

H59604AIT



# UNION/SCULPTOR

UNION/SCULPTOR



**ait**  
HEAT PUMPS

## 3. ENGLISH

### 3.1. IMPORTANT INTRODUCTION

**IMPORTANT INTRODUCTION:** the machines of the UNION/SCULPTOR 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.

AIT 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 AIT 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

UNION/SCULPTOR units are packaged reversible heat pumps on the cooling circuit with evaporation/air cooled with axial fans in high efficiency versions. They are suitable in air conditioning installations and industrial processes where chilled and hot water is required, not for human consumption.

The units are designed for outdoor installation

#### Guide to reading the code

<b>T</b>	Water production unit
<b>H</b>	Heat pump
<b>A</b>	Air cooling
<b>E</b>	Scroll-type hermetic compressors
<b>T</b>	High efficiency
<b>P</b>	R290 refrigerant gas
<b>2</b>	Number of compressors
<b>50</b>	Approximate heat capacity (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

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

#### Example: UNION/SCULPTOR 10 P1




- Water production unit
- Heat pump
- Air-cooled
- 2 Scroll-type hermetic compressors
- High efficiency unit
- R290 refrigerant fluid
- Nominal heat output of about 50 kW
- Installation with pump P1

### 3.3. COMPONENTS

Each unit is supplied complete with:

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

### 3.4. NOTE

	<b>DANGER!</b> The machine was designed and built solely and exclusively to function as a reversible packaged hydronic heat pump on the cooling circuit with air evaporation/condensation; any other use other than this is expressly <b>PROHIBITED</b> . Installing the machine in an explosive environment is prohibited.
	<b>DANGER!</b> The machine is designed for outdoor installation. Segregate the unit if installed in areas accessible to persons under 14 years of age.
	<b>IMPORTANT!</b> 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 feature a serial number plate located on the electrical panel; it bears the machine identification data.

### 3.6. ADAPTIVEFUNCTION PLUS

#### Reliable and versatile energy consumption heat pumps

##### A complete and flexible range

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

##### AdaptiveFunction Plus

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

##### Objectives

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

##### Operating logic

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

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

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

##### Main functions

##### Efficiency or Precision

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

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

### 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 each case refer to the directions found 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 spread rate (0.7 m/s) and heat of combustion (50 MJ/kg) place R290 among A3 fluids, flammable refrigerants. The refrigerant also has a low minimum ignition energy (MIE > 0.25 mj) and a self-ignition temperature of 470°C.

**Refrigerant R290****Safety classification (ISO 817) A3****PED fluid group 1****ODP 0****ATEL/ODL 0,09 kg/m<sup>3</sup>****LFL 0,038 kg/m<sup>3</sup>****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**

Usare dispositivi di protezione individuale, indumenti protettivi, guanti adatti e proteggersi gli occhi e la faccia.

• **Professional R290 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.

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 spilt material with sand, soil, or other suitable absorbent material. Prevent liquid from getting into drains, sewers, basements and work pits because the vapors 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
- CO2

### 3.8. CHECK FOR LEAKS

Operators of equipment are recommended to conduct checks for leaks and to keep records for each such equipment specifying the information required by Article 6 para. 1 under EU Regulation No.573/2024. The operator is the owner of the equipment or facility. The operator may formally delegate to an external person or Company (tra-mite a written contract) the actual control of the equipment or system. A periodic leakage check according to EN 378-4: Operation, Maintenance, Repair and Recovery should be carried out in any case.

### 3.9. PED CATEGORIES OF PRESSURE COMPONENTS

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

Component	PED category
Compressor	III
Safety valve	IV
High pressure switch	IV
Liquid receiver	III
Liquid separator	III
Finned coil	Art.4 pa.3
Plates exchanger	II

### 3.10. INFORMATION ABOUT RESIDUAL RISKS THAT CANNOT BE ELIMINATED

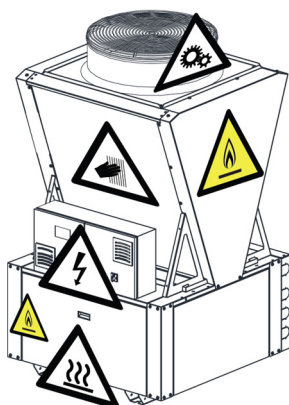







**IMPORTANT!**

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 having adopted the protective measures integrated in the design, the protections and the complementary protective measures, 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 switching 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 input to the main machine disconnect 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 switching 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 injuries 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, incision, abrasion due to the presence of finned surfaces on exchangers that have the possibility of incision.
	Fire hazard. Residual fire risk due to the presence of refrigerant gas A3 inside the refrigerant circuit which, if released, could be flammable.

### 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

- o Load-bearing structure and panels in galvanised and painted sheet metal (RAL 9018); galvanised steel sheet metal base.
- o The structure consists of two sections:
  - technical compartment dedicated to housing the compressors and the main components of the refrigeration circuit;
  - aeraulic circuit dedicated to housing the heat exchanger coils and electric fans, including safety nets;
- o Ex ventilation system to ensure the washing of the technical compartment in case of loss of refrigerant gas.
- o Scroll type hermetic rotary compressor. They include thermal protection and casing heater activated automatically when the unit stops (as long as still electrically powered).
- o Adequately insulated, braze-welded plate water side heat exchange made of stainless steel.
- o Air side heat exchanger: featuring finned coil with copper pipes and aluminium fins, with hydrophilic surface treatment.
- o Electric axial fans with external rotor and permanent magnet motor, equipped with internal thermal protection and complete with safety net.
- o Male threaded type hydraulic couplings 2"GM.
- o Differential pressure switch that protect the unit from any water flow interruptions.
- o Refrigerant circuit made of annealed copper pipe (EN 12735-1-2) complete with: hermetic drier filter, charge connections, manual reset safety pressure switch on the high pressure side, LP and HP pressure transducer, safety valves on the high and low pressure side, liquid indicator, suction line insulation, electronic expansion valve, reverse cycle valve and liquid receiver, check valves, gas separator and compressor suction cock (for heat pumps).
- o Easy-access pressure taps, complete with safety tap.
- o Unit with IP24 protection rating.
- o Control with AdaptiveFunction Plus operation.
- o The unit is complete with a charge of R290 refrigerant.

## Versions

THigh efficiency version.

## Electrical panel

- o The electrical panel with IP54 protection rating can be accessed by opening the front panel, in compliance with EN 60204-1/IEC 60204-1 Standards in force, fitted with opening and closing via specific tool.
- o Complete with:
  - electrical wiring arranged for power supply 400-3ph-50Hz;
  - numbered electric cables;
  - auxiliary circuit power supply 230V-1ph+N-50Hz derived from main power supply;
  - main power supply switch with interlocking safety door isolator;
  - automatic thermal overload switch to protect the compressors and the motor-driven fans;
  - auxiliary circuit, protected against refrigerant leakage, with safety chain conforming to Category 3 - PLd - SIL2 (according to IEC / EN 61508 and EN 13849)
  - auxiliary circuit protection fuse;
  - compressors power contactore;
  - remote machine controls: ON/OFF and summer/winter selector;
  - remote machine controls: compressor operating light and general lock light.
- o Programmable microprocessor electronic board handled by the keyboard inserted in the machine.
- o This electronic board performs the following functions:



- regulation and management of the set points for unit outlet water temperature; cycle inversion (heat pumps); safety timer delays; circulating pump; compressor and system pump hour-run meter; defrost cycles; electronic anti-freeze protection which cuts in automatically when the machine is switched off; and the functions which control the operation of the individual parts making up the machine;
- complete protection of the unit, possible shutdown and display of all the triggered alarms;
- total protection of the compressor;
- sequence/phase failure monitor to protect the compressor;
- visualization of the programmed sets through the display; of in/out water temperatures via display; the condensing and evaporating pressures; alarms via display; of chiller or heat pump operation via display (only heat pumps);
- user interface menu;
- management of the external temperature for the climatic compensation of the set-point (which can be enabled from the menu);
- display of the desuperheater inlet water temperature;
- alarm code and description;
- management of alarms log.
  - In particular, for every alarm, the following are memorised:
    - date and time of intervention;
    - in/out water temperature values as soon as the alarm was triggered;
    - the evaporation and condensation pressure values at the time of the alarm;
    - alarm delay time from the switch-on of the connected device;
    - compressor status at the time of the alarm;
  - Advanced functions:
    - Pump Energy-Saving management;
    - smart defrost management;
    - automatic management of anti-legionella cycles;
    - KPR desuperheater pump control for external supply of electric pumps (by the installer). For the unit to operate properly, activation of the recovery pump, by the installer, must be controlled by means of a specific discrete output provided in the board on the unit;
    - EEO function - Energy Efficiency Optimizer (standard, see Accessories in-depth section).
    - LKD function - Leak Detector (standard, see Accessories in-depth section).
- possibility of having a digital input for the management of the desuperheater (CDS contact) or for the production of domestic hot water via a 3-way diverter valve (CACS contact). In this case there is the possibility of using a temperature probe as an alternative to the digital input. (see specific section for further information);
- option of having domestic hot water diverter valve (VACS) control;
- management of time bands and operation parameters with the possibility of daily/weekly functioning programs;
- check-up and monitoring of scheduled maintenance status;
- computer-assisted unit testing;
- self-diagnosis with continuous monitoring of the unit functioning status.
- MASTER/SLAVE management logic integrated in single systems - Refer to the specific section for more details
- Set-point regulation via the AdaptiveFunction Plus with two options:
  - fixed set-point (Precision option);
  - set-point sliding (Economy option).

### 3.13. ACCESSORIES

#### Factory Fitted Accessories

<b>P2</b>	Installation with increased static pressure pump
<b>DS</b>	Desuperheater. Active in summer and winter mode
<b>SFS</b>	Soft starter 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>RQE</b>	Electrical panel resistance (recommended for low outdoor air temperature)
<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>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>	Interface RS485 for serial dialogue 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>DVS</b>	High pressure and low pressure double safety valve with exchanger tap
<b>SAG</b>	Rubber anti-vibration mounts (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>CMT</b>	Check the MIN/MAX values of the power supply voltage
<b>SIL</b>	Silenced set-up (sound-proof compressor compartment + compressor ear muff)
<b>RAE20</b>	Flow switch and hot wire heater protecting heat exchanger pumps and piping up to -20°C outdoor air
<b>RAE20_4</b>	Flow switch and hot wire heater protecting heat exchanger pumps and piping up to -20°C outdoor air. For units with DS and V3V set up
<b>RAP</b>	Unit with copper/pre-painted aluminium condensation coils
<b>BRR</b>	Unit with copper/copper condensation coils

<b>FIAP</b>	Condensing control with over-pressured fans with EC motor (Brushless) and available static head according to the following table:
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	Unit with a Ø800mm fan
Available static head	Up to 100 Pa
Single fan absorption	Max 1.85 kW
Average increase in noise of the unit	4 dBA

### Accessories supplied separately

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

Consult the price list or contact AIT to check the compatibility between the accessories



