WiSAN-P

14.1 - 30.2

Manual for installation, use and maintenance

en

M0SP00002-00 05/2024

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 are 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.

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.

Continual product improvements may imply manual data changes.

Visit manufacturer web site for updated data.

1.11 Original instructions

The original instructions are written in Italian.

All other languages are translations of the original instructions.

2. Information 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 indentify 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.

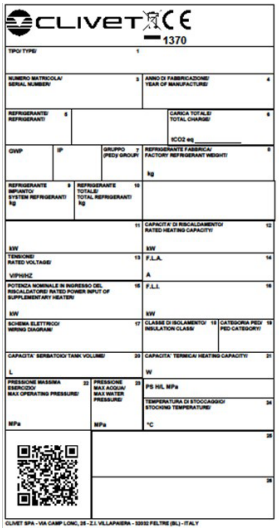
Must be quoted when ordering spare parts.

2.5 Assistance request

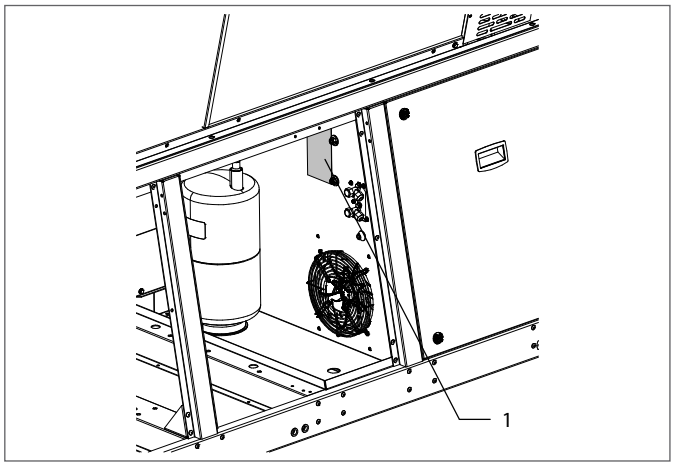
Note data from the serial number label and write them in the chart on side, so you will find them easily when needed.

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 depletation)	0	
LFL	0.038	kg/m^3
Limite inferiore di infiammabilità	2.1	% Vol
Punto di ebollizione	-42	°C
Temperatura di auto ignizione	470	°C
Densità (T=20°C; p=1 bar(a))	1.86	kg/m^3
Densità relativa all'aria (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 when entering the safety area
- 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:

- remove the refrigerant
- purge the circuit with inert gas (e.g. oxygen-free nitrogen)
- evacuate at an absolute pressure of 30 kPa (or 0.03 mPa)
- purge again with inert gas (e.g. nitrogen)
- open the circuit without using flames (cut)

Warning

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

Note

If the installation permits, it is advisable to move the equipment from its existing location to a controlled workshop where the work can be carried out safely.

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.**

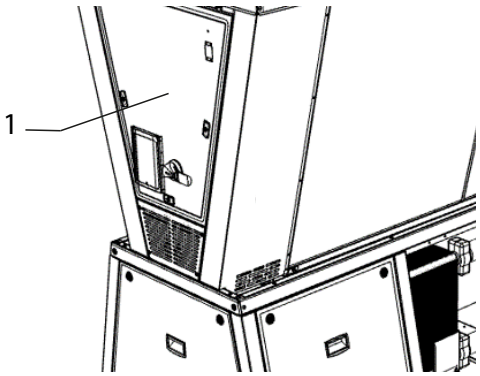
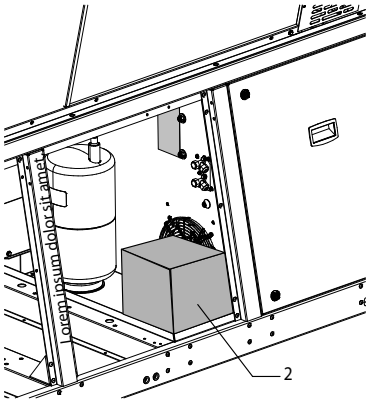
▶ **Do not use direct water jets to extinguish the fire.**

▶ **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 grilles

5. Accessories supplied

T5	DHW tank temperature probe	1	
Taf1	DHW tank antifreeze probe	1	
TW	Outlet water probe (pre-installed on the unit's supply pipe)	1	
	Probe well	1	
	Transformer for keypad power supply	1	
	Victaulic hydraulic pipe connection joints	2	

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.

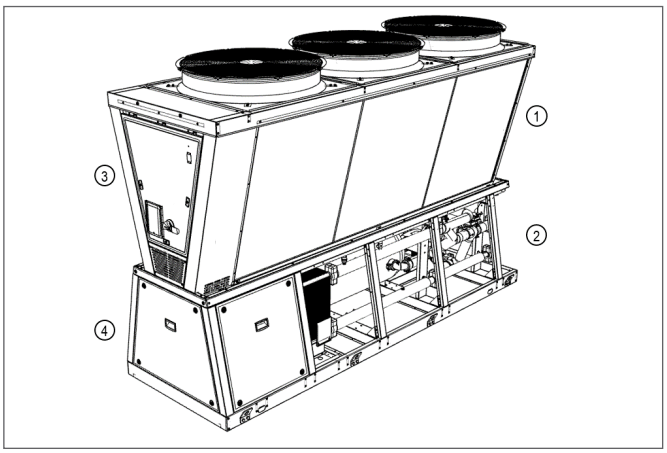
2 Water circuit: located under the source section, consisting of piping, unit safety devices and any optional components (e.g. pump, inertial tank, three-way valve, etc.). The piping connects the customer's system to the unit's exchanger. The user side exchanger is a brazed plate type.

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 the design standard applied.

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 sensor has an automatic recalibration phase, recognising any background noise
- 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

- **The flammable atmosphere will be ejected into the room in the fan's air flow direction.**
- **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
- the installation of an automatic air purge system in the water circuit is mandatory
- 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 purged air must be vented or ducted outside any building away from potential ignition sources

Warning

- ▶ **The air purge system must be the only one to open automatically in the entire system.**
- ▶ **Any other purge system must be closed or ducted to the outside to prevent the release of refrigerant in the building.**

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

- ▶ **The water pressure relief valve must be the only one to open automatically in the entire system.**
- ▶ **Any other water pressure relief valve must be calibrated to a higher pressure value or ducted to the outside to prevent the release of refrigerant in the building.**

6.2 Active safety measures on the unit (general)

Refrigerant:

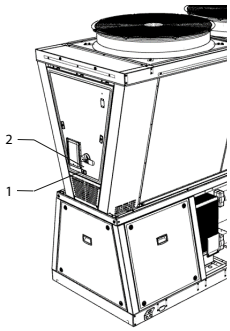
- HP-pressure switch: calibrated to the high pressure PS with manual reset. Stops the compressors in case of an anomaly. In safety chain PL=d EN ISO 13849
- pressure relief valve: calibrated to the low pressure PS against overpressure caused by fire
- unit sensors: pressure transducers and temperature 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	All the other statuses	First switch-on	All the other statuses
Manual selector switch OFF (STD)	N/A	A) Normal operation:	B) Calibration function	C) Alarm:
		● Fan OFF	● Fan ON	● Fan ON
		● Alarm OFF	● Alarm active but hidden for 5 minutes	● Alarm ON
		● LED OFF	● LED ON	● LED ON
		● Compressor ready to start	● Compressor status OFF	● 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"
- wontact 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)	+55°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 (cran, 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 of 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);

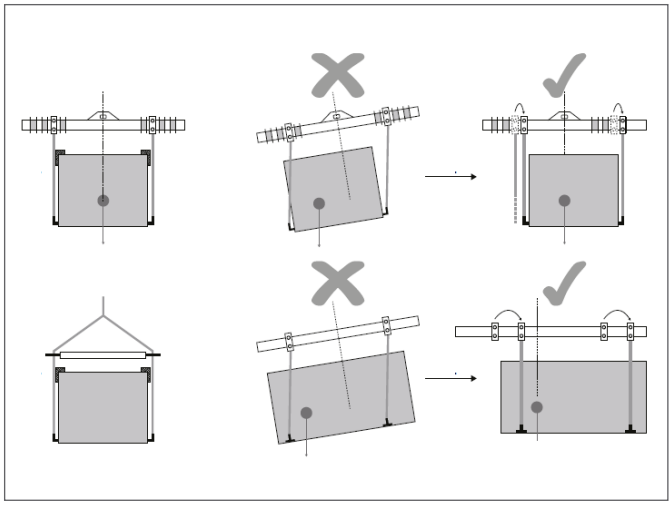
2 Protect the unit adequately to avoid damage;

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.



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	Unit
a – generic	< 5 kg	WiSAN-P 14.1 WiSAN-P 16.1
b – supervised / restricted	< 10 kg	WiSAN-P 18.1 WiSAN-P 19.1 WiSAN-P 20.1 WiSAN-P 25.2 WiSAN-P 30.2
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

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 buildings, sewer openings, closed tunnels, any ignition sources, openings on the installation level and connecting rooms below ground >2.5 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:

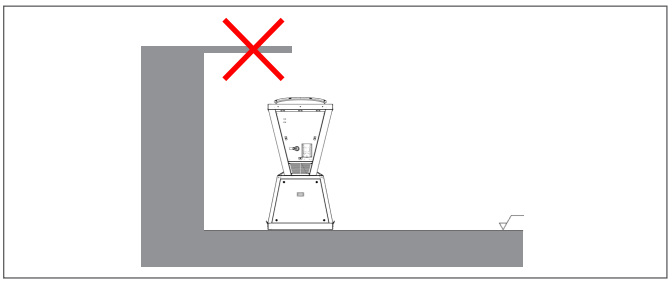
- Venting of the pressure relief valve in case of fire

Warning

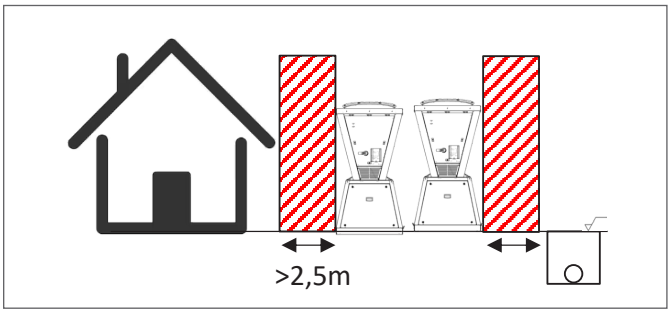
▶ **The installer must carefully asses how to duct the pressure relief valve and the potential explosive atmosphere that could be generated at the point where it is ducted**

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

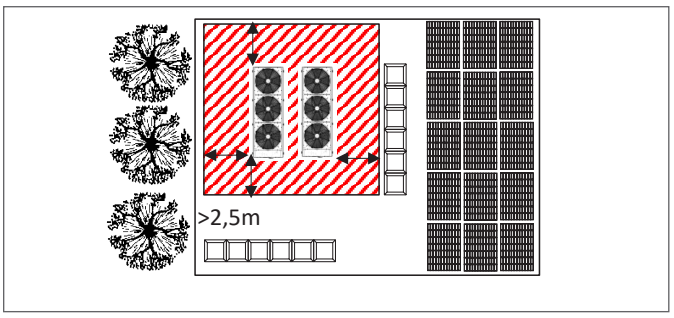
Installation in open area



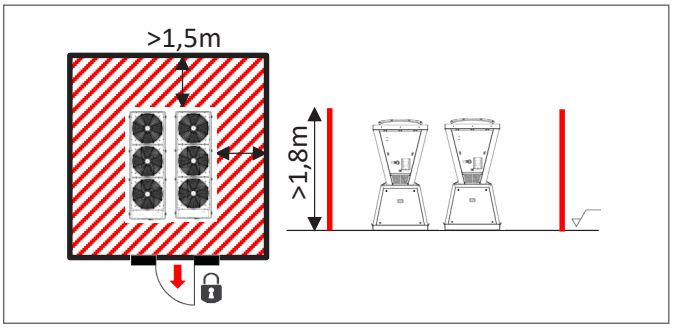
Installation in a courtyard



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.

9.3 Functional spaces

Functional spaces are designed to:

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

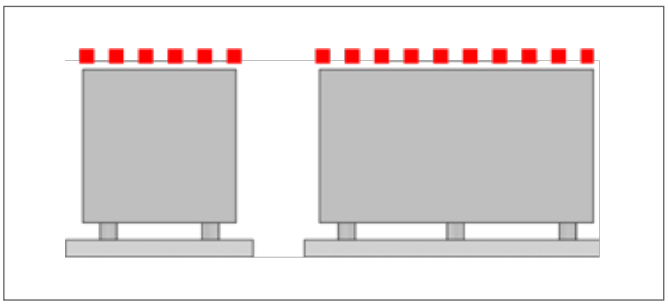
CAUTION

- ▶ **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:

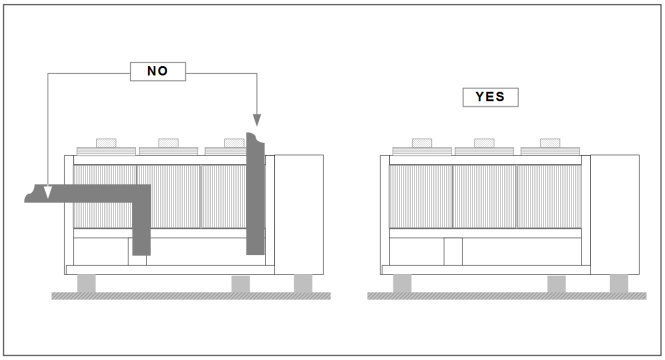
- use anti-vibration devices or neoprene strips on the unit support points
- install flexible joints on the hydraulic connections

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

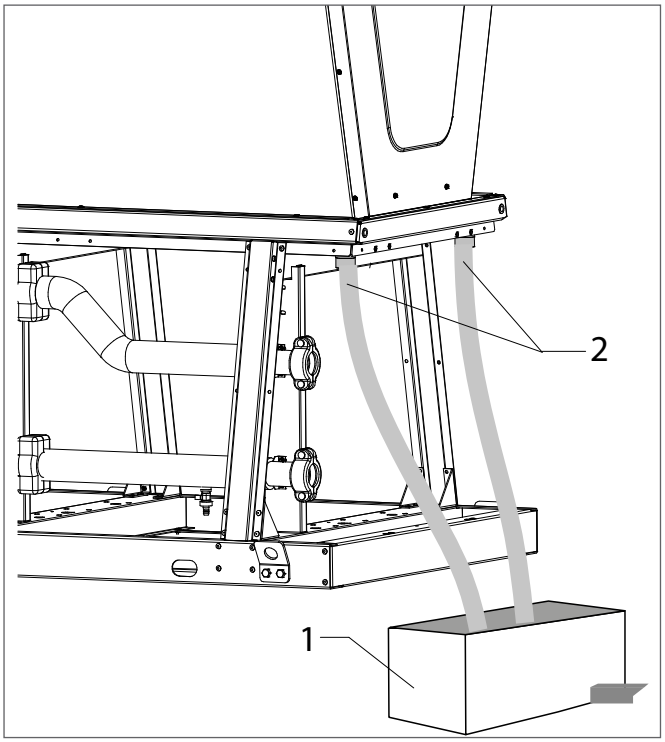
The installer is responsible for evaluating whether and how to install drain piping in compliance with the local regulations in force (EN 378).

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

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 order to avoid damage to people and property.

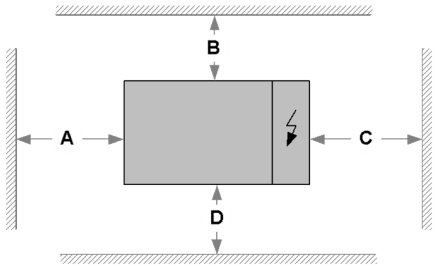


1 Discharge / drainage collection

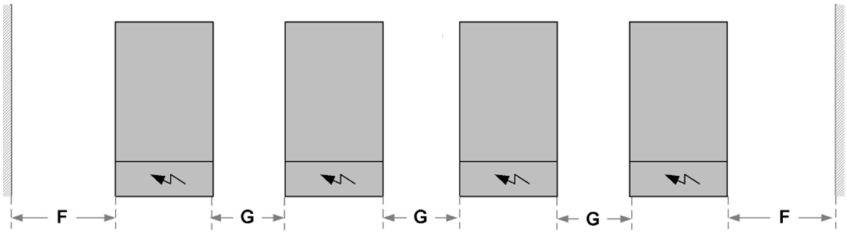
2 1"1/2 male condensation drain piping

9.8 Functional spaces

▶ **Also see “Safety area” chapter**



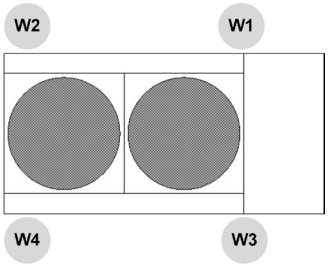
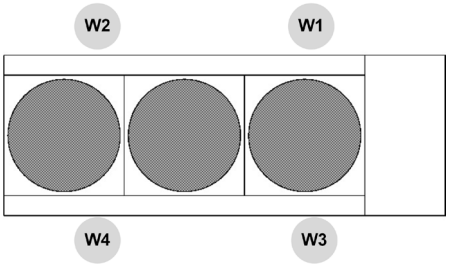
A = 500 mm
B = 500 mm
C = 1200 mm
D = 500 mm



F = 500 mm
G = 500

9.9 Anti-vibration mounts

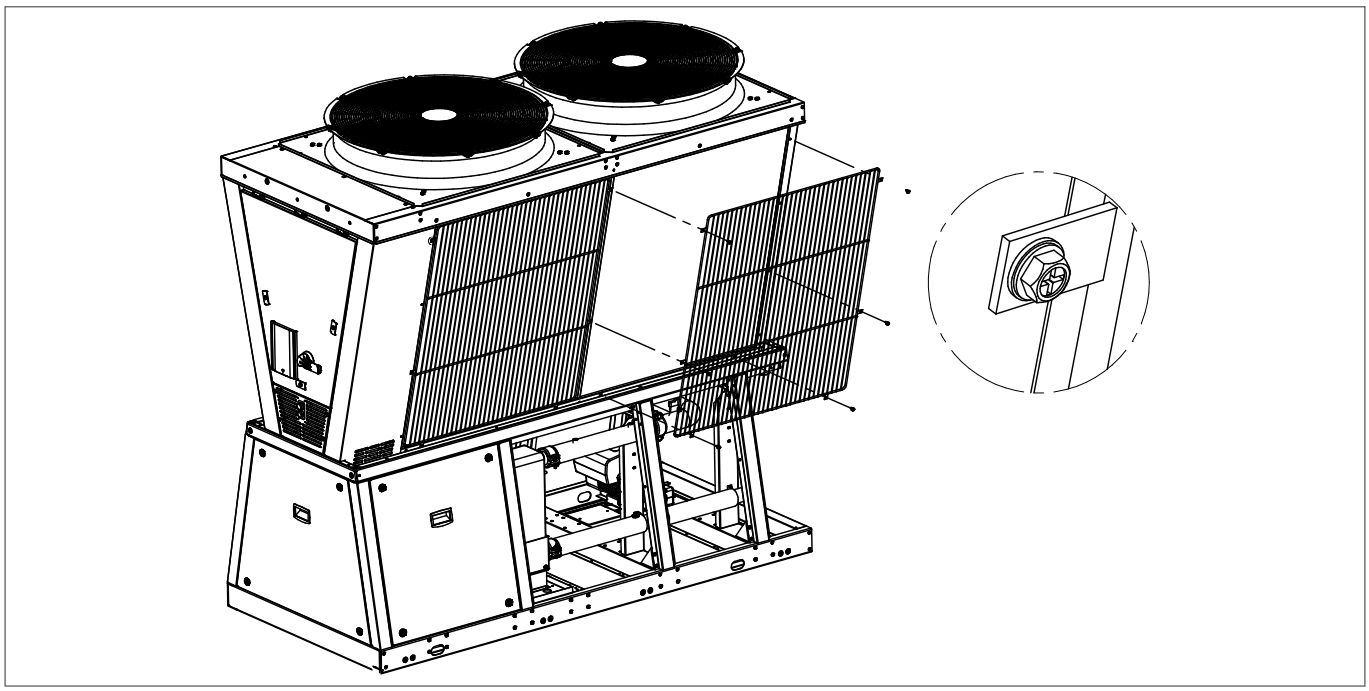
Option

Size	14.1 - 20.1		25.2 - 30.2	
Support points				
Configuration	standard	with water tank	standard	with water tank
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

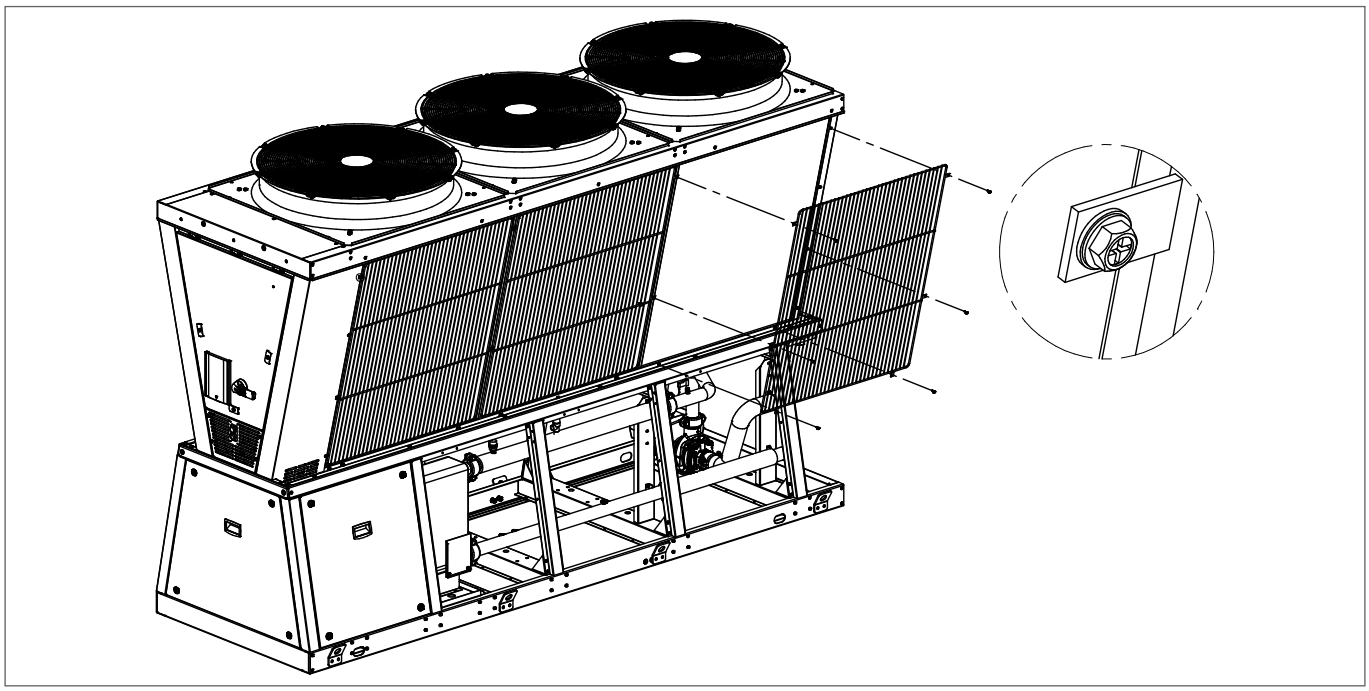
9.10 Protection grilles

Option

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

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 against frost. Otherwise irreversible damage may occur.**

