Liebert® PCW
PW400

User Manual

English, 10028556MAN_ENG, rev. K.1 - 12.01.2024

This document, written in English, is the original version

Contents

Annexes

Documents supplied with the machine

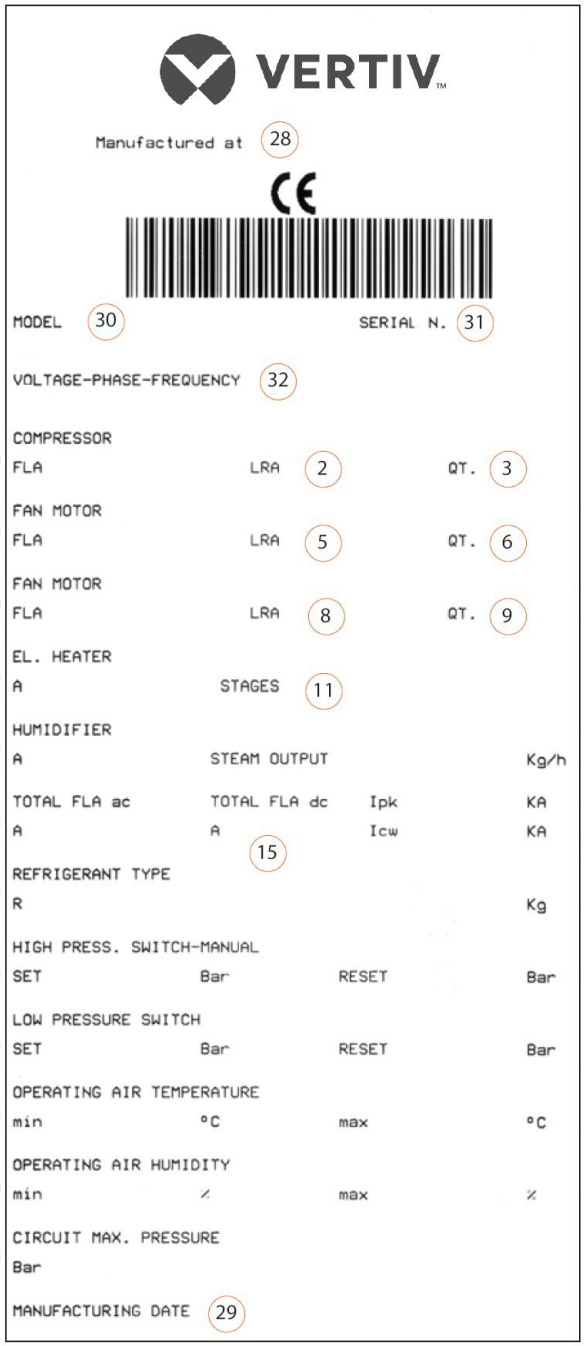
- User Manual (this document)
- PW Control Application - Manual
- Electric Diagrams
- Instruction Leaflet for Transport and Handling (on the packaging)
- Labels with Gravity Center (on the packaging)
- Warranty Certificate

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 beside an empty facsimile).



Pos.	Description
01	Not used
02	Not used
03	Not used
04	Fan Full Load Ampere [A]
05	Fan Locked Rotor Ampere [A]
06	Fan quantity
07	Not used
08	Not used
09	Not used
10	Electrical Heating Ampere
11	Electrical Heating Steps
12	Humidifier Ampere
13	Humidifier steam production capacity
14	Unit total full load Ampere AC [A]
15	Not used
16	Rated peak with stand current
17	Rated short-time current
18	Not used
19	Not used
20	Not used
21	Not used
22	Not used
23	Min. room operation temperature
24	Max. room operation temperature
25	Min. room operation air humidity
26	Max. room operation air humidity
27	Maximum hydraulic circuit pressure
28	Manufacturing plant
29	Manufacturing date
30	Model
31	Serial number
32	Power input

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

Digit Nomenclature

The unit is fully defined by the following digits.

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

Dig.	Feature	Value	Description
1 2	Family name	PW	
3 4 5	Model	400	
6	Air discharge	E	Downflow Down (in the raised floor)
7	Cooling System type	L	Legacy Single Circuit
		S	Smart Single Circuit
8	Fan type predisposition	E	EC fan advance - HE
		P	EC fan advance - HP
9	Power supply	3	400V / 3ph / 50Hz + N - CE
		T	380-400V / 3ph / 60Hz + N - CE
		6	460V / 3ph / 60Hz + N - CE
10	Cooling system	2	CW two way valve - Modbus
		P	CW two way valve - PICV
11	Humidification	0	None
		S	Electrode humidifier
12	Microprocessor control	0	None
		7	7" touch screen
		F	10" touch screen
13	Heating and re-heating	0	None
14	Air filter	1	None, with e xternal filter module
		2	External filter module + Diff.pressure transducer
		3	External filter module + Clogged filter sensor
		4	External filter
		5	External filter with diff. pressure transducer
		6	External filter module with clogged filter sensor
15	Coils and pipes	H	Bottom connections
		T	Top connections
		S	Left side connections
		C	Bottom connections

Dig.	Feature	Value	Description
16	Color	1	Black Vertiv™ RAL 7021
17	High voltage option	D	Standard Power Supply
		A	Dual Power Supply with ATS
		G	Dual Power Supply with ATS and Ultracap for control
18	Predisponition	0	None
		S	Predisposition for Smart Aisle™ (predisposition for damper sensor, 3 position switch)
19	Monitoring	0	None
		1	Monitoring (Modbus, BACnet, SNMP and HTTP)
		4	LIFE compatibility
20	Options	0	None
		E	Energy meter
21	Packaging	P	PLP and Pallet
		C	PLP and wooden crate
		S	Seaworthy
22	Water sensor	0	None
		W	Water temperature sensor IN/OUT
		V	Water temperature sensor IN/OUT + flow meter
23	EMC emissions	I	IEC61000-6-4 Compliant
24		E	Free
25	Special requirements	A	Standard Vertiv™
		X	Special Vertiv™

Fan Base Digit Nomenclature

The base is fully defined by thirteen digits:

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

Dig.	Feature	Value	Description
1 2 3	Fan Module	**BFW**	Fan base frame
4 5	Size: nominal lenght	**38**	3850 mm
6	Air discharge	**S**	All sides
7	Fans	**E**	EC fan advance - HE
		P	EC fan advance - HP
8	Heaters	**0**	None
9	Packaging	**P**	PLP and pallet
		C	PLP and wooden crate
		S	Seaworthy

Dig.	Feature	Value	Description
10	Power supply	**3**	400v / 3ph / 50Hz + N CE
		T	380-400v / 3ph / 60Hz + N CE
		6	460v / 3ph / 60Hz + N CE
11	**Devices**	**0**	None
12	**EMC emissions**	**I**	IEC61000-6-4 Compliant
13	**Special requirements**	**A**	Standard Vertiv™
		X	Special Vertiv™

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

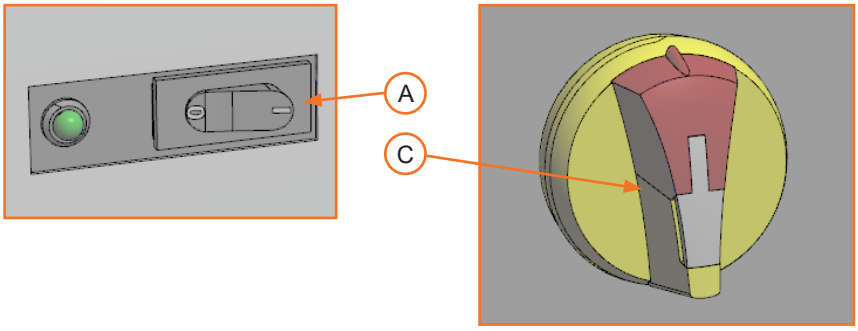
As general rule, always wear the following **PPE** (Personal Protective Equipment):

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 **PW400** 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 *5. Description* for details about the unit structure, versions and optional components.

WARNING
Do not assemble or connect the unit with systems or machines that are different from what is specified in this manual for your unit.
Contact Vertiv™ Technical Support for any question.

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.
UKCA Marking and Conformity Declaration	The units are marked “**UKCA**”. Each unit is supplied complete with individual test certificate and a certificate of conformity to the UK Safety Regulations
Performance test norms	- Cooling Capacity according to EN 14511 - Sound Power Level according to ISO 3744

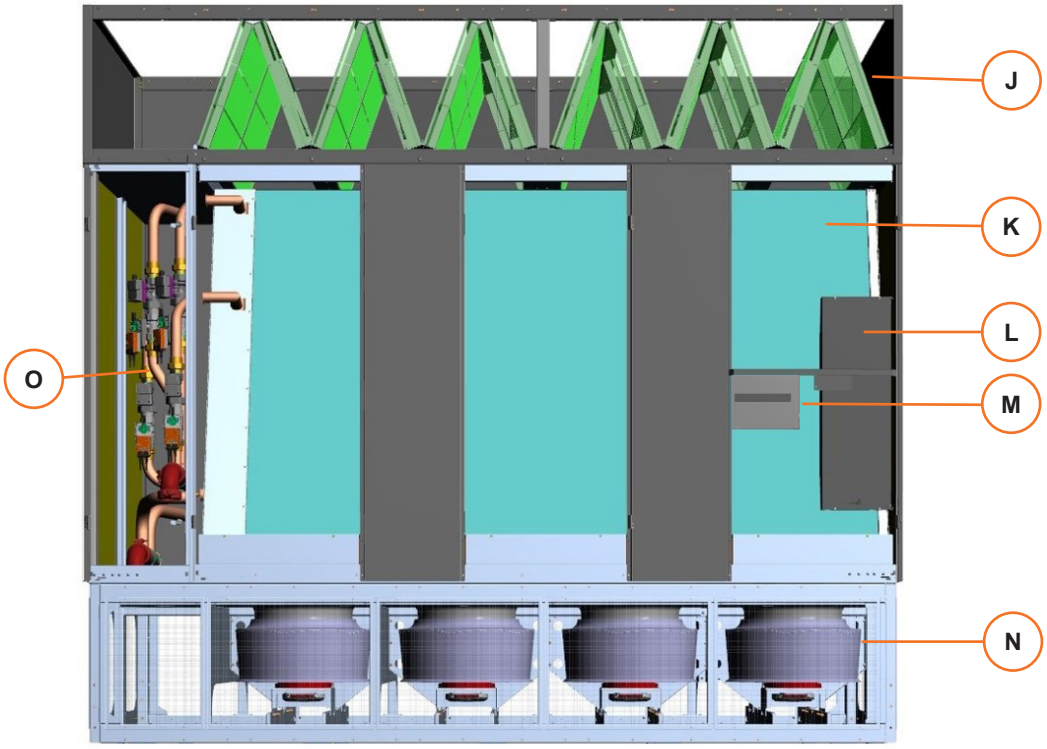
2. Unit Description

2.1. Unit structure

Chilled water unit PW400

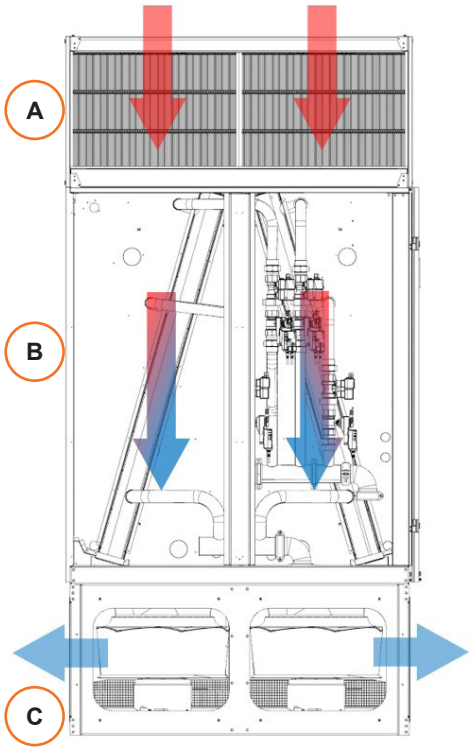
Ref.	Description	Remaks
A	**Plenum with damper (optional)**	Plenum for return air intake can be attached on top of the unit. This plenum can be equipped with dampers and connected to the air duct.
B	**Plenum with filters**	Plenum with filter assembly is attached on top of the coil section.
C	**Control 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.
D	**Shut-OFF switch**	The shut-OFF switch is located on the front door.
E	**Doors**	Frontal panels are attached on hinges. These doors allow acces to the electric panel and ATS module inside the unit. Proper tool is required to unlock the latches and open the door.
F	**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.
G	**Fan section**	The fan section is located underneath the coil section. It is completely enclosed by panels or safety grids to prevent any contact with the moving parts.
H	**Chilled water connection**	Connections for inlet and outlet of the chilled water (from external source) are located in the fan module. In this case, the unit is prepared for bottom connection of pipes. The pipes are equipped with grooved connections. For all water connection options, see *Annex C - Connections*

2.2. Internal components



Ref.	Description	Remaks
J	**Filter assembly**	The intake plenum on top of the unit is equipped with filters. The plenum allows for easy access, maintenance and replacement of the filters.
K	**Coil/heat exchanger**	The unit is equipped with two chilled water coils arranged in “**A**” shape. One coil can be accessed from the front, the other coil is accessible from the back side of the unit.
L	**Electric panel**	For details regarding the electric panel, see chapter *2.8 Electric and control system*
M	**ATS module**	The unit is delivered with dual power supply in order to have the units up and running if the main power supply fails.
N	**Fan section**	The fan section of this unit consists of 8 fans arranged in 2 rows. Fans can be easily removed for maintenance or replacement.
O	**CW pipe and valve assembly**	The unit can be equipped either with 2-way valves or PIC valves. Pipe assembly with valves for both coils is located on the left side of the unit.

2.3. Air distribution

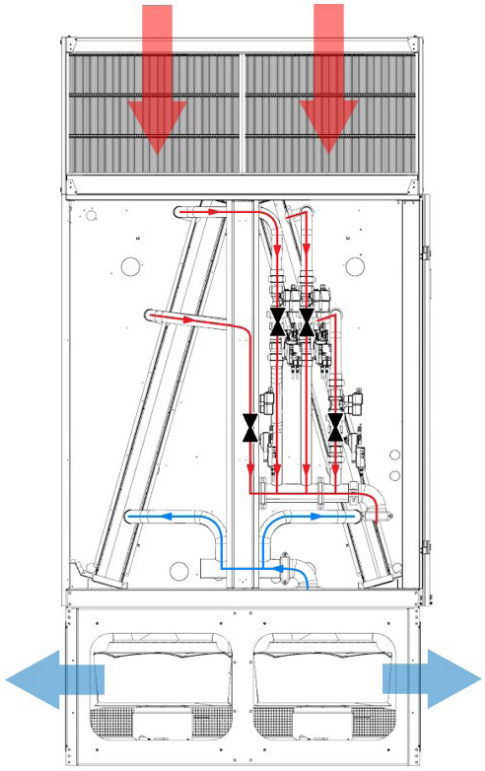


Warm air (return air from the room)

Cold air (supply air into the room)

- The unit frame consists of the Filter section [**A**], coil section [**B**] and the fan section [**C**]
- The coil section contains the cooling system of the unit, the electric panel, and the control system.
- The **warm air** returning from the room enters the unit thorough the filter section on the top. Flows through the coil, where it is cooled and afterwards is discharged through the fan. Depending on the unit configuration, the supply air discharge is possible all around the unit, either into raised floor or directly into the room.
- 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 legs. (optional accessory)
- Additional intake plenum with dampers (optional accessory) may be attached on top of the filter 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 Double circuit **PW400** unit.

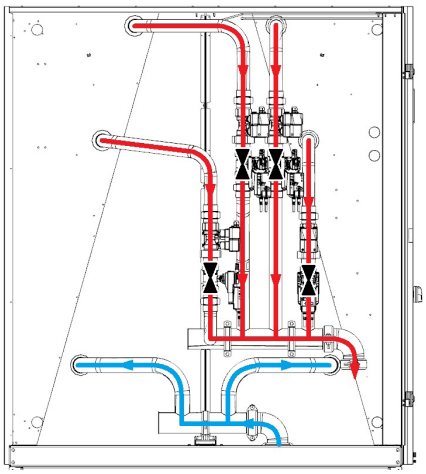
For detailed circuit scheme, see *Annex A – Chilled water circuit*.

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

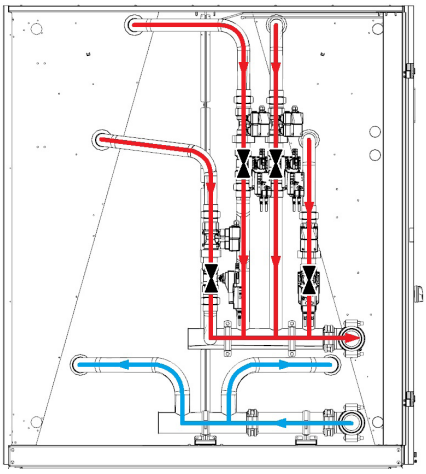
The chilled water flowing inside the coil cools down the air. This air is the discharged into the area.

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

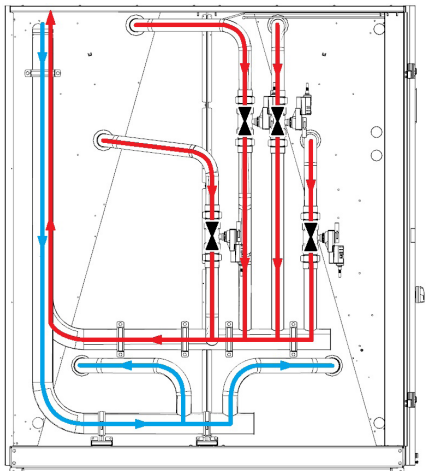
2.5. Cooling system configurations



Bottom connection



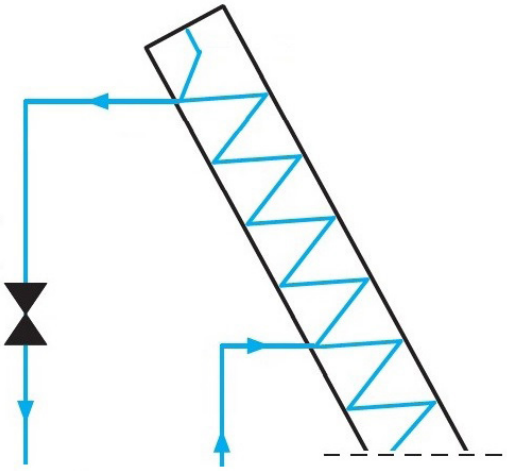
Lateral connection



Top connection

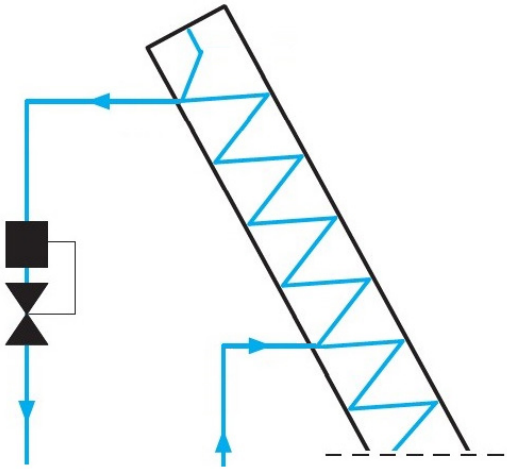
2.6. Water valve type

2-way ball valve



- Modulation of the water outlet opening.
- Operated by 0 – 10 V signal

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	25,2

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 de-aeration is recommended.

2.7. Storage and operating conditions

2.7.1. 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.

2.7.2. 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.
	Max. differential pressures on the modulating valve	350 kPa
Hot water circuit	Inlet water temperature	85°C (max)
	Water pressure	8,5 bar (max.)
Power supply tolerance	Voltage	± 10%
	Frequency (EN 60204-1:2018)	± 0,5 Hz continuously ± 1,0 Hz short time

NOTICE
These limits are referred to new machines or to those that have been correctly installed and serviced.
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.

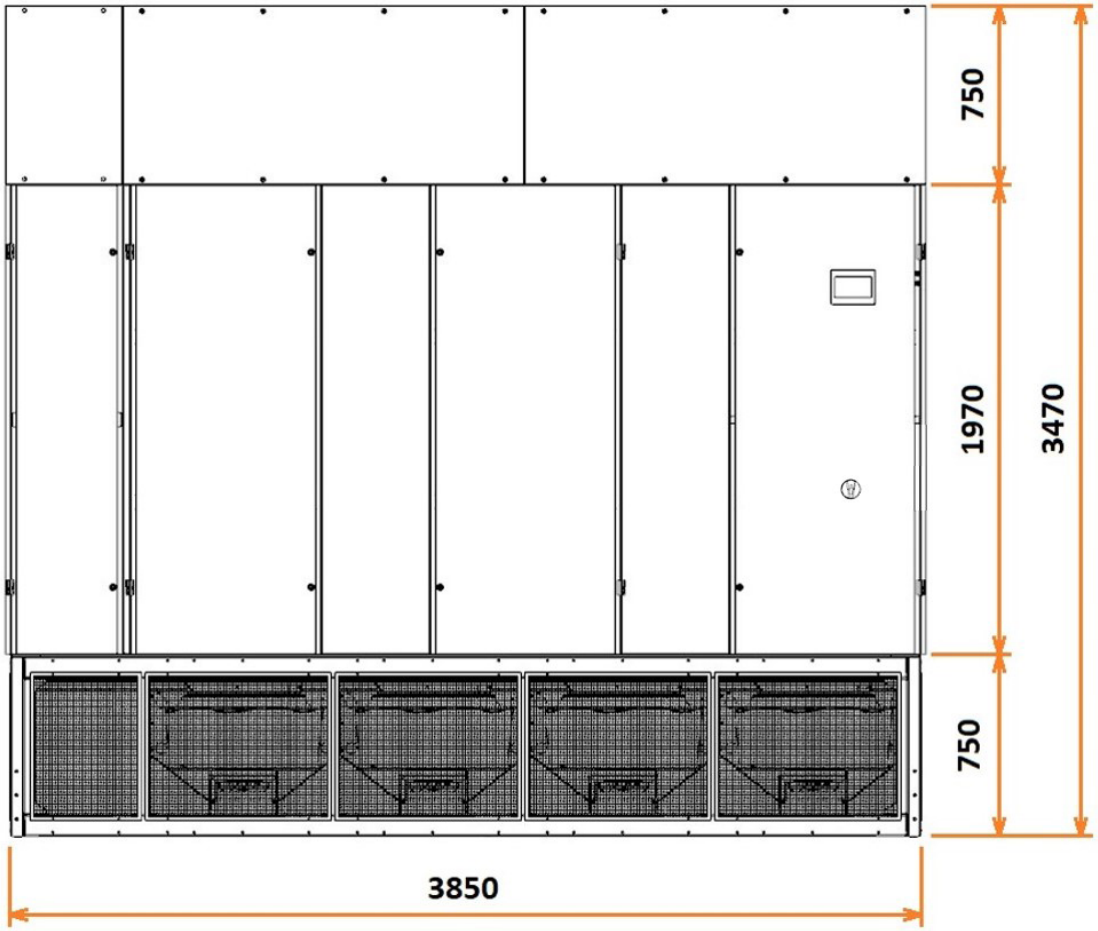
2.7.3. Noise level limits

The sound pressure level in free field at 1,5 m height and 2 m in front of the unit, with fan in operation, is less than 70 dBA for all models.

