ENERBLUE

13÷40 kW

High efficiency air/water and water/water heat pumps with CO_2 refrigerant

HP90

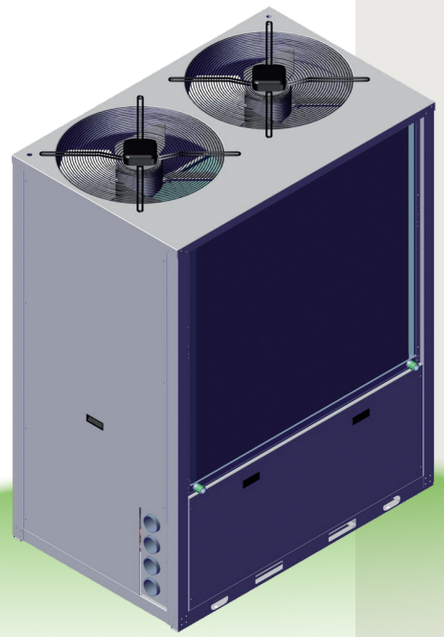
MODULARITY

REDUCED FOOTPRINT

90°C


ENERBLUE

Contents



HP90

High efficiency air/water and water/water heat pumps with CO_2 refrigerant

HP90 air/water and water/water unit ranges have features designed to be absolutely unique: ideal for heating water at temperatures up to 90°C, the ranges operate together with the R744 refrigerant, or better known as CO_2.

This natural refrigerant is fully eco-friendly and provides a series of **exclusive benefits**:

- it is not flammable
- it is not toxic
- it is a processing waste or naturally manufactured product
- it is not harmful for the ozone
- it does not require special procedures to be used
- it is not subdued to any standard and tax in any Country
- it does not require recovery
- it has maximum compatibility with lubricants and materials
- it has low cost
- it has ODP = 0 (ozone depletion potential)
- it has GWP = 1 (global warming potential).

Refrigerant	ODP(1)	GWP(2)	Necessity of recovery
CFC R12 Refrigerant	1	8500	Yes
HCF R22 Refrigerant	0.055	1700	Yes
HFC R410A Refrigerant	0	1700	Yes
HFC R134a refrigerant	0	1300	Yes
R744 natural refrigerant (CO_2)	0	1	No

(1) ODP : Ozone Depletion Potential
(2) GWP : Global Warming Potential

Currently, HP90 ranges are the best solution for the production of hot water at high temperatures (up to 90°C).
Among both natural and synthetic refrigerants, CO_2 has the best features for this application, which, together with a verification appropriately studied, developed and fully tested on field, makes HP90 ranges the best choice to produce hot water at high temperatures, either under an economic or environmental point of view.
A proprietary algorithm allows positioning the unit operation at the maximum COP possible, in any operation condition.
In air/water units, "intelligent" defrosting is performed so to not cool the water of the system, a further unique feature in the market place.
The reduction of global warming potential is a priority and this results in more stringent standards for synthetic refrigerants.
Using CO_2, HP90 heat pumps are definitely the first choice because of its low-carbon emission for the production of domestic hot water and for residential, commercial and industrial heating.

Ideal for residence, business, school, hotel, hospital, camping and industry sector and in general for all applications that require large water quantities at high temperatures.

R744

FEATURES

HP90 air/water range consists of three models from 18 to 48 thermal kW. All units are designed for **a modular use** to reach 150 kW.

HP90 water/water range consists of three models from 20 to 50 thermal kW and are designed to be used either with **geothermal probe or with well or tower water.**

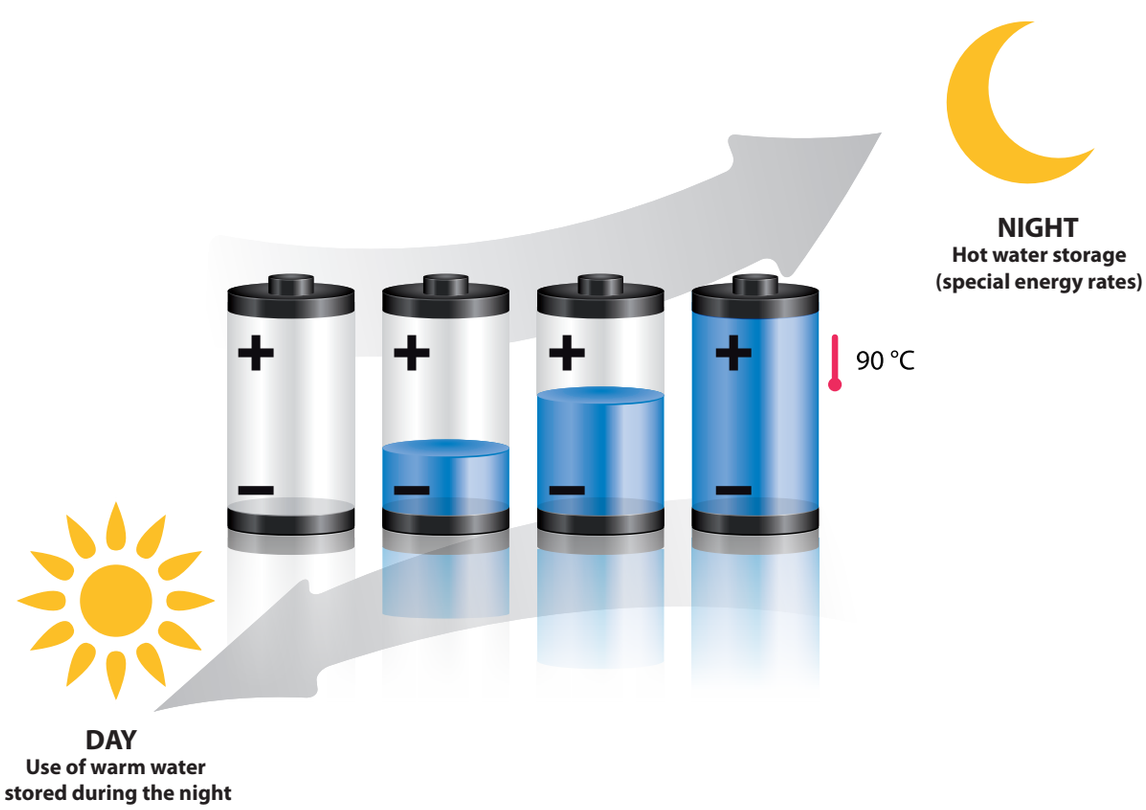
The temperature to produce domestic hot water can reach 90°C, depending on the request, and the unit can operate even with return temperatures up to 40°C.

HP90 range provides low-cost thermal energy during the night, taking advantage of the best electric rates and allowing the system to store water at high temperatures (80°C or 90°C) that can be collected the subsequent day.
HP90 range heat pumps are a valid alternative to the existing boilers for applications where high volumes of domestic hot water are required.

Use of R744 (CO_2) as refrigerant fluid allows accessing projects where a low emission of carbon dioxide is required.

These units can also be used for the direct production of hot water or to provide water at different temperatures using a thermal buffer: domestic hot water and water for heating radiators, floors, fan coils or to power a recuperator coil.

The high storage temperature of water allows reducing storage volumes.



LOW OPERATION COSTS. Example of air/water unit in the italian market

In the last year the average cost of energy decreased of 4.2% (Source: www.autorità.energia.it). During the same period the gas price trend has increased of 8.2%. Any future forecast takes for granted a further increase of the fossil fuel cost and a reduction or stabilisation of the electric energy cost.
A comparison between operating costs with several types of energy/fuel for a consumption of 20.000 thermal kW is shown below.

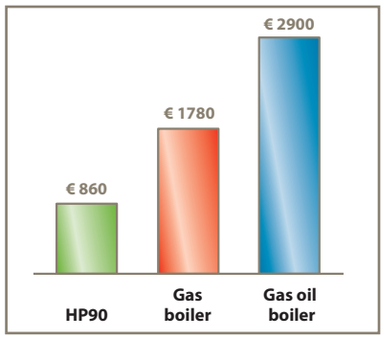
Assumption:

- Cost of 1 electric kW: 0.17 €/kW [www.autorità.energia.it , may 2011]
- Cost of 1 m^3 of gas € 0.77 per m^3 (calorific value 8.250 kcal/m^3) [www.autorità.energia.it , may 2011]
- Cost of 1 lt of gas oil € 1.315 per lt (calorific value 10.210 kcal/kg; specific weight 0.85 kg/l) [dgerm.sviluppoeconomico.gov.it, may 2011]

OPERATION COSTS

Data/Type	HP90	Gas boiler	Gas oil boiler
Efficiency/COP*	4.0	0.9	0.9
Cost of 1 thermal kWh	€ 0.043	€ 0.089	€ 0.14
Difference in %	-	+100%	225%
Annual average consumption per 20,000 kWh	€ 860	€ 1780	€ 2900
KgCO_2/kwh	0.27	0.201	0.26
Total kgCO_2 produced	1540	4020	5200

COP with air 7 °C water 15°>60 °C



Costs for maintenance on boilers, which is required by law, have not been considered in the calculation.

For high power boilers >35 kW, the annual cost exceeds hundreds of Euro. The comparison with both normal and condensing boilers sees HP90 range winning under many points of view:

- Reduced operation costs
- No costs for fuel systems (gas lines, gas cylinders, etc.)
- No maintenance required by law
- No authorisations are required
- Reduced emission of CO_2

In the event a room should be cooled with a boiler, high temperature water is required together with a chiller. This is a further cost.

The cold recovery version of the HP90 range allows activating the possibility to produce refrigerated water simultaneously, with an external consent. Cooling power is therefore free of charge.

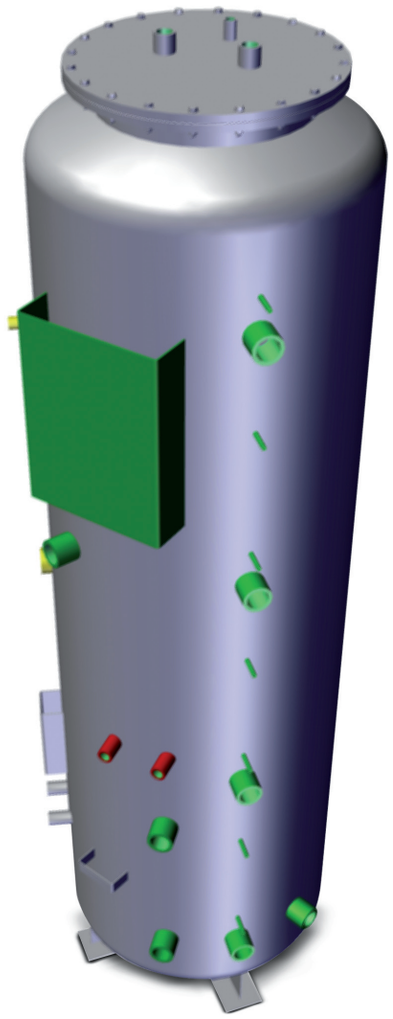
IDEAL FOR RESIDENTIAL RENOVATION

Combined with the multi-purpose tank, the HP90 range is ideal for renovation.

The possibility to have hot water at high temperatures allows:

- Keeping the existing hydraulic pipes (same diameters).
- Keeping the same terminal units: radiators, either made of cast iron or aluminium (same number of elements).
- Reducing the economic impact related to the heating system drastically. No masonry is required.
- High temperature water can be stored operating the unit at night, without further power consumption.
- Storing hot water, without the risk of formation of legionella.
- Independence from gas oil or gas.
- Reduced operation costs.

The multi-purpose tank has been designed to confer maximum system flexibility.



The main features are:

- **High stratification:** Limited in width and developed in height, dimensions create a high inner stratification (up to 40°C), which allows having water at different temperatures. Beyond the dimensions, another factor that increases the stratification is the presence of an internal chimney, which facilitates the ascent of hot water and descent of cold water.
- **Output connections for water at high temperature:** up to 80/90 °C.
  Ideal for radiators and towel heaters.
- **Output connections for water at medium temperature:** 60 °C. For use with fan coils, radiators or hot water coils for recuperators.
- **Output connections for water at low temperature:** 40 °C.For use with radiant systems and/or hot water batteries for recuperators.
- **Coil for the instantaneous production of DHW** of 4 m^2.
- **Connections for integration with a backup boiler.**
- **Inner coil at the bottom of the heat exchanger** for connecting to solar panels of 2.2 m^2.
- **Connections for installing a backup electric resistance.**
- **Thermal insulation** with 10 cm of polyurethane to limit thermal losses at 0.1°C in one hour.
- **Thermal probe pots,** to verify the indoor temperature and control the operation of the unit.
- **Plate for the installation of the control E.P.**

SAVING IN USING IN THE COMMERCIAL AND INDUSTRIAL FIELD

The ideal use of HP90 heat pumps is in all applications with high request of hot water at high temperatures.

