Liebert® PDX

Perimeter DX System PI Models with Variable Speed Compressor - 50Hz

Product Documentation

English, cod. 10010666MAN_ENG, rev. 19.02.2021

This document, written in English, is the original version

Contents

Annexes

Abbreviations - Acronyms

Item	Definition
ATS	Automatic Transfer Switch
BMS	Building Management System
EC	Electronically Commutated [fans]
EEV	Electronic Expansion Valve
OPEX	OPerating EXpense
MCB	Miniature Circuit Breaker
STO	Safe Torque Off
Ultracap	Ultra capacitor
U2U	Unit to unit
UPS	Uninterruptible Power Supply
VSD	Variable Speed Drive

1. Digit Nomenclature

The unit is fully defined by the following digits.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

Dig.	Feature	Value	Description
1 2	Family name	PI	
3 4 5	Model	000	
6	Air discharge	U	Upflow
		H	Downflow Frontal (displacement)
		D	Downflow Up
		E	Downflow Down (in the raised floor)
7	System type	A	Air-cooled
8	Air flow	L	High power EC fans
		1	EC fans
9	Power supply	3	400 V / 3 ph / 50 Hz + N CE
		T	380 V / 3 ph / 60 Hz + N CE
		6	460 V / 3 ph / 60 Hz CE
10	Cooling system	G	Single Circuit Variable Speed Scroll R410A with EEV
		I	Dual Circuit Variable Speed Scroll R410A with EEV
11	Humidification	0	None
		H	Infrared humidifier
		U	Ultrasonic humidifier
		S	Electrode humidifier
12	Microprocessor control	0	None
		7	7” touch screen
		F	10” touch screen
13	Heating and re-heating	0	None
		1	Electric heating standard capacity
		2	Electric heating high capacity
14	Air filter	1	ePM10 50%
		2	ePM10 50% + Diff. Press. Trasd.
		3	ePM10 50% + clogged filter
15	Condensing control	A	Air – Cooled
16	Color	1	Black RAL 7021

Dig.	Feature	Value	Description
17	High voltage option	D	Standard Power Supply
		F	Dual Power Supply Parallel
		G	Dual Power Supply Alternate (ATS)
18	Predisposition	0	None
		S	Predisposition for Smart Aisle (predisposition for damper sensor, 3 position switch)
		F	Predisposition for Economizer (sensors, predisposition for dampers)
		G	Predisposition for Smart Aisle + Economizer
		H	Predisposition for motorized damper
		L	Predisposition for plenum installation
19	Monitoring	0	None
		1	Monitoring (Modbus IP, BACnet IP, SNMP and HTTP)
		4	LIFE compatibility
20	Devices	0	None
		1	MCB 10A 1 ph
		2	MCB 10A 3 ph
		3	Condensate pump (1)
		4	Condensate pump + MCB 10A 1 ph (1)
		5	Condensate pump + MCB 10A 3 ph (1)
21	Packaging	P	PLP and Pallet
		C	PLP and wooden crate
		S	Seaworthy
22	EMC Emissions	I	Industrial rate
		R	Residential rate
23	Revision	E	Free option
25	Special requirements	A	Standard Vertiv™
		X	Special Vertiv™

(1) - Only available with Upflow units

Fan module

The fan module can be delivered separately:

-- always for extended height units

-- in case of fan module replacement for standard units (with the exception of the 1 bay units)

The fan modules are not available for 1 bay units, since the fan section of these units are integrated with the cabinet structure.

The fan module is fully defined by the following digits.

The unit is fully defined by the following digits.

1	2	3	4	5	6	7	8	9	10	11	12	13

Dig.	Feature	Value	Description
1 2 3	Fan Module	BMX	Fan Base Module
		BFX	Fan Base Frame
		TPX	Fan Top Plenum
4 5	Size: Normal Lenght	12	1200 mm
		17	1750 mm
		33	3350 mm
6	Air Delivery	S	Standard
		B	Back (fans removal from the front)
		F	Front
7	Fans	L	High Power EC Fan Module
		1	EC Fan Module

Dig.	Feature	Value	Description
8	Heaters	0	No heaters
		1	Standard Capacity
		2	High Capacity
9	Packaging	P	PLP and Pallet
		C	PLP and wooden crate
		S	Seaworthy
10	Power Supply	3	400 V / 3 ph / 50 Hz + N CE
		T	380 V / 3 ph / 60 Hz + N CE
		6	460 V / 3 ph / 60 Hz CE
11-12	Free Digits		
13	Special requirements	A	Standard Vertiv™
		X	Special Vertiv™

2. Highlights

Content of this chapter

2.1 Liebert® PDX with Variable Speed Compressors

The best answer to the most challenging IT applications	**Liebert® PDX**, equipped with variable speed compressors and iCOM™ control, has been designed to be the most efficient, reliable, flexible and smart air-cooled direct expansion cooling solution for small and medium data centers.
Variable Speed Scroll Technology	The best solution in terms of variable cooling capacity, with a minimum compressor speed down to 17%-25% of maximum speed , depending on the model.
Cooling capacity	The **Liebert® PDX** Model Series offers units with net rated cooling capacity from 15 to 165 kW, with R410A refrigerant.
Flexible and scalable configuration	The **Liebert® PDX** products are available across a full range of cooling modes: direct expansion, indirect water freecooling, direct air freecooling and dual fluid redundancy cooling. The models with variable speed compressors are available for the air cooled version. The scalable cooling system is able to expand with evolving business needs. As for the other **Liebert® PDX** models, the series is available for different air discharge versions (Upflow and Downflow) and the fans module may be installed above the raised floor or in the raised floor.
Eurovent Certified	Eurovent certification guarantees that variable speed compressor undergoes independent testing, thus delivering rating accuracy and enhancing the unit's reliability. Check ongoing validity of certificate: www.eurovent-certification.com

Upflow

Downflow Frontal

Downflow Up

Downflow Down

2.2 Efficiency

Partial load efficiency	Mission critical cooling systems are often designed to include a level of redundancy; as a direct consequence, they will often work at partial loads. **Liebert® PDX** maximizes part load efficiency, compared to most common direct cooling systems, therefore significantly reducing running costs, resulting in the most energy efficient direct technology available on market.
Reduced energy consumption	**Liebert® PDX** boosts part load efficiency through variable speed compressor, evaporator and coupled condenser EC fans, electronic expansion valve and staged coil design, so power consumptions and energy bills are considerably lowered. Thanks to inverter driven variable speed compressors, starting current (LRA) is reduced and power factor is improved, with a consequent benefit on running costs.
Compact design	**Liebert® PDX** cooling density has been increased, allowing for reduced footprint and leaving more space for customers to install their equipment.

2.3 Cooling Continuity

Key factors	Cooling continuity and reliability are key factors for mission critical infrastructures. Variable speed compressor grants precise and constant control of airflow, temperature and humidity. Thanks to its innovative design and use of advanced technologies, it matches requirements for cooling continuity coming from the most trusted and adopted certification authorities for data center design and operation.
Improved uptime	Variable speed compressor has enhanced reliability; it can automatically manage a power failure for 60 seconds, keeping alive the iCOM™ control board and the BMS communication and permitting system supervision during a power outage event. When power is restored, the intelligent iCOM™ control adopts a fast restart, recovering in quick time the requested operating condition. Breakdown time is also minimized through prevention of alarms and failures and real-time optimization and adaptation of working parameters.
Teamwork	Up to 32 variable speed compressor units can be connected together in a common network, sharing information on status with each other and managing critical operating situations with combined action.

2.4 Unique Flexibility

Highest efficiency at partial loads	The inherent scalability of direct expansion systems is maximized using **Liebert® PDX**, even on those data centers where the initial heat load is very low or subject to fluctuation. A wider operating range provides a step ahead of new challenges posed by data center requirements and climate change.
Wide range of working conditions	The range of permitted maximum and minimum external temperature makes variable speed compressor applicable also for extreme working conditions environments (see *3.3.2 Operating conditions* for details).
Fans speed modulation	Extended compressors and evaporator fans speed modulation range improves the system scalability, particularly in case of variable datacenter occupancy or IT load.
Electronic Expansion Valve	This valve is designed to constantly optimize the refrigeration circuit performance in order to achieve the highest efficiency also at partial load. The relevant valve management software is also embedded in the unit's Vertiv™ iCOM™ control function.
Flexible layout	The unit adapts to different installation both for position of condenser (equivalent piping length between unit and condenser can reach 100 m) and for data center air distribution path, with widest range of air configurations available on market for variable speed compressor units.
Condensers for any need	Variable speed EC fans and two different coil treatment (epoxy coating and ElectroFin®) are available for all range of **Liebert®** condensers, making their installation possible also in critical conditions.

2.5 Smart Control

iCOM™	The advanced iCOM™ control is the heart of the direct expansion cooling system, managing not only the variable speed compressor units but also outdoor heat rejection components (**Liebert™ MC** or **Liebert™ HCR** condensers). The smart control manages and optimizes the overall system, is fully programmable via an advanced and user-friendly touch display and can be linked with common BMS protocols, allowing remote supervision.
7" Touch Display	The control set up can be done through a high definition touch screen display. Its functions are replicated also in a web browser (virtual version).
Remote monitoring	A whole range of smart networking solutions is available: the unit can communicate with user BMS systems with extended parameter availability.
Teamwork	The networking software allows to create a common network from up to 32 variable speed compressor units. The iCOM™ control ensures high level management of the units to work together as a single system, thus optimizing room temperature and airflow. When multiple **PDX** units are connected together in a network, a single display can be used as a 'team display' to manage all the units.
Integrated system	All main components are connected on Modbus chain. Condensers are controlled directly from the unit's iCOM™ control. Choices are available for redundant sensor control logic.

3. Intended Use

Content of this chapter

3.1 Purpose of the Unit

The **PDX** units have been designed and manufactured for the following purpose:

- Precision air conditioning for indoor use (for data centers, network closets, technological rooms).

3.2 Refrigerant

The **PDX** units are designed for use with R410A.

3.3 Environment

WARNING

Do not use in explosive, acid or anyway aggressive atmosphere.

3.3.1 Storage conditions

Table 01 - Ambient conditions for storage

Storage environment	Indoor environment, protected against weather agents. Clean (no dust), well-ventilated, non-condensing
Ambient temperature	-20°C / +50°C
Ambient humidity	<90% and preventing condensation
Storage time	The total storage time should not exceed six months. If the storage time is longer than six months, then you must check the functionality of sensors and other electronic devices before putting in operation the unit.
Position	Keep the unit vertically upright.

3.3.2 Operating conditions

Table 02 - Ambient conditions for operation

Operating environment	The unit is designed for indoor installation, protected from weather agents, with the following ambient conditions.	
Air returning to the unit inlet (indoors conditions)	Temperature	+20°C — +40°C
	Absolute humidity	5,5 — 12 g steam / kg air
	Relative humidity	15 — 60 %
	The allowed thermal load must be higher than 20% of the unit nominal cooling capacity. A lower thermal load will cause inaccurate temperature and humidity control and frequent compressor(s) switch **ON/OFF**.	
Altitude (above sea level)	Below 1 000 m	OK
	From 1 000 to 2 000 m	Allowed with inverter derating.
	Higher than 2 000 m	Not allowed, contact Vertiv™ Technical Support

