Ferroli

RPC

AIR COOLED WATER CHILLERS
AND HEAT PUMPS
WITH CENTRIFUGAL FANS

OZONO SAFE
R407C

TECHNICAL MANUAL

TABLE OF CONTENTS

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GENERAL SPECIFICATIONS

Presentation of the unit

This new series of industrial chillers, which includes **5 sizes** with **5.9 to 14.9 kW** cooling capacity ratings and **6.5 to 15.1 kW** heating capacity ratings, has been designed to meet the air conditioning requirements of low power systems in residential and commercial buildings.
The units in question are available in the **IR** Chiller version and air condensed **IP** Heat Pump version with centrifugal fans suitable for installation indoors, thus the air exhausted by the coils must be disposed of outdoors through ducts. The air must be ducted on both the coil intake and fan delivery sides through flanges formed on the structure of the unit. The standard unit has a vertical air delivery: if necessary, the fan can be repositioned for side air delivery.
The bearing structure and panelling is made of galvanized metal plate of adequate thickness coated with polyurethane powder paints. All the fastening components are made of stainless and/or galvanized steel.
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.
All the units can produce cold water at a temperature between 5 and 10°C (summer operating mode) and hot water from 35 to 50°C (winter operating mode). As part of the standard supply, they are pre/engineered to operate at low/high outdoor temperatures thanks to use of a condensation/evaporation monitoring system through continuous control of the fan speed. This device also allows the value of the static pressure effectively required for ducting to be fixed by entering the corresponding parameter via the keyboard.
As part of the standard supply, all the units are equipped with **SCROLL** or **ROTARY** compressors with internal thermal protection and electric oil heater, a heat-insulated plate type heat exchanger, protection by means of a differential water pressure switch and antifreeze electric heater, coils with extended surfaces made from copper pipes and notched aluminium fins, centrifugal fans with electric motor and internal thermal protection, complete with safetry grilles, with an impeller whose vanes point forwards to provide sufficient static pressure to duct the air (maximum available head 150Pa), electric control and regulating panel, controller with microprocessor, **R407C ENVIRONMENT-FRIENDLY** refrigerant gas.
In the lower part, the coils have a zone for sub-cooling the fluid which, during the winter operating mode, minimizes the formation of ice and helps the condensation to flow out after it has collected in a tray complete with drain fitting installed under the coils.
The standard supply can also be integrated with a vast range of electrical and mechanical accessories. The **Storage and Pumping module (MP)** is of particular interest and can be coupled to the unit via a quick hydraulic connection.
All the units are accurately built and tested individually, thus only the electrical and wet connections need be made for installation.

Unit identification code

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.

IP - 30 - VB - AB - 7 - M - 5

Unit Type

IR: units for installation in an **H**ydronic system with operation as a **C**hiller.
IP: units for installation in an **H**ydronic system with operation as a **H**eat pump.

Power supply Type

1: Units fit to operate with **230V-1-50Hz(1) (single-phase)** voltage.
5: Units fit to operate with **400V-3+N-50Hz(2) (threephase)** voltage.

Version

VB - Basic Version

Refrigerant Type

7 - R407C

Model of unit

19
30
30/3
38
38/3
42
50

Acoustic Version

AB - Basic Version

Operating climates

M- Medium temperatures (temperate climates). These units are fit for operation up to a maximum outdoor air temperature of 46 °C with chilled water produced at a temperature of 10°C and 5°C thermal gradient.

(1): Mod. 19-30-38
(2): Mod. 30/3-38/3-42-50

GENERAL SPECIFICATIONS

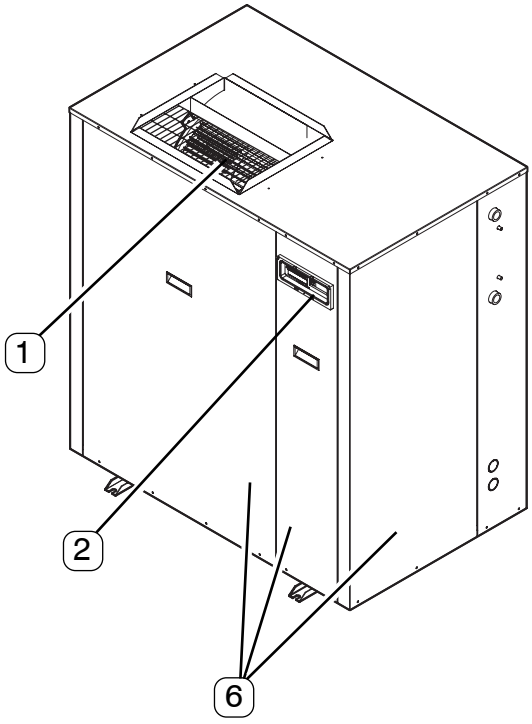
Description of the components

The series includes five sizes ranging from **5.9 to 14.9 kW** in the cooling mode and **from 6.5 to 15.1 kW** in the heating mode.

Main components
The technical specifications of the main components forming the units are:

1. **The ventilating unit** consists of centrifugal electric fans of the external rotor type with aluminium vanes pointing forwards. They provide the air to be ducted with an adequate residue head (max 150 Pa) with low noise levels. They are housed in a galvanized sheet metal screw and are protected by a safety net.

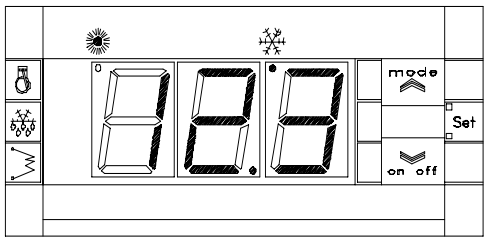
2. **Electric control and monitoring panel**. This consists of a casing made of plastic material in which the various electrical components are installed on a metal plate.



a. The main components are:
- Main Magnetothermal switch/Disconnector: disconnects the unit from the electric power supply. It can be accessed from the outside by lifting the plastic flap installed as a protection. The disconnector also safeguards the power cables and compressor motor, as well as the other standard users (e.g. fan) or accessory components (water circulator) against short-circuits or faulty operation.
- Compressor contactor: enables the compressor to operate.
- Transformer to power the auxiliary circuit and electronic controller.
- Wiring board: complete with pump relay, alarm relay and protections for the electronic controller and auxiliary circuit.

b. The monitoring section includes:
- User interface terminal with **LCD display**
- On-off key.
- Operating mode selector key.
- Compressor on-off LED.
- Antifreeze heaters on LED.
- Defrosting **request**/**activation** indicator LED (only **IP** units)
- Check-control with fault code display.

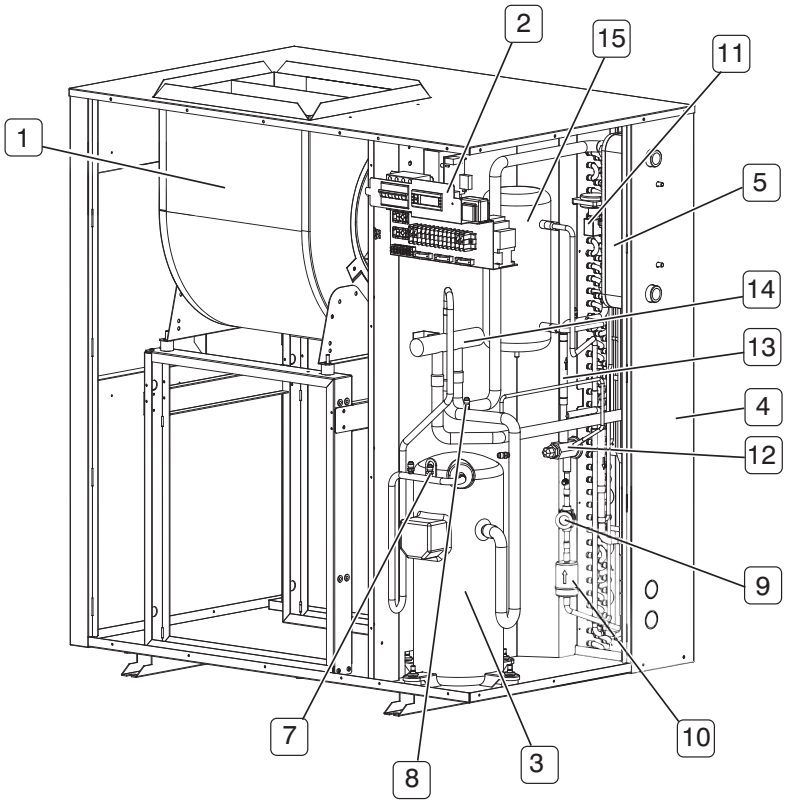
The main functions of the monitoring system are:
Temperature regulation of the water produced by the unit, operating hour counting for compressors and pump, start-up timing, parameter entry via the keyboard, alarm diagnosis.
Functions associated with the digital inputs:low and high pressure, water differential pressure switch, correct electric power phase presence-sequence (accessory); the accessory currently acts straight on the coil of the compressor contactor and not on a digital input, remote controlled **ON**/**OFF** commands, remote controlled operating mode change (summer/winter).
Functions associated with the digital outputs: compressor control, water pump control, electric antifreeze heater, general alarm (can be remote controlled), cycle reversing valve control.
Functions associated with the analog inputs: water inlet and outlet temperatures, coil temperature.
Functions associated with the analog outputs: infinite fan speed monitoring.



GENERAL SPECIFICATIONS

The controller can be directly accessed from outside the machine and is protected by a transparent plastic flap.

3. **Compressors** of the ROTARY or SCROLL type, protected by magnetothermic switches and equipped with internal thermal protection (IP units only are also equipped with oil heaters which evaporate any fluid in the casing and thus prevent fluid pressure surges). To prevent reverse rotation in threephase models, the electric panel can be equipped with an accessory device to monitor the correct sequence and presence of the powering phases. The compressors are fixed on rubber pads which reduce the vibrations transmitted to the structure.
4. **Bearing structure** made of galvanized sheet metal panels coated with polyurethane powder paint to ensure good protection against adverse weather conditions.
5. **Evaporator**. This is the single-circuit plate type on the wet side with single circuit on the refrigerant side. As part of the standard supply, it is equipped with an adhesive electric antifreeze heater and a differential water pressure switch to prevent icing up if the outdoor temperature is low or there is no water flowing. It is also insulated with thermal barrier insulating material to prevent condensation and heat dispersion.
6. **Covering panels**. Made of galvanized sheet metal panels coated with polyurethane powder paint to ensure good protection against adverse weather conditions.



Chilling circuit components.

7. **High pressure switch**, with fixed setting. It is installed on the delivery pipe and blocks the compressor if the operating pressures exceed the tolerated values. If it activates, the circuit will block and can only be restarted by resetting via the electronic board display.
8. **Low pressure switch**, with fixed setting. It is installed on the suction pipe and blocks the compressor if the operating pressures drop below the tolerated values. If it activates, the unit will block and can only be restarted by resetting via the electronic board display.
9. **Fluid and humidity indicator**. Signals when fluid passes through the circuit, indicating that the refrigerant charge is correct. The fluid indicator also changes colour to show the amount of moisture in the refrigerant.
10. **Dehydrator filter** of the mechanical type. Retains impurities and traces of moisture in the circuit.
11. **Differential water pressure switch**. This is standard supply and is installed on the connections between the exchanger's water inlet and outlet. If it activates, the unit will block and can only be restarted by resetting via the user interface terminal.
12. **Thermostatic valve**, of the type with external equalizer. It's task is to supply the evaporator correctly, keeping the selected degree of superheat at a steady level.
13. **One-way valves (only IP units),** make the refrigerant obligatorily pass through the appropriate heat exchangers, depending on the operating cycle.
14. **4-way cycle reversing valve (IP units only).** Reverses the direction in which the refrigerant flows when the summer/winter operating modes change.
15. **Fluid receiver (IP units only).** This is a plenum tank that accounts for the refrigerant charge variations required by the machine as the summer/winter operating modes change.

Pressure taps: 1/4 " SAE (7/16" UNF) type with air pump. Allow the operating pressure of the system to be measured in the 3 main points: compressor delivery, inlet to the laminating component, compressor intake.
Electrical heating element to heat the compressor oil: "belt type". They activate when the compressor turns off. Their task is to keep the temperature of the oil sufficiently high so as to prevent refrigerant from migrating during these pauses **(standard supply for IP, not available for IR)**.
Antifreeze electric heating element for evaporator: adhesive type. It is installed under the layer of insulation and activates when the temperature of the water measured by the probe at the evaporator outlet drops below a preset value. It maintains the water at a temperature able to prevent ice from forming during winter periods at a standstill.
Condensing coils, of the type with serrated aluminium fins and smooth or grooved, expanded pipes.

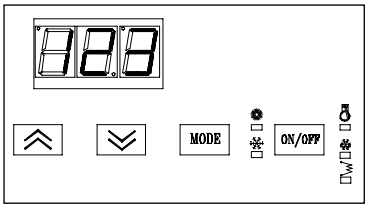
OPTIONAL EQUIPMENT AND ACCESSORIES

Mechanical accessories

GP - Protective coil grilles. Consisting of a metal grille that protects the coils with extended surfaces.
AVG - Rubber vibration dampers. Kit comprising 4 cylindrical vibration dampers made of vulcanized rubber on metal washers. They are used for mounting the units on both a base and on shelving.
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.
MP - Pumping Module.
Storage module that can be coupled to the unit via a quick hydraulic connection.
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.
Refer to the “Description of the Pumping module” section for further details of the selected model.

Electrical accessories

CR - Remote Control. This device allows all the control and monitoring functions of the control unit on the machine to be controlled up to 100 meters away from the actual machine itself. Use a threepole or three-wired section cable in **PVC** type **N07-VK** with a 1mm^2 wire section for the connections. The transmission line must be routed in a dedicated duct, separate from any electric powering lines (**230**/**400 V**).