2.8. Dimensions and weights

2.8.1. Overall dimensions

Dimensions	
Length	3850 mm
Depth	1750 mm
Overall height *	3470 mm
* The overall height consists of:	
Filter section	750 mm
Coil section	1970 mm
Fan module	750 mm

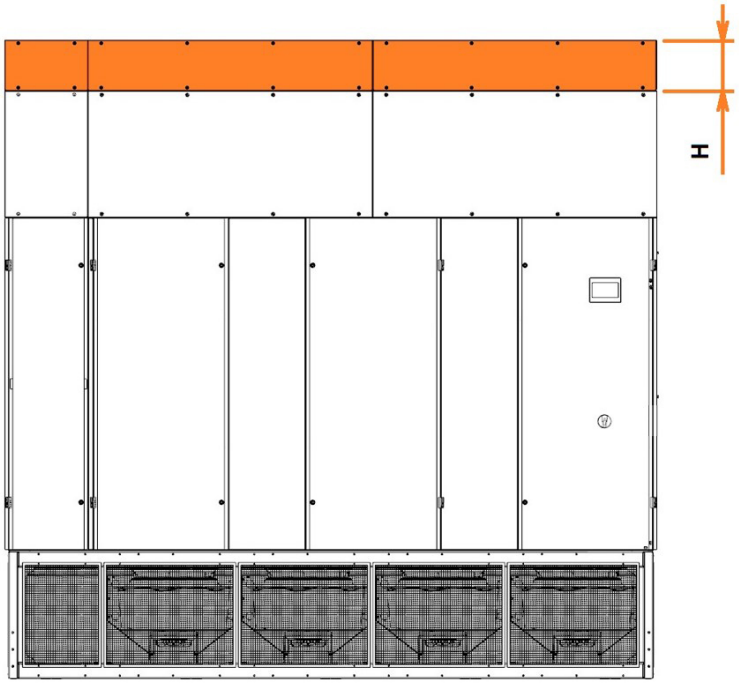


2.8.2. Weights

Dimensions	
Filter section	650 kg
Coil section	1240 kg
Fan module	650 kg
Total unit weight	2540 kg

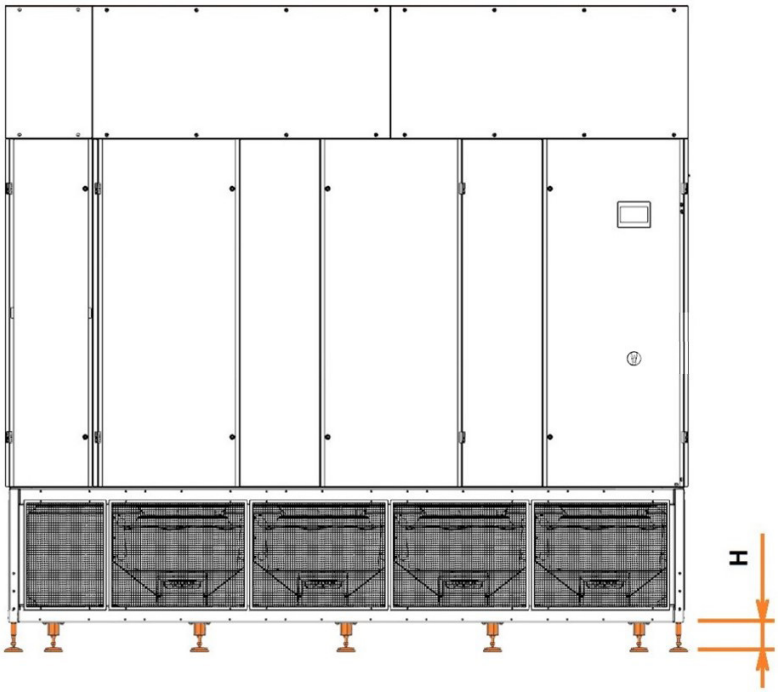
2.8.3. Optional accessory height

Modules on top of the unit



Plenum with damper *	H = 300 mm
Extension hood	H = 600 mm

* shown in the picture



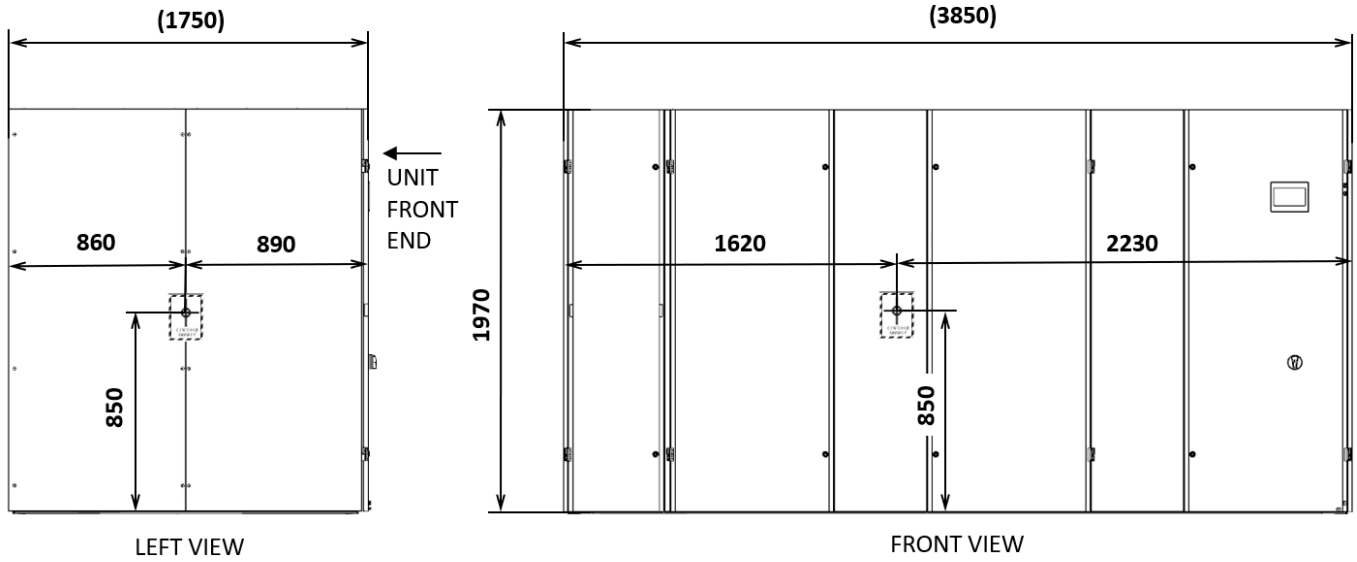
Base frame with * antivibration dampers:	H = up to 800 mm

* For specific options refer to the option price list

NOTE:

- *The plenum with filters, coil section and fan module are delivered separately and need to be connected at the installation site.*
- *Optional intake plenum with dampers is also delivered separately and needs to be attached on site.*
- *Optional base frame is delivered separately, disassembled, and need to be attached to the fan module, on site, before assembling the unit.*

2.8.4. Center of gravity2.9 Electric and Control System



2.9. Electric and control system

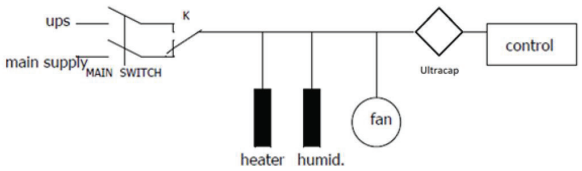
The unit is delivered with dual power supply in order to have the units up and running if the main power supply fails.

2.9.1 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.

DOUBLE POWER SUPPLY UPS/MAIN SUPPLY WITH INTERNAL CHANGE OVER



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 approx. 60 seconds.

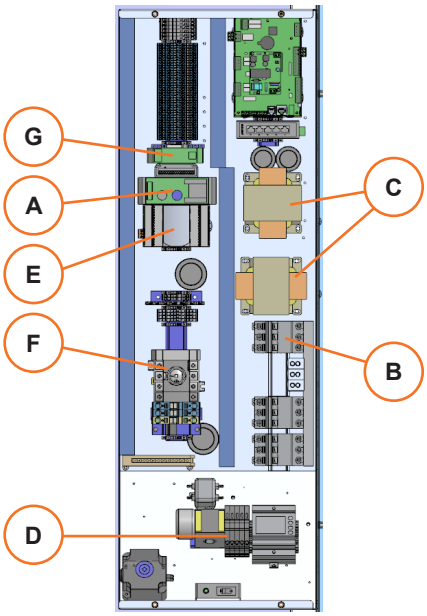
NOTE: Depending on the electric system configuration, the unit may be set to remain switched off for a certain time.

What happens when power is restored:

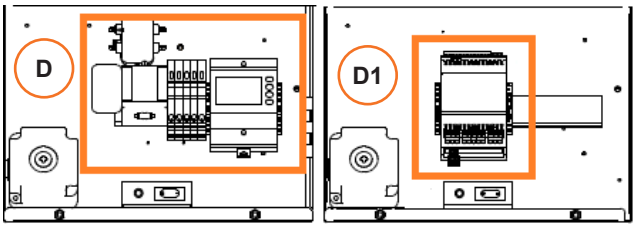
The ATS remains on the second power supply until the main power supply is restored.

2.9.2. Main components

Power side (high voltage)

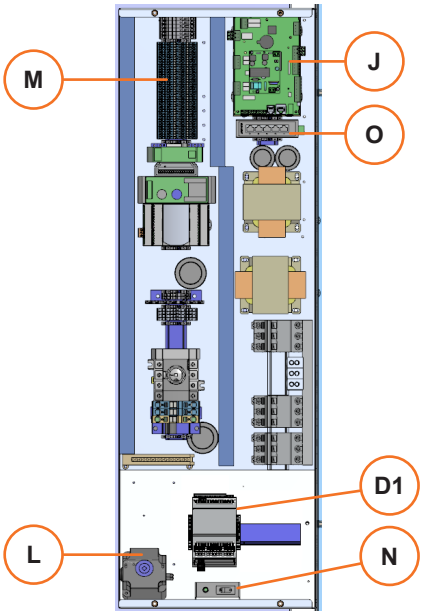


A	Power supply for touch screen
B	Thermal magnetic circuit breakers
C	Transformers
D	Alternative position: - Energy meter (high voltage) [**D**] - Expansion module (low voltage) [**D1**]

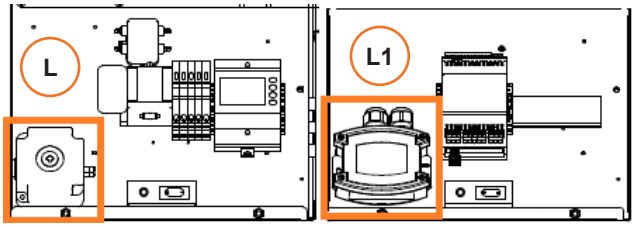


E	Ultracap
F	Disconnecting switch
G	Relay

Control side (low voltage)



J	Control board
L	Alternative position: - (ON/OFF) Clogged air filter sensor [**L**] - Modbus Clogged air filter sensor [**L1**]

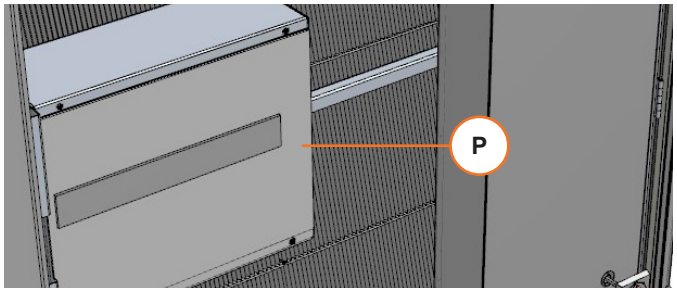


M	Terminal board
N	ON/OFF switch with LED indicator

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

O	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.



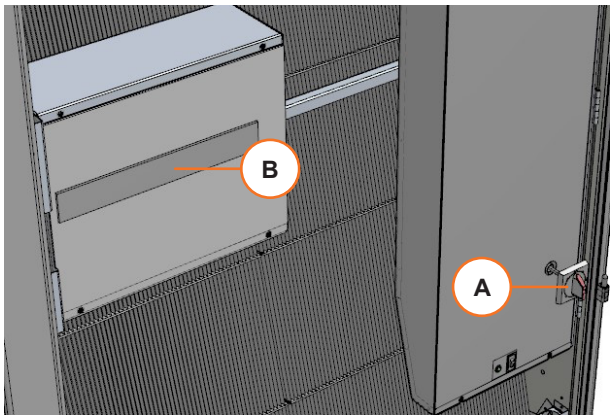
P	**ATS** (Automatic Transfer Switch) electric panel

2.9.3. 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**.

2.9.4. 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.

2.9.5. 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.

2.9.6. Ethernet connection

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

2.9.7. 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.

2.9.8. Fan control

All the units have EC fans.
The unit control system adjusts the fans rotation speed depending on the operating conditions.

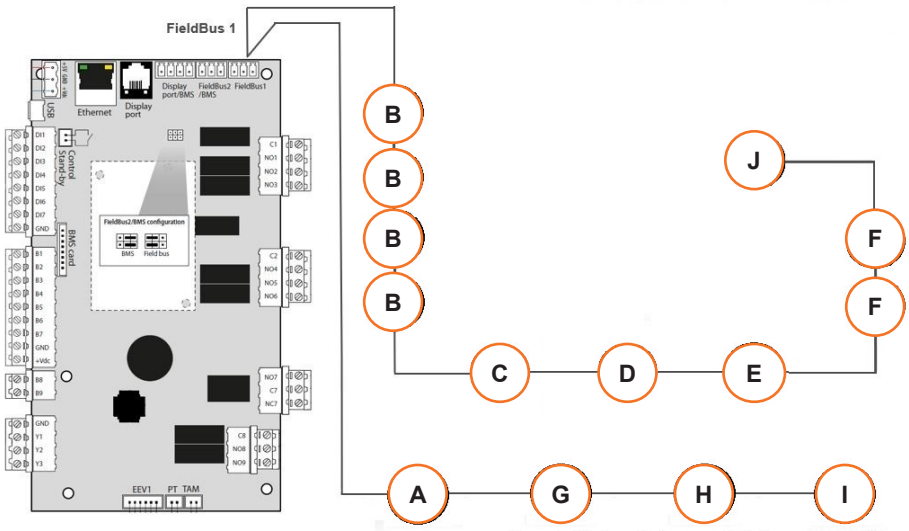
Protective functions	• Electronics overheating protection • Motor overheating protection • Locked rotor protection • Short circuit at the motor output
Fans	• Connection to the unit through Modbus protocol. If the Modbus connection is interrupted, then the fans continue to run at a preset speed. • Speed 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.*

2.10. MODBUS connections

2.10.1. 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)	**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*

2.10.2. 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*.

2.10.3. 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	condition	ESP (*) [Pa]	Return air temperature [°C]	RH [%]	Inlet water temperature [°C]	Outlet water temperature [°C]
PW400	Smart	20	35	25	18	26
	Legacy	20	26	43	10	15

(*) External static pressure

Water valve

CW valve	Max differential Pressure [kPa]	Close-OFF Pressure [kPa]
2-way valve	350	1400
PICV	350	1400

CW valve	Glycol mixture	PN	Fluid temperature limit
2-way valve	up to 50%	16	-10°C … 120°C
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		Number of fans	Individual fan weight
PW400	High power	8	30,1 kg
	High efficiency	8	25,8 kg
	Z.A. Fans	8	27,9 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.

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

Fan module	Voltage [V]	FLA [A]	LRA [A]	Recommended Circuit breaker (1)	Recommended wire size [mm²] (2)	Min./max. Cu cable size [mm²]
High power	380/400	46,3	47	63	5G25mm²	2,5…35mm²
	460	46,2	47	63	4G25mm²	2,5…35mm²
High efficiency	380/400	33,5	34	50	5G16mm²	2,5…35mm²
	460	33,4	34	50	4G16mm²	2,5…35mm²
Z.A. Fans	380/400	45,5	46	63	5G25mm²	2,5…35mm²
	460	38,2	39	50	4G16mm²	2,5…35mm²

3.3.3. Fan electrical data

Fan module	EC Fan advance – High power		
	Motor size [kW]	FLA @400V / 50Hz [A]	FLA @460V / 60Hz [A]
High power	8 x 3,70	8 x 5,70	8 x 5,70
High efficiency	8 x 2,65	8 x 4,10	8 x 4,10
Z.A. Fans	8 x 3,50	8 x 5,60	8 x 4,70

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

Risk of top-heavy unit falling over!
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.
Refer to the local safety regulations about lifting and handling heavy loads.

CAUTION

Risk of sharp edges, splinters, and exposed fasteners!
Can cause personal injury!
Only properly trained personnel wearing appropriate safety headgear, gloves, shoes, and glasses should attempt to move, lift, remove packaging from the unit or prepare the unit for installation.

CAUTION

Risk of overhead interference!
Can cause unit and/or structure damage! The unit may be too tall to fit through a doorway while on the skid.
Measure the unit and doorway heights and refer to the installation plans prior to moving the unit to verify clearances.

NOTICE

Improper operations can cause product damage.

NOTICE

Improper storage can cause product damage.
Keep the unit vertically upright, indoors and protected from dampness, freezing temperatures and contact damage. For more details about ambient conditions, see chapter *3.6.1 Storage conditions*.

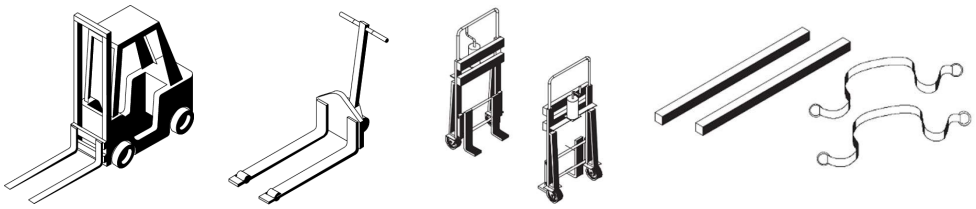
Read carefully the chapter *1. Safety*.
Pay attention to the safety labels on the unit and to the safety warnings in this chapter.

4.2 Inspection

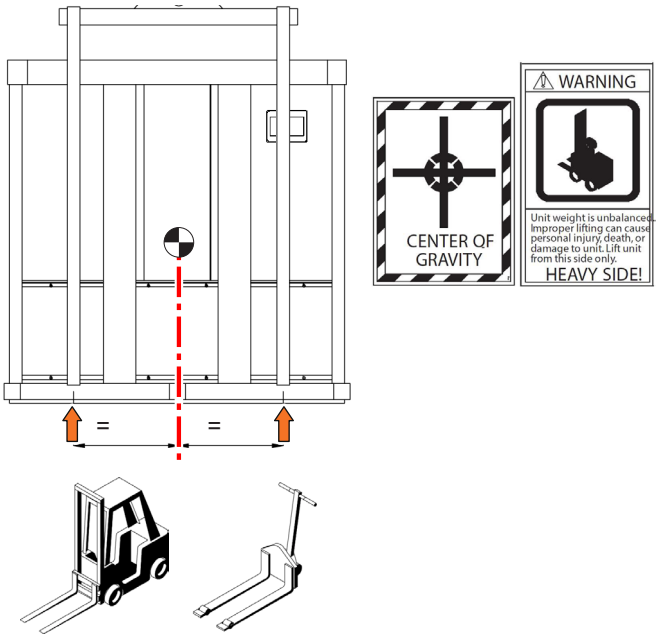
- After receiving the product, check the accessories against the packing list.
- If any parts are found missing or damaged, please report to the carrier immediately.
- If you find any damage, please report to the carrier and to the local distributor too.

4.3 Transport with Package

4.3.1 Recommended unit handling equipment



4.3.1 Using a fork lift or a pallet jack

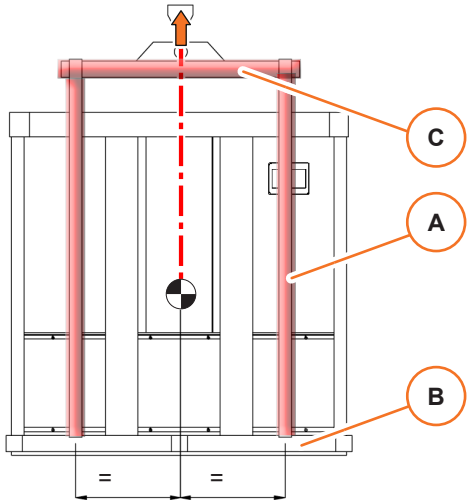


- Always refer to the location of Center of gravity indicators when lifting the unit from any side.
- Make sure that the fork length and distance is suitable for the unit length and to ensure the unit stability.
- Spread the forks to the widest allowable distance to still fit under the skid.
- Lift the 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



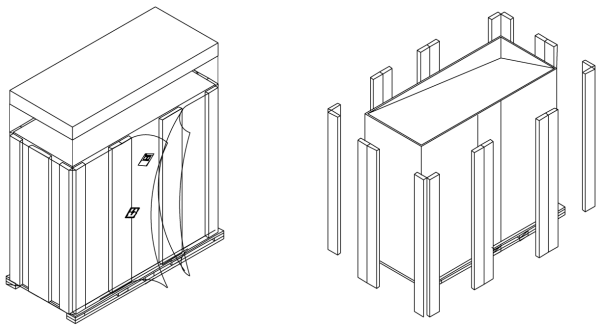
- Place the slings [**A**] between the unit bottom rails and the skid [**B**], at the widest allowable distance.
- Be sure that the distance between slings guaranties the unit stability.
- Fix the slings to the spreader bar [**C**]

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.

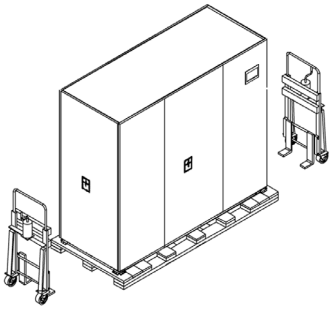
ENVIRONMENT

All material used to package this unit is recyclable.