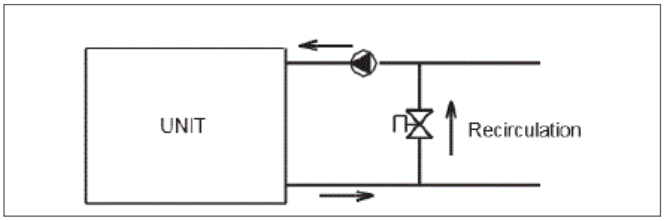
ETHYLENE - PROPYLENE GLYCOL WEIGHT %		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Freezing temperature	°C	-2	-3.9	-6.5	-8.9	-11.8	-15.6	-19.0	-23.4	-27.8	-32.7
Safety temperature	°C	3	1	-1	-4	-6	-10	-14	-19	-23.8	-29.4

10.8 Water flow-rate

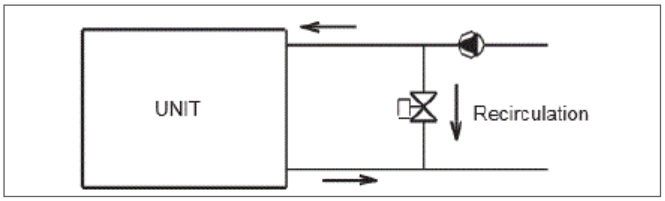
The design water flow-rate must be:

- 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

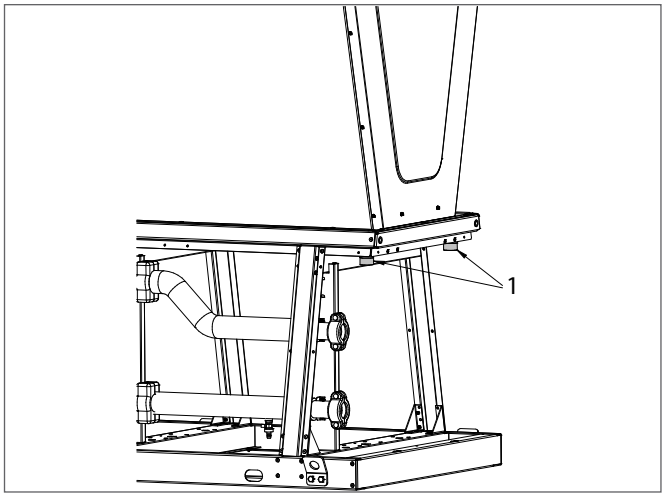
Minimum (Qmin) and maximum (Qmax) admissible water flow-rates for correct operation of the unit.

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.

10.11 Condensation drain pan



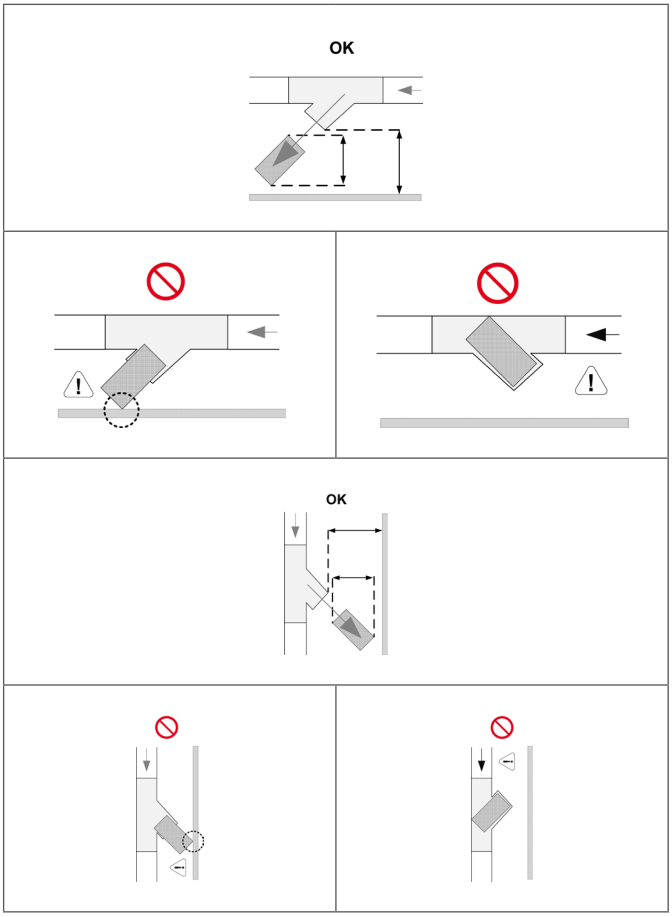
1 1"1/2 male drain pan connection

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:

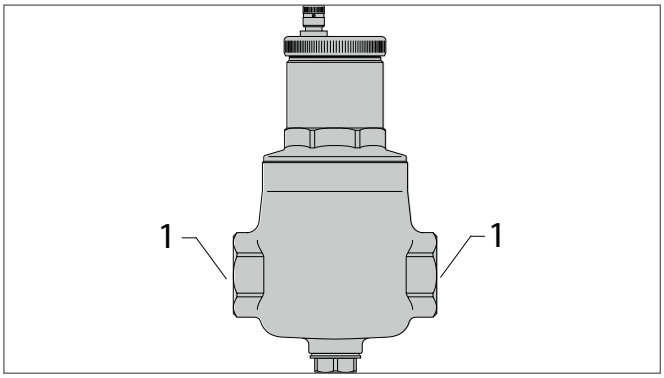
- VSAX : Automatic purge valve

- ▶ **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.

- ▶ **It must be sized correctly for the unit's water flow-rate.**

The minimum required vent efficiency is 90%



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.**
- ▶ **The air purge system must be the only one to open automatically in the entire system.**
- ▶ **Any other purge system must be closed or ducted to the outside to prevent the release of refrigerant in the building.**

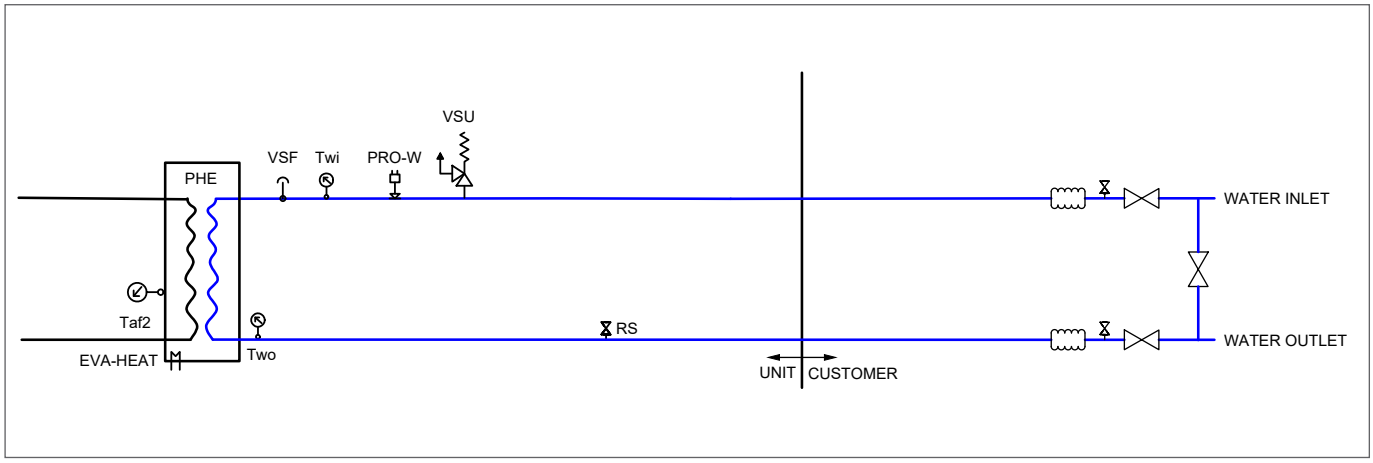
10.14 Hydronic units and connection diagrams recommended

The installer must define:

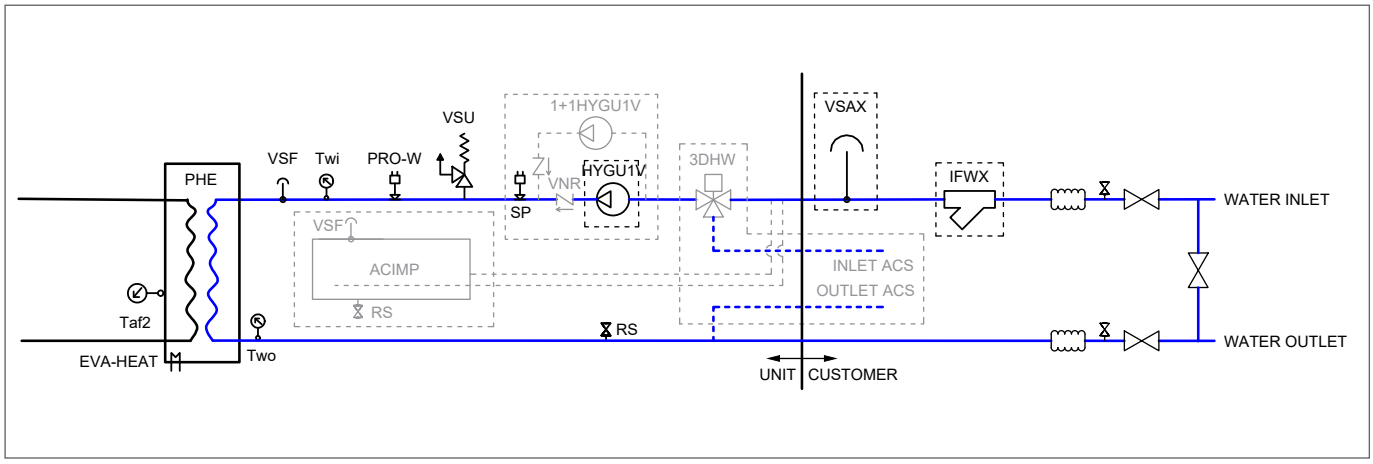
- type of components
- position in the system

See diagrams on the next pages.

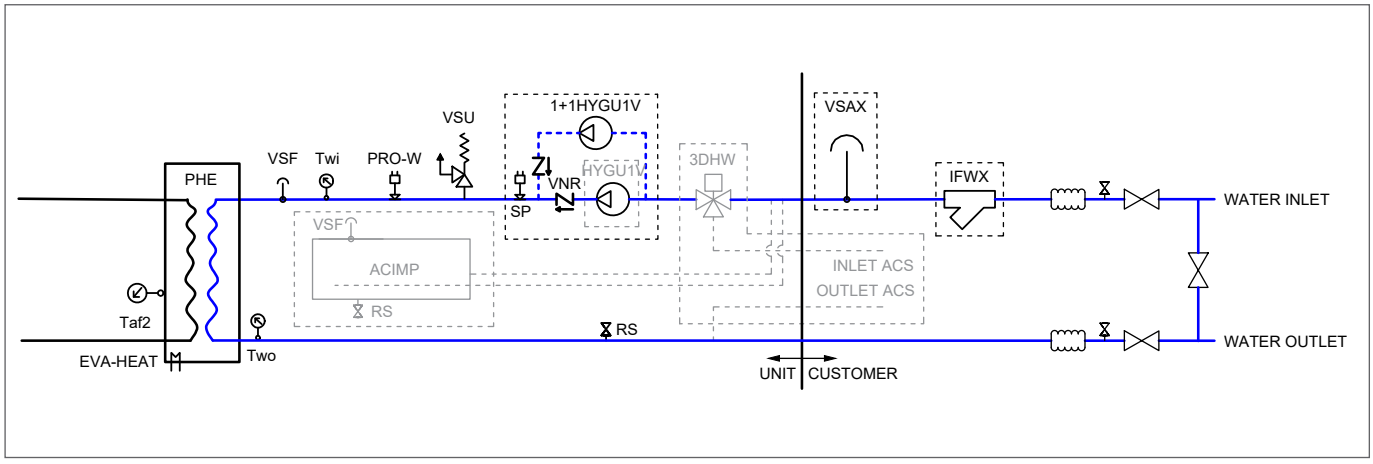
10.14.1 Basic configuration



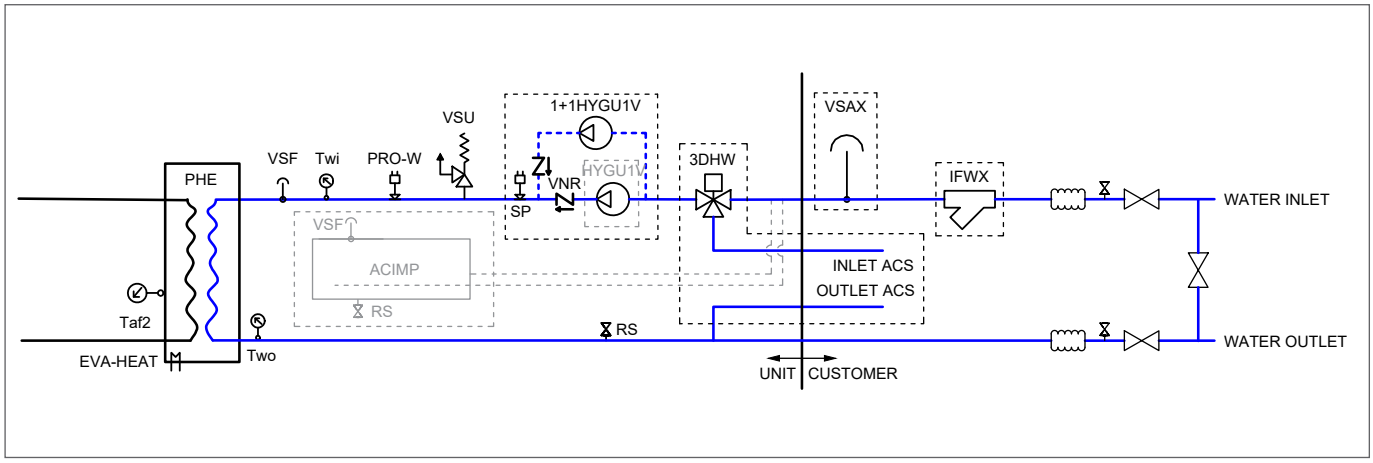
10.14.2 Configuration with pump on board HYGU1V



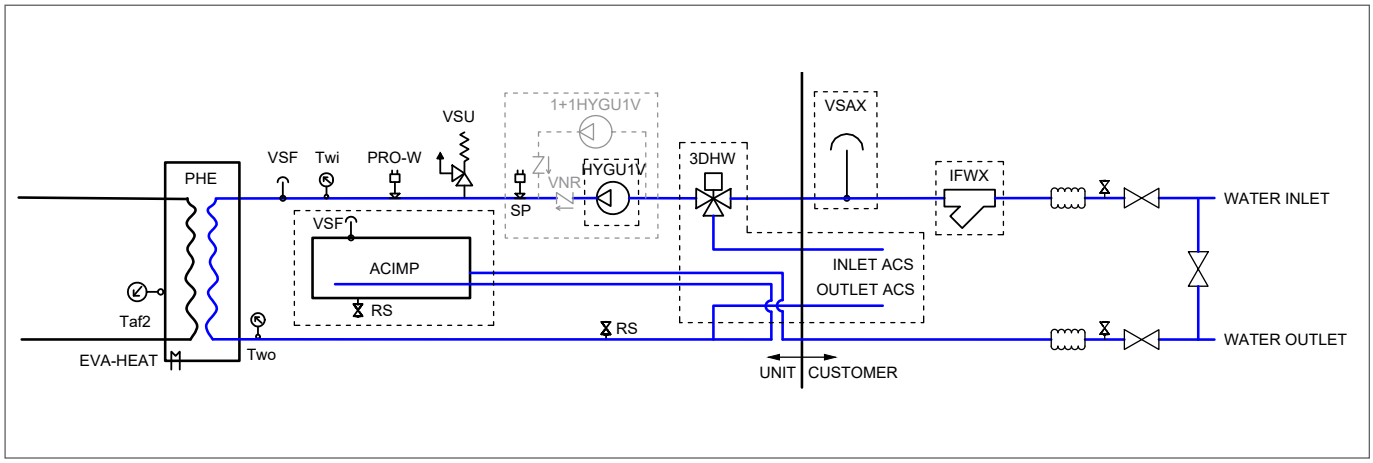
10.14.3 Configuration with double pump on board 1+1HYGU1V



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)

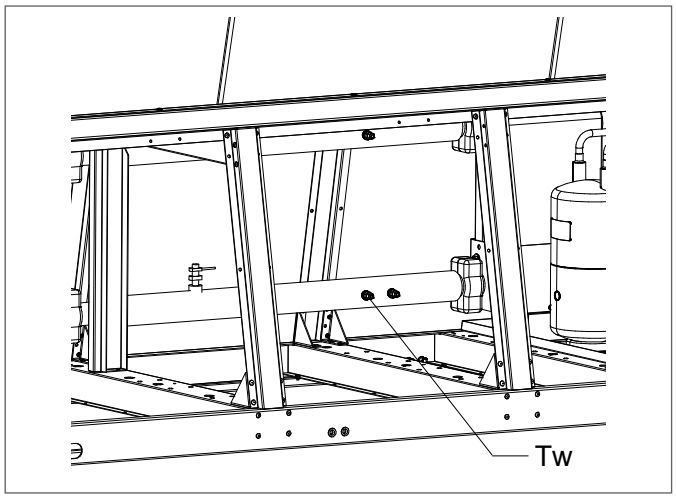
10.15 TW Probe - Total water

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

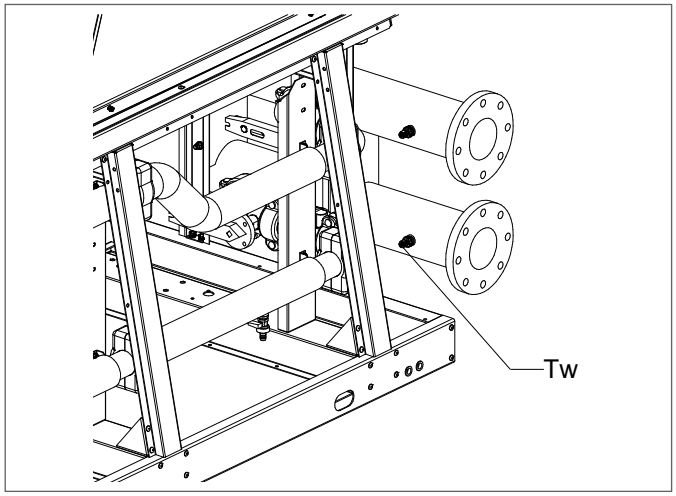
SINGLE UNIT: antifreeze function

MODULAR UNIT: thermoregulation (see diagram below)

Single unit



Multiple units



10.16 Victaulic fittings

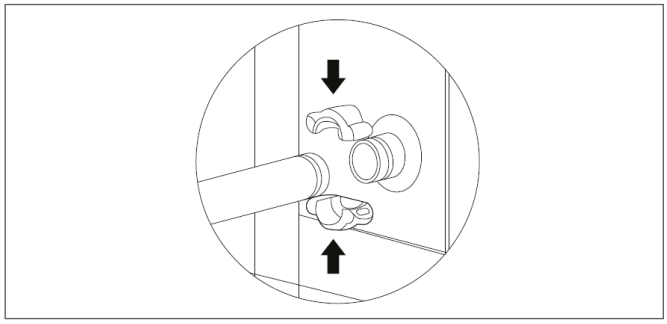
Remove the connection fitting supplied and use the Victaulic connection joint.

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

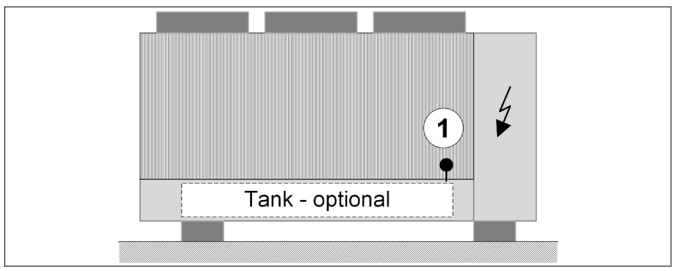
8 do not use the unit's pump

9 Conduct a leak test.

10 Insulate the piping to avoid heat dispersions and formation of condensate.
Leave various points of service free (wells, vents, etc.).

