

# Ferrolli



## RHV BTZ

AIR COOLED WATER CHILLERS  
WITH HELICAL FANS

364 ÷ 1430 kW



## TECHNICAL MANUAL



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## GENERAL SPECIFICATIONS

### Presentation of the unit

This new series of air-cooled water chillers with helical fans is suitable for outdoor installation: the bearing structure and panelling are made of adequately thick, coated and galvanized sheet metal. All the fastening components are made of stainless and/or galvanized steel. The cabinet that houses the electrical components and all the parts exposed to outdoor weather conditions (fans, pressure switches, valves, etc.) have a protection degree of at least **IP54**.

When the units were designed, particular attention was also paid to sound emission in our endeavour to comply with the increasingly more restrictive laws governing acoustic pollution.

The units produce cold water from 5 to 15°C through to the maximum air temperature of 45/46°C. If equipped with the accessory head pressure control the units can operate at low outdoor temperatures down to about -10°C.

They are equipped with 2 independent refrigerant circuits, each of which has a semi-hermetic **TWINSCREW** compressor featuring a 25 to 100% control capacity device.

As part of the standard outfit, the units are also equipped with a shell and tube heat exchanger evaporator optimized for use with **R407C**, featuring high-efficiency grooved pipes and thermally insulated

and protected by means of a differential water pressure switch and electrical antifreeze heater that enables the exchanger to be protected against winter freezing down to a min. air temperature = -10°C,

coils with extended surfaces and extensive heat exchanging areas formed by copper pipes and louvered aluminium fins, electric fans with scythe-shaped blades to reduce the sound emission, electric panel for setting and controls with a door-locking main circuit-breaker, controller with microprocessor plus display with 4 lines of 20 characters, **R407C** environment-friendly refrigerant gas.

All the units are accurately built and tested individually, thus only the electrical and wet connections need be made for installation.

### General specifications

- This manual and the wiring diagram supplied with the unit must be kept in a dry place and ready to hand for future consultation when required.
- This manual has been compiled to ensure that the unit is installed in the correct way and to supply comprehensive information about how to correctly use and service the appliance. **Before proceeding with the installation phase, please carefully read all the information in this manual, which describes the procedures required to correctly install and use the unit.**
- Strictly comply with the instructions in this manual and conform to the current safety standards.
- The appliance must be installed in accordance with the laws in force in the country in which the unit is installed.
- Unauthorized tampering with the electrical and mechanical equipment will **VOID THE WARRANTY**.
- Check the electrical specifications on the identification plate before making the electrical connections. Read the instructions in the specific section where the electrical connections are described.
- If the unit must be repaired for any reason, this must only be done by a specialized assistance center recognized by the manufacturer and using genuine spare parts.
- The manufacturer also declines all liability for any damage to persons or property deriving from failure of the information in this manual to correspond to the actual machine in your possession.
- **Proper uses: this series of chillers is designed to produce cold or hot water for use in hydronic systems for conditioning/heating purposes. The units are not suitable for the production of domestic hot water. Any use differing from this proper use or beyond the operating limits indicated in this manual is forbidden unless previously agreed with the manufacturer.**
- **The prevention of the risk of fire at the installation site is the responsibility of the end user.**

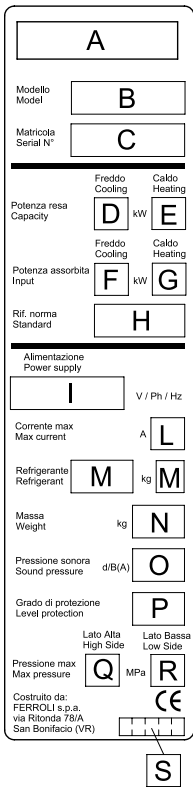
### European Directives

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

- |   |                    |
|---|--------------------|
| • Machinery directive                           | <b>2006/42/EC</b>  |
| • Pressurised equipment directive (PED)         | <b>97/23/EC</b>    |
| • Electromagnetic compatibility directive (EMC) | <b>2004/108/EC</b> |
| • Low voltage directive (LVD)                   | <b>2006/95/EC</b>  |

# GENERAL SPECIFICATIONS

## Identification plate of the Unit



The figure on the left depicts the identification plate of the unit, affixed to the outer left-hand side of the Electric Panel.

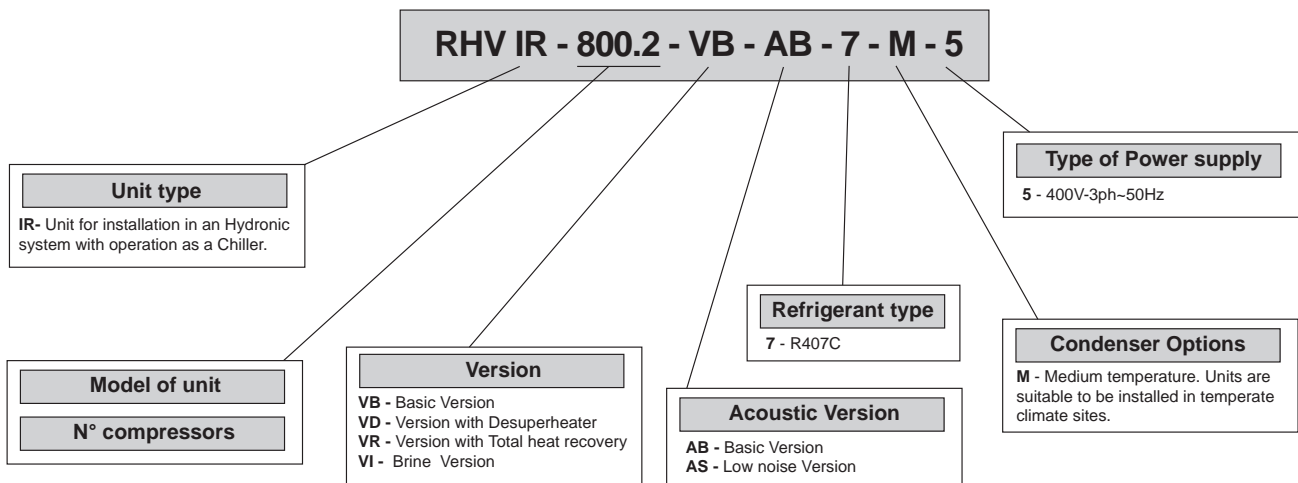
A description of the data is given below:

### Basic versions

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

## Identification code of the unit

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



### Version

**VB: Basic version.** The unit can produce cold water at a temperature of 6 to 15°C.

### Acoustic version:

**AB: Basic Version.** The compressors in these units are installed without a soundproofed cabinet and with axial fans operating at 900 rpm.

**AS: Low Noise Version.** The units are as standard equipped with head pressure control, made with compressors installed inside a soundproofed cabinet, helical fans working at low speed rotation at nominal condition. The unit can work with low noise emission up to an external air temperature of 40°C. Compared with the Basic Version the noise level is reduced of 5/6 dB and the cooling capacity decreases 3÷4% whereas the power input increases 3÷4%.

