



# UniPACK-PI

TCAIP-THAIP 175-3150



PART OF **NIBE** GROUP

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## 3 English

### 3.1 IMPORTANT INTRODUCTION

**IMPORTANT INTRODUCTION:** the machines of the UniPACK-PI series and related accessories are designed and built to be transported, installed, used, maintained and dismantled at the end of their life cycle by professional users, with a level of technical skills, training, information and qualifications also in relation to Occupational Safety and Health at a professional and advanced level.

Also this instruction manual for use and maintenance is therefore aimed at a professional user, in possession of such skills and knowledge and able to fully understand its contents.

RHOSS S.p.a. explicitly prohibits any operation on its machines and related accessories to non-professional users or private users; failure to comply with this prohibition, in addition to voiding any warranty or liability of RHOSS Spa in relation to its machines and / or accessories, could expose the non-professional user to serious or fatal risks.

### 3.2 General features

#### Declared conditions of use

TCAIP units are packaged air-cooled water chillers with axial fans respectively in high efficiency and super-silenced versions. They are suitable in air conditioning installations and industrial processes where chilled water is required (TCAIP) or hot and chilled (THAIP), not for human consumption.

The units are designed for outdoor installation

#### Guide to reading the code

|          |                                                    |
|----------|----------------------------------------------------|
| <b>T</b> | Water production unit                              |
| <b>C</b> | Cooling only                                       |
| <b>H</b> | Heat pump                                          |
| <b>A</b> | Air cooling                                        |
| <b>I</b> | Hermetic Scroll inverter compressors (i, 1+i, 2+i) |
| <b>T</b> | High efficiency                                    |
| <b>Q</b> | Super-silenced                                     |
| <b>P</b> | R290 refrigerant gas                               |

|               |                                   |
|---------------|-----------------------------------|
| <b>1÷3</b>    | Number of compressors             |
| <b>75÷150</b> | Approximate cooling power (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

**Standard** Installation without pump and without water buffer tank

#### Pump (main circuit)

|            |                                                                                                             |
|------------|-------------------------------------------------------------------------------------------------------------|
| <b>P1</b>  | Installation with pump                                                                                      |
| <b>P2</b>  | Installation with increased static pressure pump                                                            |
| <b>DP1</b> | Installation with double pump, including an automatically activated pump in stand-by                        |
| <b>DP2</b> | Set up with double pump featuring increased head pressure, of which one in standby with automatic operation |

#### Pump ("RC100" recovery circuit side) when available

|             |                                                                                                             |
|-------------|-------------------------------------------------------------------------------------------------------------|
| <b>PR1</b>  | Installation with pump                                                                                      |
| <b>PR2</b>  | Installation with increased static pressure pump                                                            |
| <b>DPR1</b> | Installation with double pump, including an automatically activated pump in stand-by                        |
| <b>DPR2</b> | Set up with double pump featuring increased head pressure, of which one in standby with automatic operation |

#### Tank & Pump (main circuit):

|              |                                                                                                                            |
|--------------|----------------------------------------------------------------------------------------------------------------------------|
| <b>ASP1</b>  | Installation with pump and water buffer tank                                                                               |
| <b>ASP2</b>  | Installation with increased static pressure pump and water buffer tank                                                     |
| <b>ASDP1</b> | Installation with double pump, including an automatically activated pump in stand-by and storage                           |
| <b>ASDP2</b> | Installation with increased static pressure double pump, including an automatically activated pump in stand-by and storage |

#### Example: THAIQP 290 ASP1

- Water production unit
- Air-cooled
- 2 Scroll hermetic compressors (1 fixed and 1 inverter)
- Super-silenced unit
- R290 refrigerant fluid
- Rated output of about 90 kW
- Installation with pump and storage tank

### 3.3 Components

Each unit is supplied complete with:

- User instructions;
- Wiring diagram;
- List of authorised service centres;
- Warranty document;
- Safety valve certificates;
- Use and maintenance manual for the pumps, fans and safety valves.

### 3.4 NOTE

|                                                                                    |                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>DANGER!</b><br>The machine has been designed and constructed solely and exclusively to function as an air-cooled water chiller; any other use is expressly PROHIBITED.<br>Installing the machine in an explosive environment is prohibited. |
|  | <b>DANGER!</b><br>The units are designed for outdoor installation. Segregate the unit if installed in areas accessible to persons under 14 years of age.                                                                                       |
|  | <b>IMPORTANT!</b><br>The correct operation of the unit is subject to the scrupulous observance of the instructions for use, compliance with the technical spaces in the installation and the limits of use reported in this manual.            |

### 3.5 Machine identification

The units are equipped with a serial number plate on the rear panel of the structure or on the electrical panel; from this the identification data of the machine can be obtained.

### 3.6 AdaptiveFunction Plus

#### Reliable and versatile energy consumption chillers and heat pumps

##### A complete, flexible range with stepless inverter control

Units with inverter-driven compressor in R290 equipped with the range's innovative AdaptiveFunction Plus control logic. 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 **AdaptiveFunction Plus** adaptive control logic is an exclusive **RHOSS S.p.A.** 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 UniPACK-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: “Economy”** Option It 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.

## 3.7 Warnings regarding potentially toxic substances



#### ATTENTION!

Read the following information about the refrigerants employed carefully. Adhere scrupulously to the warnings and first aid procedures indicated below.

☐ **Identification of the type of refrigerant fluid used** The unit uses **R290** refrigerant mixture composed of:

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

☐ **Identification of the type of oil used**

The lubrication oil used is of the polyalkylene glycol type; in any case, please refer to the information on the nameplate on the compressor.



#### DANGER!

For further information regarding the characteristics of the refrigerant and oil used, refer to the safety data sheets available from the refrigerant and oil manufacturers.

☐ **Main ecological information regarding the types of refrigerant fluids used**

#### • Persistence, degradation and environmental impact

| Fluid | Chemical formula              | GWP (over 100 years) |
|-------|-------------------------------|----------------------|
| R290  | C <sub>3</sub> H <sub>8</sub> | 0.02                 |

R290 belongs to the family of hydrofluorocarbons. It is regulated by the Kyoto protocol (1997 and subsequent revisions) being a fluid that contributes to the greenhouse effect. The index which measures how much a certain mass of greenhouse gas contributes to global warming is the GWP (Global Warming Potential). The standard measure for carbon dioxide (CO<sub>2</sub>) is GWP=1. The value of GWP assigned to each refrigerant represents the equivalent amount in kg of CO<sub>2</sub> released over a period of 100 years, in order to have the same greenhouse effect of 1kg refrigerant released over the same period of time. R290 does not contain elements that destroy the ozone layer, such as chlorine, therefore, its ODP (Ozone Depletion Potential) is zero (ODP=0). In accordance with ISO 817, R290 is classified as A3, as per ASHRAE Standard 34-1997. The lower flammability limit LFL (38 g/m<sup>3</sup>), 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**

**ATEL/ODL 0,09 kg/m³**

**LFL 0,038 kg/m³**

**Component R290**



#### SAFEGUARD THE ENVIRONMENT!

The hydrofluorocarbons contained in the unit cannot be released into the atmosphere as they are gases that contribute to the greenhouse effect.

R290 is a hydrocarbon derivative that decomposes rapidly in the lower atmosphere (troposphere). Decomposition by-products are highly dispersible and thus have a very low concentration. They do not affect photochemical smog (that is, they are not classified among VOC volatile organic compounds, according to the guidelines established by the UNECE agreement).

#### • Effects on effluent treatment

Waste products released into the atmosphere do not cause long-term water contamination.

#### • Exposure control/personal protection

Use personal protective equipment, protective clothing, suitable gloves and protect your eyes and face.

#### • R290 professional exposure limits

DNEL Not applicable

#### □ Main toxicological information on the type of refrigerant used

##### • Handling



##### ATTENTION!

Users and maintenance personnel must be adequately informed about the risks of handling potentially toxic substances. Failure to observe the aforesaid indications may cause personal injury or damage the unit.



##### ATTENTION!

The refrigerant gas is colourless and generally odourless. Pay attention to its possible exposure.

Avoid inhalation of high concentrations of vapour. The vapours are heavier than air, and thus hazardous concentrations may form close to the floor, where overall ventilation may be poor. In this case, ensure adequate ventilation. Avoid contact with naked flames and hot surfaces, which could lead to the formation of irritant and toxic decomposition by-products. Do not allow the liquid to come into contact with eyes or skin.

#### • Procedure in case of accidental escape of refrigerant

Ensure adequate personal protection (using means of respiratory protection) during clean-up operations. If the conditions are sufficiently safe, isolate the source of leak. If the extent of the spill is limited, let the material evaporate, as long as adequate ventilation can be ensured. If the spill is considerable, ventilate the area adequately. Contain the spilled material with sand, soil, or other suitable absorbent material. Prevent the liquid from entering drains, sewers, basements and work pits, as the vapours can create a suffocating and/or flammable atmosphere.

#### □ Main toxicological information on the type of refrigerant used

##### • Inhalation

A high atmospheric concentration can cause anaesthetic effects with possible loss of consciousness. Prolonged exposure may lead to an irregular heartbeat and cause sudden death. Higher concentrations may cause asphyxia due to the reduced oxygen content in the atmosphere.

##### • Contact with skin and eyes

Splashes of nebulised liquid can produce frostbite. Probably not hazardous if absorbed through the skin. Repeated or prolonged contact may remove the skin's natural oils, with consequent dryness, cracking and dermatitis. Liquid splashes can cause frostbite.

##### • Ingestion

While highly improbable, may produce frostbite.

#### First aid measures

##### • Inhalation

Move the injured away from the exposure source area and keep warm and at rest. Administer oxygen if necessary. Attempt artificial respiration if breathing has stopped or shows signs of stopping. In the case of cardiac arrest carry out heart massage and seek immediate medical assistance.

##### • Contact with skin and eyes

In case of contact with skin, wash immediately with lukewarm water. Thaw tissue using water. Remove contaminated clothing. Clothing may stick to the skin in case of frostbite. If irritation, swelling or blisters appear, seek medical assistance. Rinse immediately using an eyewash or clean water, keeping eyelids open, for at least ten minutes. Seek medical assistance.

##### • Ingestion

Do not induce vomiting. If the injured person is conscious, rinse his/her mouth with water and make him/her drink 200-300 ml of water. Seek immediate medical assistance.

##### • Further medical treatment

Treat symptoms and carry out support therapy as indicated. Do not administer adrenaline or similar sympathomimetic drugs following exposure, due to the risk of cardiac arrhythmia.

• **Extinguishing media**

Suitable extinguishing media:

- NEBULISED WATER
- DRY POWDER

Unsuitable extinguishing media:

- JETS OF WATER
- CO<sub>2</sub>

### 3.8 Check for leaks

Pursuant to Regulation (EU) No. 573/2024 of 16 April 2014, equipment operators for which checks are necessary to verify the presence of any leaks pursuant to Article 4, paragraph 1, establish and maintain, for each of these equipment, registers specifying the information required by Article 6 par. 1. The operator is the owner of the equipment or system. The operator can formally delegate the actual control of the equipment or system to an external person or company (through a written contract).

### 3.9 PED Categories of Pressure Components

List of PED critical components (Directive 2014/68/UE):

| TCAIT-QP             | 175 | 290-2100-3110 | 3120-3130-3140-3150 |
|----------------------|-----|---------------|---------------------|
| Compressor           | III | III           | III                 |
| Safety valve         | IV  | IV            | IV                  |
| High pressure switch | IV  | IV            | IV                  |
| Finned coil          | II  | II            | II                  |
| Evaporator           | III | II            | III                 |
| Recovery unit        | III | III           | III                 |
| Pipes                | II  | II            | II                  |
| Desuperheater        | I   | I             | I                   |
| Liquid receiver      | III | III           | III                 |
| Gas separator        | III | III           | III                 |
| Unit                 | III | III           | III                 |

| THAIT-QP             | 175÷3150 |
|----------------------|----------|
| Compressor           | III      |
| Safety valve         | IV       |
| High pressure switch | IV       |
| Finned coil          | II       |
| Heat exchanger       | III      |
| Pipes                | II       |
| Desuperheater        | I        |
| Liquid receiver      | III      |
| Gas separator        | III      |
| Unit                 | III      |

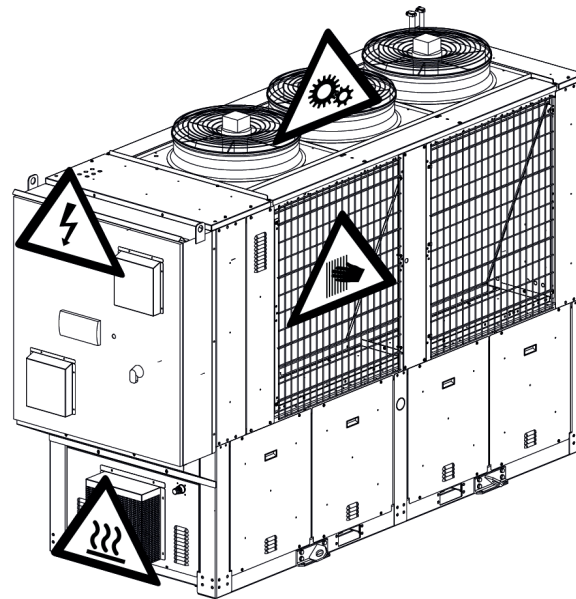
### 3.10 Information about residual risks that cannot be eliminated



**IMPORTANT!**  
Pay the utmost attention to the signs and symbols located on the appliance.

If any risks remain in spite of the provisions adopted, these are indicated by adhesive labels attached to the machine in compliance with standard "ISO 3864".

Warnings regarding residual risks In the event that risks remain, despite the protection measures integrated in the design, the protections and complementary protection measures have been adopted, the necessary warnings must be provided, including warning devices. From the technical file we have extracted the descriptions of the residual risks inherent in the various categories described with the pictograms. Residual risk inherent in contact with moving parts, where the operator removes the fixed guards without turning off the machine or accesses the lower part without waiting for a suitable stopping time.



|                                                                                     |                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | Indicates the presence of live components. Residual risk of electrocution due to the presence of line voltage at the input of the general machine disconnector and residual voltage due to capacitive elements present on machine components.                                                     |
|  | Indicates the presence of moving parts (belts, fans). Residual risk of crushing, shearing or dragging inherent in contact with moving parts, where the operator removes the fixed guards without turning off the machine or accesses the lower part without waiting for a suitable stopping time. |
|  | Indicates the presence of hot surfaces (cooling circuit, compressor heads). Residual risk of thermal injury due to the presence of hot surfaces that could cause burns if they come into contact.                                                                                                 |
|  | Indicates the presence of sharp edges on finned coils. Residual risk of cutting, engraving, abrasion due to the presence of finned surfaces on the exchangers that have the possibility of engraving.                                                                                             |

### 3.11 Description of controls

The controls consist of the master switch, circuit breaker and user interface panel.

#### GENERAL SWITCH

Manually controlled type "b" mains power supply disconnection device (ref. EN 60204-1§5.3.2).

#### CIRCUIT BREAKER SWITCHES

- **circuit breaker to protect the fixed speed compressor**

For fixed-speed compressors, there is a circuit breaker to power and isolate the power circuit.

For inverter compressors there is a dedicated fuse base installed on the power line.

- **Automatic switch for pump protection**

The switch makes it possible to supply and disconnect power from the pumps.

- **Automatic switch for fan protection**

The switch makes it possible to supply and disconnect power from the fans.

### 3.12 Structural features

- Load-bearing structure and panels in galvanised and painted sheet metal (RAL 9018); galvanised steel sheet metal base.
- The structure consists of two sections:
  - technical compartment that houses the compressors, the electrical panel and the main components of the cooling circuit;
  - aeratic 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.

- Hermetic rotary Scroll compressors. The first compressor with inverter drive, the others with fixed speed, for variable capacity control with inrush current reduction at start-up and partial rephasing of the utility to the grid. They include thermal protection and casing heater activated automatically when the unit stops (as long as still electrically powered).
- Adequately insulated, braze-welded plate water side heat exchanger in stainless steel.
- Air-side heat exchanger consisting of copper tube coil and aluminium fins for heat pumps and complete with protection grid.
- External rotor axial type electric fans equipped with internal thermal protection and complete with a single row and double row of protection nets, depending on the models.
- In the T-High efficiency version, the electronic device is supplied as per standard (FI - Fans with phase cutting).
- In the Q-Supersilenced version, the FI device (phase cut-off fans) is standard.
- Victaulic-type hydraulic connections.
- Differential pressure switch that protect the unit from any water flow interruptions.
- Refrigerant circuit made with annealed copper tube (EN 12735- 1-2) complete with: hermetic filter drier, charge connections, safety pressure switch on high pressure side with manual reset, BP and AP pressure transducer, safety valves on high and low pressure side, liquid indicator, suction line insulation, electronic expansion valve, cycle reversing valve and liquid receiver, check valves, gas separator, oil separator and tap at suction to compressors (for THAIP-THAIQP).
- 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, with enlarged condenser section (TCAIP-THAIP).

Q Super low noise version complete with compressor compartment soundproofing, super low speed fans and increased condensing section (TCAIP-THAIQP). The fan speed is automatically increased when the external temperature increases significantly.

## Electrical Control Board

- Electrical panel with IP54 protection degree (as well as the rest of the electrical components) accessible by opening the front panel, compliant with the EN 60204-1/IEC 60204-1 standards in force, equipped with opening and closing using a special tool.
- Complete with:
  - electrical wiring arranged for power supply 400-3ph-50Hz;
  - numbered electric cables;
  - auxiliary circuit power supply 230V-1ph-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)
  - automatic thermal overload switch to protect the compressors and the motor-driven fans;
  - auxiliary circuit protection fuse;
  - compressors power contactor;
  - 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;
  - sequence/phase failure monitor to protect the compressor;
  - visualisation of programmed sets via display; of water in/out temperatures via display; of condensation and evaporation pressures via display; of the values of the electrical voltages present in the three phases of the power circuit supplying the unit; of alarms via display; of chiller or heat pump operation via display (heat pumps only);
  - user interface menu;
  - automatic pump operating time balance (DP1-DP2, ASDP1- ASDP1, DPR1-DPR2 installations);
  - automatic activation of the pump in standby in the event of an alarm (DP1-DP2, ASDP1- ASDP1, DPR1-DPR2 installations);
  - external temperature management for climatic set-point compensation (menu-enabled);
  - displayed inlet water temperature at the recovery unit/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;
- evaporator pump control KPE, contactor recovery pump command KPR and KPDS desuperheater Pump Control in the case of external supply of electric pumps (to be installed 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;
- High-Pressure Prevent function with forced cooling capacity partialisation for a high outdoor temperature (in summer mode);
- EEO function - Energy Efficiency Optimiser (standard, see section on Accessories).
- LKD function - Leak Detector (standard, see Accessories section).
- VPF\_R control: (Variable Primary Flow by Rhoss in the main exchanger). VPF\_R includes the temperature probs, the inverter management and the management software of the chiller;
- 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 discrete input for total recovery management (RC100 contact), the desuperheater (CDS contact) or for the production of domestic hot water by means of a 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 (SIR - Sequenziatore Integrato Rhoss - Rhoss Integrated Sequencer) -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).
- Compressor drive control serial connection to the programmable electronic board

### 3.13 Accessories

#### Factory Fitted Accessories

|              |                                                                                                                                   |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>P1</b>    | Installation with pump                                                                                                            |
| <b>PR1</b>   | Installation with a pump on the RC100 recovery circuit                                                                            |
| <b>P2</b>    | Installation with increased static pressure pump                                                                                  |
| <b>PR2</b>   | Installation with an increased head pump on the RC100 recovery circuit                                                            |
| <b>DP1</b>   | Installation with double pump, including an automatically activated pump in stand-by                                              |
| <b>DPR1</b>  | Installation with a double pump, including one automatically activated in standby on the RC100 recovery circuit                   |
| <b>DP2</b>   | Set up with double pump featuring increased head pressure, of which one in standby with automatic operation                       |
| <b>DPR2</b>  | Installation with increased head double pump, including an automatically activated pump in standby on the RC100 recovery circuit  |
| <b>ASP1</b>  | Installation with pump and storage tank                                                                                           |
| <b>ASDP1</b> | Installation with double pump, including an automatically activated pump in standby and storage tank                              |
| <b>ASP2</b>  | Installation with an increased head pump and storage tank                                                                         |
| <b>ASDP2</b> | Installation with and increased head double pump, including an automatically activated pump in standby and storage tank           |
| <b>CAC</b>   | Compressor aphonc ear muffs                                                                                                       |
| <b>INS</b>   | Compressor technical compartment soundproofing with high acoustic impedance material (standard in the Q version)                  |
| <b>DS</b>    | Desuperheater. Active in summer and winter mode                                                                                   |
| <b>RC100</b> | Heat recovery unit with 100% recovery (TCAITP-TCAIQP). Refer to the specific section for more details                             |
| <b>FIEC</b>  | Modulating condensation control with fans with EC motor (Brushless)                                                               |
| <b>FIAP</b>  | Condensing control with over-pressured fans with EC motor (Brushless) and available static head according to the following table: |

|                                       | Unit with a Ø630mm fan |
|---------------------------------------|------------------------|
| Available static head                 | Up to 130 Pa           |
| Single fan absorption                 | Max 1.25 kW            |
| Average increase in noise of the unit | 2 dBA                  |

|                                         |                                                                                                                                                                                                                                                                                              |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SFS</b>                              | Soft starter compressor (only for fixed speed compressor)                                                                                                                                                                                                                                    |
| <b>CR</b>                               | Power factor correction capacitors ( $\cos\phi > 0.94$ )                                                                                                                                                                                                                                     |
| <b>FDL</b>                              | Forced Download Compressors Function. Compressor modulation to limit the absorbed current and power (digital input).                                                                                                                                                                         |
| <b>FNR-Q</b>                            | Forced Noise Reduction. Forced reduction of noise (digital input or time band management) - See specific section for more information                                                                                                                                                        |
| <b>RQE</b>                              | Electrical panel resistance (recommended for low outdoor air temperature)                                                                                                                                                                                                                    |
| <b>RA</b>                               | Evaporator antifreeze resistor to prevent the risk of ice formation inside the exchanger when the machine is switched off (as long as the unit is not disconnected from the power supply)                                                                                                    |
| <b>RDR</b>                              | Antifreeze electric heater for desuperheater / heat recovery (DS or RC100), to prevent the risk of ice formation inside the recovery exchanger when the machine is switched off (as long as the unit is not disconnected from the power supply)                                              |
| <b>RAE1-RAR1</b>                        | 27W electric pump antifreeze heater (available with P1-P2-PR1-PR2-ASP1-ASP2 set ups); this is used as protection against ice forming in the heat exchanger when the machine is switched off (as long as the unit is electrically powered)                                                    |
| <b>RAE2-RAR2</b>                        | 27W antifreeze electric heater for double motor-driven pumps (available for DP1-DP2-DPR1-DPR2-ASDP1-ASDP2 installations); to prevent the water contained in the pump from freezing when the machine is switched off (as long as the unit is not disconnected from the power supply)          |
| <b>RAS</b>                              | 300W antifreeze electric heater for water buffer tank (available for ASP1-ASDP1-ASP2-ASDP2 installations); to prevent the risk of ice formation in the water buffer tank when the machine is switched off (as long as the unit is not disconnected from the power supply)                    |
| <b>RAB</b>                              | Coil pan anti-freeze electrical resistance                                                                                                                                                                                                                                                   |
| <b>DSP</b>                              | Double set-point via digital consensus (incompatible with the CS accessory)                                                                                                                                                                                                                  |
| <b>CS</b>                               | Scrolling set point via analogue signal 4-20 mA (incompatible with the DSP accessory)                                                                                                                                                                                                        |
| <b>CMT1</b>                             | Control of the MIN/MAX values of the power supply voltage and back-up battery; this is used to monitor the power supply voltage and switch off the unit if the value goes out of tolerance. In this case the backup battery guarantees the perfect closure of the electronic expansion valve |
| <b>BT</b>                               | Low temperature of water produced                                                                                                                                                                                                                                                            |
| <b>EEM</b>                              | Energy Meter. Measure and display values of the electrical units - See specific section for more information                                                                                                                                                                                 |
| <b>SS</b>                               | RS485 interface for serial communication with other devices (proprietary protocol; Modbus RTU protocol).                                                                                                                                                                                     |
| <b>BE</b>                               | Ethernet interface for communication with other devices (BACnet IP, ModBus TCP/IP protocol)                                                                                                                                                                                                  |
| <b>BM</b>                               | RS485 interface for serial communication with other devices (BACnet MS/TP protocol)                                                                                                                                                                                                          |
| <b>RPB1</b>                             | Narrow mesh battery protection nets with anti-intrusion function (to be used as an alternative to protection nets or PTL)                                                                                                                                                                    |
| <b>PTL</b>                              | Side curtain panels (to be used as an alternative to battery protection nets or RPB1)                                                                                                                                                                                                        |
| <b>TOBT</b>                             | Colour touch screen user keypad mounted on board with a 7" LCD display (as an alternative to the standard keyboard)                                                                                                                                                                          |
| <b>TRT</b>                              | Colour touch screen user keypad for remote control with a 7" LCD display, with the same functions as those on the machine. The connection is made via RS485 serial bus (3-pin shielded cable).                                                                                               |
| <b>IMB</b>                              | Protective packaging                                                                                                                                                                                                                                                                         |
| <b>DVS</b>                              | High pressure and low pressure double safety valve with exchanger tap                                                                                                                                                                                                                        |
| <b>SAG</b>                              | Rubber anti-vibration mountings (supplied not installed)                                                                                                                                                                                                                                     |
| <b>SAM</b>                              | Spring anti-vibration mountings (supplied not installed)                                                                                                                                                                                                                                     |
| <b>SG</b>                               | Smart Grid contacts and photovoltaic system (incompatible with DSP and FDL accessories) - See specific section for more details                                                                                                                                                              |
| <b>BRA</b>                              | Copper/aluminium coil (alternative option to the MCHX coils in TCAITP-TCAIQP chillers)                                                                                                                                                                                                       |
| <b>RAP</b>                              | Unit with copper/pre-painted aluminium condensation coils                                                                                                                                                                                                                                    |
| <b>BRR</b>                              | Unit with copper/copper condensation coils                                                                                                                                                                                                                                                   |
| <b>BRH</b>                              | Units with copper/aluminium condensing coils with hydrophilic treatment                                                                                                                                                                                                                      |
| <b>FW1</b>                              | Auxiliary flow switch (mandatory for very low flow rates; see section Water flow rate limits for more details)                                                                                                                                                                               |
| <b>VPF_R+INVERTER P1/DP1/ASP1/ASDP1</b> | Variable Primary Flow by Rhoss. The accessory includes management via inverter of the primary side pump(s) supplied as optional P1/DP1, ASP1/ASDP1 (check that the total water content is at least 5lt/kW), the temperature probes and the management software of the chiller                |
| <b>VPF_R+INVERTER P2/DP2/ASP2/ASDP2</b> | Variable Primary Flow by Rhoss. The accessory includes management via inverter of the primary side pump(s) supplied as optional P1/DP1, ASP1/ASDP1 (check that the total water content is at least 5lt/kW), the temperature probes and the management software of the chiller                |

|                                                                               |                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>INV_P1/<br/>DP1/ASP1/<br/>ASDP1</b>                                        | P1/DP1/ASP1/ASDP1 pump adjustment (w hich must be chosen as optional) via inverter for calibration/commissioning of the system. At the end of calibration, the unit must w ork at a constant flow rate.                   |
| <b>INV_P2/<br/>DP2/ASP2/<br/>ASDP2</b>                                        | P2/DP2/ASP2/ASDP2 pump adjustment (w hich must be chosen as optional) via inverter for calibration/commissioning of the system. At the end of calibration, the unit must w ork at a constant flow rate.                   |
| <b>At the end of calibration, the unit must work at a constant flow rate.</b> | PR1/DPR1 secondary/recovery circuit pump adjustment (w hich must be chosen as optional) via inverter for calibration/commissioning of the system. At the end of calibration, the unit must w ork at a constant flow rate. |
| <b>INV_PR2/DP R2</b>                                                          | PR2/DPR2 secondary/recovery circuit pump adjustment (w hich must be chosen as optional) via inverter for calibration/commissioning of the system. At the end of calibration, the unit must w ork at a constant flow rate. |

