HEAT PUMPS

IPHP 002÷008

OPERATING AND MAINTENANCE MANUAL

WARNING
This unit uses R290 flammable refrigerant (propane).
Only experienced, responsible personnel are allowed to use the unit; incorrect use may lead to serious harm to people and damage to property.

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CHAPTER 1

GENERAL INFORMATION

1.1 Description

The machines described in this manual may hereinafter be referred to as “HEAT PUMPS”.
This manual is written for those responsible for the installation, use and maintenance of the unit.
These units are designed solely for civil applications, for cooling (when working as chillers - “SUMMER” mode) or heating (when working as heat pumps - “WINTER” mode) the liquid flow.
All the observations concerning the machine component usually (in SUMMER mode) called a “condenser” also hold true for WINTER mode, bearing in mind that in the latter case the cooling cycle is inverted and that same component works as an evaporator.
In these conditions, the same applies also to the evaporator.
Primary brand components were used and the entire process of design, production and control of the machines was carried out in accordance with ISO 9001 and IEC EN 60335-1 standards.
The liquid to be cooled must be compatible with the materials used. This analysis must be made before purchasing or installing the unit.
Here below the term “PRESSURE” will be used to indicate the gauge pressure.

CAUTION

This manual provides the user, the installer and the maintenance technician with all the technical information required to install, operate the machine and carry out routine maintenance operations that ensure a long service life.
Use only original spare parts for repairs and replacements. Failure to comply with this requirement cannot guarantee the safety of the machine.
Requests for SPARE PARTS and for any INFORMATION concerning the unit must be sent to the distributor or to the nearest service centre, providing the MODEL and SERIAL NUMBER shown on the machine data plate and in this manual.

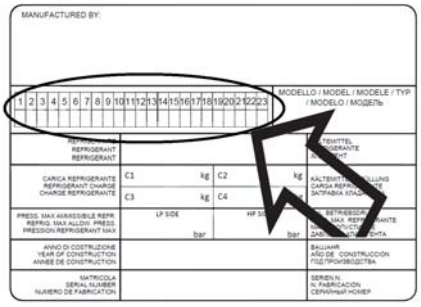
1.2 Data plate

The data plate attached to the machine shows the main technical data:

MODEL and CODE	The model number and the code identify the size of the unit and the type of construction.
MANUAL	Code number of the manual.
SERIAL NUMBER	Construction number of the unit.
YEAR OF CONSTRUCTION	The year of the final machine test.
VOLTAGES/PHASES/FREQUENCY	Electrical power supply characteristics.
MAX. CONSUMPTION	Unit current input in limit working conditions.
POWER INSTALLED	Unit power input in limit working conditions.
PROTECTION LEVEL	Protection level of the entire machine, according to European Standard EN 60529.
ELECTRICAL DIAGRAM	Indicates the electrical diagram number.
REFRIGERANT	This is the refrigerant fluid in the unit.
GLOBAL WARMING POTENTIAL	Global warming potential.
REFRIGERANT CHARGE	Quantity of refrigerant fluid contained in the unit.
PRESS. PERMISSIBLE HP SIDE (PS)	This is the design pressure of the HP side refrigeration circuit.
PRESS. PERMISSIBLE LP SIDE (PS)	This is the design pressure of the LP side refrigeration circuit.
PERMITTED TEMP. HP SIDE (TS)	Cooling circuit design temperature (high pressure side).
PERMITTED TEMP. LP SIDE (TS)	Cooling circuit design temperature (low pressure side).
FLUID CIRC. OF USE	Fluid cooled or heated by the machine (usually: water).
PRESS. MAX. ALLOWED (PS)	Max. design pressure of the user circuit.
PERMITTED TEMPERATURE (TS)	Min. and max. design temperature of the user circuit, not to be confused with the maximum operating temperature, defined at the project quote stage.
SOUND PRESSURE LEVEL	Free field sound pressure level in hemispherical radiation conditions (open field) at a distance of 1m from the condenser side of the unit and a height of 1.6m from the ground.
AMBIENT TEMPERATURE	Minimum and maximum value of the cooling or heating air temperature.
WEIGHT	Weight of the unit without packaging.

1.3 How to interpret the alphanumeric string

The alphanumeric string-code is reproduced on the metallic plate on the manual.



The empty alphanumerical string is circled in the adjacent figure. Each position will be defined by an alphanumeric value (0, 1, 2, A, B, etc.). Specific unit features are established by the position and the alphanumeric values.
Please find below each alphanumeric values position explained, which can be used.

	POS.	VALUE	DESCRIPTION
VOLTAGE	1	2	230/1/50
		D	400/3+N/50
REFRIGERANT	2	B	R290
SYSTEM COOLANT LOAD	3	0	LOAD COMPLETE
		1	PRESSURISATION IN NITROGEN
HYDRAULIC UNIT	4	0	NONE
		L	P1
FAN CONTROL	5	1	EC
EVAP. ANTIFREEZE PROTECTION	6	1	YES
		0	NO
CONDENSATE TRAY RESISTANCE	7	1	YES
		0	NO
CONDENSING BTR PROTECTION	8	0	NONE
		3	GRID
PREPAINTED CONDENSING BTRS	9	1	YES
		0	NO
PRODUCT TYPE	10	0	STANDARD
		X	SPECIAL

1.4 Performance

Unit performance depends mainly on the flow rate and temperature of the chilled water and on the ambient temperature.
These data are specified in the quote, and constitute the reference values.

1.5 Sound level measurements

CAUTION

⚠ In case of sound pressure levels exceeding 80dB(A) during maintenance of the installation, the maintenance technician must be provided with appropriate PPE.

Model	Lp dB(A) *	Lw dB(A) **
IPHP 002	48.0	61.0
IPHP 004	50.0	63.0
IPHP 006	54.0	67.0
IPHP 008	57.0	70.0

* at a distance of 1m
** global

Test conditions

The sound levels refer to the operation of the unit (in CH mode) at full load under nominal conditions.
Sound pressure level in hemispherical irradiation conditions at a distance of 1m from the condenser side of the unit and height of 1.6m from the ground. Values with tolerance of ± 2 dB.
Sound pressure level: according to ISO 3744.

CHAPTER 2

SAFETY

This system is designed for safety in its intended use, provided it is installed, commissioned, and serviced in compliance with the instructions given in the present manual.
The company excludes any contractual and non-contractual liability for damage caused to people, animals or property, due to installation, adjustment and maintenance errors, improper use or partial or superficial reading of the information contained in this manual.

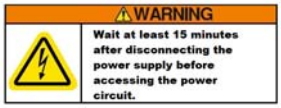
CAUTION

⚠ All persons who interact with the system must be informed of the indications, regulations and prescriptions given in this manual.

Pay special attention when working on the unit: the unit contains electrical components that operate at mains voltage and also moving parts such as fan units.
It must therefore be isolated from the electricity supply network before being opened.

WARNING

⚠ The motors contain DC bus capacitors that can remain charged even when the frequency converter is not powered. Failure to comply with the indicated waiting time after disconnecting the power supply and before carrying out maintenance or repair work, may cause serious or fatal injuries.
1. Stop the engine.
2. Disconnect the AC network.
3. Wait for the capacitors to discharge completely before performing any maintenance or repair work. The waiting time is 15 minutes.



Any maintenance operation that is outside the usual interventions must be carried out by authorised operators that are informed and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.
Keep unauthorized persons (e.g. children) away from the place of installation of the unit.

2.1 General information

When handling or servicing the unit, personnel must work safely and comply with the prescriptions concerning health and safety in the installation site.

CAUTION

⚠ Personnel must be authorised, informed and trained on the specific risks from flammable gases according to good practices and/or current regulations in accordance with ANNEX HH IEC 60335-2-40.

CAUTION

⚠ Numerous accidents that occur during operation and maintenance of the units are caused by failure to comply with basic safety rules or precautions.

An accident can often be avoided by recognising a situation that is potentially hazardous.
The user must ensure that all personnel involved in operating and servicing the unit **have read and understood** all the warnings, precautions, prohibitions and notes given in this manual and attached to the machine.
Improper operation or maintenance of the unit and auxiliary equipment could be dangerous and result in an accident causing injury or death.
It is not possible to cover all possible circumstances that could feasibly give rise to potential hazards for persons.
The warnings in this manual are therefore not all-inclusive.
If the user adopts operational procedures or uses tools or working procedures that are not specifically recommended, care must be taken to ensure that the unit and the auxiliary equipment are not damaged or made unsafe and that no risks emerge in relation to persons or property.

CAUTION

⚠ Use exclusively suitable methods that offer the maximum environmental respect in daily operation, routine or supplementary maintenance, and at the time of decommissioning of the system.

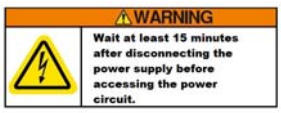
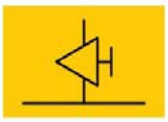
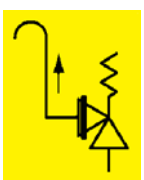
Any improper conduct or incorrect use of the unit by the user automatically releases the manufacturer from all liability for possible damage, injury and/or accidents affecting persons or property.
Arbitrary modifications made to the unit will automatically invalidate all forms of guarantee provided by the manufacturer.

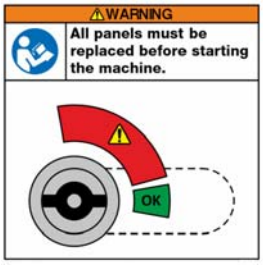
WARNING

⚠ The hot / cold water produced by the units cannot be used directly for hygienic-sanitary or food purposes. In the case of such applications, the installer is responsible for fitting an intermediate exchanger. If the intermediate exchanger is not fitted, the installer should affix a notice stating “non-drinking water”.

2.2 Symbols

The following symbols are shown on the stickers on the unit as well as on the overall dimension drawing and refrigeration circuits in this manual. Their meaning is the following:

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	Machine water-inlet		Machine water outlet
	Indication of the axis of reference for lifting operations		Drain point to empty the unit of water
	The frequency converter contains DC bus capacitors that can remain charged even when the frequency converter is not powered. After disconnecting the electricity supply, wait at least 15 minutes before accessing the power circuit.		Risk of injury due to sharp edges
	If the product is marked with this symbol, this means that the electric and electronic products cannot be disposed of together with non-separated domestic waste.		Air bleed valve
	Moving parts can crush and cut. Do not operate with guard removed. Follow lockout procedure before servicing.		Risk of burns from contact with high-temperature surfaces
	Hazardous voltage. Disconnect power before servicing or cleaning.		Safety valve discharge

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	Attention: the unit contains R290 flammable refrigerant (propane)		Danger: inflammable material
	Before starting the machine, make sure that all the panels have been correctly installed. Check that the key locks on the panels are in the OK position.		Unit with nitrogen pre-charge (see 10.2.3 “Coolant Charging Procedure”)

2.3 Instructions for the user

The machines must be installed in safe places, free of areas with potentially explosive atmospheres. They must be connected to electrical systems designed according to current standards, in areas compliant with the standards imposed by the Fire Brigade and in environments compliant with local building standards.
Within the potentially explosive areas generated by the machine, also taking into account the national regulations of the country of use, it is necessary to:

- Do not install equipment that is unsuitable for use in these potentially explosive zones (the minimum requirements of the equipment are: 3G IIB T4);
- Avoid naked flames, sparks and hot works;
- Avoid the presence of sources of ignition due to processes that may generate remote triggers (ionising and non-ionising radiation);
- Avoid the direct and indirect effects of lightning;
- Avoid electrostatic charges;
- Avoid interference with potentially hazardous elements such as drains, openings in the earth, basements, power lines, stores of flammable substances, railways, motorways etc.

As the refrigerant gas used is heavier than air, even a small gas leak, which in itself is not dangerous, can cause a build-up of gas if it infiltrates into underground areas, forming pockets.
A suitable “safety” distance should be assured also for chilling systems installed outdoors, in order to minimise the risk that flammable concentrations enter premises occupied by humans (e.g. through windows, ventilation openings, where people meet outdoors, etc.). However, external wind speeds tend to be quite high (compared to indoor environments) even when the air seems “still”, so also the amount of flammable mixture should be adjusted to consider the additional dispersion caused by the surrounding air.

WARNING

⚠ The safety zone/area around the machine must be at least 1 meter for the IPHP 002-004 and 1.5 metres for forms IPHP 006-008. Potentially explosive atmospheres may build up inside this area, and it is therefore necessary to avoid sources of ignition, as defined in standard EN378-2.

For installation precautions refer to paragraph 4.2 “Installation precautions” .

2.4 Safety aspects relating to maintenance

WARNING

⚠ Maintainers working on the electrical components or on the components of the refrigerant circuit must be authorised, informed and trained on the specific risks from flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.

Electrostatic charge may build up if refrigerant is leaked into a potentially explosive atmosphere.
To avoid this build-up, antistatic clothing (complying with Standard EN 1149-5) must be worn during machine inspection and maintenance.

DANGER

⚠ **Never use sharp tools to clean the condensing coil. The chiller contains flammable refrigerant.**

Do not clean the chiller with detergent liquid at temperatures greater than 50°C. A temperature greater than that which has been indicated could result in excess pressure inside the cooling circuit, which in turn could cause the refrigerant safety valve to open.
All repairs of the refrigerant circuit must be carried out by authorised, informed and trained operators on the specific risks of flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.
The maintenance operator must also be:

- aware of the potential risks present in explosive atmospheres, and therefore able to prevent them;
- knowledgeable of the work procedure, in order to avoid - as far as possible - the risk of inflammable refrigerant being leaked into the atmosphere.

In the case of extraordinary maintenance operations, the refrigerant circuit must be emptied using a machine suitable for recovering the type of flammable refrigerant in question. During the course of these operations, the surrounding area must be properly ventilated and monitored with the aid of a leak detection device.
In order to avoid creating potential ignition sources, only roller pipe cutters should be used to open the refrigerant circuit.
All subsequent brazing operations must be carried out by authorised operators, informed, trained and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with Annex HH IEC 60335-2-40 and taking care to flush the refrigeration circuit with nitrogen. The maintenance operations must be carried out in accordance with the national standards and regulations relating to explosive atmospheres (e.g. reference to the **EN 1127-1 standard**).

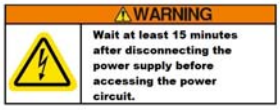
2.5 Essential safety rules for the inverter

Before carrying out any maintenance / replacement of the inverter:

- **Disconnect the inverter and external control circuits from the mains power supply by setting the main switch to 0 and wait at least 15 minutes.**
- Always use a multimeter to make sure there is no dangerous voltage on the heads of the terminals.
- Always make sure the motor is completely idle; a freely rotating motor may produce dangerous voltage on the inverter terminals, even when the inverter isn't powered.
- Make sure the dissipator temperature isn't high: risk of serious burns from contact with the dissipator.
- When the inverter is connected to the mains supply, the U, V, W motor terminals are live even if the motor isn't running.
- Do not take insulation resistance or dielectric rigidity measurements while the inverter is connected.
- The control terminals are insulated from the mains potential. There may, however, be dangerous voltage on the relay outputs even when the inverter isn't connected to the mains.
- The inverter must only be used for the purposes specified by the manufacturer. Do not make any unauthorised repair or alteration to the component.

WARNING

⚠ The frequency converter contains DC bus capacitors that can remain charged even when the frequency converter is not powered. Failure to comply with the indicated waiting time after disconnecting the power supply and before carrying out maintenance or repair work, may cause serious or fatal injuries.
1. Stop the engine.
2. Disconnect the AC network.
3. Wait for the capacitors to discharge completely before performing any maintenance or repair work. The waiting time is 15 minutes.



2.6 General precautions

2.6.1 Liquids in the user circuit

The user circuit liquids must be compatible with the materials used for the construction of the unit's hydraulic circuit.
The use of suitable chemical additives (contact your glycol supplier) is very important even in the case of glycol mixtures, to protect the machine materials from the risk of corrosion caused by the chemical deterioration that glycol is susceptible to.
If the liquids in the circuit contain dangerous substances (e.g. ethylene glycol), any leaking liquid must be collected up to prevent any harm to the environment.
Furthermore, when the unit will not be used for a long period, dangerous liquids must be disposed of by firms specialised and authorised for treating them.

2.6.2 Characteristics of the recommended glycol

Product identification: **MONOPROPYLENGLICOLE PROPANE-1,2-DIOL**
Below are the characteristics of propylene glycol:

Appearance:	Liquid
Colour:	Colourless
Odour:	Odourless
Melting point/scope: (1013 hPa)	-68°C
Boiling point/range: (1013 hPa)	185°C
Autoflammability:	371°C
Flash point:	101°C
Lower explosion threshold:	2.6 Vol-%
Upper explosion threshold:	12.6 Vol-%
Vapour pressure: (20°C)	0.1 hPa
Density: (20°C)	Data not available
Bulk density: (20°C)	1.036 kg/m^3
Solubility in water: (20°C)	Soluble
Soluble in:	Polar solvents
PH value:	Neutral
Viscosity: (20°C)	46 mPa.s

2.6.3 Transporting the unit

The unit must be transported in full compliance with local legislation. The maximum quantity of refrigerant that can be transported will be determined by the applicable transport regulations.
For shipping methods, the international directives ADR, IMDG and IATA are of reference. For road transport in Europe the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) shall apply. This regulation allows a partial exemption provided that the total amount of refrigerant carried on the same truck does not exceed 1000 points (1 kg of A3 corresponds to 3 points, 1 kg of A1 corresponds to 1 point). For example, a truck could be loaded as follows:

- 10 units with 100 kg of R410 per unit => Total Points: 1000
- 10 units with 33 kg of R290 per unit => Total Points: 990≤1000
- 4 units with 200 kg of R410 per unit + 2 units with 33 kg of R290 per unit => Total Points: 998≤1000

To take advantage of this partial exemption from ADR, some simple requirements must be respected, including (non-exhaustive list):

- that the means of transport is equipped with a fire extinguisher of at least 2 kg of powder
- that the means of transport is equipped with a non-sparking torch
- that the correct ADR marking and labelling is placed on the outer packaging of the equipment (a red class 2 label with a minimum side of 10 cm and the number UN 3358 with characters of minimum height of 12 mm)

Refrigerating machines and refrigerating machine components are not subject to ADR requirements if they contain less than 12 kg of gas or if the units are charged with nitrogen under pressure of less than 2 barg.
The unit, if equipped with pressure relief valves, could release refrigerant if exposed to high temperatures. The transport temperature must not exceed 50°C.
In the case of road-sea shipments, the ADR Agreement for road transport and the IMDG code for maritime transport are applicable. The provisions of the IMDG generally prevail over those of the ADR. For maritime transport some limitations may apply and the partial exemption of 1,000 points provided for by the ADR is not applicable, please contact the shipping company.
Transport of refrigerant-laden units by area is not allowed.

2.6.4 Precautions upon receipt of the machine

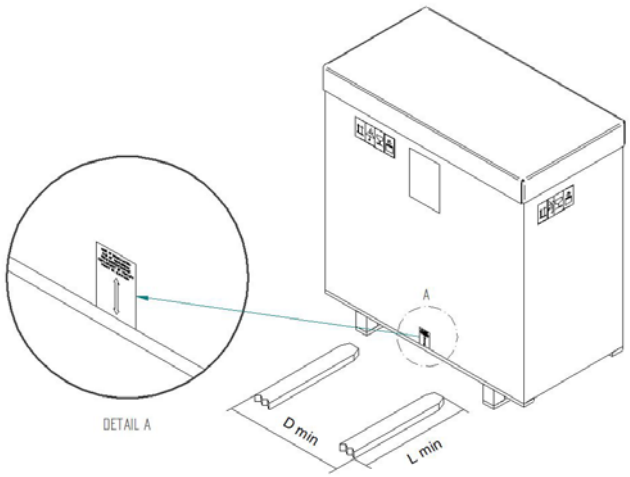
Upon receipt, check the integrity of the machine considering that the machine has been shipped in perfect condition.
Check the supply of all the accessories supplied.
In case of shortages or damage, inform the sales department as soon as possible and fill out a written report complete with photographs.

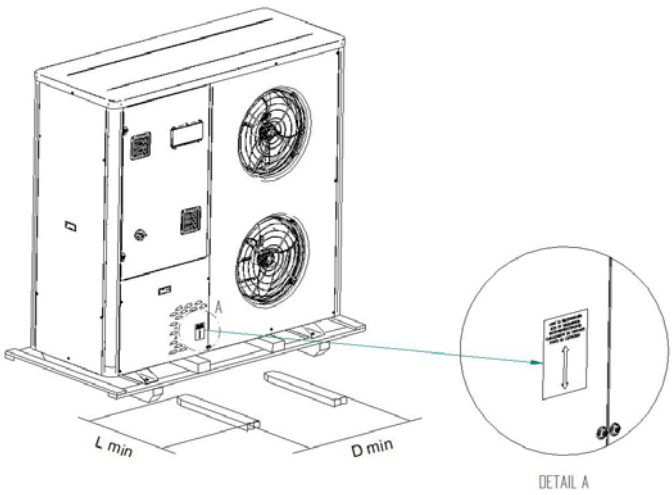
2.6.5 Lifting and transport precautions

The lifting and transport operations must be carried out by properly qualified expert personnel, with all necessary precautions and protections (active and passive, such as protective gloves, protective helmet) in order to work in complete safety.
Avoid injury by using a hoist to lift heavy loads.
Check all chains, hooks, shackles and slings are in good condition and are of the correct capacity.
They must be tested and approved according to local safety regulations.
Cables, chains or ropes must never be applied directly to lifting eyes.

NOTE
The lifting material is not furnished with the unit.

Always use an appropriate shackle or hook properly positioned.
Make sure the lifting cables don't form sharp bends.
Use a spreader bar to avoid side loads on hooks, eyes and shackles.
When a load is lifted from the ground, keep well clear of the area beneath it and the surrounding area.
Keep lifting acceleration and speed within safe limits and never leave a load hanging on a hoist for longer than is necessary.
All unit models have different weights according to the model.
Please see Technical Catalogue or the data plate applied on the casing for weight data.
Systems equipped with pallet must be handled using a forklift, as shown in the diagram below.

IPHP 002 - IPHP 004		
	**L min** 750 mm	**D min** 700 mm

IPHP 006 - IPHP 008		
	**L min** 1100 mm	**D min** 800 mm

For the calculation of lifting forces, refer to the weights shown in the following table:

Models	Net weight (plant only)	Carton weight	Pallet weight	Weight KIT (complete)	Vibration dampers
IPHP 002	152.5 Kg	6 Kg	5.5 Kg	7 Kg	15 Kg
IPHP 004	181.5 Kg	6 Kg	5.5 Kg	7 Kg	15 Kg
IPHP 006	352 Kg	not present	15 Kg	11 Kg	15 Kg
IPHP 008	394 Kg	not present	15 Kg	11 Kg	15 Kg

CAUTION

⚠ The images are purely representative, therefore the correct position of lifting lugs is the one indicated on the unit.
NEVER MOVE THE LIFTING LUGS.

2.6.6 Storage of the unit

A3 chiller units and heat pumps with refrigerant must be stored outdoors.
In the event of storage inside the building, it must meet the following requirements (non-exhaustive list):

- Well ventilated and free of combustible materials or waste
- Free of ignition sources
- Absence of direct sunlight and out of the reach of heat sources
- The storage area must be provided with safety signs
- Adequate fire safety measures must have been taken

It is also recommended to use a detection sensor for flammable gases every 36-40 m^2. Always refer to national regulations.
Whether the equipment is stored indoors or outdoors, it must comply with applicable regulations, local legislation and building regulations.
The unit may be equipped with pressure relief valves that could release refrigerant if the unit is exposed to high temperatures.
The storage temperature must not exceed 50°C.

2.6.7 Unpacking

WARNING

⚠ Before opening the packaging of the unit, use a special gas detector to check that there are no gas leaks in the environment. Check that there are no sources of ignition in the proximity of the unit.
No smoking near the unit.

The packaging must be removed only when the unit has reached its place of installation and will no longer need to be moved.
Remove the machine's packaging with care, ensuring it does not get damaged.
Use appropriate personal protective equipment (e.g. work gloves, protective helmet, safety goggles).
Since the packaging is composed of different materials (wood, polyethylene (PE), polystyrene, cardboard etc.), we recommend storing them separately and handing them to a specialised waste disposal and recycling company in order to protect the environment.

2.6.8 Precautions during operation

Operation must be carried out by competent personnel under a qualified supervisor.
All connections of the refrigerant circuit, electrical system and control unit wiring must be easily identifiable, painted or marked clearly in compliance with local safety prescriptions in force in the place of installation.

DANGER

⚠ **Do not remove or tamper with safety devices, protections, or the insulating materials installed in the unit or in the auxiliary equipment.**

All electrical connections must comply with the local prescriptions in the installation place.
The machine and the auxiliary apparatus must be earthen and protected against short-circuits and overloading.
When the main switch is closed (where present) the voltage in the electrical circuit reaches lethal values.
The maximum precautions must be adopted if work is to be carried out on the electrical circuit.
Do not open any protection panels on the electrical equipment while it is live, unless it is necessary for measurements, tests or adjustments.

This work should only be carried out by authorised operators, informed, trained and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with Annex HH IEC 60335-2-40, equipped with adequate equipment and wearing protections against electrical hazards.

Operation

Faults to electronic devices due to electromagnetic fields

Electromagnetic fields are created when using circulators with a frequency converter. This can disrupt electronic equipment. The consequence can be a malfunction of the device that can cause damage to people's health and even death, e.g. in the wearers of implanted active or passive medical devices. For this reason, people fitted with devices such as pacemakers must not stand near the system and/or the circulator during machine operation. In the case of magnetic or electronic data support devices, data may be lost.

DANGER

⚠ **Danger due to high magnetic field!**

A high magnetic field is always created in the circulator, and this can cause injury or damage if the device is improperly disassembled.
- As a general rule, the rotor should only be removed from the motor by specialised, authorised personnel!
- Risk of getting crushing. When taking the rotor out of the motor, there is a risk that the strong magnetic field pulls it back sharply into its starting position.
- The extraction of the impeller, shield and rotor unit from the engine is very dangerous, especially for people using medical aids, such as pacemakers, insulin pumps, hearing aids, implants or the like. This may result in death, serious bodily injury and property damage. The workplace doctor must issue a declaration for people in this category.
- The strong magnetic field of the rotor may affect the operation of electronic devices, or damage them.
- If the rotor is outside the motor, magnetic objects may be violently attracted. This could lead to injury or material damage.
Once the installation is complete, the magnetic field of the rotor is brought back within the metallic circuit of the motor. In this way, outside the machine there is no magnetic field that may be harmful for people's health.

2.6.9 Precautions for maintenance and repair

Accumulations of electrostatic charges can generate, in the event of loss of refrigerant, a trigger in the event of a potentially explosive atmosphere; to avoid accumulation, antistatic clothing complying with EN 1149-5 must be used during maintenance and inspection of the machine. Antistatic clothing bears the following symbol:

EN 1149-5

WARNING

⚠ Maintainers working on the electrical components or on the components of the refrigerant circuit must be authorised, informed and trained on the specific risks from flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.

CAUTION

⚠ When it is necessary to discharge waste material do not pollute water pipelines, groundwater or watercourses. Avoid the combustion of materials that could cause atmospheric pollution. Protect the environment by using only approved storage methods.

Keep a written record of all maintenance and repair work carried out on the unit and auxiliary equipment. The frequency and nature of the work required of the unit must not cause abnormal operating conditions.

WARNING

⚠ Use exclusively the refrigerant specified on the unit's data plate.

Make sure that all the instructions concerning operation and maintenance are followed scrupulously and that the entire unit and all the accessories and safety devices are maintained in proper working order.

The accuracy of pressure and temperature gauges must be regularly checked. If values exceeding the permitted tolerances are detected, the gauges must be replaced.
Coloured tracers can be used in service-maintenance operations.

CAUTION

⚠ Do not weld or perform work that generates heat close to a system that contains oil or inflammable liquids. Systems that may contain oil or inflammable liquids must be completely drained and cleaned, for example with steam, before performing any such operations.

To prevent an increase in working temperature and pressure values clean the heat exchange surfaces (e.g. the fins of condensers) regularly. For all units establish a suitable time interval for cleaning procedures.

WARNING

⚠ DO NOT damage the pressure relief valves and other pressure limiting devices.

Do not clog these devices with paint, oil, or accumulated dirt.
Use exclusively original spare parts.
Never use an open flame as a light source to inspect parts of the unit.
When a repair has been completed make sure that no tools or detached parts are left in the unit.
The pipes of the cooling circuit, and generally speaking all cooling circuit components, are not designed to be used in any way other than that specified. Do not use the pipes as a support surface or a step for climbing up.

WARNING

⚠ Check the direction of rotation of the motors when starting the unit for the first time and after work has been performed on the electrical connections or on the power supply sectioning device.

All the protections must be refitted following maintenance or repair work.
Do not use flammable liquid to clean any component during operation.
If non-inflammable hydrocarbons containing chloride are used all the relevant safety precautions must be adopted to protect against the toxic fumes that may be given off.

CAUTION

⚠ Before removing any panels or dismantling any parts of the unit perform the following steps:

- Isolate the unit from the electrical power supply by disconnecting the supply upstream of the power feeding line.
- Lock the disconnector (where present) in the “OFF” position using a padlock.
Attach a tag to the disconnecting switch, stating “WORK IN PROGRESS - DO NOT SWITCH ON”.
- Do not switch on electrical power or attempt to start the unit if a warning label is attached.
- Wait at least 15 minutes before carrying out any operation, to allow the discharging of the condensers inside the inverter.
- Make sure the motor is completely idle. A freely rotating motor may produce dangerous voltage on the inverter terminals, even when the inverter isn't powered.
- Always use a multimeter to make sure there is no dangerous voltage present.

Coloured tracers can be used in service-maintenance operations.
Inspect all refrigerant circuit unions including connectors, flanges, and more generally all critical points (open unions) in order to prevent possible leakage of refrigerant gas.

CAUTION

⚠ The R290 refrigerant used in the chiller is odour-free.

Maintenance and repair must only be carried out by authorised operators, that are informed and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.
Inspect all the cooling system joints including connectors, flanges and more generally all critical points (open joints) in order to prevent possible leakage of refrigerant gas using specific tools suited for use with flammable refrigerants.

2.6.10 Warnings for extraordinary maintenance and repair

It does not give anyone else the authority to carry out maintenance work on the unit.

- Switch the unit off, disconnecting it from the mains supply.
- Check there are no flammable materials stored in the work area, and no ignition sources such as naked flames, electric heaters, etc.
- Make sure the work area is **well aired** before doing any work on the refrigerant circuit or carrying out any welding or brazing tasks.
- Drain off the refrigerant, using a recovery machine suitable for this type of flammable refrigerant. In the meantime, monitor the area with a gas leak detector.
- Flush the circuit with inert gas (e.g. nitrogen).
- Drain the circuit with a suitable vacuum pump.
- Flush again with inert gas (e.g. nitrogen).
- Open the circuit.
- Using a pipe cutter, cut the cooling circuit components that need to be replaced. DO NOT debraze.



2.6.11 Disposal, disassembly and recycling

The product was designed and built with recyclable materials.
The correct waste sorting for the subsequent start-up of the equipment disposed of for recycling, treatment and for compatible environmental disposal, contributes to prevent possible negative consequences on the environment and health. It also favour the recycling of the materials the equipment is made up with.
The unit may include all or some of the materials listed below:

- refrigerant fluid R290
- copper parts
- aluminium parts
- carbon steel parts
- stainless steel parts
- PVC parts
- CFC-free synthetic insulating material
- polystyrene parts
- PVE oil
- brass

During dismantling, the compressor, pumps, fans, exchangers (if working) can be recovered for possible re-use thanks to specialised centres. All materials must be recycled or disposed of in compliance with the corresponding national regulations.
Refrigerant, oil and possible anti-freeze solutions recycling must be done by specialised companies in compliance with the corresponding local and national legislation.
Electrical and electronic materials cannot not be disposed of together with domestic general waste. They must be disposed of in special collection centres.
Units must be treated at a centre specialised in re-conditioning, recycling and recovery of materials.
The waste sorting of this equipment that reached the end of its useful life is organized and managed by the manufacturer of the newly purchased equipment replacing the present one, if applicable, or, in all other cases by the manufacturer of this equipment.
Therefore, the user who wishes to discard this equipment and has decided to purchase a new equivalent one to replace the present one, must refer to the manufacturer of the new equipment and follow the procedures established by the latter in terms of selective collection of the equipment that has reached the end of its useful life.
Conversely, the user who wishes to discard this equipment and has not decided to purchase a new equivalent one to replace the present one, must refer to the manufacturer of this equipment and follow the procedures established by the latter in terms of selective collection of the equipment that has reached the end of its useful life.

2.7 Refrigerant gases

R290 refrigerant is classified as group 1 “dangerous” on the basis of the criteria of the pressurised equipment directive 2014/68 / EU.

- Type of refrigerant: R290
- Global warming potential GWP: 3

In accordance with Standard ISO-817, R290 (E), it is classified in safety group A3: HIGH flammability.
The refrigerant generates toxic gases when placed in contact with open flames.

In order to ensure proper installation, the local regulations and the specified safety standards must be respected. In their absence, reference must be made to the EN-378 standard, with particular regard to the sections concerning flammable refrigerants. The end user must check whether approval is required from the competent authorities for the installation of the unit.
These units may be charged exclusively with R290.
Never attempt to mix refrigerant gases.
To clean a heavily contaminated refrigerant circuit, e.g. after the burning of a compressor, it is necessary that the work is carried out by authorised operators, that are informed and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.
The use and storage of cylinders containing refrigerants must be in compliance with the prescriptions of the manufacturers of the cylinders and in compliance with the applicable safety laws and prescriptions in force in the place of installation.

CAUTION

⚠ Maintainers working on the electrical components or on the components of the refrigerant circuit must be authorised, informed and trained on the specific risks from flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.

2.7.1 Refrigerants safety datasheet

	R290
Name:	Propane.
HAZARDS	
Main hazards:	Highly flammable gas.
Specific hazards:	Contains pressurised gas; may explode when heated.
FIRST AID MEASURES	
General information:	In high concentrations, it can cause asphyxiation. Symptoms may include loss of mobility and/or consciousness. The victim may not be aware that they are suffering from asphyxia. In low concentration, it can have a narcotic effect. Symptoms may include dizziness, headaches, nausea and loss of coordination.
Inhalation:	Move the victim to a non-contaminated area using the self-contained breathing apparatus. Keep the patient relaxed and warm. Call a doctor. Proceed with the artificial respiration in case of respiratory failure.
Contact with the eyes/face:	Wash the eyes immediately with water, continuing for at least 15 minutes.
Contact with the skin:	In case of contact with liquid, wash with water for at least 15 minutes.
FIRE-FIGHTING MEASURES	
General fire risks:	Exposure to naked flame may cause the container to rupture or explode.
Means of extinction:	Water spray. Dry powder.
Inappropriate extinguishing media:	Do not use water jets to extinguish the fire. Carbon dioxide.
Specific methods:	Use appropriate fire-fighting methods for the fire in the area. Exposure to naked flame and heat may cause the container to rupture. Keep exposed containers cool by showering with water from a safe position. Do not pour water contaminated by the fire into drains. Stop the leakage of product if possible. If possible, use water mist to abate fumes. Do not attempt to extinguish a burning gas leak unless absolutely necessary. The gas may re-ignite spontaneously and cause an explosion. Extinguish all flames in the vicinity. If it is possible to do so safely, move the recipients to a location at a safe distance from the fire.

