klimatix

User Manual

Precision Air Conditioner - CPID

Rev. 02 | August. 2022

Review History			
First Edition	**Date**	**Elaborated by**	**Approval**
New Version	12/23/2021	CPJ	GOG
Revision Description	**Date**	**Change**	**Approval**
Change of images, HMI screens, electrical data table, cooling installation. Addition of space recommendations, condensate pump illustration, unlocking of the panel, replacement of air filters, network and external interconnections.	4/12/2022	CPJ	GOG
Adding minimum thermal load information, space recommendations, CR interconnection, Modbus communication, Ethernet communication, rotation operation, adding lubricating oil, replacing the air filter, and HMI shutdown. Updated nameplate, electrical data table and refrigeration connections.	31/08/2022	CPJ	GOG

ABOUT THE MANUAL

This manual is intended to provide sufficient information needed for installation, operation and maintenance for the CPID line of In-row type Precision air conditioners to ensure the best performance and long life of the equipment for the design conditions.

Considering that technological advances will occur, Mecalor reserves the right to change this manual and the design of the equipments without prior warning, according to the same models specified.

Words like DANGER, ATTENTION and INFORMATION are used in the course of the manual to show warning situations as shown below:

	DANGER	Warns about immediate danger that may cause serious injuries or death.
	ATTENTION	Warns about unsafe practices, which if not avoided, may cause personal damages or death.
	INFORMATION	Relevant information about the equipment or recommendation about good working practices.

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	INFORMATION	**Keep this manual in a place that is accessible to the user to consult in case of doubts.** This manual cannot be reproduced whole or in part without the prior authorization from Mecalor.

	INFORMATION	**Do not perform any procedure on the equipment in case of doubts after reading this manual.** This manual serves as a guide to operate the equipment safely and it does not have the purpose of informing all the variables of the system. Contact the technical support of Mecalor in case of doubts.

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1. General Description of the Product

1.1. Equipment Description

Klimatix precision air conditioners are equipment intended for heat removal in confined environments with high thermal dissipation rate, such as Data Centers, UPS rooms and telephone centers. In these environments, the heat is predominantly generated by electric and electronic components and the main function of the equipment is to stabilize the temperature and relative humidity conditions.

Maintenance of the temperature and relative humidity conditions within the defined range is essential to ensure proper operating conditions, as well as reliability of the data and transmission equipment, and to guarantee the life expectancy of the electrical and electronic components.

Precision air conditioners are designed for high performance or high sensible heat ratio (SHR) conditions for applications where the sensible heat dissipation rate is predominant (Higher than 90% sensible heat compared to the total heat load).

The In-row air conditioner is designed for installation next to racks with high thermal load density, focusing on the air conditioning of the area where the racks are installed. The In-row operates with air insufflation between 22 and 25°C and air return of up to 35°C.

With structure manufactured in minimized galvanized steel (Finishing Z180) painted by an electrostatic process and polyester-based powder paint in RAL 9005 black, heat exchanger with copper tubes and aluminum fins, EC radial fans, and cooling and humidity control systems according to the equipment configuration.

⚠	**ATTENTION**	It is not allowed to tamper with original installed components of the equipment. This practice may put at risk the safety of the operator, the functioning of the equipment and losing the warranty.

1.2. Direct Expansion - In-row Precision Air Conditioner

The precision air conditioner, installed in the room it is to condition, can be a direct or indirect expansion unit (fancoil). When the equipment configuration is direct expansion, the equipment must operate with a remote condenser to dissipate the heat absorbed in the cooling system to the environment.

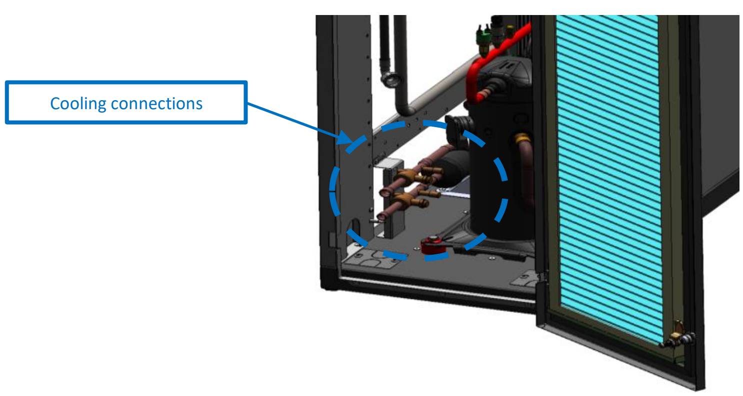
The CPID is usually installed indoors and in a confined environment, where the racks with the electrical and electronic components of the UPS, telecommunication or data center rooms are located. Generally the equipment is positioned between the racks and is prepared for air conditioning of the zone where it is positioned and is therefore designed to operate with return temperatures of up to 35°C, improving energy efficiency.

The Remote Condenser, in turn, must be installed in an external and well-ventilated environment. For this reason the CPID and its respective CR (Remote Condenser) are interconnected by two refrigerant piping lines called:

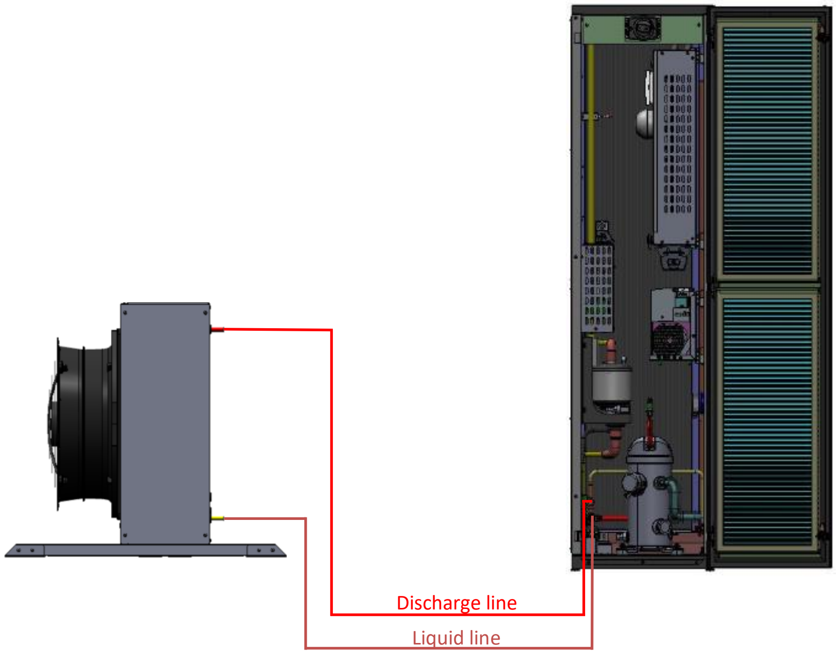
- Discharge line: conducts refrigerant in overheated vapor state at high pressure and temperature, originating from the vapor compression process carried out by the compressor.
- Liquid line: conducts refrigerant in liquid state at high pressure, originating from the condensation process.

The figure below shows the connection points and identifies the cooling lines in an illustrative way to help with the interconnection of the system. Proper cooling interconnection requires the adoption of the good practices and requirements described in this manual.

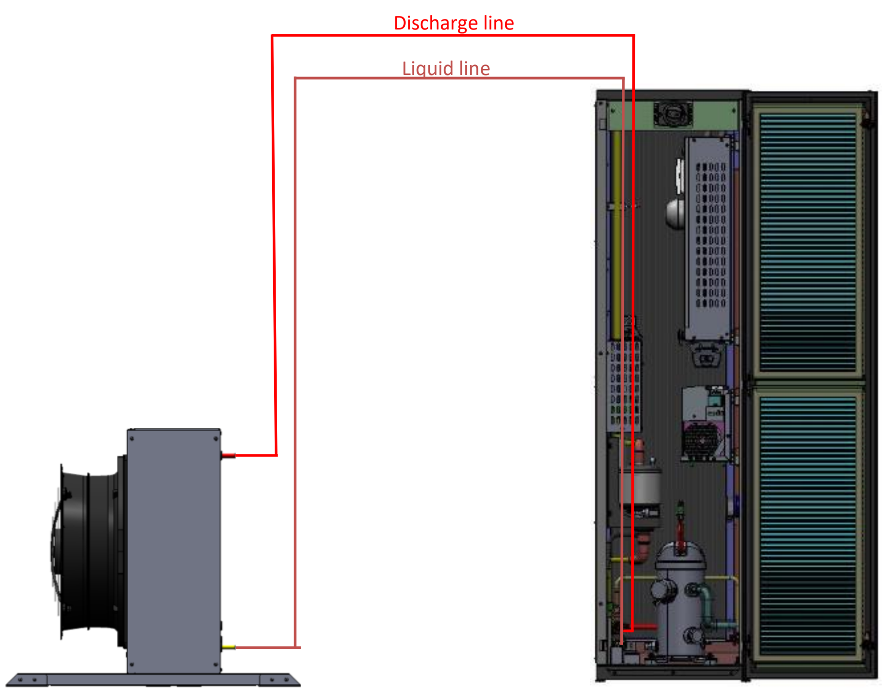
In this equipment, the connections are available on the back in horizontal position, and can be interconnected to the line through two outlet options, one on the base of the equipment and the other on the ceiling. Shown below are the position of the connections and both possibilities for interconnection.



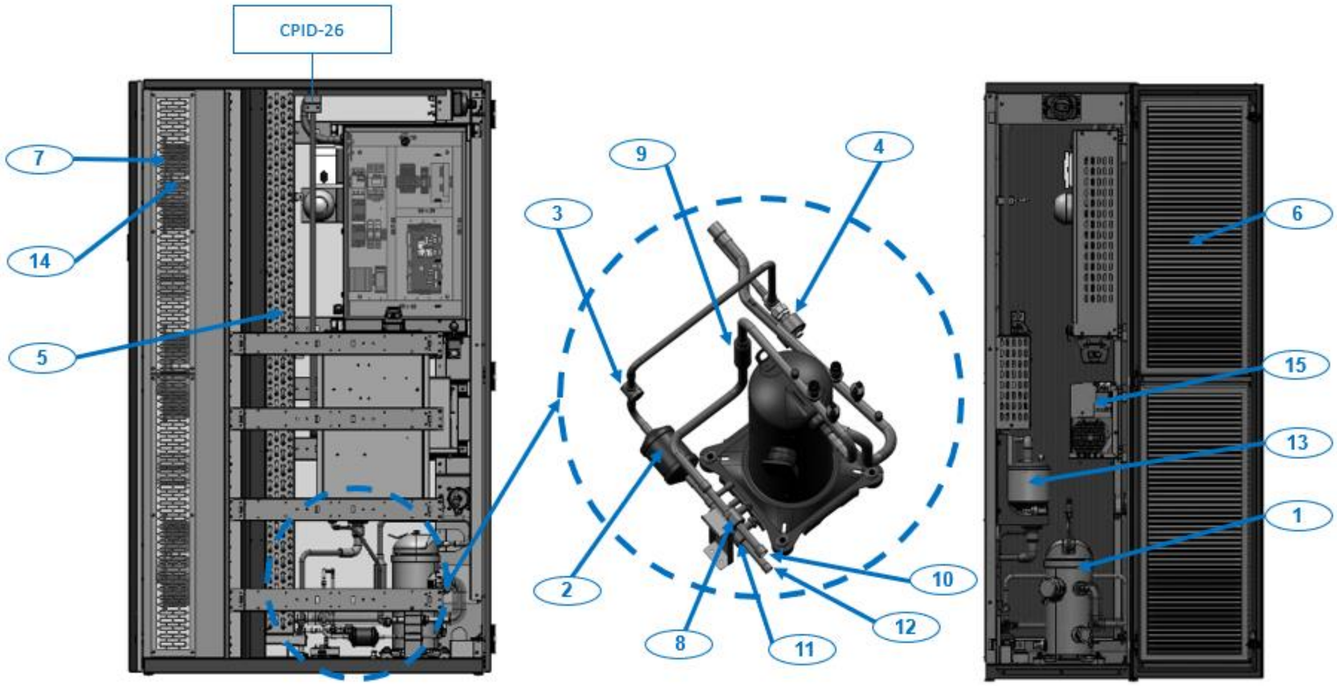
Base outlet connection



Connection through the ceiling outlet of the equipment:



The following are the main components of the equipment:



Item	Description
1	Hermetic Scroll Inverter Compressor
2	Filter Drier
3	Liquid display
4	Electronic expansion valve
5	Evaporator - Copper tubes and aluminum fins
6	Air Filter G4 (Optionally M5)
7	EC Radial Fans
8	Shut-off valve: Discharge line
9	Check valve: Discharge line
10	Discharge line connection
11	Shut-off valve: Liquid line
12	Liquid line connection
13	Vapor generator
14	Reheating resistor
15	Compressor drive (variable capacity control)

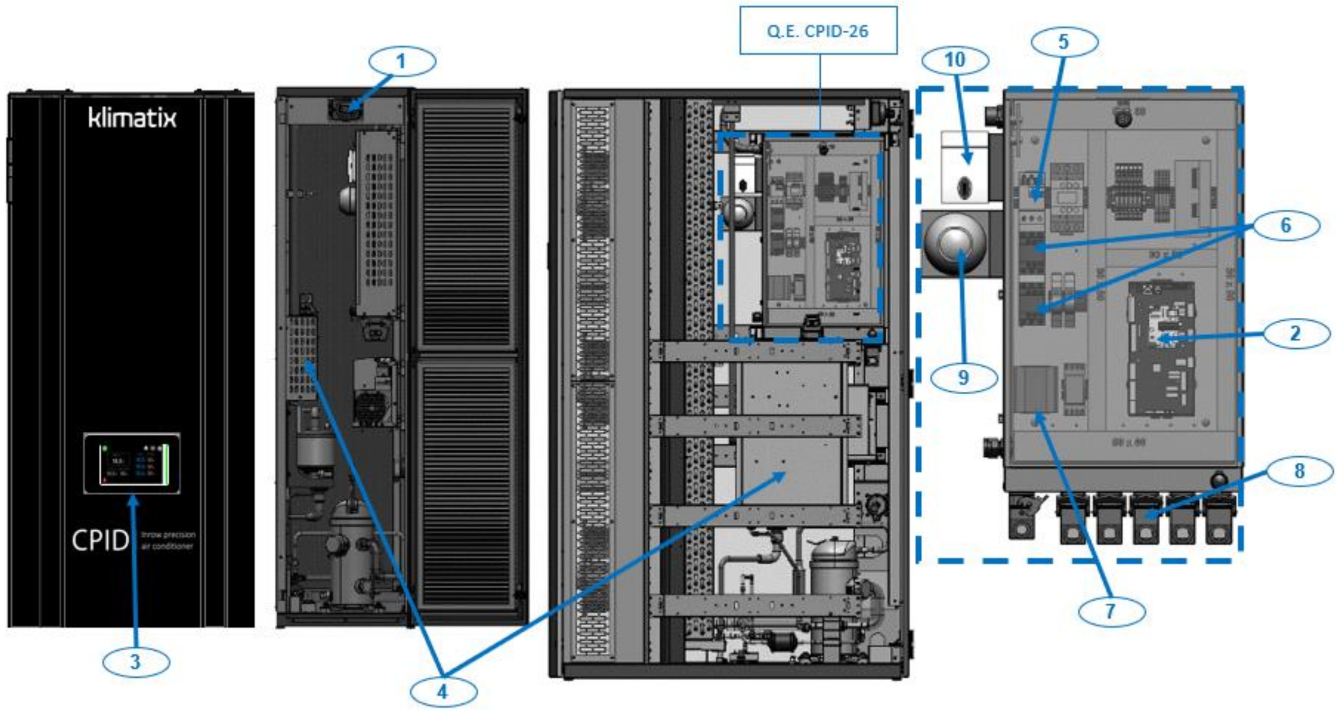
1.2.1. Operating Principle

The CPID cooling system consists of a hermetic scroll inverter compressor (1) which is responsible for displacing the refrigerant fluid in the system, directing the flow in the form of hot gas to the condenser for dissipation to the external environment. After the refrigerant passes through the remote condenser the heat from the system reaches the sub cooled liquid state and its flow is conducted again to the evaporator unit (CPID). The refrigerant fluid in the sub cooled liquid condition passes through a filter drier (2), which is responsible for eliminating impurities and moisture present in the system, and a liquid display (3) responsible for visually indicating the situation of the fluid inside the pipe. When passing through the expansion valve (4) the refrigerant suffers a pressure drop, entering in the form of saturated liquid in the evaporator (5). Inside the evaporator the refrigerant fluid receives heat from the process fluid through the forced passage of air through the evaporator, after a G4 air filter (6), by EC radial fans (7), and therefore, as it absorbs this energy, it undergoes a state transition from saturated liquid to superheated steam, a condition in which it can enter the compressor and restart the cooling cycle.

