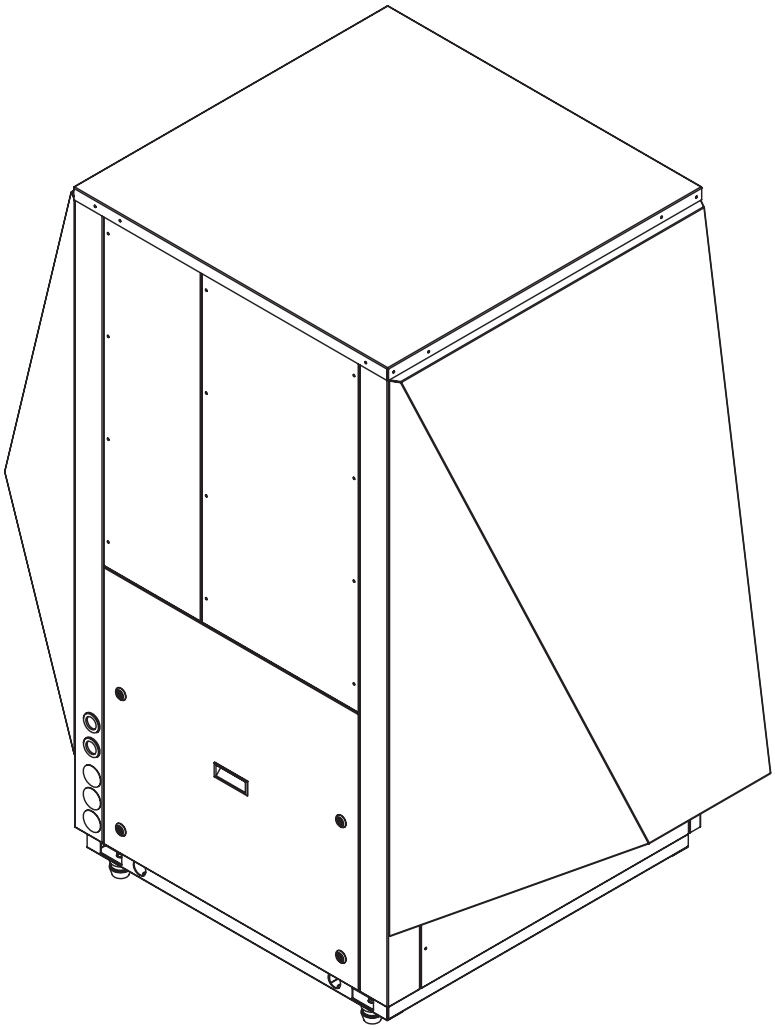
Ferroli
i migliori gradi centigradi

HMP

AIR - WATER
HEAT PUMPS
FOR OUTDOOR OR INDOOR INSTALLATION



CE

INSTALLATION AND OPERATION MANUAL

Dear Customer,
Thank you for having purchased a FERROLI product. It is the result of many years of experiences and of particular research studies and has been made with top quality materials and advanced technologies. The CE mark guarantees that the products satisfy all the applicable European Directives.
The qualitative level is kept under constant control and FERROLI products therefore offer SAFETY, QUALITY and RELIABILITY.
Due to the continuous improvements in technologies and materials, the product specification as well as performances are subject to variations without prior notice.

Thank you once again for your preference
FERROLI S.p.A

CE

GB

"CE" DECLARATION OF CONFORMITY
We, the undersigned, hereby declare under our responsibility, that the machine in question complies with the provisions established by Directives :

DE

"EG" KONFORMITÄTSERKLÄRUNG
Wir, die Unterzeichner dies er Erklärung, erklären unter unseren ausschlie ßlichen Verantworfung, daß die genannte Maschine den Bestimmungen der folgenden EG-Richtlinien entspricht :

FR

DECLARATION "CE" DE CONFORMITE
Nous soussignés déclarons, sous notre entière responsabilité, que la machine en objet est conforme aux prescriptions des Directives :

IT

DICHIARAZIONE "CE" DI CONFORMITÀ
Noi sottoscritti dichiariamo, sotto la nostra responsabilità, che la macchina in questione è conforme alle prescrizioni delle Direttive :

ES

DECLARACION "CE" DE CONFORMIDAD
Quienes subscribimos la presente declaracion, declaramos, baio nuestra exclusiva responsabilidad, que la maquina en objeto respeta lo prescrito par las Directivas :

PT

DECLARAÇÃO "CE" DE CONFORMIDADE
Nós, signatários da presente, declaramos sob a nassa exclusiva responsabilidade, que a má quina em questão está em conformidade com as prescrições das Directrizes :

NL

"EG" CONFORMITEITSVERKLARING
Wij ondergetekenden verklaren hierbij op uitsluitend eigen verantwoording dat de bovengenoemde machine conform de voorschriften is van de Richtlijnen:

DK

"CE" OVERENSSTEMMELSESERKLERING
Underfegnede forsikrer under eget ansvar al den ovennævnte maskine er i overensstemmelse med vilkårene i direktiveme :

SE

FÖRSÄKRAN OM "CE" ÖVERENSSTÄMMELSE
Underfecknade försäkrar under eget ansvar alt ovannämnda maskinskinen er i overensstemmelse med vilkarene i direktivene :

NO

BEKREFTELSE OM ÆCEØ OVERENSSTEMMELSE
Underfegnede forsikrer under eget ansvar al den ovennevnte maskinen er i overensstemmelse med vilkarene i direktivene :

FI

"CE" VAATIMUSTENMUKAISUUSVAKUUTUS
Allekirjoittaneet vakuutamme omalla vastuullamme että yllämainittu kone noudattaa ehtoja direktiiveissä :

GR

ΔΗΛΩΣΗ ΣΥΜΒΑΤΟΤΗΤΑΣ "ΕΕ"
Εμετς που υπογραφουμε την παρουσα, δηλωνουμε υπο την αποκλειστικη μας ευθυνη, οτι το μηχανημα συμμορφουται οτα οσ α ορτζουν οι Οδηγιες :

HR

IZJAVA O "CE" SUGLASNOSTI
Mi niže potpisani izjavljujemo, pod našom odgovornošu, da ova Mašina odgovara zahtijevima iz Direktiva :

PL

DEKLARACJA ZGODNOŚCI "CE"
My niżej podpisani oświadczamy z pełną odpowiedzialnością, że niżej wymienione urządzenie w pełni odpowiada postanowieniom przyjętym w następujących Dyrektywach:

2006/42/EC
97/23/EC
2004/108/EC
2006/95/EC

Il legale rappresentante
Dante Ferroli

TABLE OF CONTENTS

GENERAL FEATURES

General instructions

This manual and the wiring diagram supplied with the unit must be kept in a dry place for possible future consultation.
The manual provides information on installation and correct use and maintenance of the unit. **Before carrying out installation, please carefully read all the information contained in this manual, which describes the procedures necessary for correct installation and use of the unit.**

Follow carefully the instructions contained in this manual and respect the safety regulations in force. The unit must be installed in conformity with the laws in force in the country of use. Unauthorized tampering with the electrical and mechanical equipment **INVALIDATES THE WARRANTY**.
Check the electrical specifications given on the dataplate before making the electrical connections. Read the instructions given in the specific section on electrical connections.
Deactivate the equipment in case of fault or poor operation.
If the unit requires fixing, contact only specialized service centers recognized by the manufacturer and use original spare parts.
The unit must be installed outdoor or indoor and connected to a hydronic cooling and/or heating system. Any use different from that permitted or outside the operating limits indicated in this manual is prohibited (unless previously agreed with the firm).

The manufacturer declines any responsability for damage or injury due to non-compliance with the information given in this manual.

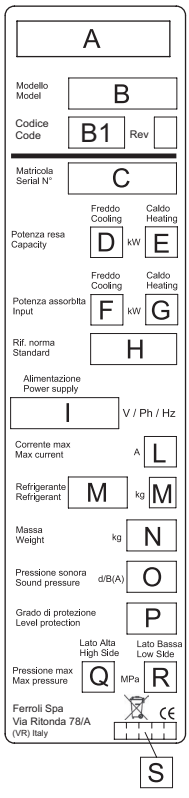
Declaration of conformity

The firm declares that the present unit complies with the requirements of the following directives :

- Machinery directive (MD) **2006/42/EC**
- Pressure equipment directive (PED) **97/23/EC**
- Electromagnetic compatibility directive (EMC) **2004/108/EC**
- Low voltage directive (LVD) **2006/95/EC**

Unit dataplate

The figure shows the fields reported on the unit dataplate :



A - Trademark
B - Model
B1 - Code
C - Serial number
D - Capacity in cooling at the condition A35W18
E - Capacity in heating (heat pump) at the condition A7W35
F - Power input in cooling at the condition A35W18
G - Power input in heating (heat pump) at the condition A7W35
H - Reference standard
I - Power supply
L - Maximum absorbed current
M - Refrigerant type and charge weight
N - Unit weight
O - Sound pressure level at 1 metre
P - IP protection level
Q - Maximum pressure - high pressure side
R - Maximum pressure - low pressure side
S - PED certification body

GENERAL FEATURES

Unit description

This series of **air-water** heat pumps satisfies the heating, cooling and domestic hot water production requirements of residential plants of small and medium size.

All the units are suitable both for outdoor or indoor installation and can be applied to **fan coil** plants, **radiant** floor plants and high efficiency **radiators** plants.

The control system allows to manage not only the refrigerant circuit but the whole plant with the possibility to choose different solutions both for the heating and cooling plant and for the domestic hot water management. The possibility of solar panels or other heating sources integration is also available.

The **heating** function optimizes the flow water temperature according both to the ambient temperature and to the outdoor temperature through climatic curves adaptable to the building features. It's possible to manage a storage tank and two independent circuits (a direct one and a mixed one).

The **domestic hot water** management allows to control the three way valve, the storage tank and the anti-legionella cycles (if necessary).

The **cooling** function can be realized through "active cooling" (refrigerant circuit inversion). When the unit is used in radiant floor plants, to avoid condensate generation, a room humidity sensor can be installed.

The **internal programmer clock** allows to define different daily switching programs for heating, cooling and domestic hot water production.

The refrigerant circuit, contained in a box repaired from the air flow to simplify the maintenance operations, is equipped with scroll compressor mounted on damper supports, brazed plate heat exchangers, electronic expansion valve, reverse cycle valve, centrifugal fan (plug fan), finned coil realized with copper pipes and alluminium fins. The circuit is protected by high and low pressure switches and flow switches on the plate heat exchanger.

The plate heat exchanger and all the hydraulic pipes are thermally insulated in order to avoid condensate generation and reduce thermal losses.

The plug fan with electronic control of the rotational speed guarantees high efficiencies and low noise in all the operating conditions and allows to install the unit both outdoor (with protection caps) or indoor (with ducted air inlet and outlet).

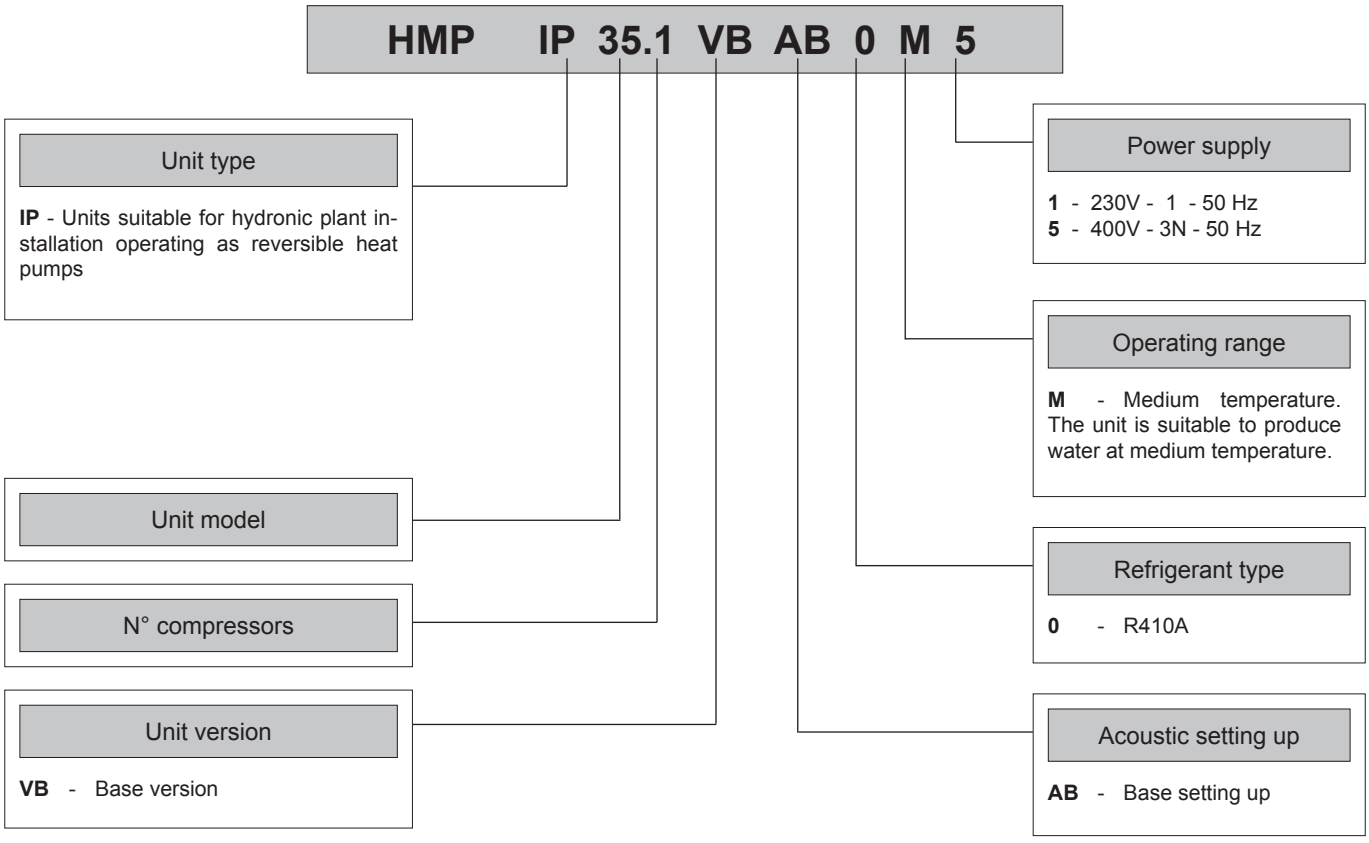
All three-phase power supply units are provided with a phase sequence and correct sequence controller device.

All the units are supplied with an outdoor temperature sensor in order to realize the climatic control.

All the units are accurately built and individually tested in the factory. Only electric and hydraulic connections are required for installation.

Unit identification code

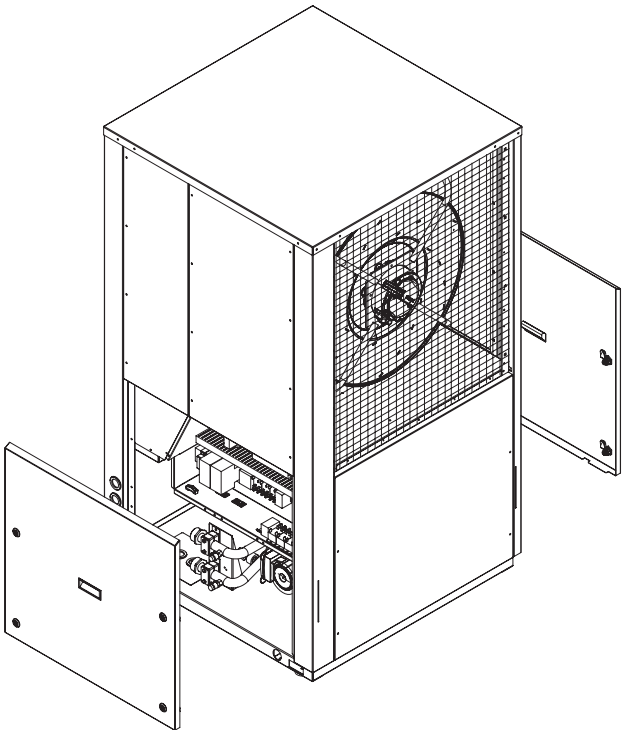
The codes that identify the units and the meaning of the letters used are described below.



Description of components

External structure. Basement, supporting structure and lateral panels are made of galvanized and painted sheet-steel to guarantee good resistance to atmospheric agents. Accessibility to internal parts is possible removing the lateral panels. For extraordinary manteinances also the other panels can be removed.

Refrigerant circuit. It is contained inside a compartment separated from the air flow to simplify maintenance and control operations.



The hermetic scroll **compressor (1)** is mounted on damper supports and is protected against overtemperatures and overcurrents. It is equipped with an electrcal heater, that is activated when the compressor turns off, to keep the compressor crankcase oil temperature high enough to prevent migration of the refrigerant during winter stops and to evaporate any liquid present in the crankcase, in order to prevent possible liquid rushes on starting.

The **plant side heat exchanger (2)** is a brazed stainless steel plate heat exchanger, properly insulated to avoid condensate generation and to minimize thermal losses, and protected by a flow switch that detects whatever water flow lack.

The **source side heat exchanger (3)** is a finned coil realized with grooved copper pipes and hydrophilic aluminium fins with waved profile to increase the heat exchange coefficient. A tray is placed under the coil to collect the condensate generated in heating mode.

The **expansion device (4)**, an electronic expansion valve, allows the unit to adjust itself to the different operating conditions keeping steady the set superheating.

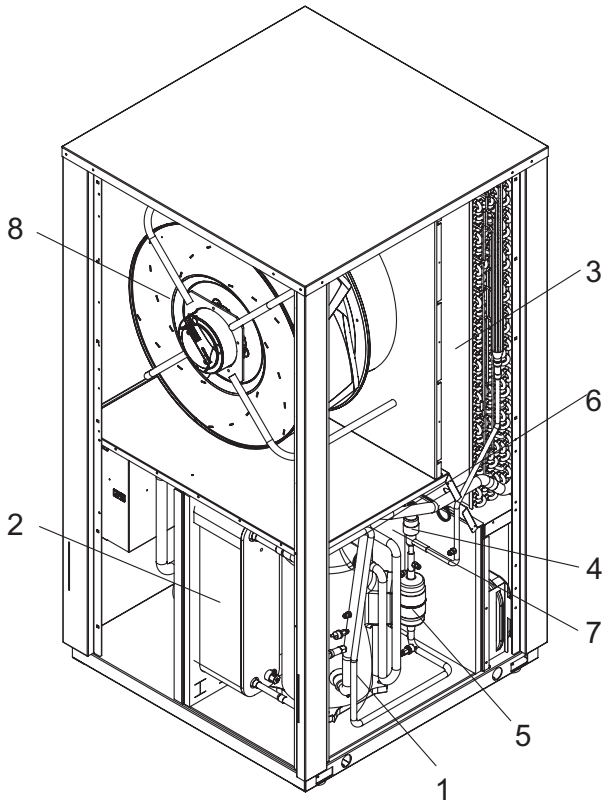
The refrigerant circuit of each unit contains moreover solid core hermetic **filter dryer (5) t**o restrain impurity and moisture residuals that could be present in the circuit, **high and low pressure switches** in order to assure the compressor to operate inside the permitted limits, **4 way reverse cycle valve (6)** to allow operating mode change reversing the refrigerant flow, **liquid receiver (7)** to compensate the different refrigerant charge required in heating and in cooling mode and pressure connections SAE 5/16" - UNF 1/2" - 20 equipped with pin, gasket and blind nut, as required for the use of R410A refrigerant (they allow the complete check of the refrigerant circuit: compressor inlet pressure, compressor outlet pressure and expansion valve upstream pressure). All the pipes of the refrigerant circuit are properly insulated to avoid condensate generation and minimize thermal losses

The **plug fan (8)** is equipped with an high efficiency electronically commutated (EC) motor and guarantees enough available static pressure to allow both the outdoor and the indoor installation.

Hydraulic circuit. All the pipes are thermally insulated to avoid condensate generation and minimize thermal losses. The circuit can be equipped with a standard or a high head circulation pump (option). The circuit is always equipped also with expansion vessel, safety valve and air vents.

Electrical panel. It contains all the power, control and security components necessary to guarantee the unit to work properly. The unit is managed by a **microprocessor controller** to which all the electrical loads and the control devices are connected. The user interface, to be placed indoor, allows to view and to modify, if necessary, all the parameters of the unit.

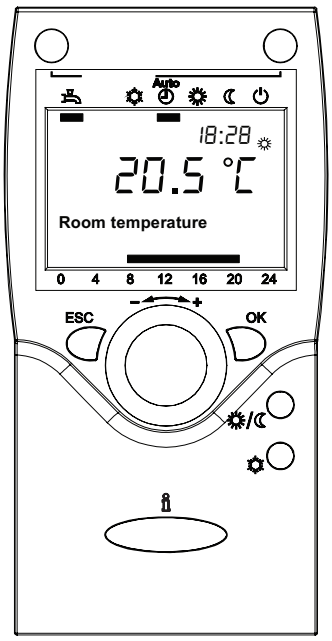
All the units are supplied with an **outdoor temperature sensor,** to be installed outside, in order to realize the climatic control.



