Liebert® PWM 30
Frontal Air Delivery Chilled Water Room Cooling Units

User Manual

English, 10037309MAN_ENG, rev. A.01 - 16.01.2024

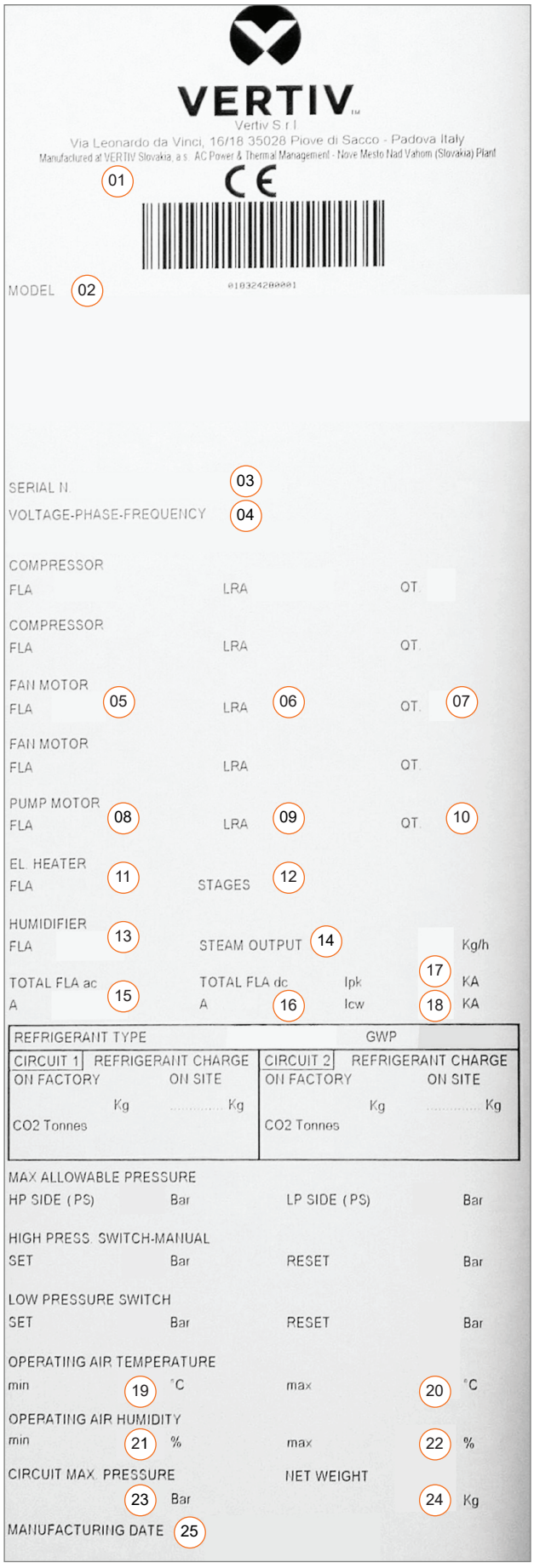
This document, written in English, is the original version

Contents

Annexes

Documents supplied with the machine

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



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	Fan Full Load Amps
06	Fan Locked Rotor Amps
07	Fan quantity
08	Pump Full Load Amps
09	Pump Locked Rotor Amps
10	Pump quantity
11	Electrical heater full load Amps
12	Electrical heater stages
13	Humidifier full load Amps
14	Humidifier steam production capacity
15	Unit total full load Amps AC [A]
16	Rated short-time current [kA]
17	Rated peak withstand current
18	Rated short-time current
19	Minimum room operation temperature
20	Maximum room operation temperature
21	Minimum room operation air humidity
22	Minimum room operation air humidity
23	Maximum hydraulic circuit pressure
24	Net weight
25	Manufacturing date

Abbreviations - Acronyms

Item	Definition
ATS	Automatic Transfer Switch
EC	Electronically Commutated [fans]
MCB	Miniature Circuit Breaker
PICV	Pressure Independent Control Valve
STO	Safe Torque Off
Ultracap	Ultra capacitor
UPS	Uninterruptible Power Supply

1. Safety

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 diagram, water 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 D - 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.
- Never operate the unit without the above mentioned safeguards.

1.3 Personal Protective Equipment

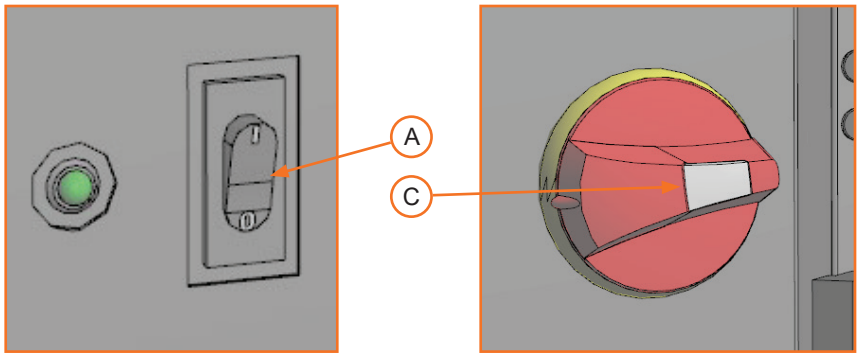
As general rule, always wear the following **PPE** (Personal Protective Equipment):

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:

- Turn the disconnecting switch [**C**] located on the front panel to **0/OFF**
- For units with ATS power supply, turn the disconnecting switch [**B**] to "**0**" position, see chapter *Annex D - ATS* (Automatic Transfer Switch) for details.

After you open the door, pay attention to the cable and components that are still energized.

Turn the disconnecting switch **OFF** before removing any protective cover.

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 **10** 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**	**General safety measures:** • Always wear temperature resistant gloves when operating on the unit.
	**Sharp elements**	Fin and tube heat exchanger is made of plates and fins, which may have sharp edges and burrs. Also, other elements inside the unit may have sharp edges, burrs, 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. During operation, the coil compartment of the unit is under positive pressure. Turn the unit **OFF** before opening any latches on the front panels. **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 chapter *2.7. 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.

1.5 Purpose of the unit

The **PWM 30** units have been designed and manufactured for the following purpose:
- Precision air conditioning for indoor use (for data centers, network closets, technological rooms).

1.6 Assembly of the unit

The unit is supplied in four separate modules:

- The coil section and fan module are delivered separately and need to be connected at the installation site.
- Base frame and intake plenum are delivered separately, in disassembled state and need to be assembled and connected at the installation site.

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

- Base frame installation, mounting of the fan section, plenum attachment
- Electrical connections for power supply
- Water piping connections to the chilled water supply system
- Other optional piping connections (condensate drain)

See Chapter *2. 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.

1.7 Heat transfer fluid

The heat transfer fluid is chilled water or mixture water + glycol supplied by an external system.

In this document we will use the word “water” in case of water + glycol mixture when not specified differently.

1.8 Functional limits

See Chapter *3. Technical data*

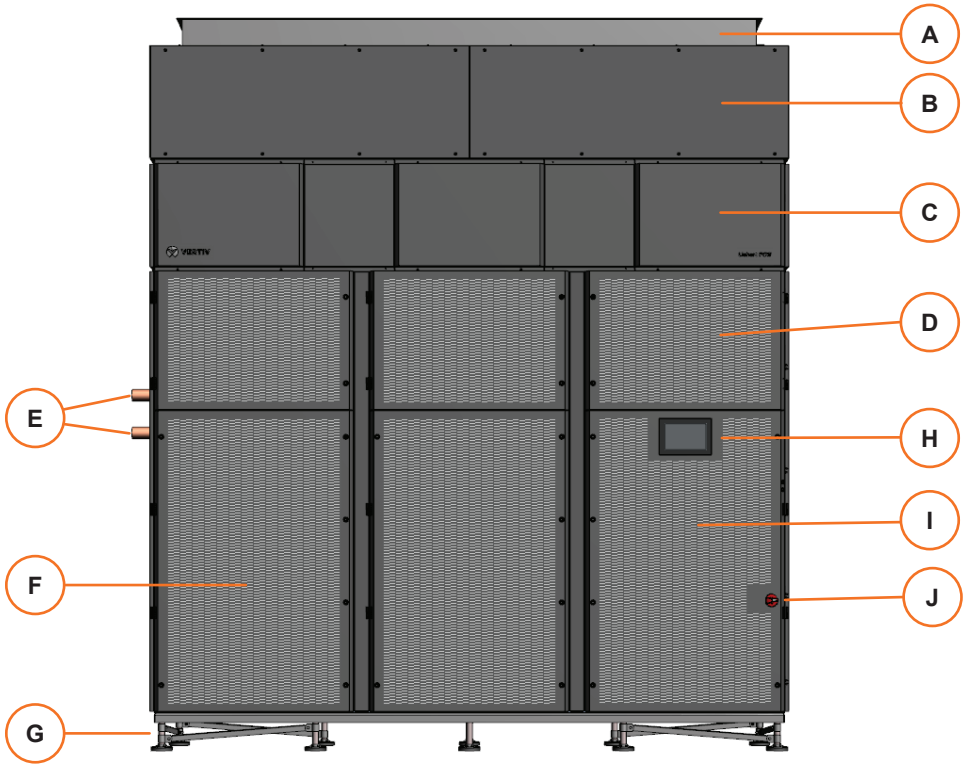
WARNING
Risk of components failure or breakage.
Do not use fluids and voltage that are different from what is specified in this manual for your unit.
Contact Vertiv™ Technical Support for any question.

1.9 Reference norms

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.
Performance test norms	- Cooling Capacity according to EN 14511 - Sound Power Level according to ISO 3744

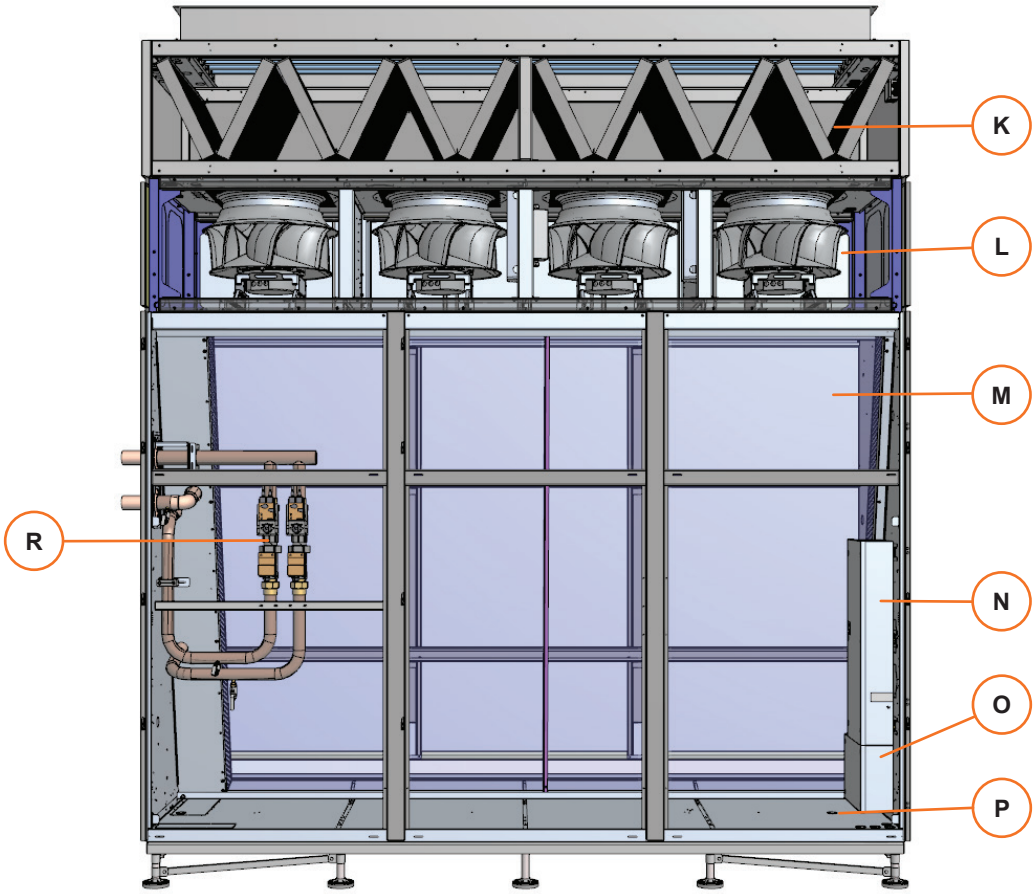
2. Unit Description

2.1. Unit structure



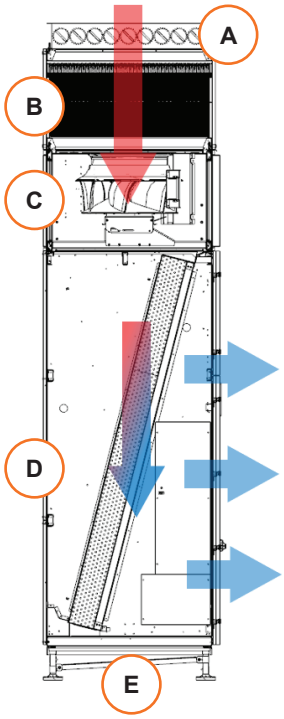
Ref.	Description	Remaks
A	**Intake damper (optional)**	The unit can be equipped with a remotely controlled damper on the air intake.
B	**Plenum with filters**	The unit is equipped with separate plenum section with replaceable filters.
C	**Fan module section**	The fan section is attached on top of the coil section. It is completely enclosed by panels and safety grids to prevent any contact with the moving parts.
D	**Coil section**	The coil section makes up the main body of the unit. This section is fully enclosed by panels and door for protection against any contact with electric components or hot and cold surfaces.
E	**CW connections**	Connections for inlet and outlet of the chilled water (from external source) are located on the lateral side of the coil section. The unit is equipped with 64 mm grooved connections and is delivered with stub pipes and clamps for customer connection.
F	**Front panels**	Removable panels are attached to the front side of the coil section. These panels allow acces ito the cabinet for maintenance purposes. **Note:** *Please refer to chapter 8.3 Removing the frot access panels before removing these panels*
G	**Base frame (optional)**	The unit is standing on a welded base frame with attached legs and stiffeners.
H	**Control panel display**	The unit is usually controlled remotely by network connection. 7” touch screen control panel is located on the front door for direct control of the unit.
I	**Doors**	The lower right panel is attached on hinges. This door allows acces to the electric panel and ATS module inside the unit. Proper tool is required to unlock the latches and open the door.
J	**Shut-off switch**	The shut-off switch is located on the front door in lower-right area of the unit.

2.2. Internal components



Ref.	Description	Remaks
K	**Filter array**	Each filter section can be individually replaced. For more details see chapter *8.6.2 Replacing the air filters*
L	**Fan**	The unit is equipped with radial fans located in the fan module above the coil section.
M	**Coil/heat exchanger**	The intake side of the coil is covered by air filters which are accesible for maintenance or exchange. For details regarding the electric panel, see chapter *2.8 Electric and control system*
N	**Electric panel**	For details regarding the electric panel, see chapter *2.8 Electric and control system*
O	**ATS module**	The unit is delivered with dual power supply in order to have the unit up and running even if the main power supply fails.
P	**Condensate drain outlet**	The tubing for draining the condensate water from the unit is connected inside the unit cabinet and the outlet leads to the dottom of the unit.
R	**CW Pressure independent control valve assembly**	The unit is equipped with a pair of PIC valves. For details regarding the actuator replacing, see chapter *8.6.4 Replacing the valve actuator*.

2.3. Air distribution

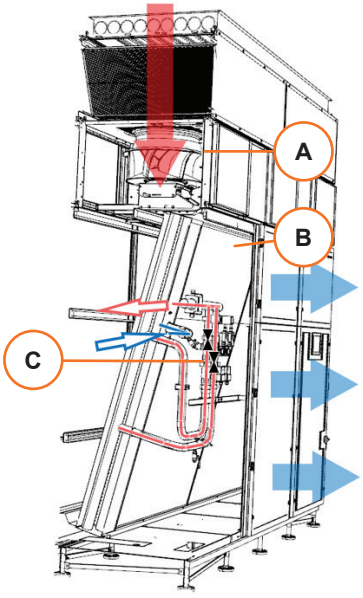


Warm air (return air from the room)

Cold air (supply air into the room)

- The unit frame consists of the coil section [**D**] and the fan section [**C**]
- The coil section contains the cooling system of the unit, the electric panel and the control system.
- The fan takes the **warm air** from the room through a damper and filter section into the unit. **Warm air** is blown through the heat exchanger, cools down and **cold air** is discharged into the room through the perforated frontal panels.
- The fan section is placed on top of the coil section.
- The cooling system of the unit is connected on site to the external chilled water supply system.
- The unit may be standing on a base frame [**E**] (optional accessory)
- Intake plenum with filter array [**B**] and a damper module [**A**] (optional accessory) is attached on top of the fan section.

2.4. Cooling system



Main components

Ref.	Description
A	Fan
B	Water coil / heat exchanger
C	CW valve (PICV)

Operating principle

This diagram shows a simplified scheme for Single circuit **PWM30 Mega CRAH** unit.

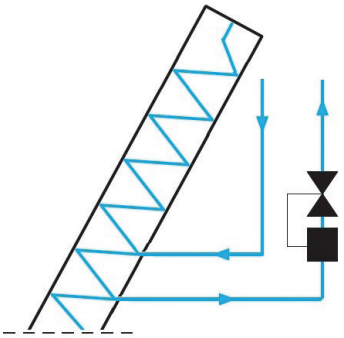
For detailed circuit scheme, see *Annex A – Chilled water circuit scheme*.

The fan [**A**] forces the **warm air** coming from the room to flow through the water coil [**B**].

The chilled water flowing inside the coil cools down the air. This air is the discharged into the area.

The control system operates the opening and closing of the water valve [**C**] at the water outlet in order to control the water flow rate to maintain desired operating conditions.

2.5. Water valve type



Pressure independent control valve (PICV)

An ultrasonic flow sensor measures the flow rate at water outlet and adjusts the valve opening. Operated by Modbus.

Max. flow volume for PIC valves	[l/s]
All models	12,6

NOTICE
Do not exceed the nominal operating pressure of the circuit components.
Air bubbles in the circuit can cause a loss of precision in cooling action, therefore deaeration is recommended.

2.6. Storage and operating conditions

2.6.1. Storage conditions

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 starting the unit.
Position	Keep the unit vertically upright.

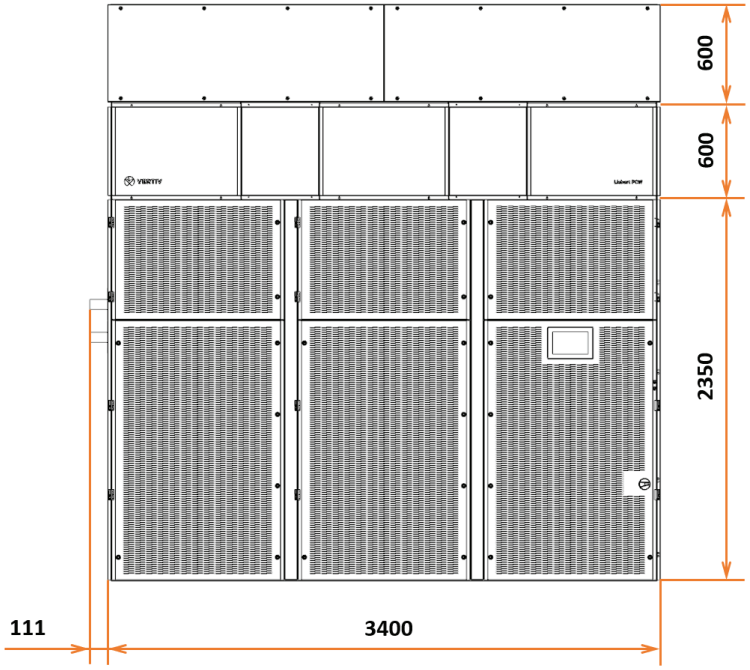
2.6.2. Operating conditions

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	+18°C — +45°C
	Absolute humidity	5,5 — 11 g steam / kg air
	Relative humidity	20 — 60 %
	A lower thermal load will cause inaccurate temperature and humidity control	
Chilled water system	Minimum water inlet temperature	5°C
	Maximum water pressure	16 Bar
	Water-Glycol mixture	Up to 50% vol.
Power supply tolerance	Voltage	± 10%
	Frequency (EN 60204-1:2018)	± 0,5 Hz continuously ± 1,0 Hz short time

NOTICE
Vertiv™ is not responsible for an improper use of the unit, such as an application outside the specified limits in this chapter. Working outside the specified limits might cause breaks and damages to compromise the unit operation.