Ideal utilities are:

- Hotels
- Restaurants
- Industrial and school canteens
- Residential and tourist buildings
- Laundries
- Gyms
- Sport centres
- Hospitals
- Tanneries
- Furnaces
- Food productions: pasteurization and cooling
- Dry cleaners and textile processing
- Concrete manufacture production
- Greenhouses
- Shopping centres and mixed structures
- Mill papers
- Meat laboratories with the necessity of hot water for disinfection

EXAMPLE: Hotel with 60 rooms and restaurant with 80 cover o seating, heating and DHW produced by gas oil

GAS OIL

Use of approximately 13.500 litres per year for heating and production of domestic hot water

Costs analysis:

18.000.00 € approximately

HP90 HEAT PUMP

Use of a HP90 heat pump, with an average COP of 4.0

Costs analysis:

5.400.00 €
electric consumption

EXAMPLE: Sport centre with 110 daily users

GAS OIL

9,600 litres every year for the production of domestic hot water

Costs analysis:

12.800.00 €/year

HP90 HEAT PUMP

Use of a HP90 heat pump, with an average COP of 4.0

Costs analysis:

€ 3.800.00
electric consumption

EXAMPLE: industry with a requirement of 12,000 l/day of water at 60°C per 250 days/year

GAS

66 m^3 a day for an expenditure of € 50.00.

Costs analysis:

12.500.00 €/year

HP90 HEAT PUMP

Use of a HP90 heat pump, with an average COP of 4.0, allows a daily expenditure of € 25.00.

Costs analysis:

6.250 €/year
electric consumption

All these examples do not consider reduced night rates for power and other maintenance costs for the boiler.

RECOVERY MODE

The HP90 cold recovery version allows cooling at no charge, upon request of the air-conditioning system. During the production of domestic hot water, the water flow of the system can be cooled, instead of the air.

In this case, energy saving increases considerably if compared to a chiller + boiler solution, taking the COP values over 7.0.

COMPARISON WITH A TRADITIONAL HIGH TEMPERATURE HEAT PUMP

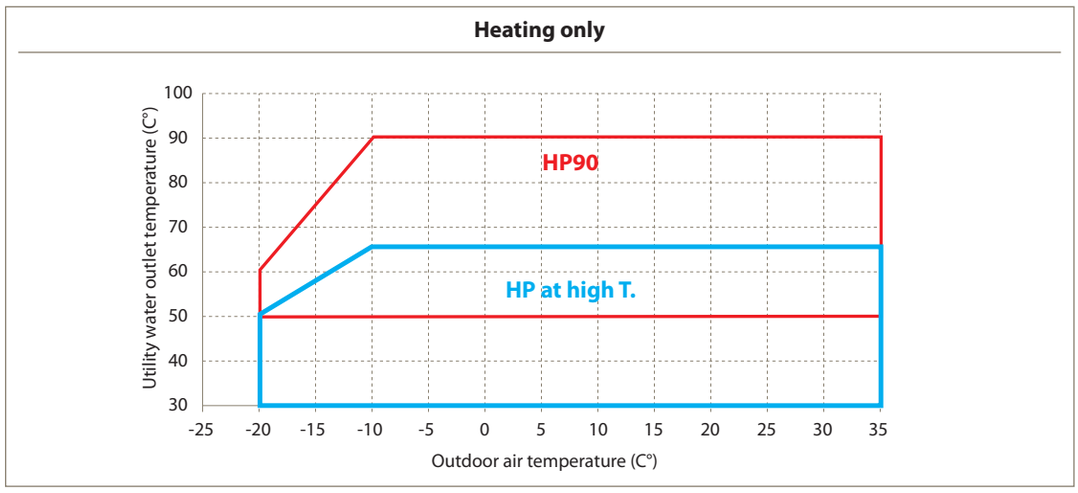
High temperature heat pumps present on the market can produce water at a maximum temperature of 65°C. This temperature value represents the maximum limit at which the heat pump can operate. Beyond 65°C (and this temperature is reached by not many heat pumps with standard refrigerants), electric resistance, boilers or a different heat source are required to intervene.
The continuous operation of the traditional high temperature heat pumps: 60/65 °C (operation limit) inevitably results in a stress of the compressor, which is the core of the unit, meaning a reduction of the system life.
For this reason, high temperature heat pumps operate at 60/65°C normally, only for the production of DHW and not continuously.

HP90 in CO_2 range does not have these limits.
65 °C represents the maximum limit value for standard heat pumps, but for HP90 range this is an operation value completely within its limits. The maximum temperature of hot water that can be reached is 90°C, far above common Heat Pumps.
HP90 range is highly reliable when temperatures exceed 50°C, but is also economically advantageous for the high COP values at high temperatures.
A comparison with some heat pumps present on the market is shown below.

Operation conditions	COP Standard Heat Pump	COP High Temperature Heat Pump	COP HP90	Delta HP90/HP at high Temperature
Air 7° (6bu) 50° water out	2.9	3.2	4.1	+ 28%
Air 7° (6bu) 60° water out	Not possible	2.6	3.9	+50%
Air 7° (6bu) 65° water out	Not possible	2.5	3.8	+52%
Air 7° (6bu) 70° water out	Not possible	Not possible	3.7	

Operation costs are considerably reduced, without considering that the unit is not operating at its feature limits.

A comparison of operation limits between a high temperature heat pump and a HP90 is shown below.



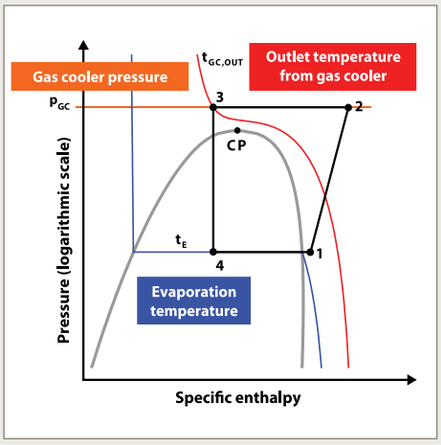
ELECTRONIC CONTROL: MAXCOP® ALGORITHM

The electronic control inside the HP90 range is a proprietary control.
Created and perfected over the years, it has now reached excellent reliable and operation levels.
The control monitors all the parameters of the unit continuously and guarantees the correct operation and maximisation of the unit COP.
In units with R744 refrigerant, the maximum value of thermal efficiency depends not only on the DHW production temperature, but also on the outdoor temperature and water return temperature to the unit.

A special algorithm is implemented inside the control, which researches the work pressure that optimises the COP. Once this value has been detected, the control commands the thermostatic valve and circulator to guarantee the desired set temperature together with the maximum COP value.

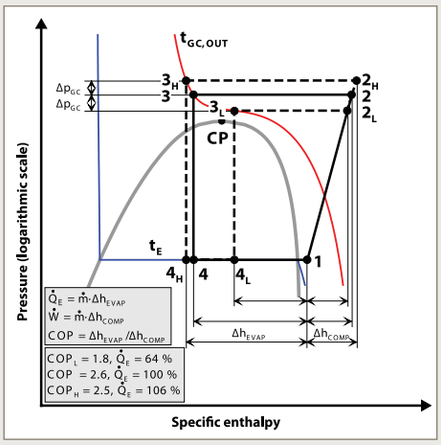
In-depth technical description

The figure below shows a pressure-enthalpy diagram with a simple transcritical cycle.



The evaporation process is identical to that performed with natural refrigerants.
The isotherm labelled t_E represents the evaporation temperature.
A condensation process does not exist in the transcritical cycle; therefore the temperature, condensation and sub-cooling conditions are not applied.
In the cycle with CO_2, the gas cooler outlet condition (point 3 status) must be specified together with the temperature and pressure.
The isotherm labelled $t_{GC,OUT}$ represents the refrigerant temperature after the water heating phase. Beyond the $t_{GC,OUT}$, also the PGC gas cooler pressure must be specified to define the operation point univocally. The intersection between isotherm $t_{GC,OUT}$ and PGC isobar identifies the outlet condition (point 3 status).

The operation of a transcritical cycle using R744 is different than the operation of a subcritical cycle, which uses a traditional refrigerant, such as R134a, R410A or R407C.
In the subcritical cycle, the heat rejection process involves the condensation of the refrigerant; the condenser that performs this task is found in the traditional units. A large part of the condenser volume on the refrigerant side will be occupied by a two-phase mixture of liquid and vapour.
For a thermal balanced two-phase mixture, the pressure will be the saturated pressure at the mixture temperature.
For a transcritical cycle, the heat rejection process does not occur through condensation (literally gas passage from liquid to gas), but involves only a gas cooling. As a result, the refrigerant temperature changes continuously during the heat rejection process.
Given that during this process a phase variation does not occur, temperature and pressure are independent.
The figure in the next page shows how the gas pressure affects the cycle process, especially the COP value.
In the figure, three different cycles are represented. All the three have the same rejection temperature and overheating
The compression process for all three cycle processes is assumed to be reversible and adiabatic (ideal = isentropic efficiency equal to 1).



The main difference between the three cycle processes is only the gas cooler pressure. The figure shows the changes in the operation points and the cycle performances when the gas cooler pressure varies. The cycle with the nominal gas cooler pressure is defined with numbers without subscript.

Status points with index L represent the cycle with a lower pressure; status points with index H represent the cycle with a greater pressure.

The image shows the consequences of a change of approximately ± 5 bar of gas cooler pressure. The influence on the cooling cycle of the cooling capacity, and as a result of the thermal capacity, can be observed by comparing the enthalpy variations specific in the DhEVAP evaporator.

For the cycle with a lower pressure, the cooling capacity is only 64% of the nominal cycle one. For the cycle process with a greater pressure, the capacity is 106% of the nominal cycle one. This demonstrates that the gas cooler pressure considerably affects the cooling and thermal capacity and the COP.

The influence of the gas cooler pressure on the compressor power consumption can be noticed by comparing the enthalpy variations specific in the DhEVAP compressor.

The ± 5 bar variation pressure causes changes to the power consumption of the app. compressor ± 10%.

Globally, the modifications of the cooling capacity and power consumed by the compressor cause the variation of the coefficient of performance (COP). The figure shows that the gas cooler pressure considerably affects the COP.

These technical considerations show how by varying the operation conditions, the pressure that maximises the COP varies as well. A unit with standard lamination devices has the maximum COP value only for well specified conditions. The variation of air or water temperature makes the unit operate under non-ideal COP conditions.

This involves a lack of efficiency of the system and so an improper use of energy; therefore, operation costs increase.

Units of the HP90 range have a special algorithm integrated: COPMAX®.

Once the unit operation parameters are known by means of the temperature and pressure probes, the control calculates which is the optimal operation pressure that maximises the COP value. Once calculated, the algorithm provides the pressure value to the control. By means of the variation of the thermostatic valve opening and of the water flow, the unit tends to operate at the set pressure, maximising the COP.

A variation of the operation conditions results in a variation of the ideal pressure. In this case the algorithm will calculate the new pressure and the unit will adapt.

Therefore, under any condition, the unit will operate at the best energy conditions possible.

Air/water unit

Standard unit

STRUCTURE

Galvanised metal sheet painted with polyester dust RAL 9018 at 180 °C, which make it highly resistant to weather conditions.
Panels installed on all four sides are easy to remove in order to guarantee access to internal components..

COMPRESSORS

The state of the art semi-hermetic compressors are piston type.
These compressors have been designed for heating with the R744 refrigerant.
The maximum compressor efficiency is obtained during the heating operation with high compression ratios.
The compressor is equipped with a thermal protection device, oil level indicator, guard electric resistance and it is installed on rubber anti-vibration devices to reduce the transmission of vibrations to the unit.
Moreover, the compressor is equipped with a cooling system of the internal oil.

INTERNAL EXCHANGER

It consists of a coil with copper pipes and aluminium fins with high heat exchange surface. An antifreeze resistance is placed at the bottom of the condensation tray, which ensures the water flow towards the drain.
A metal mesh is provided to protect the threaded pack (accessory).
The 4 mm fin spacing reduces the possibility of coil frost, further reducing the number of defrosts during operation.
This technical feature together with the "redundant" sizing of the evaporating section guarantee high operation temperatures and so high COP values.