Control system

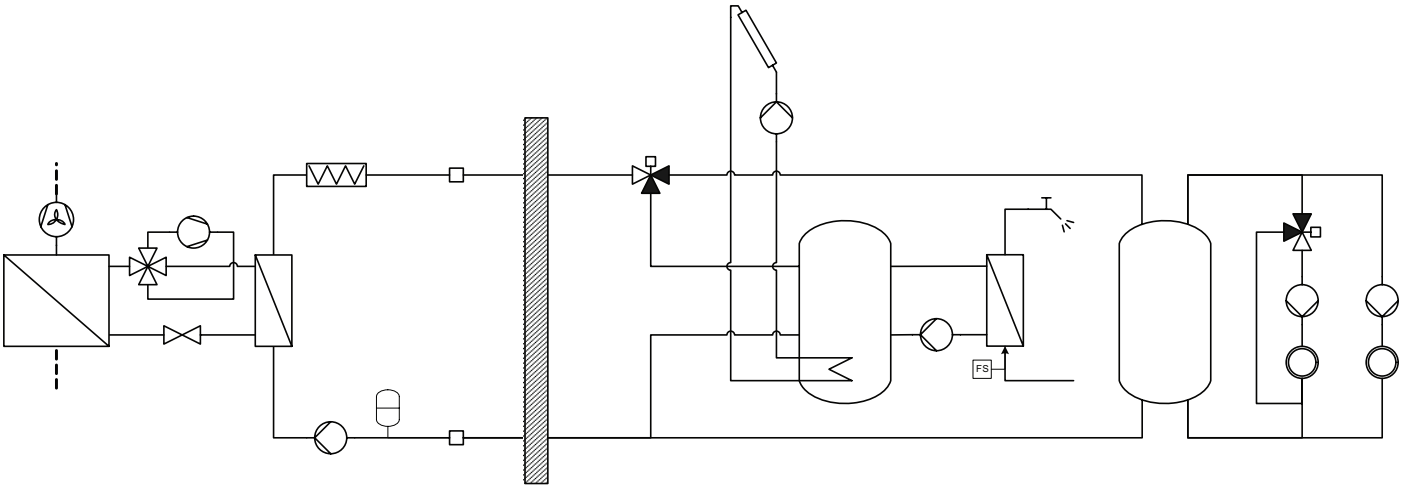
The microprocessor controller is able to manage not only the unit itself but also all that components of the plant which allow to realize a complete system.
The main functions of the control system are :

- room temperature control according to the outdoor temperature (climatic control)
- domestic hot water production (management of 3 way valve, storage tank, anti legionella cycles…)
- management of a heating and/or cooling mixed circuit (pump and 3 way mixing valve)
- management of a heating direct circuit (only pump)
- management of a storage tank for heating and/or cooling
- management of electrical heaters for heating and domestic hot water (3 steps logic)
- solar panels integration
- room humidity control for cooling with radiant systems
- internal programmer clock (for heating, cooling and domestic hot water)
- digital input for electrical energy low tariff
- alarm memory management and diagnostic
- compressor and pump operating hour counter
- possibility to manage more units in cascade (maximum 16)



Besides the user interface of the unit to be placed indoor, wired or wireless remote thermostats are available which allow to control all the operating parameters of the unit and to acquire the temperature in the different zones in order to realize a more precise and comfortable control.

The unit controller is able to manage a lot of different plant solutions enabling automatically the necessary control algorythms according to the components which have been connected. The management of such components is possible through additional expansion modules which communicate with the unit by means of an internal bus and provide all the inputs and outputs required to fulfil a complete system.



The controller is able to manage up to **two zones in heating** (one by means of a mixed circuit and the other by means of a direct circuit) and **one zone in cooling** (by means of a mixed circuit).

It's possible to realize more complex plants connecting to the heat pump controller further expansion modules in order to extend without limits the number of zones to be managed.

For each zone the following parameters can be set :

- set point
- daily or weekly operating time table
- climatic control curve
- room control sensor : it can be in common with the other zones or independent (in that case it's necessary to install an additional room thermostat)

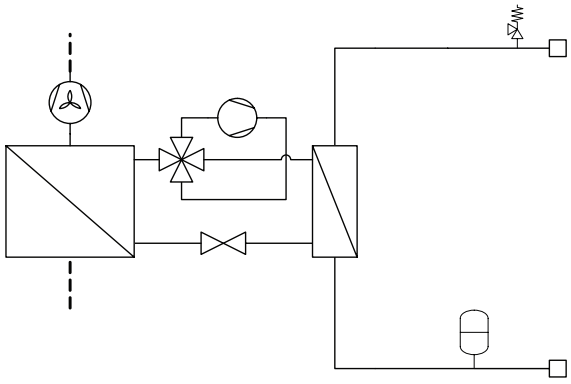
Options

Plant side flow rate management	**Standard pump**	Allows the circulation of the water on the plant side.
	High head pump	Allows the circulation of the water on the plant side and guarantees a higher available static head.
	High efficiency pump	Allows the circulation of the water on the plant side and guarantees a high efficiency.
Domestic hot water production	**3 way valve**	Allow to divert the hot water produced by the heat pump from the heating circuit to the domestic hot water circuit.
Integrative electrical heaters		Integrate or replace the heating power supplied by the heat pump and are managed by the unit controller with a 3 step logic.
Soft starter		Reduces the compressor start current.

The controller flexibility and the big number of options available allow to get, for each model, a lot of different configurations that integrate inside the heat pump many components of the plant and allow to realize compact and tested installations.

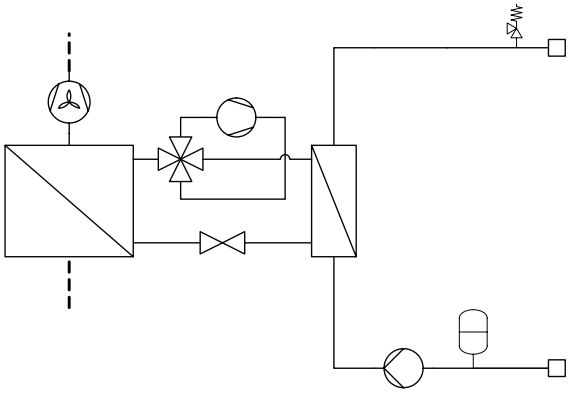
In order to select the right configuration it is necessary to define the type of plant to which the heat pump will be connected, both for what concerning the heating and cooling circuits, and for what concerning the domestic hot water management.

Reversible heat pump (IP) without options

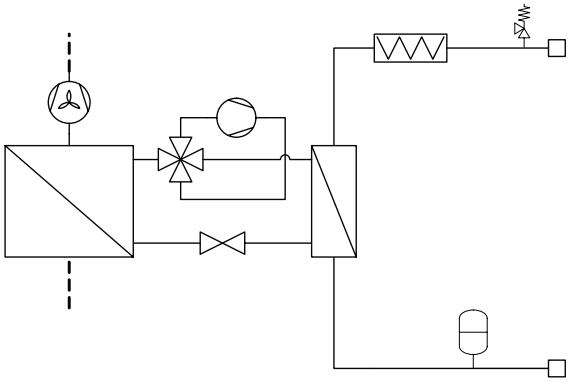


Option "Plant side flow rate management"

Pump (standard or high head or high efficiency)

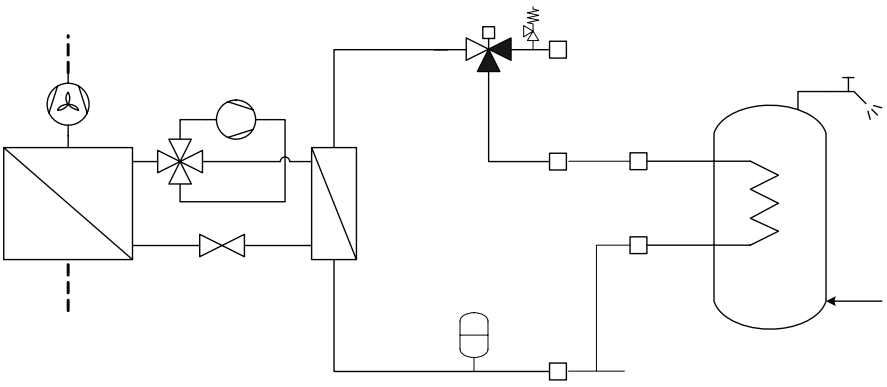


Option "Integrative electrical heaters"



Option "Domestic hot water production"

3 way valve



In this configuration the heat pump can be coupled to a domestic hot water tank equipped with a coil designed for a maximum water temperature between 55°C and 60°C.

The anti legionella cycles have to be performed by means of electrical heaters placed on the heat pump outlet (see option "Integrative electrical heaters") or directly inside the tank.

GENERAL FEATURES

Accessories

Rubber vibration dampers	Allow to reduce the transmission to the unit support plane of the mechanical vibrations generated by the compressor and by the fans in their normal operating mode.
Adjustable rubber vibration dampers	Allow to reduce the transmission to the unit support plane of the mechanical vibrations generated by the compressor and by the fans in their normal operating mode. Their height can be adjusted to fit to the ground unevenness.
Protection cap	Protect th external surface of the finned coil when it is installed on the air suction side) and the fan (when it is installed on the air expulsion side) and reduce the noise emitted by the unit.
Lateral expulsion cap	Protect the fan and reduce the noise emitted by the unit. It must be connected to one of the two lateral air flow openings and requires the installation of the accessory “Frontal shutting panel”.
Frontal shutting panel	Allow to close the frontal air flow opening when the lateral air flow openings are used.
Remote thermostat	Allows operating mode selection and set point adjustment. The on board temperature sensor can be used in order to realize a climatic control.
Remote control (wired or wireless)	Replicates all the control and visualization functionalities of the controller installed on the unit. The on board temperature sensor can be used in order to realize a climatic control.
Wireless transmitter	Connected to the unit controller, allows to communicate with wireless remote control and wireless outdoor temperature sensor.
Wireless repeater	Extends wireless operating range.
Wireless adaptor for outdoor temperature sensor	Allows to transform the wired outdoor temperature sensor, standard for all the units, in a wireless sensor.
Condensate sensor	In cooling mode it allows the minimum flow temperature control when condensate generation occurs.
Room hygrostat	In cooling mode it allows the minimum flow temperature control according to the room humidity.
Room humidity sensor (with or without display)	In cooling mode it allows the minimum flow temperature control according to the room dew point, calculated from the measured room humidity.
Transformer 230V / 24V - 3VA	It assures the correct power supply for the condensate sensor and for the room humidity sensor.

N.B. For OUTDOOR INSTALLATION is **MANDATORY** one of the two following solutions :

- installation of the accessory “Protection cap” on the air expulsion side
- installation of the accessories “Lateral expulsion cap” and “Frontal shutting panel”

TECHNICAL DATA AND PERFORMANCES

Technical data

Frame	1	2			3		
Model	**24.1**	**27.1**	**31.1**	**35.1**	**40.1**	**45.1**	U.M.
Power supply	400 -3N- 50	400 -3N- 50	400 -3N- 50	400 -3N- 50	400 -3N- 50	400 -3N- 50	V-ph-Hz
Refrigerant							
Type	R410A						-
Compressor							
Type	scroll						-
Quantity	1						n°
Power steps	0 - 100						%
Oil charge	2,50	3,30	3,30	3,30	3,30	3,30	kg
Plant side heat exchanger							
Type	stainless steel brazed plates						-
Quantity	1						n°
Water volume	3,33	4,18	4,18	4,18	5,14	5,14	l
Source side heat exchanger							
Type	finned coil						-
Quantity	1						n°
Frontal surface	0,77	1,10	1,10	1,10	1,43	1,43	m^2
Fans							
Type	plug fan with high efficiency EC motor						-
Quantity	1						n°
Diameter	630	630	630	630	630	630	mm
Maximum rotational speed	680	680	680	680	1200	1200	rpm
Total installed power	0,54	0,54	0,54	0,54	2,80	2,80	kW
Plant side hydraulic circuit							
Expansion vessel volume	10						l
Safety valve set point	3						bar
Plant pump - standard (option)							
Type	centrifugal pump						-
Quantity	1						n°
Installed power	0,7	0,7	0,7	0,7	1,0	1,0	kW
Plant pump - high head (option)							
Type	centrifugal pump						-
Quantity	1						n°
Installed power	1,2	1,2	1,2	1,2	1,6	1,6	kW
Plant pump - high efficiency (option)							
Type	inverter glandless pump						-
Quantity	1						n°
Installed power	0,14	0,31	0,31	0,31	0,31	0,31	kW
Integrative electrical heaters (option)							
Total installed power	9,0	18,0	18,0	18,0	18,0	18,0	kW
Power steps	0 - 33 - 66 - 100						%

TECHNICAL DATA AND PERFORMANCES

NOMINAL performances - Radiant plants

Frame	1	2			3		
Model	**24.1**	**27.1**	**31.1**	**35.1**	**40.1**	**45.1**	U.M.
Power supply	400 -3N- 50	400 -3N- 50	400 -3N- 50	400 -3N- 50	400 -3N- 50	400 -3N- 50	V-ph-Hz
Heating A7W35 (source : air in 7°C d.b. 6°C w.b. / plant : water in 30°C out 35°C)							
Heating capacity	23,5	26,9	30,7	34,3	39,6	45,2	kW
Power input	5,18	5,81	6,79	7,75	8,72	10,0	kW
COP	4,54	4,63	4,52	4,43	4,54	4,52	-
Water flow rate plant side	4052	4641	5299	5905	6823	7793	l/h
Pressure drops plant side	21	18	23	28	25	32	kPa
Heating A2W35 (source : air in 2°C d.b. 1°C w.b. / plant : water in 30°C out 35°C)							
Heating capacity	19,5	22,3	25,6	28,5	32,8	37,5	kW
Power input	5,08	5,70	6,66	7,59	8,53	9,82	kW
COP	3,84	3,91	3,84	3,75	3,85	3,82	-
Water flow rate plant side	3377	3862	4416	4918	5663	6477	l/h
Pressure drops plant side	15	13	16	20	18	23	kPa
Cooling A35W18 (source : air in 35°C d.b. / plant : water in 23°C out 18°C)							
Cooling capacity	24,5	28,0	32,0	35,6	41,0	46,9	kW
Power input	7,20	8,08	9,46	10,8	12,2	14,0	kW
EER	3,40	3,47	3,38	3,30	3,36	3,35	-
Water flow rate plant side	4242	4845	5535	6173	7104	8138	l/h
Pressure drops plant side	23	19	25	31	27	35	kPa

IP

Data declared according to **EN 14511.** The values are referred to units without options or accessories.

NOMINAL performances - Standard plants

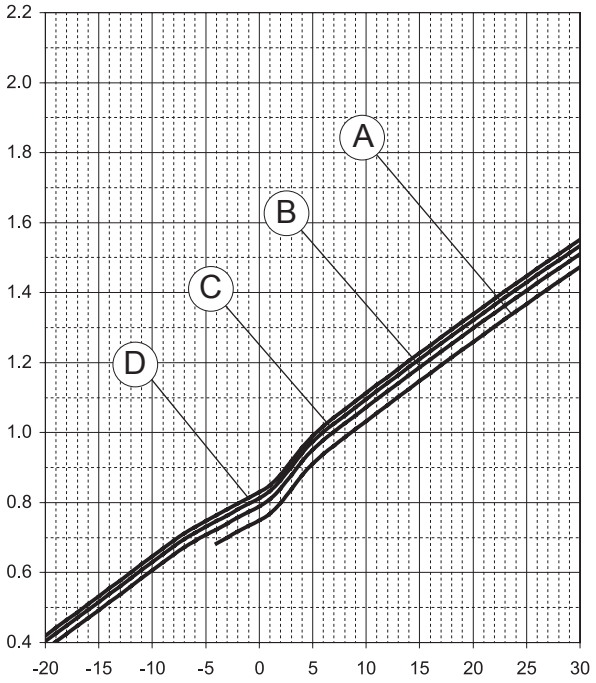
Frame	1	2			3		
Model	**24.1**	**27.1**	**31.1**	**35.1**	**40.1**	**45.1**	U.M.
Power supply	400 -3N- 50	400 -3N- 50	400 -3N- 50	400 -3N- 50	400 -3N- 50	400 -3N- 50	V-ph-Hz
Heating A7W45 (source : air in 7°C d.b. 6°C w.b. / plant : water in 40°C out 45°C)							
Heating capacity	23,0	26,3	30,0	33,5	38,5	44,1	kW
Power input	6,29	7,05	8,25	9,42	10,5	12,2	kW
COP	3,66	3,73	3,64	3,56	3,67	3,61	-
Water flow rate plant side	3980	4553	5196	5805	6674	7629	l/h
Pressure drops plant side	21	17	22	27	24	31	kPa
Heating A2W45 (source : air in 2°C d.b. 1°C w.b. / plant : water in 40°C out 45°C)							
Heating capacity	18,9	21,7	24,9	27,7	31,9	36,4	kW
Power input	6,19	6,95	8,12	9,25	10,4	11,9	kW
COP	3,05	3,12	3,07	2,99	3,07	3,06	-
Water flow rate plant side	3285	3771	4310	4797	5527	6309	l/h
Pressure drops plant side	14	12	15	19	17	22	kPa
Cooling A35W7 (source : air in 35°C d.b. / plant : water in 12°C out 7°C)							
Cooling capacity	19,1	21,8	24,8	27,6	31,8	36,4	kW
Power input	6,65	7,47	8,73	9,95	11,2	12,8	kW
EER	2,87	2,92	2,84	2,77	2,84	2,84	-
Water flow rate plant side	3278	3741	4273	4754	5474	6264	l/h
Pressure drops plant side	14	12	15	19	17	22	kPa

IP

Data declared according to **EN 14511.** The values are referred to units without options or accessories.

HEATING performances

Heating capacity



The graphs allow to get the corrective factors to be applied to the nominal performances in order to obtain the real performances in the selected operating conditions.

The reference nominal condition is :

A7W35

source : air in 7°C d.b. 6°C w.b.

plant : water in 30°C out 35°C

Outlet temperature

plant side :

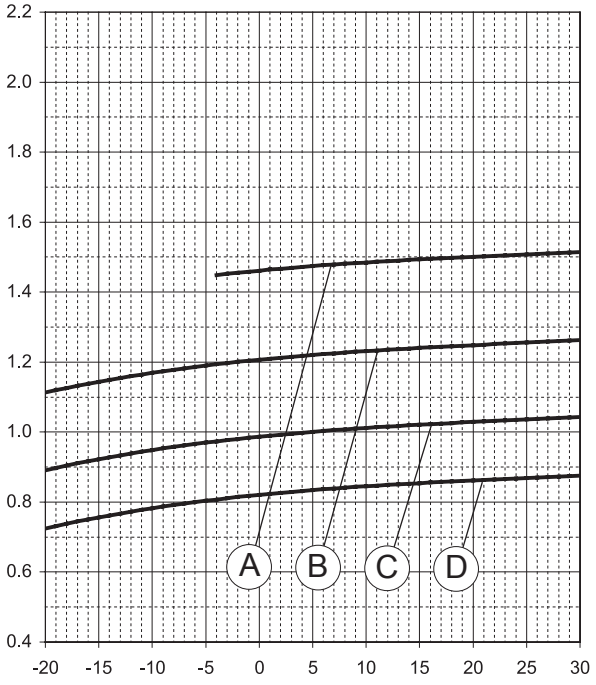
A = 55°C

B = 45°C

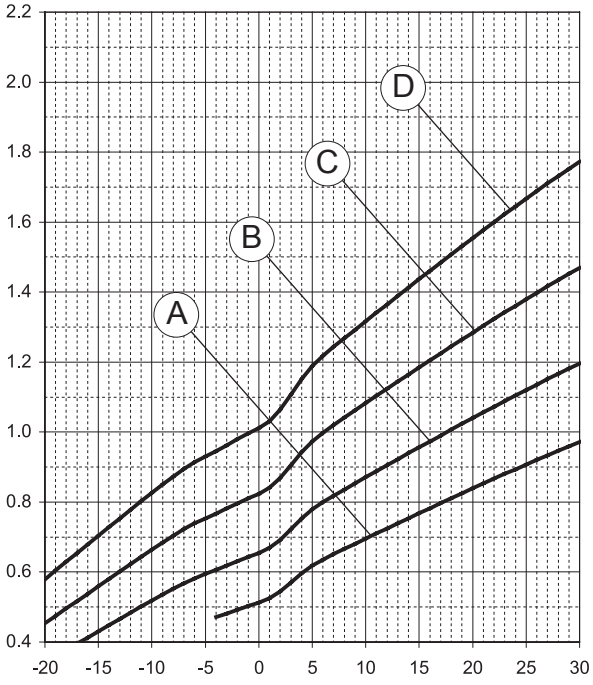
C = 35°C

D = 25°C

Power input

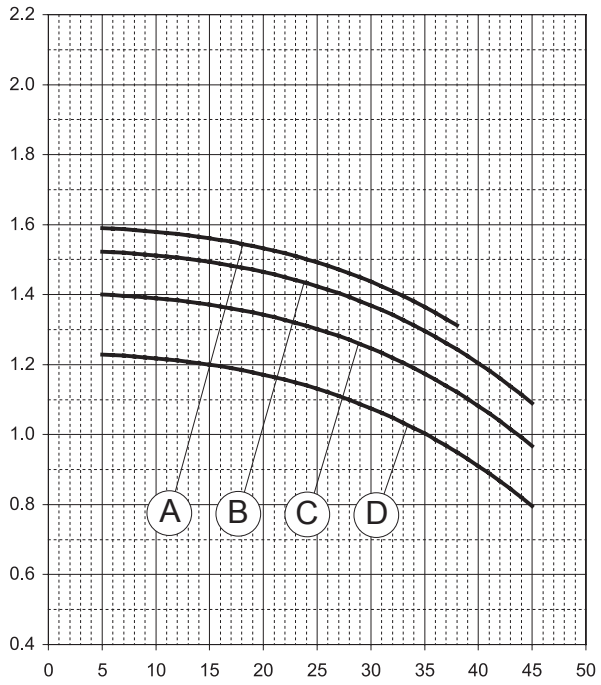


COP



COOLING performances

Cooling capacity



The graphs allow to get the corrective factors to be applied to the nominal performances in order to obtain the real performances in the selected operating conditions.