### 3.14. TECHNICAL DATA

Model UNION/SCULPTOR			10			
NUMBER OF MODULES			1	2	3	4
Nominal cooling capacity	(1)	kW	44.5	89	133.5	178
EER	(1)		2.80	2.80	2.80	2.80
Nominal cooling capacity EN 14511	(1)(*)	kW	44.8	89.3	133.8	178.3
EER EN 14511	(1)(*)		2.82	2.82	2.82	2.82
SEER EN 14825			3.80	4.03	4.07	4.11
Nominal heating capacity	(2)	kW	47.7	95.4	143.1	190.8
COP	(2)		3.23	3.23	3.23	3.23
Nominal heating capacity EN 14511	(2)(*)	kW	47.4	95.1	142.8	190.5
COP EN 14511	(2)(*)		3.20	3.20	3.20	3.20
SCOP EN 14825			3.83	3.94	4.12	4.2
SCOP MT EN 14825			3.20	3.30	3.50	3.57
Sound pressure	(3)	dB(A)	44.5	47	48.5	50
Sound power	(4)	dB(A)	76	79	81	82
Scroll/step compressor		n°	2/2	4/4	6/6	8/8
Circuits		n°	1	2	3	4
Fans		n° x kW	1 x 0,9	2 x 0,9	3 x 0,9	4 x 0,9
Fan nominal air flow		m3/h	15000	30000	45000	60000
Heat exchanger		Type	Plates			
Heat exchanger nominal flow water side	(1)	m3/h	7.7	2 x 7,7	3 x 7,7	4 x 7,7
Residual head P1	(1)	kPa	118	118	118	118
Residual head P2	(1)	kPa	155	155	155	155
Nominal thermal potential DS	(±)	kW	7.8	2 x 7,8	3 x 7,8	4 x 7,8
Nominal flow rate/pressure drop DS	(±)	m³/h / kPa	0,7/1	2 x 0,7/1	3 x 0,7/1	4 x 0,7/1
Amount of R290 refrigerant		Kg	4.3	2 x 4,3	3 x 4,3	4 x 4,3
Total oil charge of compressors		Kg	7.2	2 x 7,2	3 x 7,2	4 x 7,2
<b>Electrical data</b>						
Absorbed power	(1) (■)	kW	15.9	2 x 15,9	3 x 15,9	4 x 15,9
Absorbed power in winter mode	(2) (■)	kW	14.8	2 x 14,8	3 x 14,8	4 x 14,8
Maximale Leistungsaufnahme der Pumpe P1		kW	0.78	2 x 0,78	3 x 0,78	4 x 0,78
Maximale Leistungsaufnahme der Pumpe P2			1.41	2 x 1,41	3 x 1,41	4 x 1,41
Electrical power supply		V-ph-Hz	400 – 3 – 50			
Auxiliary power supply		V-ph-Hz	230 – 1 – 50			
Summer operation nominal current	(1) (■)	A	28.7	2 x 28,7	3 x 28,7	4 x 28,7
Maximum current	(■)	A	41.1	2 x 41,1	3 x 41,1	4 x 41,1
Starting current	(■)	A	169	210	251	292
Starting current with SFS	(■)	A	118	159	200	241
Maximum pump absorbed current P1		A	1.71	2 x 1,71	3 x 1,71	4 x 1,71
Maximum pump absorbed current P2			2.5	2 x 2,5	3 x 2,5	4 x 2,5
<b>Dimensions</b>						
Length		mm	1224	2458	3692	4926
Height		mm	2335			
Depth		mm	1320			
Heat exchanger inlet/outlet connections		Ø	2"	2 x 2"	3 x 2"	4 x 2"
DS E V3V inlet/outlet connections		Ø	2"	2 x 2"	3 x 2"	4 x 2"
Weight		Kg	685	1370	2055	2740

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

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

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

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

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

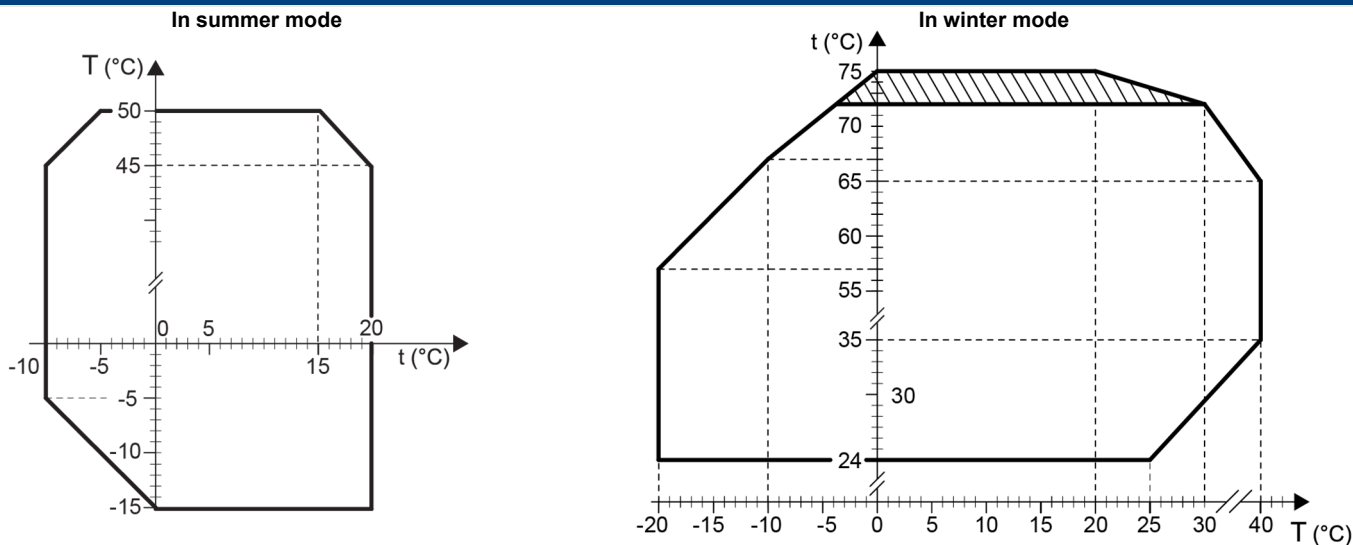
The seasonal efficiency in SEER cooling mode depends on a unique 35° design temperature and can be calculated for 2 types of distribution:

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

### 3.16. SOUND POWER AND PRESSURE LEVELS

Models		Sound power level in dB for octave bands									Average sound pressure level in dB (A)	
		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Lw dB(A)	Lp 1m	Lp 10m
UNION/SCULPTOR 10	1 module	71	75,5	76,5	75	70	95,5	64	52,5	76	58,5	44
	2 modules	74	78,5	79,5	78	73	68,5	67	55,5	79	61	47
	3 modules	76	80,5	81	79,5	75	70,5	68,5	57	81	62	48,5
	4 modules	77	81,5	82,5	81	76	71,5	70	58,5	82	62,5	50

### 3.17. FUNCTIONING LIMITS



$t(^{\circ}\text{C})$	Temperature of the water produced
$T(^{\circ}\text{C})$	Outdoor air temperature (D.B.)
	Standard functioning
	Winter operation with 10K thermal jump

#### In summer mode:

Maximum inlet water temperature 28°C.

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

#### In winter mode:

- o Minimum water inlet temperature 20°C.
- o Maximum water inlet temperature 67°C

#### N.B.:

For  $t(^{\circ}\text{C})$ ,  $< 5^{\circ}\text{C}$  (accessorio BT) it is COMPULSORY to specify the unit's operating temperature when placing the order (evaporator glycol water inlet/outlet) in order to allow for its correct parametrisation. Use of antifreeze solutions: see "Use of anti-freeze solutions".

### 3.18. OPERATING LIMITS WITH THE HEAT RECOVERY ACCESSORY

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

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

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

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

The DS accessory switches on when the external pump (provided by the customer) is switched on. The production of hot water continues until the condensation pressure remains above a minimum pre-set value. For this reason the delays that may occur between turning the unit on and turning the circulation pump on/off during operation are completely normal. If the inlet temperature to the DS recovery unit is lower than the permitted values, it is recommended to use a three-way VM modulating valve to guarantee the minimum water temperature required.

### 3.19. PERMITTED TEMPERATURE DIFFERENTIALS THROUGH THE HEAT EXCHANGERS

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

### 3.20. EVAPORATOR WATER FLOW RATE LIMITS

Type of heat exchanger		Plates		
		Min Cooling	Min Heating	Max
1 module	m3/h	4.3	3	12
2 modules	m3/h	8.6	6	24
3 modules	m3/h	12.9	9	36
4 modules	m3/h	17.2	12	48

Model		10
Heat exchanger water content	l	3.8
Minimum flow rate (water differential pressure switch intervention)	l/h	2800

#### DS:

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

### 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 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 selection program for performance data							

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

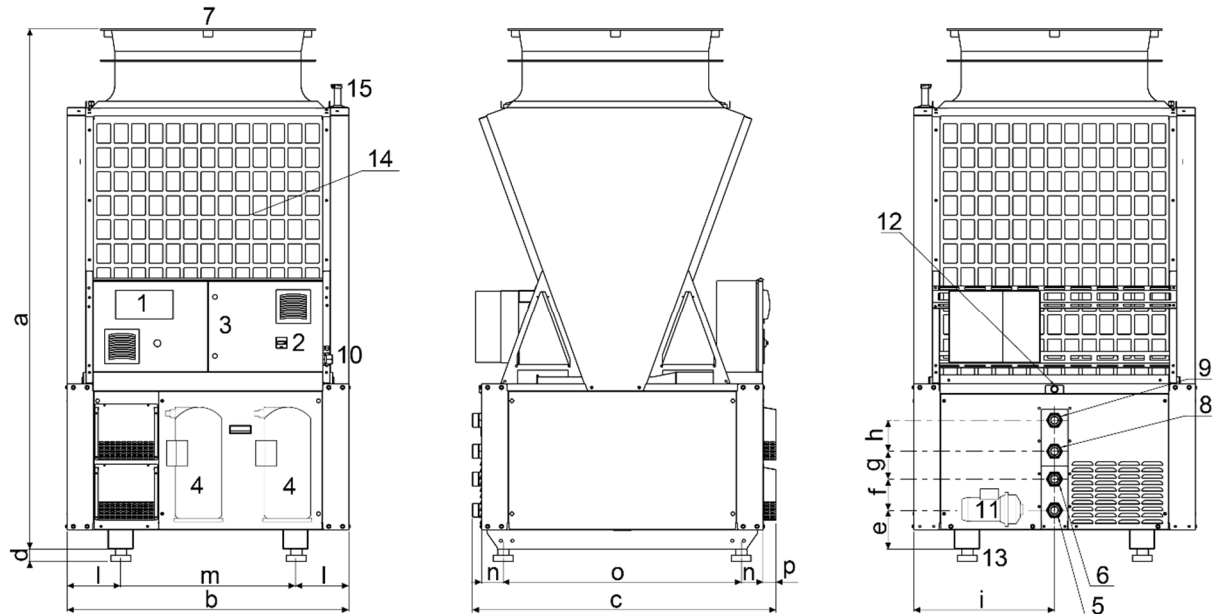
Evaporator glycol water outlet temperature	Minimum % glycol in weight	Minimum % glycol in weight
From -9,1°C to -10°C	35	37
From -8,1°C to -9°C	34	36
From -7,1°C to -8°C	33	34
From -6,1°C to -7°C	32	33
From -5,1°C to -6°C	30	32
From -4,1°C to -5°C	28	30
From -3,1°C to -4°C	26	28
From -2,1°C to -3°C	24	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