CAUTION

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

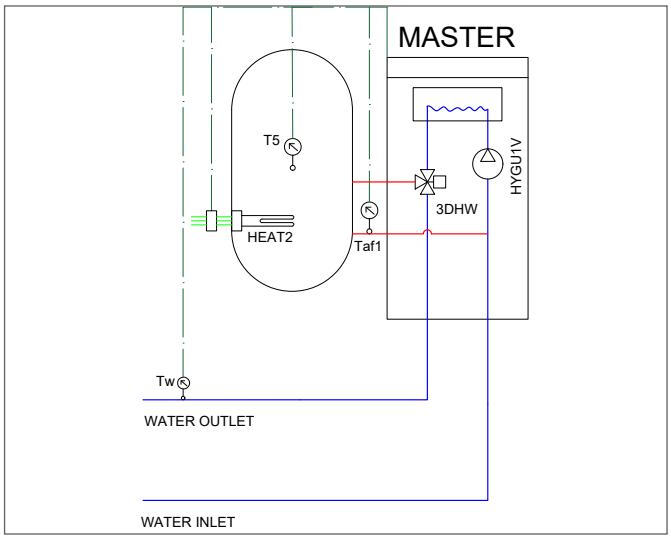


10.18 Domestic hot water

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

1) 3DHW: 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.

2) 3DHWX: 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 as follows.

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

1) "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.

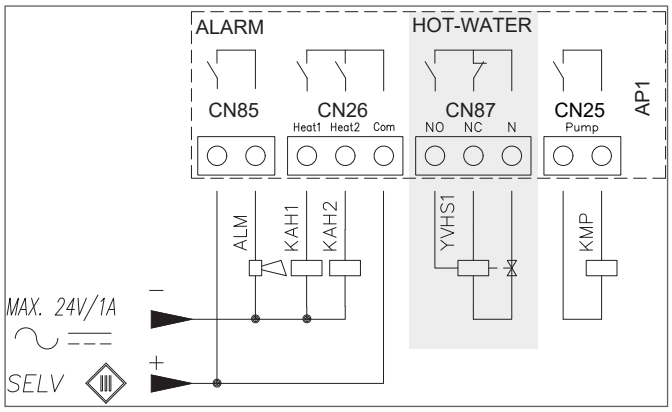
10.18.5 DHW backup electric heater HEAT2:

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

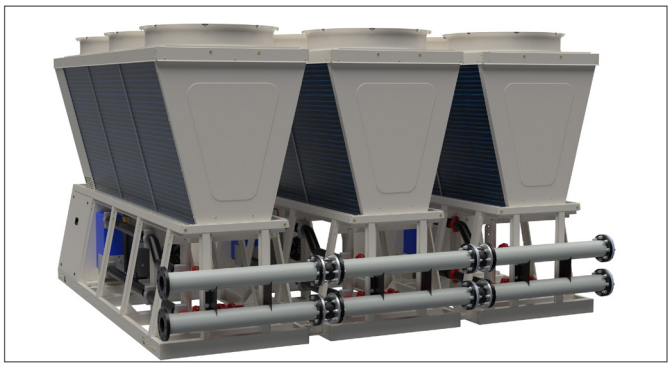
The maximum flow temperature threshold of the system varies according to the outdoor temperature.

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	◄ SI ►
PRIORITY	◄ SI ►
00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15	
←	▼▲ ◄►

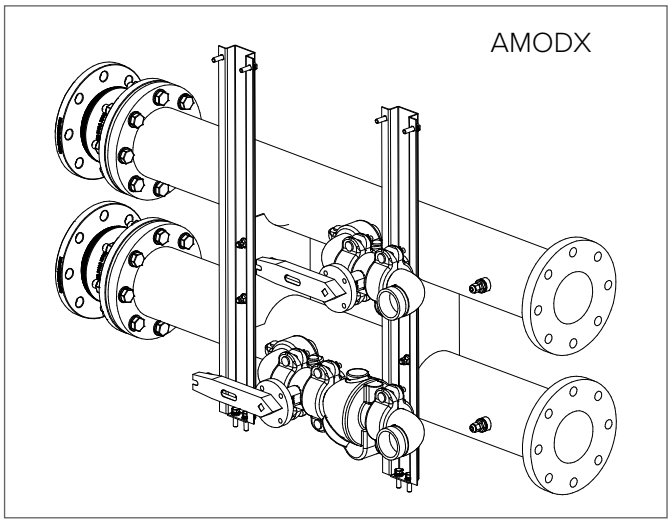
10.19 Unit in modular configuration



AMODX: Water connections for modular unit

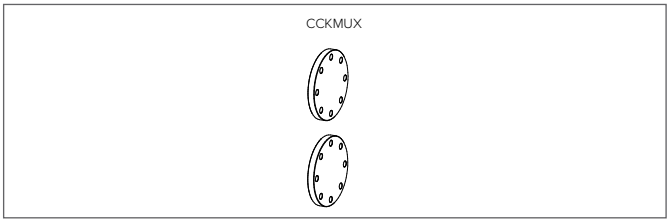
Collectors with vibration-damping joints for connecting the units in hydraulic parallel.

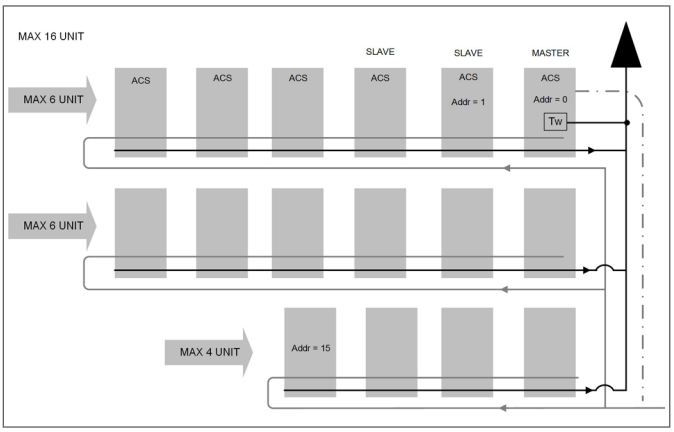
Maximum of 6 units on the same water branch.



CCKMUX: Kit containing pipe closing caps for modular units

Closing caps for collectors.





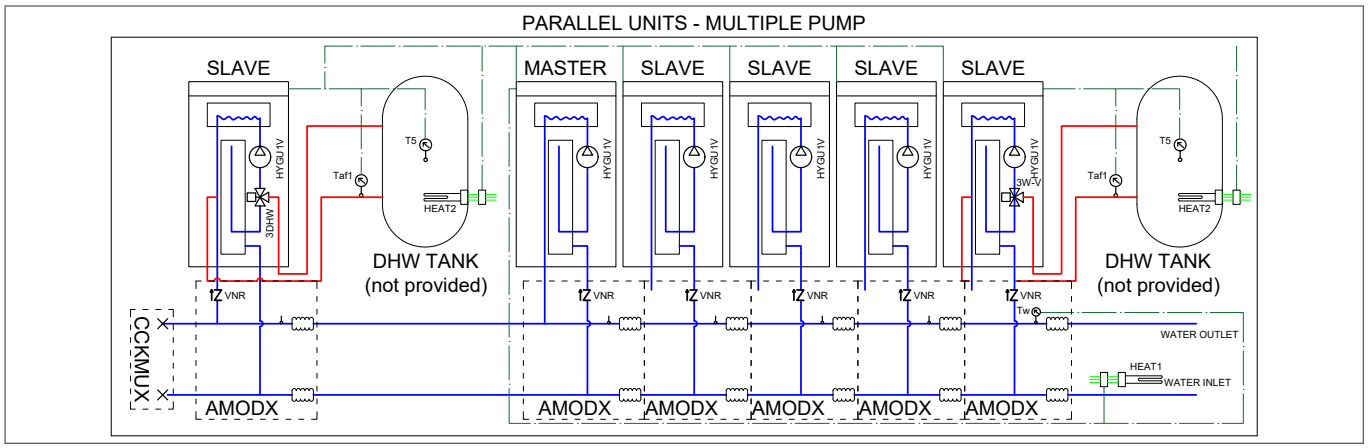
The master unit's Tw probe must be moved to the supply line downstream of all units.

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.



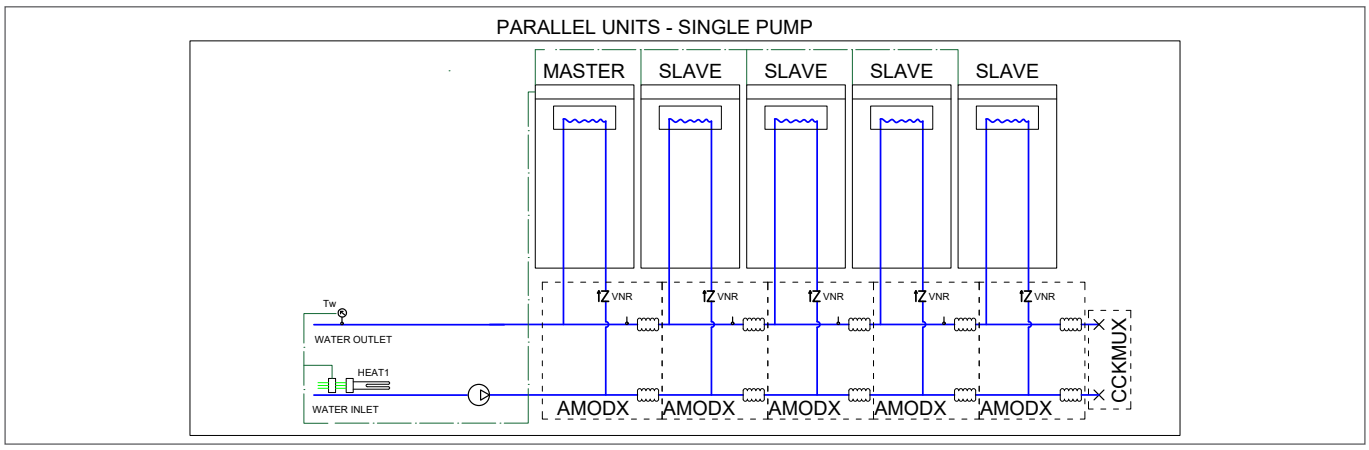
"Single pump" configuration.

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 back-up 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 SA 4): open contact means unit is ON, closed contact means it is OFF
- Mode change (SA 5): open contact means unit is in cooling mode, closed contact means it is in heating mode
- DHW (SA 6): open contact means domestic hot water is off, closed contact means DHW priority if enabled on the HMI
- Double set point (SA 7): open contact means double set point disabled, closed contact means it is enabled
- Silent mode (SA 8): open contact means unit is in standard mode, closed contact means it is in silent mode
- Smart grid (EVU - SG): open EVU contact means no action, closed EVU contact and open SG means OFF (max 2h), closed EVU contact and closed SG means DHW mode is forced if enabled on the HMI.

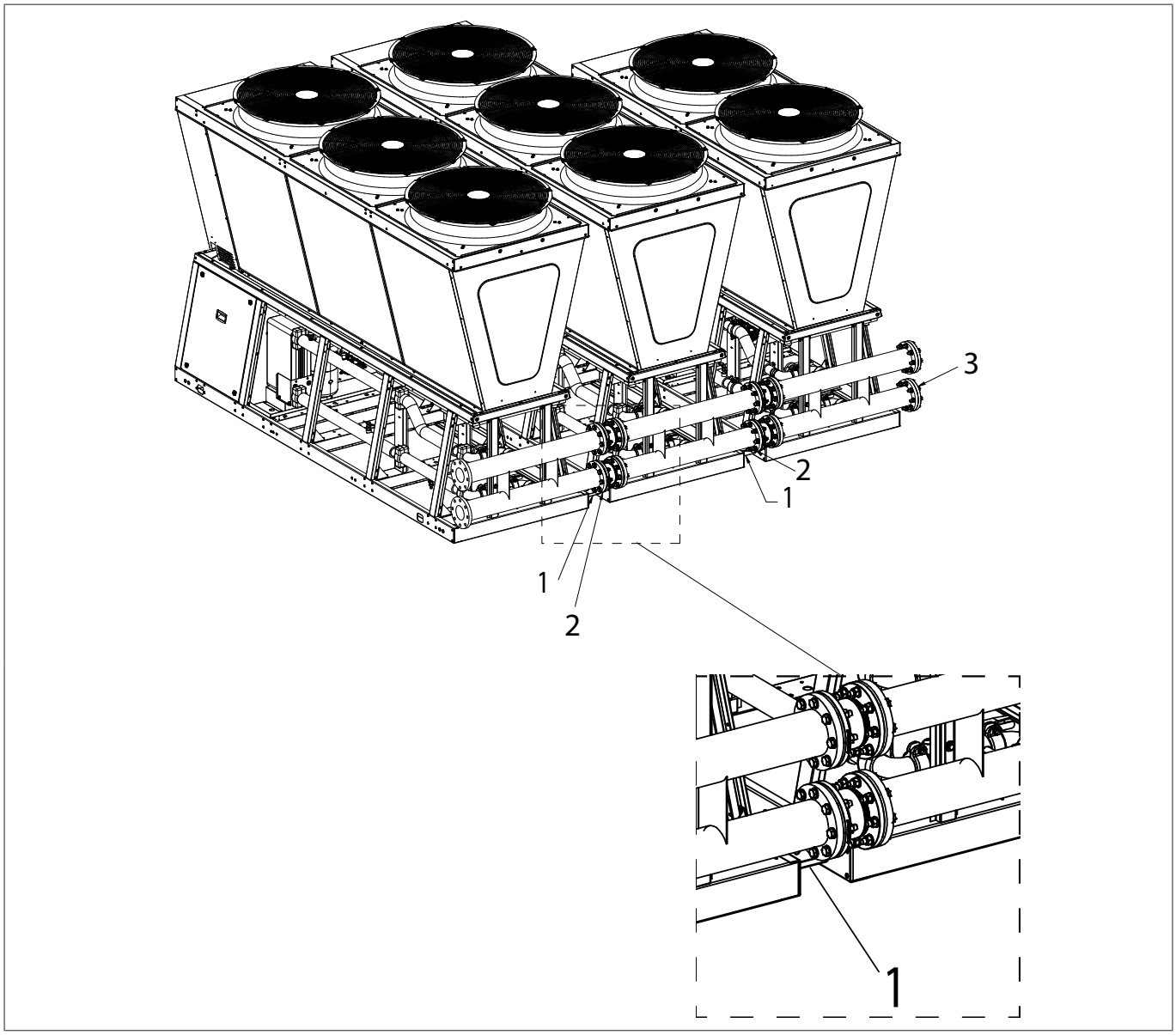
10.22.2 Analogue contacts

Configurable in 0...10V (default) or 4...20mA.

- Demand limit (dip switch S7_3 ON): unit’s power input limit, 10V or 20mA is the maximum limit of 40% of the maximum
- Cooling set point (dip switch S7_4 ON): set point difference in cooling mode, 10V or 20mA is the highest temperature set point
- Heating set point (dip switch S7_5 ON): set point difference in heating mode, 10V or 20mA is the highest temperature set point
- DHW set point (dip switch S7_5 ON): set point difference in DHW mode, 10V or 20mA is the highest temperature set point.

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:

Tensione

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.
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

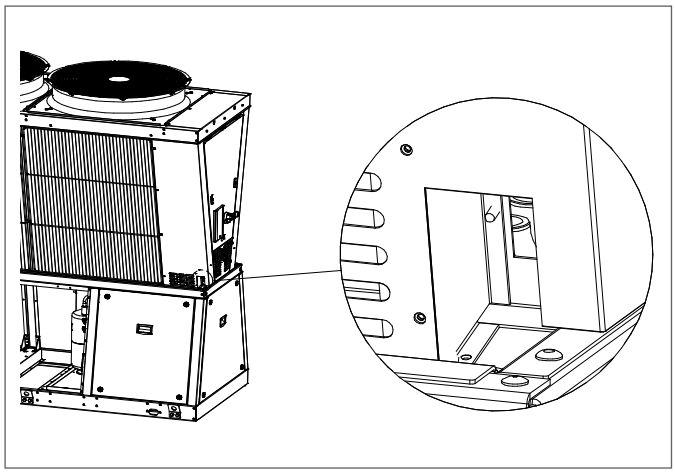
Option

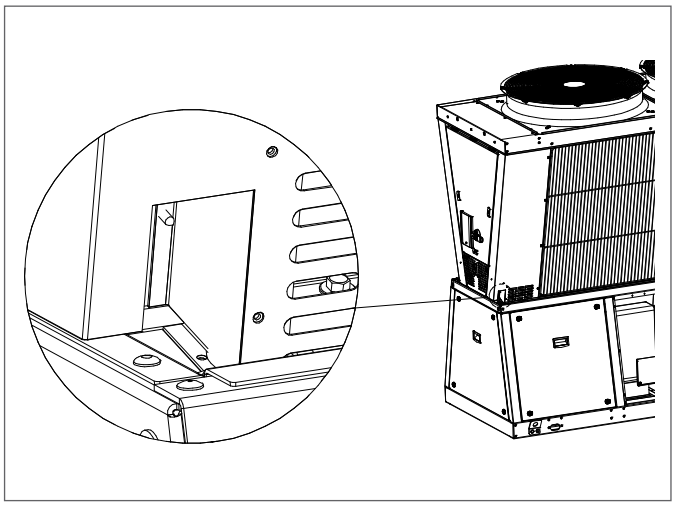
Mounted on the unit or for remote installation.

I = 67 A/A C23 M40 cable gland

11.7 Controller wiring sections

Power line inlet



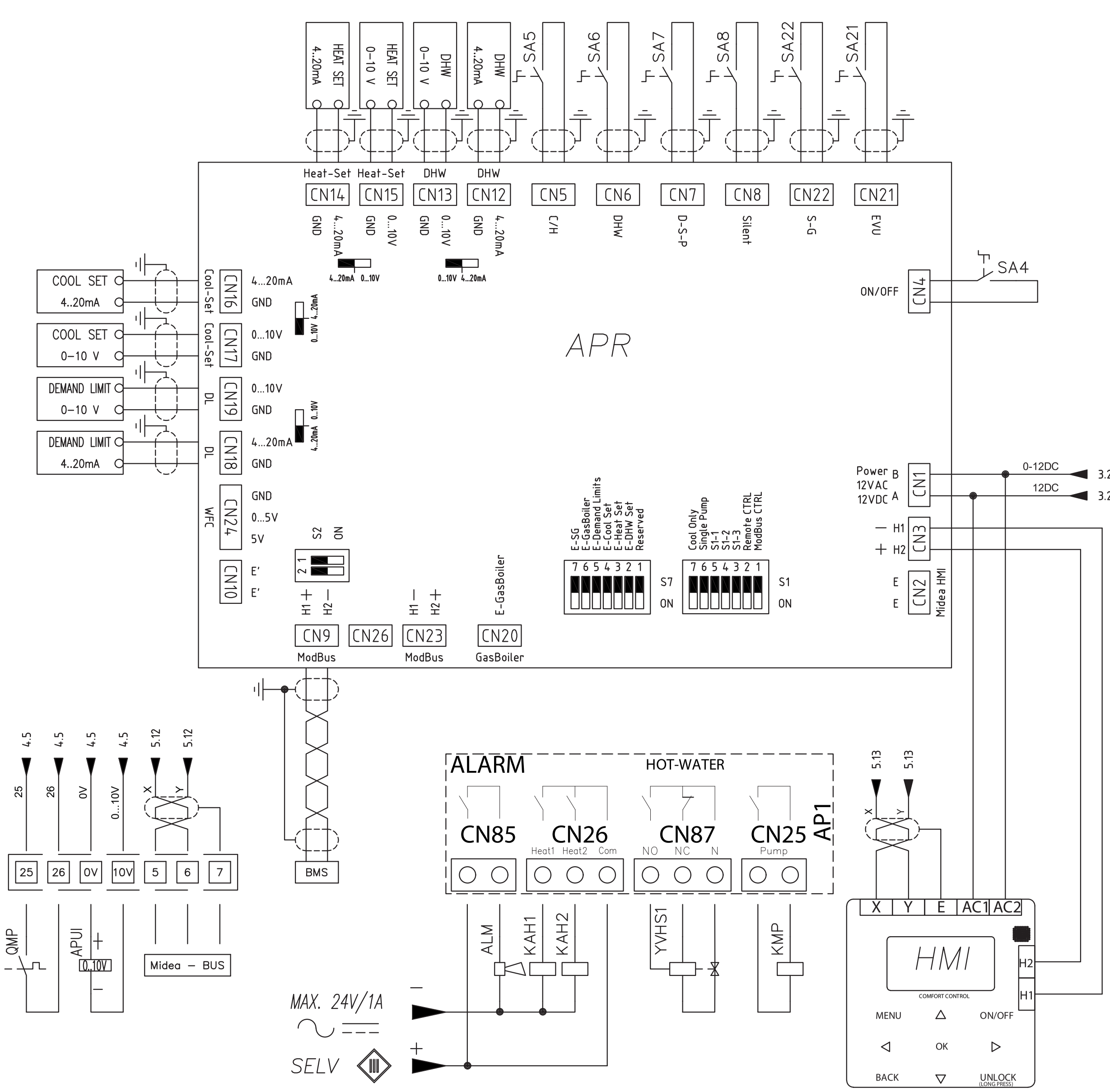


Power supply cables section

Min. cable cross-section Cu (mm^2)	35
Max. cable cross-section Cu (mm^2)	95
Larghezza max. barra Cu (mm)	20
Coppia di chiusura (Nm)	9