MEASURES IN THE EVENT OF ACCIDENTAL LEAKAGE

Individual precautions:	Try to stop the leakage. Evacuate the area. Consider the risk of explosive atmosphere. If it has not been proven that the air is breathable, use self-contained breathing apparatus to enter the area involved. Remove the sources of ignition. Ensure adequate ventilation. Prevent it from running into drains, cellars, excavation areas or places where the accumulation may be dangerous. Follow the local emergency plan. Stay upwind.
Environmental precautions:	Try to stop the leakage.

HANDLING AND STORAGE

Handling Technical measures/precautions:	Use only in well ventilated spaces.
Recommendations for safe use:	The product must be handled according to the good safety and industrial hygiene practices. The pressurised gas should be handled exclusively by experienced and suitably trained personnel. Install any safety relief valves necessary in the gas circuit. Before use, make sure that the entire gas distribution system has been (or is regularly) checked for leaks. Do no smoke while handling the product. Only use specific equipment, suitable for the product, pressure and temperature of use. In case of doubts, contact the gas supplier. Assess the risk of a potentially explosive atmosphere and the need for explosion-proof equipment. Bleed all the air from the system before inserting the gas. Take precautions against the risk of electrostatic discharges. Keep away from sources of ignition (including electrostatic charges). Assess the need for using only reduced-sparking tools. Do not inhale the gas. Avoid releasing the product in the atmosphere.
Storage:	Observe the local regulations and legal requirements concerning the storage of the containers. The containers should not be stored in conditions that may lead to corrosion. Fit all caps and/or plugs correctly. Containers in storage must be kept in an upright position and secured so that they cannot fall over. The stored containers should be checked regularly to assess their general state and identify any leaks. Keep the container at a temperature below 50°C, in a well-ventilated area. Store de containers in areas in which there is no risk of fire, away from heat and ignition sources. Keep away from combustible substances. Do not store with oxidising gases or other oxidants in general. All electrical equipment in the storage area must be certified for use in explosive atmospheres.

CONTROL OF INDIVIDUAL EXPOSURE/PROTECTION

Control parameters:	OEL (Occupational Exposure Limits): Data not available. DNEL (Derived No Effect Level): Data not available. PNEC (Predictable no-effect concentrations): Data not available.
Respiratory protection:	Filter masks may only be used if all surrounding environmental conditions (e.g. type and concentration of contaminant/s) and the envisaged duration of use are known. Recommended: AX filter (brown). See the instructions provided by the supplier for selecting suitable personal protective equipment. Filter masks do not protect against oxygen-deficient atmospheres. EN 14387 - Respiratory protective devices - Gas filters and combined filters. EN 136 - Respiratory protective devices. Full face masks.
Eye/face protection:	Wear safety eyewear with side shields. Wear safety googles when filling containers and disconnecting the hose.
Protection of the hands:	Wear safety work gloves when handling gas containers.

PHYSICAL AND CHEMICAL PROPERTIES	
Colour:	Colourless
Odour:	Often odourless. Sweetish. Less noticeable at low concentrations.
Boiling point:	-42.1°C
Relative density (water =1):	0.58
Relative density (air=1):	1.5
Solubility in water:	75 mg/l
Upper flammability limit:	9.5% (V)
Lower flammability limit:	1.7% (V)
Auto-ignition temperature:	470°C

STABILITY AND REACTIVITY	
Stability:	Stable under normal conditions.
Possibility of dangerous reactions:	May react violently with oxidants. May form explosive mixtures with air.
Materials to avoid:	Air, oxidising agents. Refer to the ISO 11114 standard for further information regarding the material compatibility.
Hazardous decomposition products:	Should not product hazardous decomposition products in normal storage and usage conditions.

TOXICOLOGICAL INFORMATION	
Acute toxicity:	This product has no known toxicological effect.
Local effects:	In high concentrations, it can cause asphyxiation. Symptoms may include loss of mobility and/or consciousness. The victim may not be aware that they are suffering from asphyxia. In low concentration, it can have a narcotic effect. Symptoms may include dizziness, headaches, nausea and loss of coordination.
Long term toxicity:	No carcinogenic, teratogenic or mutagenic effects observed in laboratory animals.

ECOLOGICAL INFORMATION	
Global warming potential GWP (EN378-1:2021):	3
Ozone depletion potential ODP (R11=1):	0
Disposal:	Do not discharge gas in areas where there is a risk of the gas forming an explosive atmosphere with air. The gas should be disposed of in a suitable torch with an anti-backfire device. Do not drain the product in places where accumulation may be harmful. Make sure that the emissions limits specified by local regulations or indicated in authorisation documentation are not exceeded.

CHAPTER 3

DESCRIPTION

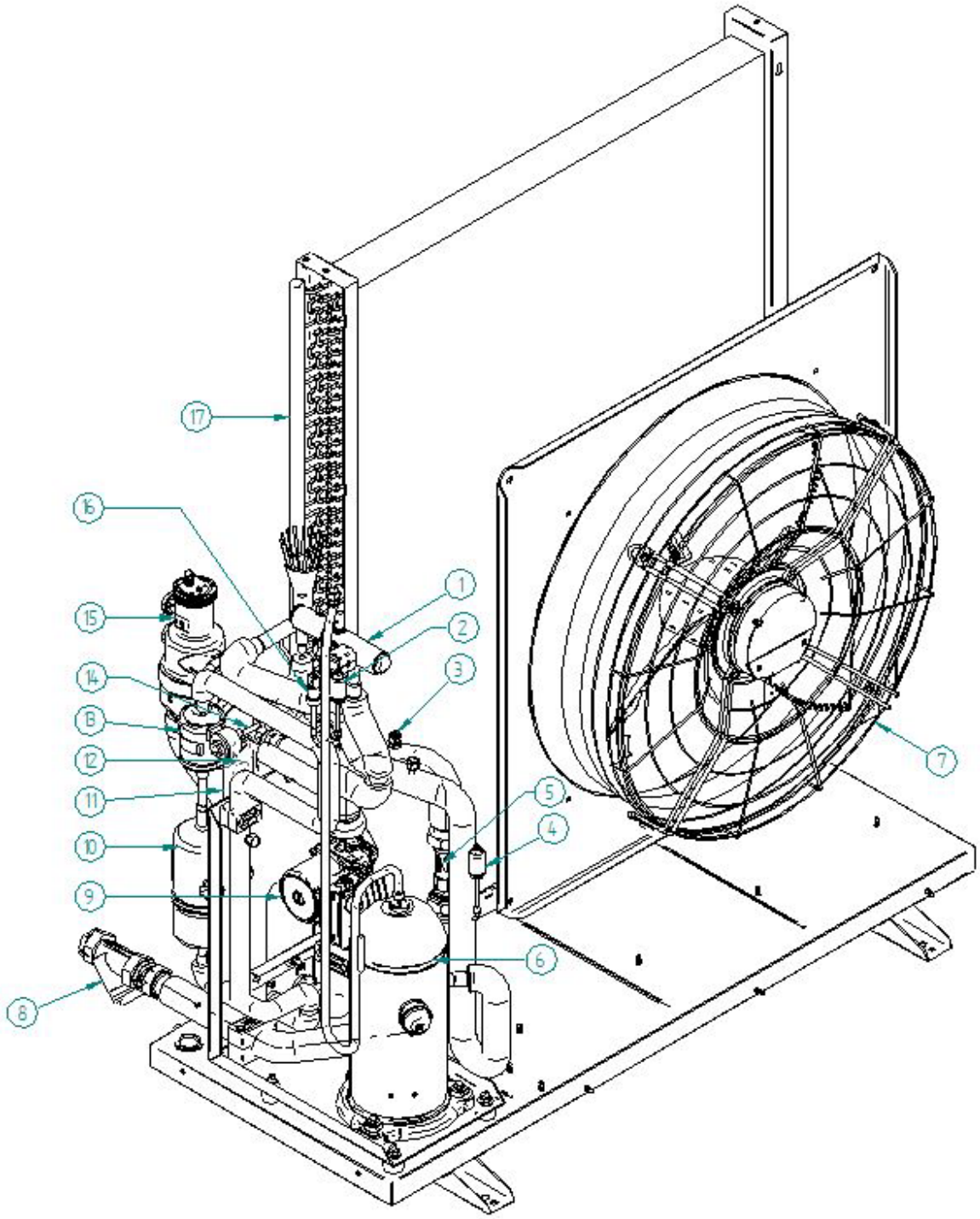
3.1 General information

They are monobloc units with air condensation equipped with hermetic compressors, water unit consisting of plate evaporator, storage tank (optional), circulator (optional) and condenser formed by finned batteries and axial fans.
The management of each chiller is entrusted to a microprocessor control that manages all the main functions including adjustments, alarms and external interface.
The coolant used is R290.
All machines are made using premium brand components, and are designed, manufactured and controlled in accordance with ISO 9001 standards.

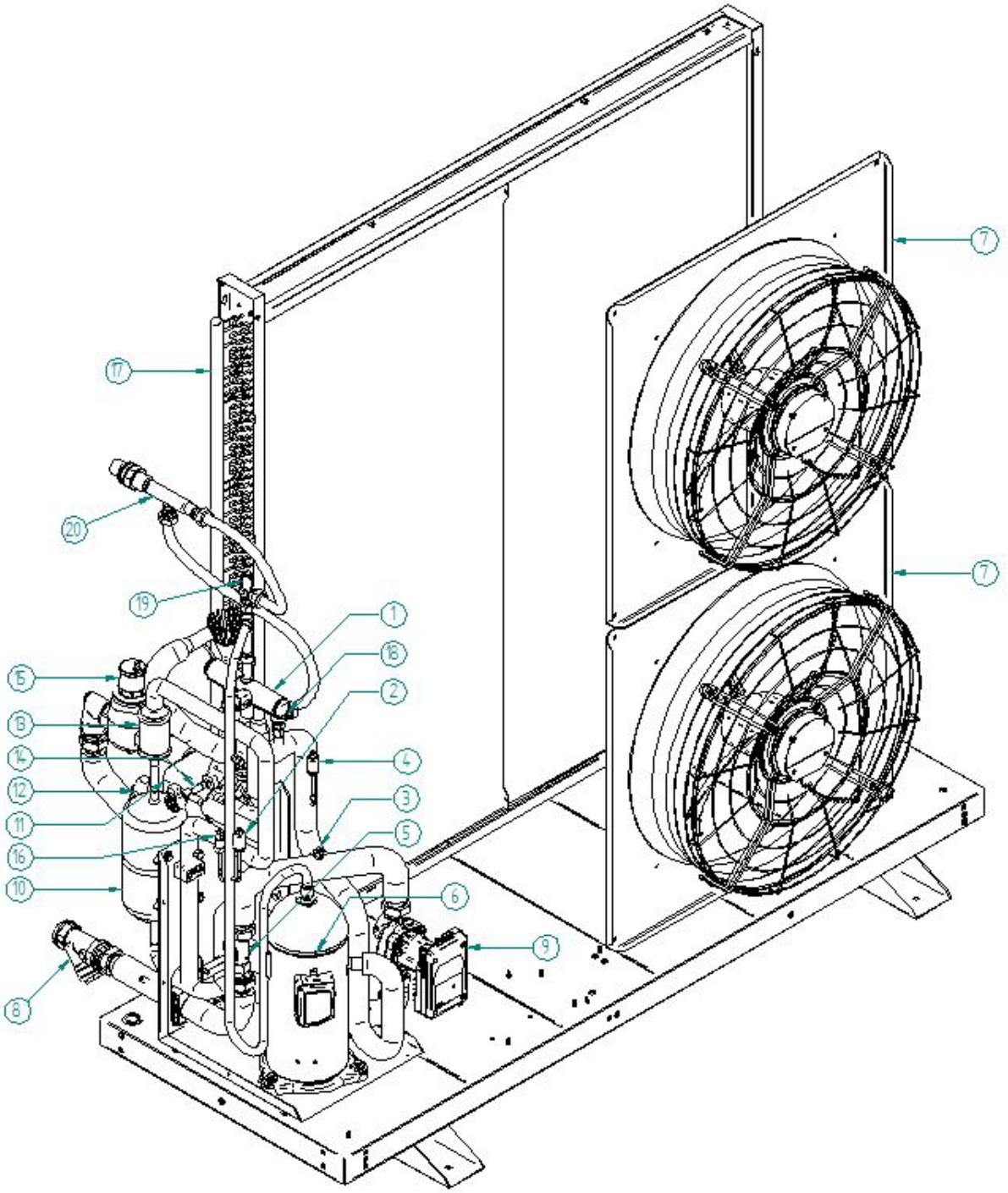
3.2 Water and refrigerator circuit

(See the attached diagrams.)
The descriptions in the following paragraphs refer to machines that work in SUMMER mode (i.e. to cool the user water).
The cooling cycle can be switched to WINTER mode by means of an electrically commanded 4-way valve that reverses the coolant flow, thereby heating the water in the evaporator.
For this reason, the same observations made for SUMMER mode operation will hold true, bearing in mind that the evaporator will work as a condenser and the condenser (of WINTER mode operation) will work as an evaporator.
All the units described in this manual use the same operating principle.
The refrigerant is pumped from the hermetic cooling compressor into the condenser.
The condenser is a heat exchanger of the finned pack type, skimmed by an air flow produced by one fan or more (depending on the machine model).
After leaving the compressor, the refrigerant passes through the reverse cycle valve before it reaches the condenser.
After the condenser, the refrigerant passes through an expansion valve.
It then enters the evaporator, which is of the plate type.
When it leaves the evaporator, it enters the liquid separator and returns to the compressor, then the cycle is repeated.
All the braze-welding for connecting the various components of the cooling circuit is made with silver alloy.
Below is information relating to the components of standard machines.
Components other than standard ones may be used to meet particular requirements.
In this case, refer to the project quote data.
The IPHP inverter range, in its standard configuration, is equipped with the following components (see images):
1 Cycle reversing valve
2 HP Control Transducer
3 Manual vent valve
4 LP Control Transducer
5 Flow sensor
6 Scroll Single Compressor
7 Axial fan
8 Water filter
9 Circulator
10 Liquid receiver
11 Plate exchanger
12 Water safety valve
13 Coolant filter
14 Electronic thermostatic valve
15 Deaerator
16 High pressure switch
17 Condensing battery
18 LP safety valve
19 HP safety valve
20 Manifold for unloading safety valves

Models IPHP 002-004 (version with pump)



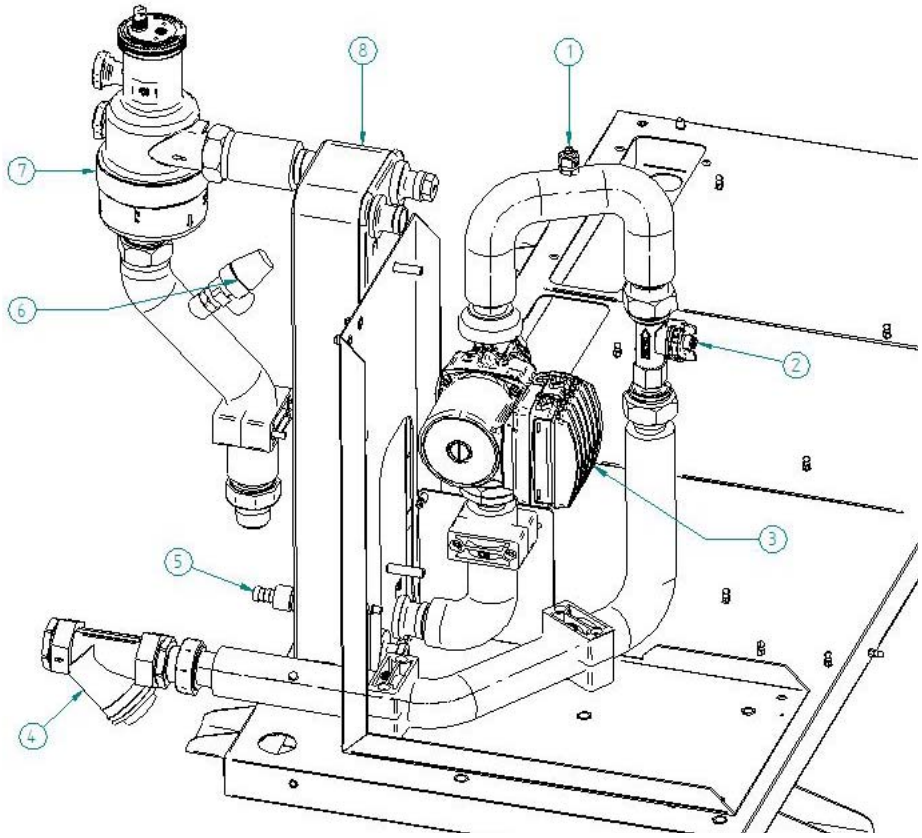
Models IPHP 006-008 (version with pump)



Depending on the operating mode (summer or winter), the cooling circuit cools or heats the water flow by means of a plate evaporator in which the coolant evaporates on one side and the liquid to be cooled flows on the other side.
The cooling compressor is commanded by an electronic control unit that regulates the water inlet temperature on the machine in order to keep the outlet temperature within the predefined limits.

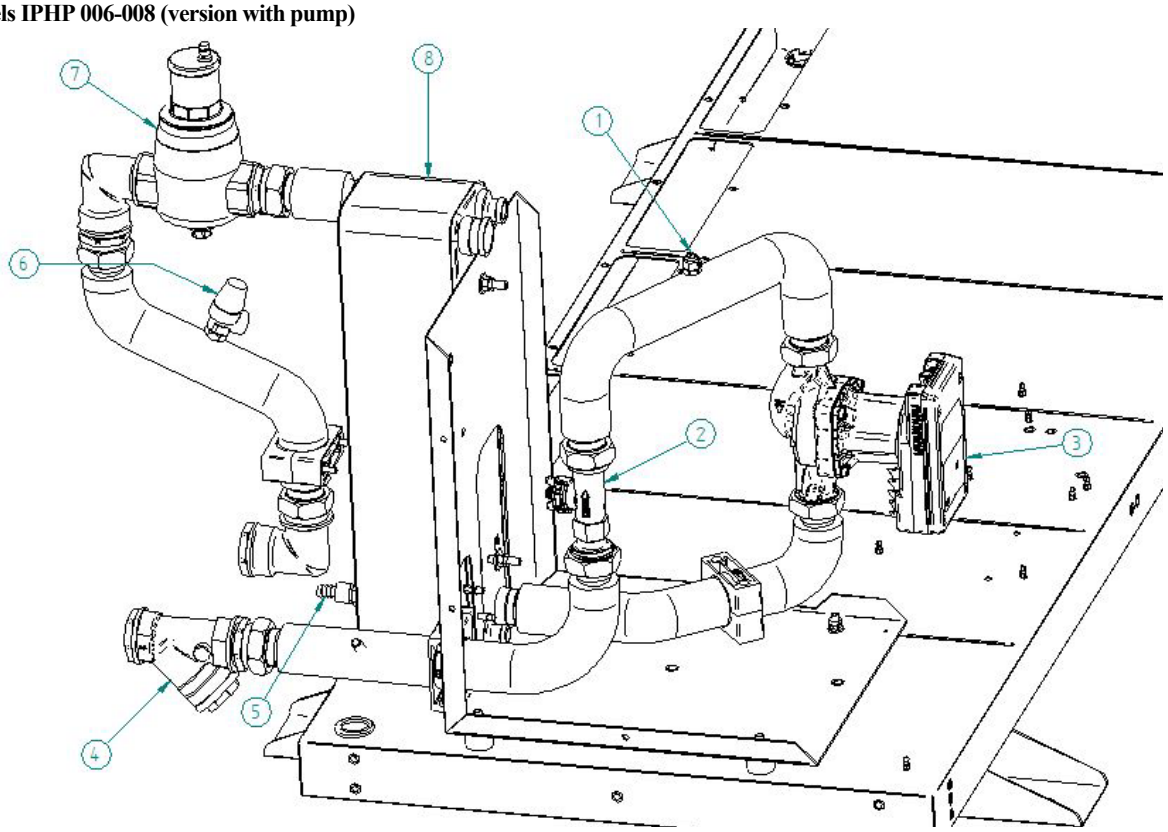
3.2.1 Hydraulic unit

Models IPHP 002-004 (version with pump)



The hydraulic unit consists of (see images):
1 Manual vent valve
2 Flow sensor
3 Circulator
4 Water filter
5 Drain valve
6 3 barg safety valve
7 Deaerator
8 Plate exchanger

Models IPHP 006-008 (version with pump)



WARNING

⚠ The circulator must never run dry and a minimum static pressure of 1 bar must be guaranteed.

3.2.2 Water circuit

When the circulator is not present, the water circuit will consist only of the plate heat exchanger.
The following description refers to a machine complete with hydraulic unit.
The water first of all enters the machine, then enters and leaves the plate evaporator where it exchanges heat with the refrigerant liquid during the evaporation phase inside the heat exchanger.
It is then picked up by the circulator and sent directly for use.

CAUTION

⚠ For proper operation install the filter supplied with the unit (with 0.4 mm mesh). The filter must be installed in the pump suction. Failure to observe this prescription can result in irreparable damage to the evaporator.
In the case of plate evaporators in fact, the clogging of even just some plates (or gaps) can cause the plate to seize (clogging), leading to the breakage of part of the exchanger, even if the water flow seems regular and operation is apparently normal.

NOTE

For the correct operation of the heat pump, it is necessary to guarantee the availability of a minimum amount of water in the system equal to 10 liters/kW of nominal thermal power, such as to avoid frequent ignition cycles and allow the execution of defrosting cycles.
However, greater amounts of water are always preferable, to further reduce the on and off cycles of the compressors and to increase the efficiency of the system.

WARNING

⚠ Install hydraulic loading unit to always ensure the minimum necessary pressure inside the hydraulic circuit.

3.3 Materials

Data for materials are referred to standard units.
Non-standard materials may be used in order to meet specific requirements.
In this case, refer to the project quote data.

3.3.1 Casing

The entire base, the uprights and the buffer panels are made of galvanised carbon steel sheet and are screwed together.
All panels undergo phosphor degreasing treatment followed by epoxy polyester power coating.
The structure is designed to ensure easy access to all the machine components.
In all the machines, the compressor compartment is lined with sound-absorbing material to reduce the noise levels.

3.3.2 Materials in contact with the liquid of the user circuit

The following description refers to the machine operating in SUMMER (chiller) mode; bear in mind that, after the reversal of the cooling cycle (when the unit is working as a heat pump - WINTER mode), the evaporator will work as a condenser.
The evaporator is of the plate type, in braze-welded stainless steel with copper. The tank is made of carbon steel and the pipes are copper.

3.3.3 Pump

The pumps that can be selected are electronic circulators equipped with EC inverter control.
The circulators are controlled at a fixed and adjustable number of revolutions, by PWM control directly from the main machine controller. The section dedicated to starting the machine provides instructions on setting the number of revolutions.
The pump will work at a fixed number of revolutions according to the percentage set both in chiller mode and in heat pump mode.

NOTE

The circulator must never run dry.

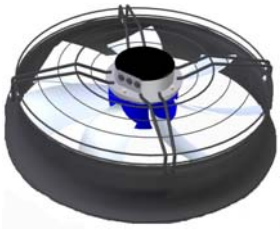
NOTE

Install a pressure gauge on the water circuit to check the pressure.

WARNING

⚠ Guarantee at least 1 bar of pressure in suction to the circulator for correct operation.

3.3.4 Fan(s)



All the machines are fitted with axial fans.
The units are equipped with fans with plastic blades and suitably radiated high-density polystyrene conveyors.
All the units have fans that are electronically adjusted with an integrated inverter motor and EC technology (permanent magnets and electronic switchover).
The protection level is IP54 with insulation class F, to enable outdoor operation in all climates.
The assembly is completed by an external fan support grille to prevent accidents.

3.3.5 Deaerator

The units are equipped with a deaerator that allows to continuously remove any refrigerant gas leaks that may come from the exchanger.
The discharge capacity of this device is very high and allows the circulation of unseparated water, reducing the risk of having R290 in the hydronic circuit.
The installation is mandatory and carried out by authorised, informed and trained personnel on the specific risks from flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.
The presence of glycol negatively affects the efficiency of deaeration, the more the higher the percentage of glycol present.
In the case of using glycol, it is recommended to use a type of glycol that has the characteristics described in the relevant paragraph (see ch. 2.6.2 “Characteristics of the recommended glycol”).
In the case of using mixtures of water and glycol, it is not recommended to add additives that may cause the formation of foams under certain conditions as they may further negatively affect the performance of the deaerator.
For the assembly of the deaerator, see “Assembly diagram” inserted in the component box.

CHAPTER 4

INSTALLATION

CAUTION

⚠ Before installing or operating these machines, make sure that all personnel have read and understood Chapter 2 “Safety“ of this manual. The unit must be installed in accordance with current national legislation in the country of use.

4.1 Overall dimensions

See the enclosed electrical diagrams.

4.2 Installation precautions

WARNING

⚠ Before opening the packaging of the unit, use a special gas detector to check that there are no gas leaks in the environment. Check that there are no sources of ignition in the proximity of the unit.
No smoking near the unit.

Always perform maximum preparatory work before the unit arrives on site: drilling holes and penetrations, installing cable walkways, installing water piping, etc.
Before transporting the unit to its final location, perform a complete leak detection.
It is also strongly recommended to repeat the detection during the different phases of installation, especially if commissioning takes several days.
Installation work must be carried out by competent personnel under a qualified supervisor.
The connections to be made concern the process water circuit. For the connection to the mains power supply consult the technical documentation attached to the machine.

DANGER

⚠ **The unit must be positioned in an area where there are no continuous ignition sources (e.g. naked flames).**

4.3 User requirements

The machines must be installed in safe places, free of areas with potentially explosive atmospheres. They must be connected to electrical systems designed according to current standards, in areas compliant with the standards imposed by the Fire Brigade and in environments compliant with local building standards.
Within the potentially explosive areas generated by the machine, also taking into account the national regulations of the country of use, it is necessary to:

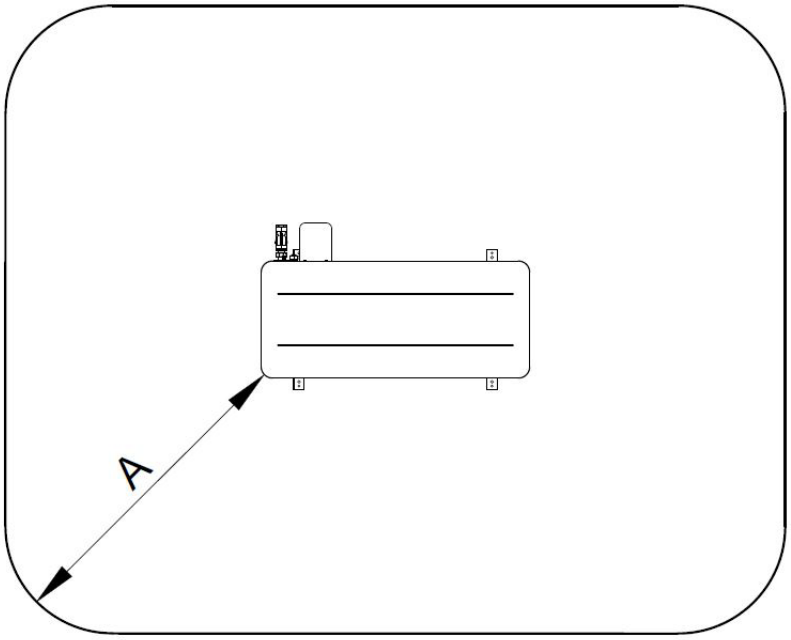
- Do not install equipment that is unsuitable for use in these potentially explosive zones (the minimum requirements of the equipment are: 3G IIB T4);
- Avoid naked flames, sparks and hot works;
- Avoid the presence of sources of ignition due to processes that may generate remote triggers (ionising and non-ionising radiation);
- Avoid the direct and indirect effects of lightning;
- Avoid electrostatic charges;
- Avoid interference with potentially hazardous elements such as drains, openings in the earth, basements, power lines, stores of flammable substances, railways, motorways etc.

As the refrigerant gas used is heavier than air, even a small gas leak, which in itself is not dangerous, can cause a build-up of gas if it infiltrates into underground areas, forming pockets.
A suitable “safety” distance should be assured also for chilling systems installed outdoors, in order to minimise the risk that flammable concentrations enter premises occupied by humans (e.g. through windows, ventilation openings, where people meet outdoors, etc.). However, external wind speeds tend to be quite high (compared to indoor environments) even when the air seems “still”, so also the amount of flammable mixture should be adjusted to consider the additional dispersion caused by the surrounding air.

WARNING

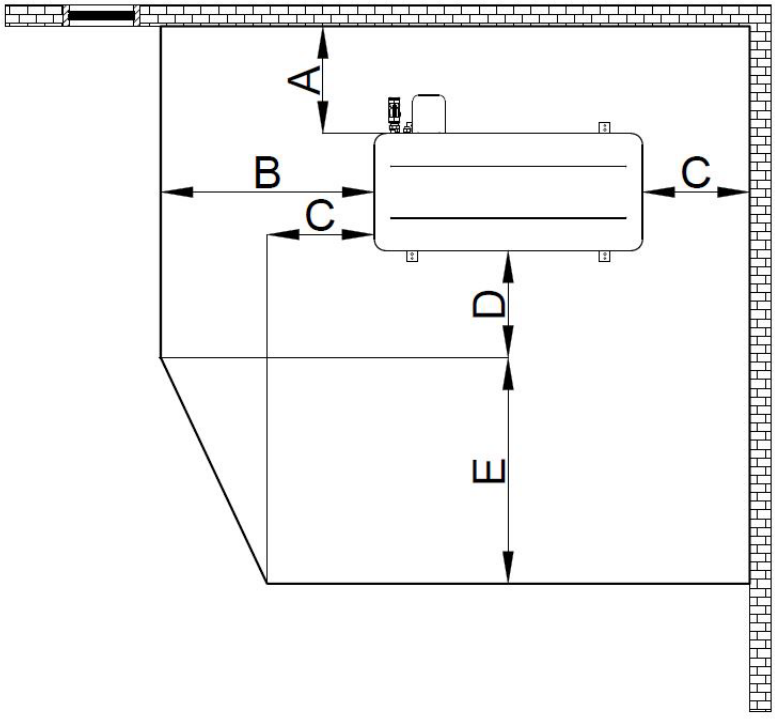
⚠ The safety zone/area around the machine must be at least 1 meter for the IPHP 002-004 and 1.5 metres for forms IPHP 006-008. Potentially explosive atmospheres may build up inside this area, and it is therefore necessary to avoid sources of ignition, as defined in standard EN378-2.

Safety distance around the machine



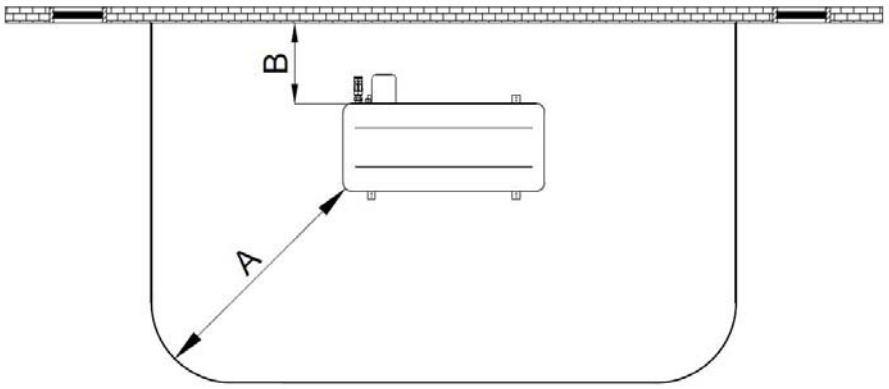
Model	IPHP 002 IPHP 004	IPHP 006 IPHP 008
A	1000 mm	1500 mm

Ground installation in a corner of the building



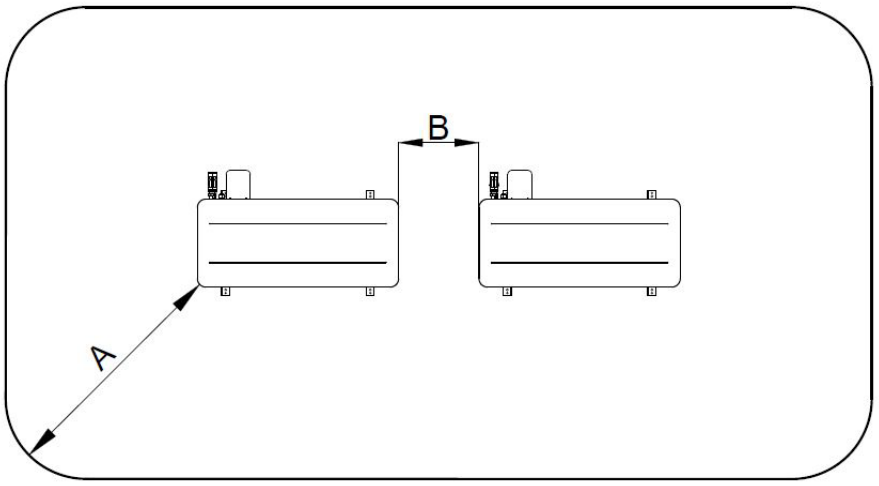
Model	IPHP 002 IPHP 004	IPHP 006 IPHP 008
A	500 mm	500 mm
B	1000 mm	1000 mm
C	500 mm	500 mm
D	500 mm	500 mm
E	500 mm	1000 mm

Installing in front of a wall



Model	IPHP 002 IPHP 004	IPHP 006 IPHP 008
A	1000 mm	1500 mm
B	500 mm	500 mm

Installing multiple machines



Model	IPHP 002 IPHP 004	IPHP 006 IPHP 008
A	1000 mm	1500 mm
B	500 mm	1500 mm

CAUTION

⚠ The flammability and classification of the danger zone for the place of installation must be assessed by the final customer, who shall refer to the local regulations in force and consequently adopt the most restrictive result.

CAUTION

⚠ Cordon off access to the area to prevent accidents.

The electricity supply line to the machine must be protected with the aid of devices that should be chosen and installed by the user on the basis of the data in the wiring diagram and in ch. 6.2 “Electrical connections” . The machine is equipped with a water safety valve. All the piping of the cooled water must be painted or clearly marked in compliance with the local safety in force in the installation place. Manual on-off valves should be provided for the unit so that the hydraulic circuit can be by-passed to carry out maintenance. All electrical connections must comply with the local prescriptions in the installation place. The machine and the auxiliary apparatus must be earthen and protected against short-circuits and overloading. If raised platforms are required to provide access to the unit they must not interfere with normal operation or obstruct access for lifting or dismantling components. Platforms and stairs should be of grid or plate construction with safety rails on all open sides.