The remote control has the following keys:
MODE key : selects the operating mode
ON/**OFF key** : turns the unit ON/OFF and resets the alarms
Mode + ON/**OFF keys** : used to access and quit the various menu levels
UP key : scrolls forwards through the menu items or increases the value of a parameter
DOWN key : scrolls backwards through the menu items or decreases the value of a parameter

CFS - Electric power Phase presence and sequence Monitoring device. This device is installed inside the electric panel and blocks the unit in the event of a phase failure or if the phase sequence is incorrect, indicating the error on the display. this safeguards the compressor’s electric motor.
OP - Programmer Clock. This is a device (housed in a modular casing 45 mm in width) that allows the unit to be turned on and off (without needing to be regulated) by means of the remote controlled digital on-off input on the control board of the unit. Up to 14 change-overs can be set-up over the 7 days of the week, as preferred. Take care when the line is routed, since the wires are live (230V).
RAG - Electric antifreeze heating element on the storage tank. Glow plug type; maintains the water at a temperature able to prevent ice from forming during winter standstills (Pumping Module accessory).

Mechanical options

Special finned heat exchangers
- Coils with copper fins
- Coils with tin-coated copper fins
- Coils with aluminium fins with acrylic coating

Electrical options

Power source voltage rating 230V-3-50Hz

Combinations of accessories-models

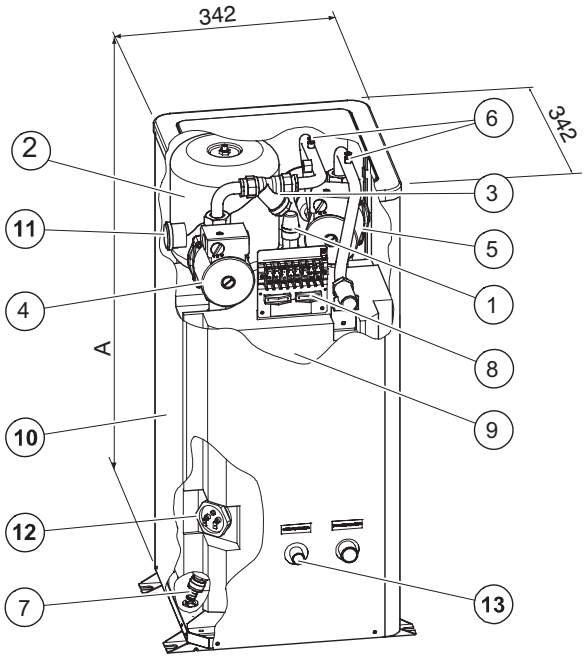
MODEL OF UNIT			CODE	19	30	30/3	38	38/3	42	50
ACCESSORIES	MECHANICAL	Protective coil grilles.	GP13	•	•					
			GP14				•		•	•
		Rubber vibration dampers	AVG6	•	•		•		•	•
	ELECTRIC	Remote Control	CR	•	•		•		•	•
		Electric power Phase presence and sequence Monitoring device	CSF(*)			•		•	•	•
		Programmer Clock	OP	•	•		•		•	•

(*):Only available for threephase models

OPTIONAL EQUIPMENT AND ACCESSORIES

Description of Pumping Module Mod. 34 - 60

The storage module can be coupled to the unit via a quick hydraulic connection.
The storage unit is equipped with :



1. **Safety valve.** With fixed setting. Activates when the pressure in the tank exceeds the preset values.
2. **Surge chamber.** This is a closed, diaphragm type chamber. It absorbs the variations in the volumes of water in the system caused by temperature variations.
3. **Mechanical gauze filter.** Can be inspected. Installed on the pump/circulator intake. Preventing machining residues (dust, swarf) in the water pipes from entering the pump or plate-type heat exchanger.
4. **Primary circulation pump.** Three-speed circulation pump that provides the chiller with the right water flow rate.
5. **Secondary circulation pump.** Three-speed circulation pump that provides the system with the right water flow rate.
6. **Air vents.** Positioned on the highest part of the module's wet pipes, it bleeds the air from the module itself when the system is filled.
7. **Drain cock.** Drains the water from the storage module to prevent it from freezing during winter periods when the system remains at a standstill (unless it is used for hot water storage), or when it is being serviced.
8. **Electric terminal board.** Reduces the number of compressor start-ups and fluctuations in the temperature of the water conveyed to the users. It is insulated with polyurethane foam to prevent the formation of condensation and heat exchanges towards the outside.
9. **Storage tank.** Insulated with a foam coating.
10. **Metal framework.** Made of galvanized sheet metal panels coated with polyurethane powder paint to ensure good protection against adverse weather conditions.
11. **Pressure gauge.** Indicates the pressure level in the storage tank.
12. **Electric antifreeze heating element connection** (Accessory). Allows the storage tank's electric antifreeze heating element to be installed.
13. **Filling fitting.**

Storage and Pumping Module Accessory

STORAGE MODEL	CODE	34			60			
MATCHABLE UNIT MODEL		19	30	30/3	38	38/3	42	50
Pumping Module	MP34	•	•					
	MP60				•		•	•

Accessory for the Storage and Pumping Module

STORAGE MODEL	CODE	34	60
Antifreeze heating element	RAG2	•	•
Flexible wet connections	KT14	•	•

OPTIONAL EQUIPMENT AND ACCESSORIES

Description of Pumping Module Mod. 30 - 55

Pumping and Storage module Mod. 30 - 55
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. Available in the Standard versions for all models and in the High Head version for models 19-30. In nominal operating conditions in the cooling mode, the Standard Version is able to provide the circulating water with 35 to 104 kPa residual head, while the High Head Version has 116 to 134 kPa residual head.

With reference to the figure alongside and depending on the model, the Storage and Pumping Module is equipped with:

1A. Multiple stage pump. With a high head, able to suit the majority of installation requirements. All pump components that come into contact with the pumped fluid are made of stainless steel.
1B. Circulation pump. Three-speed circulation pump that provides the chiller with the right water flow rate. The 3rd speed is set during the production phase: it is inadvisable to modify this speed as the operation of the Module would be impaired.

2A. Pump suction sleeve (1" GAS female) used for returning from the system**.**
2B. Returning stub pipe from the system (1" GAS male) used for returning from the system**.**

3. Pressure gauge. Indicates the pressure level in the storage tank (only for mod. 30 in the High head version and mod. 50 in the Standard version).

4. Delivery stub pipe of the system (1" GAS male).

5. Safety valve. With fixed setting. Activates when the pressure in the tank exceeds the preset values.

6. Drain cock. Drains the water from the storage module to prevent it from freezing during winter periods, if not used for hot water storage.

7. Electric antifreeze heating element connection (Accessory). Allows the storage tank's electric antifreeze heating element to be installed.

8. Storage tank. Reduces the number of compressor start-ups and fluctuations in the temperature of the water conveyed to the users. It is insulated with polyurethane foam to prevent the formation of condensation and heat exchanges towards the outside.

9A. Automatic air venting. Vents the tank when the system is filled.
9B. Air venting. Positioned on the highest part of the module's wet pipes, it bleeds the air from the module itself when the system is filled.

10. Metal gauze water filter. Can be inspected. Installed on the pump/circulator intake. Preventing machining residues (dust, swarf) in the water pipes from entering the pump or plate-type heat exchanger.

11. Surge chamber. This is a closed, diaphragm type chamber. It absorbs the variations in the volumes of water in the system caused by temperature variations.

12. Metal structure. Made of galvanized sheet metal panels coated with polyurethane powder paint to ensure good protection against adverse weather conditions.

Mod. 30 in the Standard Version

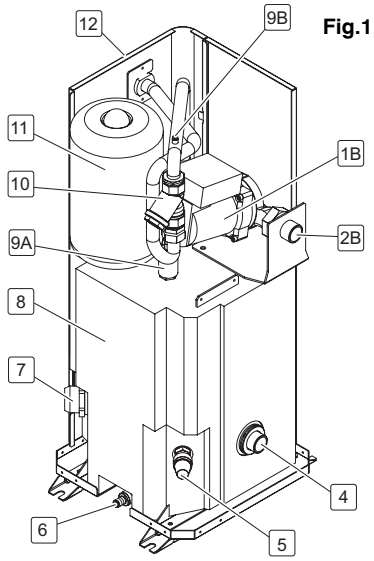


Fig.1

Mod. 30 in the High Head Version
Mod. 50 in the Standard Version

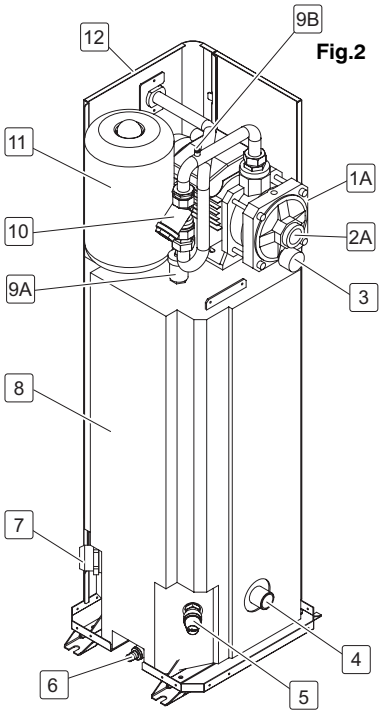


Fig.2

Storage and Pumping Module Accessory

STORAGE MODEL	CODE	30			55			
MATCHABLE UNIT MODEL		19	30	30/3	38	38/3	42	50
Standard version	SAA 8	•	•					
	SAA 12				•		•	•
High Head Version	SAA 9	•	•					

Accessory for the Storage and Pumping Module

STORAGE MODEL	CODE	30	55
Antifreeze heating element	RAG 5	•	•
Hydraulic quick couplings	AV 4	•	•
Flexible wet connections	KT14	•	•

GENERAL SPECIFICATIONS - IR UNIT FOR COOLING MODE ONLY

Common general technical specifications

The following data refer to units using **R407C refrigerant**

Model of Unit	19	30	30/3	38	38/3	42	50	MU
Compressor specifications								
Type	ROTARY	SCROLL						/
Quantity	1							N°
Exchanger data								
Type	COPPER BRAZE WELDED STAINLESS STEEL PLATES							/
Quantity	1							N°
Water capacity	0.26	0.34		0.46		0.53	0.60	l
Fan specifications								
Type	Centrifugal with vanes positioned forwards							
Quantity	1							N°
Nominal air flow rate	944	917		1667		1667	1611	l/s
Air working head	50							Pa
Maximum air head(NB)	150							Pa

(NB): The unit has a infinite fan speed monitoring device to allows it to adapt itself to the different ducted conditions. It permits the right unit working to a maximum air pressure drop value of 150 Pa.

Specifications of coils with extended surfaces

Type	Copper pipes and notched aluminium fins	/
Quantity	1	N°

Basic Version of IR Unit

Model of Unit	19	30	30/3	38	38/3	42	50	MU
Power supply	230-1-50		400-3+N-50	230-1-50	400-3+N-50			V-f-Hz
Refrigerant fluid	R407C							/
Net cooling capacity(1)	6.2	8.4		10.6		13.0	15.2	kW
Compressor power input(1)	2.15	3.05		3.60		4.60	5.50	kW
Net total power draw (1)	2.78	3.70		4.86		5.88	6.75	kW
Water flow rate(1)	0.30	0.40		0.51		0.62	0.73	l/s
Water pressre drop (1) (E)	34	39		33		37	40	kPa
Working head (1)	58	52		65		60	57	kPa
Throttling	0-100							%
Gross cooling capacity(1) (E)	6,23	8,45		10,7		13,1	15,3	kW
Gross total power draw(1) (E)	2,74	3,64		4,82		5,8	6,65	kW

Unit electrical specifications

FLA Maximum current absorption	21.6	25.6	13.1	33.6	20.1	22.6	24.6	A
FLI Maximum power draw	4.5	5.4	5.4	7.0	7.0	7.8	8.9	kW
MIC Maximum surge current	64	106	52	124	60	76	84	A

The data refer to standard operating conditions.
(1): The data refer to Water temperature: inlet: 12°C - outlet: 7°C, Outdoor air temperature 35°C D.B.
(E): Data certificated by EUROVENT.

GENERAL SPECIFICATIONS - IR UNIT FOR COOLING MODE ONLY

Noise levels (E)

MODEL	ACOUSTIC POWER (dB)										TOTAL SOUND PRESSURE
	Octave bands (Hz)								Total		
	63	125	250	500	1000	2000	4000	8000	dB	dB(A)	dB(A)
19	69.1	70.2	75.5	70.1	68.1	66.2	63.8	55.7	78.9	74.0	**60**
30	70.6	70.9	76.8	72.7	70.8	67.8	64.5	56.2	80.5	76.0	**62**
30/3	70.6	70.9	76.8	72.7	70.8	67.8	64.5	56.2	80.5	76.0	**62**
38	75.0	86.0	83.0	74.5	75.8	75.6	72.0	64.0	88.8	82.0	**67**
38/3	75.0	86.0	83.0	74.5	75.8	75.6	72.0	64.0	88.8	82.0	**67**
42	75.0	86.0	83.0	74.5	75.8	75.6	72.0	64.0	88.8	82.0	**67**
50	76.3	87.5	83.4	75.6	77.2	76.8	72.4	65.0	89.9	83.0	**68**

(E): Data certificated by EUROVENT.

SWL = Sound power levels, with reference to $1x10^{-12}$ W.

The **Total** sound power level in **dB(A)** measured in compliance with **ISO 9614** standards, 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 $2x10^{-5}$ 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.