The equipment also has block valves (8) and check valves (9) in the discharge piping (10) and a block valve (11) installed in the liquid piping (12).

Optionally the CPID can be supplied with Steam generator (13) and Reheating resistor (14), both acting in the humidity control, the former humidifying the air while the resistor ensures the reheating of the air generating enough thermal load to keep the refrigeration system operating, which with low evaporation temperatures ensures the occurrence of condensation in the evaporator, dehumidifying the air contained in the system. In addition, the system is also supplied with variable capacity control using an inverter compressor with its respective drive (15), enabling the capacity of the cooling system to be controlled from 30 to 100%, ensuring precision in the temperature control of the zones. These capacity limits may be exceeded under some operating conditions.

1.2.2. Electrical Components



Item	Description
1	Main circuit breaker
2	PLC - Programmable Logic Controller
3	HMI - Human Machine Interface
4	Steam Generator Control Panel (Optional)
5	Circuit Breakers
6	Contactors
7	Control voltage transformer
8	Multi-pole sockets
9	Fire detector (Optional)
10	Temperature and humidity sensor (Optional)

The CPID electric panel has components for switching, control and interconnection installed inside it. The electric supply to the components of the unit can be cut off by through the main circuit breaker (1), enabling safe intervention during the equipment maintenance process. The system is controlled by a PLC (2) that, through signals received from the instruments installed in the equipment, performs the operation control command and system control through the turning on/off of the electric engines and electronic valves of the CPID and CR units. The adjustment of the working conditions as well as the monitoring of the parameters is done through a 4.3" color touchscreen HMI.

The system has its own circuit breakers (5) as well as contactors (6) to activate the components via the PLC. For the instruments and the control system, the transformer (7) converts the supply voltage to the control voltage (24 VAC) for the controllers and instruments installed in the equipment. The control connections are made through the multi-pole sockets (8), directing all necessary connections between instruments and controller, allowing the PLC control logic of the system to operate. Each socket has a specific coding pin sequence to mitigate the possibility of connection error. The customer is responsible only for connecting the interconnection cable between the CPID and CR units, and the connectors required for this interconnection are available on the CPID socket and on the CR connectors, and it is only necessary to take the duly crimped wires with a tubular pin terminal to each connector. The identification of each connection is indicated in section 4.4.1 of this manual.

When the equipment configuration includes the steam generator, it is necessary to install its respective electric panel (4) to drive and control the steam generator, based on signals received from the PLC for humidity control of the system. Optionally the system can have reheating resistors installed, which are activated by contactors (6).

1.3. Application Scope

The CP line was designed for precision air conditioning of environments such as data centers, UPS and telecommunication rooms, where there is a high dissipation rate of heat, predominantly sensible heat, from electrical and electronic components. In these environments the equipment must ensure that the operating condition is maintained within the temperature and humidity ranges defined in these systems to maintain reliability and extend the useful life of these components. In-row air conditioners specifically control the temperature and humidity (when supplied with steam generator and heating elements) of the zones where the racks are installed, ensuring an air supply in the 22 to 25°C range and a maximum return temperature of 35°C.

By using a variable speed compressor, the temperature and humidity control remains stable, without oscillations caused by the compressor turning off and on, providing even greater energy savings.

⚠	**ATTENTION**	Applications different from those intended for the product may put at risk the safety of the operator, the equipment performance and even the breakage of a component of the equipment and the loss of warranty.

1.4. Optional Items Installed at the Factory and on the Field

Item	**Installed in Factory**	**Installed on Field**
Air filter M5	✓	✓
SNMP Communication	✓	✓
BACNET Communication	✓	✓
Flooded floor sensor	✓	✓

2. Technical Features

2.1. Nomenclature

CP I D - LP - 18 - URI - 380 * /C

Precision Air Conditioner

I: In-row

D: Direct Expansion

1st Digit { L: Lateral flow
F: Displacement

2nd Digit { P: Standard structure

Nominal Capacity: 18,26,40 kW

1st Digit { 0: no humidifier
U: humidifier (vapor generator)

2nd Digit { 0: no reheating
R: reheating (electrical resistance)

3rd Digit { I: Inverter Compressor

Standard Voltage of the CPID
3 F, 220 V, 60 Hz
3 F, 380 V, 60 Hz
3 F, 440 V, 60 Hz
Special Voltage – E.g.: 400 V, 480 V etc.

*: Special operating frequency: 50Hz

Special character:
/C: Special build
/E: Out-of-standard refrigerant fluid
/M: Air filter M5
/S: SNMP Communication
/N: BACNET Communication
/I: Flooded floor sensor

	INFORMATION	Check the special documentation described in the annex of this manual for the equipment that has special character (/C). Some data in this manual such as electrical data may not apply to the equipment that has special character.

2.2. CPID Technical Data

	Description	Unit	Model		
	Evaporator unit		**CPID - 18**	**CPID - 26**	**CPID - 40**
Operating conditions	Total capacity (1)	kW	17.9	28.0	38.1
	Sensible capacity	kW	17.9	28.0	38.1
	Useful capacity	kW	17.2	27.4	38.1
	Efficiency EER (CPID)	-	3.6	4.1	4.1
	Efficiency EER (CPID + CR)	-	3.0	3.4	3.3
	Sensible heat factor	-	1.00	1.00	1.00
	Cooling capacity control range (6)		30 to 100	30 to 100	30 to 100
	Direction of air insufflation	-	Side / Front		
	Nominal flow rate	m³/h	4500	6000	7749
	Maximum static pressure available	Pa	70	100	100
	Specific fan power (SFP)	W/(m³/s)	512	407	488
	Cooling circuits	-	1	1	1
	Filtering class	-	G4		
	Sound pressure (2)	dBA	57	59	65
	Refrigerant load (5)	kg	1.3	2.4	3
Dimensional	Width	mm	400	500	600
	Depth	mm	1200	1200	1200
	Height	mm	1975	1975	1975
	Occupied area	m²	0.48	0.60	0.72
	Weight	kg	370	420	490
	Maintenance	-	Front		
	Maintenance access	mm	900		
	Inlet connection diameter	in	1/2	5/8	5/8
	Outlet connection diameter	in	5/8	3/4	7/8
	Corresponding Remote Condenser		**CR-25**	**CR-35**	**CR-60**
Operating conditions	Direction of air insufflation	-	Vertical / Horizontal		Vertical
	Nominal flow rate	m³/h	7000	9000	16500
	Maximum static pressure available	Pa	10	10	10
	Specific fan power (SFP)	W/(m³/s)	484	570	454
	Sound pressure (2)	dBA	62	67	66
	Refrigerant load (5)	kg	0.9	0.9	1.9
Dimensional	Width	mm	1450	1750	1920
	Depth	mm	910	820	850
	Height	mm	1190	1160	1060
	Weight	kg	60	75	95
	Maintenance	-	Front / Rear / Side		
	Maintenance access	mm	600		
	Inlet connection diameter	in	5/8"	3/4"	7/8"
	Outlet connection diameter	in	1/2"	5/8"	5/8"
Refrigerated plant installation (5)	Maximum equivalent length (4)	m	30		
	Max. level difference (evaporator below condenser) (4)	m	17		
	Max. level difference (evaporator above condenser) (4)	m	5		
Power rating	Nominal power (1) (3)	kW	5.9	8.2	11.4
	Maximum power (3)	kW	8.1	14.2	20.0
	Reheating resistor	kW	3.0	6.0	9.0
	Humidifier	kW	2.25	2.25	2.25

(1) Return temperature 30°C, relative humidity 45% and atmospheric pressure 101.3 kPa; Condensation temperature 35°C; Leq. 20 meters

(2) Sound pressure at 2 meters from the source

(3) Power in operation considering evaporator unit and remote condenser

(4) Other measurements consult manufacturer

(5) Condensing temperature 45°C and sub-cooling 5°C

(6) Depending on the system operating condition, these limits may be exceeded

2.3. Minimum thermal load

To guarantee a stable operation and within the operation limits presented in item 2.4, it is important that the equipment meets the minimum ideal capacity condition for operation. Therefore, we recommend that the thermal load of the room to be acclimatized meet the minimum conditions indicated below:

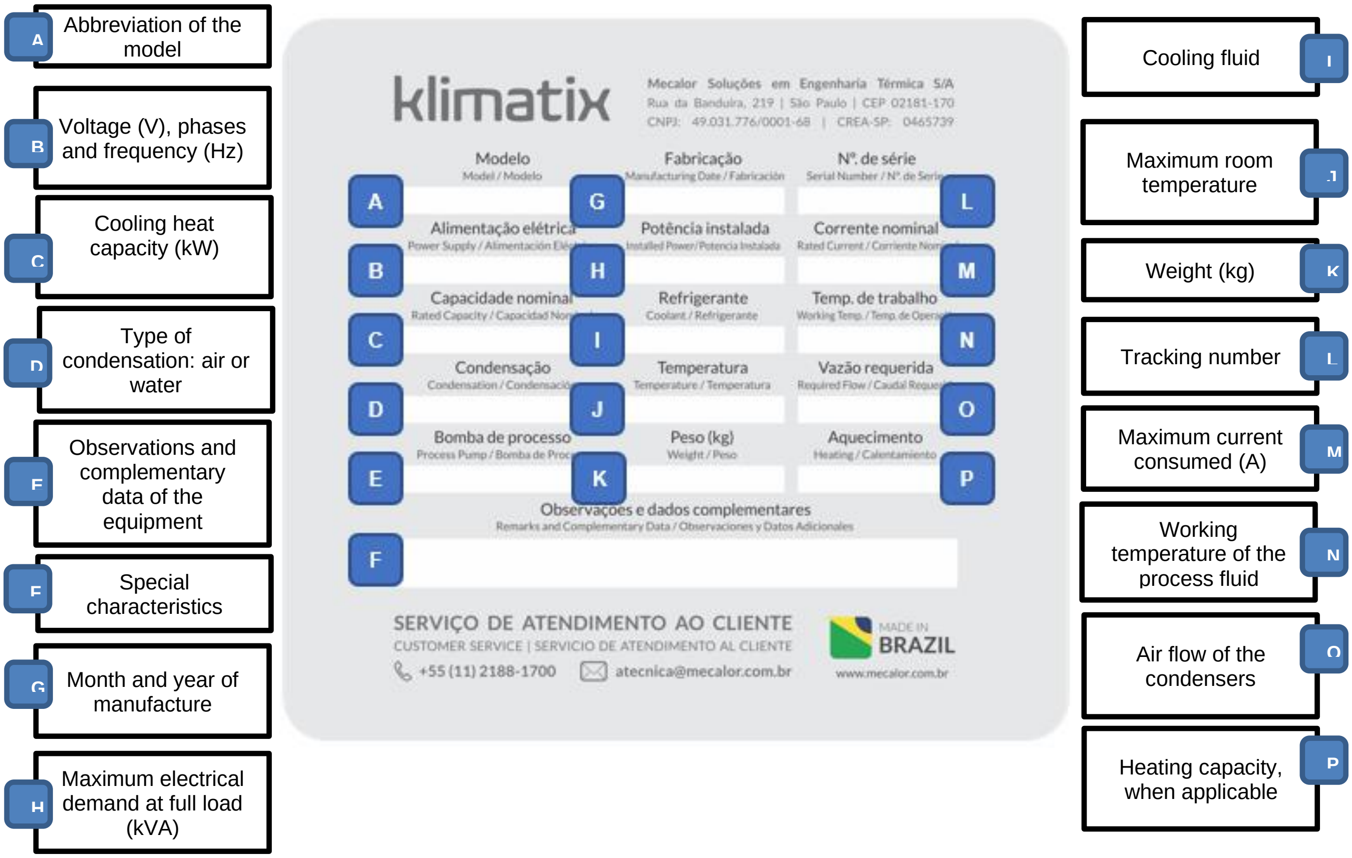
CPID Model	Minimum thermal load
CPID-18	5,37 kW
CPID-26	8,4 kW
CPID-40	11,43 kW

2.4. Operating limits

Some operating limits are described below and must be observed for good performance and operation of the equipment:

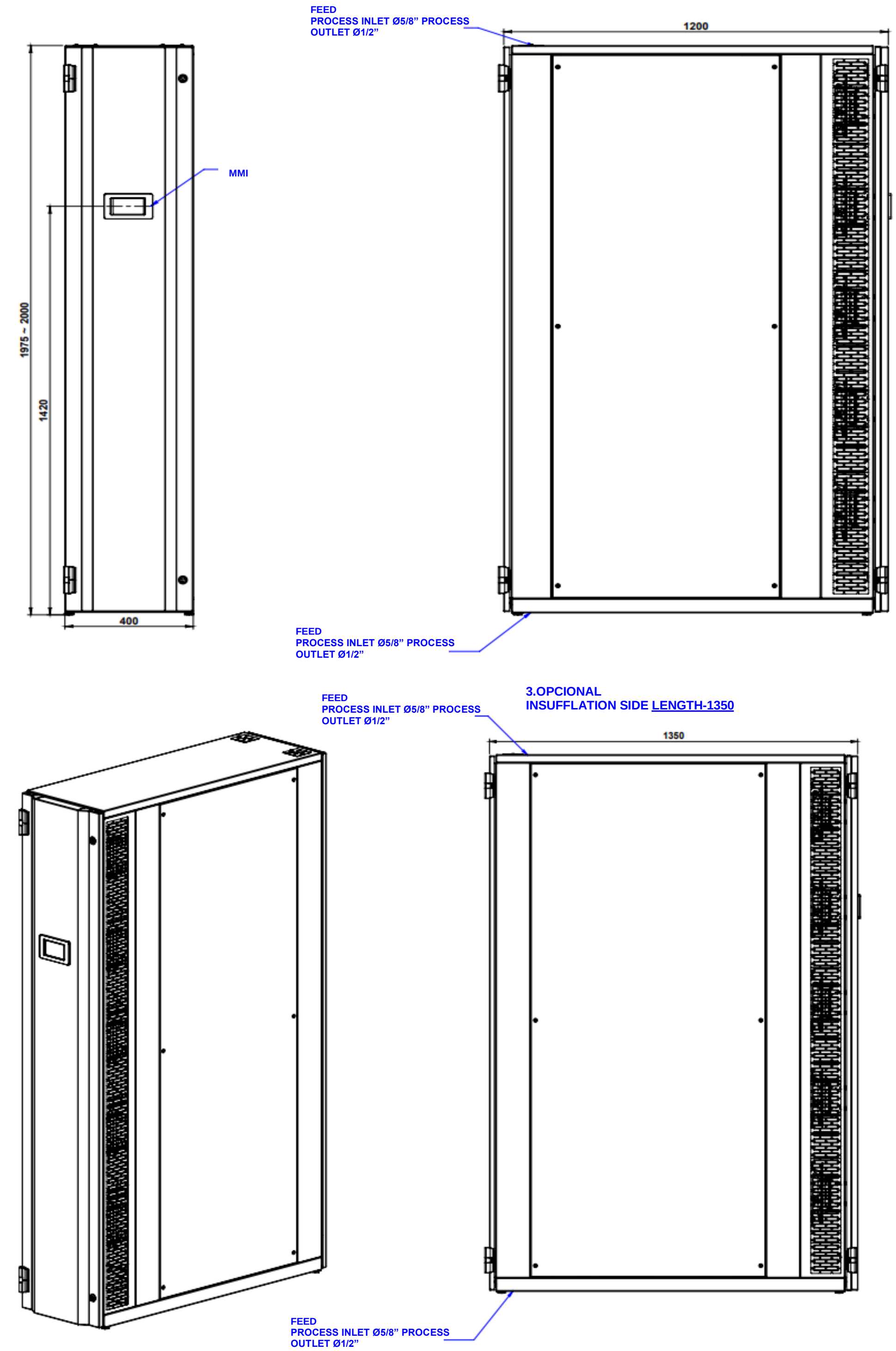
- Maximum outdoor temperature of up to 45°C;
- Minimum outdoor temperature of -10°C.
- Operation with return temperature between 20°C and 35°C;
- Operation with relative humidity in the return between 40 and 60% RH (only when applied with the steam generator and heating resistance options);