# GENERAL SPECIFICATIONS

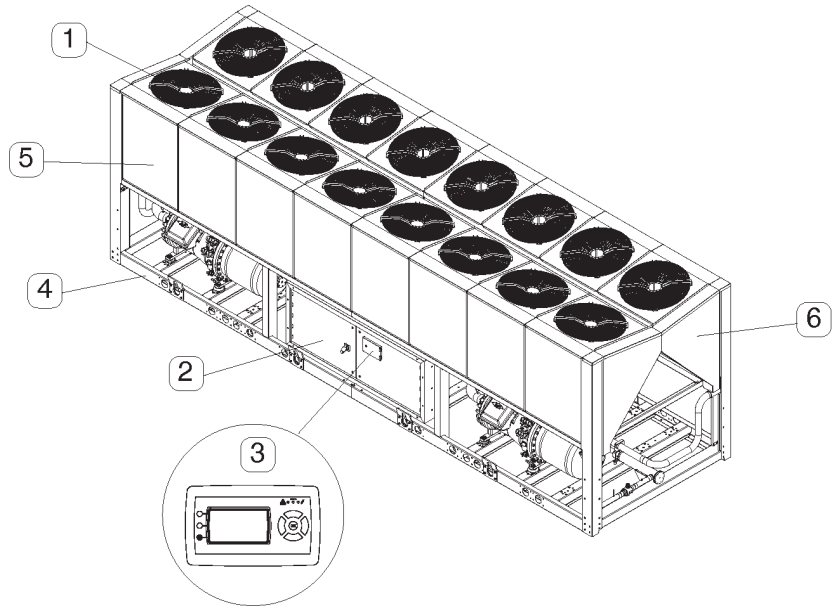
## Description of the components

**1. Fans.** These are the helical type with scythe-shaped blades to increase efficiency and reduce the sound emissions. The fans are directly coupled to the threephase motor by means of an external rotor. Thermal protection against operating faults is installed inside the winding.

**2. Electric control and monitoring panel.**

It is housed in a cabinet made of adequately thick painted sheet metal suitable for outdoor installation (protection degree IP 54). The panel comprises the following main components:

- Main door-locking circuit-breaker.
- Contactors to control and manage the star-delta starting mechanism of each compressor.
- Fuse holders with protection fuses for each compressor.
- Fuse holders with protection fuses for the oil heaters of the compressors.
- Fuse holders with protection fuses for the antifreeze heater.
- Fuse holders and protection fuses for the fans (accessories).
- Fan control contactors.
- Insulating and safety transformer to power the auxiliaries, protected with fuses.
- Basic monitoring board with microprocessor



**The main functions of the monitoring system are:**

Temperature regulation of the water produced by the unit, operating hour counting for compressors and pump/s, operating hour balancing for compressors and pumps, start-up timing, parameter entry digitized via the keyboard, alarm diagnosis.

**Functions associated with the digital inputs:** high pressure, high discharge temperature, correct electric power phase presence-sequence, thermal protection for compressors, thermal protection for fans, thermal protection for pump, differential water pressure switch, remote controlled ON/OFF commands.

**Functions associated with the digital outputs:** compressor control, solenoid valve for compressor control capacity, liquid injection, liquid solenoid valve control, water pump/s control, electric antifreeze heater, ventilating step control for condensation control function, general alarm (can be remote controlled).

**Functions associated with the analog inputs:** water inlet and outlet temperatures, coil temperature. Suction and discharge pressure, discharge temperature probe. Suction temperature, liquid temperature.

**Functions associated with the analog outputs:** speed control (only with DCC Head pressure control accessory).

**Moreover the controller allows:**

- Alarm history (max 50m alarms managed with FIFO logic)
- Time scheduling (daily and weekly)
- Precise control of the water leaving temperature
- Prevention of the block of the unit: In case of critical conditions the machine does not stop but is able to regulate itself and provide the maximum power that can be generated in those conditions with the compressors working inside the admissible limits.
- Demand Limit by Digital Input and/or by Analog Input (4-20mA)
- Dinamic Setpoint by Analog Input (4-20mA): for instance by an outdoor temperature probe for the climate control
- Second Set Point by Digital Input
- Connection to BMS (supervision systems) through serial port RS 485 and MODBUS protocol

**3. User interfacing terminal with display.**

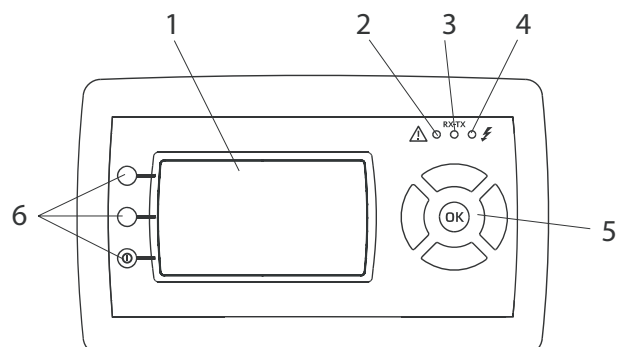
Control panel: composed of the instrument's front panel, equipped with an LCD display, three indicator LEDs, and one joystick buttons and three function button, it enables viewing and/or checking the operating mode and parameters, resources and complete alarm diagnostics.

In particular, it enables:

- Managing alarm situations
- Checking the status of resources.

**KEY**

- 1. Display
- 2. Alarms LED
- 3. LED for communication between the motherboard governing the unit a the keypad
- 4. Power supply LED
- 5. Joystick Menu Button
- 6. Function Button



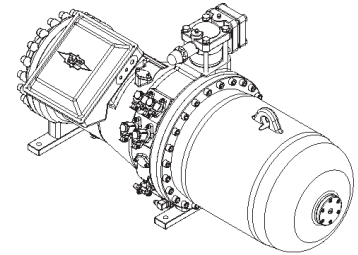
## GENERAL SPECIFICATIONS

**4. Bearing structure** made of galvanized sheet metal coated with polyurethane powder paint to ensure good protection against adverse weather conditions.

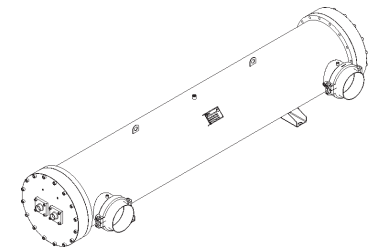
**5. Condensing coils**, the aluminium finned pack type with shaped profile to increase the heat exchange coefficient and with copper pipes arranged in staggered rows. A sub-cooling section is integrated into the lower part.

**6. Covering panels**, made of galvanized sheet metal coated with polyurethane powder paints to ensure the utmost ability to withstand adverse weather conditions.

- **Compressors.** Suitable for outdoor installation. They are the TWIN-SCREW type with 25 to 100% control capacity: in conjunction with accurate assembly, this technical solution allows the refrigerant to compress and the axial thrusts on the bearings (amongst the most critical components of the compressor) to be perfectly balanced, thus guaranteeing long life. They are equipped with an asynchronous three-phase motor (400V-3-50Hz) with aluminium squirrel-cage rotor, pre-engineered for star-delta starting (so as to reduce the current input during the starting phase to the minimum) and are protected by a chain of thermostats buried in the stator windings (controlled by an electronic module) and fuses housed in the electric panel. The standard outfit includes an efficient oil separator complete with electric heater (activated when the compressor stops). To widen the field of application to an even greater extent, they are equipped with a liquid injection system controlled by the electronic controller so that use only occurs when effectively necessary. As part of the standard supply, they are positioned on rubber vibration dampers to reduce the vibrations transmitted to the base of the unit.