Unit technical specifications with Storage and Pumping Module Accessory

Standard Versio accessory model	30			55				UM
Compatible Unit	19	30	30/3	38	38/3	42	50	
Water capacity	30			55				l
Water flow rate(1)	0.30	0.40		0.51		0.62	0.73	l\s
Working head (1)	44	35		104		78	48	kPa
Type of pump	CIRCOLATORE			POMPA MULTISTADIO				tipo
Maximum power input	210			450				W
Surge chamber capacity.	5							l
Service charge pressure of surge chamber	150							kPa
Safety valve setting	300							kPa

High Head Version of accessory model	30			-				UM
Compatible Unit	19	30	30/3	-	-	-	-	
Water capacity	30			-	-	-	-	l
Water flow rate(1)	0.30	0.40		-	-	-	-	l\s
Working head (1)	134	116		-	-	-	-	kPa
Type of pump	POMPA MULTISTADIO			-	-	-	-	tipo
Maximum power input	450			-	-	-	-	W
Surge chamber capacity.	5			-	-	-	-	l
Service charge pressure of surge chamber	150			-	-	-	-	kPa
Safety valve setting	300			-	-	-	-	kPa

Unit electrical specifications with Storage and Pumping Module Accessory(2)

Power supply	230-1-50		400-3+N-50	230-1-50	400-3+N-50			V/ph/Hz
Total maximum power input [FLA]	22.1	26.1	15.4	35.9	22.4	24.9	26.9	A
Total maximum power input [FLI]	6.80	7.70	5.85	7.45	7.45	8.25	9.35	kW
Total maximum surge current [MIC]	64	106	54	126	62	78	86	A

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

(2): Regarding unit operating in conjunction with the Storage and Pumping Module accessory:
- for mod. 16-19-24-30 Storage Module in the High Head version
- for mod. 38-42-50-30 Storage Module in the Standard version.

GENERAL SPECIFICATIONS - IR UNIT FOR COOLING MODE ONLY

Standard performances in cooling mode AB-7M5

MODEL	Tw	OUTDOOR AIR TEMPERATURE (°C D.B.)									
		25		30		35		40		45	
		kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa
19	5	6,33	1,70	6,09	1,90	5,80	2,13	5,51	2,37	5,18	2,64
	6	6,55	1,72	6,29	1,91	6,02	2,13	5,71	2,37	5,38	2,65
	7	6,76	1,73	6,51	1,92	**6,20**	**2,15**	5,89	2,38	5,56	2,66
	8	6,98	1,73	6,71	1,94	6,42	2,15	6,09	2,41	5,74	2,69
	9	7,19	1,76	6,92	1,96	6,63	2,16	6,29	2,41	5,92	2,69
	10	7,46	1,77	7,15	1,96	6,82	2,19	6,49	2,43	6,15	2,71
30	5	8,37	2,41	8,06	2,69	7,68	3,02	7,29	3,36	6,86	3,74
	6	8,66	2,44	8,32	2,71	7,96	3,02	7,55	3,37	7,12	3,76
	7	8,94	2,45	8,61	2,73	**8,20**	**3,05**	7,79	3,38	7,36	3,78
	8	9,23	2,46	8,87	2,75	8,49	3,05	8,05	3,42	7,60	3,81
	9	9,52	2,50	9,15	2,78	8,77	3,07	8,31	3,42	7,83	3,81
	10	9,86	2,51	9,45	2,78	9,02	3,11	8,59	3,45	8,13	3,85
30/3	5	8,37	2,41	8,06	2,69	7,68	3,02	7,29	3,36	6,86	3,74
	6	8,66	2,44	8,32	2,71	7,96	3,02	7,55	3,37	7,12	3,76
	7	8,94	2,45	8,61	2,73	**8,20**	**3,05**	7,79	3,38	7,36	3,78
	8	9,23	2,46	8,87	2,75	8,49	3,05	8,05	3,42	7,60	3,81
	9	9,52	2,50	9,15	2,78	8,77	3,07	8,31	3,42	7,83	3,81
	10	9,86	2,51	9,45	2,78	9,02	3,11	8,59	3,45	8,13	3,85
38	5	10,8	2,85	10,4	3,18	9,92	3,56	9,42	3,96	8,86	4,42
	6	11,2	2,88	10,8	3,20	10,3	3,56	9,76	3,98	9,21	4,44
	7	11,6	2,89	11,1	3,22	**10,6**	**3,60**	10,1	3,99	9,51	4,46
	8	11,9	2,90	11,5	3,24	11,0	3,60	10,4	4,04	9,82	4,50
	9	12,3	2,95	11,8	3,28	11,3	3,62	10,7	4,04	10,1	4,50
	10	12,7	2,96	12,2	3,28	11,7	3,67	11,1	4,08	10,5	4,54
38/3	5	10,8	2,85	10,4	3,18	9,92	3,56	9,42	3,96	8,86	4,42
	6	11,2	2,88	10,8	3,20	10,3	3,56	9,76	3,98	9,21	4,44
	7	11,6	2,89	11,1	3,22	**10,6**	**3,60**	10,1	3,99	9,51	4,46
	8	11,9	2,90	11,5	3,24	11,0	3,60	10,4	4,04	9,82	4,50
	9	12,3	2,95	11,8	3,28	11,3	3,62	10,7	4,04	10,1	4,50
	10	12,7	2,96	12,2	3,28	11,7	3,67	11,1	4,08	10,5	4,54
42	5	13,3	3,64	12,8	4,06	12,2	4,55	11,6	5,06	10,9	5,64
	6	13,7	3,68	13,2	4,08	12,6	4,55	12,0	5,08	11,3	5,67
	7	14,2	3,69	13,6	4,11	**13,0**	**4,60**	12,4	5,10	11,7	5,69
	8	14,6	3,71	14,1	4,14	13,5	4,60	12,8	5,16	12,0	5,75
	9	15,1	3,77	14,5	4,19	13,9	4,63	13,2	5,16	12,4	5,75
	10	15,6	3,78	15,0	4,19	14,3	4,69	13,6	5,21	12,9	5,80
50	5	15,5	4,35	14,9	4,86	14,2	5,44	13,5	6,06	12,7	6,75
	6	16,0	4,40	15,4	4,88	14,8	5,44	14,0	6,07	13,2	6,78
	7	16,6	4,42	16,0	4,92	**15,2**	**5,50**	14,4	6,10	13,6	6,81
	8	17,1	4,43	16,4	4,95	15,7	5,50	14,9	6,17	14,1	6,88
	9	17,6	4,51	17,0	5,01	16,3	5,54	15,4	6,17	14,5	6,88
	10	18,3	4,53	17,5	5,01	16,7	5,61	15,9	6,23	15,1	6,94

Tw= Outlet water temperature in °C **kWf** = Net cooling capacity (kW) **kWa** = Compressor power draw (kW).

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

GENERAL SPECIFICATIONS - IP HEAT PUMP UNIT

Common general technical specifications

The following data refer to units using **R407C refrigerant**

Model of Unit	19	30	30/3	38	38/3	42	50	MU
Compressor specifications								
Type	ROTARY	SCROLL						/
Quantity	1							N°
Exchanger data								
Type	COPPER BRAZE WELDED STAINLESS STEEL PLATES							/
Quantity	1							N°
Water capacity	0.26	0.34		0.46		0.53	0.60	l
Fan specifications								
Type	Centrifugal with vanes positioned forwards							
Quantity	1							N°
Nominal air flow rate	944	917		1667		1667	1611	l/s
Air working head	50							Pa
Maximum air head(NB)	150							Pa

(NB): The unit has a infinite fan speed monitoring device to allows it to adapt itself to the different ducted conditions. It permits the right unit working to a maximum air pressure drop value of 150 Pa.

Specifications of coils with extended surfaces

Type	Copper pipes and notched aluminium fins	/
Quantity	1	N°

Basic Version of IP Unit

Model of Unit	19	30	30/3	38	38/3	42	50	MU
Power supply	230-1-50		400-3+N-50	230-1-50	400-3+N-50			V-f-Hz
Refrigerant fluid	R407C							/
Cooling capacity(1)	5.9	8.1		10.3		12.6	14.9	kW
Compressor power input(1)	2.15	2.95		3.45		4.40	5.40	kW
Total power draw (1)	2.78	3.60		4.70		5.67	6.64	kW
Water flow rate(1)	0.28	0.38		0.49		0.60	0,71	l/s
Water pressre drop (1) (E)	31	35		31		35	38	kPa
Working head (1)	60	54		66		62	58	kPa
Heating capacity (2)	6.5	8.9		10.7		13.4	15.1	kW
Compressor power input(2)	2.35	3.10		3.55		4.50	5.30	kW
Total power draw (2)	3.02	3.79		4.87		5.84	6.60	kW
Water flow rate(2)	0.31	0.43		0.51		0.64	0.72	l/s
Water pressre drop (2) (E)	37	43		34		40	39	kPa
Working head (2)	58	51		65		60	57	kPa
Throttling	0-100							%
Gross cooling capacity(1) (E)	5,93	8,15		10,4		12,7	15	kW
Gross total power draw(1) (E)	2,75	3,54		4,64		5,59	6,55	kW
Gross heating capacity(2) (E)	6,46	8,84		10,6		13,3	15	kW
Gross total power draw(2) (E)	2,98	3,73		4,82		5,76	6,52	kW

Unit electrical specifications

FLA Maximum current absorption	21.6	25.6	13.1	33.6	20.1	22.6	24.6	A
FLI Maximum power draw	4.5	5.4	5.4	7.0	7.0	7.8	8.9	kW
MIC Maximum surge current	64	106	52	124	60	76	84	A

The data refer to standard operating conditions.

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

(2): The data refer to Water temperature: inlet: 40°C - outlet: 45°C, Outdoor air temperature 7°C D.B., 87% humidity

(E): Data certificated by EUROVENT.

GENERAL SPECIFICATIONS - IP HEAT PUMP UNIT

Noise levels (E)

MODEL	ACOUSTIC POWER (dB)										TOTAL SOUND PRESSURE
	Octave bands (Hz)								Total		
	63	125	250	500	1000	2000	4000	8000	dB	dB(A)	dB(A)
19	69.1	70.2	75.5	70.1	68.1	66.2	63.8	55.7	78.9	74.0	**60**
30	70.6	70.9	76.8	72.7	70.8	67.8	64.5	56.2	80.5	76.0	**62**
30/3	70.6	70.9	76.8	72.7	70.8	67.8	64.5	56.2	80.5	76.0	**62**
38	75.0	86.0	83.0	74.5	75.8	75.6	72.0	64.0	88.8	82.0	**67**
38/3	75.0	86.0	83.0	74.5	75.8	75.6	72.0	64.0	88.8	82.0	**67**
42	75.0	86.0	83.0	74.5	75.8	75.6	72.0	64.0	88.8	82.0	**67**
50	76.3	87.5	83.4	75.6	77.2	76.8	72.4	65.0	89.9	83.0	**68**

(E): Data certificated by EUROVENT.

SWL = Sound power levels, with reference to $1x10^{-12}$ W.

The **Total** sound power level in **dB(A)** measured in compliance with **ISO 9614** standards, 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 $2x10^{-5}$ 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.

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Unit technical specifications with Storage and Pumping Module Accessory

Standard Version accessory model		30			55				UM
Compatible UnitUnità abbinabile		19	30	30/3	38	38/3	42	50	
Water capacity		30			55				l
Water flow rate	in cooling mode(1)	0.28	0.38		0.49		0.60	0.71	l\s
	in heating mode(2)	0.31	0.43		0.51		0.64	0.72	l\s
Working head	in cooling mode(1)	48	40		108		84	56	kPa
	in heating mode(2)	40	28		104		72	52	kPa
Type of pump		CIRCOLATORE			POMPA MULTISTADIO				tipo
Maximum power input		210			450				W
Surge chamber capacity.		5							l
Service charge pressure of surge chamber		150							kPa
Safety valve setting		300							kPa

High Head Version of accessory model		30			-				UM
Compatible Unit		19	30	30/3	-	-	-	-	
Water capacity		30			-	-	-	-	l
Water flow rate	in cooling mode(1)	0.28	0.38		-	-	-	-	l\s
	in heating mode(2)	0.31	0.43		-	-	-	-	l\s
Working head	in cooling mode(1)	140	123		-	-	-	-	kPa
	in heating mode(2)	130	105		-	-	-	-	kPa
Type of pump		POMPA MULTISTADIO			-	-	-	-	tipo
Maximum power input		450			-	-	-	-	W
Surge chamber capacity.		5			-	-	-	-	l
Service charge pressure of surge chamber		150			-	-	-	-	kPa
Safety valve setting		300			-	-	-	-	kPa

Unit electrical specifications with Storage and Pumping Module Accessory (3)

Power supply	230-1-50		400-3+N-50	230-1-50	400-3+N-50			V/ph/Hz
Total maximum power input [FLA]	22.1	26.1	15.4	35.9	22.4	24.9	26.9	A
Total maximum power input [FLI]	6.80	7.70	5.85	7.45	7.45	8.25	9.35	kW
Total maximum surge current [MIC]	64	106	54	126	62	78	86	A

(1): The data refer to: Water temperature: inlet: 12°C - outlet: 7°C. Outdoor air temperature 35°C.
(2): The data refer to: Water temperature: inlet: 40°C - outlet: 45°C. Outdoor air temperature 7°C DB, 90% humidity
(3): Regarding unit operating in conjunction with the Storage and Pumping Module accessory:
- for mod. 16-19-24-30 Storage Module in the High Head version
- for mod. 38-42-50-30 Storage Module in the Standard version.

