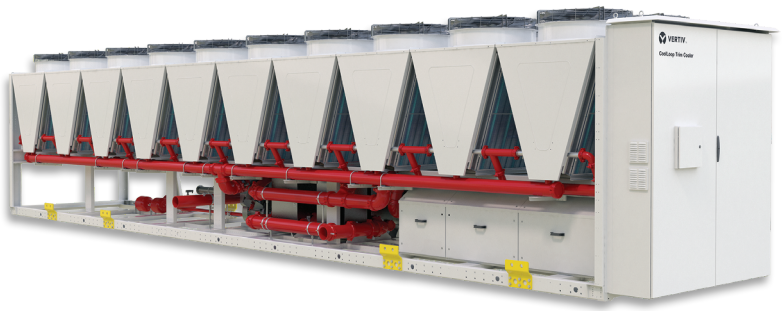
CoolLoop Trim Cooler

User Manual

English, 10173908MAN_ENG, rev. A.03 - 08.08.2025
This document, written in English, is the original version



SAVE THESE INSTRUCTIONS

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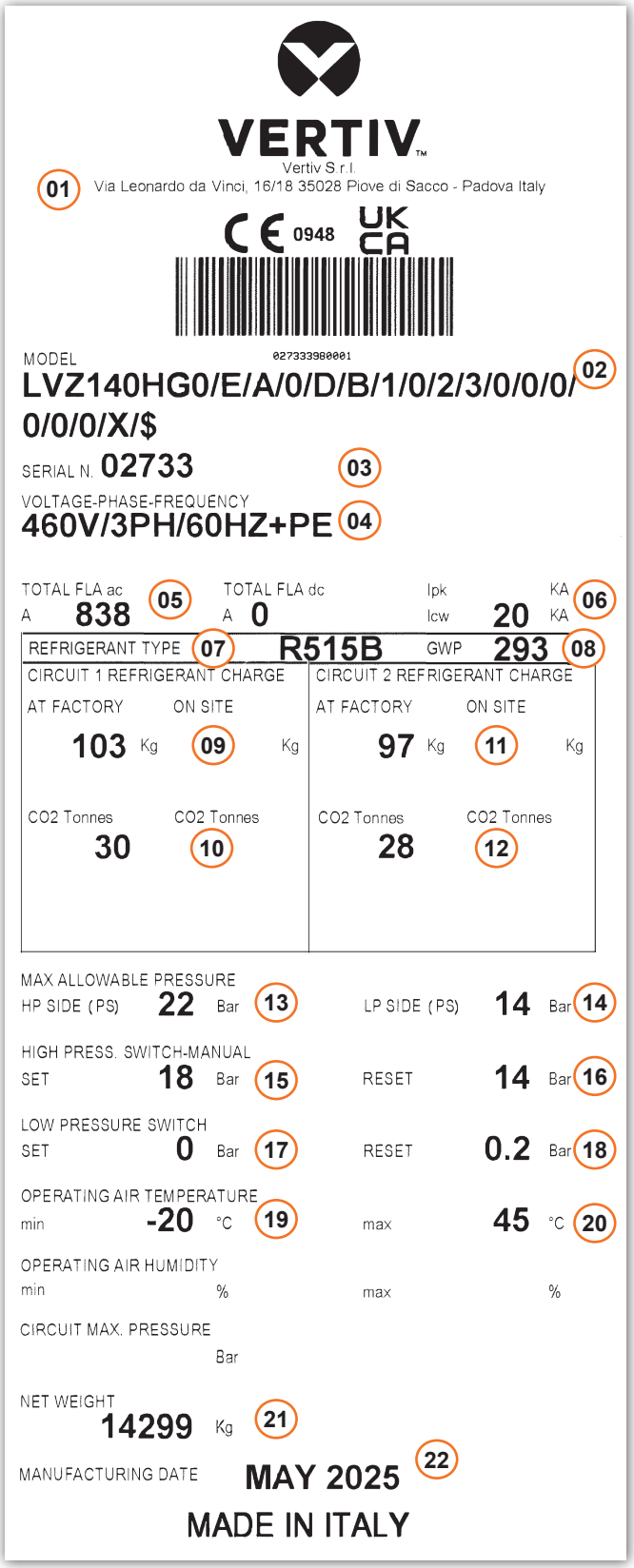
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Documents supplied with the machine

- User Manual (this document)
- Vertiv™ iCOM3™ User Manual
- Electric Diagrams
- Refrigerant and Hydraulic Diagrams
- CE – PED declaration of conformity
- Instruction Leaflet for Transport and Handling (on the packaging)
- Warranty Certificate

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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 on the left a facsimile).

Pos.	Description
01	Manufacturing plant
02	Model
03	Serial number
04	Power input
05	Unit Total Full Load Ampere AC [A]
06	Rated Short-Time Current [kA]
07	Refrigerant type
08	Refrigerant GWP
09	Circuit 1 - Refrigerant charge on factory
10	Circuit 1 - Refrigerant charge CO_2 tonnes
11	Circuit 2 - Refrigerant charge on factory
12	Circuit 2 - Refrigerant charge CO_2 tonnes
13	Max. allowable pressure - High pressure side
14	Max. allowable pressure - Low pressure side
15	High pressure switch - Stop
16	High pressure switch - Restart
17	Low pressure switch - Stop
18	Low pressure switch - Restart
19	Min. room operation temperature
20	Max. room operation temperature
21	Net weight
22	Manufacturing date

Abbreviations - Acronyms

Item	Definition
AC	Alternating Current [current]
AHF	Active Harmonic Filter
ATS	Automatic Transfer Switch
BMS	Battery Management System
CRAC	Computer Room Air Conditioning
CST	Centistokes [Oil Viscosity]
CT	Current Transformer
DC	Direct Current [current]
DX	Direct Expansion [cooling]
EC	Electronically Commutated [fans]
EP	Electronical Panel
EEV	Electronic Expansion Valve
FCL	Flammable Concentration Limit
FLA	Full Load Amps [current]
GWP	Global Warning Potential [refrigerant]
HFO	Hydro Fluoro Olefin [refrigerant]
HP	High Pressure Side
LFL	Lower Flammability Limit
LN	Low Noise
LOTO	Lockout - Tagout
LP	Low Pressure Side
LRA	Locked Rotor Amps [current]

Item	Definition
LWT	Leaving Water Temperature
NLGI	National Lubricating Grease Institute
NTC	Negative Temperature Coefficent [sensor]
PCC	Point of Common Coupling
PE	Protective Earth [cable]
PED	Pressure Equipment Directive
PELV	Protective Extra Low Voltage
PFC	Power Factor Correction
pH	Potential of Hydrogen [acid/basic scale]
PL	Practical Limit
PPE	Personal Protective Equipment
PRV	Pressure Relief Valve
PRIV	2-way Pressure Regulating Valves
PVC	Polyvinyl Chloride
PWL	Sound Power Level
PWM	Pulse Width Modulation
SC	Semi Conductor
SPL	Sound Pressure Level
THDi	Total Harmonic Distortion [filter]
Ultracap	Ultra-capacitor
UPS	Uninterruptible Power Supply
VPF	Variable Primary Flow

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.



WARNING
Low Burning velocity gas.

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** (see *5.5.1 Electric box and main switch*).
Authorized 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.
Read this manual	Carefully read the manual before performing any operation on the unit.
Keep this manual	Keep the manual during the complete life-span of the unit. Keep the diagrams provided with the unit (wiring, refrigerating circuit,...). They are part of the instructions for use. If you move or sell the unit, transfer the manual and the diagrams together with the unit. This manual may be subject to modification. For complete and up-to-date information always consult the manual supplied with the machine.
Intended use	Exclusively employ the unit for the purpose it has been designed (see *3. Intent Use*). The improper use of the unit exonerates the manufacturer of any responsibility.
Do not modify the unit	**Do not** modify the unit in any way, including the control system and the software. Any modification to the unit exonerates the manufacturer of any responsibility.
Warning labels	Pay attention to the warning labels on the unit. See *Annex III - Safety Labels* for the mapping of the safety labels placed on the unit.

1.3 Electric System



WARNING
Unit contains potentially lethal voltage in some circuits. If the electrical panel is open, the socket and the light could remain supplied.
Risk of arc flash and electric shock.
Can cause injury or death.

- Open all local and remote unit electric power disconnect switches, verify with a voltmeter that power is **OFF** and wear protective equipment per local standard before working within the electric control enclosure;
- The panel key supplied with the unit must be kept by the person responsible for maintenance.



WARNING
The electric and control enclosures can retain a stored high-voltage electrical charge for up to **10** minutes.
Risk of electric shock.

Can cause serious injury or death.

Before working within the unit electric and control enclosures proceed as follows:

- open all local and remote unit electric power disconnect switches;
- wait **10** minutes;
- verify with a voltmeter that power is **OFF**.

Only properly trained and qualified personnel may perform repair, maintenance and cleaning.

WARNING

If the electrical panel is open, the socket and the light could remain supplied.

1.4 Personal Protective Equipment

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



Ensure that all required safety measures are followed such as: wearing protective clothing (shoes, gloves and safety glasses using appropriate tools, employing qualified and skilled technicians (electricians, refrigeration engineers) trained in the use of flammable refrigerants and following local regulations (see Annex E in EN 378-4 Guidelines for repairs of equipment using flammable refrigerants **A2L**).

CAUTION

Components at high temperature (discharge line and compressor at about 90°C).
Always wear temperature resistant gloves when operating on the unit.

1.5 Disclaimer. Use of A2L Refrigerants

Important notice to users:

This user manual contains important information about the use of **A2L** refrigerants in our cooling machines. **A2L** refrigerants are classified as mildly flammable refrigerants, and their use requires adherence to specific safety guidelines and regulations. It is imperative that users carefully read, fully understand, and adhere to the guidelines provided in this manual and any applicable local regulations.

Safety Precautions

Qualified Personnel. Only trained and qualified personnel shall perform installation, maintenance, and service on Vertiv™ cooling equipment. The use of **A2L** refrigerants requires specific knowledge and skills to handle it safely. **A2L** refrigerants shall be safely retrieved ONLY by qualified personnel explicitly trained in the use and handling of such refrigerants. This manual is in **no way a substitute for adequate training**.

Regular Maintenance. Regularly inspect and maintain the cooling machine according to the manufacturer's recommendations to prevent leaks and ensure safe operation.

No Modifications. DO NOT modify the cooling machine or attempt to change the refrigerant type without approval from the manufacturer.

Emergency Procedures. Familiarize yourself with emergency procedures in case of refrigerant leaks, including evacuation protocols and contacting emergency services.

Compliance with Regulations

Legal Compliance. Users are responsible for ensuring that the installation and operation of this cooling machine comply with all relevant local, national, and international regulations, including those related to the use of **A2L** refrigerants. For instance, and not limited to, building codes, safety standards, and environmental regulations.

Liability Limitation. Vertiv™ accepts no liability for any damage, injuries, or losses incurred due to the use or misuse of Vertiv™ cooling machines with **A2L** refrigerants, including incidents related to **A2L** refrigerant usage, except where such liability cannot be excluded by law.

Contact Information. For any inquiries, concerns, clarifications, or further assistance regarding the use of **A2L** refrigerants in this cooling machine, please contact our customer support.

By using this cooling machine, the user acknowledges having read and understood this disclaimer and agrees to comply with all the instructions provided in this User Manual and take full responsibility for the safe and lawful use of the equipment.

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
L	V	Z	1	4	0																			

Digit	Feature	Value	Description
1	Versions	L	Free cooling
2	Compressor type	H	Screw
		V	Variable speed
3	Refrigerant	B	R515B
		Z	R1234ze
4-6	Size	XXX	Cooling capacity / 10 kW
7	Water Regime	S	Standard delta T
		H	High delta T
8	Efficency	G	High Efficiency
9	Power supply	0	400 V / 50 Hz
10	Fans and Acoustics	C	EC Fans / Base
		E	EC Fans / Premium
		L	Low noise
		Q	Quiet
11	Pumps	0	None
		1	Single standard head pump + Hydraulic kit
		2	Single high head pump + Hydraulic kit
		3	Double standard head pump + Hydraulic kit
		4	Double high head pump + Hydraulic kit
		5	Single inverter pump + Hydraulic kit + Flow meter
		6	Double inverter pump + Hydraulic kit + Flow meter
		7	Hydraulic kit
		A	Variable flow - 1 inverter pump + Hydraulic kit + Flow meter
		B	Variable flow - 2 inverter pump + Hydraulic kit + Flow meter
		C	Variable flow - NO pumps + Hydraulic kit + Flow meter
12	Adiabatic System	0	None
		1	Premium Adiabatic Pad System/ direct flow
		2	Premium Adiabatic Pad System/ with recirculation
		Z	Predisposition for Premium Adiabatic Pad System
13	Coil options	A	Microchannel Condenser + Microchannel FC Coil
		B	Microchannel Condenser + Microchannel FC Coil / Base Coating
		C	Microchannel Condenser + Microchannel FC Coil / Premium Coating
		D	Microchannel Condenser + Finned FC coil
		E	Microchannel Condenser + Finned FC coil / Base Coating
		F	Microchannel Condenser + Finned FC coil / Premium Coating

Digit	Feature	Value	Description
14	Display	A	Small graphic display with monitoring
		B	Large touch display with monitoring
15	Refrigerant circuit options	0	None
		1	Suction shut-off valve on compressors
		2	Dual Relief valve and changeover valve
		3	Suction shut-off valve on compressors + Dual Relief valve
		4	Plumbed shut-off valve for refrigerant safety valve
		5	Suction shut-off valve on compressors + Plumbed shut-off valve
16	Low / High Ambient temperature	0	None
		1	Heater for electrical panel
		2	Heater for electrical panel + Trace heaters
17	Power supply line option	0	Single line (main line)
		1	Single line (main line) + Ultracap for control
		2	Double line: main line + second line for control
		3	Double line: main line + second line for control + Ultracap
		A	ATS on main line
		B	ATS on main line + Ultracap for control
		C	ATS on main line + second line for control
		D	ATS on main line + second line for control + Ultracap
18	Condensing coil filter Protection grid	0	None
		1	Condensing coil filters
		2	Protection grid
		3	Condensing coil filters + protection grid
		4	Aesthetics lateral panels
		5	Aesthetics lateral panels + condensing coil filter
19	Packing	0	Standard
		1	Seaworthy + Skid for flat rack
		2	Wooden box + Seaworthy
		3	Wooden cage + Seaworthy
20	Buffer Tank	0	None
21	Harmonic Filters	0	None
		F	Harmonic Filters for TDD = 5%
		G	Harmonic Filters for TDD = 5% with active cooling
25	Special Request	0	None
		X	As specified

3. Intended Use

The **Vertiv™ CoolLoop Trim Cooler** units have been designed and manufactured for production of chilled water.

They are made of two refrigerating circuits, each one with a screw-compressor, an air-cooled condenser and a shell & tube evaporator.

The tube evaporators of both the circuits are coupled in the same heat-exchanger where the water is chilled.

The **Vertiv™ CoolLoop Trim Cooler** units are factory assembled and pre-charged. All the internal wiring is factory completed. Only electrical and water connections must be made at the installation site.

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

3.1 Responsibility

Vertiv™ accepts no present or future responsability for damage to persons, things or to unit itself due to operators negligence failing to comply with the installation, operation and maintenance instructions of this handbook, failed application of the safety norms in force for the system and the qualified staff charged with the operation and maintenance.

3.2 Functional Limits

Refrigerant

This unit is designed for use with **R515B**/**R1234ze** (all group 2, not dangerous according to **PED** Directive).

According ASTM E681-04 @ 21ºC **R1234ze** is **not flammable**, so the Safety Data Sheet of this refrigerant says that is not flammable with no issue for stock or transport for the refrigerant cylinders; for the unit see dedicated chapter.

According to ISO-819, **R515B** are classified in safety group **A1**, instead **R1234ze**(E) is classified in safety group **A2L**: **lower flammability**.

One of the characteristics of this refrigerant (**R1234ze**) is the absence of flammable mixture with air under 21°C of ambiance and controlled humidity conditions; however when humidity or temperature goes up, this refrigerant can become flammable and can represent a potential danger if flammability risks are not properly mitigated.



WARNING

Risk of components failure or breakage.
Do not use other refrigerants.
Contact the manufacturer in case of doubt.

Electrical system requirements

Voltage: 400 V - 3 phase - 50 Hz.



WARNING

Risk of components failure or breakage.
Do not use different voltage.
Contact the manufacturer in case of doubt.

Performance

See chapter *6. Techincal Data and Performances*.

3.3 Operating Environment

This unit is designed for outdoor installation, with the following ambient conditions:

Ambient temperature

The units are designed to operate in:

Minimum temperatures:

- -25°C for freecooling models;
- -20°C for all N** glycol free units;
- -20°C for all units with inverter pump;
- -10°C for only chiller models.

Maximum temperatures:

depending on the model as indicated in the *6.3 Operating Limits*.

Max altitude	< 2000 mt.
Ambient conditions	Outdoors; see *8.3 Installation site* for **A2L** restrictions. **Do not** use in explosive, acid or anyway aggressive atmosphere. Relative humidity is up to 50% at temperature of +40°C

3.4 Space Limits

Overall unit dimensions	Provide enough free space to place the unit. See *Annex I - Weights and Dimensions*.
Clearance	Keep a free space around the unit as explained in chapter *8.3.3 Space Requirements*.

4. Reference Norms

The **Vertiv™ CoolLoop Trim Cooler** units are designed and manufactured in accordance with the following European Directives:

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.

The **Vertiv™ CoolLoop Trim Cooler** units are designed, manufactured, and tested in full or partial accordance with the following Standards:

Performance test norms	- Cooling Capacity according to EN 14511; - Sound Power Level according to ISO 3744.
CE Marking and Declaration of Conformity	The units are marked "**CE**". Each unit is supplied complete with individual test certificate in accordance with internal procedures and a Declaration of Conformity to the relevant European Union Directives.
UKCA Marking and Declaration of Conformity	The units are marked "**UKCA**". Each unit is supplied complete with individual test certificate in accordance with internal procedures and a Declaration of Conformity to the relevant UK Safety Regulations.

5. Description

Vertiv™ CoolLoop Trim Cooler chillers have been designed for the production of chilled water.

They are also produced in versions with built-in freecooling or freecooling glycol free device and with pump group mounted on the machine; the chiller units can be completed with numerous accessories included in the price list.

The **Vertiv™ CoolLoop Trim Cooler** line is designed according to the most advanced techniques available in the industry today and is complete with all the elements necessary for automatic and efficient operation. Each unit is completely assembled in the factory; after the vacuum, it is charged with the necessary quantity of refrigerant and tested.

All units are equipped with one or two independent refrigerant circuits, each consisting of: air-cooled condenser, semi-hermetic screw compressor (with or without inverter regulation), shell and tube evaporator and pipes. The components of the refrigerant circuit present in the liquid line are the filling valves, the dehydrating filters, the shut-off valve, the humidity indicator light and the electronic expansion valve; on the compressor there is always the tap on the delivery line while it is optional on the suction line.

The hydraulic circuit consists of grooved hydraulic pipes connected by joints (**Grooved pipes connections**), status flow and, in the freecooling versions, by chilled water batteries and two two-way valves; in the freecooling glycol-free versions an intermediate plate exchanger separates the heat exchange between the air exchangers, where glycol is present, and the hydraulic circuit of the evaporator where there is chilled water from the user circuit; suitable heating elements prevent the water from freezing in the hydraulic circuit of the evaporator.

The semi-hermetic screw compressors are complete with the following protection/safety devices: oil heater, internal safety valve, oil level (optional), electronic protection with function for controlling the temperature of the motor windings, the oil temperature and the sense of screw rotation.

In the versions with screw compressors with integrated inverter, the operating stability and operating efficiency of the chiller is further improved thanks to the continuous speed control of the compressor itself and the optimized management of the **Vi compression ratio** (thanks to an automatic internal valve); in addition to cooling the inverter itself, the compressor also manages and monitors safety functions with integrated sensors such as high pressure, low pressure, engine temperature, temperature and oil level (optional) alarms, operating conditions close to the application limits allowed.

For the operation of the inverter compressor, a line reactor is mounted on the electrical panel; this device is indispensable and provides for reducing the harmonics transmitted by the inverter to the power supply network.

Vertiv™ CoolLoop Trim Cooler water chillers are controlled by the **Vertiv™ iCOM3™** microprocessor which manages all the operating conditions of the units. The user can vary and/or modify the operating parameters via the display keyboard installed on the electrical panel.

The electrical control panel is equipped with all the necessary safety and operating devices to ensure reliable operation.

The compressor motors are equipped with protections on all three phases and are started by three-pole contactors.

The refrigerant **R1234ze** falls into refrigerant safety group **A2L** in accordance to ISO-5149 and to EN-378 instead **R515B** is **A1**.

The **Vertiv™ CoolLoop Trim Cooler** liquid chillers are classified as “indirect vented closed system” (according ISO-5149 and EN-378) and are designated to be installed in a location class III (open air) with occupancy access category Class C (as per ISO-5149 and EN-378) where only authorized personnel have access; with these limits for both **A1** and **A2L** refrigerant gas there aren’t any charge restriction. This limitation must be managed by the customer.

Please refer to these standards for further details. This level needs to be confirmed by the customer.

5.1 Versions

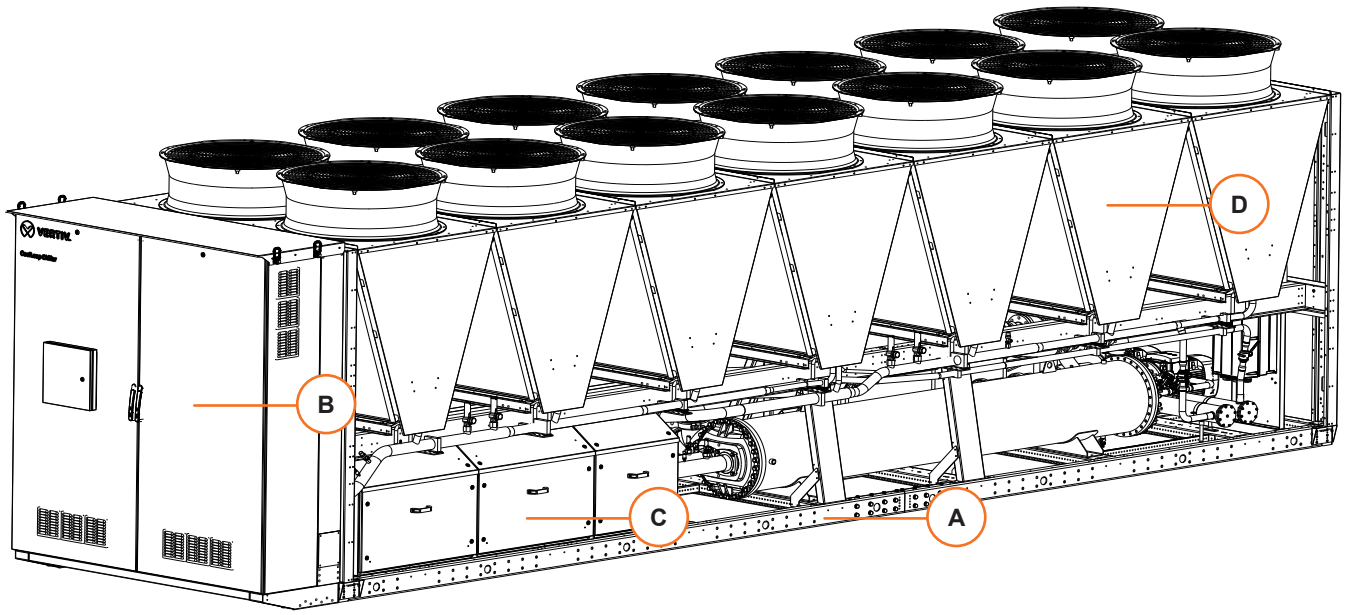
The **Vertiv™ CoolLoop Trim Cooler** units are available in the following versions:

Feature	Standard version	Optional version
Hydraulic Circuit	**Chiller**	**Chiller with pump**(s) with standard head, high head or inverter
	Freecooling chiller	**Freecooling chiller** with pump(s) with standard head, high head or inverter
	Freecooling glycol-free chiller	**Freecooling glycol-free chiller** with pump(s) with standard head, high head or inverter
Refrigerants, compressor(s) and refrigerant circuit(s)	**R1234ze** with inverter screw compressor single and double circuits	**R515B** with standard screw compressors always double circuits

Feature	Standard version	Optional version
Noise	**Standard version** with **EC** fans base and premium, with standard noise insulation material on compressor box.	**Low Noise** (**LN**) version with **LN** fans and standard noise insulation material on compressor box. **Quiet** (**Q**) version with low speed **LN** fans advanced sound insulation material on compressor box and all around the most relevant noise sources.

5.2 Structure

5.2.1 Standard version Chiller



A	Supporting structure
B	Electric panel
C	Compressors box
D	Coils/fans “**V**” block

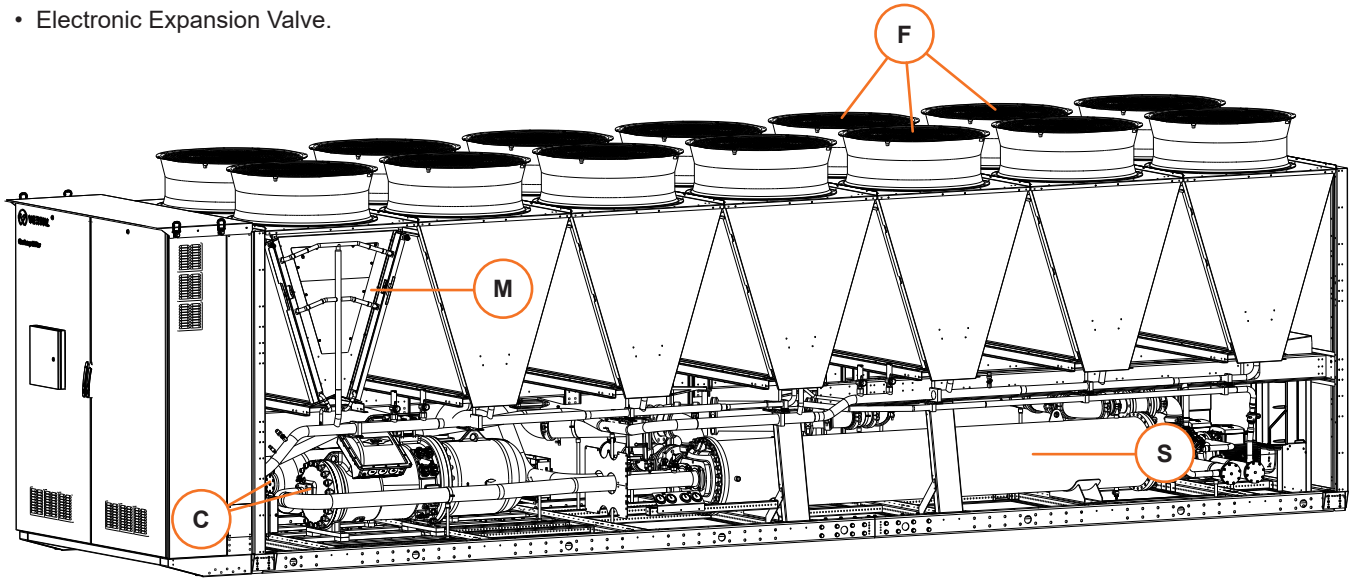
5.3 Refrigerating System

5.3.1 Main components

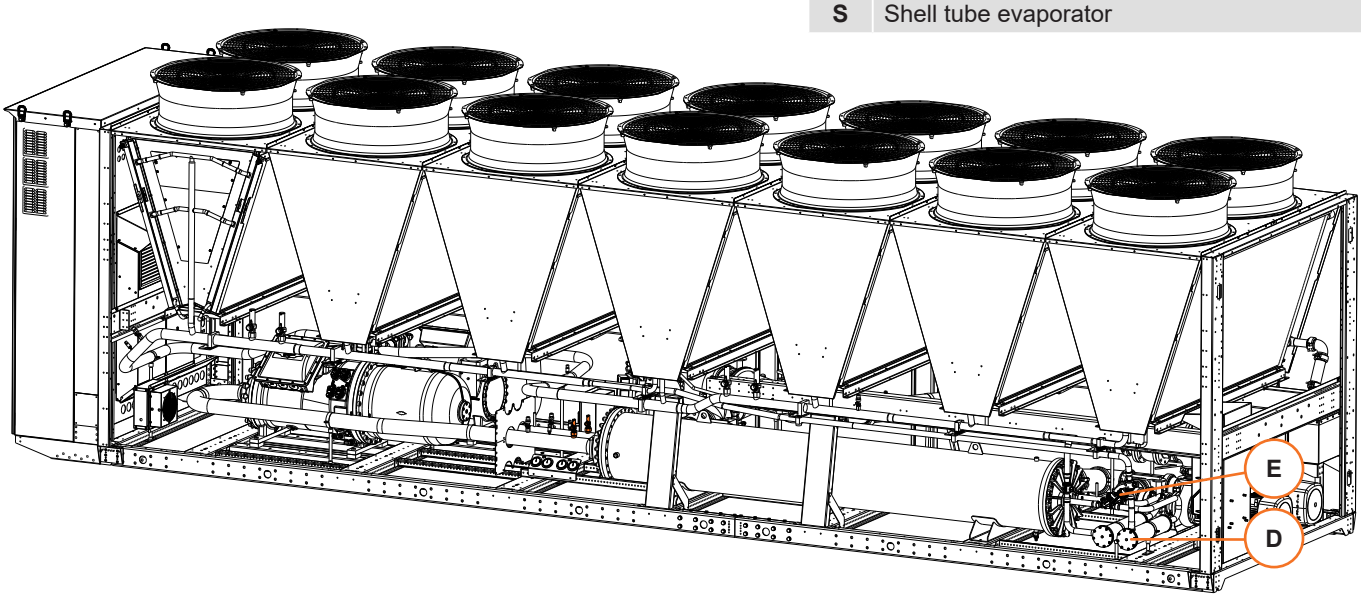
The unit is equipped with one or two independent refrigerating circuits, composed of an air-cooled condenser, a semi-hermetic screw compressor, a shell-tube evaporator. The evaporator tube of one or both the circuits are coupled in the same shell heat-exchanger. The chilled water flows through the shell side. A shut-off valve is installed on the discharge of the compressor.

See *Annex II - Refrigerating Circuit* for details. The components of the liquid line are:

- Charging valves;
- Filter-dryers;
- Moisture indicator;
- Electronic Expansion Valve.



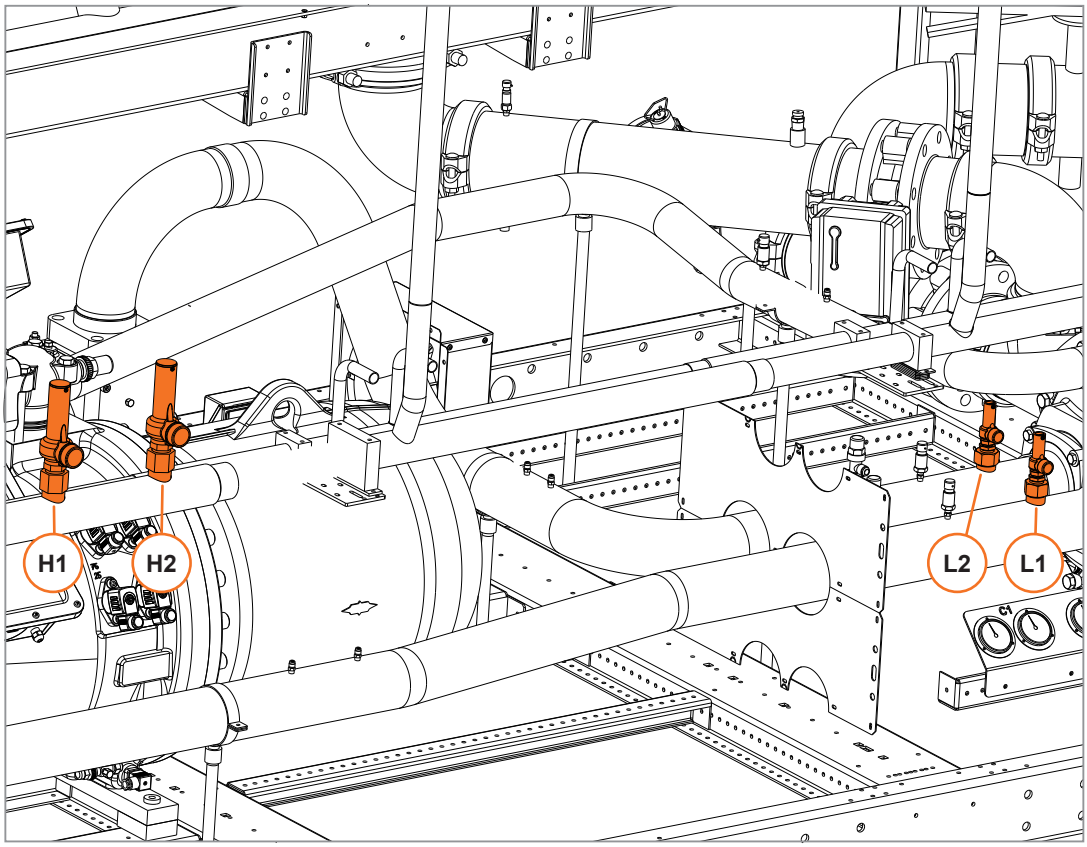
C	Semi-hermetic screw compressors
D	Filters-driers
E	Electronic Expansion Valves
F	Fans
M	Microchannel condensers
S	Shell tube evaporator



5.3.2 Safety devices

Each refrigerating circuit is provided with the following safety devices:

Safety valves



H1	High pressure safety valve(s) circuit #1
H2	High pressure safety valve(s) circuit #2
L1	Low pressure safety valve(s) circuit #1
L2	Low pressure safety valve(s) circuit #2

See chapter *6.3 Operating Limits* for details.
See also chapter *10.8 Calibrations* for maintenance and calibration operations.

WARNING

Make sure that the safety valves are always free to discharge.
Do not cover the safety valves.
For units with **A2L** refrigerant please follow safety valve connection guide.

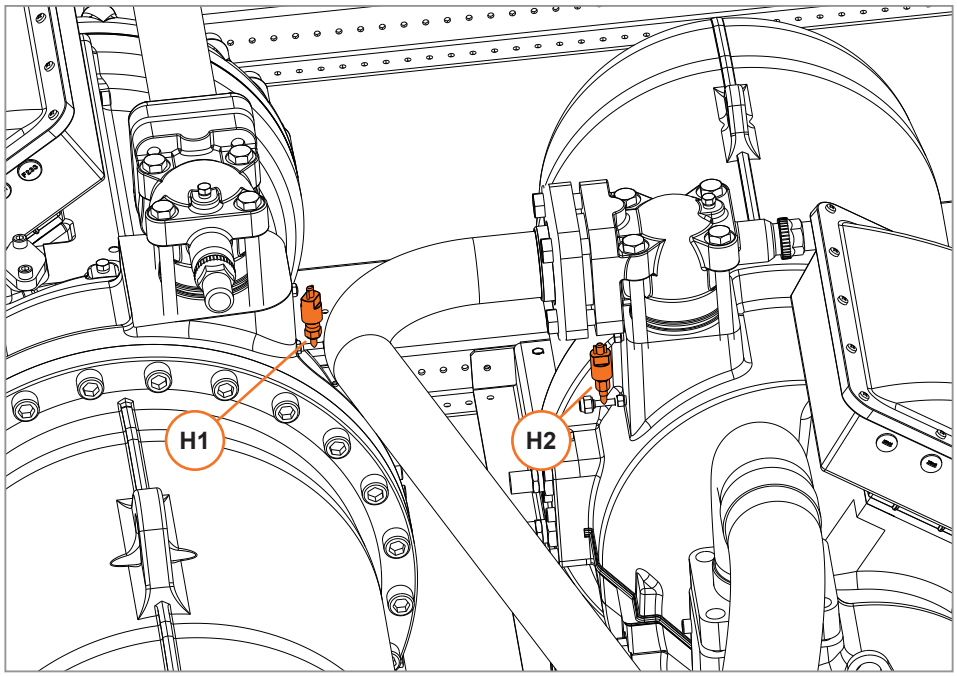
NOTICE

The operation, servicing and maintenance of pressure equipment and pressure assemblies are regulated in compliance with national regulations of Member States of European Communities.
The shut-off valves, installed between vessel and safety valve, allow removing the valve for periodic checking or replacement without **blowing OFF** all the refrigerant from a section of the system.
The safety valves are installed in open position and the ball spindle is protected by means of a cap screwed to the body and sealed with lead to it.
Any closing intervention on the valve forcedly causes the tampering of the seal and then these interventions shall be performed exclusively by:

- Staff authorized to work on the system;
- Public servant of a Competent Body.

These persons will be responsible for the next valve reopening and the new cap sealing with their own lead.

High pressure switches

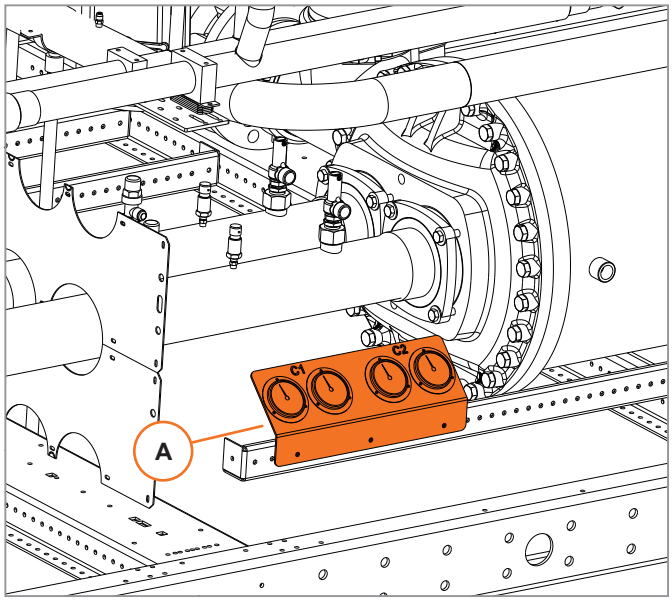


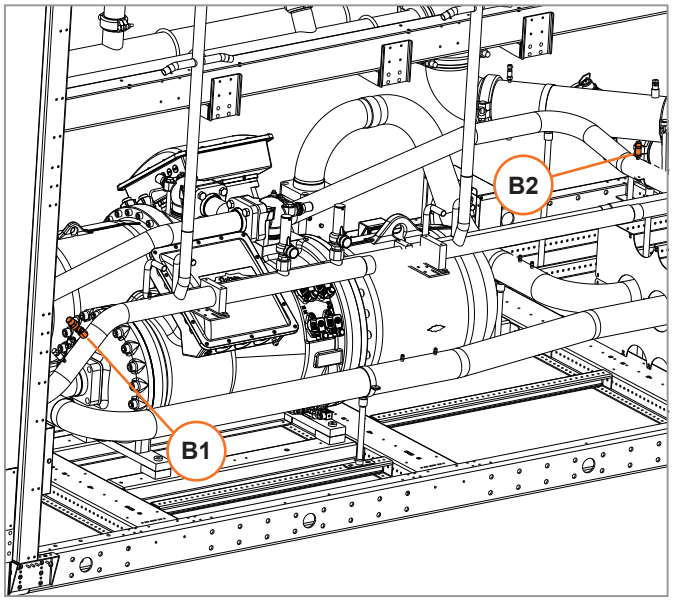
H1	High pressure switch circuit #1
H2	High pressure switch circuit #2

See chapter *6.3 Operating Limits* for details.

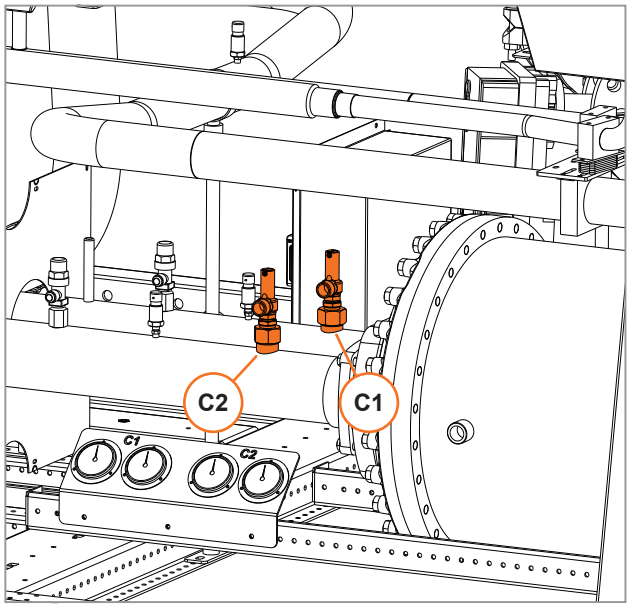
5.3.3 Sensors and instruments

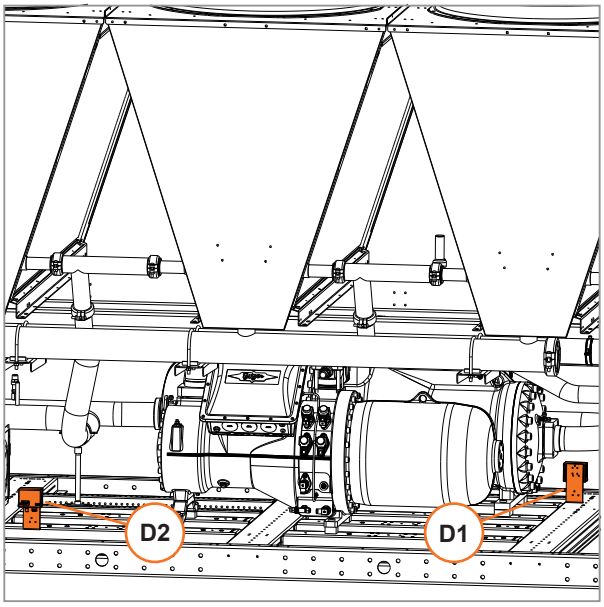
Each refrigerating circuit is provided with the following sensors and instruments:



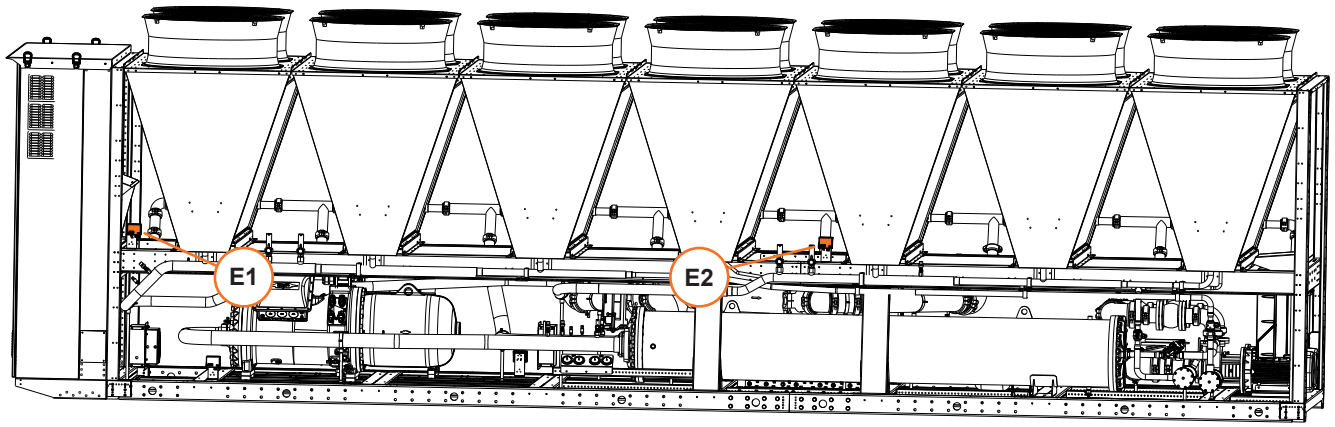


A	Refrigerant gauges
B1	Pressure transducer High pressure Circuit 1
B2	Pressure transducer High pressure Circuit 2

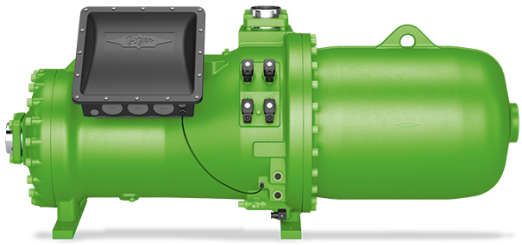




C1	Pressure transducer Low pressure Circuit 1
C2	Pressure transducer Low pressure Circuit 2
D1	Low pressure switch circuit 1 (only for model with suction valve)
D2	Low pressure switch circuit 2 (only for model with suction valve)
E1	Low pressure switch circuit 1 (only for R1234ze model)
E2	Low pressure switch circuit 2 (only for R1234ze model)



5.3.4 Compressors



Type	Semi-hermetic screw compressors Integrated shut-off valve on the discharge line
Safety	Internal safety valve
Protection	Electronic protection controlling: - the temperature of the motor windings; - the oil temperature; - the screw rotating direction. The compressor motors are equipped with protection on all the three phases and are started by their three-pole contactors.
Oil system	Oil heater Oil sight glass Oil level control (optional) Fine filter 10 µm mesh size

5.3.5 Electronic Expansion Valve



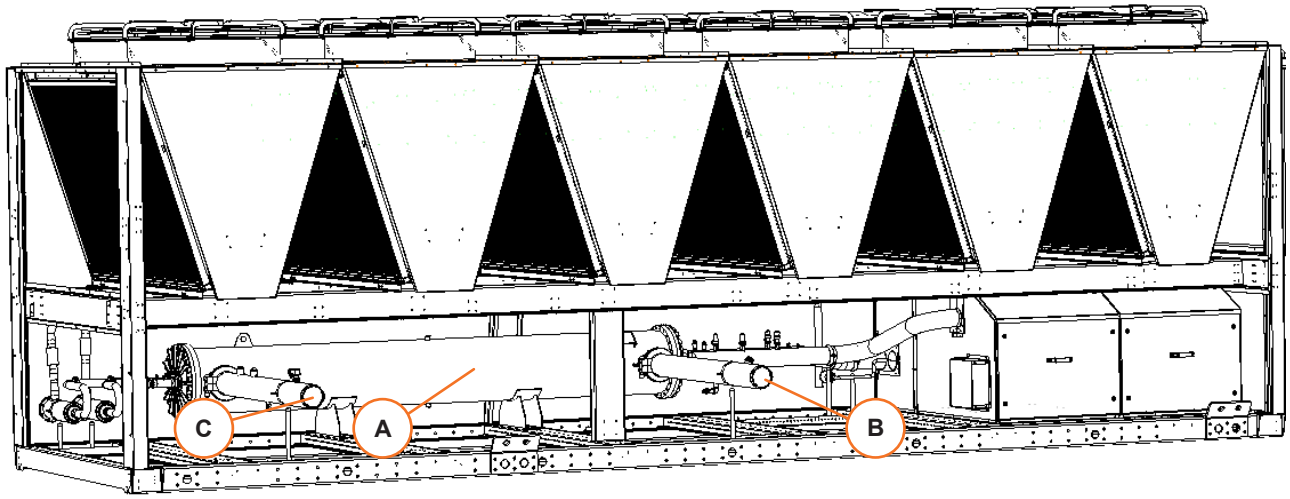
Features	The **Electronic Expansion Valve** (**EEV**) used in the **Vertiv™ CoolLoop Trim Cooler** range enables accurate and minimum possible control of the overheating of the gas sucked by the compressor under all load conditions, together with the operation at low condensation and high compressor choking. The final result of the application of the **EEV** on **Vertiv™ CoolLoop Trim Cooler** is therefore an improved energy operating costs and a higher reliability, thanks to its special adjustment features above all on partial loads, conditions under which every chiller operates for most of the time.
Operation	The superheat setpoint will be automatically adjusted according to the operating conditions and to the application limit of the compressor. The operating parameters and their programming in the microprocessor dedicated to the **EEV** control are described in the *Vertiv™ iCOM3™ User Manual.*

5.4 Hydraulic System

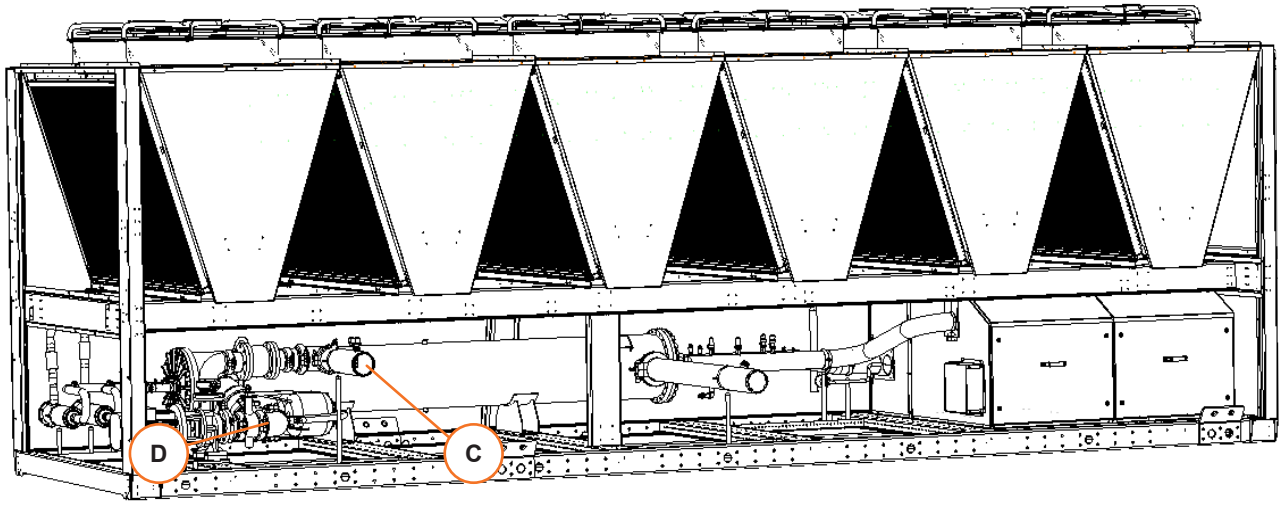
The hydraulic circuit is made up of grooved hydraulic lines ready to be connected to the plant by joints (Grooved pipes connections type).

