Liebert® CWA

Chilled Water Thermal Wall Unit

User Manual

English, 10040520MAN_ENG, rev. D - 08.12.2022

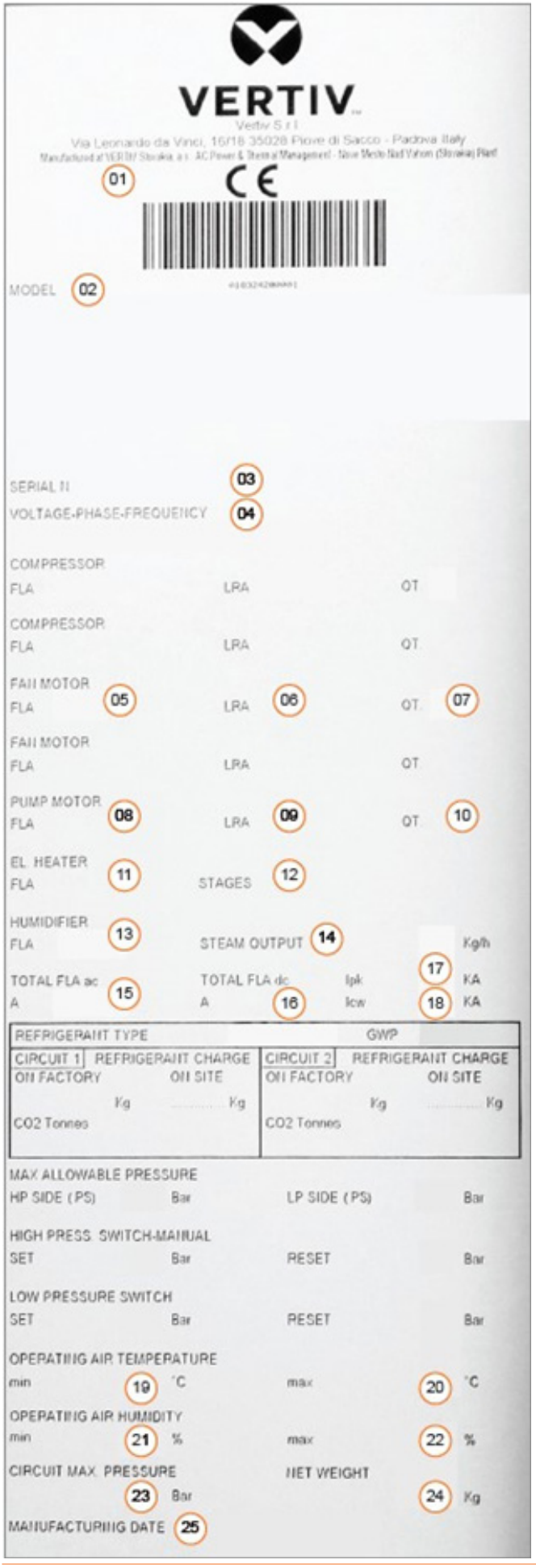
This document, written in English, is the original version

Contents

Annexes

Documents supplied with the machine

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



Onboard Label

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

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

NOTICE

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

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

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

Abbreviations - Acronyms

Item	Definition
CWA	Chilled Water Array
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
AHF	Active harmonics filter
THD	Total harmonic distortion

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 • 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

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

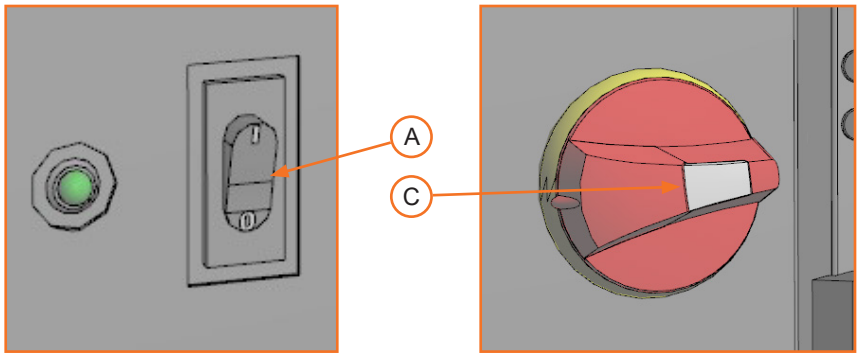
As general rule, always wear the following **PPE** (Personal Protective Equipment):

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 *4.9. 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 **Chilled Water Array (CWA)** 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 separate modules:

- The unit consists of two modules which are transported separately and need to be assembled and connected on site. The coupling kit and accessories are delivered with the unit.
- Optional motorized damper is delivered separately and needs to be attached to the unit during installation.

Operations to be made at the installation site are the following:

- Bottom module installation, mounting of the top module
- Chilled water circuits connection inside the unit
- Electrical connections for power supply
- Water piping connections to the chilled water supply system
- Other optional piping connections (condensate drain)

See Chapter *4. Unit 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 *5. 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.

2. Digit Nomenclature

The unit is fully defined by twenty-five (25) 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
C	A	6	0																					

Digit	Feature	Value	Description
1, 2	Family name	CA	
3, 4	Unit model	40	
		60	
		80	
5	Cooling system type	S	SMART single circuit
		N	NEXT GEN. single circuit
6	Fan type	2	Standard axial fan
		3	Standard axial fan + AHF
		E	High static fan-HE
		F	High static fan-HE + AHF
		P	High static fan-HP
		Q	High static fan-HP + AHF
		A	High static fan-D1
7	Water connections	V	Grooved pipe
		F	Flanged pipe
8	Valve	2	CW 2-way valve
		P	CW 2-way PICV
9	Power supply	3	400V/ 3ph/50Hz+N-CE
		T	380V-400V/3ph/60Hz+N-CE
		6	460V/3ph/60Hz-CE
10	Unit module	B	Base (Bottom) module
		T	Top module
11	Redundancy execution	0	None
		R	Independent control of Top / Bottom module
12	Microprocessor control	0	None
		7	7” touch screen
		F	10” touch screen
13	Placeholder	0	None

Digit	Feature	Value	Description
14	Air filter	0	None
		1	ePM10 50%
		2	ePM10 50% +Diff.press.transducer
		3	ePM10 50% +Clogged filter sensor
15	Coils and pipes	T	Top connection Coil Hydrophilic
16	Frame type	0	Standard
		S	Seismic (Sds=2.5 Ip=1.0) IBC
17	High voltage options	D	Standard power supply
		A	Dual power supply with ATS
		G	Dual power supply with ATS and Ultracap
		P	Parallel
18	Predisposition	0	None
		D	Damper control
19	Monitoring	0	None
		1	Monitoring (Modbus, BACnet, SNMP, HTTP)
20	Devices	0	Standard drain connection
		E	Energy meter
		C	Condensate pump
		R	Energy meter + Condensate pump
21	Packaging	P	PLP and pallet
		C	PLP and wooden crate
		S	Seaworthy
22	Water sensors	0	None
		W	Water temp.sensors
23	Free	E	Free
24	Free	E	Free
25	Special requirements	A	Standard Vertiv
		X	Special Veritv

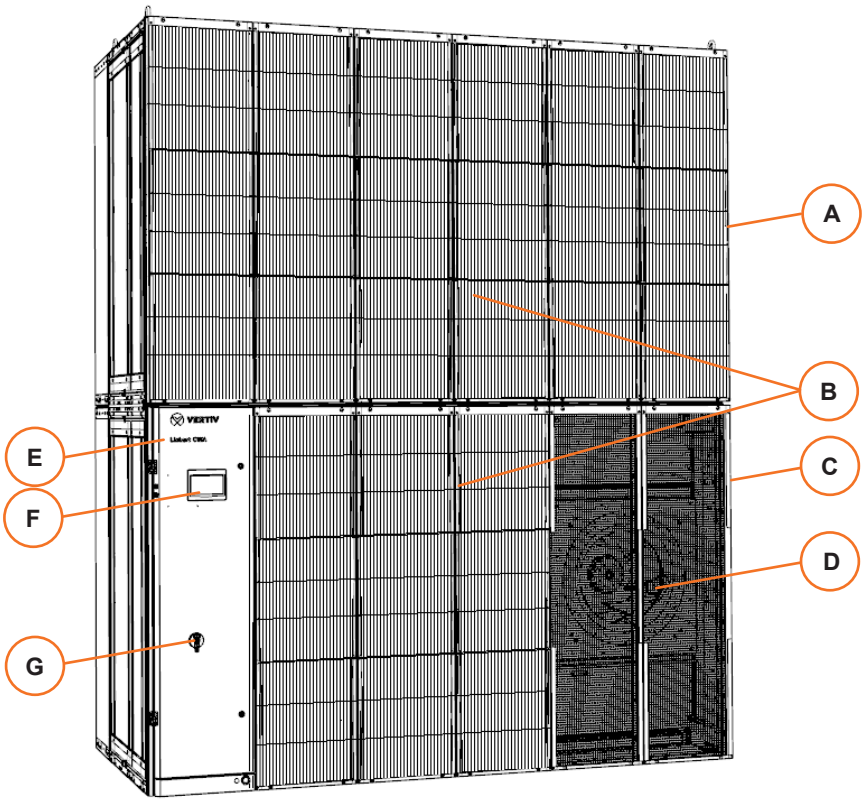
3. Reference norms

All **Liebert®** thermal units are designed, manufactured, and tested according to the following directives and standards:

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

4. Unit Description

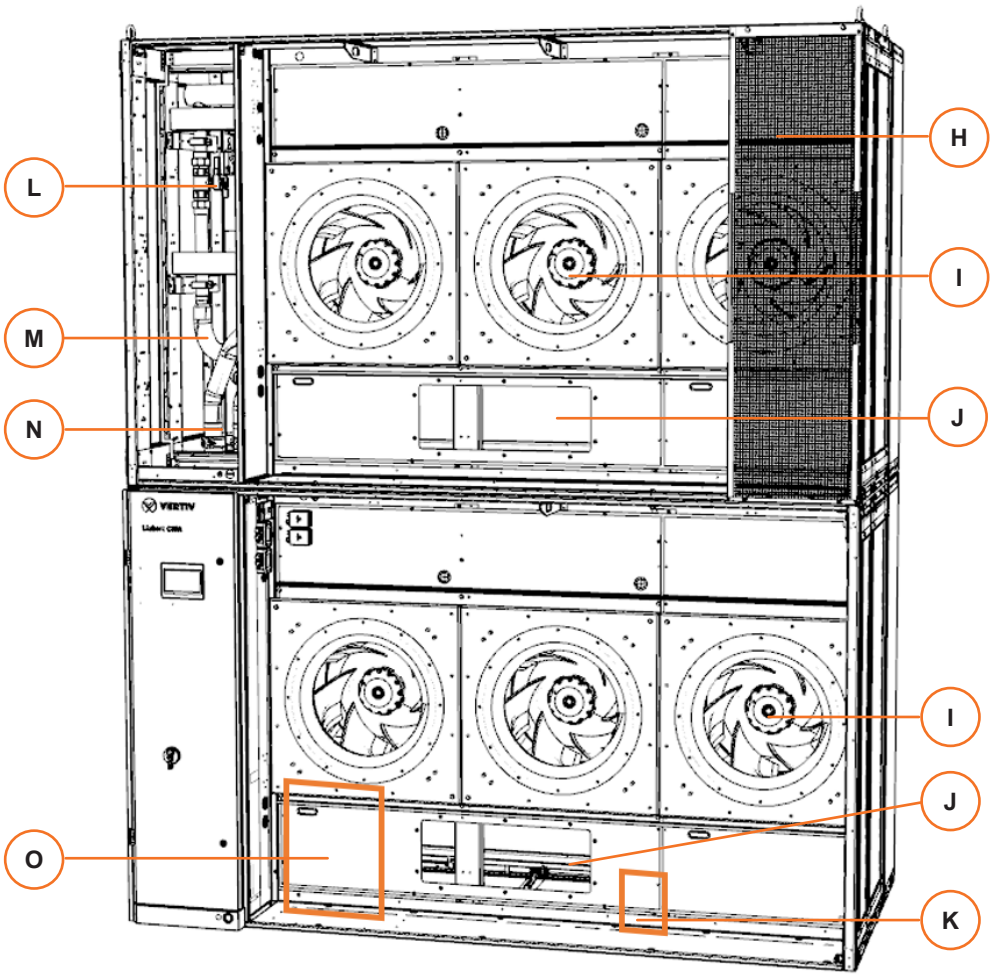
4.1. Unit structure



Ref.	Description	Remaks
A	**Top module**	The unit consist of two modules coupled together. Each module contains its own coil and fan assembly but the chilled water piping, electric and control systems are interconnected.
B	**Filter assembly**	The frontal area of the CWA unit is used air intake and the surface is covered with high efficiency filters.
C	**Bottom module**	The bottom module contains the control display and electric panel with shut-off switch.
D	**Protective grill**	There is a protective grill located underneath the filters, to prevent access to the fans after the filters are removed.
E	**Access door for EP**	The door for the electric panel is located in the left side of the bottom module. This door is attached on hinges and is secured by latches. The unit needs to be switched off by the sut-off switch to be able to open this door.
F	**Control panel/display**	The unit is usually controlled remotely by network connection. HMI display / touch screen control panel is located on the front door for direct control of the unit.
G	**Shut-off switch**	The shut off switch is located on the electric panel access door. It prevents opening of the acces door while the unit is running.

** CA60 unit shown in the picture*

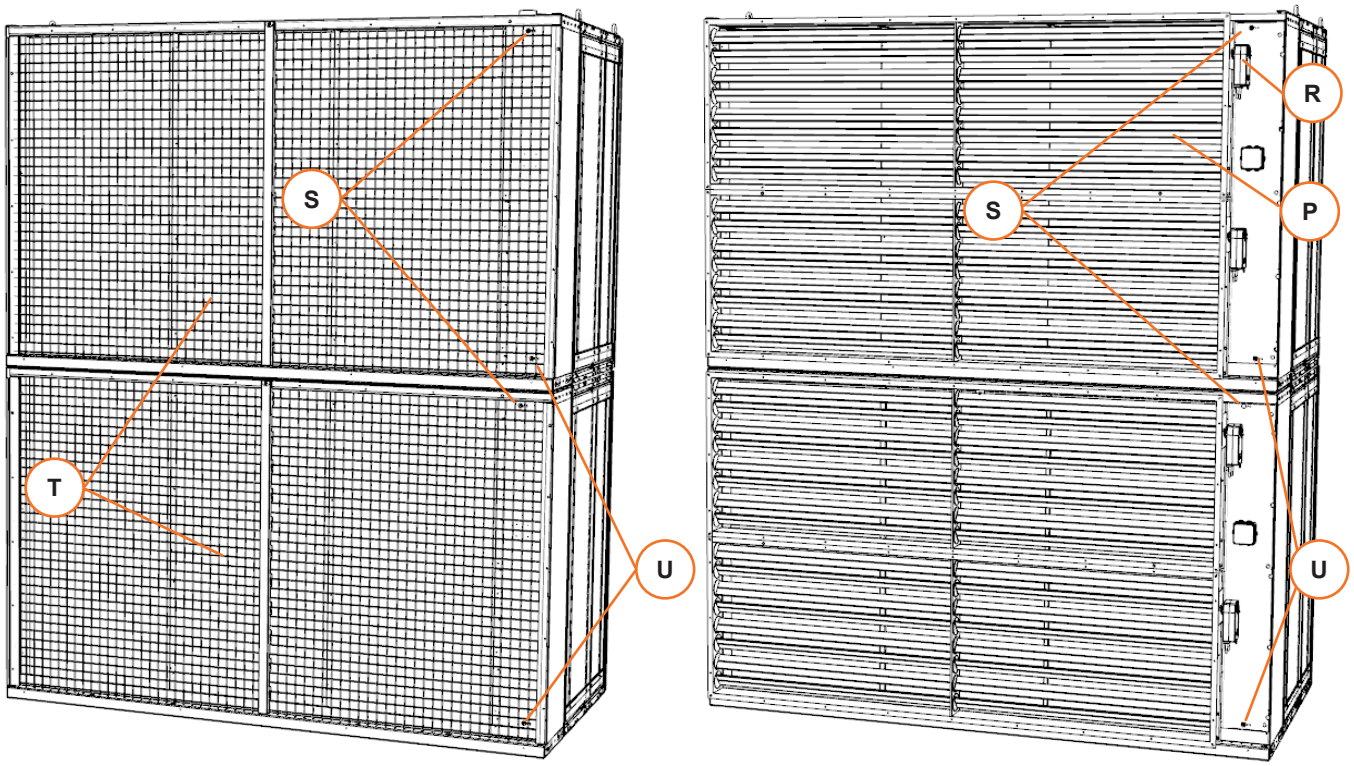
4.2. Internal components



Ref.	Description	Remaks
H	**Protective grill**	There is a protective grill located underneath the filters, to prevent access to the fans after the filters are removed.
I	**Fan array**	For CA60 unit, both top and bootom module, each contains its own fan array of 3 fans (6 fans in total for the unit). Depending on the configuration, the fan array may consist of radial or axial fans – see chapter *4.4. – Fan type*
J	**Service opening**	Service opening in the bottom module allows access to the condensate drain pipes and the condensate pump (optional)
K	**Fuse box for AHF (opt.)**	Electrical circuit protection of AHF.
L	**Chilled water valve assembly**	The valve assembly for both top and bottom circuits is located in the top module. It can be accessed after removing the covering panel behind the filters.
M	**Pipe assembly**	The unit has common chilled water inlet and outlet for both modules. The pipe assembly then leads separately into top and bottom coil.
N	**Chilled water coil**	Each module is equipped with its own coil. The coil is located inside the unit behind the fan array.
O	**Active harmonics filter - AHF (optional)**	The unit has possibility to connec a AHF device for optimization of another harmonics, which are generated during the operation. Functions: Harmonic filtering, Power factor correction, Phase balancing.

** CA60 unit shown in the picture*

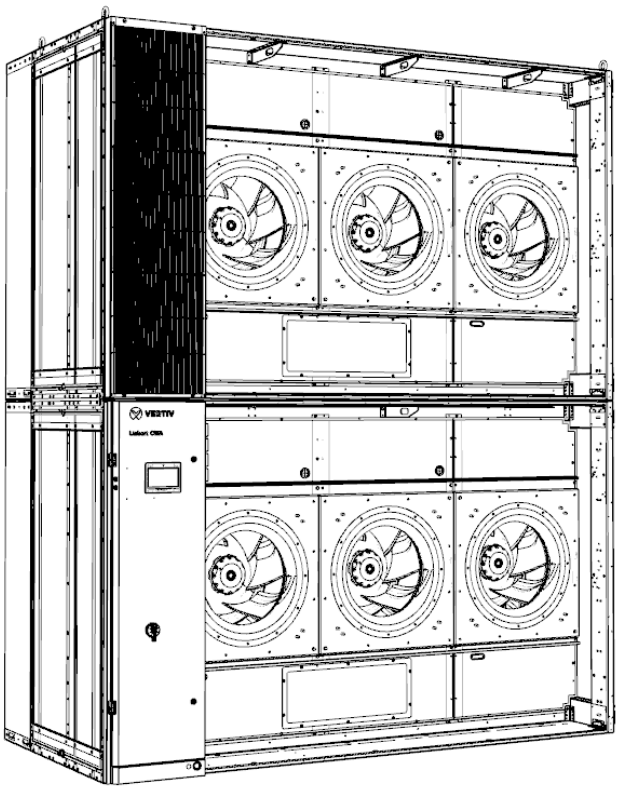
4.3. Rear side of the unit



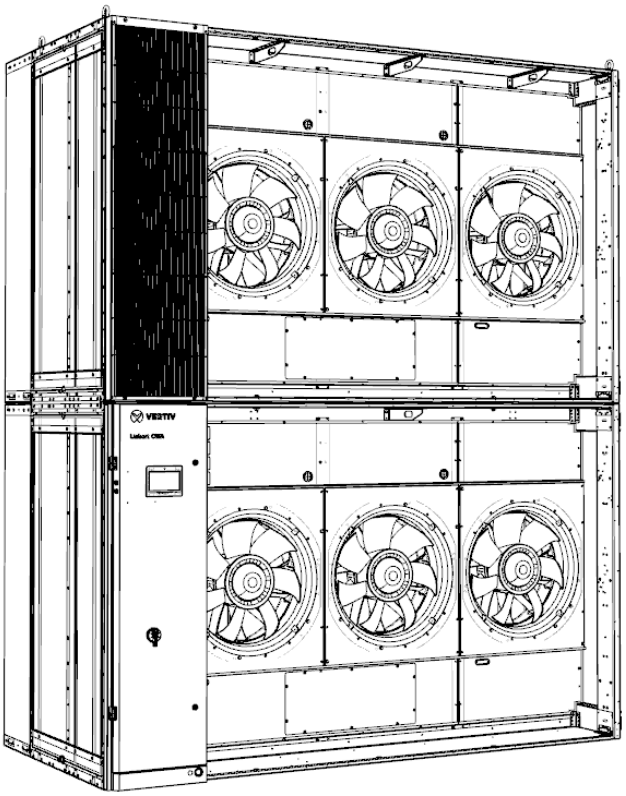
Ref.	Description	Remaks
P	**Damper section (x4)**	As an optional accessory, the unit might be equipped with damper on the supply side of the airflow. The damper consist of four sections for the entire unit, which are controlled simultaneously.
R	**Actuator for damper (x4)**	Each damper section is controlled by an actuator connected to the control system of the unit.
S	**Air bleed valve**	Each coil is equipped with access port for air bleed valve, used for venting the air from coil and pipes while filling the system with water. Another such access port is accessible from inside of the cabinet.
T	**Protective grill**	Standard configuration of the unit is not equipped with the dampers. In that case, the supply side of the unit is covered by a protective grill.
U	**Port for water drain valve**	Each coil is equipped with access port for the water drain valve, which is located in the right lower part of each module. Another such access port is accessible from inside of the cabinet.

** CA60 unit shown in the picture*

4.4. Fan type



Radial fan configuration



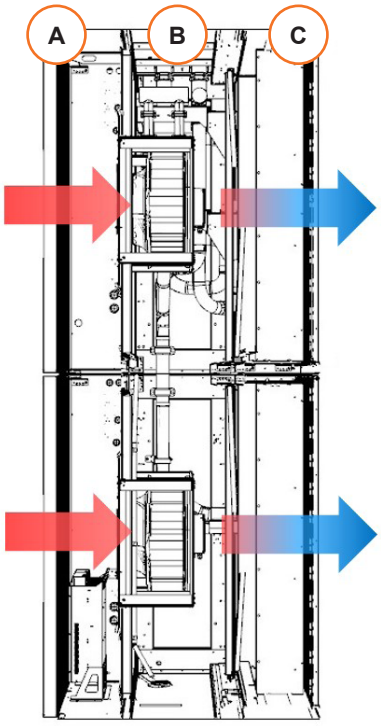
Axial fan configuration

- The **CWA CA60** unit is equipped with an array of six fans.
- 3 fans are located in the bottom module and 3 fans are located in the top module.
- Depending on the configuration, the unit may be equipped either with Radial fans or Axial fans.

Fan alternative	Number of fans			Fan impeller size	Fan motor size	Individual fan assy weight
	CA40	CA60	CA80	[mm]	[kW]	[kg]
Standard Axial Fan	4	6	8	630	3,80	45 kg
High Static Fan - HE	4	6	8	630	4,60	73 kg
High Static Fan - HP	4	6	8	630	8,00	75 kg
High Static Fan - D1	4	6	8	630	5,20	66 kg

NOTICE
Fan weight includes the fan with motor, nozzle and complete frame.

4.5. Air distribution

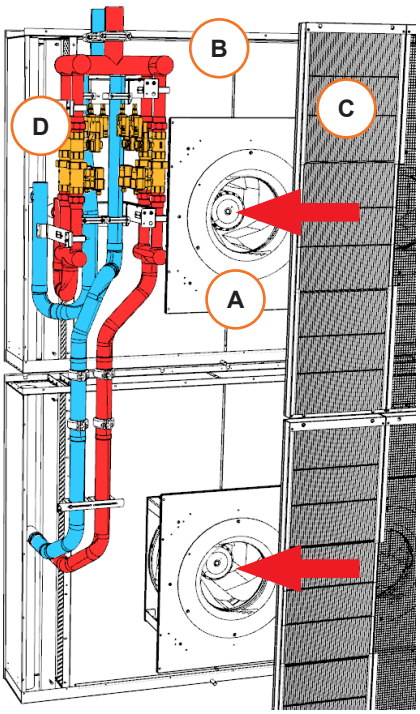


Warm air (return air from the room)

Cold air (supply air into the room)

- Chilled water array (**CWA**) unit is a blow-through type of unit.
- The unit cabinet consists of 3 basic sections:
  - Filter section **[A]**
  - Fan section **[B]**
  - Chilled water coil **[C]**
- The warm air returning from the room enters the unit through the block of filters **[A]** located on the front surface of the cabinet.
- The fan forces the warm air into the fan compartment **[B]**, over pressurizing the space and pushing the air through the coil **[C]** where it cools down.
- The cold supply air is discharged into the room.
- The cooling system of the unit is connected on site to the external chilled water supply.
- The unit might be equipped with additional damper, which would cover the discharge side of the unit.

4.6. Cooling system



Main components

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

Operating principle

This diagram shows a simplified scheme for **The CWA CA60** unit with PIC valve assembly.

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

The fan **[A]** sucks the return air through the filter section **[C]**, forces the warm air coming from the room to flow through the water coil **[B]**.
The chilled water flowing inside the coil cools down the air. This air is the discharged into the area.

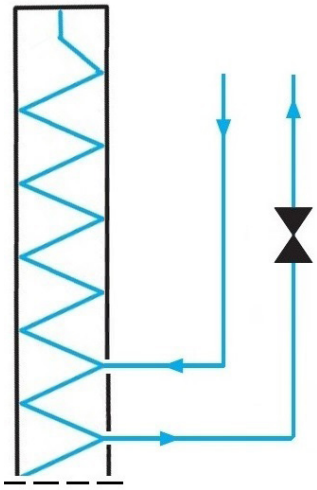
The control system operates the opening and closing of the water valve **[D]** at the water outlet to control the water flow rate to maintain desired operating conditions.

4.7. Water valve type

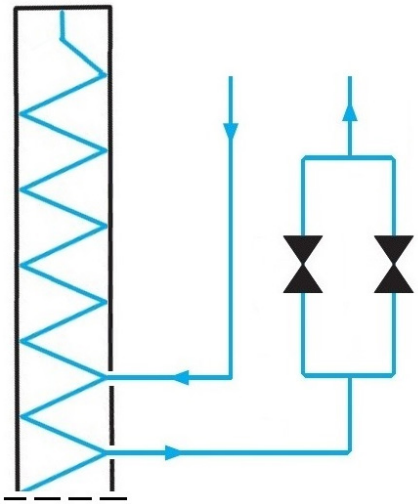
The unit can be, depending on size and configuration, equipped with either motorized ball valves or pressure independent control valves in single or twin assembly for each branch of the chilled water circuit.

Motorized ball valve

- Single valve configuration:

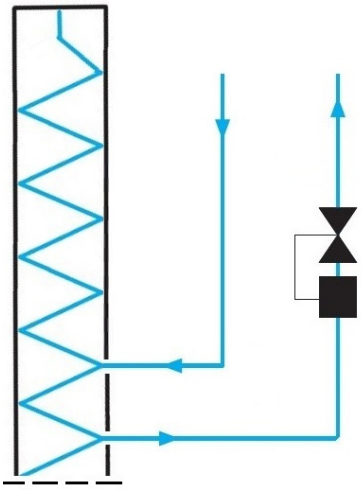


- Twin valve assembly:

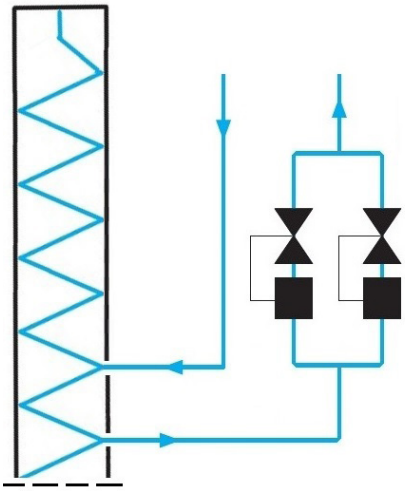


Pressure independent control valve (PICV)

- Single valve configuration:



- Twin valve assembly:



Pressure independent control valve option:

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

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.

Max. flow volume for PIC valves	[l/s]
2-valve configuration	9,6
4-valve configuration	19,2

4.8. Storage and operating conditions

4.8.1. 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.

4.8.2. Operating conditions

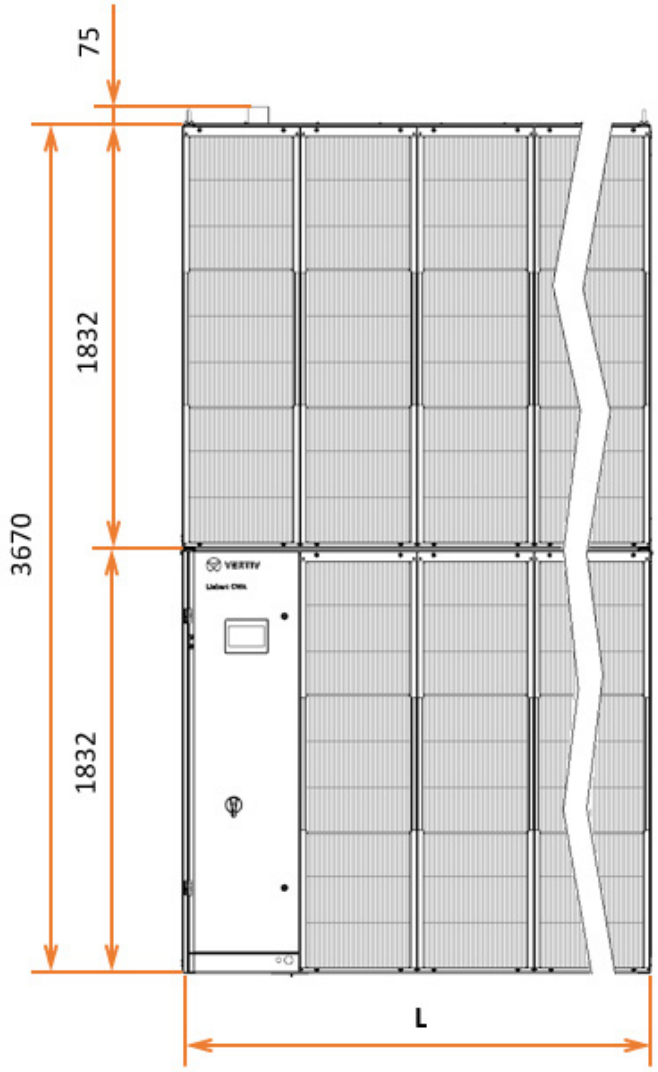
Ambient conditions for operation		
Operating environment	The unit is designed for indoor installation, protected from weather agents, with the following ambient conditions.	
Air returning to the unit inlet (indoors conditions)	Temperature	+24°C — +45°C
	Absolute humidity	6,5 — 12 g steam / kg air
	Relative humidity	20 — 35 %
	A lower thermal load will cause inaccurate temperature and humidity control	
Chilled water system	Minimum water inlet temperature	12°C
	Maximum water pressure	16 Bar
	Water-Glycol mixture	Up to 50% vol.
Power supply tolerance	Voltage	± 10%
	Frequency (EN 60204-1:2018)	± 0,5 Hz continuously ± 1,0 Hz short time
Maximum altitude without de-rating:		2000 m
Maximum air temp. without de-rating:		45°C

NOTICE

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

4.9. Dimensions and weights

4.9.1. Overall dimensions

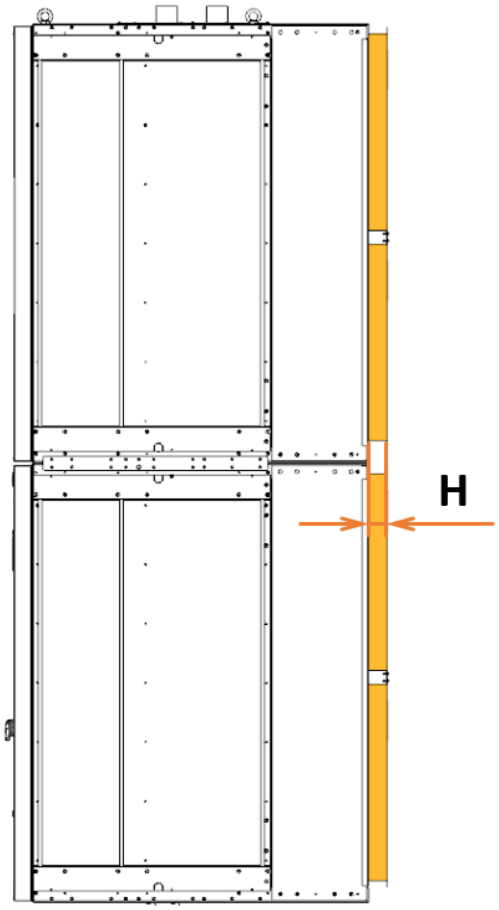


Dimensions	CA40	CA60	CA80
Unit Length * [mm]	2230	3050	3960
Depth [mm]	1480	1480	1480
Overall height ** [mm]	3670	3670	3670
** Chilled water connections are sticking 75 mm out of the top side.*			
*** The overall height consists of:*			
Bottom module [mm]	1832	1832	1832
Top module [mm]	1832	1832	1832

4.9.2. Optional accessory dimensions

Additional modules behind the unit

Dimensions	
Motorized discharge damper	H = 150 mm



NOTE:

- *The unit consists of two modules which are transported separately and need to be assembled and connected on site. The coupling kit and accessories are delivered with the unit.*
- *Optional motorized damper is delivered separately and needs to be attached to the unit during installation.*

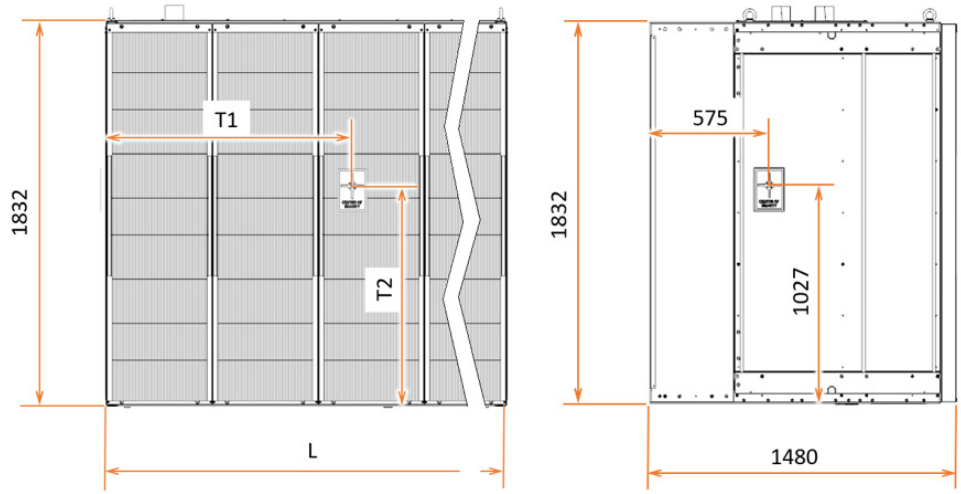
4.9.3. Weights

	CA40		CA60		CA80	
	Unit weight [kg]	Packaging [kg]	Unit weight [kg]	Packaging [kg]	Unit weight [kg]	Packaging [kg]
Top module	825	67	1100	92	1375	120
Bottom module	975	67	1300	92	1625	120
Total unit weight	1800	--	2400	--	3000	--

Weight of optional accessories	CA40	CA60	CA80
	[kg]	[kg]	[kg]
Damper	4 x 28	4 x 35	4 x 44
Active harmonics filter	35	35	35

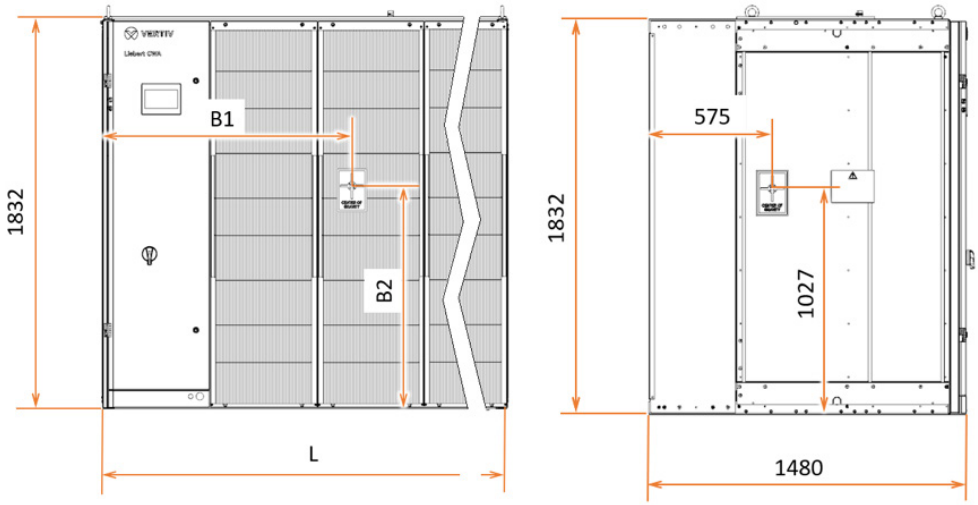
4.9.4. Center of gravity

Top module:



Unit	L [mm]	T1 [mm]	T2 [mm]
CA40	2230	975	1027
CA60	3050	1175	1027
CA80	3960	1375	1027

Bottom module:



Unit	L [mm]	B1 [mm]	B2 [mm]
CA40	2230	975	1027
CA60	3050	1175	1027
CA80	3960	1375	1027

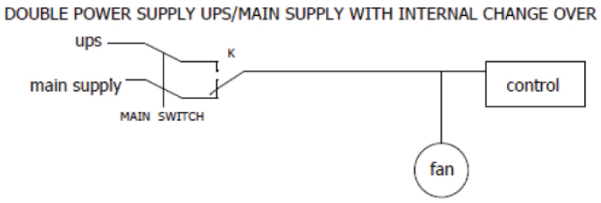
NOTICE
Picture shows approximate position of the center of gravity for basic unit.
The actual position may differ depending on the configuration and specific components such as fans, coils, or presence of the AHF.The exact position of the center of gravity might be different for bottom and top module.

4.10. 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.

4.10.1. Dual power supply – Alternate

Double power supply to the ATS electric panel,
which is connected to the main electric panel.
Each power supply can supply completely the unit.



What happens in case of power outage:

- In case of failure of the main supply, the **ATS** (Automatic Transfer Switch) automatically switches to the second power supply.
- If the Ultracap avoids power interruption to the control for the time needed for the switching, then the unit restarts with a “fast startup”, which means it restarts from the status before the power failure.
- Otherwise the unit restarts automatically from scratch and the control system reboots.

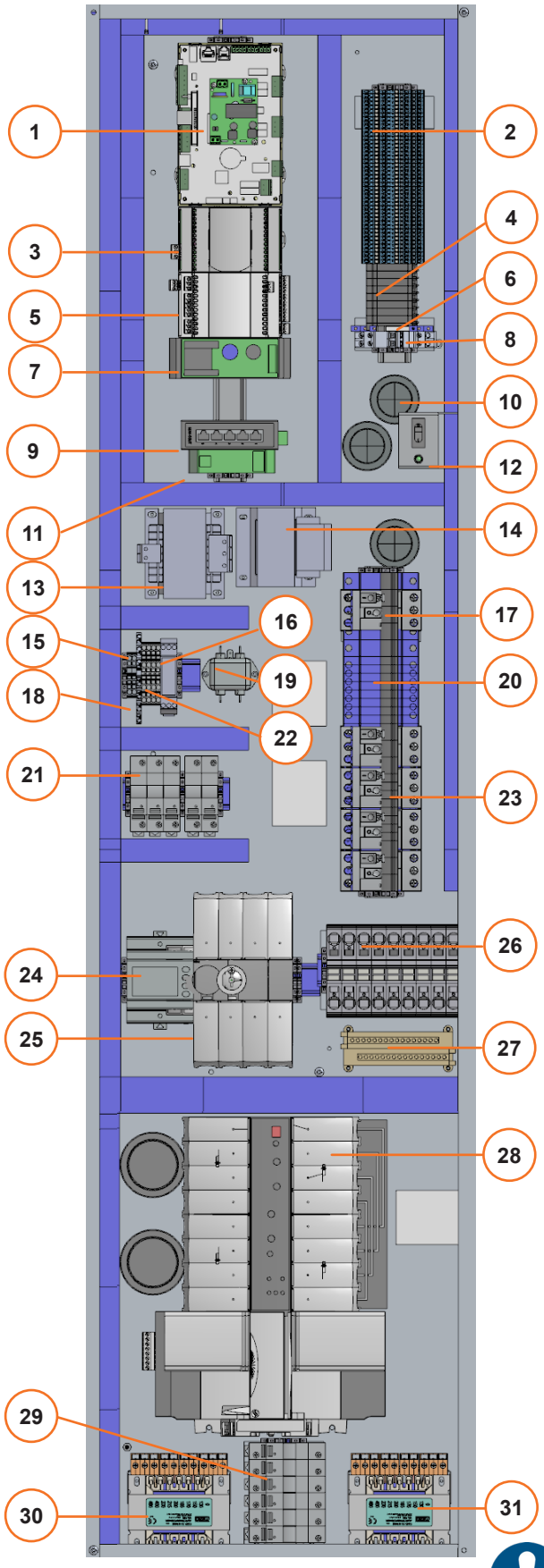
NOTE: *The Ultracap supplies power to the control for about **60** seconds.*

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.

4.10.2. Main components



Control side (LOW voltage)	
1	Control board
2	Terminal block
3	Ultracap module
4	Fuse modular terminal block
5	Expansion control board
6	Relay remote on/off
7	Feeder for touch screen
8	MAN / AUT switch
9	**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.*

10	Cutout for cables
11	Water detection digital board
12	**ON/OFF** switch with LED indicator

WARNING
This is not a disconnecting switch.
See *4.10.3 Disconnecting switches*

Power side (HIGH voltage)	
13	Transformer TC1
14	Transformer TC2
15	Spring terminal blocks
16	Seq. phase relay
17	Motor breaker
18	Spring terminal blocks
19	Anti-noise filter
20	Circuit breakers
21	Fuse holder
22	Spring terminal blocks
23	Motor breaker
24	Energy meter
25	Disconnecting switch
26	Main terminal blocks
27	Ground terminal block
28	ATS module
29	Fuse holders
30	Transformer TC3
31	Transformer TC4

NOTICE
The electric panel is shown with all possible standard components. Actual composition might differ depending on configuration.For specific list of components refer to the wiring diagram.

4.10.3. Disconnecting switches

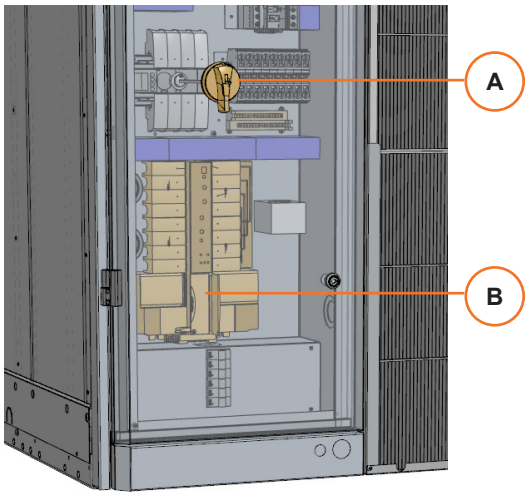
WARNING

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**.

4.10.4. Dual alternate power supply

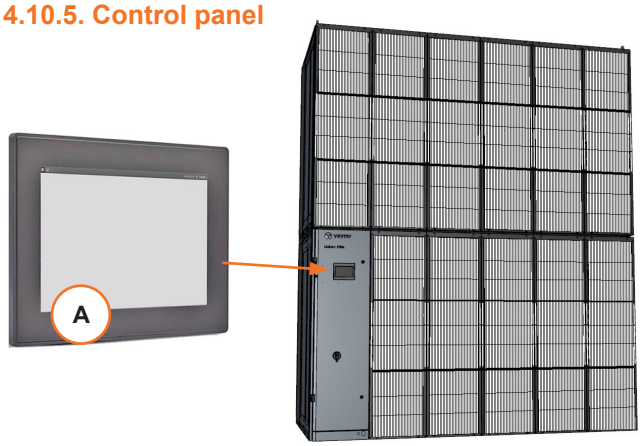


A	Standard disconnecting switch
B	ATS disconnecting switch

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.

4.10.5. Control panel

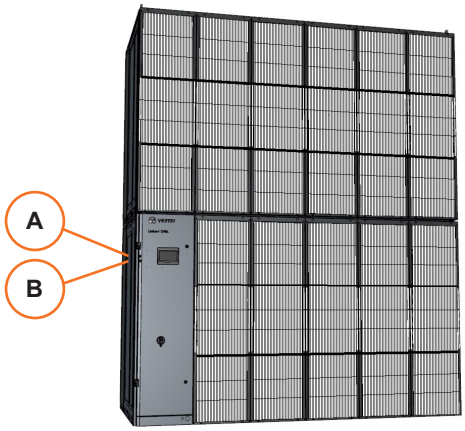


A	Control panel / touch screen

The unit is usually controlled remotely by network connection.

HMI display / touch screen control panel is located on the front door for direct control of the unit.

4.10.6. Ethernet connection



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

4.10.7. 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 *CWA Control Application User Manual* for details.

