

Poker-PI

THA1TP 150



Modular reversible heat pumps with air condensation and helical fans. Series with hermetic scroll inverter compressors and environmentally friendly R290 refrigerant



PART OF **NIBE** GROUP

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1 English

1.1 RHOSS Useful for leed

LEED certification - which stands for "Leadership in Energy and Environmental Design" - is now the most internationally established protocol for defining and assessing the environmental sustainability of buildings. It was introduced in 1998 by the U.S. Green Building Council (USGBC) and was subsequently established internationally.



It is voluntary certification based on the consent that provides investors and all stakeholders with precise references for the design, construction and management of high performance green buildings. LEED is a flexible system that can be applied to all types of buildings, both new and existing, and covers the entire life cycle of the building. LEED certification is aimed at promoting a constructive transformation of the industry to achieve seven main objectives [LEED Version 4 - BD+C Guide]:

- Invert the contribution to climate change
- Improving individual health and wellbeing
- Protect and restore water resources
- Protect, improve and restore ecosystems and biodiversity
- Promote procurement cycles of sustainable and regenerative materials
- Create "green economy"
- Improving social equity, public health and quality of life

Since LEED is certification dedicated to buildings, products, technologies or building materials cannot be LEED certified and can only help meet the criteria of specific pre-requisites and credits of the LEED reference guide and help the building increase its score.

However, making an informed choice of certain products and technologies other than others may have a significant impact on the total score of the building; an impact that can reach 50% of the total.

This is why the builder may have an important role in the certification process and provide concrete support to the concerned parties. The role of the manufacturer will be basically consist of two activities:

- Provide precise mapping of products and/or technologies, aimed at identifying which products can be used in a LEED project and which pre-requisite criteria and credits these products help fulfil
- Offer services and expertise that are able to simplify and facilitate a number of activities specifically required by LEED standards

RHOSS units have been analysed according to the criteria described in Version 4 of the LEED certification, published in November 2013 and currently still flanked by Version 3 of 2009, with particular attention paid to the LEED Building Design and Construction guide.

With regards to the minimum energy efficiency criteria, aimed at determining whether a particular model can be used in a LEED project, the reference standard of Version 4 is ASHRAE Standard 90.1-6.8, section 90.1 - 2010 and table 6.8.1C, which replaces ASHRAE Standard 6.4-2007 used as a reference for LEED certification Version 3. Clearly, all RHOSS models that meet the minimum efficiency criteria of Version 4 also automatically meet the criteria of Version 3.

RHOSS SpA is a member of USGBC and actively supports the awareness of the principles of the sustainable design in the world.

GLOSSARY

GWP = Global Warming Potential - An index that expresses the greenhouse effect caused by gas emission into the atmosphere. Each substance has a definite potential in relation to CO₂, which has been conventionally defined as a potential equal to 1.

LCGWP = Life Cycle Global Warming Potential - An index which defines the global warming potential of the entire life cycle of the product. This index depends on: GWP of the refrigerant used, useful life of the product, estimated annual loss of refrigerant and end of life, amount of unit refrigerant.

LCODP = Life Cycle Ozone Depletion Potential - The index which defines the potential destruction of the stratospheric ozone layer of refrigerant used throughout the life cycle of the product. This index is 0 for refrigerants of the HFC and HFO family (R134a, R410A, R32, R454B, R1234ze, R515B) and natural refrigerants.

1.2 General features

Declared conditions of use

THAIP units are reversible monobloc heat pumps on the cooling cycle with air evaporation/condensation and helical fans in the high-efficiency version. They are suitable in air conditioning installations and industrial processes where chilled and hot water is required, not for human consumption.

The units are designed for outdoor installation

Guide to reading the code

T	Water production unit
H	Heat pump
A	Air cooling
I	Inverter scroll-type hermetic compressors
T	High efficiency
P	Propane refrigerant gas R290

1	Number of compressors
50	Approximate heat output (in kW)

The power value used to identify the model is approximate, for the exact value, identify the machine and consult the Technical Data.

Available Installations

Pump P1	Installation with pump
Pump P1 V3V	Set up with pump and 3-way diverter valve installed on board to divert water during domestic hot water production

Example: THAIP 150 P1

- Water production unit
- Heat pump
- Air-cooled
- With hermetic Scroll inverter compressor
- High efficiency unit
- R290 refrigerant fluid
- Approximate nominal cooling capacity 50 kW
- Installation with pump P1

1.3 AdaptiveFunction Plus

Reliable and versatile energy consumption heat pumps

A complete and flexible range

Heat pumps with R290 scroll compressor equipped with the innovative control logic AdaptiveFunction Plus featured throughout the range. Besides optimising compressor activation and the relative operating cycles, the control, developed by RHoss in collaboration with the University of Padua, allows optimal comfort levels to be achieved in all load conditions and the best performance in terms of energy efficiency during seasonal operation.

AdaptiveFunction Plus

The new adaptive regulation logic **AdaptiveFunction Plus**, is an exclusive RHoss S.p.a. patent that is the result of a long period of collaboration with the University of Padua. The various algorithm processing and development operations were implemented and tested on the new Poker-PI range in the R&D Laboratory of RHoss S.p.a. by means of numerous test campaigns.

Objectives

- To always guarantee optimal unit operation in the system in which it is installed. **Evolved adaptive logic**
- To achieve the best performance from a chiller and a heat pump in terms of energy efficiency with full and partial loads. **Low consumption chillers**

Operating logic

In general, the actual control logics on chillers/heat pumps do not consider the features of the system in which the units are installed; they usually control the return water temperature and their aim is to guarantee the operation of the chillers, giving less priority to the system requirements.

The new AdaptiveFunction Plus adaptive logic contrasts these logics with the objective of optimising chiller operation according to the system characteristics and the actual thermal load. The controller regulates the flow water temperature and adjusts itself according to the operating conditions using:

- the information contained in the return and flow water temperature to estimate the load conditions, thanks to a particular mathematical function;
- a special adaptive algorithm that uses this estimate to vary the values and the start-up and switch-off limit values of the compressors; the optimised compressor start-up management guarantees a precision water supply to the user, reducing the fluctuation around the set-point value.

Main functions

Efficiency or Precision

Thanks to the advanced control, the chiller can run on two different regulation settings in order to obtain the best possible performance in terms of energy efficiency and significant seasonal savings or high water temperature precision:

1. **Low consumption chillers:** Option "**Economy**" is known that chillers work at full load for only a very small percentage of their operating time and at partial load for most of the season. Therefore, the power they must supply generally differs from the nominal design power, and partial load operation significantly affects seasonal energy performance and consumption. This makes it necessary for the unit to run as efficiently as possible with partial loads. The controller therefore ensures that the water flow temperature is as high as possible (when operating as a chiller) or as low as possible (when operating as a heat pump) whilst being compatible with the thermal loads, which means it shifts, unlike traditional systems. This prevents energy waste associated with the unnecessarily onerous chiller temperature levels being maintained, thereby guaranteeing that the ratio between the power to be supplied and the energy to be used to produce it is always optimised. The right level of comfort is finally available to everyone!
2. **High precision:** Option "**Precision**" With this operating method, the unit works at a fixed set-point. Therefore, the "Precision" option guarantees precision and reliability in all applications that require a controller that guarantees a more accurate constant water supply temperature, and where particular humidity control is required. However, it is always recommended to use a storage tank with greater system water content in process applications to guarantee high system thermal inertia.

1.4 Structural features

- Load-bearing structure and panels in galvanised and RAL 9018 painted sheet metal; galvanised steel sheet metal base.
- The structure consists of two sections:
 - technical compartment dedicated to housing the compressors and the main components of the refrigeration circuit;
 - aerologic compartment dedicated to housing the heat exchange coils and electric fans, including protection nets;
- Ex ventilation system to ensure flushing of the technical compartment in the event of a refrigerant gas leak.
- Scroll type rotary hermetic compressor with inverter activation to control variable capacity with peak current reduction during the start-up phase and power factor correction of the automatic utility towards the mains. They include thermal protection and casing heater activated automatically when the unit stops (as long as still electrically powered).
- Adequately insulated, brazed-welded plate water side heat exchanger in stainless steel.
- Air-side heat exchanger consisting of copper tube coil and aluminium fins with hydrophilic surface treatment.
- Helical electric fans with external rotor and permanent magnet motor, equipped with internal thermal protection and complete with protection grid.
- 2 "GM male threaded hydraulic connections.
- Differential pressure switch that protect the unit from any water flow interruptions.
- Refrigerant circuit made from annealed copper tubing (EN 12735- 1-2) complete with: hermetic filter drier, charge connections, safety pressure switch on high pressure side with manual reset, pressure transducer BP and AP, safety valves on high and low pressure side, liquid sight glass, suction line insulation, electronic expansion valve, cycle reversal valve and liquid receiver, non-return valves, gas separator and suction tap on compressors (for heat pumps).
- Easy-access pressure taps, complete with safety tap.
- Unit with IP24 protection rating
- Control with AdaptiveFunction Plus operation.
- The unit is complete with a charge of R290 refrigerant.

Versions

T High efficiency version.

Electrical Control Board

- The electrical panel with IP54 protection rating can be accessed by opening the front panel, in compliance with EN 60204-1/IEC 60204-1 Standards in force, fitted with opening and closing via specific tool.
- Complete with:
 - electrical wiring arranged for power supply 400-3ph-50Hz;
 - numbered electric cables;
 - auxiliary circuit power supply 230V-1ph+N-50Hz derived from main power supply;
 - main power supply switch with interlocking safety door isolator;
 - auxiliary circuit, protected against refrigerant leakage, with safety chain conforming to Category 3 - PLd - SIL2 (according to IEC / EN 61508 and EN 13849)
 - inverter compressor protection fuses;
 - auxiliary circuit protection fuse;
 - remote machine controls: ON/OFF and summer/winter selector;
 - remote machine controls: compressor operating light and general lock light.
- Programmable microprocessor electronic board handled by the keyboard inserted in the machine.
- This electronic board performs the following functions:
 - regulation and management of the set points for unit outlet water temperature; cycle inversion (heat pumps); safety timer delays; circulating pump; compressor and system pump hour-run meter; defrost cycles; electronic anti-freeze protection which cuts in automatically when the machine is switched off; and the functions which control the operation of the individual parts making up the machine;
 - complete protection of the unit, possible shutdown and display of all the triggered alarms;
 - total compressor protection;
 - visual indication of the programmed set points on the display; of the in/out water temperature via the display; of the condensation and evaporation pressures, of the alarms via the display; and of chiller/heat-pump operating mode via display (heat pumps only);
 - user interface menu;
 - external temperature management for climatic set-point compensation (menu-enabled);
 - displayed inlet water temperature at the recovery desuperheater;
 - alarm code and description;
 - management of alarms log.
- In particular, each alarm memorises:
 - date and time of intervention;
 - inlet/outlet water temperatures values when the alarm intervened;
 - the evaporation and condensation pressure values at the time of the alarm;
 - alarm delay time from the switch-on of the connected device;
 - compressor status at the time of the alarm;
- Advanced functions:
 - pump energy-saving management;
 - Smart defrost management;

- automatic management of anti-legionella cycles;
- KPR desuperheater pump control for external electric pump supply (to be provided by the installer). For the unit to operate properly, activation of the recovery pump, by the installer, must be controlled by means of a specific discrete output provided in the board on the unit;
- EEO function - Energy Efficiency Optimiser (standard, see section on Accessories).
- LKD function - Leak Detector (standard, see Accessories section).
- set-up for serial connection (SS/KRS485, BE/KBE, BM/KBM, KUSB accessory)
- possibility to have a digital input for remote management of double set point (DSP);
- possibility of having a digital input to manage desuperheater (CDS contact) or for production of domestic hot water by means of the 3-way diverter valve (CACS contact). In this case, there is the possibility of using a temperature probe instead of the discrete input. (refer to the specific section for more details);
- option of having domestic hot water diverter valve (VACS) control;
- possibility to have an analogue input for the shifting Set-point (CS) via a 4-20mA remote signal;
- management of time bands and operation parameters with the possibility of daily/weekly functioning programs;
- check-up and monitoring of scheduled maintenance status;
- computer-assisted unit testing;
- self-diagnosis with continuous monitoring of the unit functioning status.
- MASTER/SLAVE management logic integrated in single systems - Refer to the specific section for more details
- Set-point regulation via the AdaptiveFunction Plus with two options:
 - fixed set-point (Precision option);
 - set-point sliding (Economy option).

1.5 Accessories

Factory Fitted Accessories

P2	Installation with increased static pressure pump
DS	Desuperheater. Active in summer and winter mode
FDL	Forced Download Compressors Function. Compressor modulation to limit the absorbed current and power (digital input)
RQE	Electrical panel resistance (recommended for low outdoor air temperature)
DSP	Double set-point via digital consensus (incompatible with the CS accessory)
CS	Scrolling set point via analogue signal 4-20 mA (incompatible with the DSP accessory)
BT	Low temperature of water produced
SG	Smart Grid contacts and photovoltaic system (incompatible with DSP and FDL accessories) - See specific section for more details
EEM	Energy Meter. Measure and display values of the electrical units - See specific section for more information
SS	RS485 interface for serial communication with other devices (proprietary protocol; Modbus RTU protocol)
BE	Ethernet interface for communication with other devices (BACnet IP, ModBus TCP/IP protocol)
BM	RS485 interface for serial communication with other devices (BACnet MS/TP protocol)
DVS	High pressure and low pressure double safety valve with exchanger tap
SAG	Rubber anti-vibration mountings (supplied not installed)
CMT	Check the MIN/MAX values of the power supply voltage
SIL	Silenced set-up (sound-proof compressor compartment + compressor ear muff)
RAE20	Flow switch and hot wire heater protecting heat exchanger pumps and piping up to -20°C outdoor air
RAE20_4	Flow switch and hot wire heater protecting heat exchanger pumps and piping up to -20°C outdoor air. For units with DS and V3V set up
RAP	Unit with copper/pre-painted aluminium condensation coils
BRR	Unit with copper/copper condensation coils
FIAP	Condensing control with over-pressured fans with EC motor (Brushless) and available static head according to the following table:

	Unit with a Ø800mm fan
Available static head	Up to 100 Pa
Single fan absorption	Max 1.85 kW
Average increase in noise of the unit	4 dBA

Accessories supplied separately

KTRD	Thermostat with display
KTRP	Remote keypad for control at a distance with LCD display and same functions as the machine. Connection must be made with AWG 20/22 shielded cable (4 wires + shield, not supplied)
KRS485	Interface RS485 for serial dialogue with other devices (proprietary protocol, Modbus RTU protocol)
KBE	Ethernet interface for communication with other devices (BACnet IP protocol).
KBM	RS485 interface for serial communication with other devices (BACnet MS/TP protocol)
KSA	Rubber anti-vibration mountings
KVDEV	3-way diverter valve for managing the production of domestic hot water. The kit includes a protective bonnet for the valve and flexible pipes connected to the unit. Incompatible with Pump P1 V3V units
KFAR	Water filter and taps
KUSB	RS485/USB serial converter (USB cable supplied)
KRIT	Additional electrical resistance for heat pump, managed by regulation
KTRT	Colour touch screen user keypad for remote control with a 7" LCD display, with the same functions as those on the machine. The connection must be made via 3-pole shielded cable (not supplied). If multiple units are connected in parallel, only one keypad may be connected.
KEAP	Outdoor air temperature probe for set-point compensation (as an alternative to the outdoor temperature probe fitted), incompatible with the CS accessory