### GUIDE TO CHOOSING THE MCHXE ACCESSORY

(Electrofin E-Coating treatment on micro-channel coils in chillers equipped w ith the said heat exchangers)

|                                                                                                                                                                                            |   |            |   |                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------|---|----------------------------------------------------------------|
| <b>Will the cooler be installed in a marine environment?</b><br>(minimum distance from the coast 20km, or even more if the direction of the w ind is mainly from the sea and moves inland) | ► | <b>YES</b> | ► | <b>In that case, provide for the MCXHE E-Coating Accessory</b> |
| <b>NO</b>                                                                                                                                                                                  |   |            |   |                                                                |
| <b>Will the chiller be installed in a rural/urban/industrial environment with polluting agents or potentially corrosive substances?</b><br>(please refer to Annex K20344 for more details) | ► | <b>YES</b> | ► | <b>In that case, provide for the MCXHE E-Coating Accessory</b> |
| <b>NO</b>                                                                                                                                                                                  |   |            |   |                                                                |
| <b>Is there the risk of specific pollution in the chiller installation area?</b><br>(for example: animal farms, hospitals, airports, volcanic areas)                                       | ► | <b>YES</b> | ► | <b>In that case, provide for the MCXHE E-Coating Accessory</b> |
| <b>NO</b>                                                                                                                                                                                  |   |            |   |                                                                |
| <b>In that case, the MCXHE accessory is not required</b>                                                                                                                                   |   |            |   |                                                                |

### Accessories supplied separately

|                |                                                                                                                                                                                                                                                                                                                                               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>KTRD</b>    | Thermostat w ith display                                                                                                                                                                                                                                                                                                                      |
| <b>KTR</b>     | Remote keypad for control at a distance w ith LCD display and same functions as the machine. Connection must be made w ith a 6-w ire telephone cable (maximum distance 50 m) or w ith KRJ1220/KRJ1230 accessories. For greater distances up to 200 m, use an AWG 20/22 shielded cable (4 w ires+shield, not supplied) and the KR200 accessory |
| <b>KTRT</b>    | Colour touch screen user keypad for remote control w ith a 7" LCD display, w ith the same functions as those on the machine. The connection is made via RS485 serial bus (3-pin shielded cable).                                                                                                                                              |
| <b>KRJ1220</b> | Connection cables for KTR (20 m length)                                                                                                                                                                                                                                                                                                       |
| <b>KRJ1230</b> | Connection cables for KTR (30 m length)                                                                                                                                                                                                                                                                                                       |
| <b>KR200</b>   | KTR remote control Kit (distance betw een 50 and 200m)                                                                                                                                                                                                                                                                                        |
| <b>KRS485</b>  | Interface RS485 for serial dialogue w ith other devices (proprietary protocol, Modbus RTU protocol)                                                                                                                                                                                                                                           |
| <b>KBE</b>     | Ethernet interface for communication w ith other devices (BACnet IP protocol).                                                                                                                                                                                                                                                                |
| <b>KBM</b>     | RS485 interface for serial communication w ith other devices (BACnet MS/TP protocol)                                                                                                                                                                                                                                                          |
| <b>KUSB</b>    | RS485/USB serial converter (USB cable supplied)                                                                                                                                                                                                                                                                                               |

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

### 3.14 Technical Data

| TCAITP model                                         |            | 175                                            | 290                                         | 2100          | 3110                                  | 3120          | 3130          | 3140          | 3150          |
|------------------------------------------------------|------------|------------------------------------------------|---------------------------------------------|---------------|---------------------------------------|---------------|---------------|---------------|---------------|
| Nominal cooling capacity (*)                         | kW         | 75.0                                           | 90                                          | 100           | 110                                   | 120           | 130           | 141           | 154           |
| EER                                                  |            | 3.09                                           | 3.38                                        | 3.24          | 3.18                                  | 3.17          | 3.31          | 3.26          | 3.23          |
| Nominal cooling capacity (*) (°) EN 14511            | kW         | 74.9                                           | 89.9                                        | 99.9          | 109.9                                 | 119.9         | 129.9         | 140.9         | 153.9         |
| EER (*) (°) EN 14511                                 |            | 3.07                                           | 3.36                                        | 3.22          | 3.16                                  | 3.15          | 3.29          | 3.24          | 3.21          |
| SEER EN 14825                                        |            | 5.14                                           | 4.81                                        | 4.75          | 4.53                                  | 4.62          | 4.67          | 4.63          | 4.76          |
| Sound pressure (***) (*)                             | dB(A)      | 55                                             | 54                                          | 55            | 55                                    | 55            | 55            | 56            | 57            |
| Sound power (****) (*)                               | dB(A)      | 87                                             | 86                                          | 87            | 87                                    | 87            | 87            | 88            | 89            |
| Sound power with FNRQ accessory (****)(*)            | dB(A)      | 82                                             | 81                                          | 82            | 82                                    | 82            | 82            | 83            | 84            |
| Scroll/step compressor                               | n°         | Continu<br>ous<br>adjustm<br>ent (22-<br>100%) | 1+i / continuous<br>regulation<br>(15÷100%) |               | 2+i / continuous adjustment (15-100%) |               |               |               |               |
| Circuits                                             | n°         | 1                                              | 2                                           | 2             | 2                                     | 2             | 2             | 2             | 2             |
| Fans                                                 | n° x kW    | 3 x 0,59                                       | 4 x 0,59                                    | 4 x 0,59      | 4 x 0,59                              | 4 x 0,59      | 6 x 0,59      | 6 x 0,59      | 6 x 0,59      |
| Fan nominal air flow                                 | m³/h       | 27600                                          | 35600                                       | 35600         | 35600                                 | 35600         | 52200         | 52200         | 52200         |
| Heat exchanger                                       | Type       | Plates                                         |                                             |               |                                       |               |               |               |               |
| Heat exchanger nominal flow water side (*)           | m³/h       | 12.9                                           | 16                                          | 17.2          | 18.9                                  | 20.6          | 22.4          | 24.3          | 26.5          |
| Water side heat exchanger nominal pressure drops (*) | kPa        | 14                                             | 12                                          | 12            | 15                                    | 13            | 14            | 12            | 14            |
| Residual head P1 (*)                                 | kPa        | 115                                            | 109                                         | 99            | 105                                   | 100           | 109           | 106           | 96            |
| Residual head P2 (*)                                 | kPa        | 214                                            | 206                                         | 196           | 183                                   | 179           | 189           | 188           | 180           |
| Residual head ASP1 (*)                               | kPa        | 110                                            | 102                                         | 89            | 94                                    | 87            | 104           | 100           | 89            |
| Residual head ASP2 (*)                               | kPa        | 209                                            | 199                                         | 187           | 172                                   | 166           | 185           | 182           | 172           |
| Tank water content (ASP1/ASP2)                       | l          | 250                                            | 310                                         | 310           | 310                                   | 310           | 380           | 380           | 380           |
| Nominal heating capacity RC100 (±)                   | kW         | 97                                             | 114                                         | 128           | 141                                   | 154           | 165           | 180           | 197           |
| Nominal flow rate/pressure drop RC100 (±)            | m³/h / kPa | 16,7/24                                        | 19,6/19                                     | 22/20         | 24,3/25                               | 26,5/22       | 28,4/23       | 31/20         | 33,9/23       |
| Nominal heating capacity DS (±)                      | kW         | 14.1                                           | 17.1                                        | 18.6          | 20.4                                  | 22.3          | 24.8          | 27.0          | 28.6          |
| Nominal flow rate/pressure drop DS (±)               | m³/h / kPa | 2,4/6                                          | 2,9/3                                       | 3,2/3         | 3,5 / 3                               | 3,8/3         | 4,4/4         | 4,6/4         | 4,9/5         |
| Amount of R290 refrigerant (with MCHX coil)          | Kg         | 4.5                                            | 6.4                                         | 6.6           | 6.6                                   | 7.0           | 8.8           | 9.4           | 9.6           |
| Amount of R290 refrigerant (with Cu-Al coil)         | Kg         | 9.5                                            | 11.6                                        | 11.8          | 12.0                                  | 12.2          | 15.6          | 16.2          | 16.4          |
| Total oil charge of compressors                      | Kg         | 3.3                                            | 6.6                                         | 6.6           | 9.9                                   | 9.9           | 9.9           | 9.9           | 9.9           |
| <b>Electrical data</b>                               |            |                                                |                                             |               |                                       |               |               |               |               |
| Absorbed power (*) (■)                               | kW         | 24.3                                           | 27                                          | 30.9          | 34.6                                  | 37.9          | 39.3          | 43.3          | 47.7          |
| Maximum pump absorbed power (P1/ASP1) / (P2/ASP2)    | kW         | 1,1/2,2                                        | 1,1/2,2                                     | 1,1/2,2       | 1,5/3,0                               | 1,5/3,0       | 1,5/3,0       | 1,5/3,0       | 1,5/3,0       |
| Electrical power supply                              | V-ph-Hz    | 400 – 3 – 50                                   |                                             |               |                                       |               |               |               |               |
| Auxiliary power supply                               | V-ph-Hz    | 230 – 1 – 50                                   |                                             |               |                                       |               |               |               |               |
| Nominal current (■)                                  | A          | 37.3                                           | 43.6                                        | 50.7          | 56.8                                  | 62.2          | 64.5          | 71.0          | 78.2          |
| Maximum current (■)                                  | A          | 56                                             | 71                                          | 81            | 99                                    | 109           | 112           | 118           | 128           |
| Inrush current (■)                                   | A          | -                                              | 234                                         | 244           | 226                                   | 236           | 239           | 281           | 291           |
| Inrush current with SFS (■)                          | A          | -                                              | 156                                         | 166           | 163                                   | 173           | 176           | 202           | 212           |
| Maximum pump absorbed current (P1/ASP1) / (P2/ASP2)  | A          | 2,4/4,6                                        | 2,4/4,6                                     | 2,4/4,6       | 3,2/6,3                               | 3,2/6,3       | 3,2/6,3       | 3,2/6,3       | 3,2/6,3       |
| <b>Dimensions</b>                                    |            |                                                |                                             |               |                                       |               |               |               |               |
| Length                                               | mm         | 3250                                           | 3250                                        | 3250          | 3250                                  | 3250          | 3930          | 3930          | 3930          |
| Height                                               | mm         | 2260                                           | 2260                                        | 2260          | 2260                                  | 2260          | 2260          | 2260          | 2260          |
| Depth                                                | mm         | 1270                                           | 1970                                        | 1970          | 1970                                  | 1970          | 1970          | 1970          | 1970          |
| Heat exchanger inlet/outlet connections              | Ø          | 2" VIC                                         | 2" VIC                                      | 2" VIC        | 2" VIC                                | 2" VIC        | 2" 1/2<br>VIC | 2" 1/2<br>VIC | 2" 1/2<br>VIC |
| DS inlet/outlet connections                          | Ø          | 1" 1/4<br>VIC                                  | 1" 1/4<br>VIC                               | 1" 1/4<br>VIC | 1" 1/4<br>VIC                         | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC |

| TCAITP model |    | 175  | 290  | 2100 | 3110 | 3120 | 3130 | 3140 | 3150 |
|--------------|----|------|------|------|------|------|------|------|------|
| Weight       | Kg | 1025 | 1495 | 1510 | 1595 | 1620 | 1835 | 1860 | 1865 |

- (\*) Under the following conditions: condenser inlet air temperature 35°C; chilled water temperature 7°C; temperature differential at evaporator 5 K; fouling factor equal to 0 m<sup>2</sup> K/W
- (\*\*) 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.
- (\*\*\*) 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 inrush 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 average climate (Regulation (EU) No. 811/2013 and N. 813/2013)

| TCAIQP model                                         |            | 175                             | 290                                   | 2100       | 3110                                  | 3120       | 3130       | 3140       | 3150       |
|------------------------------------------------------|------------|---------------------------------|---------------------------------------|------------|---------------------------------------|------------|------------|------------|------------|
| Nominal cooling capacity (*)                         | kW         | 69.0                            | 83.0                                  | 92.0       | 101.0                                 | 109.0      | 120.0      | 130.0      | 141.0      |
| EER                                                  |            | 3.09                            | 3.4                                   | 3.32       | 3.06                                  | 3.06       | 3.30       | 3.19       | 3.17       |
| Nominal cooling capacity (*) (°) EN 14511            | kW         | 68.9                            | 82.9                                  | 91.9       | 100.9                                 | 108.9      | 119.9      | 129.9      | 140.9      |
| EER (*) (°) EN 14511                                 |            | 3.08                            | 3.40                                  | 3.30       | 3.04                                  | 3.05       | 3.28       | 3.18       | 3.15       |
| SEER EN 14825                                        |            | 5.17                            | 4.8                                   | 4.8        | 4.60                                  | 4.67       | 4.72       | 4.68       | 4.81       |
| Sound pressure (***) (*)                             | dB(A)      | 50                              | 49                                    | 50         | 50                                    | 50         | 50         | 51         | 52         |
| Sound power (****) (*)                               | dB(A)      | 82                              | 81                                    | 82         | 82                                    | 82         | 82         | 83         | 84         |
| Scroll/step compressor                               | n°         | Continuous adjustment (23-100%) | 1+i / continuous regulation (15÷100%) |            | 2+i / continuous adjustment (15-100%) |            |            |            |            |
| Circuits                                             | n°         | 1                               | 2                                     | 2          | 2                                     | 2          | 2          | 2          | 2          |
| Fans                                                 | n° x kW    | 3 x 0,43                        | 4 x 0,43                              | 4 x 0,43   | 4 x 0,43                              | 4 x 0,43   | 6 x 0,43   | 6 x 0,43   | 6 x 0,43   |
| Fan nominal air flow                                 | m³/h       | 21900                           | 28000                                 | 28000      | 28000                                 | 28000      | 40800      | 40800      | 40800      |
| Heat exchanger                                       | Type       | Plates                          |                                       |            |                                       |            |            |            |            |
| Heat exchanger nominal flow water side (*)           | m³/h       | 11.9                            | 14.3                                  | 15.8       | 17.4                                  | 18.7       | 20.6       | 22.4       | 24.3       |
| Water side heat exchanger nominal pressure drops (*) | kPa        | 12                              | 11                                    | 10         | 12                                    | 11         | 12         | 10         | 12         |
| Residual head P1 (*)                                 | kPa        | 120                             | 114                                   | 107        | 111                                   | 109        | 116        | 113        | 106        |
| Residual head P2 (*)                                 | kPa        | 220                             | 212                                   | 205        | 188                                   | 187        | 195        | 193        | 188        |
| Residual head ASP1 (*)                               | kPa        | 116                             | 108                                   | 100        | 102                                   | 99         | 112        | 108        | 100        |
| Residual head ASP2 (*)                               | kPa        | 215                             | 206                                   | 197        | 179                                   | 177        | 191        | 188        | 182        |
| Tank water content (ASP1/ASP2)                       | l          | 250                             | 310                                   | 310        | 310                                   | 310        | 380        | 380        | 380        |
| Nominal heating capacity RC100 (±)                   | kW         | 89                              | 105                                   | 117        | 131                                   | 142        | 153        | 167        | 182        |
| Nominal flow rate/pressure drop RC100 (±)            | m³/h / kPa | 15,3/20                         | 18,1/18                               | 20,1/17    | 22,5/21                               | 24,4/19    | 26,3/20    | 28,7/17    | 31,3/20    |
| Nominal heating capacity DS (±)                      | kW         | 12.9                            | 15.8                                  | 17.0       | 19.0                                  | 20.6       | 23.0       | 25.1       | 26.4       |
| Nominal flow rate/pressure drop DS (±)               | m³/h / kPa | 2,2/5                           | 2,7/3                                 | 2,9/3      | 3,3/3                                 | 3,5 / 3    | 4/3        | 4,3/3      | 4,5/4      |
| Amount of R290 refrigerant (with MCHX coil)          | Kg         | 4.5                             | 6.4                                   | 6.6        | 6.6                                   | 7.0        | 8.8        | 9.4        | 9.6        |
| Amount of R290 refrigerant (with Cu-Al coil)         | Kg         | 9.5                             | 11.6                                  | 11.8       | 12.0                                  | 12.2       | 15.6       | 16.2       | 16.4       |
| Total oil charge of compressors                      | Kg         | 3.3                             | 6.6                                   | 6.6        | 9.9                                   | 9.9        | 9.9        | 9.9        | 9.9        |
| <b>Electrical data</b>                               |            |                                 |                                       |            |                                       |            |            |            |            |
| Absorbed power (*) (■)                               | kW         | 22.3                            | 24.3                                  | 27.7       | 33.0                                  | 35.6       | 36.4       | 40.7       | 44.5       |
| Maximum pump absorbed power (P1/ASP1) / (P2/ASP2)    | kW         | 1,1/2,2                         | 1,1/2,2                               | 1,1/2,2    | 1,5/3,0                               | 1,5/3,0    | 1,5/3,0    | 1,5/3,0    | 1,5/3,0    |
| Electrical power supply                              | V-ph-Hz    | 400 – 3 – 50                    |                                       |            |                                       |            |            |            |            |
| Auxiliary power supply                               | V-ph-Hz    | 230 – 1 – 50                    |                                       |            |                                       |            |            |            |            |
| Nominal current (■)                                  | A          | 34.2                            | 39.9                                  | 45.4       | 54.1                                  | 58.4       | 59.7       | 66.9       | 73.0       |
| Maximum current (■)                                  | A          | 56                              | 71                                    | 81         | 99                                    | 109        | 112        | 118        | 128        |
| Inrush current (■)                                   | A          | -                               | 234                                   | 244        | 226                                   | 236        | 239        | 281        | 291        |
| Inrush current with SFS (■)                          | A          | -                               | 156                                   | 166        | 163                                   | 173        | 176        | 202        | 212        |
| Maximum pump absorbed current (P1/ASP1) / (P2/ASP2)  | A          | 2,4/4,6                         | 2,4/4,6                               | 2,4/4,6    | 3,2/6,3                               | 3,2/6,3    | 3,2/6,3    | 3,2/6,3    | 3,2/6,3    |
| <b>Dimensions</b>                                    |            |                                 |                                       |            |                                       |            |            |            |            |
| Length                                               | mm         | 3250                            | 3250                                  | 3250       | 3250                                  | 3250       | 3930       | 3930       | 3930       |
| Height                                               | mm         | 2260                            | 2260                                  | 2260       | 2260                                  | 2260       | 2260       | 2260       | 2260       |
| Depth                                                | mm         | 1270                            | 1970                                  | 1970       | 1970                                  | 1970       | 1970       | 1970       | 1970       |
| Heat exchanger inlet/outlet connections              | Ø          | 2" VIC                          | 2" VIC                                | 2" VIC     | 2" VIC                                | 2" VIC     | 2" 1/2 VIC | 2" 1/2 VIC | 2" 1/2 VIC |
| DS inlet/outlet connections                          | Ø          | 1" 1/4 VIC                      | 1" 1/4 VIC                            | 1" 1/4 VIC | 1" 1/4 VIC                            | 1" 1/4 VIC | 1" 1/4 VIC | 1" 1/4 VIC | 1" 1/4 VIC |
| <b>Weight</b>                                        |            |                                 |                                       |            |                                       |            |            |            |            |
|                                                      | Kg         | 1085                            | 1570                                  | 1585       | 1670                                  | 1695       | 1915       | 1940       | 1945       |

- (\*) Under the following conditions: condenser inlet air temperature 35°C; chilled water temperature 7°C; temperature differential at evaporator 5 K; fouling factor equal to 0 m<sup>2</sup> K/W
- (\*\*) 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.
- (\*\*\*) 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 inrush 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 average climate (Regulation (EU) No. 811/2013 and N. 813/2013)

| THAIP model                                          |            | 175                             | 290                                   | 2100     | 3110                                  | 3120     | 3130       | 3140       | 3150       |
|------------------------------------------------------|------------|---------------------------------|---------------------------------------|----------|---------------------------------------|----------|------------|------------|------------|
| Nominal cooling capacity (*)                         | kW         | 72.0                            | 85.0                                  | 96.0     | 105.0                                 | 114.0    | 124.0      | 134.0      | 147.0      |
| EER                                                  |            | 2.93                            | 3.08                                  | 3.00     | 2.92                                  | 2.90     | 3.05       | 3.00       | 2.99       |
| Nominal cooling capacity (*) (°) EN 14511            | kW         | 71.9                            | 84.9                                  | 95.9     | 104.9                                 | 113.9    | 123.9      | 133.9      | 146.9      |
| EER (*) (°) EN 14511                                 |            | 2.91                            | 3.06                                  | 2.98     | 2.91                                  | 2.89     | 3.04       | 2.98       | 2.98       |
| Nominal heating capacity (**)                        | kW         | 79.0                            | 90.0                                  | 101.0    | 110                                   | 122.0    | 132        | 144        | 159.0      |
| COP                                                  |            | 3.26                            | 3.27                                  | 3.23     | 3.24                                  | 3.23     | 3.30       | 3.27       | 3.26       |
| Nominal heating capacity (**) (°) EN 14511           | kW         | 79.1                            | 90.1                                  | 101.1    | 110.1                                 | 122.1    | 132.1      | 144.1      | 159.2      |
| COP (*) (°) EN 14511                                 |            | 3.25                            | 3.26                                  | 3.21     | 3.23                                  | 3.21     | 3.29       | 3.25       | 3.24       |
| SCOP EN 14825                                        |            | 4.31                            | 4                                     | 3.91     | 4.11                                  | 4.13     | 4.07       | 4.11       | 4.14       |
| SCOP MT EN 14826                                     |            | 3.57                            | 3                                     | 3.25     | 3.37                                  | 3.38     | 3.42       | 3.38       | 3.45       |
| Sound pressure (***) (*)                             | dB(A)      | 55                              | 54                                    | 55       | 55                                    | 55       | 55         | 56         | 57         |
| Sound power (****) (*)                               | dB(A)      | 87                              | 86                                    | 87       | 87                                    | 87       | 87         | 88         | 89         |
| Sound power with FNR-Q accessory (****)(*)           |            | 82                              | 81                                    | 82       | 82                                    | 82       | 82         | 83         | 84         |
| Scroll/step compressor                               | n°         | Continuous adjustment (22-100%) | 1+i / continuous regulation (15÷100%) |          | 2+i / continuous adjustment (15-100%) |          |            |            |            |
| Circuits                                             | n°         | 1                               | 2                                     | 2        | 2                                     | 2        | 2          | 2          | 2          |
| Fans                                                 | n° x kW    | 3 x 0,59                        | 4 x 0,59                              | 4 x 0,59 | 4 x 0,59                              | 4 x 0,59 | 6 x 0,59   | 6 x 0,59   | 6 x 0,59   |
| Fan nominal air flow                                 | m3/h       | 27600                           | 35600                                 | 35600    | 35600                                 | 35600    | 52200      | 52200      | 52200      |
| Heat exchanger                                       | Type       | Plates                          |                                       |          |                                       |          |            |            |            |
| Heat exchanger nominal flow water side (*)           | m3/h       | 12.4                            | 14.6                                  | 16.5     | 18.1                                  | 19.6     | 21.3       | 23.0       | 25.3       |
| Water side heat exchanger nominal pressure drops (*) | kPa        | 13                              | 11                                    | 11       | 14                                    | 12       | 13         | 10         | 13         |
| Residual head P1 (*)                                 | kPa        | 118                             | 112                                   | 103      | 108                                   | 104      | 112        | 110        | 101        |
| Residual head P2 (*)                                 | kPa        | 216                             | 210                                   | 200      | 185                                   | 183      | 192        | 191        | 183        |
| Residual head ASP1 (*)                               | kPa        | 113                             | 106                                   | 94       | 98                                    | 92       | 108        | 104        | 94         |
| Residual head ASP2 (*)                               | kPa        | 212                             | 203                                   | 192      | 175                                   | 171      | 188        | 185        | 177        |
| Tank water content (ASP1/ASP2)                       | l          | 250                             | 310                                   | 310      | 310                                   | 310      | 380        | 380        | 380        |
| Nominal heating capacity DS (±)                      | kW         | 13.7                            | 16.4                                  | 18.1     | 19.9                                  | 21.7     | 24.0       | 26.1       | 27.7       |
| Nominal flow rate/pressure drop DS (±)               | m³/h / kPa | 2,4/6                           | 2.8 / 3                               | 3.1 / 3  | 3.4 / 3                               | 3,7/3    | 4,1/4      | 4,5/4      | 4,8/5      |
| Amount of R290 refrigerant                           | Kg         | 9.8                             | 11.8                                  | 11.8     | 12.0                                  | 12.4     | 16.0       | 16.6       | 16.8       |
| Total oil charge of compressors                      | Kg         | 3.3                             | 6.6                                   | 6.6      | 9.9                                   | 9.9      | 9.9        | 9.9        | 9.9        |
| <b>Electrical data</b>                               |            |                                 |                                       |          |                                       |          |            |            |            |
| Absorbed power in summer mode (*) (■)                | kW         | 24.6                            | 27.6                                  | 32.0     | 35.9                                  | 39.3     | 40.6       | 44.7       | 49.1       |
| Absorbed power in winter mode (**) (■)               | kW         | 24.2                            | 27.5                                  | 31.3     | 33.9                                  | 37.8     | 40         | 44.1       | 48.8       |
| Maximum pump absorbed power (P1/ASP1) / (P2/ASP2)    | kW         | 1,1/2,2                         | 1,1/2,2                               | 1,1/2,2  | 1,5/3,0                               | 1,5/3,0  | 1,5/3,0    | 1,5/3,0    | 1,5/3,0    |
| Electrical power supply                              | V-ph-Hz    | 400 – 3 – 50                    |                                       |          |                                       |          |            |            |            |
| Auxiliary power supply                               | V-ph-Hz    | 230 – 1 – 50                    |                                       |          |                                       |          |            |            |            |
| Summer operation nominal current (*) (■)             | A          | 37.8                            | 45.3                                  | 52.5     | 59.0                                  | 64.5     | 66.8       | 73.3       | 80.7       |
| Maximum current (■)                                  | A          | 56                              | 71                                    | 81       | 99                                    | 109      | 112        | 118        | 128        |
| Inrush current (■)                                   | A          | -                               | 234                                   | 244      | 226                                   | 236      | 239        | 281        | 291        |
| Inrush current with SFS (■)                          | A          | -                               | 156                                   | 166      | 163                                   | 173      | 176        | 202        | 212        |
| Maximum pump absorbed current (P1/ASP1) / (P2/ASP2)  | A          | 2,4/4,6                         | 2,4/4,6                               | 2,4/4,6  | 3,2/6,3                               | 3,2/6,3  | 3,2/6,3    | 3,2/6,3    | 3,2/6,3    |
| <b>Dimensions</b>                                    |            |                                 |                                       |          |                                       |          |            |            |            |
| Length                                               | mm         | 3250                            | 3250                                  | 3250     | 3250                                  | 3250     | 3930       | 3930       | 3930       |
| Height                                               | mm         | 2260                            | 2260                                  | 2260     | 2260                                  | 2260     | 2260       | 2260       | 2260       |
| Depth                                                | mm         | 1270                            | 1970                                  | 1970     | 1970                                  | 1970     | 1970       | 1970       | 1970       |
| Heat exchanger inlet/outlet connections              | Ø          | 2" VIC                          | 2" VIC                                | 2" VIC   | 2" VIC                                | 2" VIC   | 2" 1/2 VIC | 2" 1/2 VIC | 2" 1/2 VIC |

| THAIP model                 |    | 175           | 290           | 2100          | 3110          | 3120          | 3130          | 3140          | 3150          |
|-----------------------------|----|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| DS inlet/outlet connections | Ø  | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC |
|                             |    |               |               |               |               |               |               |               |               |
| <b>Weight</b>               | Kg | 1215          | 1695          | 1730          | 1815          | 1860          | 2105          | 2130          | 2135          |

(\*) Under the following conditions: condenser inlet air temperature 35°C; chilled water temperature 7°C; temperature differential at evaporator 5 K; fouling factor equal to 0 m<sup>2</sup> K/W

(\*\*) Under the following conditions: Evaporator inlet air temperature 7°C B.S., 6°C B.U.; hot water temperature 45°C; condenser temperature differential 5 K; fouling factor of 0 m<sup>2</sup> K/W.