- **Evaporator** of the shell and tube heat exchanger type, made of carbon steel and optimized for operation with R407C. Features high-efficiency grooved pipes and also achieves low losses on the wet side. It is installed within a shell of thermal barrier insulating material to prevent the formation of condensation and heat exchanges towards the outside. Standard supply also includes a differential water pressure switch built into the water supply circuit and antifreeze electrical heater to avoid the risk of freezing if the water flow is shut off for some reason. Also ensures that mechanical stress is absorbed to a good degree: the pipe nest can also be removed so that it can be inspected and serviced when required.



### Hydraulic and refrigerant circuit components

- **Refrigerant safety valve.** (Conforms to the Directive governing pressurized equipments - PED) Installed on the delivery pipe of the compressors. It acts if critical service faults should occur.

- **Liquid cock - Gas cock.** Allow all the refrigerant in the coils to be pumped and then stored so as to carry out servicing work or to replace all the components of the chilling circuit without having to drain it.

- **Dehydrator filter.** Of the removable cartridge type. Retains impurities and traces of moisture in the circuit.

- **Liquid injection solenoid valve** (only for some models), to allow a larger operating envelope directly managed by electronic controller.

- **Electronic expansion valve.** It has the task of correctly feeding the evaporator insuring a steady superheat. The valve is managed by a dedicated electronic board. It has also the function to stop the liquid when the compressor is off, so avoiding the refrigerant migration from the coils to the evaporator and to the compressor.

- **Compressor delivery probe.** One per compressor, installed on the delivery pipe to protect the compressor if the end of compression temperature exceeds the established limits.

- **Liquid and moisture sight glass.** Signals when liquid passes through the circuit, indicating that the refrigerant charge is correct. The liquid indicator also changes colour to show the amount of moisture in the refrigerant.

- **Pressure taps: 1/4 " SAE (7/16" UNF) (schraeder).** Allow the operating pressure of both the circuits to be measured in 3 main points of each refrigerant circuit: compressor discharge, thermostatic valve inlet, compressor suction.

- **High pressure switch.** With fixed setting. It is installed on the delivery pipe and blocks the compressor of the circuit if the operating pressures exceed the tolerated values. If it activates, the circuit will block and can only be restarted by resetting via the user interface terminal.

- **Oil crankcase heater** to heat the compressor oil. One per compressor. Activated when the compressor switches off. Their task is to keep the temperature of the oil sufficiently high so as to prevent refrigerant from migrating during these pauses.

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

## ACCESSORIES AND OPTIONAL EQUIPMENT

### Available accessories

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**NOTE:** The accessories can be of the following type:

**(M):** only installed in the factory.

**(F):** supplied for installation by the customer.

**MAP (F) Storage and Pumping Module** (Storage on the Delivery or Storage on Return). The purpose of the storage and pumping module is to lower the number of compressor surges, increasing the amount of water in the system and, thus, its thermal inertia. It consists of a base made of galvanized and painted sheet metal and aluminium sheet panelling suitable for outdoor installation. Designed for connection alongside the chiller, the accessory comprises an insulated carbon steel tank, a single or double centrifugal pump with on-off valves, an electric power panel, expansion tank, safety valve, air vent, pressure gauge and filling and draining valves.

**FLS (M) Evaporator water flow switch.**

**RAG 8 (M) Antifreeze heating element for Water Storage Tank of Pumping Module.**

**GM (M) Pressure gauge unit.** This consists of low pressure gauges and high pressure gauges (one low and one high pressure gauge for circuit).

**GP (M) Protective guard for the coils.** Consisting of metal guard that protect the coils.

**GP (M) Anti-intrusion guard.** Consisting of metal guard that protect the acces to hydraulic and refrigerant circuit.

**RB(M) Compressor suction shut-off valve.**

**AVG (F) Rubber vibration dampers.** Consisting of an adequate number of rubber vibration dampers, which varies depending on the model, to install under the unit. They reduce the mechanical vibrations generated by the compressor and fans during their normal operation, that are then transmitted to the bearing surface of the machine. The insulation degree provided by the vibration dampers is about 85%.

**AVM (F) Spring vibration dampers.** Consisting of an adequate number of spring vibration dampers, which varies depending on the model, to install under the unit. They reduce the mechanical vibrations generated by the compressor and fans during their normal operation, that are then transmitted to the bearing surface of the machine. The insulation degree provided by the vibration dampers is about 80%.

**OP (F) Programmer Clock,** applied to the remote ON/OFF function.

**CR (F) Remote Control.** Repeats the functions of the control system installed in the unit, thus allowing this latter to be controlled at a distance (up to 100 m) from the unit.

**INT (M) RS485 Serial interface,** for communication with the MODBUS protocol.

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

**DCC (M) Head pressure control** (as standard per low noise version AS).

The device is made by 2 electrical drivers that, by means of phase cutting, control the fans speed rotation, with the scope of mantaining the condensation pressure inside the correct operating limits.

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### Mechanical options

Special finned heat exchangers

- Coils with copper fins
- Coils with copper prepainted

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### Electrical options

- Compressor thermal magnetic switches
- Fan thermal magnetic switches
- Compressor power factor improvement condensers
- Compressor soft-start
- Compressor enabling selectors