NOTE *This chapter describes only the components that are part of the **Vertiv™ CoolLoop Trim Cooler** units. The complete water system must be prepared by the customer according to the specifications given in 6.2 Water System.*

5.4.1 Chiller versions



A	Evaporator
B	Fluid inlet connection
C	Fluid outlet connection

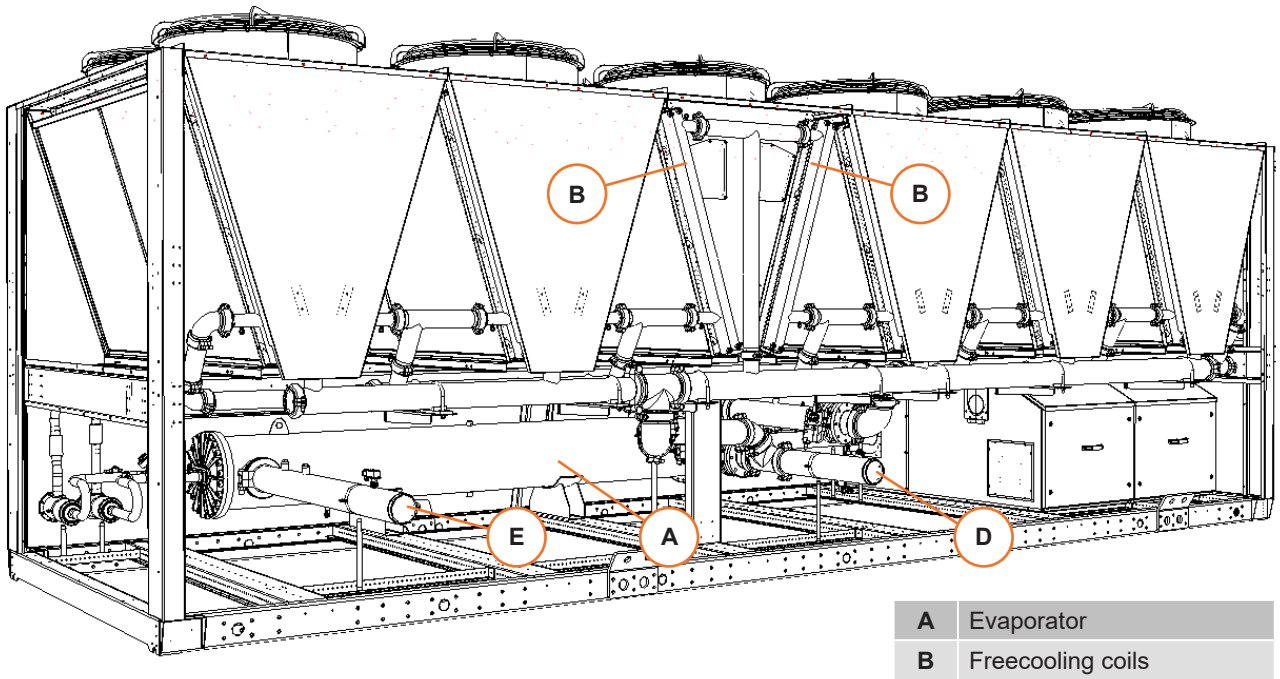


C	Fluid outlet connection
D	User pump (optional)

5.4.2 Freecooling versions

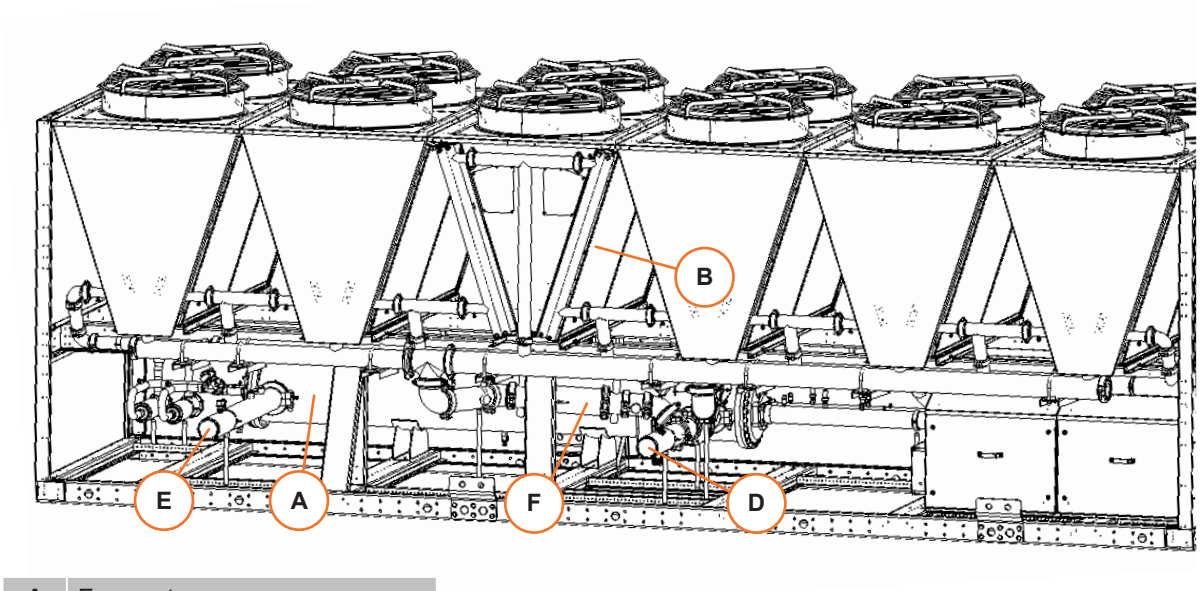
5.4.2.1 Freecooling with finned tube FC coil

Each water circuit is provided with the following sensors and instruments:

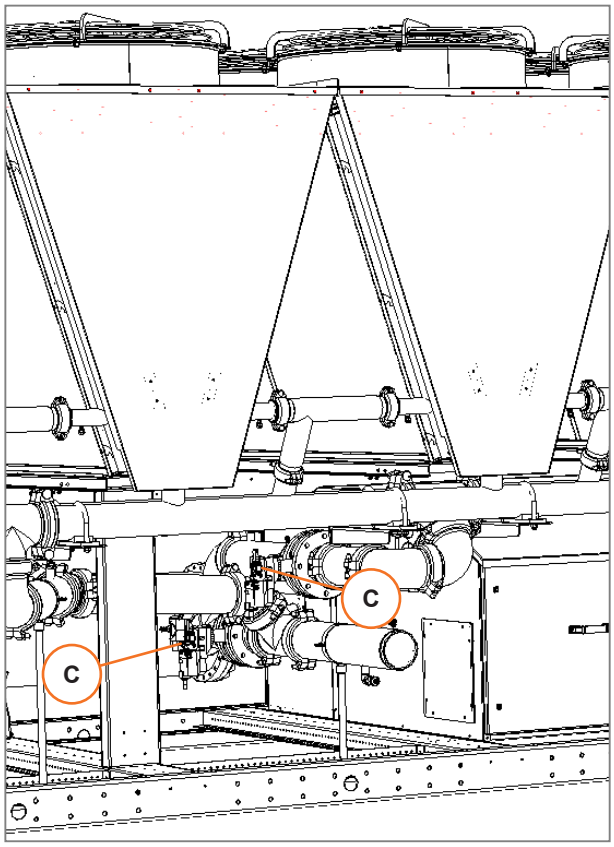


A	Evaporator
B	Freecooling coils
D	Fluid inlet connection
E	Fluid outlet connection

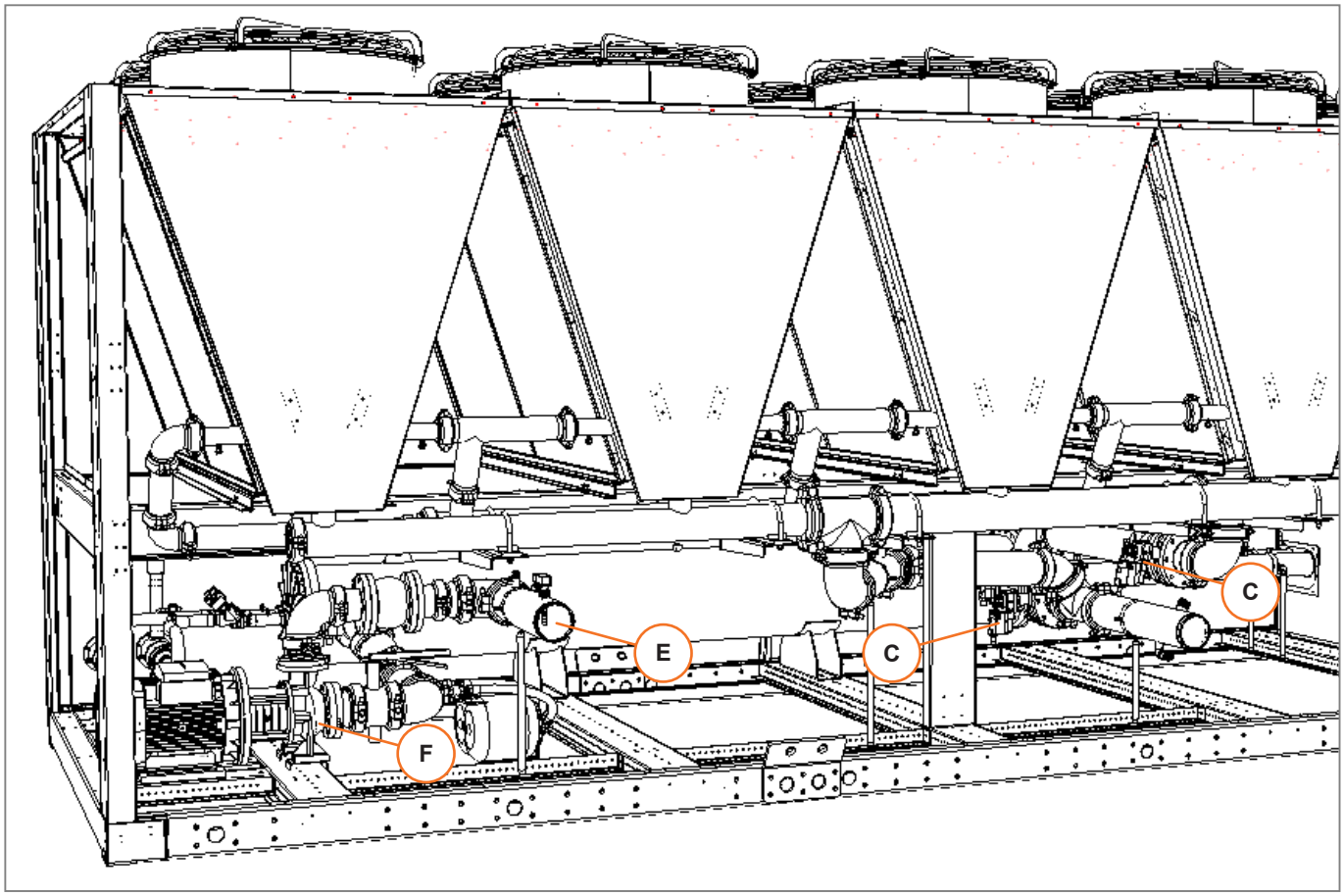
5.4.2.2 Freecooling with microchannel FC coils



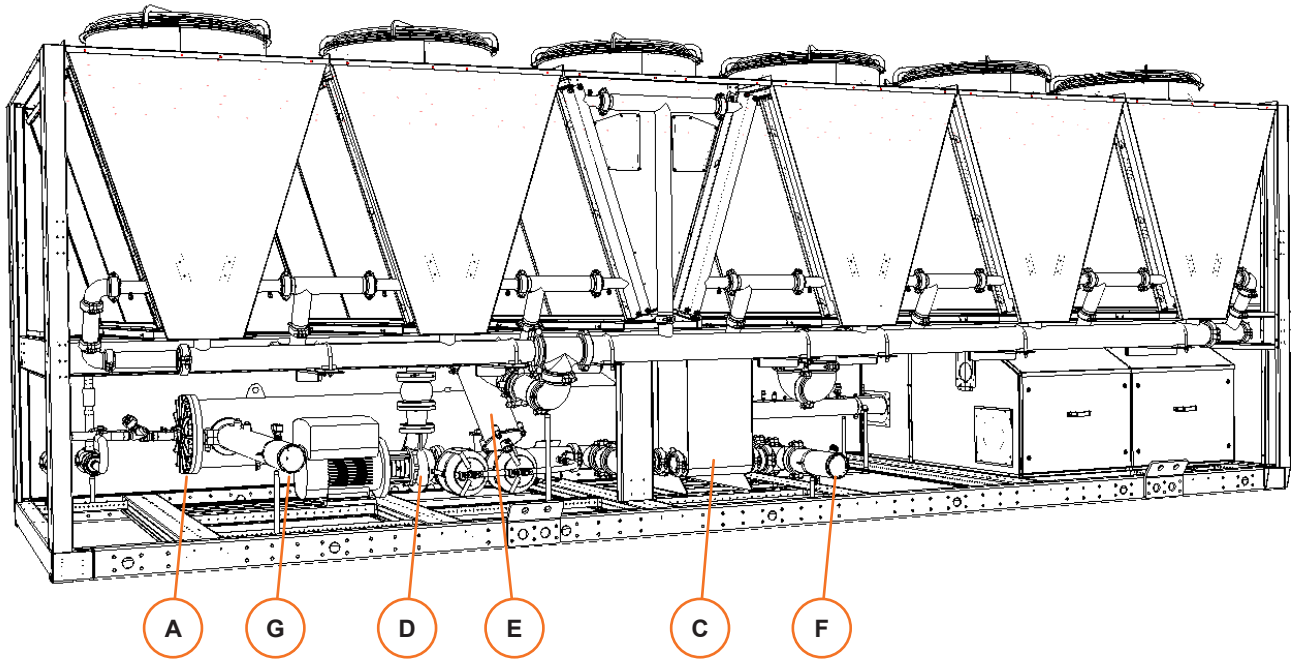
A	Evaporator
B	Freecooling coils
D	Fluid inlet connection
E	Fluid outlet connection
F	Hydraulic Filter



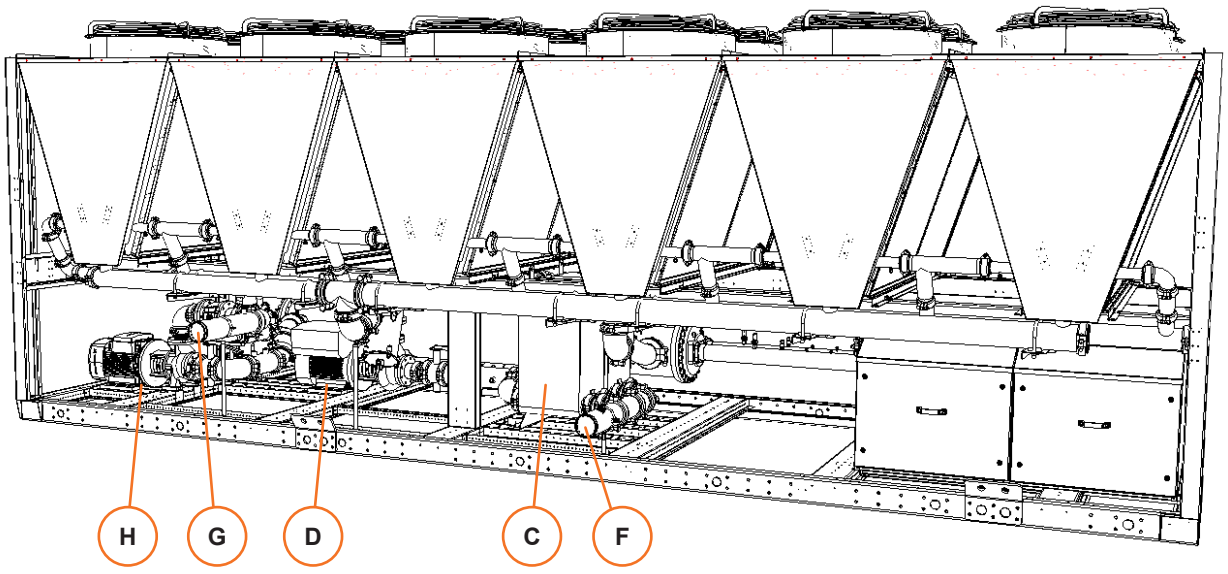
C	Freecooling commutation valves
E	Fluid outlet connection
F	User pump (optional)

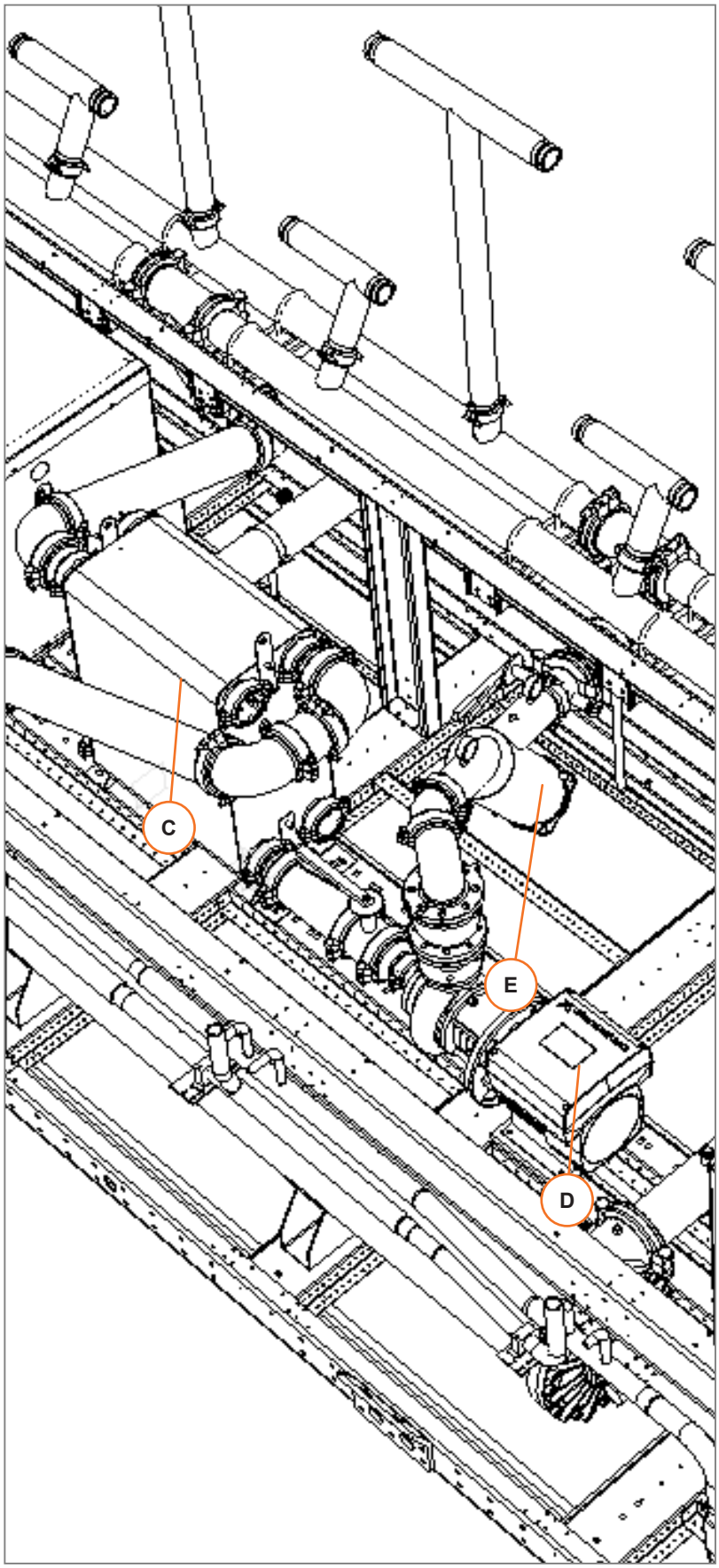


5.4.3 Freecooling glycol-free versions



A	Evaporator
C	Glycol-water exchanger(s)
D	Glycol pump
E	Glycol filter
F	Fluid inlet connection
G	Fluid outlet connection
H	User pump (optional)

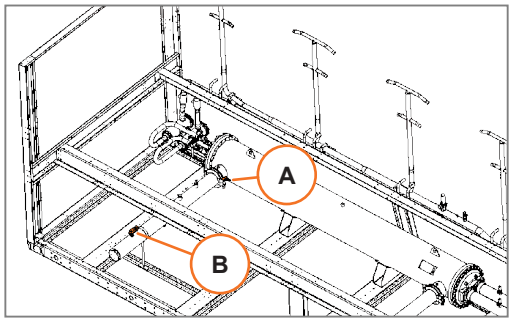


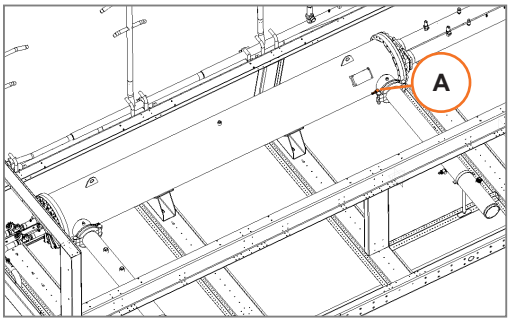


C	Glycol-water exchanger(s)
D	Glycol pump
E	Glycol filter

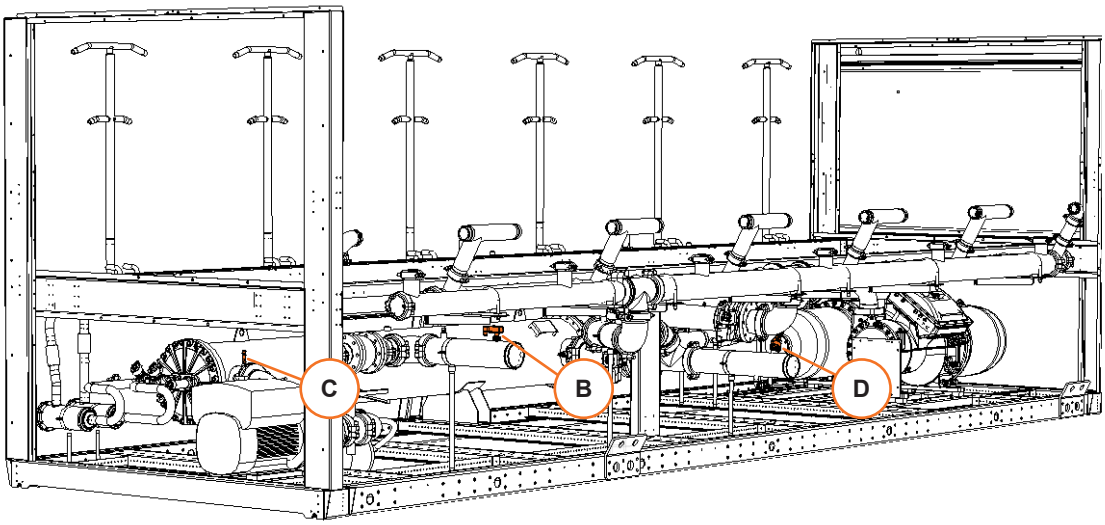
5.4.4 Sensors and instruments

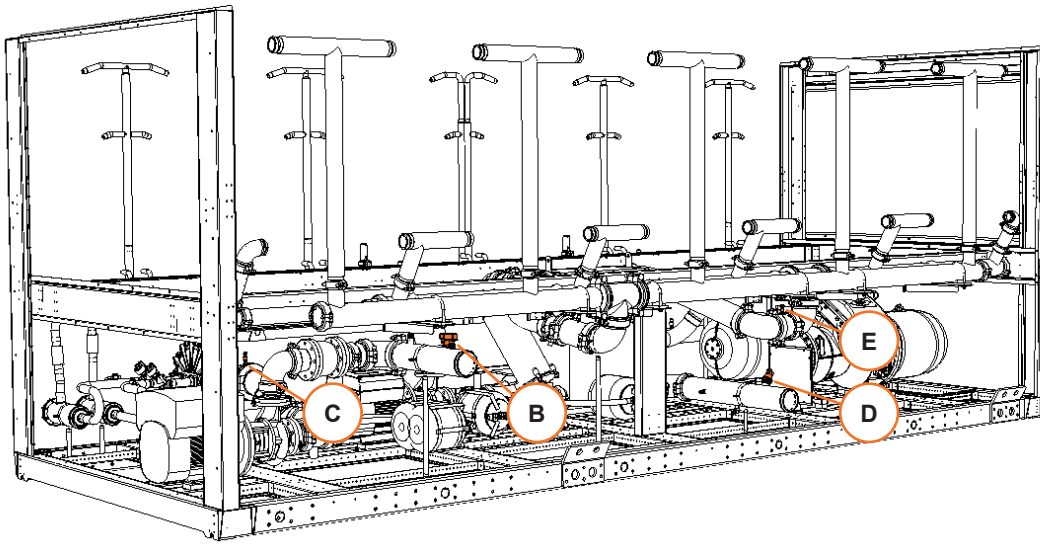
Each water circuit is provided with the following sensors and instruments:





A	Temperature sensors (NTC)
B	Flow switch
C	Anti-vacuum pressure transducer (only with user pump)
D	Flow meter (optional)
E	Pressure transducers (only with microchannel FC coils)

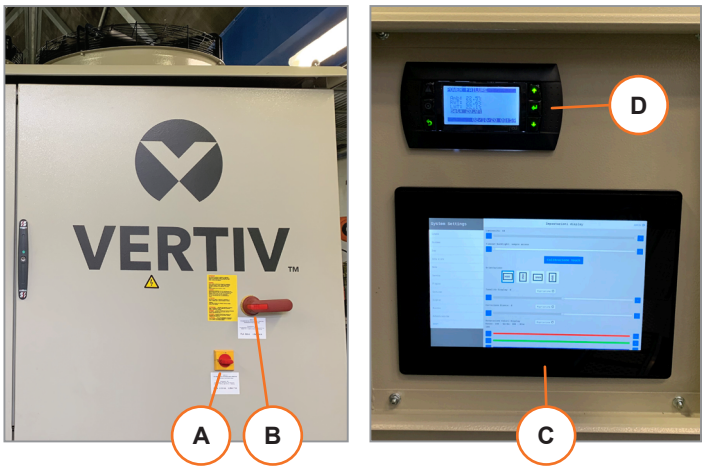




5.5 Electric System

5.5.1 Electric box and main switch

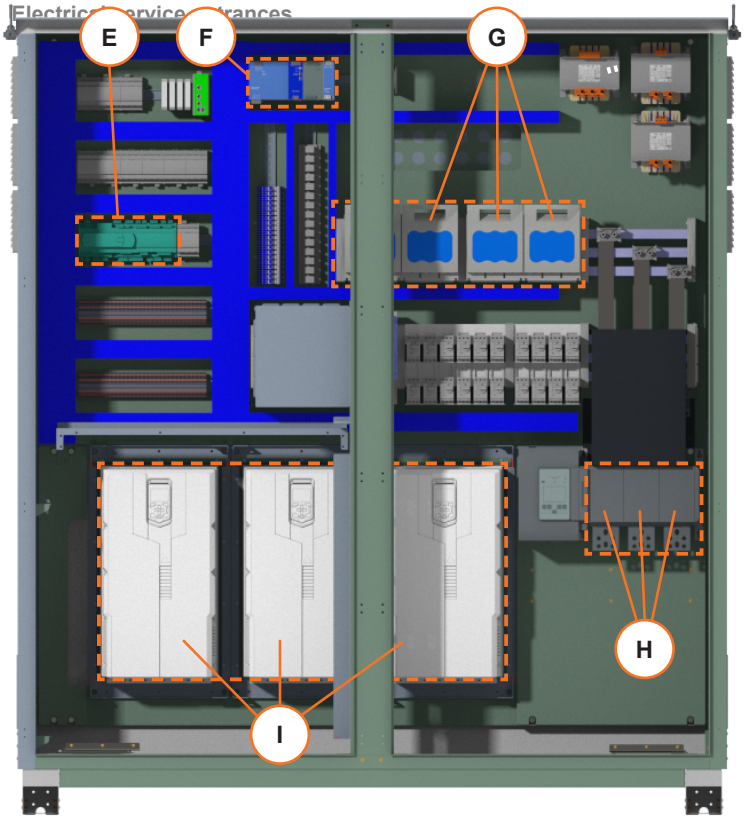
Electric box



A	**Main switch secondary power supply** (control and auxiliary systems).
B	**Main switch** This is a disconnecting switch and cuts **OFF** the electric power supply to the whole unit.
C	**Touch screen panel** (optional) See the *Vertiv™ iCOM3™ User Manual* for details.
D	**Main control panel** See the *Vertiv™ iCOM3™ User Manual* for details.

The electrical panel is designed and manufactured according to CEI EN 60204-1.

5.5.2 Electrical connections



E	**Control board**
F	**Ultra-capacitor**
G	**Fuse holder for harmonic filter**
H	**Three-phase electrical connection**
I	**Inverter of the compressors**





5.6 Control System

5.6.1 Vertiv™ iCOM3™



E

The **Vertiv™ CoolLoop Trim Cooler** water chillers are controlled by the **Vertiv™ iCOM3™** microprocessor [**E**], managing all of the unit operating conditions.

The user can change and/or modify the operating parameters through the display keyboard installed on the electrical panel.

The electrical control board with fan is equipped with all the safety and operating devices needed for reliable automatic operation.

See the *Vertiv™ iCOM3™ User Manual* for details.

NOTICE

The **Vertiv™ CoolLoop Trim Cooler** are equipped with their own microprocessor control for the water temperature adjustment.
There is no connection for a remote ON-OFF control. Any modification is forbidden.

5.6.2 Protective Functions

The **Vertiv™ CoolLoop Trim Cooler** water chillers are automatically protected through a series of warning and alarm to prevent damages to the chiller itself:



Pressure control	High pressure and low pressure alarm.
Out of Envelope alarm	Modulation of capacity based on the value of high pressure, low pressure, superheat and subcooling and the operating map of the compressor installed.
Oil level	Low level alarm.
Refrigerant charge check function	Monitoring of the subcooling value with warning or alarm depending on the working conditions.
Compressors	The compressors are equipped with an electronic protection device blocking their start if the phase sequence is not correct, or stopping their operation if a thermal relay intervenes. This device is essential for the integrity of the mechanical and electrical components of the compressors. In case of stop due to this device intervention: 1. Isolate this device; 2. Remove the causes of the lock-out; 3. Reset the device by the **Vertiv™ iCOM3™**.

5.6.3 Fast Start Ramp and Control Supply

The **Vertiv™ iCOM3™** for **Vertiv™ CoolLoop Trim Cooler** control is fed by direct current for immunizing from network disturbances.

There are **3** possible power supply choices to guarantee reliability and fast start:

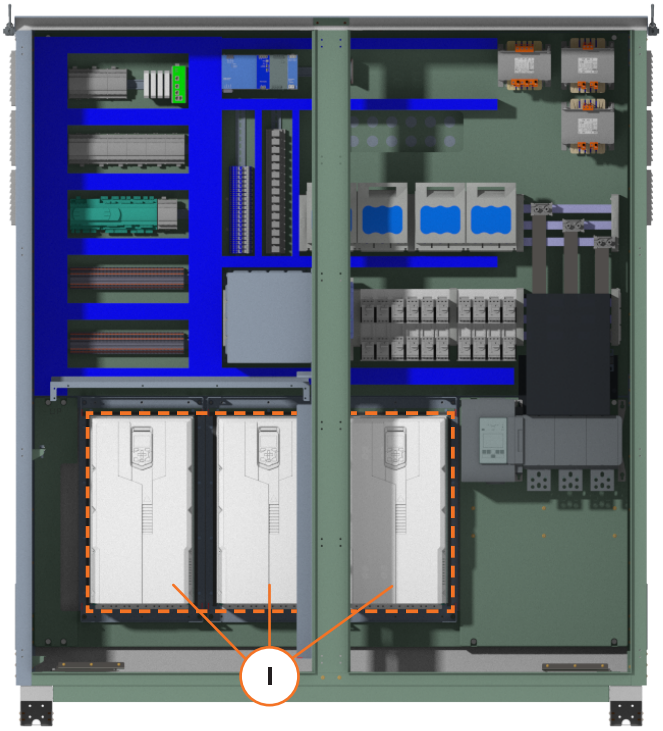
Option 0 (None)	The unit is powered by a single three-phase line. The control is powered by an **AC/DC** converter three phases, that insulate the control from the external electric noises.
Option 1 (Fast Start Ramp – Easy)	The unit is powered by a single three-phase line. A capacitors module (**Ultra-capacitor**) is installed for the direct microprocessor power supplying. In case of main supply power **OFF**, the control is powered for **90** seconds (minimum buffer time guaranteed, the amount of time is function of unit configuration). - If the main supply power restores within the buffer time, the control re-start quickly the controlled components; - If the main supply power restores out of the buffer time, the control starts the reboot procedure and the **Ultra-capacitor** requires **15** minutes to recharge completely. More repetition of power **OFF** in a short time and/or long power **OFF** time reduces the minimum buffer time. The **Ultra-capacitor** has a potentially unlimited lifetime, not required maintenance. **NOTICE** The **Ultra-capacitor** working temperature limits are -40°C ÷ +60°C
Option 2 (Fast Start Ramp – Classic)	The unit is powered by two power lines: - A three phases line for the high power components; - A single phase for the control, provided by a **UPS**, installed by the customer/user. The **Main control panel** [**D**] is powered by a **AC/DC** single-phase converter, connected to the single-phase power line, that insulates the control from the external electric noises. In case of three-phase line power **OFF**, the control remains power supplied by its dedicated power supply line, ready to start quickly when the three phases power **ON**.



5.7 Variable Frequency inverter driver for the compressors

Vertiv™ CoolLoop Trim Cooler are equipped with a compressor driver by **remote inverter [I]** installed in the electrical panel. The **inverter [I]** is a speed drive for controlling the electrical motor of the compressor, letting the cooling capacity modulate according to the feedback on the chiller setpoint. It uses electronic components like switches, diodes, and transistors to achieve this conversion. The **inverter [I]** first converts the **AC** power from the grid into **DC** with a rectifier circuit, then converts the **DC** current into a high-frequency **AC** using **Pulse Width Modulation** (**PWM**) and it replicates the typical sine profile of the **AC** current into the electrical motor.

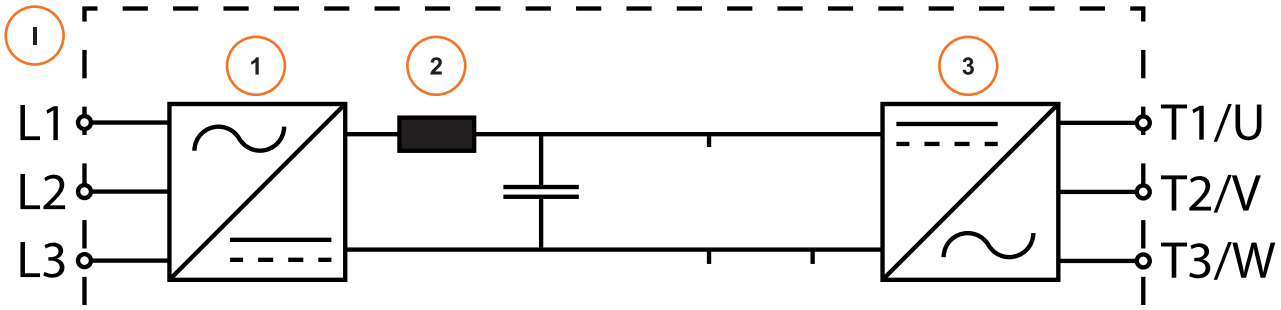
Frontal view of electrical panel of 3 compressor unit





Sample picture of one of the sizes of compressor Inverter Drive

The figure below shows the simplified main circuit diagram of the **drive**.

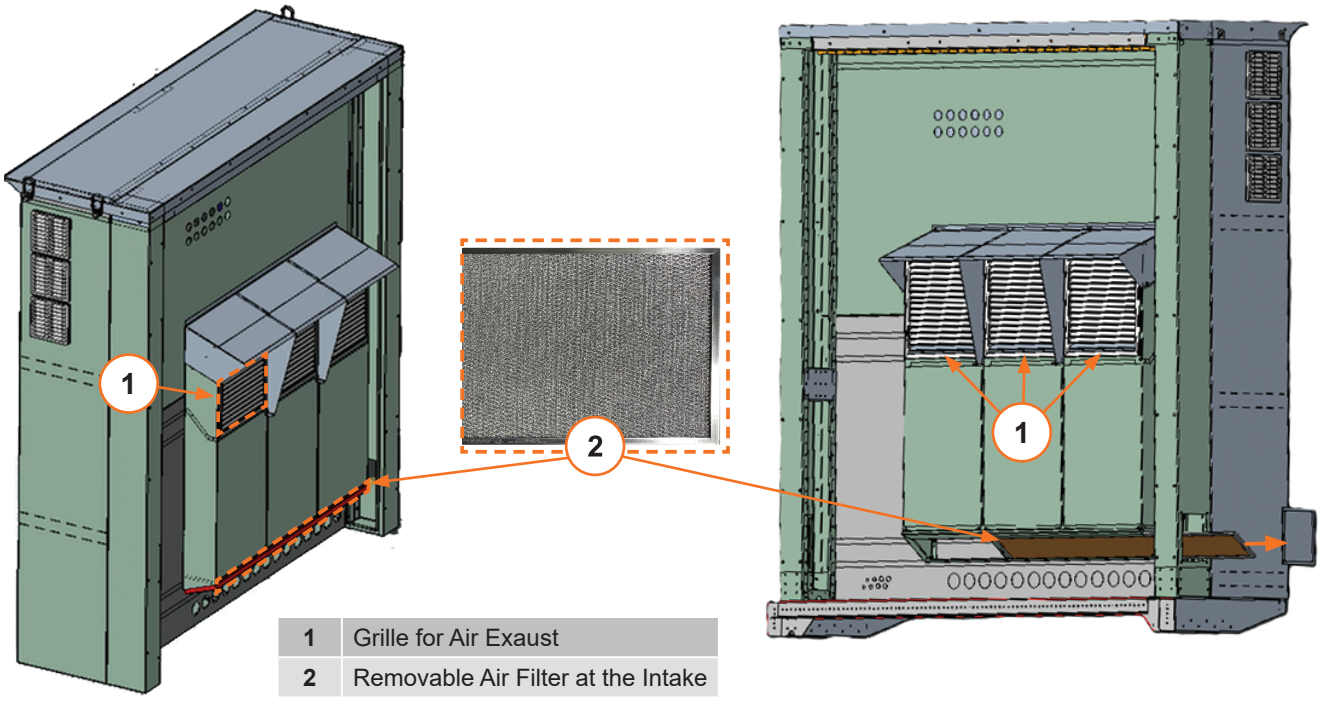


I	**Drive**.
1	**Rectifier**: Converts **Alternating Current** (**AC**) and **voltage** to **Direct Current** (**DC**) and **voltage**.
2	**DC link**: **Direct Current** (**DC**) circuit between **Rectifier** and **Inverter**.
3	**IGBT module**: Converts **Direct Current** (**DC**) and **voltage** to **Alternating Current** (**AC**) and **voltage**.

These **inverters [I]** are installed inside the electrical panel but keep the heatsink part on the back outside the electrical panel.

The flange mounting kit contains brackets to attach the drive onto a mounting plate. The heatsink of the drive is in the cooling air channel, and the front part of the drive on the other side of the mounting plate is into the electrical panel. The heatsink on the back is protected from water and dust as IP55, the main board on the front is IP21.

At the **air intake** [2] of the heatsink it is present a **rough mesh air filter** [2] to keep dirt away from entering the ventilation channel; a **grille** [1] protects the outlet from rain and dirt getting into the electrical panel when the airflow is not activated. The **Air Filter at the intake** [2] can be easily removed from the side of the chiller unit and cleaned (keep **1.5 m.** free space at the left side of each chiller to extract the **filter**).



1	Grille for Air Exaust
2	Removable Air Filter at the Intake

The cables from **inverter** [I] to the compressor motor are shielded and fixed to the compressor box with earthed cable glandes.

The communication with the **inverter** [I] is granted via **Modbus** and is managed by the chiller software, main inverter parameters and variables are available through the chiller display.



SAFETY RESTRICTION: If you have a cardiac pacemaker or other electronic medical device, keep away from the area near motor, drive, and the drive power cabling when the drive is in operation. There are electromagnetic fields present which can interfere with the function of such devices. This **can cause a health hazard**.

Application limits of the inverter driver

Air temperature and altitude cause a derate of the inverter performances (means the nominal current for the compressor).

Altitude: the maximum allowed installation altitude is 4000 m., derate happens starting from 1000 m. 1% each 100 m.

Air Temperature: the max allowed air temperature is 55°C, derate is 1% each 1°C above 45°C. The minimum application temperature for operation is the same of the chiller, supposing that the equipment is powered and installed properly. No frost is allowed during storage unpowered.

Air Humidity: maximum 95% not condensing for the internal part IP21.

Dust atmosphere: Class 3S2 No conductive dust allowed.

Compliance to applicable European legislation:

CE A **CE** mark is attached to the drive to verify that the drive follows the provisions of the European Low Voltage, **EMC** and **RoHS** Directives.The **CE** marking also verifies that the drive, in regard to its safety functions (such as **Safe Torque Off**), conforms with the Machinery Directive as a safety component.

The driver is Compliant with the EN 61800-3:2004 + A1:2012 **EMC** stands for **ElectroMagnetic Compatibility** as Category C2. The emission limits are complied with the following provisions:

1. The motor and control cables are selected as specified in this manual;
2. The drive is installed according to the instructions given in this manual.

The compliance with the European Low Voltage Directive has been verified according to standard EN 61800-5-1:2007. The driver is also compliant to UL 61800-5-1: 1st edition and CSA C22.2 no. 274-17 both norming adjustable speed drives.

Connecting the inverter to a Personal Computer

WARNING!

Do not connect the computer directly to the control panel connector of the inverter - this may cause damage.

To properly connect a PC (for example, using the "**Drive Composer**" software), follow these steps:

1. Connect the control panel to the inverter in one of the following ways:
   - Insert the panel into its holder or platform or;
   - Use an Ethernet cable (e.g., Cat 5e).
2. Remove the cover from the USB connector on the front of the control panel;
3. Connect the PC to the panel using a USB cable with a Type A connector (PC side) and a Mini-B connector (panel side);
4. When the connection is active, the panel will display a message or indicator;
5. Follow the instructions in the PC software manual to complete the setup.

Functional safety components

The mission time of functional safety components is **20** years which equals the time during which failure rates of electronic components remain constant. This applies to the components of the standard **Safe Torque Off** circuit as well as any modules, relays and, typically, any other components that are part of functional safety circuits.

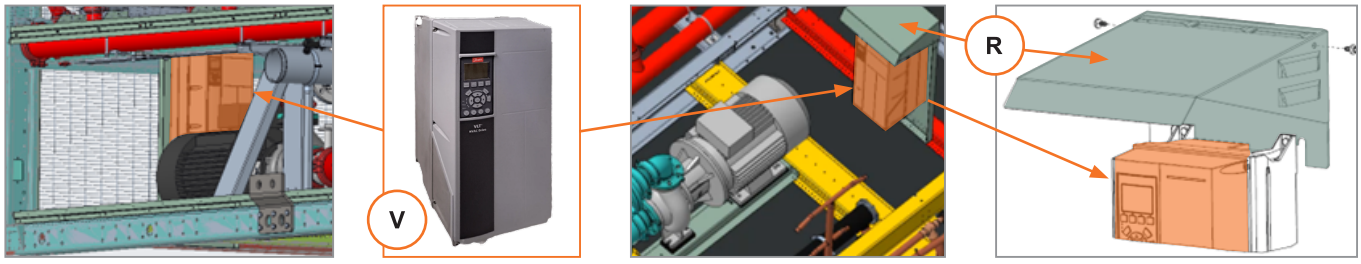
5.7.1 Harmonic Distortion generated on the electrical line

A reliable measure of the Harmonic Distortion generated by our chiller can't be performed in a electrical network with high harmonic distortion, otherwise it is like measuring noise of the chiller in a noisy environment background. Vertiv™ considers such values as minimum requirements for a good measure:

- Reference max **THDV** value of the electrical network < 4%;
- Reference transformer power big enough, as an example 4000 kVA for the load of a chiller with current absorption up to 1600 A. Additionally the ratio between short circuit current and max demand current $\mathbf{I_{sc}/I_L > 20}$.

5.8 Variable Frequency inverter driver for the pumps

In the **Vertiv™ CoolLoop Trim Cooler** the pumps can be equipped as option with one **external inverter driver** [**V**]. In case of configuration with double pump the **inverter** [**V**] is one only and can supply either first or second pump by switching the power thanks to a couple of coordinated contactors. The **inverter** [**V**] is managed by the software of the chiller and its main variables are visible through the chiller interface. For such reason the display onboard of the inverter is not present.



The **inverter** enclosure is IP55 and protected with a **metal roof** [**R**] is suitable for outdoor application with following limits:

- Maximum relative humidity 5–93 (IEC 721-3-3), Class 3K3 (non-condensing) during operation;
- Ambient temperature Maximum 52°C (122°F);
- Minimum ambient temperature -25°C;
- Derate for altitude above 1000 m. is 1% each 100 m. and 1°C max air temperature each 200 m. Above 2000 m. it is recommended to use cables with dielectric resistance of 2 kV for **5** minutes (IEC Class I equipment) and the overall altitude limit is 3000 m.

Under normal operating conditions and load profiles, the drive is maintenance-free throughout its designed lifetime. To prevent breakdown, danger, and damage, examine the drive for loose terminal connections, excessive dust buildup, and so on, at regular intervals. Keep the heatsink cleaned and replace worn or damaged parts with authorized parts.

WARNING: In case you stop the drive and disconnect it from the power line. Wait for **10** minutes and then make sure by measuring that there is **NO voltage**, otherwise there's **serious risk of arc flash and electric shock** to **cause serious injuries or death**.

5.9 Active harmonic filters

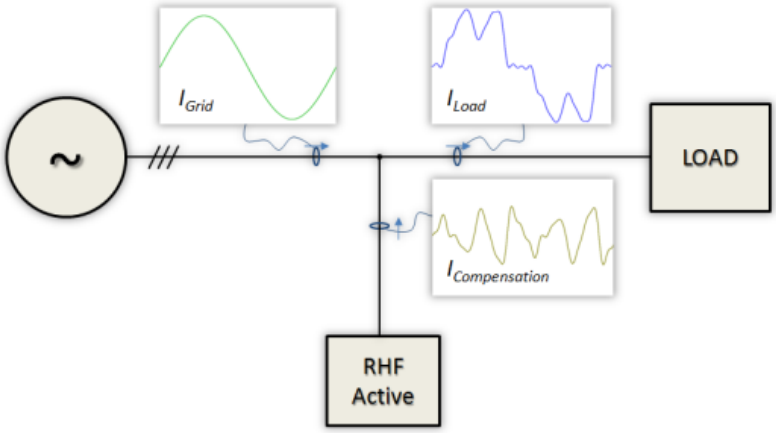


Vertiv™ CoolLoop Trim Cooler can be equipped with **Active Harmonic Filters** (**AHF**) option (**Digit 21** = **F**, **G**).

The active filter enables:

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

The following picture is showing the basic topology and the working principle of the **RHF-Active**



The **AC** mains current, disturbed by a non-linear load, is measured by the **Active Harmonic Filter** via external current transformers.

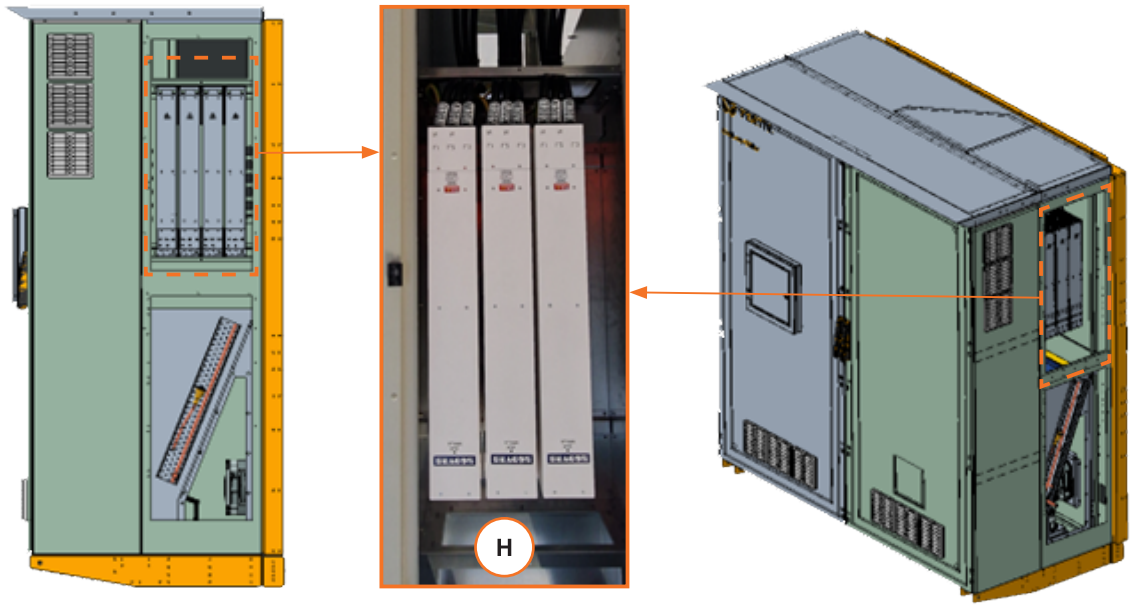
The harmonic content and reactive power components are detected and processed in a digital control structure.

The **Active Harmonic 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 Harmonic 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.

The **Active Harmonic Filters** [**H**] and their support structure are installed behind the panel on the right (see pictures below).

The pictures below, on the right side of the electrical panel shows the installation of **THDi** filters in a **Vertiv™ CoolLoop Trim Cooler** unit. The filters are served by an active cooling air conditioning coil below them, offering fresh air and avoiding derate up to 52°C ambient temperature. The active cooling circuit evaporates refrigerant coming from one compressor of the chiller. The unit software grants that the compressor is running when there's thermal load in user circuit and the high ambient temperature requires active cooling for harmonic filters.



Based on the configuration of the unit, the number, position and mode (open loop - close loop) of filters may vary.

WARNING The setting of the active filter parameters is carried out at the factory, but must be checked again and if necessary modified, depending on the operating conditions of the power supply to the chiller at the installation site. This is mandatory during commissioning and it is highly recommended to carry out such checks during normal maintenance operations, in case the quality of the power supply to the chiller changes.

In case of doubt contact the Vertiv™ technical support.

After switching **OFF** the mains supply, all terminals may remain live for up to **15** minutes, requiring verification of voltage absence before touching. The installation and maintenance should only be performed by qualified personnel who are familiar with electrical systems and relevant safety standards (IEC 364, CENELEC HD 384, or equivalent).

Operational Limits and Environmental Conditions:

- Voltage Range: 380V-480V (+10%/-15%);
- Frequency: 50Hz/60Hz (±5Hz);
- Ambient Temperature: -10°C to +40°C;
- Temperature Derating:
  - 40°C to < 45°C: 10% derating;
  - ≥ 45°C to < 50°C: 20% derating;
  - ≥ 50°C 100% derating (shutdown);
- Maximum Installation Altitude: 1000 m. without derating;
  - Altitude Derating: 1% per 100 m. above 1000 m. (maximum 4000 m.);
- Relative Humidity: 5-95% without condensation;
- Protection Class: IP20.

