



# **Liebert® EFC**

## **The Highly Efficient Indirect Evaporative Freecooling Unit**

### **Addendum for EFC320 Spacenet VDI**

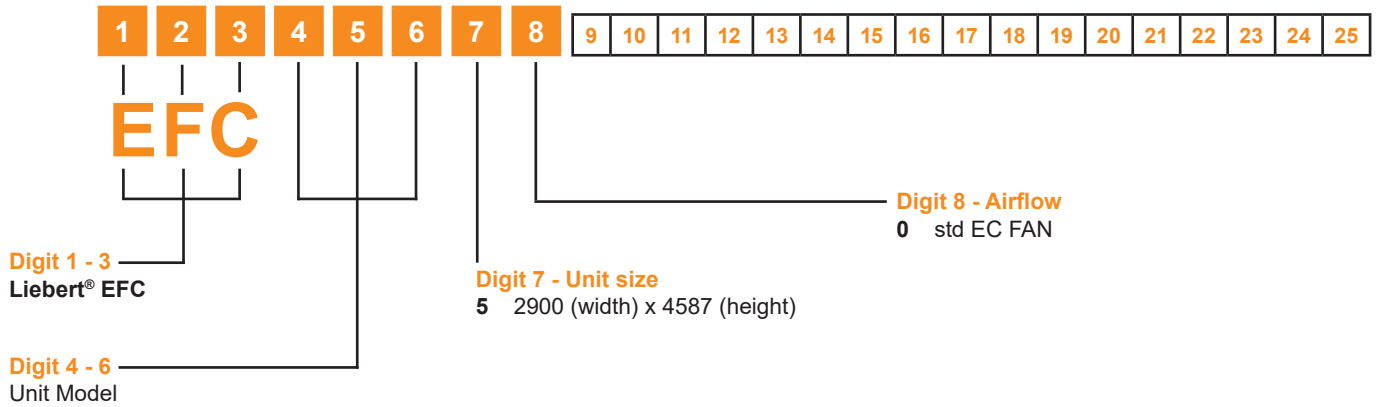
User Manual

English, Cod. 265808, rev.21.11.2018



## Digit Nomenclature

The unit is fully defined by twenty five digits.



### Digit 9 - Cooling system

**P** Evaporative, recirculating pumps

### Digit 10 - Backup

**SFA** (2 Tandem Fix Compressors)

### Digit 11 - Modular

**S** Single Unit Left

### Digit 12 - Data Center Air Delivery

**F** Frontal

### Digit 13 - External Air Discharge

**T** Top discharge

### Digit 14 - Data Center Air Suction

**B** Back Air Suction

### Digit 15 - External filters

**0** G2 + Metallic Filter

### Digit 16 - Internal filters

**1** G4 + Clogged Filter

### Digit 17 - Devices

**2** Overpressure Protection

### Digit 18 - Dual Power Supply / Control Backup

**SFA** (400/3/50+N+ATS+Ultracap)

### Digit 19 - Display and Switch

**B** Small Display + Network Switch

### Digit 20 - Monitoring

**2** Modbus IP monitoring (digit 19=B,C)

### Digit 21 - Sensors

**3** Energy Meter+ Water Meter

### Digit 22 to 24 - Free

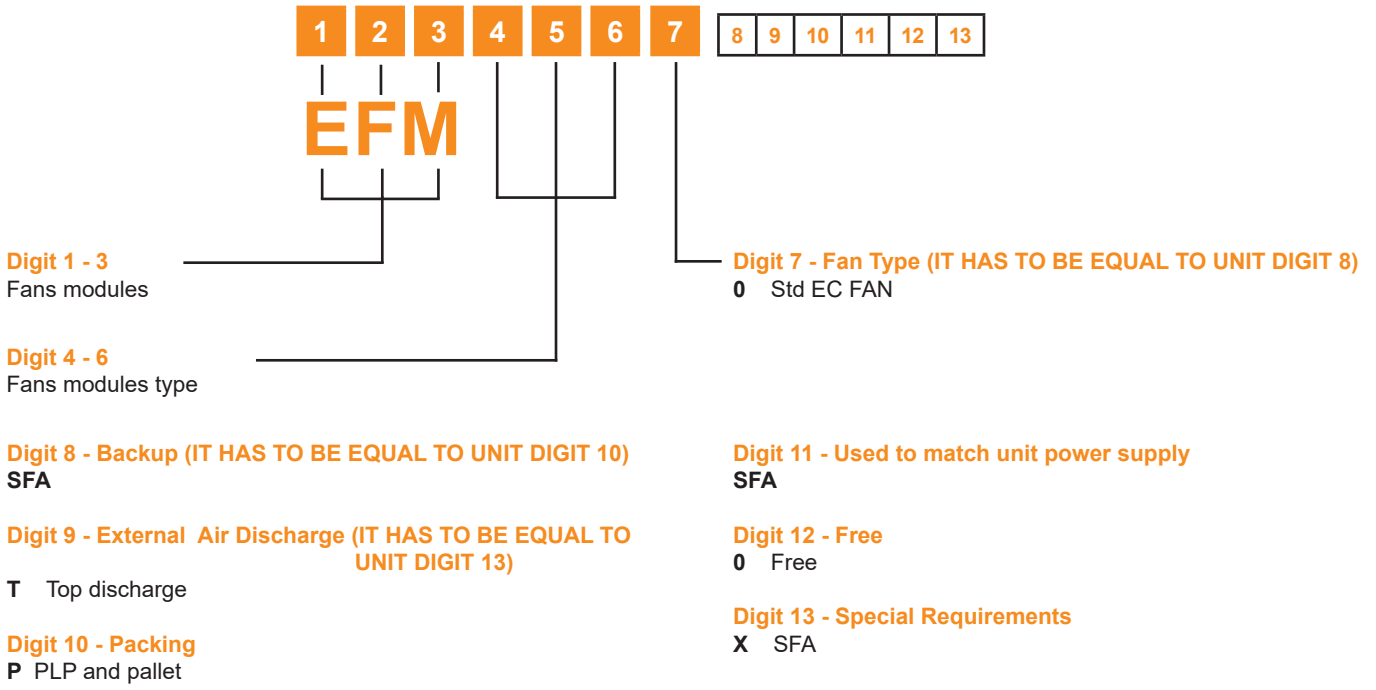
**000** Standard Unit

### Digit 25 - Special Requirements

**X** SFA

# Digit Nomenclature (Fan Module)

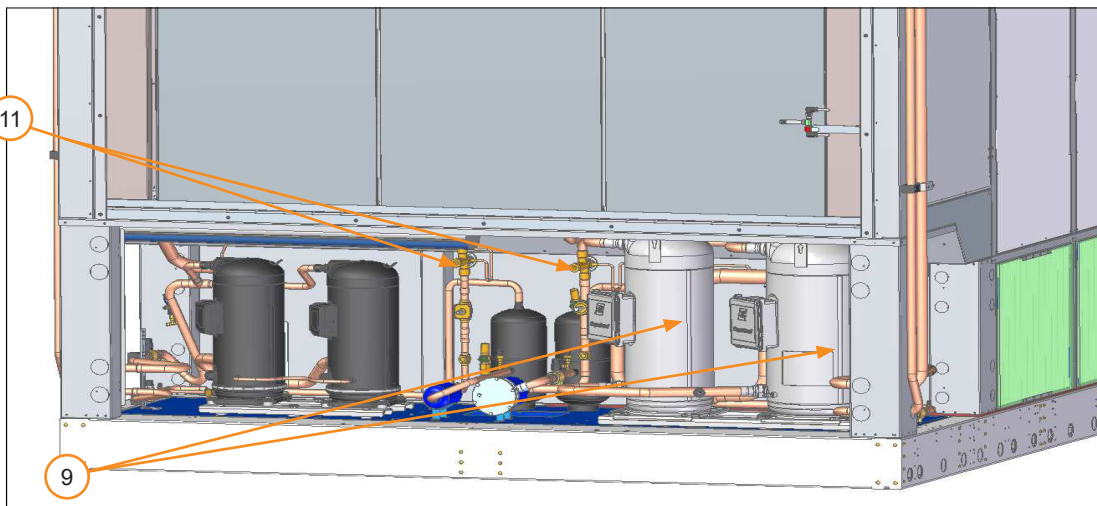
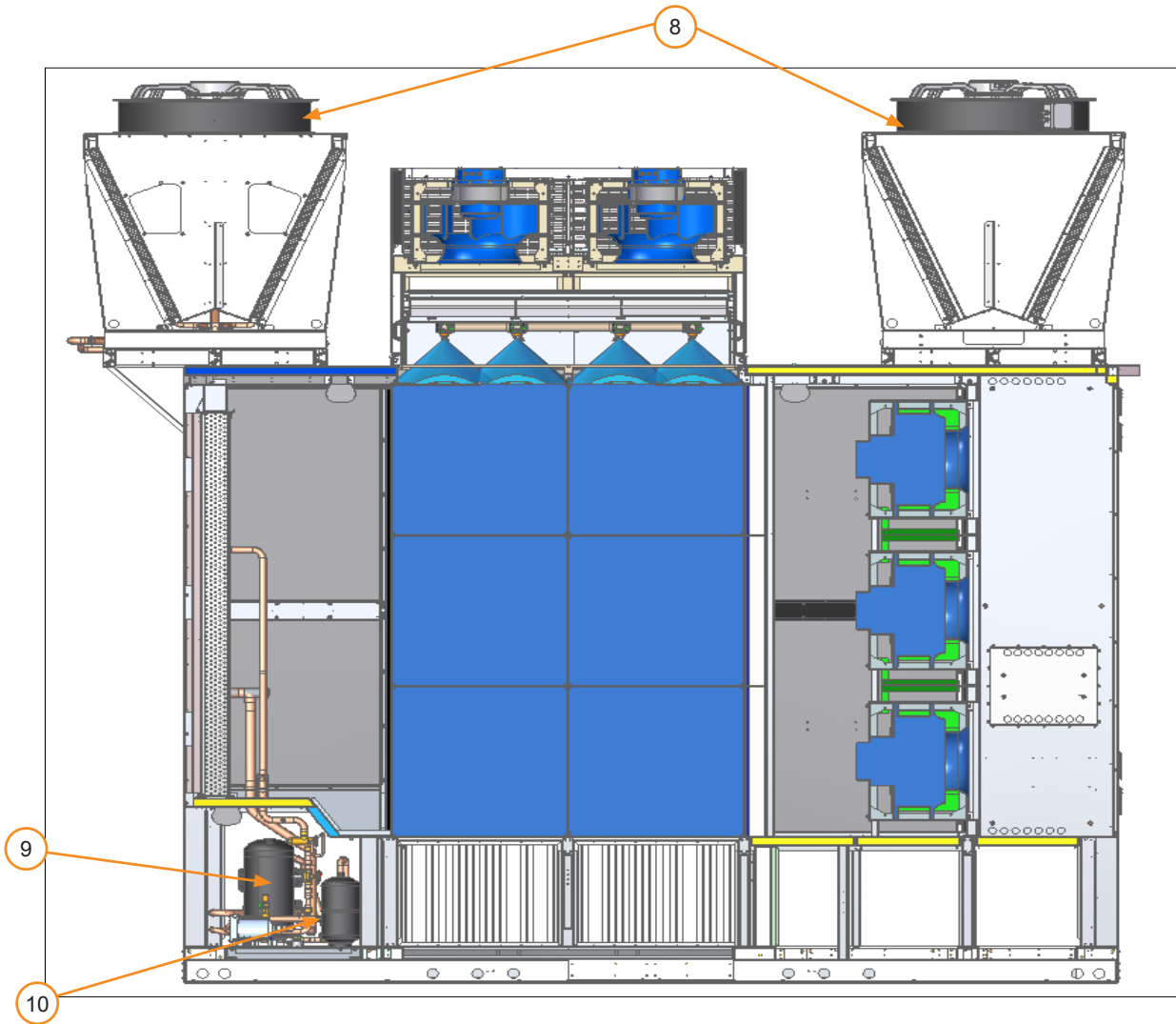
The unit is fully defined by thirteen digits.



