WiSAN-P

14.1 - 30.2

Manual for installation, use and maintenance

en

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R-290

Dear Customer,

Congratulations for choosing this product

Clivet has been working for years to offer systems able to assure the maximum comfort for a long time with highly-reliable, efficient, high-quality and safe solutions.

The target of the company is to offer advanced systems, that assure the best comfort and reduce energy consumption as well as the installation and maintenance costs for the entire life-cycle of the system.

With this manual, we want to give you information that is useful for all phases: from reception, installation and use to disposal - so that such an advanced system can provide the best performances during installation and use.

Best regards and have a good read.

CLIVET Spa

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1. General safety considerations

Before any work read:

- **Safety specifications for flammable refrigerants chapter**

The following symbols are used in some parts of the product:

Symbols present	
Caution danger Flammable material	Caution danger Explosive material
	
Caution danger Area where an explosive atmosphere may form	Caution danger Hot surfaces
	
Caution danger Low temperature / freezing	Caution danger Pressure vessels
	
Caution danger Power voltage	Caution danger Slippery surfaces
	
Caution danger Sharp elements	Ignition-proof ATEX component
	
Prohibition No naked flames: Fire, ignition sources and smoke are prohibited	Prohibition No smoking
	
Prohibition Do not remove the protection with moving parts	Prohibition No hot work
	

Pay particular attention to:

- **warnings / prohibitions / danger indicating particularly important operations or information, operations that cannot be done, which compromise the functionality of the unit or which may cause damage to things or persons.**

1.1 Safety.

Operate in compliance with safety regulations in force.

To carry out the operations use protection devices:

gloves, goggles, helmet, headphones, protective knee pads.

All operations must be carried out by personnel trained on possible risks of a general nature, electrical and deriving from operating with equipment under pressure.

Only qualified personnel can operate on the unit, as required by the regulation in force

1.2 Manual.

The manual provides correct unit installation, use and maintenance.

It is advisable to read it carefully so you will save time during operations.

Follow the written indications so you will not cause damages to things and injuries people.

The manual must be delivered to the User.

1.3 Risk situations

The unit has been designed and created to prevent injures to people.

At the design stage, it was not possible to fully eliminate all the risks.

Read the “Residual risks” section, which outlines potentially hazardous situations for property and people.

Installation, starting, maintenance and repair required specific knowledge; if they are carried out by inexperienced personnel, they may cause damages to things and injuries people.

1.4 Intended use.

Use the unit only:

- for cooling/heating water or water-glycol
- within the limits defined in the technical bulletin and in this manual.

The manufacturer accepts no responsibility if the equipment is used for any purpose other than the intended use.

- **It is not intended for use in domestic settings.**
- **Any such use is considered unsuitable.**
- **Any damage caused by such a use is not covered by the warranty.**

1.5 Installation.

▶ Outdoor installation

The positioning, hydraulic system, refrigerating, electrics and the ducting of the air must be determined by the system designer in accordance with local regulations in force.

Follow local safety regulations.

Verify that the electrical line characteristics are in compliance with data quotes on the unit serial number label.

1.6 Maintenance.

Plan periodic inspection and maintenance in order to avoid or reduce repairing costs.

Turn the unit off before any operation.

1.7 Modifications.

All unit modifications will end the warranty coverage and the manufacturer responsibility.

1.8 Fault or malfunction.

Disable the unit immediately in case of breakdown or malfunction.

Contact a certified service agent.

1.9 User training.

The installer has to train the user on:

- Start-up/shutdown
- Set points change
- Standby mode
- Maintenance
- What to do/what not to do in case of failure.

1.10 Data update.

Continuous product improvements may imply manual data changes.

Visit manufacturer web site for updated data.

1.11 Translation of original instructions

The original instructions are written in Italian.

All other languages are translations of the original instructions.

2. Indications for the User

Keep this manual with the wiring diagram in an accessible place for the operator.

Note the unit data label so you can provide them to the assistance centre in case of intervention (see “Unit identification” section).

Provide a unit notebook that allows any interventions carried out on the unit to be noted and tracked making it easier to suitably note the various interventions and aids the search for any breakdowns.

2.1 Fault or malfunction.

Disable the unit immediately in case of breakdown or malfunction.

Contact a certified service agent.

Use original spares parts only.

Using the unit in case of breakdown or malfunction:

- voids the warranty
- it may compromise the safety of the unit
- it may increase time and repair costs

2.2 The installer must train the user, particularly on:

- Start-up/shutdown
- Set points change
- Standby mode
- Maintenance
- What to do / what not to do in case of breakdown

2.3 Unit identification

The serial number label is positioned on the unit and allows to identify all the unit features.

The matriculation plate shows the indications foreseen by the standards, in particular:

- unit type
- serial number (12 characters)
- year of manufacture
- wiring diagram number
- electrical data
- type of refrigerant
- refrigerant charge
- manufacturer logo and address

The matriculation plate must never be removed.

2.4 Serial number

It identifies uniquely each unit.

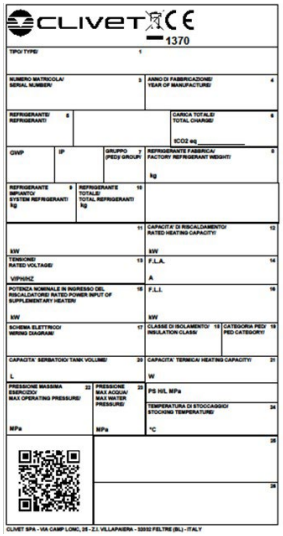
Must be quoted when ordering spare parts.

2.5 Assistance request

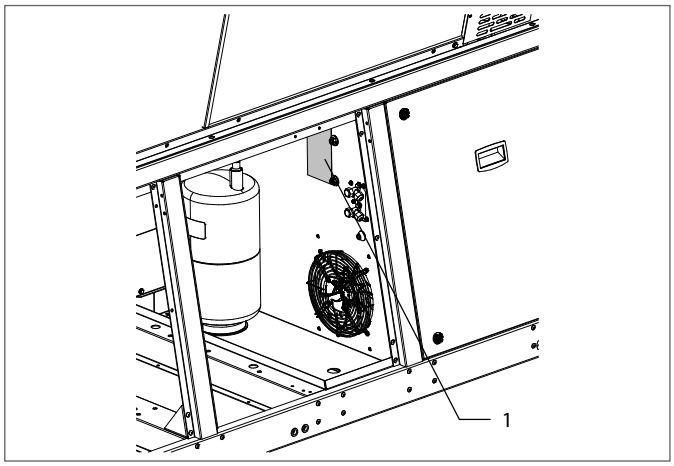
Note data from the serial number label and write them in the chart on side, so you will find them easily when needed.

Series
Size
Serial number
Year of production
Wiring diagram number

2.6 Example of serial number label



2.7 Location of the label



1 Serial number label

3. Safety specifications for flammable refrigerants

3.1 Personnel skills

Maintenance and fixing work requiring the assistance of qualified personnel must be carried out under the supervision of the person competent in the use of flammable refrigerants.

Any person carrying out assistance or maintenance on a system or associated parts of the equipment must be competent according to EN 13313 and/or EN 22712.

Persons working on refrigeration systems with flammable refrigerants must be competent in the safety aspects of handling flammable refrigerants supported by evidence of appropriate training.

This will include the following requirements:

- knowledge of legislation, regulations and standards concerning flammable refrigerants
- detailed knowledge and skills in handling flammable refrigerants, personal protective devices, preventing refrigerant leaks, handling cylinders, filling, detecting leaks, recovery and disposal

Competent persons must be able to understand and apply the requirements of European Standard EN 378-4:2020.

Caution:

- **before any operation on or near the unit, operate the emergency exhaust fan selector switch. See "Active safety measures on the unit" chapter.**
- **before any maintenance operation, check for leaks with a detector. See "Refrigerant leak detector" chapter.**

3.2 Information on refrigerant gas

The unit contains R290 refrigerant gas (Propane).

According to Directive 2014/68/EU (PED), the substance is classified as a Class 1 gas (hazardous fluids).

According to EN 378-1:2020, this refrigerant is classified as a Class A3 substance (low toxicity, high flammability).

Main characteristics:

- colourless
- odourless
- highly flammable
- heavier than air (stratifies at the bottom)

Refrigerant characteristics		
Safety class (ISO 817)	A3	Highly flammable
GWP (Global warming potential)	3	100 yr
ODP (Ozone layer depletion)	0	
LFL Lower flammability limit	0.038	kg/m^3
	2.1	% Vol
Boiling point	-42	°C
Self-ignition temperature	470	°C
Density (T=20°C; p=1 bar(a))	1.86	kg/m^3
Relative air density (T=20°C; p=1 bar (a))	1.55	

3.3 Ignition sources

Due to the highly flammable nature of the refrigerant, a leak can cause an explosive atmosphere upon contact with air.

Any source that could potentially ignite such an atmosphere must be kept outside the safety area.

A non-exhaustive list is as follows:

- naked flames, cigarettes
- electrical sockets, switches, lights
- electrical and electronic devices that are not ignition-proof, including battery devices
- electrostatic charges
- hot surfaces above 370°C

3.4 Transport

ADR Regulation (Agreement concerning the international carriage of dangerous goods by road).

Equipment containing less than 12 kg of flammable refrigerant is not subject to this transport regulation.

If the amount of refrigerant exceeds 12 kg, the equipment is subject to regulations with UN 3358 classification.

IMDG (International Maritime Dangerous Goods) Code

R290 is classified as a flammable gas within Class 2.1.

The shipping company must provide the corresponding safety data sheet for the product.

The maximum filling quantity for flammable refrigerants is restricted to 12 kg.

IATA Regulations (International Air Transport Association):

- these regulations prohibit the transport of equipment filled with more than 0.1 kg of combustible refrigerant on a passenger or cargo aircraft

General requirements:

- use ventilated vehicles for transport.
- do not walk through or stand in areas where high temperatures can be experienced.
- take heat dissipation measures when the temperature inside the compartment is hotter than that indicated on the transport label

3.5 Refrigerant leak detector

- under no circumstance may potential ignition sources be used to search for or detect refrigerant leaks
- do not use a halide torch (or any other naked flame detector)
- it must always be carried out when entering the safety area of the unit for any maintenance or verification
- it must be specific to the unit's refrigerant
- probe several points around the unit before entering the safety area
- it must not be an ignition source
- it must be calibrated to the correct detection threshold (25% LFL max)
- it must be regularly maintained

3.6 Prevention of fires and explosions

Before and while entering the safety area:

- obtain permission to carry out the work
- keep ignition sources away
- discharge static electricity
- check that there is appropriate firefighting equipment
- check that the area is adequately ventilated
- ensure that there are no flammable material deposits
- check for refrigerant leaks
- only use ignition-proof devices suitable for use in (ATEX) zone 2

A non-exhaustive list is as follows:

- refrigerant recovery pump
- vacuum pump
- leak detector
- exhaust fan

Before carrying out work on the refrigerant circuit:

- warn everyone in downwind areas of the danger of fire and explosion and evacuate them if necessary
- put up signs indicating no smoking or naked flames
- mechanically ventilate the area with a fan for the duration of the operations

Refrigerant removal procedure:

- purge the circuit with inert gas (e.g. oxygen-free nitrogen)
- re-purge at a pressure <0.2bar
- purge again with inert gas (e.g. nitrogen)
- re-purge at a pressure <0.2bar
- make the vacuum unitl pressure is < 300Pa absolute
- open the circuit withot use of flame (cut with manual pipe cutter)

Warning

- **The refrigerant charge must be collected in suitable recovery cylinders.**
- **Do not use compressed air or oxygen for purging.**

Note

It's advisable to move the equipment from its existing location to a controlled workshop where the work can be carried out safely, if the installation allows is.

3.7 Refrigerant leaks

A refrigerant leak can cause fires and explosions resulting in very serious injuries or death.

Inhaling the refrigerant can cause asphyxiation.

The refrigerant can stratify

If a leak is detected:

- leave the safety area immediately
- warn all persons present to leave the area
- mechanically ventilate the area with fans suitable for use in a danger zone
- remotely cut off power to any electrical/electronic component in the area

  CAUTION: operating a switch or disconnecting an electrical socket can cause an ignition
- remember that gas is heavier than air and tends to stratify

3.8 Firefighting measures

In case of fire:

- leave the area immediately
- operate any fire alarm warning devices present
- warn all persons in the vicinity
- call for help

▶ **An R290 (Propane) fire should only be tackled with CO_2 or powder extinguishers.**

▶ **Do not use direct water jets to extinguish the fire.**

▶ **An increase in the fire causes the pressure to rise in sealed vessels, which can explode.**

4. **Accessories**

Sign	Description
3DHWX	Switching valve for DHW production
AVIBX	Anti-vibration mounts
AMMSX	Anti-seismic anti-vibration spring mounts
AMODX	Water connections for modular unit
IFWX	Steel mesh filter
VSAX	Automatic purge valve
CCKMUX	Kit containing pipe closing caps for modular units
PGFCX	Finned coil protection grills

5. **Accessories supplied**

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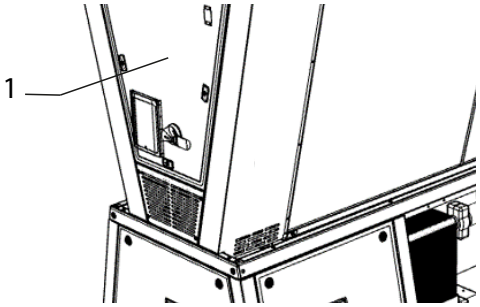
<tr><td>A</td><td>T5</td><td>DHW tank temperature probe</td><td>1</td><td rowspan="4"> 
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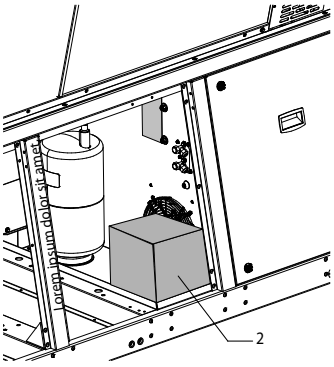
<tr><td>B</td><td>Taf1</td><td>DHW tank antifreeze probe</td><td>1</td></tr>
<tr><td rowspan="2">C</td><td rowspan="2">TW</td><td>Outlet water probe (pre-installed on the unit’s supply pipe)</td><td>1</td></tr>
<tr><td>Probe well</td><td>1</td></tr>
<tr><td>D</td><td></td><td>Transformer for keypad power supply</td><td>1</td></tr>
<tr><td>E</td><td></td><td>Victaulic hydraulic pipe connection joints</td><td>2</td><td> 
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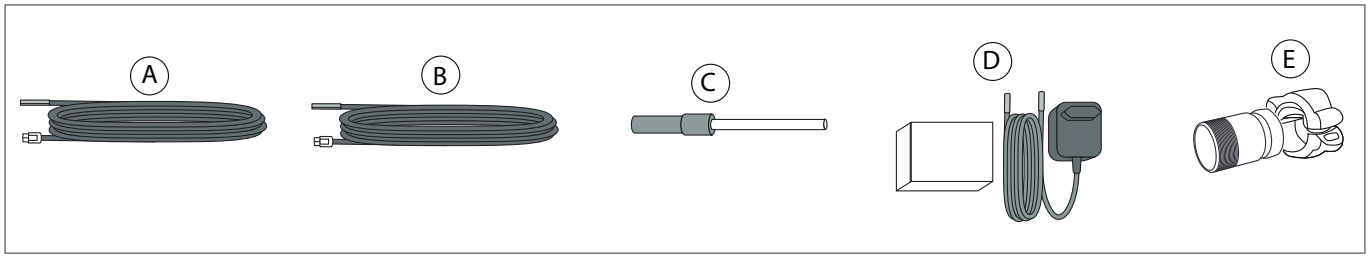


6. Description of the unit

The unit is an air-water heat pump designed for commercial & industrial applications.

The unit refrigerant is R290 (Propane).

The main components of a standard unit are as follows:

1 Source section: consisting of 2 or 3 variable speed fans and two finned coil air exchangers. The refrigerant manifolds and distributors of the exchangers are located on the front of the unit, protected by a fairing. A condensate drain pan is fitted under the source section.

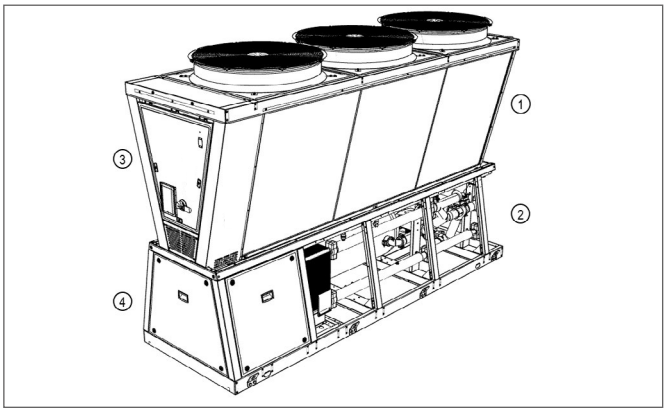
2 Water circuit: located under the source section, consisting of piping, unit safety devices and any optional components (e.g. pump, inertial tank, three-way valve, etc.). The piping connects the customer's system to the unit's exchanger. The user side exchanger is a brazed plate type.

3 IP54 electrical panel: located on the front of the unit, it contains the unit's control and power components. It is protected by a panel with sealing gaskets to keep the electrical panel protected against water infiltrations. There is also the main wired controller to control the unit, the main disconnecting switch and the selector switch for the exhaust fan on the front. The lower part of the electrical panel contains ducting for cooling the heat sinks with source fans. The unit has an earth leakage current of more than 10mA and fulfils the requirements of clause 8.2.6 of EN 60204-1.

Warning

- **The electrical panel must always be kept closed. It can only be opened for short periods during installation and maintenance.**

4 Refrigerant circuit compartment: located on the front of the unit, separated from the electrical panel by its cooling duct. It contains most of the refrigerant circuit: compressors, valves, piping, vessels. Three removable panels protect the circuit from external agents. The compartment also contains the refrigerant leak sensor and the exhaust fan.



Warning

- **The panels must always be installed. They can only be removed for short periods during start-up and maintenance**

6.1 Active safety measures on the unit (specifications for flammable refrigerants)

Safety measures on the unit

Leak sensor:

- The leak detector ensure more than 15 years of lifetime without a recalibration.
- the unit is fitted with 2 leak sensors
- when the unit is powered, the sensors are active and monitor the atmosphere within the refrigerant circuit and in the electrical panel
- the sensor signals an alarm if the R290 (Propane) concentration exceeds 25% of the LFL
- when the alarm is triggered, the unit switches off and a dedicated exhaust fan is activated to dispel the potential explosive atmosphere
- an alarm with manual reset is displayed on the wired controller

Warning

- **If the unit is not powered, the leak detection system is not active.**
- **The unit sensor does not replace the personal leak detector.**

Exhaust fan:

- the unit has an ATEX exhaust fan
- this fan dispels the atmosphere inside the refrigerant circuit box
- when the unit is switched on and the leak sensor signals an alarm, the fan is switched on until the explosive atmosphere is dissipated

Warning

- **Potential flammable atmosphere will be ejected in the outdoor ambient in the air flow direction of the fan,**
- **The fan must not be ducted in any other way than by the manufacturer.**

Pre-ventilation selector switch:

- the unit has a pre-ventilation selector switch
- when the selector switch is activated, the exhaust fan switches on, cleaning the refrigerant circuit box from a potential explosive atmosphere

Degasser / Deaerator:

- the unit is shipped without a degasser
- an automatic air purging system must be installed in the hydraulic circuit if no other systems of separation (e.g. secondary water exchangers) are

present

- the installation of this component should prevent the release of refrigerant in the building in the event of a water heat exhchanger loss (e. g. due to freezing, corrosion, etc.). The definition of the device is an installation matter that should be based on a proper risk analysis. The installer can use the VSAX proposed by the original manufacturer
- the purged air must be vented or ducted outside any building away from potential ignition sources

Warning

- ▶ **Any other purge system must be closed or ducted to the outside, away from sources of ignition, to prevent the release of refrigerant in the building.**
- ▶ **If minimum distances must be respected, consult the section on the category of access.**

Water side pressure relief valve:

- the unit is fitted with a water pressure relief valve
- the installation prevents the release of refrigerant in the building in the event of a water heat exchanger fault (e.g. due to freezing, corrosion, etc.)
- the water pressure relief valve must be installed or ducted outside any building away from potential ignition sources

Warning

- ▶ **Any other water pressure relief valve must be calibrated to a higher pressure value or ducted to the outside, away from ignition sources, to prevent the release of refrigerant in the building.**
- ▶ **If minimum distances must be respected, consult the section on the category of access.**

6.2 Active safety measures on the unit (general)

Refrigerant:

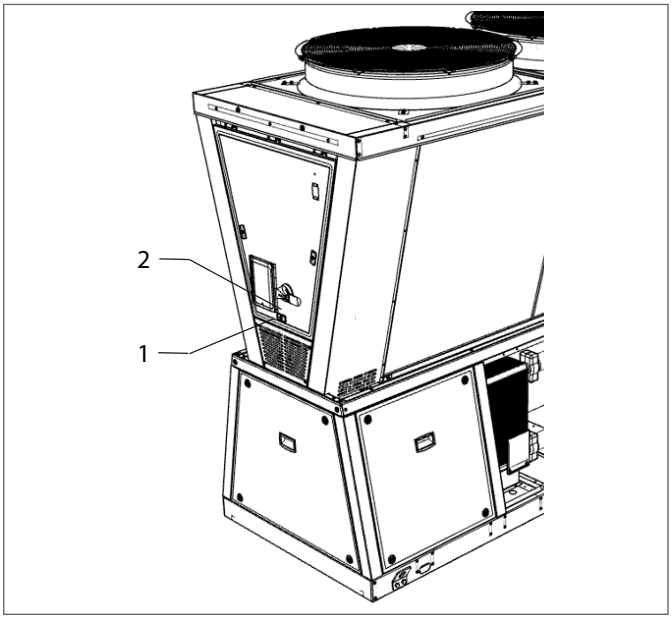
- HP-pressure switch: calibrated to the high pressure PS with manual reset. Stops the compressors in case of an anomaly. In safety chain PL=d EN ISO 13849
- pressure relief valve: calibrated to the low pressure PS against overpressure caused by fire
- unit sensors: pressure transducers and temperature probes work via software to stop and limit the unit when approaching and exceeding operating limits

Use:

- flow switch: calibrated to the minimum permissible flow-rate stops the unit to prevent overheating or freezing
- pressure switch: minimum system load, present when the pumps are configured on board the unit, prevents start-up if the system has not been loaded

Overcurrents:

- disconnector switch with fuses: safety disconnector switch with fuse holder for prompt shutdown and disconnection of the unit with overcurrent protection via fuses



1 LED

2 Manual selector switch

Unit status:	First switch-on	Normal operation	Alarms
		● Fan OFF	● Fan ON
		● Alarm OFF	● Alarm ON
		● LED OFF	● LED ON
		● Compressor ready to start	● Compressor status OFF
Manual selector switch ON (enabled)	D) Manual purge function:		
	● Fan ON		
	● Alarm OFF		
	● LED ON		
	● Compressor ready to start		
The change of status compared to Normal operation is in red			

7. Before installation

7.1 Reception

You have to check before accepting the delivery:

- For any refrigerant leaks
- That the unit hasn't been damaged during transport
- That the materials delivered correspond with that indicated on the transport document comparing the data with the identification label positioned on the packaging.

Warning

▶ **In case of transport damage, there may be a release of flammable gas.**

In case of damage or anomaly:

- write down on the transport document the damage you found and quote this sentence: "Conditional acceptance clear evidence of deficiencies/damages during transport"
- Contact by fax and registered mail with advice of receipt to supplier and the carrier.

Warning

▶ **Any disputes must be made within 8 days from the date of the delivery. Complaints after this period are invalid .**

7.2 Storage

- Check for refrigerant leaks
- Store in well-ventilated areas
- Keep away from ignition sources
- Keep away from flammable materials
- Check that there is firefighting equipment

Warning

▶ **If there is a release of refrigerant, it can build up in the area around the unit.**

Respect the indications on the outside of the pack.

In particolar:

minimum room temperature	(A)	-20°C
maximum room temperature	(B)	+50°C
maximum relative humidity	(C)	95%

Failure to comply with the above conditions can lead to:

A) possible damage to components

B) possible pressure relief valve opening

C) possible damage to electrical components

Warning

▶ **The unit may not be tilted more than 15° during transport.**

7.3 Removal of packaging

Check for refrigerant leaks.

Warning

▶ **If there is a release of refrigerant, it may still be inside the packaging**

▶ **Plastic packaging can cause electrostatic charges that can be sources of ignition**

Be careful not to damage the unit.

Recycle and dispose of the packaging material in compliance with local regulations.

7.4 Handling

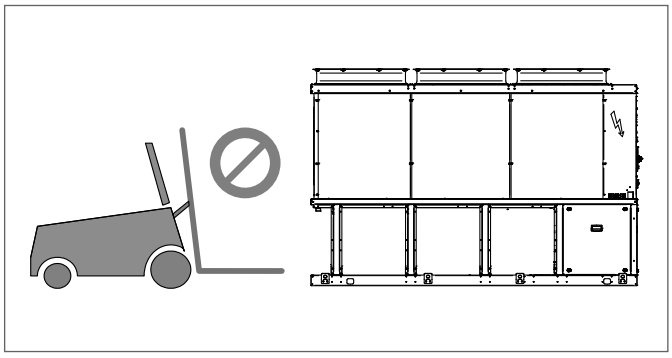
Warning

▶ **Check that all handling equipment complies with local safety regulations (crane, forklifts, ropes, hooks, etc.).**

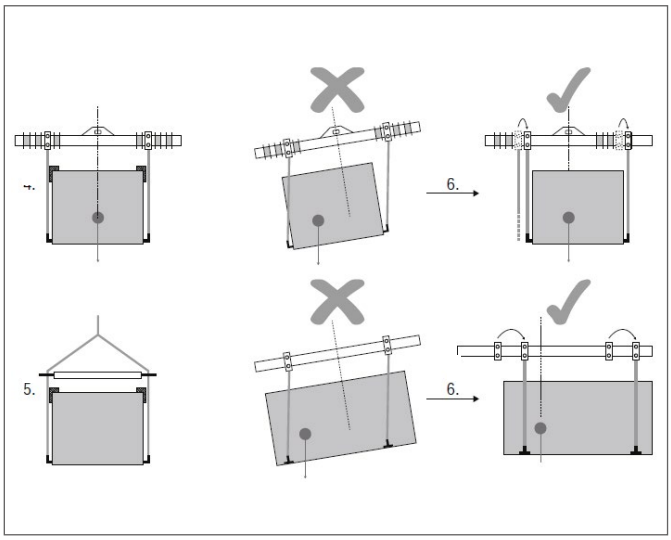
▶ **Provide personnel with personal protective equipment suitable for the situation, such as helmet, gloves, accident-prevention shoes, etc.**

▶ **Observe all safety procedures in order to guarantee the safety of the personnel present and the material.**

▶ **Check the unit weight and lifting equipment capacity. Refer to the TECHNICAL DATA chapter.**

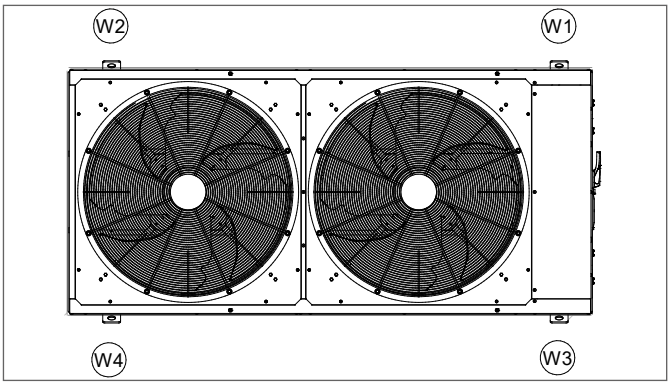


1 Identify critical points during handling (interrupted routes, flights of stairs, steps, doors);
2 Protect the unit adequately to avoid damage;
3 Lift and keep it balanced;
4 Lift with a spacer bar;
5 Align the centre of gravity with the lifting point:
   - Gradually tighten the transport straps, ensuring that they are positioned correctly;
   - Before handling the unit, ensure that it is stable.

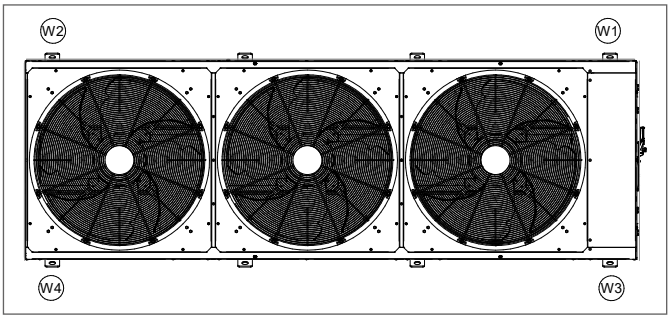


Barycentre			
Size	**14.1-16.1**	**18.1-20.1**	**25.2-30.2**
A (mm)	561	560	562
B (mm)	785	771	1124

Weight distribution



SIZES		14.1-16.1	18.1-19.1-20.1
W1 Supporting point	kg	210	226
W2 Supporting point	kg	138	145
W3 Supporting point	kg	217	233
W4 Supporting point	kg	145	153



SIZES		25.2-30.2
W1 Supporting point	kg	306
W2 Supporting point	kg	199
W3 Supporting point	kg	312
W4 Supporting point	kg	205

The weigths reported are for unit without onboard options. For unit configured with options onboard the weight can vary. Contact the manufacturer for more details.

8. Safety area

There must be a safety area near the unit due to the potential explosive atmosphere that can be created if there is a refrigerant leak.

The characteristics of the safety area depend on the refrigerant type and charge.

8.1 Access category

The installation site must comply with the requirements of EN 378-1:2020:

- Access category “a”: generic access
- Access category “b”: supervised / restricted access
- Access category “c”: access for authorised personnel only

Access category	Max. permissible R-290 charge
a – generic	< 5 kg
b – supervised / restricted	≤10 kg
c - authorised	> 10 kg

Charge up to 5kg - Access category “a”

- The “Caution: flammable material” symbol must be clearly visible
- The unit must be positioned so that any leakage cannot enter buildings or damage people and properly
- If the refrigerant leaks, it must not be able to flow through any ventilation openings, doors, hatches or similar openings or stagnate
- If a guard is built around the unit, natural ventilation must be ensured or forced ventilation must be provided
- Minimum distance from building openings, sewer openings, closed tunnels, any ignition sources, openings on the installation level and connecting rooms below ground >2.5 m

Charge up to 10kg - Access category “b”

The requirements of access category “a” apply and also:

- Access to the unit is restricted to trained personnel.
- The unit must be positioned in a place not accessible to the public.
- Caution: this requirement can be observed, for example, by fencing the unit off
- The “No naked flames: Fire, ignition sources and smoke are prohibited” and “Caution: Area where an explosive atmosphere may form” symbols must be placed near the unit and be clearly visible
- The unit must be installed in an open area to allow adequate natural ventilation of the area
- Installation on driveway ramps is not permitted
- If it is placed at a distance of < 3 m from areas with passing vehicles, it must have a protection that is at least 1 m from the floor plan perimeter. Minimum protection: kerb 0.2 m high at a distance of <1.5 m
- Minimum distance from railway lines >15 m

Charge over 10kg - Access category “c”

The requirements of access category “b” apply and also:

- access to the unit is restricted to authorised personnel only
- the unit must be positioned in a fenced off and padlocked place

Warning

▶ **This restricted area must contain the unit and all clearances surrounding it.**

- an appropriate access management procedure must be in place (list of authorised persons, access register, key management)
- the unit must be constantly monitored

Sign to be applied	Description	Access category
	Caution: flammable material	a,b,c
	No naked flames: Fire, ignition sources and smoke are prohibited	b,c
	Caution: Area where an explosive atmosphere may form	b,c
	No access: no access for unauthorised personnel	c
	Caution: explosive material	c

8.2 Safety fencing

The following requirements are mandatory to achieve access category “c”. They can still be used as requirements for access category “b”.

- The unit must be enclosed by a metal fence > 1.8 m high and with an outward opening door that can be locked or padlocked. A minimum distance of 1.5 m must be kept between the dangerous elements and the fencing
- The fencing must have a clear area of > 5 m with no vegetation that could constitute a fire hazard. If this distance cannot be observed, the base of the wire mesh must consist of a wall > 0.5 m high
- Foreign materials of any kind must not be kept within the safety perimeter

Other requirements

Consider the installation site of the unit in the fire documentation for the building in which it is installed.

A non-exhaustive list of additional safety measures that can be used is as follows:

- Addition of a mechanical safety ventilation system
- Addition of refrigerant leak detectors at the most critical points in the safety area
- Visual and audible alarm system if a leak is detected
- Fire system
- Refer to EN 378-1:2020 for further requirements

8.3 Extension of the safety area

Always consider that the safety area may extend beyond the limits of the unit due to the following anomaly operation range:

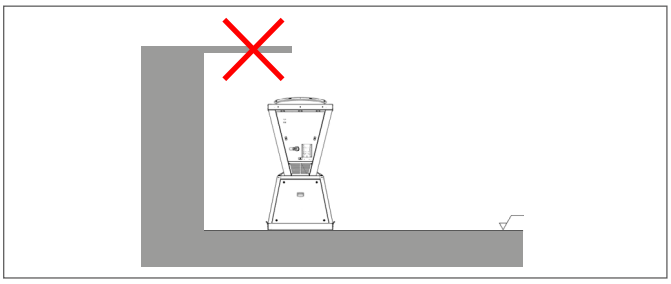
- Venting of the pressure relief valve in case of fire

Warning

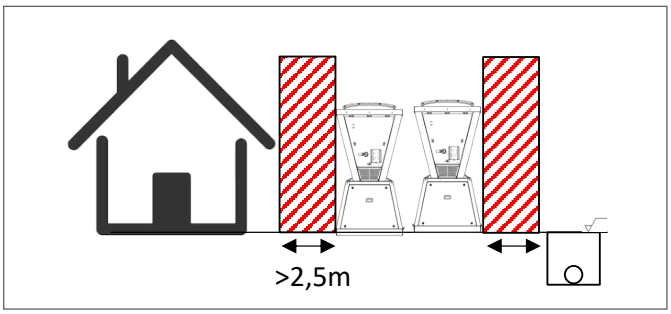
▶ **The installer must carefully asses how to duct the pressure relief valve and the potential explosive atmosphere that could be generated at the point where it is ducted**

- Operation of the unit’s exhaust fan
- Refrigerant stagnation in areas with poor ventilation or in dips in the ground

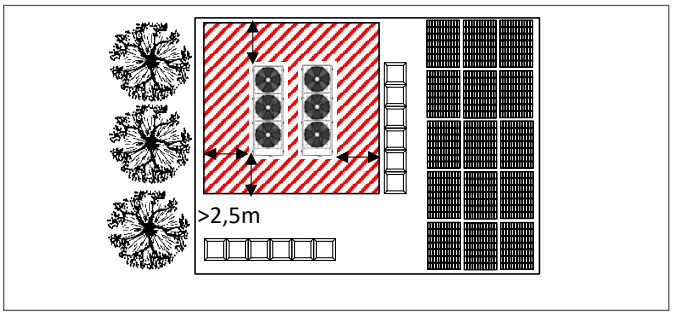
Installation in open area



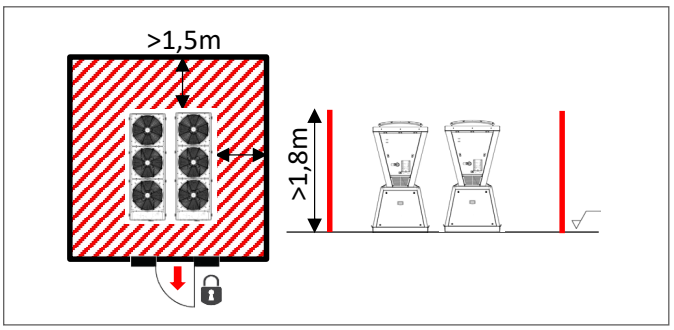
Installation in a courtyard



Minimum distances



Safety fencing



9. Choosing the installation site

9.1 General

Installation must be in accordance with local regulations. If they do not exist, follow EN378 .

The installation area must only be accessible to authorised and qualified personnel.

During positioning consider these elements:

- customer approval
- unit weight and bearing point capacity
- safe accessible position
- functional spaces
- spaces for the air intake/exhaust
- electrical connections
- max. distance allowed by the electrical connections
- water connections

9.2 Electromagnetic compatibility (EMC)

The unit fulfils the emission and immunity requirements of the harmonised generic standards EN 61000-6-4:2007/ A11:2007 and EN 61000-6-2:2005/AC:2005 for industrial environments. An industrial environment is defined as a site powered by a dedicated MV/LV transformer in compliance with the scope of the regulations applied.