4.4 Location

1. Maximum height above sea level 2000 metres.
2. The machine must only be installed outdoors and in places where natural ventilation is not hampered.
3. In fact, it is strictly forbidden to install the machine within Atex environments generated by other machinery/ plants. If the machine is installed on the roof of a building, the place of installation must be inspected in order to ensure that it is protected against lightning (evaluation of the risk of lightning according to EN 62305).
4. The refrigerant is heavier than air, so even a small leakage may cause a build-up of gas if it seeps into closed areas and stagnates; For this reason, it is important to ensure natural ventilation in the area where the unit is installed.
5. Install the unit so that, in the event of a leakage, the refrigerant cannot seep into buildings; this means guaranteeing that it cannot penetrate via doors, windows or any ventilation opening, and ensuring there is no underground infiltration leading to pockets of refrigerant. The technical rule states the need to maintain minimum installation distances from underground rooms, sewage traps, rainwater traps and any other accessible opening or empty underground container. The distance is determined on the basis of the deposit volume. This problem can be managed by applying the technical fire prevention rule in the place where the machine is installed.
6. The safety valves (if present) must be directed to the outside of the unit in a safe area and away from possible sources of ignition. The discharge must be conveyed at least 1 metre from the ground, and facing upwards. The cross section and length of the discharge pipe must comply with the national laws and the directives applicable in the place of installation.
   To avoid any possible clogging of the pressure discharge pipe, fit a cover to keep out rainwater.
7. The ambient air must be clean, avoid sea ambients (brackish air), and not contain flammable gas or corrosive solvents.
8. The minimum and maximum working ambient temperature are specified on the unit data plate. Ensure that the unit is not installed in flows of hot air emitted by other equipment.
   In extreme temperature conditions, the protection devices may be triggered.
9. Do not obstruct or interfere with the air flow produced by the unit; comply strictly with the minimum spaces/ distances specified in the installation drawings.
10. The machine must be installed on a perfectly horizontal flat surface, built and calculated to withstand the machine's operating weight, especially in the contact points highlighted in the installation drawing. **Installations which fail to comply with the above requirements will immediately render the manufacturer's warranty cover null and void, and could cause machine malfunctioning or even lockout.**
11. The units are shipped from the factory with wooden supports positioned under the base that must be removed during installation. It is advisable, however, to insert a stiff rubber belt between the main frame and the support surface. If greater insulation is needed, anti-vibration supports should be used.
12. Leave some clearance around the machine for access during service interventions (see Annexes).
13. While the heat pump is in operation, the air in contact with the finned coil may reach the dew point, causing the moisture contained in the air to condense. The quantity of condensate water produced depends on ambient conditions. The installation of the unit must allow the correct drainage and outflow of the condensate water.
14. Install a water tank if necessary. This will help reduce the extent of the temperature swings of the chilled water (DT).

CHAPTER 5

HYDRAULIC CONNECTIONS

5.0.1 Evaporator water limit features

Contents		Concentration mg/l or ppm	Material	
			AISI 316L	Copper
pH		<6	or	or
		6-7.5	or	or
		7.5-9	+	+
		>9	+	or
Alkalinity	HCO_3^-	<70	+	or
		70-300	+	+
		>300	+	or
Sulphate	SO_4^{2-}	**<70**	+	+
		70-300	+	-
		>300	+	-
Alkalinity/Sulfate	HCO_3^-/SO_4^{2-}	**>1**	+	+
		<1	+	-
Electrical conductivity	µS/cm	<10	+	or
		10-500	+	+
		>500	+	or
Ammonium	NH_4	**<2**	+	+
		2-20	+	or
		>20	+	-
Free chlorine	Cl_2	**<1**	+	+
		1-5	-	or
		>5	-	-
Hydrogen sulphide	H_2S	**<0.05**	+	+
		>0.05	+	-
Free carbon dioxide (aggressive)	CO_2	**<5**	+	+
		5-20	+	or
		>20	+	-
Nitrate	NO_3^-	**<100**	+	+
		>100	+	or
Iron	Fe	**<0.2**	+	+
		>0.2	+	or
Aluminium	Al	**<0.2**	+	+
		>0.2	+	or
Manganese	Mn	**<0.1**	+	+
		>0.1	+	or

Chloride content (Cl^-)	Maximum temperature			
	60°C	80°C	120°C	130°C
< 10 ppm	AISI 304L	AISI 304L	AISI 304L	AISI 316L
≤ 25 ppm	AISI 304L	AISI 304L	AISI 316L	AISI 316L
≤ 50 ppm	AISI 304L	AISI 316L	AISI 316L	
≤ 80 ppm	AISI 316L	AISI 316L	AISI 316L	
≤ 150 ppm	AISI 316L	AISI 316L		
≤ 300 ppm	AISI 316L			

+	Good resistance
or	When multiple factors are “or” corrosion can occur
-	Not recommended

WARNING

⚠ Note: It is important to note that this water specification is not a guarantee against corrosion, but should be considered a tool to avoid the most critical water applications.

CAUTION

⚠ For proper operation install the filter supplied with the unit (with 0.4 mm mesh). The filter must be installed in the pump suction. Failure to observe this prescription can result in irreparable damage to the evaporator.
In the case of plate evaporators in fact, the clogging of even just some plates (or gaps) can cause the plate to seize (clogging), leading to the breakage of part of the exchanger, even if the water flow seems regular and operation is apparently normal.

5.1 Expansion vessel

The expansion vessel must always be installed on the pump suction side.
To calculate the minimum volume of the expansion tank necessary for a given installation, the following calculation can be used, valid if the pressure in the circuit is less than or equal to 0.5 bar when the pump is stopped and the maximum operating pressure of the expansion tank is greater than or equal to 4 bar.
The volume of expansion vessel V in litres is provided by the formula:
$V = 2 \cdot Vt \cdot (Ptmin - Ptmax)$
where:

Vt=	Total circuit volume in litres
Ptmin=	Specific weight at the minimum temperature that the water can reach during the year °C (even with the system idle)
Ptmax=	Specific weight at the maximum temperature reachable by water during the year in °C (even when the system is stopped)

Calculation example:
Vt=200 litres
percent ethylene glycol by volume=30%
tmin = 5°C from the table **Ptmin** = (1.045+1.041)/2 = 1.043
tmax = 40°C from the table **Ptmax** = 1.0282
$V=2 \cdot 200 \cdot (1.043 - 1.0282)=5.92$ litres
Specific densities table P

	% Glycol	0%	10%	20%	30%	40%
Temperature [°C]	-20	1.0036	1.0195	1.0353	1.0511	1.0669
	-10	1.0024	1.0177	1.033	1.0483	1.0635
	0	1.0008	1.0155	1.0303	1.045	1.0598
	10	0.9988	1.013	1.0272	1.0414	1.0556
	20	0.9964	1.0101	1.0237	1.0374	1.051
	30	0.9936	1.0067	1.0199	1.033	1.0461
	40	0.9905	1.003	1.0156	1.0282	1.0408

5.2 Hydraulic connections

IPHP 002-004

IPHP 006-008

The units have threaded water connections (refer to the figure above). The pipe diameters are shown in the table below.

1. When connecting the machine to the water pipes, respect the direction of the water (as shown in the figures above or in the overall dimension drawings attached).
2. Provide two valves (one at the inlet, one at the outlet) to isolate the unit in the case of maintenance work without having to empty the user water circuit.
3. Install Y-filter in suction to the pump (supplied with the unit).
4. Install hydraulic loading unit to always ensure the minimum necessary pressure inside the hydraulic circuit.
5. Install an expansion vessel.

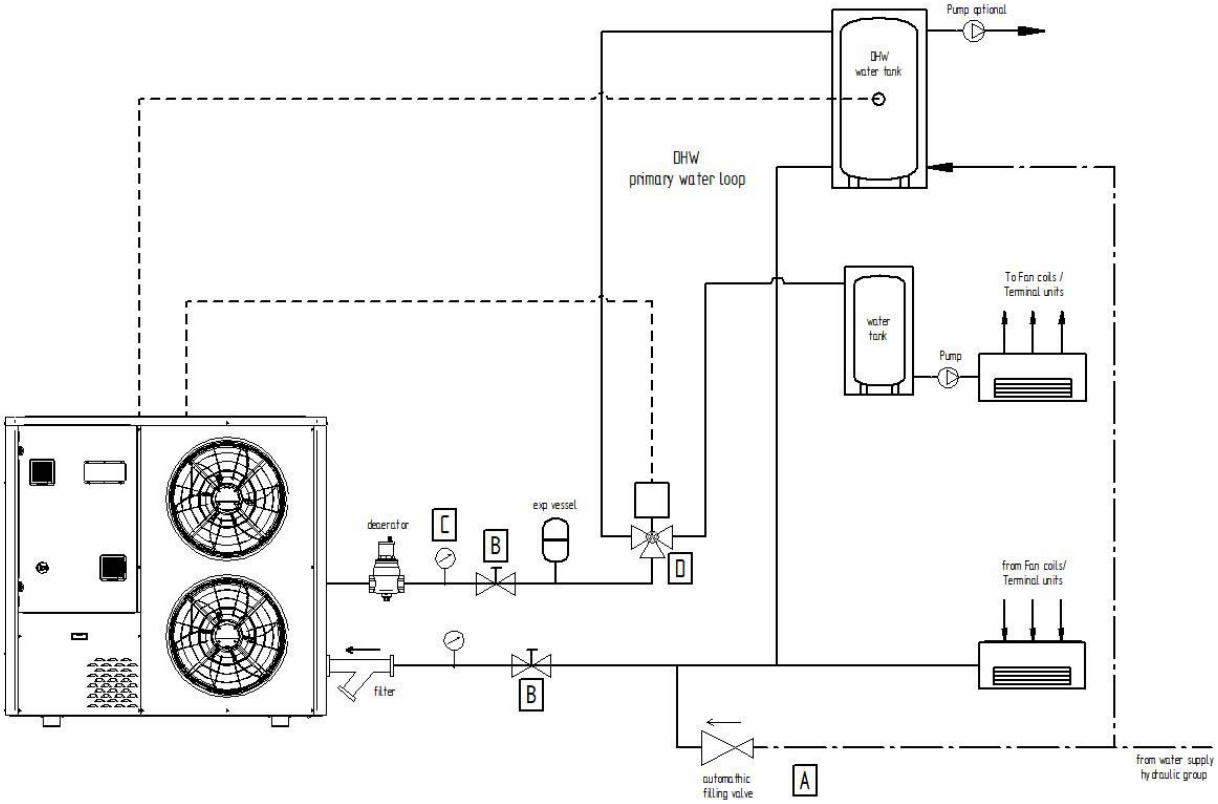
CAUTION

⚠ For proper operation install the filter supplied with the unit (with 0.4 mm mesh). The filter must be installed in the pump suction. Failure to observe this prescription can result in irreparable damage to the evaporator.
In the case of plate evaporators in fact, the clogging of even just some plates (or gaps) can cause the plate to seize (clogging), leading to the breakage of part of the exchanger, even if the water flow seems regular and operation is apparently normal.

The hydraulic system must be sized so that the pressure values of the water flowing into the machine are no higher than those shown in the table:

Model	IN/OUT water connection diameter
IPHP 002	1”
IPHP 004	1”
IPHP 006	1 1/4”
IPHP 008	1 1/4”

Below is an example of a functional diagram



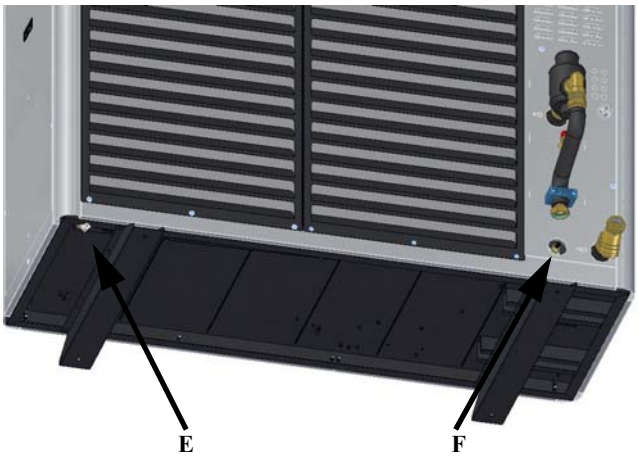
A	automatic filling valve	**C**	pressure gauge
B	tap	**D**	3-way valve

5.3 Condensate drain

All units are equipped with a drainage system at the base of the condensate collection tank located under the battery.
If draining is prolonged to convey water, prevent the pipes from freezing.
The condensate drain must not be conveyed into drains where the gas, in case of leakage, can accumulate.

IPHP 002-004

IPHP 006-008

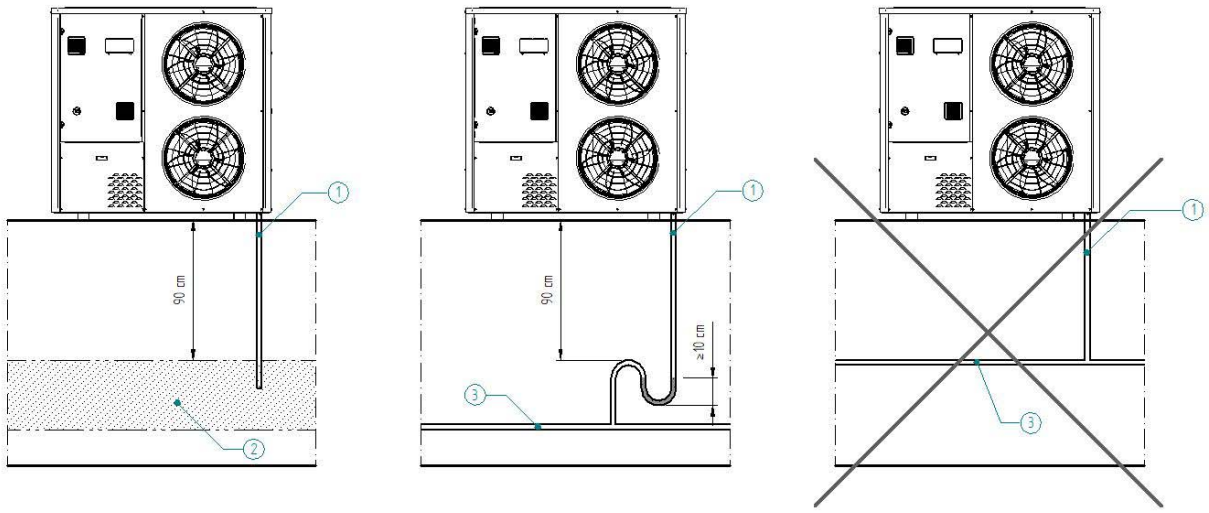


E condensate drain
F drainage

In heat pump operation, the air flow that invests the battery can condense and the water that forms is collected in the basin and from here it must be conveyed to the outside to avoid filling. The conveying can be done by connecting a pipe to the drain fitting to drain the water away from the machine. The condensate drain fitting at the base of the basin must not be obstructed or modified.

For applications in harsh climates, the water that forms inside the condensate drain pan could freeze leading to a worsening of the operation of the machine, to avoid this it is advisable to install the electrical resistance, provided as an option, in order to avoid freezing.

How to drain condensation:



1. Condensate drain pipe DN 50 insulated between floor and heat pump.
2. Gravel layer in the frost-free area to absorb condensation (up to 50 litres per day).
3. Waste water or rain water duct or drainage pipe.

- If inserted into a duct or drainage pipe: take into account the slope of the pipe and opt for a frost-free installation.
- Alternative: let the condensation flow into the building and use a siphon to introduce it directly into the duct. Lifting systems are not allowed.

5.4 Anti-freeze protection

Even if the minimum ambient operating temperature is higher than 0°C, the temperature in the place of installation may be lower than this during the winter, when the machine is not used.
In these cases, if the machine is not emptied, it is necessary, to avoid the formation of ice, to add antifreeze (propylene glycol) in the following percentages:

Ambient temperature up to [°C]	Propylene Glycol [wt %]
0	0
-5	20
-10	30
-15	35
-20	40

NOTE

The unit is equipped with an antifreeze function that starts the circulator if the water temperature drops below a set temperature value and activates the antifreeze resistance (when present).

CAUTION

⚠ In the event that the unit must remain de-energised for a certain period of time in an environment whose temperature can reach freezing values of the water contained in the evaporator (risk of evaporator breakage), the antifreeze protection can also be implemented following the instructions in paragraph 10.2.2 “Water circuit loading procedure” or on request it can be carried out by means of an antifreeze resistor whose operating logic is described in chapter 8.10.9 “Antifreeze” .

WARNING

⚠ If the machine is de-energised there is a danger of ice formation, in this case the antifreeze protections are removed.

CAUTION

⚠ To lower the anti-freeze setting, access parameter **A028** of the system menu with the service password.

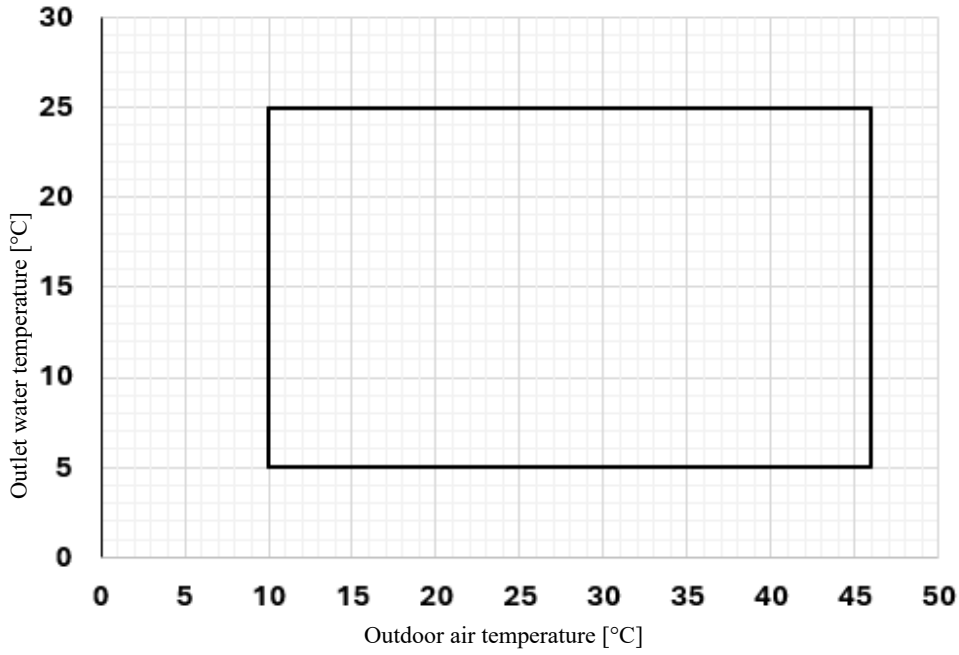
The following are the minimum and maximum flow values during chiller operation:

Model	Flow rate (m^3/h)		
	Min	Name	Max
IPHP 002	0.75	1.07	1.85
IPHP 004	1.17	1.84	3.2
IPHP 006	1.82	2.8	4.9
IPHP 008	2.5	3.8	6.6

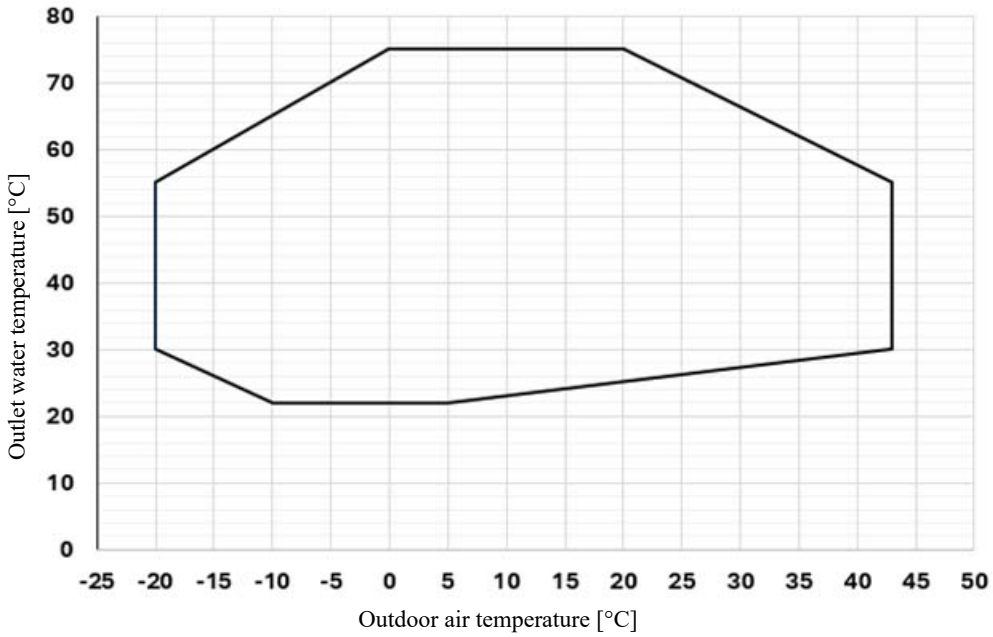
The operating temperature limits are as follows:
air min. -20°C / max. +46°C
water min. +5°C / max. +70°C

Operational map

CH mode



HP mode



CHAPTER 6

ELECTRICAL CONNECTIONS

6.1 Electrical circuit

The electrical circuit schematic is given in the annexed diagrams.

6.2 Electrical connections

The connection of the machine to the electricity supply must be made in compliance with the laws and regulations in force in the place of installation.
The voltage, frequency and number of phases must comply with the information on the machine data plate.
The power supply voltage must not be outside the tolerance range shown on the electrical diagram, even for short periods.
Unless otherwise specified, the frequency tolerance is +/-1% of the nominal value (+/-2% for short periods).
With a three-phase power supply, the voltage must be symmetrical (the effective values of phase to phase voltages and consecutive phase angles must be identical).
In particular, unless otherwise indicated, the maximum permissible phase imbalance is 2%, calculated for each phase according to the formula:

$$\frac{MaxDifferenceOfPhaseVoltageFromVavg}{Vavg} \bullet 100$$

Vavg= average phase voltage

Example: electricity mains 400V/3Ph/50Hz
L1-L2 = 410; L2-L3 = 400V; L1-L3 = 398V
Vavg= (410+ 400 + 398) / 3 = 403V

$$\frac{(410 - 403)}{403} \times 100 = 1.73$$

With a single-phase power supply, the voltage must be supplied between the phase line and neutral and the neutral conductor must be earthed in the relative step-down substation (TN system in compliance with IEC 364) or upstream by the electricity supply company (TT system in compliance with IEC 364).
The phase and neutral lines must not be swapped over.

For the electricity supply:

1. Install the supplied ferrite on the supply line (where present) (installation by the customer) (see note below).
2. Connect the machine (PE terminal in the electrical panel) to the grounding system of the building.
3. Guarantee the automatic interruption of the power supply in the event of insulation failure (protection against indirect contacts according to the requirements of IEC 60364) by means of a type B **differential current device**.
4. Make sure the level of protection against direct contact at the power cable source is at least IP2X or IPXXB (reference CEI EN 60529).
5. Install a device at the origin of the power cable that protects it from overcurrents (short circuit).
6. Use conductors that bring the required max current to the max operating ambient temperature, according to the type of installation chosen (IEC 60364-5-523).
7. Protective devices must be installed that limit the short-circuit current to 17 kA peak in correspondence with the rated breaking capacity if the short-circuit current in the point of installation is greater than an effective value of 10 kA.

Indications on the electrical diagram:

- maximum permitted sized of the type gG fuse.
  In general, the fuses can be replaced by an automatic circuit breaker set in relation to the maximum machine current input (consult the manufacturer if necessary)
- section and type of power cable (if not already supplied).
  Installation: insulated conductors, multi-pole cable in a cable duct installed overhead or fixed to a masonry structure (type C in accordance with IEC 364-5-523 1983), or without any other cables in contact
  Type of cable: copper conductors, 70°C PVC insulation (unless otherwise specified) or EPR 90°C insulation

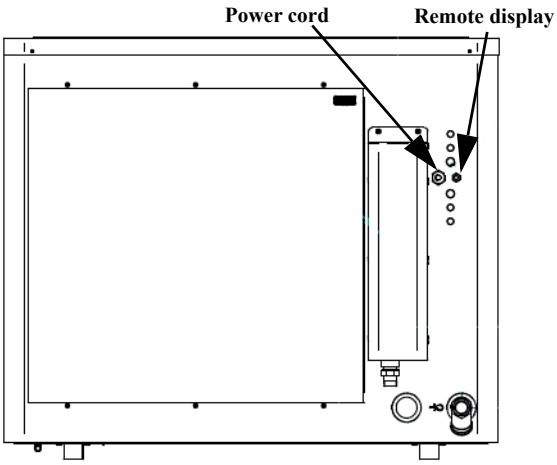
The wiring of the electricity power cable is the responsibility of the customer.
Remove the machine panels (see paragraph 10.2.1 “Accessing the machine”).

CAUTION

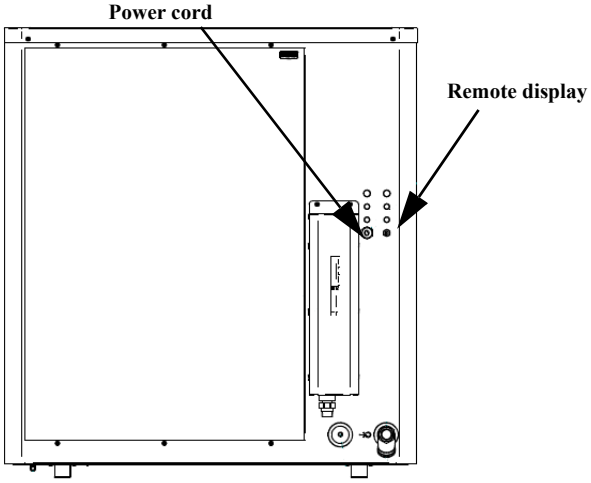
⚠ To check the machine is properly connected to the electricity mains, refer to Chapter 7 “Start-up“.

The following images highlight the holes for the power cable and for the remote display (mod. **IPHP 002-004**) or for the remote display kit (mod. **IPHP 006-008**). The other holes can be used for the kits.

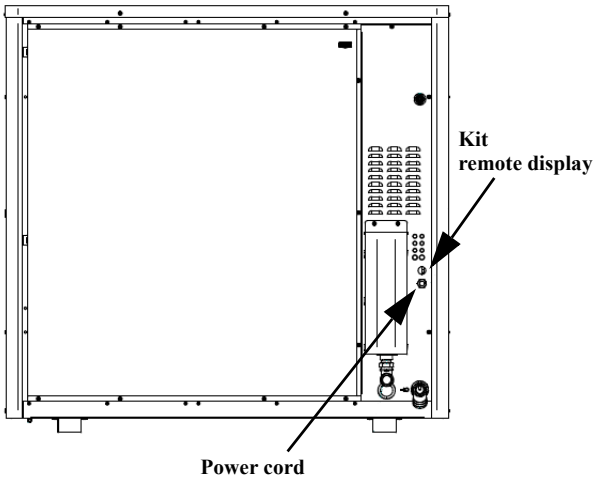
IPHP 002



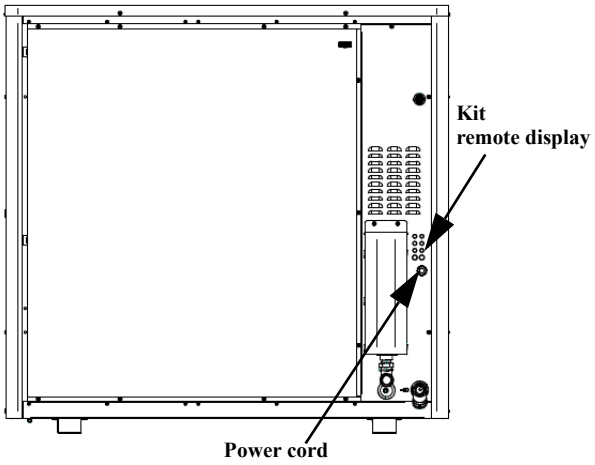
IPHP 004



IPHP 006

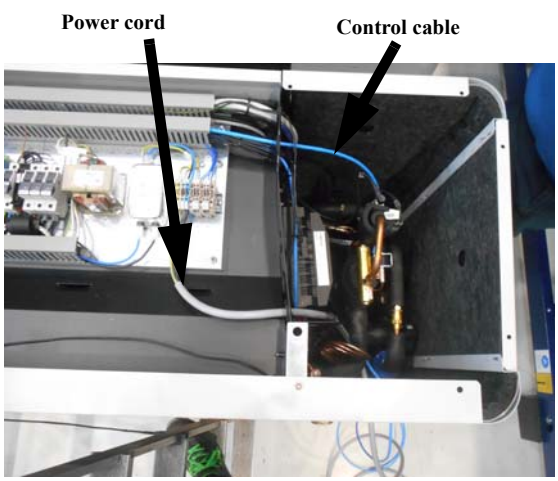


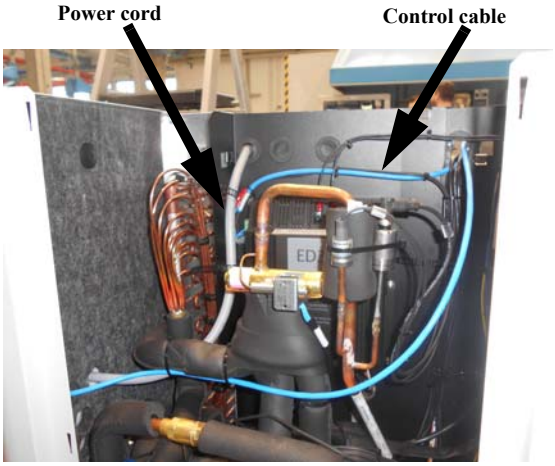
IPHP 008



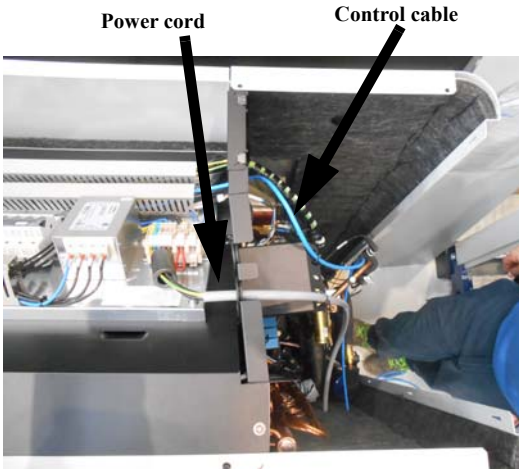
Below is an indication of the cable passage:

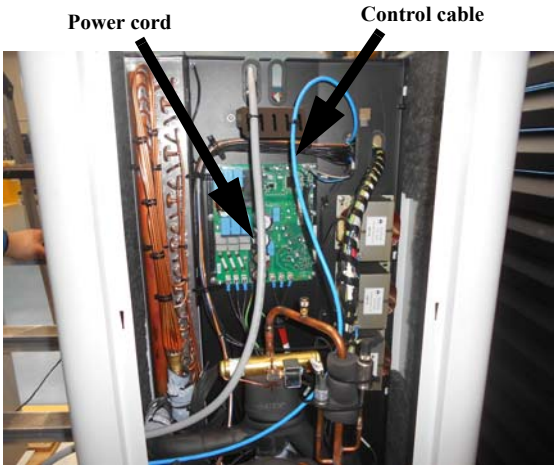
IPHP 002



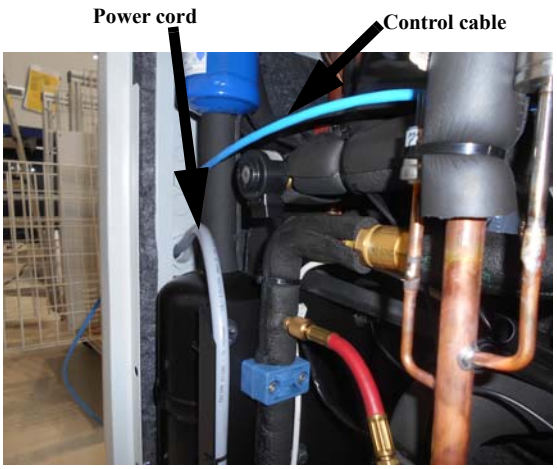


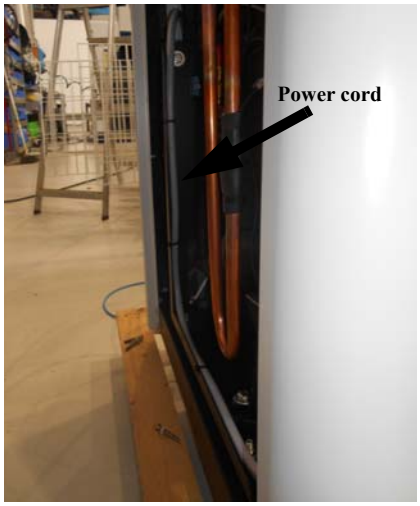
IPHP 004

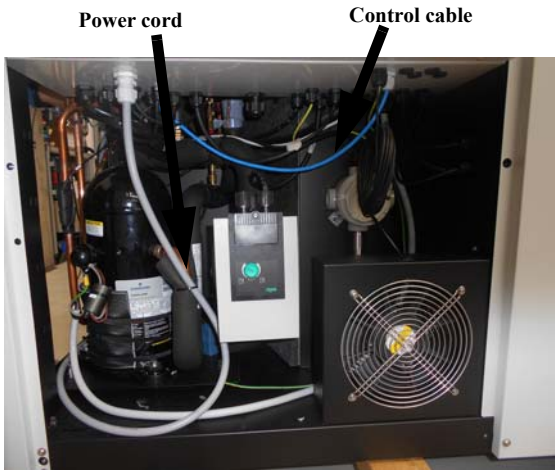




IPHP 006-008

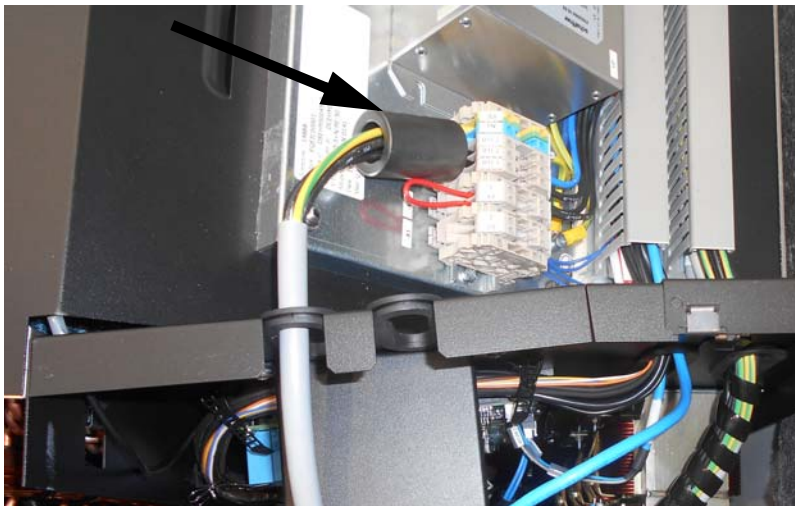






NOTE

For models IPHP 004-006-008, install the ferrite on the power cable as shown in the photo below (indicative image).



CHAPTER 7

START-UP

CAUTION

⚠ The first commissioning must be carried out by personnel trained in authorised service centres.

CAUTION

⚠ Before starting up these machines, make sure all personnel have read and understood Chapter 2 “Safety“.

WARNING

⚠ After powering the machine, if the environmental conditions require it, a phase of forced heating of the compressor oil (which can last a maximum of 1 hour) could be activated, which inhibits its start.
Feed the machine a few hours before turning on the compressor.

CAUTION

⚠ On system start-up:

If the high pressure alarm is triggered when the compressor hasn't been activated, block the machine straight away by pressing OFF on the control.
Now check the refrigerant circuit high pressure value.

Before the start-up procedure, check that the system is correctly loaded (see ch. 10.2.2 “Water circuit loading procedure”).