Refer to the price list or contact Rhoss S.p.A. to verify the compatibility of any accessory

1.6 Technical Data

Model THA1TP		150				
NUMBER OF MODULES			1	2	3	4
Nominal cooling capacity	3400 (**)	kW	41.5	83	124.5	166
EER	3400 (**)		2.43	2.43	2.43	2.43
Nominal cooling capacity EN 14511	(1)(*)	kW	41.8	83.3	124.8	166.3
EER EN 14511	(1)(*)		2.45	2.45	2.45	2.45
SEER EN 14825			4,60	4,66	4,66	4,66
Nominal heating capacity	2	kW	47.8	95.6	143.4	191.2
COP	2		3.12	3.12	3.12	3.12
Nominal heating capacity EN 14511	2	kW	47.5	95.3	143.1	190.9
COP EN 14511	2		3.10	3.10	3.10	3.10
SCOP EN 14825			4.08	4.34	4.46	4.52
SCOP MT EN 14825			3.40	3.60	3.68	3.72
Sound pressure	3	dB(A)	47.5	50	51.5	53
Sound power	(4)	dB(A)	79	82	84	85
Scroll compressor		n°	1	2	3	4
Steps			Continuous adjustment			
			(26÷100%)	(13÷100%)	(9÷100%)	(7÷100%)
Circuits		n°	1	2	3	4
Fans		n° x kW	1 x 0,9	2 x 0,9	3 x 0,9	4 x 0,9
Fan nominal air flow		m3/h	15000	30000	45000	60000
Heat exchanger		Type	Plates			
Heat exchanger nominal flow water side (*)	3400 (**)	m3/h	7.1	2 x 7,1	3 x 7,1	4 x 7,1
Residual head P1	3400 (**)	kPa	131	131	131	131
Residual head P2	3400 (**)	kPa	164	164	164	164
Nominal thermal potential DS	(±)	kW	7,8	2 x 7,8	3 x 7,8	4 x 7,8
Nominal flow rate/pressure drop DS	(±)	m³/h / kPa	0,7/1	2 x 0,7/1	3 x 0,7/1	4 x 0,7/1
Amount of R290 refrigerant		Kg	4,2	2 x 4,2	3 x 4,2	4 x 4,2
Total oil charge of compressors		Kg	3,2	2 x 3,2	3 x 3,2	4 x 3,2
Electrical data						
Absorbed power	(1) (■)	kW	16,5	2 x 16,5	3 x 16,5	4 x 16,5
Absorbed power in winter mode	(2) (■)	kW	14,7	2 x 14,7	3 x 14,7	4 x 14,7
Maximale Leistungsaufnahme der Pumpe P1		kW	0,78	2 x 0,78	3 x 0,78	4 x 0,78
Maximale Leistungsaufnahme der Pumpe P2			1,41	2 x 1,41	3 x 1,41	4 x 1,41
Electrical power supply		V-ph-Hz	400 – 3 – 50			
Auxiliary power supply		V-ph-Hz	230 – 1 – 50			
Summer operation nominal current	(1) (■)	A	25,5	2 x 25,5	3 x 25,5	4 x 25,5
Maximum current	(■)	A	41,0	2 x 41	3 x 41	4 x 41
Starting current	(■)	A	-	-	-	-
Maximum pump absorbed current P1		A	1,71	2 x 1,71	3 x 1,71	4 x 1,71
Maximum pump absorbed current P2			2,5	2 x 2,5	3 x 2,5	4 x 2,5
Dimensions						
Length		mm	1224	2458	3692	4926
Height		mm	2335	2335	2335	2335
Depth		mm	1320	1320	1320	1320
Heat exchanger inlet/outlet connections		Ø	2"	2 x 2"	3 x 2"	4 x 2"
DS E V3V inlet/outlet connections		Ø	2"	2 x 2"	3 x 2"	4 x 2"
Weight		Kg	635	1270	1905	2540

- (1) At the following conditions: condenser inlet air temperature 35°C; chilled water temperature 7°C; temperature differential at the evaporator 5 K; fouling factor of 0.
- (2) At the following conditions: Evaporator inlet air temperature 7°C D.B., 6°C W.B.; hot water temperature 45°C; temperature differential at condenser 5 K; fouling factor of 0.
- (3) Sound pressure level in dB(A) referring to a 10 m distance from the unit, in free field and directionality factor equal to Q=2 in accordance with standard UNI EN-ISO 3744. The noise data refers to the units without the electric pump.
- (4) Sound power level in dB(A) on the basis of measurements taken in accordance with UNI EN-ISO 9614 and Eurovent 8/1 Standards. The noise data refers to the units without the electric pump.
- (±) Recovery unit heating capacity. Conditions referring to the unit operating with chilled water temperature 7°C, differential temperature due to evaporation of 5 K, hot water temperature produced equivalent to 40/45°C (DS). N.B. With heat pumps operating in winter mode with DC active, the heating capacity available is decreased from the portion supplied to the desuperheater.
- (■) Absorbed current/absorbed power value without electric pump. The peak current refers to the unit's most heavy duty operating conditions.
- (*) Data calculated in accordance with EN 14511 under nominal conditions. The refrigerant charge values are indicative. Refer to the serial number plate.

SEER: Seasonal energy efficiency: low temperature cooling (EU Regulation 2016/2281)

SCOP: Seasonal energy efficiency: low temperature heating in Average climate (EU Regulation No. 811/2013 and N. 813/2013)

SCOP MT Seasonal energy efficiency: medium-temperature heating in an Average climate (Regulation (EU) No. 811/2013 and N. 813/2013)

1.7 Energy efficiency

Seasonal efficiency indices according to EN 14825: SCOP and SEER

Standard EN 14825 defines the calculation method to determine the summer (SEER) and winter (SCOP) seasonal efficiency indices of heat pumps, summing the machine's performance in one value that considers the temperature variations of outdoor air, water produced, and partialisation degree of the compressor.

Variable	Description
Project temperature:	Europe divided into 3 climate bands: Colder (Helsinki climate): -22°C Average (Strasbourg climate): -10°C Warmer (Athens climate): 2°C
User side water temperature:	Low temperature (LT): 35°C fixed or variable according to the outdoor air temperature Intermediate temperature (IT): 45°C fixed or variable according to the outdoor air temperature Medium temperature (MT): 55°C fixed or variable according to the outdoor air temperature High temperature (HT): 65°C fixed or variable according to the outdoor air temperature
Compressor partialisation degree	The standard considers, with due coefficient corrective features, the inefficiency of partial loads with "On-Off" operation of the heat pumps.
Outdoor air temperature frequency occurrence	The number of hours of occurrence of each outdoor air temperature value expressed in degrees, during the heating season.
Bivalent T	Temperature at which pdc fulfils the load at 100% Colder (Helsinki climate): -7°C or lower Average (Strasbourg climate): 2°C or lower Warmer (Athens climate): 7°C or lower

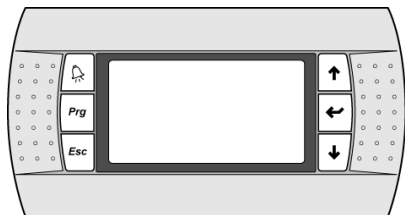
SCOP is calculated by using the Bin Method as an average weight of efficiency (COP) of the heat pump on the frequency of occurrence of outdoor air temperature.

The seasonal efficiency in SEER cooling mode depends on a unique 35° design temperature and can be calculated for 2 types of distribution:

- Radiant panel (Water T at a fixed point equivalent to 18°C)
- Fan coil (water T at a fixed point equivalent to 7°C or variable according to the outdoor air temperature)

1.8 Electronic controls

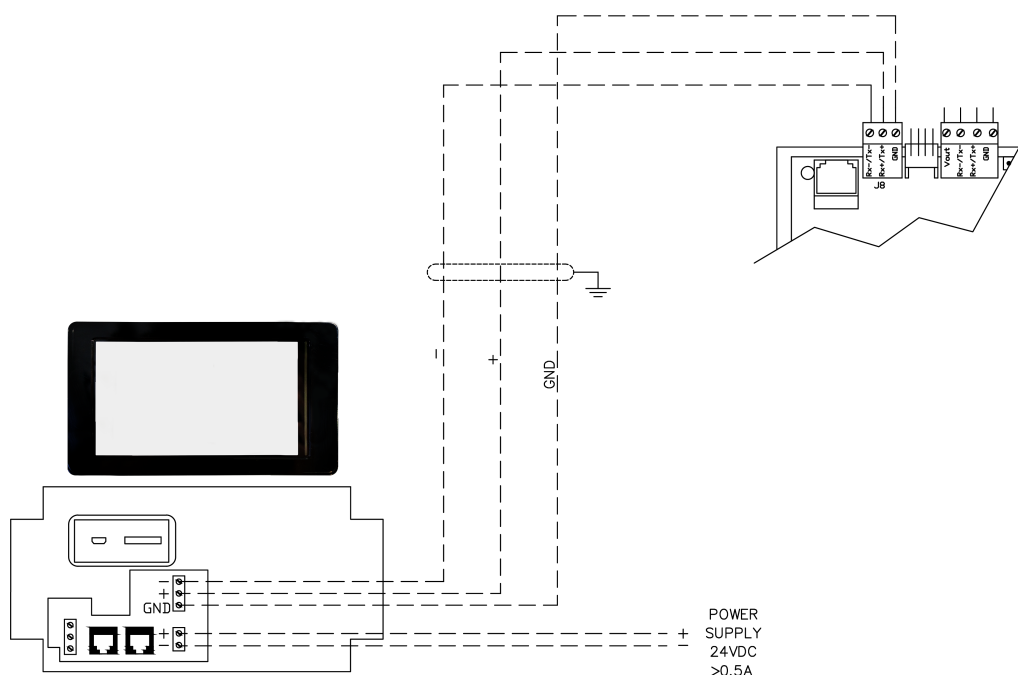
1.8.1 Standard electronic control panel display on the machine



The keyboard with display makes it possible to view the working temperature and all the unit process variables, as well as providing access to setting parameters for the operating set points and their modification. At a technical assistance level, it allows modifying the unit management parameters by entering a password (access allowed only to authorised personnel).

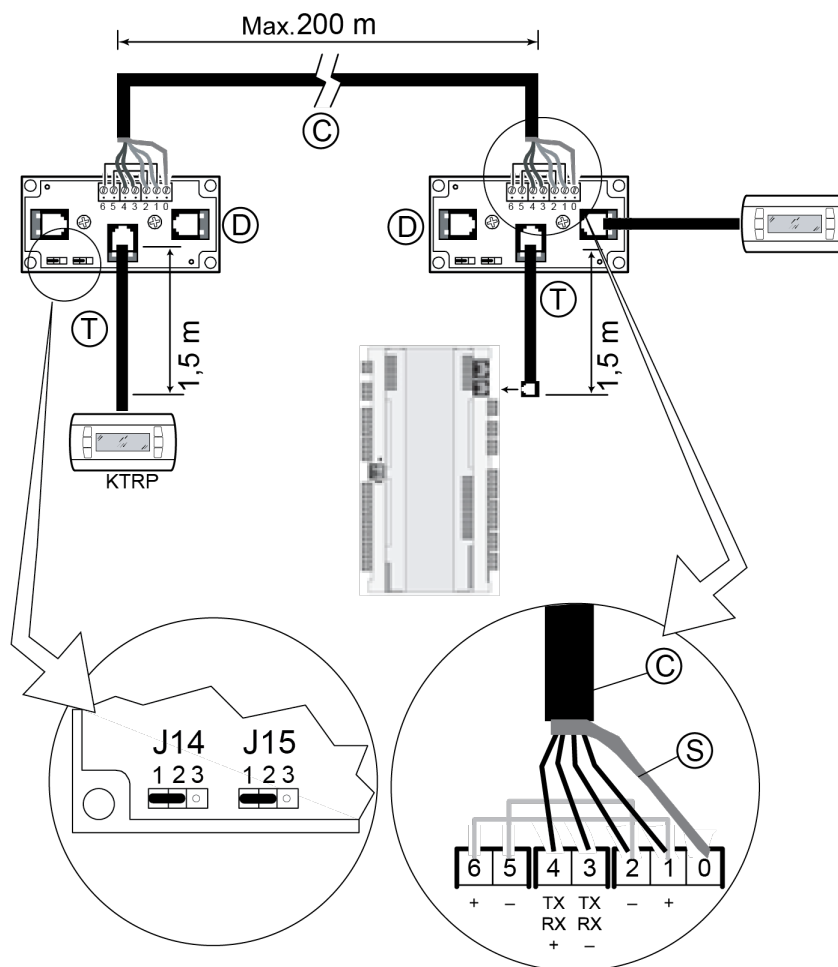
1.8.2 TRT-KTRT - Remote touch keyboard

The TRT/KTRT accessory is a keypad with a 7-inch colour touch screen that is supplied for remote installation. The shielded cable AWG 20/22 (3 wires+shield, maximum distance 500m) for remote control and the power supply (24Vdc, > 0.5 A, maximum distance 50m) are not provided. It allows for remote control over the unit with identical functions to the electronic control on the machine.

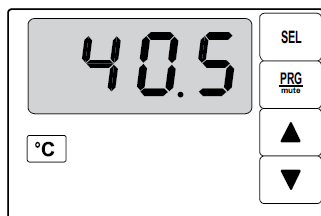


1.8.3 KTRP - Remote keyboard

The remote keyboard with display (KTRP) allows the remote control and display of all of the unit's digital and analogue process variables. It is therefore possible to control all the machine functions directly in the room. It allows setting and management of time periods. The connection must be made with AWG 20/22 shielded cable (4 wires+screen, not provided).



