

TECHNICAL MANUAL

INSTALLATION, ROUTINE, AND SPECIAL
MAINTENANCE





SYMBOLS



WARNING!

This symbol is used to indicate helpful hints for the operator.



ATTENTION! DANGER!

This symbol is used to indicate situations or operations that may be potentially dangerous or that require the operator's attention.



RISK OF ELECTRIC SHOCK!

This symbol is used to indicate situations or operations posing a potential risk of electric shock to the operator.



DANGEROUS HANDLING!

This symbol is used to indicate situations or operations posing a potential risk of crushing to the operator.



HEAVY LOADS!

This symbol is used to indicate situations or operations involving the handling of heavy loads by the operator.



RISK OF BURNS!

This symbol is used to indicate situations or operations posing a potential risk of burns to the operator.



RISK OF CUTS!

This symbol is used to indicate situations or operations posing a potential risk of cuts or abrasions to the operator.

The Manufacturer adopts a policy of continuous development and therefore reserves the right to make changes and improvements to any product described in this document without prior notice. Technical data and dimensions are not binding.

P-SERIES + PACI CLOSE CONTROL AIR CONDITIONERS TECHNICAL MANUAL

INSTALLATION, ROUTINE AND SPECIAL MAINTENANCE

List of revisions				
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WARRANTY CONDITIONS



All Products of the Manufacturer or bearing the trademark of the Manufacturer are built according to the state of the art techniques, in compliance with the current reference standards, as stipulated in the certificate of conformity provided together with the products.

All Products of the Manufacturer or bearing the trademark of the Manufacturer are designed to be installed inside a system that controls them. The designer or installer of the product assumes all liability and risk relating to its installation in the destination system.

The Manufacturer and its Branches/Affiliates do not guarantee that all aspects of the product and any software included will comply with the requirements of the destination system. In this case, following specific agreements, the Manufacturer can act as a consultant for the successful start-up of the product, but will not be held liable, under any circumstances, for the smooth operation of the destination system.

All Products of the Manufacturer or bearing the trademark of the Manufacturer are subject to the following warranty which is deemed as entirely accepted and signed at the time of placing the order.

The warranty on the Products of the Manufacturer with the model P-Series and bearing the trademark of the Manufacturer is valid for TWENTY-FOUR MONTHS (2 years) from the shipment date of the material. For the subsequent outdoor unit PACi models bearing the trademark of the Manufacturer and with model references commencing with 'U-'; please refer to your local Sales Office or Authorised Service Centre for details for the relevant warranty conditions.

The following conditions relate solely to those pertaining to the P-Series units. For the PACi outdoor unit, please refer to the relevant installation and service manuals.

If start-up is not carried out by Manufacturer-authorized technicians, the warranty is validated by submitting a completed copy of the product's technical start-up report.

During the warranty period, the Manufacturer, under its sole discretion and as quickly as possible, undertakes to repair or provide as new any parts with acknowledged defects relating to material, construction or workmanship, which make them unsuitable for their intended use.

The claim must be submitted in writing, indicating the details of the reported fault, the serial number or code of the product, where the fault was identified and indication of the component that caused the fault, if this is easily identifiable. The Manufacturer will accept no claim made over the phone.

For operational purposes, claims can only be accepted during office hours, Monday to Friday. If a request is submitted on a public holiday, the Manufacturer will consider it as received at the beginning of the next business day after it was sent.

Faulty components are replaced ex works (EXW). Transport costs are borne by the Customer, even if the warranty cover is applied, unless specified otherwise by the Manufacturer.

The costs to replace faulty components (labour, materials, refrigerant, etc.) are borne by the Customer, even if the warranty cover is applied, unless specified otherwise by the Manufacturer.

Materials replaced while under warranty are the property of the Customer, who must dispose of them according to current regulations. Any disposal costs are borne by the Customer.

If parts should be returned while under warranty, they must be returned no later than three (3) months from the shipment date of the replacement part, organised and at the expense of the Customer. Otherwise, all the parts will be charged at the applicable list price at the time of their shipment.

The Manufacturer is not liable to pay compensation for direct or indirect damage, of any kind and for any reason. The Manufacturer is also not liable for any delay in the supply of parts under warranty or in the execution of work under warranty.



WARRANTY RESTRICTIONS



The above mentioned warranty conditions are valid as long as the Customer has fulfilled all obligations according to the contract and in particular those relating to payment. A delayed payment or non-payment of the supply, even if partial, suspends any warranty. The warranty does not give the Customer any right to suspend or delay payments, which must be paid in any case according to the stipulations of the order and specified in the written order confirmation.

Without precluding due compliance with other instructions provided in the technical documentation supplied with the product, it must be noted that the following instructions must be complied with accordingly, in order for the warranty to be valid:

Transport and positioning

- Do not remove the product from its original packaging until it has reached the installation site.
- Do not drop, knock or shake the product, as the internal circuits and mechanisms may be irreparably damaged.
- Store the product in an environment that complies with the temperature and humidity limits specified in the technical documentation.

Installation

- 1) The product must be installed by skilled personnel who fulfil the adequate requisites for the task as defined by the regulations in the country where positioning and installation take place.
- 2) The system that will control the product must be implemented according to professional standards, according to the instructions provided in the technical documentation and the regulations of the country where positioning and installation take place, with particular attention to the setting up of:
 - Cooling lines serving the product and the relevant components.
 - Electrical power and connection lines of the product and the relevant components.
 - Aeraulic lines of the product and the relevant components.
- 3) Do not install the product outdoors or in areas that are subject to adverse weather.
- 4) Do not install the product in areas where there is oil, or where there are oil vapours or various kinds of aerosols, and where there are flammable vapours.
- 5) Do not install the product in environments where there is equipment that generates electromagnetic waves, and where the line voltage is subject to great fluctuations.
- 6) Do not install the product in environments where the air contains corrosive pollutants, a high dust or salt content.
- 7) Do not install the product on vehicles or boats.

First start-up

- 1) The product must be started up by skilled personnel who fulfil the qualification requisites for the task as defined by the regulations in the country where positioning and installation take place.
- 2) The system controlling the units must be started up according to professional standard, according to the instructions provided in the technical documentation and the regulations of the country where positioning and installation take place.
- 3) A copy of the technical start-up report of the product must be delivered to the Manufacturer.

Use and maintenance

- 1) Do not use the product for applications other than those specified in the technical documentation.
- 2) Do not use the product in an environment that does not comply with the temperature and humidity limits specified in the technical documentation.
- 3) Perform maintenance cycles according to the schedules specified in the technical documentation.
- 4) Clean the product with neutral detergents. Do not use corrosive chemicals and solvents or aggressive detergents.

Furthermore, the Manufacturer reserves the right to void the warranty of the products sold if:

- A) The labels or plates bearing the trademark of the Manufacturer and the serial number or the registration number of the product have been deleted and/or removed.
- B) The product has been subjected to alterations or mechanical processes not specifically authorised by the Manufacturer.
- C) The product has been used inconsistently with the instructions provided in the technical documentation and regulations of the country where positioning and installation take place, or for purposes other than what it was designed for.
- D) The defects are due to negligence, incompetence, poor maintenance, carelessness and inability of the End-user, damage caused by third parties, unforeseeable circumstances or force majeure or for any other reason not attributable to defects in the construction quality.

The following are henceforth considered excluded from the warranty:

- A) All parts with marginal defects that have a negligible effect on the value or function of the product.
- B) All parts typically subject to sliding or rolling friction (bearings, brushes, etc.).
- C) All parts typically subject to consumption (filters, humidifier cylinders, etc.).
- D) All parts typically subject to oxidation or corrosion if not properly used or serviced (headers, wires and copper contacts or metal alloys, internal or external parts of the units, etc.).
- E) All parts not supplied by the Manufacturer, even if these are an integral part of the system that controls the product.



SAFETY INSTRUCTIONS



All the Manufacturer's Products, or those distinguished by the Manufacturer's trademark have been designed and built for professional use in accordance with the applicable regulations. Check the complete list of applicable regulations in the EC declaration of conformity reported on the inside back cover of this manual, and supplied together with the product.

It is necessary to comply with the regulations of the State and Local Authority where the product will be laid and installed.

All the Manufacturer's Products, or those distinguished by the Manufacturer's trademark contain electrical and refrigerating systems that may be a source of danger to people or surrounding objects.

Therefore, in order to guarantee the safety of operating staff:

- The product must be installed, serviced and dismantled by skilled personnel who fulfil the qualification requisites for the task as defined by the regulations of the State where positioning and installation of the product take place, and where activities take place on the refrigerat circuit should hold a current valid certificate from an industry-accredited assessment authority,
- During installation, start-up, routine and special maintenance and dismantling, operating staff must comply with the health and safety instructions of the health and safety manager and the regulations of the State where the product will be positioned and installed.
- During installation, start-up, routine and special maintenance and dismantling, operating staff must wear the personal protective equipment (e.g. gloves, goggles, helmet, safety shoes) indicated by the health and safety manager and the regulations of the State where the product will be positioned and installed.
- The direct expansion units operate on R32 refrigerant, a fluorinated greenhouse gas subject to the Kyoto Protocol. Therefore, during installation, start-up, routine and special maintenance and dismantling, the health and safety instructions, professional disposal regulations of the refrigerant gas and regulations of the State where the product will be positioned and installed, must be complied with.
- During installation, start-up, routine and special maintenance and dismantling, operating staff must follow the instructions reported in the following manual.
- During normal product operation, it is prohibited to remove or bypass the protective panels and safety devices.
- Move the main switch into position 0 (Off) and check that the electrical power supply is isolated before performing any maintenance operations.
- Do not climb onto or enter the inside of the product.
- Any special opening tools must be positioned in a visible location near the unit.

The Manufacturer shall not be held liable for any damage to property or persons caused by improper use or unauthorised modifications to the product.

ATTENTION! DANGER!



Risk of immediate start-up after resetting the main switch if used as an emergency stop!
The main switch can be used as an emergency stop when the operator is near the machine (during start-up, operation and maintenance).



In this case, resetting the main switch will allow the machine to immediately restart, without any additional action by the operator.



SPECIAL PRECAUTIONS FOR R32 REFRIGERANT



These products operate on R32 refrigerant which is considered a mildly flammable refrigerant. Therefore, there are additional precautions that must be observed to ensure safe working.

To ensure the safe working operation of the system, the units must remain powered on at all times, other than for brief periods during service and maintenance

General

- Ensure the installation of pipe-work shall be kept to a minimum. Avoid using dented pipe and do not allow acute bending.
- Ensure that pipe-work shall be securely mounted and guarded from physical damage.
- Comply with national gas regulations, state municipal rules and legislation. Notify relevant authorities in accordance with all applicable regulations.
- Ensure mechanical connections be accessible for maintenance purposes.
- In cases that require mechanical ventilation, ventilation openings shall be kept clear of obstruction.
- When disposing of the product, comply with national regulations.
- In case of field charge, the effect on refrigerant charge caused by the different pipe length must be quantified, measured and labelled. Always contact to local municipal offices for proper handling.
- Ensure the refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed.
- Ensure refrigerant charge does not to leak.
- Wear appropriate protective equipment, including respiratory protection, as conditions warrant.
- Keep all sources of ignition and hot metal surfaces away.
- Explosion-proof electronic components shall only be replaced with parts specified by the Manufacturer. Replacement with other parts may result in the ignition of refrigerant in the event of a leak.
-

Servicing

Qualification of Workers

- Any qualified person who is involved with working on or breaking into a refrigerant circuit should hold a current valid certificate from an industry-accredited assessment authority, which authorises their competence to handle refrigerants safely in accordance with an industry recognised assessment specification.
- Servicing shall only be performed as recommended by the Manufacturer. Maintenance and repair requiring the assistance of other skilled personnel shall be carried out under the supervision of the person competent in the use of flammable refrigerants.
- Servicing shall be performed only as recommended by the manufacturer.
- The system is inspected, regularly supervised and maintained by a trained and certified service personnel who is employed by the person user or party responsible.

Checks to the area

- Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimised.
- For repair to the refrigerating system, the precautions shown below must be followed before conducting work on the system.

Work procedure

- Work shall be undertaken under a controlled procedure so as to minimise the risk of a flammable gas or vapour being present while the work is being performed.

General work area

- All maintenance staff and others working in the local area shall be instructed and supervised on the nature of work being carried out.
- Avoid working in confined spaces. Always ensure away from source, at least 2 meter of safety distance, or zoning of free space area of at least 2 meter in radius.

Checking for presence of refrigerant

- The area shall be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially flammable atmospheres.
- Ensure that the leak detection equipment being used is suitable for use with flammable refrigerants, i.e. non sparking, adequately sealed or intrinsically safe.
- In case of leakage/spillage happened, immediately ventilate area and stay upwind and away from spill/release, and notify persons down wind of the leaking/spill, isolate immediate hazard area and keep unauthorised personnel out.

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Presence of fire extinguisher

- If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available at hand.
- Have a dry powder or CO₂ fire extinguisher adjacent to the charging area.

No ignition sources

- No person carrying out work in relation to a refrigerating system which involves exposing any pipe work that contains or has contained flammable refrigerant shall use any sources of ignition in such a manner that it can lead to the risk of fire or explosion.
- They must not be smoking when carrying out such work.
- All possible ignition sources, including cigarette smoking, should be kept sufficiently far away from the site of installation, repairing, removing and disposal, during which refrigerant can possibly be released to the surrounding space.
- Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks.
- "No Smoking" signs shall be displayed.

Ventilated area

- Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work.
- A degree of ventilation shall continue during the period that the work is carried out.
- The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere

Checks to the refrigerating equipment

- Where electrical components are being changed, they shall be fit for the purpose and to the correct specification.
- At all times the Manufacturer's maintenance and service guidelines shall be followed.
- If in doubt consult the Manufacturer's technical department or Authorised Service Centre for assistance.
- The following checks shall be applied to installations using flammable refrigerants.
 - The refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed.
 - The ventilation machinery and outlets are operating adequately and are not obstructed.
 - If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant.
 - Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected.
 - Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which can corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are properly protected against being so corroded.

Detection of flammable refrigerants

- Under no circumstances shall potential sources of ignition be used in the searching or detection of refrigerant leaks.
- A halide torch (or any other detector using a naked flame) shall not be used.
- The following leak detection methods are deemed acceptable for all refrigerant systems.
 - No leaks shall be detected when using detection equipment with a sensitivity of 5 grams per year of refrigerant or better under a pressure of at least 0,25 times the maximum allowable pressure (>1.04 MPa, max 4.15 MPa) for example, a universal sniffer.
 - Electronic leak detectors may be used to detect flammable refrigerants, but the sensitivity can be inadequate, or can need re-calibration. (Detection equipment shall be calibrated in a refrigerant-free area.)
 - Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used.
 - Leak detection equipment shall be set at a percentage of the LFL of the refrigerant and shall be calibrated to the refrigerant employed and the appropriate percentage of gas (25 % maximum) is confirmed.
 - Leak detection fluids are also suitable for use with most refrigerants, for example, bubble method and fluorescent agent method. The use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.
 - If a leak is suspected, all naked flames shall be removed/extinguished.
 - If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system, or isolated (by means of shut off valves) in a part of the system remote from the leak.



RESIDUAL RISK



Transport, positioning and installation				
Area	Hazard	Risk	Preventive measures	PPE
Near product	Faulty lifting system that causes falls	Bruising, trauma	Keep a safe distance from the hazardous area while handling the unit	S1P shoes Cut-resistant gloves Safety helmet
	Unstable or unsuitable support that causes overturning	Bruising, trauma	Make sure the product has a suitable support for its weight, and that it is stable and level	S1P shoes Cut-resistant gloves Safety helmet
	Accidental impact with damage and leaking refrigerant	Burns, formation of vapours	Keep a safe distance from the hazardous area while handling the unit	S1P shoes Cut-resistant gloves Protective goggles Respirator

Start-up, use, routine and special maintenance and dismantling				
Area	Hazard	Risk	Preventive measures	PPE
Near product	Suction and subsequent expulsion from fan of objects, dust and substances present in the installation area	Bruising, trauma, dust inhalation	Clean the product installation area and check for the presence of foreign objects in the fan before starting the product	S1P shoes Cut-resistant gloves Safety helmet Protective goggles Respirator
	Fire following welds on cooling circuit/	Burns, formation of vapours	Clean the product installation area and check for the presence of foreign objects before welding	S1P shoes Welding gloves Protective goggles Respirator
	Projection of refrigerant from safety valve	Burns, formation of vapours, contact of oil with skin and eyes	Do not stand near the safety valve (when present)	S1P shoes Protective gloves Protective goggles Respirator
In contact with the product	Short circuit; incorrect sizing of the power cables or main switch	Electric shock, fire, formation of vapours	Check the fixing cables in the terminals, accurately select the power cables and main switch	S1P shoes Insulating gloves Protective goggles Respirator
	No ground connection	Electric shock	Remain electrically isolated from the ground	S1P shoes Insulating gloves
	Contact with hot surfaces	Burns	Avoid contact and insulate the piping	S1P shoes Protective gloves
	Condensation on the cooling pipes, if not insulated	Electric shock, slipping	Insulate the piping	S1P shoes Insulating gloves
	Contact with sharp or moving surfaces	Cuts, abrasions, bruising	Disconnect the power supply to the product and wait for the moving parts to stop	S1P shoes Cut-resistant gloves Safety helmet Protective goggles
	Oil leaks	Contact of oil with skin and eyes.	Avoid contact	S1P shoes Protective gloves Protective goggles

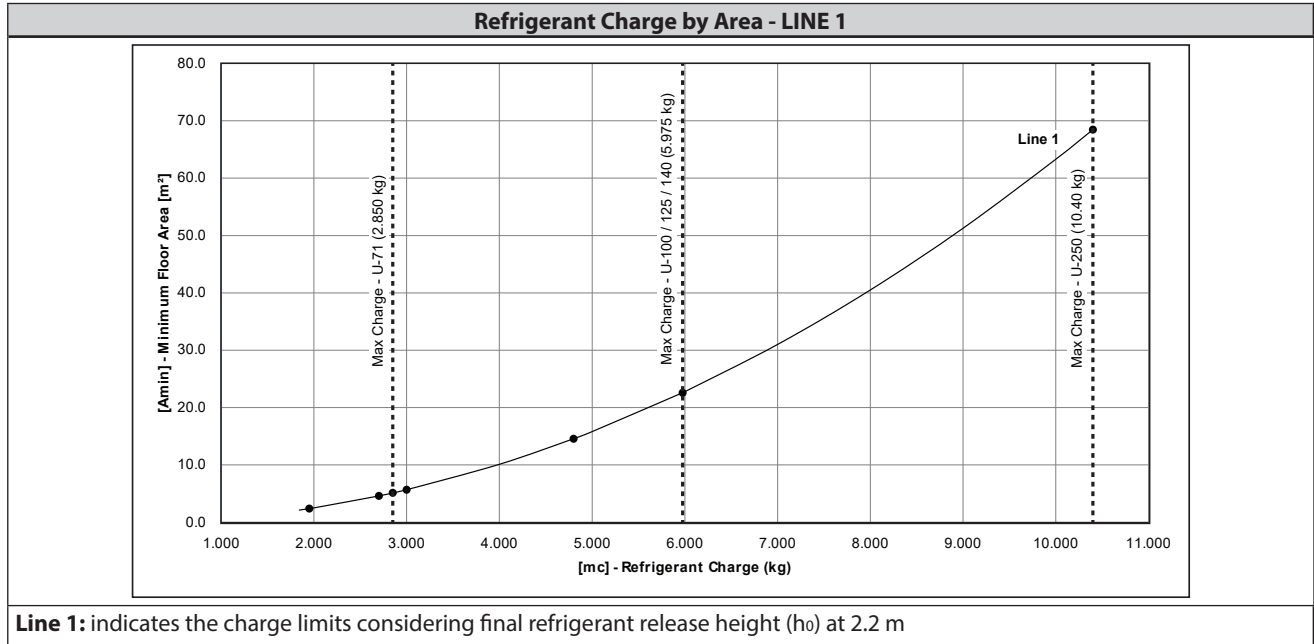
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CHECK OF DENSITY



This refrigerant (R32), which is utilised within the appliance is deemed as mildly flammable. It is therefore necessary to carefully consider the installation arrangement and area, allowing sufficient space to ensure hazardous conditions do not arise in the event of leak. The installation space is determined according to the refrigerant charge amount (m_c), see chart below **Line 1**, which considers constant fan flow.



m_c	A_{min} @ 2.2 m [m ²]
1.95	2.4
2.0	2.5
2.1	2.8
2.2	3.1
2.3	3.3
2.4	3.6
2.5	4.0
2.6	4.3
2.7	4.6
2.8	5.0
2.9	5.3
3.0	5.7
3.1	6.1
3.2	6.5
3.3	6.9
3.4	7.3
3.5	7.8
3.6	8.2
3.7	8.7
3.8	9.1
3.9	9.6
4.0	10.1

m_c	A_{min} @ 2.2 m [m ²]
4.1	10.6
4.2	11.2
4.3	11.7
4.4	12.3
4.5	12.8
4.6	13.4
4.7	14.0
4.8	14.6
4.9	15.2
5.0	15.8
5.2	17.1
5.3	17.8
5.4	18.5
5.5	19.1
5.6	19.9
5.7	20.6
5.8	21.3
5.9	22.0
6.0	22.8
6.0	22.8
6.2	24.3
6.3	25.1

m_c	A_{min} @ 2.2 m [m ²]
6.4	25.9
6.5	26.7
6.6	27.6
6.7	28.4
6.8	29.3
6.9	30.1
7.0	31.0
7.1	31.9
7.2	32.8
7.3	33.7
7.4	34.7
7.5	35.6
7.6	36.6
7.7	37.5
7.8	38.5
7.9	39.5
8.0	40.5
8.1	41.5
8.2	42.6
8.3	43.6
8.4	44.7
8.5	45.7

m_c	A_{min} @ 2.2 m [m ²]
8.6	9.6
8.7	10.1
8.8	10.6
8.9	2.4
9	2.5
9.1	2.8
9.2	3.1
9.3	3.3
9.4	3.6
9.5	4.0
9.6	4.3
9.7	4.6
9.8	5.0
9.9	5.3
10	5.7
10.1	6.1
10.2	6.5
10.3	6.9
10.4	7.3

Refrigerant Charge Calculation

It is necessary to calculate the refrigerant charge for the system dependent on the length of the refrigerant piping.

m_c = The total charge is equal to the refrigerant charge at shipment plus the charge amount in the field.

Calculation example of m_c - Refer to section **PIPE LENGTH AND DIAMETERS OF REFRIGERANT CIRCUIT PIPING** for details relating to pipe sizing and indoor outdoor piping connections, pipe length ranges, refrigerant charge at shipment, additional charge per 1 m.