1. Check the unit shut-off valves are open.
2. Check that the circuit is completely filled with water and properly vented from the air.
   Check that the ambient temperature is within the limits indicated on the machine data plate.
3. Check that the main switch (where present) is in the open position (“O”).
4. Check that the power supply voltage is correct.
5. Power the machine by means of the supply line protection device (machine in standby).
6. Close the main switch (where present) of the machine by putting it in the closed position (“1”).
7. Start up the unit using the defined procedure (see 8.2 “Main operations”).
   After powering the machine, if the environmental conditions require it, a phase of forced heating of the compressor oil (which can last a maximum of 1 hour) could be activated, which inhibits its start.
   Feed the machine a few hours before turning on the compressor.
8. In machines with a three-phase power supply, make sure the compressor is working properly (it must not be noisy), that the circulator rotation direction is correct, and that the fan rotation direction is correct (it's “correct” if it takes the air from inside the machine).
   The machines are manufactured and tested in such a way that the three aforementioned components have a sense of rotation in agreement. Therefore, if one component turns in the correct direction, the others are also correctly connected.
   Check the rotation direction of all the above-mentioned components at the first start-up and after every maintenance intervention.
   If an AC motor is rotating in the wrong direction, invert two phases on the main supply terminals of the control panel.
9. It is possible to check that the flow rate is within the limits by checking it on the appropriate display screen.
   The flow rate can be adjusted with a valve. If it is too low, it is recommended to install a gate for flow regulation.
   Consider then that an adjustment of the flow rate can be made by acting on the PLC (number of revolutions settable) (see parameters **A119-A120** ch. 8.9.1 “Plant”).

10. **If, at the first start-up,** the ambient temperature is high and the hydraulic circuit water temperature is much higher than the working value **(e.g. 25-30°C)**, this means that the unit starts up overloaded, and the **protection devices might trip**.
    To lessen this overload, an inlet valve from the machine can be gradually (but not totally!) **closed to reduce the flow of water passing through it.**
    Open the valve as the water temperature in the hydraulic circuit gradually reaches the working value.
11. If the alarm light on the front of the panel is off and the machine display is off, but the disconnecting device is ON, there may be an alarm condition with relative coolant loss. **In this case, contact technical support immediately.**
12. The machine is now ready to start operating.

NOTE

In single-phase machines with a three-phase compressor, check the direction of rotation of the compressor if it and/or the inverter are replaced.

CAUTION

⚠ **TO SWITCH THE UNIT OFF, USE THE ELECTRONIC CONTROL UNIT AS EXPLAINED IN THE MANUAL (Chapter 8 "Electronic control").**

The unit must not be switched off by disconnecting the electricity supply (do not turn off the disconnecting switch or any other disconnection device upstream of the machine).

When disconnecting the power supply, first of all make sure the machine has been switched Off via the electronic control unit, and that the compressor, circulator and fan are OFF.

CHAPTER 8

ELECTRONIC CONTROL

In IPHP 002-004 models there is always a remote display.
In IPHP 006-008 models there is always a display on the machine. Remote display kit can be provided upon request.

8.1 Keys and icons

The meaning of all the keys on the display is described below:

Key	Description	Notes
	User menu access	see 8.8 “User menu”
	Main Menu Scroll	see 8.5 “Main menu”
	Command off - can be activated	
	Command active - can be deactivated	
+ -	Setpoint Increase/Decrease	see 8.10.2 “Setpoint”
	Access to the on/off menu and operating mode	see 8.2 “Main operations”
	Machine on/off	see 8.2 “Main operations”
	Change the operating mode between chiller and heat pump	see 8.2 “Main operations”
	Access to the alarms menu/Reset alarms	The number on the red background represents the number of active alarms see 8.11 “Alarms”
	Economy Activation	see 8.7 “Quick menu” see 8.10.7 “Economy”
	Climate Curve Access	see 8.7 “Quick menu” see 8.8.1 “Climate Curve”
	Edit Custom Climate Curve	see 8.8.1 “Climate Curve”
	Scheduler Access	see 8.7 “Quick menu”
	Access to the temperature chart	see 8.7 “Quick menu” see 8.8.3 “Trend Chart”
	Access to temperature log (Service level)	see 8.8.3 “Trend Chart”
	Chart Zoom	see 8.8.3 “Trend Chart”
	Chart reset	see 8.8.3 “Trend Chart”
	Return to previous screen	

Key	Description	Notes
	Return to main menu	see 8.5 “Main menu”
	Access menu Settings	see 8.8.4 “Settings”
	Display language change access	see 8.8.4.1 “Language”
	Access to the Display menu	see 8.8.4.3 “Display”
	Access to the Network menu	see 8.8.4.5 “Network”
	Access to the Unit of Measure menu	see 8.8.4.2 “Unit of measurement”
	Access to the Date/Time menu	see 8.8.4.4 “Date/Time”
	Access to the Info menu	see 8.8.4.6 “Info”
	Login to the reserved service menu	see 8.9 “Reserved service menu”
	Logout from reserved service menu	see 8.9 “Reserved service menu”
	History download	see 8.9.6 “Alarms Log”
	History reset	see 8.9.7.4 “Initialisation”

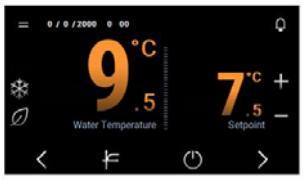
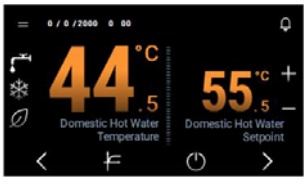
The meaning of all the icons on the display is described below:

Icon	Description	Notes
	Machine switched on in chiller mode	see 8.2 “Main operations”
	Machine off in chiller mode	see 8.2 “Main operations”
	Machine switched on in heat pump mode	see 8.2 “Main operations”
	Machine off in heat pump mode	see 8.2 “Main operations”
	Oil heating procedure in progress (flashing)	see 8.2 “Main operations” see 8.10.1 “Oil heating procedure”
	Defrosting in progress	see 8.9.8 “Defrost”
	Leak detector expiring	see 8.10.15 “Leak Detector” v. 8.11.3 “Alarms” - **AL090**
	ACS Enabled	see 8.10.12 “Domestic hot water (ACS)”
	ACS Active	see 8.10.12 “Domestic hot water (ACS)”
	ACS also active with resistance on ACS tank	see 8.10.12 “Domestic hot water (ACS)”

Icon	Description	Notes
	Anti-legionella procedure in progress (if enabled)	see 8.10.13 “Anti-legionella function”
	Supplementary resistance on active tank	see 8.10.4.1 “Supplementary resistance”
	Economy not active	see 8.10.7 “Economy”
	Economy active	see 8.10.7 “Economy”
	Smart-Grid active in maximum power mode 1	see 8.10.6 “Smart-Grid”
	Smart-Grid active in maximum power mode 2	see 8.10.6 “Smart-Grid”
	Smart-Grid active in lock mode	see 8.10.6 “Smart-Grid”
	Low-noise function active	see 8.10.11.1 “Low-noise”
	Machine on for tank temperature	see 8.2 “Main operations”
	Active modularity (Leader module)	see 8.10.16 “Modularity”
	Active modularity (Follower module)	see 8.10.16 “Modularity”
	Modularity not connected (Follower module)	see 8.10.16 “Modularity”

8.2 Main operations

Oil heating at start-up	• After the machine has been electrically powered, it keeps the compressor off and heats the oil until the delivery temperature is sufficiently high (see 8.10.1 “Oil heating procedure”) • The icon flashes on the display  • After a short blackout it does not reactivate • It can be bypassed by display: Press  at the top left in the main menu Press  **Settings** Press  top right Enter the service **2011** password and press **OK** Press  **G.Settings** Select “**Bypass Oil Heating**”

Machine On/Off	• In the main menu press  to enter the On/Off menu • Press  the machine is switched on • Press  the machine goes to standby **(*)** • Press  the machine is switched off **(*)** Stand-by: the machine can be switched on remotely or supervised. In this state it can also be lit for: antifreeze, domestic hot water, anti-legionella. In these situations, the icon appears:  The machine can be switched on at service level depending on the tank temperature **(A121, A122, A123, A124)**. If the machine is switched on, the icon appears  in the synoptic menu.
Chiller/Heat Pump	• In the main menu press  to enter the On/Off menu • Press  the machine is in heat pump. The icon is displayed  • Press  the machine is in chiller. The icon is displayed  The change-over takes place with a delay set at the service level **(A064b)**. It is possible to enable the change-over from digital input **(A064)**.
Changing the setpoint	• Scroll the main menu with  or  until you see:  • Use + - to increase/decrease setpoint value • Press the current value of the setpoint for quick change via numeric keypad
Modification of the ACS sanitary hot water setpoint (if present)	• Scroll the main menu with  or  until you see:  • Use + - to increase/decrease setpoint value • Press the current value of the setpoint for quick change via numeric keypad

Change date/time	• Press  at the top left in the main menu • Select  **Settings** • Select  **Date/Time** • Select and change the desired value • Press **SAVE** to confirm
Displaying/Resetting an Alarm	• Press the icon  in the upper right to access the menu of active alarms: the codes of the active alarms are displayed (see 8.11.3 “Alarms”) • Press and hold the icon  for 5s to reset. Non-resettable alarms still remain active
User menu access	• Press  at the top left in the main menu In the menu there are the items (see 8.8 “User menu”): - Climatic Curve - Trend chart - Scheduler - Settings - Language - Display - Network - Unit of measurement - Date/time - Info
Login to the reserved service menu	• Press  at the top left in the main menu • Select  **Settings** • Press  top right • Enter the password service **2011** and press **OK** (see 8.9 “Reserved service menu”)
Access to configuration on first boot	• In the reserved service menu, access **G. Settings** • Go to **Initialisation** • Select **Configuration at first start** (see 8.3 “Configuration at first start up”)
Return to main menu	• Press the icon  at the top left
Service Contact Information	• Press  at the top left in the main menu • Select  **Settings** • Select **Info** **The Service contact information is shown in the white box**
Password Service	**2011**

8.3 Configuration at first start up

PLEASE NOTE	
uPC3	Main electronic board for machine control
SEC	Electronic board dedicated to inverter control
c.pCOe	External expansion board for managing special functions (ACS, etc.)
pGDX	Touchscreen display. It can be on board the machine or remote depending on the model

The procedure must be carried out by the Service at the first start-up and allows the Service reference (name, telephone number, etc.), the percentage and type of glycol present in the machine to be set on display.

- Press  at the top left in the main menu
- Select  **Settings**
- Press  top right
- Enter the service **2011** password and press **OK**
- Select  **G. Settings**
- Select **Initialisation**
- Select **Configuration on first boot**

Configuration at first start up

Set Service reference (name, phone number, etc.)

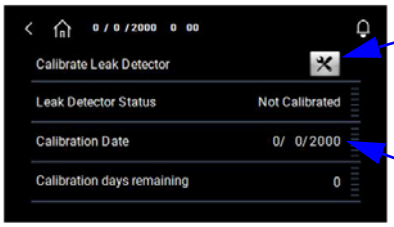
Sets the percentage and type of glycol in the machine

8.4 Leak detector calibration recording

The procedure must be carried out by the Service in the machines provided with the leak detector. When the Leak detector is calibrated by the Service, the calibration date and the days remaining until the next calibration can be saved on the display. A warning will be displayed to warn of the expiration of the days with the icon: 
At the end of the days, a machine lock alarm is activated (see 8.11.3 “Alarms” - **AL090**).

- Press  at the top left in the main menu
- Select  **Settings**
- Press  top right
- Enter the service **2011** password and press **OK**
- Select  **G. Settings**
- Select **Initialisation**
- Select **Calibration Leak Detector**

Leak detector calibration recording



Pressing the key saves the calibration date and the remaining days for the next

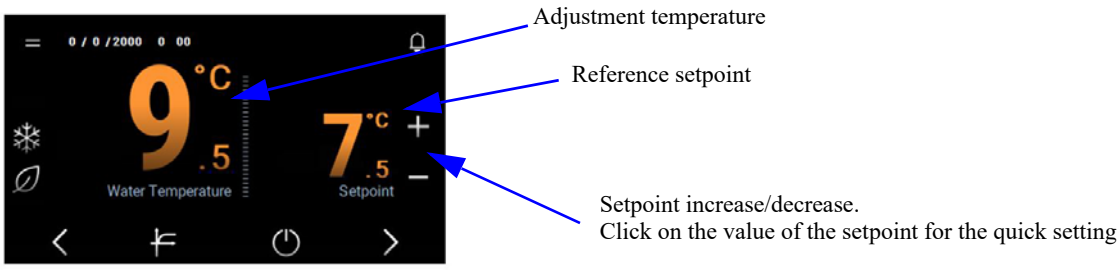
They indicate if the Leak detector is calibrated, the date of the last calibration, the remaining days at the calibration of the Leak detector

8.5 Main menu

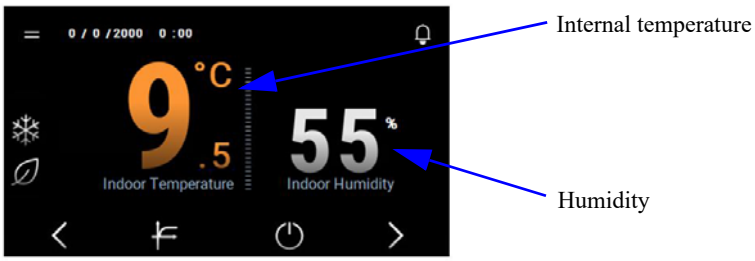
It is the menu that is displayed in the normal operation of the machine after the start phase of the display.

With the keys and scroll through the menu masks. The last screen selected is the one that remains set to display as preferred.

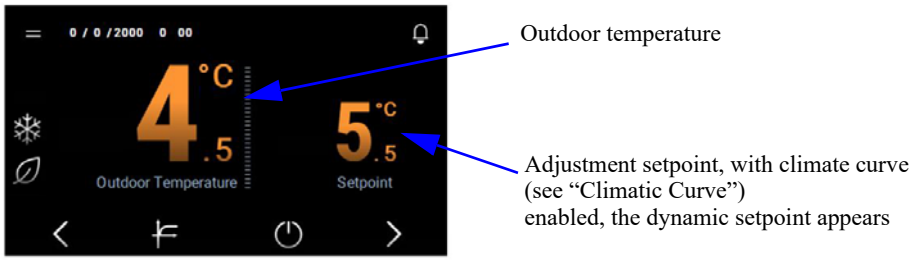
Water temperature and setpoint menu



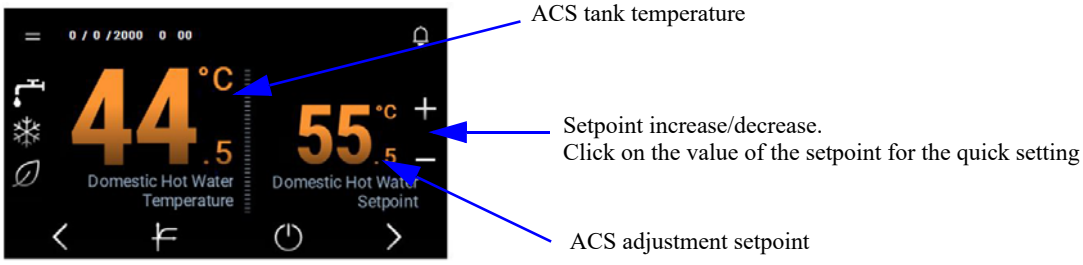
Indoor Ambient Temperature and Indoor Ambient Humidity Menu
(Displayed only if the remote display is present)



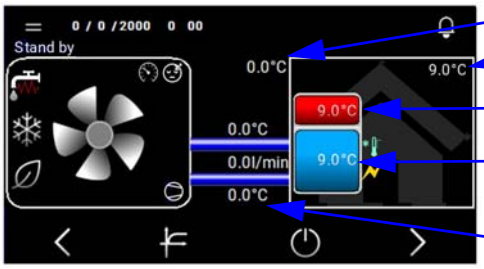
Outdoor room temperature menu and dynamic setpoint



Domestic hot water temperature menu (ACS)
(It is displayed only with domestic hot water enabled)



Synoptic
It shows the indication of the status of the machine



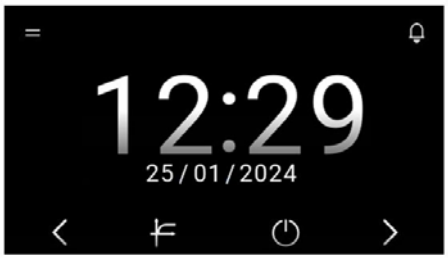
Outdoor temperature
Internal temperature (remote display only)
ACS temperature (if present)
Tank temperature and tank resistance (if present).
On icon for tank temperature (if enabled)
Water inlet and outlet temperature, flow rate measurement (if applicable)

Machine status:

- Stand by
- Off for alarm
- Off from keyboard
- Off for chq-over
- Comp. On
- Defrosting
- Shutdown
- Off from Master
- Back-up
- On from external condition
- Off from boiler

With password service active, it also shows the percentage of operation of the compressor.

Time and date



NOTE
After 4 minutes of the display on without touch input, the brightness decreases almost to a minimum and you exit any logins made. After another 5 minutes the screen is blacked out. With the screen darkened, the led bar remains functional. Pressing any area of the display reactivates it.

8.6 Led bar

Appears to the right of the display screen and indicates the status of the machine:

Solid Blue	Machine switched on in chiller mode
Solid Red	Machine switched on in heat pump mode
Solid Green	Economy mode active
Flashing red	Alarm or warning present in the machine

It is possible to disable the bar LED in the **User menu- >Settings->Display->Enable status LED**, in this case only the flashing red operation remains active in the event of a serious or offline alarm of the display.

8.7 Quick menu

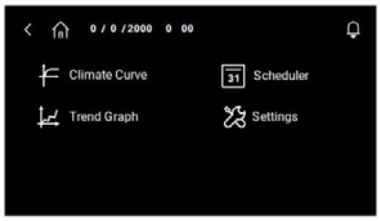
You can customise the indicated button on the main menu to access a particular operation faster:

Customisation is set in the **User Menu- >Settings->Display-> Quick Feature**. The possible particular operations that can be chosen are:

	Climate Curve	Activates/deactivates the Climate Curve (see 8.8.1 “Climate Curve”)
	Scheduler	Quickly access the Weekly Scheduler settings (see 8.8.2.1 “Weekly Scheduler”)
	Chart	Quickly access the temperature chart (see 8.8.3 “Trend Chart”)
	Economy Mode	Activate and deactivate the Economy (see 8.10.7 “Economy”)

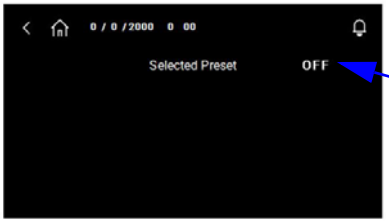
8.8 User menu

It allows access to the main functions of the display and the machine. To access, press  at the top left in the main menu.

	**User menu** It contains the following submenus: • see 8.8.1 “Climate Curve” • see 8.8.2 “Scheduler” • see 8.8.3 “Trend Chart” • see 8.8.4 “Settings”

8.8.1 Climate Curve

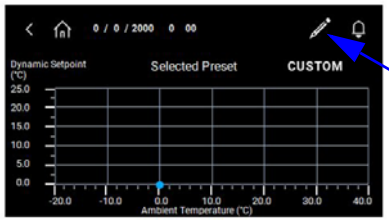
The climate curve allows you to set the machine setpoint as a function of a reference temperature. There are four preset curves (A, B, C, D) and a custom modifiable curve (see 8.10.3 “Climatic curves”). The reference temperature is set in the reserved Service menu.



It allows to select a climate curve

Selection of the climate curve

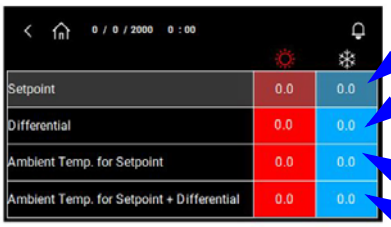
After selecting the climate curve, the corresponding graph appears



Displays the graph of the set climate curve

With the custom curve selected, it is possible to modify the parameters

It displays the parameters of the custom climate curve set



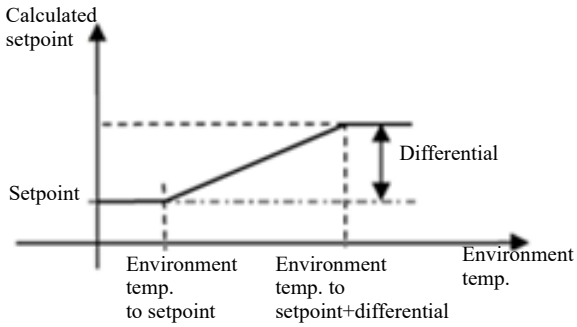
Chiller and heat pump setpoints (preset and modifiable in the main menu)

Chiller and heat pump differentials

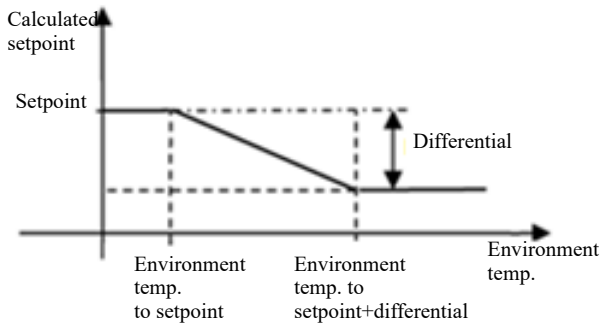
Reference ambient temperature at the preset chiller and heat pump setpoints

Reference ambient temperature at the chiller and heat pump setpoint

Chiller climate curve



Heat pump climate curve



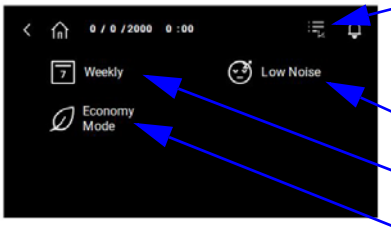
NOTE

The climate curve is a function that can be added to the Quick menu (see 8.7 “Quick menu”).

8.8.2 Scheduler

It allows access to the history of the energy saving graph (accessible only with active service password)

Scheduler



It allows access to the history of the energy saving graph (accessible only with active service password)

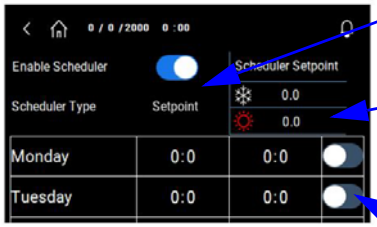
Access to silent mode

Access to weekly scheduler

Access to Economy mode

It is only accessible with active service password.
It contains energy saving information.

8.8.2.1 Weekly Scheduler



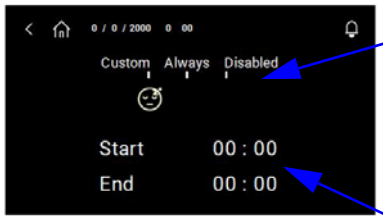
Scheduler type:

- On/Off: the machine is switched off in the set bands
- Setpoint: the second setpoint is used in the set ranges

Single Band Enablement

8.8.2.2 Silent mode

(see 8.10.11.1 “Low-noise”)



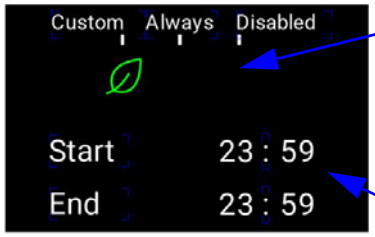
Low-noise type:

- Custom: a time slot (daily) defines when low-noise is active
- Always: Low-noise is always active
- Disabled: Low-noise always disabled

Low-noise time slot

8.8.2.3 Economy Mode

(see 8.10.7 “Economy”).



Type of Economy:

- Custom: a time slot (daily) defines when economy is active
- Always: Economy is always active
- Disabled: Economy always disabled

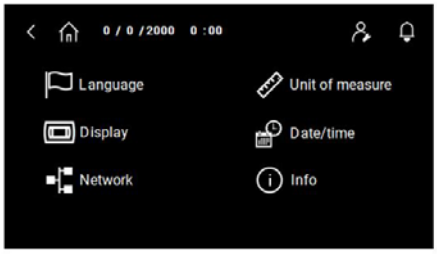
Economy custom time slot

8.8.3 Trend Chart

	Graphic display of: • Internal temperature (only with remote display connected) • Indoor humidity (only with remote display connected) • Water temperature • Outdoor temperature It is possible to hide a probe, change the sampling and enlarge the graph. Key  allows access to the chart history (accessible only with active service password).

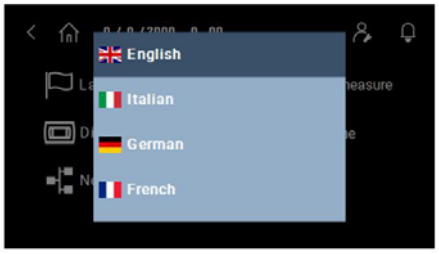
	Chart history (accessible only with active service password). You can select a time interval to view the history of the selected temperatures.

8.8.4 Settings



It contains the following submenus:
- Language
- Unit of measurement
- Display
- Date/Time
- Network
- Info

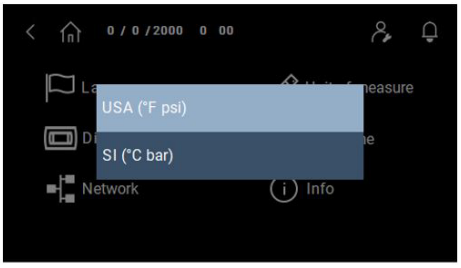
8.8.4.1 Language



Set the display language between:
- English
- Italian
- German
- French
- Spanish

Select the desired language from the drop-down menu.

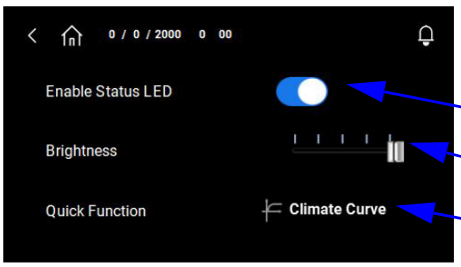
8.8.4.2 Unit of measurement



Sets the unit of measurement of the display between:
- USA (P°F psi)
- SI (°C bar)

Select the desired unit of measurement from the drop-down menu.

8.8.4.3 Display



Sets the unit of measurement of the display between:
- USA (P°F psi)
- SI (°C bar)

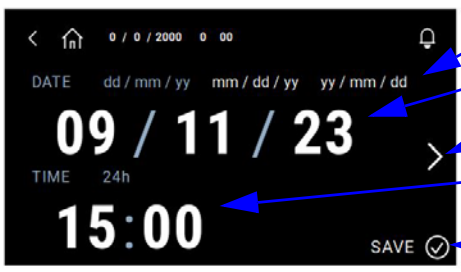
Enables/disables the led bar (see “LED Bar”)

Display brightness

Set the desired function in the Quick menu (see “Quick menu”)

8.8.4.4 Date/Time

Set date and time



Set the date format in the display

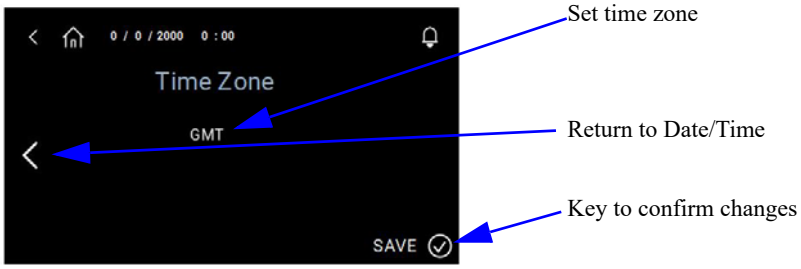
Set the date in the display

Go to time zone

Set the time in the display

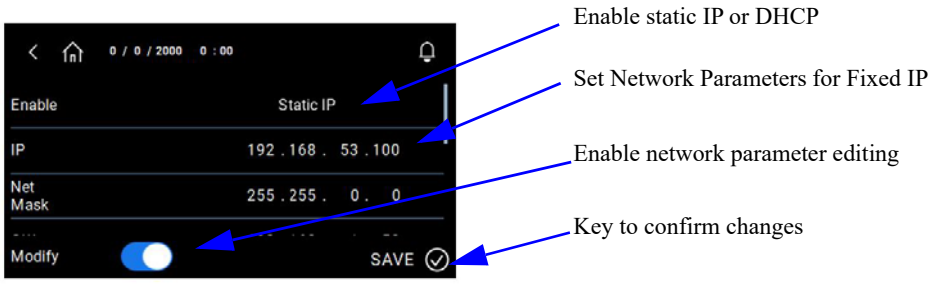
Key to confirm changes

Set time zone



8.8.4.5 Network

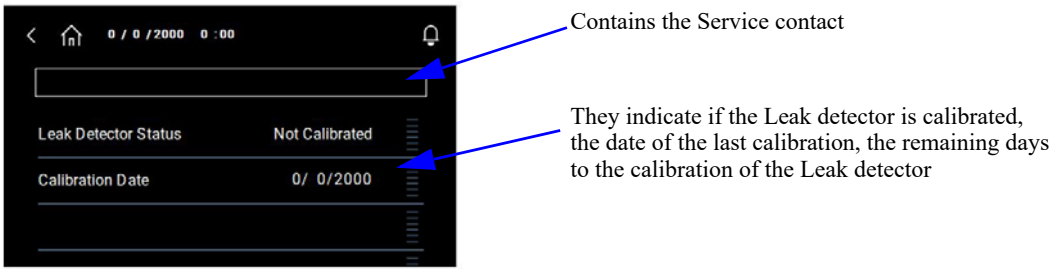
Set the IP address of the machine's electronic control (scroll-down to see all parameters)



With modularity enabled, it allows to put a follower module (see 8.10.16 “Modularity”) in stand-alone mode:

8.8.4.6 Info

Display-only information (scroll down to see all information)



Reports the yield and EER of the machine
With active modularity it displays the power of the modular system (see 8.10.16 “Modularity”)

8.9 Reserved service menu

It contains all the parameters important for the operation of the machine and accessible with password only by the Service.
The menu is organised in submenus for the different functions of the machine.

- Press  at the top left in the main menu
- Select  **Settings**
- Press  top right
- Enter the service **2011** password and press **OK**

Reserved service menu

Below are the submenus of the reserved menu.

8.9.1 Plant

It contains the parameters relating to the machine and the system. The parameters also accessible to the user are in bold.

Parameter	Description	Default	U.M.	Notes
-	Pump working hours (read only)	--	h	see 8.10.8 “Pump”
A001	Pump work hours warning intervention threshold	99	h	see 8.10.8 “Pump”
A001b	Reset pump working hours	NO	--	see 8.10.8 “Pump”
-	Pump status (read only)	--	--	see 8.10.8 “Pump”
A002	Pump activation in manual mode	AUTO	--	see 8.10.8 “Pump”
A013	Delay between pump start and compressor start	30	s	see 8.10.8 “Pump”
A014	Delay between compressor switch-off and pump switch-off	60	s	see 8.10.8 “Pump”
A014b	Sniffing enabled	FALSE	--	see 8.10.8 “Pump”
A014c	Sniffing interval	60	min	see 8.10.8 “Pump”
A014d	Sniffing duration	60	s	see 8.10.8 “Pump”
A022b	Flow Alarm Set (with Flow Meter)	**IPHP 002:** 11.25 **IPHP 004:** 17.55 **IPHP 006:** 27.3 **IPHP 008:** 37.5	l/min	v. 8.11.3 “Alarms” - **AL009**
A022c	Set for flow alarm in heat pump mode (with flow meter)	1.0	l/min	v. 8.11.3 “Alarms” - **AL009**
A023	Flow alarm delay on start-up	60	s	v. 8.11.3 “Alarms” - **AL009**
A024	Running Flow Alarm Delay	6	s	v. 8.11.3 “Alarms” - **AL009**
A024b	Water pressure switch alarm delay	5	s	v. 8.11.3 “Alarms” - **AL081**
A028	Frost Alarm Set	3.5	°C	v. 8.11.3 “Alarms” - **AL028**
A029	Alarm differential	1.0	°C	v. 8.11.3 “Alarms” - **AL028**
A030	Anti-freeze alarm reset type (0=Automatic, 1=Manual, 2= 2nd -> 8th retrial)	1	--	v. 8.11.3 “Alarms” - **AL028**
A031	Alarm relay configuration: (FALSE= only machine lock alarms, TRUE= all alarms/warning)	TRUE	--	see 8.11.3 “Alarms”
A032	Activation set antifreeze protection with unit switched off	4.0	°C	see 8.10.9 “Antifreeze”
A033	Deactivation differential frost protection with unit off	2.0	°C	see 8.10.9 “Antifreeze”
A034	Type of frost protection (1=Pump, 2=Pump and resistance)	2	--	see 8.10.9 “Antifreeze”
A038	Capacitor resistor activation set (if provided)	3.0	°C	see 8.10.9 “Antifreeze”
A039	Capacitor resistor deactivation differential (if provided)	2.0	°C	see 8.10.9 “Antifreeze”
A040	Enabling electrical panel resistance (if provided)	FALSE	--	
A041	Electrical panel resistance activation set	5.0	°C	
A042	Electrical panel resistance deactivation differential	10.0	°C	
A043	Enabling electrical panel fans (if provided)	**IPHP 002-IPHP 004:** FALSE **IPHP 006-IPHP 008:** TRUE	--	
A044	Electrical panel fan activation set	35.0	°C	

Parameter	Description	Default	U.M.	Notes
A045	Electrical panel fan deactivation differential	10.0	°C	
A046	Minimum set-point limit in chiller mode	5.0	°C	see 8.10.4 “PID and compressor adjustment”
A047	Maximum set-point limit in chiller mode	25.0	°C	see 8.10.4 “PID and compressor adjustment”
A048	Minimum set-point limit in heat pump mode	25.0	°C	see 8.10.4 “PID and compressor adjustment”
A049	Maximum set-point limit in heat pump mode	75.0	°C	see 8.10.4 “PID and compressor adjustment”
A050	Minimum operating limit in chiller mode	10.0	°C	see 8.10.5 “Operating limits”
A051	Maximum operating limit in chiller mode	46.0	°C	see 8.10.5 “Operating limits”
A052	Minimum operating limit in heat pump mode	-20.0	°C	see 8.10.5 “Operating limits”
A053	Maximum operating limit in heat pump mode	43.0	°C	see 8.10.5 “Operating limits”
A054	Operating limits differential	2.0	°C	see 8.10.5 “Operating limits”
A055	**Climatic curve (0=Disabled, 1=Custom Preset, 2=Preset A, 3=Preset B, 4= Preset C, 5=Preset D)**	**0**	**--**	**see 8.8.1 “Climate Curve”**
A055b	**Probe for compensated setpoint (FALSE= external temp., TRUE= internal temp.)**	**FALSE**	**--**	**see 8.8.1 “Climate Curve”**
A056	**Custom Preset Compensation Start Setpoint**	**20.0**	**°C**	**see 8.8.1 “Climate Curve”**
A057	**Custom Preset Compensation End Setpoint**	**37.0**	**°C**	**see 8.8.1 “Climate Curve”**
A058	**Custom Preset Compensation Differential**	**0.0**	**°C**	**see 8.8.1 “Climate Curve”**
A059	**Custom Preset Compensation Start Setpoint**	**-5.0**	**°C**	**see 8.8.1 “Climate Curve”**
A060	**Custom Preset Compensation End Setpoint**	**20.0**	**°C**	**see 8.8.1 “Climate Curve”**
A061	**Custom Preset Compensation Differential**	**0.0**	**°C**	**see 8.8.1 “Climate Curve”**
A062	**Second chiller mode setpoint (from Scheduler)**	**10.0**	**°C**	**see 8.8.1 “Climate Curve”**
A063	**Second heat pump mode setpoint (from Scheduler)**	**35.0**	**°C**	**see 8.8.1 “Climate Curve”**
A064	Type of operating mode change-over: FALSE= from display, TRUE= digital input	FALSE	--	
A064b	Delay in changing the operating mode at the change-over	5	min	
A065	Enabling probe -BTWOT (No, uPC3, cPCOe)	No	--	Set to cPCOe to remote the tank probe on c.pCOe
A065b	Enabling tank supplementary resistance (if provided)	FALSE	--	see 8.10.4.1 “Supplementary resistance”