4.10.8. 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

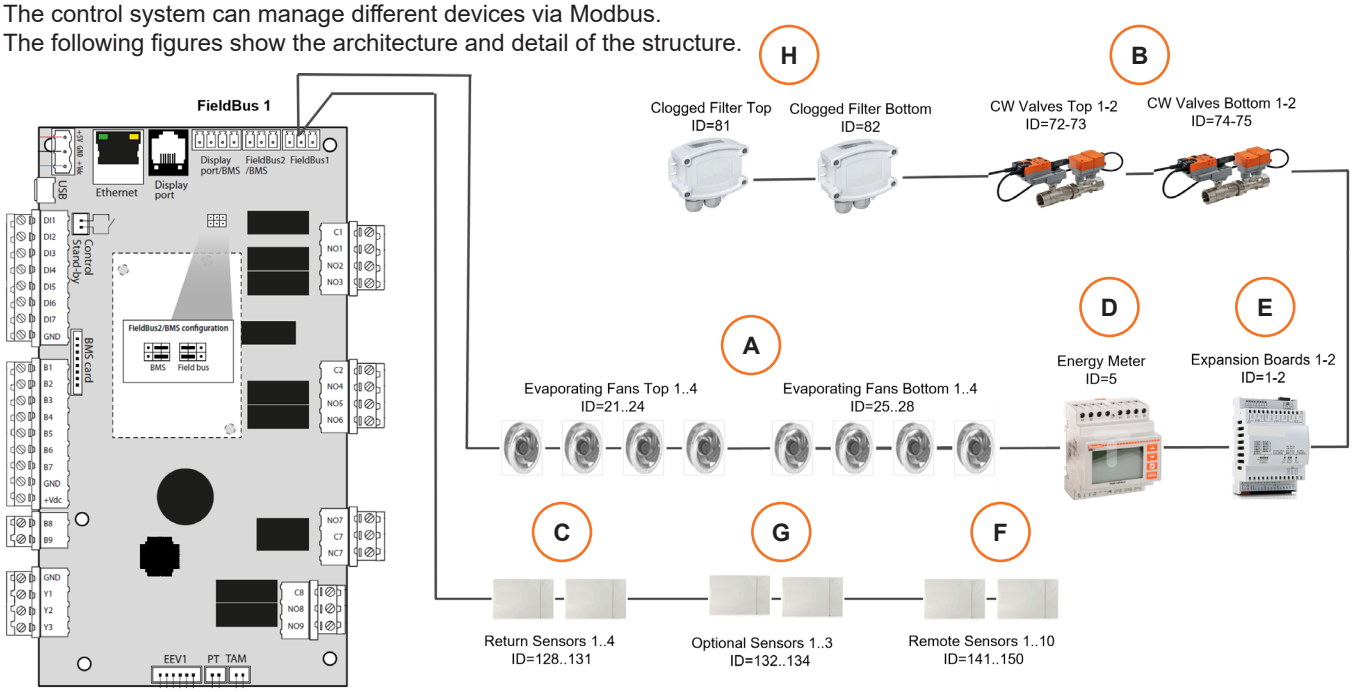
- Connection to the unit through Modbus protocol.
- If the Modbus connection is interrupted, then the fans continue to run at a preset speed.
- Speed adjustment between 0 and 100% of the maximum speed.

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

4.11. MODBUS connections

4.11.1. General description

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



A	EC fans top and bottom	**up to 4 + 4**
B	CW / PICV valves	**up to 2 + 2**
C	Return sensors T+H *	**up to 4**
D	Energy meter	

E	Expansion boards	up to 2
F	Remote sensors T+H	up to 10
G	Optional sensors T+H	up to 3
H	Clogged filter top and bottom	

NOTICE
*** The return sensors are selectable (Top / Bottom / Unit)**
"T" = temperature sensor; "H" = humidity sensor

4.11.2. 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 *4.11. Modbus Connections*.

4.11.3. 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 Return/Supply	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.
Delta Return/Remote	The control tries to achieve a constant delta T between return temperature and remote temperature. When the delta T is inside the dead band the fan speed will not change; when the delta T is outside the dead band the control will change (increasing or decreasing) the speed of the fan trying to put the delta T inside the dead band. • If the temperature difference Return - Remote is lower than the difference setpoint, then the fan will decrease the speed • If the temperature difference Return - Remote is higher than the difference setpoint, then the fan will increase the speed
Cooling	Fan speed will follow the same strategy (PI) used for the temperature control (coupled mode).
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:

Dehum. Speed	Defines the minimum fan speed when the dehumidification is ON (Default setting = 60%).
No Power Speed	Defines the minimum fan speed when the No Power event is active (Default setting = 50%).
Failure Speed	Defines the minimum fan speed in case of control sensor failure. **NOTE:** *The forcing is kept for 30 seconds once the control sensor goes back to being valid.*
High Return Temperature	If enabled the 'High Ret T Alarm' parameter defines the minimum fan speed when the High Return Temperature (unit) event is active (Default setting = 100%).
Modbus High Speed	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 100%.

5. Technical data

5.1 Water system

Chilled water coil

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

Unit	ESP (*) [Pa]	Return air temperature [°C]	RH [%]	Inlet water temperature [°C]	Outlet water temperature [°C]
SMART	50	36	30	18	26
NEXT GEN.	50	36	30	20	30

(*) External static pressure

Water valve

CW valve	Max differential Pressure [kPa]	Close-off Pressure [kPa]	Glycol mixture [%]	PN	Fluid temperature limit [°C]
PICV	350	1400	up to 50%	25	-10 … 120°C

Unit water volume

UNIT	Water volume [L]	
	SMART	NEXT GENERATION
CA40	156,8	192,4
CA60	192,6	243,6
CA80	295,0	295,0

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.

5.2 Air system

For details regarding the fan type and air distribution see chapters:

- *4.4 Fan type*
- *4.5 Air distribution*

5.3 Electrical system

5.3.1. 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 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 to Indoor unit control board.

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

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

Unit size	Fan alternative	Motor size	FLA @ 400V/50Hz	FLA	LRA	Recommended Circuit breaker (1)	Recommended wire size	Min./max. Cu cable size
		[kW]	[A]	[A]	[A]	[A]	[mm²]	[mm²]
CA40	Standard Axial Fan	4 x 3,80	4 x 6,0	24,9	25	40	3x10+1x10+1x10mm²	10...70mm²
	High Static Fan - HE	4 x 4,60	4 x 7,4	30,5	31	40	3x10+1x10+1x10mm²	10...70mm²
	High Static Fan - HP	4 x 8,00	4 x 10,4	42,5	43	50	3x16+1x16+1x16mm²	10...70mm²
	High Static Fan - D1	4 x 5,20	4 x 8,8	36,1	37	50	3x16+1x16+1x16mm²	10...70mm²
CA60	Standard Axial Fan	6 x 3,80	6 x 6,0	36,9	37	50	3x16+1x16+1x16mm²	10...70mm²
	High Static Fan - HE	6 x 4,60	6 x 7,4	45,3	46	63	3x25+1x16+1x16mm²	10...70mm²
	High Static Fan - HP	6 x 8,00	6 x 10,4	63,3	64	80	3x35+1x25+1x25mm²	10...70mm²
	High Static Fan - D1	6 x 5,20	6 x 8,8	53,7	54	63	3x25+1x16+1x16mm²	10...70mm²
CA80	Standard Axial Fan	8 x 3,80	8 x 6,0	48,9	49	63	3x25+1x16+1x16mm²	10...70mm²
	High Static Fan - HE	8 x 4,60	8 x 7,4	60,1	61	80	3x35+1x25+1x25mm²	10...70mm²
	High Static Fan - HP	8 x 8,00	8 x 10,4	84,1	85	100	3x50+1x25+1x25mm²	10...70mm²
	High Static Fan - D1	8 x 5,20	8 x 8,8	71,3	72	100	3x50+1x25+1x25mm²	10...70mm²

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

5.3.3. Electrical data for units with power supply 380V / 3ph +N / 60Hz + Earth

Unit size	Fan alternative	Motor size	FLA @ 380V/60Hz	FLA	LRA	Recommended Circuit breaker (1)	Recommended wire size	Min./max. Cu cable size
		[kW]	[A]	[A]	[A]	[A]	[mm²]	[mm²]
CA40	Standard Axial Fan	4 x 3,80	4 x 6,0	24,9	25	40	3x10+1x10+1x10mm²	10...70mm²
	High Static Fan - HE	4 x 4,60	4 x 7,4	30,5	31	40	3x10+1x10+1x10mm²	10...70mm²
	High Static Fan - HP	4 x 8,00	4 x 11,0	44,9	45	63	3x25+1x16+1x16mm²	10...70mm²
	High Static Fan - D1	4 x 5,20	4 x 8,8	36,1	37	50	3x16+1x16+1x16mm²	10...70mm²
CA60	Standard Axial Fan	6 x 3,80	6 x 6,0	36,9	37	50	3x16+1x16+1x16mm²	10...70mm²
	High Static Fan - HE	6 x 4,60	6 x 7,4	45,3	46	63	3x25+1x16+1x16mm²	10...70mm²
	High Static Fan - HP	6 x 8,00	6 x 11,0	66,9	67	80	3x35+1x25+1x25mm²	10...70mm²
	High Static Fan - D1	6 x 5,20	6 x 8,8	53,7	54	63	3x25+1x16+1x16mm²	10...70mm²
CA80	Standard Axial Fan	8 x 3,80	8 x 6,0	48,9	49	63	3x25+1x16+1x16mm²	10...70mm²
	High Static Fan - HE	8 x 4,60	8 x 7,4	60,1	61	80	3x35+1x25+1x25mm²	10...70mm²
	High Static Fan - HP	8 x 8,00	8 x 11,0	88,9	89	100	3x50+1x25+1x25mm²	10...70mm²
	High Static Fan - D1	8 x 5,20	8 x 8,8	71,3	72	100	3x50+1x25+1x25mm²	10...70mm²

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

5.3.4. Electrical data for units with power supply 460V / 3ph / 60Hz + Earth

Unit size	Fan alternative	Motor size	FLA @ 460V/60Hz	FLA	LRA	Recommended Circuit breaker (1)	Recommended wire size	Min./max. Cu cable size
		[kW]	[A]	[A]	[A]	[A]	[mm²]	[mm²]
CA40	Standard Axial Fan	4 x 3,80	4 x 4,7	20,6	21	40	3x10+1x10mm²	10...70mm²
	High Static Fan - HE	4 x 4,60	4 x 6,0	25,8	26	40	3x16+1x16mm²	10...70mm²
	High Static Fan - HP	4 x 8,00	4 x 9,1	38,2	39	50	3x10+1x10mm²	10...70mm²
	High Static Fan - D1	4 x 5,20	4 x 7,7	32,4	33	40	3x10+1x10mm²	10...70mm²
CA60	Standard Axial Fan	6 x 3,80	6 x 4,7	30,0	30	40	3x10+1x10mm²	10...70mm²
	High Static Fan - HE	6 x 4,60	6 x 6,0	37,8	38	50	3x16+1x16mm²	10...70mm²
	High Static Fan - HP	6 x 8,00	6 x 9,1	56,4	57	80	3x35+1x25mm²	10...70mm²
	High Static Fan - D1	6 x 5,20	6 x 7,7	47,7	48	63	3x25+1x16mm²	10...70mm²
CA80	Standard Axial Fan	8 x 3,80	8 x 4,7	39,4	40	50	3x16+1x16mm²	10...70mm²
	High Static Fan - HE	8 x 4,60	8 x 6,0	49,8	50	63	3x25+1x16mm²	10...70mm²
	High Static Fan - HP	8 x 8,00	8 x 9,1	74,6	75	100	3x50+1x25mm²	10...70mm²
	High Static Fan - D1	8 x 5,20	8 x 7,7	63,0	63	80	3x35+1x25mm²	10...70mm²

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

5.3.5. Noise level

Sound power level PWL and pressure level SPL at predefined distances:

Unit size	Fan type	Ref. UNI EN ISO 3744/3746	Sound power level PWL		SPL at 1m f.f.	SPL at 5m f.f.	SPL at 10m f.f.
		fan speed	[dB]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]
CA40	High Static Fan - HP	100%	106,9	102,4	82,5	74,8	70,1
CA60	High Static Fan - HP	100%	108,7	104,2	84,3	76,6	71,9
CA80	High Static Fan - HP	100%	110,0	105,5	85,6	77,9	73,2

6. 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.

6.1 Safety Instructions

WARNING

Improper operations can cause injury or death.

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

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

NOTICE

Improper operations can cause product damage.

NOTICE

Improper storage can cause product damage.

Keep the unit in a storehouse with the ambient conditions given in *4.8.1 Storage conditions*.

Carefully read the chapter *1. Safety*.

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

CAUTION

The center of gravity for either bottom or top module is not located in the middle of the cabinet.

Pay close attention to the labels located on the packaging and on the cabinet itself.

For position of the center of gravity, see chapter *4.9.4 – Center of gravity*

NOTICE

A professional rigger is required for lifting and moving the unit.

6.2 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.

6.3 Transport with Package

6.3.1 Using a fork lift or a pallet jack

CAUTION

The center of gravity for either bottom or top module is not located in the middle of the cabinet.

Pay close attention to the labels located on the packaging and on the cabinet itself.

For position of the center of gravity, see chapter *4.9.4 – Center of gravity*

Due to the weight and sheer dimensions of the modules, **it is not advised to use a single pallet jack** while handling the pallet with the module.

When using a forklift:

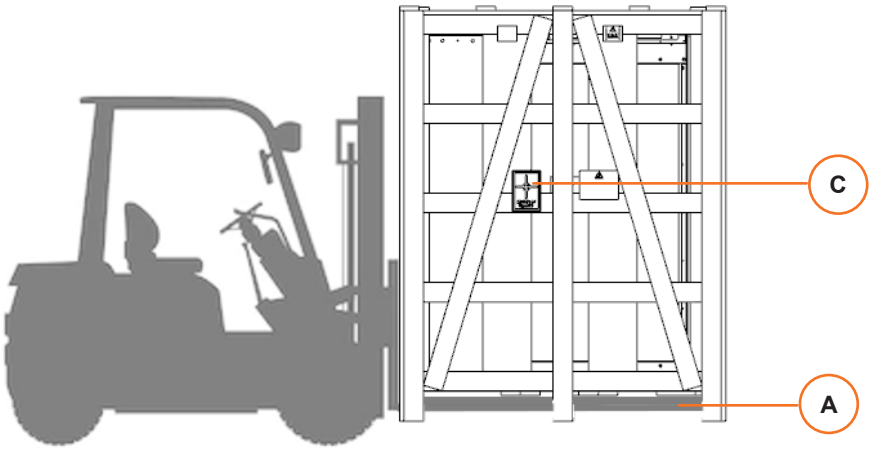
- Due to the weight of the module, consider proper counterweight to avoid overturning the vehicle.
- Due to the size of the module, use suitable carriage with forks long enough to support entire width of the pallet **[A].**
- Before lifting the module, spread the forks on the carriage as wide as possible **[B].**
- It is advised to lift the module from the side where the center of gravity would be closer to the vehicle **[C].**
- Refer to the local safety regulations about lifting and handling heavy loads.

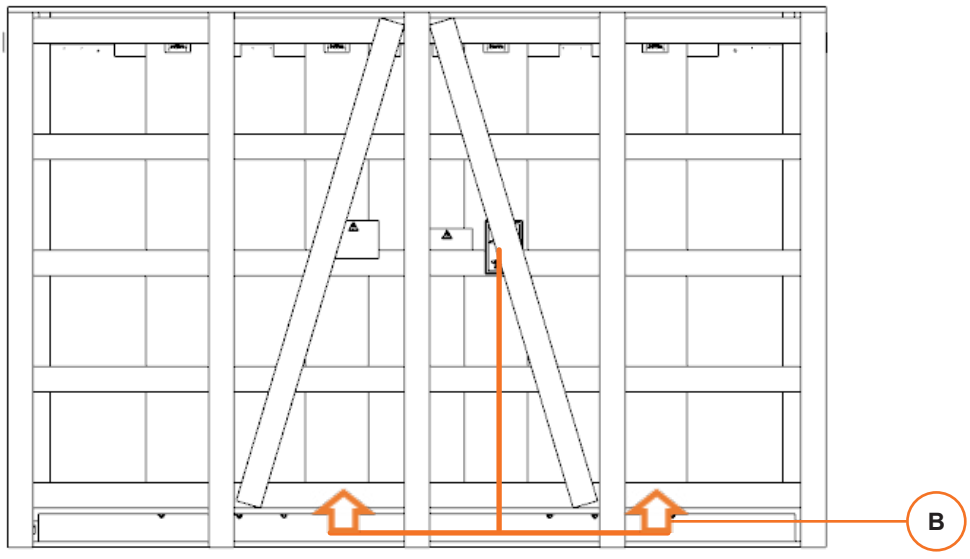
WARNING

• Pay attention to overhead obstacles, for example doorways.

• Only raise the load as high as necessary.

• Avoid abrupt turns, stops, starts and weight shifts.



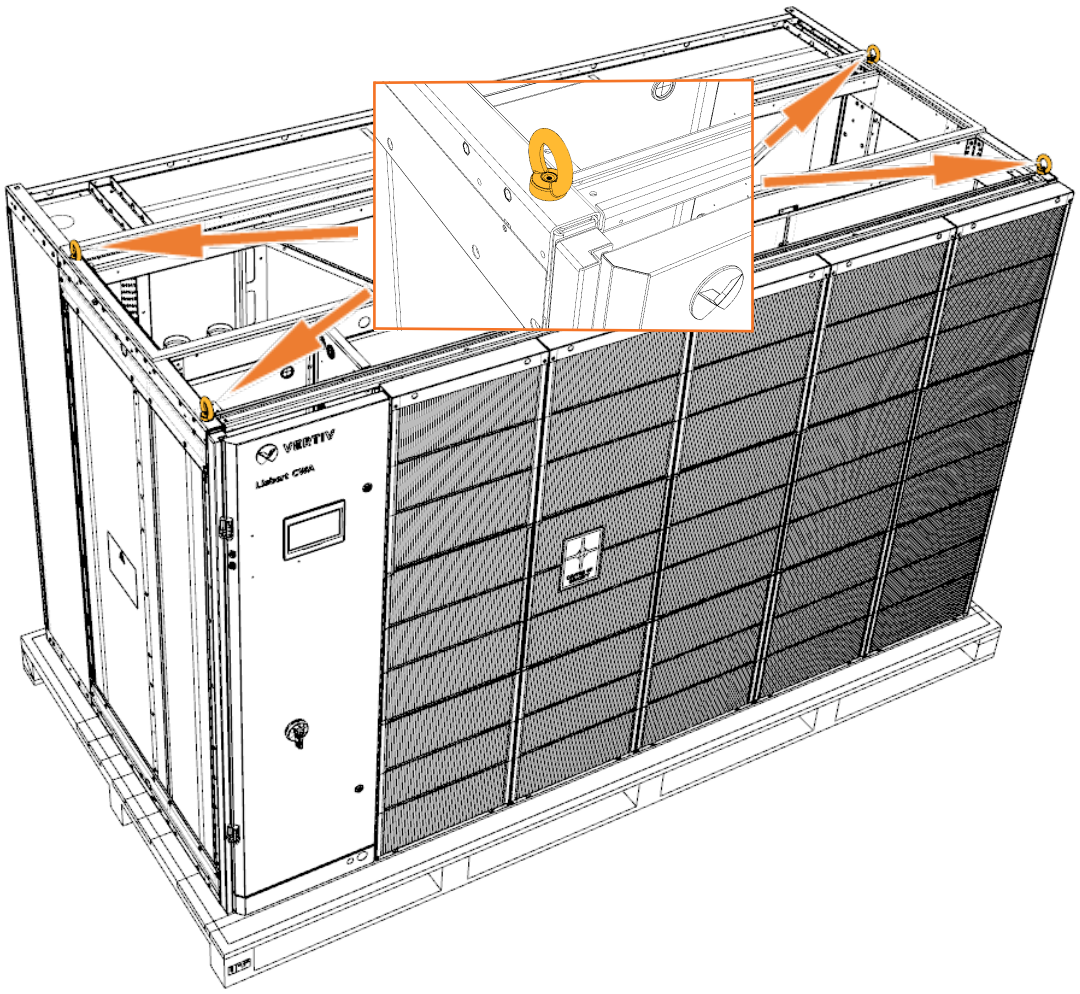


6.3.2. Lifting using a crane

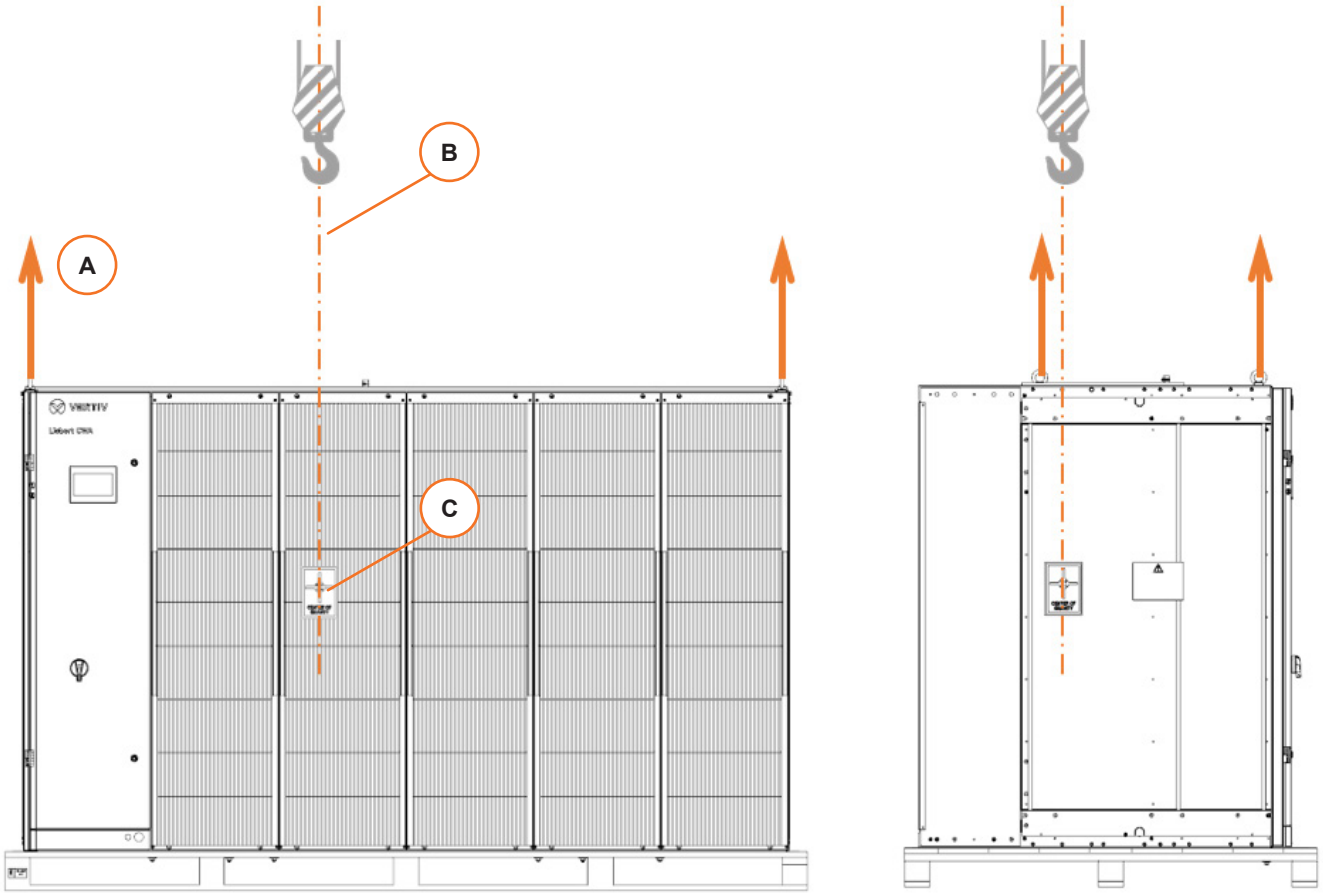
Before lifting the module with a crane, it is necessary to remove the wooden crate covering the lifting points – see chapter *6.4 – Unpacking*.

Lifting with a crane:

- Because the center of gravity of the module is not located in the middle, it is essential to use an adjustable spreader beam with lifting points suitable for lifting the module.
- Attach suitable slings or chains with hooks to the lifting eyebolts



The arrangement should be similar as shown in the reference picture:



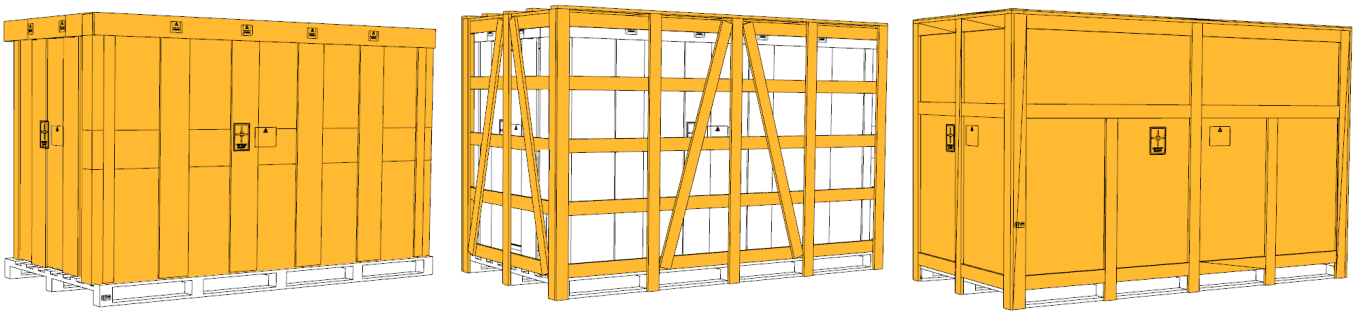
- It is important to have the slings attached vertically [**A**] to avoid unnecessary strain.
- The axis of the crane hook [**B**] should be directly above the center of gravity [**C**] to have the module properly balanced.

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

- Each module must be lifted separately.

WARNING
After coupling the bottom and top modules, it is not allowed to lift the assembly using any means.

6.4 Unpacking



[P] **[C]** **[S]**

The packaging options for the unit include:

- **[P] PLP and pallet** - Cardboard panels and protective corners, covered with stretch foil.
- **[C] PLP and wooden crate** - Additional protective wooden planks on top the covering cardboard.
- **[S] Seaworthy** - Full wooden crate.

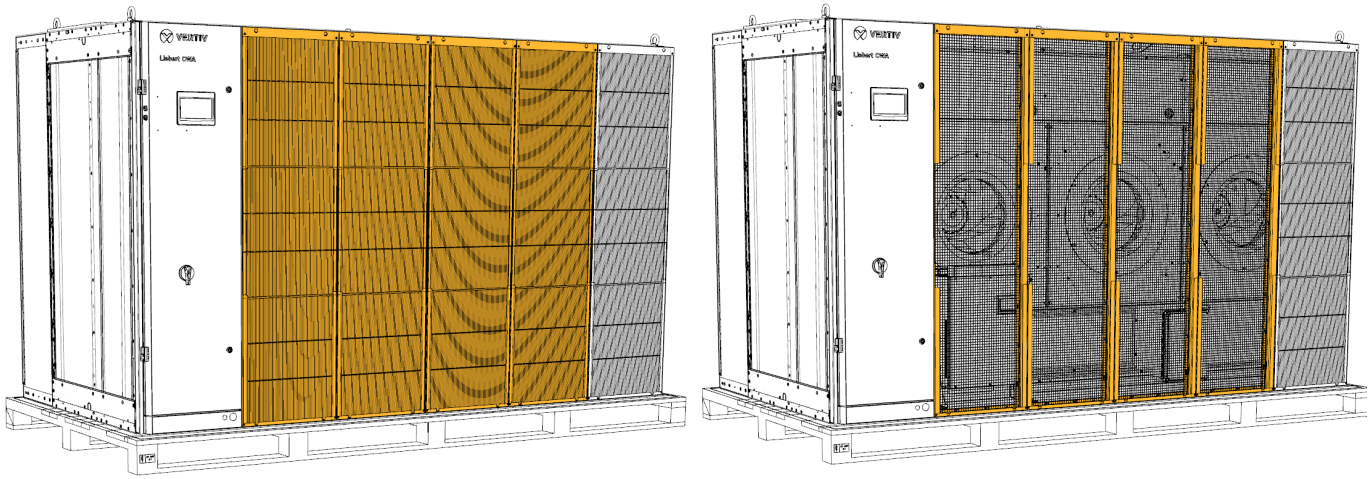
ENVIRONMENTAL NOTICE:

All material used to package this unit is recyclable.

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

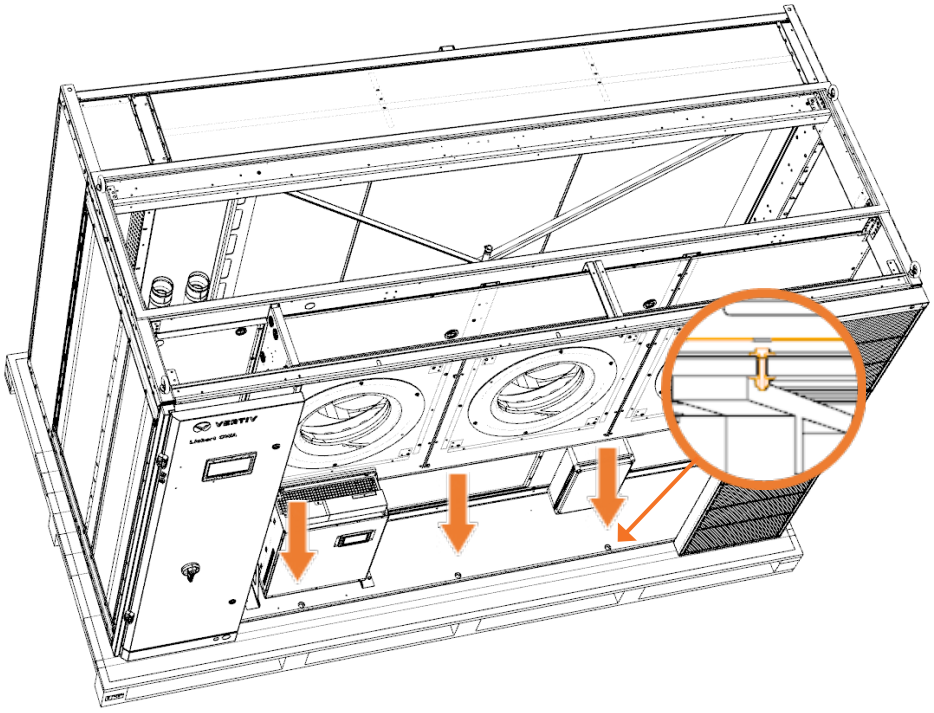
6.5 Removing the skid

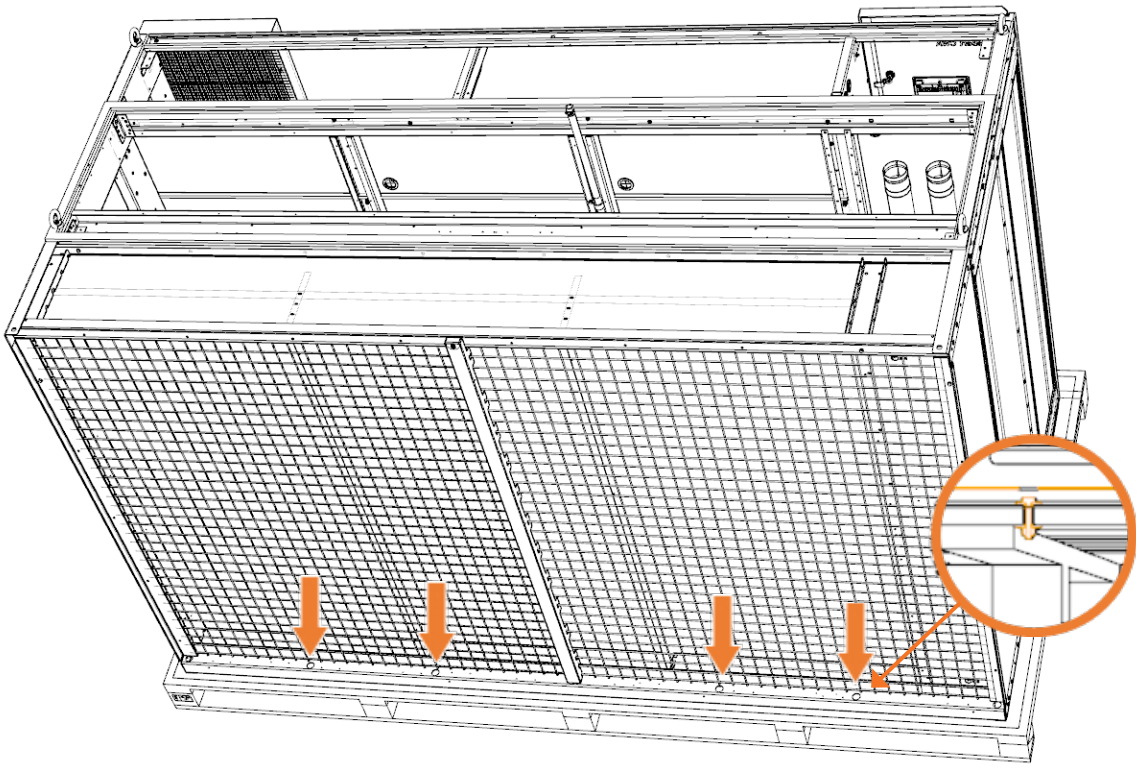
- Attach the module to the crane – see chapter *6.3.2 – Lifting using a crane.*
- Remove the filters from the four middle filter sections – the procedure how to remove the filters is described in chapter *10.6.2. – Replacing the air filters.*
- Remove the frames for these filters – See chapter *10.3. – Removing front access panels.*



- There are bolts with nuts fixing the module to the skid on the front side as well as bolts with nuts in the back..
- Remove these bolts
- Lift the module and remove the skid

Unit	No. of bolts	
	Front side	Back side
CA40	3	3
CA60	3	4
CA80	4	6





7. Assembly and positioning

7.1 Safety Instructions

WARNING

Improper operations can cause injury or death.

Verify that all the lifting and moving equipment is rated for the weight of the unit before attempting to move or lifting the modules.

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

NOTICE

Improper operations can cause product damage.

Read carefully the chapter *1. Safety*.

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

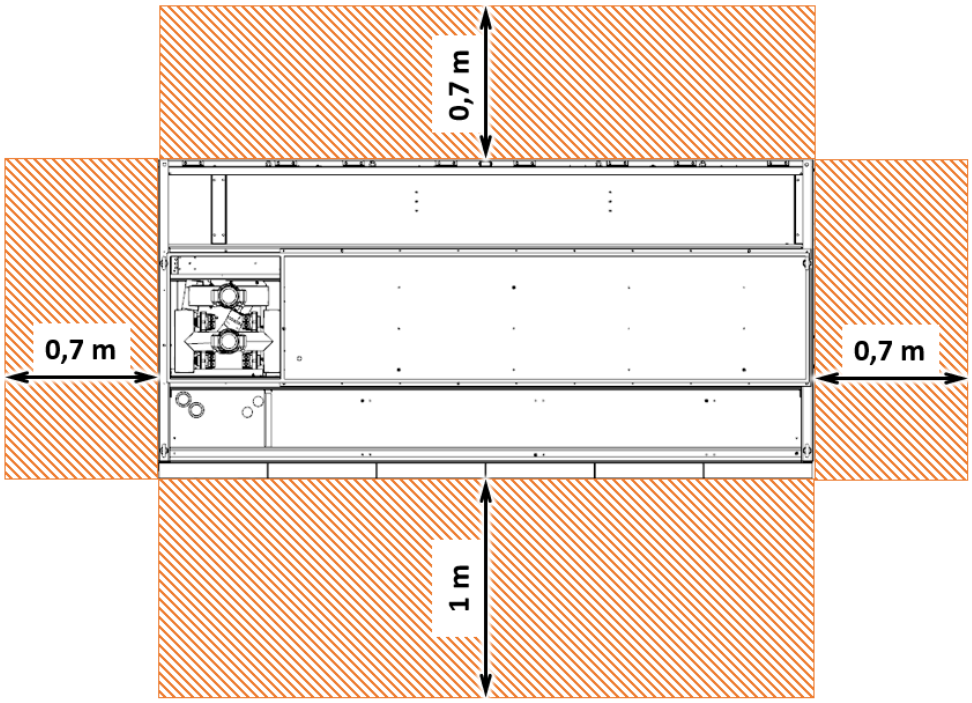
7.2 Assembly of the unit

- Make sure you have the space available for mounting operations at the installation site. Due to sheer size and weight of the unit, the final assembly needs to be done at the final location.
- The unit consists of two modules which are transported separately and need to be connected at the installation site.
- Coupling kit is supplied with the delivery and contains connecting pipes with clamps and coupling sheet metal together with screws, nuts, and other material.

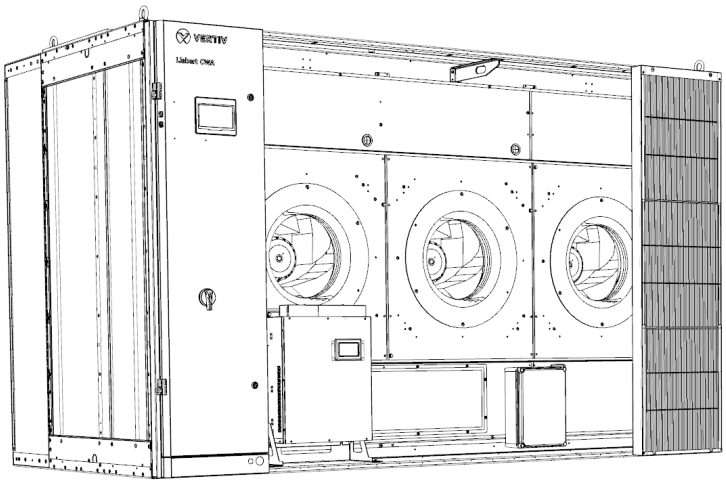
7.2.1. Area preparation

Prepare the location of the final installation prior to the arrival of the unit.

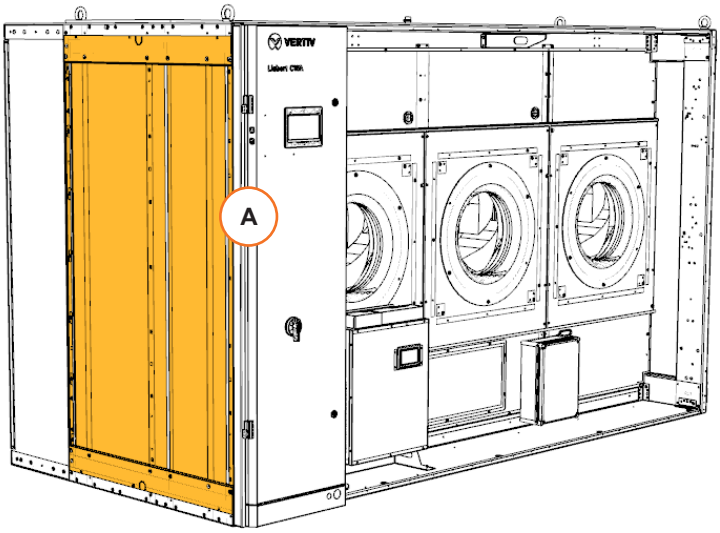
- Make sure the floor is suitable to sustain the weight of the complete unit assembly
- Sweep the floor clean and mark the final position and orientation of the unit
- Verify that all required clearances specified by **Vertiv™** are met
- Protect the stub outs for electrical connection and external chilled water connections to avoid any possible collision or damage during the installation
- For assembly operation, it is advised to leave at least 1 m free space in front of the unit and 0,7m behind the unit as well as on both sides to have access to the piping and fan assembly:



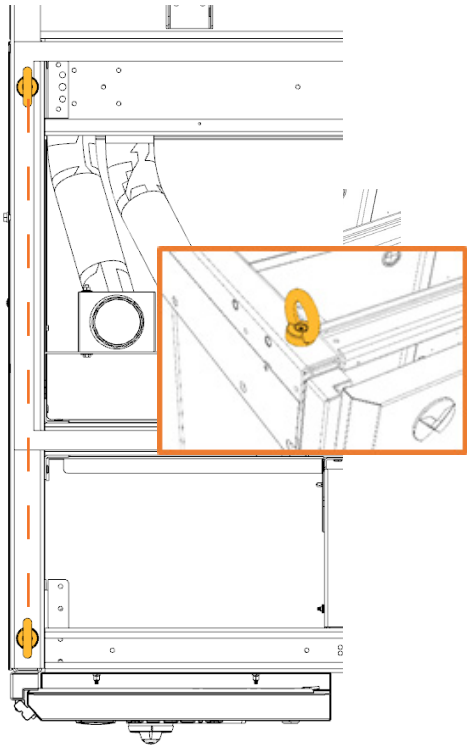
7.2.2. Unit assembly



- Bring the bottom section to the final location.
- Attach the module to the crane. See chapter *6.3.2 – Lifting using a crane*
- Remove the filters, filter frames and the skid from underneath the module as described in chapter *6.5. – Removing the skid*
- Place the module to the final position.



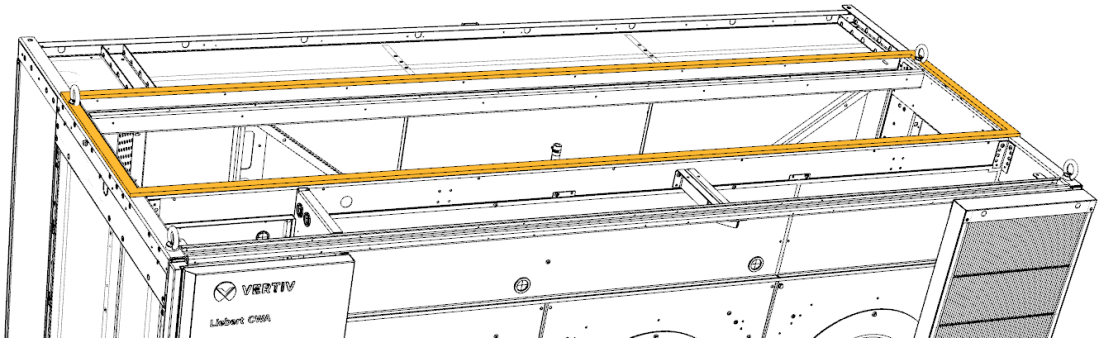
- For easier assembly and access to the pipe joints, remove the lateral panel **[A]**



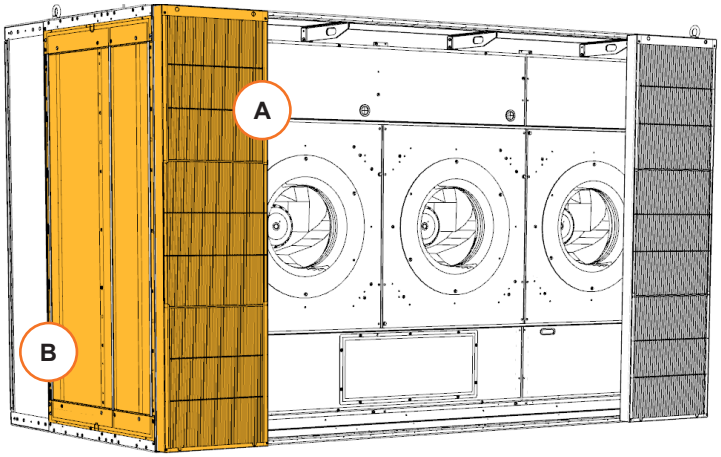
- It is possible to fix the module to the floor.

Fixing the unit to the floor is mandatory in case of “seismic” configuration – for more details see chapter *8.4.5.2. - Anchor points*

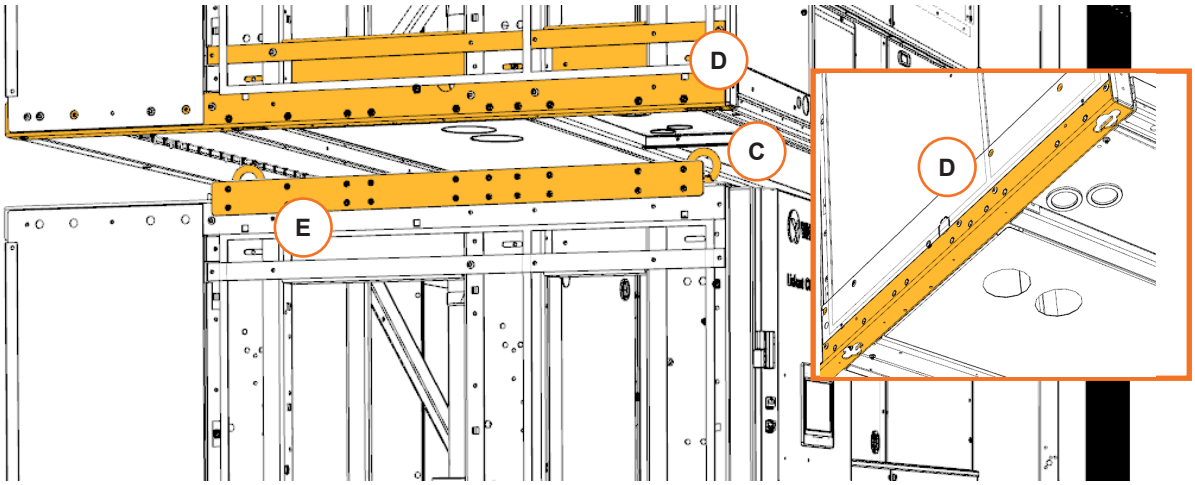
- Make sure all 4 eyebolts on top of the bottom module are properly aligned – each side needs to be in line.



- Check the presence of self adhesive gasket on the fan compartment of the bottom module. Pay attention to not damage this gasket during the next assembly operations.



