High Performance Air Conditioning

Liebert XDFN

Closed Loop Cooling for High Density Racks (13–26 kW)

PRODUCT DOCUMENTATION

Liebert®

EMERSON™ Network Power

The Quality Management System of Liebert Hiross S.p.A. High Performance Air Conditioning has been approved by Lloyd's Register Quality Assurance to the quality management system standard ISO 9001:2000

The product conforms to European Union directives 98/37/CE (89/392/CEE; 91/368/CEE; 93/68/CEE); 89/336/CEE; 73/23/CEE; 97/23/CE.
Units are supplied complete with a Test Certificate Conformity Declaration and Component List.

XDFN units are CE marked as they comply with the European directives concerning mechanical, electrical, electromagnetic and pressure equipment safety.

Contents

1 General Overview

1.1 Emerson Network Power: Business–Critical Continuity Expert

Emerson Network Power designs, builds and supports customers' entire network power from grid to chip. Global reach, combined with industry expertise and technological know–how, allows Emerson Network Power to ensure "high nines" reliability to its clients anywhere in the world. From power components to climate and power systems, Emerson Network Power solves all power reliability needs.

The viability of a Data Centre to support a business relies on several main factors:

- Floor Space
- Modular Raised Floors
- Server enclosures
- High Performance Air Conditioning and UPS Support
- Fire Detection and security systems

Today' s Data Centres are configured to allow for alternating Hot and Cold Aisle layouts. Equipment enclosures draw conditioned air through perforated floor tiles and exhaust the hot air from the rear.

Increasing the number of servers increases the heat dissipation accordingly. Managing such heat within the available space is difficult and expensive. Heat transfer systems, have a high investment value, reduce valuable floor space and have high operating costs within the Data Centre environment.

The power consumed by the equipment housed in a single rack enclosure can vary dramatically. The average power consumed by an enclosure in a Data Centre is around 1.4 KW. By populating a rack with high density servers, such as "Blade Servers", the power consumed can easily exceed 20 kW thus creating hot spots not manageable with standard air conditioning solutions.

The Cooling Challenge

The Liebert cooling challenge is to offer reliable, safe and competitive new products able to target heat density dissipation of more than 20 kW/rack.

The Liebert Adaptive Cooling Architecture *addresses the cooling challenge in the following different levels:*

- up to approximately 5 kW/rack using Liebert high performance air conditioners arranged with a cold and hot aisle layout;
- from 5 to 15 kW/rack with Liebert high performance air conditioners plus supplemental cooling approach based on the open architecture of Liebert XD series;
- up to 24 kW/rack with the close loop rack cooling approach of the Liebert XDFN, for very high heat density applications.

The Adaptive Cooling Architecture, provides a roadmap to deal with increasing heat density, maximizing flexibility and scalability while achieving the lowest cost of ownership.

1.2 XDFN Concept

Liebert XDFN basic description.

The Liebert XDFN is an integrated equipment cabinet with built in cooling, power distribution, rack for server location, monitoring and fire extinguish system offering full redundancy and back up ventilation.

XDFN is designed in order to provide cooling system for servers up to about 25 kW maximum (net cooling).

Liebert XDFN provides a safe protection to customers servers from risks related to server over heating providing a complete solution for redundancy, power protection, fire extinguish, back up ventilation.

The Liebert XDFN solution has been developed for existing and new High Density Data Centers to offer an effective, low cost and fast track on site solution. It represents the optimum solution where business disruption is unacceptable and flexibility in growth is required. The enclosure surrounding the active devices is the most critical physical element in the infrastructure. The enclosure in our scenario, becomes more than just a rack, it becomes our Data Centre.

The rack can be fully populated with the equivalent of 42 U (units) rack mount servers.

The modular design of Liebert XDFN allows redundancy, rapid replacement of faulty units, scalability and a dramatic increase in utilization of data room floor space.

Liebert XDFN units can be combined together in order to match the exact cooling capacity required by the data center. Full redundancy is given by one redundant cooling module for each block of XDFN units.

All units are connected via LAN, and in case of failure of one of the running units, the redundant unit can be activated immediately. The rotation of the cooling modules is guaranteed by the microprocessor control system in order to get always a safe standby.

Each Liebert XDFN unit is also equipped with back–up ventilation powered by UPS, to guarantee server protection from temperature increase that may occur in case of the main power failure.

1.3 Cooling module

The air conditioner module, self–contained in the XDFN product, is a modular direct expansion unit with remote air–cooled condenser. The cooling capacity is modulating from 2 to 22,3 kW thanks to the use of digital scroll technology, an innovative solution and exclusively offered by Liebert. The refrigerant used is R407C.The closed loop rack cooling provides primary cooling to customers' components installed in the rack module, using a close loop cooling system.

On the cooling module there are two air paths to the rack module, one on the top and one on the bottom of the air conditioner.

Cold air can circulate from the bottom of air conditioner module to the rack module. In the rack, the air passes from the front of each blade centre and is discharged to the back. The rejected heat air is then pushed back to the air conditioner through the top air path.

The modular design of XDFN Closed loop rack cooling, allows to combine racks and cooling modules, in order to provide cooling to multiple racks, each of them having a total maximum heat dissipation of 23.6 kW (dx units).

The XDFN is provided with DDC type control located within the electric board. The microprocessor shall be equipped with a user interface including a backlighted 3–digit Liquid Crystal Display (LCD) and a 3–push–button key board. The user interface shall allow to set all operating parameters, sensors and alarms; the display shall indicate the return–air temperature as well as the return air relative humidity (if a RH sensor is connected); the 3 LEDs shall indicate power supply, unit in operation, alarm or warning status. Dehumidification, if required, shall be obtained by automatic fan speed reduction while the compressor is in operation. Humidification and dehumidification shall be achieved through a properly designed T–H sensor. More units (up to sixteen) can be connected in order create a local network: in this way the interconnected units can share a subset of parameters and will managing the n+1 redundancy.

1.4 Connectivity

Each microprocessor control shall allow the connection to a bus–cable local network and to a remote graphic terminal for a centralized system monitoring of each and all units installed.

A SNMP interface for each rack module is available. Other connectivity option can be offered. A graphical user interface will allow the operator to monitor and react to every system condition in order to start a graceful and safe shut down procedure of the load. Temperature, humidity of each rack will be constantly monitored together with UPS status, air conditioning status.

1.5 Rack module options

Each rack will be supplied with Power Distribution Units and power strips with up to 48 outlets.

Open doors sensors.

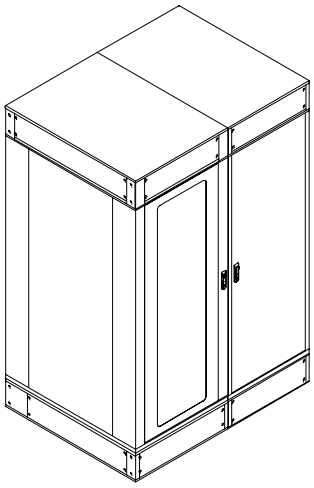
Fire extinguishing system. Vesda fire detection and extinguish system–one fire extinguishing control module for the full system (occupying 3 U). Every XDFN module (each rack and air conditioner) is equipped with an extinguishing bottle + the relevant distribution.

1.6 The Liebert XDFN is the solution for high density rack cooling, and can provide:

- humidity control in order to keep always the adequate level of humidity
- cooling redundancy N+1
- emergency back up ventilation, eventually powered by UPS (if required)
- UPS power integration
- Monitoring options
- maintenance is possible also while the unit is operating. Therefore maintenance is always possible with both front and rear door open
- absence of noise and turbulence in the room

2 Systems Lay–out

2.1 XDFN basic configuration (one rack, one air conditioner)



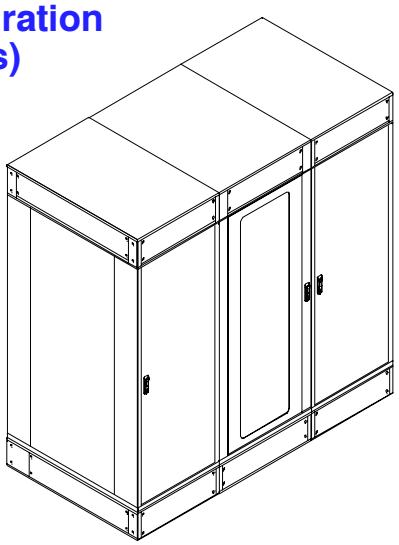
Air conditioner module selection criteria

XDFN basic configuration is particularly indicated for small data centers when the consequence of a fault has a low degree of severity. Datacenters can be either placed inside existing infrastructures with main air conditioning and raised floor or inside regular rooms.

Thanks to the back up ventilation system, energized by UPS, XDFN basic configuration is able to keep the equipment running for a safe time to take an emergency action. In case of power shut off, it can be the time to get the gen–set started. In case of fault, it is the time to get the system safely shut down.

The cooling capacity of the AC module will be equal or greater than heat load of the rack.

2.2 XDFN full redundancy configuration (one rack, two air conditioners)



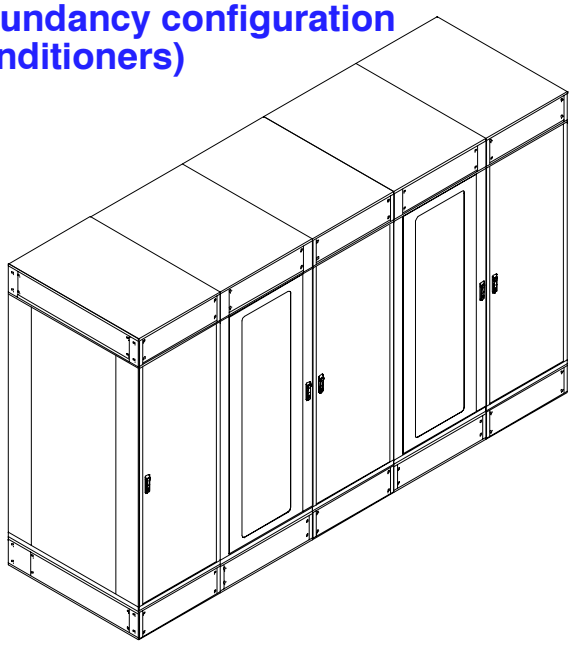
Air conditioner module selection criteria

XDFN full redundancy configuration is required when the equipment is running critical business. In such situation, even if the quality of the AC equipment assures high reliability, the consequence of a business interruption is not acceptable.

Therefore the system is provided with double AC equipment. One air AC unit runs and the other one is in stand–by mode, isolated from the air path by a damper placed in the base module. The inside control swaps the two units every day or week, to keep the same number of working hours.

The cooling capacity of each AC module will be equal or greater than the heat load of the rack.

2.3 XDFN advanced redundancy configuration (n racks, n+1 air conditioners)



Air conditioner module selection criteria

XDFN advanced redundancy configuration is used when 2 racks or more are necessary to run a mission critical business. It takes into all the know–how acquired during more than 30 years of experience in close control cooling.

The N+1 redundancy is achieved by one more stand–by AC unitper each row of XDFN units, regardless how many of them work in the system. Thanks to this configuration, a full redundancy is guaranteed in case of the first fault.

The key value of the N+1 redundancy is the time to restore (MTTR). In fact, the lower it is, the lower is the probability of a second fault.

Every rack is cooled by one AC unit that is positioned close to the rack itself. The inside control changes the stand–by unit every defined period, so all the AC units run the same number hours. Of course, the dampers inside the rack modules divert the air paths to keep every rack cooled by one close unit. This operation occurs also in case of fault, when the stand–by unit takes over.

The cooling capacity of each AC module will be equal or greater than the max heat load of each contiguous rack.