Standard performances in cooling mode AB-7M5

MODEL	Tw	OUTDOOR AIR TEMPERATURE (°C D.B.)									
		25		30		35		40		45	
		kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa
19	5	6,02	1,70	5,80	1,90	5,52	2,13	5,24	2,37	4,93	2,64
	6	6,23	1,72	5,99	1,91	5,73	2,13	5,43	2,37	5,12	2,65
	7	6,44	1,73	6,19	1,92	**5,90**	**2,15**	5,61	2,38	5,29	2,66
	8	6,64	1,73	6,38	1,94	6,11	2,15	5,80	2,41	5,47	2,69
	9	6,85	1,76	6,59	1,96	6,31	2,16	5,98	2,41	5,64	2,69
	10	7,09	1,77	6,80	1,96	6,49	2,19	6,18	2,43	5,85	2,71
30	5	8,27	2,34	7,96	2,61	7,58	2,92	7,20	3,25	6,77	3,62
	6	8,55	2,36	8,22	2,62	7,87	2,92	7,46	3,26	7,03	3,64
	7	8,83	2,37	8,50	2,64	**8,10**	**2,95**	7,70	3,27	7,27	3,65
	8	9,12	2,38	8,76	2,66	8,38	2,95	7,96	3,31	7,50	3,69
	9	9,40	2,42	9,04	2,69	8,66	2,97	8,21	3,31	7,74	3,69
	10	9,74	2,43	9,34	2,69	8,91	3,01	8,48	3,34	8,03	3,72
30/3	5	8,27	2,34	7,96	2,61	7,58	2,92	7,20	3,25	6,77	3,62
	6	8,55	2,36	8,22	2,62	7,87	2,92	7,46	3,26	7,03	3,64
	7	8,83	2,37	8,50	2,64	**8,10**	**2,95**	7,70	3,27	7,27	3,65
	8	9,12	2,38	8,76	2,66	8,38	2,95	7,96	3,31	7,50	3,69
	9	9,40	2,42	9,04	2,69	8,66	2,97	8,21	3,31	7,74	3,69
	10	9,74	2,43	9,34	2,69	8,91	3,01	8,48	3,34	8,03	3,72
38	5	10,5	2,73	10,1	3,05	9,64	3,41	9,16	3,80	8,61	4,23
	6	10,9	2,76	10,5	3,06	10,0	3,41	9,49	3,81	8,95	4,25
	7	11,2	2,77	10,8	3,09	**10,3**	**3,45**	9,8	3,82	9,24	4,27
	8	11,6	2,78	11,1	3,11	10,7	3,45	10,1	3,87	9,54	4,31
	9	12,0	2,83	11,5	3,14	11,0	3,47	10,4	3,87	9,8	4,31
	10	12,4	2,84	11,9	3,14	11,3	3,52	10,8	3,91	10,2	4,35
38/3	5	10,5	2,73	10,1	3,05	9,64	3,41	9,16	3,80	8,61	4,23
	6	10,9	2,76	10,5	3,06	10,0	3,41	9,49	3,81	8,95	4,25
	7	11,2	2,77	10,8	3,09	**10,3**	**3,45**	9,8	3,82	9,24	4,27
	8	11,6	2,78	11,1	3,11	10,7	3,45	10,1	3,87	9,54	4,31
	9	12,0	2,83	11,5	3,14	11,0	3,47	10,4	3,87	9,8	4,31
	10	12,4	2,84	11,9	3,14	11,3	3,52	10,8	3,91	10,2	4,35
42	5	12,9	3,48	12,4	3,89	11,8	4,35	11,2	4,84	10,5	5,40
	6	13,3	3,52	12,8	3,91	12,2	4,35	11,6	4,86	10,9	5,43
	7	13,7	3,53	13,2	3,94	**12,6**	**4,40**	12,0	4,88	11,3	5,45
	8	14,2	3,55	13,6	3,96	13,0	4,40	12,4	4,93	11,7	5,50
	9	14,6	3,61	14,1	4,01	13,5	4,43	12,8	4,93	12,0	5,50
	10	15,2	3,62	14,5	4,01	13,9	4,49	13,2	4,98	12,5	5,55
50	5	15,2	4,27	14,6	4,77	13,9	5,34	13,2	5,95	12,5	6,62
	6	15,7	4,32	15,1	4,79	14,5	5,34	13,7	5,96	12,9	6,66
	7	16,3	4,34	15,6	4,83	**14,9**	**5,40**	14,2	5,99	13,4	6,68
	8	16,8	4,35	16,1	4,86	15,4	5,40	14,6	6,05	13,8	6,75
	9	17,3	4,43	16,6	4,92	15,9	5,44	15,1	6,05	14,2	6,75
	10	17,9	4,44	17,2	4,92	16,4	5,51	15,6	6,11	14,8	6,81

Tw= Outlet water temperature in °C **kWf** = Net heating capacity (kW) **kWa** = Compressor power draw (kW).

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

GENERAL SPECIFICATIONS - IP HEAT PUMP UNIT

Standard performances in heating mode AB-7M5

MODEL	Tw	OUTDOOR AIR TEMPERATURE (°C D.B.)											
		-5		0		5		7		10		15	
		kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa	kWf	kWa
19	**35**	4,30	1,81	5,26	1,85	6,22	1,87	6,59	1,87	7,39	1,90	8,21	1,90
	40	4,38	2,04	5,28	2,08	6,19	2,11	6,55	2,11	7,33	2,11	8,12	2,15
	45	4,44	2,25	5,31	2,31	6,16	2,35	**6,50**	**2,35**	7,26	2,36	8,02	2,36
	50	4,52	2,55	5,33	2,58	6,15	2,64	6,48	2,66	7,20	2,67	7,93	2,68
30	**35**	5,88	2,39	7,21	2,43	8,52	2,46	9,02	2,46	10,12	2,51	11,24	2,51
	40	6,00	2,69	7,23	2,74	8,48	2,79	8,96	2,79	10,03	2,79	11,12	2,84
	45	6,08	2,97	7,27	3,05	8,44	3,10	**8,90**	**3,10**	9,94	3,12	10,98	3,12
	50	6,19	3,36	7,30	3,41	8,43	3,49	8,87	3,51	9,85	3,52	10,86	3,53
30/3	**35**	5,88	2,39	7,21	2,43	8,52	2,46	9,02	2,46	10,12	2,51	11,24	2,51
	40	6,00	2,69	7,23	2,74	8,48	2,79	8,96	2,79	10,03	2,79	11,12	2,84
	45	6,08	2,97	7,27	3,05	8,44	3,10	**8,90**	**3,10**	9,94	3,12	10,98	3,12
	50	6,19	3,36	7,30	3,41	8,43	3,49	8,87	3,51	9,85	3,52	10,86	3,53
38	**35**	7,07	2,73	8,66	2,79	10,24	2,82	10,85	2,82	12,17	2,88	13,52	2,88
	40	7,21	3,09	8,69	3,14	10,19	3,19	10,78	3,19	12,06	3,19	13,36	3,25
	45	7,31	3,40	8,74	3,50	10,15	3,55	**10,70**	**3,55**	11,96	3,57	13,20	3,57
	50	7,45	3,85	8,78	3,90	10,13	3,99	10,67	4,01	11,85	4,03	13,06	4,05
38/3	**35**	7,07	2,73	8,66	2,79	10,24	2,82	10,85	2,82	12,17	2,88	13,52	2,88
	40	7,21	3,09	8,69	3,14	10,19	3,19	10,78	3,19	12,06	3,19	13,36	3,25
	45	7,31	3,40	8,74	3,50	10,15	3,55	**10,70**	**3,55**	11,96	3,57	13,20	3,57
	50	7,45	3,85	8,78	3,90	10,13	3,99	10,67	4,01	11,85	4,03	13,06	4,05
42	**35**	8,86	3,47	10,85	3,53	12,83	3,58	13,59	3,58	15,24	3,64	16,93	3,64
	40	9,03	3,91	10,89	3,98	12,77	4,05	13,49	4,05	15,11	4,05	16,74	4,12
	45	9,16	4,32	10,94	4,43	12,71	4,50	**13,40**	**4,50**	14,97	4,52	16,53	4,52
	50	9,33	4,88	11,00	4,95	12,69	5,06	13,36	5,09	14,84	5,11	16,35	5,13
50	**35**	9,98	4,08	12,23	4,16	14,45	4,21	15,31	4,21	17,17	4,29	19,08	4,29
	40	10,17	4,61	12,27	4,69	14,39	4,77	15,21	4,77	17,02	4,77	18,86	4,85
	45	10,32	5,08	12,33	5,22	14,32	5,30	**15,10**	**5,30**	16,87	5,33	18,62	5,33
	50	10,51	5,74	12,39	5,82	14,30	5,96	15,05	5,99	16,72	6,02	18,42	6,04

Tw= Outlet water temperature in °C **kWf** = Net cooling capacity (kW) **kWa** = Compressor power draw (kW).

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

NOTE:
For temperatures of less than 7°C, the heating capacity is declared without considering the effect of the defrosting cycles, which are strictly linked to the amount of humidity in the outdoor air.

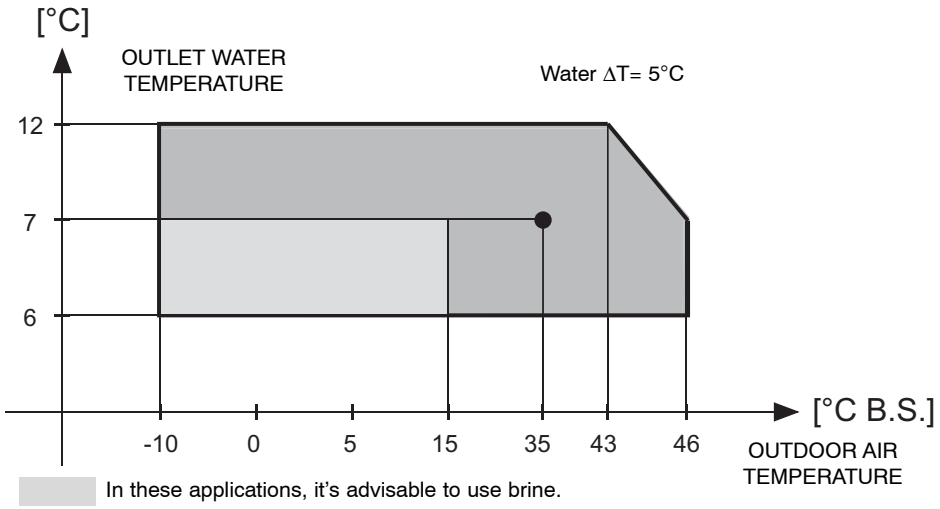
OPERATING RANGE

Operating limits

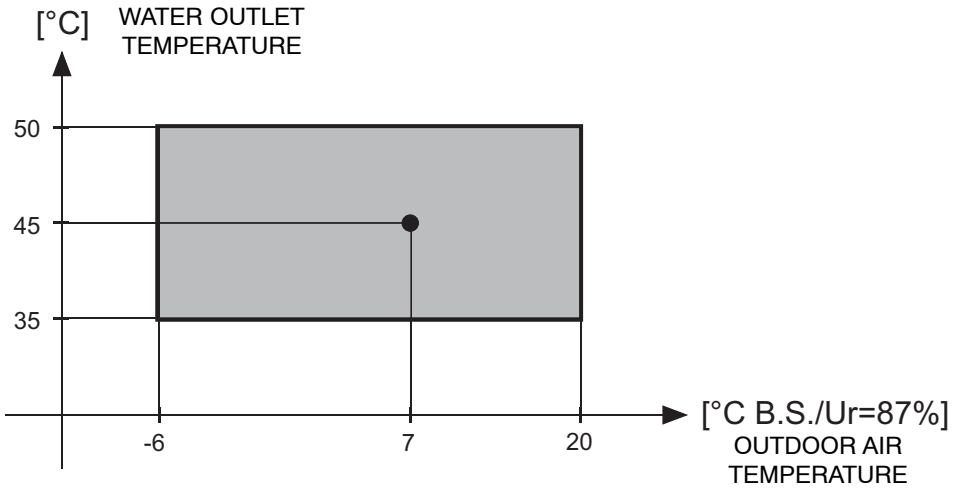
The graphs below give the operating ranges within which correct operation of the units is guaranteed.
Use of the units in conditions differing from those indicated will void the warranty with which the product is supplied.

Entity		Limit value in the cooling mode	Limit value in the heating mode
Minimum thermal gradient of the water	°C	3	3
Maximum thermal gradient of water	°C	7	7

IN COOLING MODE (units IR / IP)



IN HEATING MODE (IP units)



NOTE:
Never use more than 40% of brine in Multiple stage pump versions of units operating in conjunction with the Storage and Pumping Module.

Maximum operating pressure on wet side

Unit size	19	30	30/3	38	38/3	42	50	UM
Maximum operating pressure on wet side	1000							kPa

Pumping & Storage module	30	55	UM
Maximum operating pressure on wet side	300		kPa

HOW TO SELECT THE UNIT

How to select the appliance without storage unit

1) The "**Standard Performance**" tables give the cooling capacity in the cooling and heating modes and the relative compressor power inputs of the individual units in standard conditions, for various temperature values of the outdoor air and the water outlet from the unit. The data can be interpolated but not extrapolated.
2) The operating limits tolerated by the units are described in the "**Operating range**" section.
3) The "**Standard performances**" values are based on a 0.44 x10-4 m2°C/W fouling factor of the heat exchanger on the wet side. Use correction factor FcP indicated in **tab. 1** for different values.
4)The "**Standard Performances**" values refer to a unit installed in places at zero meters above sea level (Pb = 1013 mbar). Use "Standard Performances" correction factor FcH indicated in **tab. 2** for operation at different altitudes.
5) The "**Standard performances**" refer to 5 °C of Dt of the water between the inlet and outlet of the plate-type heat exchanger. Use correction factor FcD indicated in **tab.3** for different values in the cooling mode. Correction factor FcD is not considered in the heating mode as it has a negligible influence. To ensure the plate-type heat exchanger works in the right way, comply with the operating limits given in the "**Operating limits of the unit**" section.
6)The "**Standard Performances**" values in the case of operation in the heating mode refer to outdoor air with 87% relative humidity. Use correction factor FcUr in **tab. 4** for different values.
7)The "**Standard Performances**" values refer to use of water without antifreeze substances such as brine. If brine is used, it will be necessary to introduce multiplying correction factors that concern all the machine parameters and that vary in relation to the percentage weight of the brine added to the system, as indicated in **tab. 5**
8) Consult the "**Water pressure drop**" section to determine the water pressure drop on the wet side through the plate-type heat exchanger, if the storage and pumping kit is not used.
9) If the storage and pumping kit is used, consult the diagrams in the"**Working head**" section to determine the working head of the unit.
10) Use the "**Noise levels**" tables to check the sound emission.
11) If the storage and pumping kit is used, check the capacity of the surge tank in the system in the "**Maximum volume of water in the system with storage unit**" section.