## Liebert® EFC Cooling Options

### Evaporative Cooling and DX Cooling Working Mode

The other main components of the DX system are: the condensers (8) mounted on the top of the unit on each side of the fan module (see figure below), the scroll compressors (9), the liquid receivers (10), the safety valves and the thermostatic expansion valves (11).





## 2.1 - Safety Information WARNING!



### NOTICE!

The unit will always be shipped in three packages, one containing the unit, one containing the process fans module and one containing the condensers.

## 2.4 - Recommended Unit Handling

Air cooled condenser recommended handling: please see the user manual that can be found inside the condensers.

## 2.5 - Unit Weight

The total unit weight must be calculated by adding the heat exchanger module weight, the fan module weight and the condensers weight.

**Note:** data above refer to standard units without any option.

**Tab. 2.2a** EFC320 Unit Weight

Unit	Weight [kg]
EFC30050PT	5620
EFM3000T	800
MCV210	495 (without packaging)





## 3.1 Remote condensers installation

The Liebert® EFC unit is supplied in three modules, the heat exchanger module, the process fan module and the air-cooled condenser. The unit modules must be connected close to or on the final working position.

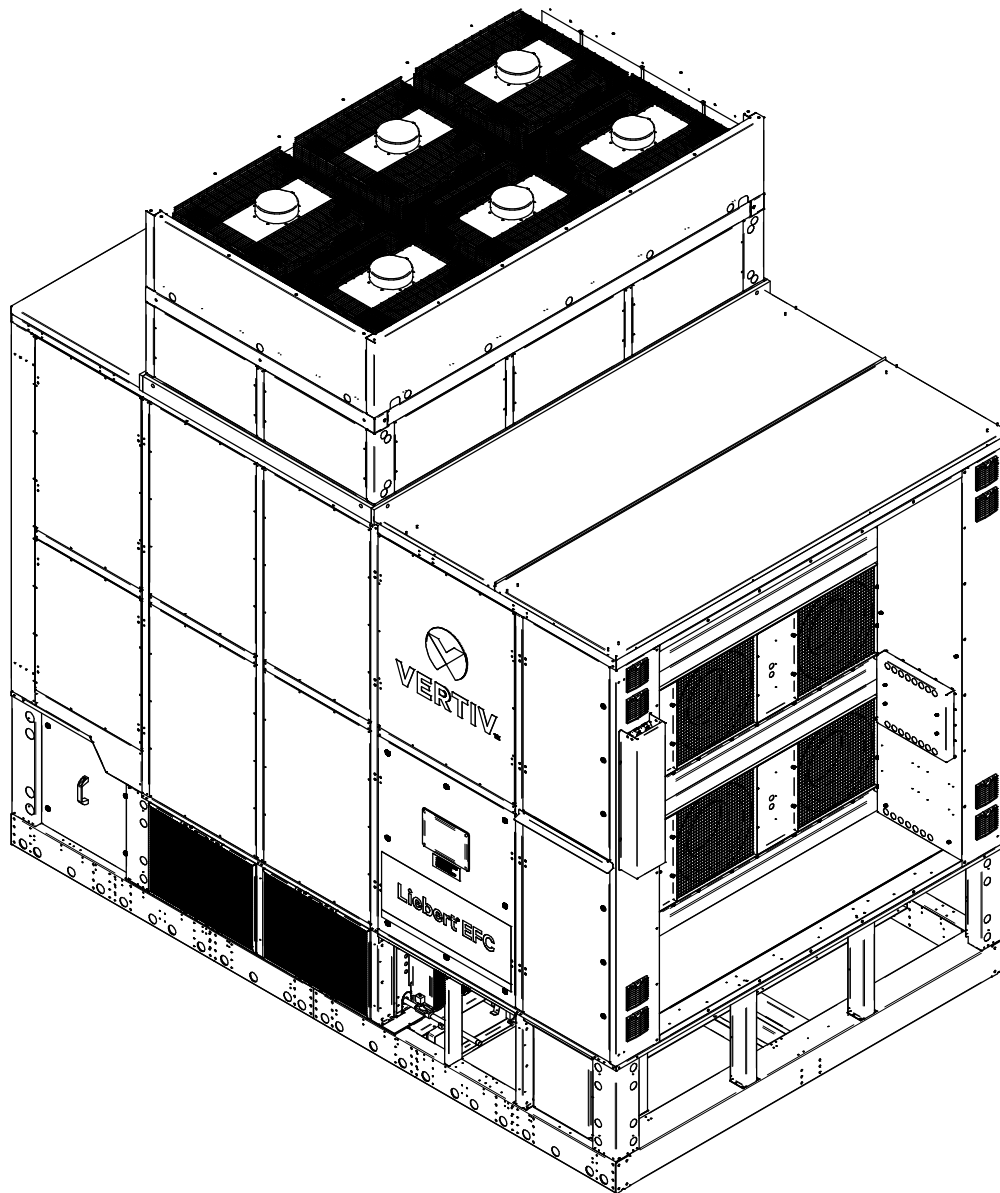
Make sure you have the space available for mounting operations.

After the assembly the unit can be moved and positioned in the working site. See chapter 5 - Positioning.

**Note:** The air-cooled condensers have to be mounted after the unit is placed on the final position

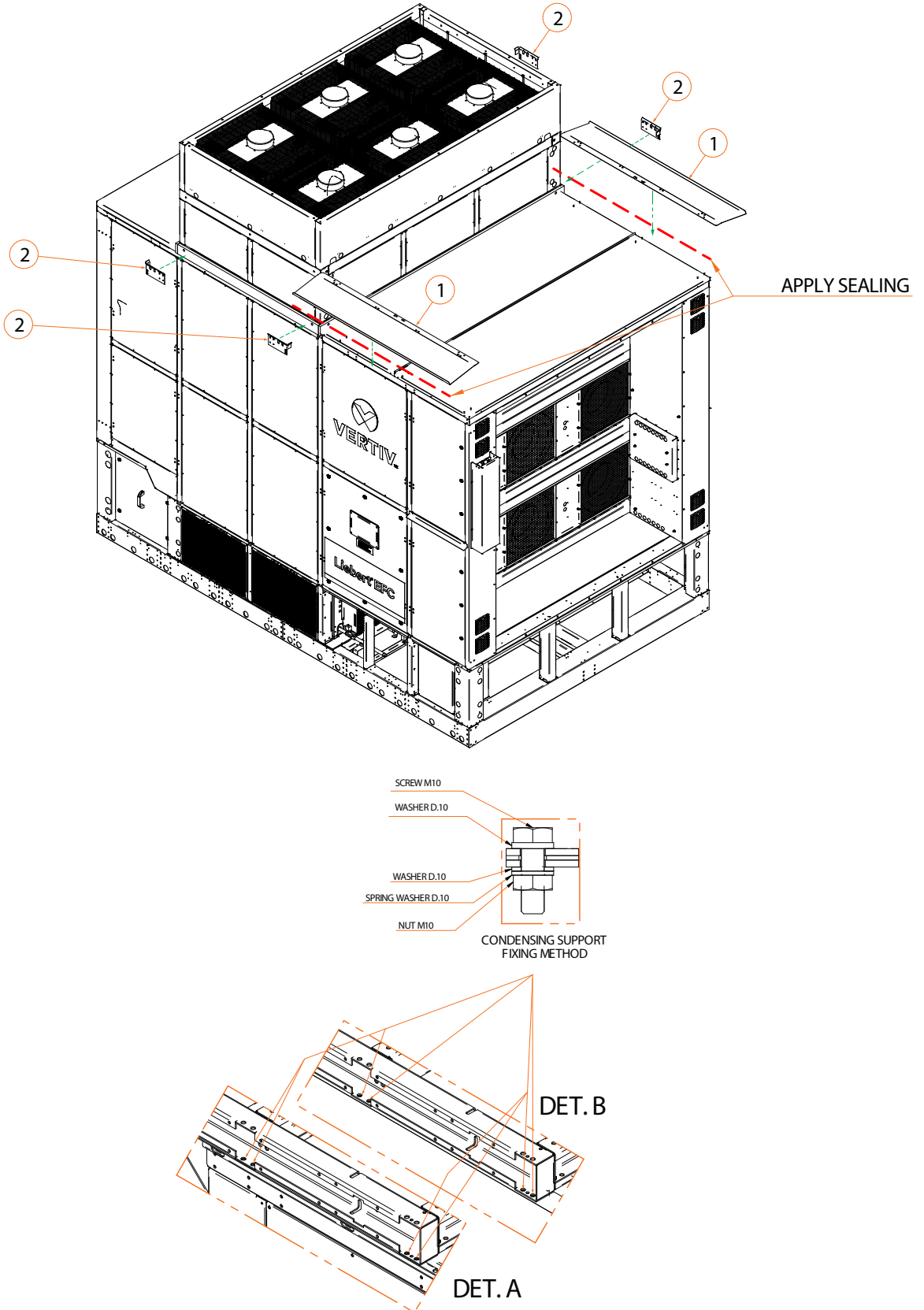
For a correct assembly you must follow the next steps:

Figure 3.1



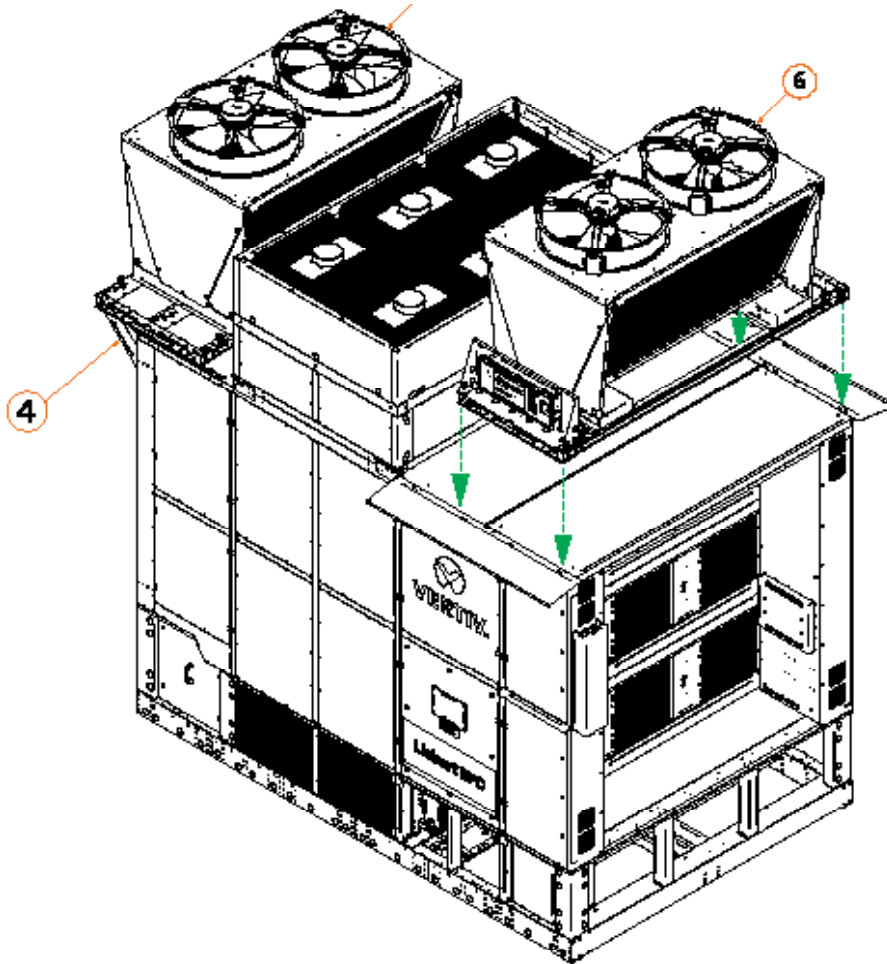
3.2. Install (2) rain protections -1, apply sealing and (3+3) M6 nuts, spring washers, washers. see figure 3.2 and detail A and B.

