Liebert® HPM-S DX

User Manual

English, 10045101MAN_ENG, rev. D.00 - 18.07.2024

Safety

Content of this chapter

This chapter gives general safety instructions.
Additional safety warnings, for specific operations, are given in the rest of the manual.

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

General Instructions

Intended readers	• This User Manual is intended for transport, installation and maintenance personnel. • The end user can only switch the unit **ON** and **OFF** and modify the setpoint.
Personnel	• The operations described in this manual must be made by technical staff, expressly authorized in compliance with the regulations in force at the installation site. • The authorized personnel must be properly trained and qualified, wear appropriate personal protective equipment and use adequate equipment and tools.
Read this manual	• Carefully read the manual before performing any operation on the unit.
Keep this manual	• Keep the manual during the complete life-span of the unit. • Keep the diagrams provided with the unit (wiring, chilled water circuit,...). They are part of the instructions for use. • If you move or sell the unit, transfer the manual and the diagrams together with the unit. • The manuals may be subject to modification. For complete and up-to-date information always consult the specific manual supplied with the unit.
Intended use	• Use the unit only for the purpose it has been designed. • The manufacturer takes no liability for any improper use of the unit.
Do not modify the unit	• Do not modify the unit without Vertiv™ permission in any way, including the safety devices, the control system and the software. • The manufacturer takes no liability for any unauthorized modification of the unit.
Warning labels	• Pay attention to the warning labels on the unit. • Do not remove or cover the labels placed on the unit by the manufacturer.

Lockout-Tagout (LOTO)	Before any intervention on the electrical system or accessing the inner components: • Lock the disconnection device by a padlock or similar tool. • Apply on the general disconnecting switch a warning plate. For units with **ATS** (Automatic Transfer Switch) power supply.
Safeguards Raised floor	When you finish the operations on the unit, always remind the following: • Mount again and fix with screws all the safeguards (panels, grids). • Close and lock all the doors, if present. • Place again all the floor panels around and under the unit. • Never operate the unit without the above mentioned safeguards.

Personal Protective Equipment

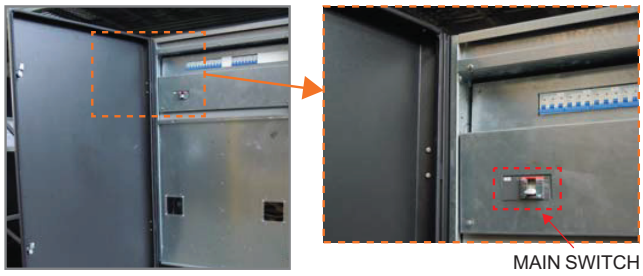
As general rule, always wear the following **PPE** (Personal Protective Equipment):

Residual Risks

Some operations may involve some residual risk.

Pay attention to the following safety measures when operating inside or near the unit.

Disconnecting switch



The ON/OFF switch on the control panel does not disconnect the unit from the power supply.

To disconnect the power supply proceed as following:

- Unscrew the door and open it;
- Open the disconnecting switch.

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

Open the disconnecting switch before removing any protective cover.

Electric and control system

The unit contains potentially lethal voltage in some circuits.

The electric and control panel can retain a stored high-voltage electrical charge for up to **10** minutes.

Risk of arc flash and electric shock.

Can cause injury or death.

General safety measures:

- Only properly trained and qualified personnel may perform repair, maintenance and cleaning.
- The key of the electric panel must be kept by the person responsible for maintenance.
- Always wear the protective equipment prescribed by the local and Vertiv™ regulations.
- It is forbidden to operate on the electrical components without using insulating platforms, or in the presence of water and humidity.

Before working inside the electric and control panels proceed as follows:

1. Open all the local and remote disconnecting switches of the unit.
2. Wait at least **5** minutes.
3. Verify with a voltmeter that the power is **OFF**.

Components at high temperature

The following components are at high temperature:

- electrical heaters
- humidifiers

General safety measures:

- Always wear temperature resistant gloves when operating on the unit.

Sharp elements

Fin and tube heat exchanger is made of plates and fins, which may have sharp edges and blurs.

Also other elements inside the unit may have sharp edges, blurs, splinters and exposed fasteners.

General safety measures:

- Always wear cut resistant gloves.

Automatic startup + rotating elements

This unit operates and restarts automatically.

The fan blades can automatically start rotating without warning at any time during a cooling cycle or after the power is restored after a power failure.

Risk of contact with high-speed, rotating fan blades.

Can cause serious personal injury or death.

Before working inside the unit, removing the fan guards or servicing the fans (speed control, blades, motors) proceed as follows:

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

Automatic startup + strong air flow

This unit operates and restarts automatically.

The fans may suddenly start blowing out a strong air flow, which may carry particles and small objects from inside the unit.

Can cause serious personal injury.

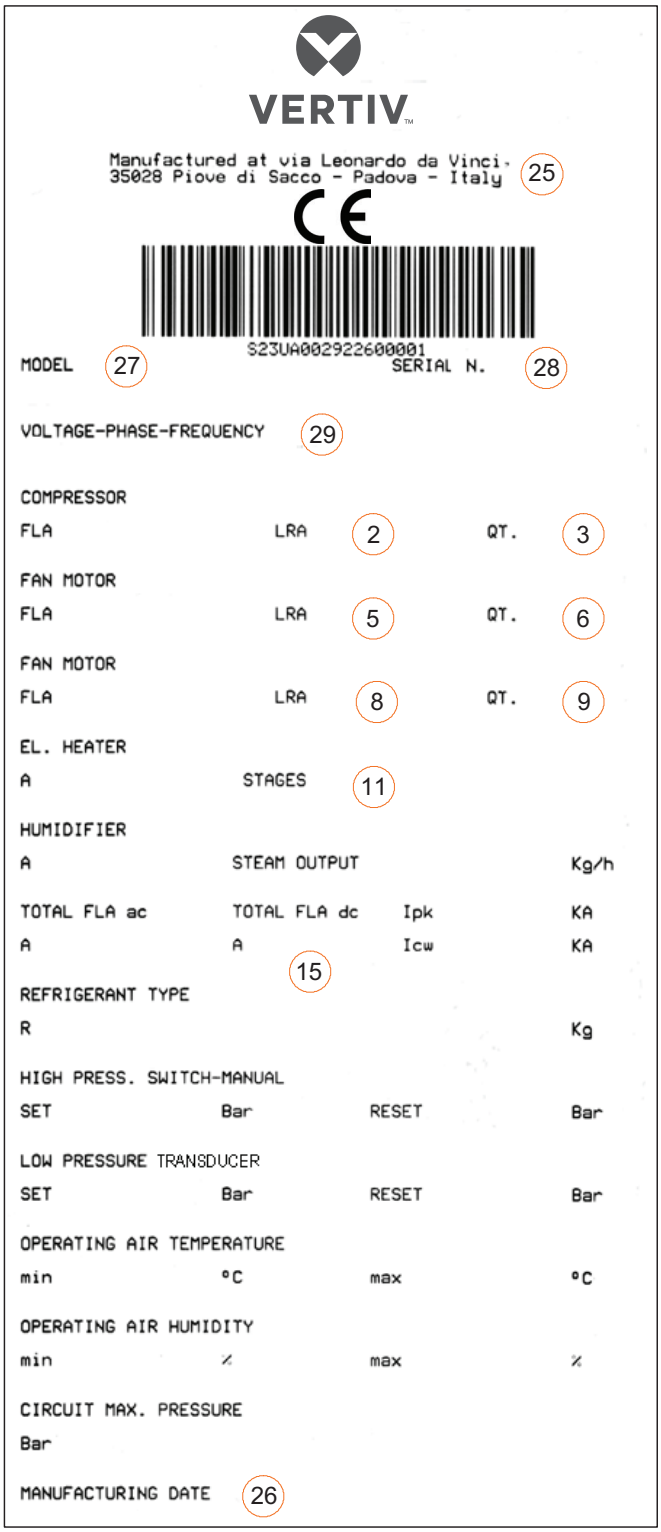
General safety measures:

- Wear eyes protection when you need to get close to the unit while it is operating.
- Pay attention to the warning labels on the unit.

Before working on the unit proceed as follows:

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

Lifting and moving	• Make sure to use transport and lifting equipment rated for the unit dimensions and weight. • Pay attention to the gravity center and warning labels placed on the unit. • Make sure that the lifting point is aligned with the gravity center. • Make reference to *Chapt. 1.5 Handling the Unit While Packaged* for dimensions, weight and gravity center position.
Handling area	• Never walk or stay below a suspended load. • The area for handling and moving must be free from obstacles and persons. • Not authorized personnel must keep at safe distance from the handling area. • The floor of the handling area must be suitable to bear the weight of the unit and of the moving equipment.



Onboard Label

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

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

NOTICE

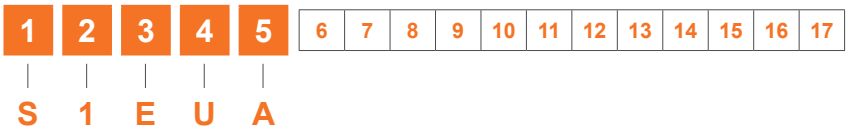
The data in the manual are referred to standard conditions and can be modified without any advance notice.

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

POS.	DESCRIPTION
1	Compressor Full Load Ampere [A]
2	Compressor Locked Rotor Ampere [A]
3	Compressor quantity
4	Evaporator fan Full Load Ampere [A]
5	Evaporator fan Locked Rotor Ampere [A]
6	Evaporator fan quantity
7	Condenser fan Full Load Ampere [A]
8	Condenser fan Locked Rotor Ampere [A]
9	Condenser fan quantity
10	Electrical heating Ampere
11	Electrical heating steps
12	Humidifier Ampere
13	Steam production capacity
14	Max. unit AC Ampere
15	Max. unit DC Ampere
16	Rated peak withstand current
17	Rated short-time current
18	Refrigerant type
19	Low pressure transducer
20	Min. room operation temperature
21	Max. room operation temperature
22	Min. room operation humidity
23	Max. room operation humidity
24	Max. refrigeration circuit pressure
25	Manufacturing plant
26	Manufacturing date
27	Model
28	Serial number
29	Power input

Digit Nomenclature

The unit is fully defined by seventeen digits.



Digit 1
Family
S - Small

Digit 2 and 3
Size: Cooling capacity "kW" (approx.)
Tens of kilowatt

Digit 4
Air distribution
U - Downflow
O - Upflow
D - Displacement
G - Frontal Upflow
Other Configurations
K - Constant (Upflow only)
L - Constant (Top Frontal Flow only)

Digit 5
Version
A - Air Cooled
W - Water Cooled

Digit 6 - Fan
1 - EC Fan Full
3 - EC Fan

Digit 7 - Main Power Supply
0 - 400V / 3ph / 50 Hz + N
2 - supply 230 V / 1ph / 50 Hz

Digit 8 - Electric Heating
1 - Electring Heating
0 - None

Digit 9 - Humidification
0 - None
V - Electrode Humidifier

Digit 10 - Microprocessor Control
N - iCOM3 & No Display temperature and humidity control
S - iCOM3 & 4.3" Display temperature and humidity control
E - iCOM3 & 7" Display temperature and humidity control

Digit 11 - Reheating System
0 - None
G - Hot gas coil
W - Hot water coil

Digit 12 - Air Filter Efficiency
0 - Coarse 60% gravimetric
1 - ePM10 50% dust spot
2 - Coarse 60% gravimetric + Clogged Filter
3 - ePM10 50% dust spot + Clogged Filter

Digit 13 - Expansion Valve TXV
0 - R410A

Digit 14 - Colour
2 - Black Vertiv™ RAL 7021

Digit 15 - Onboard MCB for Remote Condenser
0 - None
1 - 6A single ph
2 - 10A single ph

Digit 16 - Packing
F - PLP and Pallet
G - PLP and Wooden Crate
M - Seaworthy

Digit 17 - Special Requirements
0 - Standard Vertiv™
X - Special Vertiv™

Contents

1 - Preliminary operations

1.1 - Safety Information

WARNING!

Risk of top-heavy unit falling over! Improper handling can cause **equipment damage, injury, or death**! Read all of the following instructions before attempting to move, lift, remove packaging, or preparing unit for installation.

CAUTION!

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

CAUTION!

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

NOTICE!

Risk of unit damage if improperly stored! Keep the unit vertically upright, indoors, and protected from dampness, freezing temperatures, and contact damage.

NOTICE!

The conditioner must never be installed outdoor.
See drawings in *Enclosure C*.

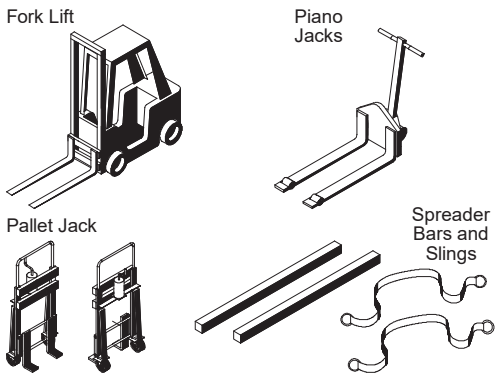
1.2 - Equipment Inspection

Upon arrival of the unit, and before unpacking, verify that the labeled equipment matches the Bill of Lading. Carefully inspect all items for either visible or concealed damage. Damage should be immediately reported to the carrier and a damage claim filled in with a copy sent to your sales representative.

1.3 - Packing material

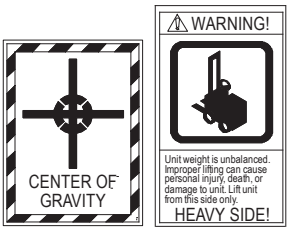
All material used to package this unit is recyclable. Please save for future use, or dispose of the material appropriately.

1.4 - Recommended Unit Handling Equipment

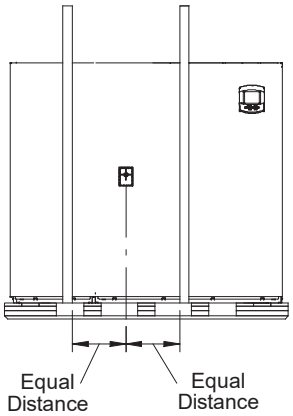


1.5 - Handling the Unit While Packaged

- Transport unit using a fork lift or pallet jack; otherwise use a crane with slings, in this case use spreader bars to avoid risk of crushing.
- If using a fork lift or pallet jack, make sure the fork (if adjustable) are spread to the widest allowable distance to still fit under the skid. Also, ensure the fork length and distance is suitable for the unit length and to ensure the unit stability.
- When moving the packaged unit with a fork lift, lift the unit from the designated side of the unit no higher than 152mm off the ground. If circumstances require the unit to be lifted higher than 152mm great care shall be exercised and all by-standing personnel are to be no closer than 5m to the lift point of the unit.
- Always refer to the location of the Center of Gravity indicators when lifting the unit from any other side.
- Use the center of gravity indicators on the unit panels to determine the position of the slings.
- Center of gravity varies per unit size and selected options.

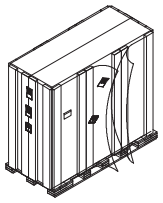


- Slings shall be equally spaced on either side of the center of gravity indicator, and with the widest allowable distance. Be sure that the distance between slings guaranties the unit stability.
- Place the slings between the unit bottom rails and the skid.

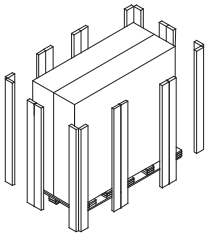


1.6 - Unpacking the Unit (Standard Height Unit, Coil Module and Fan Module)

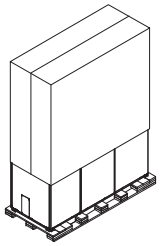
1. Remove the exterior stretch wrap packaging material from around the unit, exposing the protective corner and side packaging planks.



2. Remove the top cover, corner and side packaging planks from the unit

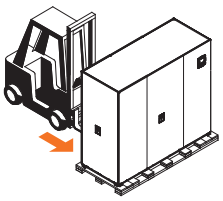


3. Remove the bag from the unit when ready to re-move the skid and install the unit.

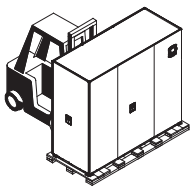


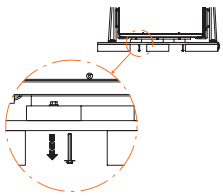
1.7 - Removing the Unit from the Skid using a Fork Lift

- Align a fork lift with either the front or rear side of the unit.
- Ensure the tines of the fork lift are locked to the widest location.
- Use the center of gravity indicators on the unit panels when determining the entry points for the tines.
- Center of gravity varies per unit size and selected options.
- Tines shall be equally spaced on either side of the center of gravity indicator.



- Insert the tines of the fork lift under the base of the unit.
- Ensure the tines are level, not angled in an upward direction.
- Tines are to be at a height that will allow proper clearance under the unit.
- Ensure the tines extend beyond the opposite side of the unit.
- If these steps are not followed, damage may occur to the panels and/ or base of the unit.

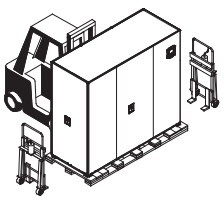




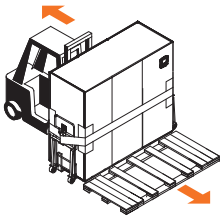
- Remove four (4) bolts, two (2) on each side of the pallet. Bolts can be removed using a 1/2" socket wrench, openend wrench, or pliers.

1.8 - Moving the Unit to the Installation Location using Piano Jacks

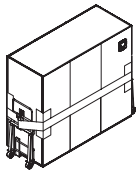
Acquire piano jacks, and with the unit elevated, place the piano jacks into position where one is at each end of the unit.



- Lower the unit to a height suitable for the piano jacks.
- Place protective material between the unit and the piano jacks and straps.
- With the unit secured to the piano jacks, move the fork lift and pallet away from the unit.



Using the piano jacks, at least two trained personell can move the unit to the site for installation.



1.9 - Removal of Piano Jacks

Lower the unit as far the piano jacks will allow.
Undo all strapping holding the piano jacks to the unit.
Use a pry bar or similar device and on one end of the unit with a piano jack, lift the unit just enough to allow for the removal of the piano jack. Repeat the previous step to remove the piano jack on the opposite end.
Remove all material that might have been used to protect the unit from the piano jacks and strapping.

1.10 - Base module

If there is no raised floor below the unit it must be placed on a base module to allow access to the external connections.
The conditioner is connected to the base module by 4 screws.

1.11 - Operating limits

The units are designed to operate within working ranges (see *Tab. a* below). These limits are referred to new machines or to those that have been correctly installed and serviced. The warranty clauses are no longer valid for any possible damage or malfunction that may occur during or due to operation outside the application values.

Tab. a - Operating limits

For all units

Room air conditions	from:	18°C, 45% R.H. for L8FUx, L9HUx- :21°C, 40% R.H.
	to:	27°C, 55% R.H
Hot water circuit	inlet water temperature	max. 85°C
	water pressure	max. 8.5 bar
Storage conditions	from:	-20°C
	to:	50°C
Power supply tolerances		V ± 10% Hz ± 2

For A units

Outdoor temperature: lower limit Exceeding of winter lower limits will temporarily cause a compressor stop.		
down to +10°C	from +9°C to -20°C	below -21°C
Standard Unit	VARIEX required	Consult HPAC Technical Sales Support

Outdoor temperature: higher limit
This limit is determined by coupled condenser model. Exceeding of this limit (or a lack of maintenance), will caused a compressor stop by HP safety thermostat. Reset to normal operation can only be carried out manually.

Relative position room unit vs. remote condenser		
From unit to condensermax distance	up to 30 m equivalent length	from 30 to 50 m equivalent length
Fromunit to condenser max geodetic height (1) (2)	from 20 m to -3 m	from 30 m to -8 m
Requirements		
Pipe diameter	see *Tab. c*	see *Tab. c*
Oil traps on vertical line of gas refrigerant	every 6 m, max	every 6 m, max
Extra oil charge	see *Tab. i*	see *Tab. i*

Variex installation	suggested	suggested
Condenser	design	oversized +15%
Hot gas reheat	allowed	NOT allowed
Additional non return valve on delivery line, at 2 m from compressor	NOT necessary	necessary

For W units

Water or mixture temperature to condenser, lower limit (other information *par. 5.4*)	min. 5°C

(1) Positive difference in height: condenser above conditioner
(2) Negative difference in height: condenser below conditioner
Other information in *par. 4.1.1*.

2 - General description

2.1 - Direct expansion units

2.1.1 - Refrigeration circuit

All models are provided with a single refrigeration circuit. The compressor (**1**) pumps the hot gaseous refrigerant into an outdoor air-cooled condenser (**2**). The liquefied refrigerant arrives to a liquid receiver (**3**) that ensures a constant and even refrigerant flow to the thermostatic expansion valve (**4**) and then arrives to the evaporator (**5**). Here the refrigerant, thanks to the heat-exchanged with the room air moved by the fan (**6**) evaporates and returns to the compressor (**1**); from this, the refrigerant begins a new refrigeration cycle. To maintain the correct refrigerant discharge pressure, the speed of the motor fan (**8**) is controlled (ON-OFF or proportional mode).
Shut-OFF valves are provided as standard to assist with routine maintenance.
The compressor (**1**) has a built-in non-return valve to avoid return of liquid refrigerant from the condenser in summertime, thus protecting the compressor from undesired refrigerant slugging during the start-up. A second non-return valve (**7**) is recommended to avoid - in wintertime - refrigerant migration from the liquid pipes and the receiver (**3**) to the condenser (**2**), that should be responsible of low pressure intervention at the start-up of compressor.
For safety reason, a relief valve (**9**) is installed on the liquid receiver (**3**); this valve is equipped with flanged connections so that the refrigerant may be discharged to the outside.