### 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



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

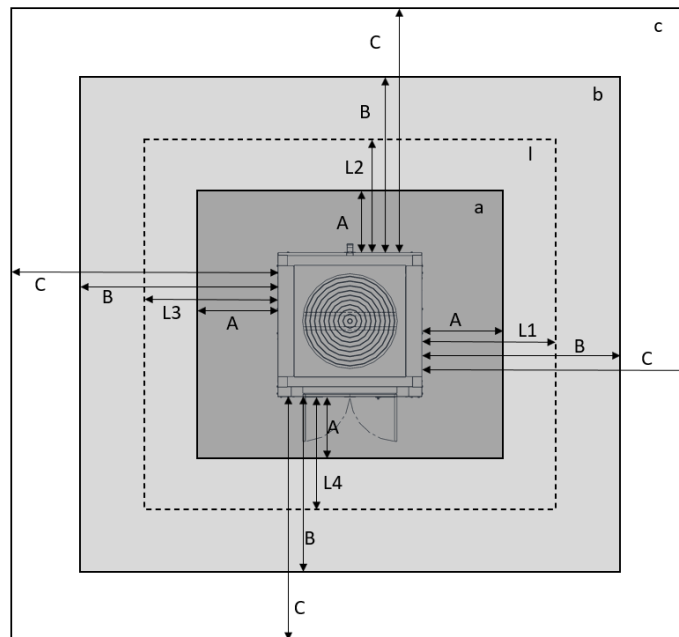
MODEL	10
a	2335
b	1224
c	1320
d	84
e	169
f	135
g	120
h	135
i	612
l	232
m	760
n	94
o	1036
p	55
Heat exchanger inlet/outlet connections	2" GM
DS/V3V Input/Output Connections	2" GM

### 3.24. NOTE

	<b>IMPORTANT!</b> Before installing the unit, check the noise limits allowed in the place where it will be used.
	<b>IMPORTANT!</b> 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> 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> 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.

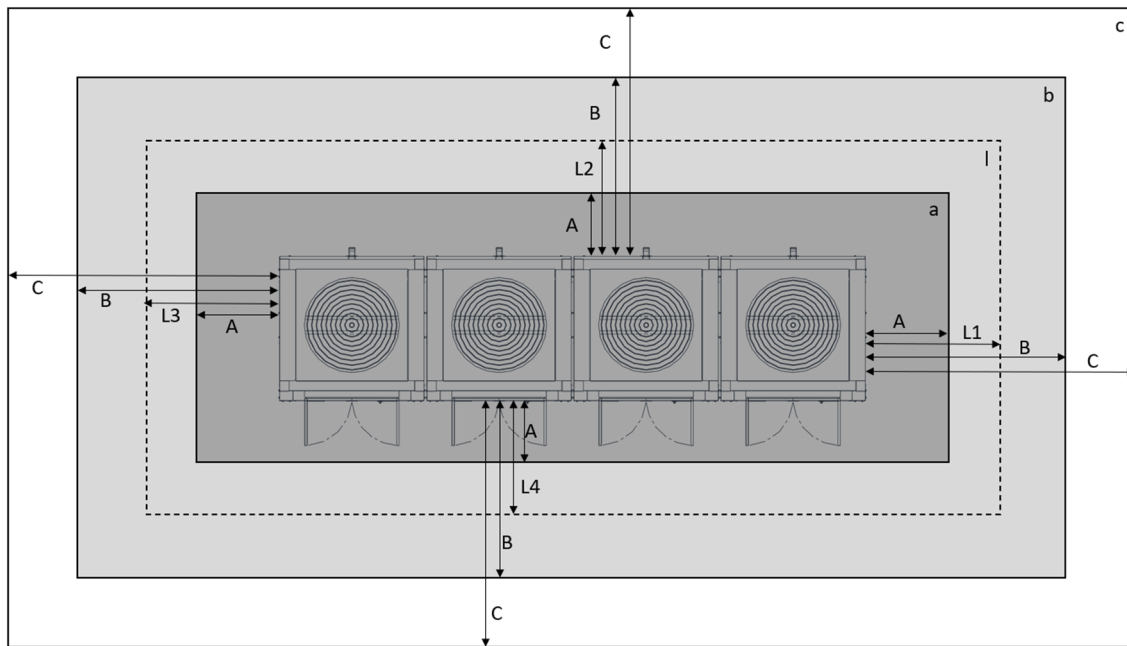
### 3.25. SPACES OF SAFETY, RESPECT AND POSITIONING

#### SINGLE UNIT





## UNIT GROUP



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

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

(\*) Minimum distance for removing the pumping unit.

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

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

The service area "I" must be free of obstacles to allow ordinary and extraordinary maintenance as well as the correct flow of air through the batteries. For the requirements concerning the safety areas "a", "b" and "c" please refer to the chapter "Installation" of this document.

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

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

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

### 3.26. LIFTING AND HANDLING



#### ATTENTION!

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.



#### ATTENTION!

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.



#### DANGER!

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.



#### DANGER!

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

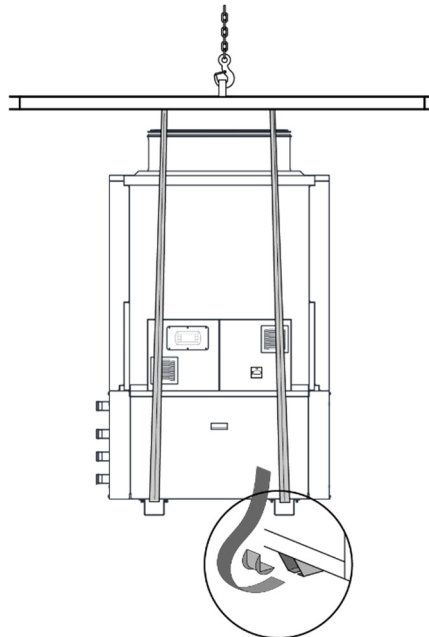
	<b>DANGER!</b> The unit must be transported and handled by skilled personnel trained to carry out this type of work.
	<b>IMPORTANT!</b> Be careful to prevent damage by accidental collision.
	UN 3358 - REFRIGERATING MACHINES containing flammable, non-toxic, liquefied gas.

### Packaging, components

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

### 3.28. HANDLING AND STORAGE

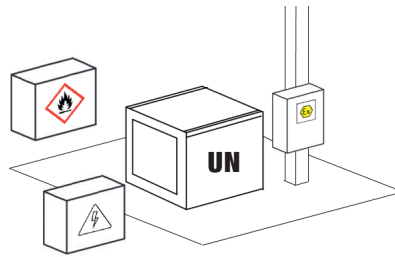
- o Movement of the unit must be performed with care, in order to avoid damage to the external structure and to the internal mechanical and electrical components.
- o Do not stack units.
- o The temperature limits for storage are: -20+50°C.
- o Remove the protective covers of the handling fans.
- o The position of the lifting belts must be checked according to the model and accessories installed.
- o During lifting and handling, check that the base of the unit always remains horizontal.



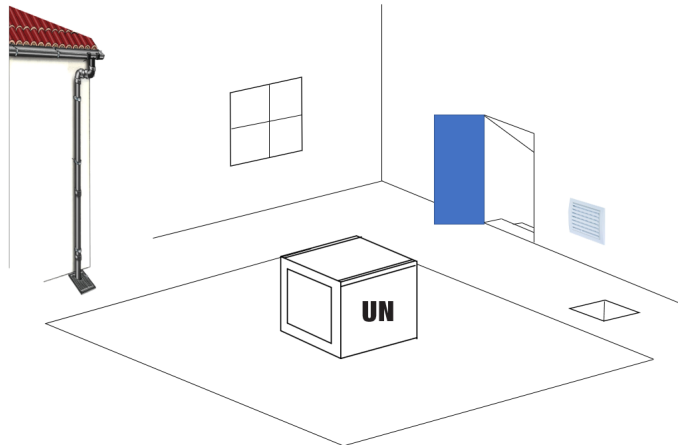
### 3.29. STORAGE CONDITIONS

The units cannot be stacked. The temperature limits for storage are: -20+50°C. Store in a non-condensing environment with relative humidity between 30-90%. In case of proximity to coastal areas provide appropriate protective measures.

The units must be stored only in an outdoor environment and respecting the minimum distance A equal to 0.5m (compliant with the safety area "a" as per paragraph "Safety spaces, respect and positioning") from any potential source of ignition, flames and heat sources.



In addition, they must be stored at a minimum distance B equal to 2.5m (compliant with the safety area "b" as per paragraph "Safety spaces, respect and positioning") from openings where dispersed gas could stagnate such as: ventilation systems, vents or ventilation ducts, entrance doors or windows, wells, gutters, drainage channels, wolf holes, trapdoors, staircases, openings towards the ground (sewers), hollows, spaces for piping passages, ducts or the like if not protected from the accumulation of flammable mixtures.



Refer to local regulations regarding the maximum quantity of units that can be stored (for example but not only fire prevention requirements).

For the maximum limit of transportable units comply with the indications of the ADR Agreement (SMI) : it is recalled that for refrigeration units containing flammable gases up to 12 kg of gas charge the ADR transport exemption applies (up to a total load of 333 kg of gas charge)

### 3.30. INSTALLATION

	<b>HAZARD!</b> Installation must only be carried out by skilled technicians, qualified for working on air conditioning and refrigeration systems. Incorrect installation can result in both a fire or explosion safety hazard and a malfunction of the unit resulting in significant drops in performance.
	<b>HAZARD!</b> The unit must be installed according to national or local standards in force at the time of installation.
	<b>HAZARD!</b> Some internal parts of the unit may be sharp. Use suitable personal protective equipment.
	<b>HAZARD!</b> 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>HAZARD!</b> The machine is designed for outdoor installation. Segregate the unit if installed in areas accessible to persons under 14 years of age.
	<b>IMPORTANT!</b> Incorrect positioning or installation of the unit may amplify noise levels and vibrations generated during operation.
	<b>HAZARD!</b> The upper part of the unit is not at any point walkable. It is absolutely forbidden to access it.

If the unit is not secured on the anti-vibration mountings (SAG or SAM), it must be firmly anchored to the floor once it is placed on the ground. The unit cannot be installed on brackets or shelving.