1.8.4 KTRD - Thermostat with display



Inserting the thermostat accessory with KTRD display into the machine allows the setpoint for activation of the unit's recovery/ACS consent to be set, thanks to the probe supplied with the unit, which must be positioned by the installer in the most appropriate point (e.g. accumulation)

1.9 Serial connection

All units are equipped with an electronic controller to communicate with an external BMS via a serial communication line by means of the SS RS485 serial interface accessory (proprietary protocol or ModBus® RTU) and the following converters:

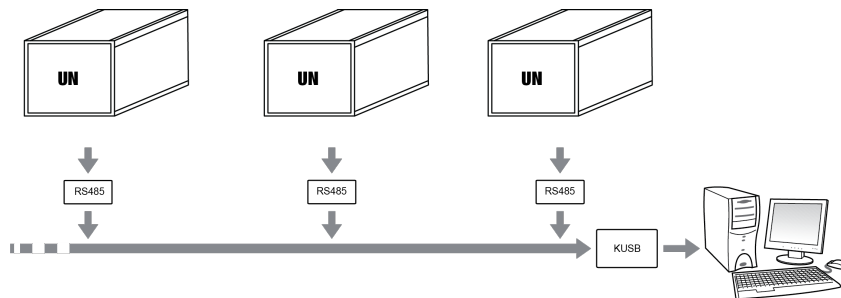
- KUSB - RS485/USB serial converter

Also available are KBE accessory (Ethernet interface), KBM accessory, RS485 interface (BACnet MS/TP protocol)

Supervision

In general, a supervision system allows access to all unit functions, such as:

- Making all settings which are accessible through the keyboard
- Reading all process variables of the inputs and outputs, whether digital or analogue
- reading the various alarm codes which are present, and resetting them as necessary



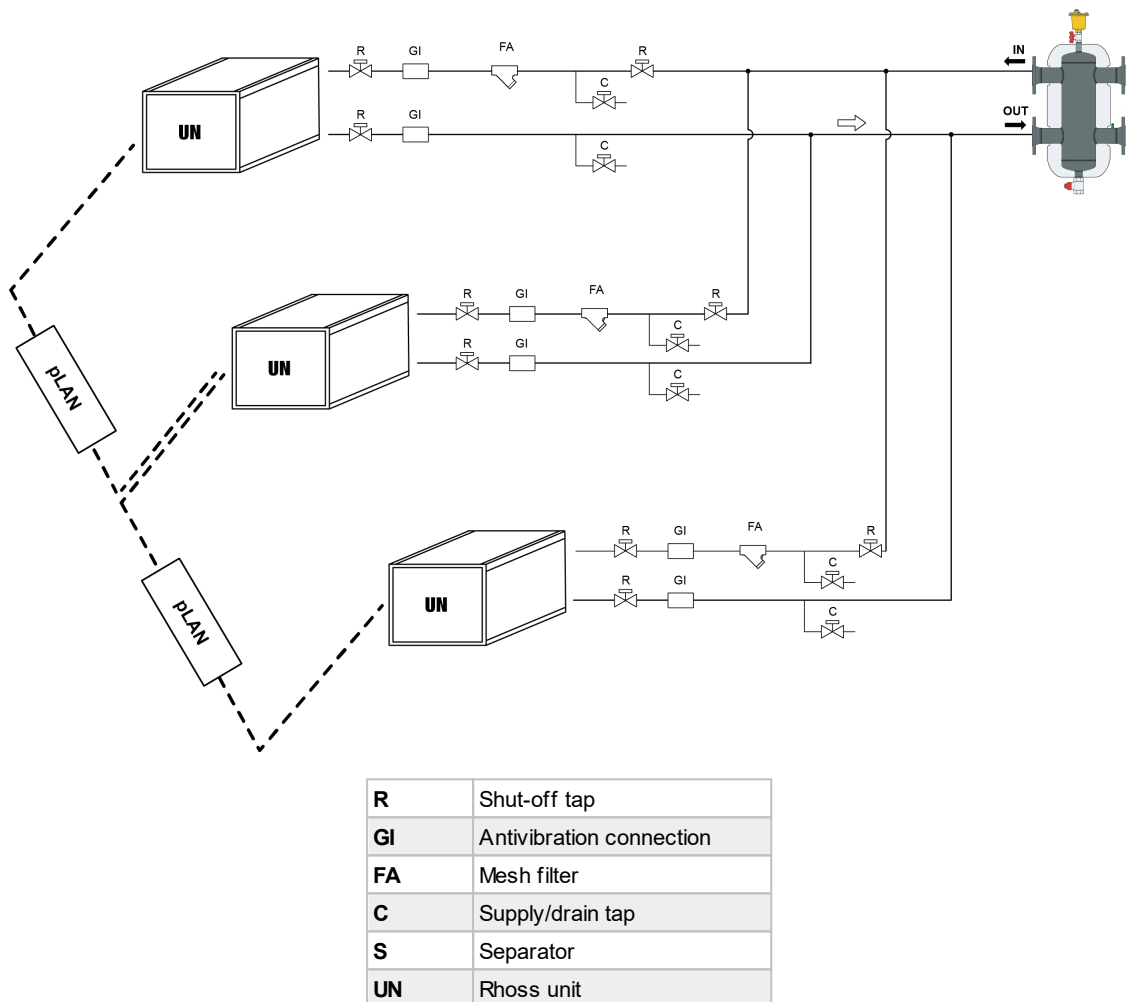
Clock card

The clock card (standard in the Poker-PI units) enhances unit flexibility and efficiency, displaying the date/time and allowing machine management with daily and weekly start/stop time bands, with the possibility of changing the set points.

The time bands are set and managed via the keyboard.

1.10 Rhoss Synamec Sequencer

A new feature has been introduced on the units, allowing for the management of up to 4 identical units in terms of type (chiller or heat pump), function, size and accessories. This operating mode allows the management logic to maintain the maximum precision in satisfying the system load. Rhoss dynamic sequencer (SDR), allows management by master-slave logic of units connected in hydraulic parallel without the use of external devices or hardware.



Identified as the MASTER unit of the group, the other units are addressed as SLAVES.

The MASTER unit has the task of controlling all of the SLAVE units and assessing, based on the system's load demand, how many and which units to be turned on to fulfil it.

In the event of a failure of the MASTER machine, the control automatically assigns another unit to the role of MASTER and the whole system continues to operate normally, excluding the failed unit.

From the MASTER terminal, the status of the network and individual units can be monitored at all times. E.g., the status of the compressors, circulation pump and the load percentage required by the utility, operating temperatures and other information are displayed.

Each unit controls its own pump (PUMP or TANK&PUMP accessory, if available), which is turned on only if at least one compressor is required to be turned on on the unit. If, on the other hand, the system load is such that it does not require any compressor to be switched on, the unit pump remains active nonetheless, ready to start up to monitor the unit's regulating temperature.

It is not necessary to install additional probes on the shared sections of the pipes in the system because the sequencer is in charge of assessing the system load based on the average of the values of the probes of the machines that are active at that time.

Balancing the operating hours of the group is another important aspect of the SDR sequencer. Unit and compressor rotation is guaranteed based on the accumulated hours of operation.

The sequencer is able to assess the type of alarm, using the units based on the respective percentages of availability, without blocking the entire unit if, for example, only one compressor is affected by an alarm.

If the units are supplied with the FDL accessory, there is the possibility of limiting the delivered power as a global percentage of the group. The algorithm dynamically determines how many machines need to be switched on and at what percentage, without limiting all of the machines at the same power in a fixed manner, and therefore only using some of them.

Rhoss dynamic sequencer (SDR), provides sequenced management of DHW (domestic hot water) if:

- ✓ each unit is equipped with a 3-way diverter valve and domestic hot water probe connected to the master unit (STACS contact)

Rhoss dynamic sequencer (SDR), provides sequenced management of DHW (domestic hot water) if:

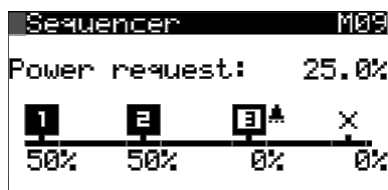
- ✓ the unit group has a single 3-way diverter valve and thermostat (CACCS contact) connected to the master unit
- ✓ each unit is equipped with a 3-way diverter valve and thermostat (CACCS contact) connected to the master unit

*In these cases all units produce domestic hot water simultaneously if there is demand.

If the chillers are supplied with the heat recovery accessory (DS or RC100) and the heat pumps are supplied with the heat recovery accessory (DS), the production of hot water from the dedicated heat exchanger will be managed but not sequenced (all units in operation at the same time). If the heat pumps are supplied with the heat recovery accessory (RC100), hot water production from the dedicated heat exchanger will be sequenced.

On the screen of the individual unit, the respective operating information is displayed and on the MASTER it is also possible to view a mimic panel that summarises the operating status of the connected units.

The group of units, managed by the SDR sequencer, can be monitored (contact Rhoss for further information).



Example: the system requires a total amount of 25% of the group's cooling capacity

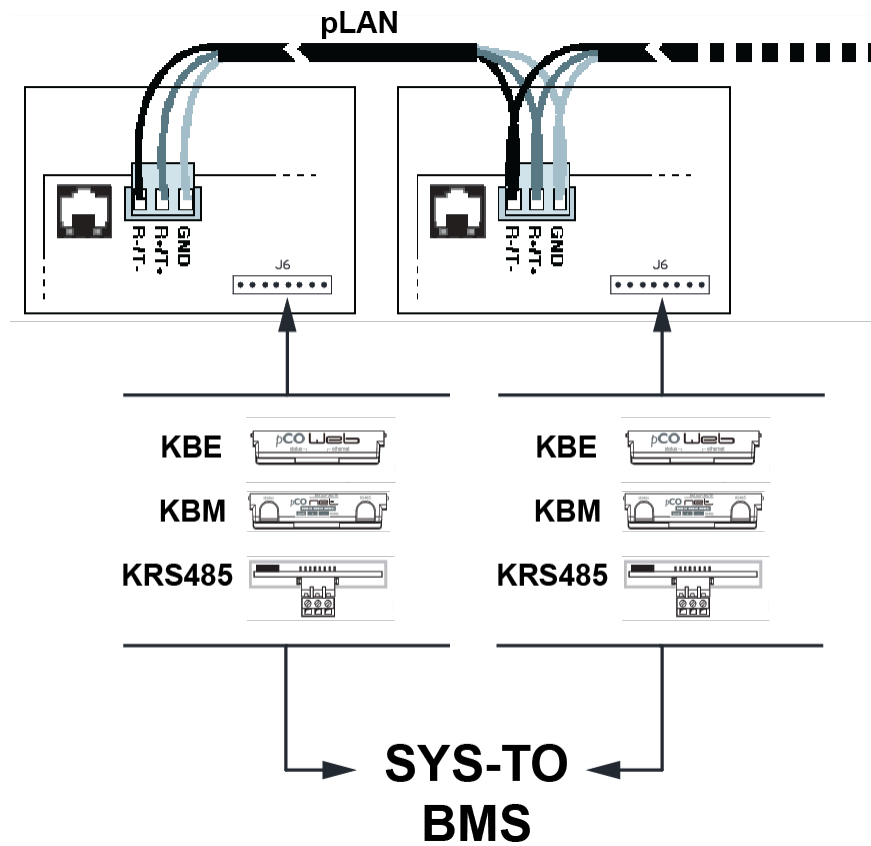
- Units 1 and 2 are on at 50%
- Unit 3 is affected by an alarm
- Unit 4 is disconnected from the network

Local serial network type

The units are connected in a local serial network using a simple AWG 20/22 shielded cable (3 wires+shield) (not supplied). The system is easily configured from the user terminal. The serial addresses of each unit and enabling the network are sufficient.

For an electro-mechanical management of the cooling unit by means of consents (digital inputs) and controls (digital and analogue outputs) available, the intervention of the installer is required with an external system that drives all the units by means of a parallel connection. Some controls and consents are different from the previous ones, as they must always be connected to the Master unit. The first is the control that modifies the set point (CS) via 4-20 mA analogue signal, used to modify the set point in a linear way. The second is the 0-10V analog signal for driving the inverter pump of the desuperheater, if any, if that mode of hydraulic management of the DS is chosen (see section on setting up with DS). The third analogue signal is the temperature probe for the request of domestic hot water to be positioned in the storage tank of the plumbing technology.

In case of failure of the original MASTER unit, all the above signals must be rewired to the new MASTER unit.



NOTE: Mandatory startup is not provided for the SDR sequencer. Contact Rhoss Service for more information on how to enable the function or for start-ups followed by authorised technical staff.

1.11 Performance

UP TO DATE

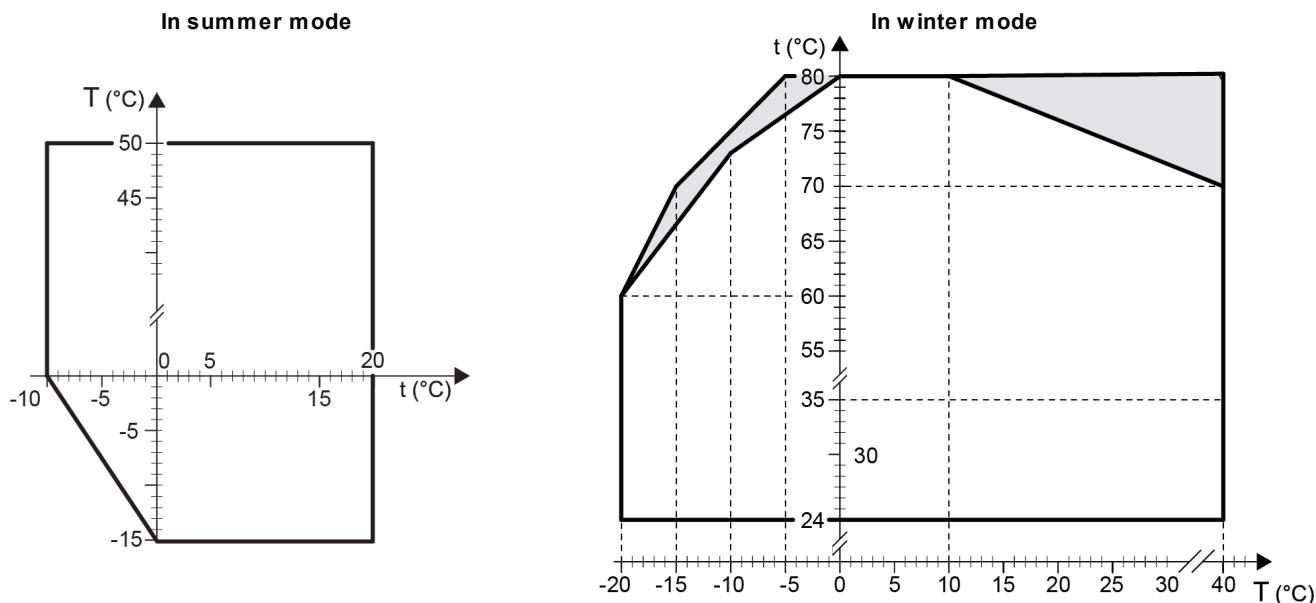
By means of the RHOSS Up To Date software selection, you are able to obtain:

- Unit performance data under the project conditions
- Technical data of the selected unit, heat exchanger pressure drops and residual head if the unit is supplied with pumps
- Performance data of RC100 and DS heat recovery

1.12 Sound power and pressure levels

Models		Sound power level in dB for octave bands									Sound power level in dB for octave bands	
		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Lw dB(A)	Lp 1m	Lp 10m
THAIP 150	1 module	83	85.5	78.5	78	71.5	69.5	60.5	54.5	79	61.5	47
	2 modules	86	88.5	81.5	81	74.5	72.5	63.5	57.5	82	64	50
	3 modules	88	91	83.5	83	76.5	74.5	65.5	59.5	84	65	52
	4 modules	89	91.5	84.5	84	77.5	75.5	66.5	60.5	85	65.5	53

1.13 Functioning limits



t(°C) Temperature of the water produced

T(°C) Outdoor air temperature (B.S.)



Standard functioning



Cooling capacity partitioning operation

In summer mode:

Maximum water inlet temperature 28°C.

- Minimum water pressure 0,5 Barg
- Maximum water pressure 10 Barg

In winter mode:

- Minimum water inlet temperature 20°C.
- Maximum water inlet temperature 77°C.

N.B.:

For $t(^{\circ}\text{C}) < 5^{\circ}\text{C}$ (BT accessory) it is **COMPULSORY** to specify the unit's work temperature when ordering (inlet/outlet glycoled water evaporator) in order to enable its correct parametrisation. Use of antifreeze solutions: see "Use of anti-freeze solutions"

1.14 Operating limits with the Heat recovery accessory

The chiller can be fitted with the DS partial heat recovery unit accessory. In that case, operating limits are the same as the unit without accessory. The desuperheater (DS) can be managed according to two modes selectable from the machine control panel (ECONOMY mode and STANDARD mode). If the "ECONOMY" mode is selected, the unit will work to optimize the efficiency of the unit to the detriment in some situations or in ambient conditions of low air temperature, of the hot water production temperature and consequently of the time of achievement of the desired thermal value. The "STANDARD" mode, on the other hand, foresees the priority in the production of hot water with possible penalization of the efficiency of the unit in some situations or in ambient conditions of low air temperature; as a result, the chiller or heat pump will reach the desired temperature as quickly as possible. The units come out of the factory with the desuperheater - DS set in the "ECONOMY" mode. The change of mode can be done by contacting the Rhoss service.