2.7. Dimensions and weights

2.7.1. Overall dimensions



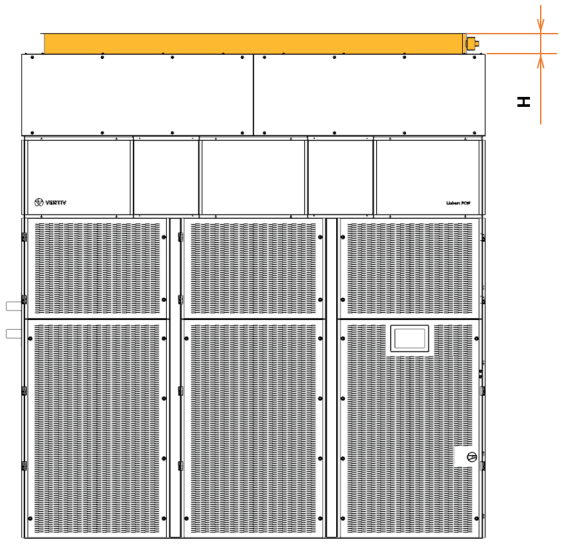
Dimensions	
Length *	3400 mm
Depth	1050 mm
Overall height **	3550 mm

* Chilled water connections are sticking 110 mm out of the lateral side.

** The overall height consists of:

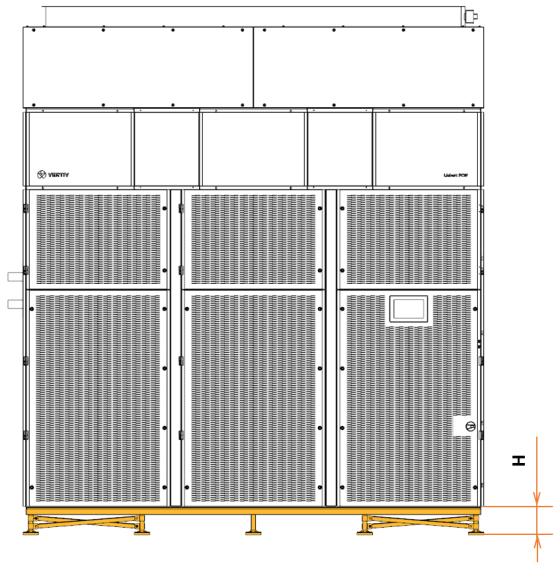
Filter section	600 mm
Fan module	600 mm
Coil section	2350 mm

2.7.2. Optional accessory height



Modules on top of the unit

Motorized damper: H = 150 mm



Modules below the unit

Base frame: H = 200 mm

NOTE:

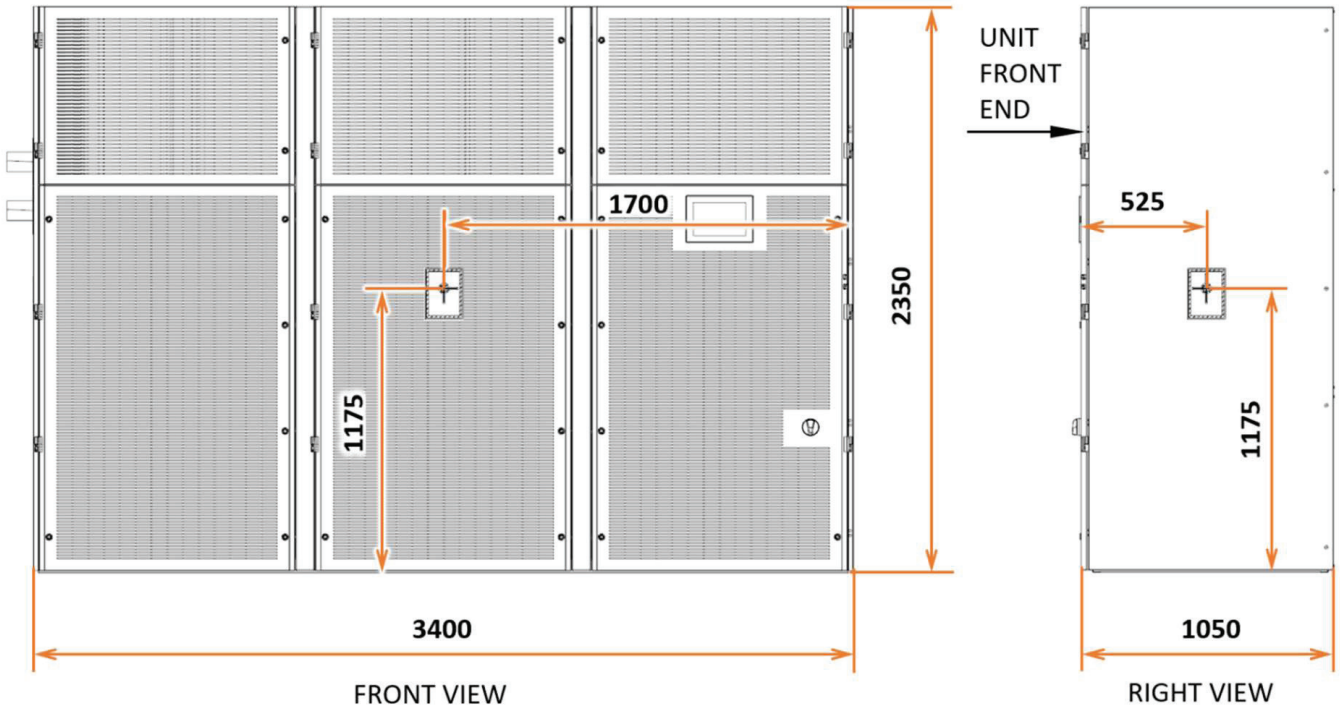
- *The coil section and fan module are delivered separately and need to be connected at the installation site.*
- *Base frame and intake plenum are delivered separately, in disassembled state and need to be assembled and connected at the installation site*

2.7.3. Weights

PWM unit weight	[kg]
Coil section	1040
Fan module	415
Filter module	250
Total unit weight	1705

Weight of optional accessories	[kg]
Base frame	52
Damper	

2.7.4. Center of gravity

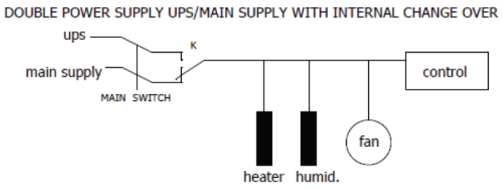


2.8. Electric and control system

The unit is delivered with dual power supply in order to have the units up and running if the main power supply fails.

2.8.1. 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.



What happens in case of power outage:

- 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: *The Ultracap supplies power to the control for about **30** seconds.*

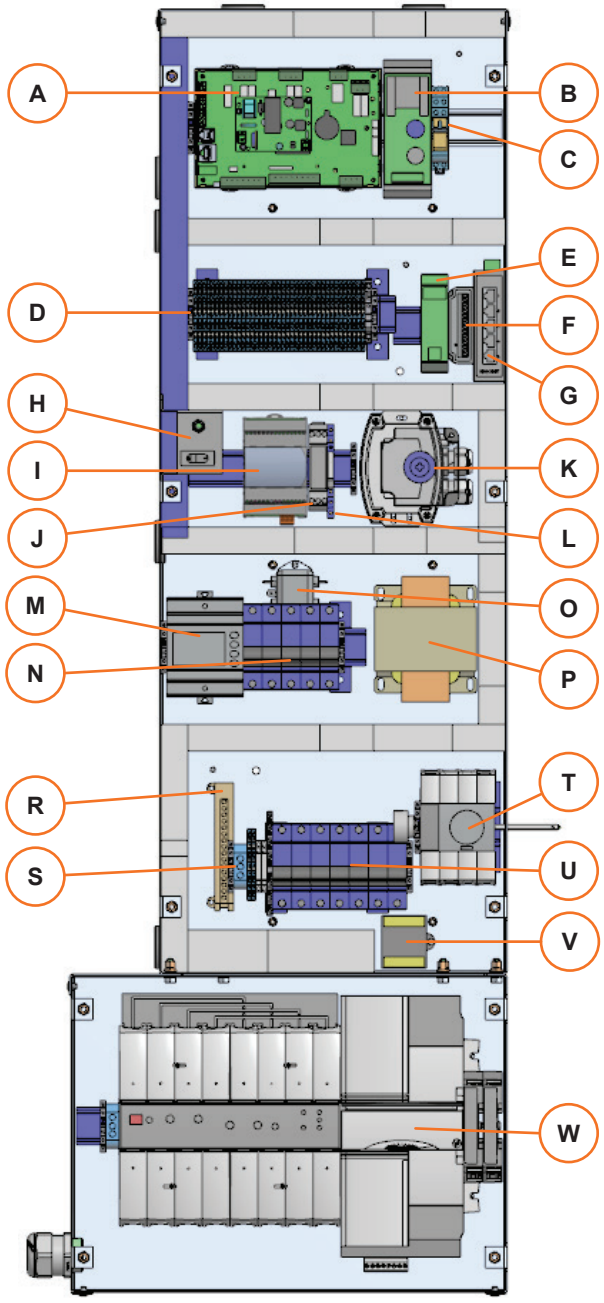
NOTE: *Depending on the electric system configuration, the unit may be set to remain switched **OFF** for a certain time.*

What happens when power is restored:

The ATS remains on the second power supply until the main power supply is restored.

2.8.2. Main components

Power side (high voltage)



Control side (LOW voltage)	
A	Control board
B	Feeder for touch screen
C	Flooding alarm relay
D	Terminal block
E	Water detection digital board
F	Damper control option
G	**HUB/Ethernet switch**

NOTE: *The electric panel is designed and manufactured according to EN 60204-1 It is recommended to use 90 degrees LAN connector for HUB/Ethernet switch.*

H	**ON/OFF** switch with LED indicator

WARNING
This is not a disconnecting switch.
See *2.8.3 Disconnecting switches*

I	Ultracap module
J	Phase sequence relay
K	Clogged filter alarm
L	Relay remote on/off

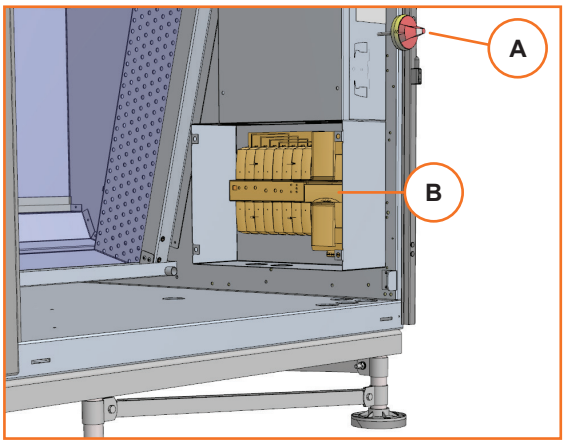
Power side (HIGH voltage)	
M	Energy meter
N	Fuse holder
O	Anti-noise filter
P	Transformer
R	Ground terminal block 1
S	Ground terminal block 2
T	Disconnecting switch
U	Thermal magnetic circuit breakers
V	Current transformer
W	ATS module

2.8.3. Disconnecting switches

WARNING
Due to the presence of Ultracaps for the control 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**.

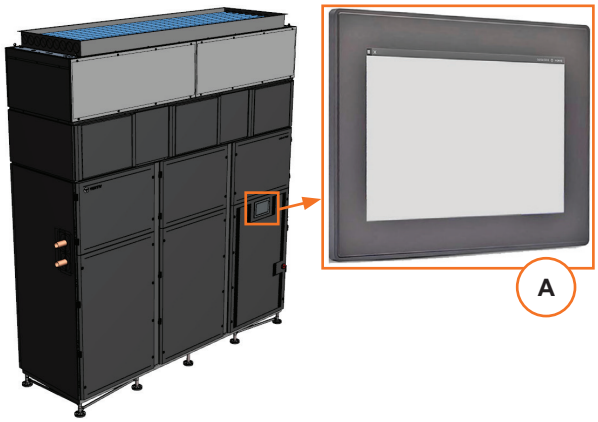
2.8.4. Dual alternate power supply



A	Standard disconnecting switch
B	ATS disconnecting switch

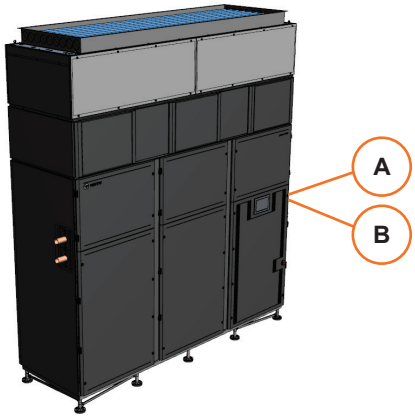
WARNING
The power supply is connected to the ATS disconnecting switch [**B**].
You must turn **OFF** the ATS disconnecting switch to cut-off the power supply to the unit.

2.8.5. Control panel



A	Control panel / touch screen The unit is usually controlled remotely by network connection. 7” touch screen control panel is located on the front door for direct control of the unit.

2.8.6. Ethernet connection



A	RJ11 - CANbus port for connection of an external display
B	RJ45 - Ethernet port for connection of an external laptop

2.8.7. Protective functions

The control system manages all the safety and operating devices needed for reliable automatic operation.
The main alarms are briefly explained below. Refer to the PDX-PCW Control Application for details.

2.8.8. Fan control

All the units have EC fans.
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

Fans

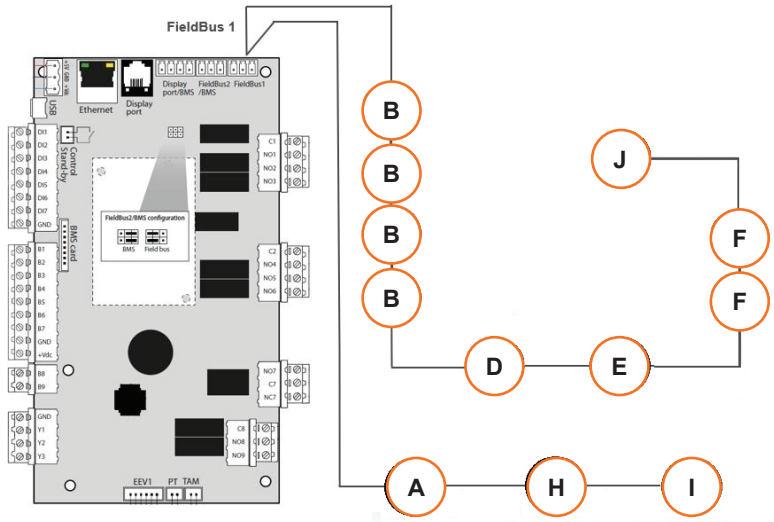
- Connection to the unit through Modbus protocol.
- If the Modbus connection is interrupted, then the fans continue to run at a preset speed.
- Speed adjustment between 0 and 100% of the maximum speed.

NOTE *It is possible to set a limit to the maximum speed in order to reduce the noise emission.*

2.9. MODBUS connections

2.9.1. General description

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



A	Return sensor T+H (up to 4)	**F**	Pressure Independent Control Valve (up to 4)
B	EC fans (up to 6)	**H**	Optional sensors T or T+H (up to 3)
D	Energy meter	**I**	Remote sensors T or T+H (up to 10)
E	Expansion board	**J**	Differential pressure transducer

NOTE: *"**T**" = temperature sensor; "**H**" = humidity sensor*

2.9.2. 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 chapter *6.6. Modbus Connections and Settings*.

2.9.3. 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 fans is 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.
Return CW priority	The CW valve modulates from 0% and 50% of the call for cooling based on return temperature. The Fan speed modulates from 50% and 100% of the call for cooling based on return temperature. This means the fan starts to modulate only when the CW valve is fully open.
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:

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 forced 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.
Control sensor failure	**Teamwork Mode:** • Return, Return CW priority, Remote or Static Pressure Control: the fan will work using the system value. • Supply or Delta: the fan will run at defined speed. If a higher call for fan speed occurs, the fan will operate at the higher call. **No Teamwork Mode:** • The fan will run at defined speed. If a higher call for fan speed occurs, the fan will operate at the higher call.

3. Technical data

3.1 Water system

Chilled water coil

Coils are optimized for the working point specified in the following table:

Unit	ESP (*) [Pa]	Return air temperature [°C]	RH [%]	Inlet water temperature [°C]	Outlet water temperature [°C]
PWM 30	50	36	28	22	31

(*) External static pressure

Water valve

CW valve	Max differential Pressure [kPa]	Close-off Pressure [kPa]
PICV	350	1400

CW valve	Glycol mixture	PN	Fluid temperature limit
PICV	up to 50%	25	-10°C … 120°C

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 using 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:

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.

3.2 Air system

Fan number and weight

Unit	Fan alternative	Number of fans	Individual fan weight
PWM 30	ZA	4	29,1 kg
	Delta	4	31,5 kg

3.3 Electrical system

3.3.1. Unit electrical data

General remarks

- The cables must be sized in compliance with local standards and according to the type and characteristics (for example Amperes) of installation.
- The recommended wire size has 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 options not explicitly described.
- The specific energy allowed to flow from the circuit breakers, installed by the user, must be lower than 300.000 A2s.
- 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 ground heater (IEC 364): Ra 50/Ia (Art. 413.1.4.1, CEI 648 or IEC 60364445).
  - In case of frequent over-voltages with mains impulse, it is advisable to install a selective differential and to evaluate the need for adopting other devices.
  - 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 100 m, 18AWG (0.82 mm²) stranded tinned copper until 130 m
  - 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.

CAUTION

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 130 m, contact Vertiv™ for assistance.

Electrical data for units with power supply 400V / 3ph +N / 50Hz + Earth

Fan alternative	High power fan module			Recommended wire size [mm²] (2)	Min./max. Cu cable size [mm²]
	FLA [A]	LRA [A]	Recommended Circuit breaker (1)		
ZA	23,9	23,9	40	5G10mm²	FLEXIBLE: 1,5…25mm² RIGID: 1,5…35mm²
Delta	27,5	27,5			

3.3.2. Fan electrical data

Fan alternative	EC Fan advance – High power	
	Motor size [kW]	FLA @400V / 50Hz [A]
ZA	4 x 3,5	4 x 5,84
Delta	4 x 4,2	4 x 6,75

NOTE: *Same fan model for 50 and 60 Hz.*

4. Handling

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.

4.1 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*.

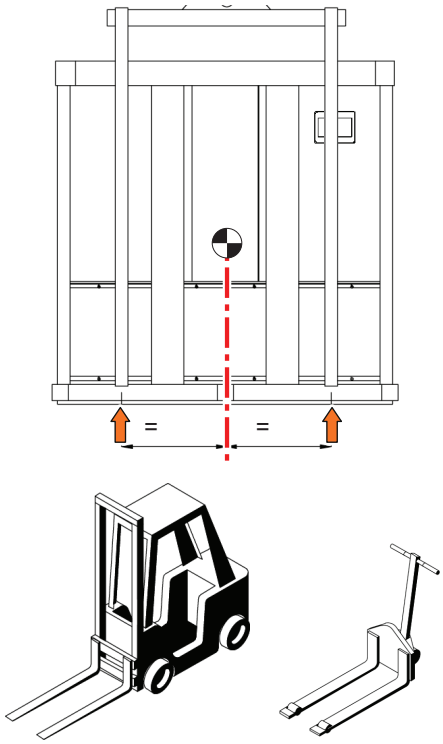
Pay attention to the safety labels on the unit and to the safety warnings in this chapter.

4.2 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.

4.3 Transport with Package

4.3.1 Using a fork lift or a pallet jack

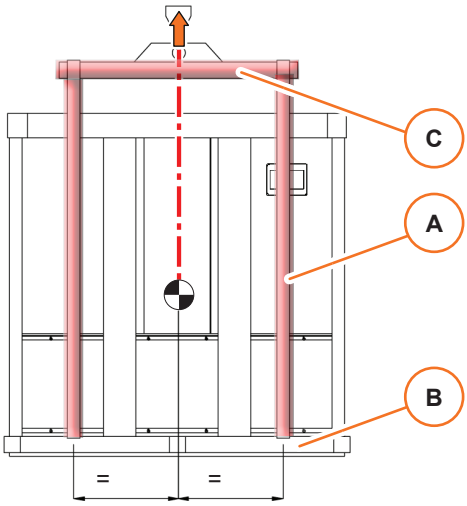


- Make sure that the fork length and distance is suitable for the unit length and to ensure the unit stability.
- Spread the forks to the widest allowable distance to still fit under the skid.
- Lift the unit from the side that is indicated in the instructions on the package.
- Make reference to the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

WARNING

Pay attention to overhead obstacles, for example doorways.

4.3.2 Using a crane



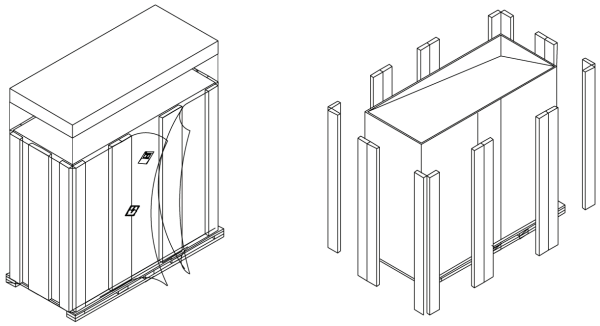
- Place the slings [**A**] between the unit bottom rails and the skid [**B**], at the widest allowable distance.
- Be sure that the distance between slings guaranties the unit stability.
- Fix the slings to the spreader bar [**C**]

NOTICE

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

4.4 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.