(\*\*\*) 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.

(\*\*\*\*) 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 inrush 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 average climate (Regulation (EU) No. 811/2013 and N. 813/2013)

| THAIQP model                                         |            | 175                             | 290                                   | 2100     | 3110                                  | 3120     | 3130       | 3140       | 3150       |
|------------------------------------------------------|------------|---------------------------------|---------------------------------------|----------|---------------------------------------|----------|------------|------------|------------|
| Nominal cooling capacity (*)                         | kW         | 67.0                            | 79                                    | 88.0     | 97.0                                  | 104.0    | 115.0      | 124.0      | 135.0      |
| EER                                                  |            | 2.96                            | 3.15                                  | 3.06     | 2.85                                  | 2.83     | 3.07       | 2.97       | 2.96       |
| Nominal cooling capacity (*) (°) EN 14511            | kW         | 66.9                            | 78.9                                  | 87.9     | 96.9                                  | 103.9    | 114.9      | 123.9      | 134.9      |
| EER (*) (°) EN 14511                                 |            | 2.95                            | 3.13                                  | 3.04     | 2.84                                  | 2.81     | 3.06       | 2.95       | 2.95       |
| Nominal heating capacity (**)                        | kW         | 72.0                            | 83.0                                  | 92.0     | 105.0                                 | 115.0    | 121.0      | 133.0      | 145.0      |
| COP                                                  |            | 3.30                            | 3.37                                  | 3.32     | 3.38                                  | 3.36     | 3.35       | 3.31       | 3.29       |
| Nominal heating capacity (**) (°) EN 14511           | kW         | 72.1                            | 83.1                                  | 92.1     | 105.1                                 | 115.1    | 121.1      | 133.1      | 145.1      |
| COP (*) (°) EN 14511                                 |            | 3.29                            | 3.36                                  | 3.31     | 3.36                                  | 3.35     | 3.34       | 3.30       | 3.28       |
| SCOP EN 14825                                        |            | 4.37                            | 3.91                                  | 3.94     | 4.15                                  | 4.17     | 4.13       | 4.15       | 4.2        |
| SCOP MT EN 14826                                     |            | 3.56                            | 3.22                                  | 3.23     | 3.4                                   | 3.39     | 3.36       | 3.39       | 3.38       |
| Sound pressure (***) (*)                             | dB(A)      | 50                              | 49                                    | 50       | 50                                    | 50       | 50         | 51         | 52         |
| Sound power (****) (*)                               | dB(A)      | 82                              | 81                                    | 82       | 82                                    | 82       | 82         | 83         | 84         |
| Scroll/step compressor                               | n°         | Continuous adjustment (23-100%) | 1+i / continuous regulation (15÷100%) |          | 2+i / continuous adjustment (15-100%) |          |            |            |            |
| Circuits                                             | n°         | 1                               | 2                                     | 2        | 2                                     | 2        | 2          | 2          | 2          |
| Fans                                                 | n° x kW    | 3 x 0,43                        | 4 x 0,43                              | 4 x 0,43 | 4 x 0,43                              | 4 x 0,43 | 6 x 0,43   | 6 x 0,43   | 6 x 0,43   |
| Fan nominal air flow                                 | m³/h       | 21900                           | 28000                                 | 28000    | 28000                                 | 28000    | 40800      | 40800      | 40800      |
| Heat exchanger                                       | Type       | Plates                          |                                       |          |                                       |          |            |            |            |
| Heat exchanger nominal flow water side (*)           | m³/h       | 11.50                           | 13.60                                 | 15.10    | 16.70                                 | 17.90    | 19.80      | 21.30      | 23.20      |
| Water side heat exchanger nominal pressure drops (*) | kPa        | 11.00                           | 9.00                                  | 10.00    | 11.00                                 | 10.00    | 11.00      | 9.00       | 10.00      |
| Residual head P1 (*)                                 | kPa        | 121                             | 117                                   | 110      | 114                                   | 112      | 118        | 115        | 108        |
| Residual head P2 (*)                                 | kPa        | 221                             | 215                                   | 207      | 191                                   | 189      | 196        | 195        | 190        |
| Residual head ASP1 (*)                               | kPa        | 117                             | 112                                   | 103      | 106                                   | 102      | 114        | 110        | 103        |
| Residual head ASP2 (*)                               | kPa        | 217                             | 209                                   | 200      | 182                                   | 179      | 193        | 190        | 184        |
| Tank water content (ASP1/ASP2)                       | l          | 250                             | 310                                   | 310      | 310                                   | 310      | 380        | 380        | 380        |
| Nominal heating capacity DS (±)                      | kW         | 12.7                            | 15.3                                  | 16.6     | 18.6                                  | 20.0     | 22.3       | 24.3       | 25.6       |
| Nominal flow rate/pressure drop DS (±)               | m³/h / kPa | 2,2/5                           | 2,6/2                                 | 2,9/2    | 3,2/2                                 | 3,4/2    | 3,8/3      | 4,2/2      | 4,4/4      |
| Amount of R290 refrigerant                           | Kg         | 9.8                             | 11.8                                  | 11.8     | 12.0                                  | 12.4     | 16.0       | 16.6       | 16.8       |
| Total oil charge of compressors                      | Kg         | 3.3                             | 6.6                                   | 6.6      | 9.9                                   | 9.9      | 9.9        | 9.9        | 9.9        |
| <b>Electrical data</b>                               |            |                                 |                                       |          |                                       |          |            |            |            |
| Absorbed power in summer mode (*) (■)                | kW         | 22.6                            | 25.1                                  | 28.8     | 34.0                                  | 36.8     | 37.4       | 41.8       | 45.6       |
| Absorbed power in winter mode (**) (■)               | kW         | 21.8                            | 24.6                                  | 27.7     | 31.1                                  | 34.2     | 36.1       | 40.2       | 44.1       |
| Maximum pump absorbed power (P1/ASP1) / (P2/ASP2)    | kW         | 1,1/2,2                         | 1,1/2,2                               | 1,1/2,2  | 1,5/3,0                               | 1,5/3,0  | 1,5/3,0    | 1,5/3,0    | 1,5/3,0    |
| Electrical power supply                              | V-ph-Hz    | 400 – 3 – 50                    |                                       |          |                                       |          |            |            |            |
| Auxiliary power supply                               | V-ph-Hz    | 230 – 1 – 50                    |                                       |          |                                       |          |            |            |            |
| Summer operation nominal current (*) (■)             | A          | 34.7                            | 41.2                                  | 47.2     | 55.8                                  | 60.2     | 61.5       | 68.6       | 74.8       |
| Maximum current (■)                                  | A          | 56                              | 71                                    | 81       | 99                                    | 109      | 112        | 118        | 128        |
| Inrush current (■)                                   | A          | -                               | 234                                   | 244      | 226                                   | 236      | 239        | 281        | 291        |
| Inrush current with SFS (■)                          | A          | -                               | 156                                   | 166      | 163                                   | 173      | 176        | 202        | 212        |
| Maximum pump absorbed current (P1/ASP1) / (P2/ASP2)  | A          | 2,4/4,6                         | 2,4/4,6                               | 2,4/4,6  | 3,2/6,3                               | 3,2/6,3  | 3,2/6,3    | 3,2/6,3    | 3,2/6,3    |
| <b>Dimensions</b>                                    |            |                                 |                                       |          |                                       |          |            |            |            |
| Length                                               | mm         | 3250                            | 3250                                  | 3250     | 3250                                  | 3250     | 3930       | 3930       | 3930       |
| Height                                               | mm         | 2260                            | 2260                                  | 2260     | 2260                                  | 2260     | 2260       | 2260       | 2260       |
| Depth                                                | mm         | 1270                            | 1970                                  | 1970     | 1970                                  | 1970     | 1970       | 1970       | 1970       |
| Heat exchanger inlet/outlet connections              | Ø          | 2" VIC                          | 2" VIC                                | 2" VIC   | 2" VIC                                | 2" VIC   | 2" 1/2 VIC | 2" 1/2 VIC | 2" 1/2 VIC |

| THAIQP model                |    | 175           | 290           | 2100          | 3110          | 3120          | 3130          | 3140          | 3150          |
|-----------------------------|----|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| DS inlet/outlet connections | Ø  | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC | 1" 1/4<br>VIC |
|                             |    |               |               |               |               |               |               |               |               |
| <b>Weight</b>               | Kg | 1275          | 1770          | 1805          | 1890          | 1935          | 2185          | 2210          | 2215          |

(\*) Under the following conditions: condenser inlet air temperature 35°C; chilled water temperature 7°C; temperature differential at evaporator 5 K; fouling factor equal to 0 m<sup>2</sup> K/W

(\*\*) Under the following conditions: Evaporator inlet air temperature 7°C B.S., 6°C B.U.; hot water temperature 45°C; condenser temperature differential 5 K; fouling factor of 0 m<sup>2</sup> K/W.

(\*\*\*) 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.

(\*\*\*\*) 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 inrush 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 average climate (Regulation (EU) No. 811/2013 and N. 813/2013)

### 3.15 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:<br>Colder (Helsinki climate): -22°C<br>Average (Strasbourg climate): -10°C<br>Warmer (Athens climate): 2°C                                                                                                                                                                                                                               |
| User side water temperature:                 | Low temperature (LT): 35°C fixed or variable according to the outdoor air temperature<br>Intermediate temperature (IT): 45°C fixed or variable according to the outdoor air temperature<br>Medium temperature (MT): 55°C fixed or variable according to the outdoor air temperature<br>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%<br>Colder (Helsinki climate): -7°C or lower<br>Average (Strasbourg climate): 2°C or lower<br>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)

### 3.16 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 (10m) | Lp (1m) |
| TCAITP - THAITP | 175  | 1 | 99.0                                     | 92.0   | 87.0   | 83.0   | 82.0    | 79.0    | 75.0    | 66.0    | 87.0                                     | 55.0     | 68.0    |
|                 | 290  | 1 | 98.0                                     | 91.0   | 86.0   | 82.0   | 81.0    | 78.0    | 74.0    | 65.0    | 86.0                                     | 54.0     | 67.0    |
|                 | 2100 | 1 | 99.0                                     | 92.0   | 87.0   | 83.0   | 82.0    | 79.0    | 75.0    | 66.0    | 87.0                                     | 55.0     | 68.0    |
|                 | 3110 | 1 | 99.0                                     | 92.0   | 87.0   | 83.0   | 82.0    | 79.0    | 75.0    | 66.0    | 87.0                                     | 55.0     | 68.0    |
|                 | 3120 | 1 | 99.0                                     | 92.0   | 87.0   | 83.0   | 82.0    | 79.0    | 75.0    | 66.0    | 87.0                                     | 55.0     | 68.0    |
|                 | 3130 | 1 | 99.0                                     | 92.0   | 87.0   | 83.0   | 82.0    | 79.0    | 75.0    | 66.0    | 87.0                                     | 55.0     | 68.0    |
|                 | 3140 | 1 | 100.0                                    | 93.0   | 88.0   | 84.0   | 83.0    | 80.0    | 76.0    | 67.0    | 88.0                                     | 56.0     | 69.0    |
|                 | 3150 | 1 | 101.0                                    | 94.0   | 89.0   | 85.0   | 84.0    | 81.0    | 77.0    | 68.0    | 89.0                                     | 57.0     | 70.0    |

| 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 (10m) | Lp (1m) |
| TCAIQP - THAIQP (*) | 175  |  | 93.0                                     | 82.0   | 80.0   | 79.0   | 79.0    | 71.0    | 65.0    | 58.0    | 82.0                                     | 50.0     | 63.0    |
|                     | 290  |  | 92.0                                     | 81.0   | 79.0   | 78.0   | 78.0    | 70.0    | 64.0    | 57.0    | 81.0                                     | 49.0     | 62.0    |
|                     | 2100 |  | 93.0                                     | 82.0   | 80.0   | 79.0   | 79.0    | 71.0    | 65.0    | 58.0    | 82.0                                     | 50.0     | 63.0    |
|                     | 3110 |  | 93.0                                     | 82.0   | 80.0   | 79.0   | 79.0    | 71.0    | 65.0    | 58.0    | 82.0                                     | 50.0     | 63.0    |
|                     | 3120 |  | 93.0                                     | 82.0   | 80.0   | 79.0   | 79.0    | 71.0    | 65.0    | 58.0    | 82.0                                     | 50.0     | 63.0    |
|                     | 3130 |  | 93.0                                     | 82.0   | 80.0   | 79.0   | 79.0    | 71.0    | 65.0    | 58.0    | 82.0                                     | 50.0     | 63.0    |
|                     | 3140 |  | 94.0                                     | 83.0   | 81.0   | 80.0   | 80.0    | 72.0    | 66.0    | 59.0    | 83.0                                     | 51.0     | 64.0    |
|                     | 3150 |  | 95.0                                     | 84.0   | 82.0   | 81.0   | 81.0    | 73.0    | 67.0    | 60.0    | 84.0                                     | 52.0     | 65.0    |

- Lw** Total sound power level in dB(A) on the basis of the measurements made in compliance with the UNI EN-ISO9614 and Eurovent 8/1 Standards
- Lp** Average sound pressure levels in dB (A) according to EN ISO 3744
- 1** If the INS (Technical compartment soundproofing) accessory is supplied, the sound power decreases by 1 dB(A) Standard in version Q
- (\*)** INS standard

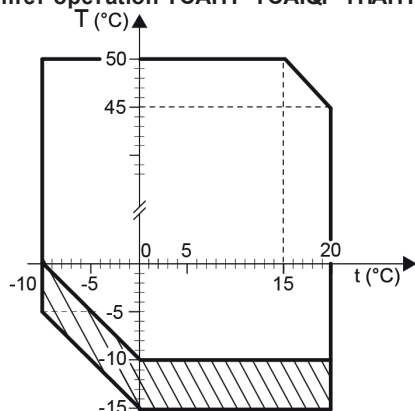
The CAC (Compressors aphonic ear muffs) accessory decreases the sound power by 1 dB(A).

#### NOTE

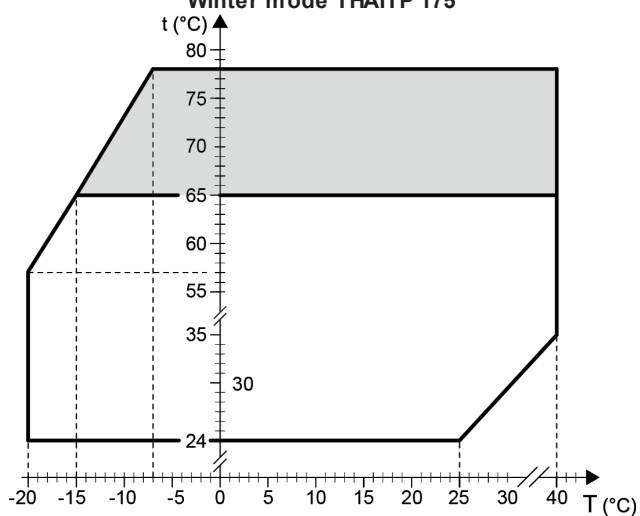
The Eurovent certification refers to the sound power value in dB(A) and it is the only binding acoustic data. The sound pressure levels refer to values calculated from the sound power for units installed in free field with directionality factor Q=2. In brackets is the measurement distance in metres. It is not possible to extrapolate sound pressure values for distances less than 10 m. With outdoor air temperatures below 35°C, or in the presence of the FI or FIEC accessories, the machine decreases its noise to a value below the nominal value indicated in the table.

### 3.17 Functioning limits

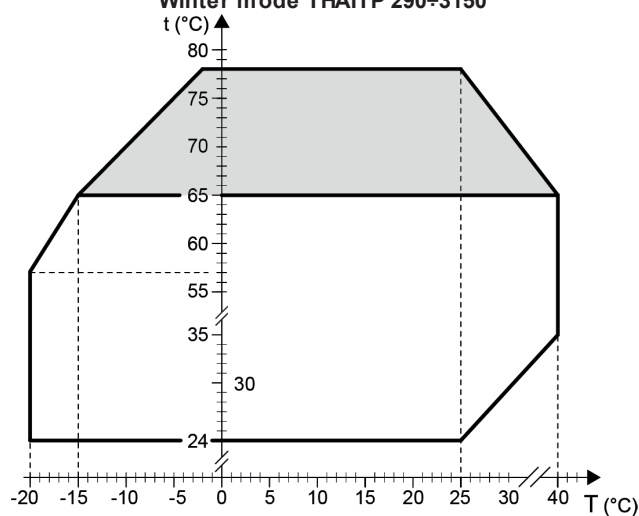
Summer operation TCAITP-TCAIQP-THAITP-THAIQP



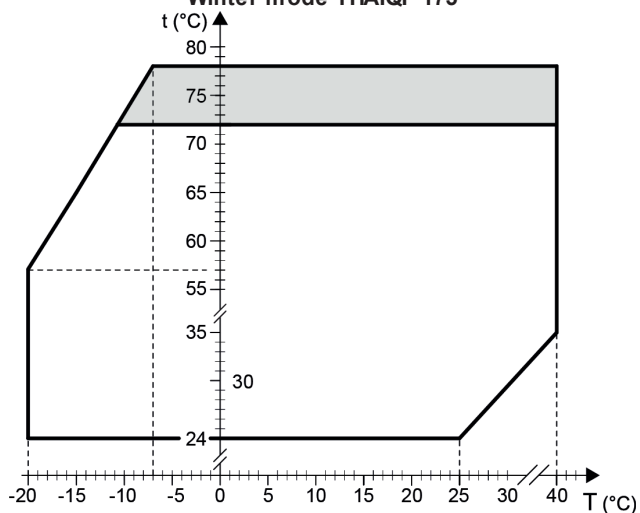
Winter mode THAITP 175



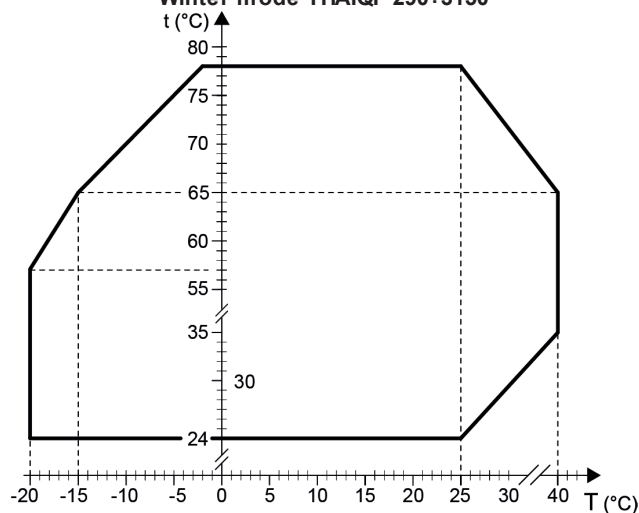
Winter mode THAITP 290÷3150



Winter mode THAIQP 175



Winter mode THAIQP 290÷3150



|                                                                                     |                                            |
|-------------------------------------------------------------------------------------|--------------------------------------------|
| t(°C)                                                                               | Temperature of the water produced          |
| T(°C)                                                                               | Outdoor air temperature (B.S.)             |
|  | Standard functioning                       |
|  | Summer mode with FIEC condensation control |
|  | Operation with power partitioning          |

**In summer mode:**

Maximum water inlet temperature 28°C

- Minimum water pressure 0,5 Barg
- Maximum water pressure: 10 Barg / 6 Barg with ASP

**In winter mode:**

- Minimum water inlet temperature 20°C.
- Maximum water inlet temperature 73°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. FI or FIEC condensing control is also compulsory. Use of antifreeze solutions: see "Use of anti-freeze solutions"

**Note**

In the case of an inlet recovery temperature below the permitted values, the use of a modulating three-way valve is recommended to ensure the required minimum water temperature. Operating at lower than the minimum input temperatures may impair functionality and lead to damage to the unit.

### 3.18 Operating limits with the Heat recovery accessory

#### ACCESSORY DS - DESUPERHEATER

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  $45 \div 75^{\circ}\text{C}$  with admitted water temperature differential  $5 \div 10\text{ K}$ .

The minimum inlet water temperature  $t_{uc}$  ( $^{\circ}\text{C}$ ) admitted is equal to  $40^{\circ}\text{C}$

Activation of the DS accessory takes place simultaneously with the activation of the external pump (supplied by the customer). The production of hot water continues until the condensation pressure remains above a predetermined minimum value. For this reason the delays between the ignition of the unit and the switching on / off of the desuperheater circulation pump that can be observed during operation are completely regular. 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.

The VW valve (provided by the customer) must be modulated by the 0-10V signal; place the consent in the terminal block.

Operation with lower minimum inlet temperatures than expected may jeopardise functioning and therefore damage the unit.

### 3.19 Permitted temperature differentials through the heat exchangers

Evaporator temperature differential  $\Delta T = 3 \div 10^{\circ}\text{C}$  with “Standard” set-ups. However, consider the minimum and maximum flow rates reported in the tables “Water flow rate limits”. The maximum and minimum temperature differentials for “Pump” and “Tank&Pump” set-ups are related to the performance of the pumps, which must always be checked by means of the Up to Date selection software.

### 3.20 Water flow rate limits

#### Evaporator water flow rate limits

##### CHILLER AND PDC OPERATING AS CHILLER

| Type of heat exchanger |      | Plates |     |
|------------------------|------|--------|-----|
| T-Q version            |      | Min    | Max |
| 175                    | m³/h | 5.6    | 28  |
| 290                    | m³/h | 6.7    | 28  |
| 2100                   | m³/h | 8.4    | 38  |
| 3110                   | m³/h | 8.4    | 38  |
| 3120                   | m³/h | 10.3   | 42  |
| 3130                   | m³/h | 10.3   | 45  |
| 3140                   | m³/h | 14.1   | 54  |
| 3150                   | m³/h | 14.1   | 54  |

##### Operation as a heat pump

| Type of heat exchanger |      | Plates                 |         |     |
|------------------------|------|------------------------|---------|-----|
| T-Q version            |      | Min with FW1 accessory | Min (*) | Max |
| 175                    | m³/h | 2.9                    | 5.6     | 28  |
| 290                    | m³/h | 3.1                    | 6.7     | 28  |
| 2100                   | m³/h | 4                      | 8.4     | 38  |
| 3110                   | m³/h | 4                      | 8.4     | 38  |
| 3120                   | m³/h | 4.8                    | 10.3    | 42  |
| 3130                   | m³/h | 4.8                    | 10.3    | 45  |
| 3140                   | m³/h | 6.4                    | 14.1    | 54  |
| 3150                   | m³/h | 6.4                    | 14.1    | 54  |

#### NOTE:

Under selection conditions, if the flow rate in heat pump operation is lower than the value (\*), the FW1-Flux switch accessory is mandatory and will only be active in heat pump operation.

For special requests, please contact Rhoss.

#### DS:

- Produced hot water temperature  $45 \div 75^{\circ}\text{C}$  with admitted water temperature differential  $5 \div 10\text{ K}$ ;
- The minimum inlet water temperature admitted is equal to  $40^{\circ}\text{C}$

### 3.21 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 % glycol in weight | Minimum % 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 %.