2.4 Systems air path

Fig. 2.a Basic configuration air path

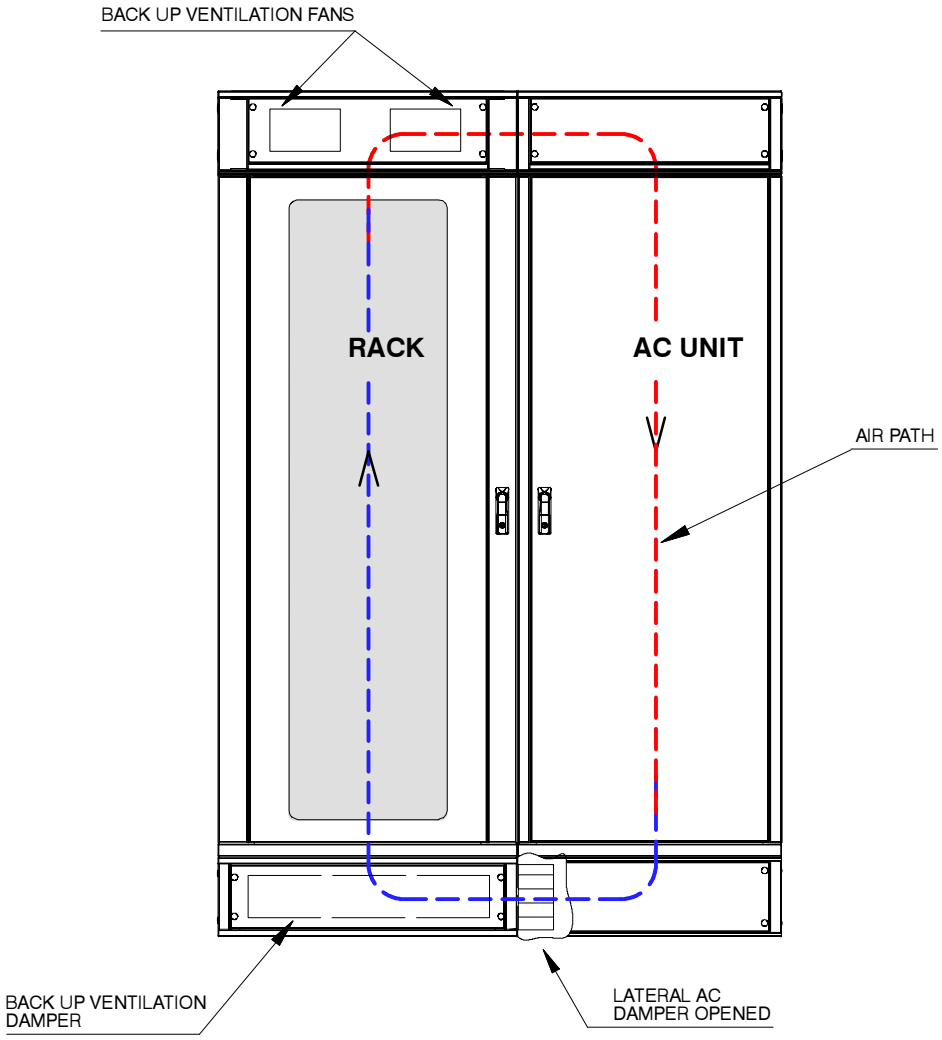


Fig. 2.b Full redundancy configutaion air path

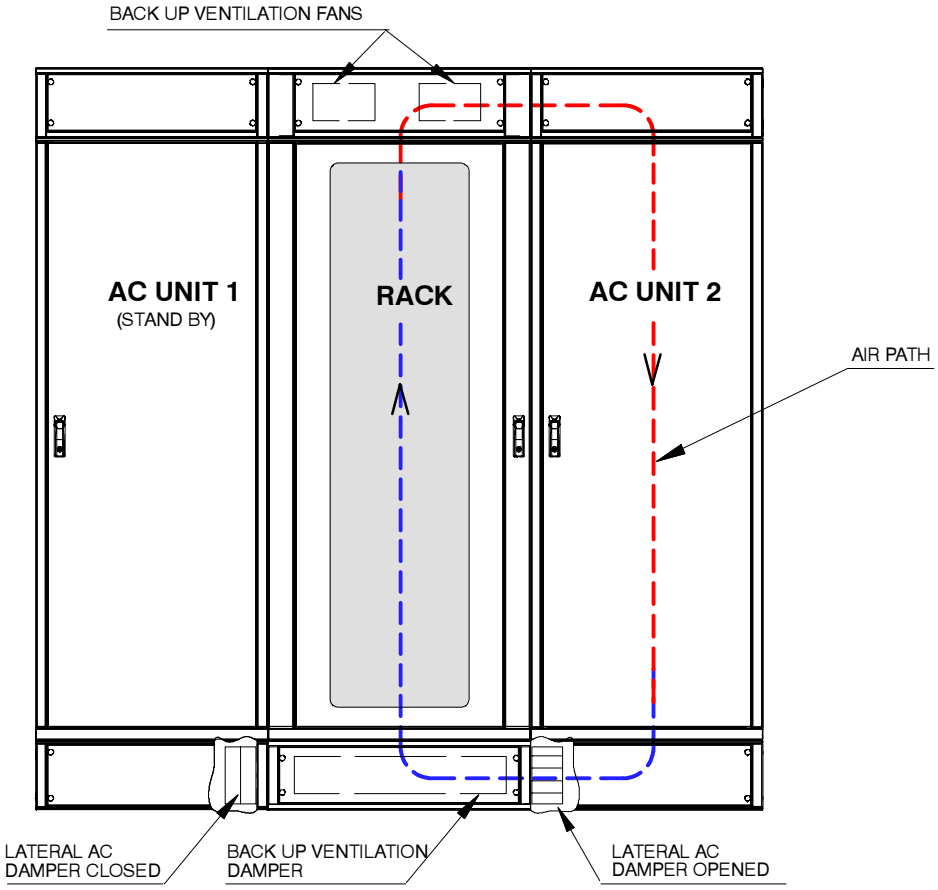
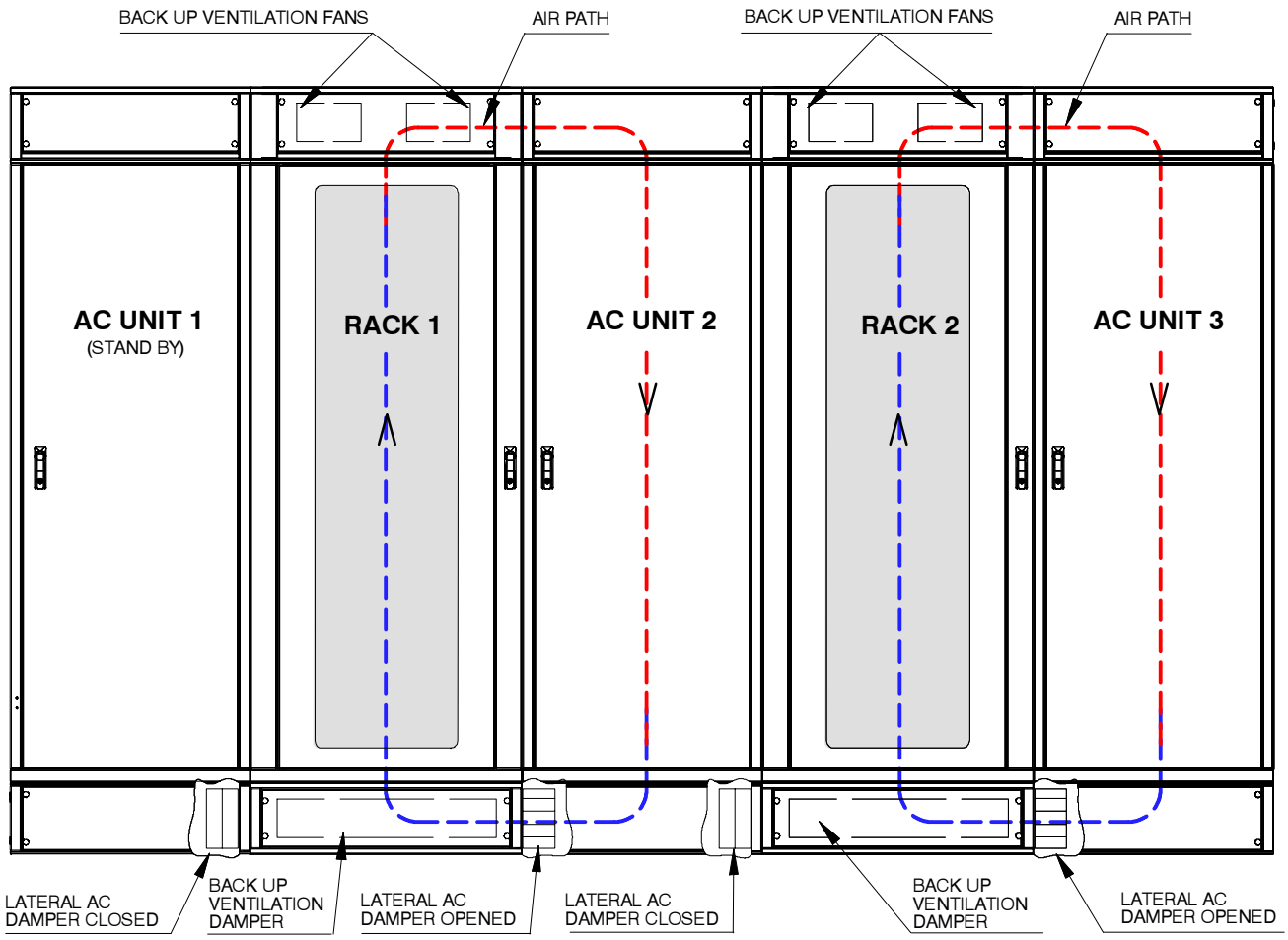


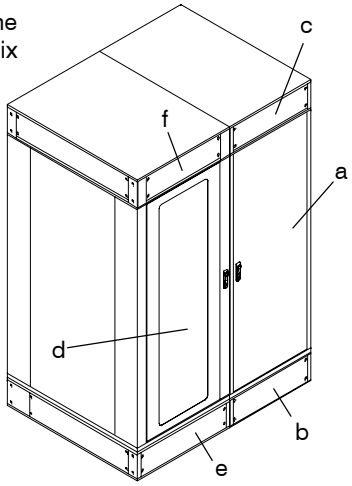
Fig. 2.c Advanced redundancy configuration air path



3 Digit Configuration

The user will configure the system choosing in between the following alternatives. The basic system is composed by six pieces to be precisely defined:

a. Air conditioner
b. Base module air conditioner
c. Top plenum air conditioner
d. Rack
e. Base module rack
f. Top plenum rack



3.1 Air conditioner

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
X	1	3	U	A												

Digit 1
X XDFN family

Digit 2 and 3

Size:
Cooling Capacity
"kW" (approx) (approx) 13, 17, 20, 23 as DX; 25 as CW

Digit 4

Air distribution
U Downflow

Digit 5

Version
A Air Cooled
W Water Cooled
C Chilled Water

Digit 6 – Fan
1 EC fan

Digit 7 – Main Power Supply
0 400 V/3 Ph/50 Hz

Digit 8 – Base module
0 no base module
N base module without dampers
L base module with damper on left side
R base module with damper on right side
2 base module with damper on both sides

Digit 9 – Humidification
0 None
V Electrode humidifier

Digit 10 – Microprocessor Control
A Microface&Hiromatic with Temperature Control
B Microface&Hiromatic with Temperature and Humidity Control

Digit 11 – Monitoring
0 None
1 Via SNMP

Digit 12 – Free

Digit 13 – Refrigerant
0 R407C
1 R22

Digit 14 – Fire detection and extinguishing
0 None
1 Fire extinguishing, one bottle
2 Fire extinguishing, two bottles

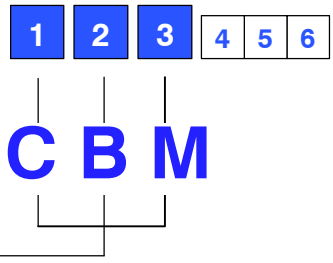
Digit 15 – Condensing control
A Condensing control

Digit 16 – Packing
P PLP and Pallet
C PLP and Wooden Crate
S Seaworthy

Digit 17 – Special Requirements
0 None
X Special requirement

Digit Configuration

3.2 Base module air conditioner



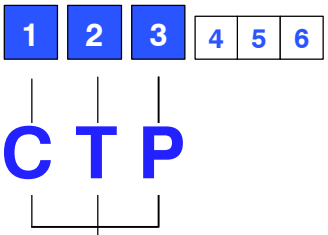
Digit 1, 2 and 3
Conditioner Base Module

Digit 4 – Dampers
0 None
L On left side
R On right side
2 Both sides

Digit 5 – Free

Digit 6 – Special Requirements
0 None
X Special requirement

3.3 Top plenum air conditioner



Digit 1, 2 and 3
Conditioner Top Plenum code no. ....

Digit 4 – Free

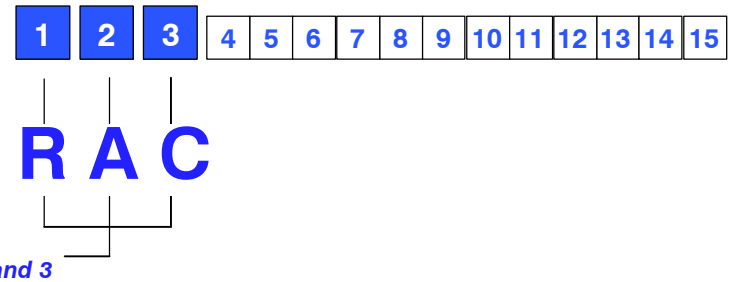
Digit 5 – Free

Digit 6 – Special Requirements
0 None
X Special requirement

Note
The number and the position of the dampers (Air conditioner, Digit 8th), Air conditioner Base Module, Digit 4th) should be chosen as a function of the system lay–out. Having a rack in the left side of the AC, a damper is needed in the left side ("L" at the same digits, see figure 2.a). Having racks in both sides, two dampers are required ("2" at digit 4, see AC unit 2 in the figure 2.c)

Digit Configuration

3.4 Rack



Digit 1, 2 and 3
RAC

Digit 4 – Front door type
0 Solid door
1 Transparent door

Digit 5 – Base module
0 no base module
N base module without backup ventilation
1 base module with backup ventilation

Digit 6 – Fire Detection and Extinguishing
0 None
A Master fire detection and extinguishing system
B Slave fire detection and extinguishing system
C Smoke detector

Digit 7 – UPS Inside
0 none
A GXT2 – 1500 for back up ventilation
B GXT2 – 3000 for back up vent. and load protection
C GXT2 – 4500 for back up vent. and load protection
D GXT2 – 6000 for back up vent. and load protection
E GXT2 – 1500 for back up ventilation + 48V batteries
F GXT2 – 3000 for back up vent. and load protection + 48V batteries
G GXT2 – 4500 for back up vent. and load protection + 72V batteries
H GXT2 – 6000 for back up vent. and load protection + 72V batteries

Digit 8 – Power Distribution Unit & Power Strip
0 none
1 one PDU with 4 sockets
2 one PDU with 4 sockets and two basic power strips (12+12 outlets)
3 one PDU with 4 sockets and four basic power strips (12+12+12+12 outlets)
4 two PDU with 4+4 sockets
5 two PDU with 4+4 sockets and two basic power strips (12+12 outlets)
6 two PDU with 4+4 sockets and four basic power strips (12+12+12+12+12 outlets)

Digit 9 – Monitoring
0 none
1 via SNMP

Digit 10 –UPS Web Card
0 none
W web card for UPS

Digit 11 –Open door sensors
0 none
1 Open Door sensors

Digit 12 –Free

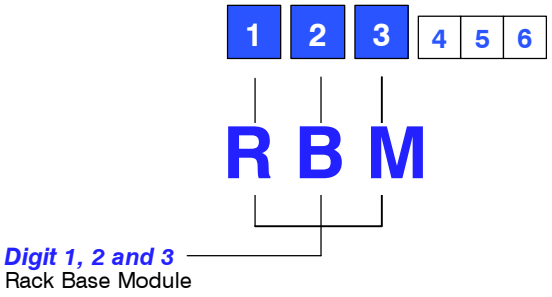
Digit 13 –Free

Digit 14 –Packing
P PLP and Pallet
C PLP and Wooden Crate
S Seaworthy

Digit 15 –Special Requirements
0 None
X Special requirement

Digit Configuration

3.5 Base module rack



Digit 4 – Backup Ventilation single phase / 230 V

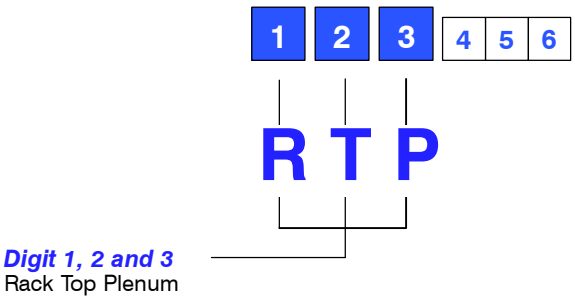
0 None
1 Backup ventilation

Digit 5 – Free

Digit 10 –Special Requirements

0 None
X Special requirement

3.6 Top plenum rack



Digit 4 – Backup Ventilation single phase / 230 V

0 None
1 Backup ventilation

Digit 5 – Free

Digit 10 –Special Requirements

0 None
X Special requirement

4 Main Components

4.1 Air conditioner technology

The generation of cooling power is entrusted to the last family of Liebert air conditioners. The configurations for the X–treme Density XDFN application can be reassumed in the following points:

- Version DX type — A air cooled, W water cooled
- Version CW type — C chilled water
- Power supply — 400V/3ph/50Hz (double power input available for power and control)
- Size DX type — up to 23 kW
- Size CW type — up to 25 kW

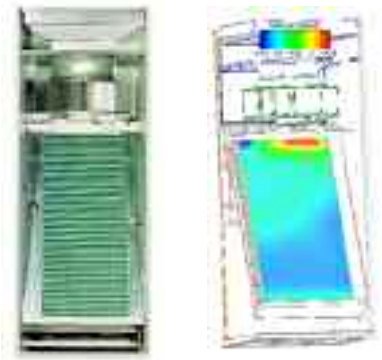
The air conditioner DX type works with ecological refrigerant R407C and optionally, where restrictions to the use do not exist, it can work with the R22 refrigerant. A sophisticated control system allows managing the conditions of the fresh air sent to the electronic equipment, continuously modulating the cooling capacity. This happens as a function of the real thermal load to be balanced by means of uses of the innovative digital scroll compressor and the electronic expansion valve. For further information on the available options and accessories please refer to Chapters 6 and 7 of the present document.

4.1.1 Heat exchanger section: Net Sensible Capacity matters

Efficiency is a fundamental requirement in all applications today. Even more so for technological applications where the operational costs are by far the most significant consideration. Sensible Heat Ratio (SHR) values of greater than 0.90 are required to reduce to a minimum the energy spent controlling humidity during normal operating conditions.

Heat exchanger design and a correct air distribution within the unit are two of the most important factors required to achieve optimum performance.

HIMOD units feature a very high coil heat exchanger surface respect the exchanged power. Using the index [frontal Surface x Rows / refrigeration Power] values of over 100 mm^2/W are obtained.



Study of the components of the vector velocity through the coil: vertical speed

Sophisticated design and development tools, such as Particle Image Velocimetry and Computational Fluid Dynamics are used by the Product Development Department to identify the best components layout in order to achieve an even and pressure–equalised airflow distribution within the unit which optimises the entire coil surface area in the heat exchanging process.

4.1.2 Easy maintenance

All components are easly accessible from the front of the room unit. The service compartment facilitates checking and setting of refrigeration circuit, without changing aeraulic conditions.
The access to the compressor is possible even when the unit is operating by removing the front panel. The access to the fan is executed with the greatest care for easier interventions (maintenance and/or fan replacement).

One very important feature, for example, is the possibility to check the total pressure drop of the high pressure piping using the schrader connections available in the front part of the machine(see below).

4.1.3 Version A

Direct expansion units with air–cooled condenser

Refrigeration circuit

All models are provided with a single refrigeration circuit. The compressor pumps the hot gaseous refrigerant into an outdoor air–cooled condenser. The liquefied refrigerant arrives to a liquid receiver that ensures a constant and even refrigerant flow to the thermostatic expansion valve and then arrives to the evaporator. Here the refrigerant, thanks to the heat – exchanged with the room air moved by the fan – evaporates and returns to the compressor; from this, the refrigerant begins a

new refrigeration cycle. To maintain the correct refrigerant discharge pressure, the speed of the motor fan is controlled (on–off or proportional mode).

Shut–off valves are provided as standard to assist with routine maintenance.
The compressor 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 is recommended to avoid – in wintertime – refrigerant migration from the liquid pipes and the receiver to the condenser, that should be responsible of low pressure intervention at the start–up of compressor.

For safety reason, a relief valve is installed on the liquid receiver; this valve is equipped with flanged connections so that the refrigerant may be discharged to the outside.

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. Chap. 8 gives the recommended matching condenser for XDFN units as a function of outdoor air temperature.

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 R407C) and oil, when request.*

Full instructions for these operations are given in the Service Manual.