Figure 3.2



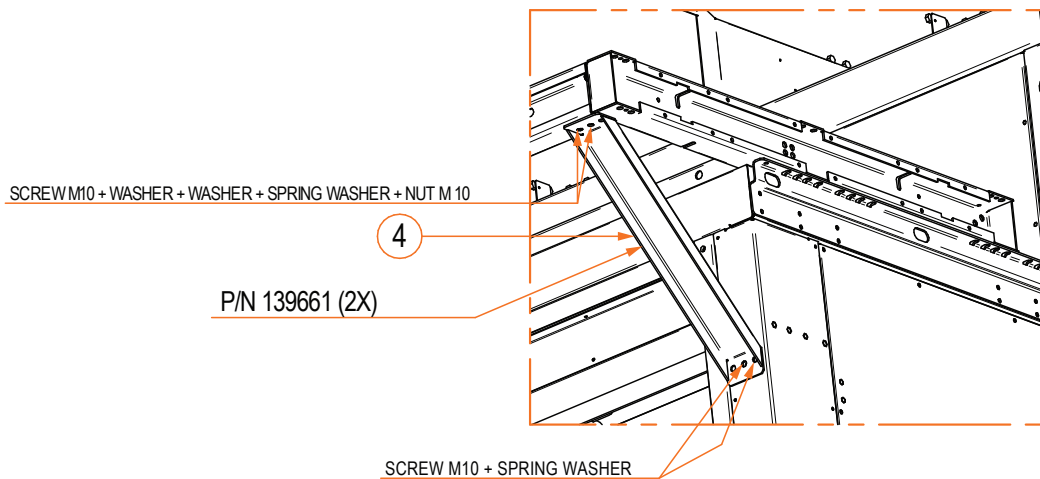
3.3. Fix (2) condensing units - 6 on the supports. See figure 3.3

Figure 3.3



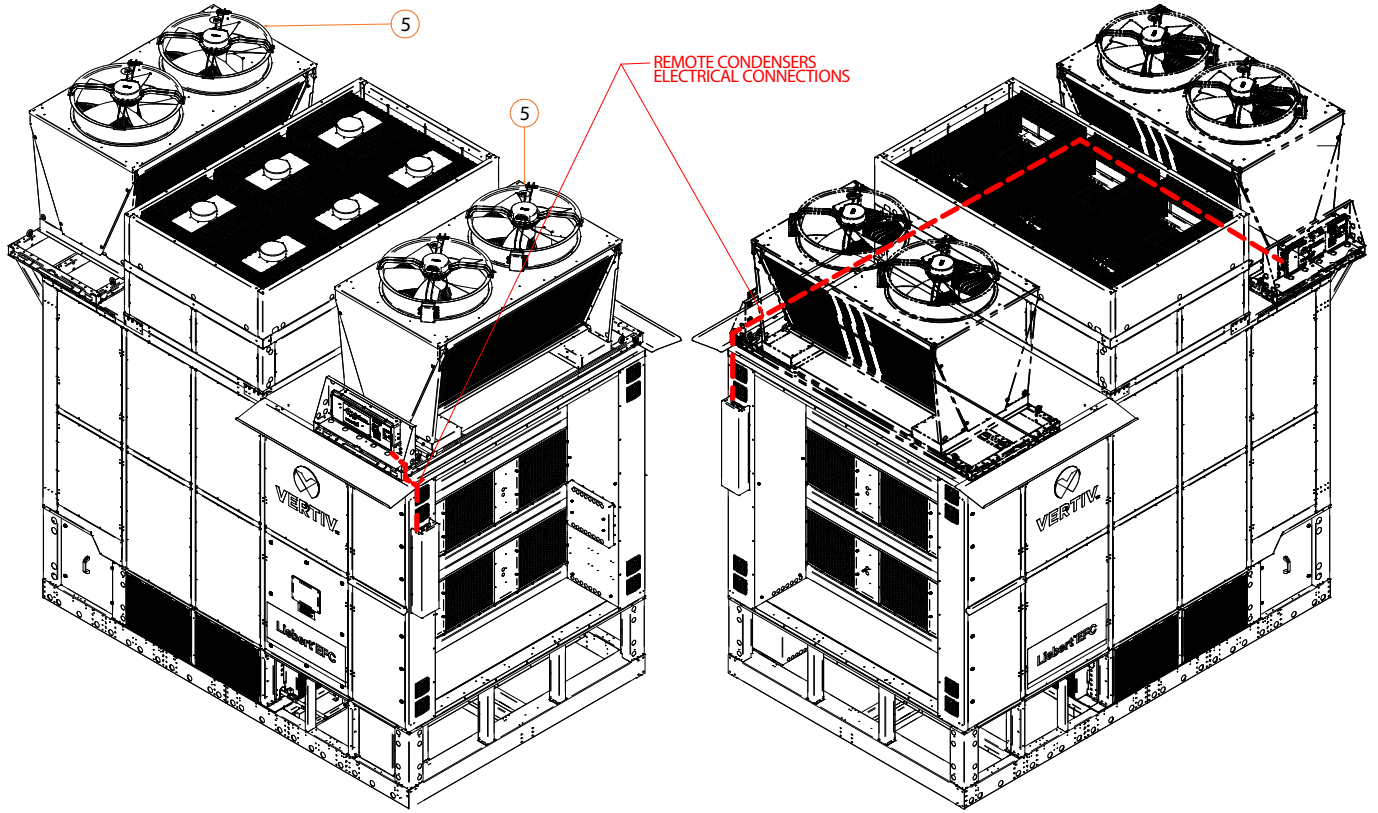
3.4. Fix each one on 4 places as shown in figures 3.3 and 3.4 and in detail C.

Detail C



3.5. Connect the remote condensers electrical connections cables. See figure 3.4.

Figure 3.4



## 4.1 - Refrigeration pipeline connections

### 4.1a. Refrigerant pipeline connections right side

Install the remote condensers pipes on the right side using  $\varnothing 22$  clamp for liquid line pipes and  $\varnothing 28$  clamps for discharge line pipes, put the clamps in the places that are indicate on the figure 3.5 and 3.6 using the screws supplied.

Figure 3.5

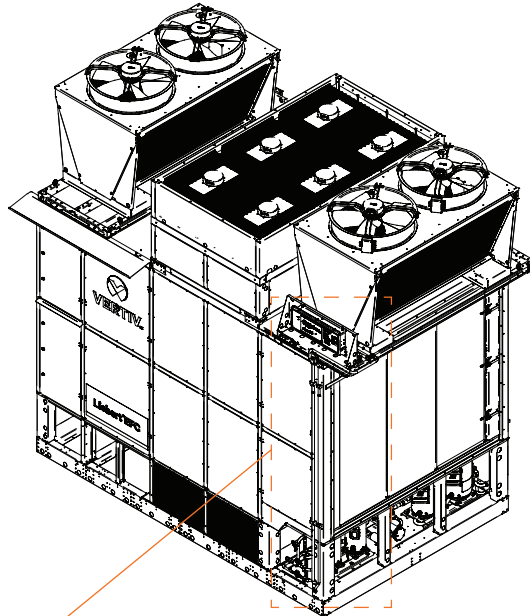
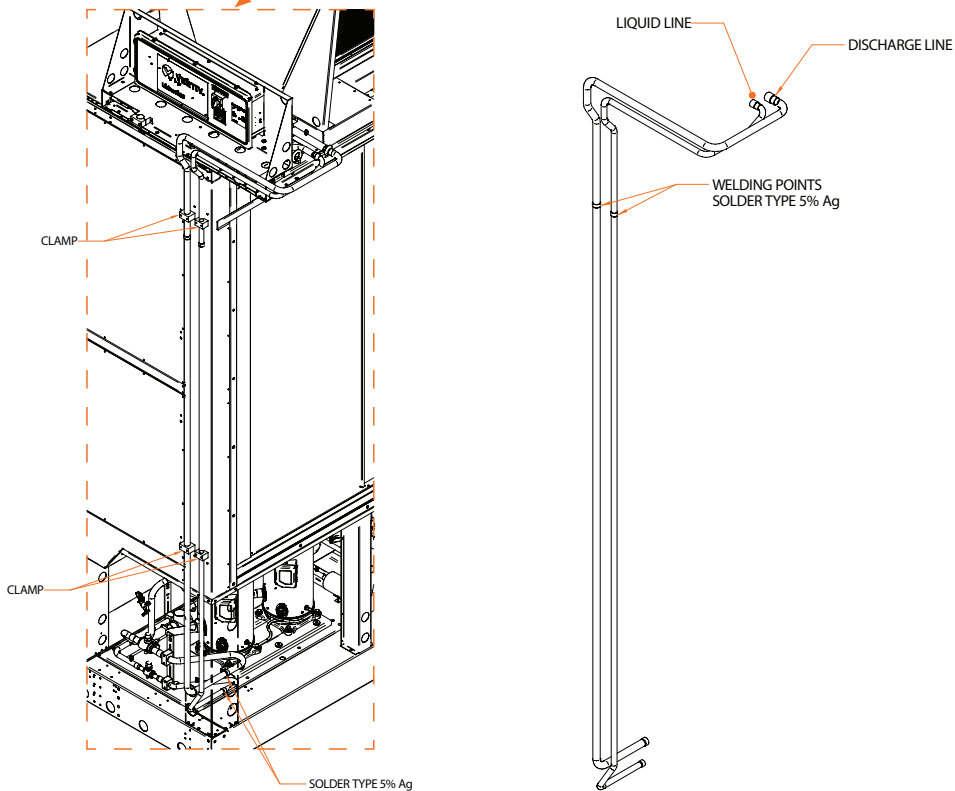