Conditions: OPZ 211 + U-250PZH4E8 - Total piping length = 40 m

$$m_c = ① + ② = ① + ((③ \times (④ - ⑤)) = 4.80 \text{ kg} + (0.08 \text{ kg} \times (40 \text{ m} - 30 \text{ m})) = 5.60 \text{ kg}$$

- ① - Refrigerant charge at shipment
- ② - Refrigerant charge amount in field
- ③ - Additional refrigerant charge per 1 m (Liquid Line)
- ④ - Total pipe length
- ⑤ - Chargeless pipe length

Conditions: UPZ 111 + U-100PZH4E5 - Total piping length = 100 m

$$m_c = ① + ② = ① + ((③ \times (④ - ⑤)) + (⑥ \times ⑦)) = 2.70 \text{ kg} + (0.04 \text{ kg} \times ((85 \text{ m} - 30 \text{ m})) + (0.025 \text{ kg} \times 15 \text{ m})) = 5.275 \text{ kg}$$

- ① - Refrigerant charge at shipment
- ② - Refrigerant charge amount in field
- ③ - Additional refrigerant charge per 1 m (Liquid Line) - 30 ~ 85 m
- ④ - 85 m pipe length
- ⑤ - Chargeless pipe length
- ⑥ - Additional refrigerant charge per 1 m (Liquid Line) - 85 ~ 100 m
- ⑦ - Pipe length greater than 85 m (i.e. total pipe length (100 m) - ④ = 15 m)



R32 SAFETY OPERATION



It is essential that the appliance remains constantly powered following commissioning. Once in operation, the fans will function constantly. This ensures, in the event of a refrigerant leak, the airflow will dissipate the refrigerant within the space, preventing the build-up of the refrigerant, which can result in hazardous, flammable conditions.

The system will provide an alarm in the event the fans are stopped due to anomaly. If this occurs, please ensure that adequate additional ventilation is provided to prevent the build-up of refrigerant in the event of a leak.

Maintenance operations should be minimised wherever possible. If the unit requires periodic maintenance, please follow the guidance as detailed in the section above SPECIAL PRECAUTIONS FOR R32 REFRIGERANT, and bring the unit back into service as quickly as possible.

If the unit will remain out of service for any length of time, the refrigerant charge should be removed and the refrigerant circuit left pressurised for Oxygen Free Nitrogen (OFN).

If there is any doubt about the refrigerant safety of unit please contact the Manufacturer or local Authorised Service Centre for support as soon as possible.

P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

DESCRIPTION OF UNITS AND OPERATING LIMITS

1.1 P SERIES UNITS

The machines in question are Close Control air conditioners with direct expansion coil designed for use in small critical environments: laboratories, museums and archives, office buildings, server rooms. The machines in question are comprised of the following sections:

- The structure is made of hot-galvanised painted RAL 7024 sheet panels or in a frame constructed of aluminium section; the panels are made from hot-galvanised sheet steel painted RAL 7024, secured by quick-thread screws that can be unscrewed using a special safety wrench. The structure incorporates a thermal and acoustic insulation system using self-extinguishing materials protected by plastic film (polyurethane foam).
- Electrical power control panel with main switch door lock and microprocessor terminal.
- Supply fan section: consisting of one or more Plug Fan EC brushless electric fans (with electronic regulation) fixed to the machine's structure.
- Filtering section: self-extinguishing non-regenerable filters; the machine includes provision for the use of a differential pressure probe to allow display of the clogged filter warning signal.
- Cooling circuit (direct expansion versions): consisting of a direct expansion coil with expanded copper pipes inside aluminium fins and hot-dip galvanised steel sheet structure, copper cooling circuit with anti-condensation thermal insulation, pressure probes for monitoring low pressure and high pressure, temperature probes for controlling temperature of intake, of the liquid and compressor discharge, high pressure manual reset safety sensor (PS HP 41 BarG).
- Electric modulating post-heating coil (Accessory): consisting of one or more filament heating stages with low thermal inertia, structure in hot-dip galvanised sheet steel, thermal protection system with manual reset thermostat.
- Immersed electrode humidifier (Accessory): consisting of a steam production cylinder, charge valve, discharge valve, support and water circuit in plastic.

1.2 OPERATING LIMITS

WARNING!



The ambient thermal load must not be less than 40% of the unit's rated cooling capacity in the case of direct expansion units.



A lower thermal load will lead to imprecise temperature and humidity control and frequent powering on/off of the compressor.

P-Series Air Conditioners	
Infeed air temperature	
	Direct Expansion
Maximum temperature	38°C
Minimum temperature	20°C
Maximum absolute humidity	11 g/kg
Minimum absolute humidity	5,5 g/kg
Maximum relative humidity	60%Rh
Minimum relative humidity	25%Rh
Minimum thermal load	40% of unit's rated cooling capacity
Storage Conditions	
Temperatures from -20°C to + 45°C. Humidity from 10%Rh to 90 %Rh non-condensing. Store indoors and sheltered from weather elements.	

In the event alternate working conditions are required, please contact the Manufacturer

1.3 P SERIES + PACi UNIT COMBINATIONS

The P-Series + PACi is designed with specific combinations to ensure the correct operational characteristics and performance. Only the following combinations are allowed. Any deviance from the defined combinations may result in incorrect operation, lack of performance, and ultimately unwanted system errors.

P-SERIES + PACi COMBINATIONS				
Standard Models	P-SERIES MODELS		PACi Outdoor Unit Models	
	Upflow	Downflow	Single Phase	Three Phase
071	OPZ 071	UPZ 071	U-71PZH4E5	U-71PZH4E8
111	OPZ 111	UPZ 111	U-100PZH4E5	U-100PZH4E8
121	OPZ 121	UPZ 121	U-125PZH4E5	U-125PZH4E8
141	OPZ 141	UPZ 141	U-140PZH4E5	U-140PZH4E8
211	OPZ 211	UPZ 211	-	U-250PZH4E8

P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

1.4 CONFIGURATION EXAMPLES

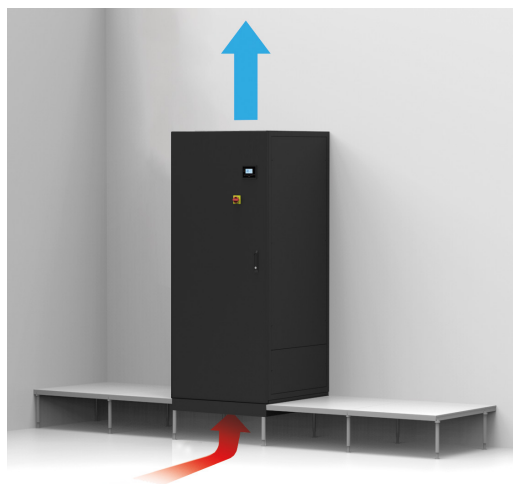
1.4.1 P SERIES - OVER (DISCHARGE FROM TOP OF UNIT)



Standard configuration

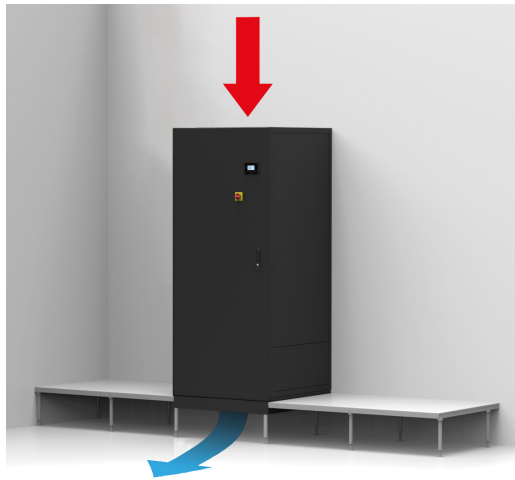


Configuration with supply plenum



Configuration with suction from the bottom and closed front panel

1.4.2 P SERIES - UNDER (DISCHARGE FROM BOTTOM OF UNIT)



Standard configuration



Configuration with lower discharge plenum



Configuration with front lower front discharge

P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

1 TRANSPORTATION, POSITIONING AND INSTALLATION PROCEDURES

1.1 OVERALL WEIGHT AND CLEARANCES FOR ROUTINE MAINTENANCE

1.1.1 OVERALL WEIGHT

WARNING!



If the units are installed on a normal floor, without vibration damping supports, it is necessary to place a layer of vibration damping material (rubber or equivalent material with a minimum thickness of 10 mm) between the machine and the floor to avoid transmitting vibrations to the structure of the building.



This layer of vibration damping material also makes up for floors that are not perfectly flat, guaranteeing the air seal between the elements and containing the noise level of the installation.

For correct installation of the units, and to ensure safety of the operators, it is essential to make sure that the surface on which the air conditioners are to be installed is capable of supporting the overall weight.

The overall weight can be found in the table below, for standard models (identified by the code number sequence).

Overall weight	
Standard models	Weight +/-5%
	kg
P Series	
071	150
111	200
121	205
141	205
211	225

For dimensions and weight for the PACi outdoor units, please refer to the relevant Installation and Service Manuals

1.1.2 DIMENSIONS FOR INSTALLATION AND CLEARANCES

The figure below shows the dimensions to be taken into account during installation. For the exact values referring to the dimensions indicated in the figure, refer to the following table and, in any case, to the drawings supplied with the order confirmation.

The units must be positioned differently based on the type of unit, and always following the design and manufacturing requirements of the unit.

During installation, observe the clearances required for routine maintenance (and if special, if necessary) indicated in the order confirmation or the table below, with reference to the standard models (identified by the code number sequence).

Clearances P Series								
Over				Under				
Standard models		Plan dimensions						
		Dimensions (mm)			Clearances (mm)		Routine Maintenance (mm)	
		Length	Depth	Height	Upper	Lower	Front	Left
		A	B	H	a	b	1	2
071 - 141	Over	750	600	1990	300	300	750	-
211	Over	860	880				860	

P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

1.2 TRANSPORT, HANDLING AND POSITIONING OF THE UNIT



DANGEROUS HANDLING! HEAVY LOADS!

Always use suitable equipment to move the unit!

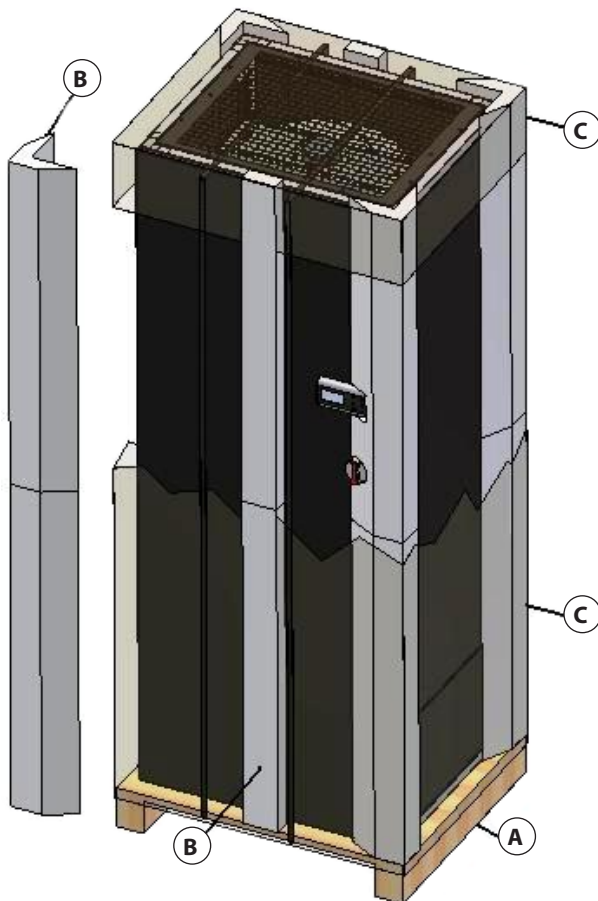


1.2.1 TRANSPORTATION AND RECEIVING THE MACHINES ON SITE

During transport the machines cannot be laid down or turned over; hence they must always stay in vertical position. Turning the unit over would cause damage to the internal components.

Unless otherwise and specifically agreed with the Client, the Manufacturer delivers its machines ex works (EXW) complete with standard packaging consisting of: loading pallet, shock-resistant polystyrene cladding and protective polyethylene film.

As the Carrier is always responsible for damage sustained by the goods during transport, before signing the delivery note to accept the supply, make sure the packaging is intact and that there are no visible signs of damage to the machine or traces of oil or refrigerant liquid leakage. If there is visible damage to the units, or if there is the slightest doubt that the conditioner may have concealed damage caused during transport, you must indicate your reservations in writing to the carrier themselves, while also informing the Manufacturer.



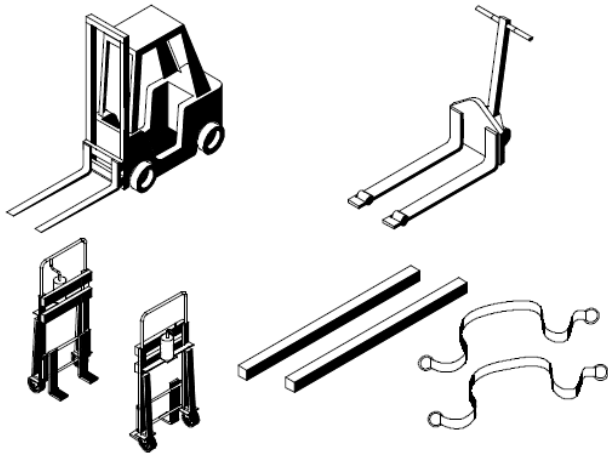
- F Loading pallet**
- G Shock-resistant polystyrene cladding**
- H Protective polyethylene film**

1.2.2 HANDLING THE UNITS

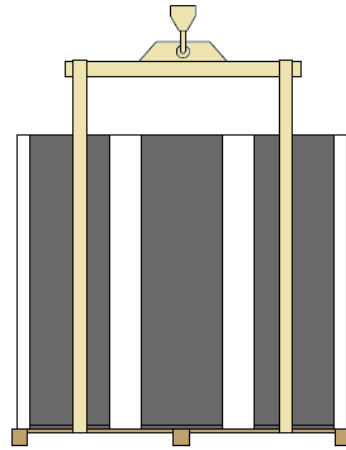
During site handling the machine must be left in its original packaging until it has reached the installation position.

The unit must be lifted and transported by means of a forklift truck, pallet truck, winch hoist or through a rope lifting system. In case of rope lifting, the ropes must be slid underneath the pallet the unit is fitted with, and stiff spacers must be arranged to ensure the ropes do not crush the unit's structure during lifting.

To avoid any form of damage it is necessary not to set the machines horizontally during storage, handling and installation operations.



Handling equipment



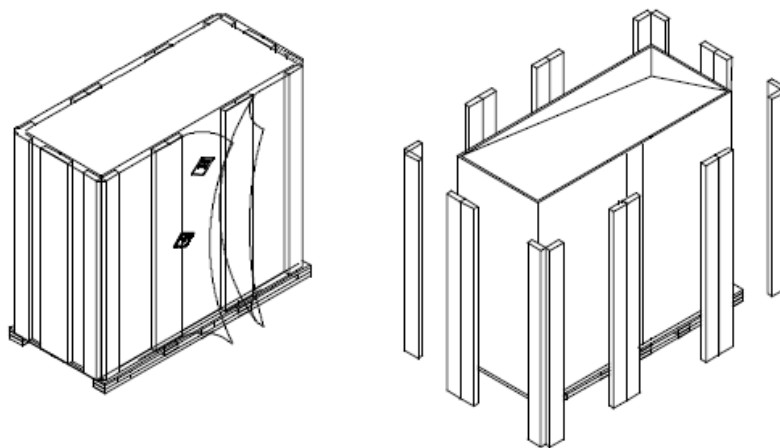
Position of ropes for lifting

1.2.3 REMOVING THE PACKAGING

If the unit is not to be installed immediately after its arrival on site, it should be stored in its original packaging, in a dry, enclosed area that is preferably heated during the winter months.

For final placement of the units the shipping packaging must be removed. Remove the packaging as follows:

- 1) Cut the protective polyethylene sheet that the unit is wrapped in, paying attention not to damage the paint while cutting.
- 2) Remove the shock-resistant polystyrene cladding.



Removing the packaging

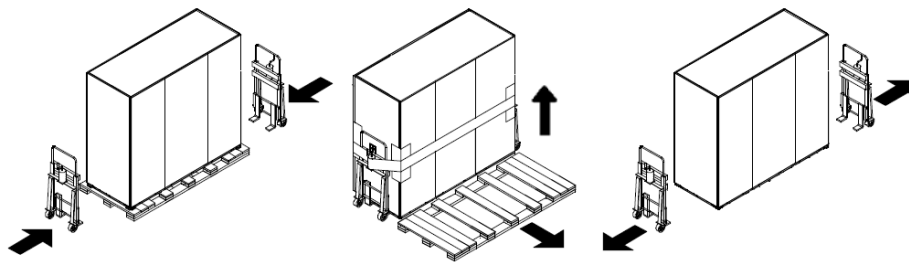
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1.3 UNIT POSITIONING

1.3.1 UNIT POSITIONING WITH WINCH HOIST

To remove the unit from the wood pallet for final positioning, use one or more winch lifters of sufficient capacity (see previous chapters). Proceed as follows for the handling operations:

- 1) Remove the straps and clamps on the wooden pallet.
- 2) Push the winch lifters to the edge of the pallet while holding it securely.
- 3) Make sure the lifting parts of the winch lifters are positioned at the bottom of the unit.
- 4) Secure the units to the winch hoists by means of safety ropes, to avoid accidentally dropping the unit.
- 5) Lift the unit and remove the wooden pallet.
- 6) Bring the unit to the final installation position, taking care not to tilt it, thereby risking damage or drops.
- 7) Should the units need to be placed on a base or plenum, ensure this is already in the final installation position (see following chapters).
- 8) When placement is completed, remove the safety beds and extract the winch hoists.



Handling with winch hoist

1.3.2 FRONT PANEL LOCKS, PANELS SCREWS AND COVER PLATES SCREWS

The front panels feature one-quarter turn safety locks. The type of insert, shown in the following image, requires a special key to be opened. Two copies of these keys are supplied with the unit, one fixed to the outside and one inserted inside the electrical panel as a backup.

The insert is the 8 mm square type, of standard size, therefore it is always possible to make a copy of the keys in specialised hardware stores, specifying the type of coupling required.



Front panel locks



Panel opening key



Insert type

The panels are fixed by screws with a TORX type insert, as indicated below:



Panels screws



Insert type

The cover plates are fixed with Phillips screws, as indicated below:



Cover plates screws





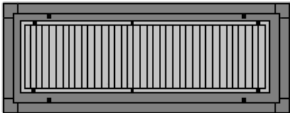

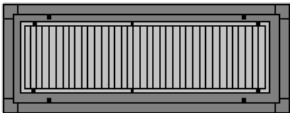
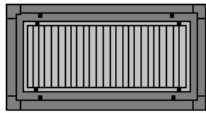
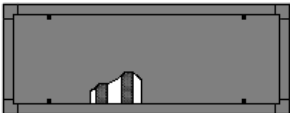
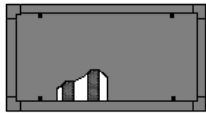
Insert type

2 PLENUMS, VENTILATED PLENUMS AND DUCT SECTIONS (ACCESSORY)

Various types of air distribution plenums are available as accessories for both the Under and Over versions of the unit.

During plenum and duct section installation it is advisable to place a seal (rubber or equivalent material with minimum 5 mm thickness) between them and the unit so as to guarantee the air-tightness of the element.

Below are the various types of plenums:

Plenums and duct sections		
Type	Front View	Right/Left side view
Plenum with solid panels(Drilling must be carried out by the customer)		
Plenum with front grilles		
Plenum with front and side grilles		
Soundproofed duct section		

2.1 PLENUM AND DUCT SECTION DIMENSIONS

The dimensions of the plenum and duct section are found in the order confirmation or in the following tables for standard models (identified by the code number sequence).

Plenum and duct section dimensions			
Standard models	Plan dimensions (mm)		
	Length	Depth	Height
P Series			
071 – 141	750	580	450 / 550 (Lower plenum)
211	860	850	550

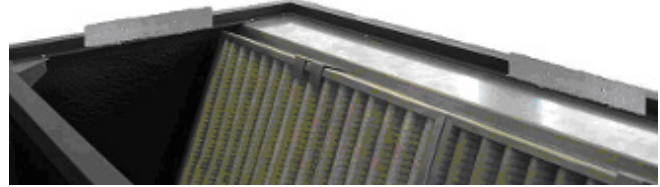
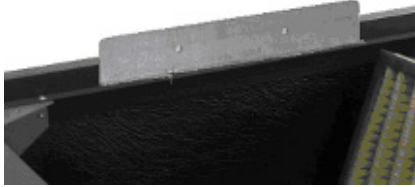
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2.2 INSTALLATION OF PLENUMS AND DUCT SECTIONS ABOVE THE UNIT

Depending on the type of plenum, they are attached in two different ways:

- Unit with sheet metal structure: With bolts inserted in the relative holes.
- Unit with aluminium profile structure: With brackets.

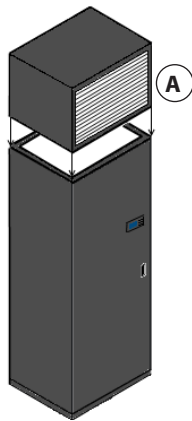
With bracket-mounted models, the brackets need to be attached to the unit's aluminium uprights with self-drilling screws. The brackets should be attached, in a central position, to each side of the unit.



Securing the brackets

Do the following to install plenums and duct sections:

- 1) Place a seal on the plenum profiles (rubber or equivalent material with minimum 5 mm thickness) and position the plenum on the unit, taking care to line the profiles up.
- 2) Attach the unit to the plenum with duly-sized self-drilling screws or bolts (models without clamping brackets).



A Plenum



Example of installation with upper plenum

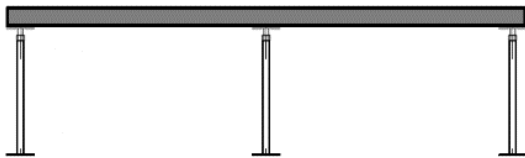

3 ADJUSTABLE AND VENTILATED PLINTHS (ACCESSORY)

When installing plinths it is advisable to place a layer of vibration damping material (rubber or equivalent material with a minimum thickness of 10 mm) between them and the floor to avoid transmitting vibrations to the structure of the building.

The interposition of vibration damping material also enables the recovery of a slight lack of flatness of the floor and to contain the noise level of installation.

It is also advisable to place a seal (rubber or equivalent material with minimum 5 mm thickness) between them and the unit so as to guarantee the air-tightness of the element.

Below are the various types of plenums and plinths:

Adjustable and ventilated plinths		
Type	Front View	Right/Left side view
Adjustable plinths		

3.1 PLINTH DIMENSIONS

The dimensions of the plinths are found in the order confirmation or in the following tables for standard models (identified by the code number sequence).

Adjustable and ventilated plinth dimensions			
Standard models	Plan dimensions - Standard model dimensions (mm)		
	Length	Depth	Minimum/Maximum height
P Series			
071 – 141	750	580	300/600
211	860	850	

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3.1.1 SIZING THE HOLE FOR THE INSTALLATION OF THE PLINTHS IN THE FINISHED FLOOR SURFACE

To permit correct installation of the bases a hole must be made in the floor tiles. The dimensions of the plinths are found in the order confirmation or in the following tables for standard models (identified by the code number sequence).

Raised floor hole size			
Standard models	Dimensions (mm)		
	Length	Depth	Tolerance
	A	B	C
P Series			
071 – 141	750	580	10
211	860	850	

3.2 ADJUSTABLE PLINTH ASSEMBLY

Adjustable plinths come unassembled in a specific kit, accordingly it will be necessary to assemble them as explained in the chapters below.

3.2.1 POSITIONING SUPPORT PROFILES

Position the metal supporting profiles supplied with the assembly kit on a flat surface according to the diagram below.

Supporting tube placement	
Models	Position
071 – 141	
211	

3.2.2 90° BRACKET AND THREADED TUBULAR SUPPORT INSTALLATION



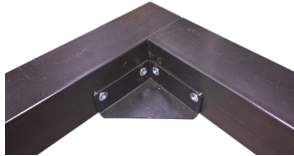





WARNING!