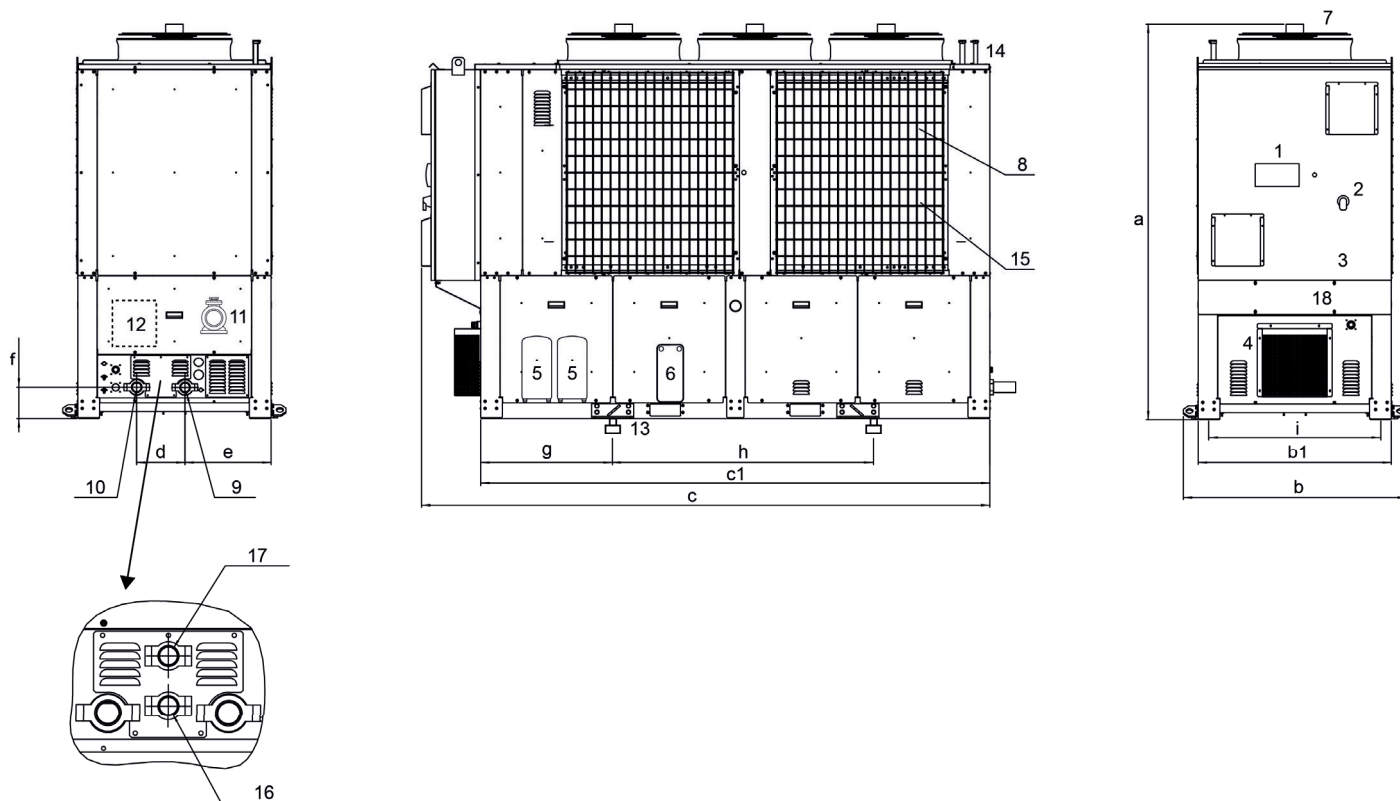
### 3.22 Liquid ethylene disposal



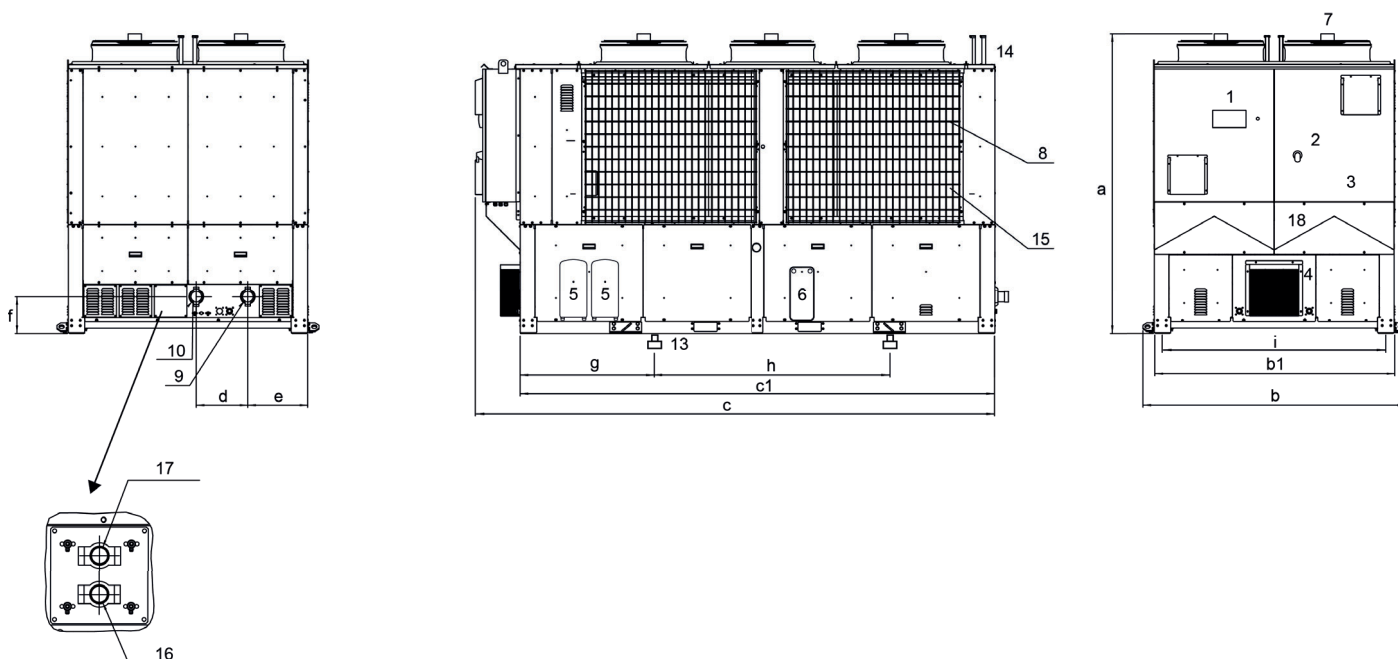
In case of use of ethylene glycol in the unit, ensure the correct disposal of the liquid according to local regulations, in case of emptying for any reason.

### 3.23 Hydraulic overall dimensions, size and connections

TCAIP-THAIP 175



TCAIP-THAIP 290-3150



|    |                                            |
|----|--------------------------------------------|
| 1  | Control panel                              |
| 2  | Isolator                                   |
| 3  | Electrical Control Board                   |
| 4  | Ex Fan                                     |
| 5  | Compressors                                |
| 6  | Evaporator                                 |
| 7  | Fan                                        |
| 8  | Finned coil                                |
| 9  | Main heat exchanger w ater inlet           |
| 10 | Main heat exchanger w ater outlet          |
| 11 | Electric pump                              |
| 12 | Storage tank                               |
| 13 | Anti-vibration mounts (SAG/SAM accessory)  |
| 14 | Safety valve manifolds                     |
| 15 | Coil protection mesh                       |
| 16 | Recovery unit w ater inlet (DS accessory)  |
| 17 | Recovery unit w ater outlet (DS accessory) |
| 18 | Power supply inlet                         |

| MODELL |    | 175  | 290  | 2100 | 3110 | 3120 | 3130 | 3140 | 3150 |
|--------|----|------|------|------|------|------|------|------|------|
| a      | mm | 2260 | 2260 | 2260 | 2260 | 2260 | 2260 | 2260 | 2260 |
| b      | mm | 1270 | 1970 | 1970 | 1970 | 1970 | 1970 | 1970 | 1970 |
| b1     | mm | 1100 | 1800 | 1800 | 1800 | 1800 | 1800 | 1800 | 1800 |
| c      | mm | 3250 | 3250 | 3250 | 3250 | 3250 | 3930 | 3930 | 3930 |
| c1     | mm | 2910 | 2910 | 2910 | 2910 | 2910 | 3590 | 3590 | 3590 |
| d      | mm | 275  | 388  | 388  | 388  | 388  | 388  | 388  | 388  |
| e      | mm | 490  | 450  | 450  | 450  | 450  | 450  | 450  | 450  |
| f      | mm | 180  | 278  | 278  | 278  | 278  | 278  | 278  | 278  |
| g      | mm | 578  | 578  | 578  | 578  | 578  | 793  | 793  | 793  |
| h      | mm | 1750 | 1750 | 1750 | 1750 | 1750 | 2000 | 2000 | 2000 |

| i                                       | mm | 975        | 1675       | 1675       | 1675       | 1675       | 1675       | 1675       | 1675       |
|-----------------------------------------|----|------------|------------|------------|------------|------------|------------|------------|------------|
| Heat exchanger inlet/outlet connections | Ø  | 2" VIC     | 2" VIC     | 2" VIC     | 2" VIC     | 2" VIC     | 2" 1/2 VIC | 2" 1/2 VIC | 2" 1/2 VIC |
| DS inlet/outlet connections             | Ø  | 1" 1/4 VIC | 1" 1/4 VIC | 1" 1/4 VIC | 1" 1/4 VIC | 1" 1/4 VIC | 1" 1/4 VIC | 1" 1/4 VIC | 1" 1/4 VIC |

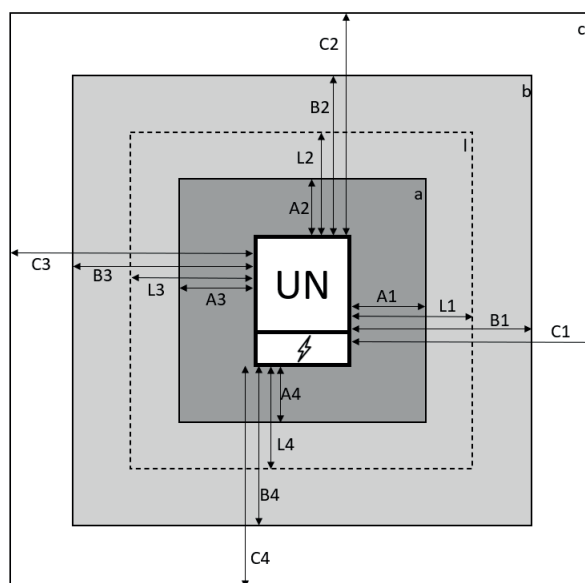
# NOTE

Use the UpToDate selection software to find the unit dimensions.

### 3.24 NOTE

|                                                                                   |                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>IMPORTANT!</b><br>Before installing the unit, check the noise limits allowed in the place where it will be used.                                                                                                                                                       |
|  | <b>IMPORTANT!</b><br>The unit should be positioned to comply with the minimum recommended clearances, bearing in mind the access to water and electrical connections.                                                                                                     |
|  | <b>IMPORTANT!</b><br>If clearance distances are not maintained at installation, it could cause malfunctioning with an increase in absorbed power and a considerable reduction in cooling capacity.                                                                        |
|  | <b>ATTENTION!</b><br>Ensure the relevant spaces indicated below in order to avoid risks due to crushing by moving parts of the electrical panel and / or movable panels and to ensure adequate spaces for respect in the event of the safe recovery of personnel on site. |

### 3.25 Spaces of safety, respect and positioning



|                 |    |       |
|-----------------|----|-------|
| <b>A</b>        | mm | 500   |
| <b>B</b>        | mm | 2500  |
| <b>C</b>        | mm | 15000 |
| <b>L1 (*)</b>   | mm | 1500  |
| <b>L2 (**)</b>  | mm | 2000  |
| <b>L3 (*)</b>   | mm | 1500  |
| <b>L4 (***)</b> | mm | 1500  |

|       |                                                                                                                                        |
|-------|----------------------------------------------------------------------------------------------------------------------------------------|
| (*)   | If more than one unit is installed, the minimum distance between the finned coils should be at least 2 m.                              |
| (**)  | Minimum distance for the removal of the pump unit and the relative tank. If the accessory is not present, the distance can be reduced. |
| (***) | Minimum distance for the electrical panel opening.                                                                                     |

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

The service area 'I' must be free of obstructions to allow routine and extraordinary maintenance as well as proper air flow through the coils. For requirements regarding safety areas 'a', 'b' and 'c', please refer to the 'Installation' chapter of this document.

#### N.B.:

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:

- The minimum functional space allowed in height between the top of the unit and any obstacle must not be less than 3.5 m to allow proper circulation of the air expelled by the fans.

- 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.

### 3.26 Lifting and Handling

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>ATTENTION!</b><br>The unit was not designed to be lifted with a forklift truck. Serious damage to the unit, and the danger of loss of control of the load with consequent risks, even fatal, for the personnel and the operator of the vehicle could result from the use of these lifting means.                                                                                                                                                                                                                                                                          |
|  | <b>ATTENTION!</b><br>Do not stack loads on top of the unit as the upper part of the unit could deform or get damaged, and any loads could fall with consequent risks, including fatalities, for the personnel and the operator of the lifting vehicle.                                                                                                                                                                                                                                                                                                                       |
|  | <b>DANGER!</b><br>The handling of the unit must be carried out with care in order to avoid damage to the external structure and to the internal mechanical and electrical parts. Also make sure that there are no obstacles or people along the way and in the installation area of the unit, which will be conveniently segregated, in order to avoid the danger of impact or crushing. Make sure that the lifting means has adequate capacity and technical characteristics for the load to be handled, and that there is no possibility of the lifting means overturning. |
|  | <b>DANGER!</b><br>Do not lift the unit or move it outdoors in the presence of unfavorable weather conditions (wind, rain, ice, fog).                                                                                                                                                                                                                                                                                                                                                                                                                                         |

After having ascertained their suitability (capacity and state of wear), and having removed the damaging components (fan domes if present), pass the belts through the passages present on the base of the unit. Pull the straps tight, checking that they remain properly attached to the lifting-hook; lift the unit a few centimetres, then, only after checking the stability of the load, carefully carry the unit to the installation site. During lifting and handling, check that the base of the unit always remains horizontal.

Lower the unit carefully and fix it into place. Be careful not to interpose body parts one handling in order to eliminate any possible risk of crushing or any other injury if the load drops or shifts suddenly.

Connect the chains to the relative lifting hooks (if available). Connect the chains to the relative lifting hooks. Lower the unit carefully and fix it into place. Be careful not to interpose body parts one handling in order to eliminate any possible risk of crushing or any other injury if the load drops or shifts suddenly.

All personnel involved in handling operations must be adequately informed and trained, and wear suitable PPE, including safety helmets and high visibility clothing. An adequate number of movers must be assigned to assist the operator of the lifting vehicle: the size and shape of the unit can make it difficult for the operator to see the lifting vehicle.

### 3.27 NOTE

|                                                                                     |                                                                                                                         |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
|  | <b>DANGER!</b><br>The unit must be transported and handled by skilled personnel trained to carry out this type of work. |
|  | <b>IMPORTANT!</b><br>Be careful to prevent damage by accidental collision.                                              |
|  | UN 3358 - REFRIGERATING MACHINES containing flammable, non-toxic, liquefied gas.                                        |

#### Packaging, components

|                                                                                     |                                                                                                                                                        |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>DANGER!</b><br>Do not open or tamper with the packaging before installation. Do not leave the packaging within reach of children.                   |
|  | <b>SAFEGUARD THE ENVIRONMENT!</b><br>Dispose of the packaging materials in compliance with the national or local legislation in force in your country. |

### 3.28 NOTE

|                                                                                     |                                                                                                                         |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
|  | <b>DANGER!</b><br>The unit must be transported and handled by skilled personnel trained to carry out this type of work. |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|



**IMPORTANT!**  
Be careful to prevent damage by accidental collision.

## Packaging, components



**DANGER!**  
Do not open or tamper with the packaging before installation. Do not leave the packaging within reach of children.



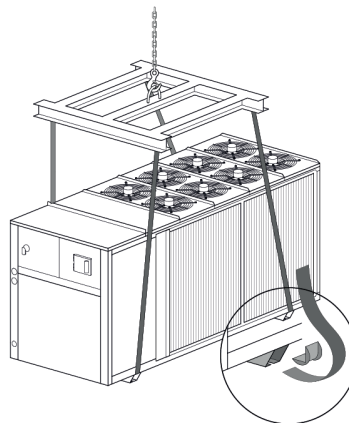
**SAFEGUARD THE ENVIRONMENT!**  
Dispose of the packaging materials in compliance with the national or local legislation in force in your country.

Each unit is supplied complete with:

- user instructions
- wiring diagram
- list of authorised service centres
- warranty document
- safety valve certificates
- use and maintenance manual for safety valves.

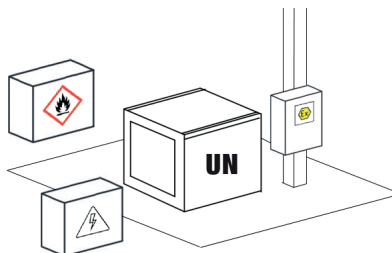
## 3.29 Handling and storage

- 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:  $-20 \div 50^{\circ}\text{C}$ .
- The position of the lifting belts must be checked according to the model and accessories installed.
- During lifting and handling, make sure that the unit is horizontal at all times.



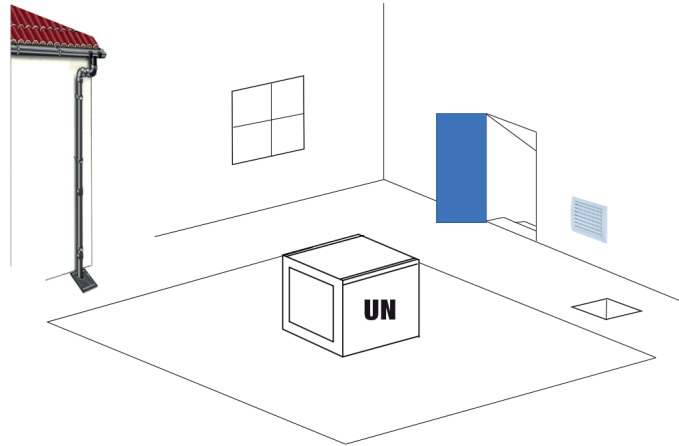
## 3.30 Storage conditions

The units cannot be stacked. The temperature limits for storage are:  $-20 \div 50^{\circ}\text{C}$ . Store in a non-condensing environment with relative humidity between 30-90%. In the case of proximity to coastal areas, provide appropriate protective measures. The units must only be stored outdoors and observing the minimum distance A of 0.5m (in accordance with safety area "a" as per section "Safety Spaces, Respect and Positioning") from all potential ignition sources, flames and heat sources.



In addition, they must be stored at a minimum distance B of 2.5m (in accordance with safety area "b" as per section "Safety Spaces, Respect and Positioning") from openings where leaked gas could accumulate such as ventilation systems, vents or ventilation ducts, entrance doors or

windows, manholes, storm drains, gutters, culverts, manholes, stairs, openings to the ground (sewers), crawl spaces, pipe passageways, conduits or similar if not protected against the accumulation of flammable mixtures.



Refer to local regulations regarding the maximum amount of units that can be stored (e.g. but not limited to fire prevention requirements).

For the maximum number of units that can be transported, please observe the guidelines of the ADR agreement (SMI): please note that refrigeration units containing flammable gases up to 12 kg gas charge are exempt from ADR transport (up to a total load of 333 kg gas charge).

### 3.31 Installation

|                                                                                    |                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <b>DANGER!</b><br>The installation must be performed exclusively by expert technicians authorized to work on air conditioning and refrigeration products. Incorrect installation can lead to both a safety hazard due to fire or explosion and to malfunctioning of the unit, resulting in a significant drop in performance. |
|  | <b>DANGER!</b><br>The unit must be installed according to national or local standards in force at the time of installation.                                                                                                                                                                                                   |
|  | <b>DANGER!</b><br>Some internal parts of the unit may be sharp. Use suitable personal protective equipment.                                                                                                                                                                                                                   |
|  | <b>DANGER!</b><br>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.                                                                                                                          |
|  | <b>DANGER!</b><br>The units are designed for outdoor installation. Segregate the unit if installed in areas accessible to persons under 14 years of age.                                                                                                                                                                      |
|  | <b>IMPORTANT!</b><br>Incorrect positioning or installation of the unit may amplify noise levels and vibrations generated during operation.                                                                                                                                                                                    |
|  | <b>DANGER!</b><br>The upper part of the unit is not walkable at any point. Access is strictly forbidden.                                                                                                                                                                                                                      |

If the unit is not fixed on the anti-vibration mounts (SAG or SAM), it must be installed at least 10 cm above the floor to allow proper ventilation of the machine base and to avoid refrigerant gas stagnation in the event of a leak. In addition, the machine must be firmly anchored to the floor. The unit cannot be installed on brackets or shelves.

### 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 installation location must in any case take into account the risks caused by an accidental leakage of the refrigerant contained in the unit.

### Outdoor Installation

The machines are intended to be installed in a class III location and with access category "a" (general access) or "b" (i.e. "supervised access") according to EN378-1 and represented in the following table:

#### TCAITP-TCAIQP

|                                           | 175 | 290 | 2100 | 3110 | 3120 | 3130 | 3140 | 3150 |
|-------------------------------------------|-----|-----|------|------|------|------|------|------|
| Access category (with MCHX-MCHXE battery) | a   | a   | a    | a    | a    | a    | a    | a    |

|                                            | 175 | 290 | 2100 | 3110 | 3120 | 3130 | 3140 | 3150 |
|--------------------------------------------|-----|-----|------|------|------|------|------|------|
| Access category (with BRA-BRR-RAP battery) | b   | b   | b    | b    | b    | b    | b    | b    |

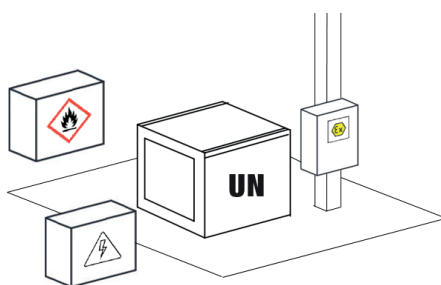
#### THAIP-THAIQP

|                 | 175 | 290 | 2100 | 3110 | 3120 | 3130 | 3140 | 3150 |
|-----------------|-----|-----|------|------|------|------|------|------|
| Access category | b   | b   | b    | b    | b    | b    | b    | b    |

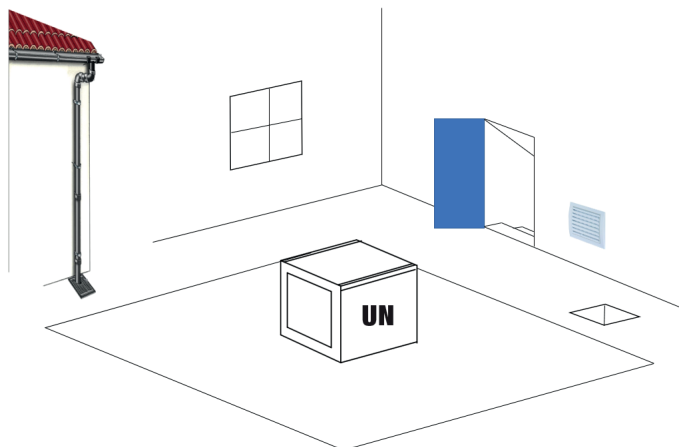
The machines are intended to be used exclusively outdoors (open air as defined in Chap. 4.2 of EN 378-3) and in a site free of ventilation obstacles (minimum ground air speed greater than 0.15 m/s according to EN 60079-10-1; condition to be understood with the machine switched off and in the absence of other ventilation systems).

The following installation prescriptions generally ensure compliance with the minimum requirements of EN378-3:

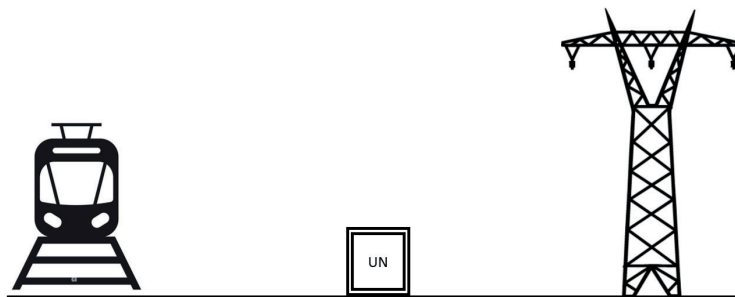
- Distance A equal to 0.5m (in accordance with safety area "a" as per section "Safety Clearances, Respect and Positioning") from any ignition source; only Ex-certified electrical or non-electrical equipment in accordance with Directive 2014/34/EU in category 3G for gas IIA Zone 2 is permitted in this area



- In order to prevent gas leaks from accumulating in enclosed spaces or rooms, a minimum safety distance B projected horizontally of 2.5m (in accordance with safety area "b" as per section "Safety spaces, compliance and positioning") must be provided from openings where leaked gas could accumulate such as ventilation systems, vents or ventilation ducts, entrance doors or windows, manholes, storm drains, gutters, culverts, manholes, stairs, openings to the ground (sewers), cavities, spaces for pipe passages, conduits or similar if not protected from the accumulation of flammable mixtures;
- Check this distance also in accordance with any local regulations in force if they are more restrictive, e.g. 5.0 m for premises intended for public, community, meeting, entertainment or public use;



- minimum safety distance C equal to 15.0m (in accordance with safety area "c" as per section "Safety Spaces, Respect and Positioning") in plan projection from railway, tram and high-voltage power lines.



#### It is forbidden to:

- install the unit indoors;
- install the unit inside structures or artefacts that limit its natural ventilation: if for aesthetic or acoustic reasons a structure is to be provided, this structure must be adequately ventilated so as to prevent the formation of dangerous concentrations of refrigerant gas and produced with non-combustible material;
- install below ground level or in underground, basement or crawl spaces;
- install in Ex zones or areas subject to fire hazards (paper mills, fuel or flammable material depots, tyres, photovoltaic plants, thermal power stations);

Installation conditions other than those described are only possible after a risk analysis according to EN378-3 by the installer (planner and system manager).

### 3.32 Installation and connection to the system

- The unit is designed for outdoor installation.
- The unit is fitted with Victaulic type water circuit connections on the air conditioning system water inlet and outlet
- Segregate the unit in case the access category required by the machine is type 'b' or in case of installation in places accessible to persons under 14 years of age
- The unit must be positioned respecting the recommended minimum technical and safety spaces, bearing in mind the accessibility of water and electrical connections.
- The unit can be fitted with anti-vibration mounts supplied on request (SAG-SAM).
- 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 rate through the heat exchanger must not fall below the value corresponding to a temperature difference of 10°C (with all compressors switched on) and in any case must comply with the limit values given 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.
- It is advisable to drain the water from the system during long periods of inactivity.
- Water drainage can be avoided by adding glycol to the hydraulic circuit (see "Using non-freezable solutions").
- The size of the expansion tank must be calculated by the installer depending on the system. In the event of models without a pump, the pump must be installed with the supply pressing against the machine's water intake.
- 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.).
- Verify the presence of a safety limitation to the thermal load in the hydraulic circuit in the presence of alternative heat sources (boilers, heating elements and similar) in order to prevent accidental opening 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 safety valve settings table.

#### 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 must not be less than 3.5 m to allow proper circulation of the air expelled by the fans.

#### Condensate discharge

THAETP models have a base equipped with a drainage point to facilitate the evacuation of condensation water. Condensate water drainage must be channelled and a siphon filled with water must be installed to intercept any refrigerant leakage. 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.

Ensure that the terminal areas of such ducts are located away from possible ignition sources and from openings where leaking gas could accumulate, such as: ventilation systems, vents or ventilation ducts, entrance doors or windows, manholes, drains, gutters, culverts, manholes, hatches, stairs, openings to the ground (sewers), crawl spaces, pipe penetrations, conduits or similar if not protected against the accumulation of flammable mixtures.

### 3.33 Guidelines for the installation of units with R290 gas

The units contain R290 gas classified A3 according to EN 378-1 and transport is regulated by ADR UN 3358 if the quantity of refrigerant exceeds 12 kg.

#### 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

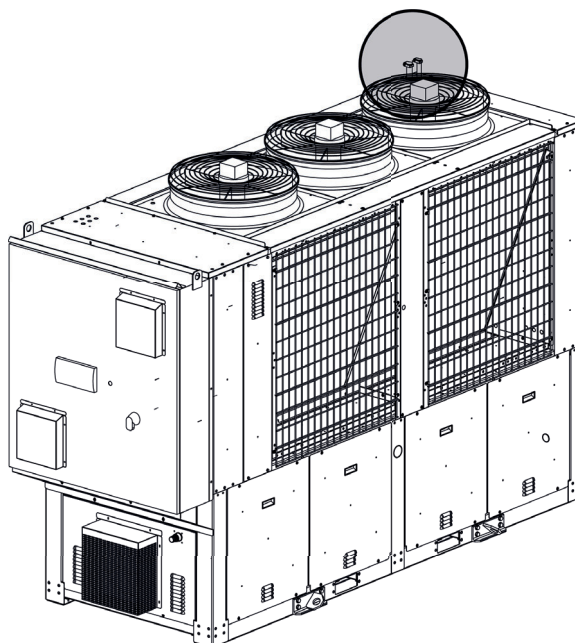
| Refrigerant | Chemical formula              | GWP (over 100 years) |
|-------------|-------------------------------|----------------------|
| R290        | C <sub>3</sub> H <sub>8</sub> | 0.02                 |

In accordance with ISO 817, R290 is classified as A3, as per ASHRAE Standard 34-1997. The lower flammability limit LFL (32 g/m<sup>3</sup>), 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 175÷3150       | 28mm ODS        | 38 bar            |

| Low pressure valve |                 |                                 |
|--------------------|-----------------|---------------------------------|
|                    | Outlet diameter | Tripping pressure               |
| Size 175÷3150      | 22mm ODS        | 30,3 bar (sat temperature 80°C) |

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

If broken, 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 using safety valves that must be placed in an area away from possible sources of ignition. An indirect type of installation, compatible with class III installation (according to Cap. 5.5 of standard EN 378-1); for example by installing an automatic deaerator, always externally and close to the unit (water IN/OUT) before any shut-off valve and at the highest point and/or where any stagnation pockets of gas could be generated in order 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.