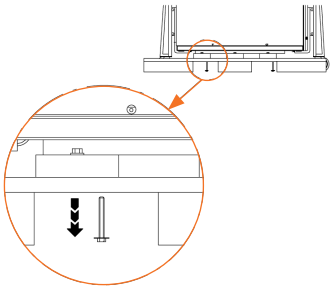
Please save for future use, or dispose the package materials according to the local regulation about waste disposal.

4.5 Transport without Package

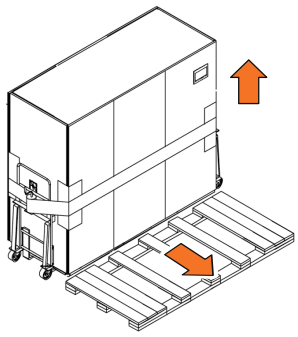
4.5.1 Using piano jacks



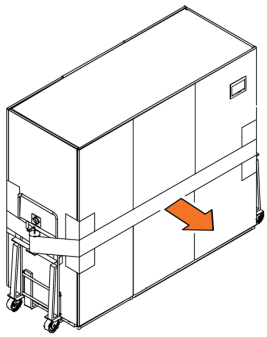
- Make sure that the floor can support the unit when you move it by piano jacks. If necessary, cover the floor by metal plates or other support that can distribute the weight on the floor.
- Place the piano jacks at the two sides of the unit.



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



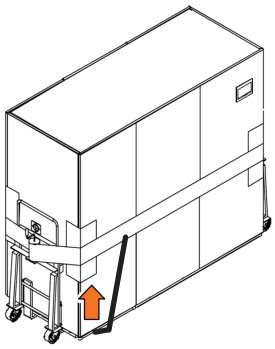
- Slide the forks of the piano jacks between the unit and the pallet.
- Place a protective material between the unit and the piano jacks.
- Fix the piano jacks to the unit by straps, placing a protective material between the unit and the straps.
- Lift slightly the forks of the piano jacks and remove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



- Move the unit to its installation site.

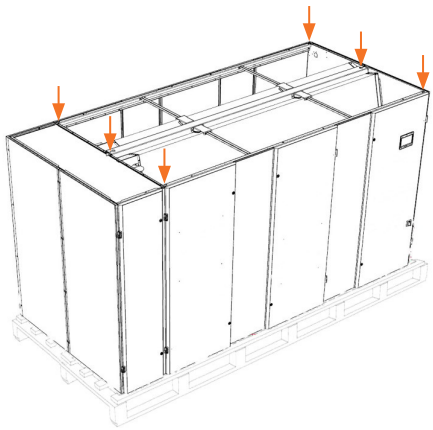
CAUTION

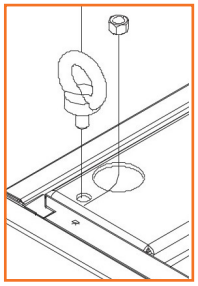
At least two persons are needed.



- 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



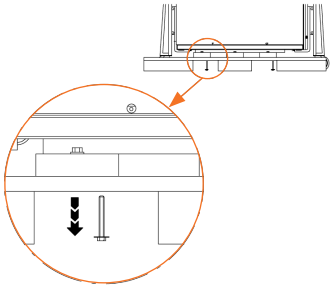


- Get six eyebolts M12 that are suitable to hold the full weight of the unit (they are not supplied with the unit).
- Insert the eyebolts in each of the holes.

- Insert a sling or a chain in each of the eyebolts.
- Fix the slings or chains to a 6-points lifting bar.

WARNING

Lift the coil module ONLY without the fan module attached.



- 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

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

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.

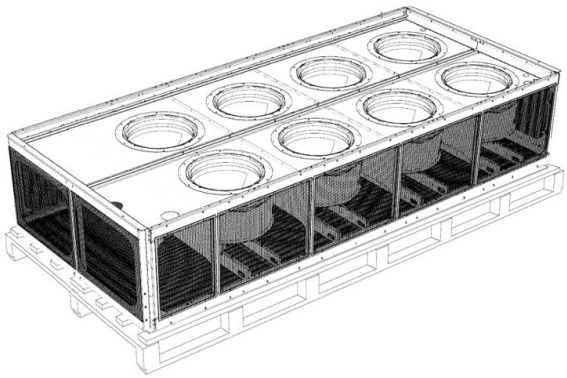
5.2 Assembly of the unit

The unit is supplied in four separate modules:

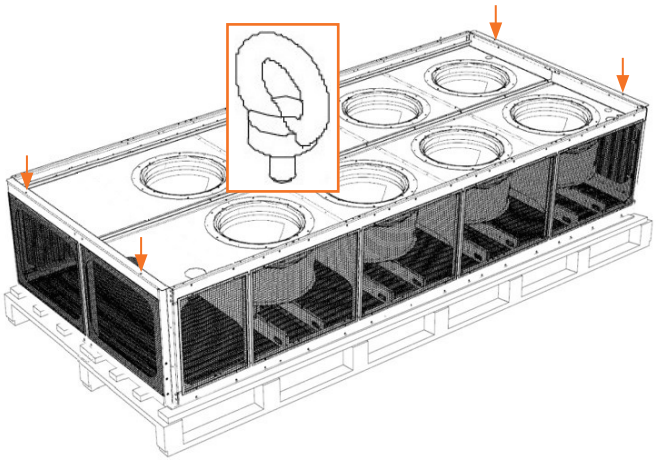
- Coil section
- Fan module
- Base frame (optional)
- Intake plenum (optional)

- 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.

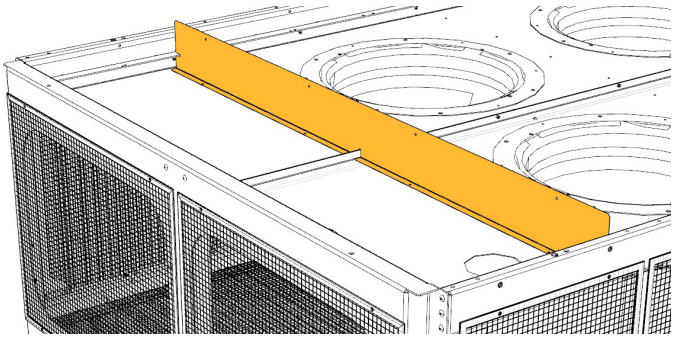
5.2.1. Fan module preparation



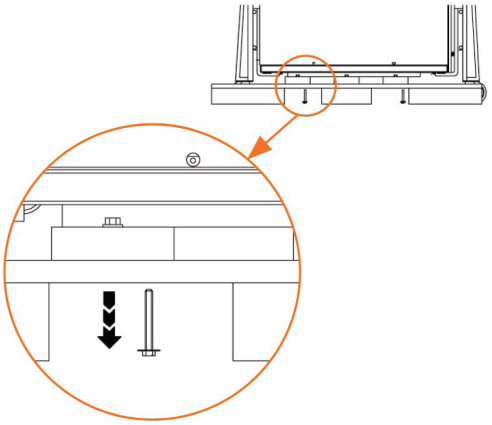
- Bring the fan section to the final location.



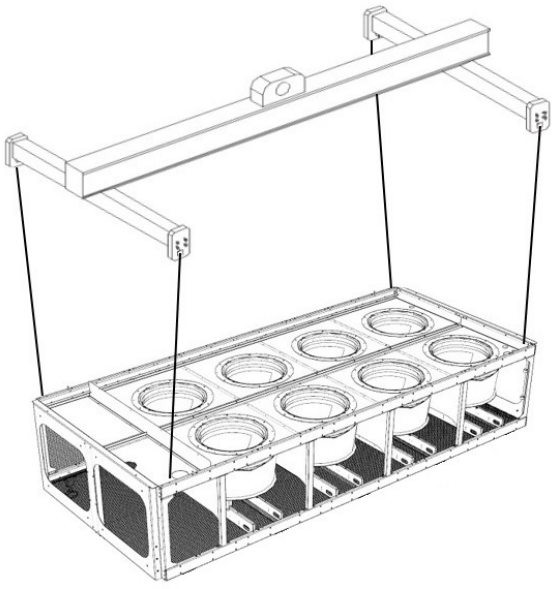
- Get four eyebolts M12 that are suitable to hold the full weight of the unit (they are not supplied with the unit).
- Attach the eyebolts M12 into the corresponding holes.



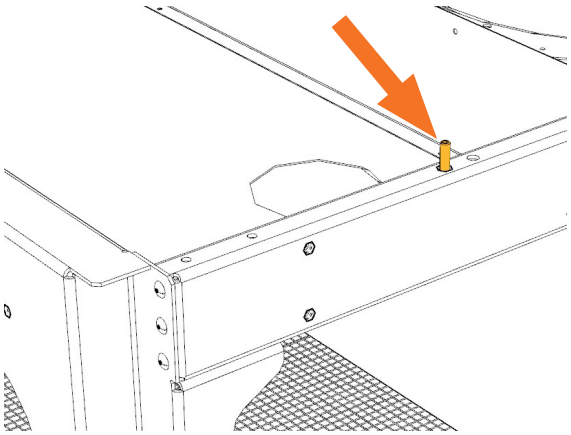
- Attach the divider panel to the frame.



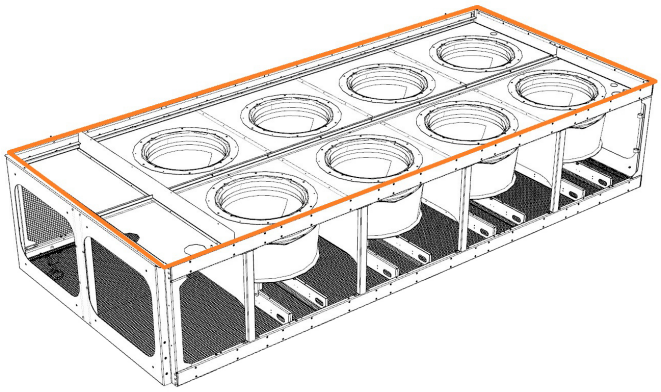
- Remove the bolts holding the fan module on the pallet



- Lift the fan section using a 4-point lifting bar and remove the pallet.

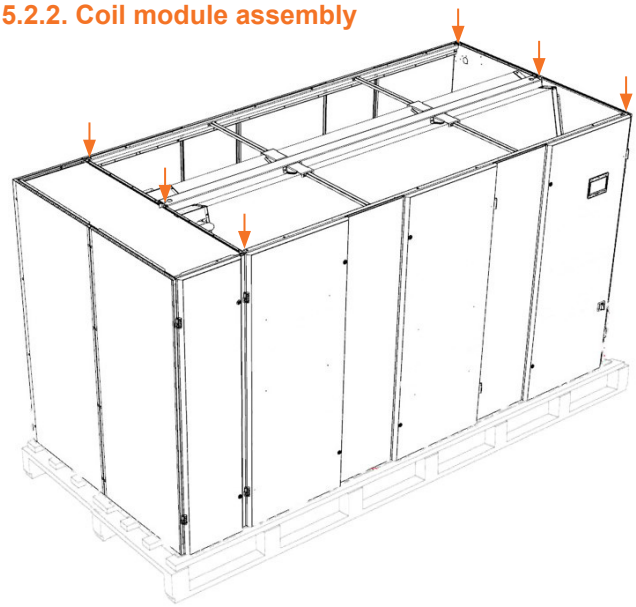


- Place the fan module on the final position.
- Remove the eyebolts from the frame.
- Remove the front and back panels or grilles from the fan module.
- Insert four dowels (M8) into the upper frame.

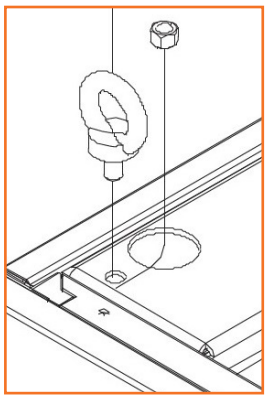


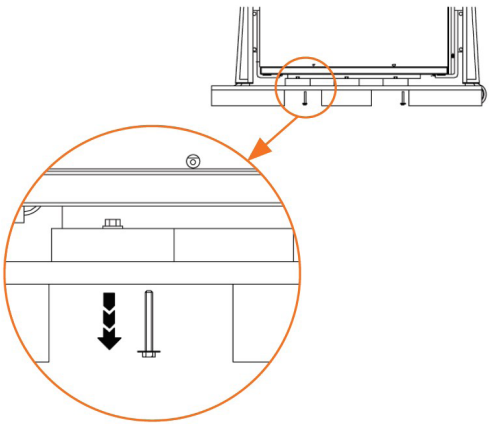
- Add gasket over the perimeter of the fan module

5.2.2. Coil module assembly

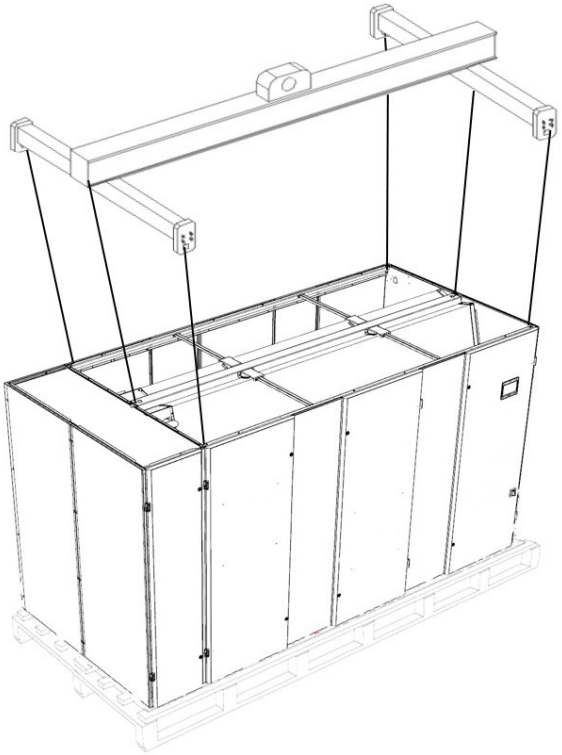


- Attach 6 shackles and six M12 eye bolts (not supplied) to the coil module.
- Use appropriate shackles to lift the total assembled unit load.





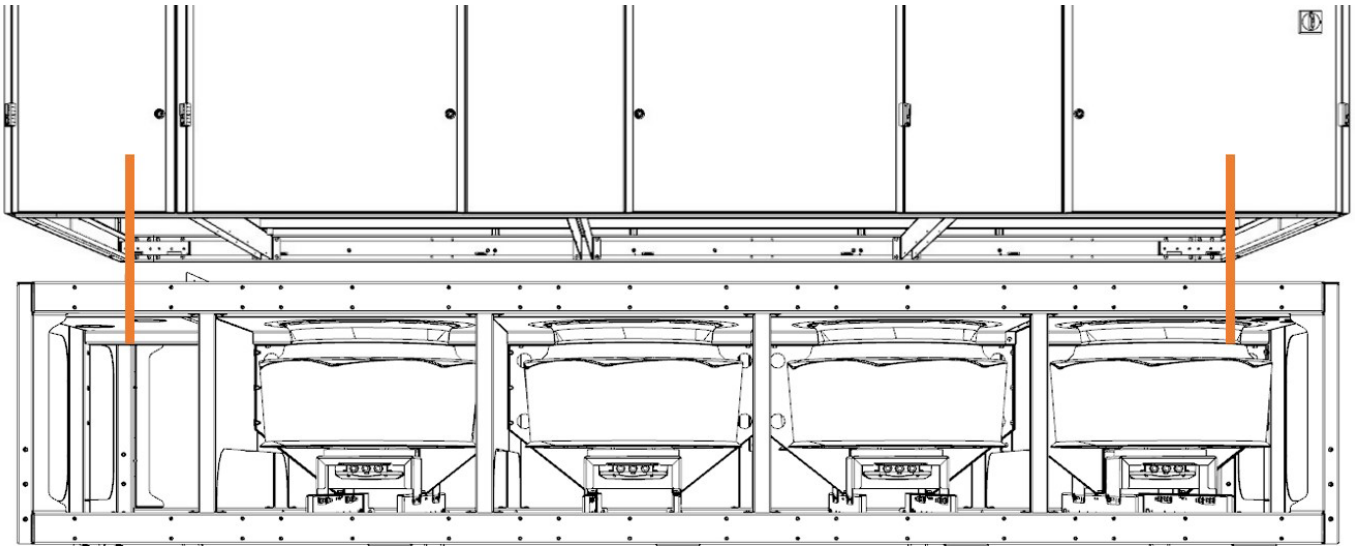
- (if not already done) Remove the 4 bolts holding the coil module on the pallet.

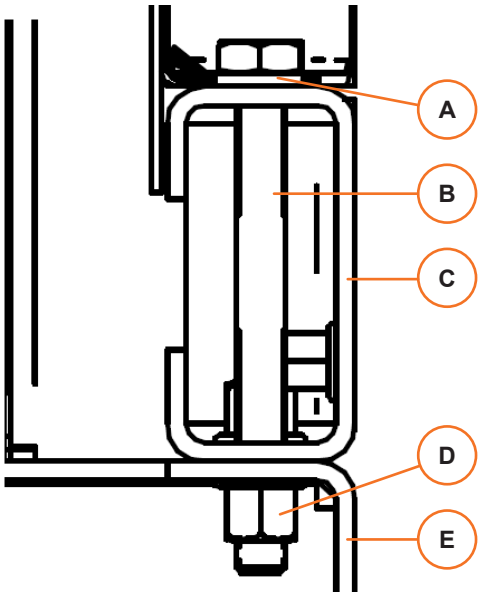


- Use a 6-point lifting bar to lift the coil module.
- Remove the pallet from underneath the module.
- Lift the coil module, move it over the fan section.

WARNING

Lift the coil module ONLY without the fan module attached.



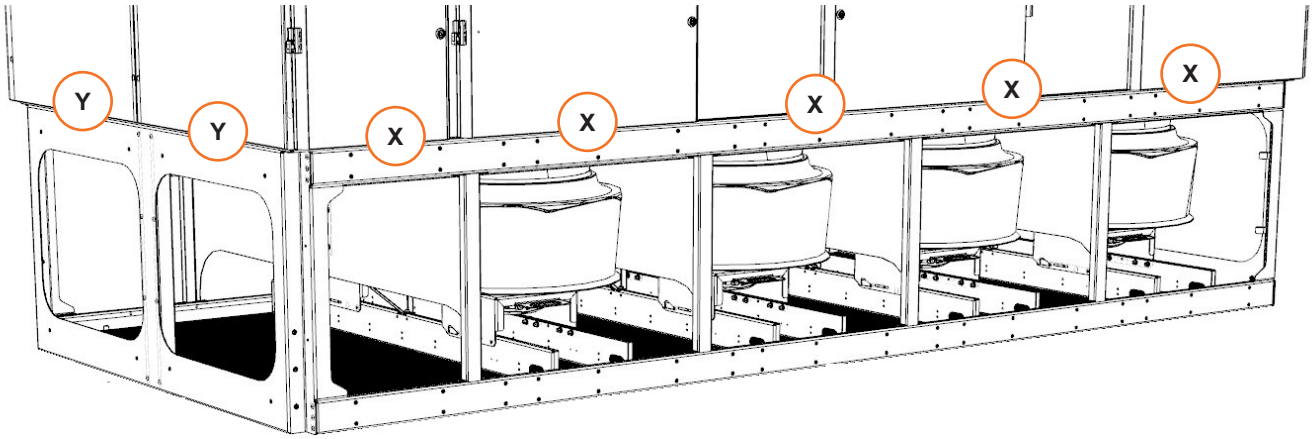


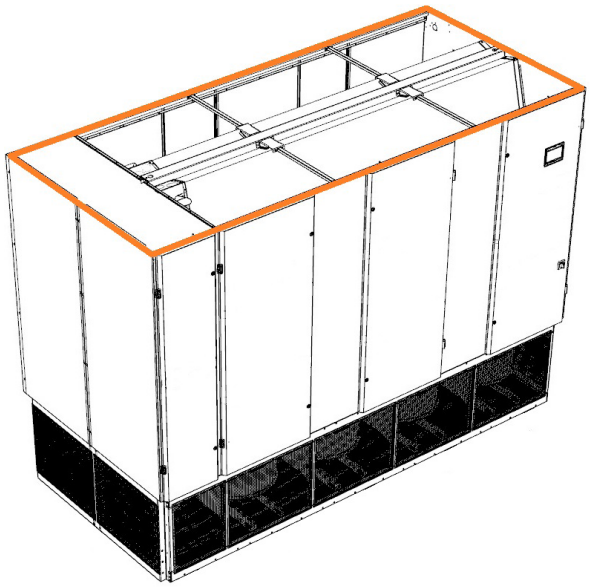
- Align the position of the coil module using the 4 dowels in the fan section.
- Carefully descend the coil module onto the fan section.
- Fix the two modules together using the supplied hex head screws:
- Secure the fan module [**C**] to the coil section [**E**] using the four hex head screws supplied with the unit:
  - screw M8x110 [**A**] (4 front + 4 back)
  - spring lock washer [**B**]
  - threaded insert [**D**] in the coil section frame structure

There are two types of screws:

[**X**] → 4 (front) + 4 (back) M8x110 hex head screws with washers

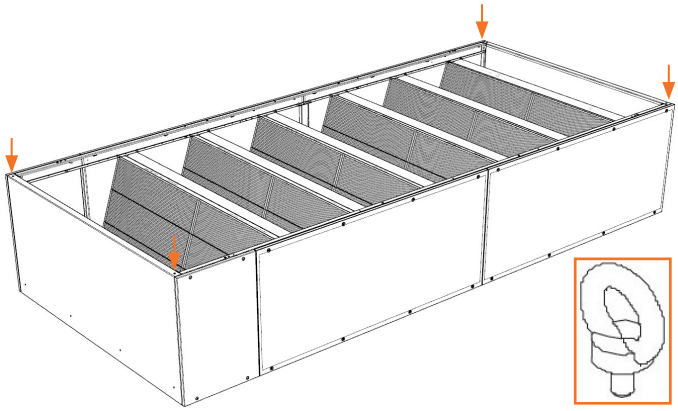
[**Y**] → 2 (left) + 2 (right) M8x20 screws