The reference nominal condition is :

A35W7

source : air in 35°C d.b.

plant : water in 12°C out 7°C

Outlet temperature

plant side :

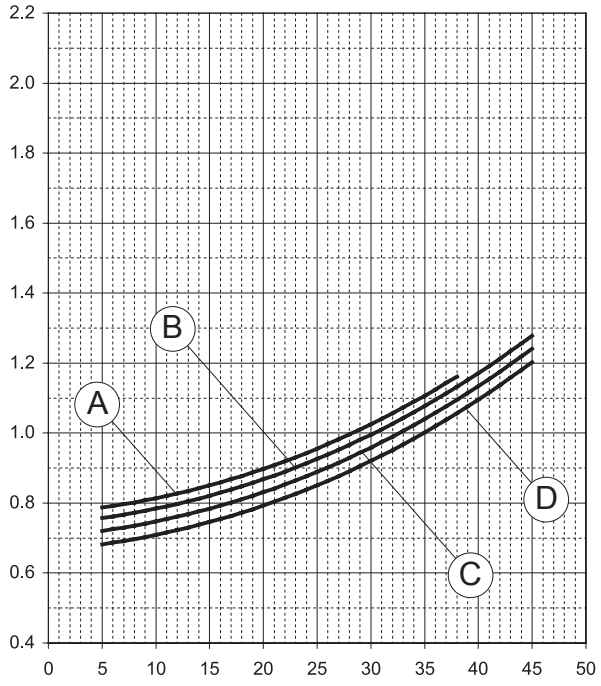
A = 24°C

B = 18°C

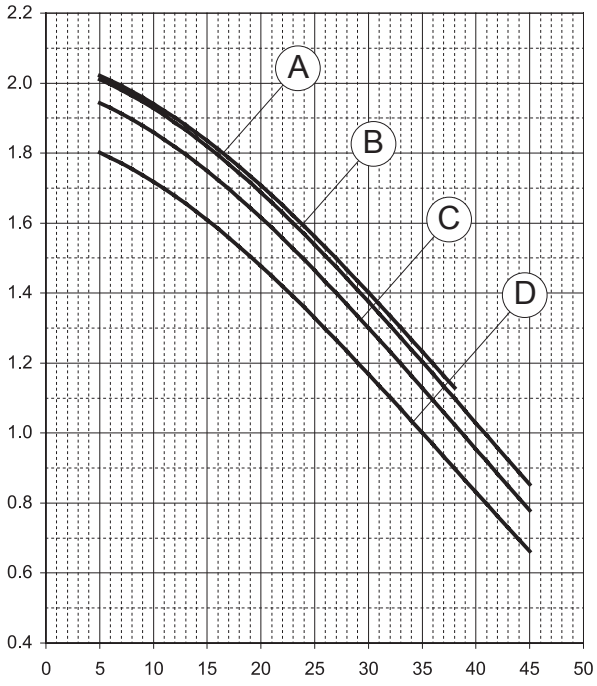
C = 12°C

D = 7°C

Power input

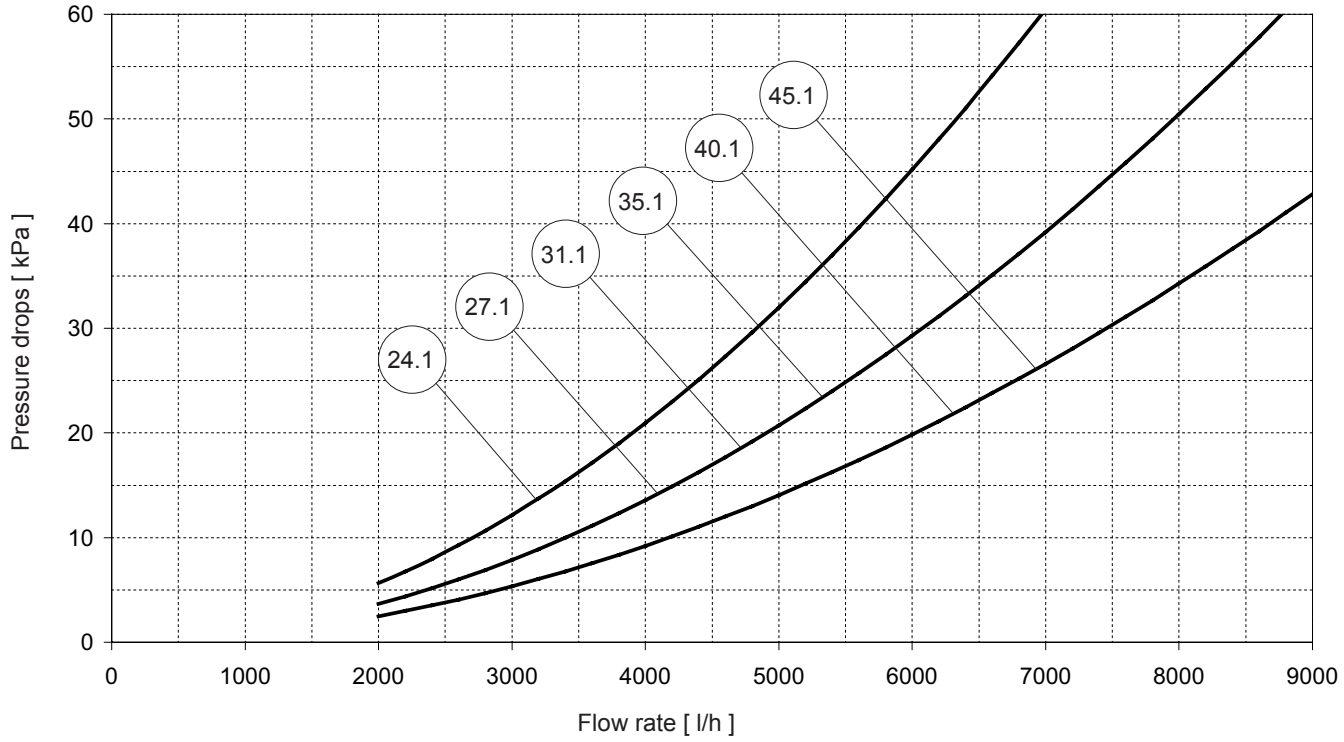


EER

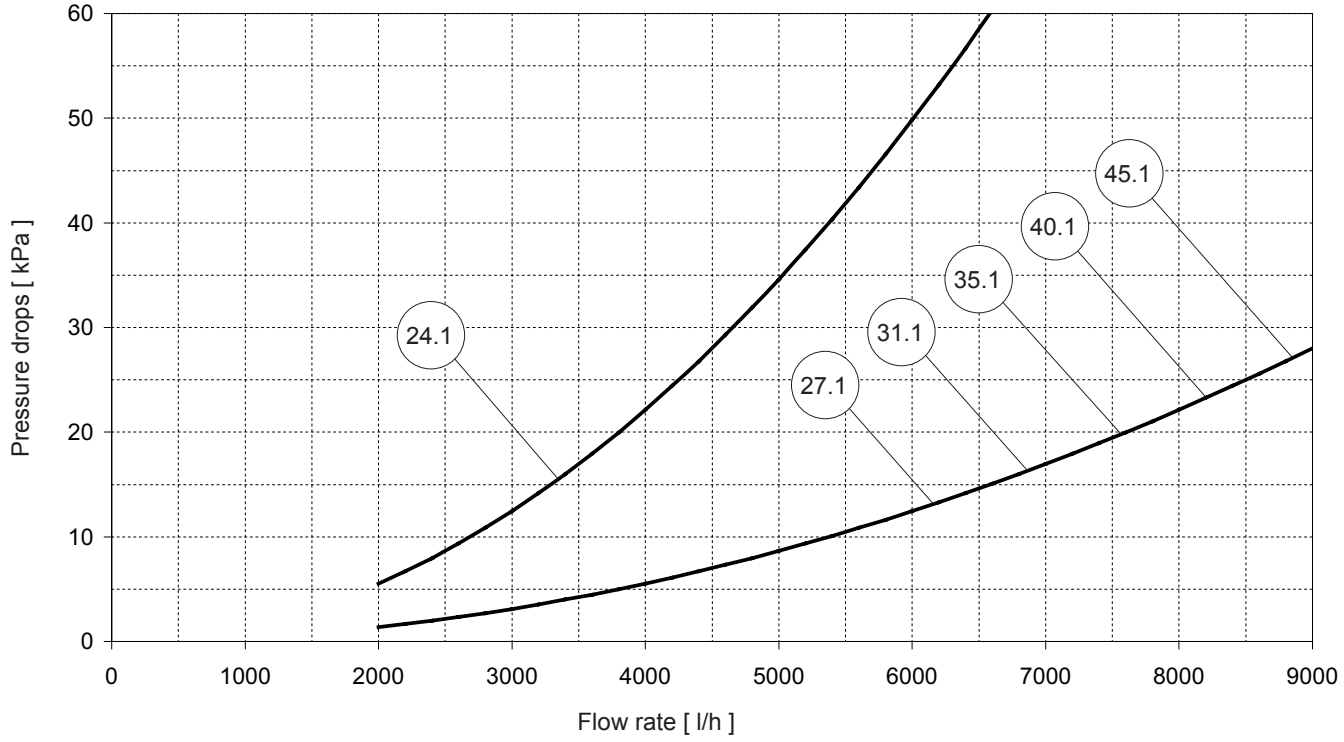


Plant side hydraulic performances

Pressure drops - unit without options

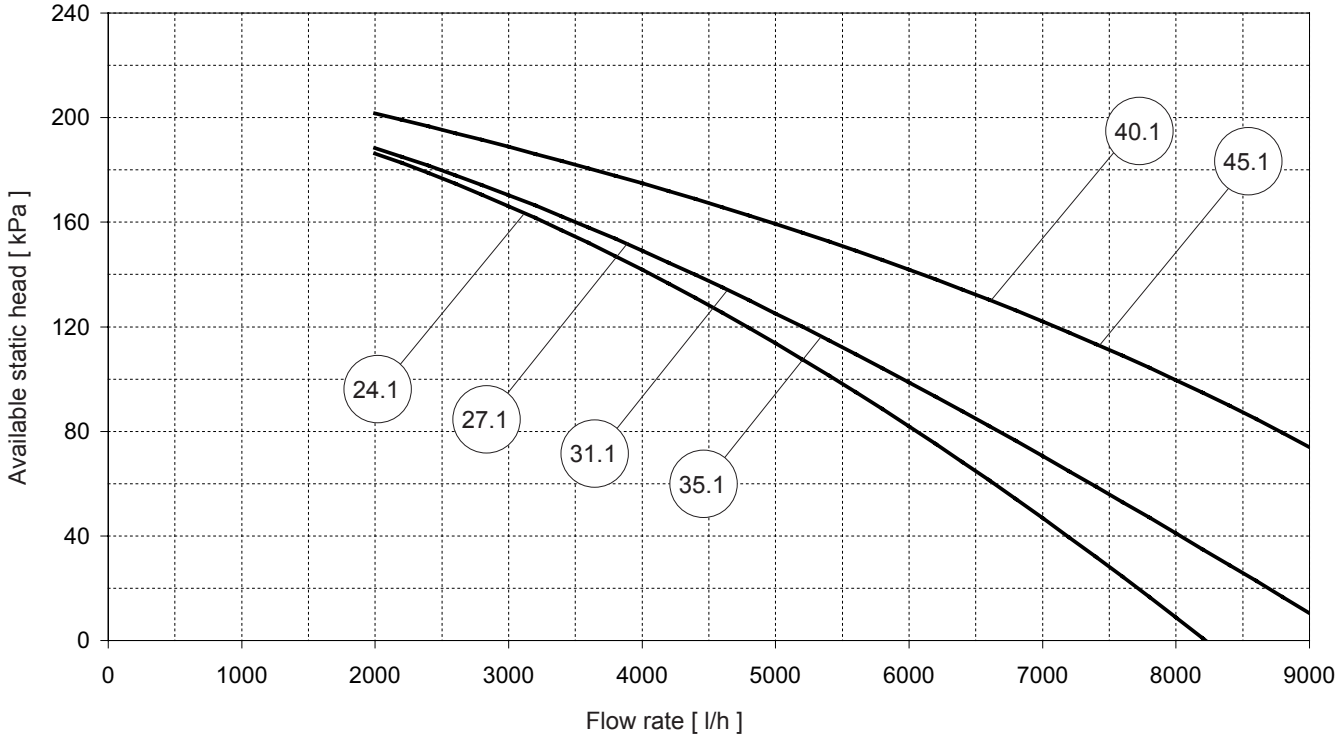


Pressure drops to be added - unit with option “Integrative electrical heaters”

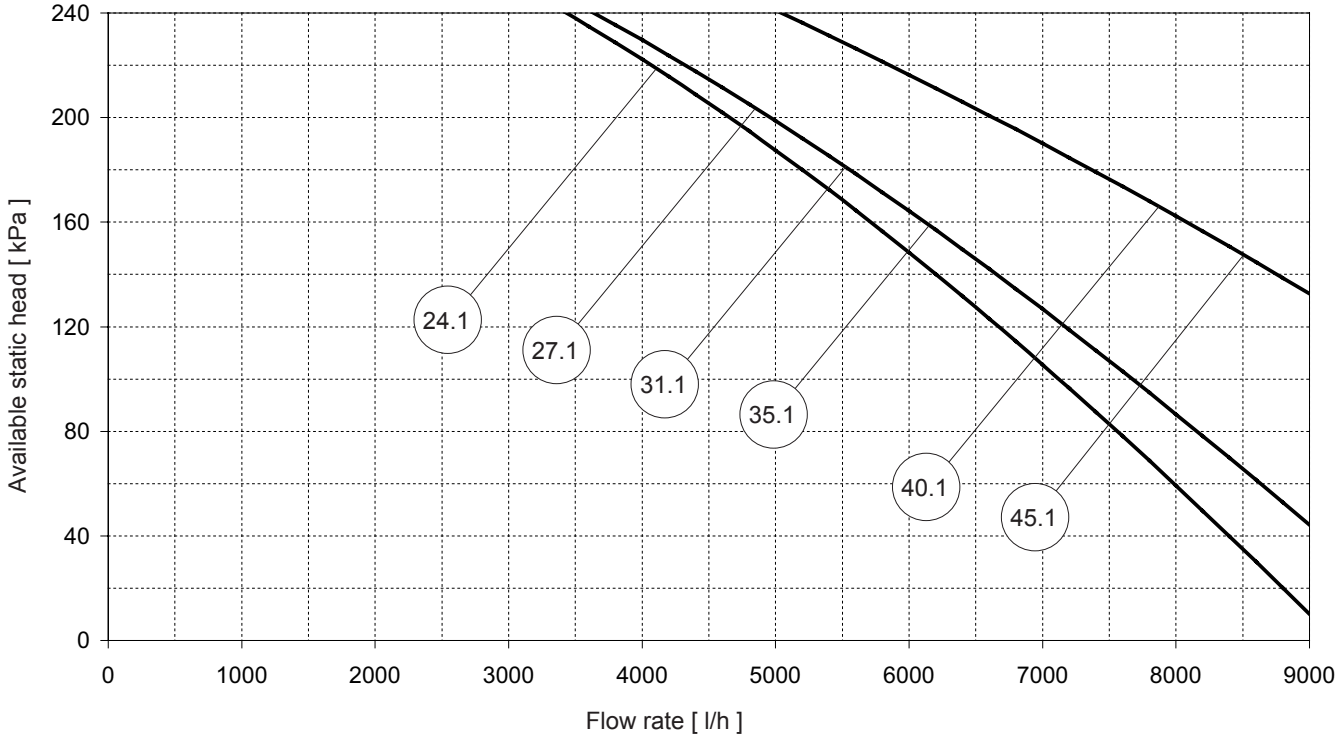


The graphs are referred to units operating with water at the temperature of 10°C (density 1000 kg/m³).

Available static head - unit with option “Plant side flow rate management” : “Standard pump”

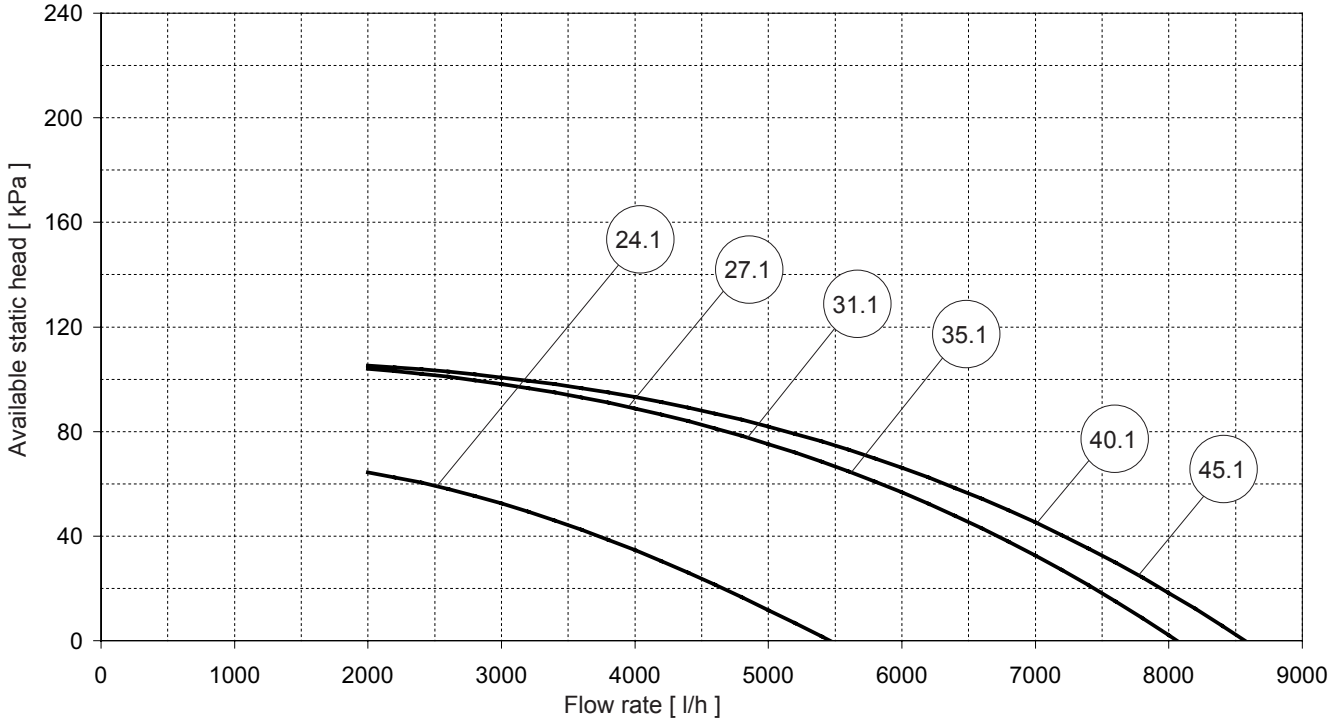


Available static head - unit with option “Plant side flow rate management” : “High head pump”



The graphs are referred to units operating with water at the temperature of 10°C (density 1000 kg/m³).