Parameter	Description	Default	U.M.	Notes
A065c	Supplementary resistance activation differential (tank/ACS)	3.0	°C	see 8.10.4.1 "Supplementary resistance" see 8.10.12.10 "ACS supplementary resistance"
A065d	Supplementary resistors activation environment setpoint (tank/ACS)	-7.0	°C	see 8.10.4.1 "Supplementary resistance" see 8.10.12.10 "ACS supplementary resistance"
A065e	Delay in activating supplementary resistors (tank/ACS)	15	min	see 8.10.4.1 "Supplementary resistance" see 8.10.12.10 "ACS supplementary resistance"
A065f	Supplementary resistors deactivation time-out (tank/ACS)	60	min	see 8.10.4.1 "Supplementary resistance" see 8.10.12.10 "ACS supplementary resistance"
A066	Probe for adjustment at start-up (INLET= water inlet, OUTLET= water outlet, TANK= tank)	OUTLET	--	see 8.10.4 "PID and compressor adjustment"
A067	Delayed transition from adjustment to start-up to full throttle	180	s	see 8.10.4 "PID and compressor adjustment"
A068	Probe for regulation at full capacity (INLET= water inlet, OUTLET= water outlet, TANK= tank)	OUTLET	--	see 8.10.4 "PID and compressor adjustment"
A069	P (PID) at startup	20.0	°C	see 8.10.4 "PID and compressor adjustment"
A070	I (PID) at startup	200	s	see 8.10.4 "PID and compressor adjustment"
A071	D (PID) at startup	0	s	see 8.10.4 "PID and compressor adjustment"
A072	P (PID) at full capacity	20.0	°C	see 8.10.4 "PID and compressor adjustment"
A073	I (PID) at full capacity	200	s	see 8.10.4 "PID and compressor adjustment"
A074	D (PID) at full capacity	0	s	see 8.10.4 "PID and compressor adjustment"
A076	Enabling smart function	FALSE	--	see 8.10.6 "Smart-Grid"
A077	**Economy mode operation (0=CH, 1=HP, 2=CH+HP)**	**2**	--	**see 8.10.7 "Economy"**
A078	**Economy mode time slot start**	**00:00**	**hh:mm**	**see 8.10.7 "Economy"**
A079	**Economy mode time slot end**	**00:00**	**hh:mm**	**see 8.10.7 "Economy"**

Parameter	Description	Default	U.M.	Notes
A080	Percentage reduction of maximum compressor speed in Economy mode	20	%	see 8.10.7 “Economy”
A083	ACS function type (False= No c.pCOe, True= With c.pCOe)	FALSE	--	see 8.10.12 “Domestic hot water (ACS)”
A084	Enabling ACS function from probe	FALSE	--	see 8.10.12 “Domestic hot water (ACS)”
A084b	Enabling ACS function from digital input	FALSE	--	see 8.10.12 “Domestic hot water (ACS)”
A085	ACS function activation mode (0=CH+HP, 1=CH, 2=HP)	0	--	see 8.10.12 “Domestic hot water (ACS)”
A086	Duration of pump shutdown during ACS switching	180	s	see 8.10.12 “Domestic hot water (ACS)”
A087	Flow switch alarm by-pass duration during ACS switching in the presence of defrost	120	s	see 8.10.12 “Domestic hot water (ACS)”
A088	P (PID) during ACS	20.0	°C	see 8.10.12 “Domestic hot water (ACS)”
A089	Delta for the calculation of the actual setpoint during ACS	5.0	°C	see 8.10.12 “Domestic hot water (ACS)”
A090	Differential with respect to the setpoint for ACS activation	3.0	°C	see 8.10.12 “Domestic hot water (ACS)”
A091	Limitation of the minimum power of the unit during ACS	0	%	see 8.10.12 “Domestic hot water (ACS)”
A092	Limitation of the maximum power of the unit during ACS	100	%	see 8.10.12 “Domestic hot water (ACS)”
A093	Enabling ACS three-way valve position control	FALSE	--	see 8.10.12 “Domestic hot water (ACS)”
A094	Three-way ACS valve position control alarm delay	60	s	see 8.10.12 “Domestic hot water (ACS)”
A095	Maximum duration of ACS operation	60	min	see 8.10.12 “Domestic hot water (ACS)”
A096	ACS forced deactivation duration after term for maximum duration	30	min	see 8.10.12 “Domestic hot water (ACS)”
A097	Anti-legionella enabling	TRUE	--	see 8.10.13 “Anti-legionella function”
A098	Enabling anti-legionella only with the machine on	FALSE	--	see 8.10.13 “Anti-legionella function”
A099	Enabling ACS resistance	FALSE	--	see 8.10.12.10 “ACS supplementary resistance”
A100	Anti-legionella activation type (0= HP and ACS resistance, 1= ACS resistance only, 2= HP only)	2	--	see 8.10.13 “Anti-legionella function”
A101	Anti-legionella Scheduler Day (1=Mon,…,7=Sun)	1	--	see 8.10.13 “Anti-legionella function”

Parameter	Description	Default	U.M.	Notes
A102	Anti-legionella start time	1	hours	see 8.10.13 “Anti-legionella function”
A103	Anti-legionella start minutes	0	min	see 8.10.13 “Anti-legionella function”
A104	Anti-legionella end time	1	hours	see 8.10.13 “Anti-legionella function”
A105	Anti-legionella term minutes	30	min	see 8.10.13 “Anti-legionella function”
A107	Number of failed attempts anti-legionella procedure for incorrect alarm activation procedure (**AL089**)	1	--	see 8.10.13 “Anti-legionella function”
A108	ACS setpoint during anti-legionella	70.0	°C	see 8.10.13 “Anti-legionella function”
A109	Enabling ACS function even with standby units	TRUE	--	see 8.10.12 “Domestic hot water (ACS)”
A110	Differential on the ACS setpoint in Smart-Grid for maximum power mode 1	5.0	°C	see 8.10.6 “Smart-Grid”
A111	Differential on the ACS setpoint in Smart-Grid for maximum power mode 2	10.0	°C	see 8.10.6 “Smart-Grid”
A112	Enabling ACS pump	FALSE	--	see 8.10.12.9 “ACS pump”
-	ACS Pump Working Hours (Read Only)	--	h	see 8.10.12.9 “ACS pump”
A113	ACS pump work hours warning intervention threshold	99	h	see 8.10.12.9 “ACS pump”
A113b	ACS pump work hours reset	NO	--	see 8.10.12.9 “ACS pump”
-	ACS pump status (read only)	--	--	see 8.10.12.9 “ACS pump”
A114	Activation of ACS pump in manual mode	AUTO	--	see 8.10.12.9 “ACS pump”
A115	ACS pump start time	19	hours	see 8.10.12.9 “ACS pump”
A116	ACS pump start minutes	30	min	see 8.10.12.9 “ACS pump”
A117	ACS pump end time	22	hours	see 8.10.12.9 “ACS pump”
A118	ACS pump end minutes	0	min	see 8.10.12.9 “ACS pump”
A119	Pump On-Off maximum percentage operation in Chiller	100	%	
A120	Pump On-Off maximum percentage operation in Heat Pump	100	%	
A121	Enabling on/off tank unit	FALSE	--	
A122	Chiller tank temperature set for on unit	10.0	°C	
A123	Heat pump tank temperature set for on unit	50.0	°C	
A124	Tank temperature differential for unit off	5.0	°C	
A125	Boiler activation enablement	FALSE	--	see 8.10.4.2 “Boiler consent”
A126	Room temperature set for boiler	-7.0	°C	see 8.10.4.2 “Boiler consent”
A127	Room temperature differential for boiler off	2.0	°C	see 8.10.4.2 “Boiler consent”

Parameter	Description	Default	U.M.	Notes
A128	Maximum percentage reduction of the compressor in chiller mode according to the setpoint	**IPHP 002:** 15 **IPHP 004-IPHP 006 -IPHP 008:** 0	%	
A129	Low temperature setpoint to start compressor reduction in chiller mode	7.0	°C	
A130	High temperature setpoint to end compressor reduction in chiller mode	18.0	°C	

8.9.2 EXV

Contains the parameters relating to the management of the electronic thermostatic valve (EXV).

Parameter	Description	Default	U.M.	Notes
B000	Enable manual positioning of EXV valve	FALSE	--	see 8.10.10 “Electronic thermostatic valve (EXV)”
B001	Manual positioning of EXV valve	OFF	%	see 8.10.10 “Electronic thermostatic valve (EXV)”
B002	Overheating setpoint in chiller mode	6.0	°C	see 8.10.10 “Electronic thermostatic valve (EXV)”
B003	P (PID) EXV valve adjustment in chiller mode	1.0	--	see 8.10.10 “Electronic thermostatic valve (EXV)”
B004	I (PID) EXV valve adjustment in chiller mode	83	s	see 8.10.10 “Electronic thermostatic valve (EXV)”
B005	D (PID) EXV valve adjustment in chiller mode	2.5	s	see 8.10.10 “Electronic thermostatic valve (EXV)”
B006	Overheating setpoint in heat pump mode	6.0	°C	see 8.10.10 “Electronic thermostatic valve (EXV)”
B007	P (PID) EXV valve adjustment in heat pump mode	0.3	--	see 8.10.10 “Electronic thermostatic valve (EXV)”
B008	I (PID) EXV valve adjustment in heat pump mode	250	s	see 8.10.10 “Electronic thermostatic valve (EXV)”
B009	D (PID) EXV valve adjustment in heat pump mode	1.5	s	see 8.10.10 “Electronic thermostatic valve (EXV)”

8.9.3 Compressor

Contains parameters related to compressor management.

Parameter	Description	Default	U.M.	Notes
-	Number of compressor starts (read only)	--	--	
-	Compressor working hours (read only)	--	h	v. 8.11.3 “Alarms” - **AL023**
C000	Working Hours Warning Intervention Threshold	30	h	v. 8.11.3 “Alarms” - **AL023**
C000b	Reset working hours and number of compressor starts	NO	--	v. 8.11.3 “Alarms” - **AL023**
-	Current work rate of the compressor	--	%	
C001	Activation of manual compressor operation	AUTO	--	see 8.10.4 “PID and compressor adjustment”
C002	Minimum compressor ON time	180	s	see 8.10.4 “PID and compressor adjustment”
C003	Minimum compressor OFF time	180	s	see 8.10.4 “PID and compressor adjustment”
C004	Minimum time between compressor ignitions	360	s	see 8.10.4 “PID and compressor adjustment”
C005	Low pressure alarm set	0.2	bar	see 8.11.3 “Alarms” - **AL026**
C006	Low pressure alarm delay at startup	60	s	see 8.11.3 “Alarms” - **AL026**
C007	Low pressure alarm delay	20	s	see 8.11.3 “Alarms” - **AL026**

8.9.4 SEC

Contains the parameters relating to the general functions of the SEC board for inverter control.

Parameter	Description	Default	U.M.	Notes
D001	Differential DT1 for oil heating	20.0	°C	see 8.10.1 “Oil heating procedure”
D002	Differential DT2 for oil heating	25.0	°C	see 8.10.1 “Oil heating procedure”
D003	Maximum oil heating duration	60	min	see 8.10.1 “Oil heating procedure”
D004	Oil heating room temperature set	5.0	°C	see 8.10.1 “Oil heating procedure”
D007	Set of blackout hours for oil heating by-pass	2	h	
D009	Manual activation of 4-way valve relay (only for stand-by tests)	FALSE	--	
D010	Manual activation of compressor relay (only for stand-by tests)	FALSE	--	
D011	Alarm relay manual activation (only for stand-by tests)	FALSE	--	
D012	Low pressure alarm set	0.5	bar	
D013	Low overheating set	3.5	°C	
D014	High overheating set	30.0	°C	
D015	High pressure alarm set	30.3	bar	
D016	Four-way valve switching delta	2.0	bar	

8.9.5 Fan

Contains the parameters related to the fans.

Parameter	Description	Default	U.M.	Notes
-	Fans working hours (read only)	--	h	
E000	Intervention threshold for fan working hours warning	99	h	
E000b	Reset working hours of the fans	NO	--	
-	Fan operating percentage	--	%	
E001	Activation of manual operation of fans	AUTO	--	
E002	Fan activation temperature set for antifreeze	-30.0	°C	
E003	Fans speed for antifreeze	10	%	
E004	Speed up activation of antifreeze fans	50	%	
E005	Fan activation speed up duration for antifreeze	5	s	
E007	**Start Low-noise function**	**00:00**	**hh:mm**	
E008	**Low-noise function end**	**00:00**	**hh:mm**	
E009	Maximum compressor speed in Low-noise	**IPHP 002:** 5100 **IPHP 004:** 5280 **IPHP 006:** 5100 **IPHP 008:** 5280	RPM	
E010	Maximum chiller fan operation in Low-noise	**IPHP 002:** 60 **IPHP 004:** 72 **IPHP 006:** 79 **IPHP 008:** 70	%	
E011	Maximum operation of heat pump fans in Low-noise	**IPHP 002:** 46 **IPHP 004:** 64 **IPHP 006:** 70 **IPHP 008:** 62	%	

8.9.6 Alarms Log

It allows to download the internal alarm log of the electronic board to the internal memory of the electronic board itself or to an external micro USB support.

After choosing where to save the history, pressing button creates a log file with the history of the machine's alarms. You can set a progressive name to the log file. After downloading the file to the internal memory, it can be retrieved via ftp. It is possible to delete the history (see 8.9.7.4 “Initialisation”).

8.9.7 Settings

Contains parameters related to general settings.

8.9.7.1 Input/Output

Input/Output

It allows to view the entire I/O of the machine's electronic boards. Refer to the machine wiring diagram for reference to the I/O.

Offset

It allows to introduce an offset to the machine probes.

Parameter	Description	Default	U.M.	Notes
Gd00	Water inlet probe offset	0.0	°C	
Gd01	Offset water outlet probe	0.0	°C	
Gd01b	Tank probe offset (if present)	0.0	°C	

Parameter	Description	Default	U.M.	Notes
Gd02	Offset of electrical panel probe (if present)	0.0	°C	
Gd03	ACS probe offset on c.pCOe expansion (if present)	0.0	°C	
Gd04	Offset tank probe on c.pCOe expansion (if present)	0.0	°C	
Gd05	Offset of ACS probe on machine electronic board (if present)	0.0	°C	

8.9.7.2 Password

Allows you to change the service password.

8.9.7.3 Serial Ports

Parameter	Description	Default	U.M.	Notes
Ge00	Modbus address	1	--	see 8.12 “Modbus Variable List”
Ge01	Baudrate Modbus (0=4800, 1=9600, 2=19200, 3=38400)	2	--	see 8.12 “Modbus Variable List”
Ge02	Parity bit Modbus (0=None, 1=Odd, 2=Even)	0	--	see 8.12 “Modbus Variable List”
Ge03	Stop Bit Modbus: 1, 2	2	--	see 8.12 “Modbus Variable List”
Ge04	ON/OFF enabling from BMS	FALSE	--	see 8.12 “Modbus Variable List”
Ge10	Bacnet Address	1	--	see 8.12 “Modbus Variable List”
Ge11	Baudrate Bacnet (0=4800, 1=9600, 2=19200, 3=38400)	3	--	see 8.12 “Modbus Variable List”
Ge13	Modularity setting (0=Disabled, 1=Leader, 2=Follower 1, 3=Follower 2, 4=Follower 3)	0	--	see 8.10.16 “Modularity”
Ge14	Number of modularity modules (2,3,4)	2	--	see 8.10.16 “Modularity”
Ge15	Modularity adjustment type (0=Avg, 1=AvgOn)	0	--	see 8.10.16 “Modularity”
IP02	Follower Form 1 IP Address	192.168.53.62	--	see 8.10.16 “Modularity”
IP03	Follower Form 2 IP Address	192.168.53.63	--	see 8.10.16 “Modularity”
IP04	Follower Form 3 IP Address	192.168.53.64	--	see 8.10.16 “Modularity”
Ge16	Leader Module Weight	50	%	see 8.10.16 “Modularity”
Ge17	Follower 1 Module Weight	50	%	see 8.10.16 “Modularity”
Ge18	Follower 2 Module Weight	0	%	see 8.10.16 “Modularity”
Ge19	Follower 3 Module Weight	0	%	see 8.10.16 “Modularity”
Ge20	Enable Back-up Module	FALSE	--	see 8.10.16 “Modularity”
Ge21	Back-up Module Selection	2	--	see 8.10.16 “Modularity”

Parameter	Description	Default	U.M.	Notes
Ge22	Hours per module rotation in back-up (0= no rotation)	0	h	see 8.10.16 “Modularity”
Ge23	Minutes to activate Overboost	0	min	see 8.10.16 “Modularity”

8.9.7.4 Initialisation

Parameter	Description
Configuration at first start up	Allows you to enter a reference to the assistance service (e.g. telephone number) and to store the percentage and type of glycol loaded
Leak Detector Calibration	Allows to save the calibration date of the Leak Detector (see 8.4 “Leak detector calibration recording”)
Clear alarm history	Deletes the alarm history on the machine display. Press OK to confirm the cancellation
Reset to factory settings	Allows to install the machine's factory parameters **WARNING** **Select the correct size of the machine**

8.9.7.5 Info

Contains all the information about the software and hardware version of the machine's electronic control system. It is possible to check the remaining days after the expiration of the calibration period of the Leak Detector.

8.9.8 Defrost

Contains defrost parameters.

Parameter	Description	Default	U.M.	Notes
H000	Room temperature set for derost inhibition	10.0	°C	see 8.10.14 “Defrost”
H001	Water temperature set for derost inhibition	25.0	°C	see 8.10.14 “Defrost”
H002	Defrost Inhibit Reset Differential	1.0	°C	see 8.10.14 “Defrost”
H003	Enabling dynamic setpoint	TRUE	--	see 8.10.14 “Defrost”
H005	Setpoint start defrost	-18.0	°C	see 8.10.14 “Defrost”
H006	Set-point for defrost condition reset	0.3	°C	see 8.10.14 “Defrost”
H007	Defrost activation delay	3	min	see 8.10.14 “Defrost”
H008	Set-point for end of defrosting cycle	37.0	°C	see 8.10.14 “Defrost”
H009	Minimum ambient temperature for dynamic defrosting	-22.0	°C	see 8.10.14 “Defrost”
H010	Maximum ambient temperature for dynamic defrosting	9.0	°C	see 8.10.14 “Defrost”
H011	Minimum set-point for dynamic defrosting	-30.0	°C	see 8.10.14 “Defrost”
H012	Maximum set-point for dynamic defrosting	-3.0	°C	see 8.10.14 “Defrost”
H013	Minimum pressure for fan adjustment during the defrosting cycle	20.0	bar	see 8.10.14 “Defrost”
H014	Maximum pressure for fan adjustment during the defrosting cycle	27.0	bar	see 8.10.14 “Defrost”
-	Total number of defrost cycles performed	--	--	see 8.10.14 “Defrost”
H015	Timed Defrost Interval	180	min	see 8.10.14 “Defrost”
H016	Maximum defrost duration	8	min	see 8.10.14 “Defrost”
H017	Condensation temperature set for end defrost	37.0	°C	see 8.10.14 “Defrost”
H018	Minimum time between two defrosting cycles	180	min	see 8.10.14 “Defrost”
H019	Manual defrost activation	--	--	see 8.10.14 “Defrost”
H020	Low Pressure Safety Defrost Set	0.6	bar	see 8.10.14 “Defrost”

Parameter	Description	Default	U.M.	Notes
H021	Safety defrost delay for low pressure	30	s	see 8.10.14 “Defrost”
H029	Enabling tank supplementary resistance activation during defrost	TRUE	--	see 8.10.14 “Defrost”
H030	Delay in reactivating the economy mode after the defrost	30	s	see 8.10.14 “Defrost”
H031	Defrost 1 Threshold	10.0	-	see 8.10.14 “Defrost”
H032	Defrost 2 Threshold	8.0	-	see 8.10.14 “Defrost”

8.10 Machine operation

The functions of the machine are described below.

8.10.1 Oil heating procedure

The oil heating procedure serves to prevent the migration of coolant to the compressor when it is not switched on and automatically activates, if necessary, whenever the compressor is switched off to maintain the exhaust temperature above 5K-10K of the evaporation temperature.

8.10.1.1 Oil heating at start-up

Each time the machine is resupplied, there is an oil heating procedure that keeps the compressor from starting until the deactivation condition of the procedure is true. The deactivation condition is set to service level and can be bypassed. As long as the oil heating procedure is active at start-up, the icon is displayed on the display  .
The procedure remains active until the compressor delivery temperature exceeds the ambient temperature by one delta. If the ambient temperature is less than the parameter **D004** then the delta corresponds to the parameter **D001** otherwise to the parameter **D002**. When time **D003** is exceeded, the procedure is interrupted and the compressor can be switched on.
In the event of a blackout lasting less than a time in hours set at the service level (**D007**), if the oil heating procedure had previously been completed correctly, both for the deactivation condition and for by-pass, then the compressor can turn on even if the function deactivation condition is not yet true.

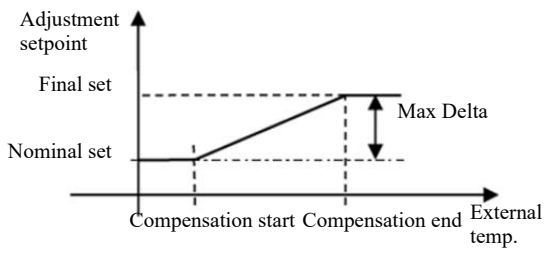
8.10.2 Setpoint

The setpoint is the temperature value to which the machine is brought during its operation. There is one setpoint for chiller mode and one for heat pump mode. The reference probe for the temperature can be set from parameter to service level.
The choice of the adjustment probe is made by parameter (**A066** probe used at start-up and **A068** probe used at full speed).
During operation for the production of domestic hot water, the regulation is set on the evaporator water outlet temperature probe.
The chiller setpoint is limited by a minimum value (**A046**) and a maximum value (**A047**) as well as the heat pump setpoint which is between a minimum value (**A048**) and a maximum value (**A049**).
A second setpoint can be set for both enabled operating modes (**A062** and **A063**) depending on the type of time slot/week set.

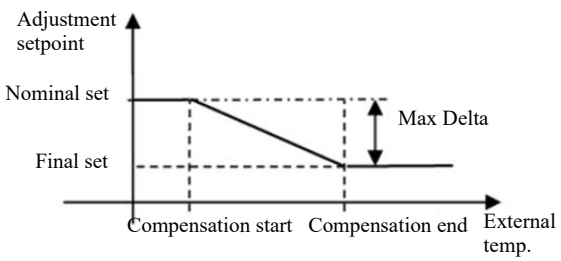
8.10.3 Climatic curves

The climatic curves give the possibility to set the setpoint of the machine as a function of a reference temperature that can be the temperature of the external ambient probe or the temperature probe of the remote display (if present), as a function of a parameter (**A055b**). There are four pre-established climate curves A,B,C,D and there is the possibility of setting a custom curve (**A055**). The custom curve is defined by the following graphs for chiller (summer compensation) and heat pump (winter compensation) modes:

Summer Compensation



Winter Compensation



The predefined climate curves include the following values for the previous graphs:

Summer Compensation	A	B	C	D
Compensation start	20.0°C	20.0°C	20.0°C	20.0°C
Compensation end	37.0°C	40.0°C	37.0°C	40.0°C
Max Delta	-5.0°C	-5.0°C	-8.0°C	-8.0°C
Winter Compensation	**A**	**B**	**C**	**D**
Compensation start	-5.0°C	-7.0°C	-8.0°C	-5.0°C
Compensation end	20.0°C	20.0°C	20.0°C	20.0°C
Max Delta	-13.0°C	-18.0°C	-10.0°C	-15.0°C

The climatic curves can be set by the user (see 8.8.1 “Climate Curve”).

Start of summer compensation **A056**
End of summer compensation **A057**
Max Delta summer **A058**
Winter Compensation Start **A059**
Winter Compensation End **A060**
Max Winter Delta **A061**

The setpoint also takes into account Scheduler and second setpoint.

8.10.4 PID and compressor adjustment

Temperature control takes place with a PID adjustment. The adjustment starts after a delay from starting the machine equal to **A013+A065**. There are two PID regulators, one at start-up and one at full capacity, each with its own parameters: reference probe (**A066** and **A068**), proportional band (**A069** and **A072**), integral time (**A070** and **A073**) and derivative time (**A071** and **A074**). The switch from one controller to another occurs after a delay (**A067**) in minutes and only if the compressor has turned on.
The start adjustment prevents an excess of call power. Since the load status is not known at startup but only the temperature value, it is necessary to enter the power little by little while waiting for the system reaction. The full speed adjustment is fast to follow any load changes and keep the outlet water temperature as close as possible to the setpoint value.
Setting the same values to the parameters of the two regulators does not change the regulation during the transition from the start-up phase to the running phase.
The compressor is activated and adjusted by the inverter according to the PID adjustment. The minimum on, off and inter-ignition times (**C002**, **C003**, **C004**) are provided at service level to protect the number of starts per hour of the compressor and the possibility of turning it on “manually” (**C001**).

8.10.4.1 Supplementary resistance

Supplementary resistance allows to increase the production of hot water during the heat pump mode. In machines with a tank, the supplementary resistance on the tank, if provided, can be enabled by a service level parameter (**A065b**). The resistor is activated if the setting temperature remains below the setpoint value minus the differential **A065c**. The temperature of the external environment must also be lower than set **A065d**. The condition must remain true for a settable time in minutes (**A065e**). Maximum resistance operation (A065f) **is** provided.

8.10.4.2 Boiler consent

It is possible to enable at the service level (**A125**) the consent to the alternative activation of a boiler during operation in heat pump mode. The function requires the installation of the external expansion board c.pCOe. When the ambient temperature becomes lower than a settable set (**A126**), the machine is switched off and the boiler is allowed to turn on until the ambient temperature rises above the set + a differential (**A127**).

NOTE
Refer to the wiring diagram for connections.

8.10.5 Operating limits

The machine's operating limits must be checked. The limits are given by a maximum and a minimum ambient temperature allowed to start the machine in chiller mode (**A050**, **A051**) and in heat pump mode (**A052**, **A053**). If the ambient temperature is outside these limits then the **AL027** automatic reset **alarm** is generated, which blocks the compressor but not the pump. The lock condition disappears if the exceeded limit falls within at least one differential (**A054**).

8.10.6 Smart-Grid

Smart-Grid means the possibility of optimising the distribution of electricity, decentralising the production of energy and minimising overloads and variations in the electrical voltage in the energy distribution network. It is possible to enable the Smart-Grid function in the unit in order to integrate it into an electrical network of this type. The function is enabled from the display at service level **(A076)** and through the combination of two digital inputs (DI5 and DI7) of the main electronic board (uPC3) which, as per standard, must be connected to the power grid control device, defines four types of operation:

ID5	ID7	SMART-GRID	DESCRIPTION
CLOSED	OPEN	1 - BLOCK	Machine Off. Antifreeze and alarms can be activated.
OPEN	OPEN	2 - NORMAL	Normal operation. The supplementary resistors can be switched on (if provided).
OPEN	CLOSED	3 - BOOST1	Increased ACS setpoint **(A110)**. The ACS resistor can be switched on, if provided. If the machine is in stand-by mode, it can be switched on (if the service level is enabled with parameter **A109**, the machine can be switched on to produce ACS). The ECONOMY function is disabled.
CLOSED	CLOSED	4 - BOOST2	Increased ACS setpoint **(A111)**. The ACS resistor can be switched on, if provided. The machine turns on if in stand-by to produce ACS (regardless of parameter **A109**). If the ACS reaches the setpoint, the machine remains on to produce technical water. The ECONOMY function is disabled.

8.10.7 Economy

The **Economy** function allows to reduce the speed of the compressor by a predetermined percentage **(A080)**, consequently reducing the energy consumption of the machine. It can be enabled by display and works from key to screen or from time slot. The activation time slot is daily. It starts at time **A078** and ends at time **A079**. If the two parameters are equal, Economy from time slot is disabled. Economy can be enabled for operation in chiller mode, heat pump mode, or both **(A077)**. The fans of the unit are controlled by the sec board (default setting) and the speed reduction of the fans in Economy is automatic as a function of the compressor power reduction.

NOTE

The Economy function can be used in the Quick Menu. It can be activated by button in both chiller and heat pump.

8.10.8 Pump

A water pump is controlled on the evaporator. The pump is switched on when the machine is switched on and after a delay **(A013+A023)** the compressor is switched on and the temperature is adjusted PID. There is a delay between the compressor shutdown and pump shutdown **(A014)**. If at the time of unit shutdown the compressor is shut down for more than the delay time between compressor shutdown and pump shutdown **(A014)** then the pump shuts down immediately. In the domestic hot water activation and deactivation phase, the pump remains off for a set time **(A086)**. The pump always remains on until the unit is turned on but it is possible to set the pump to turn off after the compressor is turned off also for thermoregulation that occurs after a delay since the compressor was turned off **(A014)**. It restarts immediately when the compressor restarts for thermoregulation. In this mode, the sniffing function turns on the pump at predetermined intervals (parameters). It is possible to manage an inverter pump.

A warning (**AL012**) is provided to signal that the working hours of the pump have been exceeded. The working hours counter with the possibility of reset **(A001b)**, the threshold for the maintenance warning **(A001)** and the manual activation procedure **(A002)** of the pump are available at service level.

It is possible to enable at the service level **(A014b)** a sniffing function that turns on the pump at scheduled intervals **(A014c)** when the machine is in stand-by for a predetermined time **(A014d)**.

8.10.9 Antifreeze

When the machine is switched off, the antifreeze function is provided to prevent water from freezing by means of a pump and/or antifreeze resistance according to a service level parameter **(A034)**. If the temperature of the water leaving the evaporator is less than or equal to the activation set **(A032)**, the antifreeze device is activated. The procedure is deactivated when the temperature becomes greater than or equal to Set **(A032)** + differential **(A033)**.

It is possible to manage, in machines where it is provided, a resistance to the capacitor. When the ambient temperature is less than or equal to the Set **(A038)**, the resistance is turned on. The resistor turns off when the ambient temperature becomes greater than or equal to Set **(A038)** + differential **(A039)**.

8.10.10 Electronic thermostatic valve (EXV)

The electronic thermostatic valve regulates the flow of refrigerant gas as a function of the superheat value so that the evaporation process is completed in the total length of the evaporator. Overheating is the difference between the temperature of the superheated gas and the saturated evaporative dew temperature. It is possible at the service level to control the valve "manually" (**B000** and **B001**) or to modify the overheating set and the parameters of the valve adjustment PID in chiller (**B002, B003, B004, B005**) and heat pump (**B006, B007, B008, B009**) modes.

8.10.11 Fans

The fans of the machine allow the adjustment of condensation in chiller mode and evaporation in heat pump mode. In both operating modes, the adjustment is made by means of a 0..10V signal as a function of a curve within a minimum and maximum speed value that depends on the condensation temperature in chiller mode and the evaporation temperature in heat pump mode. The parameters of the fans are defined by the manufacturer and cannot be modified by the display.
A warning (**AL024**) is provided to indicate that the working hours of the fans have been exceeded. The working hours counter with the possibility to reset (**E000b**), the threshold for the maintenance warning (**E000**) and the manual activation procedure (**E001**) of the fans are available at service level.
Frost protection is provided when fans are switched off and the ambient temperature is particularly low. The fans are forcibly switched on at a speed (**E003**) if the temperature is lower than a set (**E002**) set at service level. There is an activation speed-up in antifreeze mode that can be set from parameters **E004** and **E005**. The function is deactivated if the ambient temperature is higher than the value of 2°C.

8.10.11.1 Low-noise

It is possible to set a low-noise range within which it is possible to reduce the power and therefore the noise of the fans and the compressor. The low-noise is enabled from the menu as always active or by setting the start time and minutes and the end time and minutes of the mode (**E007**, **E008**). The maximum limit of the percentage of fans in chiller and heat pump can be set to service parameters **E010** and **E011**. The number of maximum revolutions of the compressor in low-noise at parameter **E009**.

8.10.12 Domestic hot water (ACS)

The domestic hot water (ACS) function allows to heat a water tank for sanitary purposes. For the production of domestic hot water, the unit is automatically set to heat pump mode with a suitable setpoint and then returns to the expected operation once the procedure is finished. The ACS function can be enabled from the display in the service menu to be activated by digital input (**A084b**) or as a function of a setpoint (**A084**). Both modes can be enabled.
It is possible to configure the operation of the ACS so that it is managed by the electronic board of the machine or through the external expansion (c.pCOe) according to a service level parameter (**A083**). In the first case, the valve position control function and the supplementary resistance are not managed.

NOTE
Refer to the wiring diagram for connections.

8.10.12.1 ACS from digital input

The ACS request is made externally via a digital input in the machine. When the digital input is closed, the ACS is requested; when the input is opened, the ACS request is deactivated. The digital input used is indicated in the wiring diagram and is different between the case of ACS and ACS "light". The machine is forced to operate in heat pump mode with a setpoint equal to the maximum setpoint limit (**A049**) minus a delta (**A089**). The one at the outlet of the evaporator is used as a reference probe for the regulation during the ACS phase. It is possible to enable the ACS activation only during the chiller or heat pump mode or in both (**A085**) and it is possible to choose whether to activate the ACS even when the machine is in stand-by mode (**A109**).

8.10.12.2 ACS from setpoint

The ACS request occurs if the ACS tank temperature is less than or equal to the **ACS SET** parameter minus a service level differential (**A090**). The request ends if the temperature becomes greater than or equal to **ACS SET**. The machine is forced to operate in heat pump mode with a setpoint equal to **ACS SET** + a differential (**A089**) and with reference probe for adjustment during the ACS phase, that exiting the evaporator. If the value set by **SET ACS** + differential (**A089**) is greater than the maximum limit of the setpoint, then the maximum limit (**A049**) is taken as the setpoint. If the ACS tank probe fails, then the production of domestic hot water is interrupted.

8.10.12.3 ACS activation logic

The logic for activating the ACS at the time of the request (from digital input or setpoint) includes the following phases:

- Shutdown of the compressor respecting its minimum on and off times
- Shutting down the pump after a delay **(A014)**
- Switching the ACS three-way valve
- Waiting for the pump off time in ACS **(A086)**
- Change-over of the 4-way valve in heat pump if the machine was in chiller mode
- Restart the compressor (and pump) respecting the minimum off time, in heat pump mode with setpoint suitable for ACS. The temperature PID regulation in ACS mode provides the possibility of using a parameter P different from that of normal operation **(A088)**.

If the request is made with the machine in stand-by, then the three-way valve is switched and then the machine is turned on in the heat pump. The activation of the ACS with the machine in stand-by must be enabled by the service parameter **(A109)**.

8.10.12.4 ACS deactivation logic

The ACS deactivation logic at the end of the request (from digital input or setpoint) includes the following phases:

- Shutdown of the compressor respecting the minimum times
- Shutting down the pump after a delay **(A014)**
- Switching the ACS three-way valve
- Waiting for the pump off time in ACS **(A086)**
- Change-over of the 4-way valve in chiller if the machine prior to ACS was in chiller mode
- Restart the compressor (and pump) respecting the minimum off time in the mode prior to the ACS request. The PID temperature adjustment returns to using the expected P parameter.

If the ACS request was made with the machine in stand-by mode, then after switching the three-way valve the machine returns to stand-by mode. The activation of the ACS with the machine in stand-by must be enabled by the service parameter **(A109)**.

