EN

INSTALLATION, USE AND MAINTENANCE MANUAL

PLN C / H

Air chillers and heat pumps with R290 refrigerant

50-150 kW

Plate exchanger | A3 gas leak detection | R-290 Refrigerant | Axial fan | Scroll compressor | Cooling only | Heating/ Cooling | 3-way external valve management

PLUS

- R290 refrigerant (GWP=3)
- Low refrigerant charge (<10 kg for circuit)
- Production of hot water up to 75°C
- Full load operation down to -20°C air (45°C water)
- Very high seasonal efficiency values
- Power output and COP monitoring (option)
- Availability of silenced setups

CE

RG66029457 10/25

EUROVENT CERTIFIED PERFORMANCE

Galletti AIR CONDITIONING

Dear Customer,
Thank you for placing your trust in one of the products of Galletti S.p.a
This product is the result of our work and our commitment to design, research, and production and has been made from the finest materials, employing state-of-the-art components and production technology.
The CE marking of the product ensures its compliance with the safety requirements of the following directives: the Machinery Directive, the Electromagnetic Compatibility Directive, the Electrical Safety Directive, and the Pressure Equipment Directive. Fulfillment of the Ecodesign requirements is fully in keeping with the environmental awareness that has always guided our company.
The company certification of the Quality and Safety management system ensures that product quality is constantly checked and improved, and that the product is manufactured in full compliance with the highest standards.
By choosing our product, you have opted for Quality, Reliability, Safety, and Sustainability.
At your disposal, once again.
Galletti S.p.a

ORIGINAL INSTRUCTIONS

The water chillers and heat pumps comply with directive 2014/68//EC (PED).

The technical and dimensional data reported in this manual may be modified in view of any product improvement.

For any information , please contact the company: info@galletti.it

The unit data are reported on the rating label in this page. (FAC-SIMILE)

THE LABEL SHOWS THE FOLLOWING DATA:

— Series and size of the unit
— Date of manufacture
— Main technical data
— Manufacturer
— The label is applied on the unit, usually on the enclosing panels

IMPORTANT: NEVER REMOVE THE LABEL

— Unit serial number
— The serial number permits to identify the technical characteristics and the components installed
— Without this datum it will be impossible to identify the unit correctly

Galletti S.p.A. - Via L.Romagnoli 12/a 40010 Bentivoglio (BO) Italy Made in Italy CATEGORY
Serial number Code Date of production Cooling capacity (W) Heating capacity (W) Power supply Power input (kW) Weight (kg) Max power input (kW) Max running amperage (A) HP power input (kW) Refrigerant Max refrigerant pressure Max refrigerant temperature (°C)

GENERAL CAUTIONARY NOTES

— Do not put into service until you have read and understood the information in the following manual. This document, together with all other documents provided, should be retained for the entire life of the unit. Contact the manufacturer for any further information.
— Keep this manual intact in a safe place for the all life of the unit.
— Carefully read all the information contained in this manual, paying special attention to sections marked "Important" and "Warning"; failure to comply with the instructions provided could result in injury to persons or damage to the equipment.
— Should a fault occur, consult this manual and if necessary contact the nearest Galletti S.p.A. service centre.
— All installation and maintenance operations must be carried out by qualified personnel, unless otherwise indicated in this manual.
— The first start up must be carried out exclusively by qualified personnel and authorized by Galletti S.p.A. (see warranty sheet attached).
— Before performing any work on the unit, disconnect it from the power supply.
— Failure to comply with the rules provided in this manual will result in the immediate invalidation of the warranty.
— Galletti S.p.A. shall not accept any liability for injury or damage resultingcfrom improper use of the equipment or failure to comply with the directions provided in this manual and on the unit it self.
— It's mandatory to install filters heat exchangers protection will immediately invalidate the warranty.

SAFETY SYMBOLS

Carefully read this manual.

Warning

Use personal protective equipment (gloves for refrigerant, protective goggles)

Warning: the unit of this range are charged with A3 fluid (highly flammable) R290

Warning:
Electrical and electronic products may not be mixed with unsorted household waste. Do NOT try to dismantle the system yourself: the dismant¬ling of the system, treatment of the refrigerant, of oil and of other parts must be done by an authorized installer and must comply with applicable legislation. Units must be tre¬ated at a specialized treatment facility for reuse,recycling and recovery. By ensuring this product is disposed of correctly, you will help to prevent potential negative consequences for the environment and human health. For more information, contact your installer or local authority.

It is strictly forbidden to smoke, use sources of ignition or have high-temperature surfaces near the unit.

It is forbidden to have electronic devices in your pocket when working near the unit.

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1 THE PLN C AND H SERIE

1.1 FIELD OF APPLICATION

PLN units are designed for heating and cooling the water to be used in process air conditioning systems for residential, commercial or industrial use.
PLN units are designed for outdoor installation (guaranteed IPX4 protection, IP54 for the electrical control board), in a place not accessible to the public.

⚠ **WARNING:** Do not install the unit in environments with gas or flammable dusts.(ATEX zone)

⚠ **DANGER!** This device is not intended to be used by children or by people with physical, sensory or mental impairments, except under supervision. Make sure that children do not have access to the device.

1.2 MAIN FEATURES

PLN is the new Galletti range of air-cooled monobloc chillers and heat pumps for outdoor installation featuring refrigerant R290. R290 is the A3 refrigerant with a GWP of only 3, one of the lowest on the market. This GWP value ensures that the unit complies with the gradual reduction of greenhouse gas emissions required by the latest revision of the F-GAS regulation.
The range consists of 7 models with cooling capacities from 50 to 150 kW. The range's main strength is its high seasonal efficiency, which is designed to permanently reduce annual energy consumption as well as meet the minimum efficiency requirements established by ErP. The efficiency at partial loads is realized with EC fans (standard up to 114 size) and electronic expansion valve.
The use of top-quality components at the cutting edge of technology in the cooling, hydraulic, and electrical systems makes the units in the PLN range state of the art in terms of efficiency, reliability, and operating limits.
In fact, the ability to produce water from -10°C to 75°C, and full load operation with external air from -20°C to 48°C.
Advanced control, which is always provided across the entire range, allows continuous monitoring of operating parameters, advanced regulation logics, and connectivity.

1.3 R290 (A3) REFRIGERANT FLUID FEATURES

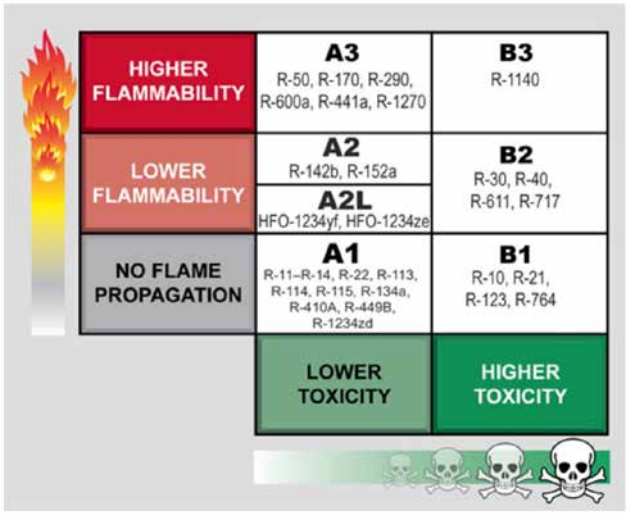
A3 gases are highly flammable refrigerants with a flame propagation speed that is always greater than 10 cm/sec (ASHRAE 34, ISO5149). By following the important precautions described in this manual and entrusting the operation of the units to qualified personnel only, installation and maintenance can be carried out in complete safety.
Refrigerant fluids are classified (under ASHRAE 34 and ISO5149 standards) according to their toxicity and flammability. They are classified according to a code consisting of a letter (indicating toxicity) and a number (indicating flammability), (e.g. A1). Initially, the classification is as follows:

— **Toxicity:**

A = refrigerants with an occupational exposure limit greater than or equal to 400 ppm
B = refrigerants with a limit lower than 400 ppm

— **Flammability:**

1 = no flame propagation under test conditions specified by the standard
2L = flame propagation with combustion speed ≤ 10 cm/s and calorific value < 19,000 kJ/kg
2 = flame propagation with combustion speed > 10 cm/s and calorific value < 19,000 kJ/kg
3 = flame propagation with combustion speed > 10 cm/s and calorific value >= 19,000 kJ/kg



⚠ **WARNING:** Since R290 refrigerant gas is denser at ambient pressure, one of the biggest dangers is its possible accumulation in confined spaces (manholes, storm drains, various recesses, basements, etc.) and consequently the creation of an area with a potentially explosive atmosphere. Do not install the unit near sources of ignition (sparks, high-temperature surfaces, open flames, etc.). Refer to the safety zone (see section 3 p. 16).

For other information refer to refrigerant fluid safety sheet.

1.4 MODELS AND VERSIONS

The PLN C / H range consists of 7 models with cooling capacities from 50 to 150 kW for cooling-only versions. All units are charged with R290, which is classified as A3 (highly flammable).
NOTE: The choice of some options can make the choice of some others forbidden or make some selection (fields) mandatory. Please contact Galletti S.p.A. for verification.

1	**Expansion valve**
A	Electronic valve
2	**Water pump and accessories**
0	Absent
1	Single standard pump
2	Double std pump - OR
3	Single HP pump
4	HP double pump - OR
A	Single inverter standard pump
B	Standard dual inverter OR pump
C	Inverter Single HP pump
D	Dual inverter HP OR pump
3	**Water buffer tank**
0	Absent
S	Selected
4	**De-superheater**
0	Absent
D	Included with pump free contact
5	**Condensation/Evaporation Control**
A	With EC Fans high pressure head
C	Phase cutting (not available up to size 114)
E	with EC Fans (supplied up to size 114)
6	**Antifreezing kit**
E	Only cooling versions and plate exchanger (supplied)
P	Plate exchanger + pump
S	Plate exchanger + pump + tank
T	For plate exchanger and tank
7	**Acoustic insulation and attenuation**
0	Absent
3	Compressor compartment acoustic insulation and sound blanket
6	Compressor compartment acoustic insulation and sound blanket + Low-noise fans

8	**Water low temperature production**
0	Up to 5°C (0% of glycol)
1	Up to 0°C (15% of glycol)
2	Up to -5°C (25% of glycol) (only if the option 5 = E or A)
9	**Remote control**
0	Absent
2	RS485 Board (Modbus protocol or Carel)
B	BACNET IP/PCOWEB serial board
G	BACNET IP / PCOWEB serial board + supervision software
S	Simplified additional remote control panel
T	Touch screen control (up to 50m)
X	Additional remote control for advanced control (up to 50m)
10	**Special coils / Protective treatments**
0	Copper / aluminium (standard for H version)
C	Cataphoresis (only for H versions)
E	Microchannel in Long Life Alloy (standard for C version)
I	Hydrophilic (only H version)
M	Microchannel with E-coating (only for C version)
P	Pre-painted fins with epoxy painting (only H version)
R	Copper-copper (heat pump only)
11	**Base vibration dampers**
0	Absent
G	Made of rubber
M	With spring
12	**Outdoor coil trace heater**
0	Absent
1	Present (only H version)
13	**Control panel**
1	Advanced
2	Advanced with touch screen display
14	**Water flow control**
2	Vane-type flow switch
3	Hot-wire electronic flow switch
15	**DHW accessory only (if option 3 = 0)**
0	Absent
1	DHW 3-way valve + tank probe
2	DHW mode enabling with dry contact
3	DHW 3-way valve (supplied) + ACS from ID contact

» Accessories

B	Outdoor finned coil heat exchanger protection grille
D	ON/OFF status of the compressors (mandatory only if opt.4 = D)
E	Remote control for power step limits (accessory 2 excluded)
F	Configurable digital alarm board
G	Soft starter
H	Power factor capacitors
I	Refrigerant sensors (standard)
L	Double insulation water side (as standard for tank)
M	0-10V signal for external user pump control (only if opt 4 =0)
N	Integration system enabling contact (boiler / electric heater) plant
O	Night-time low-noise (only if opt 7 different from 6)
Q	Temperature probe for pump shutdown on the primary circuit
R	Enabling 2nd set-point
T	Mains power analyzer for monitoring of power consumption
V	Set-point modification with 4-20mA signal
Z	Flow meter for calculating power output
1	Integration system enabling contact (electric heater) DHW (only if opt 15 different from 0)
2	Smart Grid Certification (option E excluded)
3	Deaerator for hydraulic circuit (supplied as an accessory)
4	Dirt separator (supplied as an accessory)

1.5 MAIN COMPONENTS

1.5.1 Structure

Galvanised sheet steel structure treated with a polyester powder coating (RAL9002) suitable for outdoor applications, for an attractive look and effective resistance to corrosive agents.
Acoustic insulation can reduce the unit noise emissions.
Fastening devices are made of non-oxidizable materials, or carbon steel that has undergone surface-passivating treatments.

1.5.2 Electronic valve

It is standard, offers greater responsiveness during transients. The electronics also manage the synergistic operation of the compressors and the valve, thereby making it possible to vary overheating and maximize efficiency at partial loads.

1.5.3 Cooling circuit

— Scroll compressor with optional sound insulation. The adopted components' efficiency, reliability, and noise emission levels represent the state of the art for scroll compressors.
— Brazed plate heat exchangers made of stainless steel and optimised for use with R290.
— Finned block condenser with 8 mm copper tubing and corrugated aluminium fins, characterised by circuits designed to optimise operation as both evaporator and condenser and reduce refrigerant charge. (PLN H)
— Microchannel condenser with low refrigerant charge. (PLN C)
— Dehydrating filter.
— Flow indicator with humidity indicator.
— Cycle reversing valve (PLN H)
— Liquid receiver. (PLN H)
— Liquid separator.(PLN H)
— High pressure switch.
— Electronic expansion valve: expands the liquid refrigerant towards the plate heat exchanger during operation in chiller mode and towards coils in heat pump mode.
— Gas leak detection systems: attends when there is a R290B leak, blocking operation of the unit.

1.5.4 Refrigerant with low GWP

Use of environmentally-friendly refrigerant R290. R290 is the A3 refrigerant with a GWP of only 3, one of the lowest on the market. This GWP value ensures that the PLN range complies with the gradual reduction of quotas of greenhouse refrigerants in the European market required by the latest version of the F-GAS regulation.

1.5.5 Customised hydraulic kit

The hydronic kit is fully configurable. For standard pumps, the maximum ethylene and propylen glycol content tolerated is 35% with positive water temperatures. Please contact us if higher glycol percentages are required or if it is necessary to operate with negative water temperatures.
The hydronic kit and pumping unit are designed to be used with non-industrial water within the operating range. A utility-side heat output meter (optional) is also fitted to the pumping unit.

1.5.6 Electronic microprocessor control

The electronic controller enables the complete control of the PLN unit. It can be easily accessed through a polycarbonate flap with IP65 protection rating.

By reading the outdoor air temperature, it can automatically change the setpoint to adapt it to the outdoor load conditions or keep the unit running even in the harshest winter conditions.
Main functions:
— Control of the delivery water temperature and Delta T on system with inverter modulating pump
— Possibility of adapting the set-point to the outside load conditions or to the outside temperature
— Control of the electronic valve
— Complete alarm management, including history
— An RS485 serial port is available for monitoring
— Possibility of connecting a second remote terminal (display)
— Management of multiple units connected to a LAN network
— Control of electrical power input
Devices controlled
— Compressor
— Reverse cycle valve
— Dual alarm signalling relays
— LAN networks for controlling 6 units in parallel

1.5.7 A2L gas leak detection systems

The units are equipped with a leak detector sensor near the cooling circuit. The leak sensor is equipped with a microprocessor-independent control unit, which is fitted with a relay that cuts off the power supply to the normal equipment of the unit when the critical LFL threshold is exceeded. Power to the leak sensor control unit is supplied from the branch located upstream of the main switch. This function allows the complete disconnection of the ordinary unit components during maintenance operations, while leaving all the safety systems enabled (i.e. energized).
In the event of a refrigerant leak, the gas detector control unit activates an ATEX extractor fan, which is also kept energised by the same branch upstream of the main switch.
Refer to section 7.2 p. 35 for the risk assessment and the wiring diagram 7.9 p. 37.

2 INSPECTION, CONVEYANCE DIMENSIONAL AND SITING

2.1 INSPECTION

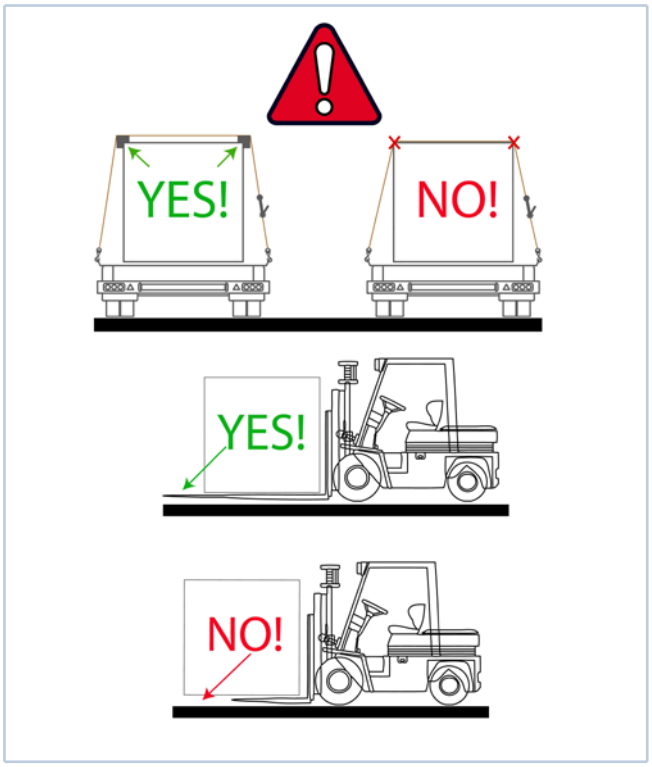
On receiving the unit, check that the packing is intact: the machine left the factory in perfect conditions and after thorough inspection.
Should you detect any signs of damage, immediately report them to the carrier and note them on the delivery slip.
Galletti S.p.A. Must be notified of the entity of the damage within 8 days of the delivery date.
Check that the following items are present:

— Starting up module;
— Wiring diagram;
— Warranty certificate and service centers list;
— Leak detector sensor manufacturer's manual for routine maintenance;
— Check that this manual is complete (60 pages).

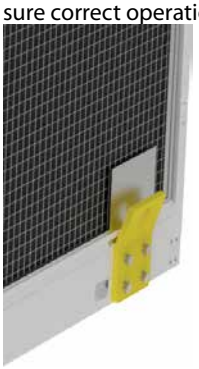
2.2 CONVEYANCE

During handling it is compulsory to check dimensions, weights, centre of gravity and anchorages. Check as well that lifting and positioning devices conform to the current safety regulations. The unit leaves the factory screwed onto a wooden pallet, which allows it to be easily conveyed with a forklift truck. After removing the unit from the pallet, handle it gently, without applying excessive pressure on the side panels, finned coil and fan grille. You should collect and separate the packing materials (wood, cardboard, nylon etc.) and make them available for recycling in order to minimise their environmental impact. Before lifting, remove the screws fastening the base of the unit to the wood platform.
The unit must be lifted using Ø 1" steel pipes at least 5mm thick, to be inserted in the round holes on the base side members (see figure) and identified by means of stickers. Piping must protrude of at least 250-300 mm from each side, be slung with ropes of equal length and secured to the lifting hook (provide stops at the ends of the pipes to prevent the ropes from slipping off due to the weight).
Use ropes and belts sufficiently long to extend beyond the height of the machine and place spacer bars and boards on the top to prevent damaging the sides and the top of the unit.
For units from 104 to 154, lifting must be carried out using the designated lifting lugs located on the base.
In this phase, before the definitive position, vibration damping supports can be installed (optional).

⚠ **WARNINGIN** all lifting operations make sure that the unit has been securely anchored, in order to avoid overturning or accidental falls.



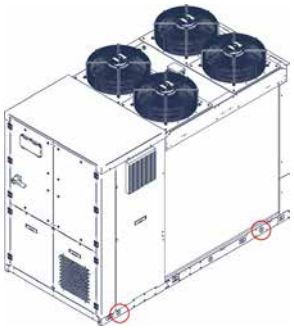
To protect the coils during the lifting and handling phases, plates have been provided in correspondence with the lifting eyebolts. Once the unit has been installed, remove the protections to ensure correct operation.



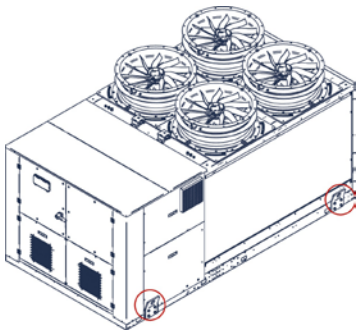
⚠ **ATTENTION** It is essential to avoid securing the load tracks with the appropriate straps without having placed the appropriate corner protections, so as to avoid damaging the carpentry.

⚠ **WARNING** Use all available lifting points!

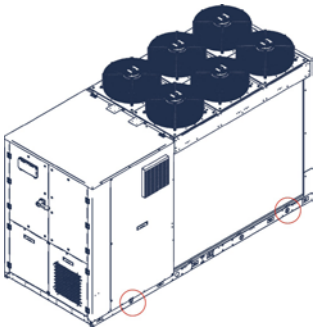
» PLN 052



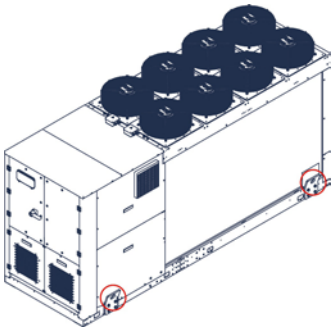
» PLN 134-154



» PLN 072-082



» PLN 104-114



2.3 SITING AND DAMPERS

It is important to bear in mind the following aspects when choosing the best site for installing the unit:

— Size and origin of water pipes;
— Location of the power supply;
— Solidity of the supporting surface;
— Avoid obstacles to the outflow of air from the fan which could cause back suction (see section on 2.4 p. 9);
— Direction of prevalent winds: (position the unit so as to prevent prevalent winds from interfering with the fan air flow). Prevalent winds opposing the fan air flow will result in a maximum air temperature below the value indicated in the operating limits;
— Avoid the possible reverberation of sound waves; do not install the unit in narrow or cramped spaces;
— Ensure adequate accessibility for maintenance or repairs (see section on 2.4 p. 9).

For installation and anti-vibration characteristics (optional), refer to manual RG66013698 supplied.

