Liebert® PDX

Perimeter DX System PI Models with Variable Speed Compressor W - F - H Versions

User Manual

English, 10022449MAN_ENG, rev. E.1 - 08.01.2024

This document, written in English, is the original version

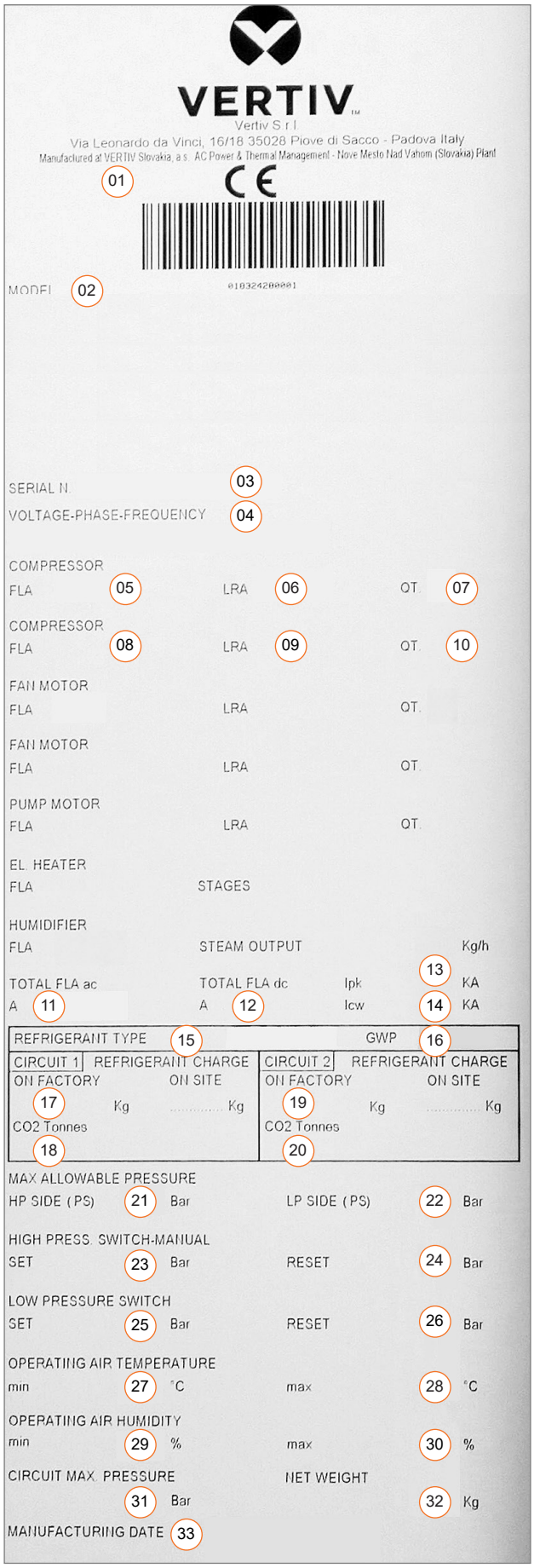
Contents

Annexes

Documents supplied with the machine

- User Manual (this document)
- iCOM™ User Manual
- Electric Diagrams
- Instruction Leaflet for Transport and Handling (on the packaging)
- Labels with Gravity Center (on the packaging)
- Warranty Certificate

List of Tables with Data by Unit Model



Onboard Label

Please refer to the label placed on the unit for the relevant operating data.

If you need assistance or spare parts, please find the model identification and the serial number on the label.

NOTICE

The data in the manual are referred to standard conditions and can be modified without any advance notice.

The data relevant to the supplied unit are filled in the inboard label (see below an empty facsimile).

Pos.	Description
01	Manufacturing plant
02	Model
03	Serial number
04	Power input
05	Circuit 1 - Compressor Full Load Ampere
06	Circuit 1 - Compressor Locked Rotor Ampere
07	Circuit 1 - Compressor quantity
08	Circuit 2 - Compressor Full Load Ampere
09	Circuit 2 - Compressor Locked Rotor Ampere
10	Circuit 2 - Compressor quantity
11	Unit Total Full Load Ampere AC [A]
12	Unit Total Full Ampere DC [A]
13	Rated Peak withstand current [kA]
14	Rated short-time current [kA]
15	Refrigerant type
16	Refrigerant GWP
17	Circuit 1 - Refrigerant charge on factory
18	Circuit 1 - Refrigerant charge CO_2 tonnes
19	Circuit 2 - Refrigerant charge on factory
20	Circuit 2 - Refrigerant charge CO_2 tonnes
21	Maximum allowable pressure - High pressure side
22	Maximum allowable pressure - Low pressure side
23	High pressure switch - Stop
24	High pressure switch - Restart (software managed)
25	Low pressure switch - Stop
26	Low pressure switch - Restart (software managed)
27	Minimum room operation temperature
28	Maximum room operation temperature
29	Minimum room operation air humidity
30	Minimum room operation air humidity
31	Circuit maximum pressure
32	Net weight
33	Manufacturing date

NOTE

For single circuit units, "Circuit 1" is the only circuit, with variable speed compressor.

For dual circuit units, "Circuit 1" is the circuit with fixed speed compressor(s), "Circuit 2" is the circuit with variable speed compressor

Abbreviations - Acronyms

Item	Definition
ATS	Automatic Transfer Switch
EC	Electronically Commutated [fans]
EEV	Electronic Expansion Valve
MCB	Miniature Circuit Breaker
STO	Safe Torque Off
Ultracap	Ultra capacitor
UPS	Uninterruptible Power Supply
VSD	Variable Speed Drive

1. Safety

Content of this chapter

This chapter gives general safety instructions.
Additional safety warnings, for specific operations, are given in the rest of the manual.

1.1 Conventions

DANGER
Indicates a hazardous situation which, if not avoided, **will** result in death or serious injury.

WARNING
Indicates a hazardous situation which, if not avoided, **could** result in death or serious injury.

CAUTION
Indicates a hazardous situation which, if not avoided, **may** result in minor or moderate injury

NOTICE
Indicates a property damage message

ENVIRONMENT
Indicates a environment damage message

1.2 General Instructions

Intended readers	• This User Manual is intended for transport, installation and maintenance personnel. • The end user can only switch the unit **ON** and **OFF** and modify the setpoint.
Personnel	• The operations described in this manual must be made by technical staff, expressly authorized in compliance with the regulations in force at the installation site. • The authorized personnel must be properly trained and qualified, wear appropriate personal protective equipment and use adequate equipment and tools.
Read this manual	• Carefully read the manual before performing any operation on the unit.
Keep this manual	• Keep the manual during the complete life-span of the unit. • Keep the diagrams provided with the unit (wiring, refrigerating circuit,...). They are part of the instructions for use. • If you move or sell the unit, transfer the manual and the diagrams together with the unit. • The manuals may be subject to modification. For complete and up-to-date information always consult the specific manual supplied with the unit.
Intended use	• Use the unit only for the purpose it has been designed (see *3. Intended Use*). • The manufacturer takes no liability for any improper use of the unit.
Do not modify the unit	• Do not modify the unit without Vertiv™ permission in any way, including the safety devices, the control system and the software. • The manufacturer takes no liability for any unauthorized modification of the unit.
Warning labels	• Pay attention to the warning labels on the unit. • Do not remove or cover the labels placed on the unit by the manufacturer.

Lockout-Tagout (LOTO)	Before any intervention on the electrical system or accessing the inner components: • Lock the disconnection device by a padlock or similar tool. • Apply on the general disconnecting switch a warning plate. For units with **ATS** (Automatic Transfer Switch) power supply, see *Annex J - ATS (Automatic Transfer Switch)* for details about the locking procedure.
Safeguards **Raised floor**	When you finish the operations on the unit, always remind the following: • Mount again and fix with screws all the safeguards (panels, grids). • Close and lock all the doors, if present. • Place again all the floor panels around and under the unit. • Never operate the unit without the above mentioned safeguards.

1.3 Personal Protective Equipment

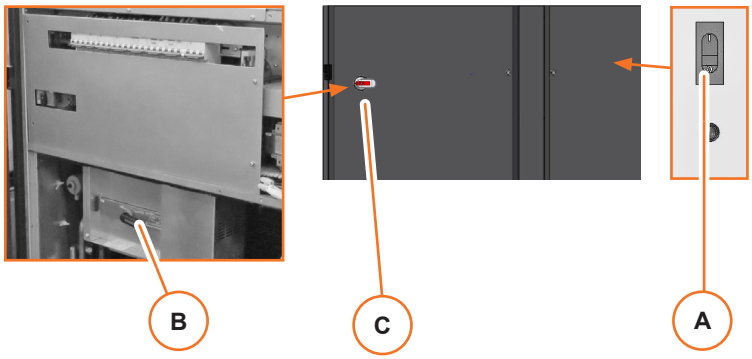
As general rule, always wear the following **PPE** (Personal Protective Equipment):

1.4 Residual Risks

Some operations may involve some residual risk.

Pay attention to the following safety measures when operating inside or near the unit.

Disconnecting switch



The **ON/OFF** switch [**A**] on the control panel does not disconnect the unit from the power supply

To disconnect the power supply proceed as following:

- For units with additional electrical disconnecting device (Extended height units only), set to position "**0**" the remote disconnector and lock it to "**0**" position. See *Annex J - electrical disconnecting device on enclosure* for details.
- Turn **OFF** the main disconnector switch [**C**];
- Unscrew the door and open it.
- For units with ATS power supply open the disconnecting switch [**B**], see *Annex J - Electrical disconnecting device on enclosure* for details.

After you open the door, pay attention to the cable and components that are still energized (ATS terminal input and output, terminal input of disconnecting device and power supply cables between ATS and main switch).

Electric and control system

The unit contains potentially lethal voltage in some circuits.

The electric and control panel can retain a stored high-voltage electrical charge for up to **15** minutes.

Risk of arc flash and electric shock.

Can cause injury or death.

General safety measures:

- Only properly trained and qualified personnel may perform repair, maintenance and cleaning.
- The key of the electric panel must be kept by the person responsible for maintenance.
- Always wear the protective equipment prescribed by the local and Vertiv™ regulations.
- It is forbidden to operate on the electrical components without using insulating platforms, or in the presence of water and humidity.

Before working inside the electric and control panels proceed as follows:

1. Open all the local and remote disconnecting switches of the unit.
2. Wait at least **5** minutes.
3. Verify with a voltmeter that the power is **OFF**.

Components at high temperature

The following components are at high temperature:

- discharge line
- compressor
- electrical heaters
- humidifiers

General safety measures:

- Always wear temperature resistant gloves when operating on the unit.

Components at low temperature

The following components are at low temperature:

- evaporator

General safety measures:

- Always wear temperature resistant gloves when operating on the unit.

Sharp elements

Evaporators and condensers are made of plates and fins, which may have sharp edges and blurs.

Also other elements inside the unit may have sharp edges, blurs, splinters and exposed fasteners.

General safety measures:

- Always wear cut resistant gloves.

Automatic startup + rotating elements

This unit operates and restarts automatically.

The fan blades can automatically start rotating without warning at any time during a cooling cycle or after the power is restored after a power failure.

Risk of contact with high-speed, rotating fan blades.

Can cause serious personal injury or death.

Before working inside the unit, removing the fan guards or servicing the fans (speed control, blades, motors) proceed as follows:

- Turn all the disconnecting switches to **OFF**.

Automatic startup + strong air flow

This unit operates and restarts automatically.

The fans may suddenly start blowing out a strong air flow, which may carry particles and small objects from inside the unit.

If the door is opened, the air flow may slam the door closed (Upflow versions only).

Can cause serious personal injury.

General safety measures:

- Wear eyes protection when you need to get close to the unit while it is operating.
- Pay attention to the warning labels on the unit.

Before working on the unit proceed as follows:

- Turn all the disconnecting switches to **OFF**.

Lifting and moving

- Make sure to use transport and lifting equipment rated for the unit dimensions and weight.
- Pay attention to the gravity center and warning labels placed on the unit.
- Make sure that the lifting point is aligned with the gravity center.
- Make reference to *Annex D - Dimensions and Weights* for dimensions, weight and gravity center position.

Handling area

- Never walk or stay below a suspended load.
- The area for handling and moving must be free from obstacles and persons.
- Not authorized personnel must keep at safe distance from the handling area.
- The floor of the handling area must be suitable to bear the weight of the unit and of the moving equipment.

Operations with the Refrigerant

NOTICE

The spindle of the shut-off valve is protected by a cap screwed on the valve body.

The cap is secured by a seal.

WARNING

During operation of the refrigerant system, the shut-off valve needs to remain always open, and the protective cap needs to be sealed to avoid unauthorized operation of the valve.

Any closing intervention must be performed with the refrigerant system stopped.

Closing intervention can be performed only by:

- Staff authorized to work on the system;
- Public servant of Competent Body;
- Before restarting the refrigerant system, the shut-off valve needs to be fully open, the protective cap must be re-attached and sealed.

2. Digit Nomenclature

The unit is fully defined by the following digits.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Dig.	Feature	Value	Description
1 2	Family name	PI	
3 4 5	Model	000	
6	Air discharge	U	Upflow
		H	Downflow Frontal (displacement)
		D	Downflow Up
		E	Downflow Down (in the raised floor)
7	System type	A	Air-cooled
		D	Dual fluid - Air cooled
		F	Freecooling
		H	Dual fluid - Water cooled
		W	Water cooled
8	Air flow	L	High power EC fans
		1	EC fans
9	Power supply	3	400 V / 3 ph / 50 Hz + N CE
		T	380 V / 3 ph / 60 Hz + N CE
		6	460 V / 3 ph / 60 Hz CE
10	Cooling system	G	Single Circuit Variable Speed Scroll R410A with EEV
		I	Dual Circuit Variable Speed Scroll R410A with EEV
11	Humidification	0	None
		H	Infrared humidifier
		U	Ultrasonic humidifier
		S	Electrode humidifier
12	Microprocessor control	0	None
		7	7” touch screen
		F	10” touch screen
13	Heating and re-heating	0	None
		1	Electric heating standard capacity
		2	Electric heating high capacity
14	Air filter	1	ePM10 50%
		2	ePM10 50% + Diff. Press. Trasd.
		3	ePM10 50% + clogged filter
15	Condensing control	A	Air – Cooled
		2	Water cooled 2 ways valve
		3	Water Cooled 3 ways valve

Dig.	Feature	Value	Description
16	Color	1	Black RAL 7021
17	High voltage option	D	Standard Power Supply
		F	Dual Power Supply Parallel
		G	Dual Power Supply Alternate (ATS)
18	Predisposition	0	None
		S	Predisposition for Smart Aisle (predisposition for damper sensor, 3 position switch)
		F	Predisposition for Economizer (sensors, predisposition for dampers)
		G	Predisposition for Smart Aisle™ + Economizer
		H	Predisposition for motorized damper
		L	Predisposition for plenum installation
19	Monitoring	0	None
		1	Monitoring (Modbus IP, BACnet IP, SNMP and HTTP)
		4	LIFE compatibility
20	Devices	0	None
		1	MCB 10A 1 ph
		2	MCB 10A 3 ph
		3	Condensate pump (1)
		4	Condensate pump + MCB 10A 1 ph (1)
		5	Condensate pump + MCB 10A 3 ph (1)
21	Packaging	P	PLP and Pallet
		C	PLP and wooden crate
		S	Seaworthy
22	EMC Emissions	I	Industrial rate
		R	Residential rate
23	Revision	E	Free option
25	Special requirements	A	Standard Vertiv™
		X	Special Vertiv™

(1) - Only available with Upflow units

Fan module

The fan module can be delivered separately:

-- always for extended height units

-- in case of fan module replacement for standard units (with the exception of the 1 bay units)

The fan modules are not available for 1 bay units, since the fan section of these units are integrated with the cabinet structure.

The fan module is fully defined by the following digits.

The unit is fully defined by the following digits.

1	2	3	4	5	6	7	8	9	10	11	12	13

Dig.	Feature	Value	Description
1 2 3	Fan Module	BMX	Fan Base Module
		BFX	Fan Base Frame
		TPX	Fan Top Plenum
4 5	Size: Normal Lenght	12	1200 mm
		17	1750 mm
		32	3200 mm
		33	3350 mm
6	Air Delivery	S	Standard
		B	Back (fans removal from the front)
		F	Front
7	Fans	L	High Power EC Fan Module
		1	EC Fan Module

Dig.	Feature	Value	Description
8	Heaters	0	No heaters
		1	Standard Capacity
		2	High Capacity
9	Packaging	P	PLP and Pallet
		C	PLP and wooden crate
		S	Seaworthy
10	Power Supply	3	400 V / 3 ph / 50 Hz + N CE
		T	380 V / 3 ph / 60 Hz + N CE
		6	460 V / 3 ph / 60 Hz CE
11-12	Free Digits		
13	Special requirements	A	Standard Vertiv™
		X	Special Vertiv™

Note: *For all configurations see* *5.2.2 Extended version*

3. Intended Use

Content of this chapter

3.1 Purpose of the unit

The **PDX** units have been designed and manufactured for the following purpose:

- Precision air conditioning for indoor use (for data centers, network closets, technological rooms).

3.2 Assembly

The **PDX** units are factory assembled, including all the internal wiring.

The only operation to be made at the installation site are the following:

- Mounting of the fan section (only for the extended versions)
- Electrical connections for power supply
- Water piping connections

See Chapter *5. Description* for details about the unit structure, versions and optional components.

WARNING

Do not assemble or connect the unit with systems or machines that are different from what is specified in this manual for your unit.

Contact Vertiv™ Technical Support for any question.

3.3 Refrigerant

The **PDX** units are designed for use with **R410A**.

3.4 Functional Limits

See *6. Technical Data*

WARNING

Risk of components failure or breakage.

Do not use refrigerants, fluids and voltage that are different from what is specified in this manual for your unit.

Contact Vertiv™ Technical Support for any question.

3.5 Space Limits

Overall unit dimensions	See *Annex C - Dimensions and Weights*
Clearance	Keep a free space around the unit as explained in *9.3.2 Space requirements*.

3.6 Environment

WARNING

Do not use in explosive, acid or anyway aggressive atmosphere.

3.6.1 Storage conditions

Table 01 - Ambient conditions for storage

Storage environment	Indoor environment, protected against weather agents Clean (no dust), well-ventilated, non-condensing
Ambient temperature	-20°C – +50°C
Ambient humidity	<90% and preventing condensation
Storage time	The total storage time should not exceed six months. If the storage time is longer than six months, then you must check the functionality of sensors and other electronic devices before putting in operation the unit.
Position	Keep the unit vertically upright.

3.6.2 Operating conditions

Table 02 - Ambient conditions for operation

Operating environment	The unit is designed for indoor installation, protected from weather agents, with the following ambient conditions.	
Air returning to the unit inlet (indoors conditions)	Temperature	+20°C — +40°C
	Absolute humidity	5,5 — 12 g steam / kg air
	Relative humidity	15 — 60 %
	The allowed thermal load must be higher than 20% of the unit nominal cooling capacity. A lower thermal load will cause inaccurate temperature and humidity control and frequent compressor(s) switch **ON/OFF**.	
Altitude (above sea level)	Below 1 000 m	OK
	From 1 000 to 2 000 m	Allowed with inverter derating. See *6.2.3 Inverter derating factors*
	Higher than 2 000 m	Not allowed, contact Vertiv™ Technical Support
Water system	Minimum water inlet temperature to condenser	6°C
	Maximum water pressure	16 bar
	Water - Glycol mixture limit	Up to 50% vol.
Outdoor temperature	Verify minumum working temperature of external Drycooler.	
	Fluid mixture must be suitable for application. See *9.3.4 Water supply requirements* for freezing temperature.	
	Contact Vertiv™ Technical Support for any question.	

4. Reference Norms

The **PDX** units are designed, manufactured and tested according to the following directives and standards:

EU Directives	- Machine Directive 2006/42/CE - PED Directive 2014/68/EU - Low Voltage Directive 2014/35/UE - EMC Directive 2014/30/UE - RoHS II Directive 2011/65/EU - RoHS III Directive EU/2015/863
CE Marking and Conformity Declaration	The units are marked "**CE**". Each unit is supplied complete with individual test certificate and a certificate of conformity to the European Union Directives. See also the last page.
UKCA Marking and Conformity Declaration	The units are marked "**UKCA**". Each unit is supplied complete with individual test certificate and a certificate of conformity to the UK Safety Regulations
Performance test norms	- Cooling Capacity according to EN 14511 - Sound Power Level according to ISO 3744

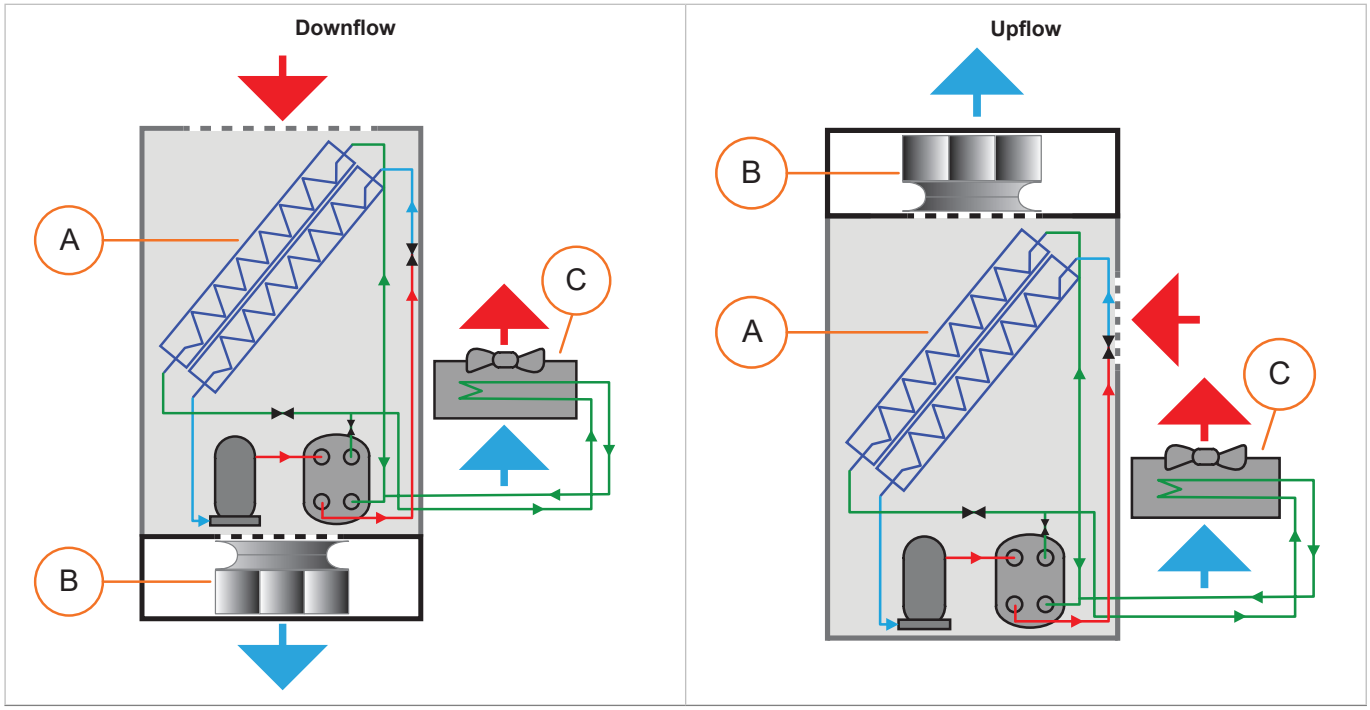
5. Description

Content of this chapter

NOTE *The images in this manual refer to sample units. Some components may be different for other units but the function remains the same.*

5.1 Versions Overview

5.1.1 Unit frame



The unit frame is made by the coil section [**A**] and the fan section [**B**].

The coil section contains the refrigerating system of the unit (compressor, evaporator, expansion valve, plates condenser, condensing control valves, accessories), the water circuit (water coil, water valves), the electric panel and the control system.

The fan takes the **warm air** from the room into the unit. The air flows through the coils (evaporator and water coil), cools down and blows out again in the room.

The fan section may be placed at the bottom of the coil section (**Downflow** versions) or on top (**Upflow** versions).

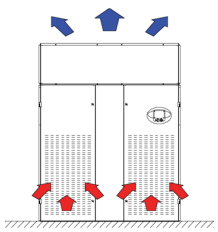
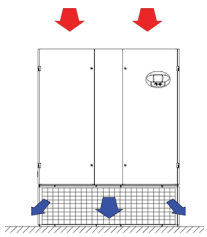
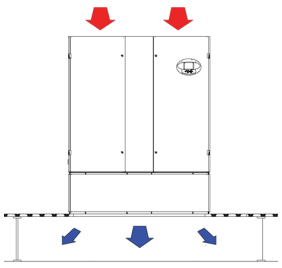
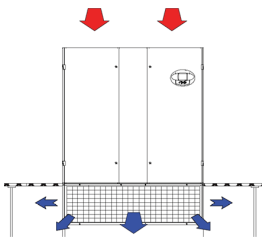
The water circuit of the unit is connected on site to the external drycooler [**C**] (which must be purchased separately).

The unit frames can be combined in different ways to obtain different versions.

Different versions are available also for the refrigerating system.

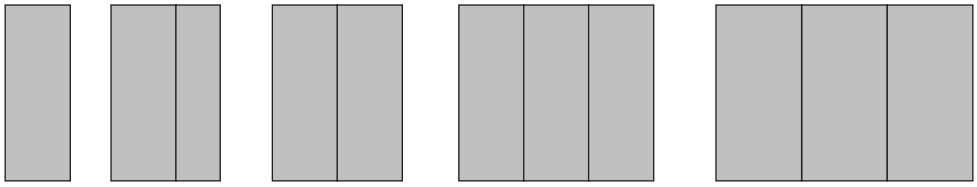
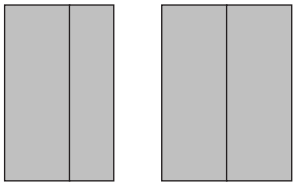
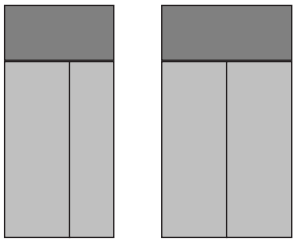
5.1.2 Air distribution

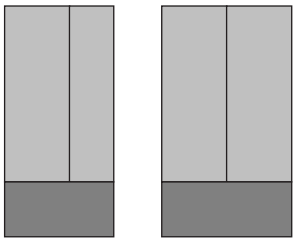
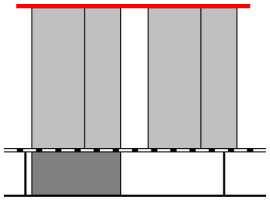
The unit is placed on a raised floor, whereas the unit fan module can be placed under a raised floor.
The air flow direction can be either **Upflow** (fan section on top) or **Downflow** (fan section at the bottom).
The following combinations are available:

U - Upflow	H - Downflow Frontal	D - Downflow Up	E - Downflow Down
			
Placed on the floor **Warm air** though the doors **Cold air** though the top	Placed on the floor **Warm air** though the top **Cold air** though the front grid	Placed on the floor **Warm air** though the top **Cold air** though the bottom grid	Placed under a raised floor **Warm air** though the top **Cold air** though the front grid

5.1.3 Cabinet size

The units can have the following cabinet size:

<table>
<tr><td rowspan="2">Width</td><td>Frame type</td><td>1</td><td>2</td><td>3</td><td>5</td><td>7 - 10</td></tr>
<tr><td>Number of bays</td><td>1</td><td>1,5</td><td>2</td><td>3</td><td></td></tr>
<tr><td colspan="7"> 
NOTE In the units of frame type 1 the coil section and the fan section are integrated. In the units with frame types 2, 3, 5, 7 and 10 the coil section and the fan section are separate modules that are assembled together.</td></tr>
<tr><td rowspan="3">Height</td><td>Standard
H=1970 mm</td><td colspan="2">  </td><td colspan="3">The coil and the fan sections are factory assembled in the same cabinet.</td></tr>
<tr><td>Extended
H=2570 mm
Fan module on top of the coil module</td><td colspan="2">  </td><td colspan="3">The coil module and the fan module are delivered separately and must be assembled at the installation site.

NOTE The top of an extended version unit placed under a raised floor will be at the same height as the top of a standard unit placed on the floor</td></tr>
<tr><td>Extended
H=2570 mm
Fan module at bottom of the coil module</td><td colspan="2">  </td><td colspan="3">  </td></tr>
</table>

5.1.4 Accessories

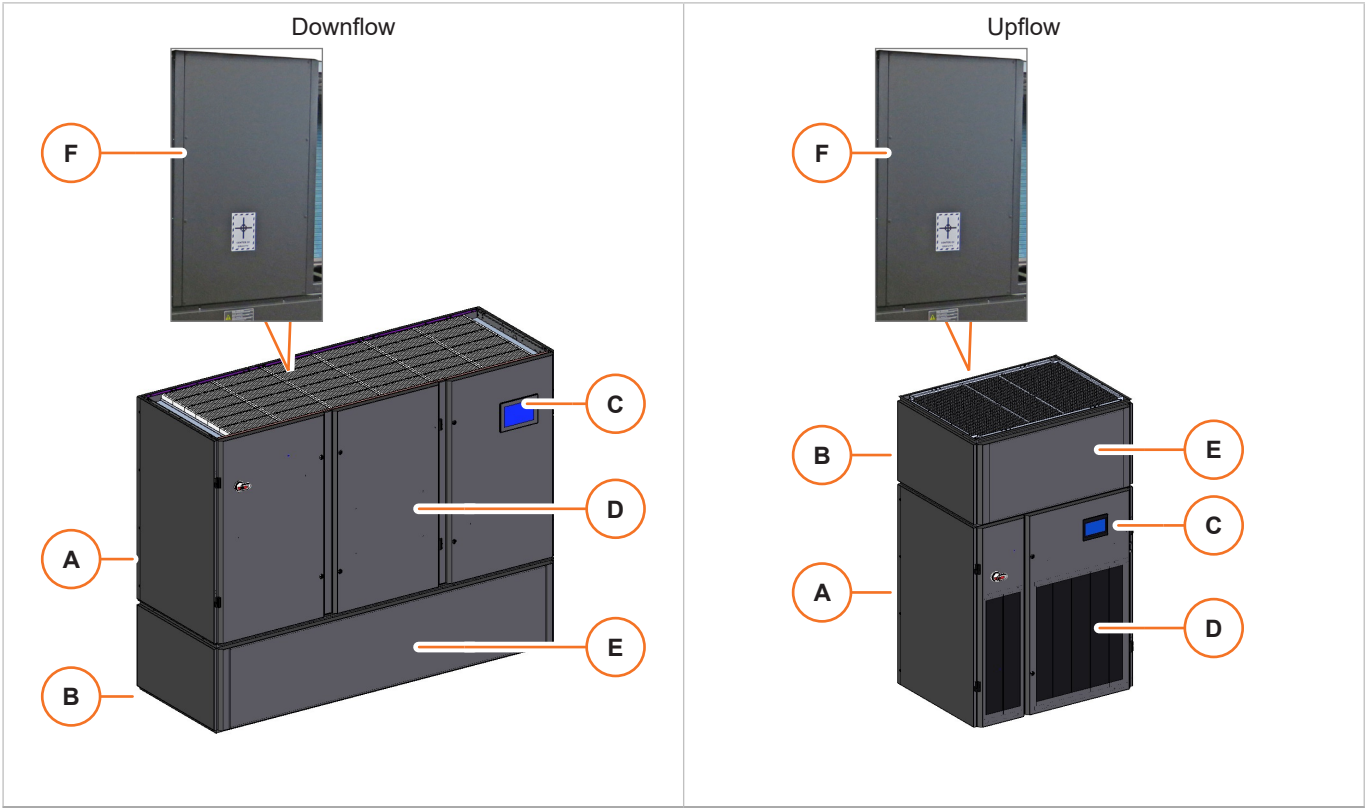
Several accessories are available for the following purposes:

- support and adjustment of the unit height
- different options for air intake (from outdoor, through hoods or plenum, ...)
- noise damping
- high efficiency filters

See *Annex F - Accessories* for details.

5.2 Structure

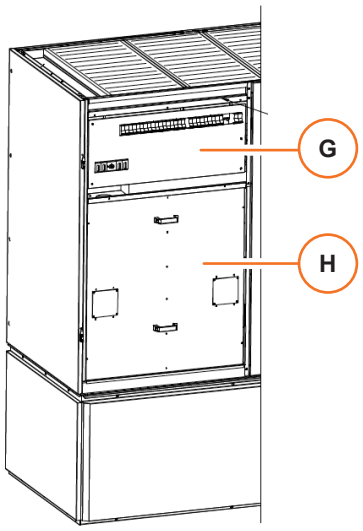
5.2.1 Standard version



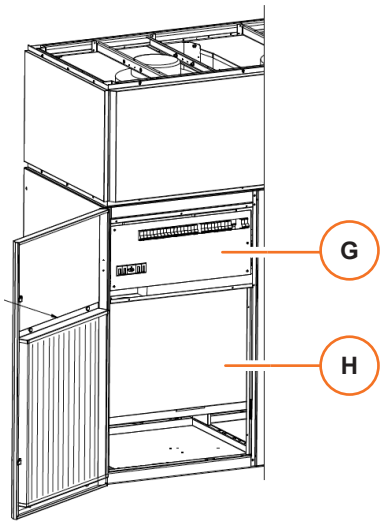
Ref.	Description	Remarks
A	Coil section	The coil section is completely closed by panels and by the door for protection against any contact with electric parts and hot or cold surfaces.
B	Fan section	The fan section is completely closed by panels and grids for protection against any contact with moving parts.
C	Control panel	The unit is usually controlled remotely by a network connection. The control panel is optional and may be placed on the front door or inside the front door.
D	Doors	The doors can be opened only by the proper tool.
E	Fan safeguards	The fixed panels (safeguards) can be removed only by loosing the fixing screws.
F	Rear safeguards	

After opening the doors:

Downflow



Upflow

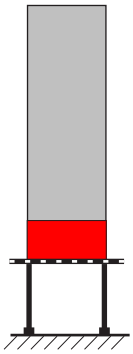


Ref.	Description	Remarks
G	Electric and control panel safeguards	The fixed safeguards can be removed only by loosing the fixing screws.
H	Compressor compartment	For the Downflow versions: - the fixed safeguards can be removed only by loosing the fixing screws - the holes for inspection and access to the connectors are protected by transparent plates, fixed by screws For the Upflow versions: - in order to allow free airflow through the door, there are no safeguards to close the compressor compartment

5.2.2 Extended version

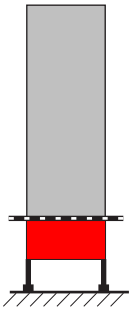
In the extended versions the fan section and the coil section are separate modules which must be assembled at the installation site.

The fan module for the extended versions is named differently as shown below.



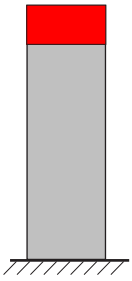
Fan base module

when placed on the floor or raised floor



Fan base frame

when placed under a raised floor



Fan top plenum

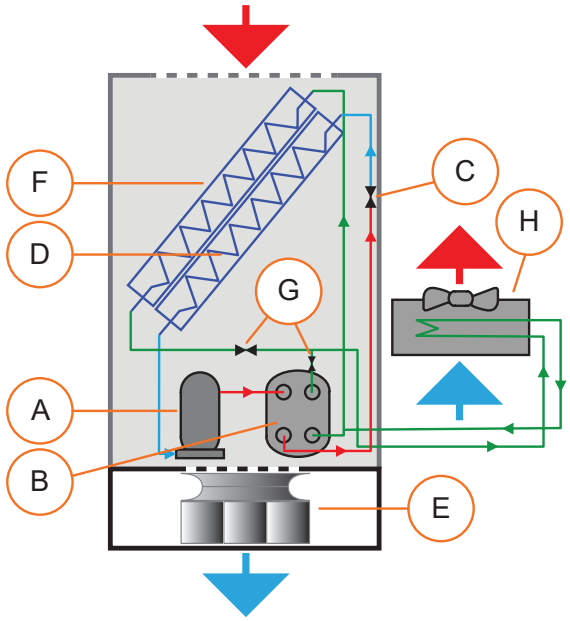
when installed on top of the cooling unit

5.3 Refrigerating System

5.3.1 Cooling versions

The **PDX** product family includes several cooling system versions.
This manual is related to units with water cooled version [**W**], dual fluid water cooled [**H**], freecooling [**F**].
For units of the other versions, please make reference to respective manuals.

5.3.2 Main components

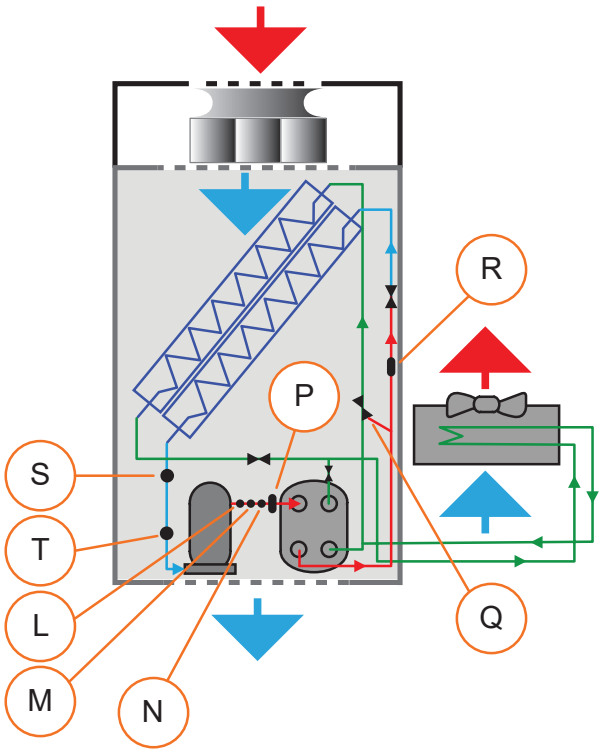


The figure shows a simplified scheme for a Downflow unit with a single circuit with one compressor.

The main components of the circuit the following:

A	Compressor
B	Plate Condenser
C	Expansion valve
D	Evaporator
E	Fan
F	Water Coil
G	Water Valve
H	Drycooler (supplied separately)

Make reference to *Annex A - Refrigerating Circuit Diagrams* for details.



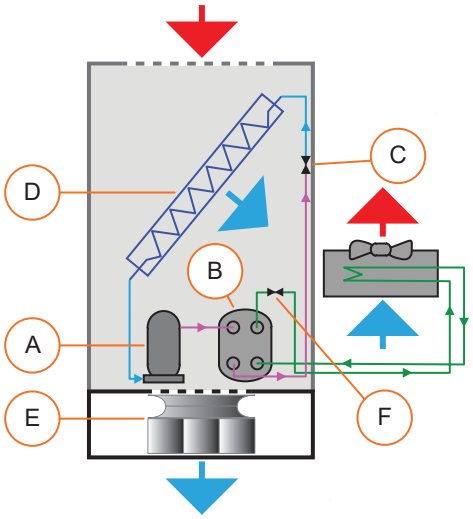
The circuit also include the following components:

L	High temperature sensor
M	High pressure switch
N	High pressure transducer
P	Oil separator (for variable speed compressors only)
Q	Safety valve
R	Filter dryer
S	Temperature sensor for the expansion valve control
T	Low pressure transducer for the expansion valve control

Make reference to *Annex A - Refrigerating Circuit Diagrams* for details, including other relevant components of the circuit (shut-off valves, check valves, access valves).

5.3.3 Operating principle

The figures show a simplified scheme for a Downflow unit with a single circuit with one compressor.
The operating principle is the same for all the models of the **W-F-H** cooling version (also including Upflow air distribution and double or tandem circuits).
Those are a direct expansion system, meaning that the refrigerant cools directly the air, without any intermediate heat exchange with other fluids.



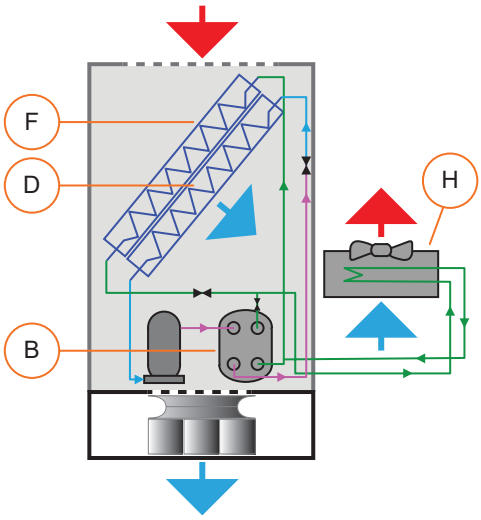
W Version – Direct expansion water cooled unit

The compressor [**A**] pumps the hot gaseous refrigerant into the water-cooled plate condenser [**B**].

The liquid refrigerant coming from the condenser [**B**] enters in expansion valve [**C**]. The refrigerant enters in the evaporator [**D**]. The fan [**E**] makes the **warm air** coming from the room to flow through the evaporator.

The refrigerant evaporates and cools down the air, which flows again into the room. The refrigerant flows back to the compressor.

The plates condenser is fitted with a modulating valve [**F**] for the automatic control of condensing pressure.



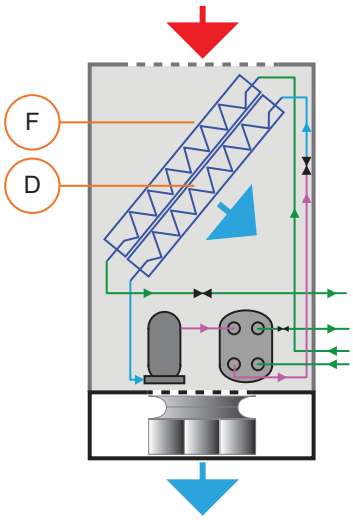
F Version – Direct expansion freecooling unit

The Freecooler unit cools the air flow by means of the evaporator coil rows [**D**] [Direct expansion mode] or, as an alternative, the water coil rows [**F**] [Freecooling mode]. In direct expansion mode [DX mode], the unit cools the air flow by means of the evaporator coil rows [**D**] and rejects heat to water through a water-cooled plate condenser [**B**].

In freecooling mode [FC mode] , the unit cools the air flow by means of the water coil rows [**F**].

In both modes, water flow is cooled by outdoor air by means of an external Dry Cooler [**H**]

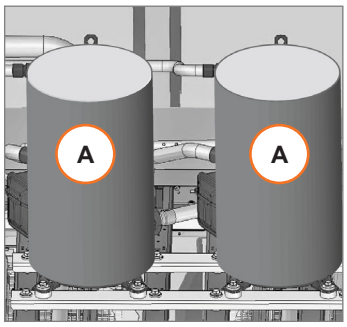
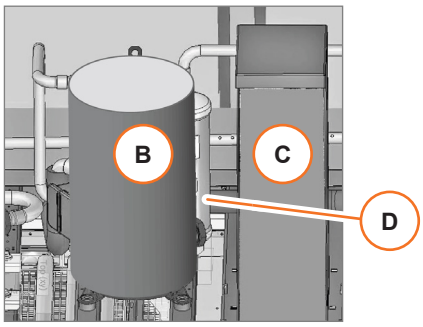
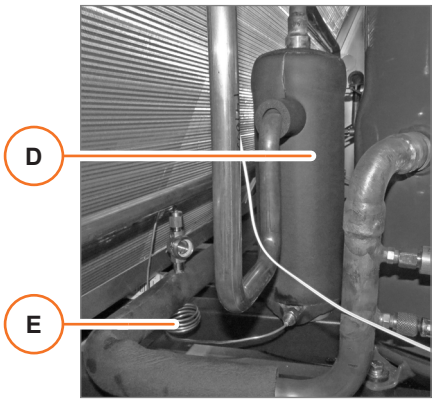
The unit switches between DX and CW mode according to external air temperature and unit inlet water temperature values; if enabled, unit allows for contemporary DX and FC operation [Mixed mode].



H Version – Dual fluid water cooled unit

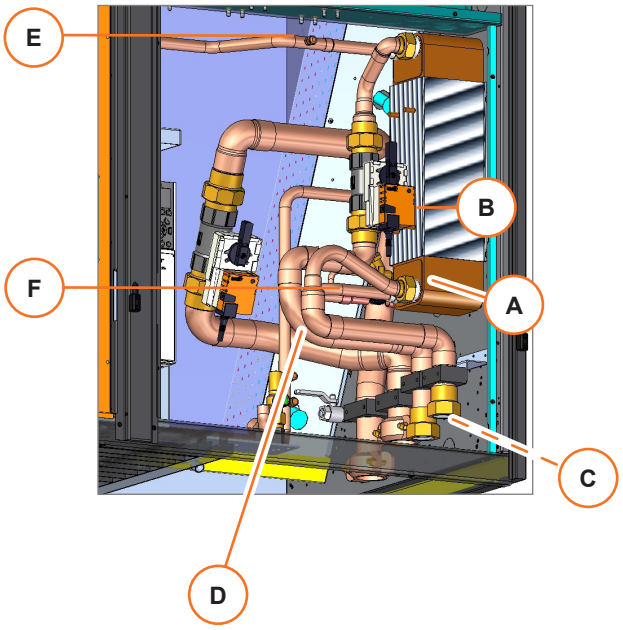
The Dual fluid unit cools the air flow by means of the evaporator coil rows [**D**] [Direct expansion mode] or, as an alternative, the water coil rows [**F**] [Chilled water mode]. The water coil and the direct expansion system must be supplied separately with external water source.

5.3.4 Compressors

	Fixed speed compressor(s)	Variable speed compressor
	The fixed speed compressor(s) are always mounted on the left side of the compressor compartment. They are present only for dual and tandem circuits. 	The variable speed compressor is always present. In dual and tandem circuits the variable speed compressor is always mounted on the right side of the compartment. 
Type	[**A**] Semi-hermetic scroll compressor	[**B**] Semi-hermetic scroll compressor
Speed	Fixed	Variable, controlled by the inverter [**C**] Speed modulation between 20% and 100% of the maximum speed
Oil separator	Not available	 The oil separator [**D**] collects the oil at the compressor delivery. The oil returns to the piping at the compressor suction through the capillary [**E**]. The high pressure drop of the capillary keeps under control the amount of oil and the temperature of the oil that returns to the compressor, even at maximum speed.
Crankcase heater	An external crankcase heater is mounted externally, on the lower part of the compressor(s). Function: pre-heating of the oil / refrigerant mixture, to avoid presence of liquid at the compressor suction during the start-up The crankcase heater may be of belt type or surface type.	
Check valve	An external check valve is mounted on the compressor discharge line. Function: to avoid return of liquid refrigerant from the condenser	

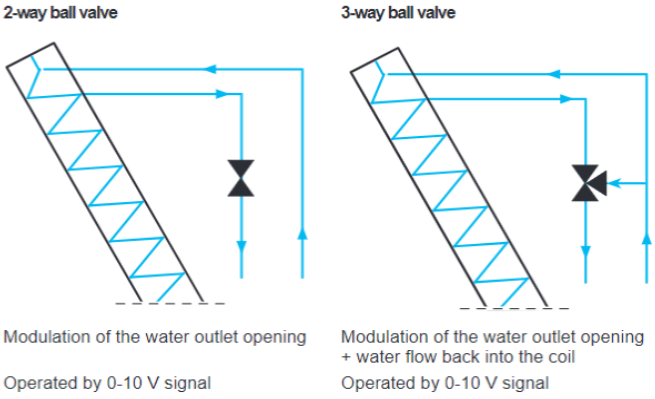
5.3.5 Condensers

Each refrigerant circuit of the unit is equipped with a brazed plates heat exchanger.



A	Plate condenser
B	Condensing regulation valve
C	Inlet water piping
D	Outlet water piping
E	Refrigerant inlet water piping
F	Refrigerant outlet water piping

5.3.6 Water valves



Water cooled units (**W** version) are equipped with:

- one valve (2-way or 3-way) for each refrigerant circuit that manage the condensing control.

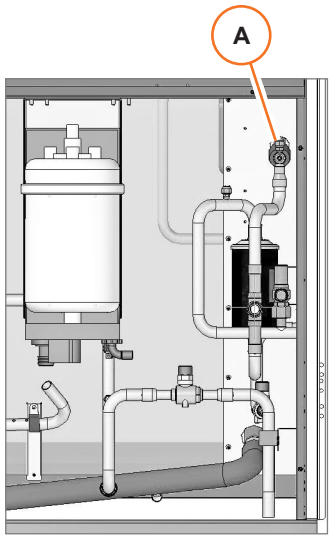
Freecooling units (**F** version) are equipped with:

- one valve (2-way only) for each refrigerant circuit that manage the condensing control
- a single 2-way valve to manage the chilled water coil.

Dual fluid water cooled units (**H** version) are equipped with:

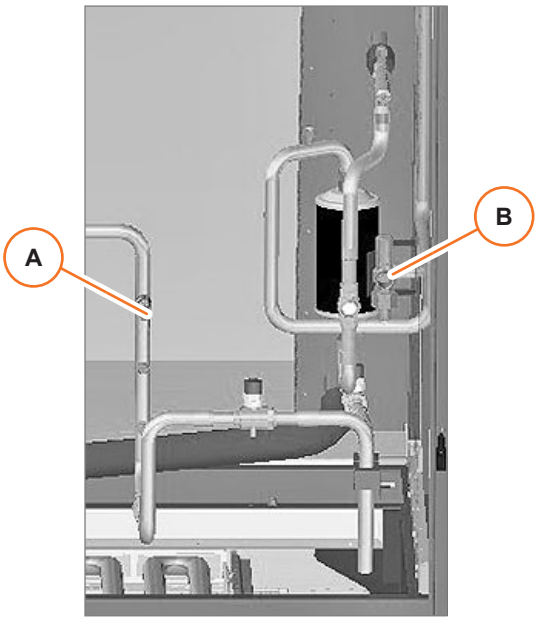
- one valve (2-way or 3-way) for each refrigerant circuit that manage the condensing control
- a single valve (2-way as standard) to manage the chilled water coil

5.3.7 Expansion valve



A	Electronic expansion valve (EEV) The control system keeps the superheat fixed at its setpoint.

5.3.8 Safety devices



A High pressure switch

Function

Protection against too high pressure in the refrigerant circuit

B Safety valve

Function

Protection against too high pressure.

The safety valve is installed on the piping.

This valve is equipped with threaded connections so that the refrigerant may be discharged to the outside.

See *6.4 Safety Devices Settings* for details.

See also *11.6 Calibrations* for maintenance and calibration operations

WARNING

Make sure that the safety valves are always free to discharge.

Do not cover the safety valves.

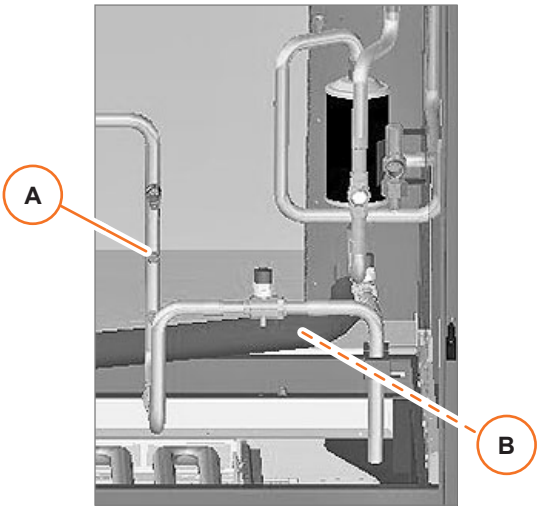
WARNING

The safety valves are installed in open position and the ball spindle is protected by means of a cap screwed to the body and sealed with lead.

Do not tamper or force the safety valves.

Only authorized technicians or officials of a Competent Body are allowed to perform interventions on the safety valves. These persons are also responsible to substitute and for restoring the safety valve operating conditions.

5.3.9 Sensors and instruments



A High pressure transducer

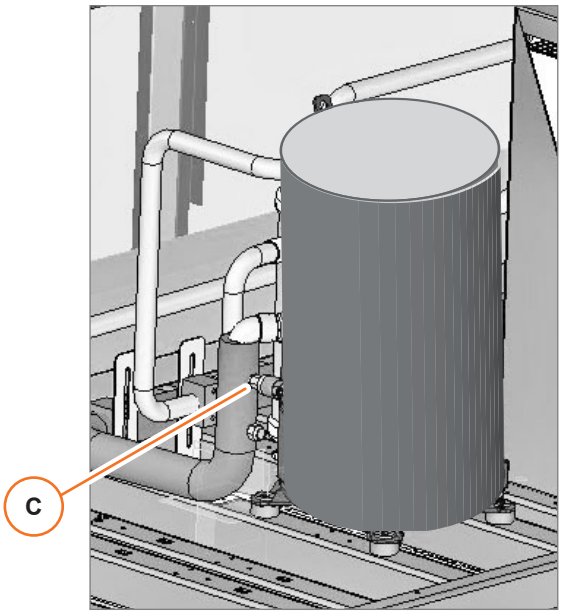
Function

Refrigerant pressure measurement at compressor delivery

B Temperature sensor

Function

Refrigerant temperature measurement at evaporator outlet for the expansion valve control



C Low pressure transducer

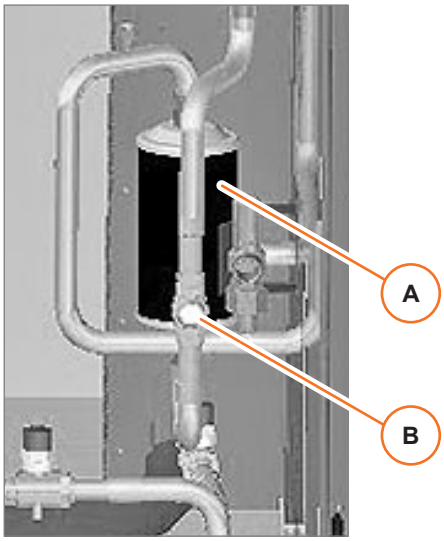
for the expansion valve control

Functions

- Measurement of the refrigerant pressure at compressor suction
- Protection of the system against too low evaporation temperature

NOTE *Other optional sensors may be connected to the unit by the end user. See 5.6 Modbus Connections for details.*

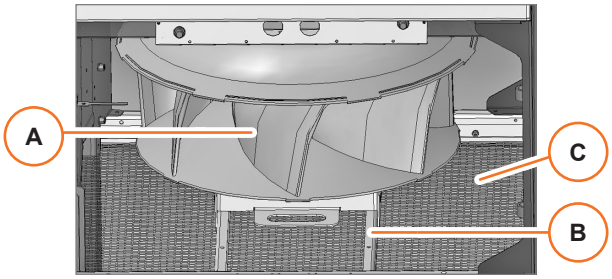
5.3.10 Filter dryer and sight glass



A	Filter dryer **Functions** - Filter: removal of any particle such as dirt, metal or chips, to prevent that they enter into the expansion valve - Dryer: removal of the moisture from the refrigerant, to prevent freezing inside the piping and formation of acids and sludge when in contact with oil in the system
B	Sight glass **Function** Check the refrigerant level and conditions (presence of bubbles, ...)

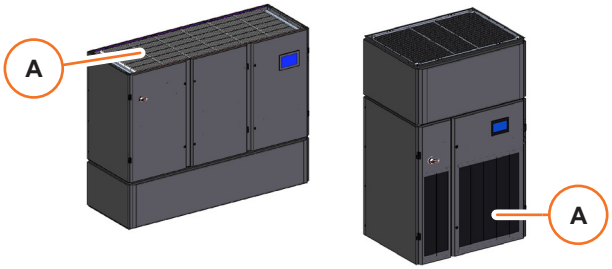
5.4 Air System

5.4.1 Fans



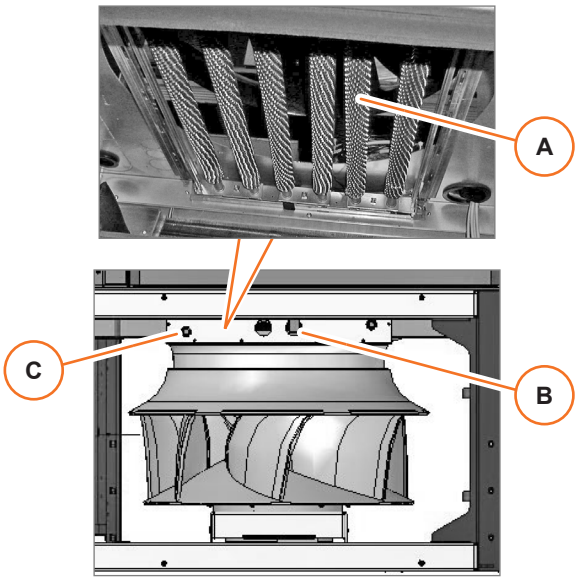
A	Fan
B	Fan supporting frame
C	Protective grid The grids protect against contact from the top (for the Upflow versions) or from below the floor, if the floor is opened for any reason near the machine (for the Downflow versions).
---	The fan motors are protected by thermal magnetic circuit breakers. See *5.5 Electric and Control System* for details.

5.4.2 Filters



A	Filter The figure shows standard filters. Other type of filters are available as options. See *Annex F - Accessories* for details
---	Filter clog sensor A sensor sends an alarm to the control system if the pressure difference through the filter is higher than a threshold value, meaning that the filter is clogged.

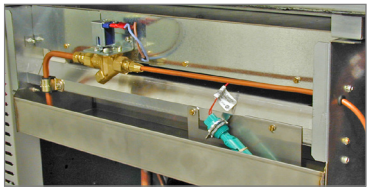
5.4.3 Heating (optional)



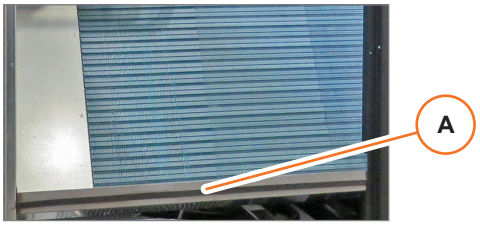
A	Heater
B	Heater temperature switch **Function** The temperature switch is installed on the heater. It switches off the heater if its temperature is higher than the alarm value.
C	Reset button **Function** In case of activation of the temperature switch, a manual reset is required. • Press the button [**C**] to do the manual reset of the heater. • Reset the temperature alarm on iCOM™ the control panel.
---	Safety air high temperature sensor This sensor measures the air temperature at the unit outlet and switches off the heater if the air temperature is higher than the alarm threshold.

5.4.4 Humidifier (optional)

The humidifier can be of the following types:

Electrode	**Infrared**	**Ultrasonic**
		
Installed inside the machine	Installed inside the machine	Independent module installed under the machine Only for Downflow configurations
See *Annex G - Electrode Humidifier*	See *Annex H - Infrared Humidifier*	See *Annex I - Ultrasonic Humidifier*

5.4.5 Condensate tray



The tray [**A**] collects the condensate from the evaporator.

NOTE *For Upflow units, an optional condensate pump is available to deliver the condensate to an higher level.*

5.4.6 Sensors and instruments

- Humidity and temperature sensor for the air returning from the room into the unit
- Temperature sensor (NTC type) for the air at the unit outlet.

This sensor is normally fixed on the fan grid, but it can be moved in a remote position since its cable is more than 1 m long.

- Remote temperature sensor (NTC type) for the external air (**F** version only).
- Temperature sensor for water / water + glycol mixture on water inlet piping (**F** version only).
- Water temperature sensor on chilled water inlet piping (**H** version only).

NOTE *Other optional remote temperature sensors may be connected to the unit by the end user. Only Modbus type are allowed.*

See *5.6 Modbus Connections* for details.

5.5 Electric and Control System

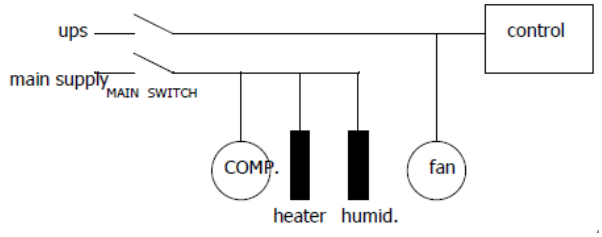
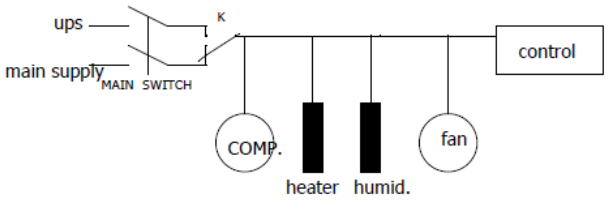
5.5.1 Standard or dual power supply

The unit may be delivered with standard power supply or optional dual power supply in order to have the units up and running if the main power supply fails.

The following table explains the main options.