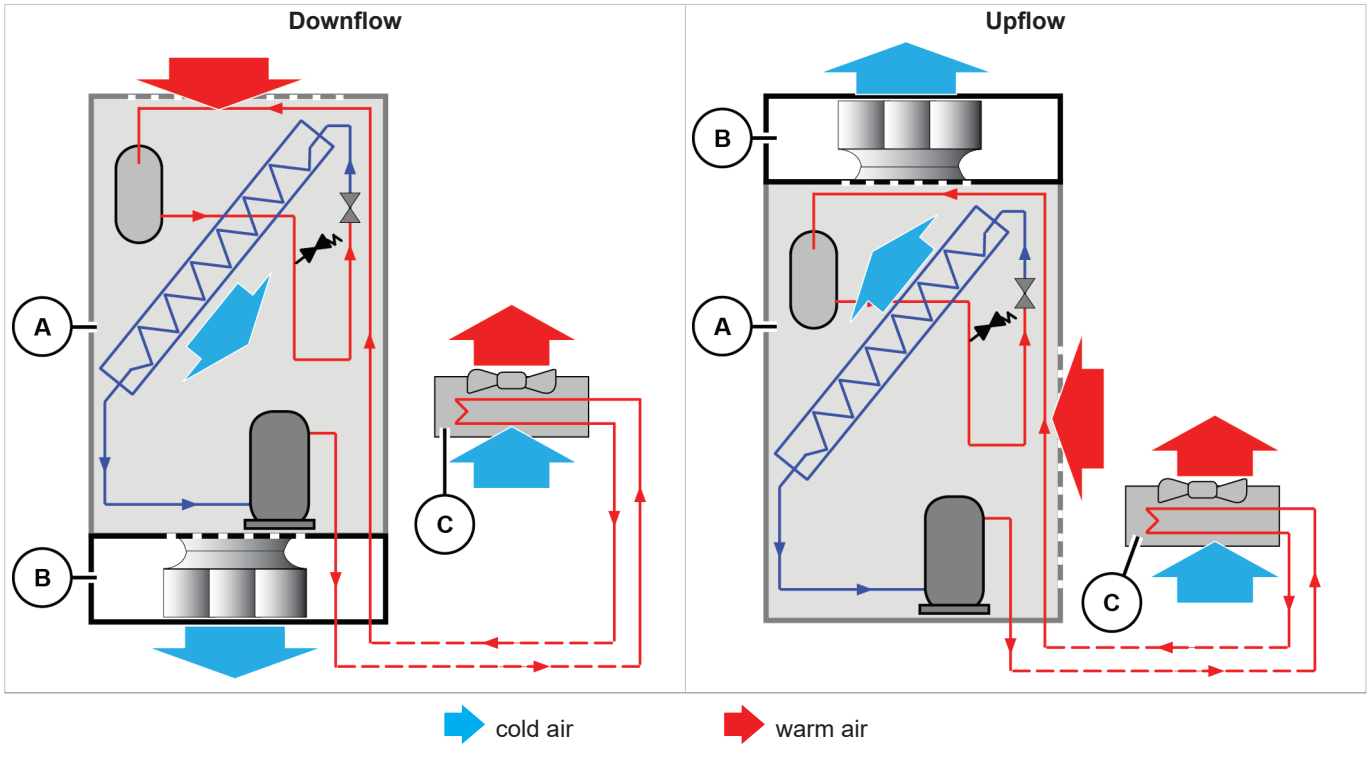
Outdoor temperature	Below -30°C	Not Allowed. Contact Vertiv™ Technical Support.
	From -30°C to -20°C	Low temperature. The following actions are required: - bigger liquid receiver - LOWTEX kit (condenser by-pass to keep the compressor discharge pressure at a preset value) Contact Vertiv™ Technical Support for any question.
	From -20°C to +52°C or +55°C	OK **NOTE** *The maximum temperature depends on the unit model and condenser model.*
	Above +52°C or +55°C	Not allowed.
Remote condensers position	See the *User Manual*	

4. Technical Specification

Content of this chapter

4.1 Versions Overview

4.1.1 Unit frame



The unit frame is made by the coil section [**A**] and the fan section [**B**].

The coil section contains the refrigerating system of the unit (compressor, evaporator, expansion valve, liquid receiver, accessories), the electric panel and the control system.

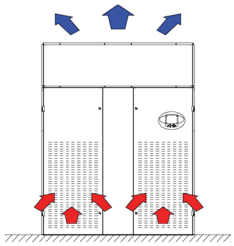
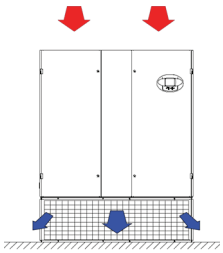
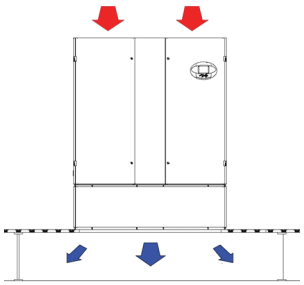
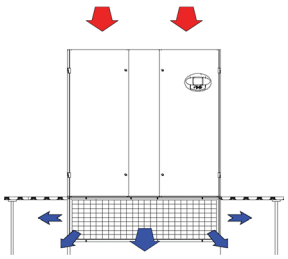
The fan takes the warm air from the room into the unit. The air flows through the evaporator, cools down and blows out again in the room. The fan section may be placed at the bottom of the coil section (Downflow versions) or on top (Upflow versions).

The refrigerating system of the unit is connected on site to the external remote condenser [**C**] (which must be purchased separately).

The unit frames can be combined in different ways to obtain different versions. Different versions are available also for the refrigerating system.

4.1.2 Air distribution

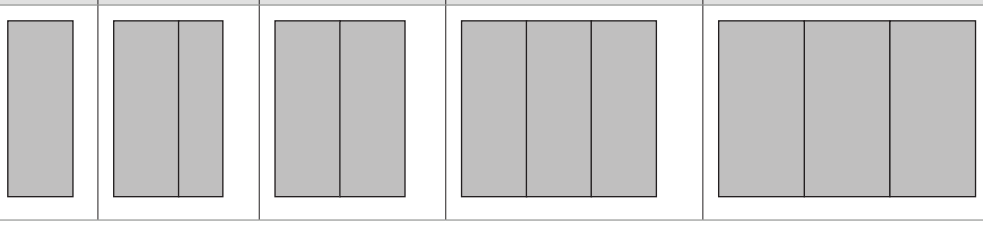
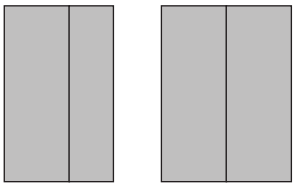
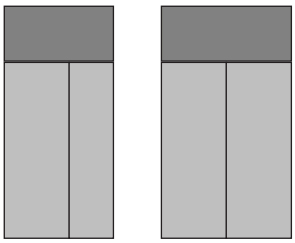
The unit is placed on a raised floor, whereas the unit fan module can be placed under a raised floor.
The air flow direction can be either **Upflow** (fan section on top) or **Downflow** (fan section at the bottom).
The following combinations are available:

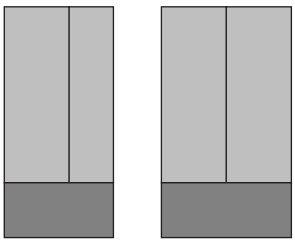
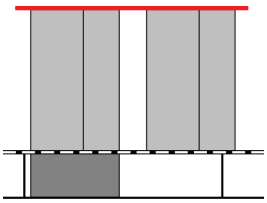
U - Upflow	H - Downflow Frontal	D - Downflow Up	E - Downflow Down
			
Placed on the floor **Warm** air though the doors **Cold** air though the top	Placed on the floor **Warm** air though the top **Cold** air though the front grid	Placed on the floor **Warm** air though the top **Cold** air though the bottom grid	Placed under a raised floor **Warm** air though the top **Cold** air though the front grid

4.1.3 Cabinet

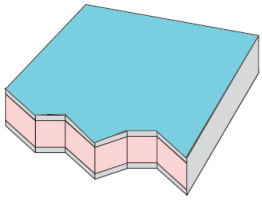
Size

The units can have the following cabinet size:

<table>
<tr><th>Width</th><th>Frame type</th><th>1</th><th>2</th><th>3</th><th>5</th><th>7</th></tr>
<tr><td rowspan="2"></td><td></td><td colspan="5">  </td></tr>
<tr><td colspan="5">NOTE In the units of frame type 1 the coil section and the fan section are integrated. In the units with frame types 2, 3, 5 and 7 the coil section and the fan section are separate modules that are assembled together.</td></tr>
<tr><td rowspan="3">Height</td><td>Standard
H=1970 mm</td><td colspan="3">  </td><td>The coil and the fan sections are factory assembled in the same cabinet.</td></tr>
<tr><td>Extended
H=2570 mm
Fan module on top of the coil module</td><td colspan="3">  </td><td>The coil module and the fan module are delivered separately and must be assembled at the installation site.

NOTE The top of an extended version unit placed under a raised floor will be at the same height as the top of a standard unit placed on the floor</td></tr>
<tr><td>Extended
H=2570 mm
Fan module at bottom of the coil module</td><td colspan="3">  </td><td>  </td></tr>
</table>

Frame and panels



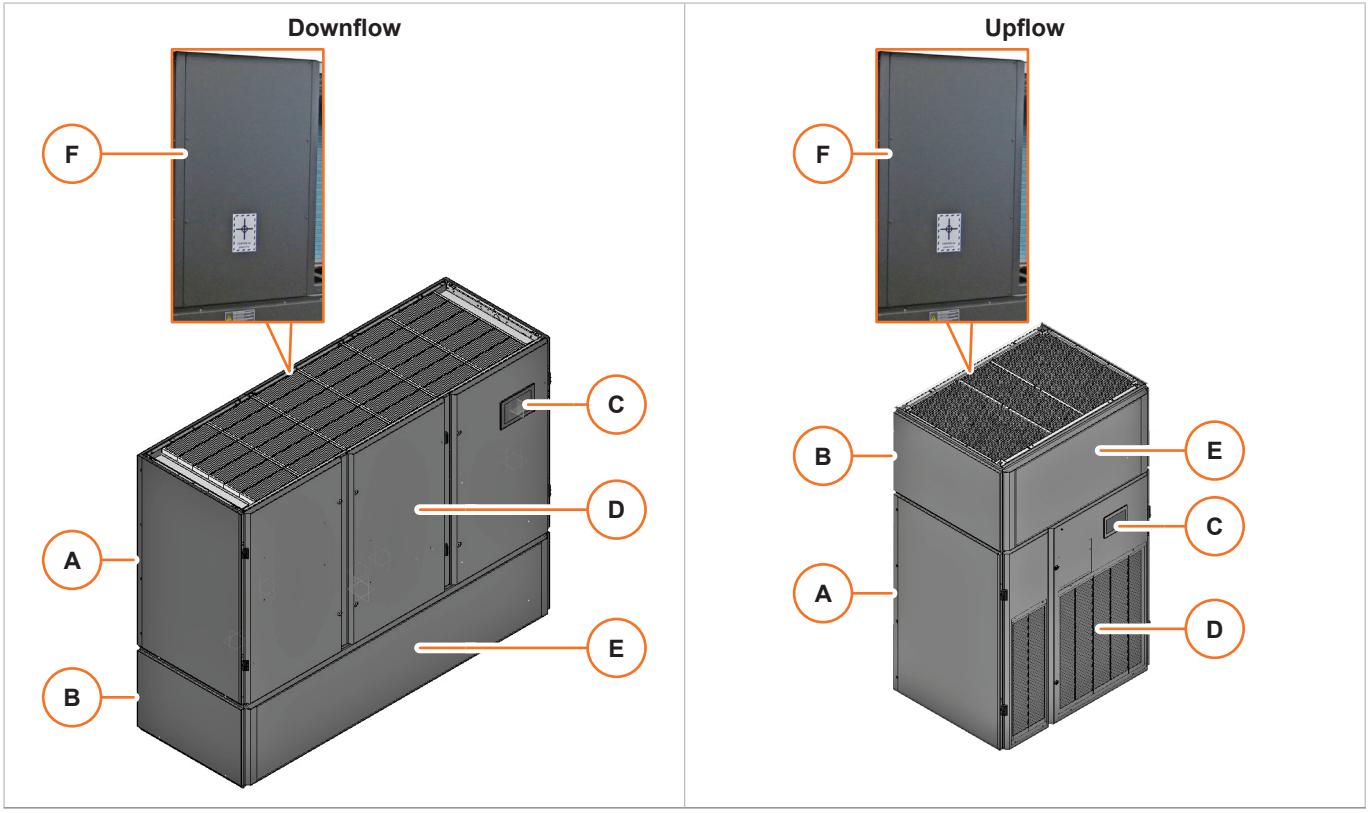
The cabinet is manufactured from hot-dipped galvanized steel sheet, externally painted with black RAL 7021 color epoxy polyester powder paint and assembled using stainless steel screws and high tensile rivets. All the zincked metals parts are hot dip galvanized or powder coated in order to avoid zinc whiskers growing, minimizing any harmful zinc whiskers.

The rear and the fans section panels are double-skinned, with 20 mm (frontal fan section panel with 40 mm) Class A1 EU fireproof insulation sandwiched between the skins to reduce noise emission and heat loss. The side panels, which are isolated from the inside of the unit to form a complete double-skinned cabinet, the small service panel for electrical heaters, are also lined with 10 mm Class A1 EU fireproof insulation.

The frontal panel(s) are assembled on hinges to make the access easier; this can be opened by the fast closing lock. The rear and side panels are screwed to the supports. The rear panel(s) are screwed directly to the frame.