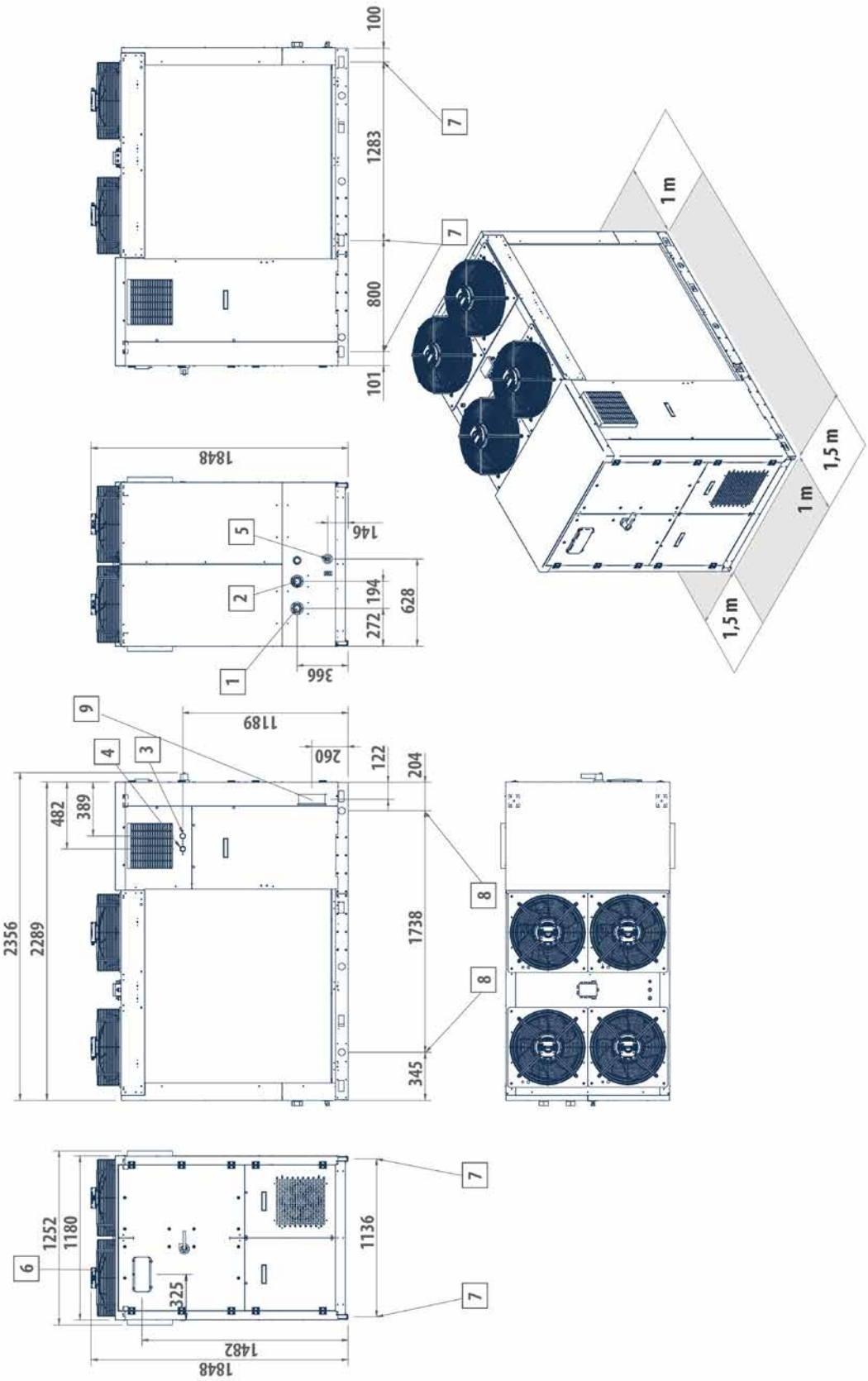
PLN	N° DAMPERS
F1	6
F2	6
F3	6
F4	6

2.4 INSTALLATION CLEARANCE REQUIREMENTS AND DIMENSIONAL

To guarantee the proper functioning of the unit and access for maintenance purposes, it is necessary to comply with the minimum installation clearance requirements shown in dimensional drawings.

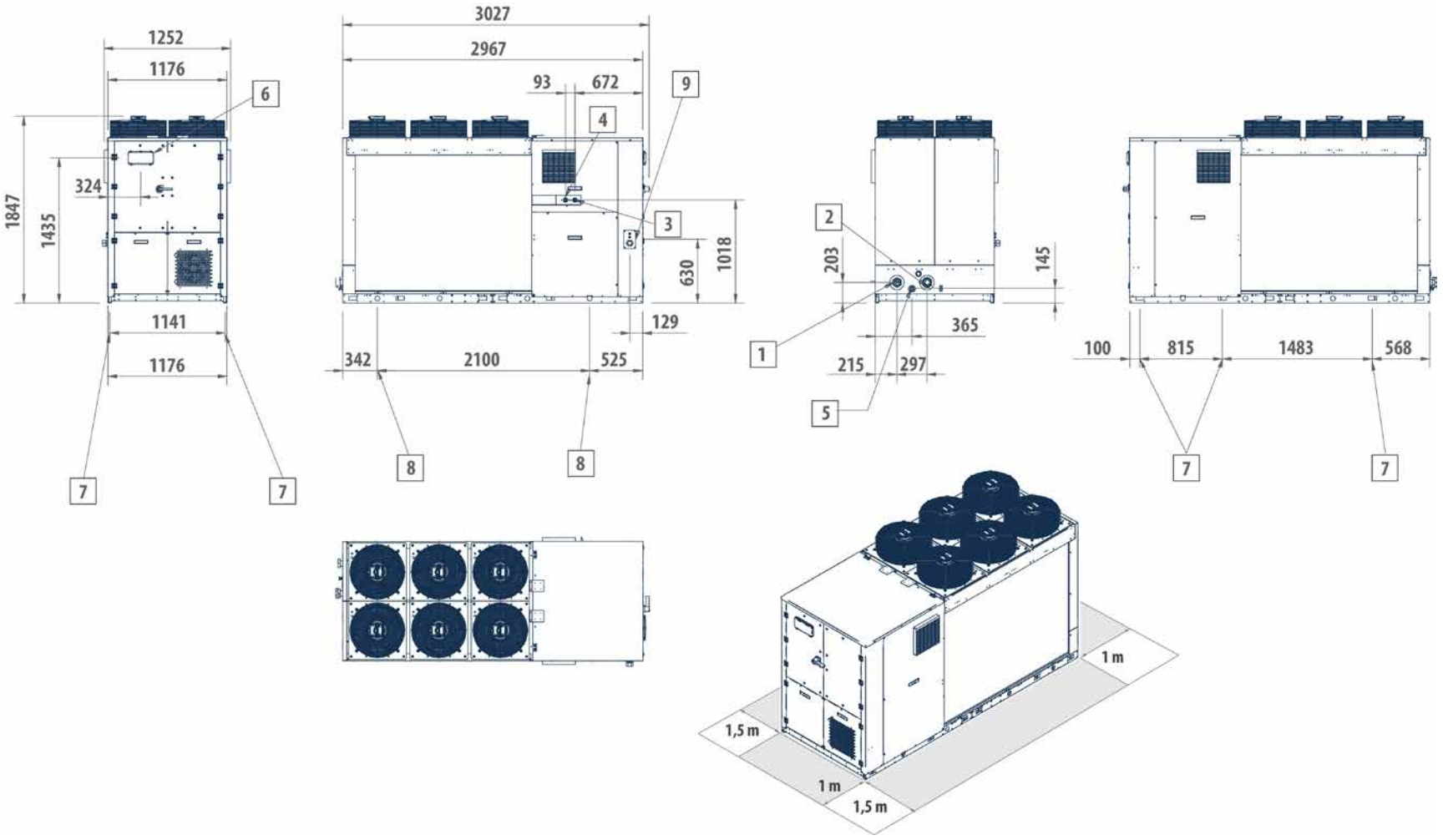
— Verify that there are no obstacoles in front of the fans air outlet.
— Avoid any and all situations of backflow of hot air between air outlet and inlet of the unit.
— In the design of the unit, special care has been taken to minimise noise and vibrations transmitted to the ground.
— Even greater insulation may be obtained, however, by using vibration damping base supports (available as optional accessories).
— If vibration damping base supports are adopted, it is strongly recommended also to use vibration damping couplings on the water pipes.
— Whenever the unit is to be sited on unstable ground (various types of soil, gardens, etc.) it is a good idea to provide a supporting base of adequate dimensions.
— If even only one of the above conditions is not fulfilled, please contact the manufacturer to check for feasibility.

⚠ **WARNING** During installation adjust the vibration damping couplings in order to make sure it is installed in a perfectly level position.



Legend

1 Water inlet on user side 2" F
2 Water outlet user 2" F
3 Desuperheater water inlet 1" F
4 De-superheater water outlet 1" F
5 Water drainage 1/2" F
6 User interface
7 Vibration dampers
8 Lifting points
9 Power supply input



Legend

1 Water inlet on user side 2" 1/2 F
2 Water outlet user 2" 1/2 F
3 Desuperheater water inlet 1" F
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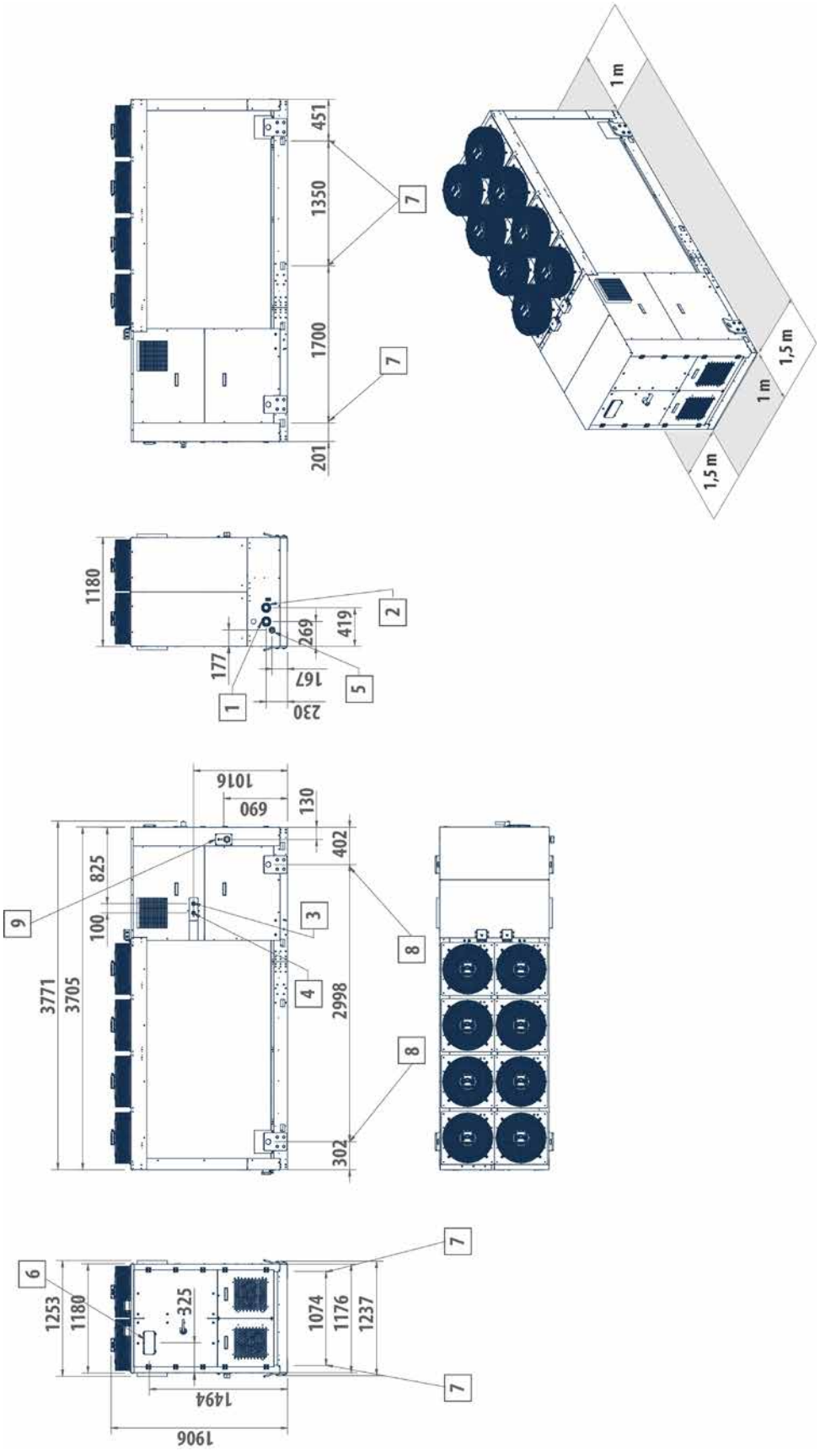

Legend

1 Water inlet on user side 2" 1/2 F
2 Water outlet user 2" 1/2 F
3 Desuperheater water inlet 1" F
4 De-superheater water outlet 1" F
5 Water drainage 1/2" F
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7 Vibration dampers
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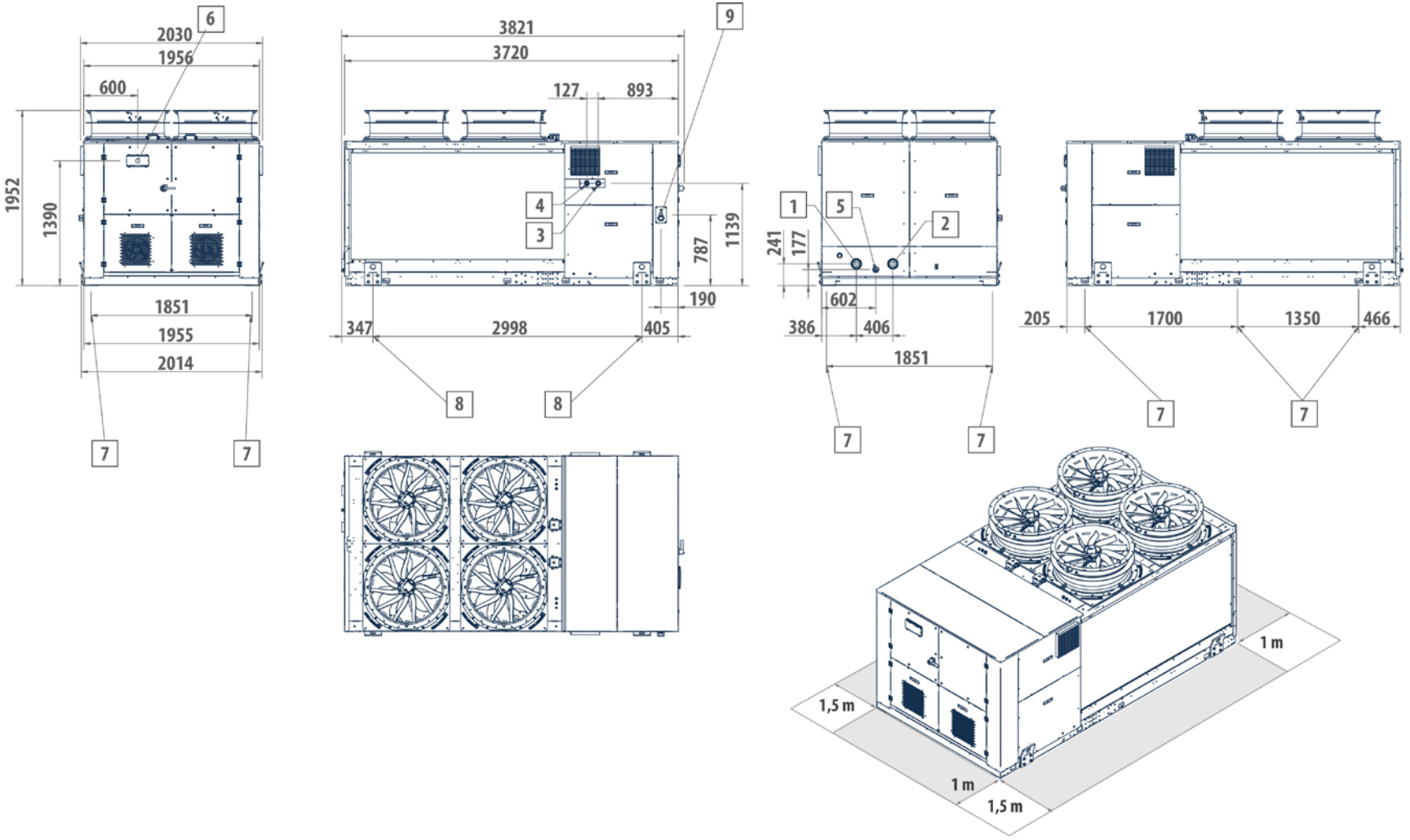
9 Power supply input



Legend

1 Water inlet on user side 3'' VIC
2 Water outlet user 3" VIC
3 Desuperheater water inlet 1'' 1/2 F
4 De-superheater water outlet 1'' 1/2 F
5 Water drainage 1/2" F
6 User interface
7 Vibration dampers
8 Lifting points
9 Power supply input

2.4.1 Condensate discharge from unit

During normal operation of the unit as a heat pump, condensate is produced due to the dehumidification of the air in contact with the finned block heat exchanger.
In order to hold the condensate that the unit normally produces during operation in winter mode (and during defrosting), it is advisable to prepare a technical tank below the base of the unit, with sufficient capacity to collect and discharge the water produced. The adoption of a drip tray may be mandatory (check the local legislation in force) in case of the use of glycol or additives such as ethylene glycol that cannot be released into the environment in case of possible leakage of the circuit. The installer is responsible for the construction of such a drip tray.
It is necessary to consider the drip tray installation as a hypothetical area of refrigerant accumulation and stagnation in the event of a leak. Therefore, a specific risk analysis must be carried out.

3 INSTALLATION SITE FEATURES

The units of the PLN range are designed for outdoor installation, in a context where the natural dilution of the refrigerant that could escape as the result of a leak guarantees a degree of safety. Each installation site must provide a safe area around the unit with the following characteristics.
Inside the safety zone there must be no:

— Possible accumulations (manholes, storm drains or recesses) or pathways through which the refrigerant can flow into a building or to an accumulation point or other dangerous access points (fresh air inlets for air conditioning or ventilation systems).
— Sources of ignition (open flames, electric motors, sparking sources, boiler drain pipes);
— Electronic devices (cell phones, radios, PCs, tablets);
— Electrical components without AtEx certification for Group IIA gas according to IEC 60079-15;
— Surfaces whose temperature can exceed the auto-ignition temperature of propane (450°C) minus 100 K;
— Large non-conductive surfaces (polymer panels, tarpaulins) that can accumulate static electricity.

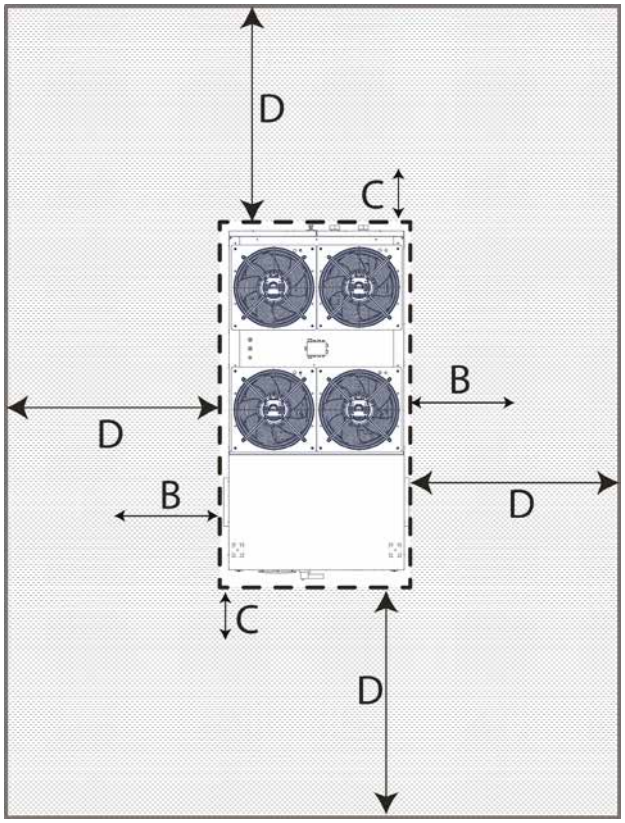
⚠ **WARNING:** The above list is only indicative of the most common conditions that may occur if installation is incorrect. The list is not exhaustive. For more information on this list, see Annex K of EN 378-2 (which refers to EN 1127).

⚠ **WARNING:** If it is not possible to comply with EN 378-2 and EN 378-3, a specific risk analysis must be carried out to identify countermeasures to eliminate the risk of fire/explosion in the event of a refrigerant leak.

⚠ **WARNING:** It is important to remember that the devices for venting air from the water circuit (safety valves, automatic/manual deaerators and sludge removers, air vent valves) must also follow the same positioning principles as the unit. It is therefore recommended that they be installed close to the unit in order to optimise and centralise the danger zone. In any case, the above components must be installed outside the occupied zone in accordance with UNI EN 378-1.

The safety zone defined above is equal to the area formed by the projection of the unit itself on the supporting surface plus the area formed by offsetting the perimeter of the unit by a distance "D" which varies depending on the refrigerant charge contained in the unit.

» Safety zone



B Area required for maintenance operations 1.5 m
C Area required for maintenance operations 1 m
D Safety zone (see table)

» PLN C - Distance value 'D': safety zone assigned to each unit

Model	D (m)
PLN052C	2,5
PLN072C	3
PLN082C	3
PLN104C	2,5
PLN114C	2,5
PLN134C	2,5
PLN154C	2,5

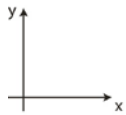
» PLN P - Distance value 'D': safety zone assigned to each unit

Model	D (m)
PLN052H	3
PLN072H	3,5
PLN082H	3,5
PLN104H	3
PLN114H	3,5
PLN134H	3,5
PLN154H	3,5

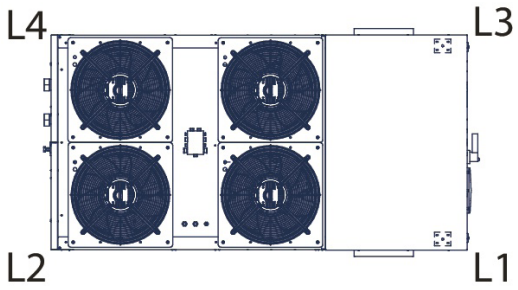
⚠ **WARNING:** In any case, the requirements listed above not be understood as a derogation from carrying out a risk analysis and detailed design pursuant to the requirements of standard EN378 (or other local regulations in force, in relation to machine rooms for units containing A3 fluids). Avoid installing the units in locations that could be dangerous during placement, start-up, operation, and maintenance operations, such as areas without adequate protection against falls, areas with obstacles that create a danger of tripping or falling, and areas with buffer spaces that are not compliant with the documentation.

4 WEIGHTS

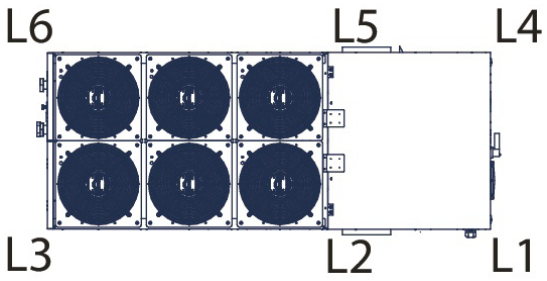
This drawing shows the points of the machine for which weights have been calculated, with respect to the basic chiller and heat pump model. The weights are shown in the tables below.