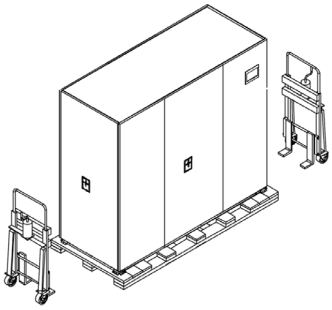
ENVIRONMENT

All material used to package this unit is recyclable.

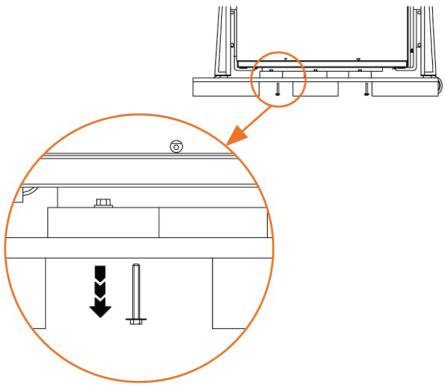
Please save for future use, or dispose the package materials according to the local regulation about waste disposal.

4.5 Transport without Package

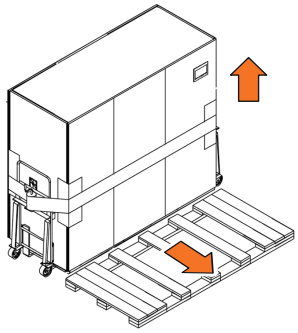
4.5.1 Using piano jacks



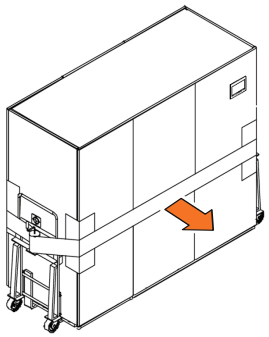
- Make sure that the floor can support the unit when you move it by piano jacks. If necessary, cover the floor by metal plates or other support that can distribute the weight on the floor.
- Place the piano jacks at the two sides of the unit.



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



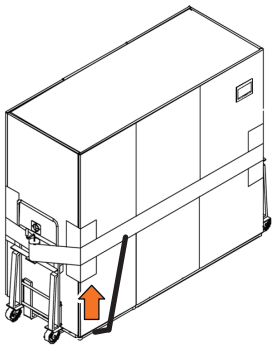
- Slide the forks of the piano jacks between the unit and the pallet.
- Place a protective material between the unit and the piano jacks.
- Fix the piano jacks to the unit by straps, placing a protective material between the unit and the straps.
- Lift slightly the forks of the piano jacks and remove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



- Move the unit to its installation site.

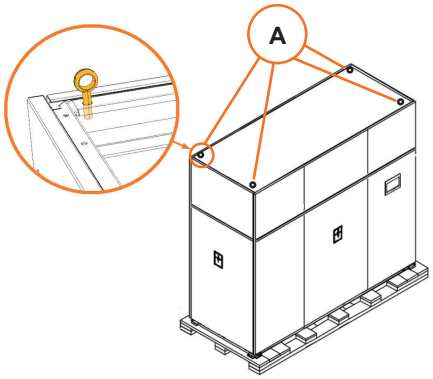
CAUTION

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.

4.5.2 Using a crane



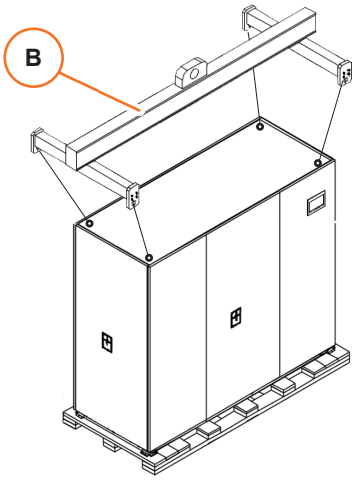
- Insert **four** eyebolts M10 into each of the holes [**A**] on the top side of the coil module and fix them with nut & washer from the opposite side of the channel.

NOTICE

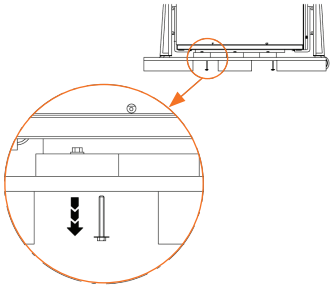
Eyebolts, nuts and washers are not supplied with the unit.

NOTICE

The eyebolts and nuts need to be suitable to support the weight of the coil module.



- 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.

5. Assembly and positioning

5.1 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 or lifting the modules.

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

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.

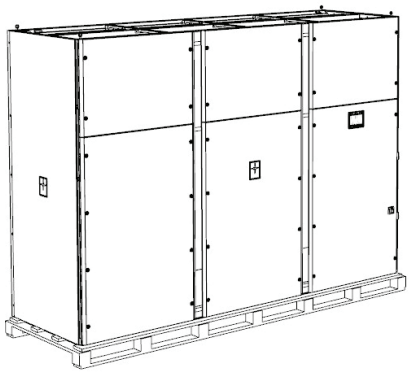
5.2 Assembly of the unit

The unit is supplied in four separate modules:

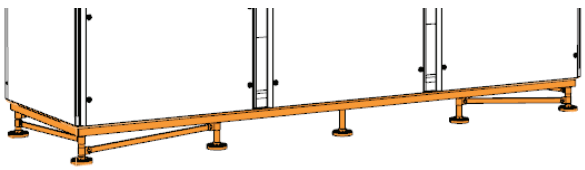
- Coil section
- Fan module
- Filter module
- Motorized damper (optional)
- Base frame (optional)

- The coil section and fan module are delivered separately and need to be connected at the installation site.
- Base frame and intake plenum are delivered separately, in disassembled state and need to be assembled and connected at the installation site.
- Make sure you have the space available for mounting operations. After the assembly the unit can be moved and positioned in the working site.

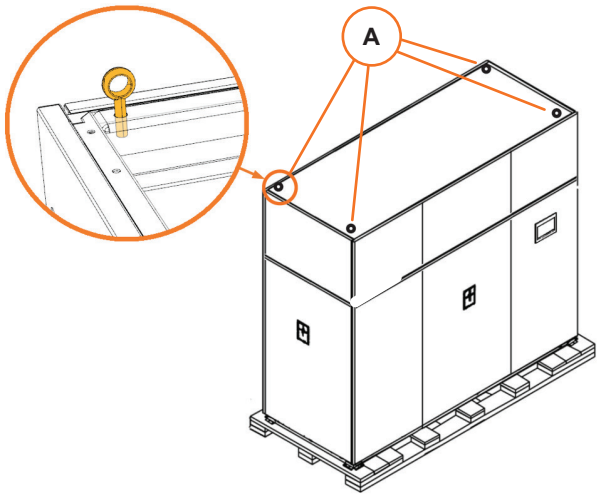
5.2.1. Coil section preparation



- Bring the coil section close to the final location.



- In case of optional base frame accessory, remove the skid accordingo to following procedure and then see *Liebert® PWM – Base frame – Mounting instructions*



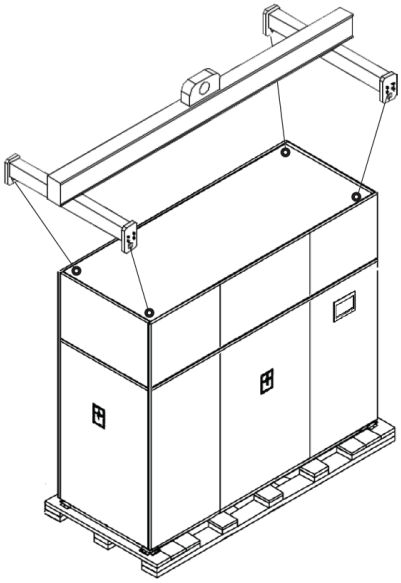
- Insert **four** eyebolts M10 into each of the holes [**A**] on the top side of the coil module and fix them with nut & washer from the opposite side of the channel.

NOTICE

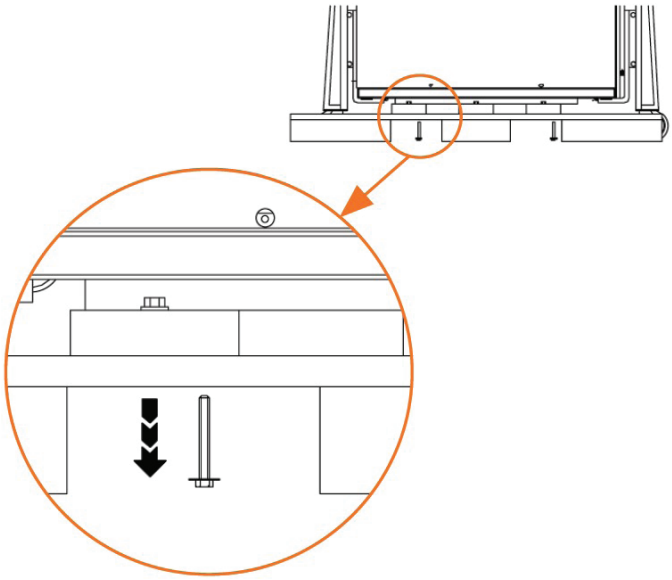
Eyebolts, nuts and washers are not supplied with the unit.

NOTICE

The eyebolts and nuts need to be suitable to support the weight of the coil module.



- Insert a sling or a chain in each of the eyebolts.
- Fix the slings or chains to a 4-point lifting bar.

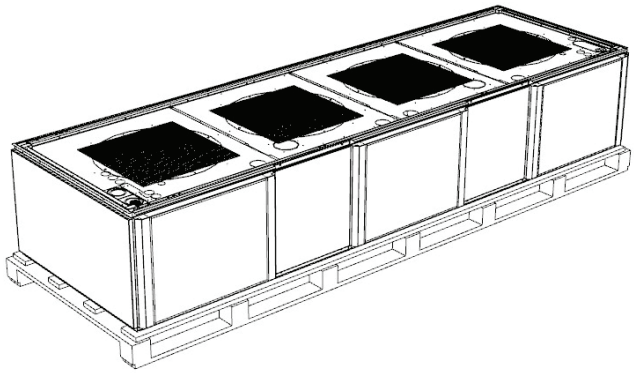


- Remove the **four** bolts (two at each side) that fix the unit to the skid.
- By a crane or bridge crane slightly lift the unit and remove the skid.

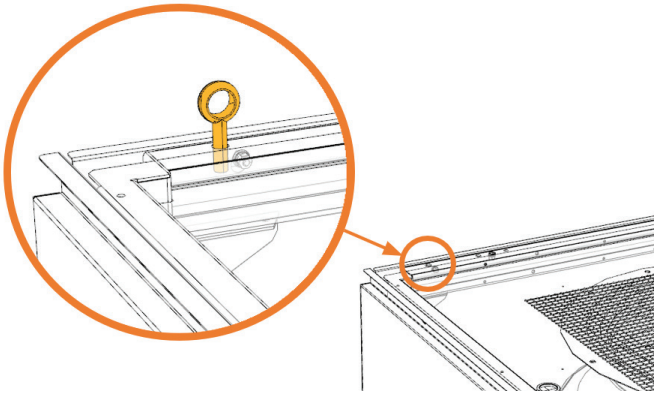
NOTICE

Lift the unit with speed suitable for the load to avoid damage to the structure.

5.2.2. Fan module preparation



- Bring the fan module close to the prepared coil section at final location.



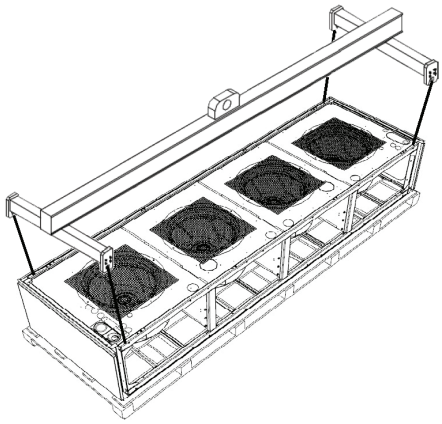
- Insert **four** eyebolts M10 into each of the holes [**A**] on the top side of the coil module and fix them with nut & washer from the opposite side of the channel.

NOTICE

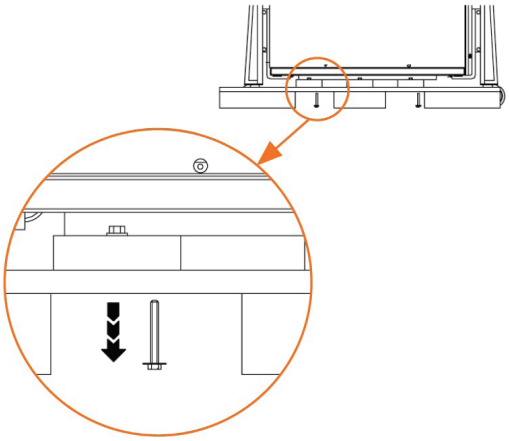
Eyebolts, nuts and washers are not supplied with the unit.

NOTICE

The eyebolts and nuts need to be suitable to support the weight of the coil module.

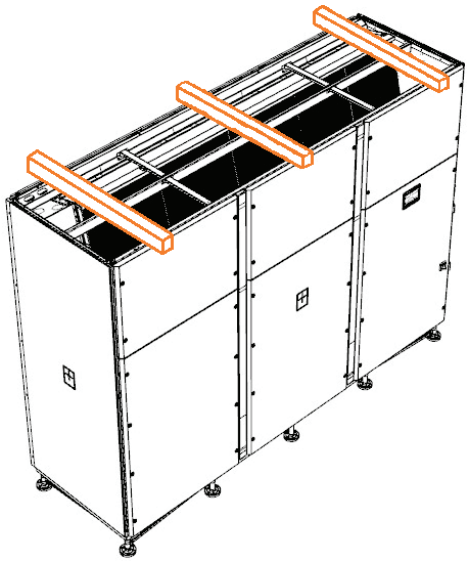


- Remove the **four** bolts (two at each side) that fix the unit to the skid.
- By a crane or bridge crane slightly lift the unit and remove the skid.

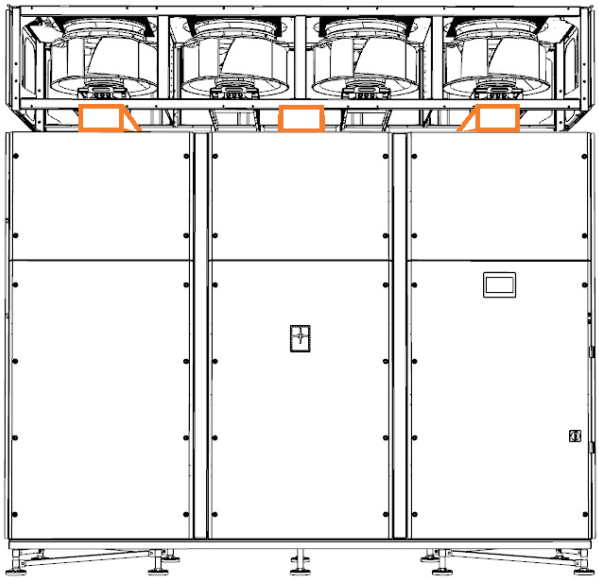


- Remove the **four** bolts (two at each side) that fix the fan module to the skid.
- By a crane or bridge crane slightly lift the fan module and remove the skid.

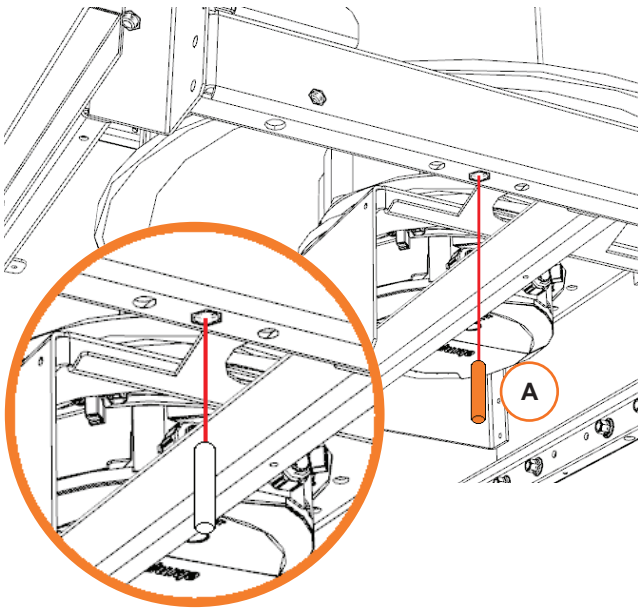
5.2.3. Fan module attachment



- Arrange at least **3** timber pieces evenly on top of the coil module.

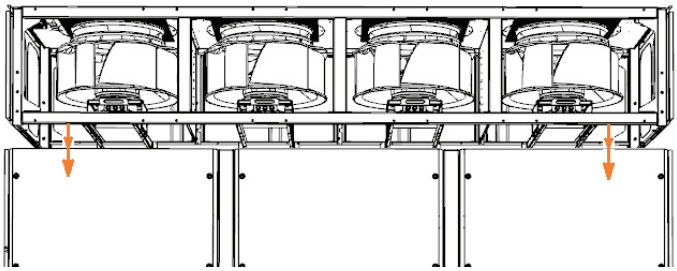


- Lift the fan module by a crane using the 4-point lifting bar – see *5.2.2. Fan module preparation*
- place it on the timber pieces on top of the coil module.



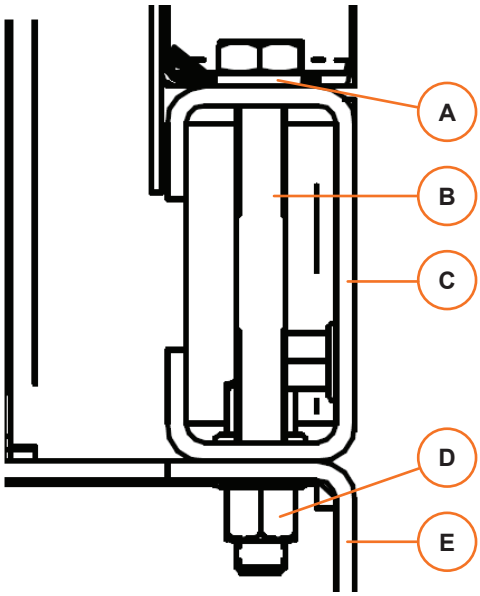
- Insert four M8 dowels [**A**] in the lower frame of the fan module.
- Take the power cable and the Modbus cable from the coil module.
- These are ready for the connection with the corresponding cables of the fan module.
- Insert the cables through the bushing into the fan module.
- Connect the power 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.
- Place the cover provided with the unit to protect the connections.
- Fix the cover to the frame by screws.

See chapter *6.5. Electrical connections for details.*



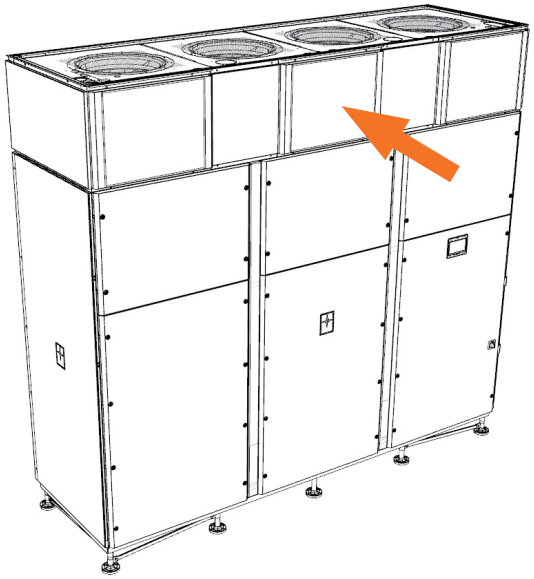
- Still using the crane and the 4-point lifting bar, slightly lift the fan module.
- Remove the wooden pieces.
- Using the four dowels [**A**], carefully align the position of the fan module to match the position of coil section.
- Lower the fan module to the coil section.

NOTICE
Pay attention not to damage the cables.
Pull the cables through the coil module.



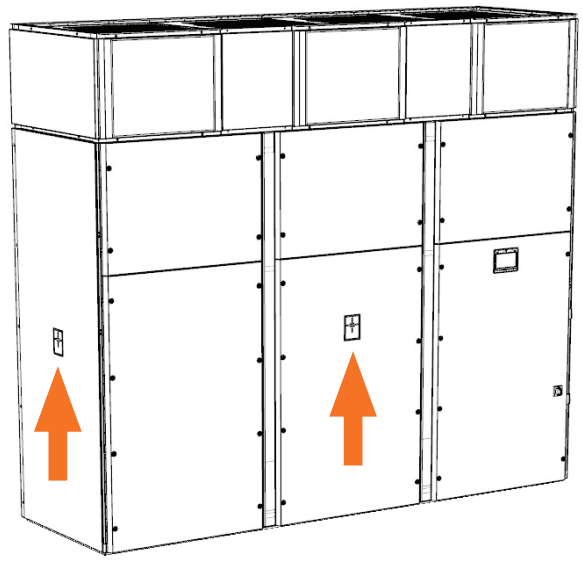
- Secure the fan module [**C**] to the coil section [**E**] using the **four** hex head screws supplied with the unit:
  - screw M8x80 [**B**]
  - spring lock washer [**A**]
  - threaded insert [**D**] in the coil section frame structure

CAUTION
The fan impeller might have sharp edges.
Use suitable protective gloves and be cautious when working inside of the fan module.