8.10.12.5 Maximum ACS duration

There is a maximum service level duration **(A095)** of operation in ACS after which the machine returns to normal operation. In case of ACS termination for maximum duration, the **AL086** automatic **reset** alarm is activated. There is a time interval at service level **(A096)** during which the ACS is kept disabled each time it ends for a maximum duration.

8.10.12.6 Defrost in ACS

In the event of defrost during ACS, the switching of the three-way valve takes place without switching off the pump, causing a reduction in the water flow and a possible consequent flow alarm. It is possible at the service level to set a time interval to disable the flow switch alarm **(A087)** at this stage.

8.10.12.7 ACS operating limits

It is possible to reduce the duration of ACS cycles as much as possible by limiting the minimum power to which the machine can be operated in ACS mode by setting a minimum power percentage at service level **(A091)** beyond which the machine cannot work during ACS.
It is possible to prioritise energy savings by reducing the maximum power at which the machine operates in ACS mode by setting a percentage of maximum power at service level **(A092)** beyond which the machine cannot work during ACS.

8.10.12.8 ACS valve position control

It is possible to enable at service level **(A093)** the position control of the ACS three-way valve (after electrical connection) to activate an alarm (**AL031**) after a set delay **(A094)** in case the valve is not in the correct position. The function is not available with ACS controlled by the machine's electronic board and not with external expansion (c.pCOe).

8.10.12.9 ACS pump

It is possible to enable the management of an auxiliary pump on the ACS at service level **(A112)**. The pump operates daily according to a time slot defined at service level **(A115, A116, A117, A118)**. For the ACS pump, there is a threshold of working hours **(A113)** beyond which the maintenance warning **(AL091)** intervenes. The working hours are resettable at service level **(A113b)**. There is no ACS pump thermal alarm.

8.10.12.10 ACS supplementary resistance

The ACS supplementary resistance allows to increase the production of sanitary water. If required, it can be enabled by parameter at service level **(A099)**. The resistor is activated if the ACS tank temperature remains below the setpoint value minus the differential **A065c**. The temperature of the external environment must also be lower than set **A065d**. The condition must remain true for a settable time in minutes (**A065e**). Maximum resistance operation (**A065f**) is provided. The parameters are in common with the supplementary resistance of the tank (see 8.10.4.1 "Supplementary resistance"). The function is not available with ACS controlled by the machine's electronic board and not with external expansion (c.pCOe).

8.10.13 Anti-legionella function

The anti-legionella function allows the machine to disinfect the ACS tank water, forcing the production of high-temperature ACS water.
The function can be enabled at service level **(A097)** and can take place weekly either with the machine switched on or in stand-by mode or exclusively only with the machine switched on according to another parameter at service level **(A098)**. In the first case, if the machine is in stand-by, then it will turn on temporarily to perform the procedure.

8.10.13.1 Anti-legionella setpoint

The machine setpoint during the anti-legionella procedure is defined at service level **(A108)** and the one at the evaporator outlet is set as the adjustment probe. The parameter **A108** can have values above the maximum limit of the setpoint (**A049**).

8.10.13.2 Anti-legionella Scheduler

The anti-legionella procedure is activated weekly depending on the service level parameters set. The parameter **A101** allows you to indicate the day of the week on which the anti-legionella is activated. The parameters **A102** and **A103** allow you to set the time and minutes of activation of the anti-legionella, the parameters **A104** and A105 those of deactivation.

8.10.13.3 Water heating mode

The way to heat the water for anti-legionella procedure can be chosen from a parameter **(A100)** at service level and can be:

- **HP + Resistance**: to heat the water, the machine is turned on in heat pump mode with ACS active and anti-legionella setpoint and the ACS tank resistance is also turned on (if present and enabled).
- **Resistance only**: only and exclusively the ACS tank resistance is used (if present and enabled). With this option, the machine does not change its operating mode and the ACS three-way valve is not exchanged, but simply the anti-legionella action is carried out by heating the ACS tank water through the resistance. In this case, there is no ACS required and therefore the pump will not circulate the water in the ACS tank.
- **HP only**: to heat the water, the machine is only turned on in heat pump mode with ACS active and anti-legionella setpoint.

8.10.13.4 Termination of the anti-legionella procedure

When the temperature of the ACS tank exceeds 60°C, a countdown begins, at the end of which the disinfection procedure is successfully completed. The countdown is inversely proportional to the water temperature of the ACS tank; the higher it is, the shorter the time to consider the procedure finished.
If the temperature does not remain above 60°C for the necessary time, the procedure will fail and will not be repeated until the next request. A service level parameter **(A107)** defines the number of failed procedures in a row before the **AL089** (manual reset) warning is generated.

8.10.13.5 Anti-legionella and defrost

Defrost has priority over the activation of the heat pump mode for anti-legionella, while the resistance of the ACS tank, if enabled, can be activated independently of the defrost. If a defrost is in progress at the time of activation of the anti-legionella, then the heat pump mode will be activated only at the end of the defrost while the ACS resistance (if present and enabled) will be activated immediately even with defrost in progress.

8.10.14 Defrost

Operating in heat pump mode with very low ambient temperatures and high humidity rates can lead to the formation of ice on the battery of the machine, reducing its performance. The defrost function allows to clean the machine battery from the ice and restore normal performance.
The activation of the defrost depends on a function of time calculated by the control system of the machine which depends on the type of evaporator and the temperature difference between ambient and evaporation. The defrost is inhibited until the ambient temperature is too high and the water temperature is too low compared to the sets set at service level.

8.10.14.1 Activation conditions

If the ambient temperature is higher than the ambient set **H000** or if the temperature of the water entering the evaporator is lower than the set **H001**, then defrost is inhibited. Ambient temperature must be less than ambient set (**H000**) - one differential (**H002**) and evaporator inlet temperature greater than or equal to set (**H001**) + one differential (**H002**) to rehabilitate deforestation.
The condition to activate the defrost depends on a normalised curve as a function of time that takes into account the type of evaporator of the machine and the temperature difference between the environment and evaporation. During the battery supply phase, the value of the normalised curve increases. When the value of the curve exceeds a set threshold (**H031**) or the difference from its minimum value exceeds a set differential (**H032**) then the defrost condition is true.
Alternatively, a logic is available that takes into account only the evaporation temperature (**H003, H005, H014, H018**).

8.10.14.2 Safety defrost

There is a safety defrost that is activated without respecting the activation conditions and without respecting the waiting time between defrost but which depends only on the evaporation pressure and the service level settings. If the evaporation pressure remains lower at a set point (**H020**) for a time (**H021**) then the defrost procedure is activated.
Each time the safety defrost is activated, a time counter is incremented. An **AL029** manual reset alarm is generated in the safety room in one hour, which blocks the machine.

8.10.14.3 Timed Defrost

A timed defrost can be set. The parameter **H015** in minutes represents the time interval whenever a defrost occurs in any case.

8.10.14.4 Manual defost

It is possible to “manually” force the defrost start from the display using the **H019** parameter at service level even if the activation conditions are not true. The activation parameter resets automatically after 3s.

8.10.14.5 Operating logic

The operating logic requires that the four-way valve is switched from the heat pump mode to the chiller mode when defrost is activated. The compressor is brought to maximum power during defrost and the fans are switched off. Defrost ends when the condensing set **(H017)** is reached or if the maximum duration **(H016)** is exceeded, both set to service level. The four-way valve is switched from chiller to heat pump at the end of the procedure. During the two phases of entry and exit from defrost, the fans are adjusted according to the compressor in heat pump or chiller mode, depending on the position of the four-way valve.
If there is an additional resistance in the tank, then it is possible to enable **(H029)** its activation at service level during defrost. This way, if the water temperature during deforestation drops below the configured set, then the resistor is turned on.
With the economy function active, it is possible to set a delay **(H030)** at service level to reactivate it at the end of the defrost. During the deforst phase, the economy function is disabled to be rehabilitated after a delay from the end of defrost.

8.10.15 Leak Detector

The Leak Detector is a refrigerant gas detector that allows to stop the machine in case of gas leaks (R290 is flammable). The leak detector, if present in the machine, must be calibrated every fixed period of time since it is installed (see 8.4 “Leak detector calibration recording”).

8.10.16 Modularity

Modularity represents the possibility of putting several machines in communication with each other to increase the total cooling power of a system.
Communication between the machines is carried out via Modbus-TCP connection and each one must have a different IP address. The maximum number of machines that can be present in a modular system is 4, even of different sizes.
In a modular system one machine acts as Leader and takes care of the operation of the system, the others act as Followers and receive commands from the Leader. When there is communication between the Leader module and the Followers, it is possible to:

- turn the entire system on and off by the Leader (by button, by digital input, by supervision or by time slot). All Followers must be switched on in advance by button;
- change the operating mode (chiller or heat pump) of the entire system by the Leader;
- change the setpoint value for the adjustment of the entire system by the Leader;
- display on the Leader’s display the main information of the Followers and their possible alarm status.

8.10.16.1 Operating logic

The temperature adjustment takes place according to the PID and the adjustment probe set in the Leader machine. The regulating probe can be the one entering, the one leaving the evaporator or the one in the tank (if present). In the case of an incoming or outgoing probe, the weighted average of the probes of all the machines is calculated, in the case of a tank probe, then the tank probe of the Leader machine is used. The machines are switched on with FIFO logic, so the first machine to switch on is the last one that had switched off. Each machine reaches its maximum power before the next one is switched on.

8.10.16.2 Leader Machine Configuration

In the Leader machine it is necessary to display, at the service level, the IP addresses of all the machines and the configuration parameters of the modular system. Therefore:

- Set the IP address of the machine (see 8.8.4.5 “Network”)
- Enable modularity by indicating that the machine is the Leader in the **Ge13** parameter
- Indicate the number of machines in the system in the parameter **Ge14**
- Indicate whether the control temperature is calculated as an average between all machines (**Avg**) or only between those with the pump on (**AvgON**) in the parameter **Ge15**
- Indicate the IP addresses of the Followers in the parameters **IP02**, **IP03**, **IP04**
- Indicate the weight of each machine in the calculation of the weighted average of the adjustment temperature in the **Ge16**, **Ge17**, **Ge18**, **Ge19** parameters. Their sum must be equal to 100.

8.10.16.3 Configuration of the Follower machine

In each Follower machine, it is necessary to display, at service level, its IP address and its index in the modular system. Therefore:

- Set the IP address of the machine (see 8.8.4.5 “Network”)
- Enable modularity by indicating which Follower is in the **Ge13** parameter

In the network settings menu, it is possible to force the stand-alone operation of a Follower machine (see 8.8.4.5 “Network”).

8.10.16.4 Communication control

LED  in the display of the Leader machine and LED  in the Follower machines indicate that the system is configured correctly and there is communication between the machines.
In case of lack of communication in the display of the Follower machines, the warning **AL166** appears, in the display of the Leader machine the warnings **AL167**, **AL168**, **AL169** appear, which also indicate which Leader machine is not connected (see 8.11.3 “Alarms”). An unconnected machine operates in stand-alone mode and uses its own probes for temperature regulation.

8.10.16.5 Back-up and Overboost

It is possible to configure the modular system at service level, so that a machine operates in back-up mode. In this way, a machine remains switched off and is only switched on to replace another in the event of an alarm or disconnection. At the end of a set time interval, however, the modules are rotated to move the back-up status to another module.
The back-up function is enabled at parameter **Ge20**. The time interval is set to parameter **Ge22**, setting it to 0 so the rotation of the back-up module can only take place in the event of a failure, disconnection or shutdown. The **Ge21** parameter allows to "manually" force the rotation of the module.
With the back-up module configured, the overboost function can also be enabled at service level. The function is to turn on the module in back-up if all other modules are working at their maximum power and the adjustment temperature continues to stay away from the setpoint beyond a set time (**Ge23**). The module just switched on returns to back-up if the temperature reaches setpoint.

8.10.16.6 Pre-antifreeze warning

The pre-antifreeze warning is used to avoid that by adjusting the temperature in the modular system in chiller mode, in a single machine the evaporator outlet temperature does not become too low and the antifreeze alarm is activated. If the evaporator outlet temperature of a machine is lower than the average value between the setpoint and the antifreeze alarm setpoint, then its compressor is switched off autonomously until the setting temperature rises above the setpoint.

8.10.16.7 Defrost

In order not to reduce the production of hot water by the modular system too much, defrosting one machine at a time is allowed. The safety defrost (see 8.10.14.2 "Safety defrost") remains enabled and can intervene if necessary at any time.

8.10.16.8 Domestic hot water (ACS)

The demand for domestic hot water (ACS) in a modular system occurs only in the Leader machine in one of the modes provided (probe or digital input).
In a modular system, the production of domestic hot water occurs in all machines with ACS. Machines without ACS are put on stand-by during the production of domestic hot water.

8.11 Alarms

8.11.1 Display and reset of alarms

When there is at least one alarm in the machine, the icon  appears and the led bar (see 8.6 "Led bar") flashes red. Depending on the type of alarm, the machine provides a certain action (see 8.11.3 "Alarms"). The number on the red background next to the icon indicates the number of active alarms.

To display the menu of active alarms, press the icon  in the upper right. The active alarm codes (see 8.11.3 "Alarms") appear on the screen.
The automatic reset alarms reset when the alarm condition disappears. The manual reset alarms are reset by holding the icon  for 5 seconds. Non-resettable alarms still remain active.
The alarm relay allows to have a remote signal of the status of the machine alarms. It is possible to set the operation of the alarm relay according to the severity of the alarm from parameter to service level (**A031**).

8.11.2 Display alarm history

With password service active, the icon appears  in the menu of active alarms to access the history of alarms on the display. It is possible to delete the history (see 8.9.7.4 "Initialisation").

8.11.3 Alarms

Below is the alarm table of the machine. The first column shows the alarm code shown on the display, in the second column the type of alarm action, in the third the type of reset (**Auto**= automatic, **User**= manual, **Auto/User**= manual after a number of automatic interventions in one hour), in the fourth the description of the alarm and in the last any notes.

Cod.	Action	Reset type	Description	Notes
AL001	Circuit block	User	Fan overload	Check the status of the fans
AL002	Warning	User	Error number of writings in electronic control retention memory	Replace electronic control
AL003	Warning	User	Error in writings in electronic control memory	Replace electronic control
AL004	Unit block/ No pump	Auto	Faulty or disconnected water inlet temperature probe	Check the sensor

Cod.	Action	Reset type	Description	Notes
AL005	Unit block/ No pump	Auto	Faulty or disconnected water outlet temperature probe	Check the sensor
AL009	Unit lock	User	Flow switch/Flow meter	Check water flow (Parameters: **A022b**, **A022c**, **A023**, **A024**)
AL012	Warning	Auto	Pump maintenance	Check working hours
AL023	Warning	Auto	Compressor maintenance	Check working hours
AL024	Warning	Auto	Fan maintenance	Check working hours
AL026	Circuit block	User	Low pressure	Check the evaporation pressure (Parameters: **C005**, **C006**, **C007**)
AL027	Compressor block/ No relay	Auto	Outdoor temperature outside operating limits	Check working conditions
AL028	Circuit block	Auto/User	Water antifreeze alarm	Check water temperature (Parameters: **A028**, **A029**, **A030**)
AL029	Circuit block	User	Maximum number of emergency defrost	Check battery condition
AL030	ACS Block/ No relay	Auto	ACS probe faulty or disconnected	Check the sensor
AL031	Circuit block	User	ACS valve	Check the status of the ACS valve (Parameters: **A093**, **A094**)
AL036	Warning / Yes relay	Auto	Electrical panel temperature probe faulty or disconnected	Check the sensor
AL037	Circuit block	User	Low pressure (SEC)	Check the evaporation pressure
AL038	Circuit block	User	Low overheating	Check working conditions
AL039	Circuit block	User	High overheating	Check working conditions
AL042	Warning	Auto	Coolant leakage (SEC)	Check coolant charge
AL043	Circuit block	User	High condensing pressure	Check working conditions
AL044	Warning	Auto	Warning Envelope low condensation temp. Tc	Check working conditions
AL045	Warning	Auto	Warning Envelope high Tc condensation temp.	Check working conditions
AL046	Warning	Auto	Warning Envelope low evaporation temperature Te	Check working conditions
AL047	Warning	Auto	Warning Envelope high evaporation temperature Te	Check working conditions
AL048	Circuit block	User	Antifreeze Alarm (SEC)	Check water temperature
AL049	Circuit block	User	Envelope Alarm	Check working conditions
AL050	Warning	Auto	Defrost terminated in time (visible only in the alarm history)	Check battery condition
AL051	Warning	Auto	Warning MCU arithmetic error	Replace SEC card
AL052	Circuit block	User	High discharge temperature	Check working conditions
AL053	Circuit block	User	4-way valve	Check the ΔP at compressor start-up
AL054	Warning	Auto	Warning High discharge temperature zone	Check working conditions
AL055	Circuit block	User	EXV valve	Check the electrical connection of the EXV valve

Cod.	Action	Reset type	Description	Notes
AL058	Circuit block	User	Suction pressure probe faulty or disconnected	Check the sensor
AL059	Circuit block	User	Discharge pressure probe faulty or disconnected	Check the sensor
AL061	Circuit block	User	Compressor suction temperature probe faulty or disconnected	Check the sensor
AL062	Circuit block	User	HP liquid temperature probe faulty or disconnected	Check the sensor
AL063	Circuit block	User	Discharge temperature probe faulty or disconnected	Check the sensor
AL064	Circuit block	User	Liquid heating temperature probe faulty or disconnected	Check the sensor
AL065	Circuit block	User	Probe T1 faulty or disconnected	Check the sensor
AL066	Circuit block	User	Outdoor temperature probe faulty or disconnected	Check the sensor
AL067	Warning	User	Suction temperature probe faulty or disconnected	Check the sensor
AL069	Circuit block	Auto	Offline VSS drive (INVERTER)	Check the connection between SEC board and Inverter
AL071	Circuit block	User	High pressure switch	Check the working conditions and reset the pressure switch
AL072	Circuit block	User	VSS drive (INVERTER) locked	Replace Inverter
AL073	Circuit block	User	EEPROM Fault	Replace SEC card
AL074	Circuit block	Auto	Communication timeout with the card	Check the connection between SEC board and electronic control
AL075	Circuit block	Auto	Compressor alarm	Check the status of the compressor
AL076	Circuit block	Auto	VSS Drive Configuration Alarm	Check the Inverter configuration
AL077	Circuit block	User	SEC Configuration Alarm	Check SEC card configuration
AL078	Circuit block	User	Flash error	Replace SEC card
AL081	Unit lock	User	Water circuit pressure switch	Check water pressure (Parameters: **A024b**)
AL082	Circuit block	Auto	SEC offline	Check the connection between SEC board and electronic control
AL083	Unit lock	Auto	Faulty tank temperature probe	Check the sensor
AL084	Unit lock	Auto/User	c.pCOe offline	Check the connection with the external expansion c.pCOe
AL085	Circuit block	User	Configuration error cpCOe/probe disconnected	Check the external expansion sensors c.pCOe
AL086	Warning	Auto	Alert for maximum ACS time	Check the operation of domestic hot water
AL087	Unit lock	Auto	Tank temperature probe faulty or disconnected on c.pCOe	Check the sensor on the external expansion c.pCOe
AL088	Warning	Auto	Probe temperature alarm on faulty pGDx or offline pGDx	Check the connection with the pGDx display and its probe
AL089	Warning	User	Maximum number of consecutive failures of the anti-legionella procedure exceeded	Check the operation of the anti-legionella procedure
AL090	Circuit block	User	Leak Detector Calibration Expired Warning	Perform Calibration

Cod.	Action	Reset type	Description	Notes
AL091	Warning	Auto	ACS pump maintenance	Check working hours
AL100	Circuit block	Auto	(INVERTER) Compressor U Current Sensor Fault	Replace Inverter
AL101	Circuit block	Auto	(INVERTER) Compressor V Current Sensor Fault	Replace Inverter
AL102	Circuit block	Auto	(INVERTER) W Current Sensor Fault Compressor	Replace Inverter
AL103	Circuit block	Auto	(INVERTER) PFC Current Sensor Fault	Replace Inverter
AL104	Circuit block	Auto	(INVERTER) IPM Temperature Sensor Fault	Replace Inverter
AL105	Circuit block	Auto	(INVERTER) PFC Temperature Sensor Fault	Replace Inverter
AL106	Circuit block	Auto	(INVERTER) DLT Sensor Fault	Replace Inverter
AL116	Circuit block	Auto	(INVERTER) Communication Lost Fault	Check the connection between SEC board and Inverter
AL117	Circuit block	Auto	(INVERTER) EEPROM fault	Replace Inverter
AL118	Circuit block	Auto	(INVERTER) AC Over Current Fault	Check working conditions
AL119	Circuit block	Auto	(INVERTER) AC Over Voltage Fault	Check working conditions
AL120	Circuit block	Auto	(INVERTER) AC Under Voltage Fault	Check working conditions
AL121	Circuit block	Auto	(INVERTER) DC Over Voltage Fault	Check working conditions
AL122	Circuit block	Auto	(INVERTER) DC Under Voltage Fault	Check working conditions
AL123	Circuit block	Auto	(INVERTER) High Pressure Fault	Check working conditions
AL124	Circuit block	Auto	(INVERTER) Input Loss of Phase Fault	Check working conditions
AL125	Circuit block	Auto	(INVERTER) IPM overheat fault	Check working conditions
AL126	Circuit block	Auto	(INVERTER) IGBT overheat fault: activates when bit10 var.321 SEC is active	Check working conditions
AL127	Circuit block	Auto	(INVERTER) Compressor Code Fault	Configuration alarm
AL132	Circuit block	Auto	(INVERTER) Compressor HW Over Current	Check working conditions
AL133	Circuit block	Auto	(INVERTER) Compressor U Phase Over Current	Check working conditions
AL134	Circuit block	Auto	(INVERTER) Compressor V Phase Over Current	Check working conditions
AL135	Circuit block	Auto	(INVERTER) Compressor W Phase Over Current	Check working conditions
AL136	Circuit block	Auto	(INVERTER) Compressor Loss of Phase	Check working conditions
AL137	Circuit block	Auto	(INVERTER) Lost Rotor Compressor	Check working conditions
AL138	Circuit block	Auto	(INVERTER) Compressor Startup Failure	Check working conditions
AL140	Circuit block	Auto	(INVERTER) Compressor Over Load	Check working conditions

Cod.	Action	Reset type	Description	Notes
AL141	Circuit block	Auto	(INVERTER) Compressor DLT Over Temperature	Check working conditions
AL143	Circuit block	Auto	(INVERTER) Compressor IPM Desat. Protection	Replace Inverter
AL144	Circuit block	Auto	(INVERTER) Compressor Lost Rotor 2	Replace Inverter
AL145	Circuit block	Auto	(INVERTER) Compressor Lost Rotor 3	Replace Inverter
AL148	Circuit block	Auto	(INVERTER) PFC HW Over Current	Check working conditions
AL149	Circuit block	Auto	(INVERTER) PFC SW Over Current	Check working conditions
AL150	Circuit block	Auto	(INVERTER) PFC Over Voltage	Check working conditions
AL164	Circuit block	Auto	(INVERTER) AD fault	Replace Inverter
AL165	Circuit block	Auto	(INVERTER) Wrong Addressing	Replace Inverter
AL166	Warning	Auto	No communication with the Leader module in modularity	Check the communication between the modules
AL167	Warning	Auto	No communication with the Follower 2 module in modularity	Check the communication between the modules
AL168	Warning	Auto	No communication with the Follower 3 module in modularity	Check the communication between the modules
AL169	Warning	Auto	No communication with the Follower 4 module in modularity	Check the communication between the modules

8.12 Modbus Variable List

The parameters for communication with a BMS system via Modbus can be set at the service level (see 8.9.7.3 “Serial Ports”).
The parameters relating to address, Baudrate, Parity bit, Stop bit are **Ge00**, **Ge01**, **Ge02**, **Ge03**. The Ge04 parameter allows you to enable the on/off of the machine from BMS.
The Bacnet address and the Baudrate Bacnet are reported in parameters **Ge10** and **Ge11**.
Below are the Modbus variables of the machine.

Types	Index	Variable Description	DataType	UoM	NoteDirection
Coil	14	Unit On/Off by BMS ((0=Off; 1=On)	Bool	NoUnits	ReadWrite
Coil	18	Chiller/HeatPump mode by Keyboard	Bool	NoUnits	ReadWrite
Coil	20	Type of scheduling (0=Switch Off/On; 1=Change setpoint)	Bool	NoUnits	ReadWrite
Coil	67	Enable Friday on week scheduling function	Bool	NoUnits	ReadWrite
Coil	68	Enable Monday on week scheduling function	Bool	NoUnits	ReadWrite
Coil	69	Enable Saturday on week scheduling function	Bool	NoUnits	ReadWrite
Coil	70	Enable Sunday on week scheduling function	Bool	NoUnits	ReadWrite
Coil	71	Enable Tuesday on week scheduling function	Bool	NoUnits	ReadWrite
Coil	72	Enable Tuesday on week scheduling function	Bool	NoUnits	ReadWrite
Coil	73	Enable Wednesday on week scheduling function	Bool	NoUnits	ReadWrite
Coil	74	Enable week scheduling function	Bool	NoUnits	ReadWrite
Coil	166	AL166	Bool	NoUnits	Read

Types	Index	Variable Description	DataType	UoM	NoteDirection
Coil	167	AL167	Bool	NoUnits	Read
Coil	168	AL168	Bool	NoUnits	Read
Coil	169	AL169	Bool	NoUnits	Read
DiscreteInput	25	AL001	Bool	NoUnits	Read
DiscreteInput	26	AL002	Bool	NoUnits	Read
DiscreteInput	27	AL003	Bool	NoUnits	Read
DiscreteInput	28	AL004	Bool	NoUnits	Read
DiscreteInput	29	AL005	Bool	NoUnits	Read
DiscreteInput	44	AL026	Bool	NoUnits	Read
DiscreteInput	49	AL012	Bool	NoUnits	Read
DiscreteInput	50	AL023	Bool	NoUnits	Read
DiscreteInput	51	AL024	Bool	NoUnits	Read
DiscreteInput	52	AL028	Bool	NoUnits	Read
DiscreteInput	53	AL031	Bool	NoUnits	Read
DiscreteInput	54	AL030	Bool	NoUnits	Read
DiscreteInput	55	AL100	Bool	NoUnits	Read
DiscreteInput	56	AL101	Bool	NoUnits	Read
DiscreteInput	57	AL102	Bool	NoUnits	Read
DiscreteInput	58	AL103	Bool	NoUnits	Read
DiscreteInput	59	AL104	Bool	NoUnits	Read
DiscreteInput	60	AL105	Bool	NoUnits	Read
DiscreteInput	61	AL106	Bool	NoUnits	Read
DiscreteInput	71	AL116	Bool	NoUnits	Read
DiscreteInput	72	AL117	Bool	NoUnits	Read
DiscreteInput	73	AL118	Bool	NoUnits	Read
DiscreteInput	74	AL119	Bool	NoUnits	Read
DiscreteInput	75	AL120	Bool	NoUnits	Read
DiscreteInput	76	AL121	Bool	NoUnits	Read
DiscreteInput	77	AL122	Bool	NoUnits	Read
DiscreteInput	78	AL123	Bool	NoUnits	Read
DiscreteInput	79	AL124	Bool	NoUnits	Read
DiscreteInput	80	AL125	Bool	NoUnits	Read
DiscreteInput	81	AL126	Bool	NoUnits	Read
DiscreteInput	82	AL127	Bool	NoUnits	Read
DiscreteInput	87	AL132	Bool	NoUnits	Read
DiscreteInput	88	AL133	Bool	NoUnits	Read
DiscreteInput	89	AL134	Bool	NoUnits	Read
DiscreteInput	90	AL135	Bool	NoUnits	Read
DiscreteInput	91	AL136	Bool	NoUnits	Read
DiscreteInput	92	AL137	Bool	NoUnits	Read
DiscreteInput	93	AL138	Bool	NoUnits	Read
DiscreteInput	95	AL140	Bool	NoUnits	Read
DiscreteInput	96	AL141	Bool	NoUnits	Read
DiscreteInput	98	AL143	Bool	NoUnits	Read
DiscreteInput	99	AL144	Bool	NoUnits	Read
DiscreteInput	100	AL145	Bool	NoUnits	Read
DiscreteInput	103	AL148	Bool	NoUnits	Read
DiscreteInput	104	AL149	Bool	NoUnits	Read

Types	Index	Variable Description	DataType	UoM	NoteDirection
DiscreteInput	105	AL150	Bool	NoUnits	Read
DiscreteInput	119	AL029	Bool	NoUnits	Read
DiscreteInput	120	AL027	Bool	NoUnits	Read
DiscreteInput	121	AL036	Bool	NoUnits	Read
DiscreteInput	122	AL037	Bool	NoUnits	Read
DiscreteInput	123	AL038	Bool	NoUnits	Read
DiscreteInput	124	AL039	Bool	NoUnits	Read
DiscreteInput	126	AL041	Bool	NoUnits	Read
DiscreteInput	127	AL042	Bool	NoUnits	Read
DiscreteInput	128	AL043	Bool	NoUnits	Read
DiscreteInput	129	AL044	Bool	NoUnits	Read
DiscreteInput	130	AL045	Bool	NoUnits	Read
DiscreteInput	131	AL046	Bool	NoUnits	Read
DiscreteInput	132	AL047	Bool	NoUnits	Read
DiscreteInput	133	AL048	Bool	NoUnits	Read
DiscreteInput	134	AL049	Bool	NoUnits	Read
DiscreteInput	135	AL050	Bool	NoUnits	Read
DiscreteInput	136	AL051	Bool	NoUnits	Read
DiscreteInput	137	AL052	Bool	NoUnits	Read
DiscreteInput	138	AL053	Bool	NoUnits	Read
DiscreteInput	139	AL054	Bool	NoUnits	Read
DiscreteInput	140	AL055	Bool	NoUnits	Read
DiscreteInput	143	AL058	Bool	NoUnits	Read
DiscreteInput	144	AL059	Bool	NoUnits	Read
DiscreteInput	146	AL061	Bool	NoUnits	Read
DiscreteInput	147	AL062	Bool	NoUnits	Read
DiscreteInput	148	AL063	Bool	NoUnits	Read
DiscreteInput	149	AL064	Bool	NoUnits	Read
DiscreteInput	150	AL065	Bool	NoUnits	Read
DiscreteInput	151	AL066	Bool	NoUnits	Read
DiscreteInput	152	AL067	Bool	NoUnits	Read
DiscreteInput	153	AL068	Bool	NoUnits	Read
DiscreteInput	154	AL069	Bool	NoUnits	Read
DiscreteInput	156	AL071	Bool	NoUnits	Read
DiscreteInput	157	AL072	Bool	NoUnits	Read
DiscreteInput	158	AL073	Bool	NoUnits	Read
DiscreteInput	159	AL074	Bool	NoUnits	Read
DiscreteInput	160	AL075	Bool	NoUnits	Read
DiscreteInput	161	AL076	Bool	NoUnits	Read
DiscreteInput	162	AL077	Bool	NoUnits	Read
DiscreteInput	163	AL078	Bool	NoUnits	Read
DiscreteInput	170	AL081	Bool	NoUnits	Read
DiscreteInput	171	AL082	Bool	NoUnits	Read
DiscreteInput	172	AL083	Bool	NoUnits	Read
DiscreteInput	173	AL091	Bool	NoUnits	Read
DiscreteInput	183	AL164	Bool	NoUnits	Read
DiscreteInput	184	AL165	Bool	NoUnits	Read
DiscreteInput	185	AL084	Bool	NoUnits	Read

Types	Index	Variable Description	DataType	UoM	NoteDirection
DiscreteInput	186	AL085	Bool	NoUnits	Read
DiscreteInput	187	AL086	Bool	NoUnits	Read
DiscreteInput	188	AL087	Bool	NoUnits	Read
DiscreteInput	189	AL088	Bool	NoUnits	Read
DiscreteInput	190	AL089	Bool	NoUnits	Read
DiscreteInput	191	AL090	Bool	NoUnits	Read
DiscreteInput	196	Antilegionella procedure active	Bool	NoUnits	Read
HoldingRegister	8	Cooling mode setpoint	Real	DegreesCelsius	ReadWrite
HoldingRegister	26	Second setpoint in cooling	Real	DegreesCelsius	ReadWrite
HoldingRegister	247	Setpoint DHW	Real	DegreesCelsius	ReadWrite
HoldingRegister	255	Heating mode setpoint	Real	DegreesCelsius	ReadWrite
HoldingRegister	256	Second setpoint in heating	Real	DegreesCelsius	ReadWrite
HoldingRegister	259	Preset Climatic Curve (0=No, 1=Custom, 2=PresetA, 3=PresetB, 4=PresetC, 5=PresetD)	Int	NoUnits	ReadWrite
HoldingRegister	309	Scheduler Friday end hour time band	Int	Hours	ReadWrite
HoldingRegister	310	Scheduler Friday end minute time band	Int	Minutes	ReadWrite
HoldingRegister	311	Scheduler Friday start hour time band	Int	Hours	ReadWrite
HoldingRegister	312	Scheduler Friday start minute time band	Int	Minutes	ReadWrite
HoldingRegister	313	Scheduler Monday end hour time band	Int	Hours	ReadWrite
HoldingRegister	314	Scheduler Monday end minute time band	Int	Minutes	ReadWrite
HoldingRegister	315	Scheduler Monday start hour time band	Int	Hours	ReadWrite
HoldingRegister	316	Scheduler Monday start minute time band	Int	Minutes	ReadWrite
HoldingRegister	317	Scheduler Saturday end hour time band	Int	Hours	ReadWrite
HoldingRegister	318	Scheduler Saturday end minute time band	Int	Minutes	ReadWrite
HoldingRegister	319	Scheduler Saturday start hour time band	Int	Hours	ReadWrite
HoldingRegister	320	Scheduler Saturday start minute time band	Int	Minutes	ReadWrite
HoldingRegister	321	Scheduler Sunday end hour time band	Int	Hours	ReadWrite
HoldingRegister	322	Scheduler Sunday end minute time band	Int	Minutes	ReadWrite
HoldingRegister	323	Scheduler Sunday start hour time band	Int	Hours	ReadWrite
HoldingRegister	324	Scheduler Sunday start minute time band	Int	Minutes	ReadWrite
HoldingRegister	325	Scheduler Thursday end hour time band	Int	Hours	ReadWrite
HoldingRegister	326	Scheduler Thursday end minute time band	Int	Minutes	ReadWrite
HoldingRegister	327	Scheduler Thursday start hour time band	Int	Hours	ReadWrite
HoldingRegister	328	Scheduler Thursday start minute time band	Int	Minutes	ReadWrite
HoldingRegister	329	Scheduler Tuesday end hour time band	Int	Hours	ReadWrite
HoldingRegister	330	Scheduler Tuesday end minute time band	Int	Minutes	ReadWrite
HoldingRegister	331	Scheduler Tuesday start hour time band	Int	Hours	ReadWrite
HoldingRegister	332	Scheduler Tuesday start minute time band	Int	Minutes	ReadWrite
HoldingRegister	333	Scheduler Wednesday end hour time band	Int	Hours	ReadWrite
HoldingRegister	334	Scheduler Wednesday end minute time band	Int	Minutes	ReadWrite
HoldingRegister	335	Scheduler Wednesday start hour time band	Int	Hours	ReadWrite
HoldingRegister	336	Scheduler Wednesday start minute time band	Int	Minutes	ReadWrite
HoldingRegister	342	Water flow (if available)	Real	Litres/minute	ReadWrite
HoldingRegister	343	Tank Water Temperature Probe	Real	DegreesCelsius	ReadWrite
HoldingRegister	353	Tank Water Temperature Probe (expansion)	Real	DegreesCelsius	ReadWrite