DS Produced hot water temperature 45÷75°C with admitted water temperature differential 5÷10 K

The minimum inlet water temperature t_{uc} (°C) admitted is equal to 40°C

The share of heat produced by partial (DS) or total (RC100) heat recovery is dependent on the power delivered on the primary circuit.

The DS accessory switches on when the external pump (provided by the customer) is switched on. The production of hot water continues until the condensation pressure remains above a minimum pre-set value. For this reason the delays that may occur between turning the unit on and

turning the circulation pump on/off during operation are completely normal. If the inlet temperature to the DS recovery unit is lower than the permitted values, it is recommended to use a three-way VM modulating valve to guarantee the minimum water temperature required.

1.15 Permitted temperature differentials through the heat exchangers

Thermal jump to exchanger $\Delta T = 3 \div 8$ K, in high temperature heat pump ΔT up to 10K is allowed. However, consider the minimum and maximum flow rates reported in the tables "Water flow rate limits". The maximum and minimum temperature difference for the machines is in any case correlated to the performance of the pumps which must always be checked using the RHOSS S.p.a. selection software.

1.16 Evaporator water flow rate limits

Type of heat exchanger		Plates		
		Min Cooling	Min Heating	Max
1 module	m ³ /h	4.3	3	12
2 modules	m ³ /h	8.6	6	24
3 modules	m ³ /h	12.9	9	36
4 modules	m ³ /h	17.2	12	48

Model		250
Heat exchanger water content	l	3.8
Minimum flow rate (water differential pressure switch intervention)	l/h	2800

DS:

- Produced hot water temperature 45÷75°C with admitted water temperature differential 5÷10K
- The minimum inlet water temperature admitted is equal to 40°C.

1.17 Use of antifreeze solutions

The use of glycol is recommended if you do not wish to drain the water from the hydraulic system during the winter stoppage, or if the unit has to supply chilled water at temperatures lower than 5°C. The addition of glycol changes the physical properties of the water and consequently the performance of the unit. The proper percentage of glycol to be added to the system can be obtained from the most demanding functioning conditions from those shown below.

The resistance of the primary water side heat exchanger (RA accessory) prevents undesired freezing effects during stops in winter functioning mode (as long as the unit is powered electrically).

NOTE: Use the RHOSS UpToDate software to check the selectability of units, with PUMP & TANK&PUMP set-up, at different glycol %.

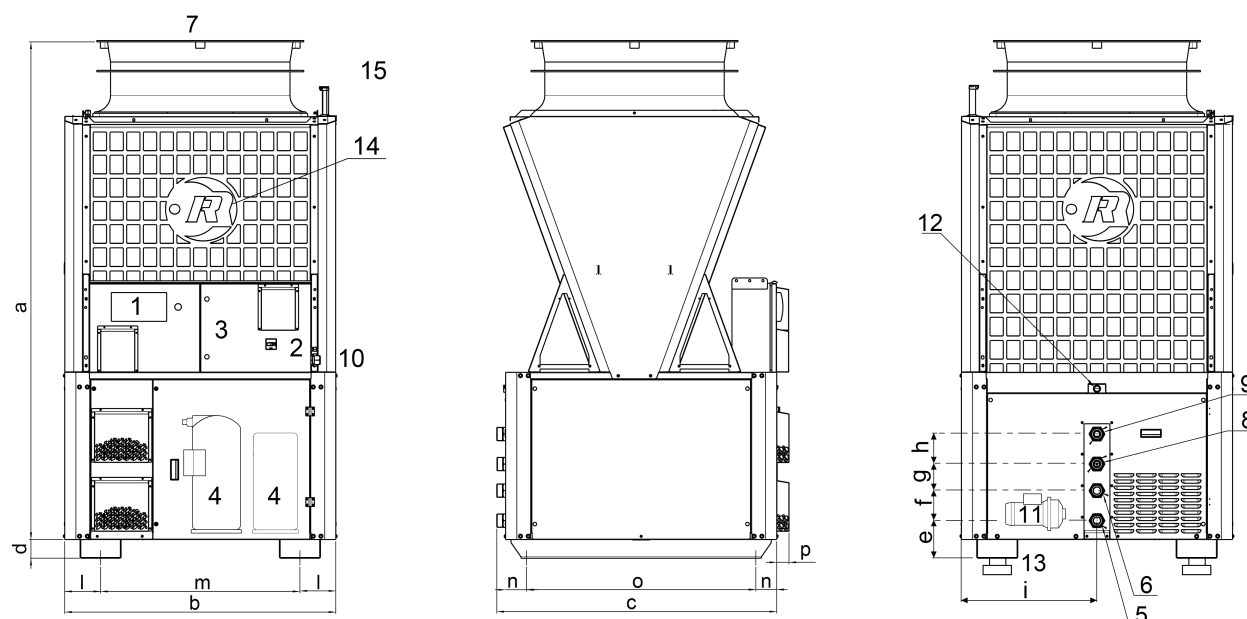
Minimum design air temperature in °C	2	0	-3	-6	-10	-15	-20
% of glycol in weight	10	15	20	25	30	35	40
Freezing temperature °C							
of ethylene glycol	-5,0	-7,0	-10,0	-13,0	-16,0	-20,0	-25,0
Propylene Glycol	-4,0	-6,0	-8,0	-10,5	-13,5	-17,0	-22,0
Warning: Refer to the technical data sheets of the Rhoss UTD selection program for performance data							

The table provides the percentage of ethylene/propylene glycol to be used in units with the BT accessory (if available), according to the temperature of the chilled water produced. Use the RHOSS UpToDate Software for unit performance.

Evaporator glycol water outlet temperature	Minimum % ethylene glycol in weight	Minimum % propylene glycol in weight
From -9,1°C to -10°C	35	37
From -8,1°C to -9°C	34	36
From -7,1°C to -8°C	33	34
From -6,1°C to -7°C	32	33
From -5,1°C to -6°C	30	32
From -4,1°C to -5°C	28	30
From -3,1°C to -4°C	26	28
From -2,1°C to -3°C	24	26
From -1,1°C to -2°C	22	24
From -0,1°C to -1°C	20	22
From 0,9°C a 0°C	20	20
From 1,9°C to 1°C	18	18
From 2,9°C a 2°C	15	15
From 3,9°C to 3°C	12	12
From 4,9°C to 4°C	10	10

NOTE: Use the RHOSS UpToDate software to check the selectability of units, with PUMP & TANK&PUMP set-up, at different glycol %.

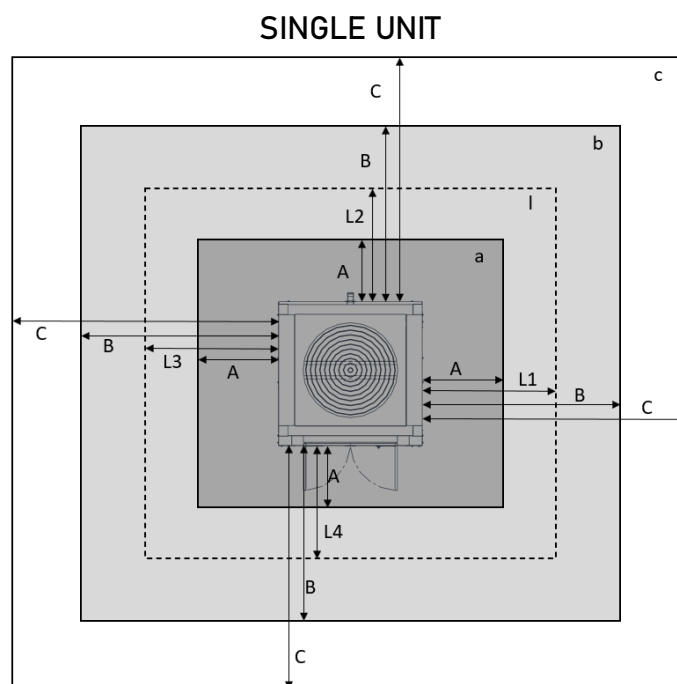
1.18 Hydraulic overall dimensions, size and connections

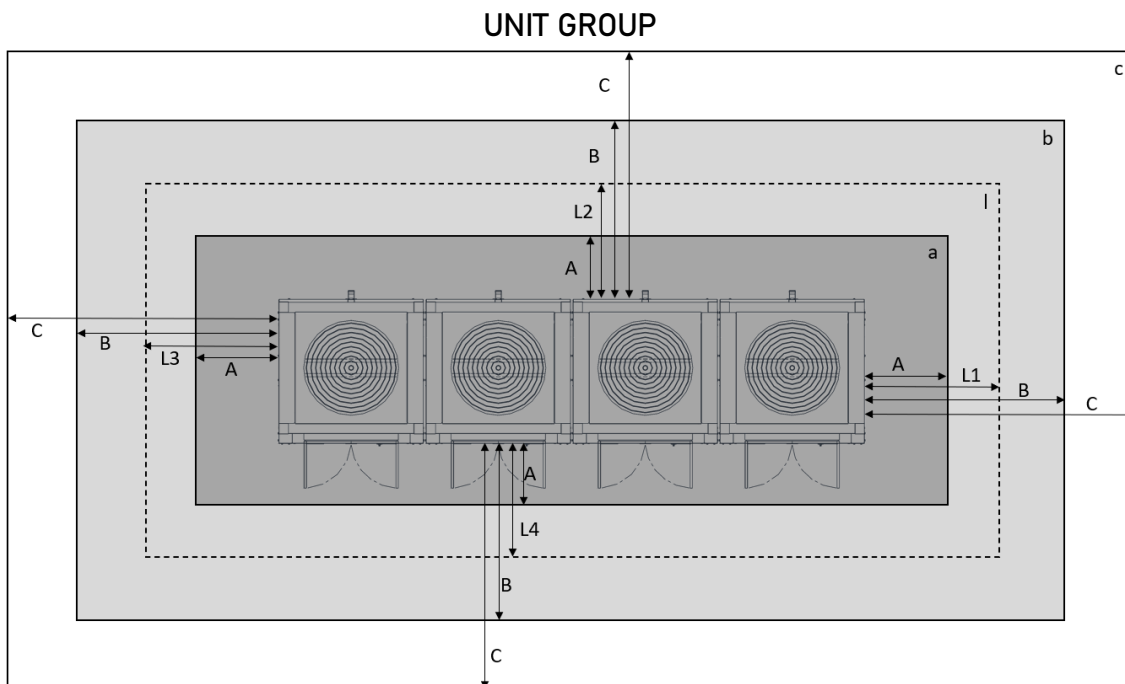


- 1 Control panel
- 2 Isolator
- 3 Electrical Control Board
- 4 Compressor / Inverter
- 5 Main heat exchanger water inlet
- 6 Main heat exchanger water outlet
- 7 Fan
- 8 Water inlet recuperator (DS accessory) or 3-way valve (V3V)
- 9 Recuperator water outlet (DS accessory) or 3-way valve (V3V)
- 10 Power supply inlet
- 11 Electric pump
- 12 Condensate outlet
- 13 Anti-vibration mounts (SAG accessory)
- 14 Coil protection mesh (RPB accessory)
- 15 Safety valve manifolds

MODELL	150
a	2248
b	1224
c	1264
d	84
e	169
f	135
g	120
h	135
i	612
l	162
m	900
n	94
o	1036
p	55
Heat exchanger inlet/outlet connections	2" GM
DS/V3V inlet/outlet connections	2" GM

1.19 Spaces of safety, respect and positioning





If more than one Poker-PI unit is installed, they can be placed side by side with a minimum distance of 1 cm between them.

A	mm	500
B	mm	2500
C	mm	15000
L1	mm	1000
L2 (*)	mm	1000
L3 (*)	mm	1000
L4 (**)	mm	1000, 1400 if group

(*) Minimum distance for removing the pumping unit.

(**) Minimum distance for opening the electrical panel and possible extraction of the unit.

Check these distances also in accordance with any local regulations in force if more restrictive.

The service area "I" must be free of obstacles to allow ordinary and extraordinary maintenance as well as the correct flow of air through the batteries.

For the requirements concerning the safety areas "a", "b" and "c" please refer to the chapter "Installation" of this document.

Note: The space above the unit must be free from obstacles. The installation must comply with the requirements of the EN 378 standard. When installing the unit, bear the following in mind:

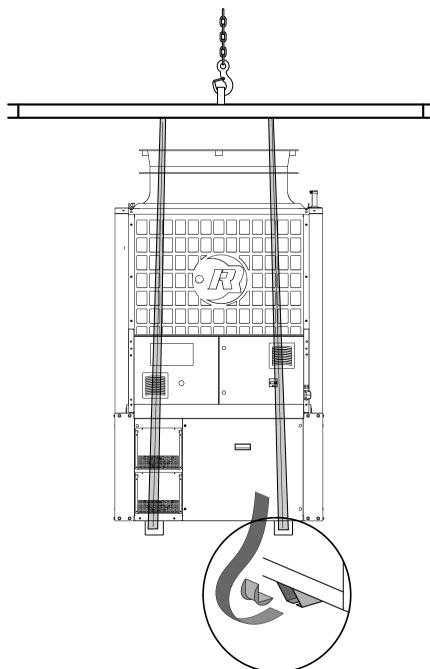
- non-soundproofed reflecting walls near the unit may increase the total sound pressure level reading near the appliance by as much as 3 dB(A) for every surface;
- install suitable anti-vibration mountings under the unit to avoid transmitting vibrations to the building structure;
- on top of buildings, solid floor frames can be provided which support the unit and transmit its weight to the support elements of the building;
- make all water connections using elastic joints; pipes must be firmly supported by solid structures. If the pipes are routed through walls or panels, insulate with elastic sleeves.

If, after installation and start-up of the unit, structural vibrations are observed in the building which provoke such strong resonance that noise is generated in other parts of the building, refer to a qualified acoustic technician for a complete analysis of the problem.

1.20 Handling and storage

- Movement of the unit must be performed with care, in order to avoid damage to the external structure and to the internal mechanical and electrical components.
- Do not stack units.

- The temperature limits for storage are: $-20 \div 50^{\circ}\text{C}$.
- Remove the protective covers of the handling fans.
- The position of the lifting belts must be checked according to the model and accessories installed.
- During lifting and handling, check that the base of the unit always remains horizontal.



1.21 Installation

Installation site requirements

The installation site should be chosen in accordance with the provisions of Standard EN 378-1 and in keeping with the requirements of Standard EN 378-3. The place of installation must in any case take into consideration the risks caused by an accidental leakage of the refrigerant contained in the unit.

The machines are intended to be installed in a Class III location and with access category "a" (i.e. "generic access") according to EN 378-1. The machines are intended to be used only outdoors (open air as defined in Chapter 4.2 of EN 378-3) and in a site without obstacles to ventilation (minimum ground air speed greater than 0.15 m/s according to EN 60079-10-1; condition to be understood with the machine switched off and in the absence of other ventilation systems).