Join the tubular elements so that they form a perfect right angle

To install 90° brackets, supporting profiles and threaded tubular supports, do the following:

1) Take the 90° brackets.		4) Take the threaded tubular supports.	
2) Place the 90° brackets in the corners of the supporting profiles, lined up with the respective clamping holes.		5) Position the threaded tubular supports between two supporting profiles so that the outer edge of the support is flush with the outer surface of the supporting profiles.	
3) Attach the 90° brackets with the self-drilling screws provided with the kit, using a battery-powered screw gun.		6) Secure the threaded tubular supports between two supporting profiles by the self-drilling screws provided with the kit (use the holes and slots provided on the threaded tubular supports), using a screw gun.	

3.3 ADJUSTABLE PLINTH HEIGHT DEFINITION AND ADJUSTMENT

The adjustable plinth support system is composed of two parts:

- One drilled tubular supporting foot.
- One threaded tubular support.

The height must be adjusted as instructed in the next chapters.

3.3.1 ADJUSTABLE PLINTH HEIGHT DEFINITION

The threaded tubular support allows heights to be manually adjusted between 600 and 530 mm with the bolt on the support.

For heights below 530 mm it is necessary to cut the tubular supporting feet to adapt them to the required measurement. The rule that needs to be followed to calculate the measurement of the tubular supporting foot is:

$$\text{Tubular supporting feet height} = \text{Plinth height in mm} - 100 \text{ mm}$$

P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

3.3.2 ADJUSTABLE PLINTH HEIGHT ADJUSTMENT



ATTENTION! DANGER! DANGEROUS HANDLING!

Maximum permitted range of the threaded tubular support is 90 mm!



Greater ranges can cause damage to the supporting feet and a risk of the units falling!

Examples of adjusting the tubular supporting feet	
<p style="text-align: center;">Adjustment from 600 mm to 530 mm</p> <p>The height is adjusted from the hex nut on the threaded tubular support which is screwed in to reduce the height of the plinth.</p>	
<p style="text-align: center;">Plinth height 480 mm</p> <p>Cut the 450 mm cylindrical tube to 380 mm (480-100). Adjust the height for the last time by turning the hex nut.</p>	
<p style="text-align: center;">Plinth height 300 mm</p> <p>Cut the 450 mm cylindrical tube to 200 mm (300-100). Adjust the height for the last time by turning the hex nut.</p>	

3.4 INSTALLATION OF ADJUSTABLE AND VENTILATED PLINTHS ON FINISHED FLOOR SURFACE



ATTENTION! DANGER! DANGEROUS HANDLING!



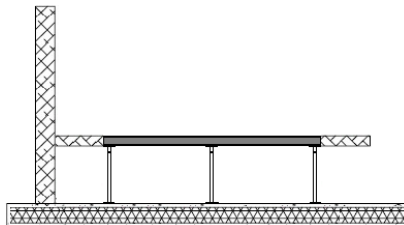
Placing the unit on the plinth before fixing the feet to the slab and positioning the raised floor can cause damage to the supporting feet and a risk of the units falling!

The plinths are installed in the finished floor surface as follows:

- 1) Place the plinth on the slab. With adjusted plinths, attach the feet to the slab with suitable plugs.



- 2) Adjust the feet to ensure that the plinth is flush with the upper edge of the finished floor surface and perfectly level.



- 3) Place a seal on the plinth profiles.
- 4) Position the unit on the plinth, making sure that the aluminium sections are properly aligned with each other.



Example of installation with plinth

P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

4 CONNECTION OF CONDENSATE DISCHARGE AND HUMIDIFIER

4.1 CONNECTION OF CONDENSATE DISCHARGE AND HUMIDIFIER



RISK OF BURNS!

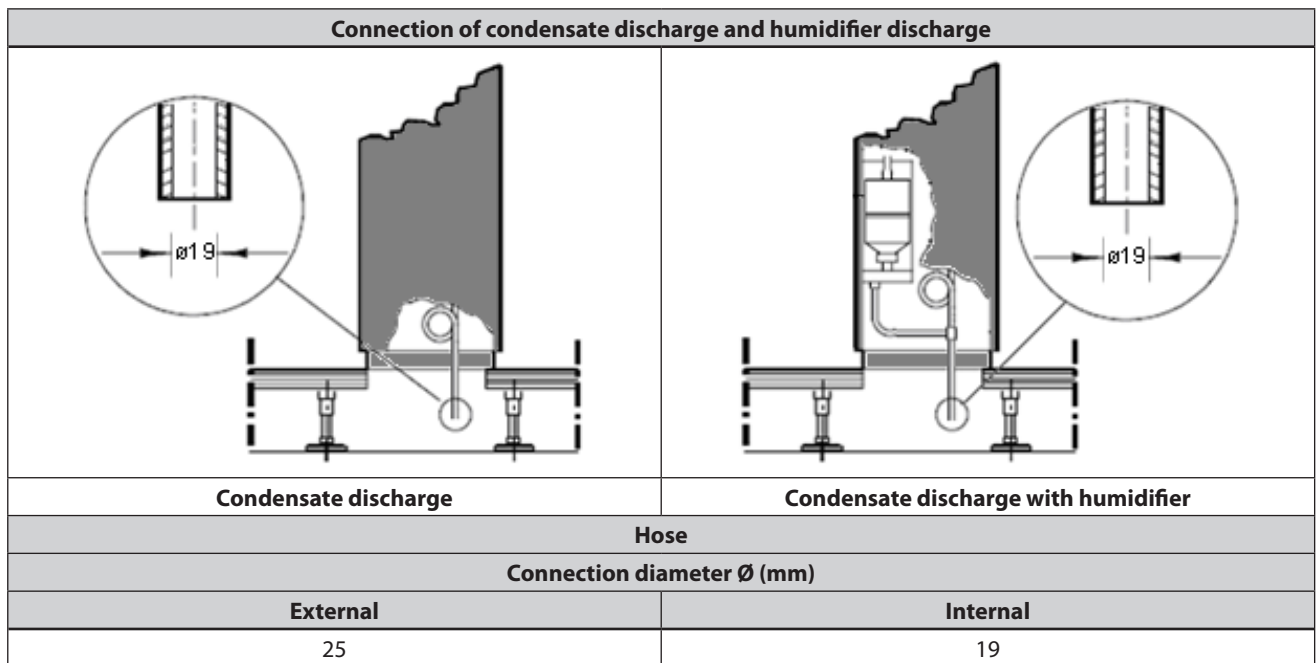


The drainage water of the humidifier may reach temperatures of 100 °C!

All air conditioners, whether direct expansion or water chilled coils, require a condensate discharge connection, and the humidifier discharge of the building waste drainage system.

The trap, essential for draining condensate as the bowl is located in a point of negative pressure, is supplied already installed on the unit and should be connected when the unit is placed in position by the installer. The discharge pipe is Reflex type with external diameter of 25 mm (internal 19 mm).

The humidifier discharge, which does not require a trap, is supplied ready connected to the termination of the condensate discharge.



WARNING!



The condensate discharge is supplied with a trap!

Do not remove the trap supplied with the unit!

In order to avoid drainage problems do not add siphons to the drainage line and plan on a funnel type fitting!



4.2 CONDENSATE BOOSTER PUMP CONNECTION (ACCESSORY)



RISK OF BURNS!

The drainage water of the humidifier may reach temperatures of 100 °C!



All conditioners, both direct expansion and chilled water, can be supplied with a condensation pumping trap (accessory).

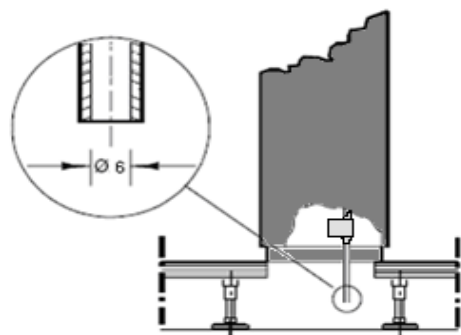


Condensation booster pump

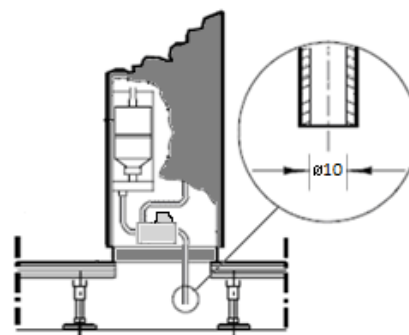
When the unit is installed the drain pipe must be connected to the building's sewage network by the installer. The drainage pipe is flexible and transparent, with an external diameter of 9 mm (internal 6 mm).

In case the unit is fitted with submerged electrode humidifier (accessory), it will be connected to the pump.

Connection of condensate discharge pump and humidifier discharge pump



Condensate discharge



Condensate discharge with humidifier

Hose

Connection diameter Ø (mm)

External	Internal	External	Internal
9	6	14	10

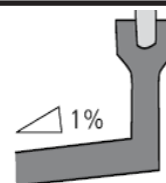
Condensate booster pump specifications

Values		Pump model		
		SI33	SI1830	SI82
Maximum flow rate	l/h	30	400	500
Maximum line difference	m	5		
Maximum line length	m	30		



WARNING!

In order to avoid drainage problems do not add siphons to the drainage line and plan on a funnel type fitting!



P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

4.3 CONNECTION OF THE INTERNAL SUBMERGED ELECTRODE HUMIDIFIER (ACCESSORY)

The units may be fitted with a submerged electrode humidifier to control environmental humidification.

This type of humidifier exploits the conductivity of the water in the cylinder to produce steam. Applying voltage to the electrodes in the cylinder, current will flow between the electrodes that will heat the water until it reaches boiling point.



The humidifier is adjusted with the electronic board installed in the electric panel. The humidifier's work conditions may be checked with the display on the machine.



Submerged electrode humidifier

4.3.1 WATER CONNECTIONS OF THE SUBMERGED ELECTRODE HUMIDIFIER

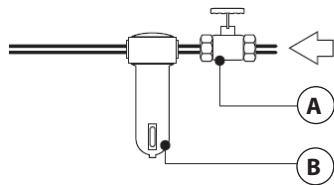
During installation of the unit, you are required to connect the supply piping of the internal humidifier to the water line of the system. The following table shows the type of water connection fitting.

Water connections				
Flexible hose adaptor		Threaded fitting		
				
Connection diameter Ø (mm)		Connection diameter Ø		Threading
External	Internal	Inches	DN	ISO 7/1
8	6	3/4	20	Male

Submerged electrode humidifier cylinder specifications			
Values		Humidifier model	
		3 kg/h	8 kg/h
Steam production	kg/h	0.6 - 3.2	1.0 - 8.0
Cylinder volume	dm ³	1.1 - 3.3	0.9 - 5.4
Instantaneous supply flow rate	l/min	0.6	0.6
Instantaneous discharge flow rate	l/min	10	

4.3.2 SETTING UP THE SUBMERGED ELECTRODE HUMIDIFIER WATER CIRCUITS

The submerged electrode humidifier's supply line shall have the features set out in the table below:



- A Shut-off cock
- B Mechanical filter

Humidifier water supply line

To ensure that circuit pipes are installed correctly, we recommend you follow the instructions below:

- A shut-off cock must be installed on the water supply pipe (A).
- A 50 µ mechanical filter must be installed on the supply line (B).
- The water pressure must range between 1-8 bar (100 and 800 kPa).
- The water temperature must range between 1 and 40 °C.
- The instantaneous water flow rate must not be lower than the nominal flow rate of the supply solenoid valve (0.6 - 1.2 l/min).
- Do not treat with softeners or demineralisation plants.

Once installation is complete, bleed the supply pipe for approximately 30 minutes, channelling the water directly to the drain pipe without letting it enter the humidifier. This will eliminate any waste or processing substances that could block the filling valve and/or create foam during boiling.

4.3.3 CHEMICAL/PHYSICAL CHARACTERISTICS OF THE WATER SUPPLY

The correct functioning of the humidifier mainly derives from the chemical/physical characteristics of the supply water. There is no reliable relationship between water hardness and conductivity and between conductivity and cylinder production!

The cylinder supplied as standard with the units is suitable for water with a specific conductivity at 20 °C between **350 and 750 µS/cm (MEDIUM conductivity)**. If the characteristics of the humidifier feed water do not comply with this type of water, it is possible to consider replacing the standard cylinder with special cylinders suitable for the following conditions:

- 1) Cylinders for **LOW conductivity**: Suitable for water with a specific conductivity at 20 °C between **75 and 350 µS/cm**.
- 2) Cylinders for **HIGH conductivity**: Suitable for water with a specific conductivity at 20 °C between **750 and 1250 µS/cm**.

The following table shows the limit values for correct operation of the various types of cylinders available:

Limit values for feed water of immersed electrode humidifiers					
Values		Waters with low salt content		Normal waters	
		Minimum	Maximum	Minimum	Maximum
Hydrogen ion activity	pH	7	8,5	7	8,5
Specific conductivity at 20 °C	$\sigma_{R,20^{\circ}\text{C}}$ - µS/cm	75	350	350	1250
Total dissolved solids	TDS - mg/l	70	325	325	1160
Fixed residue at 180 °C	R_{180} - mg/l	50	230	230	815
Total hardness	mg/l CaCO ₃	50*	160	100*	400
Temporary hardness	mg/l CaCO ₃	30**	100	60**	300
Iron + Manganese	mg/l Fe + Mn	0	0,2	0	0,2
Chlorides	ppm Cl	0	20	0	30
Silica	mg/l SiO ₂	0	20	0	20
Residual chloride	mg/l Cl ₂	0	0,2	0	0,2
Calcium Sulphate	mg/l CaSO ₄	0	60	0	100
Metallic impurities, solvents, thinners, soaps, lubricants	mg/l	0	0	0	0
* Not less than 200% of the chloride content in mg/l Cl - ** Not less than 300% of the chloride content in mg/l Cl					
Do not treat with softeners or demineralisation plants!					
Should the features of the humidifier's supply water not comply with the features of the special cylinders, alternative systems will need to be assessed that cannot be integrated inside the unit, such as resistor or ultrasound humidifiers					

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4.4 PACi Outdoor Installation

For full details of the PACi outdoor installation, please refer to the relevant Installation and Service Manual

4.4.1 SELECTING THE OUTDOOR INSTALLATION LOCATION



WARNING!



Be careful when picking up and moving the indoor and outdoor units. Get a partner to help, and bend your knees when lifting to reduce strain on your back. Sharp edges or thin aluminum fins on the air conditioner can cut your fingers.

Install the unit once you have checked that the installation location matches the following conditions.

- A location with sufficient ventilation.
- Preferably a location sheltered from rain, direct sunlight, well-ventilated, and where hot and cool air does not build up.
- A location where the area around the discharge is not exposed to animals or plants which could adversely affect the release of hot or cool air from the unit.
- A location where the discharge and operation noise will not be a nuisance surrounding properties.
- A location that can support the product's weight / vibrations and secured for horizontal installation wherever possible.
- A location that does not obstruct the air discharge or intake.
- A location where there is no danger of flammable or corrosive gas leaks.
- A location that provides space for installation and service.
- A location that allows the pipe and cable length fixture for internal and external connections.
- It may need two or more people to carry out the installation work.

4.4.2 SELECTING THE LOCATION FOR INSTALLATION SERVICE

Please secure necessary space to guarantee performance and service & maintenance.

Installation where space above outdoor unit is full exposed	
Installation with restriction on air intake	Installation with restriction on intake and sides

4.4.3 PACi UNIT BASE INSTALLATION DIMENSIONS

The following diagrams provide details of the base fixing arrangement of the PACi base units.

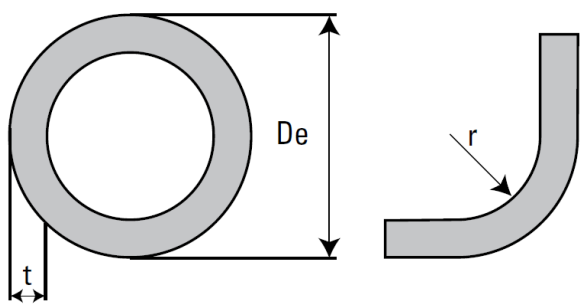
Installation where space above outdoor unit is full exposed		
U-71 ~ U-140PZH4E5(8)	U-250PZH4E8	Anchor bolt arrangement

4.5 REFRIGERANT PIPE CONNECTIONS

4.5.1 TYPE OF PIPE AND SPECIFICATION

The pipes must be made of copper that is suitable for direct expansion cooling circuits as required by standard EN 12735-1. Annealed copper coils may be used (diameters up to 7/8"), as well as hard-drawn copper bars.

In conformity with the EN14276-1 and EN14276-2 standards, the minimum recommend thickness for gas supply line piping, in particular where there are curves, for air condensed units using R32 refrigerant, it must be equal to values present in the table attached here below.

Copper pipe specifications			
			
External diameter Ø		Minimum pipe thickness	Minimum curvature radius
De		t	r
Inches	mm	mm	mm
3/8"	10	0.8	20
1/2"	12	0.8	20
5/8"	16	1	26
3/4"	18	1	27
7/8"	22	1	66
1-1/8"	28	1.2	100

4.5.2 CALCULATION OF THE EQUIVALENT PIPE LENGTH

For correctly sizing the unit cooling lines it is necessary to calculate the equivalent length of refrigerant piping. When referring to equivalent length it means the linear length of the pipes coupled to the equivalent lengths of additional elements of the circuit, such as curves, therefore, the formula for calculation is as follows:

$$\text{TOTAL EQUIVALENT LENGTH (m)} = \text{LINEAR LENGTH OF PIPE SECTIONS (m)} + \text{EQUIVALENT LENGTHS OF CIRCUIT COMPONENTS (m)}$$

The following table includes equivalent length of the most common components of a cooling line:

Equivalent lengths of the cooling circuit components					
External diameter Ø		Curve 45°	Curve 90°	Elbow 90°	Curve 180°
Inches (mm)	mm - metric	m			
3/8" (9.53)	10	0.24	0.26	0.39	0.50
1/2" (12.7)	12	0.26	0.28	0.43	0.54
5/8" (15.88)	16	0.27	0.31	0.46	0.62
3/4" (19.05)	18	0.30	0.40	0.58	0.80
7/8" (22.22)	22	0.35	0.46	0.70	0.92
1-1/8" (28.58)	28	0.45	0.55	0.82	1.10

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4.5.3 PIPE LENGTH AND DIAMETERS OF REFRIGERANT CIRCUIT PIPING

The diameters of the gas and liquid lines must be matched to the supplied outdoor unit to ensure the correct capacity can be obtained

The diameters in the following table indicate the standards based on outdoor unit connection:

Refrigerant Pipe Length Criteria			
Specifications	Standard Models	PACi	Gas / Liquid Line
Maximum pipe length	071	U-71	60 m
	111 - 211	U-100 - U250	100 m
Maximum vertical height difference (Outdoor unit installed above indoor unit)	071 - 211	U-71 - U-250	30 m
Maximum vertical height difference (Outdoor unit installed below indoor unit)	071 - 141	U-71 - U141	15 m
	211	U-250	30 m
Chargeless pipe length	071 - 211	U-71 - U-250	30 m
Please Note: The final installed length of piping must consider the calculation equivalent length See section 6.4.2 - CALCULATION OF THE EQUIVALENT PIPE LENGTH			

Refrigerant Pipe Connection				
Standard models	Gas line Ø		Liquid line Ø	
	Inches (mm)	mm - metric	Inches	mm
P Series				
071 - 141	5/8" (15.88)	16	5/8" (15.88)	16
211	7/8" (22.22)	22	5/8" (15.88)	16
PACi Outdoors				
U-71 - U-141	5/8" (15.88)	16	3/8" (9.53)	10
U-250	7/8" (22.22)	22	1/2" (12.7)	12
Please Note: The interconnecting piping between indoor and outdoor must match the piping sizes indicated for the PACi units, to ensure correct performance and operation. Failure to follow the prescribed pipe sizes may result in reduction of capacity and shorten system lifespan.				

4.6 REFRIGERANT CIRCUIT INSTALLATION

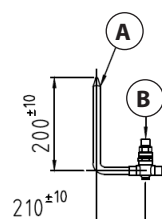
4.6.1 REFRIGERANT CIRCUIT INSTALLATION PRECAUTIONS

To correctly implement the refrigerant circuit, the following precautions must be complied with:

- Do not leave the circuit outdoors for an extended time, to prevent excessive formation of humidity.
- To prevent copper dust or swarf from getting into the system, a suitable pipe cutter must be used.
- It is necessary to carefully clean the pipe endings using the specific pipe reamer.
- Pipes requiring brazing must be cleaned with grade 00 emery paper to eliminate oxidisation and dirt.
- To avoid narrow pipe curvature radius or flattening of the piping, utilise a suitable pipe bender of sufficient diameter.
- Prepare piping with a suitable expander for copper piping to widen the diameter.
- To join the piping, use capillary brazing with oxyacetylene welding torch. The brazing alloy must be copper or a copper-silver alloy.
- During brazing protect the components with a damp cloth to prevent overheating.

4.7 P-SERIES UNIT REFRIGERANT PIPE CONNECTIONS

The refrigerant inlet and outlet connections on the unit can be identified by their adhesive labels. To facilitate connection inside the unit, there is a section of pipe approximately 200 mm long, with relative cock, crimped and welded shut on the free end.



- A Refrigerant line fitting
- B Valve

4.7.1 PRECAUTIONS FOR BRAZING



RISK OF BURNS!



Burn hazard during refrigerant circuit brazing procedures!

WARNING!



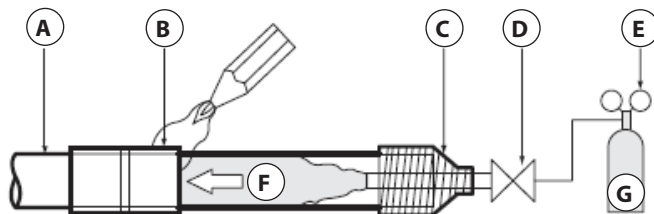
Check the nitrogen flow during brazing. If brazing is performed without using nitrogen, a strong layer of rust will develop inside the pipes, which may damage the valves and compressor and hinder the unit from operating correctly.



When performing brazing while feeding nitrogen into the pipe, the nitrogen must be regulated with a pressure reduction valve at 0.2 Bar (20 kPa) (just sufficient to be felt on the skin).

Use a suitable nitrogen pressurisation brazing kit and proceed as follows:

- 1) Connect the kit to the circuit as shown in the picture below.
- 2) Open the nitrogen feed valves.
- 3) Ensure the nitrogen feeding pressure does not exceed 0.2 Bar (20 kPa).
- 4) If necessary protect the components with a damp cloth to prevent overheating.
- 5) Proceed with heating the pipe section with an oxyacetylene welding torch.
- 6) Add welding material until weld is completed by capillarity.



- A Cooling lines
- B Spot requiring brazing
- C Insulating tape
- D Manual valve
- E Pressure reduction valve
- F Nitrogen
- G Nitrogen cylinder

4.7.2 SEAL TEST OF THE COOLING CIRCUIT WITH NITROGEN PRESSURISATION

Once the refrigerant circuit is completed, a verification of soldered joints and union fittings by way of nitrogen pressurisation is recommended.