Types	Index	Variable Description	DataType	UoM	NoteDirection
InputRegister	2	Inlet Water Temperature Probe	Real	DegreesCelsius	Read
InputRegister	3	Outlet Water Temperature Probe	Real	DegreesCelsius	Read
InputRegister	97	DHW Temperature Probe	Real	DegreesCelsius	Read
InputRegister	125	Low Pressure Probe	Real	Bars	Read
InputRegister	126	High Pressure Probe	Real	Bars	Read
InputRegister	127	Sump Oil Temperature Probe	Real	DegreesCelsius	Read
InputRegister	128	Ambient Temperature Probe	Real	DegreesCelsius	Read
InputRegister	129	Suction Temperature Probe	Real	DegreesCelsius	Read
InputRegister	130	Suction Compressor Temperature Probe	Real	DegreesCelsius	Read
InputRegister	131	HP Liquid Temperature Probe	Real	DegreesCelsius	Read
InputRegister	132	Discharge Temperature Probe	Real	DegreesCelsius	Read
InputRegister	133	CH Liquid Temperature Probe	Real	DegreesCelsius	Read
InputRegister	134	EEV % Opening	Real	NoUnits	Read
InputRegister	135	Heating Superheat	Real	NoUnits	Read
InputRegister	136	Cooling Superheat	Real	NoUnits	Read
InputRegister	138	Compressor Speed	Int	NoUnits	Read

8.13 Probe key

For the positions of the probes listed below, refer to the cooling diagram.
The following table describes the probes:

Sheet A1

Probe shown in the manual	Terminal name	Description
-BEWIT	**B2**	EVAPORATOR WATER INLET PROBE
-BEWOT	**B3**	EVAPORATOR WATER OUTLET PROBE
-BAT2	**B4**	AIR TEMPERATURE PROBE IN THE ELECTRICAL PANEL (only mod. IPHP 006-008)
-PFM1	**B5**	FLOWMETER
-BTWOT	**B6**	TANK PROBE
-BTSW	**B7**	DOMESTIC WATER TEMPERATURE PROBE

Tab A2 (SEC)

Probe shown in the manual	Terminal name	Description
-BLP1	**P1**	LOW PRESSURE TRANSDUCER
-BHP1	**P2**	HIGH PRESSURE TRANSDUCER
-BOT1	**T1**	OIL TEMPERATURE PROBE
-BAT1	**T2**	AMBIENT TEMPERATURE PROBE
-BSE1	**T3**	EVAPORATOR SIDE SUCTION TEMPERATURE PROBE
-BHT1	**T4**	COMPRESSOR SIDE SUCTION TEMPERATURE PROBE
-BLTH1	**T5**	HP LIQUID TEMPERATURE PROBE
-BDLT	**T6**	DELIVERY TEMPERATURE PROBE
-BLTH2	**T7**	LIQUID TEMPERATURE PROBE CH

Board A4 (External ACS kit c.pCOe)

Probe shown in the manual	Terminal name	Description
-BTWOT1	**U4**	TANK PROBE
-BTSW1	**U1**	DOMESTIC WATER TEMPERATURE PROBE

CHAPTER 9

CALIBRATIONS OF OTHER COMPONENTS

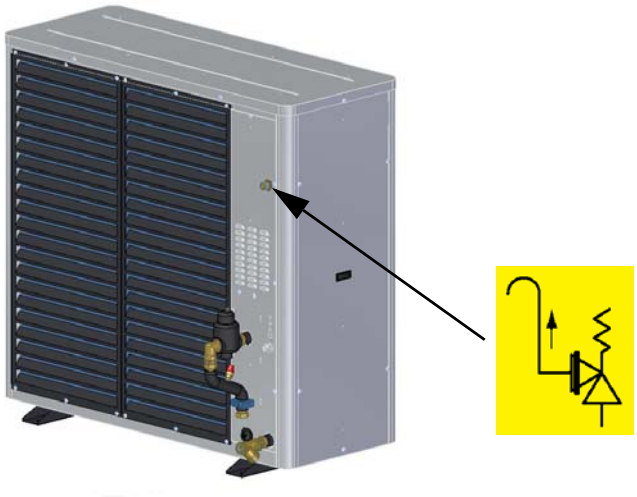
9.1 Refrigerant high pressure switch

The machines are equipped with a high pressure switch (HP)
This monitors the refrigerant compressor discharge pressure and prevents it from increasing to potentially hazardous values that could harm the compressor and people within the vicinity.
It is of the “manual reset” type.
Its intervention is detected by the electronic control unit, which opens the compressor supply circuit and visualises the **high pressure** alarm signal. When the compressor delivery pressure falls below the reset point, the pressure switch is reset.
The unit can be restarted by following the alarms reset procedure described in Chapter 8 “Electronic control“.
If the cause of the pressure switch trip has not been remedied this cycle will be repeated continuously.
The TRIP and RESET values of the pressure switches depend on the type of refrigerant and are shown in the following table:

COMPONENT	REFRIGERANT	INTERVENTION		RESTORE	
		bar	°C	bar	°C
High pressure switch HP	R290	32	82.7	24	68.3

9.2 Safety valve (IPHP 006-008 models only)

Its task is to protect the system from pressures so high as to cause serious damage to the machine and surrounding things in the event of failure to intervene with other protections.
When the pressure of the refrigerant fluid exceeds the intervention value of the valve (see table below), the latter opens the circuit and lets the gas discharge until the pressure has reached values lower than those set.
Under those conditions, the valve will automatically return to closing.
It is of the fixed calibration type and its calibration is in relation to the design pressure of the weakest component of the circuit.
The valve must be checked regularly, as laid down by the regulations in force.
Upstream of the safety valve, a shut-off valve is installed. Before removing the safety valve (for example, for periodic verification), make sure that the shut-off valve is in the closed position. After repositioning the safety valve, before starting the machine, check that the shut-off valve is in the open position and has been correctly plunged.
The unloading of the safety valve must be conveyed to the outside of the unit in a safe area according to the requirements of EN378-3 and the regulations in force at the place of installation.
The exhaust of the safety valve must be conveyed to the outside of the unit in a safe area and away from possible sources of ignition. The discharge must be positioned at least 1 metre from the ground, and facing upwards.
The cross-section and length of the drain pipe must be sized in accordance with national laws and directives applicable in the country of installation.
The image below shows the unloading of the safety valve, whose position is indicated by the relative adhesive (see 2.2 “Symbols”)



Convey the unloading of the safety valve (to be borne by the end user). Size the conveyor according to standard 13136:2019.
To avoid any possible clogging of the pressure discharge pipe, fit a cover to keep out rainwater.

DANGER

⚠ **Zone 2 that is generated by the emission of a safety valve can have a horizontal extension of up to 7.2 metres and up to 9 metres of vertical extension.**
The assessment of the risk areas is carried out by the installer.
Do not convey the exhaust in the proximity of ignition sources as defined by EN378-2.
If more restrictive, always refer to the local regulations in force.

WARNING

⚠ DO NOT remove or tamper with the safety valve.

COMPONENT	REFRIGERANT	INTERVENTION	
		bar	°C
HP Safety Valve	R290	36	89.1
LP Safety Valve		27	74.1

WARNING

⚠ The intervention of the safety valve indicates a anomalous operation of the unit.
Identify the cause of the anomaly as soon as possible and restore normal conditions.

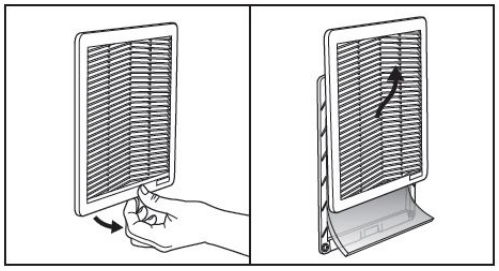
9.3 Forced panel ventilation (IPHP 006-008 models only)

The machines can be fitted with a thermostat system for control panel and/or inverter compartment ventilation.
For adequate ventilation, it is necessary to provide for a regular cleaning of the filter cloth present both on the ventilation system and on the ventilation grille.

Replacing and cleaning the filter cloth:

To replace the filter cloth, slide the cover over the base by lifting the lower tab and pushing upwards.
Then reposition the cover.
The filter cloth can be cleaned by rinsing, water jet treatment or tapping.

NOTE
The frequency of its cleaning varies depending on the amount of dust present and the operating time; it must therefore be determined from time to time by the user for each individual use.



DANGER

⚠ **The dirty filter cloth decreases the efficiency of the filter unit causing insufficient or even a total lack of ventilation.**

9.4 Coolant leak detector (IPHP 006-008 models only)

DANGER

⚠ **Before starting the machine, make sure that all the panels have been correctly installed.**

On board the units a refrigerant leak detector (Leak Detector) is installed with catalytic sensor that allows the immediate identification of refrigerant leaks. Upon exceeding 25% of the LFL (Lower Flammable Limit), the detector closes an alarm contact and, by means of 2 safety relays, disconnects the control circuit of the electrical panel and the power circuit present in the compressor box; the electrical circuit of the Leak Detector always remains energised.
To restore the system, after the refrigerant gas loss falls below 25% of the LFL, use the "ALARM/reset" button on the left door of the electrical panel to restart the machine.
The restoration operation must be carried out only after careful verification of "non-leakage" by authorised operators, that are informed and trained on the specific risks from flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.
By default, the device is calibrated to 25% of the "LFL".
Operators must be aware of regulations established by the industrial sector and/or the country of installation to test and calibrate the device.
The sensitive element of the device must be reset annually (see chapter 10.3 "Control and maintenance schedule").
For the method and methods of testing, calibrating and replacing the device, refer to the authorised service centre.

WARNING

⚠ Refer to your service centre for testing and calibration of the sensitive element.

Replacement is only provided in case of damaged sensor.

WARNING

⚠ On first start-up, it is mandatory to recalibrate the sensor and reset the sensor operation counter.

9.4.1 Washing fan removal (IPHP 006-008 models only)

Fig. 1

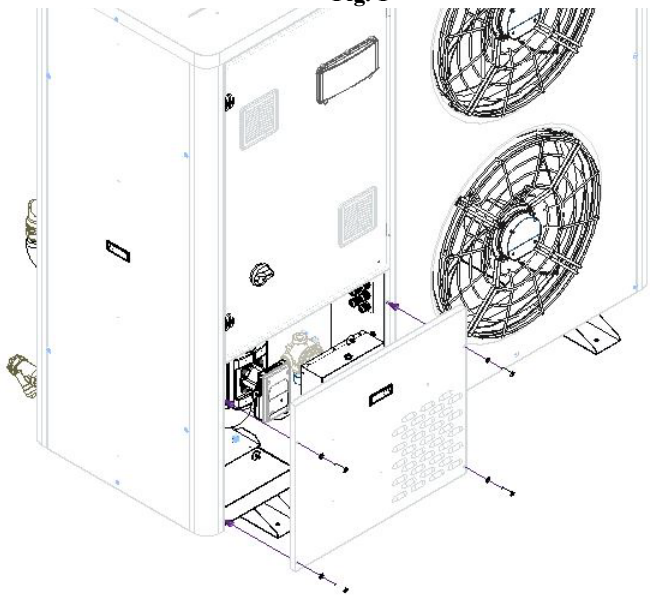


Fig. 2

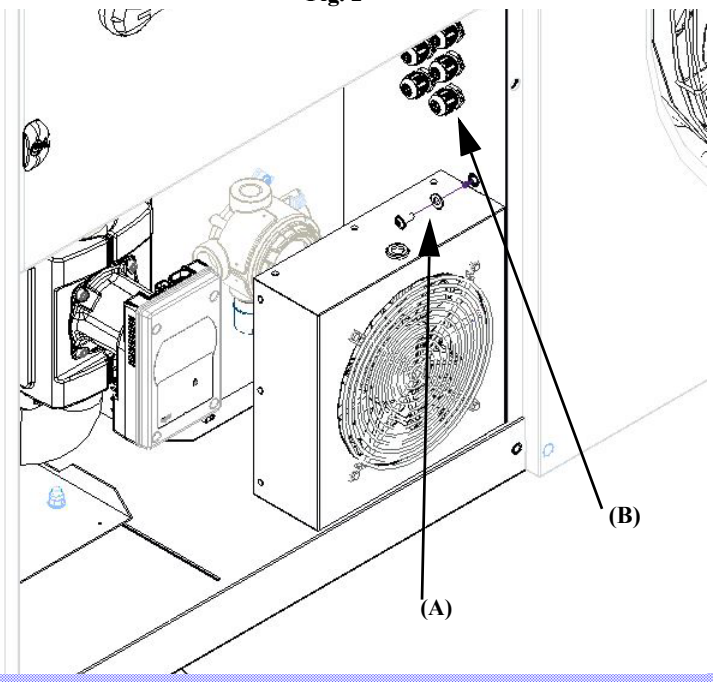
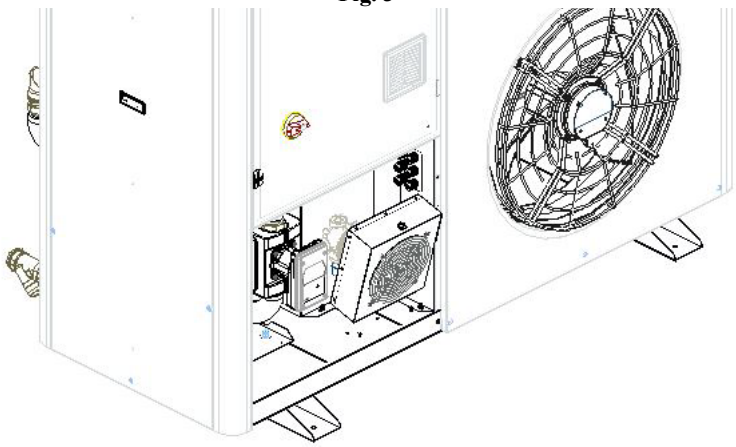


Fig. 3



To remove the washing fan, perform the following operations:

- remove the grid panel located under the electrical panel (**Fig. 1**)
- remove the fixing screw (**A**) from the fan box (**Fig. 2**)
- loosen the cable gland (**B**) and remove the cable (**Fig. 2**)
- pull the fan box upwards to release it from the fixing pins placed on the base of the machine and place it on the ground so as to have free space in front of the Leak Detector (**Fig. 3**).

After calibration it is necessary to reposition the fan in its original seat.
The previously extracted power cable must be pushed into its compartment and the cable gland must be tightened with a torque of 4Nm.

9.4.2 Leak Detector: checks

In order to access the Leak Detector it is necessary to remove the washing fan. The removal procedure is shown in the images above.
The procedure for recalibrating the sensor must be requested at the email address **service@mta-it.com**.
Perform the following checks after recalibration:

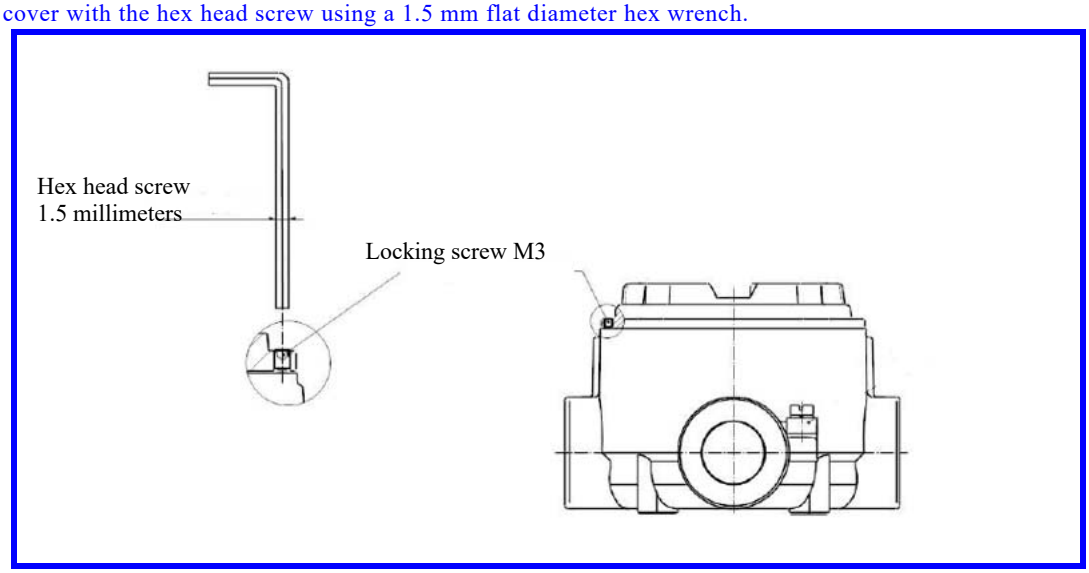
1. Reposition all the panels of the machine taking care to check that the panel closures are in the OK position
2. Check that the red light is on and that the display is off
3. If the light is off, immediately disconnect the power to the machine and check its operation by powering it separately (check to be carried out in a safe area), replace it if necessary.
   Using the air/propane mixture of the calibration kit, simulate an intervention by the Leak Detector and start from point 1
4. Press the ALARM/RESET button on the side of the indicator to allow the machine to restart
5. Press and hold button  of the display to activate the unit. After the unit has restarted, press  to put the unit on standby
6. Disconnect power to the machine by acting on the disconnecting device by moving it to the “0” position
7. Connect power to the machine by acting on the disconnecting device by moving it to the “1” position
8. Wait for the warm-up time (equal to 300 sec.) of the leak detector: during this phase, the machine display will be off, but the red light under it and the washing fan will be on
9. At the end of the warm-up time the red light and the washing fan switch off; at this point the machine is ready to be started safely.

WARNING

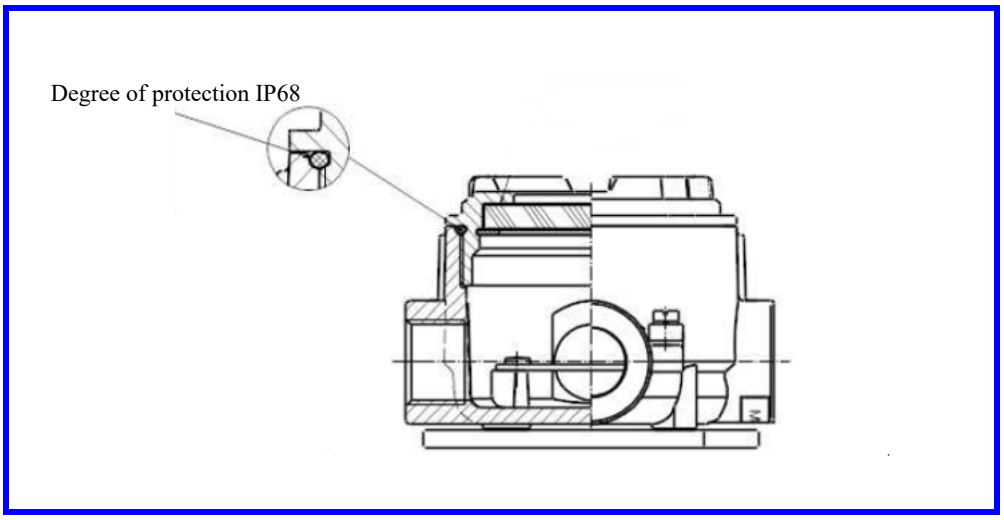
⚠ To ensure the correct seal of the Leak Detector case, follow the procedure below.

LID LOCKING

Lock the cover with the hex head screw using a 1.5 mm flat diameter hex wrench.



Tighten the lid with normal hand force to the end.



CHAPTER 10

OPERATION AND MAINTENANCE

10.1 Operation

Operation of the unit is fully automatic.
It's not necessary to turn it off when there is no thermal load, as it will turn off automatically when the pre-set inlet water temperature is reached.

10.2 Maintenance

WARNING

⚠ The maintenance operations, for which the intervention inside the machine is foreseen, must be carried out by authorised operators, informed and trained on the specific risks from flammable gases according to good practices and/or current standards incompliance with ANNEX HH IEC 60335-2-40, equipped with the appropriate precautions and protections (active and passive e.g. work gloves) in order to be able to operate in maximum safety.
Refer to the provisions of local laws and, in Europe, standard EN378-4 and standard EN13313.

WARNING

⚠ Before installing or operating these machines, make sure that all personnel have read and understood Chapter 2 “Safety“.

WARNING

⚠ This unit will give many years of trouble-free service if properly maintained and serviced.

10.2.1 Accessing the machine

DANGER

⚠ **The control panel must only be opened when the machine is switched off.**

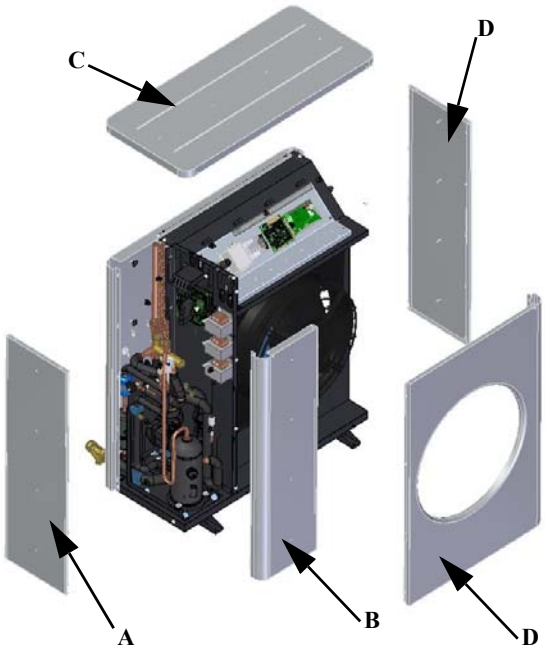
DANGER

⚠ **Before starting the machine, make sure that all the panels have been correctly installed.**

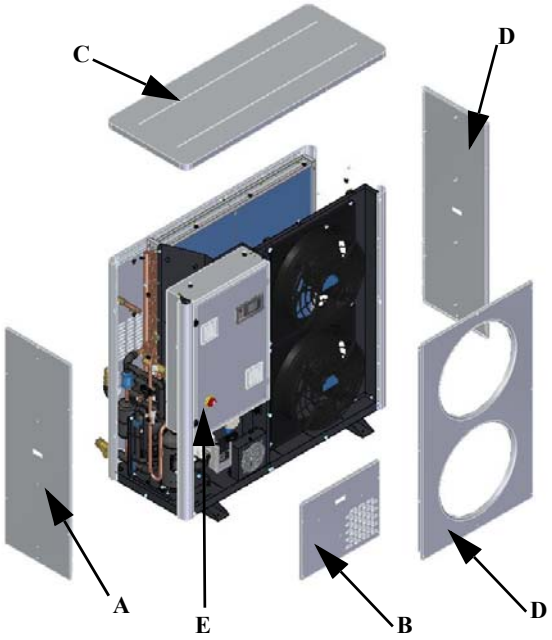
Failure to comply with this indication does not guarantee the correct operation of the Leak Detector safety device (IPHP 006-008 models only).
Check that the key locks on the panel (E) are in the OK position.

The protective panels can be removed when maintenance needs to be carried out.
To remove the panels, use a screwdriver to unscrew the fixing screws.

IPHP 002-004



IPHP 006-008



- Remove the panel "**C**".
- To access the components of the water and refrigerator circuit and the circulator, remove the "**A**" and "**B**" panels.

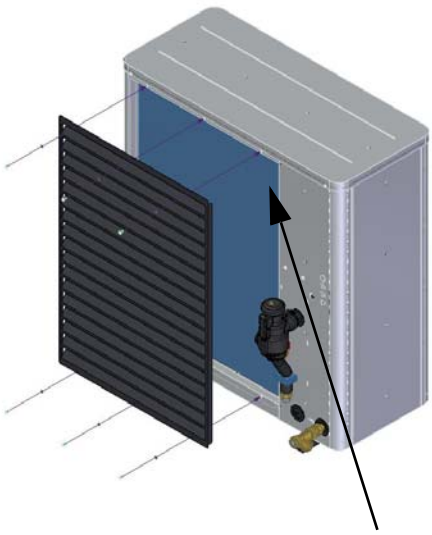
NOTE

In the **IPHP 006-008** models, by removing panel "**B**" it is also possible to access the washing fan.

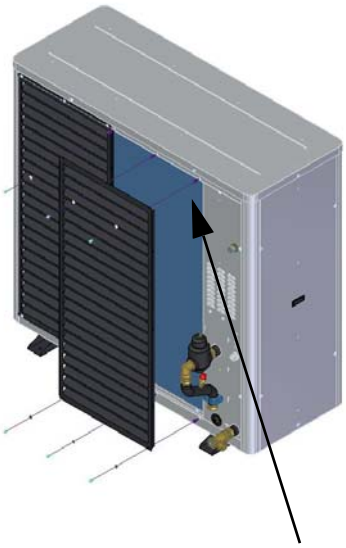
- To access the fans remove the panels "**D**".
- **IPHP 002-004** models: to access the components of the electrical panel, simply remove panel "**C**".
  Models **IPHP 006-008**: to access the components of the electrical panel, turn the main switch to the open position "O" and open the door "**E**" of the electrical panel by acting on the locking bolts with the appropriate key supplied.

To access the -BAT1 environment probe, remove the protection grid (if present). The ambient probe is positioned at the top right.

IPHP 002-004

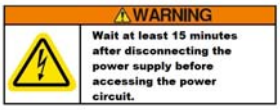


IPHP 006-008



WARNING

⚠ The motors contain DC bus capacitors that can remain charged even when the frequency converter is not powered. Failure to comply with the indicated waiting time after disconnecting the power supply and before carrying out maintenance or repair work, may cause serious or fatal injuries.
1. Stop the engine.
2. Disconnect the AC network.
3. Wait for the capacitors to discharge completely before performing any maintenance or repair work. The waiting time is 15 minutes.



10.2.2 Water circuit loading procedure

With reference to the functional diagram shown in chapter 5.2 “Hydraulic connections” , the system loading procedure is shown below:

1. Connect the water pipes to the machine, respecting the inlet and outlet (see 5.2 “Hydraulic connections”).
2. Connect the water mains to point (**A**) of the functional diagram shown in chaper 5.2 “Hydraulic connections” .
3. Make sure there are vents on the highest points of the hydraulic circuit, where air may collect.
4. Open the vent (**1**) indicated in chapter 3.2.1 “Hydraulic unit” .
5. Open the tap (**B**) of the functional diagram shown in chapter 5.2 “Hydraulic connections” to load the system with water. You are advised to fill the system very slowly, to ensure all the air is vented in the meantime.
6. Close the vent (**1**) indicated in chapter 3.2.1 “Hydraulic unit” and the vents installed on the hydraulic circuit only when the air flow stops and only water comes out.
7. Stop charging when the pressure gauge indicates that a circuit pressure compatible with the expansion vessel has been reached.
8. Start up the pump without activating the compressor, to fully bleed the system, and continue filling if necessary. Use parameter **A002** (service) for manual activation of the pump.

Emptying procedure:

CAUTION

⚠ In the case of maintenance operations for which it is necessary to empty the water circuit, the units are equipped with special taps for drainage.

If the system needs to be drained, proceed as follows:
Drain the system:

1. Switch off the machine.
2. Close any shut-off valves installed on the system IN-OUT connections.
3. Open the vent (**1**) indicated in chapter 3.2.1 “Hydraulic unit” .
4. Open the tap (**F**) indicated in chapter 5.3 “Condensate drain” to drain the water.

NOTE

To fully drain the circuit, it's a good idea to blow compressed air into the plate heat exchanger.

CAUTION

⚠ The emptying operation of the water circuit becomes essential when the machine lacks antifreeze resistance, and must remain inactive for a certain period of time in an environment whose temperature can reach freezing values of the water contained in the evaporator (risk of evaporator breakage).

10.2.3 Coolant Charging Procedure

The systems with container shipment are supplied with a nitrogen pre-charge of 1bar (indicated by the sticker below).

When the machine is put into operation this sticker must be removed.
To allow the machine to start up, it is necessary to charge the R290 refrigerant.

NOTE
The quantity of refrigerant per circuit is indicated on the data plate.

CAUTION

⚠ Vacuum / refrigerant gas filling procedures can only be performed by authorised operators, informed and trained on the specific risks of flammable gases according to good practices and/or current standards in accordance with ANNEX HH IEC 60335-2-40.

Comply with the following instructions:

- ensure that other types of refrigerant do not contaminate the R290 (the minimum purity of the refrigerant gas used for charging operations must be at least 99.5%);
- before charging the refrigerant gas, carry out three washing cycles with pressurised nitrogen followed by a suitable vacuum procedure;
- keep the gas cylinder in an upright position at the time of loading;
- use work equipment suitable for use with flammable gas.
  Keep the work area always well ventilated and equip yourself with detection devices for R290;
- do not charge more refrigerant gas than necessary. It is advisable to charge the unit using calibrated scales with a reading sensitivity of at least one tenth of a gram;
- after loading, carry out the leak detection operations before the functional test;
- once all the previous operations have been completed, it is good to carry out a second check to detect any leaks.

CAUTION

⚠ Each unit is equipped with charging connections (high pressure side and low pressure side) to ensure the charging and discharging operations of the refrigerant circuit. The tightening torque of the charging connections is 15 Nm.

10.2.4 Cleaning the plate heat exchanger

The plate heat exchanger may be susceptible to fouling, especially if the machine is operated in heat pump mode and at high produced water temperatures.
The deposit of limestone in the long term compromises the performance of the heat exchanger, leading to inefficiencies of the machine. It is therefore a good idea to monitor the performance of the heat exchanger over time, verifying that the design DeltaT is maintained and also the pressure losses of the heat exchange fluid.
To clean the exchanger, use organic acids such as formic, acetic, or citric acid, in a concentration between 1 and 5%.
Carry out the following procedure:

1. Turn off the machine and make sure the pump is switched off.
2. Disconnect the main circuit from the exchanger, or provide threaded connections during installation to connect with the pipes in which to slide the cleaning solution.

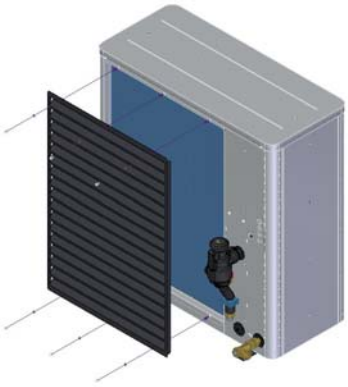
3. Pump the detergent solution through the plate heat exchanger using the bottom connection.
   Reverse the flow every 30 minutes and, if possible, apply a flow rate equal to 1.5 times the nominal flow rate.
   Monitor pH and/or pressure drop. Cleaning is finished when the pH has remained constant for 30 minutes and/or the pressure drop has returned to the initial value.
4. Discharge the detergent from the exchanger and the machine.

5. Rinse the plate heat exchanger starting from the bottom connection until the water becomes neutral (pH 7).
   Steel can be passivated after cleaning by circulating 2% phosphoric acid at 50°C for 4-6 hours. This will reduce the corrosion rate due to the precipitation of the corrosion product on the metal surface and inhibit further corrosion in water or air.

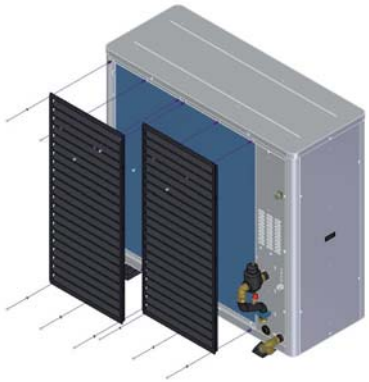
10.2.5 Cleaning procedure for condensing batteries

To clean the condensing coils, remove the screws that secure the grilles (if any).

IPHP 002-004



IPHP 006-008



1. Make sure that the unit is switched off and the disconnecting device is padlocked in position “0”.
2. If necessary, clean the area around the unit to ensure that leaves or debris are not blown into the condensing battery.
3. Remove dirt on the surface:
   The dirt on the surface must be removed before cleaning and/or rinsing with water to avoid further airflow restrictions.
   If it is not possible to backwash the side of the battery opposite to that of the air inlet, remove the dirt on the surface with a vacuum cleaner.
   If a vacuum cleaner is not available, a soft non-metallic bristle brush can be used, generally vertically. Battery surfaces can be easily damaged (folded tab edges) if the brush is applied to the tabs.
4. When cleaning, avoid directing the water jet so that it can damage the aluminium fins of the battery.

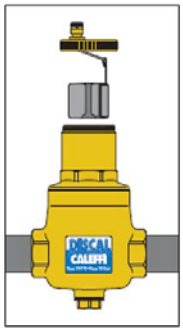
NOTE

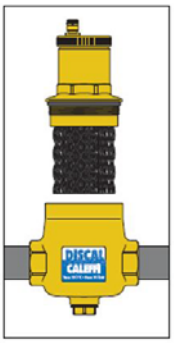
Using a water flow against a battery will push dirt into the battery. This will make cleaning efforts more difficult. The dirt on the surface must be completely removed before completing the cleaning.

5. Rinse with drinking water to remove excess soap residue.
   Starting from the top of the battery, start rinsing it from one side to the other until it reaches the bottom.
   Repeat the operation as many times as necessary to ensure that all sections/panels of the battery have been completed and thoroughly rinsed.
   Any excess soap residue mixed with removed dirt, salt and any material deposited on the batteries can constitute a potential problem and an environment suitable for battery corrosion or degradation.

10.2.6 Deaerator cleaning procedure

The particular construction of the DISCAL® deaerator allows maintenance and cleaning operations to be carried out without having to remove the device from the system, in particular the accessibility to the moving parts that control the air vent is simply obtained, after intercepting it, by removing the upper cover (all models).
For cleaning it is sufficient, after intercepting it, to unscrew the part of the body containing the automatic air relief valve, to which the separator element is fixed in an integral manner. The aforementioned part cannot be disassembled.
It is good practice to periodically check the status of the deaerator, especially if very high temperature differences between the water inlet and outlet are read, as the presence of air bubbles in the circuit reduces the available water flow by altering the flow meter reading.





10.2.7 STO (Safety Torque Off) test procedure

To perform the inverter STO (Safety Torque Off) input test, follow the procedure below:

- switch off the unit
- wait 15 minutes, the time required for the inverter capacitors to discharge
- remove panel **A** (indicated in ch. 10.2.1 “Accessing the machine”)
- disconnect the pressure switch from the STO input of the inverter (see wiring diagram)
- reposition panel **A**
- turn the system on
- check that the system does not start and the alarm code appears on the display **AL071**
- restore the connection of the high pressure switch on the inverter by performing the same operations described above.

10.3 Control and maintenance schedule

OPERATION	Daily	Monthly	Every 6 months	Yearly
Check there are no alarm signals.	◊			
Check the water outlet temperature is within the correct range.	◊			
Check that water inlet temperature is in compliance with the value used for selection of the unit.		◊		
Check that the pressure in the hydraulic circuit with the pump stopped is greater than about 0.5 bar.		◊		
In units equipped with a hydraulic unit check that the difference between the pump outlet pressure and suction pressure (measured on the pressure gauge with pump stopped) is within the prescribed range and not lower than the pump maximum flow rate value.		◊		
Clean the water filter. In any case, you are advised to clean the filter one week after the initial machine start-up.		◊		
Check the liquid sight glass (if installed) is full - or shows only a minimum amount of bubbles - when the compressor is running.			◊	
Check that the unit current absorption is within the data plate values.			◊	
Carry out visual inspection of refrigerant circuit, looking out for any deterioration of the piping or any traces of oil which might indicate a refrigerant leak.			◊	
Check the condition and firmness of the pipe connections.			◊	
Check the condition and security of wiring and electrical connections.			◊	
Using a spanner, check that any ring nuts on the refrigerant compressor intake and delivery pipes have not slackened.			◊	
Make sure the ambient temperature complies with the value used to select the machine (usually 30-35°C). Check that the environment is well ventilated.		◊		
Check that the fan is activated automatically. Check they are not noisy. Check that the grilles of the unit are free from dirt and any other obstructions.			◊	
Clean the fins of the condensing batteries with soap or neutral detergent (see ch. 10.2.5 “Cleaning procedure for condensing batteries”).				◊
Check the condensate drainage holes are not obstructed.		◊		
Calibration or replacement of the sensitive element of the refrigerant leak detector.				◊
Check the correct operation of the high pressure switch that intervenes on the STO digital input of the compressor (see paragraph 10.2.7 “STO (Safety Torque Off) test procedure”).				◊

CAUTION

⚠ The above maintenance schedule is based on normal use.