2.5. Identification plate attached to the Precision Air Conditioner

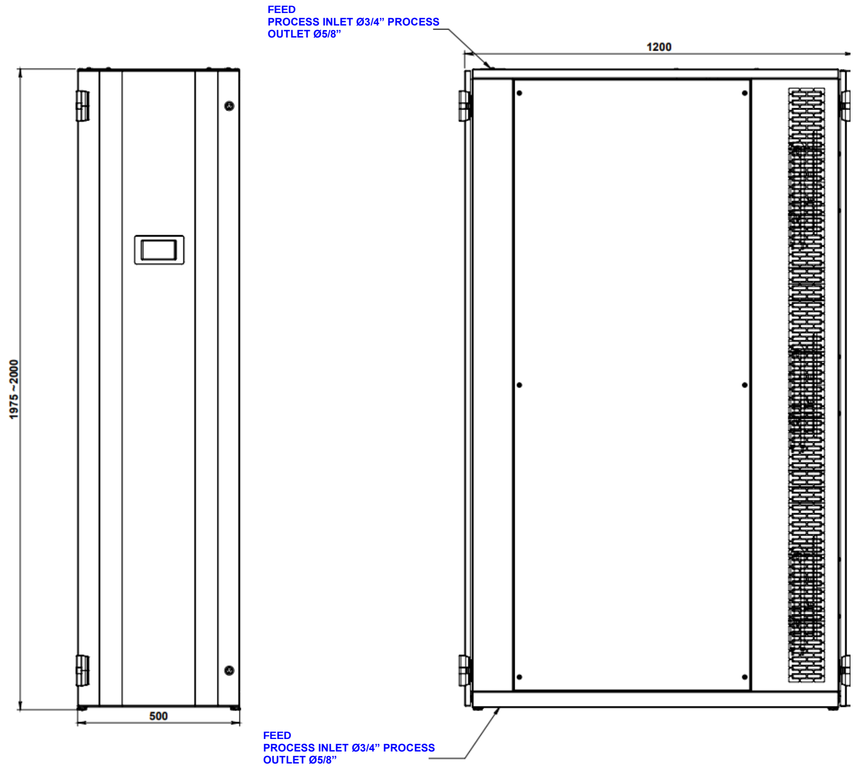


2.6. CPID External Dimensions

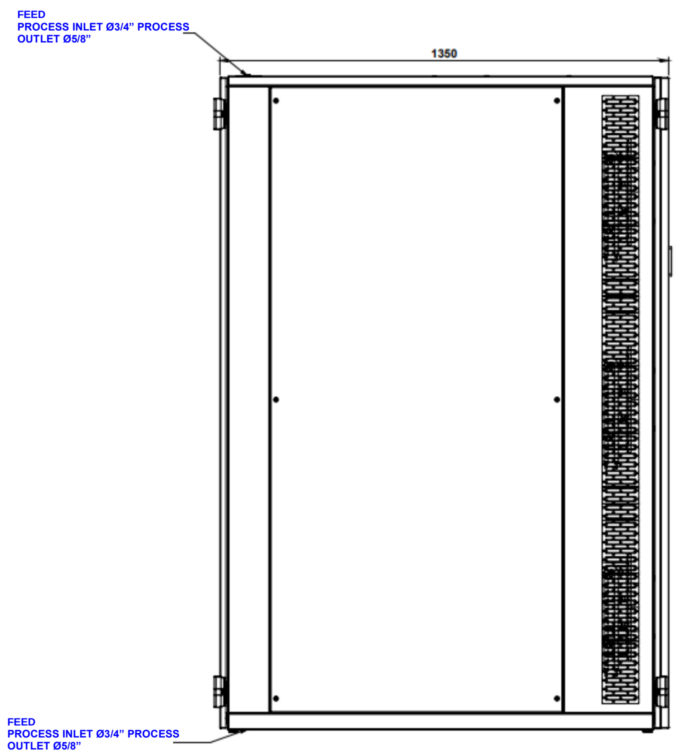
2.6.1. CPID-18



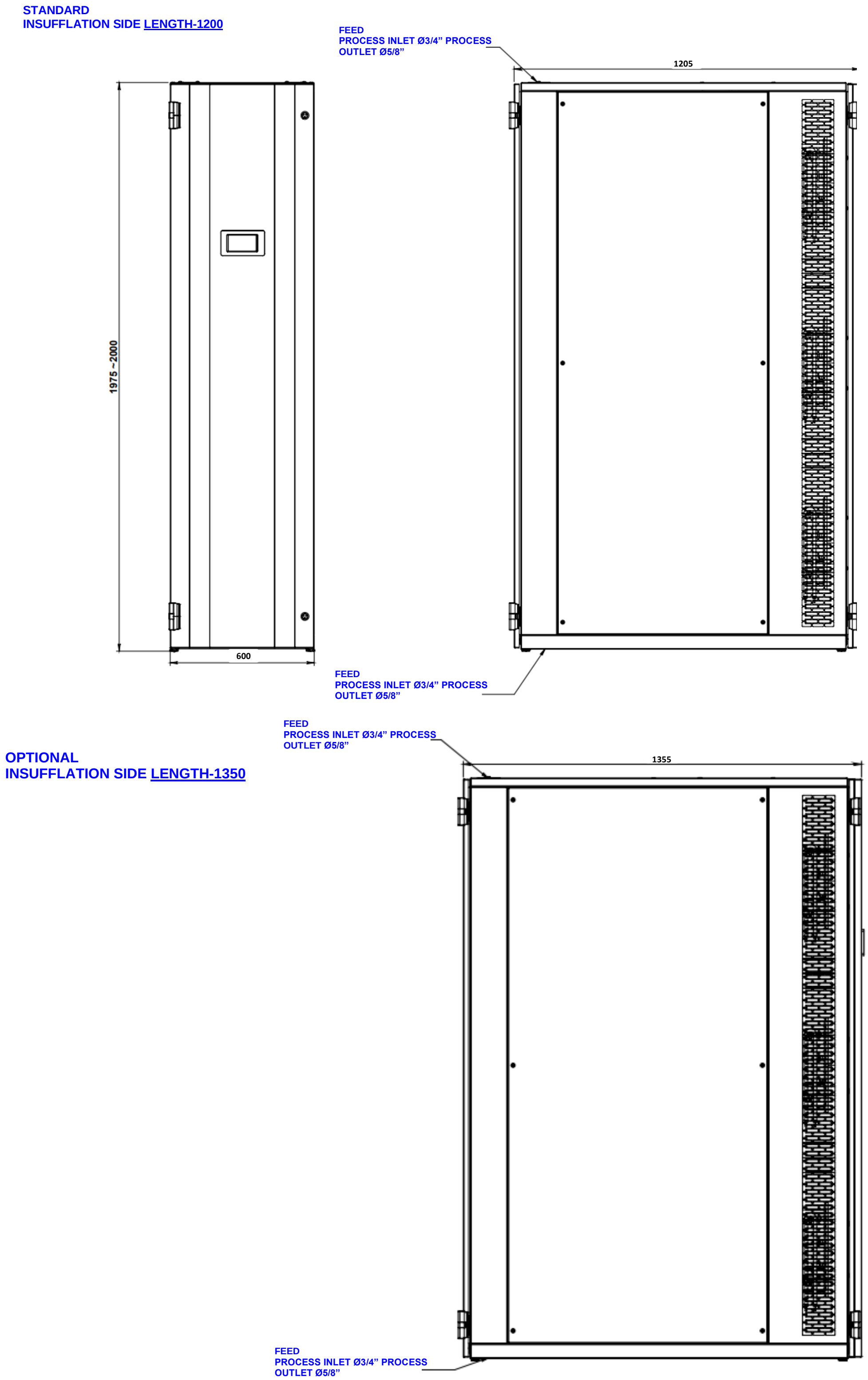
2.6.2. CPID-26



OPTIONAL
INSUFFLATION SIDE LENGTH-1350



2.6.3. CPID-40


STANDARD
INSUFFLATION SIDE LENGTH-1200
FEED
PROCESS INLET Ø3/4" PROCESS
OUTLET Ø5/8"
1205
1975 ~2000
600
FEED
PROCESS INLET Ø3/4" PROCESS
OUTLET Ø5/8"
FEED
PROCESS INLET Ø3/4" PROCESS
OUTLET Ø5/8"
OPTIONAL
INSUFFLATION SIDE LENGTH-1350
1355
FEED
PROCESS INLET Ø3/4" PROCESS
OUTLET Ø5/8"

*For more details and connection positions in each CPID configuration, see the dimensions attached to the equipment documentation.

2.7. Electrical Data

The customer is responsible for laying the electric cable up to the equipment and it must be performed by a qualified person.

Check the electrical features of the CPID on the identification plate attached to the equipment. The network voltage must comply with the CP voltage and must be within the acceptable limits of ± 10 % (Voltage variations with a tolerance of ± 10 %: 220 V (198 ~242V); 380V (342 ~412V); 440 V (396 ~484V). The electrical data of the equipment will be presented below.

	INFORMATION	A power supply point is not necessary for the command/control circuit, because it is powered by the internal transformer of the equipment.

	INFORMATION	Command/control circuit voltage of 24V according to standards NR10 and NR12. Components installed on the equipment door does not represent the risk of electric shock to the operator.

	ATTENTION	DO NOT USE the electrical data of the previous table to size the power supply point in CP models that have special characters (/C, /E and /T) Check the special documentation described in the annex of this manual for CP with special character.

	ATTENTION	The maximum power informed on the electrical data table should be used to size the protections and cables. DO NOT USE the power in regime that was calculated based on the nominal operating condition of the equipment.

	ATTENTION	Consult the standards applicable to the electrical installation at the site so as to ensure that the installation of the CP is according to the specified standards and prerequisites. For installations in Brazil, consult standard NBR5410 “Low Voltage Electrical Installations"

2.7.1. CPID Electrical Data

Equip. (1)	Voltage (2) (V)	Configuration (3)							
		Standard (00)		With Humidification (U0)		With Reheating (0R)		Humidification and Reheating (UR)	
		Maximum Current (A)	Cable (4) (mm²)	Maximum Current (A)	Cable (4) (mm²)	Maximum Current (A)	Cable (4) (mm²)	Maximum Current (A)	Cable (4) (mm²)
CPID-18	220	34,1	10	45	16	54,5	16	65,4	25
	380	22,4	4	33,3	10	42,8	16	53,7	16
	440	22,4	4	33,3	10	40,1	16	51	16
CPID-26	220	51	16	61,9	25	74,6	25	85,5	35
	380	30,7	10	41,6	16	44,4	16	55,3	25
	440	30,2	10	41,1	16	42	16	52,9	25
CPID-40	220	75	35	86	50	98,7	70	109,5	70
	380	43,4	16	54,3	25	57	25	68	35
	440	43	16	54	25	54,9	25	65,8	35

(1) Equipment in its displacement or side configuration and standard or extended structure.

(2) Three-phase electrical voltage, at 60 Hz frequency, with an allowable variation of ± 10%.

(3) Equipment configuration according to its accessories

(4) Diameter indication for cable per phase, for power supply of the main switch of the equipment. For distances greater than 50 meters, the cable should be resized.

3. Receiving

The receiving and moving of the equipment should be performed by the customer. In this stage, the following points should be checked:

- The data informed on the identification tag of the equipment should correspond to the information of the purchase order;
- The presence of all items, according to the order and invoice, and immediately inform the manufacturer in case of divergence or lack of items;

3.1. Packaging

For transports carried out in the country, the shipping of the CP is performed in a crate of wood wrapped in high resistance plastic. For export, the shipping is carried out in a closed fumigated wooden package. Both packages were designed to be transported exactly the way they are shipped.

	INFORMATION	The CP package was designed to ensure the integrity of the equipment during transport. Changes in the design of the package may result in damages on the equipment and loss of warranty

	ATTENTION	Do not pile boxes or deposit other volumes over the CP package.

3.2. Unloading, Moving and Storage

As soon as the unit is received and before unloading, check to see if the package of the CP does not have any damages caused during transport.

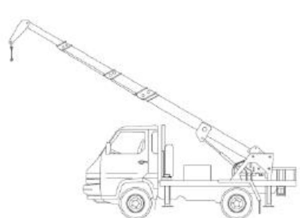
	INFORMATION	Check the general condition of the equipment IMMEDIATELY after opening the package. In case any damage is observed, take a picture and send it to the shipping company.

	INFORMATION	It is recommended to store the CP packaged in a dry place sheltered against dirt and bad weather in case the equipment remains unused for a long period of time before its installation and operation.

	INFORMATION	It is recommended to move the CP to the installation site or near the installation site with the original package.

Use a forklift or a pallet jack to unload. Check the weight of the equipment to define the capacity of the forklift that will be used to unload the equipment. Perform the transport with the equipment only in the vertical position. Transport the volume to the installation site or near it and unpack it.

In some cases, it is impossible to use the forklift, because the installation site is inaccessible, requiring the use of a munck truck or hoisting with a crane.



	ATTENTION	Use canvas belts appropriate for the weight of the equipment to lift it. Unsafe practices may cause accidents, therefore, this process should be carried out by qualified people and with the suitable safety equipments.

4. Installation

The CPID was designed thinking of efficiency, durability and safety of the operator; however, the safety should be ensured by the correct installation, preventive maintenance performed periodically and the operation within the design conditions.

	ATTENTION	It is recommended for the installation of the equipment to be performed by Mecalor or by a qualified person. It is imperative for the installer to have a knowledge of local installation codes and regulations in order to ensure that the best mounting and safety practices are used.

	DANGER	The CP was not designed to work in an area classified as risk of explosion. If the use in these conditions is detected, the equipment will lose its warranty.

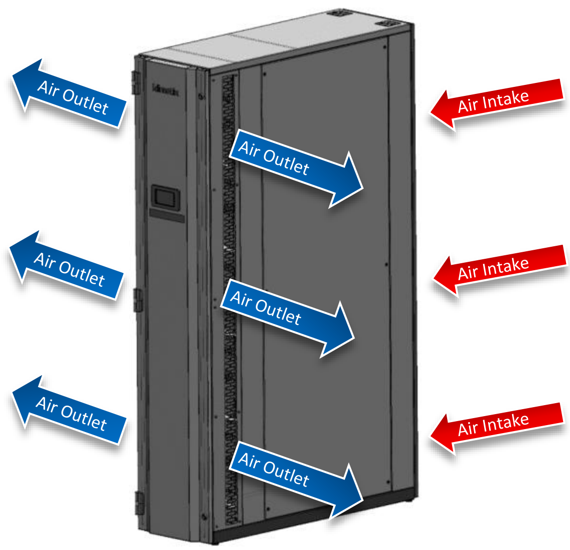
	ATTENTION	Consult the CR user manual for information regarding the correct positioning of the equipment, respecting all minimum space criteria for ventilation and maintenance.