### 3.34 Guidelines for the installation of units with R290 gas - In depth



**DANGER!**  
Be extremely careful when approaching the valves and deaerators of the hydraulic circuit, even when the unit is disconnected from the power supply; check the areas around the unit with a suitable portable gas detector (of suitable sensitivity in accordance with current standards such as EN 378-4 or local if more restrictive) to ensure there are no refrigerant leaks.

For machines operating with A3 refrigerant, a risk assessment has been carried out and appropriate risk mitigation measures have been adopted. In any case the unit is not suitable for installation in classified explosion risk areas.

The person in charge of the system must perform a risk assessment after installation of the unit considering the adjacent danger zones and generated by the unit. The risk assessment must include the analysis of any ignition sources in proximity of the unit. The risk assessment and consequent mitigation measures must be executed and applied throughout the entire lifetime of the unit, including transport, storage, installation, operation, maintenance and final disposal. The refrigerant gas is pressurised inside the unit even when not operating and completely disconnected. A possible leak would release its entire content into the environment. All personnel who have to work near or in the machine must be adequately trained to work safely.

For installations on roofs, roofing or other surfaces separating a room from the area outside where the machine is installed, or in the case of installations near facades or other elements separating a room from the area outside where the machine is installed, it is necessary to prevent the risk of a fire generated inside the room spreading to the machine and vice versa. To this end, national or local fire prevention regulations must be followed, which require that appropriate distances be maintained or that structures with certain characteristics be used (e.g. REI 30 or more effective depending on national or local regulations).

If the risk assessment requires the adoption of the safety valve discharge ducting, it is recommended to follow the instructions given in the following paragraphs concerning the safety valve ducting. They must have cross-sections and lengths in accordance with national laws and European directives (the designer must comply with the requirements of the current EN 13136 when dimensioning), a table for typical installation with indications of distances and diameters is given below. The conveyance of the safety valve discharges must be outdoors in free air with no ignition sources and in any case never in confined spaces.

The safety valves are sized so as to allow them to be connected to an exhaust pipe section downstream. The diameter, length and number of bends of the pipe section downstream of the safety valves must be chosen in such a way that the pressure losses in the section itself do not exceed the design values. The diameter of the downstream pipe of the valve must be sized according to the constraints in the table below. The table shows the minimum internal diameter (in mm) of the steel pipework as a function of length, number of bends and the type of valve installed in the machine.

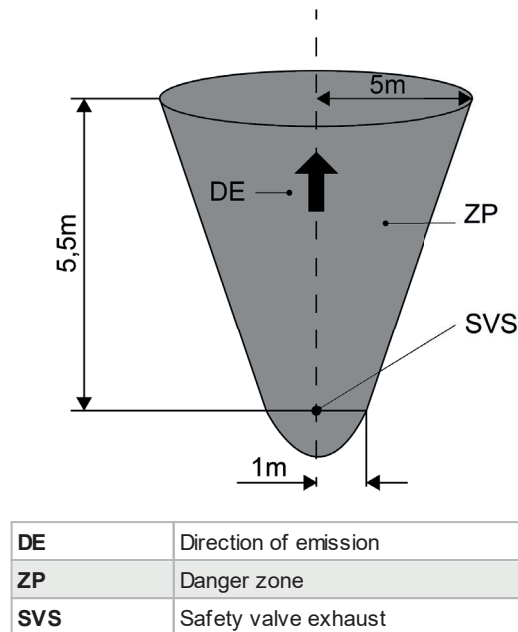
| High pressure valves |    | Length [m] |    |    |
|----------------------|----|------------|----|----|
| D10/CS               |    | 5          | 10 | 15 |
| No. of elbows        | 3  | 28         | 28 | 35 |
|                      | 6  | 28         | 28 | 35 |
|                      | 10 | 28         | 28 | 35 |

| Low pressure valves |    | Length [m] |    |    |
|---------------------|----|------------|----|----|
| D7/CS               |    | 5          | 10 | 15 |
| No. of elbows       | 3  | 18         | 22 | 22 |
|                     | 6  | 22         | 22 | 22 |
|                     | 10 | 22         | 22 | 22 |

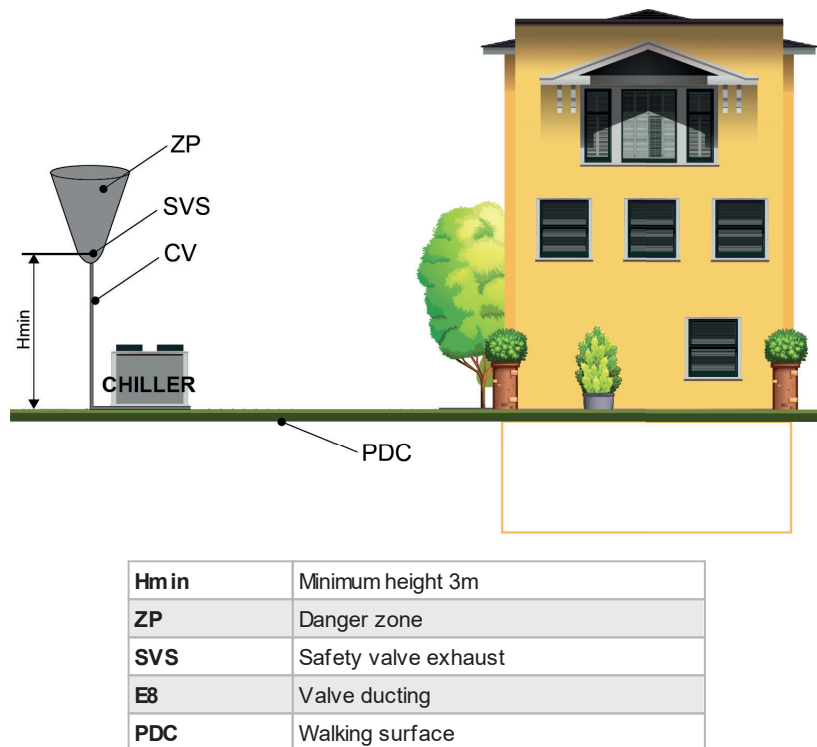
The pipes downstream of the valves must be sized with cross-sections and lengths in accordance with national laws and European directives. The thickness and type of material of the duct pipe must be chosen depending on the PS and TS indicated on the rating plate to avoid collapse and ejections of material. It is the responsibility of the installer to provide adequate bracketing to prevent deformation, collapse or mechanical stress on the safety valves themselves.

NB.: each valve must be connected to an independent exhaust pipe.

Tripping of the safety valve creates a danger zone near the exhaust where no device/structure should be present as it would modify the physical distribution of flammable gas and make it unpredictable. See the diffuser cones below.



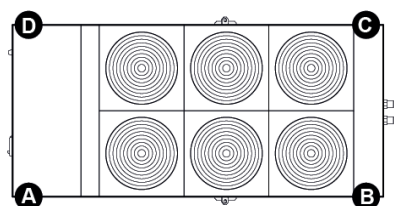
The exhausts of the safety valves must be channelled outside to open air in compliance with the requirements below. In particular, the safety valve outlet must be positioned at a minimum height of 3m from the floor level to ensure the safety of persons.



In case of breakage, the evaporator of the unit could release refrigerant into the hydraulic circuit. The installer is in charge of designing and protecting the hydraulic circuit by a safety valve located distant from possible triggering sources.

### 3.35 Weight distribution

#### THAETP-THAEQP



| THAETP-THAEQP |    |      |      |      |      |      |      |      |      |      |      |      |
|---------------|----|------|------|------|------|------|------|------|------|------|------|------|
| Weight        |    | 251  | 260  | 270  | 280  | 4100 | 4110 | 4120 | 4130 | 4140 | 4150 | 4160 |
| (*)           | Kg | 1145 | 1160 | 1365 | 1375 | 1960 | 1965 | 1995 | 2255 | 2260 | 2285 | 2290 |
| Support       |    |      |      |      |      |      |      |      |      |      |      |      |
| A             | Kg | 340  | 343  | 425  | 434  | 637  | 639  | 647  | 732  | 734  | 737  | 739  |
| B             | Kg | 207  | 210  | 232  | 229  | 335  | 336  | 341  | 387  | 387  | 394  | 395  |
| C             | Kg | 235  | 239  | 261  | 258  | 363  | 364  | 371  | 415  | 416  | 425  | 426  |
| D             | Kg | 363  | 368  | 447  | 454  | 625  | 626  | 636  | 721  | 723  | 729  | 730  |

| THAETP-THAEQP with accessory PUMP DP2 |    |      |      |      |      |      |      |      |      |      |      |      |
|---------------------------------------|----|------|------|------|------|------|------|------|------|------|------|------|
| Weight                                |    | 251  | 260  | 270  | 280  | 4100 | 4110 | 4120 | 4130 | 4140 | 4150 | 4160 |
| (*)                                   | Kg | 1200 | 1215 | 1475 | 1485 | 2075 | 2080 | 2110 | 2390 | 2395 | 2420 | 2425 |
| Support                               |    |      |      |      |      |      |      |      |      |      |      |      |
| A                                     | Kg | 337  | 341  | 414  | 419  | 619  | 621  | 628  | 701  | 702  | 705  | 706  |
| B                                     | Kg | 221  | 223  | 263  | 262  | 371  | 371  | 378  | 449  | 450  | 457  | 458  |
| C                                     | Kg | 262  | 266  | 322  | 322  | 432  | 433  | 440  | 506  | 507  | 516  | 517  |
| D                                     | Kg | 380  | 385  | 476  | 482  | 653  | 655  | 664  | 734  | 736  | 742  | 744  |

| THAETP-THAEQP with accessory TANK&PUMP ASDP2 |    |      |      |      |      |      |      |      |      |      |      |      |
|----------------------------------------------|----|------|------|------|------|------|------|------|------|------|------|------|
| Weight                                       |    | 251  | 260  | 270  | 280  | 4100 | 4110 | 4120 | 4130 | 4140 | 4150 | 4160 |
| (**)                                         | Kg | 1430 | 1445 | 1795 | 1805 | 2500 | 2505 | 2535 | 2905 | 2910 | 2935 | 2940 |
| Support                                      |    |      |      |      |      |      |      |      |      |      |      |      |
| A                                            | Kg | 376  | 379  | 457  | 465  | 696  | 697  | 704  | 777  | 779  | 782  | 783  |
| B                                            | Kg | 334  | 337  | 432  | 429  | 630  | 632  | 638  | 781  | 781  | 788  | 790  |
| C                                            | Kg | 340  | 344  | 440  | 438  | 565  | 566  | 574  | 684  | 685  | 694  | 695  |
| D                                            | Kg | 380  | 385  | 466  | 473  | 609  | 610  | 619  | 663  | 665  | 671  | 672  |

(\*) Weight of the units including the amount of water in the exchangers and pipes

(\*\*) Weight of the units including the water present in the tank

Note: In THAETP units the weight includes the INS accessory (which is standard in the THAEQP units)

### 3.36 Accessories weights

#### TCAITP-TCAIQP

| Modell        |    | 175 | 290 | 2100 | 3110 | 3120 | 3130 | 3140 | 3150 |
|---------------|----|-----|-----|------|------|------|------|------|------|
| Accessory (*) |    |     |     |      |      |      |      |      |      |
| DS            | Kg | 15  | 20  | 20   | 20   | 20   | 25   | 25   | 25   |
| RC100         |    | 55  | 70  | 80   | 80   | 95   | 95   | 125  | 125  |
| PTL           | Kg | 5   | 5   | 5    | 5    | 5    | 5    | 5    | 5    |
| RPB           | Kg | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    |
| RPB1          | Kg | 5   | 5   | 5    | 5    | 5    | 10   | 10   | 10   |
| INS           | Kg | 60  | 75  | 75   | 75   | 75   | 80   | 80   | 80   |
| FIAP          | Kg | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    |
| BRA           | Kg | 120 | 110 | 110  | 110  | 110  | 145  | 145  | 145  |
| BRR           | Kg | 245 | 235 | 235  | 235  | 235  | 310  | 310  | 310  |
| RAP           | Kg | 120 | 110 | 110  | 110  | 110  | 145  | 145  | 145  |
| P1            | Kg | 50  | 45  | 45   | 45   | 45   | 50   | 50   | 50   |
| P2            | Kg | 55  | 50  | 50   | 55   | 55   | 60   | 60   | 60   |
| DP1           | Kg | 95  | 85  | 85   | 90   | 90   | 105  | 105  | 105  |
| DP2           | Kg | 105 | 100 | 100  | 110  | 110  | 125  | 125  | 125  |
| AS            | Kg | 70  | 115 | 115  | 115  | 115  | 135  | 135  | 135  |

#### THAITP-THAIQP

| Modell        |    | 175 | 290 | 2100 | 3110 | 3120 | 3130 | 3140 | 3150 |
|---------------|----|-----|-----|------|------|------|------|------|------|
| Accessory (*) |    |     |     |      |      |      |      |      |      |
| DS            | Kg | 15  | 20  | 20   | 20   | 20   | 25   | 25   | 25   |
| PTL           | Kg | 5   | 5   | 5    | 5    | 5    | 5    | 5    | 5    |
| RPB           | Kg | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    |
| RPB1          | Kg | 5   | 5   | 5    | 5    | 5    | 10   | 10   | 10   |
| INS           | Kg | 60  | 75  | 75   | 75   | 75   | 80   | 80   | 80   |
| FIAP          | Kg | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    |
| RAP           | Kg | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    |
| BRR           | Kg | 130 | 130 | 130  | 130  | 130  | 165  | 165  | 165  |
| P1            | Kg | 50  | 45  | 45   | 45   | 45   | 50   | 50   | 50   |
| P2            | Kg | 55  | 50  | 50   | 55   | 55   | 60   | 60   | 60   |
| DP1           | Kg | 95  | 85  | 85   | 90   | 90   | 105  | 105  | 105  |
| DP2           | Kg | 105 | 100 | 100  | 110  | 110  | 125  | 125  | 125  |
| AS            | Kg | 70  | 115 | 115  | 115  | 115  | 135  | 135  | 135  |

### 3.37 NOTE



#### IMPORTANT!

The hydraulic system and the connection of the unit to the system must only be carried out by trained and qualified personnel, in compliance with the local and national regulations in force.



#### IMPORTANT!

It is necessary to install shut-off valves to isolate the unit from the rest of the system. It is mandatory to mount square section mesh filters (with a maximum side of 0.8 mm), of dimensions and pressure drops suitable for the system. Clean the filter periodically.

### 3.38 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.

### 3.39 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 |

| Model TCAITP-TCAIQP THAITP-THAIQP                |      | 175  | 290  | 2100 | 3110 | 3120 | 3130 | 3140 | 3150 |
|--------------------------------------------------|------|------|------|------|------|------|------|------|------|
| <b>Hydraulic technical data</b>                  |      |      |      |      |      |      |      |      |      |
| Expansion tank capacity                          | l    | 12   | 24   | 24   | 24   | 24   | 24   | 24   | 24   |
| Expansion tank pre-load                          | barg | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2    |
| Expansion vessel maximum pressure                | barg | 10   | 10   | 10   | 10   | 10   | 10   | 10   | 10   |
| Safety valve                                     | barg | 6    | 6    | 6    | 6    | 6    | 6    | 6    | 6    |
| <b>Water content TCAITP-TCAIQP THAITP-THAIQP</b> |      |      |      |      |      |      |      |      |      |
| Plate heat exchangers                            | l    | 10.5 | 12.2 | 13.8 | 13.8 | 17.0 | 17.0 | 23.5 | 23.5 |
| Tank water content (ASP/ASDP)                    | l    | 250  | 310  | 310  | 310  | 310  | 380  | 380  | 380  |

### 3.40 Protection from corrosion

Do not use corrosive water, containing scale or debris; the following are the corrosive limits for the heat exchangers:

|                |         |     |
|----------------|---------|-----|
| pH             | 7.5÷9.0 |     |
| SO4--          | < 70    | ppm |
| HCO3-/SO4--    | > 1.0   | ppm |
| Total hardness | 4.0÷8.5 | dH  |
| Cl-            | < 50    | ppm |
| PO43-          | < 2.0   | ppm |
| NH3            | < 0.5   | ppm |
| Fe+++          | < 0.2   | ppm |
| Mn++           | < 0.05  | ppm |
| CO2            | < 5     | ppm |
| H2S            | < 50    | ppb |
| Temperature    | < 65    | °C  |
| Oxygen content | < 0.1   | ppm |

|                                |        |       |
|--------------------------------|--------|-------|
| Alkalinity (HCO <sub>3</sub> ) | 70÷300 | ppm   |
| Electrical Conductivity        | 10÷500 | μS/cm |
| Nitrate (NO <sub>3</sub> )     | < 100  | ppm   |

If you are not reasonably sure of the water quality in the table above or if there are doubts concerning the presence of different materials which could corrode the heat exchanger over time, it is always advisable to insert an intermediate heat exchanger which can be inspected, made of materials that are able to resist these substances.

### 3.41 Protecting the unit from frost

#### Indications for unit when not running

|                                                                                   |                                                                                                                      |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
|  | <b>IMPORTANT!</b><br>If the unit is not used during the winter period, the water contained in the system may freeze. |
|  | <b>IMPORTANT!</b><br>When the unit is out of service, drain all the water from the circuit.                          |

The entire circuit must be drained in good time. A drainage point below the water exchanger must be used to make sure all the water empties out. Moreover, use the valves placed in the lower part of the water exchanger so that it empties completely. If the draining operation is felt to be too much trouble, glycol may be mixed with the water in suitable proportions in order to guarantee protection from freezing. Units are available with an antifreeze heater (accessory) to keep the evaporator intact, should the temperature drop excessively.

|                                                                                   |                                                                                                                          |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
|  | <b>IMPORTANT!</b><br>The unit must not be isolated from the electrical power supply during the entire seasonal stoppage. |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|

#### Indications for unit when running

When the unit is running, the control board protects the heat-exchanger from freezing by tripping the antifreeze alarm which stops the machine if the temperature of probe fitted on the heat-exchanger reaches the set point value. The resistance of the primary and secondary water-side exchanger and the hydraulic circuit in general, avoid unwanted frost effects during stops in winter operation (as long as the unit is kept electrically powered).

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>IMPORTANT!</b><br>In the presence of refrigerant leaks, the unit is put in a safe condition excluding the power supply to the main components, including all the resistors (with RAE option) and the compressor crankcase resistance. Therefore it is no longer protected from freezing water in the system                                                                                                                                                                                                                 |
|  | <b>IMPORTANT!</b><br>The main switch, if open, cuts off the power supply to the heaters (accessories RA, RDR, RAE, RAR, RAS) and to the compressor crankcase heater and especially to the leak detection sensor and the Ex ventilation system. This switch must be operated only in case of cleaning, maintenance or repair of the machine and in any case only after a check with appropriate portable leak detection systems by authorized personnel to verify the absence of potential leaks that occurred in the meantime. |

### 3.42 Installation and pump management if external to the unit

The circulation pump to be installed in the main water circuit should be selected to overcome any pressure drops, at nominal rates of water flow, both in the exchanger and in the entire water system. The user pump operation must be subordinated to the machine operation; the microprocessor controller runs the control and management of the pump according to the following logic: upon the machine ignition command, the first device to start in the system is the pump, which has priority over the rest of the system. During the start-up phase, the minimum water flow differential pressure switch fitted on the unit is temporarily excluded, for a preset period, in order to avoid oscillations caused by air bubbles or turbulence in the water circuit. After this time, the definitive consent to start the machine is given. The pump keeps on working all the time the unit is in operation, and it shuts down only at the switch-off command. After switch-off, the pump will continue to operate for a pre-set time before finally stopping, in order to disperse the residual heat in the water exchanger.

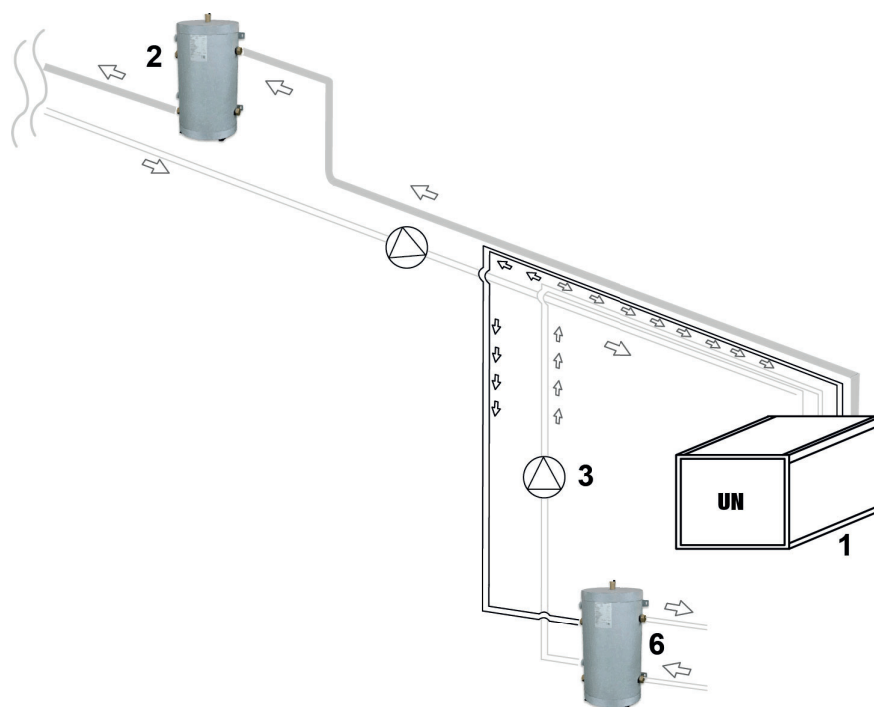
### 3.43 Information on the accessories

#### 3.43.1 Applications for partial (DS) and total (RC100) recovery and DHW production

##### Overview

In general, the condensation heat in a chiller is disposed of; it can be intelligently recovered by means of heat recovery which can be partial (SD) or total (RC100). With summer operation, a reduced value equivalent to the desuperheating of gas is recovered in the first phase, while the second phase recovers all the condensation heat that would otherwise be lost.

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.



|    |                                   |
|----|-----------------------------------|
| 1  | Chiller                           |
| 2  | System user side storage tank     |
| 3  | Pump                              |
| 6  | System recovery side storage tank |
| UN | Rhoss Unit                        |

#### Chiller or heat pump set-up with DS or RC100

##### 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. RC100 total recovery, as an alternative to DS, can be used in the same applications, however, the amount of heat produced is significantly higher and, at the same time, the heat level of the water produced is lower.

##### Heat pump with partial recovery (DS)

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 and RC100

Units equipped with DS de-superheater or RC100 total recovery are equipped with the possibility of activating heat recovery via an external digital 'CRC100-CDS recovery consent' indicated in the circuit diagram (e.g. via the KTRD accessory).

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

- "for digital contact ""CRC100-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 "CRC100-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-STRC100): 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           | $\beta$ (25/85)    | Tmax  |
|-------------|---------------|--------------------|--------------------|-------|
| NTC150      | NTC HT150     | 50k $\Omega$ @25°C | 3977 ( $\pm 1\%$ ) | 120°C |
| NTC (*)     | NTC           | 10k $\Omega$ @25°C | 3435 ( $\pm 1\%$ ) | 90°C  |

(\*) default

### 3.43.2 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.

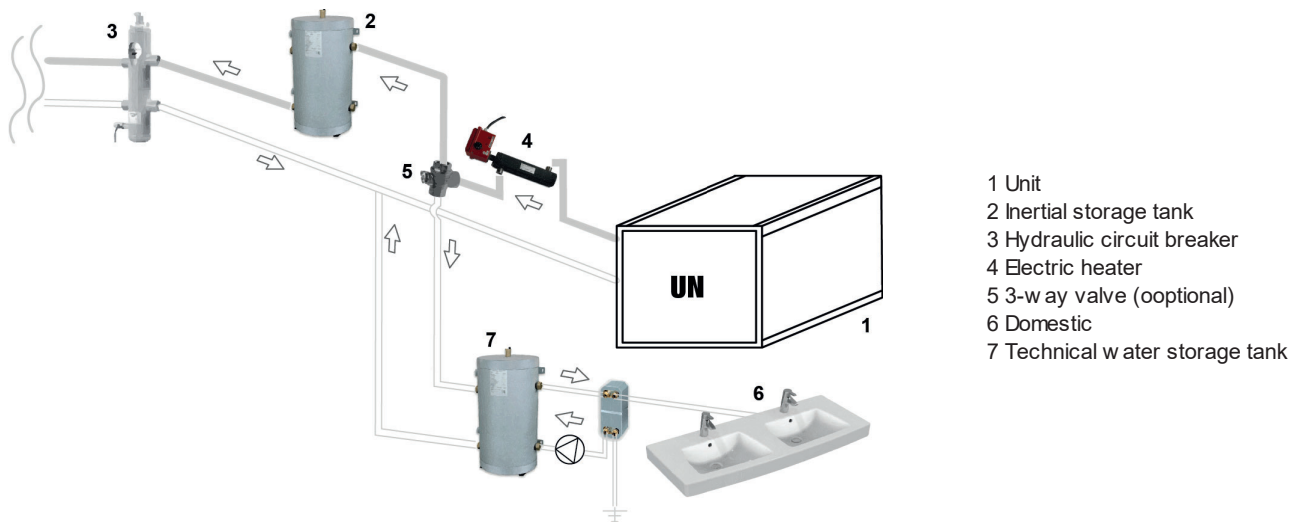
Resistance is always activated during the defrost cycle and when DHW production is requested.

When there is a 3-way valve for VDEV or 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.



#### Functioning based on external temperature (if external air probe or KEAP accessory present)

The electric heater supplements the unit heat pump mode.

The electric heater activates when the following two conditions have been met for a defined time period (ex: 10 minutes):

- the temperature of the external air goes below the electric heater activation Set point value (ex: 5°C)
- the temperature of the water detected by the thermal regulation probe is below the shut-off threshold of the compressor – differential

If during the time running counter one of the previous conditions is not met, the counter is reset.

If the temperature of the external air goes below a second set point during operations with the electric heater activated, the compressor shuts down. The compressor is restarted if the external air exceeds the previous set + a differential (ex: Set -15°C + differential 3°C = -12°C), or if the electric heater turns off

The electric heater is activated independently of the previous conditions, also during defrosting.

In the presence of the thermal regulation temperature condition, the electric heater is also activated during alarms that block compressor functioning, but not pump functioning.

The electric heater is deactivated when:

- the machine set point is reached (the compressor shuts down once the compressor shutdown threshold is reached).

ATTENTION: since management takes place via the unit electronic board, the thermostat on the electric heater must be set at maximum.

### Functioning based on estimated load

The electric heater supplements the unit heat pump mode.

Electric heater management is a part of the new adaptive logic AdaptiveFunction Plus: the objective is optimization of functioning of the chiller equipped with supplementary electric heater, with activation of the heater depending on the system characteristics and the actual thermal load.

The controller regulates the inlet water temperature and adjusts itself, as and when required, to the relative operating conditions using an estimate of the thermal load from the inlet and outlet water temperature.

In the cases of options Economy and Precision, if the estimate of the load indicates an extremely high load and the control temperature is below a threshold calculated for a defined continuous time period, the electric heater activates.

The electric heater shuts down upon reaching the setting made by the user (option Precision) or calculated by the adaptive function (option Economy).

The electric heater is kept on during the defrost cycle and in case of an alarm that blocks compressor functioning (forced shutdown if an alarm causes blocking of the water pump).

ATTENTION: since management takes place via the unit electronic board, the thermostat on the electric heater must be set at maximum.

### Operation if the domestic hot water (DHW) production mode is active in combination with VDEV or KVDEV.

When the production of DHW is enabled, the controller activates the resistance installed on the shared flow pipe, regardless of any other condition.