Example of how the unit is selected:
The unit must be able to supply an 7 kW capacity in the following conditions:
- Outdoor air temperature = **40 °C**
- Temperature of the cold water outlet by the machine = **8°C**
- Inlet/outlet temperature difference of the water Δt = **5 °C**

The unit must also be able to provide a 7.5 kW heating capacity, working in the following conditions:
- Outdoor air temperature = **5° C**
- Relative humidity of the outdoor air = **70%**
- Temperature of the hot water outlet by the machine = **50°**
- Temperature difference of the water **6° C**

Also consider a **0.88 x 10-4 m2°C/W** fouling factor on the wet side of the exchanger, with the unit installed in a locality situated **900** meters above sea level. Water containing **20%** in weight of brine will also be used.

Solution
The reversible chiller is chosen by first selecting the machine that meets the required values in the cooling mode and by then checking that the machine selected is able to provide the power required in the heating mode.
Selection for operation in the cooling mode:
Beginning with the cooling capacity required by the given conditions of use and having checked the "**Standard performances**" table, model **IP 30 VB AB 7M5** can be selected as it provides a standard cooling capacity of 7.96 kW.
The available data and tables 1, 2, 3 and 5 can be used to determine: FCP = 0.98; FCH = 0.97; FCD = 1; FCPG = 0.98 , thus:

$$Pf = Pfs \times FCP \times FCH \times FCD \times FCPG$$

where:
Pf = cooling capacity provided in the real operating conditions (kW)
Pfs = cooling capacity provided in standard conditions (kW)
The effective cooling capacity provided by the machine in the real conditions of use will be:

$$Pf = (7.96) \times (0.98) \times (0.97) \times (1) \times (0.98) = 7.42\,kW$$

In the given conditions of use, the selected unit provides a 7.42 kW cooling capacity, which meets the cooling requirements.

The flow rate Q of the water that passes through the evaporator will be:

$$Q = \frac{Pf}{C \cdot \Delta t} = \frac{7.42}{(4.185) \times (5)} = 0.35 l/s$$

with **c = 4.186 kJ/kg °C specific heat of the water.**

The water flow rate conditions are within the exchanger's operating range, as defined in the " **Operating limits of the unit**" table.

A 30 kPa water pressure drop is given in the "**Water pressure drop**" graph, on a level with the determined water flow rate and the curve of the selected model. The water pressure drop values must therefore be corrected, by taking correction factor FCDP concerning use of brine into account, as indicated in table 5. Thus, there will be:

$$DPr = (DPs) \times (FCDP)$$

where:
DPr = Water pressure drop in the real operating conditions (kPa)
DPs = Water pressure drop in the standard conditions (kPa)

$$DPr = (30) \times (1.16) = 35\ kPa$$

In the given conditions of use, the water pressure drop in the exchanger is 35 kPa.

Verification for operation in the heating mode:
With the data available for operation in the heating mode and considering the already selected model **IP 30 VB AB 7M5**, the standard power supplied in the heating mode is indicated in the "**Performances in the Heating mode-Heat Pump Model**", i.e. Prs = 8.43 kW.
Considering the real conditions in which the machine operates and using tables 1, 2 and 4 (tab. 3 is not applicable in the heating mode, as the effect of any brine used is insignificant), there will be:
FcP=0.98; FcH=0.97; FcUr=0.96; and thus :

$$Pr = (Prs) \times (FCP) \times (FCH) \times (FCUr)$$

where:
Pf = heating capacity provided in the real operating conditions (kW)
Pfs = heating capacity provided in standard conditions (kW)
The effective heating capacity provided by the machine in the real conditions of use will be:

$$Pr = (8.43) \times (0.98) \times (0.97) \times (0.96) = 7.69\ kW$$

In the given conditions of use, the selected unit provides a 7.69 kW heating capacity, which is more or less in keeping with requirements and confirms that the selected model is valid.

The flow rate of the water that passes through the exchanger - evaporator will be:

$$Q = \frac{Pf}{c \cdot Ät} = \frac{7.69}{4.185 \cdot 5} = 0.37\ l/s$$

with **c = 4.186 kJ/kg °C specific heat of the water.**
Here again, the water flow rate conditions are within the exchanger's operating range, as defined in the " **Operating limits of the unit**" table.
A 33 kPa water pressure drop is given in the "Exchanger loss of head" graph, on a level with the determined water flow rate and the curve of the selected model. The water pressure drop values must therefore be corrected, by taking correction factor FCDP concerning use of brine into account, as indicated in table 5. Thus, there will be:

$$DPr = (DPs) \times (FCDP)$$

where:
DPr = Water pressure drop in the real operating conditions (kPa)
DPs = Water pressure drop in the standard conditions (kPa)

$$DPr = (33) \times (1.16)$$

In the given conditions of use, the water pressure drop in the exchanger is 38 kPa.

NOTE: Refer to the nominal air flow rate when sizing the ducts. Thanks to continuous fan speed monitoring, the system changes the fan's powering voltage to keep the flow of air through the coils at a steady rate.

Tab.1

Correction factor FcP	
Fs (m^2 °C/W)	**Fc - P**
Clean	1.02
0.44 x 10^{-4}	1.00
0.88 x 10^{-4}	0.98
1.76 x 10^{-4}	0.94

FS = Fouling factor
Fc - P = Refrigerating power correction factor

Tab.2

Correction factor FcH		
Aslm (m)	**Pb** (mbar)	**Fc - H**
Sea level	1013	1
300	977	0.99
600	942	0.98
900	908	0.97
1200	875	0.96
1500	843	0.95
1800	812	0.94

Aslm = Height above sea level
Pb = Barometric pressure
Fc - H = Refrigerating power correction factor

Tab.3

Correction factor FcD	
ΔT (°C)	**FC- D**
3	0.98
4	0.99
5	1
6	1.012
7	1.027
8	1.033

ΔT = Thermal gradient
Fc - D = Refrigerating power correction factor

Tab.4

Correction factor FcUr Correction factor FcUr						
Outdoor air temp.	Relative humidity %					
	50	60	70	80	87	100
-5	0.905	0.932	0.960	0.980	1	1.022
0	0.944	0.952	0.960			
5	0.972	0.966	0.960			
7	0.963	0.961	0.959			
10	0.941	0.947	0.952			
15	0.924	0.935	0.946			

Tab.5

% of brine in weight		0%	10%	20%	30%	40%
Freezing temperature		0	-3.9	-8.9	-15.6	-23.4
Refrigerating power multiplier (FCPG)		1	0.99	0.98	0.97	0.95
Power input multiplier	**FCPA**	1	1	0.99	0.99	0.98
Water flow rate multiplier	**FCQG**	1	1.04	1.08	1.12	1.16
Water pressure drop multiplier	**FCDP**	1	1.08	1.16	1.25	1.35

Storage and Pumping Module selection procedure

The storage unit is supplied as an accessory for the chiller and must be selected to suit the actual chiller or heat pump itself.
First find out which Storage and Pumping Module versions are available, depending on the size of chiller or heat pump selected.
Depending on specific requirements, models 19-30 can be used with the following two versions:
1-Standard Version
2-High Head Version
Models 38-42-50 can only be used with the Standard version of the accessory.
The table gives the available Storage and Pumping Module combinations for each size of the unit.

Unit matches with Storage and Pumping Module Accessory

MODEL OF UNIT	19 - 30	38 - 42 - 50
Storage and Pumping Module model	30	55
STANDARD VERSION	SAA8	SAA12
HIGH HEAD VERSION	SAA9	/

HOW TO SELECT THE UNIT

Also remember that the specific characteristics and technical data for each Storage and Pumping Module model are given in the "TECHNICAL DATA AND STANDARD PERFORMANCES" section.
Once the accessory model has been established, the selection procedure must be completed with a final check to make sure that the volume of water in the system is compatible with the surge chamber's ability to absorb the thermal expansions of the water, also taking any differences in level between the storage tank and system into account.

Example 1
With reference to the previously described selection procedure whereby model IP 30 VB AB7M5 was chosen, let us suppose that the storage unit must be installed in the system.
This unit can be used with both the Standard and High Head versions of the Storage and Pumping Module.
The version must be chosen by simply considering the usedful head required by the system.
Supposing that the unit must operate in the following conditions:
- Outdoor air temperature = 30 °C
- Temperature of the cold water outlet by the machine = 6°C
In the given conditions, the unit will provide a standard refrigerating capacity of 8.22 kW with a 0.39 l/s water flow rate, as shown in the "Standard performances" table.
A precise available useful head value corresponds to the water flow rate found, for each version of the storage and pumping module.
The graph of the Useful Head available for model IP 30 VB AB7M5 (curve 2) shows that, in conjunction with the Standard Version of the module, the selected unit is able to provide a useful head of 38 kPa,
while the High Head version (curve 4) of the module is able to supply a 119 kPa useful head.
At this point, the appropriate version of the Storage Module can be chosen by evaluating the useful head required by the system.

Example 2
Supposing that unit IR 24 VB AB7M5 has been chosen and the water storage unit must also be installed in the system.
In this particular case, the only model that can be selected is model 55, available in the Standard Version.
Supposing that the unit must operate in the following conditions:
- Outdoor air temperature = 40 °C
- Temperature of the cold water outlet by the machine = 8°C
In the given conditions, the unit will provide a standard refrigerating capacity of 12.8 kW with a 0.61 l/s water flow rate, as shown in the "Standard performances" table., and to this flow rate, a precise available useful head value corresponds.
The graph of the Useful Head available for model IR 24 VB AB7M5 (curve 2) shows that the selected unit is able to provide a useful head of 81 kPa.
If the available useful head exceeds the required value, it is advisable to install a valve to regulate the water flow rate on the Water Outlet pipe (OUT).

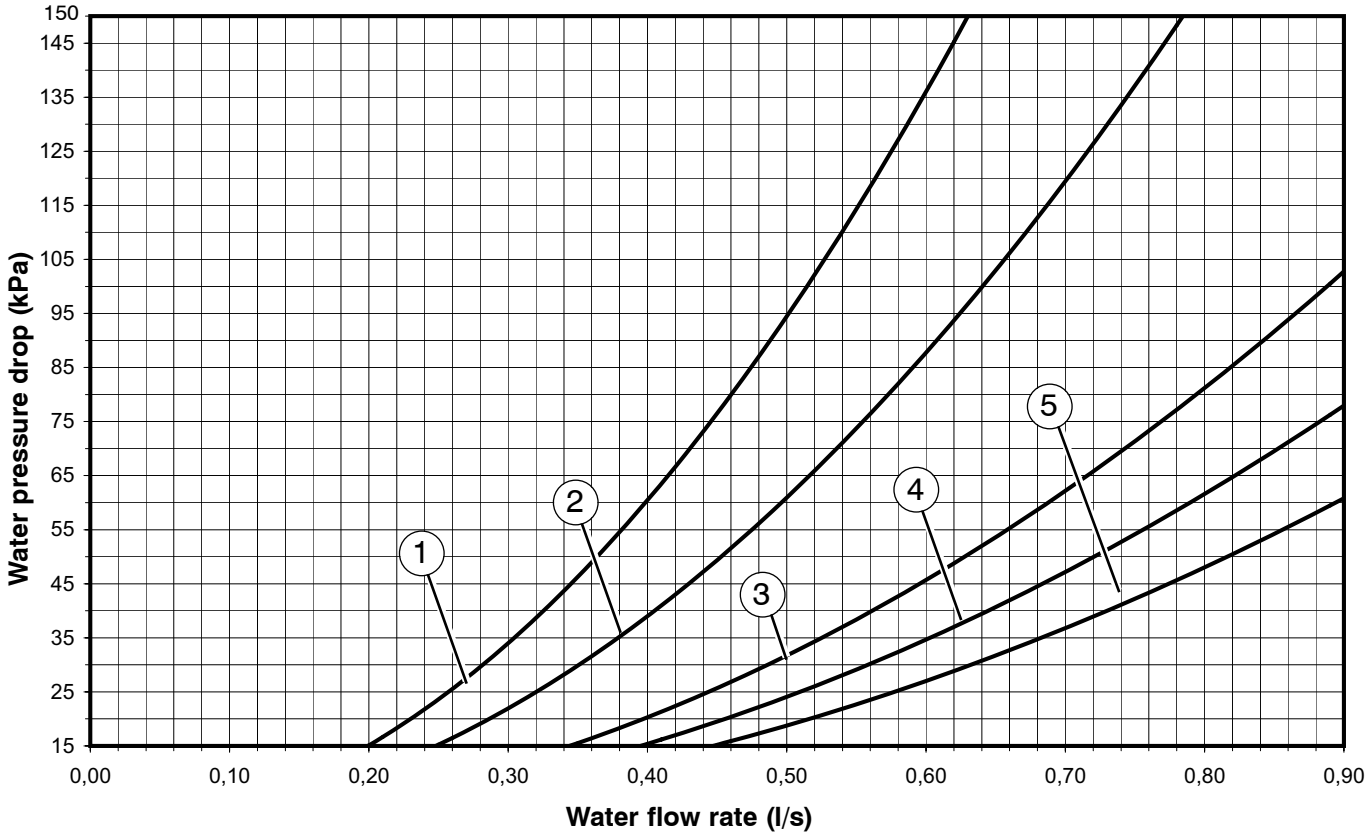
Final checks
With reference to the drawing in the "Maximum volume of water" section and supposing that the difference in level between the highest point of the circuit and the unit is 16 meters (case B of the table), the surge chamber must be set at 230 kPa while the amount of water contained by the system (including the volume of the tank) will be 117 liters (Vmax).
If the real volume of water in the system is less than 117 liters, there will be no need to install an additional surge chamber.
On the other hand, if the volume is greater, proceed as described below to size an additional surge chamber:
Volume of the system (Vi) = 150 liters
ΔV = Vi - Vmax = 33 liters
E10 to 40°C = 0.0074 (coefficient of thermal expansion)
Pi (Surge chamber service charge) = (H / 10.2 + 0.3)(100) = 230 kPa (330 kPa absolute)
Pf = 400 kPa (fixed absolute value)
Volume of additional surge chamber = (E x ΔV) / (1 - Pi/Pf) = (0.0074 x 33) / (1 -330/400) = 1.40 liters
An additional surge chamber with a capacity of more than 1.40 liters and a 230 kPa setting must therefore be installed.