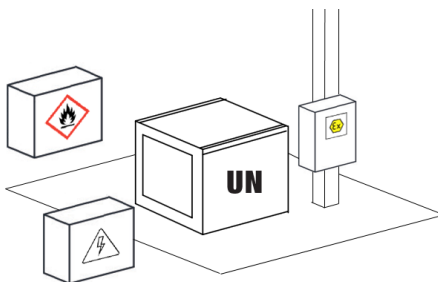
## Installation site requirements

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

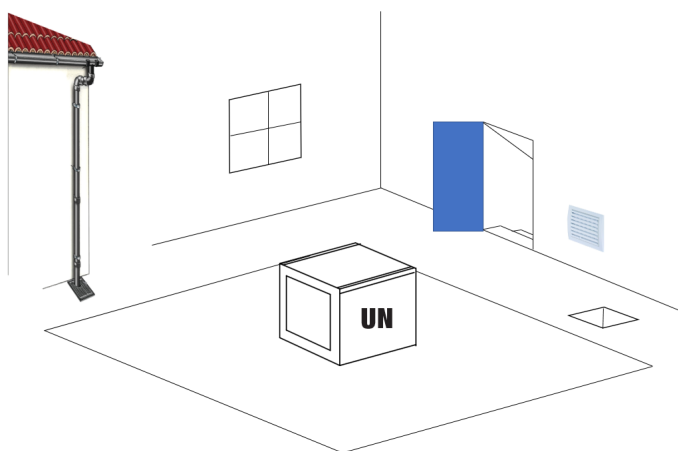
## Outdoor Installation

The machines are intended to be installed in a Class III location and with access category "a" (i.e. "generic access") according to EN 378-1. The machines are intended to be used only outdoors (open air as defined in Chapter 4.2 of EN 378-3) and in a site without obstacles to ventilation (minimum ground air speed greater than 0.15 m/s according to EN 60079-10-1; condition to be understood with the machine switched off and in the absence of other ventilation systems). The following installation requirements generally ensure compliance with the minimum requirements of EN378-3:

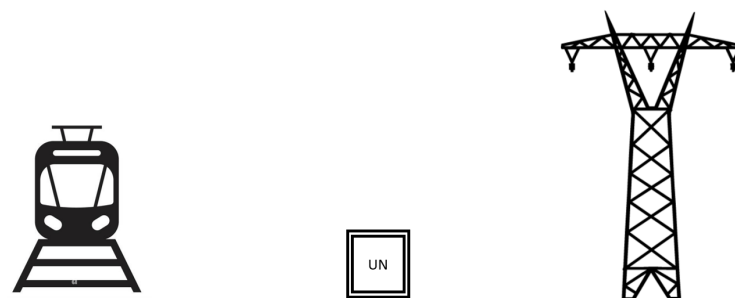
- Distance A equal to 0.5m (compliant with safety area "a" as per paragraph "Safety spaces, respect and positioning") from any ignition source; in this area only electrical or non-electrical equipment certified Ex according to Directive 2014/34/EU in category 3G for zone 2 for gas IIA -T2 is allowed



- In order that any gas leaks cannot accumulate in enclosed or local spaces, a minimum horizontal safety distance B of 2.5m must be provided (compliant with safety area "b" as per paragraph "Safety, compliance and positioning spaces") from openings where dispersed gas could stagnate such as: ventilation systems, vents or ventilation ducts, entry doors or windows, wells, drains, gutters, drainage channels, wolf holes, hatches, staircases, openings to the ground (sewers), hollows, spaces for pipe passages, ducts or the like 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 (compliant with safety area "c" as per paragraph "Safety spaces, respect and positioning") in plan projection from railway, tramway 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 you want to provide a structure, this structure must be adequately ventilated in order to prevent the formation of dangerous concentrations of refrigerant gas and produced with incombustible material;
- install under the ground floor or in underground rooms, basements or cavities;
- install in Ex areas or areas at risk of fire (paper mills, fuel depots or flammable materials, tyres, photovoltaic systems, thermal power stations);

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

### 3.31. INSTALLATION AND CONNECTION TO THE SYSTEM

- The unit is designed for outdoor installation.
- The unit is provided with 2" GM hydraulic connections on the water inlet and outlet of the air conditioning system
- Segregate the units if installed in areas accessible to persons under 14 years of age.
- The unit must be positioned respecting the minimum recommended technical and safety spaces, bearing in mind the accessibility to the water and electrical connections.
- The unit can be equipped with anti-vibration mounts upon request (SAG).
- Shut-off valves must be installed that isolate the unit from the rest of the system. Elastic connection joints and system/machine drain taps also need to be fitted.
- It is mandatory to install a square metal mesh filter (longest side = 0.8 mm) of adequate size and pressure drops on the unit return pipes

- However it is installed, the coil inlet air temperature (ambient air) must remain within the set limits.
- The water flow through the exchanger must not fall below the value corresponding to a temperature drop of 10 C (with all the compressors on) and in any case must comply with the limit values shown in the "Water flow limits" section.
- The unit cannot be installed on brackets or shelving.
- Correct installation and positioning includes levelling the unit on a surface capable of bearing its weight.
- During long periods of inactivity, it is advisable to drain the water from the system.
- The draining of the water can be avoided by adding glycol to the hydraulic circuit (see "Using brine solutions").
- The size of the expansion tank must be calculated by the installer depending on the system. In the case of models without a pump, the pump must be installed with a flow towards the machine water inlet.
- In the design of the system, it is necessary to take into account any stresses deriving from natural events (strong gusts of wind, seismic events, precipitation, including snow, flooding, etc.).
- Check the presence of a safety limitation to the thermal load present in the hydraulic circuit in the presence of alternative heat sources (boilers, resistors and the like) in order to prevent accidental openings of the safety valves located on the low pressure branch: the temperature of the hydraulic circuit must not reach the saturated temperature indicated in the table of safety valve settings.

#### NOTE

The space above the unit must be free from obstacles.

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

### 3.32. 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.

#### Identification of the type of refrigerant fluid used

- Propane (R290) CASNo: 000074-98-6

#### Main ecological information regarding the types of refrigerant fluids used

- Persistence, degradation and environmental impact

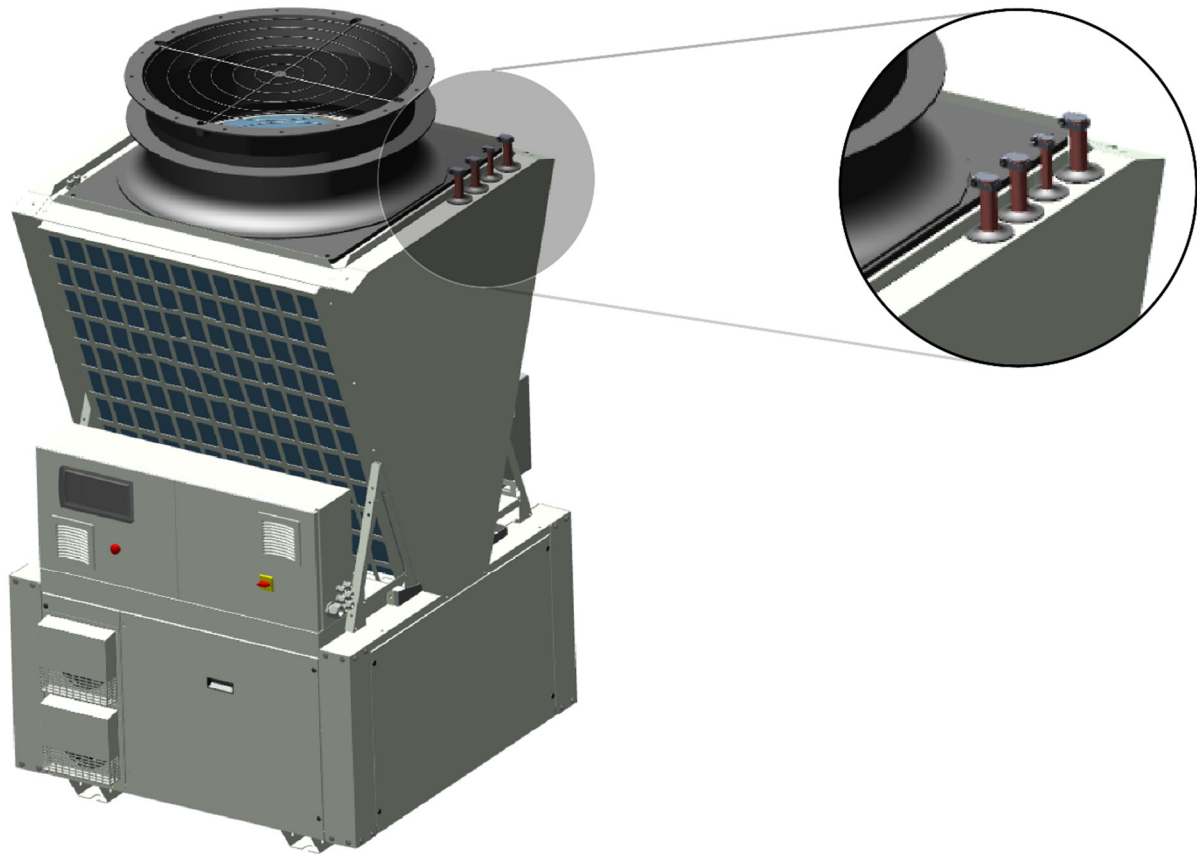
Refrigerant	Chemical formula	GWP (over 100 years)
R290	C <sub>3</sub> H <sub>8</sub>	0.02

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>), the flame propagation rate (0.7 m/s) and the 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 an auto-trigger 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

The unit must be installed following local regulations and standards (and in any case in compliance with standard EN 378-3). In the units charged with A3 gas, the system manager must evaluate the possible need to remotely discharge the safety valves so as to keep the gas from escaping in the event of the valves being triggered due to overpressure.

The ends of the safety valve drain pipes shall be protected from the ingress of water or atmospheric condensation and shall face upwards.



The following are the features of the safety valves used:

High pressure valve		
	Outlet diameter	Tripping pressure
<b>Size 10</b>	28mm ODS	40 bar

Low pressure valve		
	Outlet diameter	Tripping pressure
<b>Size 10</b>	18mm ODS	30.4 bar (saturated temperature 80°C)

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

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

### 3.33. GUIDELINES FOR THE INSTALLATION OF UNITS WITH R290 GAS - IN DEPTH

**DANGER!**  
Pay extreme attention when approaching the valves and deaerators of the hydraulic circuit even when the unit is disconnected; check the areas adjacent to the unit with an appropriate portable gas detector (of suitable sensitivity in accordance with current regulations such as EN 378-4 or rooms if more restrictive) to ensure the absence of 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, roofs or other installation floors that separate an environment from the external area where the machine is installed, or in the case of installations near facades or other elements that separate an environment from the area outside where the machine is installed, the risk that a fire generated within the environment will spread towards the machine and vice versa must be prevented. To this end, national or local fire prevention rules must be followed that provide for maintaining specific distances or that structures with certain characteristics are used (Example REI 30 or more effective according to the provisions of national or local legislation).

In the event that the risk assessment requires the adoption of the safety valve drainage channeling, it is recommended to follow the instructions given in the following paragraphs regarding the safety valve channeling. They must have a section and length compliant with national laws and European direc-

tives (the designer must comply, in sizing, with the requirements of EN 13136 in force), below is a standard installation table with indications of distances and diameters. 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.

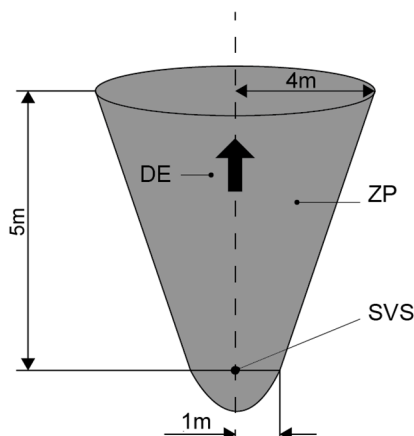
High pressure valves		Lenght [m]		
D10/CS		5	10	15
N° Curves	3	28	28	35
	6	28	28	35
	10	28	28	35

Low pressure valves		Lenght [m]		
D7/CS		5	10	15
N° Curves	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.