4.1.4 Version W

Direct expansion units with water–cooled condenser

Refrigeration circuit

All models are provided with a single refrigeration circuit. The compressor pumps the hot gaseous refrigerant into a water–cooled condenser. The liquefied refrigerant arrives to a liquid receiver that ensures a constant and even refrigerant flow to the thermostatic expansion valve and then arrives to the evaporator. Here the refrigerant, thanks to the heat – exchanged with the room air moved by the fan – evaporates and returns to the compressor; from this, the refrigerant begins a new refrigeration cycle.
Shut–off valves are provided as standard to assist with routine maintenance.
The compressor has a built–in non–return valve to avoid return of liquid refrigerant from the condenser, thus protecting the compressor from undesirable refrigerant slugging during the start up. A second non–return valve is recommended to avoid refrigerant migration from the liquid pipes and the receiver to the condenser, that should be responsible of high pressure intervention at the start–up of compressor.
For safety reason, a relief valve is installed on the liquid receiver; this valve is equipped with flanged connections so that the refrigerant may be discharged to the outside.

Water–cooled condenser

These units are provided with one very efficient stainless steel brazed–plate water–cooled condenser . The condenser is fitted with an head–pressure regulating valve 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. 8 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 (for other information see the Service Manual).
To reduce water and energy consumption (pump), it's advisable to adopt a cooling water control valve (by the user), able to stop water feeding when unit is off.
Unit microprocessor control gives a 24V contact (10VA max, please refer to the relevant Wiring Diagram, 58 and G terminals) to drive that valve.

Note. *The water–cooled Himod versions are filled with the complete charge of the requested refrigerant (standard R407C).*

4.1.5 Version C

Chilled water units

Chilled water circuit

The unit is provided with a 3–way modulating valve, complete with incremental motor for the control of water flow to the coil; the opening or closing signals, generated by the electronic controler, manage the valve actuator movement in order to maintain the desired conditions. The room air is cooled passing through the coil (air/water heat exchanger), moved by the motor fan.

The Microface (or Hiromatic / opt.) controls all parameters. It is possible to adjust, for instance: set points, proportional or proportional+integral temperature, integrating factor and valve characteristics. It is also possible to manually adjust the valve with a suitable wrench.

4.2 Digital scroll

In the XDFN application it is mandatory to have a precise and continuous equivalence between the load and the cooling capacity, due to the fact we have a short and close air circuit. We get this through the innovative compressor: the Copeland Digital Scroll. It uses a simple and effective method to modulate the capacity, giving unparalleled performance in the modulation field. To better understand how the Digital Scroll achieves its modulation effect, we first need to understand how the Copeland Scroll works.

4.2.1 Copeland Scroll Compressor

The scroll is a simple compression concept first patented in 1905. A scroll is an involute spiral which, when matched with a mating scroll form as shown in Figure 1, generates a series of crescent–shaped gas pockets between the two members. During compression, one scroll remains stationary (fixed scroll) while the other form (orbiting scroll) is allowed to orbit (but not rotate) around the first form. As this motion occurs, the pockets between the two forms are slowly pushed to the center of the two scrolls while simultaneously being reduced in volume. When the pocket reaches the center of the scroll form, the gas, which is now at a high pressure, is discharged out of a port located at the center. During compression, several pockets are being compressed simultaneously, resulting in a very smooth process. Both the suction process (outer portion of the scroll members) and the discharge process (inner portion) are continuous.

The Copeland Scroll improves on the basic scroll design by having axial compliance, which allows the fixed scroll to move in the axial direction by very small amounts. This ensures that the fixed and orbiting scrolls are always loaded together with the optimal force, thereby maximizing efficiency. Moreover, compliance helps to protect the compressor from damage by debris or liquid.

As a compressor is designed to only compress gas, having debris and liquid in the compression cycle will damage the compressor. With the Copeland Scroll, however, the small shifts release the compression pressure thereby allowing the debris or liquid to be safely discharged.

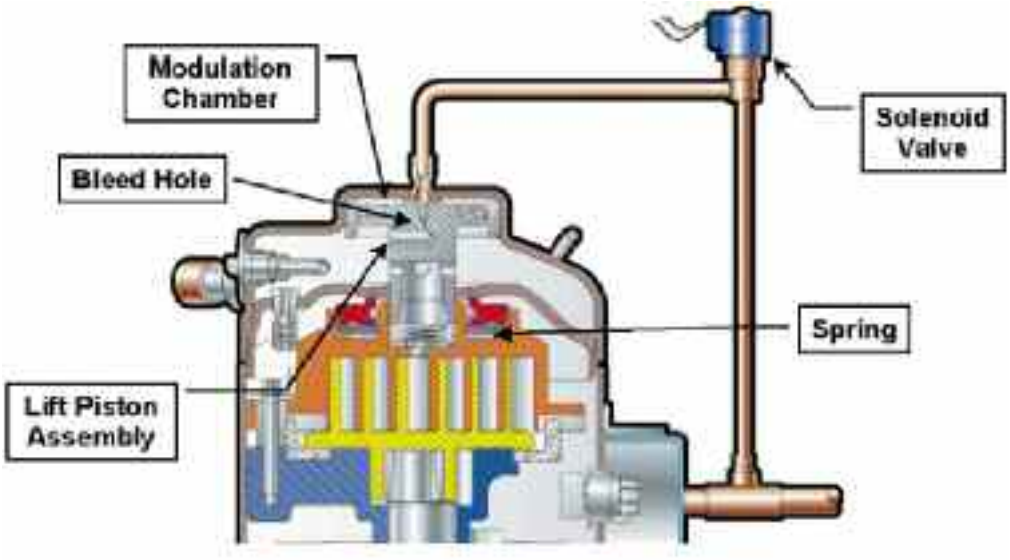
The Digital Scroll uses compliance as its basic principle, but takes it further by controlling the separation of the scolls.

4.2.2 The Copeland Digital Scroll

The controlled separation of the scrolls is achieved using a solenoid valve and a bypass connection between the discharge chamber and the intake gas (See Fig. 1). The scrolls are designed so that the upper scroll can separate from the bottom scroll by 1mm vertically. A piston is attached on top of the upper scroll and will lift up the upper scroll when it moves up. When the solenoid valve is closed, the Digital Scroll operates as a normal scroll compressor and the compressed gas is discharged at high pressure through the normal piping. When the solenoid valve is opened, the discharge chamber and intake gas pressure becomes connected, thereby releasing some of the discharge pressure. This leads to less pressure holding the piston down thereby causing the piston to shift upwards, which in turn lifts the upper scroll. Once the scrolls separate, any gas passing through is no longer compressed.

The Digital Scroll operates in two stages – the "loaded state", when the solenoid valve is normally closed and "unloaded state", when the solenoid valve is open. During the loaded state the compressor operates like a standard scroll and delivers full capacity and mass flow. However, during the unloaded state, there is no capacity and no mass flow through the compressor.

Fig. 1



At this stage, let us introduce the concept of a cycle time. A cycle time consists of a "Loaded State" time and "Unloaded State" time. The duration of these 2–time segments determine the capacity modulation of the compressor. Example: In a 20 seconds cycle time, if the loaded state time is 10 seconds and the unloaded state time is 10 seconds, the compressor modulation is 50%. If for the same cycle time, the loaded state time is 15 seconds and the unloaded state time is 5 seconds, the compressor modulation is 75%. The capacity is a time averaged summation of the loaded state and unloaded state. By varying the loaded state time and unloaded state time, any capacity between 10% and 100% can be delivered by the compressor. Hence, the Copeland Digital Scroll can achieve a continuous modulation of AC capacity to suit the system's needs precisely.

We could vary the cycle time and still achieve the same effective capacity, but Copeland and Liebert they have done extensive testing to optimize the cycle time in this application.

4.3 Electronic expansion valve device

The valve is designed for modulating control of refrigerant circuits with high speed and high precision. It is suitable for use as expansion device in refrigerant circuits with Copeland Digital Scroll compressor, with organic safety refrigerants (i.e. R407C). Pressure class PN40 (PN64). For variable capacity systems, an EXV provides superior performance as compared to a thermostatic expansion valve (TXV).

The unique feature of valve is the "Linear Magnetic Technology": magnetic actuators with modulating control. This is a proven Siemens technology, which has been used in thousands of applications. It offers outstanding features in refrigeration cycles, i.e.

- Fast and precise flow control
- Positioning time below 1 second
- Actuators of the normally closed type
- No hysteresis

The really fast positioning is used in the Digital Scroll compressor circuits in order to maintain stable the superheating during the ON–phase of the Digital Scroll cycle. In such a way we can increase the global efficiency to the biggest value.

4.4 EC Fan (plug–in electronically commutated fan)

All XDFN units are equipped with plug fans: direct driven centrifugal fans with backward curved blades and an asynchronous external rotor motor. The new generation of these fans with specifically shaped blades, designed especially for the use in air conditioning cabinets, features a very high mechanical efficiency over a wide operating range. In addition, sound radiation is free of tonal noise at the impeller suction and discharge sides.

These fans are designed to have the maximum power capacity at an intermediate operating point therefore there is no risk of motor overloading. The fans are not dependent on a minimum back pressure, as is the case with most centrifugal direct driven fans with forward curved blades.
Thanks to the use of plug fans the Available External Static Pressure is adjustable on site during commissioning, with a range of 0 to 200 Pa or more, according to the installation requirements.
A factory–installed differential static pressure gauge gives a signal and it stops the air conditioner unit in case of too low airflow.

EC Fan (plug–in electronically commutated fan)

The largest capacity XDFN units can be supplied with an exclusive fan type, this enables you to greatly increase the unit's efficiency and therefore significantly reduce operating costs.

EC fans [Electronically Commutated DC motors] have the added advantage of higher fan shaft motor efficiency: from 45% of 1– phase motors, to 65% of 3–phase motors and to 85–90% of EC fans. As an example, a chilled water XDFN requires about **50%** lower power input with this option, respect the market average value.

Additional benefits are that, on start up, the XDFN peak inrush current is lower than the operating current. This means the EC fan option features a true **soft start**. Also compared to AC fan supplied by the frequency converter, the advantages are evident and the input power is clearly inferior: from 13 to 38% as a function of the working point.

The internal electronics of the EC fan are integrated into Liebert controls.

The EC fan design allows a new approach in regulating environmental parameters within HPAC applications. To name a few:

- constant air volume
- constant external static pressure
- sound emission optimisation
- power input optimisation
- cooling capacity regulation (on request)

This enables each system to be optimized for the installation.

These features are available from standard XDFN units supplied with the EC fan option and we can summarized that with two words: versatility and efficiency.

4.5 Air conditioner dampers

The conditioner base module, located on the bottom of air conditioner column, is provided of specific dampers with aluminium blades, fully sealed when they are on closed position. On each damper, a servomotor opens or closes the blades in few seconds, driving the airflow on the useful direction depending on where the cooling capacity is required. Servomotors are 24Vac power supplied, with fail–safe function and micro–switches which give information to microprocessor control about the position of dampers.
If the optional remote monitoring system is working, a specific signal is given to remote supervisor, in case of unexpected failure.

4.6 Air conditioner filter

Removable filter installed inside the air conditioner before of fan and heat exchanger.
Efficiency filtration G4 following standard EN779 (corresponding to EU4 following standard EU4/5).
The folded structure of the filter gives high filtration efficiency and low pressure drop. The filter media used consists of synthetic fibre cells. The frame is made of cardboard.
A differential static pressure gauge after and before the filter gives a signal when the filter is dirty.

4.7 Rack features

Main physical features of rack structure:

- Galvanized steel frame painted with RAL 9005 (black colour) epoxy–polyester powders, assembled with stainless steel rivets;
- Design according to Server System Infrastructure (EIA–310–D standard) specification for computer server cabinet enclosure and rack;
- Internal dimensions for user cabinet:
  max 42U height for customer's equipment (1U equals to 44.45 mm),
  19" rack guides as defined by EIA–310–D specifications,
  max 745 mm of useful depth for customer equipment;
- Internal air flow for servers or other IT equipments is always
  from FRONT to BACK of the equipment, through system internal electronics;
- The paneling systems ensures higher stiffness
  and panels are filled with thermoacoustic insulating material;
- Front and rear doors are key–lockable
  and assembled on hinges to make the access easier;
- Front and rear access to all user equipments for service and operational requirements;

5 Control and Monitoring

5.1 Control overview

Cooling capacity modulation

The cooling capacity of each compressor is modulated according to the conditioner air discharge temperature, i.e. the air inlet to the servers. So, the system is able to maintain the inlet air temperature to the servers inside the proportional band, (i.e. 20°–24°C) independently on the actual load, that can change between zero and the max–allowed value.

Air flow modulation

Also the airflow rate, so the speed of the conditioner fan, is modulated between a minimum and a maximum speed. This happens in accordance with the difference of temperature at the inlet and outlet of the air conditioner, maintaining the right airflow in any load situation. And in any case, if the temperature to the servers achieves a maximum value, the airflow is forced to his maximum.

AC dampers management

The control allows the damper(s) on the air conditioner module to open. But it will open only if the contiguous damper in the next air conditioner is closed. The Microprocessor control advices in case of wrong dampers positions.

Working unit rotation

There is the rotation of the conditioner in stand–by (if present), allowing a fair distribution of the work for each installed unit.

Redundant working unit

If a failure occurs in one working conditioner, the control stops it and allows the stand–by unit to work. The dampers will change the position accordingly. Each conditioner will cool the adjacent rack.

Back up ventilation

If both the conditioners contiguous to one rack fail, or the air temperature to the rack reaches a defined limit, the back–up ventilation will start, using the room air to cool the rack.

5.2 Microprocessor control

Microface Evolution

Each module of XDFN system (both air conditioner and rack) is controlled by the Microface Evolution: the Main Board is housed in the relevant electrical panel and, in case of air conditioner, it is connected to the display, to be installed in the door (connection cable is included).

- The user interface is the 3–digit back–lit display showing parameter values and relevant symbols/codes in a tree menu. It features navigation push–buttons and status leds.
- Both high and low priority alarms activate a visual indicator and buzzer.
- For AC Microface: LAN management: functions provided as standard include stand–by (in case of failure of the unit in operation, the stand–by one starts automatically) and automatic rotation.
- The self–test function automatically activates/deactivates the main components (evaporator fan, compressor, heaters, alarms) without changing the pre–set parameters, to easily start–up and commission the unit. No skilled personnel are requested (*).
- All settings are protected through a 3–Level password system (*).
- Automatic restart is provided after a power failure.

(*) The Remote display is required to activate the function.

Technical Data Microface Evolution

- E2prom: . . . . . 64 Kbit
- Eprom/Flash memory: . . . . . 2 or 4 Mbit
- RAM memory space: . . . . . 256 Kbit
- Analogue Input: . . . . . 3 x Analog 0–10V
- Digital Input: . . . . . 8 x Flexible Analogue multi input
- Analogue Output: . . . . . 2 x Analogue 0–10V
- Digital output: . . . . . 7 triacs output and 2+1 relay output
- Time and date function buffered by LI–battery
- Hirobus LAN connectors: . . . . 3 RJ45 sockets (to Microf./Hirom. LAN and Slave–Board and Microf. Display)
- Hironet connectors: . . . . . 1 RJ9 socket for RS485 (direct connection to proprietary supervision)

5.3 Graphic display

At the door of each air conditioner module, you will find the Graphic Display called Hiromatic. Featuring a 24h graphic record of controlled parameters as well as the last 200 events occurred. A back–up battery keeps the data stored in the memory (graphic data record, alarms).

- 32 Kbyte buffer RAM
- integrated RS–422/485 gate to Hirolink communication manager connection (Evolution)
- Hiromatic System Window: system operation status at a glance
- Self–explanatory Icons: they are used for the Menu–Layout of the Hiromatic Evolution
- Online Help: Every single parameter has its own multi–page explanation (Evolution)
- Status Report of the latest 200 event–messages of the unit/system
- Four different Graphic Data Records (Evolution)
- 4–Level Passwords system to protect all the settings

Hiromatic

- Ergonomic design for use also as portable device (start–up and flying connections by service personnel)
- Multi–language menu with on–the–fly language selection

Technical Data Hiromatic Evolution

- Eprom/Flash memory: . . . . . 2 or 4 Mbit
- RAM memory space: . . . . . 256 Kbit
- Time and date function buffered by LI–battery
- Hirobus Lan connectors: . . . . . 2 RJ45 sockets (to Microface)
- Hironet connectors: . . . . . 2 RJ9 socket for RS422/485 (Hirolink connection towards Supervision Systems)

5.4 Adaptive condensing control

Air–cooled condenser adaptive control

The air–cooled conditioners have as standard the condensing pressure management through the speed modulation of the fan of the remote condensing unit. This is done by the control from the room unit as a function of the condensing pressure detected by a transducer on the refrigerant circuit.