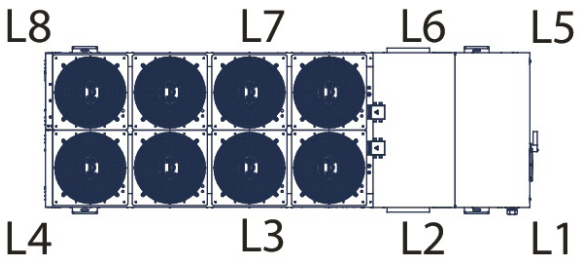
» PLN F1



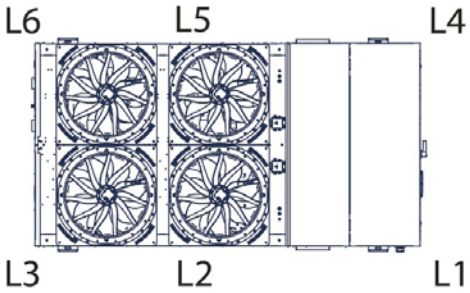
» PLN F2



» PLN F3



» PLN F4



» Lifting center of gravity for transporting unit C version without hydraulic options

Frame		1	2		3		4	
PLN C		052	072	082	104	114	134	154
Xb	mm	629	572	572	332	329	1027	1027
Yb	mm	1288	1485	1485	1350	1328	1819	1819

» Lifting center of gravity for transporting unit H version without hydraulic options

Frame		1	2		3		4	
PLN H		052	072	082	104	114	134	154
Xb	mm	621	633	631	331	327	1034	1026
Yb	mm	977	1377	1376	1295	1217	1723	1741

» Lifting center of gravity for transporting unit C version with pump and tank

Frame		1	2		3		4	
PLN C		052	072	082	104	114	134	154
Xb	mm	656	613	613	653	648	1141	1141
Yb	mm	1183	1465	1465	1740	1720	1976	1975

» Lifting center of gravity for transporting unit H version with pump + full tank

Frame		1	2		3		4	
PLN H		052	072	082	104	114	134	154
Xb	mm	653	657	656	655	649	1148	1138
Yb	mm	955	1391	1390	1695	1630	1914	1919

All weights stated below include the refrigerant charge as well as the water contained in the circuit (very important when assessing the most suitable bearing surface for the unit especially in the presence of a tank).

To get an approximate estimate of the unit's weight when empty, subtract the weight (in kg) of the water contained in the tank. In other cases the water content is negligible for these purposes.

» Operating weight C version without hydraulic options

Frame		1	2		3		4	
PLN C		052	072	082	104	114	134	154
L1	kg	139	91	91	143	150	264	264
L2	kg	204	136	136	160	163	273	273
L3	kg	166	218	218	170	171	279	279
L4	kg	231	83	83	192	188	287	287
L5	kg	-	128	128	160	164	295	295
L6	kg	-	210	210	177	177	302	302
L7	kg	-	-	-	188	185	-	-
L8	kg	-	-	-	210	202	-	-
Total	kg	740	865	865	1400	1400	1700	1700

» C - 1 pump version weight distribution with full inertial tank

Frame		1	2		3		4	
PLN C		052	072	082	104	114	134	154
L1	kg	212	120	120	178	185	278	279
L2	kg	237	182	182	195	199	364	365
L3	kg	274	294	294	206	207	432	432
L4	kg	299	140	140	228	224	417	418
L5	kg	-	201	201	220	224	503	504
L6	kg	-	313	313	238	237	571	571
L7	kg	-	-	-	248	245	-	-
L8	kg	-	-	-	271	263	-	-
Total	kg	1022	1250	1250	1785	1785	2567	2569

» Operating weight H version without hydraulic options

Frame		1	2		3		4	
PLN H		052	072	082	104	114	134	154
L1	kg	186	85	87	142	168	280	292
L2	kg	122	113	115	150	165	259	276
L3	kg	206	165	167	155	163	243	263
L4	kg	141	106	107	165	158	305	314
L5	kg	-	135	136	158	182	285	298
L6	kg	-	186	188	167	178	268	286
L7	kg	-	-	-	172	176	-	-
L8	kg	-	-	-	182	171	-	-
Total	kg	655	790	800	1290	1360	1640	1730

» Operating weight H version with pump and full buffer tank

Frame		1	2		3		4	
PLN H		052	072	082	104	114	134	154
L1	kg	260	115	117	178	205	296	309
L2	kg	156	160	162	186	201	352	369
L3	kg	314	241	243	191	199	396	416
L4	kg	210	163	164	201	194	438	447
L5	kg	-	208	209	219	243	494	508
L6	kg	-	289	291	227	239	538	555
L7	kg	-	-	-	232	237	-	-
L8	kg	-	-	-	243	232	-	-
Total	kg	940	1176	1186	1678	1751	2514	2604

5 TECHNICAL FEATURES

5.1 RATED TECHNICAL DATA PLN C

» Rated technical data PLN C chiller

PLN C			052	072	082	104	114	134	154
Power supply		V-ph-Hz	400-3N-50						
Cooling capacity	(1)(E)	kW	50,8	65,5	77,4	106	118	138	160
Total power input	(1)(E)	kW	16,5	20,1	24,3	35,6	40,6	43,3	51,7
EER	(1)(E)		3,08	3,25	3,19	2,99	2,90	3,18	3,09
SEER	(2)(E)		4,12	4,61	4,40	4,45	4,65	5,00	4,62
Water flow	(1)	l/h	8743	11262	13322	18341	20289	23702	27456
Water pressure drop	(1)(E)	kPa	25	27	35	55	65	35	44
Available pressure head - LP pumps	(1)	kPa	158	145	129	113	102	198	178
Available pressure head - HP pumps	(1)	kPa	192	180	165	172	160	322	301
Maximum available pressure head with EC fans high pressure		Pa	25	25	25	25	25	70	70
Rated air flow		m^3/h	17000	24500	24500	33750	33750	52250	52250
Compressors / circuits			2/1	2/1	2/1	4/2	4/2	4/2	4/2
Refrigerant charge - circuit 1	(3)	kg	3,3	4,8	4,9	3,8	3,85	3,9	3,95
Refrigerant charge - circuit 2	(4)	kg	-	-	-	3,8	3,85	3,9	3,95
Sound power level	(5)(E)	dB(A)	84	85	85	85	86	87	87
Low-noise sound power reduction		dB(A)	-3	-3	-3	-3	-3	-3	-3
Super low-noise sound power reduction		dB(A)	-7	-7	-7	-5	-5	-5	-5
Height		mm	1848	1848	1848	1906	1906	1952	1952
Depth		mm	1136	1136	1176	1253	1253	2030	2030
Length		mm	2356	2356	3027	3771	3771	3821	3821
Maximum transport weight		kg	1042	1270	1270	1805	1805	2587	2589

(1) Outdoor air temperature 35°C, water temperature 12°C / 7°C (EN14511:2022)
(2) η efficiency values for heating and cooling are respectively calculated by the following formulas: [η = SCOP / 2,5 - F(1) - F(2)] e [η = SEER / 2,5 - F(1) - F(2)]. For further information, please refer to the technical document "ErP 2009/125/EC DIRECTIVE" in the catalogue introducing pages, or to the EN14825:2022 regulation.
(3) If the two cooling circuits are unbalanced, it is the smaller circuit. Kg gas value is estimated. For the exact value refer to the plate data on the unit.
(4) If the two cooling circuits are unbalanced, it is the larger circuit. Kg gas value is estimated. For the exact value refer to the plate data on the unit.
(5) Sound power level measured according to ISO 9614
(E) EUROVENT certified data

5.2 RATED TECHNICAL DATA PLN H

» Heat pumps rated technical data PLN H

PLN H			052	072	082	104	114	134	154
Power supply		V-ph-Hz	400 / 3+N / 50						
Cooling capacity	(1)(E)	kW	48,6	63,4	72,0	101	111	130	148
Total power input	(1)(E)	kW	16,9	21,2	25,2	35,3	39,2	41,6	49,9
EER	(1)(E)		2,88	2,99	2,86	2,86	2,83	3,12	2,97
SEER	(2)(E)		4,02	4,32	4,11	4,28	4,50	4,90	4,55
Water flow	(1)	l/h	8355	10912	12397	17374	19097	22336	25465
Water pressure drop	(1)(E)	kPa	25	30	37	49	57	32	38
Available pressure head - LP pumps	(1)	kPa	158	144	128	116	104	199	180
Available pressure head - HP pumps	(1)	kPa	192	179	163	175	162	322	303
Heating capacity	(3)(E)	kW	54,6	68,6	79,5	106	120	132	154
Total power input	(3)(E)	kW	16,7	20,7	23,9	32,8	36,6	40,0	47,7
COP	(3)(E)		3,28	3,32	3,32	3,24	3,29	3,30	3,22
SCOP	(4)(E)		3,80	3,70	3,82	3,90	4,00	3,80	3,95
SCOP	(5)(E)		3,05	3,03	3,12	3,30	3,34	3,14	3,25
Water flow	(3)	l/h	9464	11898	13782	18364	20827	22910	26629
Water pressure drop	(3)(E)	kPa	29	33	42	49	59	32	40
Available pressure head - LP pumps	(3)	kPa	149	136	114	101	86	179	151
Available pressure head - HP pumps	(3)	kPa	183	171	149	159	144	301	272
Rated air flow		m^3/h	17850	26350	26350	35200	34500	58000	58000
Compressors / circuits			2/1	2/1	2/1	4/2	4/2	4/2	4/2
Maximum available pressure head with EC fans high pressure		Pa	25	25	25	25	25	70	70
Refrigerant charge - circuit 1	(6)	kg	5,7	8,4	8,5	6,3	7,5	7,8	7,9
Refrigerant charge - circuit 2	(7)	kg	-	-	-	6,3	7,5	7,8	7,9
Buffer tank volume		dm^3	125	200	200	200	200	600	600
Sound power level	(8)(E)	dB(A)	84	85	85	85	86	87	87
Low-noise sound power reduction		dB(A)	-3	-3	-3	-3	-3	-3	-3
Super low-noise sound power reduction		dB(A)	-7	-7	-7	-5	-5	-5	-5
Height		mm	1900	1900	1900	1900	1900	1950	1950
Depth		mm	1250	1250	1250	1250	1250	2030	2030
Length		mm	2350	3000	3000	3700	3700	3820	3820
Maximum transport weight		kg	960	1196	1206	1698	1771	2534	2624

(1) Outdoor air temperature 35°C, water temperature 12°C / 7°C (EN14511:2022)
(2) η efficiency values for heating and cooling are respectively calculated by the following formulas: [η = SCOP / 2,5 - F(1) - F(2)] e [η = SEER / 2,5 - F(1) - F(2)]. For further information, please refer to the technical document "ErP 2009/125/EC DIRECTIVE" in the catalogue introducing pages, or to the EN14825:2022 regulation.
(3) Outdoor air temperature dry bulb 7°C / wet bulb 6°C, water temperature 40°C / 45°C (EN14511:2022)
(4) η efficiency values for heating and cooling are respectively calculated by the following formulas: [η = SCOP / 2,5 - F(1) - F(2)] e [η = SEER / 2,5 - F(1) - F(2)]. For further information, please refer to the technical document "ErP 2009/125/EC DIRECTIVE" in the catalogue introducing pages, or to the EN14825:2022 regulation. Low temperature conditions.
(5) η efficiency values for heating and cooling are respectively calculated by the following formulas: [η = SCOP / 2,5 - F(1) - F(2)] e [η = SEER / 2,5 - F(1) - F(2)]. For further information, please refer to the technical document "ErP 2009/125/EC DIRECTIVE" in the catalogue introducing pages, or to the EN14825:2022 regulation. Medium temperature conditions.
(6) If the two cooling circuits are unbalanced, it is the smaller circuit. Kg gas value is estimated. For the exact value refer to the plate data on the unit.
(7) If the two cooling circuits are unbalanced, it is the larger circuit. Kg gas value is estimated. For the exact value refer to the plate data on the unit.
(8) Sound power level measured according to ISO 9614
(E) EUROVENT certified data

» Sound pressure level with acoustic insulation options

PLN C/H		052	072	082	104	114	134	154
Compressors and circuit soundproof insulations	**dB(A)**	-3	-3	-3	-3	-3	-3	-3
Compressor, circuit soundproof insulations + Low-noise EC fans	**dB(A)**	-7	-7	-7	-5	-5	-5	-5

6 MICROPROCESSOR CONTROL

Below are specified the microprocessor control functions in the basic version.

The advanced control instructios are described in service manual.

» pGD

6.1 DESCRIPTION OF CONTROL PANEL

The unit's control panel allows you to display and set the unit's operating parameters and read the main operating data. In addition it indicates what mode (cooling or heating) the unit is operating in and signals any alarms that may have been triggered. In addition to this, on the default screen it is possible to read some values read by the probes and the status of the main devices of the unit such as the compressors.
All settings are memorised in the circuit board and used when the system is switched back on, even after a power failure.

6.1.1 Remote control panels (accessories)

Installing a PCDS remote control panel enables you to switch the unit on and off, set the operating mode (cooling - heating) remotely, and have a cumulative alarm indicator (thanks to an alarm signalling relay integrated in the electronic control device). Installing a PGD remote control panel instead makes it possible to access all the electronic control functions on the unit.

6.1.2 Main functions

— Water temperature control according to the required setting
— Control of pumps (both on/off and inverter) outside the unit
— Complete alarm management (storage of history)
— Designed for serial line connection for monitoring / remote support
— Designed for connection to a remote terminal that duplicates the electronic control functions
— Designed for LAN connection (for more information see the dedicated manual)

6.1.3 Devices controlled

— Compressors
— Cycle reversing valve (heat pump versions only)
— Water circulation pumps (if present)
— Electronic expansion valve driver (if present)
— Alarm signalling relay inside the electronic controller (designed to control a warning light or buzzer)
— ...
— All other devices that are relevant for the operation of the unit are indicated on the wiring diagram

6.2 USING THE CONTROL PANEL

6.2.1 Display

The graphic display shows the plate heat exchanger inlet and outlet water temperature. In addition to this, you can see the main information regarding the status of the unit.

SYMBOL	KEY	DESCRIPTION
	ALARM	Press the ALARM key to reset alarms. When there is an alarm, it will light up.
Prg	PROGRAM	Press PRG to access the main menu.
Esc	ESC	Press ESC to move up to a higher level in the menu.
	UP	Press UP to go to the next screen or increase the value of a parameter.
	ENTER	Press ENTER to go into the fields of parameters to be edited and to confirm changes.
	DOWN	Press DOWN to go to the previous screen or decrease the value of a parameter.

6.2.2 Meaning of LEDs on the display:

The red LED on the alarm button indicates that a serious alarm is in progress. The yellow LED on the central button to the left indicates that a non-serious alarm is in progress.

6.3 SWITCHING ON AND OFF AND CHANGING THE OPERATING MODE

The unit may be switched on and off from the control panel installed on the unit itself or by remote.

6.3.1 Switching the unit on and off in the cooling for chiller or heating mode for heat pump

To switch the unit on and off in both operating modes, follow the instructions below:
— Press the UP key or the DOWN key to access the quick menu
— Move the cursor to the change mode symbol and press ENTER
— Follow the on-screen instructions to selected the desired operating mode
— Press ESC
— Move the cursor to the power-on symbol and press ENTER

— Follow the on-screen instructions to turn the unit on in the preselected operating mode (press PRG when indicated)

Switchover mode from cooling to heating is unavailable on cooling only units or motor-driven evaporating units.

6.3.2 Changing the operatining mode (heat pump only)

To enable remote ON-OFF switching from the PCDS or via an external switch (not supplied) make connections to terminals indicated on wiring diagram (normally jumpered).
Remote **ON-OFF** open: unit OFF (keyboard disabled)
Remote **ON-OFF** closed: unit ON (possibility to switch the unit ON and OFF from the keyboard)

⚠ **WARNING** Where remote ON-OFF switching is enabled, after a power failure occurs and power is restored the unit will go into the mode indicated by the remote input without considering any changes that have been made from the unit control panel. That is:

remote **ON-OFF** open: the unit remains Off
remote **ON-OFF** closed: the unit starts again
The unit leaving the factory has been configured for a fast, easy connection to the PCDS remote control (accessory), which enables the user to change the operating mode and turn the unit on and off from a distance.
If the unit is not equipped with this accessory, to select the operating mode it is necessary to use terminals 19-30 on the electric control board as follows:
— terminals 19-30 closed for cooling
— terminals 19-30 open for heating

⚠ **WARNING:** Only specialised personnel may access the electric control board.

Changing the operatining mode is unavailable on cooling only units or motor-driven evaporating units.

6.4 DISPLAY AND SETTING OF OPERATING PARAMETERS

Once on the main page, press the UP or DOWN key to display the quick menu. In the quick menu there are 4 items identified by a symbol:
— Switch-on unit
— General information about the software
— Set-point and basic temperature control
— Access to advanced menu

All items in this menu are freely accessible. If you select access to the advanced menu, you must enter your password. Depending on the password entered, you can access various types of parameters. The main menu is divided into 4 blocks, each identified by a symbol:
— Unit status information (free)
— User menu (password 000100)
— Maintenance technician menu (000118)
— Manufacturer's menu (password private)

6.4.1 Menu information

In this menu you can find all the information regarding the operation of the unit, such as:
— Status of all inputs and outputs
— Status of all the unit's devices (e.g. compressors, valve, etc.)
— LAN Status
— …

6.4.2 User Menu

In this menu you can find the parameters useful to the user in order to use the unit according to the requirements of the system. The following are the parameter categories available:
— Temperature control
— Remote control settings
— Settings for communication with BMS
— …

6.4.3 Maintenance Menu

In this menu you can find the parameters useful to the maintenance technician for properly managing and maintaining the unit. The following are the parameter categories available:
— Alarm history
— Non-serious alarm settings
— I/O forcing
— Operating hours counter
— LAN settings
— …

6.4.4 Manufacturer's menu

In this menu you can find the parameters useful to the manufacturer for properly configuring the unit. The parameters contained within it concern the construction and functional version of the unit. In addition to this, the rules for serious alarms and operation of all the unit's devices are set here. These parameters must not be modified for any reason by the end user or the maintenance technician unless explicitly instructed to do so by the manufacturer.

6.5 OTHER FUNCTIONS

6.5.1 Refrigerant leak alarm

The refrigerant leak alarm (activated by a double level gas leak sensor) has two thresholds. The first threshold (called "gas warning") produces a NON-LOCKING alarm that by default has an activation delay of 15 seconds (automatic reset) and causes the "PRG" key to light up with a yellow LED, as is the case for all warnings. The second threshold (called "gas leak") produces a LOCKING alarm that by default has an activation delay of 0 seconds (manual reset) with the following effects:
— Key «alarm» switched on with red LED, as all alarms
— Total unit swithing off
The alarm can only be reset if the sensor no longer detects the presence of refrigerant in the air above the alarm threshold.

6.5.2 Restart - Fast restart

When the power supply to the unit is interrupted, the card can store the status it is in (on/off - sum/win - set-point), and when power is restored, it starts again in the same mode. When re-starting, the compressor activation time is taken into account.
Fast restart is a function suitable for data centre or process installations. It is not recommended to enable it in other cases, which is why it cannot be enabled by default. With fast restart, when power is restored, the compressors are not subject to the delay times.

6.5.3 Clock logic board

The pCOOEM+ board has an integrated clock card by default, so that time slots can be managed locally for the unit or for individual devices. The software can also handle daylight saving time.

6.5.4 Partition of compressors power

During card programming the percentage of cooling capacity generated by each individual compressor is configured in the software. In this manner the differential is distributed in proportion to the power generated.
EXAMPLE: Unit with 2 compressors, one of which has three times the power of the other
Cmp1 = 75%
Cmp2 = 25%
Differential 2°C
Cmp2 is switched on at half a degree from the set point, while cmp1 is switched on at 2°C from the set point. The same thing happens when approaching the set point.

☞ **NB:** the compressors can be disabled by parameter. When this operation is carried out, however, it is necessary to distribute the power among the missing compressors so that the total is 100%.

6.5.5 Dynamic limit maximum ventilation

It is possible to activate a double maximum ventilation percentage threshold via a parameter (obviously with different settings for summer and winter, in relation to evaporation and condensation).
This second threshold can be activated on the basis of:
— Time schedules (es. Night noise reduction)
— Digital input
External air temperature (es. if necessary overboost activation)

6.5.6 Power analyzer

A power analyser can be installed to monitor all the electrical values of the unit, such as currents, voltages, frequencies, power, cos phi, etc., from the PGD display of the pCOOEM+.
The data collected can also be consulted via supervisor.

6.5.7 Smart logic

Smart logics are custom functions to activate by software
The analogue/digital inputs of the pCOOEM+ can be used as inputs.
Available logic functions are: AND, OR, IMPULSE, TIMER, HYSTERESIS, ...
The output signal (depending on whether it is analogue or digital) can be sent to an output of the pCOOEM+.

6.5.8 Tanks probes management

The software offers the possibility of installing a tank sensor for each device. Once the tank sensor is installed, the main regulation is switched from the return temperature to the tank temperature. The sensor is optional.

6.5.9 Antifreeze (heating element) protection management

Antifreeze protection is provided by two devices: the pump and antifreeze heating elements.
These two devices are regulated on the basis of two parameters: outdoor air temperature and outlet water temperature. In addition to this, the time variable is involved in the regulation.
When the unit is switched ON, the heating elements are NEVER ACTIVATED because protection is provided by the pump, which is always on and therefore keeps the water moving by discharging a small amount of heating capacity into the system.
If the unit enters an alarm state, it is considered to be OFF DUE TO ALARM; therefore, the heating elements switch on, if required.
When the unit is switched OFF, on the other hand, an outdoor air temperature SET POINT must be set (with hysteresis) below which the process is active.
When the procedure is active the following items are activated:
— Pump: based on a chosen timing (e.g. 2 minutes every 10). In the case of an inverter pump, it is also possible to select the speed at which the pump will run when it is switched on.
— Antifreeze heating elements: based on a thermostat setting (set point with hysteresis) on the outlet water sensor side.

6.5.10 Defrost

Defrosting cycle happens according to the logic:
1. Activation of the cycle when the evaporation pressure is below a certain threshold for a certain amount of time
2. PRE-DEFROST PHASE with compressors stopped, fans stopped, and switching of the 4-way valve at half of the time
3. DEFROST PHASE starting up the unit in chiller mode with fans off until the cycle exit pressure threshold (or the maximum cycle time) is reached
4. POST-DEFROST PHASE with compressors stopped and ventilation switched on in order to eliminate water droplets from the coils. Switching of the 4-way valve at half of the time

☞ **WARNING:** The following section concerning separate defrosting between the various cooling circuits is to be considered valid and can only be implemented on units with separate series of fans (V-shaped coil geometry or fan compartment separator).

In doublecircuits units can be setted the following parameters:
DEFROSTING LOGIC:
Total. when one of the two circuits requires defrost, the cycle is carried out by both
Separated: the cycle works indipendently from each cycle
DEFROSTING MODE:
Simultaneus: the defrost cycles of circuit can be overlapped.
Sequential: the defrost cycles of circuits even if called in the same moment, can be overlapped and one of them is «slipped» after the other.
These parameters must NOT be modified by the CAT/CUSTOMER without first consulting the parent company.

6.5.11 LAN

Local Area Network (LAN) refers to a set of functions that integrate and optimise the operation of two or more connected chillers. This is achieved through the electrical connection of the pCOOEM+ control boards.
The port used for the LAN (PLAN) is standard on the pCOOEM+ boards, so this feature is provided at no additional cost other

than that of the electrical connection at the site (twisted and shielded data cable is recommended).
In any LAN network there will be just a unit master which:

— Receives operating data from other slave units
— Processes the received data and on the basis of the chosen control logic decides how many and which machines/compressors to start
— Sends commans to slave units
— In all LAN network is possible to configurate the master display like, with a simple pushing bottons, display for all slave.

Below a summary of various available logics:
For more information about LAN menagement see the dedicated NCS manual.