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

11.8 Connections to be provided by customer

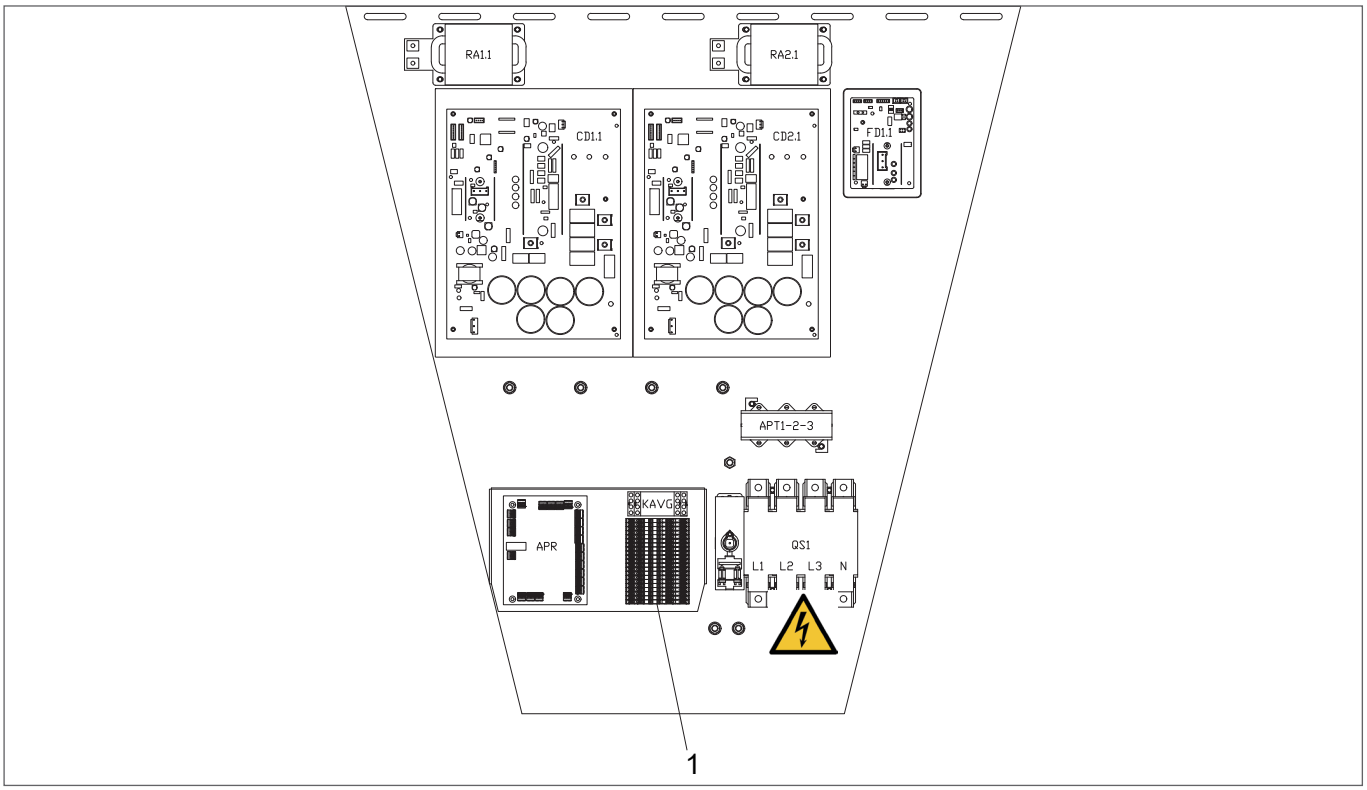


ALM	segnalazione blocco cumulativo cumulative fault signal signalisation alarme Sammelstörmeldung señalización bloqueo cumulativo	
QMP	interruttore automatico a protezione pompa ricircolo recirculation pump protection automatic device interrupteur automatique de protection pompe recirculation automaticher Schalterschutz der Umluftpumpe interruptor automático de protección bomba recirculación	— — 411_1 pg. 11.2
KMP	contattore pompa di circolazione evaporatore evaporator pump contactor contacteur pompe de circulation évaporateur Schütz Kaltwasserpumpe contactor bomba de circulación evaporador	— — 411_1 pg. 11.2
APUI	Inverter pompe lato utilizzo Inverter side pumps use Pompes côté variateur utilisation Wechselrichter-Seite Pumpen Einsatz Inverter bombas lado uso	— — 411_1 pg. 11.2
YVHS1	valvola sanitaria sanitary valve soupape sanitaire Brauchventil válvula sanitaria	
KAH1	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	
KAH2	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	
SA4	selettore on/off remoto remote on/off selector sélecteur ON/OFF déporté Fernwahlschalter Ein/Aus selector on/off remoto	
SA5	selettore remoto "estate/inverno" remote winter/summer selector sélecteur déporté "été/hiver" Fernwahlschalter Winter/Sommer selector remoto "verano/invierno"	
SA6	selettore richiesta acqua sanitaria sanitary water cycle selector sélecteur demande eau sanitaire Wahlschalter der Brauchwasser selector solicitud agua sanitaria	
SA7	selettore abilitazione secondo set-point second set-point enabling switch sélecteur validation deuxième consigne Wahlschalter 2.Sollwert selector habilitación segundo set-point	
SA8	Selettore abilitazione modo silenzioso Silent mode enable selector Sélecteur d'activation du mode silencieux Aktivieren des Silent-Modus Selector de activación del modo silencioso	
SA22	Selettore abilitazione Smart Grid Smart Grid enabling switch Sélecteur d'activation Smart Grid Smart Grid-Aktivierungsselektor Selector de activación de Smart Grid	
SA21	Selettore abilitazione EVU EVU enabling switch Sélecteur d'activation EVU EVU-Aktivierungsselektor Selector de activación de EVU	
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	

11.9 Electrical panel

Warning

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



1 Terminal block for customer connections

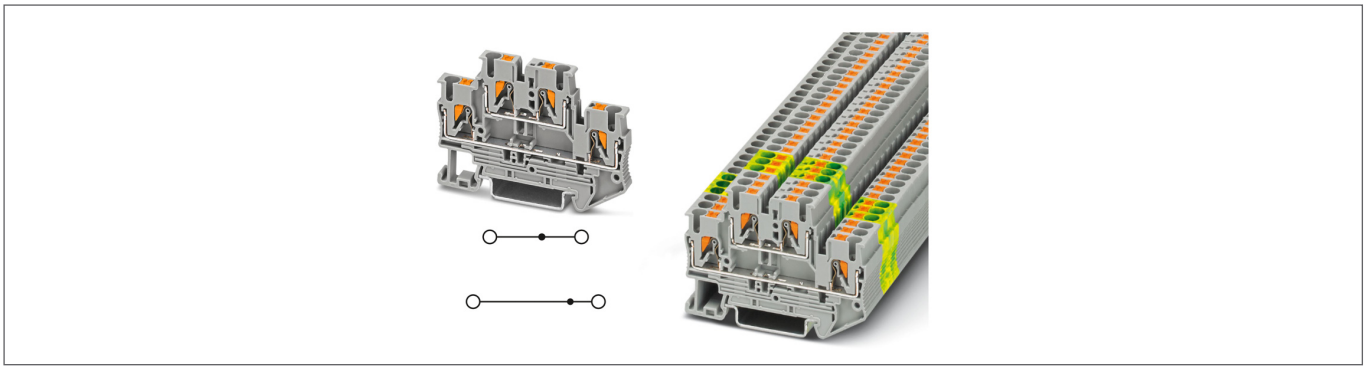
Sign	Description
APR	Auxiliary circuit board
KAVG	Booster relay
QS1	Main disconnecting switch
APT1-2-3	Transformer

Double-deck push-in terminals.

Cable cross-section:

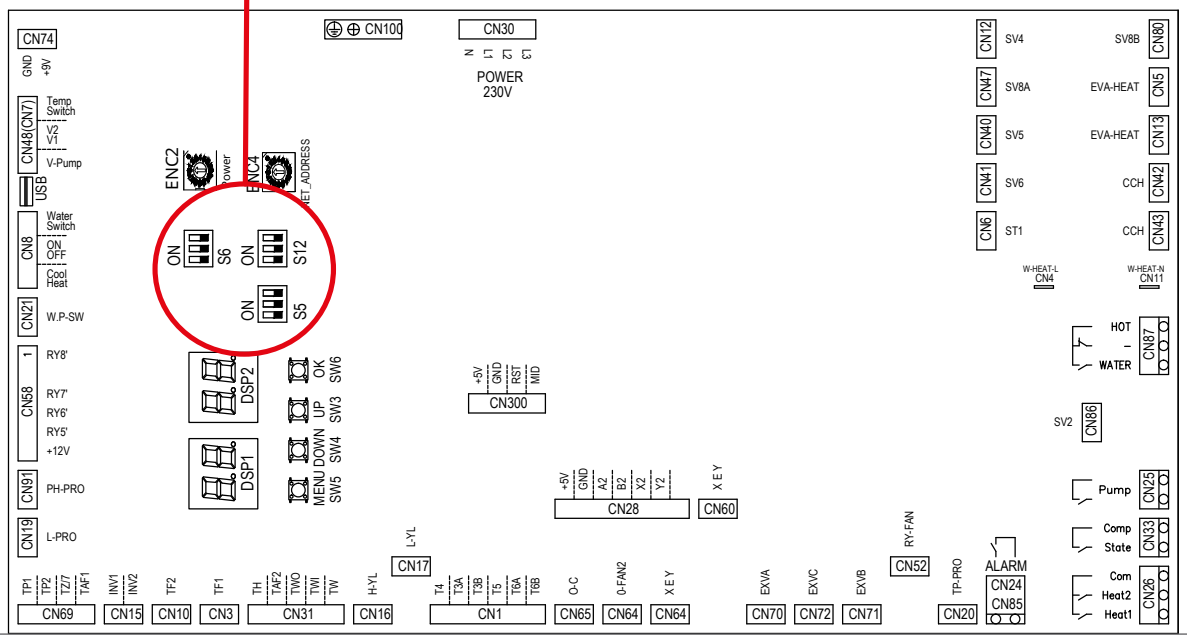
Smin: 0.14 mm^2

Smax: 2.5 mm^2



11.10 Dip switch configuration

ENC2	ENC4			Reserved
		S5-1	ON OFF 1	Outdoor unit network address dial code. 0-F represents 0-15
			ON OFF 2	Reserved
		S5-2	ON OFF 2	OFF: Backup pump disabled
			ON OFF 3	ON: Backup pump enabled
		S5-3	ON OFF 1	Reserved
		S6-1	ON OFF 1	OFF: HEAT1 is configured for the connection to the pipe electric heater
			ON OFF 2	ON: HEAT1 is configured for the connection to the auxiliary heating
		S6-2	ON OFF 2	Reserved
		S6-3	ON OFF 3	Reserved
		S12-1	ON OFF 1	Reserved
		S12-2	ON OFF 2	OFF: single pump control
			ON OFF 2	ON: Multi-pump control
		S12-3	ON OFF 3	OFF: Cooling regular outlet water temperature
			ON OFF 3	ON: Cooling low temperature outlet water temperature



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 tension 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 stresses.**

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.

NOTE

- **Also see the requirements for the register set out in Regulation (EU) no. 517/2014.**

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	unit water inlet filter + shut-off valves for cleaning	
14	hydraulic connections as per recommended diagram	
15	expansion tank	
16	minimum system water content	
17	system washed	
18	system charged + corrosion inhibitor	
19	antifreeze protections: glycol solution, heating cable if needed	
20	system under pressure + vented	
21	refrigerant circuit visual check	
22	earthing connection	
23	power supply features	
24	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		
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.**

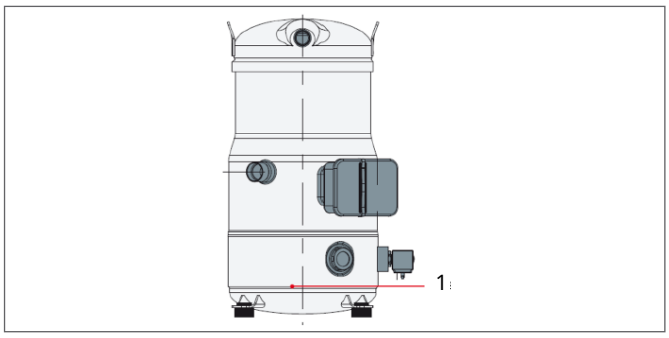
12.7 Crankcase heaters

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 15°C higher than the ambient temperature.**

▶ **Failure to comply with the above instructions can result in compressor malfunction due to its poor lubrication and possible failure.**

These requirements must be fulfilled at first start-up and each time the unit is switched off.

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.

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 on if:

Tw ≥ (setpoint + Tw_diff + 1°C)

each unit switches off if:

Tw ≤ (setpoint - 1°C)

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 on if:

Tw ≤ (setpoint - Tw_diff - 1°C)

Each unit switches off if:

Tw >= (setpoint + 1°C)

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.

12.13 Start-up report

dentifying 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 Panel

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

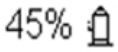
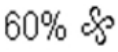
Press	

13.5 Unit in modular configuration

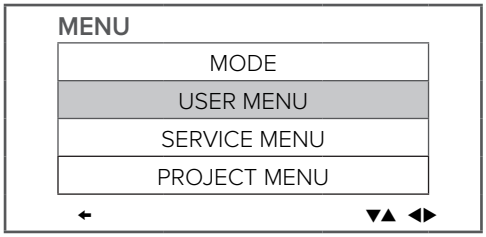
The information displayed on ALL controllers refers to the MASTER unit.

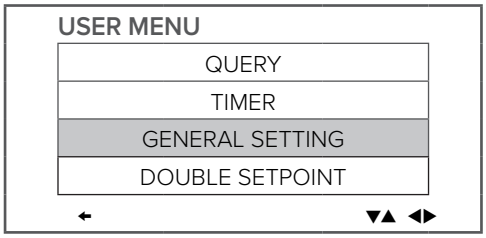
On the slave controllers, only the password-protected SERVICE menu can be opened.

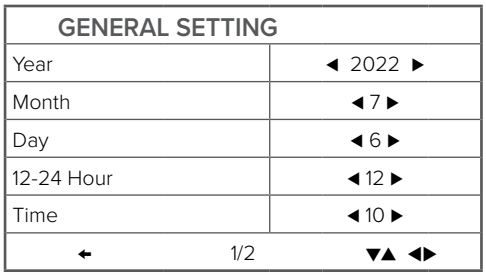
13.6 Display

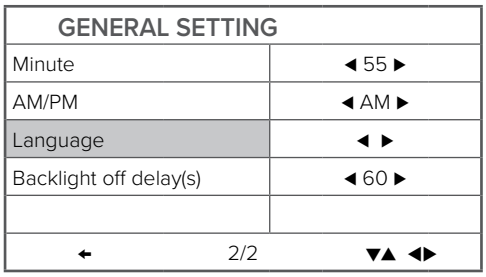
Icon	Meaning
	Cooling
	Heating
	Domestic hot water
	Controller off
	Weekly timer active
	Compressor usage value Compressor in operation
	Fan usage value Fan in operation
	Pump in operation
	Backup electric heater in operation
	Manual antifreeze or defrosting in operation
	Remote control: the unit is 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

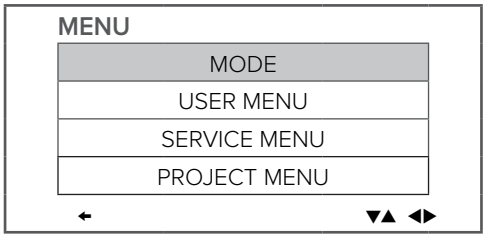








13.8 Set MODE and TEMPERATURE



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.

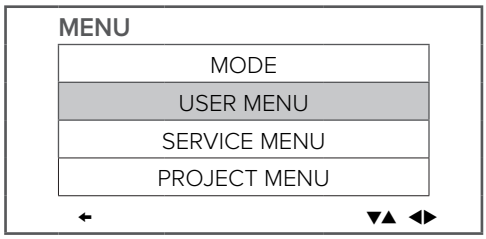
▶ **In cooling mode with ext T < 15°C, the setpoint is forced to 10 °C (see Operation limits)**

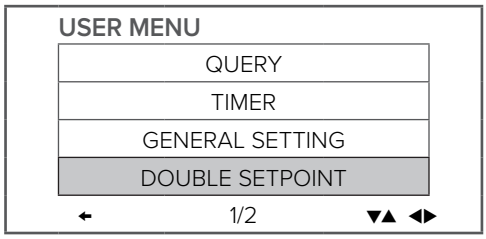
13.9 Double setpoint

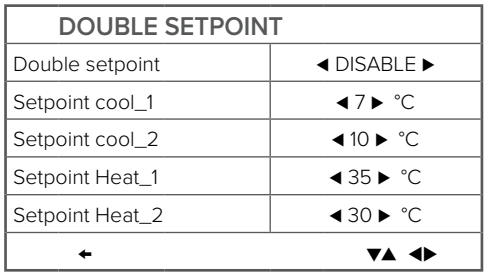
The unit is capable of handling two different setpoints, in both heating and cooling modes.

The value can be set with the user interface.

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



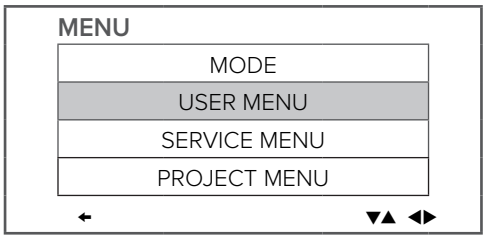


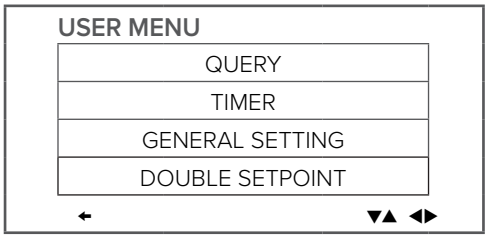


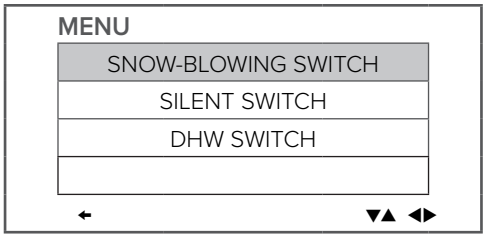
13.10 Snow-blowing function

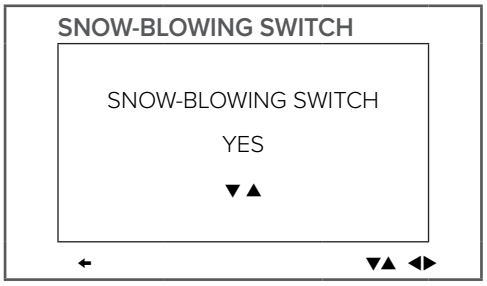
If enabled, the function activates the fans in order to prevent a build-up of snow.

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









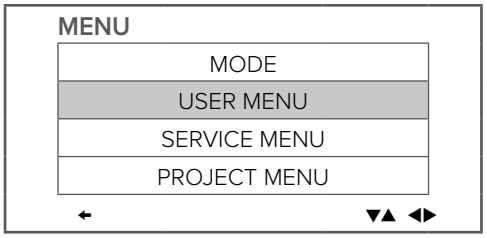
13.11 Silent mode

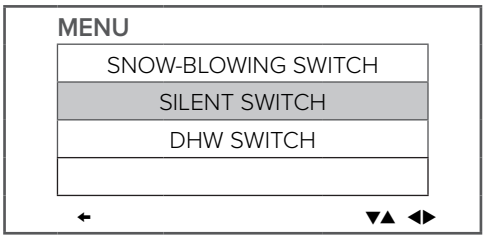
The SILENT MODE function lowers the sound emission level, which is especially useful at night.

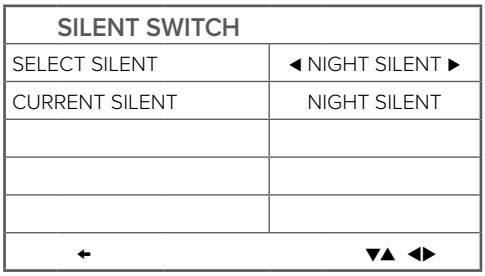
The compressor and fan speed is reduced.

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

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







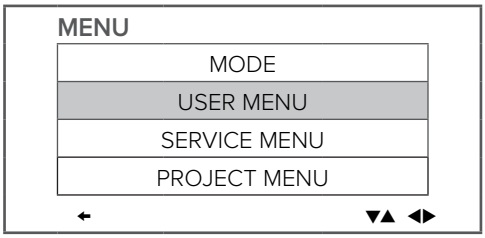
13.12 Domestic hot water

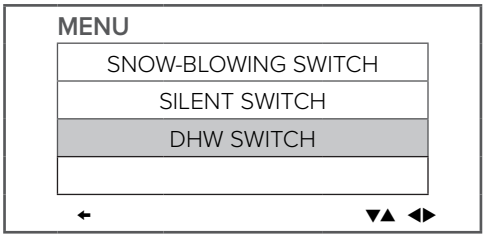
Option.

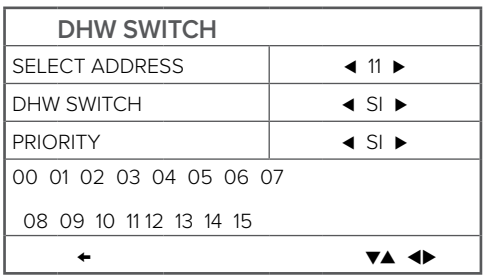
The unit is capable of handling domestic hot water production.

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.