In some cases it may be necessary to increase maintenance frequency.

CHAPTER 11

TROUBLESHOOTING

SUMMER MODE

PROBLEM	CAUSE	MANIFESTATION	REMEDY
A Water outlet temperature higher than envisaged.	**A1** Thermal load too high.	**A1.1** Temperature higher than the value envisaged.	Reduce the thermal load to within preset limits.
	A2 Ambient temperature too high.	**A2.1** See A1.1.	Check the correct installation of the machine and the correct ventilation.
	A3 Condenser fins fouled.	**A3.1** See A1.1.	Clean the condenser fins.
	A4 Front surface of the condenser blocked.	**A4.1** See A1.1.	Remove the obstruction from the front surface of the condenser.
	A5 Circuit has insufficient refrigerant charge.	**A5.1** • See A1.1; • Low evaporation pressure; • If there is a sight glass, check if there are a lot of bubbles; • High delivery temperature.	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Fill the plant.
	A6 Compressor protection trips.	**A6.1** The compressor stops and attempts to restart after a short time (even few seconds).	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Fill the plant.
B Insufficient pressure head (water pressure) at the pump outlet.	**B1** Excessively high water flow rate. The pump is running outside its operating limits (high flow rate, low pressure head, high power consumption).	**B1.1** • Possible increase in outlet temperature (see A1.1); • Possible pump thermal trip.	Bring the flow rate back within the preset limits, for example, change the control rpm. Reset pump thermal cutout and check electrical power consumption.
	B2 See point C. Before ice obstructs the whole evaporator, there is an increase in the pressure drop.	**B2.1** See point C.	See point C.
	B3 Evaporator clogged by impurities conveyed by the user circuit water.	**B3.1** High temperature difference between water inlet and outlet.	Depending on the type of dirt, clean the evaporator.

PROBLEM	CAUSE	MANIFESTATION	REMEDY
C High pressure switch (HP) trip Alarm displayed: **AL071**	**C1** The fan doesn't work.	**C1.1** Refrigerant compressor stops.	Repair or replace the fan. Where fitted, check the circuit breaker of the fan. Perform the alarm reset procedure to restart the unit (see 8.11.1 “Display and reset of alarms”).
	C2 Ambient air temperature too high.	**C2.1** • Ambient air temperature higher than maximum permitted value; • See C1.1.	If the unit is installed in an enclosed place, reduce ambient temperature to within the prescribed limits, for example by increasing room ventilation. Perform the alarm reset procedure to restart the unit (see 8.11.1 “Display and reset of alarms”).
	C3 Recirculation of warm air due to incorrect installation.	**C3.1** • Condenser cooling air temperature higher than maximum permitted value; • See C1.1.	Change the position of the unit or the position of any adjacent obstructions to avoid recirculation. Perform the alarm reset procedure to restart the unit (see 8.11.1 “Display and reset of alarms”).
	C4 See A3.	**C4.1** See C1.1.	Clean the condenser fins. Perform the alarm reset procedure to restart the unit (see 8.11.1 “Display and reset of alarms”).
	C5 See A4.	**C5.1** See C1.1.	Remove the obstruction from the front surface of the condenser. Perform the alarm reset procedure to restart the unit (see 8.11.1 “Display and reset of alarms”).
	C6 Thermal load too high.	**C6.1** • Water outlet temperature too high; • Refrigerant compressor stops; • Intervention of general alarm relay.	Restore thermal load to within prescribed limits if possible. Perform the alarm reset procedure to restart the unit (see 8.11.1 “Display and reset of alarms”).
D The compressor protection devices are triggered.	**D1** Over-high thermal load when the cooling circuit is empty.	**D1.1** • High delivery temperature; • The compressor stops and attempts to restart after a short time (even few seconds); • Intervention of general alarm relay.	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Fill the plant.
	D2 Compressor out of operating limits. The causes can't all be listed.	**D2.1** Working area outside the permitted envelope.	Contact the MTA technical assistance service. Make sure the heat exchangers are clean. Unit working outside the design conditions. Various solutions, depending on the type of alarm.
	D3 Compressor start-up failure.	**D3.1** The compressor does not start.	Contact the MTA technical assistance service.

PROBLEM	CAUSE	MANIFESTATION	REMEDY
E Display disabled with the main switch P1 ON (I).	**E1** Control circuit fuse has blown.	**E1.1** Using a tester, no voltage reading is obtained on the transformer secondary winding terminals.	Check the possible causes for blowing of the fuse. Change the fuse.
	E2 Abnormal power consumption by one or more of the control board components.	**E2.1** Despite the presence of power on the board terminals the display remains blank and the LEDs remain off.	Try powering off the unit and then powering it on again. If this fails to solve the problem contact an authorised service centre.
F Alarm displayed: **Probe ... faulty or disconnected**	**F1** Probe damaged.	**F1.1** • See problem; • Intervention of general alarm relay.	Check that the probe in question is correctly connected to the board terminals, and that the wire is not damaged. Replace the probe if necessary.
G Alarm displayed: **AL028**	**G1** Low water outlet temperature. The set value is higher than the value measured by the probe.	**G1.1** • See problem; • Compressor stops and then restarts; • Intervention of general alarm relay.	Identify and remove the cause that lowered the temperature.
	G2 Water flow rate too low.	**G2.1** • See problem; • Compressor stops and then restarts; • Intervention of general alarm relay.	Increase the water flow rate.
H Refrigerant leak alarm.	**H1** Possible propane leakage.	**H1.1** The machine stops and the red light on the panel door comes on.	Check for leaks and call technical support.
I Pressure transducer faulty or disconnected.	**I1** Transducer open or shorted.	**I1.1** Intervention of general alarm relay.	Check that the transducer is correctly connected to the control board terminals and the cable is undamaged. If necessary, replace the transducer with a genuine original replacement part.

WINTER MODE

PROBLEM	CAUSE	MANIFESTATION	REMEDY
J Water outlet temperature lower than envisaged.	**J1** Thermal load too high.	**J1.1** Temperature lower than the value envisaged.	Reduce the thermal load to within preset limits.
	J2 Condenser (working as an evaporator) has dirty fins.	**J2.1** See J1.1	Clean the fins of the condenser (working as an evaporator).
	J3 Front surface of the condenser (working as an evaporator) obstructed.	**J3.1** See J1.1	Free the front surface of the condenser (working as an evaporator).
	J4 Circuit has insufficient refrigerant charge.	**J4.1** • See J1.1; • Low evaporation pressure; • If there is a sight glass, check if there are a lot of bubbles; • High delivery temperature.	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Fill the plant.
	J5 Compressor protection trips.	**J5.1** The compressor stops and attempts to restart after a short time (even few seconds).	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Fill the plant.
K Insufficient pressure head (water pressure) at the pump outlet.	**K1** Excessively high water flow rate. The pump is running outside its operating limits (high flow rate, low pressure head, high power consumption).	**K1.1** • With pump installed on the machine: pressure difference (read on the pressure gauge) too low with pump running and pump idle; • Possible pump thermal trip.	Reduce water flow within design limits, for example by partially closing a pump outlet cock. Reset the pump thermoswitch and check the electric absorption levels.
	K2 Evaporator (working as a condenser) obstructed because of dirt transported by the water in the user circuit.	**K2.1** High temperature difference between water outlet and inlet.	In relation to the type of fouling: • clean the evaporator (working as a condenser) with a detergent solution that's not aggressive for steel, aluminium and copper; • Supply a high flow rate of water in counter-current conditions.

PROBLEM	CAUSE	MANIFESTATION	REMEDY
L High pressure switch (HP) trip Alarm displayed: **AL071**	**L1** Thermal load too high.	**L1.1** • Water outlet temperature too high; • Refrigerant compressor stops; • Intervention of general alarm relay.	Restore thermal load to within prescribed limits if possible. Perform the alarm reset procedure to restart the unit (see 8.11.1 “Display and reset of alarms”).
	L2 Evaporator (working as a condenser) obstructed because of dirt transported by the water in the user circuit.	**L2.1** High temperature difference between water outlet and inlet.	In relation to the type of fouling: • clean the evaporator (working as a condenser) with a detergent solution that's not aggressive for steel, aluminium and copper; • Supply a high flow rate of water in counter-current conditions.
	L3 SET-POINT calibration too high (beyond the maximum limit).	**L3.1** • The compressors stop; • General alarm relay trip.	Bring the water temperature back within the predefined limits. Follow the alarm reset procedure to restart the machine (see 8.11.1 “Display and reset of alarms”)
M The compressor protection devices are triggered.	**M1** Thermal load too high with insufficient refrigerant charge in circuit (see also J5).	**M1.1** • High delivery temperature; • The compressor stops and attempts to restart after a short time (even few seconds); • Intervention of general alarm relay.	Call in a qualified refrigeration engineer to check for leaks and eliminate them. Fill the plant.
	M2 Compressor out of operating limits. The causes can't all be listed.	**M2.1** Working area outside the permitted envelope.	Contact the MTA technical assistance service. Make sure the heat exchangers are clean. Unit working outside the design conditions. Various solutions, depending on the type of alarm.
	M3 Compressor start-up failure.	**M3.1** The compressor does not start.	Contact the MTA technical assistance service.
N Display disabled with the main switch P1 ON (I).	**N1** Control circuit fuse has blown.	**N1.1** Using a tester, no voltage reading is obtained on the transformer secondary winding terminals.	Check the possible causes for blowing of the fuse. Change the fuse.
	N2 Abnormal power consumption by one or more of the control board components.	**N2.1** Despite the presence of power on the board terminals the display remains blank and the LEDs remain off.	Try powering off the unit and then powering it on again. If this fails to solve the problem contact an authorised service centre.
O Alarm displayed: **Probe ... faulty or disconnected**	**O1** Probe damaged.	**O1.1** • See problem; • Intervention of general alarm relay.	Check that the probe in question is correctly connected to the board terminals, and that the wire is not damaged. Replace the probe if necessary.

PROBLEM	CAUSE	MANIFESTATION	REMEDY
P Refrigerant leak alarm.	**P1** Possible propane leakage.	**P1.1** The machine stops and the red light on the panel door comes on.	Check for leaks and call technical support.
Q Pressure transducer faulty or disconnected.	**Q1** Transducer open or shorted.	**Q1.1** Intervention of general alarm relay.	Check that the transducer is correctly connected to the control board terminals and the cable is undamaged. If necessary, replace the transducer with a genuine original replacement part.

CHAPTER 12

RISK ANALYSIS: RESIDUAL RISK

Description of risk:	Effect:	User instructions:
1. Risk of crushing.	Machine falling onto persons and/or limbs crushed.	Use lifting equipment suitable for the task, to be performed by qualified personnel referring to the labelling instructions and manual.
2. Risk of cutting and detachment caused by sheets or profiles in general.	Risk of cuts to upper limbs on sharp edges created by the shearing of sheets or saw cutting of profiles.	Strictly observe all manual instructions. Chapter 2 “Safety“; Chapter 4 “Installation“ and Chapter 10 “Operation and maintenance“.
3. Risk of cutting or detachment due to the finned surface of air-cooled condensers.	Risk of cutting upper limbs.	Strictly observe all manual instructions. Chapter 1 “General Information“; Chapter 2 “Safety“ and Chapter 10 “Operation and maintenance“.
4. Risk of cutting or detachment due to fan blades.	Cuts or dissection.	Strictly observe all manual instructions. Chapter 1 “General Information“; Chapter 2 “Safety“ and Chapter 10 “Operation and maintenance“.
5. Risk of high pressure fluid ejection from pipelines and/or pressure tanks in cooling circuit due to accidental bursting.	Contact of body parts with refrigerant gas or parts of cooling circuit pipelines launched at high speed.	Strictly observe all manual instructions. Chapter 2 “Safety“, Chapter 4 “Installation“ and Chapter 9 “Calibrations of other components“.
6. Risk of high pressure fluid ejection from pipelines and/or pressure tanks in cooling circuit due to design pressure values being exceeded.	Contact of body parts with refrigerant gas or parts of cooling circuit pipelines launched at high speed.	Strictly observe all manual instructions. Chapter 2 “Safety“;Chapter 4 “Installation“, Chapter 9 “Calibrations of other components“ and Chapter 10 “Operation and maintenance“.
7. Risk of high pressure fluid ejection from pipelines and/or pressure tanks in the hydraulic circuit, due to accidental explosions.	Contact of body parts with fluids or residual parts of hydraulic circuit pipelines launched at high speed.	Disconnect the machine from the electricity supply during interventions on the hydraulic circuit. Strictly observe all manual instructions. Chapter 2 “Safety“; Chapter 4 “Installation“ and Chapter 10 “Operation and maintenance“.
8. Risk of high pressure fluid ejection from pipes and/or pressure tanks in the hydraulic circuit, if the project pressure values are exceeded.	Contact of body parts with fluids or residual parts of circuit pipes launched at high speed.	Depressurise the machine before intervening on the hydraulic circuit. Strictly observe all manual instructions. Chapter 2 “Safety“; Chapter 4 “Installation“ and Chapter 10 “Operation and maintenance“.
9. Electrical hazards due to direct contact with live parts.	Risk of electrocution and burns.	Strictly observe all manual instructions. Chapter 2 “Safety“ and 6.2 “Electrical connections” .

Description of risk:	Effect:	User instructions:
10. Electrical hazards due to indirect contact with parts that are live due to faults, in particular due to an insulation fault.	Risk of electrocution and burns.	Strictly observe all manual instructions. Chapter 2 “Safety“ and 6.2 “Electrical connections” .
11. Electrical hazards: electrostatic phenomena.	Uncontrolled movements by victim of electrostatic discharge due to contact.	Strictly observe all manual instructions. 6.2 “Electrical connections” .
12. Electrical hazards: heat radiation or other phenomena such as the projection of melted particles, and chemical effects deriving from short circuits, overloads.	Risk of electrocution with live parts due to short-circuits, scalding on contact with hot components due to overload.	Strictly observe all manual instructions. Chapter 2 “Safety“ and 6.2 “Electrical connections” .
13. Heat-associated risk: burns and/or scalding.	Scalding on contact with pipes at temperatures over 65°C and/or freezing due to contact with surfaces at temperatures below 0°C.	Strictly observe all manual instructions. Chapter 2 “Safety“.
14. Hazards generated by noise levels that may impair hearing capacity (deafness) and other physical disorders (such as loss of balance, consciousness).	Loss of hearing capacity by operator.	Secure all components correctly after interventions and maintenance.
15. Hazards generated by materials or substances handled, used, produced or offloaded from the machine, and by the materials used to construct the machine: inhalation of refrigerant gases.	Inhalation of refrigerant gas.	Strictly observe all manual instructions. Chapter 2 “Safety“.
16. Hazards generated by materials or substances handled, used, produced or offloaded from the machine, and by the materials used to construct the machine: discharge of polluting cooling fluids.	Risk of environmental pollution caused by the drainage of water-glycol mixtures.	Strictly observe all manual instructions. Chapter 2 “Safety“.
17. Hazards generated by materials or substances handled, used, produced or offloaded from the machine and materials used to construct the machine: fire or explosion.	Risk of fire or explosion.	Install the system in an environment fitted with adequate fire fighting equipment. Strictly observe all manual instructions. Chapter 4 “Installation“.
18. Hazards generated by failure to use personal protective equipment.	Lacerations to upper limbs during maintenance or installation.	Use adequate personal protective equipment and observe all the instructions given in the manual. Chapter 1 “General Information“; Chapter 2 “Safety“; Chapter 4 “Installation“ and Chapter 10 “Operation and maintenance“.
19. Hazards generated by failure to observe principles of ergonomics during machine design, caused, for example, by: unsuitable design, layout or identification of manual controls.	Hazards associated with failure to correctly identify manual controls.	Consult all sections of the manual.

Description of risk:	Effect:	User instructions:
20. Hazards generated by failure to observe principles of ergonomics during machine design, caused, for example, by: inadequate design or layout of visual display units.	Hazards associated with failure to correctly understand the visual display units.	Consult all sections of the manual.
21. Inadvertent start-up, unexpected overstroke/excess speed (or any other similar malfunction) caused by: a fault or malfunction of the command system.	Electrical or mechanical hazard due to incorrect settings of operating parameters or settings.	Strictly observe all manual instructions. Chapter 2 “Safety“; Chapter 10 “Operation and maintenance“; 6.2 “Electrical connections” and Chapter 4 “Installation“.
22. Inadvertent start-up, unexpected overstroke/excess speed (or any other similar malfunction) caused by: fault or malfunction of control system with possibility of disabling safety devices.	Electrical hazard during interventions on machine with safety devices inhibited.	Strictly observe all manual instructions. Chapter 2 “Safety“; 6.2 “Electrical connections” ; Chapter 4 “Installation“ and Chapter 10 “Operation and maintenance“.
23. Inadvertent start-up, unexpected overstroke/excess speed (or any other similar malfunction) caused by: a fault or malfunction of the command system.	Electrical hazards associated with environmental work conditions.	Strictly observe all manual instructions. Chapter 2 “Safety“ and 6.2 “Electrical connections” .
24. Inadvertent start-up, unexpected overstroke/excess speed (or any other similar malfunction) caused by: the return of the electricity supply after a failure.	Hazards associated with inadvertent start-up of the machine when electric power supply is restored.	Strictly observe all manual instructions. Chapter 2 “Safety“; 6.2 “Electrical connections” and Chapter 7 “Start-up“.
25. Inadvertent start-up, unexpected overstroke/excess speed (or any other similar malfunction) caused by external factors on the electrical equipment (EMC).	Electrical hazards associated with electric stress faults on internal machine components, short-circuits and overloads.	Strictly observe all manual instructions. Chapter 2 “Safety“; 6.2 “Electrical connections” and Chapter 10 “Operation and maintenance“.
26. Hazards caused by assembly errors.	Hazards associated with machine instability caused by vibrations. Hazards on contact with operating fluids, risk of pollution due to dispersion of fluids into the environment.	Strictly observe all manual instructions. Chapter 2 “Safety“; Chapter 4 “Installation“ and Chapter 7 “Start-up“.
27. Risk of falling or projection of objects or fluids.	Contact of body parts with metallic materials such as the fan blades or moving parts of the compressor.	Disconnect the machine from the electricity supply during interventions on the hydraulic circuit. Strictly observe all manual instructions. Chapter 2 “Safety“; Chapter 4 “Installation“ and Chapter 10 “Operation and maintenance“.
28. Loss of machine stability / machine overturning.	Crushing of body parts.	Strictly observe all manual instructions. Chapter 4 “Installation“ and the indications on the packaging.
29. Loss of stability/overturning of the machine due to installation on unstable ground and/or vibrations caused by the connection pipes.	Crushing of body parts due to overturning of the machine. Contact of body parts with water due to loss of hydraulic circuit connections because of excessive vibrations.	Strictly observe all manual instructions. Chapter 4 “Installation“ and Chapter 7 “Start-up“.

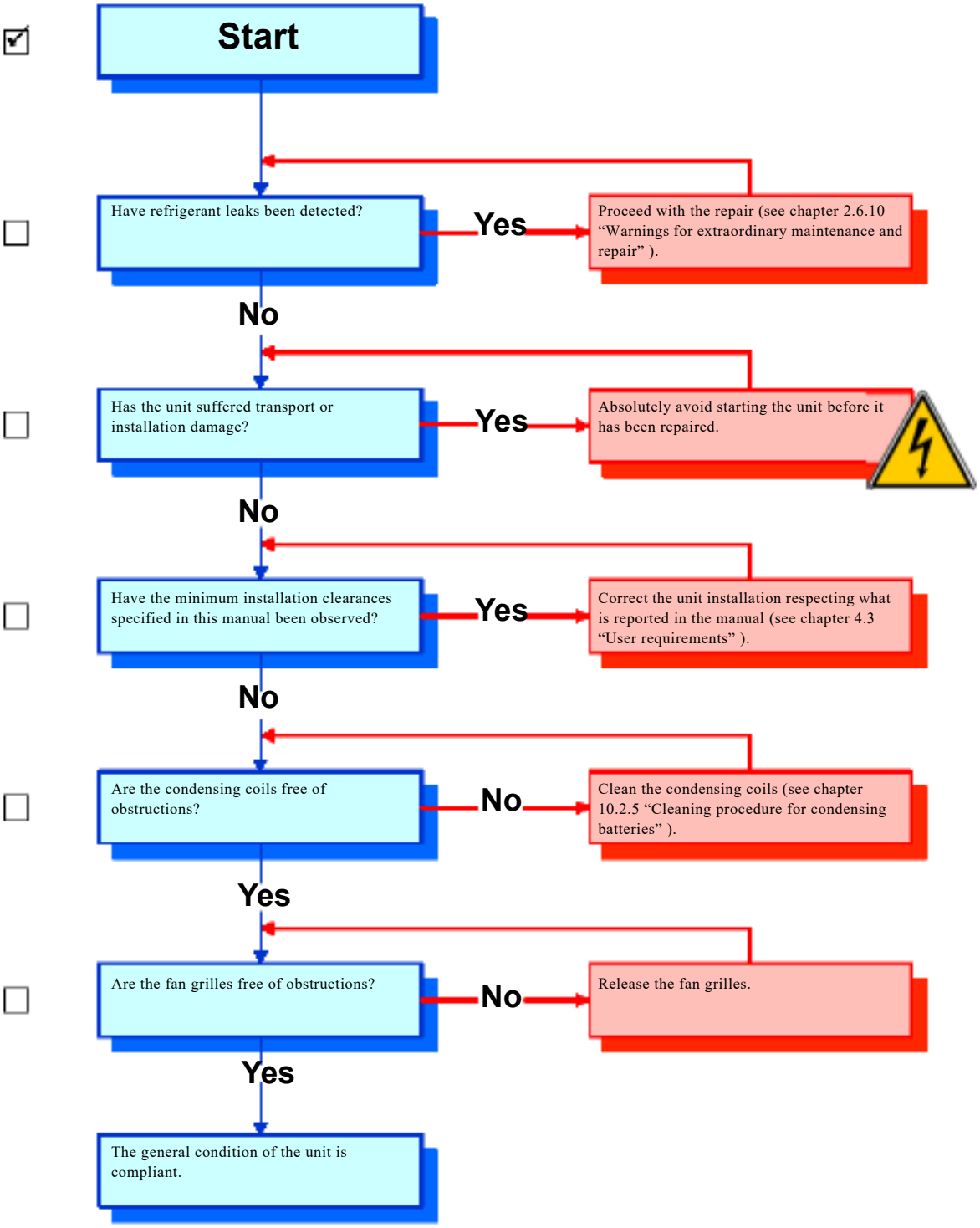
Description of risk:	Effect:	User instructions:
30. Hazards generated by the absence or incorrect position of safety measures/tools: all guards.	Hazard caused by contact with machine components and processed or used materials due to sudden ejections.	Strictly observe all manual instructions. Chapter 2 “Safety“; Chapter 4 “Installation“; Chapter 7 “Start-up“ and Chapter 10 “Operation and maintenance“.
31. Hazards generated by the absence or incorrect position of safety measures/tools: graphic safety signs.	Hazard associated with the lack of or inadequate graphic instruction and warning symbols related to dangers that could not be eliminated in design.	The operator must respect all the graphic symbols on the machine, and replace them when worn or illegible. Strictly observe all manual instructions. Chapter 1 “General Information“.
32. Hazards generated by the absence or incorrect position of safety measures/tools: manual.	Hazards associated with incorrect preparation of the manual due to absent and/or unclear information required to ensure operator safety and safe machine use.	Consult all sections of the manual.
33. Hazards generated by the absence or incorrect position of safety measures/tools: disconnection of power sources.	Contact with live parts, contact with high pressure fluids or gas.	Strictly observe all manual instructions. Chapter 2 “Safety“ and 6.2 “Electrical connections” .
34. Hazards generated by the absence or incorrect position of safety measures/tools: instruments and accessories for adjustments and/or maintenance in safe conditions.	Hazard of cutting, ejection of high pressure fluids or gases, scalding, or vibrations caused by incorrect maintenance.	Strictly observe all manual instructions. Chapter 2 “Safety“; Chapter 4 “Installation“; Chapter 10 “Operation and maintenance“.

APPENDIX

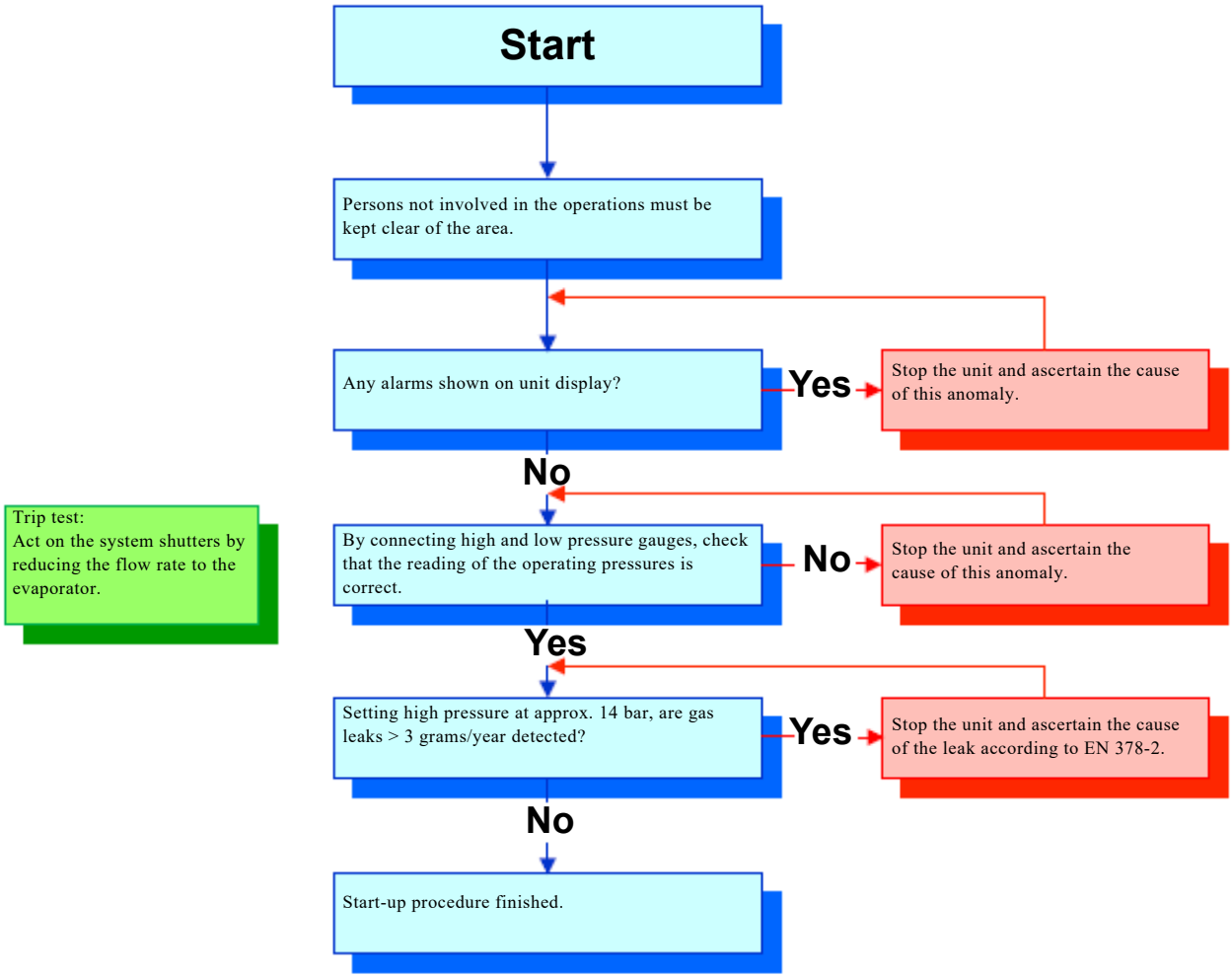
GENERAL CONDITIONS CHECKLIST

CAUTION

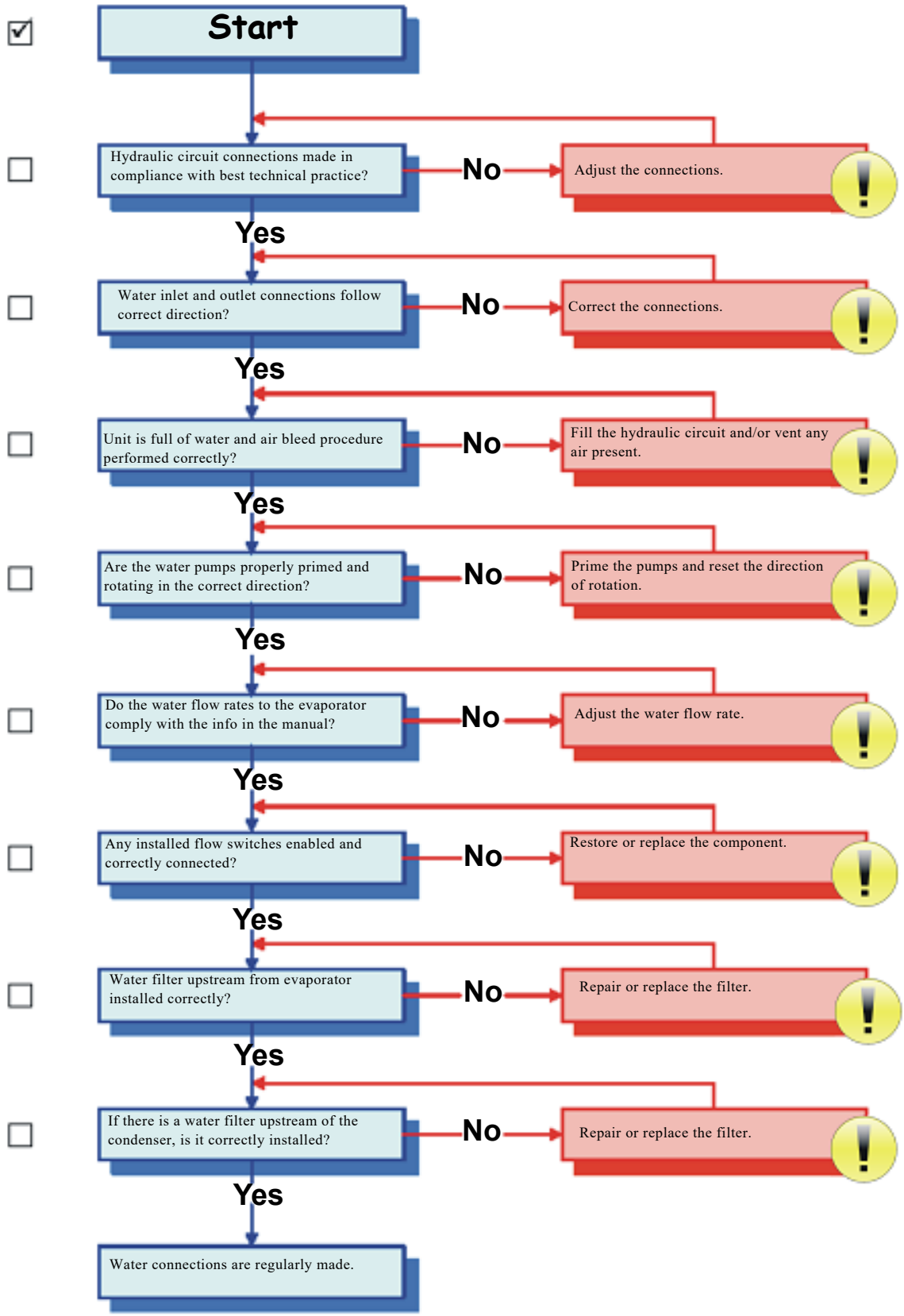
⚠ DO NOT SUPPLY THE UNIT



FIRST START CHECKLIST

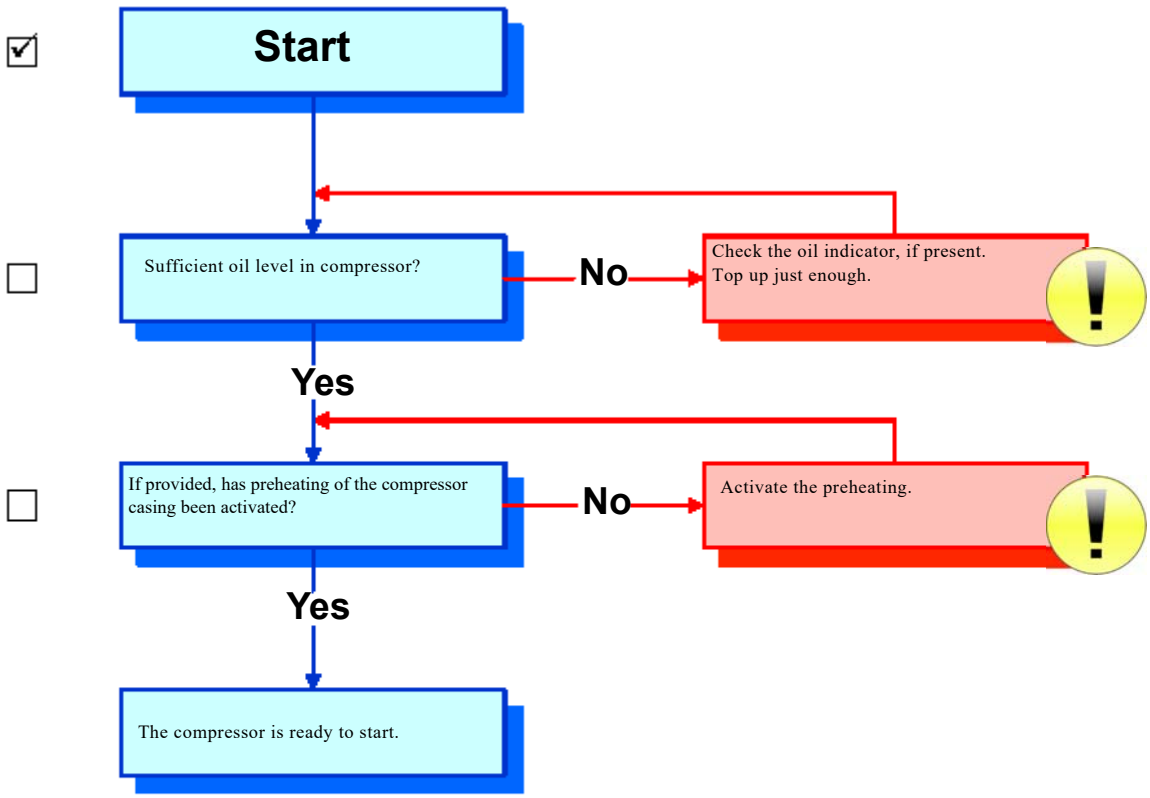


HYDRAULIC CIRCUIT CHECK LIST



CONTROLLER CHECK

OIL CHECKLIST



UNIT OPERATING CHECKLIST