Logic	Number of unit to start	System probe	Step type	Compressors regulation	Compatibility with multifunction	Arrangement
Time rotation	Fixed according to the operating mode	No	Machine	Stand alone	Yes	Working hours
Macro step	Variable based on temperature setpoint and load	Tank (2 multifunctions)	Machine	Stand alone		Work hours and priorities
Load stand alone	Variable according to load	No	Machine	Stand alone		Work hours and priorities
Load global	Variable based on temperature setpoint and load	1 on machine return line 1 on system delivery line	Machine	Stand alone	No	Work hours and priorities
Cascade	Variable based on system PID	Selecting between: System return or delivery, or Master input or output, or Average of machine inputs or outputs	Compressor	Centralised from master		Working hours and priority level/load level of the machine
Step control	Variable based on system PID	Selecting between: System return or delivery, or Master input or output, or Average of machine inputs or outputs	Compressor	Centralised from master		Working hours and priority level/load level of the machine
Cascade & step	Variable based on system PID	Selecting between: System return or delivery, or Master input or output, or Average of machine inputs or outputs	Compressor	Centralised from master		Working hours and priority level/load level of the machine

6.5.12 SG Ready certification

All units in the range can be configured for smart grid integration/interface. Two 24V AC digital inputs are used to manage 4 different operating logics in accordance with the SG Ready (Smart Heat Pumps) regulation issued by the Federal Heat Pump Association (BWP).
The activation/deactivation of the two digital inputs, hereafter referred to as SG1 and SG2, (also indicated on the unit's wiring diagram and in the MIUM supplied as standard) results in the following 4 different modes of unit behaviour:

Mod.	SG1	SG2	Name	Description
F1	1	0	LOCK	When the unit receives this combination of digital inputs (1,0) (whose external signal remains active for at least 10 minutes according to the SG Ready guidelines), the unit is forced into a forced OFF state. This state must not last longer than 2 hours. The forced BLOCK state remains active for at least 10 minutes after it is activated. Activation of this mode must not exceed 3 activations per day.
F2	0	0	FREE	In this mode (0,0) the unit is free and no restrictions apply.
F3	0	1	RECOMMENDED INCREASE	Upon activation of the combination (0,1) (whose signal remains active for at least 10 minutes according to the SG ready guidelines), several actions can be performed depending on the initial state of the unit: • If the unit is in the OFF state, it will remain in the OFF state. • When the unit is in standby, it is switched ON and the set-point value is increased in order to produce hotter water according to the operating mode, i.e. to increase the load and thus the power input from the mains. • When the unit is already ON, it will remain ON and the set-point value will be increased in order to produce hotter water according to the operating mode, i.e. to increase the load and thus the power input from the mains. The RECOMMENDED INCREASE state remains active for at least 10 minutes after it is activated. The user is free to return the unit to the OFF state. Therefore, this mode is not mandatory.
F4	1	1	POWER ON MANDATORY	Upon activation of the combination (1,1) (whose signal remains active for at least 10 minutes according to the SG ready guidelines), several actions can be performed depending on the initial state of the unit: • When the unit is in the OFF state, it is placed in forced ON and the set-point value is increased in order to produce hotter water according to the operating mode, i.e. to increase the load and thus the power input from the mains. • When the unit is in standby, it is switched ON and the set-point value is increased in order to produce hotter water according to the operating mode, i.e. to increase the load and thus the power input from the mains. • When the unit is already ON, it will remain ON and the set-point value will be increased in order to produce hotter water according to the operating mode, i.e. to increase the load and thus the power input from the mains. In this mode it is also possible to control supplementary heating elements (where present) to further increase the power demand. These heating elements will remain active until the set-point increased by the current function is reached. In the case of dual-utility units of the reversible type (heat pumps with DHW 3-way valve or 2-pipe multi-purpose units), it is possible to configure where the function is to be performed, choosing between utility only (UT1), DHW recovery (UT2) or both (UT1 and UT2), depending on the variant configured. UT1 if VARIANT „N" is configured UT2 if VARIANT „1" is configured The MANDATORY POWER ON state remains active for at least 10 minutes after it is activated. In this case, the user is not free to return the unit to standby or to reduce the load. This mode is mandatory and can only be avoided if the unit is in a maintenance or emergency condition or is simply disconnected from the mains.

7 PLUMBING AND ELECTRICAL CONNECTIONS

7.1 PLUMBING CONNECTION

PLN C / H units are equipped with a flow switch or water differential pressure switch, safety valve (supplied as standard), water pressure gauge, manual air vent valve, sludge remover (configurable) and deaerator (mandatory and configurable). See table below:

» Water circuit design constraints

	Installation mandatory	Installation recommended	Configurable component (*)	Component always supplied as standard (*)
Safety valve	Yes	No	No	Yes
Deaerator	Yes	No	Yes	No
Dirt separator for the water system (supplide loose)	No	Yes	Yes	No
Y-shaped filter	Yes	No	No	Yes
3-way valve	No	-	Yes	No

(*) Installation is the responsibility of the customer

Depending on the configuration they can then be equipped with a pumping unit (single or double pump managed in OR logic, standard or with inverter), buffer tank, expansion tank. A gate valve is also available as standard for cutting off pump suction, so that the pump can be replaced without needing to empty the unit's entire tank.
A heat meter is available on the configurator to monitor the power output and COP (in combination with the mains power analyser, available as an option).

⚠ **WARNING:** The water safety valve, air vent valves and the deaerator (in general all the components that connect the water circuit to the outside), must have the same installation characteristics as the unit (see section 3 p. 16).

7.1.1 General guidelines for plumbing connections

When you are getting ready to set up the water circuit for the evaporator you should follow the directions below and in any case make sure you comply with national or local regulations (use the diagrams included in this manual as your reference).

1. Connect the pipes to the chiller using flexible couplings to prevent the transmission of vibrations and to compensate for thermal expansions. These units are all configured for installation of the water inlet-outlet pipes outside the unit (on the rear) and these pipes are supplied as standard accessories at no extra cost for the customer.
2. It is recommended to install the following components on the water pipes, subject to the constraints indicated in Table 7.1 p. 27:

— Temperature and pressure indicators for routine maintenance and monitoring of the unit. Pressure control on the water side allows to assess the correct functioning of the expansion tank and to detect water leakage in advance.
— Sumps on the inlet and outlet pipes for temperature measurements through direct viewing of the operating temperatures. They can, however, be checked by means of the onboard microprocessor.
— Regulating valves (gate valves) for isolating the unit from the water circuit.
— Mandatory metal mesh filter (inlet pipes), supplied as standard, with a mesh size not to exceed 1 mm, to protect the heat exchanger from scale or impurities present in the pipes. If the unit is combined with process cycles, it is recommended to install a decoupling exchanger, accessible for inspection, to avoid possible blockage of operation and/or breakage of the plate evaporator.
— Air vent valve placed on the higher parts of the hydraulic circuit to bleed the air. The internal pipes of the unit are fitted with small air vent valves for bleeding the unit itself: this operation should be conducted when the unit is disconnected from the power supply - make sure that the circuit is completely full of water and check again to make sure there is no air before starting the pump for the first time.
— Water safety valve: supplied as standard, to be installed near the unit outlet pipe (if the deaerator is configured, the valve is already installed on the deaerator).
— Compulsory water deaerator (high efficiency) (is recommend the one available on the configurator): to be installed near the unit outlet pipe, protected from the weather and/or sources of obstruction.
— Water sludge remover: if configured to be installed near the unit inlet pipe.

⚠ **WARNING** Failure to use anti-freezing solutions may cause seriousdamage to the hydraulic/cooling circuit in general.

Requirements for the heat transfer fluid and maintenance of the system

In order to avoid problems of reliability and/or operation of the hydronic system, it is necessary to take into consideration the characteristics of the heat transfer fluid (water or mixtures of water and glycol) and the hydraulic circuit.
The use of an unsuitable fluid can cause sludge deposits, algae growth, scale build-up, or corrosion and in some cases even erosion.

⚠ **IMPORTANT:** Never cut off the pumping unit while the unit is turned on. This could cause irreparable damage to the pump and the unit.

The Manufacturer does not accept any responsibility for damage caused by the use of untreated water, water containing particles or debris in suspension, water that has been incorrectly treated or admixed, or salt water.
By way of example, some (non-exhaustive) advice is given below (contact a specialist and consult specific standards such as UNI 8065)

— Ammonium ions (NH4+) dissolved in water should be eliminated due to their high reactivity with copper.
— Chlorine ions (Cl-) pose a risk of holes developing due to corrosion.

— Sulfate ions (SO4--) must be eliminated because they may present a risk of corrosion.
— Limit for fluoride ions: 0.1 mg/l.
— Silicon may pose a risk of corrosion. Limit: < 1 mg/l.
— Electrical conductivity: the higher the specific resistivity, the lower the tendency of corrosion. Therefore, the following limit must be observed: Electrical conductivity: < 3,500 µS/cm
— pH: neutral pH at 20 °C (7 < pH < 8)
— Fixed residue (at 180 °C): < 2 000 mg/kg
— Conditioners Present within the concentrations prescribed by the supplier

The water must be analysed: it is advisable to contact a qualified water treatment specialist to determine the most suitable type of treatment according to the materials used in the hydraulic system.
The installed water circuit must include all the necessary devices for water treatment: mesh filter (immediately at the inlet to the unit), additive dosing systems if necessary, any intermediate heat exchangers, air vent valves at all points of possible air accumulation, air intakes, isolation valves, etc., and anything else necessary according to best practice as well as the safety devices indicated above.

⚠ **CAUTION:** in case of regular shut-down, if it is necessary to empty the hydraulic circuit, the system must be flushed internally with nitrogen, making sure to leave it pressurized (at a pressure approximately equal to half the maximum pressure of the hydraulic circuit) in order to avoid the entry of oxygen and to protect the parts of the system from the risk of corrosion.

⚠ **WARNING:** The water safety valve, air vent valves and the deaerator (in general all the components that connect the water circuit to the outside), must have the same installation characteristics as the unit (see section 3 p. 16).

7.1.2 Recommended water circuit

⚠ **WARNING** when making the plumbing connections, make sure there are no open flames in proximity to or inside the unit.

In addition to the constraints indicated in Table 7.1 p. 27, the water circuit should have:
— valves for regulating (VI) the unit on the water pipes, immediately upstream and downstream from the unit itself, to be used in the event maintenance work is required;
— a mechanical filter (FM) on the inlet pipe to the unit, near the unit itself;
— a mechanical filter (FM) and a check valve (VNR), on the supply line before the filling tap inside the unit;
— deaerator protected at the top and located close to the unit on the delivery line, preferably at the highest point of the system, ensuring the same positioning standards as the unit itself;
— water safety valve to be installed near the unit outlet pipe (if not already included in the deaerator) which guarantees the same positioning standards as the unit itself;
— escape pipe for the safety valve (**VS**), which, in the event the safety valve opens,diverts the jet of water to an area where it cannot harm persons or things, (**Important!**);
— vibration-damping couplings (**GA**) on the pipes to prevent vibrations from being transmitted toward the system.

Important! It is advisable to ensure that the pipes connected upstream and downstream from the unit are not smaller in diameter than the unit's hydraulic connections. Ensure that the pipe connected to the safety valve and to the deaerator does not lead into manholes or storm drains and that there are no accumulation points or components that could be a source of ignition within the safety zone (see section 3 p. 16).
Important! During wintertime the water circuit (or the water chiller only) must be emptied to prevent damage caused by freezing; alternatively, the circuit may be filled with a mixture of water and glycol; the percentage of glycol necessary will depend on the lowest forecast temperature (see table):

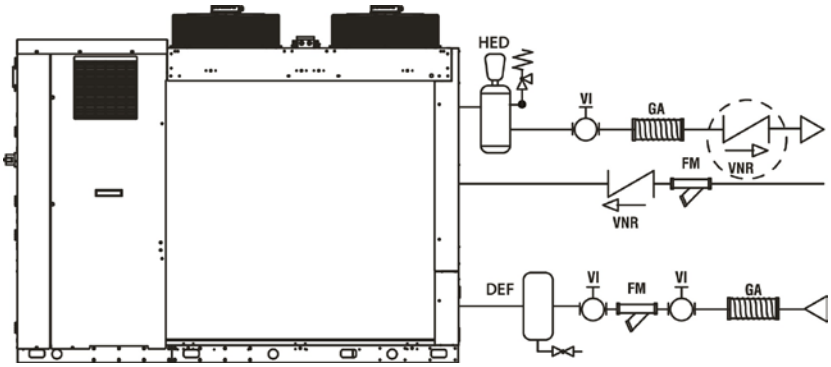
Percentage by weight of ethylene glycol (%)	Mixture freezing temperature (°C)
0	0
10	-3
20	-8
30	-15
40	-25

☞ **NOTE:** The percentage shown in the upper table are indicative. Always refer to your glycol supplier for the right freezing temperatures.

☞ **NOTE:** For choice of gycol percentage to use, in case of low temperature water produced, is recommended keeping a edge of 5K on outlet water temperature in order to consider any temperature fluctuations inside theheat exchanger. Example: water temperature produced: -10°C, minimum water temperature during the fluctuations: -10-5=-15°C, recommended ethylene glycol percentage: >30%.

Important! If different antifreeze product is to be used, please contact the manufacturer.
Failure to install filters and vibration dampers may cause problems of clogging, breakages and noise, for which the manufacturer may not be held liable.

» Recommended water circuit



LEGEND

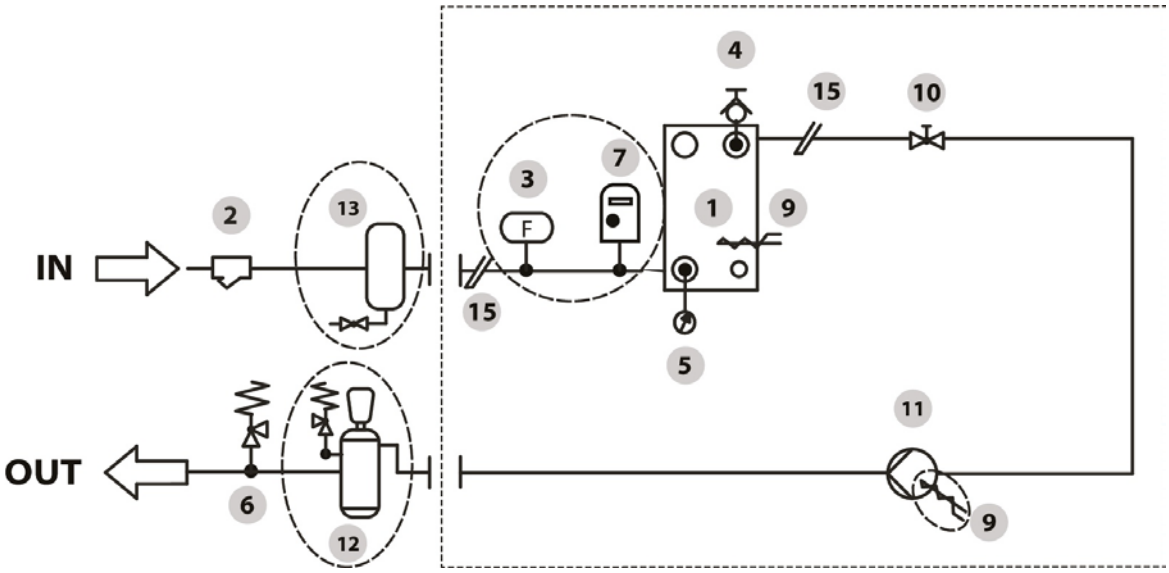
VI	Shut-off valve (not supplied)
GA	Vibration-damping coupling (not supplied)
FM	Mechanical filter (MANDATORY)
VNR	Check valve (not supplied)
HED	High efficiency deaerator
DEF	Sludge remover
- - - -	Check valve (not supplied), mandatory for LAN unit

7.1.3 Filling the system

— Before you start filling, make sure that the system draining tap is closed.
— Open all the air vent valves of the system and of the indoor units and chiller.
— Open the system regulating devices.
— To fill the circuit open slowly the water tap of the system (optional).
— When water starts coming out of the air vent valves of the indoor units, close them and continue filling until the pressure gauge reading is 1.5 bars.

7.1.4 Water circuit

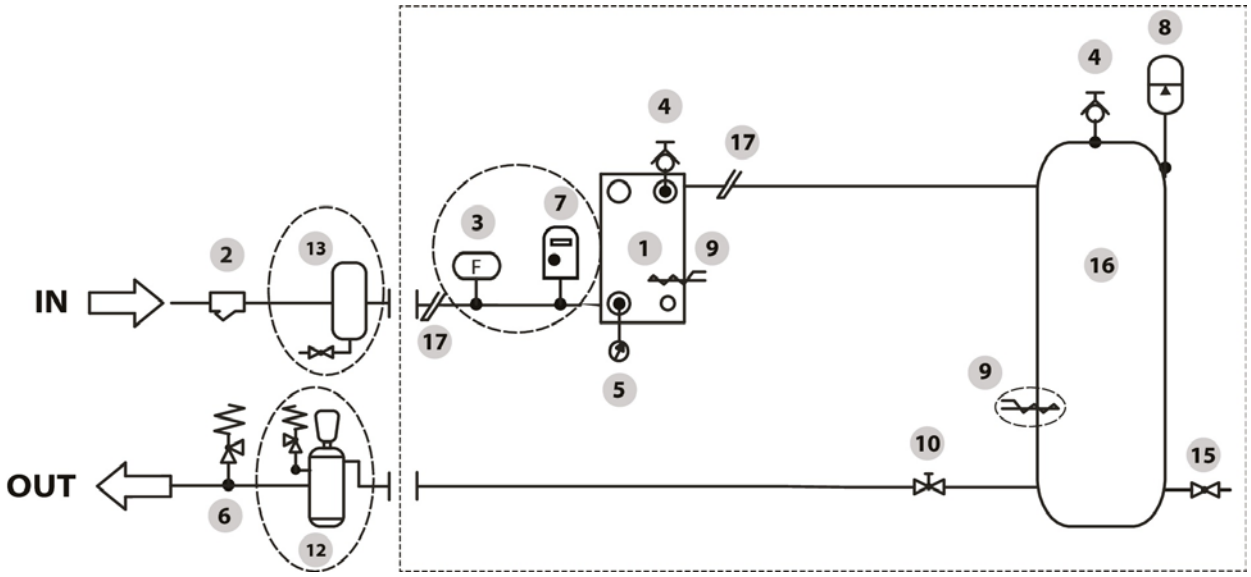
» PLN (evaporator and pump)



LEGEND

1	Evaporator
2	Water filter (included)
3	Flow switch
4	Air purge valve
5	Pressure gauge
6	Safety valve (supplied)
7	Heating capacity meter
8	-
9	Antifreeze electric heating
10	Cut-off valve
11	Hydraulic pump
12	Deaerator
13	Dirt separator for the water system (supplide loose)
14	-
15	Probe holder
	------ Internal and external borderline
	_ _ _ _ Optional

» PLN (evaporator and tank)

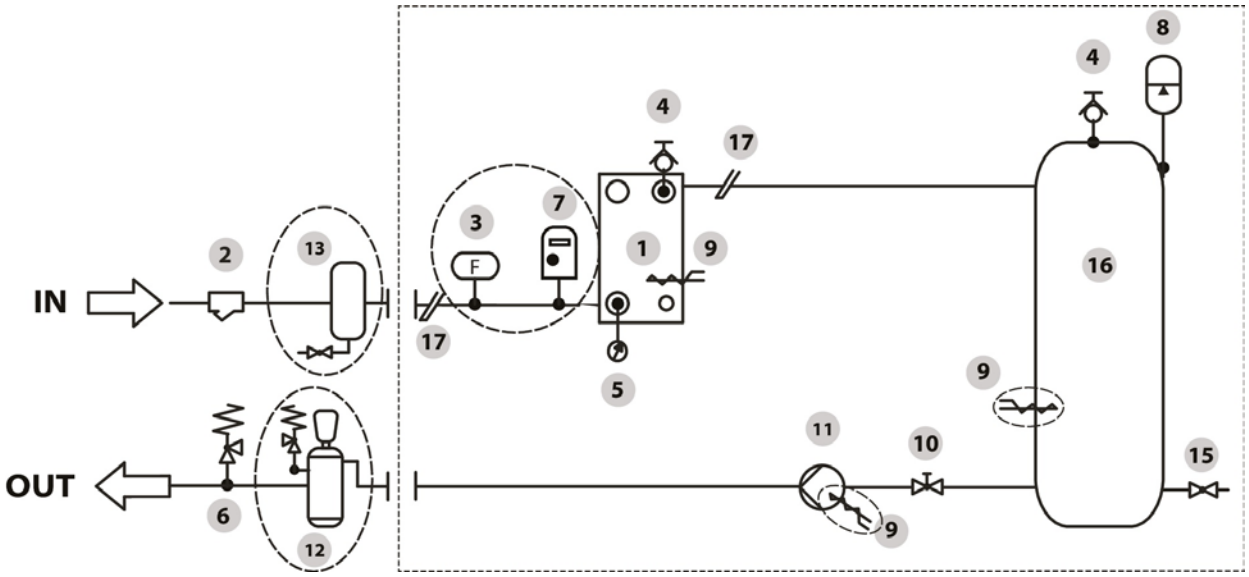


LEGEND

1 Evaporator
2 Water filter (included)
3 Flow switch
4 Air purge valve
5 Pressure gauge
6 Safety valve (supplied)
7 Heating capacity meter
8 Expansion tank
9 Antifreeze electric heating
10 Cut-off valve
11 -
12 Deaerator
13 Dirt separator for the water system (supplide loose)
14 -
15 Tank drain valve
16 Tank
17 Probe holder

------ Internal and external borderline
_ _ _ _ Optional

» PLN (evaporator, tank and pump)

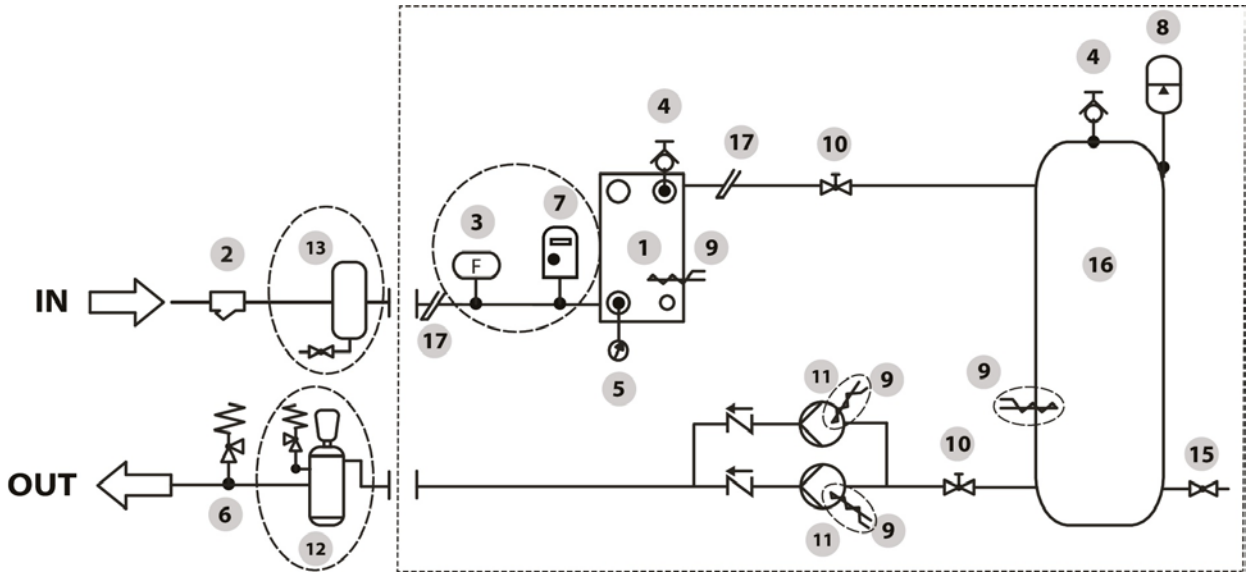


LEGEND

1 Evaporator
2 Water filter (included)
3 Flow switch
4 Air purge valve
5 Pressure gauge
6 Safety valve (supplied)
7 Heating capacity meter
8 Expansion tank
9 Antifreeze electric heating
10 Cut-off valve
11 Hydraulic pump
12 Deaerator
13 Dirt separator for the water system (supplide loose)
14 -
15 Drain
16 Tank
17 Probe holder