Figure 3.6



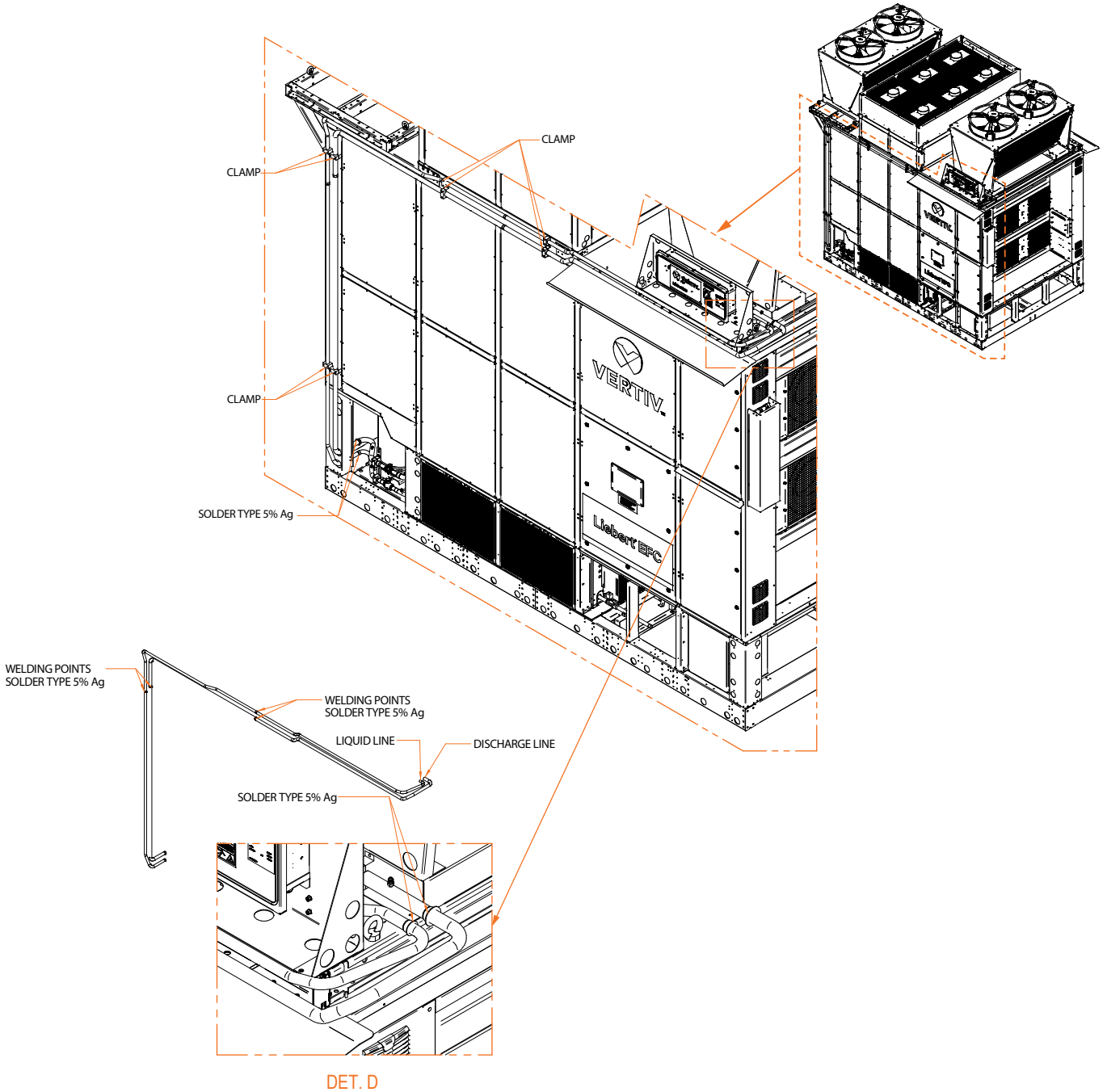
**Condensers units are supplied pressurized with coils connections closed. Remove copper caps before piping welding.**

### 4.1b. Refrigerant pipeline connections left side

Install the remote condensers pipes on the left side using phi Ø28 clamp for liquid line pipes and Ø35 clamps for discharge line pipes, put the clamps in the places that are indicate on the figure 3.7 and 3.8 using the screws supplied.

Figure 3.7

Figure 3.8



Condensers units are supplied pressurized with coils connections closed. Remove copper caps before piping welding.

## 4.2 Oil level check

Follow the procedure indicated on unit user manual for circuit made with compressors ZP182+ZPD182.

For circuit made with compressors ZP235+ZP295 follow this procedure:

After connected air cooled condensers, create vacuum and then charge with refrigerant.

Before compressors start up, the oil level on sight glass on TPTL pipe must be from ½ to full.

Follow below instructions in case of:

- First start up refrigerant circuit;
  - Oil not visible on sight glass with compressors not running at unit start up;
  - Extraordinary maintenance on refrigerant circuit.
1. Put unit on manual mode;
  2. Start 2 compressors on the same circuit and keep them on at stable conditions for at least 6 min;
  3. Switch off both compressors at the same time or within max 10 sec;
  4. Verify if you can see oil on the sight glass after 5 min of compressors switch off; if you cannot see oil, add 1 [l] of oil and repeat instructions from point 1

**Note:** never charge more than max topping up quantity indicated on table below;

5. Switch on the bigger compressor (ZP295) and keep running at stable conditions for at least 6-8 min;
6. When switch off the compressor, you have to see oil on sight glass (figure 4.1) from ¾ to full, then the sight glass will slowly emptying up to ¼ at least (due to communication between the 2 compressors through TPTL pipe) within 5 min from switch off; if you cannot see oil, charge 1 [l] of oil and then repeat instructions from point 5

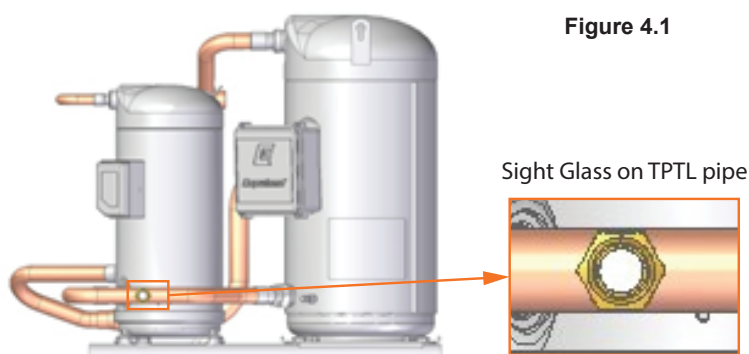


Figure 4.1

**Note:** never charge more than max topping up quantity indicated on table below;

7. Could happen after long period (more hours) of compressors inactivity the oil level on sight glass increase: this is normal and is due to oil decantation on compressors internal parts;
8. Is NOT normal to see low oil level after long period (more hours): this is ABNORMAL and could be due to liquid refrigerant mixed with oil that move due to heaters on compressors bottom; contact Technical support;
9. Repeat these instructions on each refrigerant circuit

COMPRESSORS MODEL: (each circuit)	INDICATIVE REFRIGERANT CHARGE (*) (R410A, each circuit)	INITIAL OIL CHARGE (each circuit)	MAX TOPPING UP (**) (each circuit)	OIL ADDED ON THE FACTORY (**) (***) (each circuit)
	[kg]			
ZPU530KCE (ZP295+ZP235)		11.5 (6.8+4.7)	6	3 (****)
ZPDT364 (ZP182+ZPD182)		6.5 (2x3.25)	6	2 (****)

(\*) The final refrigerant charge must be adjusted during unit start up

(\*\*) The recommended oil for units with R410A refrigerant is EMKARATE RL 32-3MA

(\*\*\*) Follow procedure to verify correct oil charge

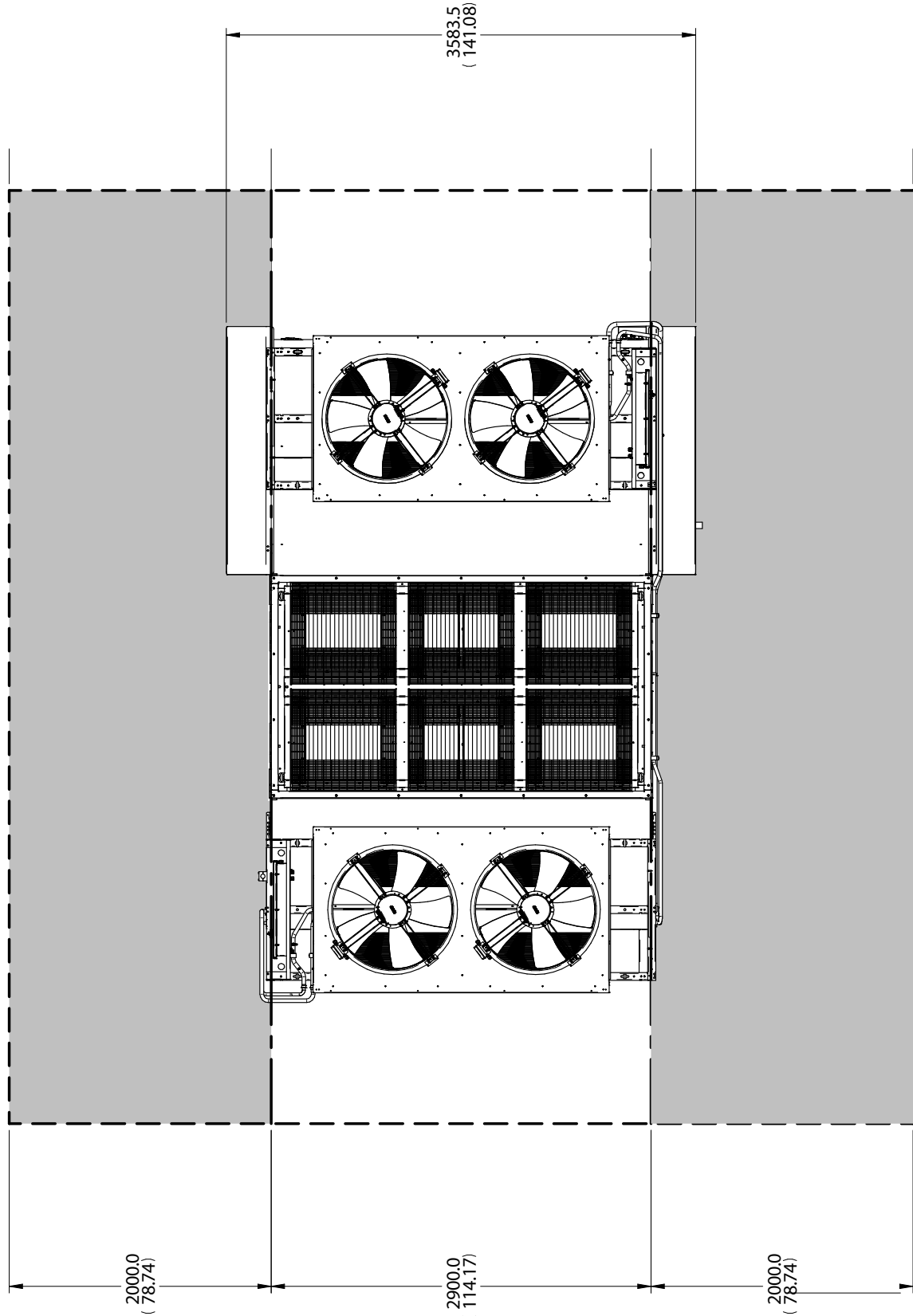
(\*\*\*\*) For units with refrigerant circuit tested on factory, add 1 [l] of oil and then follow the procedure to verify correct oil charge