EXTERNAL EXCHANGER

A temperature probe is installed on the stainless steel AISI 316 brazed plate heat exchangers with closed cell thermal insulation, ideal to reduce thermal losses, and is connected to the control to protect the heat exchanger against freeze.
The counter-current heat exchange optimises the COP values and allows reaching high temperatures. The accurate selection of the heat exchangers has allowed obtaining extremely low load losses at the water side.

FANS

Helicoid fans directly coupled to the 6-pole electric motor with external rotor, IP 54 protection rating. The fan is housed in a shaped nozzle and includes the accident-prevention grill in compliance with UNI EN 294.
Fans have reduced noise emissions to limit the acoustic impact. The always inserted rev adjuster allows modulating the air flow to limit the acoustic effects.

REFRIGERANT CIRCUIT

Includes: compressor, plate heat exchanger utility side, regenerative heat exchanger, finned coil source side, charge connections, intake filter, electronic thermostatic expansion valve, high and low pressure switch, low pressure safety valve, high pressure by-pass device, liquid receiver.

ELECTRICAL PANEL

Equipped with main sectioning device, power and auxiliary circuit protection device, compressor contactor, microprocessor control with display of the main functions.

The electric board consists of:

> Automatic protection switch of the auxiliary and power circuits.
> Main switch and fuses to protect the auxiliary and power circuits.
> Compressor contactor.
> Fan speed adjuster to control condensation.
> Pump relay or motor protector and contractor.
> General alarm free contacts.
> Main control functions:
  - Temperature adjustment of utility set point.
  - Circulator/pump management.
  - Anti-freeze protection management for the heat exchanger system side.
  - Management of the compressor operating cycle frequency.
  - Alarms indication.

CHECKS AND SAFETY DEVICES

> Automatic resetting high pressure safety device (factory-set).
> Automatic resetting low pressure safety device.
> Low pressure safety valve.
> By-pass safety device high pressure side.
> Outlet water temperature control probe.
> Gas cooler refrigerant outlet temperature probe.
> Outdoor air temperature probe.
> Intake temperature probe.
> Evaporating temperature probe.
> Pressure probe.
> Low pressure probe.
> Anti-freeze probe placed at the heat exchanger outlet system side.
> Paddle mechanical flow switch.
> Compressor over temperature protection device.

TESTING

All units are factory-tested and provided equipped with oil and refrigerant fluid.
When ordering, provide the operation values required by the unit.

MAXIMUM MODULARITY

Sizes 24 and 48 of the range are designed to be used as modules to reach the desired thermal power.
The units are conceived to be linked directly in the factory. The hydraulic circuit of the two or more units are manifolded together, so the final user has only one inlet and outlet for DHW and refrigerated water.
In case of multiple modules the E.P. will be one. Therefore, only one power supply will be required for all modules.

The possible combinations are described below:

thermal Kw required/ type and unit number	Unit 24	Unit 48	Unit and circuit total
24 kW	1	0	1
48 kW	0	1	1
72 kW	1	1	2
96 kW	0	2	2
120 kW	1	2	3
144 kW	0	3	3

Compared to the great power of a single unit, the modular solution offers several benefits, such as:

- **Reliability:** a greater number of cooling circuits ensures a sufficient operation, even in case of serious malfunctions.
- **Defrosting:** any defrosting request by multiple units installed concerns only a small fraction of the units, resulting in greater thermal power consistency to the utility.
- **Power modulation:** during the operation, a high number of circuits allows following the thermal load efficiently. During the period of low request, the redundant units can be disabled.
- **Flexibility:** the required power can be installed in those systems that will upgrade throughout the time, in order to install other modules. This way, the system will evolve according to the energy requests of the utility.
- **After-Sales and spare parts:** The repeated use of few components make sure spare parts are always available, ensuring prompt action and a rapid recover of the functions.
- **Excellence:** The continuous production of modular units allows reaching extremely high and reliable production quality.
- **The thermal/conditioning unbalance can be managed:** in case cold is a fraction of the heat efficiency, some units equipped with cold recovery can be installed. This way, thermal and cooling power can be accurately dosed.

UTILITY SIDE HYDRAULIC MODULE

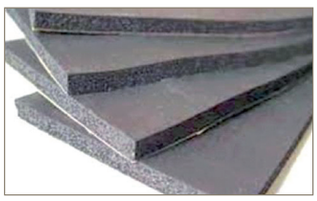
The unit standard version is equipped with a circulator or pump placed at the system side. The circulator is directly driven by the unit control. The flow will vary depending on the water outlet set point required, in order to reach the set temperature and maximise the COP value.
The presence of a solenoid valve in the water outlet pipe prevents the formation of a water flow, due to the strong thermal gradient.

Options

FEATURES CONSTRUCTION

/LN
Silenced version

It can be combined with any set up. It consists of a panel internal coating, made with soundproofing and sound absorbing material, to further limit sound emissions. The material used is made of a layer of sound absorbing material and a layer of soundproofing material, which are able to remove sound emissions within a frequency of 100 and 8000 Hz. The sound pressure is reduced of approximately 3 dBA.



/RD:
Version with radial fans

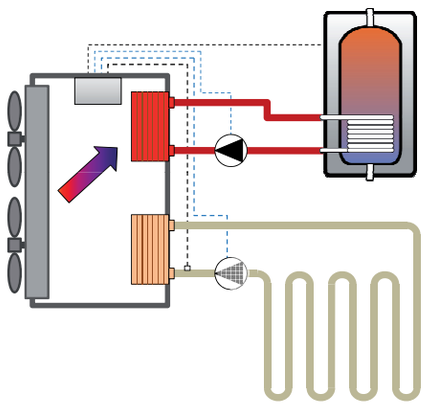
The units are equipped with 1 or 2 backward curved radial fans, without hopper.
The 4-pole electric motor is directly coupled to the fan and the rotation speed can be modified using an autotransformer to adjust the useful head provided by the fan to the system features. In this way, the unit can operate with maximum efficiency. The static useful head is of 50 Pa; however, 200-300 Pa can be reached, depending on the size. This type of fan avoids the use of belts and pulleys, which require greater maintenance.
The units can be combined with the innovative EC radial fans with electronically commutated brushless motor; the technology of these motors allows a simple adjustment of the fan speed by means of the electronic control, in order to obtain a consistent variation of both the air flow and static pressure, ensuring the correct distribution of air. The flexibility of this component allows the units to adapt to any system upgrade.
Moreover, the high motor efficiency allows less energy consumption , especially to partial loads and during the start-up phase (removal of inrush currents); this results in a reduction of energy consumption of approximately 30% compared to the AC motors.

/RF
Cold recovery version

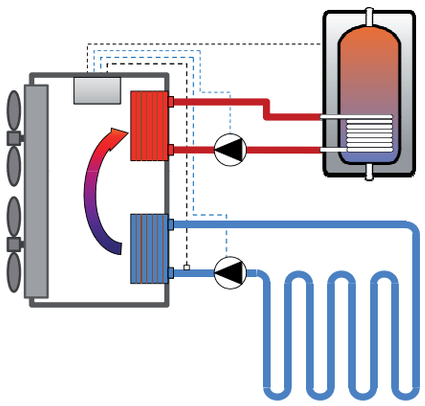
HP90 range can be requested with the following configurations: cold recovery.
Beyond producing hot water, during its normal operation, the unit can produce simultaneously refrigerated water totally free of charge.

A further thermal insulated plate heat exchanger and a three-way heat exchanger are placed inside the unit. When the operation conditions allow and basing on an external signal (external consent), the unit will pass from expanding inside the coil to expanding inside the plate heat exchanger, producing cold. This way, instead of absorbing heat from air, by means of the evaporating coil a water flow can be cooled. This increases significantly the COP value and reduces the ROI period. MAXCOP® command and algorithm will make the unit operate with the maximum COP, even in this mode.

Domestic hot water only



Domestic hot water + chilled water



ACCESSORIES

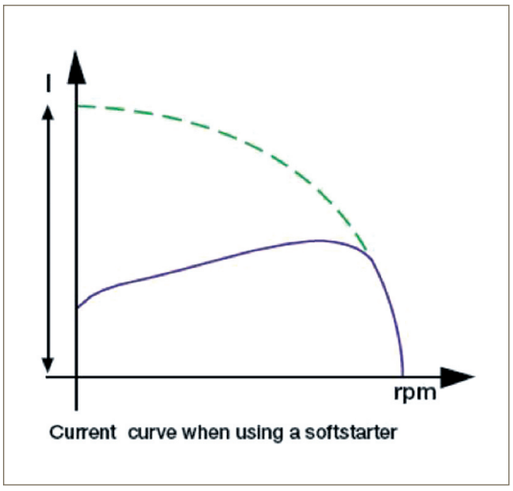
Furthermore, the HP90 range can be equipped with a series of accessories. For a complete list of accessories, refer to the price list.

GAUGES

HIGH AND LOW pressure meter for the cooling circuit.

ELECTRONIC SOFT STARTER

Electronic device placed inside the electric board. The function is to decrease the consumed current of approximately 40% at the unit start-up. Reducing the consumed current means limiting the consumed power. The accessory is ideal in case of low inertia of the system.



Current curve when using a softstarter

RUBBER ANTI-VIBRATION MOUNTS

Anti-vibration devices have the purpose to reduce significantly vibrations transmitted from the unit to the floor.
The accessory is supplied.

EVAPORATING COIL TREATED WITH ANTI-CORROSIVE PAINTS

The treatment consists of a first layer of aluminium passivation and the Second of a surface polyurethane-based cover.
For installation in marine or rural environments, urban or industrial areas.

EVAPORATING COIL ANTI HAIL PROTECTION

Aluminium mesh to protect the coil from any climatic events that may damage it, beyond preventing the accidental direct contact with the aluminium fins that may cause injuries.

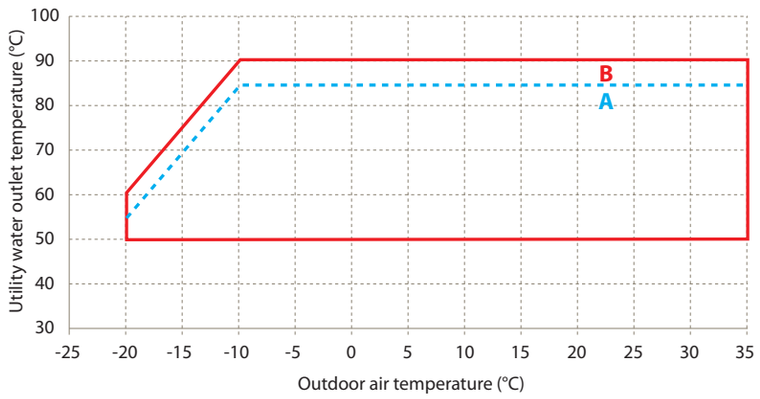
UNIT SIZE			18	24	48
Refrigerant			**R744 (CO_2)**	**R744 (CO_2)**	**R744 (CO_2)**
Quantity	Kg		7	9	12
Performances					
Heating capacity / COP	kW/-	Air -10 °C / Water 15 -> 70 °C	9.1 - 2.8	14.4 - 2.8	27.0 - 2.9
		Air -10 °C / Water 25 -> 60 °C	9.5 -2.7	15.1 – 2.8	28.4 - 2.9
		Air -10 °C / Water 25 -> 80 °C	9.4 - 2.5	15.0 - 2.5	28.1 - 2.6
		Air -7 °C / Water 15 -> 70 °C	10.1- 2.9	16.0 - 3.0	30.1 - 3.1
		Air -7 °C / Water 25 -> 60 °C	9.5 - 2.8	15.1 – 2.9	28.4 - 3.1
		Air -7 °C / Water 25 -> 80 °C	9.4 -2.6	15.0 -2.6	28.1 -2.7
		Air 0 °C / Water 15 -> 70 °C	12.4 -3.2	19.7 -3.3	36.9 -3.4
		Air 0 °C / Water 25 -> 60 °C	11.7 -3.0	18.2 -3.1	34.8 -3.2
		Air 0 °C / Water 25 -> 80 °C	11.5 - 2.7	18.2 – 2.8	34.2 - 3.0
		Air 2 °C / Water 15 -> 70 °C	13.0 - 3.2	20.6 - 3.3	38.6 - 3.4
		Air 2 °C / Water 25 -> 60 °C	12.2 - 3.3	19.2 - 3.3	36.3 - 3.4
		Air 2 °C / Water 25 -> 80 °C	12.1 – 2.9	19.1 - 3.0	35.6 - 3.0
		Air 7 °C / Water 15 -> 70 °C	14.6 - 3.5	23.1 - 3.6	43.5 - 3.7
		Air 7 °C / Water 25 -> 60 °C	13.7 - 3.5	21.6 - 3.5	40.7 - 3.7
		Air 7 °C / Water 25 -> 80 °C	13.5 - 3.0	21.4-3.1	40.4 - 3.2
		Air 15 °C / Water 15 -> 70 °C	17.1 – 3.8	27.0 – 3.9	50.9 - 3.8
		Air 15 °C / Water 25 -> 60 °C	16.1 – 3.8	25.4 – 3.9	47.8 - 4.8
		Air 15 °C / Water 25 -> 80 °C	16.0 - 3.2	25.4 – 3.3	47.9 - 3.4
		Air 20 °C / Water 15 -> 70 °C	18.6 - 4.0	29.5 - 4.1	55.4 - 4.2
		Air 20 °C / Water 25 -> 60 °C	17.5 - 4.1	27.6 - 4.2	52.0 - 4.3
		Air 20 °C / Water 25 -> 80 °C	17.6- 3.4	27.8- 3.5	52.3 - 3.7
Noise					
Sound pressure at 10 m	dBA		43	46	48
Ventilation					
Nr. of fans	nr.		1	2	3
Single fan max P.	kW		0.6	0.6	0.6
Single fan max I	A		2.62	2.62	2.62
Unit air flow	m^3/h		5000	8000	16000
Useful static pressure	Pa		-	-	-
Circulator/pump					
Type			circulator	circulator	circulator
Command			Signal 0-10 V	Signal 0-10 V	Signal 0-10 V
Pump max P.	W		4-72	8-140	16-310
pump max I	A		0.1- 0.69	0.09 - 1.30	0.16-1.37
Motor protection device			Present	Present	Present
Operating temperature	°C		-10° to +95°	-10° to +95°	-10° to +95°
Maximum operation pressure	bar		6	6	6