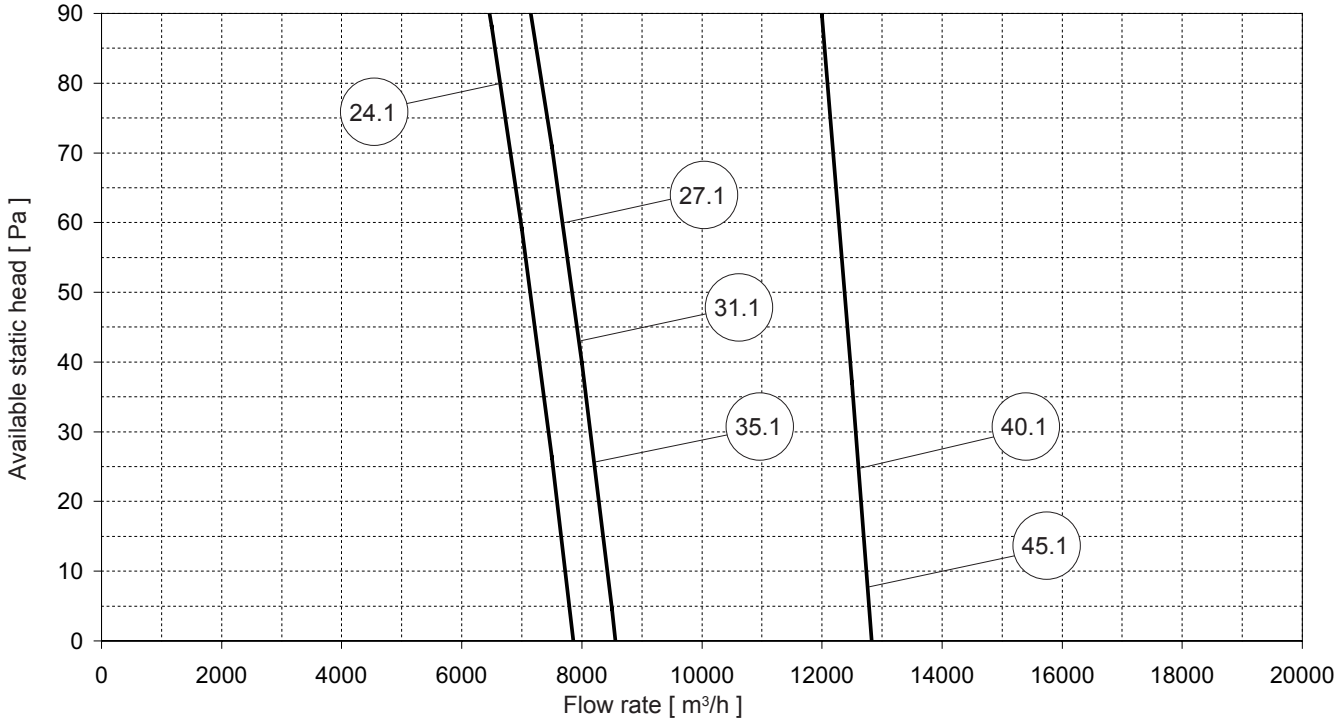
Available static head - unit with option “Plant side flow rate management” : “High efficiency pump”



The graphs are referred to units operating with water at the temperature of 10°C (density 1000 kg/m³).

Source side aeraulic performances

Available static head - unit without accessory “Protection cap” or “Lateral expulsion cap”



Frame	1	2			3		
Model	**24.1**	**27.1**	**31.1**	**35.1**	**40.1**	**45.1**	U.M.
Maximum static head available for ducted installation	50	50	50	50	150	150	U.M.

In case of ducted installation the total pressure drops in the inlet and outlet ducts can not exceed the maximum available static head.

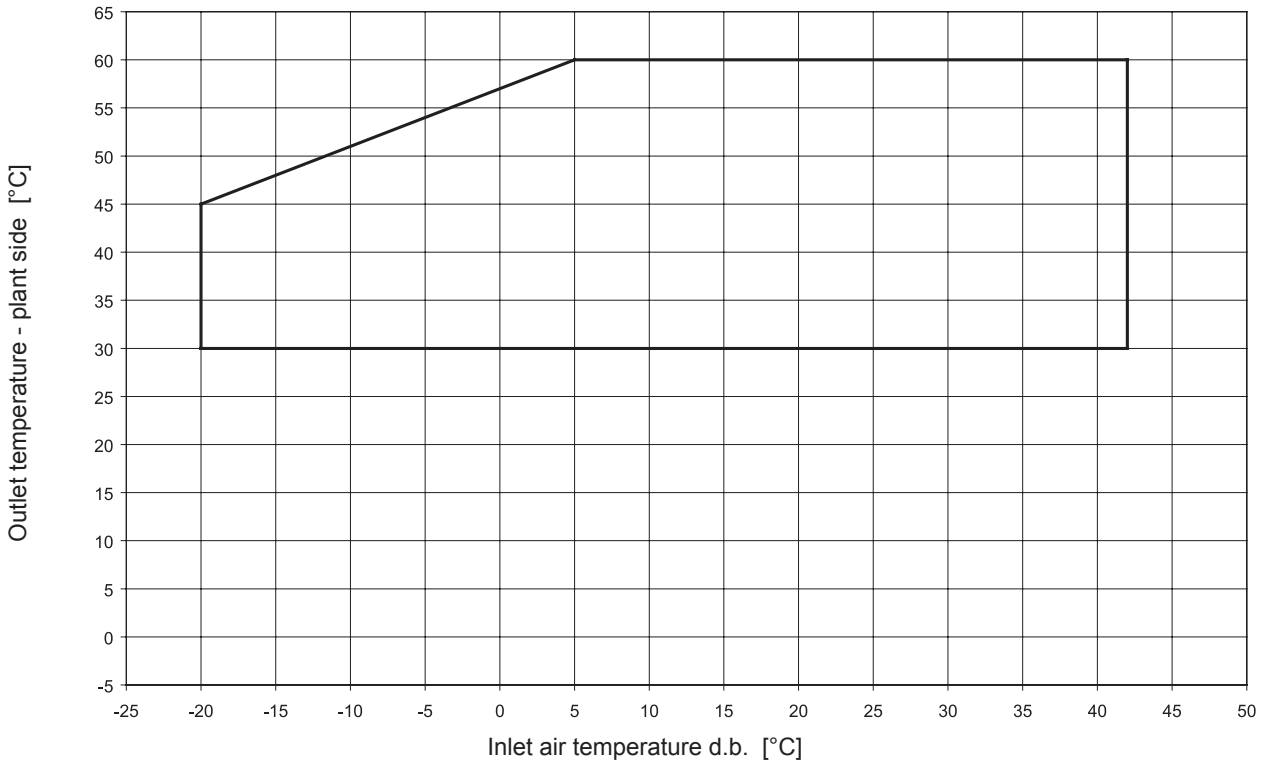
The minimum duct section must guarantee that the medium air velocity does not exceed 2,5 m/s in order to avoid noise problems and to keep the pressure drops as lower as possible.

The graphs are referred to units operating with air at the temperature of 15°C (density 1,2 kg/m³).

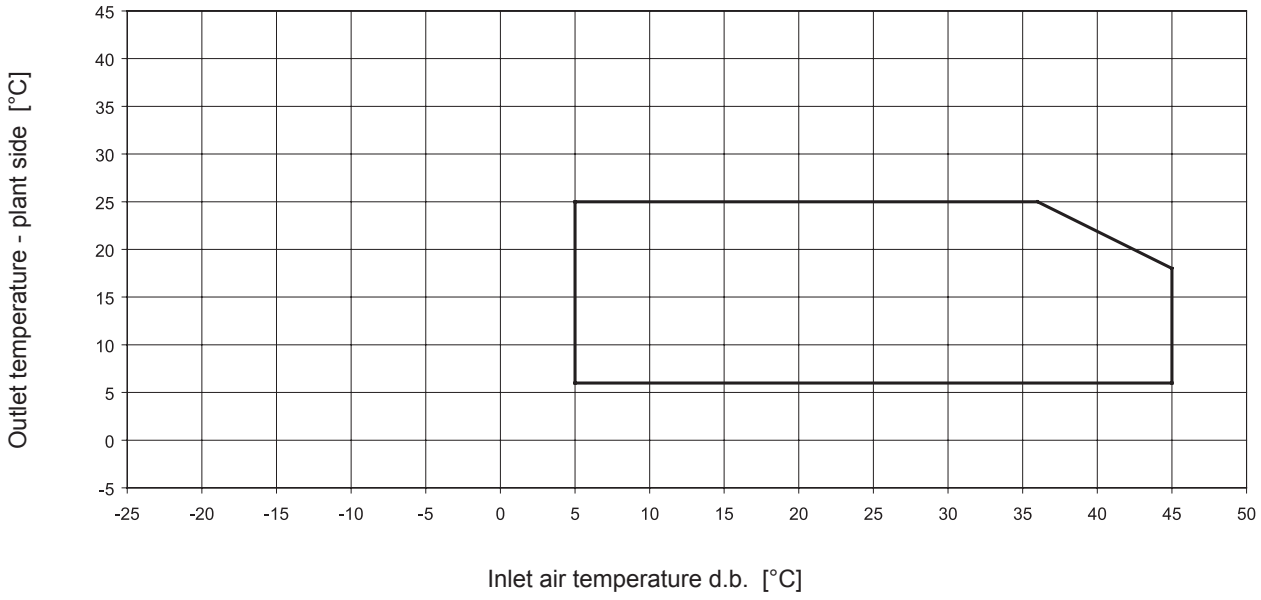
Operating limits

The graphs reported below show the operating area inside which the correct working of the unit is guaranteed.

HEATING



COOLING



Temperature difference between unit inlet and outlet		Plant side	
ΔT max	Maximum value	11	°C
ΔT min	Minimum value	3	°C

TECHNICAL DATA AND PERFORMANCES

Electrical data

Frame		1	2			3		
Model		24.1	27.1	31.1	35.1	40.1	45.1	U.M.
Unit								
Power supply		400-3N-50	400-3N-50	400-3N-50	400-3N-50	400-3N-50	400-3N-50	V-ph-Hz
F.L.A.	Maximum total current input	17,1	19,1	21,2	23,1	31,2	35,3	A
F.L.I.	Maximum total power input	10,8	12,1	13,4	14,6	19,4	22,0	kW
M.I.C.	Maximum total start current	116	132	139	146	165	199	A
	Maximum total start current with soft starter (option)	57	66	70	74	87	107	A
Integrative electrical heaters (option)								
Power supply		230-1-50 400-3N-50	230-1-50 400-3N-50	230-1-50 400-3N-50	230-1-50 400-3N-50	230-1-50 400-3N-50	230-1-50 400-3N-50	V-ph-Hz
F.L.A.	Maximum total current input (230V - 1 - 50Hz)	39,1	78,3	78,3	78,3	78,3	78,3	A
	Maximum total current input (400V - 3N - 50Hz)	13,0	26,0	26,0	26,0	26,0	26,0	A
F.L.I.	Maximum total power input	9,0	18,0	18,0	18,0	18,0	18,0	kW
Plant side pump - standard (option)								
Power supply		230-1-50	230-1-50	230-1-50	230-1-50	230-1-50	230-1-50	V-ph-Hz
F.L.A.	Maximum total current input	3,6	3,6	3,6	3,6	5,1	5,1	A
F.L.I.	Maximum total power input	0,7	0,7	0,7	0,7	1,0	1,0	kW
Plant side pump - high head (option)								
Power supply		230-1-50	230-1-50	230-1-50	230-1-50	230-1-50	230-1-50	V-ph-Hz
F.L.A.	Maximum total current input	6,1	6,1	6,1	6,1	8,2	8,2	A
F.L.I.	Maximum total power input	1,2	1,2	1,2	1,2	1,6	1,6	kW
Plant side pump - high efficiency (option)								
Power supply		230-1-50	230-1-50	230-1-50	230-1-50	230-1-50	230-1-50	V-ph-Hz
F.L.A.	Maximum total current input	0,7	1,6	1,6	1,6	1,6	1,6	A
F.L.I.	Maximum total power input	0,14	0,31	0,31	0,31	0,31	0,31	kW

Noise levels

Unit without accessory “Protection cap” or “Lateral expulsion cap”

Model	Sound power levels [dB] by octave bands [Hz]								Sound power level		Sound pressure level		
											at 1 metre	at 5 metres	at 10 metres
	63	125	250	500	1000	2000	4000	8000	[dB]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]
24.1	84,5	78,8	73,7	72,6	70,7	67,8	62,0	57,0	86	**76**	60	50	44
27.1	84,7	79,0	73,9	72,8	70,9	68,0	62,2	57,2	86	**76**	60	50	44
31.1	85,8	80,1	75,0	73,9	72,0	69,1	63,3	58,3	88	**77**	61	51	45
35.1	85,8	80,1	75,0	73,9	72,0	69,1	63,3	58,3	88	**77**	61	51	45
40.1	86,8	81,1	76,0	74,9	73,0	70,1	64,3	59,3	89	**78**	67	53	47
45.1	86,8	81,1	76,0	74,9	73,0	70,1	64,3	59,3	89	**78**	67	53	47

Reference conditions
Performances referred to units operating in heating mode at nominal conditions A7W35.
Unit placed in free field on reflecting surface (directional factor equal to 2).
The sound power level is measured according to ISO 3744 standard.
The sound pressure level is calculated according to ISO 3744 and is referred to a distance of 1 meter from the external surface of the unit.

Unit with accessory “Protection cap” on the air suction side and with accessory “Protecion cap” or “Lateral expulsion cap” on the air expulsion side

Model	Sound power levels [dB] by octave bands [Hz]								Sound power level		Sound pressure level		
											at 1 metre	at 5 metres	at 10 metres
	63	125	250	500	1000	2000	4000	8000	[dB]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]
24.1	81,2	75,5	70,4	69,3	67,4	64,5	58,7	53,7	83	**72**	56	46	41
27.1	81,2	75,5	70,4	69,3	67,4	64,5	58,7	53,7	83	**72**	56	46	41
31.1	82,3	76,6	71,5	70,4	68,5	65,6	59,8	54,8	84	**73**	57	47	42
35.1	82,3	76,6	71,5	70,4	68,5	65,6	59,8	54,8	84	**73**	57	47	42
40.1	83,3	77,6	72,5	71,4	69,5	66,6	60,8	55,8	85	**74**	64	50	44
45.1	83,3	77,6	72,5	71,4	69,5	66,6	60,8	55,8	85	**74**	64	50	44

Reference conditions
Performances referred to units operating in heating mode at nominal conditions A7W35.
Unit placed in free field on reflecting surface (directional factor equal to 2).
The sound power level is measured according to ISO 3744 standard.
The sound pressure level is calculated according to ISO 3744 and is referred to a distance of 1 meter from the external surface of the unit.

Weights

Frame	1	2			3		
Model	**24.1**	**27.1**	**31.1**	**35.1**	**40.1**	**45.1**	U.M.

Components weights

Unit without options			281	350	352	355	414	416	kg
Options	Plant side flow rate management	Standard pump	5	9	9	9	11	11	kg
		High head pump	6	12	12	12	13	13	kg
		High efficiency pump	4	6	6	6	7	7	kg
	Domestic hot water production : 3 way valve		6	6	6	6	7	7	kg
	Integrative electrical heaters		5	10	10	10	11	11	kg
Accessories	Protection cap		16	19	19	19	23	23	kg
	Lateral expulsion cap		10	10	10	10	10	10	kg
	Frontal shutting panel		8	10	10	10	13	13	kg

Transport weights

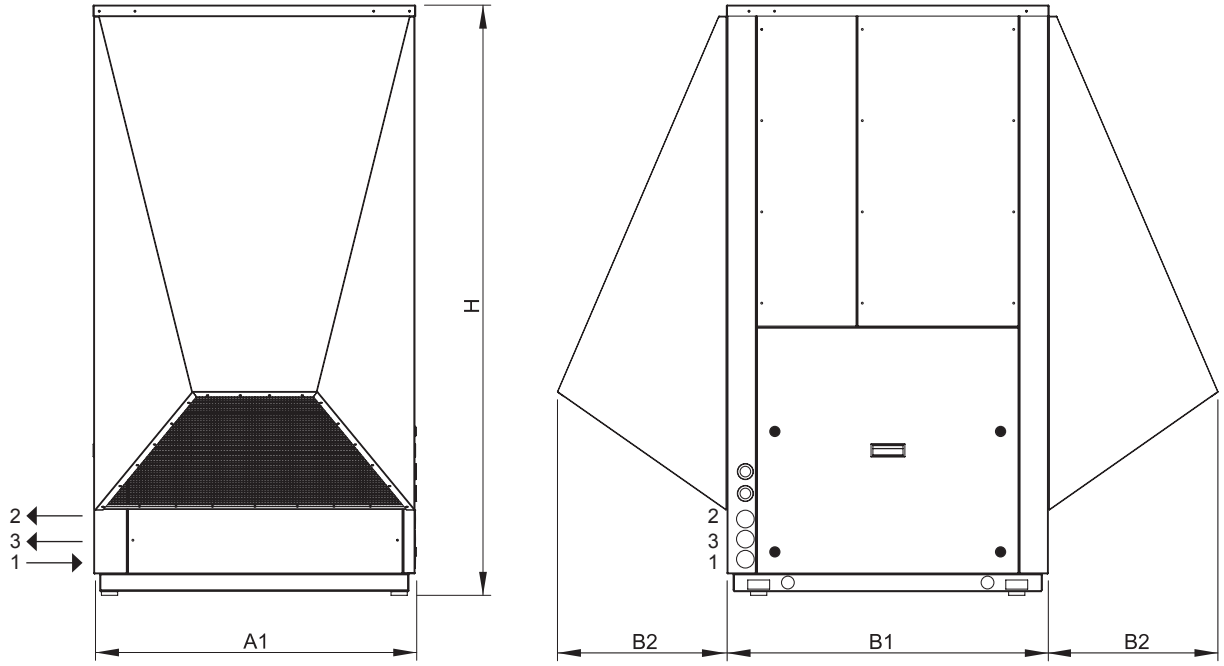
Unit without options			290	361	363	366	429	431	kg
Options	Plant side flow rate management	Standard pump	5	9	9	9	11	11	kg
		High head pump	6	12	12	12	13	13	kg
		High efficiency pump	4	6	6	6	7	7	kg
	Domestic hot water production : 3 way valve		6	6	6	6	7	7	kg
	Integrative electrical heaters		5	10	10	10	11	11	kg
Accessories	Protection cap		25	30	30	30	38	38	kg
	Protection caps (quantity 2)		41	49	49	49	61	61	kg
	Lateral expulsion cap		19	21	21	21	25	25	kg
	Frontal shutting panel		9	11	11	11	14	14	kg

Operating weights

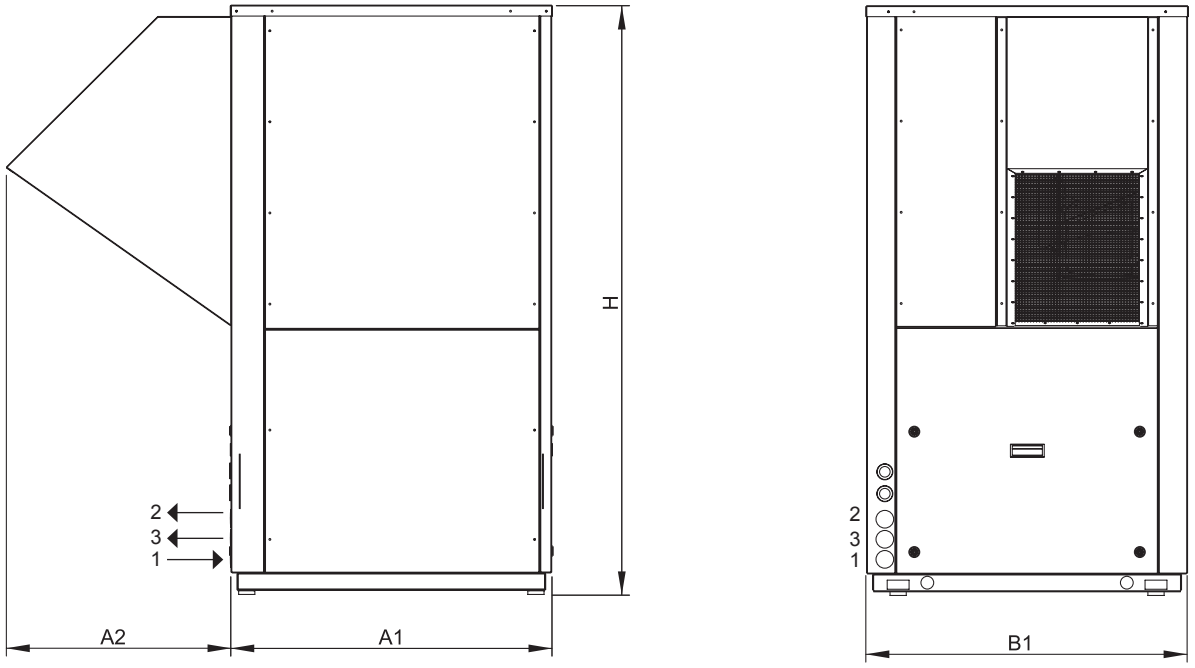
Unit without options			285	355	357	360	424	426	kg
Options	Plant side flow rate management	Standard pump	6	10	10	10	13	13	kg
		High head pump	7	13	13	13	15	15	kg
		High efficiency pump	5	7	7	7	8	8	kg
	Domestic hot water production : 3 way valve		9	9	9	9	10	10	kg
	Integrative electrical heaters		7	14	14	14	15	15	kg
Accessories	Protection cap		16	19	19	19	23	23	kg
	Lateral expulsion cap		10	10	10	10	10	10	kg
	Frontal shutting panel		8	10	10	10	13	13	kg

Overall dimensions

Unit with accessory “Protection cap” on the air suction side and on the air expulsion side



Unit with accessories “Lateral expulsion cap” and “Frontal shutting panel” on the air expulsion side



1	Plant return
2	Plant flow
3	Domestic hot water flow

The accessory “Lateral expulsion cap” can be installed both on the left side or the right side of the unit.