For first-time operation or after > **4** months of non-operation, a **1** hour waiting period is required before starting.

These safety measures and operational limits are crucial for ensuring safe and reliable operation of the **RHF-Active Harmonic Filters**. Failure to observe these guidelines may result in equipment damage, malfunction, or safety hazards. When installed in an appropriate environment the **RHF-Active** required minimal maintenance, no more than the other recommendations given for the electrical components (check tightening of screws, electrical parameters in/out, absence of dirty in the air channel…).

The constructor of the plant, who has to know the technical guidelines, bears the responsibility for the correct selection and arrangement of the electrical components. In accordance with the corresponding standards and guidelines the operation on (even for a short time) over-compensated networks (**cos ϕ ≤ 1**) respectively on un-choked compensation-units is not admissible. If this is done nevertheless, overvoltage will occur (caused by oscillating currents), which may damage all connected components, especially electronic units like controllers and filter modules.

WARNING
The Active filters are **heavy** components (up to **32 kg.** each) and require to be safely hanged, **Do not** remove their screws without holding them with a rope.



Secure the harmonic Filter with a rope throught the handle (the hole is 10 mm)

5.10 Special Instrumentation

5.10.1 Energy Meter (Optional)

For a complete description, please check the specific manual.
Parameters device are set on factory:

- Currents;
- Powers;
- Energy values.

5.10.2 Flow Meter

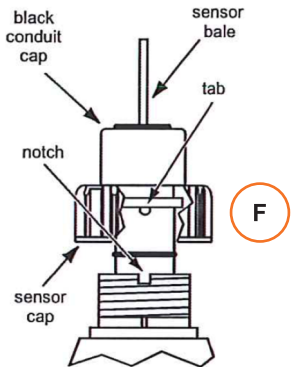
Safety informations

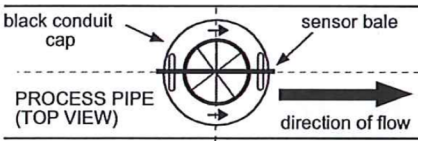
WARNING
Pressurized System
Depressurize and vent system prior to installation or removal.
DO NOT exceed maximum temperature or pressure specs.
ALWAYS wear safety goggles or faceshield during installation and/or service.
DO NOT alter product construction.

WARNING
Paddlewheel retaining nuts.
The retaining nuts of paddlewheel sensors are not designed for prolonged contact with aggressive substances.
Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly **serious consequences**, such as **damage to equipment and serious personal injury**.
Retaining nuts that may have been in contact with such substances, e.g. due to leakage or spilling, must be replaced.
Max. pressure: 12.5 bar at 20°C.

NOTICE
Hand tighten only. Do not use tools!
Overtightening may permanently damage product threads and lead to failure of the retaining nut.
Use of tool(s) may damage product beyond repair and potentially void product warranty.

Characteristics	Flow rate range 0.1 to 6 m/s (0.3 to 20 ft/s). Installs into pipe sizes DN15 to DN900 (½ to 36 in.). High resolution and noise immunity. Chemically resistant materials. Easy to replace rotor.
Installation	Lubricate O-rings with a non-petroleum based, viscous lubricant (grease) compatible with the system. Using an alternating/twisting motion, lower the sensor into the fitting, making sure the installation arrows on the black cap are pointing in the direction of flow, as shown in the following figure: Engage one thread of the **sensor cap** then turn the sensor until the alignment tab is seated in the fitting notch. Hand tighten the **sensor cap**. **Do not use** any tools on the **sensor cap** otherwise the **cap** threads and/or the fitting flange threads will be damaged.





5.11 Options: Auto-monitoring on the capacity/efficiency data indicative of the unit





Vertiv™ CoolLoop Trim Cooler can be equipped with the following options:

- **Energy meter** [**E**] which provides the reading of the instantaneous consumption of electricity (including the consumption of the pump main if this is integrated in the machine);
- **Flow meter** [**F**] that provides the flow rate of the chilled water (m/s).

If the refrigerated water **flow meter** [**F**] is present, the control unit is able to process and provide the following data:

- Total capacity (kW);
- Mechanical capacity (kW);
- Free-cooling cooling capacity (kW).

If in addition to the refrigerated water **flow meter** [**F**], the **energy meter** [**E**] is present, the control unit is able to process and provide the following data:

- **EER** (including the main pump consumption if it is integrated in the machine);
- **pPUE** (including the main pump consumption if it is integrated in the machine).

The capacity depends on the instantaneous measured value of the fluid flow, the temperature and the percentage of glycol (to be set on the unit control).

- **EER** is the ratio between the instantaneous value of the reading of the total cooling capacity and the total consumption of electricity (in the same time period);
- **pPUE = [1 + (1 / EER)]**.

All data and data outputs are calculated as instantaneous value and even the site operating conditions cannot guarantee stable measurements, so they can only provide indicative values. These values should not be considered as valid official performance measurements due to the measurement conditions and accuracy levels of instruments (other than measurement conditions and laboratory instruments).

5.12 Options: Pump group



All models of the **Vertiv™ CoolLoop Trim Cooler** series can be equipped with **double factory-connected water circulation pumps**. On each unit it is possible to select the type of pump (low or high head) both in the standard version and with External Variable Frequency Driver. All pumps are dynamically balanced according to ISO 1940 class 6.3. The electronic pump regulation algorithm allows you to modulate the pump speed so as to keep the flow rate constant through the evaporator even when the hydraulic load changes: this allows a significant energy saving, variable according to the applications. In particular in the Freecooling units this beneficial effect occurs especially in the summer season when the Freecooling battery is short-circuited.

The inverter pump can also be regulated according to the "variable flow" logic managed according to particular algorithms determined by plant requirements; the pump and machine safety devices and protections are always guaranteed; for further explanations, read the following paragraph Options: *5.14 Variable Primary Flow* with **Vertiv™ CoolLoop Trim Cooler.**

The pumps are suitable for operation with ethylene glycol-water mixture up to 35/65% by weight and refrigerant fluid temperatures up to 4°C. The pumps are of the monobloc centrifugal type, with two-pole electric motor with IP54 protection, Class F insulation and at least IE3 efficiency class.

Motors with this efficiency class (the highest on the market) not only guarantee greater energy savings compared to pumps with a lower efficiency class, but also allow a quieter operation of the electric motor and allow to reach very high limits use at room temperature (up to 60°C). The pump housings are made of cast iron, as well as the impellers, the stainless-steel shafts and the mechanical seals in **silicon carbide** / **EPDM** (Ethylene Propylene Diene Monomer) with dimensions according to EN12756, suitable for use of water mixtures containing ethylene glycol.

The *hydraulic circuit* of the pump includes a check valve on the delivery of each pump. The pump body, the lantern, the stator body and the fixing bolts are subjected to electrophoretic painting; this allows the use of these pumps in outdoor environments subject to atmospheric agents without any problem of corrosion. Each pump is also equipped with an automatic electrical protection switch.

The **microprocessor controls** [**E**] manage the rotation and stand-by of the pumps and automatically start the pump in stand-by in case of failure of the primary one.

If the **Variable Frequency Driver** [**I**] is replaced, all the parameters must be set; this intervention must be carried out by a Vertiv™ expert technician.

5.13 Options: Hydraulic Kit

Consisting of an expansion tank (preloaded at 1.5 bar, maximum operating pressure 10 bar) and a safety valve calibrated at 6 bar.

Expansion vessel volumes: **12** liters.

It is recommended to always check the total capacity of the expansion tank based on the percentage of glycol in the mixture, the expected maximum temperature variation of the mixture and the total hydraulic volume resulting from the sum of the internal volume of the unit with the volume of the user circuit.

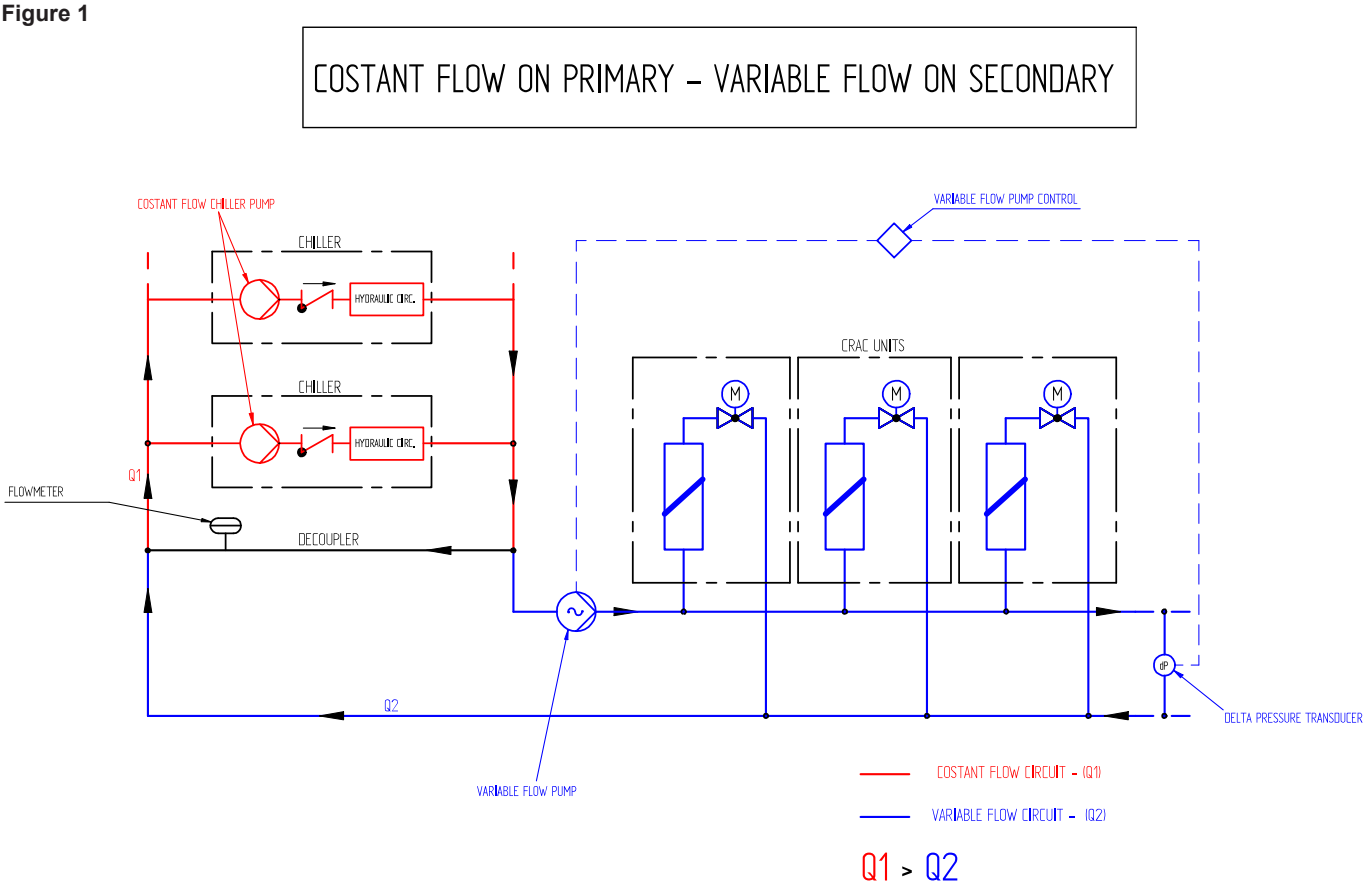
5.14 Variable Primary Flow

5.14.1 General Overview of VPF Hydronic Systems

The **Variable Primary Flow** (**VPF**) hydronic system is an evolution of the concept of the constant primary–variable secondary design, more commonly known as the “decoupled” system.

A comparison of the hydraulic schematics in *Figures 1* below and *2* in the next page, shows the similarities and differences between “decoupled” and **VPF** systems.

Figure 1



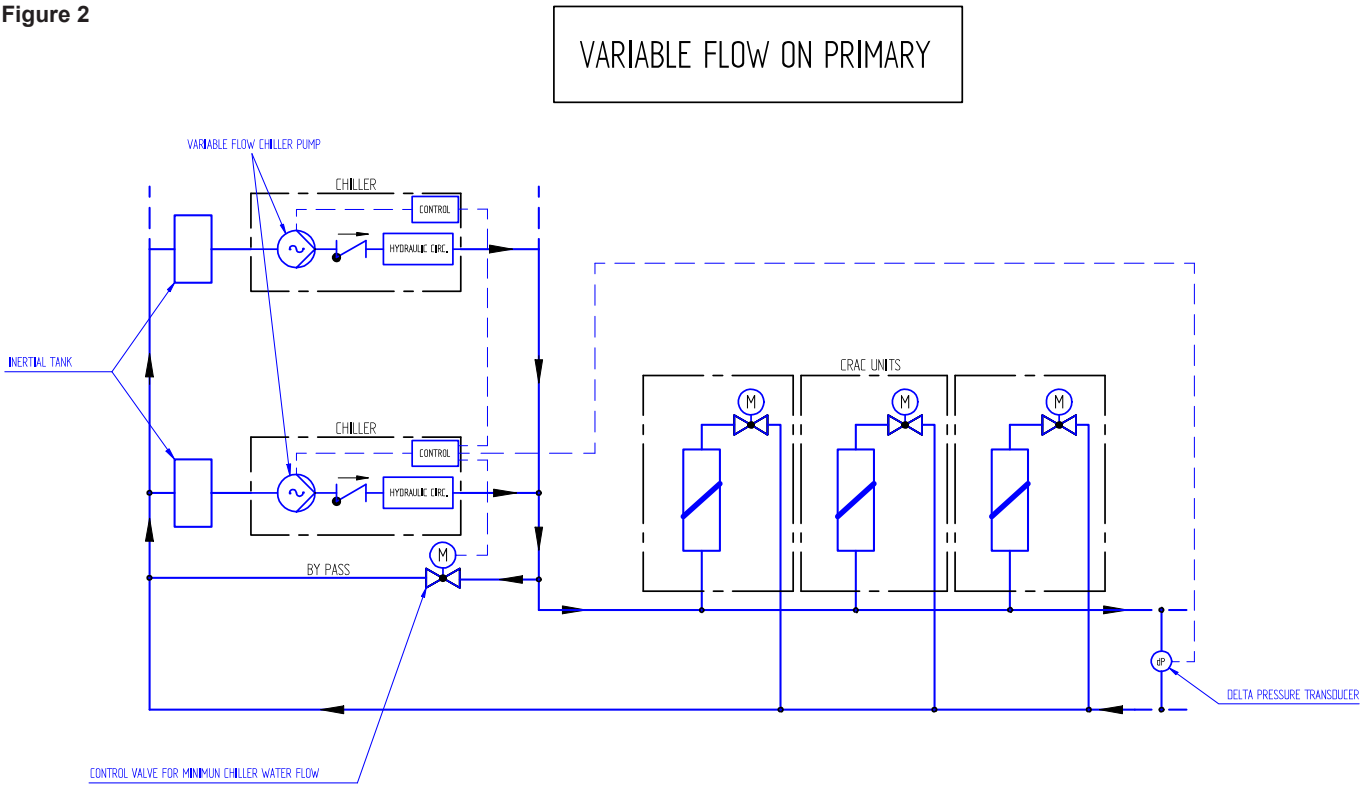
The “decoupled” system shown in *Figure 1* above uses constant water flow through each chiller and variable water flow through each **CRAC** unit to satisfy the data center loads.

This hydronic design requires:

- a constant-speed pump (and check valve) for each chiller;
- two-way control valves embedded in each **CRAC** unit to regulate the amount of chilled water that flows through the cooling coils;
- a variable-flow secondary circuit distribution pump to serve the **CRAC** units coils (usually managed by a drive that read and keep constant **DP** through **CRAC** units);
- a bypass to hydraulically decouple the **primary** (production) and **secondary** (distribution) sides of the system able to manage the water flow of the largest chiller (primary) pump;
- for multi-chiller systems, a **BMS** or a Chiller Sequencer Controller able to maintain Primary Flow higher than the secondary one.

Each **CRAC** unit adjusts the flow of chilled water to satisfy the data center's cooling demand, consequently the secondary circuit distribution pump responds by regulating the amount of chilled water delivered. Specifically, the secondary flow rate is produced to maintain the necessary system pressure differential. As the primary loop's water flow cannot deliver a step-less modulation, water flows through the bypass to balance the system. Primary flow must always meet or exceed the secondary flow. Any excess primary water flows through the decoupler to the return side and back to the chillers. Any time the primary flow is less than the secondary flow, warm return water will flow "backwards" through the decoupler and mix with the primary flow going out to the Data Center. This condition (known as Low **DT** Syndrome) has to be avoided because the chiller load control is based on return temperature of the primary circuit. It means that **DT** on secondary circuit has to be always higher than **DT** on primary or water flow on primary circuit has to be always higher than flow on secondary one.

Figure 2



The **VPF** system in *Figure 2* above, varies water flow throughout the entire system through each operating chiller as well as through the **CRAC** units. The variable flow logic can be implemented also with different hydraulic configurations, with similar logic (for example with variable flow primary pumps external to the chillers, which can be either one pump in series to each chiller, or connected in a single manifold and put in series with the chillers' system).

This hydronic design requires:

- **Two-way control valves** for each **CRAC** unit, to regulate the amount of chilled water that flows through the cooling coils;
- **Variable-flow chiller pumps**, to eliminate the need for a separate secondary distribution pump;
- A **pressure transducer**, able read and keep a constant **Delta Pressure** through the **CRAC** units, by managing the speed of the primary pumps;
- A **bypass** positioned upstream the **CRAC** units, able to manage the minimum water flow admitted by the primary loop (which corresponds to the minimum load admitted by the single chiller);
- A **control valve** in the **bypass** which ensures that the amount of flow that returns to the operating chiller(s) never falls below the minimum limit;
- **Inertial tank** at each chiller water inlet in order to ensure the requested thermal inertia for a proper chiller capacity regulation (the chiller load control is based on return temperature of water loop).

The **Variable Primary Flow** (**VPF**) system is designed to maintain a constant **Delta Pressure (DP)** through the entire water loop (**CRAC** and Chiller); the variation of the flow is followed by the chiller until the min capacity step rather than the minimum flow (in the water loop of the chiller) is reached. If a lower water flow is requested, then a bypass valve opens, to let the excess flow recirculate through the chiller.

On **VPF** system in *Figure 2* there are several cost-saving benefits not only directly related to the pumps.

The most obvious cost savings comes from energy saving at part load where the inverter pumps allow reducing their power consumption more than proportionally to the flow reduction; in addition eliminating the secondary distribution pump and having a single set of pumps enables simplification on design that ensures substantial savings in initial investment costs.

With the same thermal load required, the **VPF** system (operating within the working limits indicated below), increases operation efficiency of both the traditional chiller (better evaporator efficiency) but especially of free cooling units, increasing significantly the **FC** utilization factor during the year, thanks to the higher freecooling inlet fluid temperature at partial load, if compared to a fixed primary flow system.

On the other hand, **VPF** requires more robust (complex and properly calibrated) control system with coordinated control of chillers, pumps and isolation valves (if present). Of course this implies potentially longer commissioning times to tune the system and experienced facility managers to operate/maintain properly.

5.14.2 Options: Variable flow primary with Vertiv™ CoolLoop trim Cooler

A variable water flow involves changes in the functionality of the chiller because the load changes directly proportionally. **Vertiv™ CoolLoop Trim Cooler** units with the variable flow option are designed for this working condition, provided that the variations in the water flow remain within the defined limits of minimum flow, maximum flow and maximum speed of variation of the flow.

The maximum recommended change for the water flow rate is 10% of the current flow rate per minute. This limit is valid if the recommended inertial water volume is present on the hydraulic connection at the inlet to the chiller. Exceeding this limit could adversely affect the control of the **Electronic Expansion Valve** (**EEV**) and the reliability of the compressors.

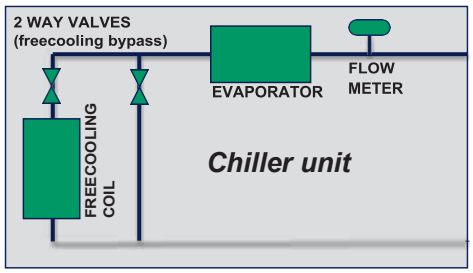
A flow below the minimum values can create a laminar flow through the exchangers causing problems of freezing, fouling, loss of efficiency and poor control. A flow rate higher than the maximum values will lead to unacceptable pressure drops and can cause excessive erosion, which could potentially lead to failure.

In assessing the minimum flow rate for each model, the accuracy required for the **Leaving Water Temperatur**e (**LWT**) by the chiller must be carefully considered according to the quantity and type of compressor regulation.

The unit controller manages the maximum and minimum limit of the flow rate and its fluctuations; if during operation the unit approaches the indicated limits, a warning is generated and then an alarm with a different strategy depending on whether the pump is installed on the unit with inverter or not.

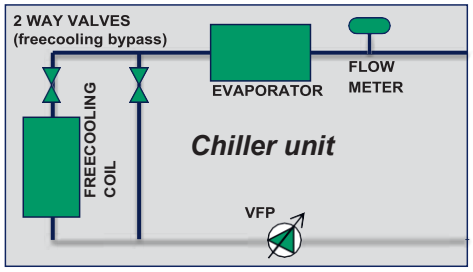
VPF solutions available for Vertiv™ CoolLoop Trim Cooler

Three types of variable flow primary logic are available for **Vertiv™ CoolLoop Trim Cooler**:



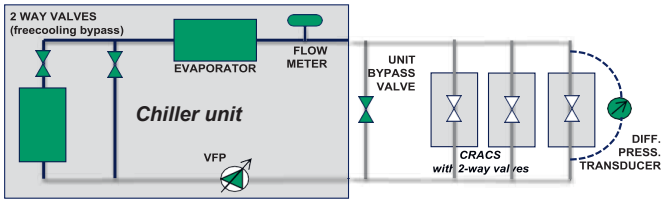
VPF Solution A:

- **Vertiv™ CoolLoop Trim Cooler** without pump;
- A built-in flow meter reads the variable flow rate in entrance;
- The **Vertiv™ CoolLoop Trim Cooler** thermal regulation logic adapts automatically under flow conditions;
- Unit limits (max./min. flow rate, max. variation speed) → if the limits are exceeded, **Vertiv™ CoolLoop Trim Cooler** generates a warning and subsequently an alarm.



VPF Solution B:

- **Vertiv™ CoolLoop Trim Cooler** with pump with inverter (also available with second backup pump);
- **Vertiv™ CoolLoop Trim Cooler** adjusts the primary flow rate based on a request external (**BMS**) with 4-20 mA or 0-10 V signal;
- The **Vertiv™ CoolLoop Trim Cooler** thermal regulation logic adapts automatically under flow conditions;
- Unit limits (max./min. flow rate, max. variation speed) automatically guaranteed.



VPF Solution C:

- **Vertiv™ CoolLoop Trim Cooler** with pump;
- A built-in flow meter reads the variable flow rate in entrance;
- The **Vertiv™ CoolLoop Trim Cooler** thermal regulation logic adapts automatically under flow conditions;
- Unit limits (max./min. flow rate, max. variation speed) → if exceeding the limits, **Vertiv™ CoolLoop Trim Cooler** generates a warning and subsequently an alarm:
- Integrated differential pressure transducer;
- Integrated bypass valve for operation with loads close to zero.

Solution A: unit without pump, designed for operation with **VPF**.
Variable flow regulation is passive: the chiller does not include the primary pump. The chiller adapts its thermal regulation logic to the variable flow of the incoming water (supplied by the external pump) within the application limits indicated in the previous paragraph. This solution is recommended if the pumps with external inverters are supplied by the customer; in this case, attention must be paid to the flow limits and its fluctuations to allow the unit to work without warnings/alarms; this solution can be applied to the **VPF** system and to a hydronic system with primary/secondary water circuit with variable flow also on the primary.
For multichiller applications, a motorized gate valve is required on the connection of the water entering the chiller and a chiller sequencer or a **BMS** capable of managing both the gate valve and the sequence/rotation of the chillers.
It does not require to be electrically powered.

Solution B: unit with pump (or double pump), primary with variable flow controlled by external request (**BMS**).
Variable flow regulation is passive: the chiller regulates the primary flow on the basis of an external request which must be supplied with a 4-20 mA or 0-10 V signal, within the application limits indicated in the previous paragraph. This solution is recommended when the pumps with inverter are managed but not supplied by the customer; in this case, the **BMS** must control the flow limits and its fluctuations in a similar way to **solution A**, but with the additional advantage that the control of the **Vertiv™ CoolLoop Trim Cooler** provides a higher level of safety since it is able to filter the request **BMS** external to avoid flow warnings or alarms. This solution can be applied to the **VPF** system and to a hydronic system with primary/secondary water circuit where with variable flow also on the primary. In both cases, however, it is necessary to have a system with **BMS** that can read the flow rate conditions of the hydronic system and correctly manage the variable flow pump installed on the unit.
For multichiller applications it is not necessary to provide a motorized gate valve for each chiller because the units are each **Vertiv™ CoolLoop Trim Cooler** with this option it is equipped with a check valve on the pump delivery; in any case, the **BMS** must manage not only the flow rate as mentioned above, but also the sequence/rotation of the chillers.
See wiring diagram attached to the machine.
Electrically connect the **BMS** signal to the A10 equipment (configurable optocoupler - see its data sheet included in the documentation attached to the machine) using the terminal block:

- XC2: 1110 + 20V DC;
- XC2: 1111 + 0VDC;
- XC2: 1112 Signal.

Solution C (with additional accessories kit for delta pressure control): unit with pump (or double pump), primary with variable flow controlled by **Vertiv™ CoolLoop Trim Cooler** according to the pressure delta in the circuit. As standard, this solution is only available for systems with a single chiller. The variable primary flow is active and guided by the **Vertiv™ CoolLoop Trim Cooler** to maintain a set pressure delta in the **CRAC** units. It is very important to follow the installation instructions for the unit bypass valve (near the chiller with the shortest bypass tube based on the nominal diameter of the valve) and for the differential pressure transducer on the farthest pipe of the system as indicated on the previous drawing. These components are supplied separately in kits and their hydraulic connection and electrical wiring to the **Vertiv™ CoolLoop Trim Cooler** must be done on site.

The hydraulic balancing valve must be positioned a downstream of the tank, the chiller and the **2-way bypass valves**.

The **2-way bypass valves** (managed by the unit control) ensures that the quantity of flow that returns to the chiller in operation never drops below the minimum limit.

The table below shows the correct correspondence between each model and the relative kit, with the minimum flow values and the general characteristics of the valve/motor.

Kit p/n	Min flow with 30% e.g. [mc/h]	Kv	Bypass 2-way valve	DN valve	Motor valve	Press. Transducer
455545	30 to 50	63	VVF32.65-63	DN65	SKB62	DPI 0-400 kPa
455546	51 to 80	100	VVF32.80-100	DN80	SKB62	DPI 0-400 kPa
455547	81 to 160	160	VVF32.100-160	DN100	SKC62	DPI 0-400 kPa

NOTE: *Motor with spring return IP54, heating element.*

The pressure delta set point in the **CRAC** units is configurable (between min 60 kPa → limit on valve selection and max 400 kPa → limit on pressure transducer reading)

Usually the **delta P** set is equal to or greater than the pressure drop of the **CRAC** unit at full load, to obtain the projected water flow rate at full load throughout the hydraulic circuit and in a single **CRAC** unit.

Vertiv™ CoolLoop Trim Cooler will manage the pump speed so as to keep the **delta P** constant in the water circuit. When the water flow required by the **CRAC** unit is lower than the minimum water flow allowed by the chiller, the **2-way bypass valve** begins to open to continue sending the minimum flow through the chiller and at the same time maintaining the **delta P** required in the water circuit of the **CRAC** unit.

To ensure system stability and avoid fluctuations, it is preferable to have a carefully balanced hydraulic system on the **CRAC** unit side. For this reason it is recommended to mount independent **2-way Pressure Regulating Valves** (**PRIV**) on the **CRAC** units.

See wiring diagram attached to the machine.

Electrically connect the **differential pressure switch** (**DP** water) to the **A10 equipment** (**configurable optocoupler**) using the terminal block:

- XC2: 1110 + 20V DC;
- XC2: 1111 + 0V DC;
- XC2: 1112 Signal.

Electrically connect the **Bypass valve** of the machine (**Ybypass** - see its data sheet included in the documentation attached to the machine) to the **A12 equipment** (**configurable optocoupler** - see its data sheet included in the documentation attached to the machine) install **A10 equipment** using the terminal block:

- XC2: 1115 GND signal;
- XC2: 1116 signal + 0V DC;
- XC2: 1117 0V AC supply;
- XC2: 1118 + 24V AC supply.

Adjust the machine **Bypass valve** (**Ybypass**) as explained in the wiring diagram.
Install and electrically connect the heating unit **Bypass valve** (**Ybypass Heating** - see its data sheet included in the documentation attached to the machine) using the terminal block:

- XC2: 1117 0V AC supply;
- XC2: 1118 + 24V AC supply.

5.15 Compressors motor power factor correction with capacitors (option)



Caution: Discharge and short circuit capacitor before handling!

This option is not available for:

1. a compressor with inverter;
2. active harmonic filters;
3. flammable refrigerant (like **A2L R1234ze**).

Enhancing power quality – improvement of power factor – saves costs and ensures a fast return on investment. In power distribution networks, **PFC** focuses on the power flow (**cos ϕ**) and the optimization of voltage stability by generating reactive power – to improve voltage quality and reliability at distribution level.

PhaseCap capacitors in cylindrical aluminum cases have been designed for power factor correction in low-voltage applications. Dielectric is made of propylene film.

Safety:

- Self-healing;
- Overpressure disconnector;
- Shock hazard protected terminals;
- Discharge resistor pre-mounted;
- IP54 with terminal CAP;
- -40D execution with -40°/+55°C min/max working air temperature.

Capacitors are activated when the compressors are operating; their contactors are selected for this particular use in combination with discharge throttle.

A relay normally open has to be managed by customer in order to enable their operation, so it's necessary to read carefully the following notes before enabling their full functionality.

It's recommended to disable capacitors:

- After power **OFF** and before switching the power from the main line to the genset power line;
- When there is low power input quality like:
  - Transient over under voltage;
  - Transient over current;
  - Interaction with other reactive power components, and also parasitic capacitances (cable) or inductivities in common circuits;
  - Network harmonics, resonances created by harmonics or flicker even when they occur only briefly or cyclically;
  - Network harmonics are normally produced in the operation of electric loads with a non linear voltage/current characteristic as rectifiers and inverters for drives, welding apparatus and uninterruptible power supplies.



CAUTION: Harmonics and relevant resonance **may cause very high overcurrents** which can lead to capacitor failures, and **worst case, to explosion and fire**.

5.16 Option ATS

ATS system is available as option, use an external **ATS** system only after consulting **Vertiv™ AE**.

5.17 Accessories

The customer is responsible for the installation of the accessories, which are provided separately.

5.17.1 Anti-vibration support

The **anti-vibration supports** have the function of isolating the structure, on which the chiller is placed, from the vibrations created by the chiller itself.



NOTICE

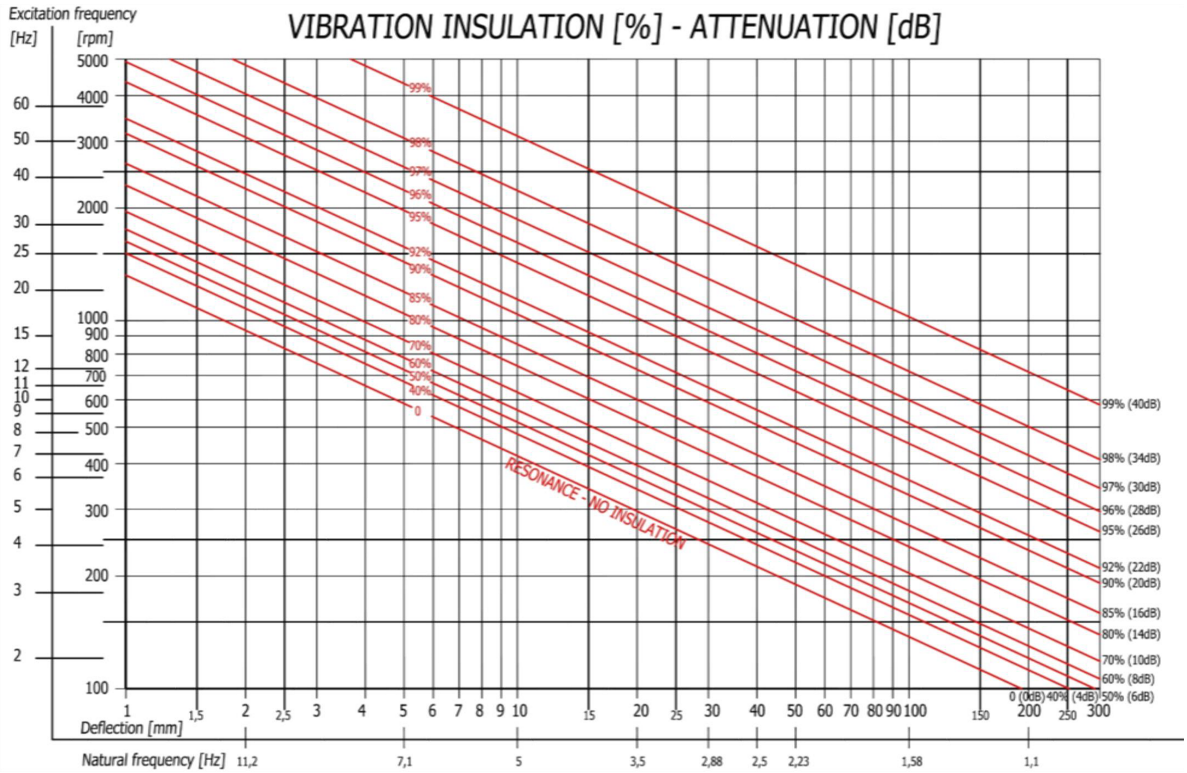
For more complete information, please refer to the dedicated manual (code *10041956MAN_ENG*) provided with the anti-vibration supports kit.

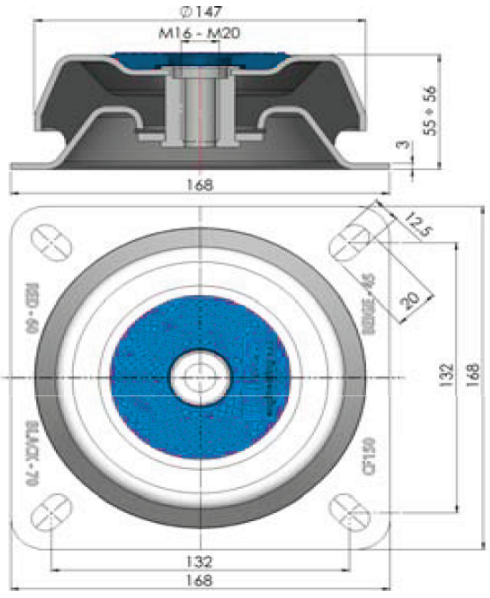
They can be of the **rubber** or **spring type**, sized and selected on the basis of the expected level of insulation calculated starting from their elastic characteristics and the weight supported by each of them.

There are therefore various kits of vibration dampers combined with each chiller, identifiable in a dedicated manual which also illustrates the procedures for their correct installation.

Unit	14 - 16 fans	8 stands
	20 fans	10 stands
	24 fans	12 stands

The **rubber antivibration mount**s are able to isolate vibrations with an efficiency of about 70-80% for forces of 20 Hz (1200 RPM).
The **spring antivibration mounts** are able to isolate vibrations with an efficiency of about 90% for forces of 14 Hz (850 RPM).







Elastic body: Natural rubber.

Operating temperatures: -20°C +90°C

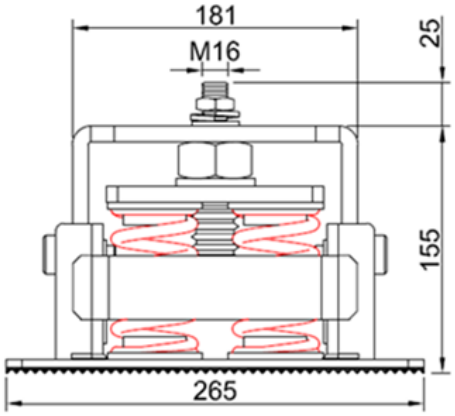
Metal body: Zinc UNI ISO 2081Fe/Zn 15c Awhite Steel UNI EN 10111 DD13

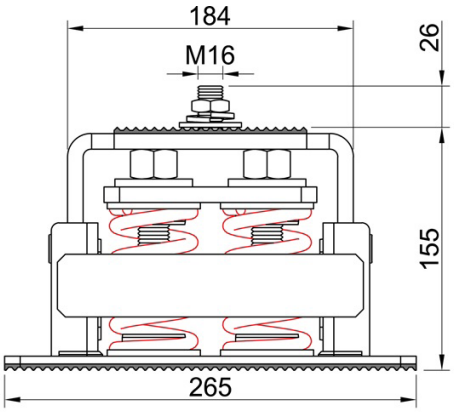
Upper pad: Thermoplastic elastomer **TPV 80shA**, coloured depending on the hardness of the inner elastic body:

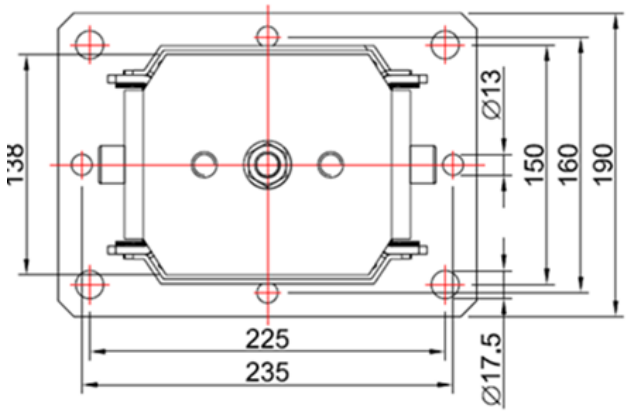
- 45shA **Beige**
- 70shA **Black**
- 60shA **Red**
- 80shA **Blue**

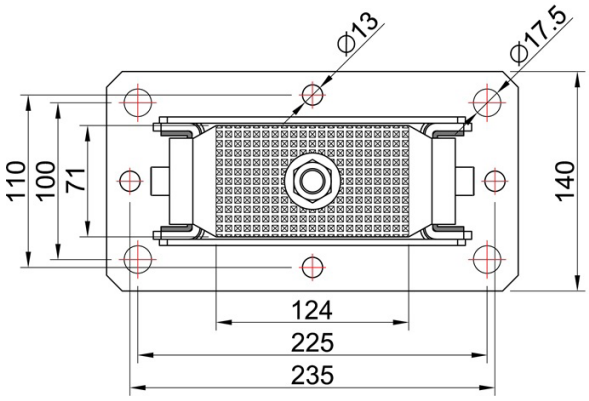
Each kit is complete with stainless steel fixing screws and plain washers for unit assembly.
Following in the next page the dimensional and mechanical characteristics of said anti-vibration mounts.

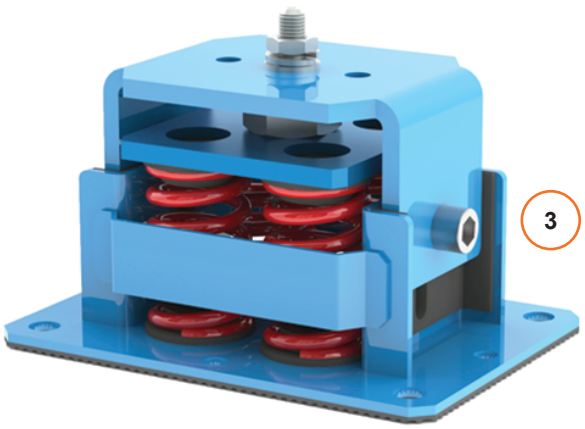
Antivibration mounth with antiseismic structure

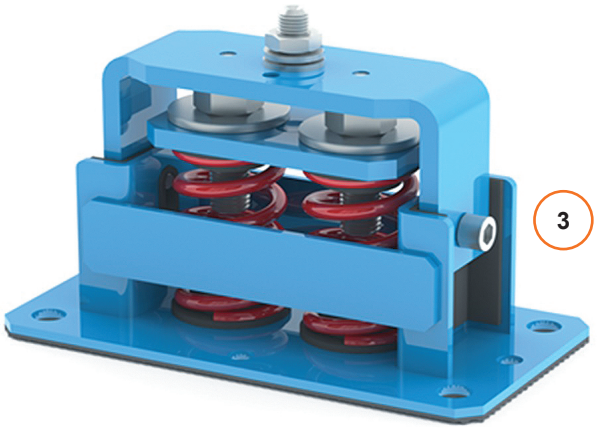


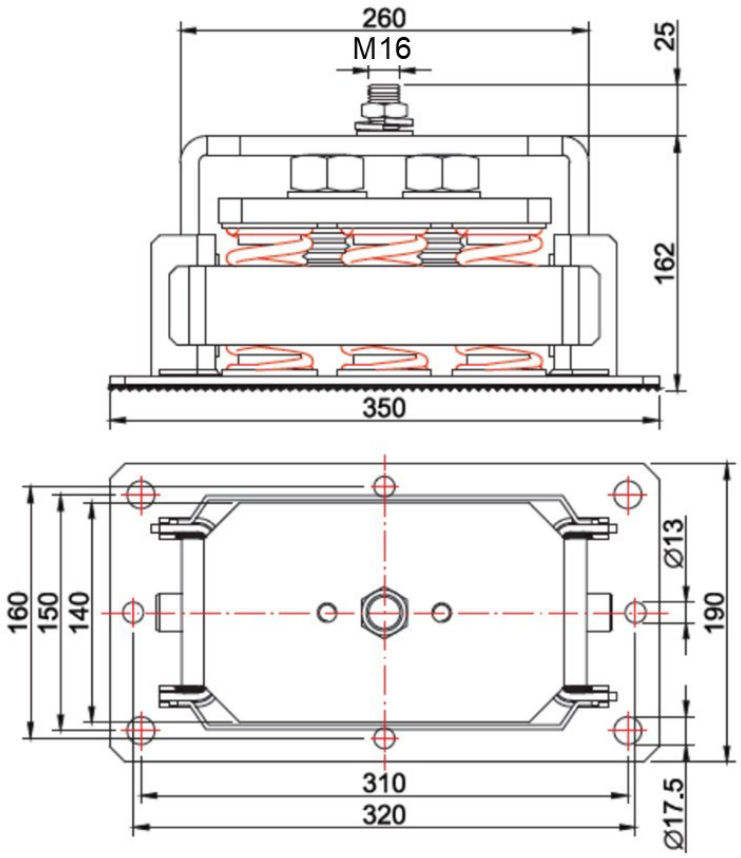




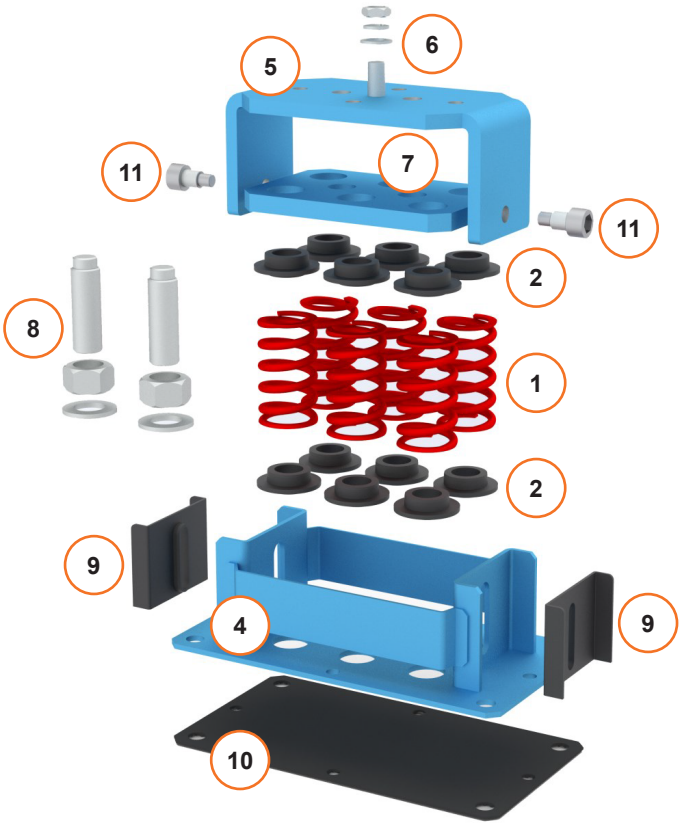








1. **Spring** in harmonic steel UNI EN 10270 1 SH with surface protected by cataphoretic treatment;
2. **Nr. 12/6 nylon disks** lock the spring to the structure and prevent the metal contact;
3. **Container structure:** base & upper plates made with S235JR UNI EN 10025 steel sandblasted, protected by cataphoretic treatment and epoxy powder coated:
    4. **Base plate** with holes for the anchorage to the floor, welded special profile guides to consent upper plate sliding and barriers to prevent the escape of the spring;
    5. **Upper plate** in folded plate 10 mm. thick with **Nr. 2** lateral **M16 holes**;
6. **Fixation to the unit** by Central **M16 threaded rod** in stainless steel AISI304;
7. **Intermediate plate** in sandblasted steel, protected by cataphoretic treatment and coated with epoxy powder;
8. **Rod and nut M30 / M20** positioned under the upper plate, to control the level of the machine;
9. **Nr. 2 elastomer guide profiles** inside the steel guide, to prevent the metal contact and assure insulation continuity even with transversal thrusts;
10. **Neoprene pad** placed under the base plate with deformable reliefs surface permits to the loaded antivibration mount to stand for friction;
11. **Nr. 2 lateral M16/M12 screws** to block the lid to the base and prevent spring displacement.



6. Technical Data and Performances

6.1 Refrigerating System

Table 1 – Refrigerating System – models

	Nominal refrigerant charge [kg]			Nominal oil charge [kg]		
Models	**Circuit 1**	**Circuit 2**	**Circuit 3**	**Circuit 1**	**Circuit 2**	**Circuit 3**
090 HG0	63	55	-	29	18	-
140 HG0	79	68	-	29	29	-
170 HG0	70	71	70	29	29	29
230 HG0	83	73	71	29	29	29

Depending on the operating conditions and compressor model, adjustments to both the charge and oil level may be necessary during commissioning. The chiller leaves the factory after a test run with the critical refrigerant charge for the nominal operating point with water 38/28 and air 42°C, but for operating conditions with warmer water a higher refrigerant charge and lower oil charge will be required. A higher refrigerant charge because it will be at higher pressure, a lower oil charge because the miscibility causes excessive oil carry over, reducing heat transfer efficiency.

HFO refrigerants and **BSE170** oil polyester are related, and an adjustment of the refrigerant charge level also implies an adjustment of the oil charge.

Contact Vertiv™ service for more information on such commissioning activities.

6.2 Water System

Flow conditions

The permitted water flow rate is indicated in the *6.3 Operating limits*. Higher flow values can cause erosion and vibrations inside the tube bundle heat exchanger.

The minimum allowed water flow corresponds to a maximum thermal variation of about 8°C for **S** (**Standard delta T**) version, about 12°C for **H** (**High delta T**) version. More severe operating conditions can cause the action of the safety devices that block the unit. The maximum return water temperature with a fully loaded unit is 32°C; higher return temperatures are allowed only at start-up.

Glycol limits

The maximum percentage of glycol allowed is 50% (35% with pump groups). The minimum percentage of glycol required depends on the minimum ambient air temperature conditions relating to the installation site.

Hydraulic pressure limits

The maximum hydraulic operating pressure is 10 barg: consider that this limit does not depend on the presence/absence of pumps mounted on the unit, therefore it is necessary to check the maximum static head of the pump (indicated on the pump plate) and that the circuit water is never pressurized to more than 10 barg maximum static head of the pump.

NOTE: *The safety valve is set to 6 barg, optional.*

Note 1 *Higher flow rate may cause corrosion and vibrations of shells and tubes.*

Note 2 *If the water flow rate is too low, then safety devices lock the unit because the heat exchange is too low. Make sure that the water flow rate is compatible with the values given in Table 2 and Table 3.*

Note 3 *These limits apply to new machines, subject to correct installation and maintenance.*

Note 4 *The maximum allowed water return temperature, when the unit is in full operation, is:*

- *32°C for all models.*

Higher return temperatures are allowed only during start-up.