If the condensing pressure reach too high values (for instance due to unexpected too high ambient temperatures) before the HP cutout, the compressor cooling capacity will be managed in such a way to maintain the service continuity and reliability.

5.5 Fire detection and extinguishing control

Fire risk management

The fire detection and extinguishing device (option) independently manages the risk of smoke and fire for up to five columns at the same time. In case of first level alarm, the info is gathered through the rack microprocessor and remotely available trough SNMP protocol. In case of high level alarm, this info is managed by the rack and conditioners control, the conditioners will be shut off, the dampers will be closed, and a count–down will be started leading to the release of the extinguishing gas into all the related modules. If a rack door is open the discharge is not allowed. Obviously also this high alarm is available on the rack control and via SNMP.

5.6 Rack data monitoring

Rack monitoring by SNMP protocol

With the Hironet SNMP Adapter (HiSNMP device) installed on the rack, the following info will be available through the SNMP (Simple Network Management Protocol) protocol. For each rack, one HiSNMP device is required.

Relevant warnings or alarms will be available for:

a. Smoke
b. Fire presence
c. Front door opened
d. Rear door opened
e. Fire detection failure

f. High inlet air temperature, level 1
g. Very high inlet air temperature, level 2
h. Low inlet air temperature
i. High outlet air temperature
j. Low outlet air temperature
k. Humidity and temperature inlet air sensor failure
l. Temperature outlet air sensor failure
m. Back up ventilation activated

Relevant values will be available for:

a. Rack inlet air temperature
b. Rack inlet air relative humidity
c. Rack outlet air temperature

5.7 Conditioner data monitoring

With the HiSNMP device installed on the air conditioner, the following info will be available through the SNMP protocol. For a deeper understanding see the HiSNMP User Manual p/n 272703. For each conditioner, one HiSNMP device is required.

Conditioner monitoring by SNMP protocol

- Relevant warnings, alarms or values will be available for:
- Discharge temperature setpoint
- Discharge temperature
- Temperature Proportional Band
- Return Temperature
- High Temp. Setpoint
- Low Temp. Setpoint
- Humidifier Setpoint
- Humidity Prop.Band
- Humidity
- High Humidity Setpoint
- Low Humidity Setpoint
- Fan State
- Cooling State
- Heating State
- Dehumidifying State
- Humidifying State
- High Room Temperature
- Low Room Temperature
- High Room Humidity
- Low room Humidity
- Fan failure
- Clogged filters
- Compressor high pressure
- Compressor low pressure
- Manual mode
- Humidifier Failure
- Humidifier High Current
- Power Off
- Sensor Failure

6 Main Installed Options

6.1 Backup ventilation

On the rack module we have the backup ventilation option. On the Rack Base Module a motorized damper connects the surrounding area with the internal rack front (figure 1). On the Rack Top Plenum two centrifugal fans blow the air from the rear of the rack to the surrounding area.
So, when 1. the two air conditioners contiguous to the rack, both, fail or 2. the temperature at inlet of the rack exceeds a defined limit (i.e. 38°C) the control allows the backup ventilation to run, closing the conditioner dampers on the side (see also the chap.11, control and monitoring) and permitting an external airflow circulation across the servers or other devices into the rack. In such a way we are able to maintain the temperature inside the required limit, for a time depending on the load. During this time the server administrator can have the possibility to shut down safely.

Fig. 6.a Backup ventilation damper (closed) on the Rack Base Module.

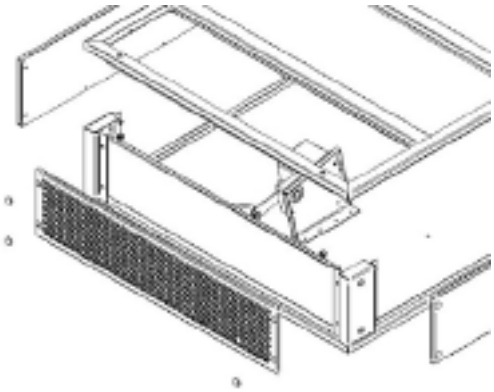


Fig. 6.b Backup ventilation damper (open) on the Rack Base Module.

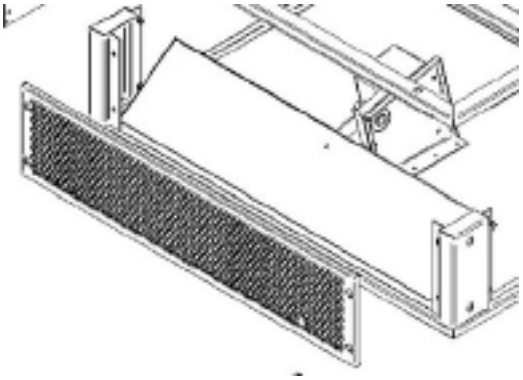
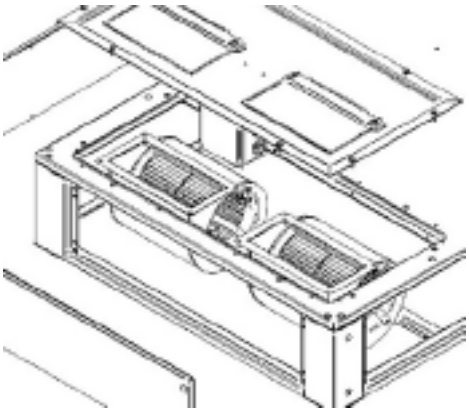


Fig. 6.c Backup ventilation fans on the Rack Top Plenum.



Backup ventilation technical data

Total airflow rate, m3/h	2000
Available static pressure across the servers, Pa	120
Total abs. current, A	2.8
Total power input, W	600
Fan q.ty and type	2 /centrifugal

The backup ventilation gives some extra time before reaching the temperature limits at thes erver, after an unexpected cooling mode failure. Considering the surrounding room temperature stable at 24°C, a limit of 38°C for the inlet server air temperature, a limit of 58°C for the outlet server air temperature, we'll have the following time available for the devices inside each rack. The values are valid only with a correct airflow distribution inside the rack and a quite even pressure drop across the servers.

Continuous thermal load inside the 42U Rack (kW)	**Expected duration** (minutes)
6	240
12	120
18	60
21	40
24	20

6.2 Uninterruptible Power Supply

The XDFN system is available bundled with the optional GXT2U rack mounted UPS and associated battery packs for 230VAC–50Hz applications. The UPS or battery is mounted on the bottom of the enclosure; if UPS & battery or multiple batteries are ordered, a mounting bracket for support and relocation is provided. The XDF system is also available without a UPS. See UPStation GXT2U web page for detailed descriptions.

6.3 Power distribution unit and power strips

The power distribution unit option is a factory–installed vertical frame located on the front side of the RAC module and configured as follows:

a. power distribution unit with four sockets (schuko type) which include two red color sockets for UPS supply and two white color sockets for main power supply. In total four sockets with max 16A each one;

b. power distribution unit with eight sockets (schuko type) which include four red color sockets for UPS supply and four white color sockets for main power supply. In total eight sockets with max 16A each one.

The power strip options are factory–installed in a vertical frame on the rear side of the RAC module, the option for two or four strips is available. 12–outlet systems fit in each power strip. Each power strip includes an input power cord with appropriate input plug connection and appropriate circuit breaker protection (16A, 3kA , two poles).

6.4 Smoke detection and fire extinguishing

The fire detection and extinguishing option is composed by a system of smoke detection and a related system of fire extinguishing in each rack or conditioner module. The relevant hardware is installed in a metallic box sized 3U, located in the upper part of the rack.

6.4.1 Smoke detector

VESDA detector

The VESDA Laserfocus early warning air sampling smoke detector incorporates world leading VESDA very early warning laser based aspirated smoke detection technology. It achieves aspirated air from each rack or conditioners modules (up to five) and it analyses the air samples with reliable and consistent response to smoke events without being affected by false alarms.

The pre–engineered pipe network from the each module to the detector will be connected on site. The airflow rate will be between 12 and 24 litre per minute. The pipes, internal diameter 21 mm, will be delivered with appropriated sampling holes, dia. 2 mm.

6.4.2 Extinguishing module

Fire suppressant HFC–236fa

The control module is able to recognize the signal from the analyzer, to manage the sound and visual alarms, to start the extinguishing procedure controlling the auxiliary actuators, to supply a series of signals through a relevant in/out board. For each column a bottle (3 litres) of extinguish agent, complete of explosive charge, is supplied and in case of high level alarm the gas is released. The gas suppressant is hexafluoropropane, HFC–236fa, formula CF3–CH2–CF3, safe for people, zero depletion potential. It is discharged as a stream of gas and liquid droplets that penetrates into the fire area, ceasing the combustion process through heat absorption and a chemical interaction. It is electrically nonconductive, no corrosive, with no thermal shock and it doesn't leave any residue.

6.5 Smoke warning (smokestat)

A simple smoke detector can be installed as option just to give a warning when the presence of smoke inside the rack is perceived. This is an optical smoke detector (it uses the Tyndall effect), which absorb very low current (100mA) and it is absolutely insensitive to light or air speed.

6.6 Monitoring options

6.6.1 HiSNMP: monitoring via SNMP

The HiSnmp is a SNMP adapter that delivers SNMP management to the XDFN system connected to an Ethernet network. The adapter supports 10 Mbit Ethernet and is suitable for in–the–field installation. The kit includes the adapter, the MIB on CD–ROM, configuration cable and a quick start guide (the users manual can be downloaded from the Liebert Hiross web site). Alarms and parametric data are transmitted over the network using SNMP for air conditioner and rack. Compatible with NForm and any other Network Management System.

6.6.2 OpenComms Web Card

The OpenComms Web Card provides SNMP and web–based management to your UPS. The card gives you the power to monitor and control your Liebert UPS from not only your Network Management Station, but from any PC running Microsoft® Internet Explorer™. Connecting to your UPS is a simple as launching a web browser.

The OpenComms Web Card is the first UPS monitoring card to truly unleash the power of the Web, with its graphical Power Flow. The animated Power Flow allows you to quickly determine the condition of your power and the operating state of your UPS. You don't need to sort through pages of text, so we've built a card that does Web like the Web was designed – with graphics and text together, giving you a window into your power.

The OpenComms Web Card integrates into your SNMP implementation and supports the UPS open standard MIB that is distributed with most Network Management Systems. Starting with our support of open standards as a baseline, the OpenComms Web Card goes a step further and extends with the Liebert Global Products MIB, which provides you Liebert–specific advanced SNMP monitoring and control capabilities

6.7 Humidifiers

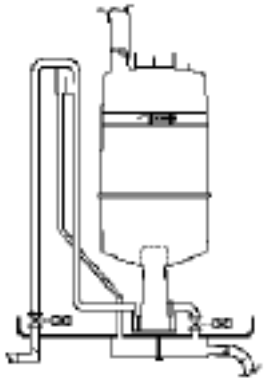
The **humidification system** is provided by a HUMIDAIR electronic humidifier. The **dehumidification function**, which is supplied as standard when the humidifier option is installed, acts by reducing the fan speed with consequent reduction of the air flow and at the same time switching on the compressor (models A/W) or completely opening the chilled water three–way valve (models C).

6.7.1 Electronic humidity control

The software of the Microface microprocessor control includes an algorithm which manages the HUMIDAIR electronic modulating humidifier and also provides the dehumidification function. There is also a special function which automatically prevents dehumidification if the return air temperature is below the required value. When the temperature reaches the correct value, the dehumidification function is automatically reactivated. Dehumidification control may be either of the proportional or of the on–off type, depending on the installation requirements: on–off is set as standard at the factory.

6.7.2 HUMIDAIR electric steam humidifier

HUMIDAIR is a replaceable plastic water cylinder with immersed electrodes. When an electronic current passes between the electrodes, the water is converted into the required quantity of steam. It is suitable for a large range of water qualities (with varying degrees of hardness) with the exception of demineralized water. It almost instantaneously produces clean, particle–free steam and avoids energy losses which are typical of other systems. HUMIDAIR is provided with the steam cylinder, water inlet and outlet valves and a maximum level sensor. The steam output can be adjusted within a range of values which can be chosen manually and is factory–set at 30% of the maximum capacity (see the relevant data).



6.7.3 Humidifier features

The steam is mixed with the delivery air of the evaporating coil by means of a suitable distributor. The Microface controller can determine when the cylinder has to be changed. Replacing the cylinder is extremely easy and quick. A self–adaptive flow control system is fitted as standard and controls the current passing through the cylinder water.

6.8 Rack doors

Rack front door is available on solid type black colour or in transparent type.
Rack front and rear doors are both with hinges and key–lockable.

6.9 Open door sensors

Factory installed open door sensors able to detect if front or rear rack door are not closed. An efficient cooling is possible only with rack doors closed. If the option fire and extinguishing system is working in the XDFN system, in case of open RAC doors a warning signal will be shown on the control display and the fire extinguishing system remains non active. With the remote monitoring option, the status of doors is available also on remote side.

7 Accessories

7.1 Accessories for the rack module

Fixed Shelf

The Fixed Shelf is a vented surface shelf for mounting to the RAC module (Rack Column of XDFN system) Front and Rear Internal Mounting Rails. The shelf is of 16–gauge sheetmetal construction, finished in powder–coat black, and will support 250 lbs/113.4 kg evenly distributed.

Pullout Shelf

The Pullout Shelf is a vented shelf for mounting to the RAC module (Rack Column of XDFN system) Front and Rear Internal Mounting Rails. The pullout shelf can extend 26"/66 cm and can support 130 lbs/59 kg evenly distributed in the extended position. The pullout shelf is of 16–gauge sheetmetal construction and be finished in powder–coat black. The pullout shelf is available to fit 19" rackmount width and is 18.5"/47 cm deep.

Internal Keyboard Tray

The Keyboard Tray is a pullout shelf to hold a keyboard(s) with a handrest in the front of the tray. The tray is for the 19" Mounting Frame and is sized for a single 19" Rack keyboard. The tray mounts to the Front and Rear internal Mounting Rails

Fixed Rails

The Fixed Rails include two horizontally positioned 90°"L" rails which extend between the RAC module (Rack Column of XDFN system) Front and Rear Internal Mounting Rails, and include hardware necessary for mounting. The rails are of 16–gauge sheetmetal construction, will support up to 150 lbs/68 kg evenly distributed, and be finished in powder–coat black.

Sealed Cables Entrance

Each RAC module is provided with two factory installed sealed cables entrances,
one entrance is able to contain and to seal up to 4 cables with diameter between 4mm and 16.5 mm, the other one up to 9 cables with diameter between 3.5 and 10.5 mm.
If necessary it is possible to order other sealed cables entrances for a total amount of six connection holes for data and power cables on each RAC module.

7.2 Accessories for the air conditioner module

7.2.1 Water leakage detector (Liquistat)

The flooding alarm detects the presence of water or of any other conductive liquid and, opening a circuit, activates an alarm.
There are no moving parts and it is not subject to dirt or vibration. Up to 5 sensors can be connected to the same flooding alarm device to control many points on the base of air conditioner column. The alarm device is supplied with a sensor. Additional sensors can be ordered separately.

7.3 Accessories for monitoring

7.3.1 Open Comms Nform software

OpenComms Nform shall be adopted to monitor the entire system.

The software shall be configured to monitor the Air conditioning unit and the servers rack (via HiSnmp), the UPS (via OC Webcard) and intelligent power Strips if present. Alarms, or SNMP traps, can be received by the software and processed to trigger event actions such as e–mail alerts or local notifications or used in combination with Multilink to shutdown workstations and server.

For ease of use, OpenComms Nform's graphical user interface enables you to view device status conditions through either a native SNMP interface or an HTML web browser interface. The Alarm Log will manage all alarms that are received by OpenComms Nform, notifying the user of new or active alarms, enabling the user to acknowledge active alarms, and then close and delete acknowledged alarms. Built–in authentication can control which users have access to configure the OpenComms Nform settings.

OpenComms Nform will monitor any Liebert SNMP devices that support a network interface, such as the OpenComms Web card and the OpenComms NIC. The customizable navigation tree provides the flexibility to design an OpenComms Nform user interface around your network layout. Authenticated alarm management and event notification ensures that alarms are detected and acted upon, which allows problems to be quickly resolved. OpenComms Nform centralizes the management of your distributed Liebert network equipment.