## GENERAL SPECIFICATIONS - IR UNIT FOR COOLING MODE ONLY

### General technical specifications Basic Version Unit

### Acoustic Version: AB (Basic Version) and AS (Low noise version)

The following data refer to an IR unit using R407C coolant

MODELS	360.2	410.2	460.2	520.2	580.2	630.2	680.2	780.2	900.2	1000.2	1150.2	1300.2	1450.2	UM
Power supply	400-3-50													V-ph-Hz
Refrigerant charge	R407C													Type
Refrigeration circuits	2													N°
Refrigerant charge	Take as reference the refrigerant charge value on the Unit Identification plate													-
Cooling capacity <sup>(1)</sup>	12.5 - 100													%
<b>AB - Basic Version</b>														
Cooling capacity <sup>(1)</sup>	364	410	452	511	576	621	672	771	882	995	1149	1308	1430	kW
Total power input <sup>(1)</sup>	130	153	171	190	209	228	242	270	313	364	416	471	448	kW
EER	145	168	186	205	228	247	261	293	340	391	446	509	494	kW
Water flow rate <sup>(1)</sup>	2.51	2.44	2.43	2.49	2.53	2.51	2.57	2.63	2.60	2.55	2.57	2.57	2.90	W/W
Water pressure drop <sup>(1)</sup>	17.4	19.6	21.6	24.4	27.5	29.7	32.1	36.8	42.1	47.5	54.9	62.5	68.3	l/s
Capacity control	54	50	44	50	39	45	53	43	55	57	46	56	46	kPa
<b>AS - Low noise Version</b>														
Cooling capacity <sup>(1)</sup>	350	396	435	494	555	601	650	743	853	963	1104	1260	1384	kW
Total power input <sup>(1)</sup>	135	159	177	197	217	236	250	280	323	376	433	489	463	kW
EER	146	169	188	207	230	249	263	295	342	394	453	515	494	kW
Water flow rate <sup>(1)</sup>	2.41	2.34	2.32	2.38	2.41	2.42	2.47	2.52	2.50	2.45	2.44	2.45	2.80	W/W
Water pressure drop <sup>(1)</sup>	16.7	18.9	20.8	23.6	26.5	28.7	31.0	35.5	40.7	46.0	52.8	60.2	66.1	l/s
Capacity control	50	47	41	47	36	42	50	40	51	53	42	52	43	kPa
<b>Compressor specifications</b>														
Type / capacity control	DOUBLE-SCREW / 25 - 100 %													-
Starting type	PART-WINDING							STAR-DELTA						-
Quantity	2													N°
Oil type	POE BSE 170													-
Oil charge CP1	15	15	15	15	22	22	22	22	28	28	28	28	28	l
Oil charge CP2	15	15	15	22	22	22	22	22	28	28	28	28	28	l
<b>Evaporator data</b>														
Type	shell and tube heat exchanger													-
Quantity	1													N°
Total water capacity	106	103	153	148	262	262	262	248	241	413	398	405	543	l
<b>Coils specifications</b>														
Type	Copper pipes notched aluminium fins													-
Quantity	4	4	4	4	4	4	4	4	4	4	4	8	8	N°
Total area	18.0	18.0	18.0	18.0	22.4	22.4	22.4	26.9	31.4	31.4	35.9	44.8	53.8	m <sup>2</sup>
<b>Fan specifications</b>														
Diameter [ Ø ]	800													mm
Quantity	8	8	8	8	10	10	10	12	14	14	16	20	24	N°
Maximum rotation speed	900													rpm
Air speed	2.55	2.55	2.5	2.45	2.45	2.375	2.3	2.3	2.45	2.3	2.3	2.3	2.3	m/s
Total air flow rate (max)	45900	45900	45000	44100	54880	53200	51520	61870	76930	72220	82570	103040	123740	l/s
Total power input	15	15	15	15	19	19	19	23	27	27	30	38	46	kW
<b>Electrical specifications</b>														
FLA Maximum current input	298	336	371	406	458	492	526	534	702	792	878	978	994	A
MIC Maximum surge current	515	607	704	739	861	914	948	956	844	1010	1121	1334	1350	A
FLI Maximum power input	180	206	226	246	276	297	318	322	434	484	536	600	608	kW
<b>Noise levels AB / AS <sup>(2)</sup></b>														
SWL Sound power levels	99 / 94	99 / 94	99 / 94	100 / 95	100 / 95	100 / 95	100 / 95	101 / 96	102 / 97	102 / 97	103 / 98	104 / 99	105 / 100	dB(A)
SPL Sound pressure levels at 1 mt	79 / 74	79 / 74	79 / 74	80 / 75	80 / 75	80 / 75	80 / 75	80 / 75	81 / 76	81 / 76	82 / 77	82 / 77	82 / 77	dB(A)
SPL Sound pressure levels at 5 mt	71 / 66	71 / 66	71 / 66	72 / 67	72 / 67	72 / 67	72 / 67	73 / 68	74 / 69	74 / 69	75 / 70	75 / 70	76 / 71	dB(A)
SPL Sound pressure levels at 10 mt	67 / 62	67 / 62	67 / 62	68 / 63	68 / 63	68 / 63	68 / 63	69 / 64	70 / 64	69 / 64	70 / 65	71 / 66	72 / 67	dB(A)

(1): The data refer to: Water temperature:inlet: 12°C - outlet: 7°C, Outdoor air temperature 35°C.

(2): The noise levels refer to units operating in the nominal conditions (water temperature: inlet: 12°C - outlet: 7°C, Outdoor air temperature 35°C).

SWL = Sound power levels, with reference to 2x10<sup>-12</sup> W.

The Total sound power level in dB(A) measured in compliance with ISO 9614 standards, is certified according to the Eurovent certification program.

Eurovent certification (E) exclusively refers to the Total Sound Power in dB(A), which is therefore the only binding acoustic specification (the values of the Octave bands in the table are indicative).

SPL = Sound pressure levels, with reference to 2x10<sup>-5</sup> Pa.

The sound pressure levels are values calculated by applying the ISO-3744 relation (Eurovent 8/1) and refer to a distance of 1 meter away from the external surface of units operating in the open field with directivity factor 2 and the units operating in nominal conditions in the cooling mode.

## GENERAL SPECIFICATIONS - IR UNIT FOR COOLING MODE ONLY

### Standard performances - Basic Version VB

Mod. 360.2-580.2

MOD.	TW	OUTDOOR AIR TEMPERATURE (°C D.B.)												
		25		30		35		40		43		45		
		kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	
<b>360</b>	5	385	106	367	117	345	127	317	137	297	145	277	150	
	6	395	107	377	118	354	128	326	139	306	146	285	152	
	7	406	109	388	119	<b>364</b>	<b>130</b>	335	141	314	148	293	153	
	8	417	110	398	121	373	132	344	142	322	150	301	155	
	9	427	111	408	122	383	133	352	144	330	152	308	157	
	10	438	112	418	124	392	135	361	146	338	153	316	159	
	11	449	114	428	125	402	136	370	147	347	155	324	161	
	12	458	115	437	126	410	138	377	149	354	157	330	162	
	13	469	116	448	128	420	139	387	151	363	159	338	164	
	14	479	118	457	129	429	141	394	153	370	161	345	166	
	15	496	119	473	131	444	143	409	154	383	162	357	168	
	<b>410</b>	5	433	125	414	137	388	149	357	162	335	170	313	176
		6	445	126	425	139	399	151	367	164	344	172	321	178
		7	458	128	437	140	<b>410</b>	<b>153</b>	377	166	354	174	330	181
		8	469	129	448	142	421	155	387	168	363	176	339	183
9		481	131	459	144	431	157	397	169	372	178	347	185	
10		493	132	470	145	442	158	406	171	381	181	355	187	
11		506	134	482	147	453	160	417	173	391	183	365	189	
12		516	135	492	149	462	162	425	175	399	185	372	191	
13		528	137	504	150	474	164	436	177	409	187	381	193	
14		539	139	514	152	483	166	444	180	417	189	389	196	
15		558	140	533	154	500	168	460	182	432	191	403	198	
<b>460</b>		5	478	140	456	153	428	167	394	181	369	190	345	197
		6	491	141	468	155	440	169	405	183	380	193	354	199
		7	504	143	481	157	<b>452</b>	<b>171</b>	416	185	390	195	364	202
		8	518	145	494	159	464	173	427	187	400	197	373	204
	9	531	146	506	161	476	175	437	189	410	199	383	206	
	10	543	148	518	162	487	177	448	192	420	202	392	209	
	11	557	150	532	164	499	179	460	194	431	204	402	211	
	12	568	151	543	166	509	181	469	196	440	206	410	214	
	13	583	153	556	168	522	183	480	198	451	209	420	216	
	14	594	155	567	170	532	185	490	201	460	211	429	219	
	15	615	157	587	172	551	187	507	203	476	214	444	221	
	<b>520</b>	5	540	155	515	170	484	186	445	201	418	212	390	219
		6	555	157	530	172	497	188	457	203	429	214	400	222
		7	570	159	544	174	<b>511</b>	<b>190</b>	470	206	441	217	411	224
		8	585	161	558	176	524	192	482	208	452	219	422	227
9		600	163	573	178	538	194	495	210	464	222	433	229	
10		614	164	586	181	550	197	506	213	475	224	443	232	
11		630	166	601	183	565	199	519	215	487	227	455	235	
12		643	168	613	185	576	201	530	218	497	229	464	237	
13		659	170	629	187	590	204	543	220	509	232	475	240	
14		672	172	641	189	602	206	554	223	519	235	485	243	
15		696	174	664	191	623	208	574	226	538	237	502	246	
<b>580</b>		5	609	171	581	187	545	204	502	221	471	233	439	241
		6	625	173	597	190	560	207	516	224	484	235	451	244
		7	643	175	613	192	<b>576</b>	<b>209</b>	530	226	497	238	464	247
		8	660	177	629	194	591	211	544	229	510	241	476	249
	9	676	179	645	196	606	214	557	232	523	244	488	252	
	10	692	181	661	199	620	216	571	234	535	247	499	255	
	11	710	183	678	201	636	219	586	237	549	249	512	258	
	12	724	185	691	203	649	221	597	240	560	252	523	261	
	13	742	187	709	206	665	224	612	242	574	255	536	264	
	14	757	189	723	208	679	227	624	245	586	258	546	267	
	15	784	192	748	210	703	229	647	248	606	261	566	270	