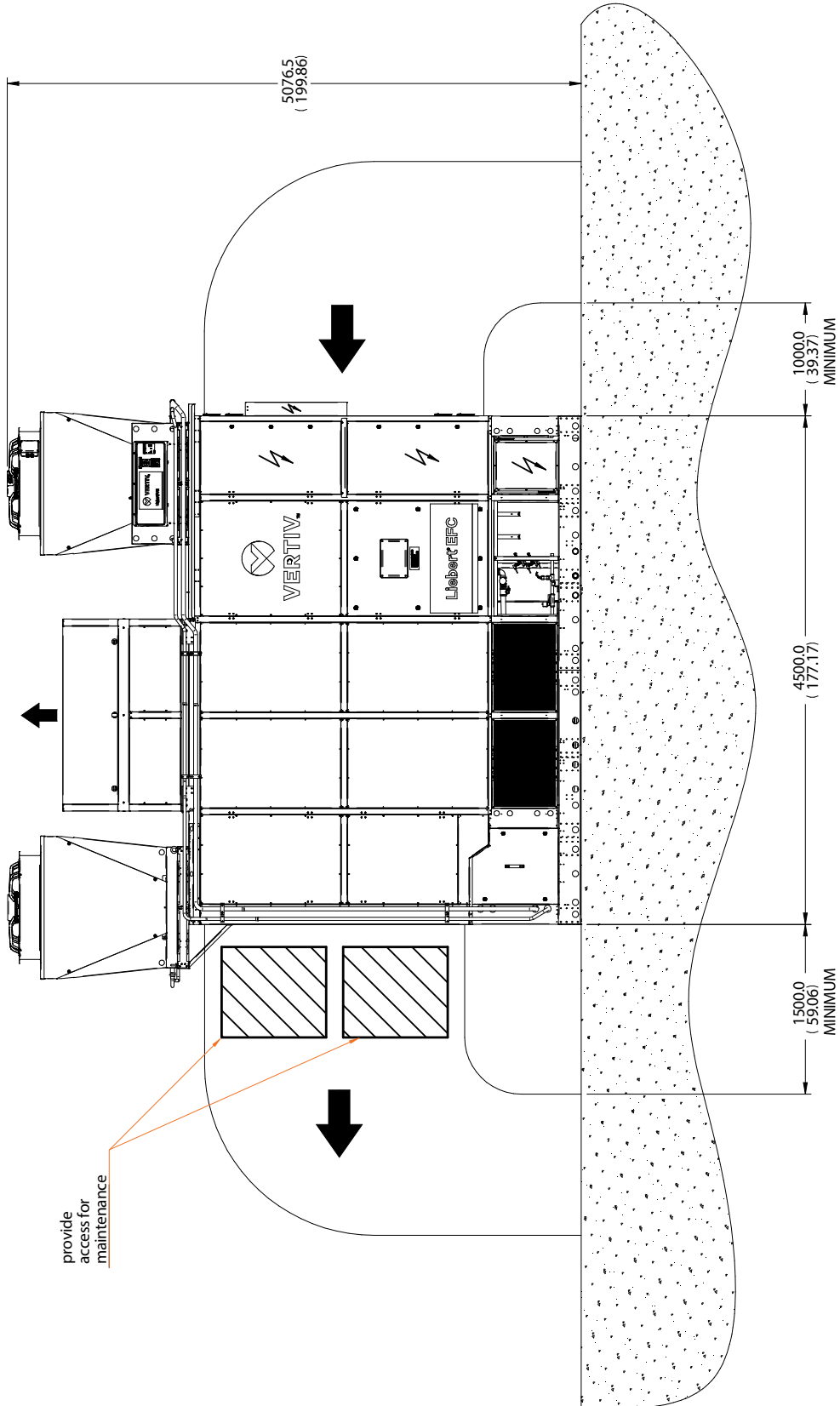
## 5.1 - Suitability of installation area

The minimum clearances (mm) requested are presented in the figure below.



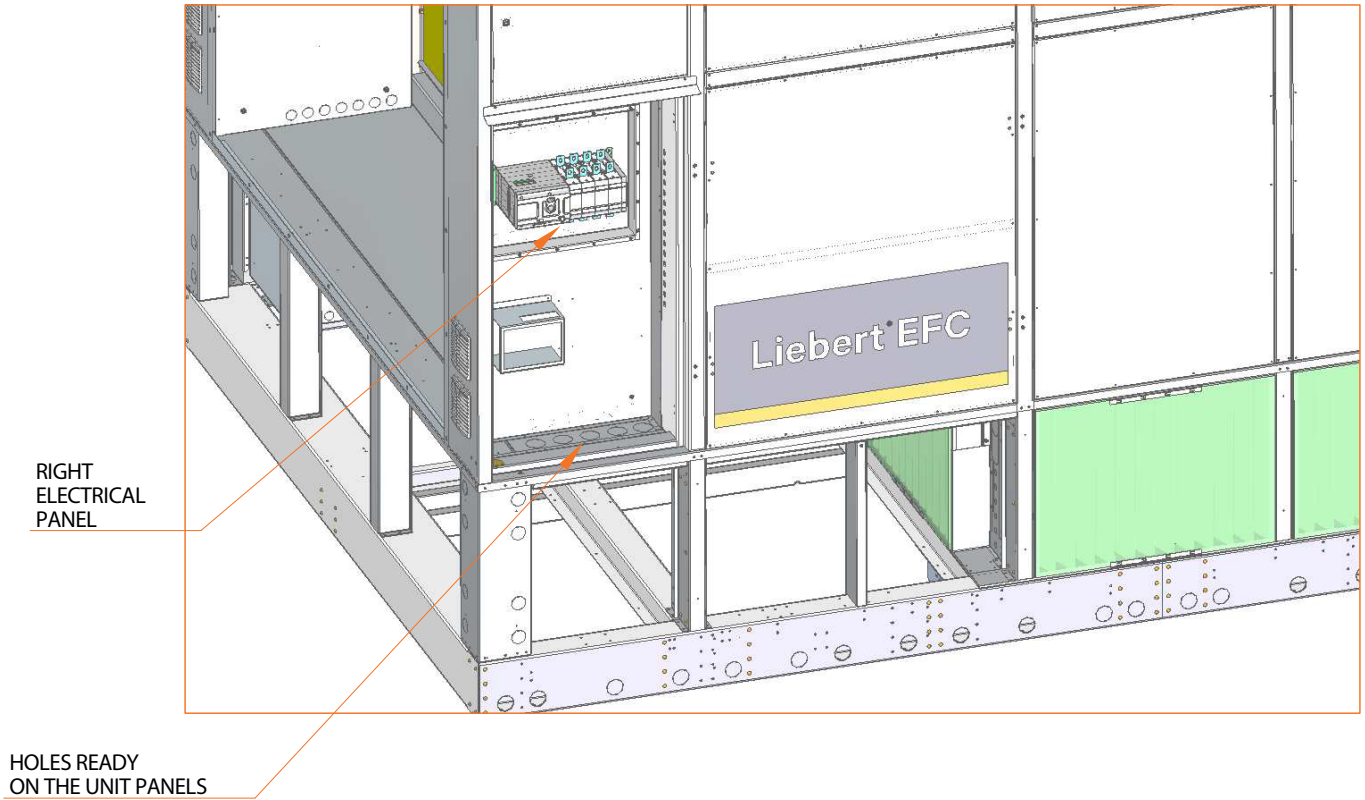


Provide access for cleaning and temperature sensors maintenance on delivery duct, see drawing below.



## 5.2 - Electrical connections

The electrical connections for the EFC320 Equinix unit are presented in the following figure



**8.6 - Refrigeration circuit**



**WARNING:** The operators must wear gloves to avoid burns caused by hot parts of the compressor.

**WHEN REPAIRING THE REFRIGERATION CIRCUIT, COLLECT ALL REFRIGERANT IN A CONTAINER: DO NOT ALLOW IT TO ESCAPE.**

- When removing (for repairs) or charging refrigerant, it must always be done on both the high and low pressure sides of the compressor simultaneously.
- The compressor copper plated steel connections should be welded with a silfos material containing a minimum of 5% silver.

**8.6.1. Oil Charge R410A**

The oil to be used when topping up (only if there are any leaks) is EMKARATE RL 32 - 3MA or Mobil EAL Arctic 22CC (see Tab. 6.1 and Tab. 6.2).

**Tab. 6.1 - EMKARATE RL 32 -3MA oil**

Viscosity at 40 °C	: 31.2 cSt
Viscosity at 100 °C	: 5.6 cSt
Viscosity index (ISO Grade)	: 32

**Tab. 6.2 - Mobil Arctic EAL 22CC oil**

Density (at 15 °C)	: 0.967 kg/l
Flash point (C.O.C.)	: 245 ° C
Pour point	: < - 54 ° C
Viscosity at 40 °C	: 23.6 cSt
Viscosity at 100 °C	: 4.7 cSt
Viscosity index (ASTM D2270)	: 130

These oils rapidly absorb humidity present in the air when they are exposed to the atmosphere. If the oil absorbs humidity, the ester molecules can break down, forming acidity.

We therefore recommend exposing the oil for as short time as possible (no more than a few minutes) and, in case of topping up, using exclusively the oil indicated on the refrigerating compressor.

Normally 1 or 2 - litre cans are available for this purpose; once they are opened, they must be completely used up.

They must not be used after a long period, as they absorb humidity.

It is therefore obvious that the taps of the compressor must only be turned after the whole plant has been subjected to a vacuum and partial filling.

**8.6.2. Oil topping-up of an installed circuit**

If oil leakages occur, the topping - up operation is necessary. (Contact the local Service before intervention).

## A1. Evaporative cooling system

### A1.1 - System description

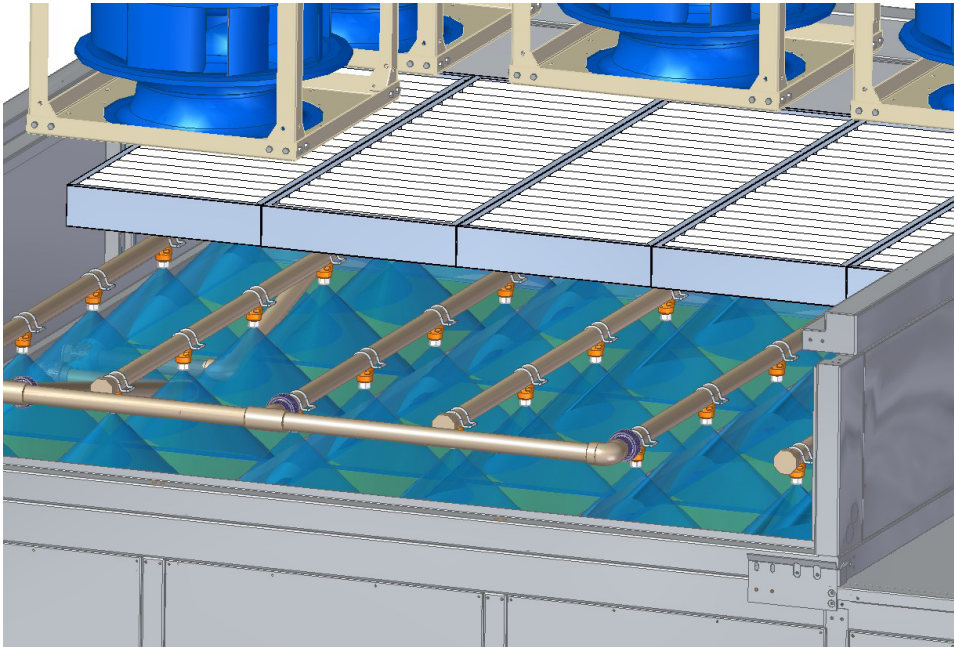
Liebert® EFC is equipped with two racks with several nozzles, placed at the exit of the heat exchanger, on the process air side. These racks spray water on the surface of the heat exchanger creating a thin water film which maximizes the cooling effect by evaporation.