13.13 Querying variables

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

MENU
MODE
USER MENU
SERVICE MENU
PROJECT MENU
← ▼▲ ◀▶

USER MENU
QUERY
TIMER
GENERAL SETTING
DOUBLE SETPOINT
← 1/2 ▼▲ ◀▶

QUERY
STATE QUERY
TEMP. QUERY
HISTORY ERRORS QUERY
← ▼▲ ◀▶

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

STATE QUERY	
SELECT ADDRESS	◀ 11 ▶
OPERATION STATE	STANDBY
RUNNING MODE	COOL
CURRENT SILENT MODE	SUPER SILENT
← 1/3	▼▲ ◀▶

STATE QUERY	
CURRENT CAPACITY	100 KW
CURRENT POWER	50 KW
CURRENT EFFICIENCY	2
TOTAL CAPACITY	100 MW
TOTAL POWER	50 MW
← 2/3	▼▲ ◀▶

STATE QUERY	
TOTAL POWER	50 MW
← 3/3	▼▲ ◀▶

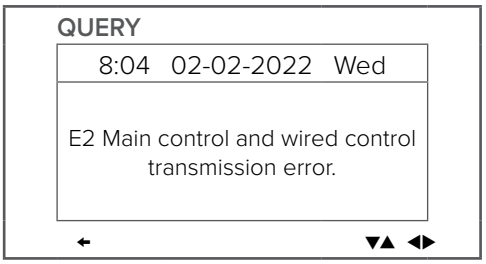
QUERY
STATE QUERY
TEMP. QUERY
HISTORY ERRORS QUERY
← ▼▲ ◀▶

TEMP QUERY	
SELECT ADDRESS	◀ 11 ▶
INLET WATER TEMP	25 °C
OUTLET WATER TEMP	25 °C
TOTAL OUTWATER TEMP	25 °C
AMBIENT TEMP.	25 °C
← 1/2	▼▲ ◀▶

TEMP QUERY	
INLET BPHE TEMP	25 °C
← 2/2	▼▲ ◀▶

QUERY
STATE QUERY
TEMP. QUERY
HISTORY ERRORS QUERY
← ▼▲ ◀▶

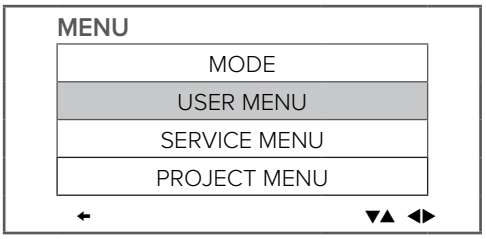
HISTORY ERRORS QUERY	
SELECT ADDRESS	◀ 11 ▶
1 2 3 4 5 6 7 8	
EU: 11/03/2020 15:05 Tz sensor error	
←	▼▲ ◀▶

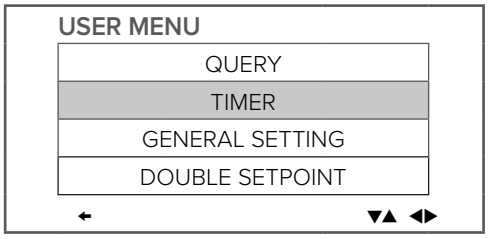


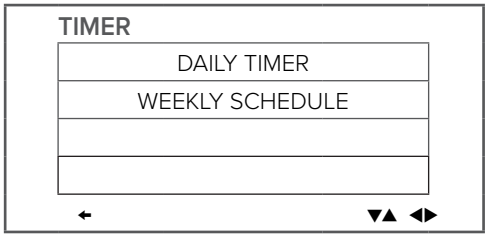
13.14 Timer

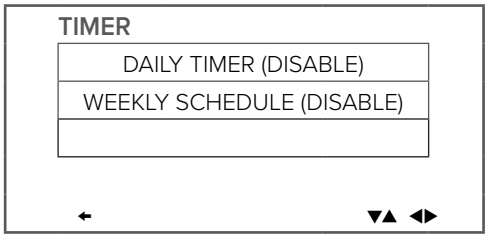
A daily or weekly schedule can be set.

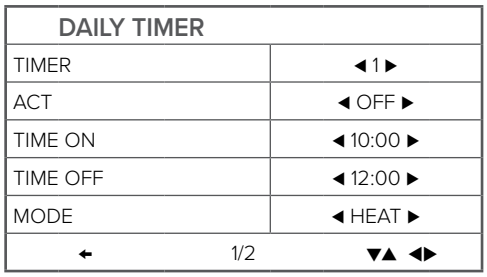
If the unit is controlled via remote ON-OFF or via Modbus, the timers are disabled.

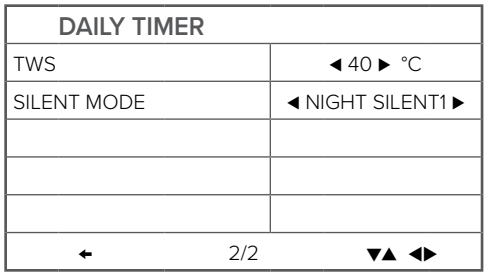


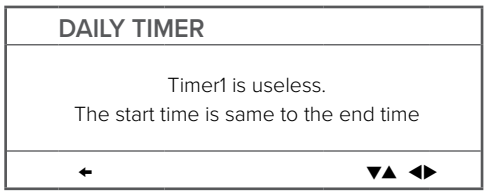


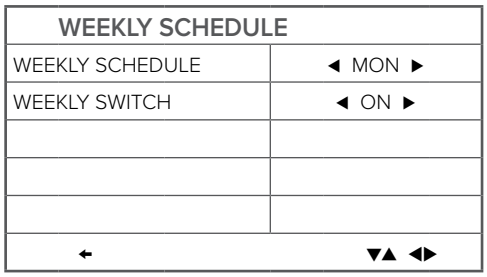


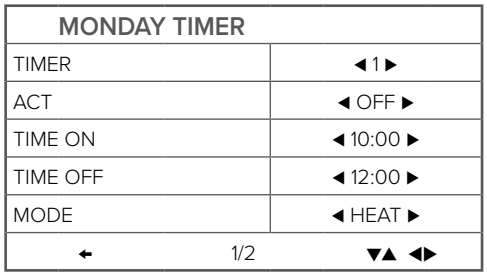


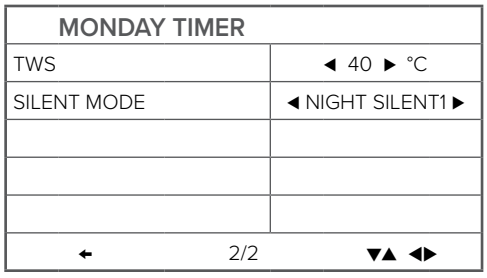












13.15 Unit Stata

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

Code	Description
31.xx	suction temperature
32.xx	silent (1st digit: 0= night mode, 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

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.

After an error has been signalled, all units stop. The error is eliminated after the sensor has been reset.

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

Code		Description
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
P1		Overvoltage or under-voltage 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
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
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

Code		Description
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
L6		Reserved
L7		L7 phase loss
L8		Frequency changes over 15Hz
L9		Frequency difference 15Hz

Code		Description
xbH	1bH	Module 1 relay blocked or chip 908 self-check failed
	2bH	Module 2 relay blocked or chip 908 self-check failed
		Leak detector alarm

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.

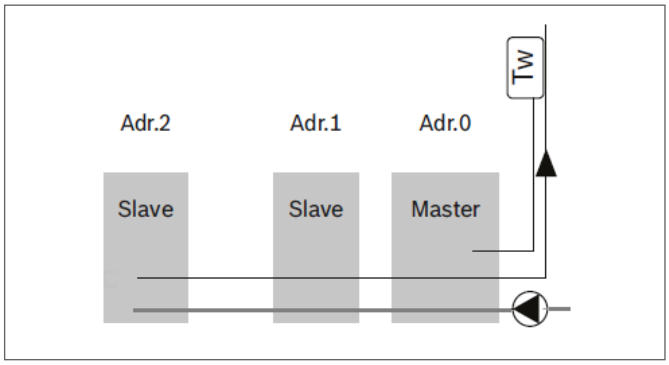
The master unit will periodically (standard time 80 seconds) evaluate the current load based on the outlet water temperature, the set point distance and speed difference of the water temperature.

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.



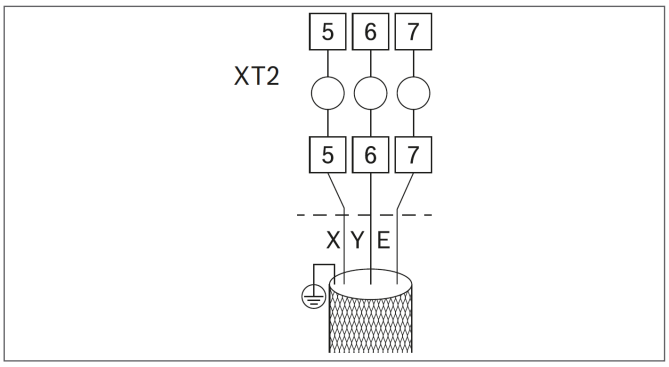
14.3 Domestic hot water

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.

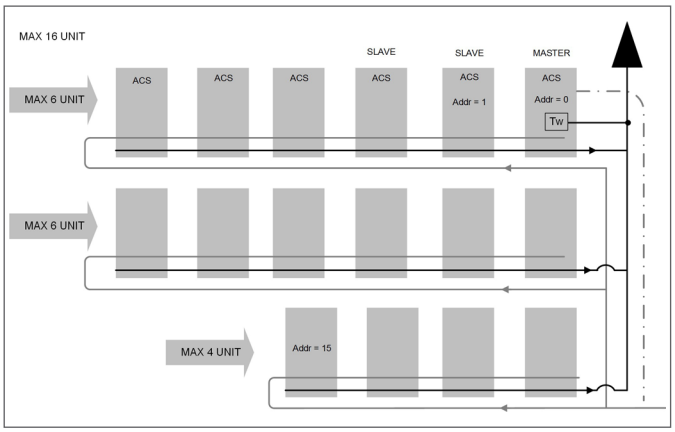
14.4 Electrical connections

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



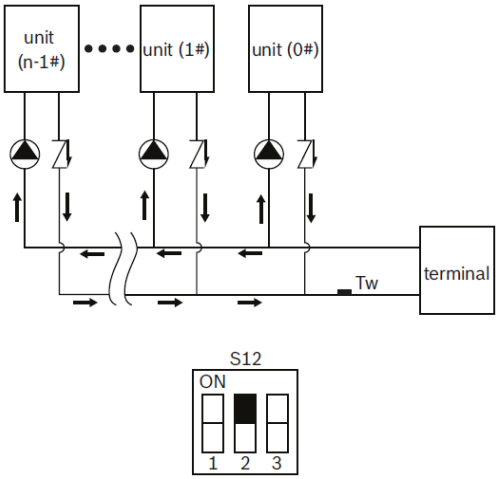
The TW outlet water temperature control probe, the flow switch and the backup electric heater must be controlled by the master unit.

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



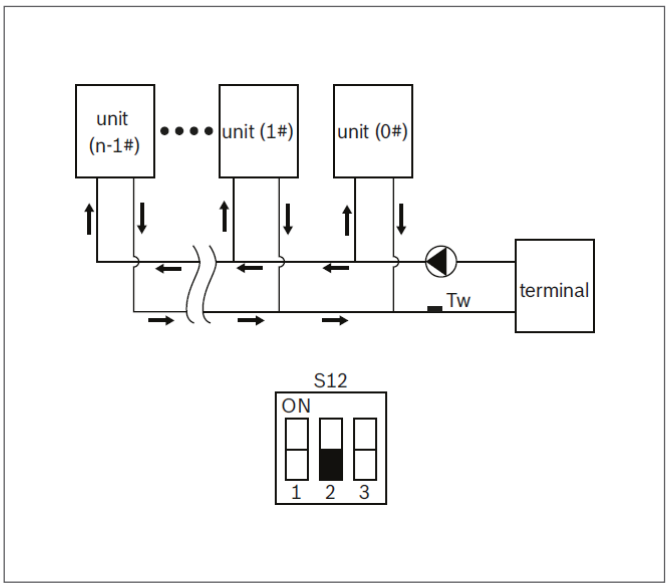
14.7 Single/multiple pump system

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

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:

SW12-2 : |t1|

- 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

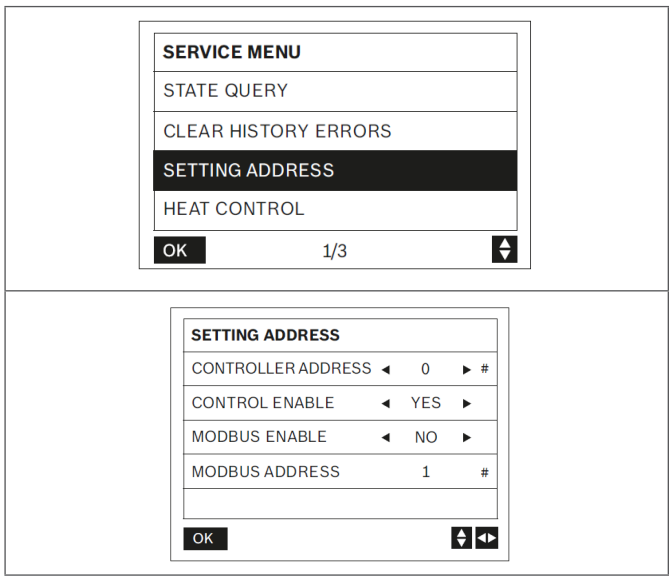
Up to16 controls can be addressed, from 0 to 15; for example:

- 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

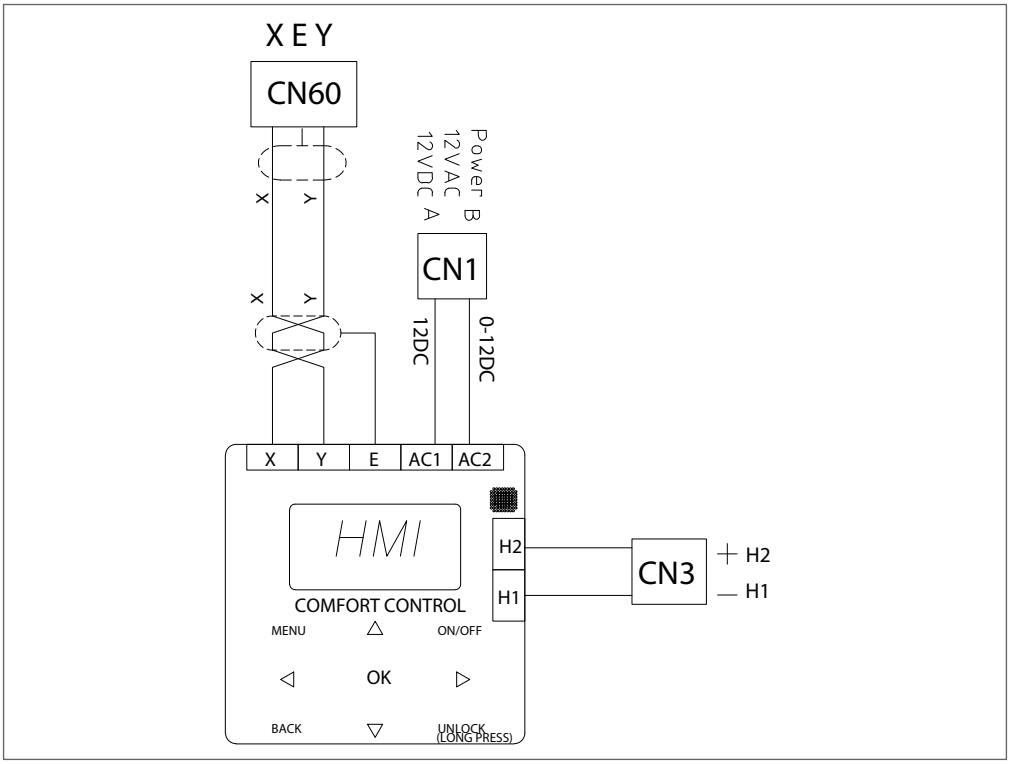
15.1 Communication specifications: RS - 485

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

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 ~ 60 **Default**: CO/FC: 7 HP cooling mode: 7 HP heating mode: 35 **Unit of measurement:** [°C] **Notes:**

Reg	Data Type	R/W	Name	Description
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 ~ 60 **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|n|**Default**: Cooling mode: 10 Heating mode: 10|n|**Unit of measurement**: [°C] **Notes**:
4	S16	R&W	DHW set temperature - T5S	**Range**: 30 ~ 70 **Default**: 50 **Notes**: Available only for HP|n|**Unit of measurement**: [°C]"
5	S16	R&W	Reserved	
6	S16	R&W	Clear lock errors	**Range**: 0-Invalid, 1-Clear all the lock errors **Default**: 0-Invalid|n|**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	Static pressure setting **Range**: 0 - static pressure, 1 - low static pressure, 2 - medium static pressure, 3 - high static pressure|n|**Default**: 0 - static pressure **Unit of measurement**: - Notes:
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	
100	S16	R&W	Silent mode	**Range**: 1 - Standard, 2 - Silent mode, 3 - Night 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 ~ 60 **Default**: 35 **Unit of measurement**: [°C] **Notes**:
105	S16	R&W	Double setpoint temperature Tws 2 in heating mode	**Range**: HP: 25 ~ 60 **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**:
112	S16	R&W	T4 HEAT 2	Temperature compensation point 2 in cooling mode **Range**: 15 ~ 30 **Default**: 15 **Unit of measurement**: [°C] **Notes**:

Reg	Data Type	R/W	Name	Description
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**: -In|**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 ~ 5In|**Default**: 2 **Unit of measurement**: [°C] **Notes**:
117	S16	R&W	T_Heat_Diff	Differential temperature in heating mode **Range**: 1 ~ 5In|**Default**: 2 **Unit of measurement**: [°C] **Notes**:"
118	S16	R&W	dT5_ON	Return hot water temperature difference **Range**: 2 ~ 10In|**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
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**: 5 ~ 100 **Default**: 50 **Unit of measurement**: [%] **Notes**: 5% step
123	S16	R&W	Ratio_Heat_First	Initial turn on ratio of cascade system in heating mode **Range**: 5 ~ 100 **Default**: 50 **Unit of measurement**: [%] **Notes**: 5% step"
124	S16	R&W	T_diff_pro	Inlet and outlet water temperature difference protection **Range**: 5 ~ 100 **Default**: 50 **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	Tw_Heat1_On	**Range**: -5 ~ 20 **Default**: 5 **Unit of measurement**: [°C] **Notes**: Valid only for FC/CO models"
131	S16	R&W	Tw_Heat1_Off	**Range**: -5 ~ 20 **Default**: 5 **Unit of measurement:** [°C] **Notes**: Valid only for FC/CO models"
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	S16	R&W	Water coil control	**Range**: 0 - Automatic, 1 - Manual1 (through), 2 - Manual2 (bypass) **Default**: 0 - Automatic **Unit of measurement:** - **Notes**: Valid only on FC units"
143	S16	R&W	DtTws	Tws rising value after entering mix **Range**: 1 ~ 3 **Default**: 1 **Unit of measurement:** [°C] **Notes**: Only valid for FC/CO unit"
144	S16	R&W	Dtmix	Enter mix hysteresis **Range**: 1 ~ 3 **Default**: 2 **Unit of measurement:** [%] **Notes**: Only valid for FC/CO unit"
145	S16	R&W	FC Offset	FC enter offset **Range**: 1 ~ 15 **Default**: 3 **Unit of measurement:** [°C] **Notes**: Only valid for FC/CO unit"
146	S16	R&W	FC Hyster	FC enter hysteresis **Range**: 1 ~ 3 **Default**: 1 **Unit of measurement:** [°C] **Notes**: Only valid for FC/CO unit"
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**:
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**: 0 - Water flow detected before the pump is turned on, 1 - Water flow switch is detected after the pump is turned on **Default**: 0 **Unit of measurement:** - **Notes**:
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**: MIN(70, Inverter pump MIN speed) ~ 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**:

Reg	Data Type	R/W	Name	Description
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	
158 ~ 199			RESERVED	
200+(Unit Address)*100	S16	R&W	RESERVED	
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"
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
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"
211+(Unit Address)*100	S16	R&W	DHW heating MAX running time	**Range**: 1 ~ 48 **Default**: 16 **Unit of measurement:** [min]In**Notes**: Only valid for multi pump systems with DHW function
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
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"
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
217+(Unit Address)*100	S16	R&W	T5S	Water tank setpoint **Range**: 30 ~ 60 **Default**: 50 **Unit of measurement:** [°C] **Notes**: Only valid for multi pump systems with DHW function
218+(Unit Address)*100	U16	R&W	DHW Disinfect Enable	**Range**: 0 - Disable, 1 - Enable **Default**: 0 - Disable **Unit of measurement**: **Notes**:

Reg	Data Type	R/W	Name	Description
219+(Unit Address)*100	U16	R&W	DHW Disinfect Days Set	**Range: Default: Unit of measurement: Notes:**
220+(Unit Address)*100	U16	R&W	DHW Disinfect time	**Range**: 00:00~24:00 **Default**: 24:00 **Unit of measurement:** [min] **Notes**:
221+(Unit Address)*100	U16	R&W	DHW Disinfect Maxtime	**Range**: 00:00~24:00 **Default**: 24:00 **Unit of measurement:** [min] **Notes**:
(2 ~ 229)+(Unit Address)*100			RESERVED	
230+(Unit Address)*100		RO	RESERVED	
231+(Unit Address)*100		RO	RESERVED	
232+(Unit Address)*100	U16	RO	Current capacity	Real time capacity **Range**: 0 ~ 65535 **Default**: - **Unit of measurement:** [kW] **Notes**:
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)*10 **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 ~ 239)+(Unit Address)*100			RESERVED	
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, 3 - Night silent, 7 - Super silentInl**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	RESERVED	
244+(Unit Address)*100	S16	RO	Twi	Inlet water temperature , **Range**: -32768 ~ 32767 , **Default**: - , **Unit of measurement:** [°C] , **Notes**: Invalid value 0x8000
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]Inl**Notes**:

Reg	Data Type	R/W	Name	Description
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	EXVB	EXV B current opening degree **Range**: 0 ~ 65535 **Default**: - **Unit of measurement:** [steps] **Notes**:
255+(Unit Address)*100	U16	RO	EXVC	EXV C current opening degree **Range**: 0 ~ 65535 **Default**: - **Unit of measurement:** [steps] **Notes**:
256+(Unit Address)*100	S16	RO	SV4	**Range**: 0 - OFF, 1 - ON **Default**: - **Unit of measurement:** - **Notes**:
257+(Unit Address)*100	S16	RO	SV5	**Range**: 0 - OFF, 1 - ON **Default**: - **Unit of measurement:** - **Notes**:
258+(Unit Address)*100	S16	RO	SV8A	**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	S16	RO	SV2 state	**Range**: 0 - OFF, 1 - ON **Default**: - **Unit of measurement:** - **Notes**:
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
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	Pressure	**Range**: -32768 ~ 32767 **Default**: - **Unit of measurement:** heating/DHW [0.01MPa], cooling [0.1MPa] **Notes**: Low pressure in cooling mode, high pressure in heating mode. 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**:

Reg	Data Type	R/W	Name	Description
275+(Unit Address)*100	S16	RO	Tp2	**Range**: -32768 ~ 32767 **Default**: - **Unit of measurement:** [°C] **Notes**: Invalid value 0x8000
276+(Unit Address)*100	S16	RO	T5s min	**Range**: -32768 ~ 32767 **Default**: - **Unit of measurement:** [°C] **Notes**: Invalid value 0x8000
277+(Unit Address)*100	S16	RO	T6A	**Range**: -32768 ~ 32767 **Default**: - **Unit of measurement:** [°C] **Notes**: Invalid value 0x8000
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	S16	RO	SV6 state	**Range**: 0 - OFF, 1 - ON **Default**: - **Unit of measurement:** - **Notes**:
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**:
283+(Unit Address)*100	S16	RO	Anti-freezing electric heater	**Range**: 0 - OFF, 1 - ON **Default**: - **Unit of measurement:** - **Notes**:
284+(Unit Address)*100	S16	RO	Remote control	**Range**: 0 - OFF, 1 - ON **Default**: - **Unit of measurement:** - **Notes**: Only the master unit provides this value
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			RESERVED	
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**: 0 ~ 65535 **Default**: - **Unit of measurement**: - **Notes**: BIT0:C1, BIT1:C2, BIT2:C3, BIT3:C4, BIT4:C5, BIT5:C6, BIT6:C7
295+(Unit Address)*100	S16	RO	T6B	**Range**: -32768 ~ 32767 **Default**: - **Unit of measurement:** [°C] **Notes**: Invalid value 0x8000
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

Reg	Data Type	R/W	Name	Description
298+(Unit Address)*100	S16	RO	Tfin2	**Range**: -32768 ~ 32767 **Default**: - **Unit of measurement:** [°C] **Notes**: Invalid value 0x8000
299+(Unit Address)*100	S16	RO	Tfin3	**Range**: -32768 ~ 32767 **Default**: - **Unit of measurement**: [°C] **Notes**: Invalid value 0x8000
1800 ~ 2299			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	S16	RO	TCSH	**Range**: -32768 ~ 32767 **Default**: - **Unit of measurement:** [°C] **Notes**: Invalid value 0x8000
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 Allarmi Modbus

Dati disponibili sono in lingua inglese

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		✓
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	✓	✓
PH	37	T4 is out of heating working range		✓

Error Code	Modbus Code	Description	Troubleshooting	
			Stop system	Stop unit
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		✓
L9	110	L9 frequency difference 15Hz		✓

Error Code	Modbus Code	Description	Troubleshooting	
			Stop system	Stop unit
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		✓

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 tension 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 stresses.**

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:

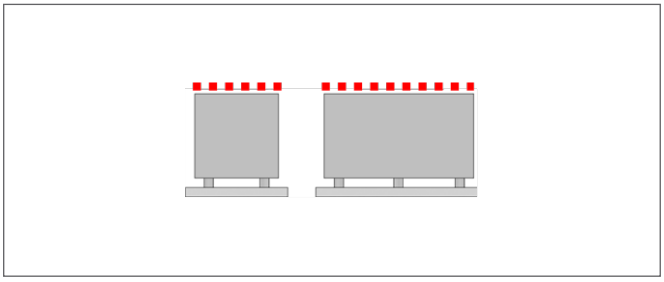
- frequent use (continuous or very intermittent use, near the operating limits, etc)
- critical use (service necessary)

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
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 using a siphon

17.12 Fans

Check that:

- they turn freely, with no effort
- 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 grille 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

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

Compared to tube and fin heat exchangers, these coils tend to accumulate more dirt on the outer surface and less on the inside, making them easier to clean.