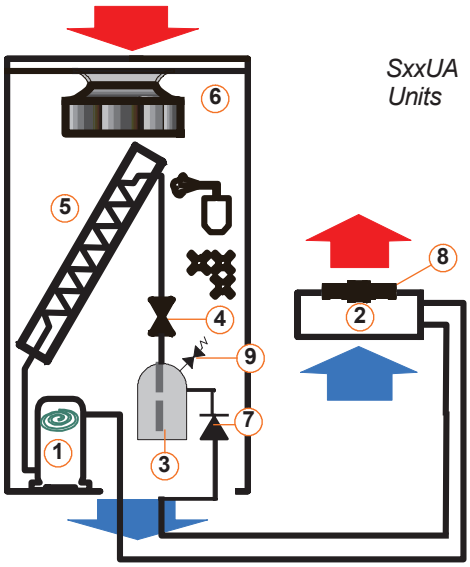
2.1.2 - Version A

External air-cooled condenser (**2**)
The units may be connected with a wide range of our condensers in standard or low noise version. For technical data and performance, refer to the relevant technical documentation.

NOTE 1 *Units and external condensers are supplied separately.*

NOTE 2 *The room unit refrigeration circuit is pressurised with helium at 3 bar and the condenser refrigeration circuit at 2 bar with dry air.*

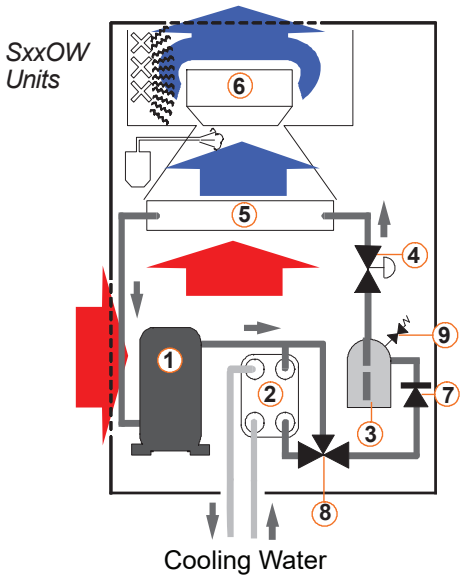
NOTE 3 *The customer is responsible for making connections between the Unit and the external condenser and for charging with refrigerant (standard R410A) and oil, when request.*



2.1.3 - Version W
Water-cooled condenser

These units are provided with one very efficient stainless steel brazed-plate water-cooled condenser (**2**). The condenser is fitted with an head-pressure regulating valve (**8**) for the automatic control of condensing pressure.
The units operate with mains water or closed circuit with an external Dry Cooler. When operating in a closed circuit, to avoid undesired ice formation in wintertime, it is advisable to use water/glycol mixture: refer to *Chap. 5.4* for the percentages to be used at minimum ambient temperatures. Dry Coolers are available as an option; water-glycol mixture and circulation pump(s) are normally supplied by others. If mains water is used, a mechanical filter must be fitted in the water circuit to protect the plate condenser (**2**) (for other information see the Service Manual).
To reduce water and energy consumption (pump), it's advisable to adopt a coolingwater control valve (by the user), able to stop water feeding when unit is **OFF**.
Unit microprocessor control gives a 24V contact (10 VA max, please refer to the relevant Wiring Diagram, 58 and G terminals) to drive that valve.

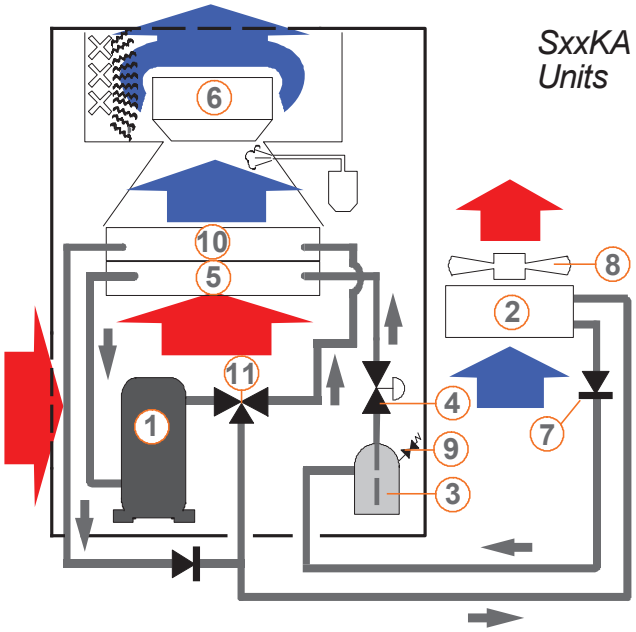
NOTE *The water-cooled **Liebert® HPM** versions are filled with the complete charge of the requested refrigerant (standard R410A).*

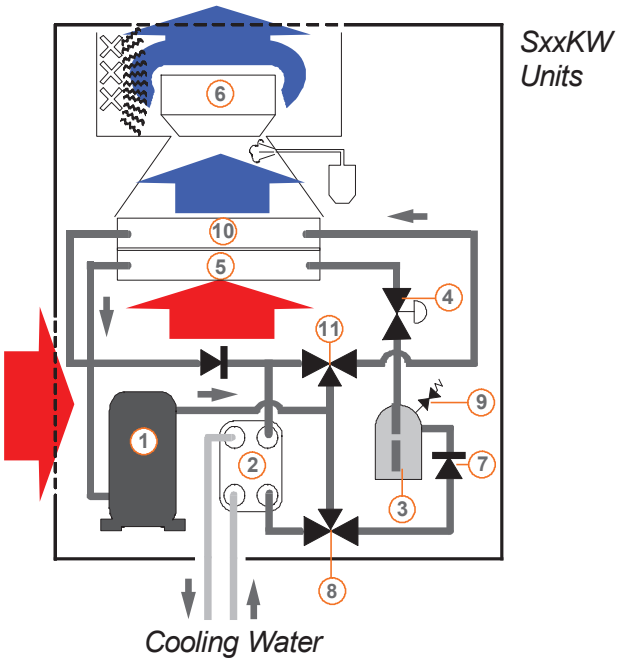


2.1.4 - Constant K/L

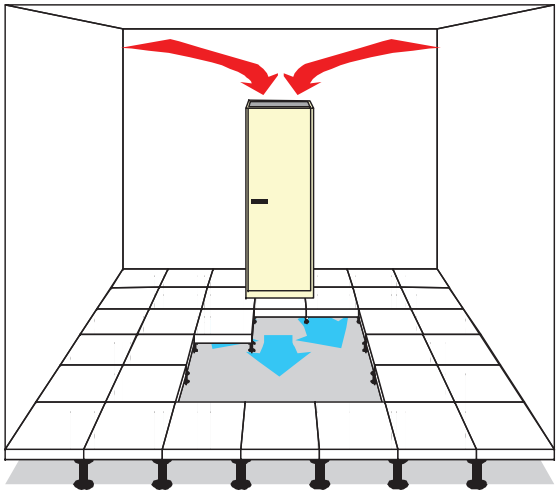
Refrigeration circuit

All models are provided with a single refrigeration circuit. The compressor (**1**) pumps the hot gaseous refrigerant into an outdoor air-cooled condenser (**2**). The liquefied refrigerant arrives to a liquid receiver (**3**) that ensures a constant and even refrigerant flow to the thermostatic expansion valve (**4**) and then arrives to the evaporator (**5**). Here the refrigerant, thanks to the heat - exchanged with the room air moved by the fan (**6**) evaporates and returns to the compressor (**1**); from this, the refrigerant begins a new refrigeration cycle. To maintain the correct refrigerant discharge pressure, the speed of the motor fan (**8**) is controlled (ON-OFF or proportional mode). When the cooling capacity of the room unit is higher than the room load and the room temperature tends to decrease, the hot gas valve (**11**) opens and the hot gas coil (**10**) heats the treated air, maintaining the room at the requested restricted temperature conditions. Shut-OFF valves are provided as standard to assist with routine maintenance. The compressor (**1**) has a built-in non-return valve to avoid return of liquid refrigerant from the condenser in summer-time, thus protecting the compressor from undesired refrigerant slugging during the start-up. A second non-return valve (**7**) is recommended to avoid - in wintertime - refrigerant migration from the liquid pipes and the receiver (**3**) to the condenser (**2**), that should be responsible of low pressure intervention at the start-up of compressor. For safety reason, a relief valve (**9**) is installed on the liquid receiver (**3**); this valve is equipped with flanged connections so that the refrigerant may be discharged to the outside.

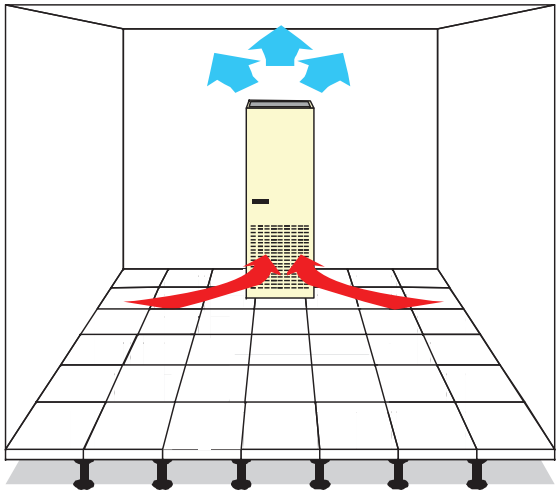




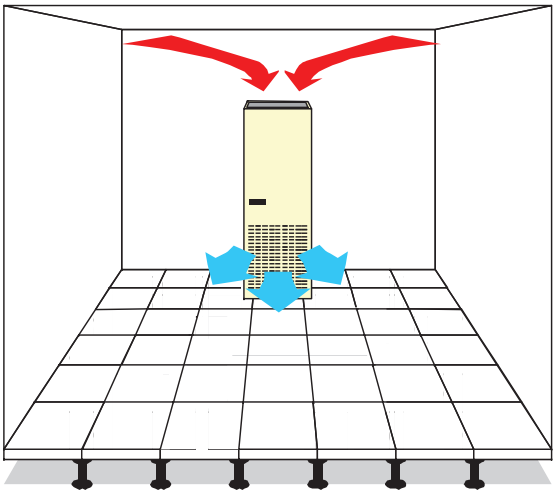
U / UNDER
Downflow



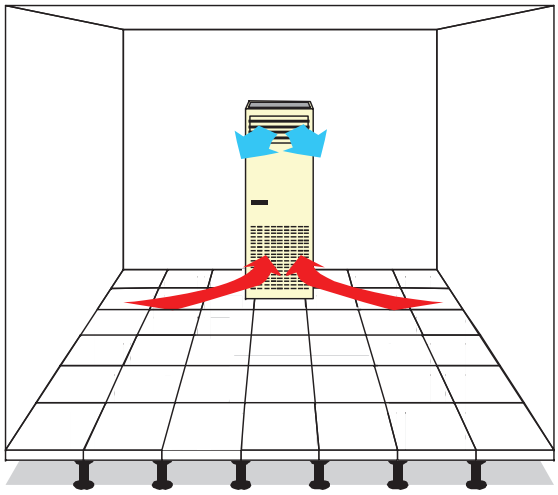
O / OVER
Upflow with front air return



D / DISPLACEMENT
Frontal air discharge at floor level



G / GRILL
Frontal upflow with front air return



S06 model

3 - Installation

ATTENTION: The conditioner must never be installed out of doors. See drawings in *Enclosures C*.

NOTE FOR CONDITIONER VERSION: *Over with electrical heaters. If the unit is ducted with air ducts not supplied by us, pay attention to the positioning of the insulation material.*

To avoid overheating of the insulation or sound-proof material inside the air duct, the insulation material must be positioned at minimum 30 cm above the top of the unit.

4 - Refrigeration connections

4.1 - Refrigeration pipeline connections (A)

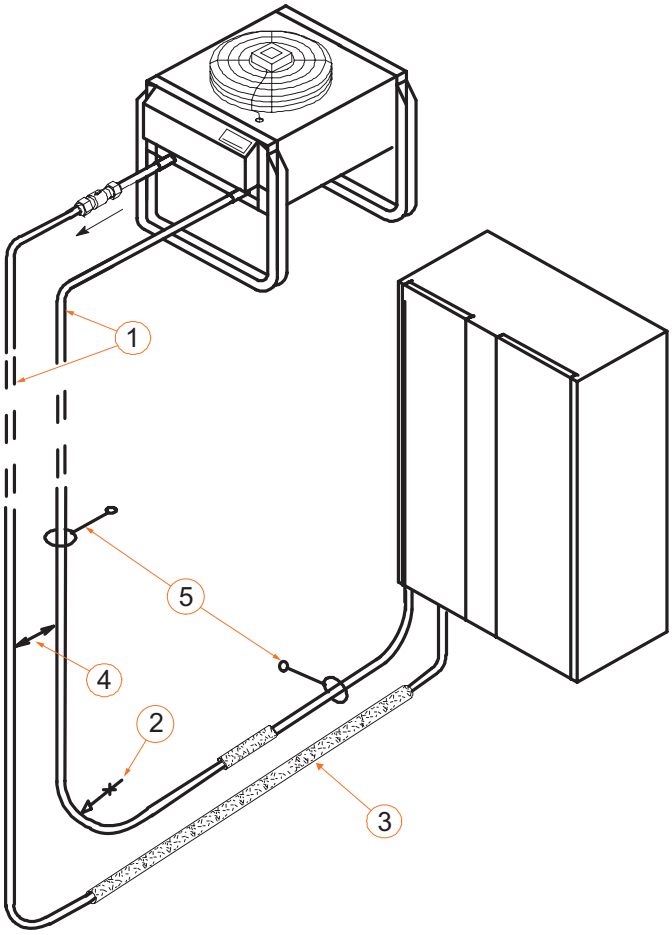
The air condensing units are delivered helium-pressurized at 1 bar.

The discharge operation of the room unit pressurized with helium (at 1 bar) and the de-welding of the bottoms from the connections must be carried out as last operations, immediately followed by the connection and emptying of the whole system.

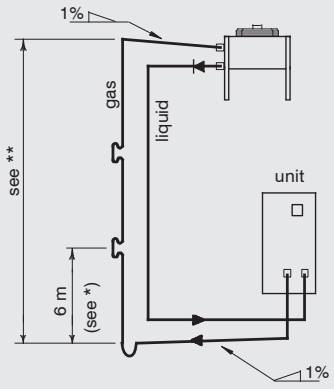
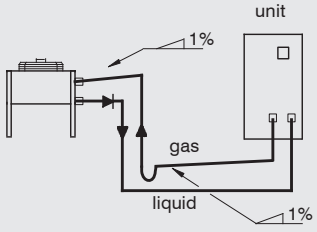
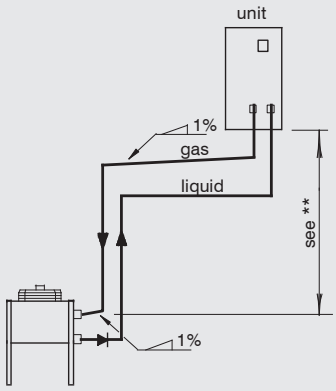
4.1.1 - General layout (Fig. a)

1. In soft or hard copper. The diameter required is stated in *Tab. c*. If the installer intends to use pipes of a larger diameter (e.g. for long winding runs) then consult HPAC Technical Sales Support. Use as short refrigeration pipelines as possible to minimize the total charge of refrigerant and the pressure drops. Forlong runs (over 50 equivalent m) contact HPAC Technical Sales Support. Lay the horizontal gas pipes with 1% downward gradient towards the refrigerant flow.
2. Reduce the number of bends, which must be of large radius, to a minimum.
3. Insulate the piping as specified in *Tab. b*. If the pipes are put next to electrical cables it is advised to insulate them to avoid damage to cable insulation.
4. There must be a minimum separation of 20 mm between the gas and liquid pipelines. If this is not possible insulate both lines.
5. Support both horizontal and vertical pipes with vibration-damping clamps (which include rubber gaskets). Place these every 1.5 - 2 m.every 1.5 - 2 m.

Fig. a - Recommended pipe layout



Tab. b - Condenser positioning

CONDENSER POSITION			CONDENSER ABOVE CONDITIONER	CONDENSER AND CONDITIONER AT SAME LEVEL	CONDENSER BELOW CONDITIONER (not recommended)
INSULATION	gas	int.	necessary	necessary	necessary
		ext.	only for aesthetic reasons	only for aesthetic reasons	only for aesthetic reasons
	lig.	int.	absolutely not	not necessary	no (expose to cold underfloor air)
		ext.	only for aesthetic reasons	only if exposed to sun	only if exposed to sun
LAYOUT					

Notes

(a) Check valve required at the condenser outlet. Follow the valve manufacturer indication for orientation and position.
(b) Oil traps every 6 m of vertical piping. Create an oil trap also on the horizontal discharge line before each lift.
(c) Max height difference between room unit and remote condenser, see Chapter 1.11, tab. a

4.1.2 - Pipe diameter

The diameters of the connecting pipes between the conditioner and the condensing unit listed in *Tab. c* below must be re-spected, otherwise the guarantee becomes invalid.

Tab. c - Pipe diameters (room unit - remote condenser)

STANDARD PIPE DIAMETERS (Valid for equivalent lengths up to 50 m)		
MOD.	copper tube external diameter x thickness [mm]	
	R410A	
	Gas	Liquid
S0F	10 X 1	10 X 1
S0H	12 X 1	12 X 1
S1A	12 X 1	12 X 1
S1D	14 X 1	14 X 1
S1E	14 X 1	14 X 1
S1G	16 X 1	16 X 1
S2E	18 X 1	16 X 1
S2G	22 X 1.5	18 X 1

When thepipes aremorethan 50 m long, contact Technical Support Department

4.1.3 - Installing pipelines

THE FOLLOWING OPERATIONS MUST BE CARRIED OUT BY AN EXPERIENCED REFRIGERATION TECHNICIAN.

NOTICE: The discharge operation of the room unit pressurized with helium (at 2 bar) and the unbrazing of the bottoms from the connections must be carried out as last operations, immediately followed by the connection and emptying of the whole system.

1. Lay the piping, taking note of the following:
   - **Welding:**
     - All joints must be braze-welded.
     - Avoid butt welds by using sleeves or enlarging one of the pipes using a pipe opener.
     - Use silver-based solders and the correct apparatus.
     - Guarantee a correct weld as a refrigerant leak, or a faulty weld which leads to a leak later on, can seriously damage the air conditioner.
   - Always use large-radius curves (bending radius at least equal to pipe diameter). Bend the pipes as follows:
     - **soft copper:** by hand or bending device.
     - **hard copper:** use preformed curves. Do not overheat the pipes when welding so as to minimize oxidation.
2. Connect the pipes to the condenser:
   - Condensers with butt-welded pipe connections: cut the pipe, enlarge it and weld it to the pipeline.
   - Condensers with threaded tap connections: flange the pipes and connect.

   RESPECT THE DIRECTION OF REFRIGERANT FLOW (SEE LABELS ON REFRIGERANT CONNECTIONS).
3. Wash out the pipelines as follows:
   a. Plug up the free ends of the pipes.
   b. Connect a helium or nitrogen cylinder, fitted with a reducer (max. pressure 10 bar), to the ¼" SAE Schrader valve of the condenser.
   c. Pressurize the pipes with helium or nitrogen.
   d. Unplug the pipes instantaneously.
   e. Repeat a. - d. several times.

THIS OPERATION IS IMPORTANT TO AVOID REFRIGERANT FILTER CLOGGING, ESPECIALLY WHEN HARD COPPER PIPING IS USED.

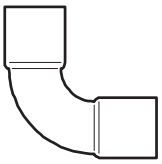
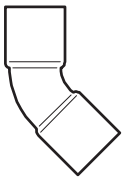
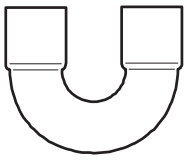
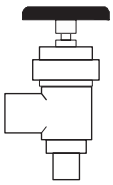
4. Open all the room unit shut-off valve.
5. Discharge the room unit pressurized with helium (at 2 bar) opening the charge valves so that all the branches of the circuit are discharged (e.g. on the receiver, on the low pressure side and on the compressor delivery).
6. Unbraze the bottoms from the connections of the room unit.
7. Fix (weld) the pipes to the connections on the air conditioner.
8. Connect the refrigerant safety valve to the outdoor with a copper pipe sized in order to satisfy the requirements of EN13163 (i.e. till 10m length, i 26mm).

Tab. e - Weight of refrigerant contained in piping during operation

EXTERNAL PIPE DIAMETER (mm)	gas(*)	liquid(+), at different condensing temperatures R410A (kg/m)		
		35.0°C	46.0°C	57.0°C
10 x 1.0	0.0048	0.0507	0.0470	0.0426
12 x 1.0	0.0075	0.0793	0.0734	0.0665
14 x 1.0	0.0108	0.1142	0.1056	0.0958
16 x 1.0	0.0147	0.1554	0.1438	0.1304
18 x 1.0	0.0192	0.2030	0.1878	0.1703
22 x 1.5	0.0271	0.2862	0.2648	0.2402
28 x 1.5	0.0469	0.4956	0.4585	0.4158

(*) Due to the small weight influence (at 15.5 bar - discharge temp. 65°C), only 46.36 kg/m^3 for R410A is considered.
(+) Liquid pressure and density varies according to condensing temperature (see *refrigerant tables*).

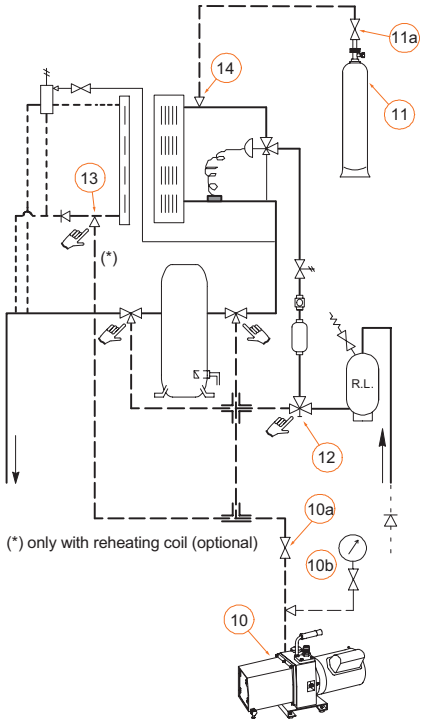
Tab. e - Equivalent lengths (m) of: curves, shut-off and non-return valves

Nominal diameter (mm)	 90°	 45°	 180°	 90°	
12	0.50	0.25	0.75	2.10	1.90
14	0.53	0.26	0.80	2.20	2.00
16	0.55	0.27	0.85	2.40	2.10
18	0.60	0.30	0.95	2.70	2.40
22	0.70	0.35	1.10	3.20	2.80
28	0.80	0.45	1.30	4.00	3.30

4.2 - Vacuum creation and refrigerant charge

NOTICE: Check the refrigerant type to be used on the data plate of the air conditioner and on the refrigerating compressor.