4.2 Structure

4.2.1 Standard version

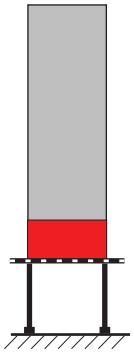
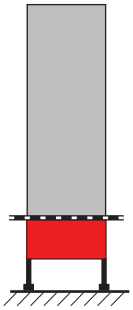
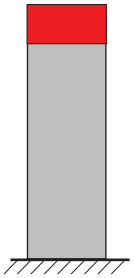


Ref.	Description	Remarks
A	Coil section	The coil section is completely closed by panels and by the door for protection against any contact with electric parts and hot or cold surfaces.
B	Fan section	The fan section is completely closed by panels and grids for protection against any contact with moving parts.
C	Control panel	The unit is usually controlled remotely by a network connection. The control panel is optional and may be placed on the front door or inside the front door.
D	Doors	The doors can be opened only by the proper tool.
E	Fan safeguards	The fixed panels (safeguards) can be removed only by loosing the fixing screws.
F	Rear safeguards	

4.2.2 Extended version

In the extended versions the fan section and the coil section are separate modules which must be assembled at the installation site.

The fan module for the extended versions is named differently as shown below.

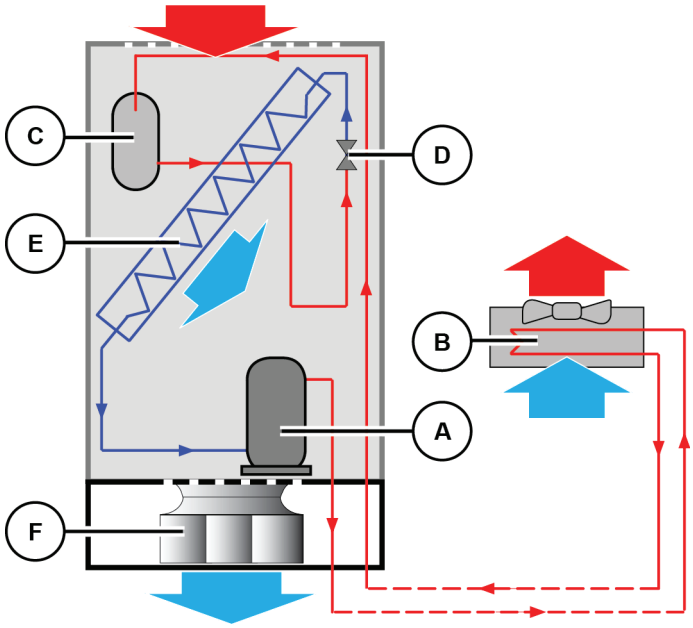
		
Fan base module when placed on the floor or raised floor	**Fan base frame** when placed under a raised floor	**Fan top plenum** when installed on top of the cooling unit

4.3 Refrigerating System

4.3.1 Cooling versions

The **PDX** product family includes several cooling system versions.
This manual is related to units with air cooled version.
For units of the other versions, please make reference to respective manuals.

4.3.2 Main components

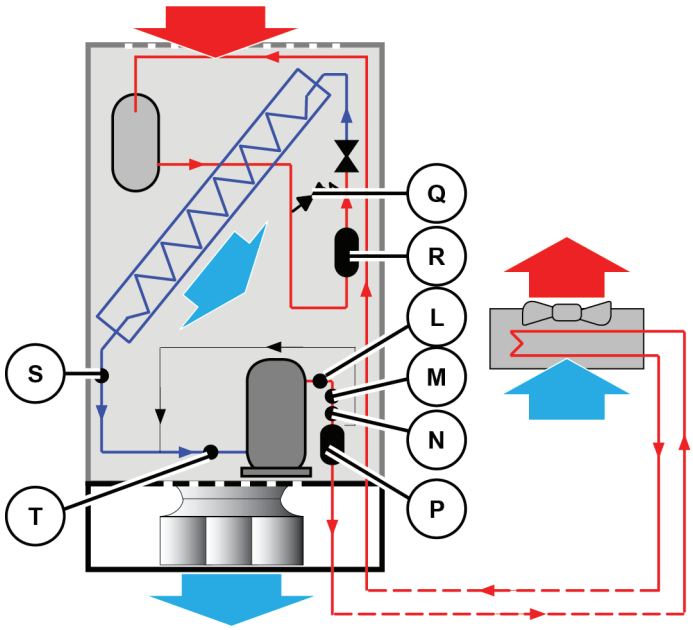


The figure shows a simplified scheme for a Downflow unit with a single circuit with one compressor.

The main components of the circuit the following:

A	Compressor
B	Condenser (supplied separately)
C	Liquid receiver
D	Expansion valve
E	Evaporator
F	Fan

Make reference to *Annex A - Refrigerating Circuit Diagrams* for details.

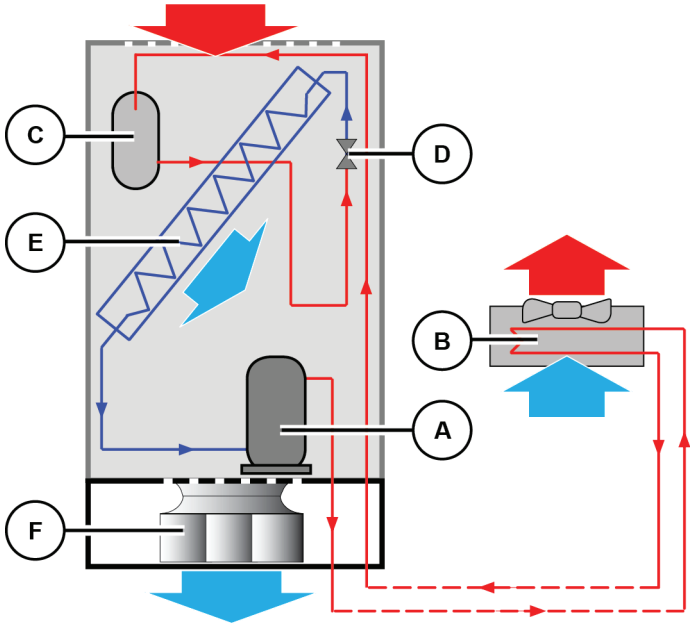


The circuit also include the following components:

L	High temperature sensor
M	High pressure switch
N	High pressure transducer
P	Oil separator (for variable speed compressors only)
Q	Safety valve
R	Filter dryer
S	Temperature sensor for the expansion valve control
T	Low pressure transducer for the expansion valve control

Make reference to *Annex A - Refrigerating Circuit Diagrams* for details, including other relevant components of the circuit (shut-off valves, check valves, access valves).

4.3.3 Operating principle



The figure shows a simplified scheme for a Downflow unit with a single circuit with one compressor.

The operating principle is the same for all of the models of the A cooling version (also including Upflow air distribution and double or tandem circuits).

This is a direct expansion system, meaning that the refrigerant cools directly the air, without any intermediate heat exchange with other fluids.

The compressor [**A**] pumps the hot gaseous refrigerant into the outdoor air-cooled condenser [**B**].

The liquid refrigerant coming from the condenser enters in the liquid receiver [**C**], which ensures a fixed and even refrigerant flow to the expansion valve [**D**].

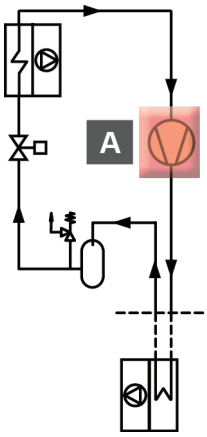
The refrigerant enters in the evaporator [**E**].

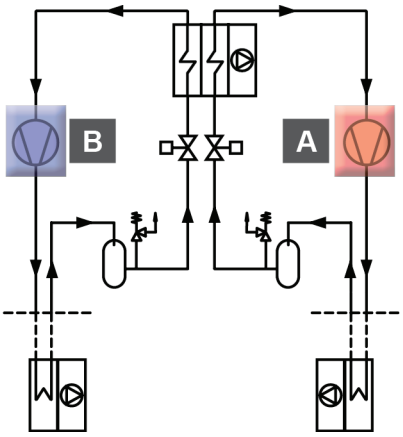
The fan [**F**] makes the warm air coming from the room to flow through the evaporator.

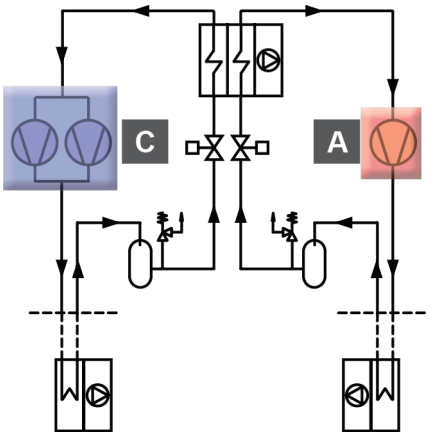
The refrigerant evaporates and cools down the air, which flows again into the room.

The refrigerant flows back to the compressor.

4.3.4 Circuit versions

<table>
<tr>
<td>Single
 

[A] variable speed compressor</td>
<td>Double
 

[A] variable speed compressor
[B] fixed speed compressor</td>
<td>Tandem
 

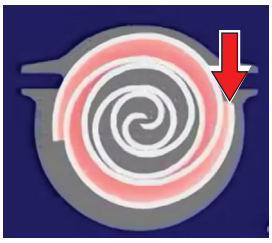
[A] variable speed compressor
[C] two fixed speed compressors</td>
</tr>
<tr>
<td></td>
<td colspan="2">The evaporators and the condensers of the two circuits are independent.
The evaporators are placed one after the other in the same coil section.</td>
</tr>
</table>

4.3.5 Compressors

Scroll compressors

The scroll is a simple compression concept first patented in 1905.

The fixed scroll remains stationary while the other scroll is allowed to orbit (but not rotate) around the first one.



The refrigerant gas enters between the two scrolls from the outer zone.

The movement of the orbiting scroll creates closed pockets of gas entrapped between the scrolls.

Each pocket is slowly pushed to the center and at the same time, the volume of the pockets is reduced, increasing the gas pressure.

When a pocket reaches the center, the gas (now at a high pressure) is discharged through a port located at the center.

Several pockets are being compressed simultaneously, resulting in a very smooth process.

Both the suction and the discharge process are continuous.

Inverter for capacity modulation

Operation	An inverter drive controls the compressor speed by changing voltage and frequency of its motor power input.
Advantages	Variable speed compressors provide the necessary level of cooling by adjusting its delivery according to the heat load, thus ensuring constant, precise temperature levels. This allows having a number of benefits in terms of efficiency: - perfect match between cooling capacity and heat load - lower power input at partial load - possibility to size the cooling system to overcome future heat load growth - improved SHR once the compressor is modulating (due to better evaporating temperature)
Energy savings	The variable speed compressors can cycle from 17-25 to 110-120 rps to effectively avoid energy waste. In part-load operation, it consumes more than 30% less energy than a fixed-speed compressor.
Accurate temperature and humidity control	The precise control of a variable speed compressors can reduce the temperature shift, so reducing the energy consumption and better matching of the cooling requirements.
Enhanced reliability	Variable speed compressors can modulate the cooling capacity according to the working load. This ensures safe operation of the compressors increases uptime and prolongs the unit life time.

4.3.6 Expansion valve

The valve is designed for modulating control of refrigerant circuits with high positioning speed and high precision in flow control.

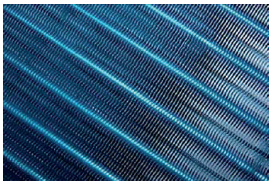
Compared to a Thermostatic Expansion Valve (TXV), an EEV ensures a better control on super heating at the end of the evaporator, ensuring at the same time that compressor will never be filled by liquid.

A TXV works well with a condensing pressure as much as possible constant, while an EEV is able to adapt to different situations, such as lower condensing temperature during the coldest period. This permits an increase of the cooling capacity of the unit, a decrease of the unit power input and so increase the energy efficiency of the entire **Liebert® PDX** unit.

To get the biggest advantage, a different pressure set point can be used tor the fan speed controller of the **Liebert®** remote condenser.

The **Liebert® PDX** series with variable speed compressors always have EEV.

4.3.7 Evaporator



Liebert® PDX units feature a very wide coil heat exchanger surface.

A wide heat exchanger surface means that a high Sensible Heat Ratio (SHR) (over 0,90) can be obtained and the latent heat is reduced. Therefore the energy spent to control the humidity under normal operating conditions is reduced to a minimum

The use of staged coils increases the efficiency, since the air flows through the whole exchange surface even at partial loads.

