4,5	425	111	3,8
147.1	4	491	78	6,3	469	89	5,3	447	100	4,5	424	112	3,8	400	126	3,2
	5	508	79	6,5	486	89	5,4	463	100	4,6	440	113	3,9	416	126	3,3
	6	526	79	6,7	503	90	5,6	480	101	4,8	456	113	4,0	431	126	3,4
	7	544	79	6,9	521	90	5,8	497	101	4,9	473	113	4,2	447	127	3,5
	8	563	79	7,1	539	90	6,0	515	102	5,1	490	114	4,3	464	127	3,6
	9	582	80	7,3	558	91	6,2	533	102	5,2	507	114	4,4	481	128	3,8
	10	602	80	7,6	577	91	6,3	551	103	5,4	525	115	4,6	498	128	3,9
208.2	4	690	113	6,1	661	128	5,2	630	144	4,4	598	162	3,7	565	182	3,1
	5	715	114	6,3	685	129	5,3	653	145	4,5	621	163	3,8	587	183	3,2
	6	740	114	6,5	709	129	5,5	677	146	4,7	644	163	3,9	609	183	3,3
	7	766	115	6,7	734	130	5,7	701	146	4,8	667	164	4,1	631	184	3,4
	8	792	116	6,8	760	130	5,8	726	147	4,9	691	165	4,2	654	184	3,6
	9	818	116	7,0	785	131	6,0	751	147	5,1	715	165	4,3	678	185	3,7
	10	845	117	7,3	812	131	6,2	777	148	5,3	740	166	4,5	702	185	3,8
229.2	4	767	124	6,2	733	141	5,2	699	159	4,4	662	179	3,7	625	201	3,1
	5	795	125	6,4	760	142	5,4	724	160	4,5	688	180	3,8	649	202	3,2
	6	823	125	6,6	788	142	5,5	751	160	4,7	713	180	4,0	674	202	3,3
	7	852	126	6,8	816	143	5,7	778	161	4,8	739	181	4,1	699	203	3,5
	8	881	127	7,0	844	144	5,9	806	162	5,0	766	182	4,2	725	203	3,6
	9	911	127	7,2	874	144	6,1	834	162	5,1	794	182	4,4	752	204	3,7
	10	942	128	7,4	903	145	6,2	863	163	5,3	822	183	4,5	779	204	3,8
249.2	4	843	134	6,3	806	153	5,3	768	173	4,4	728	195	3,7	688	219	3,1
	5	873	135	6,5	835	154	5,4	796	174	4,6	756	195	3,9	714	219	3,3
	6	903	135	6,7	865	154	5,6	825	174	4,7	784	196	4,0	741	220	3,4
	7	935	136	6,9	895	155	5,8	854	175	4,9	812	197	4,1	768	220	3,5
	8	967	137	7,1	926	156	5,9	885	176	5,0	841	197	4,3	797	221	3,6
	9	1000	137	7,3	958	157	6,1	915	177	5,2	871	198	4,4	825	221	3,7
	10	1033	138	7,5	991	157	6,3	947	177	5,3	902	199	4,5	855	222	3,9
272.2	4	918	146	6,3	878	166	5,3	836	187	4,5	793	210	3,8	749	236	3,2
	5	951	147	6,5	910	167	5,5	867	188	4,6	823	211	3,9	778	236	3,3
	6	984	147	6,7	942	168	5,6	899	189	4,8	854	212	4,0	807	237	3,4
	7	1019	148	6,9	976	168	5,8	931	190	4,9	885	213	4,2	837	238	3,5
	8	1054	149	7,1	1010	169	6,0	964	191	5,1	917	213	4,3	868	238	3,6
	9	1090	149	7,3	1045	170	6,2	998	191	5,2	950	214	4,4	900	239	3,8
	10	1126	149	7,5	1080	170	6,3	1032	192	5,4	983	215	4,6	932	240	3,9
296.2	4	988	157	6,3	944	178	5,3	898	200	4,5	852	224	3,8	804	252	3,2
	5	1024	158	6,5	978	179	5,5	932	201	4,6	884	225	3,9	835	253	3,3
	6	1060	158	6,7	1014	180	5,6	966	202	4,8	917	226	4,1	867	253	3,4
	7	1097	159	6,9	1050	180	5,8	1001	203	4,9	951	227	4,2	900	254	3,5
	8	1135	159	7,1	1087	181	6,0	1037	204	5,1	986	228	4,3	934	255	3,7
	9	1174	159	7,4	1124	182	6,2	1074	205	5,2	1022	229	4,5	968	256	3,8
	10	1213	159	7,6	1163	182	6,4	1111	206	5,4	1058	230	4,6	1003	257	3,9