Table 2 – Water System

Model Version	Min fluid flow [m³/h]	Max fluid flow [m³/h]
090 HG0	48.5	204.7
140 HG0	60.1	254
170 HG0	104.77	266.7
230 HG0	140.15	300

Table 3 – Internal Hydraulic volume

Models	LVZ 090	LVZ 140	LVZ 170	LVZ 230
Internal hydraulic volume (Freecooling versions with finned tube coils - Digit 13 = D)				
User side (dm³)	1669	1805	1885	2109

Models	LVZ 090	LVZ 140	LVZ 170	LVZ 230
Internal hydraulic volume (Freecooling versions with microchannel coils - Digit 13 = A)				
User side (dm³)	1543	1805	1705	1900

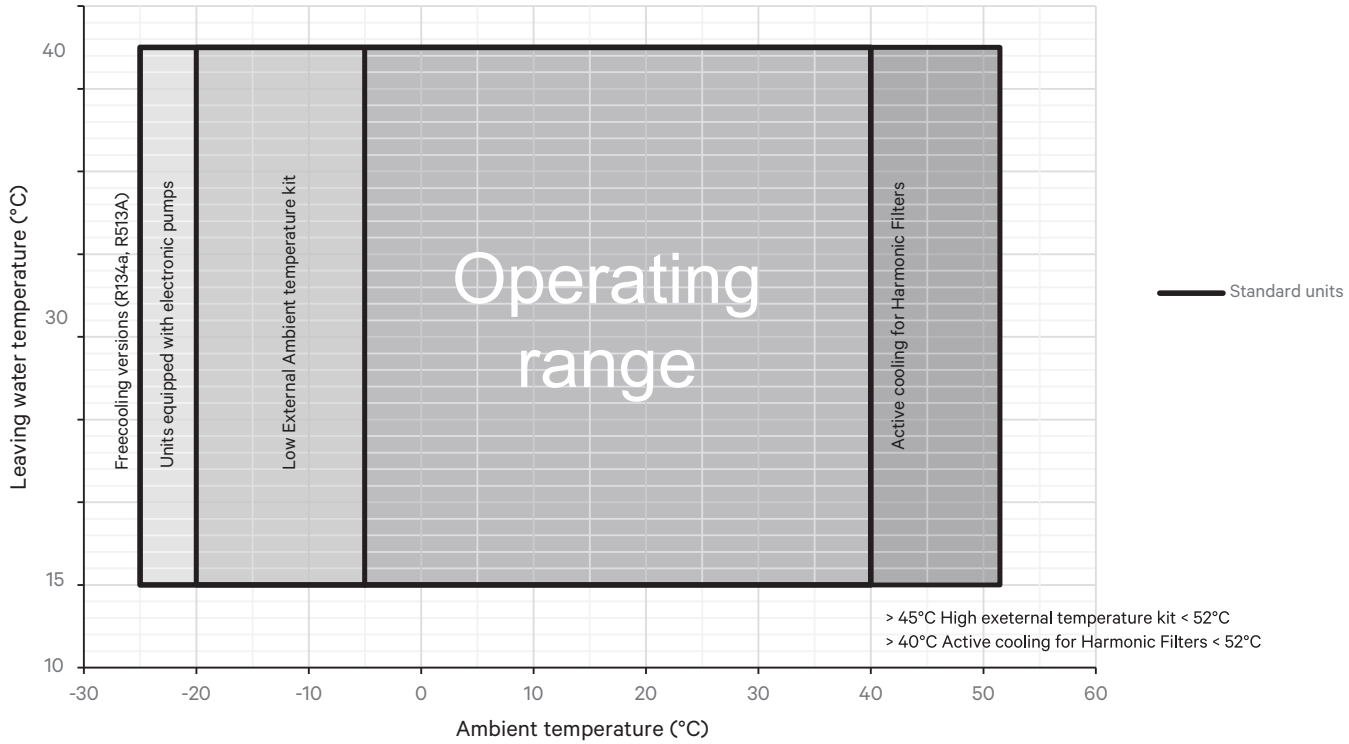
6.3 Operating Limits

Table 4 – Models: LVZ***HG0E

Models: LVZ***HG0E		090 HG0	140 HG0	170 HG0	230 HG0
Operating range					
Maximum air inlet temperature	°C	52			
Minimum air inlet temperature	°C	-20			
Maximum leaving water temperature	°C	40			
Minimum leaving water temperature	°C	15			
Minimum fluid flow	m³/h	48.5	60.1	104.77	140.15
Maximum fluid flow	m³/h	204.7	254	266.7	300

Models: LVZ***HG0E		090 HG0	140 HG0	170 HG0	230 HG0
Safety devices settings					
High pressure switch set	barg	20			
Numb of HP safety valve (each circuit)	barg	1	2		
High pressure safety valve connection	#	1 1/4" G			
Low pressure switch	inch	0,5			
Low pressure safety valve set	barg	14			
Numb of LP safety valve (each circuit)	barg	1			
Low pressure safety valve connection	#	3/4" G			

The following graph is a generic indication of the operating limits of the **Vertiv™ CoolLoop Trim Cooler** range:



NOTICE

The maximum ambient temperature for all **Vertiv™ CoolLoop Trim Cooler** units is 45°C. To extend the operating range above this threshold please contact **Vertiv™** or its representative: the unit in that case may require some design changes (tropicalized version).

NOTICE

Some configurable options like **Low Noise**, **Quiet** or **Adiabatic** versions may affect the extended limits of **Vertiv™ CoolLoop Trim Cooler** units. Please contact **Vertiv™** or its representative for detailed information.

Refer to the following tables for the extended ambient limits related to the specific **Vertiv™ CoolLoop Trim Cooler** models, in tropicalized version. This must be intended as an ultimate physical limit referring to rejection capacity of the condenser at the **HP** switch threshold, not considering intermediate protection functions normally active in the standard **Vertiv™** controller.

NOTICE

Due to environmental guidelines, thus to reduce as much as possible the refrigerant charge of the circuits, the **Vertiv™ CoolLoop Trim Cooler** chiller have a "critical refrigerant charge". It means that the charge is not exceeding the amount that optimizes the performance of the unit in nominal **DX** operative conditions. The refrigerant charge is specific for operation in a boundary around the nominal water outlet temperature. The extremely wide water outlet temperature range of this chiller (from 15°C to 40°C) doesn't mean it can work with optimal performances in all the range without an update of the refrigerant charge. For an efficient operation at different water outlet temperature it is needed a modification of the refrigerant charge by **Vertiv™** service personnel.

6.4 Electrical System

Table 5 – Electrical Data - LVZ*HG0 Models**

Models LVZ***HG0		90	140	170	230
Power supply	V/Ph/Hz	400V / 3Ph + PE / 50Hz			
Operating (1)					
Total power input (2)	kW	287	411	540	729
OA (without PFC) (2)	A	470	655	875	1164
Rated power					
MOC	A	917	1247	1600	1871
Max. power input	kW	581	743	1016	1115
FLA	A	695	911	1170	1442
LRA	A	695	911	1170	1442
Max. fuse (gG/aM)	A	1250gG/1250aM	1250gG/1250aM	1600gG/1600aM	1600gG/1600aM
Ring terminals with hole/Line screw fixing	mm/Nm	M12 / 50-75Nm	M12 / 50-75Nm	M12 / 40Nm	M12 / 40Nm
Control					
Control power supply (only for option Fast-Start)	V/Ph/Hz	230V / 1Ph + N + PE / 50Hz			
Pmax	kW	0.59	0.59	0.59	0.59
Imax	A	2.30	2.30	2.30	2.30
LRA	A	7	7	7	7
Cable section min./max.	mm²	1,5/35	1,5/35	1,5/35	1,5/35
Max. fuse (gG/aM)	A	40	40	40	40
Line screw fixing	Nm	2	2	2	2
Compressors					
Power input	kW	237	347	460	632
Nominal current	A	393	556	751	1015
Single compressor 1 - FLA	A	317	402	317	427
Single compressor 1 - MOC	A	448	570	448	570
Single compressor 1 - LRA - Method starting	A	317 - Inv.	402 - Inv.	317 - Inv.	427 - Inv.
Single compressor 2 - FLA	A	284	402	317	427
Single compressor 2 - MOC	A	375	570	448	570
Single compressor 2 - LRA - Method starting	A	284 - Inv.	402 - Inv.	317 - Inv.	427 - Inv.
Single compressor 3 - FLA	A	-	-	402	427
Single compressor 3 - MOC	A	-	-	570	570
Single compressor 3 - LRA - Method starting	A	-	-	402 - Inv.	427 - Inv.
Fans					
Fans number	-	14	16	20	24
Power input (2)	kW	50.8	64.7	80.8	97.0
Nominal current (2)	A	77.4	99.0	123.8	148.6
Max. Current (2)	A	77.4	99.0	123.8	148.6
Pumps					
Std. head pump model	-	65-160/177	80-200/188	100-200/181	100-200/192
Nominal power	kW	18.5	30.0	37.0	45.0
Motor power	kW	20.0	32.0	40.0	49.0
Max. current	A	31.5	53.0	65.0	78.0
LRA	A	221	371	455	546

Models LVZ***HG0		90	140	170	230
Inverter pump model	-				
Nominal power	kW	18.5	30.0	37.0	45.0
Motor power	kW	20.0	32.0	40.0	49.0
Max. current	A	31.5	53.0	65.0	78.0

(1) At nominal conditions: 30% ethylene glycol inlet/outet temperatures 26°/20°C, outdoor air temperature 35°C;
(2) Base EC fans versions.

OA, FLA, LRA are calculated for unit without pumps.

If the unit with EC-FAN or inverter pump is connected to an electric installation where an earthleakage circuit breaker (ELCB) is used as additional protection, the circuit breaker must be of a type marked with the following symbols (This circuit breaker is type B.):

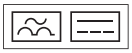


Table 6 – SPL - LVZ with Base (C) EC Fans (FN091) - Finned tube FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"SPL" Sound pressure level @1m [dB]								
090	82,1	78,1	81,3	80,5	78,3	71,9	66,5	62,1	**82,3**
140	82,6	78,6	81,8	81,0	78,8	72,4	67,0	62,6	**82,8**
170	82,9	78,9	82,1	81,3	79,1	72,7	67,3	62,9	**83,1**
230	83,4	79,4	82,6	81,8	79,6	73,2	67,8	63,4	**83,6**

Table 7 – PWL - LVZ with Base (C) EC Fans (FN091) - Finned tube FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"PWL" Sound power level [dB]								
090	104,4	100,4	103,6	102,8	100,6	94,2	88,8	84,4	**104,6**
140	105,3	101,3	104,5	103,7	101,5	95,1	89,7	85,3	**105,5**
170	106,2	102,2	105,4	104,6	102,4	96,0	90,6	86,2	**106,4**
230	107,4	103,4	106,6	105,8	103,6	97,2	91,8	87,4	**107,6**

Table 8 – SPL - LVZ with Base (C) EC Fans (SG096.GL) - Microchannel FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"SPL" Sound pressure level @1m [dB]								
090	77,8	73,8	77,0	76,2	74,0	67,6	62,2	57,8	**78,0**
140	78,7	74,7	77,9	77,1	74,9	68,5	63,1	58,7	**78,9**
170	79,0	75,0	78,2	77,4	75,2	68,8	63,4	59,0	**79,2**
230	79,9	75,9	79,1	78,3	76,1	69,7	64,3	59,9	**80,1**

Table 9 – PWL - LVZ with Base (C) EC Fans (SG096.GL) - Microchannel FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"PWL" Sound power level [dB]								
090	100,2	96,2	99,4	98,6	96,4	90,0	84,6	80,2	**100,4**
140	101,5	97,5	100,7	99,9	97,7	91,3	85,9	81,5	**101,7**
170	102,4	98,4	101,6	100,8	98,6	92,2	86,8	82,4	**102,6**
230	103,9	99,9	103,1	102,3	100,1	93,7	88,3	83,9	**104,1**

Table 10 – SPL - LVZ with Premium (E) EC Fans (S3G910) - Finned tube FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"SPL" Sound pressure level @1m [dB]								
090	79,1	75,1	78,3	77,5	75,3	68,9	63,5	59,1	**79,3**
140	79,9	75,9	79,1	78,3	76,1	69,7	64,3	59,9	**80,1**
170	80,2	76,2	79,4	78,6	76,4	70,0	64,6	60,2	**80,4**
230	81,1	77,1	80,3	79,5	77,3	70,9	65,5	61,1	**81,3**

Table 11 – PWL - LVZ with Premium (E) EC Fans (S3G910) - Finned tube FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"PWL" Sound power level [dB]								
090	101,6	97,6	100,8	100,0	97,8	91,4	86,0	81,6	**101,8**
140	102,7	98,7	101,9	101,1	98,9	92,5	87,1	82,7	**102,9**
170	103,7	99,7	102,9	102,1	99,9	93,5	88,1	83,7	**103,9**
230	105,1	101,1	104,3	103,5	101,3	94,9	89,5	85,1	**105,3**

Table 12 – SPL - LVZ with Premium (E) EC Fans (SG096.GQ) - Microchannel FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"SPL" Sound pressure level @1m [dB]								
090	80,4	76,4	79,6	78,8	76,6	70,2	64,8	60,4	**80,6**
140	81,8	77,8	81,0	80,2	78,0	71,6	66,2	61,8	**82,0**
170	82,1	78,1	81,3	80,5	78,3	71,9	66,5	62,1	**82,3**
230	82,7	78,7	81,9	81,1	78,9	72,5	67,1	62,7	**82,9**

Table 13 – PWL - LVZ with Premium (E) EC Fans (SG096.GQ) - Microchannel FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"PWL" Sound power level [dB]								
090	102,8	98,8	102,0	101,2	99,0	92,6	87,2	82,8	**103,0**
140	104,6	100,6	103,8	103,0	100,8	94,4	89,0	84,6	**104,8**
170	105,6	101,6	104,8	104,0	101,8	95,4	90,0	85,6	**105,8**
230	106,7	102,7	105,9	105,1	102,9	96,5	91,1	86,7	**106,9**

Table 14 – SPL - LVZ with Low noise (L) EC Fans (S3G800) - Finned tube FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"SPL" Sound pressure level @1m [dB]								
090	71,5	70,6	71,9	73,2	73,0	63,4	59,0	53,3	**75,6**
140	73,8	72,9	74,2	75,5	75,3	65,7	61,3	55,6	**77,9**
170	73,9	73,0	74,3	75,6	75,4	65,8	61,4	55,7	**78,0**
230	75,2	74,3	75,6	76,9	76,7	67,1	62,7	57,0	**79,3**

Table 15 – PWL - LVZ with Low noise (L) EC Fans (S3G800) - Finned tube FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"PWL" Sound power level [dB]								
090	93,9	93,0	94,3	95,6	95,4	85,8	81,4	75,7	**98,0**
140	96,6	95,7	97,0	98,3	98,1	88,5	84,1	78,4	**100,7**
170	97,4	96,5	97,8	99,1	98,9	89,3	84,9	79,2	**101,5**
230	99,2	98,3	99,6	100,9	100,7	91,1	86,7	81,0	**103,3**

Table 16 – SPL - LVZ with Low noise (L) EC Fans (SG096) - Microchannel FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"SPL" Sound pressure level @1m [dB]								
090	71,7	70,8	72,1	73,4	73,2	63,6	59,2	53,5	**75.8**
140	73,8	72,9	74,2	75,5	75,3	65,7	61,3	55,6	**77.9**
170	74,0	73,1	74,4	75,7	75,5	65,9	61,5	55,8	**78.1**
230	75,8	74,9	76,2	77,5	77,3	67,7	63,3	57,6	**79.9**

Table 17 – PWL - LVZ with Low noise (L) EC Fans (SG096) - Microchannel FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"PWL" Sound power level [dB]								
090	94,1	93,2	94,5	95,8	95,6	86,0	81,6	75,9	**98.2**
140	96,6	95,7	97,0	98,3	98,1	88,5	84,1	78,4	**100.7**
170	97,4	96,5	97,8	99,1	98,9	89,3	84,9	79,2	**101.5**
230	99,8	98,9	100,2	101,5	101,3	91,7	87,3	81,6	**103.9**

Table 18 – SPL - LVZ with Quiet (Q) EC Fans (S3G800) - Finned tube FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"SPL" Sound pressure level @1m [dB]								
090	68,1	67,2	68,5	69,8	69,6	60,0	55,6	49,9	**72,2**
140	70,8	69,9	71,2	72,5	72,3	62,7	58,3	52,6	**74,9**
170	71,0	70,1	71,4	72,7	72,5	62,9	58,5	52,8	**75,1**
230	72,0	71,1	72,4	73,7	73,5	63,9	59,5	53,8	**76,1**

Table 19 – SPL - LVZ with Quiet (Q) EC Fans (S3G800) - Finned tube FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"PWL" Sound power level [dB]								
090	90,5	89,6	90,9	92,2	92,0	82,4	78,0	72,3	**94,6**
140	93,6	92,7	94,0	95,3	95,1	85,5	81,1	75,4	**97,7**
170	94,4	93,5	94,8	96,1	95,9	86,3	81,9	76,2	**98,5**
230	96,0	95,1	96,4	97,7	97,5	87,9	83,5	77,8	**100,1**

Table 20 – SPL - LVZ with Quiet (Q) EC Fans (SG096) - Microchannel FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"SPL" Sound pressure level @1m [dB]								
090	68,3	67,4	68,7	70,0	69,8	60,2	55,8	50,1	**72.4**
140	70,3	69,4	70,7	72,0	71,8	62,2	57,8	52,1	**74.4**
170	70,5	69,6	70,9	72,2	72,0	62,4	58,0	52,3	**74.6**
230	72,2	71,3	72,6	73,9	73,7	64,1	59,7	54,0	**76.3**

Table 21 – SPL - LVZ with Quiet (Q) EC Fans (SG096) - Microchannel FC coils -

Model	Octave Band Frequency [Hz]								Total [dBA]
	63	125	250	500	1000	2000	4000	8000	
LVZ	"PWL" Sound power level [dB]								
090	90,7	89,8	91,1	92,4	92,2	82,6	78,2	72,5	**94.8**
140	93,1	92,2	93,5	94,8	94,6	85,0	80,6	74,9	**97.2**
170	93,9	93,0	94,3	95,6	95,4	85,8	81,4	75,7	**98.0**
230	96,2	95,3	96,6	97,9	97,7	88,1	83,7	78,0	**100.3**

6.5 User pump/s options

Table 22 – (2 Poles) Standard head pressure Pump Option Standard ΔT *

Models	LVZ*** HG0E	090 HG0	140 HG0	170 HG0	230 HG0
Pump model	-	65-160/177	80-200/188	100-200/181	100-200/192
Nominal motor power	kW	18.5	30	37	45
Sound power level	dB(A)	78.5	84	78.5	84
Additional unit weight (single pump option)	kg	343	569	597	696

* data referred to each pump under nominal design conditions

7. Handling

7.1 Safety Instructions



WARNING

Improper handling can cause injury or death.
Only authorized personnel is allowed to move, lift, remove packaging from or prepare the unit for installation.
The authorized personnel must be properly trained and qualified, wear appropriate personal protective equipment and use adequate moving equipment (cranes, forklift, etc.).



WARNING

Make sure to use transport and lifting equipment rated for the unit dimensions and weight.
See *Annex I - Weights and Dimensions*.



WARNING

Never walk or stay below a suspended load.



CAUTION

Sharp edges, splinters and exposed fasteners.
Wear protective gloves before operating on the unit.



NOTICE

Improper handling can cause product damage.



WARNING

The free-cooling batteries are supplied dry or charged with the right % of glycol to avoid possible problems due to frost during the storage period.

7.2 Inspection

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

Unpacking: dispose of the packaging products by transferring them to specialized collection or recycling centers (follow the local regulations in force).

Warnings for A2L Gas Supplied Units

In the case of closed trucks, the compartment containing the unit must be opened without possible ignition sources nearby and ensuring adequate subsequent ventilation before any further operation.

Upon receipt of the unit, a leak detector with a sensitivity of not less than **3** gr./year must be used to check the most critical areas of the refrigeration circuit that may have suffered damage during transport or handling (in particular the area inside the compressor box): this operation must be done in a well-ventilated environment and free from potential sources of ignition.

Special boxes for marine transport have dedicated indications for unpacking and disposal; when unpacking there is a residual risk of releasing a flammable air mixture: this operation must be done in a well-ventilated environment and free from potential sources of ignition.

7.3 Storage

You may keep the unit with the following ambient conditions:

Item	Requirement
Storage environment	Outdoor environment.
Ambient temperature	0°C ÷ +45°C, ask your Vertiv™ representative for T <0°C. **NOTE:** *The ambient temperature must not go below -20°C, because in this condition **R1234ze** pressure is below the ambient ones.*
Ambient humidity	< 80% not condensing; all electronic devices inside **EP** are protected with desiccant bags.
Storage time	The total storage time should not exceed one month; for storage with high R.H. ambient or near sea storage time should not exceed **2** weeks. If the storage time is longer than what indicated above: - Replace desiccant bags **each month** for humid climate or with temperature cycling (which causes condensation), each **3 months** in temperate dry climates; - Check the functionality of sensors and other electronic devices; - Remove by appropriate washing any dirt particles which could trigger corrosion on air heat exchangers; - Check every **three months** if the hydraulic circuit is completely saturated with nitrogen (which avoids the presence of oxygen and therefore corrosion) if necessary repeat the flushing. These steps must be respected before putting in operation the unit.

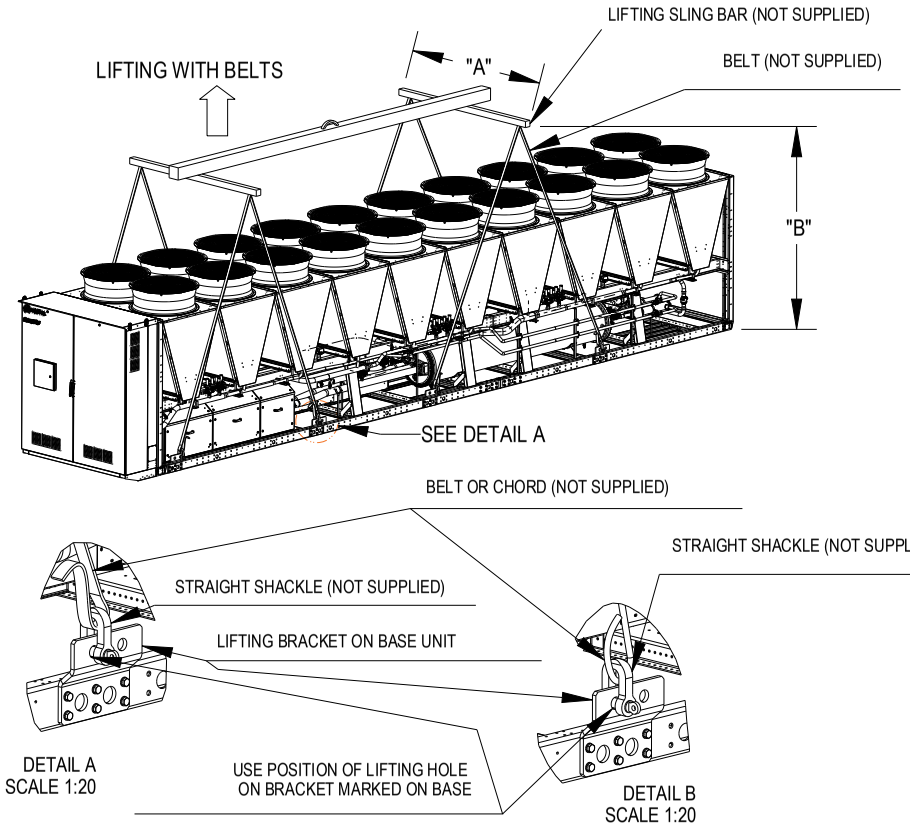
It is highly recommend to protect the microchannel coils from rain during storage period.

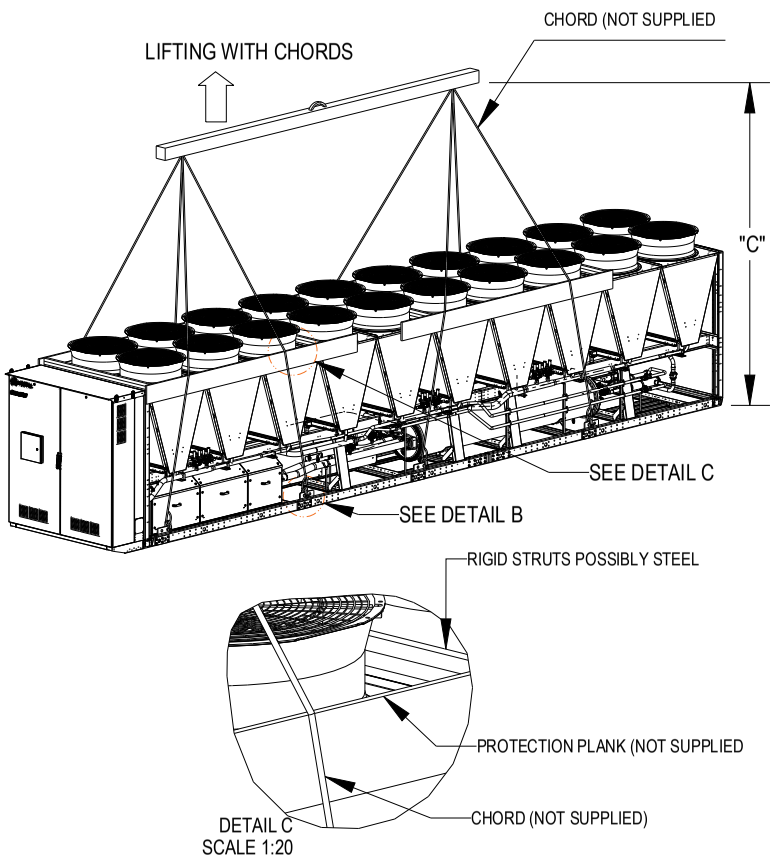
Warnings for units equipped with A2L gas

STORAGE

- Storage must only take place outdoors and away from any opening or downward compartment (for a list of examples see *8. Installation*) and from electrical or mechanical devices (such as forklifts, trucks, etc.) that can generate ignition sources;
- It is absolutely forbidden to exceed the indicated thermal limits - both maximum and minimum - to avoid any leakage from the safety valves and to avoid depression inside the refrigeration circuit that could cause oxygen to enter;
- If it is impossible to observe these requirements, it is mandatory to remove the gas contained in the unit by a qualified technician; contact Vertiv™ or its representative.

LIFTING INSTRUCTIONS WITH 8 BRACKETS (14-16-20-24 FANS)





The capacity of the lifting gear must be adequate to lift the load in question.
Check the weight of the units, the capacity of the lifting gear and ropes and the condition and suitabilit of the aforementioned equipment.
Lift the unit with a speed suitable for the load to be moved, so as not to damage the structure unit.
After lifting and positioning the unit, remove lifting accessories (ropes, slings, chains, hooks, brackets).
Lifting tools as hooks, lifting gear, ropes, chords, belts, rigid struts, protection plank are not provided with the unit.

Models (* = 4 x R134a, 3 x R513A)	Fans n.	A (mm)	B (mm)	C (mm)
LVZ090	14	~2800	~5000	~10000
LVZ140	16	~2800	~5000	~10000
LVZ170	20	~2800	~5000	~10000
LVZ230	24	~2800	~5000	~10000

1. Insert a sling in each of the iron beams;
2. Use a crane to move the unit.

NOTICE

Do not use a forklift to move the unit. The structure does not support heavy loads and would be damaged.

NOTICE

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

- If the unit is shipped with a container, for extraction, follow the instructions on the front panel;
- Move the unit by lifting it from above with a crane;
- The holes for lifting are positioned on special yellow brackets fixed to the base frame (when lifting, use spreader bars to protect the side).

The lifting capacity of the lifting parts must be adequate for the load to be lifted. Check the weight of the units, the capacity of the sling bar and the ropes, the validity and the conditions of the aforementioned equipment.

Do not tilt the unit more than 15°.

No force or effort must be applied to pressurized parts, especially via pipes connected to the condensers or to the evaporator.

WARNING

The lifting point must be aligned with the gravity center.

Make reference to *Annex I - Weights and Dimensions* for weights, dimensions and gravity center position.

According to the UNI-EN 13001-2:2021 standard, while lifting the chiller with a crane system, the lifting speed increases the stress of the chiller structure, so depending on the stiffness class of the system and the type of hoist drives, it is advisable to comply with the lifting speed limits indicated.

Stiffness class of the lifting system	Types of hoist drives of the crane	Maximum lifting velocity	
		[m/s]	[m/min]
HC1	HD1	0.88	52.8
	HD2		
	HD3		
	HD4		
	HD5		
HC2	HD3	0.44	22
	HD5		
	HD1	0.29	17.4
	HD2		
	HD4		
HC3	HD3	0.29	17.4
	HD5		
	HD1	0.1	6
	HD2		
	HD4		
HC4	HD3	0.22	13.2
	HD5		
	HD1	DO NOT USE THEM	DO NOT USE THEM
	HD2		
	HD4		

If the unit is already packaged, note the **position of gravity center** and warning labels placed on the package.

8. Installation

NOTICE

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

The refrigerant **R1234ze** falls into refrigerant safety group **A2L** in accordance to ISO-5149 and to EN-378 instead **R515B** is **A1**.

The **Vertiv™ CoolLoop Trim Cooler** chillers are classified as “indirect vented closed system” according ISO-5149 and EN-378 and are designated to be installed in a location class III (open air) with occupancy access category Class C (as per ISO-5149 and EN-378) where only authorized personnel have access; with these limits for both **A1** and **A2L** refrigerant gas there aren’t any charge restriction. This limitation must be managed by the customer.

Please refer to these standards for further details. This level needs to be confirmed by the customer.

The **A2L** chiller(s) should be installed away from medium-high voltage power lines in accordance with local safety regulations.

The **A2L** chiller(s) should be at least **5** meters from drains, manholes and should be in an area with free airflow.

During installation, the risk that any gas leaks, being heavier than air, will create pockets in compartments, rooms, chambers, tunnels or other spaces placed below the laying level of the machine must be taken into consideration.

To prevent the risk of potentially explosive bags from forming, safety distances must therefore be maintained from any opening in which gas may enter as a result of a leak from the various points of the machine.

By way of example, the possible openings that may be present in “standard” installations are listed:

- Culverts;
- Downspouts;
- Burrows;
- Sewer openings;
- Underground or basement rooms;
- Windows;
- Skylights;
- Vent openings of bathrooms;
- Ventilation and/or ventilation ducts;
- Air intakes;
- Access doors to rooms below;
- Stairwells;
- Elevator and / or elevator compartments;
- Gutters.

To determine the exact safety distance to be maintained, appropriate assessments must be conducted by the installer technician who must refer to the national legislation of the country of installation and in any case must not maintain distances of less than **5** meters from these openings.

8.1 Overview

8.1.1 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 Installation Site*
Prepare the water system	*8.4 Water System Specification*
Prepare the electric system	*8.5 Electric System Specifications*

8.1.2 Operations on the unit

The unit is delivered fully factory assembled, including all the internal wiring.

Before shipment each unit is tested under standard operating conditions and charged with the right quantity of refrigerant and oil. Operational or environmental conditions on field that differ significantly from standard ones may require charge adjustment.

The heat exchangers (evaporator and water coils) are supplied dry, with open drain plugs and exhaust valves, to avoid possible problems due to the frost in the storage period.

The following operations must be performed on the **Vertiv™ CoolLoop Trim Cooler** unit at the installation site:

Operation	See…
1. Position the unit in the final location and fix it on the floor or on supporting structure.	*8.3.2 Foundations and positioning*
2. Connect the water system to the unit	*8.6 Connections* - *8.6.1 Water system piping*
3. Connect the electric power supply	*8.6 Connections* - *8.6.2 Electrical power supply*
4. Connect the electric equipment to the electric box (optional connections)	*8.6 Connections* - *8.6.3 Ethernet cable connection* - *8.6.4 Contacts for the unit status signals* - *8.6.5 Instrumentation connection*
5. Connect the discharge of the safety valves	*8.6 Connections* - *8.6.6 Safety accessories: safety valves discharge (PRV)*
6. Fill the water system	*8.7 Filling the Water System*
7. Fill the water system	*8.8 Initial Checks*
8. Start the unit for the first time	*9. Operation*
9. Check or set-up the operating parameters of the control system	*Vertiv™ iCOM3™ User Manual*

8.2 Safety Instructions

Personnel



WARNING

Only authorized personnel is allowed to perform installation operations.

All work on pipes or components of the refrigerating circuit under pressure must be exclusively made by qualified staff, competent in such works.

The authorized personnel must be properly trained and qualified, wear appropriate personal protective equipment and use adequate tools.

Electric System



WARNING

Unit contains potentially lethal voltage in some circuits.

Risk of arc flash and electric shock.

Can cause injury or death.

- Open all local and remote unit electric power disconnect switches, verify with a voltmeter that power is **OFF** and wear protective equipment per local standard before working within the electric control enclosure;
- It is forbidden to operate on the electrical components without using insulating platforms, or in the presence of water and humidity.



WARNING

The electric connection enclosures and some components can retain a stored high-voltage electrical charge for up to **10** minutes.

Risk of electric shock.

Can cause serious injury or death.

Before working within the unit electric connection enclosures proceed as follows:

- open all local and remote unit electric power disconnect switches;
- wait **10** minutes;
- verify with a voltmeter that power is **OFF**.

Only properly trained and qualified personnel may perform repair, maintenance and cleaning.

Lockout-Tagout (LOTO)		**WARNING** Before any intervention on the electrical system or accessing the inner components: • Lock the disconnection devices by a padlock or similar tool; • Apply on the general knife switch a suitable warning plate for no operation.
Safeguards		**CAUTION** After the installation interventions, always close the unit by refitting the relevant panels, if present, fastened by the fixing screws.
PPE		**CAUTION** Sharp edges, splinters and exposed fasteners. **Wear protective gloves** before operating on the unit.
		**NOTA** Improper handling can cause product damage.

8.3 Installation Site

8.3.1 Location

- The **Vertiv™ CoolLoop Trim Cooler** units must be installed outdoors;
- Prepare a level surface suitable to support the weight of the **Vertiv™ CoolLoop Trim Cooler** unit;
- The unit produces heat. The installation site must have a good air flow to guarantee heat dispersion even in the most demanding operating conditions;
- Install the unit in an area with clean air, away from loose dirt and foreign matter;
- Earthquake resistance has not been verified.

8.3.2 Foundations and positioning

- The unit must be placed on a level surface which support its weight;
- If necessary, place the unit on suitable **anti-vibration mounts**, which can be supplied (in rubber or spring) as an option.



CAUTION

- Place the **anti-vibration mounts** on the ground, lower the unit onto them and fix them to the unit;
- See the manual “Installation of anti-vibration mounts a spring” for correct positioning;
- The chiller must be level positioned.



CAUTION

The weight distribution refers to standard unit only. The weight of accessories (eg. pump groups) must be added to the weight of the unit.

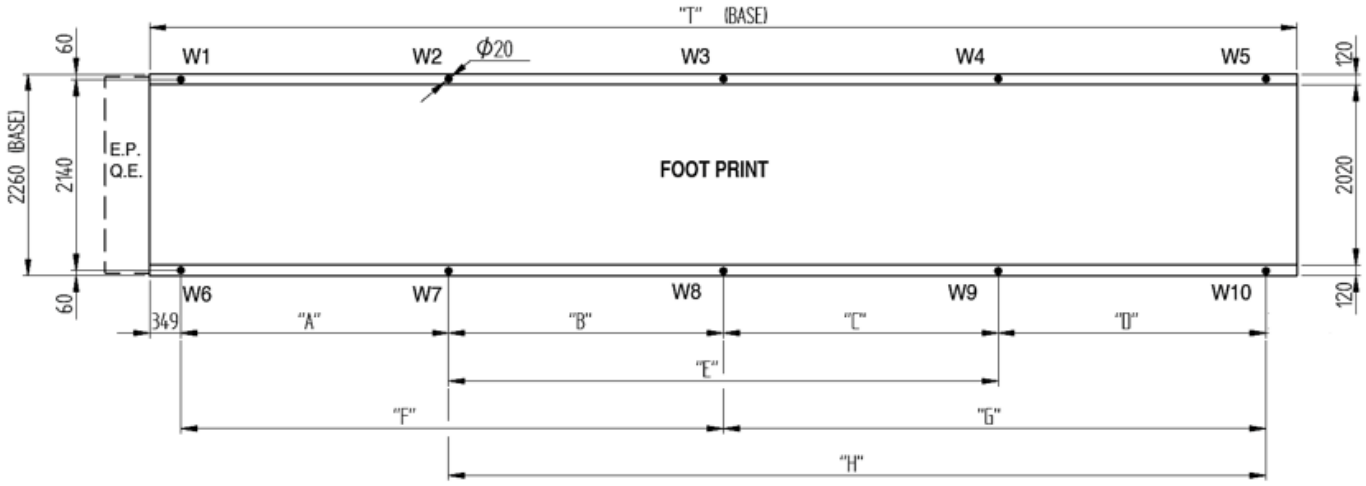


Table 23 - Operating weight distribution (unit with no active filters electrical panel and single user inverter pump):

Models	Weight distribution (kg)										Total weight (kg)
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	
LVZ 090 HG0	1873	2441	1805	-	326	1717	2239	1655	-	298	12354
LVZ 140 HG0	2095	2111	1485	1210	384	1955	1969	1385	1130	358	14082
LVZ 170 HG0	2284	2103	1800	2193	655	2246	2067	1770	2157	645	17920
LVZ 230 HG0	2269	2709	2244	1789	990	2221	2651	2196	1751	970	19790

Table 24 - Operating weight distribution (unit with active filters electrical panel and single user inverter pump):

Models	Weight distribution (kg)										Total weight (kg)
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	
LVZ 090 HG0	2345	2229	1837	-	322	2085	1981	1633	-	286	12718
LVZ 140 HG0	2589	1850	1530	1200	392	2351	1680	1390	1090	357	14429
LVZ 170 HG0	2674	1761	1944	2276	663	2566	1689	1866	2184	637	18260
LVZ 230 HG0	2593	2384	2440	1868	996	2487	2286	2340	1792	954	20140

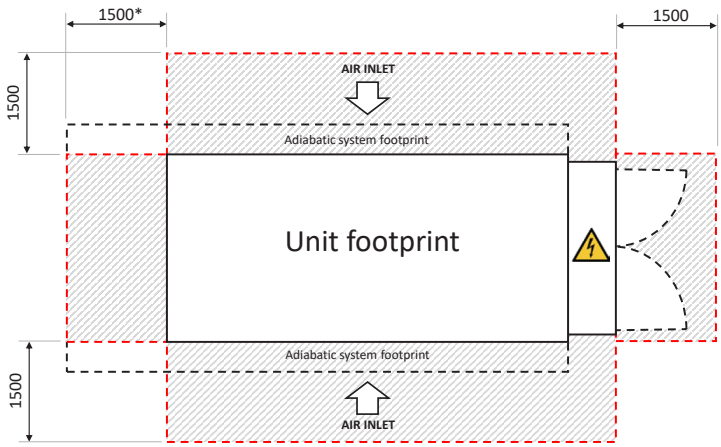
Table 25 - Position of Anti-vibration supports

TC	Units			
LVZ	090 HG0	140 HG0	170 HG0	230 HG0
N° Fans	14	16	20	24
N° Antivibration	8	10	10	10
"A" (mm)	2286	2286	2286	2286
"B" (mm)	3810	2540	2540	3810
"C" (mm)	-	2540	3810	3810
"D" (mm)	-	2286	3556	3810
"E" (mm)	-	5080	6350	7620
"F" (mm)	6096	4826	4826	6096
"G" (mm)	2286	4826	7366	7620
"H" (mm)	6096	7366	9906	11430
"I" (mm)	9080	10350	12890	15430

CAUTION
The operationing distribution refers to the base version of the unit; the weight of unit options (e.g user pump groups) can be considered as equally distributed over the supports and must be added to the total unit weight.
Please refer to the unit nameplate for the exact weight value.

8.3.3 Space Requirements

- To allow proper operation and maintenance of the unit, a minimum free space without any obstacles/obstructions is necessary according to the figure below;
- The hot air expelled by the fans must not find obstacles for a height of at least **2.5** m.;
- The installer shoud carefully evaluate the overall airflow path on the site, particularly in case of multi-chiller installations, ensuring that each unit works with the required airflow and avoiding any air bypass between discharge and suction side of the units;
- Hot air bypasses could negatively affect the unit performances or even interrupt its normal operation.



(*) Could be reduced to 1000 according to the specific unit configuration

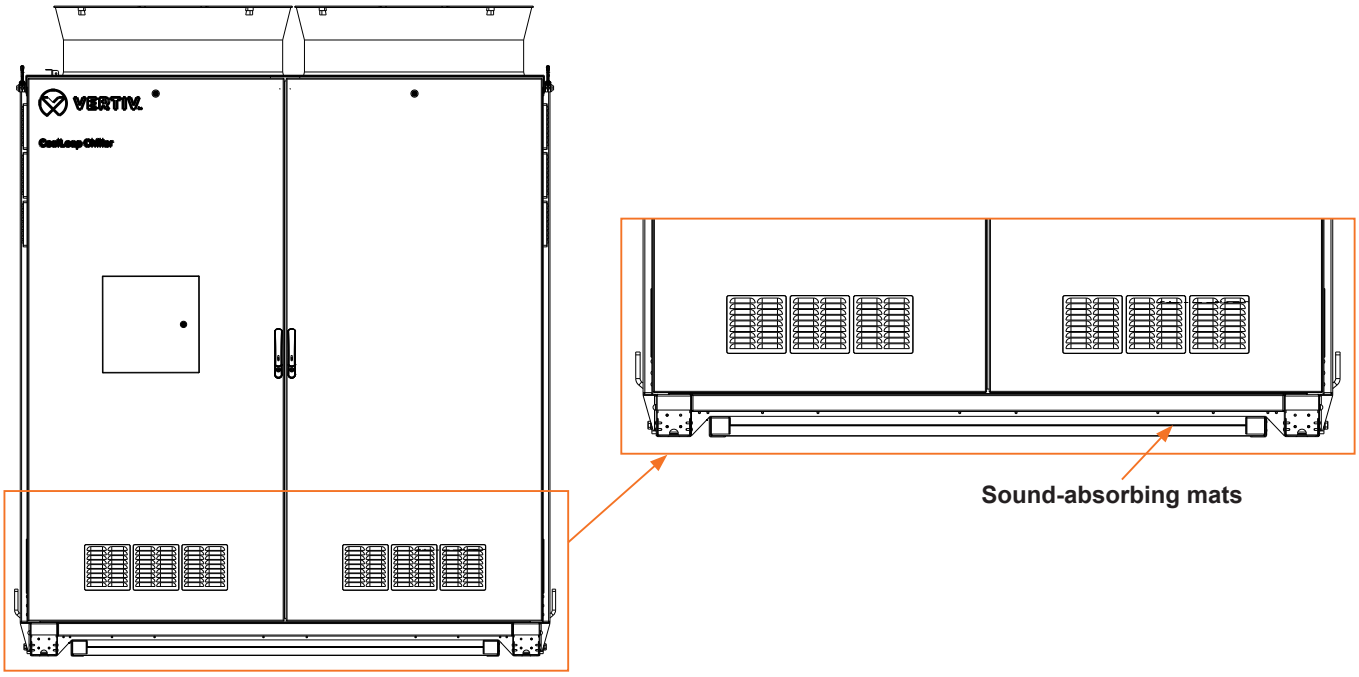
Free space / mainteinance area

- See *Annex I - Weights and Dimensions* for the unit dimensions;
- The unit has to be installed in a place that is not accessible to the public or protected against access by non-authorized persons;
- The unit environment must permit easy access for maintenance operations.

NOTICE
The maintenance of the unit become extremely difficult if placed too close to walls or other obstacles.

The floor level in the maintenance area on the electrical panel side must be aligned with the surface where the unit is placed, ensuring easy and safe access to the electrical panel, complying with applicable safety regulations.

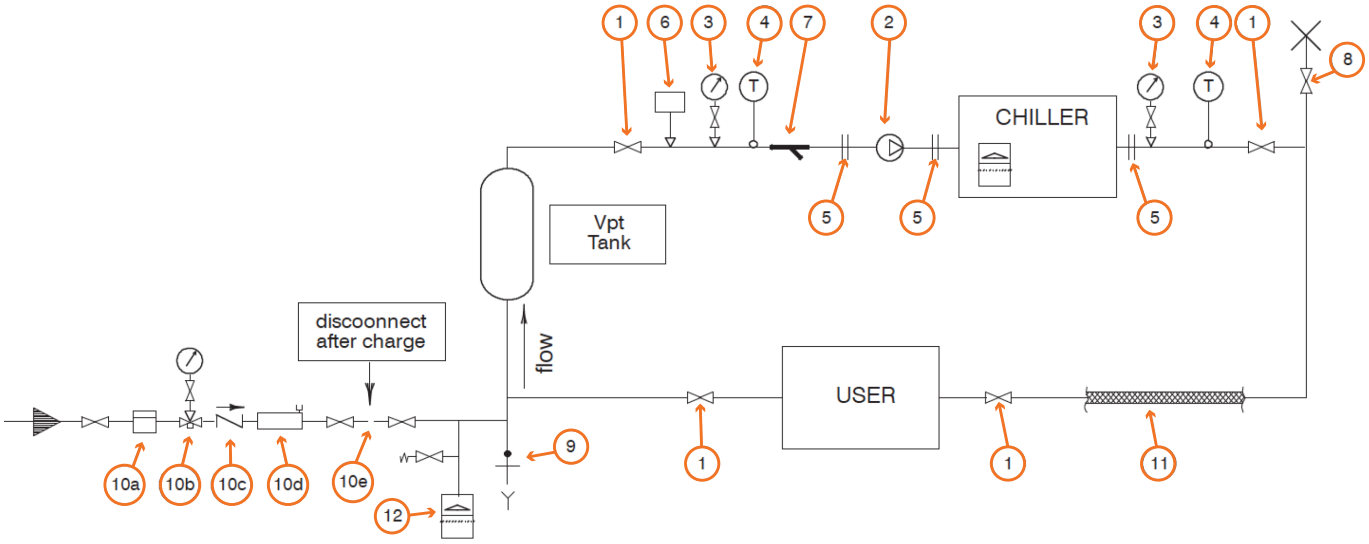
In the case of presence of **sound-absorbing mats**, leave the space indicated for their extraction absolutely free.



8.4 Water System Specifications

8.4.1 Ideal water circuit

The **Vertiv™ CoolLoop Trim Cooler** unit must be connected to the chilled water circuit.
The customer is responsible for the water circuit, according to the following example and specifications.
The following figure shows an ideal circuit for the evaporator (chilled water).



Ref.	Description	Notes
1	**Shut-off valves**	Install shut-off valves to facilitate maintenance. Do not install on the water outlet motorized shut-off valves configured as normally closed in stand-by status, because of the presence of check valves inside chiller on pump delivery. On the contrary, it is possible to install these motorized valves on the water inlets.
2	**Pump**	Install a circulation pump with the flow required by the plant and the head of all pressure drops of the plant including the chiller ones. It's possible to provide the pump(s) group fitted on chiller.
3	**Manometers**	Install manometer to the inlet and outlet of the **Vertiv™ CoolLoop Trim Cooler**.
4	**Temperature probes**	Install temperature probes to the inlet and outlet of the **Vertiv™ CoolLoop Trim Cooler**.
5	**Joints**	Piping connected to the **Vertiv™ CoolLoop Trim Cooler** shall be properly externally supported and shall in no way burden statically on the chiller connections. Flexible joints shall be used in order to avoid vibration transmission and thermal expansion issues.
6	**Pressure switch**	Install a pressure switch on water pipe to give an early warning of low water pressure.
7	**Filter**	Install mechanical at the inlet of the **Vertiv™ CoolLoop Trim Cooler**. Standard recommended mesh size is 1.25 mm. It can be supplied as an optional accessory, not assembled. If the fluid contains particles smaller than 1 mm. (0.04 inches), it is advisable to fit a filter with mesh size of maximum 0.87 mm., is at least 25 mesh (number of openings per inches).
8	**Filling and venting devices**	Install a device for the filling of glycol, placed at the highest points in the circuit. Install a device for the bleeding of air, placed at the highest points in the circuit. For **A2L** units it's mandatory to install a device for the bleeding of air according 5.5.2.1 of EN 378-1.
9	**Drain valve**	Install a drain valve, placed at the lowest points in the circuit.
10	**Water fill**	Install a water fill group including the following components: a) filling meter; b) manometer; c) non return valve; d) air separator; e) removable supply tube, which must be disconnected after each charge or topping up.
11	**Insulation**	All pipes of the system exposed to low temperature have to be isolated. Also consider to use heaters, if necessary.
12	**Expansion tank**	The circuit must include an expansion tank with suitable capacity. See *8.4.2 Sizing of the expansion tank* for the capacity calculation. **Install a safety valve on the expansion tank.**

8.4.2 Sizing of the expansion tank

$$V = \frac{C \times e}{1 - \frac{Pi}{Pf}}$$

where:

C = quantity of water inside the system expressed in liters;
e = water expansion coefficient, water at 10°C as reference;
Pi = absolute pressure of initial charging, equivalent to the tank pre-charge pressure (value 2.5 bar);
Pf = absolute final tolerated pressure, lower than the operating pressure or than the safety valve calibration pressure (value 4.0 bar).

The total volume of the expansion tank is calculated with the ratio shown on the left.

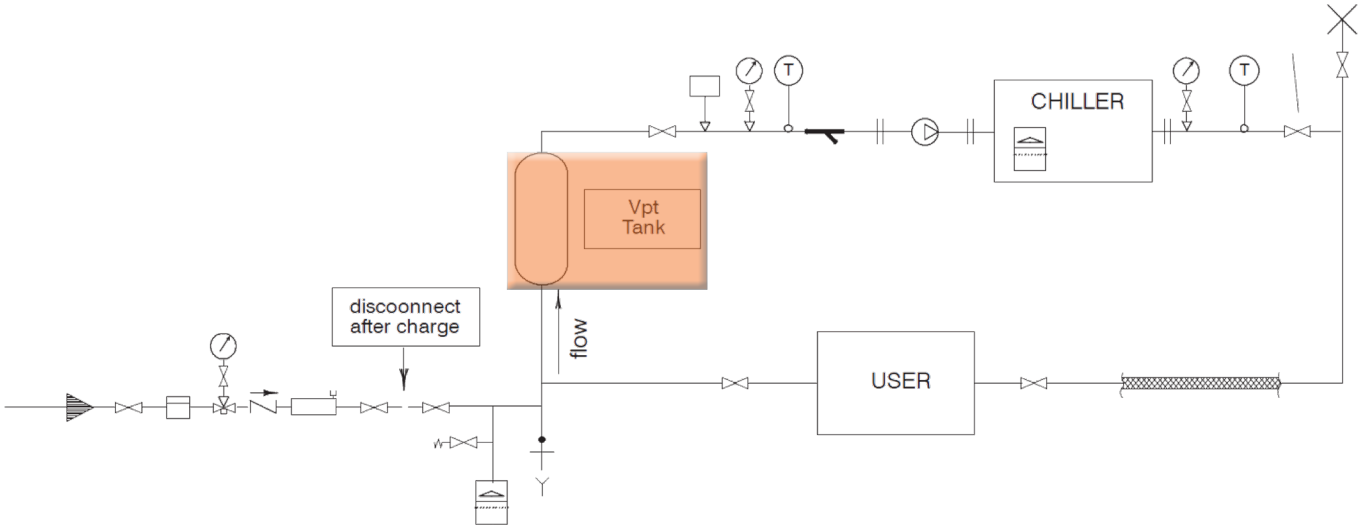
Use the values of the water expansion coefficient indicated in the table below:

T [C°]	Density [Kg/m^3]	Expansion coefficient "e" H_2O	"e" 10% glycol	"e" 20% glycol	"e" 30% glycol	"e" 40% glycol	"e" 50% glycol
10	999,6	0,001	0,003	0,005	0,007	0,013	0,015
20	997,9	0,002	0,005	0,008	0,01	0,015	0,018
30	995,6	0,004	0,007	0,011	0,013	0,017	0,02
40	992,2	0,008	0,011	0,014	0,016	0,021	0,024
50	988,1	0,012	0,015	0,018	0,021	0,025	0,028

8.4.3 Sizing of the chilled water circuit

NOTICE

Check if the minimum total volume (**V**) of the system is sufficient to avoid less than **5** minute water loop circulation in order to prevent short water loop.
For variable flow systems, consider the nominal water flow.
For units with fixed flow option, the hydraulic circuit must guarantee the constant flow of water to the evaporator in all operating conditions. Failure to do so could cause breakages of the compressors due to repeated returns of liquid refrigerant.
Whenever two or more units are used on the same chilled water loop, Vertiv™ recommends that their operation be coordinated with a higher-level system controller for optimum system efficiency and reliability.