7.3.2 MultiLink software

MultiLink version 3.5, is your scalable network power protection solution. Run MultiLink on one machine to monitor your power and ensure a graceful, unattended shutdown in the event of an extended power failure. In the one–on–one configuration, MultiLink will monitor a serially connected UPS or an SNMP–enabled UPS over the network. MultiLink can also be upgraded to support your unique needs. Purchasing the MultiLink Network Administration License allows you to monitor multiple UPS units and remotely configure other installations of MultiLink throughout your network. Purchasing the MultiLink Network Shutdown License allows you to efficiently manage your power protection on a larger UPS by running MultiLink on one computer and using that computer to coordinate the shutdown of other computers throughout your network.

8 Operating Range

8.1 Indoor and outdoor operative limits

XFDN system are provided for operating within the following working ranges (the limits concern new units on which correct installation has already been made):

8.1.1 All versions

Indoor air conditions, surrounding the XDFN system	from:	18°C, 40% R.H.
	to:	28°C, 50'% R.H
Power supply tolerances		400V ± 10%, 3ph, 50Hz ± 2Hz

8.1.2 For XDFN system with air conditioner type A

Outdoor temperature: lower limit	
Exceeding of winter lower limits will temporarily cause a compressor stop.	
down to −20°C	below −21°C
standard unit with standard condensing control	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), could cause 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 condenser max distance	up to 30 m equivalent length
From unit to condenser max geodetic height (1) (2)	from 20 m to −3 m
Requirements	
Pipe diameter	see Tab 10.c
Oil traps on vertical line of gas refrigerant	every 6 m, max
Extra oil charge	see Service Manual
Condenser	design
Additional non return valve on delivery line, at 1 m from compressor	mandatory
Additional non return valve on liquid line after condenser	mandatory

(1) Positive difference in height: condenser above conditioner
(2) Negative difference in height: condenser below conditioner
Other information in Service Manual.

8.1.3 For XDFN system with air conditioner type W

Water or mixture temperature to condenser, lower limit (other information Service Manual)	min. 5°C

8.1.4 For XDFN system with air conditioner type C

Chilled water circuit	
inlet water temperature	**min. 5°C**
water pressure	**max. 16 bar**

Max. differential pressures on the modulating valve (2 or 3 ways)

- Max. differential pressure through the closed valve: Δp_{cv}
- Max. differential pressure across the valve for modulating service: Δp_{ms}

models	Δp_{cv} (kPa)	Δp_{ms} (kPa)
X25UC	200	300

8.2 Storage limits

8.2.1 All versions

Storage conditions	from:	−5°C (not condensing)
	to:	45°C (not condensing)

9 Air Conditioner Technical Data

9.1 Air cooled air conditioners

Tab. 9a – Direct expansion XDFN unit with air remote condenser (1)

MODEL		X13UA	X17UA	X20UA	X23UA
Power supply voltage (V ± 10%)	V/Ph/Hz		400/3/50		
PERFORMANCES (2)					
Air flow	m^3/h	3780	4300	4550	4950
Max available static pressure through the servers (3)	Pa	130	150	175	180
SPL (Sound Pressure Level) (4)	dB(A)	48.2	49.9	51.8	55.0
Air temperature inlet to the servers	°C	22.0	22.0	22.0	22.0
Refrigerant			R407C		
Max net sensible cooling capacity	kW	14.5	17.1	20.8	23.6
SHR (Sensible Heat Ratio)	–	1.00	1.00	1.00	1.00
Unit power input	kW	4.38	5.67	6.46	7.73
Net EER (Energy Efficiency Ratio) (5)	A	3.31	3.02	3.22	3.05
FAN					
Type			Electronic Commutated Plug In		
Fan voltage signal, nominal	V	7.5	8.5	9.0	10.0
Fan absorbed power	kW	0.84	1.22	1.35	1.85
Fan absorbed current	A	1.36	1.97	2.20	3.02
Fan FLA	A	3.60	3.60	3.60	3.60
Fan LRA (6)	A	0.1	0.1	0.1	0.1
COMPRESSOR					
Type			Digital Scroll		
Compressor absorbed power	kW	3.34	4.25	4.91	5.68
Compressor absorbed current	A	6.12	8.04	8.72	10.79
Compressor FLA	A	10.00	10.20	10.80	16.00
Compressor LRA	A	50.0	63.0	71.0	101.0
EVAPORATING COIL					
Pipes/Fins			Copper/Alluminium		
Front surface	m^2	0.65	0.65	0.65	0.65
REFRIGERANT CONNECTIONS (7)					
Gas connect. (pipe to be welded. o.d.)	mm	18	18	18	18
Liquid line connect. (pipe to be welded. o.d.)	mm	16	16	16	16

(1) *This data sheet refers to XDFN system built with one air conditioner module and one cabinet rack module, working at standard operative conditions and max allowed thermal load.*

(2) *ON THE FOLLOWING STANDARD CONDITIONS: Air specific humidity: 9.5 g/kg$_{dry\ air}$ – Condensing temperature: 50°C (mid point) EER refers to the indoor unit only – Air flow of the units refers to the standard configuration.*

(3) *@ indicated air flow and fan voltage signal*

(4) *Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with fan and compressor working on.*

(5) *Net EER = Net sensible cooling capacity / Unit power input*

(6) *Fan is equipped with an internal soft starter wich keeps LRA approx. to zero Ampere.*

(7) *The refrigerant connections on the unit are closed with blind welded flanges.*

Air Conditioner Technical Data

9.2 Water cooled air conditioners

MODEL		X13UW	X17UW	X20UW	X23UW
Power supply voltage (V ± 10%)	V/Ph/Hz		400/3/50		
PERFORMANCES (2)					
Air flow	m^3/h	3780	4300	4550	4950
Max available static pressure through the servers (3)	Pa	130	150	175	180
SPL (Sound Pressure Level) (4)	dB(A)	48.2	49.9	51.8	55.0
Air temperature inlet to the servers	°C	22.0	22.0	22.0	22.0
Refrigerant			R407C		
Max net sensible cooling capacity	kW	14.5	17.1	20.8	23.6
SHR (Sensible Heat Ratio)	–	1.00	1.00	1.00	1.00
Unit power input	kW	4.38	5.67	6.46	7.73
Net EER (Energy Efficiency Ratio) (5)	A	3.31	3.02	3.22	3.05
FAN					
Type			Electronic Commutated Plug In		
Fan voltage signal, nominal	V	7.5	8.5	9.0	10.0
Fan absorbed power	kW	0.84	1.22	1.35	1.85
Fan absorbed current	A	1.36	1.97	2.20	3.02
Fan FLA	A	3.60	3.60	3.60	3.60
Fan LRA (6)	A	0.1	0.1	0.1	0.1
COMPRESSOR					
Type			Digital Scroll		
Compressor absorbed power	kW	3.34	4.25	4.91	5.68
Compressor absorbed current	A	6.12	8.04	8.72	10.79
Compressor FLA	A	10.00	10.20	10.80	16.00
Compressor LRA	A	50.0	63.0	71.0	101.0
EVAPORATING COIL					
Pipes/Fins			Copper/Alluminium		
Front surface	m^2	0.65	0.65	0.65	0.65
CONDENSING SECTION – Water inlet temperature 30°C					
Condenser type			plate type exchanger in AISI 316		
Water flow	l/s	0.25	0.30	0.37	0.42
Water side pressure drop	kPa	14	19	28	38
Water connections	inch	3/4 F	3/4 F	3/4 F	3/4 F
REFRIGERANT CONNECTIONS (7)					
Gas connect. (pipe to be welded. o.d.)	mm	18	18	18	18
Liquid line connect. (pipe to be welded. o.d.)	mm	16	16	16	16

(1) *This data sheet refers to XDFN system built with one air conditioner module and one cabinet rack module, working at standard operative conditions and max allowed thermal load.*

(2) *ON THE FOLLOWING STANDARD CONDITIONS: Air specific humidity: 9.5 g/$kg_{dry\ air}$ – Condensing temperature: 50°C (mid point) EER refers to the indoor unit only – Air flow of the units refers to the standard configuration.*

(3) *@ indicated air flow and fan voltage signal*

(4) *Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with fan and compressor working on.*

(5) *Net EER = Net sensible cooling capacity / Unit power input*

(6) *Fan is equipped with an internal soft starter wich keeps LRA approx. to zero Ampere.*

(7) *The refrigerant connections on the unit are closed with blind welded flanges.*

9.3 Chilled water air conditioner

Tab. 9b – Chilled Water XDFN unit (1)

MODEL		X25UC
Power supply voltage (V ± 10%)	V/Ph/Hz	400/3/50
PERFORMANCES (2)		
Air flow	m^3/h	5100
Max available static pressure through the servers (3)	Pa	180
SPL (Sound Pressure Level) (4)	dB(A)	54.0
Air temperature inlet to the servers	°C	22.0
Cooling fluid		Water
Max net sensible cooling capacity	kW	25.6
SHR (Sensible Heat Ratio)	–	1.00
Unit power input	kW	2.07
Net EER (Energy Efficiency Ratio) (5)	–	12.2
Water flow	l/s	1.32
Water pressure drop	kPa	97
FAN		
Type		Electronic Commutated Plug In
Fan voltage signal, nominal	V	10.0
Fan absorbed power	kW	1.87
Fan absorbed current	A	3.06
Fan FLA	A	3.60
Fan LRA (6)	A	0.10
CHILLED WATER COIL		
Pipes/Fins		Copper/Alluminium
Front surface	m^2	0.63
CHILLED WATER CONNECTIONS		
Water connections	inch	1 F

(1) *This data sheet refers to XDFN system built with one air conditioner module and one cabinet rack module, working at standard operative conditions and max allowed thermal load.*

(2) *ON THE FOLLOWING STANDARD CONDITIONS: Air specific humidity: 9.5 g/$kg_{dry\ air}$ – In/Out cooling water temperature 7.0/12.0 °C EER refers to the indoor unit only – Air flow of the units refers to the standard configuration.*

(3) *@ indicated air flow and fan voltage signal*

(4) *Measured in the front part at 1.5 m height, 2 m distance, referred to free field, with fan working on.*

(5) *Net EER = Net sensible cooling capacity / Unit power input*

(6) *Fan is equipped with an internal soft starter wich keeps LRA approx. to zero Ampere.*

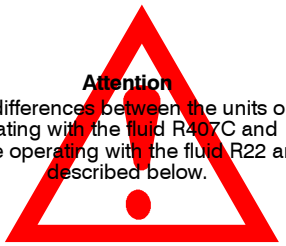
9.4 Technical notes on refrigerant (DX units only)

The units are designed for being used with refrigerant R407C and R22.

9.4.1 Technical notes R407C

ATTENTION the differences between units operating with refrigerant fluid R407C and those operating with fluid R22 are described below.

It has been proven that the chlorine inside some refrigerants (HCFC and above all CFC) is harmful for the atmosphere ozone layer.
The Montreal protocol, with the following amendments (London 1990, Copenhagen '92, Vienna '95, Montreal '97, Peking '99) and the new European regulation no. 2037/2000, in force since 1st October 2000, limit in time, with several expiry dates, the production and use of the HCFC refrigerants, among which R22.



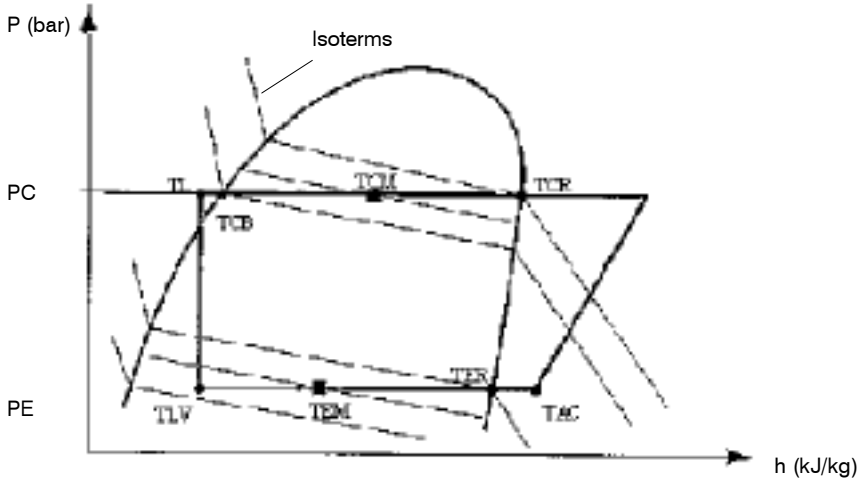
The refrigerant R407C (HFC) does not contain chlorine and is thus absolutely suitable for the use in air conditioning systems, without damaging the ozone layer. Its main features are:

- Non–azeotropic mixture made of R32/R125/R134a in which the percentage weight composition is, in ratio, 23/25/52.
- Thermophysical features similar to R22.
- ODP (Ozone Depletion Potential) equal to 0.
- Not flammable in the air.
- Low toxicity.

The new HFC fluids are essentially incompatible with the mineral oils which are usually used with R12 and R22.

Therefore, new synthetic lubricants based on polyester molecules have been developed for their use.

Note: Considering the unique thermophysical properties of RC407C the refrigeration cycle is illustrated in the diagram below.



High pressure side

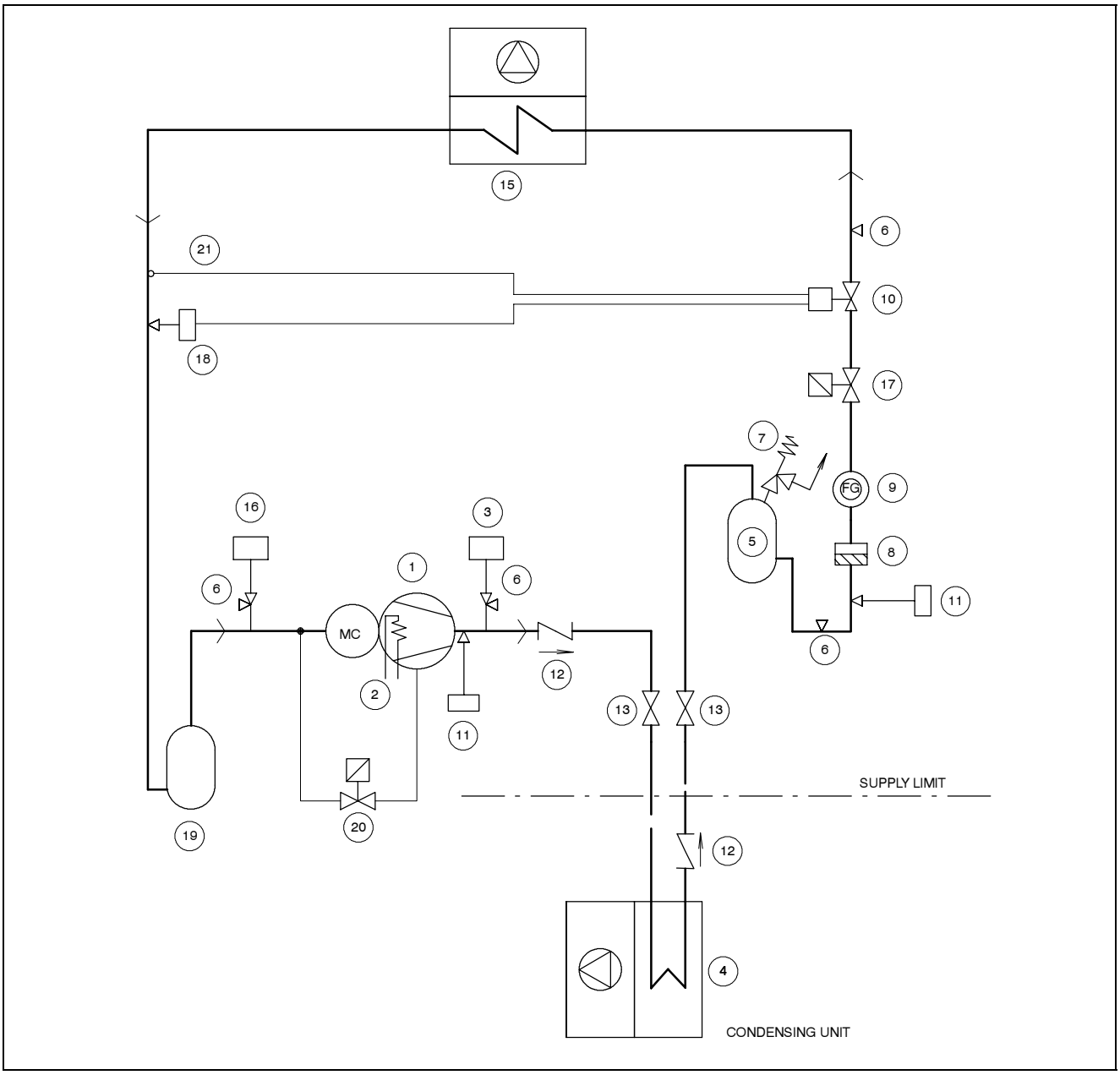
TCB: condensation temperature bubble point (Liquid)
TCR: condensation temperature dew point (Vapor)
TCM: average condensation temperature (TCB+TCM)/2
TL: temperature of the refrigerant at the expansion valve inlet
Overheating = TAC – TER