Note: **(1)** Nominal cooling capacity and power input are based on ΔT=5°C entering/leaving condenser water temperature; evaporator fouling factor=0,0176 m^2 °C/kW; condenser fouling factor=0,0440 m^2 °C/kW.

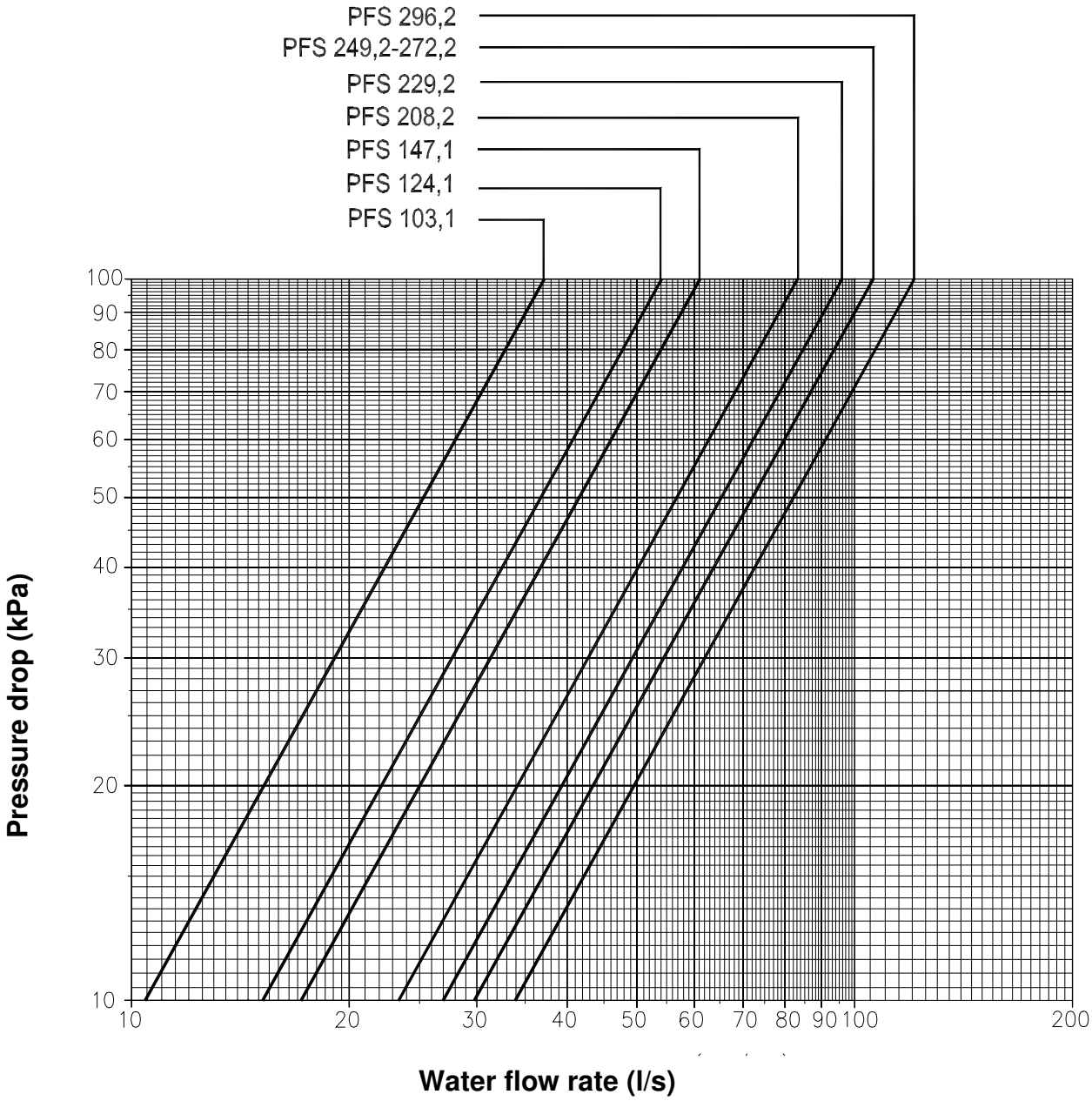
PFS “B” - 2 passes evaporator water pressure drop