The coils are made of copper pipes and aluminium fins, treated with hydrofile styrol acrylic paints to withstand corrosive atmospheres.

4.4 Air System

4.4.1 Fans

The unit is fitted with variable speed, high efficiency, single inlet, backward curved, centrifugal ‘plug’ type innovative EC fan(s).

The fan(s) have an impeller with curved blades, corrosion resistant, made of fiberglass plastic.

This new material offers the benefits of light weight and full flexibility on blade design in addition to the high strength, that was already achieved with the aluminum alloy technology.

The good dampening behavior of the plastic also helps to reduce noise emissions.

The fan motors are electronically commutated, continuous speed regulation via controller signal. The motor is three-phase, with internal IP54 protection and with internal thermal protection.

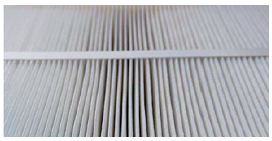
The fan wheel is statically and dynamically balanced; the bearings are self-lubricating.

An “S” shape separator is mounted between the fans with the purpose to eliminate turbulence effects due to fans interaction, so increasing the efficiency if compared to simple plate separator.

When the unit is equipped with more than one fan, the unit does not stop if one of the fans fails, so cooling continuity is assured.

4.4.2 Filters

Standard filters

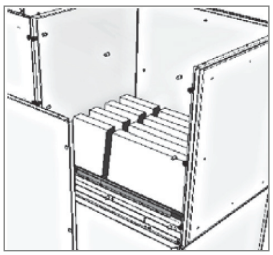


Removable filters are installed inside the unit before fan and heat exchanger.

The standard filtration grade is ePM10 50% according to EN16890.

The filter pleated structure gives high filtration efficiency, low pressure drop and permits to use the filter without metallic or cardboard frame. The filter media is composed by fibre and latex.

High efficiency filters (accessory)



An optional extension hood is available with high efficiency filters made of fiberglass (filtration class ePM10 70%, ePM1 60%, ePM1 80% according to EN16890).

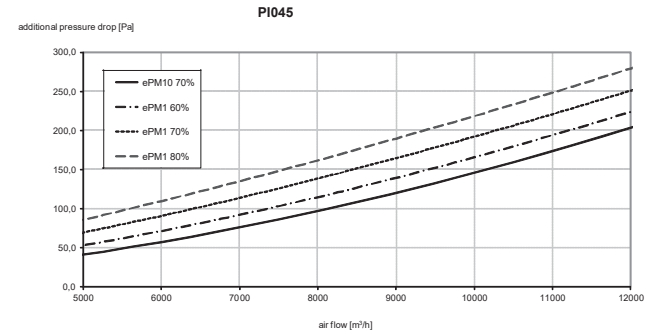
The filters are placed in 'V' sections with a solid external frame in polypropylene, and can withstand remarkable pressure and flow variations.

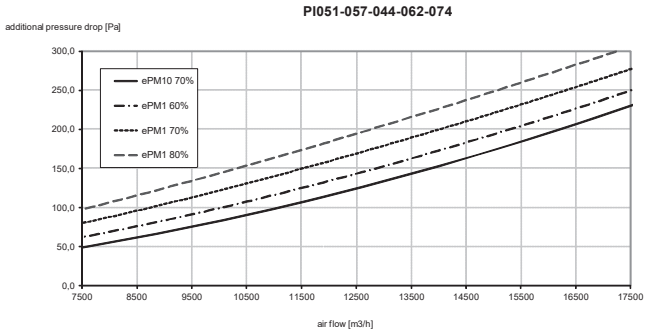
These filters will be installed within an additional duct on the unit top.

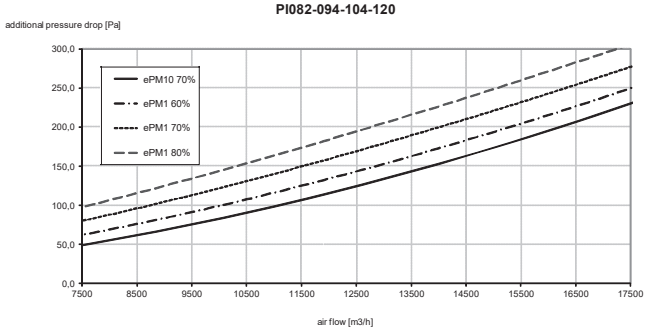
The additional pressure drop in comparison with ePM10 50% standard filters are indicated in the following graphs.

See also *Annex D - Accessories - 8 - Hood with high efficiency air filter* for details.

High efficiency filters additional pressure drop







Clogged filter alarm	A differential static pressure gauge after and before the filter gives a signal when the filter is dirty.

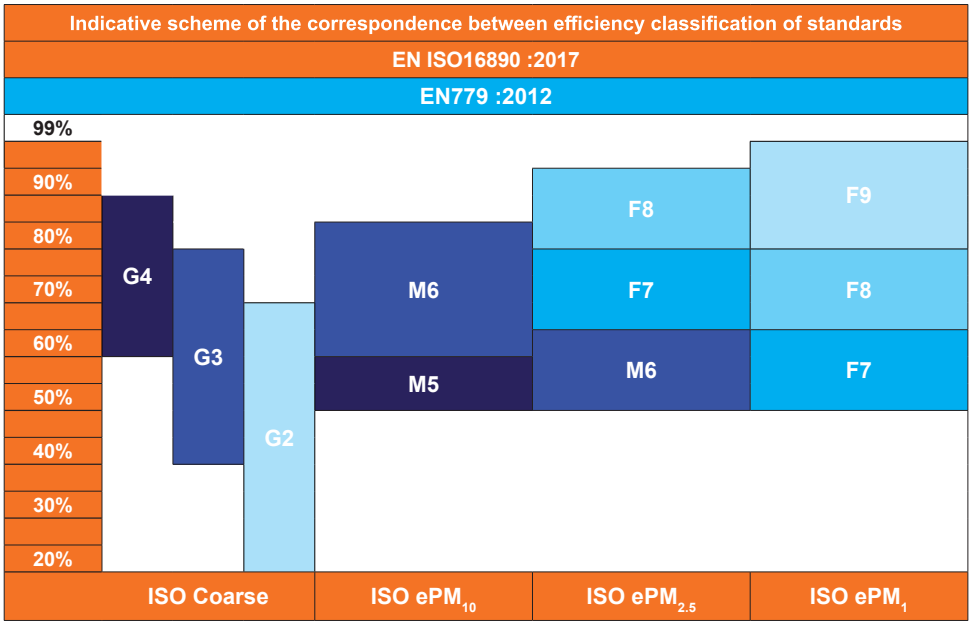
Air filters general information

Recently new test methods and relevant standard have been developed and put in place for all type of air filters in Europe.

The new standard ISO EN 16890:2017 has replaced the previous EN779:2012, used to characterize the filtration efficiency. As main difference, when in EN779 the efficiency was based on filtering particles with a diameter of 0.4 µm, in ISO EN 16890 the efficiency is based on particulate with different dimensions, from 0.3 µm to 10 µm in accordance with the test group. So, the nine classes of EN779 (G1, G2, G3, G4, M5, M6, F7, F8, F9) will be translated in the four filter groups (ISO Coarse, ISO ePM10, ePM2.5, ePM1, where ePM stands for "efficiency Particulate Matter") and the relevant efficiency percentage, e.g. ISO ePM10 60%.

In the meantime, in North America the ASHRAE standard 52.2 is still used.

To have a reference about different standards, see tables below. It must be underlined that there is no precise link between them, due to the different test procedures and different measured values: the tables can be used as first general guidance, but not to exactly convert G1-F9 Filter Classes or ASHRAE MERV into ISO Filter Groups.



Indicative scheme of the correspondence between efficiency classification of standards		
EN 779:2012	**EN 779:2012**	**ASHRAE Standard 52.2**
Coarse Filters Average Arrestance (Am)	**Medium and Fine Filters Average Efficiency (Em)**	**Minimum Efficiency Reporting Value (MERV)**
50% ≤ Am < 65% **G1**		**MERV 1-4**
65% ≤ Am < 80% **G2**		**MERV 1-4**
80% ≤ Am < 90% **G3**		**MERV 5**
90% ≤ Am **G4**		**MERV 6-8**
	40% ≤ Em < 60% **M5**	**MERV 8-10**
	60% ≤ Em < 80% **M6**	**MERV 9-13**
	80% ≤ Em < 90% **F7**	**MERV 13-14**
	90% ≤ Em < 95% **F8**	**MERV 14-15**
	95% ≤ Em **F9**	**MERV 16**

4.4.3 Heating (optional)

The heating resistors are of a rigid design for extended operational life and they are normally utilized to maintain room dry-bulb conditions during a system call for dehumidification.

Each stage of heaters is made of finned armored stainless steel AISI 304 to maintain a low surfaces power density. Ionization effects are eliminated thanks to the low heater surface temperature.

Heating control is of the ON-OFF type. The heaters are phase balanced.

A safety sensor measures the air temperature at the unit outlet and it switches off the heater if the air temperature is higher than the alarm threshold.

A safety thermostat (with manual reset) disables the heaters in the event of a high temperature.

The heating system also incorporates Miniature Circuit Breaker(s) which protect the heater(s) from short circuits, should the harness be damaged accidentally.

Table 4.03 - Electrical heaters data

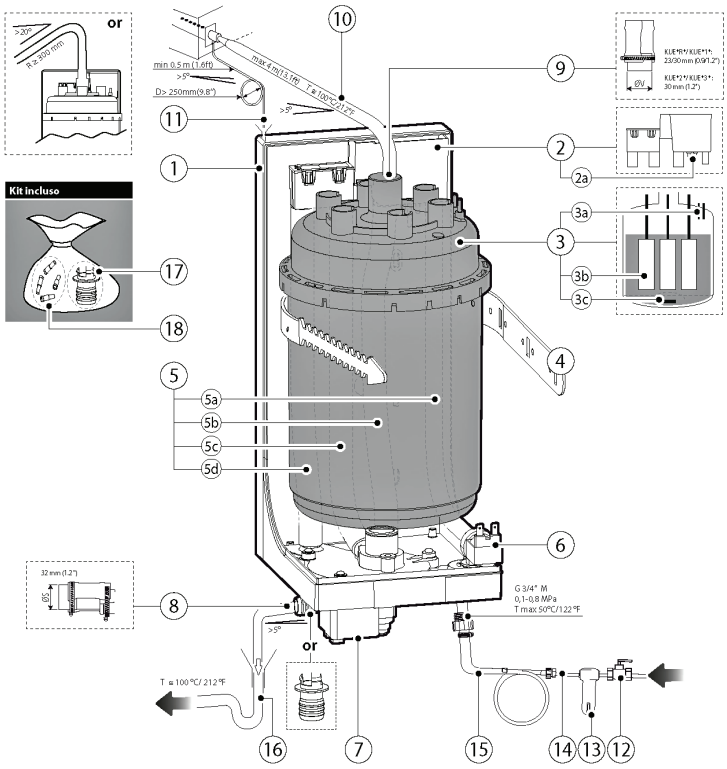
	400 V / 3ph / 50 Hz				460 V / 3ph / 60 Hz				380 V / 3ph / 60 Hz			
	Standard Capacity [A]		High Capacity [A]		Standard Capacity [A]		High Capacity [A]		Standard Capacity [A]		High Capacity [A]	
Unit model	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]	FLA [A]	Nominal Power [kW]
PI015	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI021	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI025	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI031	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI033	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI041	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI045	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI059	10,8	7,5	---	---	9,4	7,5	---	---	11,3	7,5	---	---
PI047	10,8	7,5	21.6*	15.0*	9,4	7,5	18.8*	15.0*	11,3	7,5	22.6*	15.0*
PI051	10,8	7,5	21.6*	15.0*	9,4	7,5	18.8*	15.0*	11,3	7,5	22.6*	15.0*
PI057	10,8	7,5	21,6	15	9,4	7,5	18,8	15	11,3	7,5	22,6	15
PI075	10,8	7,5	21,6	15	9,4	7,5	18,8	15	11,3	7,5	22,6	15
PI044	10,8	7,5	21.6*	15.0*	---	---	---	---	---	---	---	---
PI054	10,8	7,5	21.6*	15.0*	9,4	7,5	18.8*	15.0*	11,3	7,5	22.6*	15.0*
PI062	10,8	7,5	21,6	15	9,4	7,5	18,8	15	11,3	7,5	22,6	15
PI074	10,8	7,5	21,6	15	9,4	7,5	18,8	15	11,3	7,5	22,6	15
PI092	10,8	7,5	21,6	15	9,4	7,5	18,8	15	11,3	7,5	22,6	15
PI068	10,8	7,5	21.6** 32.4***	15.0** 22.5***	9,4	7,5	18.8** 28.2***	15.0** 22.5***	11,3	7,5	22.6** 33.9***	15.0** 22.5***
PI082	10,8	7,5	21.6** 32.4***	15.0** 22.5***	---	---	---	---	---	---	---	---
PI094	10,8	7,5	21.6** 32.4***	15.0** 22.5***	9,4	7,5	18.8** 28.2***	15.0** 22.5***	11,3	7,5	22.6** 33.9***	15.0** 22.5***
PI104	10,8	7,5	21.6** 32.4***	15.0** 22.5***	9,4	7,5	18.8** 28.2***	15.0** 22.5***	11,3	7,5	22.6** 33.9***	15.0** 22.5***
PI120	10,8	7,5	32,4	22,5	9,4	7,5	28,2	22,5	11,3	7,5	33,9	22,5
PI150	10,8	7,5	32,4	22,5	9,4	7,5	28,2	22,5	11,3	7,5	33,9	22,5
PI165	10,8	7,5	32,4	22,5	9,4	7,5	28,2	22,5	11,3	7,5	33,9	22,5