- Re-attach the front and back panels on the fan module.
- If the unit is equipped with condensate drain connection at the bottom of the cabinet, please, refer to chapter *6.4.5 Condensate drain connection* before applying the rear gasket and positioning of the unit.

5.2.4. Positioning of the unit at the final location



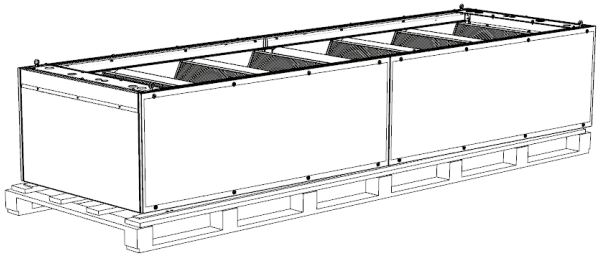
- Lift the unit from the bottom.

CAUTION
Once the fan module is attached to the coil section, it is forbidden to lift the unit from the top using a crane.

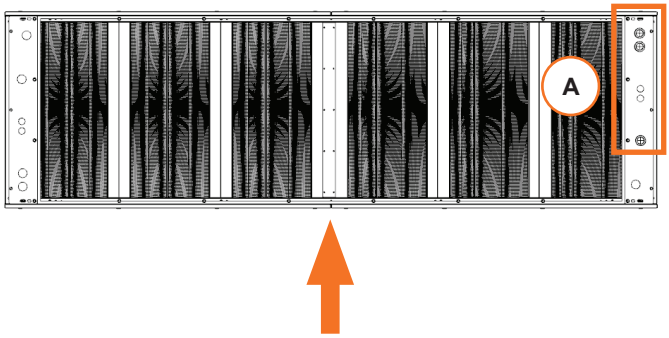
NOTICE
The center of gravity of the unit with attached fan module is shifted higher.

- Carefully move the unit to the final position
- Carefully descend the unit to the final position.

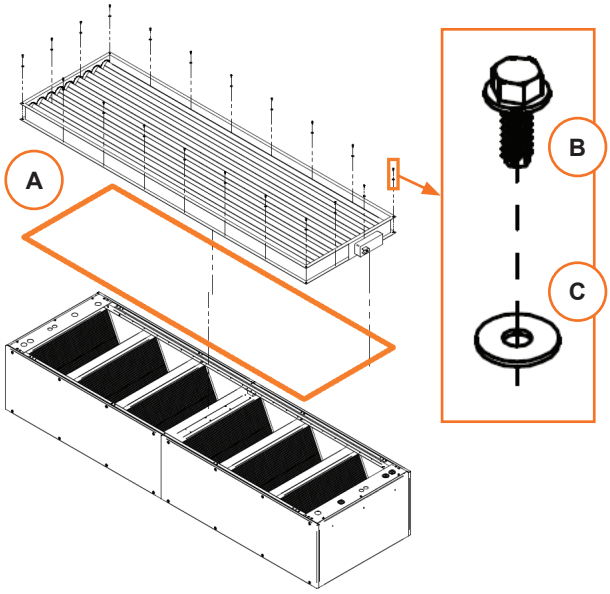
5.2.5. Filter module – mounting instruction



- Prepare the plenum with filters and bring the module close to the final location.

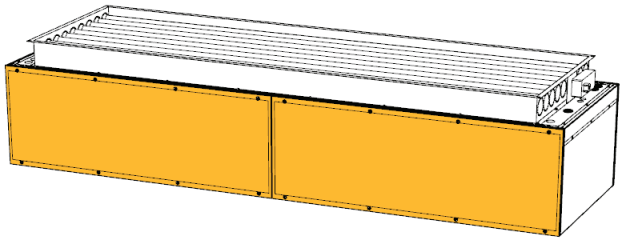


- Turn the module to have the rubber gromets [**A**] on the right side when standing in front of the module.

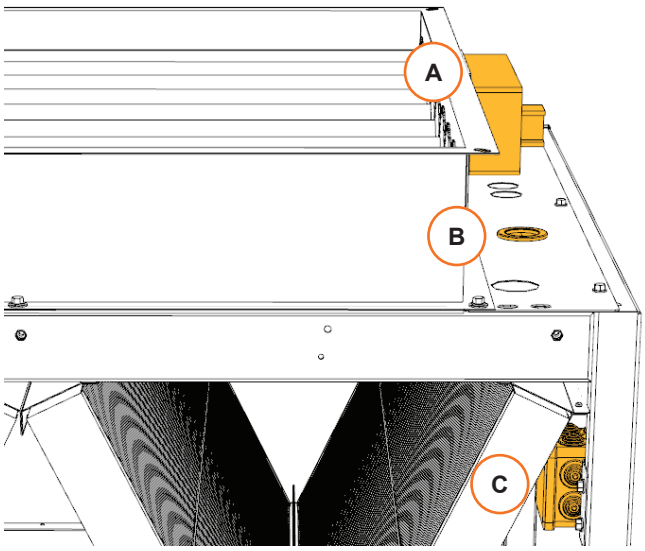


- Apply self adhesive gasket [**A**] to the damper bottom perimeter
- Align the damper with the filter module frame and fix it with 20 self-drilling screws 6,3 x 19 [**B**] with washers [**C**]

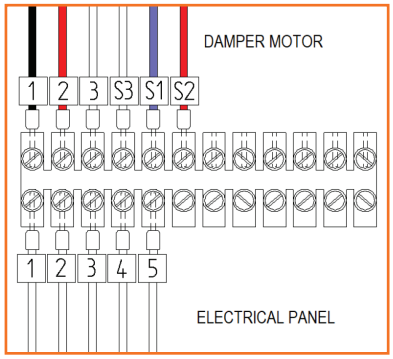
CAUTION
The frame of the damper has sharp edges.
Use suitable protective gloves and be cautious when working around the damper.

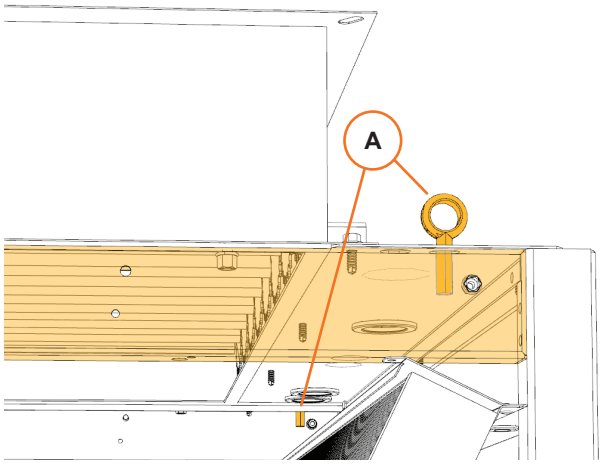


- Remove both frontal and both rear panels from the filter module



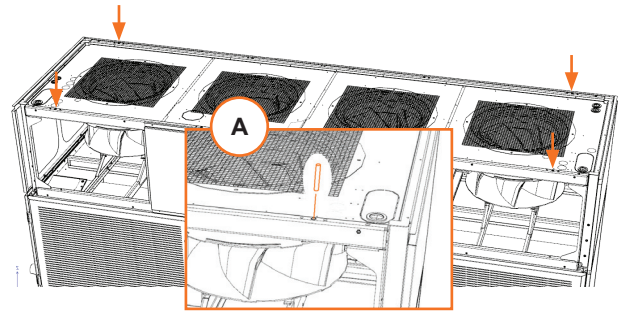
- Pull the signal cable from the damper actuator [**A**], through the grommet in the cover [**B**] and connect it into the electric box [**C**].



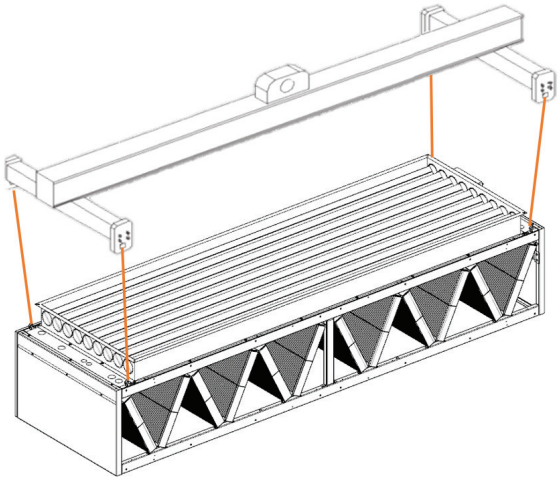


- Insert **4** eyebolts M10 into corresponding holes on both ends of the filter module and fix them with nut & washer from the opposite side.
- The eyebotls need to be suitable to support the weight of the filter module with damper

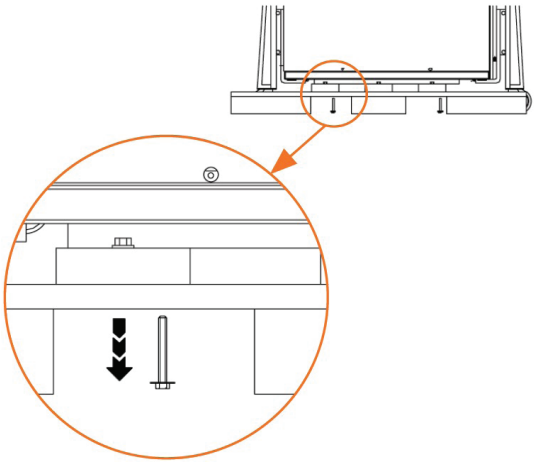
CAUTION
The frame of the damper has sharp edges.
Use suitable protective gloves and be cautious when working around the damper.



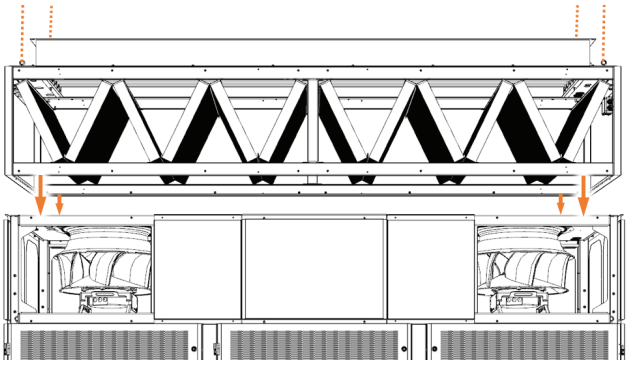
- Insert **four** M8 dowels [**A**] into the corresponding threaded inserts in the frame of the fan module.



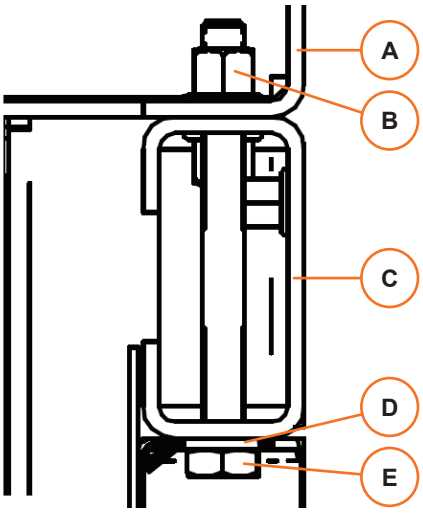
- Insert a sling or a chain in each of the eyebolts on the filter module.
- Fix the slings or chains to a 4-points lifting bar.



- Remove the **four** bolts (two at each side) that fix the filter module to the skid.
- By a crane or bridge crane slightly lift the fan module and remove the skid.



- Carefully lift the filter module and position it over the fan module of the unit.
- Align the position – the dowels have to fit into the corresponding holes on the filter module.
- Slowly descend the filter module on top of the unit.



- Secure the filter module [**A**] to the fan section [**C**] using the **four** hex head screws supplied with the unit:

  - screw M8 x 80 [**E**]

  - spring lock washer [**D**]

  - threaded insert [**B**] in the coil section frame structure

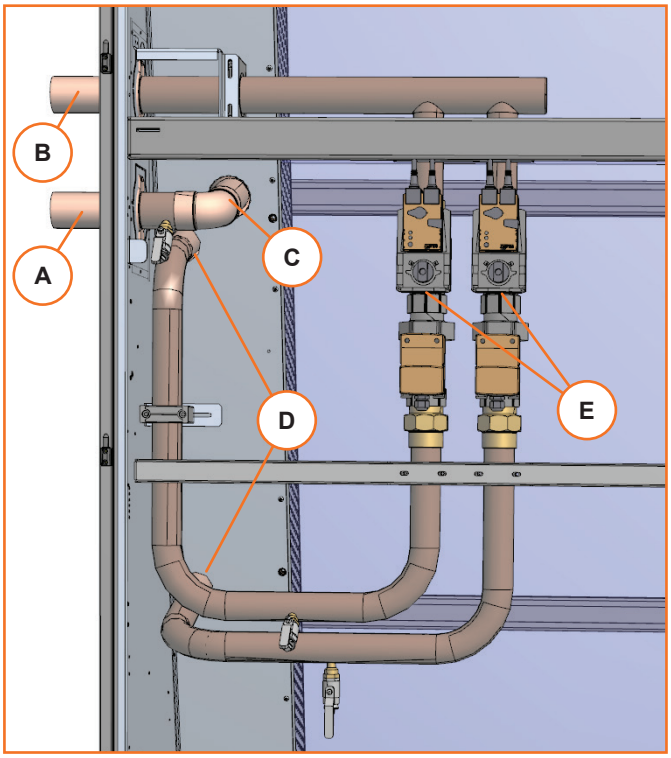
CAUTION
The fan impeller might have sharp edges.
Use suitable protective gloves and be cautious when working inside of the fan module.

- Connect the cable from the electric box inside the filter module to the main electric panel in the coil section.

- Remove the eyebolts and re-attach all the missing panels to the filter and fan sections.

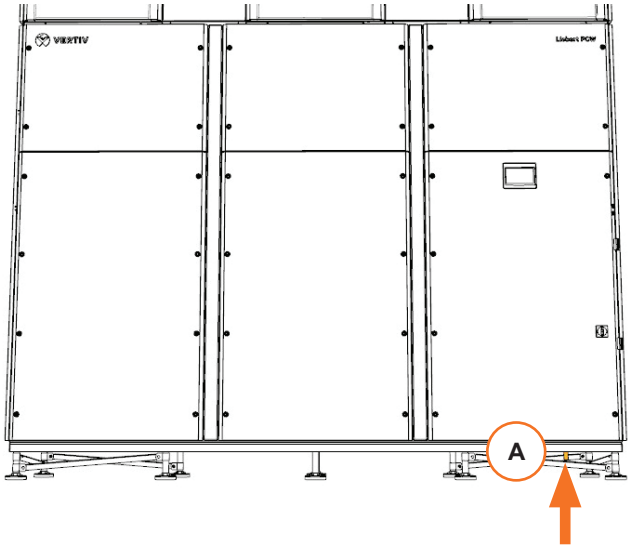
5.3. Chilled water piping arrangement – lateral connection

The unit is prepared for connecting the water supply from the top.



A	Chilled water inlet pipe
B	Chilled water outlet pipe
C	Coil inlet
D	Coil outlet
E	Pressure independent control valves

5.4. Arrangement of the drain piping



The condensate drain piping is connected inside of the cabinet and leads into single outlet [**A**] at the bottom of the coil section underneath the unit.

For more details see chapter *6.4.5 Condensate drain connection*

6. Installation

6.1 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.

6.2 Overview

6.2.1. 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.

Operation	See...
Prepare the area	*6.3.1. Location* *6.3.2. Space requirements*
Prepare the piping for the connection of the unit to the facility systems (chilled water, drainage)	*6.3.4. Chilled water piping requirements* *6.3.5. Condensate piping requirements*
Make sure that the water supply is suitable	*6.3.6. Water supply requirements*
Prepare the electric system	*6.3.7. Electric system requirements*

6.2.2. Operations on the unit

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

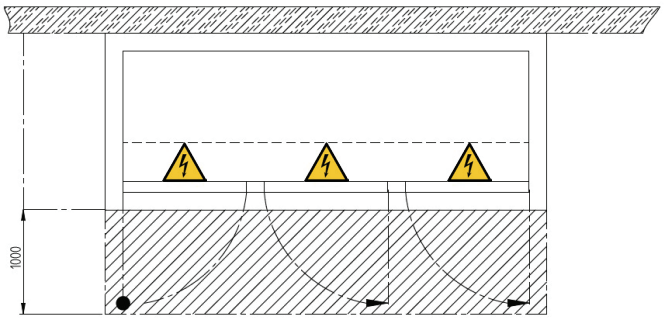
	Operation	See...
1	**Assemble the base frame (optional)**	*Liebert® PWM – Base frame – Mounting instructions*
2	**Assemble the coil section and the fan module**	*5.2. Assembly of the unit*
3	**Position the unit at the final location and fix it on the floor or the supporting structure**	*5.2.4. Positioning of the unit at the final location* (for option with base frame) *Liebert® PWM – Base frame – Mounting instructions*
4	**Connect the unit to the chilled water system**	*6.4.4. Chilled water connection to the external source*
5	**Attach the intake plenum to the fan module (optional)**	*Liebert® PWM – Intake plenum – Mounting instructions*
6	**Connect the unit to the drain system**	*6.4.5. Condensate drain connection*
7	**Connect the electric power supply**	*6.5.2. Power supply connection*
8	**Connect the electric equipment to the electric panel**	*6.5.3. Contacts for the unit status signals* *6.5.4. Sensor connections*
9	**Check or adjust the Modbus settings**	*6.6. Modbus connections and settings*
10	**Fill the ethylene glycol**	*6.7. Filling the water system*
11	**Check the whole system**	*6.8. Final checks*
12	**Start the unit**	*7. Operation*

6.3 Specification for site preparation

6.3.1 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.

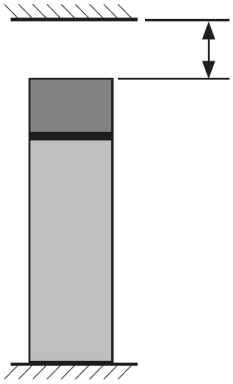
6.3.2. Space requirements



- See chapters *2.7.1.* for dimensions and *2.7.3.* for weights of the unit
- Keep a free space between the unit and any obstacle as shown in the figure.

WARNING
Leave a free space of at least 1m on the front to allow safe installation and maintenance operations.

6.3.3. Required free space from the ceiling



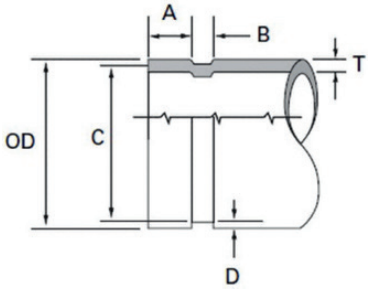
- Free space between the ceiling and the top of the unit, including any accessory mounted on top or bottom
- Minimum height to obtain the declared performance = 600 mm
- Minimum allowed height to obtain the minimum working conditions = 300 mm

6.3.4. Chilled water piping requirements

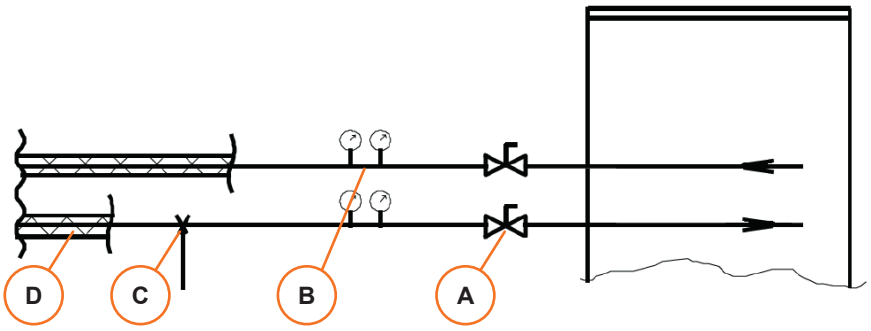
- Prepare the piping for connecting the main unit according to the following specifications.
- See also *Annex C - Connections* for details about the unit piping (dimensions and position).

Material	Use copper or steel (Mannesmann) tubing.
Threaded connections	In case of threaded connections use hemp and paste to get a reliable pressure - tight joint.
Grooved connections	See chapter *6.4.3. Joining pipes with the Grooved connection* for details regarding the assembly.

Grooved connections details:



Dimension		Tolerance	Nominal size 54 mm	Nominal size 64 mm
Actual outside diam.	min.	-	53,93	63,93
	max	-	54,07	64,07
Gasket seat	A	±0,8 mm	15,87	15,87
Groove width	B	+0,8 / -0 mm	7,62	7,62
Groove diameter	C	+0 / -0,5 mm	51,50	61,46
Groove depth	D	ref. only	1,25	1,27
Max allowed flare diameter		-	56,41	66,41

Diameter 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 Support.
Thermal insulation	Wrap the piping by thermal insulating material.
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. • Place the piping on supporting brackets [**C**]. • Insulate both pipes using insulation [**D**]. 

6.3.5. Condensate piping requirements

Prepare the piping for connecting the unit to the condensate drain system according to the following specifications.