------ Internal and external borderline
_ _ _ _ Optional

» PLN (evaporator, tank and 2 pumps)



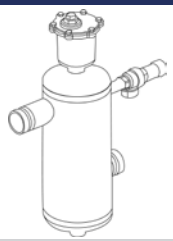
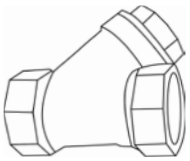
LEGEND

1 Evaporator
2 Water filter (included)
3 Flow switch
4 Air purge valve
5 Pressure gauge
6 Safety valve (supplied)
7 Heating capacity meter
8 Expansion tank
9 Antifreeze electric heating
10 Cut-off valve
11 Hydraulic pump
12 Deaerator
13 Dirt separator for the water system (supplide loose)
14 -
15 Drain
16 Tank
17 Probe holder

------ Internal and external borderline
_ _ _ _ Optional

7.1.5 Main water circuit devices

1. Deaerator with safety valve
2. Dirt separator for the water system (supplide loose)
3. 3-way valve
4. Y-shaped filter
5. Safety valve

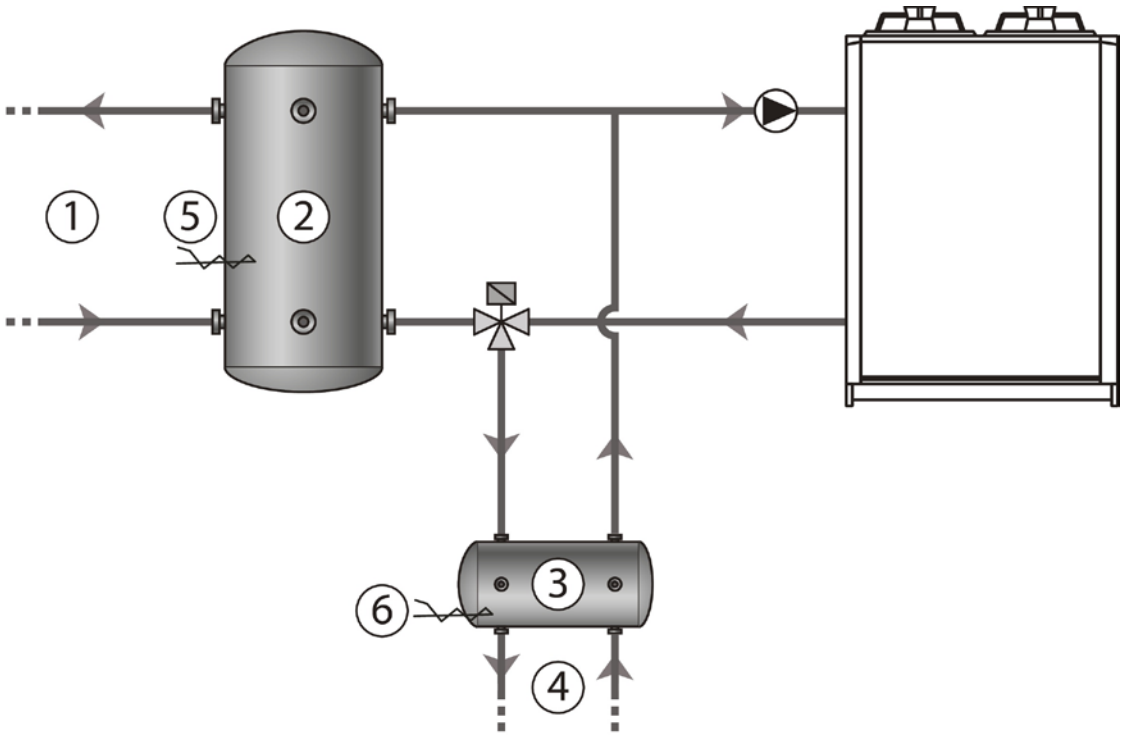
Deaerator with safety valve (*)	Insulated sludge remover	Uninsulated sludge remover	3-way valve	Y-shaped filter	Safety valve
					
The unit must be installed vertically and adequately protected from weather and cold temperatures by means of insulation and obstructions of various kinds. Use the connections provided. Refer to the hydraulic diagrams for positioning the device. (*both the deaerator and the safety valve are supplied separately as accessories)	The unit must be installed vertically and adequately protected from cold temperatures by means of insulation. Use the connections provided. Refer to the hydraulic diagrams for positioning the device. Regularly drain the accumulated sludge from the bottom of the sludge remover using the special connection at the bottom. (Use only if liquid temperature is positive)		Protect the actuator from the weather in accordance with the manufacturer's instructions.	Refer to the hydraulic diagrams for positioning the device.	Install on the delivery branch if you decide not to configure the deaerator, but to purchase it separately from a third party (not recommended).

☞ **NOTE:** Refer to the p. 29 hydraulic diagrams for positioning the device.

7.1.6 System diagram with DHW 3-way valve

If the DHW 3-way valve option is chosen, the positioning and number of supplementary heating elements must be decided.
The following diagram shows the correct and most complete installation in the case of a 3-way valve configuration on the water side. The presence of the 3-way valve also makes it possible to control the supplementary heating elements (if present) to compensate for low air temperatures that may prevent the set-point from being reached.
In the case of dual-utility units of the reversible type (heat pumps with DHW 3-way valve or 2-pipe multi-purpose units), it is possible to configure where the function is to be performed, choosing between utility only (UT1), DHW recovery (UT2) or both (UT1 and UT2), depending on the variant configured.

— UT1 if VARIANT "N" is configured
— UT2 if VARIANT "1" is configured



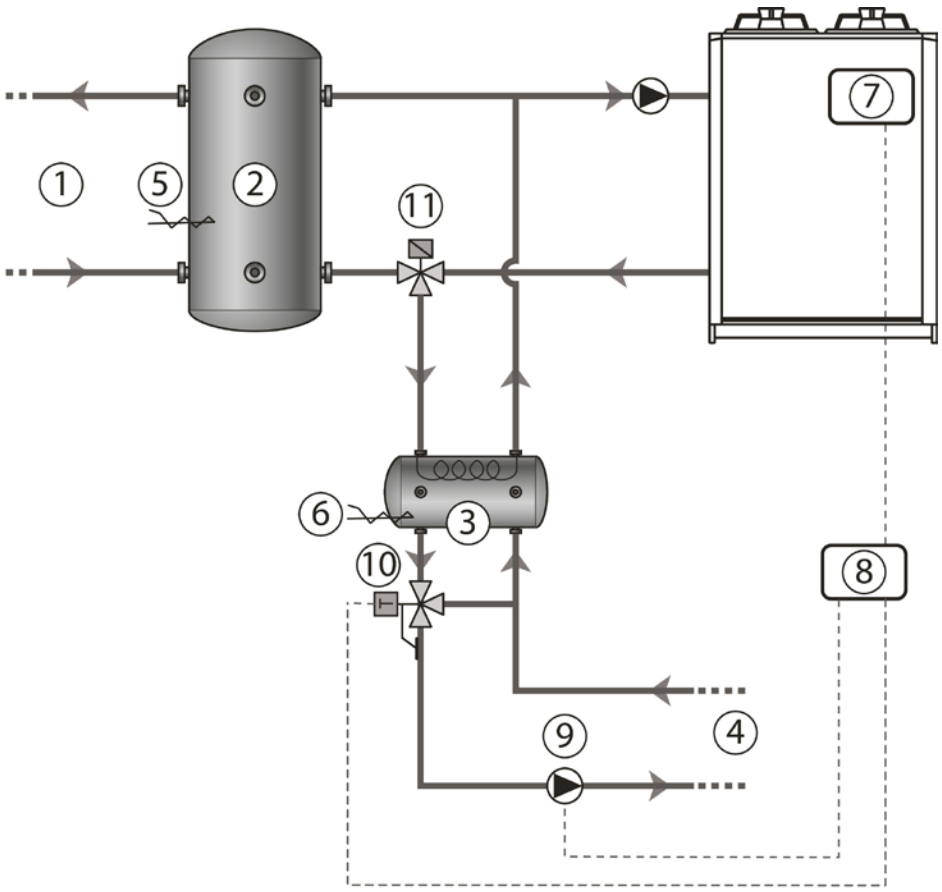
1 Main utility side (UT1)
2 Main utility buffer tank (UT1)
3 DHW buffer tank (UT2)
4 DHW side (UT2)
5 Main utility supplementary heating element (UT1)
6 DHW supplementary heating element (UT2)

The software can manage the enabling signal of a maximum of 2 supplementary heating elements.

7.1.7 Anti-legionella

On the PLN range, anti-legionella control can be used if option 1 field 15 is configured.

In order to use the anti-legionella cycle correctly, the following recommended procedure must be followed:



1 Main utility side (UT1)
2 Main utility buffer tank (UT1)
3 DHW buffer tank (UT2)
4 DHW side (UT2)
5 Main utility supplementary heating element (UT1)
6 DHW supplementary heating element (UT2)
7 Unit electrical control board
8 Utility electrical control board
9 DHW recirculation pump
10 DHW thermostatic mixing valve (hybrid mixer with digital controller recommended)
11 DHW 3-way valve

The cycle is activated by default every 24 hours (can be set minimum every 24 hours, maximum 72 hours). It is advisable to keep the frequency the same as the factory setting, i.e. 24 hours, by bringing the water into the tank at a temperature of 65°C for a period of 30 minutes.
The installer must also use the digital output available on the controller to manage the activation of the DHW recirculation pump and at the same time bypass the thermostatic mixing valve so that all the hot water from the tank can enter the system to eliminate any bacterial load that may be present.

⚠ **WARNING:** The system designer must bear in mind that following the above indications may result in the supply of water at a temperature that could cause minor burns and must therefore take steps to limit the risk.

— If the unit is disconnected, the anti-legionella cycle function is not available and there is a real risk of bacterial proliferation in the DHW tank.
— If the unit is switched OFF for more than 24 hours, it will start an anti-legionella cycle the next time it is switched on.
— When the unit is in standby mode because the setpoint has been reached, it activates the anti-legionella cycle normally and when required by the controller.

7.2 ELECTRICAL CONNECTIONS

All operations must be performed by qualified service personnel in accordance with current laws and regulations. For any electrical work on the unit, refer to the electric diagrams supplied with the unit. It is recommended to make sure that:

— The characteristics of the mains power supply are adequate for the electrical inputs specified in the table of electrical data.
— Check that the mains electricity supply is compatible with the specifications (voltage, number of phases, frequency) shown on the unit rating plate.
— The supply voltage must not vary by more than ±5% from the rated value. Electrical connections must be made in accordance with the wiring diagram provided with the unit and current regulations.

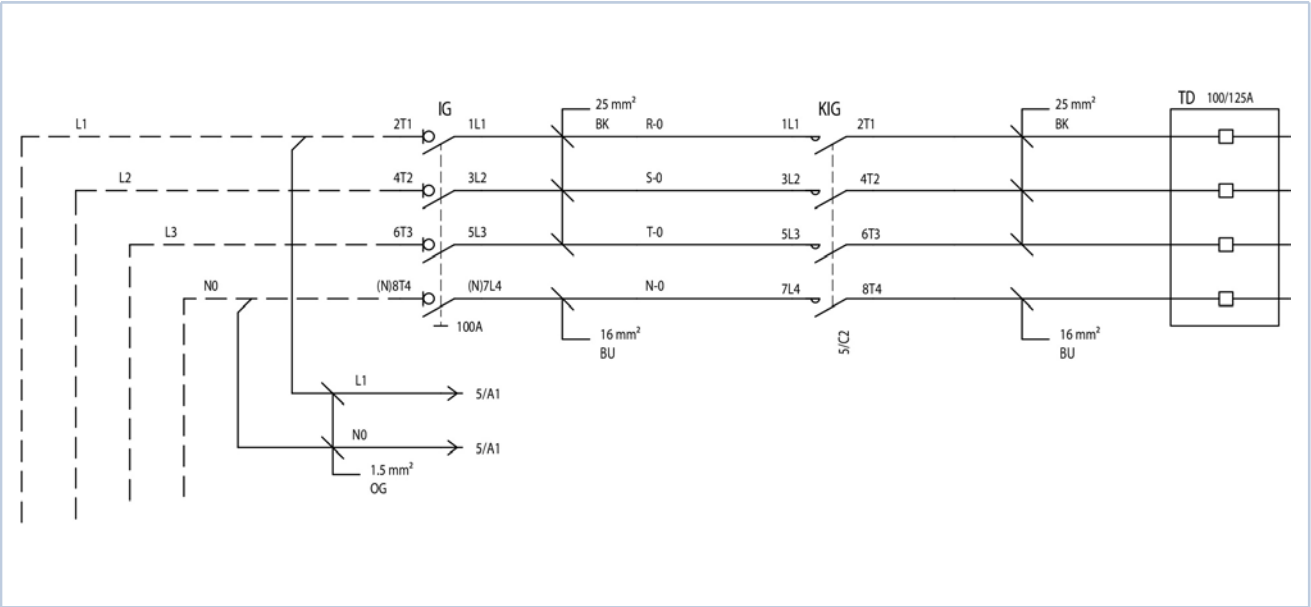
⚠ **IMPORTANT:** Before performing any work on electrical parts, make sure the power supply is disconnected. In particular, the electrical control board of the unit has a part of the circuit that is live even when the door is open and the main switch is off, protected by a Plexiglas barrier and identified by special adhesive labels with the warning "Warning: circuits are live even if the door is open". In the event of maintenance of the section concerned, it is the responsibility of the maintenance technician to disconnect the power supply line upstream of the customer's electrical control board and to affix special safety signs to prevent accidental energising, bearing in mind that when the line is disconnected, no safety devices are active.

⚠ **WARNING** Never attempt to modify internal electrical connections: any undue modifications will immediately invalidate the warranty.

In the customer's electrical control board, it is mandatory to use a thermomagnetic circuit breaker in accordance with standard EN/IEC60898-1 (contact gap of at least 3 mm), with adequate breaking capacity and differential protection in accordance with the tables in section 7.3 Electrical data.
For the unit power supply line use FG16(O)R16-type HEPR cables with the cross-section indicated in the tables in section 7.3 Electrical data. Use cable ducts and conduits suitable for outdoor installation to route the cables.
Tighten the wires firmly to the terminal board and secure the wires with cable glands.

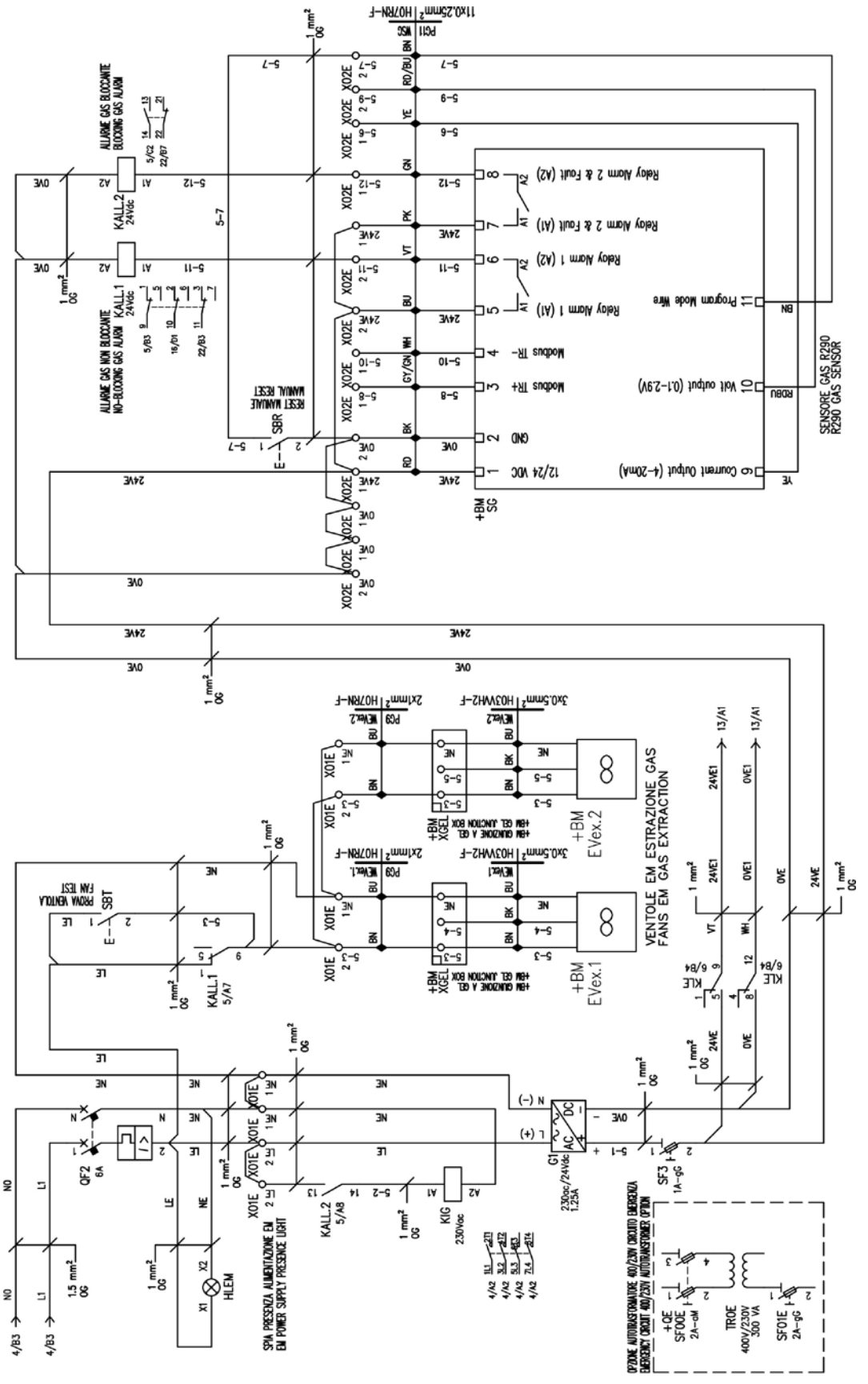
An earth connection is mandatory: connect the earthing wire to the terminal provided on the electric control board (see the electric control board layout supplied with the unit), marked ⏚.
If you wish to include:
— A remote on/off switch,
— A remote switch for changing over between the cooling and heating mode.
It is a good idea to do so at this stage of the installation procedure, by connecting the switches or PCDS remote control (accessory) to the electric control board terminals as directed in section 7.3 Electrical data and using the unit wiring diagram as your reference.
The PLN units are equipped with a control board with a special section protected by a Plexiglas barrier and identified by special adhesive labels with the warning "live even if the door is open", even if the main switch of the control board is in the OFF position and the door is open.

The wiring of the power supply to the unit's control board is the responsibility of the installer. The branch circuit upstream of the main switch ensures that the propane gas detector control unit and the ATEX extractor fan control unit are always supplied with power, so that they remain operational even when the unit's control board is switched off. In this manner it is always possible to check whether or not there is a gas leak.
The electrical control board of the PLN units is provided with a 3F+N or only 3F normal power supply to supply power to the electrical equipment for normal operation of the unit. Inside it, and in front of the main switch (which cuts off the power to all ordinary electrical equipment downstream when the electrical control board is switched off), there is a single-phase branch that cannot be disconnected (unless a circuit breaker is installed) to supply power to all the safety devices (extractor fan and leak detector sensor).



The electrical control board of the units is physically separated from the technical compartment containing the refrigerant circuit, except for the passage of cables, which is achieved by means of standard cable glands.
This precaution has been taken to avoid an open passage between the technical compartment containing the piping and the live electrical control board in the event of a refrigerant leak.

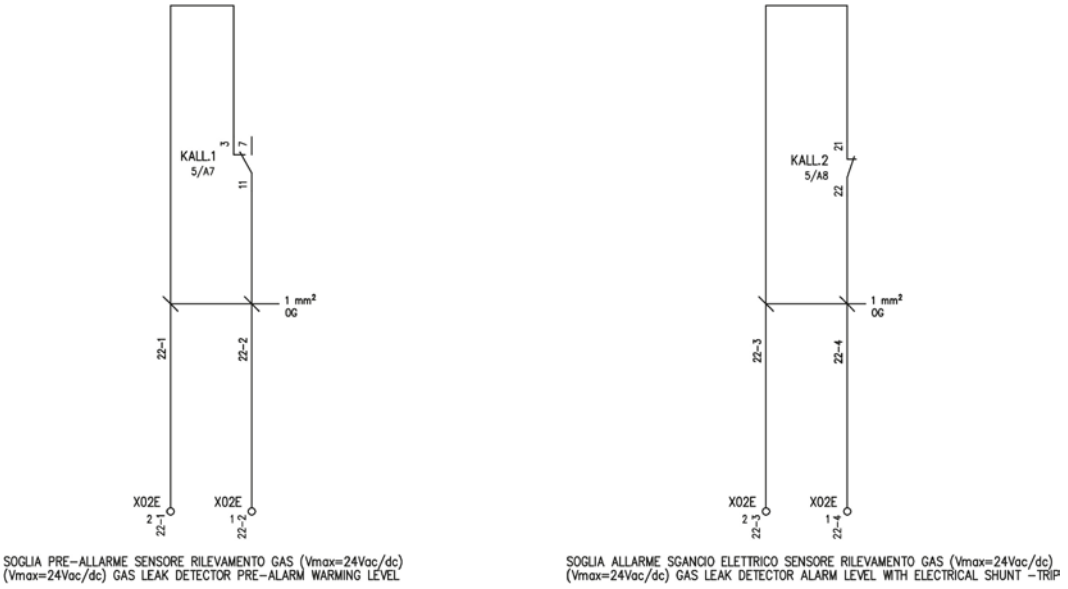
» Sensor wiring diagram



7.2.1 Electrical connection of alarm indicator lights

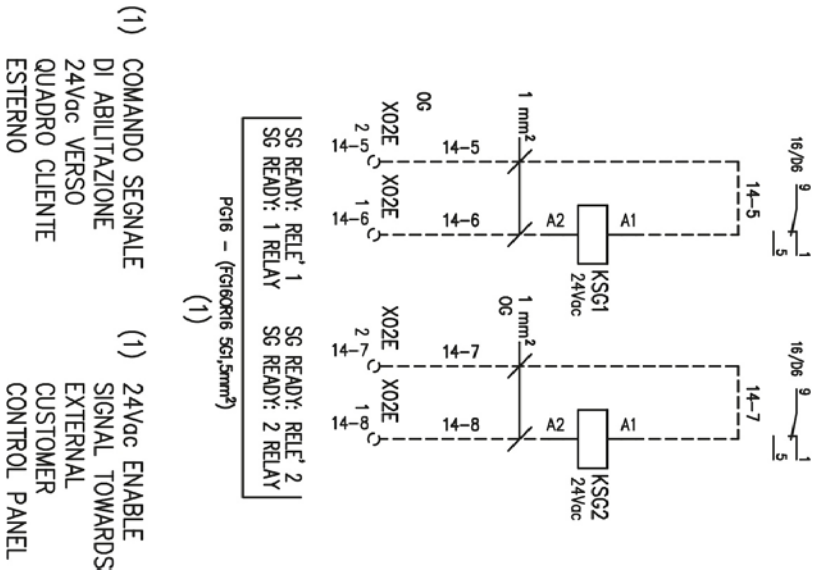
As mentioned in this manual, the two threshold gas alarms must be installed by the customer in a clearly visible location outside the safety zone (see section 3 p. 16) and used to monitor the alarm status of the unit from a safe remote position. To connect these indicator lights, the customer must use the voltage-free contacts inside the electrical control board as shown in the diagram below. The maximum allowable voltage is 24 V AC/DC.