TW= Outlet water temperature °C

kWf = Cooling capacity (kW).

kWa = Compressor power input (kW)

The standard performances refer to a 5°C temperature difference between the water entering and leaving the heat exchanger and to operation of the unit with all fans at nominal or maximum speed. A 0.44 x 10-4 m2 K/W fouling factor has also been considered with the unit installed at zero meters above sea level (Pb = 1013mbar).

## GENERAL SPECIFICATIONS - IR UNIT FOR COOLING MODE ONLY

Mod. 630.2-1000.2

MOD.	TW	OUTDOOR AIR TEMPERATURE (°C D.B.)											
		25		30		35		40		43		45	
		kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa
<b>630</b>	5	656	186	626	204	588	223	541	241	508	254	473	263
	6	674	188	644	207	604	225	556	244	521	257	486	266
	7	693	191	661	209	<b>621</b>	<b>228</b>	571	247	536	260	500	269
	8	711	193	679	212	637	231	586	250	550	263	513	272
	9	729	195	696	214	653	233	601	253	564	266	526	275
	10	746	197	712	217	669	236	615	255	577	269	538	278
	11	766	200	731	219	686	239	631	258	592	272	552	282
	12	781	202	745	222	700	241	644	261	604	275	563	285
	13	800	204	764	224	717	244	660	264	619	278	577	288
	14	816	207	779	227	732	247	673	268	631	282	589	292
15	846	209	807	229	758	250	697	271	654	285	610	295	
<b>680</b>	5	710	198	678	217	636	236	585	256	549	269	512	279
	6	730	200	696	220	654	239	602	259	564	273	526	282
	7	750	202	716	222	<b>672</b>	<b>242</b>	618	262	580	276	541	286
	8	769	205	734	225	689	245	634	265	595	279	555	289
	9	789	207	753	227	707	248	650	268	610	282	569	292
	10	808	209	771	230	724	250	666	271	625	286	583	296
	11	829	212	791	233	743	253	683	274	641	289	598	299
	12	845	214	807	235	757	256	697	277	654	292	610	302
	13	866	217	827	238	776	259	714	281	670	296	625	306
	14	883	219	843	241	792	262	728	284	683	299	637	310
15	915	222	873	244	820	265	754	287	708	302	660	313	
<b>780</b>	5	815	220	778	242	730	264	672	285	630	301	588	311
	6	837	223	799	245	750	267	690	289	647	304	604	315
	7	860	226	821	248	<b>771</b>	<b>270</b>	709	292	665	308	621	319
	8	883	228	842	251	791	273	728	296	683	311	637	322
	9	905	231	864	254	811	276	746	299	700	315	653	326
	10	927	234	884	257	830	279	764	302	717	319	668	330
	11	951	236	907	259	852	283	784	306	735	322	686	334
	12	970	239	925	263	869	286	799	310	750	326	699	337
	13	994	242	948	266	891	289	819	313	769	330	717	341
	14	1014	245	967	269	908	293	836	317	784	334	731	345
15	1050	247	1002	272	941	296	865	320	812	337	757	349	
<b>900</b>	5	932	256	890	281	835	306	768	331	721	349	672	361
	6	958	259	914	284	858	309	790	335	741	353	691	365
	7	984	262	939	287	<b>882</b>	<b>313</b>	811	339	761	357	710	369
	8	1010	265	964	291	905	317	833	343	781	361	728	374
	9	1035	268	988	294	928	320	854	347	801	365	747	378
	10	1060	271	1012	297	950	324	874	351	820	369	765	382
	11	1088	274	1038	301	975	328	897	355	841	374	785	387
	12	1109	277	1059	304	994	331	914	359	858	378	800	391
	13	1137	280	1085	308	1019	335	937	363	879	382	820	396
	14	1160	284	1107	311	1039	339	956	367	897	387	836	400
15	1201	287	1146	315	1076	343	990	372	929	391	866	405	
<b>1000</b>	5	1052	297	1004	326	942	356	867	385	813	405	759	420
	6	1080	301	1031	330	968	360	891	389	836	410	779	425
	7	1110	304	1060	334	<b>995</b>	<b>364</b>	915	394	859	415	801	430
	8	1139	308	1087	338	1021	368	939	399	881	420	822	435
	9	1168	311	1115	342	1047	372	963	403	903	425	843	440
	10	1196	315	1141	346	1072	377	986	408	925	429	863	445
	11	1227	319	1171	350	1099	381	1012	413	949	434	885	450
	12	1251	322	1194	354	1121	386	1032	417	968	439	903	455
	13	1283	326	1224	358	1149	390	1057	422	992	445	925	460
	14	1308	330	1248	362	1172	395	1078	427	1012	450	944	466
15	1355	334	1293	366	1214	399	1117	432	1048	455	977	471	

**Tw**= Outlet water temperature °C

**kWf** = Cooling capacity (kW).

**kWa** = Compressor power input (kW)

The standard performances refer to a 5°C temperature difference between the water entering and leaving the heat exchanger and to operation of the unit with all fans at nominal or maximum speed. A 0.44 x 10<sup>-4</sup> m<sup>2</sup> K/W fouling factor has also been considered with the unit installed at zero meters above sea level (Pb = 1013mbar).