The unit fullfills also the requirements of EN 61000-3-11 e 61000-3-12 for flickers and armonics for installation in light commercial environment with Rsce greater than 250.

9.3 Functional spaces

Functional spaces are designed to:

- guarantee good unit operation
- carry out maintenance operations
- protect authorized operators and exposed people

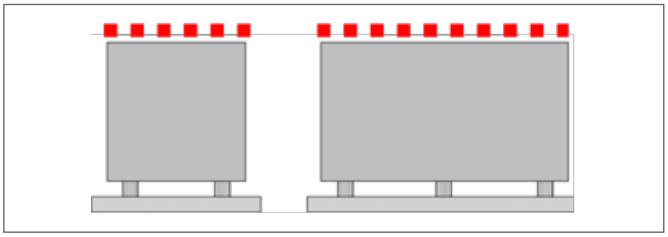
CAUTION

- ▶ **Respect all functional spaces indicated in the TECHNICAL INFORMATION section.**
- ▶ **Do not smoke or use naked flames within this area**

9.4 Positioning

CAUTION

- ▶ **Do not go up to the surface**
- ▶ **Not placing heavy objects**



Units are designed to be installed:

- in fixed positions
- on a flat surface

Put the unit in a position where any leaking gas cannot enter buildings or stagnate in closed areas. In the latter case, observe the rules for machinery rooms (ventilation, leak detection, etc.).

Installation standards:

- avoid installations in places subject to flooding
- install the unit raised from the ground
- bearing points aligned and leveled
- discharged condensation water must not cause harm/ danger to people and property
- the accumulation of snow must not cause clogging of the coils
- avoid installations in places subject to flooding

Limit vibration transmission:

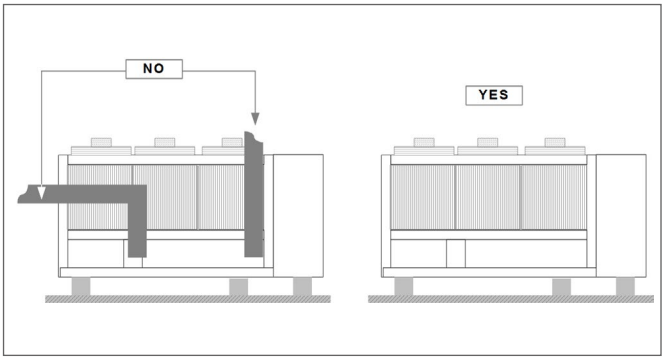
- use anti-vibration devices or neoprene strips on the unit support points
- install flexible joints on the hydraulic connections

Protect the unit with suitable fence in order to avoid access to unauthorised personnel (children, vandals, etc.)

9.5 Air flow-rate on the coils

CAUTION

- ▶ **The air flow on the coils must not be obstructed.**



A correct circulation of the air is mandatory to guarantee the good unit operating..

Avoid therefore:

- obstacles to the airflow
- exchange difficulties
- leaves or other foreign bodies that can obstruct the exchange batteries
- winds that hinder or favour the airflow
- heat or pollution sources close to the unit (chimneys, extractors etc)
- stratification (cold air that stagnates at the bottom)
- recirculation (expelled air that is sucked in again)
- positioning below the level of the threshold, close to

very high walls, attics or in angles that could give rise to stratification or recirculation phenomenons.

Ignoring the previous indications could:

- energy efficiency decrease
- alarm lockout due to HIGH PRESSURE (in summer) or LOW PRESSURE (in winter)

9.6 Gas side pressure relief valve

The installer is responsible for evaluating whether and how to install drain piping in compliance with the local regulations in force (EN 378).

If ducted, the valves must be sized according to EN13136.

▶ **The drain pipe that is connected to the shut-off valve must lead down to a suitable drain, and be protected from frost.**

Valve connection = male screw 3/4"

9.7 Condensate

When a heat pump is in operation it produces a considerable amount of water due to the defrosting cycles of the external coil.

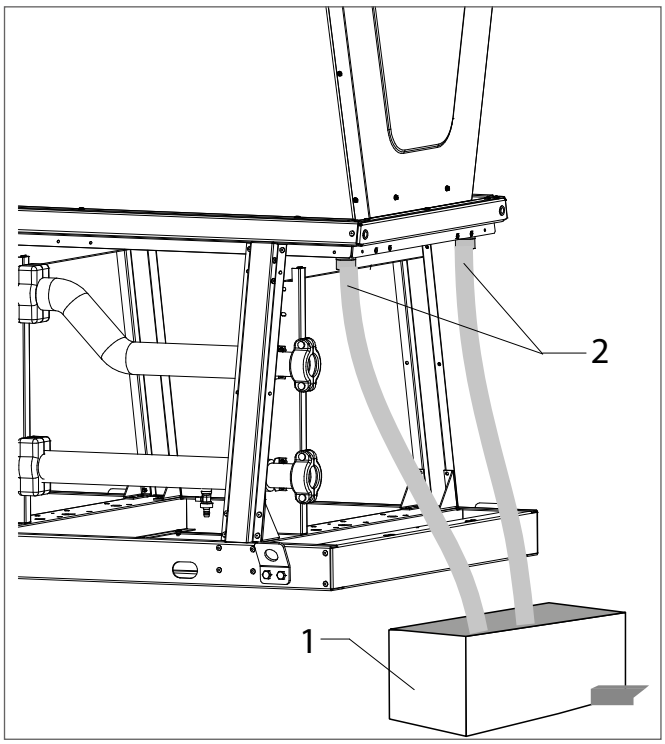
▶ **The condensate must be disposed of in such a way as to avoid spillage in places where people may be passing.**

▶ **During prolonged periods of particularly low external temperatures, the condensate may freeze on the outside of the unit, blocking the outflow and creating an increasingly large build-up of ice. So special attention needs to be paid to disposing of the condensate.**

▶ **It can reach up to 1-1.5 l/day per kW of installed heating capacity. Defrosting can take up to 10 mins/cycle.**

▶ **If necessary, use heating cables with an antifreeze function.**

▶ **Any external heater for antifreeze of these pipes shall not be a possible ignition source as defined in chapter "Ignition Source". In particular any remote switch of such heater should be out of the safety zone defined, or the switch should be ATEX, and the temperature achieved on its surface should be below autoignition temperature.**



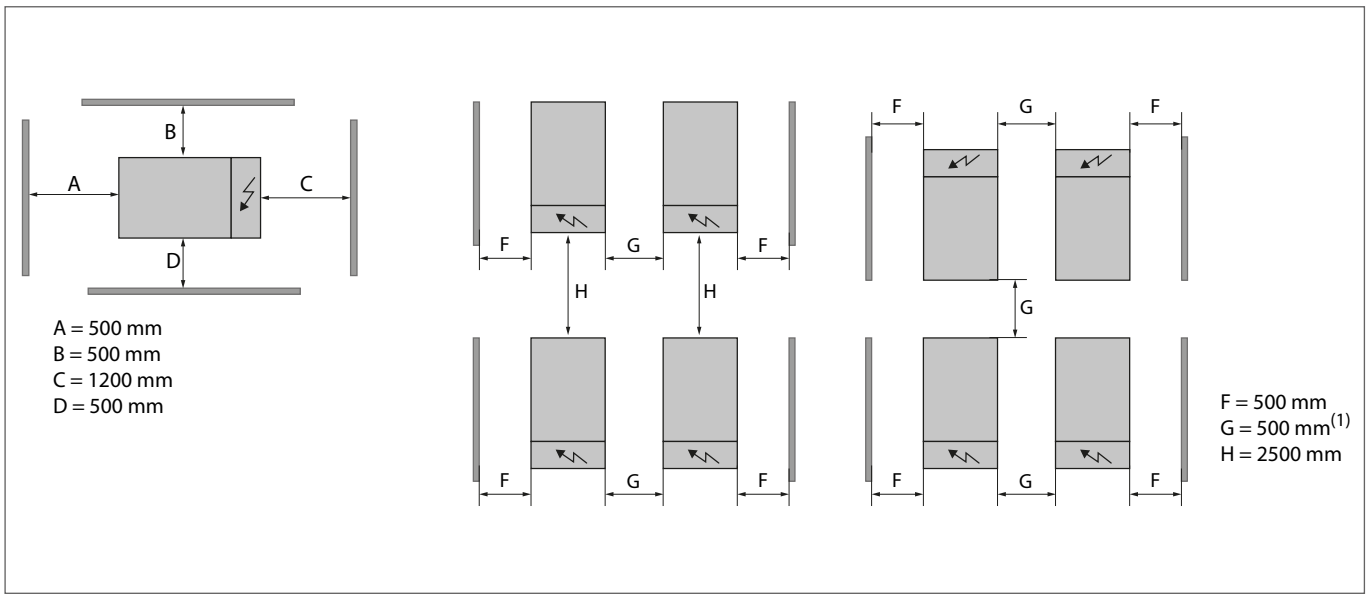
1 Discharge / drainage collection

2 1"1/2 male screw condensation drain piping

9.8 Functional spaces

Also see “Safety area” chapter

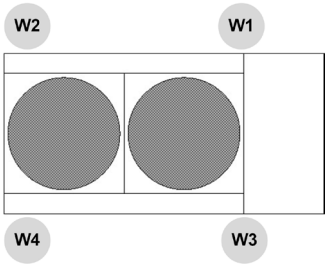
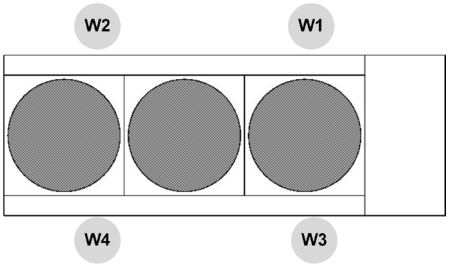
The units must be installed in parallel with the electrical panel.



1 With the AMODX option the distance is reduced to 165mm

9.9 Anti-vibration mounts

Option

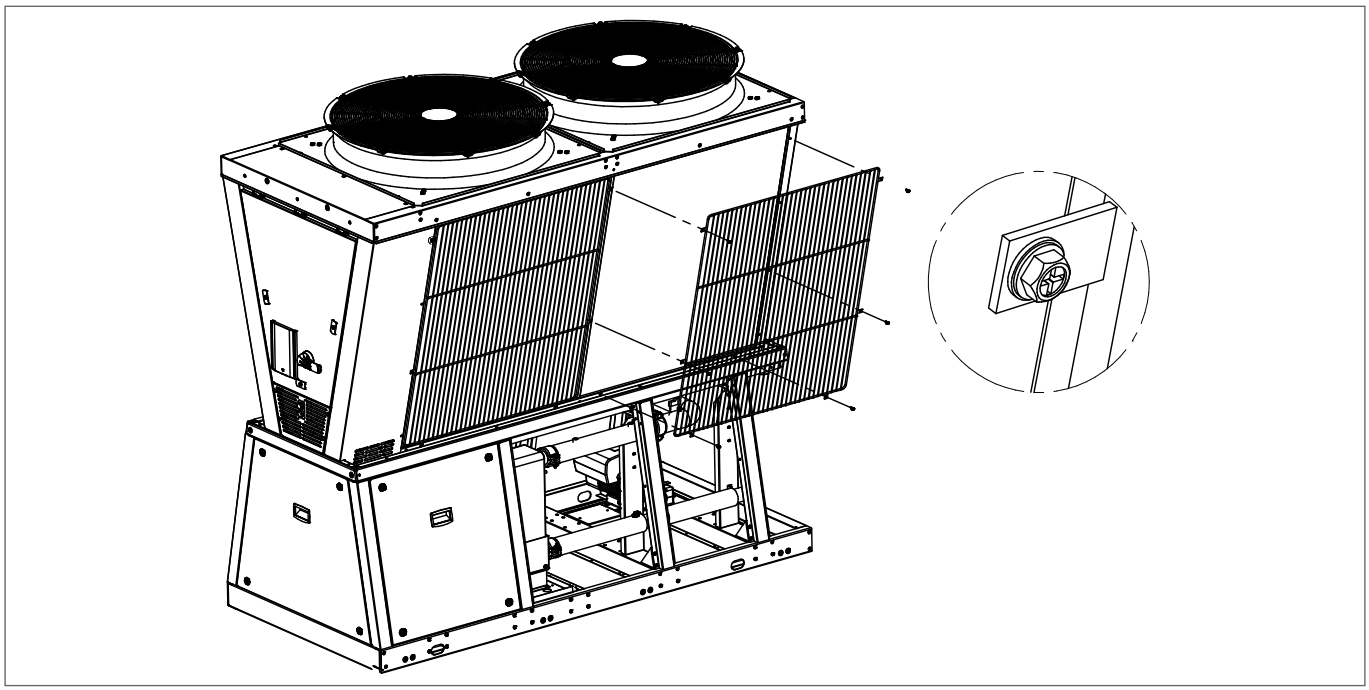
Size	14.1 - 20.1		25.2 - 30.2	
Support points				
Configuration	AVIBX - standard	AMMSX - anti-seismic	AVIBX - standard	AMMSX - anti-seismic
PE kit	PESP00003	PESP00004	PESP00005	PESP00006
W1	RZr505-202	LaLrVr 305	RXr601-Zr108	LaLrVr 33
W2	RZr703	LaLrVr 30	RZr603-Xr101	LaLrVr 300
W3	RZr505-202	LaLrVr 305	RXr601-Zr108	LaLrVr 33
W4	RZr703	LaLrVr 30	RZr603-Xr101	LaLrVr 300

- **For installation on sites where the wind speed may exceed 80 km/h, it is advisable to use AMMSX anti-seismic vibration dampers.**
- **Make sure that the antivibration are attached to the floor.**

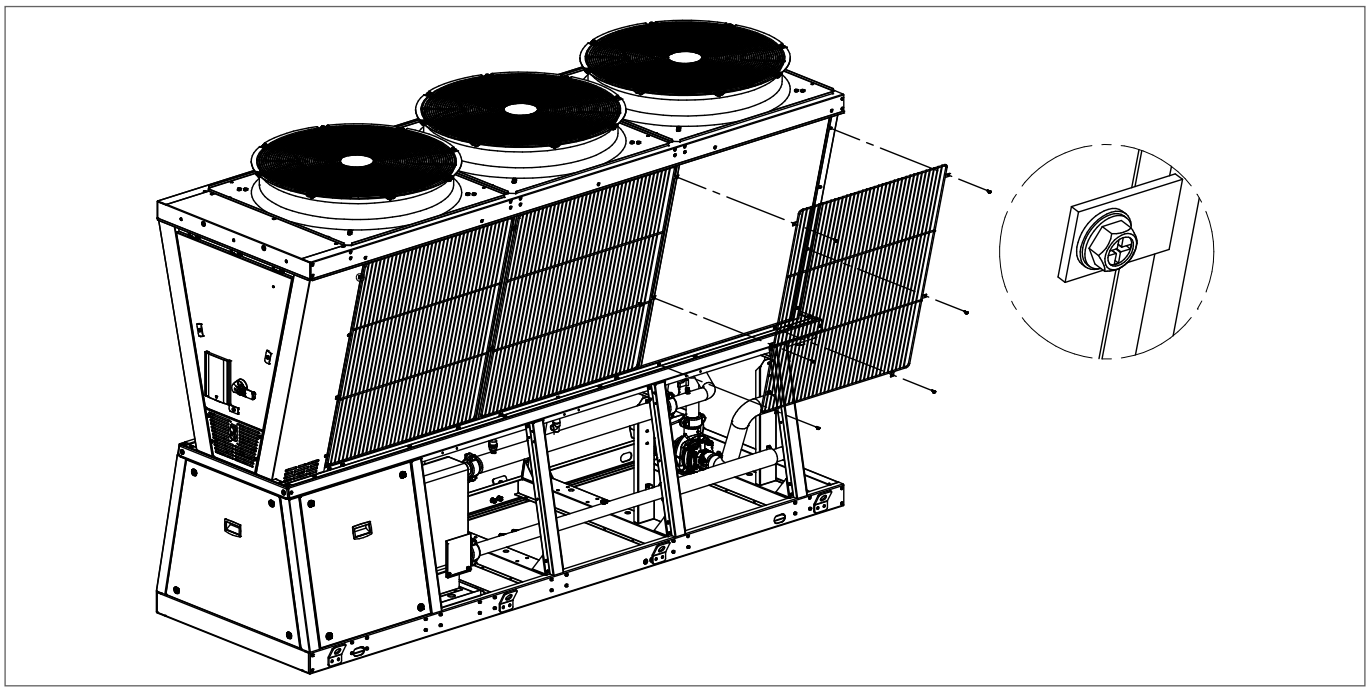
9.10 **Protection grills**

Option PGFCX

PESP00001



PESP00002



10. Water connections

10.1 Hydraulic system

The piping must be designed and manufactured to limit pressure drops as much as possible, i.e. optimise performance of the system.

Keep the following to a minimum:

- overall length
- number of bends
- number of vertical changes of direction

10.2 Water quality

The water quality can be checked by qualified personnel.

Water with inadequate characteristics can cause:

- increased pressure drops
- reduced energy efficiency
- increased corrosive phenomena

Water characteristics:

- within the limits indicated in the table

Provide a water treatment system if values fall outside the limits.

10.3 Cleaning

Before connecting the water to the unit, clean the system thoroughly with specific and effective products to remove residues or impurities that could affect operation.

10.4 New systems

In the event of new installations, it is essential to thoroughly wash the entire system before start-up. This will remove installation process residues (welding, waste, joint products, etc.).

The system must then be filled with clean, good quality water.

10.5 Existing systems

If a new unit is installed in an existing system, the system must be flushed to eliminate any particles, sludge and waste.

The system must be drained before installing the new unit.

Dirt can be removed only with a suitable water flow-rate. Each section must then be cleaned separately.

Particular attention must also be paid to “blind spots” where a lot of dirt can build up due to the low flow-rate. The system must then be filled with clean, good quality tap water.

If, after flushing, the water quality is still unsuitable, a few measures must be taken to avoid problems.

An option to remove pollutants is to install a filter.

CAUTION

- **The warranty does not cover damages caused by limescale build-up, deposits and impurities in the water supply and/or failure to clean the systems.**

Water component for corrosion limit on Copper	
PH (25°C)	7,5 ÷ 9,0
SO4--	< 100
HCO3- / SO4--	> 1
Total Hardness	8 ÷ 15 °f
Cl-	< 50 ppm
PO4 3-	< 2,0 ppm
NH3	< 0,5 ppm
Free Chlorine	< 0,5 ppm
Fe3 +	< 0,5 ppm
Mn++	< 0,05 ppm
CO2	< 50
H2S	< 50 ppb
Oxygen content	< 0,1 ppm
Sand	10 mg/L
Ferrite hydroxide Fe3O4 (black)	Dose < 7.5 mg/L 50% of mass diameter < 10 µm
Iron oxide Fe2O3 (red)	Dose < 7.5mg/L Diameter < 1 µm
Electrical conductivity (µS/cm)	<500
Sodium nitrate (mgNaNo3/l)	<100
Alkalinity(mgCaCo3/l)	<100
Copper (mgCu/l)	<1.0
Sulphide ion (S-/l)	None
Ammonium ion (mgNH4+/L)	<1.0
Silica (mgSiO2/l)	50
Max Ethylene, Propylene glycol	50%
Nitrates	<100
Free&aggressive Carbonic Acid	<5

10.6 Risk of freezing

If the unit or the relative water connections are subject to temperatures close to 0°C:

- mix the water with glycol, or
- protect the piping with heating cables laid under the insulation, or
- empty the system in the event of long downtime

▶ **If glycol is used in the DHW heat exchanger, propylene glycol must be used.**

Follow the instructions by the antifreeze manufacturer with regard to regular checks on the concentration, and relative corrective actions.

CAUTION

▶ **In the event of fracturing due to frost, the water-side heat exchanger may be damaged.**

▶ **In case of low pressure allarm and ensured that this is due to a leak in the water heat exchanger, there could be refrigerant inside the hydraulic circuit.**
In such cases cut off the power supply of the unit and vent the unit thourg its service vent or through other outdoor plant vent.
Use only vents that are placed in outdoor spaces.
During this procedure ensure that there are no external ignition source (as described in chapter "Ignition sopuces") close to the venting area, that there is a good ventilation to avoid accumulation of refrigerant and that all the prescription of chapter "Prevention of fires and explosion" are verified if applicable to the case.
During such venting procedure verify the presence of refrigerant with a service sniffer.
If the sniffer reveals presence of refrigerant it could be possible to have also refrigerant in the indoor plant (if any).
In such a case, evaluate the indoor positions in which it can have been trapped and vent them with the same consideration indicated above to the outside, channeling the release to an area with reduced risk of accumulation/ignition/occupance as in the case above.

▶ **Damage from freezing is not covered by the warranty.**

▶ **Do not reconnect the unit if there is no water in the circuit.**

10.7 Antifreeze solutions

Consider that the use of an antifreeze solution results in an increase in pressure drops.

Make sure that the type of glycol used is inhibited (not corrosive) and compatible with the water circuit components.

Do not use different glycol mixtures (e.g. ethyl with propylene).

CAUTION

▶ **The unit must always be protected from frost.In|Otherwise irreversible damage may occur.**

ETHYLENE - PROPYLENE GLYCOL WEIGHT %		20%	25%	30%
Freezing temperature	°C	-8.9	-11.8	-15.6
Safety temperature	°C	-4	-6	-10

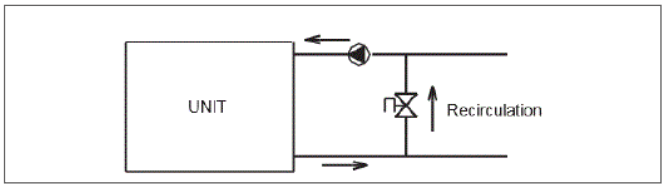
ETHYLENE - PROPYLENE GLYCOL WEIGHT %		35%	40%	45%	50%
Freezing temperature	°C	-19.0	-23.4	-27.8	-32.7
Safety temperature	°C	-14	-19	-23.8	-29.4

10.8 Water flow-rate

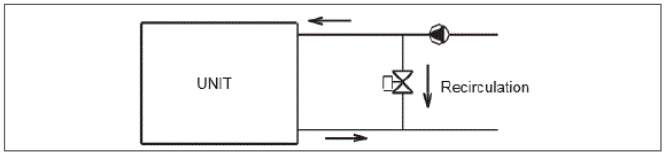
The design water flow-rate must be:

- within the usage limits of the exchangers
- guaranteed also with variable system conditions (for example, in systems where some circuits are bypassed in particular situations)

If the system flow-rate is below the minimum flow-rate, bypass the system as indicated in the diagram.



If the system flow-rate exceeds the maximum flow-rate, bypass the exchanger as indicated in the diagram.



10.9 Admissible water flow-rates

Minimum (Qmin) and maximum (Qmax) admissible water flow-rates for correct operation of the unit.

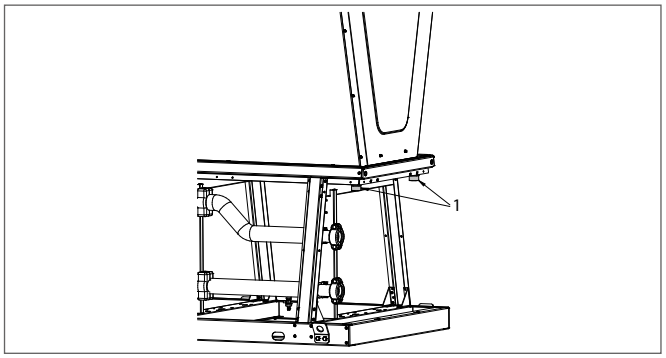
Size		14.1-16.1	18.1-20.1	25.2-30.2
Minimum flow-rate	l/s	1.1	1.5	1.8
Maximum flow-rate	l/s	3.6	5.0	6.3

10.10 Minimum system water volume

The minimum system water volumes are described in the TECHNICAL DATA chapter and must be adhered to for correct operation of the unit.

Size		14.1-16.1	18.1-20.1	25.2-30.2
Minimum system water content in heating mode	l	300	500	600
Minimum system water content in cooling mode	l	300	500	600

10.11 Condensation drain pan



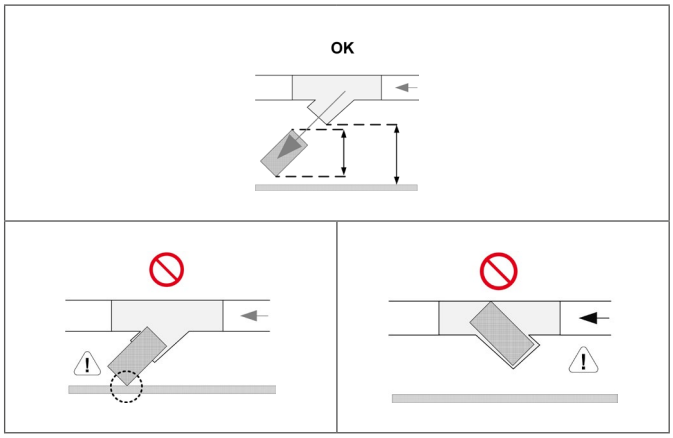
1 1"1/2 male screw drain pan connection

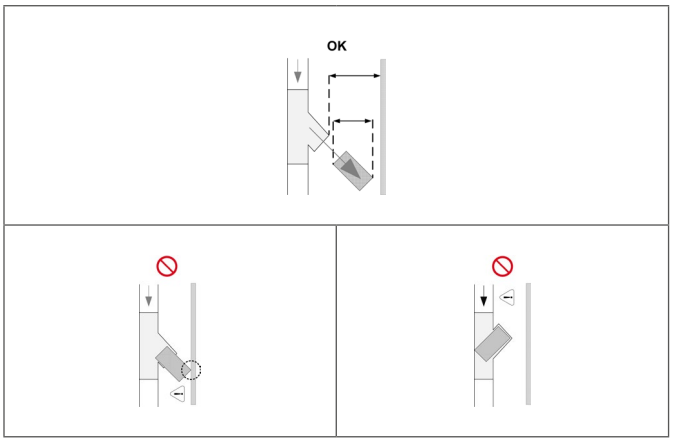
10.12 Water filter

Accessory supplied separately.

IFWX: Steel mesh filter

It must be installed immediately at the water inlet of the unit, in a position that is easily accessible for cleaning.





The filter must have a mesh size that prevents the inlet of particles larger than:

filter (mm)	0,5

CAUTION

- ▶ **The filter should never be removed as this will invalidate the warranty.**

10.13 Degasser / Deaerator

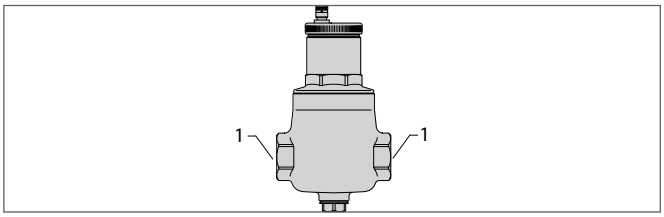
Accessory supplied separately per single unit:

- VSAX : Automatic purge valve

- ▶ **Mandatory installation.**

It must be installed immediately at the water inlet or outlet of the unit (depending on the model), in an easily accessible position.

- ▶ **Installation in all hydraulic circuits of the unit is required if a secondary heat exchanger is present.**
- ▶ **It must be sized according to the unit's water flowrate and to the plant design in order to prevent the possible accumulation of refrigerant in the building.**



1 2” female threaded water fittings

Warning

- ▶ **The deaerator should never be removed as this will invalidate the warranty.**
- ▶ **The deaerator must be installed outside the building in the unit’s safety area.**

- **Any other purge system must be closed or ducted to the outside, away from sources of ignition, to prevent the release of refrigerant in the building.**
- **If minimum distances must be respected, consult the section on the category of access.**

10.14 Hydronic units and connection diagrams recommended

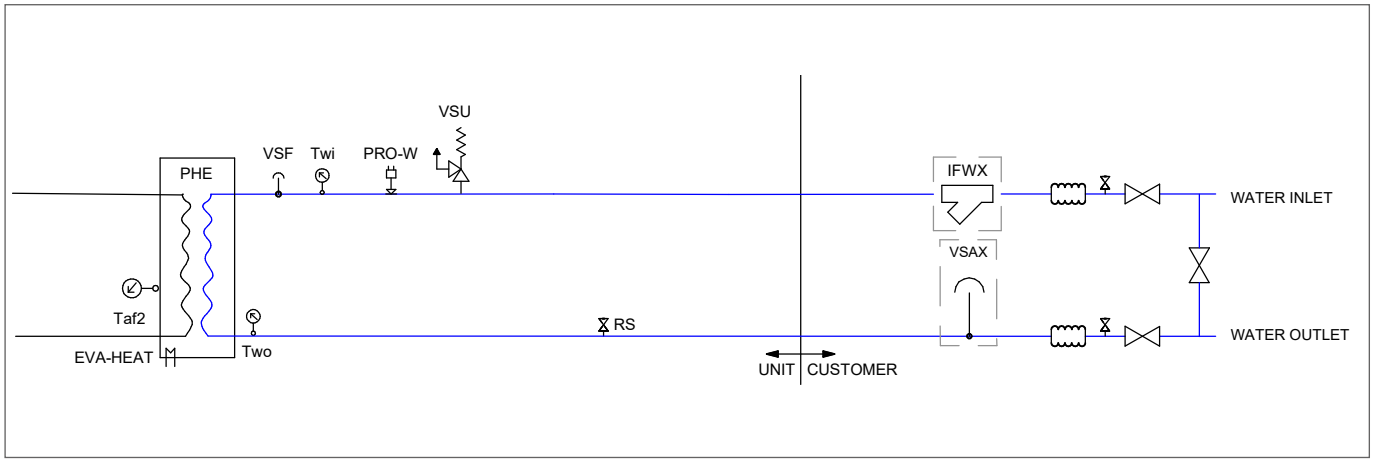
The installer must define:

- type of components
- position in the system

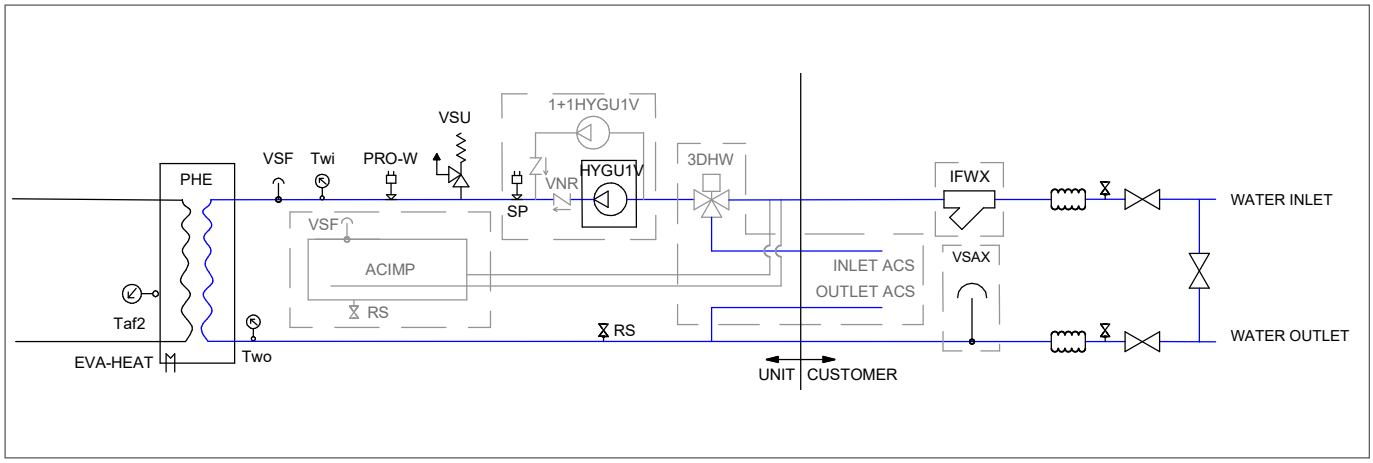
See diagrams on the next pages.

The internal layout of the hydraulic circuit in the following subparagraph is just indicative of the component already present inside the unit.

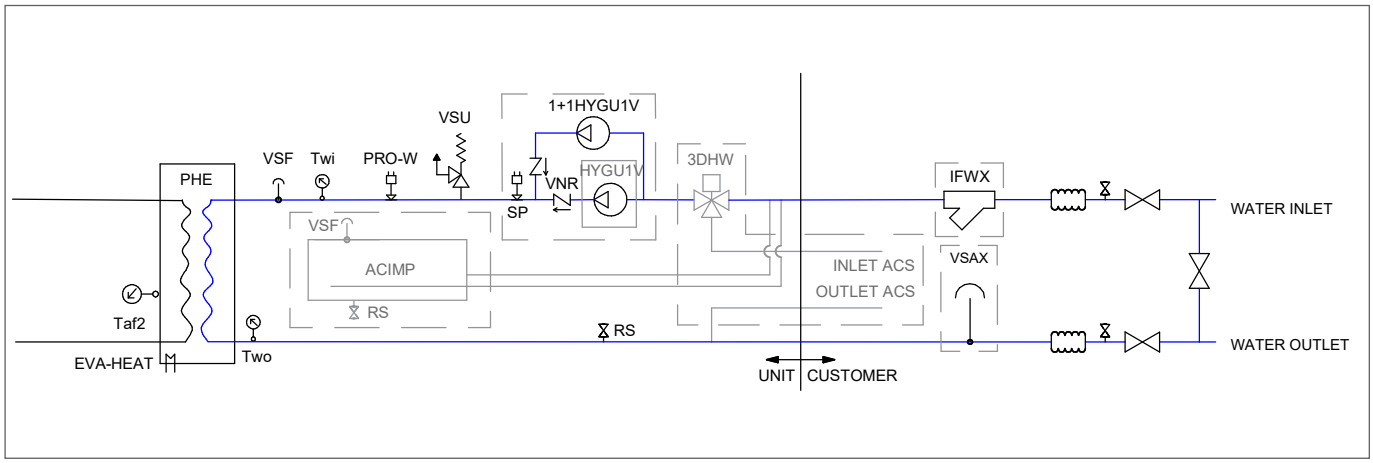
10.14.1 Basic configuration



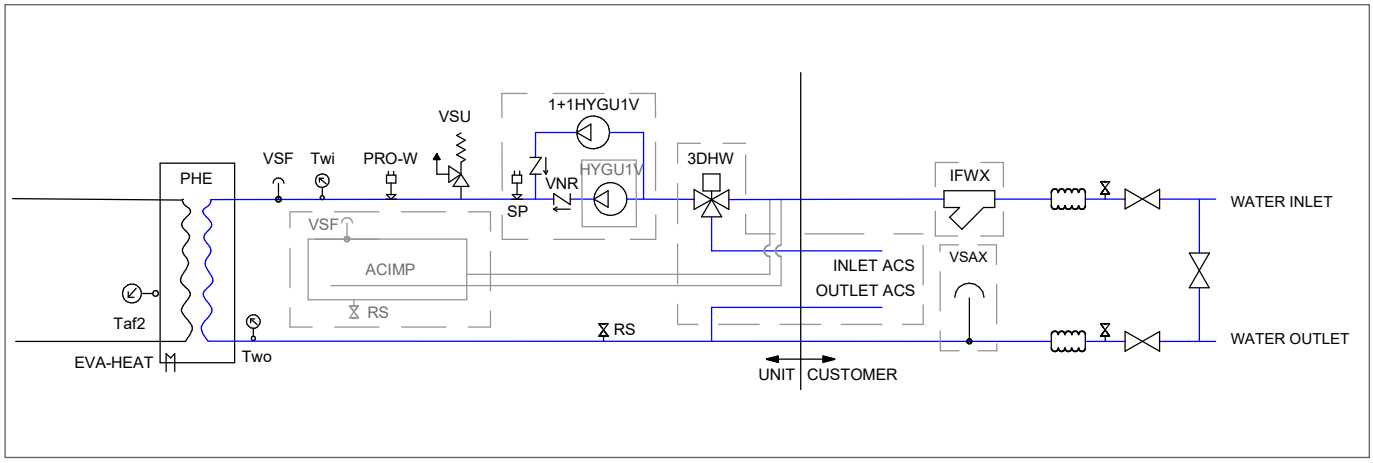
10.14.2 Configuration with pump on board HYGU1V



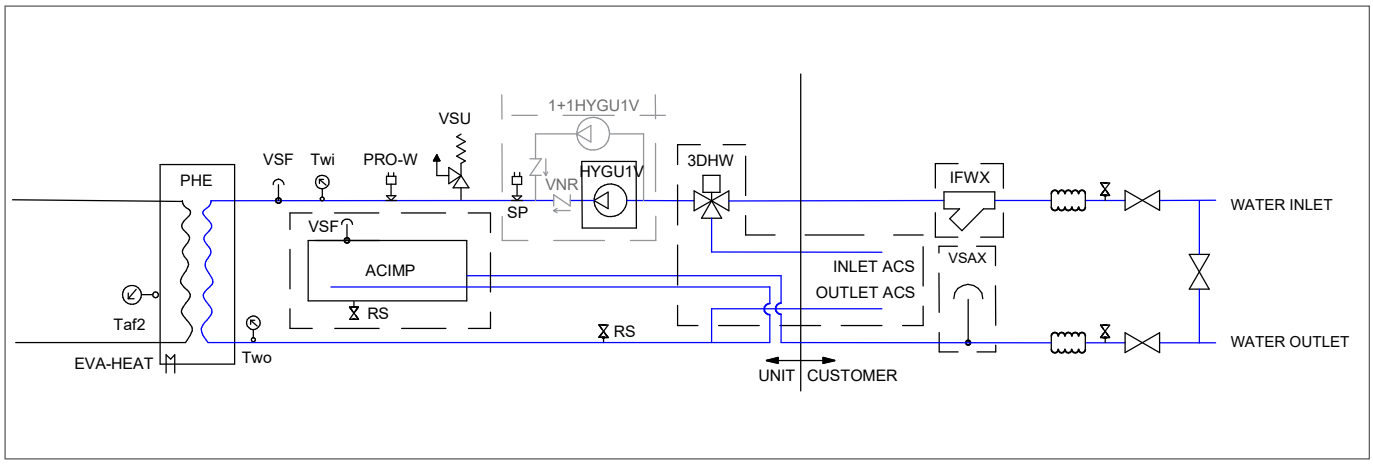
10.14.3 Configuration with double pump on board 1+1HYGU1V



10.14.4 Configuration with pump on board HYGU1V or 1+1HYGU1V DHW switching valve 3DHW



10.14.5 Configuration with pump on board HYGU1V or 1+1HYGU1V DHW switching valve 3DHW and system inertial tank ACIMP



EVA-HEAT	exchanger electric heater
Taf2	exchanger antifreeze temperature probe
PHE	plate exchanger
Two	exchanger outlet temperature probe
VSF	vent valve
Twi	exchanger inlet temperature probe
PRO-W	flow switch
ACIMP	system inertial tank (option)
RS	shut-off valve
VSU	water pressure relief valve
SP	minimum system load pressure switch
1+1HYGU1V	inverter pump 1+1 (option)
VNR	non return valve
HYGU1V	inverter pump (option)
3DHW	3-way DHW switching valve

VSAX *	degasser / deaerator (option)
IFWX *	Y mesh filter (option)

* mandatory components to be provided by the installer (can be supplied as an option)

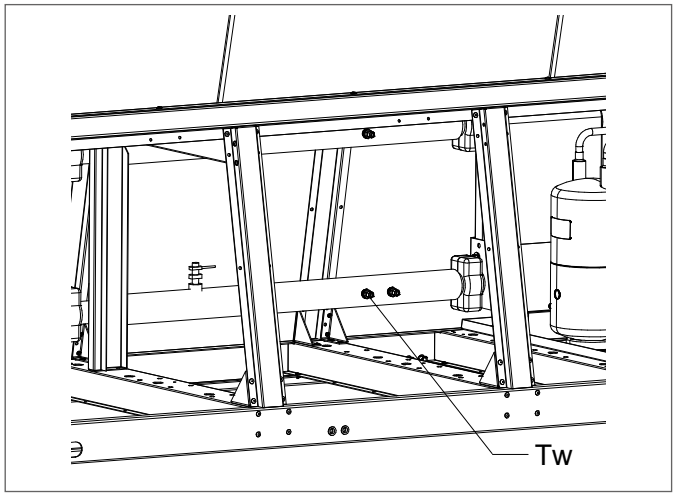
10.15 TW Probe - Total water

It must be installed on the supply line of the unit, as far away as possible.