Material	Galvanized steel, PVC or flexible polythene tubing.
Connections	The units are provided with smooth pipe stubs, ready for connecting with brazing.
Piping layout	The drain pipe must have at least a 2% gradient from the unit outlet to the connection to the site drainage system.

6.3.6. Water supply requirements

NOTE: *The following instructions refer to chilled water supply*

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 affect 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 must 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

pH	---	7,5 - 9,0
SO_4	ppm	< 100
HCO_3 / SO_4	---	>10
Total hardness	dH	4,5 - 8,5
CJ-	ppm	< 50
PO_4^{3-}	ppm	< 2,0
NH_3	ppm	< 0,5
Free Chlorine	ppm	< 0,5
Fe^{3+}	ppm	< 0,5
Mn^{++}	ppm	< 0,05
CO_2	ppm	< 50
H_2S	ppb	< 50
Temperature	°C	< 65
Oxygen content	ppm	< 0,1

The oxygen dissolved in water increases the rate of corrosion.

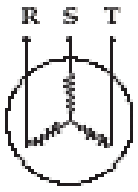
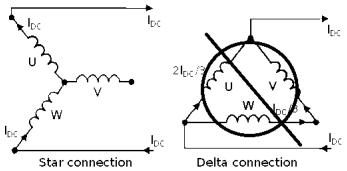
The main factors causing corrosion are Sulphur and carbon dioxide acids (see the Langelier and Ryznar indices).

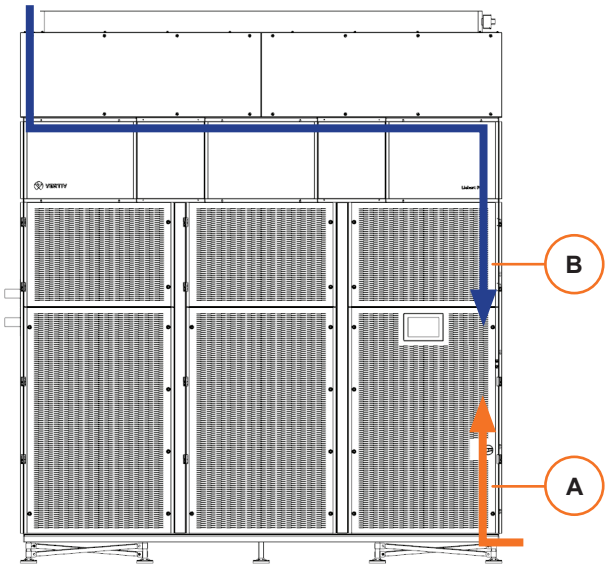
A combined effect of fouling due to dust and organic material provides a support for bacteria, fungi and algae; the growth of organisms may produce an oxygen gradient, and this results in rather severe pitting of the metallic surface.

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.

6.3.7. 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 *3. 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 *3. 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% 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: 402 - 397 = 5 V 4) The phase to phase variability is: $\frac{5}{397 \times 100} = 1{,}26$ (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.
Cable 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
Cable 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**] from the bottom right and sensor/alarms cable [**B**] is routed from the top left. • 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 connected 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.

6.4 Piping connections

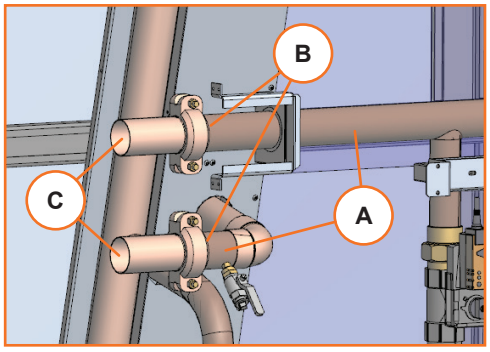
WARNING

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

6.4.1. General instructions

Connections	The inlet and outlet directions are clearly marked with labels and arrows on the respective piping. Pay attention to follow the directions.
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.

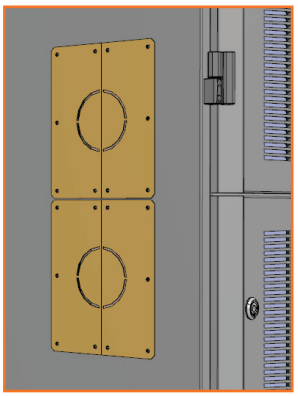
6.4.2. Chilled water connections inside the unit



The unit is equipped with grooved connections at the chilled water inlet and outlet [**A**].

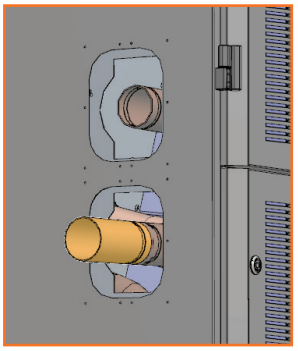
Standard packaging contains clamps [**B**] and stub pipes [**C**] for brazed or threaded connection.

The clamps and stub pipes are removed and stored inside of the cabinet during the transport.

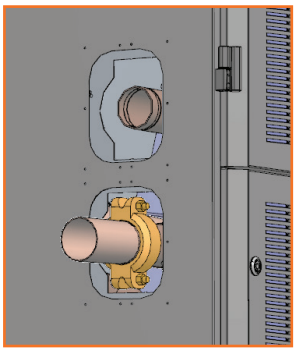


Remove the 4 covering plates for the lateral connection.

Prepare suitable external piping with grooved connection or attach desired threaded or flanged adapter to the provided stub pipes.



Align the external piping with the connections inside of the unit.

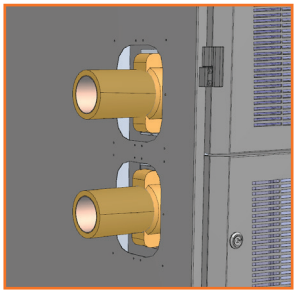


Attach the clamp to the grooved connection and tighten the joint – for details see chapter *6.4.3 - Joining pipes with the grooved connection*

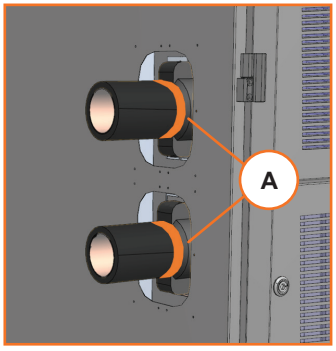
Repeat these steps also for the other pipe.

Remove the precuts from all 4 covering plates.

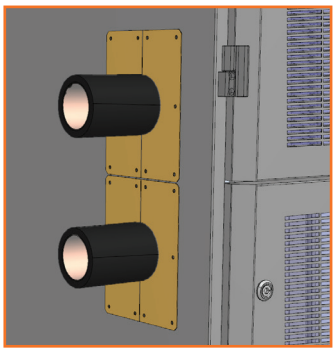
To avoid tearing up the pipe insulation, smoothen the edge and remove any burrs.



Cover the pipes and clamps with insulation.



Apply additional self-adhesive sealing stripe [**A**] around the pipe diameter, where the covering plates will be located.



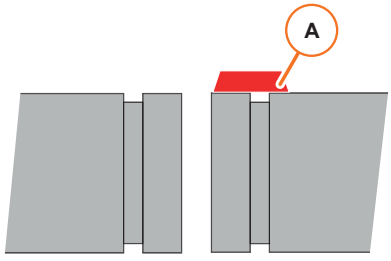
Re-attach all 4 covering plates for the lateral openings.

Be careful around the insulation.

6.4.3. Joining pipes with the grooved connection

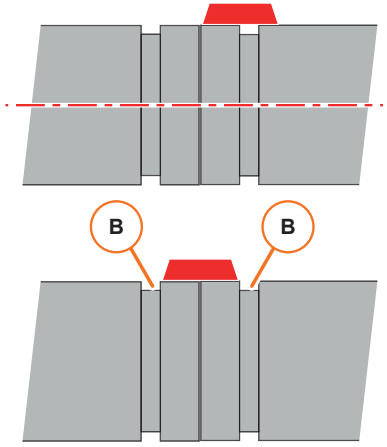
Check the pipe ends:

- 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 suitable 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.

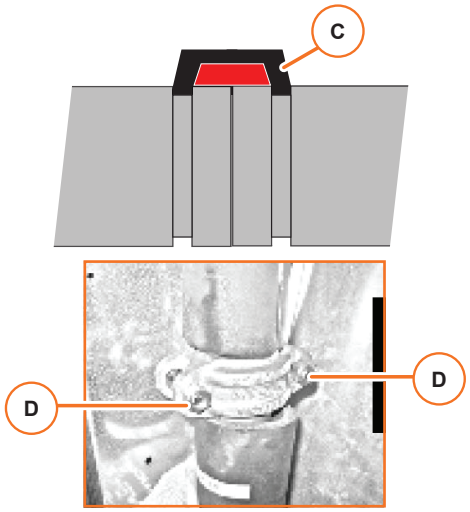


Join the ends:

- Bring together the two pipe ends and align them.
- Slide the gasket into position, and make sure that it is centered 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.*

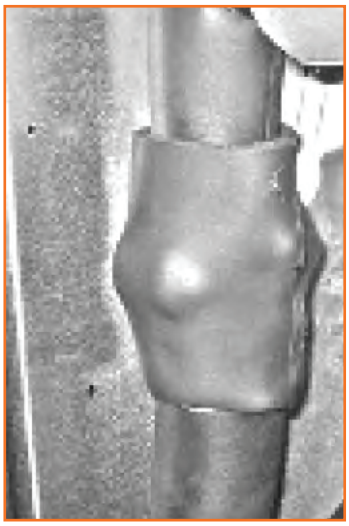
NOTICE

Leakage may occur if the gasket is pinched or damaged.

- Make sure the offsets are equal at the bolt pads.

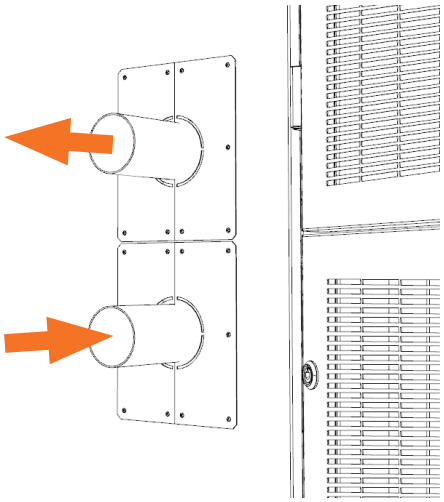
This is necessary to ensure a rigid joint.

- Visually inspect the bolt pads at each joint to ensure metal to-metal contact is achieved.



- Cover the connection with insulation.

6.4.4. Chilled water connection to the external source



After assembling the intermediate pipe section in the fan module, the unit is prepared for connecting to the external chilled water source.

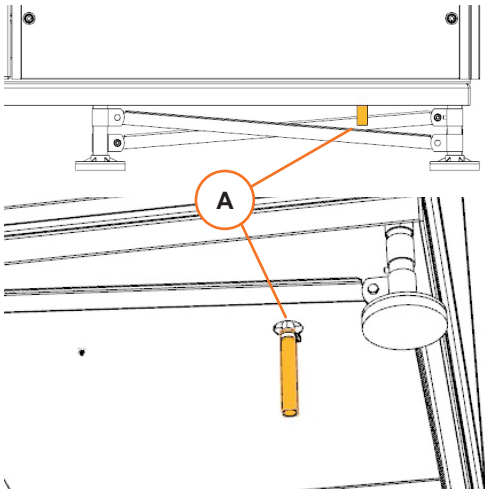
Both the inlet and outlet connections are equipped with 64 mm (male) threaded fitting.

NOTICE

Make sure to connect the inlet and outlet piping into the correct corresponding connections.

- The inlet piping should lead directly into the coil.
- The outlet piping goes from the coil into the PIC valves and from the valves out from the unit.

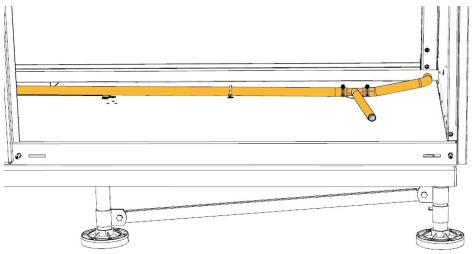
6.4.5. Condensate drain connection



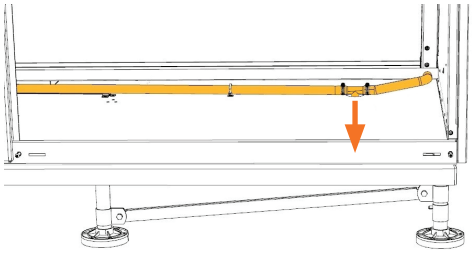
- The condensate drain piping is connected inside of the cabinet and leads into single outlet [**A**] at the bottom of the coil section.

6.4.5.1.Condensate drain outlet preparation

- Turn the cut-off switch into “**OFF**” position and open the frontal door.



- You can now reach the condensate drain tube, which is stored inside of the cabinet during the transport.

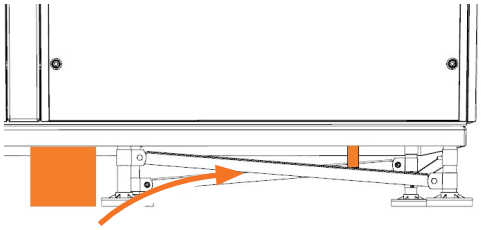


- Slide the outlet tube into the cutout in the bottom panel of the unit.

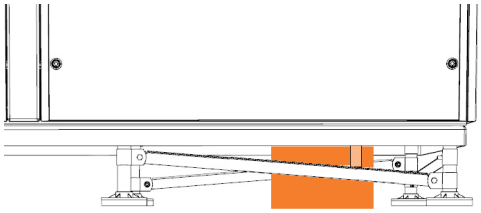
NOTICE

Take care to not damage the drain tube during unit positioning.

6.4.5.2.Condensate pump connection



- The condensate pump should be attached to the condensate drain outlet from the unit after the unit is moved to the final position.
- Slide the condensate pump sideways underneath the base frame of the unit to the correct location.



- Straighten the pump into vertical/working position.
- Slide and fix the condensate outlet tube into the pump inlet fitting.

NOTE: *Shorten the tube if necessary.*

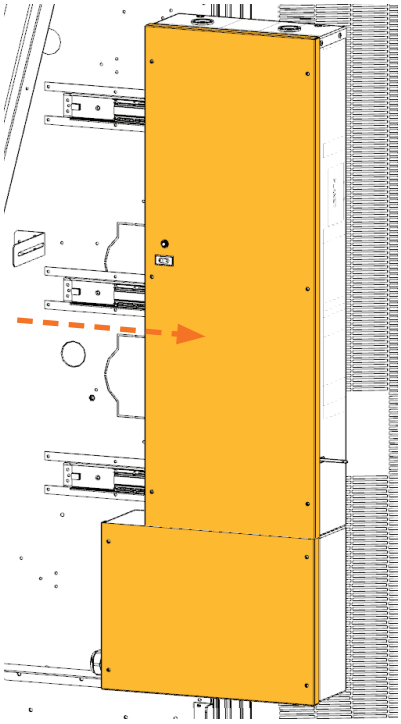
6.5. Electrical connections

6.5.1. Power supply cable

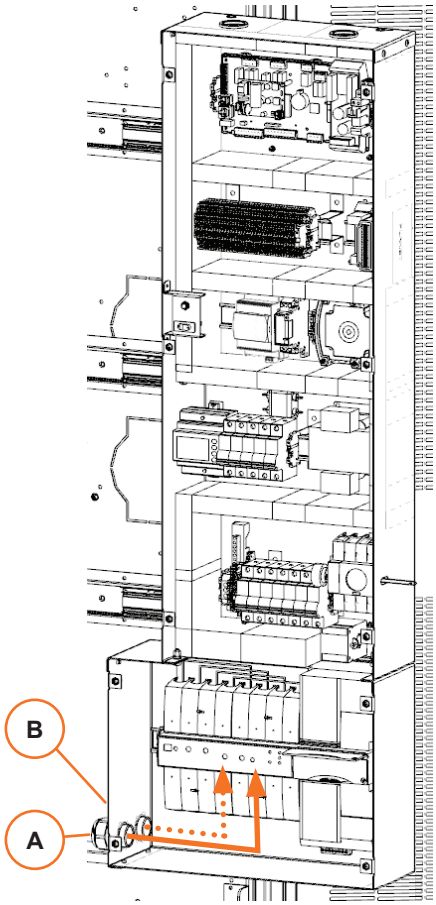
General instructions

- 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 C - Connections*.

6.5.2. Power supply connection



- Turn the main switch handle on the front panel to **0/OFF**
- Open the front door to get access to the electrical panel.
- Slide the electric box out of the unit for easier access. The module is attached on rails.
- Remove the electrical panel cover by unscrewing the screws which hold it.

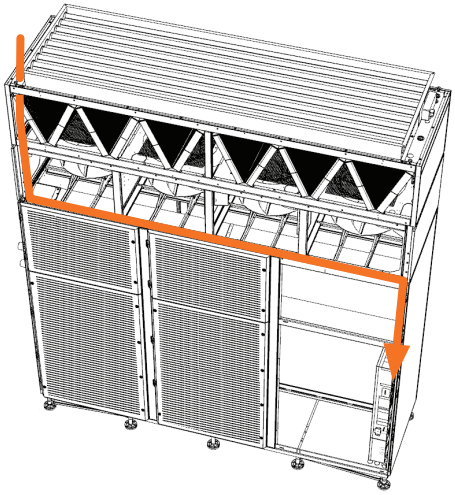


- Slide the main power cable [**A**] through the precut in lower corner of the ATS box.
- Connect the main power cable into the ATS module.
- Slide the emergency power supply cable [**B**] through the other precut in the ATS box and connect it into the ATS module.
- Re-attach the electrical panel cover and fix it properly with screws.

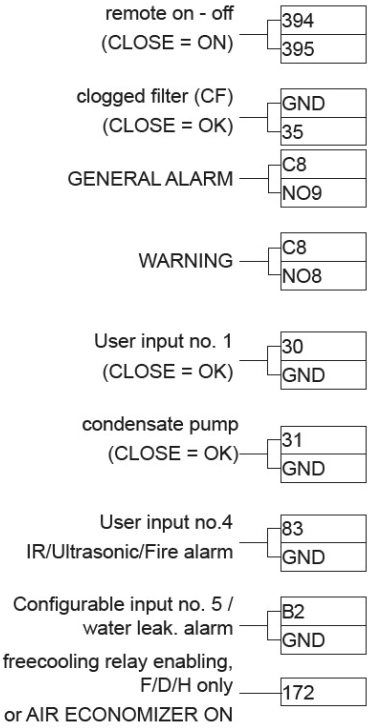
NOTICE

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

6.5.3. Contacts for the unit status signals



- Turn the main switch handle on the front panel to **0/OFF**.
- Open the front door to get access to the electrical panel.
- Remove the electrical panel cover by unscrewing the screws which hold it.
- Remove the front panels on the fan section.
- Run the signal cable down through the precut in the left top panel, through the fan module into the electric box inside the coil section.
- The same cable routing may be used also for additional remote sensors and optional Modbus probe for supply/return air temperature.
- For details about the cable entrance holes see *Annex C - Connections*.
- Use appropriate cable ties to fix the cable to the frame in the fan module.
- 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.

NOTE:

- **The C8-NO8 (warning) and C9-NO9 (alarm) terminals are on the control board.*
- *The fans alarms are managed through Modbus.*
- *The ID contacts are on the control board*

6.5.4. Sensor connections

Any remote or additional sensor must be connected to the unit via Modbus. See chapter *6.6. Modbus connections and settings*

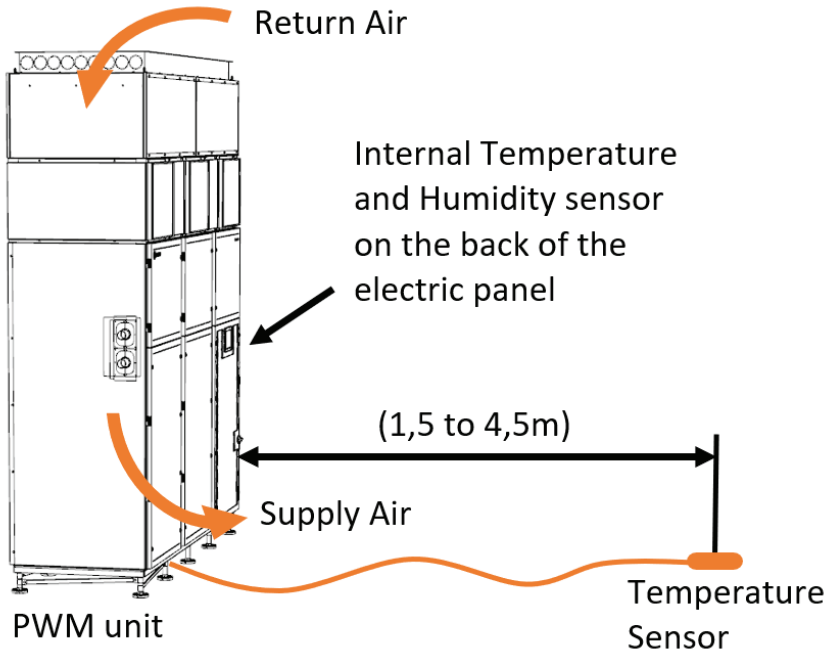
6.5.5. Supply air temperature sensor

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 length available.