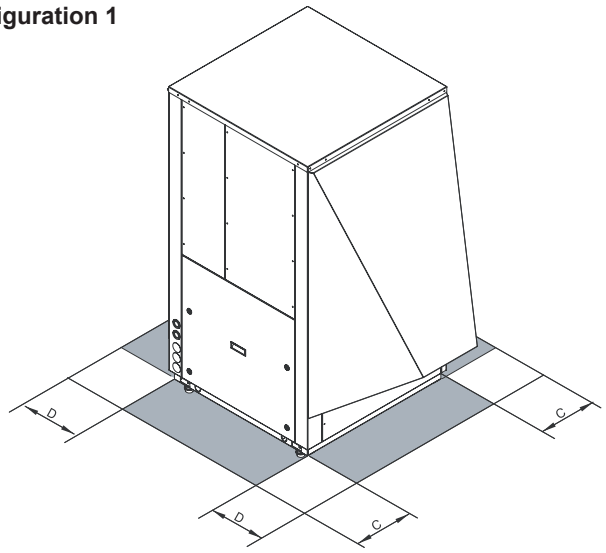
	Frame 1	Frame 2	Frame 3
1	1" 1/4 M	1" 1/4 M	1" 1/4 M
2	1" 1/4 M	1" 1/4 M	1" 1/4 M
3	1" 1/4 M	1" 1/4 M	1" 1/4 M
A1	880 mm	1180 mm	1480 mm
A2	615 mm	615 mm	615 mm
B1	880 mm	880 mm	880 mm
B2	465 mm	465 mm	465 mm
H	1620 mm	1620 mm	1620 mm

Minimum operating area

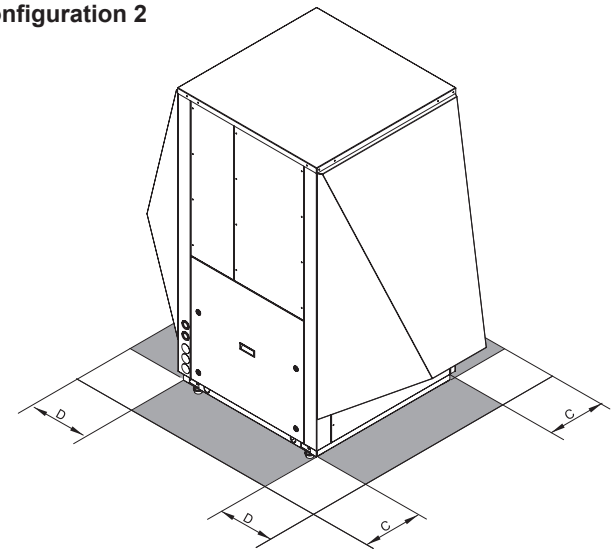
Respect the free area around the unit as shown in figure in order to guarantee a good accessibility and facilitate maintenance and control operations.

C	600 mm
D	600 mm
E	700 mm

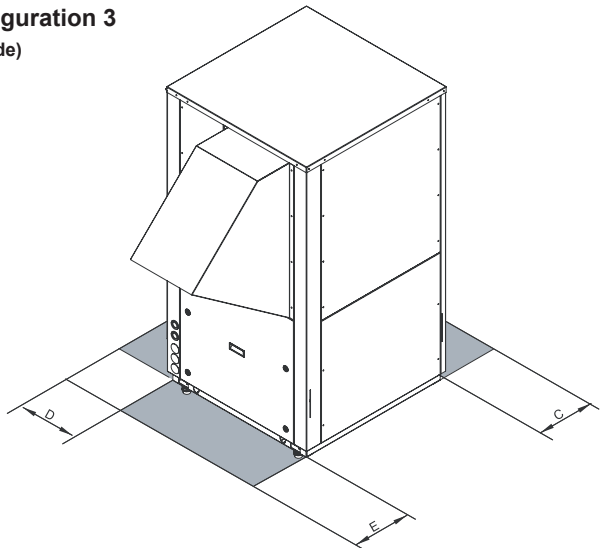
Configuration 1



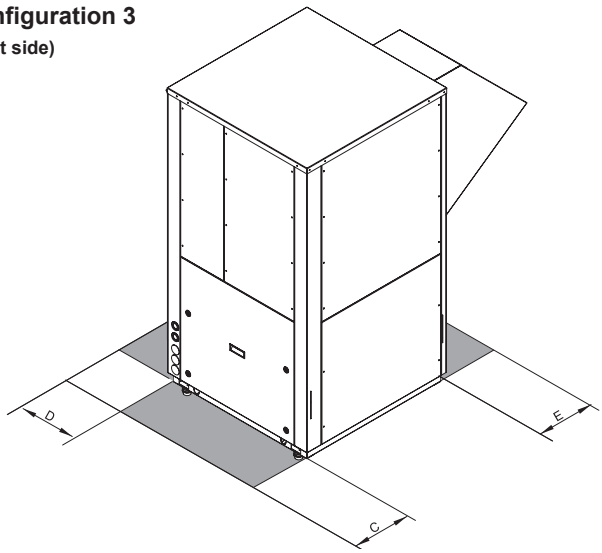
Configuration 2



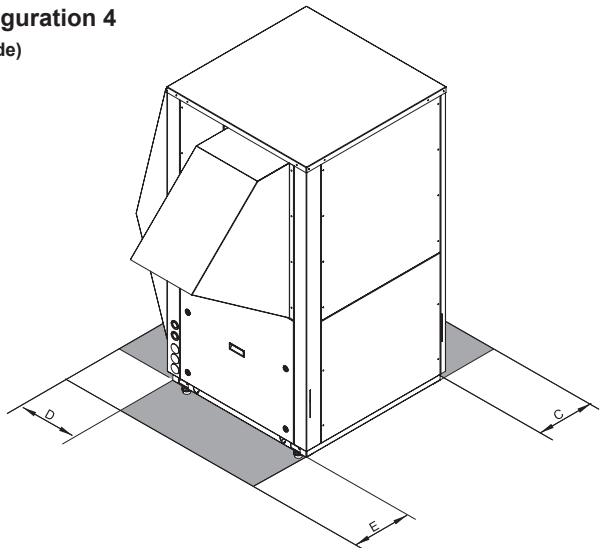
Configuration 3
(left side)



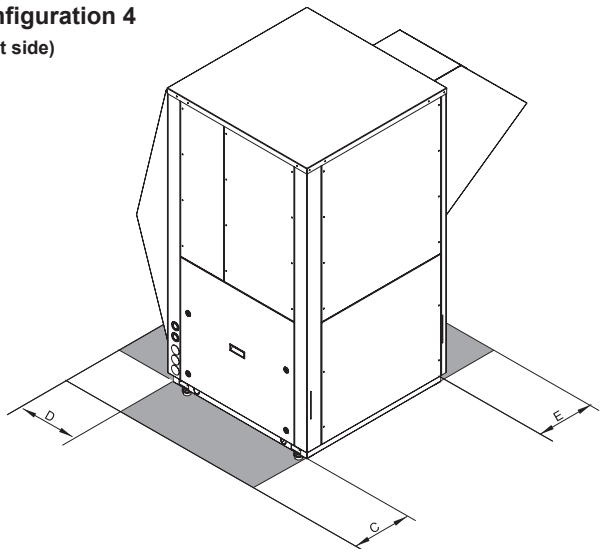
Configuration 3
(right side)



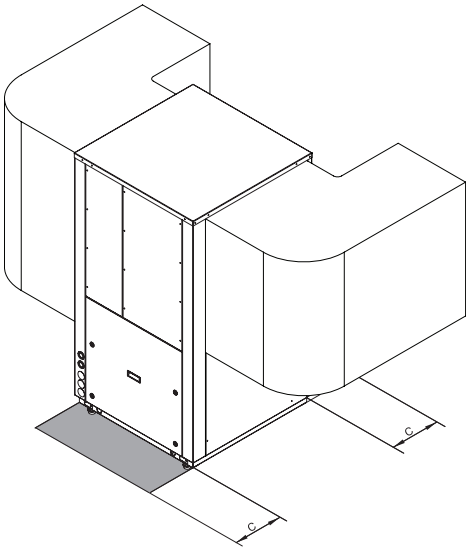
Configuration 4
(left side)



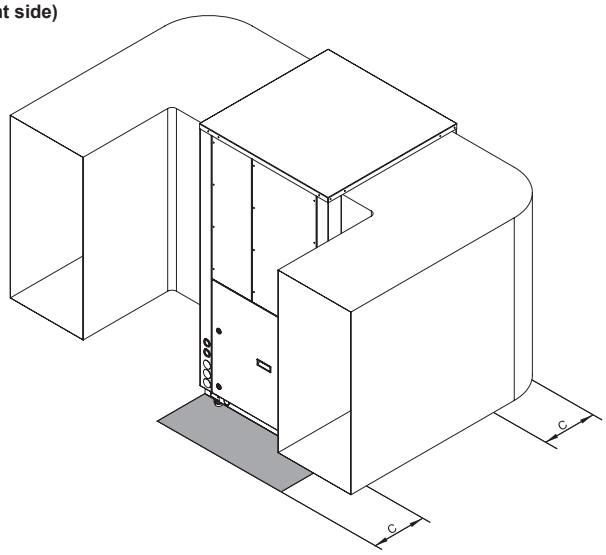
Configuration 4
(right side)



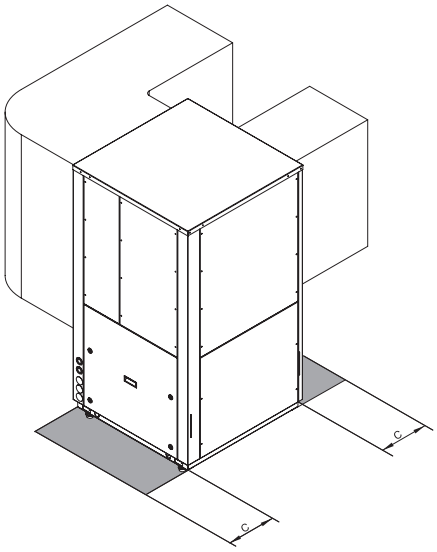
Configuration 5
(left side)



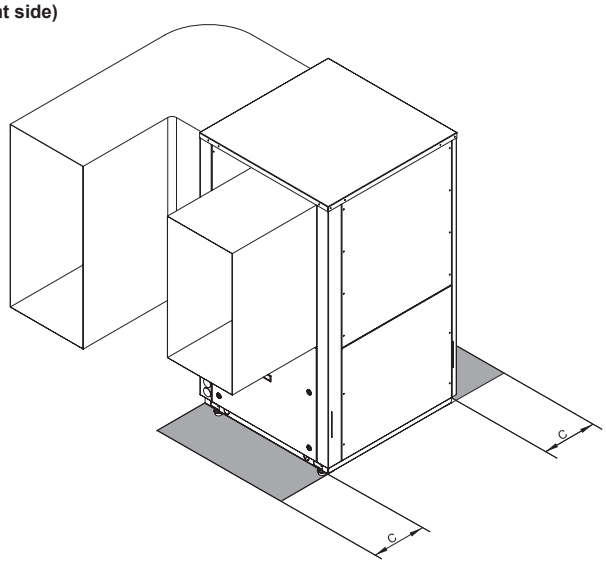
Configuration 5
(right side)



Configuration 6
(left side)



Configuration 6
(right side)



Accessories used to realize the configurations shown above

Type of installation	Configuration	Air suction side	Air expulsion side		
		"Protection cap"	"Protection cap"	"Lateral expulsion cap"	"Frontal shutting panel"
Outdoor	1		x		
	2	x	x		
	3			x	x
	4	x		x	x
Indoor	5				
	6				x

Hydraulic connections

To design properly the hydraulic system respect the local safety regulations in force.

It is always necessary to guarantee an appropriate water flow through the plate heat exchanger of the unit even if is installed, as standard, a differential pressure switch that stops the unit if the water flow rate is too low.

To adjust the water flow rate through the heat exchanger modify the speed of the pump by means of the 3 speed selector (if present). For a more accurate adjustment it is reccomended the installation of a valve on the outlet of the circuit.

It is also reccomended to install a filter on the inlet of each circuit in order to avoid the entrance of foreign substances.

The hydraulic circuit is always equipped with safety valve and expansion vessel. To mantain the circuit under pressure a self-filling group, that automatically fills the circuit, can be installed.

Suggestions for the hydraulic plant realization

Prepare the pipes with the minimum possible number of bends in order to minimize pressure losses, and suitably support them to prevent excessive stresses at the connections of the unit.

Install shut-off valves near the components that need maintenance, to allow their replacement without having to drain the system.

Provide manual or automatic valves in the highest part of the circuit to vent the air.

Make sure there are no leaks before insulating the pipes and filling the system.

In order to avoid condensate generation, insulate all the pipes using steam barrier type material.

Finned coil condensate drainage

The condensate generated by the finned coil in heating mode is collected in the tray placed under the coil and can be drained connecting a pipe to the fitting supplied as standard with all the units.

Expansion vessel setting

The precharge pressure of the expansion vessel must be adequate to the total volume of the hydraulic circuit at which the unit is connected.

The factory setting ($p_{VE\text{-}std}$ = 0,5 bar g) is the minimum value necessary to avoid the presence of zones with a negative relative pressure inside the hydraulic circuit and the risk of pump cavitation, supposing that no parts of the plant are placed at a higher level than the one at which the unit is installed. In that case the precharge pressure must be increased proportionally to the elevation of the highest part of the plant according to the following relation :

$$p_{VE} = p_{VE\text{-}std} + H_{max} / 9{,}81$$

p_{VE} expansion vessel precharge pressure [bar g]

H_{max} elevation of the highest part of the plant referred to the unit installation level [m]

The maximum value of the precharge pressure is equal to the safety valve pressure set.

Increasing the precharge pressure, the maximum plant volume supported by the expansion vessel of the unit is reduced :

$$V_l = V_{VE} \cdot C_e \cdot [\, 1 - (1 + p_{VE}) / (1 + p_{VS}) \,]$$

V_l plant volume supported by the expansion vessel [l]

V_{VE} expansion vessel volume [l]

C_e expansion coefficient

p_{VS} safety valve pressure set [bar g]

If the real plant volume is higher than such calculated volume, it is necessary to install an additional expansion vessel of appropriate volume.

Once the hydraulic circuit has been filled, the pressure at the expansion vessel must be slightly higher than the precharge pressure.

If parts of the plant are placed at a lower level than the one at which the unit is installed, verify that the components can withstand the maximum pressure that can be present.

		Water	Ethylene glycol *(percentage by volume)*				Propylene glycol *(percentage by volume)*			
			10%	20%	30%	40%	10%	20%	30%	40%
Freezing temperature [°C]		0	-3,8	-8,9	-15,7	-24,9	-3,4	-7,4	-13,1	-21,5
C_e	T_{min} = 5°C , T_{max} = 60°C	58,63	47,80	45,24	42,82	40,61	45,47	39,96	35,82	32,88
	T_{min} = 5°C , T_{max} = 45°C	101,46	72,28	68,84	64,77	61,08	69,42	60,41	53,91	49,03
	T_{min} = -10°C , T_{max} = 45°C	-	-	-	51,85	48,57	-	-	42,67	38,50

Electrical connections

The electrical wirings must be carried out by qualified personnel according to the regulations in force at the installation time in the country of installation. Before starting any work on the electrical circuit make sure that the unit power supply line is disconnected at the start.

N.B. Refer to the electrical diagram enclosed in the unit.

Power supply system

The power cables of the heat pump power supply line must be connected to :

- for **single phase** power supply : from a single phase voltage system provided with neutral conductor and separated earth wire :

  V = 230 V ± 10 %

  f = 50 Hz

- for **three phase** power supply : from a symmetrical three phase voltage system provided with neutral conductor and separated earth wire :

  V = 400 V ± 10 %

  f = 50 Hz

The units are shipped completely factory wired and arranged for the connection to the power supply.

The power cables must enter the unit through the holes on the lateral panel and must be connected to the power supply terminals of the unit.

The integrative electrical heaters (option) must be supplied by a dedicated power supply line to be connected to the power supply terminals inside the electrical board of the unit.

Heat pump power supply

The power supply cables must have an adequate section for the power absorbed by the unit and must be chosen in conformity with the regulations in force. Design the power supply line, always referring to the total FLI and FLA values of the unit, taking into account the selected options (except the integrative electrical heaters) and the installed accessories.

Integrative electrical heaters power supply

The power supply cables must have an adequate section for the power absorbed by the only integrative electrical heaters and must be chosen in conformity with the regulations in force.

It is possible to connect the integrative electrical heaters either to a single phase power supply or to a three phase power supply.

For single phase power supply heat pumps, if a three phase power supply is used for the integrative electrical heaters, connecting to the terminal R the same phase used to supply the heat pump, the current absorbed by the electrical heaters on that phase is never added to the current absorbed by the heat pump.

For three phase power supply heat pumps, the integrative electrical heaters power supply connection can be either single phase or three phase without any restriction on the phase connection.

Upstream protection

An automatic switch suitable for ensuring protection against overcurrents and indirect contacts must be installed upstream each power supply line.

Coordination between line switch must be carried out observing the regulations in force on electrical safety, regarding the type of installation and the installation ambient conditions.

Connections available for the user

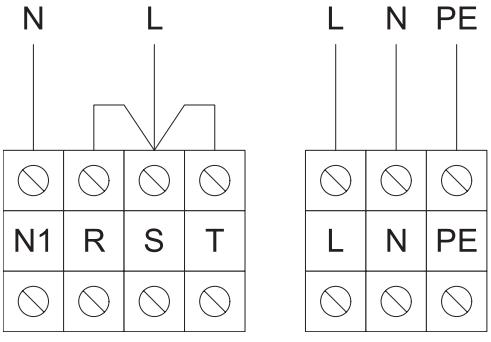
The electrical board of the heat pump contains some terminals dedicated to the connection of temperature probes, humidity probes, pumps, valves ...

Carry out all the necessary connections in order to realize the desired plant following the instructions reported in the section “Inputs and outputs”.

ATTENTION

Carry out all the connections outside the heat pump avoiding the power cables and the probe cables to be coupled.

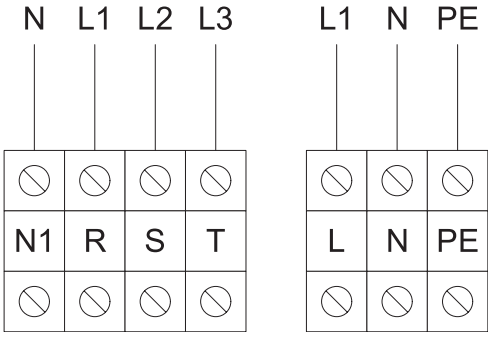
Integrative electrical heaters connection with **single phase** power supply



Integrative electrical heaters

Single phase heat pump

Integrative electrical heaters connection with **three phase** power supply



Integrative electrical heaters

Single phase heat pump

RECEIVING AND POSITIONING

Receiving

Check on receiving
As soon as the unit is received verify accurately the correspondance of the load to what was ordered to make sure that all the material has been delivered. Check carefully that the load has not been damaged. In case of goods with visible damages inform promptly the haulage contractor reporting on the delivery note the phrase **"Collected with reserves owing to evident damage"**. Delivery ex works implies reimbursement of any damage on charge of the insurance company as established by law.

Safety instructions
Observe the safety regulations in force concerning the equipment to use for unit handling or the operating formalities to follow.

Handling
Before handling the unit, check the weight of the unit, reported both on the dataplate and on the technical documentation. Make sure the unit to be handled with care avoiding any kind of collision that could damage the operating parts of the unit.
On the packaging of the unit are reported all the instructions necessary for a corect handling during storing and installation.

The unit is supplied on a pallet suitable for the transport. It is advisable to place protective material between the truck and the unit to avoid damages to the unit. Prevent the unit or parts of it from falling down.

Storing
The units must be stored in a dry place, repaired from sun, rain, sand or wind.
Do not stack the units.

Maximum temperature	=	60 °C
Minimum temperature	=	-20 °C
Humidity	=	90 %

Packaging removal
Remove the packaging taking care not to damage the unit.
Check for any visible damage.
Get rid of the packaging material sending them to specialized recycling centres (observe the regulations in force).

Positioning

The units are suitable for outdoor or indoor installation.
Verify that the support surface can bear the weight of the selected unit and is perfectly horizontal. In order to limit the vibrations transmitted by the unit it is possible to place, between the unit base and the support surface, a strip of hard rubber or, if a higher level of insulation is required, vibration dampers.
In any case it is not advisable to place the unit near private offices, bedrooms or zones where very low noise levels are required.

Protect the finned coil against direct sunlight and prevailing winds and do not place the unit on dark ground (for example tarred surfaces) to avoid the risk of overheating during operation.
Do not place the unit under roofs or near plants (even if the unit is only partly covered) in order not to reduce the possibility of air recirculation.
Respect the minimum operating area and verify that the installation place is not subject to flooding.

Start up

The following operations must be carried out only by properly trained personnel. To make the **contractual warranty** effective, start up **must be carried out by authorized service centres**.
Before calling the service centre it is advisable to make sure that all the installation steps have been completed (positioning, electrical connections, hydraulic connections...).