- Distance A equal to 0.5m (compliant with safety area "a" as per paragraph "Safety spaces, respect and positioning") from any ignition source.
- In order that any gas leaks cannot accumulate in enclosed or local spaces, a minimum horizontal safety distance B of 2.5m must be provided (compliant with safety area "b" as per paragraph "Safety, compliance and positioning spaces") (or in accordance with any local regulations in force if more restrictive) from openings where dispersed gas could stagnate. This minimum safety distance shall be increased to 5.0 m for premises intended for public establishments, collectives, places of assembly, entertainment or the public.
- Minimum safety distance C equal to 15.0m (compliant with safety area "c" as per paragraph "Safety spaces, respect and positioning") in plan projection from railway, tramway and high-voltage power lines.

1.22 Installation and connection to the system

- The unit is designed for outdoor installation.
- The unit is provided with 2" GM hydraulic connections on the water inlet and outlet of the air conditioning system.
- Segregate the units if installed in areas accessible to persons under 14 years of age.
- The unit must be positioned respecting the minimum recommended technical and safety spaces, bearing in mind the accessibility to the water and electrical connections.
- The unit can be equipped with anti-vibration mounts upon request (SAG).
- Shut-off valves must be installed that isolate the unit from the rest of the system. Elastic connection joints and system/machine drain taps also need to be fitted.
- It is mandatory to install a square metal mesh filter (longest side = 0.8 mm) of adequate size and pressure drops on the unit return pipes.
- However it is installed, the coil inlet air temperature (ambient air) must remain within the set limits.
- The water flow through the exchanger must not fall below the value corresponding to a temperature drop of 10 °C (with all the compressors on) and in any case must comply with the limit values shown in the "Water flow limits" section.

- The unit cannot be installed on brackets or shelving.
- Correct installation and positioning includes levelling the unit on a surface capable of bearing its weight.
- During long periods of inactivity, it is advisable to drain the water from the system.
- The draining of the water can be avoided by adding glycol to the hydraulic circuit (see "Using brine solutions").
- The size of the expansion tank must be calculated by the installer depending on the system. In the case of models without a pump, the pump must be installed with a flow towards the machine water inlet.
- In the design of the system, it is necessary to take into account any stresses deriving from natural events (strong gusts of wind, seismic events, precipitation, including snow, flooding, etc.).
- Check the presence of a safety limitation to the thermal load present in the hydraulic circuit in the presence of alternative heat sources (boilers, resistors and the like) in order to prevent accidental openings of the safety valves located on the low pressure branch: the temperature of the hydraulic circuit must not reach the saturated temperature indicated in the table of safety valve settings.

NOTE

The space above the unit must be free from obstacles.

The minimum functional space allowed in height between the top of the unit and any obstacle shall not be less than 3,5 m to allow proper circulation of the air expelled by the fans. Where several units are installed, the minimum space between the facing finned coils must not be less than 2 m.

1.23 Guidelines for the installation of units with R290 gas

Units contain R290 gas classified as A3 according to standard EN 378-1 and transport is regulation ADR UN 3358.

Identification of the type of refrigerant fluid used

- Propane (R290) CAS No: 000074-98-6

Main ecological information regarding the types of refrigerant fluids used

- Persistence, degradation and environmental impact

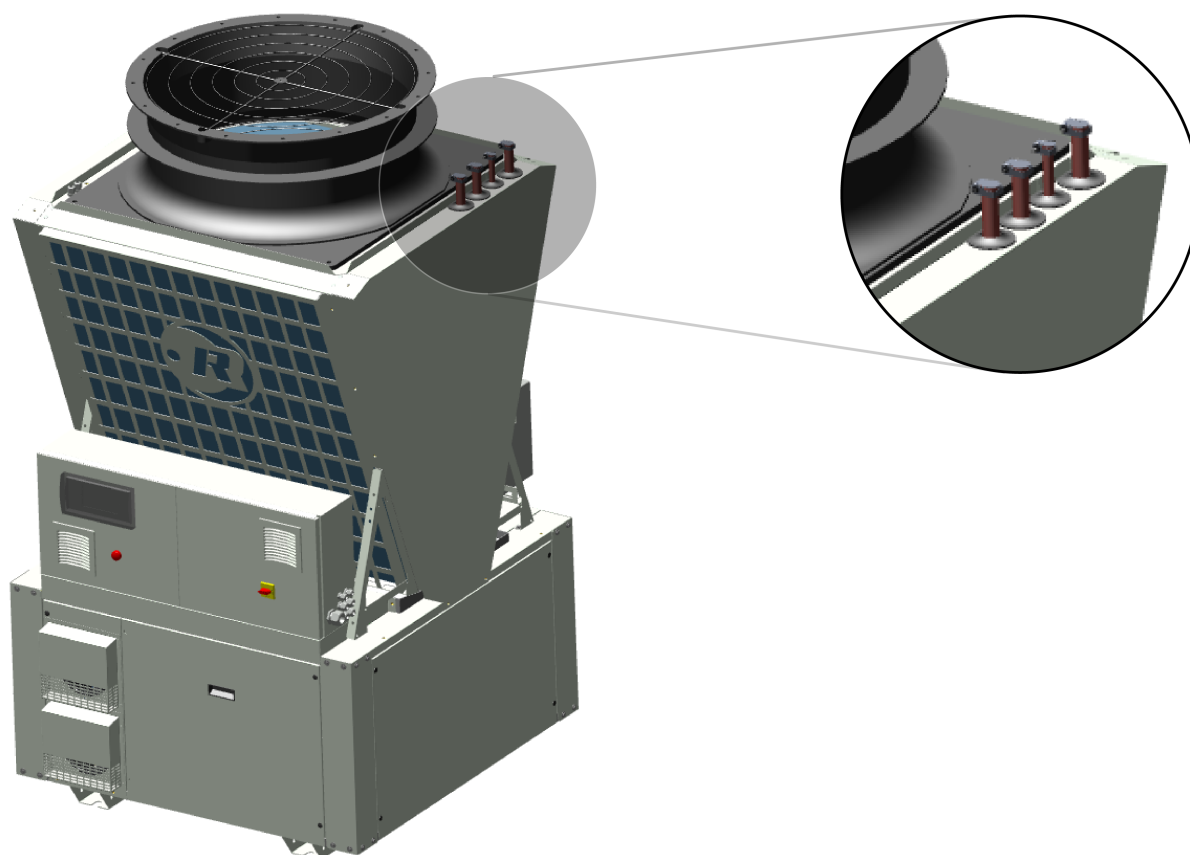
Refrigerant	Chemical formula	GWP (over 100 years)
R290	C ₃ H ₈	0.02

In accordance with ISO 817, R290 is classified as A3, as per ASHRAE Standard 34-1997. The lower flammability limit LFL (32 g/m³), flame propagation speed (0.7 m/s) and heat of combustion (50 MJ/kg) place R290 among the A3 fluids, flammable refrigerants. The refrigerant also has a low minimum ignition energy (MIE=0.25 mJ) and a self-initiation temperature of 470°C.

Refrigerant	R290
Safety classification (ISO 817)	A3
PED fluid group	1
ODP	0
GWP (AR6 - over 100 years)	0.02
Component	R290

Installation of the units must be carried out following local regulations and standards (and in any case in accordance with EN 378-3). In units, loaded with A3 gas, it must be evaluated by the person in charge of the plant whether it is necessary to remotely vent the safety valves in order to divert the escape of gas in the event of an overpressure valve trip.

The discharge pipe terminations of safety valves must be protected from the ingress of water or atmospheric condensate and point upwards.



The following are the features of the safety valves used:

High pressure valve

	Outlet diameter	Tripping pressure
Size 150	28mm ODS	38 bar

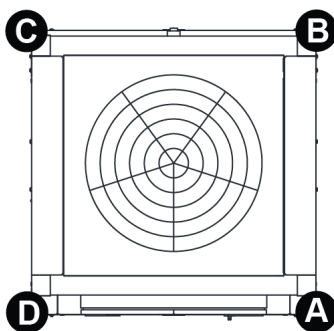
Low pressure valve

	Outlet diameter	Tripping pressure
Size 150	18mm ODS	30.4 bar (sat temperature 80°C)

Note: The number of valves doubles in the case of accessory DVS – double safety valve.

In the event of a rupture, the exchangers (evaporator/recovery) of the unit could release refrigerant into the hydraulic circuits. It is the responsibility of the installer to design and protect the hydraulic circuits by means of safety valves which must be located in an area away from possible sources of ignition. An indirect type of system must also be provided, compatible with class III installation (according to Chapter 5.5 of standard EN 378-1); for example through the installation of an automatic type deaerator, always externally and close to the unit (IN/OUT water) before any shut-off valves and at the highest point and/or where any stagnation pockets of gas could be generated to vent them in areas without sources of ignition (including the unit) and adequately distant from the unit, possibly by means of ducting with suitable piping.

1.24 Weight distribution



THAIP		150
Weight		
(*)	kg	635
Support		
A	kg	159,9
B	kg	181,9
C	kg	137,2
D	kg	156,1

(*) Weight of empty units

1.25 Accessories weights

Accessory weights	150
DS	15
V3V	5
INS	10
FIAP	-
P2	5

1.26 Hydraulic connections

System connection

- The unit is equipped with male threaded hydraulic connections and manual air vent valve and drain cock.
- It is advisable to install cut-off valves that isolate the unit from the rest of the system and elastic connection joints.
- It is mandatory to install a square metal mesh filter (longest side = 0.8 mm) on the unit return pipes.
- The rate of the water that flows through the heat exchanger must not drop below the value corresponding to a temperature differential of 10° C (the minimum and maximum flow rates must still be complied with – see “Water flow rate limits”).
- It is advisable to drain the water from the system during long periods of inactivity.
- It is possible to avoid draining the water by adding glycol to the water circuit (see “Use of antifreeze solutions”).
- It is the responsibility of the installer to design and protect the hydraulic circuits by means of safety valves which must be located in an area away from possible ignition sources.
- An indirect type of system must also be provided, compatible with class III installation (according to Chapter 5.5 of standard EN 378-1); for example, by installing an automatic type deaerator, always externally and close to the unit (water IN/OUT) before any shut-off valves and at the highest point and/or where any stagnation pockets of gas could be generated to vent them in areas free of ignition sources (including the unit) and adequately distant from the unit, possibly by means of ducting with suitable piping.

Condensate discharge

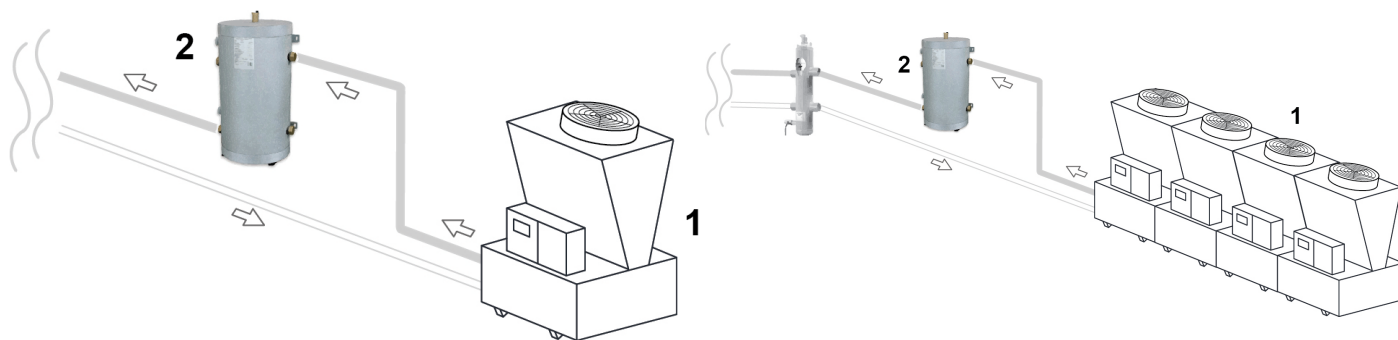
Models THAETP have a base equipped with one drainage point to facilitate evacuation of condensation water. It is necessary to channel the condensation water drain and provide for the construction of a siphon filled with water to intercept any refrigerant leaks. When the outdoor temperature is around zero, the water normally produced during the coil defrosting could form ice and make the flooring near the unit installation area slippery. We recommend diverting using an inclined pipe, minimising the number of curves and pressure drops to facilitate draining.

Check that the terminal areas of these ducts are located away from possible sources of ignition and from openings in which dispersed gas could stagnate such as: ventilation systems, vents or ventilation ducts, entrance doors or windows, manholes, drains, gutters, drains, manholes, hatches, stairs, openings to the ground (sewers), shafts, spaces for the passage of pipes, cable ducts or similar if not protected from the accumulation of flammable mixtures.

Hydraulic set-ups

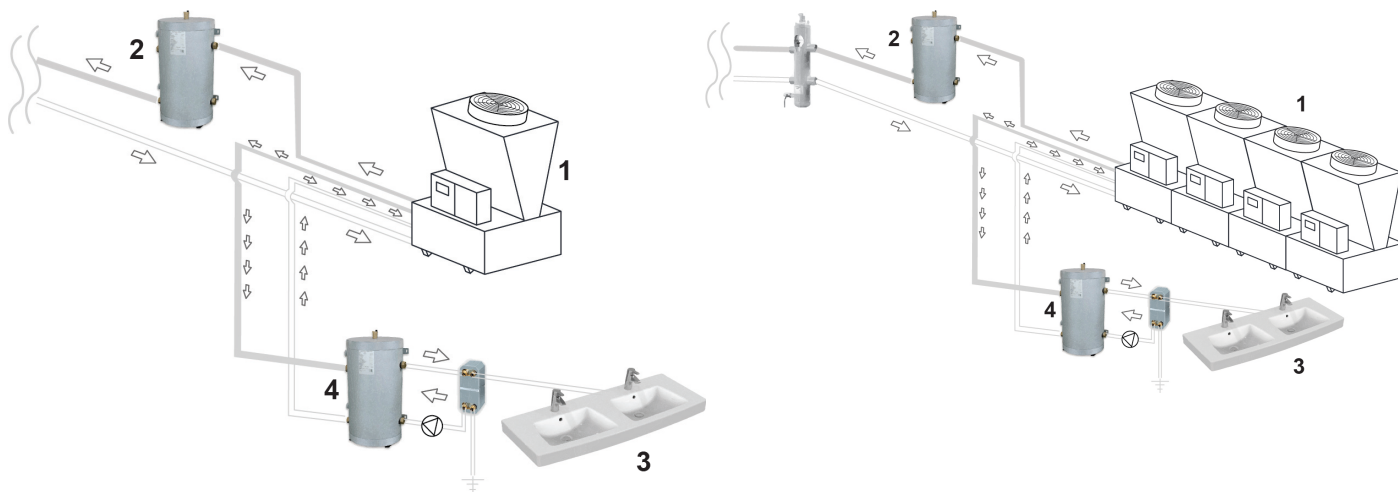
PUMP installation

The units are equipped with a pump. The unit's hydraulic circuit is complete with air bleed and drain valves.