4.1. Airflow

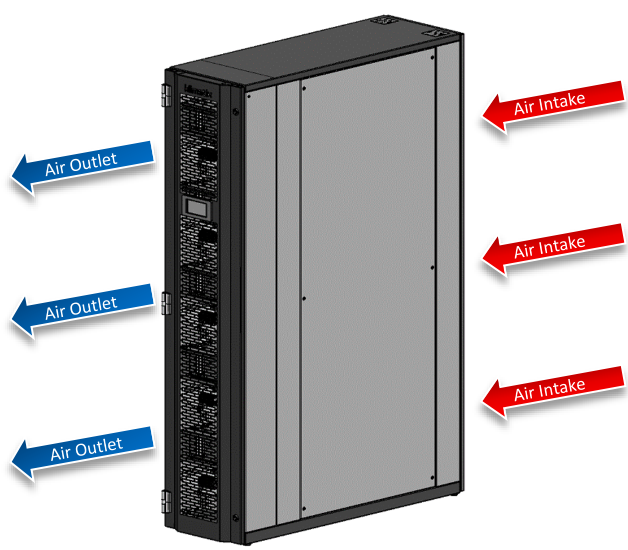
In-row type direct expansion precision air conditioners (CPID) can be supplied in two main air flow configurations, being:

Lateral flow: Configuration with the focus on air conditioning of the zone where the racks are installed, around the air conditioner. The air is captured in the hot aisle and accesses the equipment from the back. It is then directed to the evaporator for temperature and humidity control, driven by the radial fan and returned to the environment from the front through the sides of the equipment, directing the flow in front of the racks, where they capture the air for cooling.

In this configuration it is recommended for the cold aisle to be enclosed. One characteristic of the side-flow configuration is that the return temperatures tend to be higher compared to the displacement configuration. It is possible to block one of the outlets so that the cold air flow is directed in one direction only.



Displacement: In this configuration the focus is on air conditioning of the perimeter, not just the zone, as in the case of the side flow configuration. The air is captured and accesses the equipment from the back, coming from the hot aisle, and is directed to the evaporator for temperature and humidity control, driven by the radial fan and returned to the environment from the front through the equipment door, directing the flow to the cold aisle in front of the racks, for cooling.



4.2. Installation Site

The CP is designed for installation in data center rooms, UPS rooms or telephone centers. The equipment must be installed on a rigid and level base, and its condenser must be installed as close as possible to the evaporator unit being served, respecting the distances indicated in the table below.

It is important to emphasize that the siphon should be installed in the discharge line at every 6 meters of pipe length. In applications where there are level differences of more than 2 meters, the installation of a siphon must also be planned for these differences.

Position between condenser unit and evaporator unit	**Equivalent Length***	Maximum of 30 m
	Height	-5 to 17 meters
Siphon in the discharge line.	**Vertical upward**	Every 6 meters
Check valve		In the discharge line

** The length indicated in the table refers to the equivalent length of piping that comprises the distance between the evaporator and condenser units plus the equivalent length of connections and accessories. The limitation of this parameter has the purpose of limiting the load loss in the system in order to ensure nominal capacity of the equipment.*

	ATTENTION	Never block the air inlet and outlet flow.

	DANGER	Never open the front door while the equipment is running (access to the circulation fans). This practice can put at risk the operator and the operation of the equipment, able to cause loss of control of the process, breakage of the equipment and physical damages to the operator, in addition to loss of warranty.

4.3. Positioning

The installation of the precision air conditioners is simple, after defining the installation site the equipment must be positioned on the floor, and the ends of the supports can be supported on a rigid structure.

The leveling foot installed at the base allows the fine adjustment of ± 30 mm in travel, so that the height adjustment of the equipment can be perfectly aligned to the raised floor.

The installation of the equipment must be considered respecting some minimum dimensions to ensure proper maintenance and ventilation conditions for the equipment, as shown in the images below.

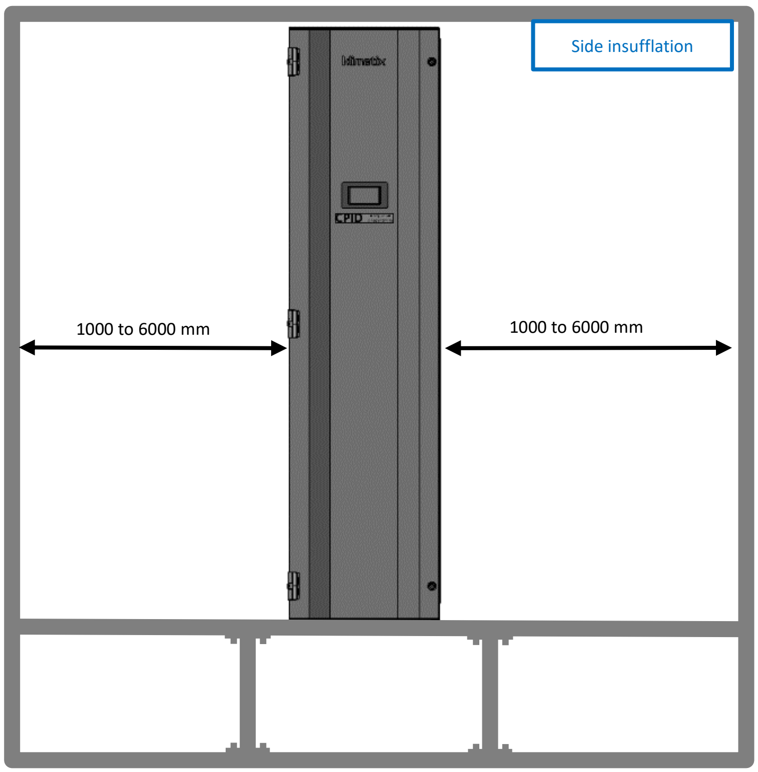
	INFORMATION	During installation, it is recommended to protect the CP to prevent dirt from surrounding works from settling in the equipment cabinet. It is recommended to carry out general cleaning after installing the equipment.

⚠	ATTENTION	In case it is necessary to adjust the height of the equipment by means of the leveling feet, be careful regarding the leveling of the equipment due to the risk of the air conditioner tipping over in case of excess unevenness.

4.3.1. Side insufflation

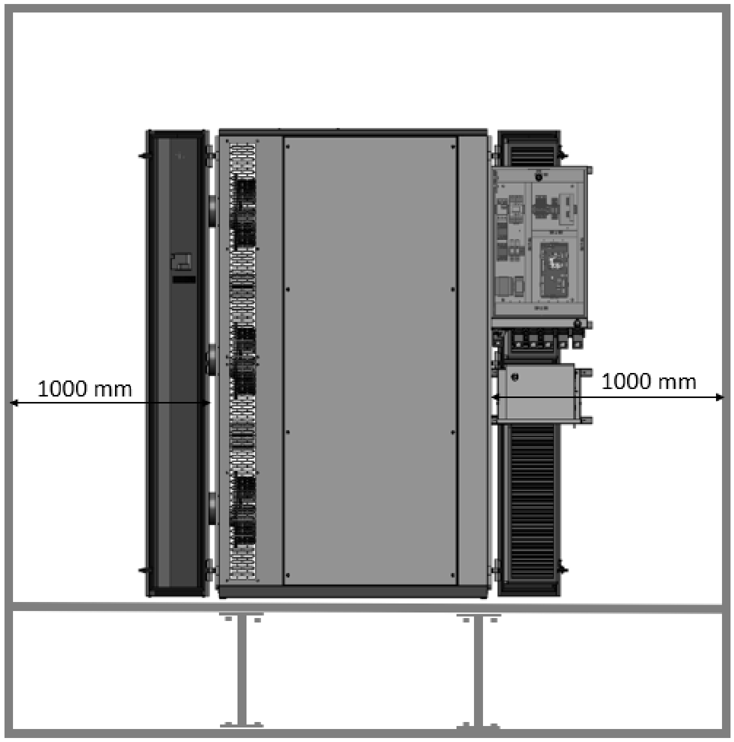
The side-flow configuration allows the racks to be installed touching the sides of the air conditioner; however, the air vents must remain free to ensure the supply of cool air to the front of the racks.

4.3.1.1. Side space requirements

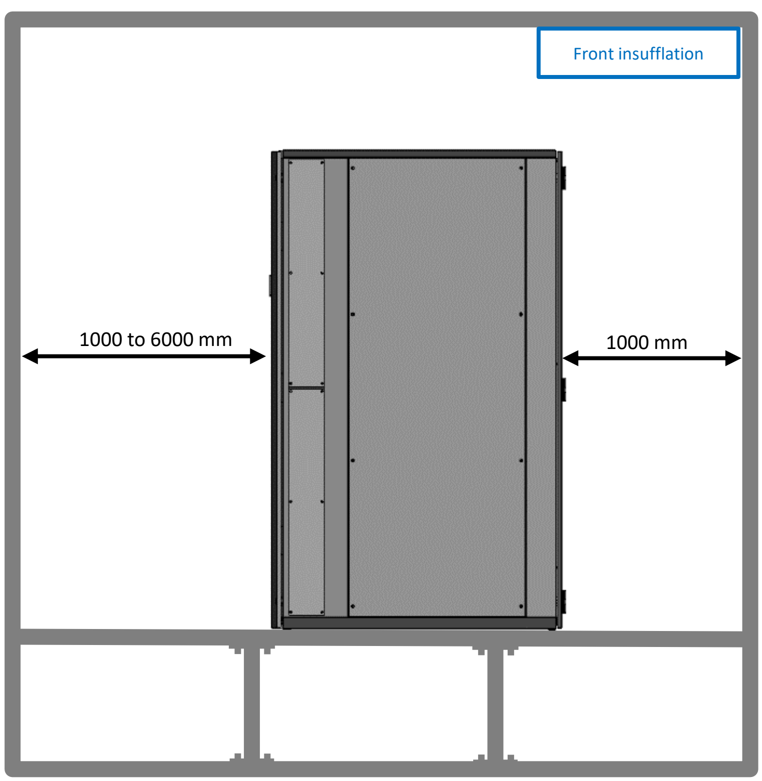


⚠	ATTENTION	In applications where the side-insufflated air conditioner is installed close to a wall or obstacle, one of the air outlets can be closed to concentrate the air flow in one direction only. Never block both air outlets simultaneously. Obstruction may cause irreversible damage to the equipment, as well as loss of warranty.

4.3.1.2. Front/back space requirements



4.3.2. Front insufflation



4.4. Electrical installation

The electrical installation between the main power point to the terminals of the main disconnector of the CPH Precision air conditioner is the responsibility of the customer or the installer hired by them.

	ATTENTION	Use blockades and warnings like *Equipment Under Maintenance* when the installation or intervention is occurring on the CP. Consult standard NR12 and local references for the correct signal of the equipment in case of installation or maintenance.

	DANGER	Keep the main switch of the equipment always switched off at the time of installation or maintenance of the CP. The noncompliance of this practice may cause personal damage or even death.

	DANGER	High voltage in the connection boxes of the electrical panel, compressor, fan, reheating electric resistor and steam generator. Risk of injury or death. Only qualified personal with suitable safety equipment can handle these components and with the prior authorization from Mecalor.

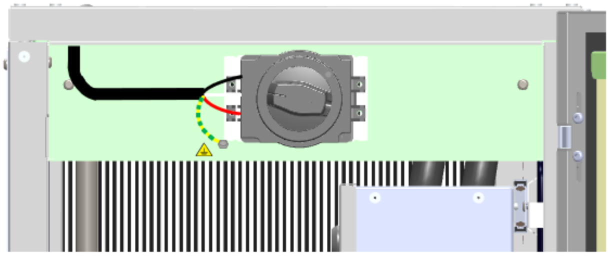
If the remote condenser is installed independently, the circuit breaker and the power cable must meet the power supply requirements of the equipment, voltage and power, described in the electrical data table in section 2.10 of this manual and support the current informed in it.

	ATTENTION	The customer is responsible for the sizing and selection of the exclusive disconnection device of the CP. Unsuitable sizing or out of the local regulations may put at risk the safety of the installation, causes damages to the equipment and loss of warranty.

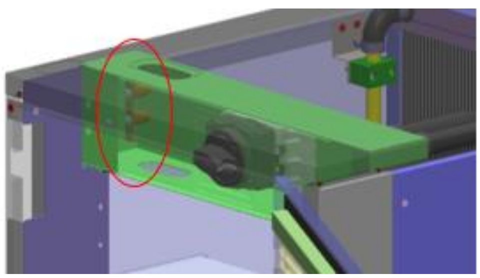
	ATTENTION	DO NOT USE the power in regime to size the circuit breaker and power cable. The electric safety devices should always be sized according to the installed/maximum power of the CP.

	ATTENTION	Consult the standards applicable to the electrical installation at the site so as to ensure that the installation of the CP is according to the specified standards and prerequisites. For installations in Brazil, consult standard NBR5410 “Low Voltage Electrical Installations"

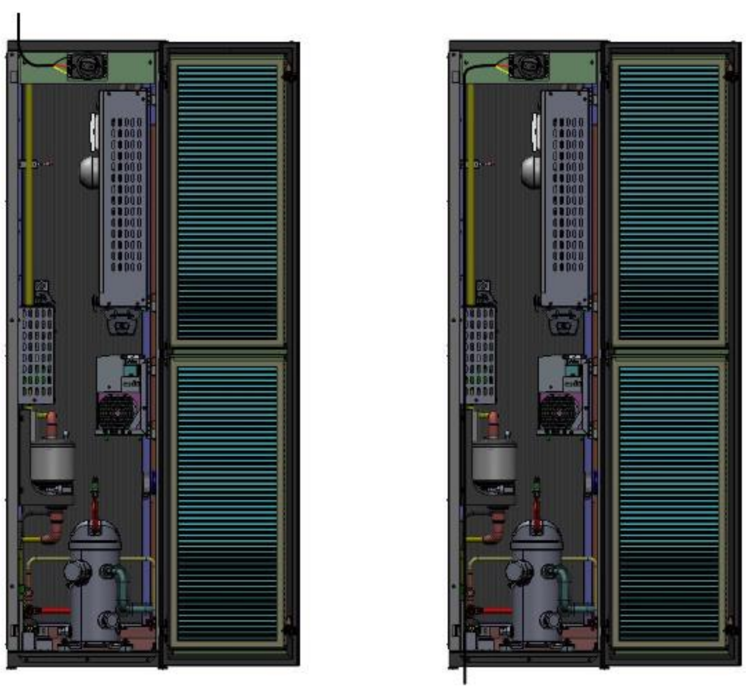
The power supply cable should enter until the main switch of the equipment, located above the electric panel. Phases R, S and T should be connected to the main switch and the ground cable attached to the panel as indicated below:



For equipment with a 380 or 440V supply voltage, it is necessary to connect the neutral. In this case, the electrical connection must pass through the electrical busbar that will be available to the left of the main circuit-breaker, as shown in the illustration below:



For the access of the power cable, the access to the main switch can be made through the top or the base of the equipment.



	INFORMATION	The piping for routing the power cable must be planned according to the installation. The wiring described in the figure are only an example general electrical installation and it does not consider the installation variables of the customer. The electrical pipe should comply with the applicable local codes.

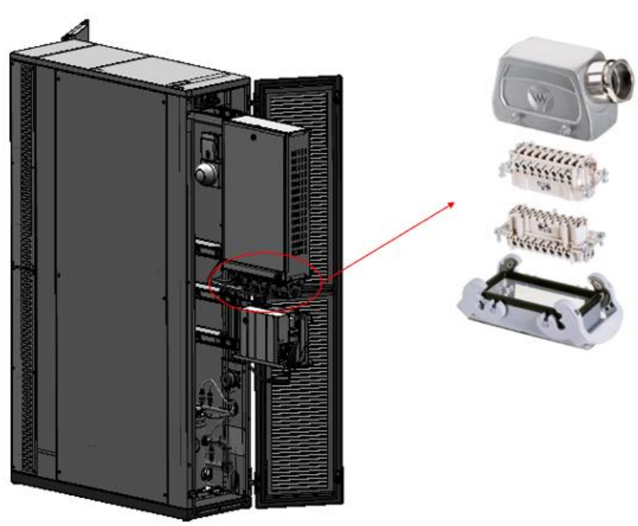
	INFORMATION	In case of power supply failure with the CP in operation and if the main disconnector is in the “ON” position, in normalization, the equipment will start operating automatically. Therefore, no action should be taken by the operator in this case.

	DANGER	Use non-tinned cables and with terminals at the points where the terminals are to be installed. Stripped cables can overheat, cause damage to equipment, personal injury and even death.