Fig. b - Vacuum Pump and refrigerant charging cylinder connections for vacuum creation and refrigerant charge



4.2.1 - R410A precharge (A)

1. **Open all cocks of the system including those used for pressurizing** (ambient unit and condensing unit).
   With this operation all the components of the refrigerating circuit must be subject to vacuum.
2. Connect a proper, high efficiency vacuum pump (**10**) **suitable for polyester** oils to the couplings:
   - **Compressor intake and delivery** using the 5/16" Schrader valves welded on the piping.
   - **Schrader coupling (12)** fit on the liquid receiver.
   - **Schrader coupling (13)** fit on the compressor or fan space, if the reheating coil option is available.
3. **Provide for a connection with refrigerant cylinder before making vacuum.**
4. Make the system vacuum up to 0.3 absolute mbar and after **3** hours check if 1.3 absolute mbar have not been exceeded. This condition ensures a humidity lower than 50 ppm inside the system. If the complete vacuum is not possible, this means that there are some leaks (to be removed according to the instructions in 6 below).

NEVER USE THE COMPRESSOR TO CREATE A VACUUM (THIS INVALIDATES ITS GUARANTEE).

5. Break the vacuum as follows:
   a) Close the cock (**10a**) for the vacuum pump (**10**).
   b) Open the cock of the refrigerant cylinder (**11a**) until the system reaches a pressure value of about 1 bar.

NOTICE: The refrigerant must be introduced and charged on evaporator inlet (5/16" Shrader valve) taking only liquid fluid from the cylinder.

   c) At this point both the vacuum pump and the refrigerant cylinder can be disconnected as follows:
      c1) close the cylinder cock (**11a**)
      c2) close the way 5/16" SAE of the connected Schrader valves.
6. Inspect all connections/joints using a leak detector. If an leak is found, empty the pipes and the condenser, seal the leak and repeat the instructions in 3) - 6).
7. Now the machine is ready for completing the charge and the start-up.
8. Charge the refrigerant (**ONLY LIQUID**) by means of the charge valve placed at the evaporator inlet.

4.2.2 - R410A refrigerant charge (A)

1. Start the unit as described in *para. 7.1*.
2. Manually start the compressor.
3. Guarantee a constant condensing temperature (preferably 42-45°C); if necessary, partially obstruct the condenser coil surface or limit its ventilating power to obtain these conditions.
4. Charge the unit until the working conditions of the entire refrigeration circuit have become normal.
5. Using a manometer, check that the evaporating temperature is above 0°C.
6. Verify that the superheat is 5-8 K (to do this refer to *para. 9.1*).

4.3 - Refrigeration circuits (see Enclosure D)

See drawings in *Enclosure D*.

5 - Water connections

5.1 - General warnings

ENSURE THAT THE TUBING DOES NOT OBSTRUCT THE AIR FLOW (Downflow units only).

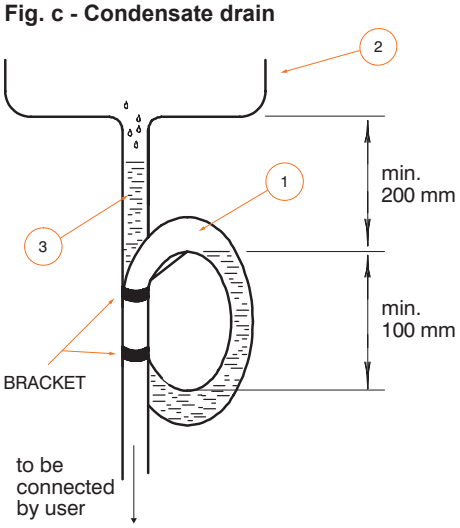
IF THE TUBING IS TO RUN OUTDOORS, ADD ETHYLENE GLYCOL TO THE CIRCUIT AS DESCRIBED IN *PAR. 5.4*.

5.2 - Water connections

Condensate drain (Fig. c):

- Use galvanized steel, PVC or flexible polythene tubing;
- Allow a 1% gradient towards the drain;
- It is necessary to make a drain trap (**1**) placed at least 200mm below the drain tray (**2**). In the Upflow configuration units the drain trap must be placed under the unit, in the false floor.
- Fill the drain trap with water (**3**).

Fig. c - Condensate drain



5.3 - Cooling water connections (W only)

The unit must receive cooling water as follows:

a) from an external cooling water source, in open circuit (*para. 5.4.1* and Figures in *Enclosures*);

b) using a Dry cooler, in closed circuit (*para. 5.4.2*).

- Connect the piping as shown in *Enclosures D*;
- It is advisable to use hoses to be connected, with 3-piece joints, to the condenser water inlet and outlet couplings;
- **IMPORTANT:** fit a standard strainer on the inlet water piping;
- Place shut-off ball valves at the conditioner inlet and outlet to allow easy maintenance;
- It is advisable to install a water drain systemat the lowest point in the circuit;
- Fully drain the piping before connecting it to the air conditioner.

5.3.1 - Notes for open circuit applications

- Use the unit with mains or well water.

DO NOT USE WATER FROM AN EVAPORATIVE COOLING TOWER UNLESS THE FILLING WATER HARDNESS IS CONTROLLED.

- The water pressure must be 2 - 10 bar (if this is not so, contact the Technical Support Department).
- The required water flow at different temperatures is given in our catalogues or on request.
- If necessary (very low water temperature) insulate both pipes using Armaflex insulation.

5.3.2 - Notes for closed circuit applications

- The installation in *Fig. e* below is indicative only; for individual installations follow the project diagram;
- Install a pump system calculated on the basis of the flow and total head of the system(see project data), and controlled by the compressor running (see label on the unit);
- Insulate both pipes using Armaflex insulation;
- **VERY IMPORTANT:** Add water and ethylene glycol to the circuit, when the ambient temperature is below zero (referring also to *para. 5.4*). Do not exceed the nominal operating pressure of the circuit components;
- Bleed air out of the circuit.

5.4 - Adding ethylene glycol

Tab. f - Ethylene glycol to be added to water

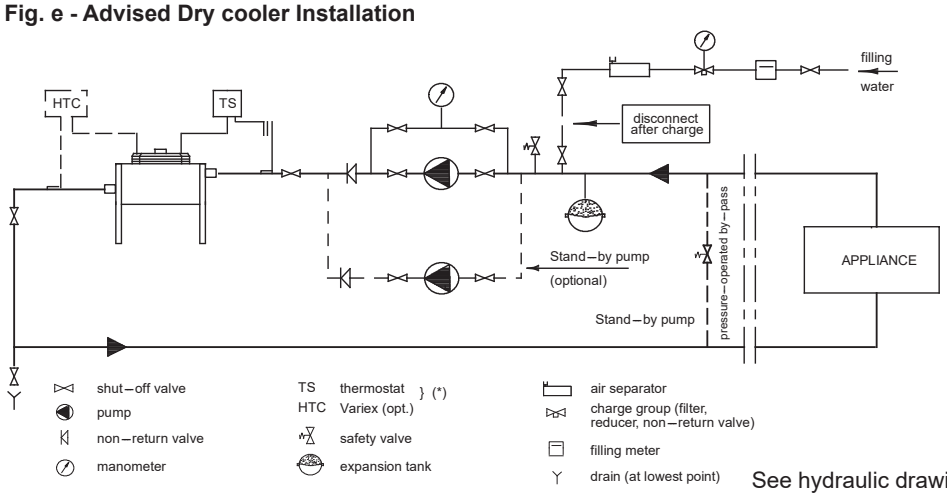
Freezing temperature (°C)	0°	-5°	-11°	-18°	-27°	-39°
Ethylene glycol to add to water (% in weight of total mixture)	0	10	20	30	40	50

N.B. Values are for Shell antifreeze 402. For different brands check manufacturer's data.

NOTES:

- To avoid stratification run the circulation pump for at least **30** min. after adding any glycol;
- After adding water to the water circuit, **disconnect the unit from the sanitary water piping system**; in this way the water mixed with glycol won't return into the same piping system;
- After any topping-up of water check the glycol concentration and add any glycol if necessary;
- The hydraulic features of the system vary by adding glycol. Therefore check the head and the flow rate of the pump to be used.

Fig. e - Advised Dry cooler Installation



See hydraulic drawings in the *Enclosures D*.

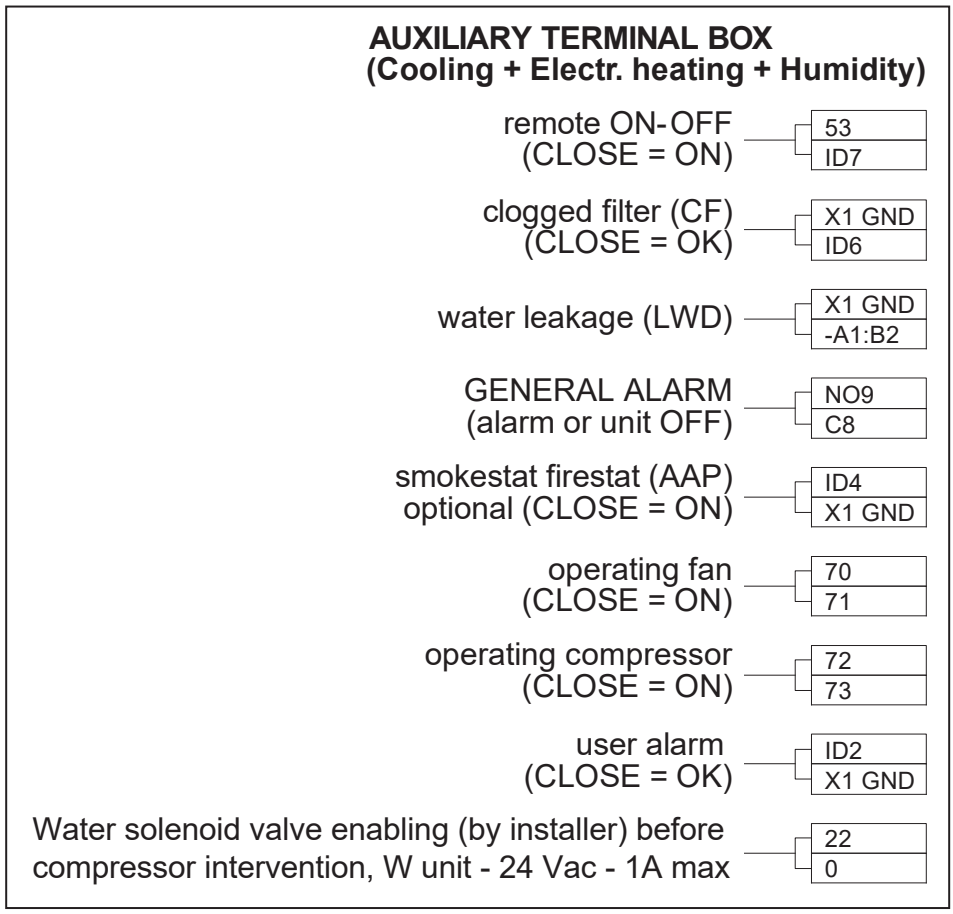
6 - Electrical connections

6.1 - Electrical connections

1. Before proceeding with the electrical connections, ensure that:
   - All electrical components are undamaged;
   - All terminal screws are tight;
   - The supply voltage and frequency are as indicated on the unit.
2. Power supply cable connections:
   - Connect the cable to the Line inlet terminal board;
   - Use the cable size defined according to the flow, the supply voltage and the installation type.
   - The system/line cable protection is to be arranged by the customer. Use a protection with differential switch. If the system is equipped with EC fans, use a B type switch.
   - Do not fit the supply cable in the raceways inside the machine electric board.
   - Use multipolar cables with sheath (CEI20-22) only.
3. Wiring connections (*Fig. f*):
   - Connections for remote ON-OFF and hot water consent must be done by the installer.
   - According with compressor running, two terminals for the opening of a water solenoid valve are available, by installer (W/H units).
   - The General Alarm terminals allow remote alarm signalling.
4. In case of short circuit, check the sticking of the involved switch and possibly replace it.

See electrical data in *Enclosures B: Technical data tables*.

Fig. f - Electrical connections



6.2 - Fan connections

The fan is electrically feeded by 1 or 2 autotransformers that are connected in order to obtain the nominal air flow and the External Static Pressure (ESP: 20 Pa for Under and 50 Pa for Over).

To change the factory connection proceed as follow:

- identify the unit's aeraulic graph in the Product Documentation;
- choose the curve's point where both the air flow and the static pressure are the most suitable for the installation;
- check the factory fan blocks connection and correct it, if necessary (see electrical diagram);
- choose the new output fan connections and connect the wires to the relevant blocks.

6.3 - Protection degree IP2x check

After whole of the connections and installation works, comprising ceiling elements (plenum, ducting) and floor elements (base frame), check and verify the protection degree IP2x (protection against finger access, std. IEC 60364-1) at the boundary of the air conditioner.

6.4 - Protective features of EC fan

The EC fan has been provided with the following protective features:

- Electronics overheating protection
- Motor overheating protection
- Locked rotor protection
- Short circuit at the motor output

With any of these failures, the motor stops (electronically - no potential separation), the status relay is released.
NO automatic restart. To reset the alarm, power supply has to be switched **OFF** for min. **20**s once motor is at standstill.

- Mains under-voltage detection:
  if mains voltage falls below 3ph/290Vac (typical value) for **5**s minimum, motor will be switched **OFF** (only by electronics, no potential separation), status relay is released.
  If mains voltage returns to correct values, the motor will restart automatically.
- Phase failure recognition:
  if one phase fails for **5**s minimum, motor will be switched **OFF** (only by electronics, no potential separation), status relay is released.
  If all 3 phases return to correct values, the motor will restart automatically within 10-40s.

The power supply for an external speed setting potentiometer is short-circuit protected.
Motor is overload-protected via motor current limitation.

WARNING! Leakage current of the motor is approx. 7 mA.

7 - Start-up

7.1 - First start-up (or after long standstill)

TO PREVENT COMPRESSOR DAMAGE THE CRANKCASE(S) MUST BE PREHEATED FOR AT LEAST 4 HOURS BEFORE CONDITIONER START-UP (FAILURE TO DO SO INVALIDATES THE GUARANTEE).

Start the air conditioner as follows:

1. Open all valves in the refrigeration circuit according to the instruction label attached to the valve.
2. **W only:** Open all valves in the water circuit according to the instruction label attached to the valve.
3. Ensure that the refrigerant charge is correct (see *Chap. 4*).
4. Using a leak detector, verify that there are no refrigerant leaks. If there are any, then repair the leak and recharge as described in *Chap. 4*.
5. At least **4** hours before start-up, close the main switch and miniature circuit breaker for transformers' protection on the electrical panel. In the iCOM™ control system factory setting the stand alone mode is standard. The stand alone mode gives the possibility of turning **ON** the unit simply rotating the main switch **ON** the electric panel. The yellow LED on the iCOM™ case will light after turning **ON** the unit, because of the presence of electric power. If the LED does not light up:
   - check the electric panel power supply;
   - check the protection devices (e.g.: thermal switches);
   - check the fuses.
6. Verify the operation of the crankcase heater.
7. Check that there are no water leakages. Verify the operation of the crankcase heater.
8. If an external condenser or Dry cooler is installed, start it by supplying power to it.
9. Close all MCBs on the electrical panel.
10. Check the supply voltage on all phases.
11. Check the supply voltage on all phases for the external condenser or Dry cooler, if fitted.
12. **ENSURE THAT THE COMPRESSOR HAS BEEN PREHEATED FOR AT LEAST 4 HOURS BEFORE STARTING THE UNIT.**
13. Start the unit by pressing ON-OFF (see *Fig. g*).
14. Check the electrical absorption of all components (see *Chap. 6*).
15. Check the electrical absorption of the external condenser/ Dry cooler, if fitted.
16. **IMPORTANT: If the compressor makes a loud and unusual noise IT IS NECESSARY TO INVERT the electrical connections of the phases supplying the corresponding scroll compressor, which accepts only one direction of rotation.**
17. Ensure that the fans rotate in the correct direction (see arrow on fan).

CAUTION: risk of contact with rotating devices.

18. Ensure that all control system settings are correct and that there are no alarms (see Control manual).
19. **W only:** Verify the water flow.
20. **W only:** For closed circuit units ensure that the water pump starts when the compressor starts.
21. Verify the Fresh Air Intake operation (if fitted).
22. Once the system is operating under load, check the various components, as follows:
    - Verify that the fans are operating properly;
    - Ensure that the temperature and relative humidity are being controlled, and that the humidifier (optional) and heating steps (optional) operate when required;
    - Ensure that the compressor operates when required;
    - Ensure that the fan operation controller on the external condenser/Dry cooler (if fitted) is calibrated correctly, and that it controls the fan operation.

7.2 - Starting and stopping

- **ALWAYS ENSURE THAT EACH CRANKCASE HAS BEEN PREHEATED. FOR BRIEF STOPPAGES KEEP THE SUPPLY TO THE CRANKCASE HEATER.**

Turn **ON** the unit operating on the ON/OFF switch placed on the left case of the unit (*Fig. g* below). The fan starts immediately (the fan always works when the unit is **ON**); after **2** minutes the regulation is activated, so the cooling (compressor), heating (electric heaters), humidifying and dehumidifying devices can start.
Adjust the set-point as indicated in Control manual.
Stop the unit putting the ON/OFF switch in OFF.

7.3 - Automatic restart

If desired, the unit will automatically restart on the return of power after a supply interruption (see Control manual). If the power interruption is expected to be of several hours, to avoid an automatic cold restart of the compressor stop the unit before the black-out and, on the return of power, allow the compressor to preheat before restarting the unit.

Fig. g - ON-OFF switch

7.4 - Checking the refrigeration piping pressure drops

Liebert® HPM-S is equipped with connections to check the refrigeration piping pressure drops:

room unit → condenser → room unit

To carry out this operation it is necessary to use 2 calibrated manometers and connect them as follows:

- M1, connected to the compressor delivery valve;
- M2, connected to the Schrader valve (**2**) of *Fig. h*.

When the compressor is running, check M1 and M2.

N.B.: *Repeat this test, inverting the manometers: to calculate the correct p consider the average value of the two readings.*

Refrigeration pipeline Pressure drops (Δp bar), at 45°C

- At the same geodetic level: Δp (bar) = M1-M2
- When condenser is above the room unit:

  Δp (bar) = M1-M2+geodetic difference (m x 1,1:10,2)
- When condenser is below the room unit:

  Δp (bar) = M1-M2-geodetic difference (m x 1,1:10,2)

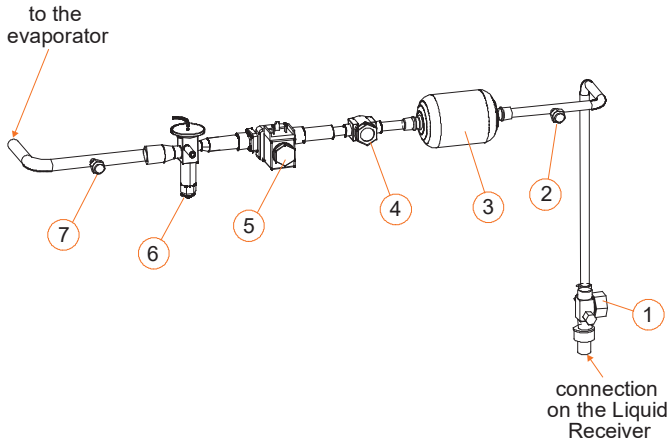


Fig. h - Refrigerant line components

1	Liquid receiver valve
2	Filter dryer inlet Schrader valve
3	Filter dryer
4	Sight glass
5	Solenoid valve
6	Thermostatic expansion valve
7	Evaporator inlet Schrader valve

8 - Operation

Unit operation is completely automatic.The below sequence explain show the unit operates:

- The air, sucked in by the fan(s), enters the unit;
- The air is immediately filtered;
- The TEMPERATURE sensor or HUMITEMP (temperature + rel. humidity) sensor (check type installed), verifies the state of the inlet air, and relays this information to the control system.
- Filtered new air is injected into the air stream via the Fresh Air Intake (optional);
- The treated air passes through the fans, which operate continuously, and is then dispersed out of the unit;
- **Under unit only:** the air passes from the underfloor void into the room via air distribution outlets;
- For “UNDER” units installed on raised floor: switch-OFF the machine before removal of the floor panels within a distance of 850 mm from the machine, to avoid risks of contact with rotating devices (fans) moving and with hot heating elements. (see *Fig. i* below);
- The control system compares the relayed information to the set point and proportional band values programmed into its memory: it then commands the air conditioner to treat the air as follows (see also Control manual):

COOLING

Direct expansion mode (DX)

The compressor is started and the cold refrigerant flows through the evaporator, thus cooling the air passing over it. For compressor operation see Control manual.

HEATING

This can take one of three forms:

- **electrical heating (optional)**: the heating elements heat the air passing over them. There are 3 heating steps.
- **hot water heating (optional)**: if hotwater is available, this flows through the hot water coil, thus heating the air passing over it. The hot water flow is controlled by an ON-OFF (3-way) valve.
- **hot gas reheat (optional used during dehumidification)**: the hot refrigerant which exits the compressor flows through the hot gas coil, thus heating the air passing over it.