Pump setup with the V3V accessory

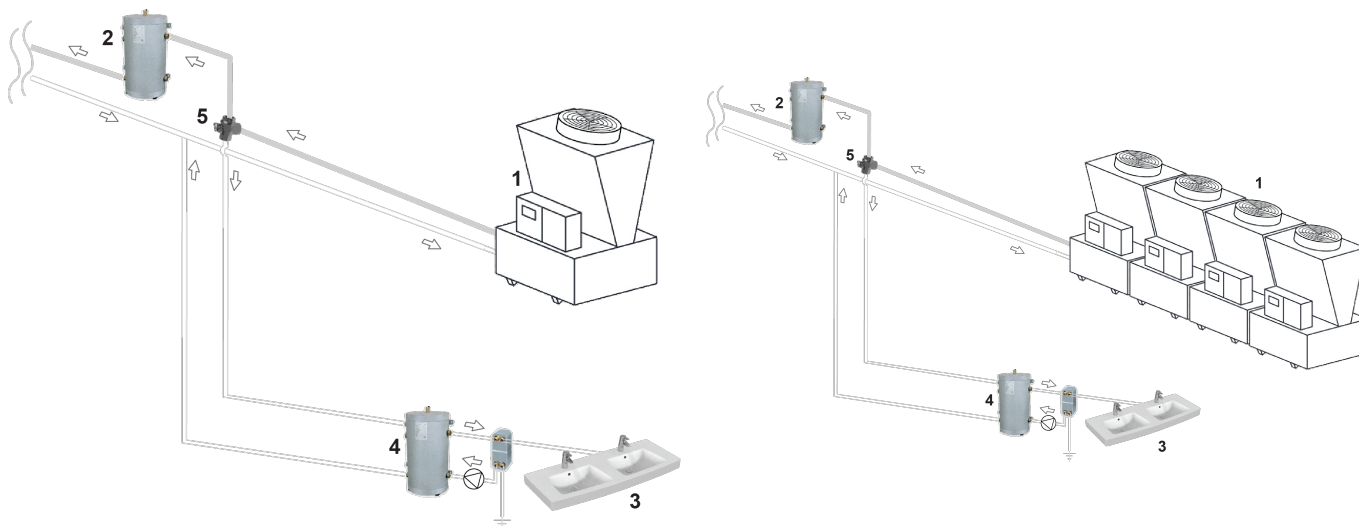
The units with the Pump P1-P2 (single electric pump) set up can be supplied with a factory-fitted 3-way diverter valve. This way it is possible to manage the production of domestic hot water without the addition of external valves.



- 1 Unit
- 2 Inertial storage tank (if necessary)
- 3 Domestic
- 4 Technical water storage tank

Applications and production of domestic hot water

Set-up of Heat pump with 3-way valve (KVDEV accessory) and domestic hot water (DHW) production



- 1 Unit
2 Inertial storage tank (if necessary)
3 Domestic
4 Technical water storage tank
5 3-way valve (KVDEV accessory)

With this type of system, the main circuit of the heat pump produces DHW (winter season) or DCW (summer season) for the user. For the production of DHW by using the heat pump, use a technical water storage tank, which cannot be used directly for human consumption, and combine it to a DHW producer/intermediate heat exchanger.

Should a 3-way valve system (KVDEV) be envisaged, it can manage production of hot water to the DHW circuit in both the summer and winter seasons. In fact, the valve enables water flow deviation from the system to the technical water storage tank for the system to produce DHW for domestic use.

The valve must be installed in proximity of the heat pump and in any case before any accumulations..

The pipes between the valve and the heat pump must be as short as possible.

Priority management and domestic hot water DHW request (3-way switch-over valve KVDEV)

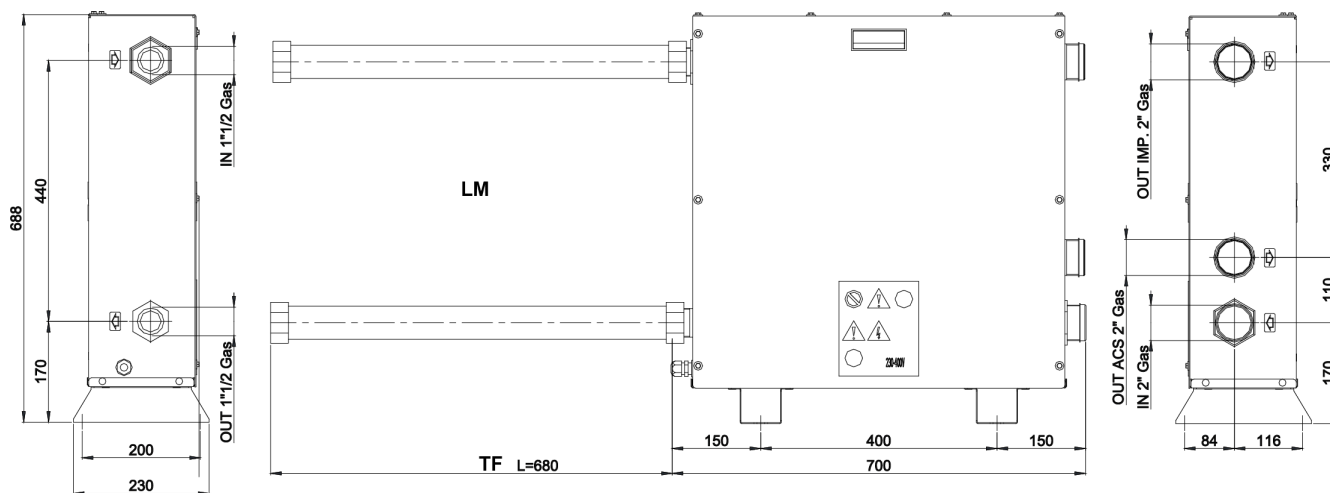
How to manage the DHW request:

- by means of the digital input: the request is assigned by a thermostat assembled by the installer. When the thermostat closes, the unit understands that there is a DHW request and, once the conditions have been verified, the procedure is activated to meet the DHW requirements
- by means of a temperature probe in the storage tank: a temperature probe is placed inside the storage tank, which is directly connected to the unit's board. The required set point can be configured from the panel together with the relative activation differential. In this case, the probe must be accurately positioned and the maximum distance allowed respected due to the type of probes used.

Type of probe:

description	type of probe	features	β (25/85)
NTC150	NTC HT150	50k Ω @25°C	3977 ($\pm 1\%$)
NTC	NTC	10k Ω @25°C	3435 ($\pm 1\%$)

Accessory KVDEV



LM Machine side
TF Flexible hose

For units assembled with Pump set up, the KVDEV kit can be installed for managing the domestic hot water production. The 3-way valve allows deviating the water flow from the system to the technical water tank for the production of domestic hot water.

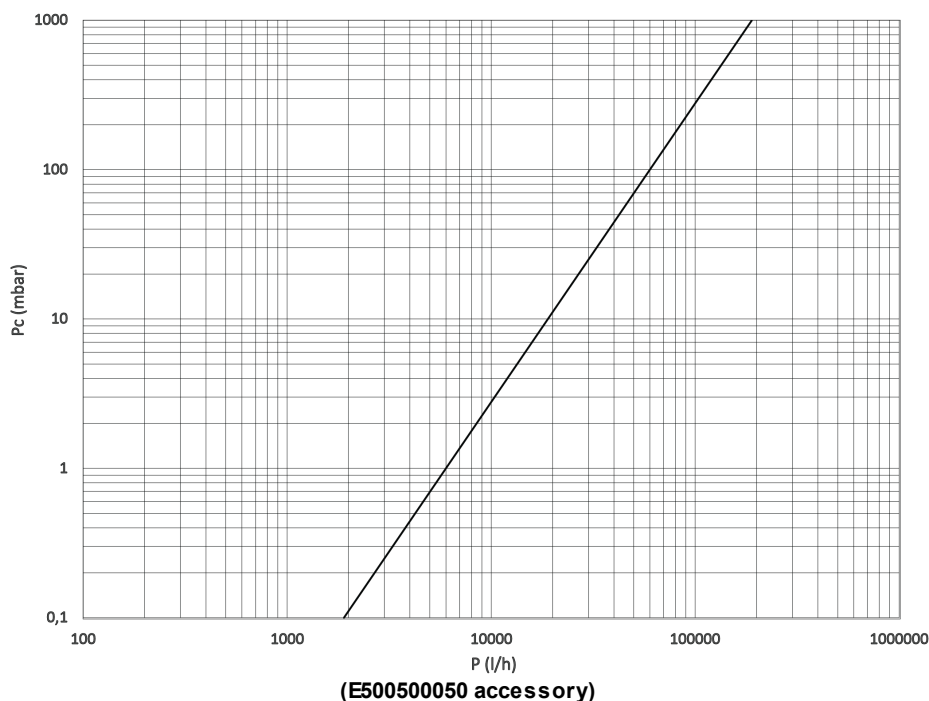
The kit includes two flexible pipes to connect the delivery and return of the unit.

The accessory must be mounted the closest possible to the heat pumps, in order to prevent a transfer of cold water inside the domestic hot water storage, during the passage between heat pump chiller operation to produce domestic hot water.

The delivery and return fittings towards the system are available with 2" connections. The kit is equipped with RAL9018 painted bonnet.

Cable gland for wiring the power supply.

IP 54 rate



Electrical connection

ATTENTION! For the electrical connections of the unit and accessories, refer to the relative wiring diagram.

1.27 Minimum hydraulic circuit contents

To ensure the unit works correctly, the system needs a minimum volume of water. The minimum water content is determined on the basis of the unit's cooling or heating capacity (for heat pumps) in the design of the unit, multiplied by the coefficient expressed in 3 l/kW (*).

If the water content of the system is below the minimum value calculated, install an additional tank. However, remember that a high water content in the system always goes to the advantage of comfort in the room, as it ensures a high thermal inertia of the system

* For heat pumps air cooled, also pay attention to the temperature difference generated during the natural defrosting cycles:

DT tank and/or DHW (by defrost effect)	K	20	15	12	10	8	7	6
Specific capacity	l/kW	3.5	5	6	7	9	10	12

Hydraulic data

Model		250
Heat exchanger water content	l	3,8
Minimum flow rate (water differential pressure switch intervention)	l/h	2800

It is the installer's duty to size and install an expansion tank that is suitable for the system.

1.28 Information on the accessories

1.28.1 Applications for partial (DS) recovery and DHW production

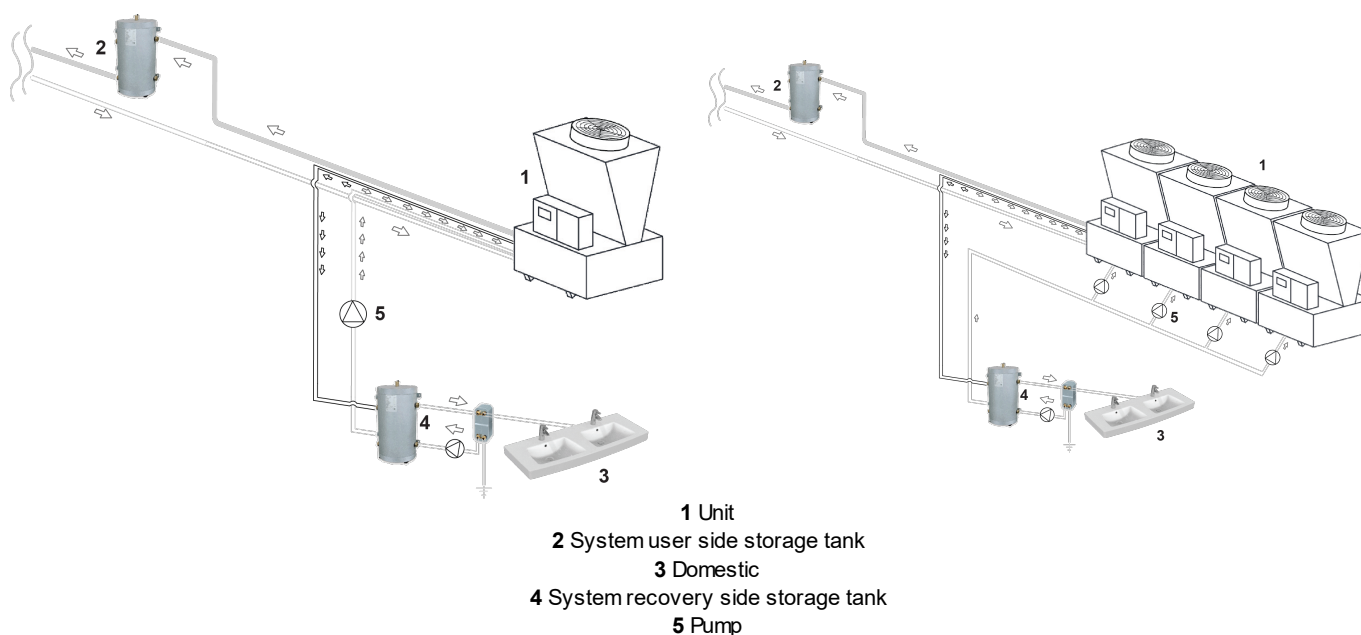
Overview

In general, the condensation heat in a chiller is dissipated into the air; it can be intelligently recovered by partial heat recovery (DS). In summer operation, a reduced share, equal to the gas de-heating, of the condensation heat that would otherwise be lost is recovered.

In the case of a reversible heat pump, the partial recovery (DS) can also operate in winter mode by subtracting an aliquot from the heat production in the main heat exchanger.

In any case, the share of heat produced by partial (DS) or total (RC100) heat recovery is dependent on the power delivered on the primary circuit.

The following information is indicative. The proposed schemes are incomplete and only serve to establish guidelines that allow the best use of units in some particular cases.



Chiller or heat pump set-up with DS

Chiller

With this type of system, the main hydraulic circuit of the chiller is connected to the user and produces cold water for air conditioning. The unit can be set-up as a pump or pump and storage tank as alternative to the traditional solution seen installed in the system.

The desuperheater (DS), with which the machine can be supplied, will be connected by means of a technical water storage tank and external pump for DHW or to the system to produce hot water for the post-heating coils of the CTA or other applications.

Heat pump with partial recovery (DS) - 2-Pipe+DHW system

Should the unit be a reversible heat pump, summer operation is the same as the aforementioned situation of the chiller. Instead, with winter operation, the user has DHW produced from the heat pump. If the unit is equipped with a DS desuperheater, this can be also active in winter mode. However, in this case, this value is deducted from the portion of heat from the hot water produced from the main heat exchanger.

Activation and deactivation of DS

Units equipped with a DS desuperheater are equipped with the digital contact 'CDS recovery consent' shown in the circuit diagram in order to activate heat recovery. This contact can be managed, for instance, with the TRD – Thermostat with display accessory.