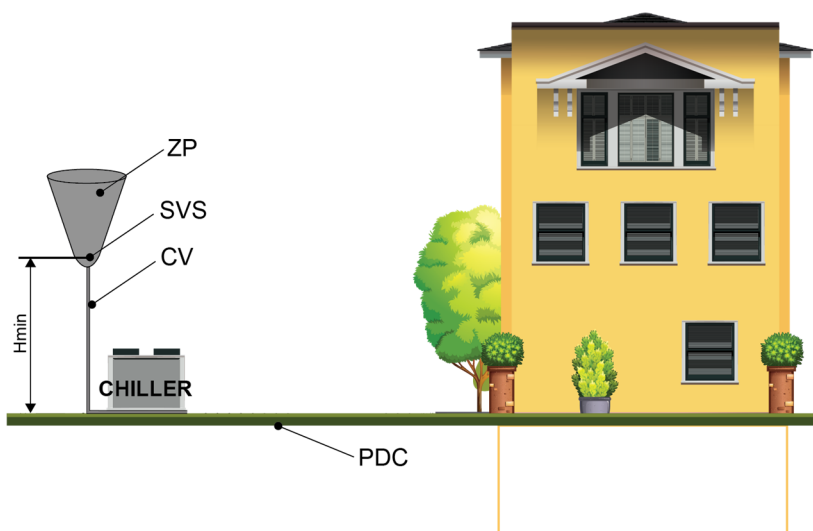
Tripping of the safety valve creates a danger zone near the exhaust where no device/structure should be present as it would modify the physical distribution of flammable gas and make it unpredictable. See the diffusion cones below.



<b>DE</b>	Direction of emission
<b>ZP</b>	Danger zone
<b>SVS</b>	Safety valve exhaust

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 above floor level to ensure the safety of persons.

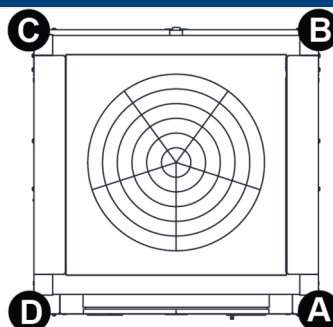




<b>Hmin</b>	Minimum height 3m
<b>ZP</b>	Danger zone
<b>SVS</b>	Safety valve exhaust
<b>CV</b>	Valve ducting
<b>PDC</b>	Treadable surface

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.

### 3.34. WEIGHT DISTRIBUTION



<b>UNION/SCULPTOR</b>		10
Weight		
(*)	kg	685
Support		
A	kg	218,9
B	kg	155,6
C	kg	129
D	kg	181,5

(\*) Weight of empty units

### 3.35. ACCESSORIES WEIGHTS

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

### 3.36. 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.

### 3.37. IDRAULIC CONNECTIONS

#### System connection

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

#### Condensate discharge

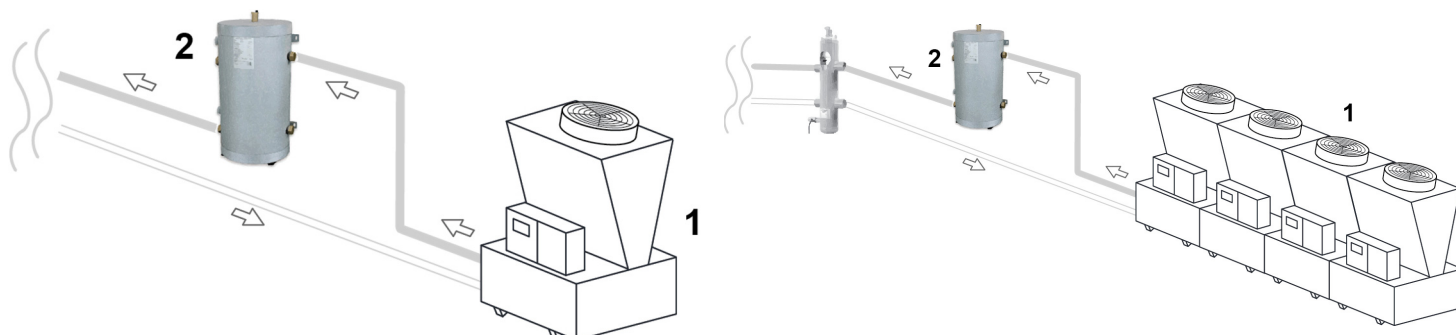
Models UNION/SCULPTOR have a base equipped with one drainage point to facilitate evacuation of condensation water. It is necessary to channel the condensation water drain and provide for the construction of a siphon filled with water to intercept any refrigerant leaks. When the outdoor temperature is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

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

#### Hydraulic set-ups

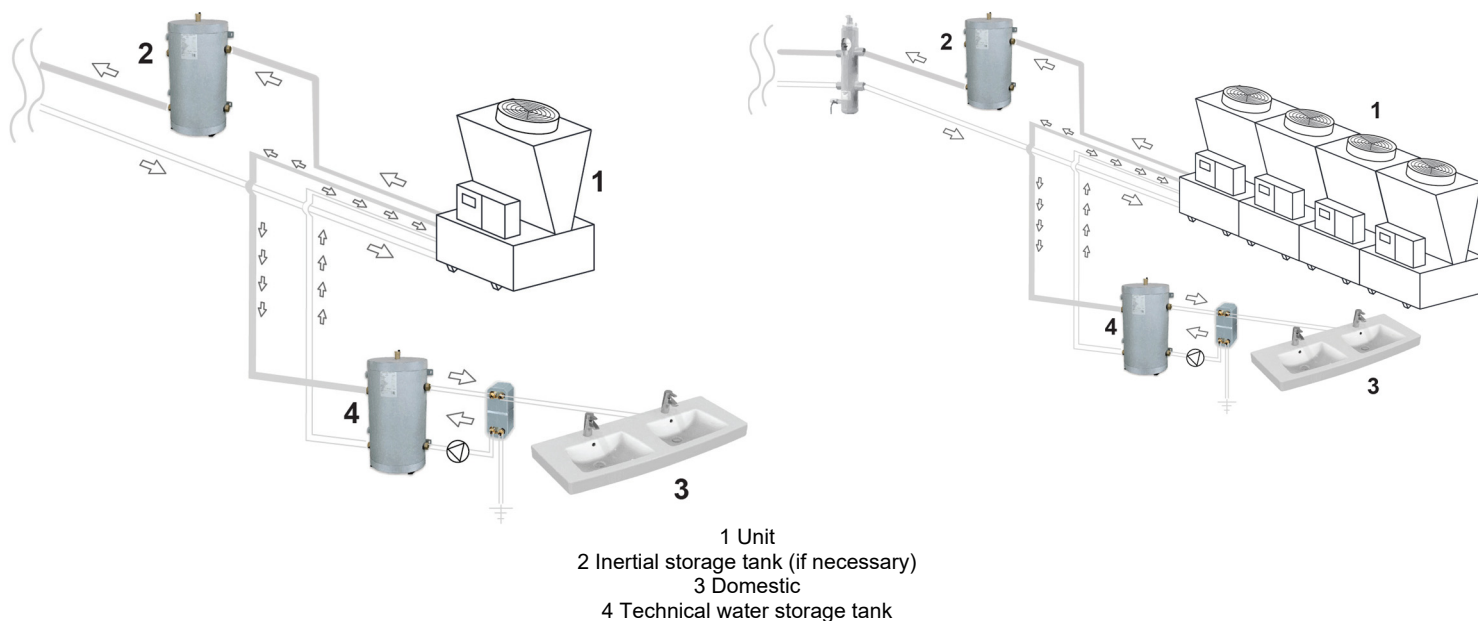
##### PUMP installation

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



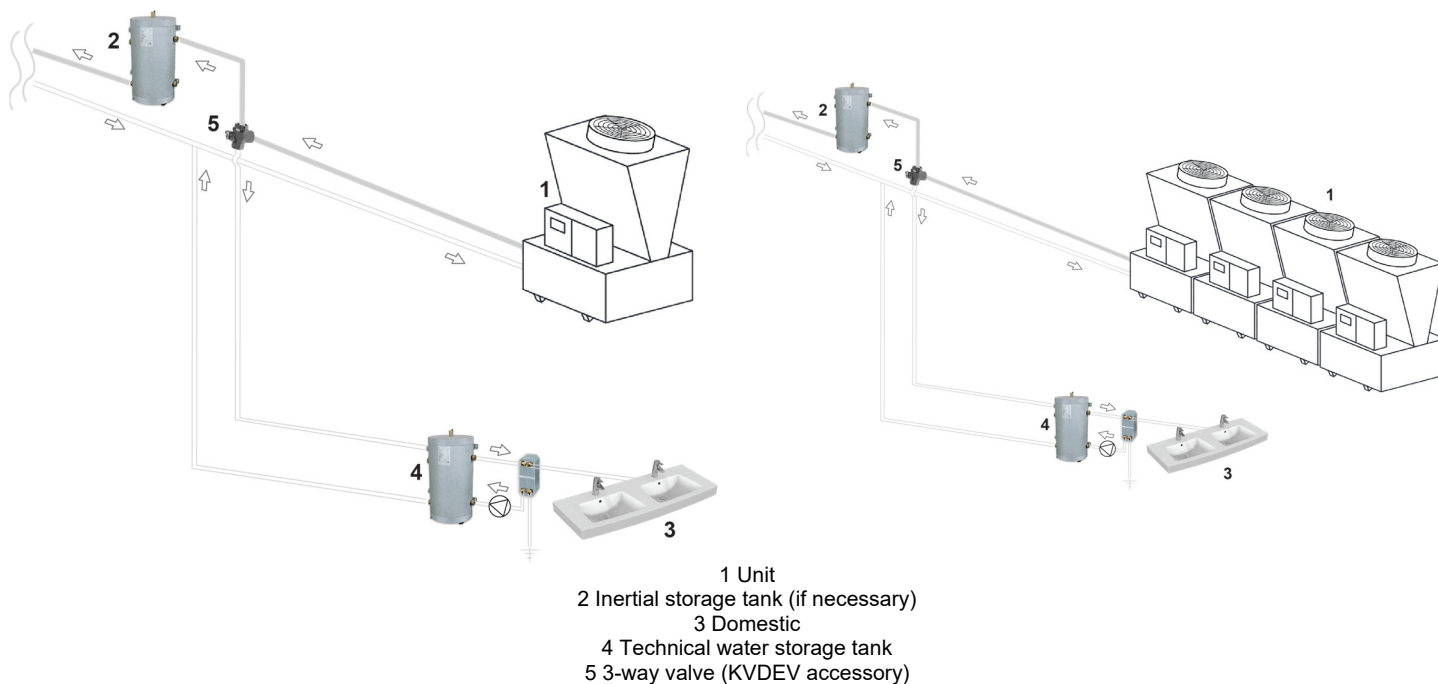
### Pump setup with the V3V accessory

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



### Applications and production of domestic hot water

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



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

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

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

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

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

How to manage the DHW request:

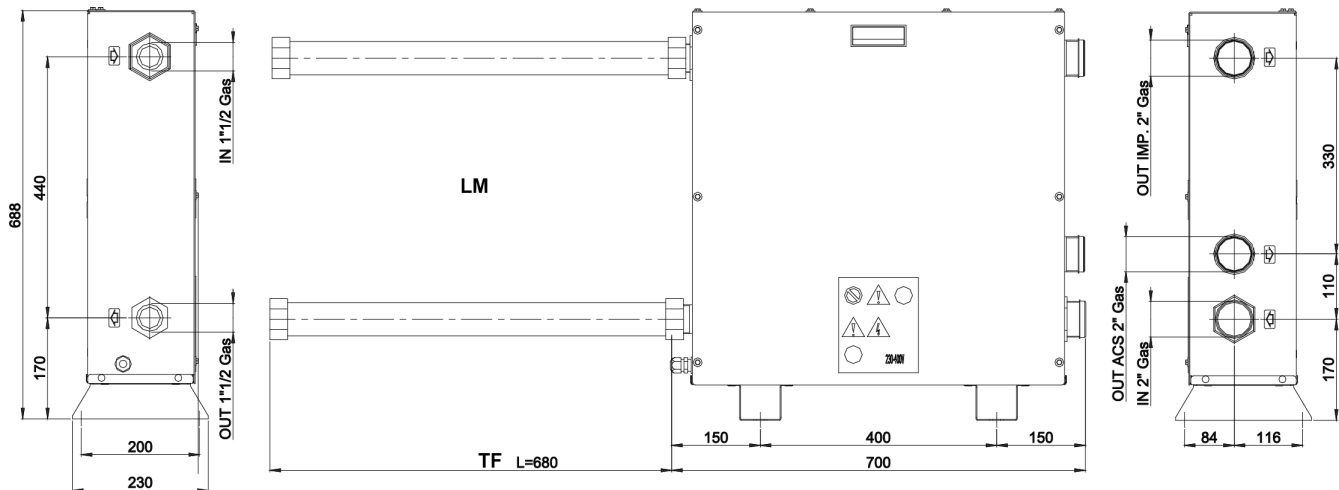
- by means of the digital input: the request is assigned by a thermostat assembled by the installer. When the thermostat closes, the unit understands that there is a DHW request and, once the conditions have been verified, the procedure is activated to meet the DHW requirements

- by means of a temperature probe in the storage tank: a temperature probe is placed inside the storage tank, which is directly connected to the unit's board. The required set point can be configured from the panel together with the relative activation differential In this case, the probe must be accurately positioned and the maximum distance allowed respected due to the type of probes used.

Type of probe:

description	type of probe	features	β (25/85)
NTC150	NTC HT150	50kΩ@25°C	3977 (±1%)
NTC	NTC	10kΩ@25°C	3435 (±1%)

Accessory KVDEV



LM Machine side  
TF Flexible hose

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

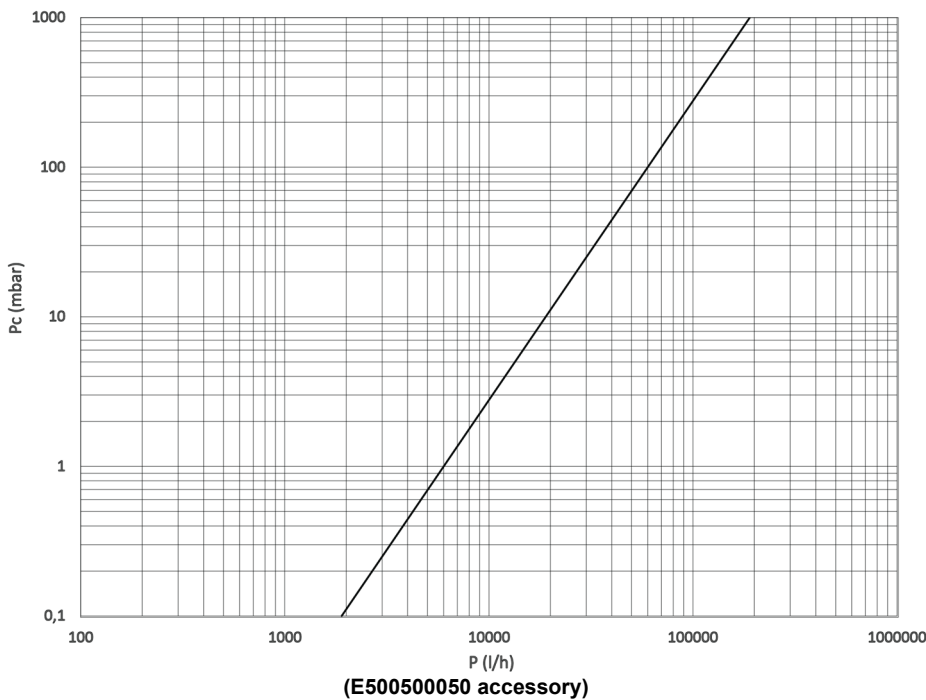
The kit includes two flexible pipes to connect the delivery and return of the unit.

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

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

Cable gland for wiring the power supply.

IP 54 rate



(E500500050 accessory)

## Electrical connection

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

### 3.38. MINIMUM HYDRAULIC CIRCUIT CONTENTS

To ensure the unit works correctly, the system needs a minimum volume of water. The minimum water content is determined on the basis of the unit's cooling or heating capacity (for heat pumps) in the design of the unit, multiplied by the coefficient expressed in 3 l/kW (\*). If the water content of the system is below the minimum value calculated, install an additional tank. However, remember that a high water content in the system always goes to the advantage of comfort in the room, as it ensures a high thermal inertia of the system

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

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

### Hydraulic data

Model		10
Heat exchanger water content	l	3,8
Minimum flow rate (water differential pressure switch intervention)	l/h	2800

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

### 3.39. 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 (HCO3)	70÷300	ppm
Electrical Conductivity	10÷500	µS/cm
Nitrate (NO3)	< 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.

### 3.40. PROTECTING THE UNIT FROM FROST

#### Indications for unit when not running



#### IMPORTANT!

If the unit is not used during the winter period, the water contained in the system may freeze.



#### IMPORTANT!

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.



#### IMPORTANT!

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).



#### IMPORTANT!

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



#### IMPORTANT!

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.

## 3.41. 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.

## 3.42. INFORMATION ON THE ACCESSORIES

### 3.42.1. APPLICATIONS FOR PARTIAL (DS) RECOVERY AND DHW PRODUCTION

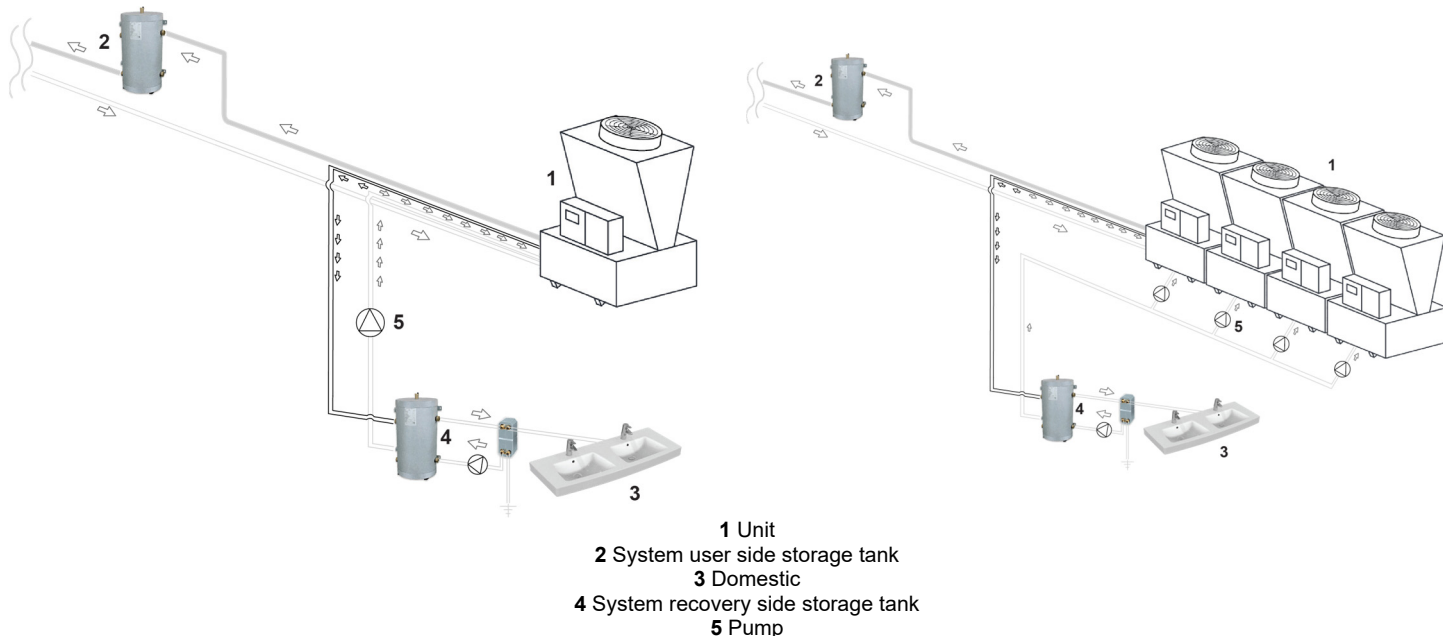
#### Overview

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

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

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

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



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

#### Chiller

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

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

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

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

### Activation and deactivation of DS

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

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

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

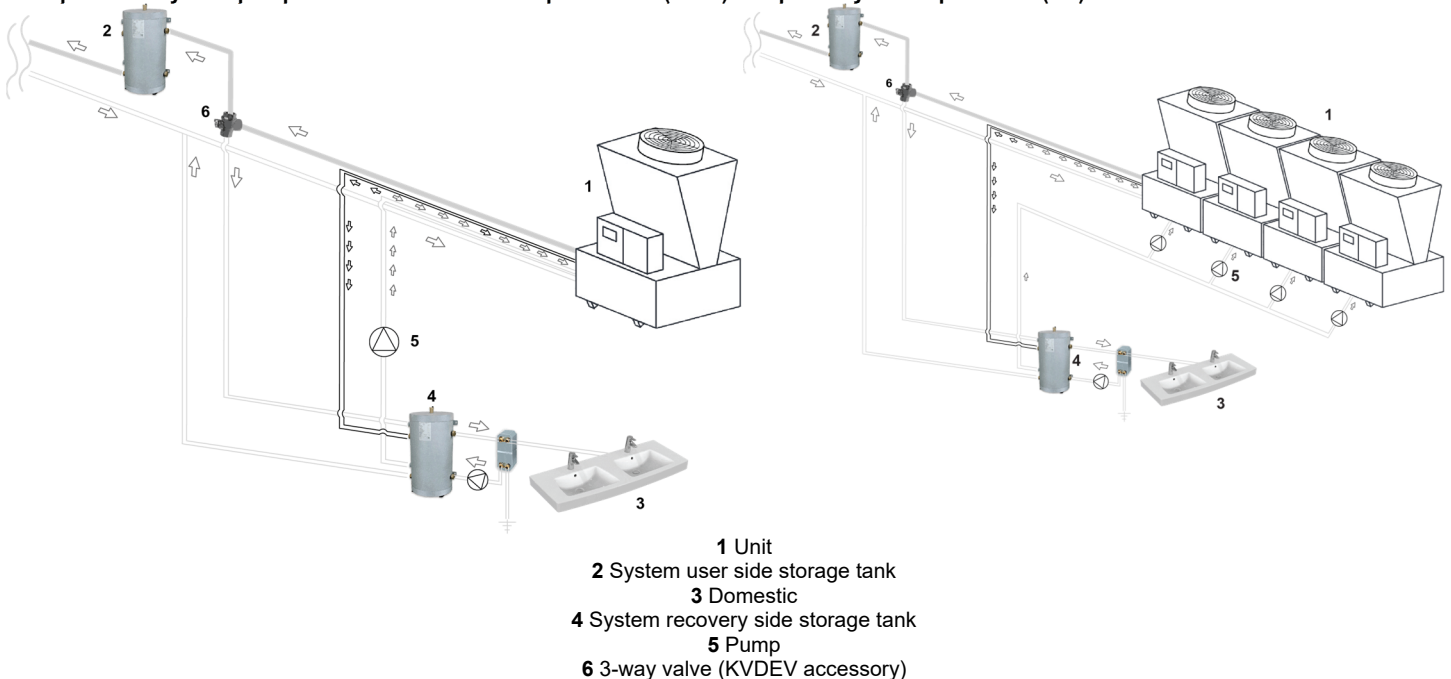
Alternatively, heat recovery management can be carried out by means of a temperature probe in the storage tank (STDS): a temperature probe connected directly to the unit board is inserted in the storage tank. The required set point can be configured from the panel together with the relative activation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