Use a suitable nitrogen pressurisation circuit test kit and proceed as follows:

- 1) Connect the kit to the circuit.
- 2) Keep the 3-way valve on the outdoor unit fully closed, pressurising through the service port only.
- 3) Ensure no circuit sections can remain isolated.
- 4) Open the nitrogen delivery valve.
- 5) Do not pressurise the circuit to the default value (4.15 MPa) at once. Pressurise gradually.
- 6) Pressurise to 0.5MPa {5 kgf/cm²G} and then leave it for 5 minutes to ensure that the pressure does not drop.
- 7) Pressurise to 1.5MPa {15 kgf/cm²G} and leave it for 5 minutes to ensure that the pressure does not drop.
- 8) Reach test pressure for R32 systems, shown on the suitable kit pressure gauge. Test to a pressure of 41.5 Bar (4.15 MPa):
 - If the pressure does not reach this value, this means that there is a leak in the circuit.
 - If it reaches the recommended pressure, and maintain for the recommended 24 hour period. The test is considered a success if, in such a period of time, there is no decrease in pressure. Otherwise, it means there is a leak in the circuit.
- 9) Should a leak be found, proceed with the repair and repeat the previous operations, otherwise proceed with vacuum drying operations of the cooling line (see the next chapter).



Kit for nitrogen pressurisation test

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4.8 REFRIGERANT CIRCUIT VACUUM DRYING OPERATIONS



WARNING!



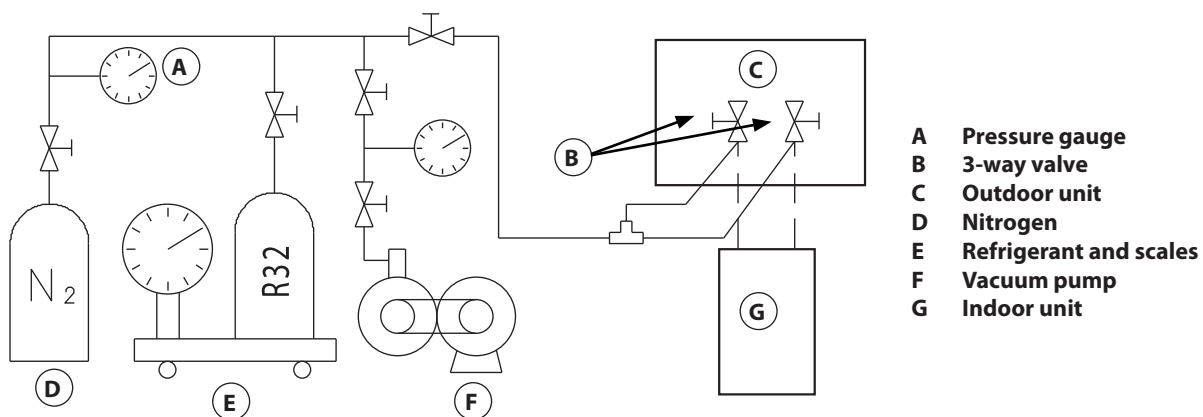
PACi outdoor units are shipped pre-charged with R32 refrigerant. To ensure a safety working environment, please follow the indications details within

After all connections and seal test operations, included in the previous chapters, have been completed for the refrigerant circuit, vacuum drying of the refrigerant circuit is required.

The vacuum drying operation is necessary to remove any residue of the technical gasses used for soldering and seal tests, atmospheric air and the water vapour that is part of it. By creating a vacuum inside the refrigerant line by means of a vacuum pump, the boiling point of water (100 °C at atmospheric pressure) is lowered to the point that, once it reaches a value lower than the temperature of the environment, humidity in the pipes turns into vapour and can, therefore, be ejected. **Vacuum pumps** are necessary to perform this operation suited to the refrigerant circuits (flow rate of 50 litres/minute).

The procedure for carrying out vacuum in the circuit is as follows:

- 1) Connect the pressure gauges to the refrigerant circuit as shown in the figure below.
- 2) Connect the vacuum pump and refrigerant tank to the pressure gauges.
- 3) Power the machine (but not the compressors) to heat the possible crankcase oil heater.
- 4) Verify that all circuit service valves are open.
- 5) Bring the pressure gauges in position for operation in vacuum phase (carry out the vacuum simultaneously from both the liquid side and the gas side).
- 6) Start the vacuum pump.
- 7) The correct vacuum that can be achieved at the installation site is $\leq -101 \text{ kPa}$ (-755 mmHg).
- 8) Leave the pump running for a period of at least 2 hours:
 - If, within two hours, the pump is unable to reach $\leq -101 \text{ kPa}$ (-755 mmHg), this means that there are still traces of humidity or there is a leak.
 - If a vacuum of $\leq -101 \text{ kPa}$ (-755 mmHg) is reached, maintain it for at least one hour. The test is considered a success if, in such a period of time, there is no increase in pressure. Otherwise, it means that there is still humidity inside the pipes, or there is a leak.
- 9) Should there be a leak, proceed with repairing it and repeat the previous operation:
- 10) Close the pressure gauges and switch off the pump.
- 11) Disconnect the pump and move on to refrigerant charging operations.



4.9 CHARGING THE REFRIGERANT CIRCUIT

4.9.1 PRECAUTIONS

WARNING!

This equipment is exclusively meant for professionally prepared operators that know the fundamentals of refrigerant cooling, refrigerant systems, refrigerant gasses, and the possible damages that pressurised equipment may cause.



The PACi outdoor unit must exclusively operate with refrigerants indicated by the Manufacturer. Oxygen must never be allowed to enter the inside of the compressor. Do not start-up the compressor when there are any significant vacuum conditions present inside the refrigerant pipework.



The units are designed to operate with R32 refrigerant. Do not dispose of R32 refrigerant as household waste. R32 is a fluorinated greenhouse gas subject to the Kyoto Protocol, with a Global Warming Potential (GWP₁₀₀) of 675. The refrigerant must be disposed of in accordance with the legislation in force in the country where the units are installed.

Do not tamper or modify the calibration of the safety and control systems. It is recommended to wear suitable personal protective equipment, such as glasses and gloves; some unit components can cause physical injuries to the operator.

4.9.2 REFRIGERANT CHARGE AND ADDITIONAL CHARGE CALCULATIONS

WARNING!



The weights set forth in the tables below must be strictly followed. Failure to follow the recommend refrigerant may result in lack of capacity, reduced performance, and in some cases may significantly reduce the lifespan of the outdoor unit.



Refrigerant charging must be carried out as shown in the subsequent chapters!

The PACi outdoor units are supplied with sufficient refrigerant charge to allow a maximum of 30 m refrigerant piping. For piping length exceeding 30 m, it is necessary to charge with additional refrigerant as per the tables below.


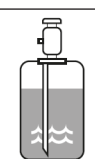
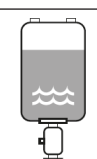
For additional details pertaining to refrigerant charge and installation requirements, please refer to the relevant outdoor unit installation and service manual

PACi Outdoor Refrigerant Charge				
Standard Models	PACi Outdoor Unit Models		PACi Refrigerant Base Charge at Shipment (30 m pipe length range)	Maximum Charge
	Single Phase	Three Phase		
071	U-71PZH4E5	U-71PZH4E8	1.95 kg	2.850 kg
111	U-100PZH4E5	U-100PZH4E8	2.70 kg	
121	U-125PZH4E5	U-125PZH4E8	3.00 kg	
141	U-140PZH4E5	U-140PZH4E8	3.00 kg	
211	-	U-250PZH4E8	4.80 kg	10.400 kg

Additional Refrigerant Charge		
Standard Models	Pipe Length Range	Additional Charge per Metre (calculated on liquid line length)
071	(30 - 60 m)	30 g
111 - 141	(30 - 85 m)	40 g
	(85 - 100 m)	25 g
211	(30 - 100 m)	80 g

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4.9.3 CHARGING THE CIRCUIT WITH REFRIGERANT

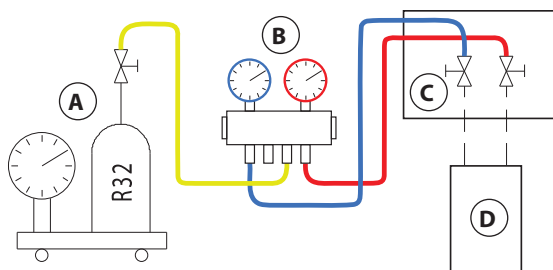
WARNING!			
	The system must only be filled with R32 refrigerant.		
	Refrigerant circuit charging operations must be carried out with the unit powered off, following the safety precautions detailed in the beginning of this manual		
	Always charge the refrigerant in its liquid state. Make sure that the connections between pipes and cylinder are always set up correctly.		
Before charging the circuit, check that the refrigerant cylinder is equipped with a dip tube for the liquid refrigerant.			
Equipped with dip tube		Not equipped with dip tube	
	Charge the liquid refrigerant with the cylinder in the up-right position.		Charge the liquid refrigerant with the cylinder in the upside down position.

It is recommended to perform refrigerant charge operations with ambient temperature within the unit's operating limits. A lower or higher temperature may compromise the actual circuit charge.

PACi units are supplied with sufficient refrigerant to allow a maximum pipe length of 30 m. If the pipe length is below 30 m, no additional refrigerant is required. If the pipe length exceed 30 m, please follow the charge requirements as detailed in REFRIGERANT CHARGE AND ADDITIONAL CHARGE CALCULATIONS, on the previous page.

In order to charge completely proceed as follows (keeping in mind that the refrigerant must always be charged in liquid phase):

- 1) Make sure that circuit valves are fully open
- 2) Fill any additionally required refrigerant charge via the liquid line only. .
- 3) Check that the pressure gauges are compatible with the pressure of the refrigerant used (R32).
- 4) Connect the pressure gauges to the refrigerant circuit as shown in the figure below.
- 5) Check that the refrigerant tank is the type of refrigerant used (R32).
- 6) Place the refrigerant tank on the calibrated scales.
- 7) Connect the refrigerant tank to the pressure gauge unit.
- 8) Place the pressure gauge in "Charge" position.
- 9) Open the LIQUID LINE SERVICE VALVE to insert refrigerant until the desired additional charge has been reached.
- 10) Open the recharging valve on the LOW PRESSURE SIDE, adding enough refrigerant to eliminate the empty condition.
- 11) Place the unit on ON, starting up the fans.
- 12) Start the compressor, being especially careful with double circuit units.
- 13) Verify overheating and operational parameters in order to evaluate the charge.



- A Refrigerant**
- B Pressure gauges**
- C Outdoor unit**
- D Indoor unit**

4.10 CHECKING THE REFRIGERANT LOAD AND COOLING CIRCUIT OPERATION



WARNING!



The compressor needs to be started up a few minutes prior to running the checks!

Correct plant operation, which depends on the choice of fundamental components and the dosage of the refrigerant load, can be checked from the cooling circuit operating values.

A correctly-installed unit that operates within the limits provided in this manual, will present values according to the following table:

Operating values of cooling circuits	
Evaporation pressure	Between 8 BarG and 12 BarG
Evaporation temperature	Between 4 °C and 15 °C
Suction temperature	Between 10 °C and 21 °C
Overheating	Stable at 6 K
Compression ratio	Greater than 1,6
Discharge temperature	Between 55 °C and 80 °C
Condensation pressure	Between 20 BarG and 38 BarG
Condensation temperature	Between 35 °C and 60 °C
Desuperheating	Between 20 K and 30 K
Liquid temperature	Between 25 °C and 50 °C
Sub-cooling	Between 2 K and 10 K
EEV expansion valve opening	Lower than 90%

For units with two cooling circuits, the operating values will be checked with both circuits running.

Values differing from those provided in the table can mean that there is an incorrect refrigerant charge or operating conditions that do not comply with the limits set forth herein.

4.10.1 VERIFY THE REFRIGERANT CHARGE WITH THE PACi OUTDOOR UNITS

During cooling capacity throttling stages, the operating values may appear satisfactory, however, they may no longer be correct at higher compressor speeds.

It is therefore essential that the compressor works at maximum speed before proceeding with the verification of the operating values of the circuit.

WARNING!

Once the charging operations of the cooling circuit are complete, it is mandatory to log the full amount of refrigerant introduced in the circuit on the CE marking found in the unit.



MODEL
OPZ 211
SERIAL NUMBER : 7291617
CODE : 10177116
Manufacturing year : 2025
Order : 4434491
Refrigerant : R32
refrigerant charge : <input type="text"/>



P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

4.11 PRECAUTIONS AGAINST REFRIGERANT LEAKS

The P-Series + PACi direct expansion units operate on R32 refrigerant. R32 refrigerant is considered as mildly flammable, a fluorinated greenhouse gas subject to the Kyoto Protocol, with a Global Warming Potential (GWP₁₀₀) of 675.

According to the REGULATION (EC) no. 517/2014, it is also mandatory for qualified personnel in charge of running the system to carry out periodic checks to identify any leaks, at the regular intervals indicated below:

- A) Devices containing less than 3 kg of fluorinated greenhouse gas are not subject to periodic checks for leaks.
- B) Devices containing fluorinated greenhouse gas in quantities equal to or greater than 5 tonnes of CO₂ equivalent (3 kg) but less than 50 tonnes of CO₂ equivalent (24 kg): at least every 12 months (1 year) or, if a leak detection system is installed, at least every 24 months (2 years);
- C) Devices containing fluorinated greenhouse gas in quantities equal to or greater than 50 tonnes of CO₂ equivalent (24 kg) but less than 500 tonnes of CO₂ equivalent (240 kg): at least every 6 months or, if a leak detection system is installed, at least every 12 months (1 year);

For units subject to periodic checks for leaks (points B and C), it is mandatory for the installer (or qualified personnel in charge of running the system) to create a register for each unit, which records:

- The quantity and type of fluorinated greenhouse gas;
- The quantity of fluorinated greenhouse gas added during installation, maintenance or due to leaks;
- The quantity of fluorinated greenhouse gas recovered during maintenance, repair or permanent dismantling operations;
- If the quantity of fluorinated greenhouse gas recovered has been recycled or regenerated, include the name and address of the recycling or regeneration company, and where applicable, the certificate number;
- The dates and results of the periodic checks carried out for the identification of any leaks.
- The identify of the company that carried out the installation, provided assistance, performed maintenance, and where applicable, repaired or dismantled the devices, including, where applicable, the relative certificate number.

4.12 CHECKING THE MAXIMUM CONCENTRATION OF REFRIGERANT

The P-Series + PACi direct expansion units operate on R32 refrigerant. As R32 refrigerant is deemed as mildly flammable, and thus additional precautions must be followed. As a mildly flammable refrigerant, it poses a risk if its concentration exceeds the Lower Flammability Limit (LFL) for the given volume of a room or area.

The unit of measure for LFL is kg/m³, or the refrigerant weight in kg contained in 1 m³ of air.

Based on current European standards, the maximum LFL concentration is 0.307 kg/m³ for R32 refrigerant.

The concentration of refrigerant can be calculated as follows:

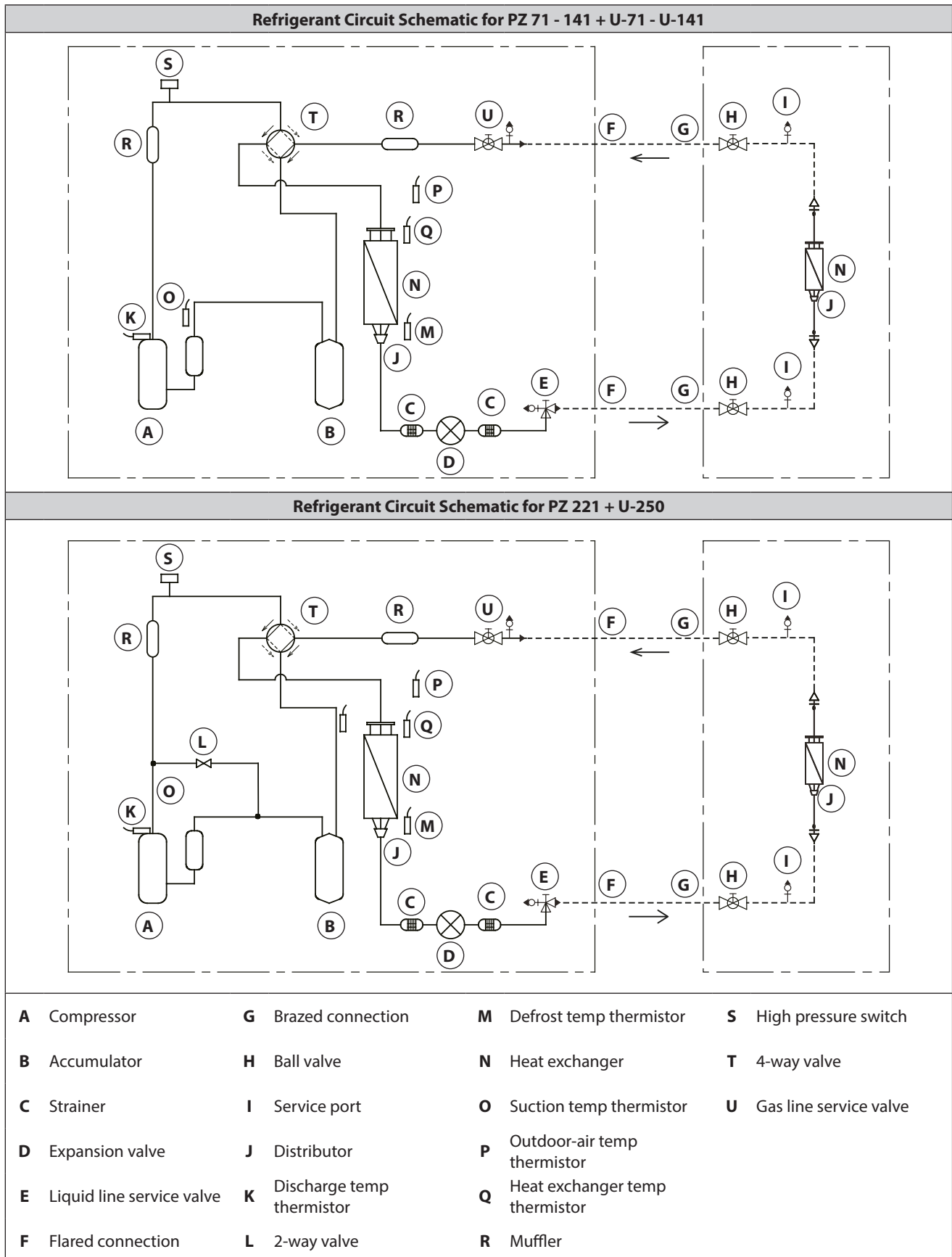
$$\frac{\text{TOTAL QUANTITY OF REFRIGERANT (kg)}}{\text{AMBIENT MINIMUM INTERNAL VOLUME (m}^3\text{)}} \leq 0.307 \text{ kg/m}^3$$

If the concentration of the refrigerant exceeds the maximum level, it will be necessary to implement adequate safety measures, such as openings to adjacent rooms, safety alarms, or an overridden extraction system controlled by a leak detector.

For additional details relating to R32, please refer to SPECIAL PRECAUTIONS FOR R32 REFRIGERANT and CHECK OF DENSITY, at the beginning of this document.

4.13 REFRIGERANT CIRCUIT WITH PACi OUTDOOR UNIT

The following image represents the refrigerant circuits with PACi outdoor unit connections.



P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

5 ELECTRICAL CONNECTIONS

WARNING!



It is necessary to always refer to the electrical diagram supplied with the unit.



The electrical wiring diagram suggests dimension values for the electricity line and the corresponding protective devices.

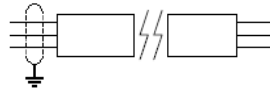
WARNING! - For Communication Cables



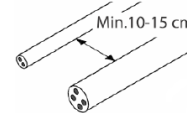
Avoid splicing



Connect one end only of shielding to earth



Do not install with power cables



The electrical connections of the air conditioner must satisfy the following prescriptions:


- The sizing of the power supply line, to be carried out by the installer, must comply with the indications provided in the technical documentation and the regulations of the country where the installation is carried out. The Manufacturer is not liable for any damage resulting from incorrect sizing.
- The electronic devices inside the unit are not compatible with IT distribution systems (Neutral insulated from the earth) as they could be damaged.
- To avoid potential damage to electrical and electronic equipment caused by voltage surges in the electricity supply line, the Manufacturer recommends evaluating the necessity of installing SPDs (Surge Protection Devices) appropriately rated for the type of installation and the frequency of direct lightning strikes on the electricity supply line (EN 62305/1-4).
- To prevent operating problems with the system, it is necessary that no other loads, even those that are part of the same system, are connected downstream of the main switch for the air conditioner, unless explicit permission is granted by the Manufacturer.
- The electronic devices inside the unit require that the differential protection is calibrated from 30 to 300 mA, in order to prevent untimely interventions.
- The electrical power supply line must have the following characteristics in compliance with EN 60654-2 & EN 61000-4-11 standards, in order to prevent possible malfunction of the installed components:

Characteristics of the standard unit electrical supply line				
Type	Nominal values	Permissible tolerance - P-Series Indoor		
		%	Minimum	Maximum
400 Vac - 3-phase - 50 Hz				
Voltage	400 Vac	± 15%	340 Vac	460 Vac
Difference of voltage between the phases	0 Vac	± 2%	- 8 Vac	+ 8 Vac
Frequency	50 Hz	± 2%	49 Hz	51 Hz
Type	Nominal values	Permissible tolerance - PACI Outdoor		
		%	Minimum	Maximum
400 Vac - 3-phase - 50 Hz				
Voltage	400 Vac	- 5% / + 4%	340 Vac	415 Vac
Difference of voltage between the phases	0 Vac	± 2%	- 8 Vac	+ 8 Vac
Frequency	50 Hz	± 2%	49 Hz	51 Hz
230 Vac - 1-phase - 50 Hz				
Voltage	230 Vac	- 4% / + 4%	220 Vac	240 Vac
Difference of voltage between the phases	0 Vac	± 2%	- 8 Vac	+ 8 Vac
Frequency	50 Hz	± 2%	49 Hz	51 Hz
Variations, short interruptions and voltage dips				
In the presence of variations, interruptions and voltage dips of short duration and / or intensity, the unit maintains its normal performance. If they are longer and / or of greater intensity, it is possible that the unit will shut down, or the components belonging to the unit.				
Upon restoration of the correct values of the supply voltage, the equipment restarts automatically, without losing the stored data and consistently with the status of the components that are part of the unit.				