NOTE:
If brine is added to the water, the final checks must be made considering the correction due to the percentage of brine used.
The correct value of the additional surge chamber to be installed in the system is found with reference to the "Correction factors for the total volume of the system with brine" table in the "Maximum Volume of Water" section.
Considering the above example again, supposing that I30% brine is to be used:
the corresponding correction value for this percentage of brine used in the cooling mode is 0.652, with reference to the "Correction factors for the total volume of the system with brine" table.
The maximum amount of water in the system with brine added is as follows:
$V_{max,G}$ = V_{max} x 0.652 = 76 liters
ΔV_G = Vi - $V_{max,G}$ = 150-76= 74 liters
E_G = Thermal expansion E /0.652= 0.0074/0.652= 0.0113
Thus, the volume of the surge chamber must be:
(E_G x ΔV_G) / (1-Pi/Pf) = (0.0113 x 74) / (1-330/400)= 4.78 liters

An additional surge chamber with a capacity of more than 4.78 liters and a 230 kPa setting must therefore be installed.

WATER PRESSURE DROP

The graph below illustrates the loss of head values in **kPa** depending on the flow rate in **liters/second**. The operating range is delimited by the minimum and maximum values given in the next table.



Limits to use of the plate-type heat exchanger

The loss of head values refer to a 10°C average water temperature.

Unit Size		19	30	38	42	50	NOTES	
Graph reference		**1**	**2**	**3**	**4**	**5**		**Q**=Water flow rate
Lower limit value	**Q**	0.20	0.25	0.35	0.40	0.45	l/s	**Δp**=Water pressure drop
	Δp	15					kPa	
Upper limit value	**Q**	0.63	0.79	0.90			l/s	
	Δp	150		102	77	60	kPa	
Maximum operating pressure on wet side		1000					kPa	

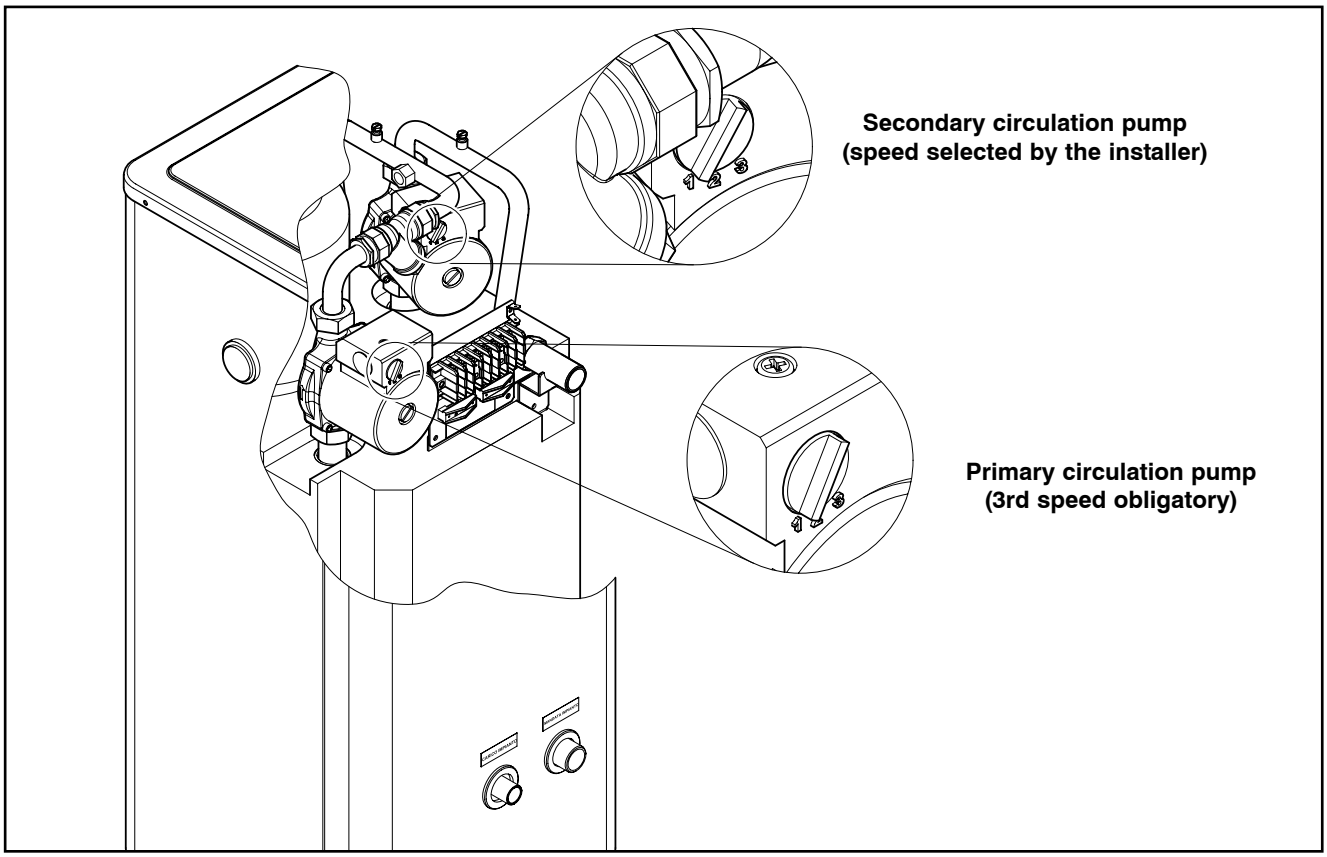
USE OF THE PUMPING MODULE MOD. 34 - 60

Primary circuit in the unit

If Storage and Pumping Module mod.34 or mod.60 are used, the water flow rate supplied to the unit is provided by the primary circulation pump. This must be left with the factory setting at top speed. Water is circulated around the system by a secondary circulation pump with three speeds that can be selected during the installation phase to suit the requirements of the actual system itself.
Consult the installation manual supplied with the Storage and Pumping Module for further information about the flow rate, head and power input values of the circulation pumps installed.
Modify the speed selectors of the circulation pumps as shown in the figure if different flow rates are required.

NOTE: The maximum operating pressure of the Storage Module is 300 kPa

IMPORTANT:
Make sure that the third speed has been selected for the circulation pump before starting.
To change the speed setting of the secondary circulation pump, open the cover of the storage kit and change the selector setting as shown in the figure.

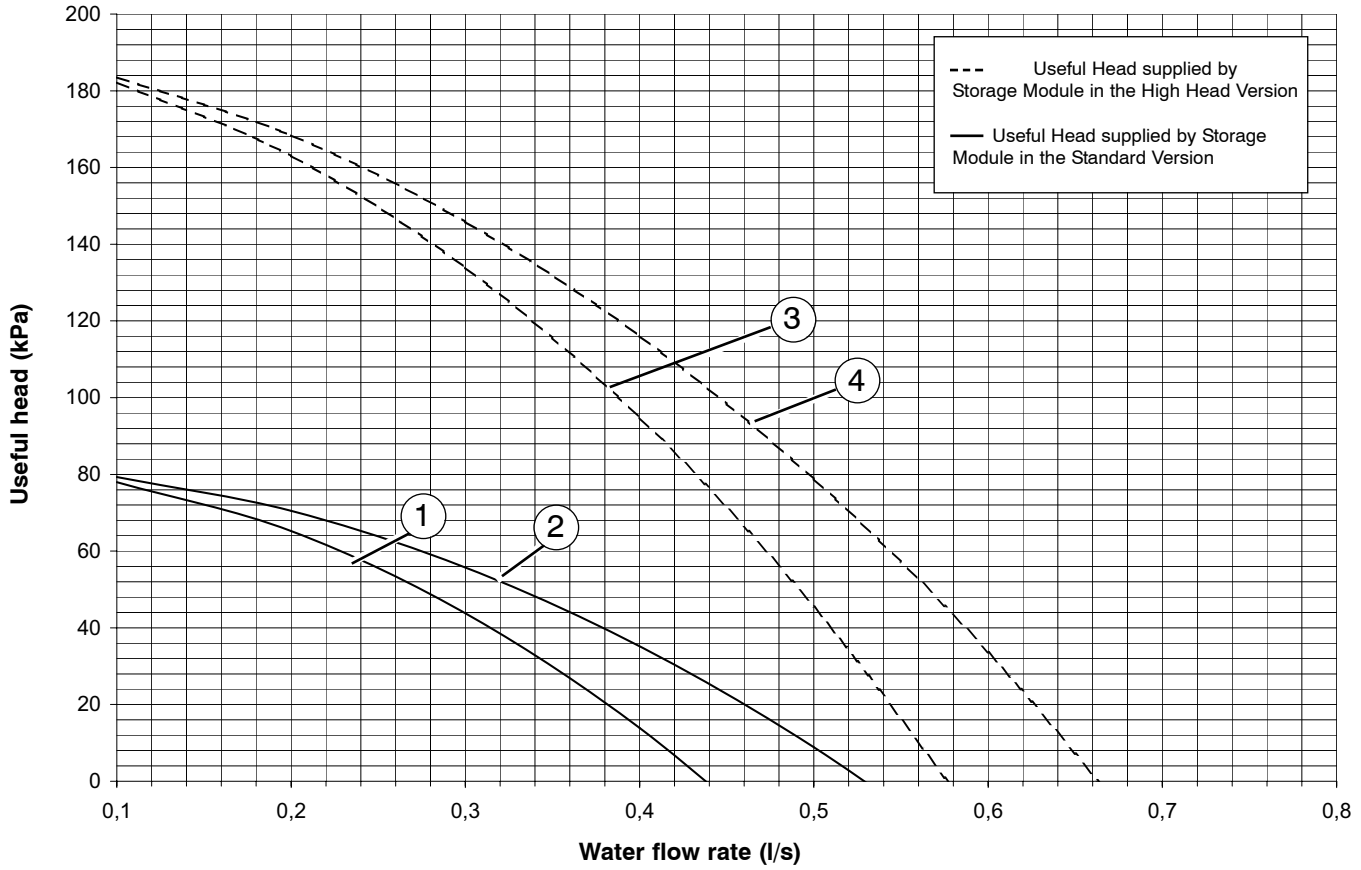


WORKING HEAD WITH STORAGE AND PUMPING MODULE Mod. 30

Units 19-30 with Storage and Pumping Module Mod. 30

The graph below illustrates the useful head values (**kPa**) depending on the water flow rate in (**liters**/**second**): the Standard or High Head Pumping Module can be used with each of models 19-30.
The operating range is delimited by the minimum and maximum values given in the next table.
Useful head is the one at the outlet of the Storage and Pumping Module minus all the loss of pressure values of the wet components of the unit and Storage and Pumping Module.

Head of Standard and High Head Versions mod. 19 - 30



Limits to operation (Standard Head)

Unit size		19	30	UM	NOTES
Graph reference		1	2	/	**Q**=Water flow rate
Lower limit value	**Q**	0.20	0.25	l\s	
Upper limit value		0.44	0.53	l\s	

Limits to operation (High Head)

Unit size		19	30	UM	NOTES
Graph reference		3	4	/	**Q**=Water flow rate
Lower limit value	**Q**	0.20	0.25	l\s	
Upper limit value		0.58	0.66	l\s	

Unit matches with Storage and Pumping Module Accessory

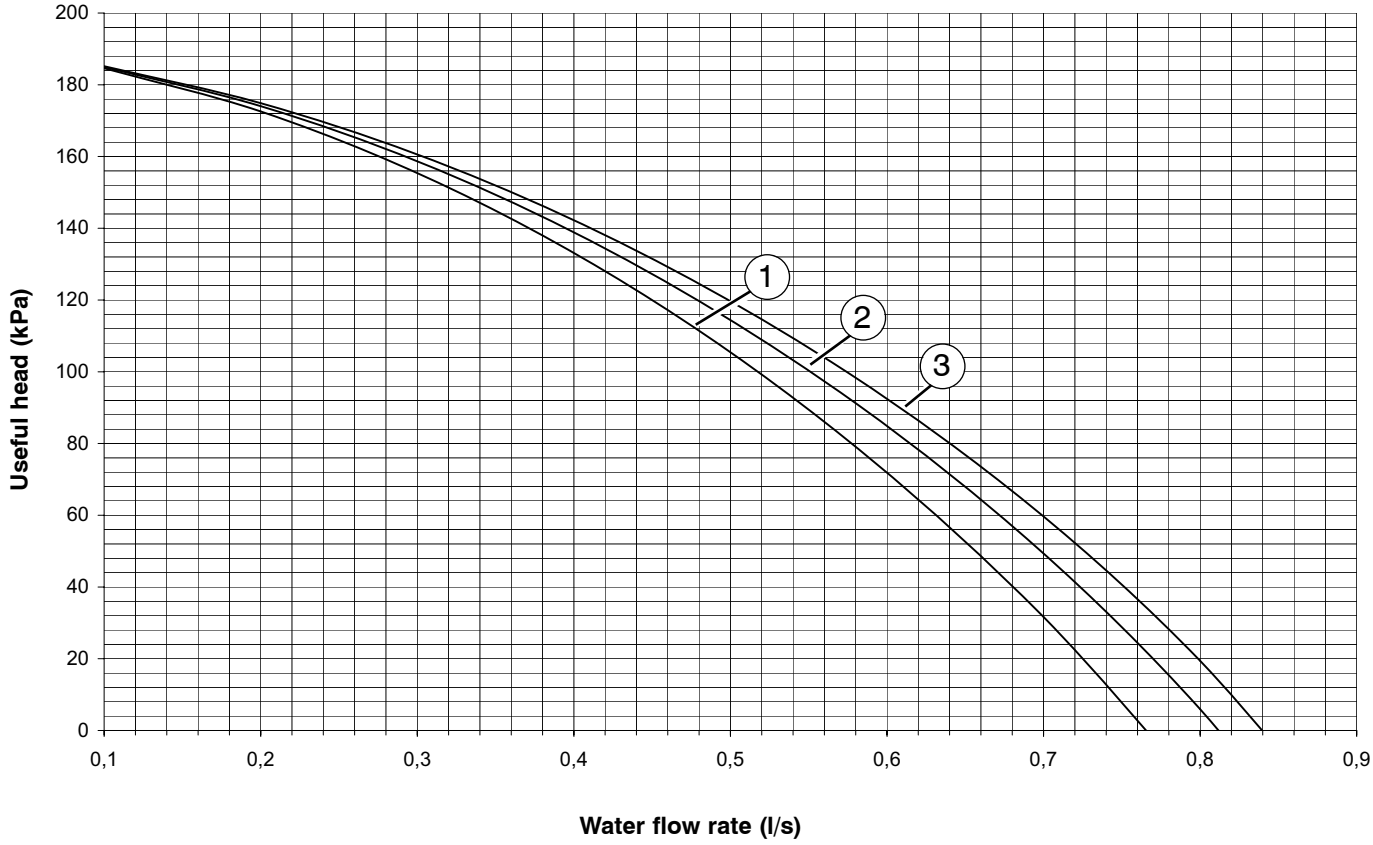
MODEL OF UNIT	19 - 30
Storage and Pumping Module model	30
STANDARD VERSION	SAA8
HIGH HEAD VERSION	SAA9

WORKING HEAD WITH STORAGE AND PUMPING MODULE Mod. 55

Units 38-42-50 with Storage and Pumping Module Mod. 55

The graph below illustrates the useful head values (**kPa**) depending on the water flow rate in (**liters**/**second**).
The operating range is delimited by the minimum and maximum values given in the next table.
Useful head is the one at the outlet of the Storage and Pumping Module in the Standard Version minus all the loss of pressure values of the wet components of the unit and Storage and Pumping Module.