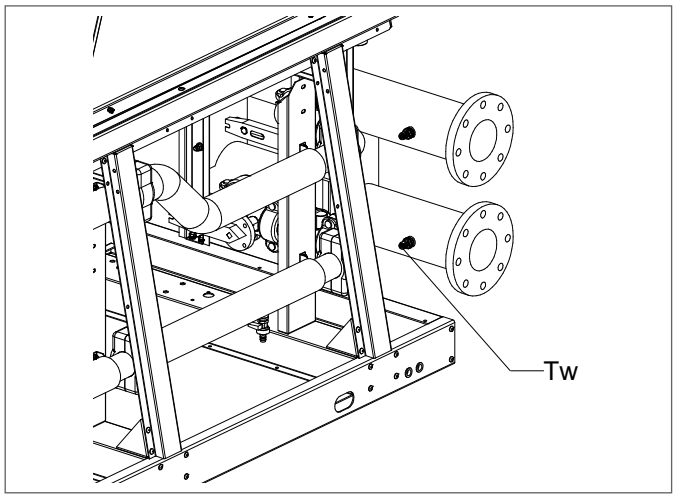
SINGLE UNIT: antifreeze function

MODULAR UNIT: thermoregulation (see diagram below)

Single unit



Multiple units



10.16 Victaulic fittings

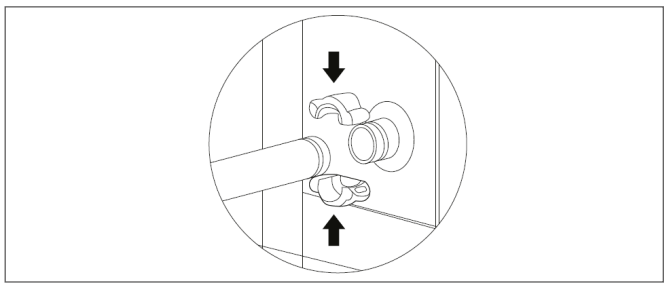
Remove the connection fitting supplied and use the Victaulic connection joint.

Weld the fitting to the system pipe.

Connect the system pipe to the evaporator with the joint.

Do not weld the system pipe with the Victaulic connection joint attached.

The rubber gaskets might be irreparably damaged



10.17 Sequence of operations

Before starting the unit's pump:

1 close all vents in the high points of the unit's water circuit except for the main unit degasser for flammable refrigerant safety

2 close all drain shut-off valves in the low points of the unit's water circuit:
exchangers
pumps
collectors
storage tanks

3 Thoroughly wash the system with clean water:

4 use the bypass to exclude the exchanger from the flow (diagram on the previous page)

5 fill and drain the system multiple times.

6 Apply additives to prevent corrosion, fouling, formation of sludge and algae.

7 Fill the system (do not use the unit's pump)

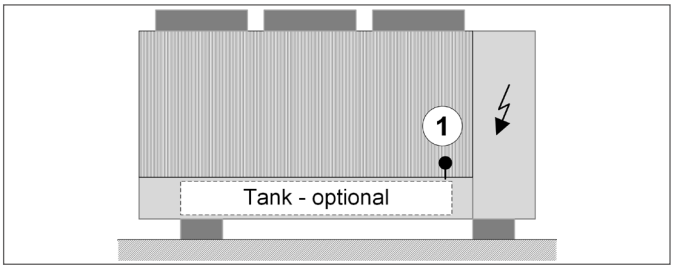
8 Conduct a leak test.

9 Insulate all the pipes to avoid heat dispersion and condensation.

10 Leave the various service points (wells, vents, etc.) free.

CAUTION

▶ **Neglecting to wash will lead to the filter having to be cleaned many times and at worst may damage the exchangers.**



10.18 Domestic hot water

Components required:

- 3-way switching valve
- DHW tank with intermediate exchanger
- DHW tank temperature probe and antifreeze temperature probe
- pump
- backup electric heater

▶ **Caution: for units in modular configuration, the unit configured with domestic hot water must not be the MASTER.**

10.18.1 3-way switching valve

3-way valve for domestic hot water mounted on board

Configuration option.

The valve is supplied as a unit configuration together with the circulation pump HYGU1V. Electrical connections and settings are done at the factory.

No further connections are necessary.

Switching valve for DHW production

Accessory supplied separately.

It must be installed upstream of the circulation pump, not supplied, which must be mounted outside the unit.

The electrical connection must be done according to the wiring diagram of the unit.

10.18.2 DHW tank with intermediate exchanger

Not supplied.

10.18.3 Temperature probes

The T5 probe (DHW set) is supplied with every unit, and must be installed in the water tank well.

The Taf1 probe (DHW antifreeze) is supplied with every unit, and must be installed in a well at the most unfavourable point in case of frost.

Probe wells not supplied.

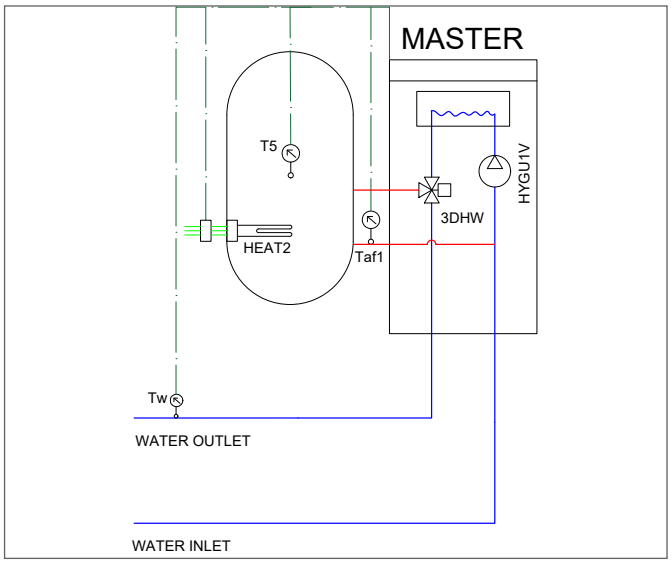
10.18.4 Pump

"Multi pump" configuration (recommended)

Unit configured with the pump on board HYGU1V option. Electrical connections and settings are done at the factory.

Set dip-switch S12-2 to ON=1.

No further connections are necessary.



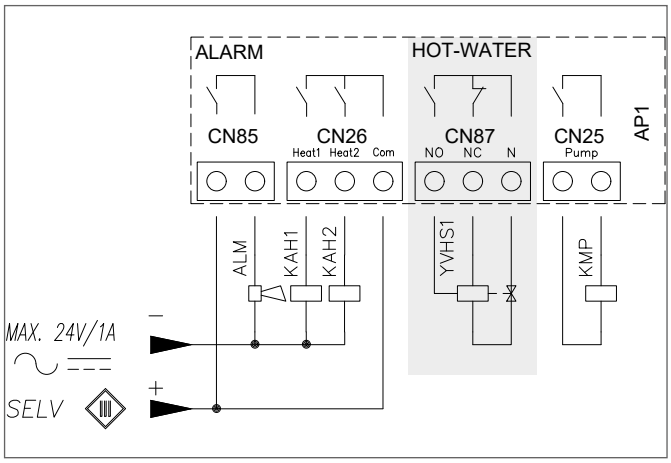
10.18.5 DHW backup electric heater HEAT2:

Not supplied.

It can be managed by the unit that provides a contact for a back-up relay KAH2.

▶ **Caution: do not supply the backup heater directly via this contact.**

Electrical connections and enabling.



10.18.6 Operation

In DHW production mode, the compressors start only if the DHW storage tank temperature (T5) is above a minimum threshold (➜ table).

The temperature threshold varies based on the outdoor temperature.

To prevent it from falling below the minimum temperature, it is advisable to install a backup electric heater (KAH2) on the DHW tank.

outdoor T	DHW tank T5	compr.	backup heater
24°C < t.o ≤ 30°C	< 15°C	OFF	ON
24°C < t.o ≤ 30°C	≥ 15°C	ON	OFF
t.o > 30°C	< 20°C	OFF	ON
t.o > 30°C	≥ 20°C	ON	OFF

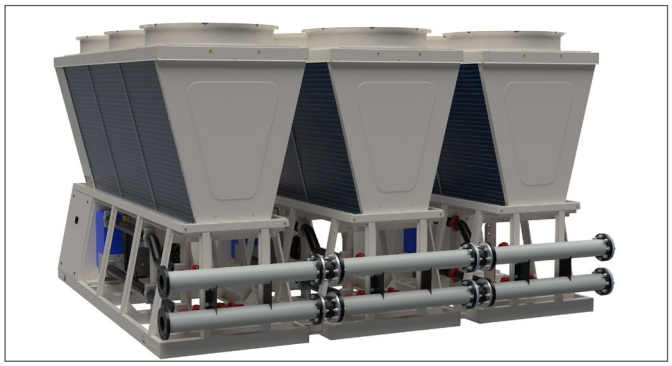
The maximum flow temperature threshold of the system varies according to the outdoor temperature.

The maximum value that can be set for T5S (domestic water set point) is lower than the maximum set point that can be attained by the unit to consider heat exchange through the customer's coil or DHW exchanger.

DHW priority is configurable on the menu:

DHW SWITCH	
SELECT ADDRESS	◄ 11 ►
DHW SWITCH	◄ YES ►
PRIORITY	◄ YES ►
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15	
←	▼▲ ◄►

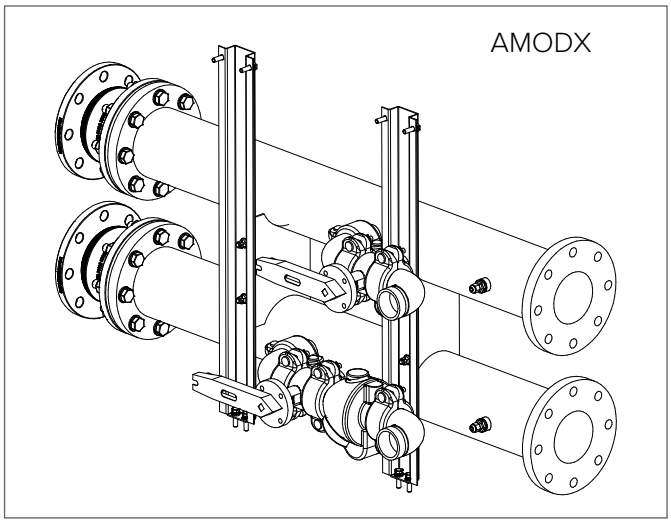
10.19 Unit in modular configuration



AMODX: Water connections for modular unit

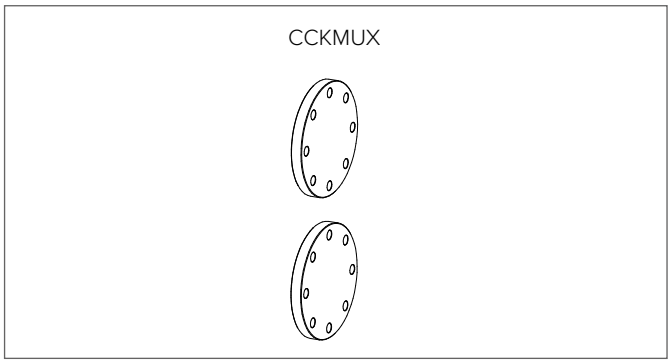
Collectors with vibration-damping joints for connecting the units in hydraulic parallel.

Maximum of 6 units on the same water branch.

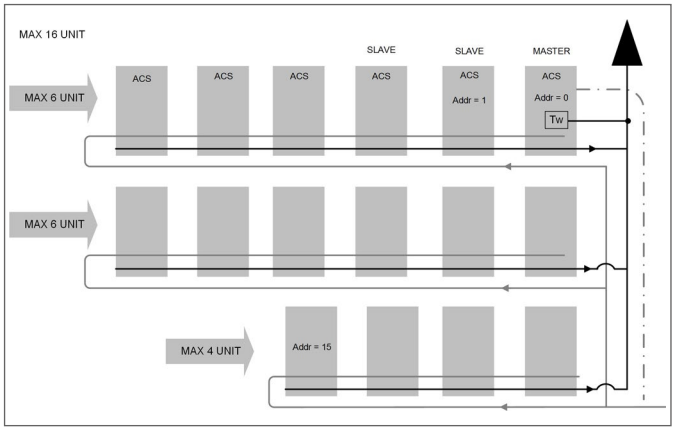


CCKMUX: Kit containing pipe closing caps for modular units

Closing caps for collectors.



The master unit's Tw probe must be moved to the supply line downstream of all units.

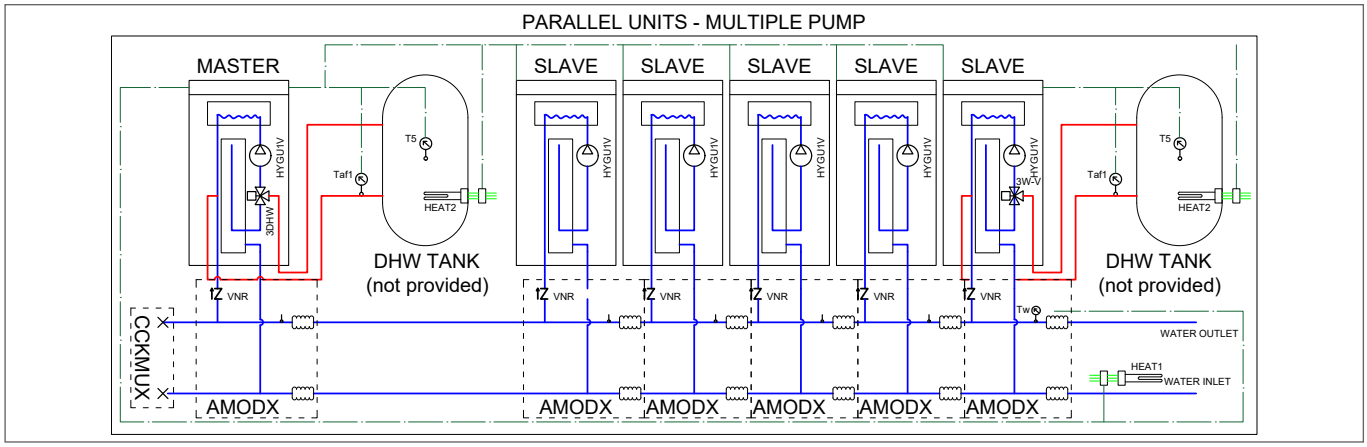


10.19.1 Pump

"Multi pump" configuration (recommended).

Set dip-switch S12-2 to ON=1 on all units.

All units are configured with the pump on board HYGU1V option.



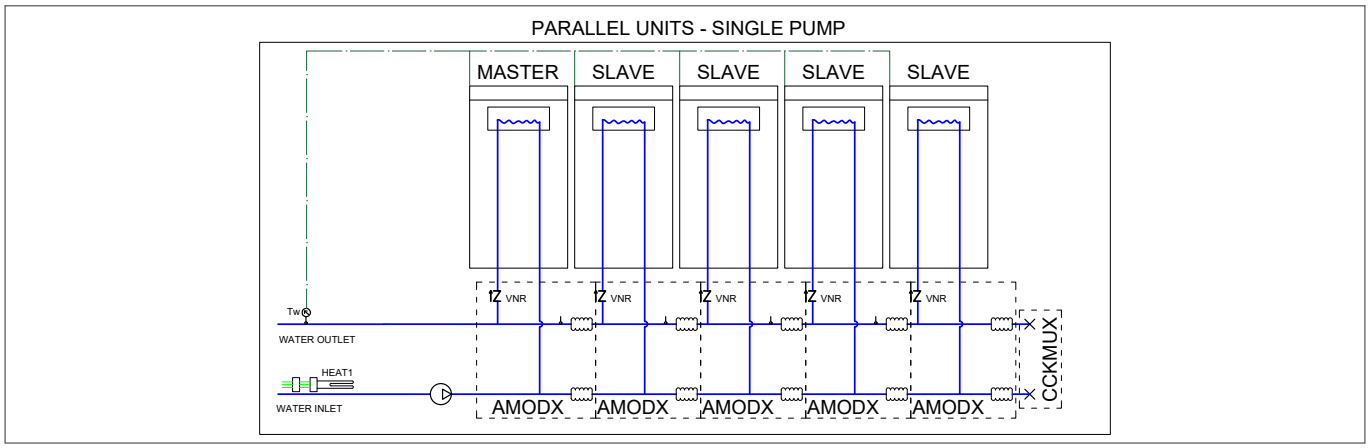
"Single pump" configuration.

Pump not supplied.

Set dip-switch S12-2 to OFF=0

The externally supplied pump serves all units.

▶ **Caution: balance the pressure drops of the units to ensure the correct water flow rate.**



10.19.2 Electrical connections

Maximum of 16 units.

The modular system is managed by the MASTER unit (address=0), ➜ Electrical connections

All units must be connected to each other with a shielded three-wire cable ➜ Electrical connections

10.20 Domestic hot water (modular units)

The instructions in the “Domestic hot water (single unit)” chapter apply.

In a "Multi pump" configuration, every unit must have a dedicated water tank.

10.21 Backup antifreeze and integration heater

Integrated heaters:

- Exchanger antifreeze electric heater (EVA-HEAT1/2)

Heater for plate exchanger antifreeze safety.

- flow switch antifreeze electric heater (W-HEAT)

Heater for flow switch antifreeze safety.

Backup heater (HEAT1)

Heater not supplied.

It can be managed by the unit that provides a contact for a relay KAH1.

- Antifreeze function

Set dip-switch S6-1 to OFF=0

The heater is designed for antifreeze operation only (e.g. heating cable).

It activates when the temperature detected by the unit’s probes falls below 6°C with a 4K hysteresis.

- Integration heater operation

Set dip-switch S6-1 to ON=1

The heater is designed (e.g. boiler) to supplement or replace the unit in case of failure.

▶ **Caution: do not supply the backup heater directly via this contact.**

10.22 REMAU (APR)

Extra board for additional customer connections.

To enable the board, set dip switches 1, 2, 4 and 5 of bank S1 to ON.

Note: not enabled for units in a modular configuration

The available functions are briefly described below.

Refer to the specific manual for more information.

10.22.1 Digital contacts

- Remote ON/OFF (contact SA4): open contact means unit is ON, closed contact means it is OFF
- Mode change (SA5): open contact means unit is in cooling mode, closed contact means it is in heating mode
- DHW (SA6): open contact means domestic hot water is off, closed contact means DHW priority if enabled on the HMI
- Double set point (SA7): open contact means double set point disabled, closed contact means it is enabled
- Silent mode (SA8): open contact means unit is in standard mode, closed contact means it is in silent mode

Smart grid (EVU - SG):

EVU	SG	Description
0	0	Unit operate normally
0	1	Unit operate normally, SG icon on HMI
1	0	Unit OFF (0 kw) or limitation (40%) The unit is forced OFF (0 kW) or limited (40%) according to the configuration made during start-up.
1	1	DHW production forced and increase setpoint, where applicable.

10.22.2 Analogue contacts

Configurable in 0-10 V (default) or 4-20 mA through dip-switch settings.

- Demand limit (dip S7_5 ON): unit power input is limited according to the analogic signal with a linear correlation from around 40% of maximum power input and maximum power input itself. Maximum limitation is with maximum signal input. The linear curve decreasing the power input with increased signal.
- Cooling set point (dip S7_4 ON): can be set through such analogic input from minimum to maximum with a linear corelation. Higher signal means higher setpoint input. The setpoint will increase with increased signal.
- Heating set point (dip S7_3 ON): can be set through such analogic input from minimum to maximum with a linear corelation. Higher signal means higher setpoint input. The setpoint will increase with increased signal.
- DWH set point (dip S7_2 ON): can be set through such analogic input from minimum to maximum with a linear corelation. Higher signal means higher setpoint input. The setpoint will increase with increased signal.

10.22.3 **Dip switch setting**

Dip switch ON: 

Dip switch OFF: 

Bank S1

Dip switch function			
	Function	ON	OFF
S1_1	S1_ModbusControl	Modbus HMI port enabled	Modbus HMI port disabled
S1_2	S1_RemoteControl	Digital device input enabled	Digital device input disabled
S1_3	S1_3	See table 5.2	See table 5.2
S1_4	S1_2	See table 5.2	See table 5.2
S1_5	S1_1	See table 5.2	See table 5.2
S1_6	S1_SinglePump	See table 5.2	Multiple pump unit
S1_7	S1_CoolOnly	Unit only in cooling mode	Heat pump unit

Dip switches for user Modbus baud rate			
S1_1	S1_2	S1_3	
OFF	OFF	OFF	1200 bps
OFF	OFF	ON	2400 bps
OFF	ON	OFF	4800 bps
OFF	ON	ON	9600 bps
ON	OFF	OFF	19200 bps
ON	OFF	ON	38400 bps
ON	ON	OFF	57600 bps
ON	ON	ON	115200 bps

Note: S1_1-S1_2-S1_3 makes reference to the Function of the previous table.

Bank S2

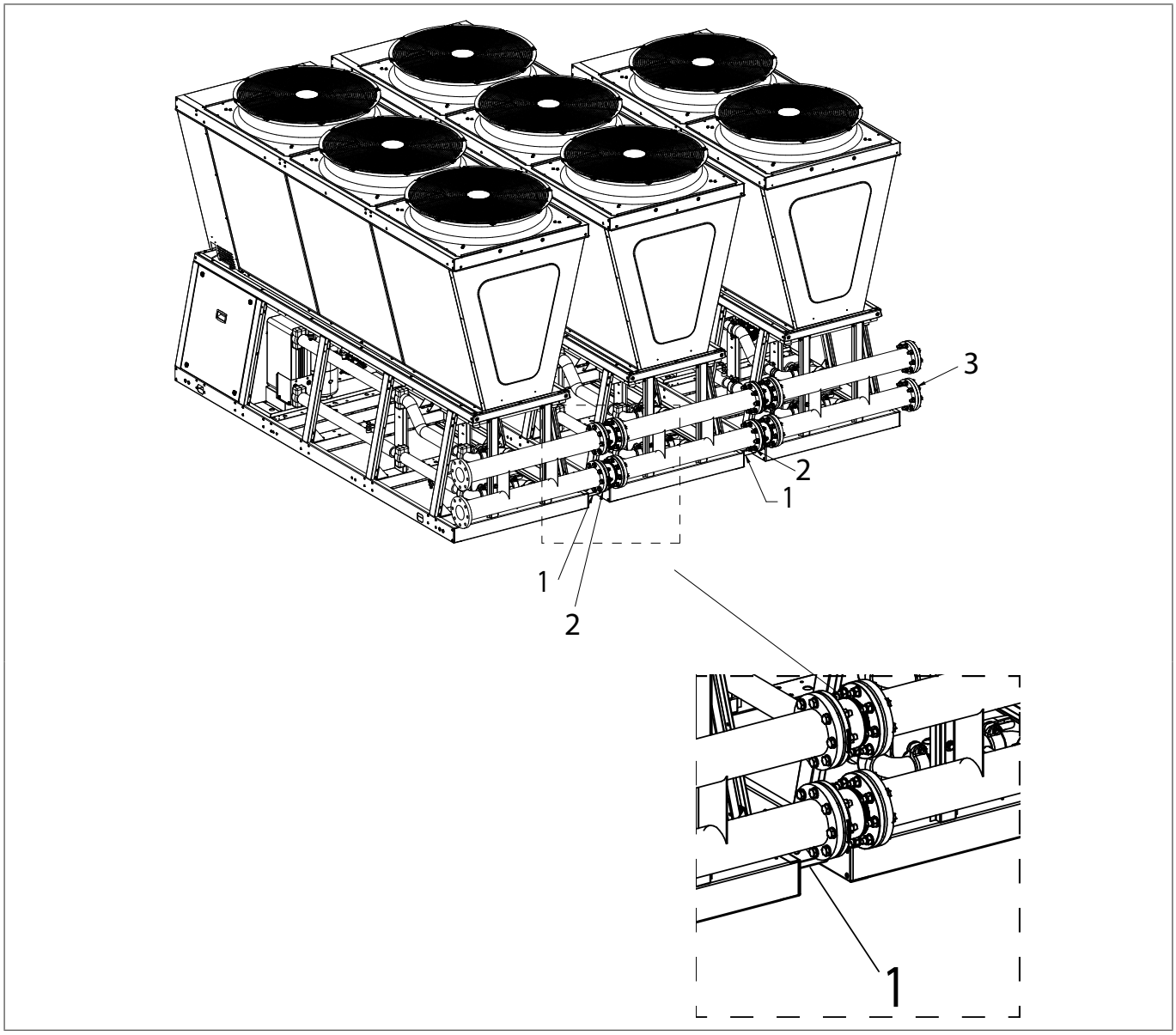
Dip switch function		
	ON	OFF
S2_1	Termination ON	Termination OFF
S2_2	Reserved	Reserved

Bank S7

Dip switch function		
	ON	OFF
S7_1	PCB test mode on	PCB test mode off
S7_2	Remote DHW setpoint setting enabled	Remote DHW setpoint setting disabled
S7_3	Remote heating setpoint setting enabled	Remote heating setpoint setting disabled
S7_4	Remote cooling setpoint setting enabled	Remote cooling setpoint setting disabled
S7_5	Demand limit function enabled	Demand limit function disabled
S7_6	Reserved	Reserved
S7_7	Smart grid function enabled	Smart grid function disabled

Spacers

Option



1 Spacer

2 Vibration-damping joint kit

3 Pipe closing caps kit

11. Electrical connections

The characteristics of the electrical lines must be determined by specialized personnel able to design electrical installations; moreover, the lines must be in conformity with regulations in force.

The protection devices of the unit power line must be able to stop the presumed short circuit current, whose value must be determined in function of system features.

The power cables and the protection cable section must be defined in accordance with the characteristics of the protections adopted.

All electrical operations should be performed by trained personnel having the necessary requirements by the regulations in force and being informed about the risks relevant to these activities.

Operate in compliance with safety regulations in force.

If the unit is to be installed in a TN system, ensure that the protective device upstream of the unit's disconnector switch can trip in less than 5s if there is an earth fault inside the unit.

If the unit is to be installed in a TT system, in addition to the overload protective device, it may be necessary to install an RCD upstream of the unit's main disconnecting switch so that the contact voltage, if there is an earth fault, does not exceed 50V".

11.1 Electrical data

The serial number label reports the unit specific electrical data, included any electrical accessories.

The electrical data indicated in the technical bulletin and in the manual refer to the standard unit, accessories excluded.

The matriculation plate shows the indications foreseen by the standards, in particular:

Voltage

F.L.A.: full load ampere, absorbed current at maximum admitted conditions

F.L.I.: full load input, full load power input at max. admissible condition

Electrical wiring diagram Nr

11.2 Connections

1 Refer to the unit electrical diagram (the number of the diagram is shown on the serial number label).
2 verify that the network has characteristics conforming to the data shown on the serial number label.
3 Before starting work, verify that the sectioning device at the start of the unit power line is open, blocked and equipped with cartel warning.
4 Primarily you have to realize the earthing connection.
5 Shelter the cables using adequate measure fairleads.
6 Prevent dust, insects or rodents from entering the electrical panel as they can damage components and cables.
7 Use the holes on the bottom of the frame for power line inlet. Seal any remaining openings to prevent noise from escaping from the compressor compartment.
8 Fix the cables: if vacated may be subject to tearing.
9 The cable must not touch the compressor and the refrigerant piping (they reach high temparatures).
10 Do not drill holes in the electrical panel.
11 Alternatively, restore the IP rating with watertight systems.
12 Before power the unit, make sure that all the protections that were removed during the electrical connection work have been restored.

11.3 Power supply network requirements

1 the presumed short circuit current at the unit's point of connection must not exceed 10 kA.
2 The units can be connected to TT and TN distribution systems; a PEN conductor must not be used.

   When the unit is going to be connected to a TT-type distribution system, a residual current device (RCD) may be required to protect against high fault loop impedance.

   The activation threshold for the RCD should ensure a contact voltage not exceeding 50 V (AC), according to Annex A2.2.2 of the EN 60204-1:2018 standard.

   The use of differential protection, whose activation causes complete disconnection from the power supply, is mandatory for installations using TT earthing systems, but only within Italy.
3 Rated power voltage 400 V ± 10%; number of phases: 3N, rated frequency: 50Hz ± 1%;
4 Phase unbalance < 2%.
5 The no-load harmonic distortion of the voltage must be less than 12% of the RMS value of the rated power voltage.
6 Voltage interruptions lasting no longer than 3ms and with at least 1 s between each one
7 Voltage dips not exceeding 20% of the RMS value, lasting no longer than a single period (50Hz) and with at least 1 s between each dip.
8 Earth cable (copper conductors) as specified in the table:

Cross-section of the line conductors (mm^2)	Minimum cross-section of the protective conductor (PE) (mm^2)
S ≤ 16	S
16 < S ≤ 35	16
S > 35	S/2

11.4 Signals / data lines

Do not overpass the maximum power allowed, which varies, according to the type of signal.

Lay the cables far from power cables or cables having a different tension and that are able to emit electromagnetic disturbances.

Do not lay the cable near devices which can generate electromagnetic interferences.

Do not lay the cables parallel to other cables; cable crossings are possible, only if laid at 90°.

The type of cable must be suitable for RS-485 serial data communication.

A 3-pole shielded bus cable is required.

The data transmission bus cable must be checked

depending on the type of installation where it will be positioned and must be in accordance with local standards.

The bus cable must comply with non-prescribed local electrical standards (e.g. insulation, voltages, flame propagation, etc.).

The cable shield must be grounded at a single point free from disturbances.

In order to ensure correct communication, the earth connection of the shield can also be configured differently depending on the area and the types of interference.

Allowed topology: daisy-chain (enter and exit). Other topologies such as "ring" or "star" are not allowed.

Other types such as "ring" or "star" are not allowed.

Do not use cable lugs on the communication bus.

Cables for interfacing with the APR remau board must be shielded (as shown in the wiring diagram) and no longer than 30 m.

11.5 Remote ON-OFF

Do not perform short On-Off cycles.

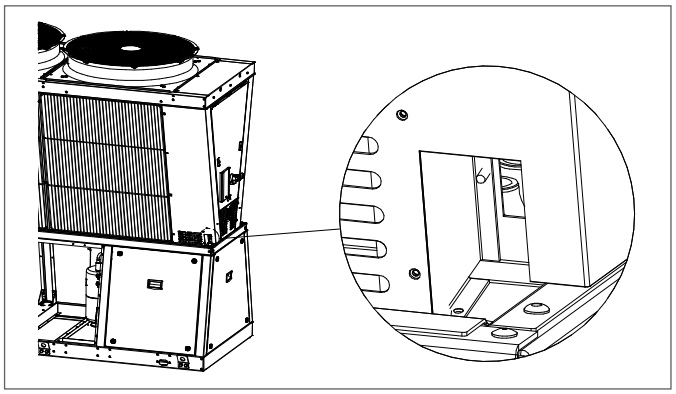
Do not use the remote On-Off with a thermoregulation function.

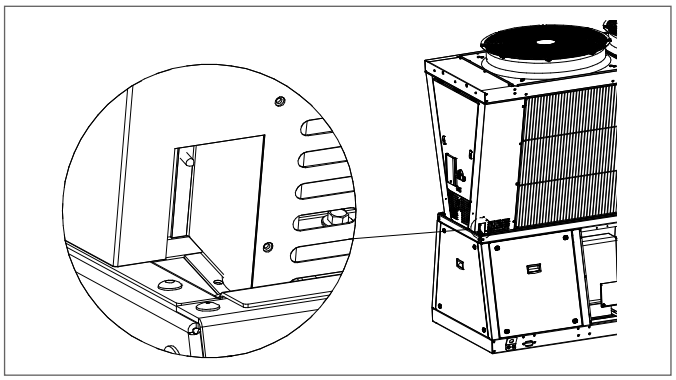
11.6 Disconnector switch

Mounted on the unit.