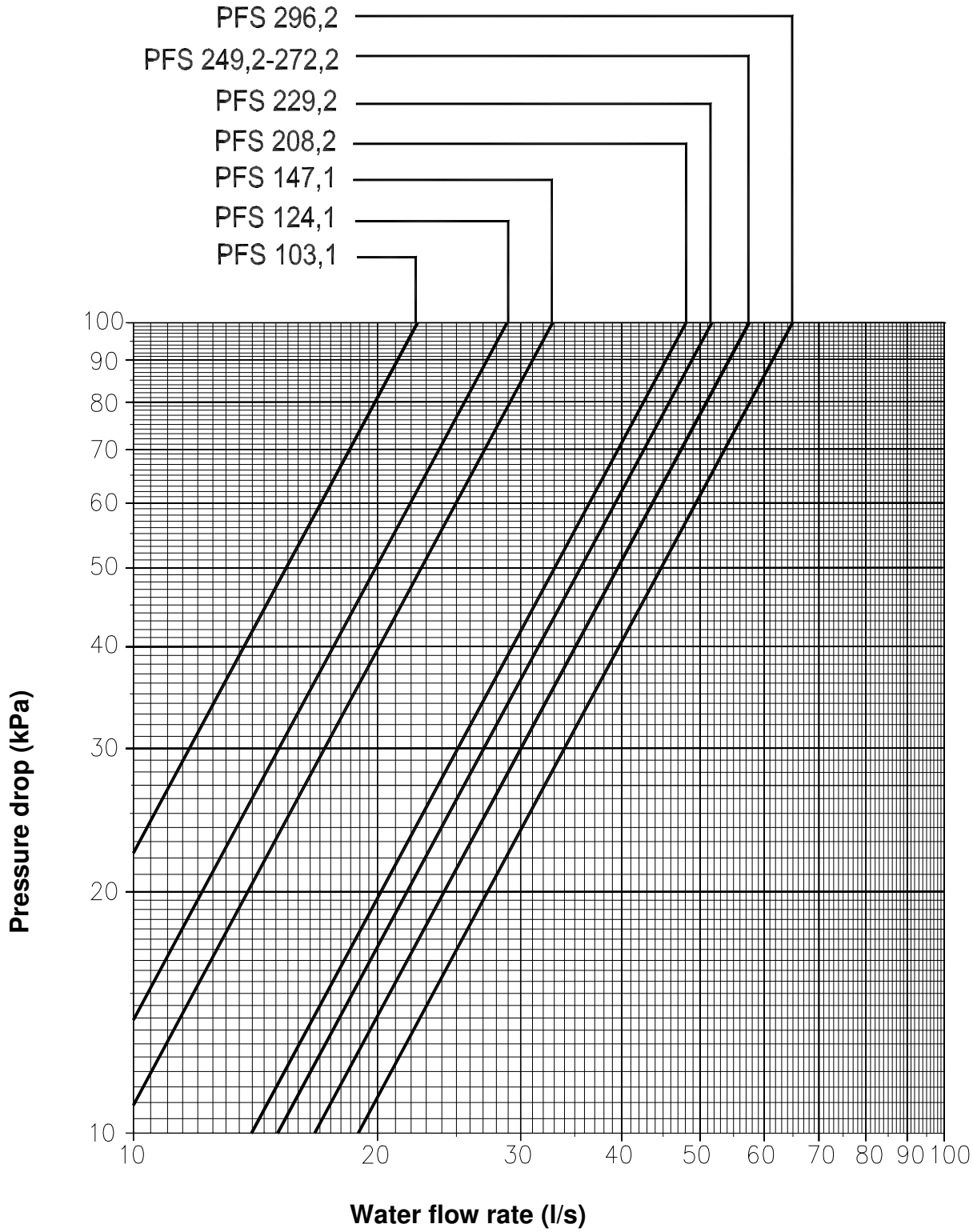
PFS “B” - 3 passes evaporator water pressure drop