When the DHW is disabled, the KRIT operates depending on the outdoor temperature or on the load estimation. The KRIT switch-off logic remains unchanged (when  $T_{out\_evap}/T_{out\_tank}$  reaches the setpoint).

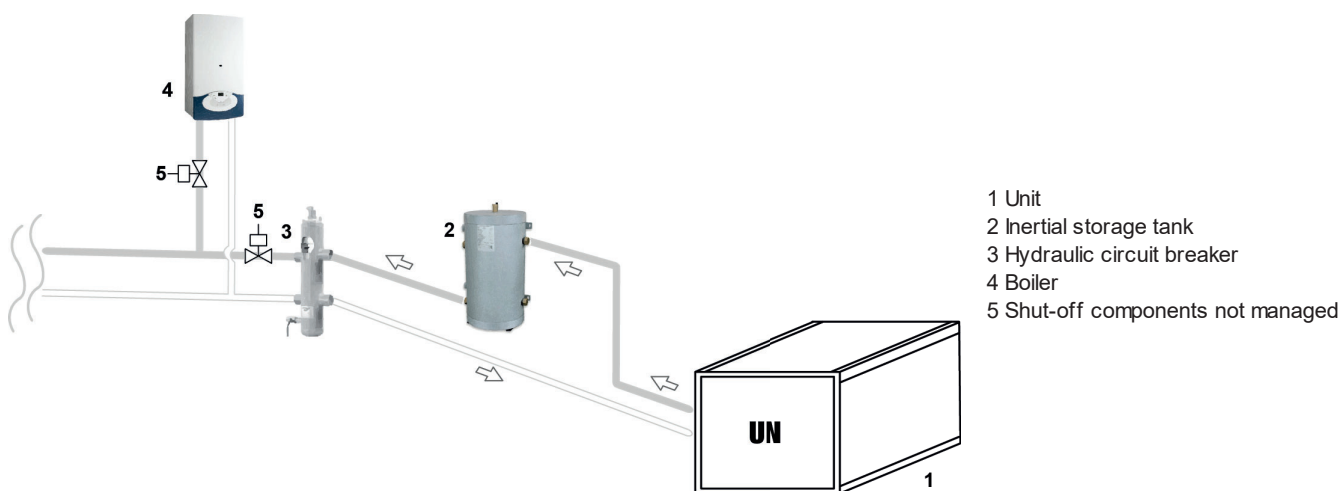
### Auxiliary thermal source

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.



### 3.43.3 FNR accessory

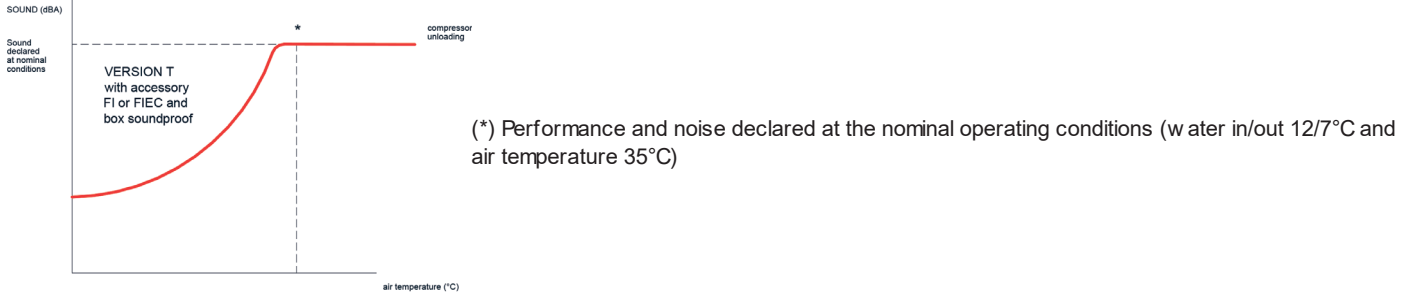
The FNR-Q accessory allows a variable acoustic layout of the unit, managing the silence in chiller mode according to the specific user needs. The accessory is available for chillers and for reversible heat pumps, adequately fitted with some accessories described in the table below.

| Range chillers and heat pumps<br>UniPACK-PI | Mandatory ACCESSORY | Mandatory ACCESSORY for compressor soundproofing | Mandatory ACCESSORY to adjust the fan speed |
|---------------------------------------------|---------------------|--------------------------------------------------|---------------------------------------------|
|---------------------------------------------|---------------------|--------------------------------------------------|---------------------------------------------|

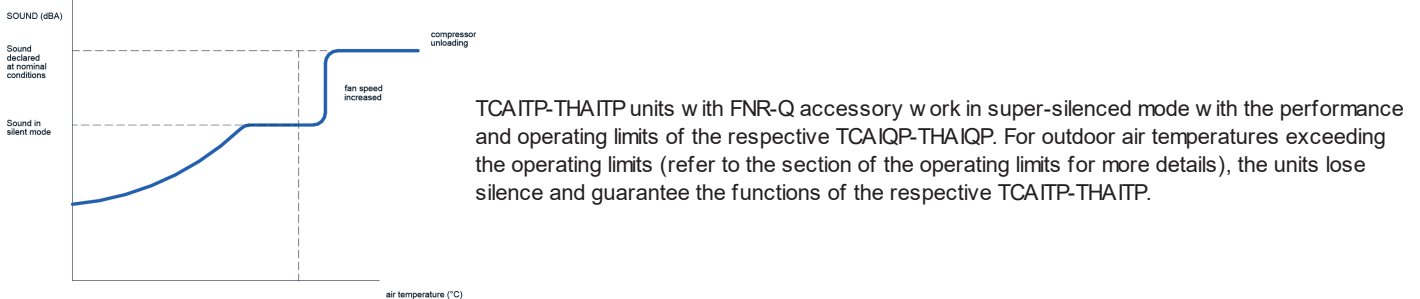
|                |       |     |            |
|----------------|-------|-----|------------|
| THAIP 175÷3150 | FNR-Q | INS | FI or FIEC |
|----------------|-------|-----|------------|

The unit is quietly controlled according to 3 modes that can be selected by acting on the control panel on the machine, using digital input and / or programming time slots. The type of FNR mode (FNR1 or FNR2), activated by digital input, must be defined via the control panel. For the configuration of the digital input, refer to the manual "Commands and controls".

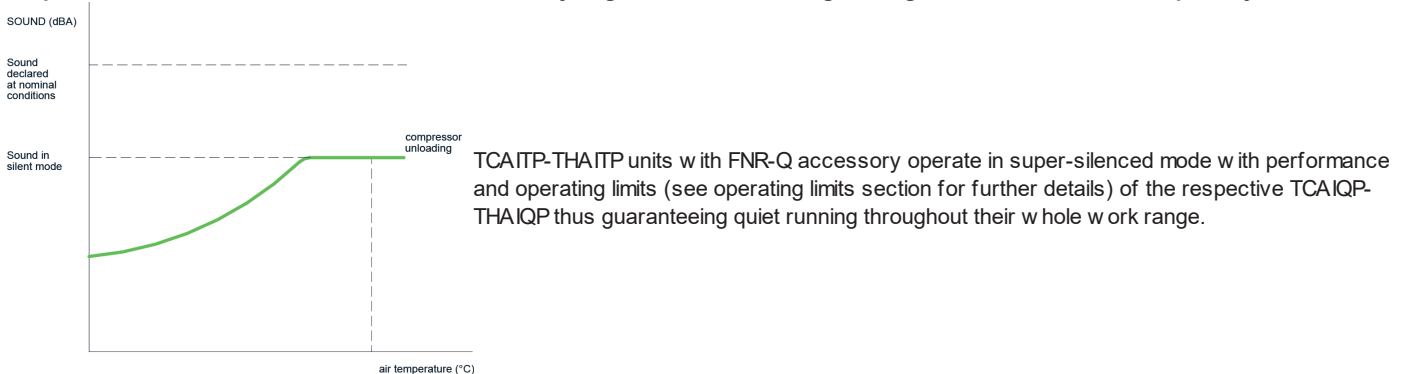
#### Unit operation with standard logic (T version) but with better "soundproofing"



#### Request to reduce noise at certain times of the day, night, etc. keeping priority "guaranteed power supply"

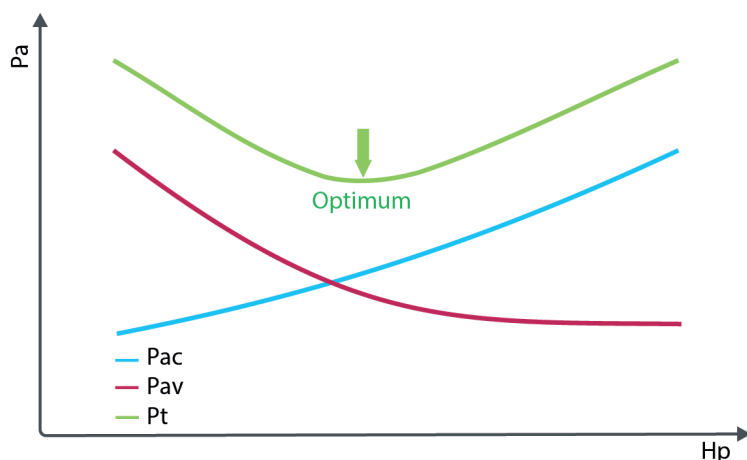


#### Request to reduce noise at certain times of the day, night, etc. "maintaining the ""guaranteed max noise"" priority"



### 3.43.4 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.



|            |                           |
|------------|---------------------------|
| <b>Pac</b> | Compressor consumed power |
| <b>Pav</b> | Fan consumed power        |
| <b>Pt</b>  | Total absorbed power      |
| <b>Pa</b>  | Absorbed power            |
| <b>Hp</b>  | Condensation pressure     |

### 3.43.5 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.

### 3.43.6 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.

### 3.43.7 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.

### 3.43.8 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.

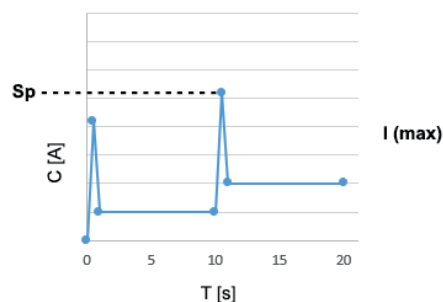
### 3.43.9 SFS accessory - Soft starter

The SFS accessory is used to reduce the start-up current peak, thereby achieving a soft and gradual start, with a noticeable benefit in terms of mechanical wear of the electric motor.

Below is a qualitative drawing to represent a unit with 2 compressors equipped with and without SFS accessory. The inrush current values with the SFS accessory are indicated in tables "A" Technical data.

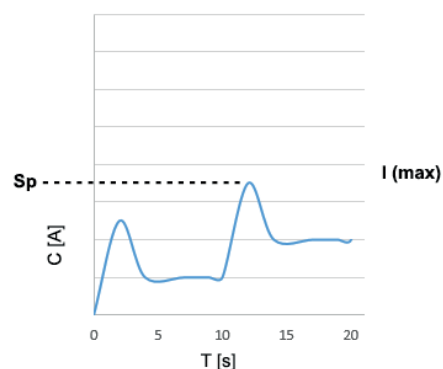
#### Inrush current - without SFS

|       |         |
|-------|---------|
| Sp    | Inrush  |
| C [A] | Current |
| T [s] | Time    |



#### Inrush current - with SFS

|       |         |
|-------|---------|
| Sp    | Inrush  |
| C [A] | Current |
| T [s] | Time    |



### 3.43.10 VPF - Variable Primary Flow

The energy used for the cooling unit to work is an important component in the system costs, and reducing the unit consumption, especially with partial load, is sometimes compromised by the pump unit operating constantly. The higher the absorption of the pumps used to maintain the

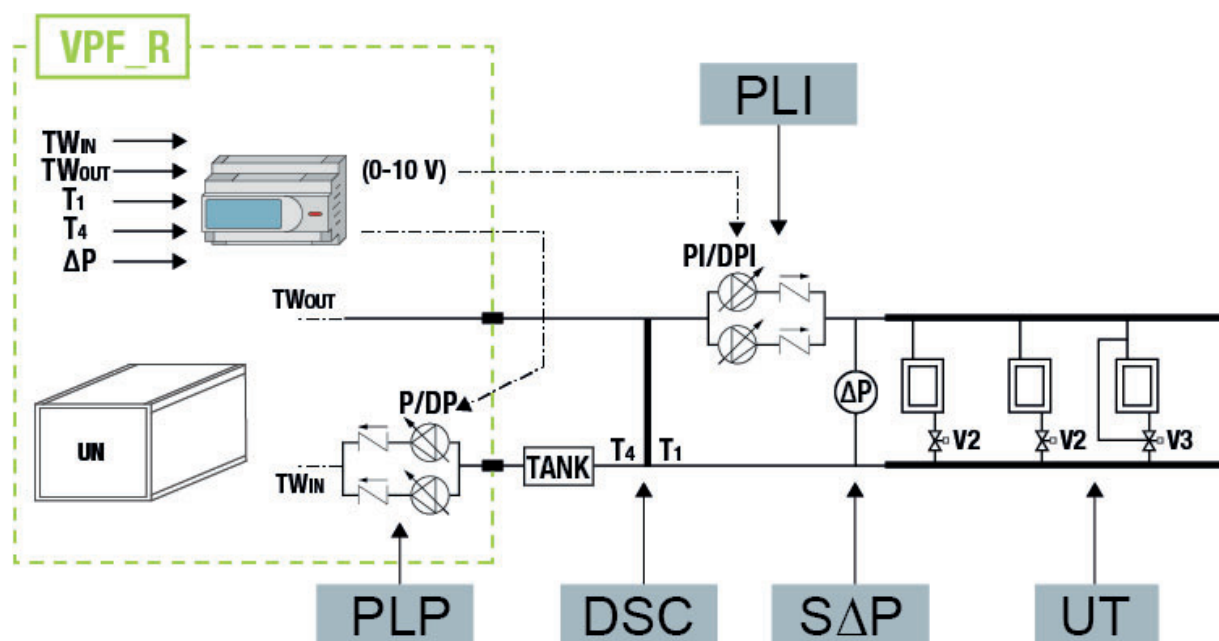
proper flow of water in the pipes the more this effect is noticed. A solution that compensates for the problem of the energy absorbed by the pump units is using pumps driven by inverter technology, able to modulate the flow rate  $G$  and reduce power consumption. This is how the systems with constant primary flow and secondary decoupled variable flow exist.

The introduction of the VPF system simplifies the systems, using a single primary variable flow circuit, in which inverter controlled pumps are installed as the only pumps in the system; this solution generates complications related to the calibration, sizing of the venting section and system setting, which burden the client and indirectly could affect the reliability of the machine. The solution proposed by Rhoss combines the simplification of the VPF system, the reliability of the system solution with primary-secondary variable flow circuits and the additional energy and cost savings derived from managing the primary with variable flow where energy saving depends on the variation in flow rate  $\Delta Pa = f(\Delta G)^3$ . The water content in the primary circuit is very important, as it stabilizes the operation of the system, the water temperature towards the system and the reliability of the refrigeration unit over time (minimum suggested content of 5Lt / kw). The refrigeration unit is connected to a hydraulic system equipped with primary side pumps with inverter regulation (managed by Rhoss) and by pumps with inverter regulation on the system side separated by a hydraulic backflow preventer. The adjustment of the pumps on the system side can be done by the user or left to Rhoss (only one pump - see the following diagram). In addition to significant energy savings, the solution with VPF technology by RHOSS also allows the design of the system's hydraulic circuit to be simplified and the operating costs to be decreased.

The Rhoss solution offered for variable flow systems is innovative for several reasons:

- Stable flow rate modulation required by the system with guaranteed reliability for the chiller installed (even with system flow rate oscillation). The flow rate can be modulated up to 20% by using pumps with an EC-type of motor.
- Simplified system calibration operations.
- Design simplification of the solutions to apply to the terminals (balancing the number of 3-way and 2-way valves with due sizing of the venting section).
- Maximising the efficiency of the cooling unit in each operating condition for the flow rate to be modulated on the system side following the route of the load, as well as on the primary side, thereby minimising the pumping energy required for it to operate correctly.
- Possibility of simplified and reliable management of multiple units in parallel (avoiding known issues of flow rate variations in traditional VPF systems when cooling units are switched on/off).

Below is a schematic diagram using the RHOSS VPF solution in the case of a single chiller:



|               |                                                                                                                                                                                                                                                                                   |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>P/DP</b>   | Single or double pump operated by a variable frequency inverter (pumps managed by Rhoss with a 0-10V signal)                                                                                                                                                                      |
| <b>PI/DPI</b> | Single or double pump, controlled by a variable frequency inverter to service the system. Adjustment is carried out by means of flow modulation and is supplied by the user (with separate supply) and in this case Rhoss can manage them (only one pump) via 0-10V analog signal |
| <b>TANK</b>   | Storage tank                                                                                                                                                                                                                                                                      |
| <b>V2</b>     | 2-way adjustment valve                                                                                                                                                                                                                                                            |
| <b>V3</b>     | 3-way adjustment valve                                                                                                                                                                                                                                                            |
| <b>ΔP</b>     | Differential pressure                                                                                                                                                                                                                                                             |
| <b>PLI</b>    | System side pumps                                                                                                                                                                                                                                                                 |
| <b>PLP</b>    | Primary side pumps                                                                                                                                                                                                                                                                |
| <b>DSC</b>    | Disconnect                                                                                                                                                                                                                                                                        |

|                              |                                    |
|------------------------------|------------------------------------|
| <b>S<math>\Delta</math>P</b> | Probe $\Delta$ P (by the customer) |
| <b>UT</b>                    | Utility                            |
| <b>UN</b>                    | Rhoss unit                         |

#### NOTES on the installation:

1. If a cooling unit with VPF technology is installed, a tank must be installed to guarantee minimum water content of 5 l/kw on the primary side. At least 20% of the flow must be guaranteed on the system side by installing a minimum number of terminals fitted with 3-way valves V3
2. The probe for determining the pressure differential  $\Delta$ P is not supplied. The installer can set the probe remotely in the most appropriate point in the system.
3. Probes T<sub>A</sub> and T<sub>B</sub> are supplied and must be installed on the return side of the system, as shown in the figure: T<sub>A</sub> before the hydraulic disconnector and T<sub>B</sub> after.

**VPF\_R** (Variable Primary Flow by Rhoss in the main exchanger). VPF\_R includes the temperature probs, the inverter management and the management software of the chiller;

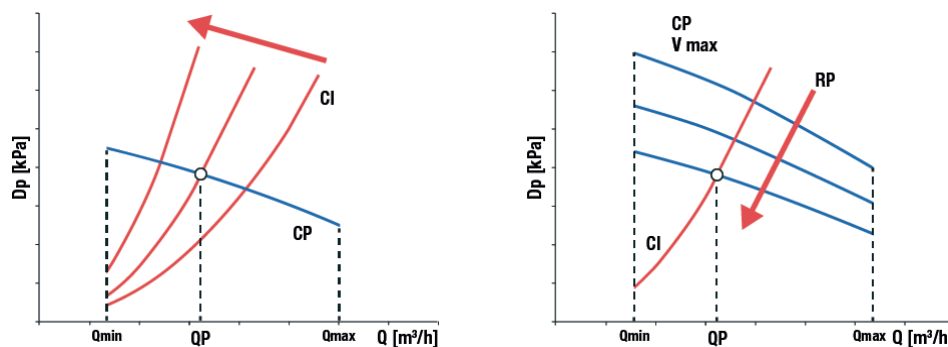
**VPF\_R+INVERTER P1/DP1/ASP1/ASDP1** (Variable Primary Flow by Rhoss in the main exchanger). The accessory includes management via inverter of the primary side pump(s) supplied as optional P1/DP1, ASP1/ASDP1 (check that the total water content is at least 5lt/kW), the temperature probes and the management software of the chiller

**VPF\_R+INVERTER P2/DP2/ASP2/ASDP2** (Variable Primary Flow by Rhoss in the main exchanger). The accessory includes management via inverter of the primary side pump(s) supplied as optional P2/DP2, ASP2/ASDP2 (check that the total water content is at least 5lt/kW), the temperature probes and the management software of the chiller

### 3.43.11 INVP accessory - Pump unit inverter regulation

With a pump at fixed speed, calibration/commissioning of the system can be carried out by acting on the traditional adjustment parts (e.g. calibration valves) entering the pressure drops to compensate for the excessive head given by the pump (fig.1). By means of the INVP accessory, calibration/commissioning of the system can be carried out efficiently by acting on the speed of the electric pump to supply the right head required by the primary circuit at the design flow rate (fig.2). The operation is carried out by accessing the PUMP menu from the controller onboard the machine and adjusting the speed regulation parameters of the electric pump.

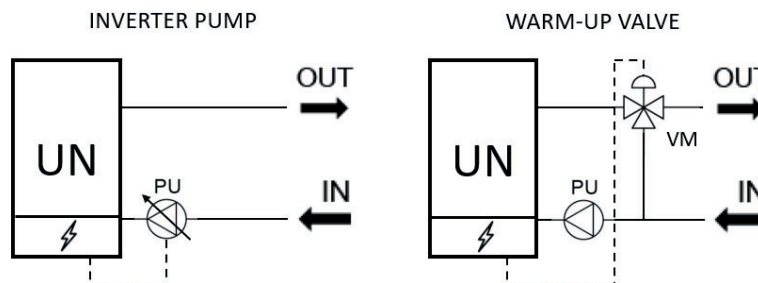
**Please note:** after calibration, the unit must work at constant flow rate. The accessory simplifies calibration and commissioning operations.



|          |                             |
|----------|-----------------------------|
| QP       | Design flow rate            |
| CP       | Pump curve                  |
| CI       | System characteristic curve |
| CP V max | Pump curve at maximum speed |
| RP       | Pump adjustment             |

### 3.44 Warm-up function

For the connection and commissioning of the unit, it is advisable to install a 3-way mixing valve between the flow and return lines of the system in order to regulate the heat exchanger inlet temperature during start-ups, until it is within the operating range of the unit. If the unit is not equipped with inverter control of the pump (VPF or INV\_P), it can instead control a 3-way modulating valve as shown in the diagram below.



### 3.45 Electrical connections

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <b>DANGER!</b><br>Before starting the connection operations, pay extreme attention when approaching the unit even if it is disconnected; check the areas surrounding the unit with a suitable portable gas detector (of suitable sensitivity in accordance with current regulations such as EN 378-4 or local if more restrictive) to ensure there are no refrigerant leaks.                                                                                                                                                                         |
|    | <b>DANGER!</b><br>Install a general automatic switch with characteristic delayed curve, of adequate capacity and interruption power, in a protected area near the unit (the device must be able to interrupt the presumed short circuit current, whose value should be determined on the basis of the system characteristics) and with a minimum contact opening distance of 3mm. Earth connection is compulsory by law to ensure user safety while the machine is in use.                                                                           |
|  | <b>DANGER!</b><br>The electrical connection of the unit must be carried out by competent and authorized personnel in the field and in compliance with the regulations in force in the country of installation of the unit. RHOSS shall not be held liable for personal harm or property damage caused by incorrect electrical connection. In making the electrical connections to the board, cables must be routed so that they do not touch the hot parts of the machine (compressor, flow pipe and liquid line). Protect the wires from any burrs. |
|  | <b>DANGER!</b><br>Check the tightness of the screws that secure the conductors to the electrical components on the board (vibrations during handling and transport could have caused them to come loose).                                                                                                                                                                                                                                                                                                                                            |
|  | <b>DANGER!</b><br>Before starting any operation of electrical connection of the unit to the distribution network, check that the power supply is not connected, or disconnect the power supply using the general automatic switch bringing it to zero position, and ensuring that it cannot be tampered with. by third parties (for example, with the L.O.T.O. procedure or equivalent); only after this operation, access the electrical panel using the necessary D.P.I.-P.P.E.                                                                    |
|  | <b>IMPORTANT!</b><br>For the electrical connections of the unit and accessories, refer to the relative wiring diagram.                                                                                                                                                                                                                                                                                                                                                                                                                               |

Check the value of the mains voltage and frequency which must be within the limit of 400 V  $\pm 10\%$  for the voltage and 50 Hz  $\pm 1\%$  for the frequency. Check the unbalance of the phases: it must be less than 2%. In specific working conditions, for the correct operation of the compressors the tolerance on the supply voltage could be lower.

#### Example:

L1-L2 = 388V, L2-L3 = 379V, L3-L1 = 377V

Average of values measured =  $(388+379+377) / 3 = 381\text{V}$

Maximum deviation from the average =  $388-381 = 7\text{V}$

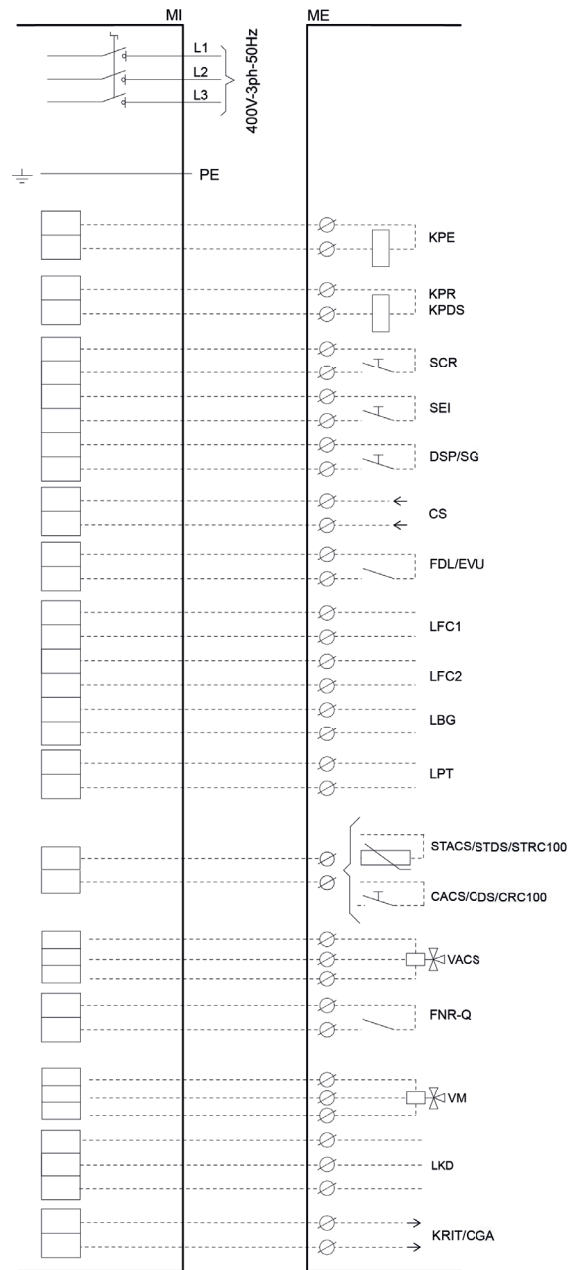
Unbalance =  $(7 / 381) \times 100 = 1,83\%$  (acceptable as it is within the envisaged limit).

|                                                                                     |                                                                                           |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
|  | <b>IMPORTANT!</b><br>Operation outside the limits could affect correct machine operation. |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|

The door lock disconnecter, in case of opening the door of the electrical panel, automatically excludes the power supply of the unit. Pass the unit power supply cables through the appropriate cable glands located on the bottom of the control panel and/or through the external cover.