DEHUMIDIFICATION - optional

DX mode

One of the compressors starts and either the air flow or the evaporator surface is reduced (depending on the model), thereby causing dehumidification (refer also to Control manual).
In freecooling mode: see Control manual.

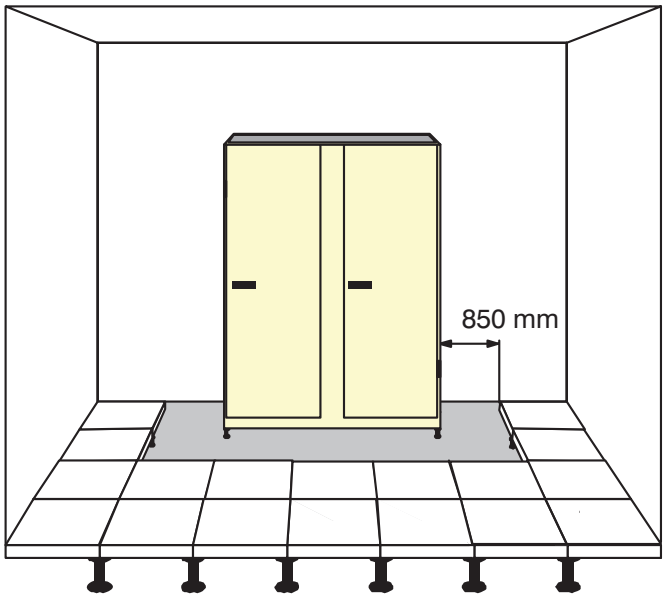
N.B.: *If, during dehumidification, the ambient temperature drops below a specified level, dehumidification will be stopped if necessary (see LOW LIMIT intervention in Control manual).*

HUMIDIFICATION - optional

The humidifier creates steam, which is distributed into the air stream via the steam distribution pipe (see also *Enclosure A*).

N.B.: Manual control can be performed using the control system (see Control manual).

Fig. i - Floor panels removal on a safety way



9 - Calibrations & Regulation (at start-up)

The air conditioner has already been factory-tested and calibrated, but it is very important to check, at start-up, the superheating of thermostatic valve (all versions) and the by-pass hot gas valve (KA/KW).
See *Tab. B4* and *Tab. B5* (*Enclosed B*) that show all valves.

- The air conditioner has already been factory;
- For calibrations of instruments installed on the external condensers/Dry coolers refer to the relevant manual;
- For control system calibrations refer to Control manual (to prevent erratic operations do not use temperature and rel. humidity set points/proportional bands which differ excessively from the Standard Settings).

9.1 - Setting the thermostatic expansion valve

THIS OPERATION MUST BE PERFORMED BY AN EXPERIENCED REFRIGERATION TECHNICIAN.
The valve has been factory preset and, if necessary, should be reset as follows:

1. **IMPORTANT:** Ensure that the instructions in *Chap. 4* have been carried out.
2. Allow the compressor to operate for **15** mins.
3. Measure the superheat as follows:
   a) Place a contact thermometer on the tube exiting the evaporator;
   b) Connect a manometer (by a tube of max. 30 cm) to the compressor suction valve;
   c) The overheating is the difference between the refrigerant saturation temperature corresponding to the pressure read on the manometer and the real temperature read on the thermometer.
4. The superheat must be 6-7 K; if not, set the expansion valve as follows:
   a) Remove the protective cover;
   b) Turn the adjustment screw by 1/4 turn only;
   c) Wait **10** minutes;
   d) Measure the superheat and repeat the operation if necessary.

N.B.: *If the superheat is too low (compressor cool to the touch) the screw must be turned in a clockwise direction. If the superheat is too high (compressor hot to the touch) the screw must be turned in a counter clockwise direction.*

9.2 - Adjustment of the hot gas injection valve as antifreeze mode and partial control of the capacity (Constant)

THIS OPERATION MUST BE CARRIED OUT BY AN EXPERT REFRIGERATION TECHNICIAN.

9.2.1 - Features

This valve is installed int some special versions (see relevant refrigeration circuits). It enables a partial control of the evaporating pressure, so as to avoid evaporation temperatures lower than zero degrees centigrade and thus any ice formation (chilled water side), even with low temperatures of the return air. It injects hot gas exiting the compressor before the evaporator through the gas-liquid mixer, so as to keep the pressure higher than the set value. See the refrigeraton diagram.

9.2.2 - Adjustment

The min. evaporating pressure is kept by calibrating the valve as follows.

- Drastically reduce the conditioner air delivery;
- Check by a precise pressure gauge the evaporating pressure and the relevant saturation temperature;
- Adjust the valve acting on the adjustment screw, so that it intervenes when the evaporation temperature has decreased to 2°C;
- Then check the correct operation of the thermostatic expansion valve.

9.3 - Water leakage sensor (Liquistat)

Due to high flooding alarm device sensitivity, to the end to avoid undesirable alarm signal because of few sporadic water drops, place the sensors at a minimum distance of 50 cm from the unit base perimeter.
This solution assures alarm intervention for real flooding risk only.

9.4 - Environment protection

A misuse or an incorrect calibration of the unit leads to increased energy consumption, resulting in an economic and environmental damage. Use the freecooling function, if available.

10 - Maintenance/Spare Parts

10.1 - Safety instructions

All maintenance operations must be carried out strictly observing the European and National accident prevention regulations. We refer especially to the accident prevention regulations concerning electrical systems, refrigerators, and manufacturing resources.
Maintenance may be done to air conditioning equipment only by authorized and qualified technicians.
To keep all warrantees valid the maintenance must ad here to the manufacturer's regulations.

The work should be done in the system only when it is at standstill. Do this by switching OFF the air conditioner at the controller and the main switch. Post a warning sign saying: "DO NOT SWITCH ON". Electrical components of device have to be switched OFF and be checked that they are not under voltage.

Ignoring the safety instructions can be dangerous to persons as well as to the environment.
Soiled parts always cause a loss of performance and for switch or control devices can lead to the break-down of a plant.

10.2 - Spare parts

Only original spare parts made by Vertiv™ may be used.
Using third-party material can invalidate the warrantee.
When making inquiries always refer to the "Component List" supplied with the equipment and specify the model number, serial number and, if available, the part number as well.

NOTES:

1. *When a faulty component is replaced, follow the relevant manufacturer instructions.*
2. *When the spare parts must be welded, be carefully do not damage the internal parts (gaskets, seals, o-rings, etc.).*

10.3 - Maintenance schedule

Monthly, quarterly, biannual and annual checks to be conducted according to the following guidelines.
All tasks and periods listed here are regulations from the manufacturer and need to be documented in an inspection report.

All these tasks should be carried out only by an authorized and trained technician. We recommend the Vertiv™ Customer Service.

Maintenance schedule

COMPONENT		MAINTENANCE PERIOD EVERY			
		1 Month	3 Months	6 Months	1 Year
FANS **Attention, do not reach into the fan while the fan wheel is running.**	Check for soiling, damage, corrosion, and proper fixing.	X			
	Check bearings noise.	X			
	Measure the current and power consumption.			X	
	Cleaning to preserve the function.		X		
AIR FILTERS	Check for soiling, damage, corrosion.	X			
	Check state of filter.	X			
	Clean or replace if necessary.	X			
	Carry out controls more frequently in dusty environments.	X			
NEW AIR FILTER *(if installed)*	see air filter. Clean or replace	X			
CONTROL SYSTEM	Check for proper and functionally correct installation and surrounding conditions.	X			
	Check the function of the LEDs of the display's control system and the alarms.		X		
	Check the connections for electrical and mechanical function.			X	
	Check the functional elements (e.g. operational controls and display devices).			X	
	Check the electrical/electronic and pneumatic input signals (e.g. sensors, remote controllers, command variable) for compliance with nominal values.			X	
	Check control function, control signals, and safety chains.			X	
	Adjust control function and control signals.			X	
HUMIDIFIER *(if installed)*	See appendix A.				
SWITCH CABINET POWER CIRCUITS **Attention, electrical cables and electrical components of the air conditioner are under voltage.**	Check the power supply on all phases.			X	
	Check the connections for electrical and mechanical function.			X	
	Check the power supply at all terminals.			X	
	Measure power consumption at all connected consumers.			X	
	Set, adjust, and tighten the functional elements (e.g. operational controls and display devices).			X	
	Check safety equipment, e.g. thermal switch.			X	
	Replace fuses (every 2 – 3 years)				X
	Check protective covers for completeness.				X
COOLING WATER *(W only)*	Check cooling water circuit.	X			
	Check for damage, leaks, and proper fixing.	X			
	Make sure there is no loss of water.				
COOLING WATER *(W only)* *Only for closed circuits:*	Make sure that the water pump works properly.			X	
	Deaerate circuits.			X	
	Check whether the heat transfer medium of circuit–connected system is frost–proof.			X	
	Check safety equipment for function.				
	Check glycol% comparing minimum yearly ambient temperature.			X	
REFRIGERATION CIRCUIT **Fluoride refrigerants increase the green–house effect and are subject to restrictions and norms, according to the national and European regulations.**	Measure the working pressures and temperatures (to be done by a refrigeration technician).			X	
	Check the power consumption, measure head temperature, and check for possible abnormal operating sounds.			X	
	Make sure that there is no frost building up on the evaporator and compressor.		X		
	Check function of all regulating devices (power regulators, valves, etc.).	X			
	Check safety devices for function.			X	
	If the quantity of refrigerant is not enough, it needs to be reclaimed and refilled with completely new refrigerant.				
	Check oil level at the sight glass.		X		
	Carry out a test to ceck humidity inside oil				X
	Check valves and replace if necessary on industrial piston compressors (every 2 years).				X
	Check crankcase heater for function.			X	
EXTERNAL CONDENSER/ Dry cooler *(if installed)*	See appropriate manual.				

10.4 - Refrigeration circuit

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.

10.4.1 - Refrigerant charge of the water-cooled units (W)

1. Start the unit as described in *para. 7.1*;
2. Manually start the compressor (ensure the unit is not in dehumidification);
3. Wait a few minutes to allow conditions to stabilize;
4. Check the refrigerant circuit using a leak detector. If there is a leak, it must be repaired & tested as sound before recharging with refrigerant, checking that the system superheat & sub-cooling are within recommended limits;
5. Using a manometer, check that the evaporating temperature is above 0°C;
6. Verify the water pressostatic valve (WV) setting (*Chap. 8*);
7. Verify that the superheat is 5-8 K (to do this refer to *Chap. 8*).

10.4.2 - 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. i* and *Tab. j*).

Tab. i - 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. j - 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 the 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 liter 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.

10.4.3 - Oil topping-up of an installed circuit

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

10.4.4 - Compressor removal (only L units)

If the innermost compressor is faulty, a few steps must be carried out to ensure an easy replacement (see *Fig. 1 - Enclosure G*).

10.5 - Dismantling the unit

The machine has been designed and built to ensure continuous operation.

The working life of some of the main components, such as the fan, depends on the maintenance that they receive.

CAUTION: The unit contains substances and components hazardous for the environment (electronic components, lead gel battery, 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.

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

Stationary air conditioners placed into the European Community market and operating with fluorinated greenhouse gases (F-gas, such as R407C, R134a, R410A), they have to comply since Jan 1, 2015 with the F-gas Regulation (EU) No. 517/2014. It replaces the Re. (EU) no. 342/2006, applied since July 4, 2007.

By the way, the refrigerants as R22 are not F-gas and their relevant regulation is Reg. (EU) no. 2037/2000.

Following notes have to be considered when operating with the above mentioned equipments:

- **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:

  R- 410A GWP 2088

• **Operators of the above mentioned applications**, 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. In case of applications containing 5 tons CO_2 equivalent, i.e. 2.4 kg of R410A (10 tons in case of hermetically sealed system) or more of F-gases: certified personnel and Companies (according to Reg. 303/2008) provides regular leak testing (according to Reg. 1516/2007 and Reg. 1497/2007) and maintain records of maintenance activities in a dedicated log book.
e. Recovery for the purpose of recycling, reclamation or destruction of the fluorinated greenhouse gases, pursuant to Art. 8 of the Regulation shall take place before the final disposal of that equipment and, when appropriate, during its servicing and maintenance.

- Operator, according to Regulation 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.
- **Direct methods of leakage checking approved by the manufacturer (Reg. 1516/2007 and Reg. 1497/2007)**

  a. gas detection device adapted to the refrigerant in the system; the sensitive of portable gas detection devices (as a

direct test method) shall be at least **five grams par year**.
b. proprietary bubble solutions / soapsuds.

- **Additional information located into a dedicated label of unit (Reg. 1494/2007)**
  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.
  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 generally, 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).
- **Safety data sheets of f-gases** used in the products are available on demand.

A.1 - Preface

The **HUMIDAIR** represents the best humidifier technology available, guaranteeing the steam as clean as possible together with simple maintenance.

In order to obtain optimum performance from the **HUMIDAIR** it is advisable to read this manual carefully.

Tab. a - Humidair specifications

HPM MODEL	HUMIDAIR MODEL	MAIN POWER SUPPLIES (V ± 10%)	SETTING [kg/h] *	ABSORBED CURRENT [A]	POWER [kW]	MAX. CYLINDER WATER VOLUME [l]	MAX. SUPPLY WATER QUANTITY [l/min.]	MAX. DRAIN WATER QUANTITY [l/min.]
S0F	**KUECLA**	230V / 1ph / 50Hz	0.6...1.5	4,9	1,13	1.7	0.6	4.0
S0H...S1D	**KUECLB**	400V / 3ph / 50Hz	1.3...3.0	3,2	2,25	3.3		
S1E...S2G	**KUECLD**		3.9...8.0	8,7	6	5.5		

Tab. b - Humidair specifications for Displacement unit

HPM MODEL	HUMIDAIR MODEL	MAIN POWER SUPPLIES (V ± 10%)	SETTING [kg/h] *	ABSORBED CURRENT [A]	POWER [kW]	MAX. CYLINDER WATER VOLUME [l]	MAX. SUPPLY WATER QUANTITY [l/min.]	MAX. DRAIN WATER QUANTITY [l/min.]
S0F D	**KUECLA**	230V / 1ph / 50Hz	0.6...1.5	4,9	1,13	1.7	0.6	4.0
S0H..S1DD	**KUECLB**	400V / 3ph / 50Hz	1.3...3.0	3,2	2,25	3.3		
S1E..S2GD	**KUECLD**		3.9...4.5	4,6	3	5.5		

For humidifier current (FLA) and rated power, refer to electrical features in the *Enclosure B*.

(*) Unit is factory- set to produce about 50% of the maximum value (see iCOM™ manual). (3) = not less than 300% of the chloride content in mg/l CL-

A.2 - Installation

The humidifier is supplied already mounted within the air conditioner. The only necessary operations are the connections for the supply water (*Fig. A1*) and drain water (*Fig. A2*).

Fig. A1 - Supply water connection

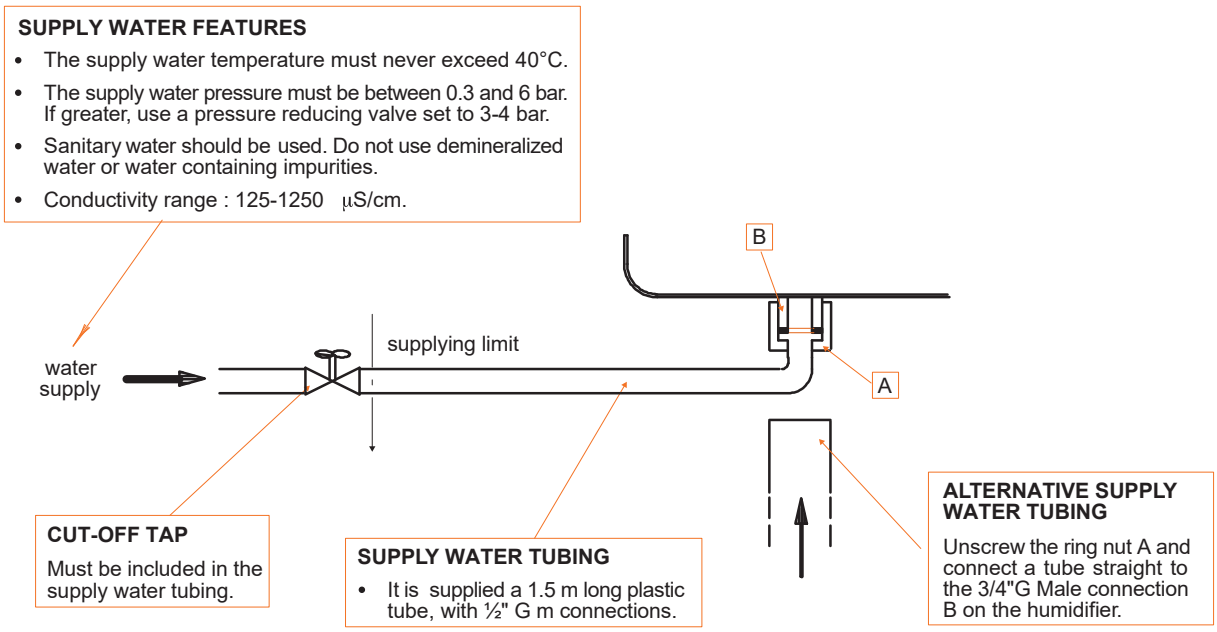
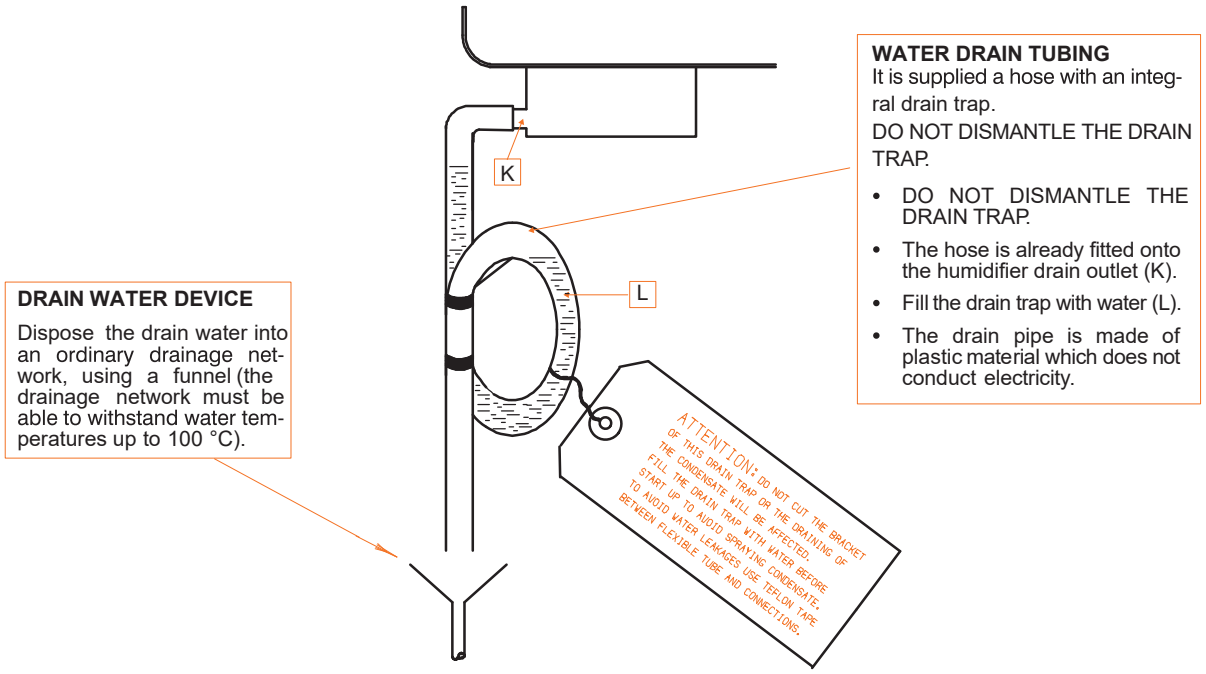


Fig. A2 - Drain water connection



NOTES:

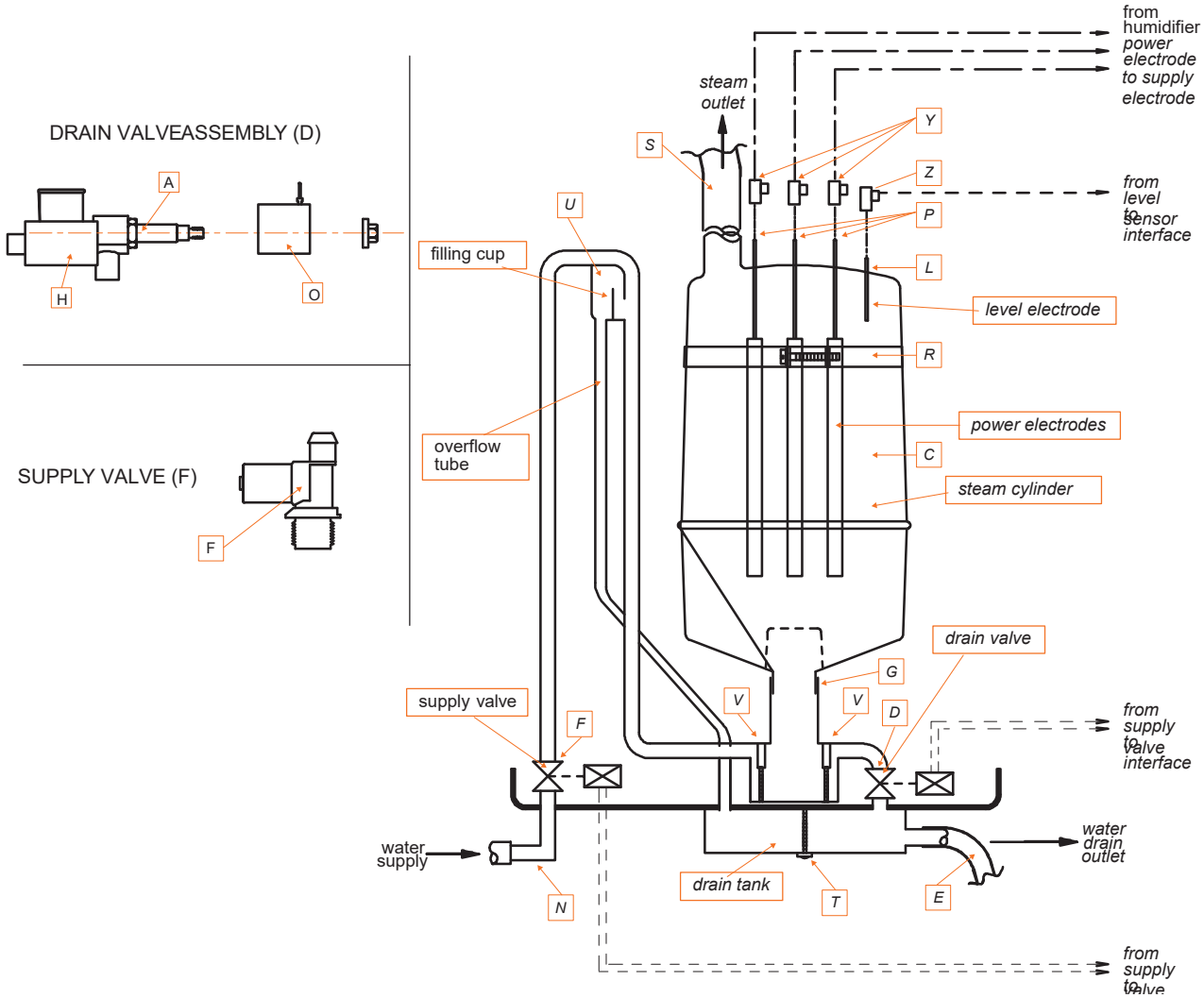
1) Allow a 2% gradient towards the drain outlet.