11.7 Controller wiring sections

Power line inlet





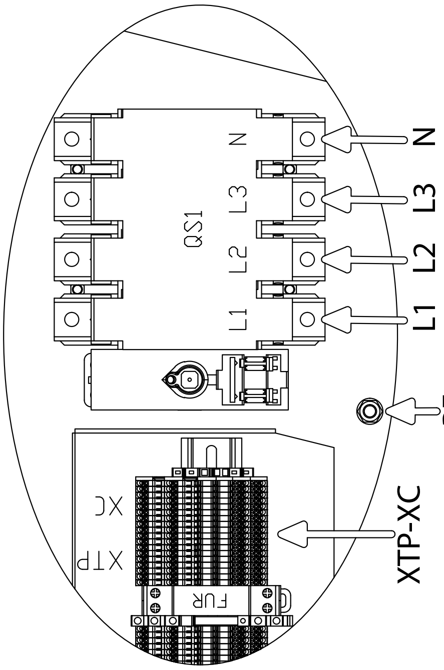
Power supply cables section

Size	14.1-16.1	18.1-30.2
Min Main switch cable cross-section allowed Cu (mm^2)	10	25
Max Main switch cable cross-section allowed Cu (mm^2)	25	95
Tightening torque		

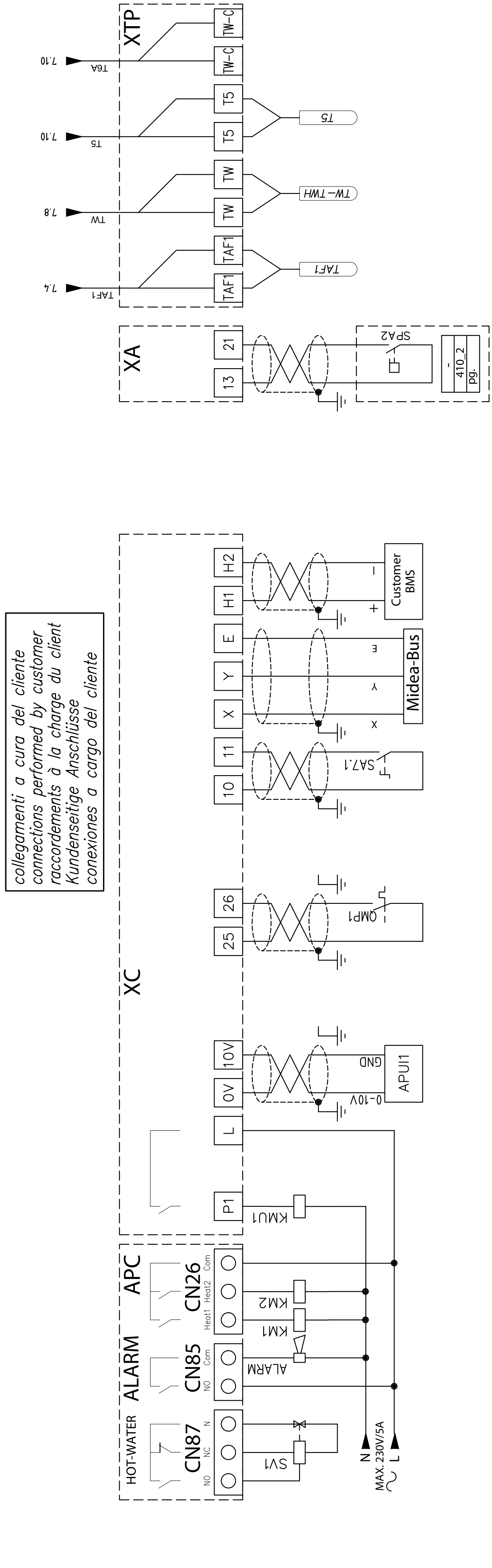
▶ **Caution: the section indicated refers to the seat of the unit's terminals and not to the sizing of the line, which is under the responsibility of the installer.**

11.8 Connections to be provided by customer

Midea Bus	BUS per unità in cascata BUS for cascade units BUS pour unités en cascade BUS für Kaskadeneinheiten BUS para unidades en cascada	
BMS	Modulo Di Comunicazione Seriale Con Pc o Bms Serial Communication Module To Pc Or Bms Interface De Communication Avec Port Série Pour Pc Ou Bms Serielles Schnittstellenmodul Für Pc Oder Glt Módulo De Comunicaciones Serie a Pc o Bms	
RB1/RB2	Resistenza della bacinella anti-condensa Resistance of the anti-condensation pan Résistance du bac anti-condensation Widerstand der Antikondensationswanne Resistencia de la bandeja anticondensaciones	
SPA2	Pressostato controllo carico impianto System load control pressure switch Pressostat de contrôle charge de l'installation Druckschalter Anlagenladung Interruptor de presión de control de carga del sistema	
TAF1	Sensore antigelo su acqua lato ACS Anti-freeze sensor on water on DHW side Sonda anticongelante lado ACS Frostschutzsensor auf der Warmwasserseite Sonda anticongelante lado ACS	
TW-TWH	Sonda totale al collettore dell'acqua in uscita (caldo) Total probe to the outlet water collector (Heat) Sonde totale au collecteur d'eau de sortie (chaude) Gesamtsonde zum Wassersammler am Ausgang (heiß) Sonda total al colector de agua de salida (caliente)	
T5	Sonda di temperatura accumulo acqua calda sanitaria Domestic hot water storage temperature probe Sonde de température de stockage d'eau chaude sanitaire Brauchwasserspeicher-Temperaturfühler Sonda de temperatura almacenamiento agua caliente sanitaria	



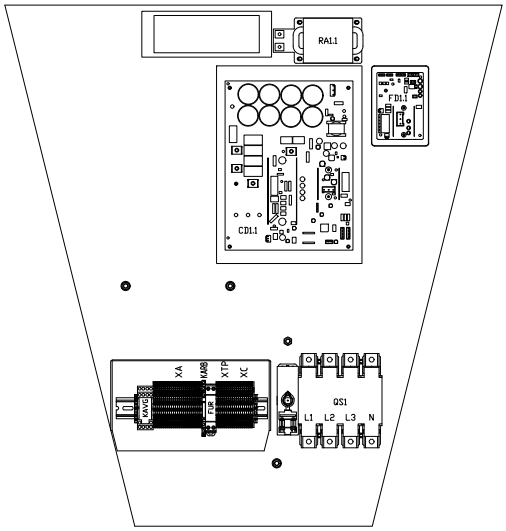
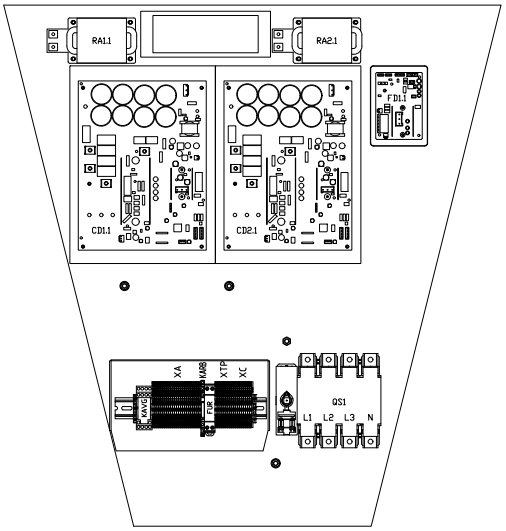
ALARM	segnalazione blocco cumulativo cumulative fault signal signalisation alarme Sammelstörmeldung señalización bloqueo cumulativo	
QMP1	interruttore automatico a protezione pompa ricircolo recirculation pump protection automatic device interrupteur automatique de protection pompe recirculation automaticher Schalterschutz der Umluftpumpe interruptor automático de protección bomba recirculación	– – 411_1 pg. 14.2
KMU1	contattore pompa di circolazione evaporatore evaporator pump contactor contacteur pompe de circulation évaporateur Schütz Kaltwasserpumpe contactor bomba de circulación evaporador	– – 411_1 pg. 14.2
APUI1	Inverter pompe lato utilizzo Inverter side pumps use Pompes côté variateur utilisation Wechselrichter-Seite Pumpen Einsatz Inverter bombas lado uso	– – 411_1 pg. 14.2
SV1	valvola sanitaria sanitary valve soupape sanitaire Brauchventil válvula sanitaria	
KM1	Relè di comando resistenza ausiliaria tubatura acqua Control Relay for pipeline Auxiliary Heater Relais de commande de chauffage auxiliaire de conduite d'eau Steuerrelais für Zusatzheizung der Wasserleitung Relé de control del calentador auxiliar de la tubería de agua	
KM2	Relè di comando resistenza ausiliaria accumulo acqua sanitaria Control relay for sanytary water storage tank auxiliary heater Relais de contrôle de résistance auxiliaire pour stockage d'eau chaude sanitaire Hilfswiderstandsregelrelais für die Warmwasserspeicherung Relé de control de calefacción auxiliar para almacenamiento de agua caliente sanitaria	
SA7.1	Selettore Remoto Per Cambio Set-point Remote Selector for Setpoint Change Sélecteur Déporté Pour Changement De Consigne Fernwahlschalter Sollwertwechsel Selector Remoto Para Cambio Set-point	



11.9 Electrical panel

Warning

▶ **Disconnect the voltage before accessing the electrical panel.**

Size 14.1-20.1	Size 25.2-30.2
	

1 Terminal block for customer connections

Sign	Description
KARB	Anti-condension tray resistor enabling relay
QS1	Main disconnecting switch
FUR	Heater drain pan fuse
KAVG	Relay in support of refrigerant leak sensor
XC	Terminal block for customer connections

Fuses

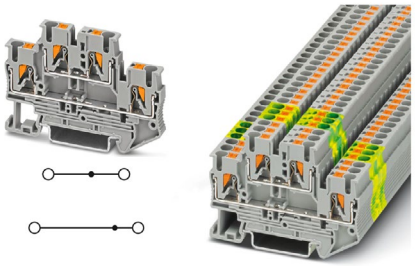
Size	Fuse
14.1-16.1	4 x 50A 22x58
18.1-19.1-20.1	4 x 63A 22x58
25.2-30.2	4 x 80A 22x58

Double-deck push-in terminals

Cable cross-section:

Smin: 0.14 mm^2

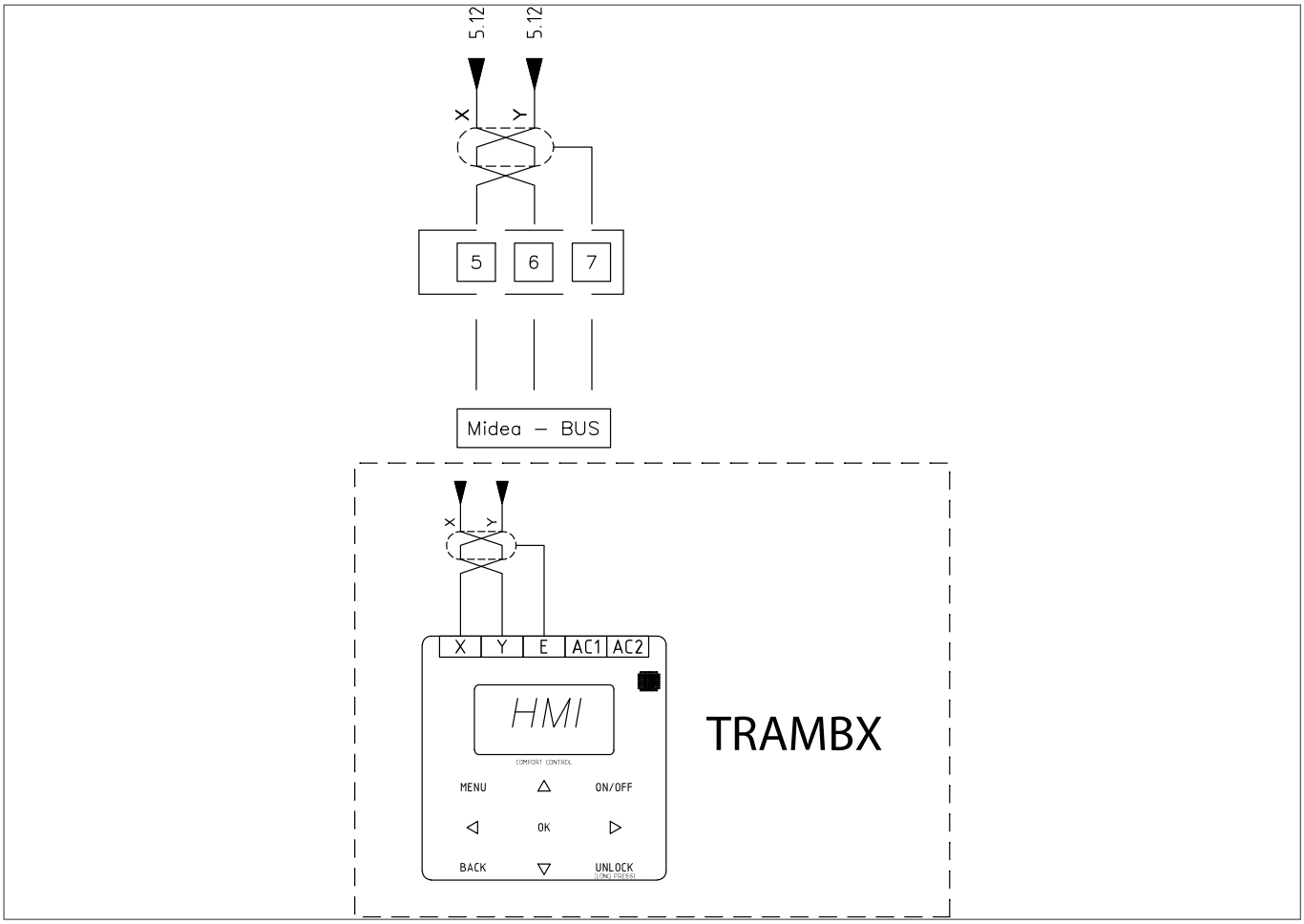
Smax: 2.5 mm^2



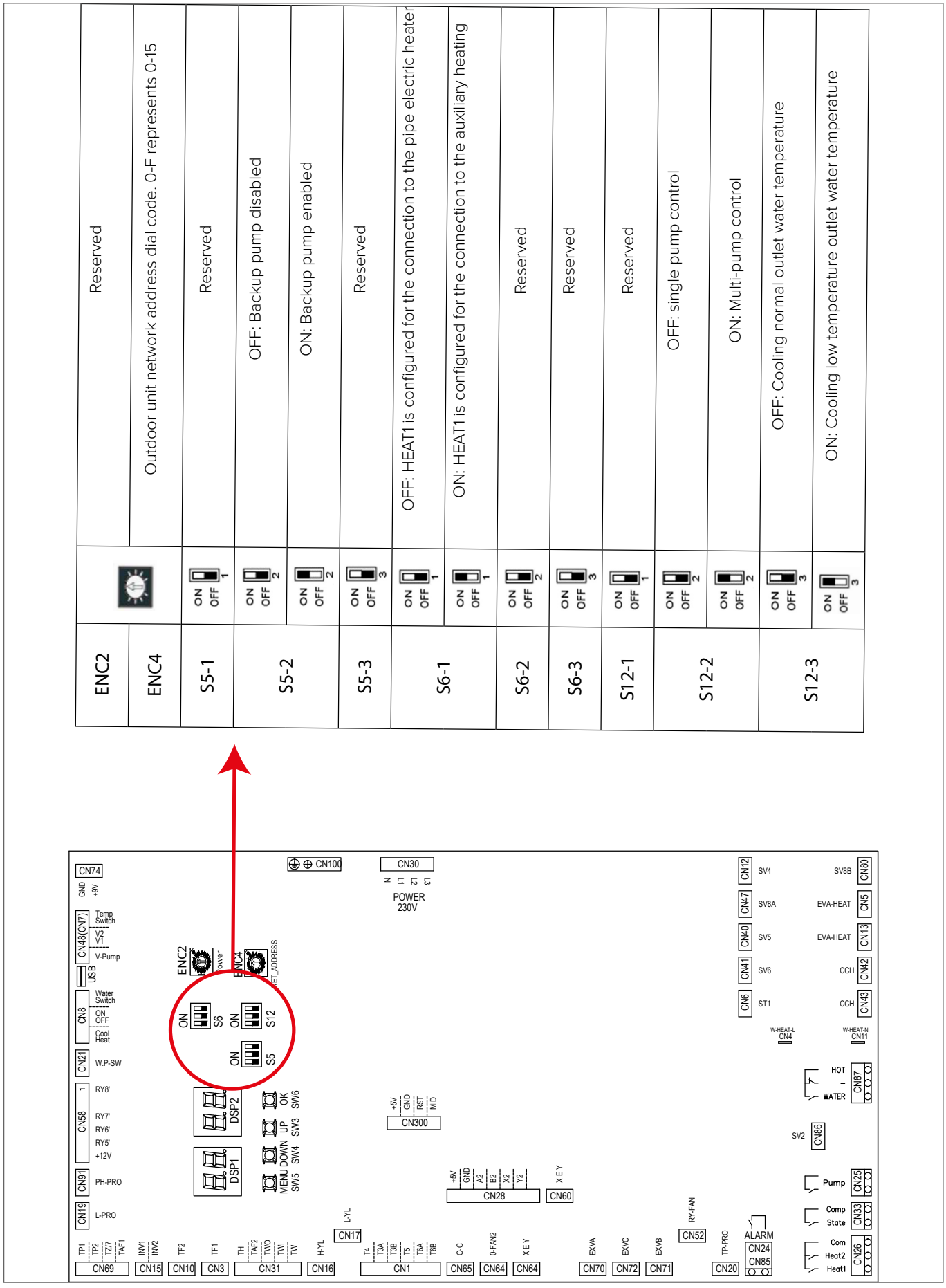
11.10 Connection 2nd HMI

Customer terminal block connection.

- **It can be used for remote control (if configured as a master) or visualization (if configured as a slave).**
- **Through a remote HMI all the units in M/S the system are visible.**



11.11 Dip switch configuration



12. **Start-up**

The indicated operations should be done by qualified technician with specific training on the product.

Upon request, the service centres performing the start-up.

The electrical, water connections and the other system works are by the installer.

Agree upon in advance the star-up data with the service centre.

Before checking, please verify the following:

- the unit should be installed properly and in conformity with this manual
- the electrical power supply line should be isolated at the beginning
- the unit isolator is open, locked and equipped with the suitable warning
- make sure no voltage is present

Warning

- ▶ **After turning off the power, wait at least 5 minutes before accessing to the electrical panel or any other electrical component.**
- ▶ **Before accessing check with a multimeter that there are no residual voltage.**

12.1 On-site information

The installer shall provide the documentation, which shall be clearly legible, in a suitable weatherproof envelope, leaving it near the place of use of the unit.

This “on-site” information must contain at least the following:

A) name(s), address(es) and telephone number(s) of the installer and customer support, and the addresses and telephone numbers of the fire brigade, police, hospitals and burns centres

B) nature of the refrigerant, with an indication of its chemical formula and numerical designation (see EN 378-1:2016, Annex E)

C) instructions for stopping the refrigerant system in an emergency

D) maximum permissible pressures

E) details on flammability if a flammable refrigerant is used (class A2L, A2, A3, B2L, B2, B3 refrigerant)

F) details on toxicity if a toxic refrigerant is used (class B1, B2L, B2, B3 refrigerant).

12.2 Unit booklet

The installer must prepare a register when installing the system. This register must be regularly updated as specified in EN 378-4.

At least the following information must be recorded in the unit’s booklet:

A) details of maintenance and fixing work

B) the quantities, the type of refrigerant (new, reused, recycled, regenerated) that was charged each time, the quantity of refrigerant that were transferred from the system each time (also see EN 378-4);

C) the results of any analyses of a reused refrigerant;

D) the source of the reused refrigerant

E) modifications and replacements of system components

F) the results of all routine periodic checks

G) significant periods of non-use.

12.3 Start-up sequence

For details refer to the different manual sections.

Unit OFF power supply

		✓
1	safety access	
2	suitable frame to withstand unit weight + people weight	
3	functional spaces and safety spaces	
4	air flow: correct intake and supply (no bypass, no stratification)	
5	level considered to be reachable by snow	
6	main winds considered: there are deflectors / windbreaks, suitable anchorage system	
7	no chimneys / corrosive atmospheres / pollutants	
8	structure integrity	
9	fans run freely	
10	unit on vibration isolators	
11	unit is on a flat surface	
12	there is condensate drainage (only for heat pump units)	
13	installation of a degasser or a different system of separation on the secondary circuits	
14	unit water inlet filter + shut-off valves for cleaning	
15	hydraulic connections as per recommended diagram	
16	expansion tank	
17	minimum system water content	
18	system washed	
19	system loaded	
20	antifreeze protections: glycol solution, heating cable if needed	
21	system under pressure + vented	
22	refrigerant circuit visual check	
23	earthing connection	
24	power supply features	
25	connections provided by Customer: electrically connected, configured	

12.4 **Start-up sequence**

For details refer to the different manual sections.

Unit ON power supply

			✓
1	operate the emergency exhaust fan selector switch for at least 5 min		
2	leak check with a suitable detector		
3	compressor crankcase heaters in operation, temperature >15K with respect to the environment, or switched on for at least 8 hrs		
4	off-load voltage measure		
5	phase sequence check		
6	manual pump start-up and flow-rate check		
7	shut-off valve refrigerant circuit open		
8	unit ON		
9	load voltage measure		
10	check for bubbles in the liquid sight glass (if present)		
11	check operation of all fans: check there are no abnormal noises or vibrations		
12	supply and return water temperature measure		
13	measure super-heating and sub-cooling		
14	check no anomalous vibrations are present		
15	climatic curve personalization		
16	scheduling personalization		
17	complete and available unit documentation		

12.5 Refrigeration circuit

1 Check carefully the refrigerating circuit: the presence of oil stains can mean leakage caused by transportation, movements or other).
2 Verify that the refrigerating circuit is in pressure: Using the unit manometers, if present, or service manometers.
3 Make sure that all the service outlets are closed with proper caps; if caps are not present a leak of refrigerant can be possible.
4 Open the valves of the refrigerant circuit, if there are any.

12.6 Electric Circuit

1 Verify that the unit is connected to the ground plant.
2 Check the conductors are tightened as: the vibrations caused by handling and transport might cause these to come loose.
3 Connect the unit by closing the sectioning device, but leave it on OFF.
4 Check the voltage and line frequency values which must be within the limits: 400-3-50 +/-10%
5 Check and adjust the phase balance as necessary: it must be lower than 2%

Warning

- **Working outside of these limits can cause irreversible damages and voids the warranty.**

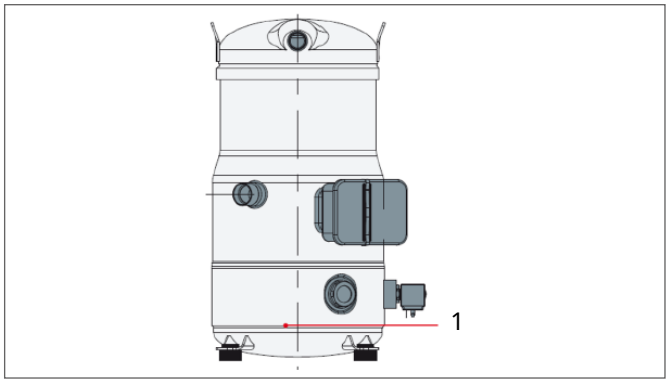
12.7 Crankcase heaters

The unit must remain powered before start-up to allow activation of the electric compressor heaters.

The heat provided will evaporate the liquid in the oil.

The times for attaining start-up conditions vary according to the environmental and system conditions.

The method for checking this is to measure the compressor casing temperature at the point indicated below.



1 Sensor

It can be measured with a contact thermometer.

- **It can only be started when the temperature measured is 15K higher than the ambient temperature. If you cannot measure the temperature, you will need to keep the compressor crankcase heaters on for at least 8 hours before start-up.**
- **Failure to comply with the above instructions can result in compressor malfunction due to its poor lubrication and possible failure.**

These rules need to be followed both on first start-up and whenever the unit is switched off for more than 24 hours.

12.8 Voltages

Check that the air and water temperatures are within the operating limits.

Start the unit.

With unit operating in stable conditions, check:

- Power supply voltage
- Total absorption of the unit
- Absorption of the single electric loads

12.9 Remote controls

Check that the remote controls (ON-OFF etc) are connected and, if necessary, enabled with the respective parameters as indicated in the “electrical connections” section.

If a dip-switch setting is required to enable remote controls cut and restore the power supply to make the change effective.

Check that probes and optional components are connected and enabled with the respective parameters (“electrical connections” section and following pages).

12.10 Checking the evaporator water flow-rate

Check that the difference between the exchanger inlet and outlet water temperature corresponds to the power according to this formula:

- unit cooling capacity (kW) x 860 = Dt (°C) x flow-rate (L/h)

The cooling capacity is shown in the GENERAL TECHNICAL DATA table in this manual referring to specific conditions, or in the tables on COOLING PERFORMANCE in the TECHNICAL BULLETIN referring to various conditions of use.

Check for water side exchanger pressure drops:

- determine the water flow-rate
- measure the difference in pressure between exchanger inlet and outlet and compare it with the graph on WATER SIDE EXCHANGER PRESSURE DROPS

The measurement of pressure will be easier if pressure gauges are installed as indicated in the RECOMMENDED WATER CONNECTION DIAGRAM.

12.11 Units in multiple configuration

Complete system management is carried out by the master unit, identified by address 0.

Thermoregulation takes place on the supply temperature of the entire system (master unit Tw).

When there is a load request, the units are switched on in sequence based on their address, from lowest to highest.

When the load decreases, the units are switched off based on their address, from highest to lowest.

If the units installed exceed requirements, those with a higher address may not be used.

Example in cooling mode

each unit switches off if:

At switch-on, If Tw ≥ set point + 10°C

- ➔ the control activates 50% of the resources.
- ➔ after a time interval (default: 240 seconds)
- ➔ if the load increases, additional resources are activated
- ➔ if the load decreases, resources are removed.

If Tw < set point + 10°C

- ➔ the control activates only the master unit.
- ➔ after a time interval (default: 240 seconds)
- ➔ if the load increases, additional resources are activated based on the set address
- ➔ if the load decreases, the master unit switches off

Example in heating mode

Each unit switches off if:

At switch-on, If Tw ≤ set point - 10°C

- ➔ the control activates 50% of the resources.
- ➔ after a time interval (default: 240 seconds)
- ➔ if the load increases, additional resources are activated
- ➔ if the load decreases, resources are removed

If Tw > set point - 10°C

- ➔ the control activates only the master unit
- ➔ after a time interval (default: 240 seconds)
- ➔ if the load increases, additional resources are activated based on the set address
- ➔ if the load decreases, the master unit switches off

12.12 Reduced load operation

The units are equipped with capacity steps and so can operate with reduced loads.

- ▶ **A constant and long reduced load operation with frequent compressor stops and start-ups can cause irreparable damage due to the absence of oil return.**
- ▶ **The above-described operating conditions must be considered outside the operating limits.**
- ▶ **If the compressor breaks down due to operating in the above-mentioned conditions, the warranty shall no longer be valid and CLIVET spa shall not accept any liability.**

Periodically check the average operating times and frequency of compressor start-ups: indicatively the minimum heat load must be such as to require a compressor to operate for at least ten minutes.

If average times are close to this limit, take appropriate corrective actions.

for example it's possible to have longer operation with increased thermal inertia. Increase the water content with an addititonal or bigger water tank.

12.13 Start-up report

Identifying the operating objective conditions is useful to control the unit over time.

With unit at steady state, i.e. in stable and close-to-work conditions, identify the following data:

- total voltages and absorptions with unit at full load
- absorptions of the different electric loads (compressors, fans, pumps etc)
- temperatures and flows of the different fluids (water, air) both in input and in output from the unit
- temperature and pressures on the characteristic points of the refrigerating circuit (compressor discharge, liquid, intake)

The measurements must be kept and made available during maintenance interventions.

12.14 **2014/68/UE PED directive**

DIRECTIVE 2014/68/UE PED gives instructions for installers, users and maintenance technicians as well.

Refer to local regulations; briefly and as an example, see the following:

Compulsory verification of the first installation:

- only for units assembled on the installer's building site (for ex. Condensing circuit + direct expansion unit)

Certification of setting in service:

- for all the units

Periodical verifications:

- to be executed with the frequency indicated by the Manufacturer (see the "maintenance inspections" paragraph)

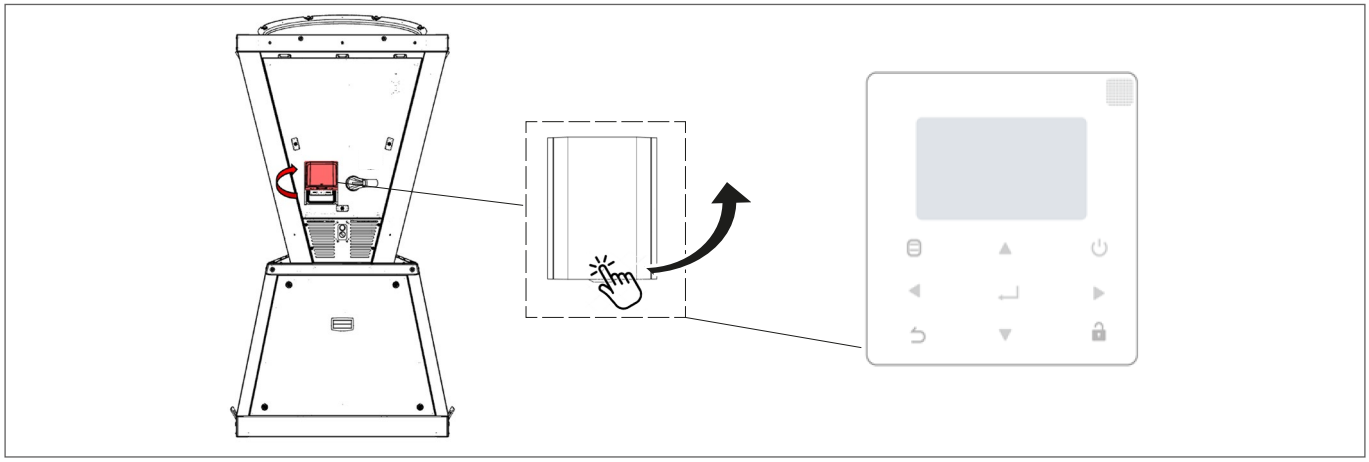
13. Control

13.1 Keypad

To access:

- press down on the panel
- raise

▶ **Always close the panel to prevent water from entering.**



13.2 Buttons

Button	Name	Function
	UNLOCK	Locks/unlocks the buttons
▲▼	UP DOWN	Changes the current setpoint
	MENU	Opens the various menus from the HOME screen
▲▼◀▶	UP DOWN LEFT RIGHT	Moves the cursor, changes the selection, changes the set value.
	ENTER	Confirms an operation.
	ON OFF	Switches on/off.
	BACK	Returns to the previous level/page.

13.3 Button Lock / Unlock

Press for 3 seconds.	

13.4 Switch-On/Off

Press	

13.5 Unit in modular configuration

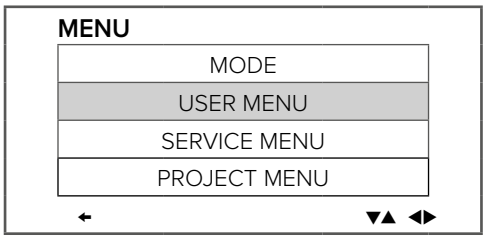
The information displayed on ALL controllers refers to the MASTER unit.

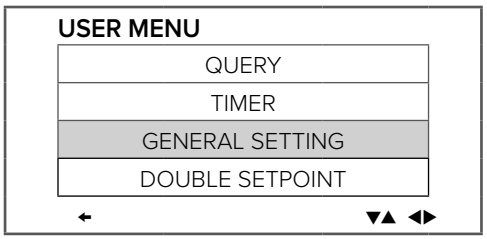
On the slave controllers, only the password-protected SERVICE menu can be opened.

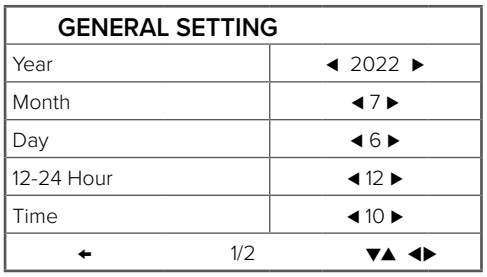
13.6 Display

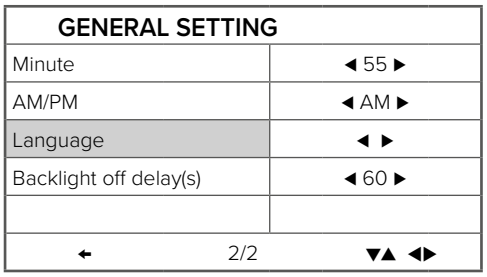
Icon	Meaning
Cool	Cooling
Heat	Heating
DHW	Domestic hot water
OFF	Controller off
	Weekly timer active
45%	Compressor usage value Compressor in operation
60%	Fan usage value Fan in operation
	Pump in operation
	Backup electric heater in operation
	Manual antifreeze or defrosting in operation
	Remote control: the unit is set from the keypad to be controlled by a remote terminal or by a remote selector switch.
	SILENT mode
	Button lock
	Timer active
	Alarm: indicator on when there is a fault or a protection is tripped.

13.7 Set Date, Time, Language

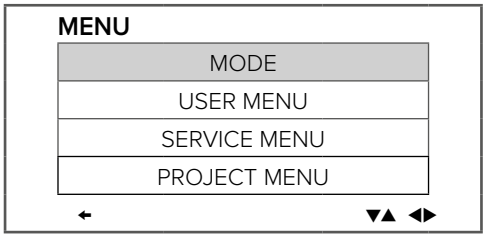








13.8 Set MODE and TEMPERATURE



Press	
Select Mode	▲▼
Confirm	
Select the mode or the temperature	◄►
Control the mode or the temperature	▲▼
Confirm	

If no operations are performed for more than 60 seconds, the system automatically saves the mode setting and returns to the home page.

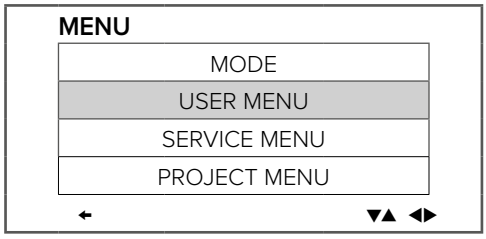
- **In cooling mode with ext T < 15°C, the setpoint is forced to 10 °C (see Operation limits)**

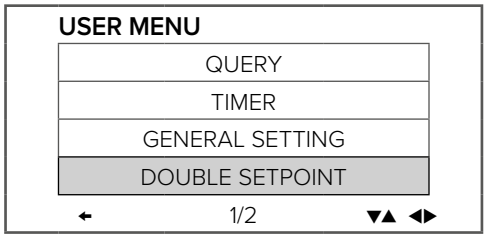
13.9 Double setpoint

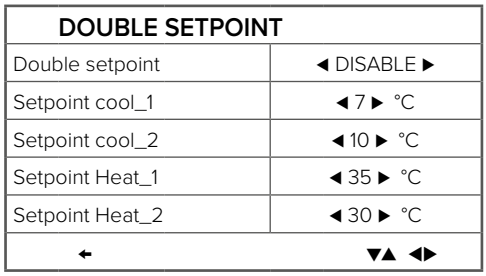
The unit is capable of handling two different setpoints, in both heating and cooling modes.

The value can be set with the user interface.

Activation is via a dry contact on the specific terminal block.



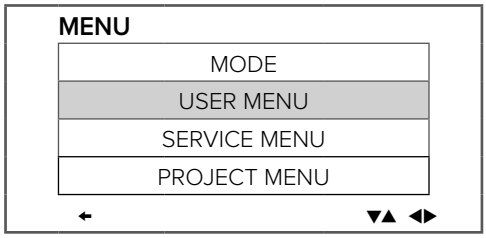


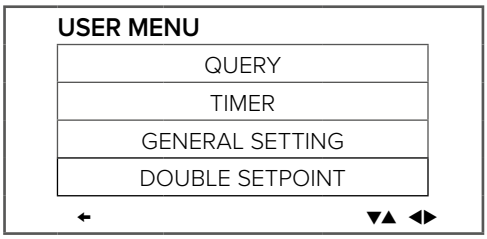


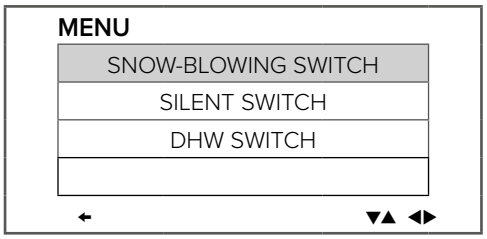
13.10 Snow-blowing function

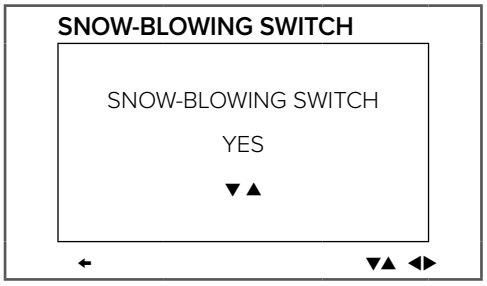
If enabled, the function activates the fans in order to prevent a build-up of snow.

The fans start for 2 minutes every 30 minutes when the air temperature is below 3°C and the unit is stopped.









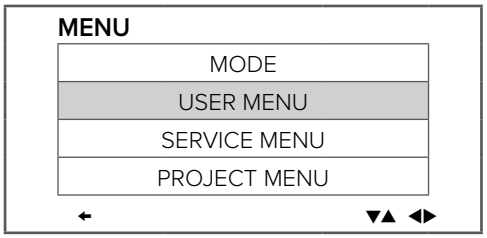
13.11 Silent mode

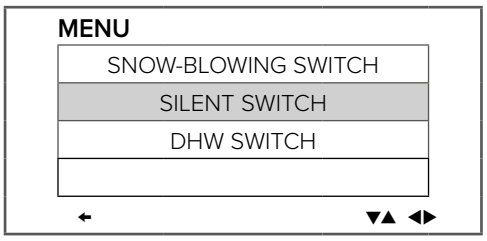
The SILENT MODE function lowers the sound emission level, which is especially useful at night.

The compressor and fan speed is reduced.

There are three silence levels available: Standard, Silent, Super silent.

Refer to the technical data in the different modes for the noise level reduction and power reduction levels of each sound configuration.