» Gas sensor wiring diagram



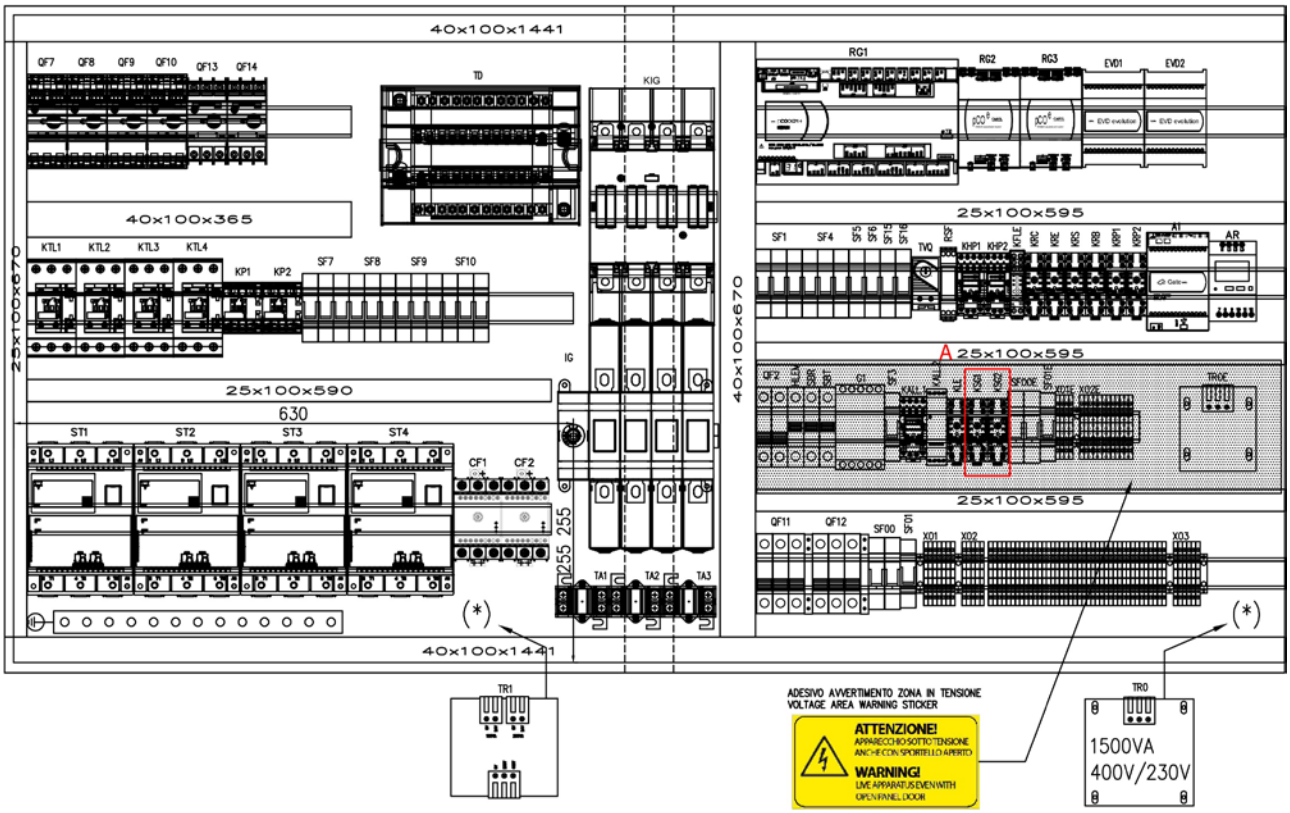
If the possibility of connection to the SMART GRID is configured, the relays available inside the electrical control board of the unit must be used to manage the operating logics associated with the SG Ready certification.

» SMART GRID connection diagram



The positioning of the various relays / voltage-free contacts to be used for the two connections mentioned above is shown below. The maximum allowable voltage is 24 V AC/DC.

» Electrical control board diagram



A Relays available for SG Ready SMART GRID connection

7.3 ELECTRICAL DATA

» Electrical data PLN C/H

PLN		052	072	082	104	114	134	154
Power supply	V-ph-Hz	400 / 3+N / 50						
Auxiliary power supply	V-ph-Hz	230-1-50						
Maximum current absorption	A	67,0	77,0	84,0	129	137	152	157
Start up current	A	187	240	247	249	264	315	320
Startup current with soft starter	A	143	181	188	205	217	256	261
Safety fuse F	A	80	100	100	160	160	160	160
Circuit breaker IL	A	80	100	100	160	160	160	160
Power supply cable type		5G16	5G25	5G25	3x(1x70)+N35+PE35	3x(1x70)+N35+PE35	3x(1x70)+N35+PE35	3x(1x70)+N35+PE35
Fuses type		aM						

- The maximum input power is the mains power that must be available in order for the unit to work.
- The maximum current absorption refers to the current that will trigger the internal safety devices of the unit. It is the maximum current allowed in the unit This value may never be exceeded; it must be used as a reference for determining the size of the power supply line and the related safety devices (refer to the wiring diagram supplied with the units).

8 OPERATING LIMITS

The graphs below illustrate the operating limits of PLN units (in the case of continuous operation) in relation to the outlet water temperature and outdoor air temperature. The following limits are to be considered valid for water temperature fluctuations of 5 K.

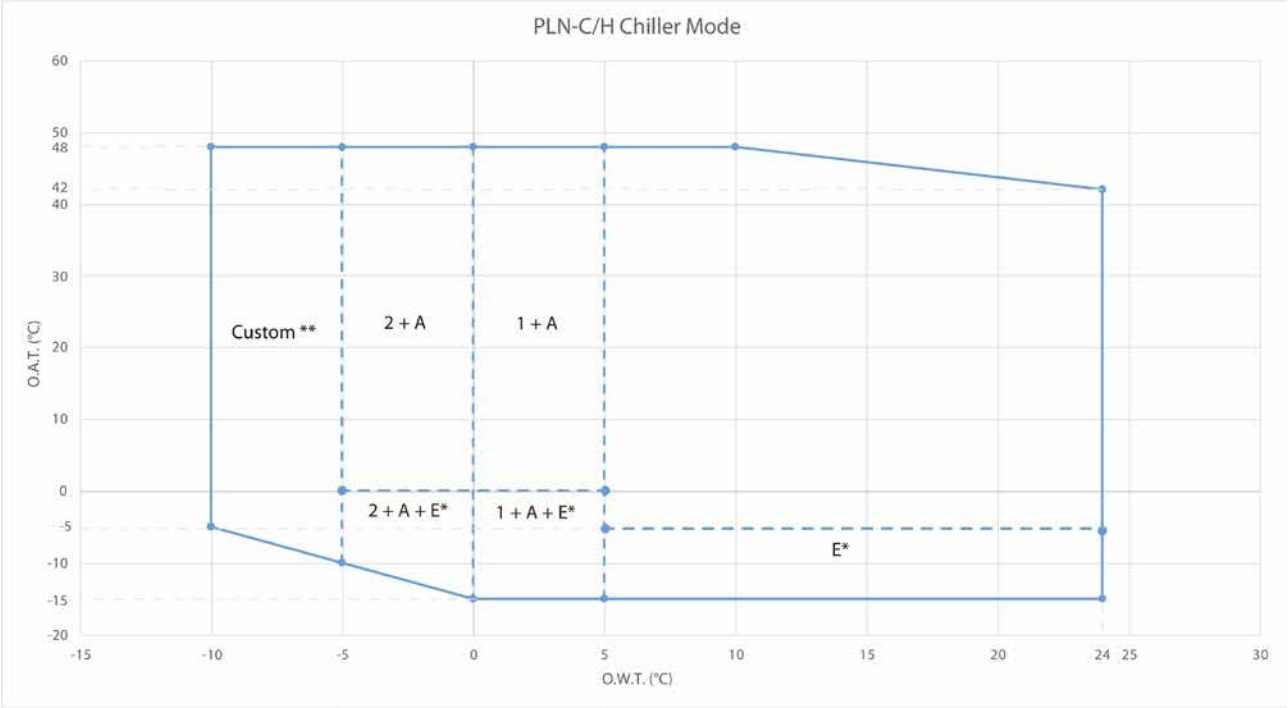
⚠ **WARNING:** contact the support area if you wish to operate with water temperature fluctuations other than 5 K at full load.

⚠ **WARNING:** except for special requests, which can be managed to order, the PLN series units set the number of compressors running according to the temperature of the water outlet the unit (temperature supply from the system) and not according to the inlet temperature. Therefore, the settable set point always refers to the temperature of the water outlet the unit.

⚠ **WARNING** The units are designed to work with water and air temperatures falling within the range defined by the operating limits. Attempting to operate the units beyond these limits could cause irreparable damage to the units themselves.

8.1 PLN C AND H OPERATING LIMITS IN COOLING MODE

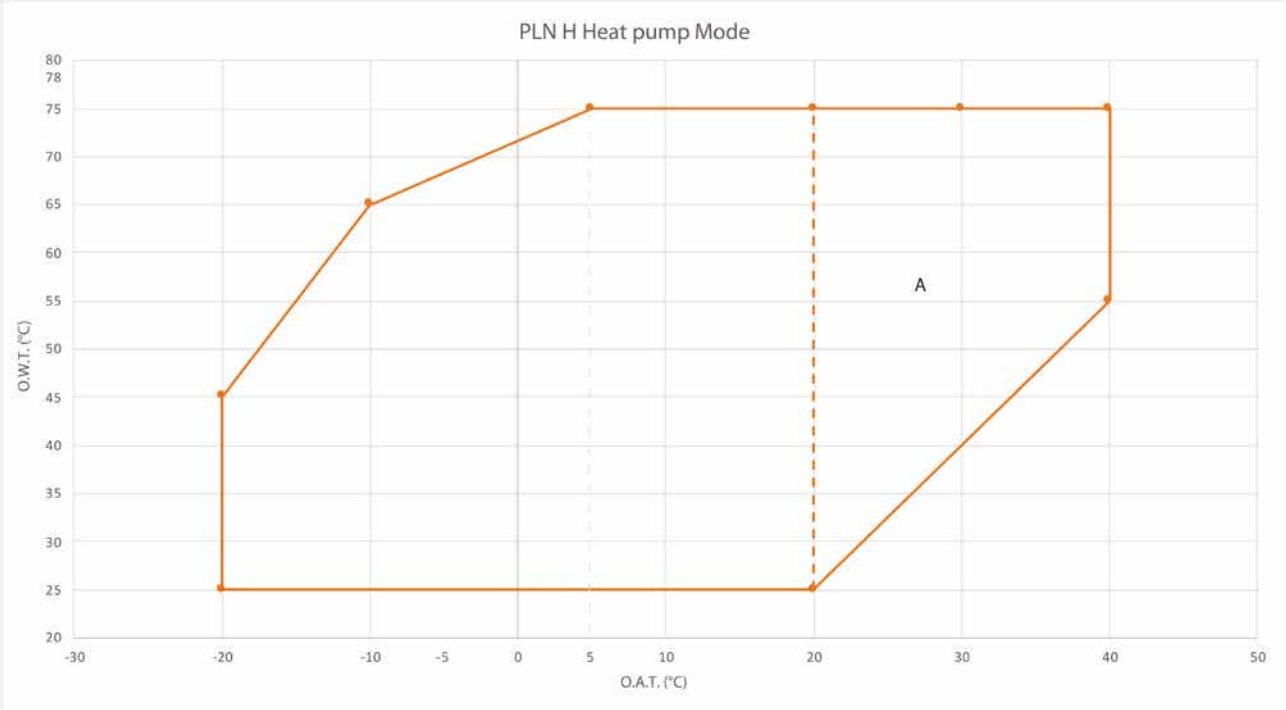
» 8.1 PLN C and H operating range - cooling mode



A Glycol
E Condenser control and EC fans
(*) standard up to size 114 included
contact the company for the development of the application
1 low temperature option
2 low temperature option
O.W.T. Outlet water temperature
O.A.T. Outdoor air temperature

8.2 PLN H OPERATING LIMITS IN HEATING MODE

» 8.2 PLN H operating range - heating mode



O.W.T. Outlet water temperature
O.A.T. Outdoor air temperature
A Evaporator control with EC fans

8.3 THERMAL CARRYING FLUID

Pumps belonging to the PLN C / Hseries can work with mixtures of water and up to 35% ethylene or propylene glycol.

⚠ **IMPORTANT:** observe the minimum water temperature indicated in the operating ranges.

⚠ **IMPORTANT:** Never go below the water flow rates indicated in the following table so as to prevent the unit from stopping due to a flow alarm.

» Minimum and maximum water flow admitted PLN C

PLN C		052	072	082	104	114	134	154
Water flow MAX	l/h	45000	45000	45000	55000	55000	60000	60000
Water flow MIN	l/h	5230	6750	8050	10730	12390	14010	16230

» Minimum and maximum water flow admitted PLN H

PLN H		052	072	082	104	114	134	154
Water flow MIN	l/h	4170	5330	6120	8640	9800	10920	12460
Water flow MAX	l/h	45000	45000	45000	55000	55000	60000	60000

☞ **WARNING:** The values indicated refer to the correct operation of the heat exchanger. Flow rates below the minimum threshold may result in a reduction of thermal exchange efficiency, potential freezing of the heat exchanger in the absence of adequate glycol concentration, and, in general, activation of the lockout alarm due to insufficient water flow. Flow rates above the maximum threshold may instead cause erosion phenomena on the plates. These values shall be considered as absolute operating limits and therefore apply only to units not equipped with onboard pumps. In the presence of onboard pumps, the limits must be redefined to take into account the minimum and maximum flow constraints of the pumping group. In such cases, please contact Galletti S.p.A. for a detailed verification of the operating point.

9 START-UP

The first start up must be carried out exclusively by qualified personnel and authorized by Galletti S.p.A. (see warranty sheet attached).
At first start-up of the installation make sure to comply with current national regulations.

9.1 PRELIMINARY CHECKS

When starting up the unit for the first time or after a seasonal period of quiescence, it is advisable to have the following checks performed by specialised personnel:

- Check that the electrical connections have been made properly and that all the terminals are securely tightened.
- Check that the external power supply is within +-5 % tolerance from the power supply reported on the unit identification label. If the power supply is subject to frequent voltage fluctuations, contact Galletti S.p.A. for advice on choosing suitable protections.
- Check for refrigerant leaks, with the aid of a leak detector if necessary
- Check that the plumbing connections have been properly made according to the indications given on the plates to be found on the unit itself (water inlet, water outlet etc.).
- Make sure that the pump is not blocked.
- Make sure that the water circuit is duly bled to completely eliminate the presence of air: load the circuit gradually and open the air vent valves, which the installer should have set in place.

In order to avoid soiling that could result in the breakage of the plate heat exchangers and hydronic pumps, it is necessary to wash the hydraulic system properly, before allowing water to circulate inside the unit. More specifically:

1. The hydraulic system must be flushed out, with a flow of water (which is then to be disposed of) and without passing through the filter at the inlet of the unit, in order to eliminate large-diameter impurities, debris, and any dirt present as residue from the work carried out (e.g. welding). Continue flushing until the water (to be disposed of) becomes clear.
2. The system can then be connected to the chiller, on which the inlet water filter must be installed. In this phase it is necessary to let the water circulate inside the unit (through the filter) without starting the compressors in any case. Perform this operation for a sufficient time to allow the water to circulate in the system a few times.
3. At the end of the previous phase, clean the inlet filter, refit the cartridge in place, and circulate the water by starting the unit. In case of a flow alarm, check whether there is air in the circuit.

The fluid in the hydraulic circuit must not contain:

- dirt or solids in suspension;
- acids or bases or corrosive liquids in general;
- sea water;
- liquids that are flammable and generally dangerous.

⚠ **CAUTION:** during the start-up phase, maximum attention must be paid to the filling pressure of the system and in particular to the pressure of the intake water to the pump (under operating flow rate conditions) in order to AVOID CAVITATION phenomena that could seriously compromise the reliability of the pump. The intake pressure value must be higher than the minimum value indicated in the paragraph 7.1.3 p. 29. The cavitation phenomenon can also be identified by the anomalous noise produced by the pump when it is running; this noise disappears if the pressure returns to its proper value.

⚠ **WARNING** before starting the unit, make sure all the covering panels are in place and secured with the fastening screws provided. To start the unit, move the main switch to on. Use the keypad of the electronic control as directed in section p. 40 to select the cooling or heating mode.

⚠ **ATTENZIONE** You should not disconnect the unit from the power supply during periods when it is inoperative but only when it is to be taken out of service for a prolonged period (e.g. at the end of the season). To turn off the unit temporarily follow the directions provided in the section p. 40.

⚠ **WARNING** do not cut off power using the main switch: the latter device serves to disconnect the unit from the power supply when there is no passage of current, i.e. when the unit is already turned OFF.

⚠ **WARNING:** BE SURE TO REMOVE ANY PLASTIC CAPS PROTECTING THE GAS LEAK SENSORS BEFORE COMMISSIONING THE UNIT.

10 CONTROL AND SAFETY DEVICES

All the control and safety devices are set and tested in the factory before the unit is dispatched.

10.1 CONTROL DEVICES

10.1.1 Service thermostat

The service thermostat activates and deactivates the compressor according to the demand for chilled water (cooling mode) or heated water (heat pump mode), as determined by a sensor installed on the water exchanger outlet. This device is governed by the microprocessor control (see also the chapter regarding the microprocessor).

10.1.2 Control device settings

CONTROL DEVICES	SET POINT	MIN	MAX
Service thermostat (outlet water temp. cooling mode)	11,5 °C	8 °C	20 °C
Service thermostat (outlet water temp. heat pump mode)	40 °C	25 °C	75 °C

10.2 SAFETY DEVICES

The safety unit consists of a device with a highly sensitive gas sensor for the specific detection of R290 propane refrigerant leaks. This sensor is designated as intrinsically safe and complies with the ATEX directive 2014/34/EU with ATEX certification.
The sensor is located at the base of the unit (to take account of the higher density of gaseous propane compared to ambient air), close to the cooling circuit / compressors, in order to detect any refrigerant leakage long before its concentration reaches levels that would allow it to ignite, with the consequent development of flames.
An ATEX extractor fan in suction configuration is fitted to each unit.

10.2.1 ATEX gas leak detector control unit

PLN units are equipped with a safety control unit with highly sensitive sensors for detecting refrigerant leaks. The sensor is located in the cooling compartment at the base of the unit.
The safety control unit employs an active protection system, which acts on two levels:

— 1st LEVEL (non-blocking alarm): if the concentration detected by the sensor reaches 10% of the lower flammability limit (LFL), the unit will continue to operate normally but an alarm message (gas sensor warning) will be activated on the front panel display. A yellow warning light (see Figure 7.11 p. 39) must be switched on in the customer's electrical control board so that the danger can be signalled from a distance without having to approach the unit. In addition, the ATEX extractor fan will immediately start at maximum speed to remove any atmosphere contaminated with refrigerant from the compressor compartment.

— 2nd LEVEL (blocking alarm): if the concentration detected by the sensor exceeds 20% of the lower flammability limit (LFL) and/or if the control unit goes into a FAULT state, the gas sensor control unit disables the power supply immediately downstream of the main switch IG, cutting off all general circuits of the unit and ensuring its immediate shutdown to place the machine in a state of electrical safety. Also on the customer's panel (outside the safety zone, see section 3 p. 16), a red indicator light must be provided to signal the second serious alarm and the electrical disconnection of the unit by means of a relay on the unit's control board (see Figure 7.11 p. 39). The F+N branch before the main switch supplies power to the gas sensor and the fan, which continues to extract air from the compressor compartment. The extractor fan is activated by a relay built into the leak detector control unit. This activation is therefore also electromechanical to ensure the safety chain.

⚠ **WARNING:** if the power supply is disconnected before the main switch, the safety devices will not function, especially during maintenance work.

10.2.1.1 Gas leak alarm management and alarm reset procedures

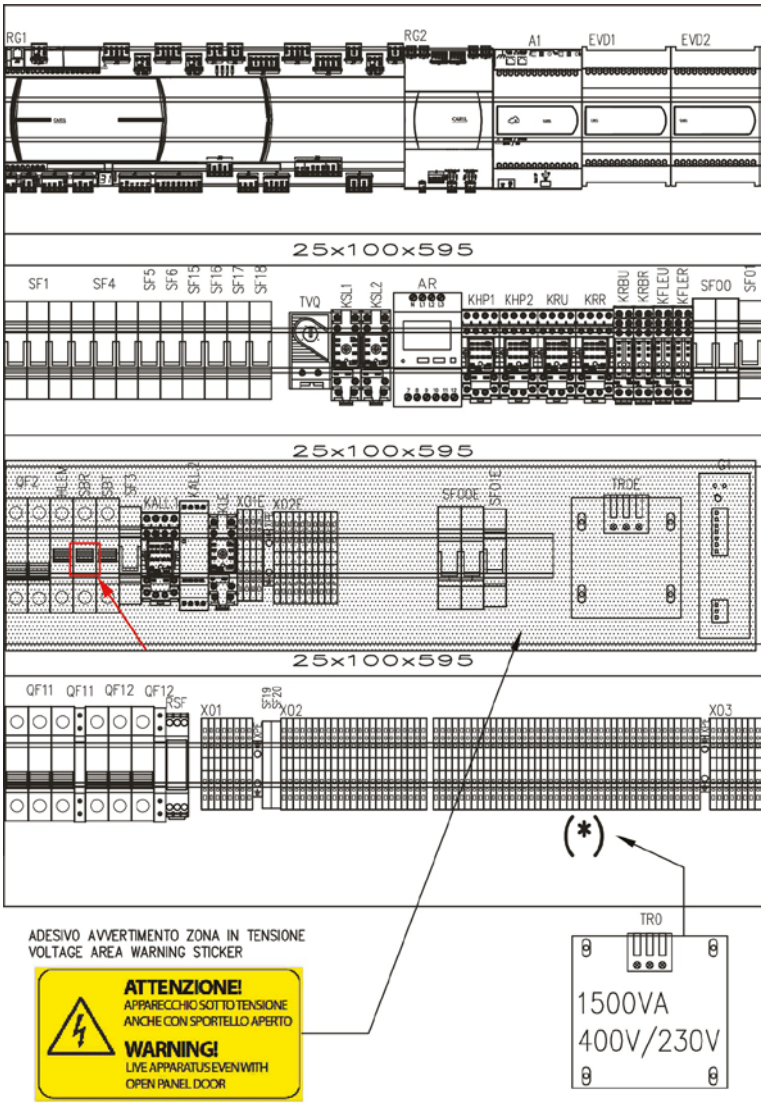
In the event of a gas leak alarm, it is necessary to call the territorial CAT immediately, move away from the unit and not take any action on it. The procedure to be followed by qualified CAT personnel is as follows:

⚠ **WARNING:** In the event of a non-serious refrigerant leak, i.e. a leak that could exceed 10% of the LFL but not more than 20% of the LFL, the first-threshold non-blocking alarm would be activated, which in turn would activate the ATEX extractor fan at maximum power and send an alarm signal both to the unit's display via the controller and to a YELLOW indicator light installed by the customer, located away from the unit and outside the safety zone and clearly visible (see section 3 p. 16). The indicator light is activated by a relay located inside the electrical control board of the unit. The first-threshold non-blocking alarm is automatically reset, i.e. if the detected LFL falls below 10% LFL, the fan and indicator light will automatically switch off.