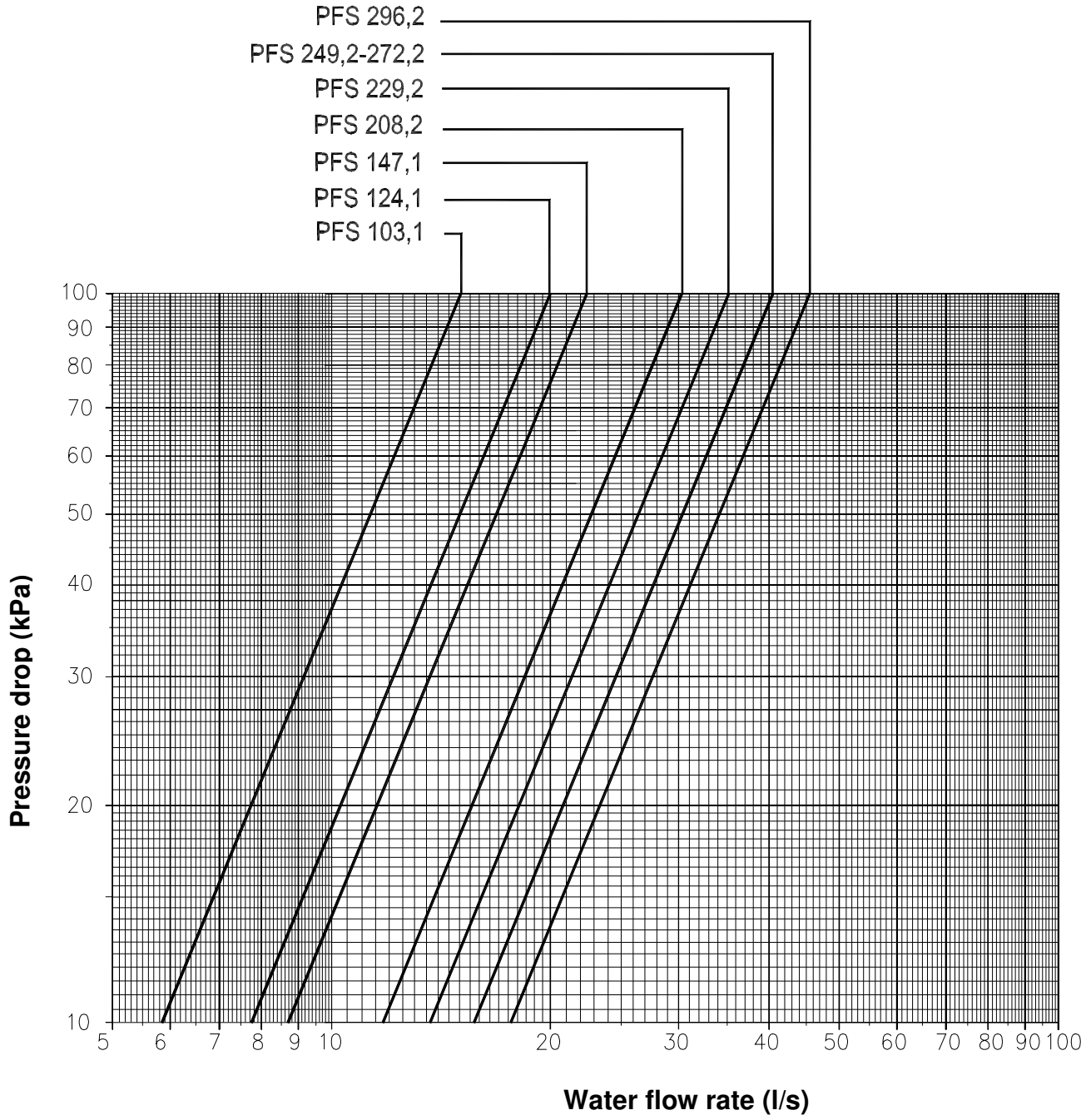
PFS “B” - 2 passes condenser water pressure drop