SILENT SWITCH	
SELECT SILENT	◄ SILENT ►
CURRENT SILENT	SILENT

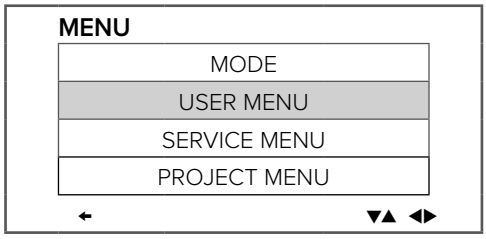
13.12 Domestic hot water

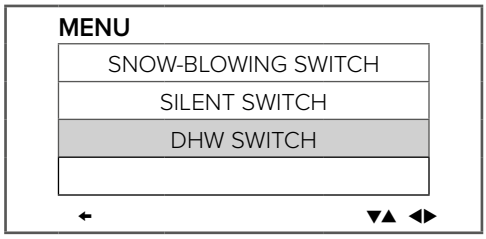
Option.

The unit is capable of handling domestic hot water production.

A dedicated valve diverts the water flow from the system to the domestic hot water tank until the DHW setpoint set on the user interface is attained.

The function must be enabled from the user interface.

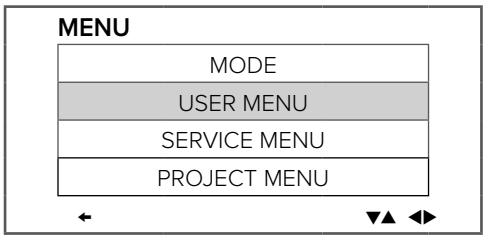


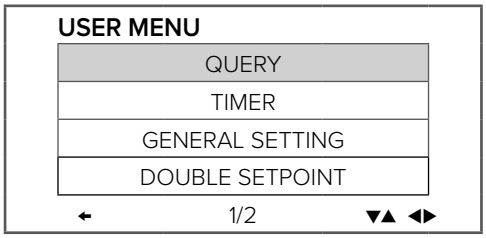


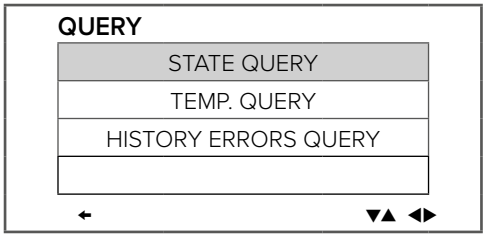
DHW SWITCH	
SELECT ADDRESS	◄ 11 ►
DHW SWITCH	◄ YES ►
PRIORITY	◄ YES ►
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15	

13.13 Querying variables

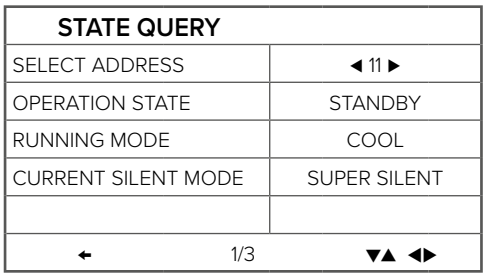
The function displays some unit variables: operation status, temperatures, alarm history.

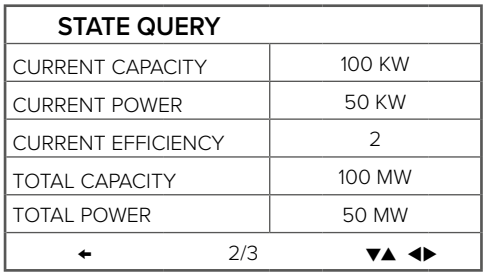


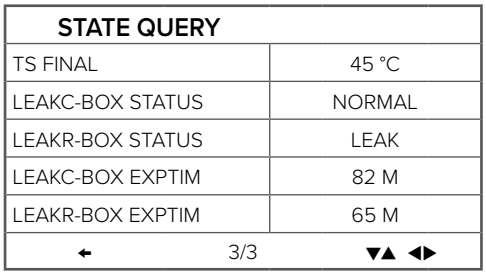


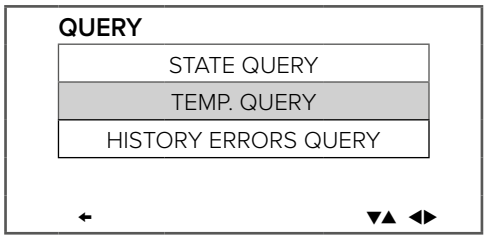


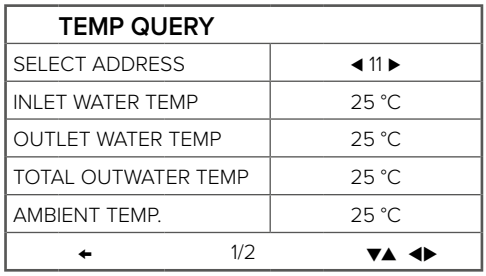
Select the unit's address (only for units in modular configuration)

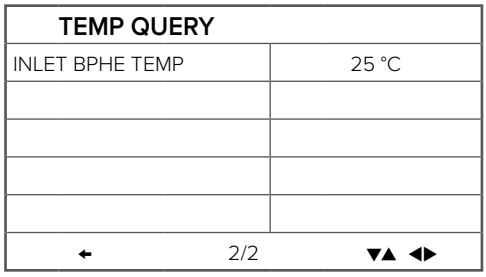


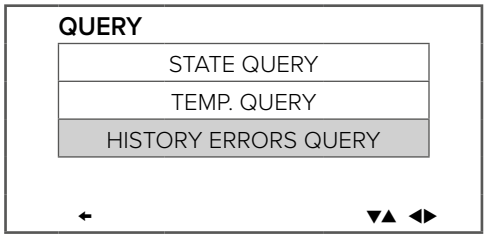


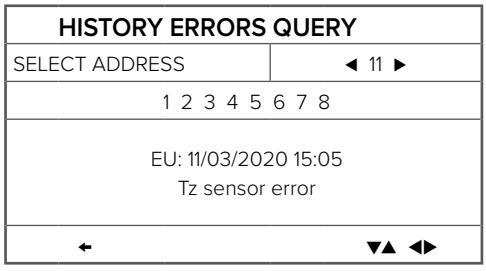


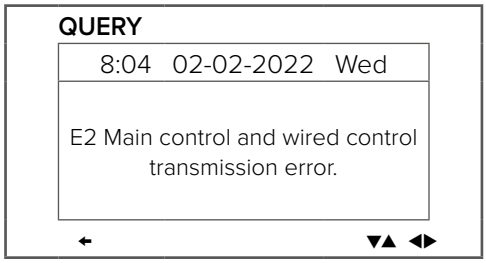








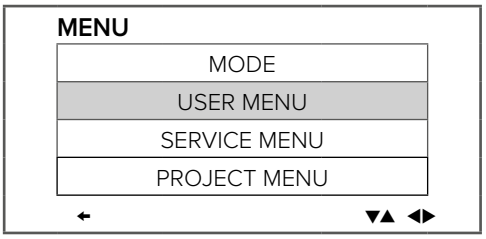


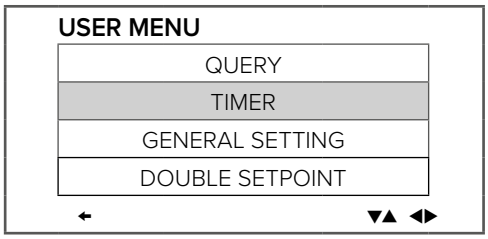


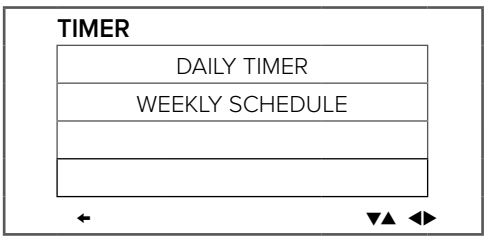
13.14 Timer

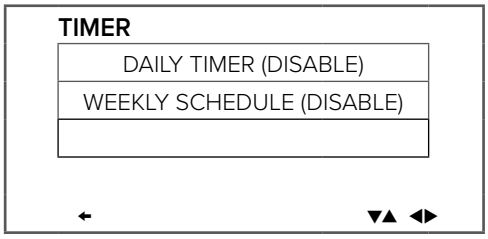
A daily or weekly schedule can be set.

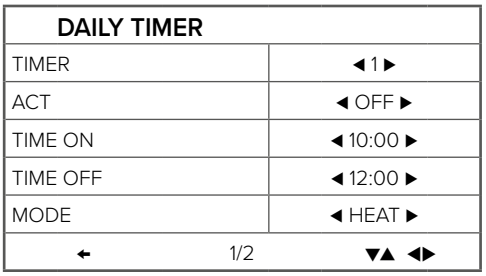
If the unit is controlled via remote ON-OFF or via Modbus, the timers are disabled.

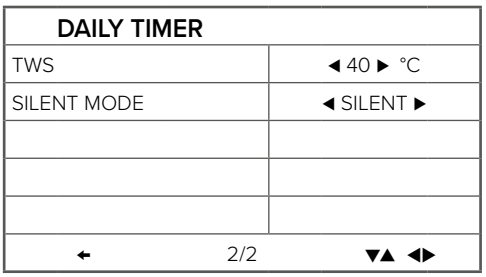


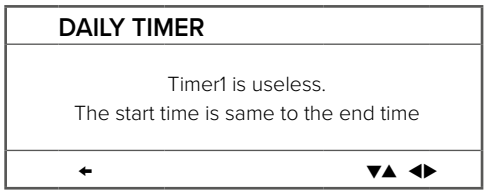


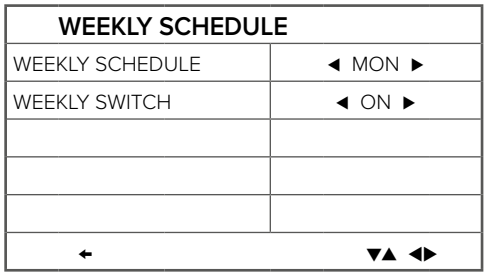


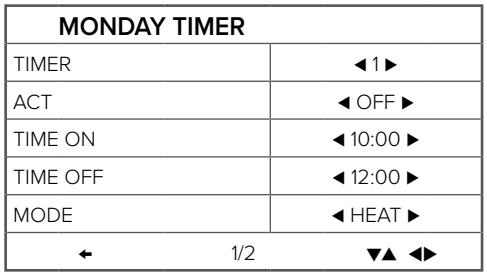


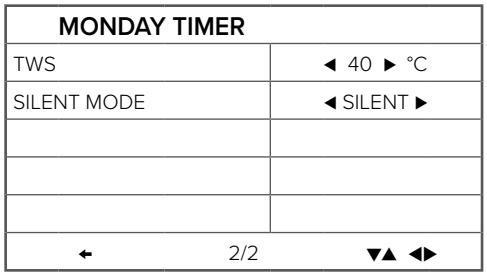












13.15 Unit Stata

Code	Description
0.xx	unit address
1.xx	nominal unit capacity (30/60/90 kW)
2.xx	number of units
3.xx	T4 correction
4.xx	Mode (8: Off; 0: Standby; 1: Cooling; 2: Heating)
5.xx	fan speed 1
6.xx	fan speed 2
7.xx	T3: coil temperature
8.xx	T4: outdoor temperature
9.xx	T5: DHW temperature
10.xx	Taf1: exchanger outlet temperature, antifreeze protection
11.xx	Taf2: exchanger outlet temperature, antifreeze protection
12.xx	Tw: common outlet water temperature, after the last unit
t.xx	Twi water inlet
14.xx	Two outlet water
15.xx	Tz total outlet water
16.xx	THeatR recovery
17.xx	Tp1 compressor 1 discharge temperature
18.xx	Tp2 compressor 2 discharge temperature
19.xx	Power module 1 (inverter) temperature
20.xx	Power module 2 (inverter) temperature
21.xx	Tdsh: compressor discharge temperature desuperheating
22.xx	compressor 1 current input
23.xx	compressor 2 current input
24.xx	reserved
25.xx	electronic expansion valve opening A (/20)
26.xx	electronic expansion valve opening B (/20)
27.xx	electronic expansion valve opening C (/4)
28.xx	high pressure
L.xx	low pressure
30.xx	overheating in cooling mode
31.xx	suction temperature

Code	Description
32.xx	silent (1st digit: 1= silent mode, 2= super silence, 3= standard)
33.xx	reserved
34.xx	DC voltage A (reserved)
35.xx	DC voltage B (reserved)
36.xx	frequency limit (0 = None; 1 = T4; 2 = pressure; 3 = discharge; 4 = low pressure ratio; 5 = Real-time; 6 = Current frequency; 7 = voltage; 8 = Adjustment of energy requirement of pressure ratio; 9 = low pressure in cooling mode)
37.xx	defrosting status (1st digit: T4 selection solution; 2nd digit: at intervals; 3rd and 4th digits: defrosting on timer)
38.xx	reserved
39.xx	defrosting
40.xx	initial frequency
41.xx	Tc: Saturation temperature corresponding to high pressure in heating mode
42.xx	Te: Saturation temperature corresponding to low pressure in cooling mode
43.xx	T6a: exchanger inlet temperature
44.xx	T6b: exchanger outlet temperature
45.xx	software version
46.xx	last error
47.xx	----

13.16 Alarms

Alarm reset: switch the unit off and on again.

NOTE

- **Before resetting an alarm identify and remove the cause that generate it.**
- **Repeated resets can cause irreversible damage.**

The unit is in protection mode in the following conditions:

- High pressure or protection due to discharge temperature
- low voltage
- compressor current protection
- frequency protection of the inverter compressor
- high coil temperature
- high temperature difference between the inlet water and the outlet water
- antifreeze protection
- discharge temperature sensor malfunction
- low evaporator temperature
- frequency protection by voltage
- compressor inverter malfunction
- fan motor protection
- water return high temperature, in cooling mode
- low pressure antifreeze protection
- high temperature of the inverter compressor module
- loss occurring
- leak detector life expired

When the unit fails or is in protection mode, the water pump continues working (except for water flow alarm, voltage protection, phase sequence protection).

13.16.1 Temperature sensors

All of the temperature sensors are classed as faulty when the voltage on the corresponding input is lower than 0,05 V or higher than 4,95 V.

Code		Description
E2		XYE communication interrupted
E3		Tw probe failure
E4		Twout probe failure
E5	1E5	T3A probe failure
	2E5	T3B probe failure
E6		T5 probe failure
E7		T4 probe failure
E8		Phase monitor alarm
E9	E9	Water flow alarm
	2E9	Water pressure alarm
xEb	1Eb	Taf1 probe failure
	2Eb	Taf2 probe failure
EC		Slave module reduction
Ed		Tp probes failure
EE	1EE	Reserved
	2EE	Reserved
EF		Twi probe failure
EP		Tp probe detects a value that is too high
EU		Tz probe failure
P0		High pressure or Tp probe protection alarm
P0		Displayed for 1min when returning from alarm P8 or on first start-up
P1		Low pressure protection
P3		T4 probe out of limits in cooling mode
P4		Inverter module A (compressor 1) over-current protection
P5		Inverter module B (compressor 2) over-current protection
P6		IPM module frequency limitation and protection
P7		T3 probe detects a value that is too high
P8		Leak detector alarm for loss or leak detector failure
P9		The difference between the Twi and Two probes is too high
PA		The difference between the Twi and Two probes is abnormal
xPb	Pb	Antifreeze
	1Pb	Antifreeze pre-alarm
	2Pb	Antifreeze alarm
PC		Evaporating pressure too low in cooling mode
PE		Antifreeze protection low temperature in cooling mode
PH		T4 probe out of limits in heating mode

Code		Description
PL		Tfin probe detects a value that is too high
xPU	1PU	Fan module A protection
	2PU	Fan module B protection
	3PU	Fan module C protection
H5		Voltage too high or too low
xH9	1H9	Inverter module A (compressor 1) not consistent
	2H9	Inverter module B (compressor 2) not consistent
xHE	1HE	Expansion valve failure
	2HE	Reserved
	3HE	Reserved
xF0	1F0	IPM module communication error
	2F0	IPM module communication error
F2		Insufficient desuperheating protection or excessive discharge temperature decrement
xF4	1F4	Protection L0 and L1 intervention 3 times in 60 minutes
	2F4	Protection L0 and L1 intervention 3 times in 60 minutes
xF6	1F6	Inverter A module BUS fault (PTC)
	2F6	Inverter B module BUS fault (PTC)
Fb		Pressure sensor error
Fd		Th probe failure
xFF	1FF	Fan A fault
	2FF	Fan B fault
	3FF	Fan C fault
FP		Multiple pump setting inconsistency (modularity)
C7		Protection PL intervention 3 times
dF		Defrosting
L0		L0 module protection
L1		Module L1 low voltage protection
L2		Module L2 high voltage protection
L3		Reserved
L4		L4MCE failure
L5		L5 null speed protection

Code		Description
L6		Reserved
L7		L7 phase loss
L8		Frequency changes over 15Hz
L9		Frequency difference 15Hz
xbH	1bH	Module 1 relay blocked or chip 908 self-check failed
	2bH	Module 2 relay blocked or chip 908 self-check failed
xdL	1dL	Communication loss with leak detector
	2dL	Leak detector lifetime near expiration
	3dL	Leak detector lifetime expired

14. Unit in modular configuration

Maximum number of connectable units:	16

The system is completely controlled by the Master unit.

Each module can be equipped with an inertial system storage tank.

Each unit with DHW option must have its own DHW tank.

14.1 Control logic

In a cascade system, Tw (supply water flow temperature for the entire system) and TWS (set point temperature) are measured by the master unit.

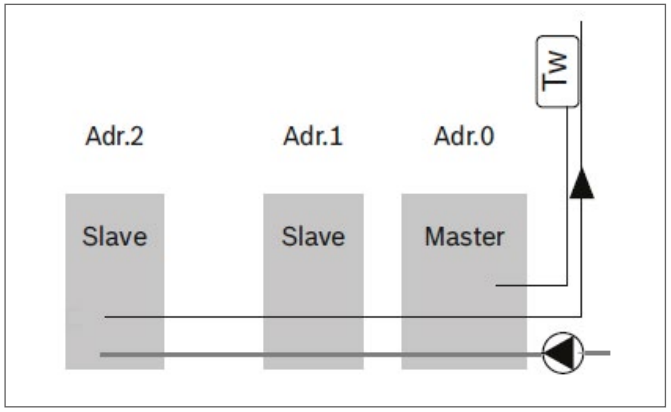
The master unit will periodically (standard time 80 seconds) evaluate the current load based on the outlet water temperature, the set point distance and speed difference of the water temperature.

Depending on evaluation of the load performed by the master unit, the number of units running will either be kept stable, increased or reduced.

Once it is switched on, a unit will continue to operate according to its own logic (T4, water temperature, etc.).

14.2 Tw control probe

The TW probe must be installed on the supply line of the unit, as far away as possible.



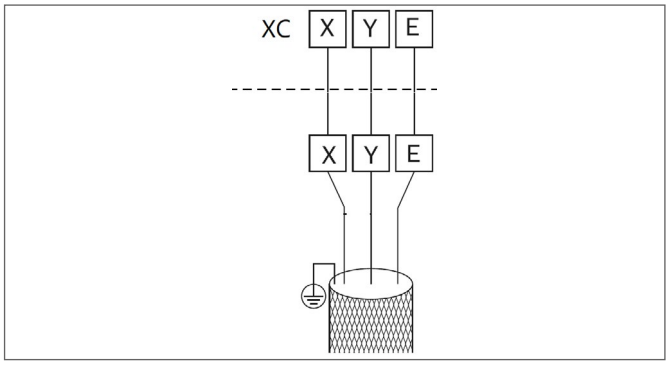
14.3 Domestic hot water

In a cascade system with DHW provision, the system configuration must be as follows:

each unit must be fitted with its own pump, the S12-2 dial on all the units must be ON. Each unit must be fitted with its own external DHW boiler because the DHW load will be evaluated by each slave unit. In a system containing units with and without DHW valve, the highest address numbers must be assigned to the DHW units.

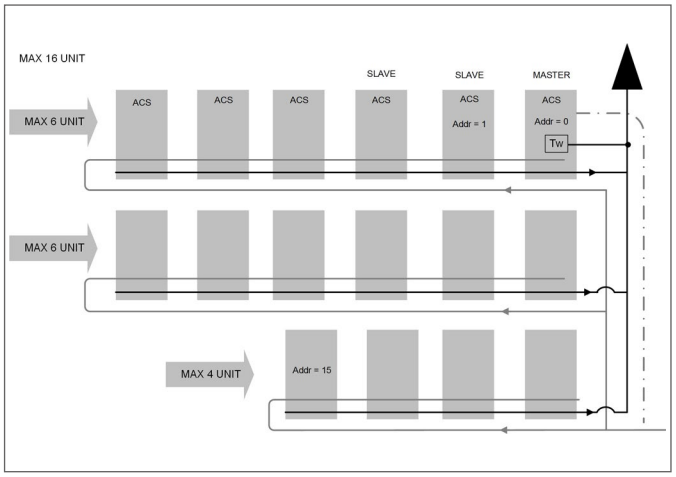
14.4 Electrical connections

All units must be electrically connected to each other via the X-Y-E BUS.



The TW outlet water temperature control probe, the flow switch and the backup electric heater must be controlled by the master unit.

14.5 System with reversed return connection



14.6 Input and output manifolds

Cooling capacity (kW)		In-out water piping
Min	Max	
15	30	DN40
30	90	DN50
90	130	DN65
130	210	DN80
210	325	DN100
325	510	DN125
510	740	DN150
740	1300	DN200
1300	2080	DN250

14.7 Single/multiple pump system

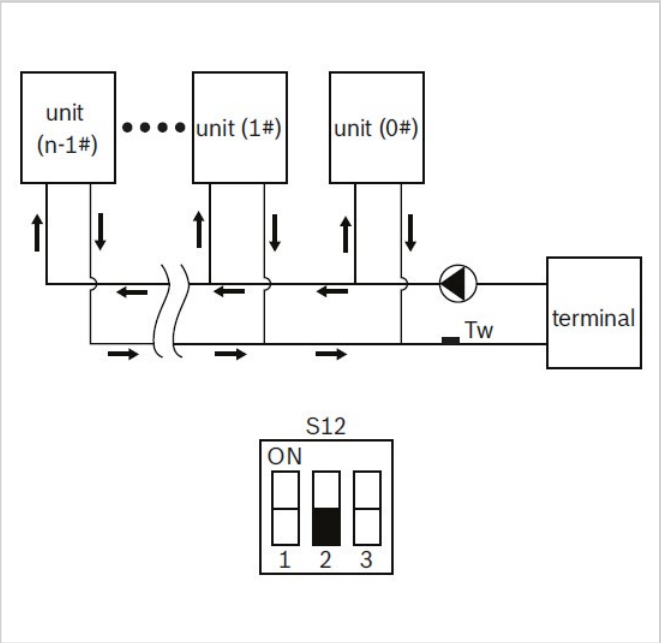
Configure DIP switch S12-2 according to the type of system.

▶ **When there is an external pump, you need to ensure the unit operates correctly, so the command for turning the pump on/off must be made from the unit via the contact described above.**

14.7.1 Single water pump

A check valve is not required in this configuration.

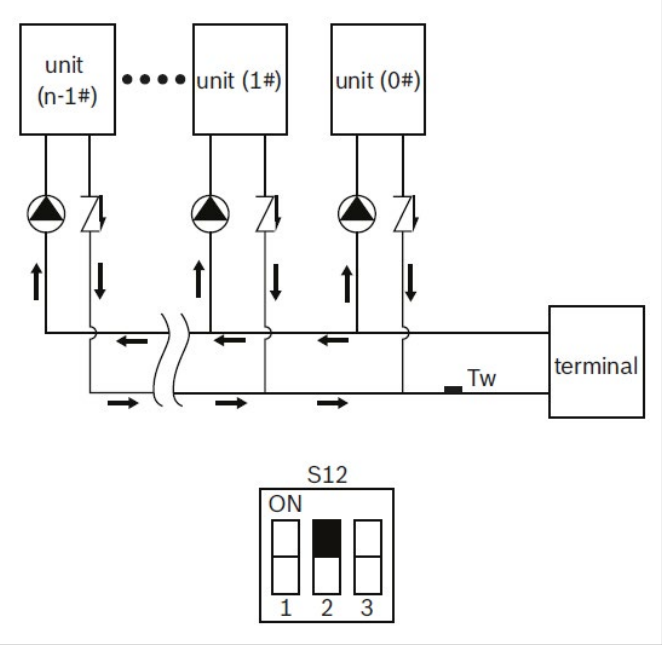
Pump control is only enabled on the master unit



14.7.2 Multiple water pumps

A check valve is required for each unit in this configuration.

Pump control is enabled on each unit



14.8 Addressing

Each connected module is identified by an address, from 0 to 15: the Master unit is identified as 0.

Set the correct date and time on each unit before connecting them to the network

Enable multiple configuration on each unit:

- ON units with on-board pump
- OFF units without on-board pump and a single pump in the system

The modular configuration consists of two networks: the controller network and the unit network (main boards).

Each network can have up to 16 addresses (from 0 to 15) and must be addressed separately.

Each network has its own master, which must have address = 0.

If some of the slave units do not have the DHW option:

- configure a unit without a DHW option as the master.
- assign the higher addresses to the slave units with DHW option

14.8.1 Addressing units

Units are addressed using encoder ENC4 on the back of the board.

The address is the number on the encoder.

E.g.:

MASTER : address = 0 encoder = 0

SLAVE 1 : address = 1 encoder = 1

SLAVE 15 : address = 15 encoder = F

14.8.2 Addressing controls

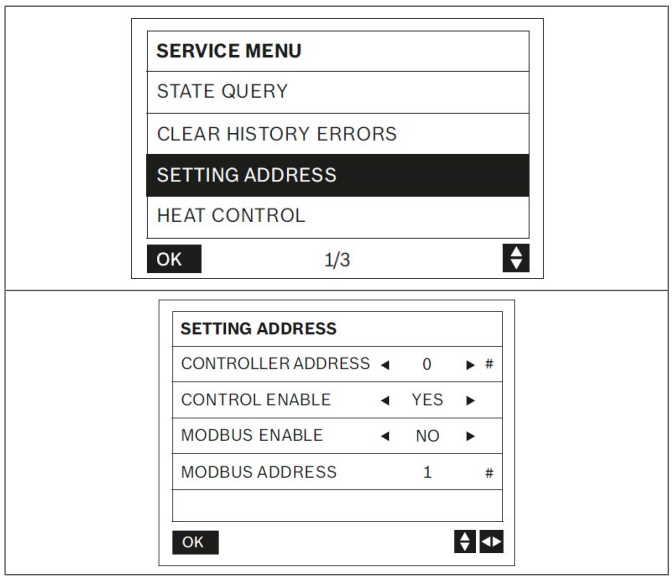
Up to16 controls can be addressed, from 0 to 15; for example:

- 16 units with relative controller on board, one of which is the master
- 15 units with relative controller on board + a remote controller as the master

Press ▼▲ to select SETTING ADDRESS.

Press ◄ ► to set the address

Press OK to confirm



14.9 Start-up

Complete system management is carried out by the master unit, identified by address 0.

Thermoregulation takes place on the supply temperature of the entire system (Tw).

At switch-on, when a load is requested, the units are switched on in sequence based on their address, in numerical order.

When the load decreases, the units are switched off following the same sequence.

Example in cooling mode:

If Tw >= set point + 10°C

- the control activates 50% of the resources in sequence based on the set address.
- after a time interval (default: 240 seconds)
- if the load increases, additional resources are activated
- if the load decreases, the units are switched off following the same sequence (first start, first stop).

If Tw < set point + 10°C (in cooling mode)

- the control activates only the master unit.
- after a time interval (default: 240 seconds)
- if the load increases, additional resources are activated based on the set address
- if the load decreases, the master unit switches off.

14.10 Alarms

In the event of an alarm on one of the system units, there could be different outcomes:

- in the event of an alarm on a slave unit, the other system units will continue to operate
- in the event of a communication or common sensor alarm on the master unit, the entire system will stop.

15. **Modbus**

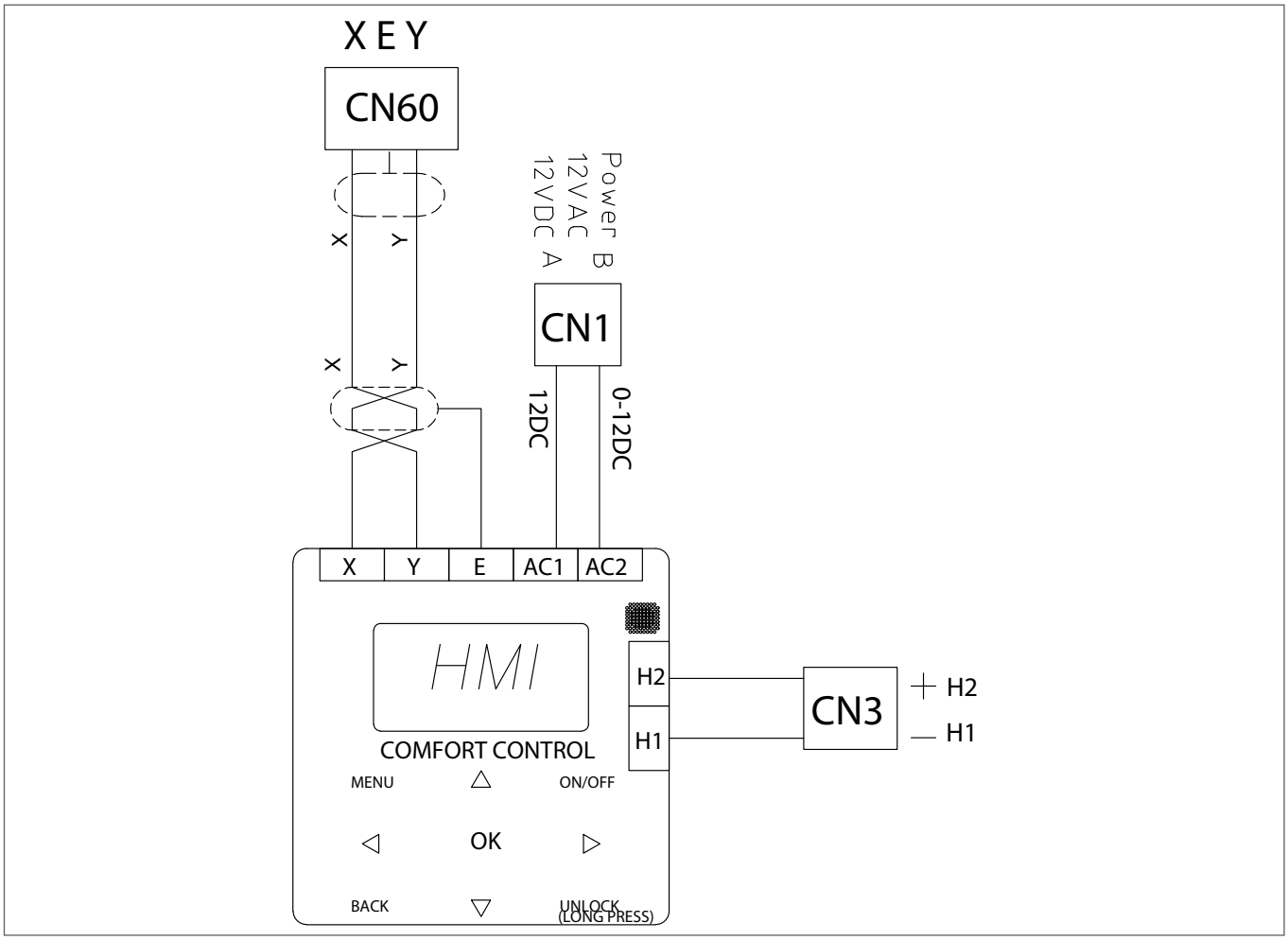
15.1 **Communication specifications: RS - 485**

Protocol	ModbusRTU: 9600, 8, N,1
Transmission speed	9600pbs
Data bit	8 data bits
Parity bit	None parity
Stop bit	1 stop bit

Connections

Connect on the back of the controller.

Modular unit: connect the Modbus to the master unit port.