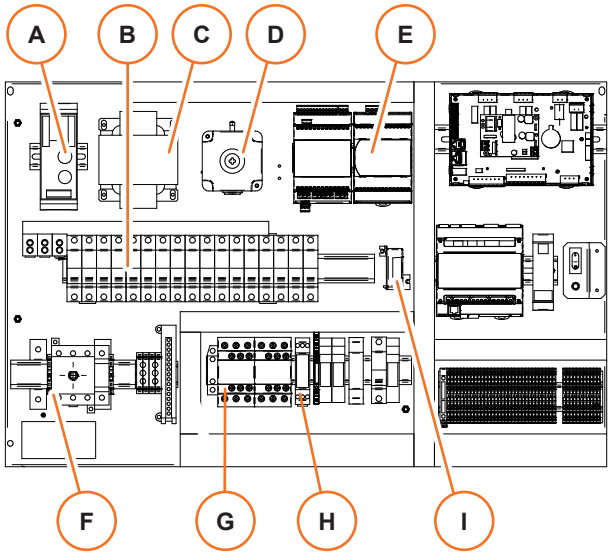
Make reference to the *Electric Diagrams* for details about your unit power supply system.

See *6. Technical Data* for the power supply relevant data and limits (voltage, frequency, ...).

Option	Description	What happens in case of power failure	What happens when power is restored
Standard power supply	Single supply line	An Ultracap device supplies power to control. Contact Vertiv® for timing. The control immediately closes the EEV, so to avoid leakage between high and low pressure pipelines.	The unit restarts automatically. The control system reboots once the Ultracap is completely discharged.
Dual power supply parallel	Double power supply to the same disconnecting switch 	A UPS is connected to the main power supply. **NOTE** *The UPS is not part of the unit.* In addition to the Ultracap(s), the UPS supplies power to the control and the fans. Heating, humidifier and compressors are disabled.	If the Ultracap and UPS have avoided power interruption to the control, then the unit restarts with a “fast startup”, which means it restarts from the status before the power failure. Otherwise the unit restarts automatically from scratch and the control system reboots.
Dual power supply alternate	Double power supply to the ATS electric panel, which is connected to the main electric panel Each power supply can supply completely the unit. 	In case of failure of the main supply, the **ATS** (Automatic Transfer Switch) automatically switches to the second power supply. If the Ultracap avoids power interruption to the control for the time needed for the switching, then the unit restarts with a “fast startup”, which means it restarts from the status before the power failure. Otherwise the unit restarts automatically from scratch and the control system reboots. **NOTE** *An Ultracap device supplies power to control. Contact Vertiv® for timing.* **NOTE** *Depending on the electric system configuration, the unit may be set to remain switched off for a certain time.*	The ATS remains on the second power supply until the main power supply is restored.

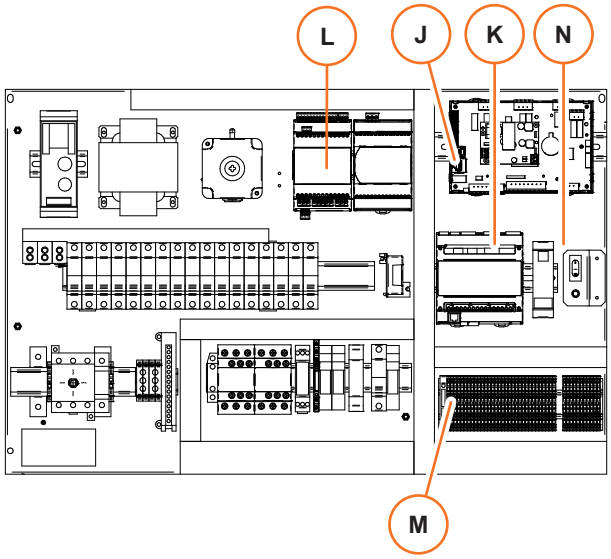
5.5.2 Main components

Power side (high voltage)



A	Power supply for touch screen
B	Thermal magnetic circuit breakers
C	Transformer
D	Clogged filter sensor
E	Ultracap
F	Disconnecting switch
G	Contactors
H	Relays
I	Amperometric transformer for humidifier

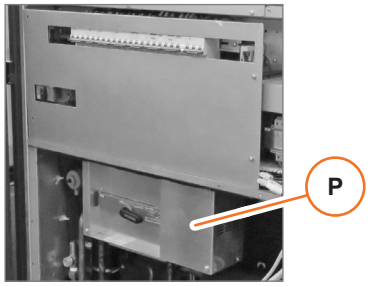
Control side (low voltage)



J	Control board
K	Humidifier control board
L	Expansion module
M	Terminal board
N	ON/OFF switch with LED indicator

WARNING
This is not a disconnecting switch.
See *5.5.3 Disconnecting switches*

NOTE *The electric panel is designed and manufactured according to EN 60204-1*



P	ATS (Automatic Transfer Switch) electric panel (optional)

5.5.3 Disconnecting switches

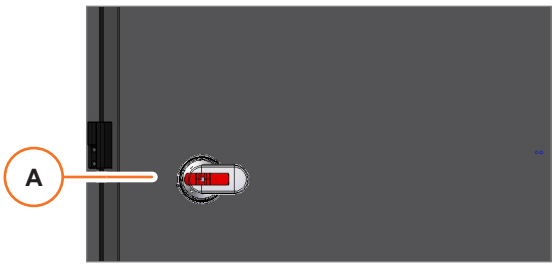
WARNING

Due to the presence of Ultracaps for the control, inverter and other devices, the electric and control panels can retain a stored high-voltage electrical charge for a certain time.

Before removing the panels and working inside the electric and control panels proceed as follows:

- Open all the local and remote disconnecting switches of the unit.
- Wait at least **5** minutes.
- Verify with a voltmeter that the power is **OFF**.

Single power supply

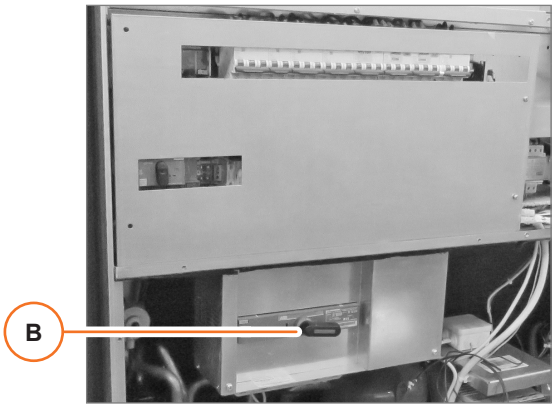


A Disconnecting switch

This is a disconnecting switch and it cuts off the electric power supply to the whole unit.

For units with additional electrical disconnecting device (Extended height units only), see *Annex K - electrical disconnecting device* on enclosure for details.

Dual alternate power supply



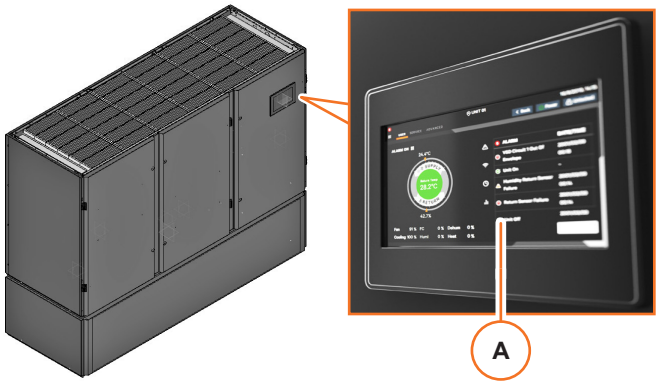
B ATS disconnecting switch

WARNING

The power supply is connected to the ATS disconnecting switch [**B**].

After you turn-**OFF** the main disconnector switch and you open the door, pay attention to the cable and components that are still energized.

5.5.4 iCOM™ control panel



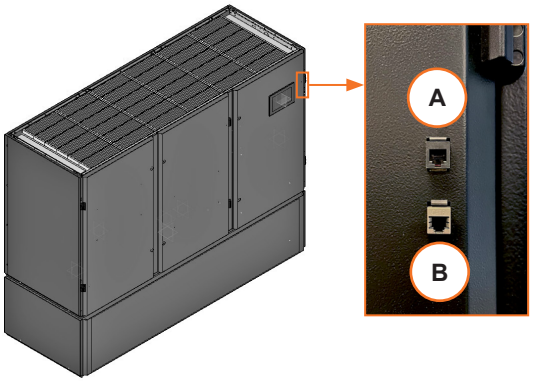
A iCOM™ control panel

The unit is usually controlled remotely by a network connection.

The unit may also have a iCOM™ control panel (optional) on the front door.

See the *iCOM™ User Manual* for details.

5.5.5 Ethernet connection



A	**RJ11 - CANbus port** for connection of an external display
B	**RJ45 - Ethernet port** for connection of an external laptop (not available when the unit is equipped with iCOM™ control panel. If required, it must be selected the ethernet switch in price list option).

5.5.6 Protective functions

The control system manages all the safety and operating devices needed for reliable automatic operation.

The main alarms are briefly explained below.

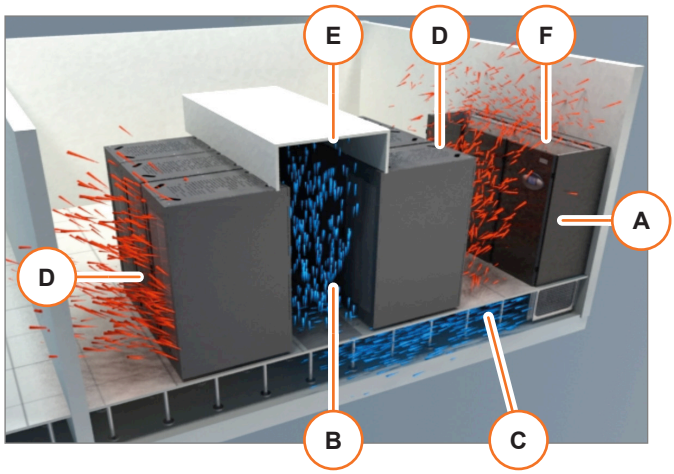
Out of Envelope alarm	An alarm may occur if the control system can not keep the compressor operating point within the compressor operating map. The controlled parameters are the following: - condensation setpoint - maximum evaporating temperature (controlled by the EEV)
Fixed speed compressors	The fixed speed compressors are equipped with a protection against overload.
Pressure control	High pressure and low pressure alarm
High pressure switch	The high pressure alarm may be handled in two different ways depending on the unit model. - Relay: the high pressure switch sends a signal to a relay that cuts-off the power supply to the compressor - STO (Safe Torque Off): the high pressure switch sends a signal to the inverter that cuts-off the power supply to the compressor (after the inverter) through a STO port. See *6.4 Safety Devices Settings* for the solution used for each unit model.

5.5.7 Fans control

The unit control system adjusts the fans rotation speed depending on the operating conditions.

Protective functions	Electronics overheating protection Motor overheating protection Locked rotor protection Short circuit at the motor output
Evaporator fans (inside the unit)	Speed adjustment between 30% and 100% of the maximum speed

5.5.8 Smart Aisle™



The **Liebert® PDX W-F-H** units can be used in a **Smart Aisle™** system.

The **Smart Aisle™** is a **Liebert®** patented system for controlling units in a vehicle with a foreign disposition.

The **Liebert® PDX W-F-H** unit [**A**] blows the air from the **Smart Aisle™** [**B**] through the raised plancher [**C**].

The air from the active equipment [**D**] returns to the **Liebert® PDX W-F-H** unit [**A**].

The air flow of the unit is directed by the modulation of the fan screw in function of the lectures of the remote temperature sensors [**E**] installed at the limit of the front/heating zone.

The unit can be equipped with the option of motor registers [**F**] for air intake.

5.5.9 Fluid economizer control

Fluid Economizer refers to a working mode where unit cools return air by means of water/glycol coil instead of evaporator coil.

The unit can run in Fluid Economizer mode only if the following conditions are satisfied:

- If the outdoor temperature is low enough to give (at least partial) capacity for Freecooling. This mode is used for Freecooler unit only.
- If the glycol temperature is low enough to give (at least partial) capacity for Freecooling.
- If the control temperature reaches a stable value above Setpoint, the Fluid Economizer will be disabled, and the compressor will be activated. A message on unit control will be shown.

The control stops the Fluid Economizer if the glycol temperature falls at or below the selected limit.

The control compares the minimum glycol temperature parameter and the glycol temperature. If the glycol temperature is lower than the threshold set, then the compressors will be stopped, and the unit will continue to run in Fluid Economizer mode only.

5.5.9.1 Parallel Mode

A parameter defines if the unit can run in parallel mode or in alternate mode.

- **Alternate mode:** Compressors and Fluid Economizer cannot work together. If all the temperature conditions (see above chapter) are satisfied, the compressors will be stopped, and Fluid Economizer will operate.
- **Parallel mode:** Compressors and Fluid Economizer can work together.

5.5.9.2 FC vs Condensation at compressor startup routine

The Fluid Economizer valve can be limited at defined value for a defined time at the compressor startup. This routine should help the condensing control avoiding the high-pressure alarm.

5.5.9.3 Fluid Economizer and Dehumidification

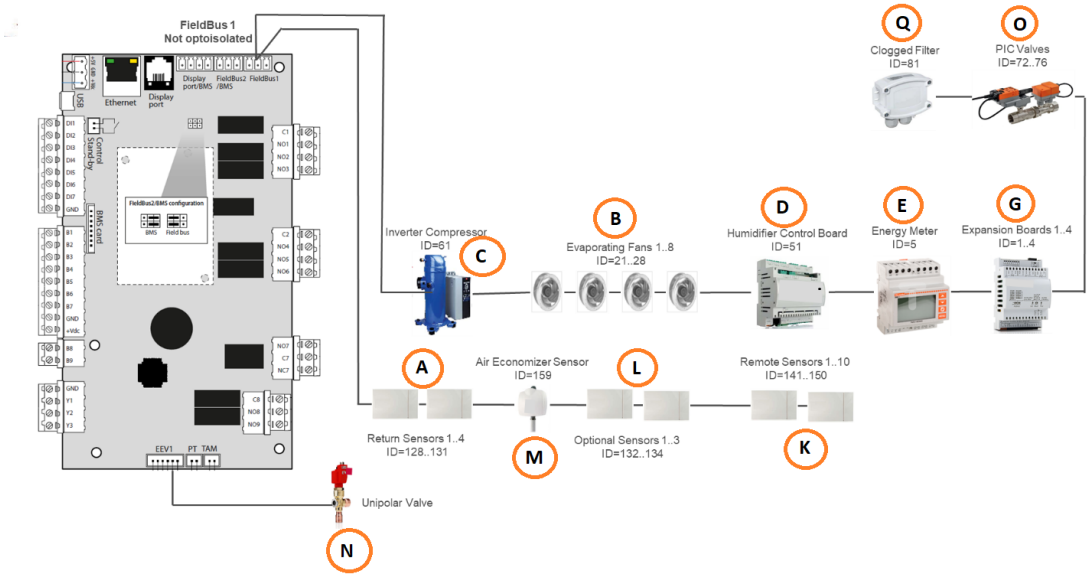
In dehumidification mode only the compressors can run. If Fluid Economizer is active, it will be temporarily locked out.

5.6 Modbus Connections

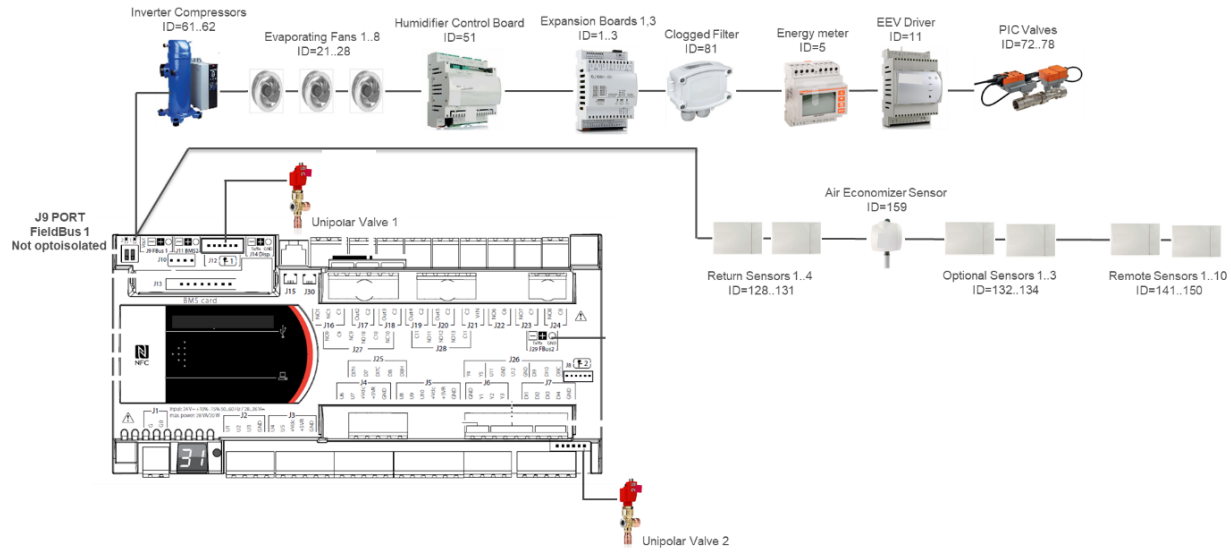
5.6.1 General description

The control system can manage different devices via Modbus.
The following figures show the architecture and detail of the structure.

Single circuit units



Dual circuit units



A	Return sensor T+H (up to 4)	**K**	Remote sensors T or T+H (up to 10)
B	Evaporating fans (up to 8)	**L**	Optional sensors T or T+H (up to 3)
C	Inverter compressor (up to 2)	**M**	Air Economizer sensor T+H
D	Humidifier	**N**	Unipolar valve 1
E	Energy meter (not available as standard)	**O**	PIC valves (up to 4)
F	EEV driver (up to 2)	**P**	Unipolar valve 2
G	Expansion board (up to 4)	**Q**	Clogged Filter

Settings

The internal connections and the related settings are factory made, but you may need to connect more remote devices at the installation or modify the settings of some Modbus devices.

In that case, you need to redo the settings for the Modbus connection. See *9.6 Modbus Connections and Settings*.

5.6.2 Fan management

Speed control

The fan speed can be managed in one of the following ways:

Return sensor	The fan speed is modulated from minimum value to maximum value following the return temperature deviation.
Supply sensor	The fan speed is modulated from minimum value to maximum value following the supply temperature deviation.
Remote sensor	The fan speed is modulated from minimum value to maximum value following the remote temperature deviation.
Delta (Temperature difference)	The control tries to achieve a fixed temperature difference between return temperature and supply temperature. When the temperature difference is inside the dead band the fan speed will not change. When the temperature difference is outside the dead band the control will change (increasing or decreasing) the speed of the fan trying to put the temperature difference inside the dead band. - If the temperature difference Return - Supply is lower than the difference setpoint, then the fan will decrease the speed. - If the temperature difference Return - Supply is higher than the difference setpoint, then the fan will increase the speed.
Static pressure	The speed of the evaporating fans are modulated in order to keep fixed the static pressure in the raised floor. When the pressure is inside the dead band the fan speed does not change; when the pressure is outside the dead band the control increases or decreases the speed of the fan trying to put the pressure inside the dead band.
Fixed speed	During normal operation the fan will operate at the fixed speed set.

Fan speed override

The fan speed can be limited or overwritten in the following cases:

Compressor(s) ON	The minimum fan speed cannot be lower than 30%.
High temperature alarm	The fan will run at defined speed. This feature can be enabled or disabled.
No power	The fan will run at defined speed.
Modbus high speed operation	If enabled in case of single fan failure or single fan communication failure (or up to N-1), the remaining fans will be forced to maximum speed.
Fan and cooling forcing by user (cool/fan 100%)	The fan will run at 100%.
Heating ON **Humidification ON** **Dehumidification ON**	The fan will run at defined speed. If a higher call for fans speed occurs, the fan will operate at the higher call.

5.6.3 Compressors management

A dedicated unit code defines the circuits and compressor number setting and related I/O to be managed.

“The minimum inverter compressor speed is set at 25% of maximum compressor velocity. The minimum speed could be decrease to the minimum compressor’s velocity through a software parameter”.

Circuit Priority for Cooling

A dedicated parameter defines the circuit activation priority for cooling:

1 First	This selection forces a defined sequence that is not respected only in case of alarms or **OFF** timings. Circuit 1 is used as lead circuit.
2 First	This selection forces a defined sequence that is not respected only in case of alarms or **OFF** timings. Circuit 2 is used as lead circuit.
Auto	Activation is based on working hours (or starts), so the first chosen is the circuit with the compressor with less hours (or starts).

Priority selection rules for two circuits:

1 Modulating compressor + 1 Fix compressor	= Forced to “2 first” because compressor on circuit 2 is modulating
1 Modulating compressor + 1 Tandem fix	= Forced to “2 first” because compressor on circuit 2 is modulating The compressor start sequence in the same circuit is based on the working hours or starts (like “Automatic”).

If a modulating compressor is present (and available with no alarms or **OFF** timings) it is always engaged with higher priority. For the **Liebert® PDX W-F-H** units the modulating compressor is placed in the circuit 2.

In case of double circuit, balanced mode is always applied: once a circuit is selected and first compressor is defined, the next compressor will be one on the other circuit.

OFF sequence is always defined by **FIFO** (First In – First Out) logic.

Circuit Priority for Dehumidification

A dedicated parameter defines the circuit activation priority for dehumidification:

Circ1	Circuit 1 only is used for dehumidification. In case of alarm the other circuit will not be activated.
Circ2	Circuit 2 only is used for dehumidification. In case of alarm the other circuit will not be activated.
Both	Both circuits (with different activation/de-activation points) are used for dehumidification.

Usually the circuit number 2 is the designated one for dehumidification.

If a compressor is running for cooling request, and a dehumidification request arrives:

Designated for dehumidification	The compressor remains active, till the cooling or dehumidification request is valid.
Not designated for dehumidification	The compressor remains active, till the cooling request is valid. The other compressor designated for dehumidification will start in addition to the first one.

Compressor Timings

Compressor minimum ON time	**180** seconds as default value
Compressor minimum OFF time	**180** seconds as default value **NOTE** *Minimum compressor **OFF** time for VSD compressor cannot be set lower than **10** seconds.*

Start to next start activation delay	**360** seconds (according to supplier indication)
Activation delay between different circuits	**30** seconds
Activation delay between compressors in the same circuit	**120** seconds
Manual mode	In case of compressor driven in manual mode the above timings are not respected.
Fast start	Compressor minimum **OFF** Time: it is internally reduced to **10** seconds for VSD compressor or **0** seconds for fixed compressor. Start to Next Start Activation delay: Not considered. **Note:** *The compressor starts cannot exceed the limit of **10** per hour.* Activation delay between different circuits: Reduced to **8** seconds. Activation delay between tandem compressors in the same circuit: Reduced to **8** seconds.

DX Restart Timings in case of fast start

- After a power cycle, if the main control board is kept alive by the Ultracapacitor (power loss lower than **1** minute), the first DX circuit will restart (if required) within **20** seconds. The second DX circuit is allowed to start **8** seconds later the first one.
- After a power cycle, if the main control board is **OFF** (power loss higher than **1** minute or Ultracapacitor is down), the first DX circuit will restart (if required) within **80** seconds. The second DX circuit is allowed to start **8** seconds later the first one. Those delays are due to the main control board rebooting time.

Note 1: *With Fast Start enabled, the watchdog feature is also activated on both evaporating and condensed fans. This means that these depart as soon as the unit is powered by missing the Modbus signal from control as it is starting.*

Note 2: *Before turning the main power switch **OFF**, shut down the unit by the control (throught he switch inside the electrical panel).*

Note 3: *ATS minimum switching time must be set at **3** seconds*

Note 4: *Functions is activated by default when digit 17=F, G and digit 18=0*

Variable Speed Compressor Startup Routine

Compressor	The compressor will start at defined speed for defined time.
Dual circuit unit	The compressor is kept **OFF** during the EEV valve preopening routine.
Single circuit unit (except PI057 and PI075)	When the compressor starts, the EEV valve is kept closed until the condensing evaporating pressure difference exceeds the minimum pressure difference.

6. Technical Data

Content of this chapter

6.1 Structure

Table 03 - Frames and air distribution

Unit model	Frame type	Number of bays	U - Upflow	H - Downflow Frontal	D - Downflow Up	E - Downflow Down	Extended
PI025	1	1	YES	YES	YES	---	---
PI045	2	1,5	YES	YES	YES	YES	---
PI055	2	1,5	YES	---	YES	YES	YES
PI059	2	1,5	YES	---	YES	YES	YES
PI062	3	2	YES	YES	YES	YES	---
PI070	3	2	YES	---	YES	YES	YES
PI092	3	2	YES	---	YES	YES	YES
PI104	5	3	YES	---	YES	YES	---
PI140	10		---	---	YES	YES	YES
PI150	7		---	---	YES	YES	YES

Unit model	W - Water cooled	H - Dual Fluid water cooled	F - Freecooling
PI025	YES	YES	YES
PI045	YES	YES	YES
PI055	---	---	YES
PI059	YES	---	---
PI062	YES	YES	YES
PI070	---	---	YES
PI092	YES	---	---
PI104	YES	YES	YES
PI140	---	---	YES
PI150	YES	---	---

6.2 Refrigerating System

6.2.1 Refrigerant Type

WARNING

All the data given in this manual refer to systems using R410A as refrigerant.

6.2.2 Circuit versions

For double circuit models:

- The circuit with fixed speed compressor(s) is on the left side and it is identified as Fixed speed circuit
- The circuit with variable speed compressor is on the right side and it is identified as Variable speed circuit

For single circuit models:

- There is only one circuit with variable speed compressor. To maintain consistency, this circuit is identified as Variable speed circuit

Table 04 - Circuit version

Unit model	Number of circuits	Fixed speed circuit	Variable speed circuit
PI025	1	---	YES
PI045	1	---	YES
PI055	1	---	YES
PI059	1	---	YES
PI062	2	YES	YES
PI070	2	YES	YES
PI092	2	YES	YES
PI104	2	YES	YES
PI140	2	YES	YES
PI150	2	YES	YES

6.2.3 Inverter derating factors

Table 05 - Refrigerating system - Inverter derating factors

<table>
<tr><th>Unit model</th><th></th></tr>
<tr><td>PI025
PI045</td><td>For altitudes below 1000 m no derating is required.
For altitudes between 1000 m and 2000 m, apply the following derating factors:
- decrease the output current by 1% per 100 m of altitude above 1000 m
- or otherwise reduce the maximum ambient temperature by 1°C per 200 m of altitude above 1000 m
For altitudes above 2000 m please contact Vertiv™ Technical Support.</td></tr>
<tr><td>PI055
PI059
PI062
PI070
PI092
PI104
PI140
PI150</td><td>For altitudes above 1000 m above sea level, apply the following derating factors:
<table><tr><th>Altitude [m]</th><th>Derating factor</th></tr><tr><td>1 000</td><td>1</td></tr><tr><td>1 500</td><td>0,95</td></tr><tr><td>2 000</td><td>0,90</td></tr></table>NOTE The derating factor is applied to the maximum output current.
The current limit must be scaled according to the derating table.
As a result the compressor might not be able to run the full envelope (need to calculate)</td></tr>
</table>

6.2.4 Piping diameter and thickness

Table 06 - Water piping diameter and thickness

Unit model	F version Freecooling		W version Water cooled				H version Dual fluid water cooled					
			Circuit 1 - DX side		Circuit 2 - DX side		Circuit 1 - DX side		Circuit 2 - DX side		Water system	
	External diameter	Thickness	External diameter	Thickness	External diameter	Thickness	External diameter	Thickness	External diameter	Thickness	External diameter	Thickness
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
PI025	28	1,5	35	1,5	/	/	35	1,5	/	/	28	1,5
PI045	35	1,5	35	1,5	/	/	35	1,5	/	/	35	1,5
PI055	42	1,5	/	/	/	/	/	/	/	/	/	/
PI059	/	/	35	1,5	/	/	/	/	/	/	/	/
PI062	42	1,5	35	1,5	35	1,5	35	1,5	35	1,5	42	1,5
PI070	42	1,5	/	/	/	/	/	/	/	/	/	/
PI092	/	/	35	1,5	35	1,5	/	/	/	/	/	/
PI104	54	1,5	42	1,5	42	1,5	42	1,5	42	1,5	54	1,5
PI140	64	1,5	/	/	/	/	/	/	/	/	/	/
PI150	/	/	42	1,5	42	1,5	/	/	/	/	/	/

6.2.5 Refrigerant charge

Table 07 - Charge [kg] of refrigerant for the reference system

Unit model	W - Water cooled		F- Freecooilng		H - Dual Fluid water cooled	
	Fixed speed circuit	Variable speed circuit	Fixed speed circuit	Variable speed circuit	Fixed speed circuit	Variable speed circuit
PI025	---	4	---	3	---	3
PI045	---	6,7	---	5,5	---	5,5
PI055	---	---	---	5,5	---	---
PI059	---	8,5	---	---	---	---
PI062	3,6	3,3	3,6	3,3	3,6	3,3
PI070	---	---	4,5	4,5	---	---
PI092	6,8	6,6	---	---	---	---
PI104	4,4	5,8	4,4	5,8	4,4	5,8
PI140	---	---	8,5	10,5	---	---
PI150	12,9	12,1	---	---	---	---

6.2.6 Compressor oil

The units are delivered with the compressor already containing the initial amount of oil given in the following table.

Table 08 - Oil type and initial amount for units with 50Hz power supply

Unit model	Fixed speed circuit - 50 Hz		Variable speed circuit - 50 Hz	
	Oil type	Initial oil charge [dm^3]	Oil type	Initial oil charge [dm^3]
PI025	---	---	DAPHNE Hermetic Oil FVC68D	1,4
PI045	---	---	DAPHNE Hermetic Oil FVC68D	2,3
PI055	---	---	POE - 160SZ Oil	3,3
PI059	---	---	POE - 160SZ Oil	3,3
PI062	POE - 160SZ Oil	3,3	DAPHNE Hermetic Oil FVC68D	1,6
PI070	POE - 160SZ Oil	3,3	DAPHNE Hermetic Oil FVC68D	1,6
PI092	POE - 160SZ Oil	3,3	DAPHNE Hermetic Oil FVC68D	1,6
PI104	POE - 160SZ Oil	6	POE - 160SZ Oil	3,3
PI140	POE - 160SZ Oil	6,6	POE - 160SZ Oil	3,6
PI150	POE - 160SZ Oil	6,6	POE - 160SZ Oil	3,6

Table 09 - Oil type and initial amount for units with 60Hz power supply

Unit model	Fixed speed circuit - 60 Hz		Variable speed circuit - 60 Hz	
	Oil type	Initial oil charge [dm^3]	Oil type	Initial oil charge [dm^3]
PI025	---	---	DAPHNE Hermetic Oil FVC68D	1,4
PI045	---	---	DAPHNE Hermetic Oil FVC68D	2,3
PI055	---	---	POE - 160SZ Oil	3,3
PI059	---	---	POE - 160SZ Oil	3,3
PI062	POE - 160SZ Oil	3	DAPHNE Hermetic Oil FVC68D	1,6
PI092	POE - 160SZ Oil	3,3	DAPHNE Hermetic Oil FVC68D	3,3
PI104	POE - 160SZ Oil	6	POE - 160SZ Oil	3,3
PI120	POE - 160SZ Oil	6,6	POE - 160SZ Oil	3,6
PI150	POE - 160SZ Oil	6,6	POE - 160SZ Oil	3,6

6.3 Water System

6.3.1 Water valves differential pressure

Table 10 - water valves differential pressure

	2-WAY & 3-WAY VALVE	
	Max differential pressure [kPa]	Close-OFF pressure [kPa]
For all models	350	1400

6.3.2 Glycol mixture correction factors

The water glycol mixtures are used as medium for heat transfer where chiller is placed outside the building and outdoor temperature is below the freezing point of water. The use of low freezing point mixtures causes a modification in the main thermodynamic properties of the units. The main parameters affected by the use of glycol mixtures are the following:

- Cooling capacity
- Mixture volumetric flow
- Pressure drop

The correction factors referred to the most common ethylene glycol mixtures are reported in the following table:

Table 11 - Cooling system - Glycol mixture correction factors

		Ethylene glycol [% in weight]					
Parameter	Correcting factor	0	10	20	30	40	50
Freezing temperature [°C]	---	0	-4,4	-9,9	-16,6	-25,2	-37,2
Cooling capacity	F3	1	0,987	0,977	0,969	0,958	0,950
Mixture volume flow rat	F4	1	1,046	1,080	1,098	1,150	1,210
Mixture side pressure drop	F5	1	1,053	1,109	1,168	1,234	1,311

We indicate as RO, VO, DP0 respectively the unit cooling capacity, the water volumetric flow rate and the pressure drop with 0% ethylene glycol.

When we use glycol mixtures at different percentage with the same inlet and outlet temperatures at the heat exchanger, the performance will vary as follows:

- Cooling capacity = RO x F3
- Volumetric flow rate = VO x F3 x F4
- Mixture pressure drop = DP1 x F5.

where DP1 is the unit water pressure drop for the new volumetric mixture flow rate.

6.4 Air System

Table 12 - Air system - Fans number and weight

Unit model	High Power EC Fan Module		EC Fan Module	
	Fan Number	Weight [kg]	Fan Number	Weight [kg]
PI025	1	27	1	23
PI045	1	27,9	1	25,6
PI055	1	27,9	1	25,6
PI059	1	27,9	1	25,6
PI062	2	27,9	2	25,6
PI070	2	27,9	2	25,6
PI092	2	27,9	2	25,6
PI104	3	27,9	2	27,9
PI140	4	34,7	4	30,1
PI150	4	34,7	4	30,1

NOTE *Values given for each single fan. The model is the same both for 50 Hz and 60 Hz.*

6.5 Safety Devices Settings

Table 13 - Safety devices settings

Unit model	High pressure alarm management		Safety devices settings	
	Fixed speed circuit	Variable speed circuit	HP Switch	Safety Valve
PI025	---	STO	Open 42 ± 1 bar(g) Manual reset 33 ± 1,5 bar(g) Normally closed Durability 10 000 times	Setting 45 bar(g) Over pressure 10% Closing variation 15%
PI045	---	Relay	Open 39,1 ± 1 bar(g) Manual reset 33 ± 1,5 bar(g) Normally closed Durability 10 000 times	Setting 41.5 bar(g) Over pressure 10% Closing variation 15%
PI055	---	STO	Open 42 ± 1 bar(g) Manual reset 33 ± 1,5 bar(g) Normally closed Durability 10 000 times	Setting 45 ± 1 bar(g) Over pressure 10% Closing variation 15%
PI059	---	STO		
PI062	Relay	STO		
PI070	Relay	STO		
PI092	Relay	STO		
PI104	Relay	STO		
PI140	Relay	STO		
PI150	Relay	STO		

Relay	The high pressure switch sends a signal to a relay that cuts-OFF the power supply to the compressor
STO (Safe Torque OFF)	The high pressure switch sends a signal to the inverter that cuts-OFF the power supply to the compressor (after the inverter) through a STO port.

6.6 Electrical System

6.6.1 Unit electrical data

General remarks

- The cables have to be sized in compliance with local standards and according to the type and characteristics (for example Amperes) of installation.
- The recommended wires size have been determined considering the maximum electrical heaters capacity selectable and the maximum humidifier capacity selectable.
- The data in the tables do not consider the absorbed current from the condensate pump and for other options not explicitly described.
- The specific energy allowed to flow from the circuit breakers, installed by the user, must be lower than 300.000 A^2s.
- Prescriptions on the differential relay required to the user:
  - For special places (healthcare facilities, etc ...) comply with the local regulations.
  - For ordinary places, a low sensitivity is suggested (300 mA) coordinated with the value of the earth resistance (IEC 364): Ra 50/Ia (Art.413.1.4.1, CEI 64-8 or IEC 60364-4-45).
  - In case of frequent over-voltages with mains impulse, it is advisable Io install a selective differential and to evaluate the need for adopting other devices.
  - The FLA is for units without the options of condensate pump and condensing unit.
  - The FLA is for units with AUTOMATIC FUNCTIONS only: in manual mode operation the FLA must be lower than the maximum current of the main switch.

    The Modbus wiring is field-supplied and must be:

    - shielded
    - 24-18 AWG (0.20-0.82 mm²) stranded tinned copper until 107m , 18AWG (0.75 mm²) stranded tinned copper until 130m
    - twisted pair (minimum 8 twists per foot)
    - low capacitance (17pF/ft or less)
    - plenum rated (NEC type CMP) if required by local codes
    - UV and moisture resistant or run within conduit once in an outdoor environment, and must be temperature and voltage rated for conditions present.

Examples: Belden part number 89207(plenum rated) or Alpha Wire part number 6454 (UV resistant outdoor rated) category 5, 5e or higher.

CAUTIONS

Do not run the Modbus cable in the same conduit, raceway or chase used for high-voltage wiring.

Mandatory shield connection to ground close Master (indoor unit control board)

For Modbus network lengths greater than 130m, contact Vertiv™ for assistance.

Note: *Refer also to the Vertiv™ document code "10027754_Modbus_Simple_Rules" to realize the Modbus chain connections between the devices (internal and external) of the unit.*

Units with power supply 400 V / 3ph + N / 50 Hz + Earth

Table 14 - Electrical data for cooling only - 400 V / 3ph + N / 50 Hz + Earth

Unit model	High Power EC Fan Module				EC Fan Module				Recommended wires size [mm²] (2)	MIN/MAX Cu cable size [mm²]
	FLA TOT [A]	LRA [A]	Recommended circuit beaker (1)	Power factor cosφ	FLA TOT [A]	LRA [A]	Recommended circuit beaker (1)	Power factor cosφ		
PI025	30	6	32	≥ 0,9	27	3	32	≥ 0,9	5G6mm²	1,5. 35mm²
PI045	46	6	63	≥ 0,9	44	4	63	≥ 0,9	5G16mm²	1,5. 35mm²
PI055	43	6	63	≥ 0,9	42	4	63	≥ 0,9	5G16mm²	1,5. 35mm²
PI059	50	6	63	≥ 0,9	48	4	63	≥ 0,9	5G16mm²	1,5. 35mm²
PI062	59	179	80	≥ 0,9	56	176	63	≥ 0,9	5G25mm²	10. 70mm²
PI070	65	184	80	≥ 0,9	62	181	80	≥ 0,9	5G25mm²	10. 70mm²
PI092	80	207	100	≥ 0,9	77	204	100	≥ 0,9	5G35mm²	10. 70mm²
PI104	97	171	125	≥ 0,9	87	166	100	≥ 0,9	5G35mm²	10. 70mm²
PI140	130	249	160	≥ 0,9	123	242	160	≥ 0,9	5G95mm²	M8X25
PI150	136	263	160	≥ 0,9	129	256	160	≥ 0,9	5G95mm²	M8X25

(1) Recommended circuit beaker size breaker C curve, RCD Idn=0,3A type B or B++
(2) PVC isolated Cu cables 40°C see tab.6 EN60204-1 B1

Table 15 - Electrical data for cooling + heating or electrical data for cooling + heating + humidification - 400 V / 3ph + N / 50 Hz + Earth

Unit model	High Power EC Fan Module			EC Fan Module			Recommended wires size [mm²] (2)	MIN/MAX Cu cable size [mm²]	Power factor cosφ
	FLA TOT [A]	LRA [A]	Reccomended circuit beaker (1)	FLA TOT [A]	LRA [A]	Recommended circuit beaker (1)			
PI025	40	40	50	35	35	50	5G10mm²	1,5. 35mm²	≥ 0,9
PI045	56	56	63	55	55	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI055	54	54	63	52	52	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI059	60	60	63	59	59	80	5G25mm²	1,5. 35mm²	≥ 0,9
PI062	81	179	100	78	176	100	5G35mm²	10. 70mm²	≥ 0,9
PI070	87	184	100	84	181	100	5G35mm²	10. 70mm²	≥ 0,9
PI092	101	207	125	98	204	125	5G35mm²	10. 70mm²	≥ 0,9
PI104	125	171	150	108	166	125	5G50mm²	10. 70mm²	≥ 0,9
PI140	162	249	200	155	242	200	5G95mm²	M8X25	≥ 0,9
PI150	168	263	200	161	256	200	5G95mm²	M8X25	≥ 0,9

(1) Recommended circuit beaker size breaker C curve, RCD Idn=0,3A type B or B++
(2) PVC isolated Cu cables 40°C see tab.6 EN60204-1 B1

Table 16 - Electrical data for cooling + humidification - 400 V / 3ph + N / 50 Hz + Earth

Unit model	High Power EC Fan Module			EC Fan Module			Recommended wires size [mm²] (2)	MIN/MAX Cu cable size [mm²]	Power factor cosφ
	FLA TOT [A]	LRA [A]	Reccomended circuit beaker (1)	FLA TOT [A]	LRA [A]	Recommended circuit beaker (1)			
PI025	33	33	40	30	30	40	5G10mm²	1,5. 35mm²	≥ 0,9
PI045	49	49	63	47	47	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI055	46	46	63	45	45	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI059	53	53	63	51	51	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI062	68	188	80	65	185	80	5G25mm²	10. 70mm²	≥ 0,9
PI070	74	193	100	71	190	100	5G35mm²	10. 70mm²	≥ 0,9
PI092	88	215	125	85	212	125	5G35mm²	10. 70mm²	≥ 0,9
PI104	101	180	125	95	174	125	5G50mm²	10. 70mm²	≥ 0,9
PI140	138	257	150	132	251	150	5G95mm²	M8X25	≥ 0,9
PI150	144	271	150	138	265	150	5G95mm²	M8X25	≥ 0,9

(1) Recommended circuit beaker size breaker C curve, RCD Idn=0,3A type B or B++
(2) PVC isolated Cu cables 40°C see tab.6 EN60204-1 B1

Units with power supply 460 V / 3ph / 60 Hz + Earth

Table 17 - Electrical data for cooling only - 460 V / 3ph / 60 Hz + Earth

Unit model	Premium Fan Module			Basic Fan Module			Recommended wires size [mm²] (2)	MIN/MAX Cu cable size [mm²]	Power factor cosφ
	FLA TOT [A]	LRA [A]	Reccomended circuit beaker (1)	FLA TOT [A]	LRA [A]	Recommended circuit beaker (1)			
PI025	25	5	32	23	3	32	4G6mm²	1,5. 35mm²	≥ 0,9
PI045	39	5	63	38	3	63	4G16mm²	1,5. 35mm²	≥ 0,9
PI055	37	5	63	36	3	63	4G16mm²	1,5. 35mm²	≥ 0,9
PI059	43	5	63	42	3	63	4G16mm²	1,5. 35mm²	≥ 0,9
PI062	50	129	80	48	127	63	4G25mm²	10. 70mm²	≥ 0,9
PI070	55	173	80	53	171	63	4G25mm²	10. 70mm²	≥ 0,9
PI092	69	188	100	67	186	100	4G35mm²	10. 70mm²	≥ 0,9
PI104	87	163	125	79	158	100	4G35mm²	10. 70mm²	≥ 0,9
PI140	110	228	125	104	222	125	4G70mm²	M8X25	≥ 0,9
PI150	118	237	125	112	231	125	4G95mm²	M8X25	≥ 0,9

(1) Recommended circuit beaker size breaker C curve, RCD Idn=0,3A type B or B++
(2) PVC isolated Cu cables 40°C see tab.6 EN60204-1 B1

Table 18 - Electrical data for cooling + heating or electrical data for cooling + heating + humidification - 460 V / 3ph / 60 Hz + Earth

Unit model	Premium Fan Module			Basic Module			Recommended wires size [mm²] (2)	MIN/MAX Cu cable size [mm²]	Power factor cosφ
	FLA TOT [A]	LRA [A]	Reccomended circuit beaker (1)	FLA TOT [A]	LRA [A]	Recommended circuit beaker (1)			
PI025	35	35	50	33	33	50	4G10mm²	1,5. 35mm²	≥ 0,9
PI045	49	49	63	47	47	63	4G16mm²	1,5. 35mm²	≥ 0,9
PI055	46	46	63	45	45	63	4G16mm²	1,5. 35mm²	≥ 0,9
PI059	52	52	63	51	51	80	4G25mm²	1,5. 35mm²	≥ 0,9
PI062	69	129	100	67	127	100	4G35mm²	10. 70mm²	≥ 0,9
PI070	74	173	100	72	171	100	4G35mm²	10. 70mm²	≥ 0,9
PI092	88	188	125	86	186	125	4G35mm²	10. 70mm²	≥ 0,9
PI104	112	163	125	98	158	125	4G50mm²	10. 70mm²	≥ 0,9
PI140	138	228	150	132	222	150	4G95mm²	M8X25	≥ 0,9
PI150	147	237	150	141	231	150	4G95mm²	M8X25	≥ 0,9

(1) Recommended circuit beaker size breaker C curve, RCD Idn=0,3A type B or B++
(2) PVC isolated Cu cables 40°C see tab.6 EN60204-1 B1

Table 19 - Electrical data for cooling + humidification - 460 V / 3ph / 60 Hz + Earth

Unit model	Premium Fan Module			Basic Fan Module			Recommended wires size [mm²] (2)	MIN/MAX Cu cable size [mm²]	Power factor cosφ
	FLA TOT [A]	LRA [A]	Reccomended circuit beaker (1)	FLA TOT [A]	LRA [A]	Recommended circuit beaker (1)			
PI025	28	28	40	26	26	40	4G10mm²	1,5. 35mm²	≥ 0,9
PI045	42	42	63	41	41	63	4G16mm²	1,5. 35mm²	≥ 0,9
PI055	40	40	63	39	39	63	4G16mm²	1,5. 35mm²	≥ 0,9
PI059	46	46	63	44	44	63	4G16mm²	1,5. 35mm²	≥ 0,9
PI062	58	137	80	56	135	80	4G25mm²	10. 70mm²	≥ 0,9
PI070	63	181	80	61	179	80	4G25mm²	10. 70mm²	≥ 0,9
PI092	77	196	125	75	194	125	4G35mm²	10. 70mm²	≥ 0,9
PI104	91	170	125	87	166	125	4G50mm²	10. 70mm²	≥ 0,9
PI140	118	236	150	112	230	150	4G70mm²	M8X25	≥ 0,9
PI150	126	245	150	120	239	150	4G95mm²	M8X25	≥ 0,9

(1) Recommended circuit beaker size breaker C curve, RCD Idn=0,3A type B or B++
(2) PVC isolated Cu cables 40°C see tab.6 EN60204-1 B1

Units with power supply 380 V / 3ph + N / 60 Hz + Earth

Table 20 - Electrical data for cooling only - 380 V / 3ph + N / 60 Hz + Earth

Unit model	High Power EC Fan Module			EC Fan Module			Recommended wires size [mm²] (2)	MIN/MAX Cu cable size [mm²]	Power factor cosφ
	FLA TOT [A]	LRA [A]	Reccomended circuit beaker (1)	FLA TOT [A]	LRA [A]	Recommended circuit beaker (1)			
PI025	30	5	32	28	3	32	5G6mm²	1,5. 35mm²	≥ 0,9
PI045	46	5	63	45	3	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI055	44	5	63	43	3	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI059	51	5	63	49	3	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI062	59	160	80	57	158	63	5G25mm²	10. 70mm²	≥ 0,9
PI070	65	196	80	63	194	80	5G35mm²	10. 70mm²	≥ 0,9
PI092	81	216	100	79	214	100	5G35mm²	10. 70mm²	≥ 0,9
PI104	102	200	125	94	195	100	5G35mm²	10. 70mm²	≥ 0,9
PI140	128	259	150	122	253	150	5G95mm²	M8X25	≥ 0,9
PI150	136	271	150	130	265	150	5G95mm²	M8X25	≥ 0,9

(1) Recommended circuit beaker size breaker C curve, RCD Idn=0,3A type B or B++
(2) PVC isolated Cu cables 40°C see tab.6 EN60204-1 B1

Table 21 - Electrical data for cooling + heating or electrical data for cooling + heating + humidification - 380 V / 3ph + N / 60 Hz + Earth

Unit model	High Power EC Fan Module			EC Fan Module			Recommended wires size [mm²] (2)	MIN/MAX Cu cable size [mm²]	Power factor cosφ
	FLA TOT [A]	LRA [A]	Reccomended circuit beaker (1)	FLA TOT [A]	LRA [A]	Recommended circuit beaker (1)			
PI025	41	41	50	39	39	50	5G10mm²	1,5. 35mm²	≥ 0,9
PI045	58	58	63	57	57	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI055	55	55	63	54	54	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI059	62	62	63	61	61	80	5G25mm²	1,5. 35mm²	≥ 0,9
PI062	82	160	100	79	158	100	5G35mm²	10. 70mm²	≥ 0,9
PI070	88	196	125	85	194	125	5G35mm²	10. 70mm²	≥ 0,9
PI092	104	216	125	101	214	125	5G35mm²	10. 70mm²	≥ 0,9
PI104	133	200	150	117	195	125	5G50mm²	10. 70mm²	≥ 0,9
PI140	162	259	200	156	253	200	5G95mm²	M8X25	≥ 0,9
PI150	170	271	200	164	265	200	5G95mm²	M8X25	≥ 0,9

(1) Recommended circuit beaker size breaker C curve, RCD Idn=0,3A type B or B++
(2) PVC isolated Cu cables 40°C see tab.6 EN60204-1 B1

Table 22 - Electrical data for cooling + humidification - 380 V / 3ph + N / 60 Hz + Earth

Unit model	High Power EC Fan Module			EC Fan Module			Recommended wires size [mm²] (2)	MIN/MAX Cu cable size [mm²]	Power factor cosφ
	FLA TOT [A]	LRA [A]	Reccomended circuit beaker (1)	FLA TOT [A]	LRA [A]	Recommended circuit beaker (1)			
PI025	33	33	40	31	31	40	5G10mm²	1,5. 35mm²	≥ 0,9
PI045	50	50	63	49	49	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI055	47	47	63	46	46	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI059	54	54	63	53	53	63	5G16mm²	1,5. 35mm²	≥ 0,9
PI062	68	169	80	66	167	80	5G25mm²	10. 70mm²	≥ 0,9
PI070	74	205	100	72	203	100	5G35mm²	10. 70mm²	≥ 0,9
PI092	90	225	125	88	223	125	5G35mm²	10. 70mm²	≥ 0,9
PI104	108	209	125	103	204	125	5G50mm²	10. 70mm²	≥ 0,9
PI140	137	268	150	131	262	150	5G95mm²	M8X25	≥ 0,9
PI150	145	280	150	139	274	150	5G95mm²	M8X25	≥ 0,9

(1) Recommended circuit beaker size breaker C curve, RCD Idn=0,3A type B or B++
(2) PVC isolated Cu cables 40°C see tab.6 EN60204-1 B1

6.6.2 Fans

Table 23 - Fans electrical data

Unit model	High Power EC Fan Module			EC Fan Module		
	Motor Size [kW]	FLA @50 Hz [A]	FLA @60 Hz [A]	Motor Size [kW]	FLA @50 Hz [A]	FLA @60 Hz [A]
PI025	2,6	5,6	4,4	1,9	3,2	2,5
PI045	3,5	5,6	4,4	2,7	4,1	3,2
PI055	3,5	5,6	4,4	2,7	4,1	3,2
PI059	3,5	5,6	4,4	2,7	4,1	3,2
PI062	3,5	5,6	4,4	2,7	4,1	3,2
PI070	3,5	5,6	4,4	2,7	4,1	3,2
PI092	3,5	5,6	4,4	2,7	4,1	3,2
PI104	3,5	5,6	4,4	3,5	5,6	4,4
PI140	4,6	7,4	6	3,7	5,7	4,5
PI150	4,6	7,4	6	3,7	5,7	4,5

NOTE *Values given for each single fan. The model is the same both for 50 Hz and 60 Hz.*

6.6.3 Compressors

Table 24 - Compressors electrical data for 400 V / 3ph / 50 Hz and 460 V / 3 ph / 60 Hz power supply

Unit model	FLA [A]		LRA [A]		Nominal Power [kW]		Winding Resistance [Ω]	
	Fixed speed	Variable speed	Fixed speed	Variable speed	Fixed speed	Variable speed	Fixed speed	Variable speed
PI025	---	24	---	[-]	---	14	---	0,32
PI045	---	40	---	[-]	---	24	---	0,23
PI055	---	37,5	---	[-]	---	15	---	0,1
PI059	---	44	---	[-]	---	18,5	---	0,08
PI062	22	26	142	[-]	11		1,05	0,177
PI070	28	26	147	[-]	11		0,92	0,177
PI092	31	31,2	158	[-]	15		0,83	0,1
PI104	19+19	37,5	98+98	[-]	15		1.47+1.47	0,1
PI140	28+28	44	147+147	[-]	18,5		0.92+0.92	0,08
PI150	31+31	44	158+158	[-]	18,5		0.83+0.83	0,08

Table 25 - Compressors electrical data -for 380 V / 3 ph / 60 Hz power supply

Unit model	FLA [A]		LRA [A]		Nominal Power [kW]		Winding Resistance [Ω]	
	Fixed speed	Variable speed	Fixed speed	Variable speed	Fixed speed	Variable speed	Fixed speed	Variable speed
PI025	---	25,2	---	[-]	---	14	---	0,32
PI045	---	42	---	[-]	---	24	---	0,23
PI055	---	39,4	---	[-]	---	15	---	0,1
PI059	---	46,2	---	[-]	---	18,5	---	0,08
PI062	23	27,3	124	[-]	11		1,05	0,177
PI070	29	27,3	160	[-]	11		0,72	0,177
PI092	33	32,8	168	[-]	15		0,62	0,1
PI104	23+23	39,4	124+124	[-]	15		1.05+1.05	0,1
PI140	29+29	46,2	160+160	[-]	18,5		0.72+0.72	0,08
PI150	33+33	46,2	168+168	[-]	18,5		0.62+0.62	0,08

Table 26 - Compressors electrical data -for 460 V / 3 ph / 60 Hz power supply

Unit model	FLA [A]		LRA [A]		Nominal Power [kW]		Winding Resistance [Ω]	
	Fixed speed	Variable speed	Fixed speed	Variable speed	Fixed speed	Variable speed	Fixed speed	Variable speed
PI025	---	20,9	---	[-]	---	14	---	0,32
PI045	---	34,8	---	[-]	---	24	---	0,23
PI055	---	32,6	---	[-]	---	15	---	0,1
PI059	---	38,3	---	[-]	---	18,5	---	0,08
PI062	19	22,6	98	[-]	11		1,05	0,177
PI070	24	22,6	142	[-]	11		1,05	0,177
PI092	28	27,1	147	[-]	15		0,83	0,1
PI104	19+19	32,6	98+98	[-]	15		1.47+1.47	0,1
PI140	24+24	38,3	142+142	[-]	18,5		1.05+1.05	0,08
PI150	28+28	38,3	147+147	[-]	18,5		0.83+0.83	0,08

6.6.4 Electrical heaters

Table 27 - Electrical heaters data

Unit model	400 V / 3ph / 50 Hz				460 V / 3ph / 60 Hz				380 V / 3ph / 60 Hz			
	Standard Capacity [A]		High Capacity [A]		Standard Capacity [A]		High Capacity [A]		Standard Capacity [A]		High Capacity [A]	
	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]
PI025	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI045	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI055	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5		
PI059	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI062	10,8	7,5	21,6	15	9,4	7,5	18,8	15	11,3	7,5	22,6	15
PI070	10,8	7,5	21,6	15	9,4	7,5	18,8	15	11,3	7,5	22,6	15
PI092	10,8	7,5	21,6	15	9,4	7,5	18,8	15	11,3	7,5	22,6	15
PI104	10,8	7,5	21.6** 32.4***	15.0** 22.5***	9,4	7,5	18.8** 28.2***	15.0** 22.5***	11,3	7,5	22.6** 33.9***	15.0** 22.5***
PI140	10,8	7,5	32,4	22,5	9,4	7,5	28,2	22,5	11,3	7,5	33,9	22,5
PI150	10,8	7,5	32,4	22,5	9,4	7,5	28,2	22,5	11,3	7,5	33,9	22,5

NOTE

* Not available with EC Fan Module;
** With EC Fan Module;
*** With High Power EC Fan Module;

6.6.5 Electrode humidifier

Table 28 - Electrode humidifier electrical data

Unit model	400 V / 3ph / 50 Hz		460 V / 3ph / 60 Hz		380 V / 3ph / 60 Hz	
	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]
PI025	3,2	2,25	2,8	2,25	3,4	2,25
PI045	3,2	2,25	2,8	2,25	3,4	2,25
PI055	3,2	2,25	2,8	2,25	3,4	2,25
PI059	3,2	2,25	2,8	2,25	3,4	2,25
PI062	8,7	6	7,5	6	9,1	6
PI070	8,7	6	7,5	6	9,1	6
PI092	8,7	6	7,5	6	9,1	6
PI104	8,7	6	7,5	6	9,1	6
PI140	8,7	6	7,5	6	9,1	6
PI150	8,7	6	7,5	6	9,1	6

6.6.6 Infrared humidifier

Table 29 - Infrared humidifier electrical data

Unit model	400 V / 3ph / 50 Hz		460 V / 3ph / 60 Hz		380 V / 3ph / 60 Hz	
	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]
PI025	6,4	4,8	6	4,8	6,9	4,8
PI045	6,4	4,8	6	4,8	6,9	4,8
PI055	6,4	4,8	6	4,8	6,9	4,8
PI059	6,4	4,8	6	4,8	6,9	4,8
PI062	13,9	9,6	12	9,6	14,3	9,6
PI070	13,9	9,6	12	9,6	14,3	9,6
PI092	13,9	9,6	12	9,6	14,3	9,6
PI104	13,9	9,6	12	9,6	14,3	9,6
PI140	13,9	9,6	12	9,6	14,3	9,6
PI150	13,9	9,6	12	9,6	14,3	9,6

6.6.7 Condensate pump

Table 30 - Condensate pump electrical data

Unit model	FLA [A]	Nominal Power [kW]
All models	1,6	0,15

NOTE *Available only for Upflow units and for 400 V / 3ph / 50 Hz power supply*

Condensate pump outlet connection: internal diameter 20 mm

As an option it is possible to have Upflow unit with a condensate pump that allows draining of the water up to 3m above the floor.
The pump discharges both condensate water from exchange coil and drain water from humidifier (if installed).
Maximum discharge total head allowed 3m (head + hydraulic connection loss); the final drain must be able to receive 10 l/min water at high temperature (max water temperature 80°C).