- Bring the top module close to the final location.
- Attach the module to the crane. See chapter *6.3.2. – Lifting using a crane*
- Remove the filters and filter frames.
- For the top module remove also the filters and frame on the left side **[A]**
- For easier assembly and access to the pipe joints, remove the lateral panel **[B]**
- Remove the skid from underneath the module as described in chapter *6.5. – Removing the skid*



• Slightly loosen the bolts on the coupling plates [**E**] which are attached on both sides of the module.

• Lift the top module using a crane – for proper procedure, see chapter *6.3.2. – Lifting using a crane.*

• Move the top module over the prepared bottom module.

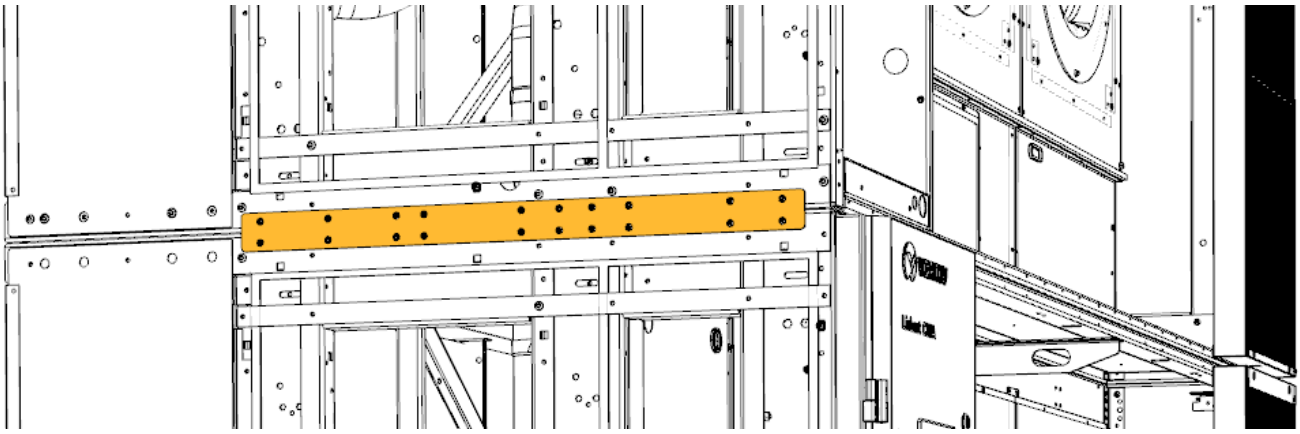
• Align the position of the eyebolts [**C**] with the corresponding openings [**D**] located at the bottom side of the top module.

• Carefully descend the top module onto the bottom module.

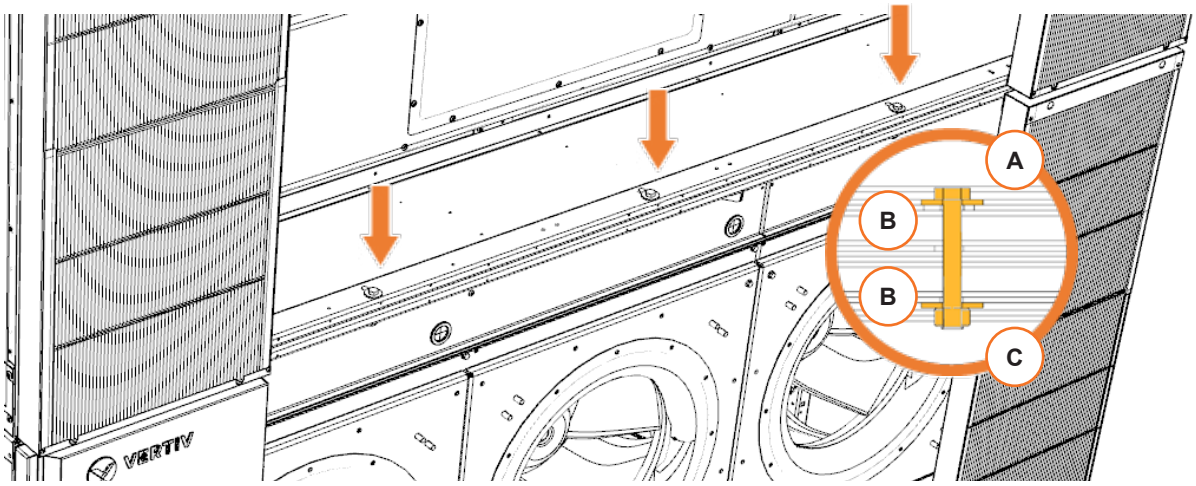
• The eyebolts must fit properly into the openings and the corners of both modules should be properly aligned.

• Pay attention to not damage the coupling plates [**E**] or the bolts.

• Be careful to not damage any cables or hoses which could stick out of the top or bottom modules. Move these out of the way to safely stack the modules.

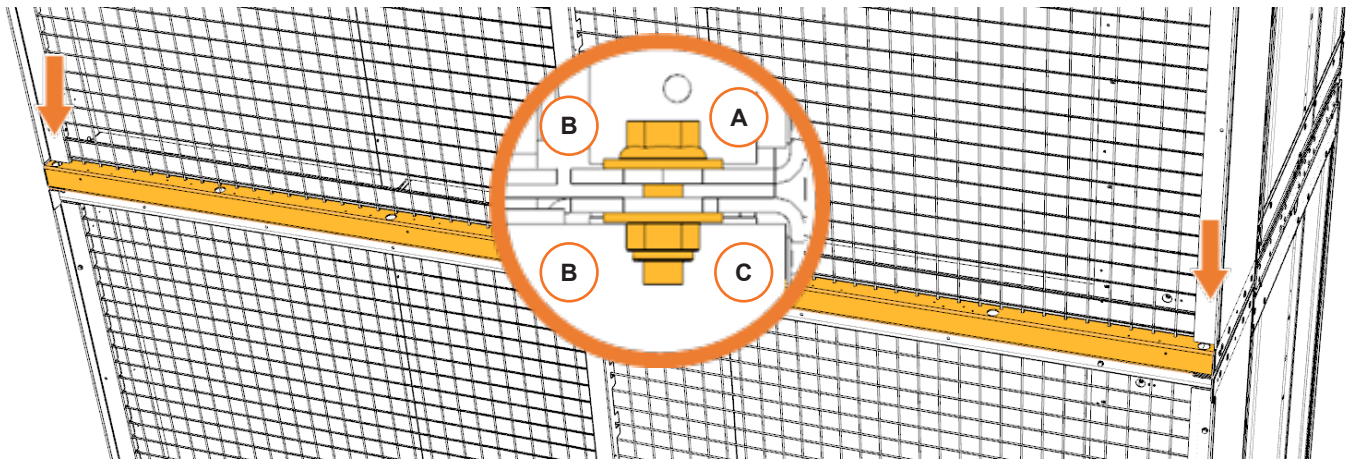


- Check the alignment of the holes on the coupling plate and the top module and fix it using 10 flanged bolts M8x25 for each side of the unit.
- Tighten the bolts on the bottom side.

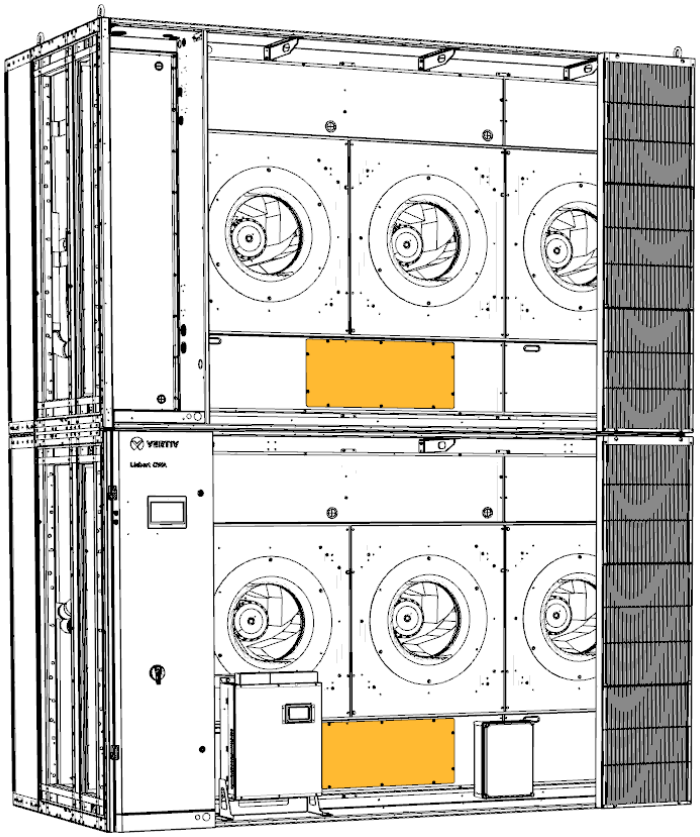


• Fix the bottom and top module together on the front side using screws M10x70 [**A**] with washers [**B**] and nut [**C**].
NOTE: *Seismic option requires more fixing points – see chapter 6.4.5.1 – Additional coupling plates*

Unit	No. of bolts	
	Front side	Back side
CA40	3	3
CA60	3	4
CA80	4	6



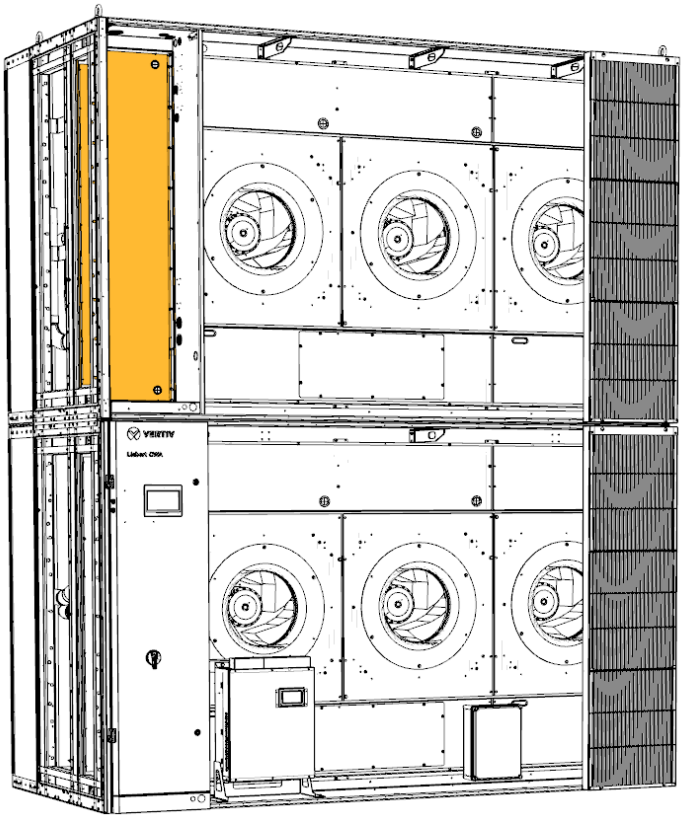
• Fix the bottom and top module together on the rear side using 2 screws M8x25 [**A**] with washers [**B**] and nut [**C**].
NOTE: *Seismic option requires more fixing points – see chapter 8.4.5.1 – Additional coupling plates*



- Remove the panels covering service access ports on both modules.

- Connect the drain pipes leading from top into bottom module – see chapter *7.4. – Arrangement of drain piping* and also chapter *8.4.6/7. – Condensate drain connection*

- Connect the electrical connections leading from the top fan array and sensors. For more information, see chapter *8.5.3. - Power and signal cable routings for motor fans*



- Remove the panel covering pipe assembly in the top module.

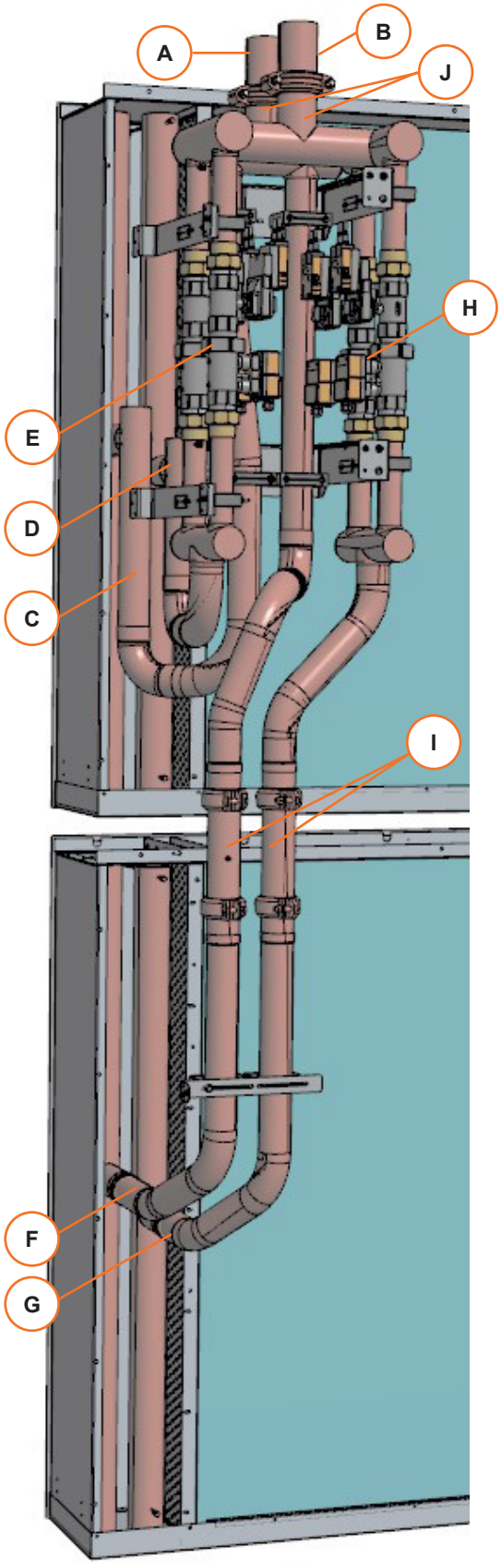
- Connect the top and bottom module chilled water circuits – see chapter *8.4.2. – Chilled water connections inside the unit*

- Connect the unit to the external chilled water source – see chapter *8.4.4. - Chilled water connection to the external source*

- Re-attach all the removed panels and the filter assembly.

7.3 Chilled water piping arrangement

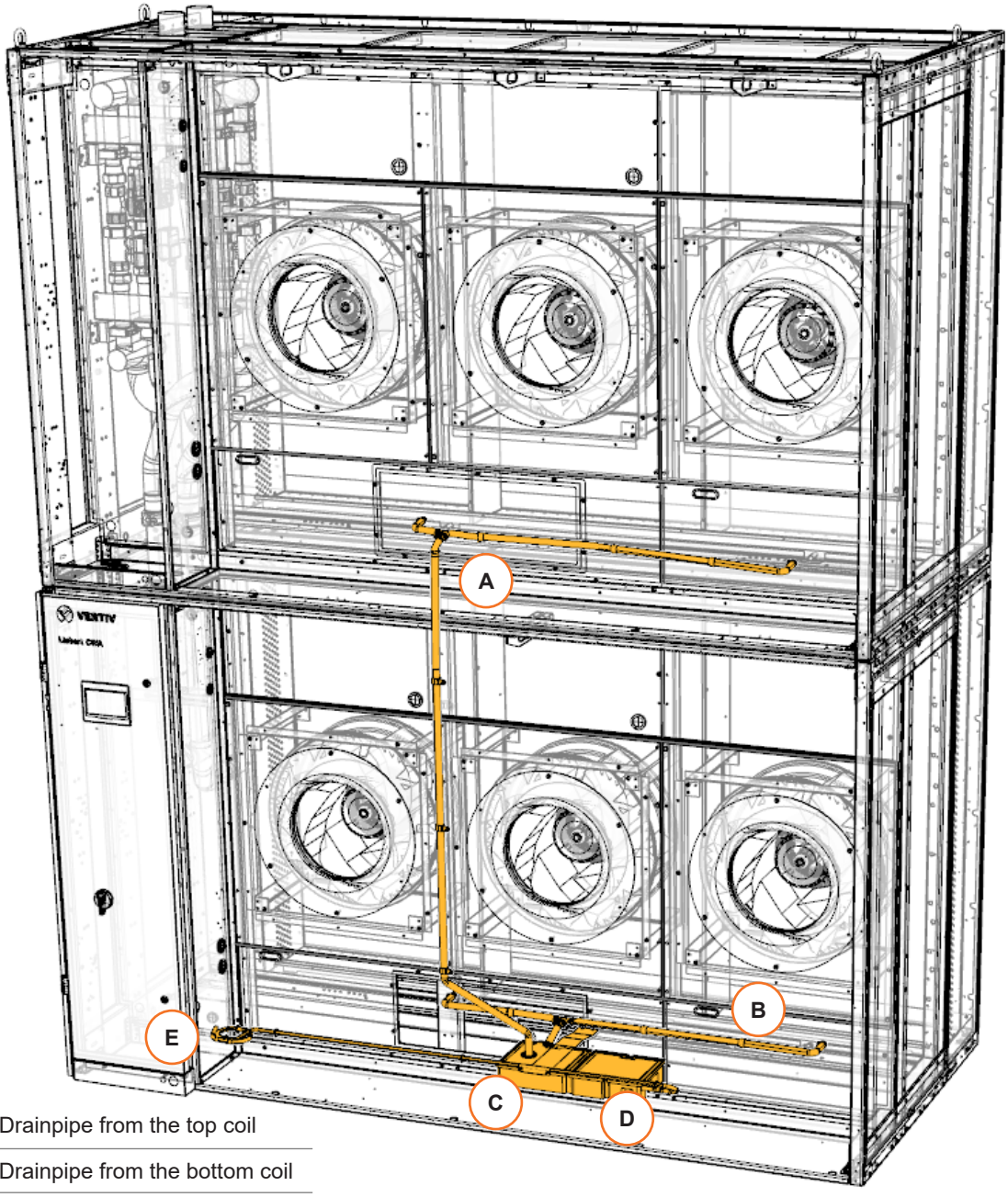
The unit is prepared for external chilled water supply with grooved connection.



A	Chilled water inlet pipe
B	Chilled water outlet pipe
C	Top coil inlet pipe
D	Top coil outlet pipe
E	Pressure independent control valves for top coil
F	Bottom coil inlet
G	Bottom coil outlet
H	Pressure independent control valves for bottom coil
I	Coupling joints for top and bottom module
J	Inlet / outlet water temperature sensors

7.4 Arrangement of the drain piping

- The drainpipes are connected inside of the unit cabinet
- If the unit is equipped with the drain pump, the drainpipes from the top and bottom modules lead into the reservoir. The water is the pumped out of the unit through the outlet hose.
- In case the unit is not equipped with a pump, the drainpipes are connected inside of the cabinet and lead directly into the outlet hose which can be connected to an external reservoir or pump.



A	Drainpipe from the top coil
B	Drainpipe from the bottom coil
C	Reservoir
D	Condensate pump
E	Outlet hose

For more details see chapters:

8.4.6. - Condensate drain connection – standard drain

8.4.7. - Condensate drain connection – condensate pump option

8. Installation

8.1 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.

8.2 Overview

8.2.1. Preparation of the installation site (by the customer)

NOTICE

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

The customer is responsible for the following operations:

Operation	See...
Prepare the area	*8.3.1. Location* *8.3.2. Space requirements*
Prepare the piping for the connection of the unit to the facility systems (chilled water, drainage)	*8.3.3. Chilled water piping requirements* *8.3.4. Condensate piping requirements*
Make sure that the water supply is suitable	*8.3.5. Water supply requirements*
Prepare the electric system	*8.3.6. Electric system requirements*

8.2.2. Operations on the unit

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

	Operation	See...
1	**Position the bottom module at the final location and fix it on the floor or the supporting structure**	*7. Assembly and positioning*
2	**Attach the top module on the bottom module**	*7.2.2. Unit assembly*
3	**Connect the power and signal cables inside the unit**	*8.5. Electrical connections*
4	**Connect the unit to the chilled water system**	*8.4.4. Chilled water connection to the external source*
5	**Connect the unit to the drain system**	*8.4.6. Condensate drain connection*
6	**Connect the electric power supply**	*8.5.2. Power supply connection*
7	**Connect the electric equipment to the electric panel**	*8.5.4. Contacts for the unit status signals* *8.5.6. Sensor connections*
8	**Check or adjust the Modbus settings**	*8.6. Modbus connections and settings*
9	**Fill the ethylene glycol**	*8.7. Filling the water system*
10	**Check the whole system**	*8.8. Final checks*
11	**Start the unit**	*9. Operation*

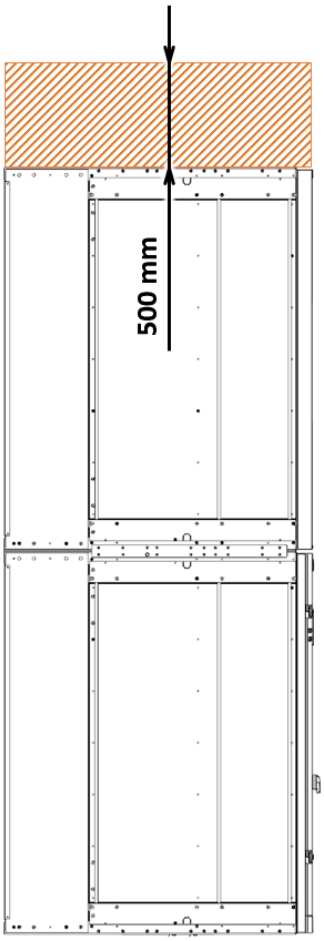
8.3 Specification for site preparation

8.3.1 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.

8.3.2. Required free space above the unit

- Grant minimum vertical clearance of at least 0,5 m between the top the unit and the nearest obstacle for service access to unit piping, electrical connections, and return air.

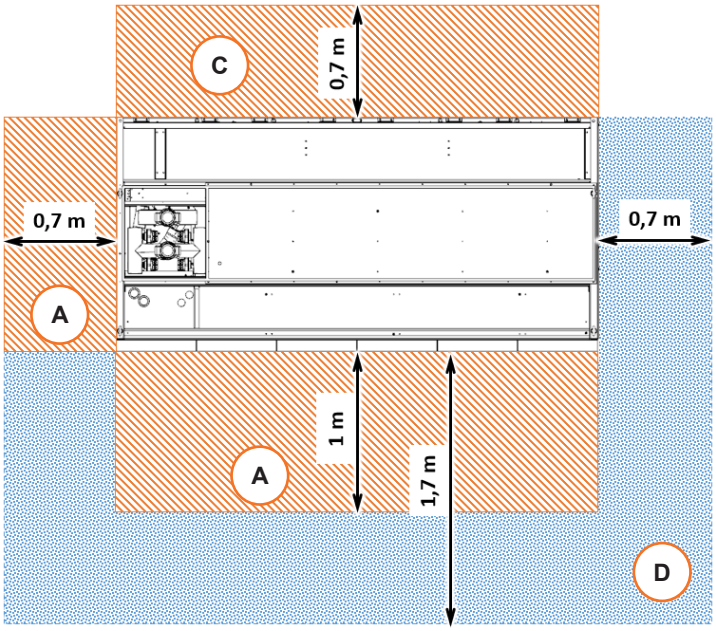


Data hall side

Gallery side

8.3.3. Space requirements

- See *chapters 4.9.1.* for dimensions and *4.9.3.* for weights of the unit



NOTICE
For maintenance or repair operations, keep a free space between the unit and any obstacle as described below.

- **Regular maintenance:** leave a free space of at least 1m on the front [**A**] to allow safe maintenance operations.
- **Pipe and valve maintenance:** leave free space of at least 0,7m on the lateral side of the unit [**B**].
- **Unit with damper:** leave at least 0,7m free space behind the unit [**C**] to access the actuators and blades.
- **To remove the unit:** In exceptional cases, it might be necessary to move the unit from its location.

It must be granted at least 1,7m from the front side of the unit as well as at least 0,7m on both sides of the unit [**D**] depending on site equipment and available tools.

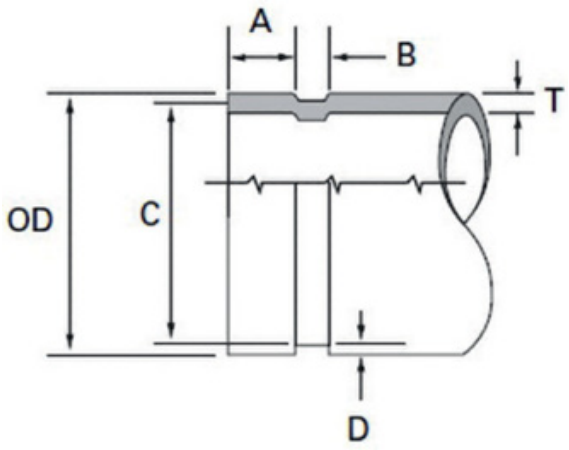
NOTICE
For maintenance or repair operations, keep a free space between the unit and any obstacle as described below.

8.3.4. Chilled water piping requirements

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

Material	Use copper or steel (Mannesmann) tubing.
Threaded connections	In case of threaded connections use hemp and paste to get a reliable pressure - tight joint.
Grooved connections	See chapter *8.4.3. Joining pipes with the Grooved connection* for details regarding the assembly.

Grooved connections details:

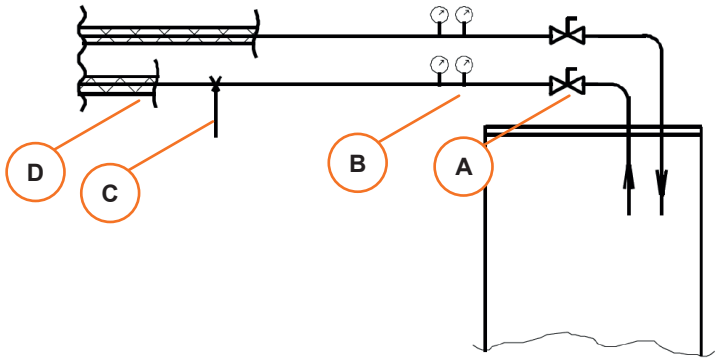


Dimension		Tolerance	Nominal size	
			76 mm	89 mm
Actual outside diam.	min.	-	75,34	88,01
	max	-	76,86	89,69
Gasket seat	A	± 0,8 mm	15,87	15,88
Groove width	B	+ 0,8 / -0 mm	8,74	8,74
Groove diameter	C	+ 0 / -0,5 mm	72,26	84,94
Groove depth	D	ref. only	1,98	1,98
Max allowed flare diameter		-	78,7	91,7

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 such as Armaflex®
Piping layout	Prepare the external piping as following: • Place shut-off ball valves [**A**] at the unit 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 Armaflex® insulation [**D**]. 

8.3.5. Condensate piping requirements

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

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

8.3.6. Water supply requirements

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

Analyze the water

It is the user's responsibility to establish the quality of the water and make sure that this is compatible with the materials used in the exchangers.

The quality of water may significantly affect the operation and the life of the exchangers.

The first step in the planning the treatment of the water is chemical analysis, which must be performed by qualified personnel from specialist organizations.

Water quality must be in accordance with VDI 2035.

Add water softeners

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

Prevent corrosion

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).

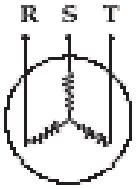
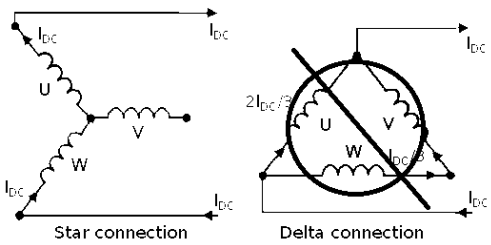
A combined effect of fouling due to dust and organic material provides a support for bacteria, fungi and algae; the growth of organisms may produce an oxygen gradient, and this results in rather severe pitting of the metallic surface.

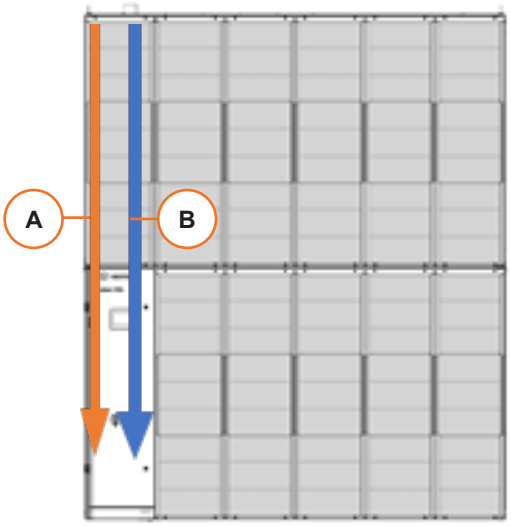
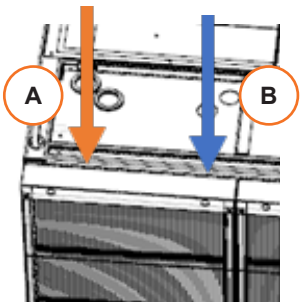
The phenomenon of corrosion is obviously related to the material used on the liquid side of the heat exchanger.

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
CJ-	ppm	< 50
PO_4^{3-}	ppm	< 2,0
NH_3	ppm	< 0,5
Free chlorine	ppm	< 0,5
Fe^{3+}	ppm	< 0,5
Mn^{++}	ppm	< 0,05
CO_2	ppm	< 50
H_2S	ppm	< 50
Temperature	°C	< 65
O_2 content	ppm	< 0,1

8.3.7. Electric system requirements

Power supply requirements for the unit	• Check the electrical data on the label applied on the unit. • Check that the available power supply is consistent with the unit power requirements given in *5. 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. • 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 3% See the figure below for variability evaluation. Example of calculating phase to phase variability 1) The 400 V supply has the following variability: RS = 388 V ST = 401 V RT = 402 V  2) The average voltage is: $\frac{388 + 401 + 402}{3} = 397$ 3) The deviation from the average is: 397 – 388 = 9 V 401 - 397 = 4 V 402 - 397 = 5 V 4) The phase-to-phase variability is: $\frac{\text{maximum voltage deviation}}{\text{average voltage}} * 100\% = \frac{9}{397} * 100\% = 2{,}267\%$ (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	  • The main power cable **[A]** is routed from top of the unit, through the top module into the electric panel in the bottom module. • The external low voltage signal cable **[B]** is routed from top of the unit, through the top module into the electric panel in the bottom module. • The connection for remote **ON-OFF** must be done by 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.

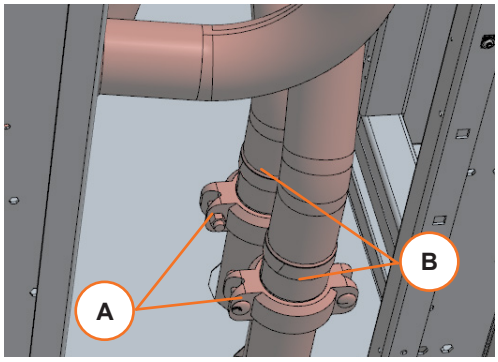
8.4 Piping connections

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

8.4.1. 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 m.

8.4.2. Chilled water connections inside the unit



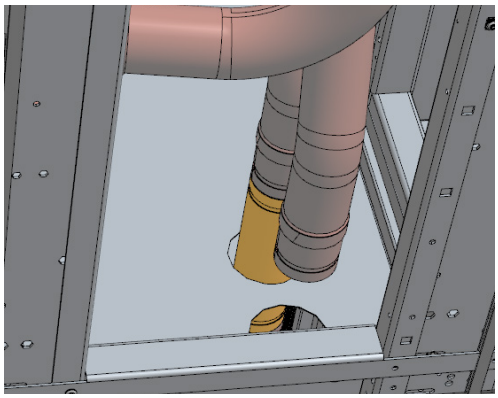
• Because the unit is transported divided in two separate modules, it is necessary to connect the chilled water circuits inside of the unit during the assembly.

• Standard packaging contains clamps **[A]** and connecting pipes **[B]**.

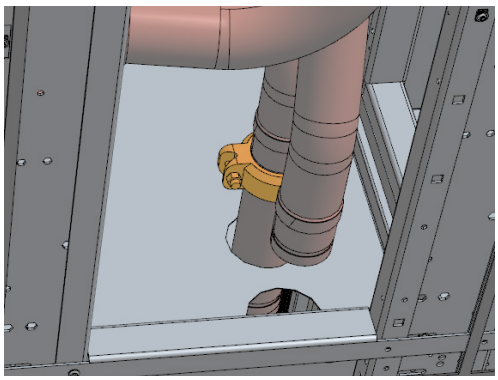
• During the transport, the piping is closed by plastic caps.

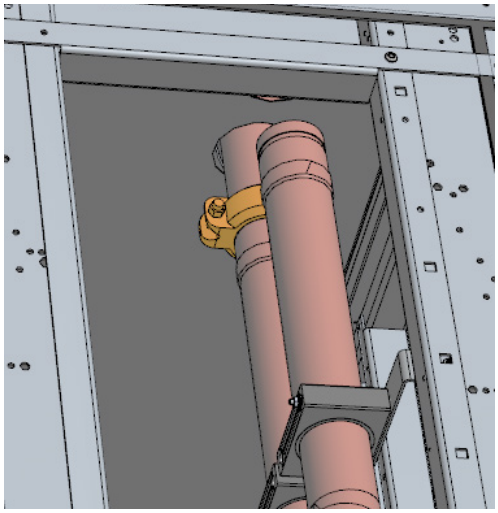
These caps need to be removed before further assembly.

• For easier access, remove the lateral side panels on both the bottom and top modules as well as frontal access panel on the top module.

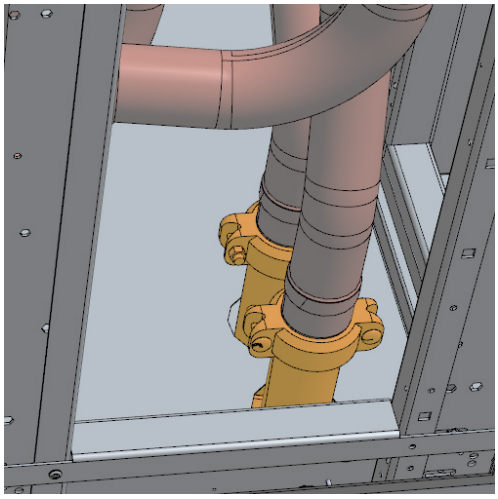


Align the position of the top and bottom piping and insert the connecting segment.





Fix the connecting segment using the clamps for grooved connection – for more details see chapter *8.4.3. – Joining pipes with the grooved connection*.



Repeat the assembly procedure for both inlet and outlet pipe.

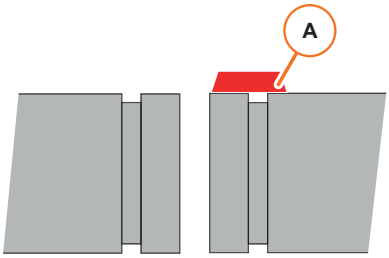
After the assembly, cover the joint with Armaflex or similar insulating material.

8.4.3. Joining pipes with the grooved connection

Check the pipe ends:

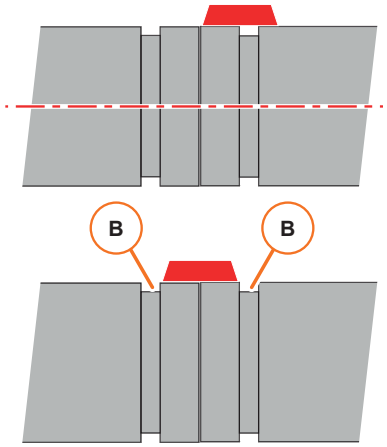
- Make sure that the outside surface between the groove and the end is smooth and clean.
- Remove any residual of oil, grease, dirt, and particles.
- Lubricate the gasket:

  Apply a thin coat of suitable lubricant or silicone lubricant to the gasket lips and exterior.



Insert the gasket:

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

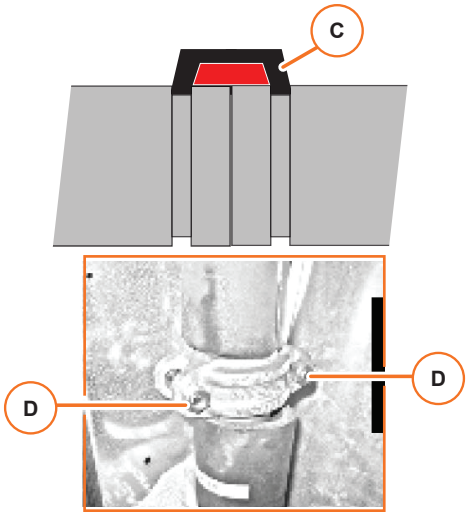


Join the ends:

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

NOTICE

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



Join the pipes:

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

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

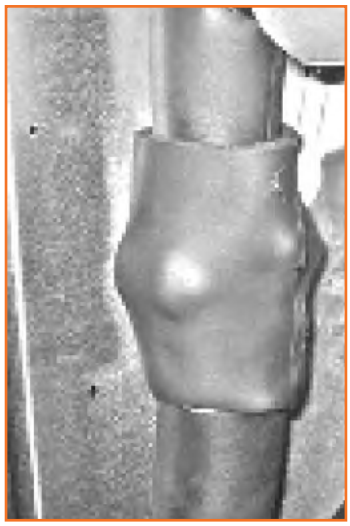
NOTICE

Leakage may occur if the gasket is pinched or damaged.

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

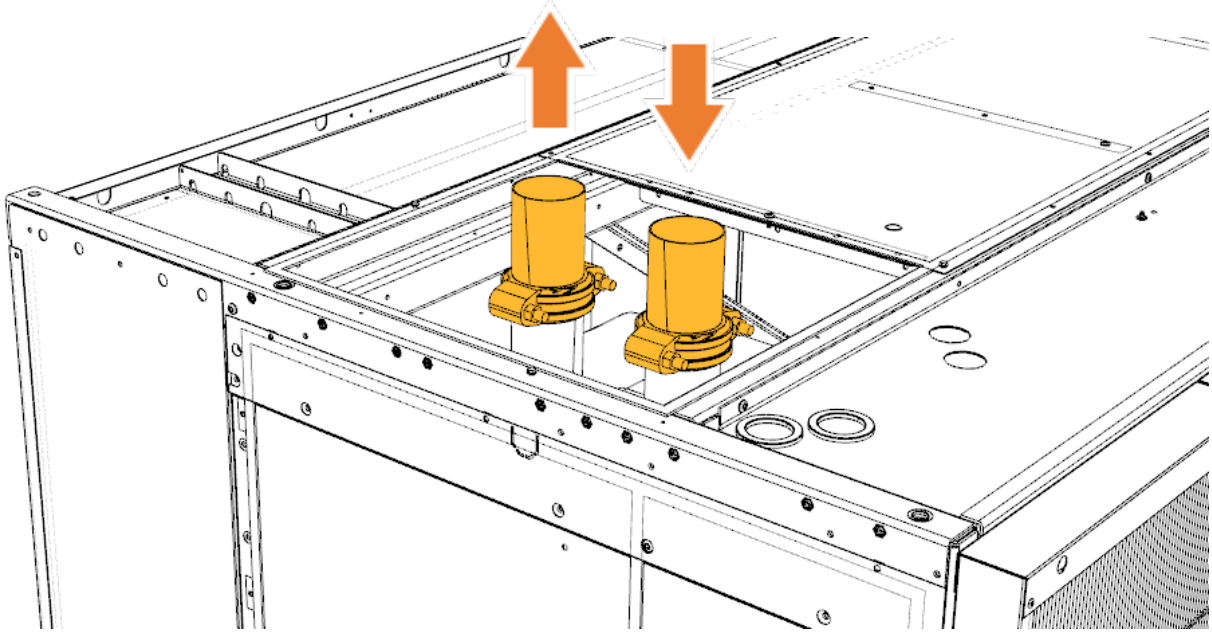
This is necessary to ensure a rigid joint.

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



- Cover the connection with Armaflex® insulation.

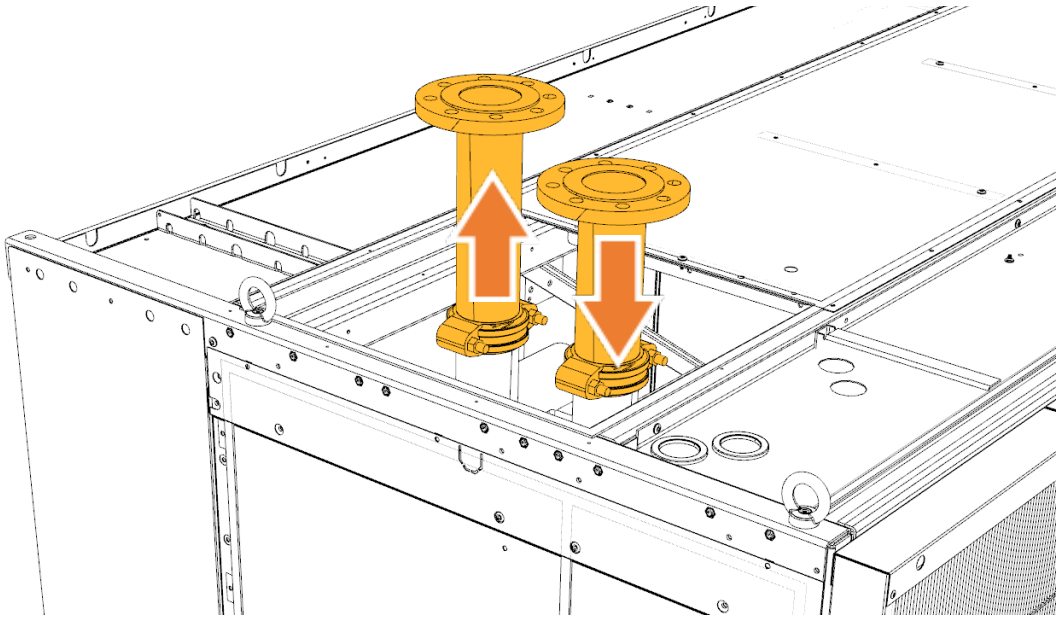
8.4.4. Chilled water connection to the external source



• The unit is equipped with top connections for external chilled water source.

• Both the inlet and outlet connections are equipped with 89 mm grooved fitting and stub pipe for brazing or threaded adaptor.

• It is possible to replace these fittings with specialized Flange kit (optional accessory)



NOTICE

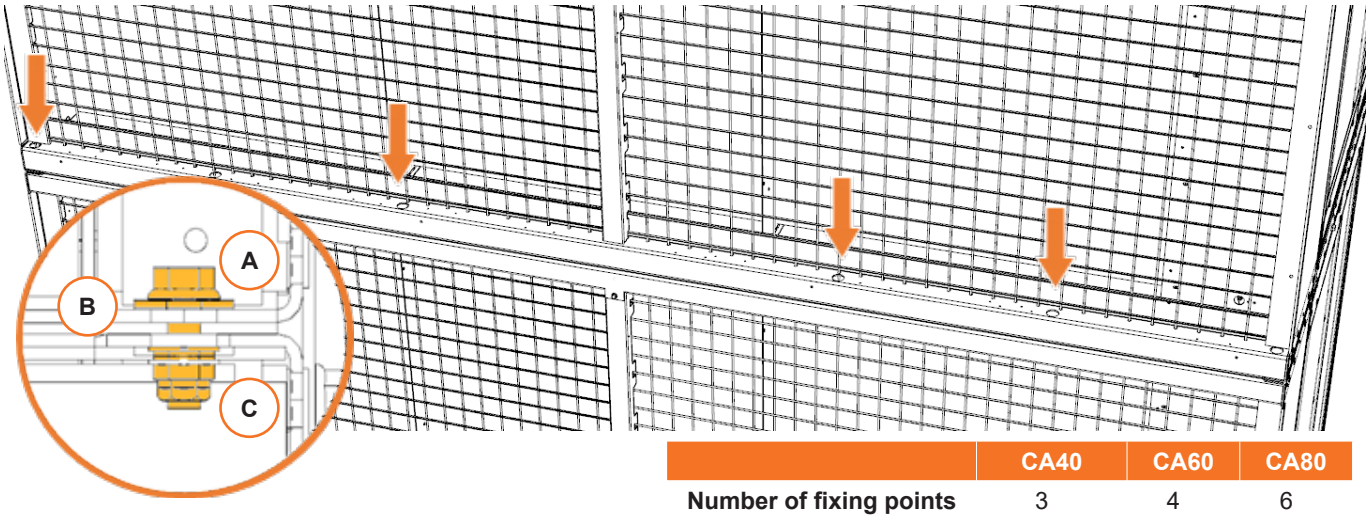
Make sure to connect the inlet and outlet piping into the correct corresponding connections.

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

8.4.5. Additional coupling plates

In case of seismic option, there is slight difference in the unit assembly procedure.
When joining the bottom and top module together, there are additional reinforcing elements and more fixing points.