Standard version head mod. 38 - 42 - 50



Limits to operation Standard Head

Unit size		38	42	50	UM	NOTES
Graph reference		1	2	3	/	**Q**=Water flow rate
Lower limit value	Q	0.35	0.40	0.45	l\s	
Upper limit value		0.76	0.81	0.84	l\s	

Unit matches with Storage and Pumping Module Accessory

MODEL OF UNIT	38 - 42 - 50
Storage and Pumping Module model	55
STANDARD VERSION	SAA12

MAXIMUM VOLUME OF WATER

Maximum volume of water in the system

Before filling the water system, it is advisable to consider the type of installation in question, i.e. check the difference in level between the Pumping Module and user. The following table gives the maximum water content of the water supply system in liters, depending on the capacity of the standard surge chamber supplied and the pressure at which it should be charged. The surge chamber setting must be regulated to suit the maximum positive difference in level of the user.
Maximum setting value **300 kPa**.
With a positive H of more than 12.25 meters, calculate the surge chamber's service charge value in kPa using the formula below:

Surge chamber service charge= [H/10.2+0.3] x100 = [kPa]

NOTE: In case **A**, make sure that the user's lowest point is able to withstand the global pressure.

Units with Storage and Pumping Module Mod. 34 - 60

Model of unit			**19 - 30 - 30/3**		**38 - 38/3 - 42 - 50**	
Storage and Pumping Module volume (liters)			**34**		**60**	
Surge chamber volume (liters)			3		5	
Thermal expansion of water (10-40°C)(IR)			0.0074			
Thermal expansion of water (10-60°C)(IP)			0.0167			
H (meters)		Surge chamber expansion (kPa)	Maximum total volume of water supply system (liters)			
			IR	**IP**	**IR**	**IP**
Case A	H <0	150 (standard)	150	67	250	112
Case B	0 ≤ H < 12.25	150 (standard)	150	67	250	112
	12.25 ≤ H < 15	180	120	54	200	90
	15 ≤ H < 20	230	70	31	117	52
	20 ≤ H ≤ 25	280	20	9	33	15

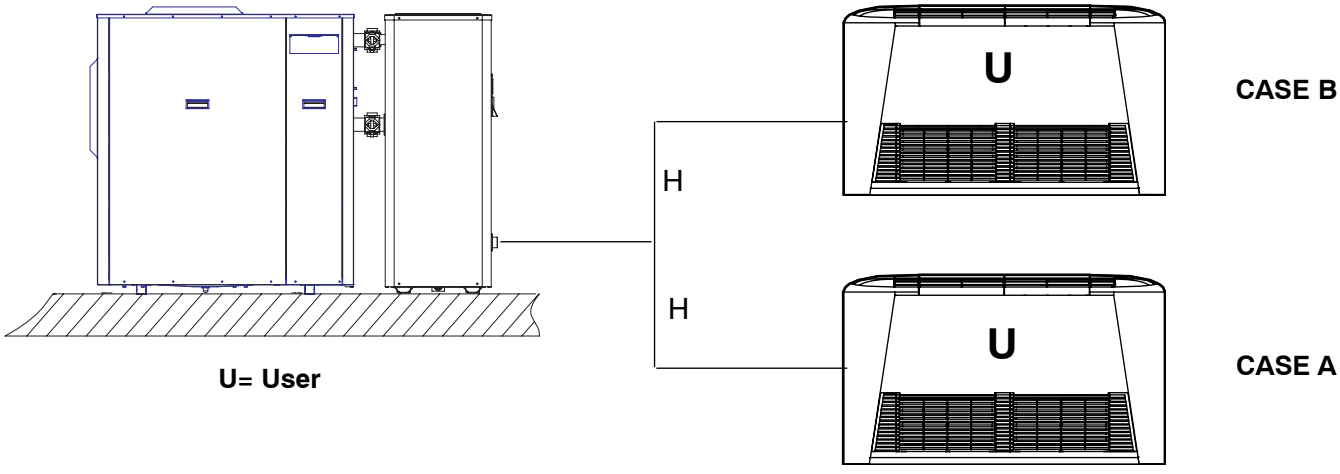
Units with Storage and Pumping Module Mod. 30 - 55

Model of unit		**19 - 30 - 30/3**	**38 - 38/3 - 42 - 50**
Storage and Pumping Module volume (liters)		**30**	**55**
Surge chamber volume (liters)		5	
Thermal expansion of water (10-40°C)(IR)		0.0074	
Thermal expansion of water (10-60°C)(IP)		0.0167	
H (meters)	Surge chamber pressure (kPa)	Maximum total volume of water supply system (liters)	
		IR	**IP**
Case A	H <0	150 (standard)	250	112
Case B	0 ≤ H < 12.25	150 (standard)	250	112
	12.25 ≤ H < 15	**180**	200	90
	15 ≤ H < 20	**230**	117	52
	20 ≤ H ≤ 25	**280**	33	15

NOTE : If the unit operates with brine, the real volume of the system must be calculated by taking into account the correction factors of the system's volume as indicated in the table below.

Correction factors per total maximum volume of the system with brine

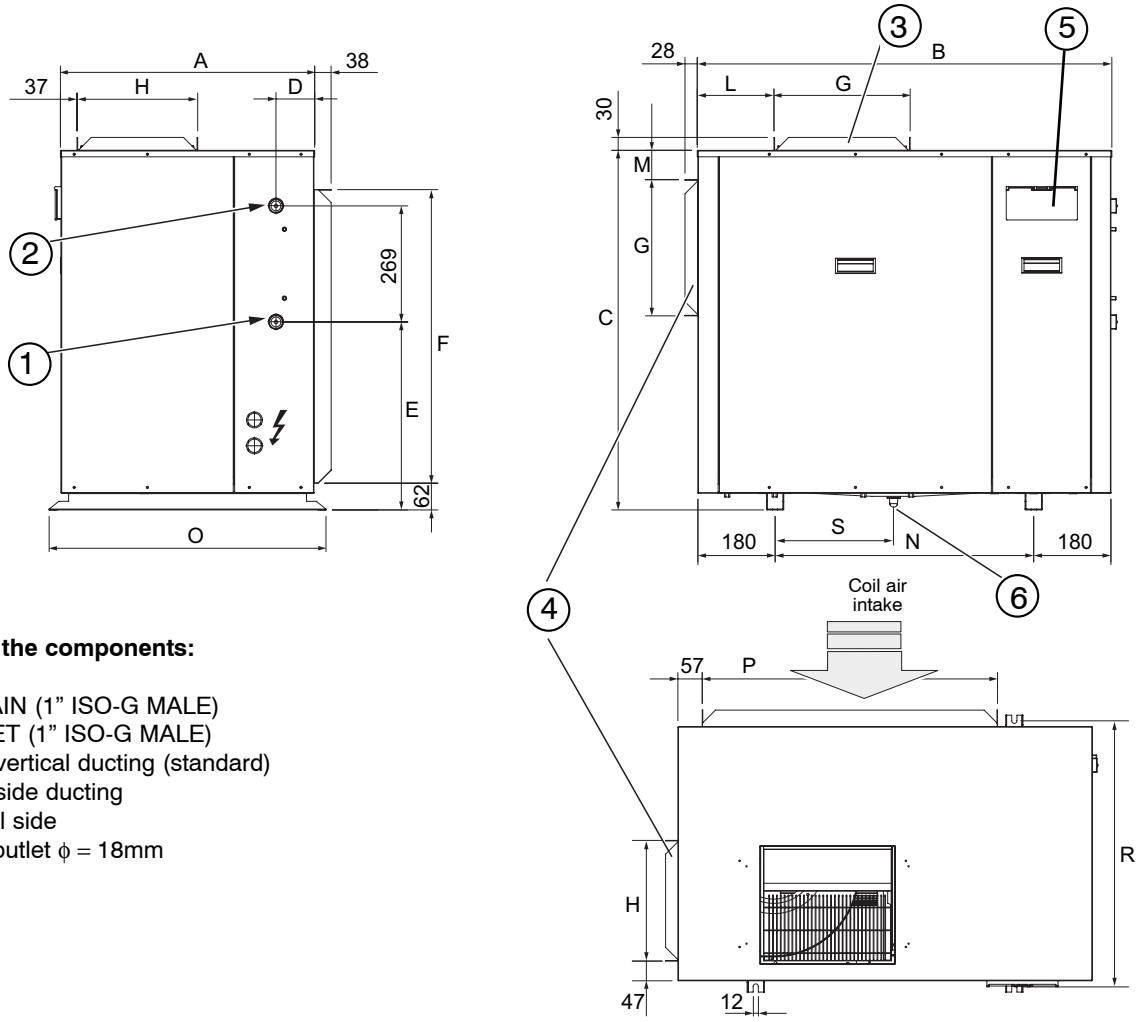
% of brine	**0%**	**10%**	**20%**	**30%**	**40%**
in cooling mode	1.000	0.738	0.693	0.652	0.615
in heating mode	1.000	0.855	0.811	0.769	0.731



U= User

OVERALL DIMENSIONS

Overall dimensions Unit



Description of the components:

1- WATER DRAIN (1” ISO-G MALE)
2- WATER INLET (1” ISO-G MALE)
3- Opening for vertical ducting (standard)
4- Opening for side ducting
5- Electric panel side
6- Water drain outlet ϕ = 18mm

Unit	19-30	38-42-50	UM
A	590	666	mm
B	962	1051	mm
C	834	1145	mm
D	90	128	mm
E	436	787	mm
F	681	981	mm
G	349	407	mm

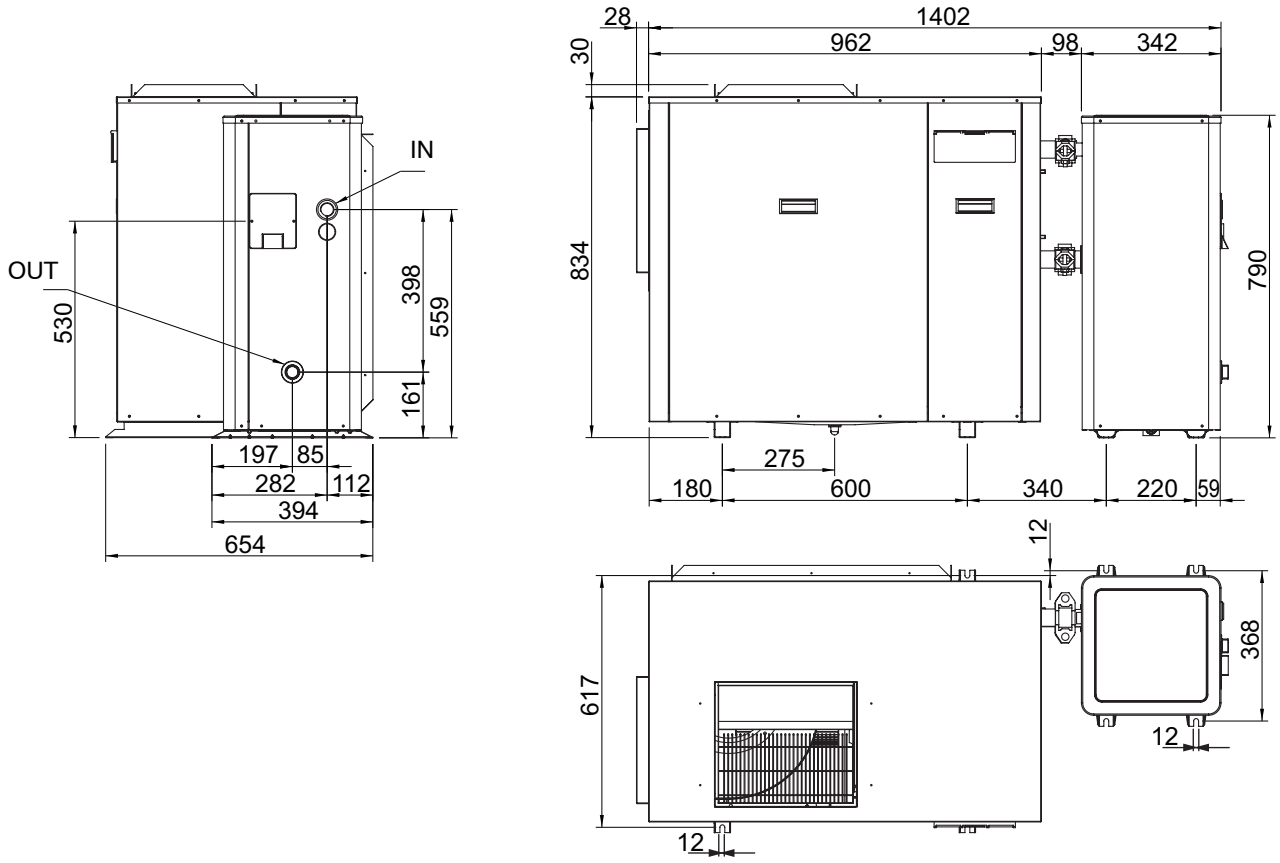
Unit	19-30	38-42-50	UM
H	307	351	mm
L	162	194	mm
M	80	181	mm
N	600	688	mm
O	642	718	mm
P	685	774	mm
R	617	692	mm
S	275	262	mm