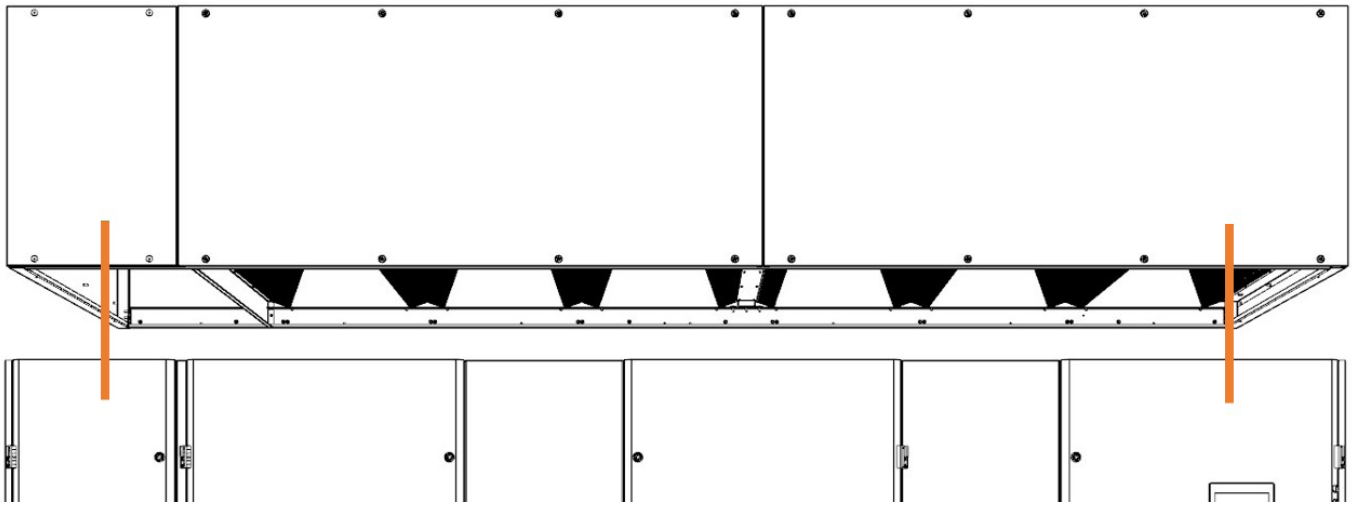


- Add gasket over the top perimeter of the coil module

5.2.3. Filter module assembly

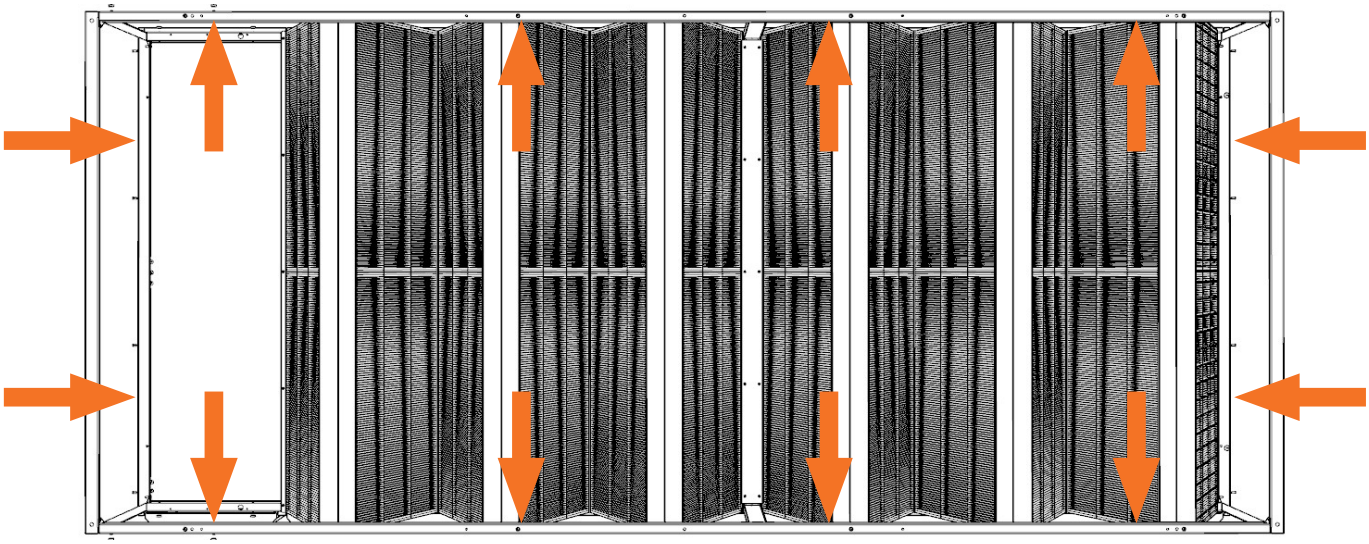


- Attach the front and back panels to the filter module
- Attach four M12 eye bolts and 4 shackles (not supplied) to the filter module.
- Use appropriate shackles to lift the module.



- Align the position of the filter module with the coil module and place in on top of the unit.

- If clogged filter sensor is installed, connect the hose.



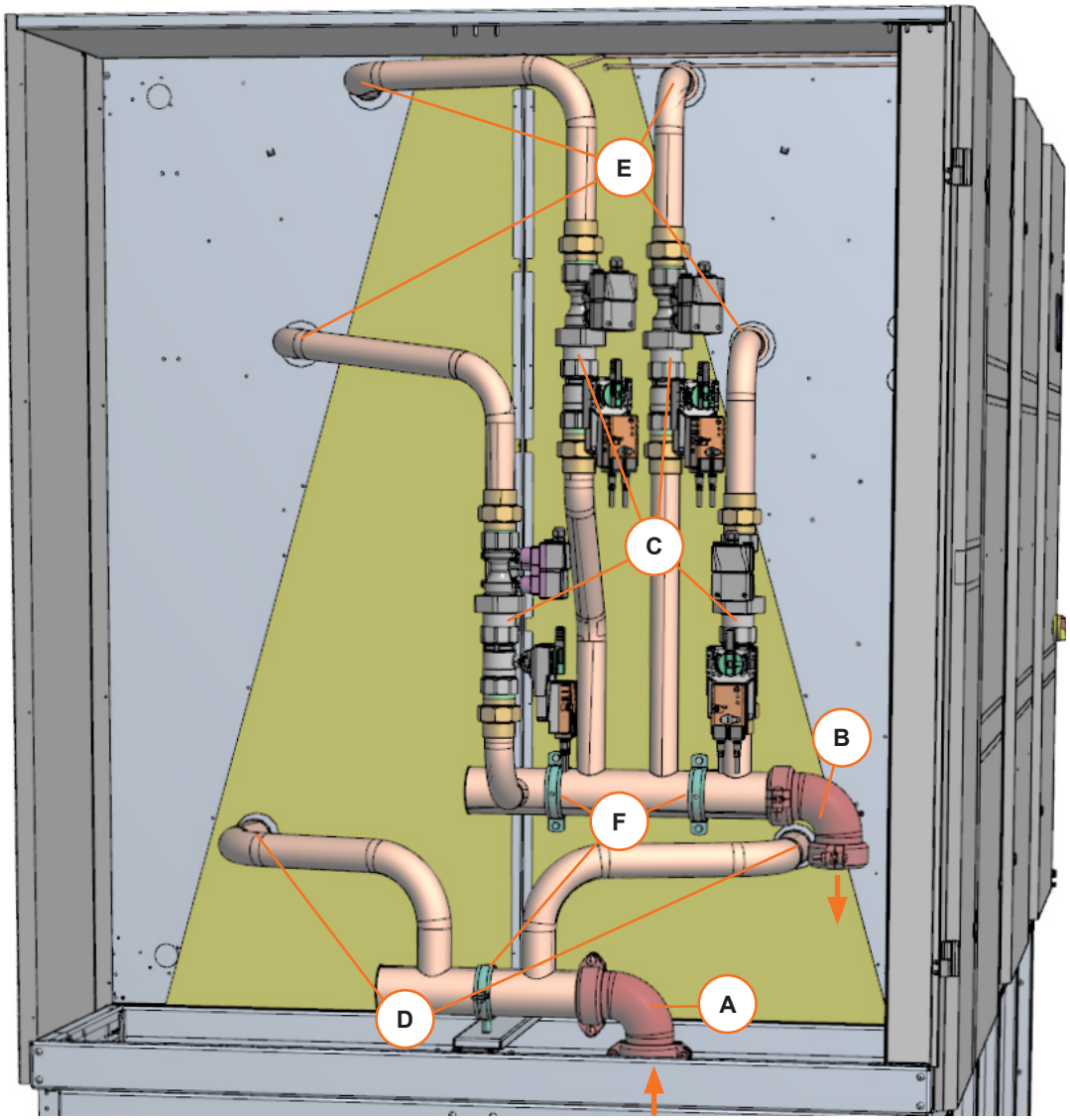
- Remove front and rear panels from the Filter module.
- Fix the Filter module to the Coil module with 12 x Ø 4,8mm tapping screws (highlighted in the picture)
- Re-attach all the panels.

5.3. Chilled water piping arrangement

The unit can be, depending on the configuration, prepared for connecting the water supply either from the bottom, top or lateral side.

- The water inlet and outlet are equipped with grooved connections. For more details about the assembly process, see chapter *6.4.3. Joining pipes with grooved connection*
- Two smooth pipe stubs are provided with the unit. These can be used to create other type of connection.
- As an option, two threaded pipe stubs can be provided on request.
- In case of threaded connections, use hemp and paste to get reliable pressure-tight joint.

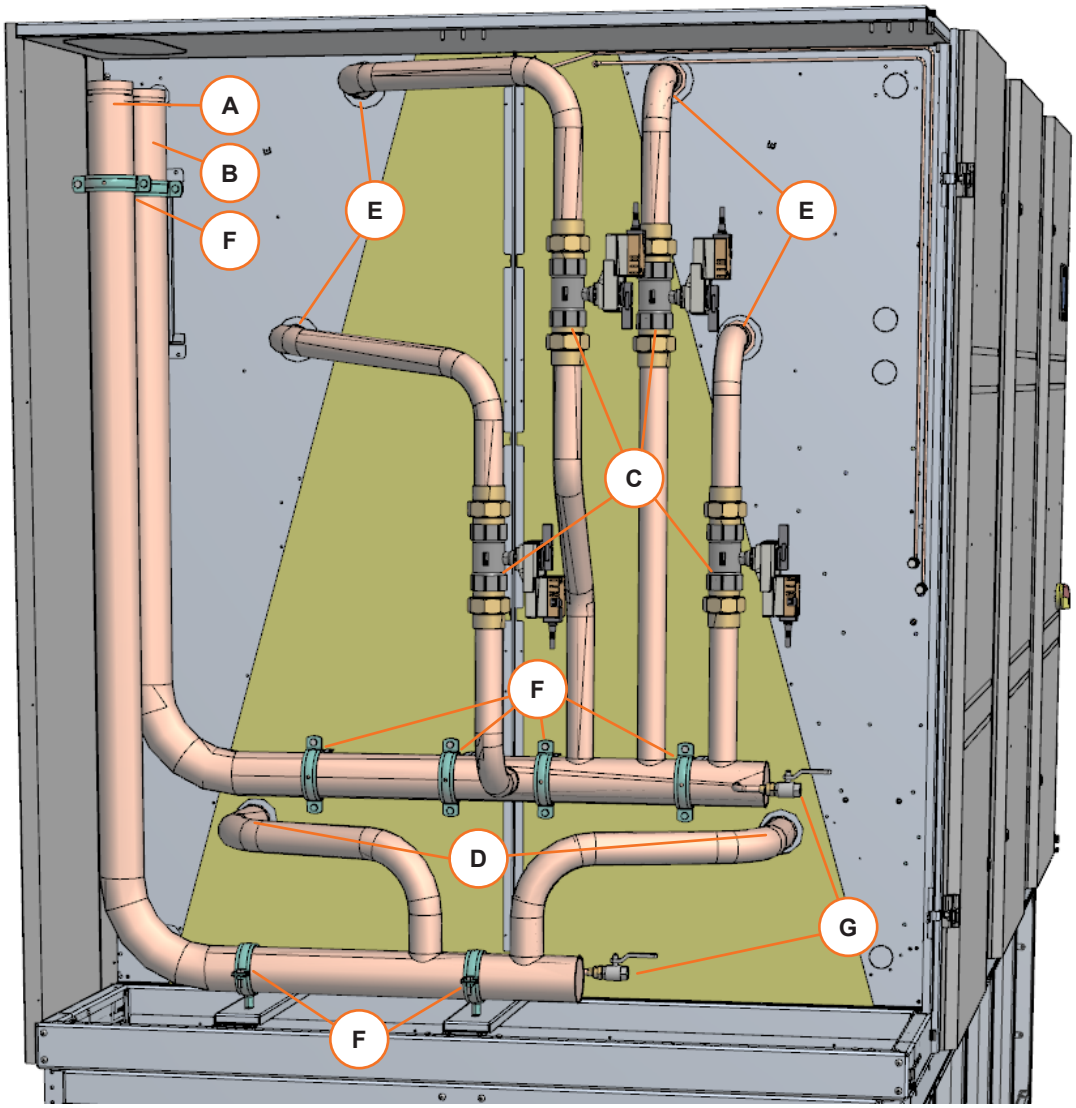
5.3.1. Water piping with bottom connection



Ref.	Description
A	Inlet grooved connection
B	Outlet grooved connection
C	PICV or 2-way valves*
D	Coil CW inlet
E	Coil CW outlet
F	Support bracket

* PICV option shown in the picture

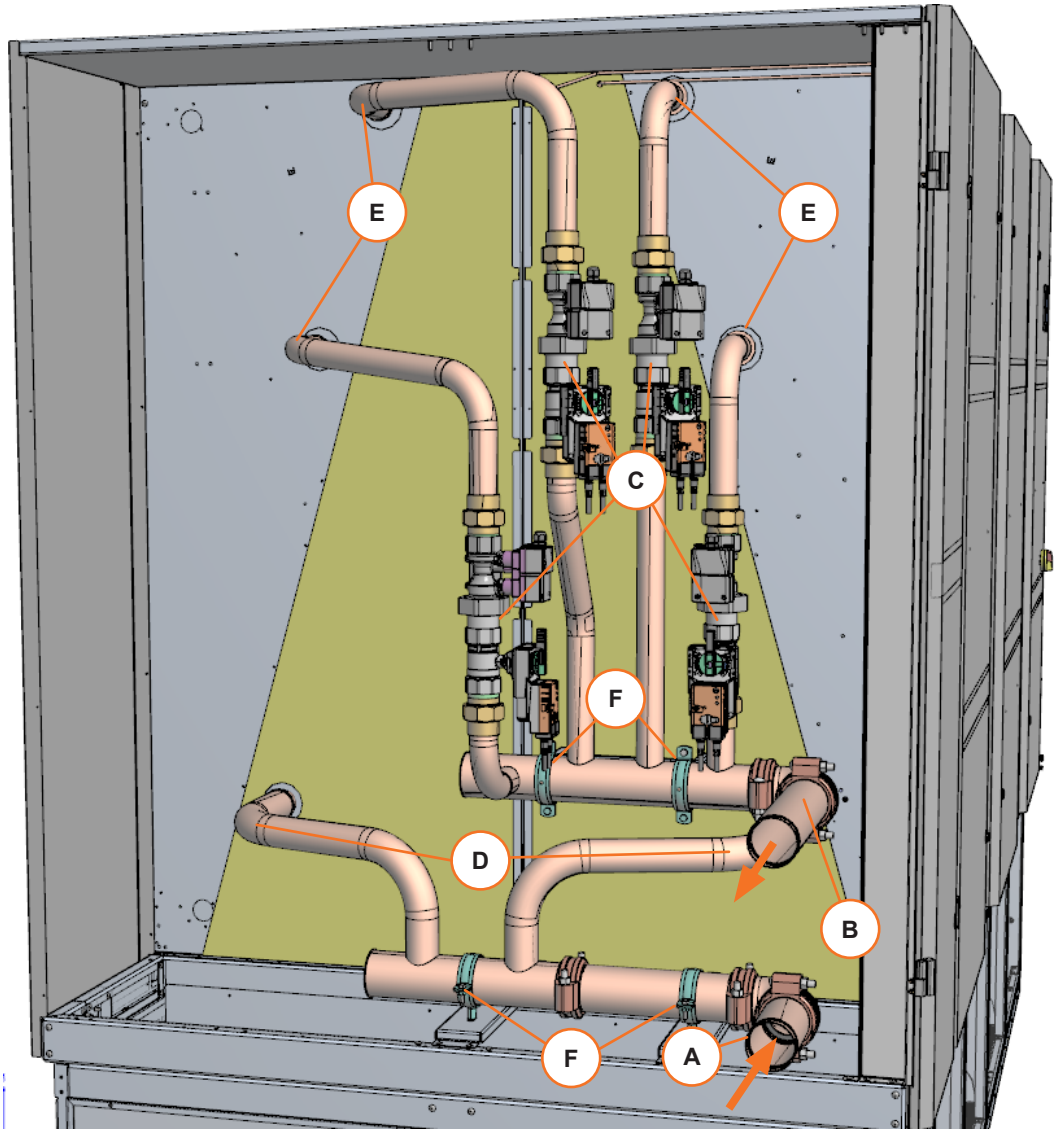
5.3.2. Water piping with top connection



Ref.	Description
A	Inlet grooved connection
B	Outlet grooved connection
C	PICV or 2-way valves*
D	Coil CW inlet
E	Coil CW outlet
F	Support bracket
G	Water drain valves

* 2-way valve option shown in the picture

5.3.3. Water piping with lateral connection



Ref.	Description
A	Inlet grooved connection
B	Outlet grooved connection
C	PICV or 2-way valves*
D	Coil CW inlet
E	Coil CW outlet
F	Support bracket

* PICV option shown in the picture

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. Coil section preparation

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)	*6.3.5. Chilled water piping requirements* *6.3.6. Condensate piping requirements*
Make sure that the water supply is suitable	*6.3.9. Water supply requirements*
Prepare the electric system	*6.3.10. Electric system requirements*

6.2.2. Operations on the unit

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

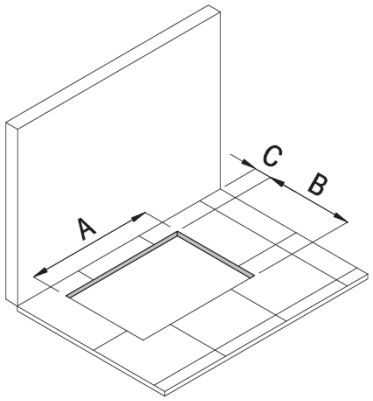
	Operation	See...
1	**Optional base legs assembly**	
2	**Assemble the coil section and the fan module**	*5.2. Assembly of the unit*
3	**Position the unit at the final location and fix it on the floor or the supporting structure**	*5.2.5. Positioning of the unit at the final location (for option with base frame) Liebert® PWM – Base frame – Mounting instructions*
4	**Attach the intake plenum to the fan module (optional)**	
5	**Connect the unit to the chilled water system**	*6.4.4. Chilled water connection to the external source*
6	**Connect the unit to the drain system**	*6.3.7. 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. Dimensions of the opening in the floor for Downflow Down version



Downflow Down PW400	
A	3832 mm
B	1710 mm
C	20 mm

CAUTION

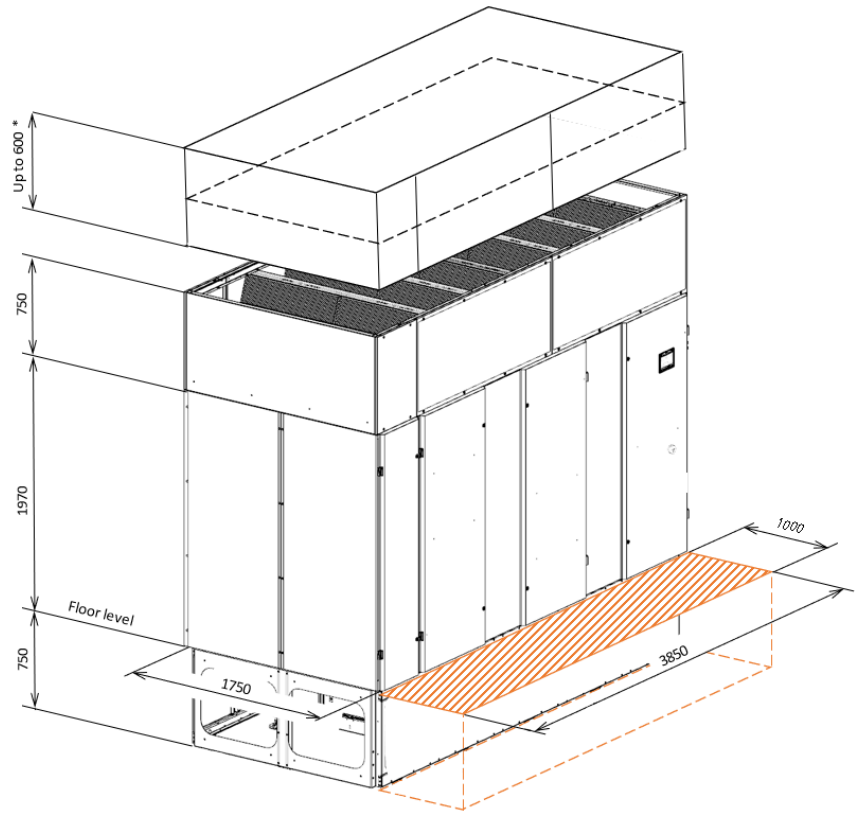
To assemble and/or install accessories, a larger distance might be required. In that case, the unit can be moved in the working position after installation / assembly procedures.

6.3.3. Space requirements

- See chapters *2.7.1.* for dimensions and *2.7.2.* for weights of the unit
- Keep a free space between the unit and any obstacle as shown in the figure.

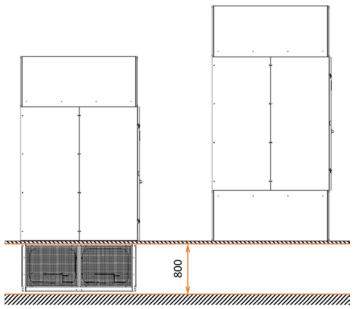
WARNING

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



* optional accessory – for more details, see chapter *2.8.3. Optional accessory height*

6.3.4. Required height of the raised floor



- Minimum height to the raised floor for Down flow-Down and Down flow-Up units, to obtain the declared performance

  H = 800 mm

6.3.5. Required free space from the ceiling

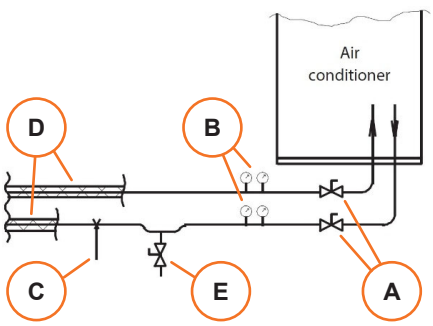
- Free space between the ceiling and the top of the unit, including any accessory mounted on top or bottom
- Minimum height to obtain the declared performance

  H = 600 mm
- Minimum allowed height to obtain the minimum working conditions

  H = 300 mm

6.3.6. 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).