The software manages two types of probe selectable from the keyboard

description	type of probe	features	$\beta$ (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

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



With this type of system, the main circuit of the heat pump produces DHW (winter season) or DCW (summer season) for the user. The unit can be set up with pumps as an alternative to the traditional solution that sees them installed in the system. For the production of DHW by using the heat pump, use a technical water storage tank, which cannot be used directly for human consumption, and combine it to a DHW producer/intermediate heat exchanger. Should a 3-way valve system be envisaged, it can manage production of hot water to the DHW circuit in both the summer and winter seasons. In fact, the valve enables water flow deviation from the system to the technical water storage tank for the system to produce DHW for domestic use (domestic hot water diverter valve CACS consent + domestic hot water valve VACS control).

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

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

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

How to manage the DHW request:

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



The software manages two types of probe selectable from the keyboard

description	type of probe	features	$\beta$ (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

### 3.42.2. MANAGEMENT OF AN INTEGRATIVE SOURCE AND AUXILIARY GENERATOR

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

#### Integrative thermal source

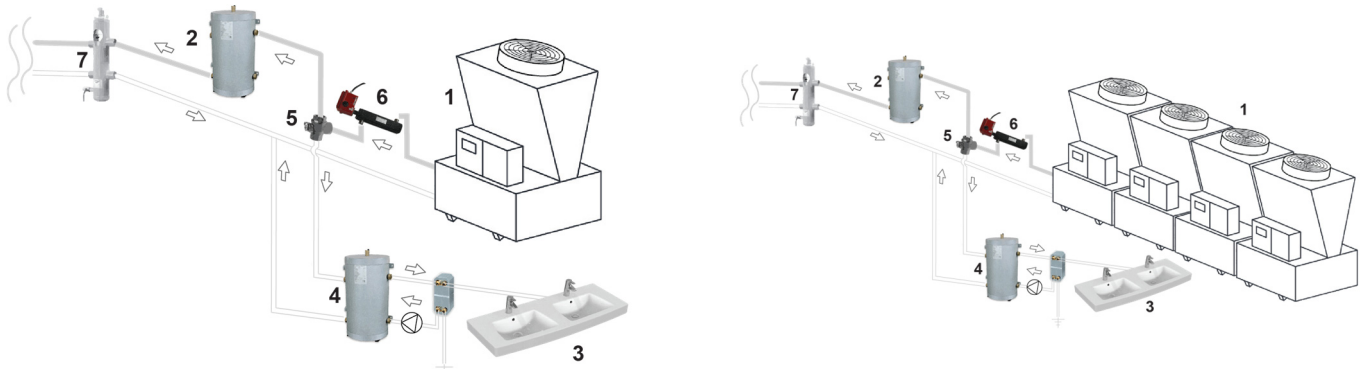
An integrative thermal source is an electrical resistance that runs together with the heat pump in winter mode. By means of the unit's control, it is possible to control start-up and switch-off according to the different variables: outdoor air temperature, delay in reaching the set-point set due to a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

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

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

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

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



- 1 Unit
- 2 Inertial storage tank
- 3 Domestic
- 4 Technical water storage tank
- 5 3-way valve (optional)
- 6 Electric heater
- 7 Hydraulic circuit breaker

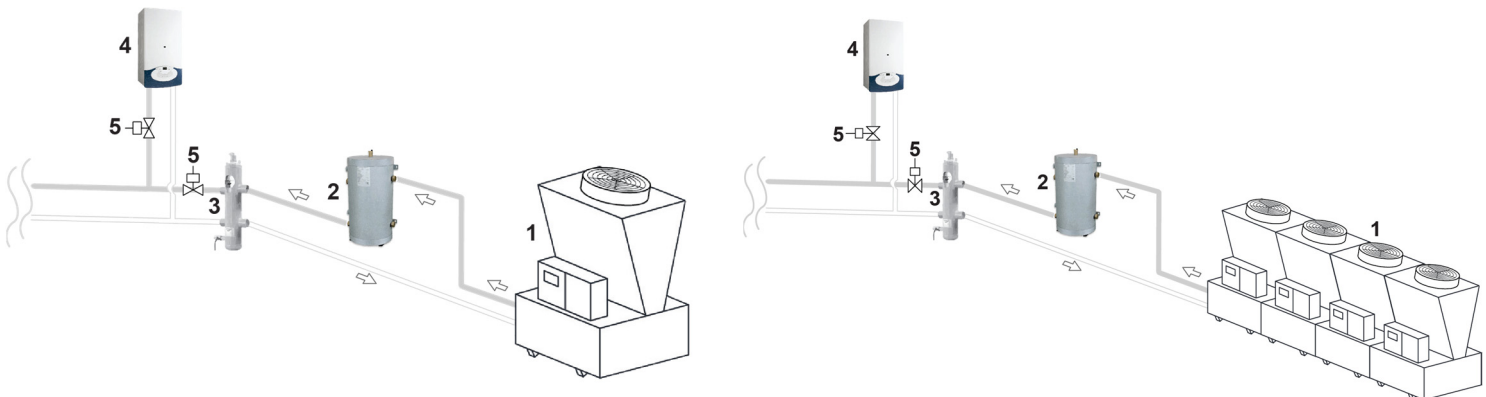
#### Auxiliary thermal source

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

#### Operation of the auxiliary source.

The auxiliary generator can be activated according to three modes:

- manually;
- for an outdoor temperature set point;
- for a convenience criterion based on the costs of electricity and fuel (methane and butane);
- for heat pump malfunction.



- 1 Unit
- 2 Inertial storage tank
- 3 Hydraulic circuit breaker
- 4 Boiler
- 5 Shut-off components not managed

### 3.42.3. EEM ACCESSORY - ENERGY METER

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

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

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

### 3.42.4. FDL ACCESSORY - FORCED DOWNLOAD COMPRESSORS

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

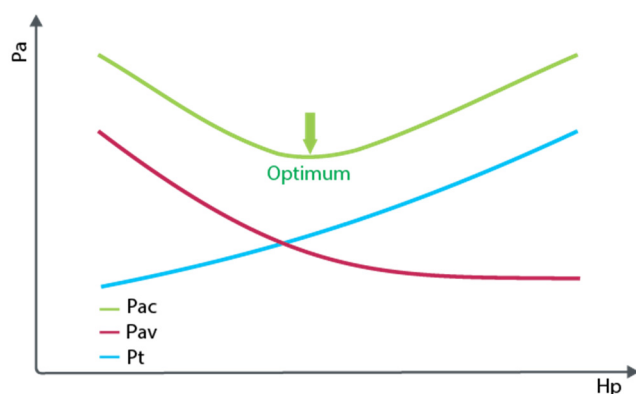
Activation of the function, which can be enabled and configured from the unit's display, can be done by means of a digital signal (dry contact), by means of daily time slots or via BMS.

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

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

### 3.42.5. EEO ACCESSORY – ENERGY EFFICIENCY OPTIMIZER

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



<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

### 3.42.6. LKD ACCESSORY - LEAK DETECTOR

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

If a refrigerant leak is detected, the unit immediately shuts off the power supply to all components, except the leak detector 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 the hydraulic circuits with a safety valve. Safety valve drains must be piped to the outside in free air free from sources of ignition and never in confined spaces.

### 3.42.7. ACCESSORY SG - SMART GRID CONTACTS

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

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

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

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

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

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

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

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

Reduced mode:

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

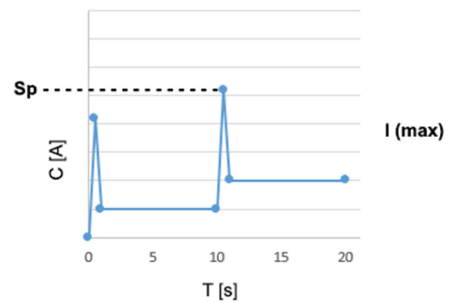
### 3.42.8. SFS ACCESSORY - SOFT STARTER

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.

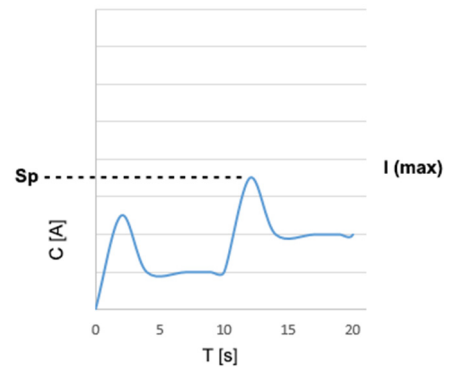
#### Inrush current - without SFS

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



#### Inrush current - with SFS

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



### 3.43. ELECTRICAL CONNECTIONS

	<b>DANGER!</b> 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> 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> 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. AIT 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> 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> 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> 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 =  $(388+379+377) / 3 = 381V$   
Maximum deviation from the average =  $388-381 = 7V$   
Unbalance =  $(7 / 381) \times 100 = 1,83 \%$  (acceptable as it is within the envisaged limit).



**IMPORTANT!**  
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.

### 3.44. 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 accessory). Use and installation of the remote control systems are described in the Instruction Sheets provided with the same.

### 3.45. START-UP

#### 3.45.1. NOTE



**IMPORTANT!**  
Machine commissioning or the first start up (where provided for) must be carried out by skilled personnel from workshops authorised by AIT, qualified to work on this type of products.



**IMPORTANT!**  
The use and maintenance manuals of the fans and any safety valves are enclosed with this manual and should be read in their entirety.



**DANGER!**  
Before starting, make sure that the installation and electrical connections have been carried out in accordance with the indications in the wiring diagram. Make sure that all safety devices that can be inspected (e.g. microswitches) are present and working correctly. Also make sure that there are no unauthorized persons near the unit during the above operations.



**DANGER!**  
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.



**IMPORTANT!**  
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.



**DANGER!**  
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.



**DANGER!**  
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.



**DANGER!**  
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.

#### 3.45.2. INSTRUCTIONS 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 electrical supply must comply with the specifications on the data plate and/or the wiring diagram and it must fall within the following limits:
  - variation of the supply frequency  $\pm 1\%$  of the nominal;
  - variation of the power supply voltage:  $\pm 10\%$  of the nominal voltage;
  - imbalance between the 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 circuit breaker by turning it to zero, 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 P.P.E. - P.P.E. and check that the power supply and contactor terminals are tightened (they may loosen during transport, this would lead to malfunctions).