## GENERAL SPECIFICATIONS - IR UNIT FOR COOLING MODE ONLY

Mod. 1150.2-1450.2

MOD.	TW	OUTDOOR AIR TEMPERATURE (°C D.B.)											
		25		30		35		40		43		45	
		kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa
<b>1150</b>	5	1214	340	1159	373	1088	406	1001	440	939	463	876	479
	6	1248	344	1191	377	1118	411	1029	445	965	469	900	485
	7	1282	348	1224	382	<b>1149</b>	<b>416</b>	1057	450	992	474	925	491
	8	1316	352	1256	386	1179	421	1085	456	1017	480	949	497
	9	1349	356	1287	391	1209	426	1112	461	1043	485	973	502
	10	1381	360	1318	395	1237	431	1138	466	1068	491	996	508
	11	1417	364	1352	400	1270	436	1168	471	1096	496	1022	514
	12	1445	368	1379	404	1295	441	1191	477	1118	502	1042	520
	13	1481	373	1413	409	1327	446	1221	482	1145	508	1068	526
	14	1511	377	1442	414	1354	451	1245	488	1168	514	1090	532
15	1564	381	1493	419	1402	456	1290	494	1210	520	1128	538	
<b>1300</b>	5	1382	385	1319	422	1239	460	1140	498	1069	524	997	543
	6	1420	389	1355	427	1273	466	1171	504	1098	531	1025	549
	7	1460	394	1393	432	<b>1308</b>	<b>471</b>	1203	510	1129	537	1053	556
	8	1498	398	1429	437	1342	476	1235	516	1158	543	1080	562
	9	1536	403	1465	442	1376	482	1266	522	1188	549	1108	569
	10	1572	407	1500	447	1409	487	1296	528	1216	556	1134	575
	11	1613	412	1539	453	1445	493	1330	534	1247	562	1163	582
	12	1645	417	1570	458	1474	499	1356	540	1272	569	1187	589
	13	1686	422	1609	463	1511	505	1390	546	1304	575	1216	595
	14	1720	427	1641	469	1541	510	1418	553	1330	582	1240	602
15	1781	432	1699	474	1596	516	1468	559	1377	589	1285	609	
<b>1450</b>	5	1511	366	1442	402	1354	438	1246	474	1169	499	1090	516
	6	1553	370	1482	406	1391	443	1280	479	1201	505	1120	522
	7	1596	375	1523	411	<b>1430</b>	<b>448</b>	1316	485	1234	511	1151	529
	8	1637	379	1563	416	1467	453	1350	491	1266	517	1181	535
	9	1679	383	1602	421	1504	458	1384	496	1298	523	1211	541
	10	1719	388	1640	426	1540	464	1417	502	1329	529	1240	547
	11	1763	392	1683	431	1580	469	1454	508	1364	535	1272	553
	12	1799	397	1716	436	1612	474	1483	514	1391	541	1297	560
	13	1843	401	1759	441	1652	480	1520	520	1425	547	1330	566
	14	1880	406	1794	446	1685	486	1550	526	1454	554	1356	573
15	1947	411	1858	451	1745	491	1605	532	1506	560	1404	580	

Tw= Outlet water temperature °C      kWf = Cooling capacity (kW).      kWa = Compressor power input (kW)  
 The standard performances refer to a 5°C temperature difference between the water entering and leaving the heat exchanger and to operation of the unit with all fans at nominal or maximum speed. A 0.44 x 10<sup>-4</sup> m<sup>2</sup> K/W fouling factor has also been considered with the unit installed at zero meters above sea level (Pb = 1013mbar).

### Standard performances - Low noise version AS

For calculating the performances of the unit in low noise version (AS) you have to use the following correction factors for cooling capacity (CCPF) and compressors power input (CCPACP)

Mod.		360.2	410.2	460.2	520.2	580.2	630.2	680.2	780.2	900.2	1000	1150	1300	1450.2
CCPF	Coeff Corr Pf	0.962	0.965	0.963	0.966	0.963	0.968	0.967	0.964	0.967	0.968	0.961	0.963	0.968
CCPACP	Coeff Corr Pass_CP	1.040	1.036	1.038	1.035	1.037	1.033	1.035	1.036	1.033	1.032	1.040	1.038	1.033

### Correction factor for the use of glycol EVAPORATOR WATER CIRCUIT

Correction factor for the use of **ETHYLENE GLYCOL** with water produced between 5±20°C.

Percentage Of glycol in mass / volume	0 / 0	10 / 8,9	20 / 18,1	30 / 27,7	40 / 37,5
Freezing point [°C]	0	-3.2	-8	-14	-22
Cooling capacity CCPF Power input CCPA	1.000	0.990	0.980	0.970	0.950
Power input CCPA	1.000	1.000	0.990	0.990	0.980
Water flow rate CCQA	1.000	1.040	1.080	1.120	1.160
Water pressure drop CCDP	1.000	1.080	1.160	1.250	1.350

Correction factor for the use of **PROPYLENE GLYCOL** with water produced between 5±20°C.

Percentage Of glycol in mass / volume	0 / 0	10 / 9,6	20 / 19,4	30 / 29,4	40 / 39,6
Freezing point [°C]	0	-3.3	-7	-13	-21
Cooling capacity CCPF Power input CCPA	1.000	0.980	0.960	0.940	0.920
Power input CCPA	1.000	0.990	0.980	0.950	0.930
Water flow rate CCQA	1.000	1.010	1.030	1.060	1.090
Water pressure drop CCDP	1.000	1.050	1.110	1.220	1.380

## GENERAL SPECIFICATIONS - BRINE VERSION (VI)

### Brine Version (VI)

Correction factors to apply to the basic version data

#### ETHYLENE GLYCOL

percentage of glycol in mass / volume	20 / 18.1						
freezing point [°C]	-8						
Produced water temperature	4	2	0	-2	-4	-6	-8
Refrigerating power c.f.	0,912	0,855	0,798	0,738	0,683	-	-
Power input c.f.	0,967	0,957	0,947	0,927	0,897	-	-
Water flow rate c.f.	0,955	0,895	0,836	0,773	0,715	-	-
Water pressure drop c.f.	1,09	1,095	1,1	1,11	1,12	-	-

percentage of glycol in mass / volume	30 / 27.7						
freezing point [°C]	-14						
Produced water temperature	4	2	0	-2	-4	-6	-8
Refrigerating power c.f.	0,899	0,842	0,785	0,725	0,67	0,613	0,562
Power input c.f.	0,96	0,95	0,94	0,92	0,89	0,87	0,84
Water flow rate c.f.	0,967	0,905	0,844	0,78	0,72	0,659	0,604
Water pressure drop c.f.	1,14	1,145	1,15	1,155	1,16	1,175	1,19

percentage of glycol in mass / volume	40 / 37.5						
freezing point [°C]	-22						
Produced water temperature	4	2	0	-2	-4	-6	-8
Refrigerating power c.f.	0,884	0,827	0,77	0,71	0,655	0,598	0,547
Power input c.f.	0,88	0,87	0,86	0,84	0,81	0,79	0,76
Water flow rate c.f.	1,062	0,929	0,887	0,798	0,74	0,672	0,607
Water pressure drop c.f.	1,19	1,195	1,2	1,21	1,22	1,235	1,25