6.7 Noise Level

"Measurement conditions: Inverter scroll cooling system@100% cooling capacity, High Power EC fan module, max airflow"

Table 31 - Sound Power Level [dB] - Upflow configuration, Inverter scroll cooling system @100% cooling capacity, High Power EC fan module, max airflow

Unit model	Model	Level	Octave band frequency (Hz)									Sound level [dB(A)]
	Mode		31,5	63	125	250	500	1000	2000	4000	8000	
PI025	(1)	SPL	63,7	63,7	66,8	73,2	66,3	57,7	54,9	54,4	50,7	68,1
	(2)	SPL	63,7	63,7	67,3	73,2	66,4	58,4	57,9	56,6	52,3	68,6
	(3)	PWL	65,9	72,6	79,5	88,3	83,7	82,0	78,8	76	73,6	87,3
PI045	(1)	SPL	53,9	53,9	64,9	61,9	63,9	62,9	61,9	59,9	51,9	68,3
	(2)	SPL	53,9	53,9	66,3	62,0	63,9	63,1	61,9	59,9	55,9	68,5
	(3)	PWL	71	71,0	84,6	80,2	82,0	81,2	82,2	79	75,1	87,6
PI059	(1)	SPL	51,1	51,1	62,1	59,1	61,1	60,1	59,1	57,1	49,1	65,5
	(2)	SPL	51,1	51,9	65,3	61,2	62,6	62,4	61,4	59,7	51,6	67,8
	(3)	PWL	84,1	70,9	86,6	81,5	82	82	80,4	78,5	71,5	87,1
PI062	(1)	SPL	51	54,1	65,1	62,1	64,1	63,1	62,1	60,1	52,1	68,5
	(2)	SPL	53,2	55,8	66,8	63,8	64,2	64,5	62,7	62,8	53,5	69,8
	(3)	PWL	91	88,8	80,4	78,9	79,5	81,3	77,1	75,4	70,6	85
PI092	(1)	SPL	51,9	55	66	63	65	64	63	61	53	69,4
	(2)	SPL	54,1	55	66	63	65,3	66,1	63,6	63,2	54,8	70,8
	(3)	PWL	91,9	88	79,6	78,1	80,6	82,9	78	75,8	71,9	86,1
PI0104	(1)	SPL	54,9	57,9	68,9	65,9	67,9	66,9	65,9	63,9	55,9	72,3
	(2)	SPL	54,9	57,9	68,9	65,9	68,1	67,7	67,2	66,1	56,6	73,4
	(3)	PWL	90,9	90,9	82,5	81,0	83,4	84,5	81,6	78,7	73,7	88,5

Table 32 - Sound Power Level [dB] - Downflow up configuration, Inverter scroll cooling system @100% cooling capacity, High power EC fan module, max airflow

Unit model	Model	Level	Octave band frequency (Hz)									Sound level [dB(A)]
	Mode		31,5	63	125	250	500	1000	2000	4000	8000	
PI025	(1)	SPL	63,7	63,7	66,8	73,2	66,3	57,7	54,9	54,4	50,7	68,1
	(2)	SPL	63,7	63,7	67,3	73,2	66,4	58,4	57,9	56,6	52,3	68,6
	(3)	PWL	65,9	72,6	79,5	88,3	83,7	82,0	78,8	76	73,6	87,3
PI045	(1)	SPL	53,9	53,9	64,9	61,9	63,9	62,9	61,9	59,9	51,9	68,3
	(2)	SPL	53,9	53,9	66,3	62,0	63,9	63,1	61,9	59,9	55,9	68,5
	(3)	PWL	86,9	86,9	79,9	77,1	79,2	79,9	76,3	72,5	73	83,8
PI059	(1)	SPL	51,1	51,1	62,1	59,1	61,1	60,1	59,1	57,1	49,1	65,5
	(2)	SPL	51,1	51,9	65,3	61,2	62,6	62,4	61,4	59,7	51,6	67,8
	(3)	PWL	84,1	70,9	86,6	81,5	82	82	80,4	78,5	71,5	87,1
PI062	(1)	SPL	51,1	54,2	65,2	62,2	64,2	63,2	62,2	60,2	52,2	68,6
	(2)	SPL	53,3	55,9	66,9	63,9	64,3	64,6	62,8	62,9	53,6	69,9
	(3)	PWL	91,1	88,9	80,5	79,0	79,6	81,4	77,2	75,5	70,7	85,1
PI092	(1)	SPL	51,6	54,7	65,7	62,7	64,7	63,7	62,7	60,7	52,7	69,1
	(2)	SPL	53,8	54,7	65,7	62,7	65	65,8	63,3	62,9	54,5	70,5
	(3)	PWL	91,6	87,7	79,3	77,8	80,3	82,6	77,7	75,5	71,6	85,8
PI0104	(1)	SPL	55	58,0	69,0	66,0	68,0	67,0	66	64	56	72,4
	(2)	SPL	55	58,0	69,0	66,0	68,2	67,8	67,3	66,2	56,7	73,5
	(3)	PWL	91	91,0	82,6	81,1	83,5	84,6	81,7	78,8	73,8	88,6
PI150	(1)	SPL	66,5	66,5	72,1	70,2	70,6	68,8	68	66	58,8	74,6
	(2)	SPL	66,5	66,5	72,1	70,2	70,8	69,2	68,4	66,6	59	75
	(3)	PWL	66,1	86,6	92,2	90,2	90,9	89,2	88,4	86,6	79	95

Table 33 - Sound Power Level [dB] - Downflow Down configuration, Inverter scroll cooling system @100% cooling capacity, High Power EC fan module, max airflow

Unit model	Model	Level	Octave band frequency (Hz)									Sound level [dB(A)]
	Mode		31,5	63	125	250	500	1000	2000	4000	8000	
PI045	(1)	SPL	52,3	52,3	63,3	60,3	62,3	61,3	60,3	58,3	50,3	66,7
	(2)	SPL	52,3	52,3	64,7	60,4	62,3	61,5	60,3	58,3	54,3	66,9
	(3)	PWL	85,3	85,3	78,3	75,5	77,6	78,3	74,7	70,9	71,4	82,2
PI059	(1)	SPL	49,7	49,7	60,7	57,7	59,7	58,7	57,7	55,7	47,7	64,1
	(2)	SPL	49,7	50,5	63,9	59,8	61,2	61	60	58,3	50,2	66,4
	(3)	PWL	82,7	69,5	85,2	80,1	80,6	80,6	79	77,1	70,1	85,7
PI062	(1)	SPL	49,6	52,7	63,7	60,7	62,7	61,7	60,7	58,7	50,7	67,1
	(2)	SPL	51,8	54,4	65,4	62,4	62,8	63,1	61,3	61,4	52,1	68,4
	(3)	PWL	89,6	87,4	79,0	77,5	78,1	79,9	75,7	74	69,2	83,6
PI092	(1)	SPL	50,2	53,3	64,3	61,3	63,3	62,3	61,3	59,3	51,3	67,7
	(2)	SPL	52,4	53,3	64,3	61,3	63,6	64,4	61,9	61,5	53,1	69,1
	(3)	PWL	90,2	86,3	77,9	76,4	78,9	81,2	76,3	74,1	70,2	84,4
PI0104	(1)	SPL	53,6	56,6	67,6	64,6	66,6	65,6	64,6	62,6	54,6	71
	(2)	SPL	53,6	56,6	67,6	64,6	66,8	66,4	65,9	64,8	55,3	72,1
	(3)	PWL	89,6	89,6	81,2	79,7	82,1	83,2	80,3	77,4	72,4	87,2
PI150	(1)	SPL	65	65	70,6	68,7	69,1	67,3	66,5	64,5	57,3	73,1
	(2)	SPL	65	65	70,6	68,7	69,2	67,6	67	65,3	57,5	73,5
	(3)	PWL	64,6	85,1	90,7	88,7	89,3	87,6	87	85,3	77,5	93,5

34 - Sound Power Level [dB] - Downflow up frontal Delivery configuration, Inverter scroll cooling system @100% cooling capacity, Premium fan module, max airflow

Unit model	Model	Level	Octave band frequency (Hz)									Sound level [dB(A)]
	Mode		31,5	63	125	250	500	1000	2000	4000	8000	
PI025	(1)	SPL	70,9	70,9	74,0	80,4	73,5	64,9	62,1	61,6	57,9	75,3
	(2)	SPL	70,9	70,9	74,5	80,4	73,6	65,6	65,1	63,8	59,5	75,8
	(3)	PWL	73,1	79,8	86,7	95,5	90,9	89,2	86	83,2	80,8	94,5
PI045	(1)	SPL	60,9	60,9	71,9	68,9	70,9	69,9	68,9	66,9	58,9	75,3
	(2)	SPL	60,9	60,9	73,3	69,0	70,9	70,1	68,9	66,9	62,9	75,5
	(3)	PWL	78	78,0	91,6	87,2	89,0	88,2	89,2	86	82,1	94,6
PI059	(1)	SPL	58,7	58,7	69,7	66,7	68,7	67,7	66,7	64,7	56,7	73,1
	(2)	SPL	58,7	59,5	72,9	68,8	70,2	70,0	69	67,3	59,2	75,4
	(3)	PWL	91,7	78,5	94,2	89,1	89,6	89,6	88	86,1	79,1	94,7
PI062	(1)	SPL	57,9	61,0	72,0	69,0	71,0	70,0	69	67	59	75,4
	(2)	SPL	60,1	62,7	73,7	70,7	71,1	71,4	69,6	69,7	60,4	76,7
	(3)	PWL	97,9	95,7	87,3	85,8	86,4	88,2	84	82,3	77,5	91,9
PI092	(1)	SPL	59,6	62,7	73,7	70,7	72,7	71,7	70,7	68,7	60,7	77,1
	(2)	SPL	61,8	62,7	73,7	70,7	73,0	73,8	71,3	70,9	62,5	78,5
	(3)	PWL	99,6	95,7	87,3	85,8	88,3	90,6	85,7	83,5	79,6	93,8

LEGEND

The sound levels global and for each octave band are expressed in dB with a tolerance of (0/+2) dB.
(1) Only ventilation (30 Pa available external static pressure), 2m in front of the unit and 1,5 m height, in free field conditions.
(2) Working compressor (30 Pa available external static pressure), 2m in front of the unit and 1,5 m height, in free field conditions.
(3) Working compressor, on discharge side.

7. Handling

Content of this chapter

This chapter explains how to handle the unit or its modules in the following situations.

- Shipping
- Moving to a storehouse
- Moving to the installation site.

7.1 Safety Instructions

WARNING

Improper operations can cause injury or death.

Verify that all the lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation.

Make reference to the local safety regulations about lifting and handling heavy loads.

NOTICE

Improper operations can cause product damage.

NOTICE

Improper storage can cause product damage.

Keep the unit in a storehouse with the ambient conditions given in *3.6.1 Storage conditions*.

Read carefully the chapter *1. Safety*.

Pay attention to the safety labels on the unit and to the safety warnings in this chapter.

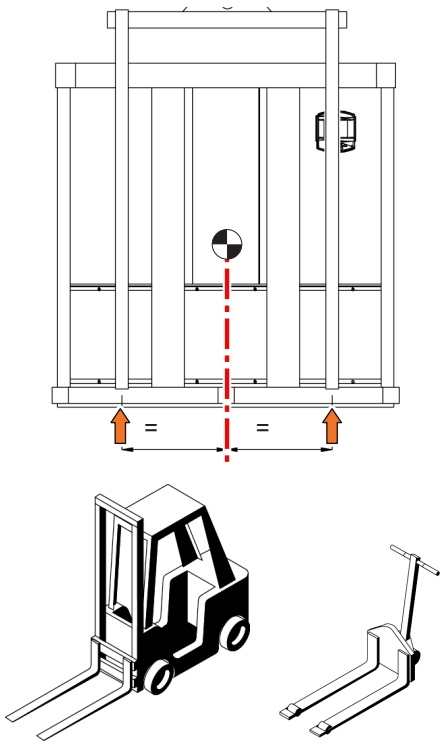
7.2 Inspection

- After receiving the product, check the accessories against the packing list.
- If any parts are found missing or damaged, please report to the carrier immediately.
- If you find any damage, please report to the carrier and to the local distributor too.

7.3 Transport with Package

NOTE *The following instructions are valid both for standard units and for the modules of the extended units (coil module and fan module).*

7.3.1 Using a fork lift or a pallet jack

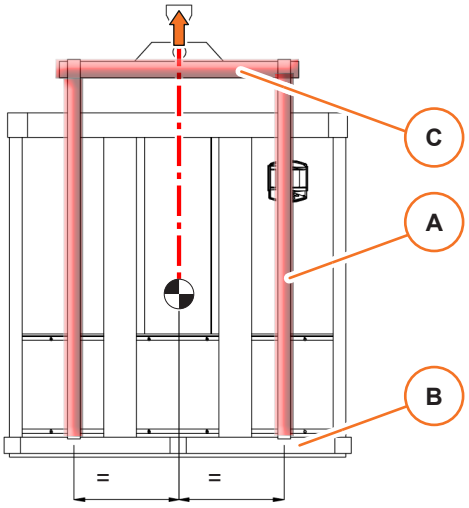


- Make sure that the fork length and distance is suitable for the unit length and to ensure the unit stability.
- Spread the forks to the widest allowable distance to still fit under the skid.
- Lift the unit from the side that is indicated in the instructions on the package.
- Make reference to the local safety regulations about lifting and handling heavy loads.

WARNING

Pay attention to overhead obstacles, for example doorways.

7.3.2 Using a crane



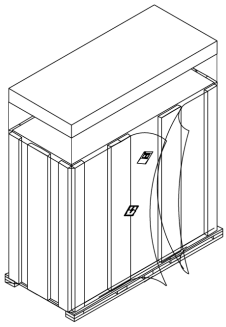
- Place the slings [**A**] between the unit bottom rails and the skid [**B**], at the widest allowable distance.
- Be sure that the distance between slings guaranties the unit stability.
- Fix the slings to the spreader bar [**C**]

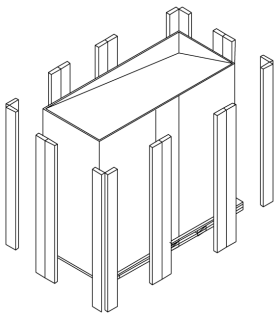
NOTICE

Lift the unit with a speed suitable for the load to be moved, so as not to damage the structure.

7.4 Unpacking

NOTE *The following instructions are valid both for standard units and for the modules of the extended units (coil module and fan module).*





- Remove the exterior packaging material from around the unit.
- Remove the top cover, the corner and the side planks.

ENVIRONMENT

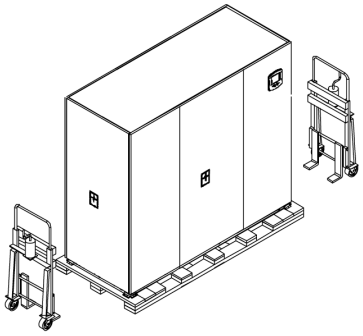
All material used to package this unit is recyclable.

Please save for future use, or dispose the package materials according to the local regulation about waste disposal.

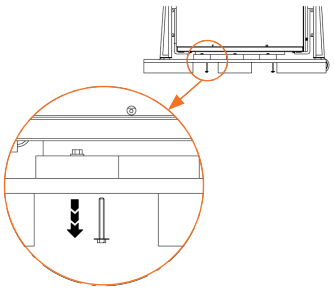
7.5 Transport without Package

NOTE *The following instructions are valid both for standard units and for the modules of the extended units (coil module and fan module).*

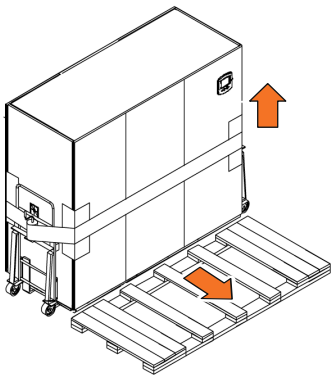
7.5.1 Using piano jacks



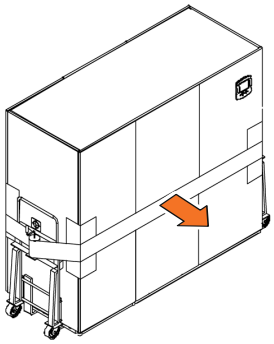
- Make sure that the floor can support the unit when you move it by piano jacks. If necessary, cover the floor by metal plates or other support that can distribute the weight on the floor.
- Place the piano jacks at the two sides of the unit.



- Remove the four bolt (two at each side) that fix the unit to the skid.



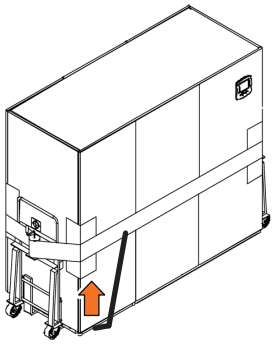
- Slide the forks of the piano jacks between the unit and the pallet.
- Place a protective material between the unit and the piano jacks.
- Fix the piano jacks to the unit by straps, placing a protective material between the unit and the straps.
- Lift slightly the forks of the piano jacks and remove the pallet.



- Move the unit to its installation site.

CAUTION

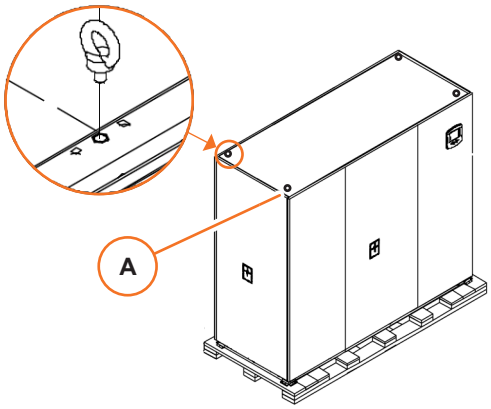
At least two persons are needed.



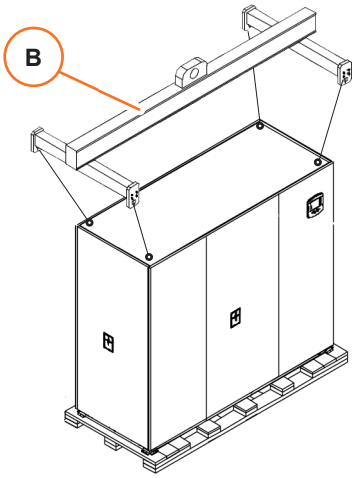
Remove the piano jacks

- Place the unit as low as the piano jacks allow.
- Remove all the straps.
- Using a pry bar or a similar tool, lift the unit at one side high enough to remove the piano jack.
- Do the same on the other side.
- Remove the protecting materials.

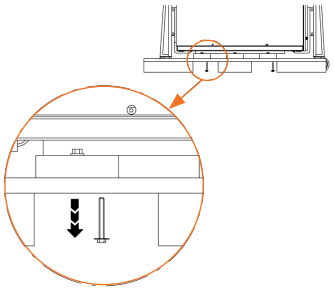
7.5.2 Using a crane



- Get four eyebolts M8 that suitable to hold the full weight of the unit (they are not supplied with the unit).
- Insert the eyebolts in each of the holes [**A**].



- Insert a sling or a chain in each of the eyebolts.
- Fix the slings or chains to a 4-points lifting bar [**B**].



- Remove the four bolts (two at each side) that fix the unit to the skid.
- By a crane or bridge crane, lift slightly the unit and remove the skid.
- Move the unit to its installation site.

NOTICE

Lift the unit with a speed suitable for the load to be moved, so as not to damage the structure.

8. Assembly and Positioning

Content of this chapter

8.1 Safety Instructions

WARNING

Improper operations can cause injury or death.

NOTICE

Improper operations can cause product damage.

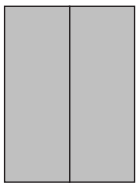
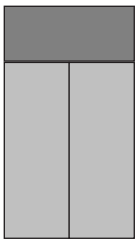
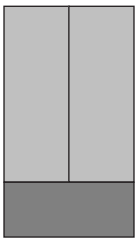
Read carefully the chapter *1. Safety*.

Pay attention to the safety labels on the unit and to the safety warnings in this chapter.

8.2 Overview

8.2.1 Assembly

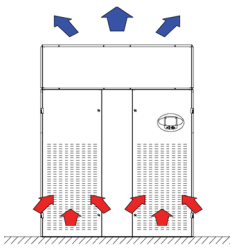
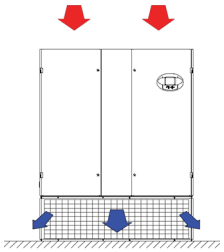
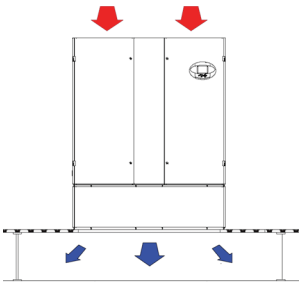
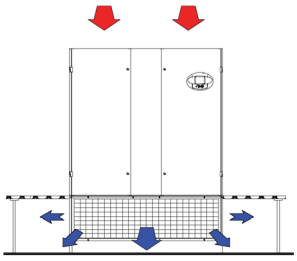
- Move the unit or the modules close too the final position as explained in *7. Handling*.
- If necessary, assemble the modules as explained below.

Standard height	Extended height Upflow	Extended height Downflow
		
The unit is already assembled.	Assemble the fan module on top of the coil module. See *8.3 Assembling an Extended Upflow Unit*	Assemble the coil module on top of the fan module See *8.4 Assembling an Extended Downflow Unit*

NOTE *For all the above versions, if you need to assemble any accessory* see *Annex F - Accessories*.

8.2.2 Positioning

- Move the unit to its final position as explained in *7. Handling*
- Place the unit as explained below.

U - Upflow	H - Downflow Frontal	D - Downflow Up	E - Downflow Down
			
Place the unit on a closed floor		Place the unit on top of a raised floor with an opening below the unit	Place the unit under a raised floor
		See *Annex D - Dimensions and Weights* for the dimensions of openings.	

NOTICE

See *9. Installation* for specifications about the installation site.

Ensure isolation between the unit and the floor to avoid transmission of vibration.

NOTICE

The Downflow Down units must be placed at the right height with respect to the floor level.

Provide the right support under the unit.

See *Annex F - Accessories* for the available support systems.

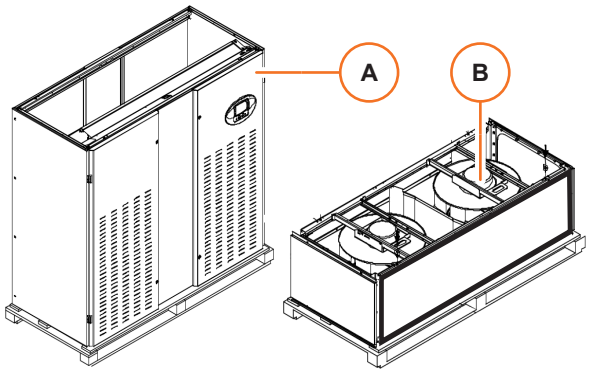
NOTICE

The unit may contain special brackets or supports that secure some elements for the transport. They are highlighted by special labels.

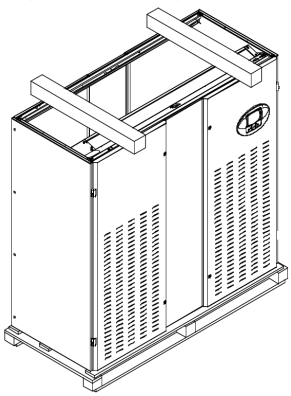
When you finish assembly and positioning of the unit, make sure that all the transport brackets and supports have been removed.

8.3 Assembling an Extended Upflow Unit

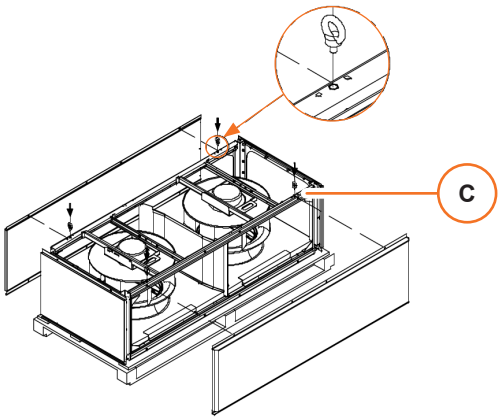
8.3.1 Prepare



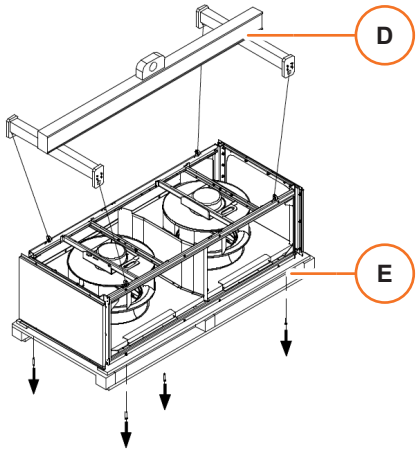
- Place the coil module [**A**] and the fan module [**B**] close to the final position.



- Place two timber pieces on top of the coil module.

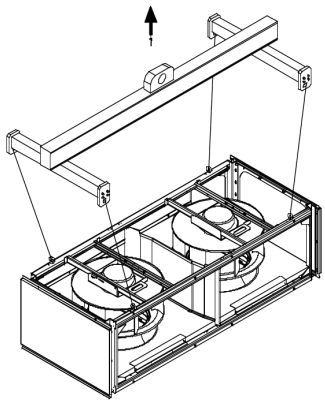


- Remove the front and back panels from the fan module.
- Get four eyebolts M8 that are suitable to hold the full weight of the fan module (they are not supplied with the unit).
- Insert the eyebolts in each of the holes [**C**].

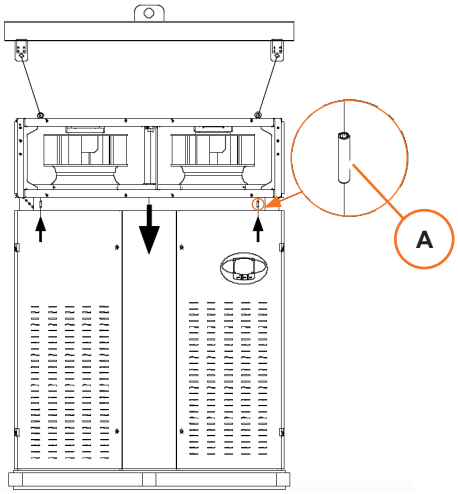


- Insert a sling or a chain in each of the eyebolts.
- Fix the slings or chains to a 4-points lifting bar [**D**].
- Remove the four bolts [**E**] (two at each side) that fix the fan module to the skid.

8.3.2 Arrange the cables



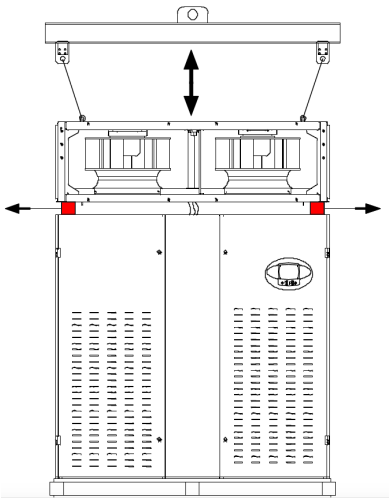
- Lift the fan module by a crane and place it on top of the coil module.



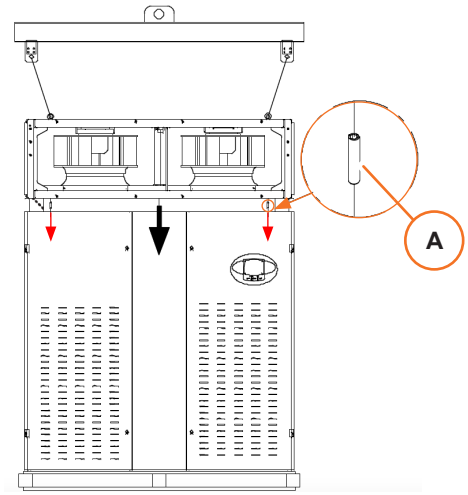
- Insert four M8 dowels [**A**] in the lower frame of the fan module.
- Take from the coil module the power cable and the Modbus cable that are ready for the connection with the correspondent cables of the fan module.
- Insert the cables through the bushing into the fan module.
- Connect the power cable of the coil module with the power cable of the fan module.
- Connect the Modbus cable of the coil module with the Modbus cable of the fan module.
- If installed, connect all the electrical heaters cables to the electrical connectors inside the electrical panel lower duct:
  - Standard Capacity: connect the electrical heaters cables to the connector Xp5.
  - High Capacity (**PI092**): connect the electrical heaters cables to the connectors Xp5 and Xp6.
  - Electrical Heater thermostats
  - Temperature sensor
- Place the cover provided with the unit to protect the connections. Fix the cover to the frame by screws.

See *9.5 Electrical connections* for details.

8.3.3 Fix the modules together and close the fan module



- Lift sightly the fan module.
- Remove the two wooden pieces.

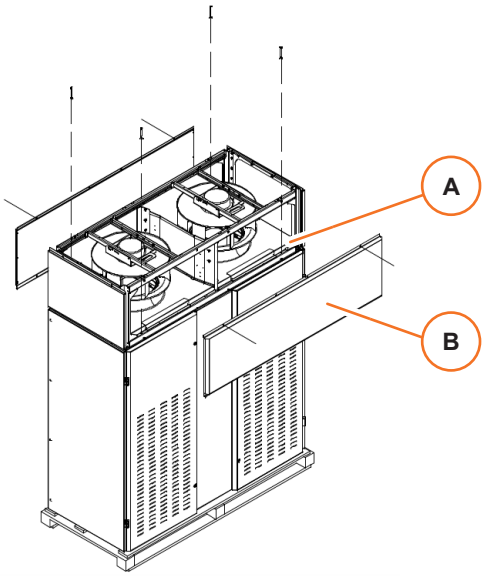


- Lower the fan module to the coil module.
- Use the four dowels [**A**] for centering the fan module with the coil module.

NOTICE

Pay attention not to damage the cables.

Pull the cables through the coil module.

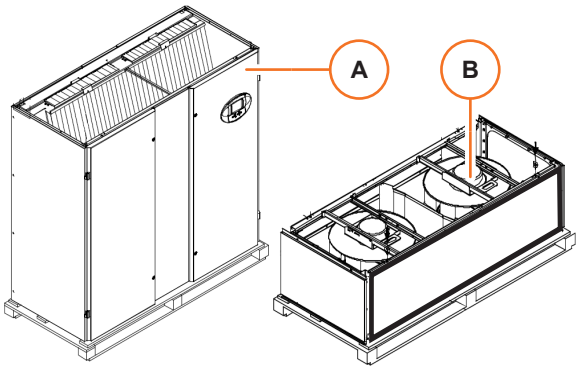


- Fix the two modules by the four hex head screws supplied with the unit.
- Mount the front and back panels on the fan module.

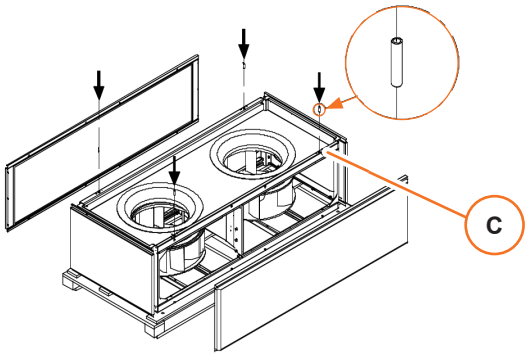
The unit is ready for positioning.

8.4 Assembling an Extended Downflow Unit

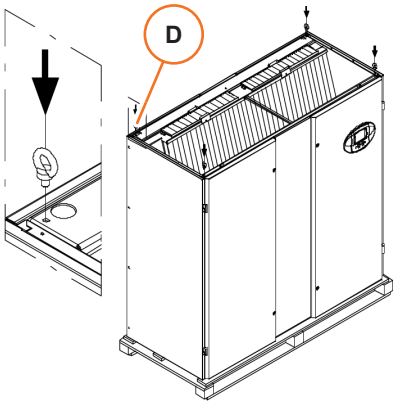
8.4.1 Prepare



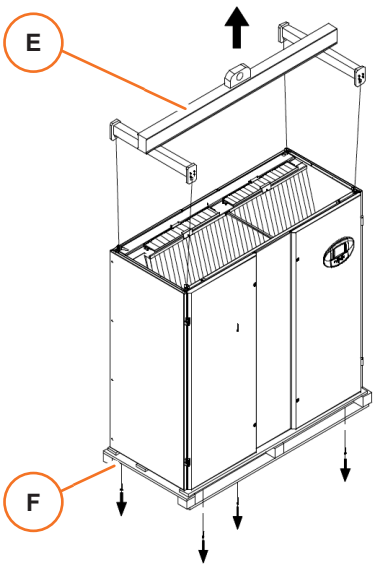
- Place the coil module [**A**] and the fan module [**B**] close to the final position.



- Remove the front and back panels from the fan module.
- Insert four M8 dowels [**C**] in the upper frame of the fan module.

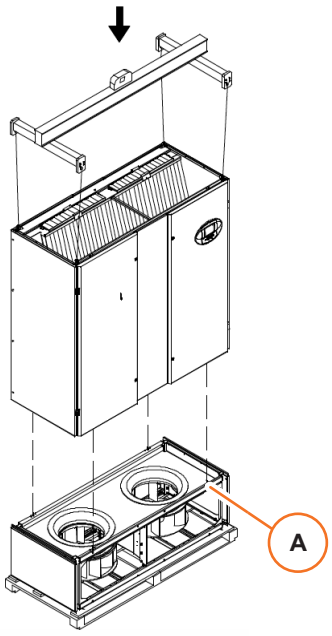


- Get four eyebolts M8 that are suitable to hold the full weight of the unit (they are not supplied with the unit).
- Insert the eyebolts in each of the holes [**D**].

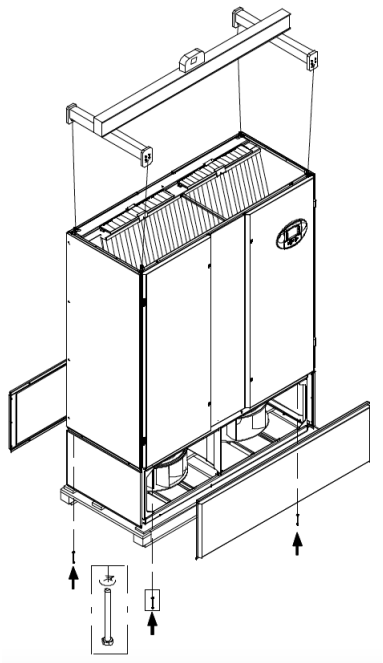


- Insert a sling or a chain in each of the eyebolts.
- Fix the slings or chains to a 4-points lifting bar [**E**].
- Remove the four bolts [**F**] (two at each side) that fix the coil module to the skid.

8.4.2 Fix the modules together

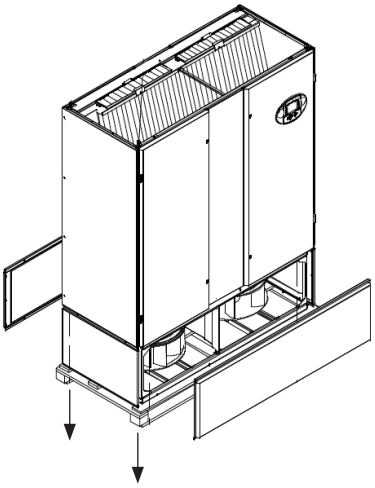


- Lift the coil module by a crane and place it on top of the fan module.
- Use the four dowels [**A**] for centering the fan module with the coil module.



- Fix the two modules by the four hex head screws supplied with the unit.

8.4.3 Arrange the cables and close the fan module



- Take from the coil module the power cable and the Modbus cable that are ready for the connection with the correspondent cables of the fan module.
- Insert the cables through the bushing into the fan module.
- Connect the power cable of the coil module with the power cable of the fan module.
- Connect the Modbus cable of the coil module with the Modbus cable of the fan module.
- If installed, connect all the electrical heaters cables to the electrical connectors inside the electrical panel lower duct:
  - Standard Capacity: connect the electrical heaters cables to the connector Xp5.
  - High Capacity (**PI092**): connect the electrical heaters cables to the connectors Xp5 and Xp6.
  - Electrical Heater thermostats
  - Temperature sensor
- Place the cover provided with the unit to protect the connections. Fix the cover to the frame by screws.

See *9.5 Electrical connections* for details.

- Remove the four bolts that fix the fan module to the skid.
- Mount the front and back panels on the fan module.

The unit is ready for positioning.

9. Installation

Content of this chapter

9.1 Safety Instructions

WARNING

Improper operations can cause injury or death.

NOTICE

Improper operations can cause product damage.

NOTICE

The installation of the unit must comply with EN378-3.

Read carefully the chapter *1. Safety*.

Pay attention to the safety labels on the unit and to the safety warnings in this chapter.

9.2 Overview

9.2.1 Preparation of the installation site (by the customer)

NOTICE
Vertiv™ takes no responsibility for systems not compliant with the specifications given in this manual.
Lack of compliance to the specifications given by Vertiv™ voids the warranty.

The customer is responsible for the following operations.

Operation	See ...
Prepare the area	*9.3.1 Location* and *9.3.2 Space requirements*
Prepare the piping for the water system	*9.3.3 Piping requirements*
Prepare the electric system	*9.3.4 Electric system requirements*

9.2.2 Operations on the unit

The following operations must be done on the unit at the installation site:

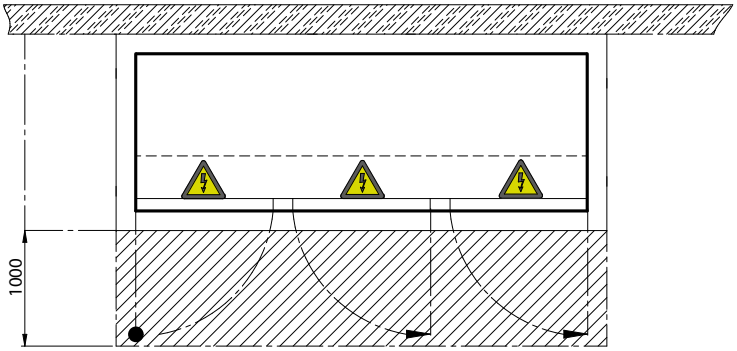
Operation	See ...
1. For extended height versions, assemble the fan module and the coil module	- *8. Assembly and Positioning*
2. Assemble any optional accessory	- *Annex F - Accessories*
3. Position the unit at the final location and fix it on the floor or the supporting structure	- *8. Assembly and Positioning*
4. Prepare the piping for the connection to the water system	- *9.4 Piping Connections*
5. Connect the outlet of the condensate drain tank to an external piping	- *9.4.3 Connecting the condensate drain tray to an external piping*
6. Connect the water supply and the water drain piping of the humidifier	- *Annex G - Electrode Humidifier,* - *Annex H - Infrared Humidifier,* - *Annex I - Ultrasonic Humidifier*
7. Connect the electric power supply	- *9.5 Electrical connections* - *9.5.1 Power supply cable*
8. Connect the electric equipment to the electric panel	- *9.5 Electrical connections* - *9.5.2 Contacts for the unit status signals* - *9.5.3 Remote condenser cables connections*
9. Check or adjust the Modbus settings	- *9.6 Modbus Connections and Settings*
10. Fill the water system	- *9.3.4 Water supply requirements* - *9.7 Water system* - *9.7.1 Fill the water system*
11. Fill system with the ethylene glycol (fow low temperature)	- *9.7.2 Add ehtylene glycol*
12. Check the whole system	- *9.8 Final Checks*
13. Start the unit	- *10. Operation*

9.3 Specifications for Site Preparation

9.3.1 Location

- The units must be installed indoors, in rooms protected from weather agents.
- Before installing the unit, determine whether any building alterations are required to run piping, wiring and ductwork.
- Prepare a level surface suitable to support the weight of the unit.
- Install the unit in an area with clean air, away from loose dirt and foreign matter.

9.3.2 Space requirements



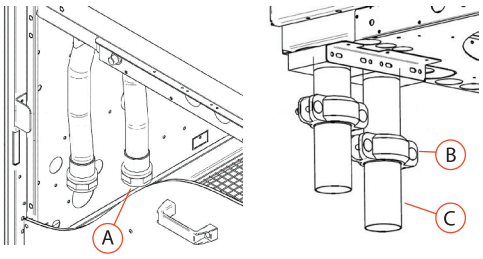
- See *Annex D - Dimensions and Weights* for the unit dimensions
- Keep a free space between the unit and any obstacle as shown in the figure.

WARNING

Leave a free space of at least 1000 mm on the front to allow safe installation and maintenance operations.

9.3.3 Piping requirements

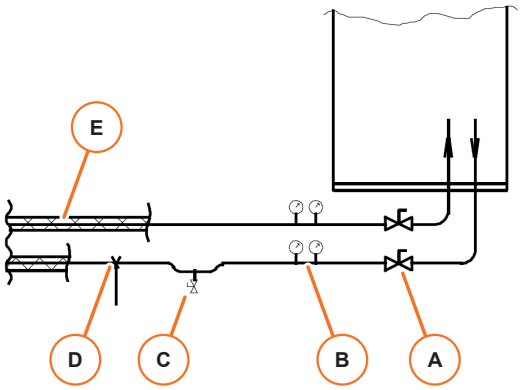
Prepare the piping for connecting the remote condenser to the main unit according to the following specifications.

Material	Soft or hard copper
Diameter and thickness	See *6.2.4 Water piping diameters and thickness* ***NOTICE*** The guarantee becomes invalid if you do not respect the diameters given in this manual. If you need to use piping with a larger diameter (for example for long winding runs), please contact Vertiv™ Technical Suppor
Threaded connections	All units with connection pipes diameter up to 42 mm (see chapter *Annex D - Connections x.xx*). In case of threaded connections use hemp and paste to get a reliable pressure - tight joint.
Grooved connections	Units with connection diameter 54 or 64 mm are supplied with grooved connections and smooth pipe stubs - see picture. On-site chilled water piping must be suitable for grooved connec tions or can be connected by brazing. See the following table for the grooved connections details 
Thermal insulation	Wrap the piping by thermal insulating material ***NOTICE*** Make sure that no electrical cables are in contact with piping that is not thermally insulated. The high temperature of the piping would damage the cables.

Piping layout

Prepare the external piping as following:

- Place shut-off ball valves [**A**] at the conditioner inlet and outlet to allow easy maintenance.
- It is advisable to install a thermometer and a manometer [**B**] on the unit inlet and outlet.
- Install a drain valve [**C**] at the lowest point in the circuit.
- Place the piping on supporting brackets [**D**].
- Insulate both pipes using Armaflex insulation [**E**].



9.3.4 Water supply requirements

WARNING

Do not use water from an evaporative cooling tower unless the filling water hardness is controlled

Analyze the water

It is the user's responsibility to establish the quality of the water and make sure that this is compatible with the materials used in the exchangers.
The quality of water may significantly a fect the operation and the life of the exchangers.
The first step in the planning the treatment of the water is chemical analysis, which must be performed by qualified personnel from specialist organizations
Water quality has to be in accordance with VDI 2035.

Add water softeners

In tower water, the tendency to form deposits may be high: to reduce this phenomenon, there are various types of water softening treatments available, including the use of ion exchange resins.

Prevent corrosion

The oxygen dissolved in water increases the rate of corrosion.

The main factors causing corrosion are sulphur and carbon dioxide acids (see the Langelier and Ryznar indices).

A combined effect of fouling due to dust and organic material provides a support for bacteria, fungi and algae; the growth of organisms may produce an oxygen gradient and this results in rather severe pitting of the metallic surface.

The phenomenon of corrosion is obviously related to the material used on the liquid side of the heat exchanger.

The table on the right shows the reference values for corrosion on copper, these values must be considered as guidelines to avoid corrosion.

pH	-	7,5 - 9,0
Total Hardness	dH°	4.5 – 8.5
Conductivity	µS/cm	10 - 500
Sulphate (SO_4^{-2})	ppm	<70
Alcalinity/Sulphate (HCO^{3-})/(SO_4^{-2})	-	>1
Clorides (Cl-)	ppm	<50
Free Chlorine (Cl_2)	ppm	<0.5
Ammonia (NH_3)	ppm	<0.5
Iron (Fe)	ppm	<0.2
Aluminium (Al)	ppm	<0.2
Manganse (Mg)	ppm	<0.1
Free carbon dioxide (CO_2)	ppm	<5
Hydrogen sulfide (H_2S)	ppm	<0.05
Water temperature	°C	<65
Oxygen content	ppm	<0.02

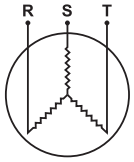
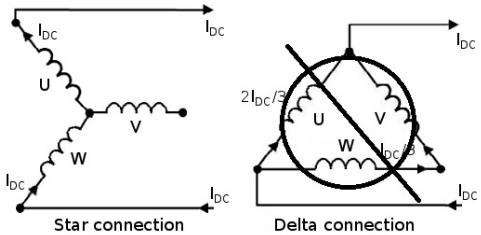
9.3.5 Electric system requirements

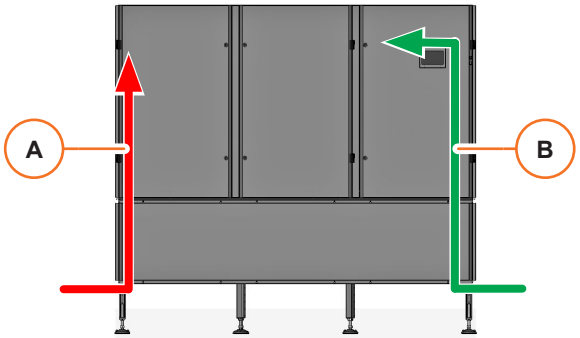
Power supply requirements for the unit

- Check the electrical data on the label applied on the unit.
- Check that the available power supply is consistent with the unit power requirements given in *6. Technical Data.*
- Refer to the electrical schematic supplied with the unit when making line voltage supply, low voltage main unit interlock and any low voltage alarm connections.

Local codes

- Electrical service must conform to national and local electrical codes.
- All wiring must be done in accordance with all applicable local, state, and national electrical codes.

External disconnecting switch	• The final customer must install on site an external disconnecting switch, easy to reach, to facilitate a quick and easy shutdown and power cut off of the unit
Protection	• Select and install the line side electrical supply wire and over current protection device(s) according to the specifications on the unit nameplate(s), per the instructions in this manual and according to the applicable national, state, and local code requirements. • The customer is responsible for the system protection. • Protect the system by a differential switch. • If the system includes devices with inverter, then use a type B or B++ RCD (Residual Current Device) switch.
Power supply variability	• Check that the maximum unbalance between the phases does not exceed the value given in *6. Technical Data.* • Make sure to comply with the following data: - Electrical voltage between 0.9 and 1.1 nominal voltage - Frequency between 0.99 and 1.01 the nominal frequency - Variability of supply voltage less than 2% - Harmonic Distortion: the supply voltage quality shall present a THD not exceeding 8% and in general shall be in compliance with CEI/EN-50160 See the figure below for variability evaluation. Example of calculating phase to phase variability 1) The 400 V supply has the following variability: RS = 388 V ST = 401 V RT = 402 V  2) The average voltage is: $\frac{388 + 401 + 402}{3} = 397$ 3) The maximum deviation from the average is: 397 - 388 = 9 4) The phase to phase variability is: $\frac{9}{397 \times 100} = 2,3$ (non acceptable)
Power supply connection	The units are equipped with electrical devices (power supplies module, control devices,...) that are designed to operate properly with star-connected power (Wye) with earthed neutral (TN or TT system). If you need three-phase distribution Delta-connected (Δ) or Star-connected power (Wye) without ground or floating ground (IT) please contact Vertiv™ Technical Support. 
Power supply type	Acceptable: - TT, TN-S, TN-C, TN-C-S systems - 460 V Wye with solidly grounded neutral (266 V line to ground) - 380 V Wye with solidly grounded neutral (220 V line to ground) Unacceptable: - 380 to 460 V Wye without ground connection or with high-resistance (or impedance) ground (IT). - 380 to 460 V Δ without ground or with high-resistance (or impedance) ground (IT). - 380 to 460 V Δ with corner ground or with grounded center-tapped.

Cables type	• Use copper wiring only. The units are equipped with electrical panel with one disconnecting switch for the power section. Choose a supply cable (four- pole type with ground) for the power section, according to: - the local norms - the system absorption (FLA unit) - the system voltage - installation type - cable length - upstream protection
Cables connection	 • Do not fit the supply cable in the raceways inside the electric panel. The electrical cables must pass through the unit shoulder; the power cable [**A**] on left and sensor/alarms cable [**B**] on the right. • The connection for remote ON-OFF must be done be the installer. • The general alarm terminals allow remote alarm signaling. • In case of short circuit, check the sticking of the involved switch and replace it. • The remote ON/OFF and the Fire Alarms Signal are connect directly to the unit.
Check integrity	• Make sure that all electrical connections are tight. • Make sure that all electrical components are undamaged.
Hot surfaces	• The cables must not touch hot surfaces. If necessary, wrap the electrical cables by a thermal insulating sheath.

9.4 Piping Connections

WARNING

Only authorized personnel is allowed to perform operations on the piping.

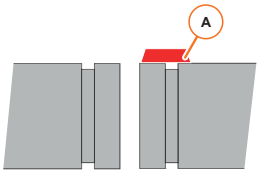
9.4.1 General instructions

Connections	• The inlet and outlet directions are clearly marked with labels and arrows on the respective pipings. • Pay attention to follow the directions.
Take care of the sensors	• Protect all refrigerant line components within 460 mm of the brazing site by wrapping them with a wet cloth or with a suitable heat-sink compound.
Keep clean	• Keep the piping clean and dry. • Make sure that the surfaces to be brazed are clean and that the ends of the tubes have been carefully reamed to remove any burrs. • Ensure that all loose material has been cleaned from inside the tubing before brazing.
Brazing	**NOTE** *When copper is heated in the presence of air, copper oxide forms. POE oil will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.* • Use copper piping with a brazing alloy with a minimum temperature of 732°C, such as Sil-Fos. • Avoid soft solders such as 50/50 or 95/5. • For copper-to-copper joints, the phosphorus in the Sil-Fos product serves as the fluxing agent and no separate flux by nitrogen is necessary to protect the brazing site. For brass application however, nitrogen flux is recommended. • In any case, during brazing always use pure dry nitrogen through the piping with a flow of 0,5-1,5 l/s. • This avoids the presence of oxygen on the heated surfaces. • Do not overheat the piping (to minimize oxidation).
Piping layout	• Keep the piping as short as possible. This helps to minimize the pressure drops • Avoid bends as much as possible. Make bends with large radius (bending radius at least equal to the pipe diameter) • For hard copper piping use preformed curves. You may bend soft copper piping by hand or by a bending tool • Support both the horizontal and the vertical piping by vibration dampening clamps that include rubber gaskets. Place the clamps every 1,5-2 mm

9.4.2 Joining pipes with grooved connections

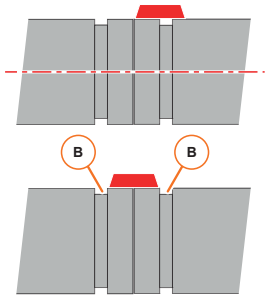
Check the pipes ends

- Make sure that the outside surface between the groove and the end is smooth and clean.
- Remove any residual of oil, grease, dirt and particles.
- **Lubricate the gasket**
- Apply a thin coat of grooved lubricant or silicone lubricant to the gasket lips and exterior.



Insert the gasket

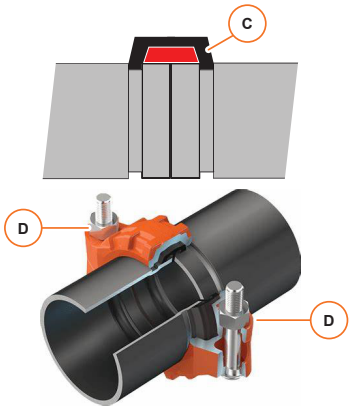
- Insert the gasket [**A**] over the end of one of the two pipes to be joined.
- Make sure that the gasket lip does not overhang the end of the copper pipe.



Join the ends

- Bring together the two pipe ends and align them.
- Slide the gasket into position, and make sure that it is centred between the grooves [**B**].

NOTICE
Make sure that no portion of the gasket extends into the grooves.



Join the pipes

- Insert the housing [**C**] over the gasket
- Screw the bolts [**D**] loosely, just enough to hold together the two parts of the housing.
- Make sure that the gasket is not rolled or pinched.
- Make sure the housing engages the grooves properly on both pipes.
- Tighten all nuts evenly by alternating sides until metal-to metal contact occurs at both bolt pads.

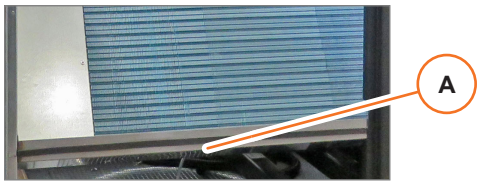
NOTE *Tightening the nuts evenly is important to prevent gasket pinching.*

NOTICE
Leakage may occur if the gasket is pinched or damaged.

- Make sure the offsets are equal at the bolt pads. This is necessary to ensure a rigid joint.
- Visually inspect the bolt pads at each joint to ensure metal to-metal contact is achieved.

- Cover the grooved connection with foam insulation suitable for the application and for the environment.

9.4.3 Connecting the condensate drain tray to an external piping



- Connect the flexible pipe that collects the condensate from the tray [**A**] to an external drainage piping.

9.4.4 Connecting the safety valves to outdoors

WARNING
If the safety valves open, they release refrigerant.
To avoid risk of refrigerant inhalation, you must convey outside the safety valves discharge.

Convey the discharge

- It is possible to convey the safety valve discharge through 3/4” G connection. Maximum equivalent length shall be in accordance with EN 14276.
- Leave free the valve body.
- Convey the piping outlet to areas where the refrigerant cannot harm people.

9.5 Electrical connections

9.5.1 Power supply cable

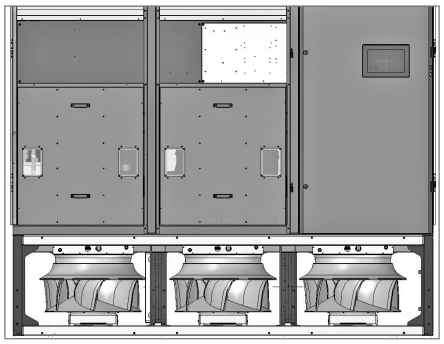
General instructions

- After opening the passage in the structural works (precut), for the supply line inlet, restore the original protection degree with suitable accessories for the wiring and junction boxes.
- Install the cable avoiding carefully to touch the hot parts.
- After having connected the cable, restore the protections against direct contacts.
- The system/line cable protection is to be arranged by the customer.
- Use a protection with differential switch.
- For details about the cable entrance holes see *Annex E - Connections*.

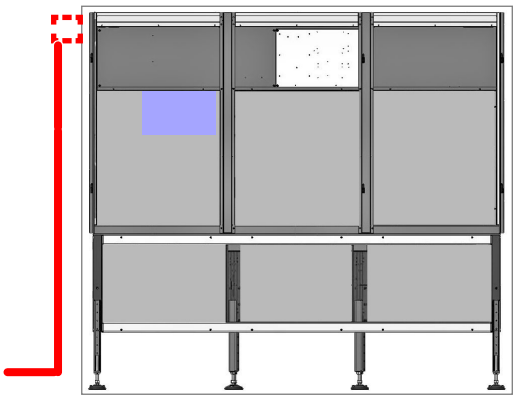
NOTICE

For fixed speed compressors, if the compressor makes a loud and unusual noise it is necessary to invert the electrical connections of the phases.

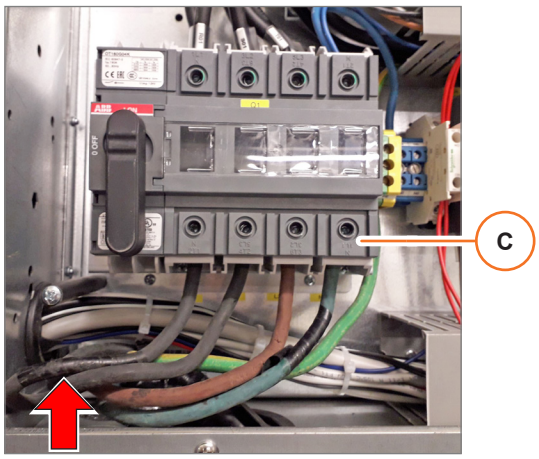
Standard power supply or dual power supply parallel



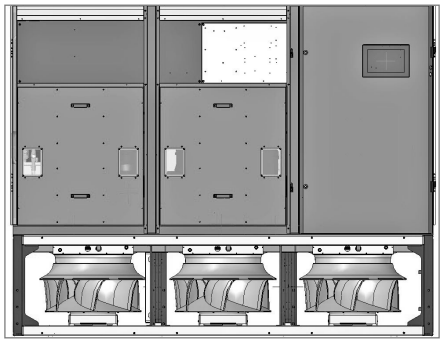
- Open the front door to get access to the electrical panel and to the internal safety panels.
- Remove the electrical panel cover by unscrewing the screws that hold it.
- Remove the internal safety panels by unscrewing the screws that hold each panel.
- Remove the frontal panels or frontal grids from the fan module.



- Run the power cable from the bottom through the precut in the fan module.
- Use appropriate cable ties to fix the cable to the frame on the left shoulder.



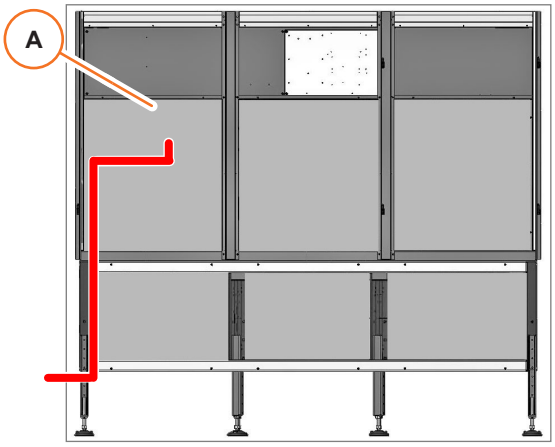
- Connect the power cable to the inlet terminals [**C**].



- Reposition all the panels removed for the cable connection:
  - the electrical panel cover
  - the internal safety panels with the appropriate screws
  - the fan electrical connection cover inside the fan module
  - the panels or grids removed from the fan module

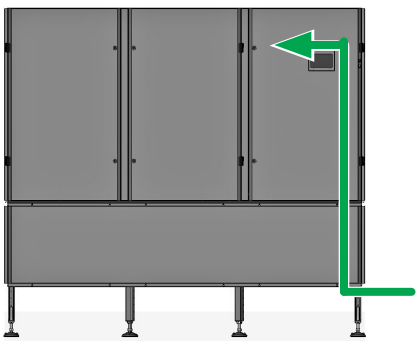
Make sure not to damage the electrical cable between the panels and the unit.

Dual power supply with ATS

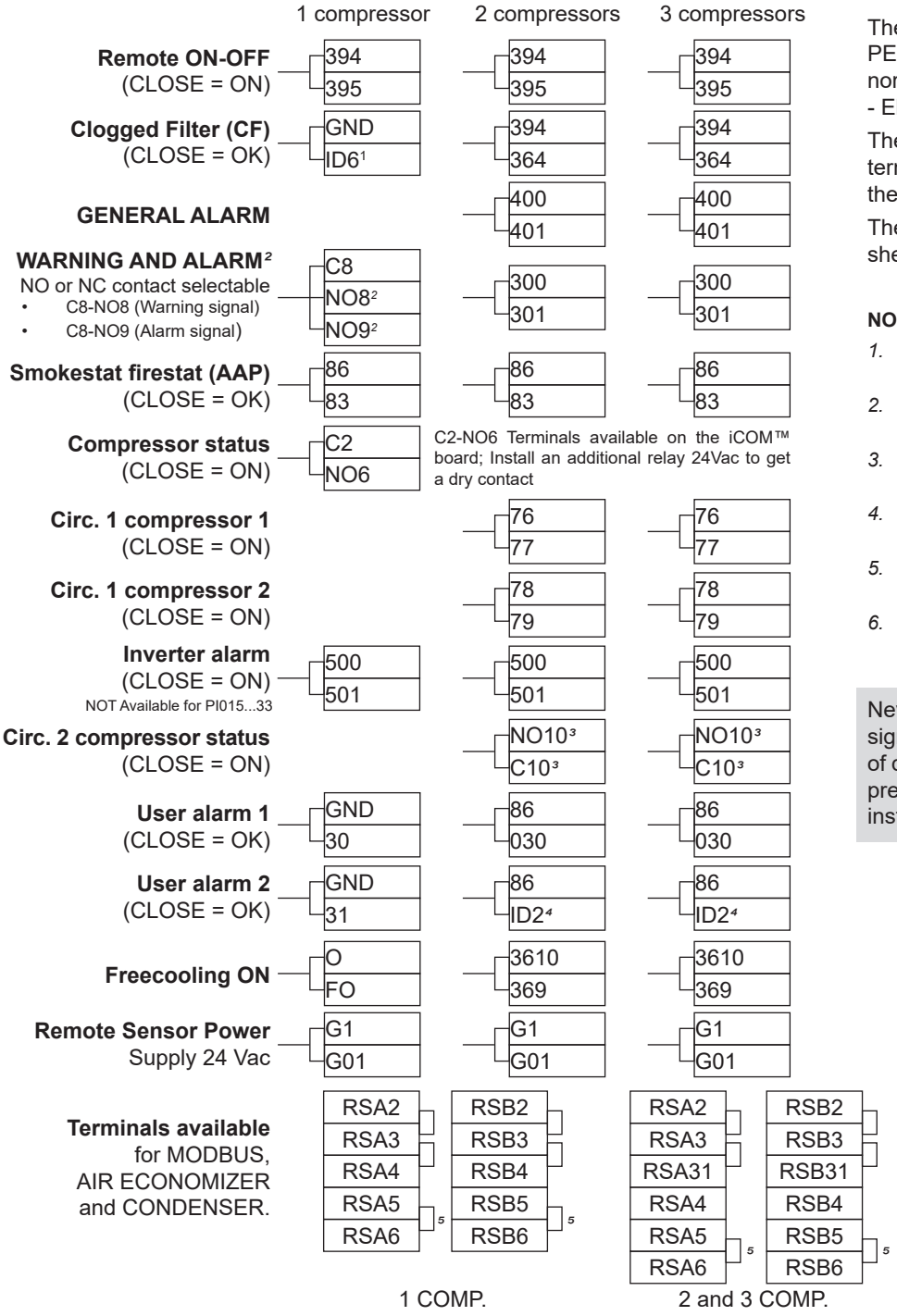


If the unit is provided with ATS, then the procedure is the same as for standard power supply or dual power supply parallel, but there are two power cables (4 + 4 cords) to be connected to the inlet terminals of the ATS panel.

9.5.2 Contacts for the unit status signals



- Run the signal cable through the precut on the right shoulder of the frame.
- For details about the cable entrance holes see *Annex E - Connections*.
- Use appropriate cable ties to fix the cable to the frame on the left shoulder.
- Restore the original protection degree with suitable accessories for the wiring and junction boxes.