Low pressure side

TLV: liquid–steam temperature
TER: evaporation temperature dew point (Vapor)
TEM: average evaporation temperature (TLV+TER)/2
TAC: temperature of the overheated vapour at the compressor inlet
Sub–cooling = TCB –TL

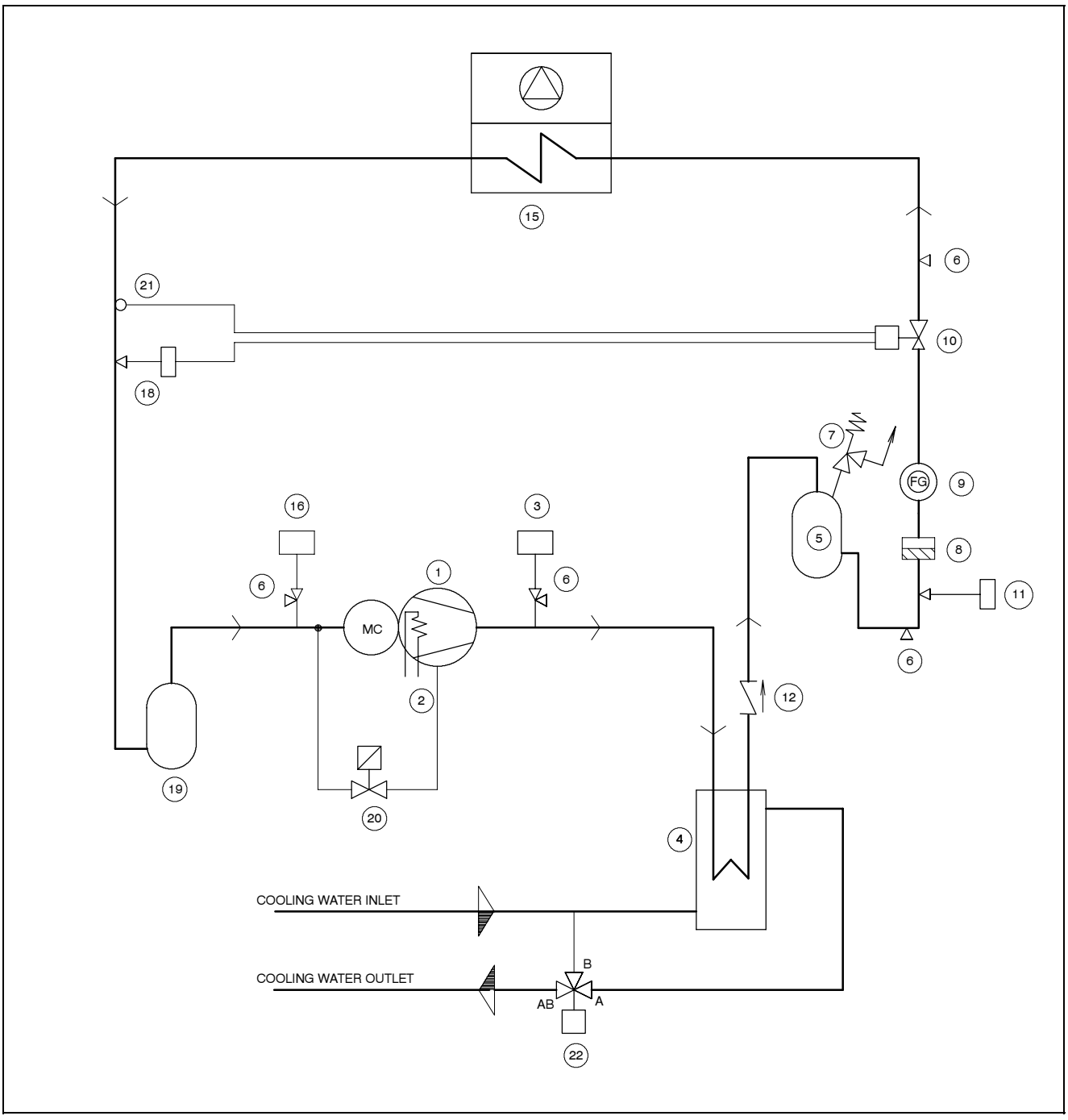
9.5 Refrigerant and hydraulic circuits

Fig. 9.a – XDFN Xxx U A



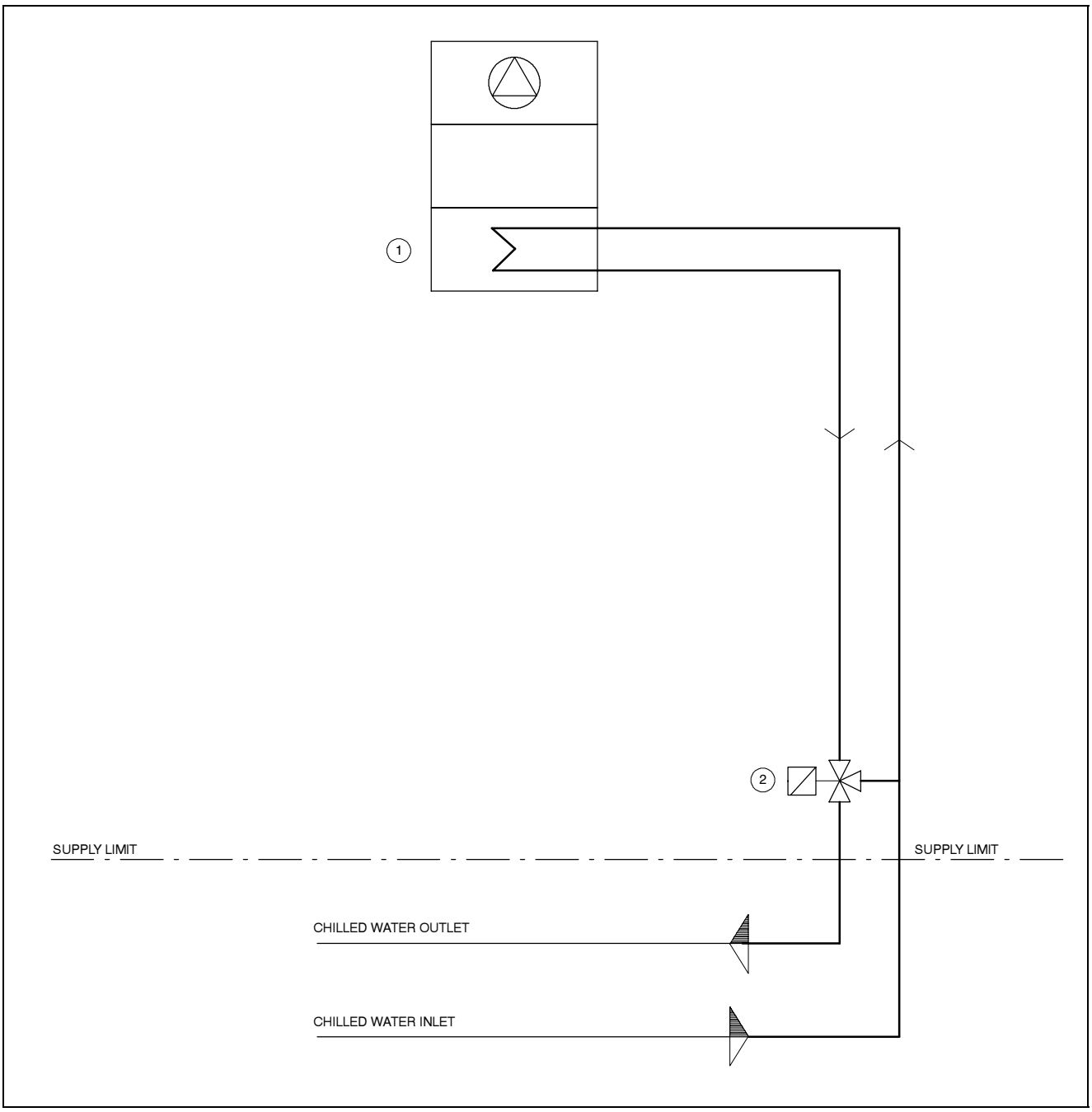
POS.	DESCRIPTION	POS.	DESCRIPTION
1	Capacity modulating compressor	11	Pressure transducer for condensing control
2	Crankcase heater	12	Check valve (mandatory)
3	High pressure switch (HP)	13	Shut–off valve
4	Air cooled condenser	15	Evaporator
5	Liquid receiver	16	Low pressure switch (LP)
6	Access valve	17	Shut–off solenoid valve
7	Safety valve	18	Pressure transducer for expansion valve
8	Filter dryer	19	Suction accumulator
9	Sight glass	20	Capacity modulating solenoid valve
10	Electric expansion valve	21	Temperature sensor for expansion valve

Fig. 9.b – XDFN Xxx U W



POS.	DESCRIPTION	POS.	DESCRIPTION
1	Capacity modulating compressor	11	Pressure transducer for condensing control
2	Crankcase heater	12	Check valve
3	High pressure switch (HP)	15	Evaporator
4	Water cooled condenser	16	Low pressure switch (LP)
5	Liquid receiver	18	Pressure trasducer for expansion valve
6	Access valve	19	Suction accumulator
7	Safety valve	20	Capacity modulating solenoid valve
8	Filter dryer	21	Temperature sensor for expansion valve
9	Sight glass	22	Condensing pressure control valve
10	Electric expansion valve		

Fig. 9.c – XDFN Xxx U C



POS.	Standard components
1	Chilled water coil
2	Chilled water 3–way valve

10 Heat Rejections (A version)

10.1 Coupling of room units with remote air–cooled condensers

The units may be connected to a wide range of our condensers single circuit (HCE).

The following paragraphs describe the suggested coupling of **XDFN** units. The data given below are approximate and must always be verified on the basis of the specific operating conditions. All XDFN systems type A have an on board MCB, for remote air condenser.
All the remote air condensers are controlled by microprocessor of the air conditioner with a specific designed condensing control.

Tab. 10a – Coupling of Condensers with XDFN A

MODEL	External temperature up to 35°C		External temperature up to 40°C		External temperature up to 46°C	
	standard	low noise	standard	low noise	standard	low noise
X13UA	1 x HCE14	1 x HCE17	1 x HCE24	1 x HCE24	1 x HCE33	1 x HCE42
X17UA	1 x HCE24	1 x HCE24	1 x HCE24	1 x HCE33	1 x HCE42	1 x HCE42
X20UA	1 x HCE24	1 x HCE24	1 x HCE33	1 x HCE33	1 x HCE49	1 x HCE49
X23UA	1 x HCE29	1 x HCE29	1 x HCE42	1 x HCE42	1 x HCE58	1 x HCE58

Tab. 10b – Technical data and performance of Air condenser

Model		Power supply [V/Ph/Hz]	Total Heat Rejection (THR)*		Air Volume [m³/h]	Noise Level ** [dB(A)] @ 5 m f.f.	Input Power [kW]	Current Absorption [A]	FLA [A]	Refrigerant connections [mm]		Unit with packing	
			R407C [kW]	R22 [kW]						Gas line [mm]	Liquid line [mm]	Dimensions [mm]	Weight [kg]
HCE 14	**std**	230/1/50	14.6	14.4	4600	44.5	0.27	1.20	1.2	18	16	L 1120 W 960 H 995	65
	low noise		11.3	11.2	3261	40.6	0.18	1.14					
HCE 17	**std**	230/1/50	15.9	15.7	4600	44.5	0.27	1.20	1.2	18	16	L 1120 W 960 H 995	65
	low noise		12.2	12.1	3261	40.6	0.18	1.14					
HCE 24	**std**	230/1/50	25.3	25.0	8300	50.5	0.56	2.50	3	22	22	L 1410 W 1175 H 1010	86
	low noise	230/1/50	21.2	21.1	6524	40.2	0.42	2.41					
HCE 29	**std**	230/1/50	28.9	28.8	7800	50.5	0.56	2.50	3	28	28	L 1410 W 1175 H 1010	96
	low noise	230/1/50	24.2	24.1	6131	40.2	0.42	2.41					
HCE 33	**std**	230/1/50	31.8	31.5	9200	47.5	0.54	2.40	2.4	28	22	L 1940 W 980 H 1010	107
	low noise		24.4	24.2	6523	43.3	0.36	2.28					
HCE 42	**std**	230/1/50	42.2	41.6	16600	53.5	1.12	5.00	5	35	28	L 2420 W 1195 H 1010	143
	low noise	230/1/50	36.0	35.9	13048	42.6	0.85	4.82					
HCE 49	**std**	230/1/50	50.4	49.9	16600	53.5	1.12	5.00	5	35	22	L 2420 W 1195 H 1010	143
	low noise	230/1/50	42.3	41.9	13048	42.6	0.85	4.82					
HCE 58	**std**	230/1/50	58.1	57.6	15600	53.5	1.12	5.00	5	42	35	L 2420 W 1195 H 1010	152
	low noise		48.2	48.1	12262	42.6	0.85	4.82					

(*) The nominal capacities refer to the following operative conditions:

- refrigerant as indicated (R407C or R22).
- temperature differences: 15 K (T condensation – Toutdoor). For R407C the condensing temperature is the **mid point** temperature.
- height of the installation = 0 m, above the sea level. For different altitudes, see Hirating program.
- clean exchange surfaces.

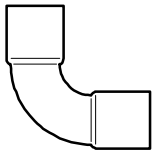
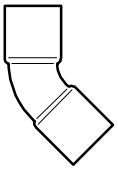
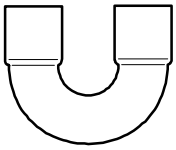
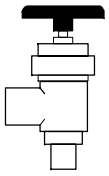
(**) The levels of sound pressure here included are measured in the same operative conditions, and are referred to 5 m far from the unit, at 1.5 m in height in free field conditions.

Heat Rejections (A version)

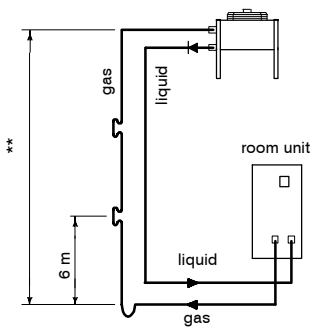
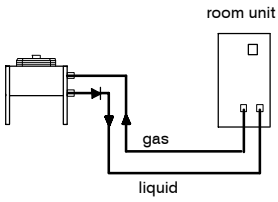
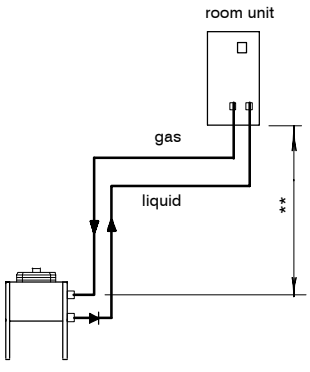
Tab. 10c – Pipe diameters (room unit – remote condenser)

MOD.	STANDARD PIPE DIAMETERS (Valid for equivalent lengths up to 30 m) copper tube external diametre X thickness (mm) R407C		copper tube external diametre X thickness (mm) R22	
	Gas	Liquid	Gas	Liquid
X13UA	14 X 1	14 X 1	16 X 1	16 X 1
X17UA	16 X 1	16 X 1	16 X 1	16 X 1
X20UA	18 X 1	16 X 1	22 X 1	18 X 1
X23UA	22 X 1	18 X 1	22 X 1	18 X 1

Tab. 10d – Equivalent lengths in meters 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

Tab. 10e – 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
	liq.	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			 (**) see Chap. 8		 (**) see Chap. 8

10.2 Coupling of water cooled units with remote Dry Coolers

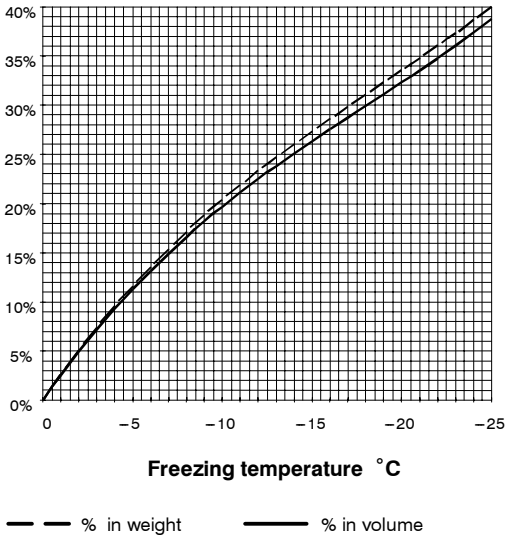
The water–condensed units are provided with a water/refrigerant exchanger with braze–welded **plates** made of **stainless steel**; this advanced exchanger type gives the highest efficiency in heat exchange. In addition, a certain oversizing of the exchanger has been provided so as to reduce pressure drops (and energy consumption of the water pump) as much as possible and thus to allow the unit to operate with the external chiller in closed circuit, even at high outdoor temperatures.