NOTE
* Not available with EC Fan Module;
** With EC Fan Module;
*** With High Power EC Fan Module;

4.4.4 Humidifier (optional)

Electrode humidifier

Main Components



1	Chassis
2	Fill tank
2a	Conductivity electrodes
3	Cylinder
3a	High level electrodes
3b	Immersed electrodes
3c	Filter inside the cylinder
4	Cylinder fastening strap
5	Hose kit
5a	Supply hose
5b	Fill hose
5c	Drain pump and overflow outlet hose
5d	Drain hose
6	Fill solenoid valve
7	Drain pump
8	Drain connection (Ø 32 mm)

Steam distribution

9	Steam outlet
10	Steam distribution hose
11	Steam condensate hose

Water fill

12	Manual valve (not supplied)
13	Mechanical filter
14	Supply hose (not supplied)
15	Connection hose with double non-return valve

Water drain

16	Drain hose with siphon (not supplied)

Kit included

17	Straight and 90° connection hose (Ø 32 mm)
18	Connectors for electrodes 2a e 3a

Operating principle

The metal electrodes are immersed in the tank filled with common drinking water. When a voltage is applied on the electrodes, an electric current is created in the water, which is slightly conductive since it contains a certain quantity of dissolved mineral salts. The electric current heats the water until producing steam (Joule effect). The quantity of steam produced is proportional to the electric current, which is in turn proportional to the level of water.

Technical data

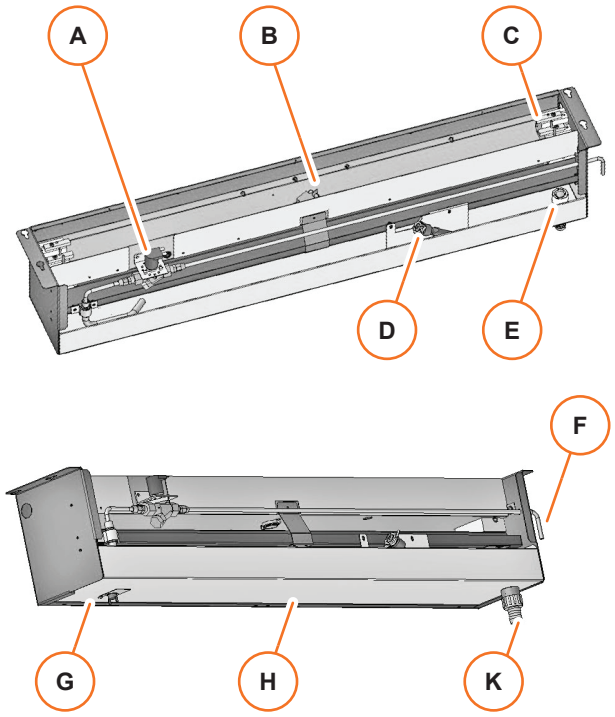
Electrode humidifier technical data

Model	Main power supply	Setting(1)	Absorbed current	Power	MAX water cylinder volume	MAX water supply	MAX drained water
	[V ± 10%]	[kg/h]	[A]	[kW]	[l]	[l/min]	[l/min]
KUECLH	400 V / 3 ph / 50 Hz	1,3 - 3	3,2	2,25	3,3	0,6	7,0
KUECLL	400 V / 3 ph / 50 Hz	3,9 - 8	8,7	6	5,5	0,6	7,0
KUECLO	380 V / 3 ph / 60 Hz	1,3 - 3	3,4	2,25	3,3	0,6	7,0
	460 V / 3 ph / 60 Hz	1,3 - 3	2,8	2,25	3,3	0,6	7,0
KUECLQ	380 V / 3 ph / 60 Hz	3,9 - 8	9,1	6	5,5	0,6	7,0
	460 V / 3 ph / 60 Hz	3,9 - 8	7,5	6	5,5	0,6	7,0

(1) The humidifier can be set between the 30 - 100% of the capacity, in steps of 10%. The humidifier mounted in the unit is factory-set to produce about 50% of the maximum value (see the iCOM™ manual).

Infrared humidifier

Main components



A	Solenoid valve flow regulation
B	Infrared quartz lamps
C	Junction block
D	Float switch
E	Standpipe
F	Water supply
G	Manual reset for the thermostat
H	Pan
K	Discharge connection

Operating principle

The quartz lamps [**B**] are mounted above the stainless steel pan [**H**], which is filled with water through the supply inlet [**F**].

The float switch [**D**] detects if the water level is too high.

When humidification is required, the lamps are switched on and infrared rays generate steam within seconds (without impurities or odor).

The lamps never come in contact with the water.

Technical data

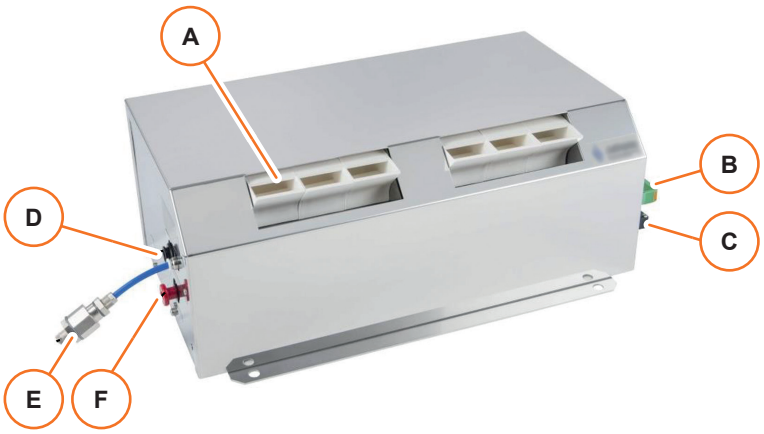
Infrared humidifier technical data

Size	Main power Supply	Pan	Capacity	Absorbed Current	Power
	[V ± 10%]	Material	[kg/h]	[A]	[kW]
Small	400 V / 3 ph / 50 Hz	Stainless steel	5,0	6,4	4,4
	380 V / 3 ph / 60 Hz	Stainless steel	5,0	6,9	4,5
	460 V / 3 ph / 60 Hz	Stainless steel	5,0	6,0	4,8
Big	400 V / 3 ph / 50 Hz	Stainless steel	10,0	13,9	9,6
	380 V / 3 ph / 60 Hz	Stainless steel	10,0	14,3	9,4
	460 V / 3 ph / 60 Hz	Stainless steel	10,0	12,0	9,6

Ultrasonic Humidifier

NOTE *This type of humidifier is available only for units with Downflow air distribution.*

Main components



A	Mist outlet
B	Input and output for control signals
C	Input for power supply
D	Water overflow push-in connection Ø 12 mm
E	Demineralized water inlet screwed connection for Ø 6/4 mm
F	Water drainage push-in connection Ø 12 mm

Operating principle

Piezoceramic transducers are attached to the bottom of a tank filled with water.

The transducers produce ultrasonic vibrations that create capillary waves on the water surface, developing a water mist.

The air flow produced by a fan diffuses the aerosol in the ambient air.

The humidifier consists of nebulization modules, valve for the control of the supply water, float switch and a case that houses the fan.

The humidifier is provided with the following protective functions:

Dry-running	If the water level falls below minimum, humidification switch-es off automatically.
Overheating	Humidification switches off at water temperatures > 60°C.
Overflow	If the water tank is overfilled, the excess water is drained off to the outside.

Technical data

Ultrasonic humidifier technical data

Model	Main power Supply(1)	Capacity(2)	Transformer	Power Consumption	Absorbed Current	Number of Transducers
	[V ± 10%]	[kg/h]	[VA]	[W]	[A]	-
RB/P-16	400 V / 1 ph / 50 Hz	0 - 8,0	800,0	530,0	11,0	16

(1) The unit is equipped with an internal transformer to provide the 48 V_{AC} at the humidifier.

(2) The humidification capacity is modulated by the control based on the request.

NOTE *The ultrasonic humidifier has its own internal microprocessor, the main unit provides a 0 – 10 V_{DC} signal to regulate the capacity.*

4.5 Electric System

4.5.1 Electric panel

The electrical panel, located at the front of the unit in a compartment isolated from the airflow, contains the MCB's, contactors, transformers, controller, overload relays etc. Each high voltage system component is provided with an MCB over-current protective device. All high voltage components are touch protected by means of a protective cover.

The electrical panel complies with the IEC norm EN60204-1.

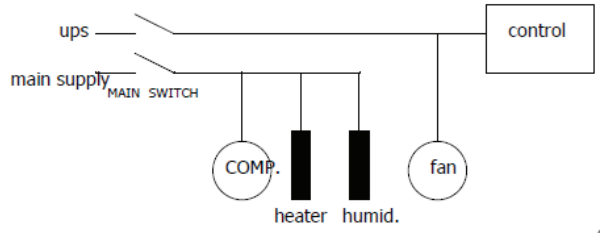
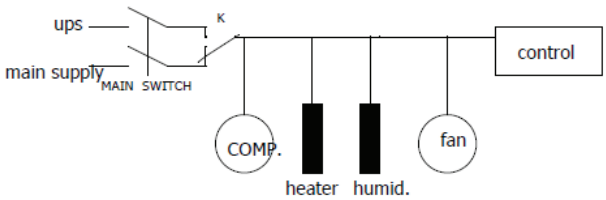
4.5.2 Standard or dual power supply

The unit may be delivered with standard power supply or optional dual power supply in order to have the units up and running if the main power supply fails.

The following table explains the main options.

Make reference to the *Electric Diagrams* for details about your unit power supply system.

See *6. Technical Data* for the power supply relevant data and limits (voltage, frequency, ...).

Option	Description	What happens in case of power failure	What happens when power is restored
Standard power supply	Single supply line	An Ultracap device supplies power to the control for about 60 seconds. The control immediately closes the EEV, so to avoid leakage between high and low pressure pipelines.	The unit restarts automatically. The control system reboots if the down time is more than 60 seconds.
Dual power supply parallel	Double power supply to the same disconnecting switch 	A UPS is connected to the main power supply. **NOTE** *The UPS is not part of the unit.* In addition to the Ultracap(s), the UPS supplies power to the control and the fans. Heating, humidifier and compressors are disabled.	If the Ultracap and UPS have avoided power interruption to the control, then the unit restarts with a "fast startup", which means it restarts from the status before the power failure. Otherwise the unit restarts automatically from scratch and the control system reboots.
Dual power supply alternate	Double power supply to the ATS electric panel, which is connected to the main electric panel Each power supply can supply completely the unit. 	In case of failure of the main supply, the ATS (Automatic Transfer Switch) automatically switches to the second power supply. If the Ultracap avoids power interruption to the control for the time needed for the switching, then the unit restarts with a "fast startup", which means it restarts from the status before the power failure. Otherwise the unit restarts automatically from scratch and the control system reboots. **NOTE** *The Ultracap supplies power to the control for about 60 seconds.* **NOTE** *Depending on the electric system configuration, the unit may be set to remain switched off for a certain time.*	The ATS remains on the second power supply until the main power supply is restored.