UNIT SIZE			18	24	48
Electrical data of the unit					
Power supply			3~. 400V. 50 Hz	3~. 400V. 50 Hz	3~. 400V. 50 Hz
Unit cons. max power	kW		6.0	11.0	17.0
Max consumed current	A		13.0	26.0	35.0
Inrush current	A		47.0	112.0	145.0
Compressor					
Type of compressor			semi-hermetic	semi-hermetic	semi-hermetic
Nr. of compressors	Nr.		1	1	1
Guard resistance	W		100	200	200
Over-temperature safety device			Internal	Internal	Internal
Oil cooling			Internal	Internal	Internal
Maximum consumption	kW		5.2	9.0	14.5
Quantity of oil	Kg		1.3	2.5	2.5
Type of oil			3MRP18	3MRP18	3MRP18
Type			Polyester	Polyester	Polyester
Hydronic circuit					
Hydraulic pipe material			Cu	Cu	Cu
IN water connection	"		1"	1"	1"1/4
OUT water connection	"		1"	1"	1"1/4
Max pressure allowed	bar		6	6	6
Unit main data					
Colour			RAL 9018	RAL 9018	RAL 9018
Unit insulation class			IPX4	IPX4	IPX4
High Pressure	bar		120	120	120
Low Pressure	bar		80	80	80
Outer dimensions	mm		1100x1000x1800	1300x900x1800	1800x900x1800
Pipe material R744			AISI 316	AISI 316	AISI 316

AIR/WATER UNIT OPERATING LIMITS

Operation limits only for the production of high temperature water.

HEATING ONLY

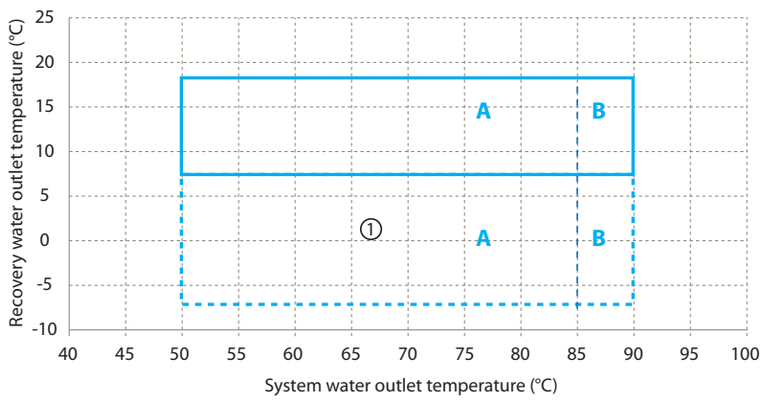


Notes:

- A standard limits.
- B extended limits; for this version contact the Technical Design Department.
- The water return temperature to the unit must not exceed 40°C.
- The operation of the unit out of the aforementioned limits can cause malfunctions and damage the unit.
- Minimum water thermal gradient 30°C between inlet and outlet.

Recovery operation limits: production of high temperature water and refrigerated water.

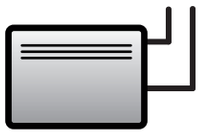
COLD RECOVERY



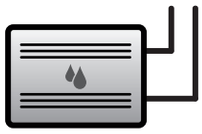
Notes:

- A standard limits.
- B extended limits; for this version contact the Technical Design Department.
- ① Operation limits for units with glycolate water.
- The water return temperature to the unit must not exceed 40°C.
- The operation of the unit out of the aforementioned limits can cause malfunctions and damage the unit.
- Minimum water thermal gradient 30°C in the gas cooler.
- Minimum and maximum thermal gradient in the evaporator between 3 and 6°C.

KEY

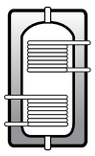


Hydronic terminals
They can be of several types: fan coils, cassettes or water air treatment units. In general, they can be used for heating, cooling and for dehumidification.



Water dehumidification
During summer operation, it can use the same water of the radiant panel system, for a pre/post treatment of the air, obtaining a isothermal humidification.

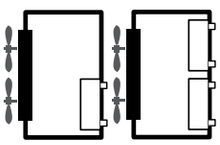
Radiant panel
It can be floor, ceiling or wall mounted and allows either heating or cooling the environments. Low water temperatures during winter and high temperatures during summer operation allow obtaining high energy efficiency, especially if combined with the heat pump technology. During summer operation, it must be combined with a dehumidification system.



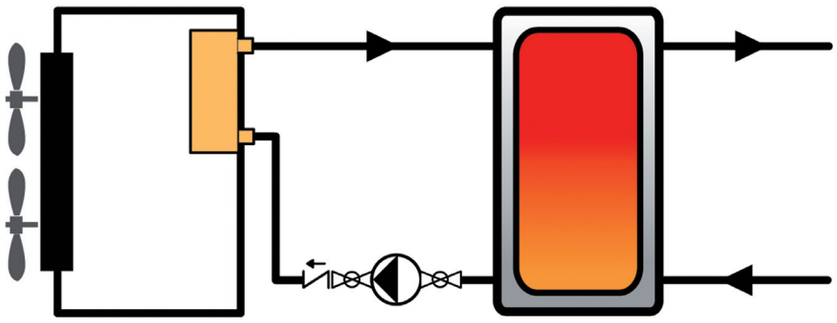
Storage tank for domestic hot water
Intended for the storage or instantaneous production of domestic hot water, it can be of several types and dimensions and it must be assessed basing on the type of application and requirements of the building. Beyond the connections to the heat pump, it can also be equipped with one or more integration systems, by means of boiler, solar panels or electrical resistances.

Remote air heat exchanger
To be used combined with units without heat exchanger at the source side, it must be connected to the inner unit by means of cooling pipes. Available in standard versions, low noise for outdoor installation or ducted for indoor installation.

Thermal solar panel
It must be combined with a storage tank and integrates the production of domestic hot water, which normally is carried out by the heat pump.



Air-water unit
They can be installed either indoors or outdoors and use air as thermal source, which facilitates the application in any field.



BASIC SYSTEM The unit stores in a tank high temperature hot water (max. 90°C). Ideal for the residential, business and industrial sector.

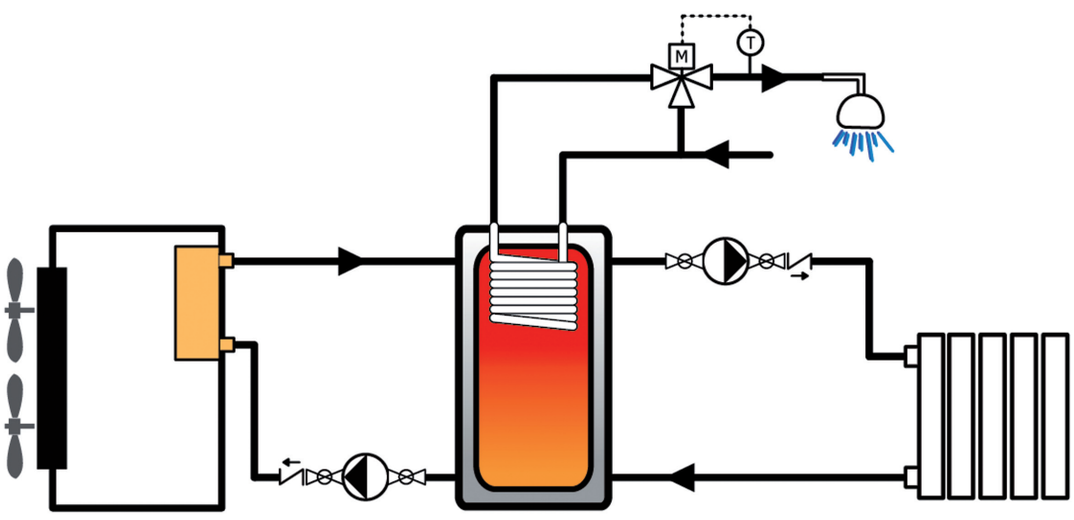


DIAGRAM 1 The unit powers the high temperature heating system and simultaneously makes domestic hot water available.

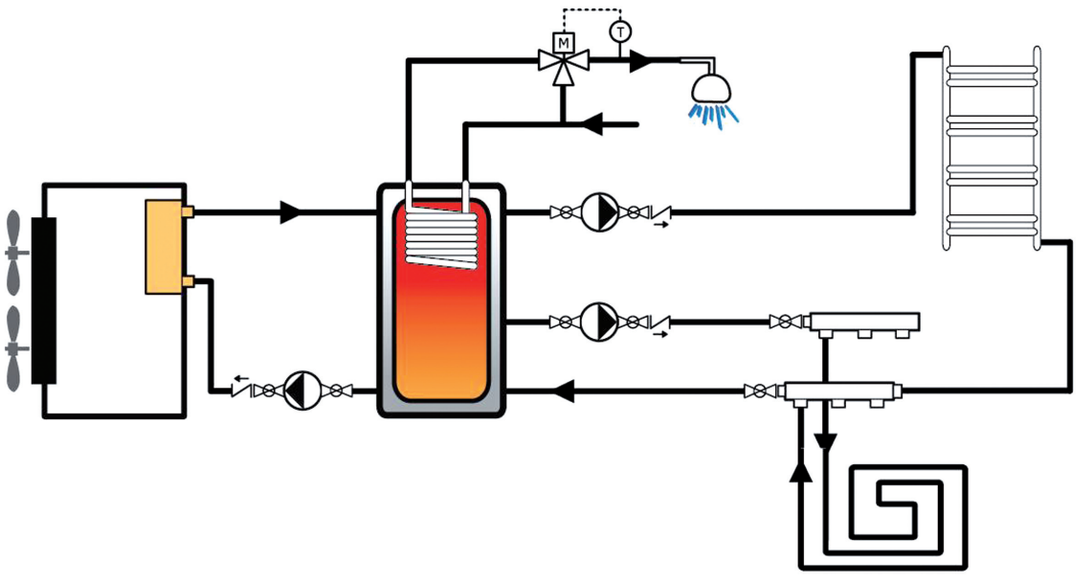


DIAGRAM 2 The unit maintains the water inside the boiler at high temperatures. From the latter, water can be drawn for radiators or towel heaters, floor system and the instantaneous production of domestic hot water.