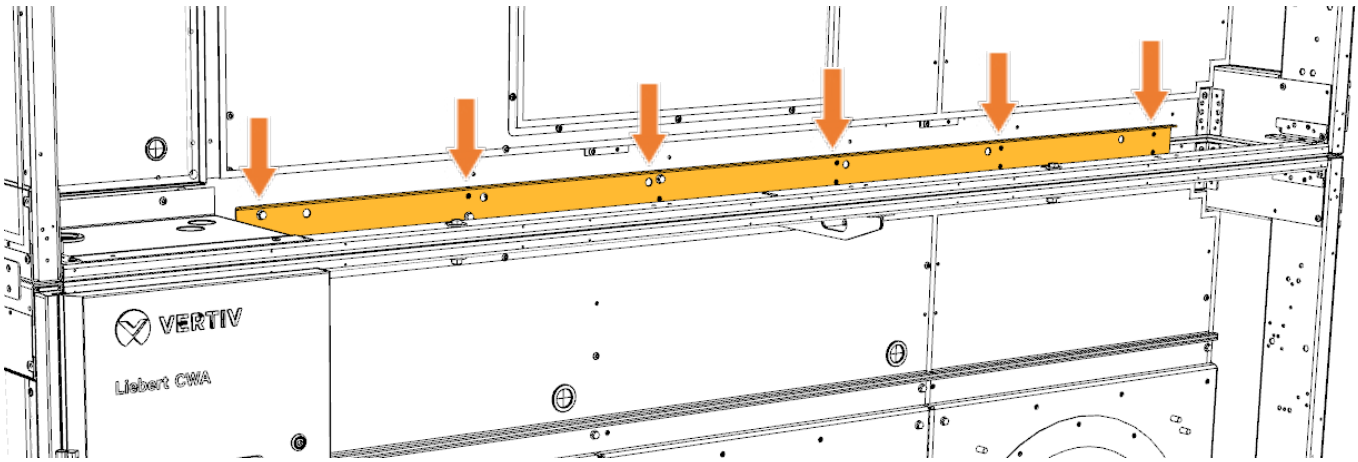
For the rear side of the unit:



	CA40	CA60	CA80
Number of fixing points	3	4	6

• Fix the bottom and top module together on the rear side using screws M8x25 **[A]** with washer **[B].**
The frame comes equipped with threaded inserts **[C]** to fit these screws.

For the front side of the unit:



• In case of the seismic option, the bottom module comes with additional coupling plate attached on the front side, below the fan array.

• During the unit assembly, before lowering the top module, loosen the screws holding this plate.

• Descend the top module on the bottom module as described in chapter *7.2.2. – Unit assembly*

• Check proper alignment of the modules and fix the coupling plate to the top module using flanged screws M8x25.
The module comes equipped with corresponding threaded inserts in the frame.

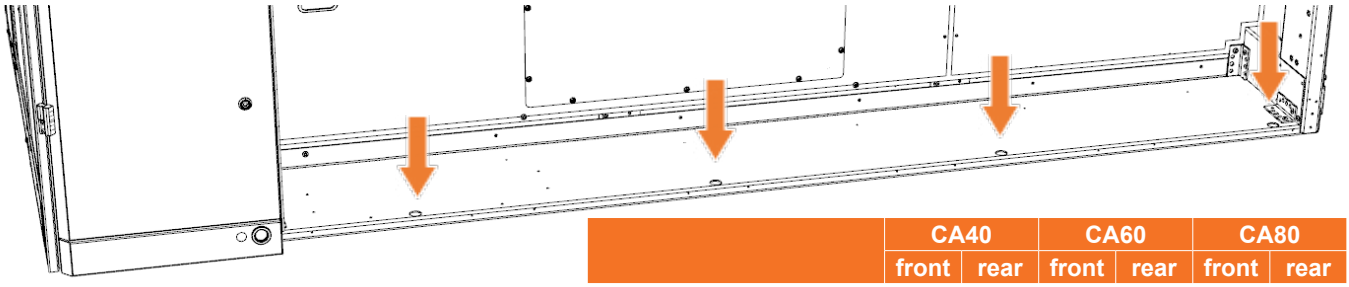
• Tighten the remaining screws.

	CA40	CA60	CA80
Number of fixing points	2 + 4	2 x 6	2 x 8

8.4.6. Anchor points

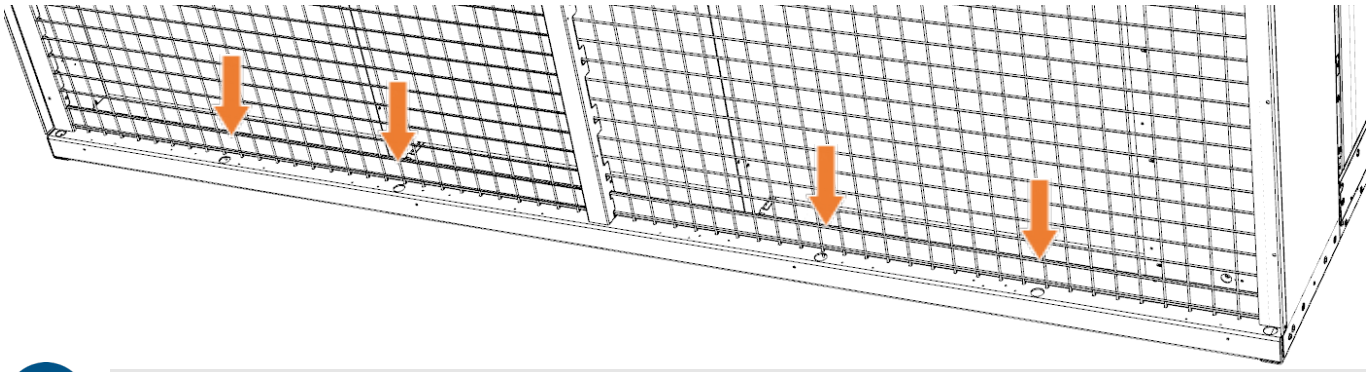
Standard configuration

• For standard unit configuration (without the additional “seismic” reinforcement), there are anchor points on the front side of the unit available for fixing the unit to the floor or base:



	CA40		CA60		CA80	
	front	rear	front	rear	front	rear
Number of fixing points	4	3	4	4	5	6

• The rear side of the unit offers another anchor points:

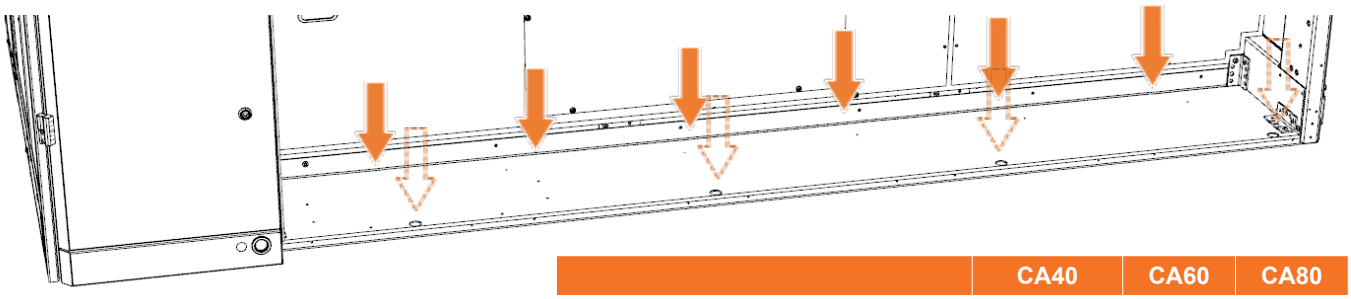


NOTICE

To anchor the unit to the floor or base, use bolt grade or chemical anchor meeting the local requirements.

Optional “seismic” configuration

• In case of unit equipped according to the „seismic“ option, the bottom module is reinforced with additional beam and offers more anchor points on the front side:



	CA40	CA60	CA80
Number of additional fixing points	4	6	8

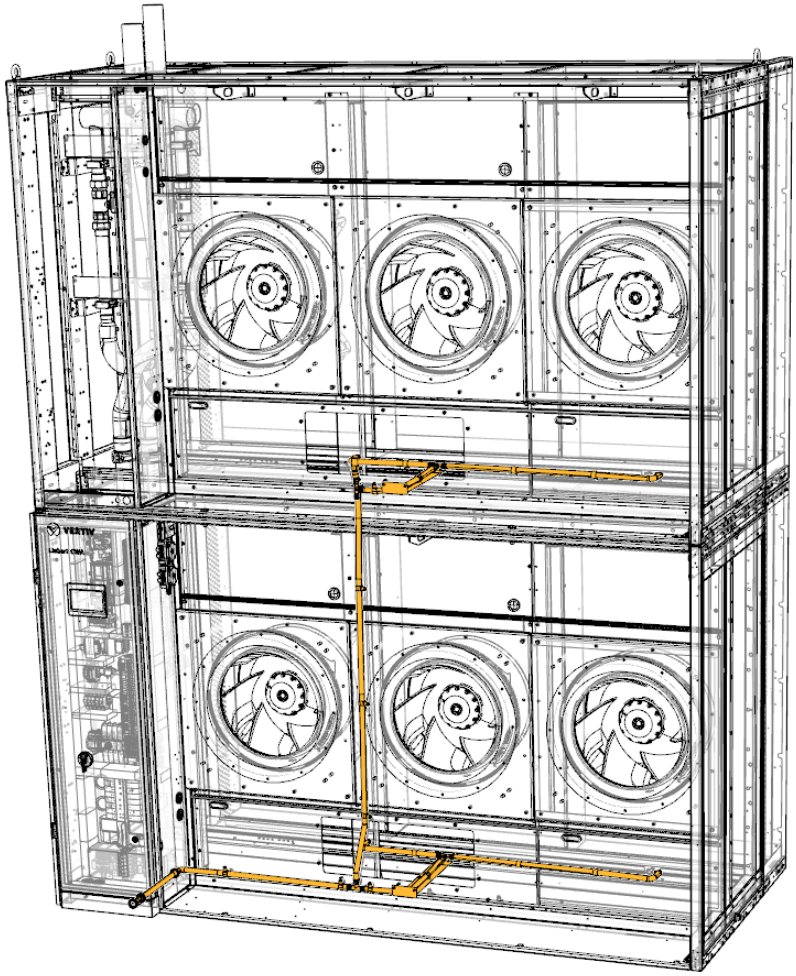
The anchor points on the rear side are the same for both options.

NOTICE

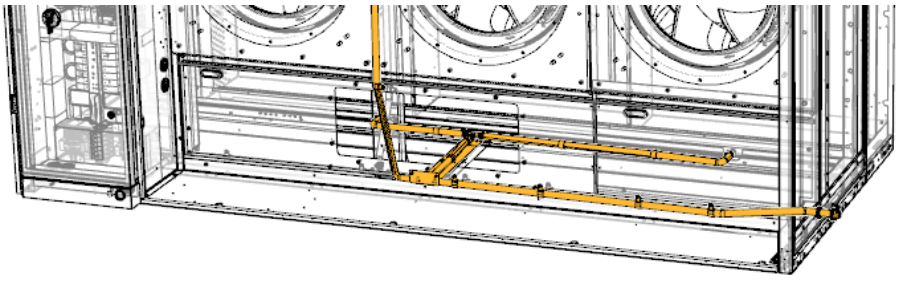
To anchor the unit to the floor or base, use bolt grade or chemical anchor meeting the local requirements.

8.4.7. Condensate drain connection – standard drain

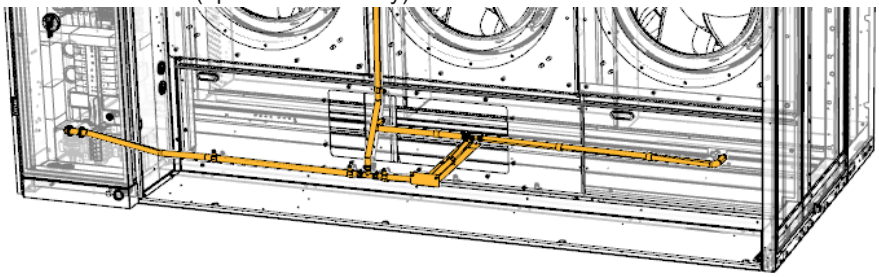
- Unit is in the standard configuration equipped with condensate drain which allows the water to freely flow out of the unit compartment.
- Pipes from top and bottom modules are connected inside of the cabinet and continue out of the unit.



- The condensate water outlet can lead to the front of the unit (shown in the picture above)
- To the right side (optional accessory):



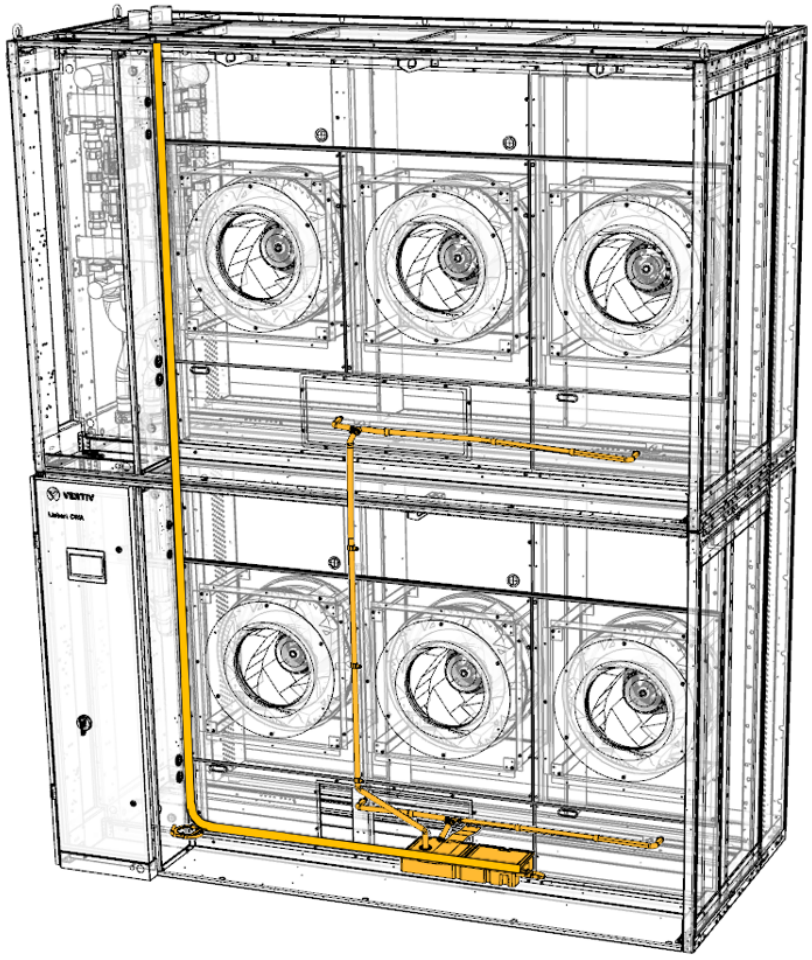
- Or to the left side of the unit (optional accessory):

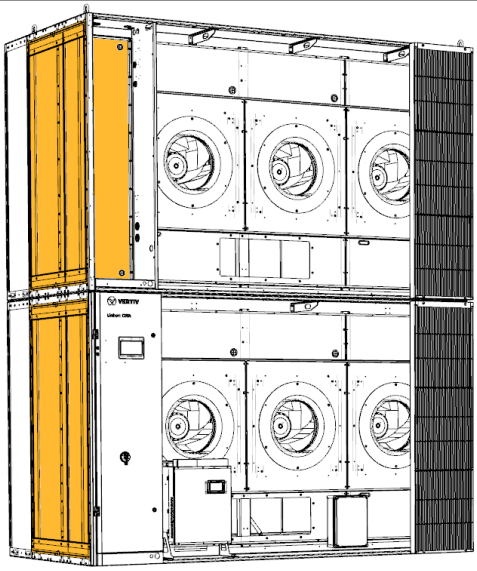


NOTE: *The drain hose is located in the fan compartment, behind the EP box.*

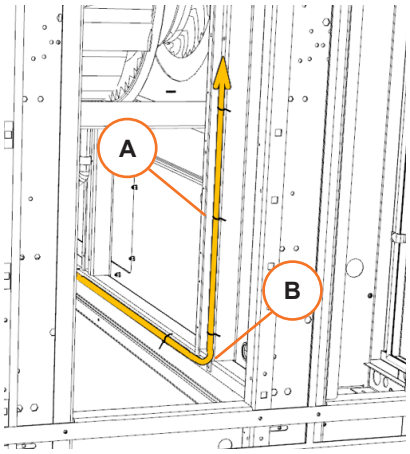
8.4.8. Condensate drain connection – condensate pump option

- If the unit is equipped with a condensate pump, the outlet hose is connected to the pump and the loose end is stored inside of the bottom module during transport.
- It is necessary to prepare the outlet before running the unit.
- The length of the hose is sufficient to route the outlet hose upwards through the bottom module and then continue upwards inside of the top cabinet.
- The final outlet should be located along the chilled water connection.





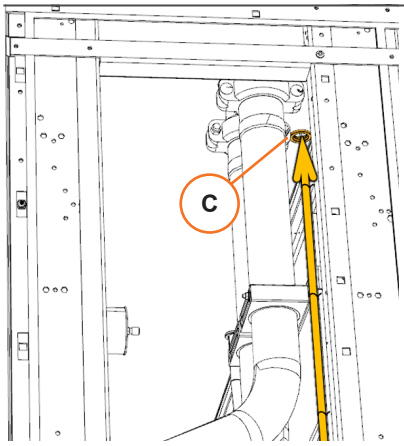
- Remove the lateral panels on both bottom and top modules.
- Also remove the frontal access panel on the top module.



Use the loose end of the outlet hose and lead it upwards along the pillar behind the EP panel.

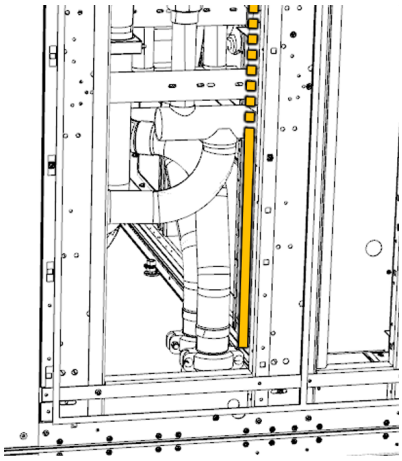
Secure the hose with zip ties **[A]**.

Create suitable radius at the bend section **[B]** to allow easy flow of the water.

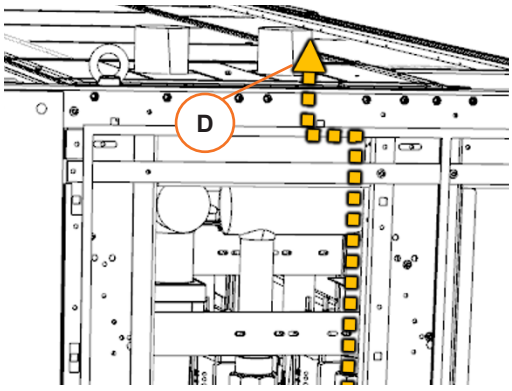


• Pull the hose through the opening **[C]** in the blocker panel into the top module.

• Secure the hose with zip ties.

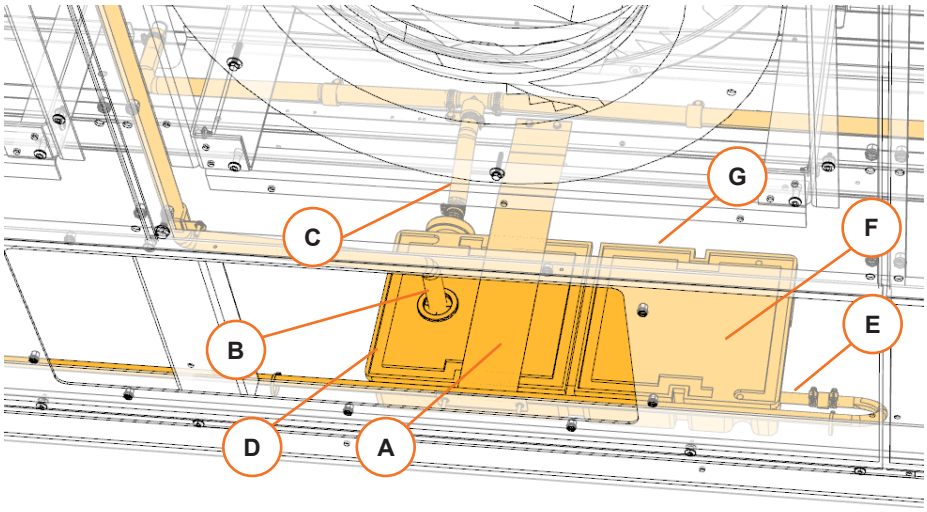


Lead the hose upwards in the top module, along the pillar and secure it with zip ties.

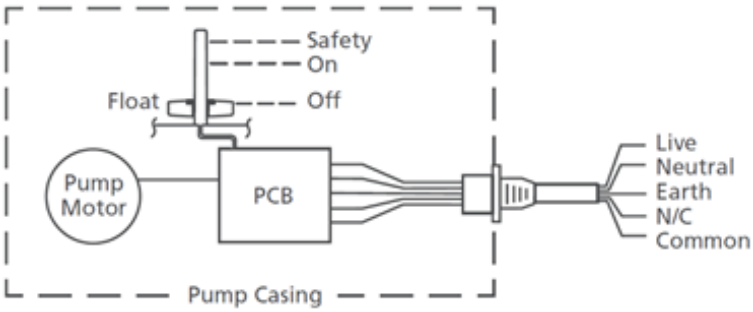


• The discharge from the cabinet **[D]** should lead through the pre-cut opening located on the top panel of the unit.
For exact location, see *Annex C - Connections*.

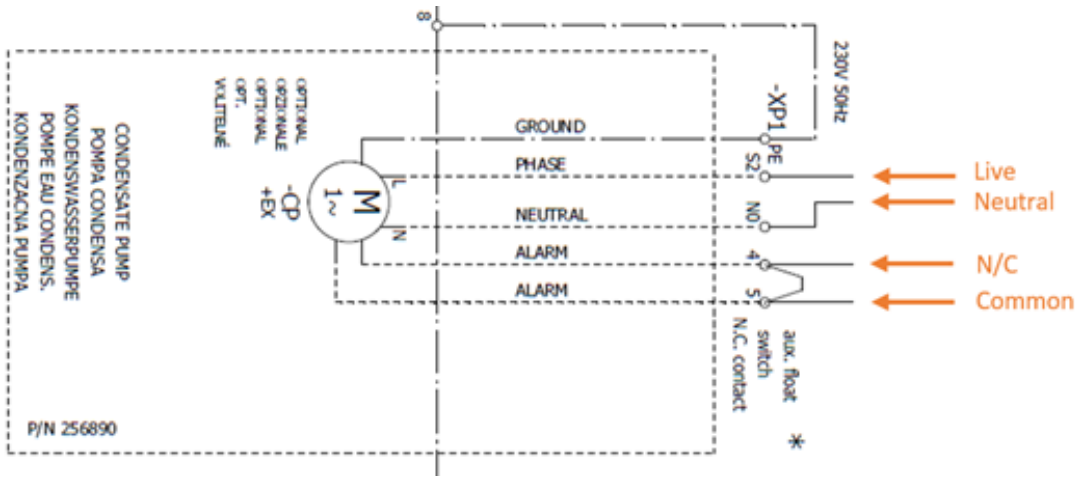
8.4.8.1. Condensate pump connection (optional accessory)



- The condensate pump is located in the bottom module, behind the service access panel and is secured by a bracket **[A]**
- Both condensate drain pipes from top **[B]** and bottom [**C]** modules are connected to the reservoir **[D]**
- The outlet hose **[E]** is connected to the pump **[F]**
- Electrical connection **[G]** is located on the back side of the box:



- Electrical connection to the EP panel needs to be connected on site according to electrical scheme.
- The power cable must be connected to the plastic box on these terminals:



- Before unit startup, check if the hose **[B]** is properly inserted in the reservoir, whether hose **[C]** and **[E]** is properly secured and whether the electrical plug **[G]** is properly inserted.

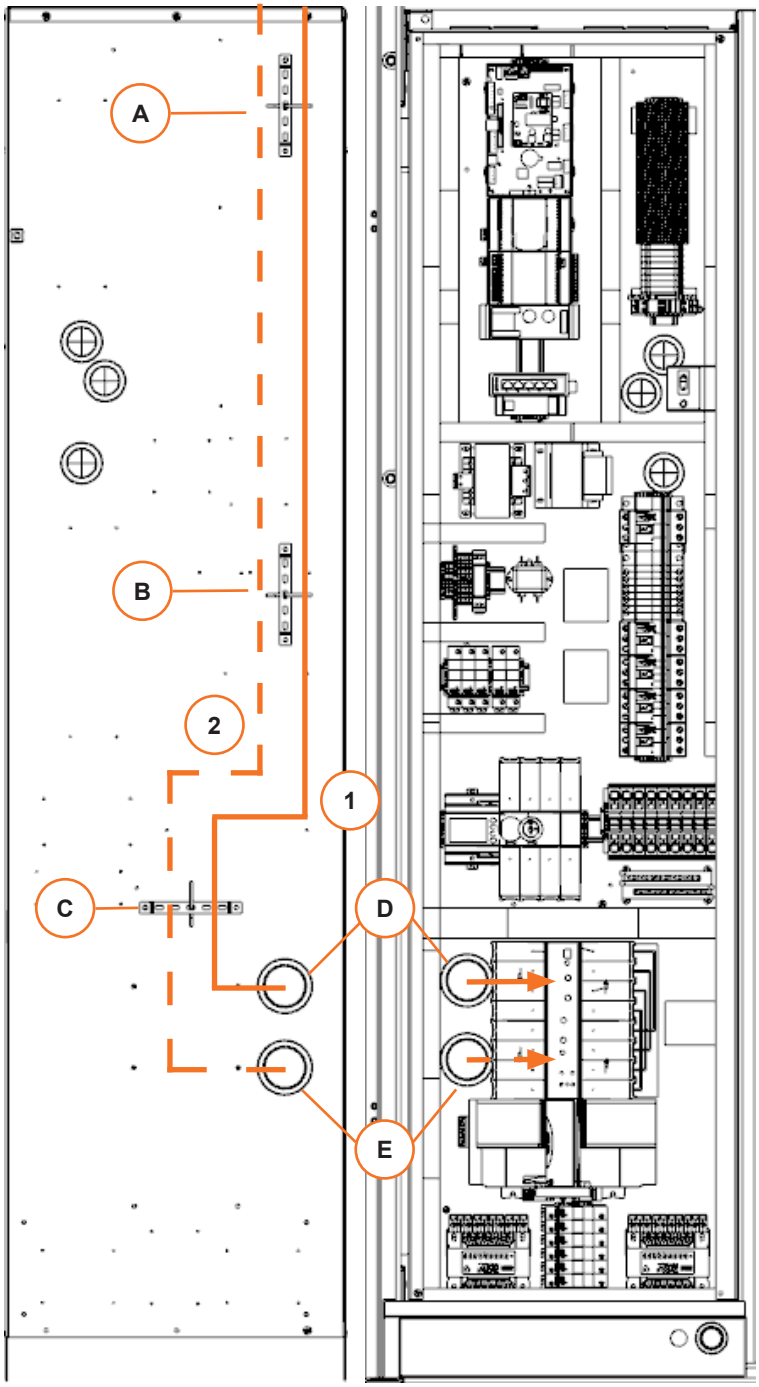
8.5. Electrical connections

8.5.1. 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*.

8.5.2. Power supply connection



Electric panel rear view **Electric panel front view**

• Turn the main switch handle on the front panel to 0/ OFF

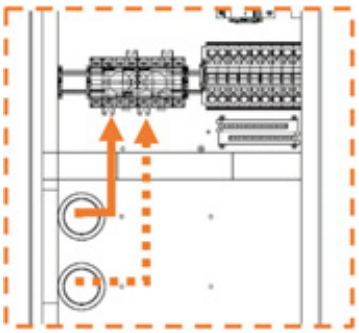
• Open the front door to get access to the electrical panel.

• The cable supply lines must lead inside the plastic conduit through the cutouts in the top module and then through cutouts into the bottom module.

• For the installation of the supply lines, use the included plastic conduit for leading the cables on the rear side of the electric panel.
Secure the plastic conduit to the brackets in points [**A**], [**B**] and [**C**].

•For easier installation and bending the cable to ATS or main terminal blocks, it is necessary to strip the insulation from the power supply cable at least 0,7m from the end.

• Remove the safety electrical covers from the ATS module.
• Slide the main power cable [**1**] through the precut [**D**] next to the ATS module.
• Connect the main power cable into the ATS module or into the main switch (for dual power configuration)
• Slide the emergency power supply cable [**2**] through the other precut [**E**] in the ATS box and connect it into the ATS module or into the main switch (for dual power configuration).



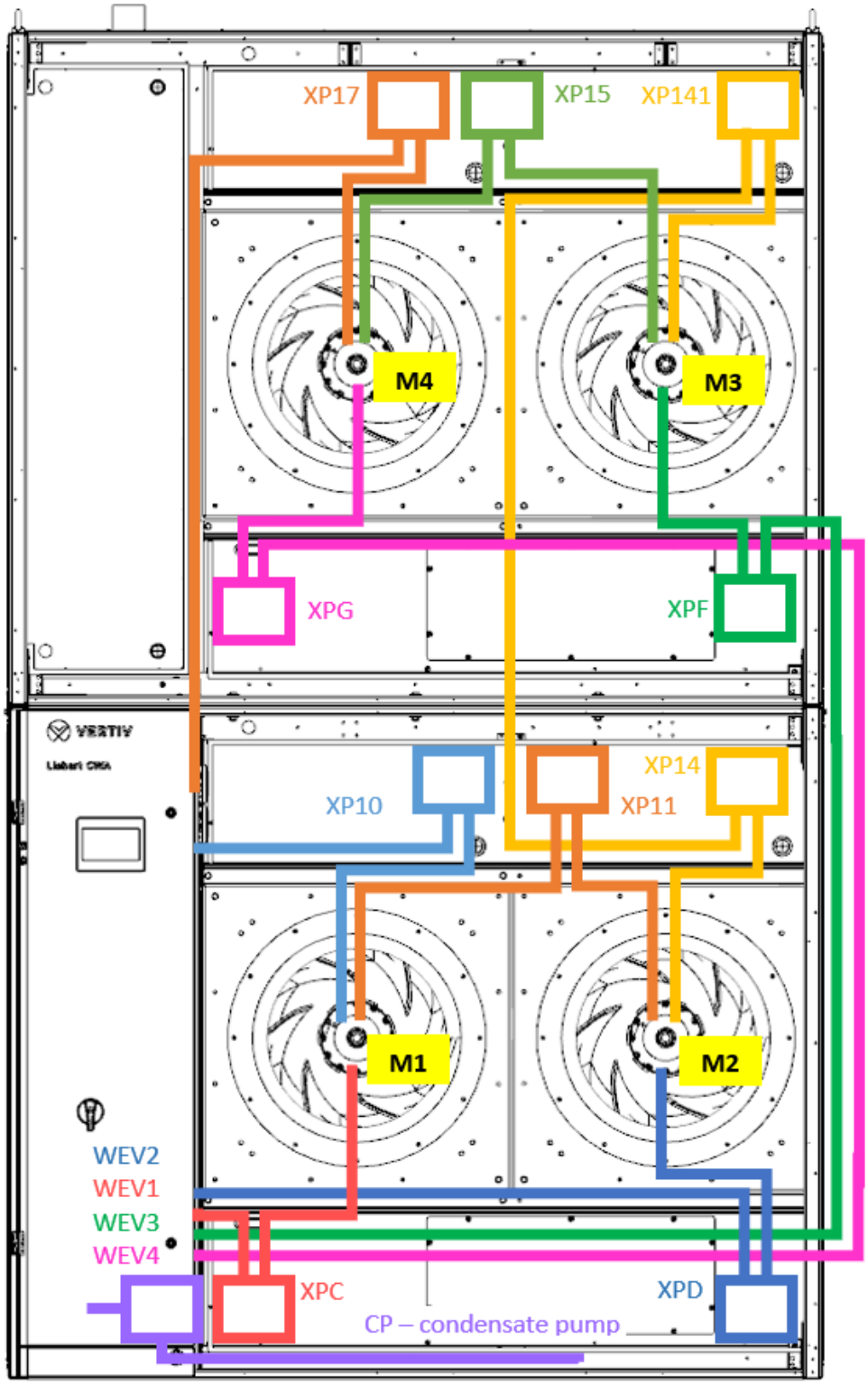
Alternative dual power configuration

• Re-attach the electrical safety ATS cover and fix it properly.

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

8.5.3. Power and signal cable routings for motor fans

CA40



The leading of power cables (WEV1, WEV2, WEV3 and WEV4) and the location of connectors are shown in picture above.

Power supply for fans, for unit CA40:

• **WEV1**, **WEV2**, **WEV3** and **WEV4**: power cables which power the fans of the unit.

• **WEV1** is distributing the main power voltage to motor fan **M1**.
• The cable of Fan motor **M1** and power cable **WEV1** are connected in distribution connector **XPC** (type of **WAGO** series **770**).

• **WEV2** is distributing the main power voltage to motors fan **M2**.
• The cable of Fan motor **M2** and power cable **WEV2** are connected in distribution connector **XPD** (type of **WAGO** series **770**).

• **WEV3** is distributing the main power voltage to motors fan **M3**.
• The cable of Fan motor M3 and power cable **WEV3** are connected in distribution connector **XPF** (type of WAGO series 770).

• **WEV4** is distributing the main power voltage to motors fan **M4**.
• The cable of Fan motor **M4** and power cable **WEV4** are connected in distribution connector **XPG** (type of WAGO series **770**).

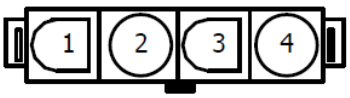
770-305 WAGO fan motor power connector

Modbus chain for fans, for unit CA40:

In bottom section is connected to the connectors:
• **XP10 (output of EP/input to M1)**
• **XP11 (output from M1/input to M2)**
• **XP14 (output from M2/to top section)**

and in top section is connected to the connectors:
• **XP141 (from bottom section/input to M3)**
• **XP15 (output from M3/input to M4)**
• **XP17 (output from M4/input to EP)**

Serial connection for **MODBUS CHAIN**.



39-03-6040+02-09-1104 MOLEX

Fan motor connector XP

CA60

The leading of power cables (WEV1, WEV2, WEV3 and WEV4) and the location of connectors are shown in picture above.

Power supply for fans, for unit CA60:

• **WEV1**, **WEV2**, **WEV3** and **WEV4**: power cables which power the fans of the unit.

• **WEV1** is distributing the main power voltage to motor fan **M1**.

• The cable of Fan motor **M1** and power cable **WEV1** are connected in distribution connector **XPC** (type of **WAGO** series **770**).

• **WEV2** is distributing the main power voltage to motors fans **M2** & **M3**.

• The cable of motor fans **M2** & **M3** and power cable **WEV2** are connected in distribution connector **XPD** (type of **WAGO** series **770**).

• **WEV3** is distributing the main power voltage to motors fans **M4**.

• The cable of motor fan **M4** and power cable **WEV3** are connected in distribution connector **XPF** (type of **WAGO** series **770**).

• **WEV4** is distributing the main power voltage to motors fans **M5 & M6**.

• The cables of motors fans **M5 & M6** and power cable **WEV4** are connected in distribution connector **XPG** (type of **WAGO** series **770**).

770-305 WAGO fan motor power connector

Modbus chain for fans, for unit CA60:

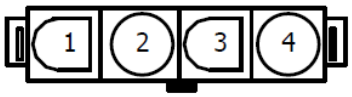
In bottom section is connected to the connectors:

• **XP10 (output of EP/input to M1)**

• **XP11 (output from M1/input to M2)**

• **XP13 (output from M2/input to M3)**

• **XP14 (output from M3/ to top section)**



39-03-6040+02-09-1104 MOLEX

and in top section is connected to the connectors:

• **XP141 (from bottom section/input to M4)**

• **XP15 (output from M4/input to M5)**

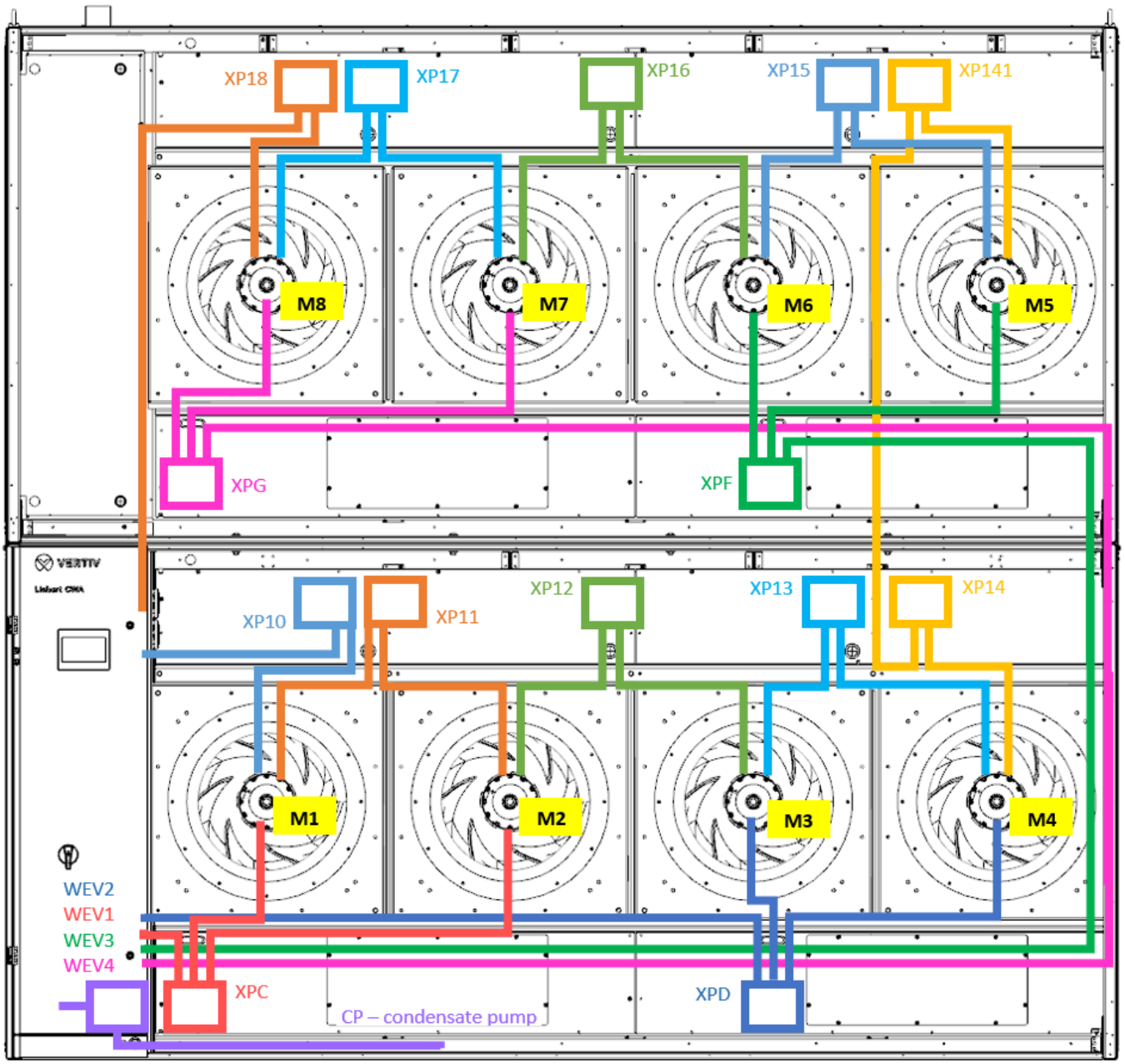
• **XP17 (output from M5/input to M6)**

• **XP18 (output from M6/input to EP)**

Fan motor connector XP

Serial connection for **MODBUS CHAIN.**

CA80



The leading of power cables (WEV1, WEV2, WEV3 and WEV4) and the location of connectors are shown in picture above.

Power supply for fans, for unit CA80:

• **WEV1**, **WEV2**, **WEV3** and **WEV4**: power cables which power the fans of the unit.

• **WEV1** is distributing the main power voltage to motor fans **M1 & M2.**

• The cable of motor fans **M1 & M2** and power cable **WEV1** are connected in distribution connector **XPC** (type of **WAGO** series **770**).

• **WEV2** is distributing the main power voltage to motors fans **M3 & M4**.

• The cable of motor fans **M3 & M4** and power cable **WEV2** are connected in distribution connector **XPD** (type of **WAGO** series **770**).

• **WEV3** is distributing the main power voltage to motors fans **M5 & M6.**

• The cable of motor fans M5 & M6 and power cable **WEV3** are connected in distribution connector **XPF** (type of **WAGO** series **770**).

• **WEV4** is distributing the main power voltage to motors fans **M7 & M8**.

• The cable of motor fans **M7 & M8** and power cable **WEV4** are connected in distribution connector **XPG** (type of **WAGO** series **770**).

770-305 WAGO fan motor power connector

Modbus chain for fans, for unit CA80:

In bottom section is connected to the connectors:

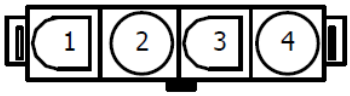
• **XP10 (output of EP/input to M1)**

• **XP11 (output from M1/input to M2)**

• **XP12 (output from M2/input to M3)**

• **XP13 (output from M3/input to M4)**

• **XP14 (output from M4/ to top section)**



39-03-6040+02-09-1104 MOLEX

and in top section is connected to the connectors:

• **XP141 (from bottom section/input to M5)**

• **XP15 (output from M5/input to M6)**

• **XP16 (output from M6/input to M7)**

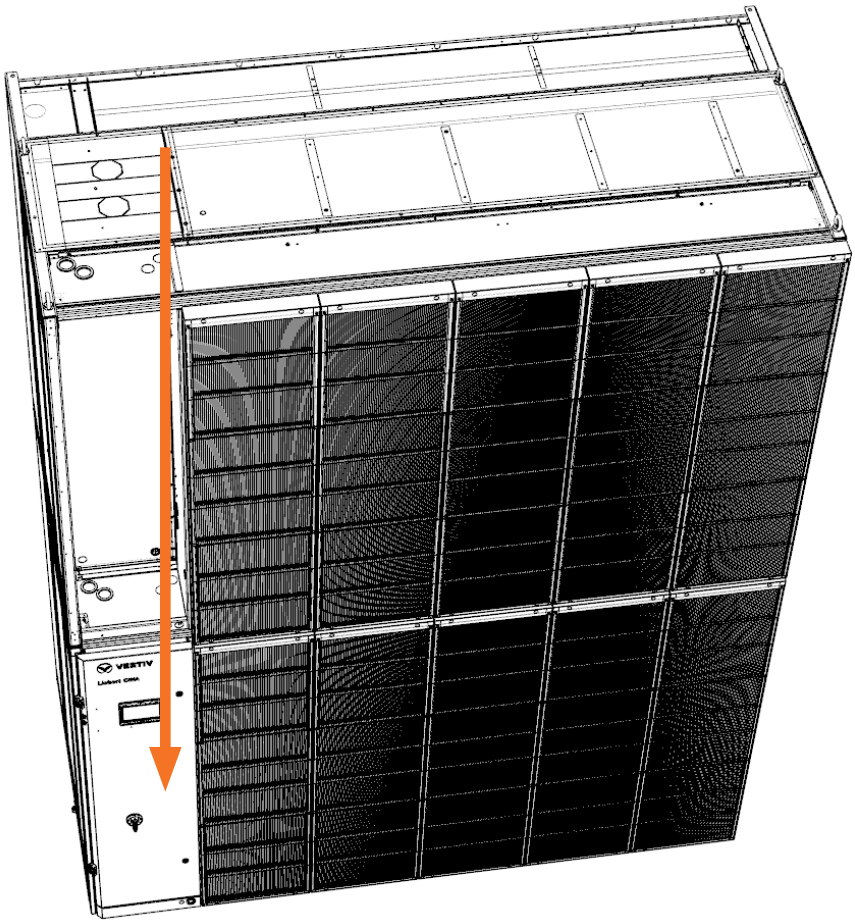
• **XP17 (output from M7/input to M8)**

• **XP18 (output from M8/input to EP)**

Fan motor connector XP

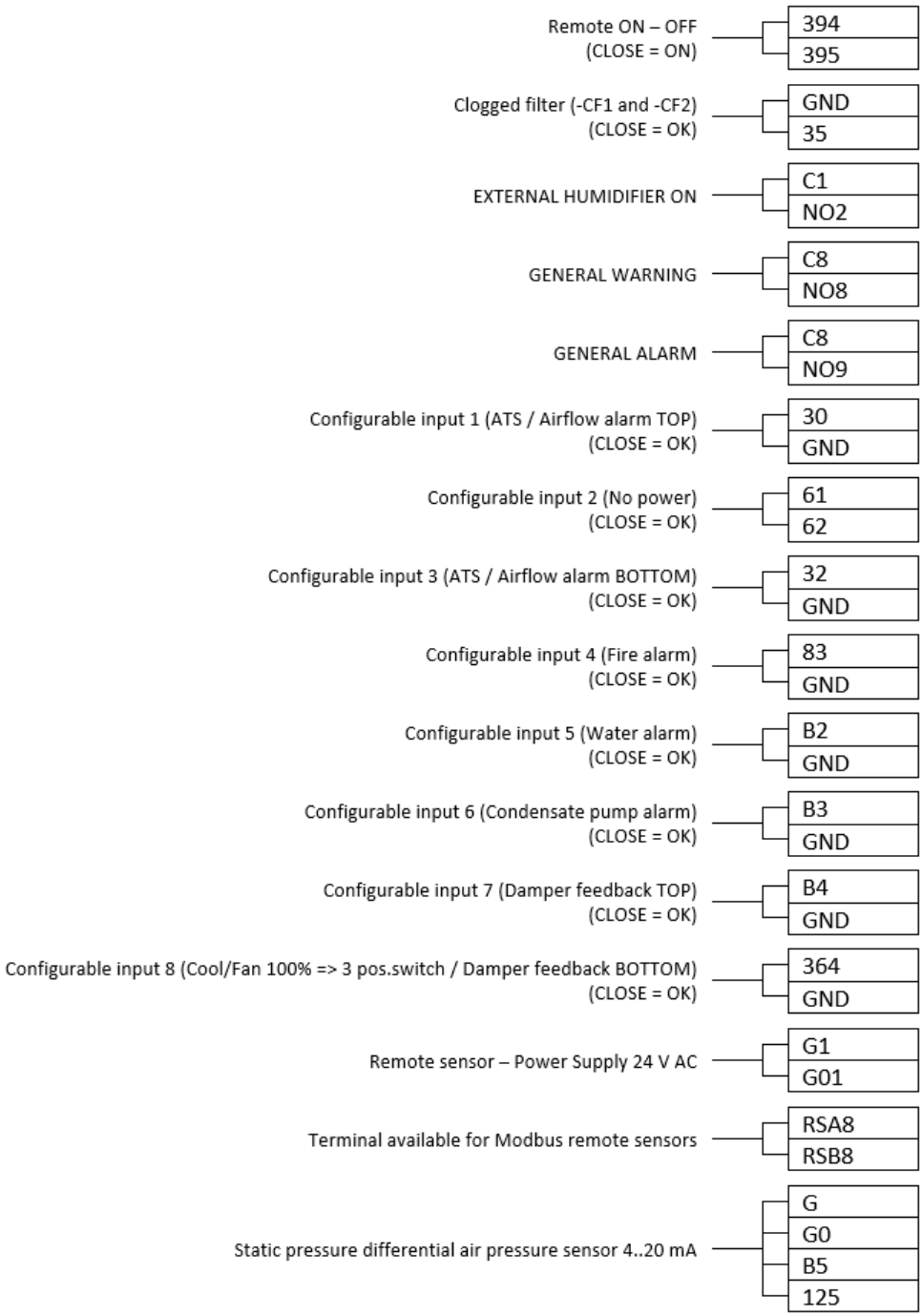
Serial connection for **MODBUS CHAIN.**

8.5.4. 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.
- Open the door to access the electric panel.
- Remove the filters and their frame from the left side of the top module.
- Run the signal cable down through the precut in the left top panel, down through the top module and into the fan module into the electric box inside the bottom 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.
- Restore the original protection degree with suitable accessories for the wiring and junction boxes.