5.1 PACi POWER SUPPLY AND CONTROL CONNECTION TO P-SERIES INDOOR UNIT

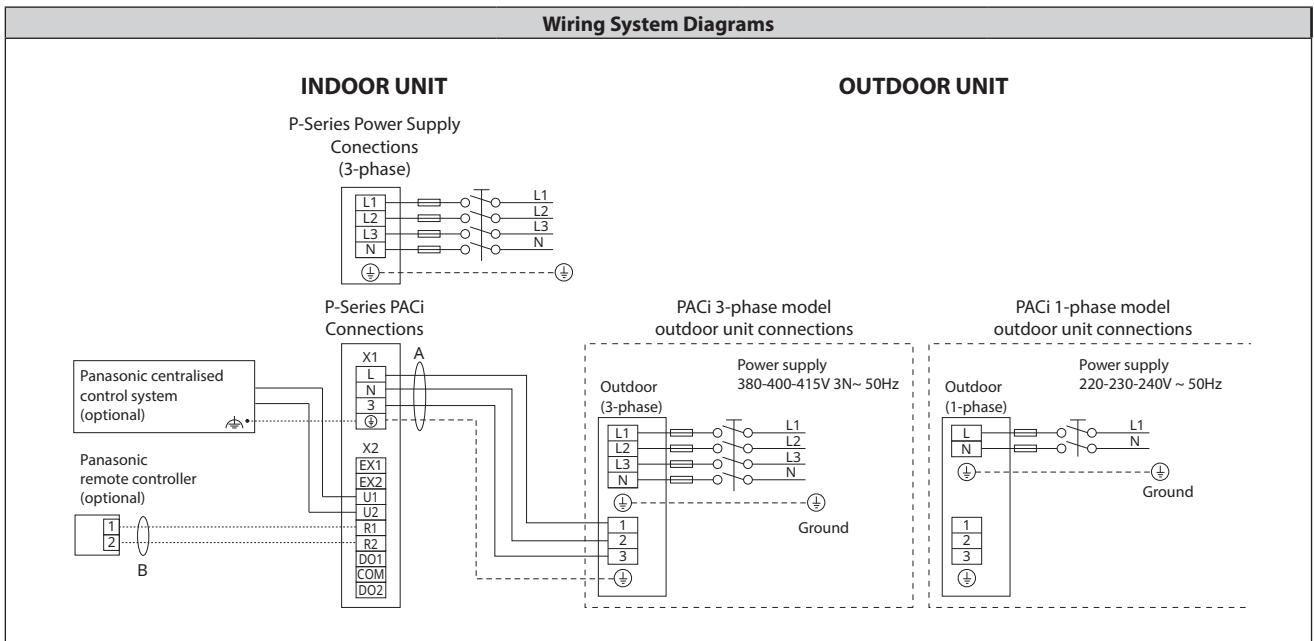
The P-Series is supplied only with 3-phase supply. The PACi outdoor units can be supplied with two types of electric power supply: The interconnecting supply between the PACi outdoor unit and the P-Series consists of a single-phase supply plus communication cable and protected earth cabling.

The following provides an overview of the wiring interconnections and power supply to the outdoor units. For additional information to the outdoor unit and related electrical supply, please refer to the relevant outdoor unit installation and service manual.

 WARNING!	This systems must be installed in accordance with national wiring regulations.
	Cables connected to outdoor unit must be approved polychloroprene sheathed type 60245 IEC 57 or H05RN-F/H07RN-F or heavier.
	The units must be connected to the supply cables for fixed wiring by a qualified technician. Circuit breaker must be incorporated in the fixed wiring in accordance with the national wiring regulations. The circuit breaker must be approved, suitable for the voltage and current ratings of equipment and have a contact separation by 3 mm in all poles.
	When the supply cable is damaged, it must be replaced by a qualified technician.
	Be sure to install a suitable residual current leakage circuit breaker, or similar, main switch and fuse to the main power supply, to prevent the the risk of electric shocks.
	Be sure to connect the unit to a secure earth connection. Earth wire shall be Yellow/Green (Y/G) in colour and longer than other AC wires for safety reasons.
	If the earthing work is not carried out properly, there may be a risk of electric shocks.
Wiring shall be connected with the specified cables and securely fixed to prevent external force transferring from the cable to the terminal connection section.	
Imperfect connection and fixing may lead to fire, and risk of electric shock, etc.	



Wiring System Diagrams



Wiring Specifications

Model name	Power supply	Min wire size (mm ²)	Max. length (m)	Time delay fuse or circuit capacity (A)
U-71PZH4E5	220-230-240V~	2.5	12	25
U-100PZH4E5		6.0	21	35
U-125PZH4E5		6.0	18	40
U-140PZH4E5		6.0	18	40
U-71PZH4E8	380-400-415V 3N~	1.5	74	15
U-100PZH4E8		1.5	51	15
U-125PZH4E8		1.5	45	15
U-140PZH4E8		1.5	45	15
U-250PZH4E8		2.5	26	25

For wiring specification other than those indicated above, please refer to the relevant installation and service manuals

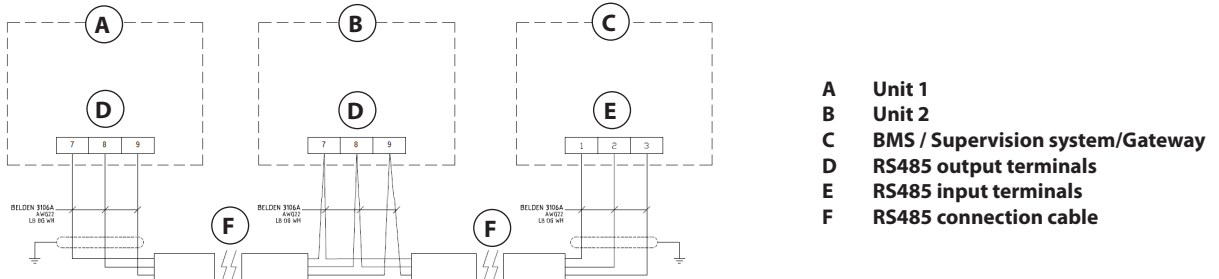
P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

5.2 RS485 SERIAL COMMUNICATION BOARD CONNECTION (Modbus RTU - BACnet MS/TP)

The SURVEY³ microprocessors can be connected to a supervision and/or BMS (Building Management System) network, which adopts the Modbus RTU (Standard) or BACnet MS/TP (Accessory) protocol through a dedicated RS485 serial board.

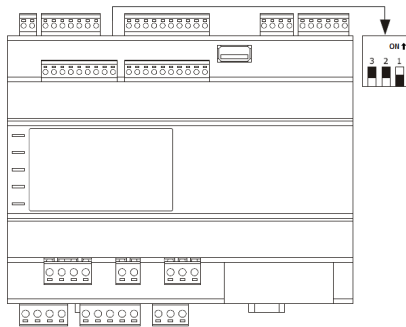
Using this type of board it is also possible to connect the gateways necessary to interface the SURVEY³ with networks that use different protocols to those available as accessories.

To create a connection to the RS485 board, simply connect the units from the terminals on it (see wiring diagram for further information):



In order to guarantee correct serial communication between the network-connected units, it may be necessary to insert a 120 Ω terminating resistor.

SURVEY³ microprocessors fitted with suitable micro switches for activating suitable 120 Ω terminating resistors if set to ON.



Set micro switch RS485LT2 (1) to ON to activate the 120 Ω terminating resistor

The type of cable to be used for the connection must have the following features:

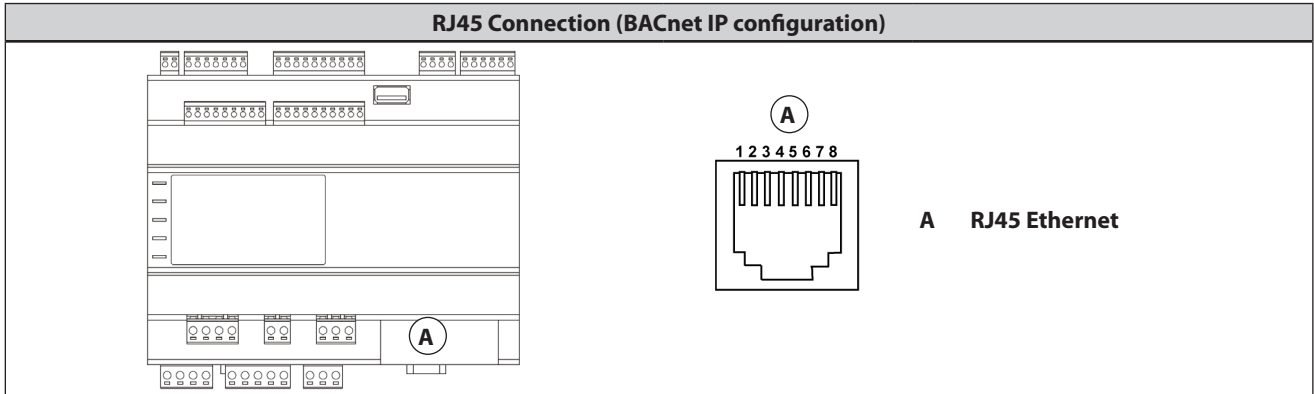
Main features of serial communication cable		
Type	Data transmission cable	
Application	EIA RS485 Interface	
Shielding	Tinned copper braid - Cover at least 65%	
Cross-section and number of conductors	2 x 0.35 mm ² - AWG 22 + 1 x 0.35 mm ² - AWG 22	
Stranding	Twisted pairs	
Nominal loss (1 MHz)	dB/100m	1.64
Maximum DC resistance for conductor at 20°C	Ω/km	49
Insulation resistance at 20°C	MΩ*km	5000
Mutual capacitance c-c / c-s	nF/km	40 - 70
Inductance	mH/km	0.7
Impedance	Ohm	120 +/- 0.12
Maximum length	m	100
Example		

5.3 ETHERNET RJ45 PORT CONNECTION (Modbus TCP - BACnet IP - Web Server)

The SURVEY³ microprocessors can be connected to a supervision and/or BMS (Building Management System) system, which adopts the Modbus TCP (Standard) or BACnet IP (Accessory) protocol through a dedicated RJ45 serial board.

Through the RJ45 serial board it is also possible to view supervision Web pages through the Web Server function (Accessory).

To make the connection to the Ethernet network, simply connect the SURVEY³ microprocessors through the RJ45 port on the board:



The type of cable to be used for the connection must have the following features:

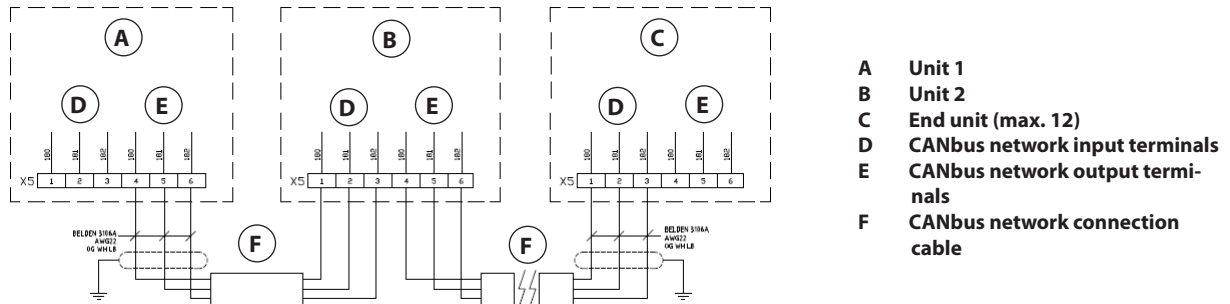
Main features of ethernet communication cable		
Type	LAN/ethernet cables Cat. 6/6A	
Application	IEEE 802.3: 10Base-T; 100Base-T; 1000Base-T; 10GBase-T	
Shielding	Pair shielded with Aluminium/Polyester foil (PiMF)	
Cross-section and number of conductors	4 x 2 x 0.13 mm ² - AWG 26	
Stranding	Twisted pairs	
Maximum DC resistance for conductor at 20°C	Ω/km	130
Insulation resistance at 20°C	MΩ*km	> 2000
Mutual capacitance c-c / c-s	pF/km	43
Impedance	Ohm	100 +/- 5
Maximum length	m	100
Example	<p>The example shows two types of Ethernet cable wiring: EIA/TIA-568B and EIA/TIA-568A. The 568B diagram shows a cross-section of a cable with 8 conductors, where the outer pairs are twisted and the inner pairs are untwisted. The 568A diagram shows a similar cross-section but with a different internal wiring arrangement.</p>	

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5.4 CANbus LAN CONNECTION (ACCESSORY)

SURVEY³ microprocessors can be interconnected in a CANbus LAN (Accessory) that allows several units to run so as to optimise the regulation of the air-conditioned rooms.

To create a LAN, simply connect the units from the terminals on it (see wiring diagram for further information). Refer to the next chapter for connecting the remote terminal.



The connection cable is supplied together with the units. If a change is required, the type of cable to be used for the connection must have the following features:

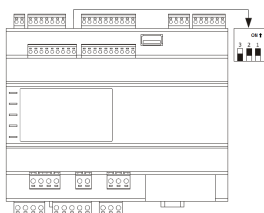
Main features of serial communication cable		
Type	Data transmission cable	
Application	EIA RS485 Interface	
Shielding	Tinned copper braid - Cover at least 65%	
Cross-section and number of conductors	2 x 0.35 mm ² - AWG 22 + 1 x 0.35 mm ² - AWG 22	
Stranding	Twisted pairs	
Nominal loss (1 MHz)	dB/100m	1.64
Maximum DC resistance for conductor at 20°C	Ω/km	49
Insulation resistance at 20°C	MΩ*km	5000
Mutual capacitance c-c / c-s	nF/km	40 - 70
Inductance	mH/km	0.7
Impedance	Ohm	120 +/- 0.12
Maximum length	m	100
Example		

5.4.1 CANBUS LOCAL NETWORK TERMINATING RESISTORS

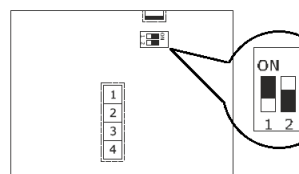
WARNING!

Set micro switches to **ON** to activate 120 Ω terminating resistor **IN THE FIRST (Unit 1) and LAST UNIT OF THE LOCAL NETWORK.**

In order to assure correct serial communication between the units connected in a CANbus network, the network must have terminating resistors at both ends. SURVEY³ microprocessors and user terminals are fitted with suitable micro switches for activating suitable 120 Ω terminating resistors if set to ON.



Set micro switch CANLT (3) to ON to activate the 120 Ω terminating resistor

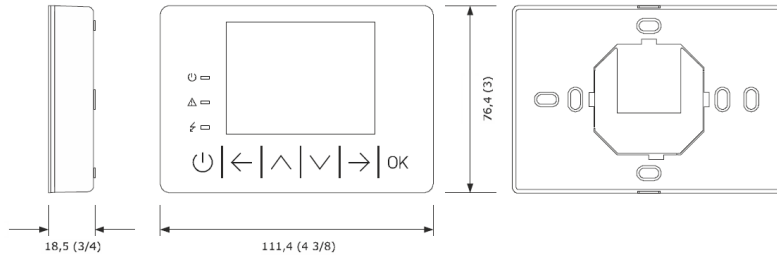


Set micro switch 2 to ON to activate the 120 Ω terminating resistor.

5.5 REMOTE CONTROL TERMINAL CONNECTION (ACCESSORY)

If the terminal is to be panel or recess-mounted, the maximum thickness of the panel must be 6 mm; if the terminal is to be recess-mounted in a wall, it is necessary a square recess-mounted resin box for 6 (3+3) modules (506E BTicino type).

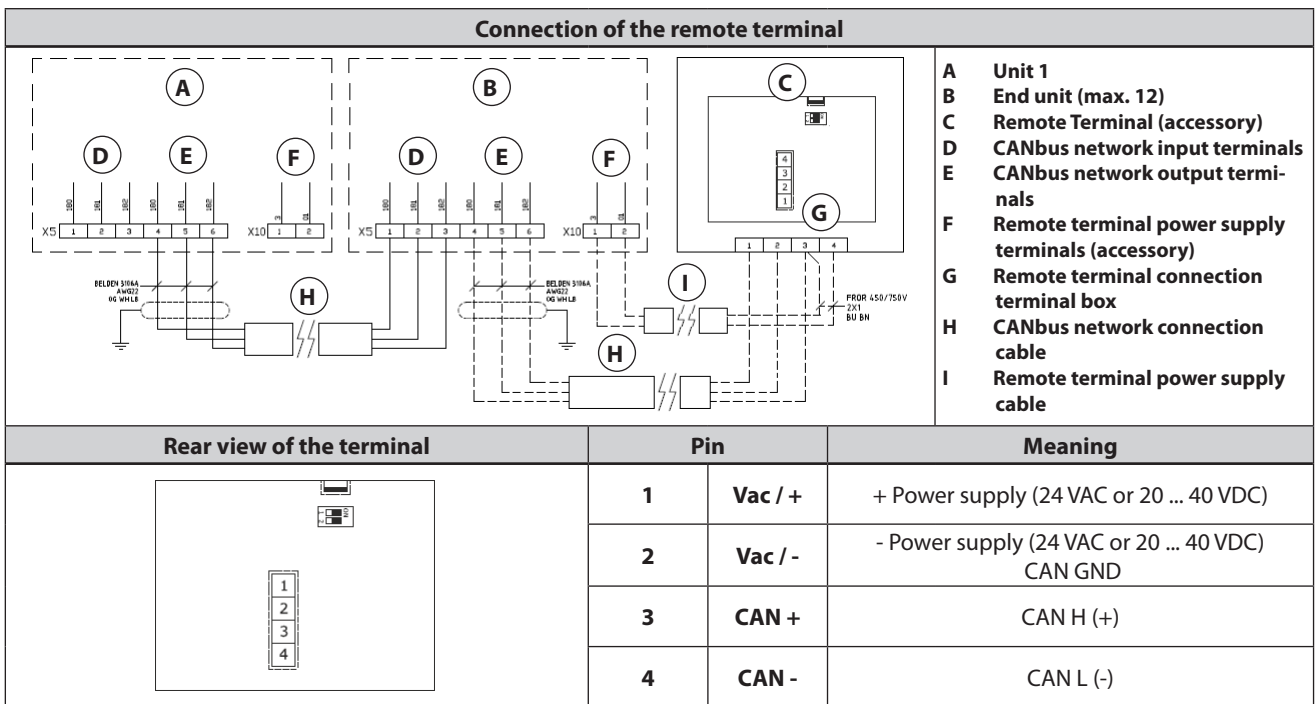
The dimensions and drilling template are as follows:



Remote terminal dimensions

In order to power the remote display through the unit, it needs to be enabled for such connection through the dedicated accessory.

The connections to the remote display must be made as indicated in the electrical wiring diagram supplied with the unit. The figure below shows the connection diagram and terminal box of the remote terminal.



The connection cable between the remote display and the CANbus communication network must have the characteristics described in the previous chapter. The power cable of the display must have the following characteristics:

Main features of the power supply cable		
Type	FS18OR18 300/500 Vac cable	
Shielding	Not required	
Cross-section and number of conductors	2 x 1 mm ²	
Maximum length	m	100
Example		

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5.6 WALL-MOUNTED TEMPERATURE AND HUMIDITY PROBE CONNECTION (ACCESSORY)

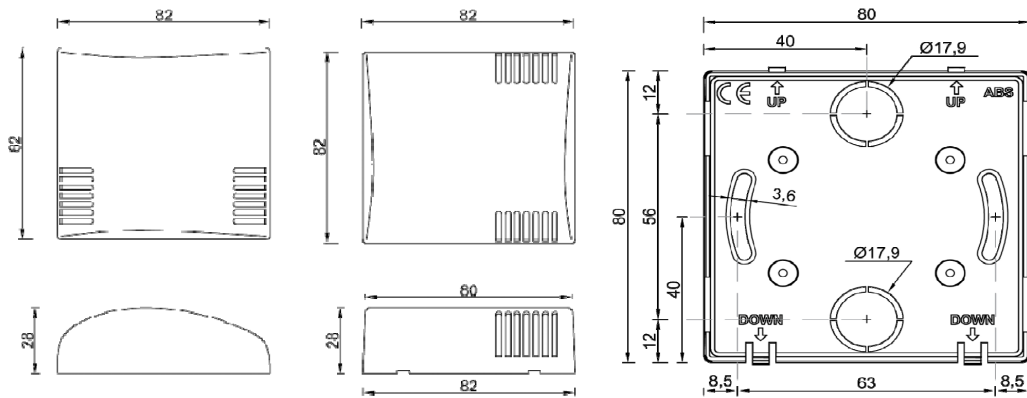
The supplied temperature and humidity probe allows managing the room temperature and humidity detection in systems where return detection is not real or satisfying like, for example, systems with partial outside air introduction in the return.

The supplied probe is of wall installation type. It is recommended to position the probe at a minimum height of 1600 mm off the floor for the most reliable temperature readings.

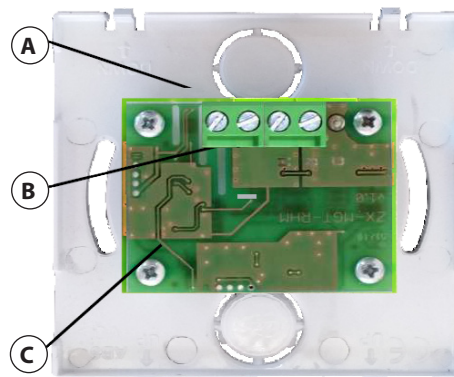
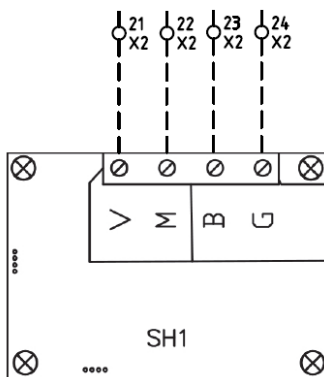
The connections must be made as indicated in the electrical wiring diagram supplied with the unit. The figure below shows the probe's connection terminal board and the position of the jumpers for correct operation of said probe.



Wall-mounted temperature and humidity probe



Size and drilling jig for wall-mounted installation



- A Probe support
- B Connection terminals
- C Electronic board

Temperature and humidity probe connection

The type of cable to be used for the connection must have the following features:

Main features of the connection cable	
Type	FR2OH2R16 450/750 Vac signal transmission cable
Shielding	Tinned copper braid - Cover at least 65%
Cross-section and number of conductors	4 x 0.35 mm ²
Maximum length	m 100
Example	

5.7 DUCTED TEMPERATURE AND HUMIDITY PROBE CONNECTION (ACCESSORY)

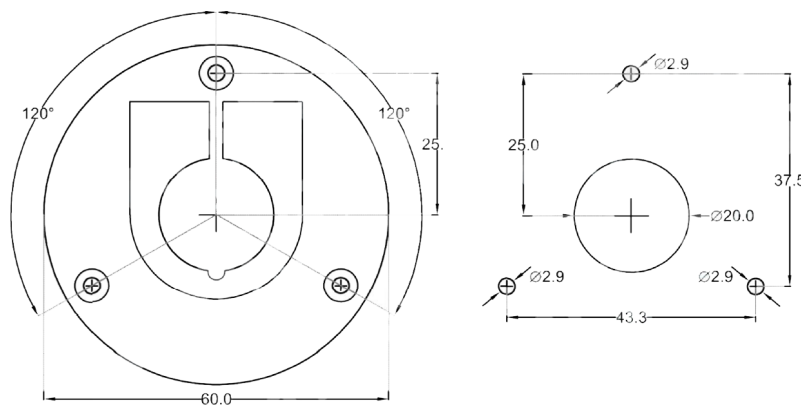
The supplied temperature and humidity probe allows managing the room temperature and humidity detection in systems where return detection is not real or satisfying like, for example, systems with partial outside air introduction in the return.

The supplied probe is the duct installation type. It is recommended to position the probe at the centre of the duct for the most reliable temperature readings.