2) Avoid back pressures in the drain piping.

A.3 - Humidair components

The components of the HUMIDAIR humidifiers are shown below.

Fig. A3 - The humidifier and its connections



A.4 - Start-up and operation

A.4.1 - Start-up

Before using the humidifier, check the following:

- Supply and drain connections;
- That the cut-off tap is open;
- All wiring;
- Earthing;
- Steam hose connection between steam cylinder and distributor;

To start the humidifier simply switch on the air conditioner, which will in turn automatically start and stop the humidifier as required. The (adjustable) parameters which determine humidifier operation have already been factory-preset (*see iCOM™ manual*).

A.4.2 - Operation

Water, provided it contains even a small quantity of salts in solution, is a conductor of electricity. Therefore, if the steam cylinder is filled with water and a potential difference is applied

between the electrodes, the water behaves like an ordinary electrical resistance and becomes hot, thus creating steam.

The steam production rate can be controlled by varying the water level in the cylinder; the higher the water level, the deeper the electrodes are immersed into it and the greater the steam production.

Note 1

In case of low water conductivity consult Technical Sales Support.

Note 2

When starting with an empty cylinder, the water conductivity is normally insufficient for the HUMIDIFIER STEAM OUTPUT to be reached immediately.

Therefore the humidifier produces as much steam as possible to fill the cylinder completely. Any evaporation water is immediately refilled.

The drain valve is kept shut and therefore, as the steam does not contain any salts, the conductivity of the water within the cylinder slowly increases until the **HUMIDIFIER STEAM OUTPUT** is obtained.

The length of the start-up period depends upon the water conductivity. For very conductive water it may occur that the **HUMIDIFIER STEAM OUTPUT** is obtained immediately.

A.5 - Maintenance

A.5.1 - Removing the steam cylinder

To remove the steam cylinder, proceed as follows (see *Fig. A3*):

1. Open the General Switch relative to the humidifier;
2. Drain all the water from the cylinder by activating "HUM. DRAIN" in the CONTROL Service menu several times (*see Control manual*);
3. Disconnect the steam hose (**S**) (made of non-conductive rubber);
4. Disconnect the power electrode wires (**P**) and level sensor wire (**L**);
5. Undo the clip (**R**);
6. Pull the cylinder (**C**) out of its gland at the bottom (**G**).

A.5.2 - Replacing the steam cylinder

When the steam cylinder is approaching the stage where it needs to be replaced, warning **A25** is generated (*see Control manual*) to advise the user that the cylinder must be replaced.

To replace the cylinder, proceed as follows (see *Fig. A3*):

1. Carry out the instructions in *para. A.5.1*;
2. Using the new cylinder, carry out 4) - 6) of *para. 5.1* in reverse order;
3. Connect the steam hose (**S**); the clip on the hose needs to be tightened only slightly;
4. Manually switch the humidifier **ON** for **2-3** minutes (in the iCOM™ Service menu). Then switch it **OFF**;
5. Drain the water as for 2) in *para. A.5.1*.
6. If the air conditioner features a iCOM™ CDL with Graphic display, reset the humidifier working hours (window no. 1 of PARAMETER MENU) to zero;
7. Close the General Switch relative to the humidifier.

A.5.3 - Annual maintenance

Annually (e.g. before any close-down period) carry out the following service on the humidifier (see *Fig. A3*):

1. Carry out the instructions in *para. A.5.1*;
2. Disconnect the supply (**F**) and drain (**D**) valve wires;
3. Unscrew and remove the drain tank (**T**);
4. Unscrew the drain valve assembly screws (**V**);
5. Remove the drain valve assembly;
6. Unscrew and remove the drain valve solenoid (**O**);
7. Unscrew and remove the drain valve armature (**D**);
8. Clean all parts of the drain valve using a commercially available descaling agent (to remove any incrustations);
9. Detach the hose from the supply valve;
10. Remove the supply valve connection (**N**);
11. Unscrew the supply valve (**F**) and remove it;
12. Clean the supply valve using a jet of water;
13. Replace any hose which has become hard and brittle;
14. Thoroughly flush the drain line (**E**);
15. Reassemble the humidifier by carrying out the above instructions in reverse order.

ATTENTION!

Always empty the cylinder completely before any close down period.

A.6 - Humidifier spare part list

It is recommended the use of original spare parts. When placing an order quote the part code, as well as the air conditioner model no. and serial no.

POSITION (see *Fig. A3*)	CODE	DESCRIPTION	Humidair Model KUExxx					Notes
			CLA	CLB	CLC	CLD	CLE	
C	**141160**	Steam cylinder CLA	1					(*)
	141161	Steam cylinder CLB		1				(*)
	141162	Steam cylinder CLD				1		(*)
T		Drain tank	1	1	1	1	1	
U		Filling cup	1	1	1	1	1	
K		Rubber gasket for drain tank	1	1	1	1	1	
F	**183240**	Complete supply valve	1	1	1	1	1	
A	**183241**	Drain valve armature	1	1	1	1	1	
H	**183242**	Drain valve housing	1	1	1	1	1	
O	**254007**	Drain valve solenoid	1	1	1	1	1	(*)
	254905	Isolator for level sensor	1	1	1	1	1	

(+) = Spare part recommended
(*) = Consumable material

Technical data table

Tab. B1 - Electrical data for units with EC Fan

Configuration	Model	Power supply	FLA [A]		LRA [A]	RESIDUAL CURRENT CIRCUIT BREAKERS Inn = 0.3A (400V) (*)
			EC Fan full	EC Fan		
Cooling (Fan + Compressor)	**S0FxA/W**	230V / 1Ph / 50Hz	16	17	63	25A
	S0HxA/W	400V / 3Ph+N / 50Hz	9,4	10,4	41	16A
	S1AxA/W		10,9	11,4	46	16A
	S1DxA/W		13	13,5	54	20A
	S1ExA/W		14	14,5	56	25A
	S1GxA/W		16	16,5	68	25A
	S2GxA/W		20	21,5	105	32A
Cooling + Electrical heating (Fan + compressor + Electrical heaters)	**S0FxA/W**	230V / 1Ph / 50Hz	22	23	70	32A
	S0HxA/W	400V / 3Ph+N / 50Hz	16	17	47	25A
	S1AxA/W		17	17,5	52	25A
	S1DxA/W		20	20,5	61	32A
	S1ExA/W		23	23,5	64	32A
	S1GxA/W		24	24,5	76	32A
	S2ExA/W		27	28,5	113	40A
Cooling + Electrical heating + Humidification (Fan + Compressor + Electrical heaters + Humidifier)	**S0FxA/W**	230V / 1Ph / 50Hz	20.4	21,4	68.4	32A
	S0HxA/W	400V / 3Ph+N / 50Hz	14.6	15,6	45.6	25A
	S1AxA/W		15.6	16,1	60.6	25A
	S1DxA/W		18.6	19,1	59.6	32A
	S1ExA/W		22.7	23,2	64.7	32A
	S1GxA/W		24.7	25,2	76.7	32A
	S2ExA/W		27.7	29,2	113.7	40A
	S2GxA/W		28.7	30,2	113.7	40A

NOTES:

- The cables have to be sized in compliance with local standards and according to the type and characteristics (e.g. Amperes) of installation.
- The specific energy allowed to flow from the circuit breaker, installed by the user, must be lower than 300,000 A2 x s.
- Prescriptions on the differential relay required to the user:
  - For special places (healthcare facilities, etc...) comply with the local regulations;
  - For ordinary places, a low sensitivity is suggested (300 mA) coordinated with the value of the ground heater (IEC 364): Ra ≤ 50/Ia (Art. 413.1.4.1, CEI 64-8);
  - In case of frequent over-voltages with mains impulse, it is advisable to install a selective differential and to evaluate the need for adopting other devices.
  - FLA: standard conditions without condensing unit

(*) **ATTENTION:** Only universal (type B, B+) RCD protective devices are permitted.

Technical data table

Tab. B2 - Electrical data

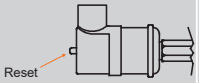
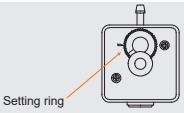
Component		EC FAN (400V - 3Ph - 50 Hz)							COMPRESSOR (400V - 3Ph - 50 Hz)				
Configuration	Model	OA (*) [A]		FLA [A]		LRA [A]	Nominal power [kW] (*)		OA (**) [A]	FLA [A]	LRA [A]	Nominal power [kW] (**)	MOTOR
		EC Fan full	EC Fan	EC Fan full	EC Fan		EC Fan full	EC Fan					Winding resistance [Ohm]
UNDER (U) OVER (O) CONSTANT (K, L) GRILL (G)	S0FxA/W (1)	3,01	1,04	3,01	2	0,10	0,15	0,15	7,40	12,80	60,00	1,59	1,30
	S0HxA/W	1,39	0,84	2,93	3,4	0,10	0,21	0,18	3,91	6,50	38,00	2,05	-
	S1AxA/W	1,65	1,71	2,93	3,4	0,10	0,25	0,39	4,58	8,00	43,00	2,87	-
	S1DxA/W	1,97	1,67	2,93	3,4	0,10	0,30	0,38	5,75	10,30	51,50	3,33	-
	S1ExA/W	1,11	1,31	4,00	5,5	0,10	0,68	0,75	5,65	10,30	51,50	3,27	-
	S1GxA/W	1,52	1,65	4,00	5,5	0,10	0,95	0,94	6,89	11,80	64,00	3,79	2,80
	S2ExA/W	1,69	1,65	4,00	5,5	0,10	1,04	0,95	10,08	15,00	101,00	5,18	1,80
DISPLACEMENT	S0FDA/W	0,52	1,04	3,01	2	0,10	0,07	0,15	7,36	12,80	60,00	1,59	1,30
	S0HDA/W	0,55	0,5	2,93	3,4	0,10	0,11	0,1	3,92	6,50	38,00	2,07	-
	S1ADA/W	1,40	0,92	2,93	3,4	0,10	0,21	0,2	4,57	8,00	43,00	2,62	-
	S1DDA/W	1,67	0,97	2,93	3,4	0,10	0,25	0,19	5,76	10,30	51,50	3,34	-
	S1EDA/W	0,96	1,04	4,00	5,5	0,10	0,60	0,49	5,66	10,30	51,50	3,28	-
	S1GDA/W	1,02	1,31	4,00	5,5	0,10	0,64	0,75	6,90	11,80	64,00	3,80	2,80
	S2EDA/W	1,14	1,3	4,00	5,5	0,10	0,70	0,75	10,07	16,20	101,00	5,55	1,80

(1) 230V-1Ph-50Hz
(*) At standard operating conditions ESP: 50 Pa for Over units and 20 Pa for Under units. Filters: class G4.
(**) At nominal operating conditions: Condensing temperature 45°C - Room conditions: 24°C / 50% R.H.

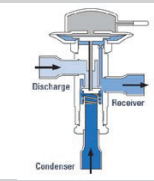
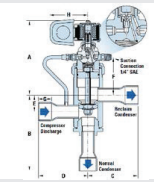
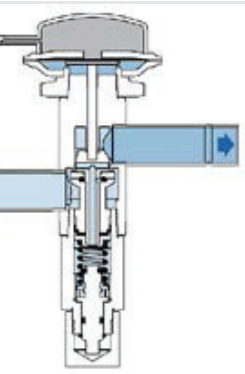
Tab. B3 - Electrical data (optional component)

Component	ELECTRICAL HEATING		HUMIDIFIER	
Model	FLA [A]	Nominal power [kW]	FLA [A]	Nominal power [kW]
(230V / 1Ph / 50Hz)				
S0F	6.50	1.50	4.90	1.13
(400V / 3Ph / 50Hz)				
S0H...S1D	6.50	-	3.20	2.25
S1E...S2E U	8.40	5.85	8.70	6.00

Tab. B4 - Calibrations of electrical components

Refrigeration Circuit Item no.	COMPONENT	SETTING	NOTES	Contact
16	Low Pressure Transducer	Model: CAREL SPKT0043P0 RANGE : 0-17,3 BAR		Nolmally closed
3	High Pressure Switch (HP)	STOP 37.0 barg START 30.0 barg DIFFER. (fixed) 7.0 bar (fixed setting - manual reset)		Nolmally closed
-	Clogged filter differential pressure switch (CF)	Filter G4 = 2 mbar Filter G5 = 3 mbar		Nolmally closed

Tab. B5 - Adjustments and calibrations of valves (see Enclosed E - Refrigeration circuits)

Refrigeration Circuit Item no.	Component	Calibration & Operating	Application	Model	Drawing
10	**Thermostatic valve**	Overheating control 6 ÷ 7 K (see *para. 9.1*)	**All versions**	**Sporlan BBIZE**	
18	**Head pressure control valve**	Factory calibrated 20 bar	**Liebert® HPM W/F/H**	**Sporlan LAC**	
11	**Hot gas injection 3-way valve Reheating mode**	ON-OFF action, controlled by iCOM™ (re-heating)	**Liebert® HPM A/W/F/D/H (no Liebert® HPM Constant)**	**Sporlan 8D7BH**	
11	**Hot gas injection 3-way valve Room thermal load control**	Modulating acton, controlled by iCOM™ 0 ÷ 10 VDC (see *para. 9.3*)	**Liebert® HPM K only (Constant)**	**Siemens M3FB15LX**	
21 + 22	**Hot gas injection Antifreeze protecion in Freecooling unit**	Modulating action N.B. Calibrated at +2°C at machine start-up	**Liebert® HPM F/D/H**	**Sporlan HGBE**	
	Hot gas injection Evaporating pressure control		**Liebert® HPM KA/KW**		
19	**2-way chilled water valve**	Modulating action (servomotor: see *para. 9*)	**Liebert® HPM F**	**Siemens VXP 459**	
	3-way chilled water valve	Modulating action (servomotor: see *para. 9*)	**Liebert® HPM D-H**	**Siemens VXP 459**	
25	**Solenoid valve**	ON-OFF action (coupled to valve 19)	**Liebert® HPM F**	**Parker 7321B**	

Tab. B6 - R410A refrigerant and oil charge for air cooled models (A type)

Model	BASE REFRIGERANT CHARGE (2) [kg - each circuit]		Initial oil charge(1) (liters)	Max oil topping up(1) (liters)	Max System Refrigerant Charge before oil addition(4)	Oil
	without hot gas reheating	with hot gas reheating			[kg – each circuit]	[l – each circuit]
S0F	2,2	2,5	0,74	0,62	9	a
S0H	2,2	2,5	0,74	0,62	9	a
S1A	2,2	2,5	1,24	1,12	9	a
S1D	2,2	2,5	1,24	1,12	9	a
S1ExA	2,9	5,7	1,24	1,24	9	a
S1GxA	2,9	5,7	1,66	1,54	17	a
S2ExA	3,2	6,0	1,77	1,66	17	a
S2GxA	3,5	6,3	1,77	1,66	17	a

a = (0.01 x (total refrigerant charge for each circuit [kg] - max system refrigerant charge before oil addition [kg])) + 0.13

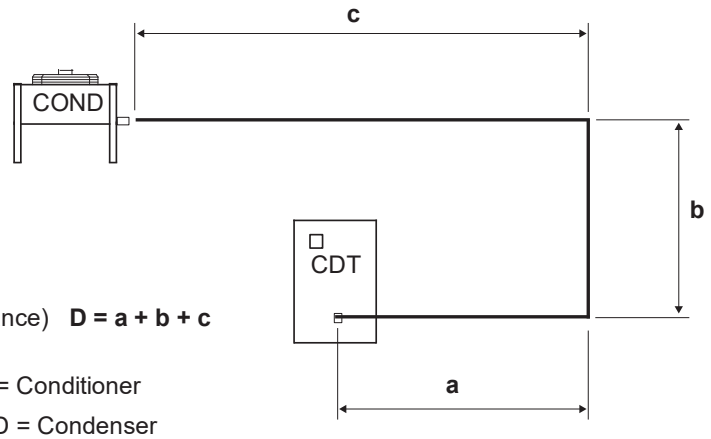
Tab. B6a - Refrigerant pipe charge

External pipe Diameter (mm)	Gas (*)	Liquid (+), at different condensing temperatures R410A (kg/m)		
		35.0°C	46.0°C	57.0°C
10 x 1	0,0048	0,0507	0,047	0,0426
12 x 1	0,0075	0,0793	0,0734	0,0665
14 x 1	0,0108	0,1142	0,1056	0,0958
16 x 1	0,0147	0,1554	0,1438	0,1304
18 x 1	0,0192	0,203	0,1878	0,1703
22 x 1,5	0,0271	0,2862	0,2648	0,2402
28 x 1.5	0,0469	0,4956	0,4585	0,4158

(1) The recommended oil for units with R410A refrigerant is EMKARATE RL 32-3MA.
(2) Unit coupled with remote condenser suggested for ambient temperature up to 35°C. The final charge must be precisely defined in field.
(3) For distance **D** see *Fig. 1* below.
(4) Topping up is requested for short pipeline too, due to the extra-charge of refrigerant.

N.B.: The air conditioner is supplied pressurized with helium at 1 bar.

Fig. 1 – Pipeline air conditioner – condenser



(Distance) **D = a + b + c**

CDT = Conditioner

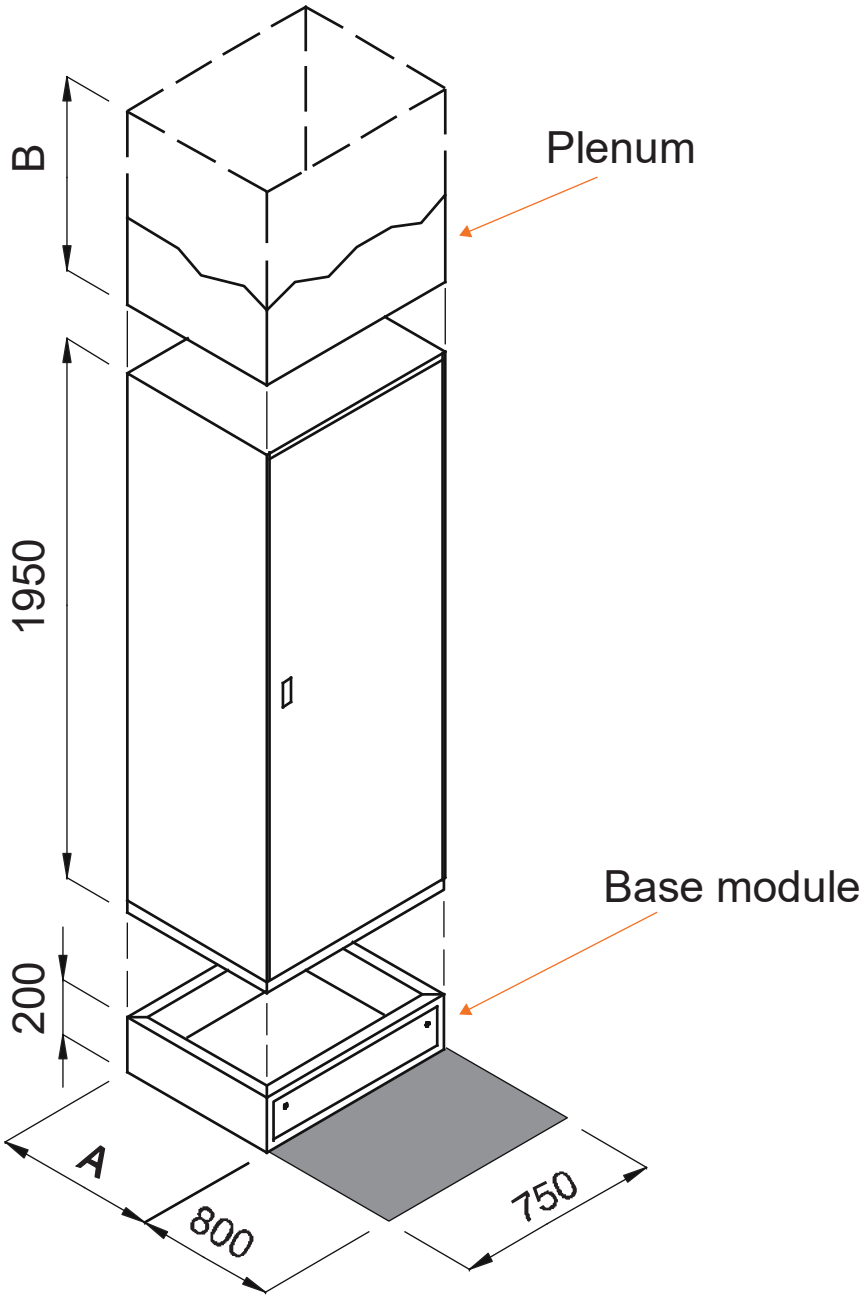
COND = Condenser

Tab. B7 - R410A refrigerant and oil charge for air cooled models (W type)

Model	BASE REFRIGERANT CHARGE (2) [kg - each circuit]		Initial oil charge(1) (liters)
	without hot gas reheating	with hot gas reheating	
S0F	2,5	2,7	0,74
S0H	2,7	3,0	0,74
S1A	2,7	3,0	1,24
S1D	2,7	3,0	1,24
S1ExA	3,8	5,1	1,24
S1GxW	3,8	5,1	1,66
S2ExW	4,1	5,4	1,77
S2GxW	4,4	5,7	1,77

N.B.: The air conditioner is supplied complete with refrigerant and oil.
(1) The recommended oil for units with R410A refrigerant is EMKARATE RL 32-3MA.