#### PROPYLENE GLYCOL

percentage of glycol in mass / volume	20 / 19.4						
freezing point [°C]	-8						
Produced water temperature	4	2	0	-2	-4	-6	-8
Refrigerating power c.f.	0,874	0,807	0,74	0,69	0,641	-	-
Power input c.f.	0,945	0,935	0,925	0,9	0,875	-	-
Water flow rate c.f.	0,915	0,845	0,774	0,723	0,671	-	-
Water pressure drop c.f.	1,11	1,115	1,12	1,13	1,14	-	-

percentage of glycol in mass / volume	30 / 29.4						
freezing point [°C]	-14						
Produced water temperature	4	2	0	-2	-4	-6	-8
Refrigerating power c.f.	0,869	0,799	0,729	0,68	0,63	0,583	0,536
Power input c.f.	0,935	0,923	0,91	0,888	0,865	0,838	0,81
Water flow rate c.f.	0,934	0,859	0,784	0,731	0,678	0,627	0,576
Water pressure drop c.f.	1,16	1,175	1,19	1,2	1,21	1,255	1,3

percentage of glycol in mass / volume	40 / 39.6						
freezing point [°C]	-22						
Produced water temperature	4	2	0	-2	-4	-6	-8
Refrigerating power c.f.	0,848	0,784	0,719	0,67	0,62	0,57	0,52
Power input c.f.	0,865	0,855	0,845	0,82	0,795	0,773	0,75
Water flow rate c.f.	1,062	0,881	0,887	0,752	0,74	0,641	0,607
Water pressure drop c.f.	1,23	1,275	1,32	1,375	1,43	1,5	1,57

## NOISE LEVELS

The noise levels refer to units operating in the nominal conditions (water temperature: inlet: 12°C - outlet: 7°C, Outdoor air temperature 35°C).

The acoustic pressure levels are measured 1/ 5 / 10 meters away from the outer surface of the unit operating in the free field and resting on a reflecting surface (directional factor of 2).

**SWL** = Sound power levels, with reference to  $2 \times 10^{-12}$  W.

The Total sound power level in **dB(A)** measured in compliance with **ISO 9614** standards, is certified according to the **Eurovent** certification program.

Eurovent certification (**E**) exclusively refers to the **Total Sound Power in dB(A)**, which is therefore the only binding acoustic specification (the values of the Octave bands in the table are indicative).

**SPL** = Sound pressure levels, with reference to  $2 \times 10^{-5}$  Pa.

The sound pressure levels are values calculated by applying the **ISO-3744 relation (Eurovent 8/1)** and refer to a distance of 1 meter away from the external surface of units operating in the open field with directivity factor 2 and the units operating in nominal conditions in the cooling mode.

### AB Basic Version

MOD.	SWL (dB)									SPL [dB(A)]			
	Octave bands (Hz)								Total		1	5	10
	63	125	250	500	1000	2000	4000	8000	dB	dB(A)			
360.2	99	98	94	93	94	94	90	82	<b>104</b>	<b>99</b>	79	71	67
410.2	99	98	94	93	94	94	90	82	<b>104</b>	<b>99</b>	79	71	67
460.2	99	98	94	93	94	94	90	82	<b>104</b>	<b>99</b>	79	71	67
520.2	100	99	96	94	95	95	90	83	<b>105</b>	<b>100</b>	80	72	68
580.2	100	99	96	94	95	95	91	84	<b>105</b>	<b>100</b>	80	72	68
630.2	100	99	96	94	95	95	91	84	<b>105</b>	<b>100</b>	80	72	68
680.2	100	99	96	94	95	95	91	84	<b>105</b>	<b>100</b>	80	72	68
780.2	102	100	97	95	96	96	90	84	<b>106</b>	<b>101</b>	80	73	69
900.2	102	101	98	96	98	96	88	84	<b>107</b>	<b>102</b>	81	74	69
1000.2	103	102	98	97	98	96	89	85	<b>108</b>	<b>102</b>	81	74	69
1150.2	104	102	99	98	98	97	91	88	<b>108</b>	<b>103</b>	82	75	70
1300.2	104	103	100	100	99	99	92	90	<b>109</b>	<b>104</b>	82	75	71
1450.2	105	103	101	101	100	100	93	92	<b>110</b>	<b>105</b>	82	76	72

### AS Low noise Version

MOD.	SWL (dB)									SPL [dB(A)]			
	Octave bands (Hz)								Total		1	5	10
	63	125	250	500	1000	2000	4000	8000	dB	dB(A)			
360.2	98	96	92	91	89	85	81	75	<b>102</b>	<b>94</b>	74	66	62
410.2	98	96	92	91	89	85	81	75	<b>102</b>	<b>94</b>	74	66	62
460.2	98	96	92	91	89	85	81	75	<b>102</b>	<b>94</b>	74	66	62
520.2	99	97	94	92	90	86	81	76	<b>103</b>	<b>95</b>	75	67	63
580.2	99	97	94	92	90	86	82	77	<b>103</b>	<b>95</b>	75	67	63
630.2	99	97	94	92	90	86	82	77	<b>103</b>	<b>95</b>	75	67	63
680.2	99	97	94	92	90	86	82	77	<b>103</b>	<b>95</b>	75	67	63
780.2	101	98	95	93	91	87	81	77	<b>104</b>	<b>96</b>	75	68	64
900.2	101	99	96	94	93	87	79	77	<b>105</b>	<b>97</b>	76	69	64
1000.2	102	100	96	95	93	87	80	78	<b>106</b>	<b>97</b>	76	69	64
1150.2	103	100	97	96	93	88	82	81	<b>106</b>	<b>98</b>	77	70	65
1300.2	103	101	98	98	94	90	83	83	<b>107</b>	<b>99</b>	77	70	66
1450.2	104	101	99	99	95	91	84	85	<b>108</b>	<b>100</b>	77	71	67

# OPERATING RANGE

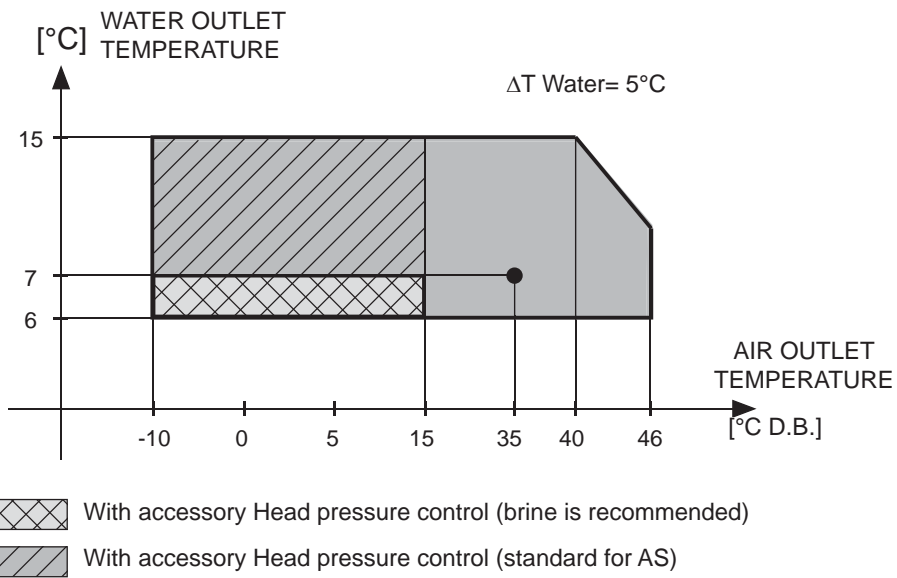
## Operating range Basic Version

The table below lists the operating ranges within which correct operation of the units is guaranteed, depending on the Version and Operating Mode available for each type of unit.

Remember that in Heat Pump units, heat recovery only takes place during operation in the cooling mode.