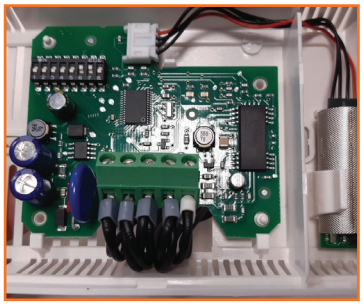
Remove the stripe and place it according the drawing.

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



6.6. Modbus connections and settings

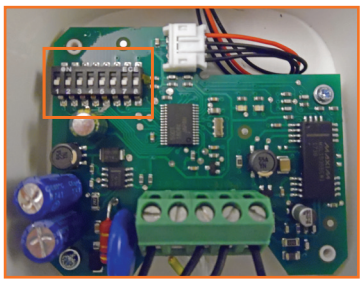
6.6.1. Connection of a device to the Modbus cable



- Use a Modbus (RS485) cable, which is made of four shielded cables inside the sheath.
- Connect a positive and a negative wire to the inlet terminal.
- Connect a positive and a negative wire to the outlet terminal.

6.6.2. Settings of Modbus devices

Dip switched address



Address of the device (unique)

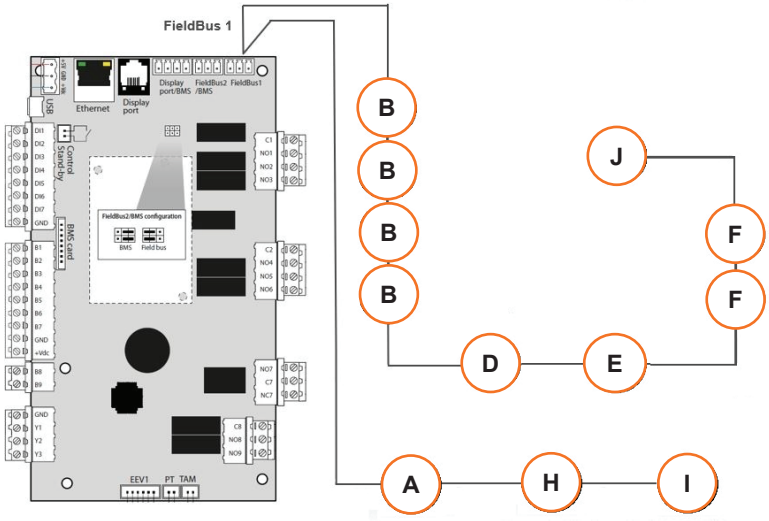
- For T/H sensor: set the pins on its board.
- For the fans (inside the unit): the setting is factory made.

  However, you might need to do again the setting in case of fan replacement.

  Do the setting by the programming tool (see the *PDX-PCW Control Application*)

Baud rate = 19200
Parity = Even
StopBits = 1

Same parameter for all the devices in the Modbus chain

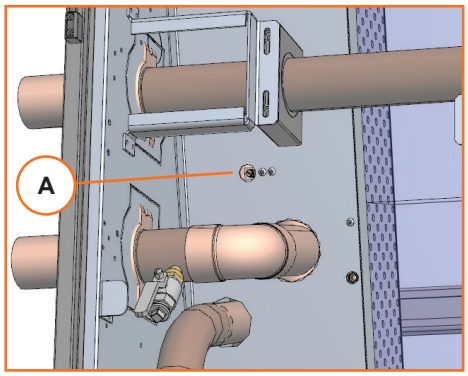


A	Return sensor T+H (up to 4)	**F**	Pressure Indipendent Control valve (up to 4)
B	EC fans (up to 6)	**G**	Air Economizer sensor T+H
C	Humidifier	**H**	Optional sensors T or T+H (up to 3)
D	Energy meter	**I**	Remote sensors T or T+H (up to 10)
E	Expansion board	**J**	Differential pressure transducer

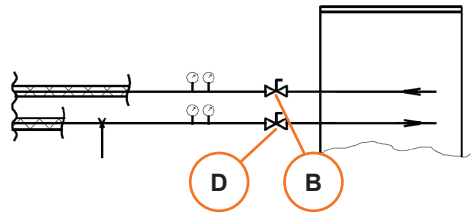
NOTE: ***T*** *- Temperature sensor*
H *- Humidity sensor*

6.7. Filling the water system

6.7.1. Water supply

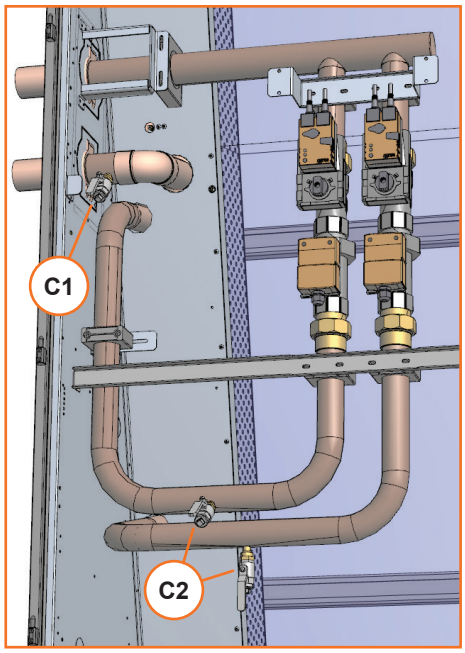


- Make sure that the drain valves [**C1**], [**C2**] are closed.
- Open the vent valve [**A**] to deaerate the unit's coils and piping.
- If there are shut-off valves [**B**] on the water return (building facility), then make sure that they are open.
- Open the shut-off valves [**D**] on the water supply system upstream the unit (building facility).
- Supply water through a filling group or from the plant
- Close the vent valve [**A**] when only water and no air blows out of them.
- If necessary, fill-in or tip-up the ethylene glycol (see chapter *6.7.2 Adding ethylene glycol*).



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 for the lowest water temperature at the installation site. Failing to comply with this instruction shall invalidate the unit warranty.



The unit is provided with the following drain valves:

- [**C1**] Drain valve on water inlet piping
- [**C2**] Drain valve on water outlet piping (2x)

6.7.2. Adding ethylene glycol

Preventing freezing

If it is required to work with temperatures below 0°C, or if the tubing is to run outdoors, 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] (*)	-	1017	1033	1049	1064	1080

(*) 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 chapter *6.7.1. 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 at 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 the hydraulic features of the system changes by adding glycol (see chapter *3.1. Water system - Glycol mixture correction factors*).

6.8. Final checks

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

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

	WARNING Disconnect the power supply before doing the following checks on the electric system as explained in *1. Safety*.
Electrical system	• Check all the cable connections particularly the main power connections on the miniature circuit breaker 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 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).
Cooling system	• 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).
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…) operate properly. • Check that all the temperature and humidity probes read correct value. • Make sure that the water drain connections are connected properly.
Safeguards	• Make sure that all the safeguards (panels, grids) have been re-attached. • Close and lock all the doors.
Everything OK?	• Start the normal operation, see chapter *7. Operation*

7. Operation

7.1 Safety Instructions

WARNING

Improper operations can cause injury or death.

NOTICE

Improper operations can cause product damage.

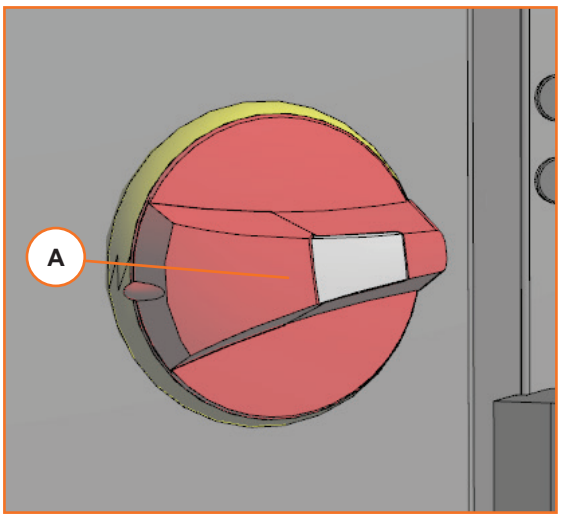
Read carefully the chapter *1. Safety*.

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

NOTICE

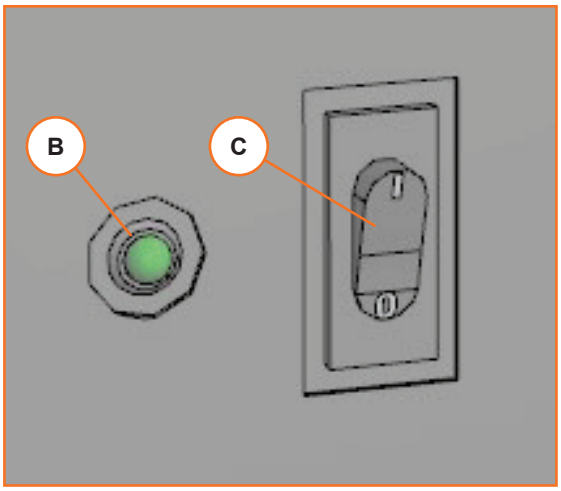
The power supply should never be disconnected during normal operation, except when performing maintenance.

7.2 Power-up



1. Close the disconnection device upstream the unit (to be installed by the customer)
2. Turn the disconnecting switch [**A**] to position **I/ON**
   - If the display is present, then check that it turns **ON**.
   - In case of first startup 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.

7.3. Start



- Turn the disconnecting switch [**A**] to position **I/ON**
- Adjust the setpoint as indicated in the *PDX-PCW Control Application*.
- Set **ON/OFF** switch [**C**] for controls to **I/ON**.

  The LED [**B**] lights up, showing the presence of the electric power.

See the *PDX-PCW Control Application* for details.

If the LED does not light up, see chapter *9. Troubleshooting*

CAUTION

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

7.4. Check the operation

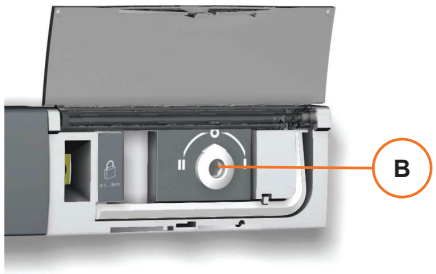
NOTICE

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 *PDX-PCW Control Application*)
Control and safety devices	• Check the correct operation of the control and safety devices.

7.5. Stop

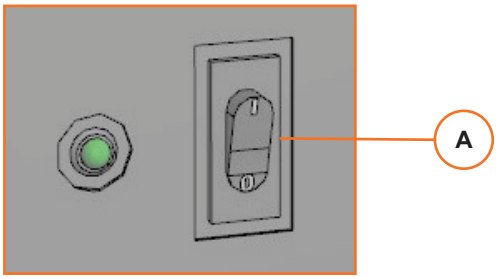


In case of a long stop (seasonal shutdown):

- Set the ATS disconnecting switch [**B**] to the position "**0**"
- Close the disconnection device upstream the unit.

7.6. Restart

After a short stop



The unit is still powered

- Set the ON/OFF switch [**A**] to **I/ON**.

After a long stop	• Do the complete procedure as described in chapters *7.2 Power-up* and *7.3 Start*
In case of power blackout	• See chapter *2.8.1. Dual power supply – Alternate*

7.7. Teamwork

The factory setting for the 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 (standby + rotation + changeover on alarm)
- Cascade

See the *PDX-PCW Control Application* for more information and instructions about the Teamwork configuration

Four 'teamwork' mode can be adopted:

1. **No Teamwork** - The units work independently on the cooling control. Sensor values and setpoints are not shared.
2. **Teamwork Mode 1 (Parallel)** - The control uses the system PI's for driving cooling, heating, ventilation, humidification and dehumidification
3. **Teamwork Mode 2 (Independent)** - The control drives cooling, heating, ventilation, humidification and dehumidification based on local requests, while avoiding operational conflict with the other units in the network.
4. **Teamwork Mode 3 (Smart Aisle™)**

8. Maintenance

8.1 Safety Instructions

WARNING

Improper operations can cause injury or death.

WARNING

Rotating elements, hot surface elements.

WARNING

The compartment of the unit is under positive pressure. Turn the unit **OFF** before opening any latches.

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.

8.2. General instructions

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.

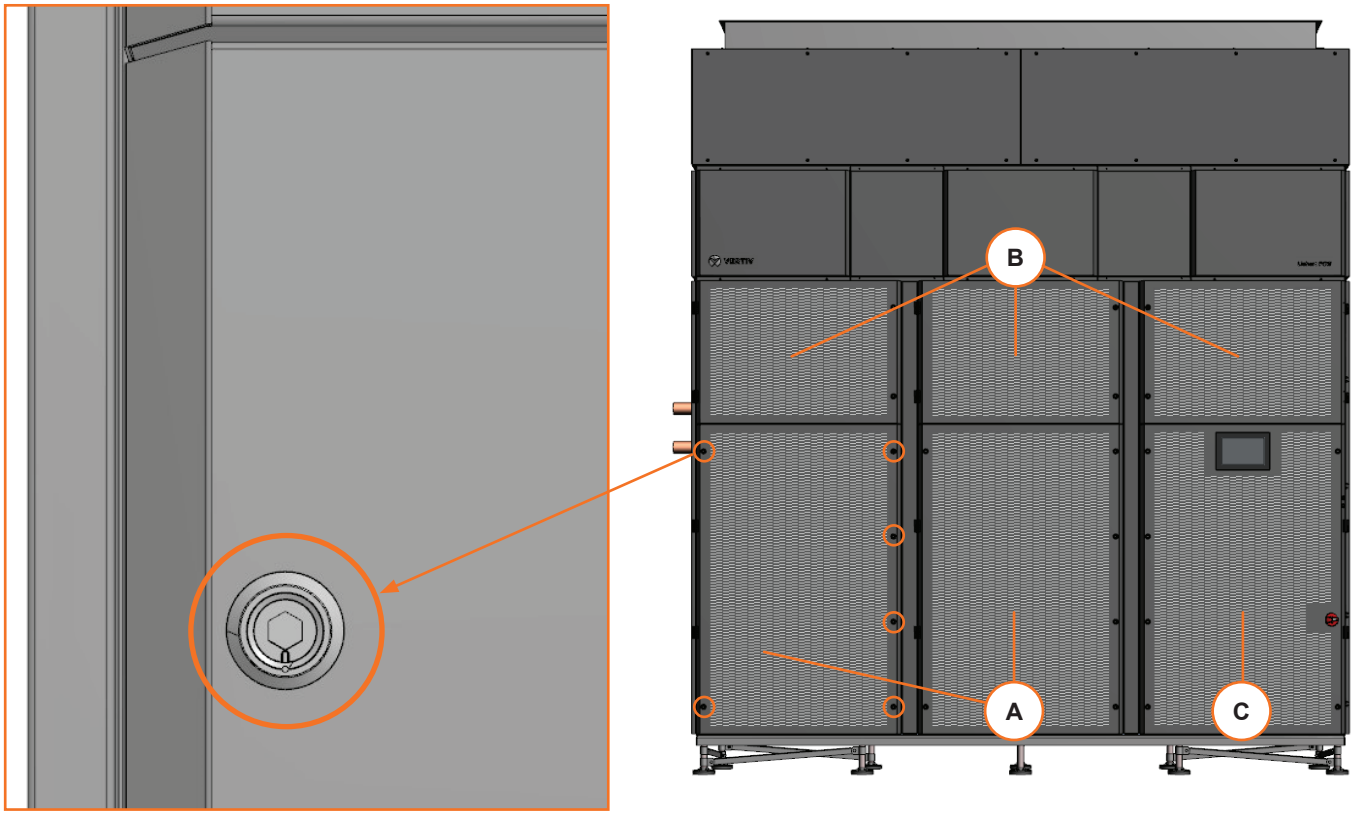
NOTICE

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

8.3. Removing the front access panels

WARNING
The compartment of the unit is under positive pressure.
Turn the unit **OFF** before opening any latches.

Using a Hex / Allen key, open all the latches on the panel.
Turn the latches 90°.
Start from the bottom upwards.



- Lower left and lower middle panels [**A**] are held by **8** latches.
- All Upper panels [**B**] on the coil section are held by **4** latches.
- Door with display [**C**] is secured by **6** latches and is attached to the unit by **2** hinges.

8.4. Maintenance program

8.4.1. 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 **10** 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**.

Refer 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	• 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	
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

8.4.2. 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 **10** 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
Piping and connections	• Make sure there is no loss of water. • Check that the water supply is ensured.		X	
Trapped air	• Remove any air from the water system using the vent valve on the top left-hand side of each coil.		X	
Ethylene glycol	• Check the level • Top up if necessary (see *6.7 Filling the water system*).		X	
Operation	• Check that the water circulation is in perfect order. • Check that the water valve operates correctly. • Check the temperature and the pressure of the water on the inlet and outlet • side using thermometers and manometers, if installed.		X	

8.4.3 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:

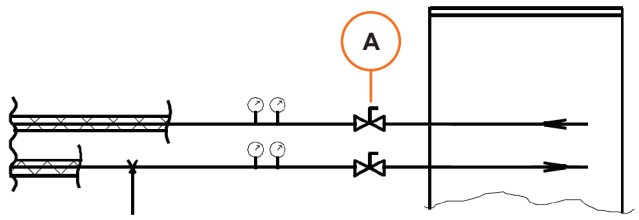
- Turn all the disconnecting switches to **OFF**.

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 *8.6.2 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 *8.7 Calibrations*		X	
Heaters (optional)	• The accessory operates as required?		X	
Temperature safety switch	• See *8.7 Calibrations*		X	
Condensate tank (optional)	• Visual inspection for dirtiness, damage, corrosion Clean if necessary.	X		

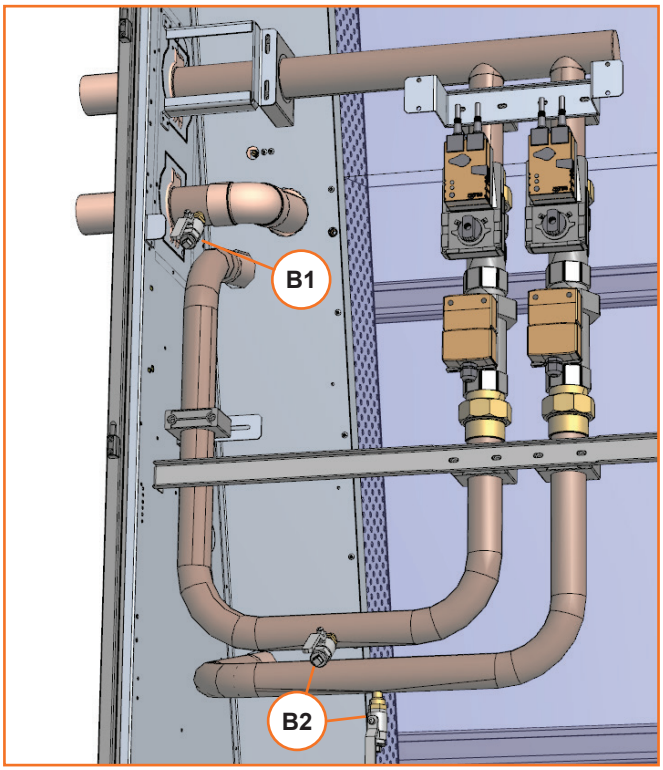
(*) Check more frequently in dusty environment.

8.5 Draining the chilled water system



For each coil:

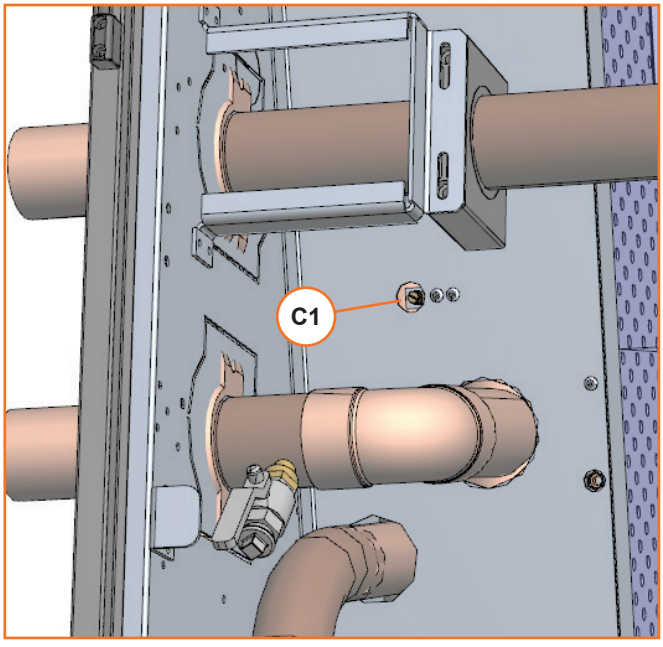
- Close the shut-off valves on the water supply system upstream the unit [**A**] (building facility).
- Open the drain valves [**B**].
- Open the vent valves [**C**] .
- Let the drain valves [**B**] open until no more water flows out of them.