Fig. C1 - Overall dimensions Service Area - S models



Models	A (mm)	AVAILABLE PLENUM HEIGHTS: B (mm)			
		Simple Plenum	Plenum for silencing cartridges	Plenum for high efficiency filters	Plenum with frontal airflow (OVER only)
S0F	400	500-600-700-800 900-1000-1100-1200	600-900-1200	500-600-700 800-900	600
S0H-1A	500				
S1E-1G-2E-2G	750				

Models	WEIGHTS (kg)						
	Versions						
	A	W	F	D	H	K/A	K/W
S0F	160	165				170	174
S0H	170	175				200	205
S1A	210	215				215	220
S1D	215	222				222	229
S1E	240	247				247	254
S1G	250	260	290	280	290	260	270
S2E	260	270	310	300	310	270	280
S2G	270	280	320	310	320	280	290

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.
- Refer to the electrical schematic supplied with the unit when making line voltage supply, low voltage main unit interlock and any low voltage alarm connections.

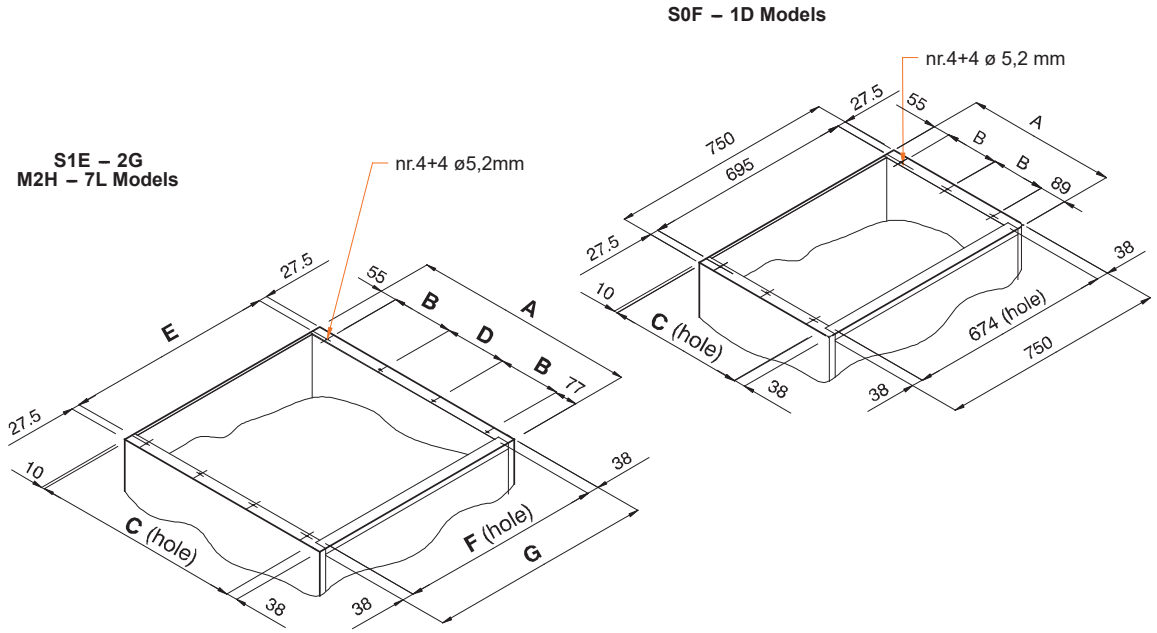
Local codes

- Electrical service must conform to national and local electrical codes.
- All wiring must be done in accordance with all applicable local, state, and national electrical codes.

External disconnecting switch

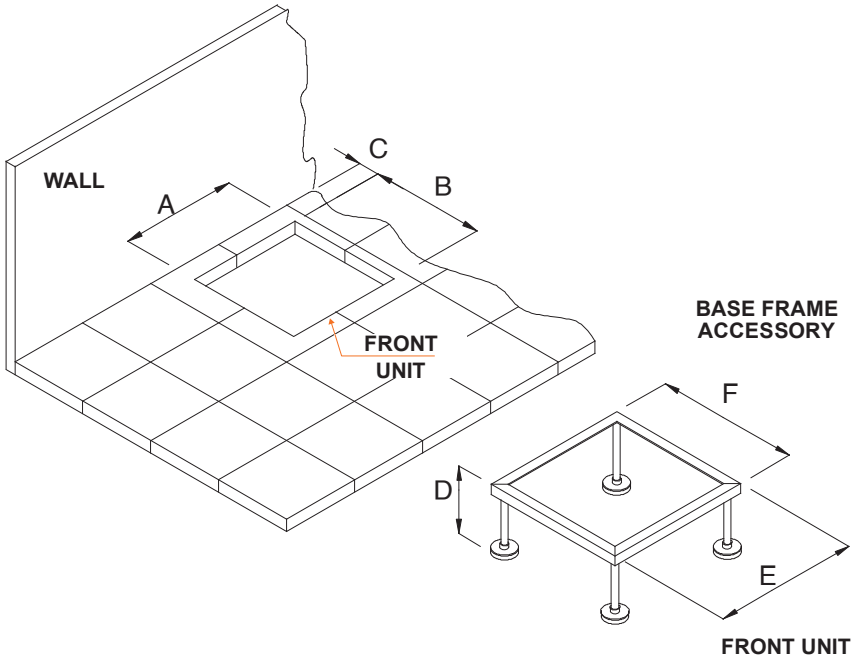
- The final customer must install on site an external disconnecting switch, easy to reach, to facilitate a quick and easy shutdown and power cut off of the unit.
- According to EN60204-1 standard, paragraph 5.3, an ON/OFF handle must be easly accessible and positioned between 0.6m and 1.9m above the service level. When this is not available on the front door of the unit, it is mandatory to install an external disconnecting device (for all power sources to the unit) positioned as close as possible to the unit, easy accessible, visible and located between 0.6m and 1.9m above the service level.

Fig. C2 - Air inlet and outlet - hole for plenum connection



Models	A mm	B mm	C mm	D mm	E mm	F mm	G mm
S0F	400	128	352				
S0H-1A-1D	500	178	452				
S1E-1G-2E-2G	750	206	702	206	695	674	750

Fig. C3 - Hole in raised floor



Models	Dimensions (mm)								
	A		B		C		D	E	F
	without base frame	with base frame	without base frame	with base frame	without base frame	with base frame			
S0F	690	750	320	390	50	10	± 300 ± 500 ± 800	740	380
S0H-1A-1D			420	490					480
S1E-1G-2E-2G			670	740					730

CAUTION: For “UNDER” units installed on raised floor, inhibit inappropriate access to the unit from the base to not-authotized staff: i.e. fixing the floor panels up to 850 mm from the unit.

Fig. C4 - Extension hood

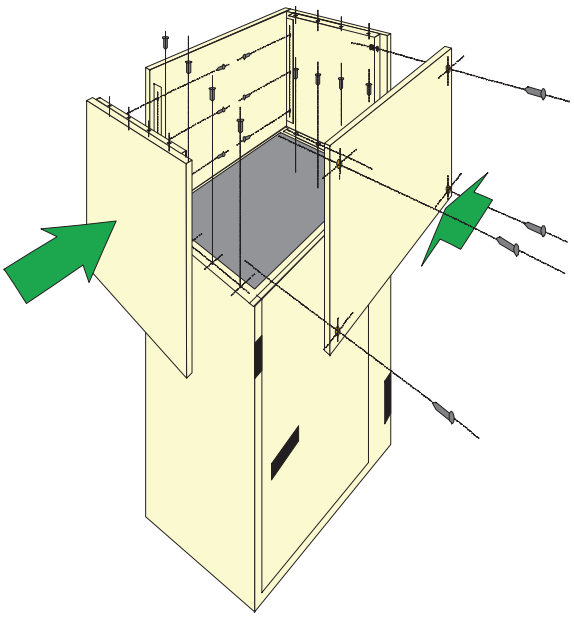
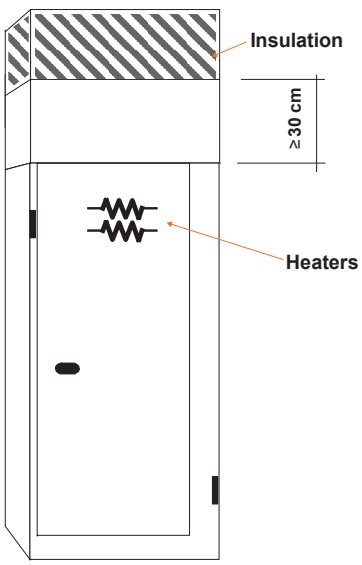


Fig. C5 - Over conditioner with electrical heaters. Upflow ducted conditioner equipped with electrical heaters,connected to airduct not supplied by Vertiv™. Pay attention to the position of insulating material!



Note: See Chap. 2

Fig. C 6 – Base module

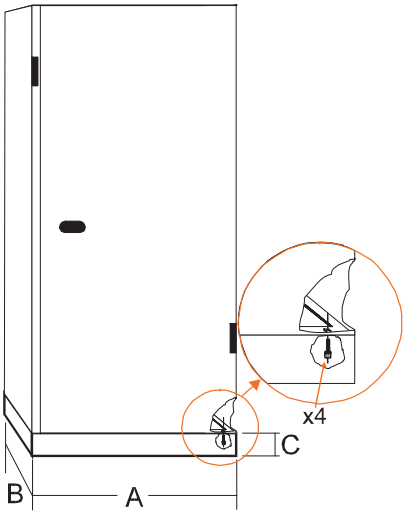


Fig. C 7 – Base frame

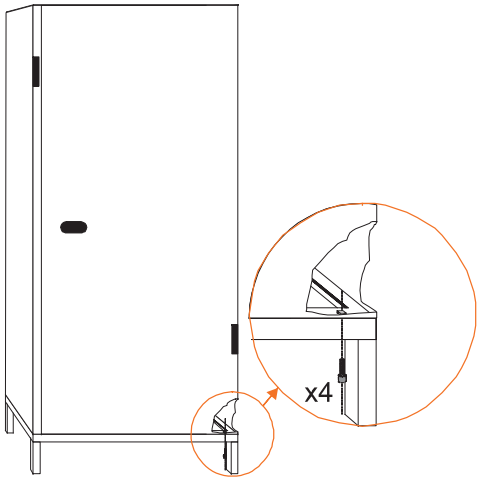


Fig. C 8 – Correct method to install the base module

The air conditioner must be placed vertically on the base module, maintaining a parallel position, avoiding having the load concentration on one small area (see figure below).

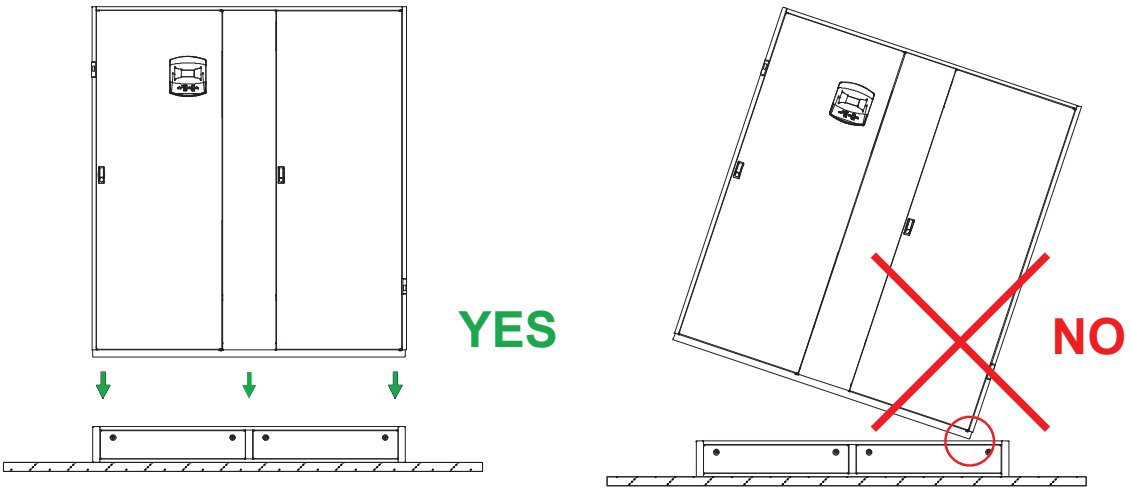


Fig. C 9 – High efficiency filters

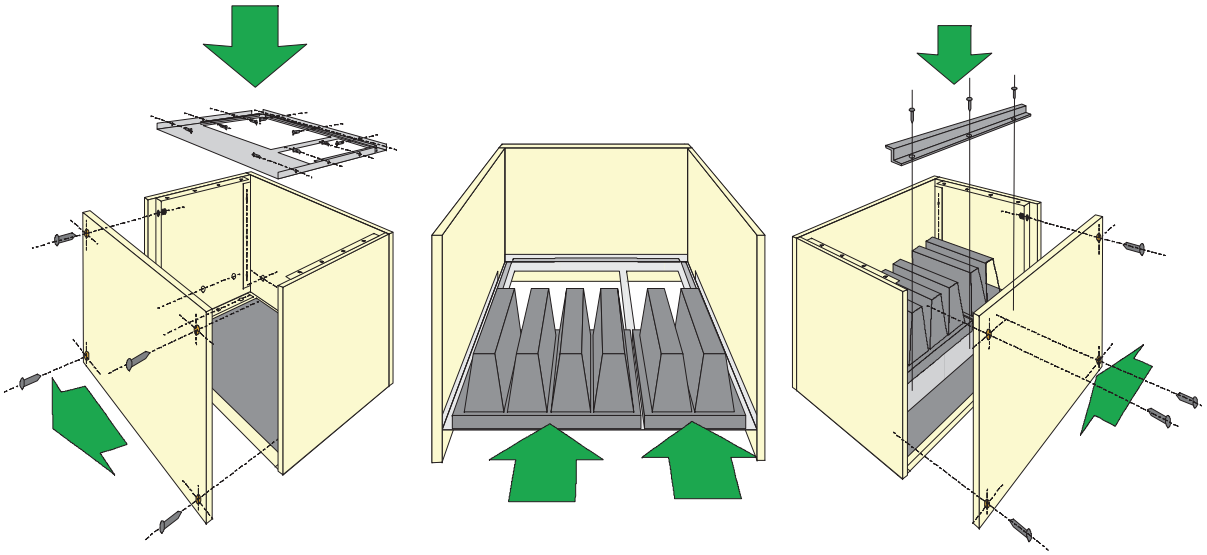
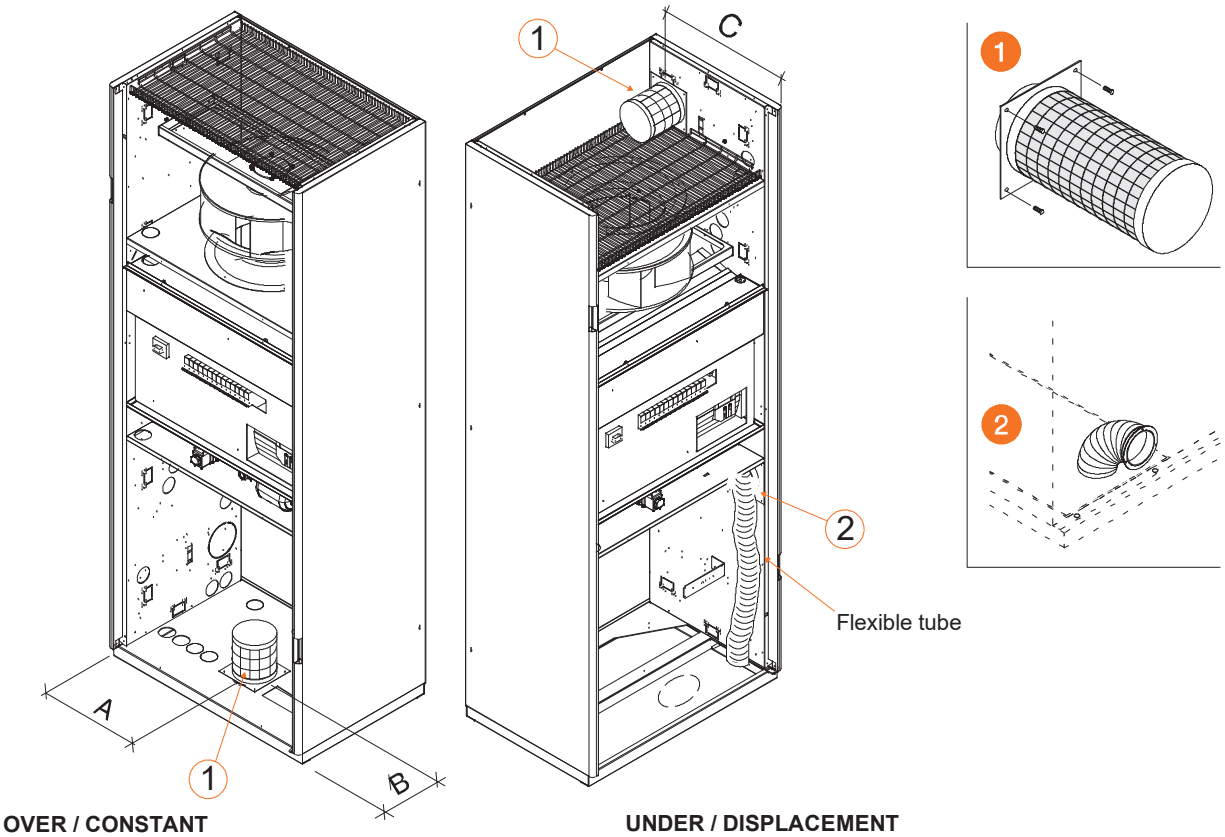


Fig. C 10 – New air module

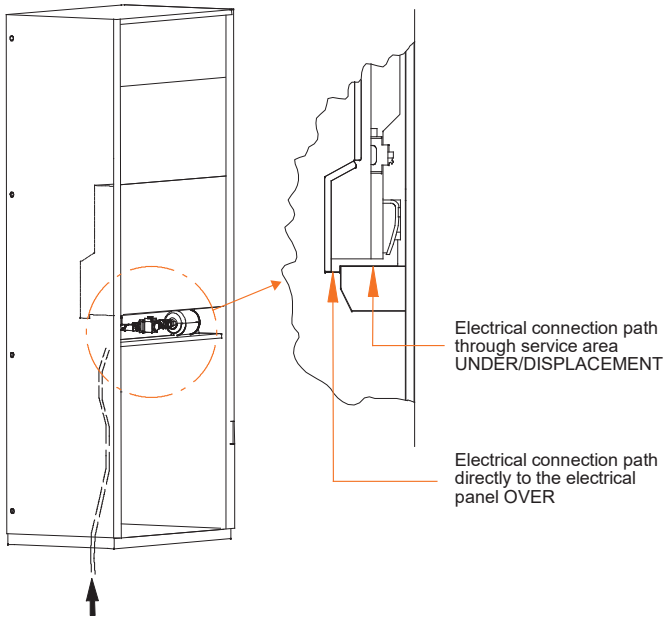
Liebert ® HPM S0F ... 2G



Models	A	B	C
S0F	185	310	320
S0H-1A-1D	375	190	420
S1E-1G-2E-2G	155	450	660

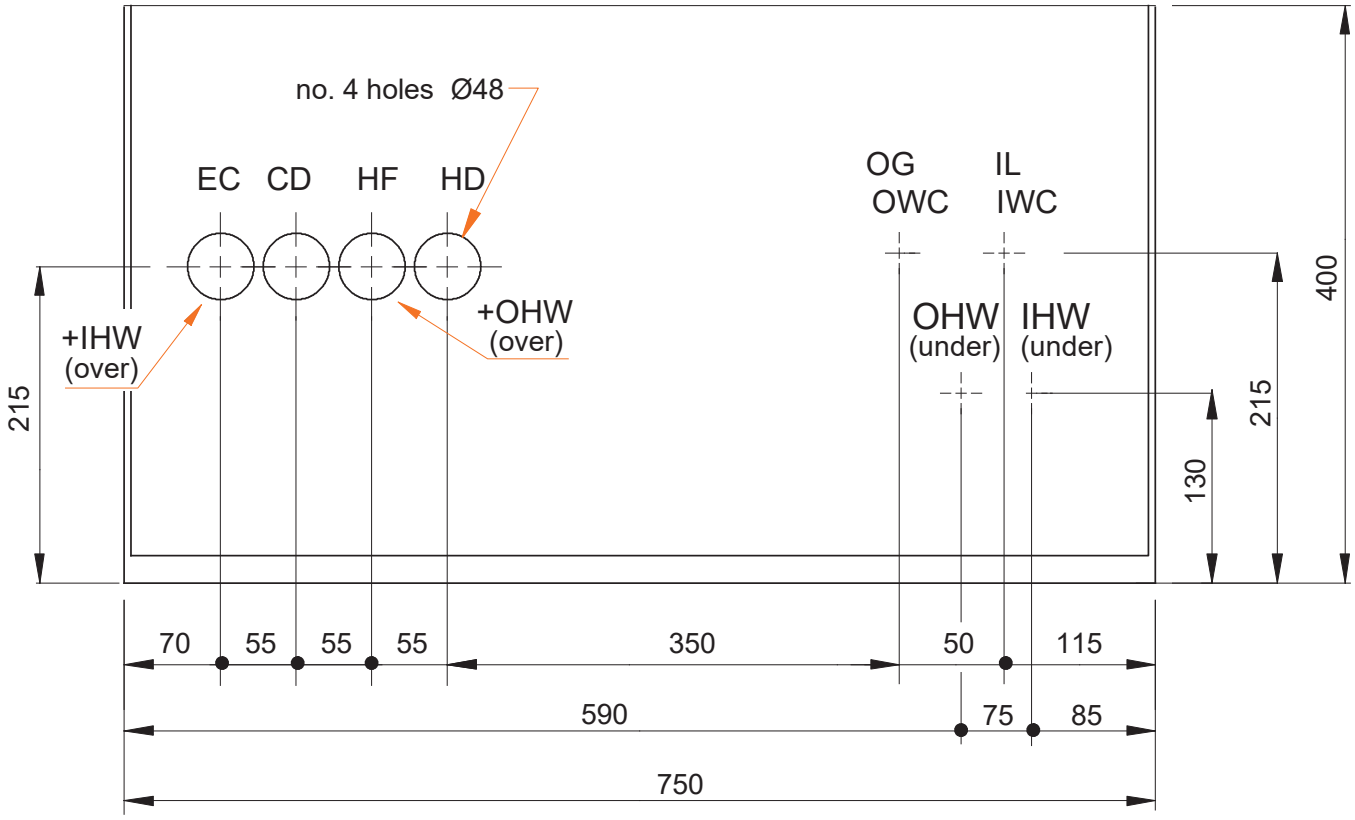
Fig. C 11 – Supply cable path

Liebert ® HPM S0F...2G



Refrigerant and hydraulic connections

Fig. D1 - Refrigerant, water and electrical connections Liebert® HPM S0F - Plan view