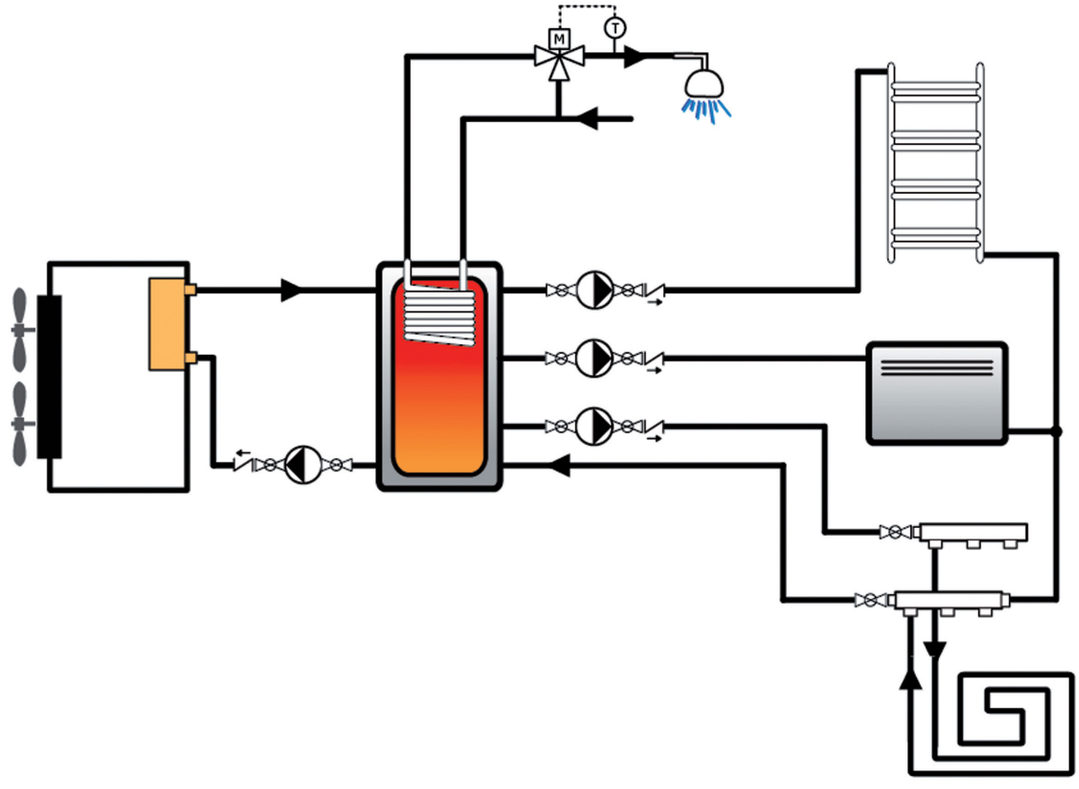


DIAGRAM 3 The unit powers a three-temperature system: high temperature for radiant heating and production of DHW, medium temperature for fan coils and low temperature for the radiant.

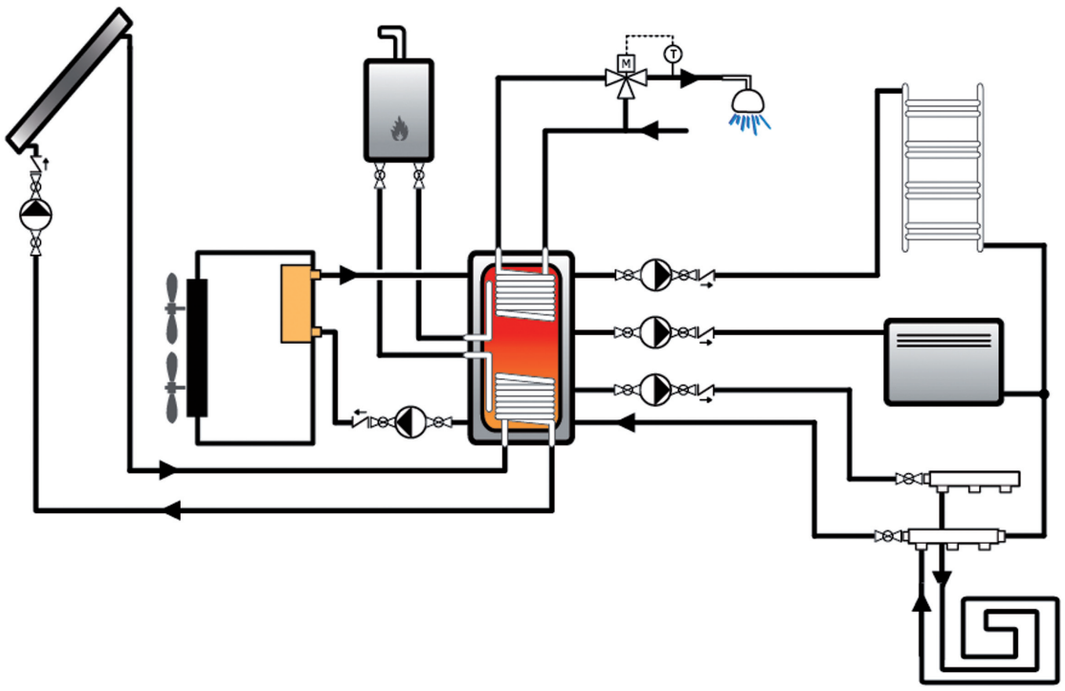


DIAGRAM 4 Combined with the appropriate boiler, the unit is able to meet all the requirements of a building. Beyond producing water at different temperatures, the boiler is set for the connection to the solar panel and a backup boiler.

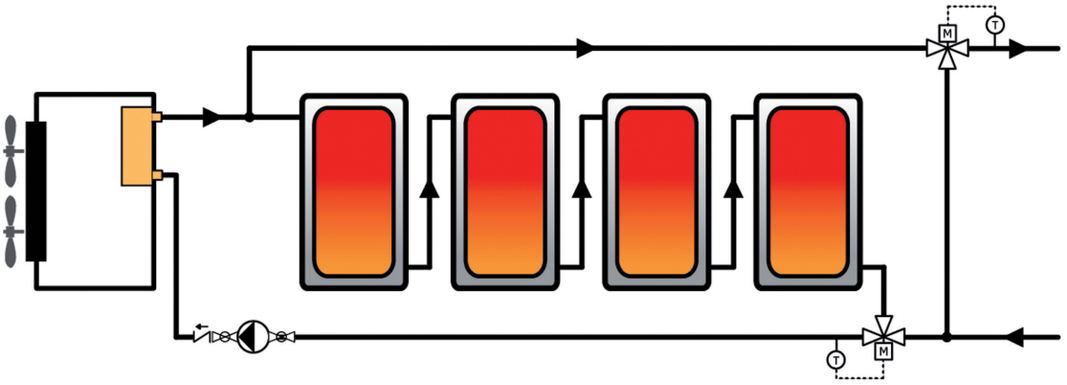


DIAGRAM 5 The system guarantees high quantity of water at high temperatures. The storage inside multiple tanks, appropriately connected, guarantees a high system COP. Thanks to this solution, the unit can operate during the night, when energy rates are lower or when other electrical loads are not operating, decreasing the electric power installed.

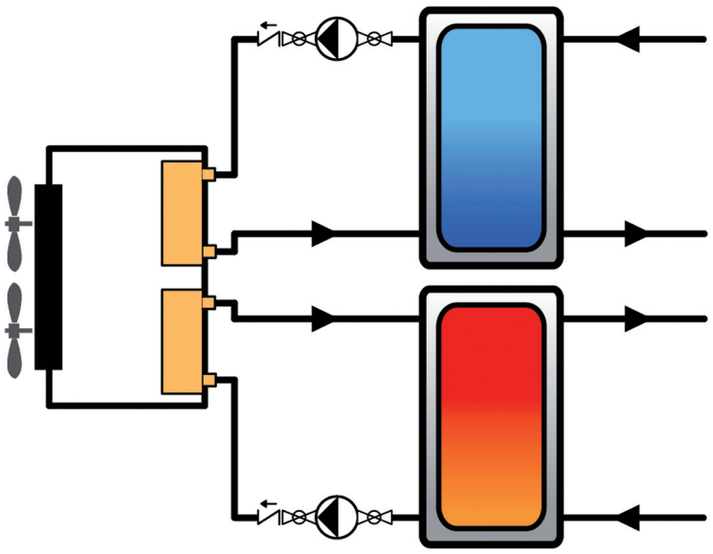
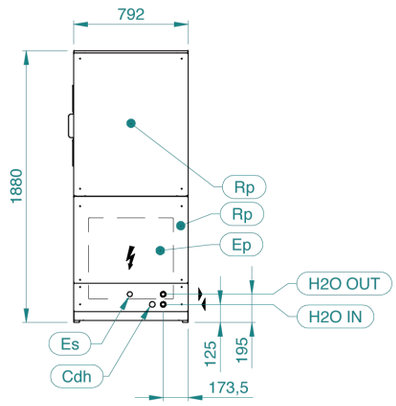
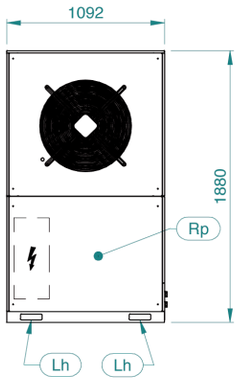
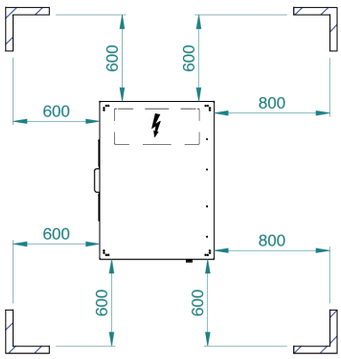


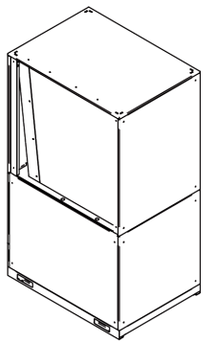
DIAGRAM 6 The "Multi-purpose" version with cold recovery allows having hot and refrigerated water always available.

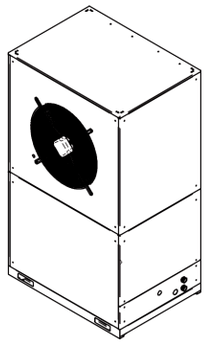
HP90 18











SPAZI DI INSTALLAZIONE / CLEARANCES

DIMENSIONI - DIMENSIONS		
LUNGHEZZA WIDTH	PROFONDITA' DEPTH	ALTEZZA HEIGHT
1092	792	1880

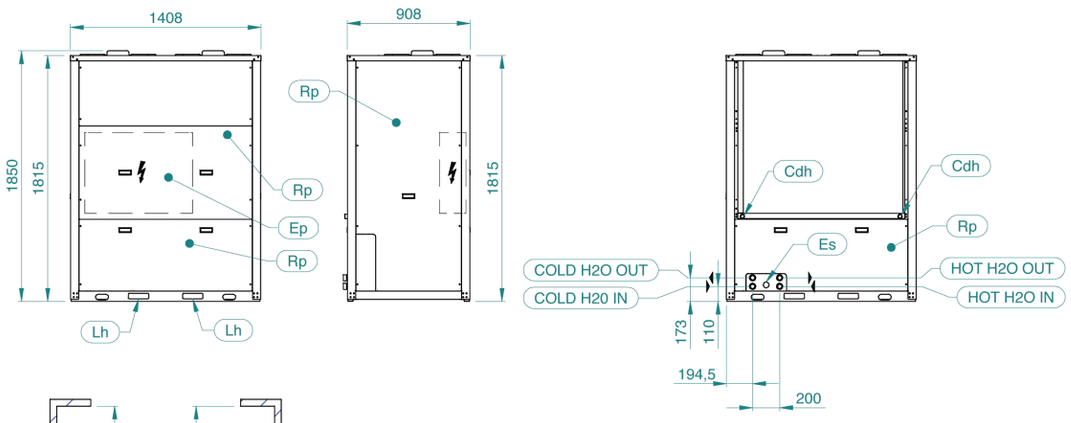
H2O IN	INGRESSO ACQUA WATER INLET
H2O OUT	USCITA ACQUA WATER OUTLET

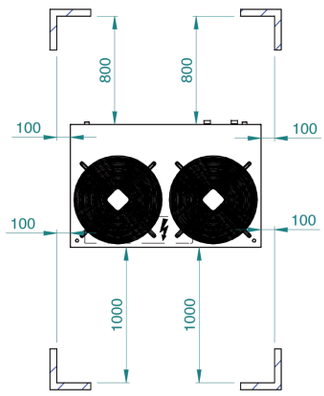
	H20 IN	H20 OUT
18	G 1" F	G 1" F

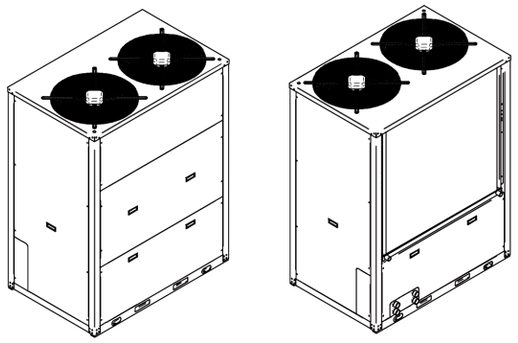
Ep	QUADRO ELETTRICO ELECTRICAL PANEL
Es	INGRESSO ALIMENTAZIONE ELETTRICA ELECTRICAL SUPPLY INLET
▨	SPAZI DI INSTALLAZIONE CLEARANCES
Rp	PANNELLO ASPORTABILE REMOVABLE PANEL
Lh	FORI DI SOLLEVAMENTO LIFTING HOLES
Cdh	SCARICO CONDENSA CONDENSATE DRAIN