### 3.46 Electrical connections



|                                                   |                                                                                                                                           |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>L</b>                                          | Line                                                                                                                                      |
| <b>N</b>                                          | Neutral                                                                                                                                   |
| <b>PE</b>                                         | Earth connection                                                                                                                          |
| <b>MI</b>                                         | Internal terminal board                                                                                                                   |
| <b>ME</b>                                         | External terminal board                                                                                                                   |
| <b>KPE</b>                                        | Mandatory evaporator pump command (consensus at voltage 230 Vac)                                                                          |
| <b>SEI</b>                                        | Summer/winter selector (control with potential free contact)                                                                              |
| <b>SCR</b>                                        | Remote control selector(control with clean contact)                                                                                       |
| <b>DSP</b>                                        | Double set-point selector (DSP accessory) (control with free contact)                                                                     |
| <b>CS</b>                                         | Shifting Set-point (CS accessory) (signal 4÷20 mA)                                                                                        |
| <b>FDL</b>                                        | Forced down load compressors (FDL accessory) (control with clean contact)                                                                 |
| <b>LFC1</b>                                       | Compressor operation lamp 1 (230 Vac voltage consent/command with dry contact)                                                            |
| <b>LFC2</b>                                       | Compressor operation lamp 2 (230 Vac voltage consent/command with dry contact)                                                            |
| <b>LBG</b>                                        | General machine lockout lamp (230 Vac voltage consent/command with dry contact)                                                           |
| <b>LPT</b>                                        | Voltage presence lamp (230 Vac voltage consent/command with dry contact)                                                                  |
| <b>SG<br/>EVU</b>                                 | Contacts for smart grid and photovoltaic system integration                                                                               |
| <b>VACS</b>                                       | Domestic hot water diverter valve control (consensus in voltage 230 Vac, maximum load 0,5A AC1)                                           |
| <b>CACS/STACS<br/>CRC100/STRC100<br/>CDS/STDS</b> | Domestic hot water diverter valve consent or RC100/DS consent; control with dry contact or temperature probe (not supplied, by installer) |
| <b>VM</b>                                         | Mixing water valve (0-10Vdc signal / 230 Vac power supply).                                                                               |
| <b>KPR<br/>KPDS</b>                               | Desuperheater pump compulsory control(consensus in voltage 230 Vac)                                                                       |
| <b>FNR-Q</b>                                      | Forced Noise Reduction.                                                                                                                   |
| <b>LKD</b>                                        | Refrigerant leak detector alarm (voltage-free consent)                                                                                    |
| <b>KRIT</b>                                       | KRIT control (additional electric resistance for heat pump) (230 Vac, maximum load 0.5 A AC1)                                             |
| <b>CGA</b>                                        | Auxiliary generator control (consent in voltage 230 Vac, maximum load 0.5A AC1)                                                           |
| <b>- - - - -</b>                                  | The connection is to be set up by the installer                                                                                           |

- 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.

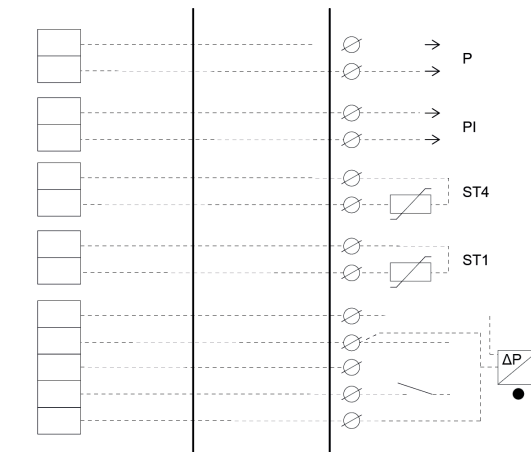
#### ATTENTION!

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 |
|-------------|-----------------|--------------|------------|-------------------------------|
| <b>175</b>  | mm <sup>2</sup> | 25           | 16         | 1.5                           |
| <b>290</b>  | mm <sup>2</sup> | 25           | 16         | 1.5                           |
| <b>2100</b> | mm <sup>2</sup> | 25           | 16         | 1.5                           |
| <b>3110</b> | mm <sup>2</sup> | 35           | 16         | 1.5                           |
| <b>3120</b> | mm <sup>2</sup> | 35           | 16         | 1.5                           |
| <b>3130</b> | mm <sup>2</sup> | 50           | 25         | 1.5                           |
| <b>3140</b> | mm <sup>2</sup> | 50           | 25         | 1.5                           |
| <b>3150</b> | mm <sup>2</sup> | 50           | 25         | 1.5                           |

### 3.47 VPF Electrical connections



**P** Primary circuit / unit side pump control

**PI** System pump control (VPF) (0-10Vdc signal)

**ST4** Temperature probe (VPF) to be positioned before the hydraulic backflow preventer

**ST1** Temperature probe (VPF) to be positioned after the hydraulic backflow preventer

●  $\Delta P$  probe / System pump alarm (VPF) (by the customer)

**NOTE** The probe must be of the ratiometric type (0.5 - 4.5V); it is recommended to set the actual reading range of the selected probe within the control parameters in order to obtain a correct signal conversion (see the Control Manual in the chapter on the VPF function).

## 3.48 Remote management using accessories supplied loose

It is possible to remote control the entire machine by linking a second keyboard to the one built into the machine (KTR/KTRT accessory). Use and installation of the remote control systems are described in the Instruction Sheets provided with the same.

## 3.49 Start-up

### 3.49.1 NOTE

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>IMPORTANT!</b><br>Machine commissioning or the first start up (where provided for) must be carried out by skilled personnel from workshops authorised by RHOSS S.p.A, qualified to work on this type of products.                                                                                                                                                                                                                                                                                                                           |
|  | <b>IMPORTANT!</b><br>The use and maintenance manuals of the fans and any safety valves are enclosed with this manual and should be read in their entirety.                                                                                                                                                                                                                                                                                                                                                                                     |
|  | <b>DANGER!</b><br>The units are equipped with safety valves. When they cut in, they cause a loud noise and violent refrigerant and oil leaks. Do not approach the safety valve tripping pressure value. Safety valves are conveyable in accordance with current regulations.                                                                                                                                                                                                                                                                   |
|  | <b>IMPORTANT!</b><br>A few hours before starting up the unit (at least 12), supply power to the machine in order to power the electrical resistances designed to heat up the compressor crankcase. Each time the unit starts up the crankcase resistances switch off automatically.                                                                                                                                                                                                                                                            |
|  | <b>DANGER!</b><br>Before starting the start-up operations, pay extreme attention when approaching the unit even if it is disconnected; check the areas surrounding the unit with a suitable portable gas detector (of suitable sensitivity in accordance with current regulations such as EN 378-4 or local if more restrictive) to ensure there are no refrigerant leaks.                                                                                                                                                                     |
|  | <b>DANGER!</b><br>It is forbidden to connect, start up and use the machine except in an external environment according to the prescriptions described above. Before commissioning, make sure that the installation and electrical connections have been carried out in compliance with the indications in the wiring diagram. Make sure that all the safety devices that can be inspected (e.g. microswitches) are present and work correctly. Also make sure that there are no unauthorized people near the unit during the above operations. |
|  | <b>DANGER!</b><br>Safety fans (panel) and technical compartment (Ex): in the case of installation with harsh operating conditions, check that the ventilation system is fully operational. The fan grilles must be kept clean of any obstructions. Check the state of cleanliness of the motors and fan blades, check for the absence of abnormal vibrations and correct rotation of the impeller. The engine must be kept clean so that there are no traces of dust, dirt, oil or other impurities.                                           |

### 3.49.2 Instruction for start-up

| Configuration parameters                                                     | Standard settings |
|------------------------------------------------------------------------------|-------------------|
| Summer working temperature setting                                           | 7°C               |
| Antifreeze temperature setting                                               | 3°C               |
| Antifreeze temperature differential                                          | 2°C               |
| Low pressure exclusion time upon start-up/in function                        | 60"/10"           |
| Water differential pressure switch exclusion time upon start-up/when running | 15"/3"            |
| Delay time for pump shutdown                                                 | 30"               |
| Anticipation time pump ignition                                              | 60"               |
| Minimum time between 2 consecutive compressor start-ups of these             | 360"              |

Before starting the unit, perform the following checks:

- the power supply must have characteristics that comply with those indicated on the identification plate and/or on the wiring diagram and must be within the following limits:
  - variation in supply frequency  $\pm 1\%$  of nominal;
  - variation in supply voltage:  $\pm 10\%$  of nominal;
  - unbalance between supply phases:  $< 2\%$ .
- The electrical supply system must be able to supply adequate current and be suitably sized to handle the load.
- Check that the power supply is not connected, or disconnect the power supply using the general automatic switch bringing it to the zero position, and ensuring that it cannot be tampered with by third parties (for example, with the L.O.T.O. procedure or equivalent); only after this operation. Access the electrical panel using the necessary PPE - P.P.E. and check that the power supply and contactor terminals are tightened (they may loosen during transport, this would lead to malfunctions).

|                                                                                     |                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>IMPORTANT!</b><br>Electrical connections must be made in compliance with the local installation standards in force in the place where the unit is installed, and with the instructions in the wiring diagram provided with the unit. |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

When all the connections have been performed, the unit may be commissioned after the following points have been checked.

#### General unit conditions

## START

|                                                                                |  |    |                                        |
|--------------------------------------------------------------------------------|--|----|----------------------------------------|
| Have the technical clearance distances indicated in the manual been respected? |  | NO | Restore the indicated technical spaces |
|--------------------------------------------------------------------------------|--|----|----------------------------------------|

YES

|                                                    |  |     |                                                         |
|----------------------------------------------------|--|-----|---------------------------------------------------------|
| Is the unit damaged due to transport/installation? |  | YES | <b>Danger! Do not start the unit! Restore the unit!</b> |
|----------------------------------------------------|--|-----|---------------------------------------------------------|

NO

|                                                          |  |  |  |
|----------------------------------------------------------|--|--|--|
| <b>The general conditions of the unit are compliant!</b> |  |  |  |
|----------------------------------------------------------|--|--|--|

## Checking of compressor oil level

### START

|                              |  |    |                     |
|------------------------------|--|----|---------------------|
| Is the oil level sufficient? |  | NO | Top up as necessary |
|------------------------------|--|----|---------------------|

YES

|                                                              |  |    |                                            |
|--------------------------------------------------------------|--|----|--------------------------------------------|
| Was pre-heating activated at least 12 hours before start-up? |  | NO | Activate pre-heating and wait 12 hours (*) |
|--------------------------------------------------------------|--|----|--------------------------------------------|

YES

|                                                          |  |  |  |
|----------------------------------------------------------|--|--|--|
| <b>The general conditions of the unit are compliant!</b> |  |  |  |
|----------------------------------------------------------|--|--|--|

(\*) The unit is equipped with a function that prevents starting, if the minimum heating time of the compressor crankcase heaters is not respected; this time is evaluated by the software according to the outdoor air temperature (see Electronic Control manual).

## Checking the water connections

### START

|                                                                  |  |    |                                      |
|------------------------------------------------------------------|--|----|--------------------------------------|
| Have the water connections been made to a professional standard? |  | NO | Bring the connections up to standard |
|------------------------------------------------------------------|--|----|--------------------------------------|

YES

|                                              |  |    |                                    |
|----------------------------------------------|--|----|------------------------------------|
| Is the water inlet/outlet direction correct? |  | NO | Correct the inlet/outlet direction |
|----------------------------------------------|--|----|------------------------------------|

YES

|                                                                                 |  |    |                                        |
|---------------------------------------------------------------------------------|--|----|----------------------------------------|
| Are the circuits full of water and have the pipes been bled of any air residue? |  | NO | Fill the circuits and/or bleed the air |
|---------------------------------------------------------------------------------|--|----|----------------------------------------|

YES

|                                                                   |  |    |                             |
|-------------------------------------------------------------------|--|----|-----------------------------|
| Does the water flow conform to what is stated in the user manual? |  | NO | Correct the water flow rate |
|-------------------------------------------------------------------|--|----|-----------------------------|

YES

|                                           |  |    |                                |
|-------------------------------------------|--|----|--------------------------------|
| Do the pumps turn in the right direction? |  | NO | Correct the rotation direction |
|-------------------------------------------|--|----|--------------------------------|

YES

|                                                                    |  |    |                                 |
|--------------------------------------------------------------------|--|----|---------------------------------|
| Are the flow meters (if installed) active and correctly connected? |  | NO | Repair or replace the component |
|--------------------------------------------------------------------|--|----|---------------------------------|

YES

|                                                                                                                                |  |    |                                 |
|--------------------------------------------------------------------------------------------------------------------------------|--|----|---------------------------------|
| Are the water filters placed upstream from the heat exchanger and recovery unit in good working order and correctly installed? |  | NO | Repair or replace the component |
|--------------------------------------------------------------------------------------------------------------------------------|--|----|---------------------------------|

YES

|                                             |  |  |  |
|---------------------------------------------|--|--|--|
| <b>The water connections are compliant!</b> |  |  |  |
|---------------------------------------------|--|--|--|

## Checking safety valve connections

### START

|                                                         |   |    |   |                                                                                                             |
|---------------------------------------------------------|---|----|---|-------------------------------------------------------------------------------------------------------------|
| Has the discharge of the safety valves been channelled? | ▷ | NO | ▷ | Connect the exhaust of the safety valves as set forth in paragraph Guidelines for the installation of units |
|---------------------------------------------------------|---|----|---|-------------------------------------------------------------------------------------------------------------|

▼ YES

|                                                                                                                                         |   |    |   |                       |
|-----------------------------------------------------------------------------------------------------------------------------------------|---|----|---|-----------------------|
| The diameter, length and number of elbows comply with the parameters in the table in paragraph Guidelines for the installation of units | ▷ | NO | ▷ | Modify the connection |
|-----------------------------------------------------------------------------------------------------------------------------------------|---|----|---|-----------------------|

▼ YES

|                                                                                                                     |   |    |   |                                    |
|---------------------------------------------------------------------------------------------------------------------|---|----|---|------------------------------------|
| Does the connection terminate by discharging outside at least 3m above ground level and away from ignition sources? | ▷ | NO | ▷ | Modify the position of the exhaust |
|---------------------------------------------------------------------------------------------------------------------|---|----|---|------------------------------------|

▼ YES

|                                                  |  |  |  |  |
|--------------------------------------------------|--|--|--|--|
| The connection of the safety valves is compliant |  |  |  |  |
|--------------------------------------------------|--|--|--|--|

## Checking electric connections

### START

|                                                                     |  |    |  |                                  |
|---------------------------------------------------------------------|--|----|--|----------------------------------|
| Does the unit power supply match the values indicated on the plate? |  | NO |  | Restore the correct power supply |
|---------------------------------------------------------------------|--|----|--|----------------------------------|

YES

|                                |  |    |  |                                    |
|--------------------------------|--|----|--|------------------------------------|
| Is the phase sequence correct? |  | NO |  | Restore the correct phase sequence |
|--------------------------------|--|----|--|------------------------------------|

YES

|                                                  |  |    |  |                                              |
|--------------------------------------------------|--|----|--|----------------------------------------------|
| Does the earth conform with current regulations? |  | NO |  | <b>Danger! Restore the earth connection!</b> |
|--------------------------------------------------|--|----|--|----------------------------------------------|

YES

|                                                                                |  |    |  |                                                |
|--------------------------------------------------------------------------------|--|----|--|------------------------------------------------|
| Are the power circuit electric conductors of the size indicated in the manual? |  | NO |  | <b>Danger! Replace the cables immediately!</b> |
|--------------------------------------------------------------------------------|--|----|--|------------------------------------------------|

YES

|                                                                             |  |    |  |                                                   |
|-----------------------------------------------------------------------------|--|----|--|---------------------------------------------------|
| Is the circuit breaker positioned upstream from the unit of the right size? |  | NO |  | <b>Danger! Replace the component immediately!</b> |
|-----------------------------------------------------------------------------|--|----|--|---------------------------------------------------|

YES

|                                         |  |  |  |  |
|-----------------------------------------|--|--|--|--|
| The electric connections are compliant! |  |  |  |  |
|-----------------------------------------|--|--|--|--|

## Commissioning

### START

|                                                                                        |  |    |  |                                                                                                                                               |
|----------------------------------------------------------------------------------------|--|----|--|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Check the start of the safety ventilation system Ex when closing the main disconnecter |  | NO |  | Stop the unit immediately by opening the isolating switch and ascertain the cause of the anomaly. Contact an authorized Rhoss Service Center. |
|----------------------------------------------------------------------------------------|--|----|--|-----------------------------------------------------------------------------------------------------------------------------------------------|

YES

|                                                                                                        |  |    |  |                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------|--|----|--|----------------------------------------------------------------------------------------------------------------------------------------------|
| Wait for the pre-heating time of the Ex leak detector and the consequent start-up of the control board |  | NO |  | Stop the unit immediately by opening the isolating switch and ascertain the cause of the anomaly. Contact an authorized Rhoss Service Center |
|--------------------------------------------------------------------------------------------------------|--|----|--|----------------------------------------------------------------------------------------------------------------------------------------------|

YES

|                                                       |  |  |  |  |
|-------------------------------------------------------|--|--|--|--|
| Disable the compressor power magneto-thermal switches |  |  |  |  |
|-------------------------------------------------------|--|--|--|--|

|                                                                                         |  |  |  |  |
|-----------------------------------------------------------------------------------------|--|--|--|--|
| Simulate a blank start in order to verify the correct insertion of the power contactors |  |  |  |  |
|-----------------------------------------------------------------------------------------|--|--|--|--|

|                                              |  |    |  |                                                                                       |
|----------------------------------------------|--|----|--|---------------------------------------------------------------------------------------|
| Are the power contactors inserted correctly? |  | NO |  | <b>Replace the component immediately!</b> Contact an authorized Rhoss Service Center. |
|----------------------------------------------|--|----|--|---------------------------------------------------------------------------------------|

YES

|                                                              |  |  |  |  |
|--------------------------------------------------------------|--|--|--|--|
| Activate the compressor power magneto-thermal switches again |  |  |  |  |
|--------------------------------------------------------------|--|--|--|--|

Start the machine from the control panel(see Electronic Controls manual).

Select operating mode (MODE key)

Check the correct rotation of the pumps and fans, the water flow rates, the operation of the probes and the machine pressure transducers.

**NO**

Check and replace the component if necessary Contact an authorized Rhoss Service Center.

**YES**

**Start-up procedure completed!**

#### Checks to be made while the machine is running

|                                                                                          |                                                                                                            |  |            |  |                                                                       |
|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--|------------|--|-----------------------------------------------------------------------|
|                                                                                          | <b>START</b>                                                                                               |  |            |  |                                                                       |
|                                                                                          | Ask all unauthorised personnel to leave the area                                                           |  |            |  |                                                                       |
|                                                                                          |                                                                                                            |  |            |  |                                                                       |
| <b>Intervention test:</b> use the water gate valves to reduce the flow to the evaporator | Is the water differential pressure switch activated correctly?                                             |  | <b>NO</b>  |  | Check and/or replace the component                                    |
|                                                                                          | <b>YES</b>                                                                                                 |  |            |  |                                                                       |
|                                                                                          | Is the working pressure reading correct?                                                                   |  | <b>NO</b>  |  | Stop the unit and check the cause of this anomaly                     |
|                                                                                          | <b>YES</b>                                                                                                 |  |            |  |                                                                       |
|                                                                                          | If you take the pressure on the high pressure side to approx. 8 bar, are there gas leaks of >3 grams/year? |  | <b>YES</b> |  | Stop the unit and check the cause of the leak (according to EN 378-2) |
|                                                                                          | <b>NO</b>                                                                                                  |  |            |  |                                                                       |
|                                                                                          | Does the unit display feature any alarms?                                                                  |  | <b>YES</b> |  | Check the cause of the alarm. See alarm table                         |
|                                                                                          | <b>NO</b>                                                                                                  |  |            |  |                                                                       |
|                                                                                          | <b>Start-up procedure completed!</b>                                                                       |  |            |  |                                                                       |

### 3.49.3 Instructions for fine tuning and general regulation

#### Calibration of safety and control devices

The units are tested in the factory, where they are also calibrated and the default parameter settings are put in. These guarantee that the appliances run correctly in rated working conditions. The devices which monitor safety of the unit are the following:

- High pressure switch (PA)
- High pressure safety valve
- High pressure safety valve
- Ex leakage detection system
- Ex ventilation system

The following are also present:

- Low pressure transducer (triggers low pressure alarm, see Electronic Control Manual coupled to the unit)
- Differential water pressure switch

| Pressure switch            | Intervention | Rearmament          |
|----------------------------|--------------|---------------------|
| high pressure              | 34 Bar       | 28 bar - Manual     |
| water differential         | 10 mbar      | 15 mbar - Automatic |
| High pressure safety valve | 38 bar       | -                   |

|                            |                                 |   |
|----------------------------|---------------------------------|---|
| High pressure safety valve | 30.3 bar (sat temperature 80°C) | - |
|----------------------------|---------------------------------|---|


**DANGER!**  
 The safety valve on the high pressure side is calibrated at 38 bar. It could intervene if the calibration value is reached during refrigerant charging operations, inducing a vent that can cause burns or even mechanical injuries (as well as the other valves in the circuit).

## Operation of components

### Compressor functioning

Scroll compressors are equipped with internal circuit breaker protection. Once the inner circuit breaker has tripped, normal operation is automatically resumed when the windings temperature drops below the pre-set safety value (this can take from a few minutes to several hours). All stationary compressors are equipped with a thermal-magnetic circuit breaker with auxiliary tripping contact connected to the circuit board.

### Operation of work probes, antifreeze, discharge and pressure

The water temperature probes (work probes and antifreeze) are inserted inside a well in contact with the conductive paste and blocked on the outside with silicone.

- one is placed at the entrance of the heat exchanger and measures the temperature of the return water from the system;
- the other one is placed at the evaporator outlet and acts as work and antifreeze probe.

Always check that both wires are firmly welded to the connector and that this is properly inserted in the housing on the electronic board (see wiring diagram provided). In order to check the efficiency of the probe, use a precision thermometer immersed with the probe in a container full of water at a certain temperature, after having removed the probe from the socket paying attention to not damage it in the process. Pay attention when repositioning the probe, by applying conducting paste in the socket, placing the probe and applying silicon on the external parts so to block it. In the event the antifreeze alarm triggers, reset the alarm from the control panel; the unit starts only when the water temperature exceeds the intervention differential. The exhaust temperature probes are inserted inside a special sump welded externally to the delivery pipe of both compressors. These probes signal to the electronic board abnormal increases in the exhaust temperature, generating a thermal protection alarm.

Pressure probes (transducers) are installed:

- **on the branch of high pressure**

it measures the high pressure by generating its alarms and activating and activating its protections. Adjust the summer operation condensation control.

- **on the low pressure branch**

it measures the low pressure generating the relative alarms and the relative protections. They manage the behavior of the electronic expansion valve, generate the low pressure alarm and regulate the evaporation control in winter operation.

### Electronic thermostatic valve functioning

The electronic thermostatic expansion valve is calibrated to maintain the gas superheated suitable to avoid any liquid being sucked into the compressor. The operator is not called upon to perform calibration since the control software of the valve monitors these operations automatically.

### Functioning of PA: high pressure switch

After the pressure switch has been triggered, it must be reset manually by pressing the black button on the pressure switch itself completely and reset the alarm from the control panel. Refer to the Troubleshooting section to detect the problem and carry out the necessary maintenance.

Our units do not require any maintenance as, for example, a car, as they do not have any parts subject to wear and tear/deterioration under normal operating conditions. Also, it must be checked that the environment in which the unit is to operate does not affect its operation (examples: unit near a cement factory will obstruct the exchange coils that I have to actually clean every 6 months, unit installed near vegetation that might block the fan with the wind). Below is an overall table with the required timing.

### Operation of the security chain

During start-up, the Ex leakage detector requires a pre-heating time of about 2 minutes during which it keeps the ventilation system activated: wait until the alarm signal returns before carrying out any operation.

At the end of this phase, the sensor takes a real-time reading of the refrigerant concentration and, if there are no leaks, gives consent for the unit's control board to start up.

In the presence of a refrigerant leak detected by the sensor, the ventilation system is activated to prevent the accumulation of a dangerous concentration of refrigerant inside the technical compartment; the alarm relay is also activated towards the control board and towards the red light optical/acoustic signaller on the electrical panel door; in this phase, power is cut off to all electrical components in the unit except for those of type EX responsible for safety actions.


**IMPORTANT!**  
 Keep the unit properly powered to avoid deactivation of safety systems.


**IMPORTANT!**

The spread of other gases in the vicinity of the unit could lead to false alarms, compromising the effectiveness of safety systems.

## 3.50 Maintenance

### 3.50.1 NOTE

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <b>DANGER!</b><br>Before starting any operation, be extremely careful when approaching the unit, even if it is disconnected; check the areas around the unit with a suitable portable gas detector (of suitable sensitivity in accordance with current standards such as EN 378-4 or local if more restrictive) to ensure there are no refrigerant leaks. Ensure that the portable gas detector is not a potential source of ignition and that it is correctly calibrated for the required refrigerant and sensitivity.        |
|   | <b>DANGER!</b><br>Any operation must be carried out in such a way as to minimise the risk of flammable gases or vapours escaping.                                                                                                                                                                                                                                                                                                                                                                                              |
|   | <b>IMPORTANT!</b><br>Maintenance work must only be carried out by qualified personnel of RHOSS S.p.A. authorised service centres, qualified to work on this type of product. Pay attention to the warning signs in this manual and those on the unit. Use the personal protective equipment provided for by the laws in force and suitable for preventing even residual risks indicated in this manual. Pay the utmost attention to the symbols located on the unit. Use <b>EXCLUSIVELY</b> original RHOSS S.p.a. spare parts. |
|   | <b>IMPORTANT!</b><br>Always use the personal protective equipment required by law and suitable for preventing even residual risks indicated in this manual (goggles, ear muffs, gloves, etc.)                                                                                                                                                                                                                                                                                                                                  |
|   | <b>DANGER!</b><br>Always use the general circuit breaker protecting the entire system before carrying out any maintenance work on the unit, even if it is for inspection purposes only. Check that no one accidentally feeds the machine, e.g. with L.O.T.O. procedure. or equivalent, lock the main circuit breaker in the zero position.                                                                                                                                                                                     |
|   | <b>DANGER!</b><br>Pay attention to high temperatures near the compressor heads and the supply pipes of the refrigeration circuit.                                                                                                                                                                                                                                                                                                                                                                                              |
|  | <b>DANGER!</b><br>In the case of operations on the unit that require open flames (e.g. brazing), or on associated parts, suitable fire-fighting equipment, such as a dry powder or CO2 extinguisher, must be at hand                                                                                                                                                                                                                                                                                                           |

### 3.50.2 Routine maintenance


**IMPORTANT!**

Provide mandatory controls and inspections pursuant to EU 517/2014.

Periodic check of reclamation fans (filter cleaning and flow control)

Check and calibration of the leak detector (follow supplier's manual)

| Area | Sensor type                      | Calibration intervals |
|------|----------------------------------|-----------------------|
| 2    | Electrochemical cell / Pellistor | 6 months              |
| 2    | Infrared                         | 12 months             |

The type of sensor in the units is infrared (IR).