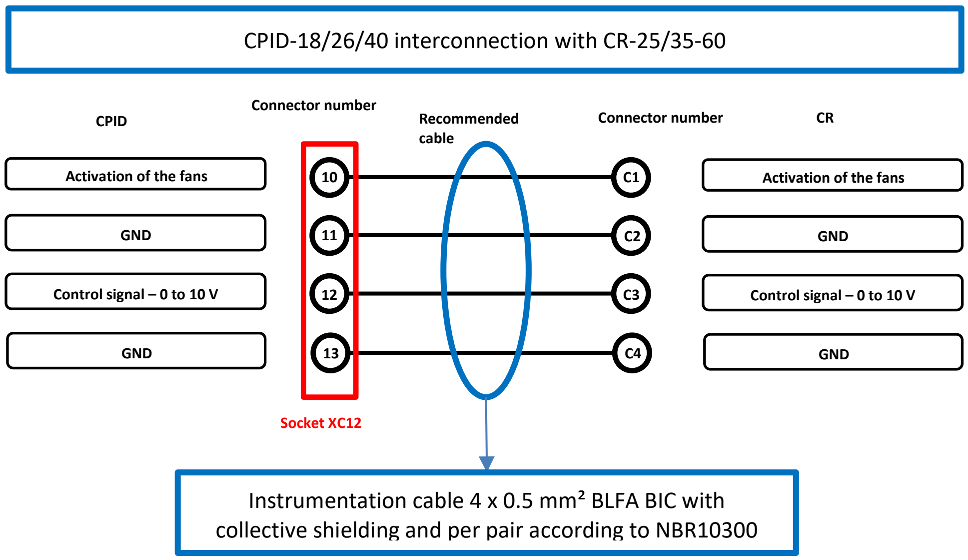
	DANGER	The cabinet of the CP can be electrically charged. The non-grounding of the equipment may cause electric shocks, short circuits, personal damages and even death. Ground the CP in the grounding grid. Location according to NBR-5410/NBR-5419.

4.4.1. Interconnection between CPID and CR

The CPID unit is supplied with multi-pole sockets to facilitate the interconnection between the components and mitigate the possibility of connection errors, since each socket has a specific pin-coded fitting.

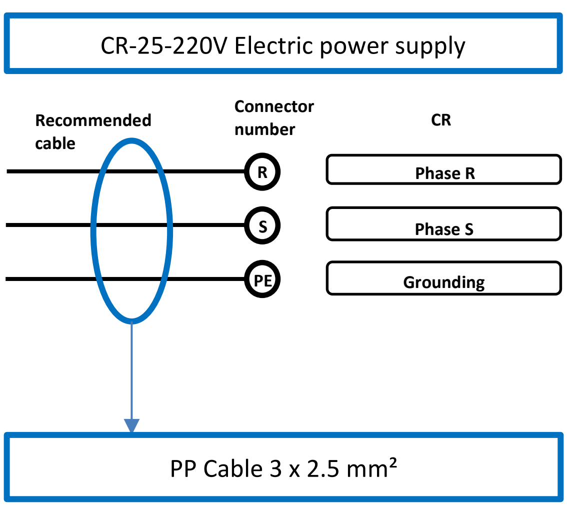


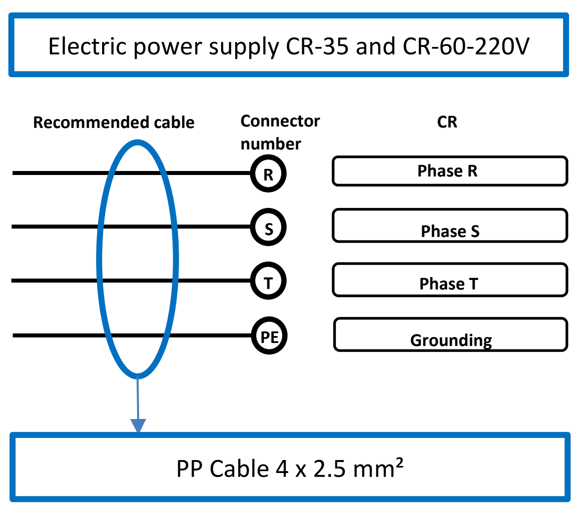
The interconnection between the CPID and CR unit is made to control the PLC installed on the CPID. For this connection it is recommended to use a 4 pairs x 0.5 mm² BLFA BIC instrumentation cable according to NBR 10300 with collective shielding and per pair. The numbering of the connectors for interconnecting the units is indicated below.

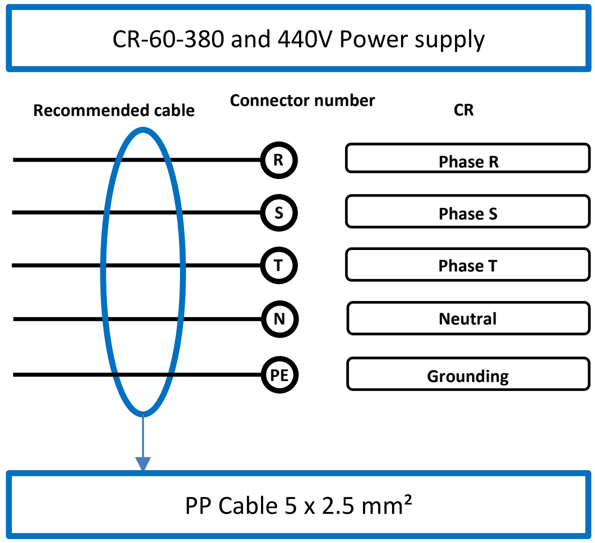


4.4.2. CR Electric power supply

In addition to the electrical interconnection between the CPID and the CR it is necessary to install a cable for the power supply of the CR. The CR unit is also supplied with a user manual containing essential information for the correct installation of this equipment. Therefore, we recommend that the manual be consulted before starting the equipment. The following are the connections and cable recommendations for the power supply of the equipment.

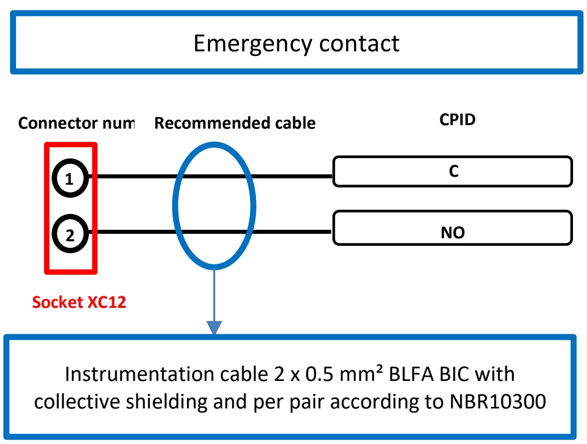


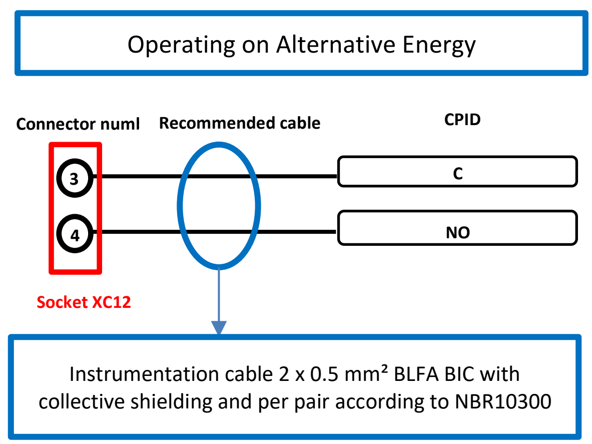


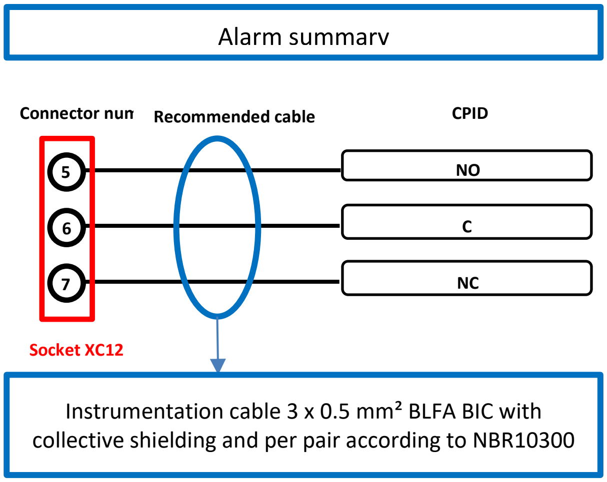


4.4.3. External interconnections

The CPID air conditioner provides some contacts for interaction with external interfaces, such as integration of an external emergency button, signal to indicate air conditioner operation with alternative power supply, and alarm summary. The contacts are all available for connection directly to the connectors of the multi-pole sockets. The connections should be carried out as shown below:

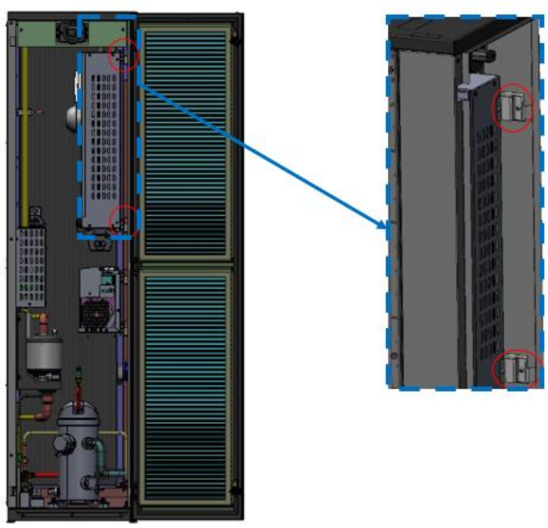






4.4.4. Access to the electric panel

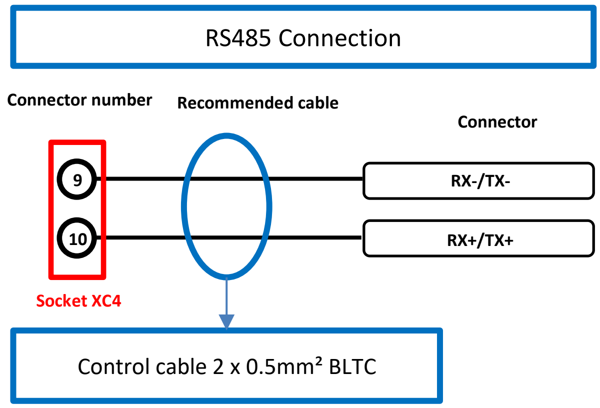
The electric panel of the CPID is accessed through the rear door of the equipment. To access it, it is necessary to remove the safety locks located on the slides of the panel. After removing the locks, the panel slides are free so that the panel can be moved to the outside of the air conditioner for handling. The safety locks are indicated in the illustration below:



	DANGER	Never handle the electric panel while the equipment is energized. This practice can put at risk the operator and the operation of the equipment, able to cause loss of control of the process, breakage of the equipment and severe physical damages to the operator, in addition to loss of warranty.

4.4.5. Interconnection via Modbus network

To connect the system via Modbus RTU via RS485 we must use a 2 x 0.5 mm² BLTC control cable according to NBR 7289. The connection must be made through the following points:

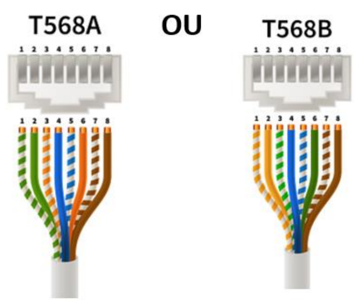


If the equipment is supplied with an included humidifier, these points will already be occupied by the communication between the air conditioner PLC and the humidifier PLC.

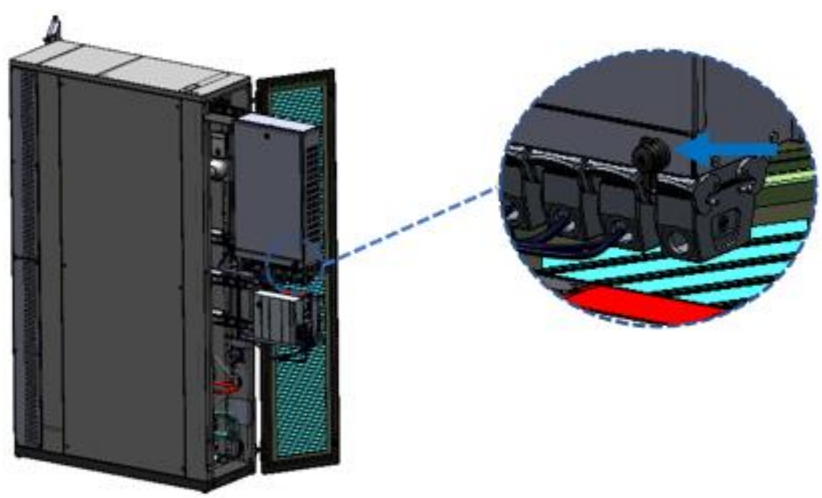
4.4.6. Interconnection via Ethernet network

For interconnection between equipment and network, and between equipment, CAT5e cable or higher must be used. The connection should be made through a switch for which the customer is responsible.

Parallel configuration must be used for terminal connection (the terminals must be crimped in an identical way in both terminals) and connection standard T568A or T568B can be followed, as shown in the figure below:



The connector for the network cable is located in the structure of the electric panel, as shown in the illustration below:



4.4.7. Interconnection of units for rotation operation

In an installation with more than one unit it is possible to carry out a network communication between the controllers to enable the rotation regime between the units, determining the time for rotation between them and the number of units in simultaneous operation. To perform the communication between the units, cables must be used according to the specifications in item 4.4.6 and a switch must be installed. After interconnecting the units, consult the controller setup for configuration of the "Multi Weather" and "Network Configuration" session within the controller settings menu.

To enable rotation operation it is necessary to adjust the addressing of the controllers, since the unit controllers are supplied with default addressing. All addressing parameters for the units are located in the “Network Configuration" menu. Each unit must be set in an exclusive IP range, so that there is no communication failure between the units. The "Multi Climates" menu contains the parameters for configuring the rotation regime of the units, such as the amount of equipment on the network, the number of equipment operating simultaneously, the time for rotation, and the identification address of each unit. It is possible to set up to 10 units in the system.

4.5. CPID cooling installation

The cooling interconnection between the evaporator unit (CPID) and remote condenser (CR) must be made with copper pipes, according to ASTM C12200, and the suggested connection diameters are indicated according to the table below:

CPID Model	**Connection dimensions**			
	Discharge line	**Indicated thickness**	**Liquid line**	**Indicated thickness**
CPID-18	5/8”	1/16"	1/2”	1/16"
CPID-26	3/4”	1/16"	1/2”	1/16"
CPID-40	7/8”	1/16"	5/8”	1/16"

The refrigeration circuit piping must be sized according to the installation conditions and must be limited according to the restrictions, recommendations and distances defined in section 4.2 of this manual, such as bends, reductions, valves and other accessories, maintaining the equivalent length and the positioning of the remote condenser can be done at the same level, above or below the evaporator unit. The tubes used for interconnection between evaporator and condenser units, as well as accessories, must be clean and free of moisture.

The connection between pipes and components should be made through spigots, never through butt weld, using a brazing process and filler material containing 15% silver according to DIN EN 1044.

To avoid the formation of oxide contaminants inside the tubes and accessories, the brazing process must be carried out with the injection of nitrogen.

⚠	**ATTENTION**	The pipes must be cleaned before being connected to the evaporator unit and remote condenser, and only nitrogen should be used for this.

The discharge and liquid pipes must be at least 25mm apart and secured by supports at a distance of not more than 2 meters.

The following table shows some additional recommendations for assembly, considering the level of the remote condenser in relation to the evaporator unit.

Installation Settings		
CR above the CPID	**CR at CPID level**	**CR below the CPID**
• The maximum level difference allowed between the units is 17 meters; • A double siphon should be provided every 6 meters for the superheated steam line (discharge); • A siphon must be provided every 2 meters of level difference; • The horizontal stretch should be designed with minimum inclination of 0.5% in the direction of the refrigerant flow.	• The horizontal stretch should be designed with minimum inclination of 0.5% in the direction of the refrigerant flow.	• The maximum level difference allowed between the units is 5 meters; • The horizontal stretch should be designed with minimum inclination of 0.5% in the direction of the refrigerant flow.

⚠	**ATTENTION**	Always use an inverted siphon in the inlet and outlet lines of the unit that must be at least 150 mm above the level of the condenser.