SD00098

HP90 24







SPAZI DI INSTALLAZIONE / CLEARANCES

Ep	QUADRO ELETTRICO ELECTRICAL PANEL
Es	INGRESSO ALIMENTAZIONE ELETTRICA ELECTRICAL SUPPLY INLET
	SPAZI DI INSTALLAZIONE CLEARANCES
Rp	PANNELLO ASPORTABILE REMOVABLE PANEL
Lh	FORI DI SOLLEVAMENTO LIFTING HOLES
Cdh	SCARICO CONDENSA CONDENSATE DRAIN

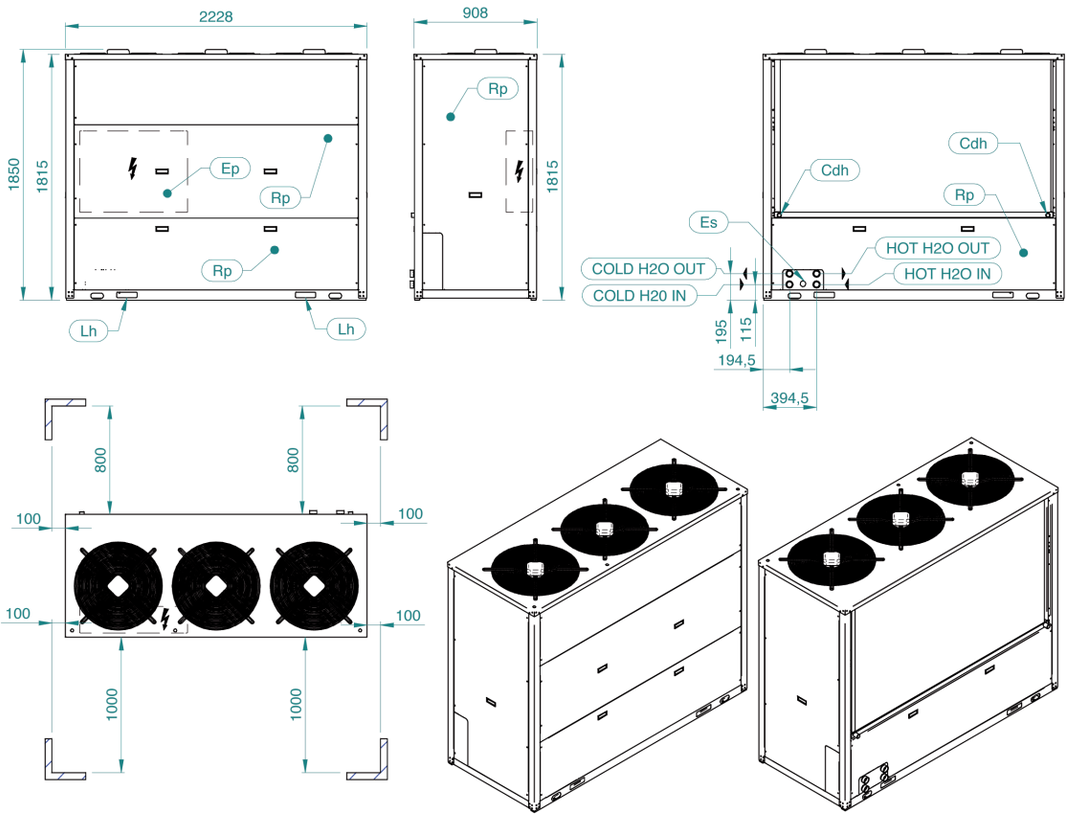
	COLD H20 IN	COLD H20 OUT	HOT H20 IN	HOT H20 OUT
24	G 1" 1/4 F	G 1" 1/4 F	G 1" 1/4 F	G 1" 1/4 F

COLD H2O IN	INGRESSO ACQUA FREDDA COLD WATER INLET
COLD H2O OUT	USCITA ACQUA FREDDA COLD WATER OUTLET
HOT H2O IN	INGRESSO ACQUA CALDA HOT WATER INLET
HOT H2O OUT	USCITA ACQUA CALDA HOT WATER OUTLET

DIMENSIONI - DIMENSIONS		
LUNGHEZZA WIDTH	PROFONDITA' DEPTH	ALTEZZA HEIGHT
1408	908	1850

SD00099

HP90 48



SPAZI DI INSTALLAZIONE / CLEARANCES

Ep	QUADRO ELETTRICO / ELECTRICAL PANEL
Es	INGRESSO ALIMENTAZIONE ELETTRICA / ELECTRICAL SUPPLY INLET
	SPAZI DI INSTALLAZIONE / CLEARANCES
Rp	PANNELLO ASPORTABILE / REMOVABLE PANEL
Lh	FORI DI SOLLEVAMENTO / LIFTING HOLES
Cdh	SCARICO CONDENSA / CONDENSATE DRAIN

	COLD H20 IN	COLD H20 OUT	HOT H20 IN	HOT H20 OUT
48	G 1" 1/2 F	G 1" 1/2 F	G 1" 1/2 F	G 1" 1/2 F

COLD H2O IN	INGRESSO ACQUA FREDDA / COLD WATER INLET
COLD H2O OUT	USCITA ACQUA FREDDA / COLD WATER OUTLET
HOT H2O IN	INGRESSO ACQUA CALDA / HOT WATER INLET
HOT H2O OUT	USCITA ACQUA CALDA / HOT WATER OUTLET

DIMENSIONI - DIMENSIONS		
LUNGHEZZA / WIDTH	PROFONDITA' / DEPTH	ALTEZZA / HEIGHT
2228	908	1850

HP90

Water/water unit

Standard unit

STRUCTURE

The structure is made of steel plate painted with epoxy powder RAL 9003, with removable panels on the three sides, to facilitate the access during maintenance and installation.
The electrical and hydronic connections and the passage for temperature probes are all installed on the upper part of the unit, thereby, allowing the adherence to the wall.
The units are intended for indoor installation.
The unit is always provided with rubber anti-vibration devices. By means of anti-vibration devices, the base of the machine supports a structure that collects all the moving components (pumps and compressor). Also the compressor is supported by anti-vibration devices. This triple damping system allows to fully remove the vibrations transmitted to the floor.

COMPRESSORS

The state of the art semi-hermetic compressors are piston type.
These compressors have been designed for heating with the R744 refrigerant.
The maximum compressor efficiency is obtained during the heating operation with compression ratios.
The compressor is equipped with a thermal protection device, oil level indicator, guard electric resistance and it is installed on rubber anti-vibration devices to reduce the transmission of vibrations to the unit.
Moreover, the compressor is equipped with an inner oil cooling system, which ensures the correct lubrication in every operation section.

UTILITY AND SOURCE SIDE EXCHANGERS

A temperature probe is installed on the stainless steel AISI 316 brazed plate heat exchangers with closed cell thermal insulation, ideal to reduce thermal losses, and is connected to the control to protect the heat exchanger against freeze. The counter-current heat exchange optimises the COP values and allows reaching high temperatures. The accurate selection of the heat exchangers has allowed maximising the efficiency of the heat pump operation and to have extremely low load losses from the water side, even in presence of high concentrations of glycol. This way, the unit minimises the power consumed by the pumps.

REFRIGERANT CIRCUIT

Includes: compressor, plate heat exchanger source side, plate heat exchanger system side, regenerative heat exchanger, charge connections, intake filter, electronic thermostatic expansion valve, high and low pressure switch, low pressure safety valve, high pressure by-pass device, liquid receiver.

ELECTRICAL PANEL

Equipped with main sectioning device, power and auxiliary circuit protection device, compressor contactor, microprocessor control with display of the main functions.
The electric board consists of:

> Automatic protection switch of the auxiliary and power circuits.
> Main switch and fuses to protect the auxiliary and power circuits.
> Compressor contactor.
> Pump relay or motor protector and contractor.
> General alarm free contacts.
> Main control functions:
  - Temperature adjustment of utility set point.
  - Circulator/pump management.
  - Anti-freeze protection management for the heat exchanger system side.
  - Management of the compressor operating cycle frequency.

CONTROL AND SAFETY DEVICES

> Automatic resetting high pressure safety device (factory-set).
> Automatic resetting low pressure safety device.
> Low pressure safety valve.
> By-pass safety device high pressure side.
> Outlet water temperature control probe.
> Gas cooler refrigerant outlet temperature probe.
> Intake temperature probe.
> Evaporating temperature probe.
> Pressure probe.
> Low pressure probe.
> Anti-freeze probe placed at the heat exchanger outlet system side.
> Paddle mechanical flow switch.
> Compressor over temperature protection device.

TESTING

All units are factory-tested and provided equipped with oil and refrigerant fluid.
When ordering, provide the operation values required by the unit.

MAXIMUM MODULARITY

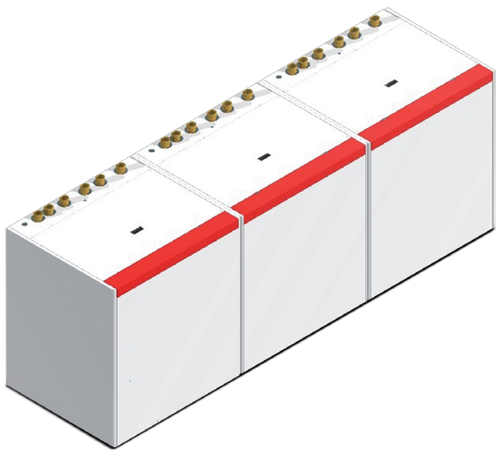
Sizes 24 and 48 of the range are designed to be used as modules to reach the desired thermal power.
The units are conceived to be linked directly in the factory. The hydraulic circuit of the two or more units are manifolded together, so the final user has only one inlet and outlet for DHW and refrigerated water.
In case of multiple modules the E.P. will be one. Therefore, only one power supply will be required for all modules.

The possible combinations are described below:

thermal Kw required/ type and unit number	Unit 24	Unit 48	Unit and circuit total
24 kW	1	0	1
48 kW	0	1	1
72 kW	1	1	2
96 kW	0	2	2
120 kW	1	2	3
144 kW	0	3	3

Compared to the great power of a single unit, the modular solution offers several benefits, such as:

> **Reliability:** a greater number of cooling circuits ensures a sufficient operation, even in case of serious malfunctions.
> **Power modulation:** during the operation, a high number of circuits allows following the thermal load efficiently. During the period of low request, the redundant units can be disabled.
> **Flexibility:** the required power can be installed in those systems that will upgrade throughout the time, in order to install other modules. This way, the system will evolve according to the energy requests of the utility.
> **After-Sales and spare parts:** The repeated use of few components make sure spare parts are always available, ensuring prompt action and a rapid recover of the functions.
> **Excellence:** The continuous production of modular units allows reaching extremely high and reliable production quality.
> **The thermal/conditioning unbalance can be managed:** in case cold is a fraction of the heat efficiency, some units equipped with cold recovery can be installed. This way, thermal and cooling power can be accurately dosed.



UTILITY SIDE HYDRAULIC MODULE

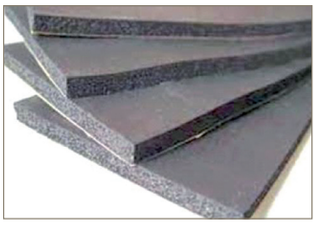
The unit standard version is equipped with a circulator or pump placed at the system side. The circulator is directly driven by the unit control. The flow will vary depending on the water outlet set point required, in order to reach the set temperature and maximise the COP value.
The presence of a solenoid valve in the water outlet pipe prevents the formation of a water flow, due to the strong thermal gradient.