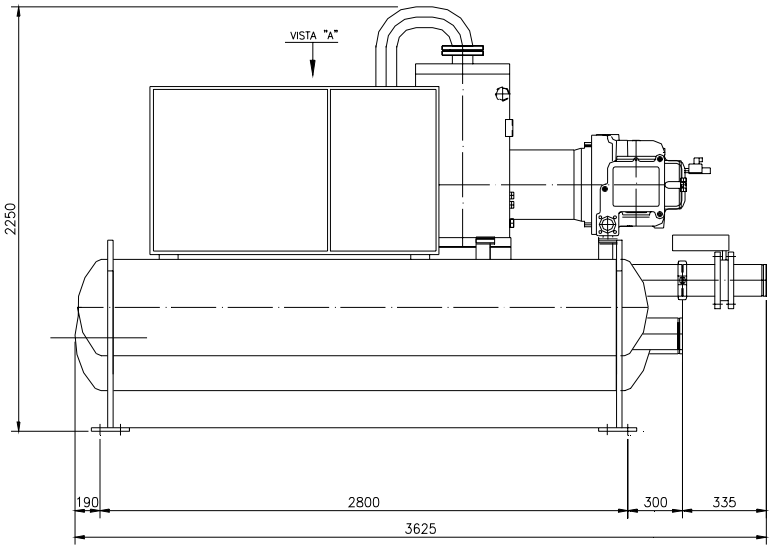
PFS “B” - 3 passes condenser water pressure drop