The water cooled air conditioners are designed for operating with mains water or water in closed circuit with an external chiller.
When operating in a closed circuit, the water is cooled by the outdoor air in a heat exchanger; in this case, to avoid unwanted ice formation during winter, it is advisable to use a water/glycol mixture.

The circulation of the water–glycol mixture is forced (the pump is not supplied). If mains water or tower water is used, when installing the unit fit a mechanical filter on the water line to protect the condenser against possible impurities contained in the water (for condenser cleaning see the service manual).

Our dry–coolers are built with a copper/aluminium cooling coil and axial fan(s).
The main data on dry coolers is shown in the following table:

Percentage of ethylene glycol mixed with water



Note:
In the closed circuits to avoid water freezing in the cold seasons, it is strictly recommended to mix water with ethylene glycol. The suggested percentage is given in the Diagram.
For safety reason, **calculate the percentage** at least at 5°C below the minimum ambient temperature.

It is also recommended to check periodically the mixture: in case of leackage of the circuit, the sanitary water, used at compensation, reduces progressively the glycol percentage and increases the freezing point of the mixture!

Heat Rejections (W version)

Tab. 10f – Coupling of Dry–coolers

Model	External temperature up to 30°C		External temperature up to 35°C		External temperature up to 40°C	
	Standard	Low noise	Standard	Low noise	Standard	Low noise
X13 W	1 x DSM013	1 x DLM011	1 x DSM013	1 x DLM015	1 x DSM022	1 x DLM023
X17 W	1 x DSM013	1 x DLM011	1 x DSM018	1 x DLM015	1 x DSM028	1 x DLT027
X20 W	1 x DSM013	1 x DLM015	1 x DSM022	1 x DLM023	1 x DST030	1 x DLT030
X23 W	1 x DSM018	1 x DLM018	1 x DSM028	1 x DLT027	1 x DST050	1 x DLT047

Tab. 10g – Technical data and performance of Dry Coolers

	Performances			Electric data			Overall dimensions		
Standard Model	Duty *(a)*	Air flow	Noise level *(c)*	Supply	Number of fans	Total absorbed power	Width	Depth	Height *(b)*
	kW	m^3/h	db(A)	V/ph/Hz	n°	kW	mm	mm	mm
DSM013	13.5	5100	50	230/1/50	1	0.64	1250	900	990
DSM018	17.6	13200	53	230/1/50	2	1.28	2050	900	990
DSM022	22.4	12600	53	230/1/50	2	1.28	2050	900	990
DSM028	27.5	18900	54	230/1/50	3	1.92	2850	1260	990
DST030	33.0	20500	55	400/3/50	2	1.44	2750	1260	1140
DST040	39.0	20000	55	400/3/50	2	1.44	2730	1260	1140
DST050	50.0	30750	57	400/3/50	3	2.16	3900	1260	1140

	Performances			Electric data			Overall dimensions		
Low Noise Model	Duty *(a)*	Air flow	Noise level *(c)*	Supply	Number of fans	Total absorbed power	Width	Depth	Height *(b)*
	kW	m^3/h	db(A)	V/ph/Hz	n°	kW	mm	mm	mm
DLM011	10.5	3700	39	230/1/50	1	0.29	1250	900	990
DLM015	15.5	9500	42	230/1/50	2	0.58	2050	900	990
DLM018	18.0	9000	42	230/1/50	2	0.58	2050	900	990
DLM023	23.0	14000	43	230/1/50	3	0.87	2850	1260	990
DLT027	27.5	15000	47	400/3/50	2	0.70	2750	1260	1140
DLT030	30.0	14500	47	400/3/50	2	0.70	2730	1260	1140
DLT040	40.0	22500	49	400/3/50	3	1.05	3900	1260	1140
DLT047	47.0	21750	49	400/3/50	3	1.05	3900	1260	1140

***(a)**: at the following conditions: outdoor temperature = 35°C, inlet/outlet water temperature = 45°C/40°C.*
***(b)**: vertical flow installation.*
***(c)**: sound pressure level, free field, at 10 m distance, according to DIN 45635*

11 Dimensional Data / Connections

11.1 Dimensions and weights

Fig. 11.a Overall dimensions
Air conditioner column components

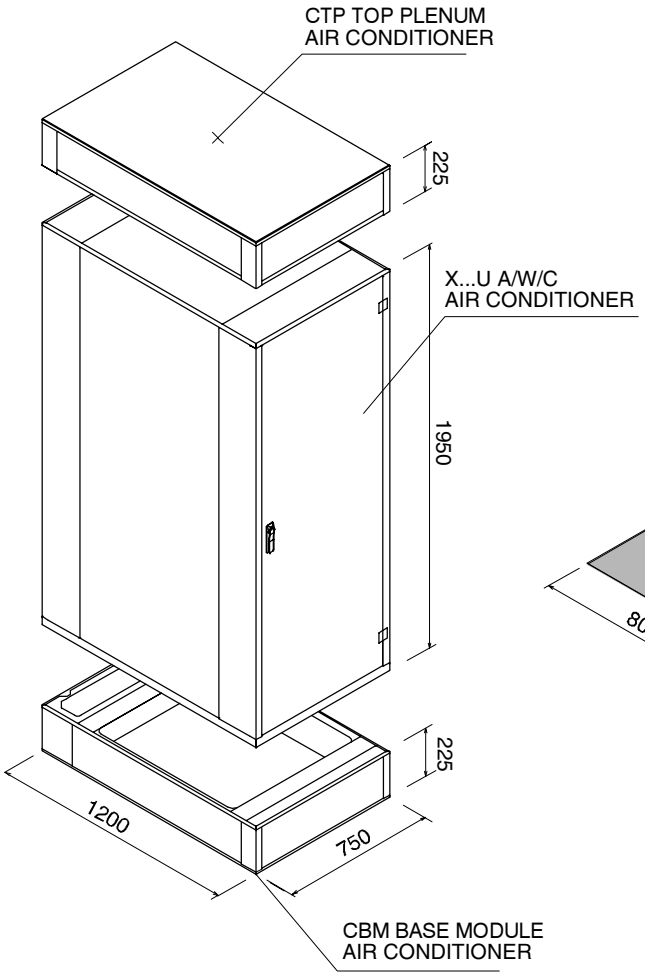
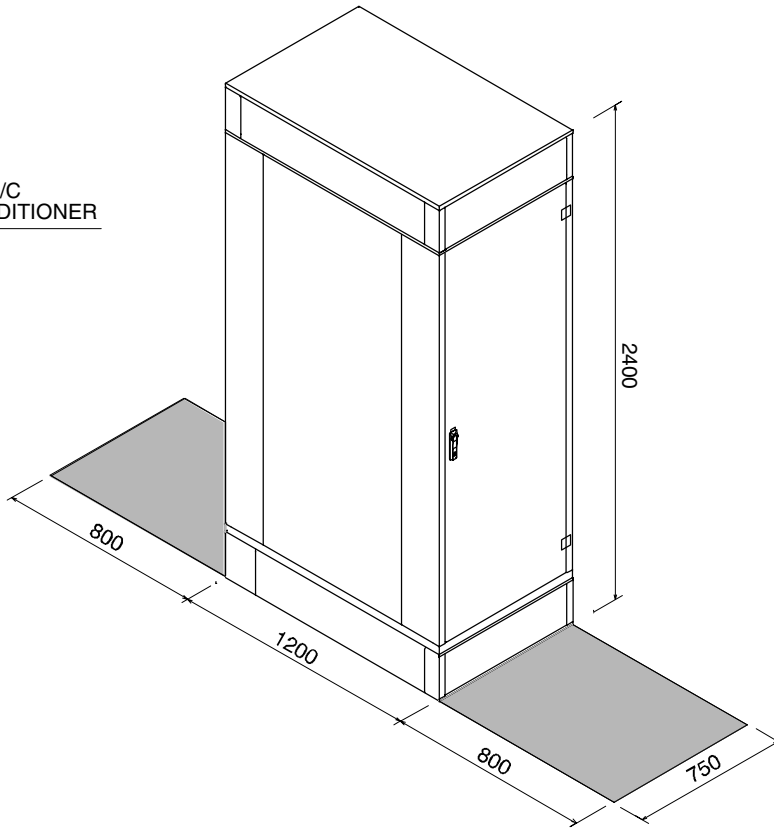


Fig. 11.b Service Area
Air conditioner column



AIR CONDITIONER COLUMN (1)	DIMENSIONS				NET WEIGHTS (Kg) version		
	Width (mm)	Depth (mm)	Height (mm)	Footprint (m^2)	A	W	C
CTP + **X13U A/W** + CBM	750	1200	2400	0.9	413	423	
CTP + **X17U A/W** + CBM	750	1200	2400	0.9	425	435	
CTP + **X20U A/W** + CBM	750	1200	2400	0.9	435	445	
CTP + **X23U A/W** + CBM	750	1200	2400	0.9	445	455	
CTP + **X25UC** + CBM	750	1200	2400	0.9			410

(1) Air conditioner column means base module (CBM) + air conditioning unit (X..U A/W/C) + top plenum (CTP)

Fig. 11.c Overall dimensions
Rack column components

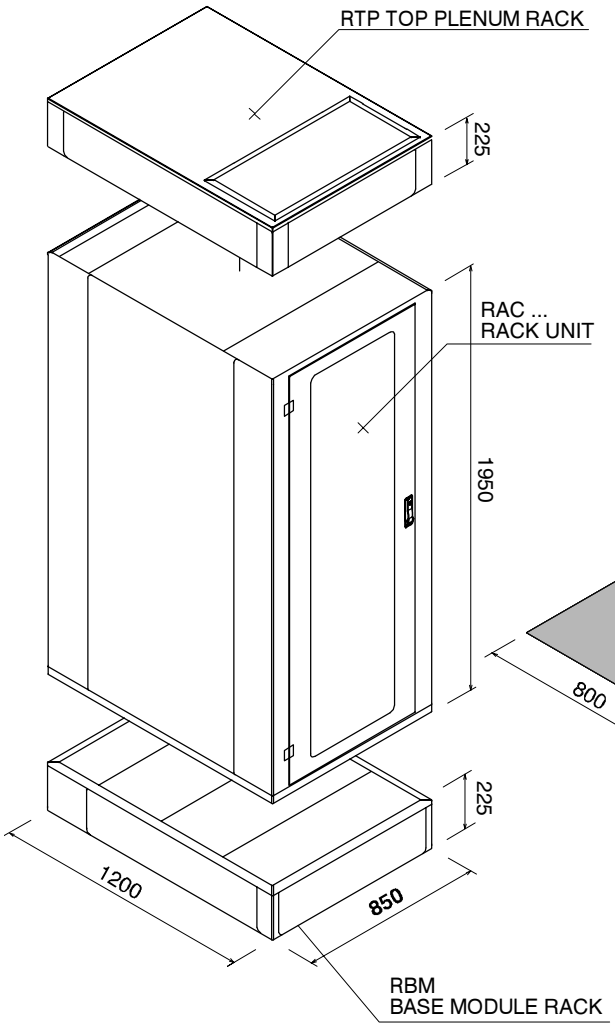
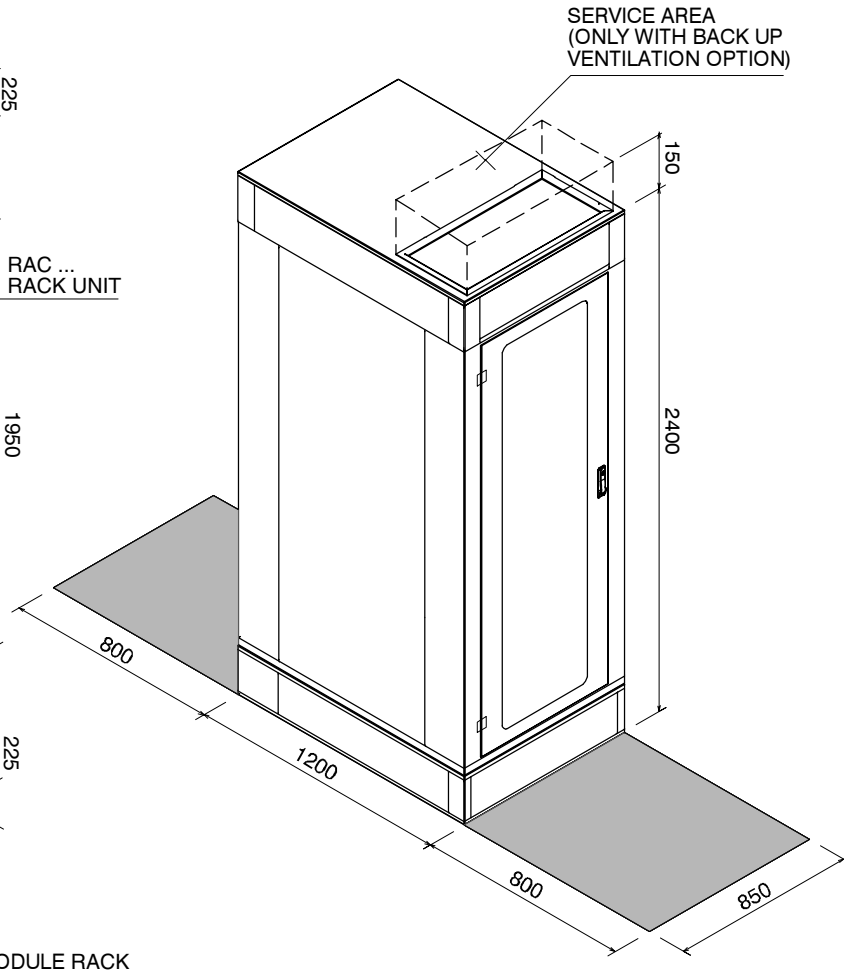


Fig. 11.d Service Area
Rack column



RACK COLUMN (1)	DIMENSIONS				NET WEIGHTS (kg)
	Width (mm)	Depth (mm)	Height (mm)	Footprint (m^2)	
RTP + **RAC** + RBM	850	1200	2400	1.02	319

(1) Rack column means base module (RBM) + rack unit (RAC) + top plenum (RTP)

11.2 Packing

Fig. 11.e Standard packing
Air conditioner / Rack
with or without base module

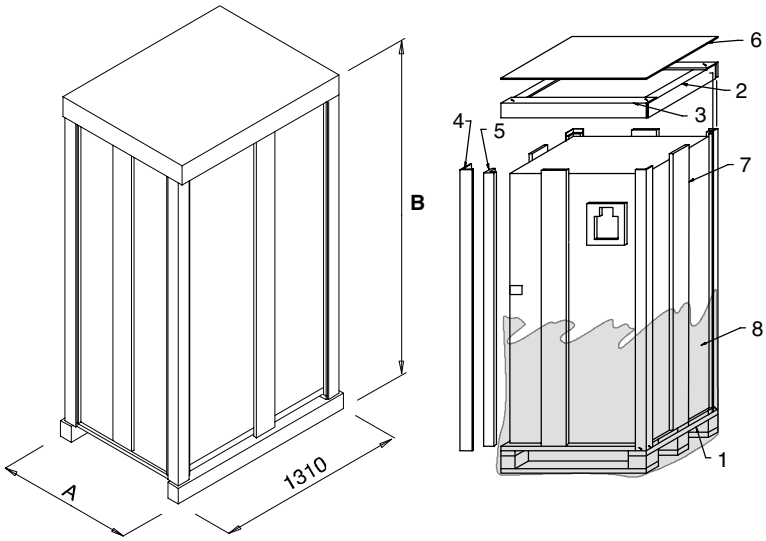
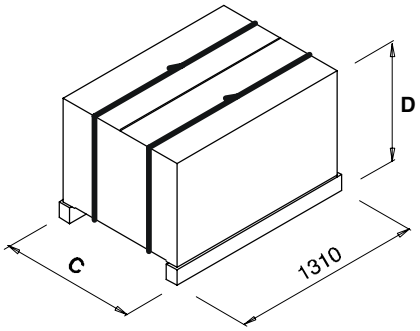


Fig. 11.f Standard packing
Plenum and/or Base module



The units are usually packed on a wooden pallet (1), with shockproof angle pieces in pressed cardboard (2, 3, 4)/polystyrene (5), panels in cardboard (6)/polystyrene (7) and flexible polythene film (8).
Base module and plenum are packed in pressed carboard (see Fig. 11.f)

Tab. 11a – Available packages following the required configuration. – Dimensions

DESCRIPTION – Re. Fig. 11.e	Dimensions (mm) A	B
Air Conditioner (X...) and Conditioner Base Module (CBM) connected together	820	2325
Air Conditioner (X...)	820	2100
Rack (RAC) and Rack Base Module (RBM) connected together	920	2325
Rack (RAC)	920	2100

DESCRIPTION – Re. Fig. 11.f	Dimensions (mm) C	D
Conditioner Top Plenum (CTP)	820	270
Conditioner Top Plenum (CTP) and Conditioner Base Module (CBM)	820	620
Rack Top Plenum (RTP)	920	270
Rack Top Plenum (RTP) and Rack Base Module (RBM)	920	620

Special packing (options)

Special packing for sea transport, consisting of a wooden box or crate, can be supplied on request.