The whole hydraulic circuit must contain a water volume suitable for the capacity of the installed refrigerating unit.
The minimum total volume (**V**) of the system where the **Vertiv™ CoolLoop Trim Cooler** is installed can be calculated by the following ratio:

$$V = \frac{43 \times Rt}{Xd}$$

where:

V = minimum required total water volume [liters]
Rt = refrigerating capacity [kW]
Xd = differential band set on the control [°C]

Check if:

$$Vm + Vpc \geq V$$

where:

Vm = hydraulic volume of the evaporator of the **Vertiv™ CoolLoop Trim Cooler** unit
Vpc = volume of the water circuit connected to the **Vertiv™ CoolLoop Trim Cooler**

If **Vm** + **Vpc** < **V** then install an inertial tank with a volume (**Vpt**) at least equal to the following value:

$$Vpt = V - Vm - Vpc$$

8.4.4 System protection

Flow-switch

Normal operation:

1. The water pumps start;
2. There is water flow in the system;
3. The compressors start;
4. The compressors operate only if there is enough water flow in the system.

In case of pumps failure:

- The compressors must not start if there is no water flow in the system;
- The **Vertiv™ CoolLoop Trim Cooler** has factory mounted protections (flow switch) in case of lack of water flow in the evaporator;
- The **Vertiv™ CoolLoop Trim Cooler** has a protection in case of lack of not sufficient water pressure if pump(s) group is installed on board: this is to avoid pump's cavitation and or depressurization of the chiller hydraulic circuit;
- The **Vertiv™ CoolLoop Trim Cooler** has a protection for variable flow systems: it's monitored and controlled the min. e max. flow and its gradient (< 10% by minute).

Max. hydraulic operating pressure

The maximum hydraulic operating pressure of the **Vertiv™ CoolLoop Trim Cooler** is 10 barg.

- Check how much is the maximum pump static head (**Pp**) (indicated on pump's name plate);
- Check the static head of the water circuit (**Pw**);
- Make sure that it is always: **Pp** + **Pw** < 10 barg.

Optional: install an expansion vessel on the hydraulic circuit. Depending on the unit model the expansion vessel goes from 12 lt. to 24 lt. The safety valve is set to 6 barg.

8.4.5 Water supply specifications

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 significantly affects the operation and the life of the exchangers.

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

Water quality has to be in accordance with VDI 2035.

Add water softeners

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

Prevent corrosion

The oxygen dissolved in water increases the rate of corrosion.

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

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

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

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

In case of freecooling units with **FC** microchannel coil, the conditions regarding the water characteristics are more restrictive (to avoid corrosion), in particular regarding the **pH**, for this reason see *chapter 8.4.6*.

pH	---	7,5 - 9,0
Alkalinity (HCO_3^-)	ppm	70 - 200
SO_4^{2-}	ppm	< 100
HCO_3^- / SO_4^{2-}	---	> 1,5
(Ca+Mg) / (HCO_3^-)	---	> 0,5
Cl^-	ppm	< 100
PO_4^{3-}	ppm	< 2,0
NH_3	ppm	< 0,5
Nitrate (NO_3^-)	ppm	< 100
Free Chlorine (Cl_2)	ppm	< 1
Iron (Fe^{3+})	ppm	< 1
Copper (Cu)	ppm	< 1
CO_2	ppm	< 10
H_2S	ppb	< 50
Oxygen content	ppm	< 0,1
Total Suspended solids	mg/l	< 1500
Electric conducibility	µS/cm	10 - 500
Total hardness	dH	4,0 - 8,5

8.4.6 Filling the hydraulic circuit with water or glycol mixtures

In chillers or freecooling chillers having **A2L** gas during the first hydraulic loading of the system (or in case of maintenance-restoration of hydraulic circuit filling following refrigerant leaks from the refrigerant circuit) it is mandatory to analyze with a gas detector (having a sensitivity of **3** gr./year) the air leaving the vents positioned on the highest parts of the **FC** exchangers and the circuit, detecting the absence of any trace of refrigerant.

After having performed the glycol loading and flushing operations, the respective freecooling valves must be opened. At this point, the water filter must be checked and eventually cleaned from impurities present in the user circuit.

This must be done during the commissioning phase and at regular intervals depending on the cleanliness conditions of the user circuit. The need can be identified using the pressure gauges inserted upstream and downstream of the filter (**DP** > approximately 0.25 bar).

To facilitate these operations, two interception valves are present in the machine to remove this component.

In the case of Freecooling units with microchannel **FC** coils and No-Glycol unit with microchannel **FC** coils, all these aspects must be verified:

- The hydraulic circuit must be loaded with the correct percentage of glycol to avoid freezing, anyway never lower than 20%;
- **It's not permitted to use pure water or a glycol mix below 20%**;
- The glycols must be compatible with the materials of the circuit itself, in particular in the presence of microchannel freecooling exchangers, must have the correct corrosion inhibitors and be compatible with the aluminum alloys used in them. Vertiv™ suggests the use of glycol mixtures with **Clariant Antifrogen N** (monoethylene) or **Clariant Antifrogen L** (propylene).

Microchannel freecooling exchangers require some special attention for their use:

- The glycol mixtures must be derived from glycols with anti-corrosion inhibitors compatible with the aluminum alloys used in them;
- The **pH** of these mixtures must be periodically checked, which must always be in the range between **7.5** and **8.2**;
- There must be no presence of oxygen in the circuit so it must be perfectly vented;
- Speeds on the exchanger channels greater than 1.4 m/s must not be exceeded to avoid deterioration of erosion.

→ For this purpose, the unit controller has a pair of pressure sensors that verify the dangerous pressure drop conditions of the circuit corresponding to the prescribed speeds, limiting (if necessary) the maximum pump speed.

In Glycol Free Freecooling chillers these operations are limited to the evaporator hydraulic circuit (no checks are needed on the vents of the freecooling exchangers as they are double isolated from the refrigerant circuit thanks to the intermediate exchanger).

8.4.7 Filling the Glycol Free hydraulic circuit with glycol mixtures

The glycol free circuit consists of:

- one or more intermediate plate heat exchangers;
- finned free cooling exchangers with **copper pipes** (coils) or totally in **aluminum** (microchannel);
- one or more inverter pump for the circulation of the glycol fluid;
- shut-off and anti-recirculation check valves;
- circuit with connection pipes;
- expansion vessels, safety valves, filling outlets, vents and drains;
- transducers for pump regulation and safety;
- high efficiency mechanical filter (mesh >80) to protect the exchangers (present only with microchannel freecooling exchangers);
- heating elements on the water side to avoid freezing during the stand by unit.

This circuit must be loaded with the correct percentage of glycol to avoid freezing, anyway never lower than 20%.

It's not permitted to fill the glycol free circuit with water or a glycol mix below 20%.

The glycols must be compatible with the materials of the circuit itself, in particular in the presence of microchannel freecooling exchangers, must have the correct corrosion inhibitors and be compatible with the aluminum alloys used in them Vertiv™ suggests the use of glycol mixtures with **Clariant Antifrogen N** (monoethylene) or **Clariant Antifrogen L** (propylene).

The loading procedure must be carried out slowly paying attention to properly vent the whole circuit; avoid operating the pump or if necessary at minimum speed in order to avoid the onset of foams in the presence of glycol which greatly lengthen the time for the elimination of air from the circuit.

The circuit must then be correctly pressurized by loading the expansion vessels, 2.5 Barg is recommended as a reference value.

To load the fluid in the circuit in the presence of microchannel freecooling exchangers.

1. Use the connection prepared for loading, open the vents and intercept the butterfly valve: in this way you are sure that all the fluid passes through the filter;
2. After having vented and removed all the air, start the pump at minimum speed and proceed by opening the vents to remove the residual air pockets;
3. After having circulated the fluid for at least **10** minutes, **turn OFF** the pump, intercept the filter and remove the residues on the magnet and clean and/or replace the filter sock; recharge the system and proceed according to points two and three until all the residues are eliminated and the sock is clean;
4. During these operations, pay attention to flush the filter only if the circuit is fully loaded, avoid accelerating the pump in the presence of bubbles, avoid opening, closing valves and causing water hammers on the filter itself: this avoids producing breakages and/or lacerations on the shirt of the same;
5. Pressurize the circuit by loading the expansion vessels, gradually accelerate the pump to the maximum speed allowed by the control, check correct operation.

Microchannel freecooling exchangers require some special attention for their use:

- The glycol mixtures must be derived from glycols with anti-corrosion inhibitors compatible with the aluminum alloys used in them;
- The **pH** of these mixtures must be periodically checked, which must always be in the range between **7.5** and **8.2.**;
- There must be no presence of oxygen in the circuit so it must be perfectly vented;
  - For this purpose, the unit controller has a pump suction pressure sensor which warns if the circuit approaches depressed conditions (situation in which the pump can suck air); in these cases it is recommended to check the integrity of the circuit, of the expansion vessels and of their correct pressurization;
- Speeds on the exchanger channels greater than 1.4 m/s must not be exceeded to avoid deterioration of erosion;
  - For this purpose, the unit controller has a pair of pressure sensors that verify the dangerous pressure drop conditions of the circuit corresponding to the prescribed speeds, limiting (if necessary) the maximum pump speed.

8.4.8 Prevent freezing for chiller or freecooling chiller

Prevent freezing by glycol

In winter, if the system is stopped, the water inside the exchangers can freeze damaging the system irreparably.

Thus, it is recommended to use glycol mixtures: please consider the different outputs and power absorption by the chiller, the pump sizing and the performance of the system terminals/ conditioners).

After any topping-up of water check the concentration and add glycol if necessary.

Water-glycol mixtures are used as the thermal carrier fluid in very cold climates or with temperatures below zero degrees centigrade.

Determine the % ethylene glycol which must be added to the water, using the following table:

Tab. a - Ethylene glycol to be added to water (% in weight of total mixture)

Ethylene glycol [% in weight]	0	10	20	30	40	50
Freezing temperature,°C (*)	0	-4,4	-9,9	-16,6	-25,2	-37,2
Mixture density at 20°C (*) [kg/l]	---	1.017	1.033	1.049	1.064	1.080

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

For the water charges in the **Vertiv™ CoolLoop Trim Cooler** circuit refer to *6.2 Water System*.

- To avoid stratification, run the circulation pump for at least **30** minutes after each addition of glycol. If the pumps are installed on board the chiller, they must all be operated simultaneously;
- Flush all parts of the chiller hydraulic circuit including the free cooling batteries and the by-pass sections; to do this, manually move the 2-way valves to both positions, making the circuit flush for the necessary time;
- After adding water to the circuit, it is mandatory to disconnect the system from the sanitary water network; this will avoid the danger of the return of glycol water in the same network;
- After each top up of water, check the concentration and add glycol if necessary.

ALWAYS LOAD THE HYDRAULIC CIRCUIT WITH THE REQUEST % OF GLYCOL REQUIRED FOR THE MINIMUM AMBIENT TEMPERATURE OWN OF THE INSTALLATION SITE; DO NOT COMPLY WITH THIS REQUIREMENT MEANS INVALIDATE THE UNIT WARRANTY.

To avoid stratification run the circulation pump for at least **30** minutes after adding any glycol.

After adding water to the hydraulic circuit always disconnected the water supply coming from the sanitary circuit; this avoids the danger of glycol entering the sanitary water circuit.

Water glycol fluid mixture has to be circulated inside the unit hydraulic parts including freecooling coils and by-pass pipes. In order to do it move the two 2-way valves on both positions for the time necessary.

NOTICE

Always charge the hydraulic circuit with the required glycol % necessary for the minimum ambient temperature of the installation site.
Failing to comply with this instruction shall invalidate the unit warranty.

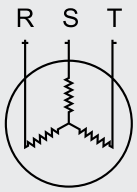
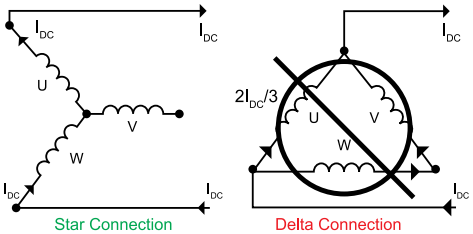
Prevent freezing by draining

Otherwise drain the system completely, using the suitable shut-off valves arranged in the exchangers and in the circuit, trying to drain the water residues blowing air in the lines.

NOTICE

During the winter or in the event of plant shutdown, if you decide to completely empty the unit, the water in the exchangers can freeze causing irreparable damage, so it is advisable to flush the circuit with glycol mixtures before carrying out this operation; however residues of fluid in the exchangers in the presence of oxygen (air) can trigger deleterious corrosion phenomena, therefore it is recommended to flush the non-nitrogen anhydrous hydraulic circuit (**N2**) in order to dry it as much as possible and remove the oxygen present; after this operation, close the circuit, vents, drains making sure that no air returns into it.

8.5 Electric System Specifications

Power supply requirements for the unit	• Check the electrical data on the label applied on the unit; • Check that the available power supply is consistent with the unit power requirements given in *6.4 Electrical System*; • 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.
Disconnecting switch and protection	• A manual electrical disconnect switch should be installed in accordance with local codes; • Select and install the line side electrical supply wire and over current protection device(s) according to the specifications on the unit nameplate(s), according to 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 pumps with inverter, then use a type B or B** switch.
Power supply variability	• Check that the maximum unbalance between the phases does not exceed the value given in *6.4 Electrical System*; • Make sure to comply with the following data: - Electrical voltage between 0.95 and 1.05 nominal voltage; - Frequency between 0.99 and 1.01 the nominal frequency; - Variability of supply voltage less than 2%. See the figure below for variability evaluation. **Example of calculating phase to phase variability** 1) The 400 V supply has the following variability: **RS** = 388 V **ST** = 401 V **RT** = 402 V  2) The average voltage is: $\frac{388 + 401 + 402}{3} = 397$ 3) The maximum deviation from the average is: 402 - 397 = 5 V 4) The phase to phase variability is: $\frac{5}{397}$ x 100 = 1.26% (acceptable) Harmonic distortion not exceeding 12% of the total r.m.s. voltage between live conductors for the sum of the 2nd through to the 30th harmonic.
Power supply connection	The **Vertiv™ CoolLoop Trim Cooler** units are equipped with electrical devices (power supplies module, control devices, etc.) that are designed to operate properly with Star Connected power (Wye) with earthed neutral (TN or TT system). Three-phase distribution Delta Connected (Δ) or Star-connected power (Wye) without ground or floating ground (IT) contact Vertiv™. 

Supply voltage	**Voltage interruption:** interrupted or at zero voltage for not more than **3** ms at any random time in the supply cycle with more than **1** s between successive interruptions. Voltage dips not exceeding 20% of the rms voltage of the supply for more than one cycle with more than **1** s between successive dips.
Power supply type	**Acceptable:** - TT, TN-S, TN-C, TN-C-S systems; - 400V Wye with solidly grounded neutral (230V line to ground). **Unacceptable:** - 400 V Wye without ground connection or with high-resistance (or impedance) ground (IT); - 400 V Δ without ground or with high-resistance (or impedance) ground (IT); - 400 V Δ with corner ground or with grounded center-tapped.
Cables type	• Use copper wiring only; • Cable Sizing is responsibility of the installer. The units are equipped with electrical panel with one main switch for the power section and one switch (option) for the control section. Choose a supply cable (three-pole type with ground) for the power section and a supply cable (two-pole type with ground) for the control section (option) according to: - the local norms; - the system absorption (**FLA** unit); - the system voltage; - installation type; - cable length; - upstream protection.
Check integrity	• Make sure that all electrical connections are tight; • Make sure that all electrical components are undamaged.
Sealing	• When leading the cable through the joint, you are recommended to use the sealant for waterproof disposal; • If you do not follow the recommended cable sizes and mode to connect the cables, water leakage may occur at the waterproof joint.
Hot surfaces 	• The cables cannot contact hot objects, such as the copper pipe and water pipe without thermal insulation pipe, lest the insulation layers should be damaged; • Before proceeding with the electrical connections, make sure that: - the electrical components are in good condition; - all the terminal screws are well tightened; - the supply voltage and frequency comply with those indicated on the unit and respect the tolerances indicated in the paragraph *6.3 Operating limits*; - the maximum balance between the phases does not exceed the value indicated in the paragraph *6.3 Operating limits*.

- Power cable connection:
  The units are equipped with an electrical panel equipped with a main disconnector that powers the entire unit and one that powers the control only (optional).
  Choose a power cable (three-pole with earth) for the power section and a power cable (bipolar with earth) for the control section (optional):
  - local regulations;
  - plant absorption (**FLA** unit);
  - system voltage;
  - type of laying;
  - cable length;
  - UPSTREAM protection.
- After opening the passage in the carpentry (pre-cut) for the power line input, restore the original degree of protection with appropriate wiring accessories and mittens. Lay the cable paying particular attention not to touch hot parts.

  Connect the cable to the input terminal block (terminals disconnectors for phases, earth bar for the **PE** conductor). Once the cable is connected, restore the protections against direct contacts.

3. The protection of the system / line cable is the responsibility of the customer. Use a differential switch protection. If the system is equipped with **EC** type fans and/or with inverter pumps, use a type B switch.

4. Ethernet cable connection.
   The control can be connected to a remote display through an Ethernet network cable (see *HW User Manual*).
   - Fasten the cable to the cable tie plates and pass it through the first free hole on the bottom of the switchboard (provide cable gland);
   - After opening the passage in the carpentry (pre-cut) opposite the power line input, restore the original degree of protection with appropriate wiring accessories and mittens;
   - The cable must be protected by a sheath.

5. Connection of free contacts signaling machine status.
   The dry contacts can only be used with **PELV** type sources as described in the CEI EN 60204-1 standard "Safety of machinery - Electrical equipment of machines".
   The *table at page 72* shows the terminals available and their meaning (see the wiring diagram for further information).
   The passage of the cable must be carried out as described in the previous point 4.

NOTE: *The power supply must never be excluded, except when performs maintenance. Operate the switch-disconnector before any intervention on electrically powered parts.*

NOTE: *It is forbidden to operate on electrical components without using insulating platforms and in the presence of water or humidity.*

NOTE: *The external pump unit must be powered before the chiller unit starts and must be maintained for the entire period of use; in fact, an incorrect operation locks the group due to internal protections (flow switch intervention).*

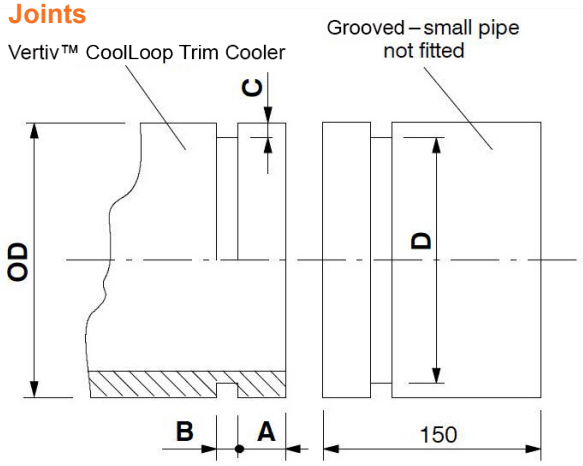
NOTE: *The compressors are equipped with an electronic protection device that blocks their start if the sequence of phases is not the correct one or blocks their operation if thermal protection intervenes; this device is vital for the integrity of the mechanical and electrical components of the compressors themselves. The restoration of normal functions must be carried out by removing the power supply to this device and removing the causes that caused the shutdown.*

NOTE: *The chillers are equipped with their own regulation with microprocessor control: the use of the remote ON-OFF (provided in the Q.E. terminal board) as a system thermostating element is prohibited.*

8.6 Connections

8.6.1 Water system piping

Joints



For welded hydraulic connection use the small pipes supplied with the unit, otherwise directly connect grooved lines with the grooved pipes connections joints of the unit, taking care to suitably grease the joint gaskets.





Ref.	Unit	Dimensions				
OD (Ø)	Inch	4"	5"	6"	8"	10"
	DN	100	125	150	200	250
	mm	114,3	139,7	168,3	219,1	273,1
A	mm	15,88	15,88	15,88	19,05	19,05
Tolerance on **A**	mm	± 0,77	± 0,77	± 0,77	± 0,77	± 0,77
B	mm	9,53	9,53	9,53	11,13	12,7
Tolerance on **B**	mm	± 0,77	± 0,77	± 0,77	± 0,77	± 0,77
C	mm	2,11	2,13	2,16	2,34	2,39
D	mm	110,08	135,50	163,96	214,40	268,27
Tolerance on **D**	mm	- 0,51	- 0,56	- 0,56	- 0,64	- 0,69
	mm	+ 0,00	+ 0,00	+ 0,00	+ 0,00	+ 0,00

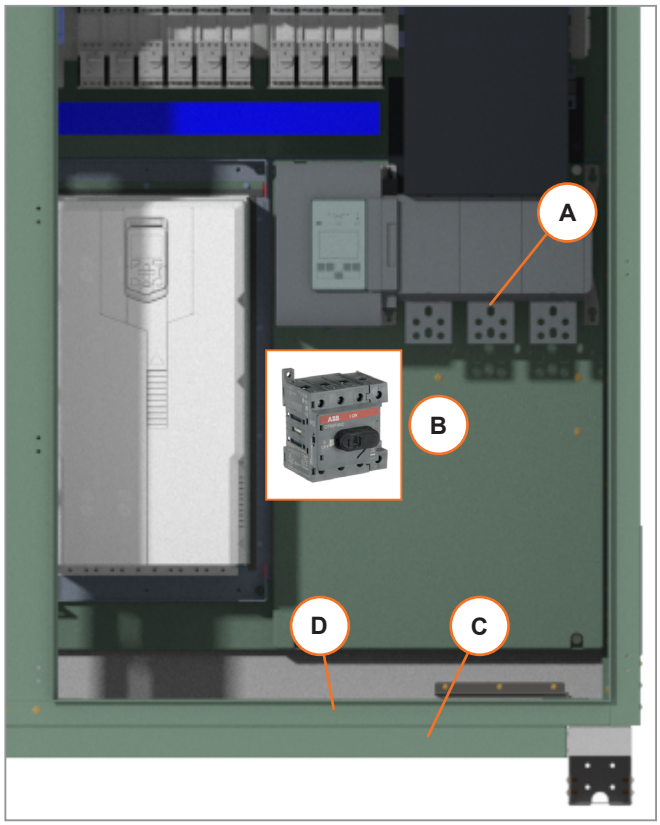
Vibration damping

Piping connected to the **Vertiv™ CoolLoop Trim Cooler** shall be properly externally supported and shall in no way burden statically on the chiller connections. Flexible joints shall be used in order to avoid vibration transmission and thermal expansion issues.

Use flexible joints also for the pump assembly outside the **Vertiv™ CoolLoop Trim Cooler**.

Isolate piping from the building using vibration isolating supports.

8.6.2 Electrical power supply



A	**Power supply**
B	**Low voltage connection for the control system**
C	**Passage for cables**
D	**Protective Earth Connection**

- After opening the passage [**C**] 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;
- Connect the cable to the inlet terminal board (disconnecting switch terminals for phases, ground bar for **PE** conductor);
- 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.

NOTICE

The unit is equipped with its own microprocessor control adjustment. The use of the remote ON-OFF input (located in the electrical panel terminal board) as system temperature control element is forbidden.

8.6.3 Ethernet cable connection

The control can be connected with a remote display through an Ethernet network cable (see *Vertiv™ iCOM3™ User Manual*).

- Fasten the cable to the clamp-holding plates and make it pass through the first free hole on the panel bottom (arrange a cable clamp);
- After opening the passage in the structural works (precut), opposite the supply line inlet, restore the original protection degree with suitable accessories for the wiring and junction boxes.

The cable must be protected by a sheath.

8.6.4 Contacts for the unit status signals

Free contacts available

400 401 402	General Alarm - Supply B OFF	→400-401 NC
300 301 302	Warning - Supply B OFF	→300-301 NC
450 451	Compressor 1 ON	→450-451 NC
452 453	Compressor 2 ON	→452-453 NC
462 463	Pump 1 ON	→462-463 NC
464 465	Pump 2 ON	→464-465 NC
466 467	Pump FC Operation Signal	→466-467 NC
468 469	Programmable events relay	→468-469 NC
602 603	Compressor contactor melted	→602-603 NC

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

The table on the left shows the available terminals and their meaning (refer to the wiring diagrams for further information).

- Fasten the cable to the clamp-holding plates and make it pass through the first free hole on the panel bottom (arrange a cable clamp);
- After opening the passage in the structural works (precut), opposite the supply line inlet, restore the original protection degree with suitable accessories for the wiring and junction boxes.

The cable must be protected by a sheath.

Input contact

470 471	Remote ON-OFF	Supply voltage 24V AC
472 473	User Input	Supply voltage 24V AC
482 483	PFC enabling	Supply voltage 24V AC

8.6.5 Instrumentation connection

- Make reference to the *Electric Diagrams*.

8.6.6 Safety accessories: safety valves discharge (PRV)

Convey the discharge

Safety valves are installed on the refrigerating circuit on both on the high and low pressure sides. For all refrigerants the discharge connection of the valves must be conveyed to areas where the jet cannot harm people. The conveying pipe must be sized according EN13136, and must not burden the valve body. In particular, for **A2L** refrigerants the jet discharge of safety valves generates a classified **ZONE 2** according ATEX EU Directive; for this reason, the discharge zone (better described below) must not present any source of ignition like:

- Open flames with Minimum Ignition Energy 60.000 mJ at 54°C and 1 atm;
- Electric arcs with Minimum Ignition Energy 60.000 mJ at 54°C and 1 atm;
- Hot surfaces at temperature t > 360°C;
- Other ignition sources listed in EN1127-1.

Each valve should preferably be connected individually with the discharge pipe sized according to EN13136. If several valves are conveyed together, the user must size the manifold according to EN13136 as well, in order to avoid harmful back pressure on the valves that have not opened. The conveying pipe of the **PRV** must have a suitable geometry, structure and materials in order to avoid:

- Its occlusion due to the entry of water or snow (which may freeze in the winter season) or dirt;
- Its corrosion over time such as to compromise the ATEX classified area;
- Its breakage due to winds or weather phenomena; the supporting structure must be solid and not burden through the connections on the **PRV** themselves;
- Maintenance difficulties on **PRV**s (the threaded connections to the valves must be easily removable).

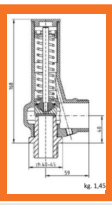
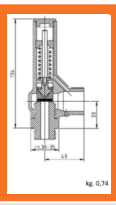
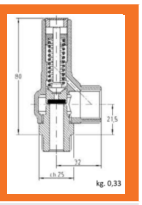
Periodic check of the relief valves: see *10. Maintenance.*

It is recommended to install an indicating device to show if part of the refrigerant has leaked from the **PRV**. The presence of oil at the outlet orifice is a useful indicator that refrigerant has leaked. Keep this orifice clean to ensure that any leaks are evident. The calibration of a valve that has leaked is generally lower than its original calibration. The new calibration may affect the operating range. To avoid further leaks, replace the **PRV**.

The following table shows the technical and outflow characteristics of each safety valve mounted on the chillers.

This table also shows an example sizing for the conveying pipe (EN 13136) and for the determination of the area classified according to EN 60079-10-1 for each **PRV**.

Reference **A2L** refrigerant **R1234ze**.

PRV Model	G20 S 	G14 S 	D10 CS 
Circuit side x quantity for each circuit	HP 1-3	LP 1	LP 1
Outlet connections	G. 1 1/4" ISO228	G. 1" ISO228	G. 3/4" ISO228
Flow diameter [mm]	20	13.5	10
Flow section [mm^2]	314	143	79
Low flow discharge coefficient Kdr	0,83	0,86	0,86
Set pressure [barg]	22	14	14
Discharge approx. capacity [Kg/h]	11900	3450	1900
Discharge recommended pipe for 5 m equivalent length	2 1/2"	2"	1 1/2"
Conic jet dangerous distance r [m]	7	5	4
Conic jet dangerous distance r' [m]	2,1	1,5	1,2
Conic jet dangerous distance r'' [m]	6,14	4,4	3,52

NOTICE

Suitable gloves and **goggles** must be used when handling pressurized fluids especially during maintenance work on the safety valves.

The following graph shows the zone classified according to **ATEX (Zone II)** that is generated at the end of the conveying pipe of each safety valve; it is a conical **ATEX Zone** which must be properly managed inside the installation site and in particular must not contain ignition sources (see EN1127-1) or devices not suitable for operation in explosive atmospheres.

If several valves are conveyed together, the user must recalculate this ATEX classified zone according to EN60079-10-1, considering a discharge flow rate equal to the sum of the **PRV**s that are connected to the manifold (contact Vertiv™ for how to consider the simultaneity coefficient of the **PRV**s under the same manifold).



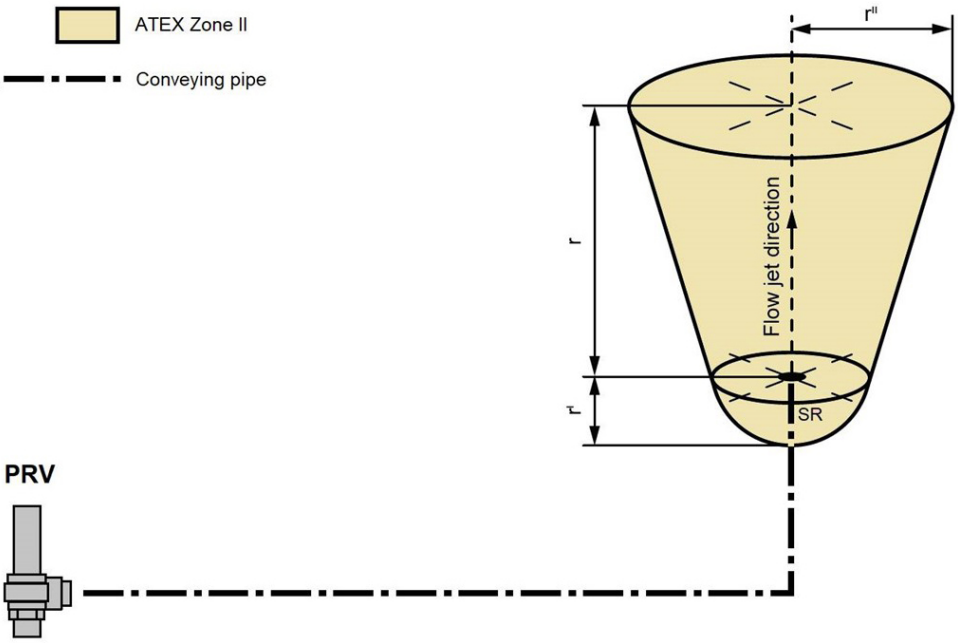
G20 S



G14 S



D10 CS



If multiple conical zones corresponding to multiple valves physically overlap, their categorization according to ATEX does not change (**Zone II** remains).

NOTICE

Safety is only guaranteed, if these instructions are carefully followed. If this is not the case, there is a risk of material deterioration and injuries to personnel.

Never cover any protection devices.

This applies to the relief valves, in the refrigerant or heat transfer medium circuits, and the pressure switches.

Ensure that the valves are correctly installed, before operating the unit.

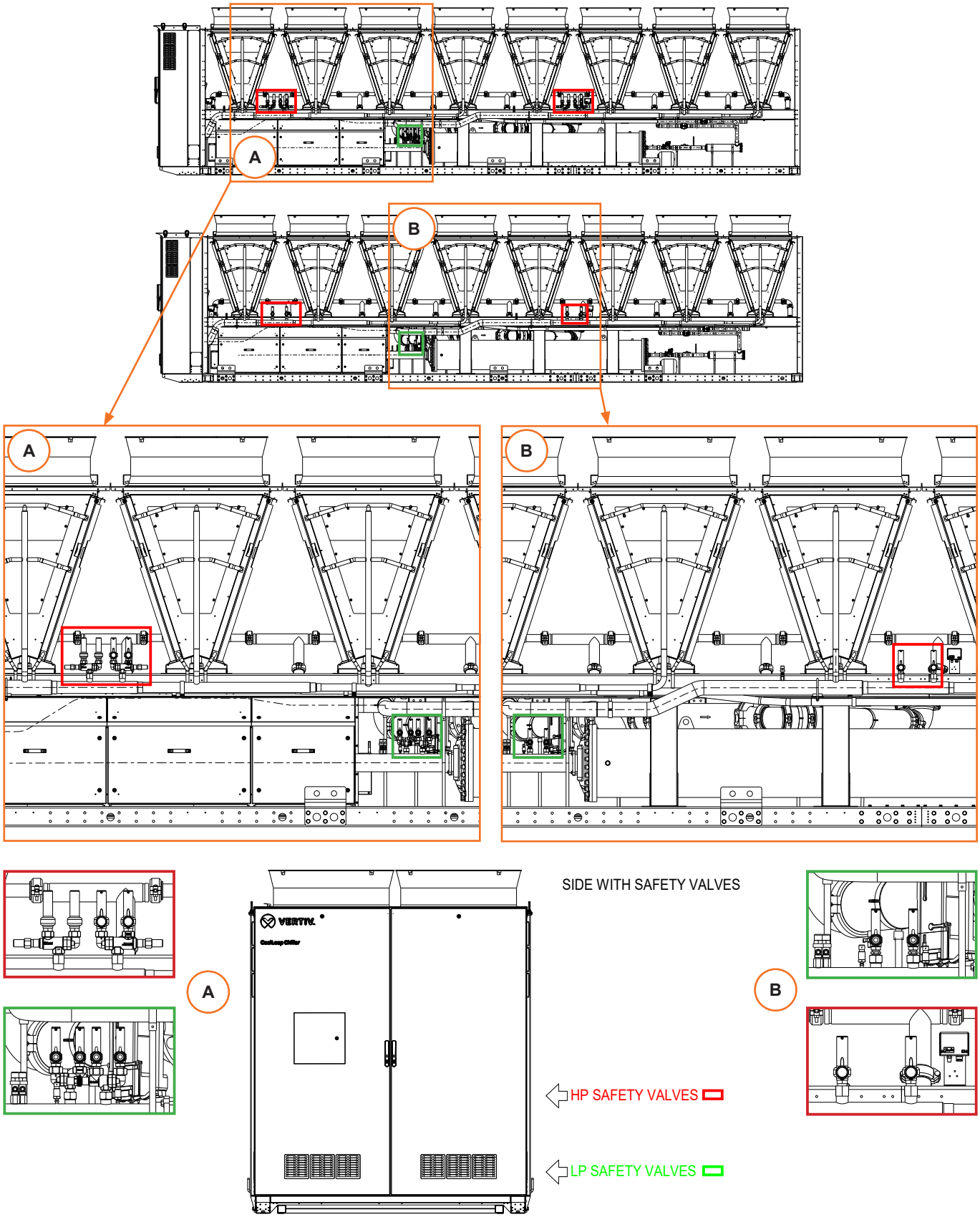
If the relief valves are installed on a change-over manifold, this is equipped with a relief valve on each of the two outlets. Only one of the two relief valves is in operation, the other one is isolated. Never leave the change-over valve in the intermediate position, i.e. with both ways open (locate the control element in the stop position). If a relief valve is removed for checking or replacement please ensure that there is always an active relief valve on each of the change-over valves installed in the unit.

The relief valve must only be removed and fully controlled and after checking that this is allowed by local regulations and authorities. This is the responsibility of the operator.

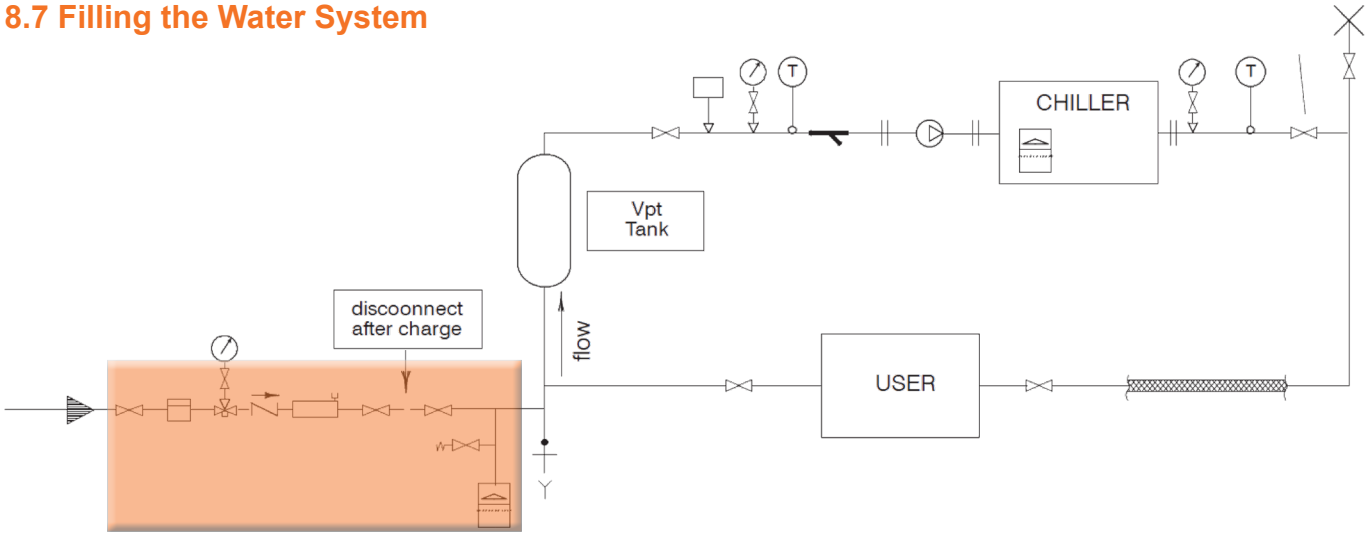
If the exchange tap is not installed, it is possible to have a ball valve installed upstream of the safety valve; to close this ball valve and proceed with maintenance operations, it is essential to break a sealed seal which must be restored when the valve opens once these operations are completed. These operations can only be done by authorized and qualified personnel according to EN 378. This is the responsibility of the operator.

Please check that this is allowed by local regulations and authorities.

Figure Safety valves positions



8.7 Filling the Water System



- Supply water through the fill group;

See *8.4 Water System Specifications* for the amount of water to charge.

- In case of low ambient temperature, add glycol: see *8.4.8 Prevent freezing for chiller or freecooling chiller*;
- To avoid stratification, run the circulation pump for at least **30** minutes after adding any glycol;
- At the end of the filling operation, disconnect the water supply tube;
- After any topping-up of water check the concentration of the glycol if necessary.

NOTICE
Always charge the hydraulic circuit with the required glycol percentage necessary for the minimum ambient temperature of the installation site. Failing to comply with this instruction shall invalidate the unit warranty.

NOTICE
In units having **A2L** gas during the first hydraulic loading of the system (or in the case of maintenance-restoration of hydraulic circuit filling following refrigerant leaks from the refrigerant circuit) it is mandatory to analyze with a gas detector (having a sensitivity of **3** gr./year) the air leaving the vents positioned on the highest parts of the **FC** exchangers and the circuit, detecting the absence of any trace of refrigerant.

NOTICE
Do not exceed the nominal operating pressure of the circuit's component.

8.8 Initial Checks

NOTE: *Follow these instructions at first start-up and also in case of restart after a long stop.*
NOTE: *Record the functional data on the Start-Up certificate.*

Electrical system

WARNING
Disconnect the power supply before doing the following checks on the electric system as explained in *8.2 Safety Instructions*.

WARNING
When installing units with **A2L** refrigerant, **before connecting the power supply through the EP main switch**, open the compressor box approaching it in total absence of possible ignition sources (ref. EN1127-1) and check the internal box atmosphere with a portable ATEX leak detector.

WARNING
After the commissioning, units with **A2L** refrigerant (even when not operating) must have the **nominal power supply continuously granted in order to keep the safety equipment functionality**. Each time the unit is physically powered-off for a continuous period for any reasons, the manual check with portable leak detector must be repeated to grant safe operation and avoid incident risks.

- Check all the cable connections particularly the main power connections on the power fuses and contactors;
- Check that all thermal protections are calibrated according the electrical data tables reported on wiring diagram.

Refrigerating system

- Open the discharge valve (and the suction valve, if installed) of the compressor and the shut-off valve on the liquid line;
- Open the valves of the refrigerating circuit that had been closed before the initial check.

Water system	• Check all water connections; • Open all isolating valves and/or water ball valve; • In case of climates with temperatures below 0°C, make sure the chilled water circuit is filled with the correct concentration of water/glycol, see *8.4.8 Prevent freezing for chiller or freecooling chiller*; • Bleed all air out of the chilled water circuit; • Verify the water flow rate and its direction; • Ensure that the thermal load is sufficient and stable for start-up; • Start the pumps, check that they rotate in the correct direction.
Covers and seals	• Make sure that all the protective covers and seals have been mounted again.
Replace the cartridge of the driers	At first start-up is recommended to replace the cartridge of the driers, see *10.7.5 Cartridge of the driers*.
Everything OK?	Power-up and prepare for normal operation: see *9. Operation*.

9. Operation

9.1 Safety Instructions

Personnel

WARNING

The operation has to be done by a qualified technician with an experience and know-how on units, **Vertiv™ iCOM3™** control board and software.
The authorized personnel must be properly trained and qualified, wear appropriate personal protective equipment and use adequate tools.

Electric System

NOTICE

The power supply should never be disconnected during normal operation, except when performing maintenance (see *10. Maintenance*).

Personal Protective Equipment

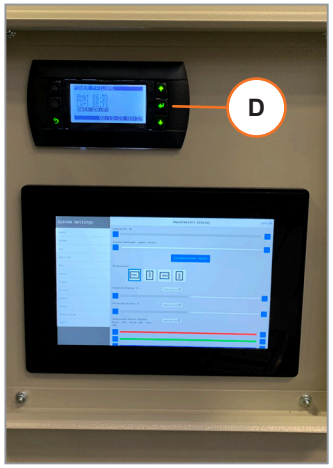
Environment

ENVIRONMENT

A misuse or an incorrect calibration of the unit leads to increased energy consumption, resulting in an economic and environmental damage.
See *10.8 Calibrations* and make reference to the *Vertiv™ iCOM3™ User Manual* for correct parameter settings.

9.2 Power-up





1. Close the disconnection device upstream the **Vertiv™ CoolLoop Trim Cooler**.
2. Close the main switch [**A**]
3. Set the general knife switch [**B**] to the position "**I**".

- Check that the **Vertiv™ iCOM3™** display [**D**] switches **ON**.
- In case of first start-up or after maintenance on the electric system, check again by a voltmeter or tester if the voltage and phase difference fall within the indicated limits.

WARNING

When installing units with **A2L** refrigerant, **before connecting the power supply through the EP main switch**, open the compressor box approaching it in total absence of possible ignition sources (ref. EN1127-1) and check the internal box atmosphere with a portable ATEX leak detector.

WARNING

After the commissioning, units with **A2L** refrigerant (even when not operating) must have the **nominal power supply continuously granted in order to keep the safety equipment functionality**. Each time the unit is physically powered-off for a continuous period for any reasons, the manual check with portable leak detector must be repeated to grant safe operation and avoid incident risks.

9.3 Preparation

NOTE: *Follow these instructions at first start-up and also in case of restart after a long stop.*

Compressor pre-heating and check

When you set the general knife switch [**B**] to the position "**I**", the compressor oil heaters are automatically powered **ON**.

NOTICE

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

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

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

At the end of the pre-heating:

- **check** that all the valves the refrigerating circuit are open;
- **check** that the compressor intake pressure is higher than 6.5 bar for R134a-R513A or higher than 4.5 bar for **R1234ze**.

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

For A2L refrigerants: Gas detector stabilizing after power ON or restart

After applying power, the instrument will enter a warm-up period to allow the sensor element to stabilize before reporting a valid output; it's possible that this time period could last about **20** minutes.

NOTE: *When you set the general knife switch [**B**] to the position "**I**", the gas detector instrument is automatically powered **ON**.*

MANDATORY: never enable starting the normal operation first start or restart (compressors start automatically) before **20** min.

MANDATORY: in case the unit is without Power for a time more than **5** minutes, it's mandatory to **STOP** the normal operation mode (switching **OFF** the unit control) and waiting **20** minutes or more (till the oil temperature is **OK**) when the Power coming back to **ON**.

NOTE: *This procedure is not necessary to apply for unit with fast start procedure because the gas detector instrument is still powered by a dedicated **UPS** safety line and because the power **OFF** time period is very short (usually less than **5** minutes); both conditions has to be checked and provided by customer for safety reasons.*

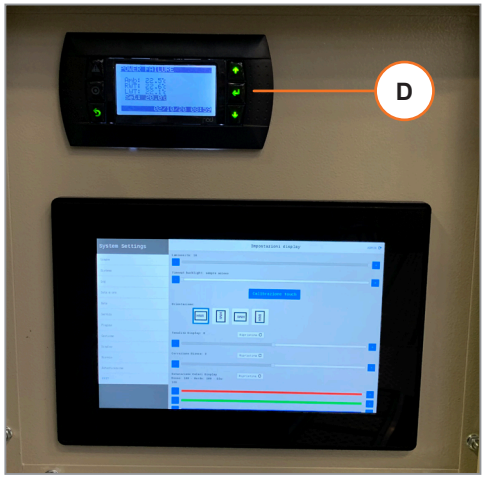
Water system

- Check the evaporator water system, which is the thermal load connected with the **Vertiv™ CoolLoop Trim Cooler**;
- Start the evaporator pumps.

To avoid an increase in the water temperature inside the evaporator, with the risk of deposit formation:

- when you are going to start the **Vertiv™ CoolLoop Trim Cooler** unit, start the pumps in advance;
- when you stop the **Vertiv™ CoolLoop Trim Cooler** system, let the pumps run for a while.

9.4 Start



NOTICE

Before starting the unit, make sure that the compressor has been heated for at least **8** hours.

- On the **Vertiv™ iCOM3™** control panel [**D**] set the switch to **ON**.

9.5 Check the Operation

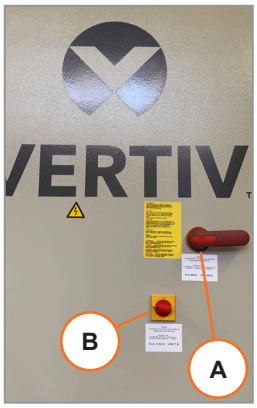
NOTICE

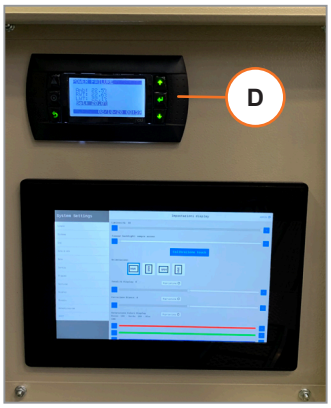
The following checks must be done:

- at first start-up;
- in case of restart after a long stop;
- at time intervals during the normal operation.

Protection Flow-switch	Check the flow switch operation (installed by the customer). • **close** the shut-off valve downstream the evaporator till the flow switch intervenes; • **check** if, without flow, the **Vertiv™ CoolLoop Trim Cooler** locks and the alarm message is displayed; • **open** again the shut-off valve downstream the evaporator.
Alarms	• Make sure that all the alarms due to protective devices interventions have been reset (see *Vertiv™ iCOM3™ User Manual*).
Water temperature	• **Check** the outlet temperature of the chilled water; • **Check** calibration of water temperature sensors; • **Check** if the set-point set on the control is reached. **NOTE:** *During the unit start-up a temperature of the water/glycol inlet higher than 26°C is allowed.* • Under standard operating conditions, **check** that the limits indicated in *6.3 Operating Limits* are not exceeded.
Control and safety devices	• **Check** the correct operation of the control and safety devices.
Compressor	• **Check** the compressor oil level. See *10.7.3 Oil charge* if you need to top-up the oil; • With the compressor at full load, **check** there are no bubbles visible in the flow indicator. If there are any, charge the unit according to *10.7.2 Refrigerant charge*.

9.6 Stop





- On the **Vertiv™ iCOM3™** control panel [**D**] set the switch to **OFF**.

In case of a short stop:

- Maintain the general knife switch [**A**] to the position "**I**" to maintain the supply to the crankcase heater.

In case of a long stop (seasonal shutdown):

1. Set the general knife switch [**A**] to the position "**0**".

This will disconnect the compressor crankcase heaters.

2. Close the main switch [**B**] to the position "**0**".
3. Close the disconnection device upstream the **Vertiv™ CoolLoop Trim Cooler**.

9.7 Restart

After a short stop	• On the **Vertiv™ iCOM3™** control panel [**D**] set the switch to **ON** (as in *9.4 Start*).
After a long stop	Do the complete procedure as described in: *9.2 Power-up*, *9.3 Preparation*, *9.4 Start*.
In case of Power failure	If the Power failure is shorter than a certain time, the **Vertiv™ CoolLoop Trim Cooler** restarts automatically. The time limits (to be managed by customer) are: • up to **4** hours without Fast Start Ramp Option; • up to **1** hour with Fast Start Ramp Option.
In case of Power failure for units with A2L refrigerant	If the Power failure is shorter than a certain time, the **Vertiv™ CoolLoop Trim Cooler** restarts automatically. The time limits (to be mandatory managed by customer) are: • up to **5** minutes with or without Fast Start Ramp Option. If the power failure is longer the **Vertiv™ CoolLoop Trim Cooler** needs a manual restart: • on the **Vertiv™ iCOM3™** control panel [**D**], clear the alarm message due to the power fault; • repeat the procedure of the previous point after a long stop.

9.8 Freecooling



Freecooling is a pre-cooling and/or cooling system of the water/glycol mixture that uses ambient air when the latter has a temperature lower than that of the return mixture. If the external temperature is low enough to dissipate the entire thermal load, the refrigeration compressors automatically turn **OFF** and the mixture temperature is controlled by the fan speed regulation. If the mixture temperature is too high, the compressors will run as long as necessary.

In the freecooling hydraulic circuit, two motorized two-way valves are installed which work in opposition: when one is open, the other is closed.

The rotation time of the actuator (90° angular rotation) is **150** seconds.

They manage the insertion of the free cooling system as well as its capacity adjustment, together with the management of the fans, if the compressors are **OFF**.

In the units configured with **Glycol Free Freecooling**, the activation of the freecooling system is managed by the inverter pump while its speed adjustment (up to the minimum limit determined by the inverter), together with the fan management, allows adjustment of the chiller capacity when the compressors are **OFF**.

9.9 Microprocessor Control

See the *Vertiv™ iCOM3™ User Manual.*

10. Maintenance

NOTICE

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

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

10.1 Safety Instructions

Personnel

WARNING

Only authorized personnel is allowed to do maintenance operations.

All work on pipes or components of the refrigerating circuit under pressure must be exclusively made by qualified staff, competent in such works.

The authorized personnel must be properly trained and qualified, wear appropriate personal protective equipment and use adequate tools.

Electric System

WARNING

Unit contains potentially **lethal voltage** in some circuits.

Risk of arc flash and electric shock.
Can cause injury or death.