Preliminary checks before turning on

1. Verify that :
- the unit has not suffered visible damages due to transport or positioning
- the unit is placed on an horizontal surface able to bear its weight
- the minimum operating area are respected
- the ambient conditions comply with the provided operating limits
- the hydraulic and electrical connections has been carried out correctly

2. Disconnect the unit power suply line at the start and make sure that :
- the unit power supply line complies with the regulations in force
- the screws, fastening the electrical cables to the components inside the electrical panel of the unit, are well tightened (vibrations during transport phases could have caused some loosening)

3. Connect the unit power supply line and verify that :
- the voltage of the power supply line complies with the the nominal one of the unit
- for three phase power supply units, the unbalance between the phases is lower than 2% (a higher value produces an excesive current input on one or more phases causing possible damages to the electrical components of the unit)

NOTE. *Example of phase unbalance calculation*

- Read the value of the three line voltages using a voltmeter :
  line voltage between phases L_1 and L_2 : $V_{1-2} = 390$ V
  line voltage between phases L_2 and L_3 : $V_{2-3} = 397$ V
  line voltage between phases L_3 and L_1 : $V_{3-1} = 395$ V
- Calculate the difference between the maximum and minimum value of the measured line voltages :
  $\Delta V_{max} = \max (V_{1-2} ; V_{2-3} ; V_{3-1}) - \min (V_{1-2} ; V_{2-3} ; V_{3-1}) = V_{2-3} - V_{1-2} = 397 - 390 = 7$ V
- Calculate the average line voltage value :
  $\Delta_{average} = (V_{1-2} + V_{2-3} + V_{3-1}) / 3 = (390 + 397 + 395) / 3 = 394$ V
- Calculate the percentage unbalance value :
  $\Delta V_{max} / V_{average} \times 100 = 7 / 394 \times 100 = 1,78\ \% < 2\ \%$

Turning on

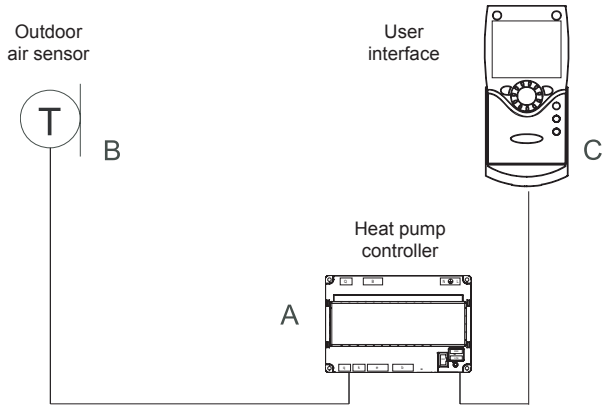
Start all the plant components necessary to guarantee an adequate water flow rate on the plant hydraulic circuit.
Activate the unit in heating or in cooling mode operating on the user interface or on the remote controls and insert a set point suitable to require the unit to work.

Control system configuration

The control system can be configured in different ways in order to adapt itself to the user needs and to the kind of plant managed by the heat pump.

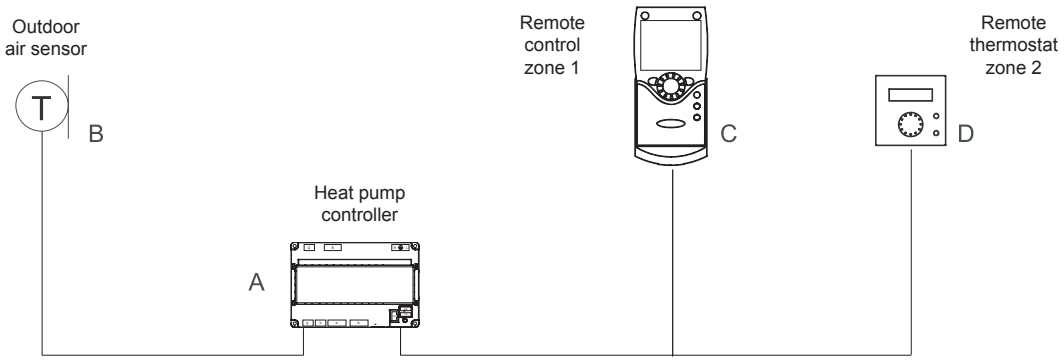
The simpler configuration consists of unit controller (A) and outdoor air temperature sensor (B). Such components are always supplied with the unit and allow to realize a climatic control based only on the outdoor air temperature.

The user interface, necessary to modify set points and operating parameters and to visualize alarm messages, is the remote control (C) to be installed inside the building.

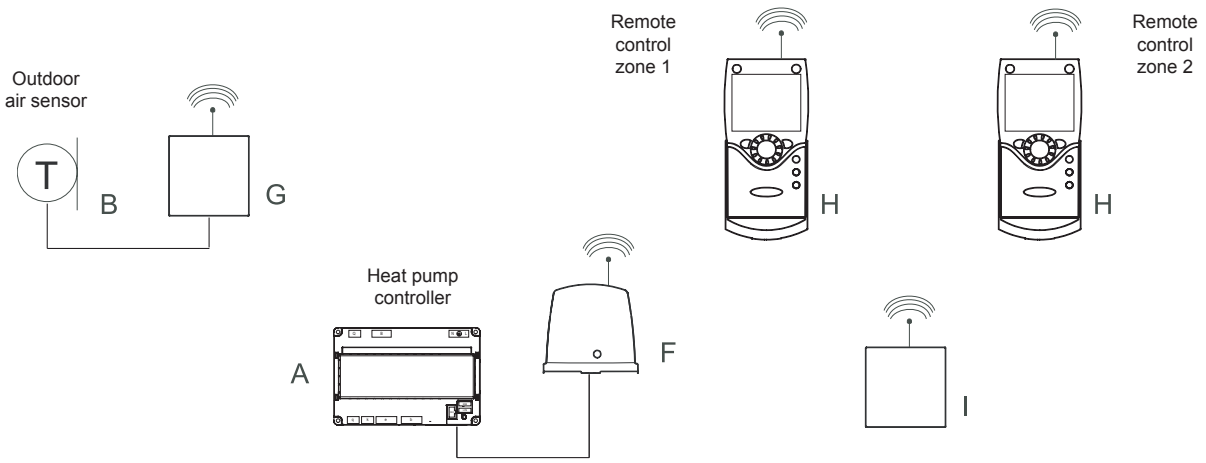


The remote control can be used, besides as user interface, also as room unit for the management of a zone both in heating and in cooling. The temperature sensor contained inside the remote control allows to detect the room temperature and to realize a climatic control based on the outdoor air temperature and on the room temperature.

If the heat pump controller manages a further heating zone, in order to realize a climatic control based on the outdoor air temperature and on the room temperature, it is necessary to add a remote thermostat (D) dedicated to that zone.



The communication between the devices of the control system can be carried out through wired or wireless connections. To realize a wireless network are available, as accessories : wireless transmitter (F) to be connected to the heat pump controller, wireless adaptor for outdoor temperature sensor (G) , wireless remote control (H) and wireless repeater (I) to be used to amplify the signal when the distance between the devices is large.



Heating and cooling circuits

The controller of the heat pump is able to manage up to **two zones** :

- **zone 1** : heating and cooling
- **zone 2** : only heating

The management of further zones, possibile by means of additional zone controllers, is not treated in this manual.

For each zone can be set :

- set point
- daily or weekly operating time table
- climatic curve
- room control sensor

The management of such zonesis performed by means of **three** independent **distribution circuits**.

	Function	Distribution circuit		
Zone 1	Heating and cooling	HC1	Heating circuit 1	mixed
		CC1	Cooling circuit 1	mixed
Zone 2	Heating	HCP	Heating circuit P	NOT mixed

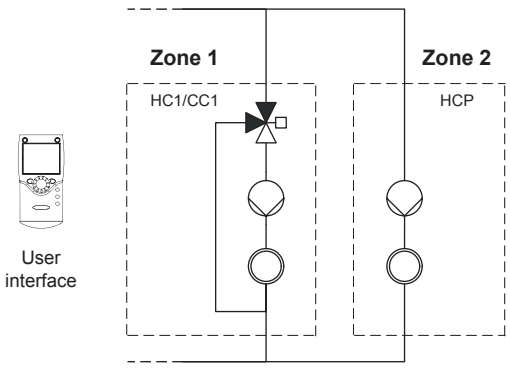
The heating circuit 1 and the cooling circuit 1 control the same plant components (pump and mixing valve). Such circuits can be managed either as unmixed circuits or as mixed circuits (in this case for the mixing valve management the installation of a temperature sensor on the flow of the circuit is necessary).

The management of each zone can be realized by means of :

- **Climatic control based only on the outdoor air temperature**

The room temperature detection is not required. The plant management is realized only through the unit user interface. The flow water temperature of each circuit is calculated by means of independent climatic curves for each distribution circuit.

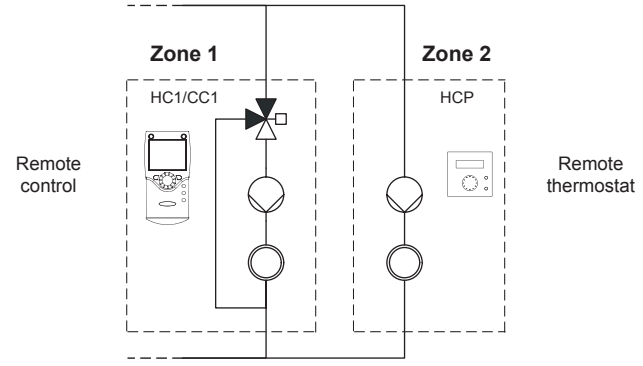
	User interface
40	Operator unit 1
42	HC1 + HCP



- **Climatic control based on the outdoor air temperature and on the room temperature**

A room unit (a remote control or a remote thermostat) is required for each zone in order to detect the room temperature and to modify the flow water temperature of each circuit, calculated according to the climatic curves, with the possibility to define a relative weight to the influence of the outdoor air temperature and of the room temperature.

	Remote control
40	Room unit 1
42	HC1
	Remote thermostat
rU	3 (HCP)

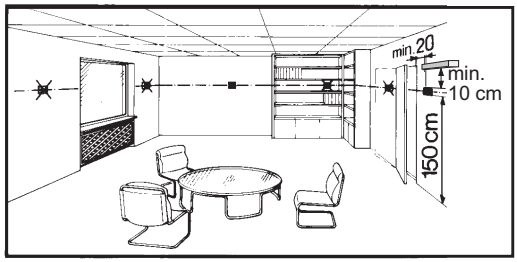


Control system devices installation

REMOTE THERMOSTAT AND REMOTE CONTROL (WIRED OR WIRELESS)

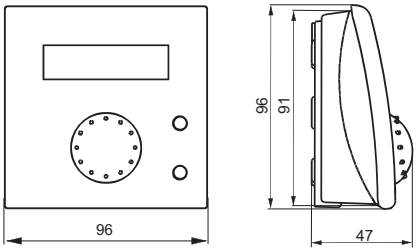
They should be located in the main room of the zone they manage taking into account the following criteria :

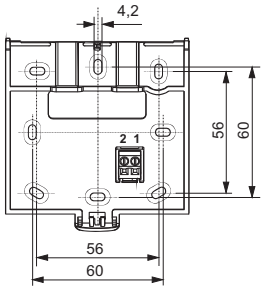
- the place of installation should be chosen so that the sensor can measure the room temperature as accurately as possible without being influenced by the direct solar radiation or by other hot or cold sources (about 1,5 meters above the floor);
- in the case of wall mounting, enough clearance above the device must remain, enabling it to be fitted and removed.

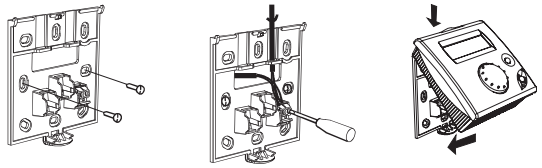


The power supply of the remote thermostat and of the remote control is supplied by the mounting base. When the devices are removed from their base, power is cut off and the devices are out of operation. The wireless remote control is powered by three 1,5 V alkaline batteries type AA (LR06).

Remote thermostat

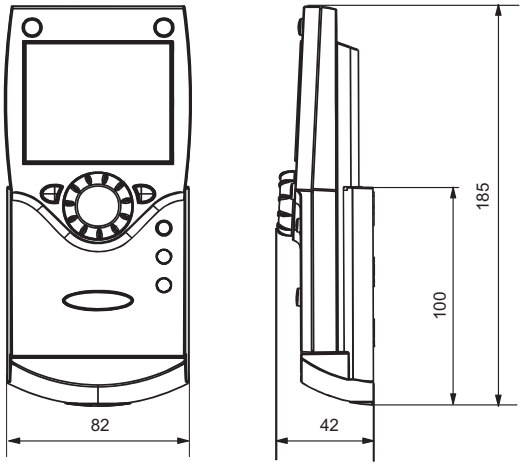


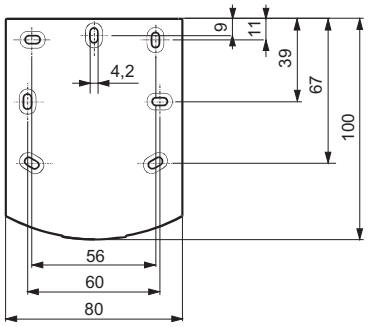


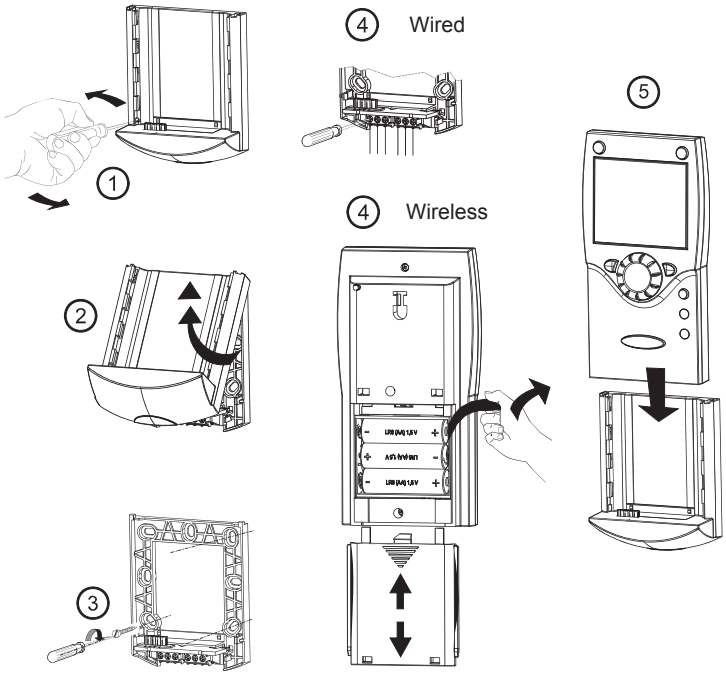


1	CL+	BSB data
2	CL-	BSB ground

Remote control



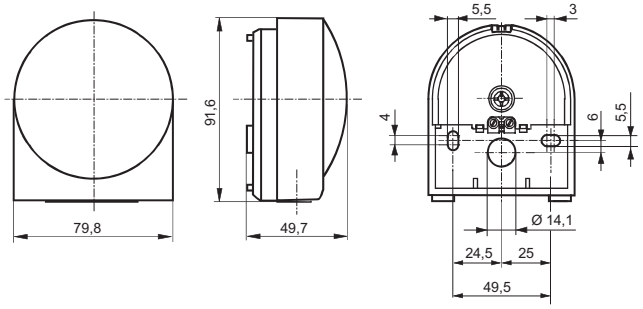


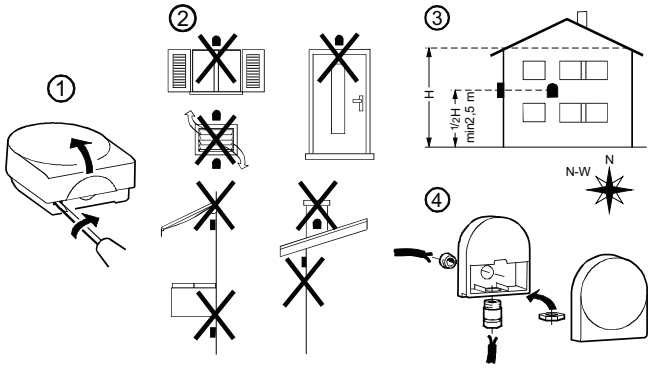


1	CL+	BSB data
2	CL-	BSB ground
3	G+	Power supply

OUTDOOR AIR SENSOR

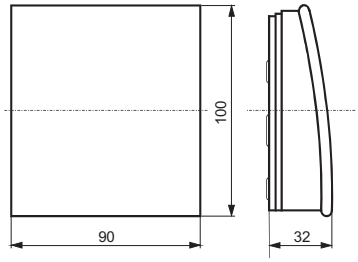
The device must be installed outside the building. The sensor is connected to the controller of the unit or to the wireless adaptor through a two wire cable (the wires are interchangeable).

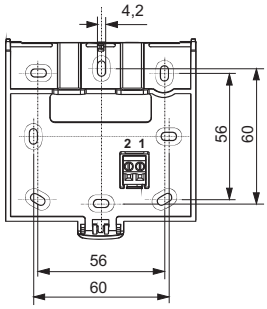


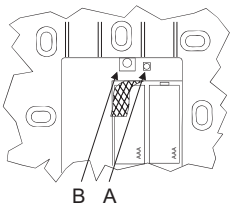


WIRELESS ADAPTOR FOR OUTDOOR TEMPERATURE SENSOR

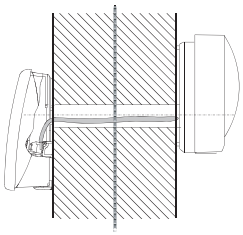
The device must be installed inside the building. The device is powered by two 1,5 V alkaline batteries type AAA (LR03). The outdoor air sensor is connected to the adaptor through a two wire cable (the wires are interchangeable).

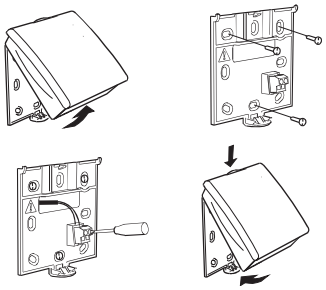






A	LED
B	Button

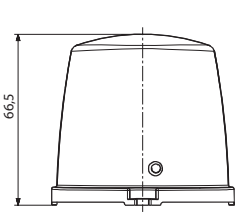


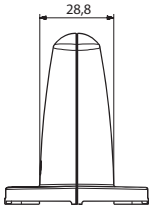


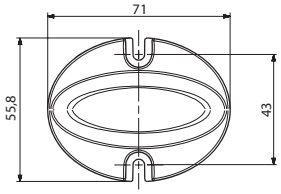
WIRELESS TRANSMITTER

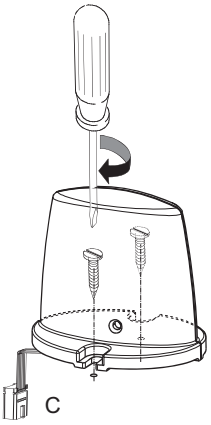
The transmitter must be connected to the X60 terminal of the heat pump controller. Before connecting the transmitter, the controller must be disconnected from power.

Do NOT install the transmitter inside metal casing.

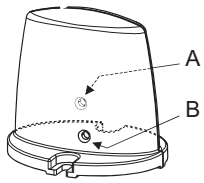






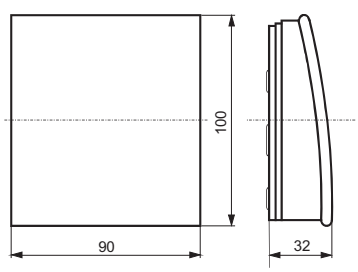


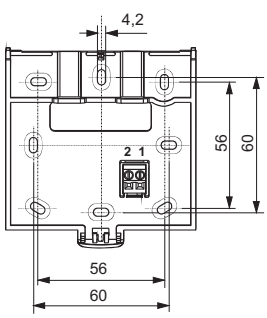
A	LED
B	Button
C	Connector X60

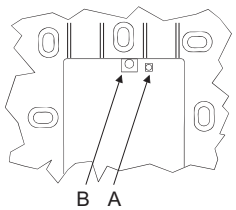


WIRELESS REPEATER

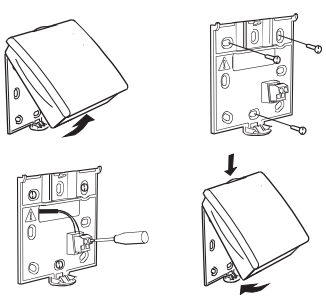
The device must be installed inside the building. The device is powered through the mounting base by the power pack supplied with the device (the wires are interchangeable).







A	LED
B	Button



Wireless devices connection

The wireless devices should be located in such a way that the transmission is as interference free as possible. The following criteria must be observed :

- do not place the devices in the vicinity of electrical cables, strong magnetic fields or equipments as PC, televisions, micro wave ovens...
- do not place the devices near large metal structures or constructional elements with fine meshes as special glass or special concrete;
- the distance of the devices from the transmitter should not exceed 30 meters or 2 floors.