4.6 Control System

4.6.1 Control system and display

ON/OFF switch and indication	An ON/OFF switch (placed in the internal electrical panel) allows to turn ON-OFF the unit in case the display is not available. A LED provides visual indication of the unit ON/OFF status.
Microprocessor features	The unit control system is microprocessor based. Terminals are provided for remote start/stop control plus Volt-free 'Common Alarm', 'Common Warning'. Microprocessor features for single circuit units: - up to 6 configurable digital inputs (for instance condensate pump alarm, heater alarm, fire alarm, water alarm, no power, etc..) - 1 digital input for remote ON/OFF - 2 digital outputs to report general warning and general alarm - 1 Ethernet port Microprocessor features for double circuit units: - Up to 8 configurable digital inputs (for instance condensate pump alarm, heater alarm, fire alarm, water alarm, no power, etc..) - 1 digital input for remote ON/OFF - 2 digital outputs to report general warning and general alarm - 1 Ethernet port
Programming devices	The microprocessor can be programmed by one of the following devices: - 7-inch, high definition (resolution 800x480 pixel), color resistive touchscreen display. Power supply = 24 V_{DC}. - 10-inch, high definition (resolution 1280x800 pixel), widescreen, multitouch projected capacitive touchscreen display. Power supply = 24V_{DC}. - Small semi-graphic LCD display - External PC/Laptop **NOTE** *All the display functions can also be replicated in a web browser.*
Menu-driven control	The system displays user menus for active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in percentage of each function, date and time), various sensors and display setup. A password is required to make system changes. Service menus include setpoints, standby settings, total run hours, timers/sleep mode, alarm setup, sensor calibration, options setup, system/network setup, auxiliary boards and service control mode.
Main control functions	The unit control provides the following functions: - unit to unit Ethernet connection to operate with multiple units - run/stand-by rotation - automatic changeover and parameter sharing functions - external communications through BMS or service remote monitoring solution - sequential auto restart timer, with adjustable time delays to be applied to unit restart after a power loss

Warnings / alarms	More than 240 types of warnings / alarms / messages are displayed including: - high temperature - low temperature - high relative humidity - low relative humidity - compressor failure - fan failure - electrical heater high temperature - sensor failure
Sensors	Each unit has one factory mounted supply temperature sensor and one return temperature and humidity sensor. The control as standard allows to manage: - a return temperature and humidity sensor - a supply temperature sensor - up to 10 remote temperature and humidity sensors - up to 3 room temperature and humidity reference sensors When multiple remote sensors are installed, the user can choose the minimum, maximum or average value. This value will be used by the control for managing the unit. The user can also choose the redundancy option, in this case the control will consider the value of the first sensor only; the second sensor will be used only if the first one is broken or missing. The same rule will be applied for succeeding redundant sensors. The cooling capacity and fan speed can be controlled from multiple different sensor selections. In case of sensor failure, the unit automatically adapts and switch to a different preset emergency control mode.
PID settings	The control has auto adaptive algorithms known as PIDs. The user can adjust the set points of the main PIDs (like air temperature and humidity control). Specific PIDs settings can be adjusted by the Service Personnel during commissioning. Cooling capacity and fan speed PIDs can be decoupled, if needed.
Temperature control mode	The temperature control mode defines from which sensor the cooling capacity will be driven. The following options are available: - return - supply - remote
Fan speed control mode	The fan speed control mode defines how airflow will be controlled. The following options are available: - return sensor - remote sensor - delta t between return temperature and supply temperature - static pressure - fixed speed
Humidity control mode	The humidity control mode defines from which sensor humidification and dehumidification will be driven. The following options are available: - return - remote
Humidity Control Type	The following options are available: - relative - relative compensated - absolute - dew point

4.6.2 Teamwork

U2U (unit to unit) communication between multiple units via Ethernet network (up to 32 units) allows for advanced control functionality (teamwork modes, sharing sensor data, standby rotation, lead-lag, cascade operation and rotating master function).

A master (the lowest U2U_ID in a network after the first start) controls duty, standby and rotation, calculates the system values and sends them to the other units in the system.

The master holds the selected number of units and starts/stops the units in order to have the requested number of units working.

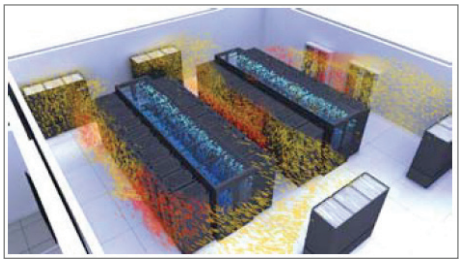
When the master gets disconnected from the network, another unit (the unit with the lowest U2U_ID in the remaining network) will automatically become the master.

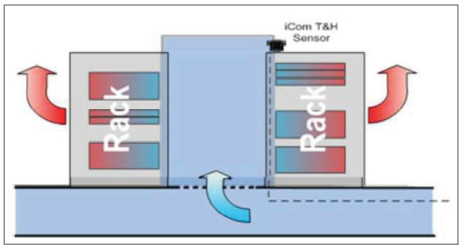
This feature avoids system reset when the master disappears or when it becomes again available in the system.

The following teamwork modes are available:

Teamwork mode 1 (Parallel)	All units use a system temperature PI value for heating/cooling control and a system humidity PI value for humidification/dehumidification. In this teamwork mode, all relevant control parameters are shared. The call for cooling is based on the average readings of all connected units.
Teamwork Mode 2 (Independent)	This teamwork mode prevents units from performing conflicting operations. For example: units are not allowed to heat if other units are cooling and vice versa, and units are not allowed to humidify if other units are dehumidifying and vice versa. The call for cooling is based on the average readings of all connected units.
Teamwork Mode 3 (Smart Aisle)	All units use a system temperature PI value for managing the fan speed; and their local sensors for driving the cooling. In this teamwork mode, all relevant control parameters are shared; if a value is changed in any of the units, all other units will follow with the same changed setting. The call for fan is based on the average or maximum readings of all connected units. **Note:** *this teamwork mode can be set only if the smart aisle option has been enabled and remote sensors are ordered.*

4.6.3 Smart Aisle™





Smart Aisle™ Solution - When smart means efficient

To drastically reduce the energy consumption, and thus truly optimize the investment in the installation, Vertiv™ offers the solution that will exactly adjust the cooling capacity to the needs of the servers.

This solution includes the separation of the cold and hot zone through a cold aisle, or hot aisle, containment. This allows the cooling units to operate with higher air temperature therefore increasing both capacity and efficiency.

The solution is designed to have the latest cooling unit (compressor modulating technology, EC fan, Electronic Expansion Valve) with the best control for the Data Center application and well optimized distribution of the air and of the temperatures.

Vertiv™ cold aisle containment solution can achieve an energy saving of up to 65% higher than other manufacturers cooling units with standard technology.

The control algorithm developed for Smart Aisle™ applications drives the compressor(s) based on the supply temperature, while the airflow will be driven based upon the patented control method on the remote temperature and humidity sensors installed on the calibrated holes of the Smart Aisle™.

This allows equalizing the pressures inside and outside the closed aisle and therefore matching exactly the airflow required by the servers. This means higher availability for the servers equipment that will be working with the right airflow and the right temperature, and minimum power consumption as the unit will not waste any single watt on not needed cooling.

The **Liebert® PDX** for Smart Aisle™ applications comes with return and supply sensors, remote sensors, a damper to aeraulically insulate the units not working and a button to force the unit on full cooling for emergency situations.

5. Technical Data

Content of this chapter

5.1 Performances

Liebert® PDX performances are linked to room conditions, cooling system, airflow.

The unit fitted with Variable Speed Cooling System and High Power EC Fan Module can also modulate cooling capacity and airflow depending on the cooling needs. Therefore each single model can provide a wide range of capacity depending on the environment it is applied in.

Below is a description of the most common conditions currently used in Data Center applications. This can help giving a picture on unit performances.

Liebert® PDX is an extremely flexible unit able to adapt to different sites needs.

Vertiv sales force has a selection tool able to provide the unit performances at the different conditions required.

Working point

Return air conditions

Temperature	Humidity
30°C	35%
37°C	24%

Refrigerant: R410A

Power supply: 400V / 3ph / 50 Hz + N

ESP: 30 Pa for Downflow Up, Downflow Down and Upflow, 0 Pa for Downflow frontal

Fan type: High power EC fan

Condensation temperature: 45°C

			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Single	Single	Single	Single
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Down Flow up	Nominal air flow	4053	5022	6192	7080	8113	11022	12651	13100	13100
	Total gross cooling capacity	16,2	20,4	25,4	29,1	33,80	45	51,9	64	64
	Sensible gross cooling capacity	16,2	20,4	25,4	29,1	33,80	45	51,9	64	64
	SHR	1	1	1	1	1	1	1	1	1
	Fixed speed compressor power input									
	Fixed speed compressor OA									
	Variable speed compressor power input	3,04	3,81	4,98	6,42	7,52	9,23	11,01	13,34	13,34
	Variable speed compressor OA	5,59	7,21	9,18	11,8	15,13	15,12	18,8	18,9	18,9
	Net sensible cooling capacity	15,8	19,8	24,4	27,7	31,80	43,2	49,3	60,5	60,5
	Fan power input	0,37	0,63	1,03	1,43	1,99	1,82	49,3	3,52	3,52
	Unit power input	3,41	4,44	6,01	7,85	9,51	11,05	13,63	17,18	17,18

			PI047	PI051	PI057	PI075	PI044	PI054	PI062	PI074
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Double	Double	Double	Double
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Down Flow up	Nominal air flow	m3/h	11191	13052	13232	16724	11468	13032	15527	18035
	Total gross cooling capacity	kW	45	53	54,2	69,4	46,8	53,3	63,9	75,4
	Sensible gross cooling capacity	kW	45	53	54,2	69,4	46,8	53,3	63,9	75,4
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW					5,63	5,59	6,63	7,38
	Fixed speed compressor OA	A					11,32	11,29	13,77	14,41
	Variable speed compressor power input	kW	9,23	11	12,55	13,3	2,63	3,72	4,84	6,46
	Variable speed compressor OA	A	15,11	18,78	16,27	21,67	3,88	5,41	8,51	10,76
	Net sensible cooling capacity	kW	43,6	51	51,9	65,3	45,1	51	60,4	70,4
	Fan power input	kW	1,38	2	2,32	4,14	1,7	2,3	3,44	5,08
	Unit power input	kW	10,93	13,32	12,55	17,76	10,28	11,93	15,23	19,24

			PI092	PI068	PI082	PI094	PI104	PI120	PI150	PI165
	Refrigerant circuit	Single/ Double	Double	Double	Double	Double	Double	Double	Double	Double
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Down Flow up	Nominal air flow	m3/h	20532	16844	20618	22718	24868	31060	38604	40147
	Total gross cooling capacity	kW	86,2	66,9	82,7	91,5	100,9	129,5	157	165,3
	Sensible gross cooling capacity	kW	86,2	66,9	82,7	91,5	100,9	129,5	157	165,3
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW	9,67	6,45	11,35	11,29	11,23	14,92	19,36	21,92
	Fixed speed compressor OA	A	18,15	13,59	22,72	22,67	22,62	29,01	36,22	42,4
	Variable speed compressor power input	kW	6,22	4,82	3,86	5,44	7,34	10,49	9,99	10
	Variable speed compressor OA	A	9,06	8,47	7,04	9,27	12,43	17,49	16,8	16,8
	Net sensible cooling capacity	kW	80,4	64,7	79,1	87,5	95,3	119,5	146,2	153,4
	Fan power input	kW	5,8	2,25	3,78	4,5	95,3	9,99	10,72	11,92
	Unit power input	kW	22,01	13,84	19,31	21,55	24,53	35,72	40,39	44,16

			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Single	Single	Single	Single
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Upflow	Nominal air flow	m3/h	4024	4991	6205	7095	8724	10899	12390	12662
	Total gross cooling capacity	kW	16,3	20,3	25,4	29,4	34,70	44,9	51,6	59,8
	Sensible gross cooling capacity	kW	16,3	20,3	25,4	29,4	34,70	44,9	51,6	59,8
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW								
	Fixed speed compressor OA	A								
	Variable speed compressor power input	kW	3,05	3,81	4,98	6,42	7,5	9,23	11,01	13,35
	Variable speed compressor OA	A	5,58	7,22	9,18	11,8	15,11	15,12	18,8	21,74
	Net sensible cooling capacity	kW	15,9	19,7	24,4	28	32,20	42,7	48,6	59,8
	Fan power input	kW	0,37	0,6	1,03	1,43	2,48	2,17	3,03	3,51
	Unit power input	kW	3,42	4,41	6,01	7,85	9,98	11,40	14,04	17,18