Vibration damper installation

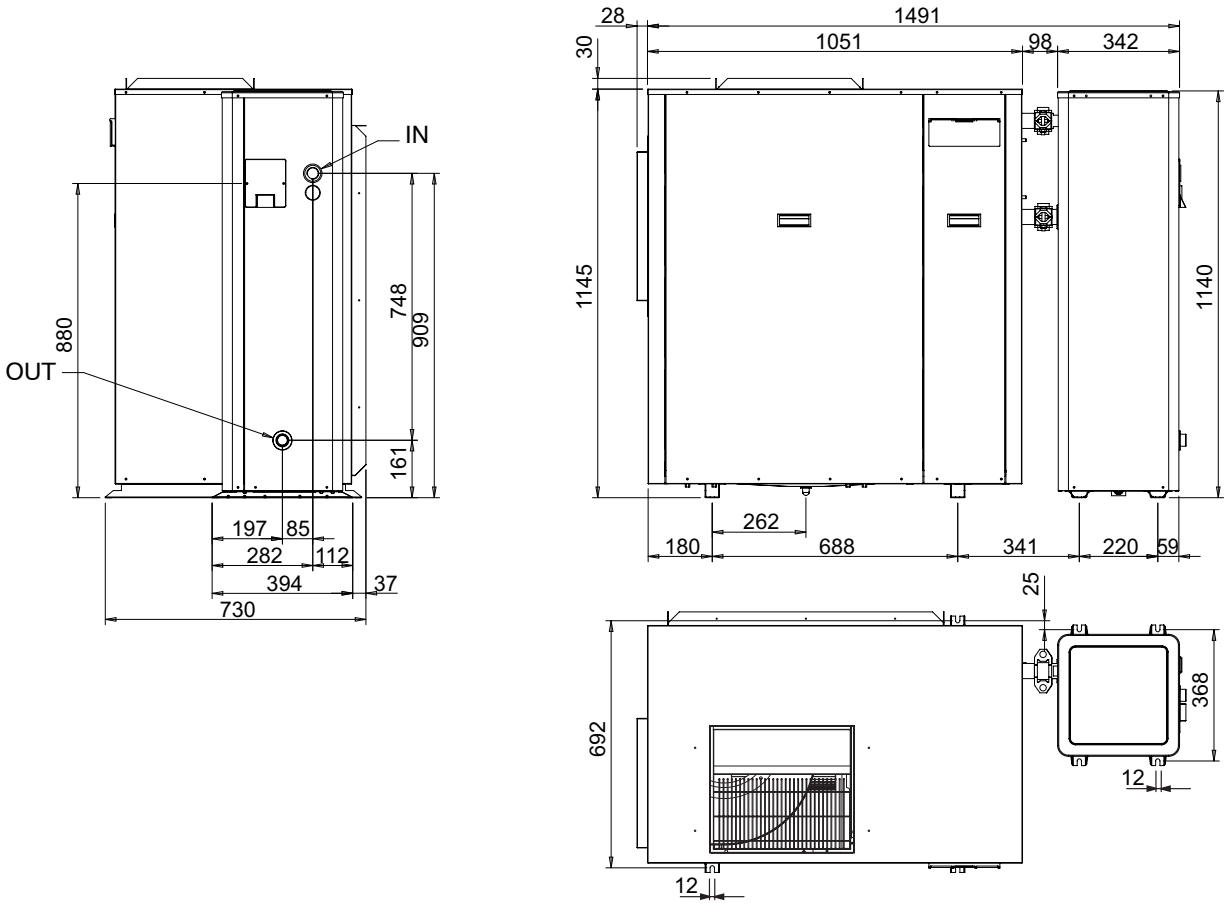
Remember to install vibration dampening material, depending on the bearing structure. This material should be placed under the bearing points of the unit. The unit can be supplied with the rubber or spring type vibration damper accessory. This accessory must be assembled at the installer’s charge.

OVERALL DIMENSIONS

Overall dimensions Unit Mod. 19-30 + Storage and Pumping Module Accessory Mod. 30



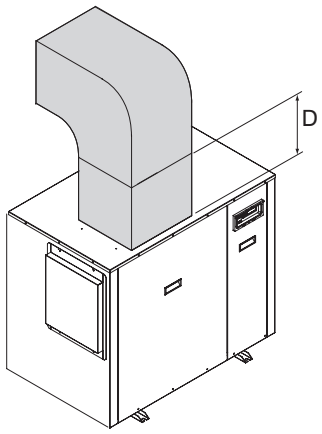
Overall dimensions Unit Mod. Mod. 38-42-50 + Storage and Pumping Module Accessory Mod. 55



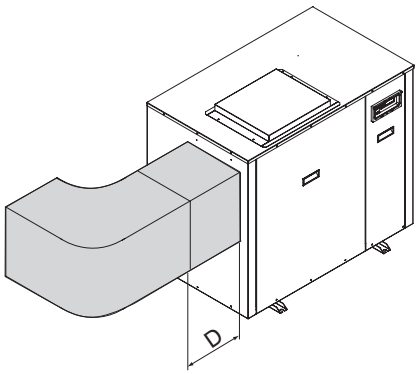
OVERALL DIMENSIONS

Possible installation configurations

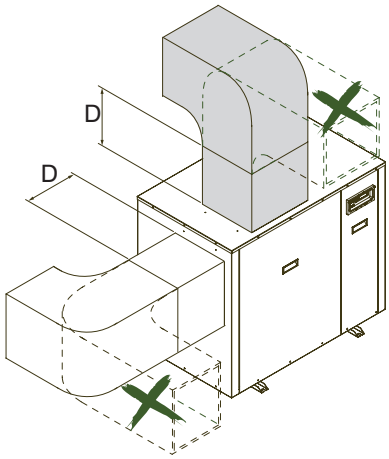
Configuration with duct for VERTICAL delivery air exhaust



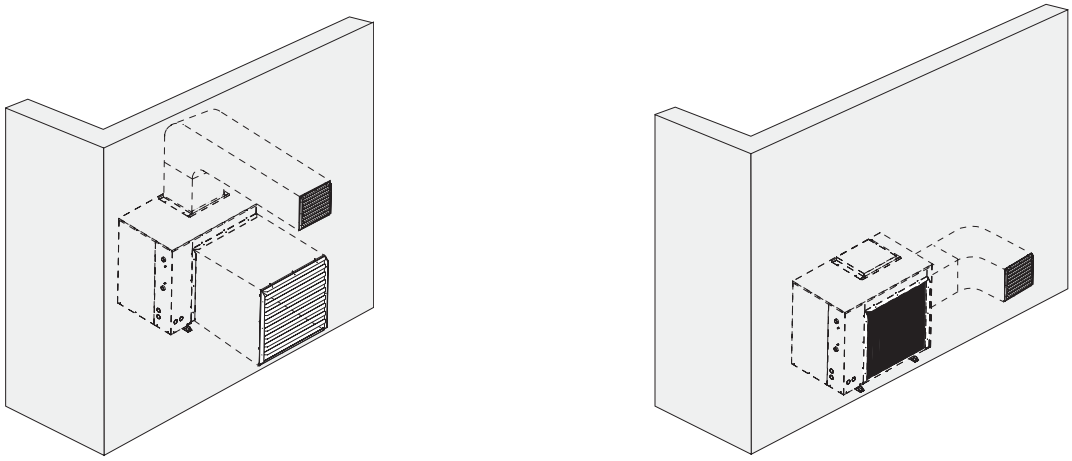
Configuration with duct for HORIZONTAL delivery air exhaust



Correct position for Delivery duct



Configuration with duct for delivery air exhaust and duct for outdoor air intake



Minimum space required for operation

To correctly install the unit, comply with the measurements for the free area that must be left around the machine to allow air to circulate correctly and to facilitate future maintenance work. Comply with the distances given in the table:

Model	19	30	38	42	50

Vacant space [mm]		
A(1)	700	1000
B	500	
C	**UNIT WITH DELIVERY EXHAUST DUCT** Dimension **C**, the space required for ducting the delivery, must be able to guarantee a straight section of duct (dimension **D**), as indicated in the figure. **UNIT WITHOUT DELIVERY EXHAUST DUCT** Allow for an uncluttered area of not less than 2.5 meters.	
D	750	900

(1) Dimension **A** is valid for applications without outdoor air intake duct.
The functional areas must be doubled if multiple units are installed.
Consider double values for the functional areas if the unit is installed in a pit.
NOTE:
If you install the unit outside without duct for the vertical delivery air exhourst, it is necessary to make a vertical duct, as shown in fig. 2, to avoid the rain water to enter in the unit and damage it.

NOTE: Consult the **"Weights and centers of gravity during operation"** section for how the loads are distributed over the supports.

Fig.1

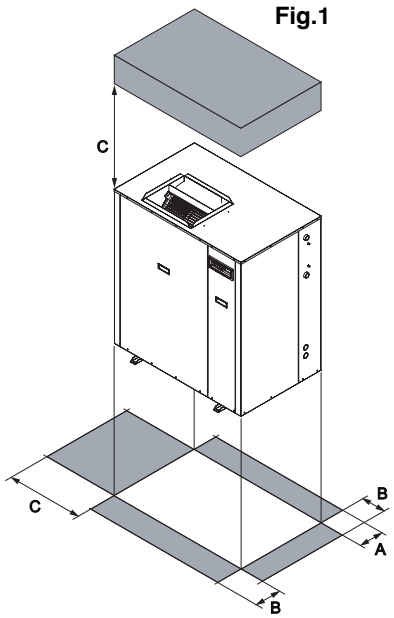
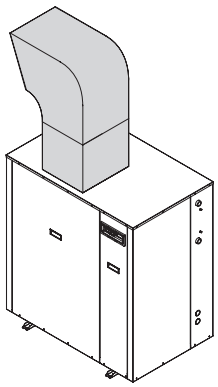


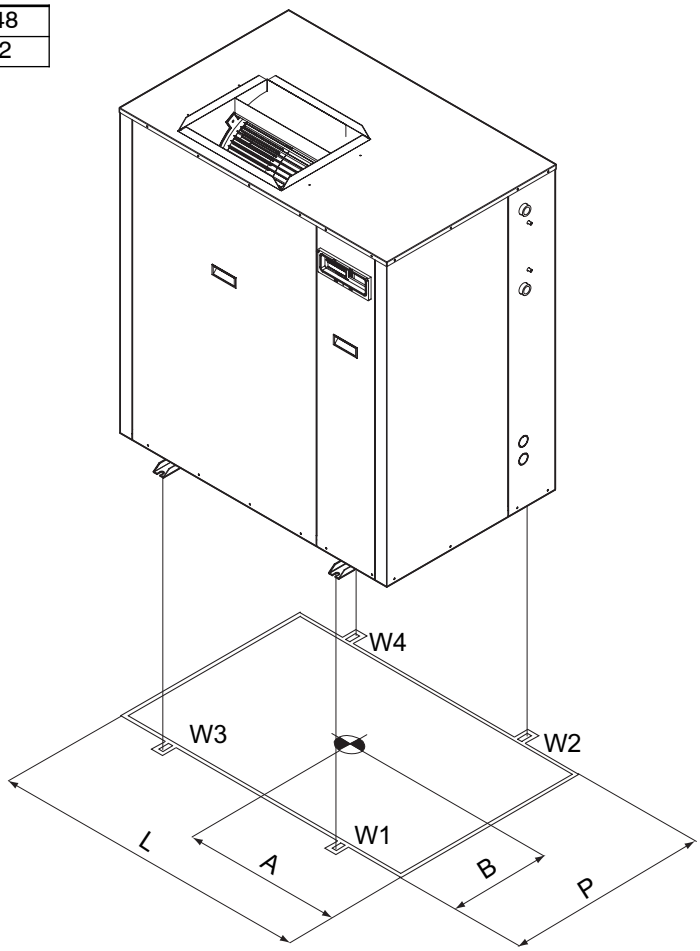
Fig.2



WEIGHTS AND CENTERS OF GRAVITY ON ARRIVAL AND DURING OPERATION

Center of gravity position

Model	19 - 30	38 - 50
L [mm]	960	1048
P [mm]	617	692



Weight distribution and center of gravity position

Consider the following center of gravity position values and load on the bearing surfaces to correctly match the machine to the bearing structure, with reference to the figure:

IP Version

Unit	VS AB 7 M5						
	Center of gravity position [mm]		Load on bearing points [kg]				total kg
	A	B	W1	W2	W3	W4	Weight
19	415	275	33	29	21	19	**103**
30	420	285	39	37	26	25	**127**
38	435	298	46	47	34	35	**162**
42	440	315	55	50	34	30	**169**
50	430	300	62	51	35	29	**178**

IR Version

Unit	VS AB 7 M5						
	Center of gravity position [mm]		Load on bearing points [kg]				total kg
	A	B	W1	W2	W3	W4	Weight
19	412	275	30	27	19	17	**93**
30	416	285	36	34	23	22	**114**
38	428	298	42	43	30	31	**146**
42	435	315	50	45	30	27	**152**
50	425	300	56	47	31	26	**160**

The manufacturer declines all responsibility for any inaccuracies in this manual due to printing or typing errors.

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