The dry contacts can be used only with PELV type sources, as described by the norm EN 60204-1 “Safety of machinery - Electrical equipment of machines”.

The table on the left shows the available terminals and their meaning (refer to the Electric diagrams for details).

The cable must be protected by a sheath.

NOTES

1. *ID6 Terminal available on the iCOM™ control board;*
2. *The fans alarms are managed through Modbus;*
3. *The compressor inverter alarms are managed through Modbus.*
4. *C10-NO10 (Available on the iCOM™ control board)*
5. *ID2 (Available on the iCOM™ control board)*
6. *Remove the link if the AIR ECONOMIZER SENSOR is installed*

Never connect the same external signal to more than one digital inputs of different units control card in order to prevent any damage of the control card installed on the VERTIV™ machine.

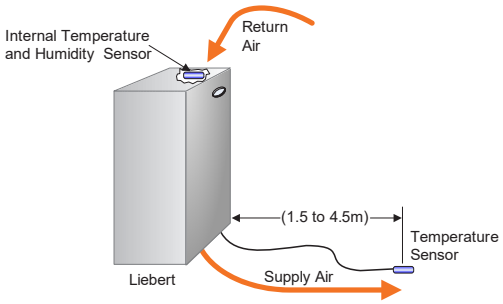
9.5.3 Teamwork and Monitoring

The Monitoring Port must not be connected in the same network of the iCOM3 boards, in order to separate completely the Monitoring from the Teamwork local network.

The iCOM3 Teamwork port shall not be used for monitoring or management purposes by Customer since it is reserved for authorized Service.

9.5.4 Supply air Temperature sensor

The supply temperature sensors should be installed in an area that is influenced only by the unit it is connected to. The supply sensor should be 1.5 - 4.5m from the cooling unit to provide an accurate reading for the control.
The sensor has been already installed in the unit and it's fixed in the fan module with at least 3m of cable lenght available. Remove the stripe and place it according the drawing.
The external air temperature sensors should be installed in an area that is not influenced by UV rays. The external air sensor should be placed outside to provide an accurate reading for the control.
The sensor has been connected on the electrical panel and the length of the cable is 12m.



Do not run the external air temperature sensor in the same conduit, raceway or chase used for high-voltage wiring.

NOTE: *To grant a proper unit regulation, install the sensor according the drawing. Vertiv™ is not responsable in case of improper installation.*

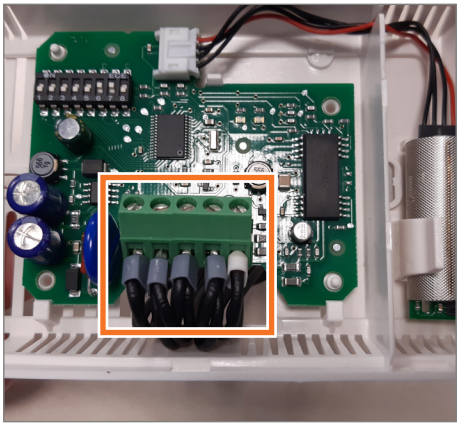
9.5.5 Sensors connections

Any remote or additional sensor must be connected to the unit via Modbus.

See *9.6 Modbus Connections and Settings*.

9.6 Modbus Connections and Settings

9.6.1 Connection of a device to the Modbus cable

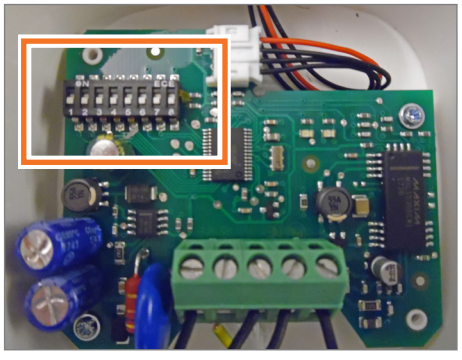


- Use a Modbus (RS485) cable, which is made of four shielded cables inside the sheath.
- Connect two wires to terminal G and G0 24 VAC
- Connect two wires to Modbus RX+ and RX-
- Refer also to the Vertiv™ document code "*10027754_Modbus_Simple_Rules*" to realize the Modbus chain connections between the devices (internal and external) of the unit.

9.6.2 Setting of Modbus devices

The setting of a Modbus device requires the setting of the following parameters:

Dip switched address	Address of the device (unique)	• For any sensor: set the pins on its board.



- For the evaporator fans (inside the unit): the setting is factory made. However you might need to do again the setting in case of fan replacement. Do the setting by the programming tool.
- For the condenser fans: you need to do the setting at the installation by the programming tool

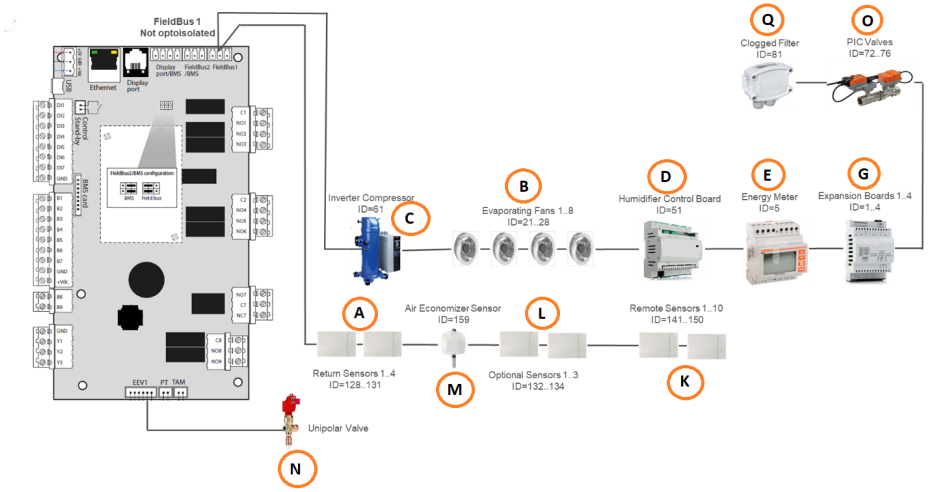
NOTICE
In case of dual circuit, pay attention to match the condenser fan name with the related circuit.

Baud rate = 19200
Parity = Even
StopBits = 1

Same parameter for all the devices in the Modbus chain

The following figures and table *Table 37 - Modbus options and addresses* provide the details and the addresses for the settings.

Single circuit units



Dual circuit units

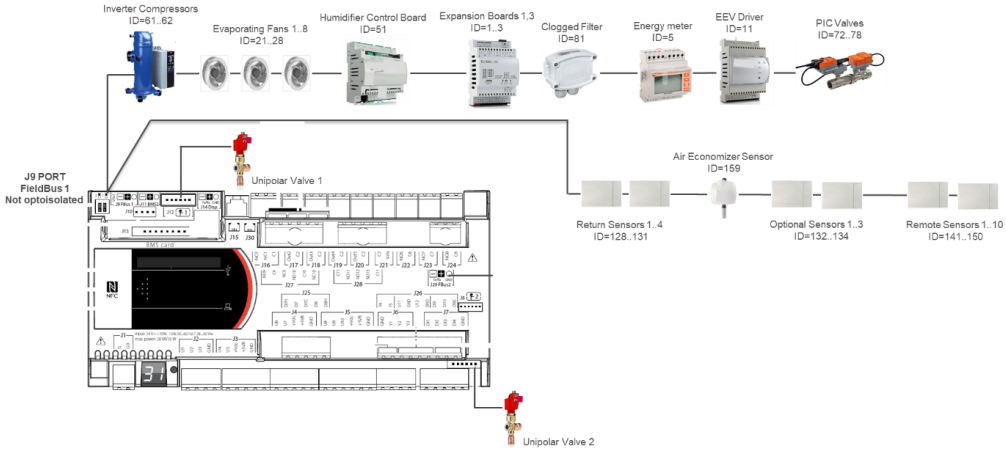


Table 35 - Modbus options and addresses

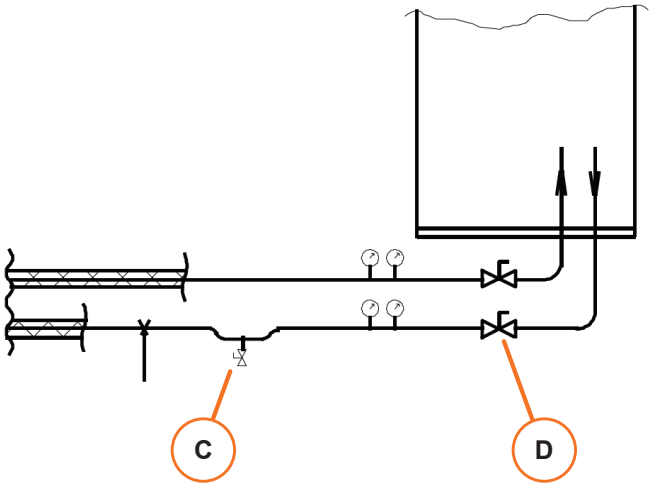
Ref.	Device	Number	Modbus address
A	Return sensor T+H	Up to 4	Return: 128..131
B	Evaporating fans	Up to 6	21...26
C	Inverter Compressors	Up to 2	61...62
D	Electrode humidifier	1	51
E	Energy meter (not available as standard)	Up to 4	5...8
F	Driver for bipolar electronic expansion valve	Up to 2	11...12
G	Expansion board	Up to 4	1..4
H	Temperature and humidity remote probes	Up to 10	141...150
K	Optional sensors T or T+H	Up to 3	132...134
L	Air Economizer Probe	1	159
M	Unipolar valve 1		
N	PIC Valves	Up to 4	72…76
P	Unipolar valve 2		
Q	Diff. Press. Sensor	1	81

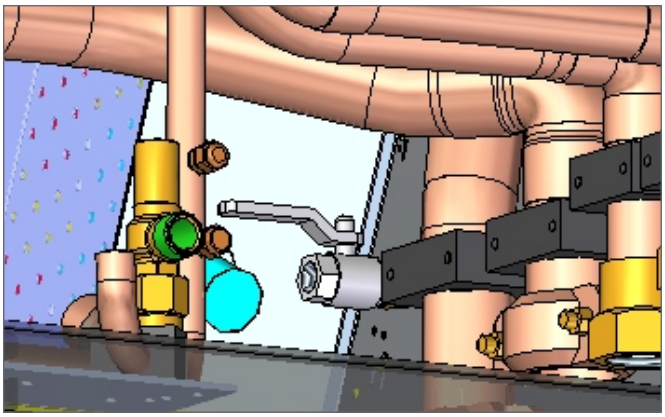
9.7 Water system

9.7.1 Fill the water system

NOTICE

Do not exceed the nominal operating pressure of the circuit components.
Air Bubbles on the circuit can cause a loss of precision in cooling action so de-aeration is recommended





It is possible to drain the water coil with a ball valve positioned near the water piping.

W Version – Direct expansion water cooled unit

For each condenser (DX system):

- Make sure that the drain valves [**C**] is closed;
- If there are shut-off valves [**D**] on the water return (building facility), then make sure that they are open;
- Open the shut-off valves on the water supply system upstream the unit (building facility);
- Supply water through a filling group or from the plant;
- If necessary, fill-in or tip-up the ethylene glycol (see *9.7.2 Adding ethylene glycol*).

F Version – Direct expansion freecooling unit

- Make sure that the drain valve [**C**] is closed;
- Open the vent valves on the chilled water coil, to deaerate the unit's coils and piping;
- If there are shut-off valves [**D**] on the water return (building facility), then make sure that they are open;
- Open the shut-off valves on the water supply system upstream the unit (building facility);
- Supply water through a filling group or from the plant;
- Close the vent valves when only water and no air blow out of them;
- If necessary, fill-in or tip-up the ethylene glycol (see *9.7.2 Adding ethylene glycol*).

H Version – Dual fluid water cooled unit

For each condenser (DX system):

- Make sure that the drain valves [**C**] is closed;
- If there are shut-off valves [**D**] on the water return (building facility), then make sure that they are open;
- Open the shut-off valves on the water supply system upstream the unit (building facility);
- Supply water through a filling group or from the plant;
- If necessary, fill-in or tip-up the ethylene glycol (see *9.7.2 Adding ethylene glycol*).

For the chilled water coil (CW system):

- Make sure that the drain valve [**C**] is closed;
- Open the vent valves on the chilled water coil, to deaerate the unit's coils and piping;
- If there are shut-off valves [**D**] on the water return (building facility), then make sure that they are open;
- Open the shut-off valves on the water supply system upstream the unit (building facility);
- Supply water through a filling group or from the plant;
- Close the vent valves when only water and no air blow out of them;
- If necessary, fill-in or tip-up the ethylene glycol (see *9.7.2 Adding ethylene glycol*).

9.7.2 Adding ethylene glycol

Prevent freezing	If it is required to work with temperatures below 0°C, it is recommended to use glycol mixtures.
How much ethylene glycol to add	Use the following table to calculate the percentage of ethylene glycol that must be added to the water:

Ethylene glycol [% in weight]	0	10	20	30	40	50
Freezing temperature,°C (*)	0	-4,4	-9,9	-16,6	-25,2	-37,2
Mixture density at 20°C (*) [kg/l]	---	1 017	1 033	1 049	1 064	1 080

(*) Values are for Clariant Antifrogen N. For different brands, check manufacturer's data.

NOTICE

Always charge the water system with the required glycol percentage necessary for the lowest water temperature at the installation site. Failing to comply with this instruction shall invalidate the unit warranty.

Procedure	• Fill the water system with water (see *9.7.1 Water supply*). • Disconnect the water system from the sanitary water supply, so to prevent any return of water mixed with ethylene glycol to the sanitary water supply. • Add the ethylene glycol until up to the required percentage. • To avoid stratification, run the circulation pump of the chilled water system (building facility) for a least **30** minutes after adding any glycol.
Checks	• After any topping-up of water check the concentration of the glycol if necessary. • Check the head and the flow rate of the circulation pump (building facility) to be used, since th hydraulic features of the system changes by adding glycol (see *Table 11 - Cooling system - Glycol mixture correction factors*).

9.7.3 System arrangement

The unit must receive cooling water as follows:

a. From an external cooling water source, in open circuit (see *9.7.3.1* and *Figures* in *Annexes*).

b. Using a Dry cooler, in closed circuit (see *9.7.3.2*).

- Connect the piping as shown in *Annex D – Connections*;
- It is advisable to use hoses to be connected, with 3-piece joints, to the condenser water inlet and outlet couplings.

IMPORTANT: fit a standard strainer on the inlet water piping.

- Place shut-off ball valves at the conditioner inlet and outlet to allow easy maintenance;
- It is advisable to install a water drain system at the lowest point in the circuit;
- Fully drain the piping before connecting it to the air conditioner.

9.7.3.1 Notes for open circuit applications

1. Use the unit with mains or well water.

DO NOT USE WATER FROM AN EVAPORATIVE COOLING TOWER UNLESS THE FILLING WATER HARDNESS IS CONTROLLED.

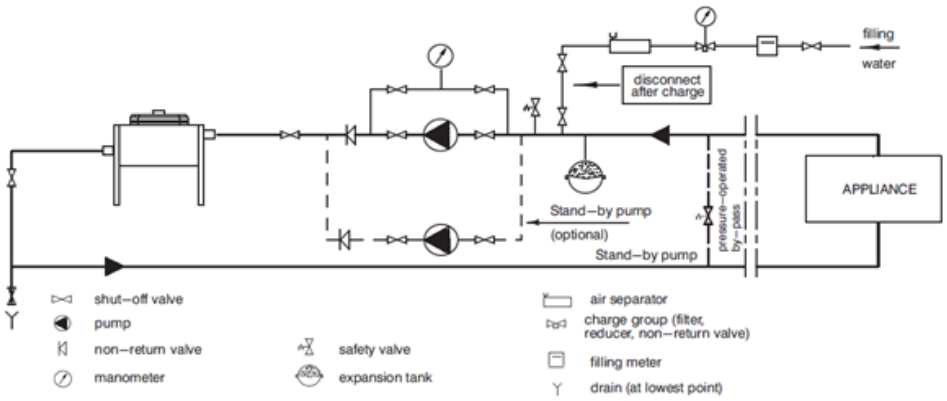
- The water pressure must be 2 - 10 bar (if this is not so, contact the Technical Support Department).
- The required water flow at different temperatures is given in our catalogues or on request.
- If necessary (very low water temperature), insulate both pipes using insulation material.

9.7.3.2 Notes for closed circuit applications

The installation in below schematic is indicative only; for individual installations follow the project diagram.

- Select and install the pump according to water flow rate and head pressure required by the system (please refer to project data). A dry contact provides the status (ON/OFF) of each compressor;
- Insulate both pipes using insulation material;

- **VERY IMPORTANT:** Add water and ethylene glycol to the circuit when the ambient temperature is below zero (referring also to *par. 9.7.2*). Do not exceed the nominal operating pressure of the circuit components;
- Bleed air out of the circuit.



9.8 Final Checks

NOTE
Follow these instructions at first startup and also in case of restart after a long stop.

NOTE
Record the functional data on the Start-Up certificate.

Electrical system

WARNING
Disconnect the power supply before doing the following checks on the electric system as explained in *1. Safety*.

- Check all the cable connections particularly the main power connections on the power fuses and contactors.
- Check that all thermal protections are calibrated according the electrical data tables reported on wiring diagram.
- Check the electrical absorption of all components.
- Check the tightening of all terminal block and screws

Tightness

After finishing all of the connections and installation operations, including mounting accessories (plenum, ducting) and floor elements (base frame), check all the unit edges and gaps and make sure that they comply with the protection degree IP2x specification (protection against finger access).

Refrigerating system

- Make sure that the electric and hydraulic connection of each drycooler is consistent withe the respective refrigerating circuit connections.
- Make sure that the condensate drain line is connected and not obstructed.
- Make sure that all the factory clamps that fix the piping to the structure have been reinstalled (if removed during the installation).
- Check that the compressor operates when required.
- Check that there is no anomalous vibration of the piping while the compressor is operating.

Air system

- Check that the unit fans are operating properly.
- Check all the unit options that involve the air flow management (such as air economizer, return dampers and Smart Aisle™) operate properly.
- Check that all the temperature and humidity probes read a correct value.
- Make sure that the humidifier supply and drain water connections are connected properly.
- Check that the humidifier works properly.
- Check that electrical heaters operate when required.

Safeguards

- Make sure that all the safeguards (panels, grids) have been mounted again.
- Close and lock all the doors.
- Place again all the floor panels around and under the unit.

Everything OK?

Start the normal operation: see *10. Operation*

10. Operation

Content of this chapter

10.1 Safety Instructions

WARNING

Improper operations can cause injury or death.

NOTICE

Improper operations can cause product damage.

Read carefully the chapter *1. Safety*.

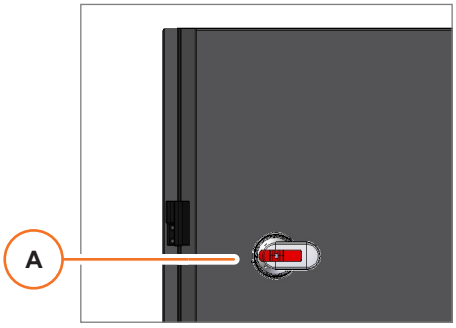
Pay attention to the safety labels on the unit and to the safety warnings in this chapter.

NOTICE

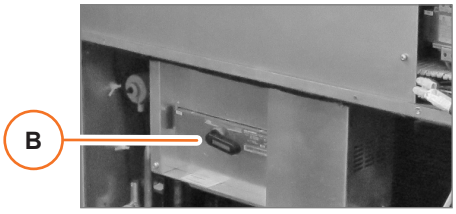
The power supply should never be disconnected during normal operation, except when performing maintenance.

10.2 Power-up

Single power supply



Dual power supply



1. Close the disconnection device upstream the unit (to be installed by the customer).
2. Close the main disconnecting switch [**A**]
3. For units with additional electrical disconnecting device (Extended height units only), set to position "**I**" the remote disconnector. See *Annex K - electrical disconnecting device on enclosure* for details.

For units with ATS:

1. Put ATS in automatic mode by removing the manual handle [**B**]
2. Close the door and screw it
3. Close the main disconnecting switch [**A**]
4. For units with additional electrical disconnecting device (Extended height units only), set to position "**I**" the remote disconnector. See *Annex K - electrical disconnecting device on enclosure* for details.

- If the iCOM™ display is present, then check that it switches **ON**.
- In case of first start-up or after maintenance on the electric system, check again by a voltmeter or tester if the voltage and phase difference fall within the indicated limits.

10.3 Preparation

NOTE

Follow this instructions at first startup and also in case of restart after a long stop.

Compressor pre-heating and check

When you set the disconnecting switch to the position "**I**", the compressor crankcase heaters are automatically powered **ON**.

NOTICE

The pre-heating of the compressor crankcase takes about **8** hours.

Remember to power up the unit well in advance before starting the normal operation.

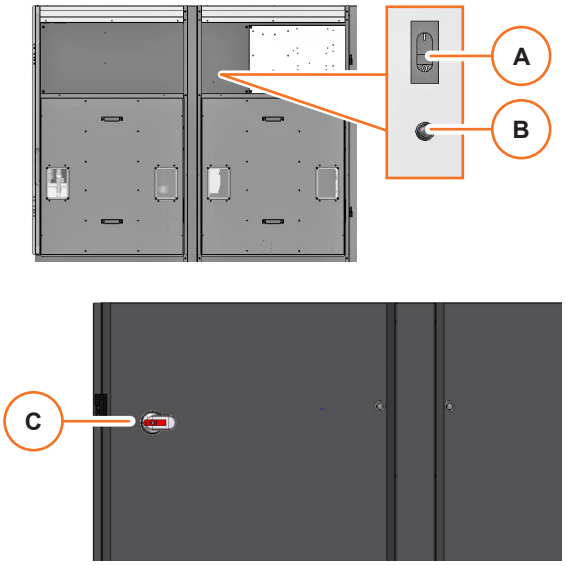
- Make sure the auxiliary circuit has been powered and check the operation (a fault due to an incorrect procedure will invalidate the compressor guarantee).

At the end of the pre-heating:

- check that all the manually operated valves of the refrigerating circuit are open
- check that the suction pressure is higher than 7.0 bar

If this is not the case, extend the pre-heating of the compressor and check that the refrigerant EEV valve is properly closed.

10.4 Start



NOTICE

Before starting the unit, make sure that the compressor has been heated properly.

- Set the ON/OFF switch [**A**] to **ON**.
- Close the door and screw it;
- Close the main disconnecting switch [**C**];
- For units with additional electrical disconnecting device (see *Annex K*), set to position "**I**" the remote disconnector;
- Adjust the setpoint as indicated in the iCOM™ User Manual.

The LED [**B**] lights up (from PI041 to PI165), showing the presence of the electric power.

See the iCOM™ User Manual for details.

If the LED does not light up see *12. Troubleshooting* (only for PI from 041 to 165).

NOTE

*The fan starts immediately (the fan always works when the unit is **ON**).*

*The compressors start **30** seconds after the fans (if there is cooling request).*

The dehumidification can start after the compressors.

*The heaters can start **10** seconds later.*

*The variable speed compressors run at fixed speed for **60** seconds before starting the speed regulation.*

10.5 Check the Operation

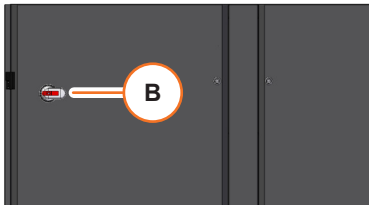
NOTICE

The following checks must be done:

- at first startup
- in case of restart after a long stop
- at time intervals during the normal operation

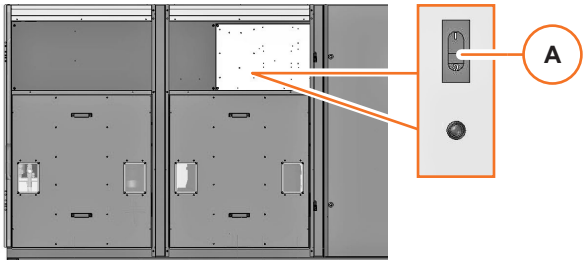
Alarms	• Make sure that all the alarms due to protective devices interventions have been reset (see *iCOM™ User Manual*)
Control and safety devices	• Check the correct operation of the control and safety devices.
Compressor	• With the compressor at full load, check there are no bubbles visible in the flow indicator. If there are any, check the charge.

10.6 Stop



In case of a short stop:

- For units with additional electrical disconnecting device (see *Annex K*), set to position "**O**" the remote disconnector and lock it;
- Turn-OFF the main disconnector switch [**B**];
- Unscrew the door and open it;
- Set the ON/OFF switch [**A**] to **OFF**;
- Close the door and screw it;
- Set the disconnecting switch [**B**] to the position "**I**" to maintain the supply to the crankcase heater.
- For units with additional electrical disconnecting device (see *Annex K*), set to position "**I**" the remote disconnector



In case of a long stop (seasonal shutdown):

- For units with additional electrical disconnecting device (see *Annex K*), set to position "**O**" the remote disconnector and lock it;
- Turn-OFF the main disconnector switch [**B**];
- Unscrew the door and open it;
- Set the ON/OFF switch [**A**] to **OFF**;
- Close the door and screw it;
- Maintain the disconnecting switch [**B**] and the remote disconnector to the position "**O**". This will disconnect the compressor crankcase heaters.
- For units with additional electrical disconnecting device (Extended height units only), see *Annex K - electrical disconnecting device on enclosure* for details.

10.7 Restart

After a short stop	The unit is still powered • Set the ON/OFF switch to **ON**.
After a long stop	• Do the complete procedure as described in: *10.2 Power-up, 10.3 Preparation, 10.4 Start*
In case of power blackout	See *5.5.1 Standard or dual power supply*

10.8 Teamwork

The factory setting for the iCOM™ control system is the stand-alone mode.
If the unit is connected to other units in a network (by Ethernet), a master unit controls the switching ON/OFF of all of the units.

The base configuration for the Teamwork can be one of the following:

- Lead-Lag (stabdby + rotation + changeover on alarm)
- Cascade

See the iCOM™ User Manual for more information and instructions about the Teamwork configuration.

10.8.1 Dehumidification

The setpoint for the dehumidification is the required value of relative humidity or the required dew point of the air returning from the room into the unit.

The actual dew-point of the returning air is calculated from the humidity and temperature measured by the sensor of the unit.
If the returning air dew point is higher than the required value, then the dehumidification function is activated: the compressors run at full capacity and the evaporator fans could reduce the speed.

11. Maintenance

Content of this chapter

11.1 Safety Instructions

WARNING

Improper operations can cause injury or death.

NOTICE

Improper operations can cause product damage.

Check the unit regularly and solve the problems as they occur.

Lack of maintenance could reduce the performance or damage the unit.

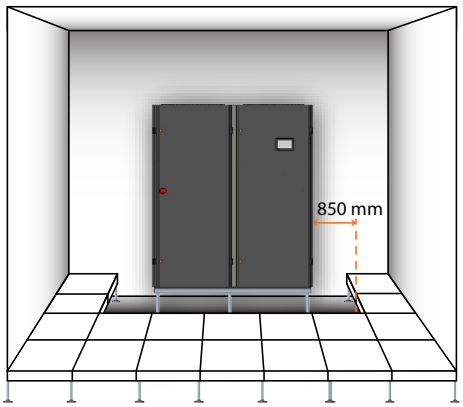
NOTICE

All the tasks that are explained in this chapter must be carried out only by authorized and trained technicians. We recommend the Vertiv™ Customer Service.

For any operation that is not specifically mentioned in this manual you must contact Vertiv™ Technical Support.

Read carefully the chapter *1. Safety*.

Pay attention to the safety labels on the unit and to the safety warnings in this chapter.



For **Downflow** units installed on a raised floor

WARNING

Rotating elements, hot surface elements

If you need to remove the floor tiles within a distance of 850 mm from the unit, first disconnect the unit from the power supply.

11.2 General Instructions

Safety components

- Check and calibrate the safety valves according to the local regulations.

Warning labels

- Check regularly that the warning label are still on the unit and that they are clearly visible.
- Replace any missing or damaged label.

See *Annex B - Safety Labels* for the mapping of the safety labels placed on the unit.

Spare parts

The use of original spare parts is recommended.

Using third-party material can invalidate the warranty.

When placing an order refer to the *Component List* enclosed with the unit and quote the unit model and serial number.

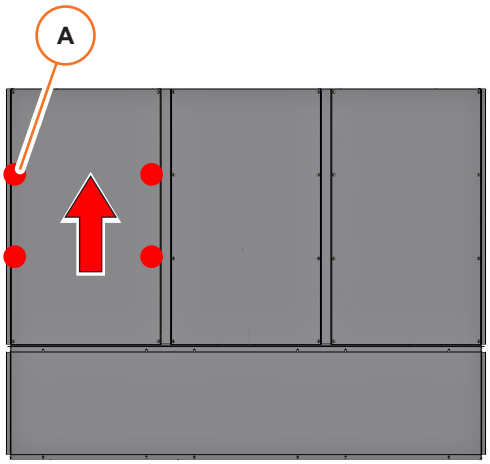
NOTICE

If you need to replace a component, then follow carefully the instructions of the manufacturer that come with the component.

NOTICE

If you need to weld a component, then be careful not to damage other components (like gaskets, seals, O-rings, ...)

Removing the upper panels



- Loose the fixing screws [**A**].
- Lift the panel and release it from the hook on top.

CAUTION

The panels are heavy (up to 25 kg).

This operation must be done by two maintenance operators.

11.3 Maintenance Program

NOTE *If you encounter any problem, then see also 12. Troubleshooting.*

11.3.1 Electrical and control system

WARNING

The unit contains potentially lethal voltage in some circuits.

The electric and control panels can retain a stored high-voltage electrical charge for up to **15** minutes.

Before working inside the electric and control panels proceed as follows:

- Open all the local and remote disconnecting switches of the unit.
- Wait at least **5** minutes.
- Verify with a voltmeter that the power is **OFF**.

NOTICE

Make reference to the *Electric Diagrams* provided with the unit.

Perform the periodic checks and maintenance operations as specified in the following table.

Component or function	Operation	Frequency [months]		
		3	6	12
Power consumption	Measure the power consumption of the connected devices. Do the measurements after the thermal magnetic circuit breakers. If a measured value is different from its nominal value, then check the power supply line and the cables. If you do not find any fault in the cables, then replace the device.		X	
Connections	Check if the connections are tight. Tighten any loose connection.		X	
Display (if present)	Check if there are faulty pixels or any malfunctioning		X	
Ultracap	Check that the ultracap feeds the control board at least for **30** seconds		X	
Controll battery	Check that the ultracap feeds the control board at least for **30** seconds		X	
Safety devices	See *11.6 Calibrations*		X	
Protective covers	Make sure that all the protective covers are in place and that they are not loose or damaged. Repair or replace if necessary.			X
Fuses	Check visually. Replace if necessary.			X

11.3.2 Refrigerant and water system

WARNING

The unit contains potentially lethal voltage in some circuits.

The electric and control panels can retain a stored high-voltage electrical charge for up to **15** minutes.

Before working inside the electric and control panels proceed as follows:

- Open all the local and remote disconnecting switches of the unit.
- Wait at least **5** minutes.
- Verify with a voltmeter that the power is **OFF**.

Perform the periodic checks and maintenance operations as specified in the following table.

Component or function	Operation	Frequency [months]		
		3	6	12
Operating conditions	See the following points in *9.7.7 Charge the refrigerant by the compressor*: - Check the evaporating temperature - Measure the superheat - Measure the sub-cooling	X		
Compressor	The compressor operates as required? The compressor is noisy? Any frost on the surface? Check the following parameters: - power consumption - surface temperature of the compressor upper part	X		
Compressor oil	Check the level (see *9.7.8 Check the oil level).* Top up if necessary (see *9.7.5 Fill up the compressor oil*). Check the moisture indicator on the sight glass. If the indicator shows high moisture then change the filter dryer and make sure that there are no leaks in the circuit.	X		
Compressor crankcase heater	Measure the temperature on the crankcase heater surface to check if the crankcase heater is operating properly. Make reference to the manufacturer documentation for details.		X	
Piping	Any abnormal vibration?			
	Tighten or replace the clamps fixing the piping and the anti-vibration connections.		X	
	Make sure there is no loss of water		X	
	Check that the water supply is ensured		X	
Safety devices	See *11.6 Calibrations*		X	
Evaporator	Any frost on the surface?		X	
	The resistance operates as required?			
Cooling water	Check cooling water circuit	X		
	Check for damage, leaks, and proper fixing	X		
	Make sure there is no loss of water	X		
Cooling water (only for closed circuits)	Make sure that the water pump works properly		X	
	Deaerate circuits		X	
	Check whether the heat transfer medium of circuit-connected system is frost-proof		X	
	Check safety equipment for function		X	
	Check glycol % comparing minimum comparing yearly ambient temperature		X	

Component or function	Operation	Frequency [months]		
		3	6	12
Chilled water circuit	Make sure there is no loss of water		X	
	Deaerate the coolin water circuit using the vent valve near unit hydraulic connections		X	
	Check that the cold water supply is ensured		X	
	Check the temperature and the pressure of the water on the inlet and the outlet side using thermometers and manometers if installed		X	
	Check the proper function of three/two-way valve		X	
	Make sure that the system is filled with the prescived amount of glycol and that there is no frost in the hydraulic circuit		X	
	In case of water loss, it needs to be refilled. Make sure that the glycol concentration is correct		X	
	Check that the water circulation is in perfect order		X	

11.3.3 Air system

WARNING

This unit operates and restarts automatically.

The fan blades can automatically start rotating without warning at any time during a cooling cycle or after the power is restored after a power failure.

The fans may suddenly start blowing out a strong air flow, which may carry particles and small objects from inside the unit.

Before working inside the unit cabinet, removing the fan guards or servicing the fans (speed control, blades, motors) proceed as follows:

- Turn all the disconnecting switches to **OFF**.

Perform the periodic checks and maintenance operations as specified in the following tables.

Component or function	Operation	Frequency [months]		
		3	6	12
Fans	The fans operate as required?	X		
Fans	Visual inspection for dirtiness, damage, corrosion Clean if necessary	X (*)		
Fans	Any abnormal vibration? Then tighten the fixing to the supporting structure	X		
Fans	Any abnormal sound? Then check the bearings	X		
Fans	Measure the power consumption.		X	
Filters	Visual inspection for dirtiness, damage, corrosion Clean or replace if necessary (see *11.5.2 Replacing an air filter)*	X (*)		
Filter clog sensor	The sensor operates as required?		X	
Fresh air intake Economizer (if present)	The accessory operates as required?		X	
Humidity and temperature sensor	See *11.6 Calibrations*		X	
Heaters (optional)	The accessory operates as required?		X	

Component or function	Operation	Frequency [months]		
		3	6	12
Temperature safety switch	See *11.6 Calibrations*		X	
Condensate tank (optional)	Visual inspection for dirtiness, damage, corrosion Clean if necessary.	X		
Humidifier	See the related *annex*.			

(*) Check more frequently in dusty environment.

11.4 Operations with the Refrigerant

Shut-off valves

You can separate some sections of the refrigerating system by closing the shut-off valves shown in *Annex A - Refrigerating Circuit Diagrams*.

Piping

In case of operations on the piping, for example for replacing components or sealing a leak, see *9.4 Piping Connections*.

NOTICE

Make sure to clean properly the piping before restoring the refrigerant charge.

Refrigerant charge

WARNING

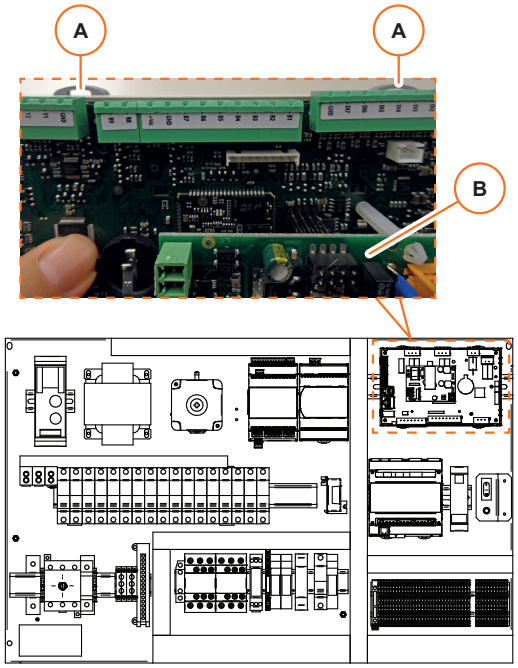
Use only the refrigerant type specified on the *Onboard Label*.

Refrigerant recover

- In case of operations that require to empty the refrigerating circuit, or a section of the circuit, recoverall the refrigerant in a container.
- Do not allow the refrigerant to escape.

11.5 Replacement of Components

11.5.1 Replacing the control board



WARNING

Disconnect the unit from the power supply.

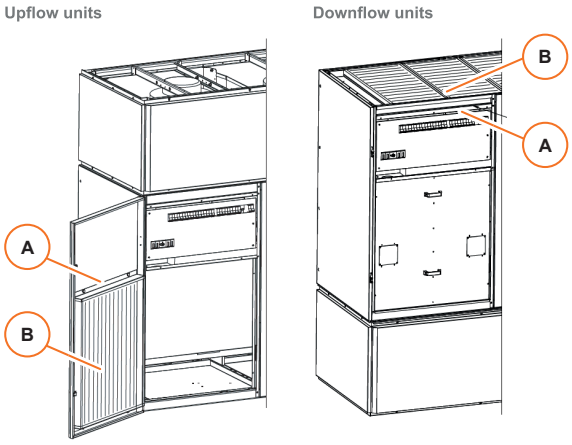
How to remove

- Remove the cover plate of electrical and control panel.
- Remove all the cables connected with the control board.
- Insert a screw driver in one of the eyes [**A**] and lever out the control board [**B**].
- Repeat for the other eye(s) until the control board is released.

How to reassemble

- Press the control board in the DIN rail until it locks.
- Connect again the cables.
- Reassemble the cover plate of electrical and control panel.
- Connect the unit from the power supply.
- Upload the software from the computer (or USB drive) to the control board.
- Restart the unit.

11.5.2. Replacing an air filter



- Switch off the unit and open the front panel with the key.
- Unscrew and remove the filter brackets [**A**].
- Remove the air filter [**B**].

11.5.3 Replacing a fan - general instructions

Safety

WARNING

Disconnect the unit from the power supply.

CAUTION

The fans and the panel are heavy.

This operation must be done by two maintenance operators.

Use adequate lifting equipment and follow the fan manufacturer instructions for handling

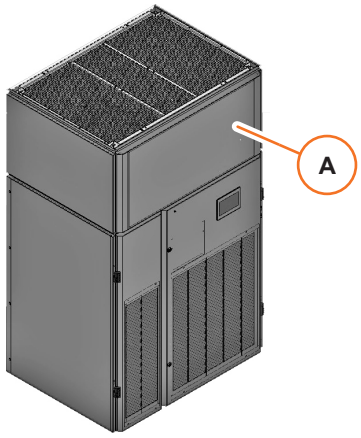
Additional information

Make reference to the fan manufacturer instructions for transport, handling and mounting the fans.

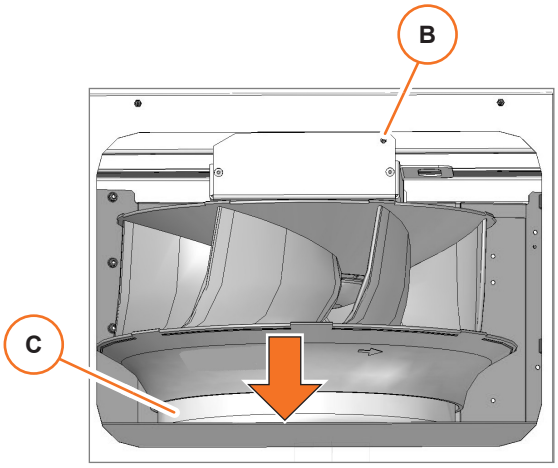
Modbus address

After reassembling, connect the fan to a laptop and use the configuration software provided by the manufacturer to set the fan Modbus address (see *9.6.2 Setting of Modbus devices* and the *iCOM™ User Manual* for details.

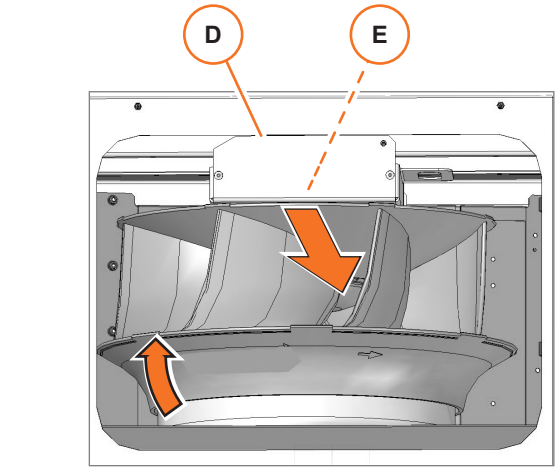
11.5.4 Replacing a fan - Upflow units



- Remove the panel [**A**].
- Disconnect the fan electrical cable from the connector.



- Remove the screw [**B**] and slowly put down the fan on its inlet collar [**C**].

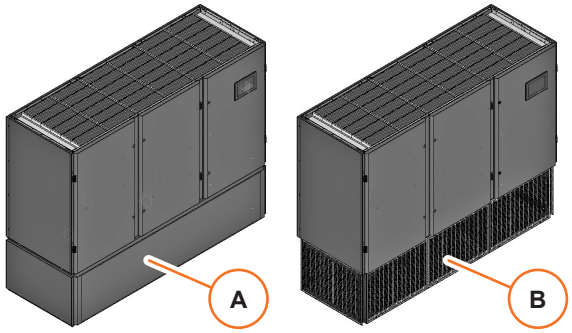


- Remove the screw [**D**].
- Lift the fan higher than its inlet collar.
- Pull the handle [**E**] to slide the fan out of the bay

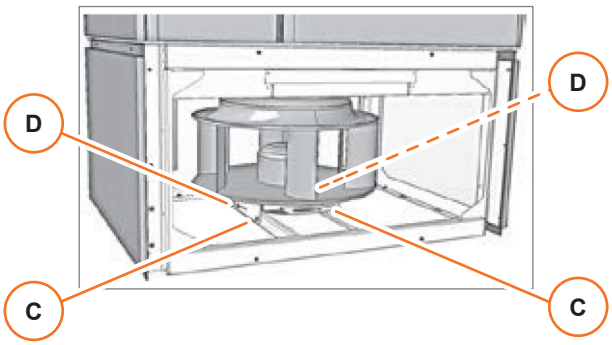
- Proceed in reverse order to reassemble the fan.

11.5.5 Replacing a fan - Downflow units

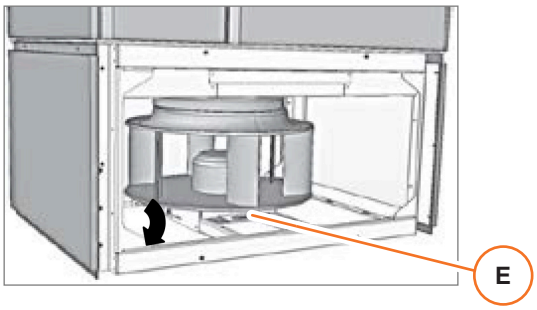
- Remove a few floor tiles in front of the fan section.
- Remove any obstacle in front of the fans to allow the fan extraction (raised floor structure, piping, ...).

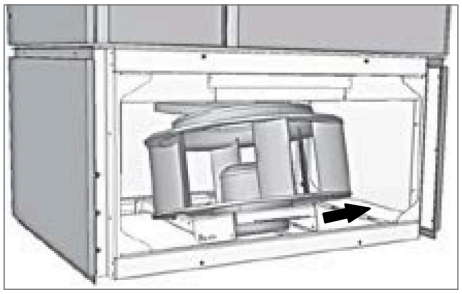


- Remove the panel [**A**] or the grid [**B**].



- Disconnect the fan electrical cable from the connector.
- Remove the two front screws [**C**] that fix the fan support to the sliding bars.
- Loosen the two back screws [**D**] that fix the fan support to the sliding bars.





- Slide down the fan by pulling the handle [**E**].
- Remove completely the two screws [**D**] on the back of the fan.
- Pull the handle to slide the fan out of the bay

- Proceed in reverse order to reassemble the fan.

11.5.6 Replacing the filter dryer

NOTICE

The spindle of the shut-off valve is protected by a cap screwed on the valve body.

The cap is secured by a seal.

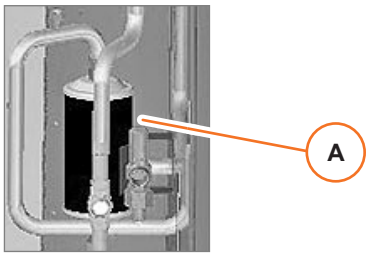
WARNING

During operation of the refrigerant system, the shut-off valve needs to remain always open, and the protective cap needs to be sealed to avoid unauthorized operation of the valve.

Any closing intervention must be performed with the refrigerant system stopped.

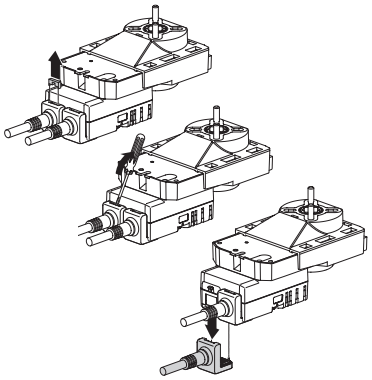
Closing intervention can be performed only by:

- Staff authorized to work on the system;
- Public servant of Competent Body;
- Before restarting the refrigerant system, the shut-off valve needs to be fully open, the protective cap must be re-attached and sealed.



- Shut-down the unit. The EEV closes completely.
- Close the shut-off valves on the piping to/from the condenser.
- Discharge and recover the refrigerant.
- Unsolder the pipings connecting the filter dryer [**A**].
- Weld the new filter dryer.

11.5.7 Replacing the valve actuator

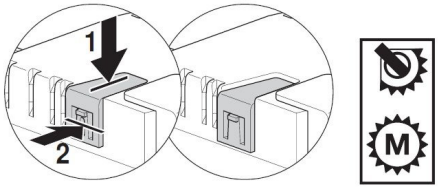


1) Turn off the unit – set the disconnection switch of the unit to position "**0**" (see chapter *10.5 Stop*)

2) Disconnect the wires from electric panel (from power and control terminals) (see wiring diagram attached to the unit for specific terminals)

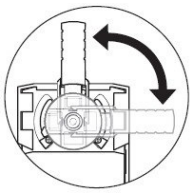
In case of PIC valve: follow procedure on the first picture to disconnect cables from actuator.

- Remove two pins from actuator's connectors with small straight screwdriver.
- Disconnect connector from actuator (see the picture beside).

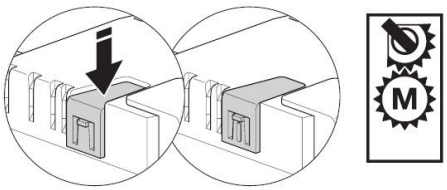


3) Set the actuator / valve into default position:

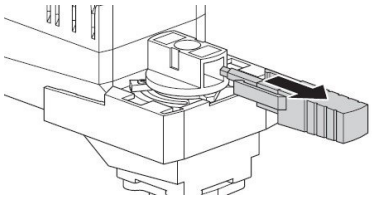
- Press the disconnect button down (**1**) and hold it in position by pressing the latch (**2**)



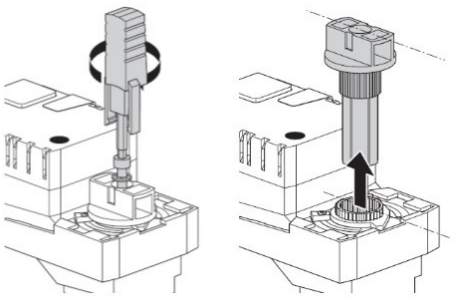
- Manually turn the valve using the actuator handle until you reach the end stop



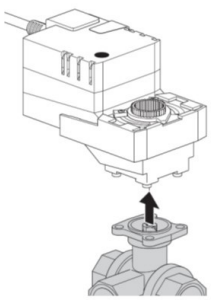
- Press the disconnect button again to release it



4) Pull the handle out. Notice the handle is equipped with hex/ Allen key



5) Hold the actuator and use this key to remove (rotate counter-clockwise) the bolt. Pull the spindle out



6) Now you can safely remove the actuator.

7) To install new actuator it is necessary to set ring to end stop. Then proceed with steps 6 – 1 in this order.

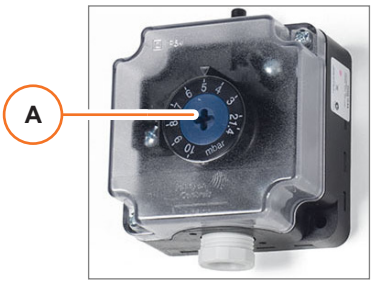
11.6 Calibrations

ENVIRONMENT

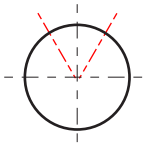
A misuse or an incorrect calibration of the unit leads to increased energy consumption, resulting in an economic and environmental damage.

For calibrations of sensors installed on the external condensers refer to the respective manual.

For control system calibrations refer to *iCOM™ User Manual*

Safety valves	See *6.4 Safety Devices Settings*
High pressure switches	**WARNING** The safety devices are mounted and calibrated by the manufacturer. • Do not tamper with the safety devices. In case of intervention of an pressure switch, press the button on the pressure switch to reset it manually.
Electronic expansion valve (EEV)	The control system monitors continuously the super-heating. The EEV is factory set for a super-heating of 6K. The super-heating must not exceed 30K. The super-heating may be different from the setpoint for variable speed compressors, while they are modulating.
Pressure transducers	Low pressure transducer range: 0 – 17,3 bar High pressure: 0 – 45 bar
Clogged filter differential pressure switch	Adjustment range: 0,5 – 4 mbar Setting: 3 mbar (300 Pa)  In case of replacement of the clogged filter differential pressure switch, then turn the screw [**A**] to adjust the setting.
Temperature safety switch (if heating is present	Setting: 120°C ± 6°C Manual reset

12. Troubleshooting

Symptom	Possible Cause	Check or Remedy
The unit does not start	No power supply to the unit	Check voltage at input terminal block
	The circuit breaker or fuse for low-voltage transformer in unit is tripped	Locate the problem in the unit electrical panel and repair
	Remote ON/OFF	Check the remote switch
	The local control switch is opened	Check the local switch (green = **ON**)
Low evaporating pressure	Low refrigerant charge	Check the refrigerant charge
	EEV problem	Check the EEV configuration
	High pressure drop on the liquid line	Check shut-OFF valve, filter drier...
High condensing pressure	High refrigerant charge	Check the refrigerant charge
	High pressure drop on the discharge line	Check shut-OFF valve, pipes
	Dirty condenser fins	Clean the drycooler
	Drycooler fans not operating	Check the fan motors and fuses
The compressor does not run or does not run properly	The connection is loose or disconnect	Check the connection to verify that is connected securely
	The phases of the fixed compressor are wrong	Check the phase sequences
	The compressor does not modulate the capacity properly	Check the Modbus connection and the inverter setting
High vibration on the unit	The compressor is not properly fixed	Check the compressor dampers
	The discharge and suction piping are not properly fixed	Check the piping
The pressure transducer does not read correctly	The sensor is not enough tight	Fix the sensor
	The sensor is fixed in a wrong position	Change the position
	The sensor has a wrong reading range	Change the sensor with a right one
The EEV temperature sensor does not read a correct value	The probe is too close to the evaporator outlet	Move the probe at least 30 cm from the evaporator outlet
	The probe is located in a wrong position	Place the probe at hour 2:00 or 10:00 
	The sensor is located after the oil injection (from the oil separator)	Move the sensor before the oil injection
A Modbus component is not read	Wrong Modbus cabling	Check the cabling
	The address name is not correct	Check the address
The fans do not run	The power cables are not connected	Connect the cables
	There is not signal	Check the Modbus chain
The unit is noisy	The compressor is noisy	Check the compressor fixing
	The fan is noisy	Check the fan fixing
High Superheating	Check if there are bubbles on sight glass	Adding refrigerant charge on the unit

13. Dismantling the Unit

The unit has been designed and built to ensure continuous operation.
The working life of some of the main components, such as the compressors, depends on the maintenance that they receive.
The unit must be dismantled if it is moved to another site, or at the end of its technical and operational life.

13.1 Safety Instructions

WARNING
Improper operations can cause injury or death.

Read carefully the chapter *1. Safety*.
Pay attention to the safety labels on the unit and to the safety warnings in this chapter.

ENVIRONMENT
While operating on the refrigerating circuit recover all the refrigerant in a container: do not allow it to escape.

ENVIRONMENT
The unit contains substances and components hazardous for the environment (electronic components, refrigerating gases and oils).
At the end of the useful life, when the unit is dismantled, the operation must be carried out by specialized refrigerating technicians.
The unit must be delivered to suitable centers specialized for the collection and disposal of equipment containing hazardous substances.
The electronic components, the refrigerating fluid and the lubricating oil inside the circuit must be recovered according to the laws in force at the installation site.

13.2 Operations

Operation	Notes
1. Disconnect the disconnecting switch from the electric power supply	Reverse the procedure from chapter *9. Installation*: *9.5.1 Power supply cable*
2. Remove the refrigerant	 ***NOTICE*** Handle the refrigerant according to regulations about F-Gases and safety data sheet. See *14. Regulation (EU) no. 517/2014 (F-gas)*
3. Drain the water system	Use drain valve on the water circuit.
4. Cut the piping at inlet and outlet of the unit	 **WARNING** Before cutting the pipeline, make sure that the circuit is completely discharged.
5. Remove the unit	Reverse the procedure from chapter *8. Assembly and Positioning*
6. Move away the unit	See *7. Handling*
7. If you need to keep the unit in a storehouse for reuse	See *3.6.1 Storage conditions*
8. If you need to scrap the unit	Handle to authorized disposal company according to the local regulations about waste disposal.

14. Regulation (EU) no. 517/2014 (F-gas)

Content of this chapter

14.1 Introduction

Stationary air conditioners placed into the European Community market and operating with fluorinated greenhouse gases (F-gas, such as R407C, R134a, R410A), have to comply with the F-gas Regulation (EU) No. 517/2014.

This Regulation is in force since Jan 1, 2015 an it replaces the Re. (EU) no. 342/2006.

This document summarizes the obligations for the operators that are responsible for the equipment during all its operative life until its disposal.

14.2 Normative References

F-gas	517/2014	Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006
Certified personnel and Companies	2015/2067	Commission Implementing Regulation (EU) 2015/2067 of 17 November 2015 establishing, pursuant to Regulation (EU) No 517/2014 of the European Parliament and of the Council, minimum requirements and the conditions for mutual recognition for the certification of natural persons as regards stationary refrigeration, air conditioning and heat pump equipment, and refrigeration units of refrigerated trucks and trailers, containing fluorinated greenhouse gases and for the certification of companies as regards stationary refrigeration, air conditioning and heat pump equipment, containing fluorinated greenhouse gases
Leak check air conditioning	1516/2007	Commission Regulation No 1516/2007 of 19 December 2007 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, standard leakage checking requirements for stationary refrigeration, air conditioning and heat pump equipment containing certain fluorinated greenhouse gases
Leak check fire protection systems	1497/2007	Commission Regulation No 1497/2007 of 18 December 2007 establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, standard leakage checking requirements for stationary fire protection systems containing certain fluorinated greenhouse gases From 01/01/2017 to be replaced by: Commission Implementing Regulation (EU) 2015/2068 of 17 November 2015 establishing, pursuant to Regulation (EU) No 517/2014 of the European Parliament and of the Council, the format of labels for products and equipment containing fluorinated greenhouse gases

14.3 Fluorinated Greenhouse Gases

Following notes have to be considered when operating with the above mentioned equipments:

- Fluorinated greenhouse gases are covered by the Kyoto Protocol.
- The fluorinated greenhouse gases in this equipment should not be vented to the atmosphere.
- Referring to the value noted in Annex I and Annex IV of Regulation (EU) No 517/2014 here below the global warming potential (GWP) of some major F-gases or mixtures:
  - R-134a GWP 1430
  - R-407C GWP 1774
  - R-410A GWP 2088

NOTE: *the refrigerants as R22 are not F-gas and their relevant regulation is Reg. (EU) no. 1005/2009.*

14.4 Operators

14.4.1 Definitions

- Operator, according to Regulation 517/2014 Article 2, point 8, means the natural or legal person exercising actual power over the technical functioning of products and equipment covered by this Regulation.
- The State may, in defined, specific situations, designate the owner as being responsible for the operator's obligations.
- Where large installations are involved, service companies are contracted to carry out maintenance or servicing. In these cases the determination of the operator depends on the contractual and practical arrangements between the parties.

14.4.2 Obligations

Operators of stationary air conditioners, which contain fluorinated greenhouse gases, shall, using all measures which are technically feasible and do not entail disproportionate cost:

a Prevent leakage of these gases and as soon as possible repair any detected leakage.

b Ensure that they are checked for leakage by certified personnel.

c Ensure for putting in place arrangements for the proper recovery by certified personnel.

d According to Regulation 517/2014 the operators shall ensure that the equipment is checked for leaks as following:

Case 1 - Non-sealed equipment contains less than 5 tonnes of CO_2 equivalent of fluorinated greenhouse gases.

► Leakage test not required

Case 2 - Hermetically sealed equipment contains less than 10 tonnes of CO_2 equivalent of fluorinated greenhouse gases.

► Leakage test not required

Case 3

► **Leakage test required:** check the equipment for leaks with the minimum frequency given in the following table:

X = Tonnes of CO_2 Equivalent	Y = equivalent amount of refrigerant [kg]			Minimum frequency for leak check	
	R134a	R410A	R407C	without leakage detection	with leakage detection
5 ≤ X < 50	3,5 ≤ Y < 35	2,4 ≤ Y < 24	2,8 ≤ Y < 28	12 Months	24 Months
50 ≤ X < 500	35 ≤ Y < 350	24 ≤ Y < 240	28 ≤ Y < 282	6 Months	12 Months
X ≥ 500	Y ≥ 350	Y ≥ 240	Y ≥ 282	3 Months	6 Months

e Recovery for the purpose of recycling, reclamation or destruction of the fluorinated greenhouse gases, pursuant to Art. 8 of the Regulation 517/2014 shall take place before the final disposal of that equipment and, when appropriate, during its servicing and maintenance.

14.5 Leakage Detection

The manufacturer approves the following leakage check methods according to Reg. 1516/2007 and Reg. 1497/2007:

	Method	Specifications
a	Check of circuits and components representing a risk of leakage with gas detection devices adapted to the refrigerant in the system	Gas detection devices shall be checked every 12 months to ensure their proper functioning. The sensitivity of portable gas detection devices shall be at least five grams per year.
b	Application of ultraviolet (UV) detection fluid or suitable dye in the circuit	The method shall only be undertaken by personnel certified to undertake activities which entail breaking into the refrigeration circuit containing fluorinated greenhouse gases.
c	Proprietary bubble solutions/soapsuds	---

14.6 Labelling

The label applied on the unit (see *Onboard Label*) is designed to fill-in the relevant amounts of refrigerant according to Regulation 1494/2007 (2015/2068):

Where fluorinated greenhouse gas is foreseen to be added to the equipment outside of the manufacturing site at the point of installation, a dedicated label accommodates notation of both the quantity [kg] pre-charged in the manufacturing plant and of the quantity charged at the installation site as well as the resulting total quantity of F-gas as a combination of the above mentioned quantities, in a manner which conforms to the legibility and indelibility.

Our split units are usually not pre-charged on factory, in this case the total quantity of refrigerant charged in the unit has to be written in the relevant label, during the commissioning operation at the installation site.

a All of the quantities of must be given both as mass of refrigerant [kg] and as Tonnes of CO_2 Equivalent.

Use the following rule for computation:

$$\text{Tonnes of } CO_2 = \frac{\text{kg of refrigerant x GWP of refrigerant}}{1000}$$

where:

Refrigerant	GWP
R-134a	1430
R-407C	1774
R-410A	2088

b Our packaged units (not split) operating with F-gas are usually full charged on factory and the total amount of refrigerant charge is already reported on the label. In this case, the label has no need of further written information.

c In general, the above mentioned information has been located in the main nameplate of relevant unit.

d For equipment with double refrigeration circuits, in regards to differentiates requirements on the basis of the quantity of F-gas contained, the required information about refrigerant charge quantities has to be listed separately for each individual circuit

e For equipment with separate indoor and outdoor sections connected by refrigerant piping, the label information will be on that part of the equipment which is initially charged with the refrigerant. In case of a split system (separate indoor and outdoor sections) without a factory pre-charge of refrigerant, the mandatory label information will be on that part of the product or equipment which contains the most suitable service points for charging or recovering the fluorinated greenhouse gas(es).