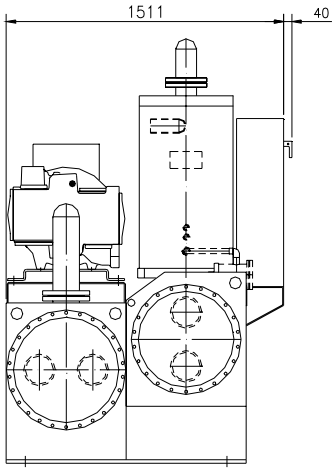


PFS “B” - 4 passes condenser water pressure drop

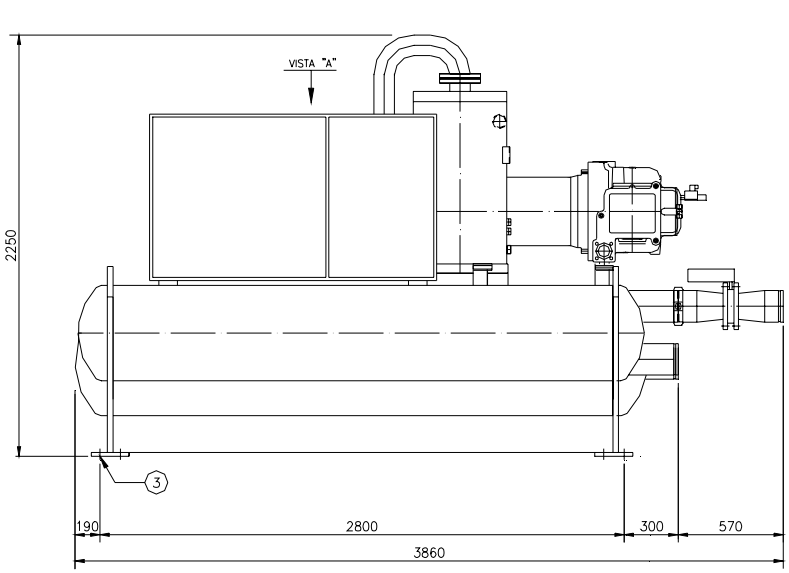


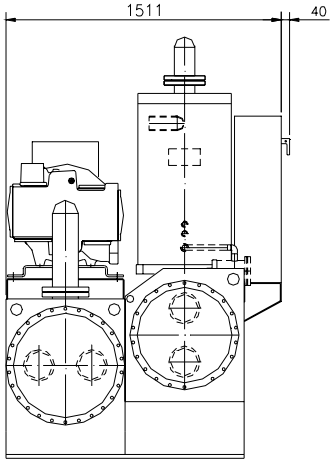
Dimensions PFS “B” 103.1



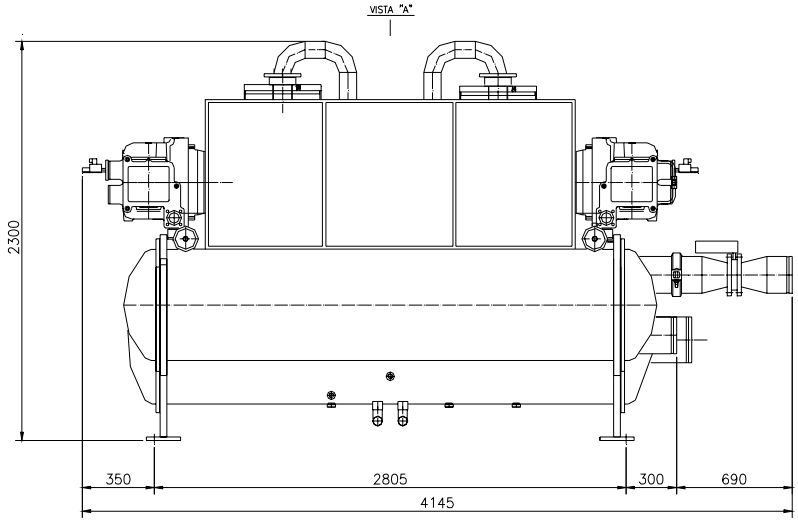


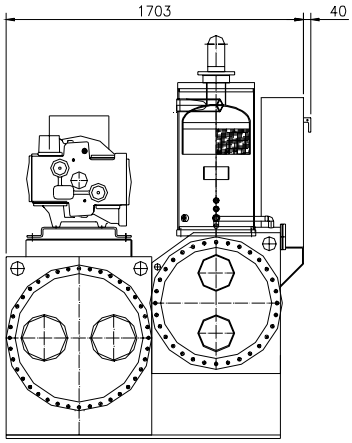
Dimensions PFS “B” 124.1-147.1



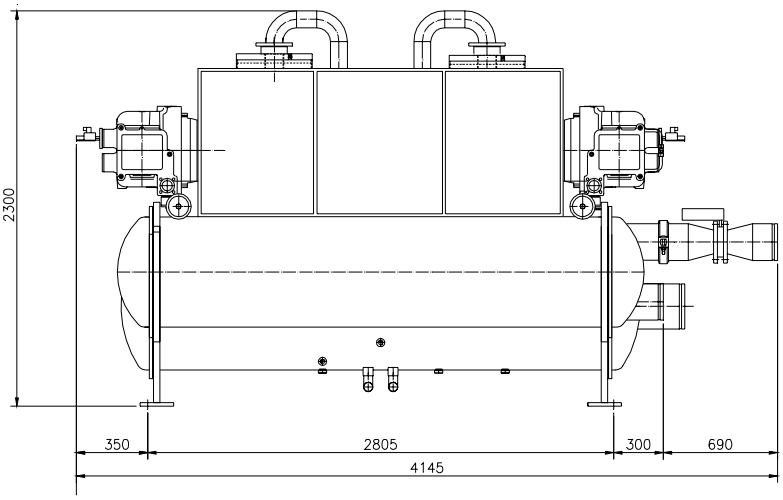


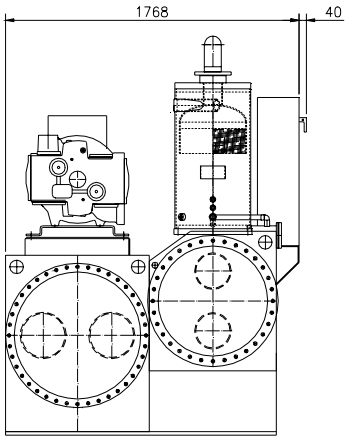
Dimensions PFS “B” 208.2-229.2



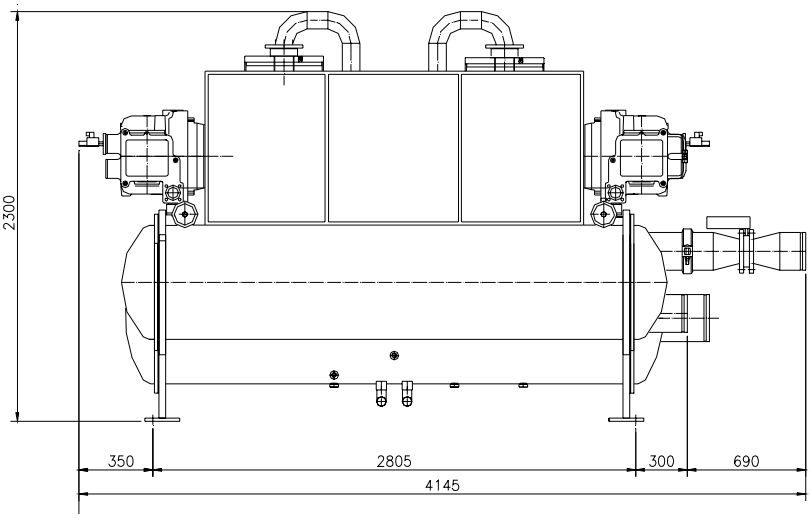


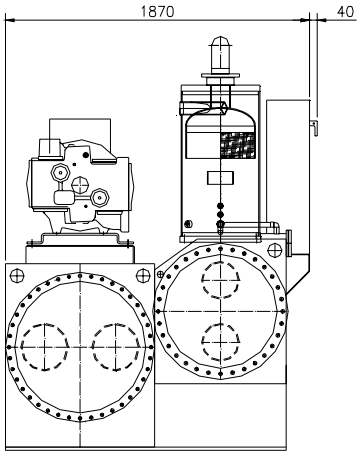
Dimensions PFS “B” 249.2





Dimensions PFS “B” 272.2-296.2





PFS “B” Frame 4 - Technical specifications

To supply and install, where specified in the project n ..... unit(s) water cooled chiller with cooling capacity of ..... kW, to cool ..... l/sec. of water from ..... °C to ....., condenser entering water temperature ….°C, condenser leaving water temperature ….°C. The unit should work with electricity at ..... V, 3ph, 50Hz. The electrical power absorbed should not exceed ..... kW. The units COP will be at least ..... at the working conditions of the project. Part load COP will be at least ..... at the working conditions of the project. For the units with 1 or 2 compressors the chillers will have only one refrigerant circuit, and the electronic microprocessor will allow the starting of the compressors. Each chiller will be factory assembled on a robust baseframe. The unit will be tested at full load in the factory at the nominal working conditions and water temperatures. Before shipment a full test will be held to avoid any losses, and the units will be filled with oil and refrigerant.