### A1.2 - Components of the systems

The evaporative cooling system is comprised of (see enclosure D):

- Submersible pumps, are able to provide water to the racks at a maximum pressure of 3 bar;
- One or two racks with several nozzles used to spray water on the surface of the heat exchanger;
- Droplet separator;
- Water filters, to prevent nozzle clogging;
- Flow switches;
- Calibration valve;
- Level switch to control water level;
- Conductivity sensor, to measure water conductivity;
- Feeding valve;
- Discharge valve;
- Flow meter (if installed).

Fig. A.5 - Nozzles spray water on the surface of the heat exchanger



## A2. Maintenance and water quality



**WARNING:** The operators must wear gloves, mask and eye protection to avoid coming into contact with bacteria, fungi, mud, etc which may appear in the evaporative system if correct maintenance is not performed.

### A2.1 - Maintenance procedures

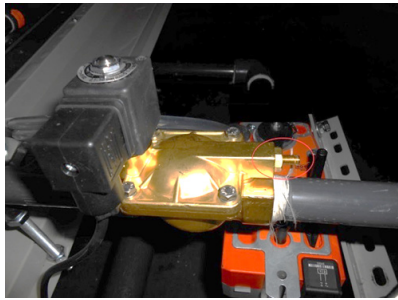
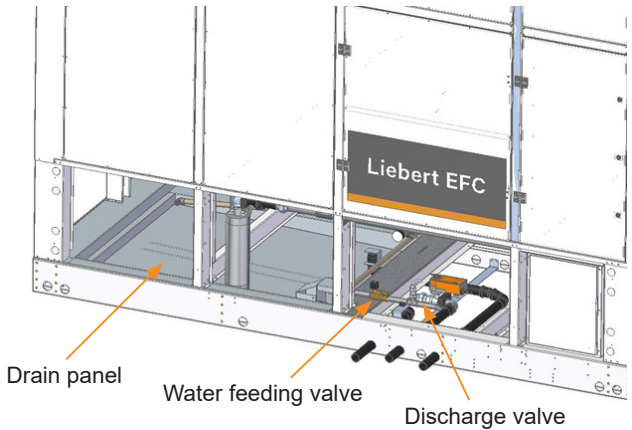
- Before the warm season, when the evaporative system could be activated, the unit must be disinfected;
- If the heat exchanger and drain panels show hard limescale deposition, the descaling procedure is necessary;
- In compliance with local regulations relating to the worker's health, verify the need and frequency of legionella monitoring, we recommend to make quarterly analysis to verify the presence of legionella in the system. If contamination is detected, contact local certified and authorized water treatment companies and local authorities where required by legislation;
- Any activity should be carried out by qualified and trained technicians.

The interval depends on the water quality: the more salts or impurities in the water, the more frequently the inspections must be performed.

- Check the condition of the nozzles; clean or replace if necessary.
- Check the tightness of the connections whether threaded or compression-based
- Check the drain panel by removing air filters (figure A.6). clean and remove any dust or foreign bodies to keep the unit cleaned and to avoid pump premature failure.
- Clean water filters (figure A.7);

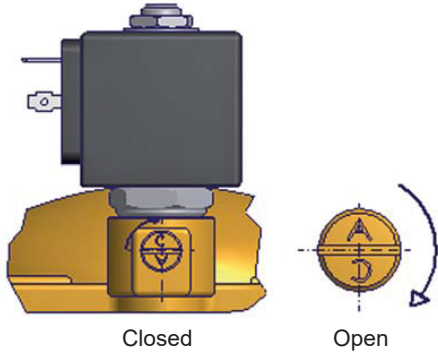
- Clean level switch and conductivity sensor (figure A.8);
- Check conductivity sensor calibration using the solution supplied within the unit;
- Clean droplet separator (figure A.9);
- Clean nozzles (Figure A.10);
- Check and clean water discharge valve (Figure A.6).

**Figure A.6 - Drain panel and water discharge valve**



Water feeding valve speed set: Close the screw fully and then open 3/4 turn to limit water hammering

Water feeding valve manual control



**Note:** **Closed:** (valve operates normally when coil is energised/de-energised): The letter "C" is in the upper position of the screw head  
**Open:** The letter "A" is in the upper position of the screw head

**Figure A.7 - Water filters**

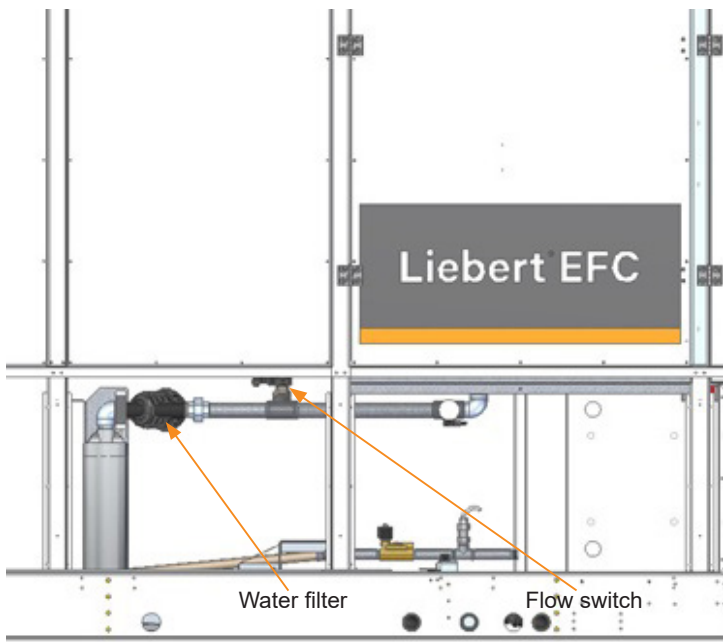


Figure A.8 - Level switch and conductivity sensor

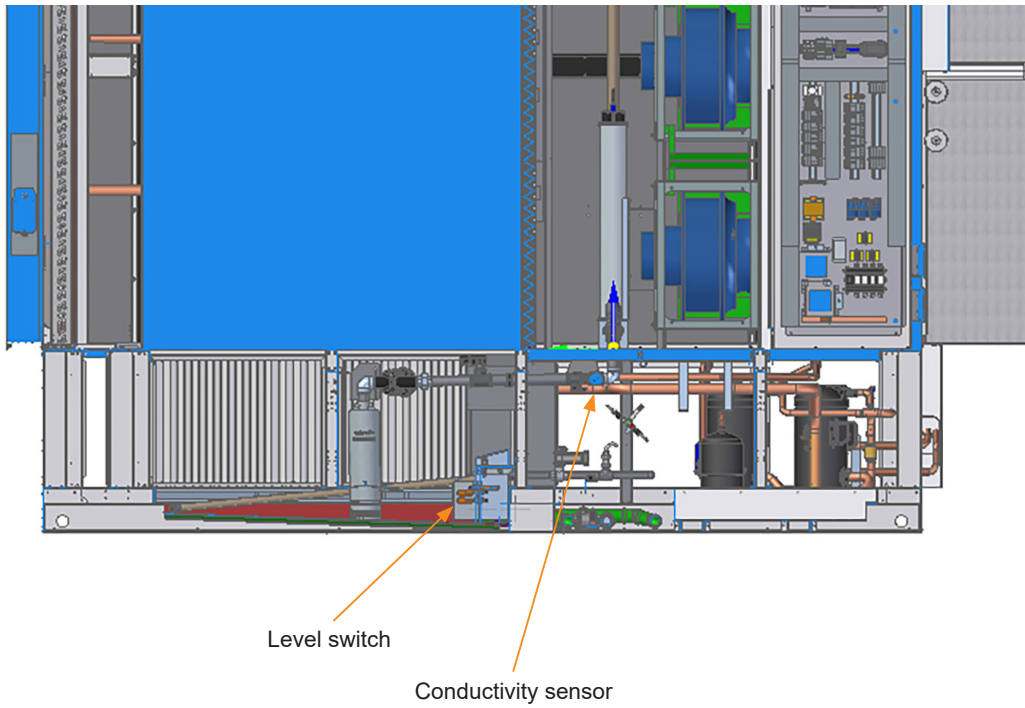
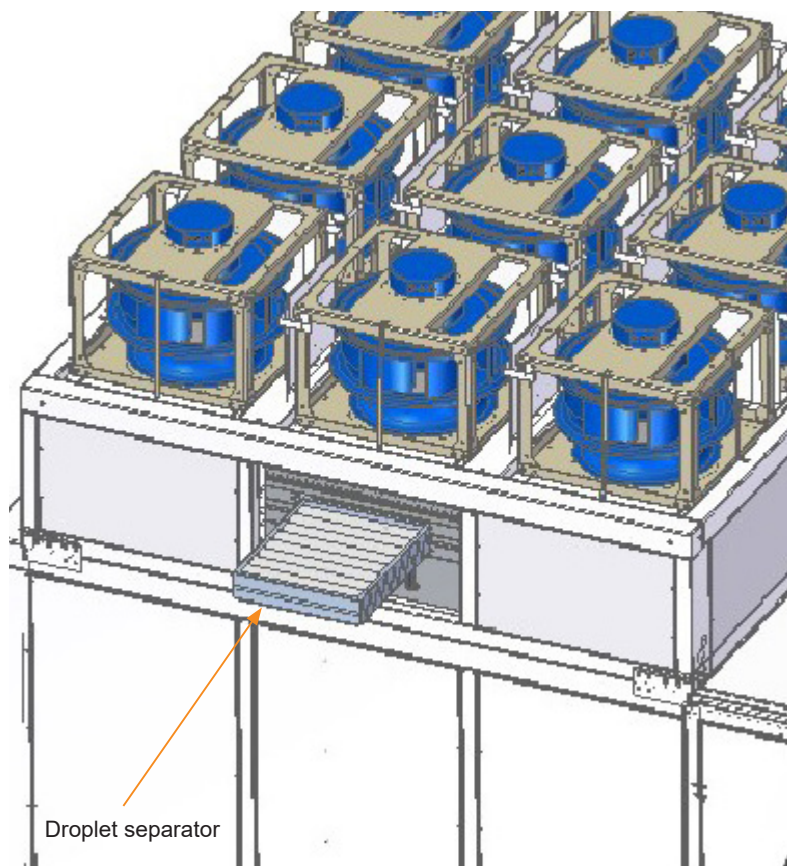
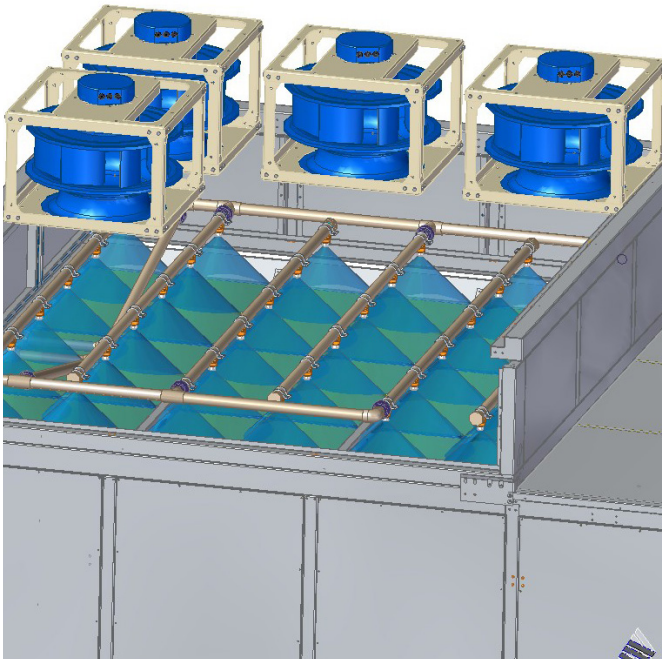