NOTE: *Safety data sheets of F-gases used in the products are available on demand.*

14.7 Record Keeping

Operators of equipment which is required to be checked for leaks (see *14.5 Leakage Detection*), shall establish and maintain records for each piece of such equipment specifying the following information:

a the quantity and type of fluorinated greenhouse gases installed

b the quantities of fluorinated greenhouse gases added during installation, maintenance or servicing or due to leakage

c whether the quantities of installed fluorinated greenhouse gases have been recycled or reclaimed, including the name and address of the recycling or reclamation facility and, where applicable, the certificate number

d the quantity of fluorinated greenhouse gases recovered

e the identity of the undertaking which installed, serviced, maintained and where applicable repaired or decommissioned the equipment, including, where applicable, the number of its certificate

f the dates and results of the leak checks carried out (see *14.5 Leakage Detection*)

g if the equipment was decommissioned, the measures taken to recover and dispose of the fluorinated greenhouse gases

Unless the records are stored in a database set up by the competent authorities of the Member States the following rules apply:

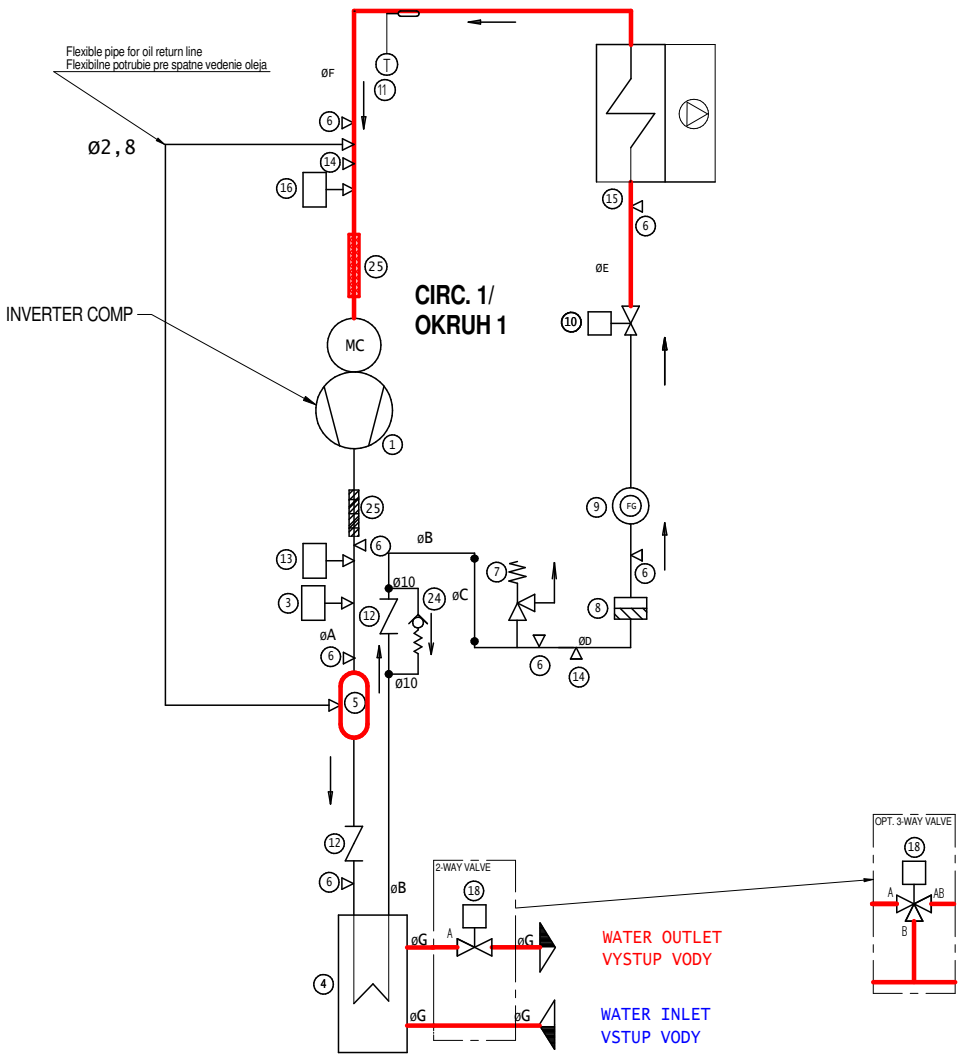
a the operators shall keep the records for at least five years

b undertakings carrying out activities for operators shall keep copies of the records for at least five years

Annex A - Refrigerating Circuit Diagrams

Content

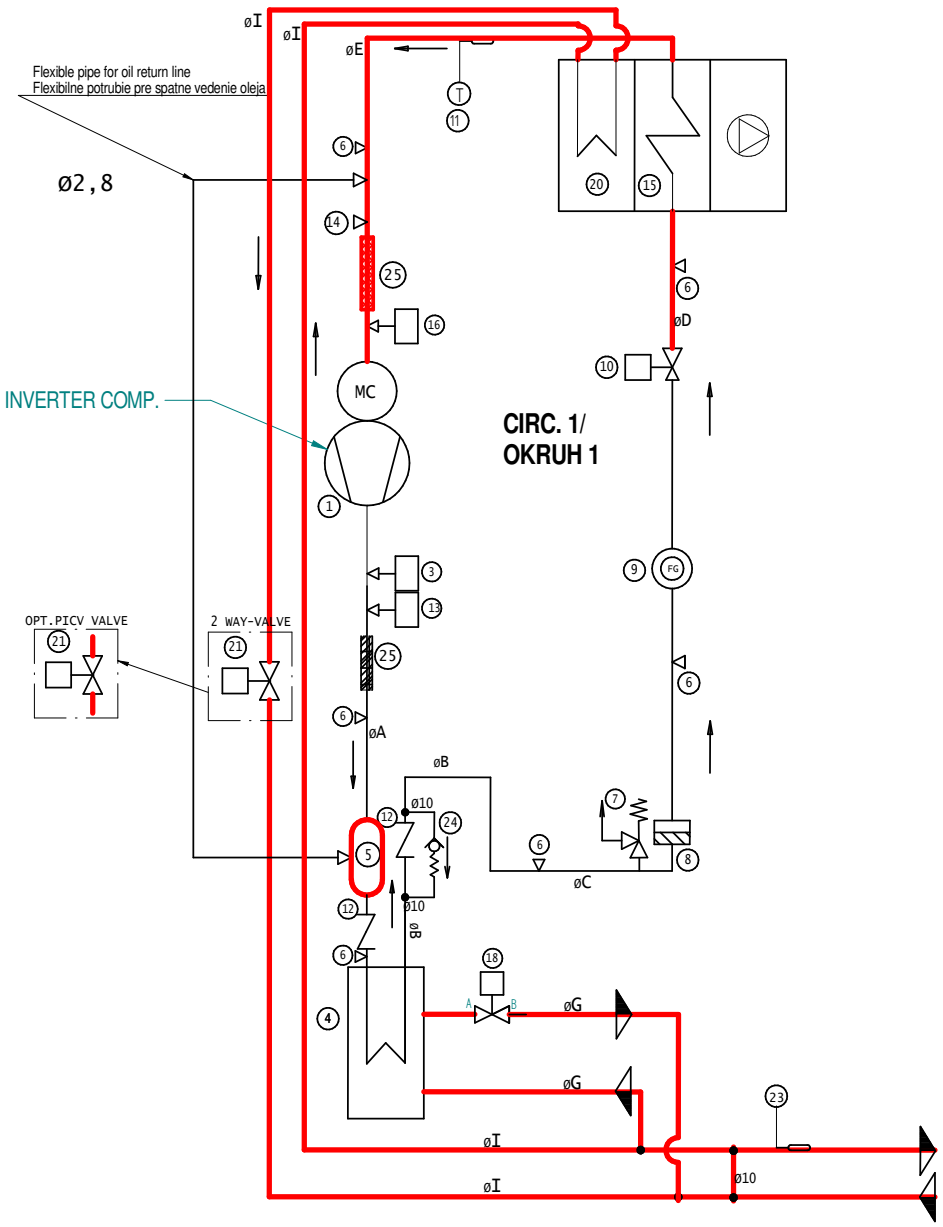
1 - PI025 - PI045 Water cooled (W)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
18	Condensing Regulation Water Valve
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)
25	Vibration adsorber

Pipe insulation

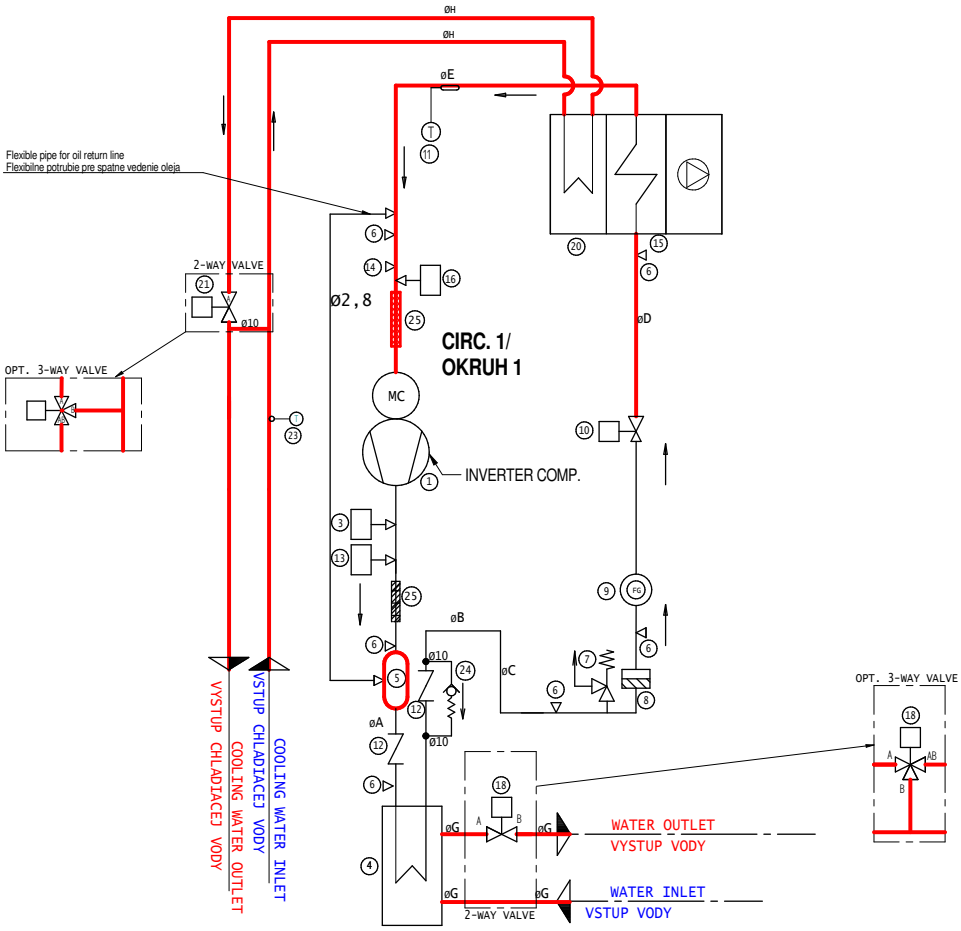
2 - PI025 - PI045 Free cooling (F)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
18	Condensing Regulation Water Valve
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)
25	Vibration adsorber

Pipe insulation

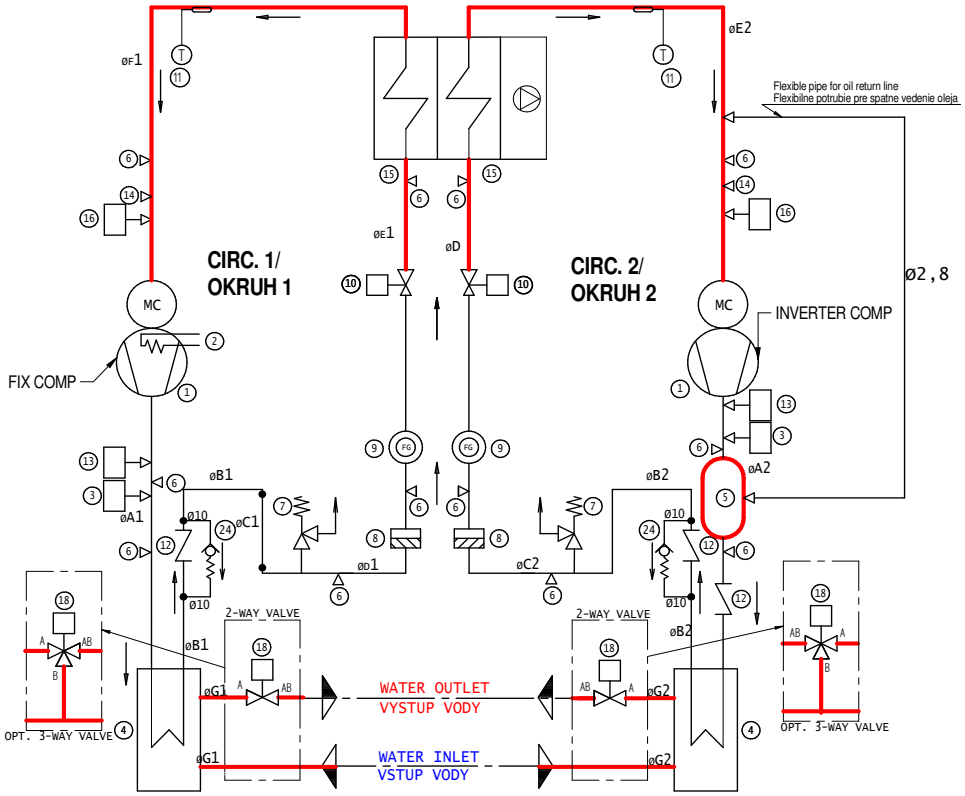
3 - PI025 - PI045 Dual fluid water cooled (H)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
18	Condensing Regulation Water Valve
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)
25	Vibration adsorber

Pipe insulation

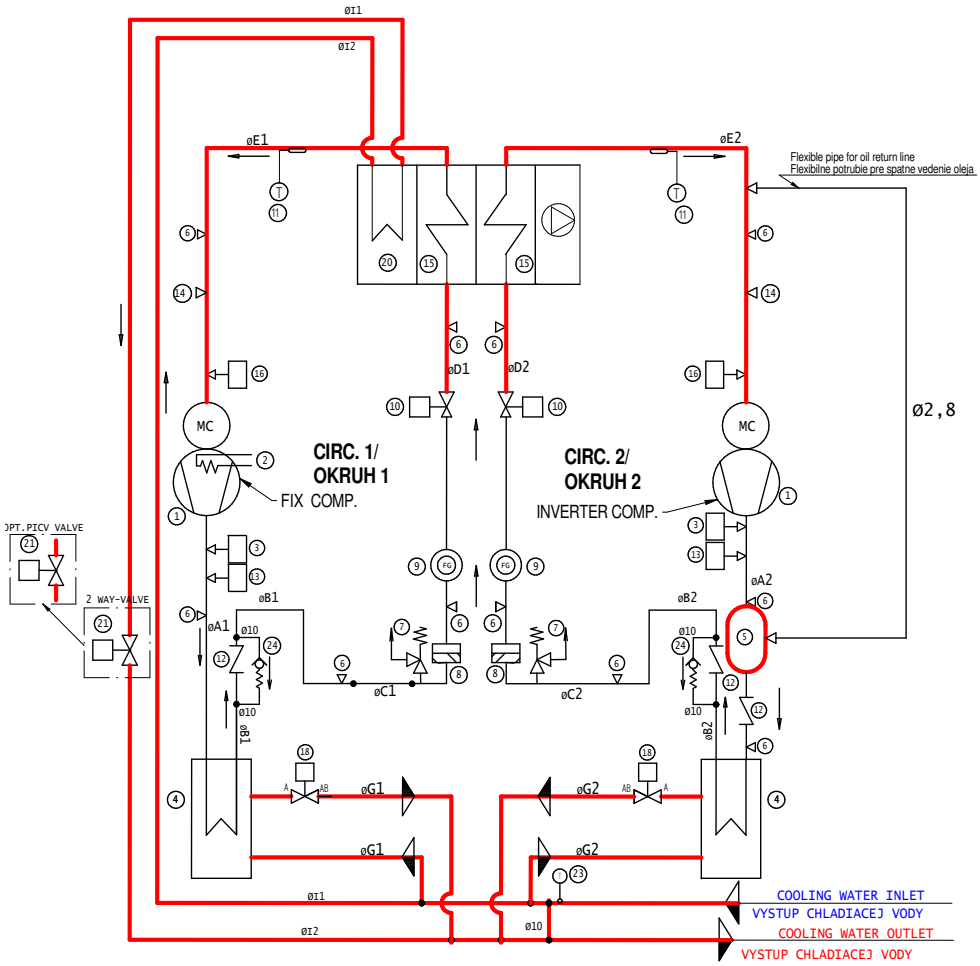
4 - PI062 - PI092 Water cooled (W)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
18	Condensing Regulation Water Valve
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)

Pipe insulation

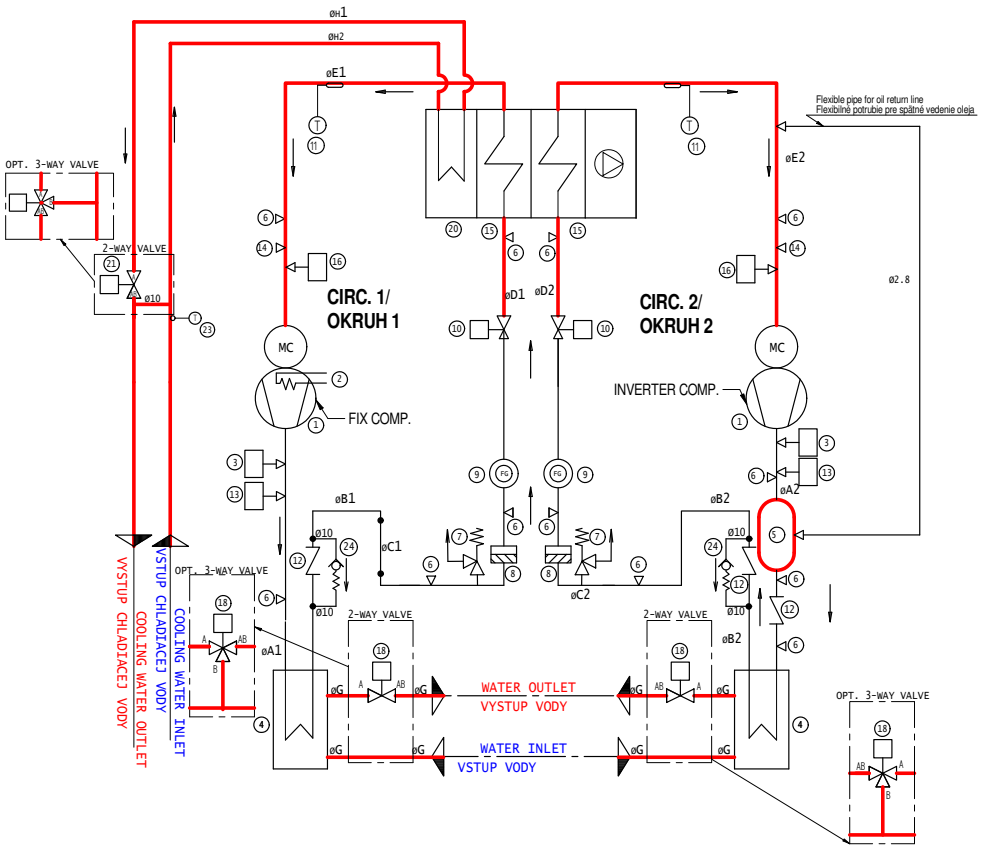
5 - PI062 - PI070 Free cooling (F)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
17	Temperature Discharge Sensor
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)

Pipe insulation

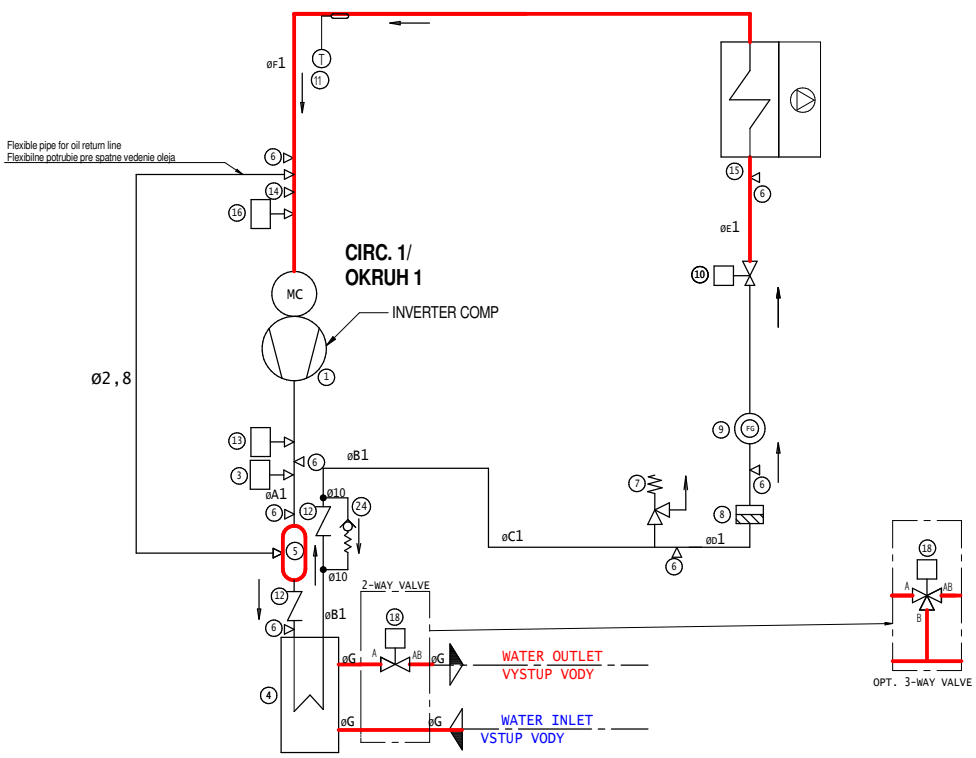
6 - PI062 - Dual fluid water cooled (H)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
18	Condensing Regulation Water Valve
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)

Pipe insulation

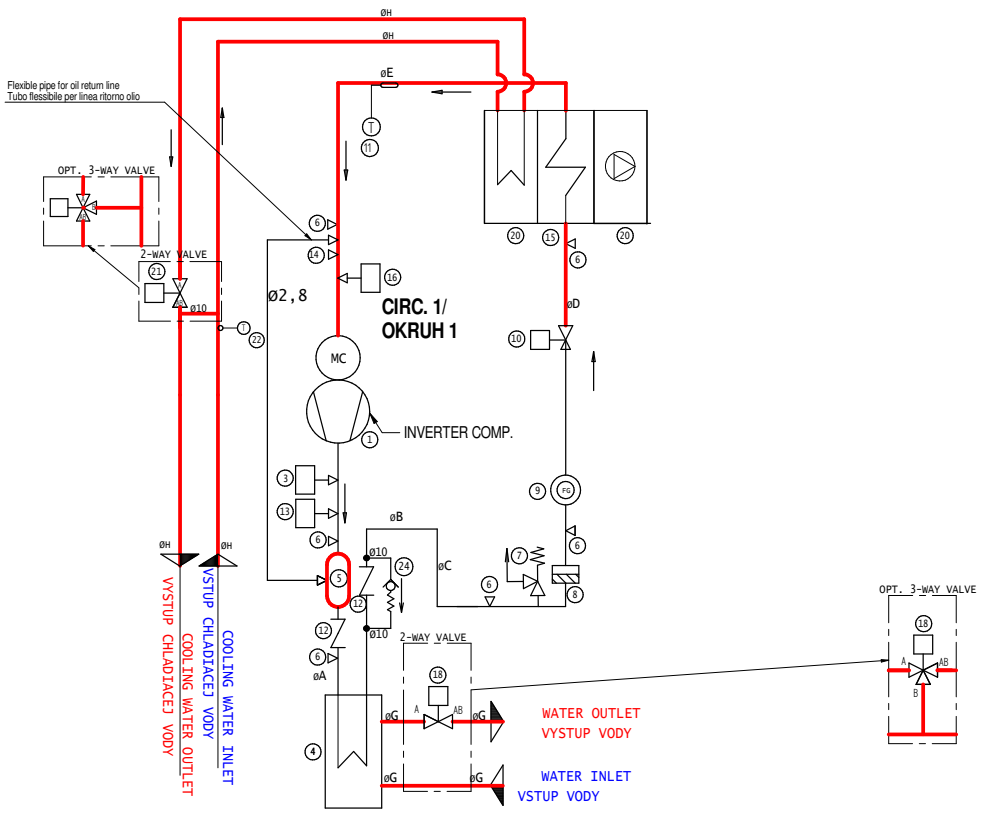
7 - PI059 - Water cooled (W)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
18	Condensing Regulation Water Valve
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)

Pipe insulation

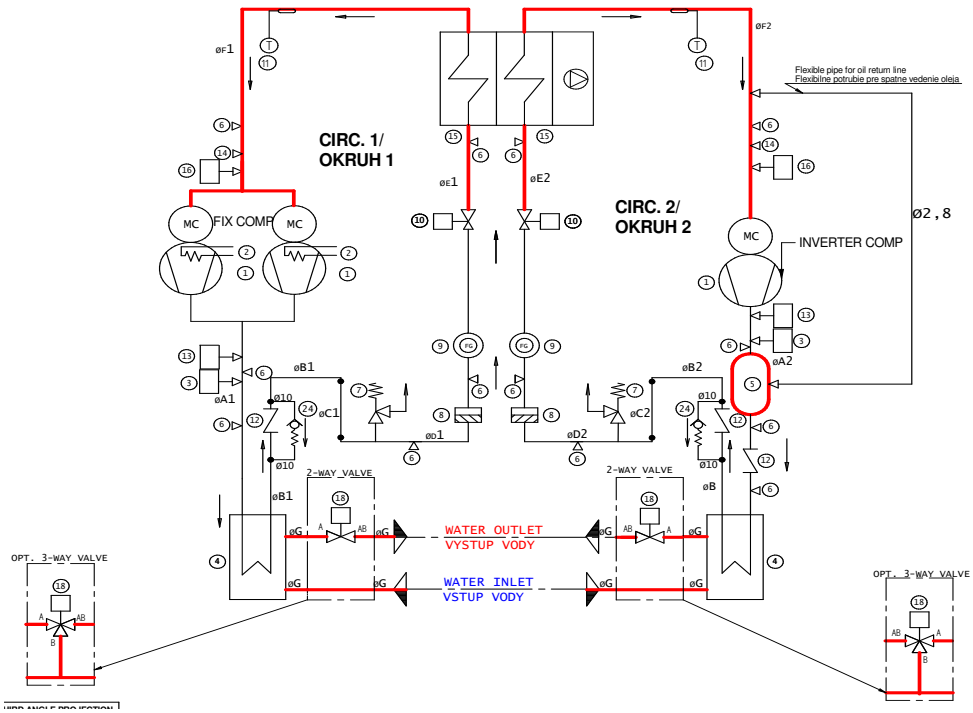
8 - PI055 - Free cooling (F)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
18	Condensing Regulation Water Valve
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)

Pipe insulation

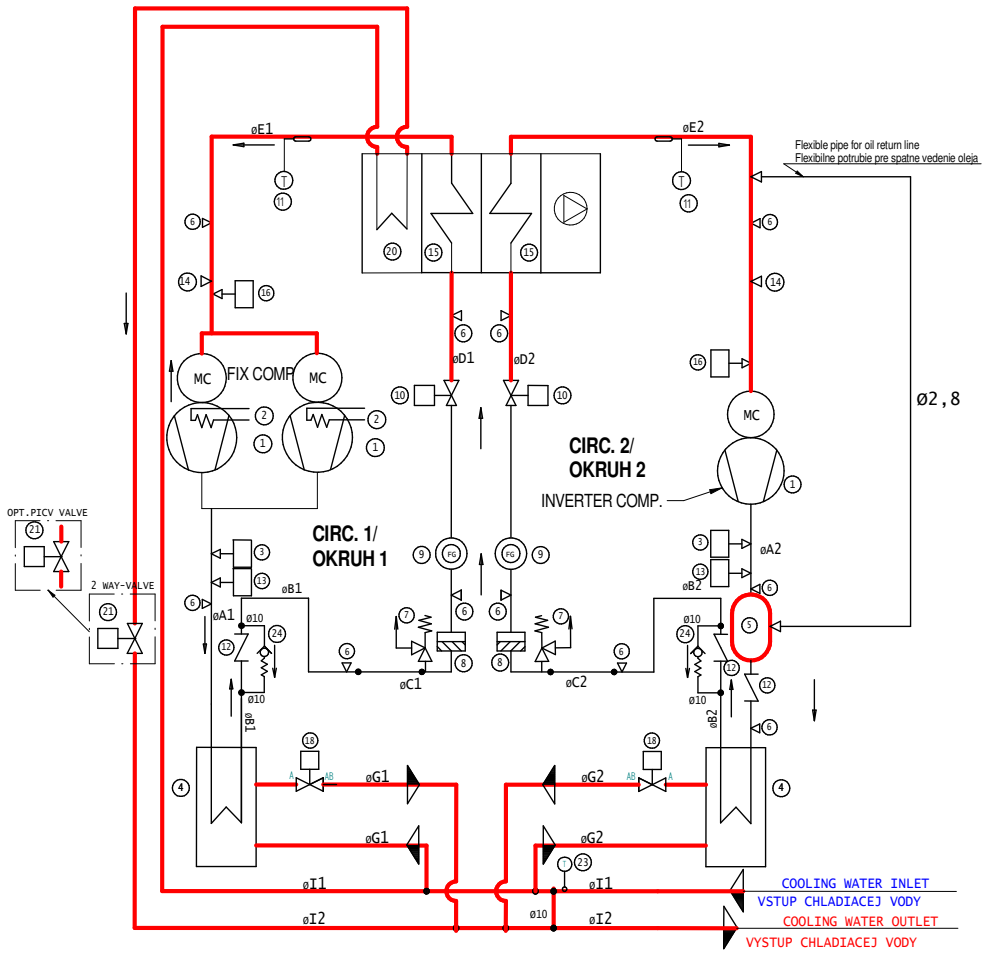
9 - PI104 - PI150 - Water cooled (W)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
18	Condensing Regulation Water Valve
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)

Pipe insulation

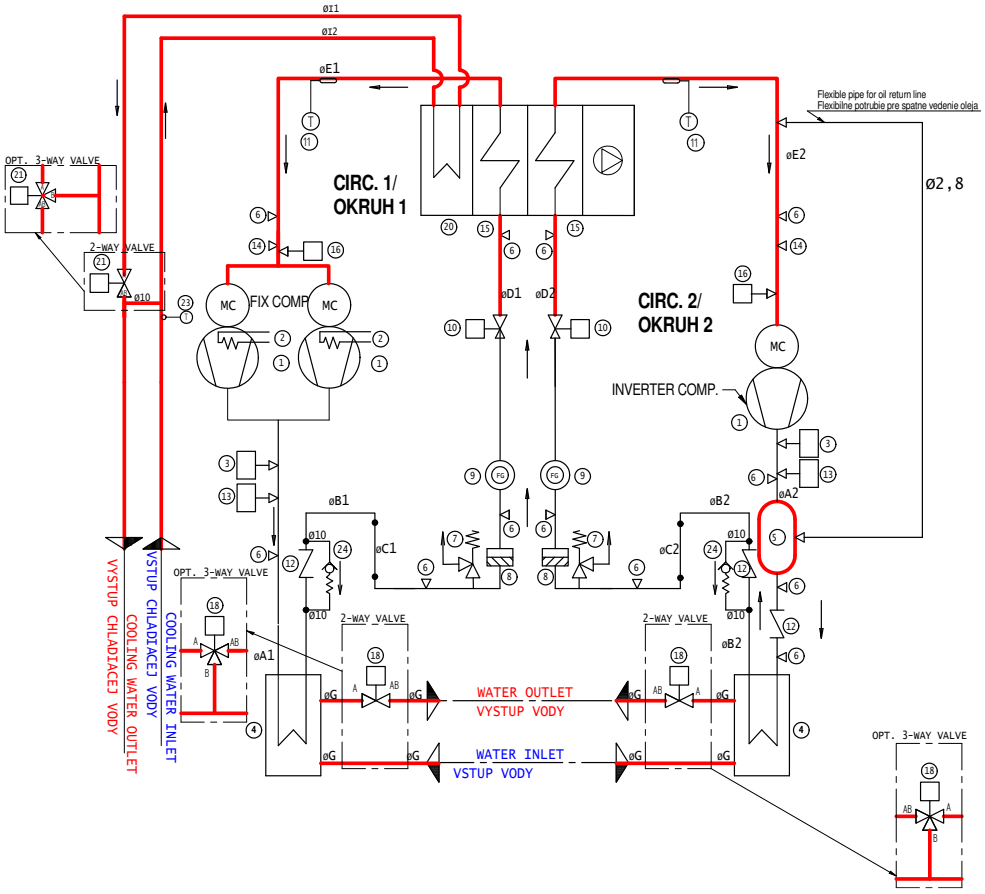
10 - PI104 - PI140 - Free cooling (F)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
18	Condensing Regulation Water Valve
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)

Thermal insulation

11 - PI104 - Dual fluid water cooled (H)



Ref.	Description
1	Compressor
2	Crankcase Heater
3	High Pressure Switch
4	Water Cooled Condenser
5	Oil Separator
6	Access Valve 5/16
7	Safety Valve
8	Filter Dryer
9	Sight Glass
10	Electronic Expasion Valve EEV
11	Temperature Sensor For EEV
12	Check Valve
13	High Pressure Transducer
14	Access Valve 1/4
15	Evaporator
16	Low Pressure Trasducer
18	Condensing Regulation Water Valve
19	Pressure Trasducer Cond. Regulation
20	Chilled Water Coil
21	Chilled Water 2 Way Valve
22	Manual Bleed Valve
23	Inlet Water Sensor
24	Check Valve 10 bar (145psi)

Pipe insulation

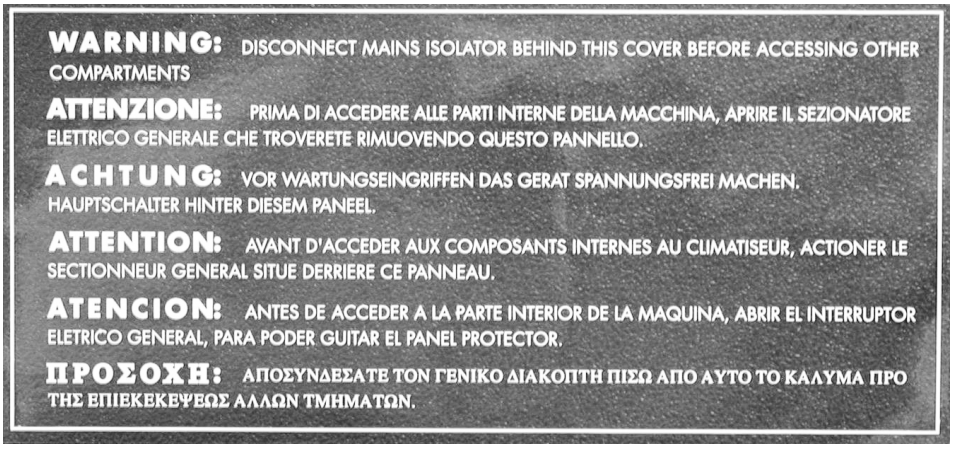
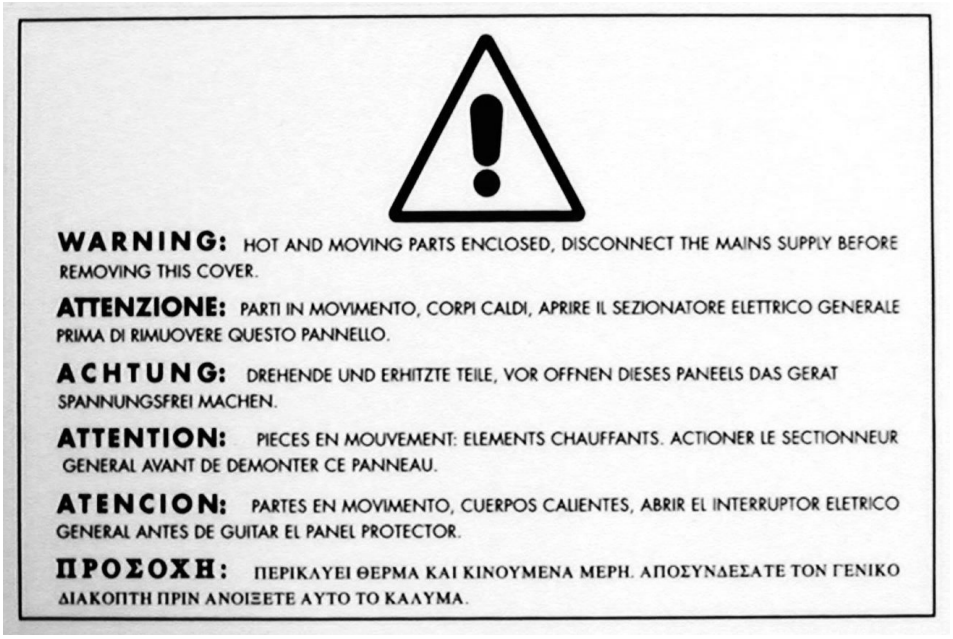
Annex B - Safety Labels

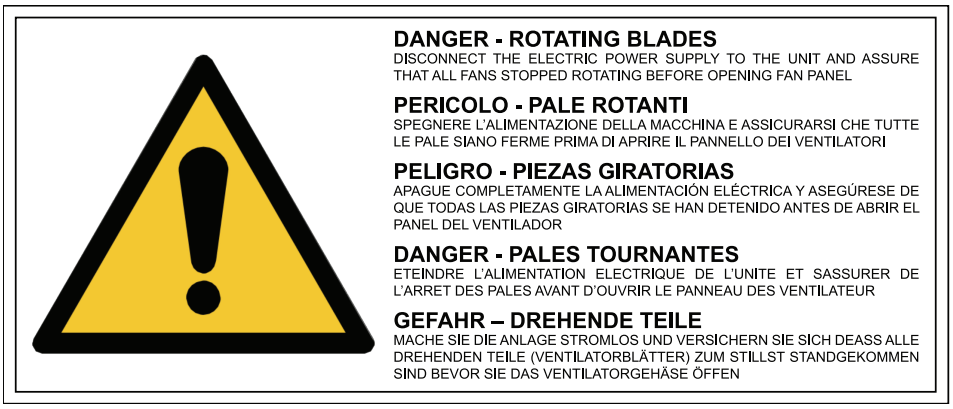
Content

WARNING

Do not remove or cover the labels placed on the unit by the manufacturer.
Check regularly that the warning label are still on the unit and that they are clearly visible.
Replace any missing or damaged label.

1 - Labels list

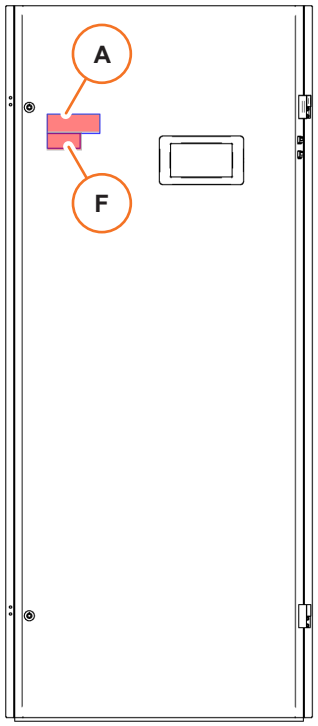
Identification	Description
A	
B	

Identification	Description
C	
D	
E	
F	

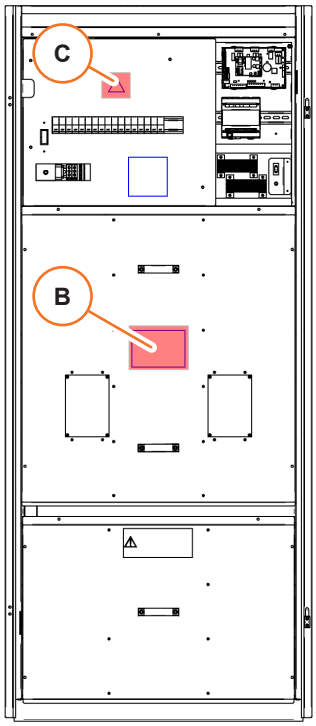
2 - Labels position

Frame type 1 (1 bay)

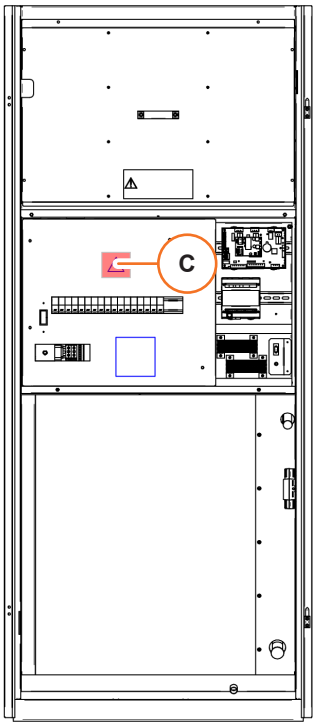
Downflow/Upflow - Outside



Downflow - Inside

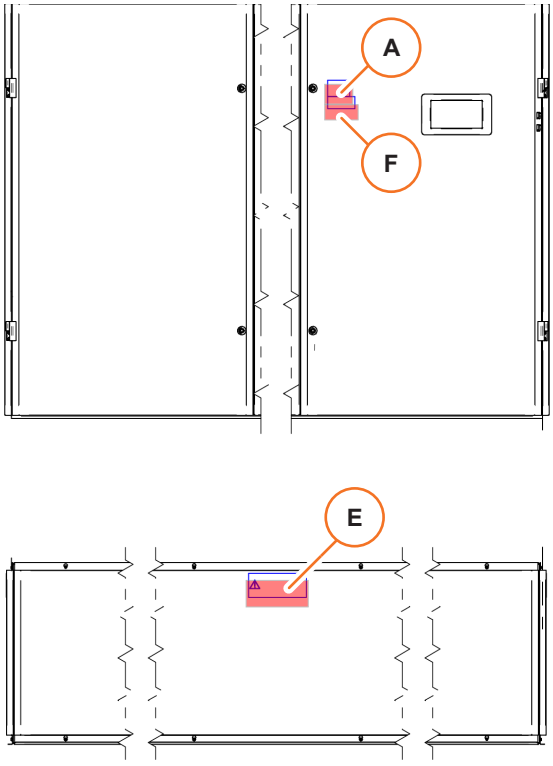


Upflow - Inside

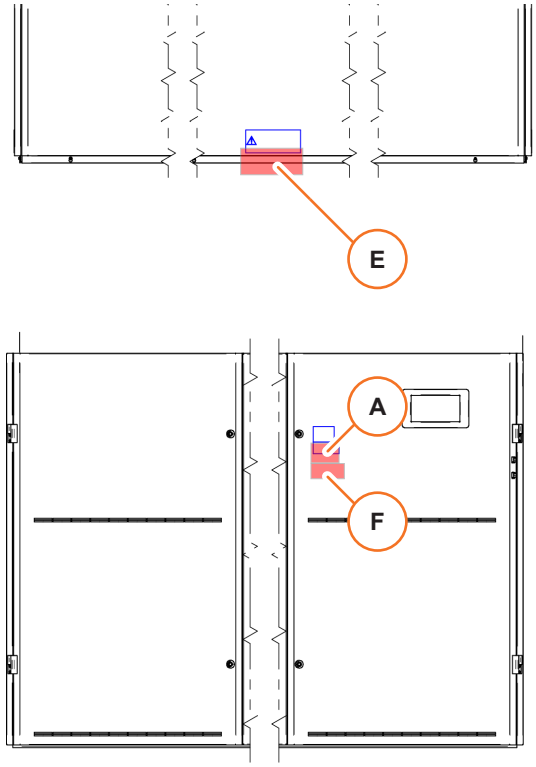


Frame types 2, 3, 5 (1,5 / 2 / 3 bays)

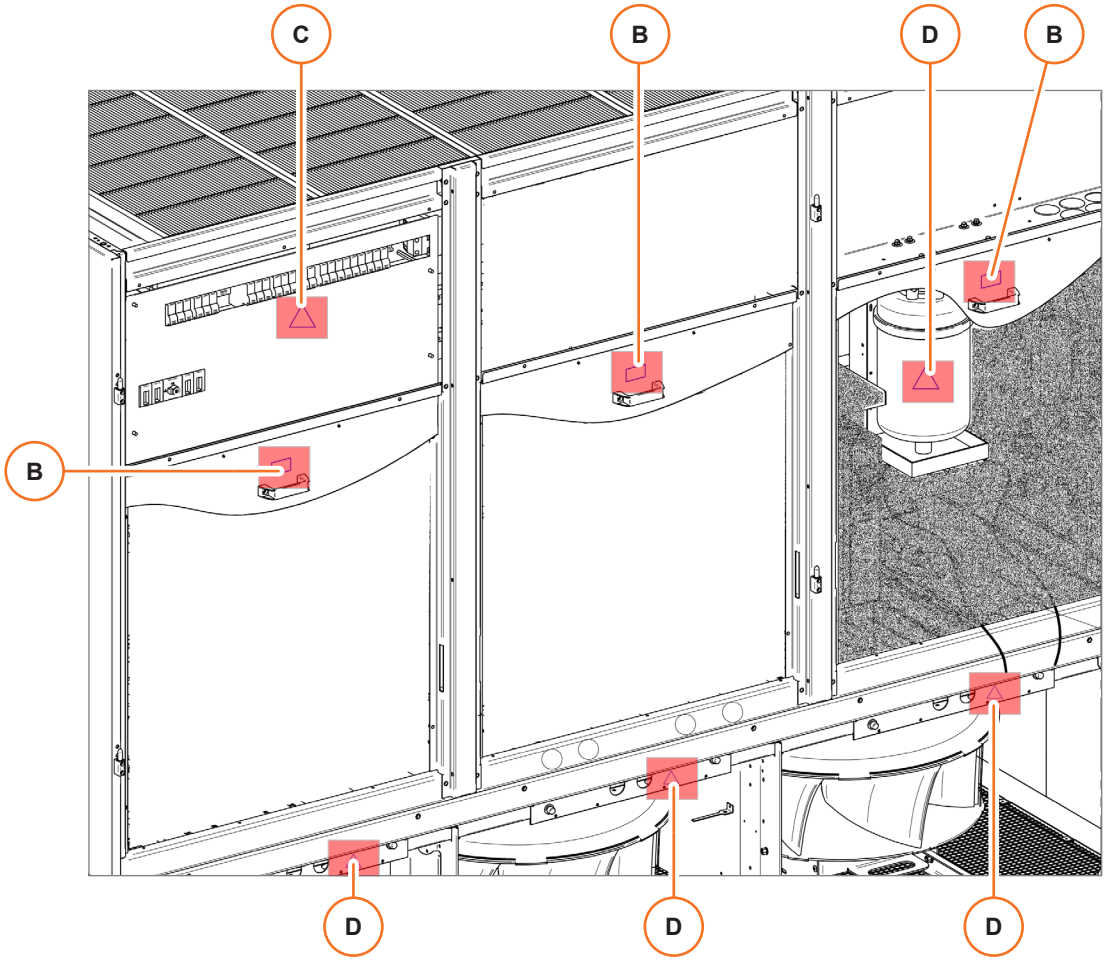
Downflow - Outside



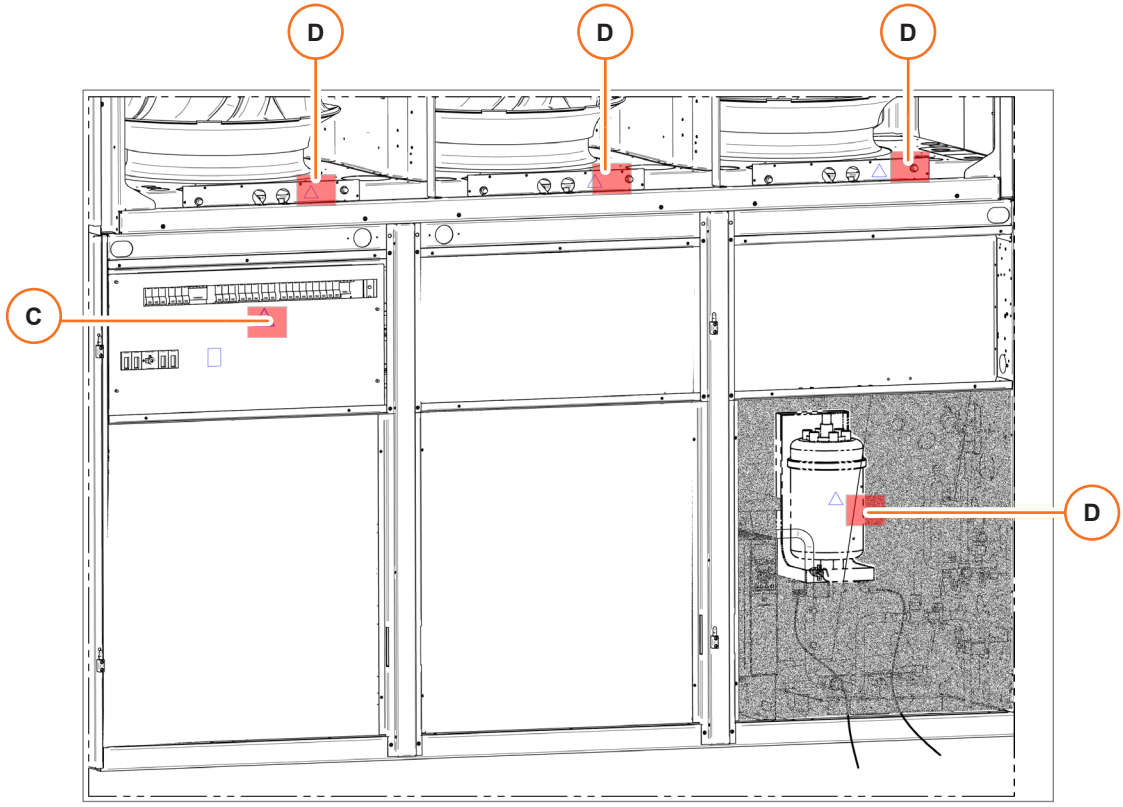
Upflow - Outside



Downflow - Inside



Upflow - Inside



Annex C - Dimensions and Weights

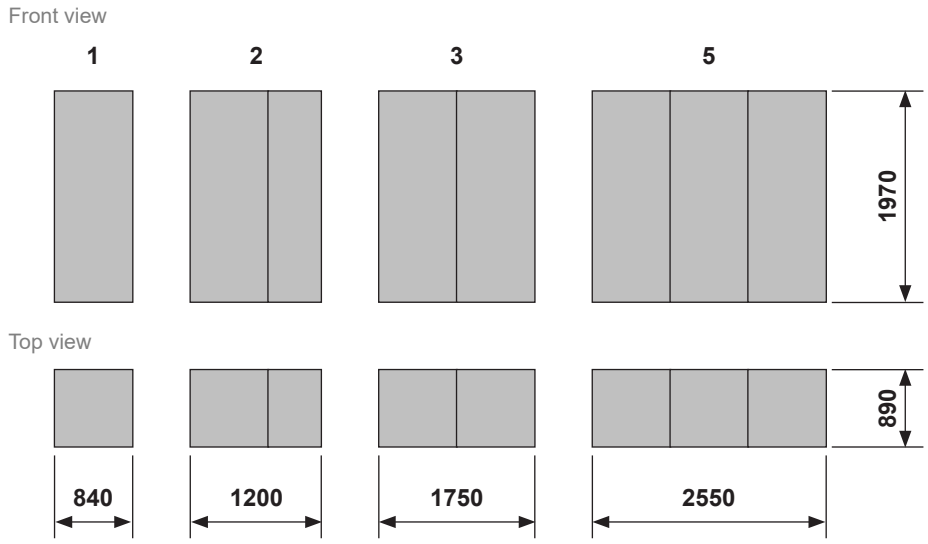
Content

1 - Overview

Identify the model and air distribution of your unit	See *2. Digit Nomenclature*
Identify the type of frame of your unit	See *6.1 Structure*
Find the overall dimensions for the unit frame, without accessories	See in this annex: *2 - Overall dimensions* *3 - Height from the floor*
Check which accessories are mounted on the unit	See *Annex F - Accessories*
Find the dimensions of the accessories Calculate the total height of the unit	See in this annex: *4 - Height of the accessories at bottom* *5 - Height of the accessories on top*
Check if there is enough free space at top and bottom of the unit	See in this annex: *6 - Free space from the floor* *7 - Free space from the ceiling*
If you are going to install a Downflow unit: find the dimensions of the hole in the raised floor	See in this annex: *8 - Hole in the floor for Downflow Up units* *9 - Hole in the floor for Downflow Down units*
Check if there is enough free space for service in front of the unit	See *9.3.2 Space requirements*

2 - Overall dimensions

Standard units

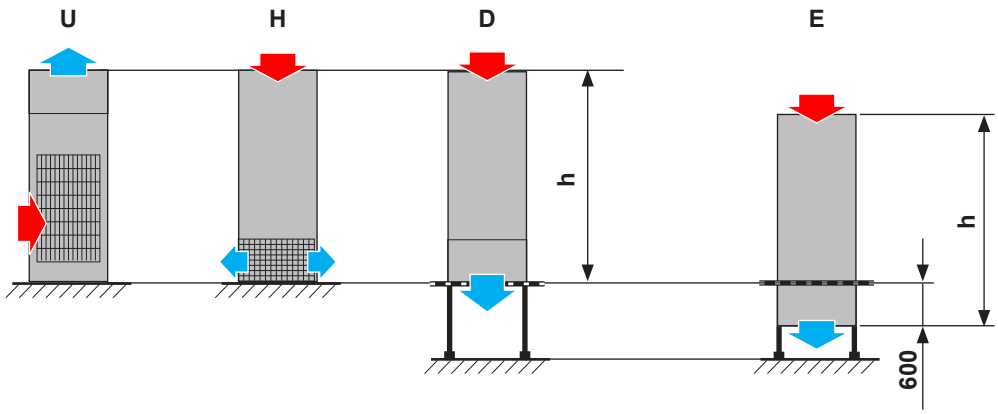


The figure above shows the dimensions of the standard units, by frame type, without any accessory.

Extended units

The figure above shows the dimensions of the extended units, by frame type, without any accessory.

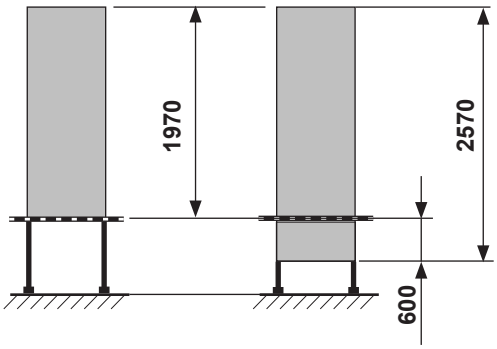
3 - Height from the floor



Standard h = 1970 mm

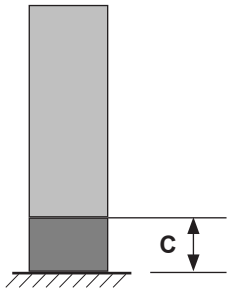
Extended h = 2570 mm

The figure above shows the height from the floor for each air distribution configuration.



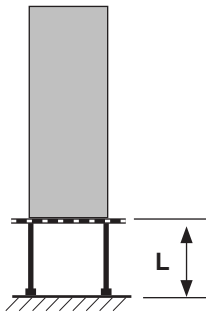
NOTE *The top of an extended unit placed under a raised floor will be at the same height as the top of a standard unit placed on the floor*

4 - Height of the accessories at bottom



U - Upflow
H - Downflow Frontal

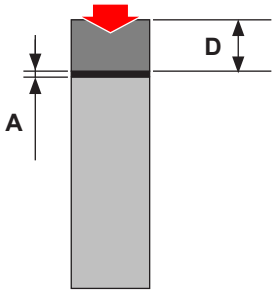
Base module	Height [**C**]: - 200 mm
Base module H 600/300 mm with rear air intake	Height [**C**]: - 600 mm for rear/bottom air intake - 300 mm for bottom air intake



D - Downflow Up
E - Downflow Down

Legs kit	The height [**L**] is adjustable within the following ranges: - 30–370 mm - 370–570 mm - 570–800 mm
Base frame	The height [**L**] is adjustable within the following range: - 120–800 mm

5 - Height of the accessories on top

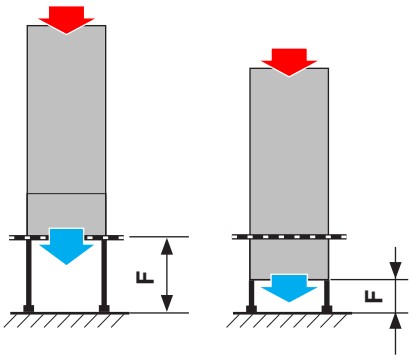


H - Downflow Frontal
D - Downflow Up
E - Downflow Down

Connecting flange (accessory needed to mount other accessories on top of the unit)	Height [**A**] 50 mm
Accessory on top of the unit	Height [**D**]: see the table below.