8.5.5. Terminal block



- 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 above shows the available terminals and their meaning (refer to the Electric diagrams for details).
- The cable must be protected by a sheath.

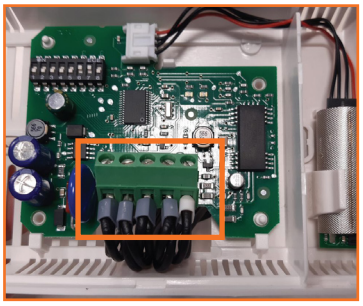
NOTE:
**The C1-NO2 (External humidifier ON), *C8-NO8 (General warning) and *C8-NO9 (General alarm) terminals are on the control board.*
The fans alarms are managed through Modbus.
The ID contacts are on the control board
The B analog input are on the control board

8.5.6. Sensor connections

Any remote or additional sensor must be connected to the unit via Modbus. See chapter *8.6. Modbus connections and settings*

8.6. Modbus connections and settings

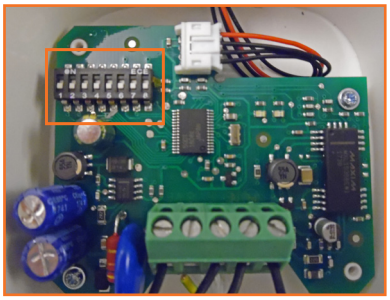
8.6.1. Connection of a device to the Modbus cable



- 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.

8.6.2. Settings of Modbus devices

Dip switched address



Address of the device (unique)

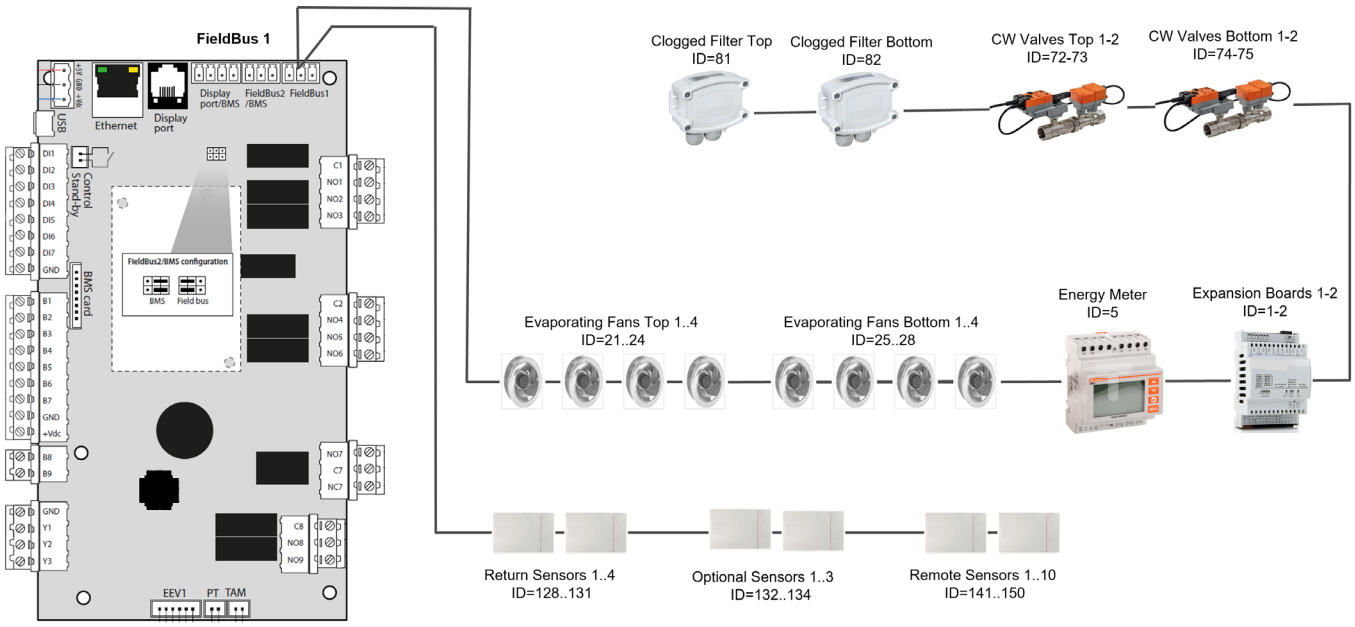
- For T/H sensor: set the pins on its board.
- For the fans (inside the unit): the setting is factory made.

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

  Do the setting by the programming tool (see the *CWA Control Application User Manual*)

Baud rate = 19200
Data Bits = 1
Parity = Even
Stop Bits = 1

Same parameter for all the devices in the Modbus chain



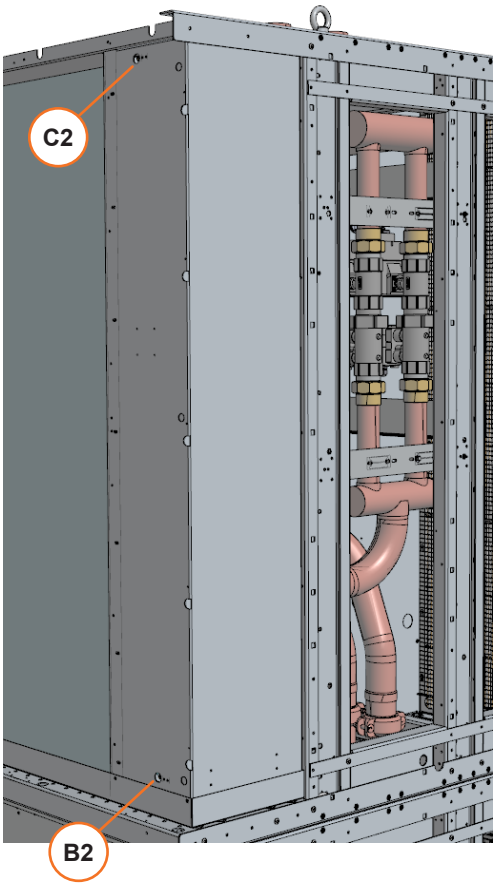
NOTE: *For detailed description of the Modbus chain, see chapter* ***4.11 – MODBUS connections***

8.7. Filling the water system

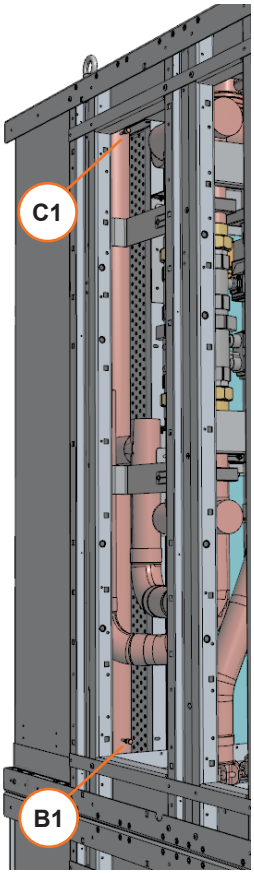
8.7.1. Water supply

Each coil, in the top and in the bottom module, is equipped with

- a pair of water drain valves **[B1]** and **[B2]** – one valve is located inside of the cabinet and one valve can be accessed from outside of the unit on the air supply side.
- and a pair of air bleed valves **[C1]** and **[C2]**



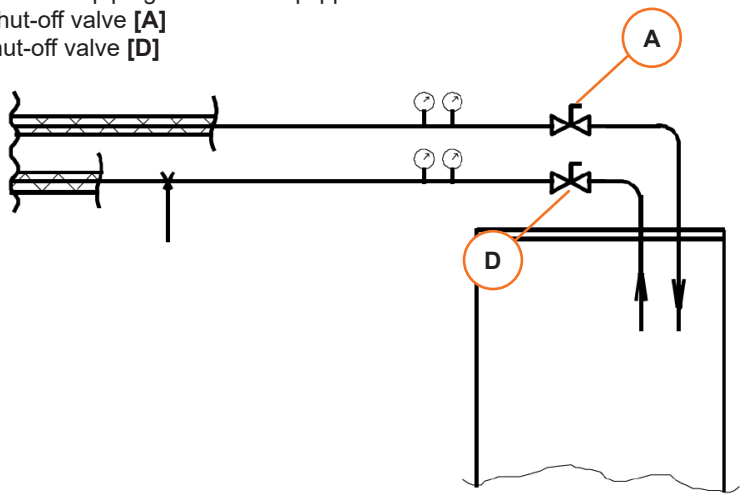
Valves on the air supply side of the unit



Valves located inside of the cabinet

The external chilled water piping should be equipped with

- supply shut-off valve **[A]**
- return shut-off valve **[D]**



•To fill the unit with water, connect the external chilled water source.

• Make sure all the drain valves **[B1]** and **[B2]** on both modules are closed.

• Open the air bleed valves **[C1]** or **[C2]** (depending on the accessibility) on both modules of the unit.

Use the air bleed valves to vent all the air from the pipes and coils.

• Open the shut-off valves **[D]** on the return side of the external chilled water circuit.

• Open the water supply shut-off valves **[A]** and fill the unit with water.

• Keep an eye on the opened air bleed valves **[C]**. Close these valves once only water stars flowing out of them.

• If necessary, fill-in or tip-up the ethylene glycol (see chapter *8.7.2 Adding ethylene glycol*).

NOTICE

Do not exceed the nominal operating pressure of the circuit components.
Air Bubbles on the circuit can cause a loss of precision in cooling action so de-aeration is recommended for the lowest water temperature at the installation site. Failing to comply with this instruction shall invalidate the unit warranty.

8.7.2. 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 *8.7.1. 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 *5.1. Water system - Glycol mixture correction factors*).

8.8. Final checks

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

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

	WARNING Disconnect the power supply before doing the following checks on the electric system as explained in *1. Safety*.
Electrical system	• Check all the cable connections particularly the main power connections on the miniature circuit breaker and contactors. • If the unit is equipped with AHF device, check power and signal connections. • 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).
Pressure leak test	• After assembling the chilled water circuits, perform visual leak check on the pipe system, valves, and coils in both top and bottom module. • Perform pressure test of the system according to local legislative. • For operating limits, see chapter *4.8.2 – Operating conditions.*
Air system	• Check that the unit fans are operating properly. • Check all the unit options that involve the air flow management (such as air supply dampers) operate properly. • Check that all the temperature and humidity probes read correct value.
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 *9. Operation*

9. Operation

9.1 Safety Instructions

WARNING

Improper operations can cause injury or death.

NOTICE

Improper operations can cause product damage.

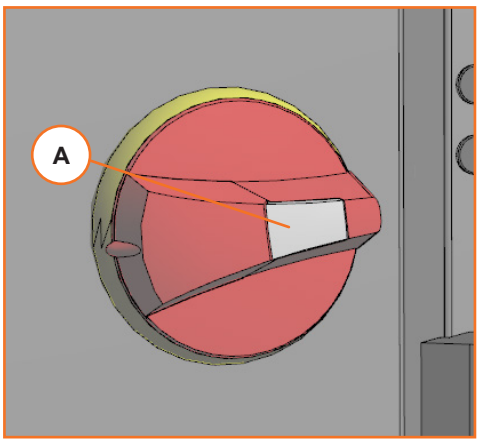
Read carefully the chapter *1. Safety*.

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

NOTICE

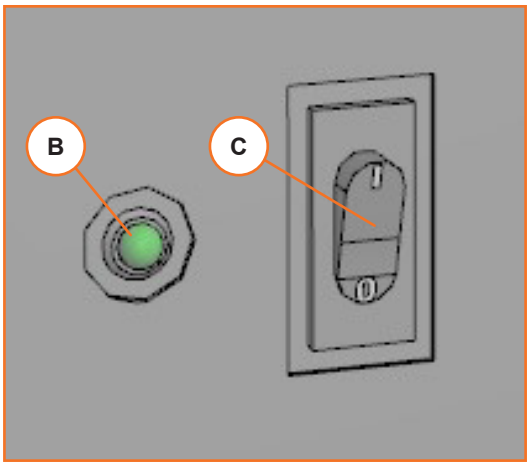
The power supply should never be disconnected during normal operation, except when performing maintenance.

9.2 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.

9.3. Start



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

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

See the *CWA Control Application User Manual* for details.

If the LED does not light up, see chapter *11. Troubleshooting*

CAUTION

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

9.4. Check the operation

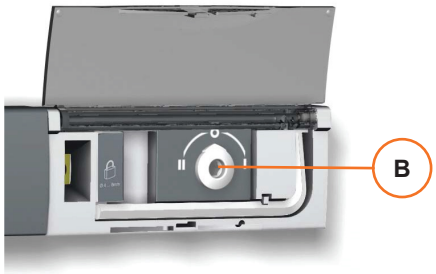
NOTICE

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 *CWA Control Application User Manual*)
Control and safety devices	• Check the correct operation of the control and safety devices.

9.5. Stop

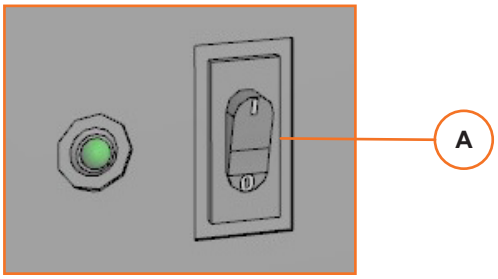


In case of a long stop (seasonal shutdown):

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

9.6. Restart

After a short stop



The unit is still powered

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

After a long stop	• Do the complete procedure as described in chapters *9.2 Power-up* and *9.3 Start*
In case of power blackout	• See chapter *4.10.1. Dual power supply – Alternate*

9.7. Teamwork

Four different Teamwork modes can be selected:

No Teamwork:

I. The units work independently. Sensor values and setpoints are not shared.

II. The control drives cooling, ventilation, and dehumidification based on the local requests.

III. Standby function and unit rotation are possible; cascade is not allowed.

Teamwork Mode 1 (Parallel):

I. The control uses the system PI's for driving cooling, ventilation, humidification, and dehumidification.

II. In this Teamwork mode, all relevant control parameters are shared; if a value is changed in any of the units, all other units will follow with the same changed setting.

III. This Teamwork Mode can be set in case of Return or Return + Supply Limit or Remote temperature control only.

Teamwork Mode 2 (Independent):

I. The control drives cooling, ventilation, humidification, and dehumidification based on local requests, while avoiding operational conflict with the other units in the network. For example: If one unit is on dehumidification, no other unit may start humidification.

II. In this Teamwork mode, all relevant control parameters are shared; if a value is changed in any of the units, all other units will follow with the same changed setting.

Teamwork Mode 3 (Smart Aisle – Optimized Aisle):

I. The control uses the system PI's for driving ventilation, humidification, and dehumidification. Local request is used for driving the cooling source.

II. In this Teamwork mode, all relevant control parameters are shared; if a value is changed in any of the units, all other units will follow with the same changed setting.

III. This Teamwork Mode can be set in case of Supply temperature control only.

10. Maintenance

10.1 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.

10.2. 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.

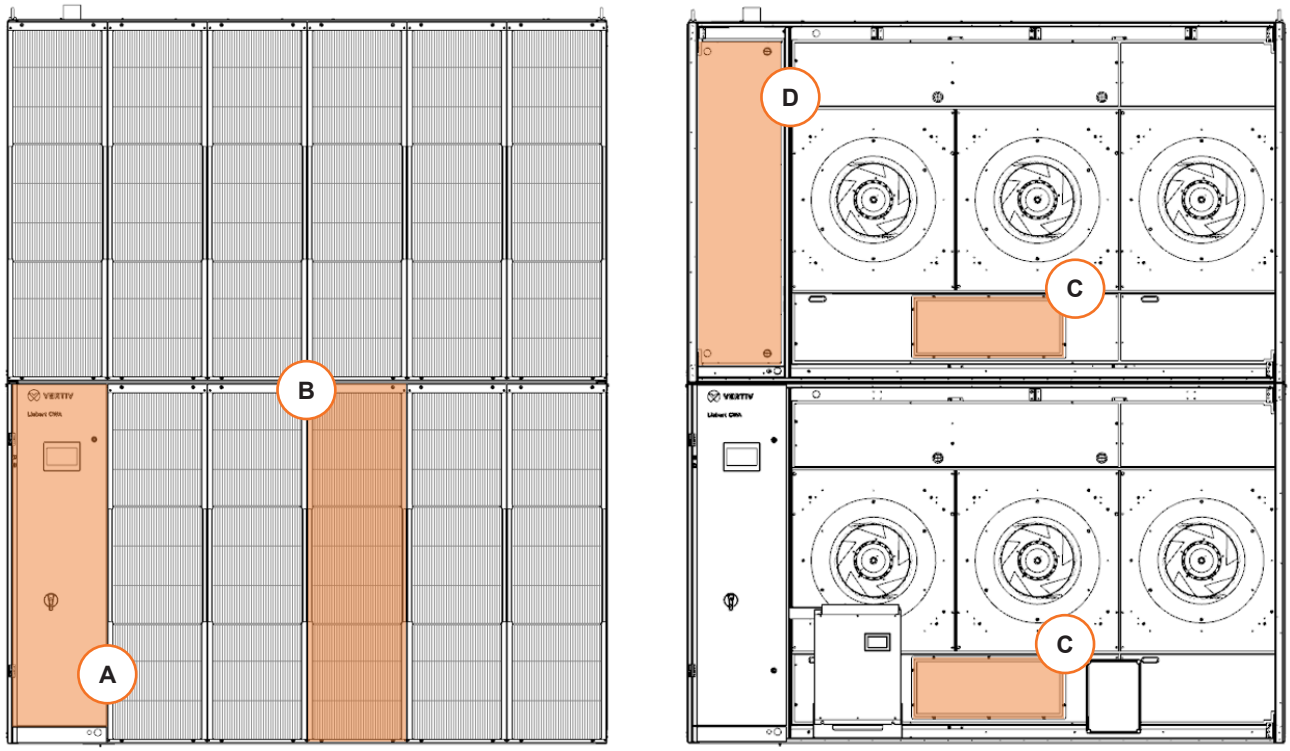
NOTICE

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

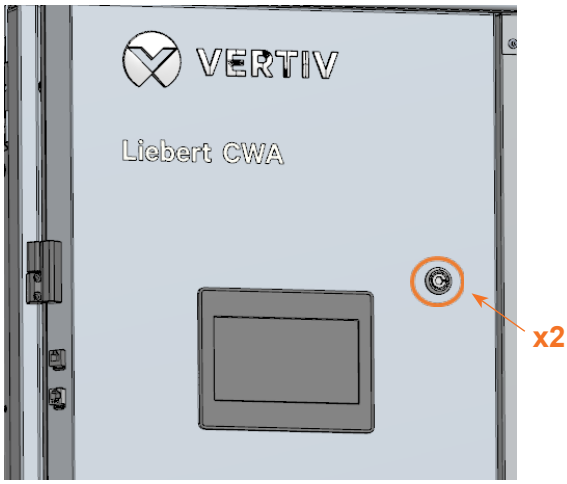
10.3. Removing the front access panels

WARNING
Turn the unit off before accessing the electric panel or removing any filter brackets.

The inside of the unit can be accessed through the door **[A]** or by removing the filter brackets **[B]**.
After removing the filter brackets, it is possible to reach into the cabinet via the service access panel **[C]**.
Chilled water valves and most of the piping manifold are accessible after removing the blocker panel **[D]**.

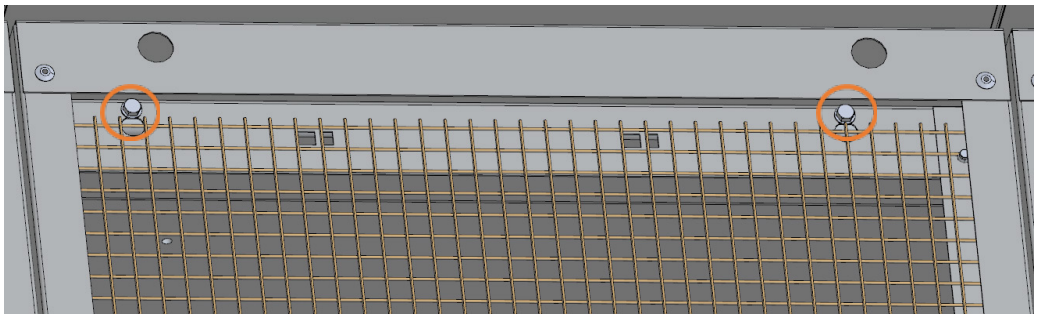


- To open the door [A] switch off the unit with the cut-off switch and turn the 2 latches securing the door.
- The door is attached on hinges.

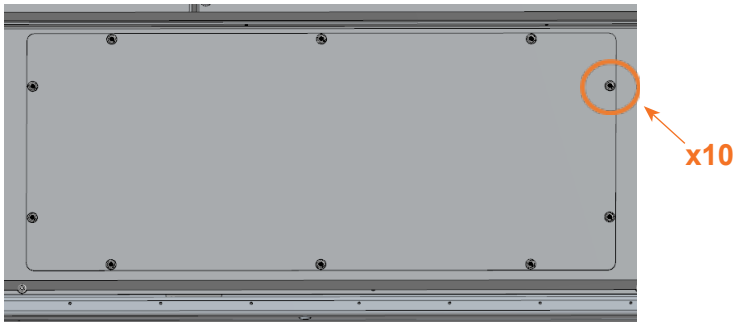


- To remove the filter brackets **[B]**, remove the filters from the frame.
- For filter removal, see *Chapter 10.6.2 – Replacing the air filters*

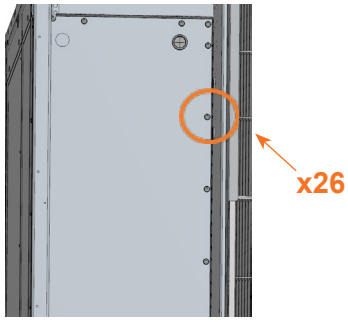
• Then loosen the screws on top and bottom holding it to the unit frame and push the filter bracket upwards.



• To remove the service access panel, remove the 10 screws and then remove the panel itself.



• To remove the blocker panel, remove the 26 screws and then remove the panel itself.



10.4. Maintenance program

10.4.1. 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

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**

10.4.2. 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**.

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 *8.7 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**	

10.4.3 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:

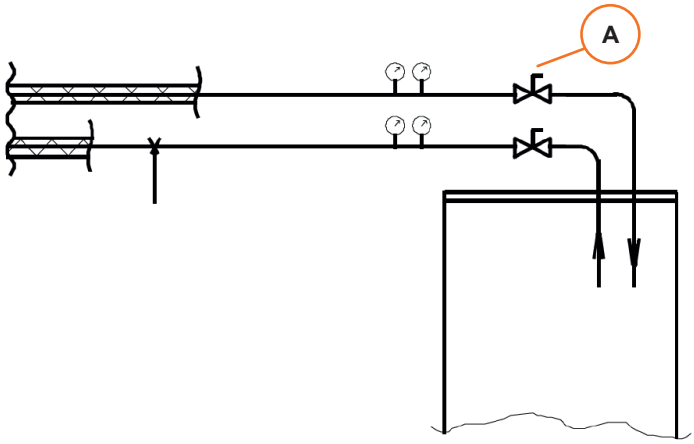
- Turn all the disconnecting switches to **OFF**.

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

Component or function	Operation	Frequency [months]		
		3	6	12
Fans	• Does 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 *10.6.2 Replacing an air filter*)	X (*)		
Filter clog sensor	• Does the sensor operate as required?		X	
Humidity and temperature sensor	• See *10.7 Calibrations*		X	
Condensate tank (optional)	• Visual inspection for dirtiness, damage, corrosion Clean if necessary.		X	

(*) Check more frequently in dusty environment.

10.5. Draining the chilled water system



• Close the shut-off valves on the water supply system upstream the unit [A] (building facility).

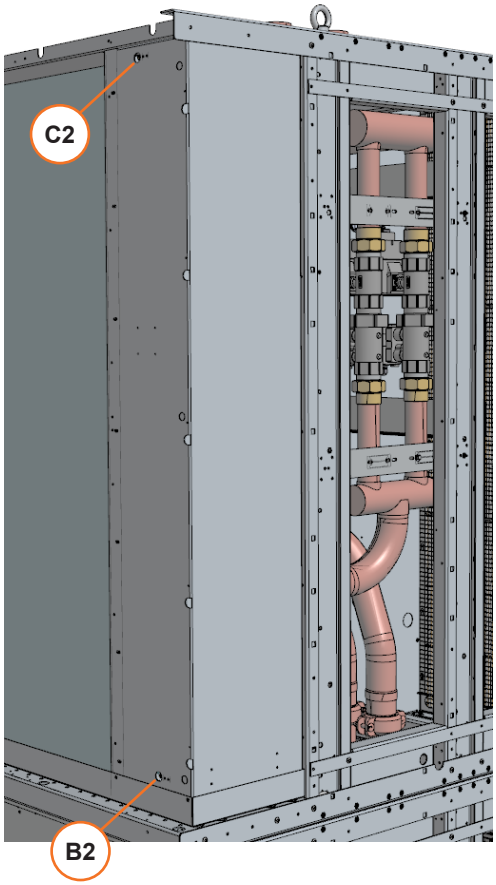
• Open the water drain valves in both modules **[B]**.

• Open the air bleed valves in both modules **[C]**.

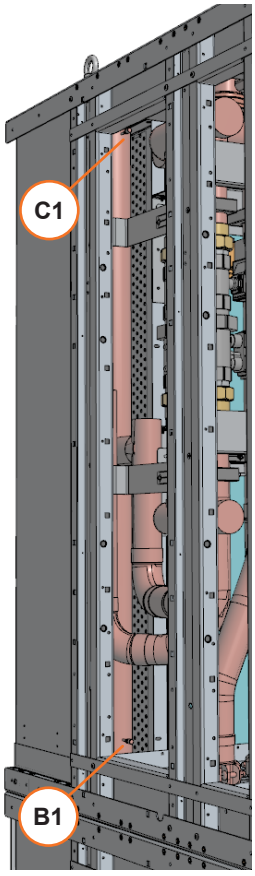
• Let the drain valves **[B]** open until no more water flows out of them.

Each coil, in the top and in the bottom module, is equipped with

- a pair of water drain valves **[B1]** and **[B2]** – one valve is located inside of the cabinet and one valve can be accessed from outside of the unit on the air supply side.
- and a pair of air bleed valves **[C1]** and **[C2]**



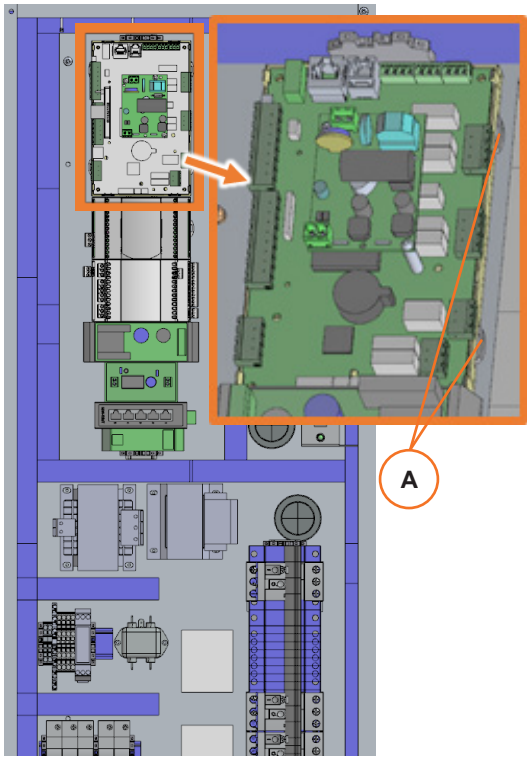
Valves on the air supply side of the unit



Valves located inside of the cabinet

10.6 Components replacement

10.6.1 Replacing the control board



WARNING
Disconnect the unit from the power supply.

How to remove

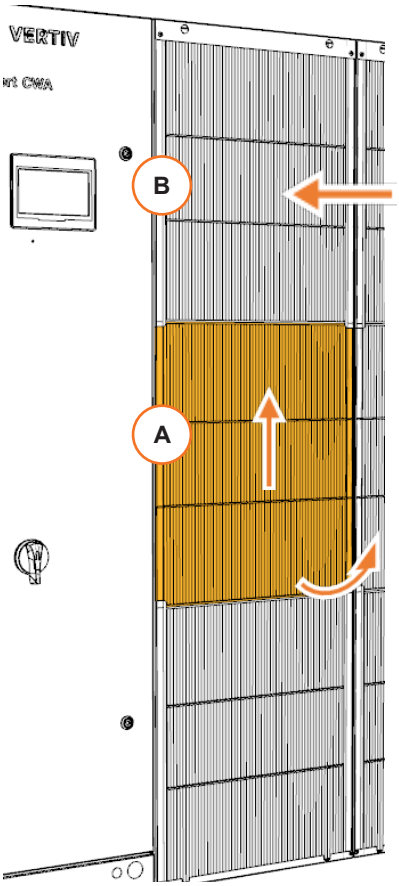
- Remove the cover plate of electrical and control panel.
- Remove all the cables connected to the the control board.
- Insert a screwdriver in one of the loops [**A**] and lever/pull the latch to release the lock [**B**].
- Repeat for the other latches until the control board can be removed from the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

How to reassemble

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

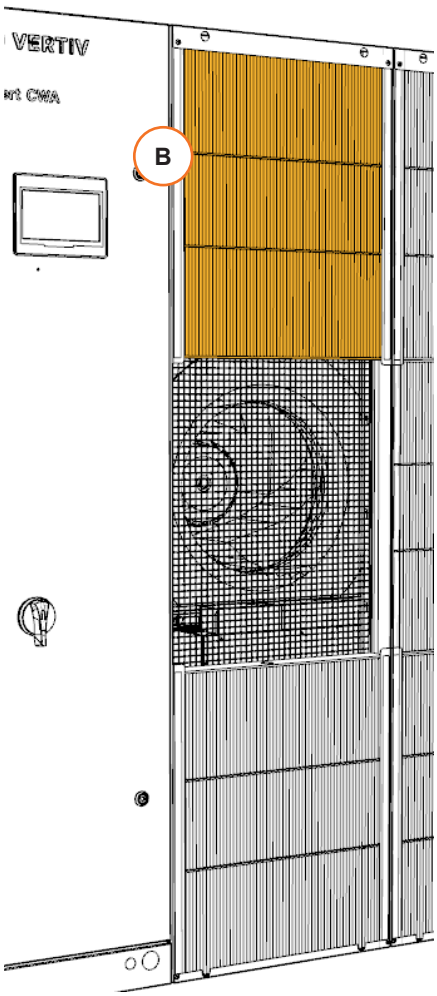
NOTE: *Battery type - Lithium button (removable), BR2032, 3Vdc*
*Duration min. **8** years in normal operating conditions*

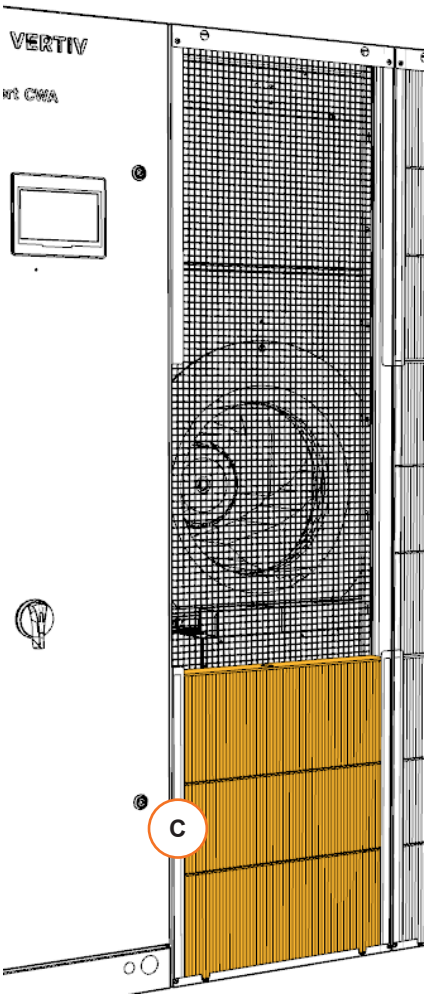
10.6.2. Replacing the air filters



• Switch off the unit

• To remove the filter, start from the middle panel **[A]**.
• Hold the top panel **[B]** in place
• Push the middle panel up a pull the lower end of this panel forward





- Pull the top panel **[B]** down and remove it through the opening in the frame.
- Lift the bottom panel **[C]** up and remove it through the opening in the frame.
- Slide in the replacement filter panels in reverse order = bottom **[C]** -> top **[A]** -> middle **[B]**
- Pay attention to correct filter orientation relative to the airflow.

10.6.3 Replacing a fan

10.6.3.1.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.

CAUTION
Risk of contact with sharp edges, splinters, and exposed fasteners.
Can cause injury!
Only properly trained and qualified personnel wearing appropriate personal protective equipment should move, lift, remove packaging from the components.

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 *8.6.2 Setting of Modbus devices* and the *CWA Control Application* for details.

10.6.3.2. Fan removal

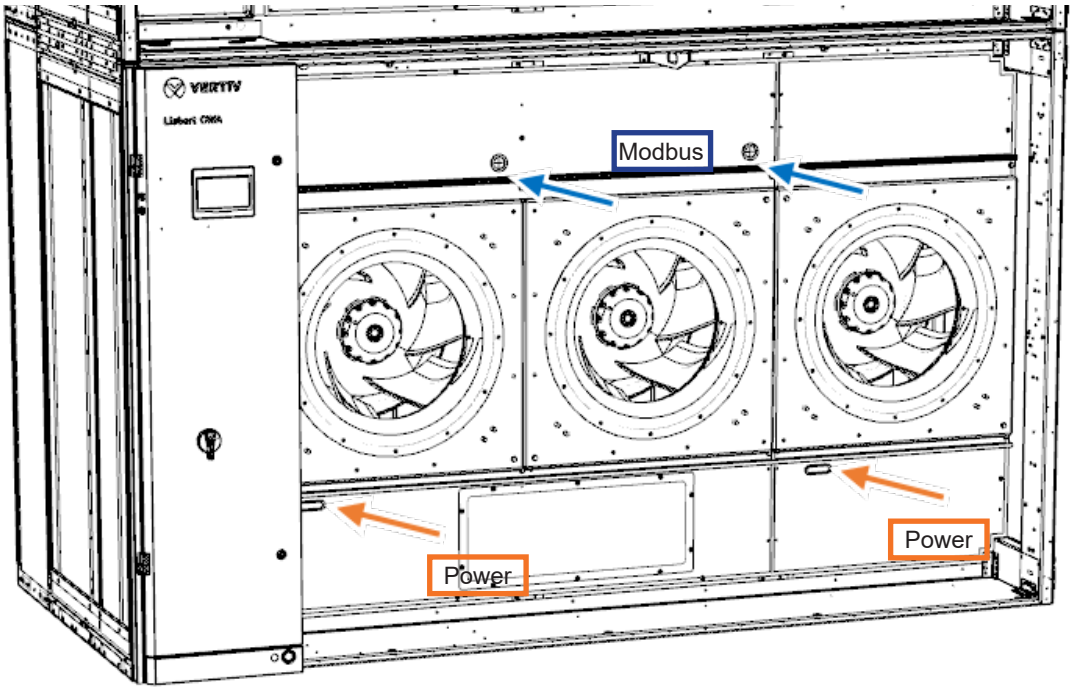
• Turn the main switch handle on the front panel to 0/OFF

• Depending on the specific fan to be replaced, remove all necessary filters and their frames from the unit.
If the fan is located in the bottom module, also filters from the top module need to be removed.

• Disconnect the power cable from the respective connector - see chapter *8.5.3. - Power and signal cable routings for motor fans* and the supplied electrical scheme for more details.

• Disconnect the Modbus signal cable from the respective connector - see chapter *8.5.3. - Power and signal cable routings for motor fans* and the supplied electrical scheme for more details.

• Push the loose ends with connectors through the opening into fan compartment.

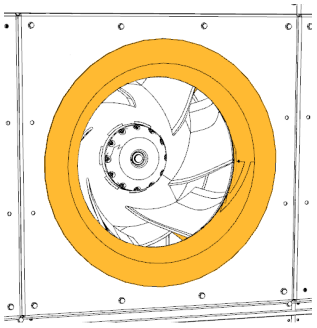


NOTE: *In case of fan M1, if the unit is equipped with an AHF device, it is necessary to remove the AHF box, to make enough space for the fan removal – see chapter 10.6.4 - AHF device removal.*

• Insert M8 eye bolts (not provided with unit) into the openings and secure them with a washer and nut from the opposite side.

- It is possible to remove some of the screws on the upper part of the nozzle support or use other free holes on the upper part of the nozzle support.
- The position of available mounting holes might differ depending on fan type.

• If there is not sufficient space to reach behind the nozzle support and secure the eyebolt, it is possible to remove the nozzle from the fan – Hold the nozzle in place and unscrew the self-tapping screws.



• For lifting the fan, prepare:

- a balancer / or lifting chain / sling
- a pulley / or manual / motorized hoist

NOTICE

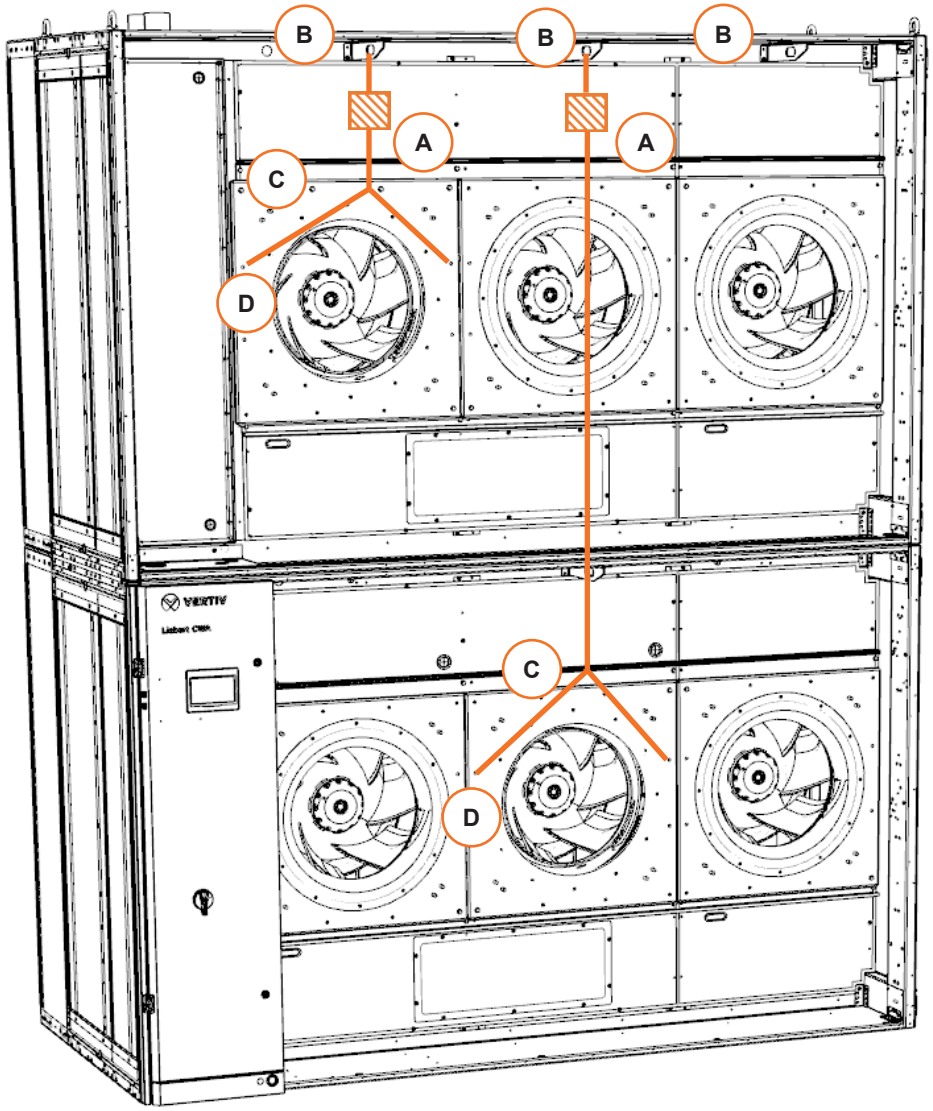
The lifting equipment needs to be able to support the weight of the fan and frame assembly. See chapter *4.4. Fan type.*

• Attach the hoist [**A**] into the bracket [**B**] in the top module

• Attach the balancer or sling [**C**] into the eye bolts [**D**] on the fan nozzle support plate

NOTE: *Depending on fan configuration, it is possible to use* **one** *lifting point in the middle or* **two** *wider lifting points (shown)*

• Attach the sling to the hoist.

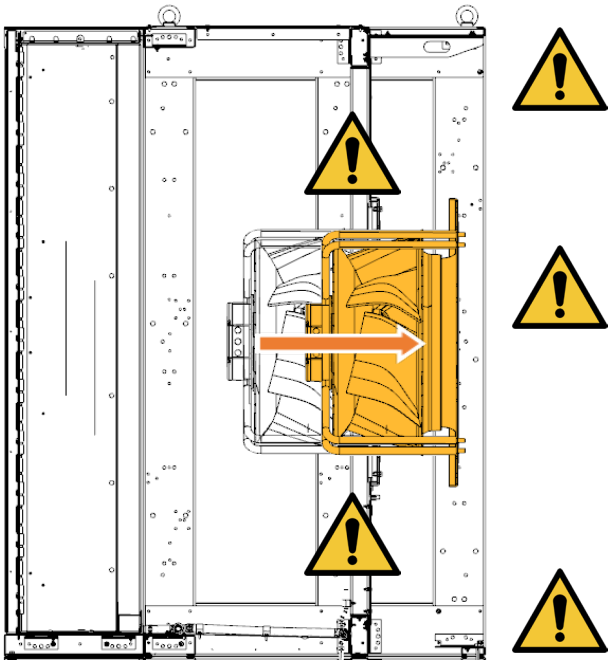


NOTE: *The hoist needs to be always attached in the top module even for lifting the bottom fan.*

• Put some tension on the sling so the fan would be hanging on the hoist.

• Remove all the screws from the upper part of the nozzle support.

• Keep the balance of the fan assembly – the fan should stay in the same position to avoid any damage on the impeller or cables.



WARNING

• The fan assembly is heavy (see chapter *4.4. Fan type for specific weight*)

• The fan assembly attached to the hoist is unbalanced with the center of gravity shifted towards the rear.

• Do not remove the fan assembly using ladders.

CAUTION

• It is important to keep the balance of the fan using suitable tooling.

• Can cause personal injury and equipment damage.

• Consider using a two-person lift for safe removal and installation of components.

• Only properly trained and qualified personnel should work on this equipment.

WARNING

• The fan assembly is heavy (see chapter *4.4. Fan type for specific weight*)

• The fan assembly attached to the hoist is unbalanced with the center of gravity shifted towards the rear.

• Do not remove the fan assembly using ladders.

• Remove all the screws from the bottom part of the nozzle support.

• Pull the fan straight forward while maintaining the position.

• Descend the fan on a prepared pallet. Be careful to not damage the impeller, motor, or cables.

• Remove both signal and power cable from the disassembled fan.

NOTE:
- *Notice the routing of the cables relative to the fan frame.*
- *Keep the cable kit for fan replacement.*

10.6.3.3. Fan replacement

• Bring the replacement fan to the unit

• Equip the replacement fan with power and signal cables.
- Connect the cables into corresponding brackets on the motor according to electric scheme.
- Align the cable routing on the fan frame. The routing should be the same as on the previously removed fan.
- Fix the cables to the fan frame with cable zip-ties.

• Turn the fan assembly into correct position – pay attention to:
- The position of holes
- Position of the cable connectors
- The routing of the cable on the fan frame.