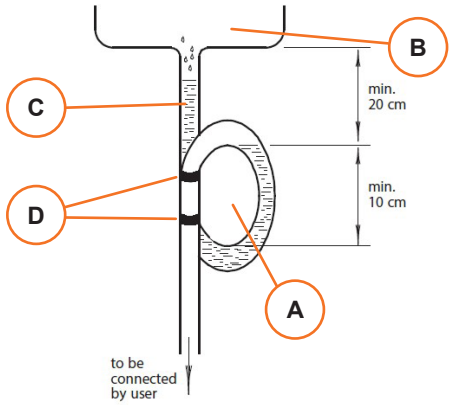
Material	Use copper or steel (Mannesmann) tubing.
Threaded connections	In case of threaded connections use hemp and paste to get a reliable pressure - tight joint. **NOTICE** Usage of Teflon is allowed but Vertiv™ is not responsible for any damages during the joint couplings, such as cracking brass nipple.
Grooved connections	See chapter *6.4.2. Joining pipes with grooved connection* for details regarding the assembly.
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 thermal insulating material [**D**]. • Install a water drain valve [**E**] at the lowest point of the circuit. **NOTICE** Usage of Teflon is allowed but Vertiv™ is not responsible for any damages

6.3.6. Condensate piping requirements

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

• Use galvanized steel, PVC or flexible polythene tubing.

• The drain pipe must have at least a 2% gradient from the unit outlet to the connection to the site drainage system.

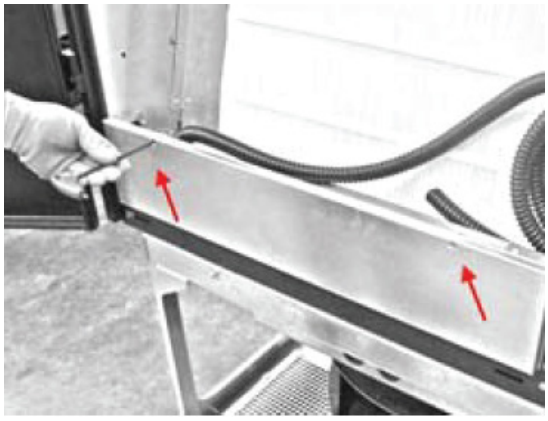


- It is necessary to make a drain trap [**A**] place at least 20 cm below the drain tray [**B**].
- Fill the drain trap with water before the start-up to avoid spraying the condensate [**C**].
- In the Upflow configuration units the drain trap must be placed under the unit, in the false floor.

CAUTION

If the drain trap is done inside the fan module in the Downflow configurations attach the tube and the drain trap properly to the fan module frame using a cable tie [**D**], avoiding the risk of contact with fans.

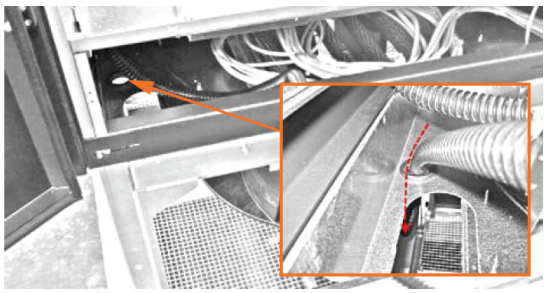
6.3.7. Condensate drain



Place the condensate pipe inside the fan module before making the drain trap.

- Remove the internal bottom cover by unscrewing the two screws that hold it.

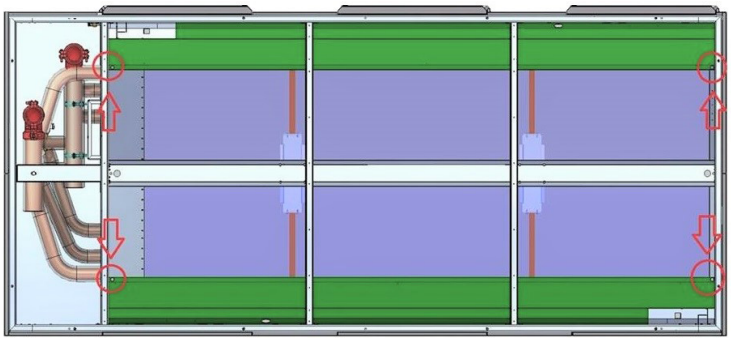
- Remove the drain pipe from the hole on the drain panel by pulling it down



- Pass the drain pipe through the cable bushing on the top of the fan module along the entire tube length.
- Reposition the internal bottom panel and fix it with the two screws.

6.3.8. Condensate drain routing

The condensate drain tubes are routed inside of the fan section. These tubes are connected to the outlets from the condensate drain pan below the coils.



The exact routing and outlet from the unit can be adjusted according to the requirements.

CAUTION

Drain tubes inside of the fan module need to be properly fixed to the frame using cable ties to avoid any risk of contact with fans.

6.3.9. 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

The oxygen dissolved in water increases the rate of corrosion.

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

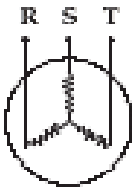
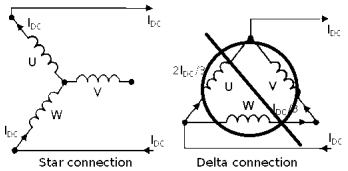
A combined effect of fouling due to dust and organic material provides a support for bacteria, fungi and algae; the growth of organisms may produce an oxygen gradient, and this results in rather severe pitting of the metallic surface.

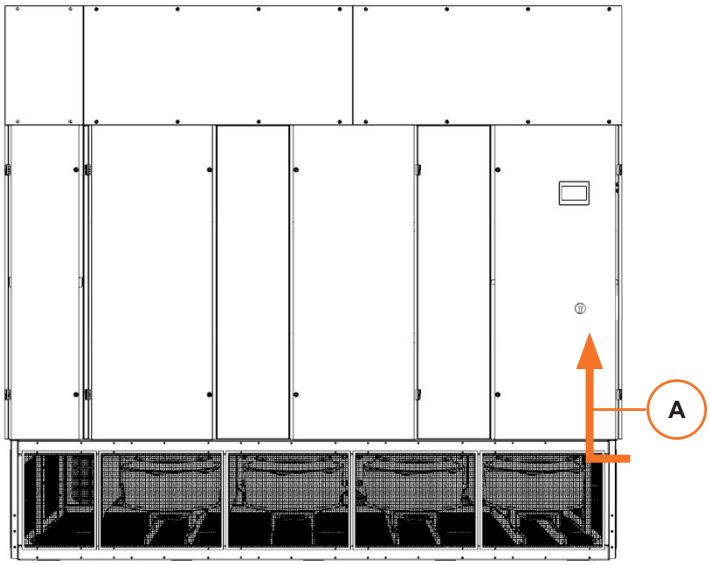
The phenomenon of corrosion is obviously related to the material used on the liquid side of the heat exchanger.

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

pH	---	7,5 - 9,0
SO_4	ppm	< 100
HCO_3 / SO_4	---	>10
Total hardness	dH	4,5 - 8,5
Cl-	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

6.3.10. 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 = 394 V ST = 401 V RT = 402 V  2) The average voltage is: $\frac{394 + 401 + 402}{3} = 399$ V 3) The maximum deviation from the average is: 399-394=5V 401-399=2V 402-399=3V 4) The phase to phase variability is: $\frac{\text{maximum voltage deviation}}{\text{average voltage}} \times 100\% = \frac{5}{399} \times 100\% = 1{,}253\%$ (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

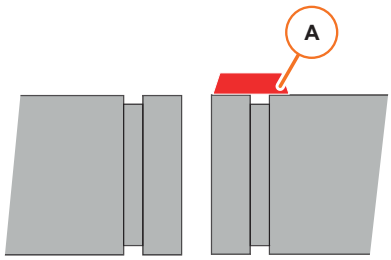
Connections	The inlet and outlet directions are clearly marked with labels and arrows on the respective piping. Pay attention to follow the directions.
Keep clean	• Keep the piping clean and dry. • Make sure that the surfaces to be brazed are clean and that the ends of the tubes have been carefully reamed 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. Joining pipes with the grooved connection

Check the pipe ends:

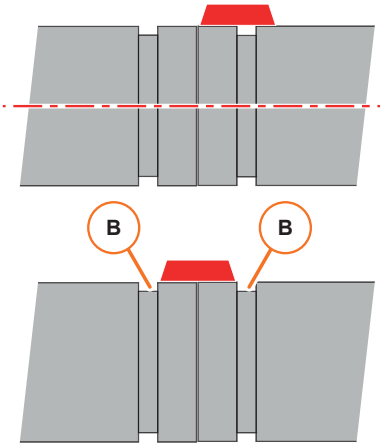
- Make sure that the outside surface between the groove and the end is smooth and clean.
- Remove any residual of oil, grease, dirt and particles.
- Lubricate the gasket:

  Apply a thin coat of 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.

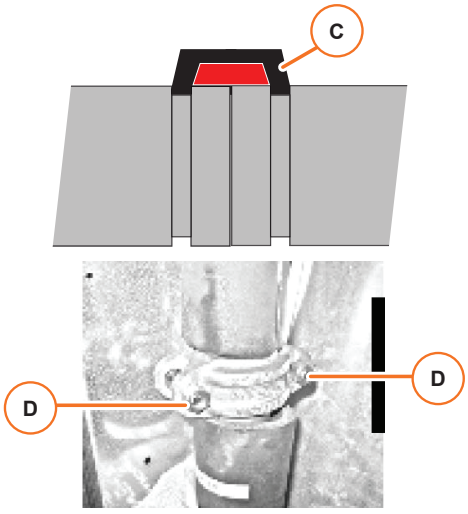


Join the ends

- 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.*

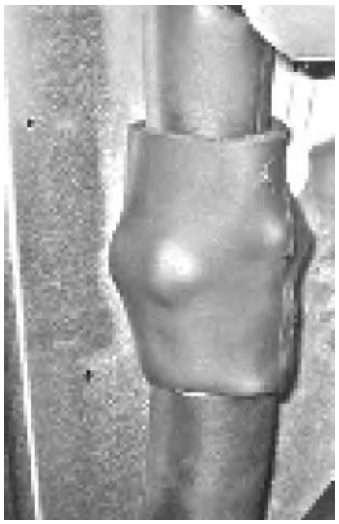
NOTICE

Leakage may occur if the gasket is pinched or damaged.

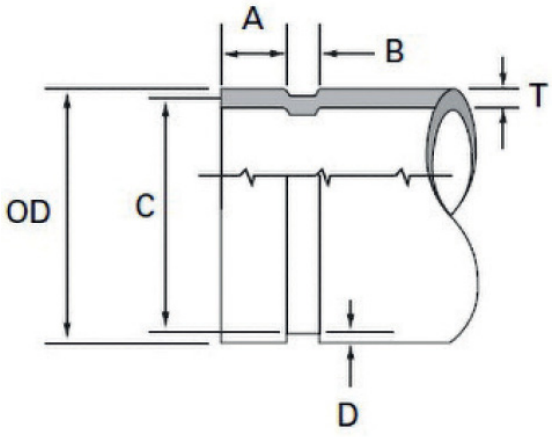
- Make sure the offsets are equal at the bolt pads.

This is necessary to ensure a rigid joint.

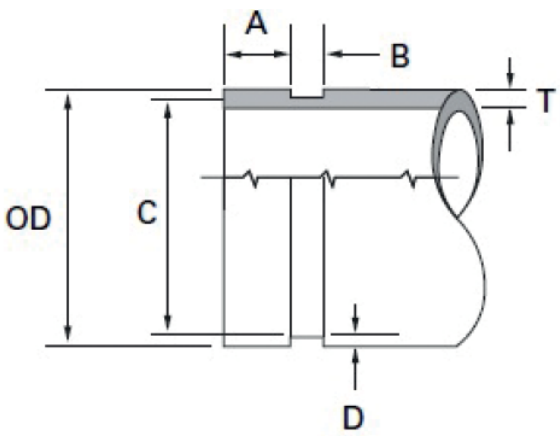
- Visually inspect the bolt pads at each joint to ensure metal to-metal contact is achieved.



- Cover the grooved connection with thermal insulating material.



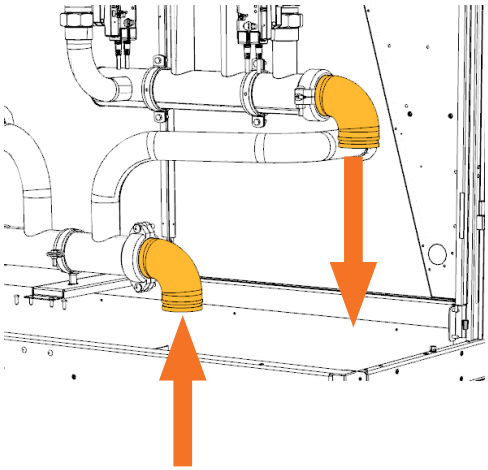
(1) Roll groove

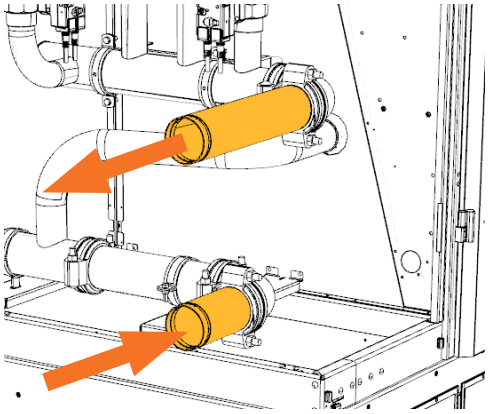


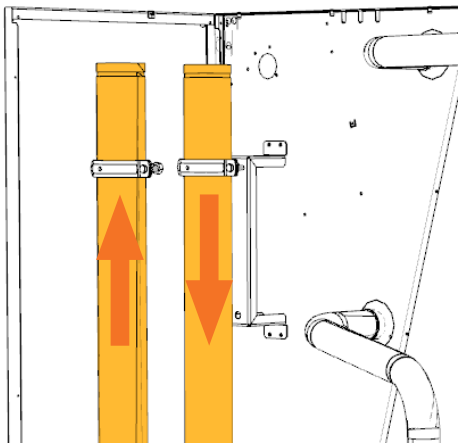
(2) Cut groove

	Nominal Pipe size [mm]	Pipe outside Ø [mm]			Gasket seat "A" [mm]	Groove width "B" [mm]	Groove diameter "C" [mm]		Groove depth "D" [mm]	Min. allowed wall thickness "T" [mm]	Max. flare Ø [mm]
		nom.	min.	max.	±0,76 mm	±0,76 mm	Actual	+ 0,00	(ref. only)		
(1)	80	88,9	0,79	0,89	15,88	8,74	84,94	- 0,46	1,98	2,11	91,44
(2)	80	88,9	0,79	0,89	15,87	7,95	84,94	- 0,46	1,98	4,78	-

6.4.3. 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 80 mm grooved 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 valves and from the valves out from the unit.

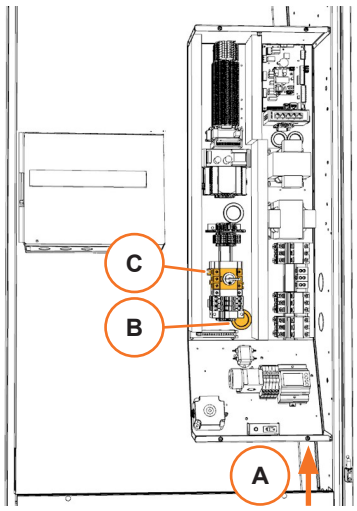
6.5. Electrical connections

6.5.1. Power supply cable

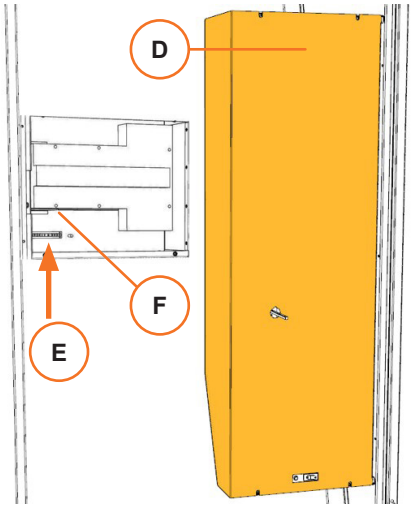
General instructions

- 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.
- Remove the electrical panel cover by unscrewing the screws which hold it.
- Run the power cable [**A**] from the bottom through the precut in lower right corner in the bottom of the unit
- Use appropriate cable ties to fix the cable to the frame on the left shoulder.
- Slide the cable from behind of the electric box, through the opening [**B**].
- Connect the power cable to the inlet terminals [**C**].



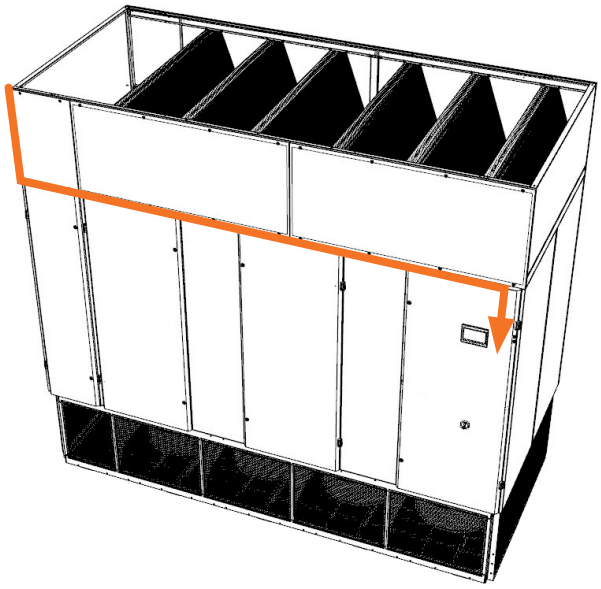
- Re-attach the electrical panel cover [**D**] removed for the cable connection.

NOTICE

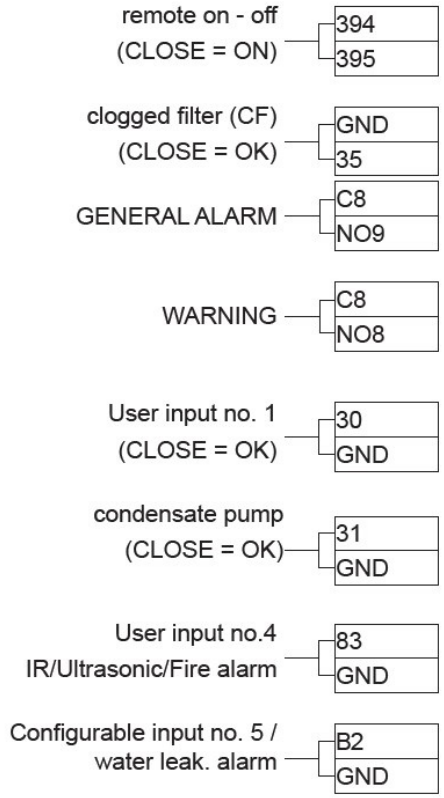
Make sure not to damage the electrical cable between the panels and the unit.

- If the unit is provided with ATS, there are two power cables [**E**] (4 + 4 cords) to be connected to the inlet terminals of the ATS panel [**F**].

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 filter section.
- Run the signal cable around the filter 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 filter 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*.

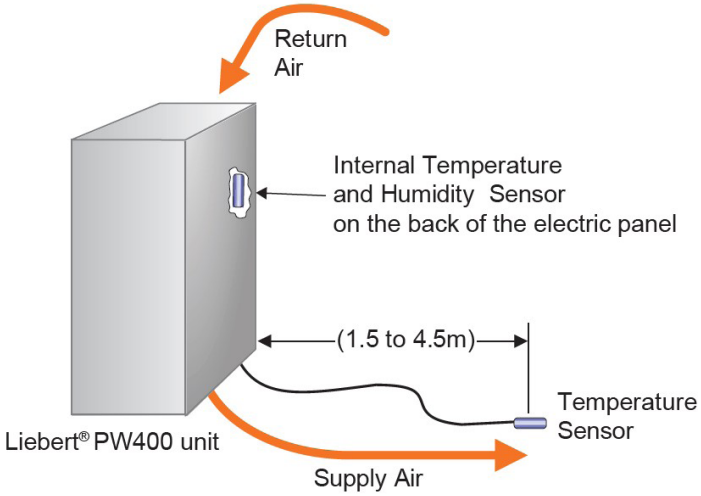
6.5.5. Supply air temperature sensor

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.

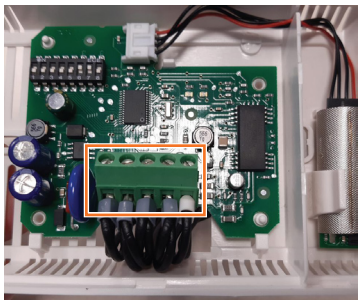
Remove the stripe and place it according the drawing.