Enabling

SERVICE MENU ➜ SETTING ADDRESS ➜ Modbus enable ➜ YES

Available data is in English

Reg	Data Type	R/W	Name	Description
0	S16	R&W	Running mode	Range: HP: 1-Cool, 2-Heat, 4-DHW, 8-OFF FC/CO: 1-Cool, 8-OFF Default: 8-OFF Unit of measurement: - Notes: DHW mode setting is NOT valid for slave units of multi pump system which uses dedicated item at address 207
1	S16	R&W	Double setpoint temperature Tws 1	Range: CO/FC cooling mode: -8 ~ 20 HP cooling mode: 0 ~ 20 HP heating mode: 25 ~ 75 Default: CO/FC: 7 HP cooling mode: 7 HP heating mode: 35 Unit of measurement: [°C] Notes:
2	S16	R&W	Double setpoint temperature Tws 2	Range: CO/FC cooling mode: -8 ~ 20 HP cooling mode: 0 ~ 20 HP heating mode: 25 ~ 75 Default: CO/FC 10 HP cooling mode: 10 HP heating mode: 30 Unit of measurement: [°C] Notes:
3	S16	R&W	Offset temperature (OFFSET-C/ OFFSET-H)	Range: Cooling mode 0 ~ 15 Heating mode: 0 ~ 30 Default: Cooling mode: 10 Heating mode: 10 Unit of measurement: [°C] Notes:
4	S16	R&W	DHW set temperature - T5S	Range: 25 ~ 70 Default: 50 Notes: Available only for HP Unit of measurement: [°C]
5	S16	R&W	RESERVED	Always you can read zero
6	S16	R&W	Clear lock errors	Range: 0-Invalid, 1-Clear all the lock errors Default: 0-Invalid Unit of measurement: - Notes:
7	S16	R&W	Snow blowing function	Range: 0 - OFF, 1 - ON Default: 0 - OFF Unit of measurement: - Notes:
8	S16	R&W	Out pressure switch setting	Always you can read zero
9	S16	R&W	Smart grid	Smart grid function enable Range: 0 - All function disabled, 1 - SG enable, 2 - EVU enable, 3 - SG and EVU enable Default: 0 - All functions disabled Unit of measurement: - Notes:
10 ~ 99			RESERVED	

Reg	Data Type	R/W	Name	Description
100	S16	R&W	Silent mode	Range: 1 - Standard, 2 - Silent mode, 7 - Super silent mode Default: 1 - Standard Unit of measurement: - Notes:
101	S16	R&W	Double setpoint	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes:
102	S16	R&W	Double setpoint temperature Tws 1 in cooling mode	Range: CO/FC : -8 ~ 20 HP: 0 ~ 20 Default: 7 Unit of measurement: [°C] Notes:
103	S16	R&W	Double setpoint temperature Tws 2 in cooling mode	Range: CO/FC : -8 ~ 20 HP: 0 ~ 20 Default: 10 Unit of measurement: [°C] Notes:
104	S16	R&W	Double setpoint temperature Tws 1 in heating mode	Range: HP : 25 ~ 75 Default: 35 Unit of measurement: [°C] Notes:
105	S16	R&W	Double setpoint temperature Tws 2 in heating mode	Range: HP: 25 ~ 75 Default: 30 Unit of measurement: [°C] Notes:
106	S16	R&W	Temperature compensation enable in cooling mode	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes:
107	S16	R&W	T4 COOL 1	Temperature compensation point 1 in cooling mode Range: 15 ~ 30 Default: 25 Unit of measurement: [°C] Notes:
108	S16	R&W	T4 COOL 2	Temperature compensation point 2 in cooling mode Range: 40 ~ 45 Default: 40 Unit of measurement: [°C] Notes:
109	S16	R&W	OFFSET-C	Temperature compensation offset in cooling mode Range: 0 ~ 15 Default: 10 Unit of measurement: [°C] Notes:
110	S16	R&W	Temperature compensation enable in heating mode	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes:
111	S16	R&W	T4 HEAT 1	Temperature compensation point 1 in heating mode Range: -15 ~ -10 Default: -10 Unit of measurement: [°C] Notes:

Reg	Data Type	R/W	Name	Description
112	S16	R&W	T4 HEAT 2	Temperature compensation point 2 in cooling mode Range: 15 ~ 30 Default: 15 Unit of measurement: [°C] Notes:
113	S16	R&W	OFFSET-H	Temperature compensation offset in cooling mode Range: 0 ~ 30 Default: 10 Unit of measurement: [°C] Notes:
114	S16	R&W	Heat 2 force on	Range: 0 - No, 1 - Yes Default: 0 - No Unit of measurement: - Notes: Only valid for single pump system
115	S16	R&W	DHW enable	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes: Only valid for single pump system
116	S16	R&W	T_Cool_Diff	Differential temperature in cooling mode Range: 1 ~ 5 Default: 2 Unit of measurement: [°C] Notes:
117	S16	R&W	T_Heat_Diff	Differential temperature in heating mode Range: 1 ~ 5 Default: 2 Unit of measurement: [°C] Notes:
118	S16	R&W	dT5_ON	Return hot water temperature difference Range: 2 ~ 10 Default: 8 Unit of measurement: [°C] Notes:
119	U16	R&W	T_Heat1_Delay	Heat1 start time delay Range: 60 ~ 240 Default: 90 Unit of measurement: [min] Notes: Valid only for HP models
120	S16	R&W	dTw_Heat1_Off	Range: 2 ~ 10 Default: 5 Unit of measurement: [°C] Notes: Valid only for HP models, the value was in offset (X*2)+60
121	S16	R&W	Tw differential temperature (TW_COOL DIFF/TW_HEAT_DIFF)	Range: 1 ~ 5 Default: 2 Unit of measurement: [°C] Notes:
122	S16	R&W	Ratio_Cool_First	Initial turn on ratio of cascade system in cooling mode Range: 0 ~ 100 Default: 50 Unit of measurement: [%] Notes: 5% step

Reg	Data Type	R/W	Name	Description
123	S16	R&W	Ratio_Heat_First	Initial turn on ratio of cascade system in heating mode Range: 0 ~ 100 Default: 50 Unit of measurement: [%] Notes: 5% step
124	S16	R&W	T_diff_pro	Inlet and outlet water temperature difference protection Range: 8 ~ 15 Default: 15 Unit of measurement: [%] Notes: 5% step
125	S16	R&W	T_Frost	Defrost cycle time Range: 20 ~ 180 Default: 45 Unit of measurement: [min] Notes:
126	S16	R&W	T_Defrost_in	Defrost entry temperature Range: -5 ~ 5 Default: -2 Unit of measurement: [°C] Notes:
127	S16	R&W	T_Defrost_out	Defrost exit temperature Range: -10 ~ 10 Default: 0 Unit of measurement: [°C] Notes:
128	S16	R&W	Heat 1 enable	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes:
129	S16	R&W	T4_Heat1_On	Range: -5 ~ 20 Default: 5 Unit of measurement: [°C] Notes:
130	S16	R&W	Dtw_PHE	Range: 0 ~ 10 Default: 0 Unit of measurement: [°C] Notes:
131		RW	RESERVED	
132	S16	R&W	Heat 2 enable	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes: Only valid for single pump system with DHW function
133	S16	R&W	T_Heat2_delay	Heat 2 turn on delay Range: 60 ~ 240 Default: 90 Unit of measurement: [min] Notes: 5 min step. Only valid for single pump system with DHW function
134	S16	R&W	dT5_Heat2_Off	Range: 2 ~ 10 Default: 5 Unit of measurement: [min] Notes: Only valid for single pump system with DHW function

Reg	Data Type	R/W	Name	Description
135	S16	R&W	T4_Heat2_On	Range: -5 ~ 20 Default: 5 Unit of measurement: [°C] Notes: Only valid for single pump system with DHW function
136	S16	R&W	Inverter pump enable	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes: Valid only for single pump system
137	S16	R&W	Inverter pump running speed	Range: 30 ~ 100 Default: 100 Unit of measurement: [%] Notes: 5% step. Only valid if register 136 is enabled
138	S16	R&W	Modbus control enable	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes: Enable this item bofer writing other Modbus registers
139	S16	R&W	Gycol type	Range: 0 - Ethylene, 1 - Propylene Default: 0 - Ethylene Unit of measurement: - Notes:
140	S16	R&W	Glycol percentage	Range: 0 ~ 50 Default: 0 Unit of measurement: [%] Notes: 5% step
141	S16	R&W	Paf offset	Protection pressure compensation Range: 0 ~ 20 Default: 0 Unit of measurement: 0.01Mpa Notes: step of 5
142 -146			RESERVED	
147	S16	R&W	TWI_O ABNORMAL	Abnormal differ bettween inlet and outlet water temperature Range: 1 ~ 5 Default: 2 Unit of measurement: [°C] Notes:
148	S16	R&W	Low outlet water control	Range: 0 ~ 20 Default: 7 Unit of measurement: [°C] Notes: valid only when Lwo TWO enable
149	S16	R&W	Power limit	Energy saving level Range: 40 ~ 100 Default: 40 Unit of measurement: [%] Notes: 10% step
150	S16	R&W	E9 protection time	Water flow switch protection time Range: 2 ~ 20 Default: 5 Unit of measurement: [s] Notes:
151	S16	R&W	E9 detection method	Range: 1 - Water flow detected before the pump is turned on, 2 - Water flow switch is detected after the pump is turned on Default: 1 Unit of measurement: - Notes:

Reg	Data Type	R/W	Name	Description
152	S16	R&W	Inverter pump MIN speed	Range: 40 ~ Max(100, Inverter pump MAX speed) Default: 75 Unit of measurement: [%] Notes: 5% step. Only valid for multiple pump system
153	S16	R&W	Inverter pump MAX speed	Range: Max (70% Min. ratio) ~ 100% Default: 75 Unit of measurement: [%] Notes: 5% step. Only valid for multiple pump system
154	S16	R&W	Pump turn on time	Range: 5 ~ 60 Default: 5 Unit of measurement: [min] Notes: 5 min step
155	S16	R&W	Pump turn off time	Range: 0 ~ 60 Default: 0 Unit of measurement: [%] Notes: 5 min step
156	S16	R&W	TW_COOL_DIFF	Differential temperature Tw in cooling mode Range: 1 ~ 5 Default: 2 Unit of measurement: [°C] Notes:
157	S16	R&W	TW_HEAT_DIFF	Differential temperature Tw in heating mode Range: 1 ~ 5 Default: 2 Unit of measurement: [°C] Notes:
158	U16	R&W	Heat1Forceon	Range: 0 - OFF , 1 - ON Default: 0 Unit of measurement: - Notes:
159	S16	R&W	ODU online num	Range : [0:16] Unit of measurement:
160	S16	R&W	Slave Online Addrees	Range :BIT [0:16] Unit of measurement: 0 Offline 1 Online Notes :BIT [0:16] Each bit represnts Each unit online or offline
161 ~ 199			RESERVED	
200+(Unit Address)*100	S16	RO	Read Brand	Range: -32768 ~ 32767 Default: - Unit of measurement: Notes: 0 BOSCH 1 CLIVET Only can read whenFCT status enable.
201+(Unit Address)*100	S16	R&W	Heat 2 enable	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes: Only valid for multi pump systems with DHW function
202+(Unit Address)*100	S16	R&W	Heat 2 force on	Range: 0 - OFF, 1 - ON Default: 0 - OFF Unit of measurement: - Notes: Only valid for multi pump systems with DHW function

Reg	Data Type	R/W	Name	Description
203+(Unit Address)*100	S16	R&W	T-HEAT2-DELAY	Heat 2 opening delay Range: 60 ~ 240 Default: 90 Unit of measurement: [min] Notes: Only valid for multi pump systems with DHW function
204+(Unit Address)*100	S16	R&W	DT-HEAT2-OFF	Heat2 turn off delta temperature Range: 2 ~ 10 Default: 5 Unit of measurement: [°C] Notes: Only valid for multi pump systems with DHW function
205+(Unit Address)*100	S16	R&W	T4-HEAT2-ON	Range: -5 ~ 20 Default: 5 Unit of measurement: [°C] Notes: Only valid for multi pump systems with DHW function
206+(Unit Address)*100	S16	R&W	DHW enable	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes: Only valid for multi pump systems
207+(Unit Address)*100	S16	R&W	DHW turn on	Range: 0 - OFF, 1 - ON Default: 0 - OFF Unit of measurement: - Notes: Only valid for multi pump systems
208+(Unit Address)*100	S16	R&W	DHW priority	Range: 0 - OFF, 1 - ON Default: 0 - OFF Unit of measurement: - Notes: Only valid for multi pump systems
209+(Unit Address)*100	S16	R&W	DHW cooling MAX running time	Range: 1 ~ 48 Default: 16 Unit of measurement: [min] Notes: Only valid for multi pump systems with DHW function(Real Value *30)
210+(Unit Address)*100	S16	R&W	DHW cooling MIN running time	Range: 1 ~ 48 Default: 1 Unit of measurement: [min] Notes: Only valid for multi pump systems with DHW function(Real Value *30)
211+(Unit Address)*100	S16	R&W	DHW heating MAX running time	Range: 1 ~ 48 Default: 16 Unit of measurement: [min] Notes: Only valid for multi pump systems with DHW function(Real Value *30)
212+(Unit Address)*100	S16	R&W	DHW heating MIN running time	Range: 1 ~ 48 Default: 1 Unit of measurement: [min] Notes: Only valid for multi pump systems with DHW function(Real Value *30)
213+(Unit Address)*100	S16	R&W	DHW MAX running time in DHW mode	Range: 1 ~ 48 Default: 4 Unit of measurement: [min] Notes: Only valid for multi pump systems with DHW function(Real Value *30)

Reg	Data Type	R/W	Name	Description
214+(Unit Address)*100	S16	R&W	DHW MIN running time in DHW mode	Range: 1 ~ 48 Default: 1 Unit of measurement: [min] Notes: Only valid for multi pump systems with DHW function
215+(Unit Address)*100	S16	R&W	Inverter pump enable	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: - Notes: Only valid for multi pump systems
216+(Unit Address)*100	S16	R&W	Inverter pump running speed	Range: 30 ~ 100 Default: 100 Unit of measurement: [%] Notes: 5% step. Only valid for multi pump systems(Real Value *30)
217+(Unit Address)*100	S16	R&W	T5S	Water tank setpoint Range: 30 ~ 75 Default: 50 Unit of measurement: [°C] Notes: Only valid for multi pump systems with DHW function(Real Value *30)
218+(Unit Address)*100	U16	R&W	DHW Disinfect Enable	Range: 0 - Disable, 1 - Enable Default: 0 - Disable Unit of measurement: Notes:
219+(Unit Address)*100	U16	R&W	DHW Disinfect Days Set	Range: 0-6 Default: Unit of measurement: Notes: 0 -MON , 6 -SUN
220+(Unit Address)*100	U16	R&W	DHW Disinfect time	Range: 0-143 Default: Unit of measurement: [min] Notes: 0- 00:00~143- 24:00
221+(Unit Address)*100	U16	R&W	DHW Disinfect Maxtime	Range: 0-180 Default: Unit of measurement: [min] Notes:
(222 ~ 229)+(Unit Address)*100			RESERVED	
230+(Unit Address)*100	S16	RO	SG Limit ON	Range: 0 -OFF 1- ON Default: - 0 Unit of measurement: Notes: ON unit set to 40% , OFF set to 0%
231+(Unit Address)*100	U16	RO	Inv Pump Ratio get	Variable frequency water pump status opening percentage Range: 0 ~ 100 Default: - Unit of measurement: [%] Notes:
232+(Unit Address)*100	U16	RO	Current capacity	Real time capacity Range: 0 ~ 65535 Default: - Unit of measurement: [kW] Notes:

Reg	Data Type	R/W	Name	Description
233+(Unit Address)*100	U16	RO	Current power	Real time power consumption Range: 0 ~ 65535 Default: - Unit of measurement: [kW] Notes:
234+(Unit Address)*100	U16	RO	Current efficiency	(Current capacity / Current power)*100 Range: Default: - Unit of measurement: - Unit:
235+(Unit Address)*100	U16	RO	Total capacity	Range: 0 ~ 65535 Default: - Unit of measurement: [MWh] Notes:
236+(Unit Address)*100	U16	RO	Total power	Total power consumption Range: 0 ~ 65535 Default: - Unit of measurement: [MWh] Notes:
237+(Unit Address)*100	U16	RO	SG status	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:"
238+(Unit Address)*100	U16	RO	EVU status	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:
239+(Unit Address)*100	S16	RO	Ts final	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
240+(Unit Address)*100	S16	RO	ODU running mode	Range: 1 - Off, 2 - Cooling, 3 - Heating, 4 - DHW Default: - Unit of measurement: - Notes:
241+(Unit Address)*100	S16	RO	Silent mode	Range: 1 - Standard, 2 - Silent, 7 - Super silent Default: - Unit of measurement: - Notes:
242+(Unit Address)*100	S16	RO	T5S	Water tank setpoint Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
243+(Unit Address)*100	S16	RO	SG Limit Enable	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:ON - Unit set to 40% demand limit, OFF - Unit sets back to user demand limit
244+(Unit Address)*100	S16	RO	Twi	Inlet water temperature Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000

Reg	Data Type	R/W	Name	Description
245+(Unit Address)*100	S16	RO	Two	Outlet water temperature Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
246+(Unit Address)*100	S16	RO	Tw	"Water temperature Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000"
247+(Unit Address)*100	S16	RO	T4	Ambient temperature Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
248+(Unit Address)*100	S16	RO	Compressor frequency	Range: -32768 ~ 32767 Default: - Unit of measurement: [Hz] Notes:
249+(Unit Address)*100	S16	RO	Cmpressor 1 current	Range: -32768 ~ 32767 Default: - Unit of measurement: [A] Notes: Invalid value 0x8000"
250+(Unit Address)*100	S16	RO	Fan 1 speed	"Range: -32768 ~ 32767 Default: - Unit of measurement: [rpm] Notes:
251+(Unit Address)*100	S16	RO	Fan 2 speed	Range: -32768 ~ 32767 Default: - Unit of measurement: [rpm] Notes:
252+(Unit Address)*100	S16	RO	Fan 3 speed	Range: -32768 ~ 32767 Default: - Unit of measurement: [rpm] Notes:
253+(Unit Address)*100	U16	RO	EXVA	EXV A current opening degree Range: 0 ~ 65535 Default: - Unit of measurement: [steps] Notes:
254+(Unit Address)*100	U16	RO	SV4	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:
255+(Unit Address)*100	U16	RO	Leak C-box status	Range: 0 - NOT AVAILABLE, 1 - OK, 2 - WARNING EXP TIMES, 3 -WARNING COMMUNICATION, 4 -EXPIRED, 5 - ALARM ON, 6 - FAIL STATE Default: - Unit of measurement: - Notes:

Reg	Data Type	R/W	Name	Description
256+(Unit Address)*100	U16	RO	Leak R-box status	Range: 0 - NOT AVAILABLE, 1 - OK, 2 - WARNING EXP TIMES, 3 -WARNING COMMUNICATION, 4 -EXPIRED, 5 - ALARM ON, 6 - FAIL STATE Default: - Unit of measurement: - Notes:
257+(Unit Address)*100	U16	RO	Leak C-box Exp Time	Range: 0 - 180 Default: - Unit of measurement: - MONTHS Notes:
258+(Unit Address)*100	U16	RO	Leak C-box Exp Time	Range: 0 - 180 Default: - Unit of measurement: - MONTHS Notes:
259+(Unit Address)*100	S16	RO	SV8B	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:
260+(Unit Address)*100	S16	RO	4 way valve	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:
261+(Unit Address)*100	S16	RO	Fix pump state	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:
262+(Unit Address)*100	S16	RO	SV1 state	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:
263+(Unit Address)*100			RESERVED	
264+(Unit Address)*100	S16	RO	Heat 1 state	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:
265+(Unit Address)*100	S16	RO	Heat 2 state	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:
266+(Unit Address)*100	S16	RO	Tp1	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
267+(Unit Address)*100	S16	RO	Th	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
268+(Unit Address)*100	S16	RO	T3	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000

Reg	Data Type	R/W	Name	Description
269+(Unit Address)*100	S16	RO	Tz	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
270+(Unit Address)*100	S16	RO	T5	"Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000"
271+(Unit Address)*100	S16	RO	Low Pressure	Range: -32768 ~ 32767 Default: - Unit of measurement: [0.01MPa] Notes: Invalid value 0x8000
272+(Unit Address)*100	U16	RO	Error Code	Range: 0-65535 [0-No Error] Default: - Unit of measurement: - Notes: refer to sheet error code define.
273+(Unit Address)*100	U16	RO	Last error code of the error history	Range: 0-65535 [0-No Error] Default: - Unit of measurement: - Notes: refer to sheet error code define.
274+(Unit Address)*100	U16	RO	HMI software version	Version number Range: 0 ~ 65535 Default: - Unit of measurement: - Notes:
275+(Unit Address)*100	S16	RO	Tp2	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
276-277+(Unit Address)*100			RESERVED	
278+(Unit Address)*100	U16	RO	HMI error code	Range: 0/1/2 Default: - Unit of measurement: - Notes: 0: No error, 1: XYE communication lost, 2: number of online unit reduced
279+(Unit Address)*100			RESERVED	
280+(Unit Address)*100	S16	RO	Compressor 2 current	Range: -32768 ~ 32767 Default: - Unit of measurement: [A] Notes: Invalid value 0x8000
281+(Unit Address)*100	U16	RO	Unit Capacity	Unit size Range: 0 ~ 65535 Default: - Unit of measurement: [kW] Notes:
282+(Unit Address)*100	S16	RO	Defrost status	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:

Reg	Data Type	R/W	Name	Description
283+(Unit Address)*100	S16	RO	Anti-freezing electric heater	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes:
284+(Unit Address)*100			RESERVED	
285+(Unit Address)*100	S16	RO	FCT status	Range: 0 - OFF, 1 - ON Default: - Unit of measurement: - Notes: Only the master unit provides this value
286+(Unit Address)*100	S16	RO	Pump system status	Range: 0 - Single pump, 1 - Multi pump Default: - Unit of measurement: - Notes:
287+(Unit Address)*100	S16	RO	Unit type	Range: 0 - HP, 1 - CO, 2 - FC Default: - Unit of measurement: - Notes:
288+(Unit Address)*100	S16	RO	High Pressure	Range: -32768 ~ 32767 Default: - Unit of measurement: [0.1MPa] Notes: Invalid value 0x8000
289+(Unit Address)*100	S16	RO	Tsafe	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
290+(Unit Address)*100	S16	RO	PAF	Range: -32768 ~ 32767 Default: - Unit of measurement: [kPa] Notes: Invalid value 0x8000
291+(Unit Address)*100	S16	RO	Taf1	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
292+(Unit Address)*100	U16	RO	Mainboard software version	Version number Range: 0 ~ 65535 Default: - Unit of measurement: - Notes:
293+(Unit Address)*100	U16	RO	Mainboard software version date	Version date Range: 0 ~ 65535 Default: - Unit of measurement: - Notes: bit[0-4]: Day 1~31 bit[5:8]: Month 1~12 bit[9:15]: Year 0~127 (2000~2127)
294+(Unit Address)*100	S16	RO	FCT STEPS	Range: -32768 ~ 32767 Default: - Unit of measurement: - Notes: 0:C1, 1:C2, 2:C3, 3:C4, 4:C5, 5:C6, 6:C7
295+(Unit Address)*100			RESERVED	

Reg	Data Type	R/W	Name	Description
296+(Unit Address)*100	S16	RO	Taf2	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
297+(Unit Address)*100	S16	RO	Tfin1	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
298+(Unit Address)*100	S16	RO	Tfin2	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
299+(Unit Address)*100			RESERVED	
1800 ~ 2299+(Unit Address)*200			RESERVED	
2300+(Unit Address)*200	S16	RO	TDSH	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
2301+(Unit Address)*200	S16	RO	TSSH	Range: -32768 ~ 32767 Default: - Unit of measurement: [°C] Notes: Invalid value 0x8000
2302+(Unit Address)*200			RESERVED	
2303+(Unit Address)*200	U16	RO	Inverter pump running speed	Range: 0-100 Default: - Unit of measurement: [%] Notes: Invalid value 0x8000
2304+(Unit Address)*200	U16	RO	ErrTypeGet	Range: 0-65535 [0-No Error] Default: - Unit of measurement: - Notes:
2305+(Unit Address)*200	U16	RO	ErrCodeGet	Range: 0-65535 [0-No Error] Default: - Unit of measurement: - Notes:
2306+(Unit Address)*200	U16	RO	LastErrTypeGet	Range: 0-65535 [0-No Error] Default: - Unit of measurement: - Notes:
2307+(Unit Address)*200	U16	RO	LastErrCodeGet	Range: 0-65535 [0-No Error] Default: - Unit of measurement: - Notes:
(2308 ~ 2399)+(Unit Address)*200			RESERVED	

15.2 **Modbus alarms**

Available data is in English

Error Code	Modbus Code	Description	Troubleshooting	
			Stop system	Stop unit
E2	3	XYE communication lost	✓ (master)	✓ (slave)
E3	4	Tw failure (the master is valid)	✓	
E4	5	Twout failure		✓
E5	262	1E5- T3A failure		✓
	518	2E5- T3B failure		✓
E6	7	T5 failure	✓ (single pump)	✓ (multi-pump)
E7	8	T4 failure		✓
E8	9	Power phase detector alarm		✓
E9	10	E9 Water flow detection failure	✓ (single pump)	✓ (multi-pump)
	522	2E9 Water pressure detection failure		
xEb	268	1Eb-Taf1 failure		✓
	524	2Eb- Taf2 failure		
EC	13	Slave module reduction	✓	✓
Ed	14	Both Tp of A system and Tp of B system are failure		✓
EE	271	1EE-T6A failure		✓
	527	2EE-T6B failure		
EF	16	Twi failure		✓
EP	19	Tp is too high		✓
EU	20	Tz failure		✓
P0	21	System high pressure protection or Tp protection		✓
P1	22	System low pressure protection		✓
P2	23	Tz is too high		✓
P3	24	T4 is out of cooling working range		✓
P4	25	System A Current Protection		✓
P5	26	System B Current protection		✓
P7	28	T3 is too high		✓
P8	29	Refrigerant Loss detected or Leak detector failed		✓
P9	30	The difference between Twi and Two is too high		✓
PA	31	The difference between Twi and Two is abnormal		✓
xPb	32	Pb- Anti-freeze reminder	✓	✓
	288	1Pb- electric heating insufficient reminder	✓	✓
	544	2Pb- electric heating is seriously insufficient reminder	✓	✓
PC	33	Evaporator pressure too low during cooling		✓
PE	35	Cooling evaporator low temperature antifreeze protection		✓
xPf	292	1PF - Water pump 1 failure	✓	✓
	548	2PF - Water pump 2 failure	✓	✓

Error Code	Modbus Code	Description	Troubleshooting	
			Stop system	Stop unit
PH	37	T4 is out of heating working range		✓
PL	38	Tfin is too high		✓
xPU	296	1PU-DC fan A module protection		✓
	552	2PU-DC fan B module protection		
	808	3PU-DC fan C module protection		
H5	46	Voltage is too high or too low		✓
xH9	306	1H9: A press drive model does not match		✓
	562	2H9: B press drive model does not match		
xHE	311	A valve is not inserted fault 1HE		✓
	567	B valve is not inserted fault 2HE		
	823	C valve is not inserted fault 3HE		
xF0	317	1F0: IPM module communication failure		✓
	573	2F0: IPM module communication failure		
F2	63	Insufficient exhaust superheat protection or exhaust temperature sensor falling off		✓
xF4	321	1F4: L0 or L1 protection occurs 3 times within 60 min		✓
	577	2F4: 3 occurrences of L0 or L1 protection within 60 min		
xF6	323	1F6 A system bus voltage fault (PTC)		✓
	579	2F6 B System bus voltage fault (PTC)		✓
Fb	72	Pressure sensor failure		✓
Fd	74	Return air temperature sensor failure		✓
xFF	332	1FF-DC fan A fault		✓
	588	2FF-DC fan B fault		
	844	3FF-DC fan B fault		
FP	79	Dial codes of multiple pumps are inconsistent		✓
C7	88	3 times PL report C7		✓
C0	81	Circuit model configuration error		✓
C2	83	The unit types of cascade system are not matched with each other	✓	
L0	101	L0 module protection		✓
L1	102	L1 low voltage protection		✓
L2	103	L2 high voltage protection		✓
L3	104	Reserved		✓
L4	105	L4MCE failure		✓
L5	106	L5 zero speed protection		✓
L6	107	Reserved		✓
L7	108	L7 phase loss		✓
L8	109	L8 frequency changes over 15Hz		✓

Error Code	Modbus Code	Description	Troubleshooting	
			Stop system	Stop unit
L9	110	L9 frequency difference 15Hz		✓
dF	136	Defrosting reminder	✓	✓
dU	140	Reaching the DHW max time without reaching T5s	X	X
xbH	413	1bH: Module 1 relay is stuck or 908 chip self-check failed		✓
	669	2bH: Module 2 relay is stuck or 908 chip self-check failed		✓
xdL	1dL	Communication loss with leak detector		✓
	2dL	Leak detector lifetime near expiration		✓
	3dL	Leak detector lifetime expired		✓

16. Gas safety warnings

16.1 The safety requirements in the "SAFETY SPECIFICATIONS FOR FLAMMABLE REFRIGERANTS" chapter apply

16.2 Work procedures

Operations must be performed following a controlled procedure so as to reduce the risk of flammable gases or vapours developing.

16.3 General work area

All the personnel in charge with maintenance operations and other operators working in the local area must be instructed and monitored as regards the nature of the intervention.

Avoid working in tight spaces. The area surrounding the working space must be cordoned off. Make sure the area is secured by monitoring the flammable material.

16.4 Check the presence of refrigerant

Both before and during operations, the area must be monitored with a dedicated refrigerant detector to make sure the technician is aware of the presence of potentially-flammable environments.

16.5 Presence of the fire extinguisher

If hot interventions are not performed on cooling equipment or connected components, suitable fire fighting equipment must be kept at hand.

16.6 Ventilated area

Before intervening on the system or performing any hot intervention, make sure to be in an outdoor or suitably ventilated area.

Ventilation must be maintained during operations. Ventilation must disperse the released refrigerant safely, preferably outdoors in the atmosphere.

16.7 Cooling equipment checks

Should a replacement be necessary, the new components installed must be suitable for the purpose envisaged and compliant with specifications.

Always follow the manufacturer guidelines on maintenance and assistance. In case of doubt, contact the manufacturer technical office for assistance.

The following checks must be performed on the system:

- the quantity of the charge must comply with the size of the room where the parts containing refrigerant are installed;
- the machine and ventilation intake function correctly and are not obstructed;
- If an indirect cooling circuit is used, the secondary circuits must be checked to verify the presence of refrigerants; the marking on the equipment remains visible and readable;
- ensure that markings and symbols are always clearly legible;
- refrigerant pipes or components must be installed in such a position that they are unlikely to be exposed to any substance that could corrode the components containing refrigerant, unless they are manufactured with material intrinsically resistant to corrosion or suitably protected against corrosion.

16.8 Electrical device checks

The reparation and maintenance of electric components must include initial safety checks and component inspection procedures.

In case of a fault that compromises safety, do not perform any electrical connection to the circuit until said fault is suitably resolved.

If it is not possible to repair the fault immediately and electrical components need to remain functioning, a temporary solution must be adopted. This must be reported to the owner of the equipment so as to keep all parties informed.

Initial safety checks must include:

- that condensers are emptied. This operation must be performed safely to avoid any sparks:
- that electrical components and wiring are not exposed during the charging, recovering or venting phases;
- That the earth conductor is continuous.

16.9 Repairing sealed components

- During the reparation operations of sealed components, disconnect all the equipment before removing sealed casings etc. If, during operations, it is absolutely necessary for the equipment to remain connected, a leak detection device must be placed in the most critical point so as to report any potentially-dangerous situation.
- Pay particular attention to what follows to guarantee that, while intervening on electrical components, the housing is not altered in a way so as to affect the level of protection. This includes damage to cables, an excessive number of connections, terminals not compliance with the original specifications, damage to gaskets, an unsuitable installation of gaskets, etc.
- Make sure the device is installed safely.
- Check that the seals or sealing materials are not altered in such a way that they no longer the impede the entry of flammable environments. Spare parts must comply with manufacturer specifications.

Warning

▶ **Using silicone sealants may inhibit the effectiveness of a few types of leak detection equipment. It is not necessary to isolate intrinsically safe components before performing operations on them.**

16.10 Reparation of intrinsically safe components

Do not apply permanent inductive or capacitive loads to the circuit without making sure that they do not exceed the admissible voltage and current allowed for equipment in use.

Intrinsically safe components are the only component type on which operations can be performed in a flammable atmosphere. The testing device must show a correct value. Replace components only with the parts specified by the manufacturer.

Following a leak, other parts could lead to the combustion of the refrigerant in the atmosphere.

16.11 Wires

Make sure wires are not subjected to wear, corrosion, excessive pressure or vibration, that there are no sharp edges and that they do not produce other negative effects on the environment. The inspection must also keep into consideration the effects of tine or the continuous vibration caused e.g. by compressors or fans.

16.12 Charging operations

In addition to conventional charging operations, the following requirements must be complied with:

- When using charging equipment, make sure that the various refrigerants are not contaminated. Flexible tubes or conduits must be as short as possible to reduce to the minimum the quantity of refrigerant contained.
- Tanks must be kept in a vertical position.
- Before loading the system with refrigerant, check that the cooling system is earthed.
- Label the system when fully charged (unless already labelled).
- Make sure not to fill the cooling system excessively.
- Before recharging the system, the pressure must be tested with OFN. A leak test must be performed after the charging operations but before commissioning. Before leaving the site, perform an additional leak test.

16.13 Dismantling

Before performing this procedure, it is essential that the technician has become familiar with the equipment and the relative details.

We recommend employing good practices for a safe recovery of the refrigerants.

Before performing the operation, take a sample of oil and refrigerant should an analysis be necessary before reusing the regenerated refrigerant. Before performing the operation, check the availability of electric energy.

- Become familiar with the equipment and how it functions.
- Electrically isolate the system.

Before attempting the procedure, check that:

- The mechanical manipulation equipment is available, if necessary, to handle refrigerant tanks;
- All the personal protection equipment is available and employed correctly;
- The recovery procedure is monitored at all times by skilled personnel;
- The recovery equipment and tanks comply with suitable standards.
- If possible, pump the cooling system.
- If it is not possible to obtain a vacuum, make sure that a collector removes the refrigerant from various parts of the system.
- Before proceeding with the recovery, check that the tank is located on the scales.
- Start up the recovery machine and use it following the instructions by the manufacturer.
- Do not fill the tanks excessively. (Do not exceed 80% of the liquid volume).
- Do not exceed the tank's maximum operating pressure, not even momentarily.
- Once the tanks are filled correctly and the process is over, make sure that the tanks and equipment are immediately removed from the site and that all insulation valves on the equipment are closed.
- The refrigerant recovered must not be loaded into another cooling system unless it has been cleaned and checked.

16.14 Labelling

Equipment must be labelled reporting the dismantling and emptying of the refrigerant.

Labels must be dated and signed.

Make sure all the equipment is labelled and reporting the presence of flammable refrigerant.

16.15 **Recovery**

When removing the refrigerant from the system, please adopt good practices to remove all refrigerants safely in case of both assistance or decommissioning operations.

When transferring the refrigerant into the tanks, make sure only suitable tanks are used to recover the refrigerant.

Make sure enough tanks are used.

All the tanks to be used are designated for the recovered refrigerant and are labelled for that specific refrigerant (e.g. special tanks for refrigerant collection.

Tanks must be equipped with a perfectly-functioning safety valve and relative interception valves.

Empty recovery tanks are evacuated and, if possible, cooled before recovery.

Recovery equipment must be perfectly functioning with the respective instruction booklets at hand and they must be suitable to recover flammable refrigerants. A series of perfectly-functioning calibrates scales must also be available.

Flexible tubes must be equipped with leak-proof disconnection fittings in good condition. Before using the recovery machine, make sure it is in good condition, maintained and that all associated electrical components are sealed to avoid combustion in case of a refrigerant leak. Please contact the manufacturer in case of doubt.

The refrigerant recovered must be taken to the supplier in suitable recovery tanks and with the relative waste transfer note suitably filled in.

Do not mix the refrigerants in the recovery units nor in the tanks.

If it is necessary to remove compressors or compressor oils, make sure they are evacuated to an acceptable level to make sure no trace is left of the flammable refrigerant inside the lubricant. The evacuation process must be performed before taking the compressors back to the suppliers.

The electric resistance must be used with the compressor body only to accelerate this process.

Operations to discharge the oil from the system must be performed in full safety.

17. Maintenance

17.1 Safety

Operate in compliance with safety regulations in force.

To carry out the operations use protection devices:

gloves, goggles, helmet, headphones, protective knee pads.

All operations must be carried out by personnel trained on possible risks of a general nature, electrical and deriving from operating with equipment under pressure.

Only qualified personnel can operate on the unit, as required by the regulation in force

17.2 General

Maintenance must be performed by authorized centres or by qualified personnel

The maintenance allows to:

- maintaining the unit efficient
- reduce the deterioration speed all the equipment is subject to over time
- collect information and data to understand the efficiency state of the unit and prevent possible faults

Warning

- **Before checking, please verify the following:**
- **the electrical power supply line should be isolated at the beginning**
- **the unit isolator is open, locked and equipped with the suitable warning**
- **make sure no voltage is present**
- **After turning off the power, wait at least 5 minutes before accessing to the electrical panel or any other electrical component.**
- **Before accessing check with a multimeter that there are no residual voltage.**

17.3 Frequency of interventions

Perform an inspection every 6 months.

However, frequency depends on the type of use.

Pan inspections at close intervals in the event of:

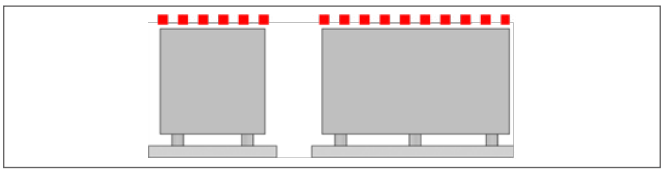
- frequent use (continuous or very intermittent use, near the operating limits, etc)
- critical use (service necessary)

Warning

- **Before performing any work, carefully read: SAFETY SPECIFICATIONS FOR FLAMMABLE REFRIGERANTS**

CAUTION

- **Do not go up to the surface**
- **Do not place heavy loads on it.**



17.4 Unit booklet

It's advisable to create a unit booklet to take notes of the unit interventions.

In this way it will be easier to adequately note the various interventions and aid any troubleshooting.

Report on the booklet:

- date
- intervention description
- carried out measures etc.

17.5 Standby mode

If a long period of inactivity is foreseen:

- turn off the power
- avoid the risk of frost (use glycol or empty the system)
- turn off the power to avoid electrical risks or damages by lightning strikes.
- at extremely cold temperatures keep the heaters in the electrical panel turned on (option).

It is recommended to have a qualified technician start the system after a period of inactivity, especially after seasonal stops or for seasonal switch-over.

At start-up, follow the instructions in the "start-up" section.

Schedule technical assistance in advance to prevent mishaps and to be able to use the system when required.

17.6 Recommended periodic checks sheet

intervention frequency (months)		1	6	12	24	48	180
1	presence of corrosions			X			
2	panel fixing			X			
3	pan fixing		X				
4	coil cleaning		X				
5	water filter cleaning		X				
6	water: quality, pH, glycol concentration		X				
7	exchanger efficiency check			X			
8	circulation pump		X				
9	check of the fixing and the insulation of the power lead			X			
10	check of the earthing cable			X			
11	electric panel cleaning			X			
12	power remote controls status			X			
13	clamp closure, cable isolation integrity			X			
14	voltage and phase unbalancing (no load and on-load)		X				
15	absorptions of the single electrical loads		X				
16	compressor casing heaters test		X				
17	checking for leaks *			*			
18	cooling circuit work parameter detection		X				
19	safety valve *			*			
20	protective device test: pressure switches, thermostats, flow switches etc..			X			
21	control system test: setpoint, climatic compensations, capacity stepping, air flow-rate variations			X			
22	control device test: alarm signal, thermometers, probes, pressure gauges, etc.			X			
23	leak detection system efficiency check			X			
24	replace the refrigerant leak sensor						X

Warning

- ***Refer to the local regulations. Companies and technicians performing installation, maintenance/repair, leak control and recovery operations must be CERTIFIED as set out by the local regulations.**

17.7 System drain

The system must be drained only if necessary.

Do not drain the system periodically; this can lead to corrosion.

1 empty the system

2 empty the exchanger, use all of the shut-off valves and grub screws present

3 blow the exchanger with compressed air

4 dry the exchanger with hot air; for greater safety, fill the exchanger with glycol solution

5 protect the exchanger from air by filling it with nitrogen

6 take the drain caps off the pumps

Any antifreeze liquid contained in the system should not be discharged freely as it is a pollutant. It must be collected and reused.

Before start-up, wash the system.

It is recommended to have a qualified technician start the system after a period of inactivity, especially after seasonal stops or for seasonal switch-over.

At start-up, follow the instructions in the “start-up” section.

Schedule technical assistance in advance to prevent mishaps and to be able to use the system when required.

17.8 Unit control

Ensure that:

- the installation is carried out following the instructions in the specific chapter
- the hydraulic connections must not leak
- the controller wiring is in good condition, with no damage to the coating and connected properly
- the unit is stable, check the condition of the anti-vibration mounts if present
- the unit is not damaged in any way that would preclude its functionality
- all closing panels are present
- there are no foreign materials in the unit’s safety area

Labels:

- check that the unit’s labels are clearly visible and in good condition.