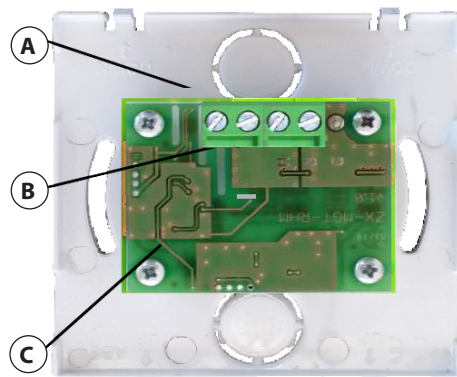
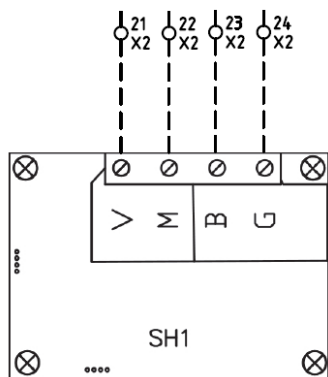
The connections must be made as indicated in the electrical wiring diagram supplied with the unit. The figure below shows the probe's connection terminal board and the position of the jumpers for correct operation of said probe.



Ducted temperature and humidity probe



Drilling template for duct installation



- A Probe support**
- B Connection terminals**
- C Electronic board**

Temperature and humidity probe connection

The type of cable to be used for the connection must have the following features:

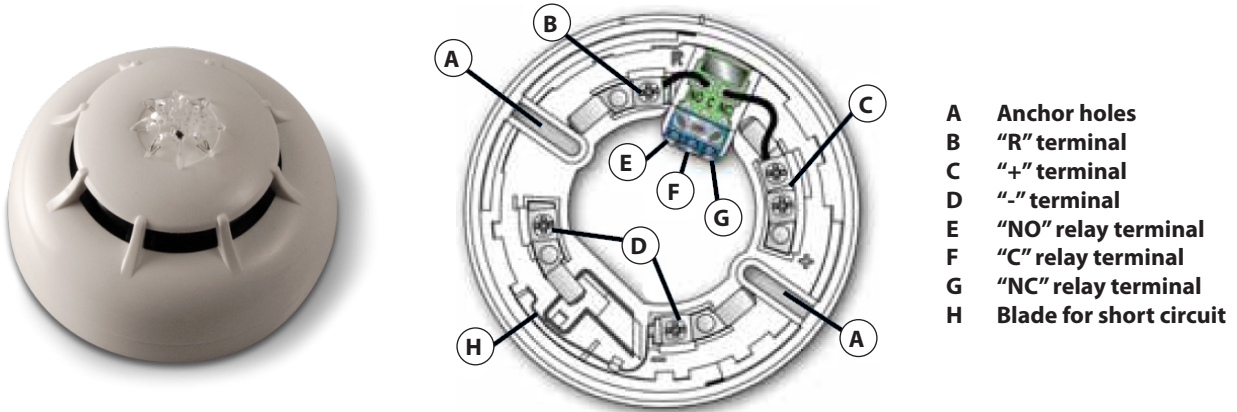
Main features of the connection cable	
Type	FR20H2R16 450/750 Vac signal transmission cable
Shielding	Tinned copper braid - Cover at least 65%
Cross-section and number of conductors	4 x 0.35 mm ²
Maximum length	m 100
Example	

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5.8 CONNECTION OF THE SMOKE AND FLAME DETECTORS SUPPLIED (ACCESSORY)

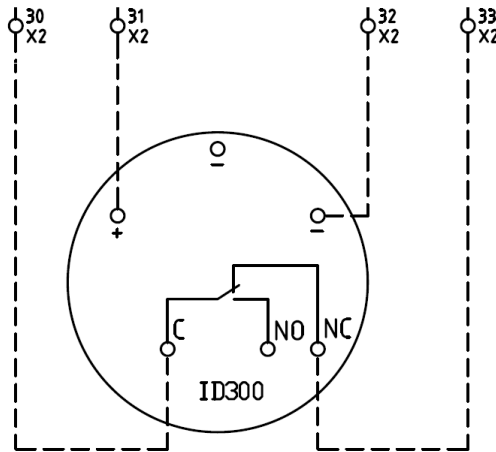
The smoke and flame detectors supplied detect the presence of smoke or flames in the environment.

The supplied probe is of wall installation type. The connections must be made as indicated in the electrical wiring diagram supplied with the unit. The terminal board for connecting the sensor is shown in the figure below.



Smoke and flame sensors

Anchor base and connection



Connection of the smoke and flame sensors

The type of cable to be used for the connection must have the following features:

Main features of the connection cable		
Type	FS18OR18 300/500 Vac cable	
Shielding	Not required	
Cross-section and number of conductors	4 x 1 mm ²	
Maximum length	m	100
Example		

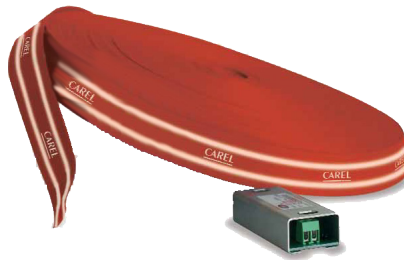
5.9 WATER DETECTION PROBE CONNECTION (ACCESSORY)

The accessory for detecting the presence of water provides an alarm if the probe, supplied with the device, is even partially covered with water.

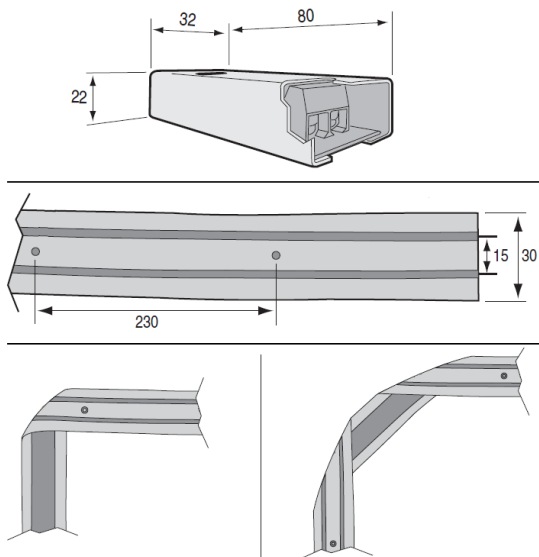
The probes are comprised of an anti-corrosive metal container (local probe) or a fabric belt (belt probe). Inside the probes there are two stainless steel metal electrodes to read the alarm condition.

The water presence probe must be positioned in the area being controlled and connected as shown on the wiring diagram supplied with the unit, being careful to ensure that the detection part is positioned correctly.

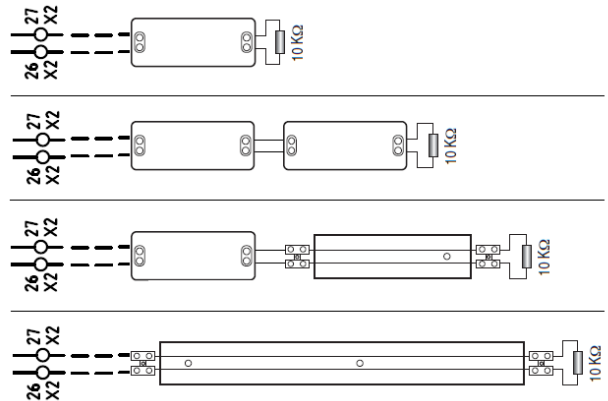
It is possible to connect multiple probes in series to control a wider area. The following figure shows an example of connection.



Water detection probe



Probe dimensions



Probe connection

The type of cable to be used for the connection must have the following features:

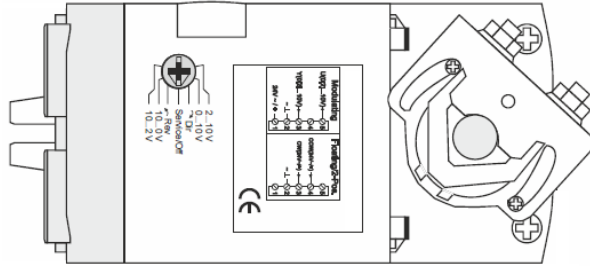
Main features of the connection cable		
Type	FS18OR18 300/500 Vac cable	
Shielding	Not required	
Cross-section and number of conductors	2 x 1 mm ²	
Maximum length	m	100
Example		

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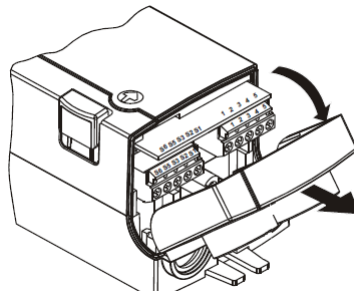
5.10 CONNECTION OF FREE COOLING PLENUM MOTORISED DAMPER ACTUATORS (ACCESSORY)

The Free Cooling plenum accessory has two motorised dampers controlled by the regulator through a 0-10 Vdc signal.

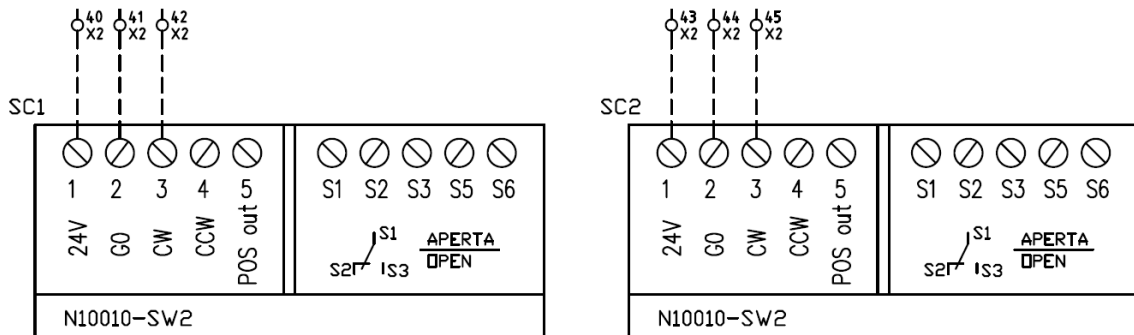
The damper actuators are supplied mounted on the dampers, and equipped with 3 metres of pre-wired cable in the actuators. The actuator cables have to be connected inside the unit's electrical panel, as shown in the figure:



Motorised damper actuator



Position of damper actuator connection terminals



Connection of the damper actuators

The type of cable to be used for the connection must have the following features:

Main features of the connection cable		
Type	FS18OR18 300/500 Vac signal transmission cable	
Shielding	Not required	
Cross-section and number of conductors	3 x 0.5 mm ²	
Maximum length	m	100
Example		

6 ROUTINE AND SPECIAL MAINTENANCE



WARNING!

The product must be serviced by skilled personnel who fulfil the adequate requisites for the task as defined by the regulations in the country where positioning and installation of the product take place.

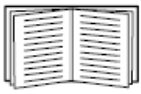


Routine and special maintenance checks					
		Check at least every			
Components		1 Week	1 Month	3 Months	6 Months
Routine maintenance to be carried out by the user					
Special maintenance to be carried out by the maintenance service or service centre					
Control micro-processor	Make sure the system works properly	X			
	Check for any alarms	X			
	Check the mother board connections				X
	Check the control boards and displays				X
	Make sure that the sensor readings on the unit are correct				X
Air filters	Check filters for clogging		X		
	Check filter status: Fastening, any damage			X	
	Check operation and calibration of differential pressure sensors				X
Humidifier	Check the condition of the cylinder		X		
	Carry out the automatic cylinder washing procedure		X		
	Check the condition of the charging and discharge valves			X	
	Inspect the gaskets/seals			X	
	Replace the cylinder if necessary			X	
Fans	Check the general condition: corrosion, fastening, cleanliness			X	
	Verify the noise of the motor			X	
	Check the impeller: vibrations, unbalancing			X	
	Verify the absorbed current				X
	Clean the impeller and the motor				X
Electrical panel	Clean the components with compressed air			X	
	Check the unit's power supply				X
	Check the correct tightening of the clamps				X
	Check the power consumption of electrical components				X
	Test safety devices				X
Water circuits	Check operation of the 3-way valves			X	
	Check circuits for leaks			X	
	Bleed air from circuits			X	
	Check circuit temperatures and pressures			X	
	Check the amount of glycol in the circuit				X
	Make sure the water circulates properly				X
Cooling circuits	Check the operating temperatures and pressures			X	
	Check the condition of the compressor			X	
	Check the condition of the liquid sight glass filter			X	
	Check operation of the safety devices				X
	Check the amount of refrigerant in the circuit				X
Condensers	Check the condition of the remote condenser			X	
	Check the calibration of the remote condenser regulator			X	
	Check that the remote condenser is receiving power correctly				X
	Check the adjustment valve of the water cooled condenser				X
	Verify the circulation of water/air in the condenser				X

P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

6.1 ROUTINE MAINTENANCE

6.1.1 CONTROL MICROPROCESSOR MAINTENANCE



For further and more detailed information concerning regulation, see the **MICROPROCESSOR OPERATING MANUAL**.



The microprocessor requires periodical checks to verify operational statuses and the presence of possible alarms in components that may compromise proper unit operation.

For further information concerning alarms and operations, see the installed microprocessor operating manual.



6.1.2 MAINTENANCE ON THE AIR FILTERS

ATTENTION! DANGER!



Risk of immediate start-up after resetting the main switch if used as an emergency stop!

The main switch can be used as an emergency stop when the operator is near the machine (during start-up, operation and maintenance). In this case, resetting the main switch will allow the machine to immediately restart, without any additional action by the operator.

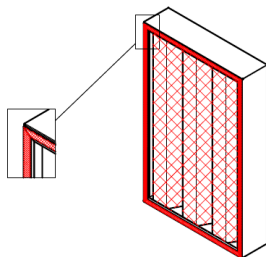


WARNING!



The filters are non-regenerable.

It is advisable to replace with original pieces only. Filters that do not conform to the original filters may not be compatible with the unit performance and cause operating problems.



WARNING!

To guarantee the efficiency of the filters, it is necessary to install a 15 x 3 mm seal.



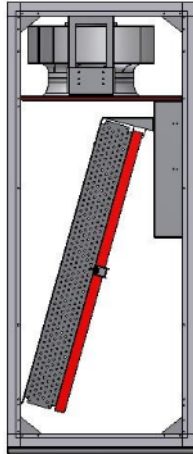
The Manufacturer's air conditioners are equipped with, on all installed filters, differential pressure sensors in order to monitor pressure loss of the dirty filter. The microprocessor signals when the measured pressure difference exceeds the set value. To change the trip setting of a differential pressure switch, simply unscrew the cover and turn the setting dial to the desired pressure drop value.

FILTER TYPE	POSITION	VALUE [Pa]
G4 Filter	Return	250
M5 filter (Accessory)	Return	250

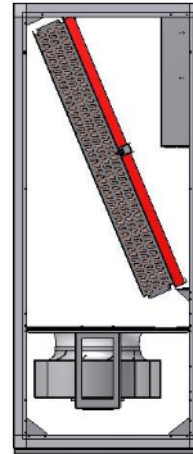
6.1.3 AIR FILTER REPLACEMENT

To replace the air filters the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

- 1) Set the main switch to "0".
- 2) Open the panels via the relevant safety locks.
- 3) Remove the filter support by turning the screws.
- 4) Replace the dirty filters with clean ones.
- 5) Position the support and secure it with the screws.
- 6) Close the panels and return the main switch to "I".



Position P unit air filters with air supply facing upwards







Position P unit air filters with air supply facing downwards

P-SERIES + PACI - CLOSE CONTROL AIR CONDITIONERS

6.1.4 MAINTENANCE OF INTERNAL HUMIDIFIER

ATTENTION! DANGER!

	Risk of immediate start-up after resetting the main switch if used as an emergency stop!		
The main switch can be used as an emergency stop when the operator is near the machine (during start-up, operation and maintenance). In this case, resetting the main switch will allow the machine to immediately restart, without any additional action by the operator.			
	RISK OF BURNS! The cylinder may be hot! Let cool before handling or use protective gloves	RISK OF ELECTRIC SHOCK! Set the main switch to "0" before every activity	

The service life of the humidifier cylinder depends on various factors, including: correct sizing and operation, the supply water, which must fall within the nominal values, the hours of use and correct maintenance. After a variable period of time, the cylinder will inevitably need to be replaced. To meet the above requirements, follow the instructions below.

The humidifier requires periodic checks to ensure correct operation and extended cylinder lifetime. These checks should be performed as follows:

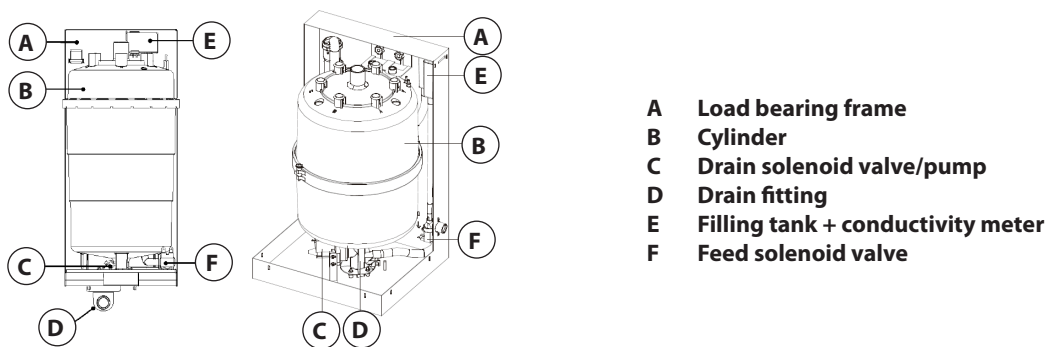
- **No later than the first 300 hours of operation:** Check operation, make sure there are no significant leaks of water, and check the general condition of the housing. Make sure that no sparks or arcs between electrodes are formed during operation.
- **Quarterly and never less frequently than every 1000 hours of operation:** Check operation, make sure there are no significant leaks of water, and replace the cylinder if necessary.
- **Annually and never less frequently than every 2500 hours of operation:** Proceed with changing the cylinder

After prolonged use, and above all in the event of water with a high salt content, solid deposits may cover the electrodes completely and adhere to the side walls. In some cases the heat produced may deform the cylinder and, in more serious cases, may create holes in the plastic wall with resulting leaks of water into the tray. To prevent this problem, increase the frequency of checks, halving the intervals between maintenance procedures.

6.1.5 CYLINDER REPLACEMENT









To replace the humidifier cylinder the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

- 1) Drain all water from the cylinder using the relative function.
- 2) Set the main switch to "0".
- 3) Open the panels via the relevant safety locks.
- 4) Slide out the cylinder steam tube.
- 5) Detach the electrical connections from the top of the cylinder.
- 6) Release the cylinder from its fixture and lift to remove.
- 7) Connect the new cylinder and secure to the support.
- 8) Close the panels and return the main switch to "1".



Internal humidifier components

6.2 SPECIAL MAINTENANCE

	RISK OF ELECTRIC SHOCK! Set the main switch to "0" before every activity	
	RISK OF BURNS! Some parts of the cooling circuit may be hot!	
	RISK OF CUTS! Sharp parts!	
	ATTENTION! DANGER! Risk of immediate start-up after resetting the main switch if used as an emergency stop! The main switch can be used as an emergency stop when the operator is near the machine (during start-up, operation and maintenance). In this case, resetting the main switch will allow the machine to immediately restart, without any additional action by the operator.	

6.2.1 MAINTENANCE OF THE ELECTRICAL CONTROL PANEL AND ELECTRICAL COMPONENTS

For the electrical control panel and electrical components maintenance the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

- 1) Check the unit's power supply.
- 2) Check the electrical connections and make sure the terminals are properly tightened.
- 3) Check the power consumption of electrical components.
- 4) Test safety devices.
- 5) Change protection fuses, if required.
- 6) Clean the components with compressed air jets from a minimum distance of 30 cm (to avoid damaging plastic parts), paying particular attention to the cooling fans and heat sinks.

6.2.2 REPLACING THE CONTROL MICROPROCESSOR

To replace the control microprocessor the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

- 1) Set the main switch to "0".
- 2) Open the panels via the relevant safety locks.
- 3) Disconnect all connectors on the board.
- 4) Remove the microprocessor from the DIN guide.
- 5) Replace with the scheduled original spare part.
- 6) Close the panels and return the main switch to "I".
- 7) Proceed with configuration, as specified in the SURVEY³ microprocessor technical manual.



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6.2.3 FAN MAINTENANCE

For fans maintenance the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

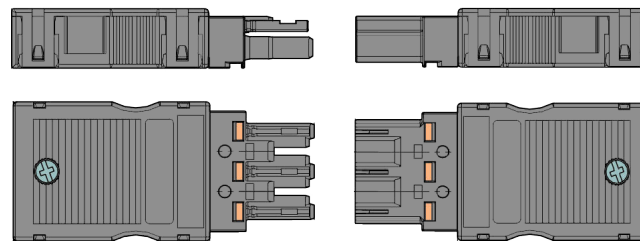
- 1) Check the general condition: corrosion, fastening, cleanliness.
- 2) Verify the noise of the motor.
- 3) Check the impeller: vibrations, unbalancing.
- 4) Verify the absorbed current.
- 5) Clean the impeller and the motor.



6.2.4 REPLACING THE FANS

To replace the fans the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

- 1) Set the main switch to "0".
- 2) Open the panels via the relevant safety locks.
- 3) Disconnect the electrical connections from the terminal block of the fan.
- 4) Remove the fan from its seat.
- 5) Replace with an original spare.
- 6) Carry out electrical connections from the terminal board of the fan as specified in the wiring diagram.
- 7) Close the panels and return the main switch to "I".



Plugs and sockets for quick connection

6.2.5 FAN AUTO-ADDRESSING IN CASE OF REPLACEMENT



During the auto-addressing process the NEW FANS will have to be connected ONE AT A TIME.



In the event of fan replacement, the SURVEY³ microprocessor features a check and auto-addressing function of the Modbus master network. In the event of a communication alarm of one or more fans the SURVEY³ microprocessor will start checking whether there are new fans in the network.

If the SURVEY³ microprocessor finds a non configured fan (new) in the network, it will change the address to that of the faulty one. If there is an alarm on several fans, this fan will be given the first free address.

6.2.6 REFRIGERANT CIRCUIT MAINTENANCE

For the refrigerant circuit maintenance the following instructions must be observed, as well as full compliance with safety obligations regarding use of the equipment:

- 1) Check the work pressures and temperatures from the screen of the Survey^{EVO} controller microprocessor.
- 2) Check overheating, sub-cooling and desuperheating from the screen of the Survey^{EVO} controller microprocessor.
- 3) Check the condition of the liquid sight glass filter.
- 4) Check operation of the safety devices.
- 5) Check the calibration and operation of the regulation components.
- 6) Check the refrigerant charge level and make sure there are no circuit leaks.
- 7) Check the condition of the cooling coil. Any cleaning needs to be carried out with hot water and soap, using a brush with long, soft bristles. It is also possible to use compressed air as long as it is oil-free.

6.2.7 REPLACEMENT OF THE MAIN COMPONENTS OF THE REFRIGERANT CIRCUIT



ATTENTION! DANGER!

Neither the circuit nor the compressor must be left in open air for more than 15 minutes to avoid humidity contaminating the oil.



To replace the main components of the cooling circuit (valves, sight glass filter, coils etc.) the following instructions must be complied with, without prejudice to full compliance with safety obligations arising from use of the equipment:

- 1) Set the main switch to "0".
- 2) Open the panels via the relevant safety locks.
- 3) Collect all refrigerant (with the special recovery pump, pressure gauges and rechargeable tank). This gas may be re-used.
- 4) Open the cooling circuit by unscrewing the service needle valves with the provided key.
- 5) Disconnect any electrical connections of the components in question.
- 6) Remove the component by cutting the pipes next to it and install the new component.
- 7) Braze everything as indicated in the previous chapters.
- 8) Close the cooling circuit by re-applying the service needle valves using the appropriate spanner.
- 9) Perform a test using pressurised Nitrogen to verify that the system is airtight, as specified in the previous chapter.
- 10) With soap lather, check all new soldering has been carried out and leave under pressure for at least 24 hours.
- 11) After the required time, perform a pressure check with the provided pressure gauges.
- 12) When the test has been completed, empty out all of the nitrogen and proceed to the vacuum phase.
- 13) Vacuum the cooling circuit, as specified in the previous chapters.
- 14) Close the panels and return the main switch to "I".
- 15) Charge with new refrigerant, as specified in the previous chapters.
- 16) Check the operating conditions of the cooling circuit, as specified in the previous chapters.