The unit is provided with the following drain valves:

[**B1**] Drain valve on water inlet piping

[**B2**] 2x Drain valve on water outlet piping

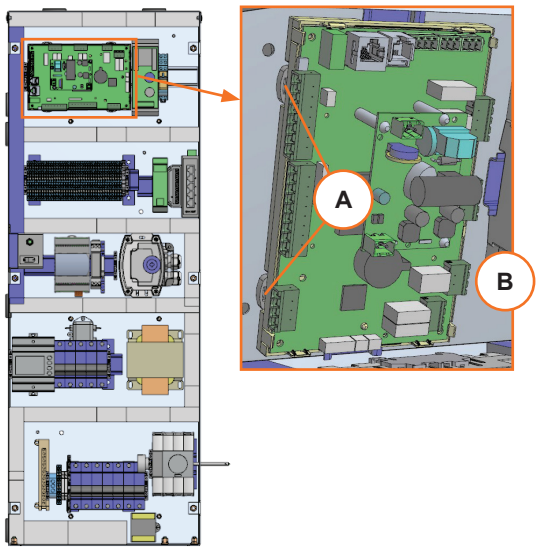


The unit is provided with the following vent valve:

[**C1**] Vent valve on chilled water heat exchanger

8.6 Components replacement

8.6.1 Replacing the control board



WARNING
Disconnect the unit from the power supply.

How to remove

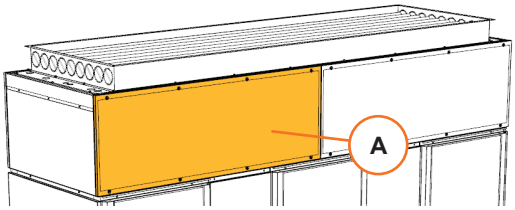
- Remove the cover plate of electrical and control panel.
- Remove all the cables connected to the the control board.
- Insert a screwdriver in one of the loops [**A**] and lever/pull the latch to release the lock [**B**].
- Repeat for the other latches until the control board can be removed from the rail.

How to reassemble

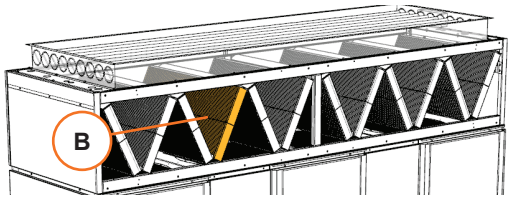
- Press the control board in the DIN rail until it locks.
- Connect the cables.
- Reassemble the cover plate of electrical and control panel.
- Connect the unit from the power supply.
- Upload the software from the computer (or USB drive) to the control board.
- Restart the unit.

NOTE: *Battery type - Lithium button (removable), BR2032, 3Vdc*
*Duration min. **8** years in normal operating conditions*

8.6.2 Replacing an air filter



- **Switch OFF** the unit
- **Remove** the frontal panels [**A**].



- **Remove** the air filters [**B**]

- **Slide** in the replacement filter blocks.
- Pay attention to correct filter orientation relative to the airflow.
- **Re-attach** the frontal panels.

8.6.3 Replacing a fan

8.6.3.1.General instructions

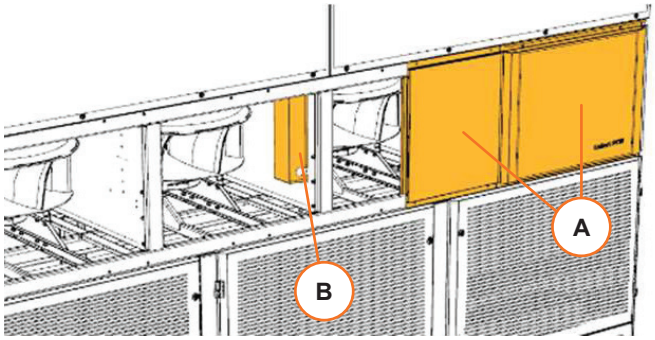
Safety

WARNING
Disconnect the unit from the power supply.

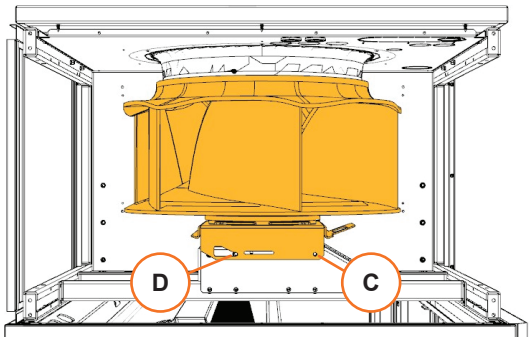
CAUTION
The fans and the panel are heavy.
This operation must be done by two maintenance operators.
Use adequate lifting equipment and follow the fan manufacturer instructions for handling.

Additional information	Refer 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 *6.6.2 Setting of Modbus devices* and the *PDX-PCW Control Application* for details.)

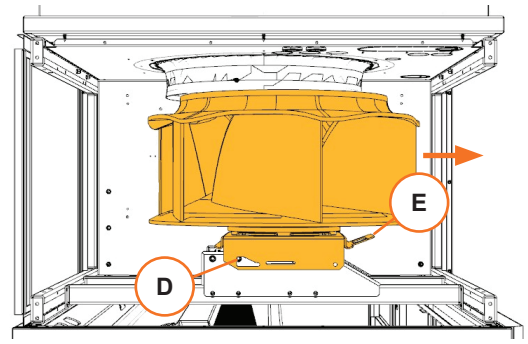
8.6.3.2 Replacing a fan



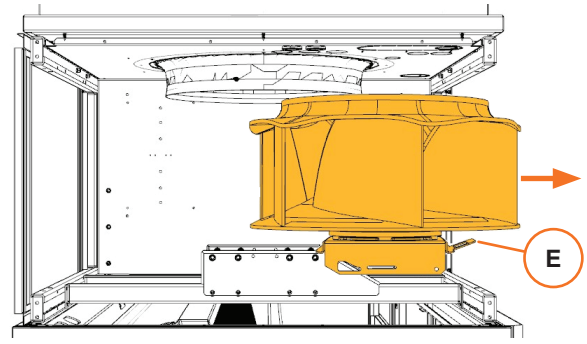
- Disconnect the unit from the power supply.
- **Remove** the frontal panels [**A**] on the fan module
- If necessary, remove the cable covers [**B**] in the fan bay.



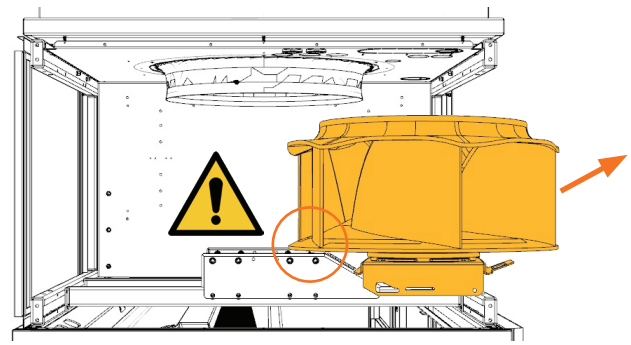
- Disconnect the electrical cable from the connector
- **Remove** the two front screws [**C**] that fix the fan support to the sliding bars.
- **Loosen** the two back screws [**D**] that fix the fan support to the sliding bars.



- **Pull** the handle [**E**] and **carefully slide** the fan down.
- Keep the fan in a horizontal position - Pay attention to not damage the propeller on the edge of the fan nozzle.
- **Remove** the back screws [**D**]

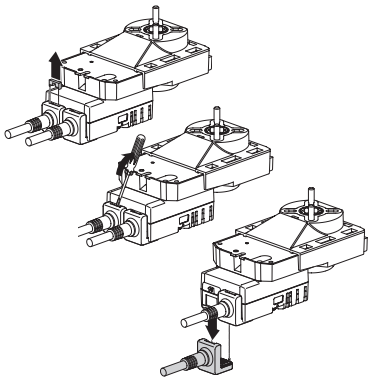


- **Pull** the handle [**E**] and **slide** the fan down the slope, out of the bay.
- Keep the fan in a horizontal position.
- Pay attention to not damage any cables present in the fan bay, especially after removing the cable cover.



- It might be necessary to **slightly lift** the fan to avoid contact between the propeller and the bracket.
- To reassemble the fan, proceed in reverse order

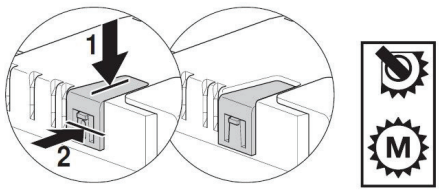
8.6.4 Replacing the valve actuator



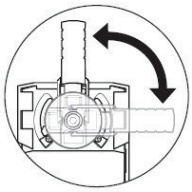
1. Turn **OFF** the unit – set the disconnection switch of the unit to position "**0**" (see chapter *7.5. Stop*)
2. Disconnect the wires from electric panel (from power and control terminals) (see wiring diagram attached to the unit for specific terminals)

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

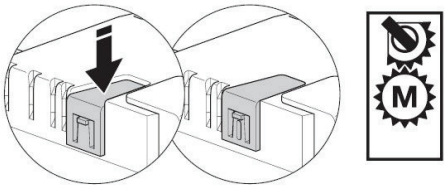
   - Remove two pins from actuator's connectors with small straight screwdriver.
   - Disconnect connector from actuator (see the picture beside).



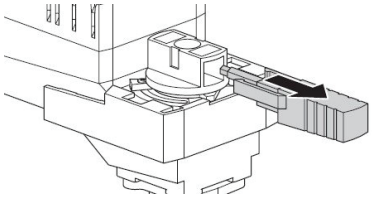
3. Set the actuator / valve into default position:
   - Press the disconnect button down (**1**) and hold it in position by pressing the latch (**2**)



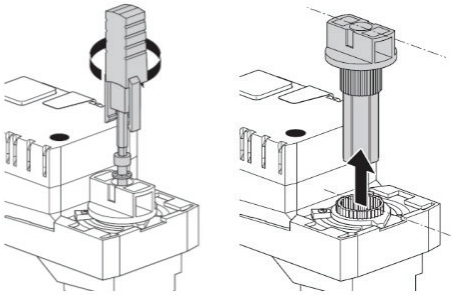
   - Manually turn the valve using the actuator handle until you reach the end stop



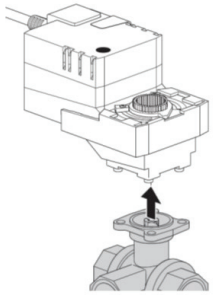
   - Press the disconnect button again to release it



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

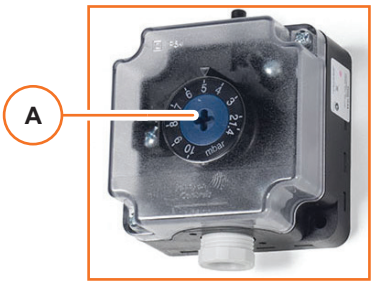


6. Now you can safely remove the actuator.
7. To install new actuator, it is necessary to set ring to end stop. Then proceed with steps 6 – 1 in this order.

8.7 Calibrations

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

- For control system calibrations refer to *PDX-PCW Control Application*

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	

9. 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**)
High vibration on the unit	The piping are not properly fixed	Check the piping
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 no signal	Check the Modbus chain
The unit is noisy	The fan is noisy	Check the fan fixing

10. 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 fans, 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.

10.1 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.

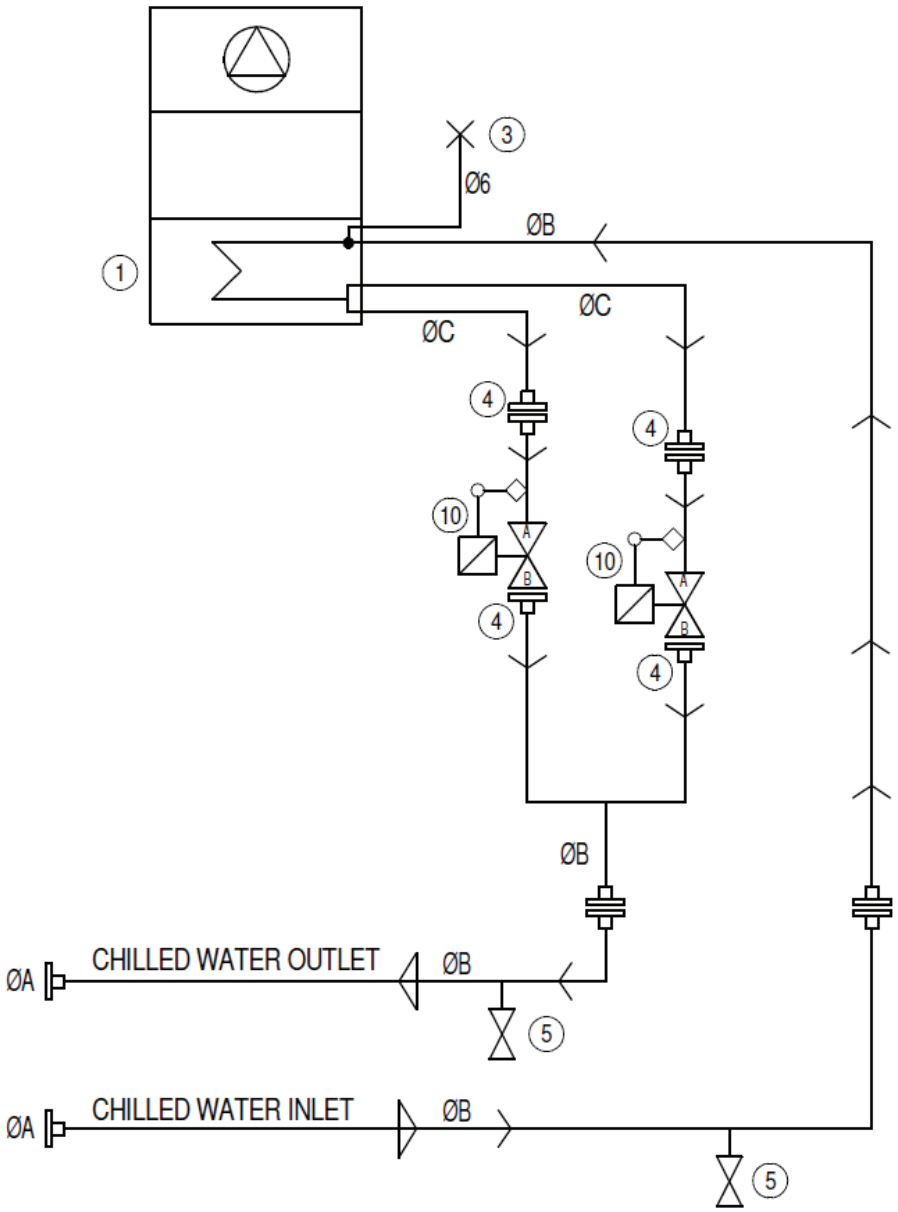
ENVIRONMENT

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

10.2 Operations

Operation	Notes
1. Disconnect the disconnecting switch from the electric power supply	Reverse the procedure from chapter *6. Installation*: *6.5.1 Power supply cable*
2. Drain the water	See *8.5 Draining the water system*
3. Cut the piping at inlet and outlet of the unit	
4. Remove the unit	Reverse the procedure from chapter *5. Assembly and Positioning*
5. Move away the unit	See *4. Handling*
6. If you need to keep the unit in a storehouse for reuse	See *2.6.1 Storage conditions*
7. If you need to scrap the unit	Handle to authorized disposal company according to the local regulations about waste disposal.

Annex A - Chilled water circuit scheme



Ref.	Description
1	Chilled water coil
3	Manual air bleeding valve
4	Valve fittings
5	Drain valve
10	Chilled water PIC valve

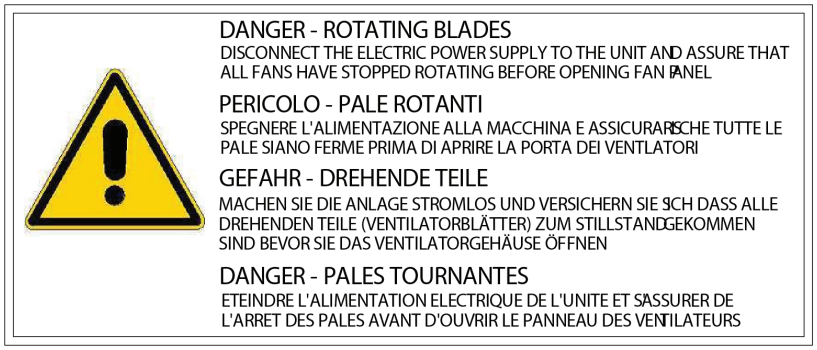
Pipe size	
Ø A	64 mm
Ø B	64 mm
Ø C	54 mm

Annex B - Safety Labels

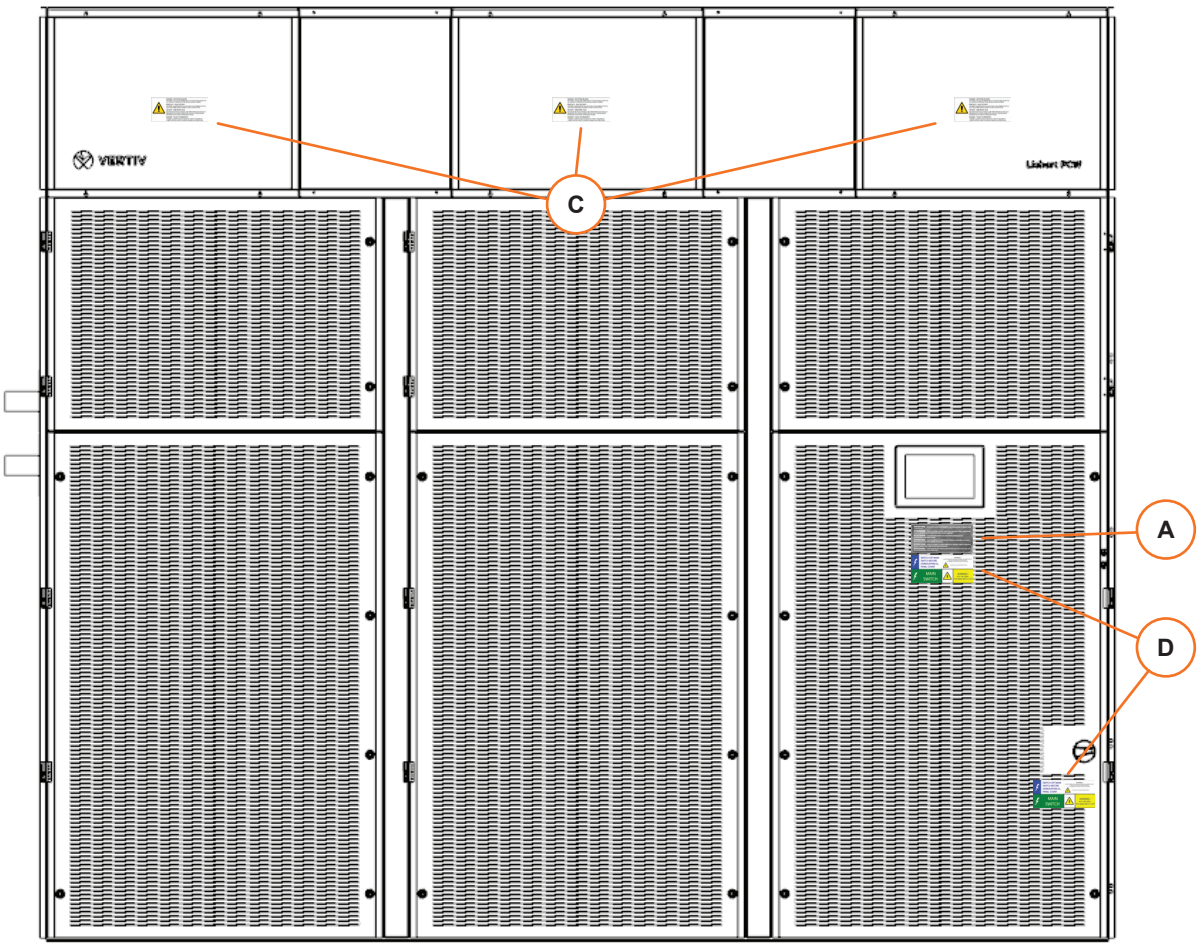
WARNING

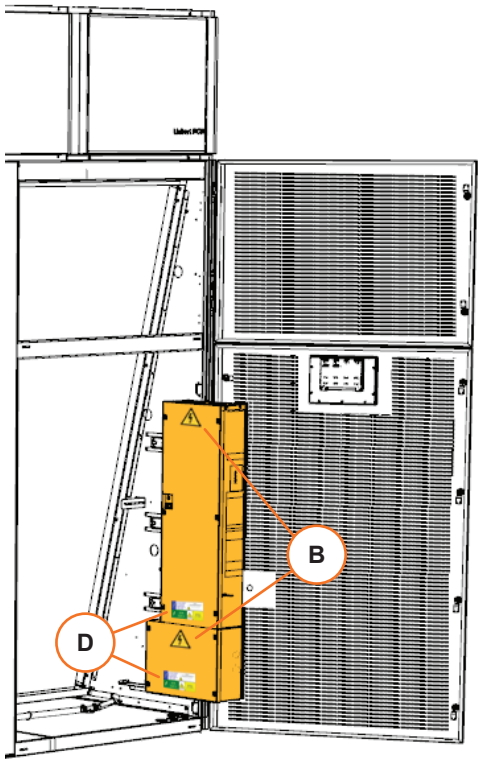
Do not remove or cover the labels placed on the unit by the manufacturer.
Check regularly that the warning label are still on the unit and that they are clearly visible.
Replace any missing or damaged label.