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 6 months, check that the correct alarm triggers by disconnecting the active part (nose) of the leak sensor

Warning

Replace the sensor

- if there are any anomalies
- every 2 years, replacing only the active part (nose) of the leak sensor

Note

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

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

17.30 Extraction ventilation

Check that:

- it turns freely, with no effort
- there are no foreign bodies in the fan area
- the fan and grille 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

17.31 Safety valve

The pressure relief valve must be replaced:

- if it has intervened
- 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 close the shut-off valve

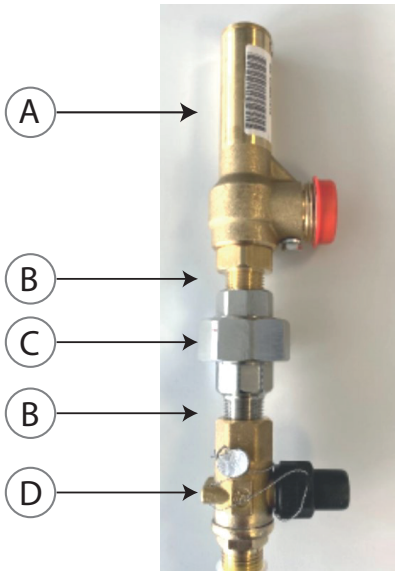
2 remove the pressure relief valve
DO NOT HEAT THE PART

3 remove the valve from the connection joint

4 fit the new valve to the connection joint
clean the parts to be assembled and apply white paste

5 install the new valve

6 open the shut-off valve



A) pressure relief valve

B) white paste

C) 3-piece connection joint

D) shut-off valve

2	3	4	5
 			

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.

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:

- the flammable atmosphere will be ejected into the room in the fan's air flow direction

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 circuit components have thermal inertia, can stay hot/cold for several minutes after the unit has been switched off 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	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 - W35	7	-	A++	A++	A++	A++	A++	A++	A++
SCOP - MEDIUM Climate - W35	9	-	3,54	3,51	3,39	3,38	3,36	3,63	3,60
ηs,h - MEDIUM climate - W35	10	%	139	137	133	132	131	142	141
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 14511:2022)	5	-	2,84	2,81	2,58	2,46	2,35	2,86	2,64
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	1,66	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	10,90	12,60	13,80	15,70
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	3,39	3,38	3,36	3,63	3,60
ηs,h - MEDIUM Climate - W55	10	%	139	137	133	132	131	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	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 - W35	7	-	A++	A++	A++	A++	A++	A++	A++
SCOP - MEDIUM Climate - W35	9	-	3,54	3,51	3,39	3,38	3,36	3,63	3,60
ηs,h - MEDIUM climate - W35	10	%	139	137	133	132	131	142	141
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	9,4	11,1	9,8	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 14511:2022)	5	-	2,87	2,78	2,60	2,41	2,31	2,81	2,59
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	1,54	1,60	2,14	2,28	2,42	2,82	3,02
User side exchanger pressure drops	6	kPa	7,2	7,7	7,8	8,8	9,8	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	3,39	3,38	3,36	3,63	3,60
ηs,h - MEDIUM Climate - W55	10	%	139	137	133	132	131	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	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 - W35	7	-	A++	A++	A++	A++	A++	A++	A++
SCOP - MEDIUM Climate - W35	9	-	3,54	3,51	3,39	3,38	3,36	3,63	3,60
ηs,h - MEDIUM climate - W35	10	%	139	137	133	132	131	142	141
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	10,50	12,10
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 14511:2022)	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	1,49	1,59	1,94	2,16	2,41	2,76	3,02
User side exchanger pressure drops	6	kPa	6,8	7,7	6,5	8,0	9,7	10,4	12,2
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	3,39	3,38	3,36	3,63	3,60
ηs,h - MEDIUM Climate - W55	10	%	139	137	133	132	131	142	141

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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

SIZE			14.1	16.1	18.1	19.1	20.1	25.2	30.2
Compressor									
Type of compressors						SCROLL INVERTER			
Refrigerant						R-290			
N° 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 version standard (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).
1.
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 - Acoustic version silent

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).
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 - Acoustic version super silent

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).
1.
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

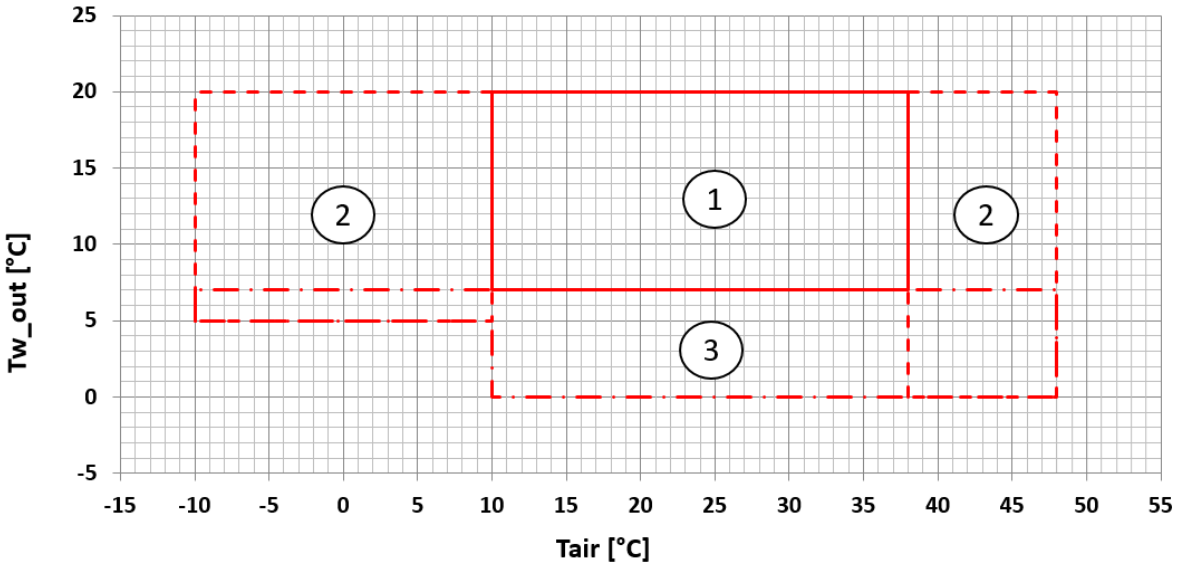
Electrical data

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 limits

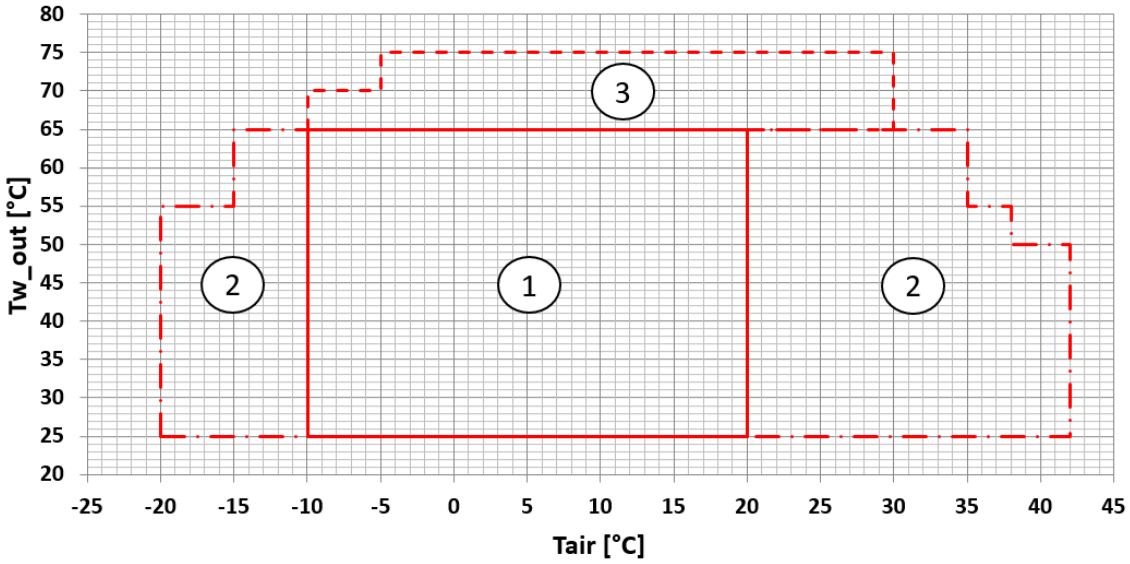
Cooling



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

Heating / DHW Production



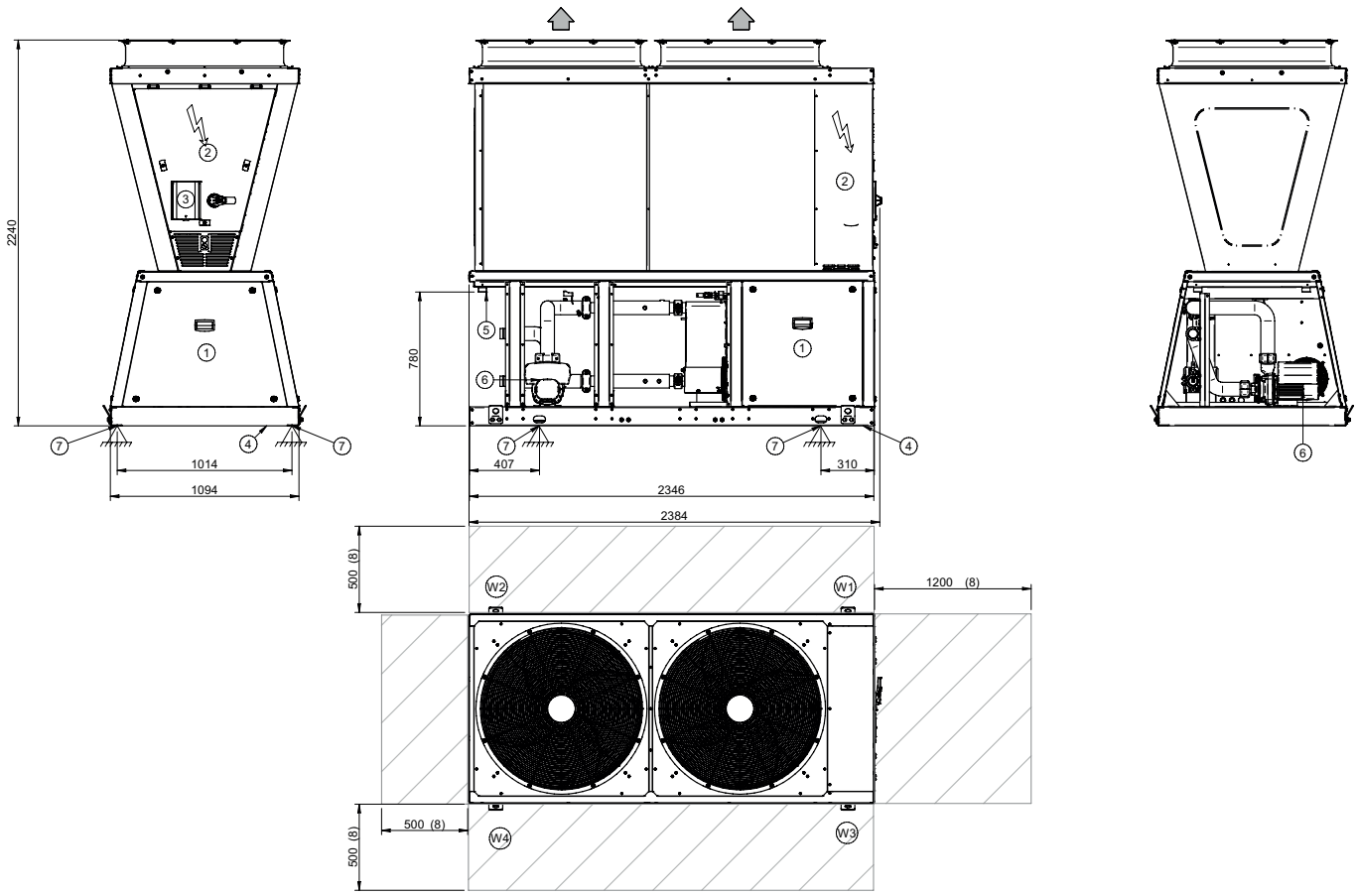
Twu [°C] = Temperature of the outlet water from the exchanger
Tae [°C] = External exchanger inlet air temperature

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 the compressor capacity

21. Dimensional drawings

SIZE 14.1 ÷ 20.1

DAASP0001_00
DATA/DATE 25/09/2023



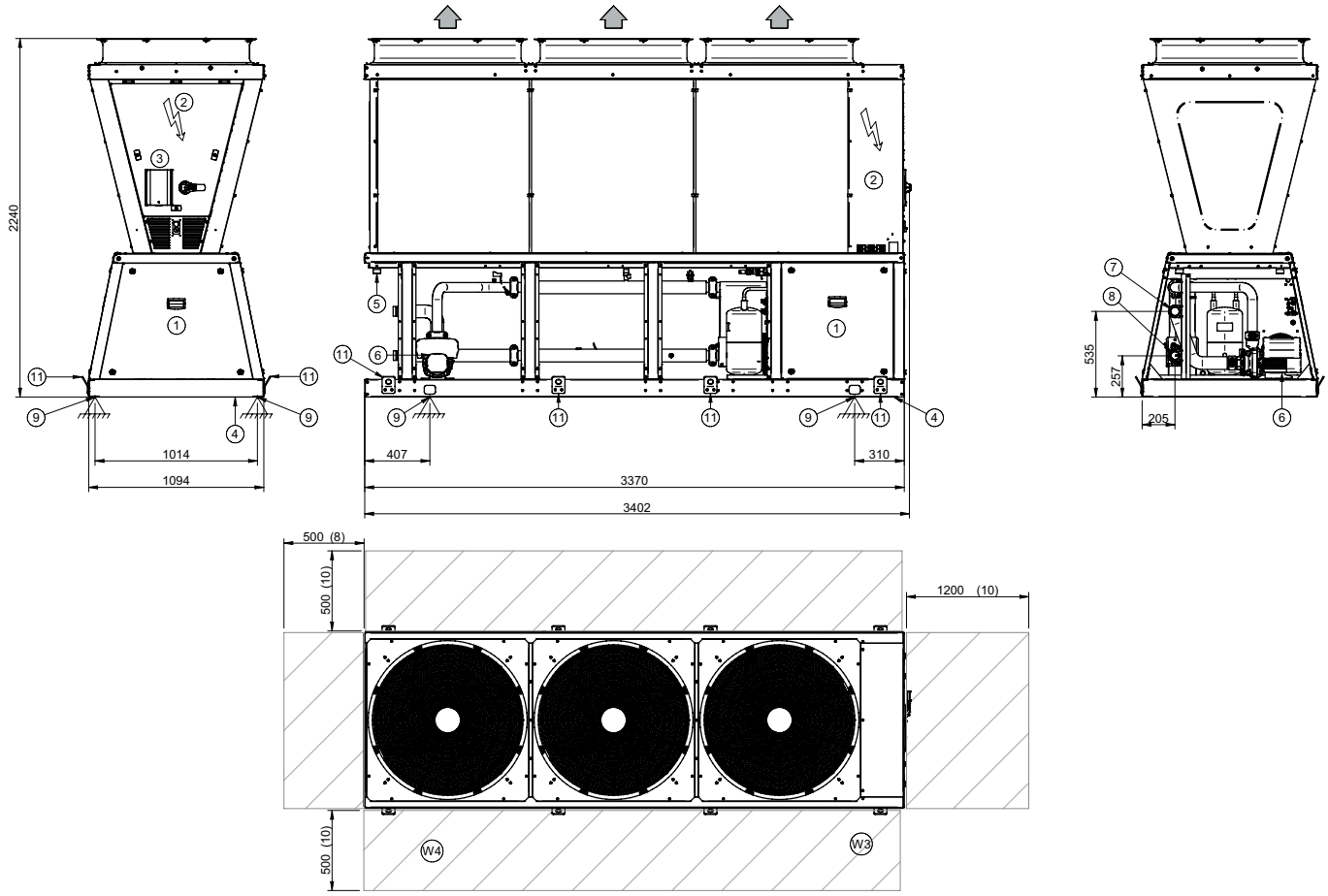
1. Compressor enclosure
2. Elecrical panel
3. Control keypad
4. Power input
5. Condensate drain
6. Water pump (optional)
7. Fixing point
8. Functional spaces
9. Lifting bracket (Removable)

SIZE		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 Support point	kg	210	210	226	226	226
W2 Support point	kg	138	138	145	145	145
W3 Support point	kg	217	217	233	233	233
W4 Support point	kg	145	145	153	153	153
Operation weight	kg	709	709	757	757	757
Operating weight	kg	689	689	737	737	737

Optional accessories may result in a substantial variation of the weight shown in table

SIZE 25.2 ÷ 30.2

DAASP0002_00
DATA/DATE 25/09/2023



1. Compressor eclosure
2. Electrical panel
3. Control Kaypad
4. Power input
5. Condensate drain
6. Water pump (optional)
7. Water inlet 2" Victaulic
8. Water outlet 2" Victaulic
9. Fixing point
10. Functional spaces
11. Lifting bracket (removable)

SIZE		25.2	30.2
Length	mm	3402	3402
Depth	mm	1094	1094
Height	mm	2240	2240
W1 Support point	kg	306	306
W2 Support point	kg	199	199
W3 Support point	kg	312	312
W4 Support point	kg	205	205
Operation weight	kg	1021	1021
Operating weight	kg	1001	1001

Optional accessories may result in a substantial variation of the weight shown in table

22. Safety data sheets

22.1 Refrigerant safety data sheet

Scheda di Dati di Sicurezza

Conforme al Regolamento (CE) n° 1907/2006 (REACH) come modificato dal Regolamento (UE) 2015/830

Propano

Numero di riferimento: 104

Data di pubblicazione: 01/02/2015 Data di revisione: 01/11/2020 Sostituisce la versione di: 08/01/2019 Versione: 3.0

Pericolo

SEZIONE 1: Identificazione della sostanza/miscela e della società/impresa

1.1. Identificatore del prodotto

Nome commerciale	:	Propano, MIX G31, R290
Scheda Nr.	:	104
Denominazione chimica	:	Propano
		Numero CAS : 74-98-6
		Numero CE : 200-827-9
		Numero indice : 601-003-00-5
		EU
Numero di registrazione	:	01-2119486944-21
Formula chimica	:	C3H8

1.2. Usi identificati pertinenti della sostanza o della miscela e usi sconsigliati

Usi pertinenti identificati	:	Impiego industriale e professionale. Fare un'analisi di rischio prima dell'uso. Gas di test/Gas di calibrazione. Reazione chimica/Sintesi. Utilizzato come combustibile. Gas combustibile per applicazioni di saldatura, taglio, riscaldamento e brasatura. Contattare il fornitore per ulteriori informazioni sull'utilizzo.
Usi sconsigliati	:	Uso di consumo.

1.3. Informazioni sul fornitore della scheda di dati di sicurezza

Identificazione della società

1.4. Numero telefonico di emergenza

Numero telefonico di emergenza	:	+39.800.011.566

SEZIONE 2: Identificazione dei pericoli

2.1. Classificazione della sostanza o della miscela

Classificazione secondo il regolamento (CE) n. 1272/2008 [CLP]

Pericoli fisici	Gas infiammabili, categoria 1A	H220
	Gas sotto pressione : Gas liquefatto	H280

2.2. Elementi dell'etichetta

Etichettatura secondo il Regolamento CE n. 1272/2008 [CLP]

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Pittogrammi di pericoli (CLP) :

GHS02 GHS04

Avvertenza (CLP) : Pericolo

Indicazioni di pericolo (CLP) : H220 - Gas altamente infiammabile.
H280 - Contiene gas sotto pressione; può esplodere se riscaldato.