▶ **Caution: replace any labels found to be incompliant.**

17.9 Electrical panel / wiring

Check that:

- the electrical panel gasket is in good condition to ensure tightness against water and against any refrigerant leaks
- the lifting pistons of the electrical panel door are working properly
- there is no foreign material inside the electrical panel
- boards and electrical connections are clean and show no sign of burn marks
- electrical connections are not loose
- the wired controller on the unit is in good condition
- the ventilation duct of the electrical panel is free from foreign material with the grille correctly installed

17.10 Structure and panelling

Check that:

- there is no oxidation, paint if necessary
- the panel coating is in good condition and not peeling off
- the panel locks are working properly
- the fixed panels are correctly installed with all fixings in place

▶ **Caution: Wash with lukewarm water, do not use chemicals.**

17.11 Condensation drain pan

Check that:

- it is free from foreign material
- the drain is free and correctly installed without a siphon

17.12 Fans

Check that:

- they can run freely with no obstacles
- the bearings are in good condition and do not generate noise or abnormal vibrations
- there are no foreign bodies in the fan area
- the fan and grills fixing is not loose
- the electrical box is closed and free from oxidation
- the controller and signal wiring is in good condition

17.13 Water circuit

General:

- Check for limescale or fouling
- the hydraulic connections must not leak

17.14 Flow switch

Check:

- operation
- remove scaling from the blade
- the electrical connection

17.15 Degasser / Deaerator

Check that:

- there are no impurities preventing the correct passage of water
- the air purge is effective

17.16 Water pressure relief valve

Check:

- operation
- there must be no impurities preventing water from coming out

▶ **Caution: replace if the valve leaks**

17.17 Water filter

Check that:

- no impurities prevent the correct passage of water.

17.18 Pump (optional)

Check that:

- it is free from oxidation
- the cooling fan is in good condition and free from obstructions
- the electrical box is closed, the cables are tightened properly
- the impeller rotates freely, with no effort, noise or abnormal vibrations.

17.19 Inertial tank (optional)

Check:

- the insulation is in good condition
- the hydraulic connections must not leak
- the presence of limescale or fouling

17.20 Three-way valve (optional)

Check:

- that switching is with no effort or noise
- the hydraulic connections must not leak
- the electrical box is closed, the cables are tightened properly
- the presence of limescale or fouling

17.21 Plate exchanger

The exchanger must be able to provide the maximum thermal exchange, therefore its inner surfaces must be cleaned from dirt and fouling.

Check the difference between the outlet water temperature and the evaporation temperature: if the difference is greater than 8°C–10°C, it is advisable to clean the exchanger.

It must be cleaned:

- with circulation opposite to the usual one
- at least 1.5 times faster than the nominal one
- with an appropriate moderately acid product (95% water + 5% phosphoric acid)
- after washing, flush with water to remove detergent residues

▶ **During the cleaning operation it's worth to remove the flow-switch from the circuit and replace it after the cleaning operation**

17.22 Finned coil exchanger

▶ **Accidental contact with the exchanger flaps can cause injuries from cut: use protective gloves.**

The coil must allow maximum thermal exchange, therefore, the surface must be clear from dirt and scaling.

The cleaning frequency must be increased according to the build-up of dirt/dust and the environment (e.g. coastal areas with chlorides and salts or industrial areas with aggressive substances).

17.23 Periods of inactivity

During periods when the unit is not used for more than a week, the coil must be completely cleaned following the cleaning procedure.

Cleaning procedure

Follow the steps below to clean it properly:

- remove surface dirt, leaves, fibres, etc. with a vacuum dirt exhauster (preferably using a brush or other soft accessory rather than a metal hose), compressed air blown from the inside and/or a soft bristle brush
- do not bump or scrape the coil

Rinse:

- rinse with water only.
- do not use chemicals to clean heat exchangers as they may cause corrosion
- wash gently, preferably from the inside out and from the top down, running water through each fin passage until it comes out clean
- do not use a steam cleaner as it could cause damage

▶ **Warranty claims relating to cleaning damages, particularly from steam cleaners or corrosion from chemical coil detergents, will NOT be accepted.**

Dry:

- drain or vacuum residual water to speed up drying and prevent clogging

17.24 Refrigeration circuit

General:

- there must be no foreign bodies inside the refrigerant circuit box
- check the general condition of all components and ensure that their controller wiring is correctly fixed

- there must not be any corrosion

▶ **Caution: the circuit is under pressure and contains a flammable refrigerant, any impact could lead to a breakage and unwanted release.**

17.25 Piping

Check that:

- the piping insulation is in good condition
- the pipes are properly secured to the brackets provided by the manufacturer

Vessels:

- must be properly secured to the unit
- the identification plate is legible

17.26 Valves

Check that:

- the electrical connection is in good condition
- the electrical coils are properly secured

17.27 Compressor

Check that:

- the crankcase heater is correctly positioned and working properly
- the electrical box is closed, the cables are tightened properly
- the identification plate is legible

17.28 Temperature probes and pressure transducers

Check:

- temperature probes must be inserted correctly into the wells with the right thermal paste
- electrical cables must be in good condition
- the correct reading of all sensors

17.29 Leak sensor

Check:

- the sensitive element must not be dirty or obstructed
- the sensor calibration must be 25% of the LFL
- operation of the safety system
- every 12 months, check the correct alarm triggers by disconnecting the leak detector communication cable, opening the contact output of the leak detector and make it triggering simulatin a real small loss close to the sensor itself.

Warning

Replace the sensor

- if there are any anomalies
- every 15 years

Note

If the sensor is not replaced within the above period, it will trigger a permanent shutdown alarm 3dL.

▶ **Caution: if there are any anomalies, do not repair the sensor but replace it with a new one**

17.30 Extraction ventilation

Check that:

- can run freely without obstacles
- there are no foreign bodies in the fan area
- the fan and grills fixing is not loose
- the electrical box is closed and free from oxidation
- the controller and signal wiring is in good condition

A) Technical compartment sensor

B) Electrical panel sensor

▶ **Please consider that the unit is equipped with two leak detectors, one in the refrigerant compartment and one in the control box**

17.31 Safety valve

The pressure relief valve must be replaced:

- if it has opened
- if there is oxidation
- based on the date of manufacture, in accordance with local regulations.

Valve replacement

The 3-piece connection joint enables the valve to be replaced.

1 discharge the unit with the procedure at chapter "Safety specifications for flammable refrigerants"

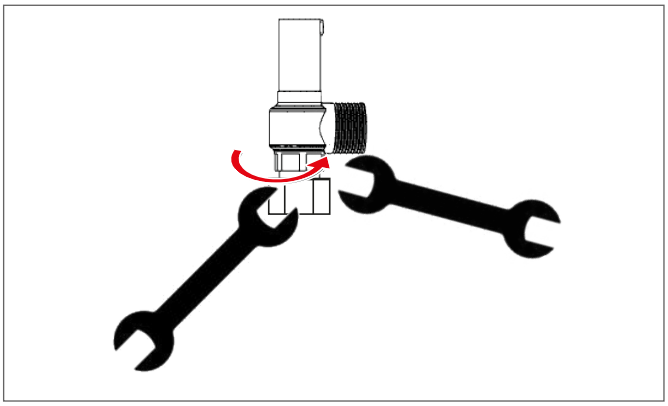
2 remove the valve, don't heat up the valve

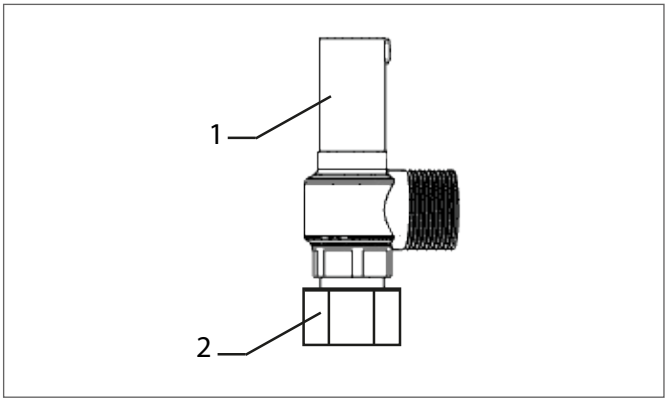
3 use 2 manual tool: one in the fixed joint and one in the valve body

4 install the new valve

5 make a tightness test

6 recharge the unit





1 Safety valve

2 Fixed joint

18. **Decommissioning**

18.1 Disconnection

Warning

▶ **Before performing any work, carefully read: SAFETY SPECIFICATIONS FOR FLAMMABLE REFRIGERANTS**

Avoid leak or spills into the environment.

Before disconnecting the unit, the following must be recovered, if present:

- refrigerant gas
- Anti-freeze solutions in the hydraulic circuit

Awaiting decommissioning and disposal, the unit can also be stored outdoors, as bad weather and rapid changes in temperature do not harm the environment provided that the electric, cooling and hydraulic circuits of the unit are intact and closed and the temperature operating limits are repected.

WEEE INFORMATION

The manufacturer is registered on the EEE National Register, in compliance with implementation of Directive 2012/19/EU and relevant national regulations on waste electrical and electronic equipment.

This Directive requires electrical and electronic equipment to be disposed of properly.

Equipment bearing the crossed-out wheelie bin mark must be disposed of separately at the end of its life cycle to prevent damage to human health and to the environment.

Electrical and electronic equipment must be disposed of together with all of its parts.

To dispose of “household” electrical and electronic equipment, the manufacturer recommends you contact an authorised dealer or an authorised ecological area.

“Professional” electrical and electronic equipment must be disposed of by authorised personnel through established waste disposal authorities around the country.

In this regard, here is the definition of household WEEE and professional WEEE:

WEEE from private households: WEEE originating from private households and WEEE which comes from commercial, industrial, institutional and other sources which, because of its nature and quantity, is similar to that from private households. Subject to the nature and quantity, where the waste from EEE was likely to have been by both a private household and users of other than private households, it will be classed as private household WEEE;

Professional WEEE: all WEEE which comes from users other than private households.

This equipment may contain:

- refrigerant gas, the entire contents of which must be recovered in suitable containers by specialised personnel with the necessary qualifications;
- lubrication oil contained in compressors and in the cooling circuit to be collected;
- mixtures with antifreeze in the water circuit, the contents of which are to be collected;
- mechanical and electrical parts to be separated and disposed of as authorised.

When machine components to be replaced for maintenance purposes are removed or when the entire unit reaches the end of its life and needs to be removed from the installation, waste should be separated by its nature and disposed of by authorised personnel at existing collection centres.

19. Residual risks

19.1 General

The risks listed below refer to hazardous situations for which it was not possible to act at the design stage due to practical restrictions in their mitigation or that their mitigation would lead to an alteration of the unit's functionality.

The residual risks consider the installation to have been carried out correctly following all the above requirements and according to the state of the art as regards anything not covered by this manual.

19.2 Risks during transport/storage/installation

Fire and explosion risk

Leak sensor:

- if the unit is not powered, the leak detection system is not active
- The unit sensor does not replace the personal leak detector

Exhaust fan:

- potential flammable atmosphere will be ejected in the outdoor ambient in the air flow direction of the fan,

Pressure relief valve:

- if the pressure relief valve opens due to an external fire, it will vent into the atmosphere and feed the fire. The jet will be directed according to the position of the vent
- if the valve is ducted, a potential flammable atmosphere will be generated at the end of the duct

Transport and storage:

- during transport and storage, if the unit is damaged refrigerant could be released

Storage of the finished product in the warehouse must be managed in the warehouse risk analysis (e.g. fire brigade documentation).



Pressure risk

Pressure relief valve:

- if the pressure relief valve opens, a jet of pressurised refrigerant will escape in the direction of the vent.
- if the valve is ducted, a pressure jet may be generated at the end of the duct

Cut-off risk

Air exchanger:

- the air exchanger fins are sharp.

Falling risk:

Electric cables:

- the unit's controller wiring can cause obstructions

Slipping:

- puddles of water or ice may form around the unit

Burns risk

- the pressure relief valve jet can cause burns
- the water piping temperature can reach 75°C, contact with the water pipes can cause burns


Risk due to atmospheric phenomena:

- the unit is not protected against lightning
- the unit is not protected against strong wind
- the unit is not protected against flooding
- a switched-off unit is not protected against a build-up of snow
- a switched-off unit is not protected against freezing/ thawing

These phenomena can create additional risks due to the damage they can cause to the unit (e.g. water inlet near electrical components, breakage of components due to the formation of ice, air flow blockage, etc.)

19.3 Additional risks during start-up/ maintenance/decommissioning

These risks are in addition to those listed above because access is required inside the unit's closed compartments.

Fire and explosion risk:

Refrigerant circuit:

- during access to the refrigerant circuit, the components are not protected against accidental impacts that could cause a release of flammable refrigerant



Pressure risk

Refrigerant circuit:

- during access to the refrigerant circuit, the components are not protected against accidental impacts that could cause a release of flammable refrigerant

Cut-off risk

Internal parts of the unit and plate edges can be sharp.

The fans have mechanical inertia and can continue rotating for several minutes after the unit has been switched off.

Falling risk

Falling from above:

- access to the source area to check the fans is high off the ground with a potential falling danger

Burns risk

- the refrigerant piping and components can reach 120 °C as well as -30 °C in their operation and can cause hot/cold burns
- while charging/discharging the unit, the refrigerant circuit components cool down/heat up and can cause hot/cold burns


Electrical risk

- The electrical capacitors can continue charging for several minutes after the unit has been switched off and can cause electric shocks

Risk due to atmospheric phenomena

- If it rains, components inside the unit can get wet
- if it is windy, panels/components partially removed from the unit can overturn

20. **Technical information**

Performance - Acoustic version standard (SC)

Size			14.1	16.1	18.1	19.1	20.1	25.2	30.2
Radiant panels									
Heating									
Heating capacity (EN 14511:2022)	1,8	kW	40,1	46,8	50,4	55,8	61,0	70,2	84,4
COP (EN 14511:2022)	2	-	3,92	3,71	3,81	3,78	3,73	3,91	3,74
ErP Space Heating Energy Class - AVERAGE Climate - W35	7	-	A+++	A+++	A++	A++	A++	A+++	A+++
SCOP - MEDIUM Climate - W35	9	-	4,51	4,45	4,36	4,29	4,22	4,70	4,54
ηs,h - MEDIUM Climate - W35	10	%	177	175	171	169	166	185	179
Cooling									
Cooling capacity (EN 14511:2022)	4,8	kW	42,6	46,8	55,6	59,7	64,7	79,9	86,1
EER (EN 14511:2022)	5	-	4,28	3,99	3,66	3,63	3,41	4,23	3,90
Water flow-rate	4	l/s	2,04	2,24	2,66	2,86	3,09	3,82	4,12
User side exchanger pressure drops	4	kPa	11,9	14,1	11,7	13,3	15,5	18,8	21,6
Terminal units									
Heating									
Heating capacity (EN 14511:2022)	3	kW	39,9	45,2	55,1	61,5	68,5	78,6	85,9
COP (EN 14511:2022)	2	-	3,11	3,08	3,19	3,13	2,92	3,14	3,01
Cooling									
Cooling capacity (EN 14511:2022)	6	kW	34,9	38,5	49,9	54,0	58,2	67,8	72,7
EER (EN 14511:20228)	5	-	2,84	2,81	2,58	2,46	2,35	2,86	2,64
SEER	9	-	5,36	5,20	4,73	4,58	4,36	5,47	5,3
ηs,c	11	%	211	205	186	180	171	216	209
Water flow-rate	6	l/s	1,66	1,83	2,37	2,57	2,77	3,22	3,46
User side exchanger pressure drops	6	kPa	8,27	9,86	9,44	10,9	12,6	13,8	15,7
Radiators									
Heating									
Heating capacity (EN 14511:2022)	12	kW	37,0	42,9	47,4	51,2	55,7	65,9	76,6
COP (EN 14511:2022)	2	-	2,71	2,57	2,67	2,60	2,55	2,74	2,56
ErP Space Heating Energy Class - AVERAGE Climate - W55	7	-	A++	A++	A++	A++	A++	A++	A++
SCOP - MEDIUM Climate - W55	9	-	3,54	3,51	3,51	3,47	3,41	3,63	3,60
ηs,h - MEDIUM Climate - W55	10	%	139	137	137	136	133	142	141

The Product is compliant with the ErP (Energy Related Products) European Directive. It includes the Commission delegated Regulation (EU) No 811/2013 (rated heat output ≤ 70 kW at specified reference conditions) and the Commission delegated Regulation (EU) No 813/2013 (rated heat output ≤ 400 kW at specified reference conditions)
Contains fluorinated greenhouse gases (GWP 675)

1. Entering/leaving water temperature user side 30/35 °C, Entering external exchanger air temperature 7 °C (R.H. = 85%)
2. COP (EN 14511:2022) Heating performance coefficient. Ratio between delivered heating capacitu and power input in compliance with EN 14511:2022. The overall power absorbed is calculed by adding the power absorbed by the compressor + the power absorbed by the fan - the percentage value of the fan to overcome external pressure drop + the power absorbed by the pump - the percentage value of the pump to overcome pressure drop outside + thepower absorbed by the auxiliary electrical circuit.
3. Entering/leaving water temperature user side 40/45 °C, Entering external exchanger air temperature 7 °C (R.H. = 85%)
4. Entering/leaving water temperature user side 23/18 °C, Entering external exchanger air temperature 35 °C.
5. EER (EN 14511:2022) cooling performance coefficient. Ratio between delivered coolimg capacitu and power input in compliance with EN 14511:2022. The overall power absorbed is calculated by adding the power absorbed by the compressor + the powerabsorbed by the fan - the percentage value of the fan to overcome external pressure drop + the power absorbed by the pump - the percentage value of the pump to overcome presure drop outside + thepower absorbed by the auxiliary electrical circuit.
6. Entering/leaving water temperature user side 12/7 °C, Entering external exchanger air temperature 35 °C.
7. Seasonal Space Heating Energy Efficiency Class according to Commission delegated Regulation (EU) No 811/2013. W = Water outlet temperature (°C)
8. The data refers to the unit operating with optimized inverter frequency
9. Data calculated in compliance with EN 14825:2022.
10. Seasonal energy efficiency in heating EN 14825:2022.
11. Seasonal energy efficiency in cooling EN 14825:2022.
12. Entering/leaving water temperature user side 50/55 °C, Entering external exchanger air temperature 7 °C (R.H. = 85%)

Performance - Acoustic version silent (LN)

Size			14.1	16.1	18.1	19.1	20.1	25.2	30.2
Radiant panels									
Heating									
Heating capacity (EN 14511:2022)	1,8	kW	35,1	40,9	44,0	48,8	53,3	61,4	73,7
COP (EN 14511:2022)	2	-	3,86	3,65	3,74	3,71	3,66	3,84	3,67
ErP Space Heating Energy Class - AVERAGE Climate - W35	7	-	A+++	A+++	A++	A++	A++	A+++	A+++
SCOP - MEDIUM Climate - W35	9	-	4,51	4,45	4,36	4,29	4,22	4,70	4,54
ηs,h - MEDIUM Climate - W35	10	%	177	175	171	169	166	185	179
Cooling									
Cooling capacity (EN 14511:2022)	4,8	kW	37,2	40,9	50,6	52,2	56,6	69,8	75,2
EER (EN 14511:2022)	5	-	4,21	3,91	3,62	3,61	3,35	4,16	3,83
Water flow-rate	4	l/s	1,78	1,95	2,42	2,50	2,70	3,34	3,60
User side exchanger pressure drops	4	kPa	9,38	11,1	9,77	10,4	12,0	14,7	16,8
Terminal units									
Heating									
Heating capacity (EN 14511:2022)	3	kW	37,0	39,5	48,1	53,8	59,8	68,7	75,1
COP (EN 14511:2022)	2	-	3,15	3,05	3,13	3,07	2,87	3,09	2,96
Cooling									
Cooling capacity (EN 14511:2022)	6	kW	32,4	33,6	44,9	47,9	50,9	59,3	63,5
EER (EN 14511:20228)	5	-	2,87	2,78	2,60	2,41	2,31	2,81	2,59
SEER	9	-	5,30	5,08	4,66	4,49	4,27	5,35	5,19
ηs,c	11	%	209	200	184	177	168	211	205
Water flow-rate	6	l/s	1,54	1,60	2,14	2,28	2,42	2,82	3,02
User side exchanger pressure drops	6	kPa	7,24	7,74	7,76	8,75	9,78	10,8	12,2
Radiators									
Heating									
Heating capacity (EN 14511:2022)	12	kW	32,3	37,5	41,4	44,8	48,7	57,6	66,9
COP (EN 14511:2022)	2	-	2,66	2,52	2,62	2,55	2,50	2,69	2,51
ErP Space Heating Energy Class - AVERAGE Climate - W55	7	-	A++	A++	A++	A++	A++	A++	A++
SCOP - MEDIUM Climate - W55	9	-	3,54	3,51	3,51	3,47	3,41	3,63	3,60
ηs,h - MEDIUM Climate - W55	10	%	139	137	137	136	133	142	141

The Product is compliant with the ErP (Energy Related Products) European Directive. It includes the Commission delegated Regulation (EU) No 811/2013 (rated heat output ≤ 70 kW at specified reference conditions) and the Commission delegated Regulation (EU) No 813/2013 (rated heat output ≤ 400 kW at specified reference conditions)
Contains fluorinated greenhouse gases (GWP 675)

1. Entering/leaving water temperature user side 30/35 °C, Entering external exchanger air temperature 7 °C (R.H. = 85%)
2. COP (EN 14511:2022) Heating performance coefficient. Ratio between delivered heating capacitu and power input in compliance with EN 14511:2022. The overall power absorbed is calculed by adding the power absorbed by the compressor + the power absorbed by the fan - the percentage value of the fan to overcome external pressure drop + the power absorbed by the pump - the percentage value of the pump to overcome pressure drop outside + thepower absorbed by the auxiliary electrical circuit.
3. Entering/leaving water temperature user side 40/45 °C, Entering external exchanger air temperature 7 °C (R.H. = 85%)
4. Entering/leaving water temperature user side 23/18 °C, Entering external exchanger air temperature 35 °C.
5. EER (EN 14511:2022) cooling performance coefficient. Ratio between delivered coolimg capacitu and power input in compliance with EN 14511:2022. The overall power absorbed is calculated by adding the power absorbed by the compressor + the powerabsorbed by the fan - the percentage value of the fan to overcome external pressure drop + the power absorbed by the pump - the percentage value of the pump to overcome presure drop outside + thepower absorbed by the auxiliary electrical circuit.
6. Entering/leaving water temperature user side 12/7 °C, Entering external exchanger air temperature 35 °C.
7. Seasonal Space Heating Energy Efficiency Class according to Commission delegated Regulation (EU) No 811/2013. W = Water outlet temperature (°C)
8. The data refers to the unit operating with optimized inverter frequency
9. Data calculated in compliance with EN 14825:2022.
10. Seasonal energy efficiency in heating EN 14825:2022.
11. Seasonal energy efficiency in cooling EN 14825:2022.
12. Entering/leaving water temperature user side 50/55 °C, Entering external exchanger air temperature 7 °C (R.H. = 85%)

Performance - Austic version super silent (EN)

Size			14.1	16.1	18.1	19.1	20.1	25.2	30.2
Radiant panels									
Heating									
Heating capacity (EN 14511:2022)	1,8	kW	29,2	34,1	36,7	40,6	44,4	51,1	61,4
COP (EN 14511:2022)	2	-	3,93	3,73	3,82	3,79	3,74	3,92	3,76
ErP Space Heating Energy Class - AVERAGE Climate - W35	7	-	A+++	A+++	A++	A++	A++	A+++	A+++
SCOP - MEDIUM Climate - W35	9	-	4,51	4,45	4,36	4,29	4,22	4,70	4,54
ηs,h - MEDIUM Climate - W35	10	%	177	175	171	169	166	185	179
Cooling									
Cooling capacity (EN 14511:2022)	4,8	kW	31,0	34,1	42,1	43,5	47,1	58,2	62,7
EER (EN 14511:2022)	5	-	4,30	4,00	3,70	3,69	3,42	4,25	3,92
Water flow-rate	4	l/s	1,48	1,63	2,01	2,08	2,25	2,78	3,00
User side exchanger pressure drops	4	kPa	6,77	8,01	6,96	7,39	8,58	10,5	12,1
Terminal units									
Heating									
Heating capacity (EN 14511:2022)	3	kW	30,8	32,9	40,1	44,8	49,9	57,2	62,5
COP (EN 14511:2022)	2	-	3,21	3,11	3,20	3,14	2,93	3,15	3,02
Cooling									
Cooling capacity (EN 14511:2022)	6	kW	27,0	28,0	37,4	39,9	42,4	49,4	53,0
EER (EN 14511:20228)	5	-	2,94	2,84	2,66	2,46	2,36	2,87	2,65
SEER	9	-	5,33	5,16	4,73	4,61	4,41	5,42	5,26
ηs,c	11	%	210	204	186	181	174	214	207
Water flow-rate	6	l/s	1,28	1,33	1,78	1,90	2,01	2,35	2,52
User side exchanger pressure drops	6	kPa	5,22	5,59	5,53	6,24	6,97	7,71	8,76
Radiators									
Heating									
Heating capacity (EN 14511:2022)	12	kW	26,9	31,2	34,5	37,3	40,6	48,0	55,7
COP (EN 14511:2022)	2	-	2,71	2,57	2,68	2,61	2,56	2,74	2,57
ErP Space Heating Energy Class - AVERAGE Climate - W55	7	-	A++	A++	A++	A++	A++	A++	A++
SCOP - MEDIUM Climate - W55	9	-	3,54	3,51	3,51	3,47	3,41	3,63	3,60
ηs,h - MEDIUM Climate - W55	10	%	139	137	137	136	133	142	141

The Product is compliant with the ErP (Energy Related Products) European Directive. It includes the Commission delegated Regulation (EU) No 811/2013 (rated heat output ≤ 70 kW at specified reference conditions) and the Commission delegated Regulation (EU) No 813/2013 (rated heat output ≤ 400 kW at specified reference conditions)
Contains fluorinated greenhouse gases (GWP 675)

1. Entering/leaving water temperature user side 30/35 °C, Entering external exchanger air temperature 7 °C (R.H. = 85%)
2. COP (EN 14511:2022) Heating performance coefficient. Ratio between delivered heating capacitu and power input in compliance with EN 14511:2022. The overall power absorbed is calculed by adding the power absorbed by the compressor + the power absorbed by the fan - the percentage value of the fan to overcome external pressure drop + the power absorbed by the pump - the percentage value of the pump to overcome pressure drop outside + thepower absorbed by the auxiliary electrical circuit.
3. Entering/leaving water temperature user side 40/45 °C, Entering external exchanger air temperature 7 °C (R.H. = 85%)
4. Entering/leaving water temperature user side 23/18 °C, Entering external exchanger air temperature 35 °C.
5. EER (EN 14511:2022) cooling performance coefficient. Ratio between delivered coolimg capacitu and power input in compliance with EN 14511:2022. The overall power absorbed is calculated by adding the power absorbed by the compressor + the powerabsorbed by the fan - the percentage value of the fan to overcome external pressure drop + the power absorbed by the pump - the percentage value of the pump to overcome presure drop outside + thepower absorbed by the auxiliary electrical circuit.
6. Entering/leaving water temperature user side 12/7 °C, Entering external exchanger air temperature 35 °C.
7. Seasonal Space Heating Energy Efficiency Class according to Commission delegated Regulation (EU) No 811/2013. W = Water outlet temperature (°C)
8. The data refers to the unit operating with optimized inverter frequency
9. Data calculated in compliance with EN 14825:2022.
10. Seasonal energy efficiency in heating EN 14825:2022.
11. Seasonal energy efficiency in cooling EN 14825:2022.
12. Entering/leaving water temperature user side 50/55 °C, Entering external exchanger air temperature 7 °C (R.H. = 85%)

Construction characteristics

SIZE			14.1	16.1	18.1	19.1	20.1	25.2	30.2
Compressor									
Type of compressors						SCROLL INVERTER			
Refrigerant						R-290			
No. of compressors		Nr			1			2	
Oil charge		l			3,3			6,6	
Refrigerant charge		kg		4,9		4,5		10	
No. of circuits		Nr				1			
User side exchanger									
Internal exchanger type	1					PHE			
No. of internal exchangers		Nr				1			
Water content		l		6,2		8,4		10,7	
External exchanger									
Type of external exchanger	2					CCHY			
Number of coils		Nr				2			
External Section Fans									
Type of fans	3					AX			
No. of fans		Nr			2			3	
Motor type						Brushless DC			
Standard airflow		m3/h			38000			53000	
Installed unit power		kW			1,5			1,5	
Water circuit									
Water fittings						2"			
Maximum water side pressure - without pump on board		bar				10			
Maximum water side pressure - with pump on board		bar				6			
Minimum system water content in heating mode		l		300		500		600	
Minimum system water content in cooling mode		l		300		500		600	
Total internal water volume	4	l		12,3		14,6		21,3	
Power supply									
Standard power supply						400/3~/50			

1. PHE = Plate exchanger
2. CCHY = Coil with aluminium hydrophilic fins
3. AX = Axial fan
4. With ACC option, add the water content of the inertial tank.

Sound levels - Acoustic configuration with compressor soundproofing (SC)

SIZE	Sound power level (dB) - Octave band (Hz)								Sound pressure level	Sound power level
	63	125	250	500	1000	2000	4000	8000	dB(A)	dB(A)
14.1	65	64	64	67	71	68	62	59	57	75
16.1	65	64	64	67	71	68	62	59	57	75
18.1	67	66	66	69	73	71	65	61	59	77
19.1	67	66	66	69	73	71	65	61	59	77
20.1	67	66	67	70	73	71	65	61	60	78
25.2	67	67	67	70	73	71	66	61	59	78
30.2	68	68	68	71	74	72	67	62	60	79

Sound levels refer to a unit under nominal operating conditions.
The sound pressure level refers to 1 m from the unit outer surface operating in open field.
Sound power levels are determined using the intensimetric method (UNI EN ISO 9614-2).

Data referring to the following conditions in heating mode:
- internal exchanger water = 30/35 °C
- ambient temperature 7/6 °C

Data referring to the following conditions in cooling mode:
- internal exchanger water = 12/7 °C
- ambient temperature 35 °C

Sound levels - Silenced acoustic configuration (LN)

SIZE	Sound power level (dB) - Octave band (Hz)								Sound pressure level	Sound power level
	63	125	250	500	1000	2000	4000	8000	dB(A)	dB(A)
14.1	58	67	63	63	69	60	58	59	55	73
16.1	58	67	63	64	69	60	58	59	55	73
18.1	59	68	64	65	70	62	59	60	56	74
19.1	59	68	64	65	70	62	59	60	56	74
20.1	59	68	65	65	70	62	59	60	56	74
25.2	59	68	65	65	70	62	59	60	56	74
30.2	60	69	66	66	71	63	60	61	56	75

Sound levels refer to a unit under nominal operating conditions.
The sound pressure level refers to 1 m from the unit outer surface operating in open field.
Sound power levels are determined using the intensimetric method (UNI EN ISO 9614-2).

Data referring to the following conditions in heating mode:
- internal exchanger water = 30/35 °C
- ambient temperature 7/6 °C

Data referring to the following conditions in cooling mode:
- internal exchanger water = 12/7 °C
- ambient temperature 35 °C

Sound levels - Super-Silenced acoustic configuration (EN)

SIZE	Sound power level (dB) - Octave band (Hz)								Sound pressure level	Sound power level
	63	125	250	500	1000	2000	4000	8000	dB(A)	dB(A)
14.1	62	54	58	61	63	59	55	57	51	69
16.1	62	54	58	61	63	59	55	57	51	69
18.1	62	54	58	62	63	59	55	57	51	69
19.1	62	54	58	62	63	59	55	57	51	69
20.1	62	54	58	62	63	59	55	58	51	69
25.2	63	55	59	62	63	59	56	58	50	69
30.2	63	55	59	62	64	59	56	58	50	69

Sound levels refer to a unit under nominal operating conditions.
The sound pressure level refers to 1 m from the unit outer surface operating in open field.
Sound power levels are determined using the intensimetric method (UNI EN ISO 9614-2).