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

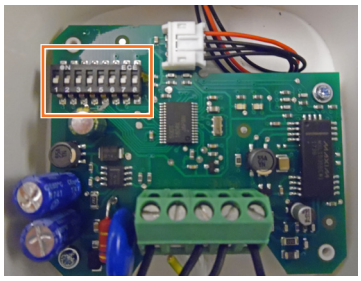
6.6.1. Connection of a device to the Modbus cable



- 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



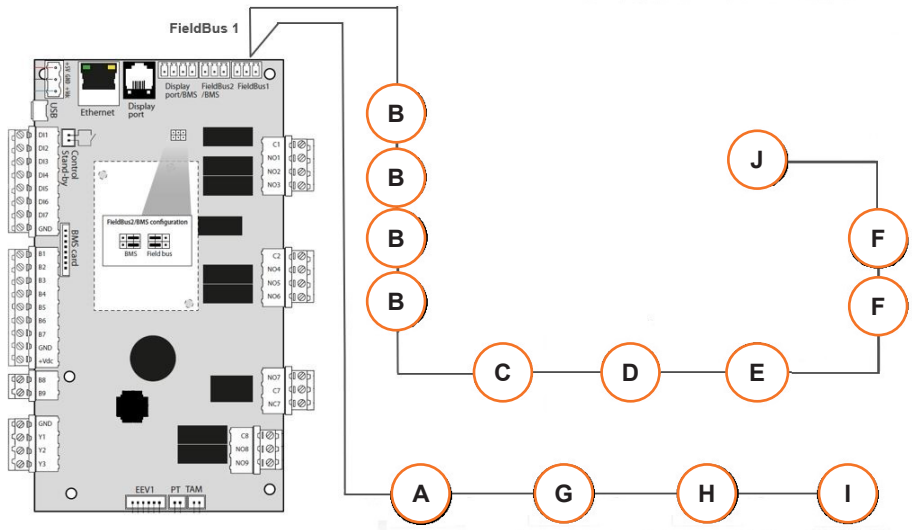
Address of the device (unique)

- 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 P*DX-PCW Control Application*)

Baud rate = 19200 **Parity = Even** **StopBits = 1**	Same parameter for all the devices in the Modbus chain

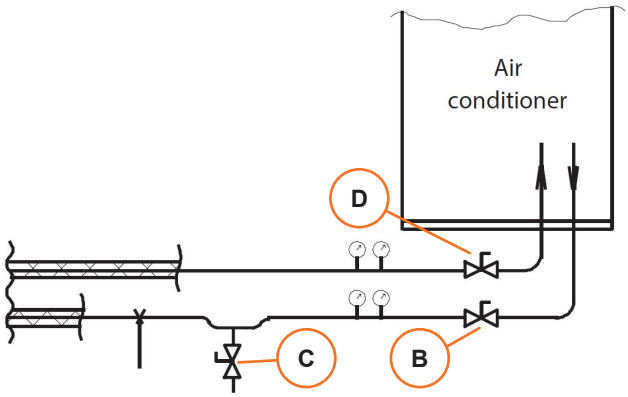


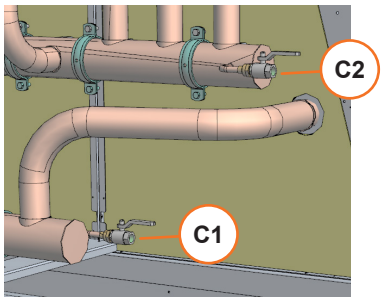
A	Return sensor T+H (up to 4)	**F**	Pressure Indipendent Control valve (up to 4)
B	EC fans (up to 6)	**G**	Air Economizer sensor T+H
C	Humidifier	**H**	Optional sensors T or T+H (up to 3)
D	Energy meter	**I**	Remote sensors T or T+H (up to 10)
E	Expansion board	**J**	Differential pressure transducer

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

6.7. Filling the water system

6.7.1. Water supply

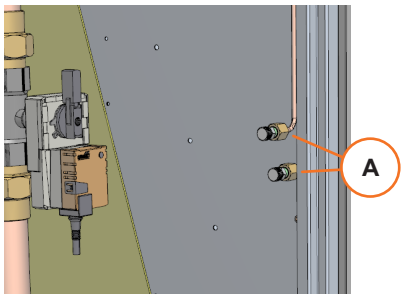




- Units with lateral or bottom connection do not contain the water drain valves. These should be located at the lowest point of the circuit [**C**]
- Unit with top connection contains following water drain valves:

  [**C1**] Drain valve on water inlet piping

  [**C2**] Drain valve on water outlet piping
- Make sure the drain valves [**C**] and/or [**C1**], [**C2**] are closed.
- Open the air



- Open the air vent valves [**A**] to allow the air to escape from the unit's coils and piping.
- If there are shut-OFF valves [**B**] on the water return (building facility), then make sure 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 void the unit warranty.

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.

Electrical system

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

- Check all the cable connections particularly the main power connections on the 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.

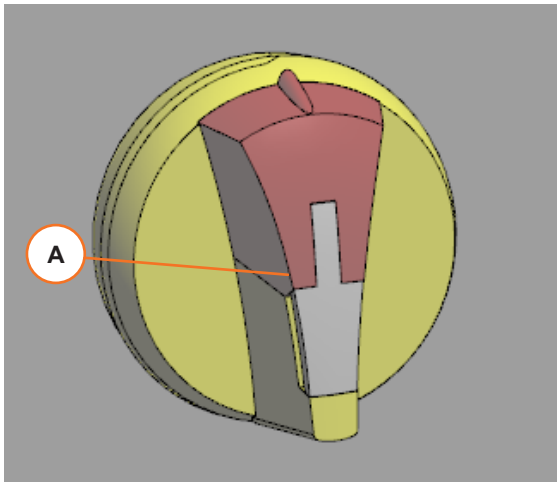
Read carefully the chapter *1. Safety*.

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

NOTICE

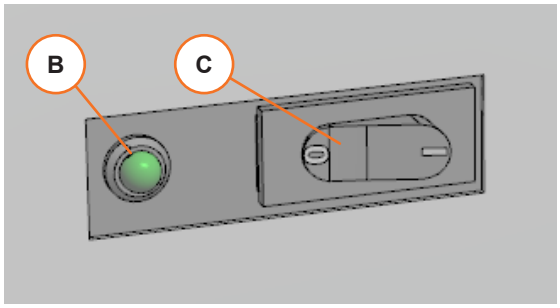
The power supply should never be disconnected during normal operation, except when performing maintenance.

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 **0/OFF**
- 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

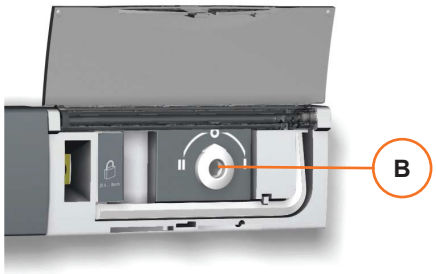
NOTICE

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

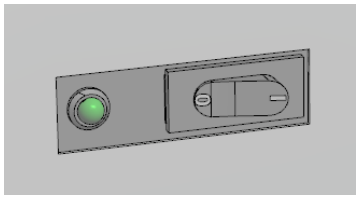


In case of a long stop (seasonal shutdown):

- 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 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:

- **No Teamwork** - The units work independently on the cooling control. Sensor values and setpoints are not shared.
- **Teamwork Mode 1 (Parallel)** - The control uses the system PI's for driving cooling, heating, ventilation, humidification and dehumidification
- **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.
- **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

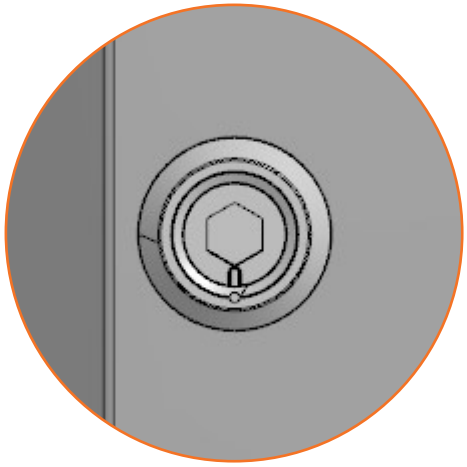
If you need to replace a component, then follow carefully the instructions of the manufacturer that come with the component.

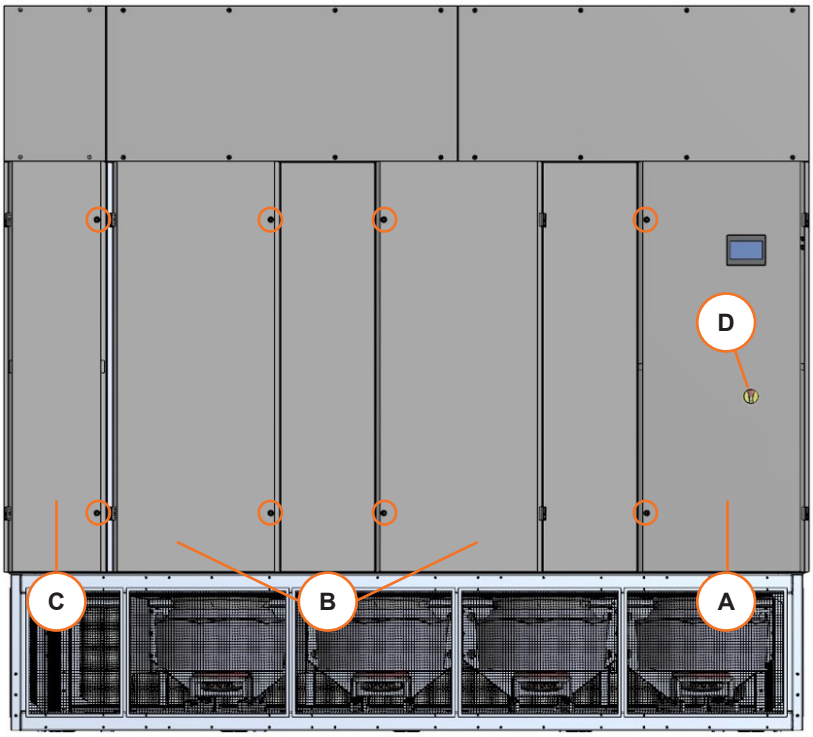
NOTICE

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

- Using a Hex / Allen key, open all the latches on the panel.
- Turn the latches 90°.





There are four doors located on the front side of the unit:
• Display door [**A**] which allows access to the electric panel

WARNING
Access to the electric panel while the unit is **ON** is prevented by the cut-OFF switch [**D**] on the front door.
Turn the unit **OFF** before opening this door.

- Pair of large doors [**B**] for direct access into the cabinet for maintenance of the coil
- Smaller door [**C**] located on the left side to access the chilled water pipes and valves.

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:

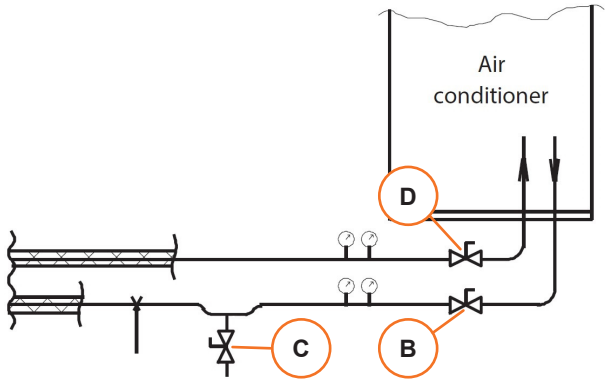
- Turn all the disconnecting switches to **OFF**.

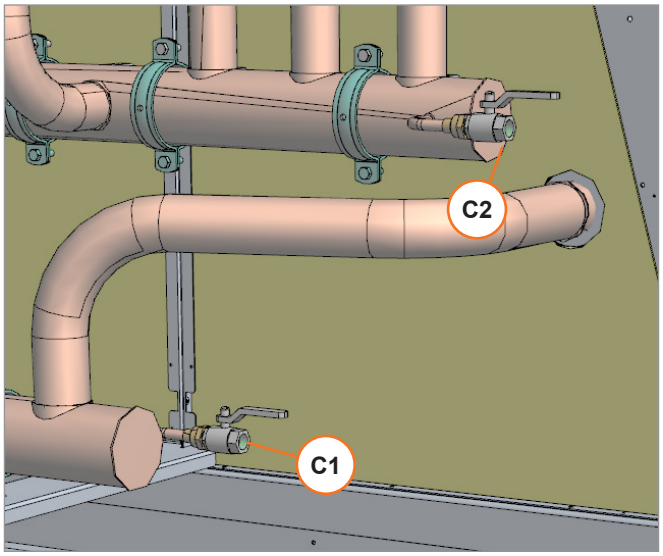
Perform the periodic checks and maintenance operations as specified in the following tables.

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





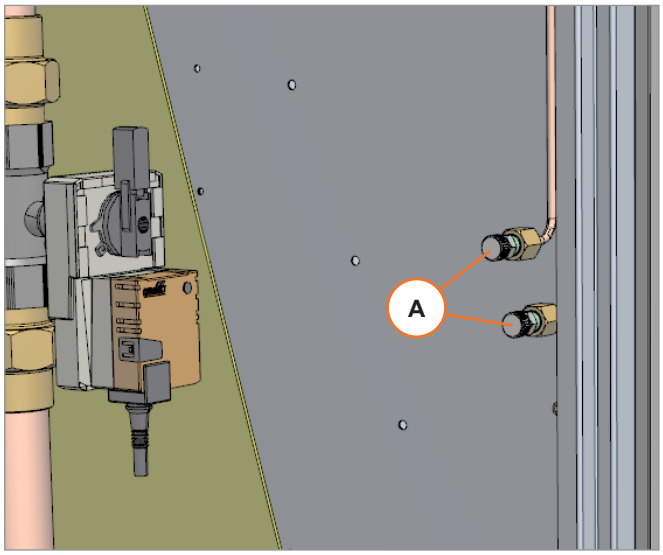
Units with lateral or bottom connection do not contain the water drain valves. These should be located at the lowest point of the circuit [**C**]

- Unit with top connection contains following water drain valves:

[**C1**] Drain valve on water inlet piping

[**C2**] Drain valve on water outlet piping

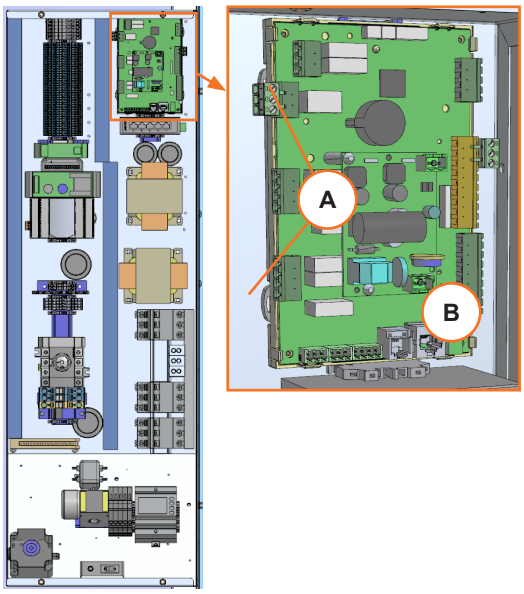
- Close the shut-OFF valves on the water supply system upstream the unit [**D**] (building facility).
- If there are shut-OFF valves [**B**] on the water return (building facility), then make sure they are open.
- Open the drain valve [**C**], or [**C1**] and [**C2**] in case of unit with top connection.



- Open the air vent valves [**A**]
- Keep the drain valves [**C**] or [**C1**], [**C2**] open until no more water flows out of them.

8.6 Components replacement

8.6.1 Replacing the control board



WARNING
Disconnect the unit from the power supply.

How to remove

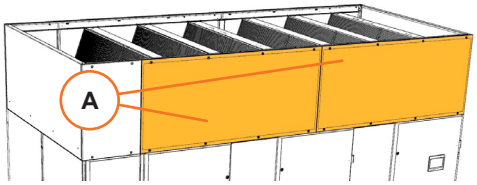
- Remove the cover plate of electrical and control panel.
- Remove all the cables connected to the the control board.
- Insert a screwdriver in one of the loops [**A**] and lever/pull the latch to release the lock [**B**].
- Repeat for the other latches until the control board can be removed from the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

How to reassemble

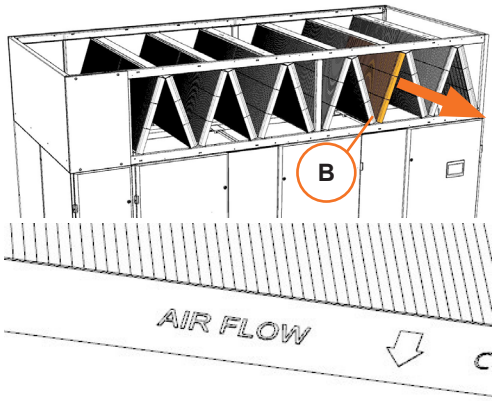
- Press the control board in the DIN rail until it locks.
- Connect the cables.
- Reassemble the cover plate of electrical and control panel.
- Connect the unit to the power supply.
- Upload the software from the computer (or USB drive) to the control board.

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 two frontal panels [**A**]. These panels are held by 8 screws.



- Pull out the air filters [**B**]
- Slide new filter elements back into the rails.
- Re-attach the frontal panels.

CAUTION
Pay attention to proper orientation of the filter

8.6.3 Replacing a fan

8.6.3.1.General instructions

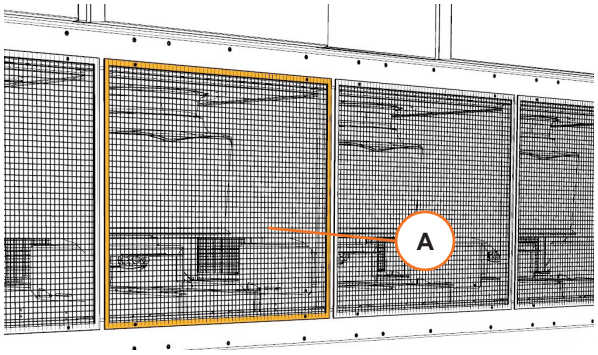
Safety

WARNING
Disconnect the unit from the power supply.

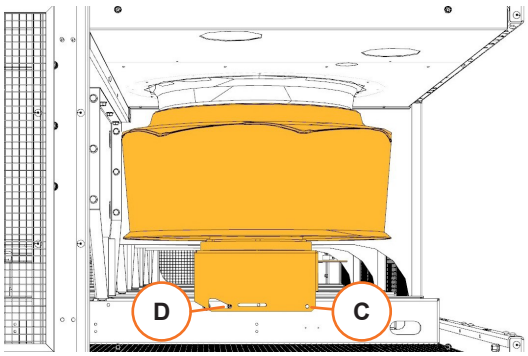
CAUTION
The fans and the panel are heavy.
This operation must be done by two maintenance operators.
Use adequate lifting equipment and follow the fan manufacturer instructions for handling.

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.)

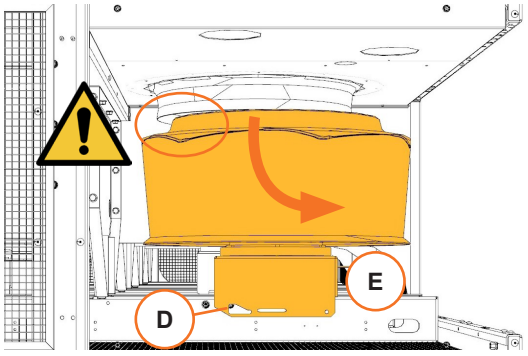
8.6.3.2 Replacing the front fan



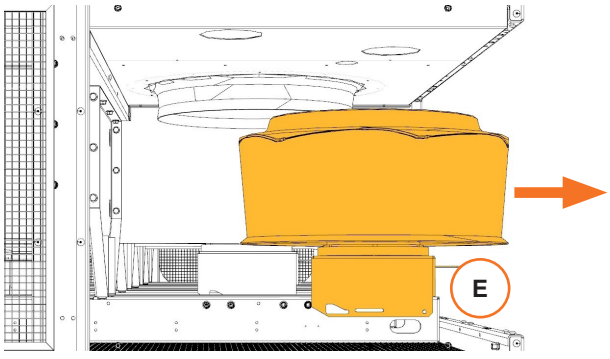
- Disconnect the unit from the power supply.
- Remove the frontal grid panels [**A**] on the fan module.



- 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.



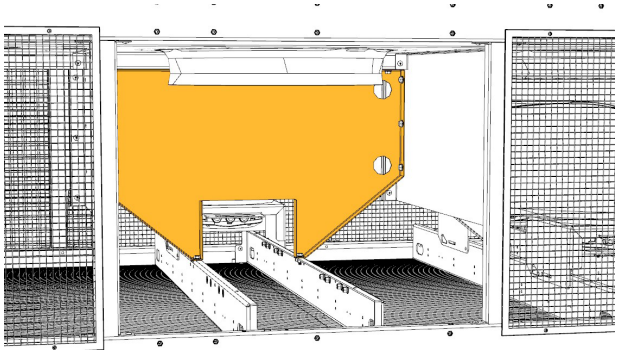
- Pull the handle [**E**] and carefully slide the fan down.
- Keep the fan in a horizontal position - Pay attention to not damage the propeller on the edge of the fan nozzle.
- Remove the back screws [**D**]



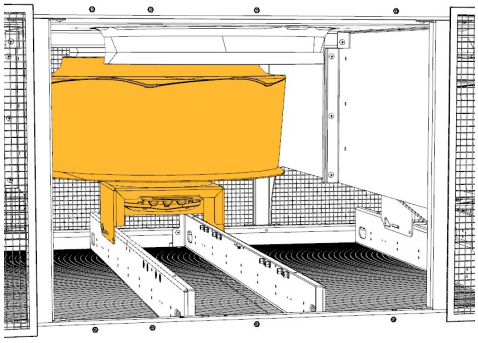
- Pull the handle [**E**] and slide the fan forward, out of the bay.
- Keep the fan in a horizontal position.
- Pay attention to not damage any cables present in the fan bay.

- To reassemble the fan, proceed in reverse order

8.6.3.3. Replacing the rear fan



- To gain access to the rear fan, it is necessary to first remove the front fan.
- Remove the dividing panel between the front and back row.
- This panel is held by 12 screws.



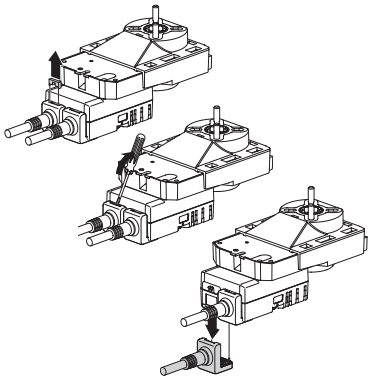
- Disconnect the electrical cable from the connector
- The removal procedure is the same as with the front fan, described in chapter *8.6.3.2. Replacing the front fan*

- To reassemble the fan, proceed in reverse order

NOTICE

Re-attach the divider panel between the fansmand the frontal protective grid panels.

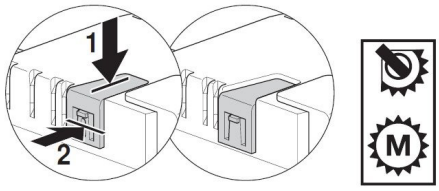
8.6.3.4. Replacing the rear fan



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)

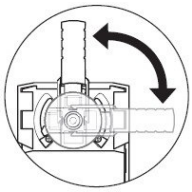
In case of PIC valve: follow procedure on the first picture to disconnect cables from actuator.

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

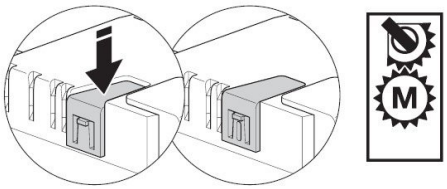


3. Set the actuator / valve into default position:

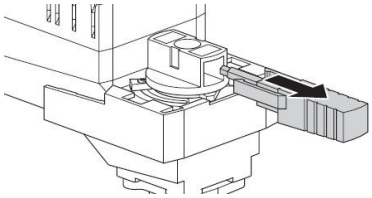
- Press the disconnect button down (**1**) and hold it in position by pressing the latch (**2**)



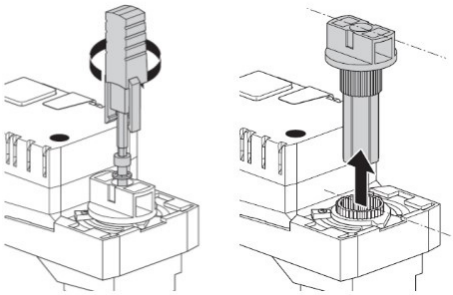
- Manually turn the valve using the actuator handle until you reach the end stop



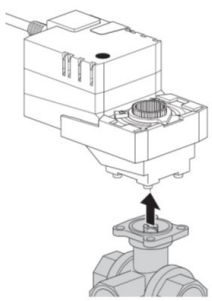
- Press the disconnect button again to release it



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 counterclockwise) the bolt. Pull the spindle out



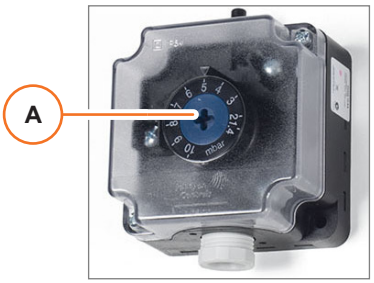
6. Now you can safely remove the actuator.