Consigli di prudenza (CLP)

- Prevenzione : P210 - Tenere lontano da fonti di calore, superfici calde, scintille, fiamme libere o altre fonti di accensione. Non fumare.
- Reazione : P377 - In caso d'incendio dovuto a perdita di gas, non estinguere a meno che non sia possibile bloccare la perdita senza pericolo.
P381 - In caso di perdita, eliminare ogni fonte di accensione.
- Conservazione : P403 - Conservare in luogo ben ventilato.

2.3. Altri pericoli

Asfissiante in alte concentrazioni.
Il contatto con il liquido può causare ustioni da congelamento.
Tali alte concentrazioni sono comprese entro i limiti di infiammabilità del prodotto.

SEZIONE 3: Composizione/informazioni sugli ingredienti

3.1. Sostanze

Nome	Identificatore del prodotto	%	Classificazione secondo il regolamento (CE) n. 1272/2008 [CLP]
Propano	Numero CAS: 74-98-6 Numero CE: 200-827-9 Numero indice EU: 601-003-00-5 Numero di registrazione: 01-2119486944-21	100	Flam. Gas 1A, H220 Press. Gas (Liq.), H280

Non contiene altri prodotti e/o impurezze che influenzano la classificazione del prodotto.

3.2. Miscele Non applicabile

SEZIONE 4: Misure di primo soccorso

4.1. Descrizione delle misure di primo soccorso

- Inalazione : Spostare la vittima in zona non contaminata indossando l'autorespiratore. Mantenere il paziente disteso e al caldo. Chiamare un medico. Procedere alla respirazione artificiale in caso di arresto della respirazione.
- Contatto con la pelle : In caso di ustioni da congelamento spruzzare con acqua per almeno 15 minuti. Applicare una garza sterile. Procurarsi assistenza medica.
- Contatto con gli occhi : Lavare immediatamente gli occhi con acqua per almeno 15 minuti.
- Ingestione : L'ingestione è considerata una via di esposizione poco probabile.

4.2. Principali sintomi ed effetti, sia acuti che ritardati

In alta concentrazione può causare asfissia. I sintomi possono includere perdita di mobilità e/o conoscenza. Le vittime possono non rendersi conto dell'asfissia.
Fare riferimento alla sezione 11.

4.3. Indicazione dell'eventuale necessità di consultare immediatamente un medico e di trattamenti speciali

Nessuno(a).

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SEZIONE 5: Misure antincendio

5.1. Mezzi di estinzione

- Mezzi di estinzione idonei : Acqua nebulizzata.
Diossido di carbonio.
Polvere secca.
Interrompere il rilascio di gas è il metodo di controllo preferibile.
Prestare attenzione al rischio di formazione di energia elettrostatica quando si utilizzano estintori a CO2. Non utilizzarli in aree in cui è possibile la formazione di atmosfere infiammabili.

- Mezzi di estinzione non idonei : Non usare getti d'acqua per estinguere l'incendio.

5.2. Pericoli speciali derivanti dalla sostanza o dalla miscela

Pericoli specifici : L'esposizione alle fiamme può causare la rottura o l'esplosione del recipiente.

Prodotti di combustione pericolosi : Monossido di carbonio.

5.3. Raccomandazioni per gli addetti all'estinzione degli incendi

Metodi specifici : Utilizzare misure antincendio adeguate all'incendio circostante. L'esposizione alle fiamme e al calore può causare la rottura del recipiente. Raffreddare i contenitori esposti al rischio con getti d'acqua a doccia da una posizione protetta. Non riversare l'acqua contaminata dell'incendio negli scarichi fognari.
Se possibile arrestare la fuoriuscita di prodotto.
Se possibile utilizzare acqua nebulizzata per abbattere i fumi.
Non spegnere una fuga di gas incendiato se non assolutamente necessario. Può verificarsi una riaccensione esplosiva. Spegnere tutte le fiamme circostanti.
Spostare i recipienti lontano dall'area dell'incendio se questo può essere fatto senza rischi.

Dispositivi di protezione speciali per addetti antincendio : Usare l'autorespiratore in spazi confinati.
Indumenti di protezione e dispositivi di protezione (autorespiratori) standard per vigili del fuoco.
EN 137 - Dispositivi di protezione delle vie respiratorie - Autorespiratori a circuito aperto ad aria compressa con maschera intera.
EN 469:Indumenti di protezione per vigili del fuoco. EN 659: Guanti di protezione per vigili del fuoco.

SEZIONE 6: Misure in caso di rilascio accidentale

6.1. Precauzioni personali, dispositivi di protezione e procedure in caso di emergenza

Per chi non interviene direttamente : Operare in accordo al piano di emergenza locale.
Tentare di arrestare la fuoriuscita.
Evacuare l'area.
Eliminare le fonti di ignizione.
Assicurare una adeguata ventilazione.
Evitarne l'ingresso in fognature, scantinati, scavi e zone dove l'accumulo può essere pericoloso.
Rimanere sopravvento.
Per maggiori informazioni sui dispositivi di protezione individuale fare riferimento alla sezione 8

Per chi interviene direttamente : Monitorare la concentrazione del prodotto rilasciato.
Considerare il rischio di atmosfere esplosive.
Usare l'autorespiratore per entrare nella zona interessata se non è provato che l'atmosfera sia respirabile.
Per maggiori informazioni fare riferimento alla sezione 5.3

6.2. Precauzioni ambientali

Tentare di arrestare la fuoriuscita.

6.3. Metodi e materiali per il contenimento e per la bonifica

Ventilare la zona.

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6.4. Riferimento ad altre sezioni

Vedere anche le sezioni 8 e 13.

SEZIONE 7: Manipolazione e immagazzinamento

7.1. Precauzioni per la manipolazione sicura

Uso sicuro del prodotto : Il prodotto deve essere manipolato in accordo alle buone prassi di sicurezza e di igiene industriale.
Soltanto il personale con esperienza e opportunamente addestrato può manipolare i gas sotto pressione.
Prendere in considerazione le valvole di sicurezza nelle installazioni per gas.
Assicurarsi che l'intero sistema di distribuzione del gas sia stato (o sia regolarmente) verificato contro le fughe prima dell'uso.
Non fumare mentre si manipola il prodotto.
Utilizzare solo apparecchiature specifiche, adatte per il prodotto, la pressione e la temperatura di impiego. In caso di dubbi contattare il fornitore del gas.
Evitare il risucchio di acqua, acidi ed alcali.
Valutare il rischio di potenziali atmosfere esplosive e la necessità di apparecchiature explosion-proof.
Eliminare l'aria dal sistema prima di introdurre il gas.
Prendere precauzioni contro le scariche elettrostatiche.
Tenere lontano da fonti di ignizione (comprese cariche elettrostatiche).
Valutare la necessità di utilizzare solo attrezzi antiscintilla.
Non respirare il gas.
Evitare il rilascio del prodotto in atmosfera.
Assicurarsi che le apparecchiature siano adeguatamente messe a terra.

Manipolazione sicura del contenitore del gas : Far riferimento alle istruzioni del fornitore per la manipolazione del contenitore.
Non permettere il riflusso del gas nel contenitore.
Proteggere i recipienti da danni fisici; non trascinare, far rotolare, far scivolare o far cadere.
Quando si spostano i recipienti, anche se per brevi distanze, utilizzare gli opportuni mezzi di movimentazione (carrelli, carrelli a mano, etc…) progettati per il trasporto di tali recipienti.
Lasciare i cappellotti di protezione delle valvole in posizione fino a quando il contenitore non è stato fissato a un muro o a un banco di lavoro o posizionato in un opportuno sostegno ed è pronto per l'uso.
Se l'operatore incontra una qualsiasi difficoltà durante il funzionamento della valvola interrompere l'uso e contattare il fornitore.
Mai tentare di riparare o modificare le valvole dei contenitori o i dispositivi di sicurezza.
Le valvole danneggiate devono essere immediatamente segnalate al fornitore.
Mantenere le valvole dei contenitori pulite e libere da contaminanti, in particolare olio e acqua.
Rimontare i tappi e/o i cappellotti delle valvole e dei contenitori, ove forniti, non appena il contenitore è disconnesso dall'apparecchiatura.
Chiudere la valvola del contenitore dopo ogni utilizzo anche se vuoto, anche se ancora connesso all'apparecchiatura.
Mai tentare di trasferire i gas da un contenitore a un altro.
Non utilizzare fiamme dirette o riscaldamento elettrico per aumentare la pressione interna del contenitore.
Non rimuovere né rendere illeggibili le etichette apposte dal fornitore per l'identificazione del contenuto del recipiente.
Evitare il risucchio di acqua nel contenitore.
Aprire lentamente la valvola per evitare colpi di pressione.

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7.2. Condizioni per lo stoccaggio sicuro, comprese eventuali incompatibilità

Osservare le normative e i requisiti legislativi locali relativi allo stoccaggio dei recipienti.
I recipienti non devono essere immagazzinati in condizioni tali da favorire fenomeni corrosivi.
I cappellotti e/o i tappi devono essere montati.
I recipienti devono essere immagazzinati in posizione verticale e ancorati in modo da prevenirne la caduta.
I contenitori in stoccaggio dovrebbero essere controllati periodicamente per verificarne le condizioni generali ed eventuali perdite.
Mantenere il contenitore sotto i 50°C in zona ben ventilata.
Immagazzinare i recipienti in aree dove non vi è rischio di incendio, lontano da sorgenti di calore e da fonti di ignizione.
Tenere lontano da sostanze combustibili.
Non immagazzinare con gas ossidanti o altri ossidanti in genere.
Tutte le apparecchiature elettriche presenti nell'area di stoccaggio dovrebbero essere compatibili con il rischio di formazione di atmosfere esplosive.

7.3. Usi finali particolari

Nessuno(a).

SEZIONE 8: Controllo dell'esposizione/protezione individuale

8.1. Parametri di controllo

DNEL (Livello derivato senza effetto) : Nessuno stabilito.

PNEC (Prevedibili concentrazioni prive di effetti) : Nessuno stabilito.

8.2. Controlli dell'esposizione

8.2.1. Controlli tecnici idonei

Fornire adeguata ventilazione degli scarichi a livello generale e locale.
Il prodotto deve essere manipolato in circuito chiuso.
I sistemi sotto pressione devono essere controllati periodicamente per verificare l'assenza di perdite.
Assicurare che l'esposizione sia ben al di sotto dei limiti di esposizione professionale (ove disponibili).
Quando è possibile il rilascio di gas o vapori infiammabili, devono essere utilizzati dei rilevatori di gas.
Considerare l'uso di un sistema di permessi di lavoro, per esempio per le attività di manutenzione.

8.2.2. Misure di protezione individuale, ad es, dispositivi di protezione individuale

Dovrebbe essere condotta e documentata un'analisi del rischio in ogni area di lavoro, per valutare il rischio correlato all'utilizzo del prodotto e per individuare i DPI appropriati ai rischi identificati. Devono essere considerate le seguenti raccomandazioni:
Devono essere selezionati DPI conformi agli standard EN/ISO raccomandati.

• Protezione per occhi/volto : Indossare occhiali a mascherina durante le operazioni di travaso o disconnessione della manichetta.
EN 166 - Protezione personale degli occhi.

• Protezione per la pelle
- Protezione per le mani : Indossare guanti da lavoro quando si movimentano i contenitori di gas.
EN 388 - Guanti di protezione contro rischi meccanici.
Indossare guanti criogenici durante le operazioni di travaso o disconnessione della manichetta.
EN 511 - Guanti di protezione contro il freddo.

- Altri : Valutare l'utilizzo di indumenti di sicurezza resistenti alle fiamme e antistatici.
EN ISO 14116 - Materiali e indumenti a propagazione limitata di fiamma.
EN ISO 1149-5 -Indumenti di protezione - Proprietà elettrostatiche.
Indossare scarpe di sicurezza durante la movimentazione dei contenitori.
EN ISO 20345 - Dispositivi di protezione individuale - Calzature di sicurezza.

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• Protezione per le vie respiratorie	:	Le maschere a filtro possono essere utilizzate se sono note tutte le condizioni dell'ambiente circostante (per es. tipo e concentrazione del/i contaminante/i) e la durata di utilizzo. Utilizzare maschere a filtro e maschere a pieno facciale quando i limiti di esposizione possono essere superati per un breve periodo, per esempio durante la connessione o la disconnessione dei recipienti. Consigliato: filtro AX (marrone). Le maschere a filtro non proteggono dalle atmosfere sottossigenate. EN 14387 - Apparecchi di protezione delle vie respiratorie - Filtri antigas e filtri combinati. EN 136 - Apparecchi di protezione delle vie respiratorie. Maschere intere. Si raccomanda l'utilizzo di autorespiratori se non si conoscono le caratteristiche dell'esposizione, ad esempio, durante le attività di manutenzione. EN 137 - Dispositivi di protezione delle vie respiratorie - Autorespiratori a circuito aperto ad aria compressa con maschera intera.
• Pericoli termici	:	Nessuno oltre a quelli indicati nelle sezioni precedenti.

8.2.3. Controlli dell'esposizione ambientale

Fare riferimento alla legislazione locale per restrizioni alle emissioni in atmosfera. Vedere la sezione 13 per i metodi di trattamento/smaltimento specifici del gas.

SEZIONE 9: Proprietà fisiche e chimiche

9.1. Informazioni sulle proprietà fisiche e chimiche fondamentali

Aspetto		
- Stato fisico a 20°C / 101.3kPa	:	Gassoso
- Colore	:	Incolore.
Odore	:	Spesso odorizzato. Dolciastro. Poco avvertibile a basse concentrazioni.
Soglia olfattiva	:	La soglia olfattiva è soggettiva e inadeguata per avvertire di una sovraesposizione.
pH	:	Non applicabile per i gas e le miscele di gas.
Punto di fusione / Punto di congelamento	:	-188 °C
Punto di ebollizione	:	-42,1 °C
Punto di infiammabilità	:	Non applicabile per i gas e le miscele di gas.
Velocità di evaporazione	:	Non applicabile per i gas e le miscele di gas.
Infiammabilità (solidi, gas)	:	Gas altamente infiammabile.
Limiti di infiammabilità o esplosività	:	1,7 – 10,8 vol %
Tensione di vapore [20°C]	:	8,3 bar(a)
Tensione di vapore [50°C]	:	17 bar(a)
Densità di vapore	:	1,55
Densità relativa, liquido (acqua=1)	:	0,58
Densità relativa, gas (aria=1)	:	1,5
Idrosolubilità	:	75 mg/l a 20°C
Coefficiente di ripartizione n-ottanolo/acqua (Log Kow)	:	2,36
Temperatura di autoaccensione	:	470 °C
Temperatura di decomposizione	:	Non applicabile.
Viscosità	:	Dati attendibili non disponibili.
Proprietà esplosive	:	Non applicabile.
Proprietà ossidanti	:	Non applicabile.

9.2. Altre informazioni

Massa molecolare	:	44,1 g/mol
Temperatura critica [°C]	:	96,7 °C
Altri dati	:	Gas/vapore più pesante dell'aria. Può accumularsi in spazi chiusi particolarmente al livello del suolo o al di sotto di esso.

SEZIONE 10: Stabilità e reattività

10.1. Reattività

Non ci sono ulteriori pericoli di reattività oltre a quelli descritti nei paragrafi sottostanti.

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10.2. Stabilità chimica

Stabile in condizioni normali.

10.3. Possibilità di reazioni pericolose

Può formare miscele esplosive con l'aria.
Può reagire violentemente con gli ossidanti.

10.4. Condizioni da evitare

Tenere lontano da fonti di calore/scintille/fiamme libere/superfici riscaldate – Non fumare.
Evitare l'umidità negli impianti.

10.5. Materiali incompatibili

Aria, agenti ossidanti.
Consultare la norma ISO 11114 per informazioni addizionali sulla compatibilità dei materiali.

10.6. Prodotti di decomposizione pericolosi

In condizioni normali di stoccaggio e utilizzo, non dovrebbero generarsi prodotti di decomposizione pericolosi.

SEZIONE 11: Informazioni tossicologiche

11.1. Informazioni sugli effetti tossicologici

Tossicità acuta : I criteri di classificazione non sono soddisfatti.

CL50 Inalazione - Ratto [ppm]	20000 ppm/4h

Corrosione/irritazione cutanea : Nessun effetto conosciuto da parte di questo prodotto.

Lesioni/irritazioni oculari gravi : Nessun effetto conosciuto da parte di questo prodotto.

Sensibilizzazione respiratoria o cutanea : Nessun effetto conosciuto da parte di questo prodotto.

Mutagenicità : Nessun effetto conosciuto da parte di questo prodotto.

Cancerogenicità : Nessun effetto conosciuto da parte di questo prodotto.

Tossico per la riproduzione: fertilità : Nessun effetto conosciuto da parte di questo prodotto.

Tossico per la riproduzione: feto : Nessun effetto conosciuto da parte di questo prodotto.

Tossicità specifica per organi bersaglio (STOT) — esposizione singola : Nessun effetto conosciuto da parte di questo prodotto.

Tossicità specifica per organi bersaglio (STOT) — esposizione ripetuta : Nessun effetto conosciuto da parte di questo prodotto.

Pericolo in caso di aspirazione : Non applicabile per i gas e le miscele di gas.

SEZIONE 12: Informazioni ecologiche

12.1. Tossicità

Valutazione : I criteri di classificazione non sono soddisfatti.

EC50 48h - Daphnia magna [mg/l] : 27,1 mg/l
EC50 72h - Algae [mg/l] : 11,9 mg/l
CL50 96h - Pesce [mg/l] : 49,9 mg/l

12.2. Persistenza e degradabilità

Valutazione : La sostanza è biodegradabile. È improbabile che possa persistere nell'ambiente.

12.3. Potenziale di bioaccumulo

Valutazione : Non considerato suscettibile di bioaccumulo a causa di un basso log Kow (log Kow < 4).
Fare riferimento alla sezione 9.

12.4. Mobilità nel suolo

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Valutazione : A causa della sua elevata volatilità, è improbabile che il prodotto causi inquinamento del suolo e delle falde acquifere.
La ripartizione nel suolo è improbabile.

12.5. Risultati della valutazione PBT e vPvB

Valutazione : Non classificato come PBT o vPvB.

12.6. Altri effetti avversi

Altri effetti avversi : Nessun effetto conosciuto da parte di questo prodotto.
Effetto sullo strato d'ozono : Nessun effetto sullo strato di ozono.
Potenziale di riscaldamento globale (GWP) [CO2=1] : 3
Effetti sul riscaldamento globale : Se scaricato in grosse quantità può contribuire all'effetto serra.
Contiene gas a effetto serra.

SEZIONE 13: Considerazioni sullo smaltimento

13.1. Metodi di trattamento dei rifiuti

Contattare il fornitore se si ritengono necessarie istruzioni.
Non scaricare in zone con rischio di formazione di atmosfere esplosive con l'aria. Il gas dovrebbe essere smaltito in opportuna torcia con dispositivo anti-ritorno di fiamma.
Non scaricare dove l'accumulo può essere pericoloso.
Assicurarsi che non siano superati i limiti di emissione previsti dalle normative locali o indicate nelle autorizzazioni.
Per ulteriori informazioni sui metodi di smaltimento idonei, consultare il Code of Practice EIGA Doc 30 "Disposal of gases", reperibile all'indirizzo http://www.eiga.eu.
Restituire al fornitore il prodotto non utilizzato nel recipiente originale.

Elenco dei rifiuti pericolosi (secondo la Decisione della Commissione 2000/532/CE e s.m.i.) : 16 05 04*: gas in contenitori a pressione (compresi gli halon), contenenti sostanze pericolose.

13.2. Informazioni supplementari

Il trattamento e lo smaltimento dei rifiuti da parte di imprese esterne deve essere effettuato in conformità alla normativa vigente.

SEZIONE 14: Informazioni sul trasporto

14.1. Numero ONU

Secondo i requisiti di ADR / RID / IMDG / IATA / ADN
Numero ONU : 1978

14.2. Nome di spedizione dell'ONU

Trasporto su strada/ferrovia (ADR/RID) : PROPANO
Trasporto per via aerea (ICAO-TI / IATA-DGR) : Propane
Trasporto per mare (IMDG) : PROPANE

14.3. Classi di pericolo connesso al trasporto

Etichettatura :

2.1 : Gas infiammabili.

Trasporto su strada/ferrovia (ADR/RID)
Classe : 2
Codice classificazione : 2F
N° di identificazione del pericolo : 23

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Codice di restrizione in galleria	:	B/D - Trasporto in cisterna: passaggio vietato nelle gallerie di categoria B, C, D, ed E; Altri trasporti: passaggio vietato nelle gallerie di categoria D, ed E

Trasporto per via aerea (ICAO-TI / IATA-DGR)

Classe/ Divisione(rischio(i) accessorio(i))	:	2.1

Trasporto per mare (IMDG)

Classe/ Divisione(rischio(i) accessorio(i))	:	2.1
Scheda di Emergenza (EmS) - Fuoco	:	F-D
Scheda di Emergenza (EmS) - Sversamento	:	S-U

14.4. Gruppo di imballaggio

Trasporto su strada/ferrovia (ADR/RID)	:	Non applicabile
Trasporto per via aerea (ICAO-TI / IATA-DGR)	:	Non applicabile
Trasporto per mare (IMDG)	:	Non applicabile

14.5. Pericoli per l'ambiente

Trasporto su strada/ferrovia (ADR/RID)	:	Nessuno(a).
Trasporto per via aerea (ICAO-TI / IATA-DGR)	:	Nessuno(a).
Trasporto per mare (IMDG)	:	Nessuno(a).