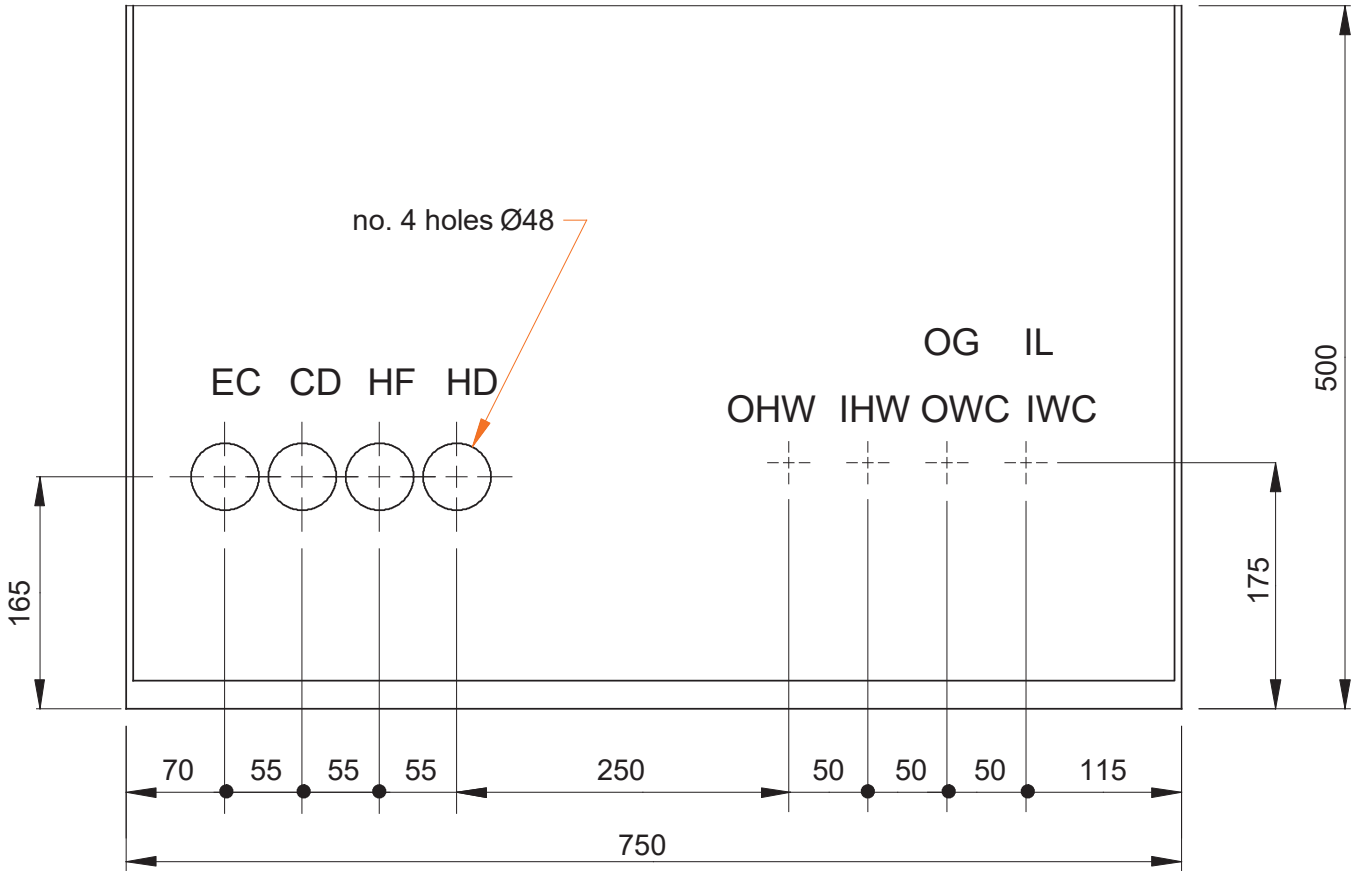


Unit Connection		Version	
		A	W
IL	Refrigerant liquid line inlet *	OD 12 mm	-
OG	Refrigerant gas line outlet *	OD 12 mm	-
IWC	Water to condenser inlet - ISO 7/1	-	Rp ½
OWC	Water from condenser outlet - ISO 7/1	-	Rp ½
IHW	Hot water inlet (opt.)	OD 16 mm	
OHW	Hot water outlet (opt.)	OD 16 mm	
CD	Condensate drain	ID 20 mm	
HF	Humidifier feed (opt.) - ISO 7/1	R ½	
HD	Humidifier drain (opt.)	ID 22 mm	
EC	Electrical power supply	Hole Ø 48 mm	

* Connection size only. The dimension of the connecting pipe depends on unit model and refrigerant, see see *Tab. c* on *para. 4.1.2*.

Refrigerant and hydraulic connections

Fig. D2 - Refrigerant, water and electrical connections Liebert® HPM S0H - 1D - Plan view

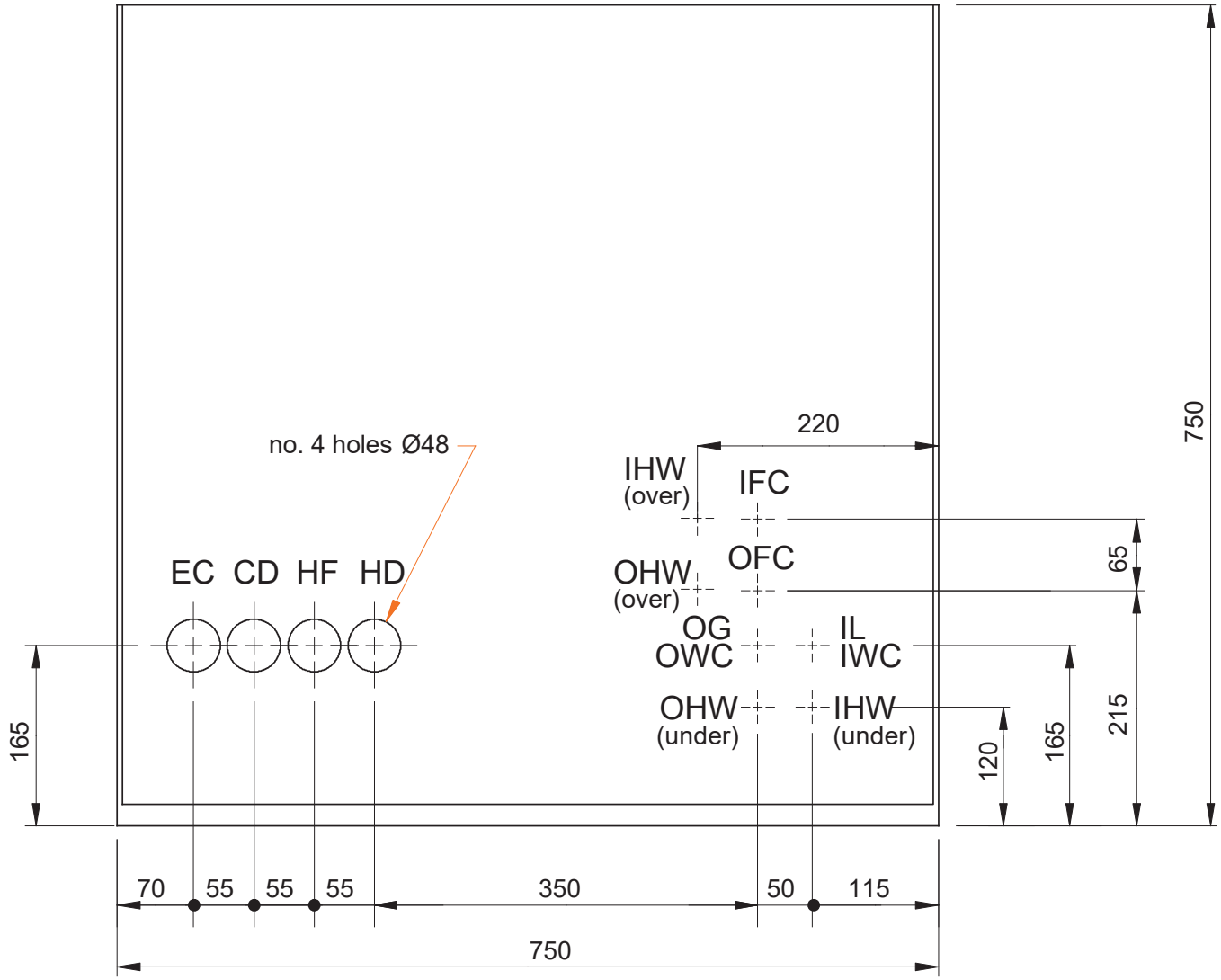


Unit Connection		Version	
		A	W
IL	Refrigerant liquid line inlet *	OD 12 mm	-
OG	Refrigerant gas line outlet *	OD 16 mm	-
IWC	Water to condenser inlet - ISO 7/1	-	Rp ¾
OWC	Water from condenser outlet - ISO 7/1	-	Rp ¾
IHW	Hot water inlet (opt.)	OD 16 mm	
OHW	Hot water outlet (opt.)	OD 16 mm	
CD	Condensate drain	ID 20 mm	
HF	Humidifier feed (opt.) - ISO 7/1	R ½	
HD	Humidifier drain (opt.)	ID 22 mm	
EC	Electrical power supply	Hole Ø 48 mm	

* Connection size only. The dimension of the connecting pipe depends on unit model and refrigerant, see *Tab. c* on *para. 4.1.2*.

Refrigerant and hydraulic connections

Fig. D3 - Refrigerant, water and electrical connections Liebert® HPM S1E - 2G

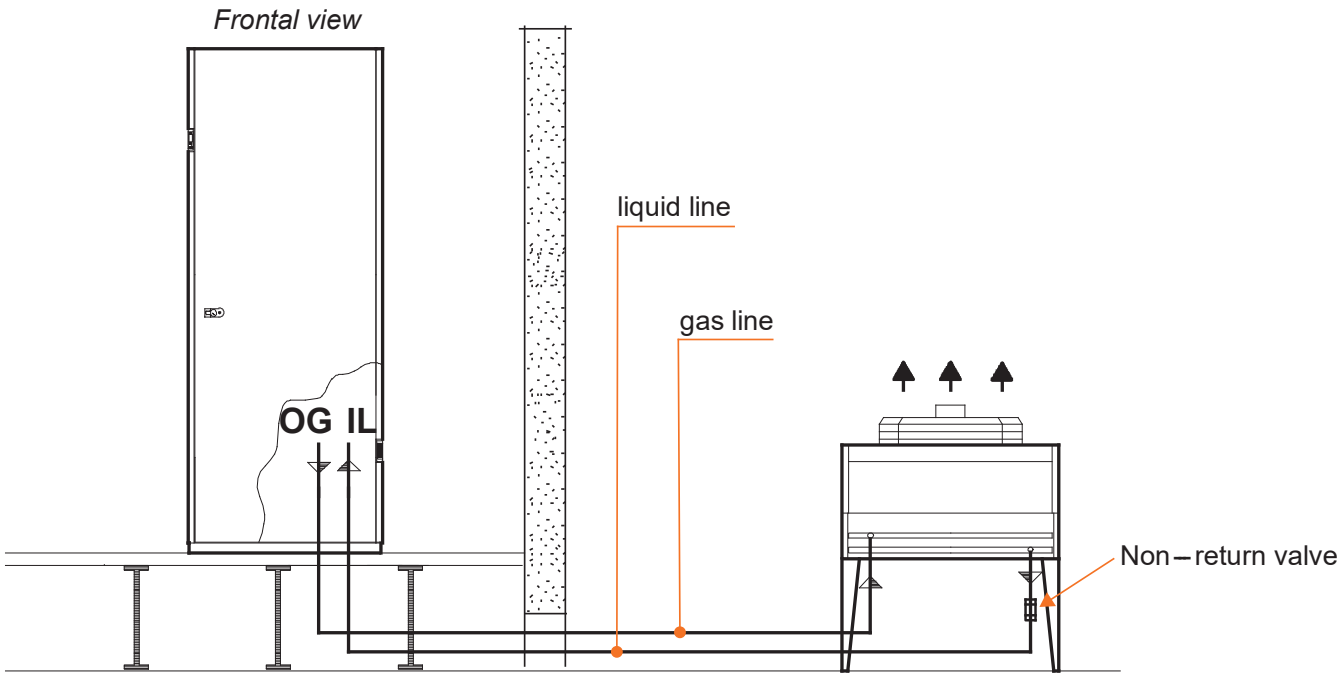


Unit Connection		Version				
		A	W	D	H	F
IL	Refrigerant liquid line inlet *	OD 16 mm	-	OD 16 mm	-	-
OG	Refrigerant gas line outlet *	OD 18 mm	-	OD 18 mm	-	-
IWC	Water to condenser inlet - ISO 7/1	-	Rp ¾	-	Rp ¾	-
OWC	Water from condenser outlet - ISO 7/1	-	Rp ¾	-	Rp ¾	-
IHW	Hot water inlet (opt.)	OD 18 mm				
OHW	Hot water outlet (opt.)	OD 18 mm				
IFC	Water inlet to Freecooling/Dualfluid coil ISO 7/1	-	-	Rp 1		
OFC	Water outlet from Freecooling/Dualfluid coil ISO 7/1	-	-	Rp 1		
CD	Condensate drain	ID 20 mm				
HF	Humidifier feed (opt.) --- ISO 7/1	R ½				
HD	Humidifier drain (opt.)	ID 22 mm				
EC	Electrical power supply	Hole Ø 48 mm				

* Connection size only. The dimension of the connecting pipe depends on unit model and refrigerant, see see *Tab. c* on *para. 4.1.2*.

Refrigerant and hydraulic connections

Fig. D4 - Refrigerant, water and electrical connections Liebert® HPM S0H - 1D - Plan view

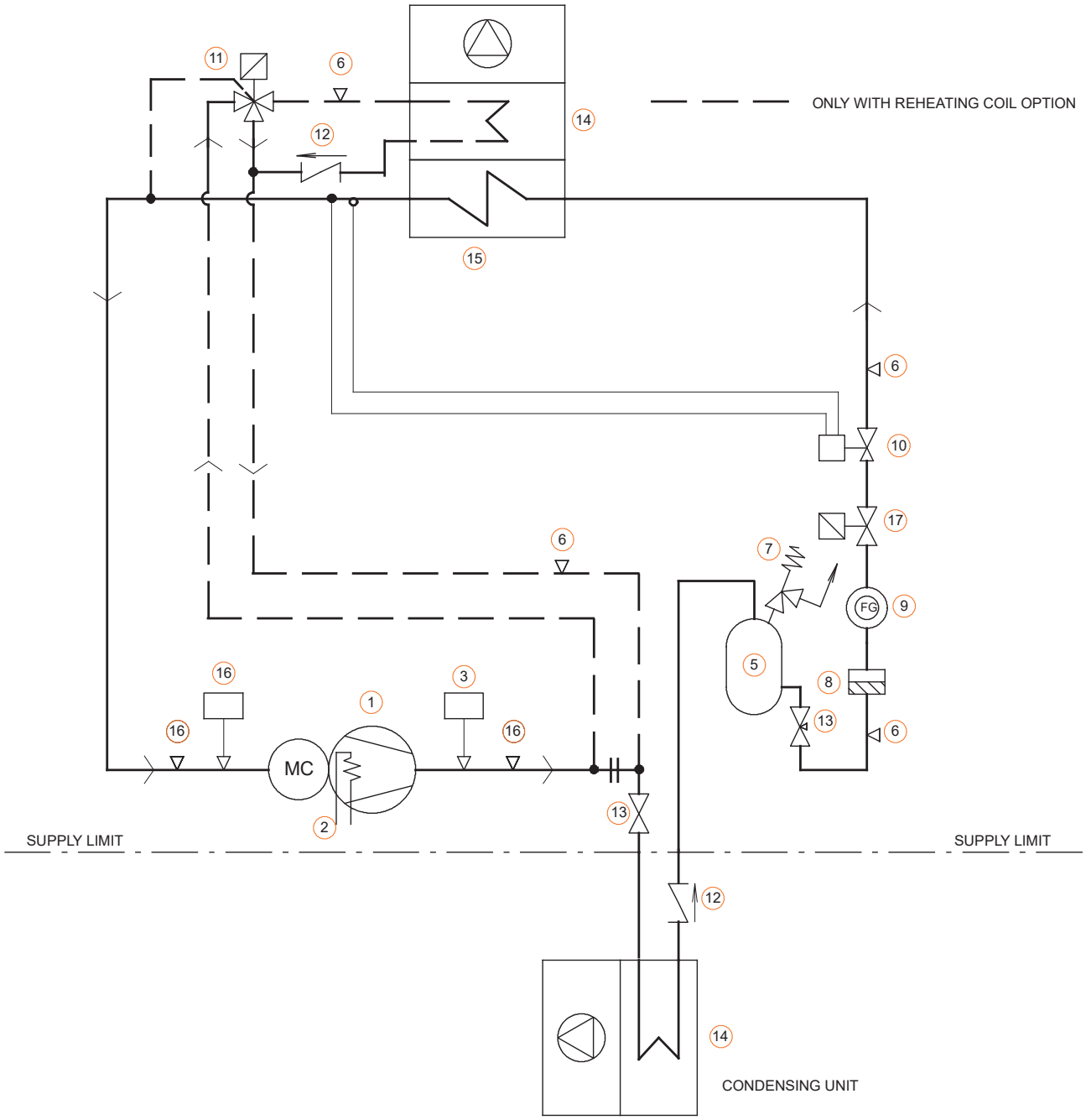


IL	Refrigerant pipe inlet
OG	Refrigerant pipe outlet

Notes: *Recommended diameters see Tab. c on para. 4.1.2.*

Refrigeration circuits

Fig. E1 - Refrigerant diagram Liebert® HPM S0F-S2G A (R410A)

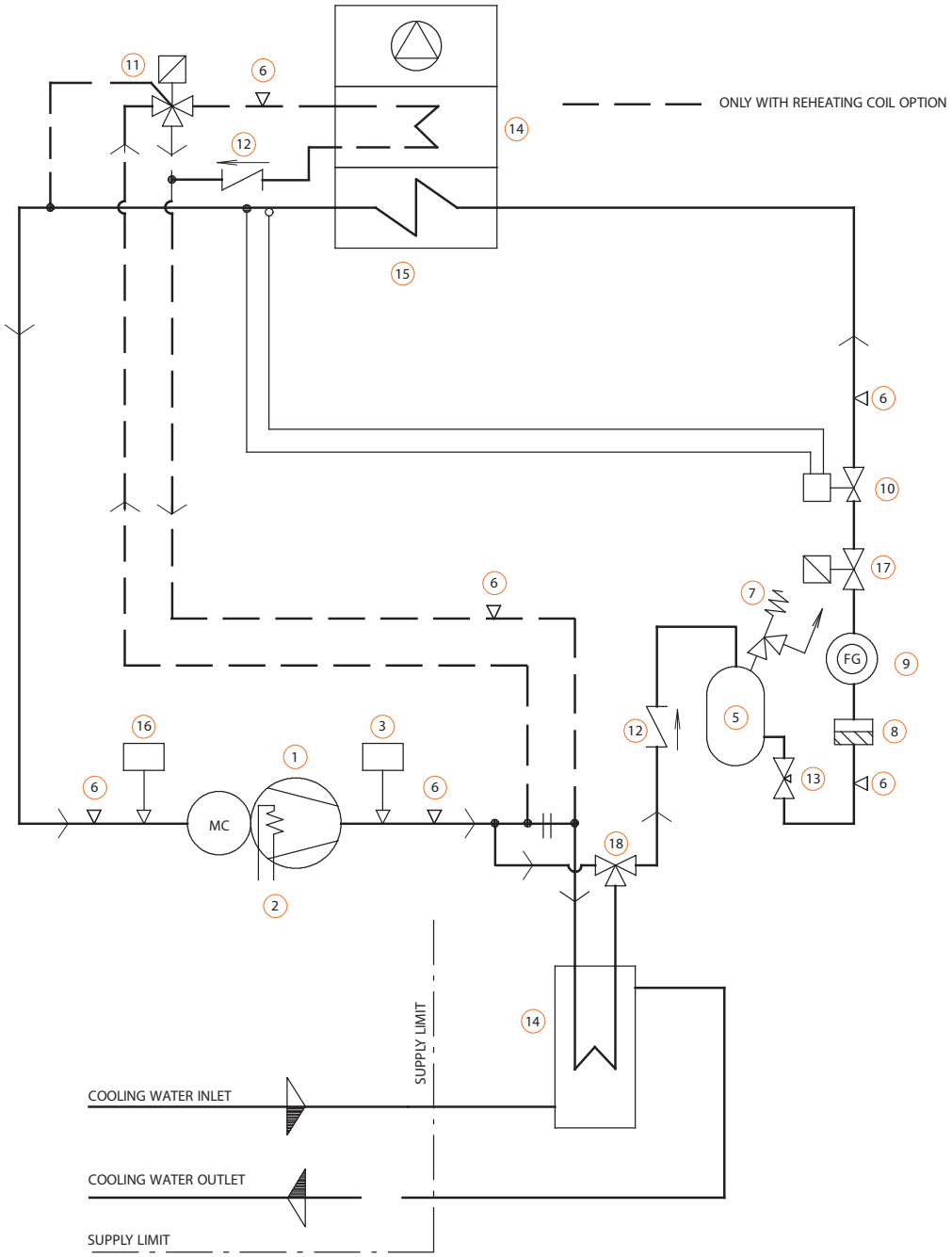


Pos.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve (5/16")
7	Safety valve
8	Filter dryer
9	Sight glass