⚠	**ATTENTION**	The temperature of the discharge pipe can reach values over 90°C, so do not attach elements or components that may suffer damage or malfunction.

4.5.1. Leak check

Perform the procedure to detect leak by pressurizing the refrigeration circuit with nitrogen. The system should be pressurized to maximum pressure of 4.0 MPa (40 bar).

After 1 hour check for any pressure variation and check for leak points in case variation is observed.

	ATTENTION	Do not apply pressure greater than 4.0 MPa (40 bar) in the refrigeration circuit.

4.5.2. Vacuum

To ensure performance in air conditioner operation it is essential to remove the moisture contained in the refrigeration circuit through an evacuation process.

The procedure to be adopted is started by connecting the vacuum pump to the service valves, installed on the high and low pressure sides of the refrigeration circuit, followed by activating the pump. When the pressure in the refrigeration circuit reaches an absolute value of 40 Pa (300 mmHg) close the connections and switch off the pump.

Then follow the pressure rise, and if the pressure increases quickly, repeat the procedure to check for leaks, because the rapid pressure variation is an indication of a leak.

Three hours after switching off the pump, the value measured in a vacuum gauge must not be higher than 160 Pa (1200 mmHg), if the pressure is higher than specified, the leak check procedure must be performed.

4.5.3. Oil charge

Due to the length of the piping that interconnects the evaporator and condenser units, it is necessary to add lubricating oil to the system. The amount of oil to be added varies based on the length of the interconnection path of the units.

It is recommended to add 0.1 to 0.13 liters of oil for each Kg of coolant added to the refrigerant circuit.

4.5.4. Refrigerant load

With the refrigerant cylinder connected to the liquid tank, open the regulator and let the refrigerant in the liquid phase enter the system until the pressure reaches approximately 0.3 MPa.

The completion of the coolant load will be carried out with the equipment in operation. This requires connecting the cylinder with refrigerant to the suction line using a manifold, then opening the cylinder valve and slowly opening the manifold regulator. Allow the refrigerant to enter the system until there are no more bubbles in the liquid display. In this condition, the overheating should be between 5 and 6°C and sub-cooling should be between 6 and 9°C.

	ATTENTION	The refrigerant load should be executed exclusively in the liquid phase.

	ATTENTION	Do not activate the compressor with a suction pressure below 0.05 Mpa. Operating the compressor in this situation for more than a few seconds can cause the compressor to overheat, causing irreversible damage.

4.6. Installation of the Options

4.6.1. Air filter M5

It is possible to replace the G4 air filter supplied with the equipment to ensure a finer degree of filtration. The equipment has an optional M5 air filter supplied according to ABNT NBR 16101:2012. The filter can be supplied with the equipment or installed on site, and must be replaced when it is saturated

4.6.2. SNMP Communication

The standard equipment has a Carel PLC and standard communication via MODBUS TCP/IP or MODBUS RTU RS-485, allowing the monitoring of parameters, remote on/off and setpoint adjustment. Optionally the system can be supplied with a plugin for SNMP communication, if necessary for compatibility with management or monitoring software of the plant where the equipment is installed.

4.6.3. BACNET Communication

Besides the possibility of providing the SNMP communication plugin, it is possible to supply the equipment with a plugin for Bacnet communication, another communication option for compatibility with management or supervisory software of the plant where the equipment is installed.

4.6.4. Flooded floor sensor

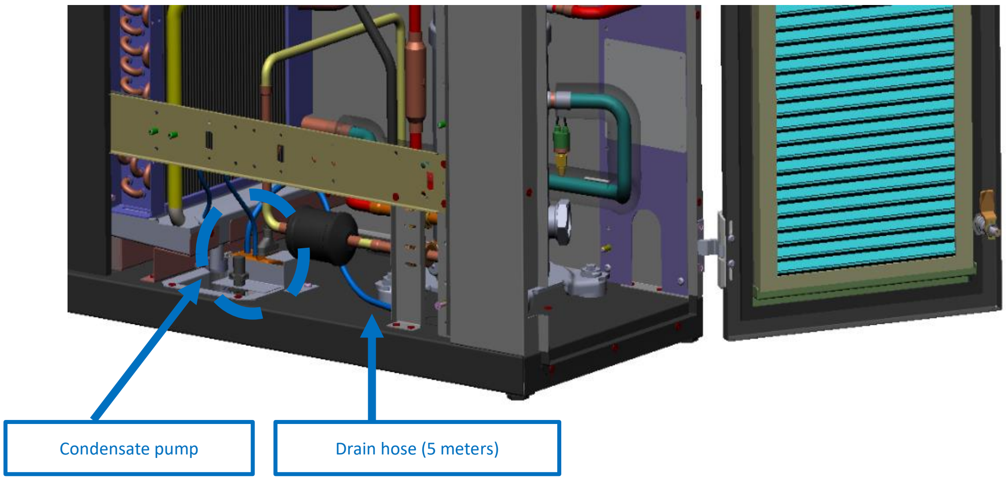
The flooded floor sensor is also an optional item that can be supplied with the equipment. It is a ribbon-shaped sensor that detects the presence of water on the floor. The sensor is connected to a relay, responsible for sending the signal to the PLC, indicating a fault on the HMI of the CPID unit.

4.7. Drain installation

Due to the low temperature of the refrigerant fluid that passes through the evaporator and the ambient air humidity, condensation can occur on the evaporator. There is a tray inside the CPID unit to collect the condensation water from the evaporator. This tray is hydraulically connected to a small tank with a condensate removal pump, which is automatically activated as soon as the tank reaches a certain level of accumulated water.

For the hydraulic interconnection of the pump, we recommend the use of a ¼" polyurethane hose. A 5-meter-long hose within these specifications is supplied with the equipment, and the customer is responsible for connecting this hose to the hose of its drainage network.

The condensate removal pump has a water discharge capacity of approximately 2.5 meters of height; therefore we recommend that the hydraulic installation be carried out respecting this height limit. The hose may have its outlet through the base or the ceiling of the equipment.



⚠	**ATTENTION**	The discharge hose of the condensate removal pump must be installed far from beds and electrical interconnections.

⚠	**ATTENTION**	The drainage network must not have level differences of more than 5 meters. In such cases the use of a booster in the drainage system must be provided.

4.8. Leveling

The base of the equipment must be leveled to ensure the correct oil return to the cooling system compressor. A bad leveling can cause not only compressor damage due to lack of proper lubrication, but also excess vibration in the equipment, which may result in premature breakage of components and cracks in the cooling piping.

The CPID unit is supplied with leveling feet with threaded adjustment and nut locking, in case adjustments are needed to ensure correct equipment leveling. To make sure that the base of the equipment is level, we recommend the use of an instrument called a bubble level.

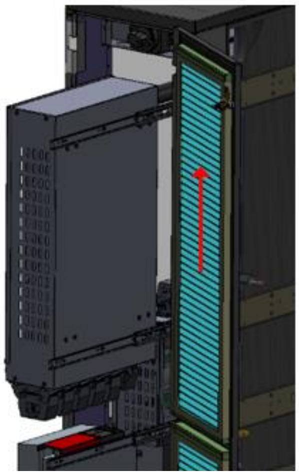
4.9. Replacement of the air filter

The CPID air conditioner by default is supplied with G4 air filters, with the possibility of purchasing the equipment with M5 filters according to ABNT NBR 16101:2012.

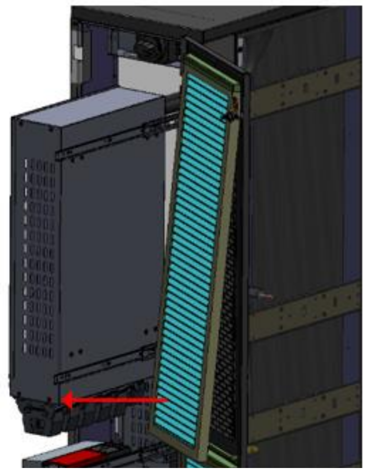
The filters are located inside the rear door of the air conditioner fixed by ducts.

Over time, depending on the conditions of the installation environment, the filters will be saturated with dirt, requiring their replacement. Optionally the equipment can be supplied with a digital differential pressure switch, which measures the pressure drop in the input and output of the filter, indicating an alert in the HMI when the loss exceeds the pressure switch limits.

The replacement of the filters is very simple, with no tools required. Simply lift the filter until it reaches the top of the top mounting duct so that the bottom of the filter is free for removal, as shown in the illustration below:



Lifting the filter to the top



Pull the bottom of the filter in the opposite direction of the door

For this equipment we recommend the use of pleated filters with galvanized steel sheet frames that meet the specifications below:

CPID Model	Filter specifications			
	Filtration grade	**Initial load loss**	**Final load loss**	**Nominal flow rate**
CPID-18	G4 (Standard)	120 Pa	200 Pa	2700 m^3/h
CPID-18	M5 (Optional)	160 Pa	250 Pa	2700 m^3/h
CPID-26	G4 (Standard)	120 Pa	200 Pa	3500 m^3/h
CPID-26	M5 (Optional)	160 Pa	250 Pa	3500 m^3/h
CPID-40	G4 (Standard)	120 Pa	200 Pa	4400 m^3/h
CPID-40	M5 (Optional)	160 Pa	250 Pa	4400 m^3/h

⚠	**ATTENTION**	Operation with saturated air filters damages the air conditioning performance of the equipment, and may result in damage to the air conditioner and loss of warranty.

5. Operation

Below is a set of instructions for the correct operation of the CPID, as well as the change of the control temperature and humidity of the equipment and access to the alarm screens.

The operating actions do not require the use of PPEs unless the environment where the CPID is located requires it. The customer is responsible for establishing which PPEs the operator must use. The customer must provide suitable lighting for the environment where the CP is installed and where maintenance services will be performed, if necessary.

Before starting operation with equipment, we must:

- Check the position of the service valves of the CPID cooling circuit, which must be open;
- Check the electrical connections between the components, cables and terminals, tightening when necessary;
- Check the gauges and fittings of the electrical conductors;
- Check the gauges and fittings of the pipes;
- Check to see if the safety devices of the equipment and installation are not activated;
- Check the control fuses;
- Check the voltage and difference between the electric power supply phases;
- Check to see if the air flow of the unit is not blocked and if there is suitable ventilation in the equipment installation site.

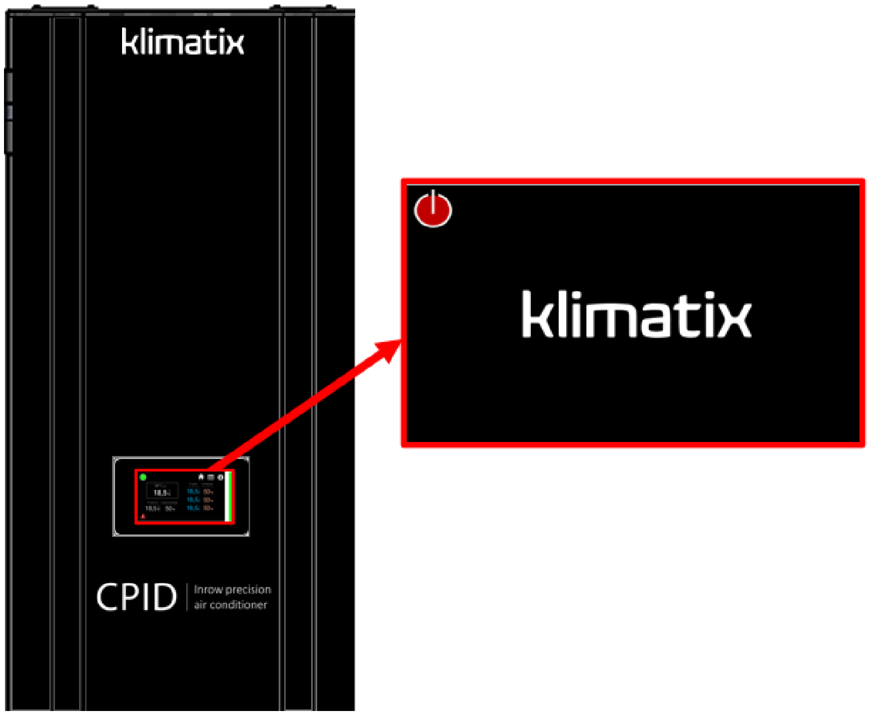
The equipment control is done through the PLC installed in the Precision Air Conditioner, including all the functions related to the temperature and humidity control of the system, including, in the case of the system with direct expansion. For more information about alarms and faults, refer to the manual of the corresponding evaporator unit.

	ATTENTION	It is recommended for the operator to go through training before operating the equipment. The CP is easy to operate, but the operator must be qualified and have the minimum knowledge to operate the equipment safely.

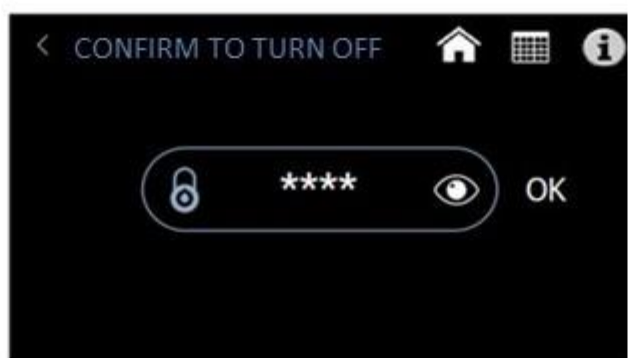
5.1. Start-up

After performing the electrical installation, change the position of the main disconnector to the 'ON' position. The equipment will be energized.

With energized equipment the HMI should be initiated and to activate the equipment, just press the button on the top left corner of the screen, as shown in the figure below. In case the HMI does not start operating, check to see if voltage is reaching the inlet of the Main Switch and if there is no phase inversion failure. In case of failure, carry out the phase inversion to invert the RS phases.



To turn off the equipment, the access password will be requested, according to the following sequence of illustrations:



After the password field is displayed, touch the password field to display the virtual keyboard.

	INFORMATION	The equipment should not be switched on without prior authorization from Mecalor, under the penalty of suspension of the warranty.

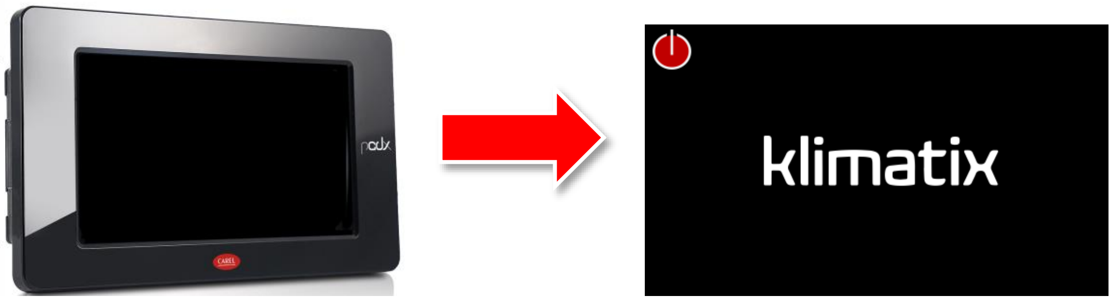
	INFORMATION	Fill out the “Final inspection checklist of the installation before Start-up” before contacting Mecalors Technical Support for startup of the CP.

	INFORMATION	Use the main switch only to turn off the CP power in cases of maintenance. The main switch should not be used to switch the equipment on and off routinely. For this, use the HMI. The control panel monitors the CP variables and must be powered.