Options

FEATURES CONSTRUCTION

/LN
Silenced version

It can be combined with any above-mentioned set ups. It consists of a panel internal coating, made with soundproofing and sound absorbing material, to further limit sound emissions. The material used is made of a layer of sound absorbing material and a layer of soundproofing material, which are able to remove sound emissions within a frequency of 100 and 8000 Hz. The sound pressure is reduced of approximately 5 dBA.



/1S
Source side pump

On the hydraulic circuit source side, the unit is equipped with a circulator or pump (depending on the model) and a water discharge valve.

ACCESSORIES

Furthermore, the HP90 range can be equipped with a series of accessories. For a complete list of accessories, refer to the price list.

GAUGES

HIGH AND LOW pressure meter of the cooling circuit.

ELECTRONIC SOFT STARTER

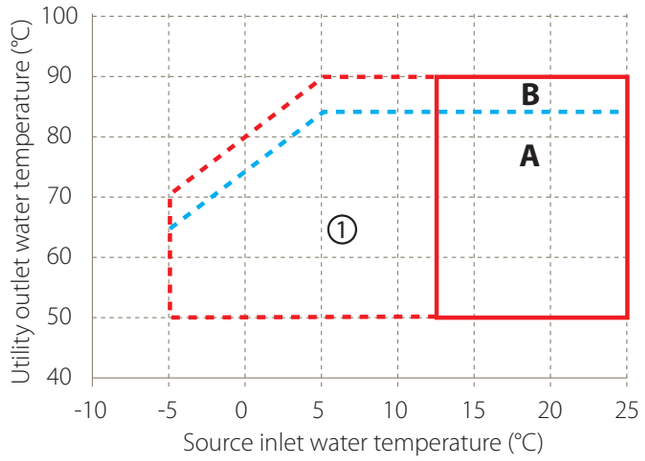
Electronic device placed inside the electric board. The function is to decrease the consumed current of approximately 40% at the unit start-up. Reducing the consumed current means limiting the consumed power. The accessory is ideal in case of low inertia of the system.

UNIT SIZE			18	24	48
Refrigerant			**R744 (CO_2)**	**R744 (CO_2)**	**R744 (CO_2)**
Quantity	Kg		2	3	5
Performances					
Heating capacity / COP	kW/-	Water 10 -> 5 °C / Water 10 -> 80 °C	14.6-3.3	23.1-3.4	43.4-3.4
		Water 10 -> 5 °C / Water 10 -> 70 °C	14.8-3.7	23.4-3.7	44.0-3.6
		Water 10 -> 5 °C / Water 10 -> 60 °C	15.1-4.1	23.9-4.1	44.9- 4.2
		Water 15 -> 10 °C / Water 10 -> 80 °C	16.4-3.6	25.9-3.6	48.8-3.6
		Water 15 -> 10 °C / Water 10 -> 70 °C	16.5-3.9	26.1- 4.0	49.1-4.0
		Water 15 -> 10 °C / Water 10 -> 60 °C	16.8-4.5	26.5-4.5	50.0-4.6
		Water 0 -> -3 °C / Water 10 -> 80 °C	11.3-2.9	17.9-3.0	33.6-3.0
		Water 0 -> -3 °C / Water 10 -> 70 °C	11.7-3.1	18.5-3.2	34.8-3.2
		Water 0 -> -3 °C / Water 10 -> 60 °C	11.9-3.4	18.8- 3.4	35.4-3.4
Noise					
Sound pressure at 1 m, Q=4	dBA		45	49	55
Circulator/pump					
Type			circulator	circulator	circulator
Command			Signal 0-10 V	Signal 0-10 V	Signal 0-10 V
Pump max P.	W		4-72	8-140	16-310
pump max I	A		0.1- 0.69	0.09 - 1.30	0.16-1.37
Motor protection device			Present	Present	Present
Operating temperature	°C		-10° to +95°	-10° to +95°	-10° to +95°
Maximum operation pressure	bar		6	6	6
Electrical data of the unit					
Type of compressor			semi-hermetic	semi-hermetic	semi-hermetic
Nr. of compressors	Nr.		1	1	1
Guard resistance	W		100	200	200
Over-temperature safety device			Internal	Internal	Internal
Oil cooling			Internal	Internal	Internal
Maximum consumption	kW		5.2	9.0	14.5
Quantity of oil	Kg		1.3	2.5	2.5
Type of oil			3MRP18	3MRP18	3MRP18
Type			Polyester	Polyester	Polyester
Hydronic circuit					
Hydraulic pipe material			Cu	Cu	Cu
IN water connection	"		1"	1"	1" 1/4
OUT water connection	"		1"	1"	1" 1/4
Max pressure allowed	bar		6	6	6
Unit main data					
Colour			RAL 9003	RAL 9003	RAL 9003
Unit insulation class			IPX4	IPX4	IPX4
High Pressure	bar		120	120	120
Low Pressure	bar		80	80	80
Outer dimensions (W,D,H)	mm		1200x1040x1305	1200x1040x1305	1200x1040x1305
Pipe material R744			AISI 316	AISI 316	AISI 316

WATER/WATER UNIT OPERATING LIMITS

Operation limits only for the production of high temperature water.

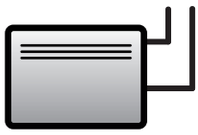
CHILLER AND HEAT PUMPS



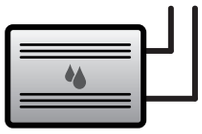
Notes:

- A standard limits.
- B extended limits; for this version contact the Technical Design Department.
- Operate in area ① only with appropriate concentration of glycol.
- Minimum water thermal gradient in the gas cooler of 30°C.
- Minimum and maximum thermal gradient in the evaporator between 3 and 6°C.

KEY

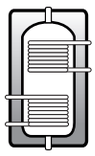


Hydronic terminals
They can be of several types: fan coils, cassettes or water air treatment units. In general, they can be used for heating, cooling and for dehumidification.



Water dehumidification
During summer operation, it can use the same water of the radiant panel system, for a pre/post treatment of the air, obtaining a isothermal humidification.

Radiant panel
It can be floor, ceiling or wall mounted and allows either heating or cooling the environments. Low water temperatures during winter and high temperatures during summer operation allow obtaining high energy efficiency, especially if combined with the heat pump technology. During summer operation, it must be combined with a dehumidification system.

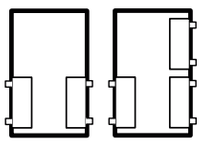


Storage tank for domestic hot water
Intended for the storage or instantaneous production of domestic hot water, it can be of several types and dimensions and it must be assessed basing on the type of application and requirements of the building. Beyond the connections to the heat pump, it can also be equipped with one or more integration systems, by means of boiler, solar panels or electrical resistances.

Thermal solar panel
It must be combined with a storage tank and integrates the production of domestic hot water, which normally is carried out by the heat pump.

Geothermal probes
They can be horizontal or vertical and their dimension must be determined by the designer, basing on the power to be exchanged with the ground.

Well
This generic symbol indicates all heat sources that can operate with running water, such as water tables, streams or reservoirs. This kind of application is normally regulated by local laws and may require the installation of an intermediate heat exchanger (not represented in these layouts).



Water-water or geothermal units
Intended for indoor installation, they require a water source or geothermal probes.

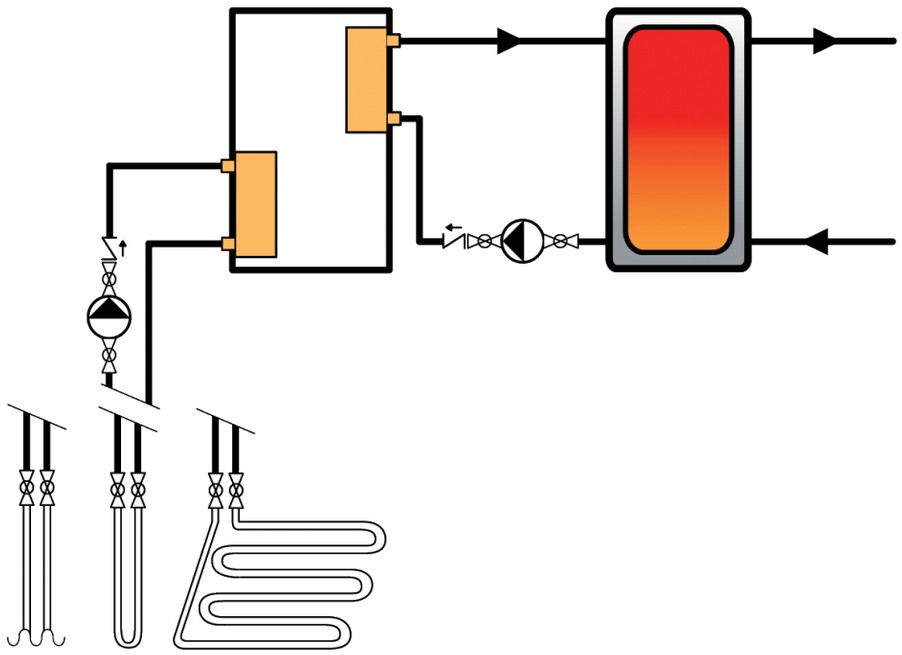


DIAGRAM 0W Basic system. The unit stores in a tank high temperature hot water (max. 90°C). Ideal for the residential, business and industrial sector. As source, water tables and vertical or horizontal geothermal probes can be used.

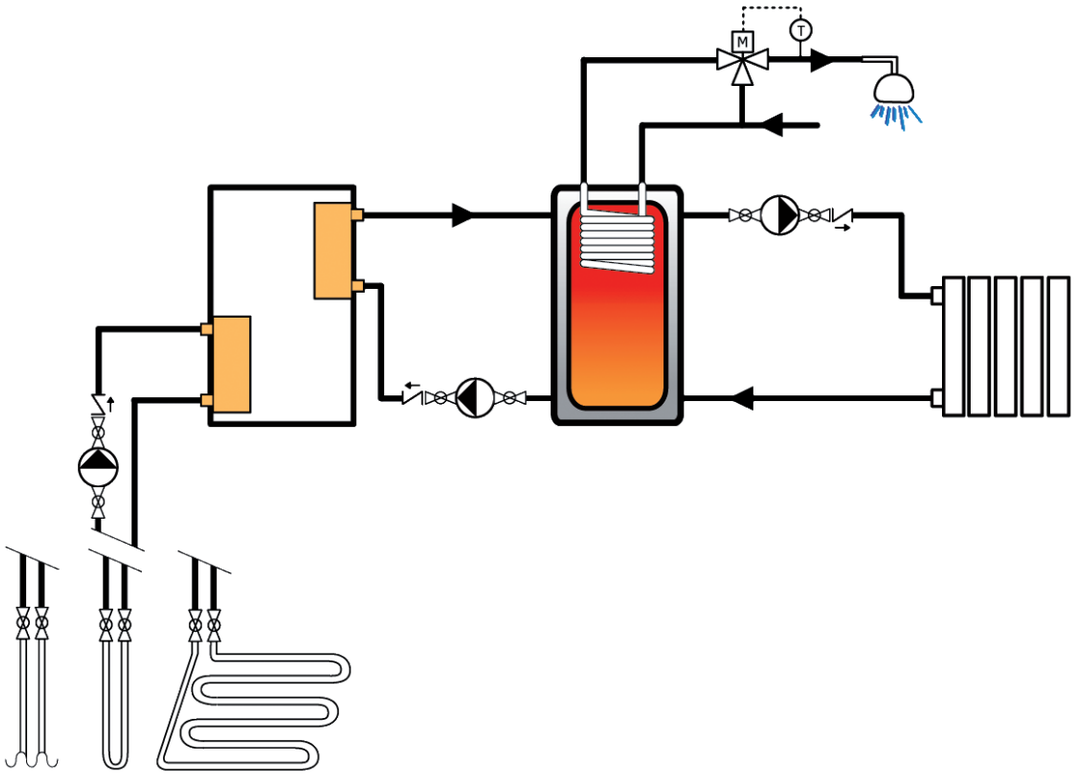


DIAGRAM 1W The unit powers the high temperature heating system and simultaneously makes domestic hot water available.