Operating range of Basic Version

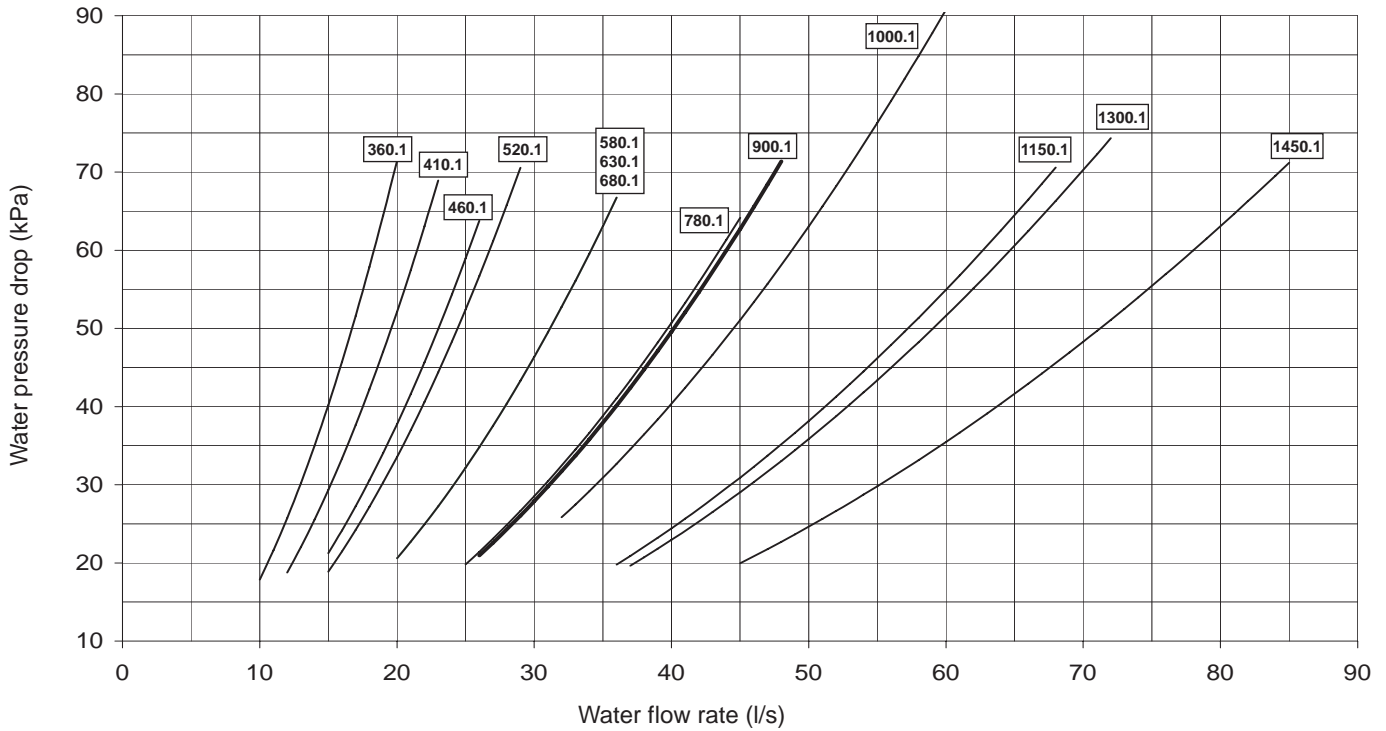
Thermal gradient of the water*		Limit value
Minimum	°C	4
Maximum	°C	8



\* : Verify that water flow rate to the exchanger is inside the admissible limits.

## WATER PRESSURE DROP EVAPORATOR

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



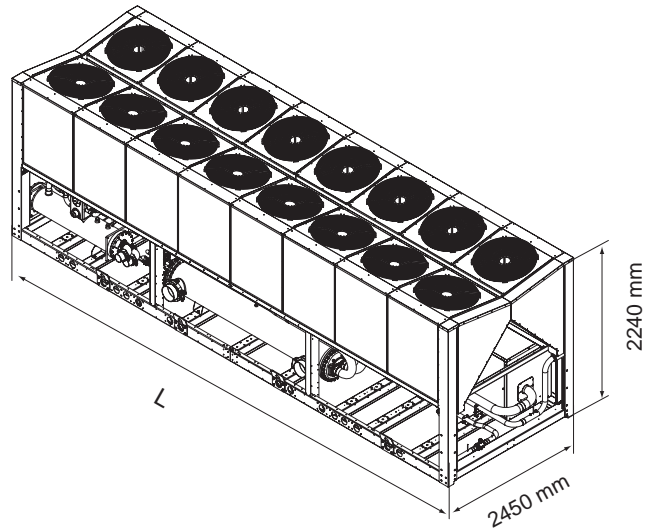
### Operating range

MOD.	360.2	410.2	460.2	520.2	580.2	630.2	680.2	780.2	900.2	1000.2	1150.2	1300.2	1450.2	UM
Min water flow rate	10,0	12,0	15,0	15,0	20,0	20,0	20,0	25,0	26,0	32,0	36,0	37,0	45,0	l/s
Max water flow rate	20,0	23,0	26,0	29,0	36,0	36,0	36,0	45,0	48,0	65,0	68,0	73,0	85,0	l/s



## DIMENSIONAL AND PHYSICAL DATA

### Overall dimension



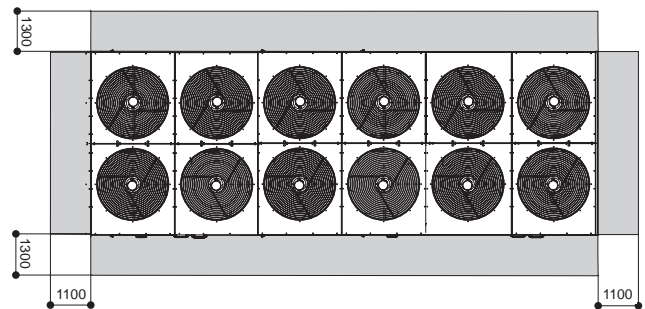
MOD.		360.2	410.2	460.2	520.2	580.2	630.2	680.2	780.2	900.2	1000.2	1150.2	1300.2	1450.2	UM
Transport weigh	AB	3464	3477	3839	4180	4632	4827	5022	5578	6582	7515	7862	8811	9379	kg
	AS	3663	3676	4053	4409	4861	5056	5251	5807	6846	7779	8126	9075	9643	kg
Operation weigh	AB	3570	3580	3992	4328	4894	5089	5284	5826	6823	7928	8260	9216	9922	kg
	AS	3769	3779	4206	4557	5123	5318	5513	6055	7087	8192	8524	9480	10186	kg
Length [L]		4070	4070	4070	4070	5000	5000	5000	5935	6875	6875	7810	10000	11868	mm

### Minimum space required for operation

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

**NOTE: Allow for a clear area of not less than 2.5 meters above unit.**

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



### Victaulic connections and water flow switch

These comprise two wet connections of the Victaulic type (Fig. 1-A) composed by steel joint (Fig. 1-B) and rubber packing not installed (supplied with the unit). The steel joints are suitable to be welded or threaded.

Nota:  
Supplied as accessory (see "Accessory and optional equipment")