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.

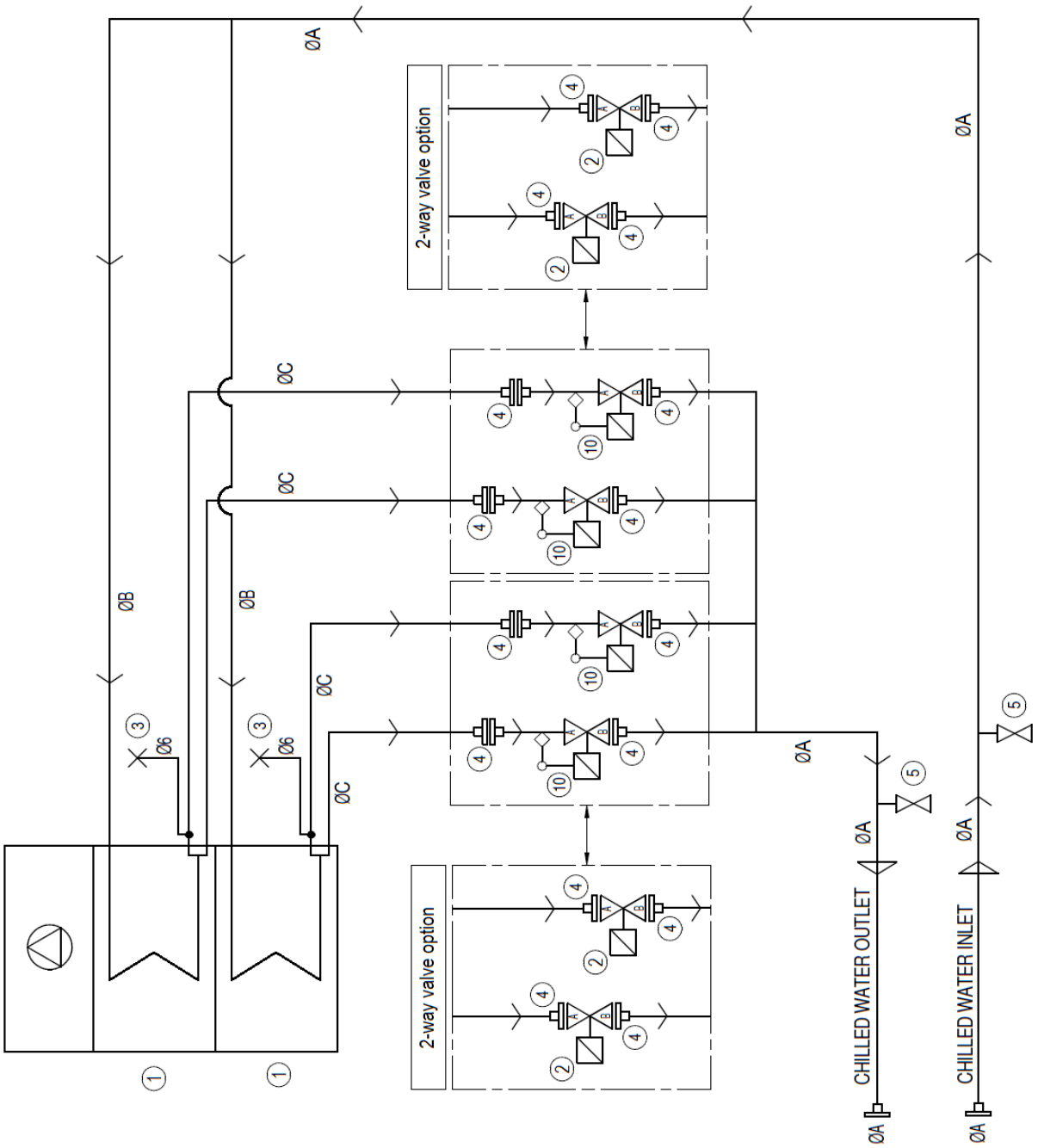
ENVIRONMENT

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	89 mm
Ø B	64 mm
Ø C	54 mm

Annex B - Safety Labels

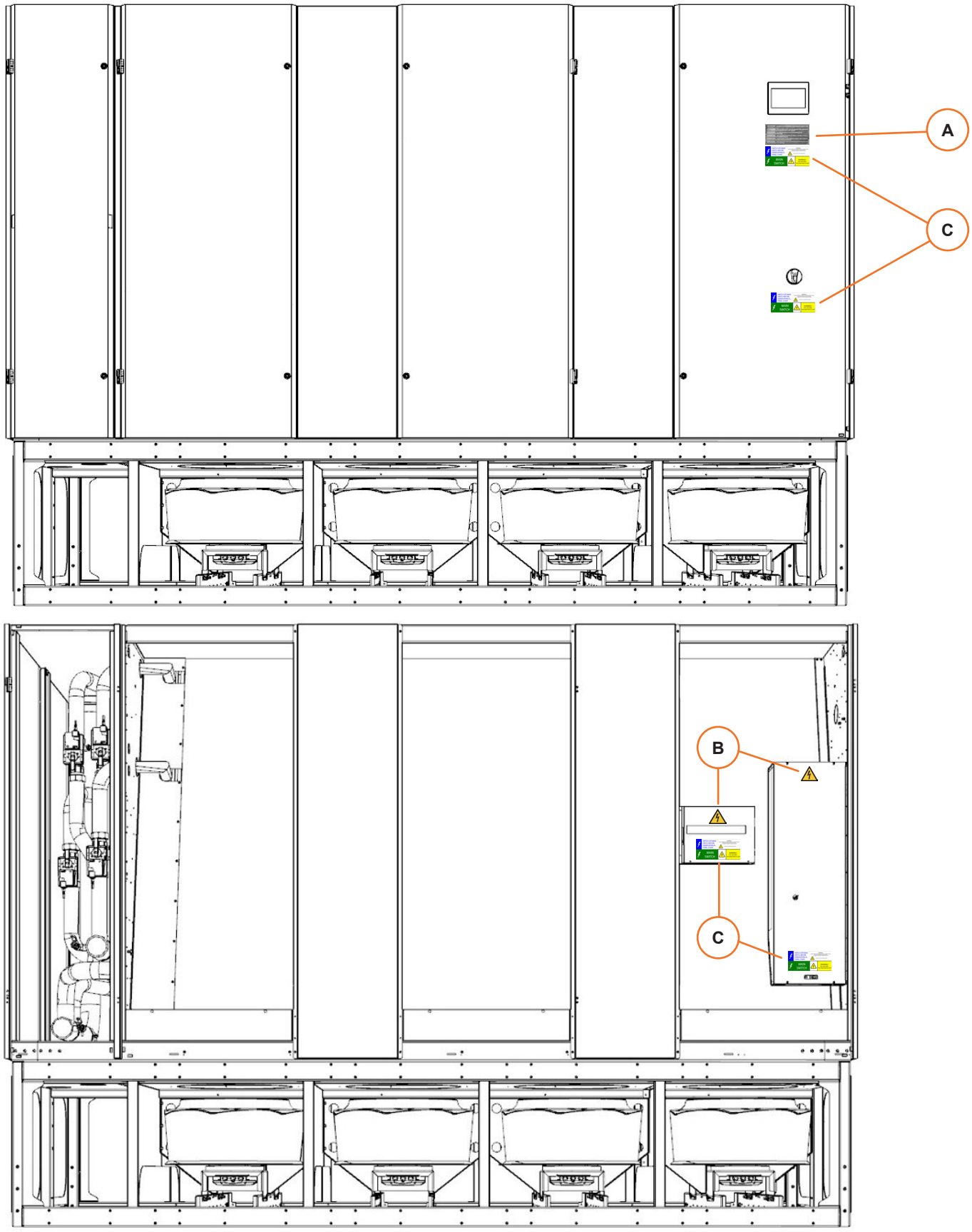
WARNING

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	

Labels position



Annex C - Connections

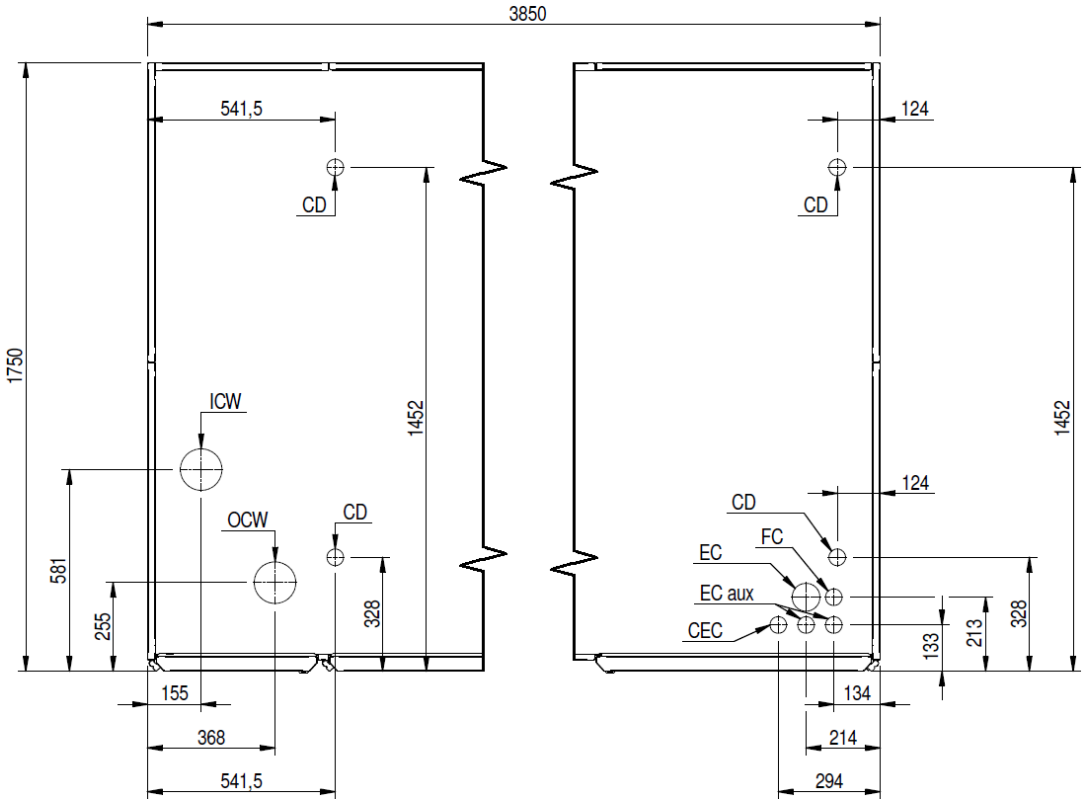
Key to symbols

Symbol	Description	See ...
ICW	Chilled water **INLET**	Chapter *2.4 Cooling System* Chapter *5.3. Chilled water piping arrangement*
OCW	Chilled water **OUTLET**	
EC	Electrical power supply	Chapter *6.5 Electrical connections*
EC aux	Low voltage cables	
CD	Condensate Drain	Chapter *6.3.7 Condensate drain*

Hydraulic and electrical connections

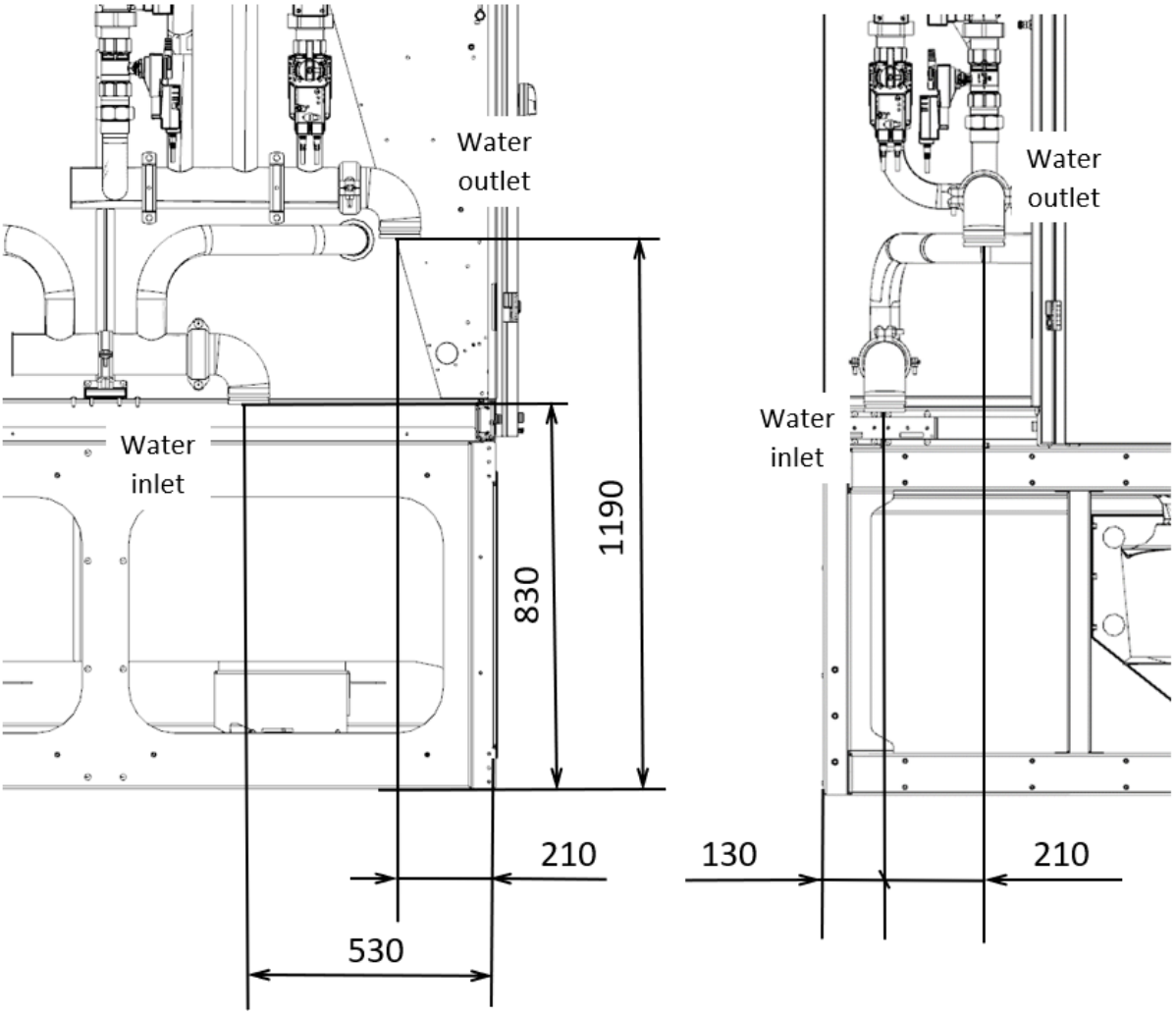
Point	Description	Connection size [mm] PW400
ICW	Chilled water **INLET**	O.D. Ø 88,9 mm
OCW	Chilled water **OUTLET**	O.D. Ø 88,9 mm
CD	Condensate drain	4 x I.D. Ø 20 mm
EC	Electrical power supply	Ø 80,5 mm
EC aux	Low voltage cables	2 x Ø 48 mm
FC	Free cutout	Ø 48 mm
CEC	Customer low voltage connection	Ø 48 mm

Dimensions for piping – Top connection (Top view)



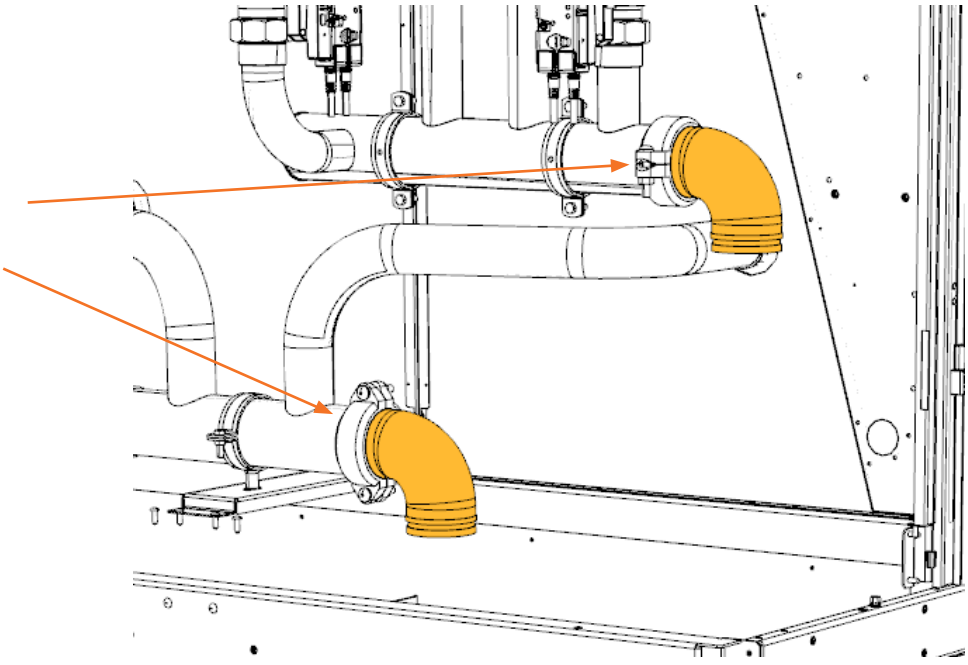
External CW piping connections

Bottom connection

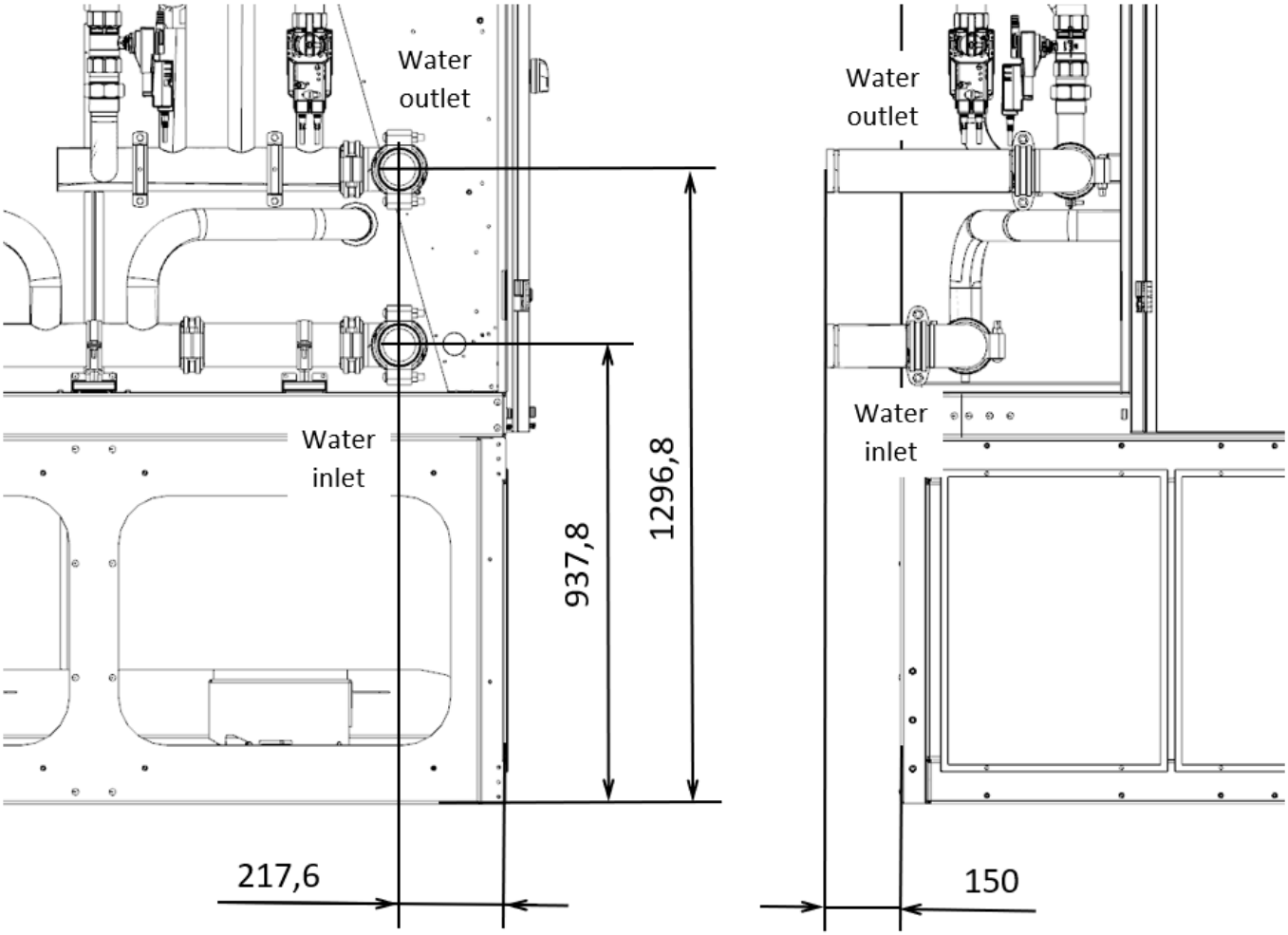


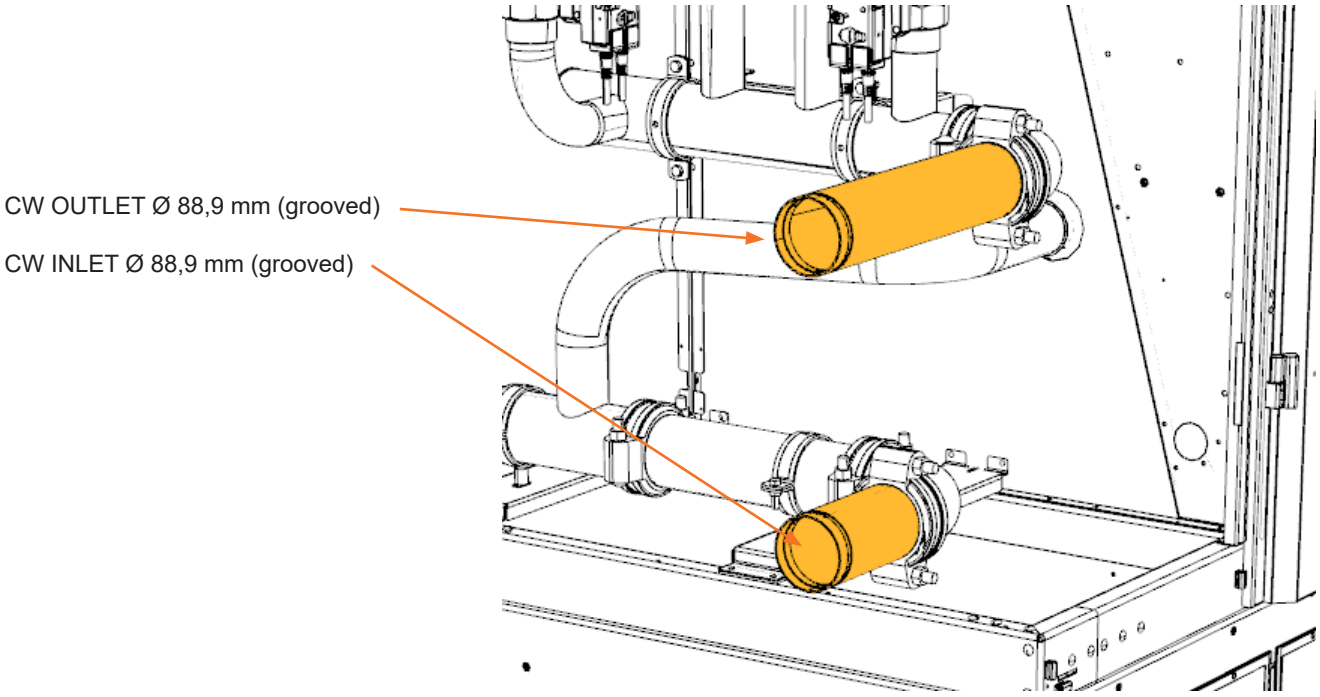
CW OUTLET Ø 88,9 mm (grooved)