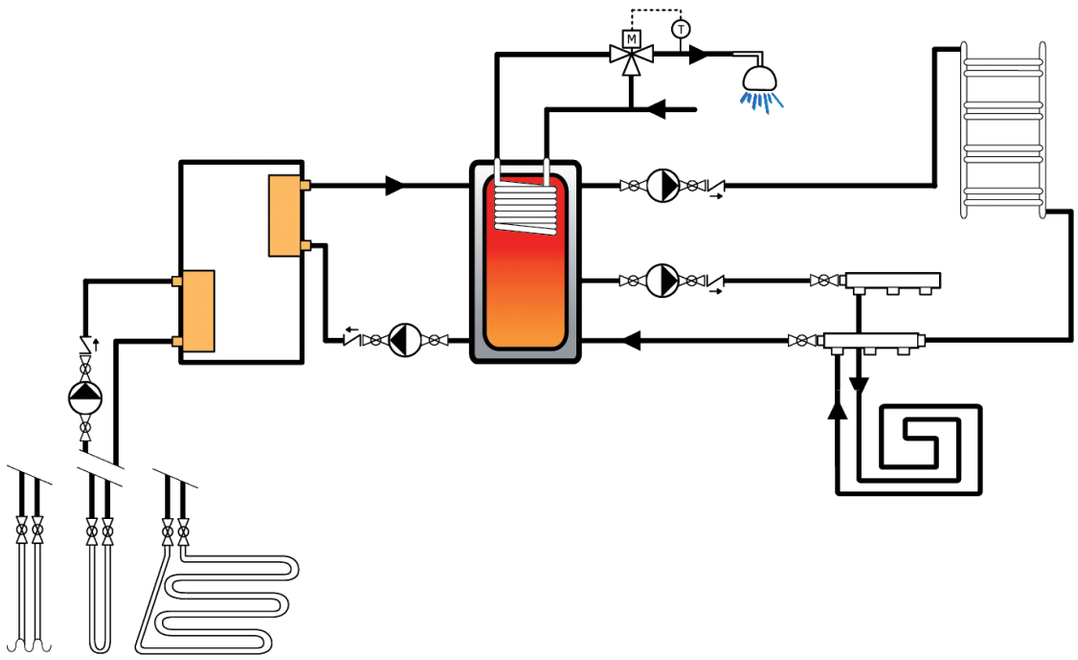


DIAGRAM 2W The unit maintains the water inside the boiler at high temperatures. From the latter, water can be drawn for radiators or towel heaters, floor system and the instantaneous production of domestic hot water.

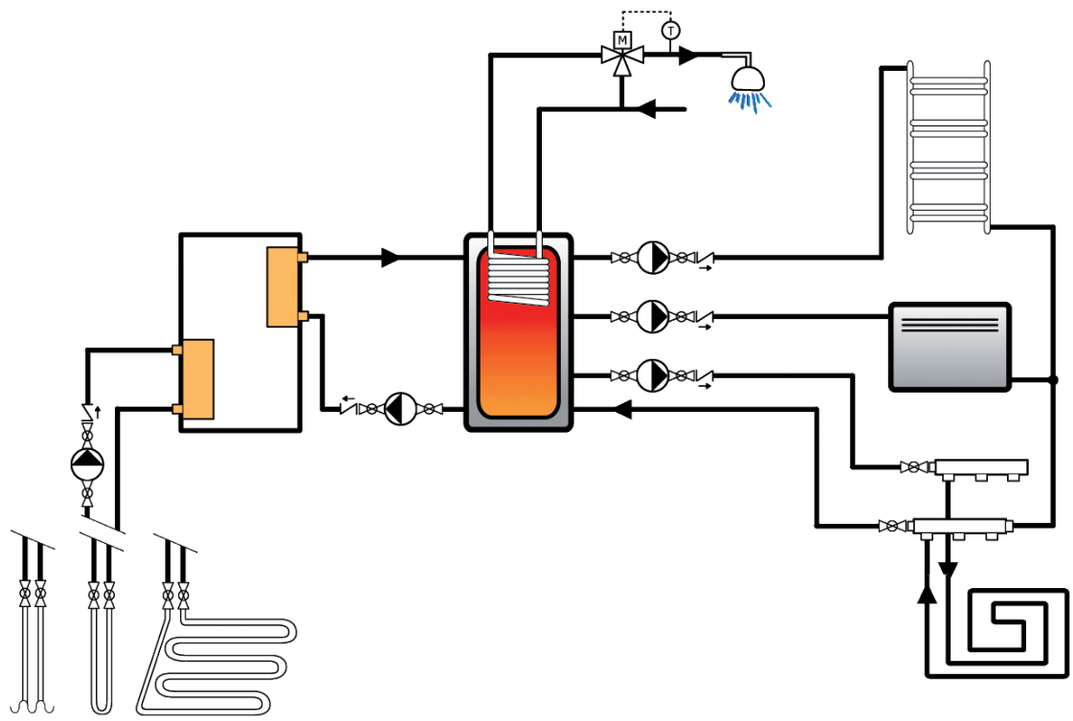


DIAGRAM 3W The unit powers a three-temperature system: high temperature for radiant heating and production of DHW, medium temperature for fan coils and low temperature for the radiant.

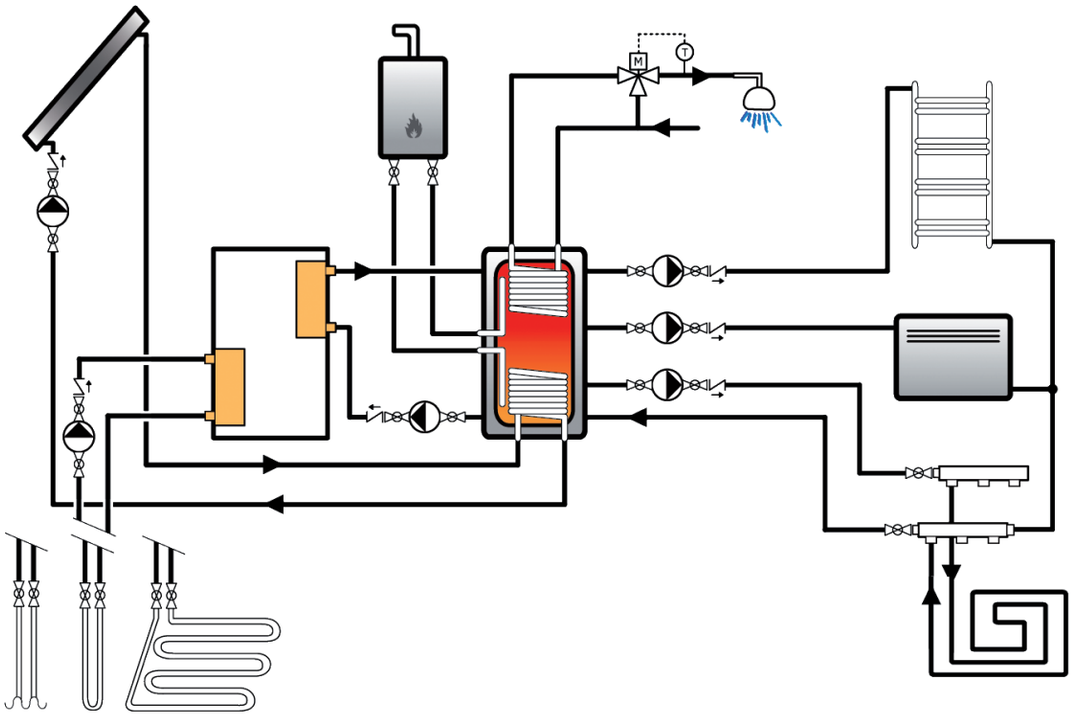


DIAGRAM 4W Combined with the appropriate boiler, the unit is able to meet all the requirements of a building. Beyond producing water at different temperatures, the boiler is set for the connection to the solar panel and a backup boiler.

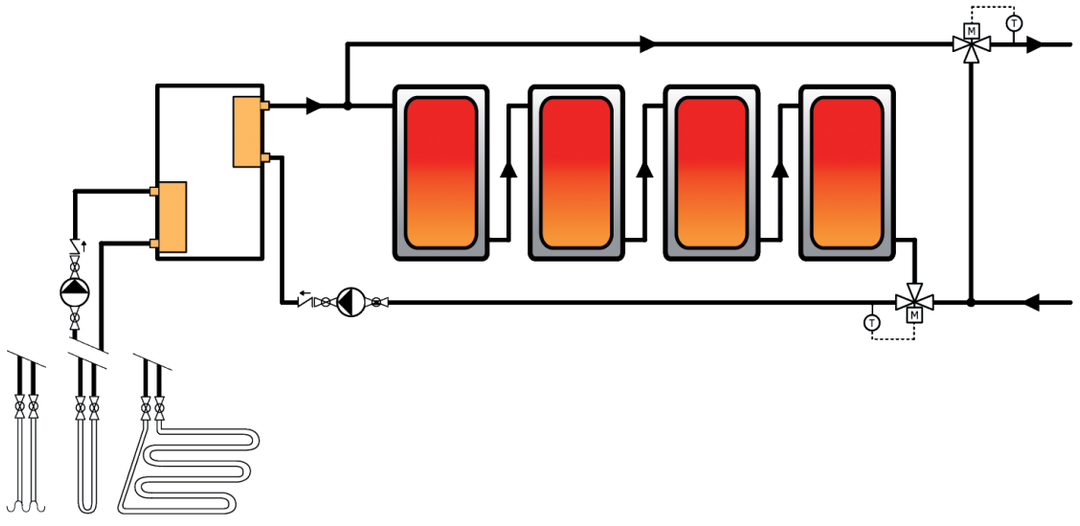
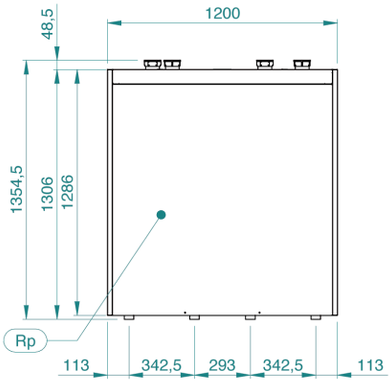
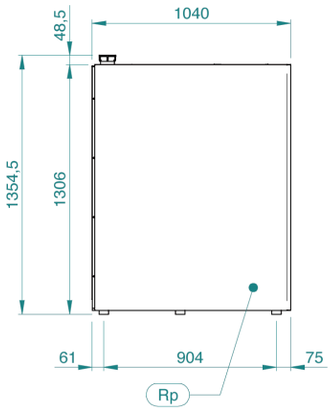
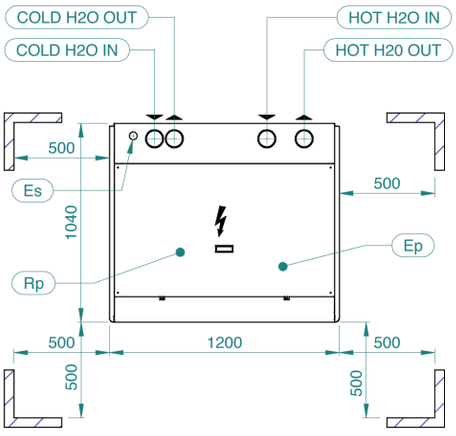
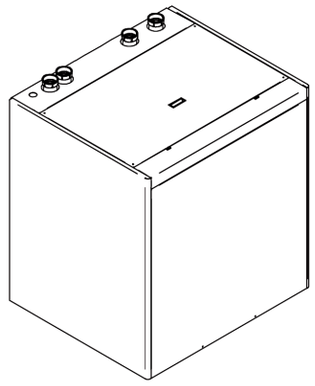


DIAGRAM 5W The system guarantees high quantity of water at high temperatures. The storage inside multiple tanks, appropriately connected, guarantees a high system COP. Thanks to this solution, the unit can operate during the night, when energy rates are lower or when other electrical loads are not operating, decreasing the electric power installed.









Ep	QUADRO ELETTRICO ELECTRICAL PANEL
Es	INGRESSO ALIMENTAZIONE ELETTRICA ELECTRICAL SUPPLY INLET
Rp	PANNELLO ASPORTABILE REMOVABLE PANEL
	SPAZI DI INSTALLAZIONE CLEARANCES

MODELLO MODEL	COLD H2O IN	COLD H2O OUT	HOT H2O IN	HOT H2O OUT
18 - 48	G 1" 1/2 F	G 1" 1/2 F	G 1" 1/2 F	G 1" 1/2 F

COLD H2O IN	INGRESSO ACQUA FREDDA COLD WATER INLET
COLD H2O OUT	USCITA ACQUA FREDDA COLD WATER OUTLET
HOT H2O IN	INGRESSO ACQUA CALDA HOT WATER INLET
HOT H2O OUT	USCITA ACQUA CALDA HOT WATER OUTLET

Note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