Pos.	DESCRIPTION
10	Thermostatic expansion valve
11	Hot gas solenoid valve (optional)
12	Check valve
13	Shut-off valve
14	Reheating coil (optional)
15	Evaporator
16	Low pressure transducer
17	Shut-off solenoid valve

Refrigeration circuits

Fig. E2 - Refrigerant diagram Liebert® HPM S0F-S2G W (R410A)

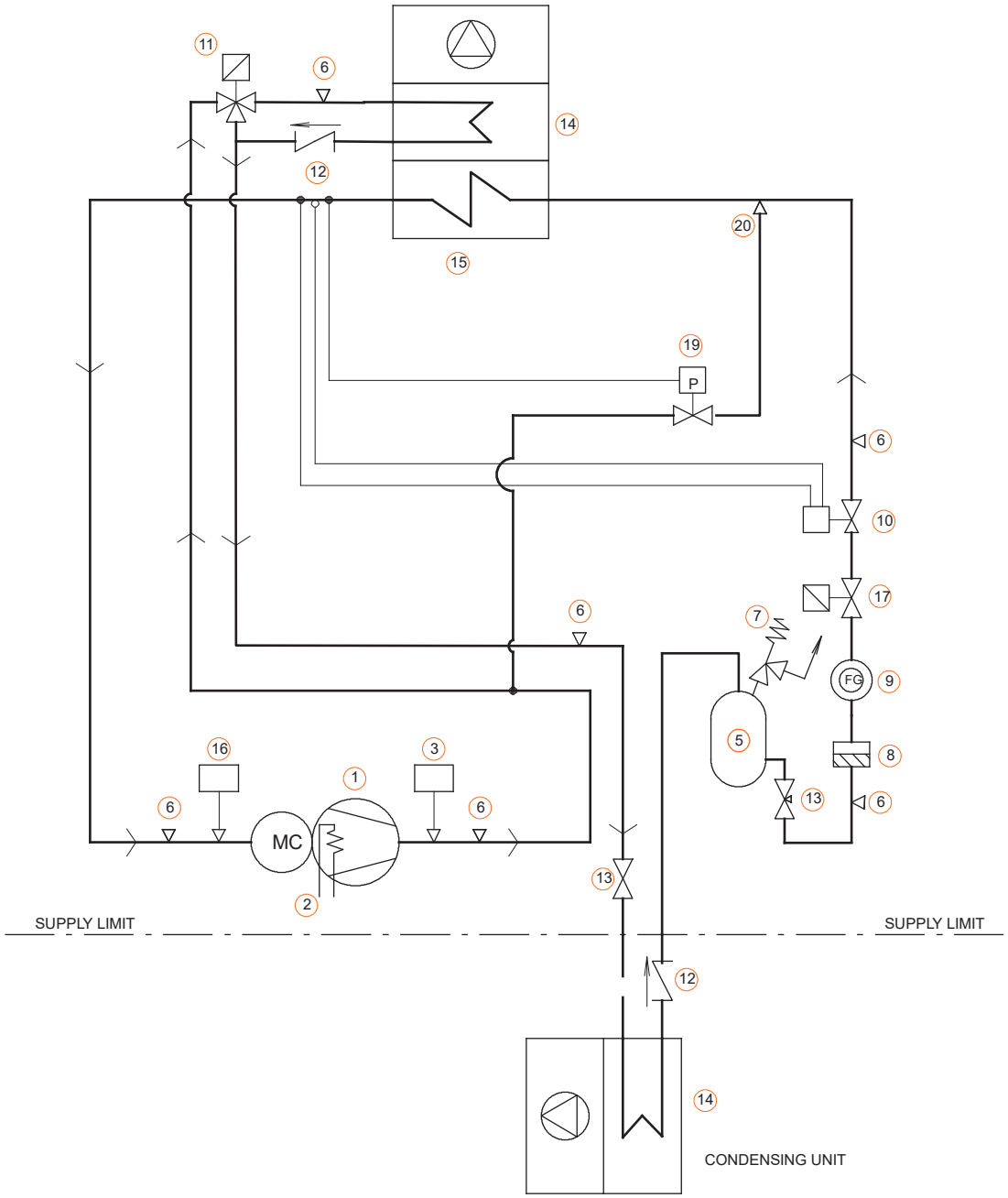


Pos.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve (5/16")
7	Safety valve
8	Filter dryer
9	Sight glass

Pos.	DESCRIPTION
10	Thermostatic expansion valve
11	Hot gas solenoid valve (optional)
12	Check valve
13	Shut-off valve
14	Reheating coil (optional)
15	Evaporator
16	Low pressure transducer
17	Shut-off solenoid valve
18	Head pressure control valve

Refrigeration circuits

Fig. E3 - Refrigerant diagram Liebert® S0F-S2G KA (R410A)

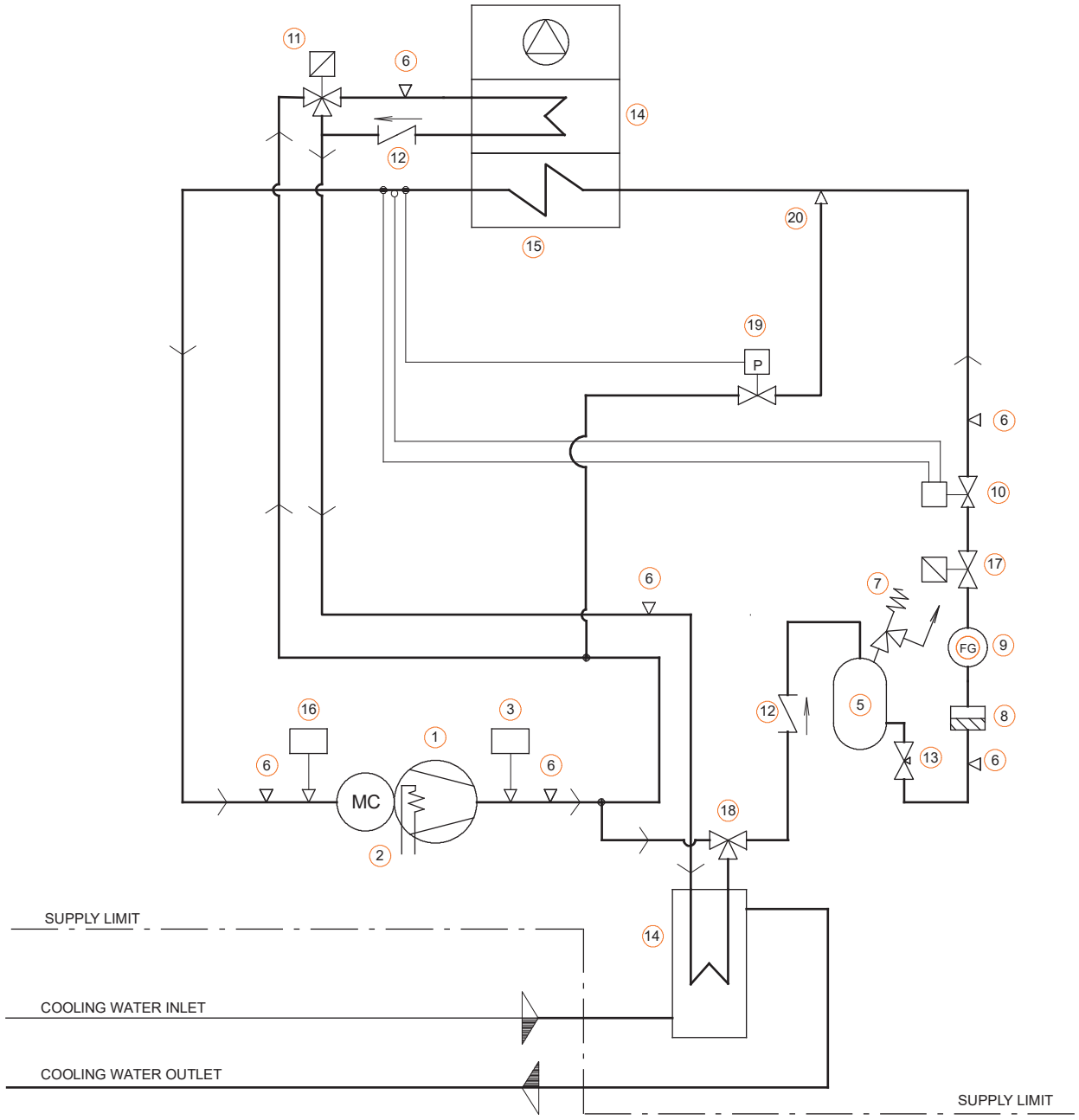


Pos.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Air cooled condenser
5	Liquid receiver
6	Access valve (5/16")
7	Safety valve
8	Filter dryer
9	Sight glass
10	Thermostatic expansion valve

Pos.	DESCRIPTION
11	3-way hot gas modulating valve
12	Check valve
13	Shut-off valve
14	Reheating coil
15	Evaporator
16	Low pressure transducer
17	Shut-off solenoid valve
18	-
19	Hot gas valve injection
20	Hot gas injector

Refrigeration circuits

Fig. E4 - Refrigerant diagram Liebert® S0F-S2G KW (R410A)

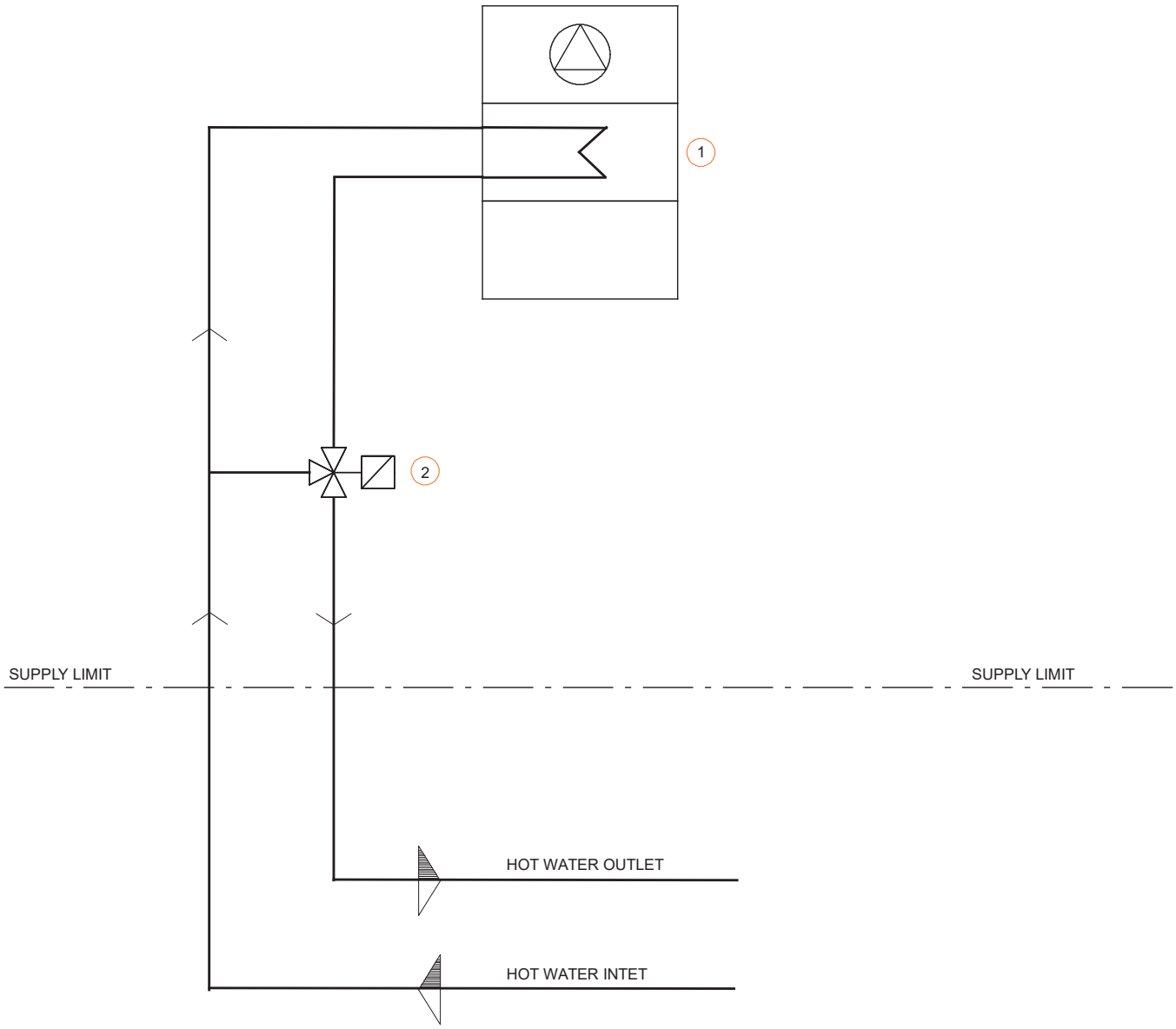


Pos.	DESCRIPTION
1	Compressor
2	Crankcase heater
3	High pressure switch (HP)
4	Water cooled condenser
5	Liquid receiver
6	Access valve (5/16")
7	Safety valve
8	Filter dryer
9	Sight glass
10	Thermostatic expansion valve

Pos.	DESCRIPTION
11	3-way hot gas modulating valve
12	Check valve
13	Shut-off valve
14	Reheating coil
15	Evaporator
16	Low pressure transducer
17	Shut-off solenoid valve
18	Head pressure control valve
19	Hot gas valve injection
20	Hot gas injector

Hot water circuit

Fig. F1 - Hot water reheating coil-optional



Pos.	DESCRIPTION
1	Hot water coil
2	Hot water 3-way valve

G.1 - Control panel

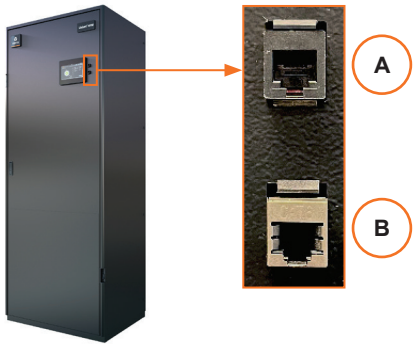
A **Control panel**

The unit is usually controlled remotely by a network connection.

The unit may also have control panel (optional) in the front door.

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

G.2 - Ethernet connection



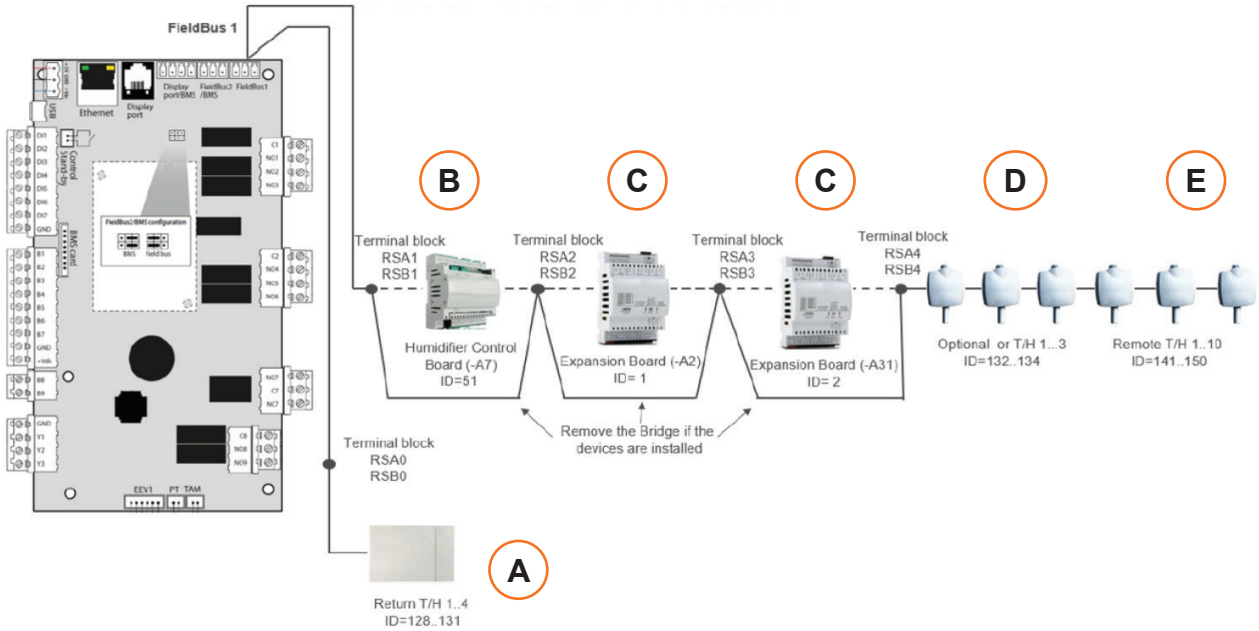
A	**RJ11 - CANbus port** for connection of an external display
B	**RJ45 - Ethernet port** for connection of an external laptop

G.3.1 Modbus Connections

G.3.1.1 General description

The control system can manage different devices via Modbus.

The following figures show the architecture and detail of the structure.



A	Return sensor T+H (up to 4)	**D**	Optional or TH
B	Humidifier	**E**	Remote TH
C	Expansion board		

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

G.4 Sensors and instruments

- Humidity and temperature sensor for the air returning from the room into the unit
- Temperature sensor (NTC type) for the air at the unit outlet.

This sensor is normally fixed on the fan grid, but it can be moved in a remote position since its cable is more than 1 m long.

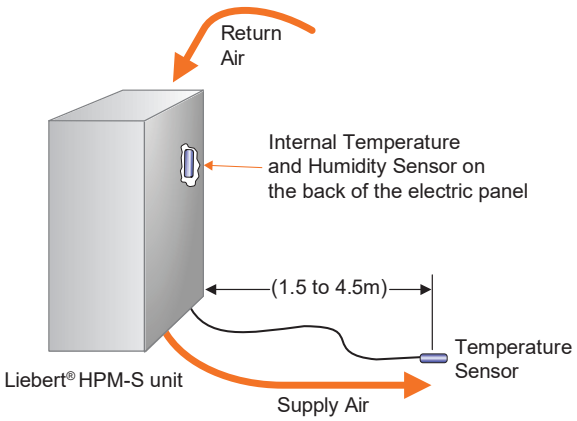
NOTE *Other optional remote temperature sensors may be connected to the unit by the end user. Only Modbus type are allowed.*

See *G.3.1 Modbus Connections* for details.

G.5 Sensors connections

Any remote or additional sensor must be connected to the unit via Modbus. See *G.6 Modbus Connections and Settings*.

G.5.1 Supply air Temperature sensor



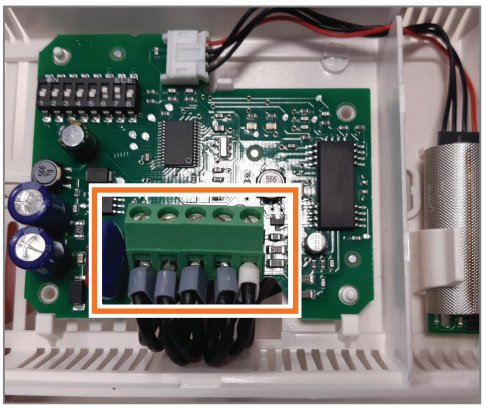
The supply temperature sensors should be installed in an area that is influenced only by the unit it is connected to. The supply sensor should be 1.5 - 4.5m from the cooling unit to provide an accurate reading for the control.

The sensor has been already installed in the unit and it's fixed in the fan module with at least 3m of cable lenght available. Remove the stripe and place it according the drawing.

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

G.6 Modbus Connections and Settings

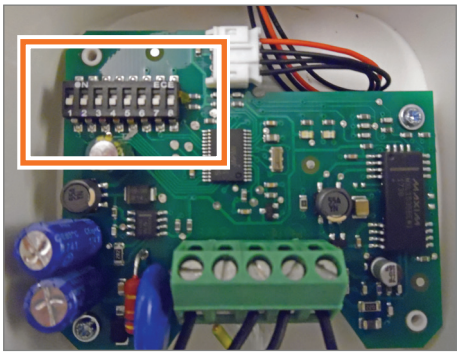
G.6.1 Connection of a device to the Modbus cable



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

G.6.2 Setting of Modbus devices

Dip switched address	Address of the device (unique)	• For T/H sensor: set the pins on its board.



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

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