**IMPORTANT!**  
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 and safety spaces foreseen by 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		

**The general conditions of the unit are compliant!**

### Checking 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		

**The general conditions of the unit are compliant!**

(\*) 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		

**The water connections are compliant!**

### Checking safety valve connections

#### START

Has the discharge of the safety valves been channelled?	▶	NO	▶	Perform the connection of the discharge of the safety valves according to what is reported in the paragraph <i>Indication for the installation of the machines</i>
▼ YES				
The diameter, length and curves comply with the parameters shown in the table of paragraph <i>Indication for the installation of the machines</i>	▶	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 connection is 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 AIT 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 AIT 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 AIT 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 AIT Service Center.
YES		

## Start-up procedure completed!

### Verification of the electrical connection for the management of groups of units

#### START

Does the unit need to be connected to the AIT integrated sequencer?	NO	No operation
YES		

Complete the electrical connection of all the units and configure the application according to the instructions given in the control manual

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

##### START

Ask all unauthorised personnel to leave the area

**Intervention test:** use the water gate valves to reduce the flow to the evaporator

Is the water differential pressure switch activated correctly? **NO** Check and/or replace the component

**YES**

Is the working pressure reading correct? **NO** Stop the unit and check the cause of this anomaly

**YES**

Check the alarm history for refrigerant leakage events. If you take the pressure on the high pressure side to approx. 8 bar, are there gas leaks of >3 grams/year? **YES** Stop the unit and check the cause of the leak (according to EN 378-2)

**NO**

Does the unit display feature any alarms? **YES** Check the cause of the alarm. See alarm table

**NO**

**Start-up procedure completed!**

### 3.45.3. 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
- low pressure safety valve
- Ex leak 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 or flow switch

Pressure switch	Intervention	Rearmament
high pressure	34 bars	28 bar - MANUAL
water differential	37 mbar	25 mbar - Automatic
high pressure safety valve	40 bar	-
low pressure safety valve	30,4 bar (saturated temperature 80°C)	-



#### DANGER!

The safety valve on the high pressure side is calibrated at 40 bar. It could intervene if the calibration value was reached during the refrigerant charging operations, inducing an outburst that can cause fire, burns or injuries, even of a mechanical type (as well as the other valves in the circuit).

#### Operation of components

##### Compressor functioning

Fixed Scroll compressors are equipped with internal thermal 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 fixed compressors are equipped with a magneto-thermal switch with auxiliary trip signaling contact connected to the electronic 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. If the antifreeze alarm is triggered, this must be reset through the control panel. The unit starts up again only when the water temperature exceeds the triggering difference. 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**

measures low pressure generating the relative alarms and 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, such as an automobile without parts subject to wear and tear under normal operating conditions. It should also be checked that the environment in which the unit is to operate does not compromise its operation (examples: the unit near a cement factory could have dust problems which will obstruct the exchange coils which must be cleaned effectively every 6 months, unit installed near vegetation which could block the fan directly with the wind or through foliage). Below is an overall table with the required timing.

### Safety chain operation

During start-up, the Ex leak detector requires a pre-heating time of approximately 2 minutes during which it keeps the ventilation system activated: wait for the alarm signal to return before carrying out any operation.






At the end of this phase, the sensor carries out a real-time reading of the concentration of refrigerant and, in the absence of leaks, gives consent for the start-up of the unit control board.

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; moreover, the alarm relay is activated towards the control board and towards the optical/acoustic red light indicator on the door of the electrical panel; in this phase power is cut off to all the electrical components present in the unit with the exception of those of the EX type responsible for safety actions.


	<b>IMPORTANT!</b> Keep the unit properly powered to avoid disabling the safety systems.
	<b>IMPORTANT!</b> The diffusion of other gases near the unit could cause false alarms, compromising the effectiveness of the safety systems.

## 3.46. MAINTENANCE

### 3.46.1. NOTE

	<b>DANGER!</b> Before starting any operation, 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>IMPORTANT!</b> Maintenance operations must be carried out exclusively by qualified personnel of the AIT authorized workshops, qualified to operate on this type of product. Pay attention to the hazard warnings in this manual and those placed on the unit. Use the personal protective equipment required by the laws in force and designed to prevent the risks, including residuals, indicated in this manual. Pay close attention to the indications on the machine. Use <b>EXCLUSIVELY</b> original AIT spare parts.
	<b>IMPORTANT!</b> Always adopt the personal protective equipment required by law and designed to prevent even residual risks indicated in this manual (goggles, headphones, gloves, etc.)
	<b>DANGER!</b> Always act on the general automatic switch placed to protect the entire system before any maintenance operation, even if purely for inspection purposes. Check that no one accidentally feeds the machine, for example with the L.O.T.O. or equivalent, lock the main circuit breaker in the zero position.
	<b>DANGER!</b> Pay attention to high temperatures near the compressor heads and the flow pipes of the cooling circuit.

### 3.46.2. ROUTINE MAINTENANCE


	<b>IMPORTANT!</b> Provide for mandatory checks and inspections in accordance with EN 378-4.
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Periodic check of remediation fans (filter cleaning check and flow rate check)

Leak detector control and calibration (follow supplier manual instructions)

Zone	Type of sensor	Calibration intervals
2	Electrochemical cell / Pellistor	6 months
2	Infrared	12 months

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



**DANGER!**  
The refrigerant leak detector is a safety component that must be periodically maintained according to the Manufacturer's instructions: refer to the instructions in 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 operating conditions of the refrigeration circuit (overheating, undercooling and high and low pressure).
Visual check of the finned exchanger and fans.
Visual check of compressor oil levels where required.
<b>Every six months</b>
Cleaning and general verification of the unit: Every 6 months the general washing must be carried out and the state of the machine checked. Any points where corrosion is starting need to be touched up with protective paint.
Finned batteries: The coils must be kept clear from any obstructions. If needed, they must be washed with detergents and water. Brush the fins gently to keep them from being damaged.
Fans: In the case of installation with harsh operating conditions, increase the frequency of the 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: Besides checking the various electrical devices, the electrical insulation of all the cables and their correct tightening on the terminal boards must be verified, paying special attention to the earth connections.
Check the power consumption of the unit.
Check gas charge and humidity in the circuit (unit at full capacity): Check for bubbles in the liquid sight glass and dry color on the indicator
Verify that there are no gas leaks: For this check, refer to the regulations in force according to the quantity of equivalent C02
Vent any air pockets from the chilled water system only if a portable refrigerant leak detection system is in place to check for the possible presence of flammable mixtures.
Check for the presence of water in the siphons relating to the hydraulic circuits, condensate drain, wells, etc. as a restriction on the circulation of any flammable mixtures.
<b>Annual checks</b>
Exchangers; Any fouling of the exchangers can be detected by measuring the pressure drop between the unit inlet and outlet pipes using a differential pressure gauge.
The refrigerant leak detector is a safety component: carry out the calibration according to the Manufacturer's instructions (refer to the documentation supplied with the unit)
Panel and technical compartment safety fans (Ex): in the case of installation with harsh operating conditions, increase the frequency of the checks. 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.
<b>Seasonal machine stop</b>
Emptying the water system (if necessary): Emptying is necessary in case 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





**DANGER!**  
Pay attention to the lugs and edges of the battery.

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.

## Cleaning fans

	<b>DANGER!</b> 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 for a suitable stopping time, in any case not less than 3/5 minutes.
	<b>DANGER!</b> 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.



Check the fan grids making sure they are not obstructed by any objects and/or filth. The latter in addition to drastically reducing the overall performance of the machine, in some cases they can lead to the breakage of the fans and the compromise of the safety ventilation system Ex.

## Checking compressor oil level

	<b>IMPORTANT!</b> Do not use the unit if the oil level in the compressor is low.
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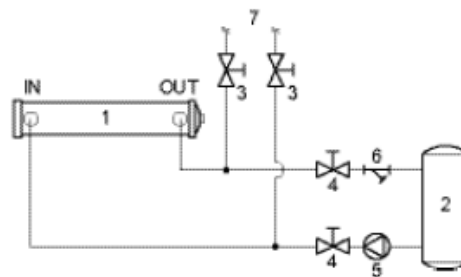
The units are equipped with a warning light for checking the oil level in the equalization pipe located at the bottom of the compressors. The lubricating oil level in the compressor can be checked by means of the sight-glass. The oil level in the sight-glass can be inspected while all compressors are 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> The acids used for washing the heat exchangers are toxic. Use suitable personal protective equipment.
	<b>IMPORTANT!</b> 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 reservoir |
| 3 | Cut-off gate valve      |
| 4 | Auxiliary cock          |
| 5 | Wash pump               |
| 6 | Auxiliary filter        |
| 7 | User                    |

### 3.46.3. 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> Maintenance is reserved exclusively for skilled personnel from workshops authorised by AIT, qualified to operate 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 AIT spare parts.
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Control	Frequency	Notes
Fans	Every 6 months In the case of installation with harsh operating conditions, increase the frequency of the control.	Make sure the motors and fan blades are clean and that there are no abnormal vibrations.
Electric motor of fans	Every 6 months In the case of installation with harsh operating conditions, increase the frequency of the control.	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 AIT workshops, qualified to operate on this type of products.
Check the functionality of the automatic deaerator (not supplied in the unit and by the installer)	Every 6 months	
Draining the water system (if necessary)		If the unit is idle during winter months, it must be emptied. Alternatively a glycol mixture can be used according to the information reported in this manual.


**DANGER!**  
 Before starting any operation, take extreme care when approaching the unit even if it is disconnected; check the areas surrounding the unit with an appropriate portable gas detector (of suitable sensitivity in accordance with current regulations such as EN 378-4 or rooms if more restrictive) to ensure that there is no leakage of refrigerant.

## 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 AIT 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. A check of the absence of any gas leaks is mandatory before returning the unit to normal operating conditions.




### 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. Fluid should not be discharged into the atmosphere. 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.

### 3.47. DISMANTLING THE UNIT

	<b>SAFEGUARD THE ENVIRONMENT!</b> 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>DANGER!</b> 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.
	<b>DANGER!</b> 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. Keep the heating elements active during draining operations to promote evaporation and evacuation of the refrigerant.












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;
- 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.

 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 AIT 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.

### 3.48. 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 Cardboard corner pieces		PAPER COLLECTION
Bottom paper support		PAPER COLLECTION
Various metals/cardboard and paper		PAPER COLLECTION + METAL COLLECTION
Plastic bags		PLASTIC COLLECTION
Clips Straps Packaging tape		PLASTIC COLLECTION
Expanded polyethylene / polyethylene corner pieces Adhesive protective film Flexible film Plastic protective elements		PLASTIC COLLECTION
Polystyrene elements		PLASTIC COLLECTION
Pallet, wooden boards, wooden crates		SEPARATE WASTE COLLECTION
Iron brackets, metal staples, stainless steel screws and washers, galvanised steel plates		METAL COLLECTION

\* Check the disposal methods with your local municipality

### 3.49. 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 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 functional limits of the unit
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 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 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 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 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 2. detect and eliminate any leaks
Damaged heat exchanger (in cooling mode)	1. check 2. replace
Irregular operation of the expansion valve	1. check operation 2. clean the nozzle 3. adjust overheating 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.