			PI047	PI051	PI057	PI075	PI044	PI054	PI062	PI074
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Double	Double	Double	Double
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Upflow	Nominal air flow	m3/h	11162	12792	13187	16773	11465	12972	15424	17955
	Total gross cooling capacity	kW	45	51,9	54,1	69,5	46,8	53,2	63,8	75,4
	Sensible gross cooling capacity	kW	45	51,9	54,1	69,5	46,8	53,2	63,8	75,4
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW					5,63	5,59	6,64	7,38
	Fixed speed compressor OA	A					11,32	11,29	13,77	14,41
	Variable speed compressor power input	kW	9,23	11,01	9,91	13,3	2,63	3,72	4,84	6,46
	Variable speed compressor OA	A	15,11	18,78	16,27	21,67	3,88	5,41	8,51	10,76
	Net sensible cooling capacity	kW	43,5	49,9	51,7	65,5	45	50,8	60,1	70
	Fan power input	kW	1,44	1,98	2,4	4,02	1,76	2,38	3,66	5,36
	Unit power input	kW	10,99	13,31	12,63	17,64	10,34	12,01	15,46	19,52

			PI092	PI068	PI082	PI094	PI104	PI120	PI150	PI165
	Refrigerant circuit	Single/ Double	Double	Double	Double	Double	Double	Double	Double	Double
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Upflow	Nominal air flow	m3/h	20519	16756	20563	22596	24682	30337	_	_
	Total gross cooling capacity	kW	86,2	66,8	82,7	91,4	100,7	128,7	_	_
	Sensible gross cooling capacity	kW	86,2	66,8	82,7	91,4	100,7	128,7	_	_
	SHR	---	1	1	1	1	1	1	_	_
	Fixed speed compressor power input	kW	9,67	6,46	11,35	11,3	11,24	14,93	_	_
	Fixed speed compressor OA	A	18,15	13,59	22,72	22,67	22,62	29,01	_	_
	Variable speed compressor power input	kW	6,22	4,83	3,86	5,45	7,34	10,5	_	_
	Variable speed compressor OA	A	10,41	8,48	7,04	9,27	12,43	17,49	_	_
	Net sensible cooling capacity	kW	80,1	64,5	78,9	86,8	94,9	118,8	_	_
	Fan power input	kW	6,12	2,34	3,78	4,8	5,82	9,9	_	_
	Unit power input	kW	22,33	13,95	19,31	21,87	24,72	35,65	_	_

			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Single	Single	Single	Single
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Down Flow Frontal	Nominal air flow	m3/h	4065	5020	6205	7109	8147	10981	12534	13343
	Total gross cooling capacity	kW	16,2	20,4	25,4	29,2	33,80	45	51,8	64,4
	Sensible gross cooling capacity	kW	16,2	20,4	25,4	29,2	33,80	45	51,8	64,4
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW								
	Fixed speed compressor OA	A								
	Variable speed compressor power input	kW	3,04	3,81	4,98	6,42	7,52	9,23	11,01	13,34
	Variable speed compressor OA	A	5,58	7,21	9,18	11,8	15,13	15,12	18,8	21,73
	Net sensible cooling capacity	kW	15,8	19,8	24,5	27,8	31,9	43	48,9	60,8
	Fan power input	kW	0,33	0,54	0,94	1,37	1,91	1,95	2,85	3,53
	Unit power input	kW	3,37	3,81	5,92	7,79	9,43	11,18	13,86	17,19

			PI047	PI051	PI057	PI075	PI044	PI054	PI062	PI074
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Double	Double	Double	Double
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Down Flow Frontal	Nominal air flow	m3/h	11201	13128	12750	16829	11799	13149	15466	18058
	Total gross cooling capacity	kW	45	53,1	51,9	69,6	47,8	53,4	63,8	75,4
	Sensible gross cooling capacity	kW	45	53,1	51,9	69,6	47,8	53,4	63,8	75,4
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW					5,58	5,59	6,64	7,38
	Fixed speed compressor OA	A					11,28	11,28	13,77	14,41
	Variable speed compressor power input	kW	9,23	11	9,98	13,3	2,63	3,71	4,84	6,46
	Variable speed compressor OA	A	15,11	18,78	16,33	21,67	3,87	5,41	8,51	10,76
	Net sensible cooling capacity	kW	43,8	51,3	50	65,7	46,2	51,3	60,6	70,6
	Fan power input	kW	1,22	1,78	1,9	3,9	1,58	2,08	3,22	4,8
	Unit power input	kW	10,77	13,1	12,2	17,52	10,11	11,41	15,02	18,67

			PI092	PI068	PI082	PI094	PI104	PI120	PI150	PI165
	Refrigerant circuit	Single/ Double	Double	Double	Double	Double	Double	Double	Double	Double
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Down Flow Frontal	Nominal air flow	m3/h	20719	_	_	_	_	_	_	_
	Total gross cooling capacity	kW	86,5	_	_	_	_	_	_	_
	Sensible gross cooling capacity	kW	86,5	_	_	_	_	_	_	_
	SHR	---	1	_	_	_	_	_	_	_
	Fixed speed compressor power input	kW	9,67	_	_	_	_	_	_	_
	Fixed speed compressor OA	A	18,15	_	_	_	_	_	_	_
	Variable speed compressor power input	kW	6,22	_	_	_	_	_	_	_
	Variable speed compressor OA	A	10,41	_	_	_	_	_	_	_
	Net sensible cooling capacity	kW	81	_	_	_	_	_	_	_
	Fan power input	kW	5,5	_	_	_	_	_	_	_
	Unit power input	kW	21,71	-	_	-	_	-	_	-

			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Single	Single	Single	Single
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Down Flow Down	Nominal air flow	m3/h	_	_	_	_	_	11271	12608	14432
	Total gross cooling capacity	kW	_	_	_	_	_	46	51,8	65,8
	Sensible gross cooling capacity	kW	_	_	_	_	_	46	51,8	65,8
	SHR	---	_	_	_	_	_	1	1	1
	Fixed speed compressor power input	kW	_	_	_	_	_			
	Fixed speed compressor OA	A	_	_	_	_	_			
	Variable speed compressor power input	kW	_	_	_	_	_	9,22	11,01	13,33
	Variable speed compressor OA	A	_	_	_	_	_	15,1	18,8	21,72
	Net sensible cooling capacity	kW	_	_	_	_	_	44,1	49,3	62,3
	Fan power input	kW	_	_	_	_	_	1,89	2,54	3,54
	Unit power input	kW	-	_	-	_	-	11,11	13,55	17,19

	Refrigerant circuit	Single/ Double	PI047 Single	PI051 Single	PI057 Single	PI075 Single	PI044 Double	PI054 Double	PI062 Double	PI074 Double
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Down Flow Down	Nominal air flow	m3/h	11252	13319	13417	16829	11844	13084	15581	18235
	Total gross cooling capacity	kW	45,1	53,3	51,9	69,6	47,8	53,3	64	75,7
	Sensible gross cooling capacity	kW	45,1	53,3	51,9	69,6	47,8	53,3	64	75,7
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW					5,58	5,59	6,63	7,37
	Fixed speed compressor OA	A					11,28	11,28	13,77	14,4
	Variable speed compressor power input	kW	9,23	11	9,9	13,3	2,63	3,71	4,84	6,46
	Variable speed compressor OA	A	15,11	18,78	16,26	21,67	3,87	5,41	8,5	10,76
	Net sensible cooling capacity	kW	43,8	51,5	52,3	66	46,2	51,2	60,9	71,2
	Fan power input	kW	1,22	1,76	2,06	3,58	1,6	2,12	3,04	4,44
	Unit power input	kW	10,77	13,08	12,28	17,2	10,13	11,45	14,83	18,59

	Refrigerant circuit	Single/ Double	PI092 Double	PI068 Double	PI082 Double	PI094 Double	PI104 Double	PI120 Double	PI150 Double	PI165 Double
Air conditions 30°C/35% RH, compressor modulation 80% - supply 18°C										
Down Flow Down	Nominal air flow	m3/h	21088	16869	20858	22833	25073	31725	38784	40396
	Total gross cooling capacity	kW	86,8	67	83	91,6	101	130,2	157,2	165,5
	Sensible gross cooling capacity	kW	86,8	67	83	91,6	101	130,2	157,2	165,5
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW	9,66	6,45	11,35	11,29	11,23	14,92	19,36	21,91
	Fixed speed compressor OA	A	18,14	13,59	22,72	22,67	22,62	29,01	36,31	42,4
	Variable speed compressor power input	kW	6,22	4,82	3,85	5,44	7,34	1048	9,99	10
	Variable speed compressor OA	A	10,41	8,47	7,03	9,27	12,43	17,49	16,8	16,8
	Net sensible cooling capacity	kW	82,1	64,9	79,7	87,6	95,9	120,7	148	155,2
	Fan power input	kW	4,7	13,66	3,27	4,05	24,08	9,42	9,24	10,28
	Unit power input	kW	20,9	2,07	18,79	21,1	5,19	35,12	38,91	42,51

			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Single	Single	Single	Single
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Down Flow Up	Nominal air flow	m3/h	3727	4673	5741	6594	7602	10342	11739	13139
	Total gross cooling capacity	kW	18,2	23	28,6	32,7	38,00	50,8	58,3	73,4
	Sensible gross cooling capacity	kW	18,2	23	28,6	32,7	38,00	50,8	58,3	73,4
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW								
	Fixed speed compressor OA	A								
	Variable speed compressor power input	kW	2,93	3,75	4,88	6,41	7,41	9,14	10,96	13,26
	Variable speed compressor OA	A	5,36	7,1	8,99	11,77	14,94	14,99	18,72	21,6
	Net sensible cooling capacity	kW	17,9	22,5	27,7	31,5	36,30	49,3	56,2	69,8
	Fan power input	kW	0,32	0,52	0,84	1,19	1,69	1,55	2,12	3,52
	Unit power input	kW	3,25	4,27	5,72	7,60	9,10	10,69	13,08	17,10

			PI047	PI051	PI057	PI075	PI044	PI054	PI062	PI074
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Double	Double	Double	Double
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Down Flow Up	Nominal air flow	m3/h	10365	12146	12415	15723	10789	12216	14611	17126
	Total gross cooling capacity	kW	50,6	59,7	61,4	78,6	53,3	60,7	72,8	86
	Sensible gross cooling capacity	kW	50,6	59,7	61,4	78,6	53,3	60,7	72,8	86
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW					5,38	5,31	6,34	7,04
	Fixed speed compressor OA	A					11,10	11,04	13,49	14,02
	Variable speed compressor power input	kW	9,14	10,95	9,65	13,19	2,53	3,6	4,72	6,38
	Variable speed compressor OA	A	14,99	18,7	16,02	21,47	3,75	5,26	8,29	10,72
	Net sensible cooling capacity	kW	49,5	58	59,5	75,1	51,8	58,7	69,8	81,6
	Fan power input	kW	1,18	1,66	1,96	3,46	1,46	1,94	2,96	4,44
	Unit power input	kW	10,64	12,93	11,93	16,97	9,69	11,17	14,34	18,18

			PI092	PI068	PI082	PI094	PI104	PI120	PI150	PI165
	Refrigerant circuit	Single/ Double	Double	Double	Double	Double	Double	Double	Double	Double
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Down Flow Up	Nominal air flow	m3/h	19491	15845	19415	21313	23457	29510	35852	37826
	Total gross cooling capacity	kW	98,2	76,7	94,3	104,4	115	147,3	177,6	187,4
	Sensible gross cooling capacity	kW	98,2	76,7	94,3	104,4	115	147,3	1776	187,4
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW	9,37	6,05	10,9	10,8	10,7	14,35	18,81	21,41
	Fixed speed compressor OA	A	17,88	13,24	22,23	22,24	22,16	28,34	35,82	41,88
	Variable speed compressor power input	kW	6,1	4,7	3,73	5,33	7,15	10,37	9,83	9,83
	Variable speed compressor OA	A	10,66	8,25	6,8	9,18	12,25	17,36	16,55	16,55
	Net sensible cooling capacity	kW	93,1	74,7	91,3	100,5	110,2	138,5	169	177,4
	Fan power input	kW	5,08	1,95	3,09	3,84	4,86	8,82	8,64	10
	Unit power input	kW	20,89	13,02	18,04	20,29	23,03	33,86	37,60	41,57