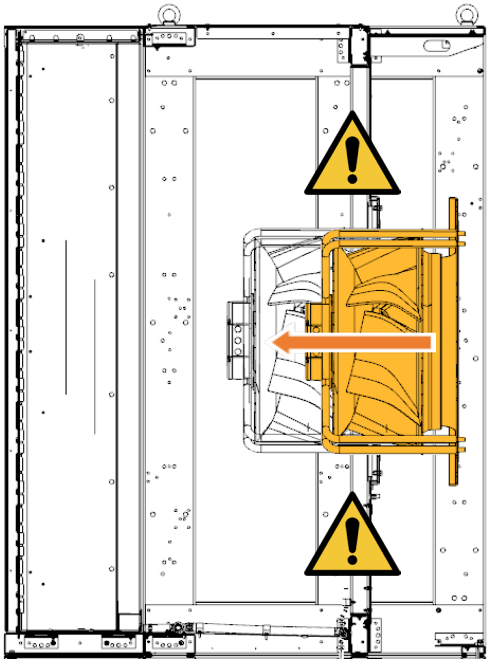
• Equip the nozzle support with suitable M8 eye bolts and secure them with washer and nut.

NOTE: *The eye bolt and nut need to be able to support the weight of the fan and frame assembly*.

• Attach the fan assembly to the hoist. Maintain the balance of the fan and lift it into position.

• Insert the signal and power cables into the cabinet and pull them out, forward through the corresponding opening.

• Connect the power cable and the signal cable to the corresponding connectors – see chapter *8.5.3 - Power and signal cable routings for motor fans*



• Maintain the balance of the fan and slowly insert the fan assembly into correct location.

Be careful to not damage the impeller or the cables.

• Align the position of holes and fix the fan in place using flanged screws M8x25.

• Remove the nozzle from the fan

• Demount the eye bolts from the nozzle support plate.

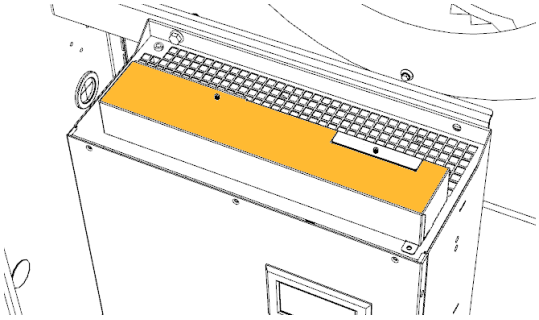
• Fix the fan properly in place using the available holes and threaded inserts in the frame.

• Re-attach the nozzle to the fan.

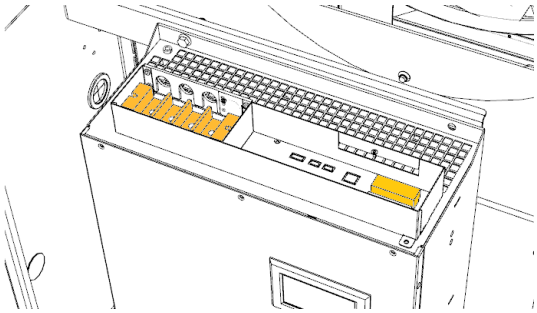
Be careful to not damage the impeller.
Check if the impeller can freely rotate and is not in touch with the nozzle.

• Set the Modbus address of the fan in the system.
See *10.2 - General instructions*

10.6.4. AHF device removal

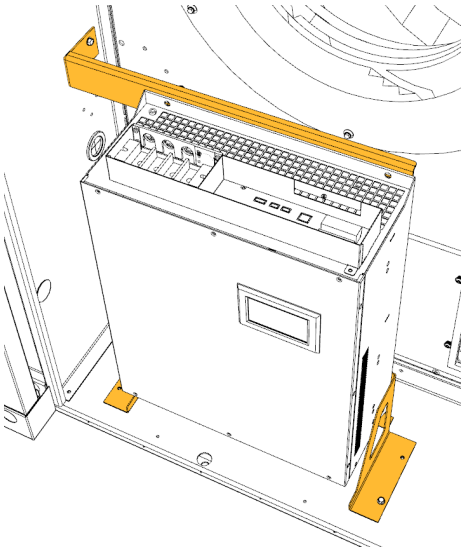


• Open the cover on top of the AHF box.
NOTE: *50 Amp variant shown.*



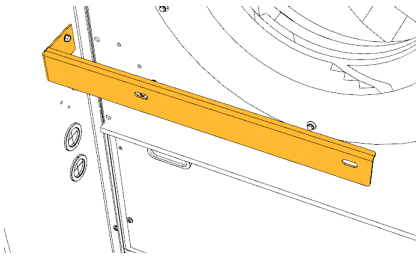
• Disconnect the power and control cables from the terminals.

• Disconnect the grounding wire.



• Hold the AHF device and demount the box from the brackets.

NOTE: *The AHF device is heavy (up to 35kg).*



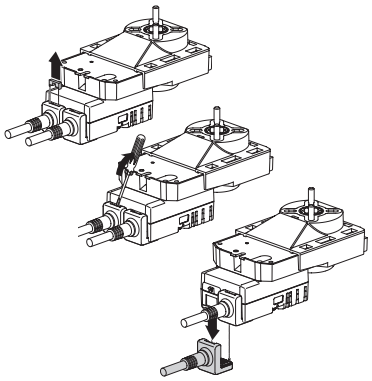
• Remove the AHF box from the cabinet – be careful to not damage the device, brackets, or cables.

• Remove the upper bracket.

• Continue with the removal of fan M1.

• To attach the AHF box into the unit, proceed in reverse order.

10.6.5 Replacing the valve actuator

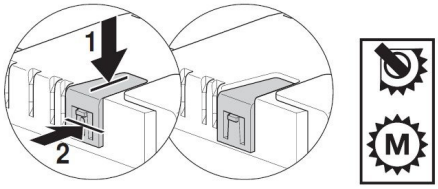


1) Turn off the unit – set the disconnection switch of the unit to position “0” (see chapter *9.5. Stop*)

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

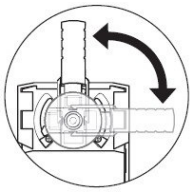
In case of PIC valve: follow procedure on the first picture to disconnect cables from actuator.

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

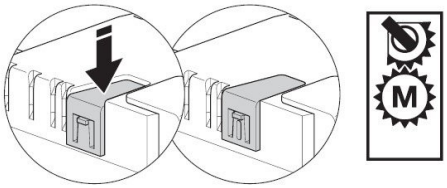


3) Set the actuator / valve into default position:

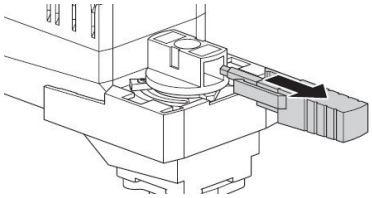
- Press the disconnect button down (**1**) and hold it in position by pressing the latch (**2**)



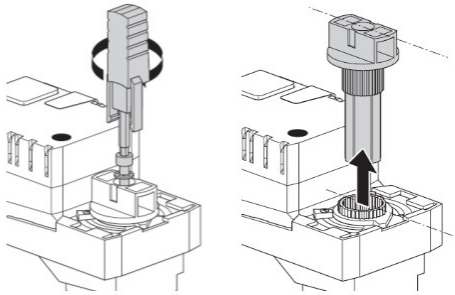
- Manually turn the valve using the actuator handle until you reach the end stop.



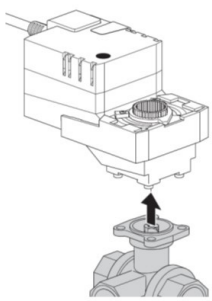
- Press the disconnect button again to release it.



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



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



6) Now you can safely remove the actuator.

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

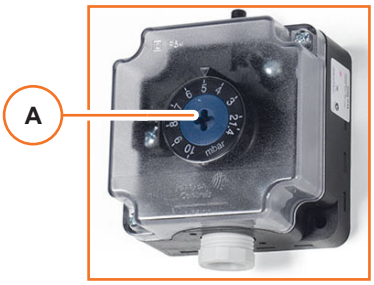
10.7 Calibrations

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 *CWA Control Application User Manual*

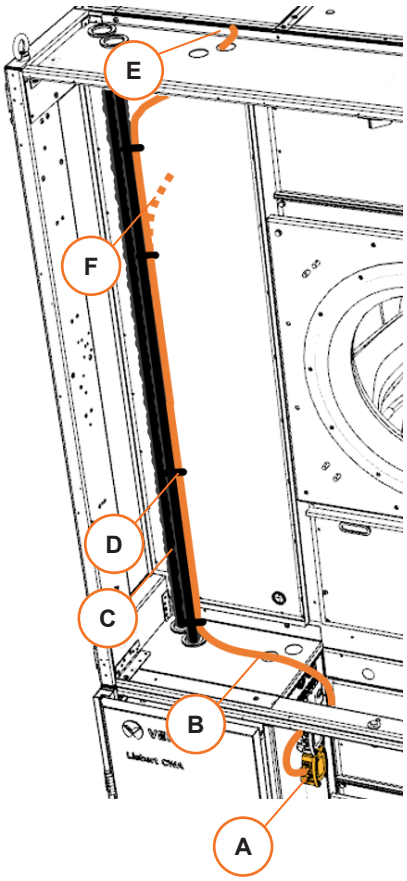
Clogged filter differential pressure switch

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.

10.7.1. Pressure sensor tube routing



1) **Standard configuration** - the unit is equipped with one clogged filter sensor, the routing of the sensor tube inside of the unit should be:

• Connect the tube [**B**] to the (**+**) port on the sensor box [**A**]. The (**-**) port can remain vented into the inner area.

• Route the tube [**B**] upwards into the Top module, along the plastic cable conduit [**C**].
• Fix the tube to the conduit using suitable clamps or zip-ties [**D**].

CAUTION
Keep sufficient bend radius on the tube.
Do not choke the tube with the clamps.

• Use one of the cut-outs [**E**] on the top panel to route the tube out of the unit cabinet.

2) Independent control configuration - the unit is equipped with two clogged filter sensors.

• For the second (**+**) tube use the same routing as described above –> outside of the cabinet.

• Connect the tube to the (**-**) port on the sensor.
• Route the tube along the cable conduit, fix it using suitable clamps or zip-ties.

• The loose end [**F**] of the (**-**) tube should vent to the inner space of the Top module, in area where it would not be affected by the airflow.

11. 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

12. 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.

12.1 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.

12.2 Operations

Operation	Notes
1. Disconnect the disconnecting switch from the electric power supply	Reverse the procedure from chapter *8. Installation*: *8.5.1 Power supply cable*
2. Drain the water	See *10.5 Draining the chilled water system*
3. Cut the piping at inlet and outlet of the unit	
4. Remove the unit	Reverse the procedure from chapter *7. Assembly and Positioning*
5. Move away the unit	See *6. Handling*
6. If you need to keep the unit in a storehouse for reuse	See *4.8.1 Storage conditions*
7. If you need to scrap the unit	Handle to authorized disposal company according to the local regulations about waste disposal.

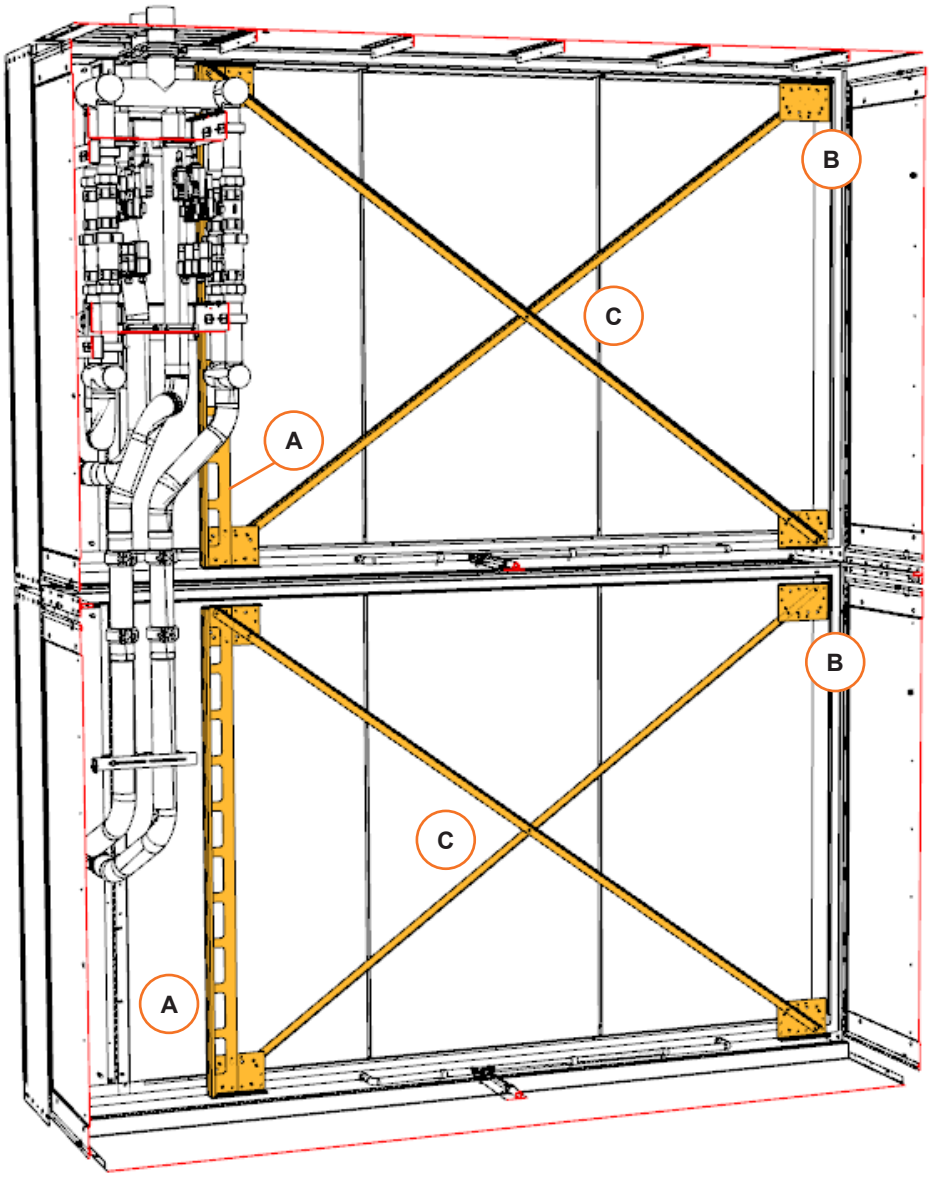
13. Seismic configuration

In case of “seismic” configuration of the unit – see chapter 2. Digit Nomenclature, the unit is delivered with special reinforcing elements.
This configuration contains additional stiffeners and equipment to increase the rigidity of the unit frame.

13.1. Component description

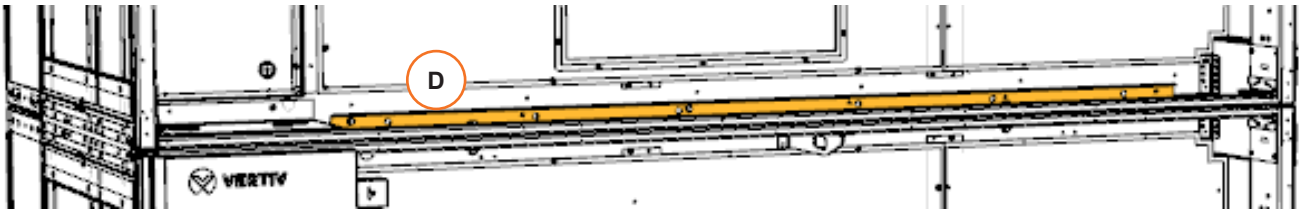
If selected, the unit comes pre-assembled with all the additional componets:

* Additional pillar **[A]** in the bottom and top module
* Reinforcing brackets **[B]** in the corners of the coil for both top and bottom module
* Cross strut **[C]** in both top and bottom module

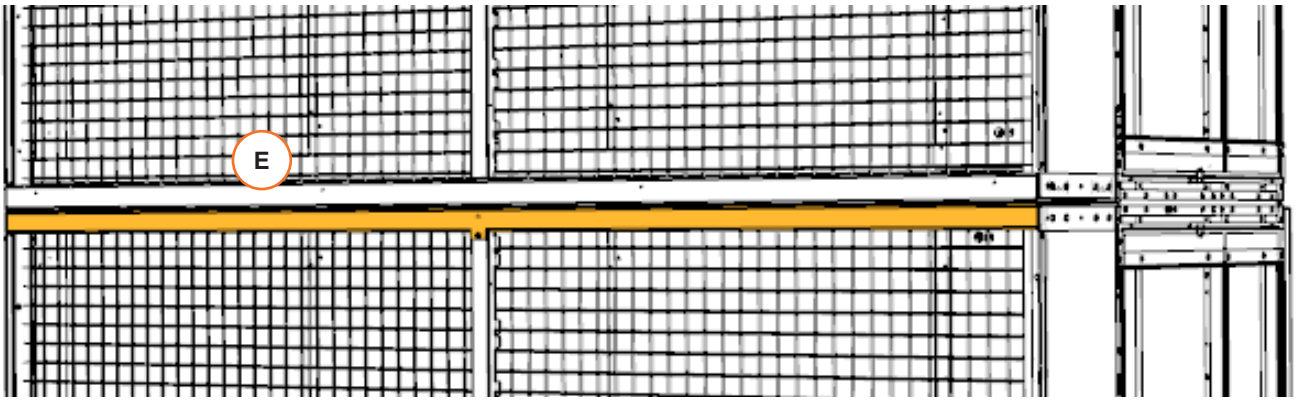


* section view of the unit with „seismic“ reinforcement

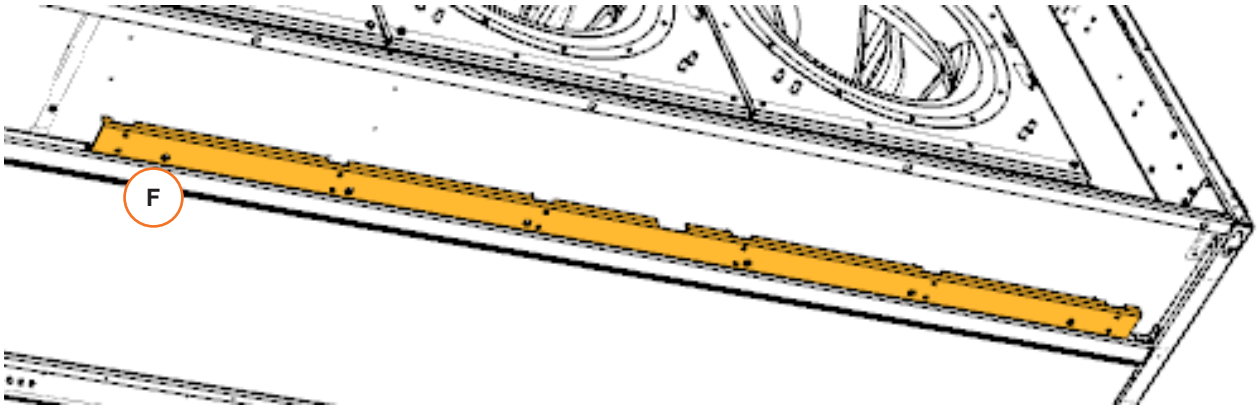
* Additional coupling plate [D] on the front side of the unit to connect bottom and top module – see chapter *8.4.5.1 – Additional coupling plates*



* Additional beam [E] on the rear side of the unit which provides more fixing points to connect the bottom and top module – see chapter *8.4.5.1 – Additional coupling plates*



* Reinforcing beam [F] on the bottom side of the unit – the purpose is to provide additional anchor points for fixing the unit to the floor. For more details, see chapter *8.4.5.2 – Anchor points*



13.2. Seismic application

NOTICE

The unit operation after a seismic event is not guaranteed.

WARNING

A solid fixing system must be guaranteed during the installation in order to prevent unit tilting during seismic event, evaluating any potential fixing system deformation due to the seismic event.

NOTICE

In case of a seismic event, it is necessary to check the structural integrity of the frame of the unit.

It is crucial to double check the reinforcing elements and anchor points for any damage or deformation.

NOTICE

Connections (i.e. cables/pipes/ducts…) must not apply any force or add seismic mass to the unit. Consider also to provide adequate connections for the cables, pipes, ducts to permit the deformations of the unit during a seismic event.

NOTICE

The unit cannot be mounted on isolators, non-rigid curb, neoprene pads, or anything that could amplify the seismic motions. The supporting structure must have adequate strength to transfer the forces to the equipment.

Additionally, the supporting structure must have adequate stiffness to not amplify the equipment forces and to not overload the unit with forces coming from the building.

- The calculations are according to the regulations and the seismic acceleration below reported. The frame of the unit and the connection points to the ground are calculated to support the values indicated. The installer is left with the task of checking the local seismic acceleration value with that reported below.
- Attention should be done at the integrity of the frame during transport, installation and after every event that can damage the frame of the structure (i.e. seismic event). Eventually critical points (deformed/broken) present after the final installation or after an important seismic event should be repaired to prevent failure during following seismic events.
- A solid fixing must be done to prevent the tilting of the unit during seismic events. Number of anchor points with a resistance forces greater than the values reported in the table below must be used. The use of a large washer for the fixing points is suggested.

Unit	Number of available anchor points
CA40	11
CA60	14
CA80	19
Max.nominal (traction) force (per fixing point) [N]	**Max.shear force (per fixing point) [N]**
26 300	14 000

- Please, note that the values above reported already include also an overstrength factor (i.e. a multiplication factor for the force) suggested for connection in concrete or masonry support (i.e. Ω0 = 2 for ASCE standard).The installer is left with the task of comparing the admissible load values for the anchor points with that indicated above.
- Connections (i.e. cables/pipes/ducts…) must not apply any force or add seismic mass to the unit. Consider also to provide adequate connections for the cables, pipes, ducts to permit the deformations of the unit during a seismic event.
- The unit cannot be mounted on isolators, non-rigid curb, neoprene pads, or anything that could amplify the seismic motions. The supporting structure must have adequate strength to transfer the forces to the equipment. Additionally, the supporting structure must have adequate stiffness (i.e. must be rigid) to not amplify the equipment forces.
- No practical seismic test was performed on the unit.
- The calculation account for the stability of the unit during a seismic event but not for the ability to function after the seismic event.

13.3. Acceleration calculation:

The forces considered in the analysis are in line with the American regulations (ASCE7-16). Through static analysis the stresses on the fixings and on the unit are examined.
The accelerations and forces values are summarized below.
The calculation was done for the largest, most critical unit – CA80.

Calculations:

Design Spectral Response Acceleration

S_S =		1,125 g
F_a =		1,0
S_{DS} =	$2/3F_aS_S$	0,750 g

Seismic Design Force

a_p =		2,5
R_p =		1,0
I_p =		1
z/h =		1
F_p =	$0,4a_pS_{DS}W_p(1+2z/h)/(R_p/I_p)$	2,25 g

Test for Limits of Seismic Design Force
Not greater than

F_p =	$1,6S_{DS}I_pW_p$	1,2 g

Not less than

F_p =	$0,3S_{DS}I_pW_p$	0,225 g

Horizontal Forces:

$F_H = F_p$	$0,3S_{DS}I_pW_p$	1,200 g

Vertical Forces:

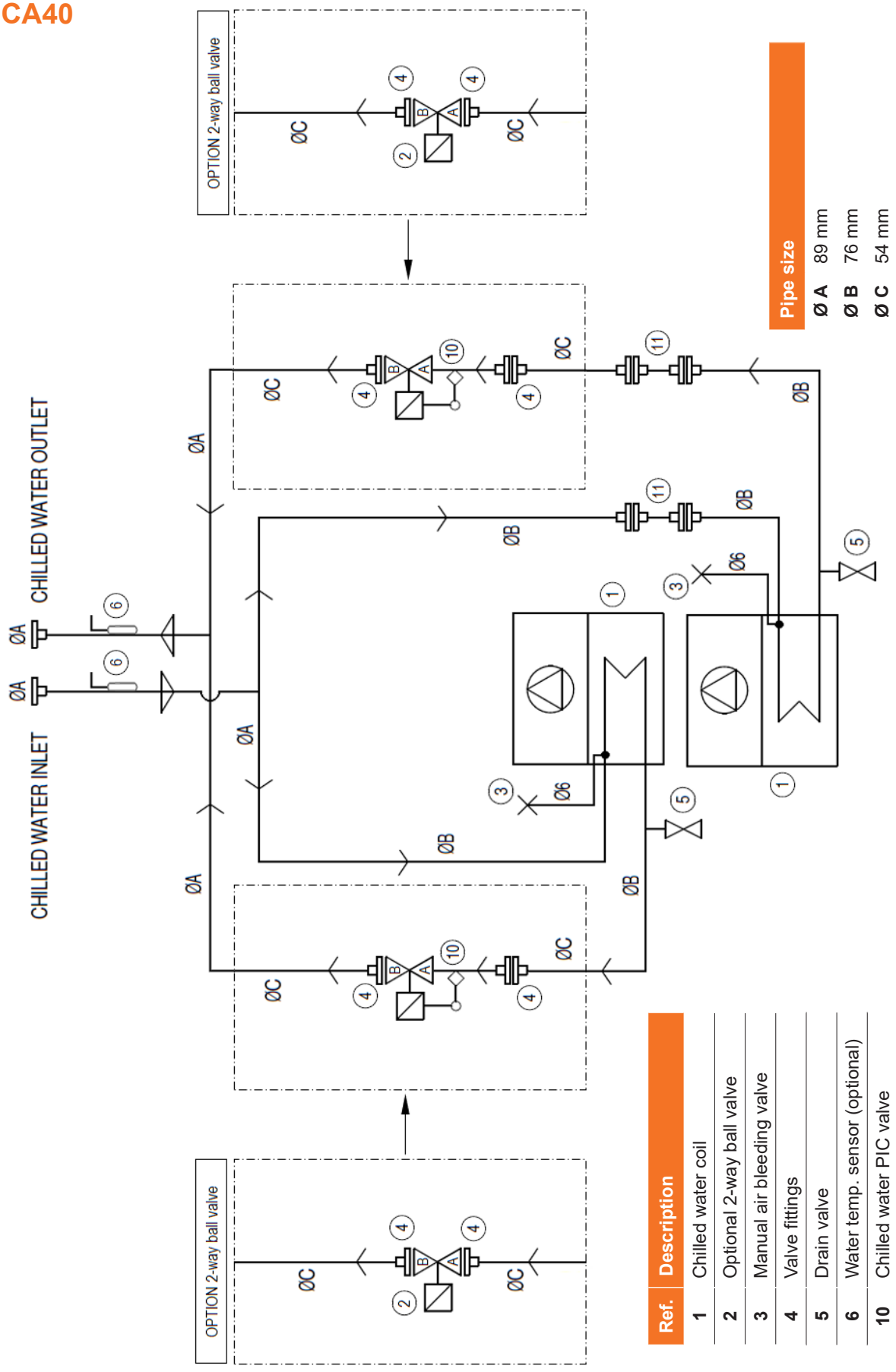
F_Z =	$1,2 + 0,2S_{DS}$	1,350 g
F_Z =	$0,9 – 0,2S_{DS}$	0,750 g

With:
F_p = seismic design force;
a_p = component amplification factor;
S_{DS} = design earthquake spectral response acceleration (at short period);
z/h = ratio between the component mounting height (z) and the building height (h);
W_p = weight of the component;
R_p = component response modification factor;
I_p = component importance factor;

In our calculation
a_p = 2,5
S_{DS} = 0,75 g
z/h = 1
R_p = 1
I_p = 1

Annex A - Chilled water circuit scheme

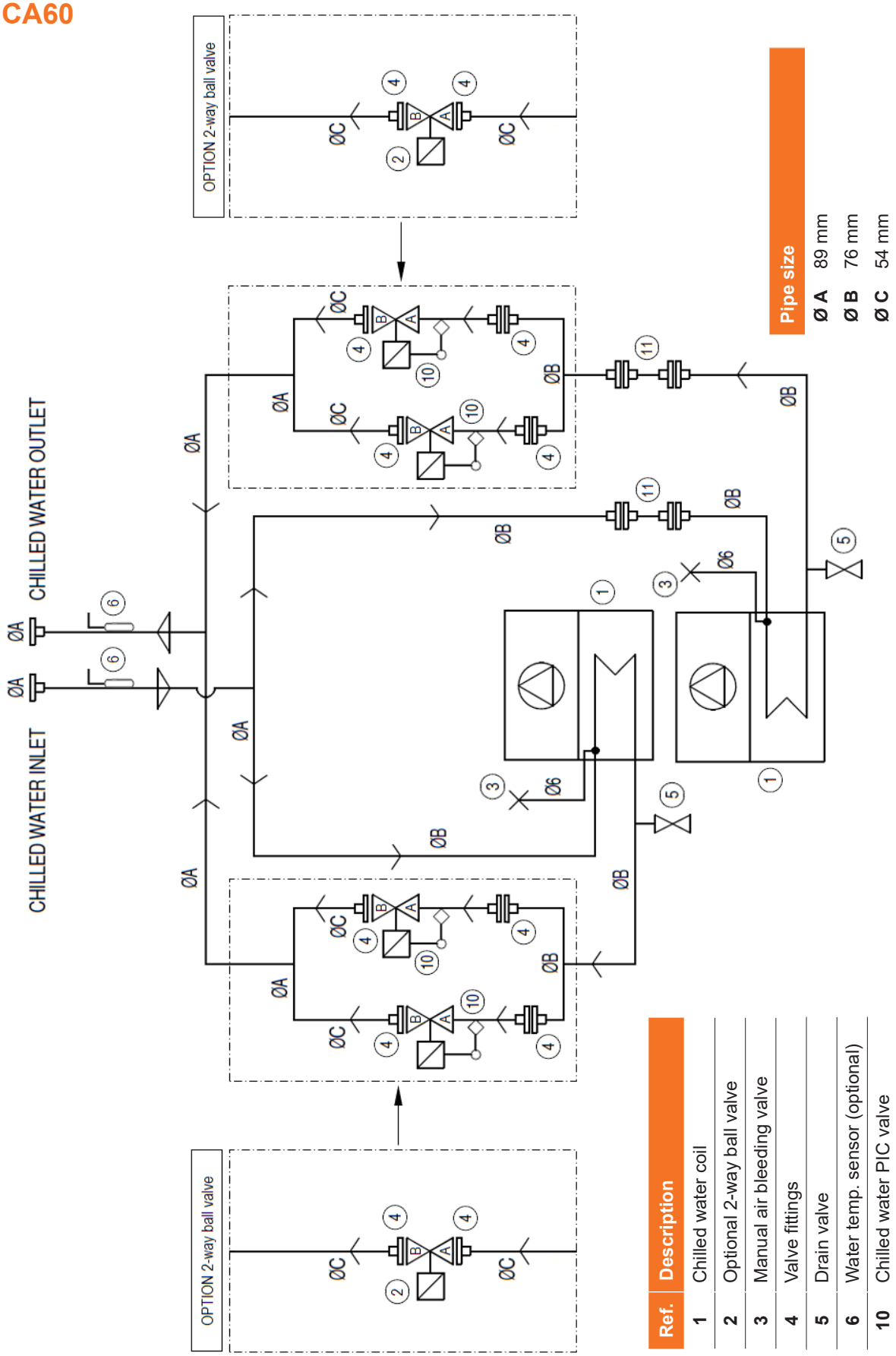
CA40



Ref.	Description
1	Chilled water coil
2	Optional 2-way ball valve
3	Manual air bleeding valve
4	Valve fittings
5	Drain valve
6	Water temp. sensor (optional)
10	Chilled water PIC valve
11	Grooved coupling between bottom and top module

Annex A - Chilled water circuit scheme

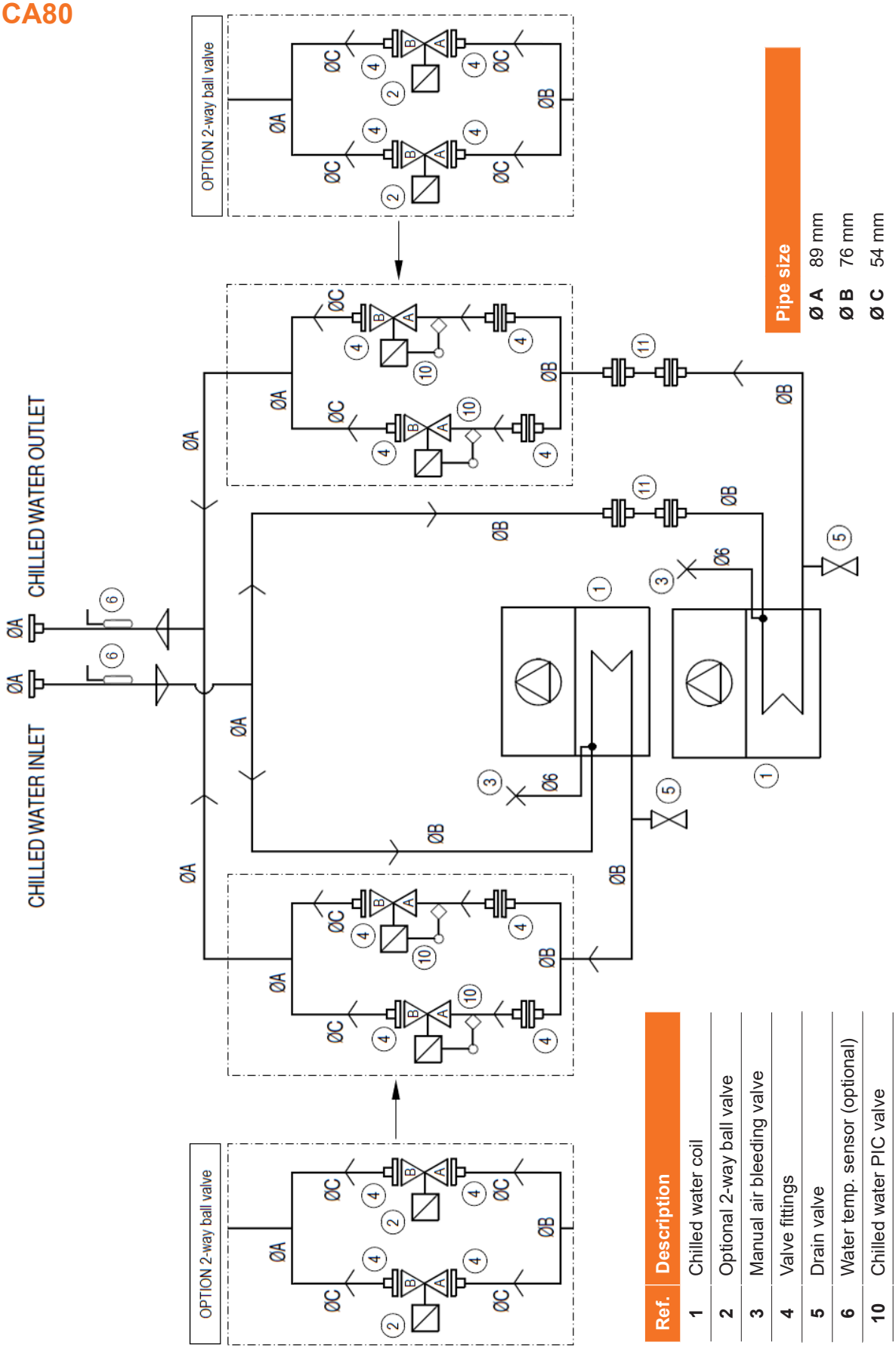
CA60



Ref.	Description
1	Chilled water coil
2	Optional 2-way ball valve
3	Manual air bleeding valve
4	Valve fittings
5	Drain valve
6	Water temp. sensor (optional)
10	Chilled water PIC valve
11	Grooved coupling between bottom and top module

Annex A - Chilled water circuit scheme

CA80



Pipe size

Ø A	89 mm
Ø B	76 mm
Ø C	54 mm

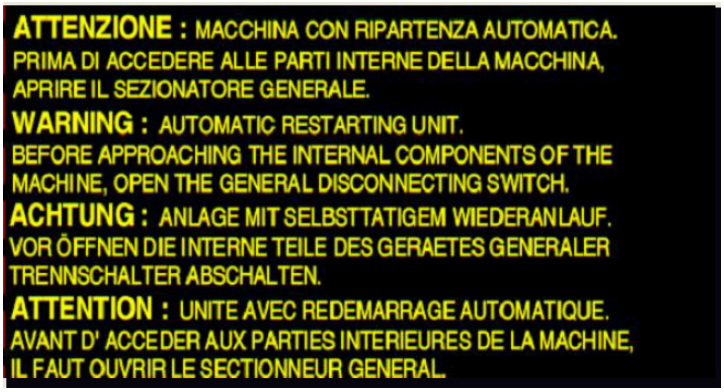
Ref.	Description
1	Chilled water coil
2	Optional 2-way ball valve
3	Manual air bleeding valve
4	Valve fittings
5	Drain valve
6	Water temp. sensor (optional)
10	Chilled water PIC valve
11	Grooved coupling between bottom and top module

Annex B - Safety Labels

WARNING

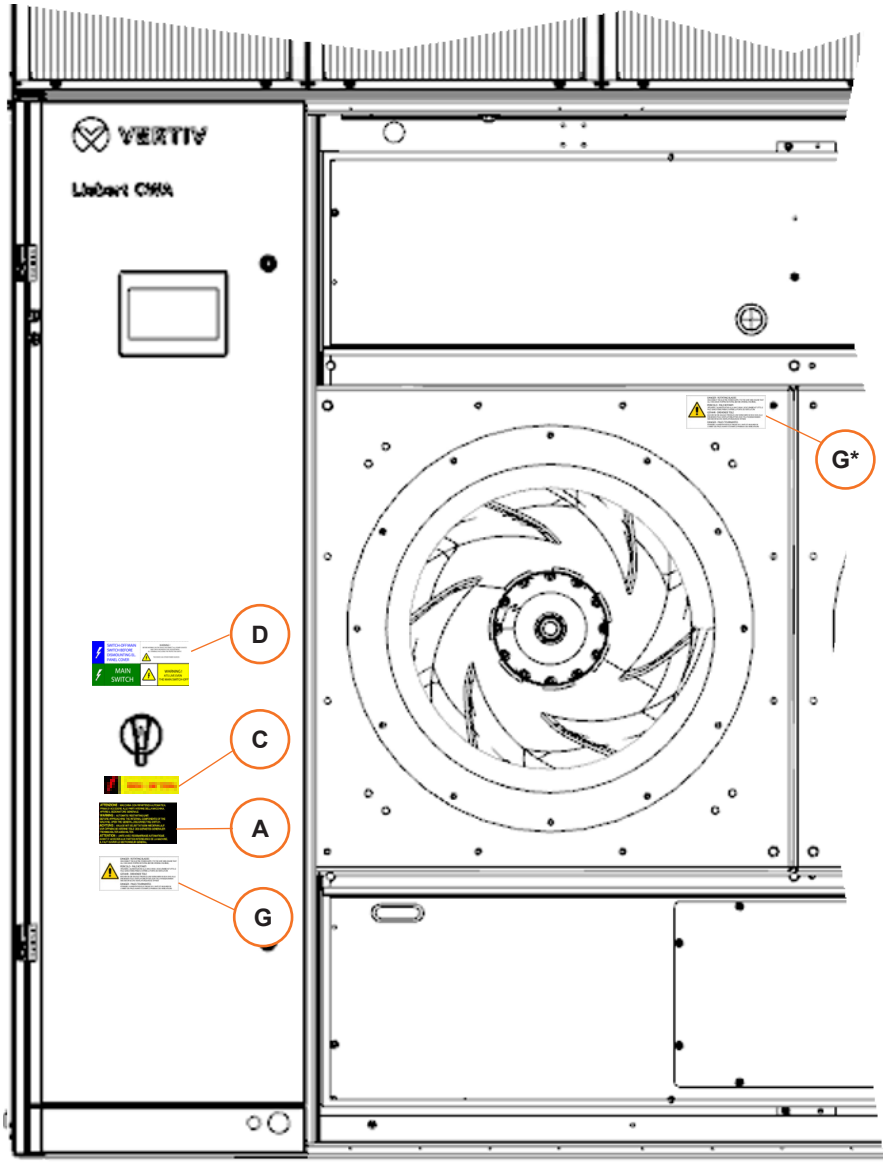
Do not remove or cover the labels placed on the unit by the manufacturer.
Check regularly that the warning label are still on the unit and that they are clearly visible.
Replace any missing or damaged label.

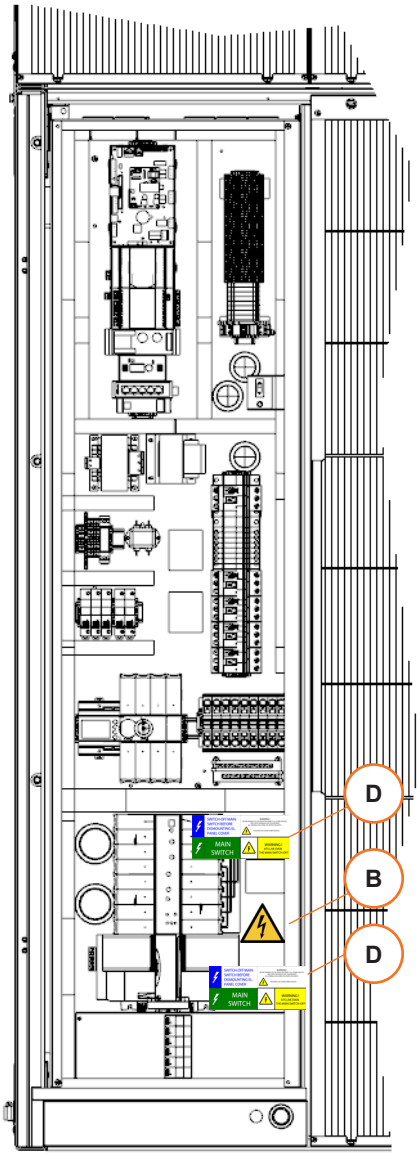
Labels list

Identification	Description
A	
B	
C	 * Specific label inscription depends on the unit configuration
D	

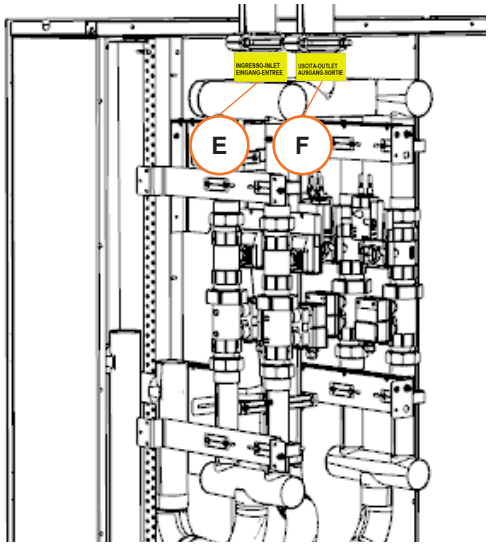
E	INGRESSO-INLET EINGANG-ENTREE
F	USCITA-OUTLET AUSGANG-SORTIE
G	 DANGER - ROTATING BLADES DISCONNECT THE ELECTRIC POWER SUPPLY TO THE UNIT AND ASSURE THAT ALL FANS HAVE STOPPED ROTATING BEFORE OPENING FAN PANEL PERICOLO - PALE ROTANTI SPEGNERE L'ALIMENTAZIONE ALLA MACCHINA E ASSICURARSI CHE TUTTE LE PALE SIANO FERME PRIMA DI APRIRE LA PORTA DEI VENTILATORI GEFAHR - DREHENDE TEILE MACHEN SIE DIE ANLAGE STROMLOS UND VERSICHERN SIE SICH DASS ALLE DREHENDEN TEILE (VENTILATORBLÄTTER) ZUM STILLSTAND GEKOMMEN SIND BEVOR SIE DAS VENTILATORGEHÄUSE ÖFFNEN DANGER - PALES TOURNANTES ETEINDRE L'ALIMENTATION ELECTRIQUE DE L'UNITE ET S'ASSURER DE L'ARRET DES PALES AVANT D'OUVRIR LE PANNEAU DES VENTILATEURS

Labels position





* Label G is located on the EP door and on each fan in bottom and top module.