Accessory	Height D [mm]	+ Height A of connecting flange [mm]
Vertical flow extension hood	500 - 600 - 700 - 800 - 900	50
Hood with high efficiency air filter	600 - 900	50
Plenum with silencing cartridges	600 - 900	50
Horizontal hood with grid	600	50
Air economizer	850	50

6 - Free space from the floor

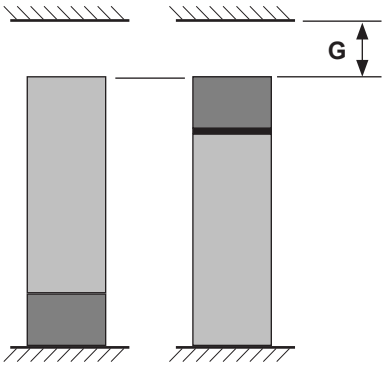


D - Downflow Up
E - Downflow Down

Free space [**F**] between the bottom of the unit and the floor

- Maximum: 800 mm, which is the maximum available height for the base frame or legs kit (see above).
- Minimum to obtain the declared performances: 600 mm
- Minimum allowable to obtain the minimum working conditions: 300 mm

7 - Free space from the ceiling

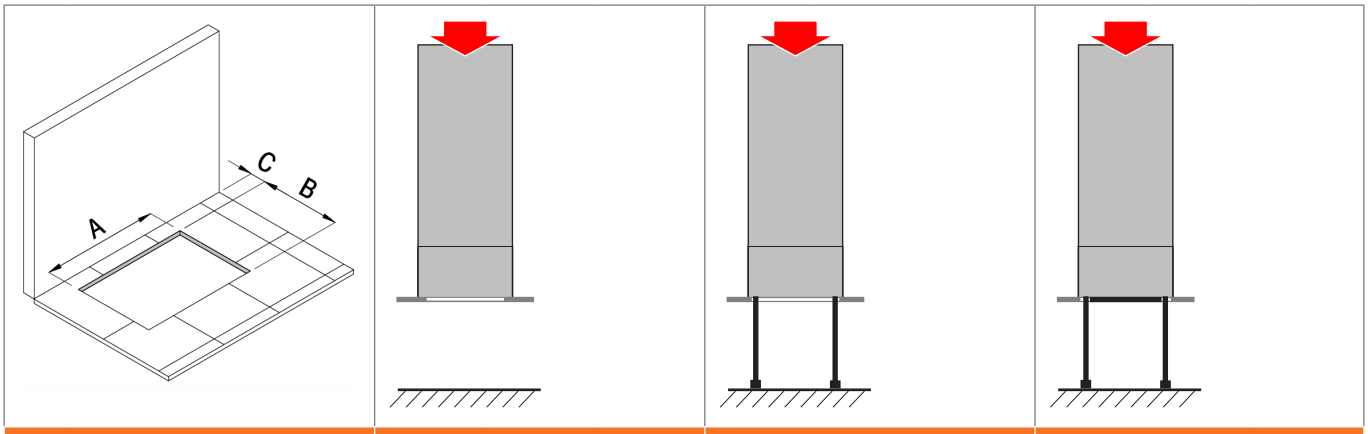


H - Downflow Frontal
D - Downflow Up
E - Downflow Down

Free space [**G**] between the ceiling and the unit top, including any accessory mounted on top or bottom

- Minimum to obtain the declared performances: 600 mm
- Minimum allowable to obtain the minimum working conditions: 300 mm

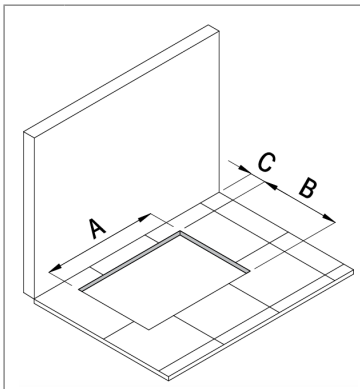
8 - Hole in the floor for Downflow Up units

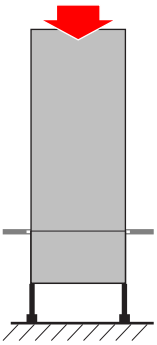


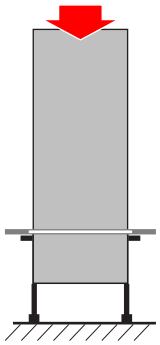
Frame type	No accessories for support			With legs kit			With base frame		
	A [mm]	B [mm]	C [mm]	A [mm]	B [mm]	C [mm]	A [mm]	B [mm]	C [mm]
1 (840 × 890)	740	760	70	Not available			804	830	30
2 (1200 × 890)	1 100	760	70	1 156	820	30	1 176	840	30
3 (1750 × 890)	1 650	760	70	1 706	820	30	1 726	840	30
5 (2550 × 890)	2 450	760	70	2 506	820	30	2 526	840	30
7 (3350 × 890)	3 250	760	70	3 306	820	30	3 326	840	30
10 (3200 × 1050)	3100	900	70	3150	950	30	3160	980	30

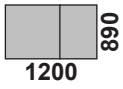
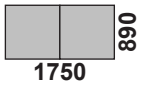
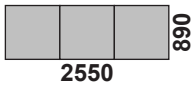
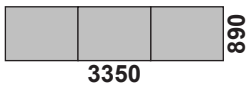
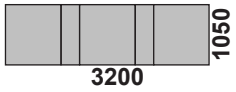
NOTE *[C] is the minimum free space between the unit at its final position and any back wall or obstacle. You might need more space for assembly or installation operations. In that case, do the assembly or installation operation nearby and then place the unit at the final position.*

9 - Hole in the floor for Downflow Down units







Frame type	No accessories for support			With floor tiles support kit		
	A [mm]	B [mm]	C [mm]	A [mm]	B [mm]	C [mm]
1 	Not available			Not available		
2 	1 182	846	20	1 220	885	50
3 	1 732	846	20	1 770	885	50
5 	2 532	846	20	2 570	885	50
7 	3 332	846	20	3 370	885	50
10 	3182	1006	20	3220	1045	50

NOTE *[C] is the minimum free space between the unit at its final position and any back wall or obstacle. You might need more space for assembly or installation operations. In that case, do the assembly or installation operation nearby and then place the unit at the final position.*

10 - Weights

Table 36 - Unit weight

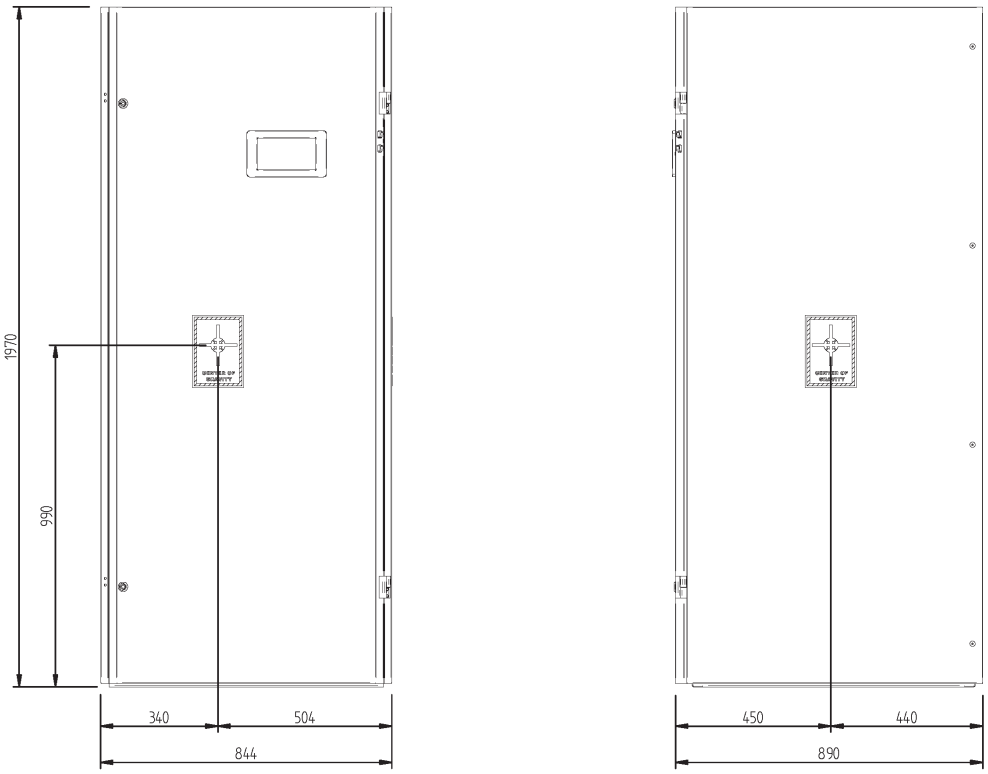
Unit Model	Unit Weight [kg] W	Unit Weight [kg] F	Unit Weight [kg] H	Packaging Weight [kg]
PI025	349	365	370	19
PI045	491	545	545	23
PI055	---	517	---	23
PI059	479	---	---	23
PI062	749	830	827	28
PI070	---	689	---	28
PI092	652	---	---	28
PI104	1027	1113	1112	42
PI140	---	1487	---	58
PI150	1180	---	---	58

Table 37 - Fan module weight

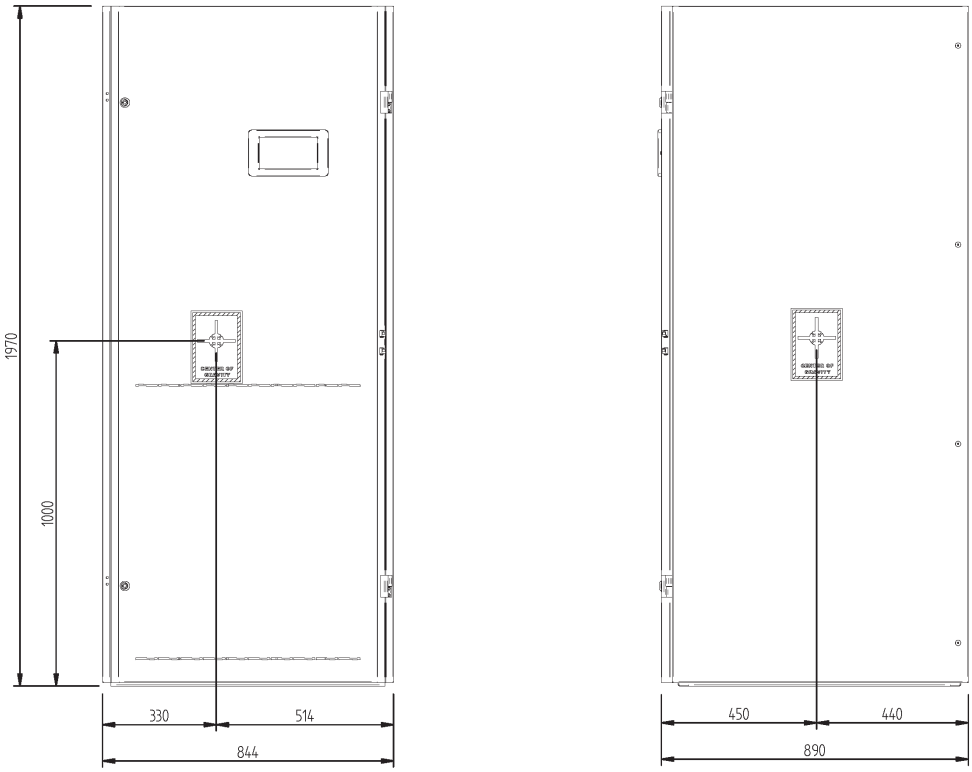
Type	Model	Unit Weight [kg]	Packaging Weight [kg]
Base Frame	**BFX12**	91	26
	BFX17	150	35
	BFX32	380	78
	BFX33	325	78
Base Module	**BMX12**	132	26
	BMX17	200	35
	BMX32	460	78
	BMX33	405	78
Fan Top Plenum	**TPX12**	132	26
	TPX17	200	35
	TPX33	---	---

11 - Gravity centers

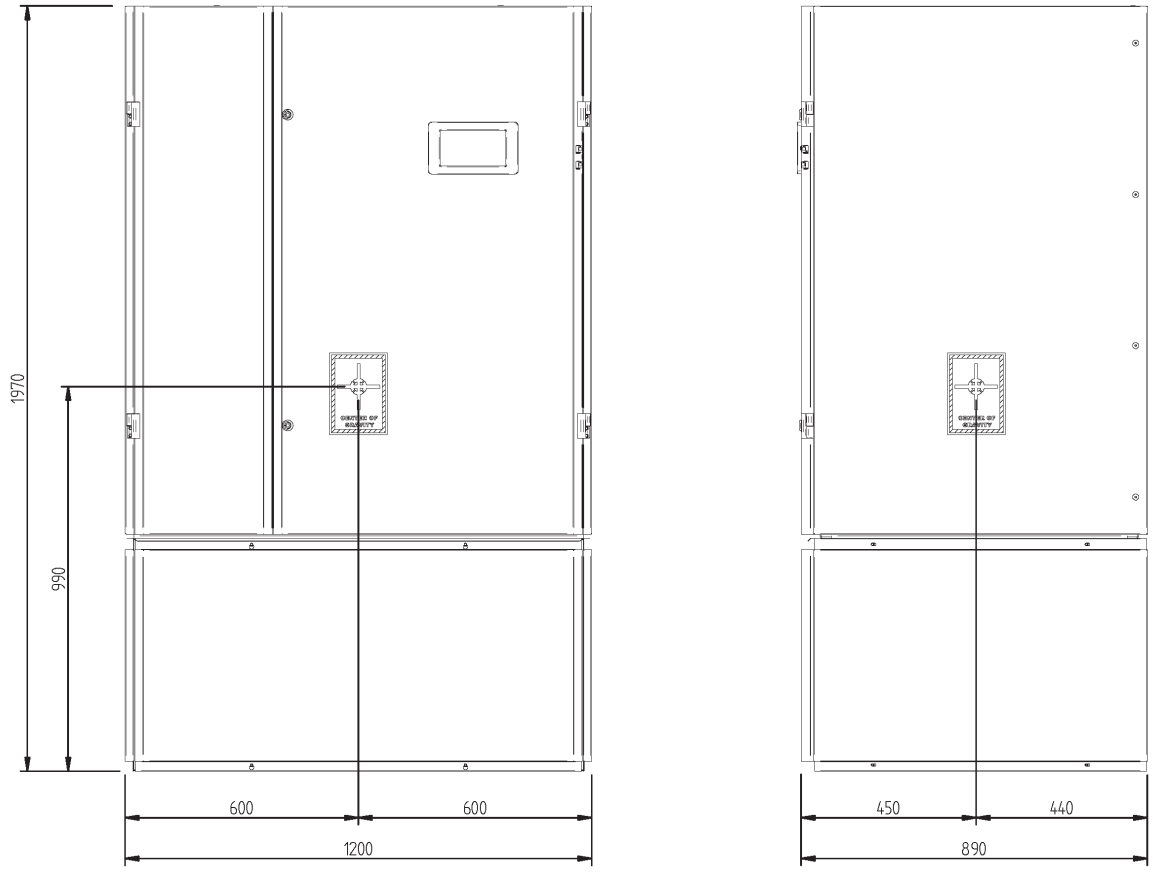
Gravity center - Frame type 1 (1 bay) - Downflow



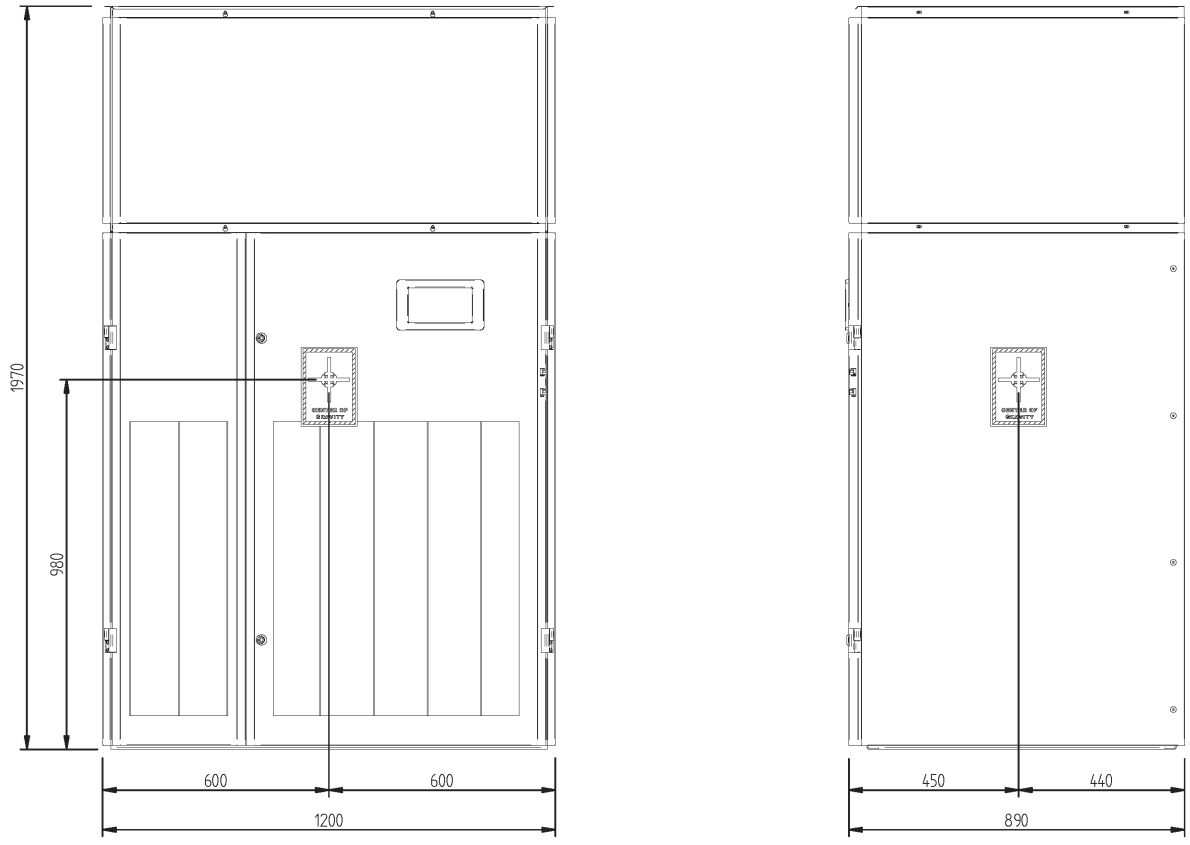
Gravity center - Frame type (1 bay) - Upflow



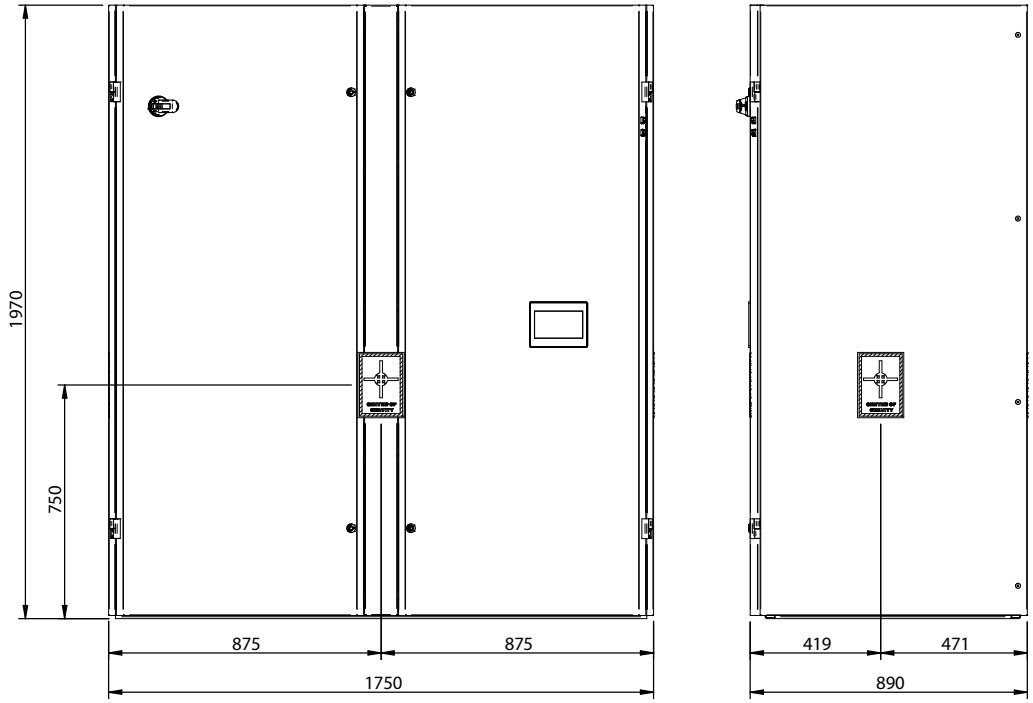
Gravity center - Frame type 2 (1,5 bays) - Downflow



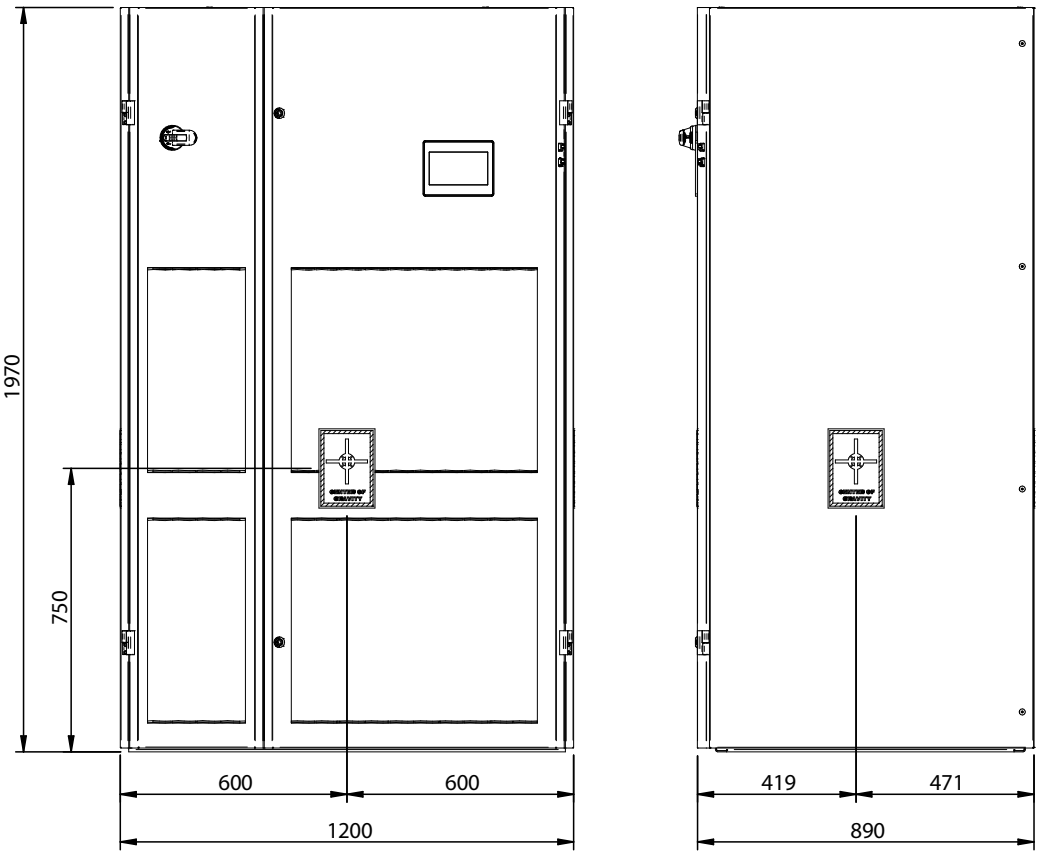
Gravity center - Frame type 2 (1,5 bays) - Upflow



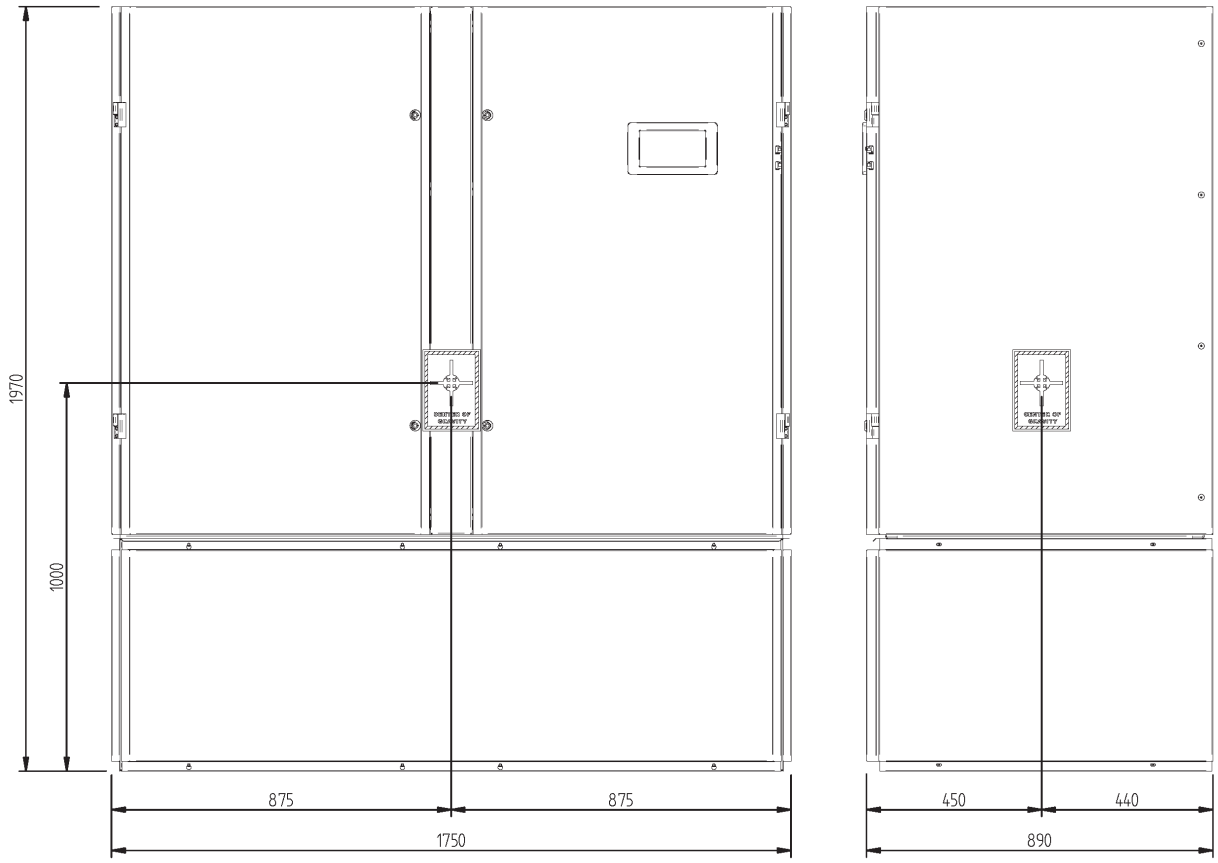
Gravity center - Frame type 2 (1,5 bays) - Downflow Extended Height



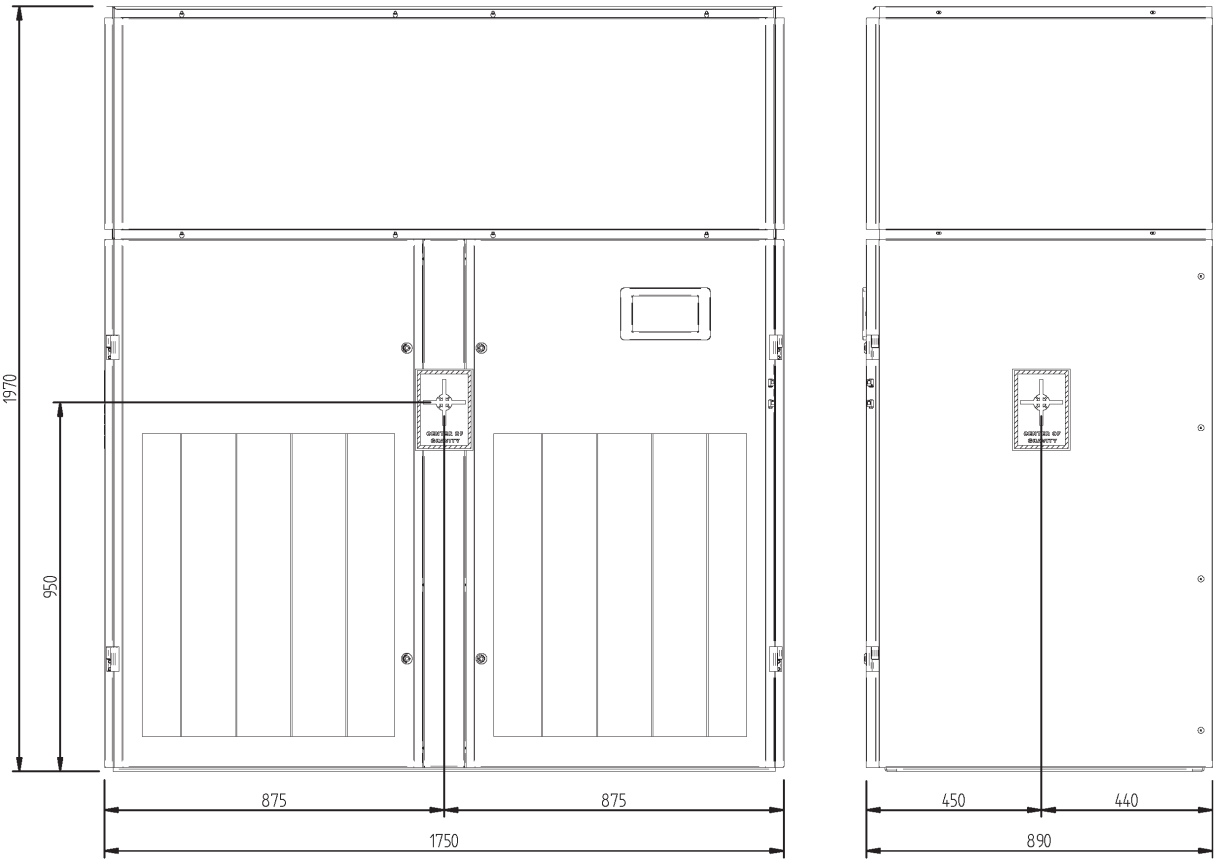
Gravity center - Frame type 2 (1,5 bays) - Upflow Extended Heigth



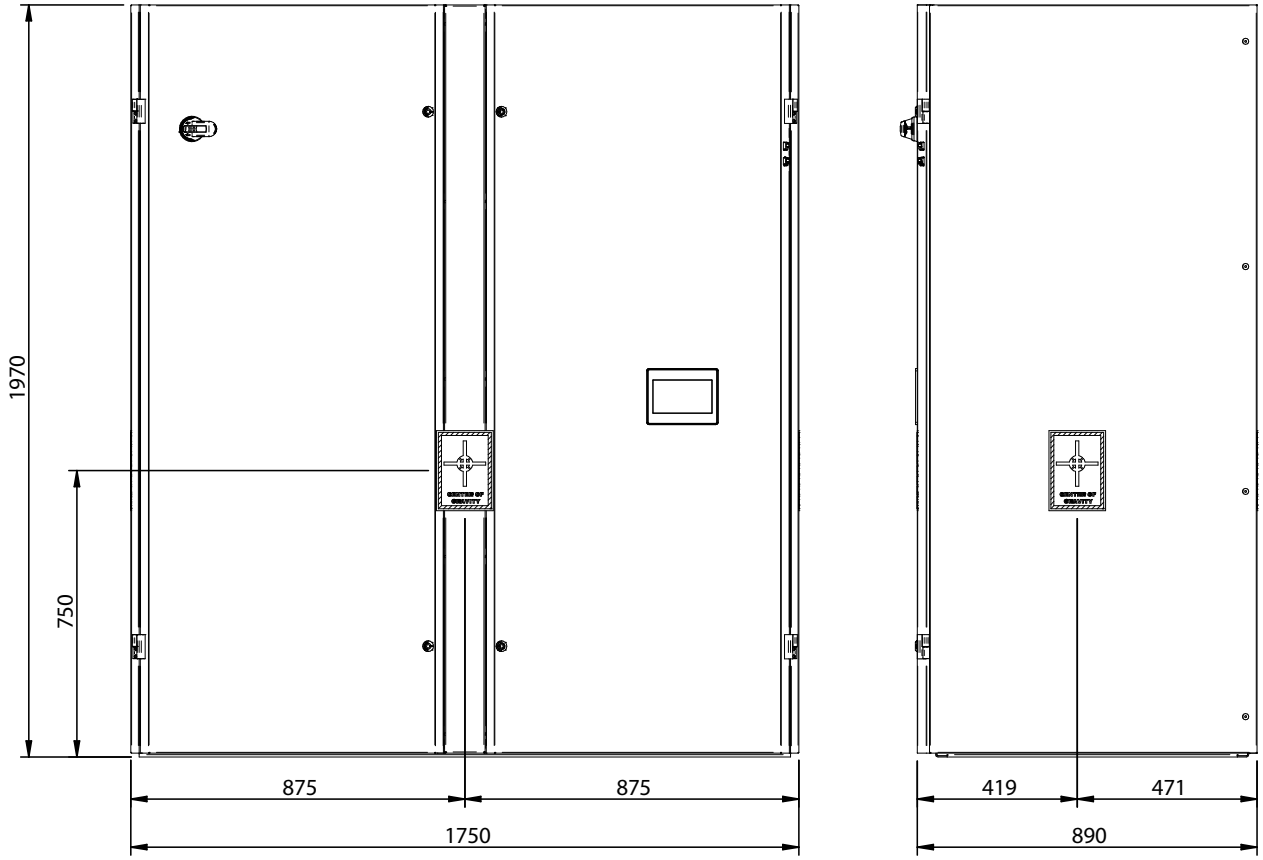
Gravity center - Frame type 3 (2 bays) - Downflow



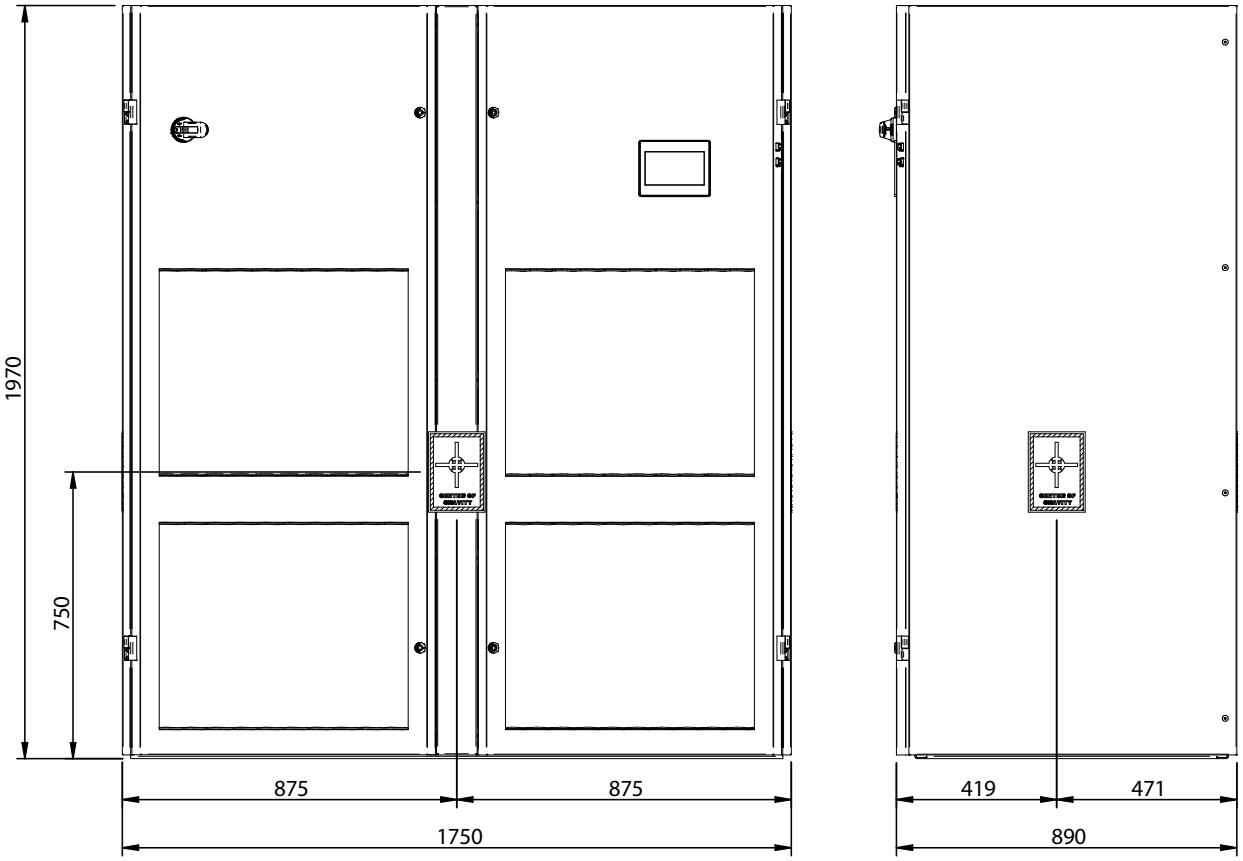
Gravity center - Frame type 3 (2 bays) - Upflow



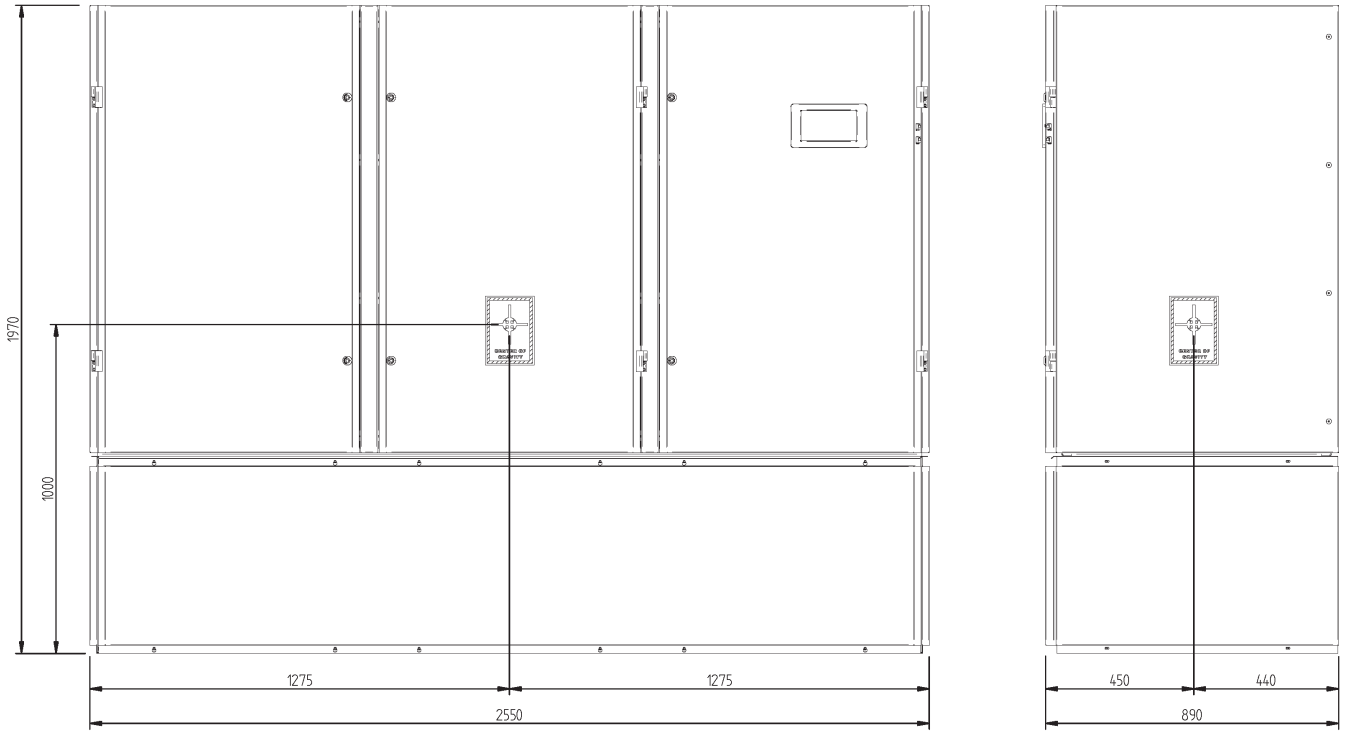
Gravity center - Frame type 3 (2 bays) - Downflow Extended Height



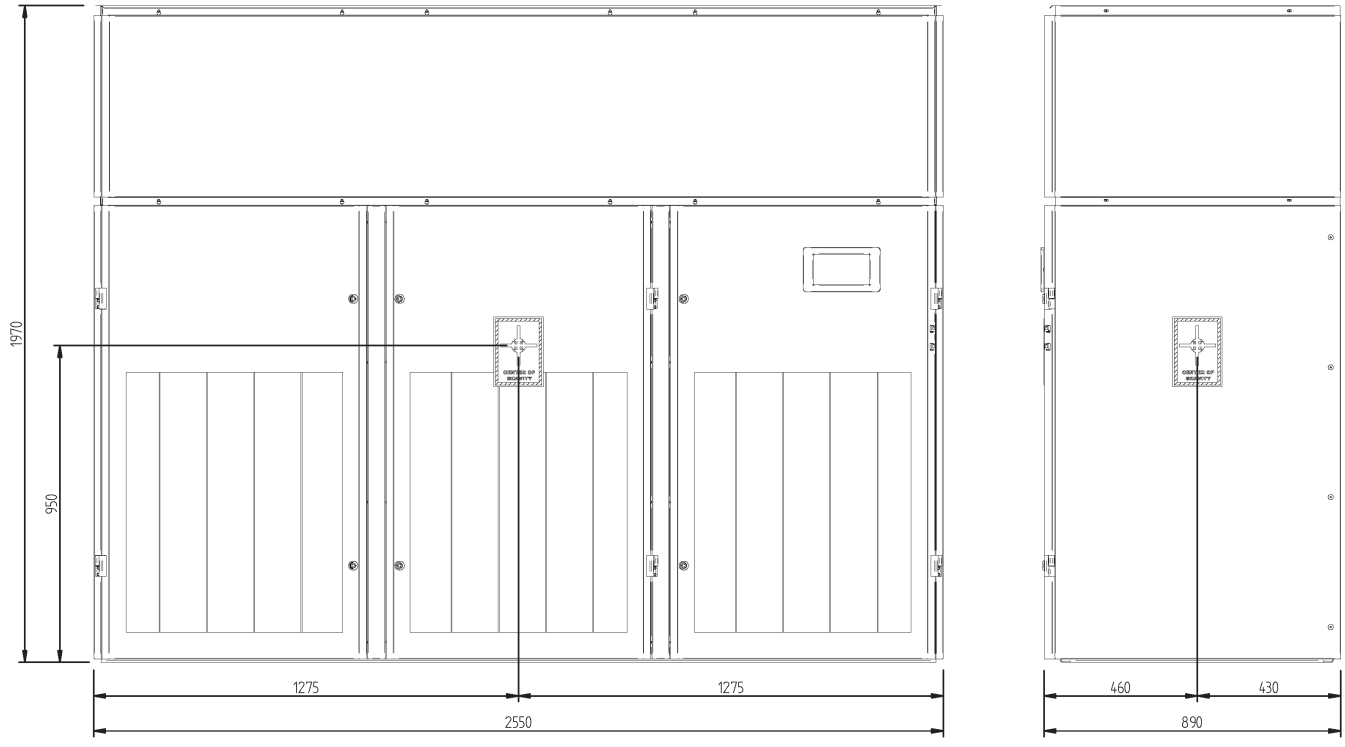
Gravity center - Frame type 3 (2 bays) - Upflow Extended Heigth



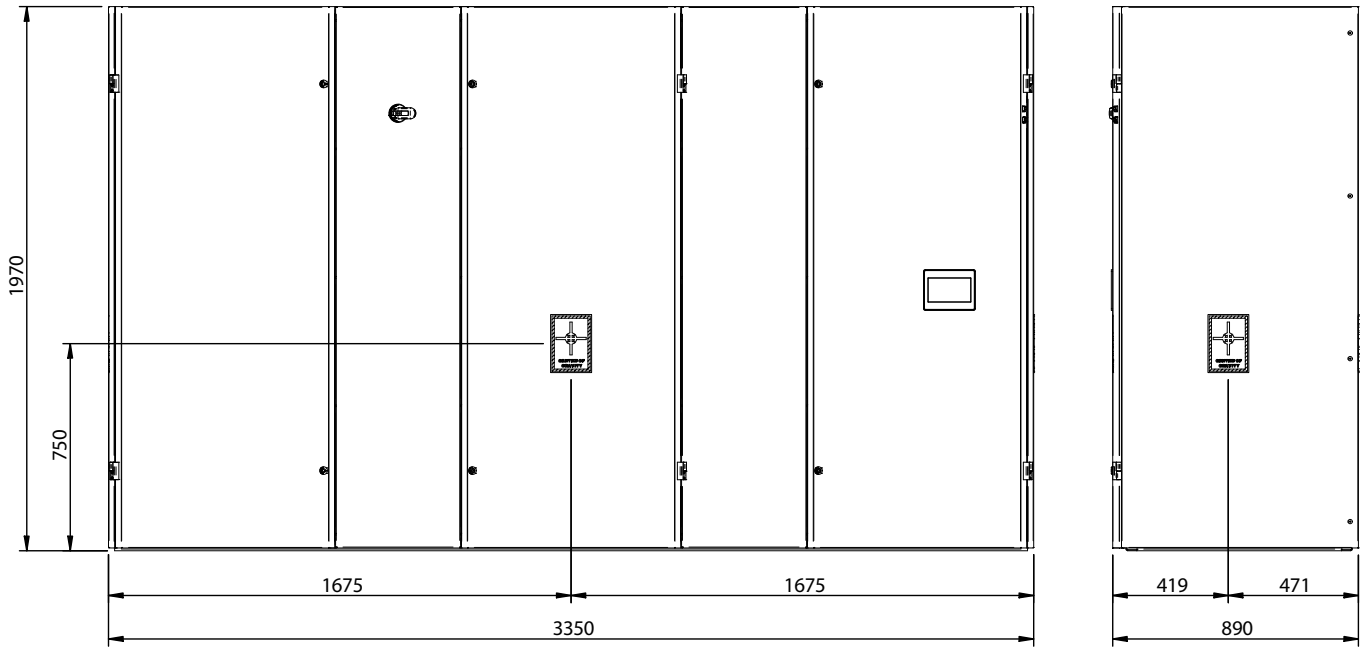
Gravity center - Frame type 5 (3 bays) - Downflow



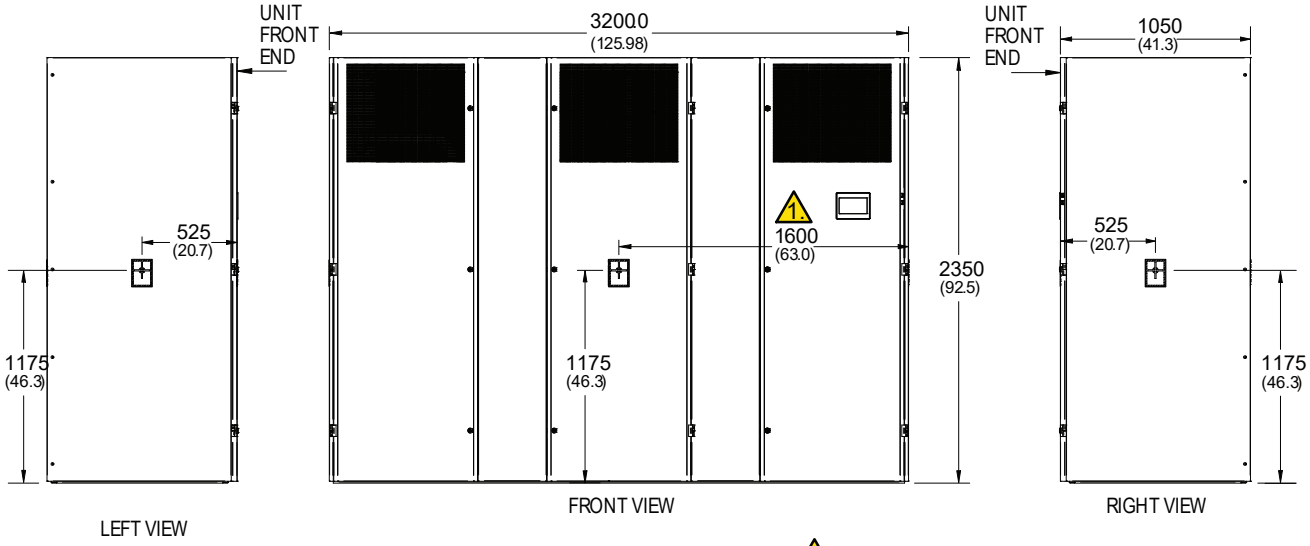
Gravity center - Frame type 5 (3 bays) - Upflow



Gravity center – Frame type 7 – Downflow Extended Height



Gravity center - Frame type 10 (4 bays)



Dimensions in mm (inches)

1. FOR DUAL CIRCUIT "W" MOVE BY 30 MM (1.2 IN) TO THE RIGHT SIDE

Annex D - Connections

Content

Key to symbols

Symbol	Description	See ...
IWC1	"Water to condenser 1 inlet"	Table *Unit Water Connections*
IWC2	"Water to condenser 2 inlet"	
OWC1	"Water to condenser 1 outlet"	
OWC2	"Water to condenser 2 outlet"	
IFC	Water inlet (Freecooling and dual fluid)	
OFC	Water outlet (Freecooling and dual fluid)	
HF	Humidifier feed	*Annex G - Electrode Humidifier* *Annex H - Infrared Humidifier*
HD	Humidifier drain	
EC	Electrical power supply	Chapter *6.5.1 Unit electrical data*
EC aux	Low voltage cables	
CD	Condensate Drain	Chapter *6.5.7 Condensate pump*

NOTE *All the dimensions are in millimeters*

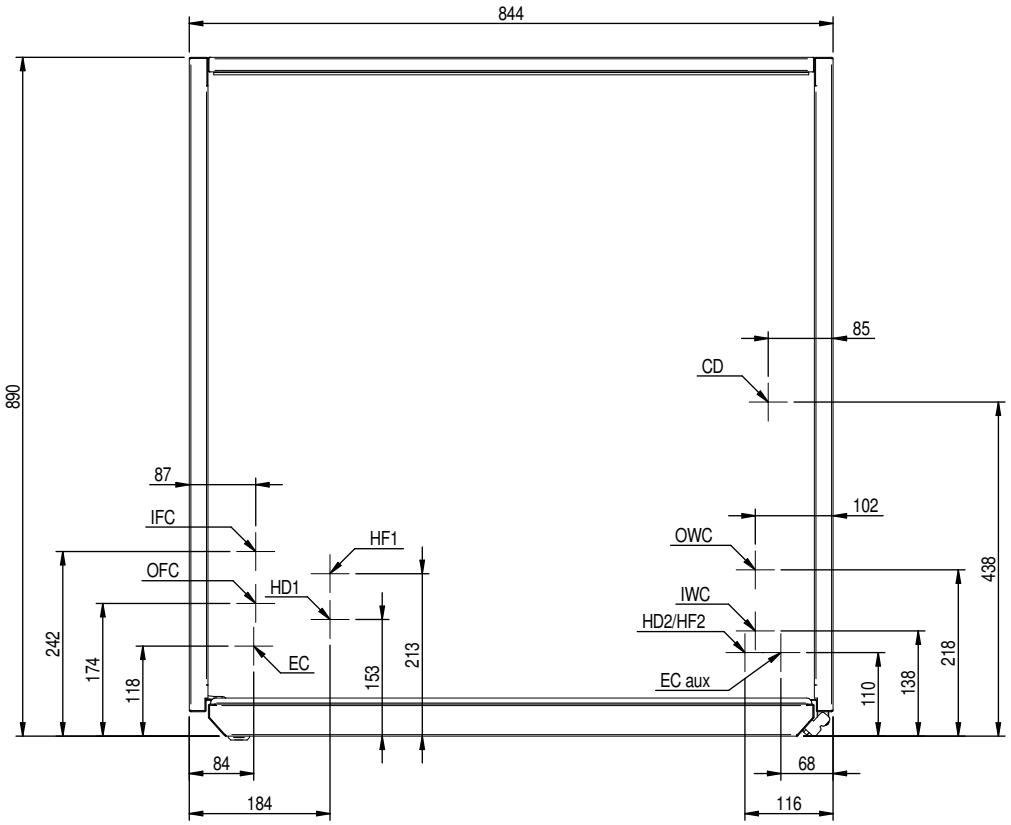
W - Water cooled	1 BAY	1.5 BAY		2BAY		3 BAY	4 BAY
	PI025W	**PI045W**	**PI059W**	**PI062W**	**PI092W**	**PI104W**	**PI150W**
IWC1	Rp 1 ¼ ISO 7/1	*Rp 1 ¼ ISO 7/1*	*Rp 1 ¼ ISO 7/1*	*"Rp 1 ¼ ISO 7/1"*	*Rp 1 ¼ ISO 7/1*	*"Rp 1 ½ ISO 7/1"*	*"Rp 1 ½ ISO 7/1"*
IWC2	/	/	/	*"Rp 1 ¼ ISO 7/1"*	*Rp 1 ¼ ISO 7/1*	*"Rp 1 ½ ISO 7/1"*	*"Rp 1 ½ ISO 7/1"*
OWC1	Rp 1 ¼ ISO 7/1	*Rp 1 ¼ ISO 7/1*	*Rp 1 ¼ ISO 7/1*	*"Rp 1 ¼ ISO 7/1"*	*Rp 1 ¼ ISO 7/1*	*"Rp 1 ½ ISO 7/1"*	*"Rp 1 ½ ISO 7/1"*
OWC2	/	/	/	*"Rp 1 ¼ ISO 7/1"*	*Rp 1 ¼ ISO 7/1*	*"Rp 1 ½ ISO 7/1"*	*"Rp 1 ½ ISO 7/1"*

F - Freecooling	1 BAY	1.5 BAY		2BAY		3 BAY	4 BAY
	PI025F	**PI045F**	**PI055F**	**PI062F**	**PI070F**	**PI104F**	**PI140F**
IFC	Rp 1 ¼ ISO 7/1	*Rp 1 ¼ ISO 7/1*	*Rp 1 ½ ISO 7/1*	*"Rp 1 ½ ISO 7/1"*	*Rp 1 ½ ISO 7/1*	*O.D. 54 mm* *R 2** - ISO 7/1*	*O.D. 64 mm* *R 2** - ISO 7/1*
OFC	Rp 1 ¼ ISO 7/1	Rp 1 ¼ ISO 7/1	Rp 1 ½ ISO 7/1	"Rp 1 ½ ISO 7/1"	Rp 1 ½ ISO 7/1	O.D. 54 mm* R 2** - ISO 7/1	O.D. 64 mm* R 2** - ISO 7/1

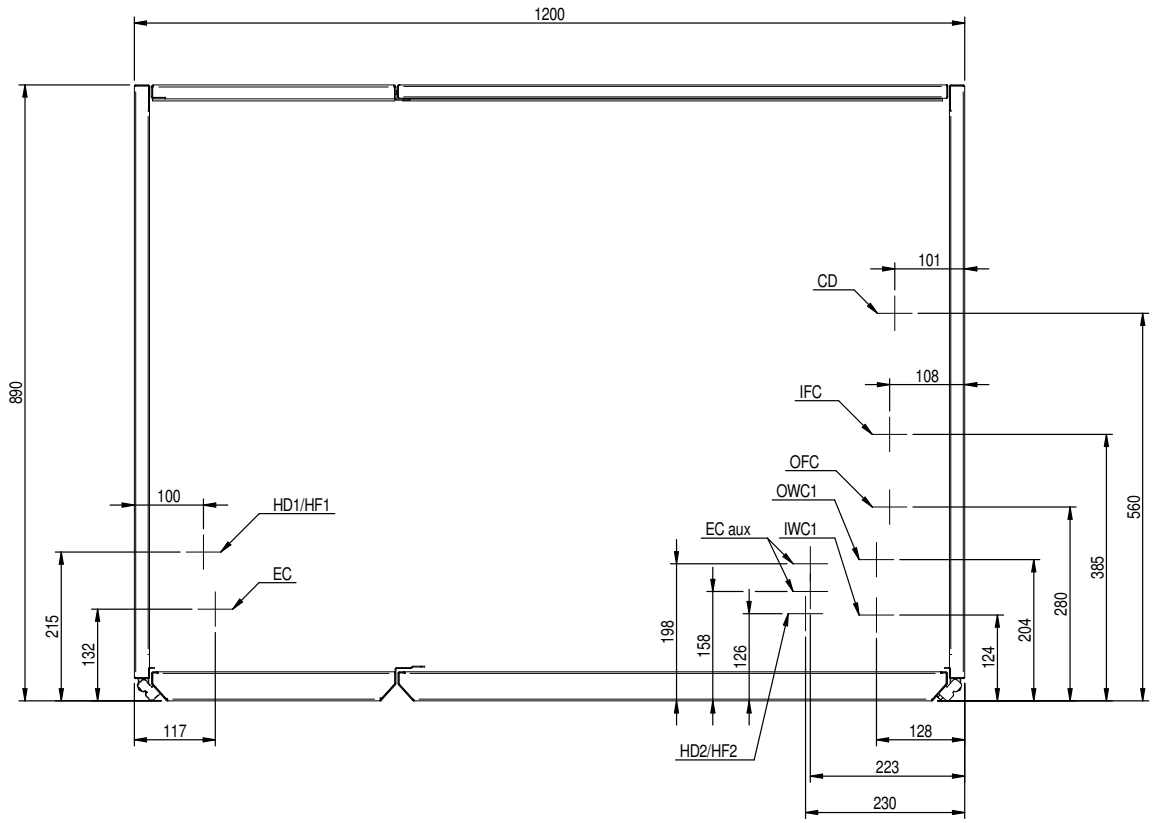
H - Dual Fluid water cooled	1 BAY	1.5 BAY	2 BAY	3 BAY
	PI025H	**PI045H**	**PI062H**	**PI104H**
IFC	Rp 1 ¼ ISO 7/1	*Rp 1 ¼ ISO 7/1*	*Rp 1 ½ ISO 7/1*	*O.D. 54 mm* *R 2** - ISO 7/1*
OFC	Rp 1 ¼ ISO 7/1	*Rp 1 ¼ ISO 7/1*	*Rp 1 ½ ISO 7/1*	*O.D. 54 mm* *R 2** - ISO 7/1*
IWC1	Rp 1 ¼ ISO 7/1	*Rp 1 ¼ ISO 7/1*	*Rp 1 ¼ ISO 7/1*	*"Rp 1 ½ ISO 7/1"*
IWC2	/	/	*Rp 1 ¼ ISO 7/1*	*"Rp 1 ½ ISO 7/1"*
OWC1	Rp 1 ¼ ISO 7/1	*Rp 1 ¼ ISO 7/1*	*Rp 1 ¼ ISO 7/1*	*"Rp 1 ½ ISO 7/1"*
OWC2	/	/	*Rp 1 ¼ ISO 7/1*	*"Rp 1 ½ ISO 7/1"*