Moreover, the criterion to stop the thermal recovery can be established from the panel

- for digital contact ("CDS" consent recovery): if the consent is interrupted, heat recovery will cease. This mode meets the requirement to carry out a temperature control system of the tank connected to the recovery;
- for maximum temperature: in this case the "CDS - recovery consent" must always be enabled. The maximum recovery temperature limit is set from the panel on the machine (see manual Electronic controls) or from the remote keypad (KTR accessory). The recovery keeps operating until the recovery temperature is below the set limit;

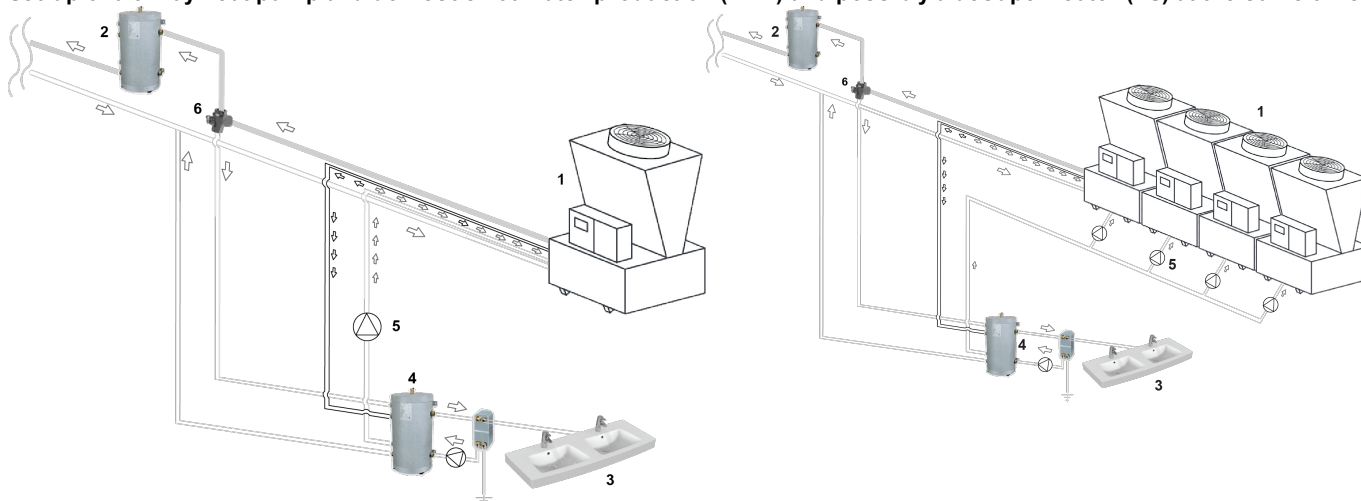
Alternatively, heat recovery management can be carried out by means of a temperature probe in the storage tank (STDS): a temperature probe connected directly to the unit board is inserted in the storage tank. The required set point can be configured from the panel together with the relative activation differential. In this case, the probe must be accurately positioned and the maximum distance allowed respected due to the type of probes used.

The software manages two types of probe selectable from the keyboard

description	type of probe	features	β (25/85)	Tmax
NTC150	NTC HT150	50k Ω @25°C	3977 ($\pm 1\%$)	120°C
NTC (*)	NTC	10k Ω @25°C	3435 ($\pm 1\%$)	90°C

(*) default

Set-up of a 3-way heat pump and domestic hot water production (DHW) and possibly a desuperheater (DS) at the same time



- 1 Unit
2 System user side storage tank
3 Domestic
4 System recovery side storage tank
5 Pump
6 3-way valve (KVDEV accessory)

With this type of system, the main circuit of the heat pump produces DHW (winter season) or DCW (summer season) for the user. The unit can be set up with pumps as an alternative to the traditional solution that sees them installed in the system. For the production of DHW by using the heat pump, use a technical water storage tank, which cannot be used directly for human consumption, and combine it to a DHW producer/intermediate heat exchanger.

Should a 3-way valve system be envisaged, it can manage production of hot water to the DHW circuit in both the summer and winter seasons. In fact, the valve enables water flow deviation from the system to the technical water storage tank for the system to produce DHW for domestic use (domestic hot water diverter valve CACS consent + domestic hot water valve VACS control).

The desuperheater, with which the machine can be fitted, must be connected to the same technical water storage tank for the DHW production system, and is able to keep the heat storage tank level high. This way, the system allows maximum service continuity to the DHW and system, regardless of the operation mode summer or winter.

If the DS accessory and the 3-way diverter valve are present at the same time, the desuperheater is activated first when DHW is required, with the diverter valve being activated next only when necessary.

Priority management and domestic hot water DHW request (3-way switch-over valve VDEV and activation of any DS)

How to manage the DHW request:

- by means of the discrete input: the request is assigned by a thermostat (e.g. via a KTRD accessory). When the thermostat is closed, the machine senses that there is a DHW demand and, after checking the conditions, activates the procedure to satisfy DHW (dry contact CACS/CDS);
- by means of a temperature probe in the storage tank (STACS): a temperature probe connected directly to the unit board is inserted in the DHW storage tank. The required set point can be configured from the panel together with the relative activation differential. In this case, the probe must be accurately positioned and the maximum distance allowed respected due to the type of probes used.

The software manages two types of probe selectable from the keyboard

description	type of probe	features	β (25/85)	Tmax
NTC150	NTC HT150	50k Ω @25°C	3977 ($\pm 1\%$)	120°C
NTC (*)	NTC	10k Ω @25°C	3435 ($\pm 1\%$)	90°C

(*) Default

1.28.2 Management of an integrative source and auxiliary generator

The integrative heat source (electric heater) or an auxiliary thermal source (boiler) can be managed from the unit board.

Integrative thermal source

An integrative thermal source is an electrical resistance that runs together with the heat pump in winter mode. By means of the unit's control, it is possible to control start-up and switch-off according to the different variables: outdoor air temperature, delay in reaching the set-point set due to a high thermal load.

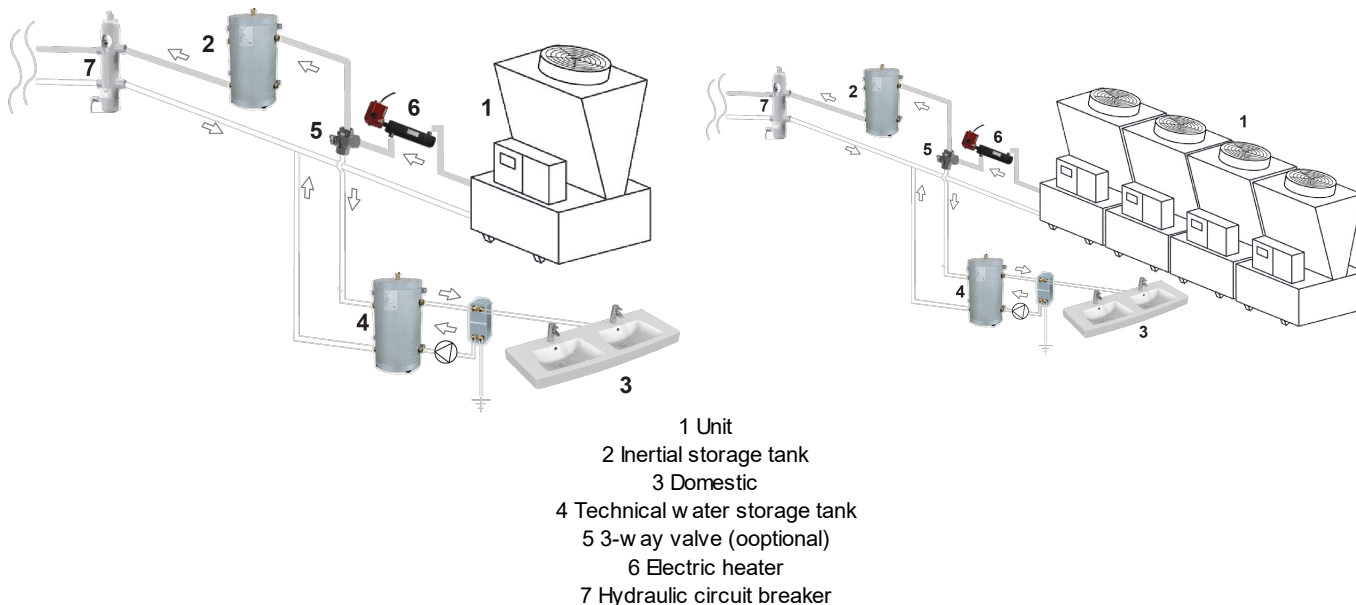
Resistance is always activated during the defrost cycle and when DHW production is requested.

When there is a 3-way valve for KVDEV DHW production, the electrical resistance must be placed upstream of the valve, as illustrated in the figure.

The valve must be installed in proximity of the heat pump.

The pipes between the valve and the heat pump must be as short as possible.

It is always recommended to accurately check the electrical power available when integrative electrical resistances are installed.



Auxiliary thermal source

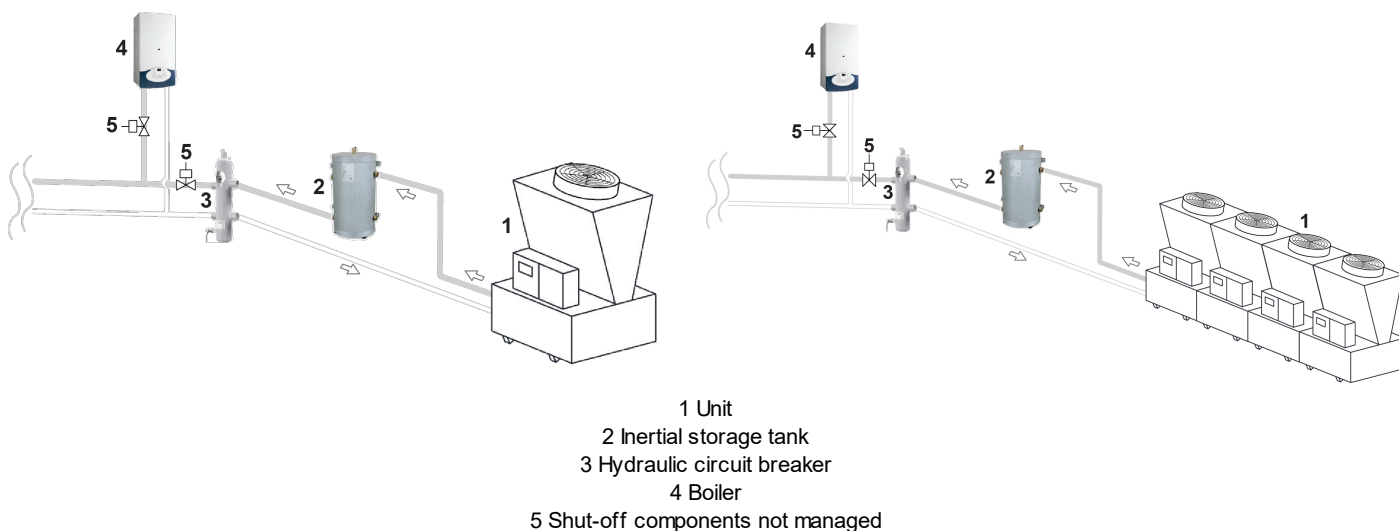
An auxiliary generator is a heat generator that runs alternatively to the heat pump; typically, it is a boiler. When the alternative generator is activated, the heat pump and all its auxiliaries are off, even if powered. The auxiliary generator can be enabled only for heating the systems.

Operation of the auxiliary source.

The auxiliary generator can be activated according to three modes:

- manually;
- for an outdoor temperature set point;

- for a convenience criterion based on the costs of electricity and fuel (methane and butane);
- for heat pump malfunction.



1.28.3 EEM accessory - Energy Meter

The EEM accessory allows certain unit features, such as those below, to be measured and displayed:

- Power supply voltage and total instantaneous current absorbed by the unit
- Total instantaneous electric power absorbed by the unit
- Instantaneous power factor ($\cos\phi$) of the unit
- Electricity consumption (kWh)

If the unit is connected via a serial network to a BMS or external supervisory system, the trends of the measured parameters can be stored and the operating status of the unit itself checked.

1.28.4 FDL accessory - Forced Download Compressors

The FDL accessory (forced reduction of the power absorbed by the unit), allows the limitation of the power according to the needs of the user by setting, on a dedicated mask, the desired maximum power %. The unit will partialise its power so as to come as close as possible to the desired value, guaranteeing first of all its correct operation.

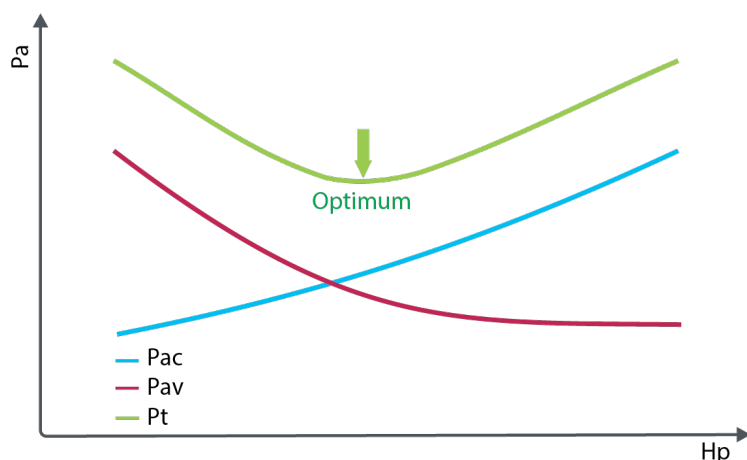
Activation of the function, which can be enabled and configured from the unit's display, can be done by means of a digital signal (dry contact), by means of daily time slots or via BMS.

In the presence of the EEM accessory, which allows instantaneous measurement of the absorbed power, it is possible to set a precise value of the maximum absorbed power desired.

ATTENTION! in some phases of its operation, even with FDL enabled, the unit may increase the electrical absorption to guarantee functionality and reliability, therefore the power line must always be sized for the maximum value shown on the nameplate and technical data table.

1.28.5 EEO accessory – Energy Efficiency Optimizer

The EEO accessory allows the unit efficiency to be optimised by acting on the electrical absorption, thereby minimising consumption. The EEO accessory identifies the optimal point that minimises the total absorbed power (compressors+fans) of the unit by actuating the fan rotation speed. It is particularly effective in the partial load operation, a situation which arises for most of the useful life of the chiller.



Pac	Compressor consumed power
Pav	Fan consumed power
Pt	Total absorbed power
Pa	Absorbed power
Hp	Condensation pressure

1.28.6 LKD accessory - Leak Detector

The LKD accessory allows the detection of any refrigerant gas leaks.

If a refrigerant leak is detected, the unit immediately shuts off the power supply to all components, except the leak detector Ex and the Ex ventilation system, which is activated to ventilate the technical compartment until the gas concentration refrigerant drops below the maximum safety threshold. In this period, an acoustic/luminous red light signal is active on the front of the electrical panel and the relative remote contact is activated.

In the event of a rupture, the unit's heat exchangers could release refrigerant into the hydraulic circuits. It is the responsibility of the installer to design and protect hydraulic circuits from refrigerant leaks that could flow into occupied rooms.

1.28.7 Accessory SG - Smart Grid Contacts

The SG accessory (Smart Grid contacts), allows connection to a smart grid, so that the unit's operation can be adapted to the grid conditions. This makes it possible to optimise the management of peaks in demand, by reducing absorption, or of electricity availability, by activating the charging of thermal storage by the unit; in addition, this makes it possible to optimise consumption from self-production (e.g. from photovoltaic panels) or according to cost/hour logic.

The function, which can be enabled from the unit's display, is available in two predefined configurations. By combining a pair of digital signals (dry contact), the following modes can be activated:

SG contact	EVU contact	Configuration 1	Configuration 2
open	open	Normal mode	Reduced Mode 2
open	closed	Enhanced mode	Normal mode
closed	open	Reduced mode 1	Boost Mode
closed	closed	Boost Mode	Boost Mode

Normal Mode: The unit operates normally as per the set-point settings.

Enhanced Mode: The unit operates normally, with the set-points thus modified:

- In cooling the set-point is decreased by 1°C.
- In heating mode the set-point is increased by 2°C.
- In DHW mode, the set-point is increased by 5°C.