Annex C - Connections

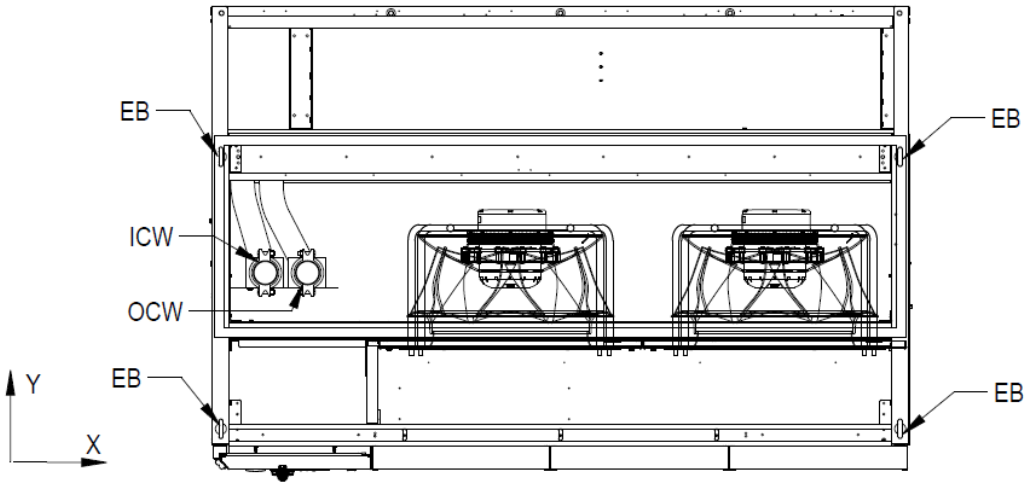
Key to symbols

Symbol	Description	See ...
ICW	Chilled water INLET	*8.4.4 Chilled water connection to the external source*
OCW	Chilled water OUTLET	
EC	Electrical power supply	*8.5. Electrical connections*
EC opt	Electrical power supply (optional)	
EC aux	Low voltage cables	
CD	Condensate drain	*7.4. Arrangement of the drain piping*
CEC	Customer low voltage connection	*8.5.4. Contacts for the unit status signals*
SOF	Smoke and fire detector	
CDB	Coil drain port	*10.5. Draining the chilled water system*
CBP	Coil bleed port	
MMFC	Modbus motor fan connection	*8.5.3. Power and signal cable routings for motor fans*
PMFC	Power motor fan connection	
EB	M16 eye bolt (lifting position)	*6.3.2. Lifting using a crane*

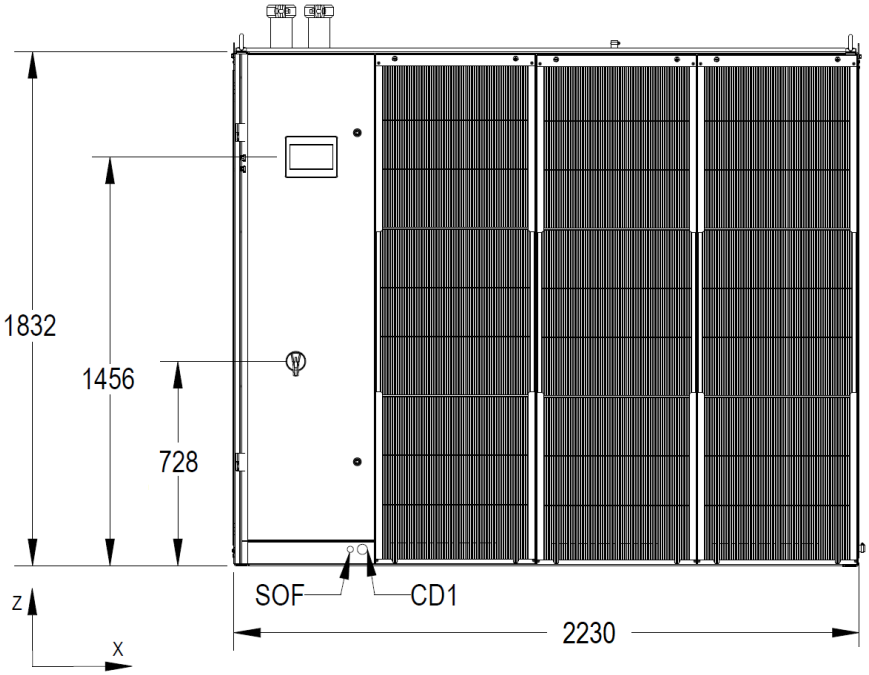
CA40 - Hydraulic and electrical connections – Bottom module

Point	Description	X [mm]	Y [mm]	Z [mm]	Size [mm]
ICW	**Chilled water INLET**	171	627	--	O.D.76
OCW	**Chilled water OUTLET**	305	627	--	O.D.76
CD1	Condensate drain	460	--	59	O.D.36
CD2	Condensate drain – Lateral (optional)	--	602	64	O.D.28
SOF	Smoke and fire detector	417	--	59	O.D.22
CDB	Coil drain port	124	--	156	O.D.22
CBP	Coil bleed port	176	--	1756	O.D.22
MMFC1/2	Modbus motor fan connection	1275	--	1451	O.D.48
MMFC2/3	Modbus motor fan connection	2109	--	1451	O.D.48
PMFC1/2	Power motor fan connection	663	--	424	OBROUND 26x84
EB	M16 eye bolt (lifting position)	--	--	--	--

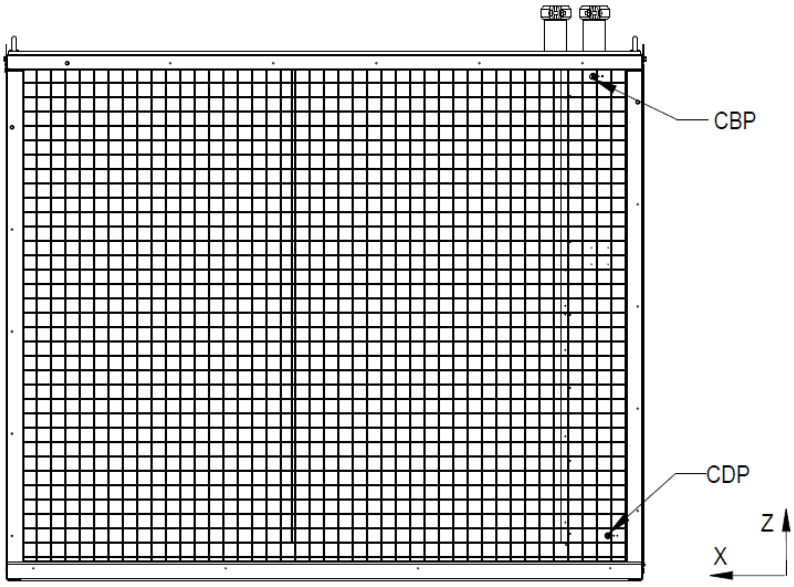
Top view:



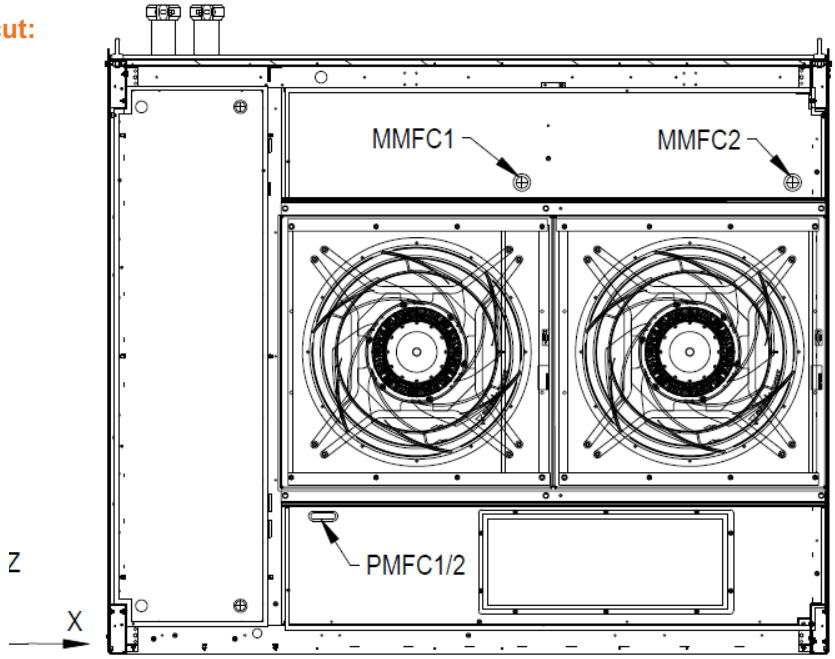
Front view:



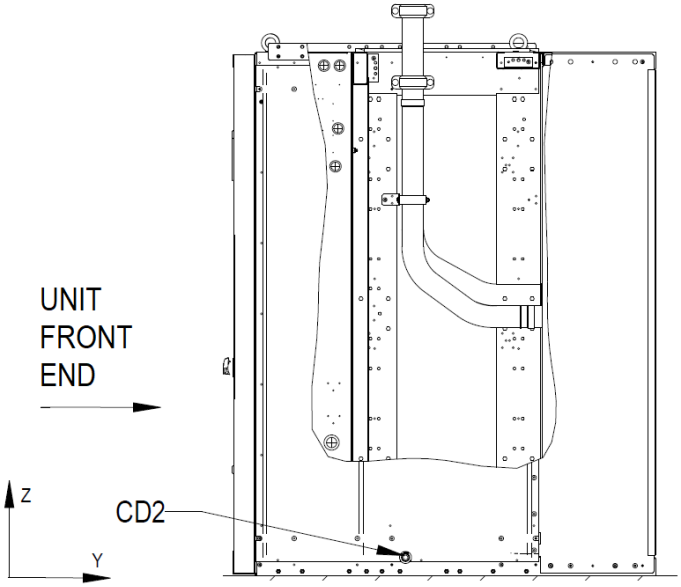
Rear view:



Front view / cut:



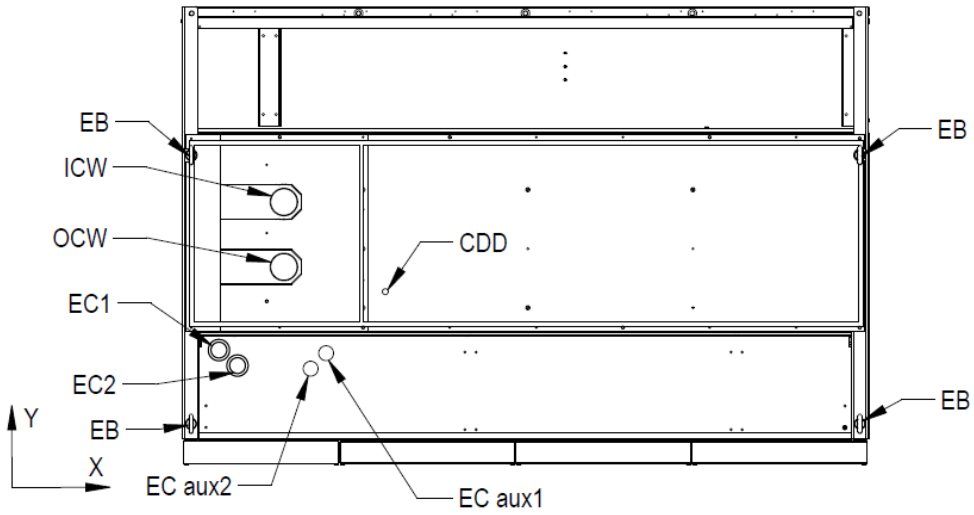
Side view / cut:



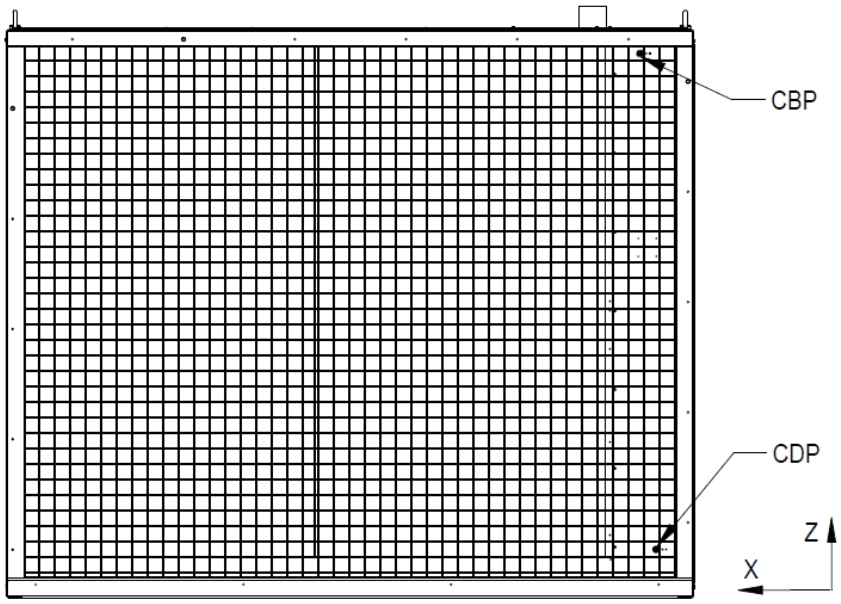
CA40 - Hydraulic and electrical connections – Top module

Point	Description	X [mm]	Y [mm]	Z [mm]	Size [mm]
ICW	**Chilled water INLET**	330	845	--	O.D.89
OCW	**Chilled water OUTLET**	330	636	--	O.D.89
CDD	Condensate drain discharge (optional)	657	556	--	O.D.14
EC1	Electrical power supply	120	368	--	O.D.63
EC2	Electrical power supply	180	318	--	O.D.63
EC aux1	Low voltage cables	466	358	--	O.D.48
EC aux2	Low voltage cables	416	308	--	O.D.48
CDB	Coil drain port	124	--	156	O.D.22
CBP	Coil bleed port	176	--	1756	O.D.22
MMFC1/2	Modbus motor fan connection	1275	--	1451	O.D.48
MMFC2/3	Modbus motor fan connection	2109	--	1451	O.D.48
PMFC1/2	Power motor fan connection	663	--	424	OBROUND 26x84
EB	M16 eye bolt (lifting position)	--	--	--	--

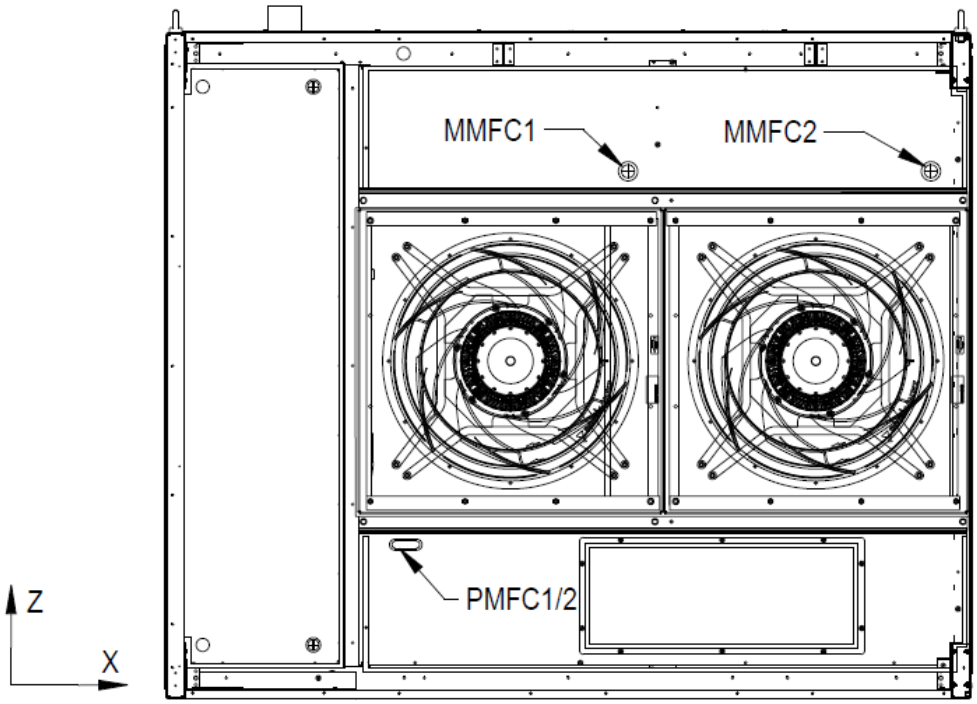
Top view:



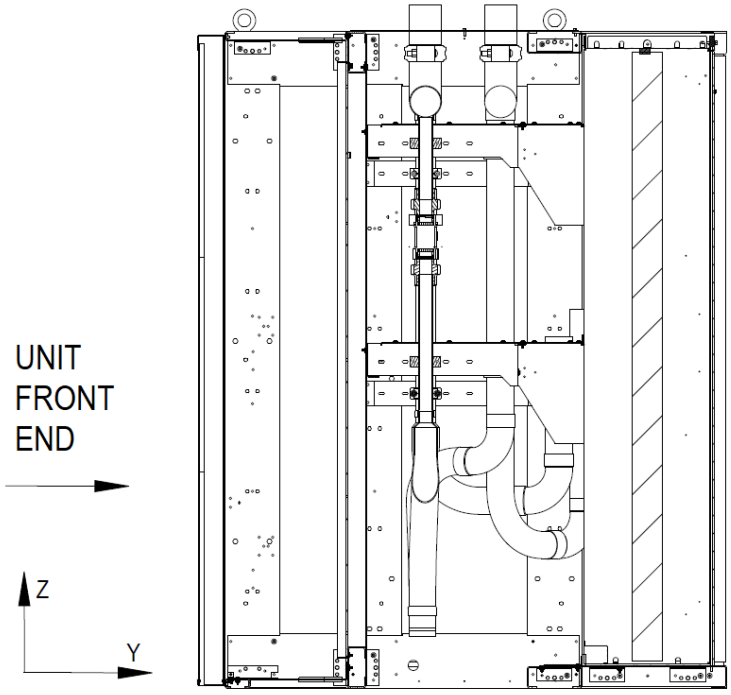
Rear view:



Front view / cut:



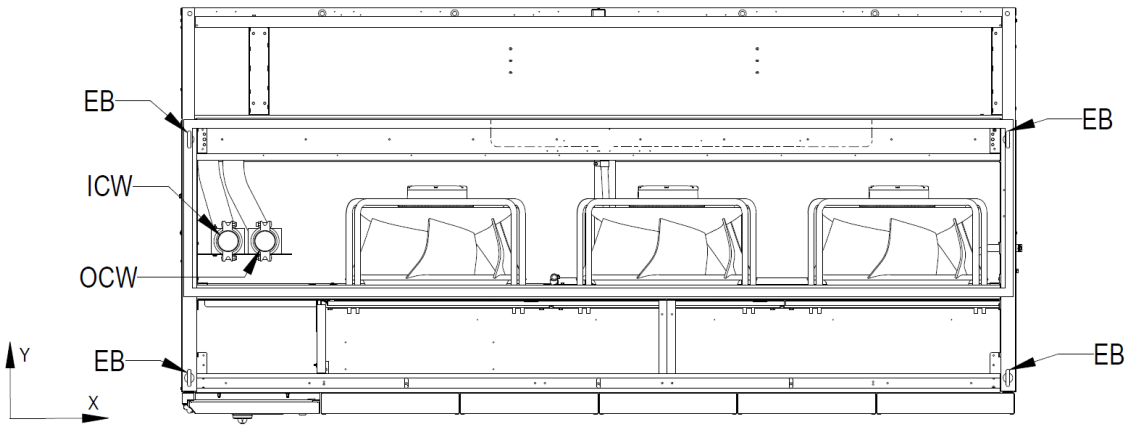
Side view / cut:



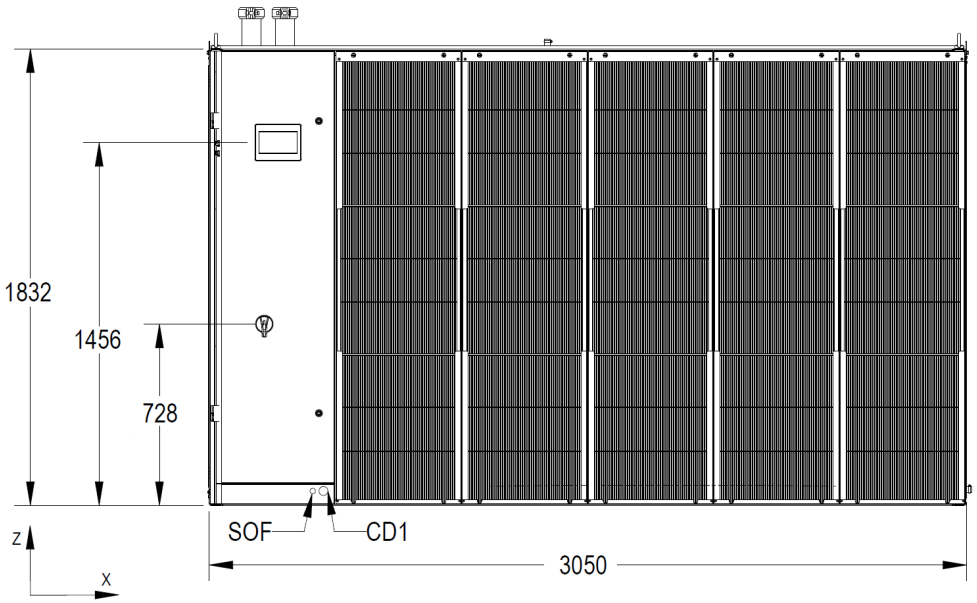
CA60 - Hydraulic and electrical connections – Bottom module

Point	Description	X [mm]	Y [mm]	Z [mm]	Size [mm]
ICW	**Chilled water INLET**	171	627	--	O.D.76
OCW	**Chilled water OUTLET**	305	627	--	O.D.76
CD1	Condensate drain	460	--	59	O.D.36
CD2	Condensate drain – Lateral (optional)	--	602	64	O.D.28
SOF	Smoke and fire detector	417	--	59	O.D.22
CDB	Coil drain port	124	--	156	O.D.22
CBP	Coil bleed port	176	--	1756	O.D.22
MMFC1/2	Modbus motor fan connection	1275	--	1451	O.D.48
MMFC2/3	Modbus motor fan connection	2109	--	1451	O.D.48
PMFC1/2	Power motor fan connection	663	--	424	OBROUND 26x84
PMFC3/4	Power motor fan connection	2354	--	424	OBROUND 26x84
EB	M16 eye bolt (lifting position)	--	--	--	--

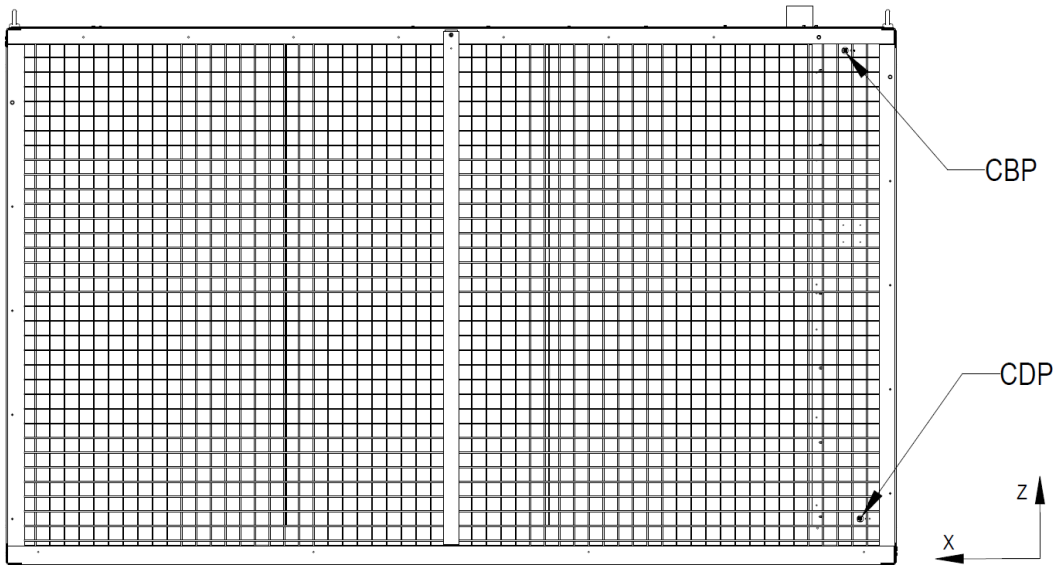
Top view:



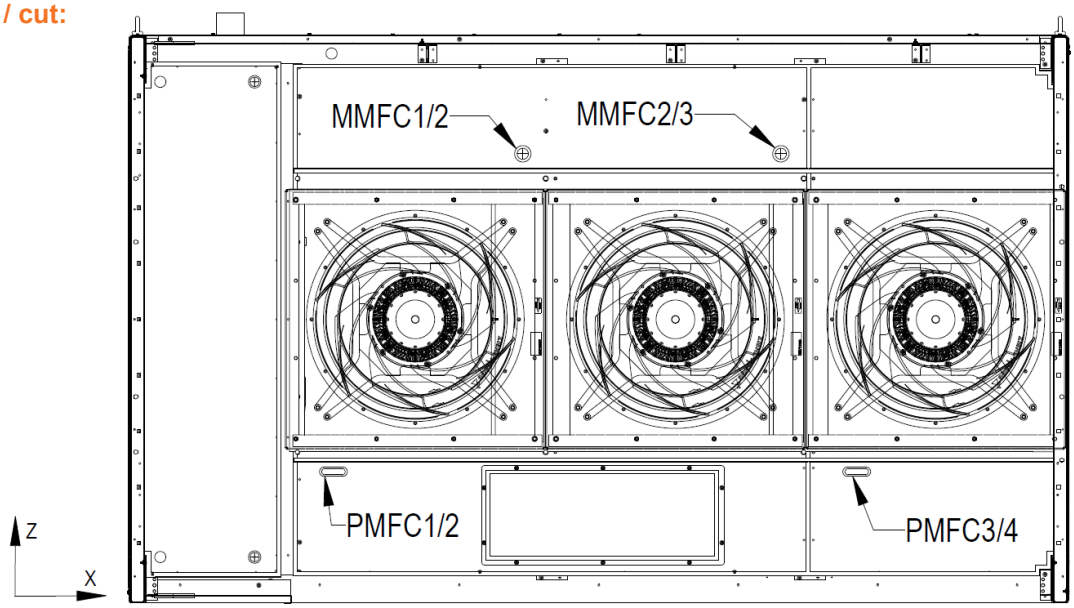
Rear view:



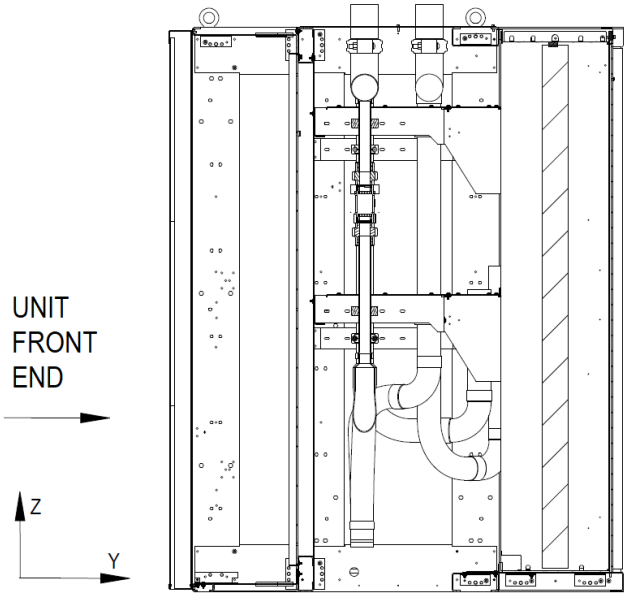
Rear view:



Front view / cut:



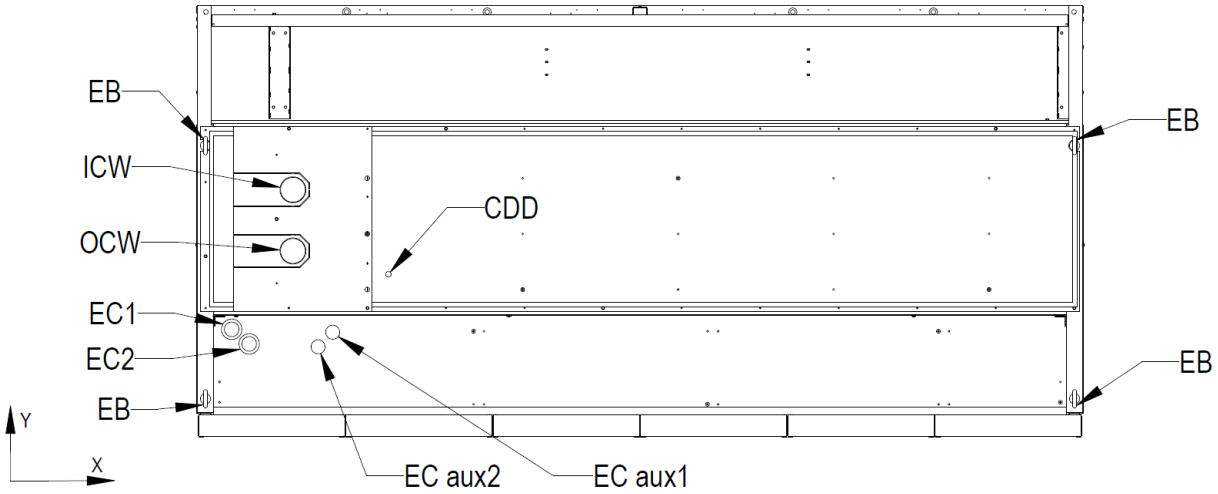
Side view / cut:



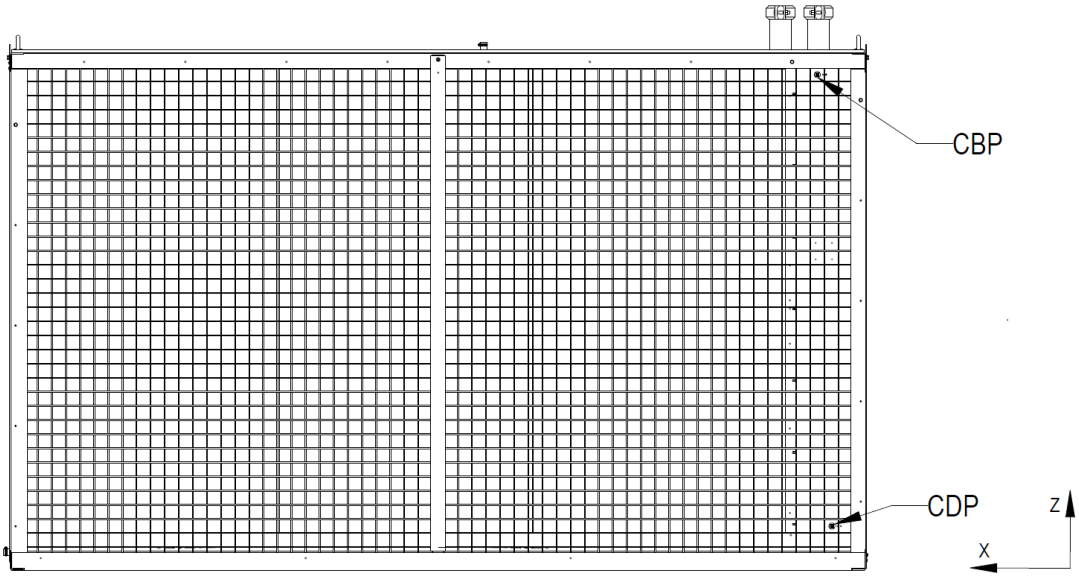
CA60 - Hydraulic and electrical connections – Top module

Point	Description	X [mm]	Y [mm]	Z [mm]	Size [mm]
ICW	**Chilled water INLET**	330	845	--	O.D.89
OCW	**Chilled water OUTLET**	330	636	--	O.D.89
CDD	Condensate drain discharge (optional)	657	556	--	O.D.14
EC1	Electrical power supply	120	368	--	O.D.63
EC2	Electrical power supply	180	318	--	O.D.63
EC aux1	Low voltage cables	466	358	--	O.D.48
EC aux2	Low voltage cables	416	308	--	O.D.48
CDB	Coil drain port	124	--	156	O.D.22
CBP	Coil bleed port	176	--	1756	O.D.22
MMFC1/2	Modbus motor fan connection	1275	--	1451	O.D.48
MMFC2/3	Modbus motor fan connection	2109	--	1451	O.D.48
PMFC1/2	Power motor fan connection	663	--	424	OBROUND 26x84
PMFC3/4	Power motor fan connection	2354	--	424	OBROUND 26x84
EB	M16 eye bolt (lifting position)	--	--	--	--

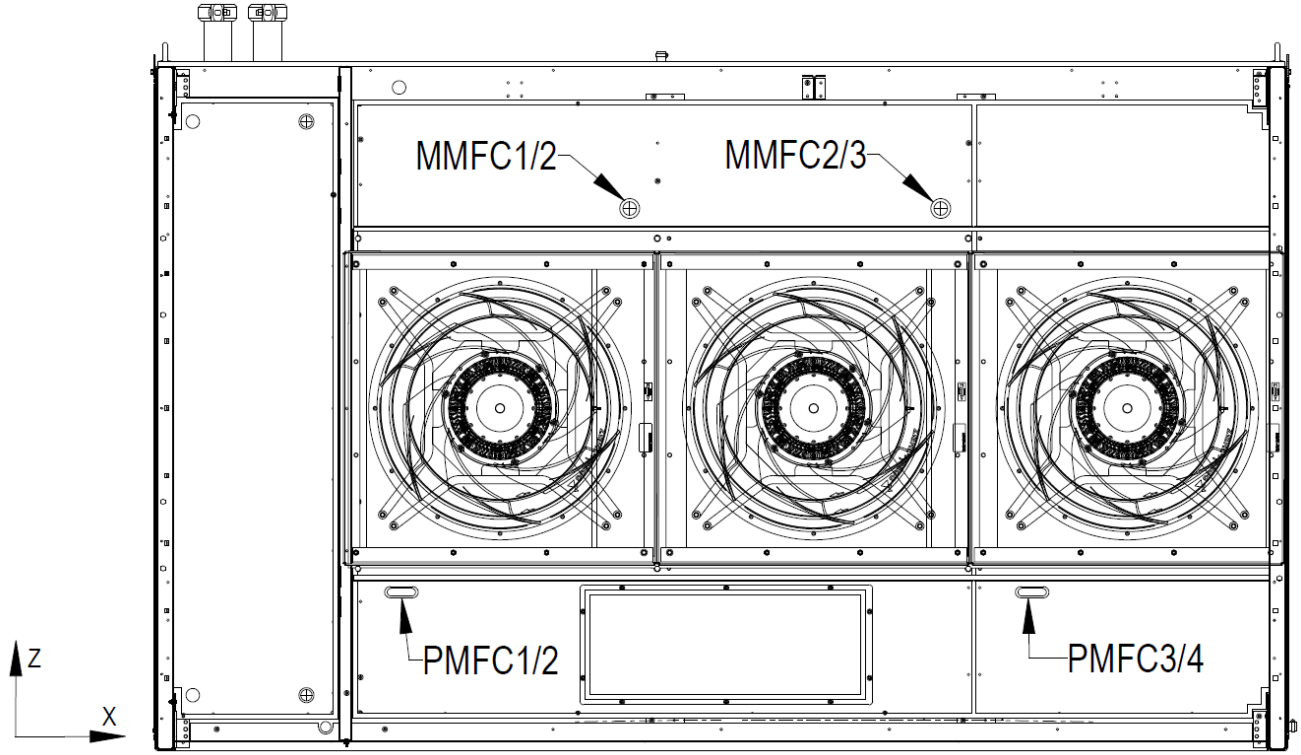
Top view:



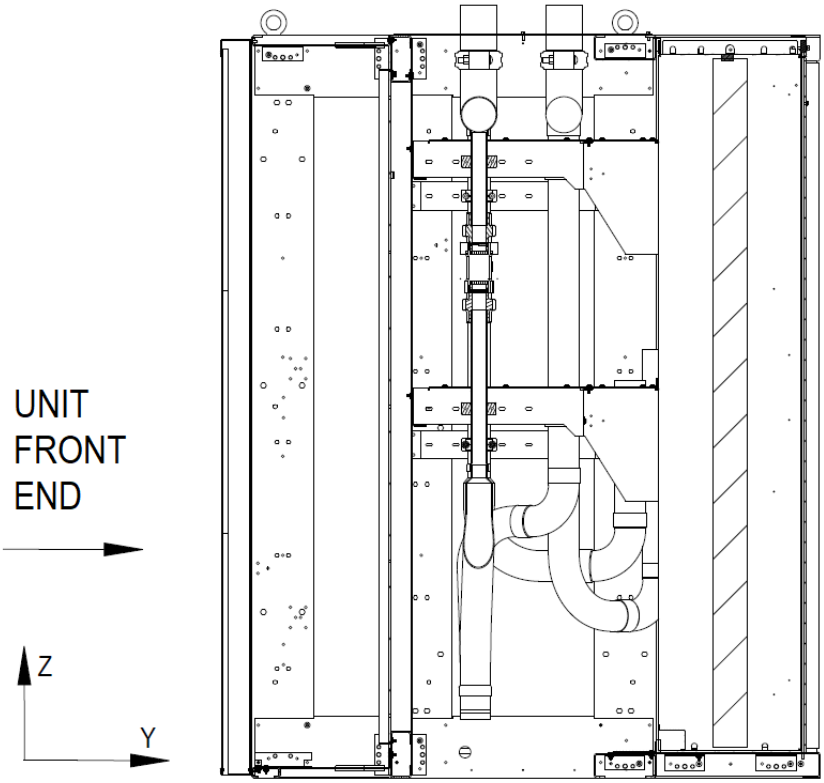
Rear view:



Front view / cut:



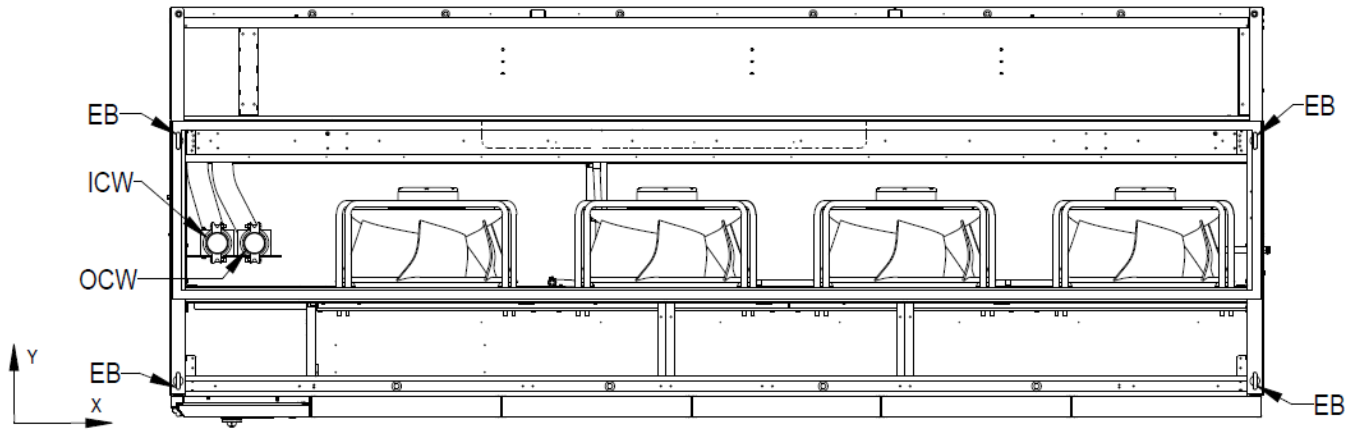
Side view / cut:



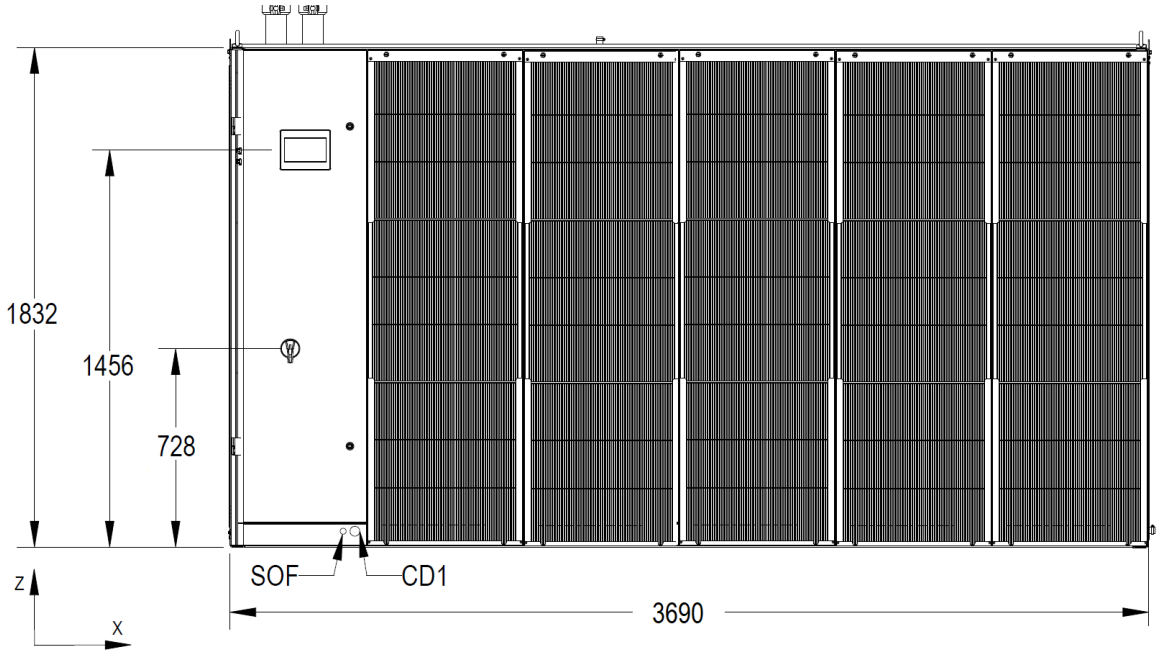
CA80 - Hydraulic and electrical connections – Bottom module

Point	Description	X [mm]	Y [mm]	Z [mm]	Size [mm]
ICW	**Chilled water INLET**	171	627	--	O.D.76
OCW	**Chilled water OUTLET**	305	627	--	O.D.76
CD1	Condensate drain	460	--	59	O.D.36
CD2	Condensate drain – Lateral (optional)	--	602	64	O.D.28
SOF	Smoke and fire detector	417	--	59	O.D.22
CDB	Coil drain port	124	--	156	O.D.22
CBP	Coil bleed port	176	--	1756	O.D.22
MMFC1/2	Modbus motor fan connection	1287	--	1451	O.D.48
MMFC2/3	Modbus motor fan connection	2147	--	1451	O.D.48
MMFC3/4	Modbus motor fan connection	3006	--	1451	O.D.48
PMFC1/2	Power motor fan connection	663	--	424	OBROUND 26x84
PMFC3/4	Power motor fan connection	2725	--	424	OBROUND 26x84
EB	M16 eye bolt (lifting position)	--	--	--	--

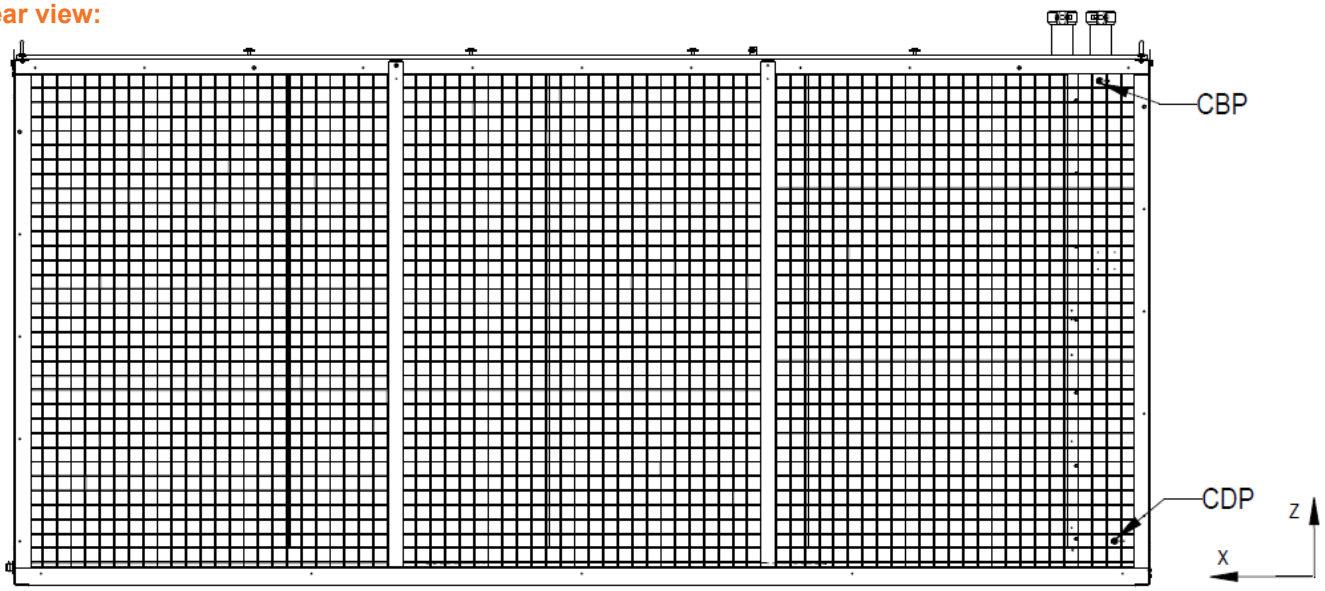
Top view:



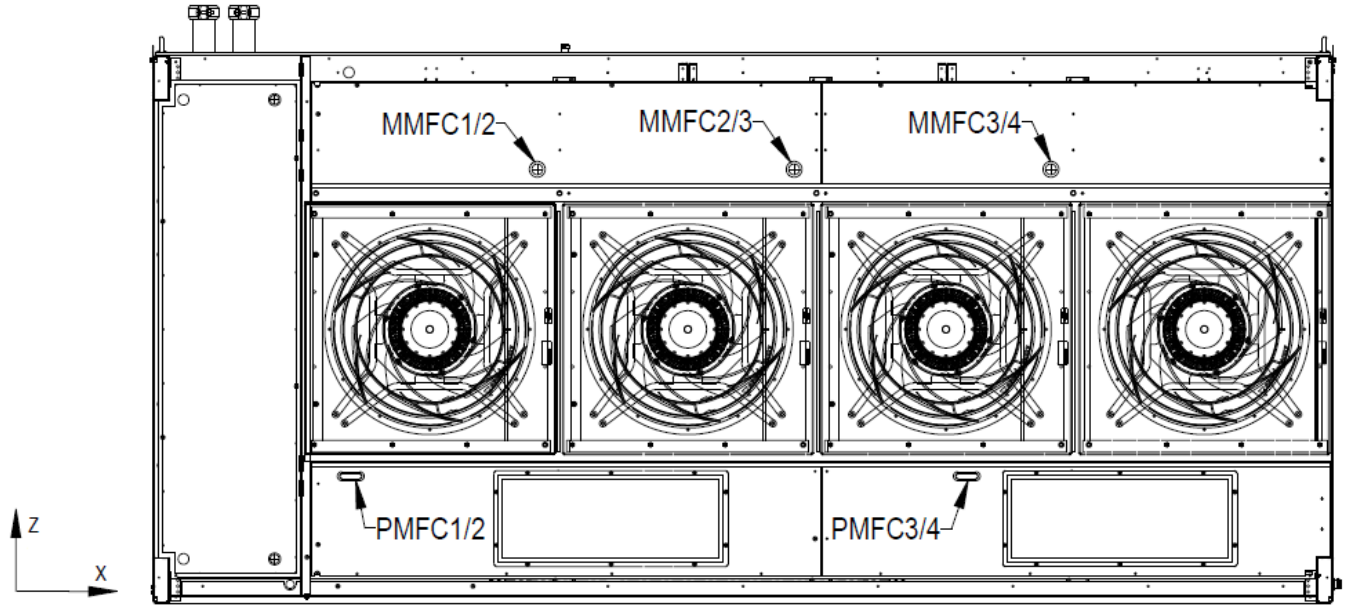
Rear view:



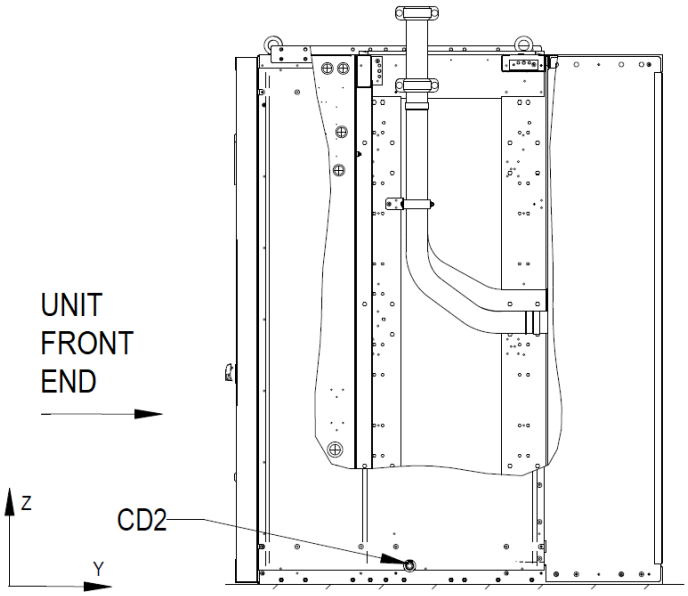
Rear view:



Front view / cut:



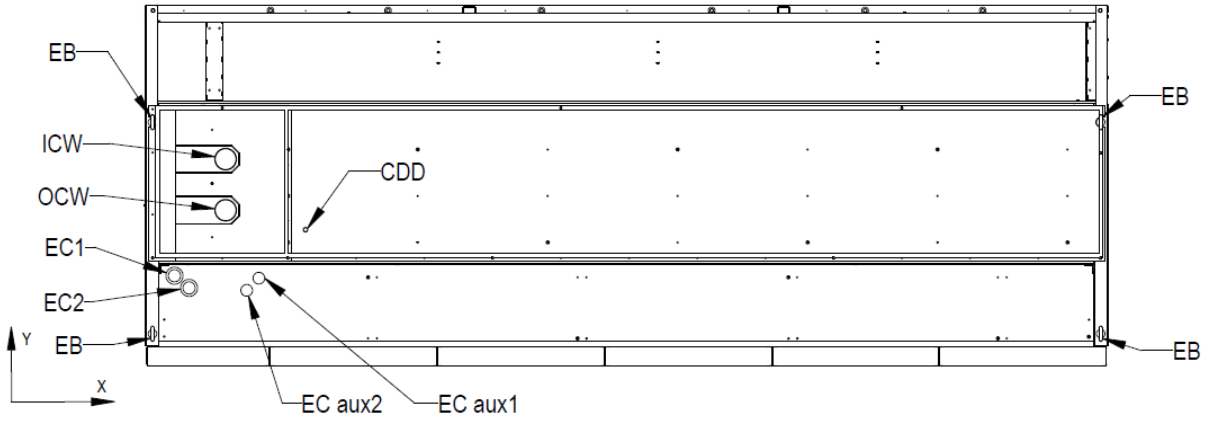
Side view / cut:



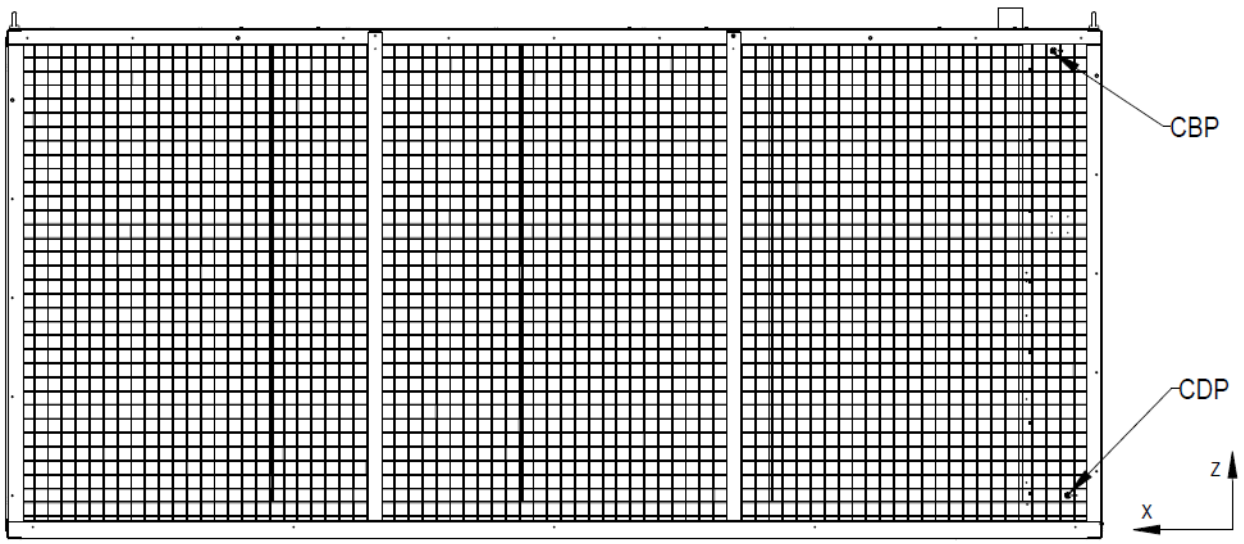
CA80 - Hydraulic and electrical connections – Top module

Point	Description	X [mm]	Y [mm]	Z [mm]	Size [mm]
ICW	**Chilled water INLET**	330	845	--	O.D.89
OCW	**Chilled water OUTLET**	330	636	--	O.D.89
CDD	Condensate drain discharge (optional)	657	556	--	O.D.14
EC1	Electrical power supply	120	368	--	O.D.63
EC2	Electrical power supply	180	318	--	O.D.63
EC aux1	Low voltage cables	466	358	--	O.D.48
EC aux2	Low voltage cables	416	308	--	O.D.48
CDB	Coil drain port	124	--	156	O.D.22
CBP	Coil bleed port	176	--	1756	O.D.22
MMFC1/2	Modbus motor fan connection	1287	--	1451	O.D.48
MMFC2/3	Modbus motor fan connection	2147	--	1451	O.D.48
MMFC3/4	Modbus motor fan connection	3006	--	1451	O.D.48
PMFC1/2	Power motor fan connection	663	--	424	OBROUND 26x84
PMFC3/4	Power motor fan connection	2725	--	424	OBROUND 26x84
EB	M16 eye bolt (lifting position)	--	--	--	--

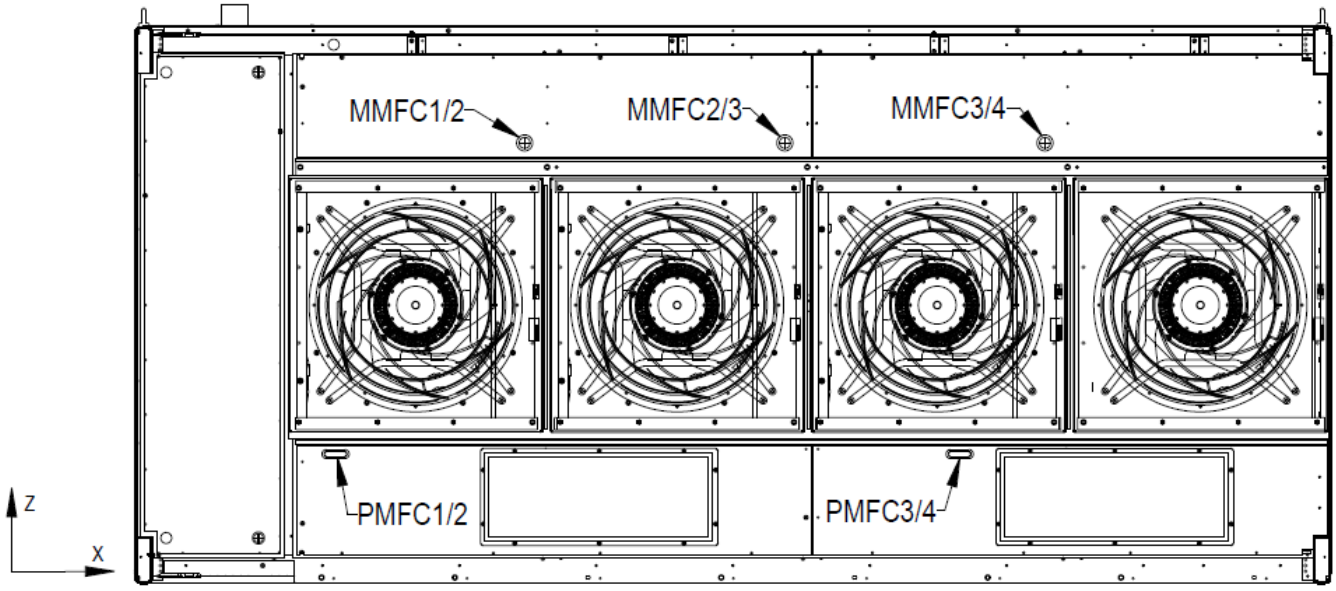
Top view:



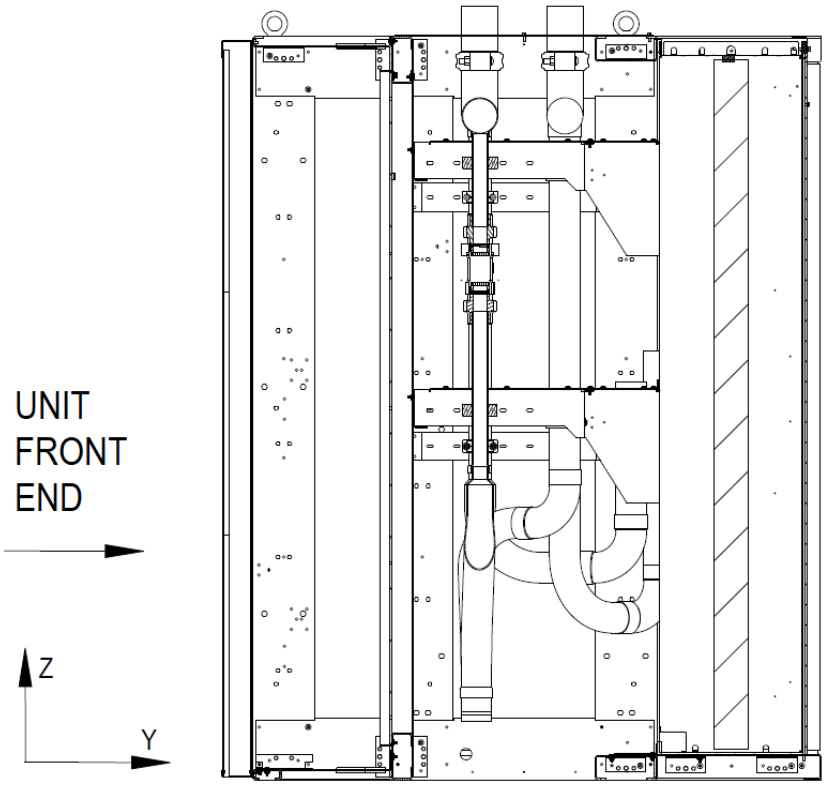
Rear view:



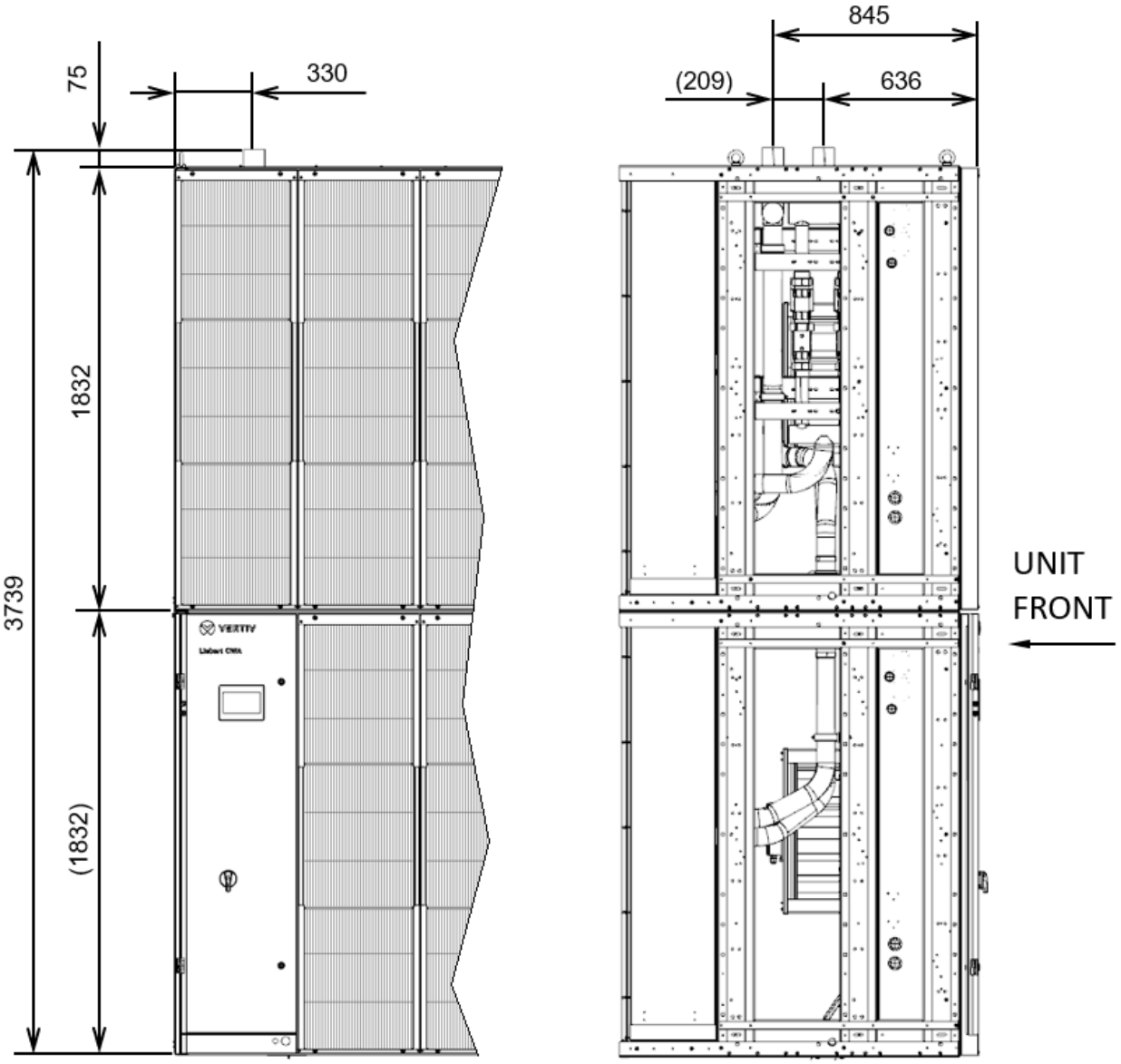
Front view / cut:

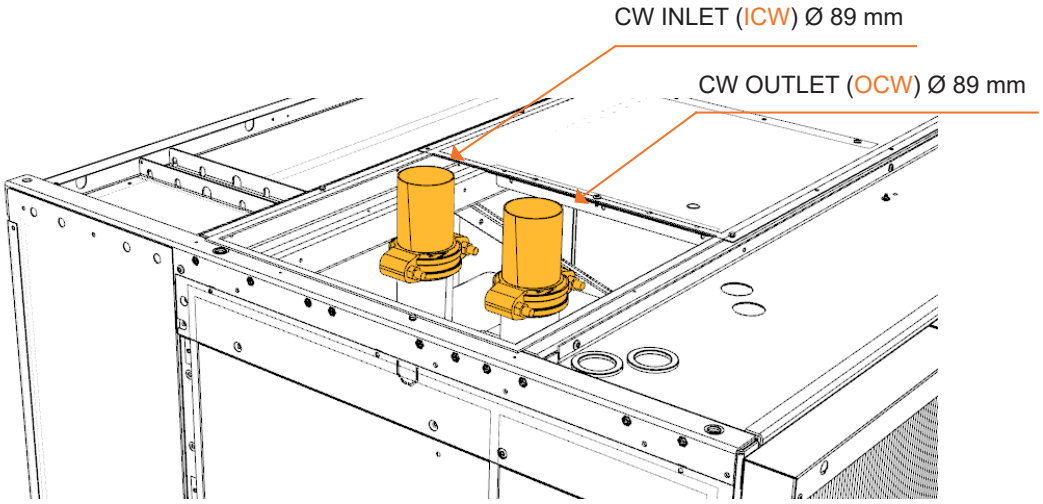


Side view / cut:



CA40, CA60, CA80 External CW piping connections





Annex D - ATS (Automatic Transfer Switch)

1 - Safety instructions

WARNING

Improper operations can cause injury or death.

NOTICE

Improper operations can cause product damage.

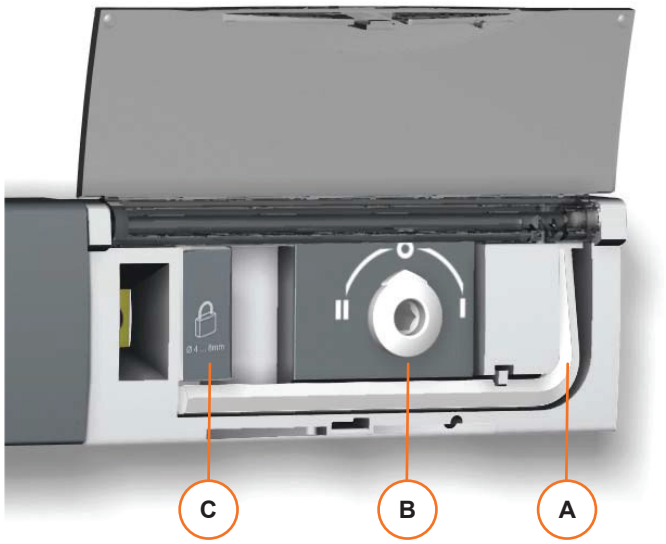
Read carefully the chapter *1. Safety*.

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

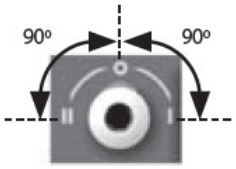
Covers	- The only cover that can be opened is the one for the auto/manual switching. - Do not open any other cover (with or without voltage) as there may still be dangerous voltage inside the unit from external circuits.
Cables	- Do not handle any control or power cables connected to the ATS when voltage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

Description

Components for manual operation and locking



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



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

Operating principle

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

The changeover is done in open transition and with minimum supply interruption.

The ATS models used in the **CWA** 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:

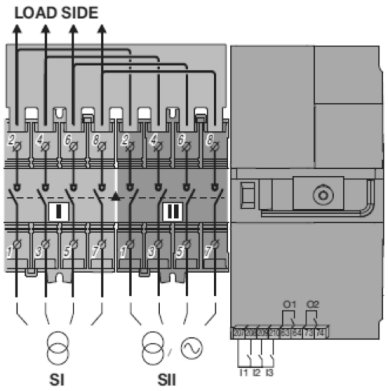
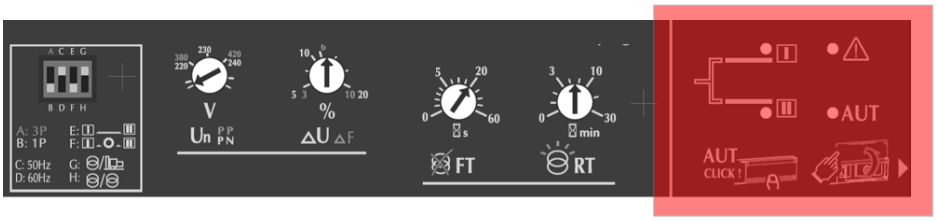
- Type 03: configurable through four potentiometers and DIP switches

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

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

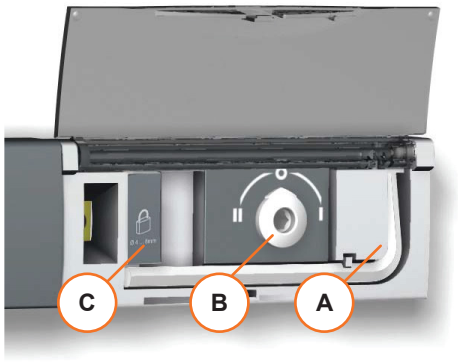
Installation

The **CWA** 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.

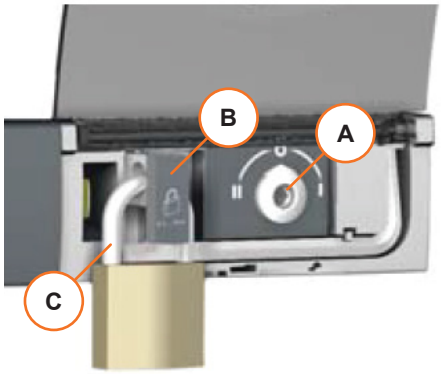
The ATS is placed inside a separate electrical panel and fixed on a DIN rail.

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 **CWA** unit through the general disconnecting switch.
- Insert the Hex/Allen key [**A**] in the ATS disconnecting switch [**B**] and turn the handle to position "**O**".
- Insert a padlock in the handle [**C**] 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.

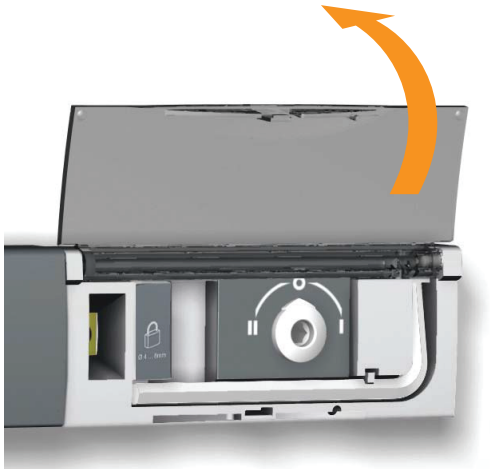
The ATS type 03 arrives pre-configured from the factory as described in the following table:

	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	3 sec
Potentiometer 4	Return time, minimum required time to return on the main/priority line	5 min

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.

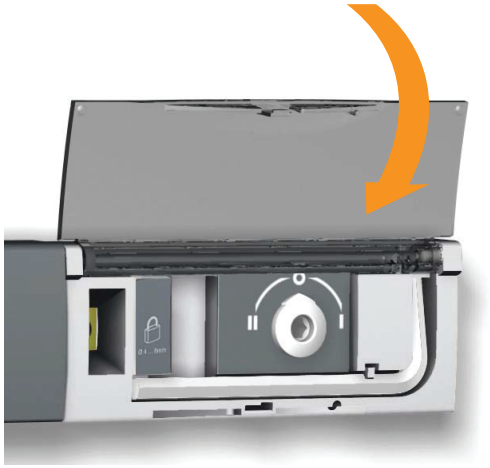
You may turn the switch to each of the following positions:

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

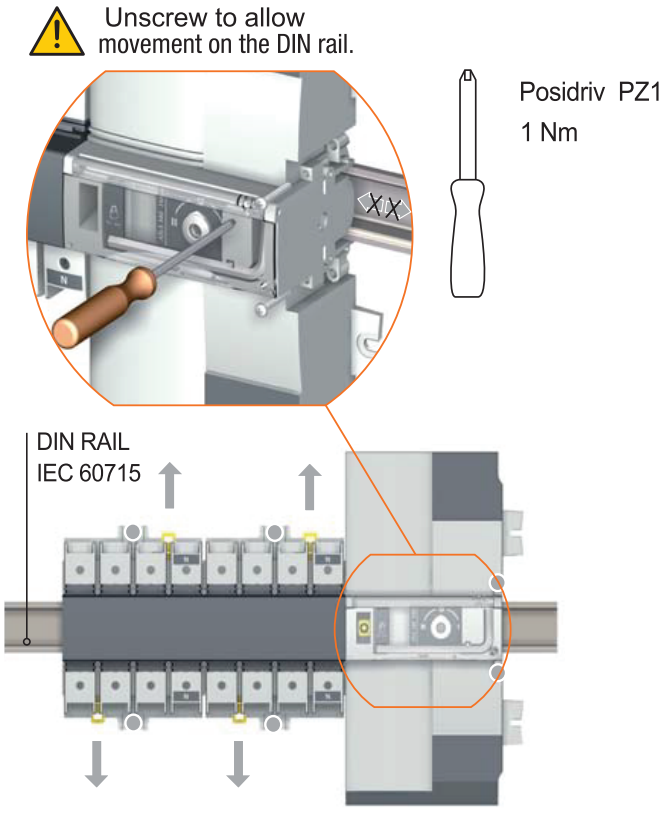
Before powering on the ATS, manually operate it to ensure that it can move normally.

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 **CWA** 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 *9. 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 **CWA** unit to the power supply.
- Restart the **CWA** 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 – Active harmonics filter (AHF) / Surge Protection Device (SPD)

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.

Arc hazard	Ensure that no metal objects can fall in the cabinet (risk of electrical arcing).
Controls	Check the device for external damage before installation, if the device is defective, it must not be used.
Electric shock	When the device is installed, unused terminal points may be live.
Personnel	Installation of the active filter, inspection for proper operation, and certain troubleshooting measures may only be performed by qualified personnel. All other measures may be performed by people who have read these instructions.
Regulations	The relevant country-specific regulations must be observed.

WARNING

DANGEROUS VOLTAGE

Risk of death due to short circuits and electric shock if the active filter is opened while connected to the AC mains or for up to 30 minutes after being disconnected from the AC mains.

- All interventions involving opening the device cover or removing or installing the connection cable may only be performed by qualified personnel.
- Make absolutely sure that the filter is grounded. Good grounding is required to prevent any risk from leakage current.
- Do not setup the filter near liquids.
- Do not expose the filter to excessive humidity.
- Remove or open the covers / doors only if the power is switched off.

CAUTION

All AHF must be installed in a clean, dry location, e.g., in sufficiently ventilated or air-conditioned electric cabinets or closed electric rooms.

Contaminants such as oils, liquids, corrosive vapors, abrasive debris, dust, and aggressive gases must be kept out of the filter enclosure.

WARNING

Conductive dust may cause damage to AHF. Ensure that installation site of AHF is free of conductive dust.

During the power-on process, AHF output terminal is electrified.

User needs to make sure whether it is safe to supply power to the load if it is connected to AHF output terminal. If the load is not ready to receive power, it must be separated from AHF output terminal.

To prevent personal injury, if maintenance or cabinet opening is needed after power off, a multimeter is required to measure the voltage at input terminals to make sure no grid power is connected!

Operation should be done more than 10 minutes after power off when the internal DC busbar capacitance is discharged!

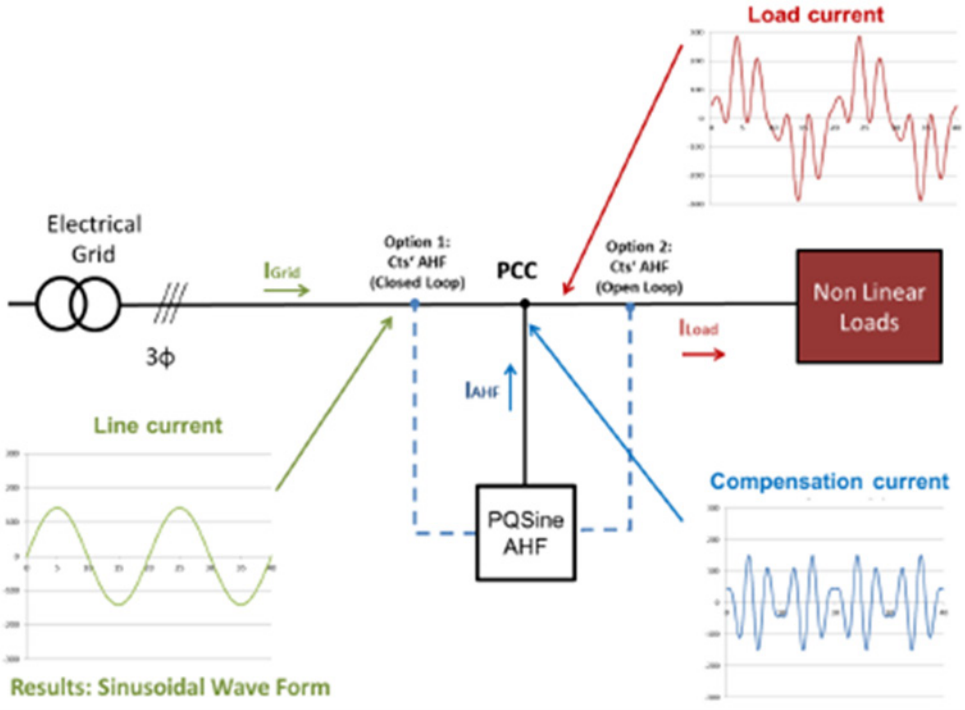
Description

The active filter enables:

- Reduction of the harmonic current content.
- Compensation of reactive power.
- Load balancing.

The AC mains current, disturbed by a non-linear load, is measured by the active filter via external current transformers. The harmonic content and reactive power components are detected and processed in a digital control structure.

The active filter continually generates a compensating current that compensates the harmonic content and reactive current in the load, so the AC mains only has to provide only the active fundamental phase current:

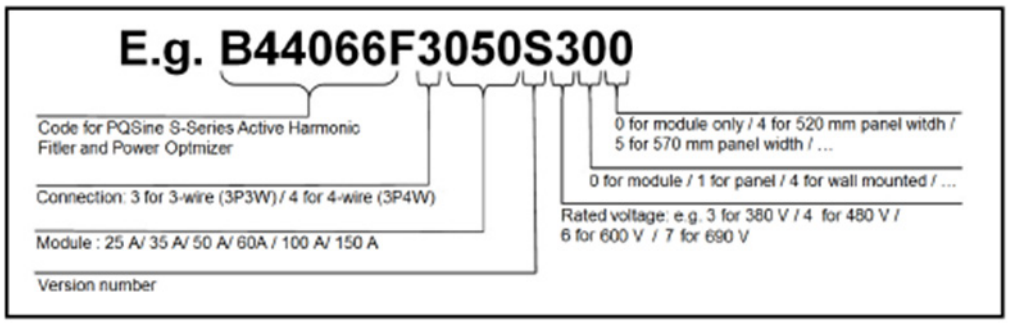


The active filter instantly adapts to all changes in the load and the system harmonic content spectrum, in order to be able to optimally respond at any time.

The active harmonic filter is primarily designed to eliminate harmonic oscillations, additionally it can also perform reactive power compensation and load balancing, AHF monitors the current permanently and compensates the unwanted elements of the measured current.

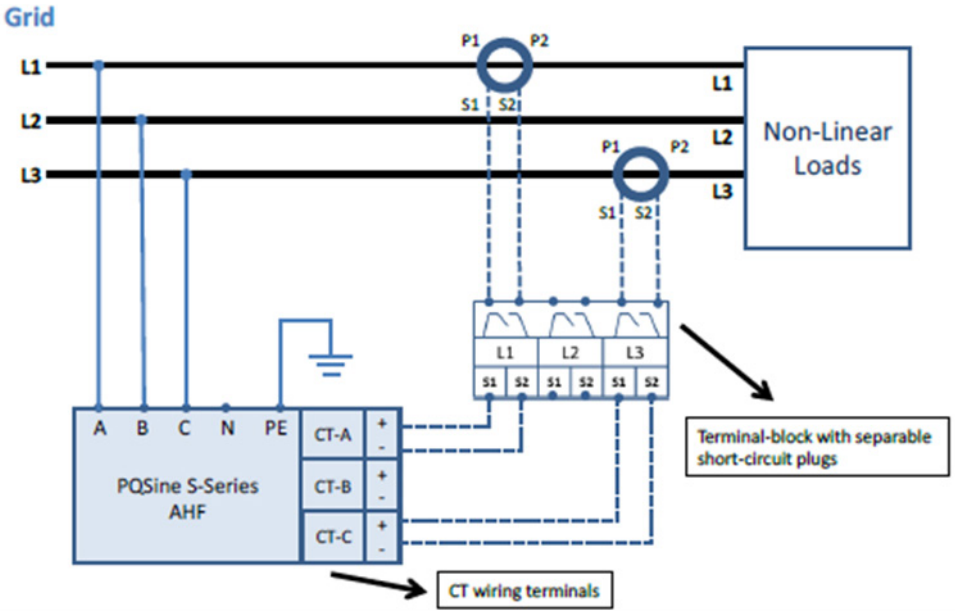
Specifications

- Multifunction: A filter allows harmonic suppression, reactive compensation and three phase imbalance compensation at the same time;
- Wide range: 2nd to 50th harmonic simultaneous compensation, with designated compensation frequency;
- Excellent effect of reactive compensation: Allow fast (ms response), exact (-1.0<PF<1.0) and two way (both capacitive and inductive compensation) suppression;
- Excellent effect of three-phase imbalance compensation: Correct the active or reactive imbalance and filter out neutral current (only for three-phase four-wire series);
- Wide range of input voltage and frequency, suitable for site of power supplied by diesel engine or bad power site, upper voltage limit 793V, and lower limit of 228V;
- Simple and flexible application: Modular construction, easy installation, able to work together with other power distribution systems;
- Easy maintenance and expansion: Supporting easy modular change and expansion, fool-proofing design ensuring maintenance without the assistance from professional personnel;
- Wide capacity coverage: Modular system of 25A, 35A , 50A, 60A, 75A, 90A, 100A and 150A extendable;
- User-friendly English interface: auto failure warning, failure alarm and operation record;
- Perfect function setup: parameter personalization setup, self-inspection, start-up and EPO (Emergency Power OFF);
- Easy installation and external CT connection;
- Internal fuse protection;
- Three level topology inverter;
- Low electric power losses;
- Harmonic compensation for 3-wire and 4-wire application;



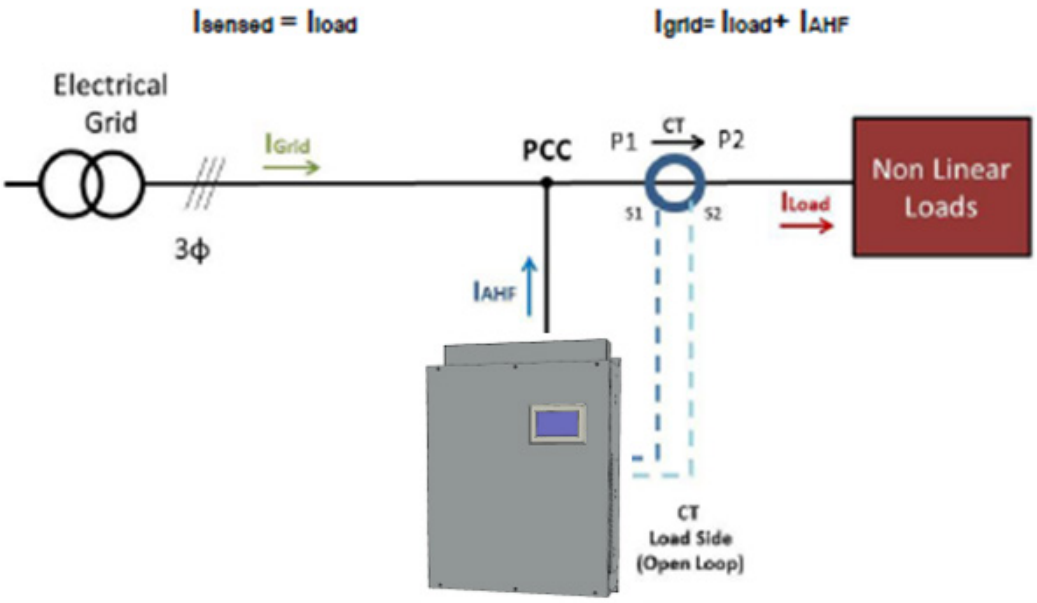
Installation

For the electrical installation of the wall-mounted AHF device 3-phase power cable, **PE** cable and external **CT** (current transformer) are required to install. As indicated on this picture for a 3-phase 3-wire system the **CT** (current transformer) need to be installed on phase **A** and phase **C** only.



- Input **A** – phase **L1** power input terminal;
- Input **B** – phase **L2** power input terminal;
- Input **C** – phase **L3** power input terminal;
- **PE** – protective earth, because the shell of the chassis is metal, it must be confirmed that the terminal is connected to the ground before the machine is turned **ON** so as to prevent any personal injury;
- **CT-A (+)** connected to **S1** of phase **A CT**
- **CT-A_GND (-)** connected to **S2** of phase **A CT**
- **CT-C (+)** connected to **S1** of phase **C CT**
- **CT-C_GND (-)** connected to **S2** of phase **C CT**

The **CT** (current transformer) are installed at the load side with reference to the point of installation **AHF**. In 3-phase 3-wire system two set of **CTs** are required, one on phase **A** and the second one on phase **C** is only need. The installation direction of **CT** must be observed as in the figure and the phase order of detection signal cannot be interchanged:

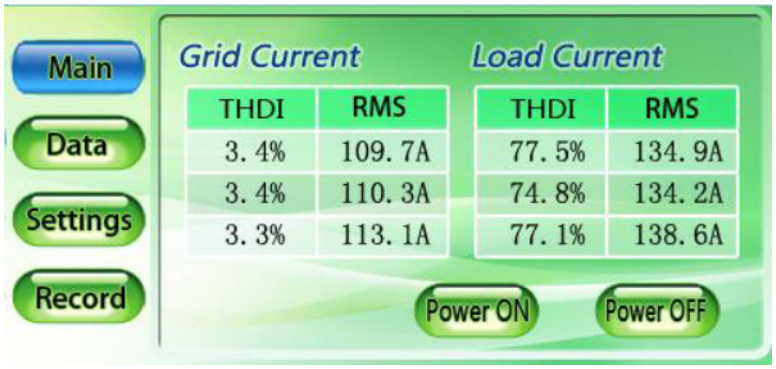


Operating

The device does not require any external / manual operation (for example adjustment of setting) by the user after the installation on the electrical panel.

From the factory it is already electrically installed on the machine and configured.

The device is provided with a 4.3-inch LCD screen which allows to display all the information about voltage and current on a real-time basis:



The only required activities are:

- Maintenance (See chapter *10. Maintenance*);
- Replacement exhaust or broken parts (See chapter *10. Maintenance*);

Maintenance

Precautions:

The **AHF device** adopt modular design. As to daily maintenance, user only needs to check whether the display data on the LCD screen is correct. If possible, used can use infrared thermo detector to check whether there are some exceptional high temperature points in the machine. User should turn off the power and contact the EPCOS – TDK product engineer if any abnormalities are found.

The **AHF device** is a strong – current product. To ensure the safety of the maintenance staff, no one is allowed to touch any live part of the device when it is working. The earth point should be regularly checked to see if the connections is solid.

CAUTION

To prevent personal injury, if maintenance or cabinet opening is needed after power off, a multimeter is required to measure the voltage at input terminals to make sure no grid power is connected!

Operation should be done more than 10 minutes after power off when the internal DC busbar capacitance is discharged!

General maintenance:

Because the **AHF device** has implemented air channel isolation, air filter is not required in ordinary usage environments. But in adverse environments, such as high temperature, high humidity, or environments with heavy conductive dust, user should contact the **AHF device** product engineer in advance to determine the specific planning of project before installation and electrical connections.

The maintenance schedule depends on the operation and ambient conditions and is valid for the following typical conditions:

- Device mounted in clean environment without dust in the air or in a cabinet with air inlet filter;
- Ambient temperature approx. 25°C;
- Symmetrical load in steady state operation;
- Typical device output 60%;
- One power OFF/ON per month

In the other cases the maintenance interval has to be adapted. Please ask the service department for specific support and for the service and maintenance documents.

Year after start operation	1	2	3	4	5	6	7	8	9	10	11	12
Maintenance job												
Check operation and clean air inlet / outlet grilles	V	V	V	V	V	V	V	V	V	V	V	V
Replace cabinet fan *			V			V			V			V
Replace air filter pads **		V		V		V		V		V		V
Replace the internal fans						V						V
Replace input fuses			V			V			V			V
General inspection at factory / service point (Check of all components, replace of DC link capacitors and wom components if needed)						V						V

(*) Only in the case of special cabinet having additional fans;
(**) Only in the case of cabinets / wall mounted designs having air filters

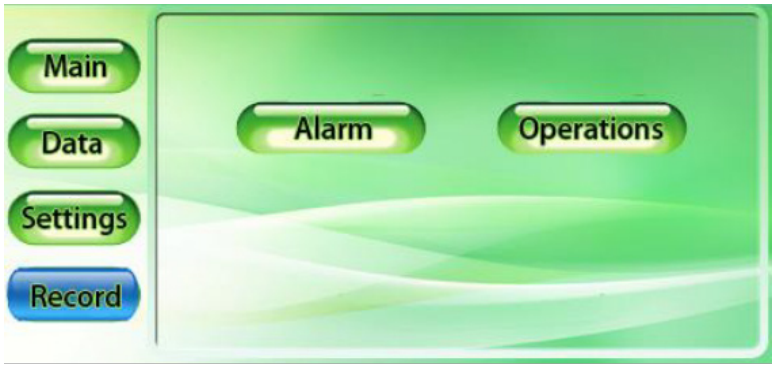
Troubleshooting

For your personal safety, whatever failure the device encounters, you should not disassemble it without permission from the equipment manufacturer.
Damaging or tearing the original equipment tags voids the warranty.

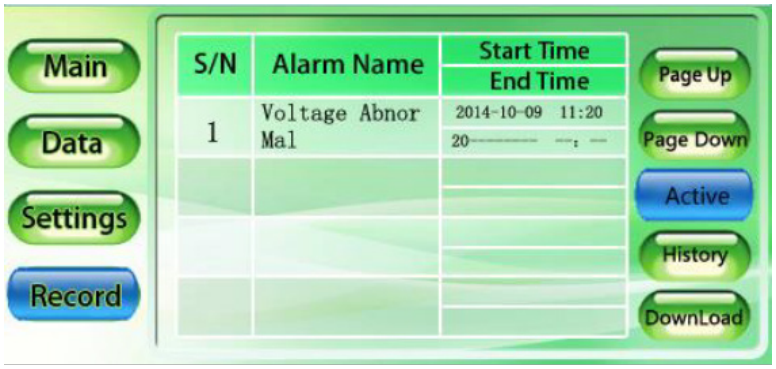
No	Fault & alarm	Possible cause	Solution
1	Communication failure	Communication failure between monitor and AHF module	Check if communication cable is reliably connected
2	Over temperature	1. Ambient temperature too high; 2. Air duct blocked; 3. Fan failure	Troubleshooting the faults one by one
3	Input voltage abnormal	1. Wiring system of power cable is not correct (3-phase 3-wire or 3-phase 4-wire); 2. Input voltage over-loaded or under-loaded; 3. Inverter not working or disabled	Check whether the model is correctly connected according to its wiring system, whether the power cable is reliably connected, and input phase voltage is within mentioned range
4	Input frequency abnormal	Inverter is disabled or not work as input frequency exceeds limitation	Check whether the frequency of AC inputs is within 45-62.5Hz
5	DC bus overvoltage	Inverter disabled or not work due to excessively high DC bus voltage	Contact **Vertiv™** Technical Service Support
6	Auxiliary power supply (APS) failure	Internal failure of APS	Contact **Vertiv™** Technical Service Support
7	No compensation current	1. AHF is not powered on; 2. Something wrong with CT installation and wiring; 3. Compensation rate too low	Check if AHF is turned on, check the setup of compensation rate and CT location and wiring, and whether CT cable is reliably connected
8	Fuse failure	At least one input fuse open circuit	Contact **Vertiv™** Technical Service Support
9	Controller parameter setup	The read controller parameter and the set controller parameter not matched	Contact **Vertiv™** Technical Service Support
10	Inverter overloaded	AHF compensation current exceeding rated current	Check if AHF capacity is matched with load

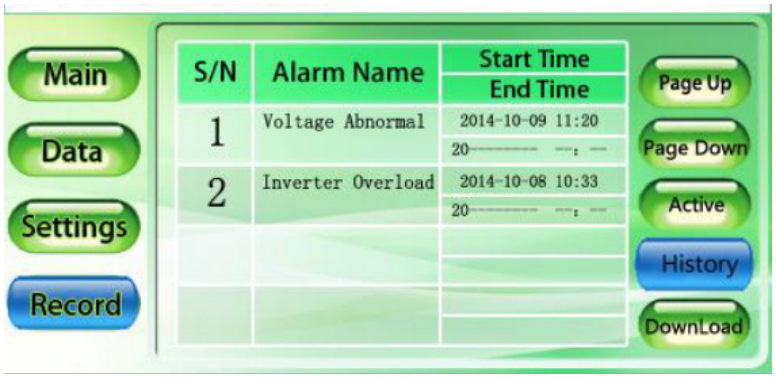
11	Fan failure	Fan malfunctioning	Contact **Vertiv™** Technical Service Support
12	CT ratio setup failure	External CT ratio setup failure	Check if installation direction of CT and phase order are correct

Click "**Record**" on the main menu to enter the record interface:



Click "**Alarm**" to enter the alarm interface, click "**Active**" and "**History**" to check information of active and history alarm:





Click "**Operations**" to enter the operations interface, the name, start time, original set value of history operation is displayed:

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