11.3 XDFN installation quick guideline

Fig. 11.a Hole on the raised floor for piping and electrical connections
AIR CONDITIONER COLUMN

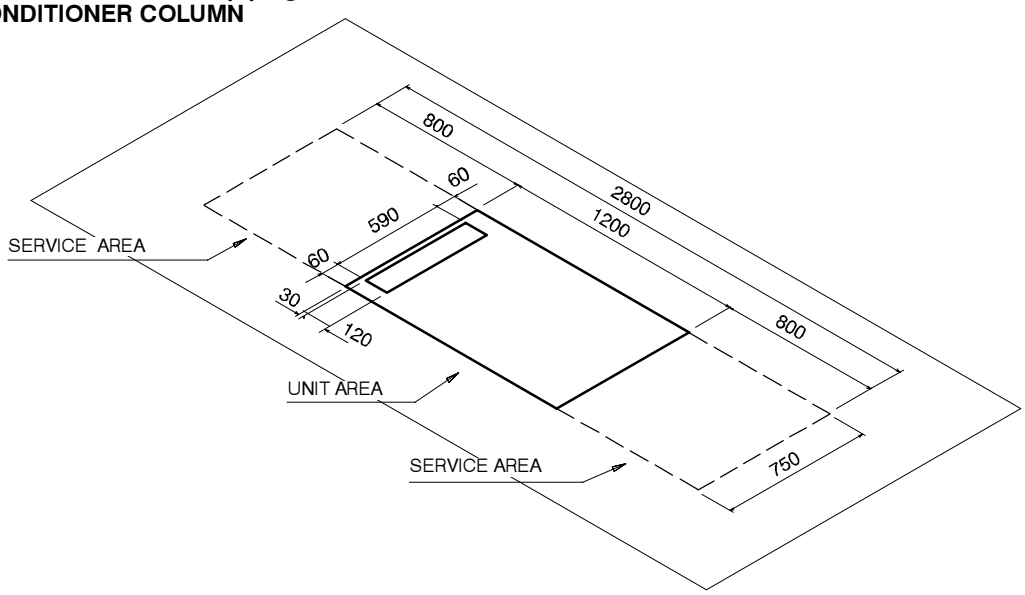
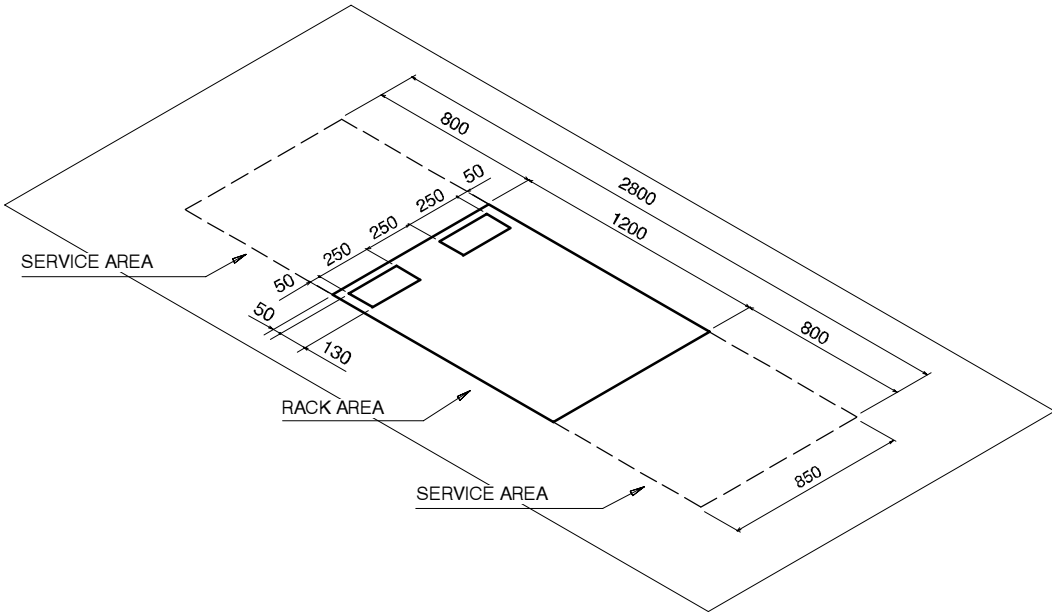
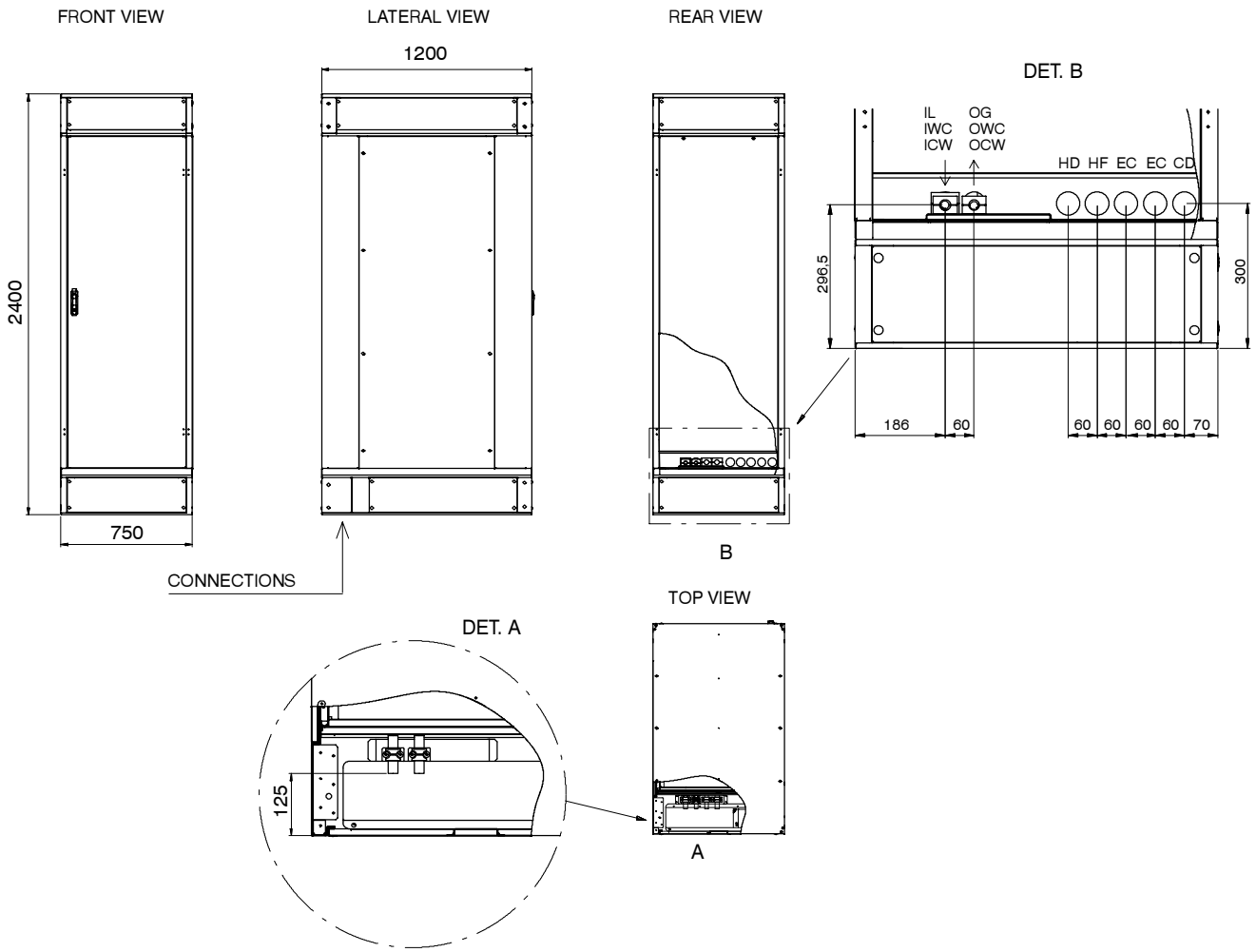


Fig. 11.b Holes on the raised floor for electrical connections
RACK COLUMN



Dimensional Data / Connections

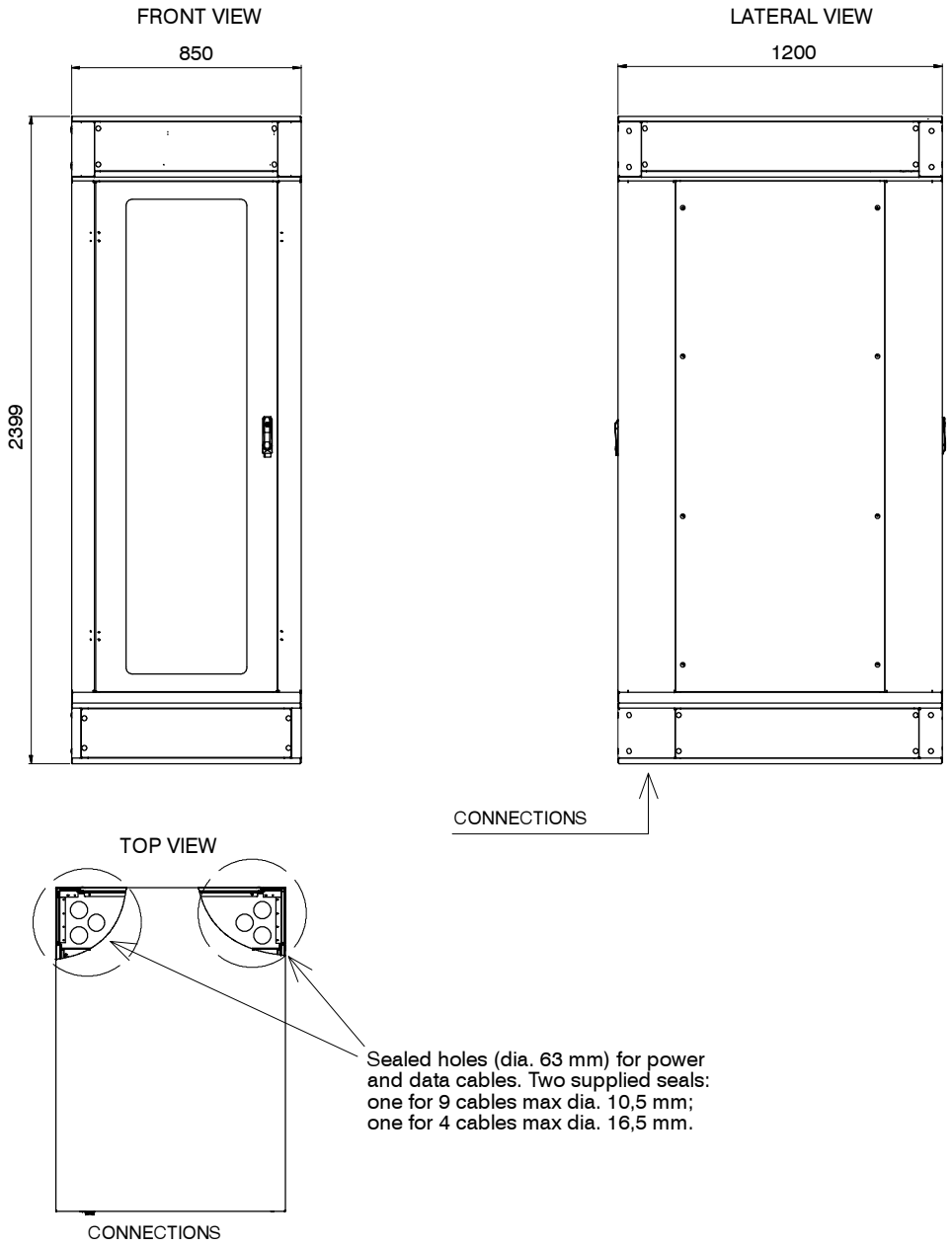
Fig. 11.c Connections
AIR CONDITIONER COLUMN



Unit Connection		Version		
		A	W	C
IL	Liquid line inlet *	OD 16 mm		
OG	Gas line outlet *	OD 18 mm		
ICW	Chilled water inlet			1" GAS–F
OCW	Chilled water outlet			1" GAS–F
IWC	Water to condenser inlet		3/4" GAS–F	
OWC	Water from condenser outlet		3/4" GAS–F	
CD	Condensate drain	ID 20 mm		
HF	Humidifier feed (opt.)	1/2" GAS–M		
HD	Humidifier drain (opt.)	ID 22 mm		
EC	Electrical power supply	Hole ∅ 48 mm		

* ***Connection size only. The dimension of the connecting pipe depends on unit model and refrigerant.***

Fig. 11.d Connections
RACK COLUMN



12 ElectricalServiceRequirementsandConnections

12.1 Rack electrical data

12.1.1 Power input

Power supply: 230 V 1 Phase 50 Hz+EARTH

Input power cable size 2x2,5 mm^2 +EARTH

12.1.2 Rack electrical panel

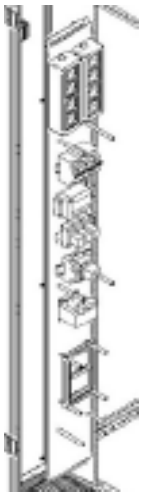


Fig. 12.a Rack electrical panel (open)

On the front of the rack we have the relevant electrical board, closed by 6 screws. It has been designed in order to fulfill the following functions.

1. to manage the power input, from std network (single phase + earth) or from UPS, according with the local rules;
2. to have inside the microprocessor, able to check the temperatures, manage the backup ventilation, support the monitoring via SNMP (opt.)
3. to power supply and control the damper and backup ventilation fan
4. to locate one or two PDUs, supplying the power strips
5. to manage the optional devices, i.e. fire extinguishing system, open door sensors.

12.1.3 PDU power limitations

To reduce the risk of overload, do not load any single PDU with more than its rated maximum current: 32 A for 1 PDU, 40 A for 2 PDU. Each PDU is protected with a residual current MCB in order to reduce the risk of electric shock.

12.1.4 Power strip limitations

To reduce the risk of overload, do not load any single strip with more than its rated maximum: 3400W, 16A.

12.2 Air conditioner electrical data

12.2.1 Power input

Power Supply 400 V 3N 50 Hz+EARTH

Cable power size 4x6 mm^2+EARTH

12.3 Mutual connections

Between the rack and the air conditioning modules, following connections are required to be set on the field:

- Main power cables
- Auxiliary connections between rack and air conditioning
- Electrical connections between dampers
- Fire detection and extinguishing system (opt.)
- Data cables

12.4 Safety warnings

IMPORTANT SAFETY NOTES FOR INSTALLATION

Check the grounding when hen installing the rack and the air conditioning units.

Check the max power absorbed from each strip.

Check the voltage before connecting any equipment to the PDU and before to switch on the XDFN

Open the main switch installed inside the rack and the air–conditioning before any maintenance operation.

12.5 Standards

The product conforms to EU directives EN 60204–1.

Il Fabbricante dichiara che questo prodotto è conforme alle direttive Europee:
The Manufacturer hereby declares that this product conforms to the European Union directives:
Der Hersteller erklärt hiermit, dass dieses Produkt den Anforderungen der Europäischen Richtlinien gerecht wird:
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Tillverkare försäkrar härmed att denna produkt överensstämmer med Europeiska Uniones direktiv:
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Vaimistaja vakuuttaa täten, että tämä tuote täyättää seuraavien EU−direktiivien vaatimukset:
Produsent erklærer herved at dette produktet er i samsvar med EU−direktiver:
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