In order to fulfill the connection two stages are necessary.

Connection establishment : wireless devices are connected to the controller of the heat pump. This stage must be done before installing the devices so that all the parts are within easy reach.

Connection test : the signal quality is checked. The devices must be already installed in their final position. If the test fails it's necessary to modify the position of the devices or to add a wireless repeater in order to extend wireless operating range.

WIRELESS REMOTE CONTROLLER

Connection establishment

Verify if the wireless transmitter is connected to the heat pump controller and that the controller is powered.
Verify if the batteries of the wireless remote controller are properly installed.
Press the button on the wireless transmitter for at least 8 seconds. The led starts blinking at high frequency.
Press the OK button on the wireless remote controller to enter the menu PROGRAMMING.
Press the INFO button for at least 3 seconds, select the operating level COMMISSIONING and press OK.
Select the menu WIRELESS and press OK.
Set the parameter 40 "USED AS" according to the use of the component and press OK.
Select YES with the knob and press OK.
The process of opening the connection is started. The display shows the progress of opening the connection in %. The process can take 2 to 120 seconds.
The connection is established when "DEVICE READY" appears and the led on the wireless transmitter extinguishes.

Connection test

Press the OK button on the wireless remote controller to enter the menu PROGRAMMING.
Press the INFO button for at least 3 seconds, select the operating level COMMISSIONING and press OK.
Select the menu WIRELESS and press OK.
Set the parameter 121 "TEST MODE" as ON and press OK.
The digits on the left show the telegrams sent, the digits on the right the telegrams received. The test will be ended after 24 telegrams. The test is considered successful when at least 50% of the telegrams sent have been received.

WIRELESS ADAPTOR FOR OUTDOOR TEMPERATURE SENSOR

Connection establishment

Verify if the wireless transmitter is connected to the heat pump controller and that the controller is powered.
Verify if the batteries of the wireless adaptor are properly installed.
Press the button on the wireless transmitter for at least 8 seconds. The led starts blinking at high frequency.
Press the button on the wireless adaptor for at least 8 seconds. Also the led on the adaptor starts blinking at high frequency.
The connection is established when the led on the wireless transmitter extinguishes.
Press briefly the button on the wireless adaptor until also the led on the wireless adaptor extinguishes.

Connection test

Press the button on the wireless adaptor for a maximum of 8 seconds. The led on the adaptor starts blinking at low frequency.
If the connection works correctly the led on the wireless transmitter flashes briefly at 10 second intervals.
After the test press briefly the button on the wireless adaptor until the led on the adaptor extinguishes.
The test can be aborted pressing the ESC button.

WIRELESS REPEATER

Connection establishment

Verify if the wireless transmitter is connected to the heat pump controller and that the controller is powered.
Verify if the wireless repeater is properly powered.
Press the button on the wireless transmitter for at least 8 seconds. The led starts blinking at high frequency.
Press the button on the wireless repeater until also the led on the repeater starts blinking at high frequency.
The connection is established when the led on the wireless transmitter extinguishes.
Press briefly the button on the wireless repeater until also the led on the wireless repeater extinguishes.

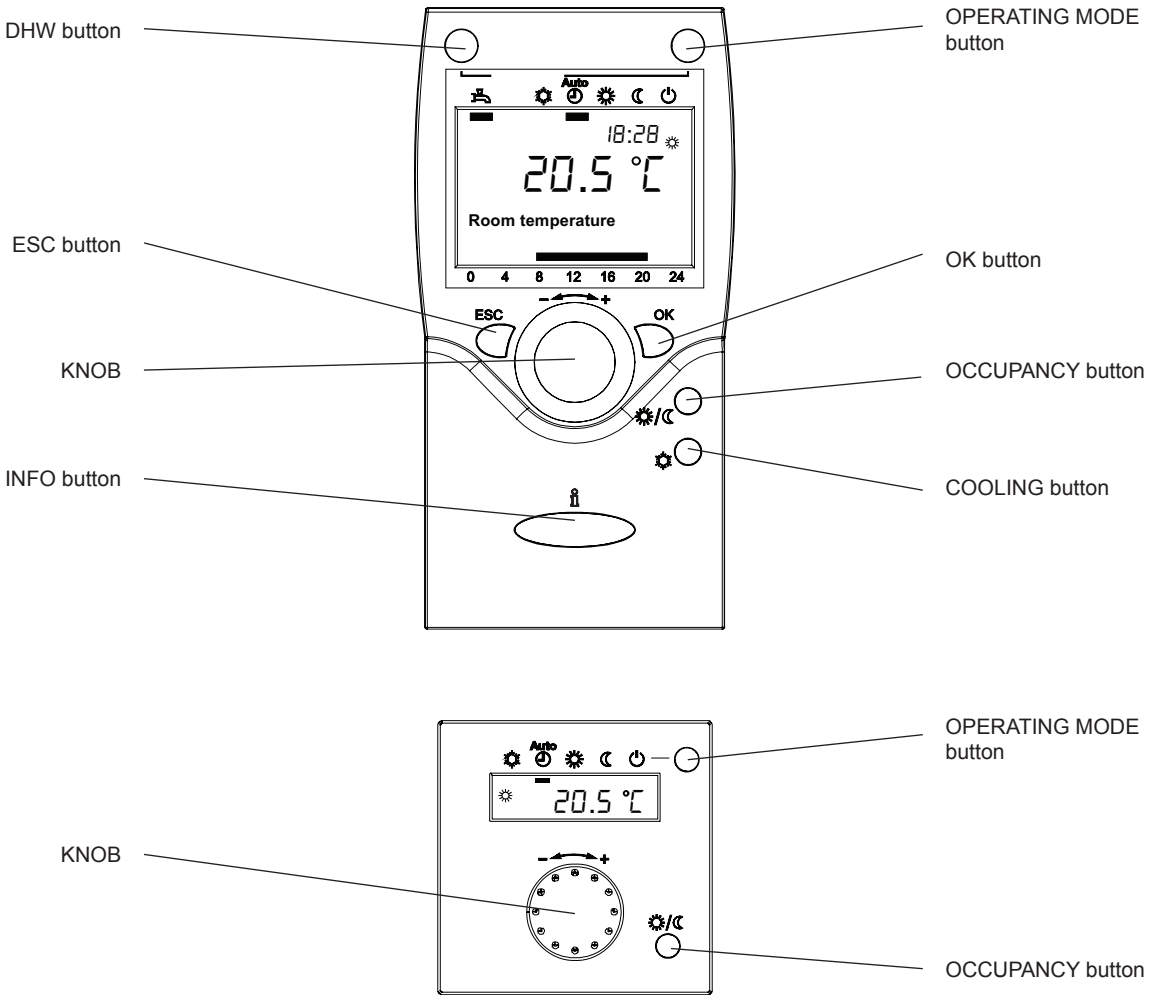
Connection test

Press the button on the wireless repeater for a maximum of 8 seconds. The led on the repeater starts blinking at low frequency.
If the connection works correctly the led on the wireless transmitter flashes briefly at 10 second intervals.
After the test press briefly the button on the wireless repeater until the led on the repeater extinguishes.
The test can be aborted pressing the ESC button.

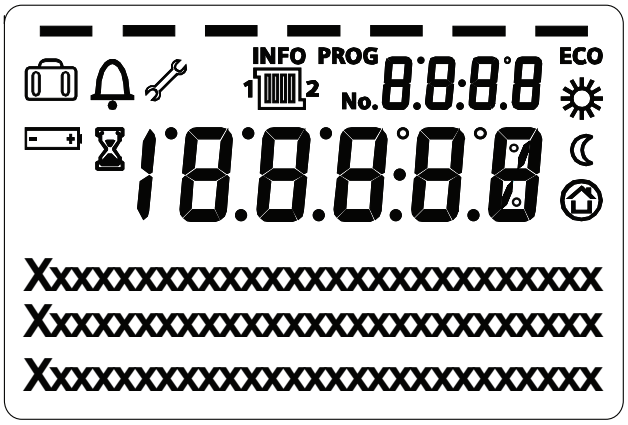
Control system use

The remote control (wired or wireless) allows the complete control of the system permitting to visualize and modify all the operating parameters of the unit and is equipped with a temperature sensor to measure the room temperature of the zone that it manages.

Also the remote thermostat contains a temperature sensor to measure the room temperature but allows the access to a limited number of functions.



USER INTERFACE AND REMOTE CONTROL DISPLAY



REMOTE THERMOSTAT DISPLAY

Heating : Comfort set point

Heating : Reduced set point

Heating : Frost Protection set point

Cooling : Comfort set point

Wait

Change batteries

Holiday function active

Reference to heating circuit

Alarm message

Maintenance messages

INFO Info level

PROG Programming level

ECO ECO functions active

OPERATING MODE button
Allows to select the active heating mode (indicated by a bar under the corresponding symbol).

Auto

Heating mode **Automatic**
- room temperature controlled according to the set time table (switching between Comfort and Reduced set point)
- protective functions active
- ECO functions active (automatic summer/winter changeover and automatic 24 hour heating limit)

Heating mode **Comfort**
- room temperature controlled according to Comfort set point
- protective functions active
- ECO functions not active (automatic summer/winter changeover and automatic 24 hour heating limit)

Heating mode **Reduced**
- room temperature controlled according to Reduced set point
- protective functions active
- ECO functions active (automatic summer/winter changeover and automatic 24 hour heating limit)

Heating mode **Frost Protection**
- room temperature controlled according to Frost Protection set point
- protective functions active
- ECO functions active (automatic summer/winter changeover and automatic 24 hour heating limit)

COOLING button
Allows to select the cooling mode (indicated by a bar under the corresponding symbol).

Cooling mode **Automatic**
- room temperature controlled according to the set time table (switching between Comfort set point and OFF)
- protective functions active
- cooling enabled according to the outdoor temperature

Cooling mode **OFF**
- protective functions active

DHW button
Allows to select the domestic hot water heating mode (indicated by a bar under the corresponding symbol).

Domestic hot water heating mode **ON**

- domestic hot water temperature controlled according to the set time table
- protective functions active

Domestic hot water heating mode **OFF**

- protective functions active

Domestic hot water heating mode **FORCED**
Pressing for at least 3 seconds the DHW button the domestic hot water tank forced charging function is activated.

RESET button
Permette di cancellare messaggi di errore pendenti e di ignorare i ritardi previsti alla partenza evitando tempi di attesa indesiderati durante l'installazione o la ricerca di guasti. Questa funzione NON dovrebbe essere utilizzata nel normale funzionamento.

OCCUPANCY button
When a room is not used for a short period of time, pressing the OCCUPANCY button is possible to lower the room temperature in order to save energy. When the room is occupied again, pressing again the OCCUPANCY button, normal operation is restored.
The function is active only in automatic heating mode or in automatic cooling mode :

- in heating : changeover from Comfort heating to Reduced heating
- in cooling : changeover from Comfort cooling to cooling OFF

The function remains active until the next operating mode change set through the time table program.

KNOB
Allows to modify the Comfort set point (in heating or in cooling according to the active operating mode). Press the OK button to confirm.
Allows moreover to select the different parameters inside the menu and to select the values of each parameter.

INFO button
Pressing the INFO button various informations about the operating status of the system can be displayed. The list of informations changes according to the type of unit, the plant configuration and the active operating mode.
When error or maintenance messages are displayed, pressing the INFO button further details about the event are provided.

ECO FUNCTIONS

Automatic summer/winter changeover
This function is used to switch on or off the heating mode in the course of the year according to the outdoor air temperature. It is possible to extend or to shorten the period of time during which the heating mode is active modifying the threshold of the outdoor air temperature at which the changeover takes place.
The threshold set is independent for each circuit (parameter 730 for heating circuit 1, parameter 1330 for heating circuit P). Increasing the threshold the heating mode will be switched on earlier and switched off later. To take into account the building thermal inertia the outdoor temperature is attenauted.

Automatic 24 hour heating limit
This function is used to switch on or off the heating mode in the course of the day according to the outdoor air temperature. This function allows, in the intermediate seasons (spring and autumn), to respond to sudden changes of the outdoor air temperature.
It is possible to extend or to shorten the period of time during which the heating mode is active modifying the temperature threshold at which the changeover takes place. The threshold is calculated adding to the Comfort set point a differential. The differential set is independent for each circuit (parameter 732 for heating circuit 1, parameter 1332 for heating circuit P). Increasing the differential the heating mode will be switched on earlier and switched off later.
To take into account the building thermal inertia the outdoor temperature is attenauted.

Control system programming

The settings that can not be modified directly through the buttons of the user interface and of the remote controls are accessible through the programming parameters, grouped inside the various programming menus. The menus concerning functions which are not active are automatically hidden.
It is possible to enter the programming menus with different user names. Each user has different authorizations concerning the possibility to visualize and modify the parameters :

- **End user E**
- **Commissioning I**
- **Heating engineer F**

The programming menus are accessible only through the user interface and the remote control.

To enter the programming menus :
- return to the main display (from whatever position press repeatedly the ESC button)
- press the OK button
- press the INFO button for at least 3 seconds
- select the user name with the knob and press the OK button
- select the desired menu and press OK

To modify the parameters inside the menus :
- select the desired parameter with the knob
- press the OK button to modify the parameter
- select the new value with the knob
- press the OK button to confirm the new value or the ESC button to cancel

Menu structure

Menu	Level	Parameter	Function
Hour and date	E	1	Hour / minutes
	E	2	Day / Month
	E	3	Year
Operator section	E	20	Language
Time table 1 Heating circuit 1	E	500	Preselection
	E	501	Phase 1 on
	E	502	Phase 1 off
	E	503	Phase 2 on
	E	504	Phase 2 off
	E	505	Phase 3 on
	E	506	Phase 3 off
	E	516	Default values
Time table 3 Heating circuit P	E	540	Preselection
	E	541	Phase 1 on
	E	542	Phase 1 off
	E	543	Phase 2 on
	E	544	Phase 2 off
	E	545	Phase 3 on
	E	546	Phase 3 off
	E	556	Default values
Time table 4 Domestic hot water	E	560	Preselection
	E	561	Phase 1 on
	E	562	Phase 1 off
	E	563	Phase 2 on
	E	564	Phase 2 off
	E	565	Phase 3 on
	E	566	Phase 3 off
	E	576	Default values

Menu	Level	Parameter	Function
Time table 5 Cooling circuit 1	E	600	Preselection
	E	601	Phase 1 on
	E	602	Phase 1 off
	E	603	Phase 2 on
	E	604	Phase 2 off
	E	605	Phase 3 on
	E	606	Phase 3 off
	E	616	Default values
Holidays program Heating circuit 1	E	642	Start
	E	643	End
	E	648	Operating level
Holidays program Heating circuit P	E	662	Start
	E	663	End
	E	668	Operating level
Heating circuit 1	E	710	Comfort set point
	E	712	Reduced set point
	E	714	Frost Protection set point
	E	720	Climatic curve slope
	E	730	Summer/winter changeover temperature
Cooling circuit 1	E	901	Operating mode
	E	902	Comfort set point
	E	907	Release
Heating circuit P	E	1300	Operating mode
	E	1310	Comfort set point
	E	1312	Reduced set point
	E	1314	Frost Protection set point
	E	1320	Climatic curve slope
	E	1330	Summer/winter changeover temperature
Domestic hot water	E	1610	Nominal set point
	E	1612	Reduced set point
Service Special operations	E	7120	Economy mode
	E	7141	Emergency operation
Diagnostic heat source	E	8410	Heat pump return temperature
	E	8411	Set point heat pump return temperature
	E	8412	Heat pump flow temperature
	E	8427	Source return temperature
	E	8429	Source flow temperature
Diagnostic consumers	E	8700	Outdoor temperature
	E	8701	Minimum outdoor temperature
	E	8702	Maximum outdoor temperature
	E	8740	Room temperature heating circuit 1
	E	8741	Set point room temperature heating circuit 1
	E	8743	Flow temperature heating circuit 1
	E	8744	Set point flow temperature heating circuit 1
	E	8756	Flow temperature cooling circuit 1
	E	8757	Set point flow temperature cooling circuit 1
	E	8800	Room temperature heating circuit P
	E	8801	Set point room temperature heating circuit P
	E	8803	Set point flow temperature heating circuit P
	E	8830	Temperature 1 Domestic Hot Water
	E	8831	Set point Domestic Hot Water temperature
	E	8980	Temperature 1 Buffer
	E	8981	Set point Buffer temperature
	E	8982	Temperature 2 Buffer
	E	9031	Relay output QX1
	E	9032	Relay output QX2
	E	9033	Relay output QX3
	E	9034	Relay output QX4
	E	9035	Relay output QX5
	E	9036	Relay output QX6

Remote thermostat programming

The configuration parameters of the remote thermostat must be set on the device itself.
A long press (longer than 3 seconds) on the OCCUPANCY button allows to enter the Programming menu from which is possible to modify the parameters listed in the table.
When a parameter is selected the current value blinks. Use the knob to adjust the value of the parameter. Press briefly the OCCUPANCY button to select the following parameter.
Press the HEATING button to escape from the Programming menu.

Parameter	Function
rU	Remote thermostat used as rU = 1 management heating circuit 1 rU = 3 management heating circuit P
P1	SSave settings P1 = 1 save pressing HEATING button or for timeout P1 = 2 save pressing HEATING button
P2	Operation lock P2 = 0 lock disabled P2 = 1 all the buttons are locked (access to Programming menu granted)

Remote control (wired o wireless) programming

The configuration parameters of the remote control must be set on the device itself. Entering the “Operator section” menu it is possible to adjust the parameters listed in the table.

Menu	Level	Parameter	Function
Operator section	E	20	Language
	F	22	Informations
	F	26	Operation lock
	F	27	Programming lock
	I	28	Save settings
	I	40	Renote control use
	I	42	Heating circuits assignment
	I	46	Operation heating circuit P
	I	48	Action OCCUPANCY button
	F	54	Room temperature sensor offset

For details on the settings of parameters 40, 42, 44 and 46 see paragraph “Heating and cooling circuits”.
The room temperature sensor contained inside the remote control can be calibrated adding an offset (parmeter 54) to the value read.

Functions available for the user

Hour, date and language setting

In order to set hour and date enter the “Hour and date” menu and modify the parameters 1, 2 and 3. It is possible to select the desired language for the user interface and for each remote control through the “Operator section” menu (parameter 20).

Time tables setting

When the selected operating mode is “Automatic”, the circuits are activated according to the set time tables.
It is possible to set the time table independently for each circuit (heating circuit 1, heating circuit P, domestic hot water circuit, cooling circuit 1).

For the cooling circuit 1 it is possible to select, through the parameter 907, whether :

- keep the circuit always activated (24 hour per day)
- activate the circuit according to time table 5
- activate the circuit according to heating circuit 1 time table

For each time table it is possible to specify the program to use in the different days of the week :

- daily (a different program for each day of the week)
- weekly (same program for all the days of the week)
- week end (a program from Monday to Friday and another program from Saturday to Sunday)

For each program it is possible to specify 3 different operating phases per day (6 switch on or switch off events per day).

Holidays setting

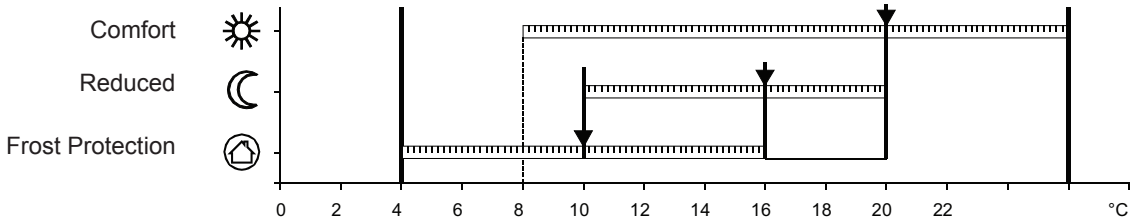
It is possible to set a holidays period for the heating circuit 1 and for the heating circuit P.
For each period it is possible to specify the start and the end date and the set point to be adopted during the holidays period.

Operating mode selection for heating and cooling circuits

Heating circuit 1 : through the Heating button on the remote control
Heating circuit P : through the Heating button on the remote thermostat
Cooling circuit 1 : through the Cooling button on the remote control or through the parameter 901

Set point setting

For each heating circuit 3 set points can be set : Comfort, Reduced and Frost Protecion.
For each cooling circuit only one set point can be set : Comfort.
The set points of the heating circuits are related one each other : the Comfort set point can not be lower than the Reduced set point, the Reduced set point can not be lower than the Frost Protection set point and the Frost Protection set point can not be lower than 4°C.