Should the refrigerant leak be more serious, i.e. should the sensor detect a concentration greater than 20% of the LFL, the second-threshold blocking alarm would also be activated, in addition to the first alarm of course. In this scenario, the second-threshold alarm would intervene by opening switch IG1, which would cut power to all normal equipment, but keep the extractor fan and gas detector sensor active, which would continue to function. Nothing would appear on the unit's display as the controller would no longer be powered. However, a RED indicator light installed by the customer would light up, located away from the unit and outside the safety zone (see section 3 p. 16) and clearly visible. The indicator light is activated by a relay located inside the electrical control board of the unit. The second-threshold blocking alarm does not reset automatically. It must therefore be reset manually by experienced personnel, strictly following the instructions below.
Should the gas leakage problem, after a serious blocking alarm, fall below the non-blocking alarm 1 (LFL < 10%) due to natural gas dilution or removal from the circuit, or simply due to a false alarm, the red indicator light would remain lit while the yellow one would turn off, as the first non-blocking alarm is automatically reset in any case.
The remote reset of the first-threshold alarm allows the second-threshold alarm to be reset as it indicates a lack of refrigerant in the gas compartment. It would therefore be possible for experienced personnel to approach the unit with powered ATEX

gas detectors and portable ATEX extractor fans before entering the perimeter of the unit to check the status of the unit.
After confirming that the first alarm threshold has been reached, the control unit can be reset by de-energising the gas sensor by pressing and holding down for at least 1 second the reset button located inside the electrical control board.

» Serious alarm reset button



10.2.2 ATEX extractor fan

Each unit is equipped with an ATEX extractor fan in suction configuration with at least Ex II 3G Ex xx IIA T4 Gc certification (for both the electric motor and the mechanical fan part) with the following operating range of the unit -30°C <= Ta <= 50°C.

⚠ **WARNING:** It is necessary to periodically test the operation of the extractor fan to ensure that it is working properly as it is an essential safety device. It can be tested by means of the dedicated button inside the electrical control board, as indicated in the technical installation manual.

⚠ **WARNING:** Ensure that there are no obstacles or obstructions in the vicinity of the discharge outlet and the fan intake grille that could prevent the passage of air.

⚠ **WARNING:** It is necessary to periodically test the operation of the extractor fan to ensure that it is working properly as it is an essential safety device. It can be tested by means of the dedicated button inside the electrical control board, as indicated in the technical installation manual.

10.2.3 High pressure switch

The high pressure switch stops the compressor when the delivery pressure exceedsthe set value.

10.2.4 Anti-recycle timer

The function of the timer is to prevent excessively frequent compressor starts and stops. This device is a function included in the microprocessor control; it prevents the compressor from starting up again after a stop until a set period of time has elapsed (approximately 5 minutes).

10.2.5 Flow switch

The water differential pressure switch stops the unit in the event of an excessive reduction in the water flow, thus protecting it

from the formation of ice (chiller operation) and excessively high condensation temperatures (heat pump operation)

10.2.6 Antifreeze thermostat

The antifreeze thermostat situated at the evaporator outlet performs a dual function: it prevents ice from forming in the evaporator in the event of an excessive decrease in the water flow; it stops the unit in the event of a failure of the service thermostat. This device is governed by the microprocessor control (see also the chapter regarding the microprocessor).

10.2.7 Water safety

Water-side safety systems refer to the set of devices designed to protect the hydraulic circuit and, indirectly, the machine and the end user under abnormal operating conditions, in order to ensure the continuous and safe operation of the system. Among these devices are the safety valve and the air separator. The water safety valve consists of a calibrated spring and a shutter: when the system pressure exceeds the set value (6 bar), the spring–shutter resistance is overcome, allowing discharge until the system pressure drops back below the threshold. This accessory is supplied as standard; installation is the responsibility of the installer, and the valve must be positioned in a part of the system away from ignition sources and/or sparking components.
To explain the operation of the air separator, let us consider the scenario of a plate heat exchanger failure due to freezing or perforation. In the event of a hypothetical rupture or micro-leak, if the refrigerant side pressure exceeds the water side pressure, propane gas would be injected into the water circuit. The high-efficiency air separator, with a maximum operating pressure of 6 bar, intervenes by physically separating the gaseous component (R290) from the system water with extremely high efficiency, already from the first passage through the component. This configurable accessory is supplied with the unit; installation is the responsibility of the installer, and the device must be positioned in a section of the system away from ignition sources and/or sparking components. Its presence is mandatory, whether supplied as standard or purchased from third parties.

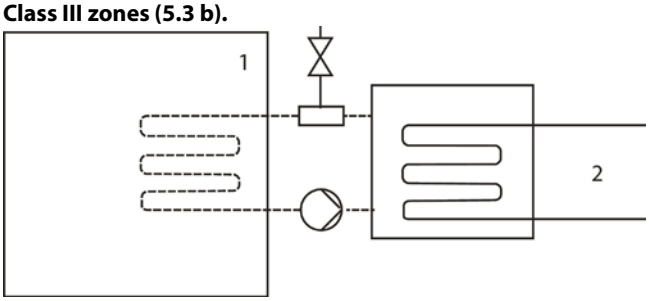
⚠ **IMPORTANT:** The devices for venting air from the water circuit (safety valves, automatic/manual deaerators and sludge removers) must also follow the same positioning principles as the unit. It is therefore recommended that they be installed close to the unit in order to optimise and centralise the danger zone. In any case, the above components must be installed outside the occupied zone in accordance with UNI EN 378-1.

⚠ **IMPORTANT:** The water safety valve and deaerator must be installed on the delivery branch from the unit to protect the user in the event of a plate heat exchanger rupture.

The correct installation positions of the deaerator and the sludge remover are shown in section 7.1 p. 29. Since these devices are equivalent to safety devices, they must be installed in an area that guarantees the same safety standards as the unit (see section 3 p. 16).
It is therefore recommended to install it close to the unit in order to optimise the danger zone.

⚠ **IMPORTANT:** The decision to make the safety valve and a deaerator mandatory is based on section 5.5.2.2 of EN 378-1, which states that a mechanical gas release device must be installed according to the installation category of the units in this range, depending on the type of refrigerant gas, as shown below:

Indirectly ventilated systems are considered to be located in Class III zones (5.3 b).



1 Space occupied
2 Part containing A3 refrigerant

10.2.8 Low pressure safety

Intake pressure is limited at the low end by software control via the low-pressure ratiometric sensor reading.

⚠ **IMPORTANT:** If the unit is stored with a full charge, in a high-temperature environment or exposed to direct sunlight for an extended period, the maximum allowable low-pressure line pressure of 30.3 bar may be reached. In addition, the operation of electronic equipment would be adversely affected. Therefore, storage and/or transport in environments where the temperature cannot be controlled or where it may exceed the unit's storage limit of 70°C should be avoided.

10.2.9 Safety device settings

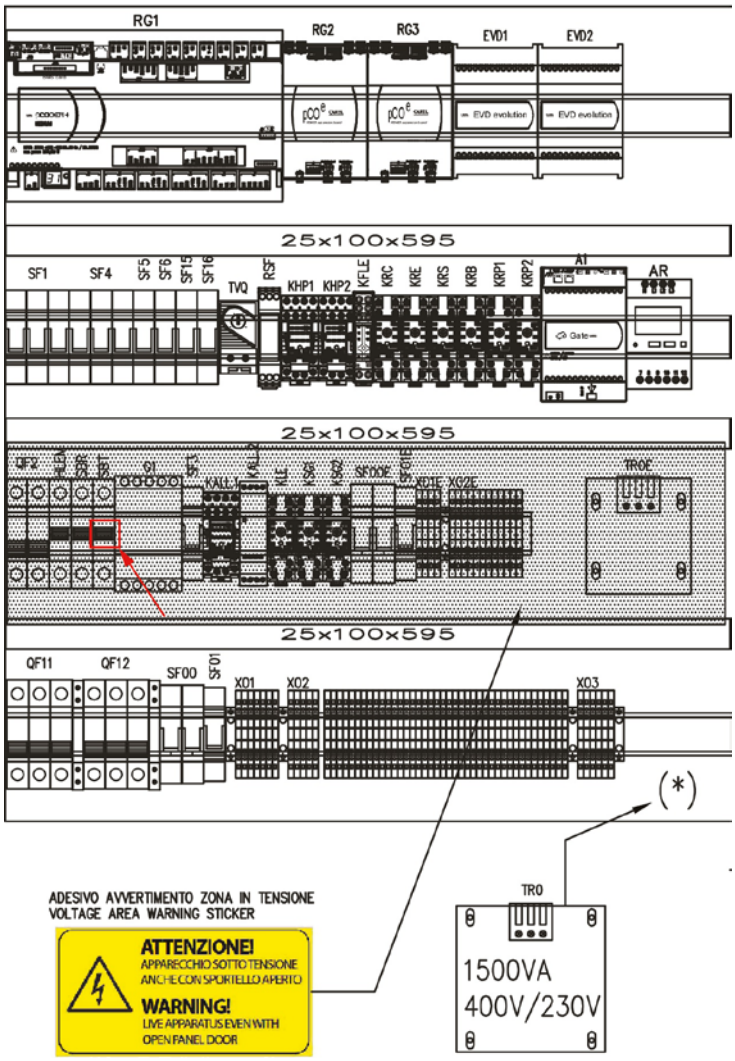
Safety device	Start up	Differential	Resetting
Maximum pressure switch (bars)	35	-	Manual
Minimum block intervention (bar)	0,7	-	Automatic
Antifreeze thermostat (°C)	3	3	Manual
Water safety valve (bars)	6	-	-

11 ROUTINE MAINTENANCE AND CHECKS

To keep the unit in good working order and guarantee the expected levels of performance and safety, it is necessary to carry out some periodic routine checks: some may be performed directly by the user while others must be carried out solely by specialised personnel. It is necessary to periodically check the correct functioning of safety devices (pressure switches and safety valves) and that there are no refrigerant leaks.

It is necessary to periodically test the operation of the extractor fan to ensure that it is working properly as it is an essential safety device. It can be tested by means of the dedicated button inside the electrical control board, as indicated in the technical installation manual.

» Extractor fan test button position



The gas detector sensor must also be checked regularly (at least twice a year) because, although the manufacturer specifies a service life of 15 years, it must always be kept in good condition and free from obstructions or obvious signs of deterioration. During the start-up phase of the unit, the sensor must be in a condition where no propane concentration is detected in the air, otherwise the sensor's auto-offset will fail. This must therefore be taken into account after restarting the unit in the event of a leak.
If you want to check the actual function of the safety devices, you must have a leakage cylinder calibrated to simulate the conditions of a refrigerant leak.

⚠ **WARNING:** NEVER test the function of the sensors with an unsuitable cylinder or directly with propane.

⚠ **IMPORTANT.** After the first start-up, the periodic checks must be carried out in conformity with the schedule and the manners provided for by current national regulations.

11.1 CHECKS TO BE PERFORMED BY THE USER

The checks and operations described in this section may be easily performed by the user, provided that the latter shows a minimum of attention.

— Remove any dirt that has built up around the coil or objects trapped in the mesh protecting the coil itself (leaves, paper etc., to be carried out monthly).

⚠ **WARNING** Be especially careful when working in proximity to finned coils since the aluminium fins are extremely sharp and can cause cuts.

— Check the level of water in the circuit using the water pressure gauge, which should indicate a pressure of about 1.5 bars (monthly).
— Check that the escape pipe of the water safety valve (if provided by the installer) is tightly secured.
— Check the water circuit for leaks (monthly).
— If the unit is to remain out of service for a long time, drain the water (or other fluid present in the circuit) from the pipes and the unit itself. This is indispensable if during the period of quiescence the ambient temperature is expected to fall below the freezing point of the fluid used (seasonal operation). Drain the unit and parts of the circuit subject to the risk of freezing by opening the RS (optional) emptying tap.
— Before placing the unit back in service at the start of the season, refill the water circuit as directed in section 1.5 p. 7.
— Check that the noise emissions of the unit are regular (monthly).
— If necessary, release the pump rotor.

11.1.1 Microchannels air condenser maintenance

For PLN C units, proper cleaning and periodic maintenance of the microchannel heat exchanger is essential in order to maintain its aeraulic performance.

⚠ **IMPORTANT:** a dirty microchannel heat exchanger negatively affects the performance of the unit by increasing the condensation temperature. As a result, there is a drop in the unit's energy efficiency and, in the most serious cases, the unit's safety devices are activated in order to prevent irreversible damage.

There are significant differences between the microchannel heat exchanger and the conventional finned block heat exchanger: one of which is that the microchannel coil tends to accumulate more dirt on the surface than inside, which makes it easier to clean.
The maintenance procedures listed below are recommended:

— Use a vacuum cleaner to remove surface dirt (preferably using a soft accessory). It is also possible to use compressed air, taking the utmost care to blow from the inside out
— Flush with water at low pressure through all the fin openings, with the spray direction strictly perpendicular to the edge of the fins. The spray pattern must be flat. Cleaning with pressurised water is not recommended since spraying in the wrong direction can destroy the microchannel heat exchanger, which is a significant risk factor.

⚠ **IMPORTANT:** do not use high-pH products for cleaning. Always use water with neutral pH.

— After the heat exchanger has been cleaned, it must be visually inspected for any traces of corrosion. If environmental corrosion factors cannot be eliminated, the heat exchanger must be requested with a surface treatment to protect it (e.g. epoxy paint or electrophoresis treatment)

The heat exchanger must be cleaned every three months or whenever it has not been operated for more than a week.
In the case of heat exchangers with an electrophoresis treatment, failure to clean them will void the warranty and could lead to a reduction in the life of the heat exchanger. In these cases it is necessary to use a detergent approved for cleaning and a product approved for removing chlorides and soluble salts.

⚠ **IMPORTANT:** do not use corrosive cleaning chemicals, bleach, or acid cleaners.

11.2 CHECKS AND MAINTENANCE TO BE PERFORMED BY SPECIALISED PERSONNEL

⚠ **WARNING:** Each operator must use personal protective equipment such as gloves, headgear, safety goggles, safety shoes, and hearing protection.

»

⚠ **WARNING:** Personnel working on units containing A3 refrigerant must have adequate and documented preparation and appropriate training in relation to the fire safety aspects of flammable fluids and their handling.

⚠ **WARNING:** Always use appropriate Personal Protective Equipment. The most common protective equipment is: helmets, protective goggles, goggles for braze welding, gloves, ear plugs, and safety shoes. Do not wear flammable clothing. Always perform a risk analysis of the installation site.

⚠ **WARNING:** ADOPT, IF AND WHEN NECESSARY, ADDITIONAL COLLECTIVE AND PERSONAL PROTECTION MEASURES.

All the operations described in this section MUST ALWAYS BE PERFORMED BY QUALIFIED PERSONNEL.

⚠ **WARNING:** Before carrying out any work on the unit or accessing any of its internal parts, ensure that the power supply has been switched off at the main switch and that you have waited at least 3 minutes before removing the enclosing panels, and ensure that the appropriate "WORK IN PROGRESS - DO NOT PERFORM ANY OPERATIONS" sign is affixed near the main switch on the unit's control board. This ensures that the safety devices remain energised.

⚠ **CAUTION:** If you need to work on safety devices, or if you are not sure which devices you need to work on, you must disconnect the power to the entire unit by disconnecting the unit before the customer's electrical control board.

⚠ **CAUTION:** The unit's electrical control board remains live even when the door is open, as indicated on the labels on the outside and inside of the electrical control board.

⚠ **WARNING** The upper part of the compressor casing and the outlet pipe reach high temperatures. Be especially careful when working in their vicinity.

⚠ **WARNING** Be especially careful when working in proximity to the finned coils: the aluminium fins are extremely sharp and can cause cuts.

⚠ **ATTENTION** In case of extraordinary weather events, the unit must be stopped; prior to putting it back into operation, it must be inspected by qualified personnel who must first check the integrity of the cooling circuit (pipes and components) and electrical connections, and verify that the safety devices are working properly.

After completing maintenance jobs, always replace the panels enclosing the unit and secure them with the fastening screws provided.

The checks and operations described in this section must be carried out on a yearly basis by specialised personnel.

— Check the electric control board terminals to ensure that they are securely tightened: the movable and fixed contacts of the circuit breakers must be periodically cleaned and replaced whenever they show signs of deterioration.
— Check the compressor and pipes for oil leaks.
— Check the efficient operation of the flow switch or water differential pressure switch.
— Clean the metal filters mounted in the water pipes.
— Clean the finned coil by aiming a jet of compressed air in a direction opposite to the outflow of air, taking care not to bend the fins.

⚠ **CAUTION:** Installation and maintenance activities performed on heat pumps may only be carried out by personnel and companies holding the appropriate certificate in compliance with Regulation (EU) no. 2015/2067, which establishes, in accordance with Regulation (EU) no. 517/2014 of the European Parliament and of the Council, minimum requirements for companies and personnel with regard to stationary refrigeration equipment, air conditioning equipment, and heat pumps containing certain fluorinated greenhouse gases.

under penalty of voiding the warranty and CE marking of the unit.

⚠ **WARNING:** During routine inspections of the unit, it is essential to check the correct operation of the extractor fan (see Figure 11.1 p. 47) using the test button located inside the electrical control board.

⚠ **IMPORTANT:** If the gas sensor is not functioning properly, the LED on the sensor itself (and on the remote red indicator light on the customer panel) will illuminate red. If there is no power to the sensor, a FAULT alarm will sound, which will also be displayed remotely on the customer control unit.

⚠ **IMPORTANT:** THE ON-BOARD CONTROL UNIT MUST NOT BE CONSIDERED A SUBSTITUTE FOR THE SAFETY AND DETECTION SYSTEM REQUIRED FOR THE INSTALLATION SITE, THE MACHINE ROOM, OR ANYTHING ELSE REQUIRED BY THE SYSTEM DESIGNER FOLLOWING THE NECESSARY RISK ASSESSMENT.

11.3 PROCEDURE FOR REPLACING COMPONENTS

The following recommendations are the result of a risk analysis carried out by simulating maintenance operations on a standard unit and assessing the additional risks due to the presence of an A3 fluid. These recommendations will be included in the installation, use and maintenance manual.

— Before carrying out any work on the unit, check that the leak detector control unit located inside the technical compartment containing the compressors/cooling circuit is energised and does not give an alarm. If this is not the case, remove any possible source of ignition, take steps to dilute the leaked coolant and wait until the work area has returned to a safe condition. Always be aware of any operations that may cause accidental ignition.
— It is essential to use an ATEX II gas zone approved portable fan to ensure effective ventilation of the areas where work is being carried out, especially when working on the cooling circuit. Note: keep the power supply of this fan outside the safety zone (see section 3 p. 16).
— **Instrumentation:** Always check that the pipes are in good condition and that there are no leaks at the connections. Any refrigerant leak creates an area of potentially flammable atmosphere, the extent of which depends on the size of the leak. Non-powered instruments can be used without risk when working on units containing an A3 refrigerant. In general, any instrument with an electrical power supply must be suitable for use with A3 refrigerants or compatible with ATEX Zone II for gases.
— **Refrigerant leak detectors:** Electronic leak detectors designed exclusively for use with flammable gases must be used. If it is not possible to use such devices, the refrigerant in the circuit must be safely recovered and the system then checked for leaks with nitrogen.
— **Vacuum pumps:** Vacuum pumps approved for use with A3 refrigerants must be used. Non-approved vacuum pumps may have various sparking elements (motors, contactors, switches, etc.) which are possible sources of ignition in the event of a leak. In general, it is advisable to switch on the vacuum pump from an isolating switch located outside the safety zone (see section 3 p. 16) and not from the switch on the pump. ALWAYS make sure that all pipes connected to the refrigerant circuit are free of leaks; check all connections (on pressure taps, cylinders, vacuum pumps, etc.) with an electronic leak detector before proceeding.
— **A3 refrigerant containers:** The refrigerant contained in the unit must not be released into the atmosphere. Instead, it must be recovered using a recovery unit and a cylinder approved for flammable fluids. The cylinder must be emptied to remove all air before it is filled with flammable refrigerant. Care must also be taken not to mix flammable refrigerants with other types of refrigerant: use separate cylinders as indicated above. Never use containers with labels other than the original ones, to avoid dangerous situations where the user cannot recognise the contents as flammable. Never fill the collection container completely to allow for variations in storage temperature. Leave at least 20% of the container volume empty.

⚠ **CAUTION:** The above devices must be switched on before entering the safety zone.

— **Working on the cooling circuit and brazing:** Firstly, ensure that there are no ignition sources within the safety zone (see section 3 p. 16) and that no flammable materials of any kind are stored there. Also ensure that the following conditions are met:
  — An appropriate fire extinguisher must be available.
  — The work area must be adequately ventilated before working on the cooling circuit and especially before brazing the circuit or using any ignition source.
  — The area must be checked with a leak detector before any work is carried out.
  — The unit's control unit must not signal any refrigerant alarms.
  — The personnel taking action must be properly trained and able to carefully follow the procedure below:
  — Remove the refrigerant from the circuit and recover it using suitable equipment and in accordance with the procedure described in this manual. Reach the minimum residual pressure allowed by the recovery unit. Ensure that THERE ARE NO DISCONNECTED PARTS OF THE CIRCUIT where refrigerant could be trapped in spite of this procedure. If you are not sure whether certain devices (electronic valves, solenoid valves, etc.) are open, pressurise and vent the circuit by connecting it at several points to avoid disconnecting parts;
  — Pressurise the circuit for the first time with inert gas (e.g. NITROGEN) to a pressure of about 20-25 bar (without exceeding the low pressure PS);
  — Evacuate the circuit with an ATEX vacuum pump to a minimum absolute pressure of 0.3 bar. This is essential to degas the compressor oil, which normally retains refrigerant;
  — Pressurise the circuit a second time with nitrogen (same pressure) and vent to ambient pressure;
  — At this point the circuit can be opened (with a pipe cutter and not with a flame).

⚠ **CAUTION:** When replacing a component that requires brazing (i.e. in the presence of an open flame), a continuous FLOW of nitrogen (at low pressure) must be maintained within the piping and components to be brazed. Ensure that the flow is effectively continuous and directed at the joints in question.

Remember that a non-negligible quantity of refrigerant is retained by the oil in the compressor sump and can be released in gaseous form in the circuit even after the unit has been emptied. Nitrogen flushing is therefore essential to ensure the absence of a combustion agent and to dilute the gas released in the circuit. In any case, strict compliance with EN 378-4 is required.