Figure A.9 - Droplet separator



Note: Here shown the single unit left, on the single unit right the level switch and conductivity sensor are on the opposite side

Figure A.10 - Evaporative system nozzles



## A2.2 - Water quality

### Water quality

The unit must be supplied with drinking water as indicated on Directive 98/83/EC, filtered with a filtration grade not less than 89 micron, having the following characteristics:

- $6.5 < \text{pH} < 8$
- Electrical conductivity  $< 400 \mu\text{S}/\text{cm}$
- $\text{TDS} < 260 \text{ mg}/\text{l} @ 180 \text{ }^\circ\text{C}$
- Total hardness  $< 10^\circ\text{f}^*$
- Total alkalinity  $< 50 \text{ mg}/\text{l} \text{ CaCO}_3$
- Chlorides  $< 20 \text{ mg}/\text{l}$
- Silica  $< 5 \text{ mg}/\text{l}$
- Organic matter  $< 3 \text{ mg}/\text{l}$

**Note:**

If softened water is used consider  $3^\circ\text{f}$  as minimum value for total hardness.

**Note:**

It is highly recommended to dose the antiscalant in the feeding water to avoid scaling on the system.



Ensure a pressure between 2 and 4 bar on the evaporative system water inlet and a waterflow at least 20% higher than the total water consumption (refer to unit selection sheet for specific value).



**Tab. B.1a - Electrical data**

Configuration	Model	Power supply	Electrical Data			min/max Cu cable size mm2
			FLA	LRA	RESIDUAL-CURRENT CIRCUIT BREAKERS I $\Delta$ n=0.3A (400V)*	
			[A]	[A]		
Evaporative Cooling + DX Fans + Pump + Compressor(s) + Humidifier + Air-cooled Condensers	EFC320 Spacenet	400 V / 3 Ph / 50 Hz + earth	321.1	535.8	350	95

**Tab. B.1b - Electrical data**

Component	Model	Quantity	FLA	LRA	Power input	cos $\phi$
		no.	[A]	[A]	[kW]	
Fans primary	EFC320 Spacenet	9	9x7.4	9x0.1	9x6	-
Fans process		6	6x7.4	6x0.1	6x6	-
Compressor		2+2	2x(34+48.5)	2x(173+272)	-	-
Recirculating pumps		1	6	-	1.2	-
Air-cooled Condensers		2	2x8.8	4x0.1	2x5.32	-

**Tab. B.3 - Refrigerant and oil charge for units with remote condenser**

COMPRESSORS MODEL: (each circuit)	INDICATIVE REFRIGERANT CHARGE (*) (R410A, each circuit)	INITIAL OIL CHARGE (each circuit)	MAX TOPPING UP (**) (each circuit)	OIL ADDED ON FACTORY (**) (***) (each circuit)
	[kg]	[l]	[l]	[l]
ZPU530KCE (ZP295+ZP235)	36	11.5 (6.8+4.7)	6	3 (****)
ZPDT364 (ZP182+ZPD182)	27	6.5 (2+3.25)	6	2 (****)

(\*) The final refrigerant charge must be adjusted during unit start up

(\*\*) The recommended oil for units with R410A refrigerant is EMKARATE RL 32-3MA

(\*\*\*) Follow procedure to verify correct oil charge

(\*\*\*\*) For units with refrigerant circuit tested on factory, add 1 [l] of oil and then follow the procedure to verify correct oil charge



## Liebert EFC320 Spacenet

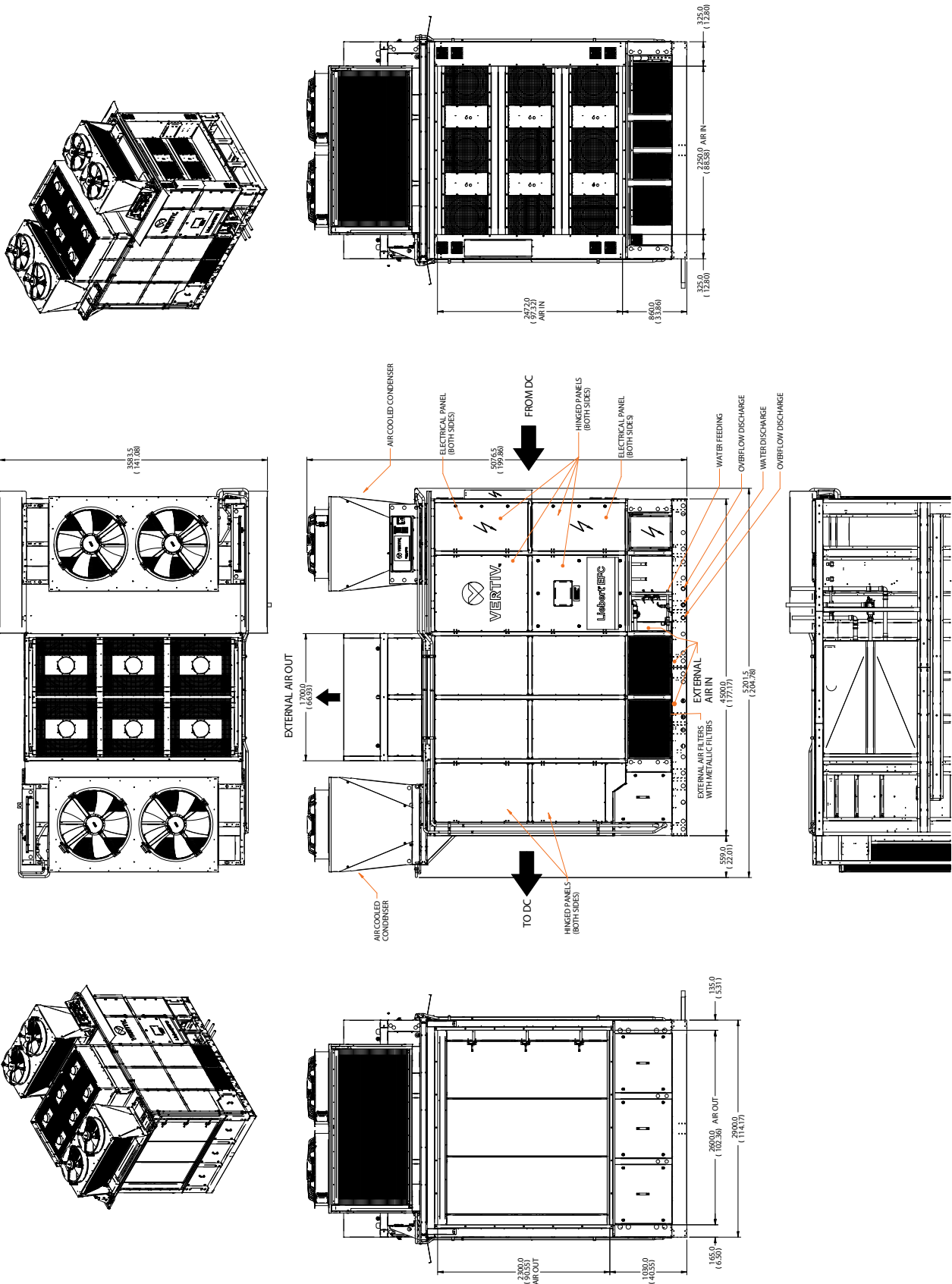
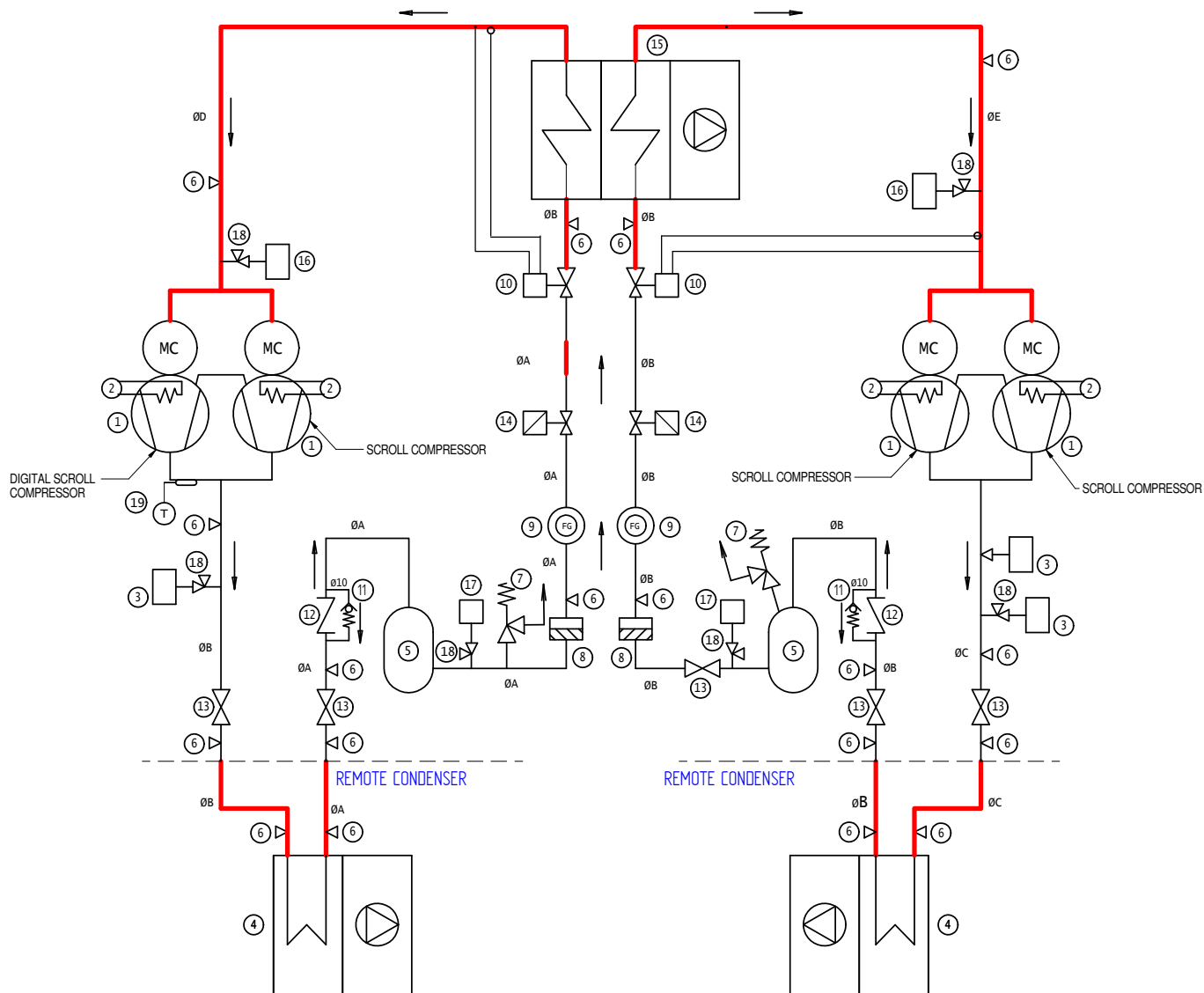