Labels list

Identification	Description
A	
B	
C	
D	

Labels position





Annex C - Connections

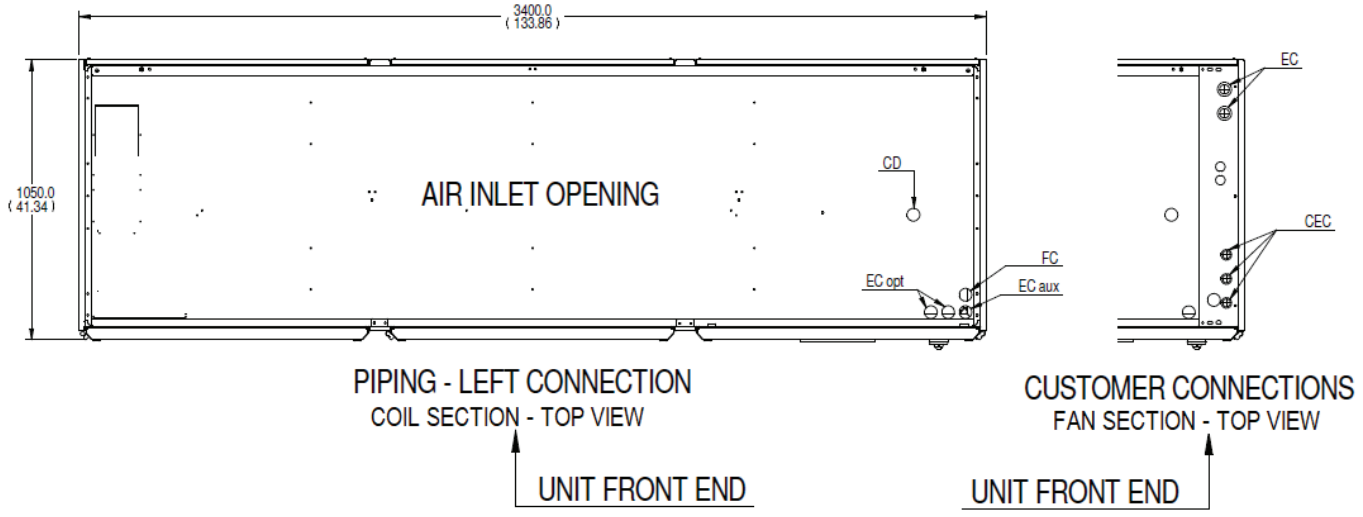
Key to symbols

Symbol	Description	See ...
ICW	Chilled water INLET	Chapter *2.4 Cooling System*
OCW	Chilled water OUTLET	
EC	Electrical power supply	Chapter *6.5 Electrical connections*
EC opt	Electrical power supply (optional)	
EC aux	Low voltage cables	
CD	Condensate Drain	Chapter *6.4.5 Condensate drain connection*
FC	Free cutout	
CEC	Customer low voltage connection	

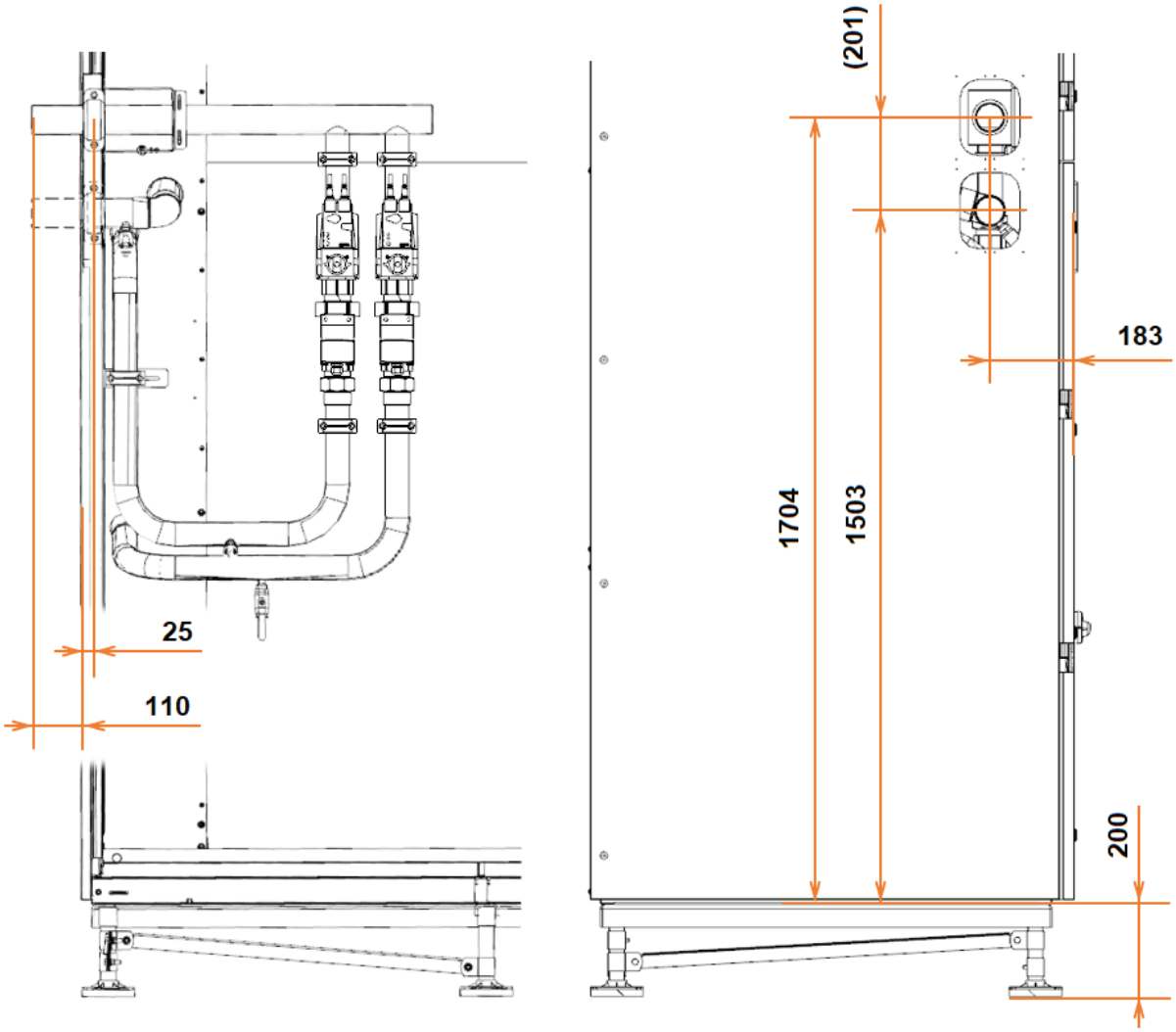
Hydraulic and electrical connections

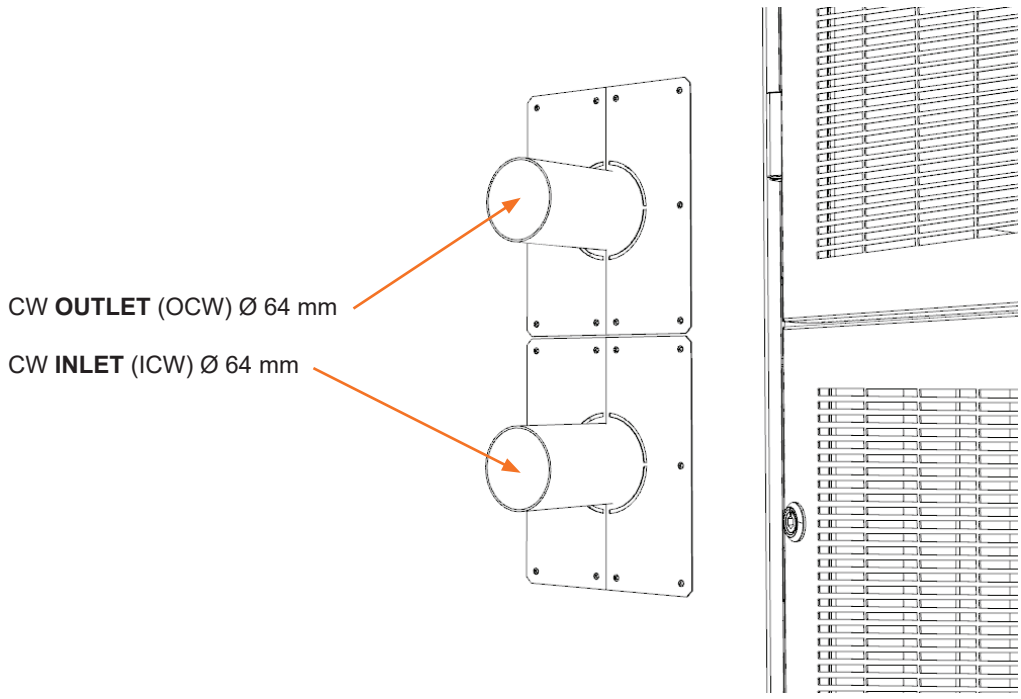
Point	Description	Connection size [mm] PWM30
ICW	Chilled water **INLET**	O.D. Ø 64 mm
OCW	Chilled water **OUTLET**	O.D. Ø 64 mm
CD	Condensate drain	I.D. Ø 20 mm
EC	Electrical power supply	2 x Ø 48 mm
EC opt	Electrical power supply (optional)	2 x Ø 48 mm
EC aux	Low voltage cables (optional)	Ø 48 mm
FC	Free cutout	Ø 48 mm
CEC	Customer low voltage connection	3 x Ø 36 mm

Dimensions for piping – Top connection (Top view)



External CW piping connections





Annex D - ATS (Automatic Transfer Switch)

1 - Safety instructions

WARNING

Improper operations can cause injury or death.

NOTICE

Improper operations can cause product damage.

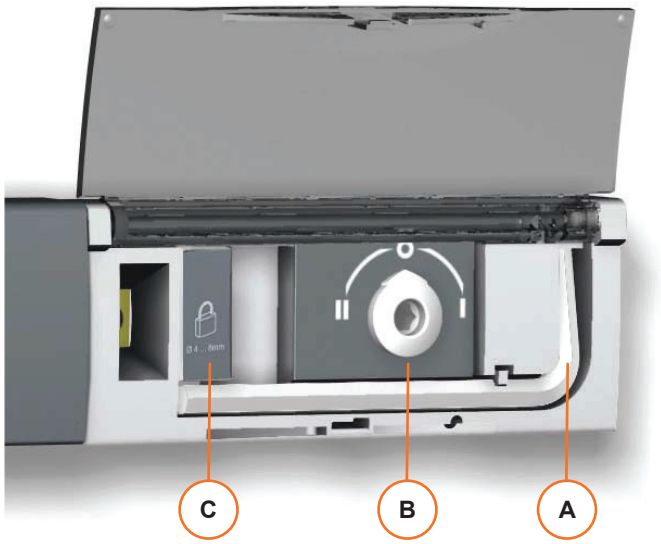
Read carefully the chapter *1. Safety*.

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

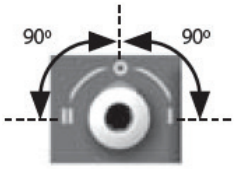
Covers	- The only cover that can be opened is the one for the auto/manual switching. - Do not open any other cover (with or without voltage) as there may still be dangerous voltage inside the unit from external circuits.
Cables	- Do not handle any control or power cables connected to the ATS when voltage 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).

Description

Components for manual operation and locking



A	The hex/Allen key for manual operation
B	Changeover switch for manual operation
C	Safety locking clip for locking disconnected position = **O**



NOTE: *Open the front cover as shown to put into manual mode.*

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 **PWM** 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:

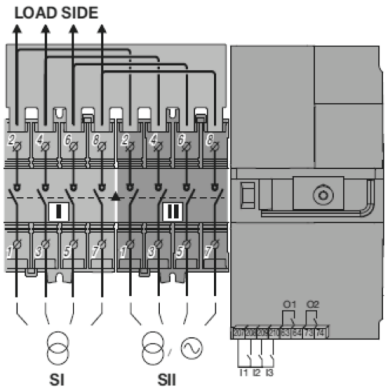
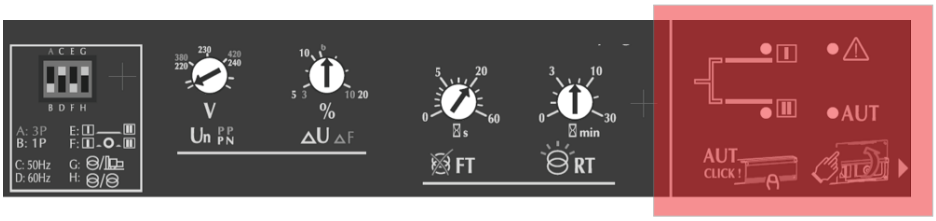
- Type 03: configurable through four potentiometers and DIP switches

ATS feedback (optional):

Monitoring Relay to provide customer information for use of Main or Backup line.

Specifications

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
Type		**Type 03**
Frequencies		**50 – 60 Hz**
Thermal current I_{th} at 40°C [A]		63 A
Short-circuit capacity	Rated short-term withstand current: I_{CW} 1s [KA_{eff}]	4
	Rated short-term withstand current: I_{CW} 30ms [KA_{eff}]	10
Switching time at I_n excluding loss of supply sensing time and excluding any delay timers applicable	I – II or II – [ms]	180
	Duration of "Electrical Blackout" at U_n [ms]	90
	I – O, O – I, II – O, O – II [ms]	45
Connection cross-section	Minimum size [Cu mm^2] flexible and rigid	10
	Maximum size [Cu mm^2] flexible and rigid	70

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

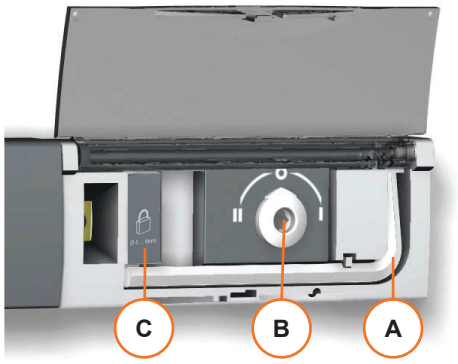
Installation

The **PCW** 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.

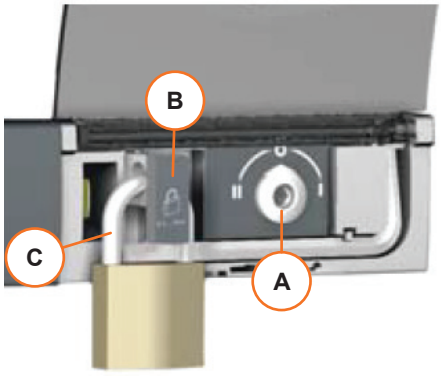
The ATS is placed inside a separate electrical panel and fixed on a DIN rail.

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



- Disconnect the power supply to the **PCW** unit through the general disconnecting switch.
- Insert the Hex/Allen key [**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**.

Locking the switch in the disconnecting position

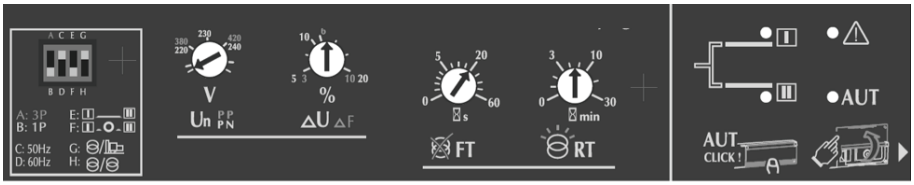


- Insert the handle to the switch [**A**] and turn it to position "**O**".
- Lift the locking clip [**B**].
- Insert your padlock [**C**] in the clip (4-8 mm shackle diameter).

Now the switch is locked in the power disconnecting position.

NOTE: *The handle can be padlocked only in the "**O**" position.*

Configuration for type 03



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

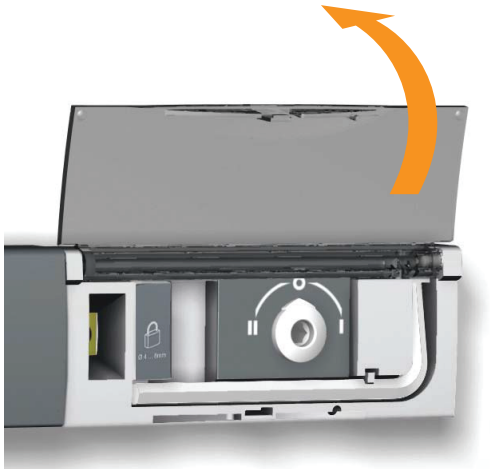
The ATS type 03 arrives pre-configured from the factory as described in the following table:

	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	0 sec
Potentiometer 4	Return time, minimum required time to return on the main/priority line	0 sec

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

Operation

Manual mode



- Open the cover to switch to manual mode
- Insert the Hex/Allen key 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.

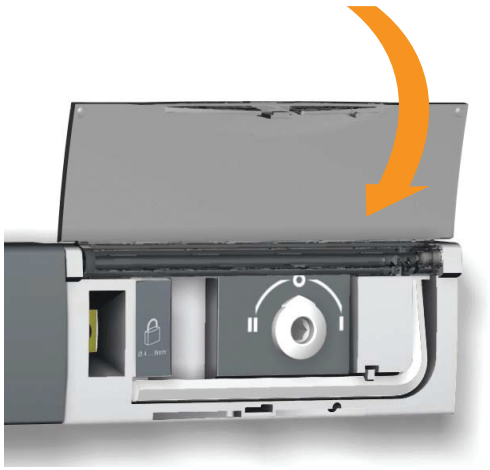
You may turn the switch to each of the following positions:

I - priority power supply

O - power supply disconnected

II - secondary (alternate) power supply

Automatic mode



- Close the cover to switch to 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 cover open if you do not want the ATS to be in automatic mode during the initial power-up.*

NOTICE

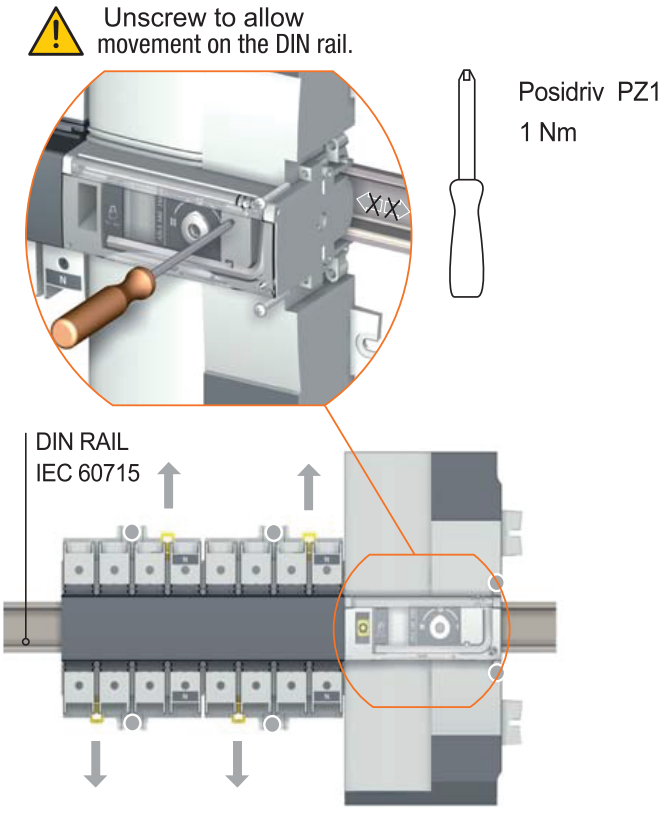
Before powering on the ATS, manually operate it to ensure that it can move normally.

Maintenance

Periodic checks and operations

- Check if the electrical connections are tight.
- Tighten any loosen connection.

Replacement



NOTE: *Screws indicated by grey dot* ●
Eyes [A], [B] indicated by grey arrow ↓

The ATS fault is indicated by the LEDs as following:

- 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 **PWM** unit through the general disconnecting switch.
- Switch in manual mode and set the position of the handle on “**O**”.
- Secure disconnected position with the padlock (follow previous chapter 5 Operation - Locking the switch in the disconnecting position
- 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 (2 x screws on the left from position switch - PZ1 screwdriver needed) and on the electrical panel (6 x screw - Hex nut driver 10 mm needed).
- Insert a screw driver in one of the eyes 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 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 connect the ATS

- Switch the new ATS in manual mode and set the position of its handle on “**O**”.
- Secure disconnected position with the padlock (follow previous chapter 5 Operation - Locking the switch in the disconnecting position
- 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.
- 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 **PWM** unit to the power supply.
- Restart the **PWM** unit.

Troubleshooting

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
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).

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