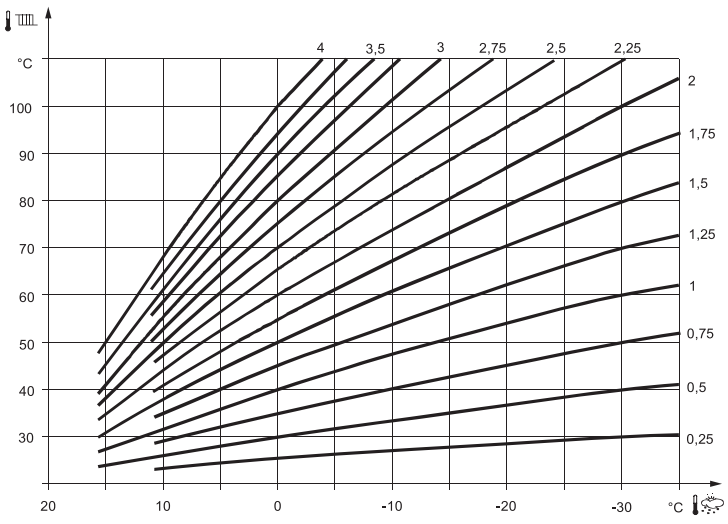


All the set points can be adjusted through the parameters.
The Comfort set points of the heating circuit 1 and of the cooling circuit 1 can also be adjusted by means of the knob of the user interface.
The Comfort set point of each circuit can also be adjusted by means of the knob of the remote control or of the remote thermostat assigned to that circuit (if present).

	Heating circuit 1	Heating circuit P	Cooling circuit 1
Comfort set point	parameter 710	parameter 1310	parameter 902
Reduced set point	parameter 712	parameter 1312	-
Frost Protection set point	parameter 714	parameter 1314	-
Maximum Comfort set point	parameter 716	parameter 1316	40 °C
Minimum Comfort set point	-	-	15 °C

Heating circuits climatic curves setting

The climatic curves allow to calculate the flow temperature set point of each circuit according to the outdoor air temperature in order to keep the room temperature as near as possible to the set value.
The curves are referred to a room set point of 20°C . If the set point is modified, the curve automatically change to adapt themselves to the new value.
It is possible to modify the parameters of the climatic curves in order to fit the features of the plant and of the building.
The higher the slope of the curve, the higher is the change of the flow temperature set point for low values of the outdoor air temperature.
If the room temperature is correct for high outdoor air temperature but is lower than the set point for low outdoor air temperature, the slope of the curve must be increased and vice versa.
If on the other hand the room temperature is always lower or higher than the set point the curve must be translated without modifying its slope.



	Heating circuit 1	Heating circuit P
Climatic curve slope	parameter 720	parameter 1320
Climatic curve displacement	parameter 721	parameter 1321

Heating integration with external heating source

It is possible to manage the activation of an external heating source to integrate the heating capacity supplied by the heat pump. The external source can be enabled only when the outdoor temperature is lower than a fixed limit (parameter 3700) in order to realize a bivalent operation.

Inputs and outputs

The following table shows the list of the inputs and outputs available on the controller of the heat pump along with the expected use. Some inputs and outputs can be configured in a different way by the user in order to manage other plant components which are not contained inside the heat pump.

	ID	Use	Description	Features	Available for the user
Inputs	B9	B9	outdoor air temperature	temperature sensor NTC 1K	
	B91	B91	source heat exchanger inlet temperature (finned coil inlet)	temperature sensor NTC 10K	
	B84	B84	liquid line temperature	temperature sensor NTC 10K	
	BX1	B21	plant heat exchanger outlet temperature	temperature sensor NTC 10K	
	BX4	B71	plant heat exchanger inlet temperature	temperature sensor NTC 10K	
	BX5	-	-	temperature sensor NTC 10K	x
	H1	-	Heating request	voltage free digital input 0-10 Vdc input	x
	H3	-	Cooling request	voltage free digital input 0-10 Vdc input	x
	EX1	E5	Electrical power supply lock	230 Vac digital input	x
	EX2	E6	Low tariff	230 Vac digital input	x
	EX3	-	-	230 Vac digital input	
	EX4	E9	Low pressure switch	230 Vac digital input	
	EX5	E10	High pressure switch	230 Vac digital input	
	EX6	E24	Plant flow switch	230 Vac digital input	
	EX7	E20	Phase sequence controller	230 Vac digital input	x (1)
Outputs	QX1	K1	Compressor	2 A - 230 Vac	
	QX2	Q3	Domestic hot water 3 way valve	2 A - 230 Vac	x (3)
	QX3	Q9	Plant pump	2 A - 230 Vac	
	QX4	Y22	Reversing cycle valve	2 A - 230 Vac	
	QX5	K25	Integrative electrical heaters - step 1	2 A - 230 Vac	x (2)
	QX6	K26	Integrative electrical heaters - step 2	2 A - 230 Vac	x (2)
	QX7	-	-	2 A - 230 Vac	x
	QX8	K32	Heating integration	2 A - 230 Vac (voltage free)	
	UX	K19	Fans	0-10 Vdc	

(1) Available for the user only for single phase power supply heat pumps.
(2) Available for the user only if the “Integrative electrical heaters” option has not been chosen.
(3) Available for the user only if as “Domestic hot water production” option has not been chosen “3 way valve”.

Alarms

Alarms activation and reset

The controller is able to perform a complete diagnosis of the unit detecting all the operating faults and notifying different alarms.
The activation of an alarm implies :

- involved consumers locked
- alarm icon shown on the display
- event recorded in the alarm history

To show the details about the active alarm press the INFO button.

Alarms that can damage the unit or the plant require a **manual reset** that implies that the operator has to reset manually the controller. It is advisable to verify accurately the cause that originated the alarm and to make sure that the problem has been solved before restarting the unit. In any case the unit will restart only if the cause of the alarm has disappeared.
For the manual reset alarms, pressing the INFO button, along with the details about the alarm, also the message “Reset ?” will appear. Press the OK button. When the message “Yes” blinks press again the OK button to confirm the alarm reset.

The less critical alarms have an **automatic reset**. As soon as the minimum compressor switch off time has elapsed the controller tries to reset the alarm. If the cause that originated the alarm has disappeared, the unit starts working again and the alarm icon is no more shown on the display. Some of these alarms become manual reset alarms if the number of events in an hour exceeds a fixed threshold.

It is possible to reset the active alarms also through the RESET button. In that case the scheduled delays at the unit switch on are ignored avoiding undesired waiting times during commissioning or fault tracing. This function should NOT be used in normal operation.

Alarm history

The controller allows to save the last 10 alarms occured during the unit operation. For each event the following details are recorded :

- alarm code
- hour
- date

Such details can be displayed entering the “Errors” menu (parameters from 6800 to 6819).
When the number of saved events is higher than 10 the following events are saved deleting the oldest alarms.

Alarms table

Code	Alarm	Reset (1)	Input	Heat pump lock
10	Outdoor air temperature sensor	A	B9	No
33	Plant side flow temperature sensor	A	B21	No
35	Source side return temperature sensor (finned coil inlet)	A	B91	Yes
39	Liquid line temperature sensor	A	B84	Yes
44	Plant side return temperature sensor	A	B71	No
106	Sorce side temperature too low	M	-	Yes
134	Phase sequence controller	A	E20	Yes
201	Plant side frost protection alarm	A	B21	Yes
204	Fans overload	A / M	E14	Yes
222	High pressure during heat pump operating	A / M	E10	Yes
223	High pressure during heating circuit start	M	E10	Yes
224	High pressure during domestic hot water circuit start	M	E10	Yes
225	Low pressure	A / M	E9	Yes
247	Defrosting fault	A / M	-	Yes
356	Plant side differential pressure switch	A / M	E24	Yes

The controller diagnostic takes into account, besides the alarms reported in the table, many other alarm codes the meaning of which is indicated on the unit display when the corresponding alarm becomes active. Such alarms are not critical and don’t lock the heat pump operation.

Note:
(1) A = automatic reset , M = manual reset , A / M = manual reset only if the number of events in an hour is higher than 3.

Controller technical data

Controller

Power supply	230 Vac (+10% / -15%) 50 Hz / 60 Hz max 11 VA
Safety class (EN 60730)	II
Degree of protection (EN 60529)	IP 00
Operating room temperature (not condensing)	-20°C ... 50°C
Storing room temperature	-20°C ... 65°C

Remote thermostat and wired remote control

Power supply	bus BSB
Communication	wired BSB bus 2 wire connection not interchangeable (200m max)
Safety class (EN 60730)	III
Degree of protection (EN 60529)	IP 20
Operating room temperature (not condensing)	0°C ... 50°C
Storing room temperature	-20°C ... 65°C
Room temperature sensor	Range : 0°C ... 50°C Resolution : 0,1°C Tolerance : 1,0°C

Comando remoto wireless

Power supply	3 alkaline batteries 1,5 V type AA (LR06)
Communication	wireless BSB bus frequency 868 MHz
Safety class (EN 60730)	III
Degree of protection (EN 60529)	IP 20
Operating room temperature (not condensing)	0°C ... 50°C
Storing room temperature	-20°C ... 30°C
Room temperature sensor	Range : 0°C ... 50°C Resolution : 0,1°C Tolerance : 1,0°C

Wireless transmitter

Power supply	5,5 Vdc (X60 terminal of the controller) max 0,11 VA
Communication	6 wire connection not interchangeable (1,5m max)
Safety class (EN 60730)	III
Degree of protection (EN 60529)	IP 40
Operating room temperature (not condensing)	0°C ... 50°C
Storing room temperature	-20°C ... 65°C

Wireless repeater

Power supply	230 Vac (+10% / -15%) 50 Hz (+6% / -6%) max 0,5 VA
Communication	wireless BSB bus frequency 868 MHz
Safety class (EN 60730)	III
Degree of protection (EN 60529)	IP 20
Operating room temperature (not condensing)	0°C ... 50°C
Storing room temperature	-20°C ... 65°C

Wireless adaptor for outdoor temperature sensor

Power supply	2 alkaline batteries 1,5 V type AAA (LR03)
Communication	wireless BSB bus frequency 868 MHz
Safety class (EN 60730)	III
Degree of protection (EN 60529)	IP 20
Operating room temperature (not condensing)	0°C ... 50°C
Storing room temperature	-20°C ... 30°C
Outdoor temperature sensor cable length	max 5m

Sensors features

The temperature sensors used in the hydraulic circuit are type NTC 10K (10 kΩ at 25°C).

The outdoor air sensor is type NTC 1K (1 kΩ at 25°C).

When the sensor is at the temperature of 25°C the electrical resistance measured at the sensor ends is 1 kW for the NTC 1K sensor and 10 kΩ for the NTC 10K sensors.
The thermistor of these sensors has a negative temperature coefficient : the electrical resistance value decreases when the temperature increases.

In order to verify if a sensor is faulty or interrupted, check the correspondence between the resistance value in kΩ and the temperature of the sensor in °C according to the table.

For a reliable check it is not necessary to control each single value, but some sample values are enough. If the instrument shows an infinite resistance the sensor is interrupted.

	NTC 1K	NTC 10K
Temperature [°C]	Resistance [kΩ]	Resistance [kΩ]
-20	7,578	96,360
-15	5,861	75,502
-10	4,574	55,047
-5	3,6,00	42,158
0	2,857	32,555
5	2,284	25,339
10	1,840	19,873
15	1,492	15,699
20	1,218	12,488
25	1,000	10,000
30	0,827	8,059
35	0,687	6,535
40	0,575	5,330
45	0,483	4,372
50	0,407	3,605
55	-	2,989
60	-	2,49
65	-	2,084
70	-	1,753
75	-	1,481

MAINTENANCE

Maintenance

IMPORTANT. MAKE SURE THE UNIT IS NOT ELECTRICALLY POWERED BEFORE CARRYING OUT ANY CLEANING OR MAINTENANCE OPERATION. ALL ORDINARY AND EXTRAORDINARY MAINTENANCE OPERATIONS MUST BE CARRIED OUT BY SPECIALIZED AND AUTHORIZED PERSONNEL, IN ORDER TO ENSURE COMPLIANCE WITH THE CURRENT SAFETY REGULATIONS.

NB.: always make sure that the power supply lines (of the unit and of the integrative electrical heaters) are disconnected at the start before carrying out any maintenance operation.

This section is extremely important for efficient operation of the unit during the years. A few operations carried out periodically can avoid the need to call specialized personnel. The operations to be carried out do not require particular technical knowledge and consist of simple checks of the components of the unit.
Contact an authorized service centre if maintenance is required.

Structure
To prevent noise and strange vibrations to rise make sure that the various steel parts are well fastened together and that the inspection panels are properly fixed to the unit.
In case of oxidation, treat with paints, suitable to avoid or reduce the problem, the parts of the unit affected.

Hydraulic plant
Visually check that the hydraulic plant is leaks free and is pressurized. Verify there is no air in the circuit (acting on the air vents). Verify that the filters in the plant are clean.

Electrical plant
Verify that the power supply cable that connects the unit to the distribution panel is not affected by cuts, cracks or alterations that could compromise the insulation. Contact an authorized service center if maintenance is required. After a first period of time from the first start up and at every stop or seasonal start up carefully check that each electrical connection is well fixed.

Fans
Verify that the fans are well fixed to the protective grilles and to the structure of the unit. Check any unbalance of the fans pointed out by anomalous vibrations and noise.

Finned coil
Accidental contact with the exchanger fins can cause small cuts. Use protective gloves to carry out the operations described below. The exchangers must be able to ensure the maximum heat exchange, therefore their surfaces must always be clear of any dirt and dust that can present on them due to the action of the fans. Using a brush, remove all the impurities present on the surface of the coil. Clean the aluminium surface of the coil with a compressed air jet, making sure to aim the jet with the direction of the fins so as to avoid damages. If the aluminium fins has been damaged, “comb” the coil with a special tool until the damage is completely eliminated.

Finned coil condensate drainage
Verify that, during the defrosting cycles that take place in heating mode, the drainage of the water from the finned pack occurs properly and that the drainage fitting on the unit basement is not clogged. If the flow is not correct, with low outdoor temperature, a layer of ice could be generated on the unit basement and the operating of the unit could be compromised.

SAFETY AND POLLUTION

General considerations

Accessing the unit

The access to the unit must be granted exclusively to qualified personnel trained to operate on this type of units and provided with the necessary protection equipment. Moreover such personnel, to operate, must be authorized by the owner of the unit and recognized by the Manufacturer.

Residual risks

The unit are designed and built in such a way to minimize risks for people and for the place where the unit is installed. The residual risks, impossible to eliminate during the design process, are reported in the following table along with the indications necessary for their neutralization.

Considered part	Residual risk	Mode	Precautions
Compressor	Burns	Contact	Use protective gloves
Refrigerant circuit pipes	Burns	Contact	Use protective gloves
	Cold burns	Fuoriuscita di refrigerante e contatto con la pelle	Use protective gloves
Electrical circuit	Electrocutions	Contact with live parts	Verify the unit earth connection Disconnect the power supply line before carrying out any operation inside the unit
Finned coil	Cuts	Contact	Use protective gloves

Pollution

The unit contains refrigerant gas and lubricating oil. During discarding such fluids must be recovered and eliminated according to the regulations in force in the country where the unit is installed. The unit must not be abandoned during discarding.

Refrigerant safety card

1 SUPPLIER COMPANY AND PRODUCT IDENTIFICATION

Card No.	FRIG 8
Product	R-410A
Supplier company identification	RIVOIRA SpA

2 COMPOSITION / INFORMATION ON INGREDIENTS

Substance / Preparation	Preparation
Components / Impurities	Contains the following components : Difluoromethane (R32) 50 % in weight Pentafluoroethane (R125) 50 % in weight
EEC No.	Non-applicable for mixtures
Trade-name	/ /

3 IDENTIFICATION OF HAZARDS

Identification of hazards	Liquefied gas. The vapours are heavier than air and can cause suffocation, reducing the oxygen available for breathing. Rapid evaporation of the fluid can cause freezing. Can cause cardiac arrhythmia.

4 FIRST-AID MEASURES

Inhalation	Do not administer anything if the person has fainted. Take the person outdoors. Use oxygen or artificial respiration if necessary. Do not administer adrenaline or similar substances.
Contact with eyes	Rinse thoroughly with plenty of water for at least 15 minutes and see a doctor.
Contact with skin	Wash immediately with plenty of water. Immediately remove all contaminated garments.
Swallowing	

5 FIRE-PREVENTION MEASURES

Specific hazards	Increase in pressure.
Dangerous fumes	Halogen acids, traces of carbonyl halides.
Fire-extinguishing means usable	All the known fire-extinguishing means can be used.
Specific methods	Cool the containers/tanks with water sprays.
Special protection equipment	Use self-contained breathing apparatus in confined spaces.

6 MEASURES AGAINST ACCIDENTAL SPILLING OF THE PRODUCT

Personal protection	Evacuate personnel to safe areas. Provide for adequate ventilation. Use personal protection equipment
Protection for the environment	It evaporates.
Product removal methods	It evaporates.

7 HANDLING AND STORAGE

Handling and storage	Ensure an adequate air change and/or extraction in the workplaces. Only use well-ventilated rooms. Do not breathe vapours or aerosols. Carefully close the containers and keep them in a cool, dry and well-ventilated place. Keep in the original containers.
Incompatible products	Explosives, flammable materials, organic peroxides.

8 CONTROL OF EXPOSURE / PERSONAL PROTECTION

Personal protection	Ensure adequate ventilation, especially in closed areas.
Control parameters	Difluoromethane (R32): Recommended exposure limits: AEL (8h and 12h TWA) = 1000 ml/m3 Pentafluoroethane (R125): Recommended exposure limits: AEL (8h and 12h TWA) = 1000 ml/m3

Respiratory tract protection	For rescue and for maintenance works in tanks, use self-contained breathing apparatus. The vapours are heavier than air and can cause suffocation, reducing the oxygen available for breathing.
Eye protection	Total protection glasses.
Hand protection	Rubber gloves.
Hygiene measures	Do not smoke.

9 CHEMICAL-PHYSICAL PROPERTIES

Relative density, gas (air=1)	Heavier than air.
Solubility in water (mg/l)	Not known, but deemed very low.
Appearance	Colourless liquefied gas.
Odour	Similar to ether.
Fire point	Does not ignite.

10 STABILITY AND REACTIVITY

Stability and reactivity	No decomposition if used according to the special instructions.
Materials to be avoided	Alkali metals, alkali-earth metals, granulated metal salts, Al, Zn, Be, etc. in powder.
Hazardous products of decomposition	Halogen acids, traces of carbonyl halides.

11 TOXICOLOGICAL INFORMATION

Local effects	Concentrations substantially above the value TLV (1000 ppm) can cause narcotic effects. Inhalation of highly concentrated products of decomposition can cause respiratory insufficiency (pulmonary oedema).
Long-term toxicity	No carcinogenic, teratogenic or mutagenic effects have been recorded in experiments on animals.
Specific effects	Rapid evaporation of the fluid can cause freezing. Can cause cardiac arrhythmia.

12 ECOLOGICAL INFORMATION

Effects linked to ecotoxicity	Pentafluoroethane (R125) Potential global warming with halocarbides; HGWP (R-11 = 1) = 0.84 Potential impoverishment of the ozone; ODP (R-11 = 1) = 0

13 CONSIDERATIONS ON DISPOSAL

General	Do not dispose of where accumulation can be hazardous. Usable with reconditioning. The depressurised containers must be returned to the supplier. Contact the supplier if instructions for use are deemed necessary.

14 INFORMATION FOR TRANSPORT

Designation for transport	LIQUEFIED GAS N.A.S. (DIFLUOROMETHANE, PENTAFLUOROETHANE)
UN No.	3163
Class/Div	2.2
ADR /RID No.	2, 2nd A
ADR/RID hazard no.	20
ADR label	Label 2 : non-toxic non-flammable gas.
CEFIC Groupcard	20g39 - A
Other information for transport	Avoid transport on vehicles where the loading zone is not separate from the cab. Make sure the driver is informed about the potential risk of the load and knows what to do in case of accident or emergency. Before starting transport, make sure the load is properly secured and : make sure the valve of the container is closed and does not leak; make sure the blind cap of the valve (when provided) is correctly fitted; make sure the cap (when provided) is correctly fitted and that there is an adequate ventilation passage; ensure compliance with the current provisions.

15 INFORMATION ON REGULATIONS

The product must not be labelled according to Directive 1999/45/EC.
Comply with the regulations given below, and the relevant applicable updates and amendments.
Circulars no. 46/79 and 61/81 of the Ministry of Labour : Risks related to the use of products containing aromatic amines
Leg. Decree no. 133/92 : Regulations on the discharge of hazardous substances in waters
Leg. Decree no. 277/91 : Protection of workers against noise, lead and asbestos
Law 256/74, Decree 28/1/92, Leg. Decree no. 52 dated 3/2/97, Decree dated 28/4/97 as amended : Classification, packing and labelling of hazardous substances and preparations
Decree no. 175/88, as amended : Activities with significant accident risks (Seveso Law)
Decree no. 203/88 : Emissions into the atmosphere
Decree no. 303/56 : Work hygiene
Decree no. 547/55 : Regulations on accident prevention
Leg. Decree no.152 dated 11/5/99 : Protection of waters

16 OTHER INFORMATION

Recommended uses Refrigerant
Can cause suffocation in high concentration.
Keep in a well-ventilated place.
Do not breathe the gas.
The risk of suffocation is often underestimated and must be clearly explained during the training of operators.
Ensure compliance with all the national and regional regulations.
Before using this product in any new process or trial, an in-depth study on safety and compatibility of the product with the materials must be carried out.
The above information is based on our current know-how and describes the product according to the safety requirements. It does not however represent a guarantee and assurance of the qualities in a legal sense. Each person responds personally for compliance with such regulations.

Ferroli

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