7 DEACTIVATION, DISMANTLING AND DISPOSAL



WARNING!



The product must be dismantled by skilled personnel who fulfil the adequate requisites for the task as defined by the regulations in the country where positioning and installation of the product take place.

For the deactivation, dismantling and disposal of the units, the following must also be considered:

- The direct expansion units contain R32 refrigerant, a fluorinated greenhouse gas subject to the Kyoto Protocol. Therefore, during dismantling, the health and safety provisions, professional disposal regulations of the refrigerant gas and regulations of the country where the product will be positioned and installed, must be complied with.
- This device may contain hazardous substances (oil, glycol, etc.), therefore improper use or incorrect disposal may have negative effects on human health and the environment. Public or private waste collection systems are to be used for disposal, as defined by local laws and regulations.
- The units are made mostly of recyclable materials. It is therefore recommended to carry out a separate collection of these materials.

7.1 DISPOSAL OF MATERIALS CONTAINED IN UNITS

Disposal activities inherent to the product are carried out at three separate times. Once the materials have been separated as indicated below, these must be assigned the CER codes and then sent for disposal according to the provisions of the national legislation in force.

- **Disposal of packaging:**
 - 1) Packaging must be disposed of taking care to separate recyclable materials (see the following table):
- **Disposal of substances during maintenance operations:**
 - 1) Waste material resulting from maintenance operations must be sorted for disposal, separating any recyclable materials.
 - 2) The air filters must be disposed of as special waste depending on the substances contained therein, originating from the environment in which the units operate.
 - 3) If the cooling system needs to be emptied, regulations concerning the recovery and professional disposal of the refrigerant gas in the country where the product is positioned and installed, must be complied with.
 - 4) If the compressor oil needs to be replaced, it must be disposed of in accordance with the regulatory provisions of the country where the product is positioned and installed.
 - 5) The gas filters must be disposed of as materials contaminated by the compressor oil, in accordance with the regulatory provisions of the country where the product is positioned and installed.
 - 6) The copper pipes may contain traces of compressor oil.
- **Disposal at end of unit's service life:**
 - 1) Waste material resulting from dismantling operations must be sorted for disposal, separating any recyclable materials (see the following table).
 - 2) The air filters must be disposed of as special waste depending on the substances contained therein, originating from the environment in which the units operate.
 - 3) If the cooling system needs to be emptied, regulations concerning the recovery and professional disposal of the refrigerant gas in the country where the product is positioned and installed, must be complied with.
 - 4) If the compressor oil needs to be replaced, it must be disposed of in accordance with the regulatory provisions of the country where the product is positioned and installed.
 - 5) The gas filters must be disposed of as materials contaminated by the compressor oil, in accordance with the regulatory provisions of the country where the product is positioned and installed.
 - 6) The copper pipes may contain traces of compressor oil.

7.1.1 LIST OF THE MATERIALS CONTAINED IN THE UNITS

The following table lists the materials used, **upon shipment**, to produce the units.

Standard packaging P series units				
Material	Composition	Weight	Recyclability	CAS n° or Alloy
Pallets	ISPM15 fumigated wood	33%	100%	-
Plastic film	PE	33%	100%	9002-88-4
Polystyrene	EPS 6	33%	100%	9003-53-6

P series units				
Material	Composition	Weight	Recyclability	CAS n° or Alloy
Galvanised sheet metal	Steel/Zinc	70%	95%	DX51D + Z150
Aluminium	-	13%	95%	91728-14-2
Copper	-	12%	96%	65357-62-2
Plastic	ABS	2%	85%	97048-04-09
Plastic	PE	2%	85%	9002-88-4
Paint	Epoxy/Polyester	0.2%	-	-
Refrigerant	R32	See chapters above	99%	-
Other materials	Miscellaneous	0.8%	-	-

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8 APPENDIX 1: RECOMMENDED EQUIPMENT

The table below lists the equipment required to perform unit installation, start-up and maintenance.

	Heavy duty American type pipe wrench		Set of flathead screwdrivers
	Adjustable wrench		Set of Phillips screwdrivers
	Reversible ratchet wrench		Set of Torx® screwdrivers
	Cordless drill		Grinder or saw
	Pipe-bending device for copper pipes		Expander for copper pipes
	Pipe cutter for copper pipes		Pipe reamer for copper pipes
	Oxygen/propane soldering kit		Nitrogen pressurisation kit
	4-way manometric unit with hoses (R32)		High performance vacuum pump
	Electronic scale		Refrigerant suitable for the unit (R32)
	Digital multimeter with current clamp		Electronic leak detector

9 APPENDIX 2: PRELIMINARY CHECKS AND FIRST START-UP



WARNING!



The product must be installed and started up by skilled personnel who fulfil the adequate requisites for the task as defined by the regulations in the country where positioning and installation of the product take place.

9.1 PRELIMINARY CHECKS

9.1.1 VERIFICATION OF POSITION AND INSTALLATION

	Description	Positive	Negative
1	Check that the units received comply with the order and transport documents.		
2	Check for any damage due to transport or positioning of the unit.		
3	Check that the packaging of the unit is completely removed.		
4	Check that the unit is placed flat and sufficiently insulated from the floor and walls (if necessary).		
5	Verification of compliance with the space for routine maintenance.		
6	Check for obstructions on the supply and return air vents and the front of the machine.		
7	Verify that the environmental conditions are favourable so as to enable the start-up and there is no hazard.		

9.1.2 VERIFYING THE DISCHARGE CONNECTIONS

	Description	Positive	Negative
1	Verify that the condensate and humidifier discharges are connected properly to the discharge line.		
2	Verify that the trap in the unit has not been removed.		
3	Make sure the drain line has no counter slopes or traps that may prevent the regular flow of water.		

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9.1.3 CHECKS ON THE AIR CONDENSED DIRECT EXPANSION CIRCUIT

Description		Positive	Negative
1	Diagram of cooling circuit		
2	Check that the supply and liquid pipe diameter fulfils the indications in the installation manual.		
3	Make sure there are oil traps at the base of each rising pipe and every 5 m rising pipe section (raised condenser).		
4	Check that the supply pipe is insulated in the sections where accidental operator contact is possible (Pipe temperature in operation approx. 70/80 °C).		
5	Check that support brackets are installed on the supply and liquid pipe are not too tight, so as to allow expansion of the pipe.		
6	Check that cooling circuit pipe connections of the condenser with the evaporator are opposite the flow direction of the air flow.		
7	Check that the outdoor units is positioned correctly, to prevent air recirculation that would otherwise impair performance.		

CHECKS OF THE VACUUM OF THE AIR CONDENSED DIRECT EXPANSION CIRCUIT

Description		Positive	Negative
1	Make sure the cooling circuit valves are open.		
2	Check opening of the solenoid valve (if present on circuit).		
3	Check the seal of the cooling circuit.		
4	Check the high and low side pressure gauges connection in VACUUM position.		
5	Check the vacuum level of the cooling circuit.		

9.1.4 REFRIGERANT CHARGE OF THE AIR CONDENSED DIRECT EXPANSION CIRCUIT

Description		Positive	Negative
1	Check the high and low side pressure gauges connection in CHARGING position.		
2	Check the correspondence of refrigerant with that used by the unit (R32)		
3	Check final refrigerant charge by filling in through the suitable fitting downstream of the expansion valve.		

9.1.5 ELECTRICAL POWER SUPPLY CHECK

	Description	Positive	Negative
1	Check the connection of the three phases, neutral and earth.		
2	Verify that the characteristics of the electrical supply line fall within the operating limits and comply with that indicated in the wiring diagram.		
3	Verify that the electrical connections with the condenser isolator fall within the operating limits and comply with that indicated in the wiring diagram.		

9.1.6 VERIFY CONNECTIONS TO ROOM PROBE, REMOTE TERMINALS, LAN AND RS485 SERIAL BOARD (IF PRESENT)

	Description	Positive	Negative
1	Make sure the RS485 board is wired as indicated on the wiring diagram and in the installation manual.		
2	Check the activation of the terminating resistance of the RS485 network.		
3	Check connection of LAN cable as indicated in the electrical wiring diagram and the installation manual.		
4	Check the activation of the opening and terminating resistance of the LAN.		
5	Check the positioning of the remote terminal as described in the installation manual.		
6	Check that the electrical connection between the remote terminal and the electrical panel is as indicated in the wiring diagram and the installation manual.		
7	Check the positioning of the room probes as described in the installation manual.		
8	Check that electrical connection between the sensors and the electrical panel is as indicated in the electrical wiring diagram and the installation manual.		
9	Check the positioning of the smoke and flame detectors as described in the installation manual.		
10	Check the electrical connection between the smoke and flame sensors, as indicated in the electrical wiring diagram and the installation manual.		
11	Check the positioning of the water detection probes as described in the installation manual.		
12	Check that the electrical connection between the water detection sensors and the electrical panel is as indicated in the electrical wiring diagram and the installation manual.		
13	Check the wiring of the closing resistance of the water detection sensors.		

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9.2 FIRST START-UP

WARNING!



Starting up or checking machines with cooling circuit requires the units to be powered on for at least two hours prior to the arrival of the technician, in order to allow the compressor's crankcase oil heater to reach working temperature and allow evaporation of any refrigerant deposited in it and guarantee correct compressor operation.



The crankcase heaters switch on automatically when the machine is powered on.

9.2.1 UNIT SUPPLY

	Description	Positive	Negative
1	Make sure the disconnecting switch is ON (unit powered).		
2	Make sure the disconnecting switch of the outdoor units is ON (PACi is powered on).		
3	Make sure the phase sequencer is working properly.		
4	Make sure all electrical utilities of the unit are correctly powered.		

9.2.2 TURNING THE UNIT ON

	Description	Positive	Negative
1	Check the setting of the unit Set-point.		
2	Check the settings of the microprocessor user parameters.		
3	Check unit switch-on with the ON/OFF key.		

9.2.3 REFRIGERANT CHARGE OF THE AIR CONDENSED DIRECT EXPANSION CIRCUIT

	Description	Positive	Negative
1	Check the high and low side pressure gauges connection.		
2	Check the evaporation pressure.		
3	Check the condensation pressure.		
4	Check the overheating of the refrigerant aspirated by the compressor.		
5	Check the sub-cooling of the liquid refrigerant.		
6	Check that the liquid line filter is not clogged.		

9.2.4 QUANTITY OF REFRIGERANT IN THE CIRCUIT

	Description	Type	Kg
1	Charging refrigerant during the start-up phase.		
2	Adding refrigerant on site.		

9.2.5 CHECKING REFRIGERANT CIRCUIT OPERATION

Description		Value	Positive	Negative
1	Evaporation pressure			
2	Evaporation temperature			
3	Suction temperature			
4	Overheating			
5	Compression ratio			
6	Discharge temperature			
7	Condensation pressure			
8	Condensation temperature			
9	Desuperheating			
10	Liquid temperature			
11	Sub-cooling			

9.2.6 CHECKING CORRECT COMPONENT OPERATION

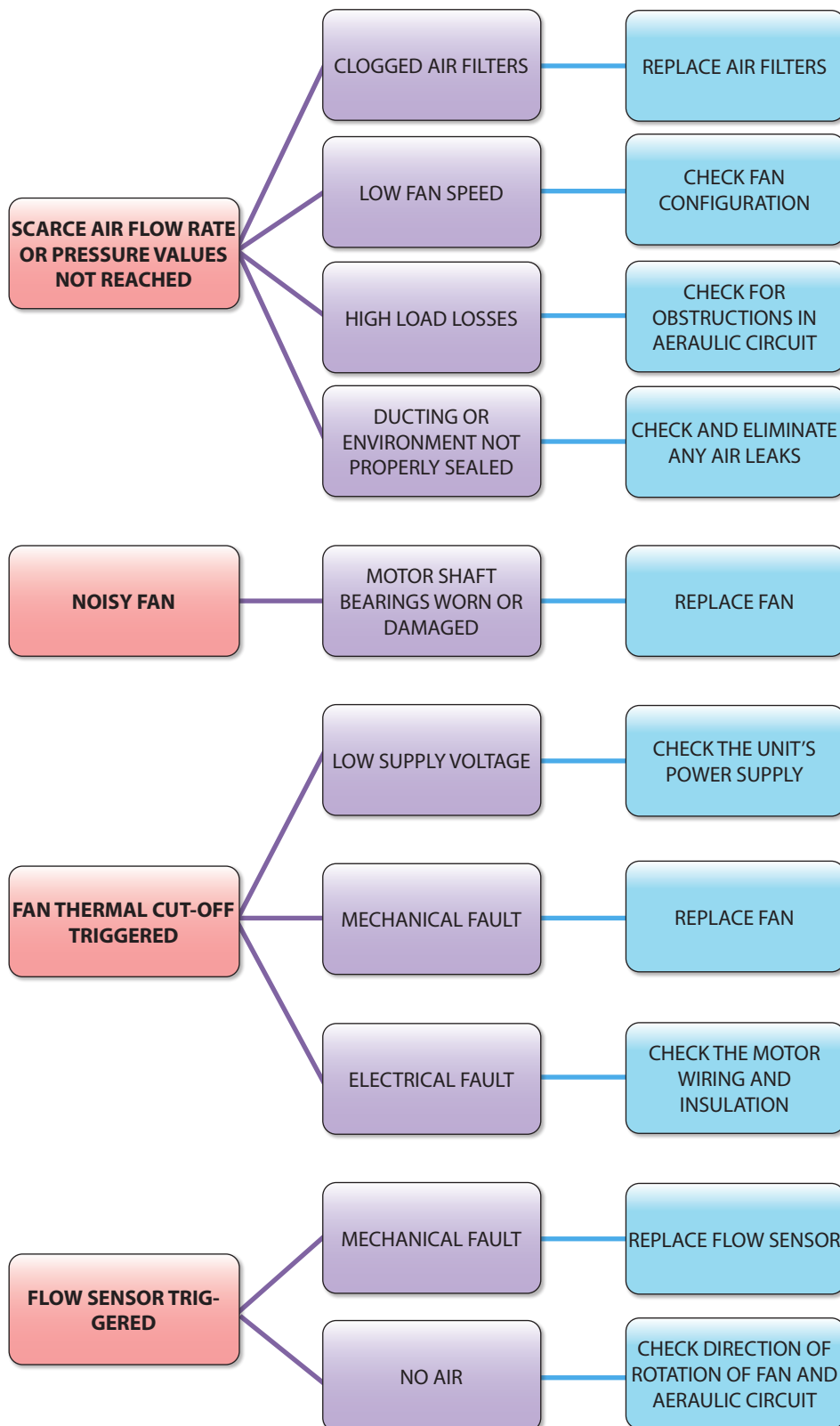
Description		Value	Positive	Negative
Fans				
1	Check fan current consumption.			
2	Check flow sensor operation.			
3	Check reading of the differential pressure probe (if present).			
Electric coils				
1	Check the current consumption of the electric coil.			
2	Check correct operation of the electric coil.			
Humidification				
1	Check the current absorbed by the humidifier.			
2	Check correct operation of the humidifier.			
3	Make sure the water charges correctly.			
4	Make sure the water discharges correctly.			
Local network				
1	Check correct operation of the LAN.			
2	Check rotation of the unit in LAN.			
Miscellaneous				
1	Check correct operation of the dirty filter alarm.			
2	Check correct operation of the water alarm.			
3	Check correct operation of the smoke and flame detectors.			
4	Ensure that the remote OFF is working.			
5	Carry out a general check of the unit's electrical components.			

9.2.7 MAKE SURE THE UNIT IS OPERATING CORRECTLY

Description		Positive	Negative
1	Ensure that the set temperature is reached.		
2	Ensure that the set humidity is reached.		
3	Check correct general operation of the unit.		

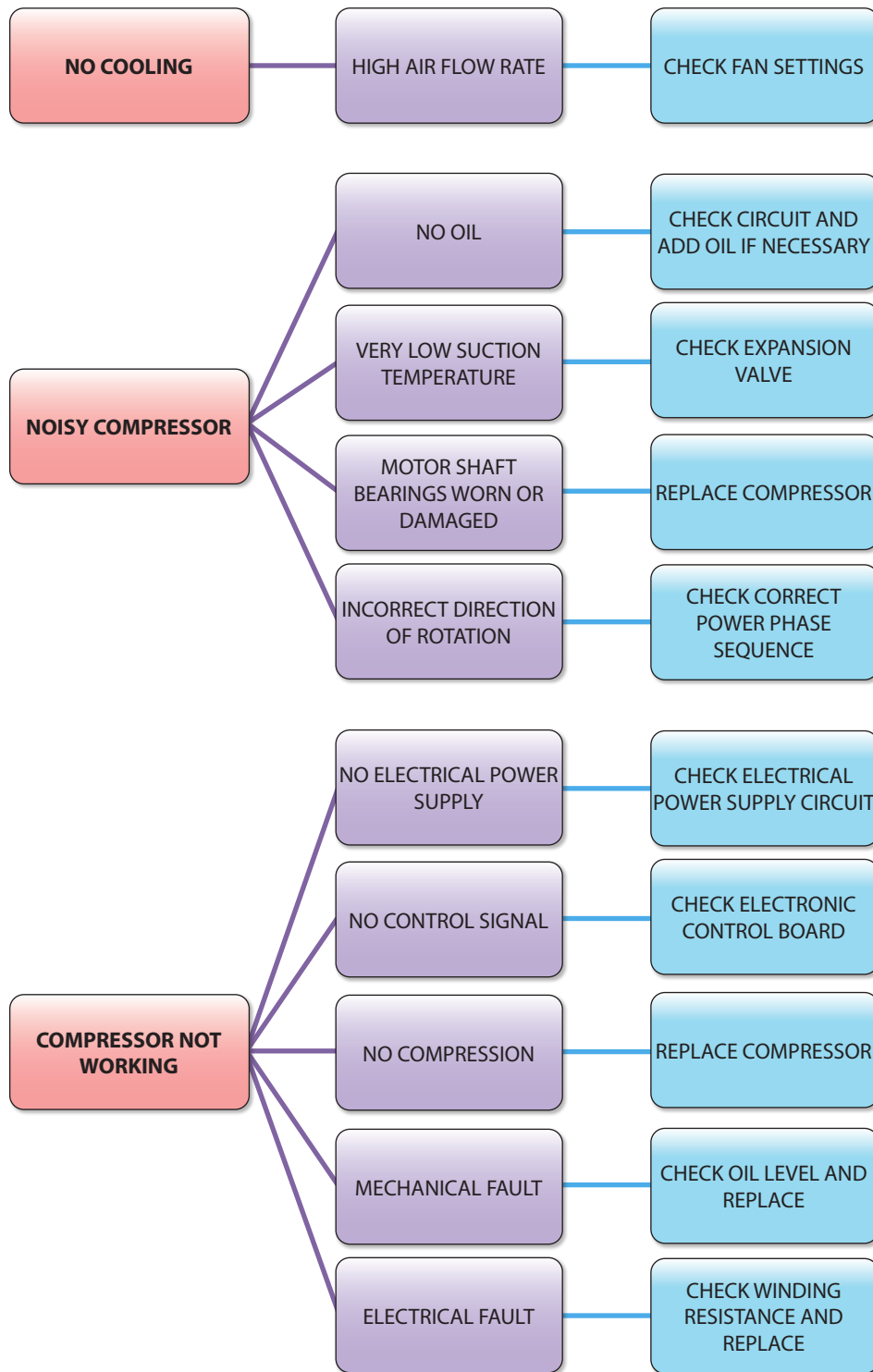
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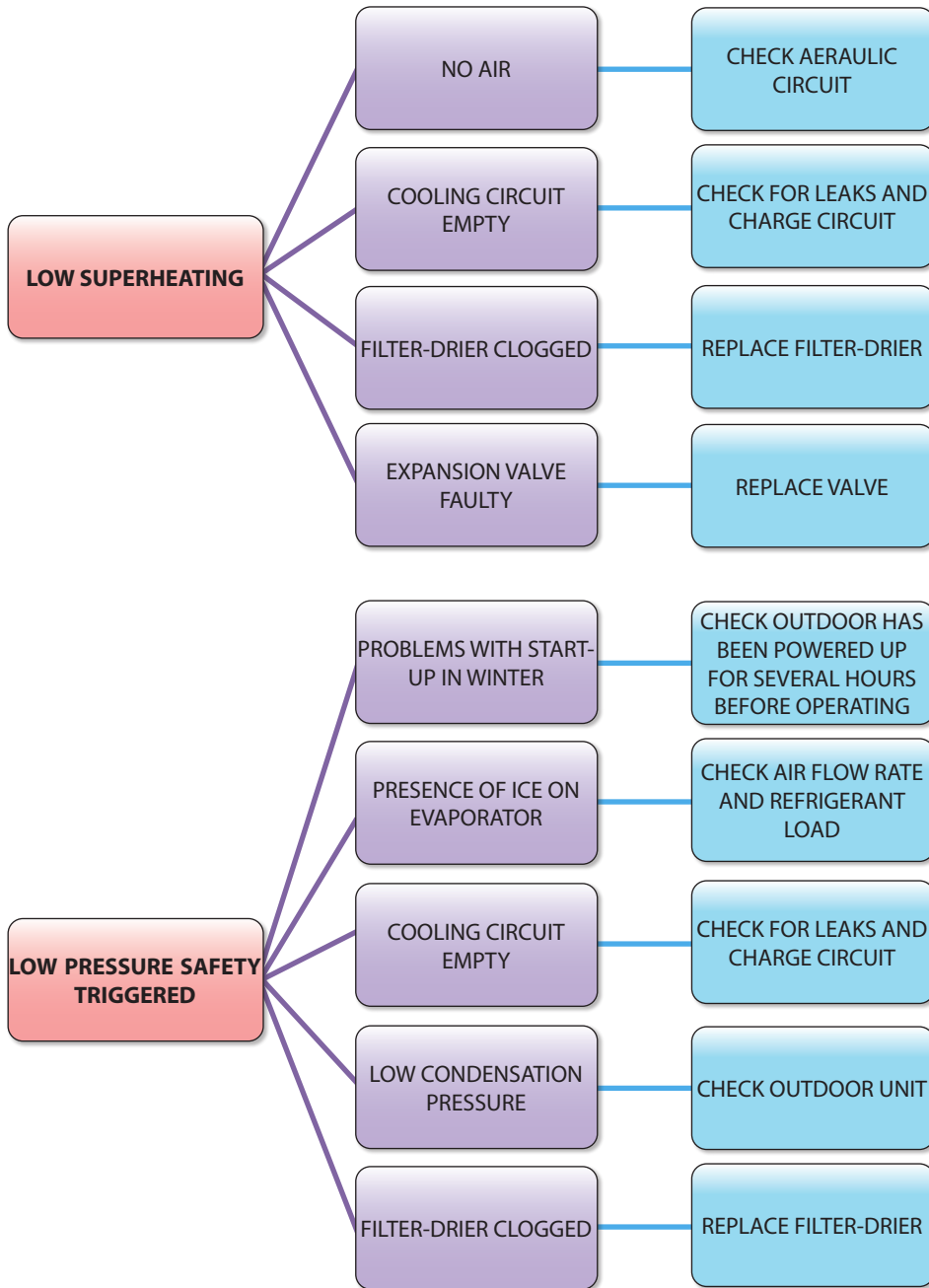
10.1 PROBLEMS WITH VENTILATION