**DANGER!**

The refrigerant leak detector is a safety component that must be serviced periodically according to the manufacturer's instructions: please refer to the documentation supplied with the unit

## General cleaning and inspection of the unit

Every six months, the unit should be cleaned using a moist cloth. The general conditions of the unit should always be checked every six months. Any corrosion must be treated with protective paints in order to prevent possible damage.

|                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Monthly checks</b>                                                                                                                                                                                                          |
| Check refrigerant circuit operating conditions (overheating, subcooling and high and low pressure.                                                                                                                             |
| Visual check of finned exchanger and fans.                                                                                                                                                                                     |
| Visual check of compressor oil levels where applicable.                                                                                                                                                                        |
| <b>Six-monthly checks</b>                                                                                                                                                                                                      |
| Cleaning and general check of the unit: Every 6 months a general cleaning and check of the condition of the machine should be carried out. Any points where corrosion is starting need to be touched up with protective paint. |

**Finned batteries:** Batteries must be kept clean of any obstructions. If needed, they must be washed with detergents and water. Brush the fins gently to keep them from being damaged.

**Fans:** In case of installation with severe operating conditions, increase the frequency of control. The fan grilles must be kept clear from any obstructions. Make sure the motors and fan blades are clean and that there are no abnormal vibrations. The motor must be kept clean with no traces of dust, filth, oil or other impurities. These could cause it to overheat due to low heat dissipation. The bearings are usually watertight with permanent lubrication and sized in order to last approximately 20.000 hours in standard operational and environmental conditions.

**Water filter:** It is mandatory to install a mesh filter in the inlet water pipe of the unit. This filter must be cleaned from time to time.

**Electrical system:** In addition to checking the various electrical components, the electrical insulation of all cables and their correct tightening on the terminal blocks must be checked, with particular attention to the earth connections.

Check the power consumption of the unit.

**Check of gas charge and humidity in the circuit (unit at full load):** Check for absence of bubbles in the liquid sight glass and dry colouring on the liquid sight glass

**Check for gas leaks:** For this check, refer to the regulations in force according to the equivalent amount of CO<sub>2</sub>

Only vent any air pockets from the chilled water system if a portable refrigerant leak detection system is present to check for the possible presence of flammable mixtures.

Check for the presence of water in the siphons for the hydraulic circuits, condensate drainage, sumps, etc. as a restriction on the circulation of any flammable mixtures.

### Annual checks

**Exchangers;** Any fouling of the exchangers can be detected by measuring the pressure drop between the inlet and outlet pipes of the unit using a differential pressure gauge.

The refrigerant leak detector is a safety component: carry out calibration in accordance with the manufacturer's instructions (refer to the documentation supplied with the unit)

**Enclosure and technical compartment safety fans (Ex):** in the case of installation with severe operating conditions, increase the frequency of monitoring. The fan grilles must be kept clear from any obstructions. Make sure the motors and fan blades are clean and that there are no abnormal vibrations. The motor must be kept clean with no traces of dust, filth, oil or other impurities. These could cause it to overheat due to low heat dissipation. The bearings are usually watertight with permanent lubrication and sized in order to last approximately 20.000 hours in standard operational and environmental conditions.

### Seasonal machine stoppage

**Emptying the water system (if necessary):** Emptying is necessary if the machine does not work during the winter season. Alternatively a glycol mixture can be used according to the information reported in this manual.

## Cleaning of Finned Coils

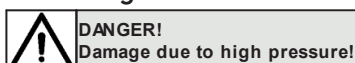


The coils must be washed and brushed gently with water and soap. Remove any foreign bodies from the condensing coils which may block the passage of air, such as: leaves, paper, debris, and so on.

Replace the coils should it not be possible to clean them. Failure to clean the coils increases load losses and therefore reduces overall performance of the unit in terms of its flow rate.

For better battery protection, it is recommended to install the RPE accessories (battery protection networks) or FMB (metal filters batteries).

## Cleaning of MCHX micro-channel finned coils



When steam- or high-pressure cleaning:

- use all necessary D.P.I. - P.P.E.;
- keep minimum distance of 400 mm;
- if possible, always clean in the opposite direction of the air flow.

In order to prevent warping and damage of fins:

- always align cleaning jet at right angles with fins of condenser;
- brush exclusively in longitudinal direction of fins;
- before starting, verify suitability of all cleaning methods on a small part of the device;
- if possible, always clean in the opposite direction of the air flow.
- Remove dry dust and dirt or normal soiling with:
  - soft brush or hand broom

- compressed air (3 to 5 bar)
- industrial vacuum cleaner
- hosepipe (water, 3 to 5 bar)
- Remove coarse or stubborn dirt with:
  - high pressure cleaner (max pressure 50 bar; min. distance 400 mm; fan with nozzle)
  - steam cleaner (max. pressure 50 bar; min. distance 400 mm; fan with nozzle)
- Use neutral cleaning agent if necessary.
- Avoid aggressive or corrosive detergents in order to not affect the aluminium or the rest of the unit.
- Once cleaning is finished, there must not be any traces of detergent on the condenser.

## Cleaning fans

|                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>DANGER!</b></p> <p>Pay attention to the fans. Do not remove the protective grids for any reason whatsoever! Presence of moving parts (belts, fans). Residual risk of crushing, shearing, dragging inherent in contact with moving parts, where the operator removes the fixed guards without switching off the machine or accesses the lower part without waiting an appropriate stopping time, in any case not less than 3 to 5 minutes.</p> |
|  | <p><b>DANGER!</b></p> <p>Always act on the general automatic switch protecting the system before carrying out any maintenance work, even if it is purely for inspection purposes. Make sure that no one accidentally supplies power to the machine; lock the general automatic switch in the zero position.</p>                                                                                                                                     |

Check the fan grilles making sure they are not obstructed by any objects and/or filth. The latter, besides drastically reducing the overall performance of the unit, in some cases causes the fans to break.

## Checking compressor oil level

 **IMPORTANT!**  
Do not use the unit if the oil level in the compressor is low.

The units are equipped with a sight glass to check the oil level in the equalisation pipe at the bottom of the compressors.

The lubricating oil level in the compressor can be checked by means of the sight-glass. The oil level in the sight-glass can be inspected while all compressors are running. At times a small amount of oil could migrate towards the refrigeration circuit causing slight level fluctuations; they can therefore be considered normal. Level fluctuations are also possible when capacity control is activated; in any event, the oil level must always be visible through the sight-glass.

The presence of foam when the unit starts is normal. A prolonged and excessive presence of foam during operation, on the other hand, means that the refrigerant has not dissolved in the oil.

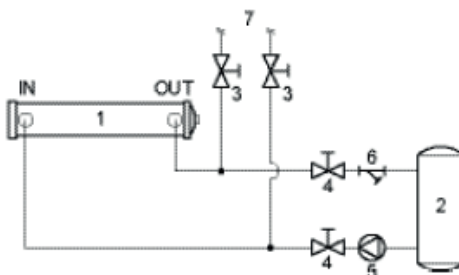
## Inspecting and washing the heat exchangers

|                                                                                     |                                                                                                                                                                           |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>DANGER!</b><br>The acids used for washing the heat exchangers are toxic. Use suitable personal protective equipment.                                                   |
|  | <b>IMPORTANT!</b><br>Use only chemical detergents suitable for cleaning the exchangers. Unsuitable chemical detergents can corrode the exchanger damaging it irreparably. |

Exchangers, with the passage of time, are subject to fouling even under nominal conditions of use. The working temperatures of the unit, the speed of the water in the pipes and the suitable finish of the heat exchanging surface reduce fouling of the exchangers to a minimum.

Any incrustation of the exchanger may be detected by measuring the pressure-drop between the inlet and outlet pipes, using a differential pressure gauge. Any sludge that may form in the water circuit or any silt that cannot be trapped by the filter, as well as extremely hard water conditions or high concentrations of any antifreeze solution used, may clog the exchangers and undermine their heat exchanging efficiency. In this case, it is necessary to wash the heat exchanger with suitable chemical detergents. Provide already existing systems with adequate charge and discharge connections. The liquid detergent must circulate around the exchanger at a flow rate at least 1.5 times higher than the rated working flow rate (without exceeding the maximum admitted flow : see "Operating limits").

The first detergent cycle cleans up the worst of the dirt. After the first cycle, carry out another cycle with clean detergent to complete the operation. Before starting up the system again, rinse abundantly with water to get rid of any traces of acid and bleed any air from the system; if necessary start up the service pump.



|   |                    |
|---|--------------------|
| 1 | Evaporator         |
| 2 | Acid solution tank |
| 3 | Cut-off gate valve |
| 4 | Auxiliary cock     |
| 5 | Wash pump          |
| 6 | Auxiliary filter   |
| 7 | User               |

### 3.50.3 Special maintenance

These are all those repairs or replacements which allow the unit to keep on working in standard conditions. The spare parts must be identical to the previous ones. Namely, they must have equivalent performance, dimensions etc. according to the specifications provided by the manufacturer.

|                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>IMPORTANT!</b><br>Maintenance must be carried out exclusively by skilled personnel from workshops authorised by RHOSS S.p.A, qualified to work on this type of products. Pay close attention to the danger signs on the unit. Use the personal protective equipment foreseen by current laws. Pay the utmost attention to the symbols located on the unit. Use <b>EXCLUSIVELY</b> original RHOSS S.p.a. spare parts. |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Control                                                                          | Frequency                        | Notes                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fans                                                                             | Every 6 months<br>Every 6 months | Make sure the motors and fan blades are clean and that there are no abnormal vibrations.                                                                                                                                                                                                                                      |
| Electric motor of fans                                                           | Every 6 months<br>Every 6 months | The motor must be kept clean with no traces of dust, filth, oil or other impurities. These could cause it to overheat due to low heat dissipation. The bearings are usually watertight with permanent lubrication and sized in order to last approximately 20.000 hours in standard operational and environmental conditions. |
| Checking gas charge and humidity in circuit (with unit running at full capacity) | Every 6 months                   |                                                                                                                                                                                                                                                                                                                               |
| Check that there are no gas leaks                                                | Every 6 months                   | This operation must be carried out by skilled personnel of authorised RHOSS S.p.A. workshops, qualified to operate on this type of products.                                                                                                                                                                                  |
| Check the cleanliness of the inverter compartment filter                         | Every 3 months                   | Clean or replace the filter protecting the inverter from the weather and prevent overheating in case of clogging (reduce interval depending on installation site)                                                                                                                                                             |
| Bleeding air from the chilled water system                                       | Every 6 months                   |                                                                                                                                                                                                                                                                                                                               |
| Draining the water system (if necessary)                                         |                                  | If the unit is idle during winter months, it must be emptied. In alternative, a glycol mixture can be used according to the information provided in this manual.                                                                                                                                                              |

### Warnings in the event of a refrigerant leak alarm

In the event of a refrigerant gas leak, the safety systems (detection and ventilation) ensure the safety of the unit and the alarm signal in the electronic control. This alarm requires manual reset by the authorized operator; this operation must be carried out only and exclusively at the end of the operations to restore the integrity and functionality of the product.

### Top-up / replacement of refrigerant charge

The units are tested in the factory with the gas charge necessary for their correct operation. The quantity of gas contained in the circuit is indicated directly on the serial number plate. If it is necessary to restore the refrigerant charge, the emptying procedure and the evacuation of the circuit must be carried out, eliminating traces of incondensable gases with any humidity.

It is mandatory to flush oxygen-free nitrogen through the piping during brazing/welding operations in A2 and A3 type flammable gas applications. Restoring the gas charge following maintenance work on the cooling circuit must therefore only take place after thorough washing of the circuit. Then restore the exact quantity of refrigerant and new oil shown on the serial number plate. The refrigerant must be tapped from the charge cylinder in the liquid phase. At the end of the recharging operation it is necessary to repeat the starting procedure of the unit and monitor the working conditions of the unit for at least 24 hours. If, for particular reasons, for example in the event of a loss of refrigerant, it is preferred to proceed with a simple top-up of refrigerant, a possible slight deterioration in the unit's performance must be taken into consideration. In any case, topping up must be carried out on the low pressure branch of the machine, using the pressure points set up for this purpose; care must also be taken to introduce refrigerant only in the liquid phase.

## Restoring compressor oil level

Correct oil level can be checked from the oil sight glasses. When the unit is stopped, the oil level in the compressors must partially cover the spy glass. The level is not always constant since it depends on the ambient temperature, the fraction of refrigerant in solution in the oil and the speed of rotation of the compressor (in the case of an inverter compressor). With the unit on and in near nominal conditions, the oil level should be clearly visible through the sight-glass on the level matching tube and must be flat without any ripples. Any integration can be made after having put the compressors under vacuum, using the pressure point located on the inlet. For the quantity and type of oil, refer to the adhesive plate of the compressor. To perform the oil replenishing operation, contact the Rhoss service center.

## Repairing and replacing components

- Always refer to the wiring diagrams enclosed with the appliance when replacing electrically powered components. Always take care to clearly label each wire before disconnecting, in order to avoid making mistakes later when re-connecting.
- When the machine is started up again, always go through the recommended start-up procedure.
- After maintenance has been performed on the unit, the liquid-humidity indicator (LUE) must be under control. After at least 12 hours of running, the cooling circuit of the unit must be perfectly "dry", with the LUE green. Otherwise, the filter needs to be replaced.

## Replacing the drier filter

To replace the drier filters, drain and eliminate humidity from the cooling circuit by also draining the refrigerant dissolved in oil. Once the filter has been replaced, evacuate the circuit again to eliminate any trace of non-condensable gases, which could have entered the system while replacing the filter. It is advisable to check that there are no gas leaks before restarting the machine for normal working.

## Instructions on how to drain the cooling circuit

In order to drain the cooling circuit completely by means of type-approved devices, drain the refrigerant fluid from both the high and low-pressure sides and in the liquid line. Use the load connections in every section of the circuit. In order to drain the refrigerant fluid completely all the circuit lines must be drained. The fluid must not be discharged into the atmosphere as it causes pollution. It should be recovered in suitable cylinders and delivered to a company authorised for the collection.

## Eliminating Circuit Humidity

If during machine operation there is evidence of humidity in the cooling circuits, it is essential to drain the circuit completely of refrigerant fluid and eliminate the cause of the problem. To remove all the humidity, the operator must dry out the circuit and place it under vacuum up to 70 Pa. It is then possible to proceed to top up the refrigerant fluid indicated in the plate located on the unit.

## 3.51 Dismantling the unit

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <b>SAFEGUARD THE ENVIRONMENT!</b><br>Dispose of the packaging materials in compliance with the national or local legislation in force in your country. Do not leave the packaging within reach of children.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|  | <b>IMPORTANT!</b><br>Pay close attention to the danger signs on the unit. Use the personal protective equipment foreseen by current laws. Pay the utmost attention to the symbols located on the unit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|  | <b>DANGER!</b><br>Before starting any operation, be extremely careful when approaching the unit, even if it is disconnected, due to the possible presence of flammable atmosphere and risk of fire. Check the areas around the unit with a suitable portable gas detector (of suitable sensitivity in accordance with current standards such as EN 378-4 or local if more restrictive) to ensure there are no refrigerant leaks. Remove all coolant before accessing the system. When working on refrigerant-filled systems, follow safety instructions. Ensure that the portable gas detector is not a potential source of ignition and that it is correctly calibrated for the required refrigerant and sensitivity. |
|  | <b>DANGER!</b><br>The oil contained within the refrigerant circuit retains the refrigerant dissolved within it. It is therefore possible for a flammable and explosive atmosphere to persist even after the coolant has been drained. The presence of a mixture of oil and/or coolant and air can trigger flames and explosions at high temperatures even in the absence of ignition sources.                                                                                                                                                                                                                                                                                                                          |

The dismantling of the unit by a company authorised to take back obsolete products/machinery and by personnel adequately trained in handling flammable substances is obligatory. The unit as a whole is composed of materials considered as secondary raw materials and the following conditions must be observed:

- the compressor oil must be removed. It must be recovered and delivered to a body authorised to collect waste oil;
- refrigerant gas should not be discharged into the atmosphere. It should instead be recovered by means of type-approved devices, stored in suitable cylinders and delivered to a company authorised for the collection;
- for draining the refrigeration circuit refer to the relevant paragraph;
- the filter-drier and electronic components are considered special waste, and must be delivered to a body authorised to collect such items;
- the foamed polyurethane rubber insulation material of the water exchangers must be removed and processed as urban waste.
- If the unit is only partially dismantled, label the machine as 'out of service, containing flammable gas residues', with date and signature.



This symbol means that this product must not be disposed of with household waste. Properly dispose of the unit according to local laws and regulations. When the unit reaches the end of its useful life, contact the local authorities for information on disposal and recycling, or ask RHOSS S.p.A. to collect the used equipment free of charge. Separate collection and recycling of the product at the time of disposal will help conserve natural resources and ensure that the unit is recycled properly to safeguard human health and the environment.

### 3.52 Environmental labelling of packaging

Directive (EU) 2018/852, (EU) 2018/851 and Italian Leg. Decree 116/2020

| Type of packaging (if present)                                                                                                 | Classification                                                                      | Destination*                        |
|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------|
| Cardboard boxes and parts                                                                                                      |    | PAPER COLLECTION                    |
| Corrugated fibreboard                                                                                                          |    | PAPER COLLECTION                    |
| Honeycomb paper<br>Cardboard corner pieces                                                                                     |    | PAPER COLLECTION                    |
| Bottom paper support                                                                                                           |    | PAPER COLLECTION                    |
| Various metals/cardboard and paper                                                                                             |    | PAPER COLLECTION + METAL COLLECTION |
| Plastic bags                                                                                                                   |    | PLASTIC COLLECTION                  |
| Clips<br>Straps<br>Packaging tape                                                                                              |    | PLASTIC COLLECTION                  |
| Expanded polyethylene / polyethylene corner pieces<br>Adhesive protective film<br>Flexible film<br>Plastic protective elements |   | PLASTIC COLLECTION                  |
| Polystyrene elements                                                                                                           |  | PLASTIC COLLECTION                  |
| Pallet, w ooden boards, w ooden crates                                                                                         |  | SEPARATE WASTE COLLECTION           |
| Iron brackets, metal staples, stainless steel screw s and w ashers,<br>galvanised steel plates                                 |  | METAL COLLECTION                    |

\* Check the disposal methods w ith your local municipality

### 3.53 Check-list

| Problem                                                                                                 | Recommended action                                                                   |
|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| <b>1 – THE CIRCULATION PUMP DOES NOT START (IF CONNECTED): water differential pressure switch alarm</b> |                                                                                      |
| No voltage to the pump unit                                                                             | check the electrical connections                                                     |
| No signal from control board                                                                            | check, call in authorised assistance                                                 |
| Pump blocked                                                                                            | check and clear as necessary                                                         |
| Pump motor failure                                                                                      | repair or replace pump                                                               |
| The water mesh filter (mounted by installer) is dirty                                                   | clean the filter                                                                     |
| <b>2 - COMPRESSOR: IT DOES NOT START</b>                                                                |                                                                                      |
| Microprocessor board alarm                                                                              | identify alarm and take appropriate action                                           |
| No voltage, switch open                                                                                 | close the isolator                                                                   |
| Circuit breakers tripped due to overload                                                                | reset the switches; check the unit at start-up                                       |
| No request for cooling on user with correctly entered work set-point                                    | check and if necessary wait for cooling request                                      |
| Work set-point too high in cooling mode                                                                 | check and if necessary readjust set-point                                            |
| Setting the working set too high in heating mode:                                                       | check and if necessary readjust set-point                                            |
| Defective contactors                                                                                    | replace the contactor                                                                |
| Compressor electric motor failure                                                                       | check for short circuit                                                              |
| Head of the compressor very hot, internal circuit breaker tripped                                       | wait an hour at least for cooling                                                    |
| <b>3 –THE COMPRESSOR DOES NOT START BUT YOU CAN HEAR A BUZZING NOISE</b>                                |                                                                                      |
| Incorrect power supply voltage:                                                                         | check voltage, investigate causes                                                    |
| Defective contactors                                                                                    | replace the contactor                                                                |
| Mechanical problems in the compressor                                                                   | replace the compressor                                                               |
| <b>4 - THE COMPRESSOR WORKS INTERMITTENTLY: low pressure pressure-switch alarm</b>                      |                                                                                      |
| Faulty low pressure transducer:                                                                         | check operation of pressure switch                                                   |
| Insufficient amount of refrigerant fluid                                                                | 1. detect and eliminate any leaks<br>2. top-up to the correct amount                 |
| Clogged refrigerant fluid line filter (appears frosted)                                                 | replace the filter                                                                   |
| Irregular operation of the expansion valve                                                              | check calibration, adjust overheating, replace if necessary                          |
| <b>5 - THE COMPRESSOR STOPS: high pressure pressure-switch alarm</b>                                    |                                                                                      |
| Faulty high pressure switch                                                                             | check operation of pressure switch                                                   |
| Insufficient cooling air in coils (cooling mode):                                                       | check fans, check clearances around unit and possible coil obstructions.             |
| Insufficient water circulation on the plate exchanger (in heating mode):                                | check and adjust as necessary                                                        |
| Excessive ambient temperature:                                                                          | Check unit operation limits.                                                         |
| Presence of air in the water system                                                                     | bleed the water system                                                               |
| Excessive amount of refrigerant fluid                                                                   | drain the excess                                                                     |
| <b>6 - EXCESSIVE COMPRESSOR NOISE - EXCESSIVE VIBRATIONS</b>                                            |                                                                                      |
| The compressor is pumping liquid, excessive refrigerant fluid in crankcase                              | 1. check operation of the expansion valve<br>2. replace expansion valve if necessary |
| Mechanical problems in the compressor                                                                   | overhaul compressor                                                                  |
| Unit running at the limit of the specified condition of use                                             | check performance according to declared limits                                       |
| <b>7 - COMPRESSOR RUNS CONTINUOUSLY</b>                                                                 |                                                                                      |
| Excessive thermal load                                                                                  | check system sizing, leakage and insulation of rooms served                          |
| Work set-point too low in cooling mode                                                                  | check calibration and reset                                                          |
| Work set-point too high in heating mode                                                                 | check calibration and reset                                                          |
| Poor ventilation in the coils                                                                           | check fans, check clearances around unit and possible coil obstructions.             |
| Poor water circulation in the plate exchanger                                                           | check and adjust as necessary                                                        |
| Presence of air in the chilled water system                                                             | bleed the system                                                                     |

|                                                                            |                                                                                                      |
|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Insufficient amount of refrigerant fluid                                   | 1. detect and eliminate any leaks<br>2. top-up to the correct amount                                 |
| Clogged refrigerant fluid line filter (appears frosted)                    | replace the filter                                                                                   |
| Faulty control board                                                       | replace the board and verify                                                                         |
| Irregular operation of the expansion valve                                 | check calibration, adjust operation, replace if necessary                                            |
| Irregular contactor operation                                              | check operation                                                                                      |
| <b>8 - LOW OIL LEVEL</b>                                                   |                                                                                                      |
| Refrigerant fluid leakage                                                  | 1. check, identify and eliminate any leaks<br>2. top-up to the correct amount of refrigerant and oil |
| Unit running under irregular conditions compared to the functioning limits | check unit sizing                                                                                    |
| <b>9 - THE CRANKCASE HEATER DOES NOT WORK</b>                              |                                                                                                      |
| No electrical supply                                                       | check connections                                                                                    |
| The crankcase heater is off                                                | check and replace if necessary                                                                       |
| <b>10 - OUTLET PRESSURE HIGH IN NOMINAL CONDITIONS</b>                     |                                                                                                      |
| Insufficient cooling air in coils (cooling mode):                          | check fan operation, check technical spaces and possible coil obstructions                           |
| Insufficient water circulation on the plate exchanger (in heating mode):   | check and adjust as necessary                                                                        |
| Presence of air in the water system                                        | bleed the system                                                                                     |
| Excessive amount of refrigerant                                            | drain the excess                                                                                     |
| Dirty or blocked batteries (in cooling mode):                              | check and clean and/or remove any obstructions                                                       |
| <b>11 - OUTLET PRESSURE LOW IN NOMINAL CONDITIONS</b>                      |                                                                                                      |
| Insufficient amount of refrigerant fluid                                   | 1. detect and eliminate any leaks<br>2. top-up to the correct amount                                 |
| Presence of air in the water system (in cooling mode)                      | bleed the system                                                                                     |
| Insufficient water flow to the evaporator (in cooling mode)                | check hydraulic system and adjust as necessary                                                       |
| Mechanical problems in the compressor                                      | overhaul compressor                                                                                  |
| Irregular working of fan speed regulator (in cooling mode)                 | check calibration and adjust if necessary                                                            |
| <b>12 - INTAKE PRESSURE HIGH IN NOMINAL CONDITIONS</b>                     |                                                                                                      |
| Excessive thermal load (in cooling mode)                                   | check system sizing, leakage and insulation                                                          |
| Irregular operation of the expansion valve                                 | check operation, clean nozzle, adjust overheating, replace if necessary                              |
| Mechanical problems in the compressor                                      | overhaul compressor                                                                                  |
| <b>13 - INTAKE PRESSURE LOW IN NOMINAL CONDITIONS</b>                      |                                                                                                      |
| Insufficient amount of refrigerant                                         | 1. top-up to the correct amount<br>2. detect and eliminate any leaks                                 |
| Damaged heat exchanger (in cooling mode)                                   | 1. check<br>2. replace                                                                               |
| Irregular operation of the expansion valve                                 | 1. check operation<br>2. clean the nozzle<br>3. adjust overheating<br>4. replace if necessary        |
| The water mesh filter (mounted by installer) is dirty                      | clean the filter                                                                                     |
| Presence of air in the water system (in cooling mode):                     | bleed the system                                                                                     |
| Insufficient air to the batteries (in heating mode):                       | check fans, check clearances around unit and possible coil obstructions.                             |
| Dirty or blocked batteries (in heating mode):                              | check and clean and/or remove any obstructions                                                       |
| Insufficient water flow (in cooling mode):                                 | check and adjust if necessary                                                                        |
| <b>14 - ONE OF THE FANS DOES NOT WORK OR STARTS AND STOPS</b>              |                                                                                                      |
| Switch or contactor faulty, break in the auxiliary circuit:                | check and replace if necessary                                                                       |
| Circuit breaker protection activated:                                      | check for short circuits, replace motor                                                              |
| Condensation control not working:                                          | 1 check functioning of board and replace if necessary                                                |

|                                            |                                                                                                                                                                                                                                                                             |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            | 2 check pressure transducer.                                                                                                                                                                                                                                                |
| <b>15 - THE CARD DOES NOT GIVE SIGNALS</b> |                                                                                                                                                                                                                                                                             |
| Refrigerant Leak Alarm                     | Check the presence of an audible/visual alarm on the appropriate signal on the QE door, move away from the unit and wait for the end of the alarm. Then approach with a suitable portable detector to exclude the persistence of the leak in the area surrounding the unit. |



# New air for the future.

**RHOSS S.P.A.**  
Via Oltre Ferrovia, 32  
33033 Codroipo (UD) - Italy  
tel. +39 0432 911611  
rhoss@rhoss.com

**Italy Sales Departments**  
Via Oltre Ferrovia, 32  
33033 Codroipo (UD)  
tel. +39 0432 911611

**Via Venezia, 2 - p. 2**  
20834 Nova Milanese (MB)  
tel. +39 039 6898394

**RHOSS France**  
Bat. Cap Ouest - 19 Chemin de la Plaine  
69390 Vourles - France  
tel. +33 (0)4 81 65 14 06  
rhossfr@rhoss.com

**RHOSS Deutschland GmbH**  
Hölzlestraße 23, D  
72336 Balingen, OT Engstlatt - Germany  
tel. +49 (0)7433 260270  
rhossde@rhoss.com

**RHOSS Iberica Climatizacion, S.L.**  
Frederic Mompou, 3 - Plta. 6a Dpcho. B 1  
08960 Sant Just Desvern - Barcelona  
tel. +34 691 498 827  
rhossiberica@rhossiberica.com

rhoss.com

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