- Open all local and remote unit electric power disconnect switches, verify with a voltmeter that power is **OFF** and wear protective equipment per local standard before working within the electric control enclosure;
- It is forbidden to operate on the electrical components without using insulating platforms, or in the presence of water and humidity.

WARNING

The electric connection enclosures and some components can retain a stored **high-voltage electrical charge** for up to **10** minutes.

Risk of electric shock.
Can cause serious injury or death.

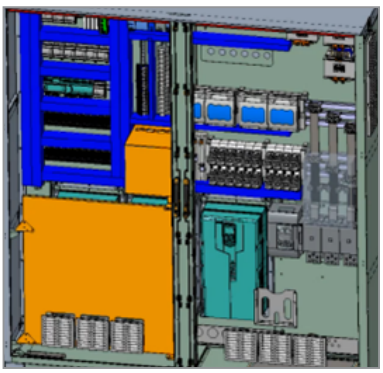
Before working within the unit electric connection enclosures proceed as follows:

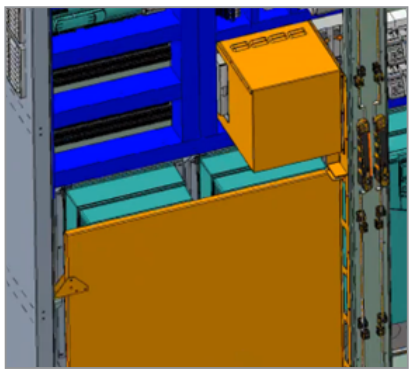
- open all local and remote unit electric power disconnect switches;
- wait **10** minutes;
- verify with a voltmeter that power is **OFF.**

Only properly trained and qualified personnel may perform repair, maintenance and cleaning.

WARNING

The components at 400V behind the left door of the electrical panel, are partially covered by a second door panel and a metal box (highlighted in orange in the pictures below) with the aim to help keeping separated the parts at 400V from the 24V and 230V (lower currents, not harmful arc flash). Such layout of covers partially protects but can't be intended as a safety equipment and **can't exclude operators from the arc flash risk**. For this reason, it is **mandatory** to **shut-off** the power before opening the doors of the electrical panel, unless it is done by trained personnel, **wearing proper safety equipment for electrical risk**.





Lockout-Tagout (LOTO)		**WARNING** Before any intervention on the electrical system or accessing the inner components: • Lock the disconnection devices by a padlock or similar tool; • Apply on the general knife switch a suitable warning plate for no operation.
High temperature		**CAUTION** The front part of the compressor and the delivery pipe and the condenser are **very hot**. • Be careful when operating nearby; • Always wear temperature resistant gloves when operating on the unit.
Safeguards		**CAUTION** After the maintenance interventions, always close the unit by refitting the relevant panels, if present, fastened by the fixing screws.
PPE		**CAUTION** Sharp edges, splinters and exposed fasteners. **Wear protective gloves** before operating on the unit.



NOTICE
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 Safety Labels

- Check regularly that the safety label is still on the unit and clearly visible. See *Annex III – Safety Labels* for safety label mapping. Replace any missing or damaged label.

10.3 Spare parts

The use of original spare parts is recommended.
When placing an order refer to "Component List" enclosed with the machine and quote the unit model and serial number.



NOTICE
If one or more compressors must be replaced, you must contact Vertiv™ Service.

10.4 Maintenance Programme

The Maintenance Programme below must be carried out by a qualified technician, preferably working under a maintenance contract.
Maintenance and component replacement intervals are based on the assumption that the equipment is operated within the specified ratings and ambient conditions. Maintenance intervals should be shortened if necessary (do to environment very dirt, or corrosive at *C4 C5 levels*, if maintenance instructions were not followed, or other causes of risk).

		1 month	3 months	6 months	12 months	when needed
Fans	Check that the fans rotate freely and without any abnormal noise. Ensure that the bearings do not heat up excessively.		x			
	Measure the fans current absorption, checking it is aligned with datasheets and plate data.		x			
	Make sure that, after maintenance activity, the electrical box of fans is properly closed and all cable glands are properly tightened to preserve the original IP protection rating.					x
Condenser, air filter and PADs	Check the conditions of the filters protecting the air exchangers and the PADs; clean them if necessary.	x				
	Check the condition of the electrical panel ventilation filters or electrical accessory compartments, if necessary replace them.		x			
	Check the condensing coils and freecooling coils and clean them if necessary.	x	x			
Control	Check that the control equipment, LEDs and display are operating correctly.		x		x	
	Check the supply voltage.		x			
	Check the operation of the compressor's oil heaters.		x			
	Check the operation of the compressors' partialization solenoid valves.				x	
	Check the conditions of the power contacts of the contactors (compressors, pumps, etc.).				x	
	Check the conditions of the remote control switch contacts.				x	
	Check the operation of the trace heating system of the hydraulic circuit (if present).				x	
	Check the operation of the electrical panel fan and heaters (if present).				x	
Electrical circuit	Check the electrical supply on all phases.				x	
	Ensure that all electrical connections are tight.				x	
	Check for signs of hot spot / discolouration on power cables.				x	
	Check the correct calibration of the safety and control devices, as well as their proper intervention.		x			
Inverter Drives	Slide-off the filter at air intake of compressor inverters and clean the mesh.		x			
	Capacitor reforming in the compressor inverters (only in case the chiller for **1** year got no power supply).				x	
	Clean with airflow the Heatsink of both the inverters of pumps and compressors.			x		x
	Replace in the inverters of compressors the Main Cooling fans and the Auxiliary Cooling fans for circuit boards every **5** years.					x
Active Harmonic Filters	Check and eventually clean with air flow the airduct of the **Active Harmonic Filters**.				x	
	Measure the relevant electrical parameters (including **THDi**) in order to keep possible deviations of the **THDi** under control. Keep a database of the (eventually) modified parameters (from the factory set to the last modification) and the corresponding **THDi** measures.				x	
Refrigeration circuit	Check for refrigerant leaks (Follow F-gas regulations).					x
	Check the condensing and evaporating pressures.	x				
	Check the compressor's current absorption, the delivery temperature and possible unusual noises.		x			
	Check the freon charge by means of the sight glass.	x				

		1 month	3 months	6 months	12 months	when needed
Refrigeration circuit	Check that the safety devices operate correctly.		x			
	Check the correct operation of the **EEV** valve (superheat between 5-8 K) included the one in the economiser circuit (if installed).	x				
	Check that the oil level indicated by the compressor sight glass is higher than the min. value.	x				
	Check the sealing of the on/off components (solenoid valves, taps, etc...).	x				
Chilled water circuit	Ensure that the are no water leaks.	x				
	Bleed any air out of the hydraulic circuit using the bleed valve on the chilled water coil.	x				
	Verify the correct water flow inlet.	x				
	Check the inlet-oulet water temperature and pressure.	x				
	Check the correct operation of the two-way valves.				x	
	Check if the system is charge with the specified glycol percentage to avoid freezing in the hydraulic circuit.			x		
	Check the pump is charged.	x				
	Measure the pump current absorption, checking it is aligned with datasheets and plate data.		x			
	Check the absence of abnormal noise coming from the pump.		x			
Pressure Relief Valves	Replace **PRV** on the refrigerant circuit periodically, according to local regulations.					x
Phase correction capacitors	Check the **Cr** [**µF**] is as indicated on component label (accepted -5% / +10%).				x	
	Check the state of aluminum can and overpressure disconnector.				x	
	In case of installation with hot climate, over voltage, transient over voltage or low power quality (harmonics) it's necessary to replace capacitors every **2** years according working conditions.					x
	In case of normal working conditions, it's necessary to replace capacitors every **4** years.					x
Refrigerant leak detector (R1234ze)	Semiconductor gas sensor element calibration by a trained technician.			x		
	Replace gas sensor element every **2** years.					x
Compressor box ventilation fans	Check fans functionality.	x				
	Replace compressor box ventilation fans every **4** years.					x
Hydraulic circuit filter	Check the conditions of the water filter; clean it or substitute it if necessary.			x		x
Sound-absorbing mats	Clean using water with medium pressure washer; use some soap with water only if sound absorbing panels are very dirty. See *chapter 8.3.3*			x		x

10.4.1 Functional and maintenance remarks for AFC with A2L

WARNING

When installing units with **A2L** refrigerant, **before connecting the power supply through the EP main switch**, open the compressor box approaching it in total absence of possible ignition sources (ref. EN1127-1) and check the internal box atmosphere with a portable ATEX leak detector.

WARNING

After the commissioning, units with **A2L** refrigerant (even when not operating) must have the **nominal power supply continuously granted in order to keep the safety equipment functionality**. Each time the unit is physically powered-off for a continuous period for any reasons, the manual check with portable leak detector must be repeated to grant safe operation and avoid incident risks.

Check any possible leakage on joints, flange, connections, sealings of refrigerant circuit according.

Necessary to have a leakage detector with sensitivity **<3** gr./year.

All servicing devices used for checking and repairing the refrigerant circuits has to be ATEX compliant.

During checking or repairing activity in case of leakage, ensure good ventilation, as accumulation of refrigerant in an enclosed space can displace oxygen and cause asphyxiation or explosions.

Engineers working on the electric or refrigeration components must be authorized, trained and fully qualified to do so according EN378.

All welding operations must be carried out by qualified specialists.

Before opening a refrigerant circuit, purge and consult the pressure gauges. Reclaim the refrigerant using a proper refrigerant reclaim device and reclaim cylinders.

The refrigerant circuit should be pumped down and then purged with nitrogen before servicing.

During a brazing operation, the refrigerant circuit should be purged with nitrogen. Also when servicing the refrigerant circuit, all ignition sources should be disabled.

Any manipulation (opening or closing) of a shut-off valve must be carried out by a qualified and authorized engineer, observing applicable standards (e.g. during draining operations). The unit must be switched **OFF** during maintenance.

NOTE: *The unit must never be left shut down with the liquid line valve closed, as liquid refrigerant can be trapped between this valve and the expansion device and lead to the risk of a pressure increase. This valve is situated on the liquid line before the filter drier box.*

During the life-time of the system, inspection and tests must be carried out in accordance with national regulations.

- Periodic inspections of the safety devices and external overpressure devices (external relief valves) must be carried out in accordance with national regulations;
- Periodic inspections for refrigerant leaks may be required depending on European or local legislation.

Please contact Vertiv™ for more information.

Repair the leak, detect and recharge the circuit with the total **R1234ze**(E) charge, as indicated on the unit name plate. Certain parts of the circuit can be isolated. Only charge liquid refrigerant **R1234ze**(E) at the liquid line. Always ensure you are using the correct refrigerant type before recharging the unit. Charging any refrigerant other than the original type (**R1234ze**(E)) will impair machine operation and can even lead to a destruction of the compressors. The compressors operating with this refrigerant type are lubricated with a synthetic polyester oil as indicated on stickers attached on compressor's frame.

RISK OF EXPLOSION: **Never use** air or a gas containing oxygen during leak tests to purge lines or to pressurize the unit. Pressurized air mixtures or gases containing oxygen can be the cause of an explosion.
Only use dry nitrogen for leak tests, possibly with an appropriate tracer gas.

If the recommendations above are not observed, this can have serious or even fatal consequences and damage the installation.

Never exceed the specified maximum operating pressures.

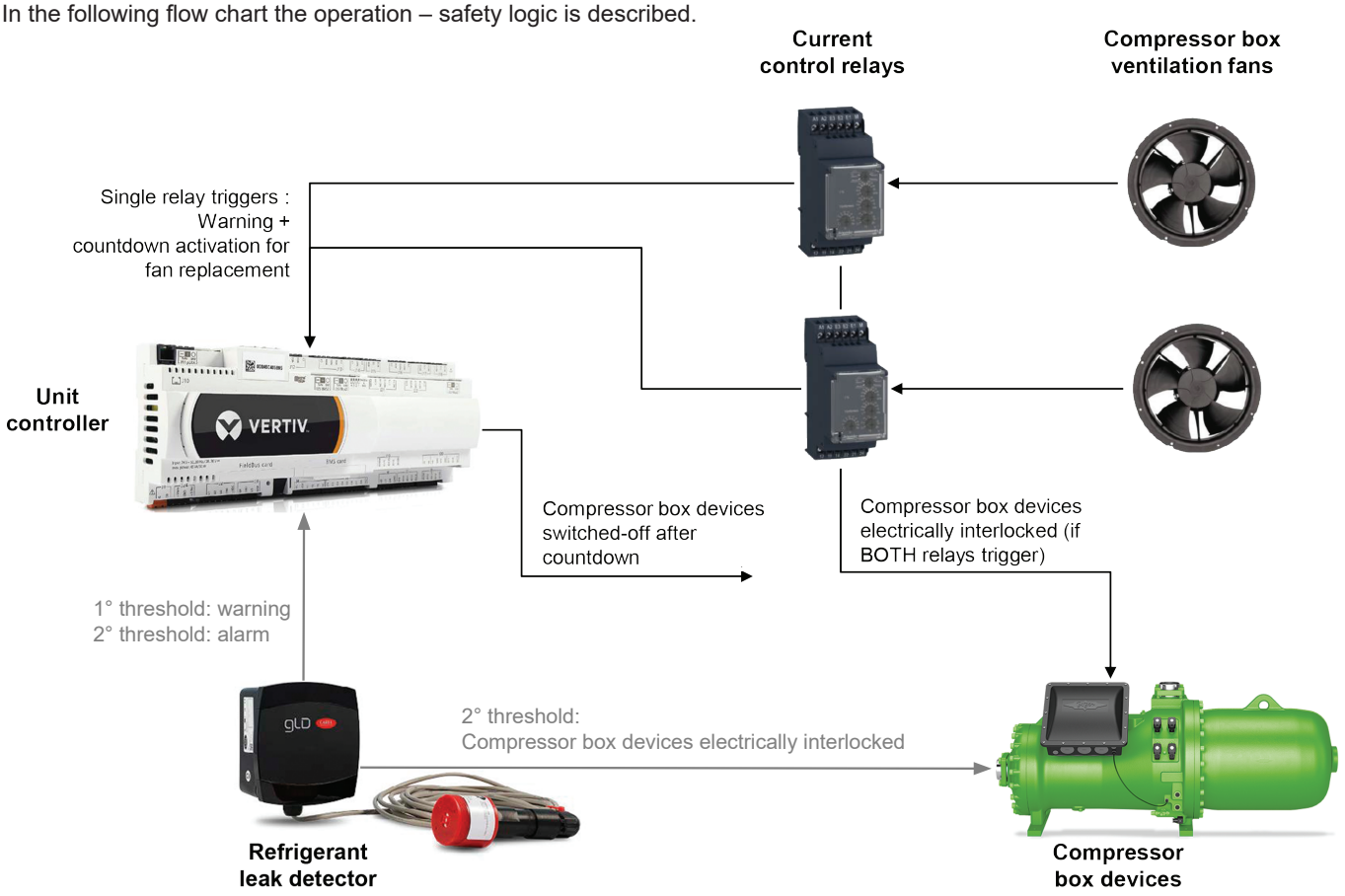
Verify the allowable maximum high and low-side test pressures by checking the instructions in this manual and the pressures given on the unit name plate.

Do not unweld or flamecut the refrigerant lines or any refrigerant circuit component until all refrigerant (liquid and vapour) as well as the oil have been removed from chiller. Traces of vapour should be displaced with dry nitrogen.

The compressors box has a continuous safety mechanical ventilation system necessary to declassify the zone according ATEX EU directive.

The logic of mechanical ventilation, alarm management shall also be assured with an emergency controls (connected to unit control by modbus) located outside the compressor box (only sniffer sensor is located at the ATEX fan's inlet); a proof of airflow in case of leakage is assured by fans & sensor location and a proper safety LAB testing.

In the following flow chart the operation – safety logic is described.



Please consult leakage sensor control for respond time (normally always less than **20** minutes), settings of lower and alarm threshold (150 – 500 ppm) taking care that full scale is at 1000 ppm.

- The sensor should include internal self-checking diagnostics;
- The sensor should be set with lowest value from **FCL** (**Flammable Concentration Limit**) or 50% of **PL** (**Practical Limit**) as defined by EN-378;
- For **R1234ze**(E), the different limits are defined as follow:
  - **LFL** - **Lower Flammability Limit** = 65,000 ppm;
  - **FCL** - **Flammable Concentration Limit** equal 25% of the **LFL** = 16,000 ppm.
- The ventilation system, refrigerant sensor and alarm system should be routinely inspected as part of the maintenance programmed of the chiller:

During Commissioning:

- Check leak detector calibration;
- Check leak detector leds for proper operation;
- Check the correct functioning of the buzzer and relay relating to gas leak detection;
- Check the leak detector signal transmission to the unit controller. Verify that disconnecting the device generates an alarm in the unit.

Periodic Maintenance

For **SC** semiconductor element: **6** months after commissioning and every **12** months thereafter including ATEX fans ventilation check.

10.4.2 Components for calibration of Gas Leak Detector

WARNING: Semiconductor sensitive elements should be checked after exposure to significant concentrations of gas, which can shorten the sensor lifetime and/or reduce its sensitivity.

Component replacement:

- **Gas Detector Sensor** has a typical sensor lifetime about **4** years, Vertiv™ requests to replace it every **2** years;
- **Compressor box ventilation fans** has a typical sensor lifetime about **8** years, Vertiv™ requests to replace it every **4** years.

The calibration procedure is performed periodically and involves introducing a known gas concentration at the sensor inlet, using the **calibration kit**. The gas cylinder and pressure adapter to perform the calibration need to be procured separately.



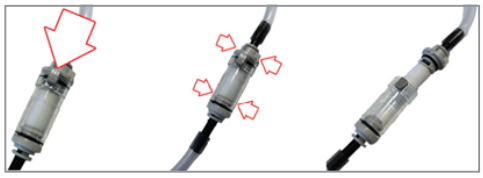
Calibration kit with adapter;



Once the required gas cylinder is available, screw the pressure reducer onto the cylinder, keeping the valve closed so that no gas is released;



Screw the highlighted part of the calibration kit onto the sensor on the product being calibrated;



Remove the cylinder by pressing the lever and then detaching the two parts;



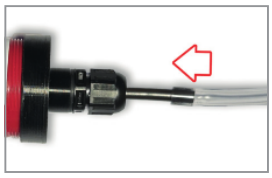
Immerse the cylinder in a container filled with tap water for a **few seconds**;



Place it back in the previous position and close the filter, as shown in the figure.
Note the direction of air flow (towards the sensor);

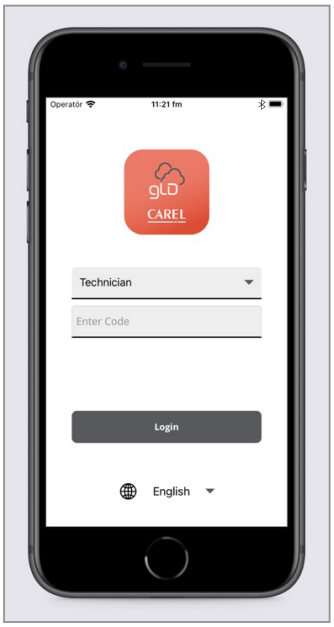


Assemble the various components as shown in the figure, without connecting the tube to the **GLD**.
Open the regulator on the gas cylinder to a pressure of around 0.5 l/min. and let the gas flow for a **few seconds** without the calibration adapter connected to the sensor, then connect the tube to the **GLD**;



Alternatively, to vent any residual air from the kit, before fixing the cap to the sensor, let some gas flow out for a **few seconds**.

10.4.3 Calibration procedure of Gas Leak Sensor by using the app



Before connecting to the device via the **Rileva TE app**, first make sure that the **Bluetooth** ᛒ **connection** and **Geolocation** are enabled on the smartphone used.

Make sure that the **Bluetooth** mode on the **GLD** small has been activated using the magnetic latch as described in the previous chapters. Refer to the Functions chapter of the **Rileva TE app** manual for details of all the app's features.

1. **Start calibration** on the navigation bar;

   Before connecting the calibration kit make sure the sensor is ready and free of gas or other sources of pollution;

   Click **Fresh air calibration** at the bottom right, then select **Next**.
2. To perform the calibration, the specific gas indicated as the "**calibration GAS**" needs to be used;

   Enter the **gas cylinder reference** (serial number of the reference gas or other information to be shown on the certificate);

   Enter the **concentration of the gas used for calibration**;

   Click **send to device** to set the gas concentration used for calibration.
3. Supply the gas at the known concentration using the calibration kit, suitably installed as described in the previous chapter;

   Wait about **1 minute** until the gas concentration stabilizes;

   Click **Span Calibration** to set the calibration concentration.
4. Enter the **room temperature** and **relative humidity**;

   These values will be entered on the calibration certificate to indicate the environmental conditions during calibration. It is not necessary to use a calibrated instrument to perform this measurement, an indicative value is sufficient.
5. Verify the summary screen, checking that all the information has been entered correctly before generating the calibration report.
6. **Save the calibration report**;

   Use **File manager** to share the calibration report via **email**.
7. Correct completion of the calibration process can be verified by checking that the value of "**Days since last calibration**" has been updated to 0.

Available on the App Store ANDROID APP ON Google play

10.5 Coils cleaning

Periodic cleaning can reduce the extent of corrosion and is necessary for the continuos service of **Microchannel (MC)**. In the *table 26* below, the guidelines for application of **MC** in different atmosferic corrosivity categories according to ISO 9223:2012 standard:

Tab. 26 - The guidelines for MC coil coating selection for different atmosferic corrosivity category

	Athmospheric Corrosivity ISO 922	C1 - C2	C3		C4	C5	CX
			Inland	Coastal			
	Corrosivity	Very Low - Low	Medium		High	Very High	Extreme
	Typical enviroments / examples	Indoor, Rural areas	Urban areas	Urban areas	Polluted Urban, Industrial, coastal areas	Very High pollution & salt deposition areas	Extreme Industrial, costal areas
Corrosion Resistance	digit 13 = 0/A	OK	OK	AP	NR	NR	NR
	digit 13 = 1/B	OK	OK	OK	OK	AP	NR
	digit 13 = 2/C	OK	OK	OK	OK	OK	NR

OK: **Recommended**;
AP: **Acceptable** when protection is applied, life mat be shortened. Protection could be a additional separating wall or filter screen;
NR: **Not Recommended**;

According to the atmosferic corrosivity, the frequency of cleaning is suggested to be not less than the one indicated in the table. Particular adverse conditions of the installation site (dust, sand, etc.) may require significant higher frequency of cleaning.

Tab. 27 - Frequency indication for Cleaning Procedures based on different areas

	Athmospheric Corrosivity ISO 922	C1 - C2	C3		C4	C5	CX
			Inland	Coastal			
	Corrosivity	Very Low - Low	Medium		High	Very High	Extreme
	Typical enviroments / examples	Indoor, Rural areas	Urban areas	Urban areas	Polluted Urban, Industrial, coastal areas	Very High pollution & salt deposition areas	Extreme Industrial, costal areas
Cleaning Frequency	Visual Inspection	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
	Water Rinse Cleaning	Annually	Once a quarter	Once a quarter	Monthly	Monthly	Monthly
	Cleaner Cleaning	Biannually	Biannually	Biannually	Quarterly	Quarterly	Quarterly

Obstructions due to dust, pollution, etc. accumulated between the fins of the coil, they can be removed by washing under pressure.

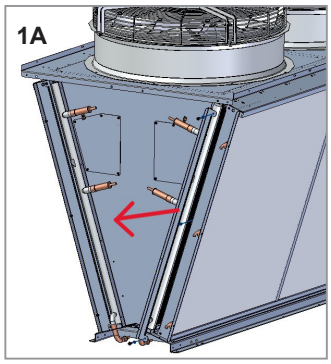
This should be done periodically.

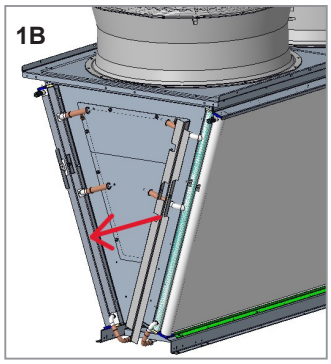
Before operating:

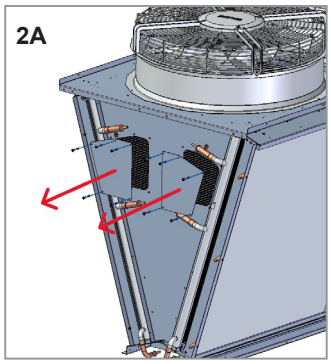
1. Disconnect the unit from the power supply;
2. Wait for the fans to stop completely;
3. Make sure that the fan blades cannot move for any reason (for example: wind). Lock them mechanically to avoid accidental contact with the rotating blades;
4. If present, remove the adiabatic system as described in the manual *Adiabatic System for Liebert® AFC (code10049109)*;
5. If present, remove the air filters and the "**V**" shaped panels;
6. Remove surface dirt, leaves, fibers, etc. with a vacuum cleaner or a soft bristle (do not impact or scrape the coil with the vacuum tube, air nozzle, etc.).

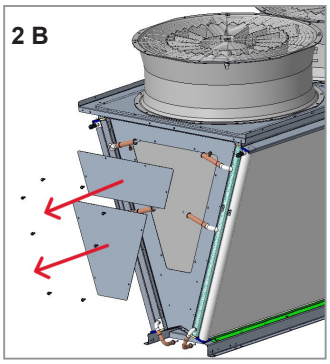
NOTICE
In the following instruction, the **pictures A** show the configuration with **Finned tube coil** in Freecooling, while the **pictures B** show the configuration with **Microchannel coil** in Freecooling. The maintenance operations are the same, just slightly different geometry of components.

7. Remove the inspection side rail [**1A-B**] and the covers [**2A-B**] placed in the lateral "**V**" shaped plate;

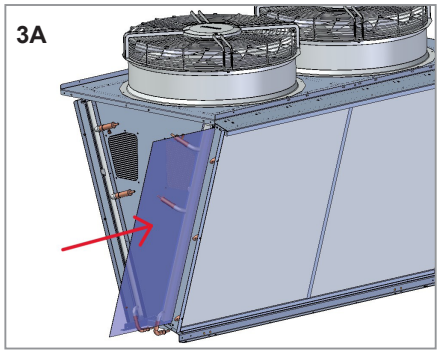


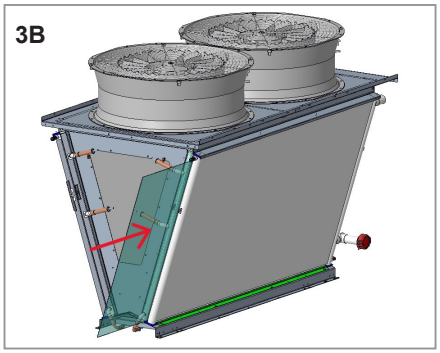




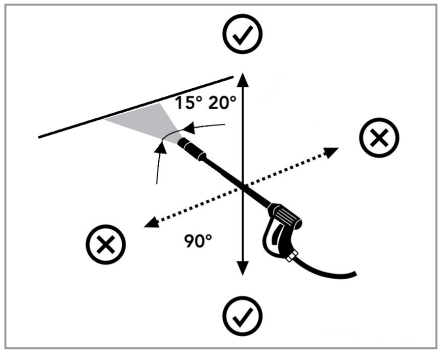


8. Insert the separation panel between the condensing and the freecooling coils [**3A-B**]. If there is a drainage channel in the separation panel, position it downwards. Ask to Vertiv™ service and get the separation panel as part of the service kit for the unit. Repeat this operation to both sides of the chiller, for each coil;





9. Wash the freecooling coil with a pressure washer maintaining a distance of at least **20** cm. The maximum pressure of the cleaning equipment must **not exceed 4 bar** in case of microchannel and in the case of a finned tube coil **2 bar**. The water outlet angle for the high pressure cleaning equipment must be between **15°** and **20°**, never use direct water jet mode for cleaning. The temperature of the cleaning fluid **must not exceed 55°C**;



CAUTION
Higher pressures and/or the use of the pressure washer with a distance of less than **20** cm. from the coil surface could damage the fins of the freecooling coil.

10. Dry the freecooling coil with an air compressor;
11. Entering from the side holes (or if not possible from the upper holes obtained by removing the fans) wash the condensing coil from the inside using a pressure washer maintaining a distance of at least **10** cm. The maximum pressure of the cleaning equipment must not exceed 4 bar. The water outlet angle for the high pressure cleaning equipment must be between 15°C and 20°C, never use direct water jet mode for cleaning. The temperature of the cleaning fluid must not exceed 55°C.
For this purpose the fans could be removed.

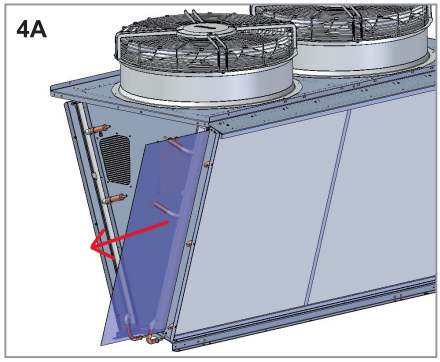
CAUTION
Higher pressures and/or the use of the pressure washer with a distance of less than **10** cm. from the battery surface could damage the fins of the microchannel coil.

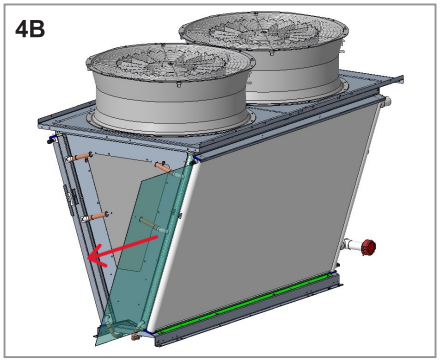
Do not use chemicals to wash the microchannel condenser.
This can lead to corrosion!

12. Dry the condensing coil with an air compressor;

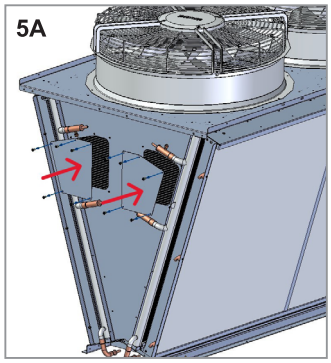
CAUTION
Climbing on the roof of the machine is prohibited without personal protection devices as required by the safety regulations in force in the place of installation. This also applies to maintenance of the fans for reasons other than cleaning the exchangers.

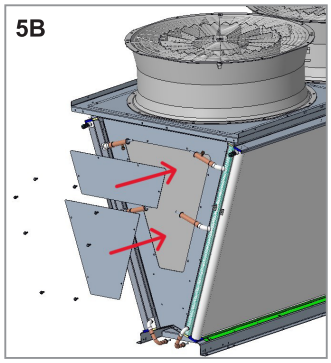
13. Remove the separation panel inserted between the freecooling and the condensing coil [**4A-B**];

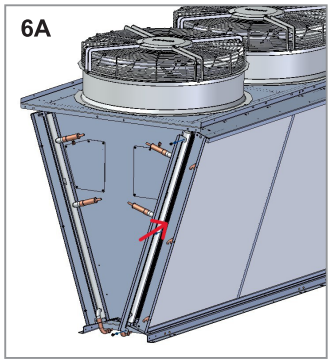


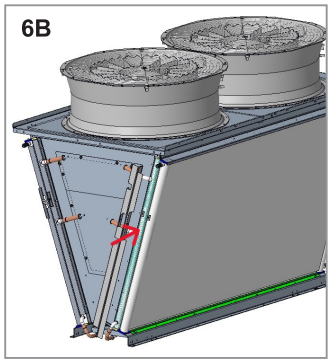


14. If fans were removed, then reinstall them. Close the covers [**5A-B**] in the lateral "**V**" shaped plate and insert the inspection side rail [**6A-B**].









10.6 Lubrication of pumps

The bearings of motors with power up to 11 kW are greased for life and therefore do not require lubrication.

The bearings of motors with power equal to or greater than 11 kW must be lubricated in accordance with the indications on the motor nameplate, in particular observing the required intervals.

The engine must be lubricated with lithium-based grease that meets the following specifications:

- **NLGI** grade 2 or 3;
- Base oil viscosity: 70 to 150 **cSt** at 40°C (approximately +104°F);
- Temperature range: -30°C (-22°F approximately) to 140°C (+284°F approximately) in continuous operation.

10.7 Refrigeration System

10.7.1 Inspection

- Check that the refrigeration pipes are firmly fixed. The refrigeration pipes shall not shake with the vibration of wall, earth or equipment frame. Otherwise reinforce the refrigeration pipes with fasteners;
- Check that there is no oil on the accessories of all refrigeration pipes, and make sure that the pipes do not leak.

10.7.2 Refrigerant charge

Before shipment each unit is charged with the right amount of refrigerant and oil.
You may need to do again the refrigerant charge in case of interventions on the refrigerating circuit.

NOTICE

Never use the compressor for the system vacuum with **A1** refrigerant (this invalidates the warranty).

NOTICE

Never use the compressor for the system vacuum with **A2L** refrigerant: possible entry of air in the refrigerant circuit could create the hazard risk of explosion.

NOTICE

It is important to carry out charging correctly.
An excess of refrigerant causes an increase in sub-cooling and consequent operating difficulties in the hot season.
A shortage of charge generates an increase in superheating and possible compressor stoppages.
Whenever work is carried out on the unit, ensure afterwards that the working conditions are correct, checking subcooling and superheating.

NOTICE

Never use the compressor for the system vacuum with **A2L** refrigerant: possible entry of air in the refrigerant circuit could create the hazard risk of explosion.

ENVIRONMENT

While repairing the refrigerating circuit recover all the refrigerant in a container: **do not** allow it to escape.

Before starting the refrigerant charge	• Ensure there are no water leaks; • Check the refrigerant charge in the refrigerating circuit: a unit originally charged by the manufacturer with a certain refrigerant cannot be charged with other refrigerant; • Apply to the Technical Support Department if you need more information.
Do the charge	• Charge with the compressor in operation, by connecting the gas cylinder with the charge connector after the thermostatic expansion valve; • Drain the connection pipe between the cylinder and the charging point; tighten the seal joint and then start charging the unit; • It is imperative that the cylinder is weighed both before and after the operation; • Charge the unit until the bubbles in the sight glass have disappeared and the working conditions of the entire refrigeration circuit have returned to normal (sub-cooling and superheating within the limits indicated below).
Measure the superheat	• Detect the temperature on the suction line, close to the bulb of the thermostatic expansion valve, using a contact thermometer; • Connect a pressure gauge (by max. a 30 cm. pipe) with the Schraeder connection and read the corresponding saturated evaporating temperature; • The superheat is the difference between the two readings; • Verify that the superheat is 4°- 8°C.
Measure the sub-cooling	• Detect the temperature on the liquid line using a contact thermometer; • Connect a pressure gauge (by max. a 30 cm. pipe) with the Schraeder connection on the liquid line and read the corresponding saturated condensing temperature; • The sub-cooling is the difference between the two readings; • Verify that at the condenser outlet, sub-cooling is 4°- 8°C.
Check the oil level	Let the compressors run for a short time, then check the oil level for each compressor.
Check the operating conditions	With the pressure gauges connected, check: - the working pressures and that; - the evaporation temperature is lower than the water temperature exiting the evaporator. For a correct system testing, also check the compressor discharge temperature: - with the indicated over-heating and sub-cooling data, it must be about 15° - 20°C higher than the condensing temperature for **R134a**, 10° - 15°C higher for **R513A**, 8°-12°C higher for **R1234ze**; - it must never exceed 95° - 100°C.

10.7.3 Oil charge

Before shipment each unit is charged with the right amount of refrigerant and oil.
If there has been any loss of oil then this must be topped up as follows.

NOTICE
PAY ATTENTION on the type of synthetic polyester oil as indicated on stickers attached on compressor's frame; on **R1234ze** units there are two different type of oil between each circuit (**BSE170** for fixed screw, **BSE170 L** on inverter screw).

NOTICE
The oil changes according to the type of used refrigerant and the type of compressor; please refer to stickers attached on compressor's frame for the correct synthetic polyester oil type.
Contact the Technical Support Department for the specifications of the oil to be used for topping up.
Top-ups of up to 20-30% of the total amount of oil contained in the compressor crankcase are permitted; for larger percentages contact the technical support department.

NOTICE
Never mix different oils together.
Clean the piping completely before changing the type of oil used.

Prepare the oil	• Take a clean, dry, transparent container (with volume calibrations) and fill it with at least twice the amount of oil required.
Prepare the compressor	• Isolate the compressor by closing the delivery and suction shut-off valves (or the one on the liquid line); • Connect to the fittings on the compressor body (Schraeder valves) and empty it of refrigerant until atmospheric pressure (1 bar) is reached.
Refill with oil	• Using a pipe, connect the oil container to the oil service shut-off valve on the lower central part of the compressor; • Open the oil service shut-off valve lifting the container, so that the oil flows by gravity; • Charge the required quantity of oil (make sure the tube always remains below the oil level).
Restore the compressor operation	• Close the oil service shut-off valve; • Open the shut-off valves of the compressor and on the refrigerating circuit; • Restore the drained refrigerant charge (see *10.7.2 Refrigerant charge*).

10.7.4 Compressor maintenance schedule - checks and tests

Compressor reverse direction	To protect against reverse rotation when stopped, a check valve is incorporated under the compressor's delivery valve. If the compressor runs in reverse direction for more than **5** seconds after **switch-OFF**, the valve may be damaged and should be replaced.
Periodic check	Check the correct functioning every **5.000** compressor working hours.
Bearings	Screw compressors are equipped with fatigue resistant bearings, therefore replacement is not necessary provided that the refrigerant circuits are operated under standard conditions within the operating limits and respecting the indicated maintenance schedule. Bearing wear detection is to be carried out by sound analysis. The recommended inspection interval is every **10.000** compressor working hours. For preventive maintenance, the recommended interval for replacing the bearings is every **40.000** working hours of the compressors. Anyway, under the standard operating conditions of the **Vertiv™ CoolLoop Trim Cooler** units (resulting from the airconditioning application where the condensation is mainly lower than 50°C in one operating year) the life limits of the bearings are not reached. Due to occasional variations of the compressor standard operating conditions, such as: lack of oil, moisture in the refrigerant, insufficient superheating or thermal overload, the bearings may need to be replaced. Please contact our Service department if it's necessary to replace the compressor's bearings: • Only authorized service centers are authorized to open the screw compressor.
Motor	It is important to check the motor wear by measuring the resistance of the insulation of its windings. The recommended inspection interval is every **10.000** compressor working hours.

10.7.5 Cartridge of the driers

Replace the cartridges

Vertiv™ CoolLoop Trim Cooler is equipped with a shut-off valve on the liquid line upstream of the refrigerant filter (see *Annex II - Refrigerating Circuit*).

- shut-off the ball valve on the liquid line and the **EEV**;
- suck out the refrigerant from the filter dryer;
- replace the filter dryer;
- create vacuum;
- open the shut-off valve.

ENVIRONMENT
The used cartridges are hazardous waste and must be disposed according with the local norms in force.

10.8 Calibrations

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

10.8.1 Safety devices

The **Vertiv™ CoolLoop Trim Cooler** has been already tested and calibrated by the manufacturer.
The following setting values are used for **R515B** and **R1234ze**:

Component	Settings for R1234ze and R515B models
Safety valves	High Pressure Side (**HP**): 22 barg Low Pressure Side (**LP**): 14 barg
High pressure switches	STOP: 20 barg START: 16 barg DIFF.: 4 barg (fixed)
Low Pressure switches (*)	STOP: 0,0 barg START: 0,2 barg DIFF.: 0,2 barg
Antivacuum Low Pressure switches	STOP: -0,2 barg START: 0,5 barg DIFF.: 0,7 barg

NOTE: *(*) The low pressure side is managed by electronic control **Vertiv™ iCOM3™**, not by electromechanical devices.*

10.8.2 Electronic expansion valve

The valve has already been factory-set and superheat should be reset only when it's not between 6°C and 9°C or it's present oil foam (visible on compressor's oil sight glass).

NOTICE
This operation must be performed by an experienced refrigeration technician.

NOTICE
Stop the relevant compressor before changing the **EEV** superheat setpoint.

Preparation	Before beginning this calibration be sure that the refrigerant charge is correct: do the subcooling measurement as specified in *10.7.2 Refrigerant charge*).
Setting	Compressor's suction pressure, temperature and superheat can be read on **Vertiv™ iCOM3** control display as described in the suitable *Vertiv™ iCOM3™ User Manual* available on the machine. Use **Vertiv™ iCOM3™** for resetting the superheat.
NOTE:	*If the superheat is too low, there is a risk of poor lubrication and consequent breakage of the compressor as a result of pressure shock.* *If the superheat is too high the output of the system is limited and the compressor overheats.*

10.8.3 Chiller serving special plant

The units are capable of cooling a water-glycol mixture to temperatures close to 0°C without the need for significant modifications.
In the case of modification, the set values of the safety and control components must also be modified.
This can be carried out in the factory (at the time of testing) or at the time of installation, only by qualified and authorized personnel.

10.9 Water System

Glycol

In winter, if the system is stopped, the water inside the exchangers can freeze damaging the system irreparably.

See *8.4.8 Prevent freezing for chiller or freecooling chiller*.

NOTICE
Always charge the hydraulic circuit with the required glycol % necessary for the minimum ambient temperature of the installation site.
Failing to comply with this instruction shall invalidate the unit warranty.

Draining

Otherwise drain the system completely, using the suitable shut-off valves arranged in the exchangers and in the circuit, trying to drain the water residues blowing dehydrated nitrogen in the lines. Keep a small pressurization on the hydraulic circuit with nitrogen for long stock periods because the humidity on the circuit with oxygen (present in the air) could start in a corrosion process inside the exchangers piping.

10.9.1 Cleaning

Exchangers cleaning may be performed only with chemical method, using commercially available products with a dual action, that is, the removal of the scale and the prevention of corrosion.
A recommended product is **P3 T288** by **Henkel**.

10.9.2 Hydraulic filter cleaning

After having performed the glycol loading and flushing operations, the respective freecooling valves must be opened. At this point, the water filter must be checked and eventually cleaned from impurities present in the user circuit.
This must be done during the commissioning phase and at regular intervals depending on the cleanliness conditions of the user circuit. The need can be identified using the pressure gauges inserted upstream and downstream of the filter (**DP** > approximately 0.25 bar).
To facilitate these operations, two interception valves are present in the machine to remove this component.

10.10 Maintenance of the inverter of Compressors

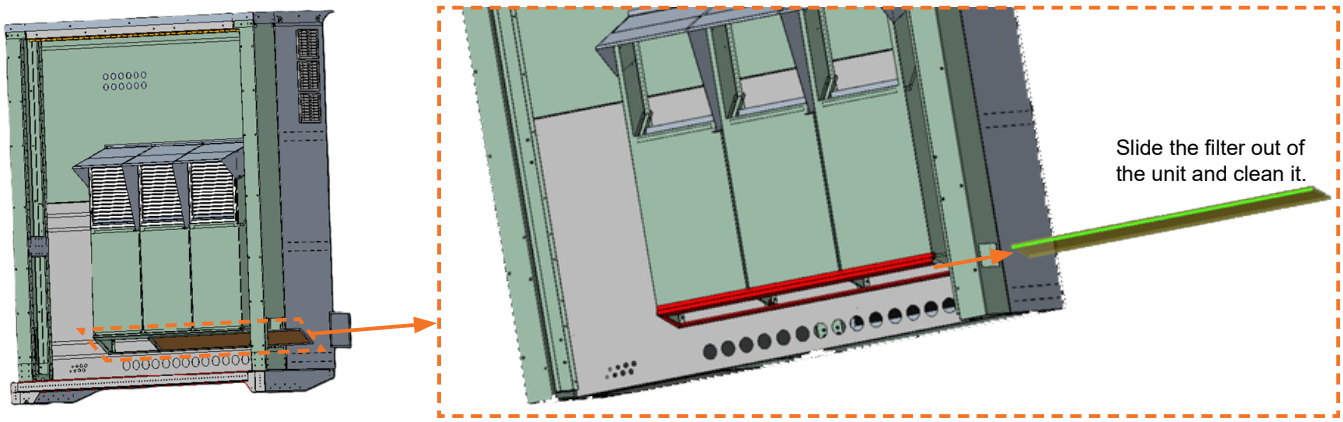
WARNING: Stop the drive and disconnect it from the power line. Wait for **10** minutes and then make sure by measuring that there is **NO voltage**, otherwise there's serious **risk of arc flash** and **electric shock** to cause **serious injuries or death**.

Do not do insulation or voltage withstand tests on the drive.

Cleaning the air filter
At the air intake of the inverter heatsink it is present a filter with rough mesh air filter to keep dirty away from entering the ventilation channel. The air filter at the intake can be removed from the side of the chiller unit and cleaned, you get the access by removing a metal plate fixed with screws.

WARNING: Keep 1.5 m. free space at the left side of each chiller, it is mandatory to extract the filter.

WARNING: don't clean with water jet the filter mounted on the unit, because the water jet would go through its rough mesh, reach the fans of the inverter, hit them and damage (although they are IP55, it doesn't mean they are mechanically resistant to such a pressure on the blades).



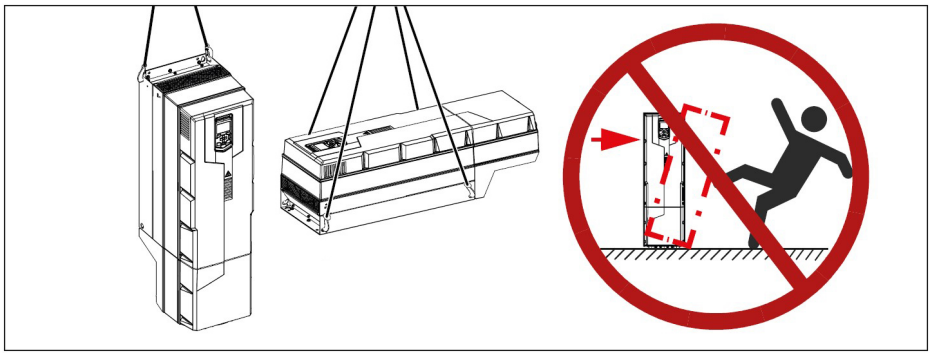
10.11 Cleaning or replacement of the inverter drive

WARNING!
Obey the safety instructions of the drive. If you ignore them, **injury or death**, or **damage to the equipment** can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

1. Stop the drive and do the steps in section Electrical safety precautions before you start the work. Disconnect all possible voltage sources. Make sure that re-connection is not possible;

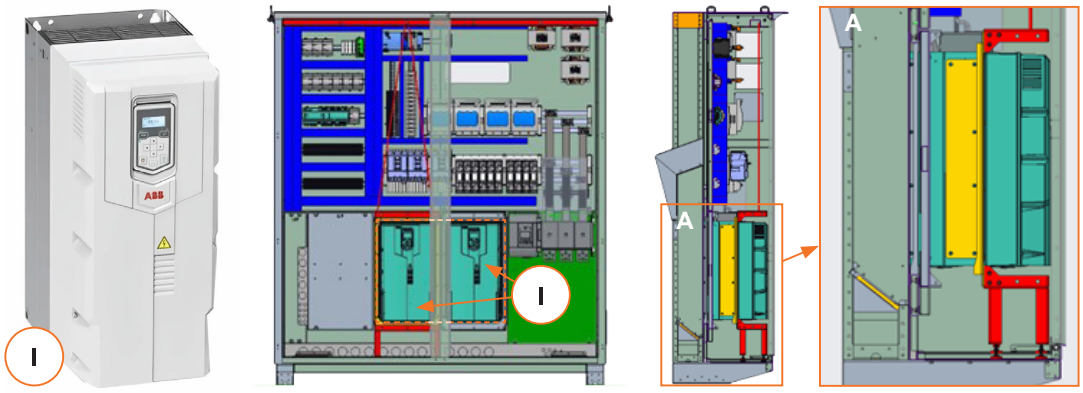
IMPORTANT! Repeat the measurement also with the **DC** voltage setting of the tester. Measure between each phase and ground. There is a risk of dangerous **DC** voltage charging due to leakage capacitances of the motor circuit. This voltage can remain charged for a long time after the drive **Power-OFF**. The measurement discharges the voltage.

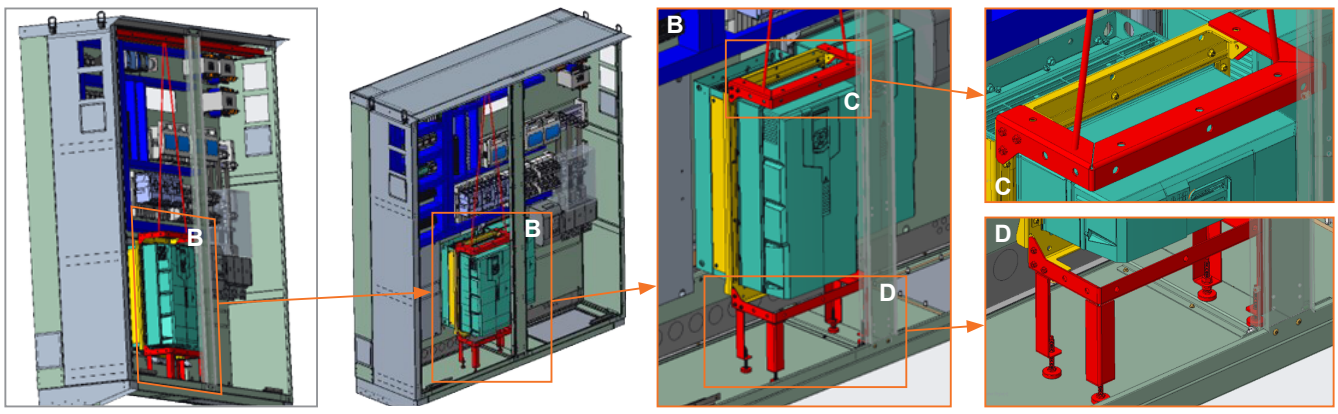
2. Lift a heavy drive with a lifting device. Use the designated lifting points. The drive is heavy (can be 100 kg.) and its center of gravity is high. Be careful when handling a tall module. The module overturns easily because it is heavy and has a high center of gravity. Whenever possible, secure the module with chains. **Do not** leave an unsupported module unattended especially on a sloping floor. An overturning drive can cause **physical injury**;





3. Vertiv™ offers a service kit to hold the **inverter driver** [**I**] during cleaning or replacement. It includes a skid [**D**] to mount at the bottom of the inverter flange, a handle [**C**] to mount at the top of the inverter flange, and a beam [**A**] to fix near the electrical panel roof, where to fix a rope and hang the **inverter driver** [**I**] at the lifting hoods of the handle (remove always the **inverter** with skid and handle mounted to its **flange**). Use proper belt or sling to rise [**B**] the **inverter** in a safe manner, consider the heavy weight when you choose the way to lift it. **Two people** might be necessary to lift the **inverter driver** [**I**], rather than a hoist





or other suitable lifting devices compatible with safety norms. The kit lets safely remove the **inverter driver** [I] from its position and operate for standard maintenance of the back heatsink for its cleaning (as per instructions in following paragraphs);

4. Clean the exterior of the drive. Use:
   - vacuum cleaner with an antistatic hose and nozzle;
   - soft brush;
   - dry or damp (not wet) cleaning cloth. Moisten with clean water, or mild detergent (**pH** between 5-9 for metal, **pH** between 5-7 for plastic).