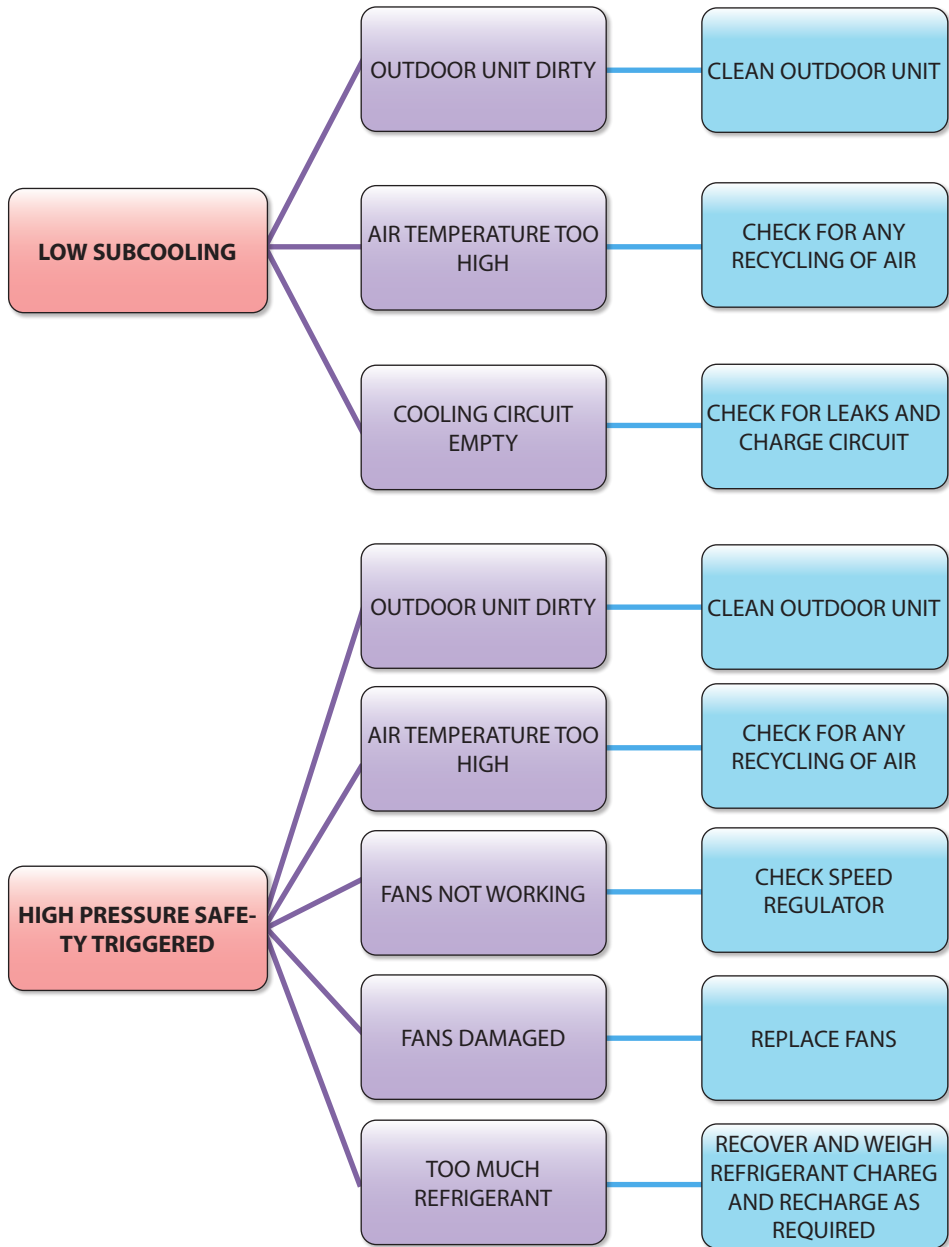
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10.2 PROBLEMS WITH DIRECT EXPANSION COOLING CIRCUIT

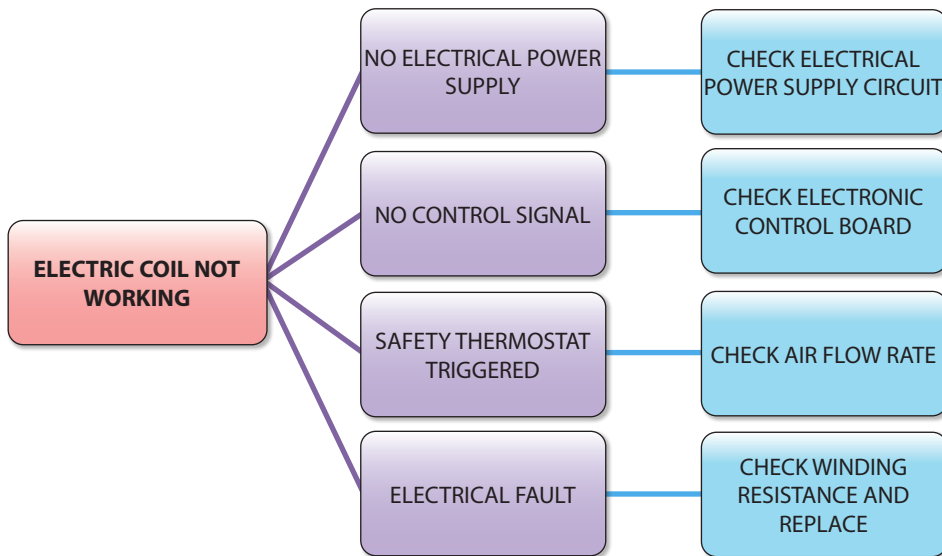




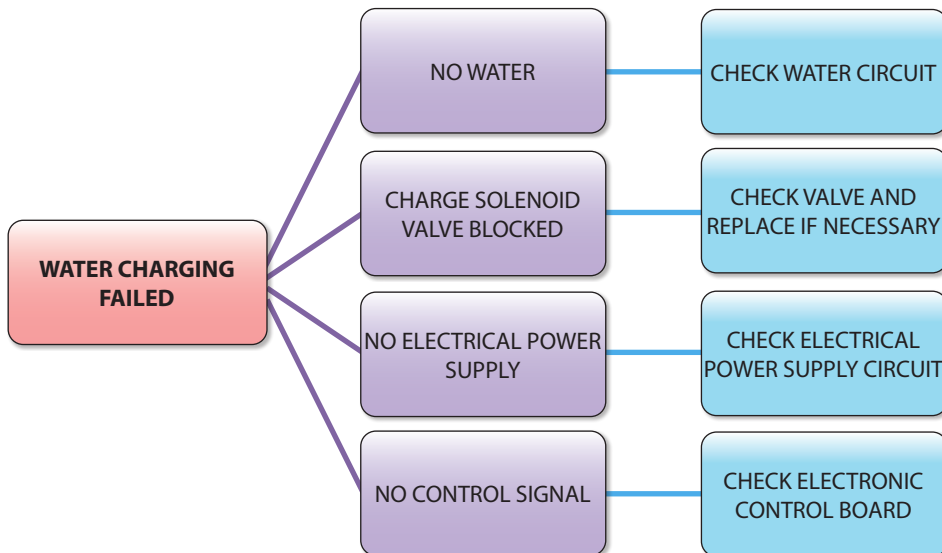
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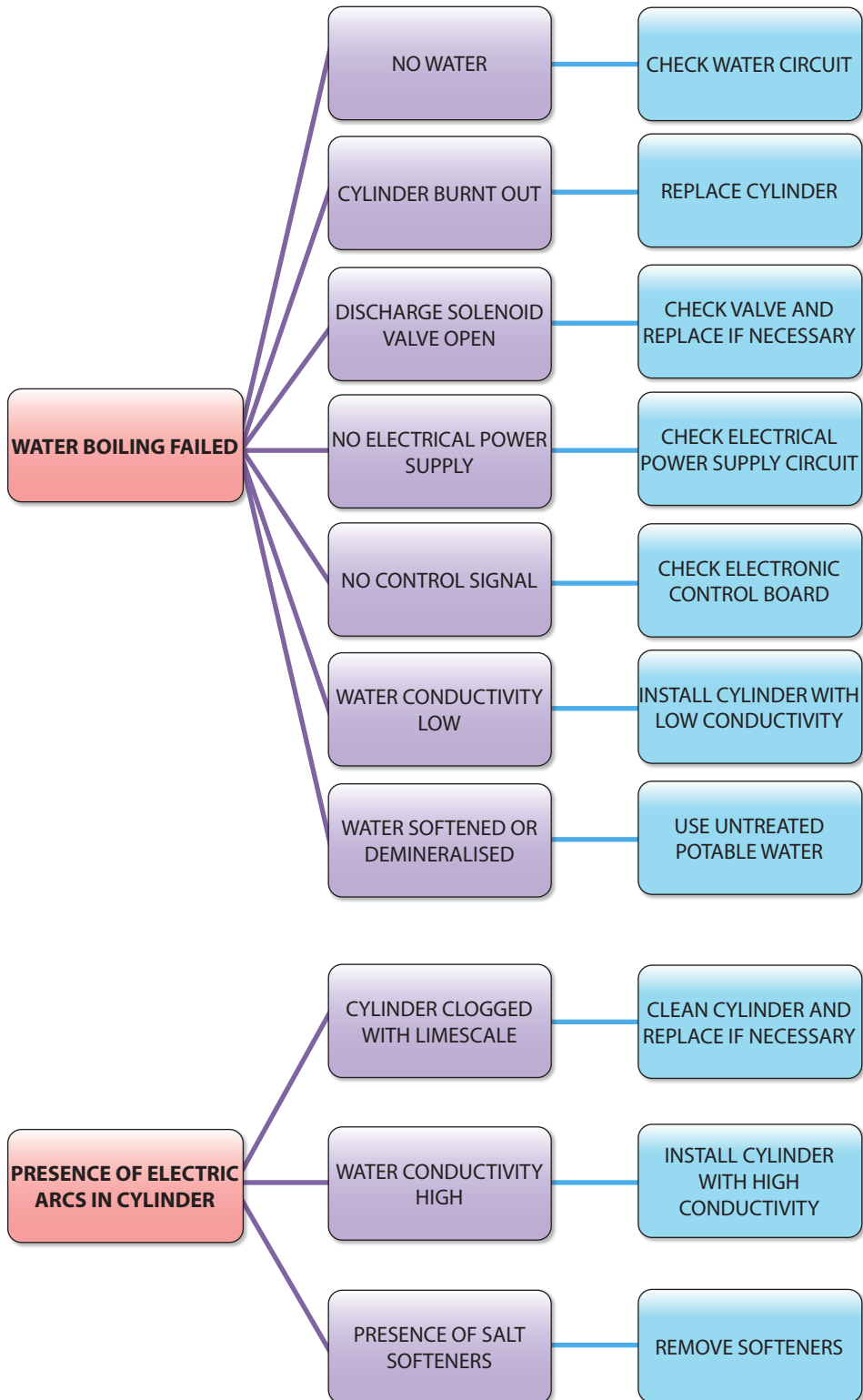
10.3 PROBLEMS WITH HEATING SECTION

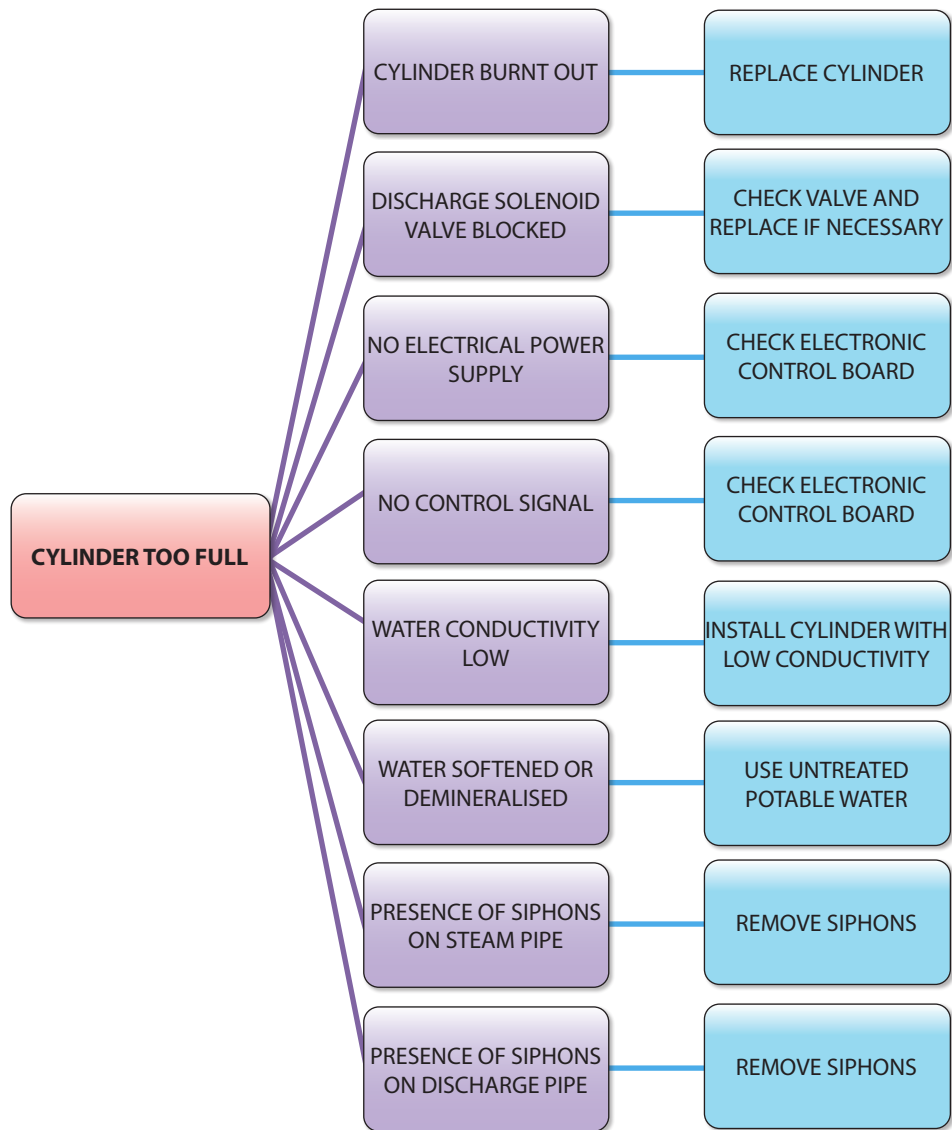


10.4 PROBLEMS WITH HUMIDIFICATION

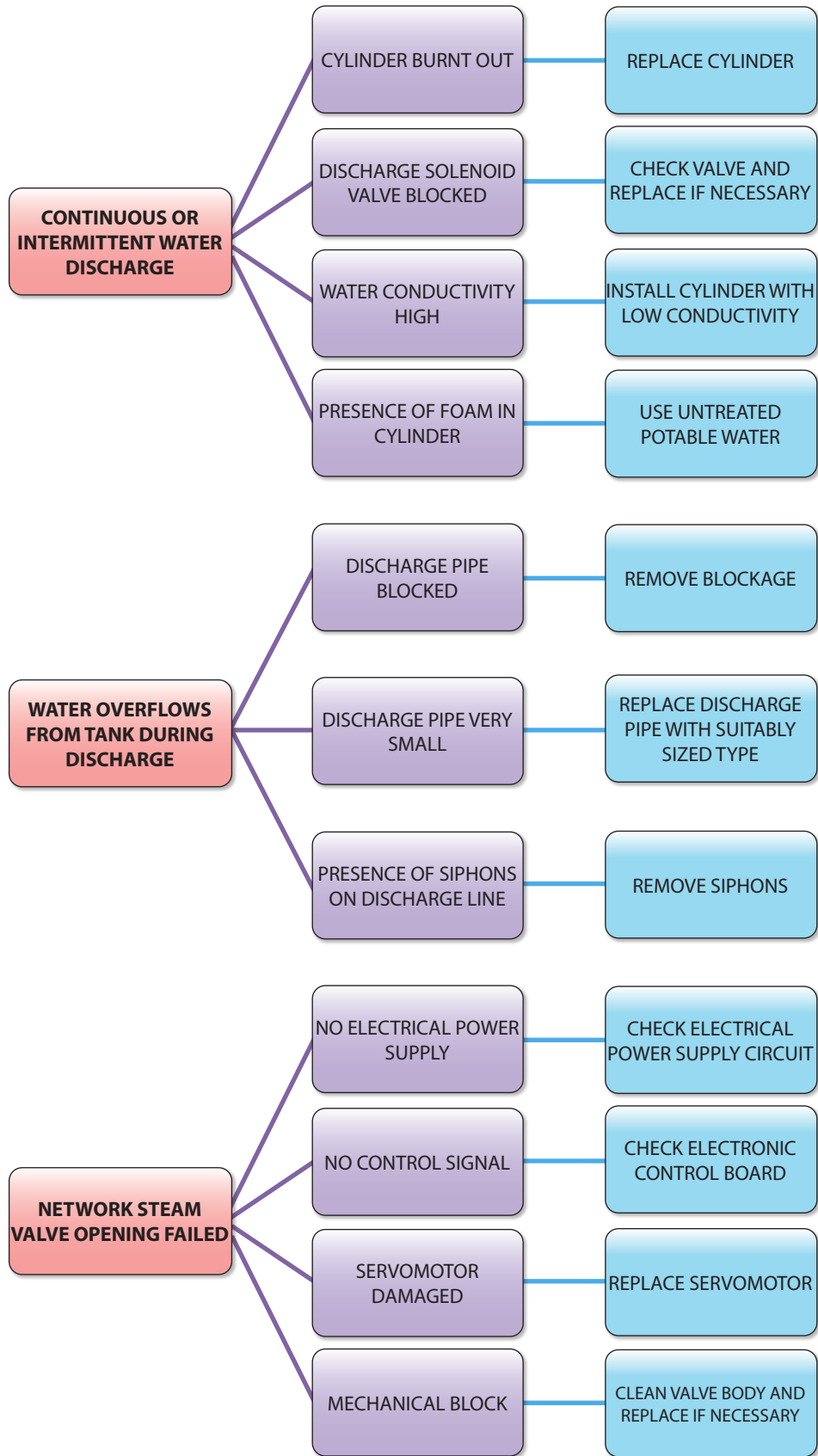


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11 PACi ERROR CODES

The following provides an overview of some of the error codes that may be experienced on the PACi outdoor unit and interconnecting circuit. This list is not exhaustive. For full detailed explanation of the error codes and recommended interventions, please refer to the relevant outdoor unit service manual.

Error Code	Alarm Meaning
E01	Remote Controller Reception Error
E02	Remote Controller Transmission Error
E03	Error in Indoor Unit Receiving Signal from Remote Controller (central)
E04	Error in Indoor Unit Receiving Signal from the Outdoor Unit
E05	Error in Indoor Unit Transmitting Signal to the Outdoor Unit
E06	Outdoor Unit Failed to Receive Serial Communication Signals from Indoor Unit
E08	Duplicate Indoor Unit Address Settings Error
E09	More Than One Remote Controller Set to Main Error
E10	Faulty Communication between Main & Fan Motor PCB
E12	Automatic Address Setting Start is Prohibited while Auto-address Setting in Progress.
E14	Main Unit duplication in Simultaneous-operation Multi Control (detected outdoor unit)
E15	Automatic Address Alarm (The total capacity of indoor units is too low.)
E16	Automatic Address Alarm (The total capacity of indoor units is too high or the total number of indoor units is too many.)
E18	Faulty Communication in Group Control Wiring
E20	Connection Problem of Indoor/Outdoor Units
F04	Compressor Discharge Temperature Sensor (TD) Trouble
F06	Inlet Temperature Sensor (C1) in Heat Exchanger Trouble
F07	Intermediate Temperature Sensor (C2) in Heat Exchanger Trouble
F08	Outdoor Air Temperature Sensor (TO) Trouble
F12	Compressor Inlet Suction Temperature Sensor (TS) Trouble
F31	Outdoor Unit Nonvolatile Memory (EEPROM) Trouble
H01	Primary (input) Overcurrent Detected
H02	PAM Trouble
H03	Primary Current CT Sensor (current sensor) Failure
H31	HIC Trouble
L04	Outdoor Unit Address Duplication
L10	Outdoor Unit Capacity not Set or Invalid
L13	Indoor Unit Type Setting Error
L18	4-way Valve Operation Failure
P03	Compressor Discharge Temperature Trouble
P04	High Pressure Trouble
P05	AC Power Supply Trouble
P13	Alarm Valve Open
P14	O2 Sensor Detect
P15	Insufficient Gas Level Detected
P16	Compressor Overcurrent Trouble
P22	Outdoor Unit Fan Motor Trouble
P29	Lack of INV compressor wiring, INV compressor actuation failure (including locked), DCCT failure
P31	Group Control Error



EC DECLARATION OF CONFORMITY



The manufacturer declares, under its own responsibility, that the equipment covered by this manual:

- Is intended for installation in air conditioning systems. It is prohibited to place this equipment into operation before the system has been declared as compliant with the provisions of the applicable Directives.
- It satisfies the requirements of the following harmonised standards:

EN ISO 14120:2015	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards
EN ISO 13849-2:2012	Safety of machinery - Safety-related parts of control systems - Part 2: Validation
EN ISO 13850:2015	Safety of machinery - Emergency stop function - Principles for design
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 14118:2018	Safety of machinery - Prevention of unexpected start-up
EN 60204-1:2018	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN IEC 61000-6-2:2019	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards - Immunity for industrial environments
EN IEC 61000-6-4:2019	Electromagnetic compatibility (EMC) – Part 6-4: Generic standards - Emission for industrial environments
EN IEC 61000-3-2:2019 + A1:2021	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
EN 61000-3-3:2013 + A1:2019 + A2:2021	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
EN 378-2:2016	Refrigerating systems and heat pumps - Safety and environmental requirements - Part 2: Design, construction, testing, marking and documentation

- It satisfies the requirements of the following directives:

2006/42/EC	Directive concerning machinery, which amends directive 95/16/EC (recast)
2014/30/EU	Directive concerning the harmonisation of the legislation of member states in relation to electromagnetic compatibility (recast)
2014/68/EU	Directive concerning the harmonisation of the legislation of member states in relation to the availability on the market of pressure equipment

The pressure equipment covered by this declaration satisfies the requirements of Directive 2014/68/EU in the following ways:

- Direct expansion unit with liquid receiver with volume less than 4.8 l: complies with category PED I.



TEST CERTIFICATE



The manufacturer declares, under its own responsibility, that the equipment covered by this manual has passed the functional and electrical safety tests with a positive outcome in accordance with the procedures of the Vision ISO 9001:2015 certified quality management system.

The Manufacturer adopts a policy of continuous development and therefore reserves the right to make changes and improvements to any product described in this document without prior notice. Technical data and dimensions are not binding.

Manual code PAC-PZ001 "ORIGINAL INSTRUCTIONS"

TECNAIR
A PANASONIC COMPANY

TECNAIR S.p.A
20825 Barlassina (MB) - Italy
Via XXV Aprile, 29

www.tecnair.com