5.2. Command Panel

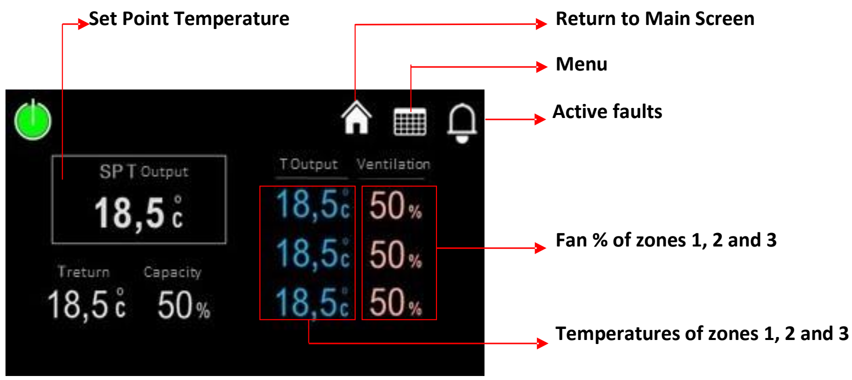
The Control Panel of the CP consists of a touch screen and it is installed on the door of the equipment, as shown in the image above. In case of a fault the HMI will present an alarm signal and the led located on the right side will turn on in red, as shown in the image below:

5.2.1. Operating description of the MMI

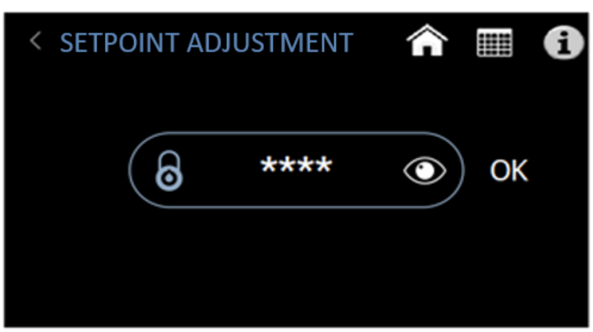


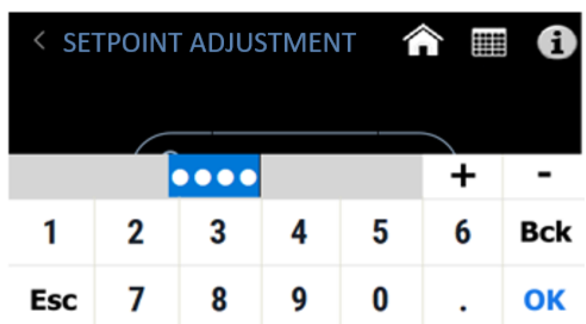
MMI Mask **Presentation Screen**

Main Screen

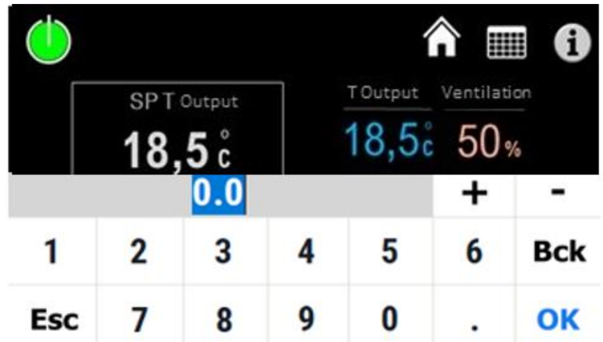


To change the setpoint of the return temperature or relative humidity, touch the screen. The access password will be requested initially.

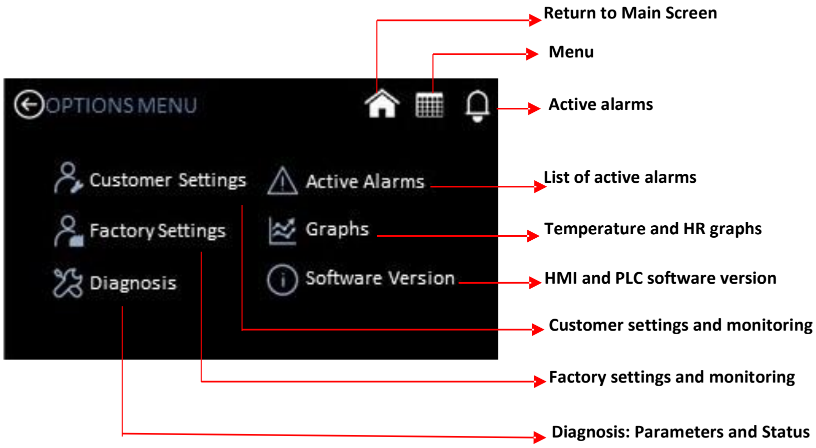




After releasing access, a virtual keyboard will be displayed, type the desired set point value and confirm.

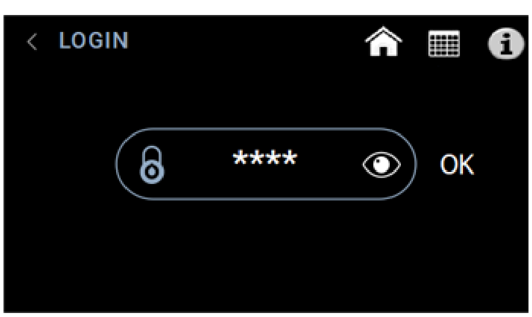


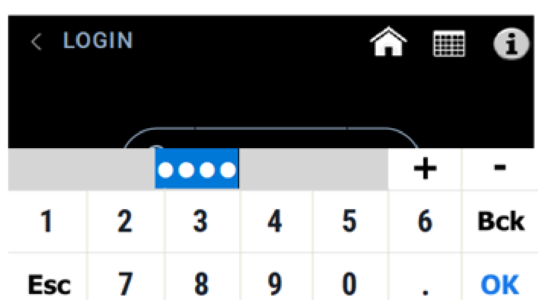
Menu



The Settings screens allow access to the configurations of the system and its components, as well as PID parameters, operating parameters, operating modes, activation of optional features (when applicable), and reading of variables.

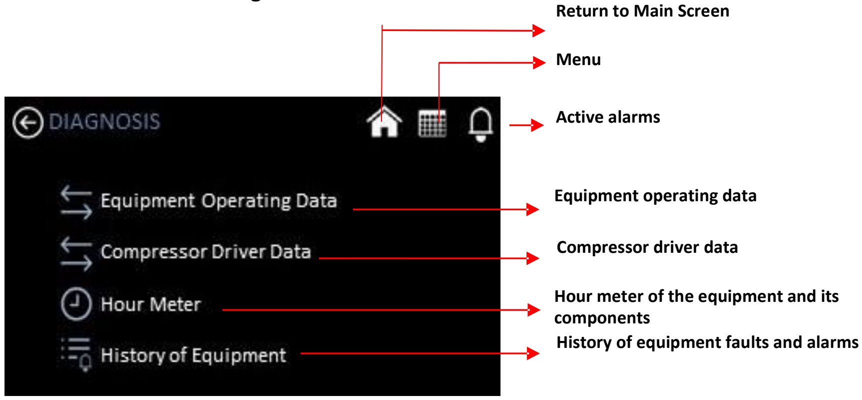
A user or factory password is required to access it. The password entry screen is displayed when the Settings icon is touched. When you click on the field to fill in the password, the virtual keyboard will be displayed. Use the password provided in the equipment setup and then confirm it.





	DANGER	It is not allowed to change the software, parameters or operating conditions on the MMI screen in the factory menu. This practice can put at risk the operator and the operation of the equipment, able to cause loss of control of the process, breakage of the equipment and physical damages to the operator, in addition to loss of warranty.

Diagnosis



The "Diagnostics" screen allows visualization of the process variables, equipment status, operating hours of the equipment, components, and alarms history. In case of alarm occurrence, after the fault has been solved, reset the equipment so that it is possible to resume the operation.

6. Maintenance

Carrying out the maintenance procedures at the recommended intervals will ensure the proper functioning of the equipment within the conditions for which it was designed and manufactured.

The maintenance activity must be carried out only by technical specialists who must observe and respect the safety rules in any type of intervention on the equipment.

It is recommended to record and control the maintenances performed.

	DANGER	Never perform any type of maintenance while the equipment is energized. This practice can put at risk the operator and the operation of the equipment, able to cause loss of control of the process, breakage of the equipment and physical damages to the operator, in addition to loss of warranty.

6.1. Corrective maintenance

All CP faults are indicated on the HMI alarm screen. The failures of the CP are divided into two types: Warnings and Alarms. In case a failure occurs on the CP, before applying the procedures described below, check the failure log as described in the previous session.

When the fault is an Alert, it is only recorded in the fault history; however, in alarm conditions, the alarm icon is displayed on the HMI and the red LED on the left side of the Interface is activated, as shown in section 5.2 of this manual.

	ATTENTION	The procedures described below can only be performed by qualified people who have the knowledge on the operation of the equipment. Procedures performed by the layman may result in injuries or breakage of a component.

6.2. Fault indication

All equipment faults are recorded in the HMI fault history, however, the alert signal is only issued when there are active alerts. Some alarms stop the operation of the equipment partially or completely and depending on the situation require an immediate diagnosis and solution.

When an alarm is identified, it is recommended to check the fault history to identify previously registered alerts, complementing the information for an accurate diagnosis.

Below is a table containing all the faults that may be indicated in the MMI of the CP, the causes and procedures to be adopted when these are indicated. In case the failure cannot be corrected by following the procedure below, contact the Technical Support of Mecalor.

Description of the fault	Component		Consequence	Type		Rearm		Probable cause	Procedure
	TAG	Description		Alert	Alarm	Manual	Automatic		
Disabled air conditioner	EM1	Emergency Contact	Shutdown the equipment		X		X	Opened emergency contact	Check to see if the electrical contact is closed. If it is, check for the presence of 24V signal in the connection wires of the EM1 contact. If there is no signal continuity, check for poor contact in the connection.

Fault in circulation fan start	TC1	Current relay of circulation fans	Turns off the cooling system		X	X	X	Operating current of the fan is above nominal	Check if the fan of the condenser unit is operating with current within the specifications of the electrical data table. If it is identified that the current is above the nominal value of the fan operation, check if the supply voltage is correct or if there is poor contact in the electrical connection of the condenser unit. Also check if the fan is presenting any malfunction.
Electrical protection of the condensation fan	VF	Condenser unit fan	Turns off the cooling system		X	X	X	Disarm the fan thermistor	Check to see if the voltage and current of the fan are within the specification of the electrical data table of the equipment In case of abnormalities in the operating current, check for the existence of poor contact in the electrical connection, imbalance or lock in the fan or excess ambient temperature at the installation site of the condenser unit.
Pressure fault	PLL	Low pressure switch	Turns off the cooling system		X	X	X	Low pressure in cooling circuit	Carry out an alarm reset attempt. If the refrigeration system starts operating again, check if there are bubbles in the liquid display. In case the liquid display is bubbling, call a refrigeration technician to perform an analysis on the equipment in order to identify leakage points of the refrigerant fluid.
Clogged air filter	F	Air filter	Alert	X		X	X	Dirt accumulation in the air filter	Replace the air filter

Fault in condensate pump	SL1	Condensate tray level sensor	Disable the humidifier		X	X	X	Condensate pump malfunction	The condensate pump starts automatically when water accumulates in the tray. If the pump does not start, check for poor contact in the power connection of the pump.
High level in the condensate tray								Clogging of the drain	Check to see if the drain hose is not clogged.
Fault in the resistor activation system	Q2	Resistor circuit breaker	Disable the humidifier and heating resistor		X	X	X	Disarm the circuit breaker	Try to reset the circuit-breaker and check if the voltage and current of the resistor are as specified in the electrical data table.
	TC2	Current relay of the resistor						Operating current of the resistor is above nominal	Check to see if the operating current of the resistor is according to the electrical data table of the equipment. If abnormalities in the operation current are identified, check for poor contact in the electrical connection or discrepancy in the supply voltage to the resistor.
Imminent risk of fire	FD1	Smoke detector	Shutdown the equipment		X	X	X	Activate the smoke detection device	Eliminate the smoke focus to reset the device.
Fault in the sensor – Air inlet/outlet temperature Z1/Z2/Z3	TT1, 2, 3, 4, 5	Temperature sensor	Temperature control will operate at the average reading of the operating sensors		X	X	X	Temperature not within sensor reading range	Check to see if the sensor is properly in the equipment.
								Bad sensor connection contact	Check to see if the electrical connection of the sensor is according to the electrical diagram.
High/low temperature at air inlet/outlet Z1/Z2/Z3			Alert	X		X	X	Temperature not within setpoint	Check for the existence of other alerts/alarms that are preventing the operation of the equipment.

Fault in the sensor - Humidity Of the air return	TTH1 (Optional)	Temperature and humidity sensor	Turn off the humidifier and heating resistor		X	X	X	Humidity not within sensor reading range	Check to see if the sensor is properly in the equipment
								Bad sensor connection contact	Check to see if the electrical connection of the sensor is according to the electrical diagram.
High/low humidity in the air return			Alert	X		X	X	Humidity not within setpoint	Check for the existence of other alerts/alarms that are preventing the operation of the equipment.
Fault in the sensor – High pressure	PS1	Discharge pressure transmitter of the compressor	Keep the condenser fan operating at 100% of its capacity		X	X	X	Poor contact in the pressure transmitter connection	Check to see if the connection of the pressure transmitter is according to the electrical diagram.
								High pressure fault	Check the cleaning conditions of the condenser and the existence of hot air recirculation in the installation room of the condenser unit.
High/low condensation temperature	PTS1	Discharge temperature sensor of the compressor	Alert	X		X	X	Pressure not within limits established in the controller setup	Check for the existence of other alerts/alarms that are preventing the operation of the condensation system or for dirt accumulation in the condenser.
Fault in the sensor – Low pressure	PS2	Suction pressure transmitter of the compressor	Disable the cooling circuit		X	X	X	Poor contact in the pressure transmitter connection	Check to see if the connection of the pressure transmitter is according to the electrical diagram.
								Low pressure fault	Carry out the indicated verifications in the low pressure fault diagnostics.
High/low evaporation temperature	PTS2	Suction temperature sensor of the compressor	Alert	X		X	X	Pressure not within limits established in the controller setup	Check for the existence of other alerts/alarms that are preventing the operation of the cooling system.

Low SH alarm	NV1	Electronic expansion valve	Disable the cooling system		X	X	X	Low superheating	Call a refrigeration technician to check the operation of the cooling system.
								Reading error in the pressure sensors/transmitters	Check to see if the temperature sensors and pressure transmitters are making the correct reading. In case of abnormalities, check to see if the connection of the component is according to the electrical diagram.
LOP Alarm	NV1	Electronic expansion valve	Disable the cooling system		X	X	X	Low pressure	Call a refrigeration technician to check the operation of the cooling system.
								Reading error in the pressure sensors/transmitters	Check to see if the temperature sensors and pressure transmitters are making the correct reading. In case of abnormalities, check to see if the connection of the component is according to the electrical diagram.
MOP Alarm	NV1	Electronic expansion valve	Disable the cooling system		X	X	X	High pressure	Check the cleaning conditions of the condenser and the existence of hot air recirculation in the installation room of the condenser unit
								Reading error in the pressure sensors/transmitters	Check to see if the temperature sensors and pressure transmitters are making the correct reading. In case of abnormalities, check to see if the connection of the component is according to the electrical diagram
Fault in humidifier control thermal relay	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Disarm the humidifier thermal relay	Check to see if the power voltage of the humidifier is correct.
Required replacement of the cylinder								Humidifier cylinder life exhausted	Replace humidifier cylinder

High conductivity in the humidifier water	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Bad quality of the supply water of the humidifier	Carry out cleaning of the cylinder of the humidifier and the electrodes of the conductivity sensor. If the problem persists, install a demineralization system for the supply water of the humidifier.
Configuration error	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Incorrect parameterization	Check to see if the parameters of the controller are according to the setup.
Humidity controller memory error	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Damaged controller	Check to see if the parameters of the controller are according to the setup. If the fault persists, contact technical support.
High current in the electrode of the humidifier	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Very high conductivity	Drain part of the water and reset the alarm.
								High water level	Check to see if the drain valve is okay.
								Fault in the electrode	Search for leaks on the water supply valve.
Low steam production in the humidifier	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Water conductivity not within the limits	Check the quality of the water used in the humidifier supply.
								Excessive dirt in the humidifier cylinder	Clean the cylinder and replace the water.
								Incorrect parameterization	Check to see if the parameters of the controller are according to the setup.
High level of water in the humidifier	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Excessive water in the humidifier cylinder	Check to see if the drain valve is okay.
External signal not connected	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Incorrect parameterization	Check to see if the parameters of the controller are according to the setup.
								Poor contact	Check to see if all connections of the humidifier controller are according to the electrical diagram.
Fault in the filling of the humidifier	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Lack of supply water of humidifier cylinder	Check for possible lack of water in the supply system of the humidifier or clogging in the hydraulic circuit.
Fault in humidifier drainage	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Fault in the drainage valve	Check to see if the electric power supply of the drainage valve is correct. Also check for possible clogging in the drainage system.