Fig. D.1a - DX system refrigerant circuit - double tandem compressors - TXV



øA	øB	øC	øD	øE
22	28	35	42	54

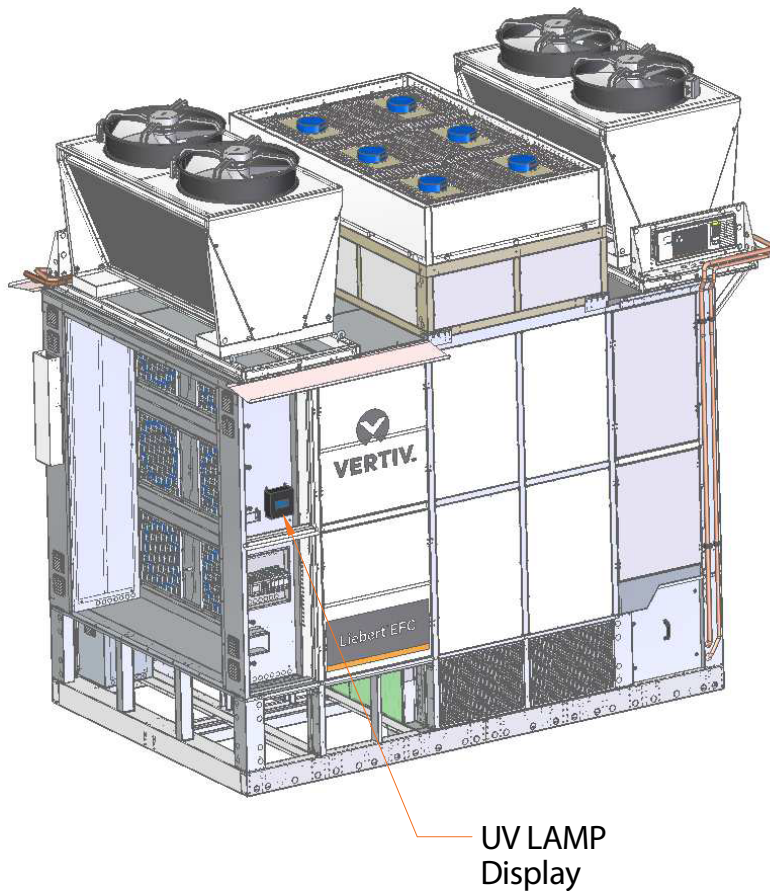
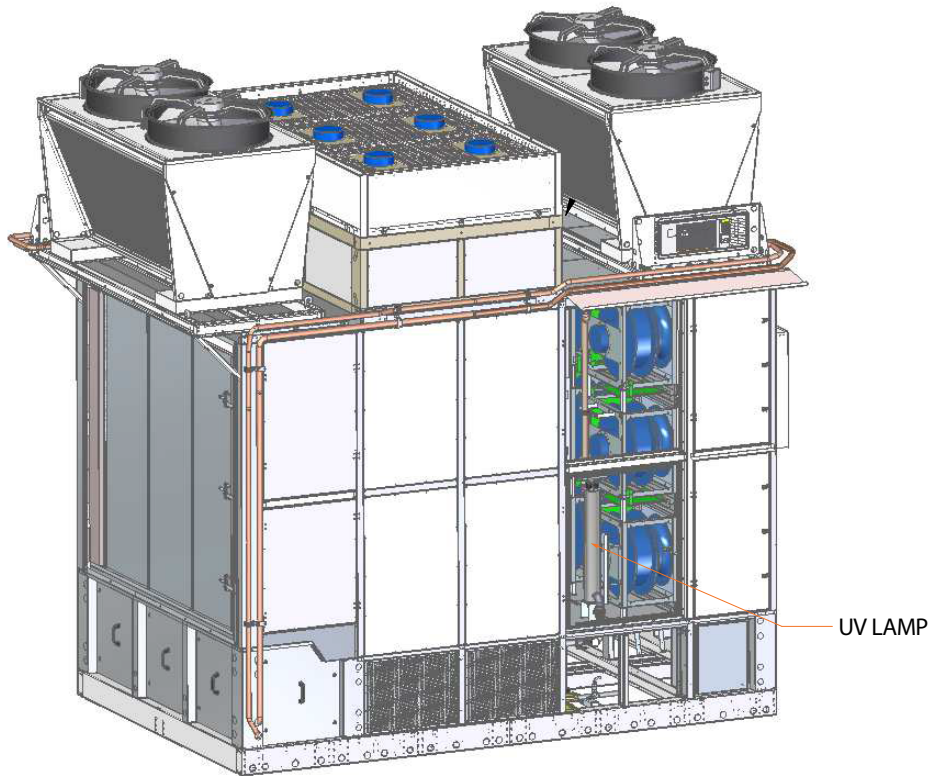
PIPE INSULATION / TUBI COIBENTATI

SCROLL COMPRESSOR

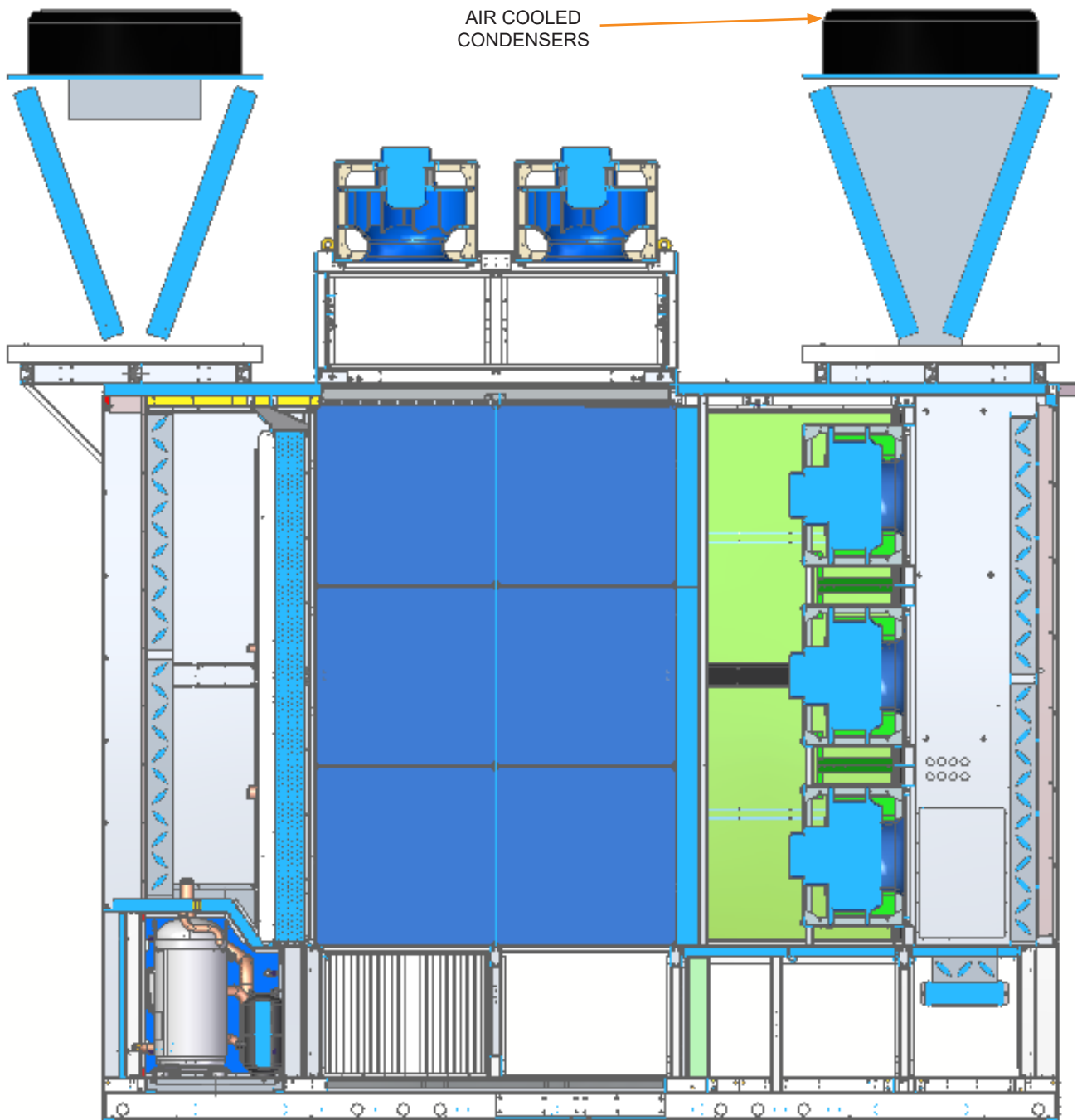
19	PTC TEMPERATURE SENSOR FOR DIGITAL COMP.	
18	ACCESS VALVE 1/4	
17	HIGH PRESSURE TRASDUCER	
16	LOW PRESSURE TRASDUCER	
15	EVAPORATOR	
14	SHUT OFF SOLENOID VALVE	
13	SHUT-OFF VALVE	
12	CHECK VALVE	
11	CHECK VALVE 10 bar	
10	THERMOSTATIC EXPANSION VALVE	
9	SIGHT GLASS	
8	FILTER DRYER	
7	SAFETY VALVE	
6	ACCESS VALVE 5/16	
5	LIQUID RECEIVER	
4	AIR COOLED CONDENSER	
3	HIGH PRESSURE SWITCH	
2	CRANKCASE HEATER	
1	COMPRESSOR	
N.	DESCRIPTION	DESCRIZIONE



## E1. UV Lamp on evaporative circuit



For the operation and maintenance of this equipment please consult the manual 'Manuale UV serie LCD Marchiato Atlas Italia' delivered with the EFC320 Equinix unit.



For the dimensions, operation and maintenance of this equipment please consult the user manual delivered inside the condensers.





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**2006/42/EC; 2014/30/EU; 2014/35/EU; 2014/68/EU**



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