** Grooved Connection.*
*** Optional. Threaded union on request.*

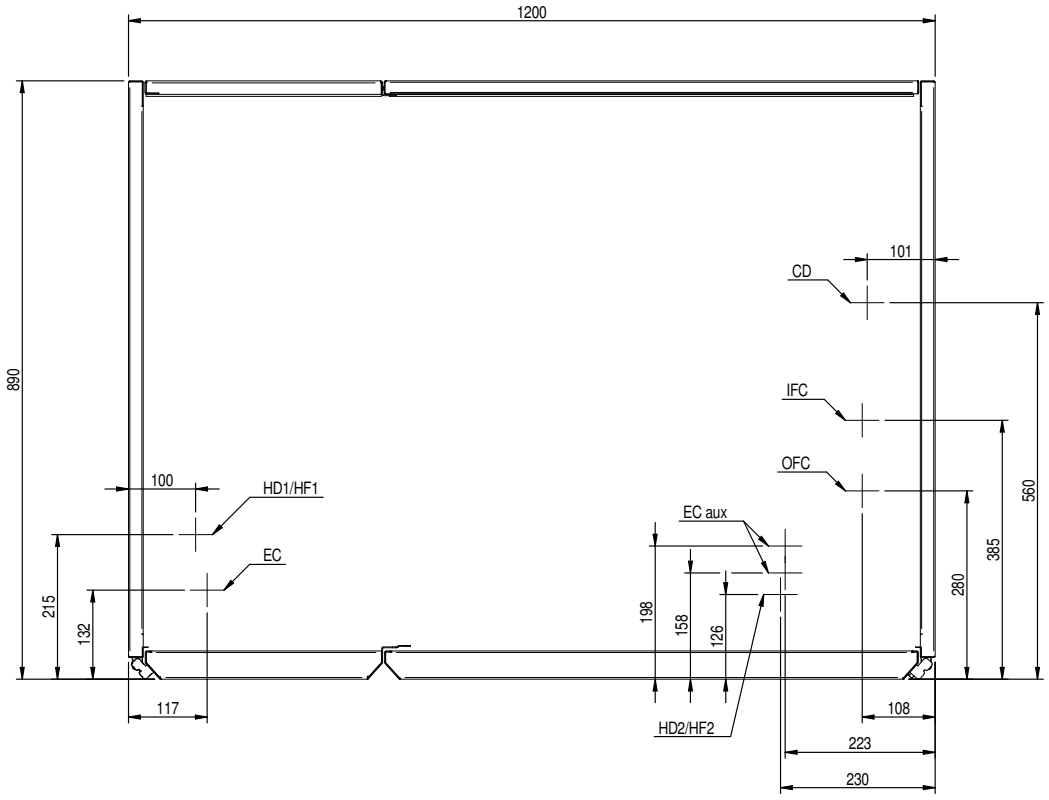
1 - PI025 W-F-H



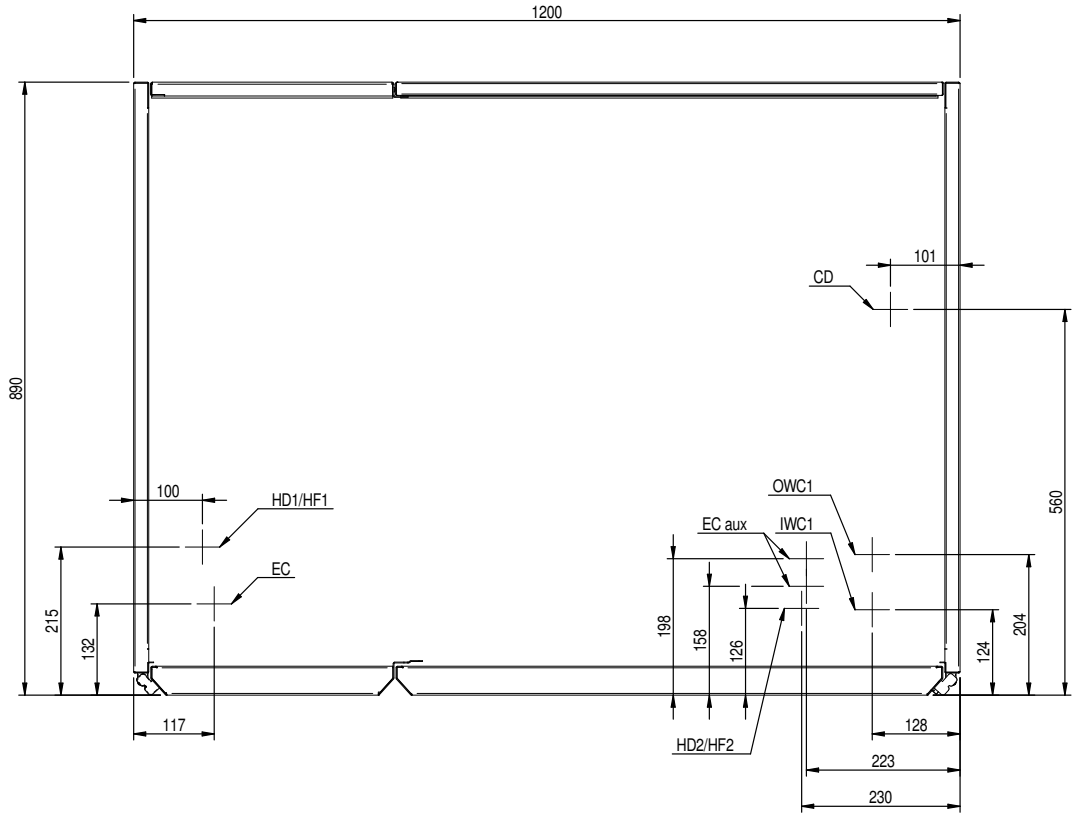
2 - PI045 W-F-H



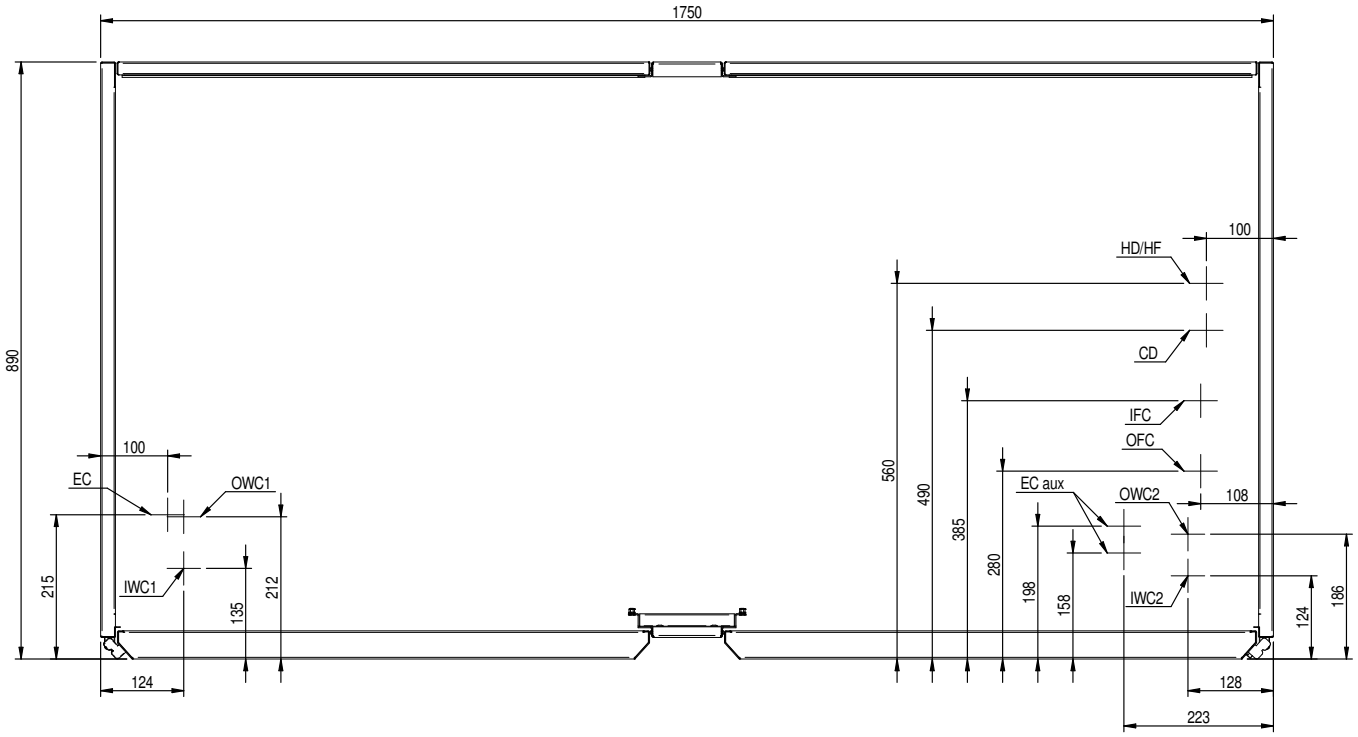
3 - PI055 F



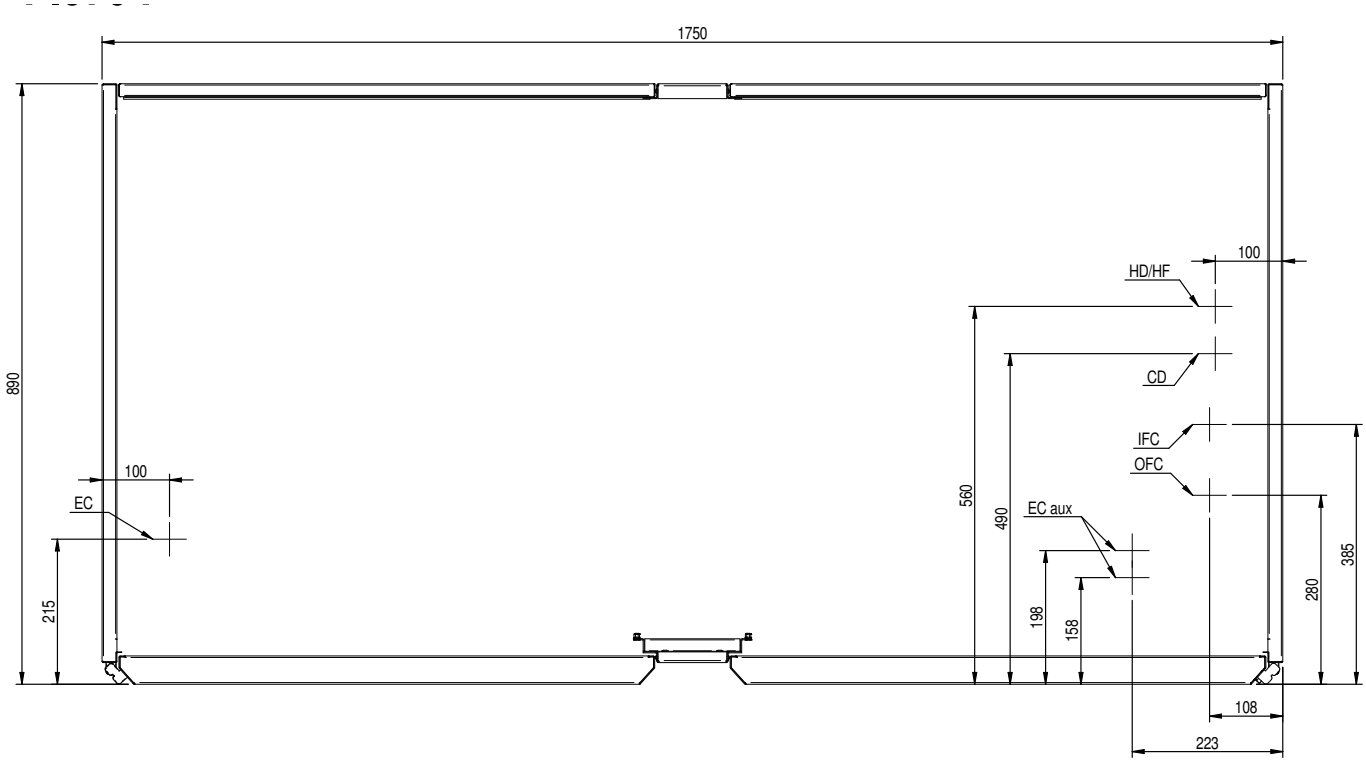
4 - PI059 W



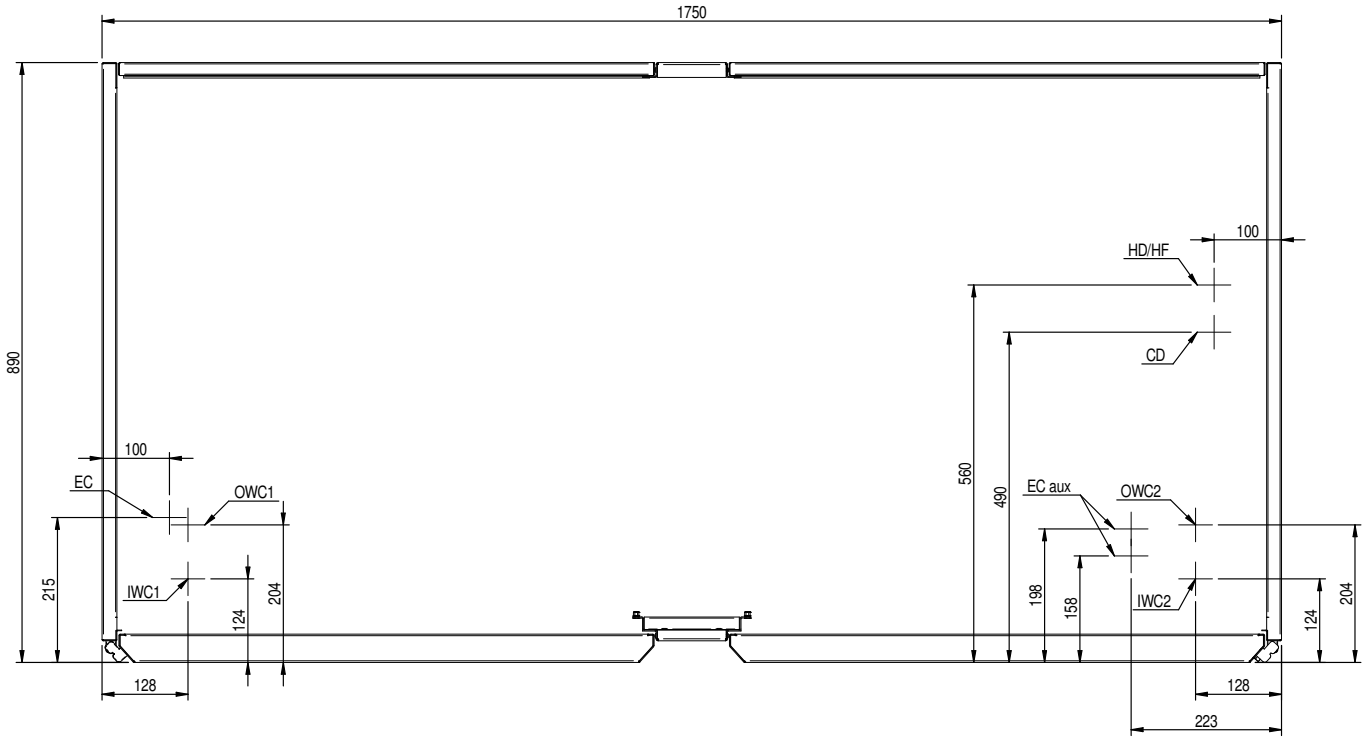
5 - PI062 W-F-H



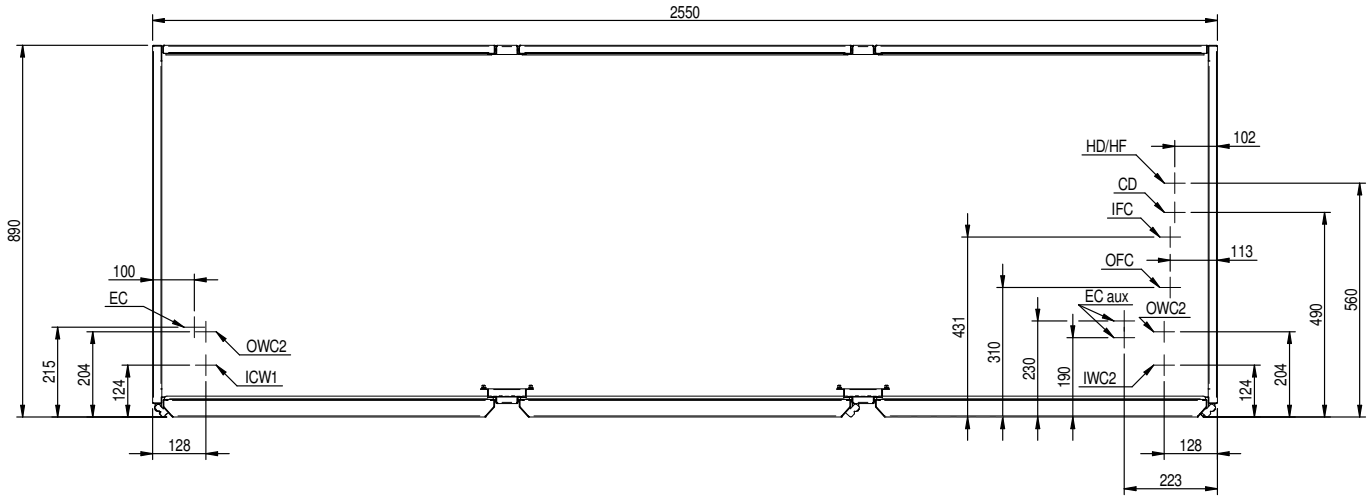
6 - PI070 F



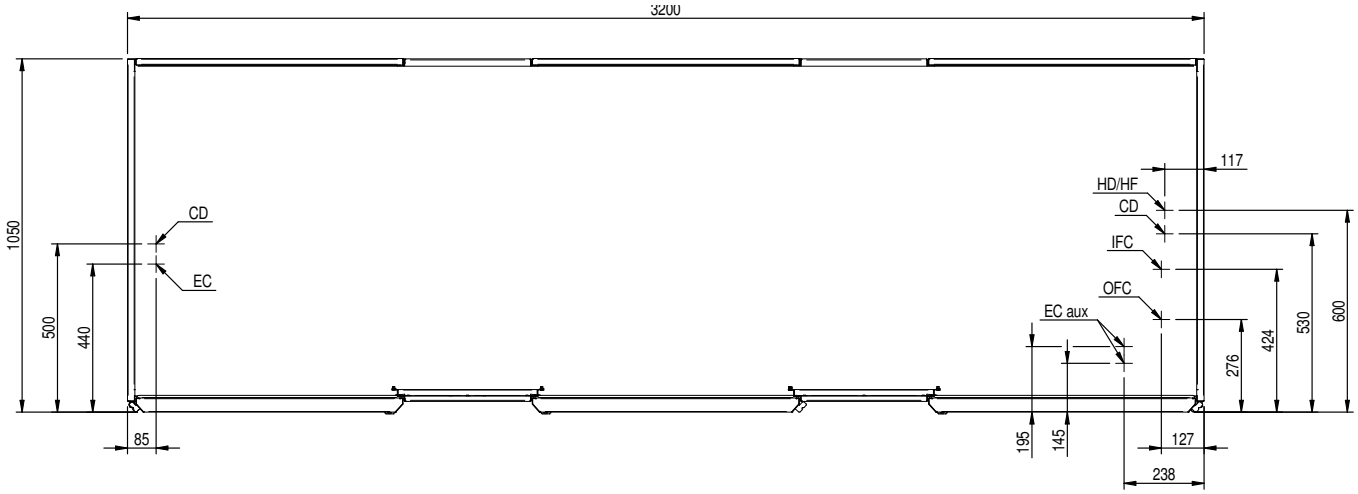
7 - PI092 W



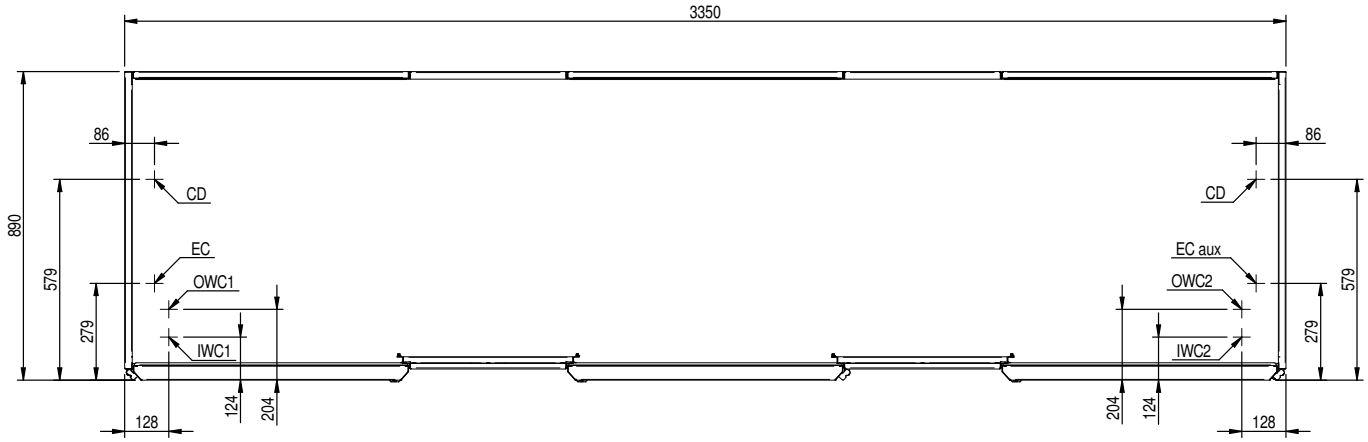
8 - PI104 W-F-H



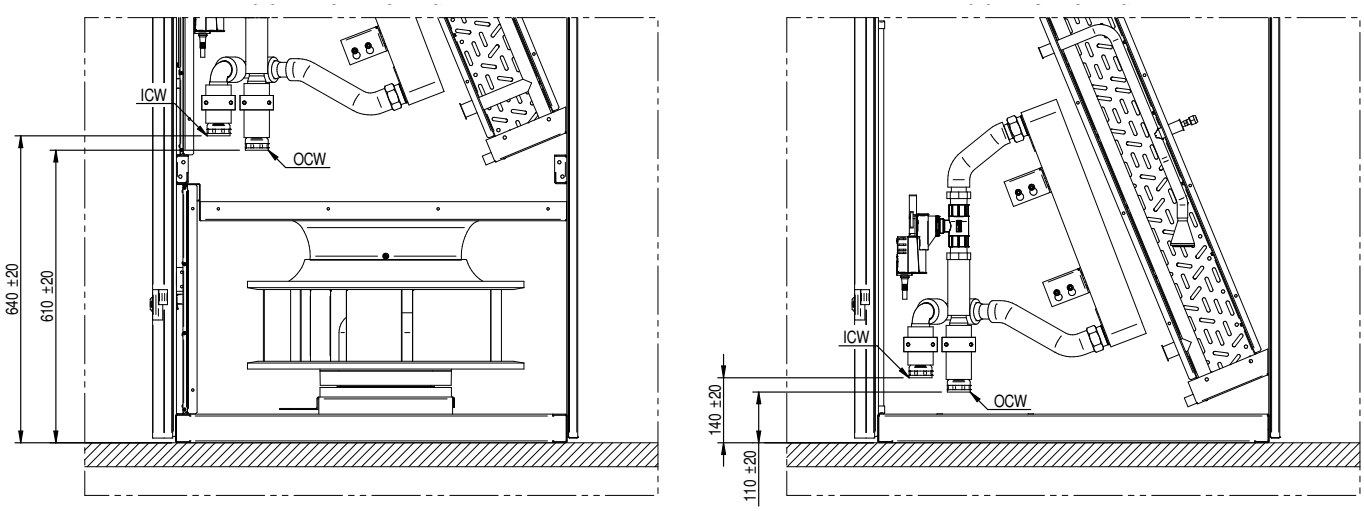
9 - PI0140 F



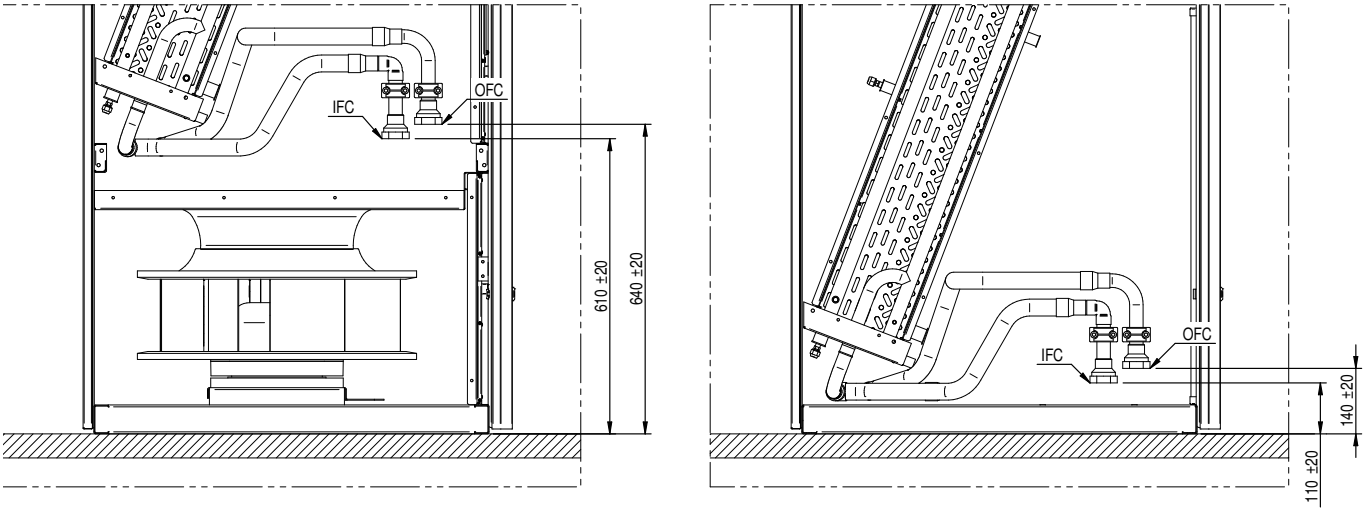
10 - PI150 W



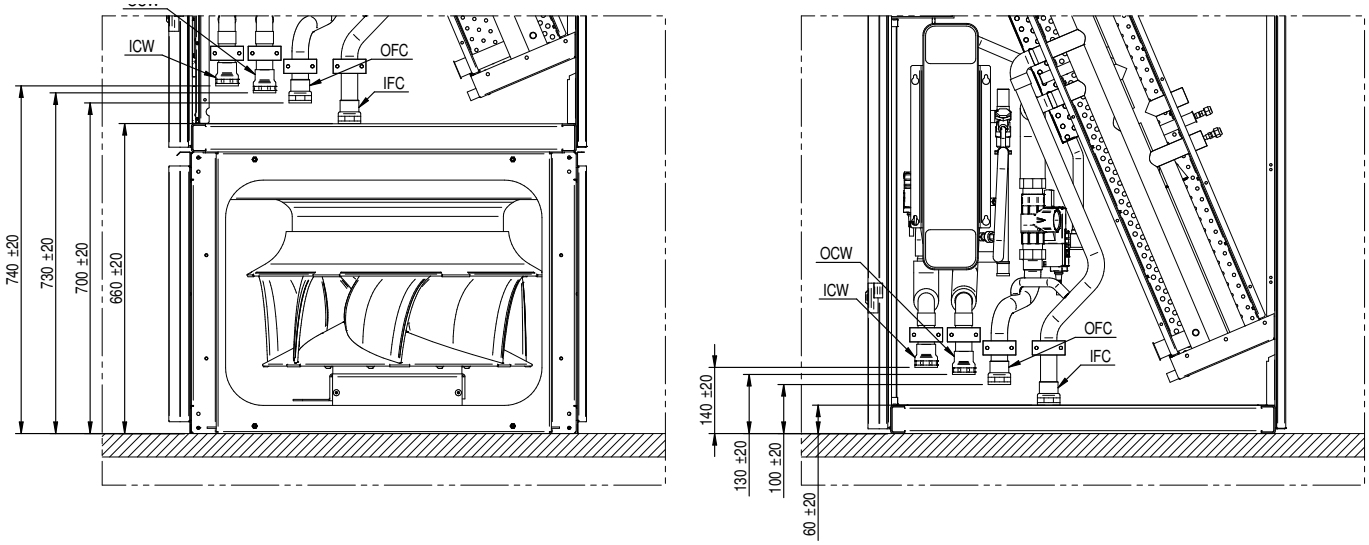
11 - PI025 W-HDOWNFLOW/UPFLOW Right view



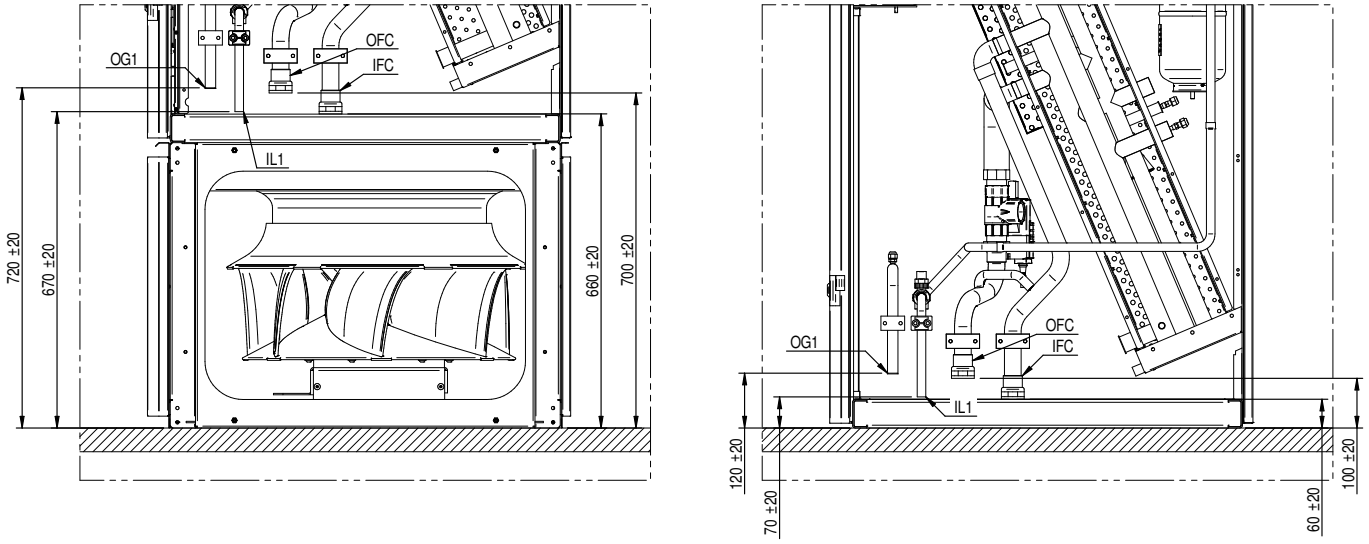
12 - PI025 F-H DONWFLOW/UPFLOW Left view



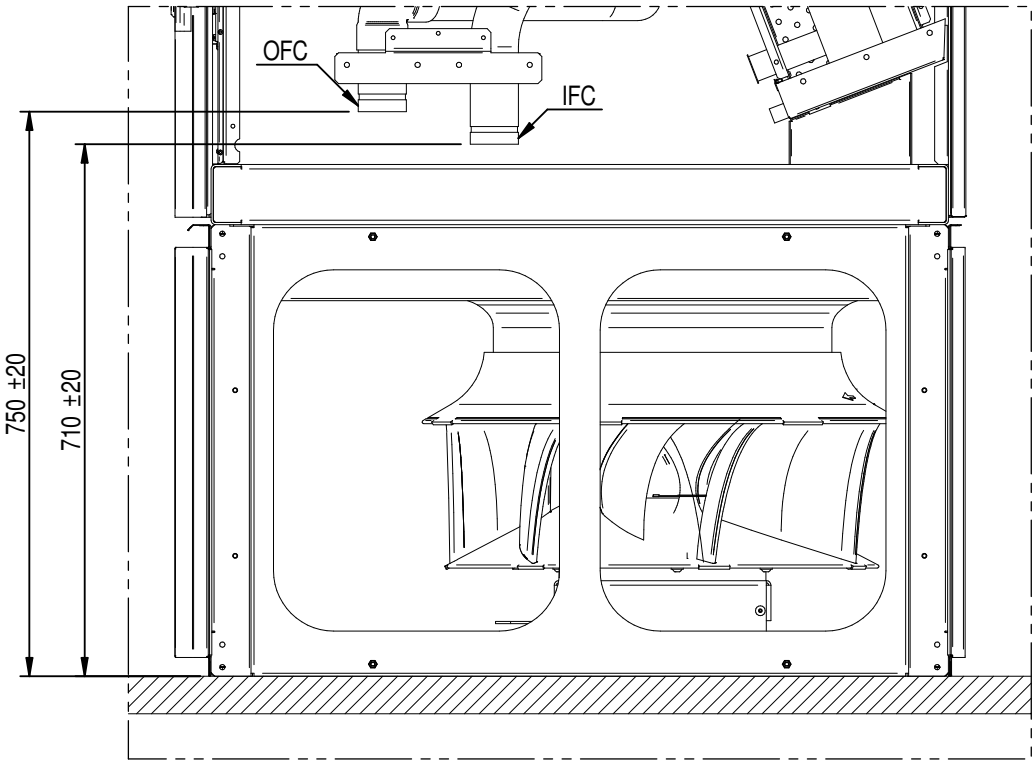
13 - PI045 TO PI150 DOWNFLOW/UPFLOW



14 - PI045 TO PI104 DOWNFLOW/UPFLOW



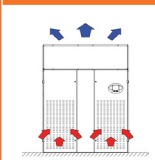
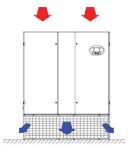
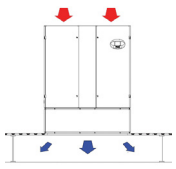
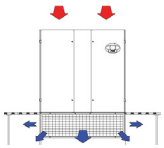
15 - PI40 F DOWNFLOW



Annex E - Accessories

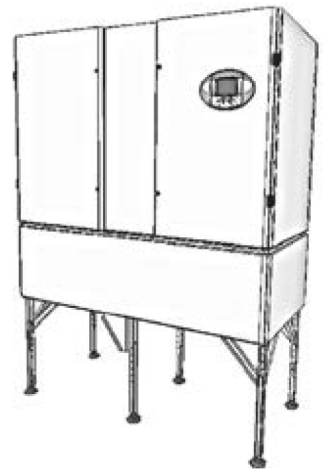
Content

1 - Overview

Accessory	Purpose	Position	U Upflow	H Downflow Frontal	D Downflow Up	E Downflow Down
						
Legs kit	Support	Bottom	NO	NO	YES	YES
Base frame	Support	Bottom	YES	YES	YES	YES
Base module	Support + piping lay-down	Bottom	YES	YES	NO	NO
Base module 600/300 mm high with rear/bottom air intake	Air flow	Bottom	YES	NO	NO	NO
Fresh air module	Air flow	Fan inlet	YES	YES	YES	YES
Vertical flow extension hood (*)	Air flow	Top	YES	YES	YES	YES
Hood with high efficiency air filter (*)	Better filtering	Top	YES	YES	YES	YES
Plenum with silencing cartridges (*)	Noise reduction	Top	YES	YES	YES	YES
Horizontal hood with grid	Air flow	Top	YES	NO	NO	NO
Air economizer (*)	Air flow	Top	NO	YES	YES	YES
Floor tiles support kit	Support	Bottom	NO	NO	NO	YES
Fans maintenance kit	Maintenance	Bottom	NO	NO	NO	YES
Connecting flange	(*)	Top	NO	YES	YES	YES

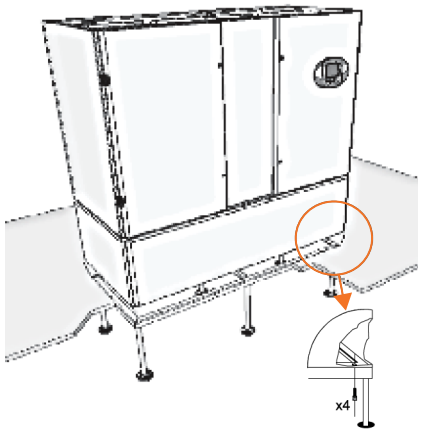
(*) The connecting flange is required to mount the accessory on top of the Downflow units.

2 - Legs kit



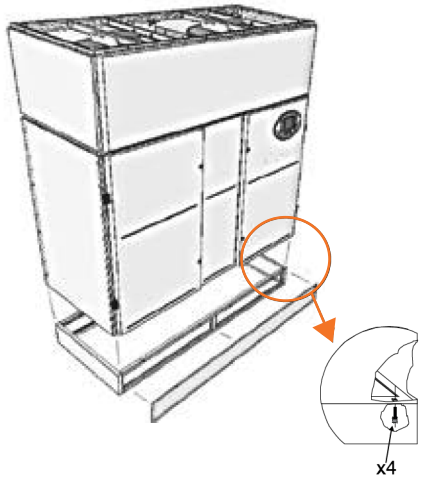
Purpose	To support the unit when installed with a raised floor.
Description	The legs are adjustable and allow to support the unit at different height.
For airflow version	**D** - Downflow Up **E** - Downflow Down
Available height	30–370 mm 370–570 mm 570–800 mm
Assembly	Fix the accessory using the threaded inserts that you find in the fan module frame. You need M8 screws (they are not supplied with the unit).

3 - Base frame



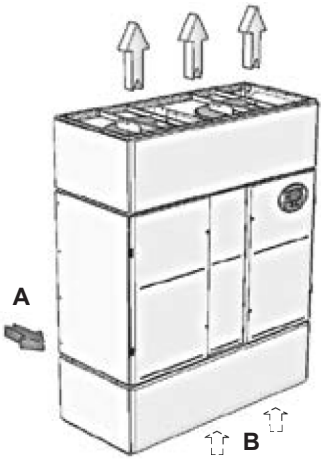
Purpose	To support the unit when installed with a raised floor.
Description	The legs are adjustable and allow to support the unit at different height. A protective grid prevents any contact with the fans from below.
For airflow version	**D** - Downflow Up **E** - Downflow Down **U** - Upflow Frontal
Available height	120–800 mm
Assembly	Fix the accessory using the threaded inserts that you find in the fan module frame. You need M8 screws (they are not supplied with the unit).

4 - Base module



Purpose	To support the unit. Allow the piping to enter the base of the unit when a raised floor is not installed.
For airflow version	**U** - Upflow **H** - Frontal
Available height	200 mm
Assembly	Fix to the unit base by 4 screws (the screws are not supplied with the unit)

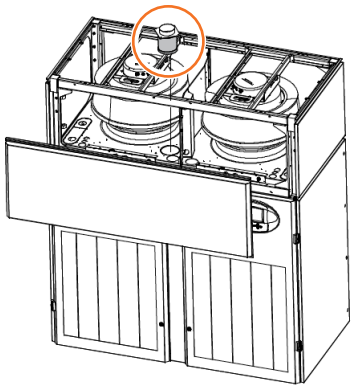
5 - Base module 600/300 mm high with rear/bottom air intake



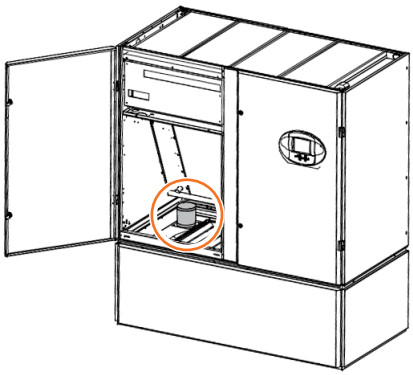
Purpose	To allow an Upflow unit to work with a rear/bottom or a bottom air intake. Supporting the unit. Allow the piping to enter the base of the unit when a raised floor is not installed.
For airflow version	**U** - Upflow
Available height	[**A**] rear/bottom air intake H=600 mm [**B**] bottom air intake H=300 mm
Assembly	Fix to the unit base by 4 screws (the screws are not supplied with the unit)
NOTE	*The unit must be ordered with a blind front panel and an open basement*

6 - Fresh air module

Upflow



Downflow

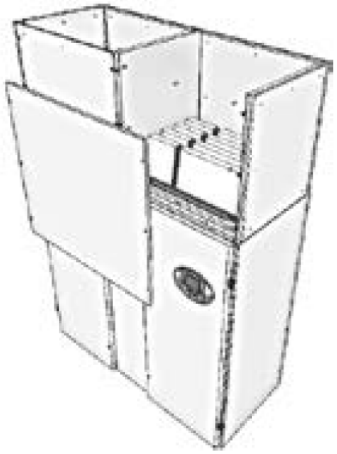


Purpose	To allow filtered fresh air intake from outdoor. The fresh air is mixed with the recirculation air returning from the room.
Description	The kit is made of a G3 class filter with a 100 mm diameter plastic duct.
Available diameter	100 mm
For airflow version	**U** - Upflow **H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Assembly	The kit must be installed on the low pressure side of the fan. • Remove the pre-cut in the plate that separates the fan module from the coil module. • Insert the kit in the hole, paying attention to push the filter into the low pressure side. • Connect the fresh air piping to the kit.

7 - Vertical flow extension hood

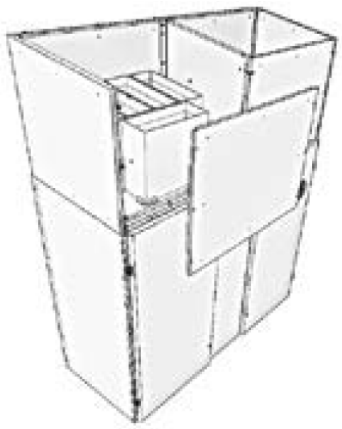
Purpose	Additional duct on the unit top, to simplify the connection to the ceiling or to other equipment.
Description	The hood has the same design as the unit and consists of sandwich panels lined with non-flammable insulation material of class 0 (ISO 1182.2), density 30 kg/m^3.
For airflow version	**U** - Upflow **H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Available heights	500 mm 600 mm 700 mm 800 mm 900 mm
Assembly	For the Downflow units: mount first the connecting high flange on top of the unit (see *14 - Connecting flange*). For all units: fix the accessory to the unit top by screws (the screws are not supplied with the unit).

8 - Hood with high efficiency air filter



Purpose	Optional high efficiency filters, filtration class ePM10 70% in accordance with the ISO/EN 16890 standard.
Description	The filters are made of fiberglass filter media. They are placed in ”V” sections with a solid external frame in polypropylene and can withstand remarkable pressure and flow variations. The filters are installed inside an additional duct on the unit top.
For airflow version	**U** - Upflow **H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Available height	600 mm 900 mm
Assembly	For the Downflow units: mount first the connecting high flange on top of the unit (see *14 - Connecting flange*). For all units: fix the accessory to the unit top by screws (the screws are not supplied with the unit).

9 - Plenum with silencing cartridges

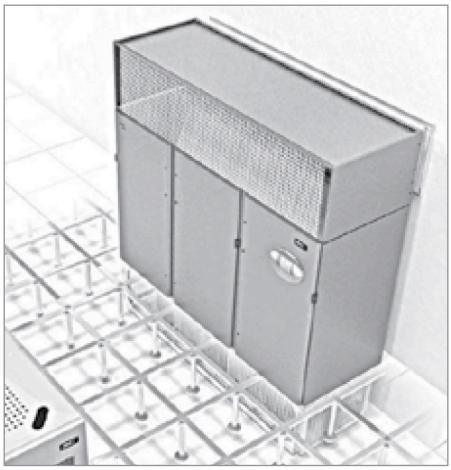


Purpose	Noise reduction
Description	These are special cartridges made of self - extinguishing material with a high noise attenuation capacity. They are guaranteed against disintegration and release of particles do to friction of the air. Despite a small additional pressure drop, these cartridges provide a remarkable sound power level reduction.
For airflow version	**U** - Upflow **H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Available height	600 mm 900 mm
Assembly	For the Downflow units: mount first the connecting high flange on top of the unit (see *14 - Connecting flange*). For all units: fix the accessory to the unit top by screws (the screws are not supplied with the unit).

10 - Horizontal hood with grid

Purpose	Airflow optimization Noise reduction
Description	A supply plenum with horizontal air flow can be installed on top of the unit. The plenum consists of sandwich panels lined with non- flammable insulation material of class 0 (ISO 1182.2), density 30 kg/m^3. It is equipped with a double deflection grill
For airflow version	**U** - Upflow
Available height	600 mm
Assembly	For the Downflow units: mount first the connecting high flange on top of the unit (see *14 - Connecting flange*). For all units: fix the accessory to the unit top by screws (the screws are not supplied with the unit).

11 - Air economizer



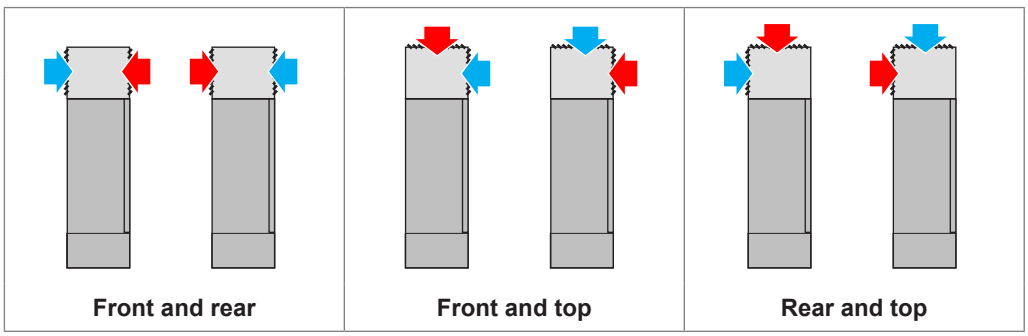
Purpose	High energy savings by reducing the refrigerant circulation. The unit takes cool air from outdoors and uses it for room conditioning.
Description	The air economizer is an extension hood with two dampers and two temperature sensors. A sensor measures the temperature of the outdoor (cold) air. The other sensor measures the temperature of the warm air returning to the unit from the room. When the outdoor temperature is low enough, the control stops the compressor(s) and opens the dampers, one for outdoor air intake, the other for room air intake. The outdoor air is mixed with the room air to adjust the temperature. The air mixture is filtered by flowing through to unit. When the outdoor temperature is too high, the control restarts the compressor(s) and closes the dampers.
For airflow version	**H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Available height	860 mm
Assembly	Mount first the connecting high flange on top of the unit (see *14 - Connecting flange*). Then fix the accessory to the unit top by screws (the screws are not supplied with the unit).
NOTE	*To use the air economizer the building has to be equipped with suitable air ducts for the outdoor air intake.* *The air economizer is supplied with a remote temperature sensor, to be mounted on the outdoor air intake.*

Dampers arrangement

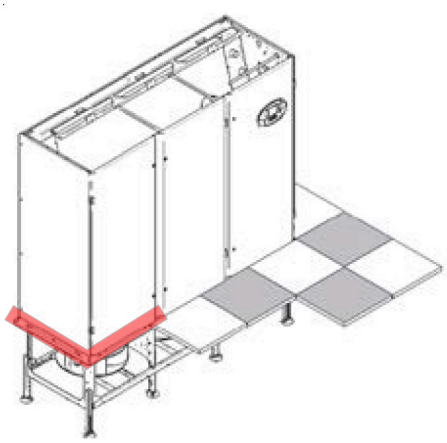
The two dampers can be placed in different positions, to fit best the room and air ducts layout. See below all the possible arrangements.

Outdoor (**cold**) air

Room (**warm**) air

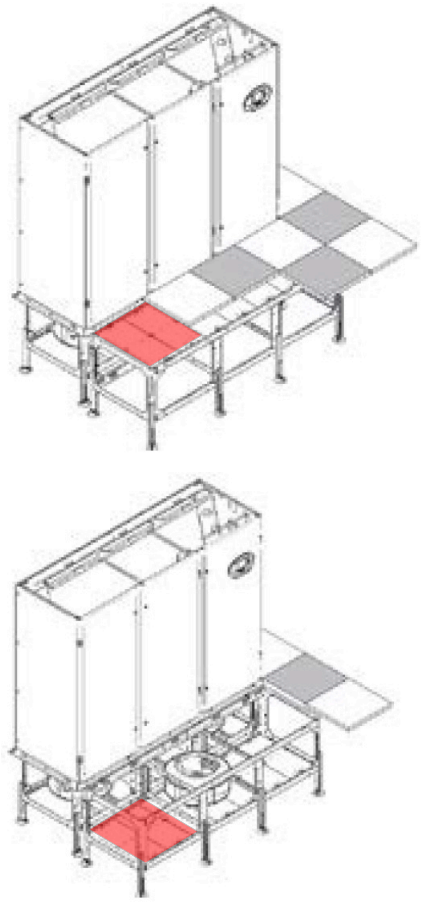


12 - Floor tiles support kit



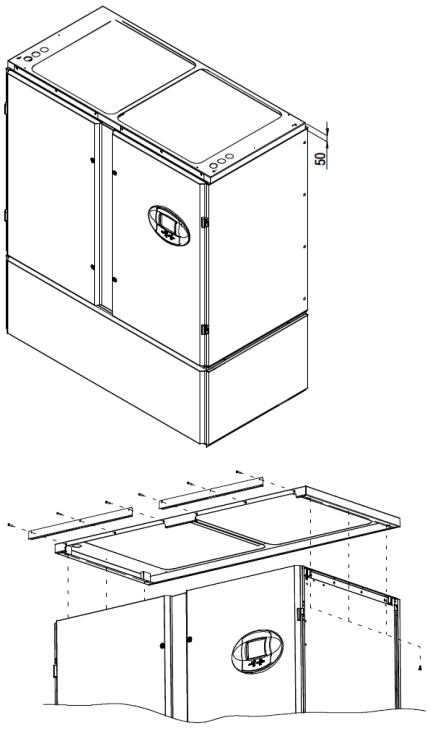
Purpose	To support the floor tiles around the Downflow Down units when installed with a raised floor.
Description	The floor tiles support is fixed on the fan module frame.
For airflow version	**E** - Downflow Down
Available dimension	For tiles thickness up to 40 mm.
Assembly	Fix the accessory using the threaded inserts that you find in the fan module frame. You need M8 screws (they are not supplied with the unit).
NOTE 1	*With a correct installation, the maximum admitted vertical distributed load on the perimeter is 180 kg/m.* *It means that on the lateral side, which is 870 mm long, the maximum admitted distributed load is 157 kg.*
NOTE 2	*The floor tiles support is earthed with the unit frame.* *Follow local rules for system grounding*

13 - Fans maintenance kit



Purpose	To allow maintenance operations, in particular fans replacement, when the fans are installed below the floor level.
Description	Removing tiles on the frontal area, it is possible to lift some footboards, moving them on the lower level, creating a service volume in the raised floor.
For airflow version	**E** - Downflow Down
Dimension of the footboards	50x50 mm
Assembly	Additional frame to be placed under the raised floor in front of the fan compartment.
NOTE 1	*The footboards are designed to support a maximum vertical distributed load of 600 kg/ m^2 and a maximum concentrated load of 150 kg.*
NOTE 2	*The fans maintenance kit must be earthed following the local rules.*

14 - Connecting flange



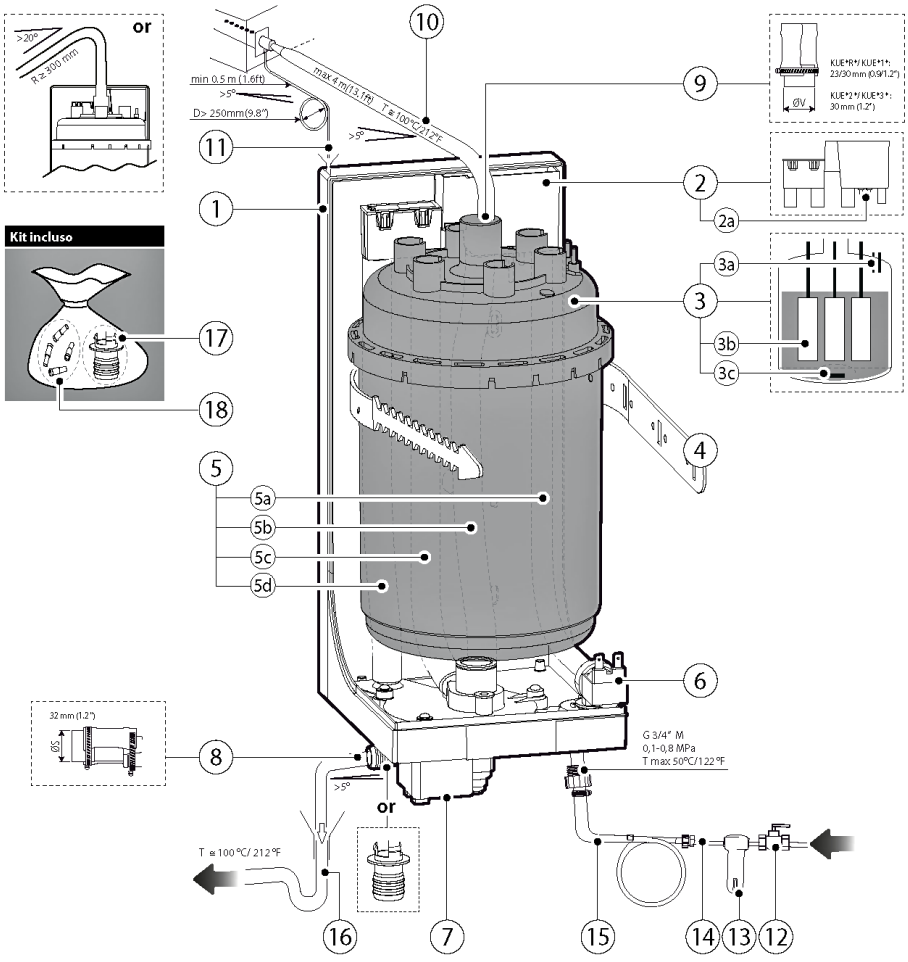
Purpose	To allow mounting on top of the unit the following accessories: - Vertical flow extension hood - Hood with high efficiency air filter - Plenum with silencing cartridges - Air economizer
For airflow version	**H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Available height	50 mm
Assembly	If you ordered a unit with the arrangement for the above mentioned accessories, the flange is already mounted on the unit top. Therefore the unit is 50 mm higher. To remove the flange you need to remove the side panel to access the fixing screws.

Annex F - Electrode Humidifier

Content

1 - Description

Main Components



1	Chassis
2	Fill tank
2a	Conductivity electrodes
3	Cylinder
3a	High level electrodes
3b	Immersed electrodes
3c	Filter inside the cylinder
4	Cylinder fastening strap
5	Hose kit
5a	Supply hose
5b	Fill hose
5c	Drain pump and overflow outlet hose
5d	Drain hose
6	Fill solenoid valve
7	Drain pump
8	Drain connection (Ø 32 mm)

Steam distribution

9	Steam outlet
10	Steam distribution hose
11	Steam condensate hose

Water fill

12	Manual valve (not supplied)
13	Mechanical filter
14	Supply hose (not supplied)
15	Connection hose

Water drain

16	Drain hose with siphon (not supplied)

Kit included

17	Straight and 90° connection hose (Ø 32 mm)
18	Connectors for electrodes **2a** e **3a**

Operating principle

The metal electrodes are immersed in the tank filled with common drinking water. When a voltage is applied on the electrodes, an electric current is created in the water, which is slightly conductive since it contains a certain quantity of dissolved mineral salts. The electric current heats the water until producing steam (Joule effect). The quantity of steam produced is proportional to the electric current, which is in turn proportional to the level of water.

2 - Specifications

Technical data

Electrode humidifier technical data

Model	Main power supply	Setting (1)	Absorbed current	Power	MAX water cylinder volume	MAX water supply	MAX drained water
	[V ± 10%]	[kg/h]	[A]	[kW]	[l]	[l/min]	[l/min]
KUECLH	400 V / 3 ph / 50 Hz	1,3 - 3	3,2	2,25	3,3	0,6	7,0
KUECLL	400 V / 3 ph / 50 Hz	3,9 - 8	8,7	6	5,5	0,6	7,0
KUECLO	380 V / 3 ph / 60 Hz	1,3 - 3	3,4	2,25	3,3	0,6	7,0
	460 V / 3 ph / 60 Hz	1,3 - 3	2,8	2,25	3,3	0,6	7,0
KUECLQ	380 V / 3 ph / 60 Hz	3,9 - 8	9,1	6	5,5	0,6	7,0
	460 V / 3 ph / 60 Hz	3,9 - 8	7,5	6	5,5	0,6	7,0
KUET3 (2)	400 V / 3 ph / 50 Hz	4,5 - 15	16,2	11,25	9,8	1,2	10

(1) The humidifier can be set between the 30 - 100% of the capacity, in steps of 10%. The humidifier mounted in the unit is factory-set to produce about 50% of the maximum value (see the iCOM™ manual).
(2) Optional for **PI140**

Supply water

Only use drinking water with the following specifications:

- pressure between 0,1 and 0,8 MPa (1 and 8 bar)
- temperature between 1 and 40°C
- instant flow rate no higher than the “MAXwater supply” given in the table *Electrode humidifier technical data*
- hardness no greater than 400 ppm of $CaCO_3$ (40°fH)
- conductivity range: 75-1250 µS/cm

Supply water chemical specifications

Inorganic compounds	Unit of measure	Normal water		Water with low salt content	
		MIN	MAX	MIN	MAX
Hydrogen ions	(pH)	7	8,5	7	8,5
Specific conductivity at 20°C (σR, 20°C)	(σR, 20°C) S/cm	350	1250	75	350
Total dissolved solids (TDS)	mg/l	(1)	(1)	(1)	(1)
Dry residue at 180°C (TH)	mg/l	(1)	(1)	(1)	(1)
Total hardness	mg/l $CaCO_3$	100 (2)	400	50 (2)	160
Temporary hardness	mg/l $CaCO_3$	60 (3)	300	30 (3)	100
Iron + Manganese	mg/l Fe+Mn	=	0.2	=	0.2
Chlorides	ppm Cl-	=	30	=	20
Silica	mg/l SiO_2	=	20	=	20
Residual chlorine	mg/l Cl_2	=	0.2	=	0.2
Calcium sulphate	mg/l $CaSO_4$	=	100	=	60
Metallic Impurities	mg/l	0	0	0	0
Solvents, thinners, detergents, lubricants	mg/l	0	0	0	0

(1) = values depend on the specific conductivity; in general: TDS≈0,93*σR, 20 °C; R180≈0,65*σR, 20 °C
(2) = not less than 200% of the chloride content in mg/l CL-
(3) = not less than 300% of the chloride content in mg/l CL-

NOTE *There is not reliable relationship between hardness and conductivity of the water*

CAUTION

Do not add disinfectants or anticorrosive compounds to the water, as these are potential irritants.

The use of well water, industrial water or water from cooling circuits and, in general, any potentially chemically or bacteriologically contaminated water is not recommended.

NOTICE

Do not treat the water with softeners, this may cause the entrainment of foam, affecting the operation of the unit.

Drain water

The drain water contains the same substances dissolved in the supply water, however in larger quantities.

It may reach a temperature of 100°C.

It is not toxic and can be drained into the sewerage system, category 3, EN 1717.

Connect the drain hose to an ordinary drainage network with the following specifications:

- install a siphon that must be able to withstand temperatures up to 100°C
- the network must be able to drain a water flow up to 10 l/min

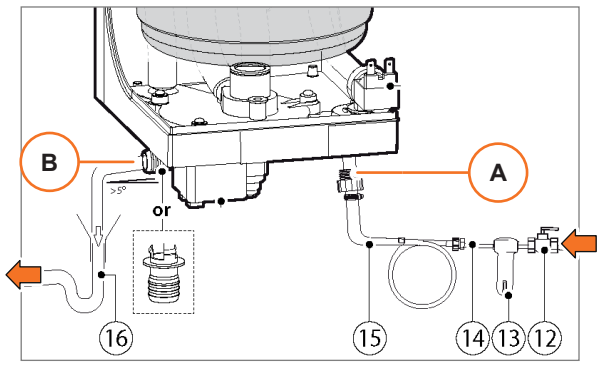
NOTICE

Pay attention in the manual drainage of the steam cylinder if the drainage network is not able to drain 10 l/min, there is a risk of water overflow on the humidifier.

3 - Installation

The humidifier is supplied already mounted within the **PDX** unit.

The only necessary operations are the connections to the supply water and drain water.



Supply water connection

- Connect to the pipe connection [**A**] (G 3/4") the following components:
  - [**15**] connection hose with double non-return valve
  - [**14**] supply hose (not supplied)
  - [**13**] mechanical filter
  - [**12**] manual valve (not supplied)

Drain water connection

- Connect to the drain connection [**B**] (Ø 32 mm) the drain hose with siphon [**16**] (not supplied).

Use a drain hose Ø32 mm, maximum length 10 m with minimum 5% gradient, don't make siphon on this hose to avoid back pressures in the drain piping.

For configuration with bigger length or high head consider the **Liebert® PDX** option with condensate pump.

4 - Startup and operation

Initial checks

Before using the humidifier, check the following conditions:

- The water supply and drain piping are properly connected.
- The shut-off valve is open.
- All the wirings are properly connected.
- The steam hose is properly connected to the steam cylinder and distributor.

Startup

The humidifier is available as soon as the **PDX** unit is switched on. The humidification request starts the humidifier.

When starting with an empty cylinder, the water conductivity is normally insufficient for the humidifier steam output to be reached immediately. Therefore, the humidifier produces as much steam as possible to fill the cylinder completely.

If the cylinder is empty at the startup, then the water conductivity could be insufficient to reach immediately the required humidifier steam output. In this case the following actions take place:

- The water that has evaporated is immediately refilled.
- The drain valve is kept shut and therefore, as the steam does not contain any salts, the conductivity of the water within the cylinder slowly increases until the required humidifier steam output is obtained.

The length of the startup period depends on the water conductivity.

For very conductive water it may occur that the required humidifier steam output is obtained immediately.

Operation

The adjustable parameters which determine the humidifier operation have already been factory-preset (see iCOM™ manual).

The steam production rate is controlled by varying the water level in the cylinder.

The higher the water level, the deeper the electrodes are immersed into the water and the greater the steam production.

Note *In case of low water conductivity consult Vertiv™.*

5 - Maintenance

WARNING

Presence of potentially lethal voltage in some circuits. Presence of water that may leak or pour out.

Before doing any operation, always disconnect the power supply.

WARNING

High temperature of some components. High temperature of water.

Before doing any operation, wait until all the components and the water have cooled down. Use protective gloves.

NOTICE

Maintenance operations must be carried out only by authorized and trained technicians. We recommend the Vertiv™ Customer Service.

For any operation that is not specifically mentioned in this manual you must contact Vertiv™ Technical Support.

Periodic checks

After extended use, or when using water with a high salt content, the solid deposits that naturally form on the electrodes may reach the stage where they also stick to the inside wall of the cylinder.

If the deposits are very conductive, the heat may melt the plastic, with possible puncture of the cylinder, allowing water to leak back into the tank.

As a precaution, check, at the frequency recommended below, for deposits and the blackening of the wall of the cylinder, and replace the cylinder if necessary.

When	What to check	Disposable cylinders	Openable cylinders
After one hour of operation	• Any significant water leaks	YES	YES
Every fifteen days or no more than 300 operating hours	• Regular operation • Any significant water leaks • General condition of the casing • Arcs or sparks between the electrodes during operation	YES	YES
Every three months or no more than 1000 operating hours	• Regular operation • Any significant water leaks - If necessary, replace the cylinder.	YES	NO
Every three months or no more than 1000 operating hours	• Marked blackened parts on the casing - If this is the case, check the condition of the electrodes. - If necessary, replace the electrodes together with the O-rings and the cover gasket.	NO	YES
Annually or no more than 2500 operating hours	• Regular operation • Any significant water leaks • General conditions of the container • Marked blackened parts on the casing - If this is the case, check the condition of the electrodes. - If necessary, replace the electrodes together with the O-rings and the cover gasket.	NO	YES

Cylinder replacement

Due to the aging of the plastic and the consumption of the electrodes, even an operable steam cylinder has a limited life and it is, therefore, recommended to replace it according to the following table.

When to replace the cylinder	Disposable cylinders	Openable cylinders
Annually or no more than 2500 operating hours	YES	NO
After five years or no more than 10000 operating hours	YES	YES

Procedure

- Completely drain the water contained in the cylinder.
- Switch off the **PDX** unit and open the disconnecting switch of the power supply (safety procedure).
- Remove the steam hose from the cylinder.
- Disconnect the electrical connections from the top of the cylinder.
- Release the cylinder from the fastening device and lift it up to remove it.
- Fit the new cylinder in the humidifier by performing the previous operations in reverse order.

NOTICE

Check that the model and the power supply voltage of the new cylinder is the same as the one being replaced.

Replacement and maintenance of other components

Fill solenoid valve	After having disconnected the cables and the piping, remove the solenoid valve and check the condition of the inlet filter. Clean, if necessary, using water and a soft brush.
Supply and drain manifold	Check that there are no solid residues in the cylinder attachment, remove any impurities. Check that the gasket (O-ring) is not damaged or cracked. If necessary, replace it.
Drain pump	Disconnect the power supply. Unscrew the three fastening screws and remove the motor body. Remove any impurity and rinse.
Supply tank and conductivity meter	Check that there are no obstructions or solid particles. Check that the electrodes for measuring the conductivity are clean. Remove any impurity and rinse.
Hose kit	Check that the hoses are free and do not contain impurities. Remove any impurity and rinse.