Cleaning in the humidifier is required	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Dirt accumulation in the humidifier cylinder	Clean the humidifier cylinder and replace the water.
Foam in the cylinder	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Foam accumulation in the humidifier cylinder	Check for chemical products in the supply water of the humidifier. Clean the cylinder and replace the water.
Salt accumulation in the humidifier	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Bad quality of the supply water of the humidifier	Clean the cylinder and replace the supply water. Install a water demineralization system if the problem persists.
Protection for oil circulation	C1	Compressor	Alert	X				Compressor operating at low rotations for a long period of time	Compressor operating momentarily at high speed for oil circulation
Overcurrent in compressor phase	C1	Compressor	Turn off the compressor		X	X	X	High current in the compressor phases	Check to see if the operating current of the compressor complies with the specifications in the electrical data table. If abnormalities in compressor operation are identified, check for poor contact in the electrical connection or if the compressor is operating outside the operating limits.
Overcurrent in compressor phase									
Overcurrent in driver inlet	C1	Compressor	Turn off the compressor		X	X	X	High current in compressor driver supply	Check to see if the operating current of the driver complies with the specifications in the electrical data table. Also check for poor contact in the electrical connection and if the compressor is operating within the operating limits
Overvoltage in the DC busbar of the driver	C1	Compressor	Turn off the compressor		X	X	X	Driver supply voltage above limits	Check to see if the operating current of the driver complies with the specifications in the electrical data table. Also check to see if the compressor is operating within operating limits

Undervoltage in the DC busbar of the driver	C1	Compressor	Turn off the compressor		x	x	x	Driver supply voltage below the limits	Check to see if the operating current of the driver complies with the specifications in the electrical data table. Also check to see if the compressor is operating within operating limits
Overvoltage in the AC busbar of the driver	C1	Compressor	Turn off the compressor		x	x	x	Driver supply voltage above limits	Check to see if the operating current of the driver complies with the specifications in the electrical data table. Also check to see if the compressor is operating within operating limits
Undervoltage in the AC busbar of the driver	C1	Compressor	Turn off the compressor		x	x	x	Driver supply voltage below the limits	Check to see if the operating current of the driver complies with the specifications in the electrical data table. Also check to see if the compressor is operating within operating limits
High pressure in cooling system	C1	Compressor	Turn off the compressor		x	x	x	High pressure fault	Check the cleaning conditions of the condenser and the existence of hot air recirculation in the installation room of the condenser unit.
High temperature in the compressor driver	C1	Compressor	Turn off the compressor		x	x	x	Superheating of the driver	Check to see if the driver has suitable ventilation and if there are no obstructions at the driver ventilation inlets

Loss of compressor rotor position	C1	Compressor	Turn off the compressor		x	x	x	Failure in compressor electric power supply	Check for the existence of poor contact in the compressor phases. If the problem persists, perform a continuity test between compressor coils and between coil and compressor housing
Low voltage in DC busbar	C1	Compressor	Turn off the compressor		x	x	x	Power supply voltage below the limits	Check to see if the operating current of the driver complies with the specifications in the electrical data table. Also check to see if the compressor is operating within operating limits

Compressor phase with overcurrent	C1	Compressor	Turn off the compressor		X	X	X	High current in the compressor power supply	Check for poor contact in the electrical connection of the compressor. Also check to see if the compressor is operating within operating limits. If the problem persists, perform a continuity test between compressor coils and between coil and compressor housing
Protection - Compressor current	C1	Compressor	Reduce compressor speed	X				Compressor speed above limits	Driver reduces compressor rotation in order to protect the components and the compressor
Compressor current out of specification			Turn off the compressor		X	X	X		Check to see if the compressor is operating with rotation within the specified limits
Protection - High driver temperature	C1	Compressor	Alert	X				Superheating of the driver	Check to see if the driver has suitable ventilation and if there are no obstructions at the driver ventilation inlets
Protection - AC voltage supply to driver	C1	Compressor	Alert	X				Driver supply voltage above limits	Check to see if the operating current of the driver complies with the specifications in the electrical data table. Also check to see if the compressor is operating within operating limits
Driver supply AC voltage out of limit	C1	Compressor	Turn off the compressor		X	X	X	Driver supply voltage above limits	Check to see if the operating current of the driver complies with the specifications in the electrical data table. Also check to see if the compressor is operating within operating limits
Communication failure	C1	Compressor	Alert	X				Failure in communication with the driver	Verify that the PLC parameterization is according to the equipment setup
Loss of communication	C1	Compressor	Turn off the compressor		X	X	X	Failure in communication with the driver	Check for poor contact in the communication link between the PLC and the compressor driver
High temperature in the compressor discharge	C1	Compressor	Turn off the compressor		X	X	X	Operation outside compressor envelope	Also check to see if the compressor is operating within operating limits

Failure in the communication with the driver DSP module	C1	Compressor	Turn off the compressor		X	X	X	Failure in communication with the driver	Check for poor contact in the communication connection between the PLC and the compressor driver and verify if the PLC parameterization is according to the equipment setup
Compressor phase current imbalanced	C1	Compressor	Turn off the compressor		X	X	X	Imbalance between the compressor power supply phases	Check if there is a difference greater than 2% between the compressor power supply phases and if there is poor contact in the electrical connection
Fault in the driver memory	C1	Compressor	Turn off the compressor		X	X	X	Internal driver fault	Restart the compressor driver. If the problem persists, contact Mecalor technical support
Error in the configuration of the compressor model	C1	Compressor	Turn off the compressor		X	X	X	PLC parameterization error	Check PLC parameterization, model indication error in compressor parameters
Error when configuring the high pressure sensor									Check PLC parameterization, sensor model indication error in compressor parameters
Fault in discharge temperature sensor	C1	Compressor	Turn off the compressor		X	X	X	Poor contact in the connection of the compressor discharge temperature sensor	Check the electrical connection of the PTS1 sensor
Fault in driver temperature sensor	C1	Compressor	Turn off the compressor		X	X	X	Fault in driver internal temperature sensor	Restart the compressor driver. If the problem persists, contact Mecalor technical support
Limit of sequential faults reached	C1	Compressor	Turn off the compressor		X	X	X	Excessive alarm reset attempts	Check for other active faults that are preventing the operation of the equipment

6.3. Preventive Maintenance

The correct Preventive Maintenance of the equipment may avoid future breakdowns and shutdowns of the equipment. For this, we recommend the procedures described below.

Preventive Maintenance – General			
Item	**Frequency**	**Procedure**	**Notes**
Painted Structure	Monthly	Check the general condition of the cabinet painting and retouch if necessary	Cabinet color specifications: white color: RAL 9003 black color: RAL 9005

Insulation of the pipe	Every six months	Check the insulation conditions of the pipes and replace damaged insulations	Damaged insulations or insulations with excess moisture should be replaced.
Vibration	Every six months	Check for excess vibration in the equipment.	Check for possible cracks on welded points.
		Place your hand on the body of the compressor and visually check the pipe; this procedure is necessary to obtain a reference standard in relation to the normal vibration of the equipment	
Fixation of components	Every six months	Check the engine fittings: fan and compressor	Retighten loose bolts.
Air filter	Monthly	Check the condition of the air filters	Replace if saturated or damaged.
Equipment door	Monthly	Open and close the door	The door should be aligned and closed without difficulty.
Equipment door locks	Monthly	Close the door, lock it and then unlock it	There should be no interferences between the lock and the door. The door should be pressed against the rubber seal and not allow gaps.
Alignment and closing of the set of plates	Monthly	Check the alignment of the closing plates of the cabinet	They should be aligned and must not have any fixation bolts.
Insulation of the electrical panel	Monthly	Check the fastening of the seal and possible damages to the seal of the panel.	Carry out the replacement of the electrical panel seal.

Preventive Maintenance - Mechanical			
Item	**Frequency**	**Procedure**	**Notes**
Fan	Monthly	Check for excess vibration in the fan	Retighten the bolts
		Check cleaning of the fan	Clean the fan
Evaporator	Every six months	Check to see if it is necessary to clean the evaporator fins.	Clean the blades of the condensers with compressed air at low pressure (be careful not to bend the exchanger fins)
		Check for signs of encrustation on the fins of the heat exchanger	In case of signs of encrustation, call for technical support to assess and eventually carry out technical cleaning of the exchanger.
Compressor	Monthly	Check the oil level in compressors with oil display	With the compressor switched off, the oil level should at least be 1/4 and at most 3/4 of the display
Refrigeration piping	Monthly	After 2 minutes of operation, check to see if the liquid display indicates the dark color and no bubbles	If the display indicates a light color, there is moisture in the system. If it shows bubbles, there is refrigerant leak
		Check for signs of oil leak in the pipe	The fluid leak should be corrected as soon as possible. Complete the refrigerant gas and oil load of the compressor, if necessary

Preventive Maintenance – Electrical			
Item	**Frequency**	**Procedure**	**Notes**
Electrical Panel	Every six months	Check for any loose components of the electrical panel	Retighten the terminals or bolts
		Measure the fan currents and compare them to the current specified in the equipment checklist	Motor operation should be checked when currents are above specified
Engine switch box	Every six months	Check to see if the junction box terminals of the engines are coming loose	Retighten the terminals or bolts
Temperature sensors	Monthly	Check the calibration of the temperature sensors	Compare the outlet and return air temperatures with a calibrated standard thermometer
Clean the electrical panel	Every six months	Clean inside the electrical panel	The electrical panel should be clean, without dust and fillings
Terminal strips	Every six months	Check to see if all the electric cables are connected to their respective terminals	There should be no loose wires or "jumpers" inside the electrical panel
Electrical Resistance	Quarterly	Check fastening, cleaning and tightening the terminals	Carry out cleaning and retighten terminals and bolts
		Measure the current of phases R, S and T	Compare the currents indicated in the electrical data of the equipment
		Check the voltage variation between phases	It should not exceed 10%
Fan	Monthly	Measure the current of phases R, S and T	Compare the currents indicated in the electrical data of the equipment
		Check the voltage variation between phases	It should not exceed 10%
Compressor	Monthly	Measure the current of phases R, S and T	Compare the currents indicated in the electrical data of the equipment
		Check the voltage variation between phases	It should not exceed 10%

7. Technical Services

In addition to quality products, Mecalor offers its customers customized service through a specialized team up to date with the technological innovations and prepared to suggest suitable solutions for each issue. Contact the technical support team for further information.

7.1. Start-Up

Despite being a very simple procedure, it is important for the customer to contact Mecalor in order for the installation conditions to be checked and for the start-up to be authorized.

7.2. Preventive Maintenance Agreements

With aim to prevent failures, Mecalor offers customized preventive maintenance agreements. The agreements consist of the periodic visits of technicians who check, gauge and test the condition and performance of the equipments.

The Mecalor Preventive Maintenance Plan ensures a longer service life of the equipment and reduces the possibility of shutdowns due to failure.

7.3. Retrofitting (Reform of Equipments)

In many cases an equipment with outdated technology may be technologically updated through the application of modern techniques developed by Mecalor.

Mecalor Retrofitting Service consists of:

- Study of the current conditions of the equipment, evaluating whether retrofitting is worthwhile;
- Study of the adaptability of the equipment to the new technology;
- Execution of the scope;
- Try-out;
- Project Documentation.

7.4. Training

Mecalor conducts specific training to meet the most diverse preparation needs of the maintenance and operation teams. The trainings are provided according to the specific needs of each customer.

8. Disposal and the environment

The CPID should be disposed at the end of its service life so as to reduce any negative impact on the environment. The following are recommended for such:

- Dismount the equipment according to all the safety recommendations applicable in the execution of the maintenance services.
- Reuse its components by their application in other machines or in the production process, for example: reuse the CPID fans, or their electric engines, the frequency inverter, etc.
- Separate materials that can be recycled and send them for recycling; for example: recycle aluminum, stainless steel, bronze, plastics of the CPID.
- Separate non-reusable materials and components and dispose of them, observing the effective legal recommendations. Special attention should be given to batteries, lubricant oil and cooling gas.

In case cooling fluid leakage is detected in the equipment, the maintenance of the leak should be requested urgently.

Any mechanical or electric component that is replaced due to failure or upgrade should be disposed according to the recommendations and effective rules.

9. Warranty Term

1. OBJECT AND VALIDITY

1.1. The warranty includes repair and/or replacement of any faulty component, as long as it is due to fabrication defect.

1.2. The validity of the warranty of the equipments manufactured by Mecalor is 365 days counted from the date of issuance of the sales invoice of the product, of which there are 90 consecutive days of legal warranty and 275 consecutive days of complementary warranty, the latter provided by Mecalor as an additional benefit to the customer.

1.3. In case the equipment is purchased with extended warranty, this should be recorded in the official business proposal issued by Mecalor and it exclusively consists of the increase of the complementary warranty, being that the legal warranty will always be 90 consecutive days.

1.4. This warranty term is valid only for products sold and used in Brazil.

2. WARRANTY VALIDATION

2.1. The customer should inform Mecalor technical support in writing immediately after identification of the possible manufacturing defect.

2.2. Once the information of the possible defect is received, the technical support team of Mecalor should evaluate the possible causes and issue a technical opinion.

2.3. In case the manufacturing defect is confirmed, Mecalor must provide the replacement or repair of the defective component within the shortest period of time possible.

2.4. The Warranty period offered by Mecalor covers the costs for repair and replacement of parts with manufacturing defect, including expenses with the transport of technicians and tools, equipment freight or expenses with shipping of parts and components to the billing address of the equipment.

2.5. It is mandatory for the customer to return the defective components to Mecalor to confirm the failure at the supplier (if applicable), under the penalty of bearing the costs involved.

2.6. The warranty establishes the execution of services during business hours, with additional charge for extra hours of services provided outside this period and transport fee for services performed on the installations of third parties.

3. LOSS OF WARRANTY

3.1. The warranty will lose its validity in case it is confirmed through technical evaluation that the defect is as a result of failures during transport, installation, startup, maintenance or improper use by the customer or third parties.

3.2. Start-up of the equipment can only be performed by the customer with the written authorization form the technical support of Mecalor or with the presence of our authorized technicians, when this optional service is part of the Mecalor scope of supply, under the penalty of loss of warranty.

3.3. Incompatibility caused by products purchased from third parties and installed with Mecalor products or application in noncompliance with the information established in our technical and business proposal.

3.4. The warranty will lose its validity if the contracting party fails to comply with purchase and sales agreement, even if the agreement is tacit, including regarding the compliance of the equipment purchased.

4. GENERAL EXCLUSIONS AND LIMITATIONS

4.1. Once Mecalor provides technical support in warranty within the limits established by law and by the good service practices, we shall not be held responsible for direct or indirect costs or loss of revenue eventually supported by the customer as a result of eventual equipment defect.

4.2. The customer will be responsible for the expenses with eventual shipping of the equipment to the factory or to any authorized technical representative of Mecalor to carry out technical support.

4.3. The replacement of components due to use or natural wear of the equipment, such as seals, sensors, engines, contactors, circuit breakers, among others.

4.4. Normal operating adjustments, maintenance and application of the equipment, such as sending of technicians to check the safety alarms, parameterization and technical assistance to optimize the performance of the product.

Customer	**Serial number**	**Warranty period**

10. Attachments

The documents that complement this manual are described below and may be different from standardized documents. In case the nomenclature of the CPID has a special character, consult the specific documentation applied to the equipment.

	INFORMATION	Consult the special documents in case the nomenclature of the CPID has a special character as described in the *nomenclature* section in the *technical characteristics* chapter of this manual..

Complementary documents of this manual:

1. Engineering design, containing:
    - Dimensional;
    - Electrical Data;
    - Layout of the electrical panel;
    - Wiring diagram;
    - Flowchart;
    - List of Components.
2. Fan Operation Curve;
3. Equipment setup.
4. Modbus and SNMP addressing table