14.6. Precauzioni speciali per gli utilizzatori

Istruzioni di imballaggio

Trasporto su strada/ferrovia (ADR/RID)	:	P200
Trasporto per via aerea (ICAO-TI / IATA-DGR)		
Aerei passeggeri e cargo	:	Vietato.
Solo aerei cargo	:	200.
Trasporto per mare (IMDG)	:	P200

Misure di precauzione per il trasporto : Evitare il trasporto su veicoli dove la zona di carico non è separata dall'abitacolo.
Assicurarsi che il conducente sia informato del rischio potenziale del carico e sappia cosa fare in caso di incidente o di emergenza.
Prima di iniziare il trasporto:
- Assicurarsi che vi sia adeguata ventilazione.
- Accertarsi che il carico sia ben assicurato.
- Assicurarsi che la valvola della bombola sia chiusa e che non perda.
- Assicurarsi che il tappo cieco della valvola, ove fornito, sia correttamente montato.
- Assicurarsi che il cappellotto, ove fornito, sia correttamente montato.

14.7. Trasporto di rinfuse secondo l'allegato II di MARPOL ed il codice IBC

Non applicabile.

SEZIONE 15: Informazioni sulla regolamentazione

15.1. Disposizioni legislative e regolamentari su salute, sicurezza e ambiente specifiche per la sostanza o la miscela

Normative UE

Restrizioni consigliate	:	Nessuno(a).
Direttiva Seveso: 2012/18/UE (Seveso III)	:	Indicata nella lista.

Norme nazionali

Riferimento normativo	:	Assicurare l'osservanza di tutte le norme nazionali e locali.

15.2. Valutazione della sicurezza chimica

Per questo prodotto è stata condotta una valutazione della sicurezza chimica (CSA).

SEZIONE 16: Altre informazioni

Indicazioni di modifiche	:	Scheda di dati di sicurezza redatta in accordo con il Regolamento (UE) 2015/830.

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Sezione	Elemento modificato	Modifica	Note
	Data di revisione	Modificato	Logo aziendale
1.1		Modificato	Nome della società
1.3		Modificato	E-mail
1.3		Modificato	Website

Abbreviazioni ed acronimi : ATE - Acute Toxicity Estimate - Stima della tossicità acuta
CLP - Classification Labelling Packaging - Regolamento (CE) N. 1272/2008 relativo alla classificazione, all'etichettatura e all'imballaggio delle sostanze e delle miscele
REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals - Regolamento (CE) N. 1907/2006 concernente la registrazione, la valutazione, l'autorizzazione e la restrizione delle sostanze chimiche
EINECS - European Inventory of Existing Commercial Chemical Substances - Registro europeo delle sostanze chimiche in commercio
n. CAS - Chemical Abstract Service number - Identificativo numerico attribuito dal Chemical Abstract Service alle sostanze chimiche
DPI - Dispositivi di Protezione Individuale
LC50 - Lethal Concentration 50 - Concentrazione letale per il 50% della popolazione sottoposta a test
RMM - Risk Management Measures - Misure di gestione dei rischi
PBT - Persistent, Bioaccumulative and Toxic - Persistente, bioaccumulabile e tossico
vPvB - very Persistent and very Bioaccumulative - Molto persistente e molto bioaccumulabile
STOT-SE: Specific Target Organ Toxicity-Single Exposure - Tossicità specifica per organi bersaglio-esposizione singola
CSA - Chemical Safety Assessment - Valutazione della sicurezza chimica
EN - European Standard - Norma europea
ONU - Organizzazione delle Nazioni Unite
ADR - Accord européen relatif au transport international des marchandises Dangereuses par Route - Accordo europeo relativo al trasporto internazionale di merci pericolose su strada
IATA - International Air Transport Association - Associazione internazionale del trasporto aereo
IMDG code - International Maritime Dangerous Goods code - Codice per il trasporto via mare di merci pericolose
RID - Règlement concernant le trasport International ferroviaire des merchandises Dangereuses - Regolamento concernente il trasporto internazionale di merci pericolose per ferrovia
WGK - Wassergefährdungsklassen - Classi di pericolo per l'acqua
STOT-RE: Specific Target Organ Toxicity-Repeated Exposure - Tossicità specifica per organi bersaglio-esposizione ripetuta
UFI - Identificatore unico di formula

Consigli per la formazione : Assicurarsi che gli operatori capiscano il pericolo dell'infiammabilità.

Dati supplementari : Classificazione in conformità con le procedure e i metodi di calcolo del Regolamento (CE) n. 1272/2008 (CLP).
I riferimenti bibliografici e le fonti di dati principali sono conservati e mantenuti aggiornati nel documento “Classification and labelling guide” (EIGA Doc. 169) reperibile all'indirizzo http://www.eiga.eu.

RINUNCIA ALLA RESPONSABILITA' : Prima di utilizzare questo prodotto in qualsiasi nuovo processo o esperimento, deve essere condotto uno studio approfondito sulla sicurezza e sulla compatibilità del prodotto stesso con i materiali.
Le informazioni contenute in questo documento sono da ritenersi valide al momento della stampa.
Sebbene sia stata posta la massima cura nella redazione di questo documento, la Società non deve essere ritenuta responsabile per eventuali danni o infortuni derivanti dal suo utilizzo.

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Fine del documento

22.2 Compressor oil safety data sheet

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SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended.

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

1.1 Product identifier
Product name: **HUILE ESTER 160SZ/160Z (BULK)5402030P01B**

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses: Refrigeration Lubricants.
Uses advised against: None identified.

1.3 Details of the supplier of the safety data sheet
Supplier

Company Name:	LUBRIZOL FRANCE
Address:	25 QUAI DE FRANCE CS 61062 76173 ROUEN CEDEX, 76173 FR
Telephone:	(33) 02.35.58.14.00
E-mail contact:	EUSDS@lubrizol.com {Lubrizol Safety Data Sheets can be obtained at www.mylubrizol.com}

1.4 Emergency telephone number:
FOR TRANSPORT EMERGENCY CALL CHEMTREC (+1) 703 527 3887 OR WITHIN FRANCE 09.75.18.14.07

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture
This product does not meet the classification requirements of the current European legislation.

Classification according to Regulation (EC) No 1272/2008 as amended.
Not classified

2.2 Label elements according to Regulation (EC) No 1272/2008 as amended
Not applicable

2.3 Other hazards:

Endocrine Disruption- Toxicity
The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

Endocrine Disruption- Ecotoxicity
The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

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SECTION 3: Composition/information on ingredients

3.2 Mixtures
Regulation No. 1272/2008.
This material has no known hazards under applicable laws.

See Section 15 for Regulation (EC) No. 1907/2006 REACH Article 59(1). Candidate List (Substances of Very High Concern (SVHC))

SECTION 4: First aid measures

4.1 Description of first aid measures

Inhalation:	Remove exposed person to fresh air if adverse effects are observed.
Eye contact:	Flush thoroughly with water. If irritation occurs, get medical assistance. Remove contact lenses, if present and easy to do. Continue rinsing.
Skin Contact:	Take off contaminated clothing and wash before re-use. Wash with soap and water. If skin irritation occurs, get medical attention.
Ingestion:	Treat symptomatically. Get medical attention. Do not induce vomiting. Rinse mouth. Get medical attention if symptoms occur.
4.2 Most important symptoms and effects, both acute and delayed:	See section 11.

4.3 Indication of any immediate medical attention and special treatment needed

Hazards:	No data available.
Treatment:	Treat symptomatically.

SECTION 5: Firefighting measures

General Fire Hazards:	No unusual fire or explosion hazards noted.
5.1 Extinguishing media	
Suitable extinguishing media:	CO2, dry chemical, foam, water spray, water fog.
Unsuitable extinguishing media:	Do not use water jet as an extinguisher, as this will spread the fire.
5.2 Special hazards arising from the substance or mixture:	A solid stream of water will spread the burning material. Material creates a special hazard because it floats on water. See section 10 for additional information.

5.3 Advice for firefighters

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Special fire fighting procedures:	No data available.
Special protective equipment for fire-fighters:	Recommend wearing self-contained breathing apparatus.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:	Personal Protective Equipment must be worn, see Personal Protection Section for PPE recommendations.
6.2 Environmental Precautions:	Avoid release to the environment. Do not contaminate water sources or sewer. Environmental manager must be informed of all major spillages. Prevent further leakage or spillage if safe to do so.
6.3 Methods and material for containment and cleaning up:	Dike far ahead of larger spill for later recovery and disposal. Pick up free liquid for recycle and/or disposal. Residual liquid can be absorbed on inert material.
6.4 Reference to other sections:	See sections 8 and 13 for additional information.

SECTION 7: Handling and storage:

7.1 Precautions for safe handling:	Observe good industrial hygiene practices. Provide adequate ventilation. Wear appropriate personal protective equipment.
Maximum Handling Temperature:	Not determined.
7.2 Conditions for safe storage, including any incompatibilities:	Store away from incompatible materials. See section 10 for incompatible materials.
Maximum Storage Temperature:	Not determined.
7.3 Specific end use(s):	End uses are listed in an attached exposure scenario when one is required.

SECTION 8: Exposure controls/personal protection

8.1 Control Parameters

Occupational Exposure Limits

None of the components have assigned exposure limits.

8.2 Exposure controls

Appropriate engineering controls:	No special requirements under ordinary conditions of use and with adequate ventilation.

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Individual protection measures, such as personal protective equipment

General information: Please follow the recommended personal protective equipment (PPE) guidelines below and refer to the appropriate EN standard where applicable. Use personal protective equipment as required.

Eye/face protection: If contact is likely, safety glasses with side shields are recommended. Eye protection should meet the standards set out in EN 166.

Skin protection

Hand Protection: Neoprene. Suitable gloves can be recommended by the glove supplier. Nitrile.

General: Because specific work environments and material handling practices vary, safety procedures should be specific for each intended application. The correct choice of protective gloves depends upon the chemicals being handled, and the conditions of work and use. Most gloves provide protection for only a limited time before they must be discarded and replaced (even the best chemically resistant gloves will break down after repeated chemical exposures). Gloves should be chosen in consultation with the supplier / manufacturer and taking account of a full assessment of the working conditions. For typical use and handling of chemical substances, gloves should meet the standards set out in EN 374. For applications involving mechanical risks with potential for abrasion or puncture, the standards set out in EN 388 should be considered. For tasks involving thermal hazards, the standards set out in EN 407 should be considered.

Break-through time: Breakthrough time data are generated by glove manufacturers under laboratory test conditions and represent how long a glove can be expected to provide effective permeation resistance. It is important when following breakthrough time recommendations that actual workplace conditions are taken into account. Always consult with your glove supplier for up-to-date technical information on breakthrough times for the recommended glove type.
For continuous contact, we suggest gloves with a minimum breakthrough time of 240 minutes, or > 480 minutes if suitable gloves can be obtained. If suitable gloves are not available to offer that level of protection, gloves with shorter breakthrough times may be acceptable as long as appropriate glove maintenance and replacement regimes are determined and adhered to.
For short-term, transient exposures and splash protection, gloves with shorter breakthrough times may commonly be used. Therefore, appropriate maintenance and replacement regimes must be determined and rigorously followed.

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Glove thickness:	For general applications, we recommend gloves with a thickness typically greater than 0.35 mm. It is important to note that glove thickness is not the only predictor of glove resistance to a specific chemical, as the permeation efficiency of the glove will be dependent on the exact composition of the glove material. Therefore, glove selection should also be based on consideration of the task requirements and knowledge of breakthrough times. Glove thickness may also vary depending on the glove manufacturer, the glove type and the glove model. Therefore, the manufacturers' technical data should always be taken into account to ensure selection of the most appropriate glove for the task. Note: Depending on the activity being conducted, gloves of varying thickness may be required for specific tasks. For example: Thinner gloves (down to 0.1 mm or less) may be required where a high degree of manual dexterity is needed. However, these gloves are only likely to give short duration protection and would normally be just for single use applications, before being disposed of. Thicker gloves (up to 3 mm or more) may be required where there is a mechanical (as well as a chemical) risk i.e. where there is abrasion or puncture potential.
Other:	No data available.
Respiratory Protection:	A respiratory protection program compliant with all applicable regulations must be followed whenever workplace conditions require the use of a respirator. Under normal use conditions, respirator is not usually required. Use appropriate respiratory protection if exposure to dust particles, mist or vapors is likely. Use self-contained breathing apparatus for entry into confined space, for other poorly ventilated areas and for large spill clean-up sites. Respiratory Protective Equipment (RPE) is not normally required where there is adequate natural or local exhaust ventilation to control exposure. In case of insufficient ventilation, wear suitable respiratory equipment. The correct choice of respiratory protection depends upon the chemicals being handled, the conditions of work and use, and the condition of the respiratory equipment. Safety procedures should be developed for each intended application. Respiratory protection equipment should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions. Please refer to the relevant EN standards for the RPE selected.
Hygiene measures:	Observe good industrial hygiene practices.
Environmental Controls:	No data available. See section 6 for details.

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SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance

Physical state:	liquid
Form:	liquid
Color:	Colorless to yellow
Odor:	Mild
Odor Threshold:	No data available.
pH:	Not applicable
Freezing point:	No data available.
Boiling Point:	No data available.
Flash Point:	270 °C (Tagliabue Open Cup)
Evaporation Rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability Limit - Upper (%):	No data available.
Flammability Limit - Lower (%):	No data available.
Vapor pressure:	No data available.
Relative vapor density:	No data available.
Relative density:	0.977 (20 °C)
Solubility(ies)	
Solubility in Water:	Insoluble in water
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Autoignition Temperature:	No data available.
Decomposition Temperature:	No data available.
Viscosity:	33.7 mm2/s (40 °C); 5.9 mm2/s (100 °C)
Explosive properties:	No data available.
Oxidizing properties:	No data available.
VOC Content:	No data available.

Particle characteristics

Particle Size:	Not applicable
Particle Size Distribution:	Not applicable
Specific surface area:	Not applicable
Surface charge/Zeta potential:	Not applicable
Assessment:	Not applicable
Shape:	Not applicable
Crystallinity:	Not applicable
Surface treatment:	Not applicable

Other information

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Pour Point Temperature: Approximate -46 °C

SECTION 10: Stability and reactivity

10.1 Reactivity: No data available.

10.2 Chemical Stability: Material is stable under normal conditions.

10.3 Possibility of hazardous reactions: Will not occur.

10.4 Conditions to avoid: Do not expose to excessive heat, ignition sources, or oxidizing materials.

10.5 Incompatible Materials: Strong acids. Oxidizing agents. Strong bases.

10.6 Hazardous Decomposition Products: Thermal decomposition or combustion may generate smoke, carbon monoxide, carbon dioxide, and other products of incomplete combustion.

SECTION 11: Toxicological information

Information on likely routes of exposure

Inhalation: No data available.

Ingestion: No data available.

Skin Contact: Causes mild skin irritation.

Eye contact: No data available.

11.1 Information on toxicological effects

Acute toxicity

Oral
Product: Ingestion of this material may cause gastric disturbances. Not classified for acute toxicity based on available data.

Dermal
Product: Not classified for acute toxicity based on available data.

Inhalation
Product: Not classified for acute toxicity based on available data.

Skin Corrosion/Irritation:
Product: Remarks: Causes mild skin irritation. Prolonged or repeated contact may cause irritation.

Serious Eye Damage/Eye Irritation:
Product: Remarks: Not classified as a primary eye irritant.

Respiratory sensitization:
No data available

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Skin sensitization:

No data available

Specific Target Organ Toxicity - Single Exposure:

Product: If material is misted or if vapors are generated from heating, exposure may cause irritation of mucous membranes and the upper respiratory tract.

No data available

Aspiration Hazard:

No data available

Chronic Effects

Carcinogenicity:

No data available

Germ Cell Mutagenicity:

No data available

Reproductive toxicity:

No data available

Specific Target Organ Toxicity - Repeated Exposure:

No data available

11.2 Information on health hazards

Other hazards

Product: If material is misted or if vapors are generated from heating, exposure may cause irritation of mucous membranes and the upper respiratory tract.;

Endocrine Disruption

Product: The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.;

SECTION 12: Ecological information

12.1 Ecotoxicity

Fish

No data available

Aquatic Invertebrates

No data available

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Toxicity to Aquatic Plants

No data available

Toxicity to soil dwelling organisms

No data available

Sediment Toxicity

No data available

Toxicity to Terrestrial Plants

No data available

Toxicity to Above-Ground Organisms

No data available

Toxicity to microorganisms

No data available

12.2 Persistence and Degradability

Biodegradation

Product: OECD TG 301 B, 63.1 %, 28 d, Not readily degradable.

BOD/COD Ratio

No data available

12.3 Bioaccumulative potential

Bioconcentration Factor (BCF)

No data available

Partition Coefficient n-octanol / water (log Kow)

No data available

12.4 Mobility:

No data available

12.5 Results of PBT and vPvB assessment

No data available

12.6 Endocrine Disruption:

Product: The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

12.7 Other adverse effects

No data available

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Disposal methods: Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations. Dispose of packaging or containers in accordance with local, regional, national and international regulations. Empty container contains product residue which may exhibit hazards of product.

Contaminated Packaging: Container packaging may exhibit hazards.

SECTION 14: Transport information

ADR
Not regulated.

IMDG
Not regulated.

IATA
Not regulated.

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code
None known.

Shipping descriptions may vary based on mode of transport, quantities, temperature of the material, package size, and/or origin and destination. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material. For transportation, steps must be taken to prevent load shifting or materials falling, and all relating legal statutes should be obeyed. Review classification requirements before shipping materials at elevated temperatures.

SECTION 15: Regulatory information

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

EU Regulations
EU. Regulation 1005/2009/EC on substances that deplete the ozone layer, Annex I, Controlled Substances:
None present or none present in regulated quantities.

EU. Regulation 2019/1021/EU on persistent organic pollutants (POPs) (recast), as amended:
None present or none present in regulated quantities.

EU. Chemicals Subject to PIC Procedure: Regulation 649/2012/EU on export and import of dangerous chemicals, as amended:
None present or none present in regulated quantities.

Regulation (EC) No. 1907/2006, REACH Article 59(1). Candidate List:
None present or none present in regulated quantities.

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Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorisation, as amended:
None present or none present in regulated quantities.

Regulation (EC) No. 1907/2006 Annex XVII Substances subject to restriction on marketing and use:
None present or none present in regulated quantities.

Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens and mutagens at work.:
None present or none present in regulated quantities.

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breast feeding.:
None present or none present in regulated quantities.

EU. Directive 2012/18/EU (SEVESO III) on major accident hazards involving dangerous substances, Annex I:

None present or none present in regulated quantities.

EU. Regulation No. 166/2006 PRTR (Pollutant Release and Transfer Registry), Annex II: Pollutants:
None present or none present in regulated quantities.

Directive 98/24/EC on the protection of workers from the risks related to chemical agents at work:
None present or none present in regulated quantities.

Inventory Status

Australia (AIIC)
All components are in compliance with chemical notification requirements in Australia.

Canada (DSL/NDSL)
All substances contained in this product are in compliance with the Canadian Environmental Protection Act and are present on the Domestic Substances List (DSL) or are exempt.

China (IECSC)
All components of this product are listed on the Inventory of Existing Chemical Substances in China.

European Union (REACh)
To obtain information on the REACH compliance status of this product, please e-mail REACH@SDSInquiries.com.

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Great Britain (UK REACH)
To obtain information on the UK REACH compliance status of this product, please e-mail REACH@SDSInquiries.com.

Japan (ENCS)
All components are in compliance with the Chemical Substances Control Law of Japan.

Korea (ECL)
All components are in compliance in Korea.

New Zealand (NZIoC)
All components are in compliance with chemical notification requirements in New Zealand.

Philippines (PICCS)
All components are in compliance with the Philippines Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 (R.A. 6969).

Switzerland (SWISS)
All components are in compliance with the Environmentally Hazardous Substances Ordinance in Switzerland.

Taiwan (TCSCA)
All components of this product are listed on the Taiwan inventory.

Turkey (KKDIK)
To obtain information on the KKDIK compliance status of this product, please e-mail REACH@SDSInquiries.com.

United States (TSCA)
All substances contained in this product are listed on the TSCA inventory or are exempt.

The information that was used to confirm the compliance status of this product may deviate from the chemical information shown in Section 3.

15.2 Chemical safety assessment: No Chemical Safety Assessment has been carried out.

SECTION 16: Other information

Key literature references and sources for data: Internal company data and other publically available resources.

Wording of the H-statements in section 2 and 3: none
none

Other information:

Abbreviations and acronyms:

ACGIH – American Conference of Governmental Industrial Hygienist
ADR - International Carriage of Dangerous Goods by Road
AICS - Australian Inventory of Chemical Substances
ATEmix - Acute Toxicity Estimate for the mixture

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BCF - Bio concentration factor
DMSO - Dimethyl sulfoxide
DSL - Domestic Substance List
EC50 - Effective concentration that gives a response in 50% of the population
ECHA - European Chemical Agency
ECL - Existing Chemical List
ENCS - Existing and New Chemical Substances
EPA – Environmental Protection Agency
IARC - International Agency for Research on Cancer
IATA - International Air Transport Association
IECSC - Inventory of Existing Chemical Substances
IMDG - International Maritime Dangerous Goods
IP 346 – A gravimetric assay used to determine the percentage weight of polycyclic aromatics in oil, via a DMSO extraction technique
LC50 - Lethal concentration required to kill 50% of the population
MARPOL - International Conventions for the Prevention of Pollution from Ships
NDSL - Non Domestic Substance List
NOAEC - No observed adverse effect concentration
NOAEL - No observed adverse effect level
NOEC - No observed effective concentration
NTP - National Toxicology Program
NZloc - New Zealand Inventory of chemicals
OECD TG - Organization for Economic Cooperation and Development Test Guidelines
OSHA – Occupational, Safety, and Health Administration
PBT – Persistent bioaccumulative toxic chemical
PEL – Permissible Exposure Level
PICCS - Philippine Inventory of Chemicals and Chemical Substances
PPE - Personal Protective Equipment
PRTR - Pollutant Release and Transfer Register
REACH - Registration, Evaluation, Authorization & restriction of Chemicals
SVHC - Substance of Very High Concern
SWISS - Switzerland chemical ordinance
TCSCA - Toxic Chemical Substance Control Act
TLV – Threshold Limit Value
TSCA - Toxic Substances Control Act
TWA – Time Weighted Average
vPvB – very Persistent very Bioaccumulative

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