Data referring to the following conditions in heating mode:
- internal exchanger water = 30/35 °C
- ambient temperature 7/6 °C
Data referring to the following conditions in cooling mode:
- internal exchanger water = 12/7 °C
- ambient temperature 35 °C

Sound levels ERP - Acoustic configuration SC / LN / EN

SIZE	Sound power level (dB) - Octave band (Hz)								Sound pressure level	Sound power level
	63	125	250	500	1000	2000	4000	8000	dB(A)	dB(A)
14.1	62	55	58	61	63	59	55	56	51	68
16.1	62	55	58	61	63	59	55	56	51	68
18.1	62	54	58	62	63	59	55	57	51	69
19.1	62	54	58	62	63	59	55	57	51	69
20.1	62	54	58	62	63	59	55	57	51	69
25.2	63	55	59	62	63	59	56	58	50	69
30.2	63	55	59	62	63	59	56	58	50	69

Sound levels refer to units operating at Part Load Conditions (PLC) as defined in standard EN12102-1.
Data referring to the following conditions in heating mode:
- internal exchanger water temperature = */55 °C
- ambient temperature 7/6 °C

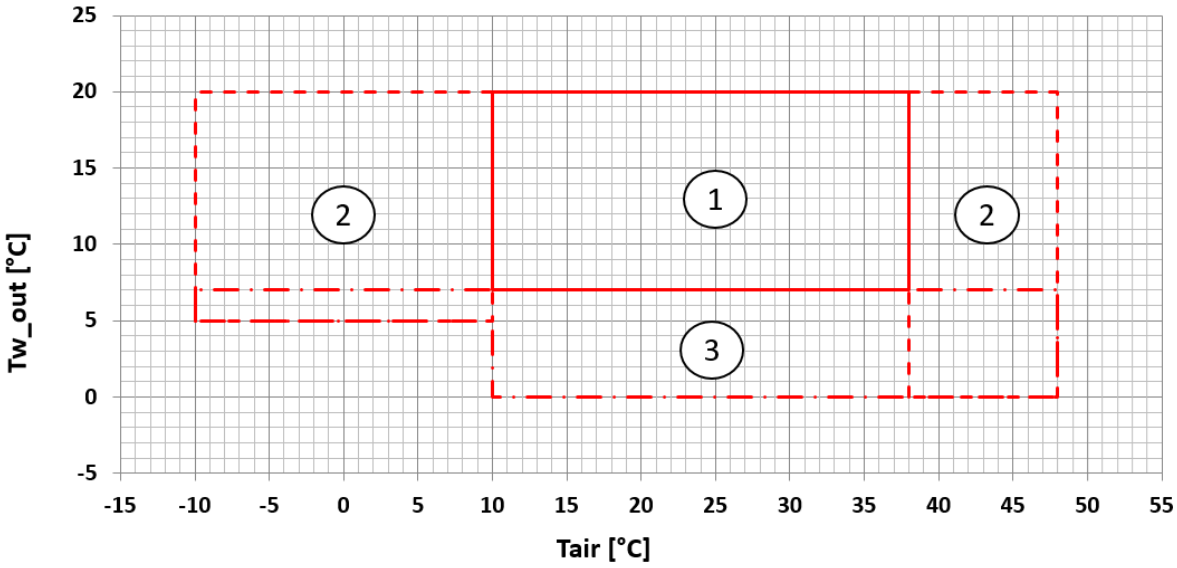
Electrical data

Power supply voltage 400/3/50+N

SIZE		14.1	16.1	18.1	19.1	20.1	25.2	30.2
F.L.A. - Full load current at max admissible conditions								
F.L.A. - Total	[A]	34,9	34,9	53,3	53,3	53,3	65,8	65,8
F.L.I. - Full load power input at max admissible conditions								
F.L.I. - Total	[kW]	22,0	22,0	34,0	34,0	34,0	41,8	41,8
M.I.C. Maximum inrush current								
M.I.C. - Total	[A]	34,9	34,9	53,3	53,3	53,3	65,8	65,8

Operating range

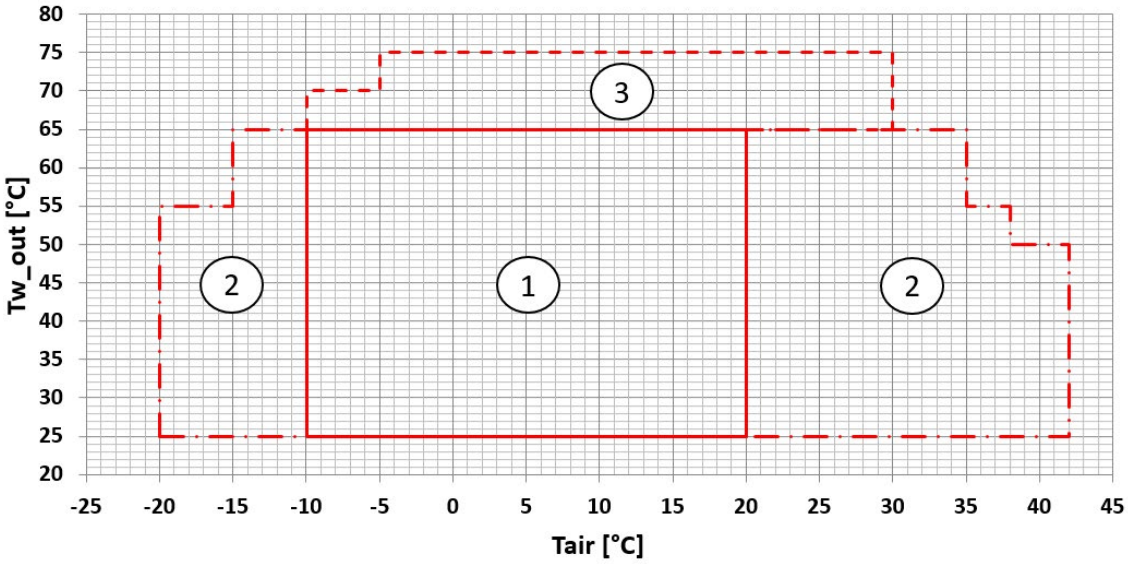
Cooling



Twu [°C] = Temperature of the outlet water from the exchanger
Tae [°C] = External exchanger inlet air temperature

1. Normal operating range.
2. Unit operating range with automatic staging of th compressor capacity
3. Unit operating range with low water temperature, where it's mandatory the use of ethylene or propylene glycol

Heating / DHW Production



Twu [°C] = Temperature of the outlet water from the exchanger
Tae [°C] = External exchanger inlet air temperature

1. Normal operating range.
2. Unit operating range with automatic staging of the compressor capacity, sudden changes in water temperature not permitted
3. Unit operating range with automatic staging of th compressor capacity

21. **Dimensional**

SIZE 14.1 ÷ 20.1

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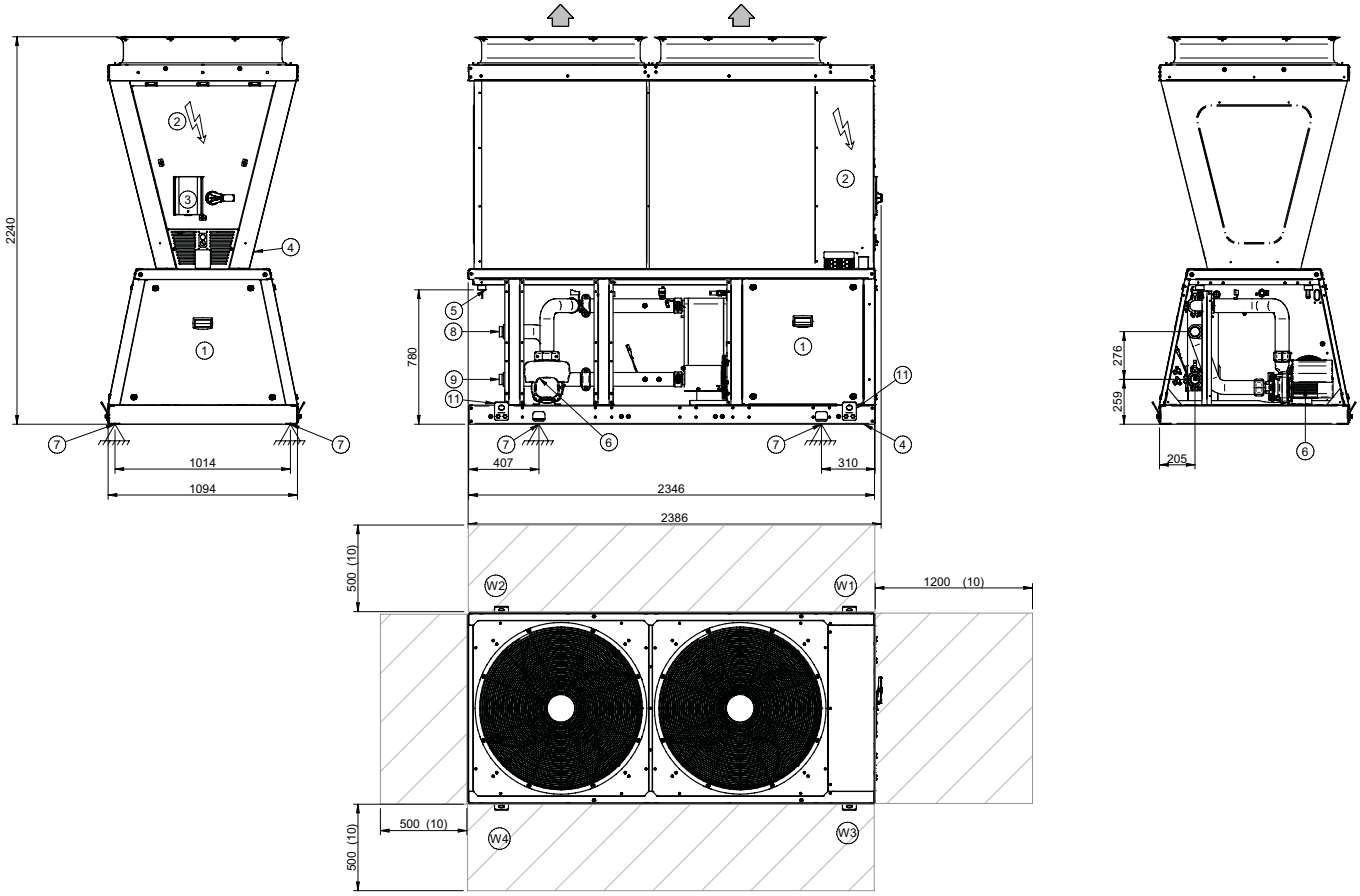
DATA/DATE 25/09/2023



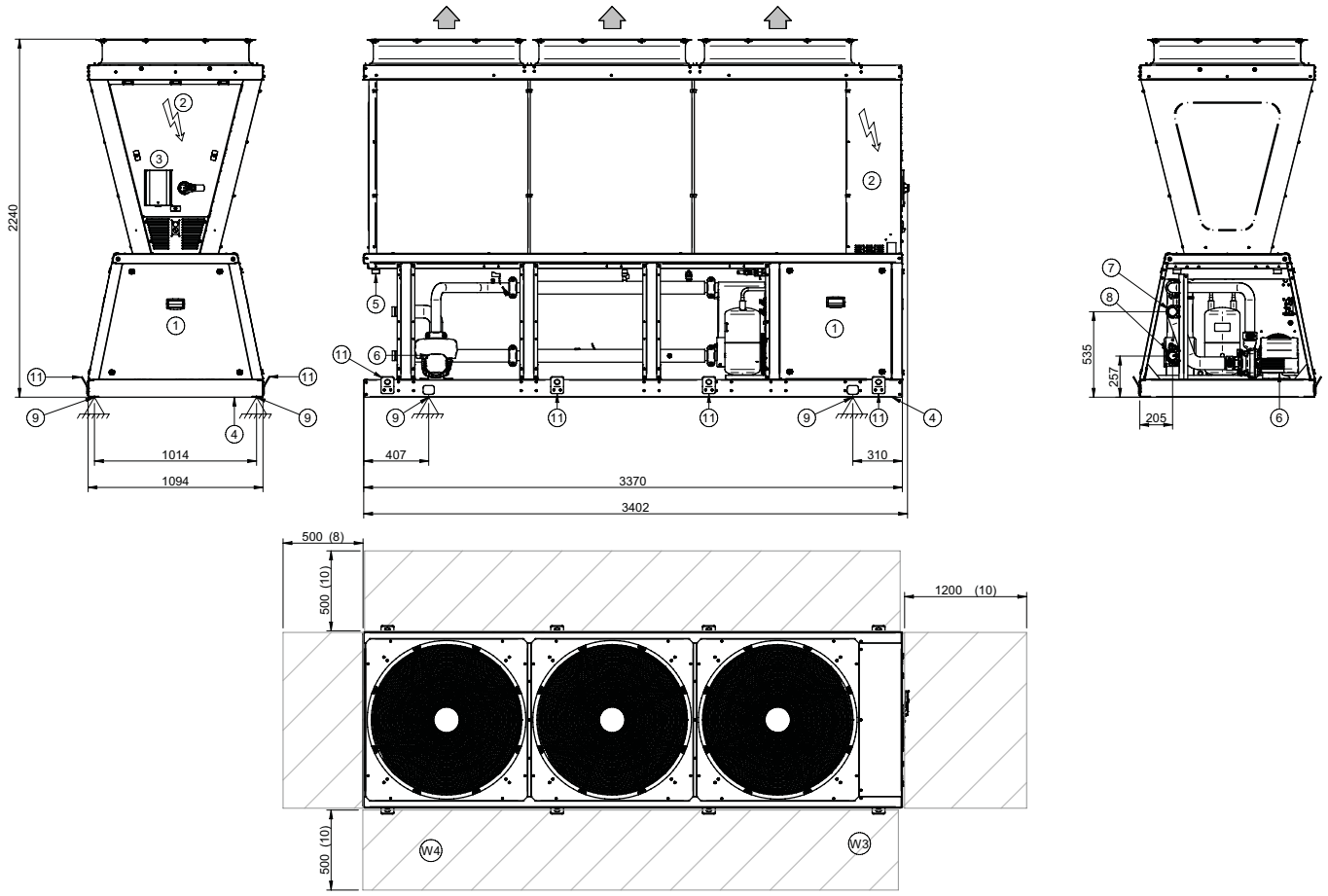
1. Compressor compartment
2. Electrical panel
3. Unit control keypad
4. Power input
5. Condensate drain
6. Water pump (optional)
7. Fixing point
8. Functional spaces
9. Lifting bracket (removed)

SIZES		**14.1**	**16.1**	**18.1**	**19.1**	**20.1**
Length	mm	2384	2384	2384	2384	2384
Depth	mm	1094	1094	1094	1094	1094
Height	mm	2240	2240	2240	2240	2240
W1 Supporting point	kg	210	210	226	226	226
W2 Supporting point	kg	138	138	145	145	145
W3 Supporting point	kg	217	217	233	233	233
W4 Supporting point	kg	145	145	153	153	153
Operation weight	kg	709	709	757	757	757
Shipping weight	kg	689	689	737	737	737

The presence of optional accessories may result in a substantial variation of the weights shown in the table.

SIZE 25.2 ÷ 30.2

DAASP0002_00
DATA/DATE 25/09/2023



10. Compressor compartment
11. Electrical panel
12. Unit control keypad
13. Power input
14. Condensate drain
15. Water pump (optional)
16. Water inlet 2" Victaulic
17. Water outlet 2" Victaulic
18. Fixing point
19. Functional spaces
20. Liftin bracket (Removed)

SIZES		25.2	30.2
Length	mm	3402	3402
Depth	mm	1094	1094
Height	mm	2240	2240
W1 Supporting point	kg	306	306
W2 Supporting point	kg	199	199
W3 Supporting point	kg	312	312
W4 Supporting point	kg	205	205
Operation weight	kg	1021	1021
Shipping weight	kg	1001	1001

The presence of optional accessories may result in a substantial variation of the weights shown in the table.

22. Safety data sheets

22.1 Refrigerant safety data sheet

Available data is in English

Safety Data Sheet

R290

according to the REACH Regulation (EC) 1907/2006 amended by Regulation (EU) 2020/878
Reference number: 104x
Revision date: 02/03/2023
Supersedes version of: 30/09/2021
Version: 4.0

Danger

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Trade name	:	R290
SDS no	:	104x
Other means of identification	:	R290
	CAS-No.	: 74-98-6
	EC-No.	: 200-827-9
	EC Index-No.	: 601-003-00-5
REACH registration No	:	01-2119486944-21
Chemical formula	:	C3H8

1.2. Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses : Industrial and professional uses. Perform risk assessment prior to use.
Test gas/Calibration gas.
Laboratory use.
Chemical reaction / Synthesis.
Use as a fuel.
Contact supplier for more information on uses.

1.3. Details of the supplier of the safety data sheet

Company identification

1.4. Emergency telephone number

Emergency telephone number : Linea verde SET - 800452661 (24h/24h, 365 giorni l'anno); Dall'estero +39 0283421263

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Physical hazards	Flammable gases, Category 1A	H220
	Gases under pressure : Compressed gas	H280

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :

GHS02 GHS04

: Danger

Safety Data Sheet

R290

according to the REACH Regulation (EC) 1907/2006 amended by Regulation (EU) 2020/878
Reference number: 104x

Hazard statements (CLP) : H220 - Extremely flammable gas.
H280 - Contains gas under pressure; may explode if heated.

Precautionary statements (CLP)
- Prevention : P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
- Response : P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 - In case of leakage, eliminate all ignition sources.
- Storage : P403 - Store in a well-ventilated place.
P410+P403 - Protect from sunlight. Store in a well-ventilated place.

2.3. Other hazards

Contact with liquid may cause cold burns/frostbite.

SECTION 3: Composition/information on ingredients

3.1. Substances

Name	%	Product identifier	Classification according to Regulation (EC) No. 1272/2008 [CLP]
R290	100	CAS-No.: 74-98-6 EC-No.: 200-827-9 EC Index-No.: 601-003-00-5 REACH registration No: 01-2119486944-21	Flam. Gas 1A, H220 Press. Gas (Comp.), H280

Contains no other components or impurities which will influence the classification of the product.

3.2. Mixtures

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

- Inhalation : Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Perform cardiopulmonary resuscitation if breathing stopped.
- Skin contact : For liquid spillage - flush with water for at least 15 minutes.
- Eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes.
- Ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation.
In low concentrations may cause narcotic effects. Symptoms may include dizziness, headache, nausea and loss of co-ordination.

4.3. Indication of any immediate medical attention and special treatment needed

None.

SECTION 5: Firefighting measures

5.1. Extinguishing media

- Suitable extinguishing media : Water spray or fog.
Dry powder.
- Unsuitable extinguishing media : Do not use water jet to extinguish.
Carbon dioxide.

Safety Data Sheet

R290

according to the REACH Regulation (EC) 1907/2006 amended by Regulation (EU) 2020/878
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5.2. Special hazards arising from the substance or mixture

Specific hazards : Exposure to fire may cause containers to rupture/explode.
Hazardous combustion products : Incomplete combustion may form carbon monoxide.

5.3. Advice for firefighters

Specific methods : Use fire control measures appropriate for the surrounding fire. Exposure to fire and heat radiation may cause gas receptacles to rupture. Cool endangered receptacles with water spray jet from a protected position. Prevent water used in emergency cases from entering sewers and drainage systems.
If possible, stop flow of product.
Use water spray or fog to knock down fire fumes if possible.
Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire.
Move containers away from the fire area if this can be done without risk.

Special protective equipment for fire fighters : In confined space use self-contained breathing apparatus.
Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.
Standard EN 469 - Protective clothing for firefighters. Standard - EN 659: Protective gloves for firefighters.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Try to stop release.
Evacuate area.
Consider the risk of potentially explosive atmospheres.
Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
Eliminate ignition sources.
Ensure adequate air ventilation.
Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
Act in accordance with local emergency plan.
Stay upwind.

6.2. Environmental precautions

Try to stop release.

6.3. Methods and material for containment and cleaning up

Ventilate area.

6.4. Reference to other sections

See also sections 8 and 13.

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SECTION 7: Handling and storage

7.1. Precautions for safe handling

Safe use of the product : The product must be handled in accordance with good industrial hygiene and safety procedures.
Only experienced and properly instructed persons should handle gases under pressure.
Consider pressure relief device(s) in gas installations.
Ensure the complete gas system was (or is regularily) checked for leaks before use.
Do not smoke while handling product.
Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt.
Assess the risk of potentially explosive atmospheres and the need for explosion-proof equipment.
Purge air from system before introducing gas.
Take precautionary measures against static discharge.
Keep away from ignition sources (including static discharges).
Consider the use of only non-sparking tools.
Do not breathe gas.
Avoid release of product into work area.

Safe handling of the gas receptacle : Refer to supplier's container handling instructions.
Do not allow backfeed into the container.
Protect containers from physical damage; do not drag, roll, slide or drop.
When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders.
Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use.
If user experiences any difficulty operating valve discontinue use and contact supplier.
Never attempt to repair or modify container valves or safety relief devices.
Damaged valves should be reported immediately to the supplier.
Keep container valve outlets clean and free from contaminants particularly oil and water.
Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment.
Close container valve after each use and when empty, even if still connected to equipment.
Never attempt to transfer gases from one cylinder/container to another.
Never use direct flame or electrical heating devices to raise the pressure of a container.
Do not remove or deface labels provided by the supplier for the identification of the content of the container.
Suck back of water into the container must be prevented.

7.2. Conditions for safe storage, including any incompatibilities

Observe all regulations and local requirements regarding storage of containers.
Containers should not be stored in conditions likely to encourage corrosion.
Container valve guards or caps should be in place.
Containers should be stored in the vertical position and properly secured to prevent them from falling over.
Stored containers should be periodically checked for general condition and leakage.
Keep container below 50°C in a well ventilated place.
Store containers in location free from fire risk and away from sources of heat and ignition.
Keep away from combustible materials.
Segregate from oxidant gases and other oxidants in store.
All electrical equipment in the storage areas should be compatible with the risk of a potentially explosive atmosphere.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

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8.2. Exposure controls

8.2.1. Appropriate engineering controls

Provide adequate general and local exhaust ventilation.
Systems under pressure should be regularily checked for leakages.
Ensure exposure is below occupational exposure limits (where available).
Gas detectors should be used when flammable gases/vapours may be released.
The substance is not classified for human health hazards or for environment effects and it is not PBT or vPvB so that no exposure assessment or risk characterisation is required. For tasks where the intervention of workers is required, the substance must be handled in accordance with good industrial hygiene and safety procedures.
Consider the use of a work permit system e.g. for maintenance activities.

8.2.2. Individual protection measures, e.g. personal protective equipment

A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk.
The following recommendations should be considered:
PPE compliant to the recommended EN/ISO standards should be selected.

• Eye/face protection	:	Wear safety glasses with side shields. Wear goggles when transfilling or breaking transfer connections. Standard EN 166 - Personal eye-protection - specifications.
• Skin protection		
- Hand protection	:	Wear working gloves when handling gas containers. Standard EN 388 - Protective gloves against mechanical risk, performance level 1 or higher.
- Other	:	Consider the use of flame resistant anti-static safety clothing. Standard EN ISO 14116 - Limited flame spread materials. Standard EN 1149-5 - Protective clothing: Electrostatic properties. Wear safety shoes while handling containers. Standard EN ISO 20345 - Personal protective equipment - Safety footwear.
• Respiratory protection	:	Gas filters may be used if all surrounding conditions e.g. type and concentration of the contaminant(s) and duration of use are known. Consult respiratory device supplier´s product information for the selection of the appropriate device. Recommended: Filter AX (brown). Gas filters do not protect against oxygen deficiency. Standard EN 14387 - Gas filter(s), combined filter(s) and standard EN136, full face masks .
• Thermal hazards	:	None necessary.

8.2.3. Environmental exposure controls

Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance		
- Physical state at 20°C / 101.3kPa	:	Gas.
- Colour	:	Colourless.
Odour	:	Stenchant often added. Sweetish. Poor warning properties at low concentrations. Odour threshold is subjective and inadequate to warn of overexposure.
Melting point / Freezing point	:	-188 °C -188 °C
Boiling point	:	-42.1 °C
Flammability	:	Not available
Lower explosion limit	:	Not available
Upper explosion limit	:	Not available
Flash point	:	Not applicable for gases and gas mixtures.
Auto-ignition temperature	:	470 °C
Decomposition temperature	:	Not available
pH	:	Not applicable.
Viscosity, kinematic	:	Not applicable.

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Water solubility [20°C]	:	75 mg/l
Partition coefficient n-octanol/water (Log Kow)	:	Not available
Vapour pressure [20°C]	:	8.3 bar(a)
Vapour pressure [50°C]	:	17 bar(a)
Density and/or relative density	:	Not applicable.
Relative vapour density (air=1)	:	1.5
Particle characteristics	:	Not applicable.

9.2. Other information

9.2.1. Information with regard to physical hazard classes

Explosive properties	:	Not applicable.
Explosion limits	:	1.7 – 10.8 vol %
Oxidising properties	:	None.
Tci	:	3.7 %
Critical temperature [°C]	:	96.7 °C

9.2.2. Other safety characteristics

Molar mass	:	44 g/mol
Evaporation rate	:	Not applicable for gases and gas mixtures.
Gas group	:	Press. Gas (Liq.).
Other data	:	Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.

SECTION 10: Stability and reactivity

10.1. Reactivity

No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

May react violently with oxidants.
Can form explosive mixture with air.

10.4. Conditions to avoid

Keep away from heat/sparks/open flames/hot surfaces. – No smoking.

10.5. Incompatible materials

Air, Oxidisers.
For additional information on compatibility refer to ISO 11114.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11: Toxicological information

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Acute toxicity : No known toxicological effects from this product.

LC50 Inhalation - Rat [ppm]	20000 ppm/4h

Skin corrosion/irritation : No known effects from this product.

Serious eye damage/irritation : No known effects from this product.

Respiratory or skin sensitisation : No known effects from this product.

Germ cell mutagenicity : No known effects from this product.

Carcinogenicity : No known effects from this product.

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Toxic for reproduction : Fertility	:	No known effects from this product.
Toxic for reproduction : unborn child	:	No known effects from this product.
STOT-single exposure	:	No known effects from this product.
STOT-repeated exposure	:	No known effects from this product.
Aspiration hazard	:	Not applicable for gases and gas mixtures.

11.2. Information on other hazards

No additional information available

SECTION 12: Ecological information

12.1. Toxicity

EC50 48h - Daphnia magna [mg/l]	:	27.1 mg/l
EC50 72h - Algae [mg/l]	:	11.9 mg/l
LC50 96 h - Fish [mg/l]	:	49.9 mg/l

12.2. Persistence and degradability

Assessment	:	The substance is readily biodegradable. Unlikely to persist.

12.3. Bioaccumulative potential

Assessment	:	Not expected to bioaccumulate due to the low log Kow (log Kow < 4). See section 9.

12.4. Mobility in soil

Assessment	:	Because of its high volatility, the product is unlikely to cause ground or water pollution.

12.5. Results of PBT and vPvB assessment

Assessment	:	Not classified as PBT or vPvB.

12.6. Endocrine disrupting properties

Assessment	:	

12.7. Other adverse effects

Effect on the ozone layer	:	None.
Global warming potential [CO2=1]	:	3
Effect on global warming	:	No known effects from this product.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Do not discharge into areas where there is a risk of forming an explosive mixture with air.
Waste gas should be flared through a suitable burner with flash back arrestor.
Do not discharge into any place where its accumulation could be dangerous.
Ensure that the emission levels from local regulations or operating permits are not exceeded.
Refer to the EIGA code of practice Doc.30 "Disposal of Gases", downloadable at http://www.eiga.org for more guidance on suitable disposal methods.

List of hazardous waste codes (from Commission Decision 2000/532/EC as amended)	:	16 05 04 *: Gases in pressure containers (including halons) containing hazardous substances.

13.2. Additional information

None.

SECTION 14: Transport information

14.1. UN number or ID number

In accordance with ADR / RID / IMDG / IATA / ADN

UN-No.	:	1978

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14.2. UN proper shipping name

Transport by road/rail (ADR/RID) : PROPANE
Transport by air (ICAO-TI / IATA-DGR) : PROPANE
Transport by sea (IMDG) : PROPANE

14.3. Transport hazard class(es)

Labelling :

2.1 : Flammable gases.

Transport by road/rail (ADR/RID)
Class : 2
Classification code : 2F
Hazard identification number : 23
Tunnel Restriction : B/D - Tank carriage : Passage forbidden through tunnels of category B, C, D and E. Other carriage : Passage forbidden through tunnels of category D and E

Transport by air (ICAO-TI / IATA-DGR)
Class / Div. (Sub. risk(s)) : 2.1

Transport by sea (IMDG)
Class / Div. (Sub. risk(s)) : 2.1
Emergency Schedule (EmS) - Fire : F-D
Emergency Schedule (EmS) - Spillage : S-U

14.4. Packing group

Transport by road/rail (ADR/RID) : Not applicable.
Transport by air (ICAO-TI / IATA-DGR) : Not applicable.
Transport by sea (IMDG) : Not applicable.

14.5. Environmental hazards

Transport by road/rail (ADR/RID) : None.
Transport by air (ICAO-TI / IATA-DGR) : None.
Transport by sea (IMDG) : None.

14.6. Special precautions for user

Packing Instruction(s)
Transport by road/rail (ADR/RID) : P200.
Transport by air (ICAO-TI / IATA-DGR)
Passenger and Cargo Aircraft : Forbidden.
Cargo Aircraft only : 200.
Transport by sea (IMDG) : P200.

Special transport precautions : Avoid transport on vehicles where the load space is not separated from the driver's compartment.
Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.
Before transporting product containers:
- Ensure there is adequate ventilation.
- Ensure that containers are firmly secured.
- Ensure valve is closed and not leaking.
- Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
- Ensure valve protection device (where provided) is correctly fitted.

14.7. Maritime transport in bulk according to IMO instruments

Not applicable.

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SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU-Regulations

Restrictions on use	:	None.
Other information, restriction and prohibition regulations	:	Ensure all national/local regulations are observed. Not listed on the PIC list (Regulation EU 649/2012).
Seveso Directive : 2012/18/EU (Seveso III)	:	Listed.

National regulations

No additional information available

15.2. Chemical safety assessment

A CSA has been carried out.
Refer to section 8.2.

SECTION 16: Other information

Indication of changes	:	Revised safety data sheet in accordance with commission regulation (EU) No 2015/830.
Training advice	:	Ensure operators understand the flammability hazard. The hazard of asphyxiation is often overlooked and must be stressed during operator training.
Further information	:	This Safety Data Sheet has been established in accordance with the applicable European Union legislation.

Full text of H- and EUH-statements	
Flam. Gas 1A	Flammable gases, Category 1A
H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
Press. Gas (Comp.)	Gases under pressure : Compressed gas

DISCLAIMER OF LIABILITY : Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.
Details given in this document are believed to be correct at the time of going to press.
Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted.

End of document

22.2 Compressor oil safety data sheet

Available data is in English

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Safety Data Sheet

according to Regulation (EU) 2020/878

Date of issue: 11.07.2024 Revision date: - Version/Replaced version: 1.0/-

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture

Product name : 160SZ

UFI : PQE0-A040-V00U-WTYC

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.2.1. Relevant identified uses

Use of the substance/mixture : Refrigeration lubricants

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

Manufacturer/Supplier
Danfoss Commercial Compressors S.A
Rue du Pou du Ciel
01600 Reyrieux - France
T +33 (0)4 74 00 28 29
contact.cc@danfoss.com

Safety Data Sheet: DLAC Dienstleistungsagentur Chemie GmbH, E-mail: sds@dlac-gmbh.de

1.4. Emergency telephone number

Country	Organisation/Company	Address	Emergency number
Germany	Giftinformationszentrum (GIZ-Nord) Universitätsmedizin Göttingen - Georg-August-Universität	Robert-Koch Straße 40 37075 Göttingen	+49 551 19240

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [CLP]

Not classified

Adverse physicochemical, human health and environmental effects

To our knowledge, this product does not present any particular risk, provided it is handled in accordance with good occupational hygiene and safety practice.

2.2. Label elements

Labelling according to Regulation (EC) No 1272/2008 [CLP]

No labelling applicable

2.3. Other hazards

The mixture does not contain substance(s) classified as PBT or vPvB in concentrations above 0.1%. The mixture does not contain substance(s) included in the list established in accordance with Article 59(1) of REACH for having endocrine disrupting properties, or is not identified as having endocrine disrupting properties in accordance with the criteria set out in Commission Delegated Regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605.

SECTION 3: Composition/information on ingredients

3.1. Substances

Not applicable

3.2. Mixtures

This mixture does not contain any substances to be mentioned according to the criteria of section 3.2 of REACH Annex II.

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Get medical advice/attention if you feel unwell. If possible show him this sheet. Failing this, show him the packaging or label. Never give anything by mouth to an unconscious person. Place the affected person in the recovery position.

First-aid measures after inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing.

First-aid measures after skin contact : Remove/Take off immediately all contaminated clothing. Wash with plenty of soap and water.

First-aid measures after eye contact : IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

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First-aid measures after ingestion : Rinse mouth. Drink water as a precaution. Do NOT induce vomiting.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after skin contact : Causes mild skin irritation. Prolonged or repeated contact may cause irritation.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Use extinguishing agents that suit the environment. Carbon dioxide. Extinguishing powder. Water spray. For a significant fire: Alcohol resistant foam.

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

Hazardous decomposition products in case of fire : Carbon dioxide. Carbon monoxide. Toxic gases and vapours.

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Prevent fire-fighting water from entering environment.

Protection during firefighting : Use a self-contained breathing apparatus and also a protective suit.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Provide adequate ventilation. Do not breathe vapours. Avoid contact with skin and eyes.

6.1.1. For non-emergency personnel

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Use personal protective equipment as required. In case of inadequate ventilation wear respiratory protection. For further information refer to section 8: "Exposure controls/personal protection".

6.2. Environmental precautions

Prevent entry to sewers and public waters.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Wipe up with absorbent material (for example cloth). Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Keep in suitable, closed containers for disposal. Dispose of in accordance with relevant local regulations.

6.4. Reference to other sections

Exposure controls and personal protection, see section 8. Concerning disposal elimination after cleaning, see section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Ensure good ventilation of the work station. Avoid breathing vapours, spray. Avoid contact with skin and eyes. Wear personal protective equipment.

Hygiene measures : Handle in accordance with good industrial hygiene and safety procedures. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. When using do not eat, drink or smoke.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store in original container. Keep container tightly closed. Store in a dry, cool and well-ventilated place. Protect from heat and direct sunlight.

Prohibitions on mixed storage : Keep away from food, drink and animal feedingstuffs.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

8.2. Exposure controls

Appropriate engineering controls : Provide local exhaust or general room ventilation to minimize vapour concentrations.

Hand protection : Wear suitable gloves (EN 374 or equivalent). Nitrile rubber, neoprene. > 0.35 mm. The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

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Eye protection	:	Chemical goggles or safety glasses (EN 166).
Skin and body protection	:	Wear suitable protective clothing.
Respiratory protection	:	Where exposure through inhalation may occur from use, respiratory protection equipment is recommended.
Environmental exposure controls	:	Avoid release to the environment.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid.
Colour	:	Colourless to yellow
Odour	:	Mild
Melting point/freezing point	:	No data available
Boiling point or initial boiling point and boiling range	:	No data available
Flammability	:	No data available
Lower and upper explosion limit	:	No data available
Flash point	:	270 °C (Tagliabue Open Cup)
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
pH	:	No data available
Kinematic viscosity	:	33.7 mm²/s (40 °C); 5.9 mm²/s (100 °C)
Solubility	:	Water: practically insoluble
Partition coefficient n-octanol/water (log value)	:	Not applicable
Vapour pressure	:	No data available
Density and/or relative density	:	0.977 (20 °C)
Relative vapour density	:	No data available
Particle characteristics	:	Not applicable

9.2. Other information

9.2.1. Information with regard to physical hazard classes

Explosive properties	:	None
Oxidising properties	:	None

9.2.2. Other safety characteristics

Pour point	:	ca. -46 °C

SECTION 10: Stability and reactivity

10.1. Reactivity

No dangerous reactions known.

10.2. Chemical stability

Stable under use and storage conditions as recommended in section 7.

10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use.

10.4. Conditions to avoid

High temperature. Sources of ignition. Oxidizing agents.

10.5. Incompatible materials

Oxidizing agents. Strong acids. Strong bases.

10.6. Hazardous decomposition products

No hazardous decomposition products known at room temperature. In case of fire: Carbon dioxide. Carbon monoxide. Toxic gases and vapours.

SECTION 11: Toxicological information

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008

Acute toxicity	:	Not classified Based on available data, the classification criteria are not met
Skin corrosion/irritation	:	Not classified Based on available data, the classification criteria are not met
Serious eye damage/irritation	:	Not classified Based on available data, the classification criteria are not met

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Respiratory or skin sensitisation	:	Not classified Based on available data, the classification criteria are not met
Germ cell mutagenicity	:	Not classified Based on available data, the classification criteria are not met
Carcinogenicity	:	Not classified Based on available data, the classification criteria are not met
Reproductive toxicity	:	Not classified Based on available data, the classification criteria are not met
Specific target organ toxicity (single exposure)	:	Not classified Based on available data, the classification criteria are not met
Specific target organ toxicity (repeated exposure)	:	Not classified Based on available data, the classification criteria are not met
Aspiration hazard	:	Not classified Based on available data, the classification criteria are not met

11.2. Information on other hazards

11.2.1. Endocrine disrupting properties

Endocrine disruption for human health : The mixture has no endocrine disrupting properties.

11.2.2. Other information

Potential adverse human health effects and symptoms : Causes mild skin irritation. Prolonged or repeated contact may cause irritation.

SECTION 12: Ecological information

12.1. Toxicity

Acute aquatic toxicity : Not classified

Chronic aquatic toxicity : Not classified

12.2. Persistence and degradability

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Persistence and degradability	Readily biodegradable.
Biodegradation	63.1 %, 28 d (OECD 301 B)

12.3. Bioaccumulative potential

No additional information available

12.4. Mobility in soil

No additional information available

12.5. Results of PBT and vPvB assessment

Not fulfilling Persistent, Bioaccumulative and Toxic (PBT), very Persistent and very Bioaccumulative (vPvB) criteria.

12.6. Endocrine disrupting properties

Endocrine disruption for the environment : The mixture has no endocrine disrupting properties.

12.7. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Regional legislation (waste) : Dispose in a safe manner in accordance with local/national regulations.

Waste treatment methods : Do not empty into drains.

Waste disposal recommendations : Empty the packaging completely prior to disposal.

Waste code : The valid EWC waste code numbers are source related. The manufacturer is therefore unable to specify EWC waste codes for the articles or products used in the various sectors. The EWC codes listed are intended as a recommendation for users.

SECTION 14: Transport information

In accordance with ADR / IMDG / IATA

14.1. UN number or ID number

UN-No. (ADR) : Not applicable

UN-No. (IMDG) : Not applicable

UN-No. (IATA) : Not applicable

14.2. UN proper shipping name

Proper Shipping Name (ADR) : Not applicable

Proper Shipping Name (IMDG)	:	Not applicable
Proper Shipping Name (IATA)	:	Not applicable

14.3. Transport hazard class(es)

ADR

Transport hazard class(es) (ADR)	:	Not applicable

IMDG

Transport hazard class(es) (IMDG)	:	Not applicable

IATA

Transport hazard class(es) (IATA)	:	Not applicable

14.4. Packing group

Packing group (ADR)	:	Not applicable
Packing group (IMDG)	:	Not applicable
Packing group (IATA)	:	Not applicable

14.5. Environmental hazards

Dangerous for the environment	:	No
Marine pollutant	:	No
Other information	:	No supplementary information available.

14.6. Special precautions for user

Overland transport

Not applicable

Transport by sea

Not applicable

Air transport

Not applicable

14.7. Maritime transport in bulk according to IMO instruments

Not applicable

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1. EU-Regulations

REACH Annex XIV (Authorisation List)

Contains no substance(s) listed on REACH Annex XIV (Authorisation List).

REACH Candidate List (SVHC)

Contains no substance(s) listed on the REACH Candidate List.

PIC Regulation (Prior Informed Consent)

Contains no substance(s) listed on the PIC list (Regulation EU 649/2012 concerning the export and import of hazardous chemicals).

POP Regulation (Persistent Organic Pollutants)

Contains no substance(s) listed on the POP list (Regulation EU 2019/1021 on persistent organic pollutants).

Explosives Precursors Regulation (2019/1148)

Contains no substance(s) listed on the Explosives Precursors list (Regulation EU 2019/1148 on the marketing and use of explosives precursors).

Drug Precursors Regulation (273/2004)

Contains no substance(s) listed on the Drug Precursors list (Regulation EC 273/2004 on the manufacture and the placing on market of certain substances used in the illicit manufacture of narcotic drugs and psychotropic substances).

15.1.2. National regulations

No additional information available

15.2. Chemical safety assessment

Chemical safety assessments for substances in this mixture were not carried out.

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according to Regulation (EU) 2020/878

SECTION 16: Other information

Data sources : REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

Changes compared to the previous version : -

Abbreviations and acronyms:

ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures
DMEL	Derived Minimal Effect Level
DNEL	Derived No-Effect Level
EC50	The effective concentration of substance that causes 50% of the maximum response (Median Effective Concentration)
IATA	International Air Transport Association
IMDG	“International Maritime Dangerous Goods Code” for the transport of dangerous goods by sea
LC50	Lethal Concentration to 50 % of a test population (Median Lethal Concentration)
LD50	Lethal Dose to 50% of a test population (Median Lethal Dose)
NOEC/L	No Observed Effect Concentration/Level
OECD	Organisation for Economic Cooperation and Development
PBT	Persistent, Bioaccumulative and Toxic substance
PNEC	Predicted No-Effect Concentration
REACH	Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
SDS	Safety Data Sheet
STP	Sewage Treatment Plant
UFI	Unique Formula Identifier
vPvB	Very Persistent and Very Bioaccumulative

SDS EU (REACH Annex II)

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

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