Boost mode: The unit operates normally, with the set-points thus modified:

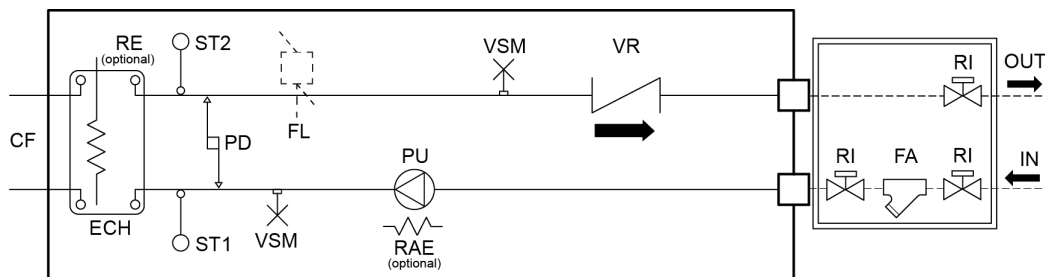
- In cooling mode the set-point is decreased by 2°C.
- In heating mode, the set-point is increased by 5°C.
- In DHW mode, the set-point is raised to the maximum possible, with a restart differential of 1°C, and the additional electric heaters (if present) are activated.

Reduced mode:

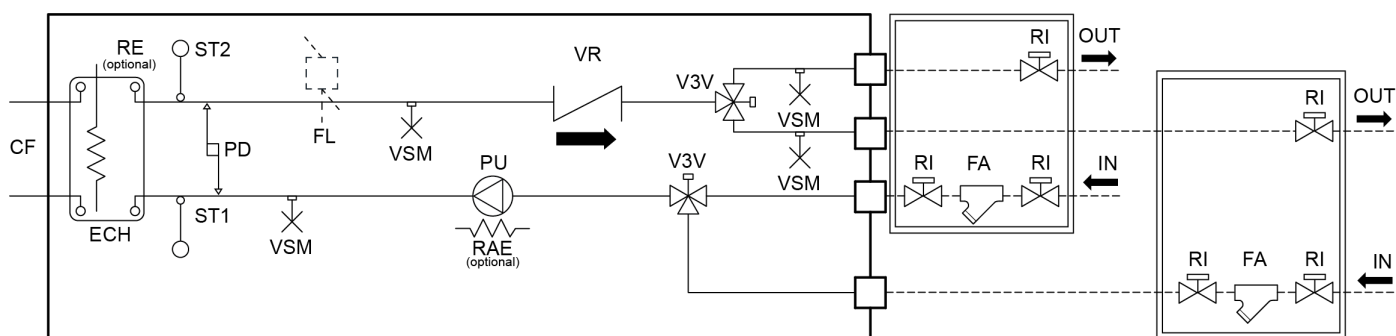
- In Configuration 1 (Reduced mode 1) the unit is switched off for a settable time (up to a maximum of 2 hours), then operates in normal mode.
- In Configuration 2 (Reduced Mode 2) the unit runs in normal mode for an adjustable time (up to a maximum of 2 hours), then is switched off.

1.29 Hydraulic circuit

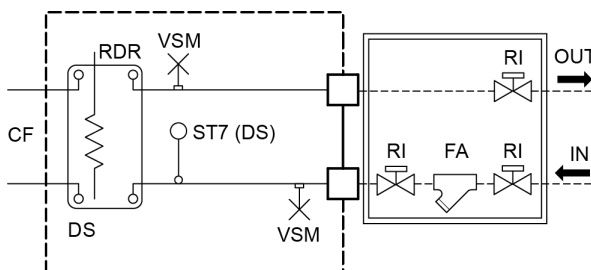
Installation P1/P2



Installation P1/P2 V3V



Hydraulic recovery circuit for RC100/DS set ups

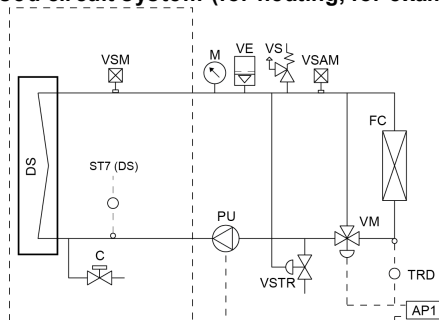


CF	Refrigerant circuit
ECH	Plate evaporator
RE	Evaporator antifreeze heater (optional w ith RAE20 or RAE20_4 kit)
PD	Differential w ater pressure sw itch
VSM	Manual bleed valve
VS	Safety valve
AP1	Electronic controls
ST1	Primary inlet temperature probe
ST2	Primary outlet temperature probe - w ork and antifreeze
ST7	DS inlet temperature probe
FA	Mesh filter (set up by the installer)
KRIT	Integrative electrical resistance (accessory)

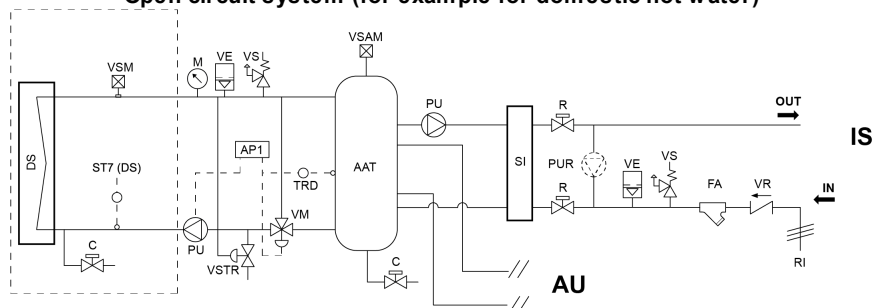
RAE	Pump antifreeze heater (optional w ith RAE20 or RAE20_4 kit)
RDR	Desuperheater antifreeze heater (optional w ith RAE20_4 kit)
FL	Flow sw itch (replaces PD if RAE20 or RAE20_4 kit present)
V3V	3-w ay diverter valve
PU	Pump
S	Water drain
RI	Shut-off tap
VR	Non-return valve
- - - - -	Connections by installer
— — —	FAR kit

1.30 System suggestion with RC100/DS accessory and DHW domestic hot water production management

Closed circuit system (for heating, for example)

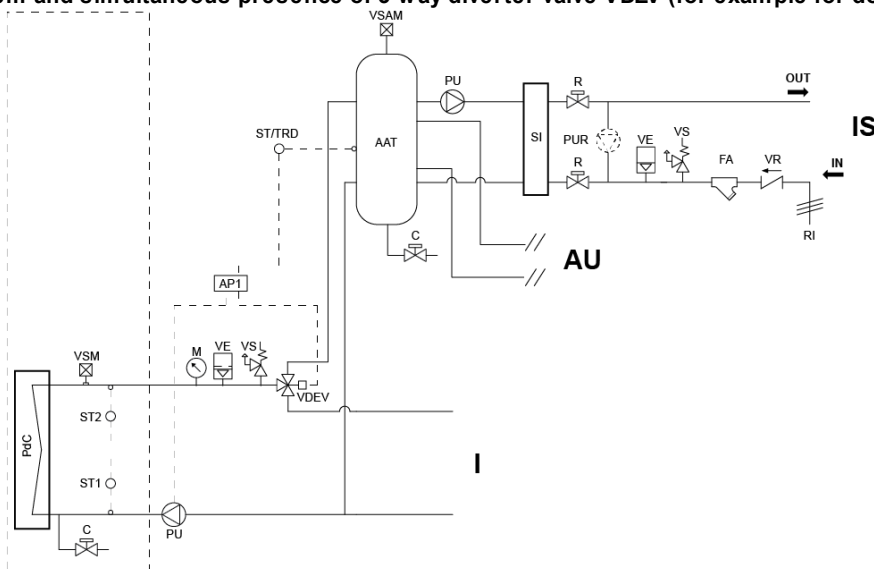


Open circuit system (for example for domestic hot water)



IS	DHW indication (tap, shower, sink)
AU	Other utilities
I	System

Open circuit system and simultaneous presence of 3-way diverter valve VDEV (for example for domestic hot water)



IS	DHW indication (tap, shower, sink)
AU	Other utilities
I	System

The diagram illustrates a water treatment process with three main sections: DS (Dissolved Solids), AAT (Air Treatment), and AU (Air Unit). The DS section includes a tank (DS) and a pump (PU) connected to a valve (VSM). The AAT section features a large tank (AAT) with a pump (PU) and a valve (VSM). The AU section includes a tank (SI) and a pump (PU) connected to a valve (VSM). The diagram also shows flow directions for IN and OUT water, with various valves and pumps labeled throughout the system.

IS	DHW indication (tap, show er, sink)
AU	Other utilities
I	System

PdC	Reversible heat pump unit
DS	Desuperheater
M	Manometer
VS	Safety valve
VE	Expansion vessel
VSTR	Recovery heat drain valve
VSM	Manual air bleed valve
VSAM	Automatic/manual air bleed valve
AP1	Unit board
VR	Check Valve
VM	3-w ay mixing valve
PU	Circulation pump
VDEV	3-w ay diverter valve
R	Cock
PUR	Recirculation loop circulation pump
FC	Fan coil/utility
UT	Upon use
RI	From the w ater mains
ST	Temperature probe
SI	Intermediate heat exchanger
AAT	Technical w ater storage tank
C	Charge/drain w ater valve

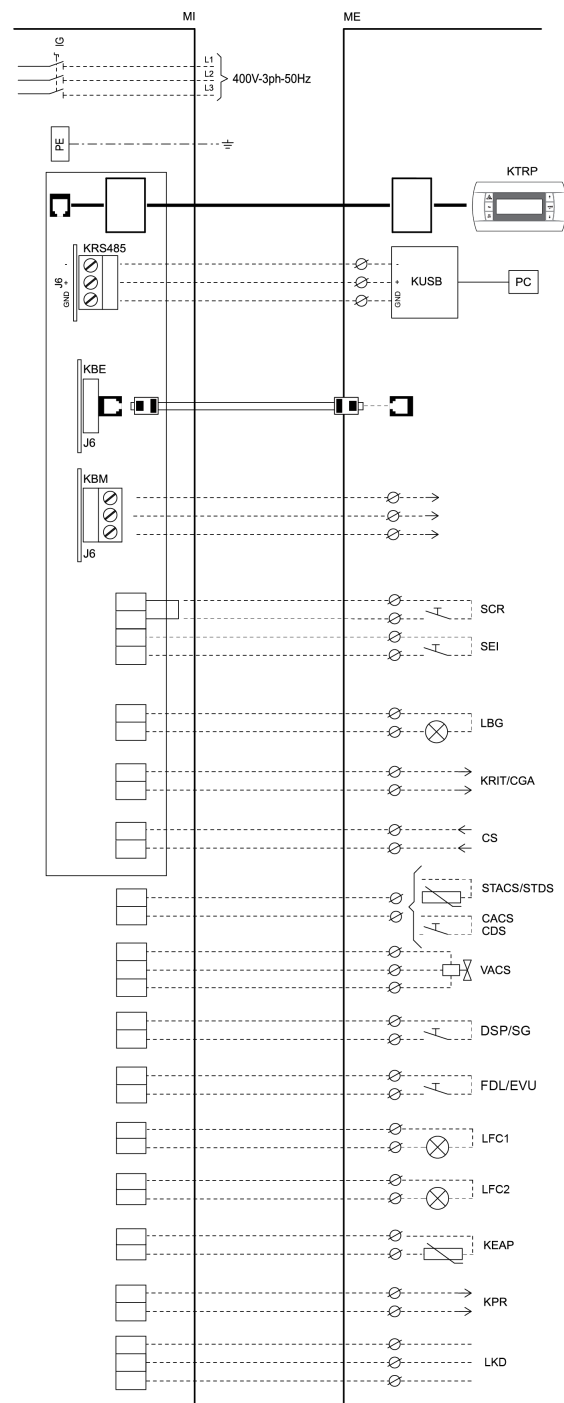
ST	Temperature probe
TRD	Recovery activation thermostat provided by the installer (KTRD - Thermostat with display provided by Rhoss as possible accessory)
FA	Water filter
ST1	Main heat exchanger inlet temperature probe
ST2	Main heat exchanger outlet temperature probe
ST7	DS inlet temperature probe

N.B.

For the unit to operate properly, activation of the DC/RC100 recovery pump must be controlled by means of a specific discrete output provided in the board on the unit

- The minimum water inlet temperature allowed is at recovery DS is 40°C.

1.31 Electrical connections



MI	Electrical panel internal terminal board
ME	User external terminal board
L1	Line 1
L2	Line 2
L3	Line 3
PE	Earth connection
IG	Manoeuvre isolator switch
KRS485	RS485 serial interface (accessory)
KUSB	RS485/USB converter (accessory)
KBE	Bacnet Ethernet interface (accessory)
KBM	Bacnet MS/TP interface (accessory)
J6	Connector to insert the KRS485, KBM, KBE accessories
KTRP	Remote keyboard (accessory)
PC	Personal computer
SCR	Remote control selector (control with clean contact)
SEI	Summer/winter selector (control with potential free contact)
LBG	General block light (consensus in voltage 230 Vac, maximum load 0.5A AC1)
KRIT	KRIT control (additional electric resistance for heat pump) (230 Vac, maximum load 0.5 A AC1)
KEAP	Outdoor air probe for Set-point compensation (as an alternative to that already fitted on the machine)
CS	4-20 mA analogue signal for shifting Set-point (incompatible with the DSP accessory), this must also be handled as a special feature by our Pre-Sales Department
CACS/CDS	Domestic hot water diverter valve consent (control with potential free contact) or DS consent
DSP	Double set-point via digital consensus (incompatible with the CS and CACS accessory)
SG EVU	Contacts for smart grid and photovoltaic system integration
VACS	3-way diverter valve for managing the production of domestic hot water (KVDEV) (230 Vac, maximum load 0.5A AC1)
CGA	Auxiliary generator control (consent in voltage 230 Vac, maximum load 0.5A AC1)
STACS/STDS	Domestic hot water/DS temperature probe (not supplied, set up by the installer); an alternative to domestic hot water/DS consensus (CACS/CDS)
FDL	Forced down load compressors (FDL accessory) (control with clean contact)
LFC1-2	Compressor functioning light (consensus in voltage 230 Vac, maximum load 0,5A AC1)
KPR	Compulsory control of recovery/desuperheater pump (consent in voltage 230 Vac, maximum load 0.5A AC1)
LKD	Refrigerant leak detector alarm (voltage-free consent)
- - - -	Connection by installer
—————	4-wire shielded cable

- The electrical board can be accessed from the front panel of the unit.
- Connections must be made in compliance with current standards and with the diagrams provided with the machine.
- Machine earthing is legally compulsory.
- Always install a main automatic switch or fuses with adequate capacity and blackout power in a protected area or near the machine.

ATTENTION!

The diagrams only show the connections to be carried out by the installer.

For the electrical connections of the unit and accessories, refer to the relative wiring diagram.

		Line Section (*)	PE section	Commands and controls section
150	mm ²	16	16	1.5

(*) The indicated supply sections (cable type FG16) are approximate. The installer is responsible to suitably size the electrical supply line switch - including the earth cable - according to: line length, distribution system, type of cable, type of layout, maximum absorption of the unit

1.32 General switch

Models	Circuit breaker cutter	Power cable section
150	80 A	1,5÷35 mm ²



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