Refrigerant - only HFC 134a will be accepted.

Noise level and vibrations – Sound pressure level at 1 meter distance in free field shall not exceed ……dBA
Vibration level should not exceed 2 mm/s.

Units will have the following components:

Compressors - The compressor should be single screw type with one main screw rotor that meshes with two diametrically opposed gaterotors. The two exactly opposed gaterotors create two exactly opposed compression cycles which results in balanced forces acting on the compressor. The gaterotors should be constructed of a carbon impregnated engineered composite material. The gaterotor supports will be constructed of cast iron. The semi-hermetic compressor should be gas-cooled.

Oil injection shall be used for this compressor in order to get high COP at high condensing pressure. The unit should be provided with an oil separator and it will be the high efficiency, augmented gas impingement type to maximise oil extraction.

Evaporator - The units will be supplied with shell-and-tube flooded type evaporator (refrigerant flow in the shell and water flow in tubes). Replaceable tubes will be fabricated from integral finned copper and mechanically bonded to steel tube sheet. Refrigerant side will be ISPESL designed, constructed, inspected and stamped. Water side working pressure should be designed for 10,5 bar. Vessels will include spring loaded pressure relief valves. Shell and non-connection water heads will be insulated with 3/4 ” thick closed cell insulation.

Condenser – Condenser will be shell-and-tube type operating with refrigerant in shell and water in tubes. Replaceable water tubes should be fabricated from integral finned copper and mechanically bonded to steel tube sheets. Condenser will be designed to conform ISPESL. Water side working pressure should be designed for 10.5 bar.

Servo controlled modulating liquid level regulators - The refrigerant circuit will be equipped with a modulating servo-controlled main expansion valve type controlled by a pilot float valve type to perfectly modulate refrigerant flow to the evaporator, proportionally to the required capacity. This will ensure a stable regulation and economic operation, because pressure and temperature variations will be strongly reduced.

Modulating condenser water flow valve – It is factory mounted on condenser outlet water connection, in order to allow fast and safe unit starting. It is not supplied for condensers with water side pressures higher than 10 bar.

Control panel - Field power connection, control interlock terminals, and unit control system should be centrally located in an electric panel (IP 43). Power and starting controls should be separate from safety and operating controls in different compartments of the same panel. Starting will be star/delta type. Power and starting controls should include fuses and contactors for each compressor winding. Operating and safety controls should include energy saving control; emergency stop switch; overload protection for compressor motor; high and low pressure cut-out switch; compressor lead-lag switch (on 2 compressor units only); cut-out switch for each compressor.
All of the information regarding the unit will be reported on a display and with the internal built-in calender and clock that will switch the unit ON/OFF during day time all year long.

Regulation of cooling capacity - Each unit will have a microprocessor for the control and operation of the unit that should have a infinitely variable capacity control down to 12,5% (two compressors) or to 25% (one compressor) of the cooling capacity.

Refrigerant piping - Refrigerant circuit should include a factory insulated suction line, manual liquid line shut-off valve with charging connection, refrigerant filter drier with replaceable core, sensor indicator, servo controlled liquid regulator and relief valve.

We reserve the right to make changes in design and construction at any time without notice, thus the cover picture is not binding.

McQuay partecipa al programma di Certificazione Eurovent. I prodotti interessati figurano nella Guida Eurovent dei Prodotti Certificati.

McQuay is participating in the Eurovent Certification Programme Product are as listed in the Eurovent Directory of Certified Products

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