6 - Troubleshooting

Problem	Cause	Solution
The humidifier does not turn ON	No electrical power supply	Check the protection device upstream of the humidifier and that the power supply is present
	Controller connectors plugged in incorrectly	Make sure the connectors are properly connected
	Fuses blown Transformer fault	Check the fuses
The humidifier does not start operation	Remote ON/OFF contact open or control signal not compatible with the type set	Make sure the controller is working correctly
	Manual supply valve closed, fill solenoid valve fault or inlet filter dirty	Open the manual valve, check or clean the inlet filter to the fill solenoid valve, replace the fill solenoid valve
	The steam hose is blocked or not installed correctly, that is, blocked by condensate or choked (pocket that fills with condensate)	Check the positioning of the steam hose with reference to the assembly instructions
The humidifier fills with water without producing steam	Excessive back-pressure in steam outlet	Check that the steam outlet hose is not bent or choked
	Cylinder inlet filter blocked	Clean the filter
	Lime scale in the supply tank	Clean the fill/supply tank
	Drain solenoid valve/pump fault	Check for presence of voltage 24 VAC/230 VAC at the drain solenoid valve/pump and/or replace the drain solenoid valve/pump
The line circuit breaker is activated	The circuit breaker is under-rated	Check that the circuit breaker is rated for a current equal at least 1,5 times the rated current of the humidifier
	Excess current at the electrodes	Check the operation of the drain solenoid valve/pump, the seal of the fill solenoid valve when not energized, drain some of the water and restart

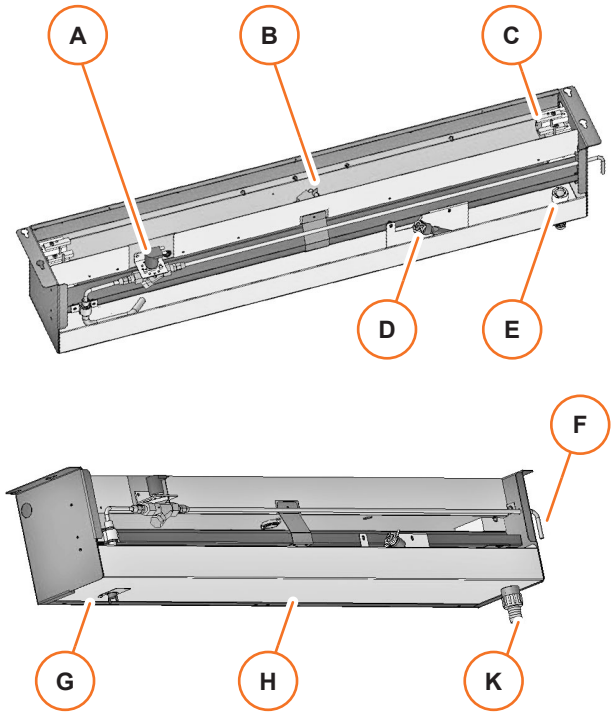
Problem	Cause	Solution
The humidifier wets the duct	The steam distributor is not installed correctly (too near the top of the duct or the condensate return is blocked)	Make sure the steam distributor has been installed correctly
	The system is oversized	Decrease the steam production, CP/CPY board
	Humidifier on when the fan in the duct is off	Check the connection of the device (flow switch or differential pressure switch) slaving the operation of the humidifier to the fan in the duct Check the remote on/off input
The humidifier wets the floor below	The supply or overflow circuit has leaks	Check the entire water circuit
	The steam outlet hose is not properly secured to the cylinder	Check that the clamp on the steam outlet is tight

Annex G - Infrared Humidifier

Content

1 - Description

Main components



A	Solenoid valve flow regulation
B	Infrared quartz lamps
C	Junction block
D	Float switch
E	Standpipe
F	Water supply
G	Manual reset for the thermostat
H	Pan
K	Discharge connection

Operating principle

The quartz lamps [**B**] are mounted above the stainless steel pan [**H**], which is filled with water through the supply inlet [**F**].

The float switch [**D**] detects if the water level is too high.

When humidification is required, the lamps are switched on and infrared rays generate steam within seconds (without impurities or odor).

The lamps never come in contact with the water.

2 - Specifications

Technical data

Infrared humidifier technical data

Size	Main power Supply	Pan	Capacity	Absorbed Current	Power
	[V ± 10%]	Material	[kg/h]	[A]	[kW]
Small	400 V / 3 ph / 50 Hz	Stainless steel	5,0	6,4	4,8
	380 V / 3 ph / 60 Hz	Stainless steel	5,0	6,9	4,8
	460 V / 3 ph / 60 Hz	Stainless steel	5,0	6,0	4,8
Big	400 V / 3 ph / 50 Hz	Stainless steel	10,0	13,9	9,6
	380 V / 3 ph / 60 Hz	Stainless steel	10,0	14,3	9,6
	460 V / 3 ph / 60 Hz	Stainless steel	10,0	12,0	9,6

Supply water

- Pressure between 138 kPa and 1000 kPa
- Flow rate 3,8 l/min

CAUTION

Do not add disinfectants or anticorrosive compounds to the water, as these are potential irritants.

The use of well water, industrial water or water from cooling circuits and, in general, any potentially chemically or bacteriologically contaminated water is not recommended.

Drain water

The drain water contains the same substances dissolved in the supply water, however in larger quantities.

It may reach a temperature of 100°C.

It is not toxic and can be drained into the sewerage system, category 3, EN 1717.

Connect the drain hose to an ordinary drainage network with the following specifications:

- install a siphon that must be able to withstand temperatures up to 100°C

3 - Installation

The humidifier is supplied already mounted within the **PDX** unit.

The only necessary operations are the connections to the supply water and drain water.

- Supply water connection: external diameter 6 mm
- Drain water connection: internal diameter 22 mm, male tread

4 - Startup and operation

Initial checks	Before using the humidifier, check the following conditions: - The water supply and drain piping are properly connected. - The shut-off valve is open. - All the wirings are properly connected. - The steam hose is properly connected to the steam cylinder and distributor.
Startup	The humidifier starts up automatically as soon as the **PDX** unit is switched **ON**.
Operation	The adjustable parameters which determine the humidifier operation have already been factory-preset (see iCOM™ manual).

5 - Maintenance

WARNING

Presence of potentially lethal voltage in some circuits. Presence of water that may leak or pour out.

Before doing any operation, always disconnect the power supply.

WARNING

High temperature of some components. High temperature of water.

Before doing any operation, wait until all the components and the water have cooled down. Use protective gloves.

WARNING

Optical radiation from the quartz lamps.

Before opening the door, always switch **OFF** the **PDX** unit.

NOTICE

Maintenance operations must be carried out only by authorized and trained technicians. We recommend the Vertiv® Customer Service.

For any operation that is not specifically mentioned in this manual you must contact Vertiv® Technical Support.

Periodic checks

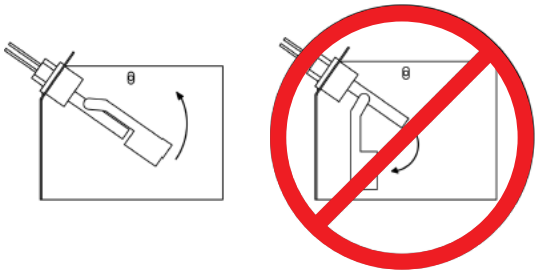
- Check drain piping and trap for clogs.
- Check the pan. Clean it from mineral deposits.
- Clean the reflector.
- Check the water supply valve for leaks.
- Check the quartz lamps (replace if burnt out).
- Check the wirings connections (inside the humidifier electric panel).

NOTE *Deposits of mineral solids will collect in the humidifier pan and on the float switch. These must be cleaned periodically to ensure proper operation. The frequency of cleaning must be locally established because it depends on humidifier usage and local water quality. A spare pan is recommended to reduce the maintenance time. The Liebert® autoflush system can greatly increase the time between cleaning, but does not eliminate the need for periodic checks and maintenance.*

Removing the pan

Before switching off **PDX** unit	• With the **PDX** unit operating, remove the call for humidification at the iCOM™ control. • Let the fans operate 5 minutes to allow the humidifier and water to cool. • Let the pan drain and the condensate pump operate (if applicable) until the pan is dry. • If applicable, let the condensate pump operate until the drain tank is dry. • Switch off the **PDX** unit.
With the **PDX** unit disconnected from the power supply	• Remove safety panels, if installed. • Pull out the humidifier standpipe from the pan. • Inspect the O-ring (replace if necessary). • Disconnect the drain coupling from the bottom of the pan. • Remove the thermostat from the bottom of the pan. • Remove the fixing screws from the sides of the pan and slide the pan out.

Cleaning the pan and the float switch

With the **PDX** unit disconnected from the power supply	• Loosen the scale on the side and bottom of the pan with a stiff nylon brush or plastic scraper. • Flush with water. • Carefully clean the scale from the float switch. Make sure to reassemble it correctly:  • Reassemble pan, thermostat, standpipe, drain coupling, cover and screws into the humidifier.
With the **PDX** unit connected again to the power supply	• Operate the humidifier and check for leaks.

Changing the lamps

NOTICE

Touching quartz lamps with bare hands will severely shorten their life. Skin oils create hot spots on lamp surface. Wear clean cotton gloves when handling lamps

With the PDX unit disconnected from the power

- Remove the humidifier pan as explained in *Removing the pan*.
- Remove the screws and cover from the high-voltage compartment of the humidifier.
- Disconnect one end of the purple jumper wires.
- Using a continuity meter, locate the burned-out lamp.
- Remove the lamp brackets under the lamps.
- Loosen the two screws securing the lamp lead wires to the junction block.
- Pull the quartz lamp straight down and discard it.
- Wrap the lead wires once around the new lamp's metal ends. This will support the lamp and allow for thermal expansion.
- Insert the lead wires into the junction block and tighten the screws
- Reassemble by performing the previous operations in reverse order.

6 - Troubleshooting

Symptom	Possible cause	Check or remedy
No humidification	Humidifier pan not filling	• Check water supply
		• Check fill valve operation
		• Check drain stand pipe adjustment
		• Check for clogged water supply piping
	Control not calling for humidity	• Check status on iCOM™
	Control calling but humidifier not starting	• Check visually • If contact is made, check line voltage after contactor, fuses and circuit breakers.
		• Check for open humidifier safety stat
	Quartz lamp burned out	• Replace the quartz lamp
	Loosen lead on old quartz lamp	• Trim excess lead length on new quartz lamp to avoid shorts

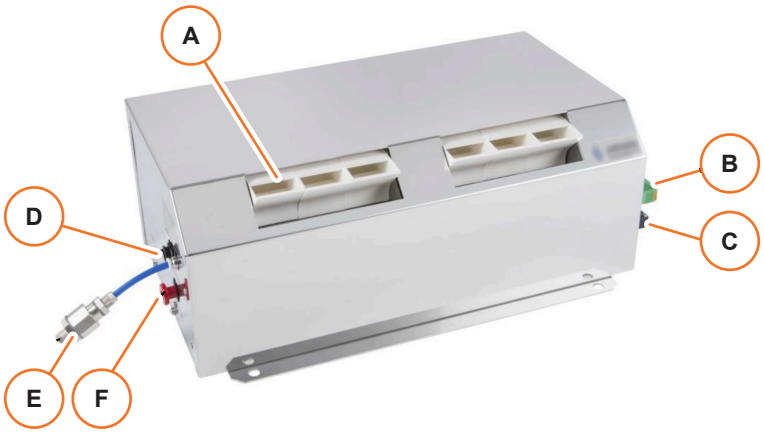
Annex H - Ultrasonic Humidifier

Content

1 - Description

NOTE *This type of humidifier is available only for units with Downflow air distribution.*

Main components



A	Mist outlet
B	Input and output for control signals
C	Input for power supply
D	Water overflow push-in connection Ø 12 mm
E	Demineralized water inlet screwed connection for Ø 6/4 mm
F	Water drainage push-in connection Ø 12 mm

Operating principle

Piezoceramic transducers are attached to the bottom of a tank filled with water.

The transducers produce ultrasonic vibrations that create capillary waves on the water surface, developing a water mist.

The air flow produced by a fan diffuses the aerosol in the ambient air.

The humidifier consists of nebulization modules, valve for the control of the supply water, float switch and a case that houses the fan.

The humidifier is provided with the following protective functions:

Dry-running	If the water level falls below minimum, humidification switches **OFF** automatically.
Overheating	Humidification switches **OFF** at water temperatures > 60°C.
Overflow	If the water tank is overfilled, the excess water is drained off to the outside.

2 - Specifications

Technical data

Ultrasonic humidifier technical data

Model	Main power Supply (1)	Capacity (2)	Transformer	Power Consumption	Absorbed Current	Number of Transducers
	[V ± 10%]	[kg/h]	[VA]	[W]	[A]	-
RB/P-16	400 V / 1 ph / 50 Hz	0 - 8,0	800,0	530,0	11,0	16

(1) The unit is equipped with an internal transformer to provide the 48 V_{AC} at the humidifier.
(2) The humidification capacity is modulated by the control based on the request.

NOTE *The ultrasonic humidifier has its own internal microprocessor, the main unit provides a 0 – 10 V_{DC} signal to regulate the capacity.*

Operating conditions

Air	Maximum air humidity	< 90 % relative humidity – no condensation
	Air temperature	5 - 45°C
Supply water	Pure water pressure	1 - 4 bar
	Pure water quality	fully demineralized
	Pure water conductivity	5 - 20 µS/cm

NOTE *If demineralized water is not available, provide a demineralizer (not supplied). Dust or dirt must not get into the water lines.*

CAUTION
Do not add disinfectants or anticorrosive compounds to the water, as these are potential irritants.

NOTICE
The demineralized water is corrosive, therefore use stainless steel or plastic only.
Non-ferrous metals (e.g. copper, brass) must not be used.

Drain water

The drain water contains the same substances dissolved in the supply water, however in larger quantities.
It is not toxic and can be drained into the sewerage system, category 3, EN 1717.
Connect the drain hose to an ordinary drainage network with the following specifications:

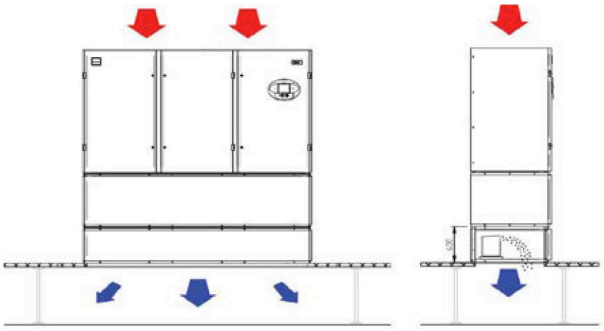
- install a siphon

3 - Installation

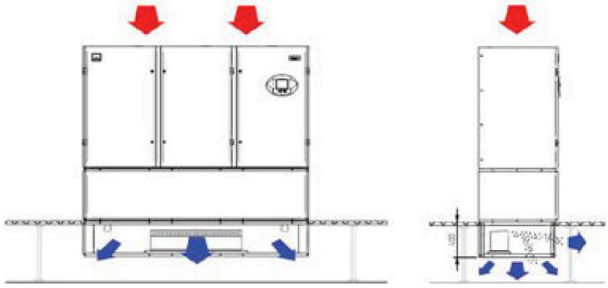
Assembly with the PDX unit

The humidifier is supplied mounted within a base module 400 mm high.

The base module with humidifier is supplied stand alone and it must be installed and connected with the **PDX** unit on field, in one of the following configurations:



On a raised floor



Under a raised floor

The sides and the back of the base module must be closed.

The front and bottom of the base module must be opened.

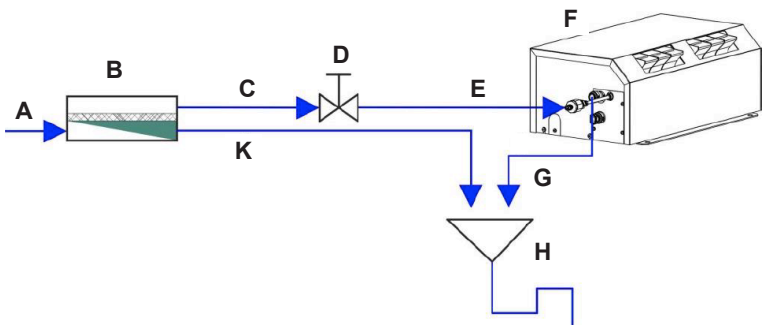
Therefore it is necessary to remove the frontal panel of the module.

A base frame, available on request, is required to support the base module (see *Annex F - Accessories*).

- Ensure 1 m of free space (without obstacles) on ultrasonic humidifier module outlet.
- For Extended Height unit, connect the fan module above the humidifier module and then the coil module above the fan module.

Connections

- Connect humidifier electrical cable, coming from the air conditioner, to the ultrasonic humidifier.
- Connect demineralization water supply, water drain, safety overflow and humidifier drain as shown in the following figure.



A	Drinking water supply (on site)
B	Demineralization system (not included with the humidifier)
C	Demineralized water inlet
D	Shut-off valve (delivered with the humidifier)
E	Plastic tube Ø 6/4 mm for demineralized water supply
F	Humidifier
G	Water overflow and discharge for plastic tube Ø 12 mm
H	Drainage (on site)
K	Concentrate

NOTICE

Demineralized water pipes must be flushed prior to commissioning the humidifier.

4 - Startup and operation

Initial checks	Before using the humidifier, check the following conditions: - The water supply and drain piping are properly connected. - The shut-off valve is open. - All the wirings are properly connected. - The steam hose is properly connected to the steam cylinder and distributor.
Startup	The humidifier starts up automatically as soon as the **PDX** unit is switched on.
Operation	The adjustable parameters which determine the humidifier operation have already been factory-preset (see iCOM™ manual).

5 - Maintenance

WARNING

Presence of potentially lethal voltage in some circuits. Presence of water that may leak or pour out.

Before doing any operation, always disconnect the power supply.

WARNING

High temperature of some components. High temperature of water.

Before doing any operation, wait until all the components and the water have cooled down. Use protective gloves.

NOTICE

Maintenance operations must be carried out only by authorized and trained technicians. We recommend the Vertiv™ Customer Service.

For any operation that is not specifically mentioned in this manual you must contact Vertiv™ Technical Support.

NOTICE

Never use high pressure cleaners to clean the humidifier.

Use grease and oil-free materials only.

Never operate the humidifier without air supply.

NOTICE

If the humidifier is not used for a long period, the water must be drained off.

Periodical checks

- Check drain piping and trap for clogs.
- Check the wirings connections (inside the humidifier electric panel).
- Check the condition of the air intake filters. Clean them, if necessary.

Cleaning

Water tank	Use a clean, totally fat-free medium hard brush and clean water.
Transducers	Wipe with a soft, scratch-free cloth. Scaling or solid deposits on the transducers must be carefully removed. For that purpose, it is recommended to use 20 % formic acid. **NOTE** *Deposits are a direct consequence of inadequate water quality.*

Annex I - ATS (Automatic Transfer Switch)

Content

1 - Safety instructions

WARNING

Improper operations can cause injury or death.

NOTICE

Improper operations can cause product damage.

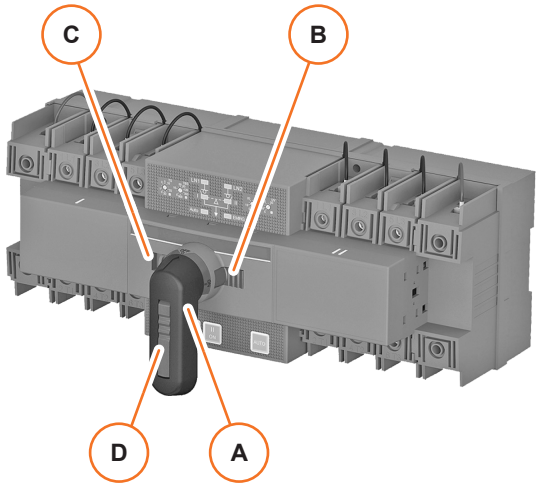
Read carefully the chapter *1. Safety*.

Pay attention to the safety labels on the unit and to the safety warnings in this chapter.

Covers	- The only cover that can be opened is the one for the auto/manual switching. - Do not open any other cover (with or without voltage) as there may still be dangerous voltage inside the unit from external circuits.
Cables	- Do not handle any control or power cables connected to the ATS when voltage may be present on the unit (directly through the mains or indirectly through external circuits). - Always use an appropriate voltage detection device to confirm the absence of voltage.
Personnel	- Maintenance and servicing operations must be performed only by trained and authorized personnel.
Arc hazard	- Ensure that no metal objects can fall in the cabinet (risk of electrical arcing).

2 - Description

Components for manual operation and locking



A	Handle for manual operation
B	Locking clip for padlock
C	Locking latch for releasing the handle and locking electrical control
D	Locking clip for locking manual operation

Operating principle

ATS is an “Automatic Transfer Switching” equipment and it is designed for use in power system for the safe transfer of a load supply between a normal (priority) power supply and a secondary (alternate) power supply. The changeover is done in open transition and with minimum supply interruption.

The **ATS** models used in the **PDX** units are with 4 poles.

The transfer switch ensures:

- Power control and safety between a normal and an alternate source.
- Intuitive HMI for emergency and local operation.
- Integrated and robust switch connection.
- Clearly visible position indication I – O – II.
- An inherent failsafe mechanical interlock.
- Stable positions (I – O – II) non-affected by typical vibrations and shocks.
- Fixed pressure on the contacts non-affected by network voltage.
- Energy efficiency with virtually no consumption whilst on the normal, alternate or off positions.

Three types of **ATS** are available:

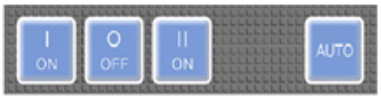
- Type 01: configurable through four potentiometers and DIP switches
- Type 02: Configurable through a controller
- Type 03: configurable through four potentiometers and DIP switches

3 - Specifications

ATS type 01

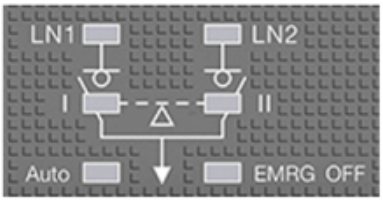
Operation	The module integrates a simplified **ATS** (Automatic Transfer Switch) functionality: in case of line I failure, it can be used for operating the motorized change-over switch to the line II, provided that line II is operational.
Electrical connection	A bridge bars provides a common point on the outgoing side of the switch (load side) and it is direct linked to the unit disconnecting switch. This cabling arrives from the factory. The terminal below the handle (for motor operator and control) are linked to the dual power source that provides power supply to the motor by using two 230 V_{ac} lines. Thereby the motor operator is automatically energized whenever power is available in one of the lines.
Product overview	The automatic transfer switch can be used as a source transfer switch in a threephase or single-phase networks. Monitored conditions are, no-voltage, phase-loss, overvoltage and under-voltage detection, transfer delays, generator start and stop, and remote test function Source transfer can be performed using a manu¬ally operated handle, locally using push buttons or fully automatically. The automatic mode includes several operating methods: Line 1 priority, no line priority and manual back switching mode

Buttons



Button	Function	Remarks
I ON	Transfer to LN1	Only available in automatic mode and remote test mode
O OFF	Transfer to 0 position	
II ON	Transfer to LN2	
Auto	Select automatic mode, fault clearance and reset	

LEDs display



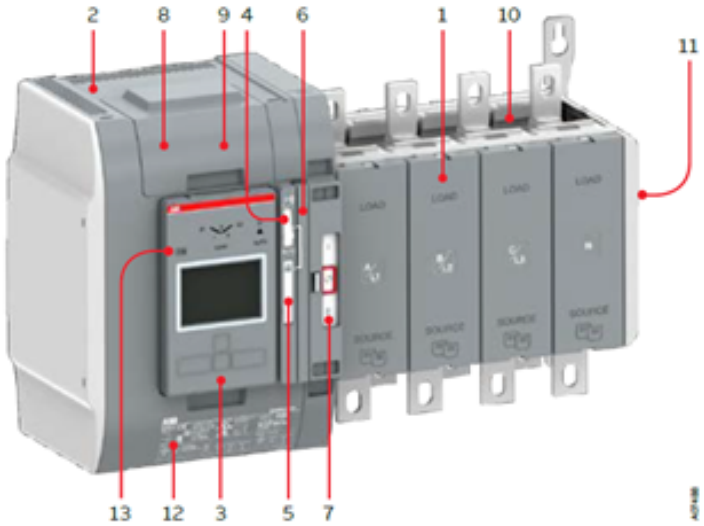
LED	Display	Status description
LN1/LN2	ON	Sourse available
	Blinking	Overvoltage, undervoltage or phase loss
	OFF	Source not available
I/II	ON	Switch I or II closed
	OFF	Switch I or II open
	Blinking	Switching failure
Auto	ON	Transfer switch in automatic mode
	Blinking	Transfer switch in test mode or invalid setting
	OFF	Transfer switch in manual mode
EMRG OFF	ON	Receiving emergency signals
	OFF	No emergency signals input

Terminals outputs and inputs

The automatic transfer has 11 bits of signal terminals for users to input and output signals.

Terminal No.	Function
1, 2	Remote test: connection for at least 100 ms for the switch to enter the remote test mode.
3, 4	EMRG OFF: Input the 24VDC EMRG OFF signals for at least 1s until the switch transfers to the EMRG OFF position and the EMRG OFF LED is on. At this time, the switch cannot enter the automatic or test mode and only handle operation is allowed. After the signal is canceled, press "AUTO" to quit EMRG OFF.
5, 6	Generator start: Dry contact, Generator start signal output. When the secondary power is a generator, they are used to start (close signal) and stop (disconnect signal) the generator. After the switch transfers to the primary power, the generator stop signal is sent after the preset delay for generator stop (see the No. 9 in section 4.3 for the generator stop delay setting).
7,8,9	Switch status, Dry contact, Switch feedback output signal to show the actual position of the transfer switch.
10, 11	Alarm: Dry contact, The switch outputs consecutive alarm signals in EMRG OFF mode or refuses to perform operations. The alarm signals are cleared after quitting the EMRG OFF mode or fault recovered.
Output contacts	Output contact relays are dry contactz and therefore external voltage supply is required. 24VDC or up to 250VAC max. 3A AC1

ATS type 02

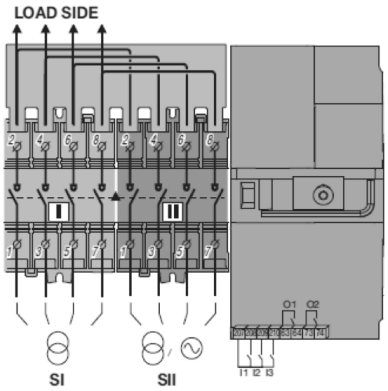
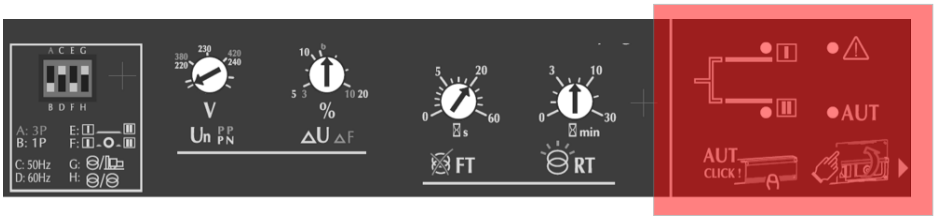
Power section	Fully integrated and interlocked transfer switch, with high electrical performance offering microprocessor control and monitoring.
Operation	Flexible operating mechanism enabling quick motorized transfer in automatic mode or locally in manual mode for emergency operations. A locking device ensures (in position "**O**") a secured isolation of the load.
General overview	

Level 3:
HMI with
LCD-screen

I - O - II (or II - O - I)

1 Transfer switch
2 Embedded ATS control unit and mechanism
3 DIP-switches, LCD or touch control interface (HMI) for configuration and automatic operation
4 Slide switch (Hand - Locking - AUTO) for selection of the operation mode
5 Padlocking the automatic transfer switch to prevent automatic and manual operation. Remark: Slide switch (Hand - Locking - AUTO) has to be in Locking-position
6 Handle for manual operation
7 Position indication
8 Terminals for control circuit connections
9 Place for Ekip-modules; communication, signaling and connectivity modules
10 Place for sensor module
11 Place for auxiliary contact blocks
12 The product identification label
13 Programming port, only for Ekip Programming and Ekip Bluetooth-modules

ATS type 03

Power section	Fully integrated and interlocked transfer switch, with high electrical performance offering microprocessor control and monitoring.
Operation	Flexible operating mechanism enabling quick motorized transfer in automatic mode or locally in manual mode for emergency operations. A locking device ensures (in position "**O**") a secured isolation of the load.
Measurement	Accuracy: frequency ±1% and voltage ±1%.
Electrical connection	 A bridge bars provides a common point on the outgoing side of the switch (load side) and it is direct linked to the unit disconnecting switch. This cabling arrived from the factory.
LEDs indications	 The LEDs indicates the source availability, the fault and the state of the product as specified in the following table:

Source / State	LED ON	LED OFF	LED blinking
I	Source 1: Available	Source 1: missing or out of range	A timer is counting down or test mode
II	Source 2: Available	Source 2: missing or out of range	A timer is counting down or test mode
	Fault	Product OK	Wait
AUT	Auto Mode	Manual Mode	Manual retransfer

NOTE *To reset a fault, it is required to open the cover.*

Technical data

Ratings		63 A	125 A	200 A	160 A
Type		**Type 01**	**Type 01**	**Type 02**	**Type 03**
Frequencies		**50 – 60 Hz**	**50 – 60 Hz**	**50 – 60 Hz**	**50 – 60 Hz**
Thermal current I_{th} at 40°C [**A**]		63	125	200	160
Short-circuit capacity	Rated short-term withstand current: I_{CW} 1s [KA_{eff}]	2,5 @ 1sec	2,5 @ 1sec	18 @ 415V 0,1sec	4
	Rated short-term withstand current: I_{CW} 30ms [KA_{eff}]	Not available	Not available	Not available	10
Switching time at I_n excluding loss of supply sensing time and excluding any delay timers applicable	I – II or II – [ms]	1200 – 1500	1200 – 1500	<500ms	180
	Duration of “Electrical Blackout” at U_n [ms]	Not available	Not available	<50ms	90
	I – O, O – I, II – O, O – II [ms]	500 - 1000	500 - 1000	1000	45
Connection cross-section	Minimum size [Cu mm^2] flexible and rigid	10	10	bolt size M8x25	10
	Maximum size [Cu mm^2] flexible and rigid	70	70	bolt size M8x25	70

NOTE *Maximum altitude without de-rating: 2000 meters. Maximum air temperature without de-rating: 40°C.*

Unit models	ATS Type	Rating
PI015 - 021 - 025 - 031 - 033	Type 01	63 A
PI041 - 045 - 047 - 051 - 057 - 075 - 044 - 054 - 062 - 074 - 068 - 059 - 092	Type 01	125 A
PI150 - 165	Type 02	200 A

4 - Installation

The **PDX** unit is delivered with the ATS already installed.

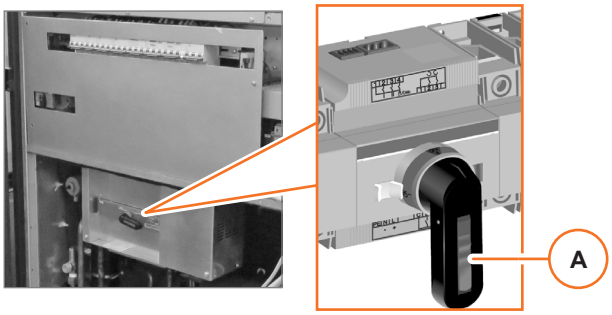
The only operation to be done on site is to connect the priority supply line and the secondary supply line to the ATS.

The ATS is placed inside a separate electrical panel and fixed on a DIN rail.

Two cable glands are present on the bottom part of the electric panel to allow the cable passage with the required IP rates.

The position of the ATS can be different than attached picture.

Cables connections



- Disconnect the power supply to the **PDX** unit through the general disconnecting switch.
- Insert the handle [**A**] in the ATS disconnecting switch and turn the handle to position "**O**".
- Insert a padlock in the handle as explained in *Locking the switch in the disconnecting position* to prevent uncontrolled restore of the electrical power.
- Connect the priority line on the terminals I.
- Connect the secondary line on the terminal II.

Configuration for type 01

Rotary switch settings

1. Switching delay Ts: The delay of switcing from primary line to secondary line in automatic mode; Choose from 0, 1, 2, 3, 5, 10, 15, 20, 25, and 30 seconds.
2. Back switching delay TBs: The delay of switching from secondary line to primary line in automatic mode; Choose from 0, 5, 10, 20, 30, 60, 120, 300, 600, and 900 seconds.

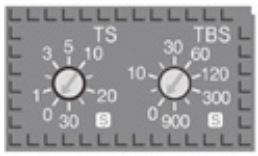


Figure 12. Rotary switch, Ts and TBs

3. Overvoltage threshold OV (%) and under voltage threshold UV (%): The benchmarks of the OV and UV are the rated voltage of the switch. When the voltage is higher than the preset OV value or lower than the preset UV value, the switch performs automatic transfer. The value of OV can be 5%, 10%, 15%, 20%, 25%, and 30%. The value of UV can be 5%, 10%, 15%, 20%, 25%, and 30%.

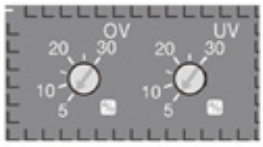


Figure 13. Rotary switch, OV and UV

Dip switch setting

1. Switching delay Ts: The delay of switcing from primary line to secondary line in automatic mode; Choose from 0, 1, 2, 3, 5, 10, 15, 20, 25, and 30 seconds.

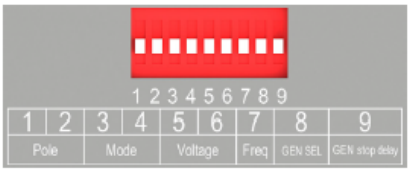


Figure 14. The 9-dip switch is used to set the working modes of transfer switch

dip switch n°	function	setting			
		01	10	11	00
1,2	pole setting	01 = 2 poles	10 = 3 poles	11 = 4 poles	invalid setting
3,4	mode setting	01 = no line priority	10 = manual back switching	11 = line priority LN1 (default)	invalid setting
5,6	Voltage setting	01 = 240/415Vac	10 = 230/415Vac	11 = 220/380Vac	invalid setting
7	Frequency setting	0 = 60Hz 1 = 50Hz (default)			
8	generator selection	0 = NO 1 = YES (default)			
9	generator stop delay setting	0 = 240 sec 1 = 30 sec (default)			

Factory settings:

dip switch n°	function	setting
1,2	pole setting	11 = 4 poles
3,4	mode setting	11 = line priority LN1 (default)
5,6	Voltage setting	10 = 240/415Vac
7	Frequency setting	1 = 50Hz (default)
8	generator selection	1 = YES (default)
9	generator stop delay setting	1 = 30 sec (default)
Rotary switch settings		
TS	Delay from primary to secondary	3 sec.
TBS	Delay from secondary to primary line	300 sec.
OV	Over voltage	10%
UV	Under voltage	10%

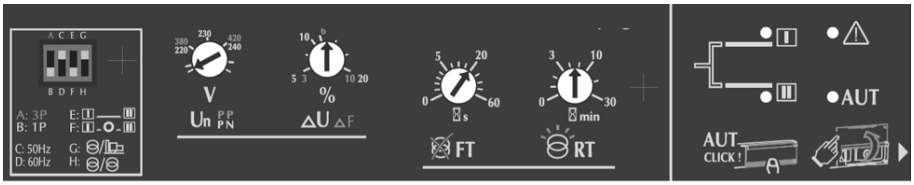
Configuration for type 02

Parameter		Setting Range
operation		
	automatic mode	OFF
	HMI Control Keys	Enabled
System parameters		
	source 1	Phase with Neutral (3ph4w)
	source 2	Phase with Neutral (3ph4w)
	rated voltage	400V
	Rated Frequency	50Hz
	Neutral Position	pole 4
	phase sequence	ABC
Device Parameters		
	In-phase Monitor	ENABLE OFF
	Synchronization DELAY	**60** s
	Delay Times	
	transfer from S1 to S2 0…60 min (2* s)	**3** sec.

	Parameter	Setting Range
	transfer from S2 to S1 0…120 min (2* s)	**300** sec.
	Override S1 Fail **0...60** s (2* s)	**2** sec.
	Override S2 Fail **0...60** s (2* s)	**2** sec.
	Center-OFF 0*...300 s	0 sec.
	Generator Stop 0*...60 min	0 sec.
	Pre-transfer S1 to S2 0*...60 s	0 sec.
	Post-transfer S1 to S2 0*...60 s	0 sec.
	Pre-transfer S2 to S1 0*...60 s	0 sec.
	Post-transfer S2 to S1 0*...60 s	0 sec.
	Load Shed 0*...60 s	0 sec.
Voltage & Frequency Setpoints	**S1 SET POINT**	
	S1 Drop-out Voltage	Upper Threshold 10%
		Lower Threshold 10%
	S1 Pick-up Voltage	Upper Threshold 10%
		Lower Threshold 10%
	S1 Drop-out Frequency	Upper Threshold 1%
		Lower Threshold 1%
	S1 Pick-up Frequency	Upper Threshold 1%
		Lower Threshold 1%
	S2 SET POINT	
	S2 Drop-out Voltage	Upper Threshold 10%
		Lower Threshold 10%
	S2 Pick-up Voltage	Upper Threshold 10%
		Lower Threshold 10%
	S2 Drop-out Frequency	Upper Threshold 1%
		Lower Threshold 1%
	S2 Pick-up Frequency	Upper Threshold 1%
		Lower Threshold 1%
Generator Exercisers		
	Exerciser 1 / 2 / 3 / 4	
	Status	Disabled
	function	no function
	duration	**0....60** s
	time	Time of the exercising event
	date	Date of the exercising event
Application		
		S1-Transformer/S2-Generator*

Parameter		Setting Range
manual retransfer		**OFF**
Commit Transfer		**OFF**
Harmonics Phase		Disabled*
	MEASUREMENT	
	SWITCH DIAGNOSTICS	READ ONLY
	Parameter	**Setting Range**
	Standard I/O Settings	
	Function	Emergency Stop* (default in I 01)
		Remote Test On Load* (default in I 02)
		Remote Test Off Load* (default in I 03)
	contact type	**NO***
	System	
	Date	SELECT DATE
	Time	SELECT TIME
	Language	
	English	SET ENGLISH LANGUAGE
	Italian	
	French	
	German	
	Spanish	
	Russian	
	Chinese	
	New Password	
	Temperature Unit	
	Celsius*	Celsius*
	Fahrenheit	
	Display Contrast	
	10 - 100% (30%*)	30%*

Configuration for type 03



- Open the Auto / Manual cover to set the DIP switches.

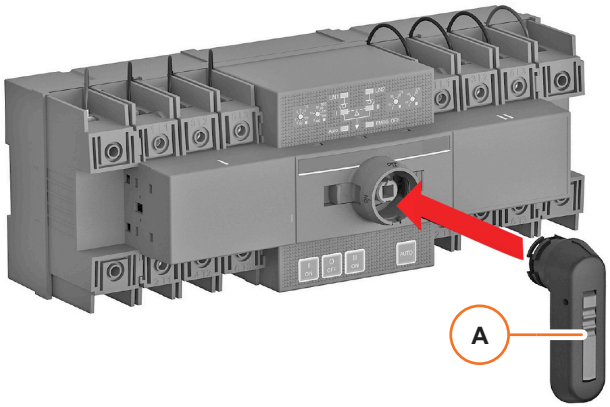
The ATS type 03 arrives pre-configured from the factory as described in the following table:

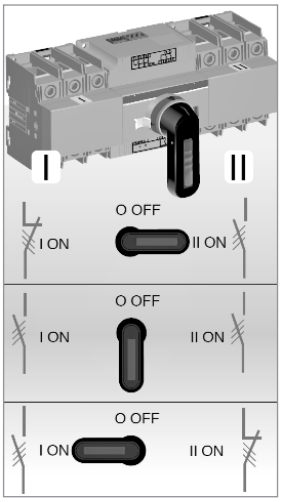
	Available configuration	Factory configuration
DIP switch 1	**A**: three phases **B**: single phase	**A**
DIP switch 2	**C**: 50 Hz **D**: 60 Hz	According to unit power supply
DIP switch 3	**E**: no stop in **0** position **F**: **2** seconds of stop in **0** position	**E**
DIP switch 4	**G**: Network – Genset **H**: Network – Network	**H**
Potentiometer 1	Adjustment potentiometers of the rated voltage threshold	230 – 400 V
Potentiometer 2	Adjustment potentiometers of the rated frequency threshold (as % of frequency and voltage)	10%
Potentiometer 3	Fault time, no commutation if the missing voltage time is less than the setting	**3** sec.
Potentiometer 4	Return time, minimum required time to return on the main/priority line	**300** sec.

NOTE *For different voltage and frequency, please contact the Vertiv™ Technical Support.*

5 - Operation

Manual mode





- Insert the handle to set the ATS to the manual mode.

Now the automatic operations are disabled and the switch will not operate automatically in case of power failure.

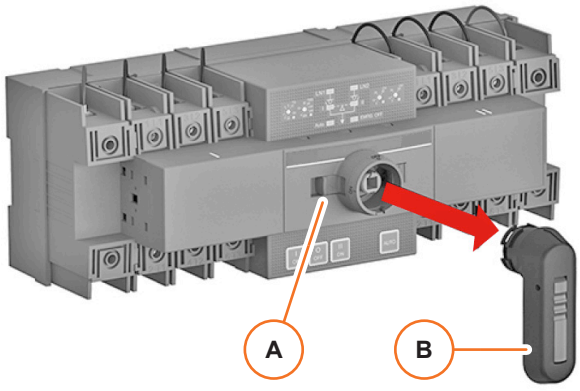
You may turn the handle to each of the following positions:

I - priority power supply

O - power supply disconnected

II - secondary (alternate) power supply

Automatic mode



- Pull the latch [**A**] and remove the handle [**B**] to enable the automatic mode.

Now the power supply is normal.

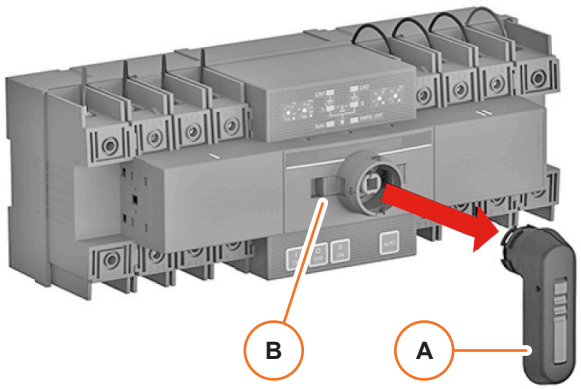
During the initial power-up the ATS will be in automatic mode and it will switch to the primary line.

NOTE *Keep the handle attached if you do not want the ATS to be in automatic mode during the initial power-up.*

NOTICE

Before powering on the ATS, manually operate it to ensure that it can move normally.

Locking the electrical operation



The purpose of this procedure is to lock the ATS in a selected electrical operation mode:

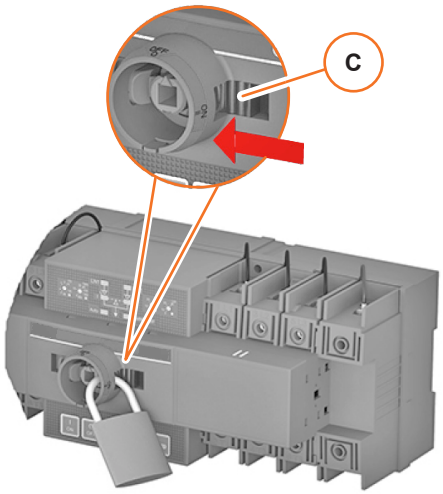
I - priority power supply

O - power supply disconnected

II - secondary (alternate) power supply

To lock the electrical operation:

- Turn the handle [**A**] in the position that you want to lock.
- Pull the latch [**B**] and remove the handle.

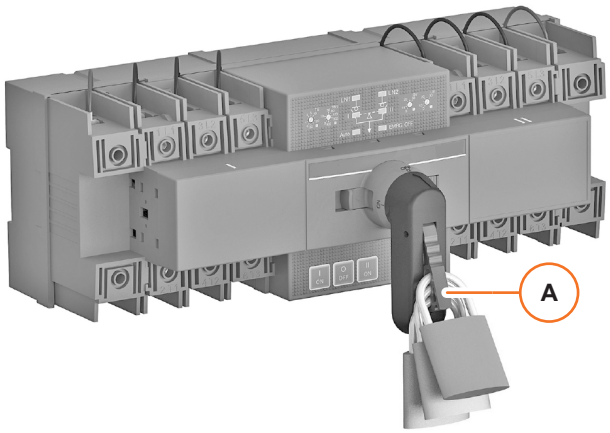


- Push the latch [**C**].
- Insert a padlock in the switch.

Now all operating modes and test operations are disabled and handle cannot be inserted.

NOTE *The switch can be padlocked in any position.*

Locking the switch in the disconnecting position



- Insert the handle and turn it to position "**O**".
- Lift the locking clip [**A**].
- Insert your padlock in the clip.

Now the switch is locked in the power disconnecting position.

NOTE *The handle can be padlocked only in the "**O**" position.*

6 - Maintenance

Periodic checks and operations

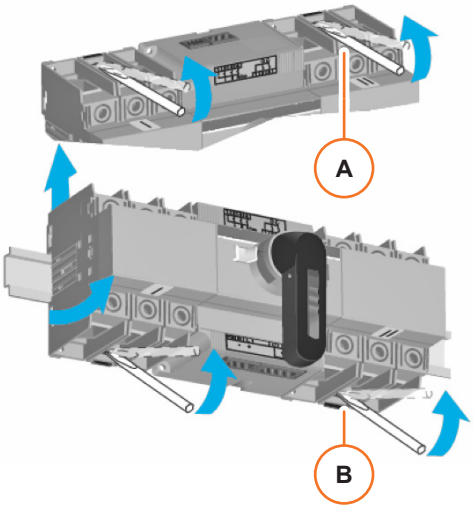
- Check if the electrical connections are tight.
- Tighten any loosen connection.

Replacement

The ATS fault is indicated by the LEDs as following:

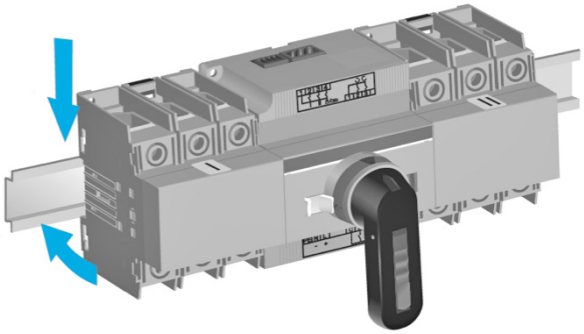
- ATS type 01: both LEDs are **OFF**.
- ATS type 03: the “Fault” LED IS **ON**

NOTE *For ATS type 03, you may try to reset the error by opening and the closing the cover. If the fault persists, follow the procedure below to replace it.*



How to remove the ATS

- Disconnect the power supply to the **PDX** unit through the general disconnecting switch.
- Switch in manual mode and set the position of the handle on “**O**”.
- Disconnect all the electrical cables:
  - line **I**
  - line **II**
  - outgoing line (load side)
  - control cables
- Remove all the screws that fix the ATS on the DIN rail and on the electrical panel (if they are present).
- Insert a screw driver in one of the eyes [**A**] placed on the upper part of the ATS and pull it out from the DIN rail (repeat for the other eye(s)).
- Insert a screw driver in one of the eyes [**B**] placed below the ATS and pull it out from the DIN rail (repeat for the other eye(s)).
- When all the connection points are free, lift the ATS and remove it.



How to reassemble the ATS

- Switch the new ATS in manual mode and set the position of its handle on “**O**”.
- Place the ATS on the DIN rail and press until it locks.
- Fix all the screws that fix the ATS at the DIN rail and at the electrical panel (if they are present).
- Connect all the electrical cables:
  - line **I**
  - line **II**
  - outgoing line (load side)
  - control cables
- For the ATS type 03: adjust the configuration settings.
- Connect the **PDX** unit to the power supply.
- Restart the **PDX** unit.

7 - Troubleshooting

ATS type 01

Symptom	Possible Cause	Check or remedy
Power supply functioning normally, but LED not ON	Control unit power supply terminal not connected with switch wiring terminal	Check and connect the switch wiring terminal
Transition failure in case of faulty power supply	• Switch not operating in “AUTO” mode • Both power supplies malfunctioning	Make sure the switch is working in “AUTO” mode. Make sure that both power supplies are not malfunctioning simultaneously.

ATS type 02

Alarms

Symptom	Possible Cause	Check or remedy
Locked, Alarm LED on	Lock input activated	Unlock
Switch not in AUTO mode, Alarm LED on	"Slide switch is in handle or lock position"	Turn slide switch into the AUTO position
Phases crossed	"Phase rotation of sources 1 and 2 are different"	"Connect the phases of both sources in the same order"
S1 undervoltage	Voltage of source 1 is under the threshold level set in parameter “Drop-out voltage, lower threshold“	"Check the correlation between power source and device configuration"
S1 overvoltage	Voltage of source 1 is over the threshold level set in parameter “Drop-out voltage, upper threshold“	"Check the correlation between power source and device configuration"
S1 phase missing	"One or two phases of source 1 are missing"	"Check the power source and connections"
S1 unbalance	Phases of source 1 are not symmetric	Check the power source
S1 phase rotation	"Phase rotation of source 1 is different from the value of parameter “Phase sequence“"	"Connect the phases according to the configuration"
S1 invalid frequency	Frequency of source 1 is out of range set in parameters “Drop-out frequency, upper threshold“ and “Drop-out frequency, lower threshold“	"Check the correlation between power source and device configuration"
S2 undervoltage	Voltage of source 2 is under the threshold level set in parameter “Drop-out voltage, lower threshold“	"Check the correlation between power source and device configuration"
S2 overvoltage	Voltage of source 2 is over the threshold level set in parameter “Drop-out voltage, upper threshold“	"Check the correlation between power source and device configuration"
S2 phase missing	"One or two phases of source 2 are missing"	"Check the power source and connections"
S2 unbalance	Phases of source 2 are not symmetric	Check the power source
S2 phase rotation	"Phase rotation of source 2 is different from the value of parameter “Phase sequence“"	"Connect the phases according to the configuration"
Frequency Difference	"Frequency difference of voltage sources is greater than 3 Hz while in-phase monitor is **ON**"	"Check the correlation between power source and device configuration"

Symptom	Possible Cause	Check or remedy
S2 invalid frequency	Frequency of source 2 is out of range set in parameters “Drop-out frequency, upper threshold“ and “Drop-out frequency, lower threshold“	"Alarm is active and transfer operations disabled as long as the high current status remains"
High current alarm	"Measured current is higher than ten times the nominal value"	Reset alarm by pressing Auto button or via menu page Operation / Alarm Reset
"Open I failure, Alarm LED blinking"	"Switch transfer from position **I** to **O** or **II** failed"	Reset alarm by pressing Auto button or via menu page Operation / Alarm Reset
"Close I failure, Alarm LED blinking"	Switch transfer to position **I** failed	Reset alarm by pressing Auto button or via menu page Operation / Alarm Reset
"Open II failure, Alarm LED blinking"	"Switch transfer from position **II** to **O** or **I** failed"	Reset alarm by pressing Auto button or via menu page Operation / Alarm Reset
"Close II failure, Alarm LED blinking"	Switch transfer to position **II** failed	Switch service needed
Switch position alarm, Alarm LED on	More than one switch position indication inputs are activated	Switch service needed
Pole temperature alarm	Measured pole temperature is too high	Switch service needed
Contact wear alarm	Switch contact wear is near the limit that requires maintenance	Check connection
Local bus	"Communication between HMI and switch controller is **OFF**"	Check connection
Ethernet disconnected	Ethernet module not connected	"Alarm is active and disables transfer operations as long as the input is active"
Fire Fighting	Fire fighting input activated	Check power source
"Control Voltage Failure"	"Control voltage dropped during switch control"	Check power source
Control Voltage Low	"Switch control voltage is below the minimum"	Check parameter values
Configuration Error	Invalid configuration	Check configuration file
IEC 61850 Error	IEC 61850 failure	Check configuration
Ekip Com Hub Alarm	Ekip Com Hub failure	Ekip Com Hub failure

Warnings

Message	Reason
S1 and S2 not in sync	Voltage sources are not synchronized
Voltage Not Calibrated	Calibration data in power module is invalid or unavailable
Current Not Calibrated	Calibration data in current measurement module is invalid or unavailable
Pole temperature warning	Measured pole temperature is near the alarm level
Control Retry	Failed transfer sequence retry activated
Auto Control Disabled	Device is in manual operating mode
Local Bus	Module heartbeat error
Configuration	Configuration session ports are open

Message	Reason
RTC capacitor charging	Real time clock is not yet operational, date & time setting is disabled as long as this warning is active. RTC capacitor is charged from source voltage (not AUX) and takes about **10** minutes

ATS type 03

Symptom	Possible Cause	Check or remedy
The "Priority SOURCE availability" LED does not come ON	DIP switches not set correctly	Set the DIP switch according to electrical diagram
	Wrong nominal voltage	Measure the voltage across the terminals and report the value on the potentiometer
The "Emergency SOURCE availability" LED does not come ON	DIP switches not set correctly	Set the DIP switch according to electrical diagram
	Wrong nominal voltage	Measure the voltage across the terminals and report the value on the potentiometer
The product remains switched OFF after the "Priority SOURCE" is lost	The voltage across the power supply terminal of the emergency mode is not between 176 to 288 V_{ac}	Check it through a potentiometer
	In case of transformer/Genset, check that **FT** timer (Main Failure Timer) has finished counting down.	Check the setting of the failure timer.
The product remains switched off after the "Priority SOURCE" is lost	The product is in manual mode.	Make sure the switch is working in "AUTO" mode.
	The automatic operation is inhibited by an external control command.	Check the configuration of the remote control.
	The LED "AUT" and "Emergency SOURCE availability" are lit.	Check the power line status.
The product remains switched off after the "Priority SOURCE" is restored	The product is in manual mode.	Make sure that the switch is working in "AUTO" mode.
	The automatic operation is inhibited by an external control command.	Check the configuration of the remote control.
	The LED "Primary SOURCE Availability" is lit.	Check the power line status.
	The Main Return Timer (RT) could be set between **0 – 30** minutes	Check that RT is set correctly.
	"Manual retransfer" is activate.	Check the "Manual Retransfer" function.
Return to "Priority SOURCE" has been execute, but the "Emergency SOURCE" (for a generator) continues to operate	The product is in manual mode.	Make sure the switch is working in "AUTO" mode.
	CDT (cool down timer) has not finished counting down – Fixed time delay **4** minutes.	Check the stopwatch.
	The automatic operation is inhibited by an external control command.	Check the configuration of the remote control.
The product cannot be switched over using the handle	Wrong rotation handle	Check the rotation handle
	The product is Padlocked	Check that the product is not padlocked

Symptom	Possible Cause	Check or remedy
Automatic mode is not activated even when the cover is closed	The “AUT” LED is not lit	Check that the plastic pin is in place at the bottom of the cover. This pin activates the sensor which indicates the position of the cover (open or closed).

Annex J - Electrical disconnecting device on enclosure

For PI extended units, models 055-059-070-092-140-150-165 in DOWNFLOW FRONTAL and DOWNFLOW UP configuration the external handle of the main disconnecting device on the unit it is located over the limit heigh of 1,9 meters indicated on the electrical standard EN 60204-1:2018 “Safety of machinery Electrical equipment of machine”.

In order to comply with this requirement of the electrical standard, VERTIV™ supply this units with a disconnecting device on an enclosure (loose supply) to install near the machine by the end user.

During the installation of external disconnecting device supply by VERTIV™ the end user must respect these following points:

1. The external disconnecting device must be visible during the activities of maintenance on the PI units in order to prevent unexpected operations (for example the disconnecting device is turn ON when the operator is working on the electrical panel of the machine);
2. The operating means of the supply disconnecting device shall be easily accessible;
3. The handle of the external disconnecting device must be located between 0,6 m and 1,9 m above the servicing level but an upper limit of 1,7 m is recommended;
4. The power supply cable from the distribution power panel (upstream the unit) to the external disconnecting device and from the external disconnecting device to the electrical panel of the PI machine must have the same cross-sectional area and current capacity;
5. No reduction of the cross-sectional area of the two power supply cable are admit;
6. The conductors must installed in such a manner as to reduce the possibility of a short-circuit, for example, protected by an enclosure or duct;
7. The protective device on the power distribution panel must be coordinated with the two power supply line and the two disconnecting device (the external and the internal on the PI machine);

Follow the steps below for installing the external disconnecting device on enclosure:

1. Install the device between 0,6 m and 1,9 m above the service level, an upper limit of 1,7 m is recommended;
2. The operating means must be easily accessible and visible during the maintenance activities on the PI unit;
3. Connect the power cable for each supply (main power supply and emergency power supply if this option is provided for the PI unit) to the input terminals of the external disconnecting on enclosure:

   a. L1-L2-L3-(N)-PE for single power supply (main)

   b. L1-L2-L3-(N)-PE and L1-L2-L3-(N)-PE for double power supply (main and emergency):

4. Connect a power cable (for main power supply and emergency power supply if this option is provided for the PI unit) from the external disconnecting device on enclosure output terminals to the input terminals of the main disconnecting device installed on the PI unit that could be:

   a. Main disconnecting device (label “-Q1” on wiring diagram) if the PI unit is in configuration “standard power supply” or “dual power supply parallel”;

 or 

b. ATS device (label “-QS” on wiring diagram) if the PI unit is in configuration “dual power supply parallel”:

STANDARD POWER SUPPLY	DUAL POWER SUPPLY PARALLEL	DUAL POWER SUPPLY ALTERNATE
		
Customer distribution power panel One power supply cable from the distribution panel to the external disconnecting device on enclosure	Customer distribution power panel Two power supply cable from the distribution panel to the external disconnecting device on enclosure	Customer distribution power panel Two power supply cable from the distribution panel to the external disconnecting device on enclosure
		
External disconnecting device (3P / 4P) on enclosure supply by VERTIV™ One power supply cable from the external disconnecting device on enclosure to the PI unit	External disconnecting device (6P / 8P) on enclosure supply by VERTIV™ Two power supply cable from the external disconnecting device on enclosure to the PI unit	External disconnecting device (6P / 8P) on enclosure supply by VERTIV™ Two power supply cable from the external disconnecting device on enclosure to the PI unit
		
Disconnecting device (3P / 4P) on PI unit	Disconnecting device (6P / 8P) on PI unit	Automatic transfer switch device (6P / 8P) on PI unit

VERTIV™

Fabbricante - Manufacturer - Hersteller - Fabricant - Fabricante Fabricante - Tillverkare - Fabrikant - Valmistaja - Produsent Fabrikant - Κατασκεναστηζ - Producent
Vertiv S.r.l. - Zona Industriale Tognana
Via Leonardo da Vinci, 16/18 - 35028 Piove di Sacco - Padova (Italy)

Il Fabbricante dichiara che questo prodotto è conforme alle direttive Europee:
The Manufacturer hereby declares that this product conforms to the European Union directives:
Der Hersteller erklärt hiermit, dass dieses Produkt den Anforderungen der Europäischen Richtlinien gerecht wird: Le Fabricant déclare que ce produit est conforme aux directives Européennes:
El Fabricante declara que este producto es conforme a las directivas Europeas:
O Fabricante declara que este produto está em conformidade com as directivas Europeias: Tillverkare försäkrar härmed att denna produkt överensstämmer med Europeiska Uniones direktiv: De Fabrikant verklaart dat dit produkt conform de Europese richtlijnen is:
Vaimistaja vakuuttaa täten, että tämä tuote täyättää seuraavien EU-direktiivien vaatimukset: Produsent erklærer herved at dette produktet er i samsvar med EU-direktiver:
Fabrikant erklærer herved, at dette produkt opfylder kravene i EU direktiverne:
Ο ΚατασÀευαστÞj δηλÞνει ütι το παÃüν πÃοÍüν εßναι ÀατασÀευασμÝνο αýμφωνα με τιj οδηγßεj τηj E.E.:

2006/42/EC; 2014/30/EU; 2014/35/EU; 2014/68/EU; 2011/65/EU; EU/2015/863

VertivCo.com | Vertiv - EMEA, via Leonardo Da Vinci 16/18, Zona Industriale Tognana, 35028 Piove di Sacco (PD) Italy, Tel: +39 049 9719 111, Fax: +39 049 5841 257

Liebert® PDX W-F-H | UM | 10022449MAN_ENG | 08.01.2024