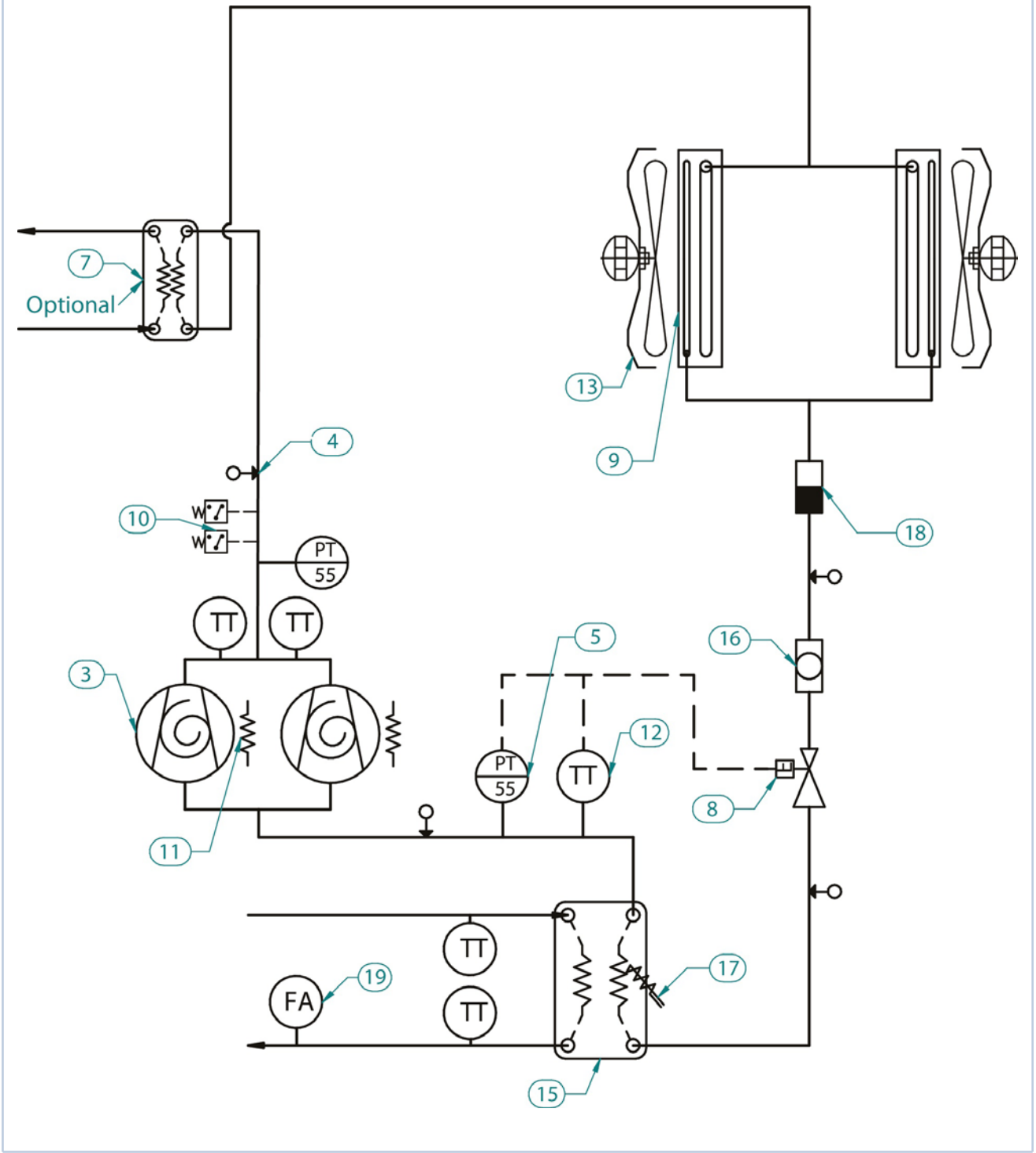
— **Replacement of components:** In order to comply with the requirements of the PED, it is essential to EXCLUSIVELY use original spare parts with characteristics identical to those of the part to be replaced (e.g. pressure switch or safety valve of the same type and with the same calibration value).

12 COOLING CIRCUITS

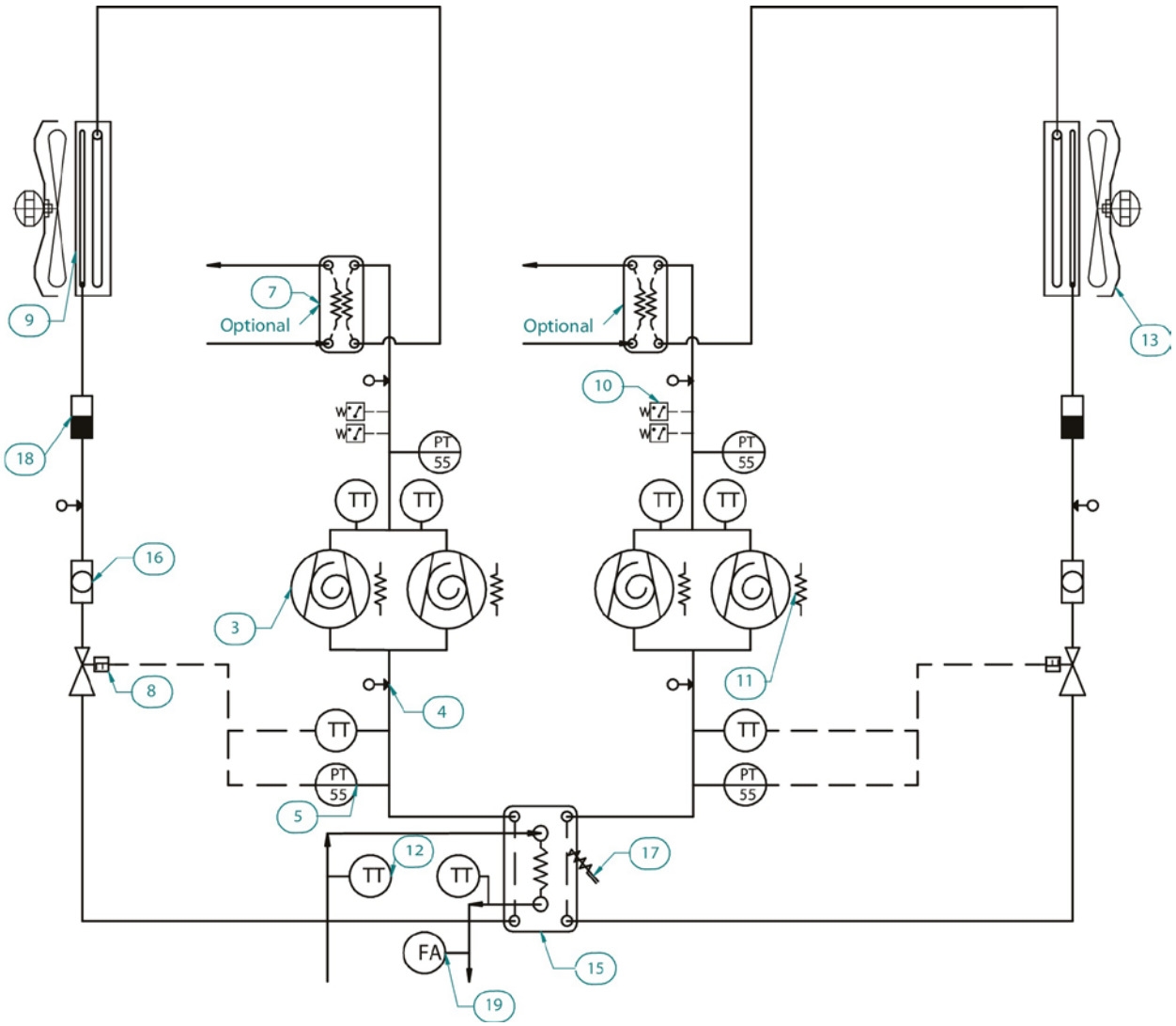
» PLN H 114 F3 Legend

N°	COMPONENT
1	Liquid separator
2	Vertical liquid receiver
3	Scroll compressor
4	Service connection
5	Ratiometric pressure probe
6	4-way valve
7	Gas desuperheater
8	Electronic expansion valve
9	Finned battery
10	High pressure switch
11	Crankcase electrical heater
12	Temperarature transmitter
13	Air fan
14	Outdoor coil trace heater
15	Plate exchanger
16	Sight glass
17	Evaporator adhesive heating element
18	Dehydrating filter
19	Flow switch
	Note: The water outlets of the desuperheaters are manifolded.

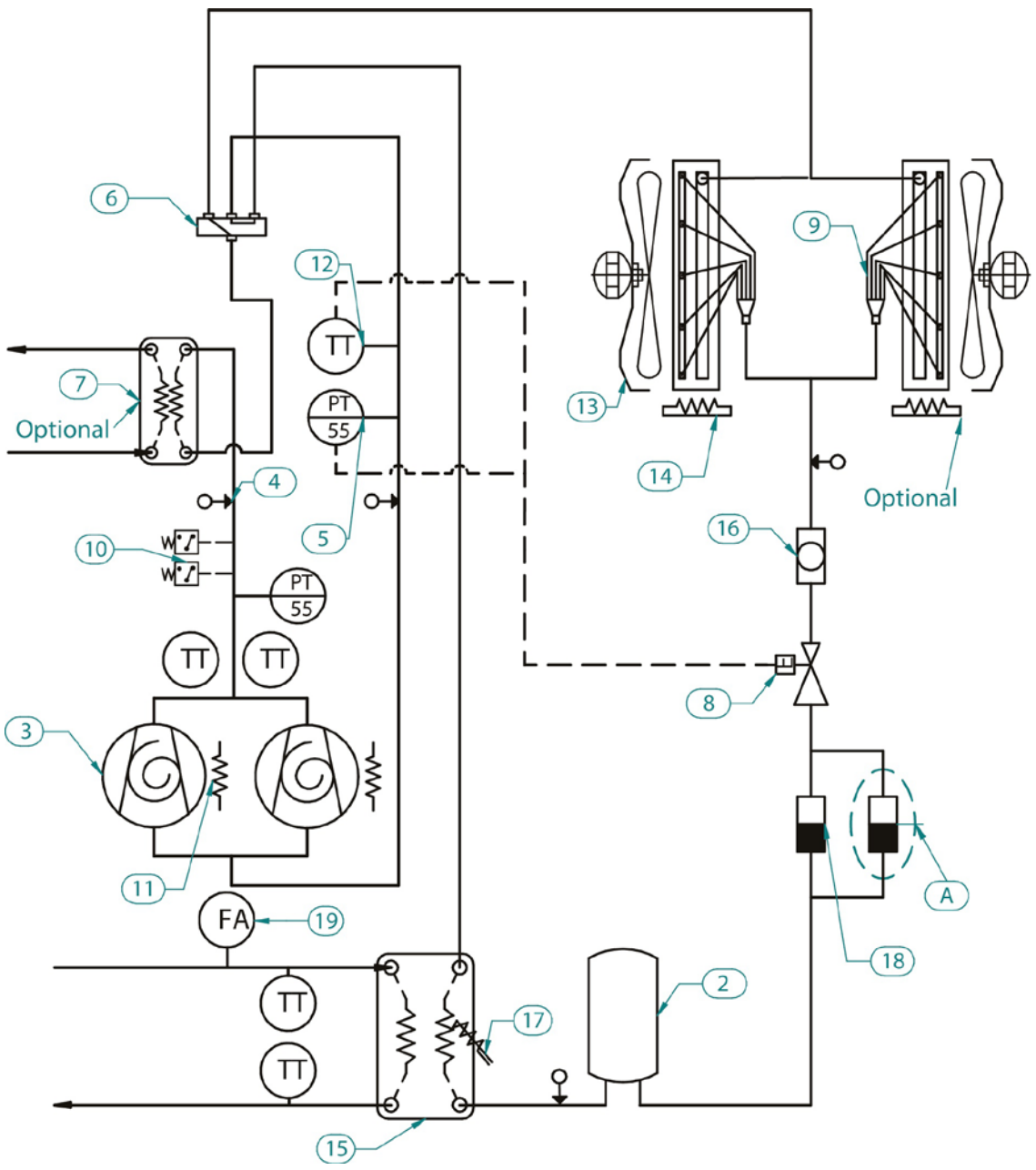
» Monocircuit PLN C



» Dual-circuit PLN C

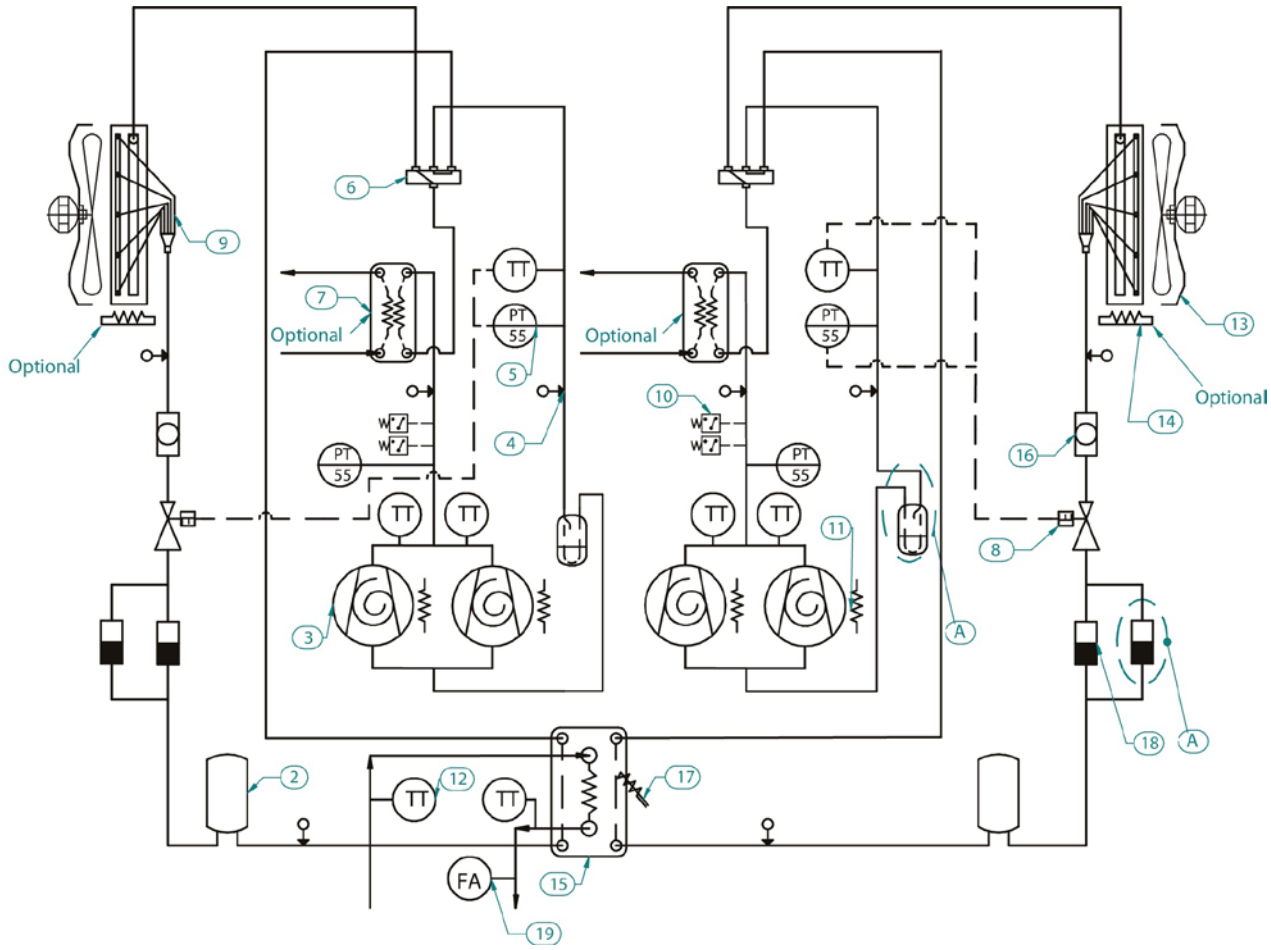


» Monocircuit PLN H F1-2



A Only for superior from/to PLN072

» PLN H double circuit



13 TROUBLESHOOTING

In this section you will find a list of the most common problems that may cause the chiller unit to stop or malfunction. Possible remedies are shown alongside a description of easily identifiable remedies.

⚠ **WARNING** Extreme care should be taken when performing work or repairs on the unit: overconfidence can result in injuries, even serious ones, to inexpert individuals. Operations marked with the letter "U" can be performed directly by the user, who must carefully follow the instructions provided in this manual. Operations marked with the letter "S" may be performed exclusively by specialised personnel. Once the cause has been identified, you are advised to contact a Galletti S.p.A. service centre or a qualified technician for help.

SYMPTOM	❄	☀	Who can take corrective action U = User S = specialised personnel	Probable cause	Possible remedy
A The unit does not start	X	X	S	Faulty connection or contacts open. Wrong voltage	Check the voltage and close the contacts
	X	X	S	Not enabled by remote controls	Check the efficiency of the water circulation pump, pressure switch, bleed air from the circuit; check whether contacts 16 and 30 on the terminal board are closed
	X	X	U	Anti-recycle timer active	Wait 5 minutes until the timer enables operation
	X	X	S	Service thermostat sensor defective	Check and replace if necessary
	X	X	U	Not enabled by service thermostat	System at the set temperature, no demand; Check the setting
	X	X	U	Not enabled by antifreeze thermostat	Check the water temperature Check the antifreeze setting
	X	X	S	Antifreeze sensor defective	Check whether it is functioning properly
	X	X	S	Tripping of main circuit breaker	Check for the presence of short circuits in the wiring or windings of the pump, fan and compressor motors or in the transformer
	X	X	S	Not enabled by high or low pressure switch	See items D-E
	X	X	S	Compressor defective	See item B
	X	X	S	Refrigerant leak	See item Q
	X	X	U	Block set by SG Ready	See section 6.5.12 p. 26
B The compressor does not start	X	X	S	Compressor burnout or seizure	Replace the compressor
	X	X	S	Compressor contactor deenergized	Check the voltage at either end of the compressor contactor coil and verify the continuity of the coil itself
	X	X	S	Power circuit open	Locate the cause that tripped the protection; check for the presence of short circuits in the wiring or windings of the pump, fan and compressor motors or in the transformer
	X	X	S	Power circuit open	The compressor has operated in critical conditions or there is insufficient refrigerant within the circuit: check the working conditions and make sure they fall within the operating limits. Refrigerant leak: refer to item G
C The compressor starts up and stops repeatedly	X	X	S	Minimum pressure switch has tripped	See item E
	X	X	S	Compressor contactor defective	Check and replace if necessary
	X	X	U	Wrong set-point or differential setting	Change them according to the indications given in the tables
	X	X	S	Lack of refrigerant	See item G
D The compressor does not start because the maximum pressure switch has tripped	X	X	S	Pressure switch failure	Check and replace
	X	X	S	Excessive refrigerant charge	Discharge the excess gas
	X		U	Finned coil obstructed, insufficient air flow	Remove dirt from the coil and any obstacles to air flow
	X	X	S	Fan not working	See item F
		X	U	Water circulation pump blocked	Release the pump
		X	S	Water circulation pump defective	Check the pump and replace it if necessary.
	X	X	S	Presence of incondensable gas in the cooling circuit	Recharge the circuit after having drained and evacuated it
	X	X	S	Refrigerant filter clogged	Check and replace

SYMPTOM	❄	☀	Who can take corrective action U = User S = specialised personnel	Probable cause	Possible remedy
E The compressor does not start because the minimum pressure switch has tripped	X	X	S	Pressure switch failure	Check and replace
	X	X	S	Unit completely empty	See item G
		X	U	Finned coil obstructed, insufficient air flow	Remove dirt from the coil
	X		S	Water circulation pump blocked	Release the pump
	X		S	Water circulation pump blocked defective	Check the pump and replace it if necessary.
		X	S	Presence of frost on the evaporating coil	See item O
		X	S	Evaporator fan not working	See item F
	X	X	S	Refrigerant filter clogged	Check and replace
	X	X	S	Expansion valve is not working properly	Check and replace if necessary
	X	X	S	Presence of humidity in the cooling circuit	Replace the filter and, if necessary, dry out the circuit and recharge
F The fans do not start	X	X	S	Fan contactor deenergized (C only)	Check the voltage at either end of the compressor contactor coil and verify the continuity of the coil itself
	X	X	S	No power output by the fan speed control card	Check and replace if necessary
	X	X	S	The fan's internal thermal protection has tripped	Check the fan conditions and the air temperature while the unit is running
	X	X	S	Fan motor defective	Check and replace if necessary
	X	X	S	Loose electrical connections	Check and fasten securely
G Lack of gas	X	X	S	Cooling circuit leak	Check the cooling circuit using a leak detector after pressurising the circuit to approximately 4 bars Repair, evacuate and refill
I Frost in liquid pipe downstream from a filter	X	X	S	Liquid filter clogged	Replace the filter
L The unit works continuously without ever stopping	X	X	S	Lack of refrigerant gas	See item G
	X	X	U	Wrong setting of operating thermostat	Check the setting
	X	X	S	Thermal overload	Reduce the thermal load
	X	X	S	Compressor does not provide the rated heating capacity	Check and replace or overhaul
	X	X	S	Liquid filter clogged	Replace
	X	X	U	Operation set by SG Ready	See section 6.5.12 p. 26
M The unit works regularly but with an insufficient capacity	X	X	S	Low level of refrigerant	See item G
	X	X	S	4-way cycle reversing valve defective	Check the valve power supply and coils and replace the valve if necessary
N Frost in the compressor intake pipe	X	X	S	Expansion valve is not working properly	Check and replace
	X		S	Water circulation pump blocked	Release the pump
	X	X	S	Water circulation pump defective	Check the pump and replace it if necessary.
	X	X	S	Low level of refrigerant	See item G
	X	X	S	Liquid filter clogged	Replace
O The defrosting cycle is never activated		X	S	4-way cycle reversing valve defective	Check the valve power supply and coil and replace the valve if necessary
		X	S	The defrost thermostat has broken down or has been set incorrectly	Check and replace if defective or change the setting
P Abnormal noises detected in the system	X	X	S	The compressor is noisy	Check and replace if necessary
	X	X	S	The panels vibrate	Fasten properly
Q Release of A3 gas	X	X	S	Leak presence in refrigerant circuit	DO NOT enter the area until the sensors detect the presence of gas. Always request the assistance of specialised personnel for gas refilling. Always follow the correct procedure in the event of a gas alarm (see 10.2.1.1 p. 44).

14 RETIRING THE UNIT

When the unit has reached the end of its working life and needs to be removed and replaced, a series of operations should be carried out: In particular, the disposal of the unit should be carried out solely by qualified technicians specifically trained for this type of equipment, in conformity with current regulations.
Main components and materials:

— Plastic (ABS) and pre-painted or painted sheet metal
— Heat exchanger: copper and aluminium / steel
— Electric motors: copper, aluminium, iron
— Fans: plastic material (ABS) or aluminium/iron
— Internal structure: galvanized sheet (ferrous materials)
— Refrigerant piping: copper / brass
— Packaging: cardboard / polystyrene / wood
— Instructions: paper

The refrigerant gas and the compressor's lubricating oil must be recovered and sent to an authorized collection center.
In general, the structure and the components (if they can no longer be used) must be disassembled and separated according to the main type of material. Especially for the parts made of iron, copper, and aluminum, which are present in large quantities in the product.
If the unit contains electronic boards or controls of any kind, at the time of disposal of the unit, it is necessary to consider these components to be "electrical and electronic waste," and they must be disposed of in accordance with the requirements of Directive 2012/19/EU - (also known as the WEEE (Waste Electrical and Electronic Equipment) – Directive.
These products should be handled properly and the materials that they are made of – such as copper, iron, steel, aluminum, glass, silver, gold, lead, and mercury – should be sorted for recycling, thereby avoiding a waste of resources that can be reused to manufacture new equipment, thus contributing to environmental sustainability.
To learn the EWC (European Waste Catalog) code of the different types of materials listed above, refer to Decision 2014/955 /EU of the European Commission (and any subsequent amendments thereto).

Galletti S.p.A Organization has a Management System Certified according to the UNI EN ISO 9001:2015, UNI EN ISO 14001:2015 and UNI ISO 45001:2018 standards.

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