CW INLET Ø 88,9 mm (grooved)

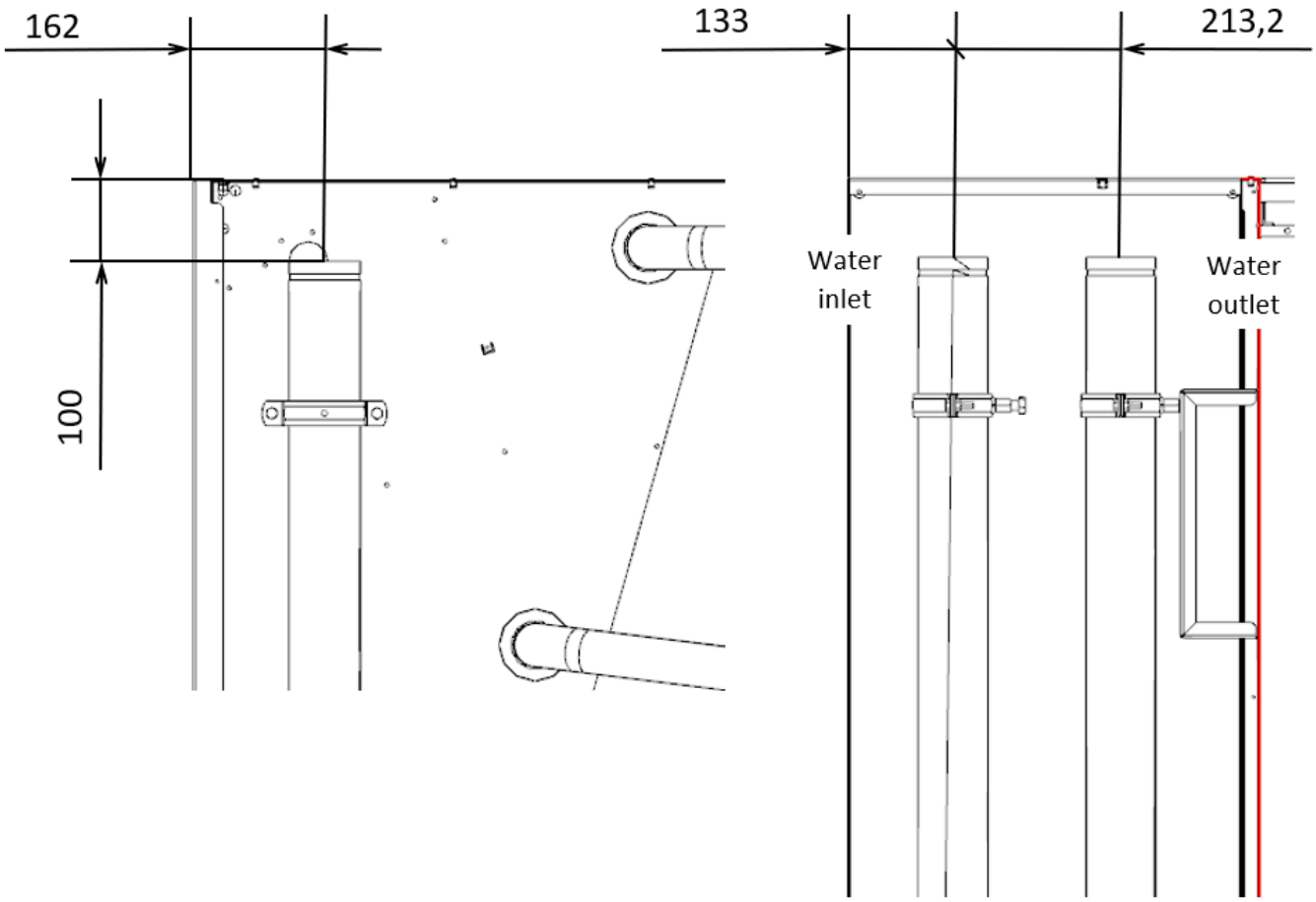


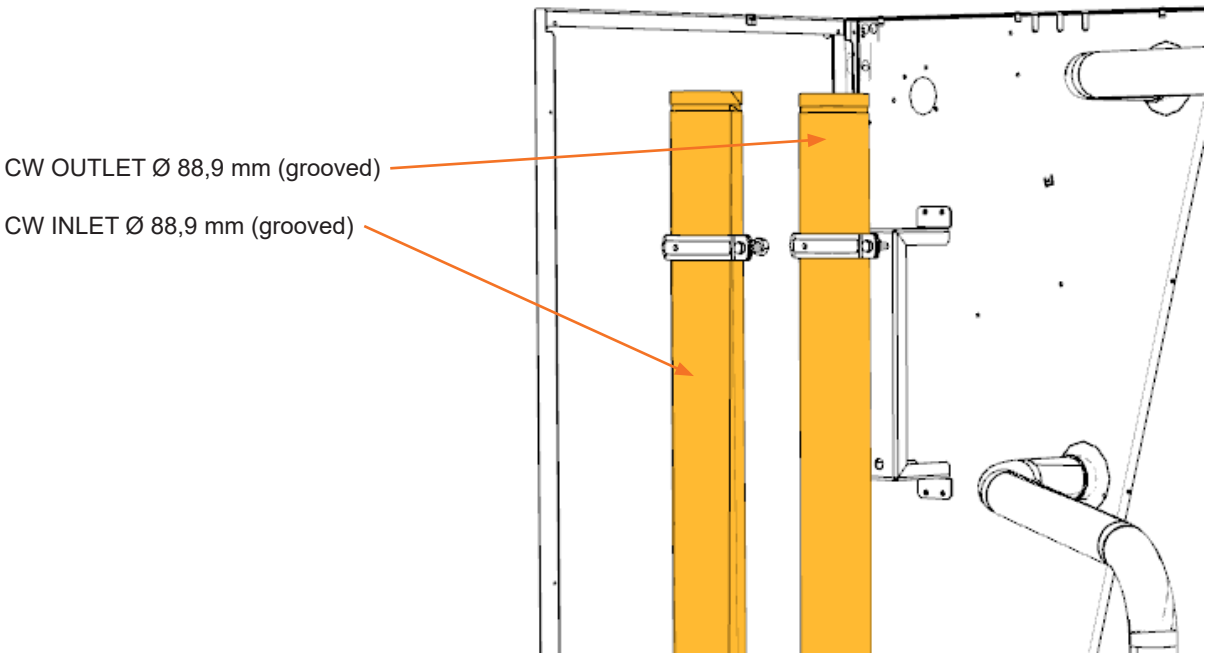
Lateral connection





Top connection





Annex D - ATS (Automatic Transfer Switch)

Safety instructions

WARNING

Improper operations can cause injury or death.

NOTICE

Improper operations can cause product damage.

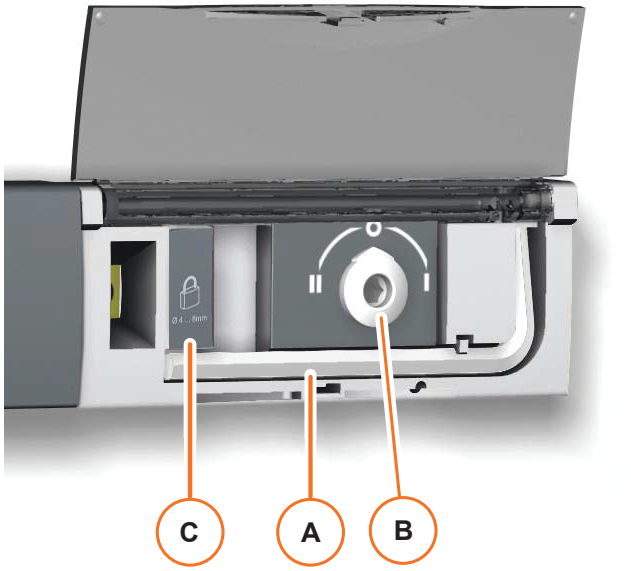
Read carefully the chapter *1. Safety*.

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

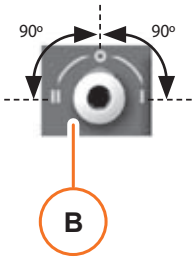
Covers	- The only cover that can be opened is the one for the auto/manual switching. - Do not open any other cover (with or without voltage) as there may still be dangerous voltage inside the unit from external circuits.
Cables	- Do not handle any control or power cables connected to the ATS when voltage 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 **PW400** 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:

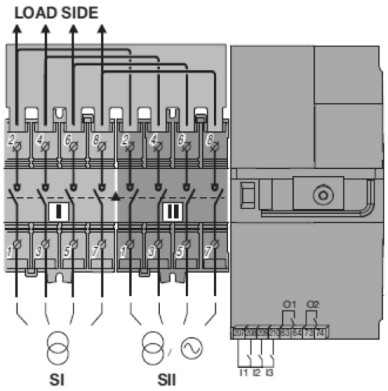
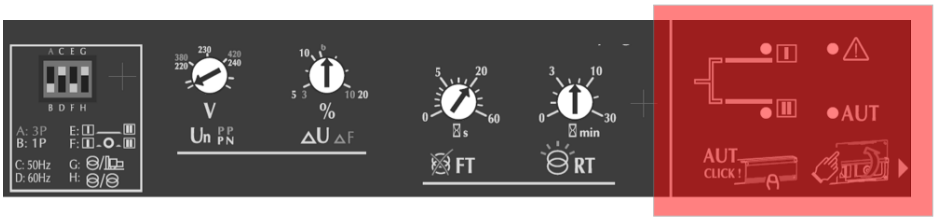
- Type 03: configurable through four potentiometers and DIP switches

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
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.*

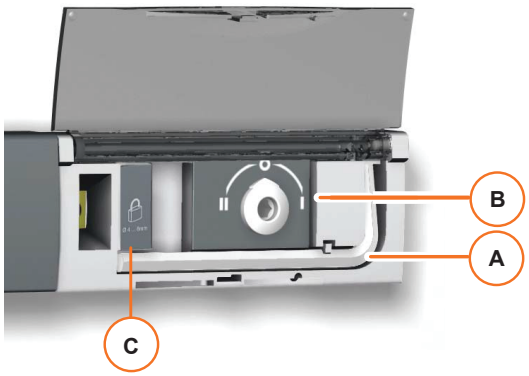
Installation

The **PW400** 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.

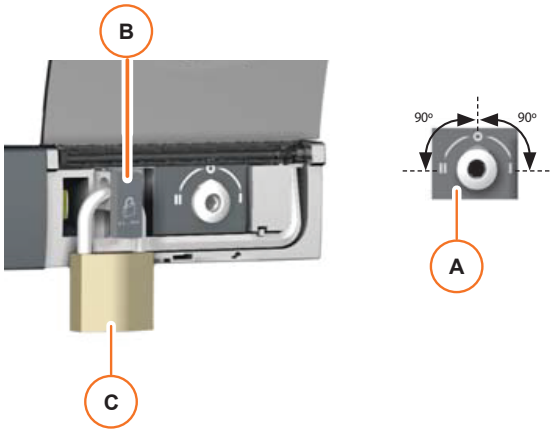
The ATS is placed inside a separate electrical panel and fixed on a DIN rail.

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 **PW400** 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

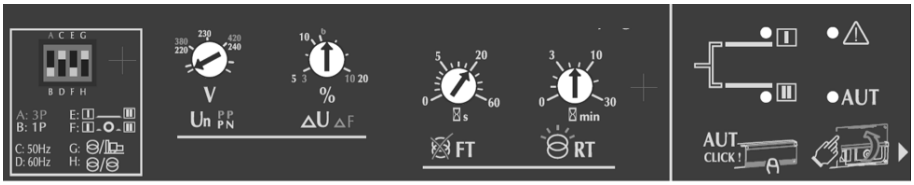


- Insert the handle to the switch [A] and turn it to position "**O**".
- Lift the locking clip [**B**].
- Insert your padlock [**C**] in the clip (4-8 mm shackle diameter).

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.

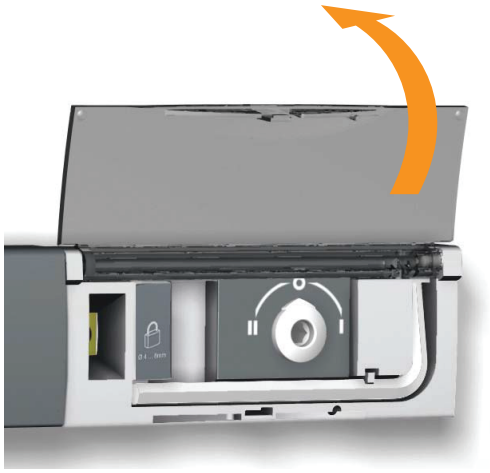
The ATS type 03 arrives pre-configured from the factory as described in the following table:

	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.

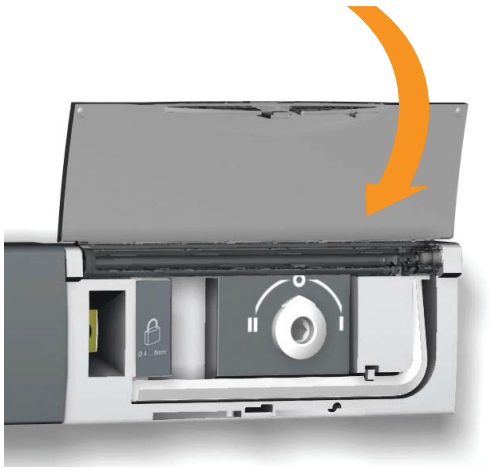
You may turn the switch to each of the following positions:

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

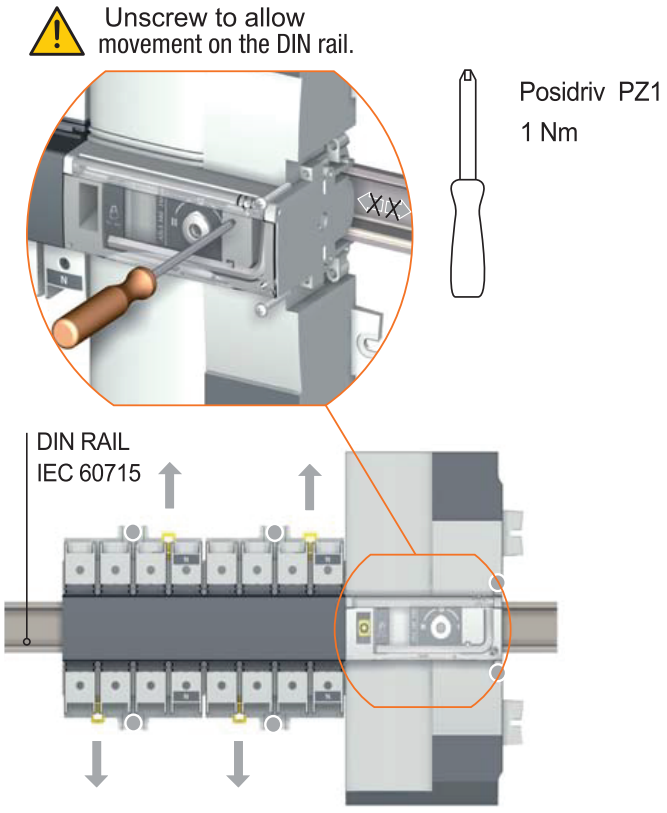
Before powering on the ATS, manually operate it to ensure that it can move normally.

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 **PW400** 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 **PW400** unit to the power supply.
- Restart the **PW400** unit.

Troubleshooting

ATS type 03

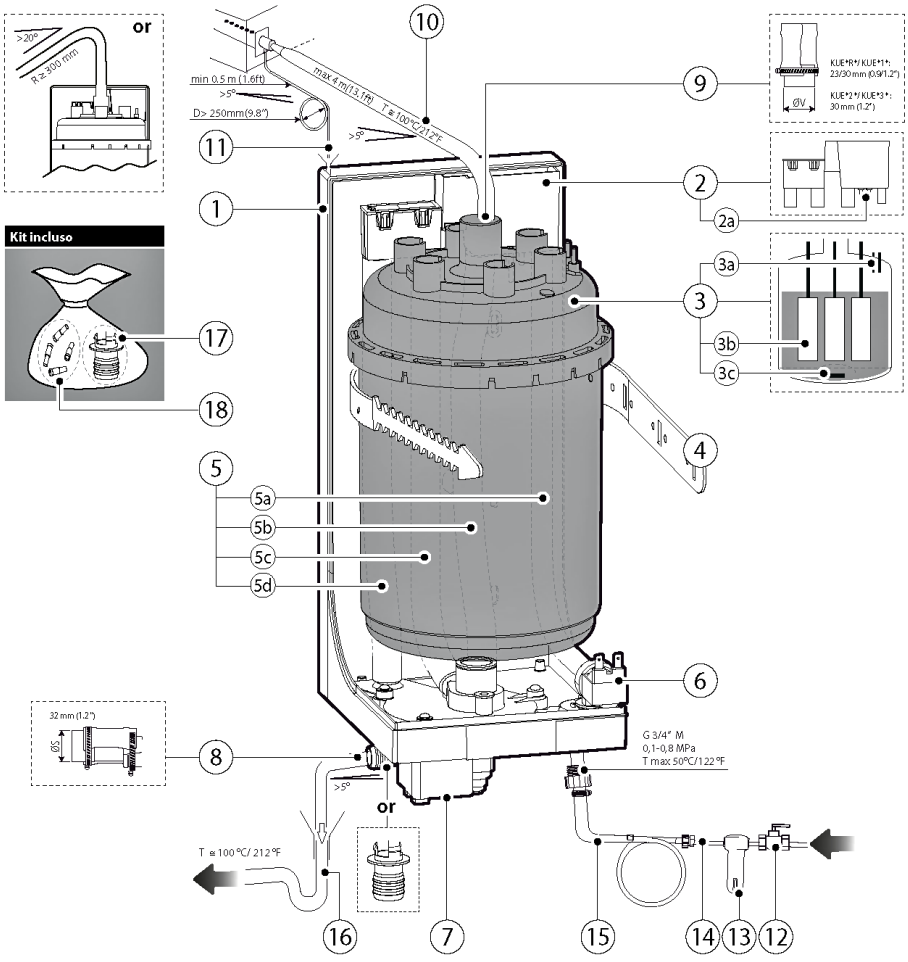
Symptom	Possible Cause	Check or remedy
The “Priority SOURCE availability” LED does not come **ON**	DIP switches not set correctly	Set the DIP switch according to electrical diagram
	Wrong nominal voltage	Measure the voltage across the terminals and report the value on the potentiometer
The “Emergency 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).

Annex E - Electrode Humidifier

Content

1 - Description

Main Components



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

Steam distribution

9	Steam outlet
10	Steam distribution hose
11	Steam condensate hose

Water fill

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

Water drain

16	Drain hose with siphon (not supplied)

Kit included

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

Operating principle

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

2 - Specifications

Technical data

Electrode humidifier technical data

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

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

Supply water

Only use drinking water with the following specifications:

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

Supply water chemical specifications

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

(1) = values depend on the specific conductivity; in general: TDS≈0,93*σR, 20 °C; R180≈0,65*σR, 20 °C

(2) = not less than 200% of the chloride content in mg/l CL-

(3) = not less than 300% of the chloride content in mg/l CL-

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

CAUTION

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

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

NOTICE

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

Drain water

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

It may reach a temperature of 100°C.

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

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

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

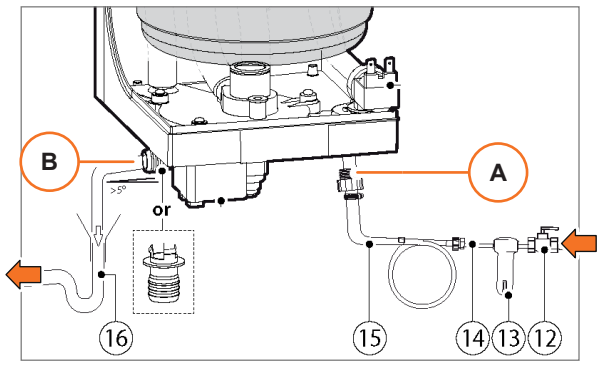
NOTICE

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

3 - Installation

The humidifier is supplied already mounted within the **PW400** unit.

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



Supply water connection

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

Drain water connection

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

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

4 - Startup and operation

Initial checks

Before using the humidifier, check the following conditions:

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

Startup

The humidifier is available as soon as the **PW400** unit is switched **ON**. The humidification request starts the humidifier.

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

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

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

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

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

Operation

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

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

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

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

5 - Maintenance

WARNING

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

Before doing any operation, always disconnect the power supply.

WARNING

High temperature of some components. High temperature of water.

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

NOTICE

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

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

Periodic checks

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

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

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

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

Cylinder replacement

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

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

Procedure

- Completely drain the water contained in the cylinder.
- Switch off the **PW400** unit and open the disconnecting switch of the power supply (safety procedure).
- Remove the steam hose from the cylinder.
- Disconnect the electrical connections from the top of the cylinder.
- Release the cylinder from the fastening device and lift it up to remove it.
- Fit the new cylinder in the humidifier by performing the previous operations in reverse order.

NOTICE

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

Replacement and maintenance of other components

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

6 - Troubleshooting

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

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

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