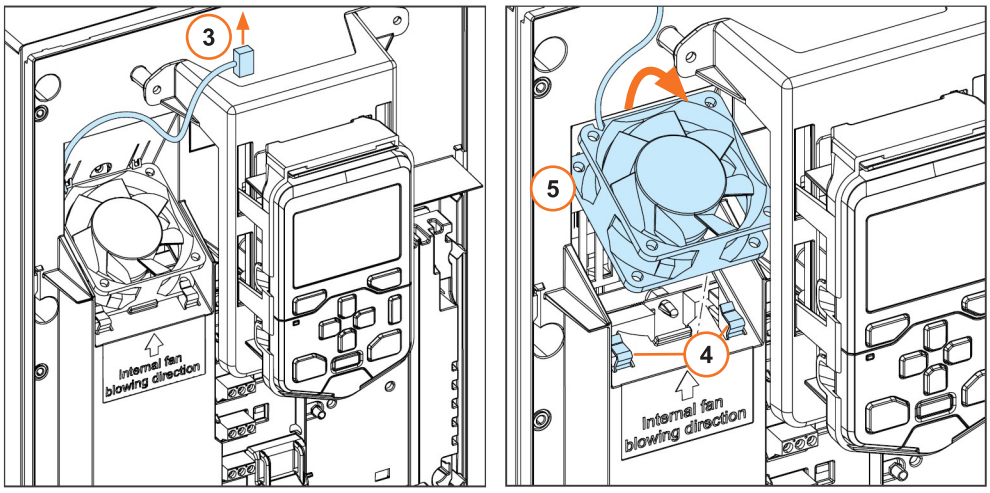
WARNING!
Prevent water from entering any of the parts of the drive. Although the back of the driver is IP55, the front part is IP21: never use excessive water during cleaning and dry thoroughly.

5. **Do not** cover the air inlet or outlet when the drive is running.

WARNING!
If the drive is in remote control mode, you cannot stop or start the drive with the control panel.

10.11.1 Internal Fan

1. **Stop** the **drive** and disconnect it from the power line. Wait for **5** minutes and then make sure by measuring that there is **NO VOLTAGE**. See section Electrical safety precautions before you start the work;
2. **Remove** the front cover;
3. **Unplug** fan power supply wires from the drive;
4. **Release** the retaining clips;
5. **Lift** the fan **OFF**;
6. **Install** the new fan in reverse order.



Note: *Make sure that the arrow on the fan points up.*

10.11.2 Cleaning the heatsink of the inverter

The **drive module heatsink fins** pick up dust from the cooling air. The **drive** runs into overtemperature warnings and faults if the heatsink is not clean. When necessary, suggested at least **every year** in case of continuous operation, clean the heatsink as follows:

Use the required personal protective equipment. **Wear protective gloves** and **long sleeves**. Some parts have **sharp edges**.

WARNING Use a vacuum cleaner with antistatic hose and nozzle, and wear a grounding wristband. Using a normal vacuum cleaner creates static discharges which can damage circuit boards.

1. **Stop** the drive and do the steps in section *Electrical safety* precautions before you start the work;
2. **Remove** the cooling fan module. See the specific instructions in the next *paragraph 10.11.3*;
3. **Blow dry**, **clean** and oil-free compressed air the heatsing of the inverter from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust. If there is a risk of dust entering other equipment, do the cleaning in another room;
4. **Reinstall** the cooling fans.

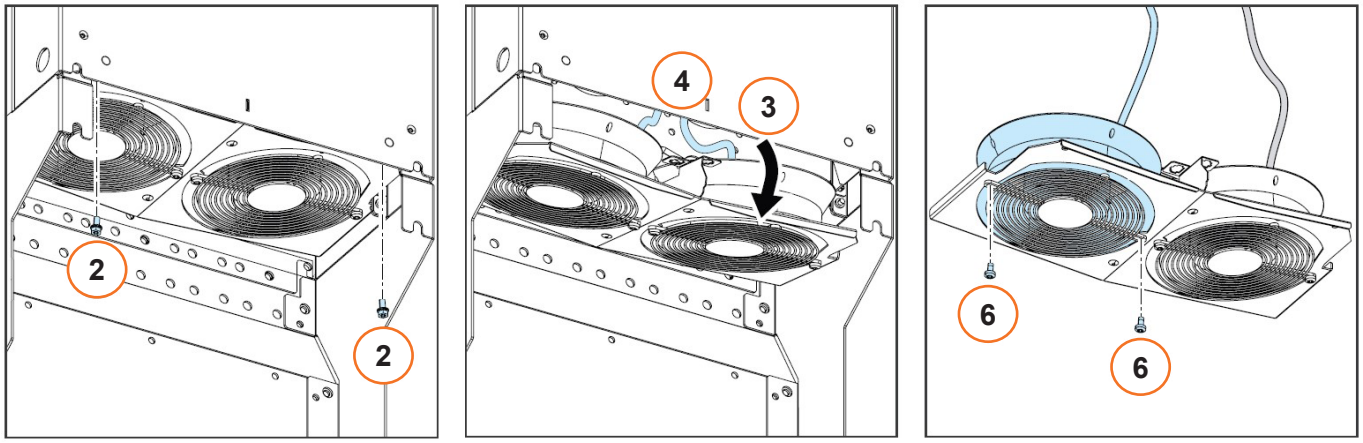
10.11.3 Replace the cooling fans of the heatsink

Parameter 05.04 Fan on-time counter indicates the running time of the cooling fan. Reset the counter after a fan replacement. See the firmware manual. It is important to note that the main fans "**Do Not**" **turn OFF** fully, even when the modulation is stopped, and even when the drive **IGBT** temperature is low. These main fans need to continue circulating air to avoid the accumulation of heat in the power supply areas of these drives. This minimum speed is at approximately 30-40% of full speed even if the **IGBT** temperature is low and the drive is not running.

In a speed-controlled fan, the speed of the fan matches the cooling needs. This increases the life span of the fan.

Main fans are speed controlled. When the drive is stopped, the main fan runs at low speed until the drive cools down. Replacement fans are available from the manufacturer. **Do not** use other than specified spare parts.

1. **Stop** the drive and disconnect it from the power line. Wait for **10** minutes and then make sure by measuring that there is **NO voltage**. Otherwise there is **risk of electro shock causing serious injuries and death**. See section *10.1 Safety Instructions - Electrical System* before you start the work;
2. **Remove** the two mounting screws of the fans mounting plate;
3. **Turn** the mounting plate downwards;
4. **Unplug** the fans power supply wires from the drive;
5. **Remove** the fans mounting plate;
6. **Remove** the fans by removing the two mounting screws;
7. **Install** the new fans in reverse order.



10.11.4 Reforming the capacitors

The capacitors must be reformed if the drive has not been powered (either in storage or unused) for **1 year** or more. Please contact Vertiv™ technical support.

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 unit electrical panel and repair.
Low evaporating pressure	Low refrigerant charge.	Check refrigerant charge.
	EEV problem.	Check **EEV** configuration.
	High pressure drop on the liquid line.	Check shut-OFF valve, filter drier...
High condensing pressure	High refrigerant charge.	Check refrigerant charge.
	Problem with condensing control fans.	Check condensing control fans.
The compressor does not run or does not run properly	Flow switch not responding.	Check the flow switch.
	The connection is loose or disconnect.	Check the connection to verify that is connected securely.
	The compressor doesn't modulate capacity properly.	Check the solenoid valves.
	The high pressure switch has shut-off the unit.	Check the high pressure switch.
High vibration on the unit	The compressor is not properly fixed.	Check the compressor dampers.
	The discharge and suction piping are not properly fixed.	Check the piping.
	The unit damper (if installed) is not properly fixed.	Check the unit damper.
	The unit is not properly connected to the hydraulic circuit.	Check the joint connection.

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 compressors, depends on the maintenance that they receive.
The unit must be dismantled if it is moved to another site, or at the end of its technical and operational life.

ENVIRONMENT

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

12.1 Safety Instructions

Personnel

WARNING

Only authorized personnel is allowed to do dismantling operations.

All work on pipes or components of the refrigerating circuit under pressure must be exclusively made by qualified staff, competent in such works.

The authorized personnel must be properly trained and qualified, wear appropriate personal protective equipment and use adequate tools.

Electric System

WARNING

Unit contains potentially lethal voltage in some circuits.

Risk of arc flash and electric shock.
Can cause injury or death.

- Open all local and remote unit electric power disconnect switches, verify with a voltmeter that power is **OFF** and wear protective equipment per local standard before working within the electric control enclosure;
- It is forbidden to operate on the electrical components without using insulating platforms, or in the presence of water and humidity.

WARNING

The electric connection enclosures and some components can retain a stored **high-voltage electrical charge** for up to **10** minutes.

Risk of electric shock.
Can cause serious injury or death.

Before working within the unit electric connection enclosures proceed as follows:

- open all local and remote unit electric power disconnect switches;
- wait **10** minutes;
- verify with a voltmeter that power is **OFF**.

Only properly trained and qualified personnel may perform repair, maintenance and cleaning.

Lockout-Tagout (LOTO)

WARNING

Before any intervention on the electrical system or accessing the inner components:

- Lock the disconnection devices by a padlock or similar tool;
- Apply on the general knife switch a suitable warning plate for no operation.

PPE

CAUTION

Sharp edges, splinters and exposed fasteners.
Wear **protective gloves** before operating on the unit.

12.2 Operations

Operation	Notes
1. Disconnect the main switch from the electric power supply	Reverse the procedure from chapter *8. Installation*: *8.6.2 Electrical power supply*
2. Discharge the water	Reverse the procedure from chapter *8. Installation*: *8.6.1 Water system piping*
3. Remove the refrigerant	**NOTICE** Handle the refrigerant according to regulations about F-gases and safety data sheet. See *13. Regulation (EU) no. 517/2014 (F-gas)*
4. Cut the piping at inlet and outlet of the unit	**WARNING** Before cutting the pipeline, make sure that the circuit is completely discharged.
5. Remove the fixing bolts	Reverse the procedure from chapter *8. Installation*: *8.3.2 Foundations and positioning*
6. Move away the unit	See *7. Handling*
7. If you need to keep the unit in a storehouse for reuse	See *7.3 Storage*
8. If you need to scrap the unit	Handle to authorized disposal company according to the local regulations about waste disposal.

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

13.1 Introduction

Stationary air conditioners and liquid chillers placed into the European Community market and operating with fluorinated greenhouse gases must comply with the F-gas Regulation (EU) no. 517/2014.

The fluorinated greenhouse gases are listed in the Annex I of the Regulation (F-gas, e.g. R407C, R134a, R410A, R417A, R32).

The **Hydro-Fluoro-Olefins** (**HFO**) R1234yf, R1234ze, and all the gases listed in the Annex II of the F-gas Regulation, are subject to reporting if imported, exported or destroyed. The other F-gas rules do not apply to these gases.

The refrigerants as R22, i.e. substances depleting the ozone layer, are not F-gas, they are banned, and the relevant regulation is Regulation (EU) no. 1005/2009 and the following amendments.

13.2 Normative References

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

13.3 Fluorinated Greenhouse Gases

Following notes must be considered when operating with the above-mentioned equipment:

- Fluorinated greenhouse gases are covered by the Kyoto Protocol;
- The fluorinated greenhouse gases in this equipment should not be vented to the atmosphere;
- Referring to the value noted in Annex I and Annex IV of Regulation (EU) no. 517/2014, here below the **Global Warming Potential** (**GWP**) of some major F-gases or mixtures:

R134a	GWP 1430	**R407C**	GWP 1774	**R410A**	GWP 2088
R417	GWP 2346	**R32**	GWP 675	**R515B**	GWP 299

As previously told, the **HFO** gas as R1234ze or R1234yf are not F-gas and the relevant **GWP**s, per info, are as follows:

R1234yf	GWP 4	**R1234ze**	GWP 7

13.4 Operators

13.4.1 Definitions

- Operator, according to Regulation (EU) no. 517/2014 Article 2, point 8, means the natural or legal person exercising actual power over the technical functioning of products and equipment covered by this Regulation;
- The State may, in defined, specific situations, designate the owner as being responsible for the operator's obligations;
- Where large installations are involved, service companies are contracted to carry out maintenance or servicing. In these cases the determination of the operator depends on the contractual and practical arrangements between the parties.

13.4.2 Obligations

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

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

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

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

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

Case 1 - Non-sealed equipment contains less than **5** tonnes of CO_2 equivalent of fluorinated greenhouse gases.
► Leakage test not required;

Case 2 - Hermetically sealed equipment contains less than **10** tonnes of CO_2 equivalent of fluorinated greenhouse gases.
► Leakage test not required;

Case 3
► **Leakage test required:** check the equipment for leaks with the minimum frequency given in the following table:

X = Tonnes of CO_2 Equivalent	Y = equivalent amount of refrigerant [kg]				Minimum frequency for leak check	
	R513A	R134a	R410A	R1234ze	with leakage detection	without leakage detection
5 ≤ X < 5	7,9 ≤ Y < 79	3,5 ≤ Y < 35	2,4 ≤ Y < 24	714 ≤ Y < 7143	12 Months	24 Months
50 ≤ X < 500	79 ≤ Y < 790	35 ≤ Y < 350	24 ≤ Y < 240	7143 ≤ Y < 71429	6 Months	12 Months
X ≥ 500	Y ≥ 790	Y ≥ 350	Y ≥ 240	Y ≥ 71429	3 Months	12 Months

e Recovery for the purpose of recycling, reclamation or destruction of the fluorinated greenhouse gases, pursuant to Art. 8 of the Regulation (EU) no. 517/2014 shall take place before the final disposal of that equipment and, when appropriate, during its servicing and maintenance.

13.5 Leakage Detection

The manufacturer approves the following leakage check methods according to Commission Regulation no. 1516/2007 and Commission Regulation no. 1497/2007:

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

13.6 Labelling

The label applied on the unit (see *Onboard Label*) is designed to fill-in the relevant amounts of refrigerant according to Regulation no. 1494/2007 (2015/2068):

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

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

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

Use the following rule for computation:

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

where:

Refrigerant	GWP
R513A	631
R134a	1430
R1234ze	7
R410A	2088
R515B	299

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

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

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

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

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

13.7 Record Keeping

Operators of equipment which is required to be checked for leaks (see *13.5 Leakage Detection*), shall establish and maintain records for each piece of such equipment specifying the following information:

a	the quantity and type of fluorinated greenhouse gases installed.
b	the quantities of fluorinated greenhouse gases added during installation, maintenance or servicing or due to leakage.
c	whether the quantities of installed fluorinated greenhouse gases have been recycled or reclaimed, including the name and address of the recycling or reclamation facility and, where applicable, the certificate number.
d	the quantity of fluorinated greenhouse gases recovered.
e	the identity of the undertaking which installed, serviced, maintained and where applicable repaired or decommissioned the equipment, including, where applicable, the number of its certificate.
f	the dates and results of the leak checks carried out (see *13.5 Leakage Detection*).
g	if the equipment was decommissioned, the measures taken to recover and dispose of the fluorinated greenhouse gases.

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

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

NOTICE

R1234ze is not a F-gas, but it's a **A2L** (mildly flammable) refrigerant; for this reason Vertiv™ recommend to keep the highest frequency of refrigerant leak check (as per *13.4.2 table*) for safety issues; for the same reason Vertiv™ recommend to maintain the record keeping as indicated on *13.7 Record Keeping*.

NOTICE

When the unit is subjected to fire, safety devices prevent rupture due to over-pressure by releasing refrigerant. The fluid may then be decomposed into toxic residues when subjected to the flame:

- Stay away from the unit;
- Set-up warnings and recommendations for personnel in charge to stop the fire;
- Fire extinguishers appropriate to the system and the refrigerant type must be easily accessible.

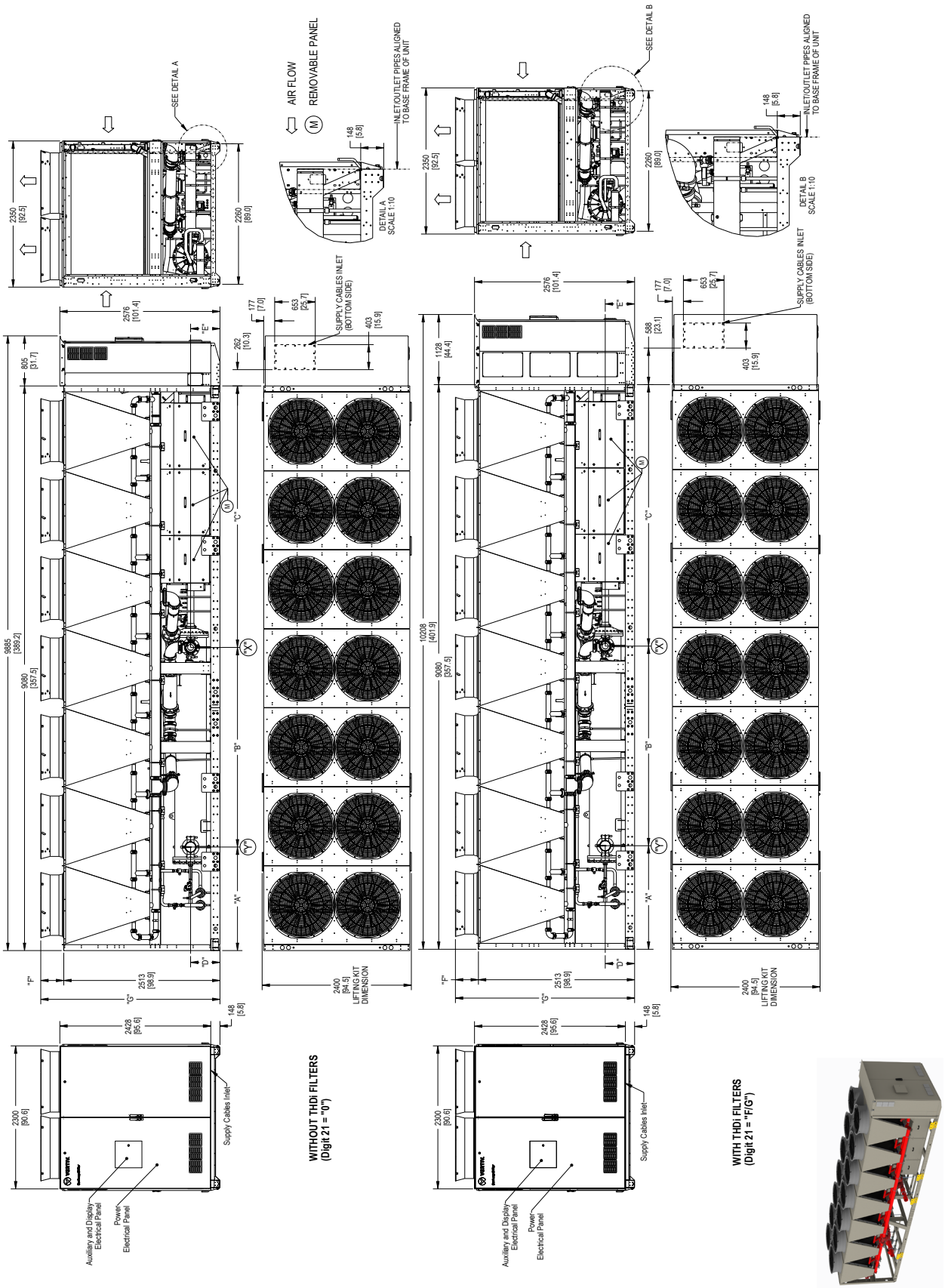
Annex I – Weights and Dimensions

Weights

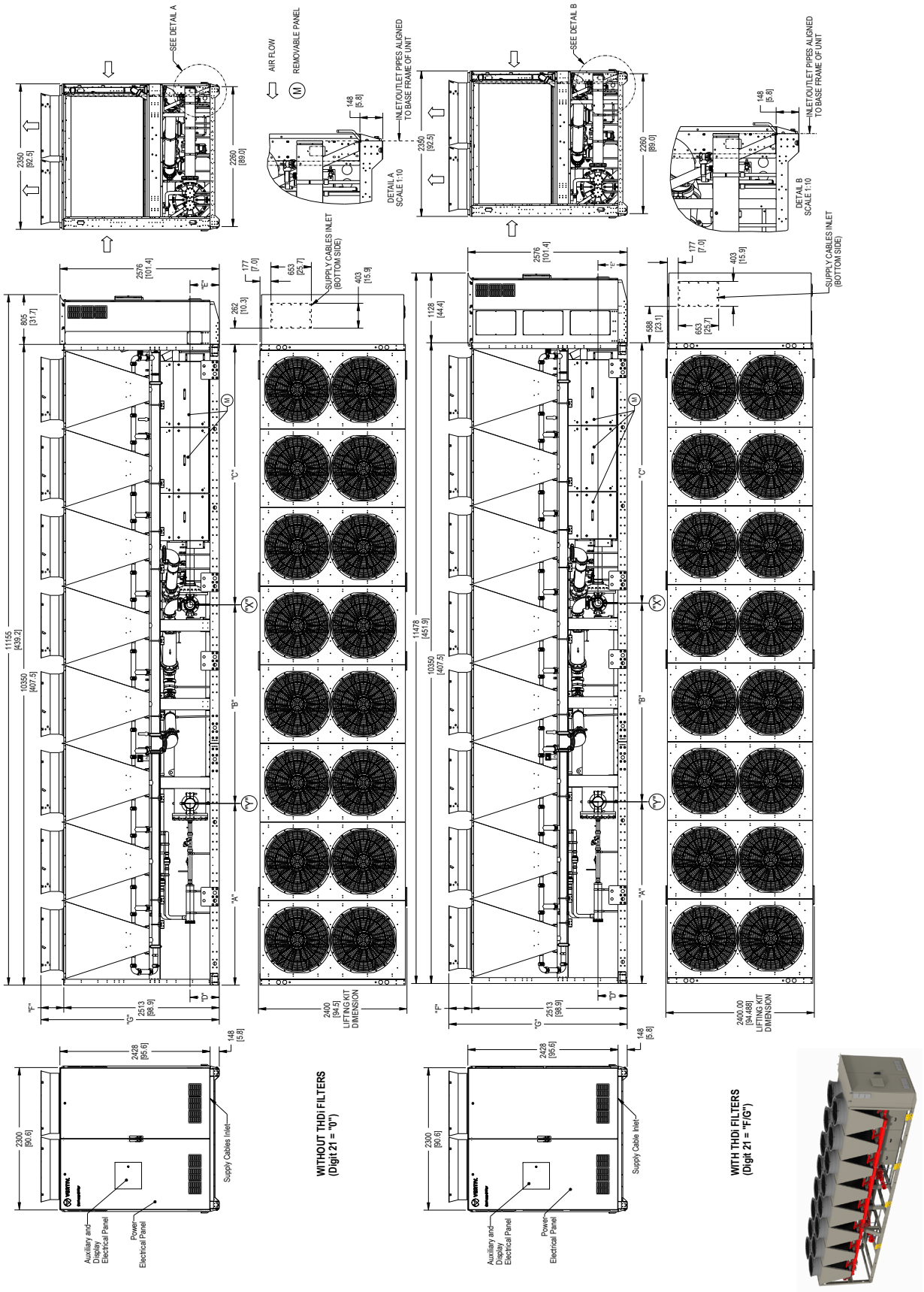
Chiller models	LVZ 090HG0	LVZ 140HG0	LVZ 170HG0	LVZ 230HG0
Net Weight [kg]	10462	11856	15462	17149
Weight included water [kg]	12019	13538	17259	19142

NOTE: *Weights refer to basic version units without options/accessories. Please refer to the unit nameplate for the exact weight value.*

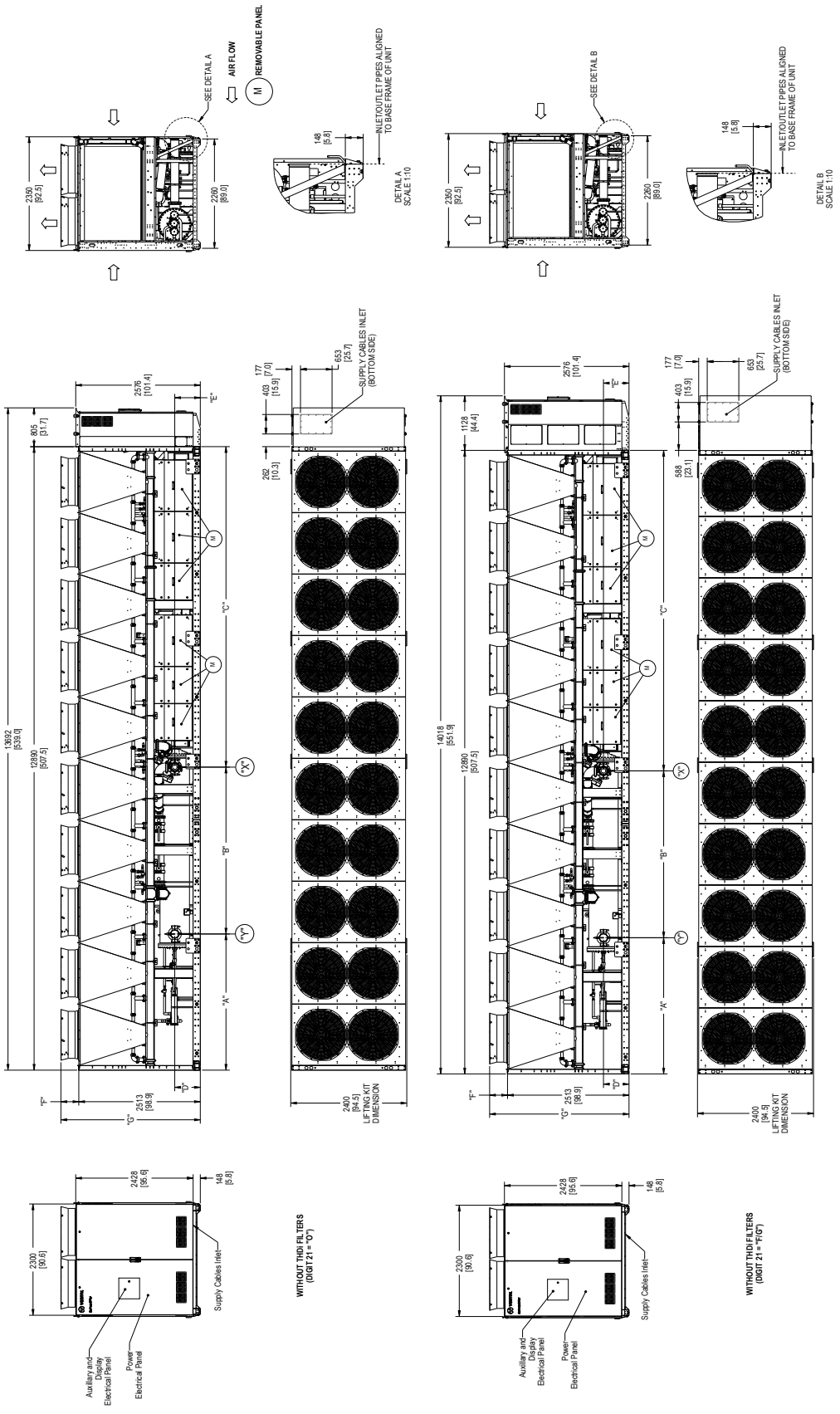
Overall dimensions - 14 Fans Units

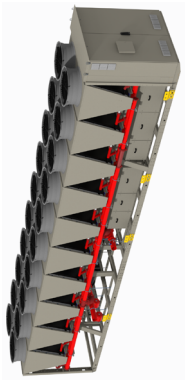


Overall dimensions - 16 Fans Units

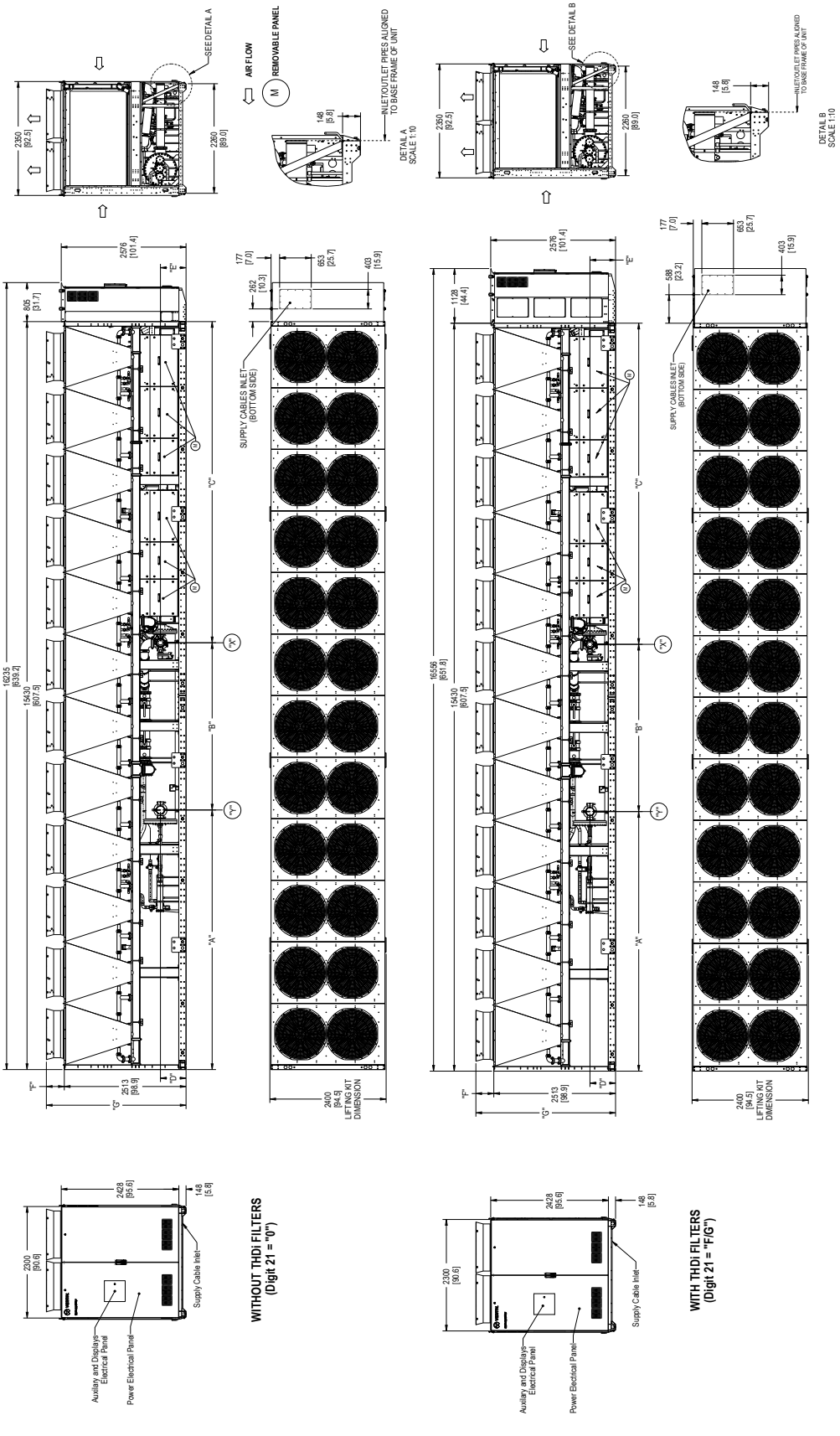


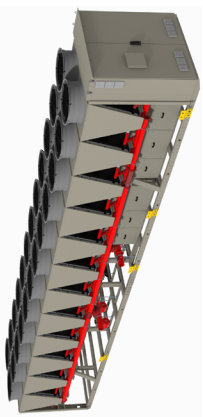
Overall dimensions - 20 Fans Units





Overall dimensions - 24 Fans Units





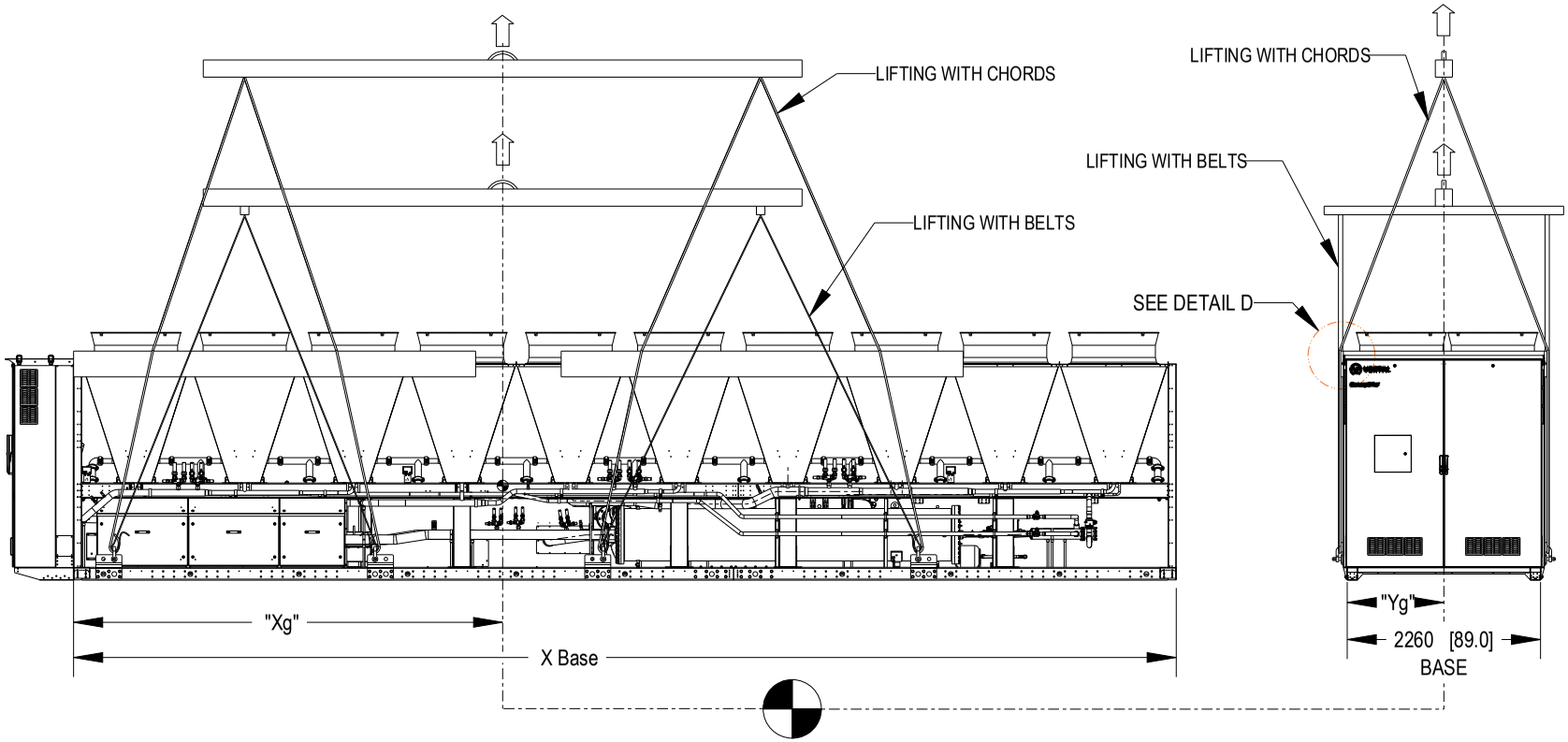
Model	SINGLE PUMP VERSION H ΔT=10°	N. Fans	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	FAN OPT. 1* F (mm)	FAN OPT. 1* G (mm)	FAN OPT. 2* F (mm)	FAN OPT. 2* G (mm)	FAN OPT. 3* F (mm)	FAN OPT. 3* G (mm)	CHILLED WATER CONNECTIONS "X" (mm)		CHILLED WATER CONNECTIONS "Y" (mm)	
LVZ 090	Without pump	14	1665	3210	4205	473	473	370	2883	353	2866	333	2846	INLET	GROOVED DN150-6"-168.3	OUTLET	GROOVED DN150-6"-168.3"
	With 1 pump - std low press./ High press./Inverter pump		1554	3320	4205	732	473	370	2883	353	2866	333	2846				
	With 2 pump - std low press./ High press./Inverter pump		1554	3320	4205	732	473	370	2883	353	2866	333	2846				

Model	SINGLE PUMP VERSION H ΔT=10°	N. Fans	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	FAN OPT. 1* F (mm)	FAN OPT. 1* G (mm)	FAN OPT. 2* F (mm)	FAN OPT. 2* G (mm)	FAN OPT. 3* F (mm)	FAN OPT. 3* G (mm)	CHILLED WATER CONNECTIONS "X" (mm)		CHILLED WATER CONNECTIONS "Y" (mm)	
LVZ 140	Without pump	16	2935	3210	4205	473	473	370	2883	353	2866	333	2846	INLET	GROOVED DN150-6"-168.3	OUTLET	GROOVED DN150-6"-168.3"
	With 1 pump - std low press./ High press./Inverter pump		2512	3633	4205	805	473	370	2883	353	2866	333	2846				
	With 2 pump - std low press./ High press./Inverter pump		2512	3633	4205	805	473	370	2883	353	2866	333	2846				

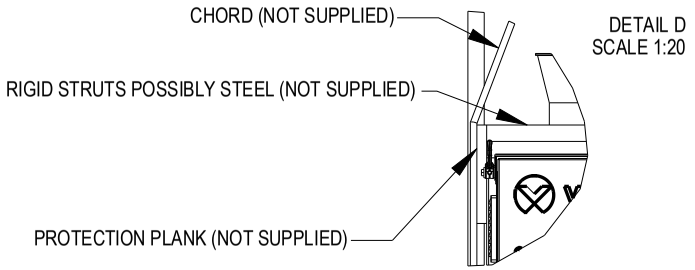
Model	SINGLE PUMP VERSION H ΔT=10°	N. Fans	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	FAN OPT. 1* F (mm)	FAN OPT. 1* G (mm)	FAN OPT. 2* F (mm)	FAN OPT. 2* G (mm)	FAN OPT. 3* F (mm)	FAN OPT. 3* G (mm)	CHILLED WATER CONNECTIONS "X" (mm)		CHILLED WATER CONNECTIONS "Y" (mm)	
LVZ170	Without pump	20	2815	3450	6625	528	528	370	2883	353	2866	333	2846	INLET	GROOVED DN150-6"-168.3"	OUTLET	GROOVED DN150-6"-168.3"
	With 1 pump - std low press./ High press./Inverter pump		2510	3755	6625	787	528	370	2883	353	2866	333	2846				
	With 2 pump - std low press./ High press./Inverter pump		2510	3755	6625	787	528	370	2883	353	2866	333	2846				

Model	SINGLE PUMP VERSION H ΔT=10°	N. Fans	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	FAN OPT. 1* F (mm)	FAN OPT. 1* G (mm)	FAN OPT. 2* F (mm)	FAN OPT. 2* G (mm)	FAN OPT. 3* F (mm)	FAN OPT. 3* G (mm)	CHILLED WATER CONNECTIONS "X" (mm)		CHILLED WATER CONNECTIONS "Y" (mm)	
LVZ230	Without pump	24	5355	3450	6625	528	528	370	2883	353	2866	333	2846	INLET	GROOVED DN150-6"-168.3"	OUTLET	GROOVED DN150-6"-168.3"
	With 1 pump - std low press./ High press./Inverter pump		5051	3754	6625	787	528	370	2883	353	2866	333	2846				
	With 2 pump - std low press./ High press./Inverter pump		5051	3754	6625	787	528	370	2883	353	2866	333	2846				

FAN OPT. 1*: **Digit 13 A/B/C** and **Digit 10 C/E/L/Q** (MICROCHANNEL + ANY FAN OPTION)
FAN OPT. 2*: **Digit 13 D/E/F** and **Digit 10 E** (FIN TUBE + PREMIUM FAN)
FAN OPT. 3*: **Digit 13 D/E/F** and **Digit 10 Q** (FIN TUBE + LOW NOISE FAN)



N.B: The lifting point has to be on the vertical baricentric axis, which is individualized by symbols indicated on the base.

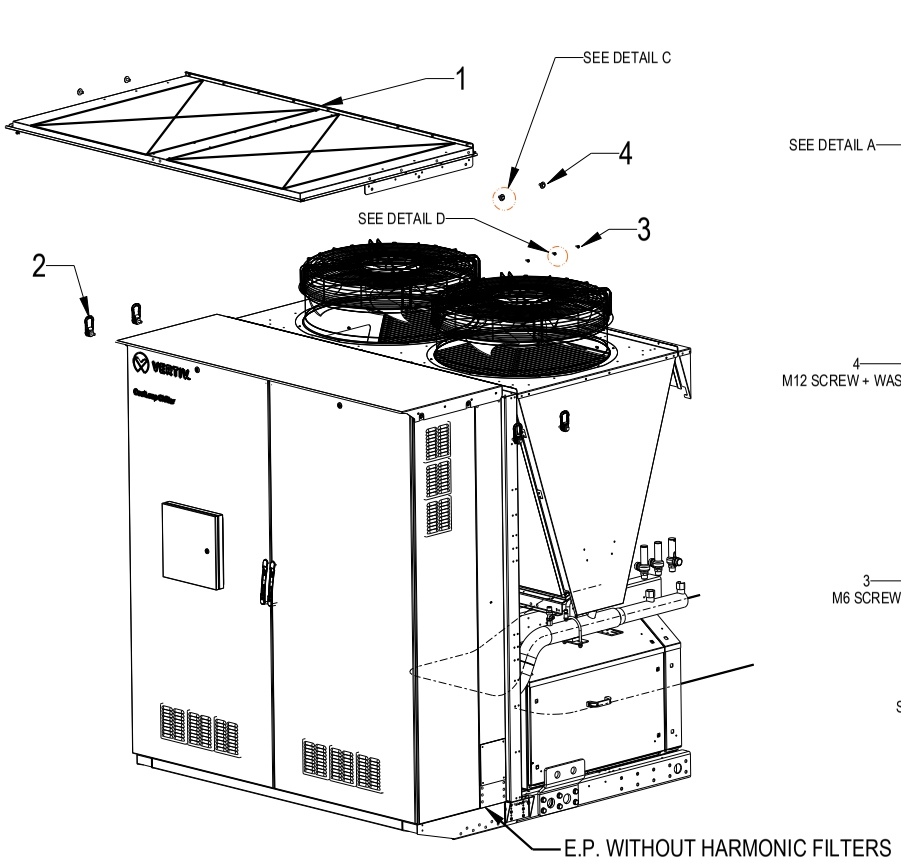


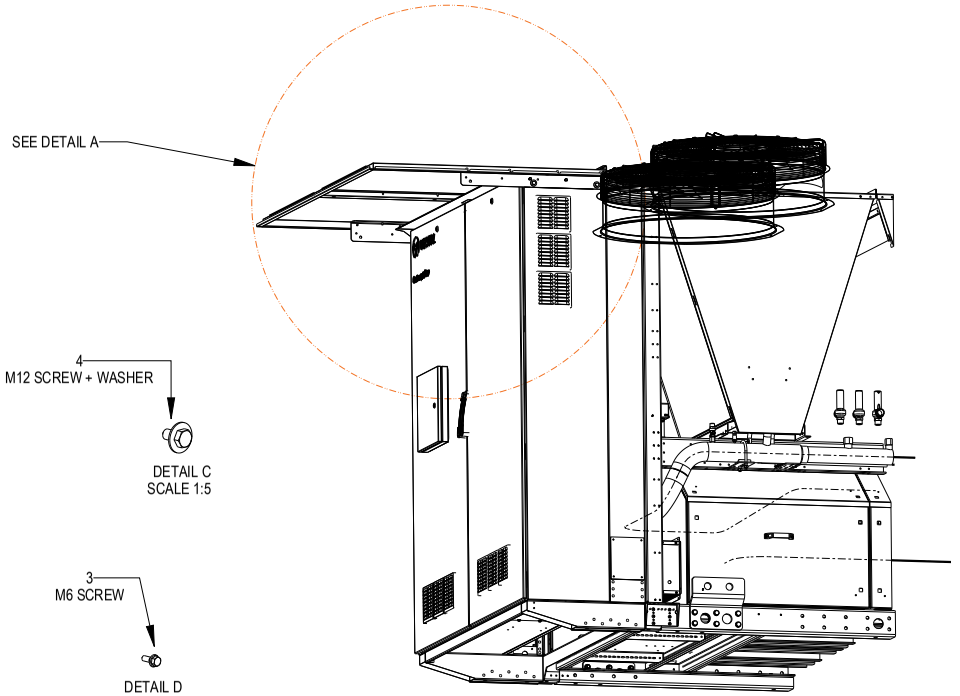
Do not tilt the unit more than 15°
Non inclinare l'unità oltre 15°
No force must be applied to pressurized parts, especially pipes connected to the condensers or to evaporator

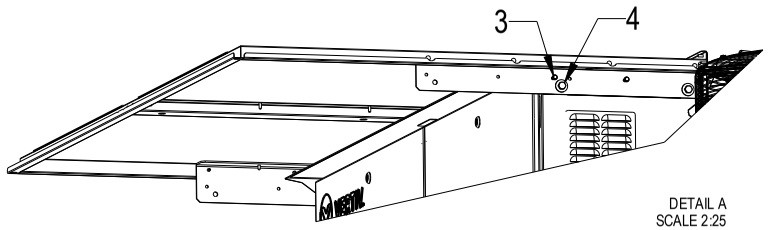
Models	X Base (mm)	UNIT WITHOUT PUMPS		
		Xg (mm)	Yg (mm)	Weight (kg)
Trim Cooler Liquid Cooling models (Microchannel FC coils)				
LVZ 090	9080	3218	1180	10560
LVZ 140	10350	3505	1184	11980
LVZ 170	12890	4760	1158	15450
LVZ 230	15430	5430	1162	17200

Models	X Base (mm)	UNIT WITHOUT PUMPS		
		Xg (mm)	Yg (mm)	Weight (kg)
Trim Cooler Liquid Cooling models (Finned tube FC coils)				
LVZ 090	9080	3281	1169	11095
LVZ 140	10350	3589	1173	12590
LVZ 170	12890	4843	1148	16215
LVZ 230	15430	5580	1141	17580

INSTRUCTIONS ASSEMBLY EXTENSION ROOF E.P.



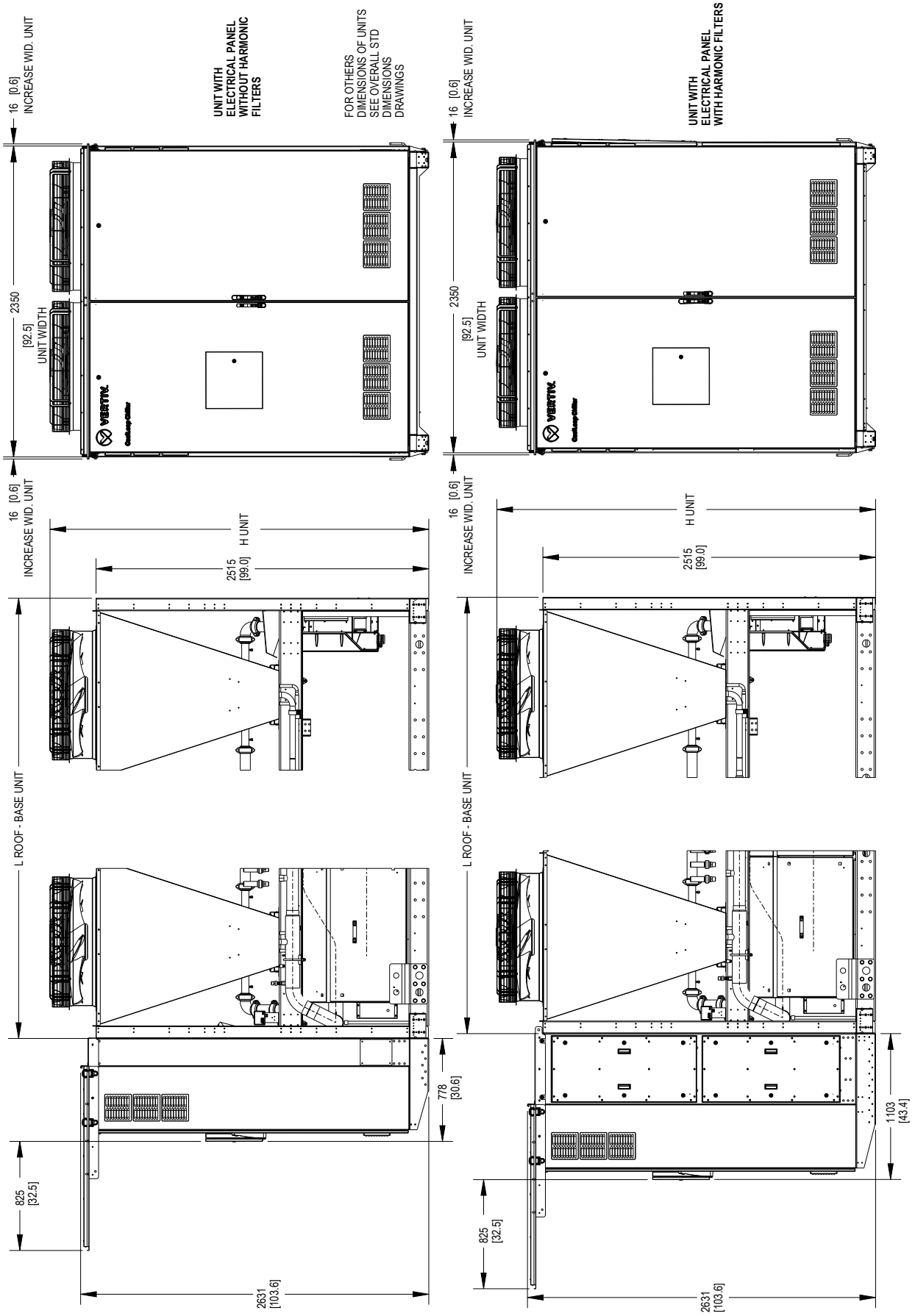




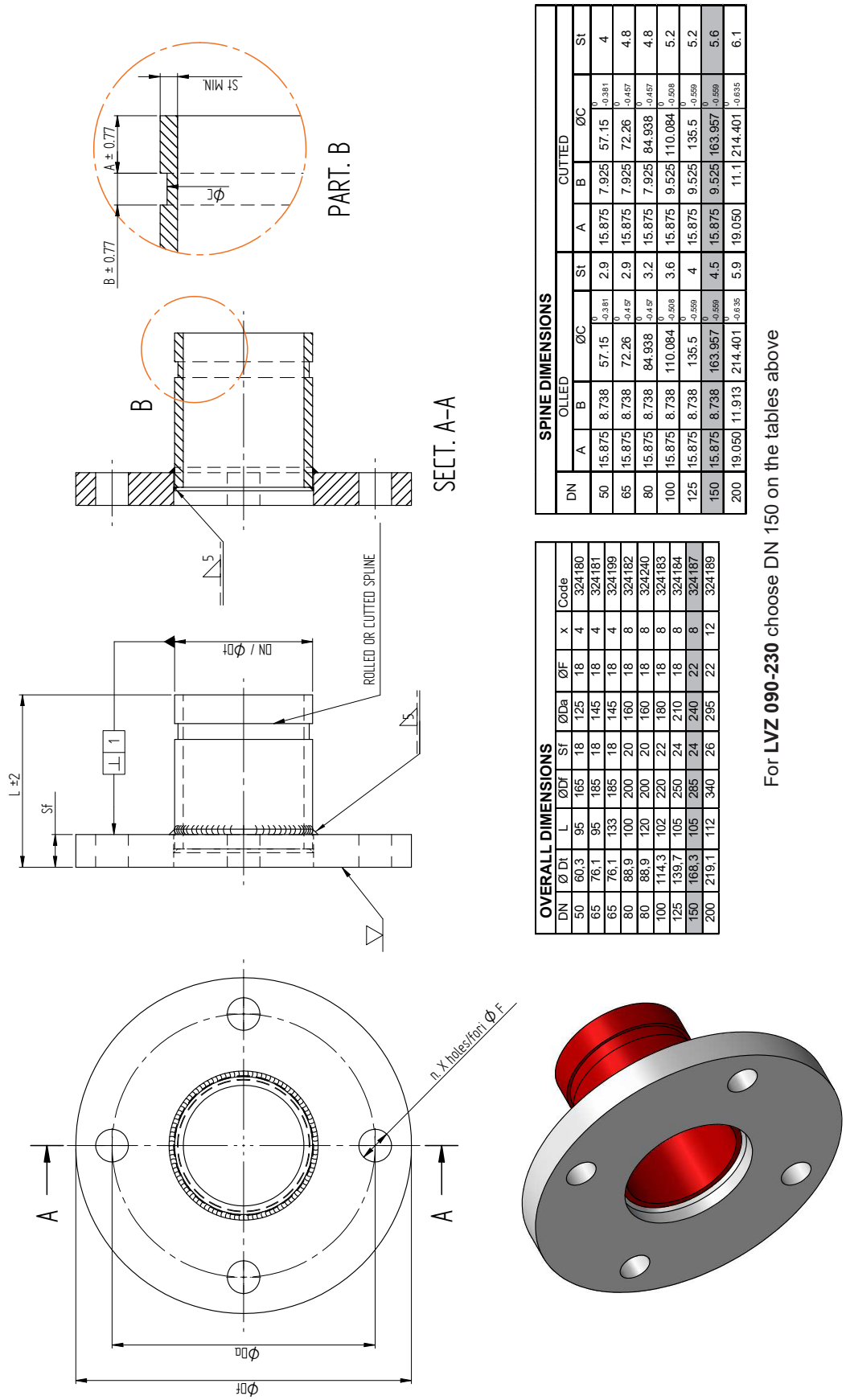


ASSEMBLY STEPS

- Remove, if present, the lifting eyebolts (**2**) from the roof of the electrical panel;
- Remove the M6 screws (**3**) on both sides of the roof of the elecrtical panel (3 screws per side);
- Place the extension cover (**1**) on the roof of the electrical panel;
- Fix the extension cover sidewards using the supplied M12 screws + washers (**4**) on the holes of the lifting eyebolts;
- Reassemble the previously removed M6 screws to the side profiles of the extension cover by screwing them on the hexagonal inserts on the sides of the roof of the electrical panel.


16 [0.6]
INCREASE WID. UNIT
2350
[92.5]
UNIT WIDTH
UNIT WITH
ELECTRICAL PANEL
WITHOUT HARMONIC
FILTERS
FOR OTHERS
DIMENSIONS OF UNITS
SEE OVERALL STD
DIMENSIONS
DRAWINGS
UNIT WITH
ELECTRICAL PANEL
WITH HARMONIC FILTERS
H UNIT
2515
[99.0]
L ROOF - BASE UNIT
778
[30.6]
1103
[43.4]
825
[32.5]
2631
[103.6]

ACCESSORIES: ADDITIONAL FLANGED HYDRAULIC CONNECTIONS



SPINE DIMENSIONS

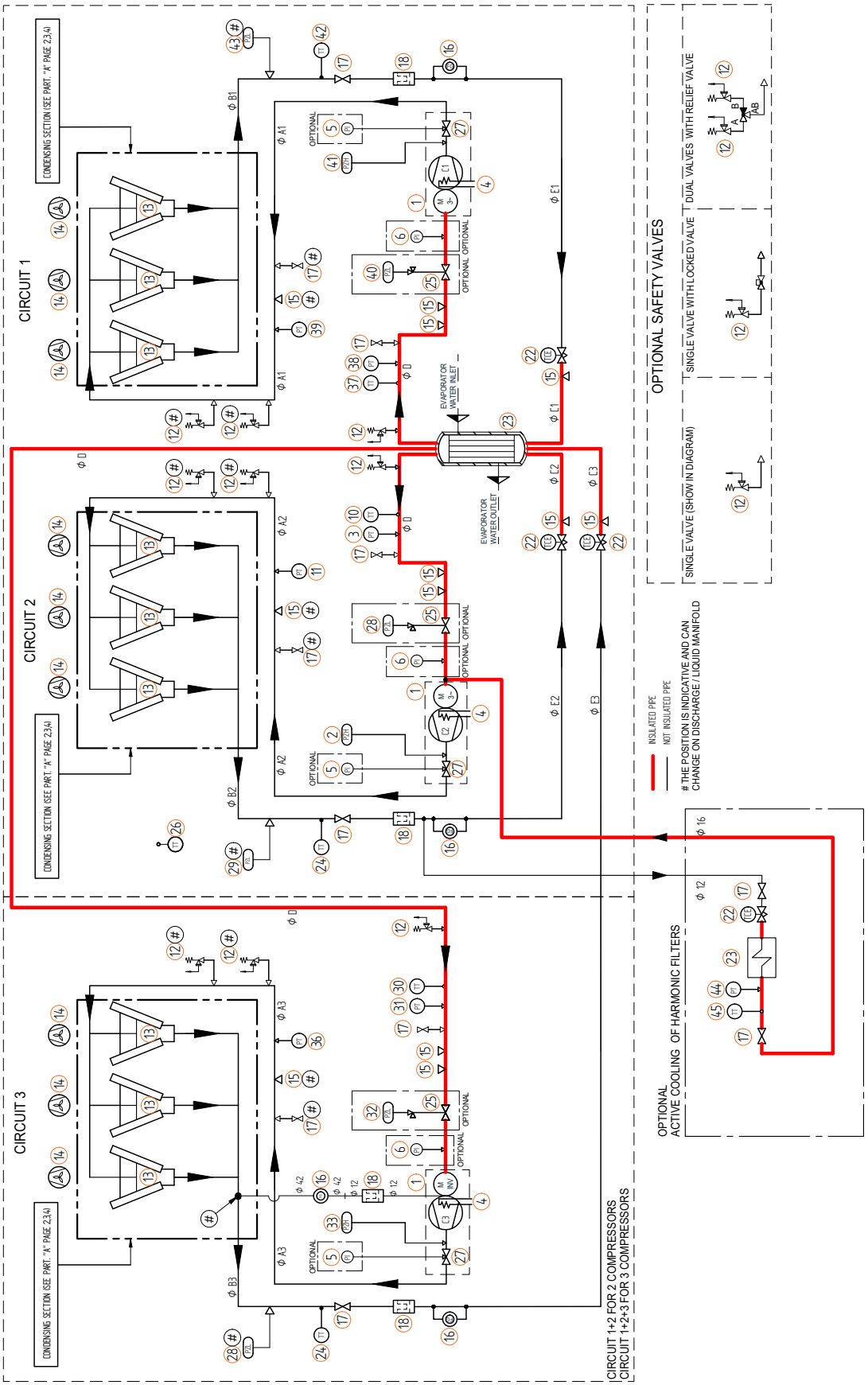
DN	ROLLED A	ROLLED B	ROLLED ØC	ROLLED St	CUTTED A	CUTTED B	CUTTED ØC	CUTTED St
50	15.875	8.738	57.15 $^{0}_{-0.381}$	2.9	15.875	7.925	57.15 $^{0}_{-0.381}$	4
65	15.875	8.738	72.26 $^{0}_{-0.457}$	2.9	15.875	7.925	72.26 $^{0}_{-0.457}$	4.8
80	15.875	8.738	84.938 $^{0}_{-0.457}$	3.2	15.875	7.925	84.938 $^{0}_{-0.457}$	4.8
100	15.875	8.738	110.084 $^{0}_{-0.508}$	3.6	15.875	9.525	110.084 $^{0}_{-0.508}$	5.2
125	15.875	8.738	135.5 $^{0}_{-0.559}$	4	15.875	9.525	135.5 $^{0}_{-0.559}$	5.2
150	15.875	8.738	163.957 $^{0}_{-0.559}$	4.5	15.875	9.525	163.957 $^{0}_{-0.559}$	5.6
200	19.050	11.913	214.401 $^{0}_{-0.635}$	5.9	19.050	11.1	214.401 $^{0}_{-0.635}$	6.1

OVERALL DIMENSIONS

DN	Ø Dt	L	ØDf	Sf	ØDa	ØF	x	Code
50	60,3	95	165	18	125	18	4	324180
65	76,1	95	185	18	145	18	4	324181
65	76,1	133	185	18	145	18	4	324199
80	88,9	100	200	20	160	18	8	324182
80	88,9	120	200	20	160	18	8	324240
100	114,3	102	220	22	180	18	8	324183
125	139,7	105	250	24	210	18	8	324184
150	168,3	105	285	24	240	22	8	324187
200	219,1	112	340	26	295	22	12	324189

For **LVZ 090-230** choose DN 150 on the tables above

Annex II – Refrigerating Circuit

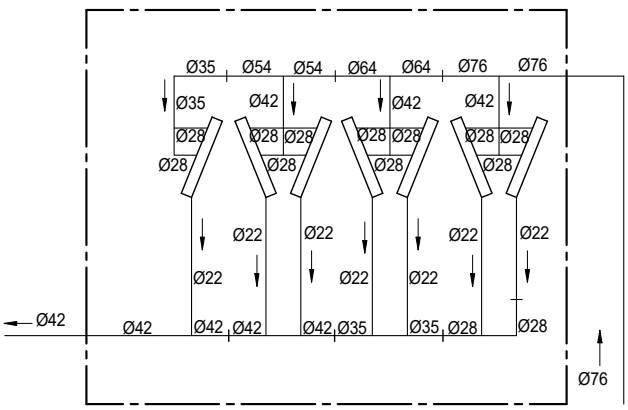


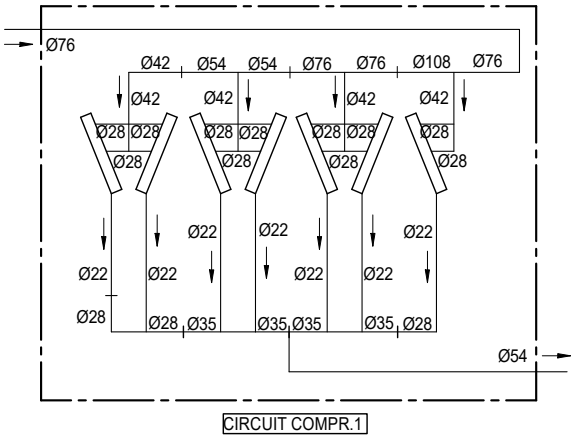
Annex II – Refrigerating Circuit

1	COMPRESSOR
2	HIGH PRESSURE SWITCH
3	TRANSDUCER PRESSURE SENSOR LP CONTROL
4	CRANCKASE HEATER
5	HIGH PRESSURE MANOMETER
6	LOW PRESSURE MANOMETER
7	SOLENOID VALVE
8	NO RETURN VALVE
9	MOTORIZED BALL VALVE
10	TEMPERATURE SENSOR
11	TRANSDUCER PRESSURE SENSOR HP CONTROL
12	SAFETY VALVE
13	CONDENSER
14	CONDENSER FANS
15	SERVICE CONNECTION
16	SIGHT GLASS
17	SHUT-OFF VALVE
18	FILTER DRYER
19	SHUT-OFF SOLENOID VALVE
20	ECONOMIZER
21	THERMOSTATIC EXPANSION VALVE
22	ELECTRONIC EXPANSION VALVE
23	EVAPORATOR
24	LIQUID TEMPERATURE SENSOR
25	COMPRESSOR SUCTION VALVE
26	EXTERNAL AIR SENSOR
27	COMPRESSOR DISCHARGE VALVE
28	LOW PRESSURE SWITCH
29	LOW PRESSURE SWITCH
30	TEMPERATURE SENSOR
31	TRANSDUCER PRESSURE SENSOR LP CONTROL
32	LOW PRESSURE SWITCH
33	HIGH PRESSURE SWITCH
34	LIQUID TEMPERATURE SENSOR
35	LOW PRESSURE SWITCH
36	TRANSDUCER PRESSURE SENSOR HP CONTROL
37	TEMPERATURE SENSOR
38	TRANSDUCER PRESSURE SENSOR LP CONTROL
39	TRANSDUCER PRESSURE SENSOR HP CONTROL
40	LOW PRESSURE SWITCH
41	HIGH PRESSURE SWITCH
42	LIQUID TEMPERATURE SENSOR
43	LOW PRESSURE SWITCH
44	TRANSDUCER PRESSURE SENSOR LP CONTROL
45	TEMPERATURE SENSOR

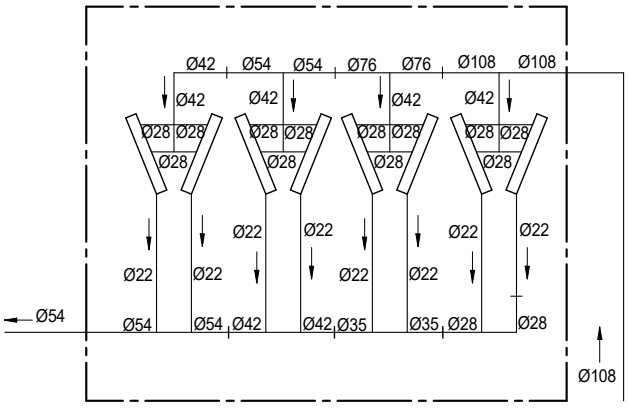
Annex II – Refrigerating Circuit

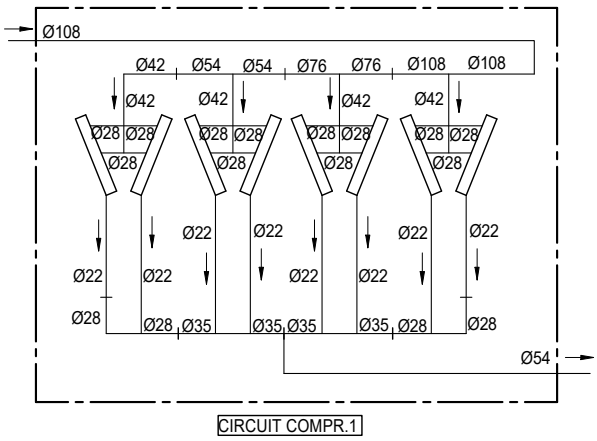
PART. "A"
mod. 090





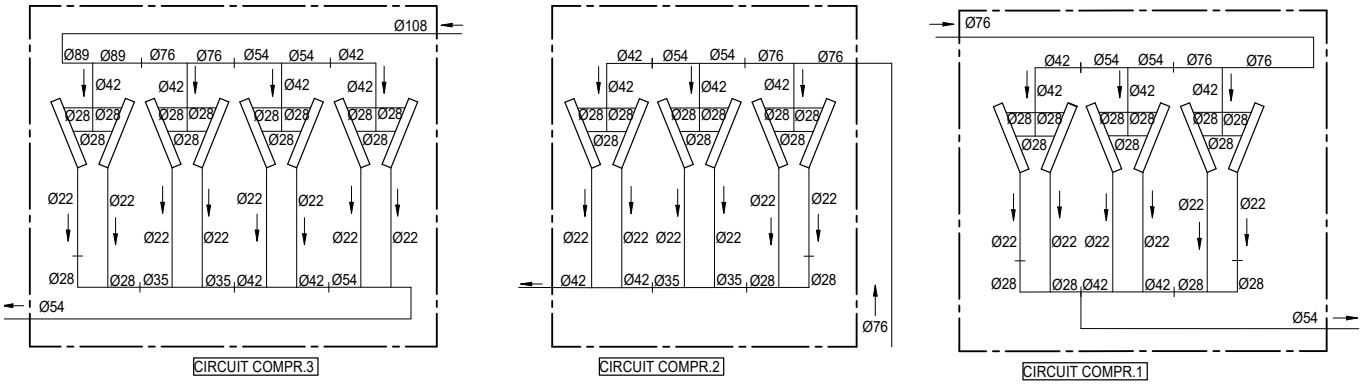
PART. "A"
mod. 140



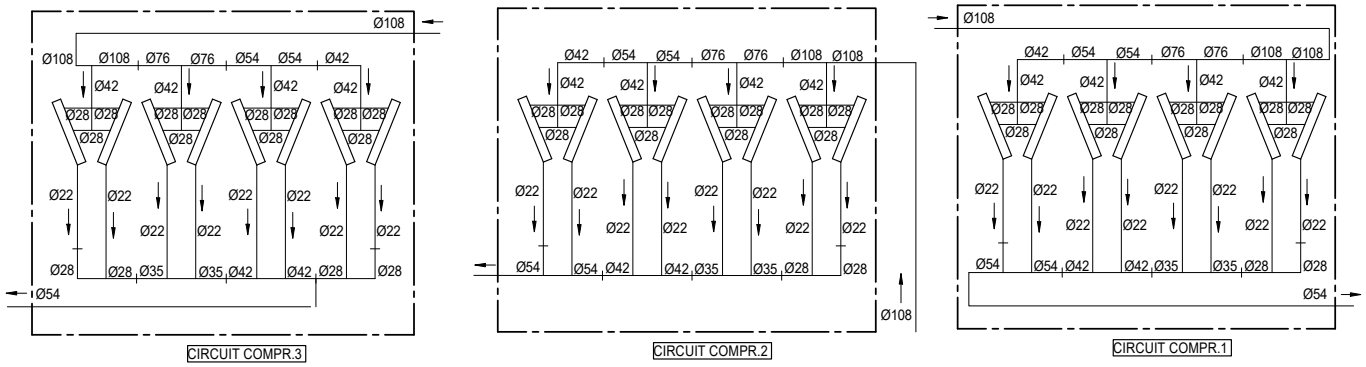


Annex II – Refrigerating Circuit

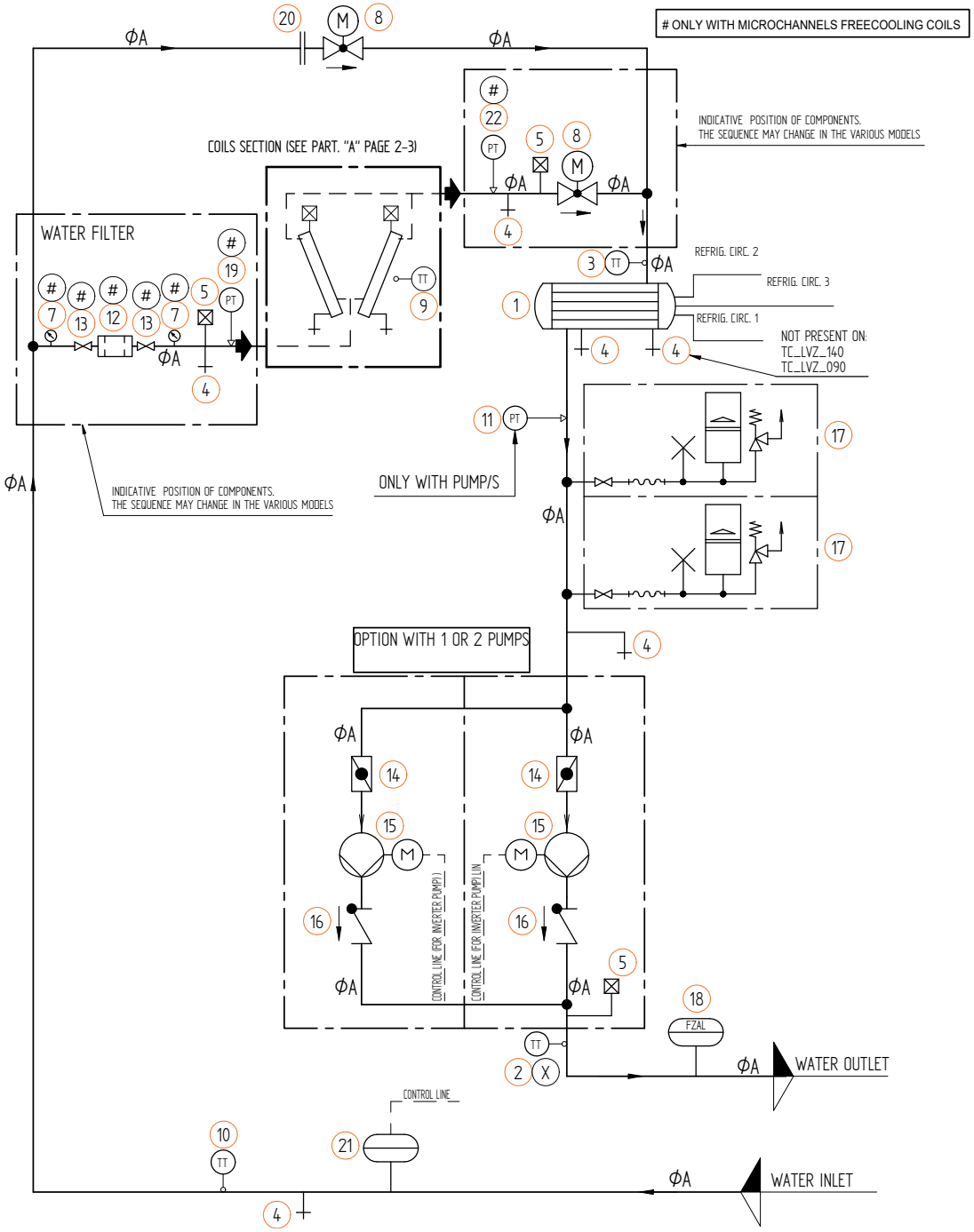
PART. "A"
mod. 170



PART. "A"
mod. 240



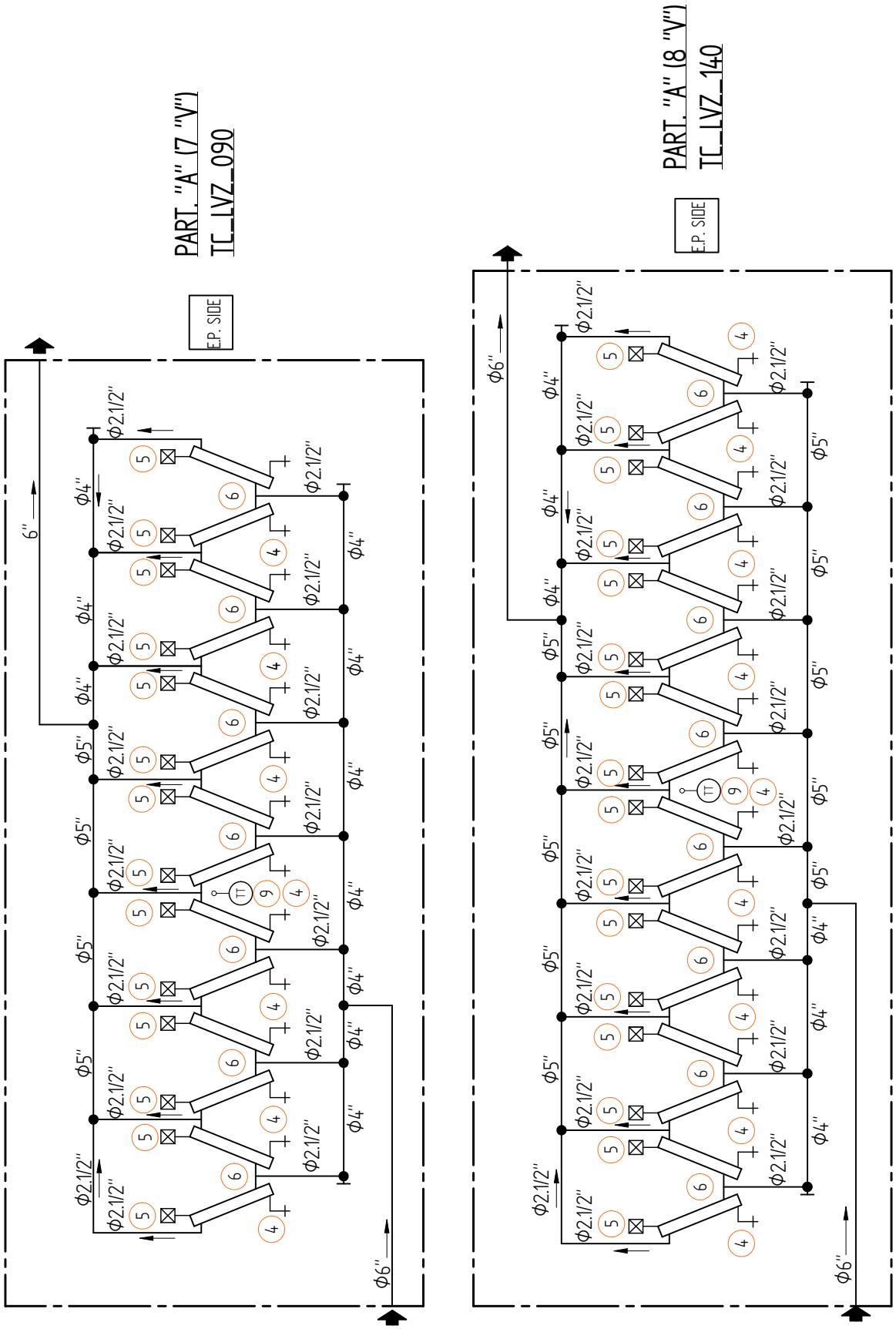
Annex II – Hydraulic Circuit



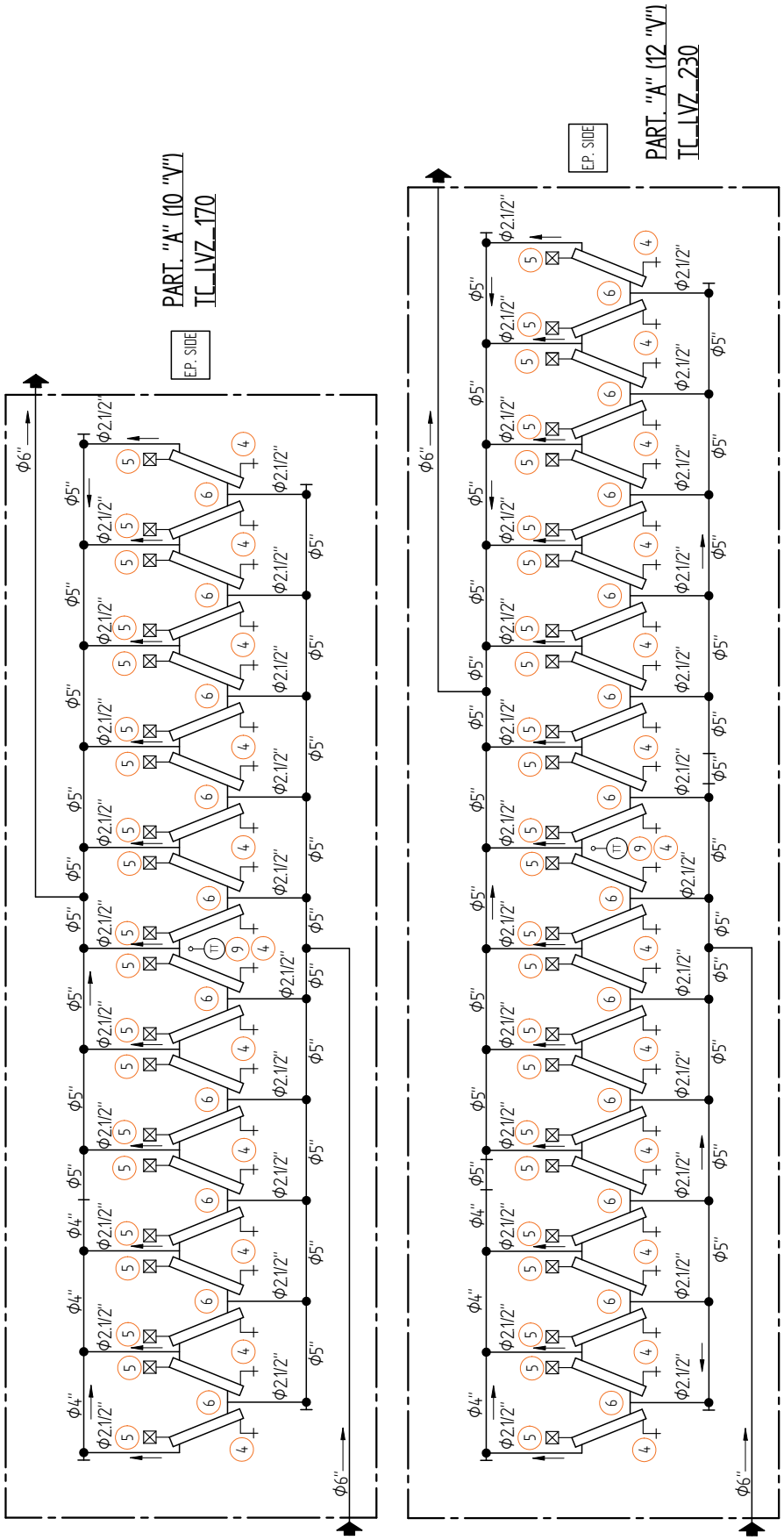
N°	ID	Description
1		Evaporator
2	S7	Evaporator water outlet sersor/antifreeze
3	S8	Evaportator water inlet sensor
4		Discharge valve
5		Manual air valve
6		Freecooling coil
7		Manometer
8		2-way valve
9	S9	Air temperature sensor
10	S6	Control freecooling thermostat sensor
11	S60	Pressure trasducer

N°	ID	Description
12		Water filter
13		Valve
14		Butterfly valve
15		Pump
16		No return valve
17		Kit expasion vassel - safety valve - manual air valve - flex pipe - valve (std with pump/s)
18	FS	Flow switch
19	S5FC	Pressure trasducer
20		Calibrate baffle
21		Flow meter (std with electronic pumps, optional for others)
22	S4FC	Pressure trasducer

Annex II – Hydraulic Circuit



Annex II – Hydraulic Circuit



Annex III – Safety Labels

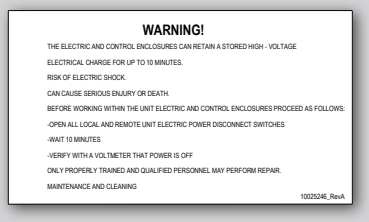
WARNING

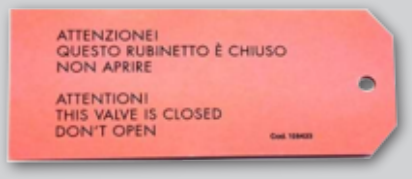
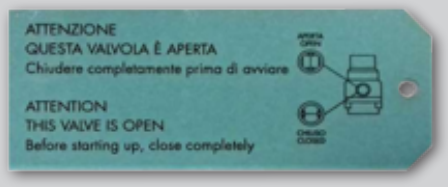
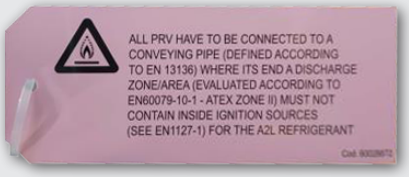
Do not remove or cover the labels placed on the unit by the manufacturer.

Check regularly that the warning label are still on the unit and that they are clearly visible.

Replace any missing or damaged label.

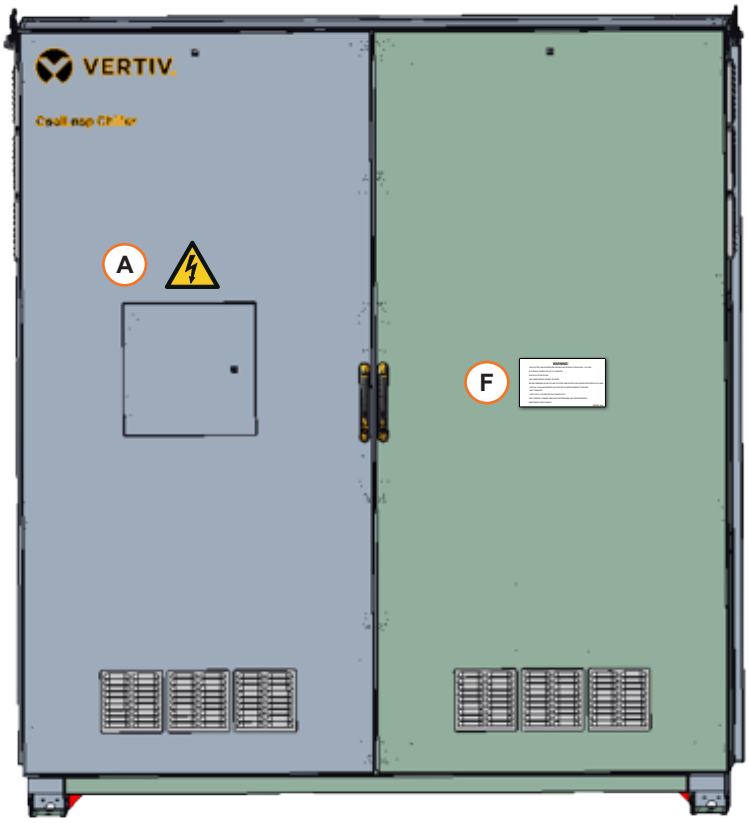
Labels list

Code	Description	Code	Description
A		B	
C		D	
E		F	
G		H	

Code	Description	Code	Description
I		J	
K		L	

Code	Description	Code	Description
A	Use this label to indicate the presence of life equipment or dangerous electrical cables.	G	Use this label to indicate the presence of Hot and Moving parts inside a cover that must be disconnected from the main supply to be touched.
B	Use this label to indicate the presence of magnetic or electrical, static fields.	H	Use this label to indicate the presence of a closed valve that needs to be opened before starting the machine.
C	Use this label to indicate the presence of a moving fan.	I	Use this label to indicate the presence of a closed valve that must not be opened.
D	Use this label to indicate the presence of low burning flammable **A2L** refrigerant gas.	J	Use this label to indicate the presence of an opened valve that needs to be closed before starting the machine.
E	Use this label to indicate the presence of hot surfaces.	K	Use this label to indicate the presence of **Pressure Relief Valve** (**PRV**) that must be connected to a conveying pipe related to a discharge area.
F	Use this label to indicate the presence of electric shock risk.	L	This label indicates that the object it is attached to is heavy enough to require lifting by **two** people, in order to prevent the risk of musculoskeletal injuries. The warning is intended for all personnel involved in handling the load and emphasizes the importance of using proper manual lifting techniques, in accordance with best practices and current occupational health and safety regulations.

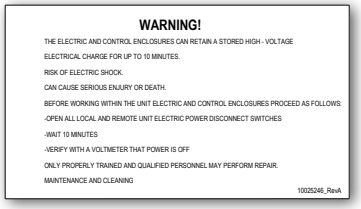
Labels position

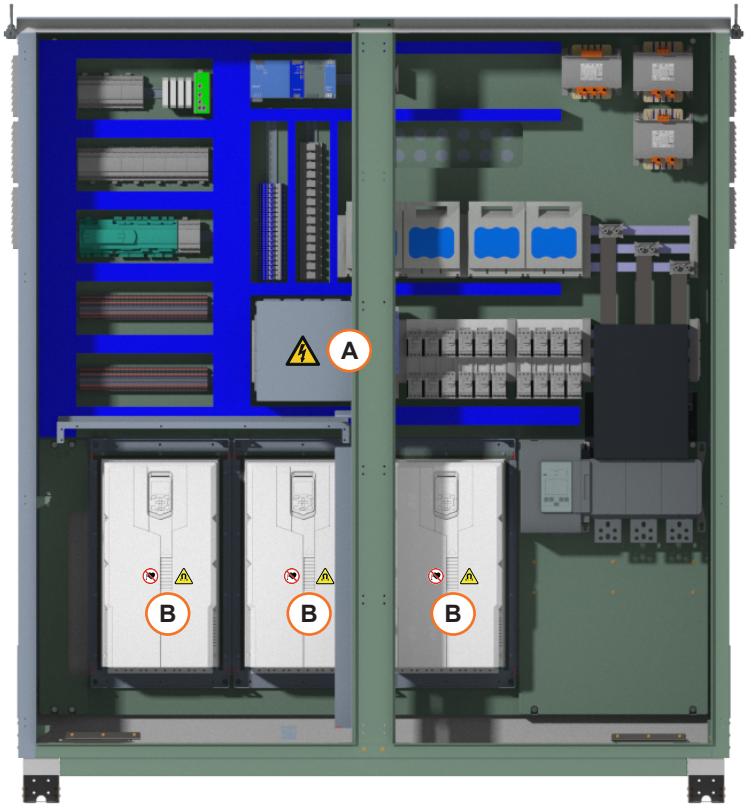


A



F

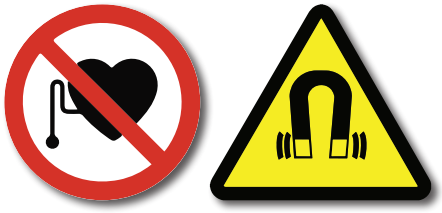




A

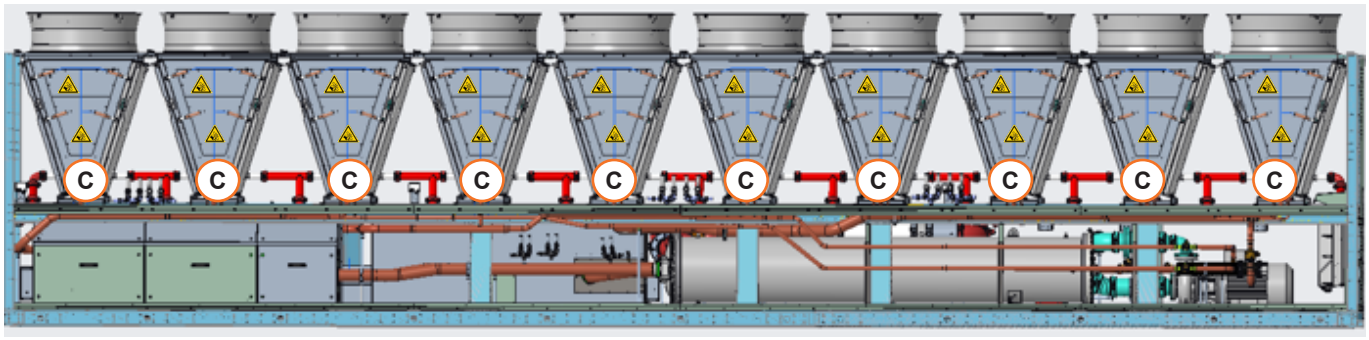


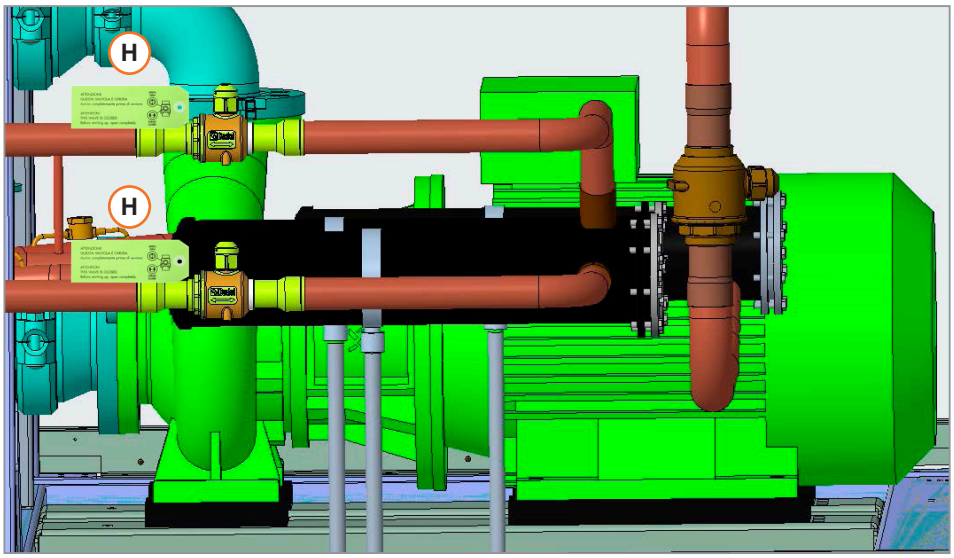
B



C

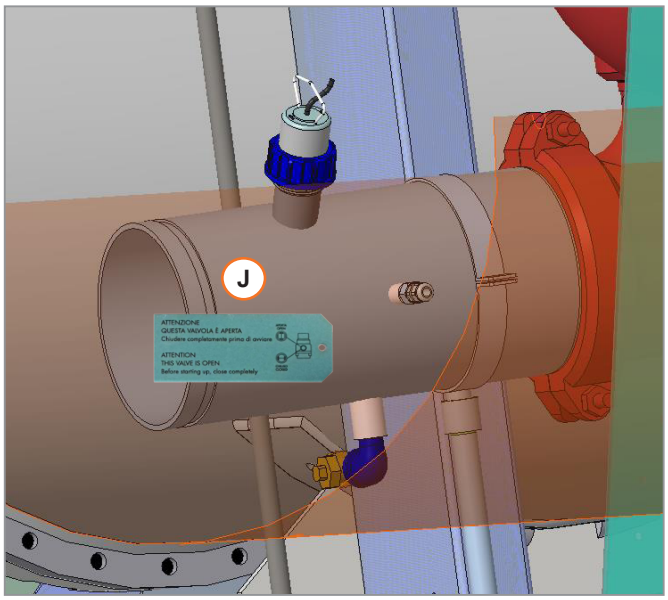



C
C
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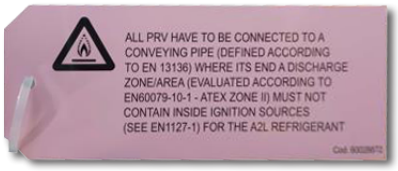

ATTENZIONE
QUESTA VALVOLA È CHIUSA
Aprire completamente prima di avviare
ATTENTION
THIS VALVE IS CLOSED
Before starting up, open completely

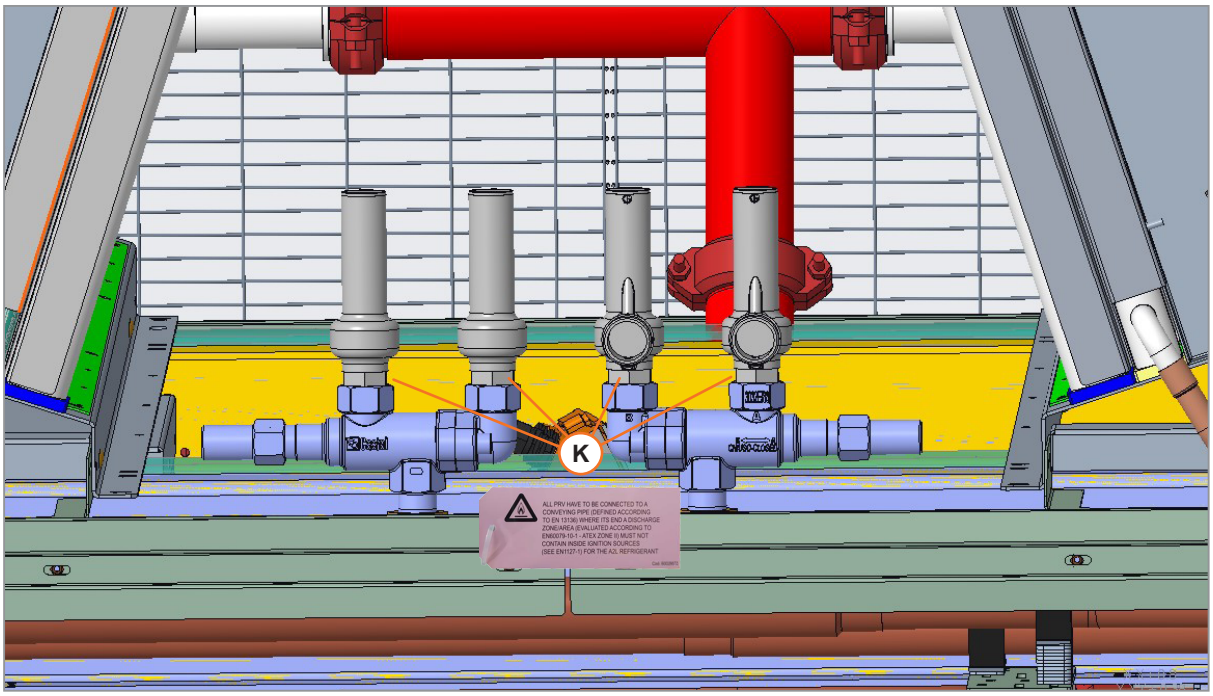

J

J

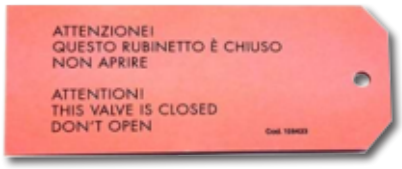

ATTENZIONE
QUESTA VALVOLA È APERTA
Chiudere completamente prima di avviare
ATTENTION
THIS VALVE IS OPEN
Before starting up, close completely

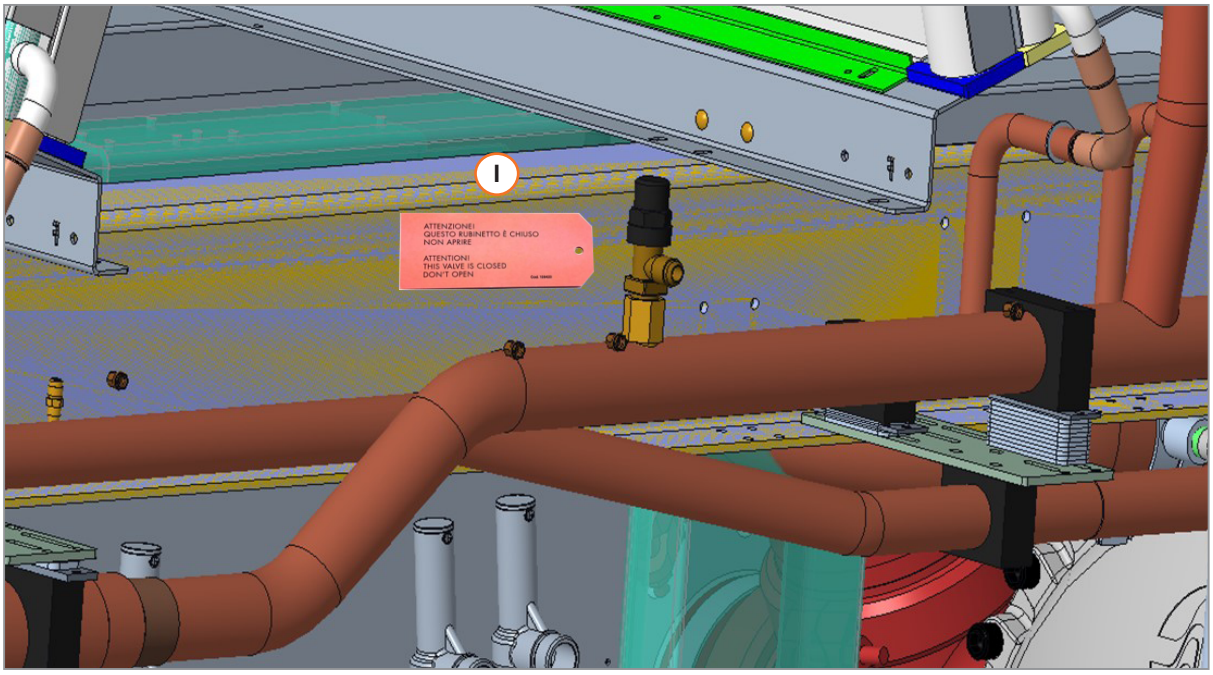
K


ALL PRV HAVE TO BE CONNECTED TO A
CONVEYING PIPE (DEFINED ACCORDING
TO EN 13136) WHERE ITS END A DISCHARGE
ZONE/AREA (EVALUATED ACCORDING TO
EN60079-10-1 - ATEX ZONE II) MUST NOT
CONTAIN INSIDE IGNITION SOURCES
(SEE EN1127-1) FOR THE A2L REFRIGERANT


K

I


ATTENZIONE!
QUESTO RUBINETTO È CHIUSO
NON APRIRE
ATTENTION!
THIS VALVE IS CLOSED
DON'T OPEN


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Fabbricante - Manufacturer - Hersteller - Fabricant - Fabricante Fabricante - Tillverkare - Fabrikant - Valmistaja - Produsent Fabrikant - Κατασκεναστηζ - Producent

Il Fabbricante dichiara che questo prodotto è conforme alle direttive Europee:
The Manufacturer hereby declares that this product conforms to the European Union directives:
Der Hersteller erklärt hiermit, dass dieses Produkt den Anforderungen der Europäischen Richtlinien gerecht wird: Le Fabricant déclare que ce produit est conforme aux directives Européennes:
El Fabricante declara que este producto es conforme a las directivas Europeas:
O Fabricante declara que este produto está em conformidade com as directivas Europeias: Tillverkare försäkrar härmed att denna produkt överensstämmer med Europeiska Uniones direktiv: De Fabrikant verklaart dat dit produkt conform de Europese richtlijnen is:
Vaimistaja vakuuttaa täten, että tämä tuote täyättää seuraavien EU-direktiivien vaatimukset: Produsent erklærer herved at dette produktet er i samsvar med EU-direktiver:
Fabrikant erklærer herved, at dette produkt opfylder kravene i EU direktiverne:
Ο ΚατασÀευαστÞj δηλþνει ütι το παÃüν πÃοÍüν εßναι ÀατασÀευασμÝνο αýμφωνα με τιj οδηγßεj τηj Ε.Ε.:

2006/42/EC; 2014/30/EU; 2014/35/EU; 2014/68/EU; 2011/65/EU; EU/2015/863



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