			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Single	Single	Single	Single
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Upflow	Nominal air flow	m3/h	3738	4639	5753	6585	7573	10226	11645	12702
	Total gross cooling capacity	kW	18,3	22,9	28,6	32,9	38,20	50,7	58,2	72,5
	Sensible gross cooling capacity	kW	18,3	22,9	28,6	32,9	38,20	50,7	58,2	72,5
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW								
	Fixed speed compressor OA	A								
	Variable speed compressor power input	kW	2,93	3,75	4,88	6,41	7,41	9,14	10,96	13,27
	Variable speed compressor OA	A	5,36	7,11	8,99	11,77	14,94	15	18,72	21,62
	Net sensible cooling capacity	kW	18	22,4	27,7	31,7	36,60	48,8	55,6	69
	Fan power input	kW	0,32	0,52	0,84	1,19	1,69	1,87	2,57	3,51
	Unit power input	kW	3,25	4,27	5,72	7,60	9,10	11,01	13,53	17,10

	Refrigerant circuit	Single/ Double	PI047 Single	PI051 Single	PI057 Single	PI075 Single	PI044 Double	PI054 Double	PI062 Double	PI074 Double
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Upflow	Nominal air flow	m3/h	10310	11865	12442	15709	10833	12342	14512	16925
	Total gross cooling capacity	kW	50,6	58,3	61,5	78,6	53,3	60,8	72,6	85,7
	Sensible gross cooling capacity	kW	50,6	58,3	61,5	78,6	53,3	60,8	72,6	85,7
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW					5,37	5,3	6,35	7,05
	Fixed speed compressor OA	A					11,10	11,04	13,5	14,03
	Variable speed compressor power input	kW	9,14	10,96	9,65	13,19	2,53	3,59	4,73	6,38
	Variable speed compressor OA	A	15	18,72	16,02	21,47	3,75	5,26	8,3	10,73
	Net sensible cooling capacity	kW	49,3	56,7	59,4	74,9	51,8	58,7	69,5	81,2
	Fan power input	kW	1,22	1,66	2,1	3,68	1,54	2,1	3,14	4,54
	Unit power input	kW	10,68	12,94	12,07	17,19	9,76	11,31	14,54	18,29

	Refrigerant circuit	Single/ Double	PI092 Double	PI068 Double	PI082 Double	PI094 Double	PI104 Double	PI120 Double	PI150 Double	PI165 Double
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Upflow	Nominal air flow	m3/h	14452	15819	19373	21349	23354	29389	_	_
	Total gross cooling capacity	kW	89,8	76,6	94,3	104,4	114,9	147,1	_	_
	Sensible gross cooling capacity	kW	89,8	76,6	94,3	104,4	114,9	147,1	_	_
	SHR	---	1	1	1	1	1	1	_	_
	Fixed speed compressor power input	kW	9,56	6,05	10,9	10,8	10,7	14,35	_	_
	Fixed speed compressor OA	A	18,05	13,24	22,33	22,24	22,16	28,34	_	_
	Variable speed compressor power input	kW	6,22	4,7	3,73	5,33	7,15	10,37	_	_
	Variable speed compressor OA	A	10,41	8,25	6,8	9,18	12,25	17,37	_	_
	Net sensible cooling capacity	kW	87,3	74,6	91,1	100,4	109,9	138,1	_	_
	Fan power input	kW	2,48	2,01	3,21	3,96	5,01	9,03	_	_
	Unit power input	kW	18,58	13,08	18,16	20,41	23,18	34,07	_	-

			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Single	Single	Single	Single
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Down Flow Frontal	Nominal air flow	m3/h	3740	4660	5794	6624	7635	10292	11719	13139
	Total gross cooling capacity	kW	18,2	23	28,7	32,7	38,10	50,7	58,3	73,4
	Sensible gross cooling capacity	kW	18,2	23	28,7	32,7	38,10	50,7	58,3	73,4
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW								
	Fixed speed compressor OA	A								
	Variable speed compressor power input	kW	2,93	3,75	4,88	6,41	7,41	9,14	10,96	13,26
	Variable speed compressor OA	A	5,36	7,11	8,99	11,77	14,94	14,99	18,72	21,6
	Net sensible cooling capacity	kW	17,9	22,5	27,9	31,6	36,4	49,1	56	69,8
	Fan power input	kW	0,27	0,45	0,77	1,1	1,63	1,62	2,33	3,52
	Unit power input	kW	3,2	4,2	5,65	7,51	9,04	10,76	13,29	17,1

			PI047	PI051	PI057	PI075	PI044	PI054	PI062	PI074
	Refrigerant circuit	Single/ Double	Single	Single	Single	Single	Double	Double	Double	Double
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Down Flow Frontal	Nominal air flow	m3/h	10367	12242	11921	15749	11130	12358	14658	17156
	Total gross cooling capacity	kW	50,6	59,8	58,7	78,6	54,5	60,9	72,8	86,1
	Sensible gross cooling capacity	kW	50,6	59,8	58,7	78,6	54,5	60,9	72,8	86,1
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW					5,30	5,3	6,34	7,04
	Fixed speed compressor OA	A					11,04	11,04	13,49	14,02
	Variable speed compressor power input	kW	9,14	10,94	9,76	13,19	2,53	3,59	4,72	6,38
	Variable speed compressor OA	A	14,99	18,7	16,12	21,47	3,74	5,26	8,51	10,72
	Net sensible cooling capacity	kW	49,7	58,3	57,1	75,4	53,2	59,1	70,1	81,9
	Fan power input	kW	0,98	1,48	1,6	3,26	1,38	1,74	2,78	4,18
	Unit power input	kW	10,44	12,74	11,68	16,77	9,53	10,66	14,16	17,92

	Refrigerant circuit	Single/ Double	PI092	PI068	PI082	PI094	PI104	PI120	PI150	PI165
			Double	Double	Double	Double	Double	Double	Double	Double
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Down Flow Frontal	Nominal air flow	m3/h	19496	_	_	_	_	_	_	_
	Total gross cooling capacity	kW	98,2	_	_	_	_	_	_	_
	Sensible gross cooling capacity	kW	98,2	_	_	_	_	_	_	_
	SHR	---	1	_	_	_	_	_	_	_
	Fixed speed compressor power input	kW	9,37	_	_	_	_	_	_	_
	Fixed speed compressor OA	A	17,88	_	_	_	_	_	_	_
	Variable speed compressor power input	kW	6,12	_	_	_	_	_	_	_
	Variable speed compressor OA	A	10,36	_	_	_	_	_	_	_
	Net sensible cooling capacity	kW	93,1	_	_	_	_	_	_	_
	Fan power input	kW	5,08	_	_	_	_	_	_	_
	Unit power input	kW	20,89	-	_	-	_	-	_	-

	Refrigerant circuit	Single/ Double	PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059
			Single	Single	Single	Single	Single	Single	Single	Single
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Down Flow Down	Nominal air flow	m3/h	_	_	_	_	_	10543	11790	14471
	Total gross cooling capacity	kW	_	_	_	_	_	51,9	58,4	75,6
	Sensible gross cooling capacity	kW	_	_	_	_	_	51,9	58,4	75,6
	SHR	---	_	_	_	_	_	1	1	1
	Fixed speed compressor power input	kW	_	_	_	_	_			
	Fixed speed compressor OA	A	_	_	_	_	_			
	Variable speed compressor power input	kW	_	_	_	_	_	9,12	10,96	13,23
	Variable speed compressor OA	A	_	_	_	_	_	14,97	18,72	21,55
	Net sensible cooling capacity	kW	_	_	_	_	_	50,4	56,3	72,1
	Fan power input	kW	_	_	_	_	_	1,55	2,12	3,54
	Unit power input	kW	-	_	-	_	-	10,67	13,08	17,09

	Refrigerant circuit	Single/ Double	PI047 Single	PI051 Single	PI057 Single	PI075 Single	PI044 Double	PI054 Double	PI062 Double	PI074 Double
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Down Flow Down	Nominal air flow	m3/h	10335	12156	12498	15839	11140	12302	16300	17135
	Total gross cooling capacity	kW	50,6	59,7	61,6	78,7	54,5	60,7	72,8	86
	Sensible gross cooling capacity	kW	50,6	59,7	61,6	78,7	54,5	60,7	72,8	86
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW					5,30	5,3	6,34	7,04
	Fixed speed compressor OA	A					11,03	11,04	13,49	14,02
	Variable speed compressor power input	kW	9,14	10,95	9,65	13,19	2,53	3,6	4,72	6,38
	Variable speed compressor OA	A	15	18,7	16,01	21,46	3,74	5,26	8,29	10,72
	Net sensible cooling capacity	kW	49,6	58,3	59,9	75,7	53,2	59	70,2	82,2
	Fan power input	kW	0,98	1,44	1,7	3,06	1,38	1,76	2,56	3,84
	Unit power input	kW	10,44	12,71	11,67	16,57	9,53	10,98	13,94	17,58

	Refrigerant circuit	Single/ Double	PI092 Double	PI068 Double	PI082 Double	PI094 Double	PI104 Double	PI120 Double	PI150 Double	PI165 Double
Air conditions 37°C/24% RH, compressor modulation 80% - supply 22°C										
Down Flow Down	Nominal air flow	m3/h	19866	15960	19541	21550	23539	29753	36418	38003
	Total gross cooling capacity	kW	98,7	76,9	94,5	104,7	115,2	147,6	178,4	187,7
	Sensible gross cooling capacity	kW	98,7	76,9	94,5	104,7	115,2	147,6	178,4	187,7
	SHR	---	1	1	1	1	1	1	1	1
	Fixed speed compressor power input	kW	9,36	6,05	10,89	10,79	10,69	14,34	18,79	21,42
	Fixed speed compressor OA	A	17,87	13,23	22,32	22,23	22,15	28,33	35,8	41,88
	Variable speed compressor power input	kW	6,12	4,69	3,73	5,33	7,15	10,37	9,89	9,82
	Variable speed compressor OA	A	10,35	8,25	6,8	9,18	12,24	17,36	16,53	16,54
	Net sensible cooling capacity	kW	94,8	75,1	91,7	101,1	110,8	139,8	170	178,8
	Fan power input	kW	3,94	12,83	2,73	3,57	22,57	7,77	7,92	8,88
	Unit power input	kW	19,74	1,77	17,67	20,01	4,41	32,8	36,85	40,44

5.2 Compressor Data

Compressors electrical data for 400 V / 3ph / 50 Hz power supply

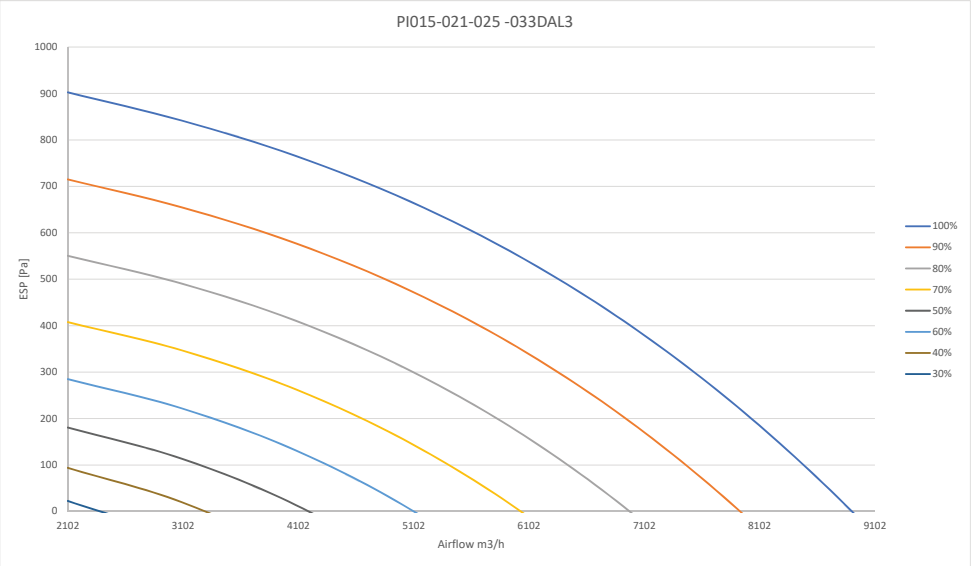
			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059	PI047	PI051
FLA	A	Fixed speed	---	---	---	---	---	---	---	---	---	---
		Variable speed	18	18	24	24	24	40	40	44	40	40
LRA	A	Fixed speed	---	---	---	---	---	---	---	---	---	---
		Variable speed	[-]	[-]	[-]	[-]	[-]	[-]	[-]	[-]	[-]	[-]

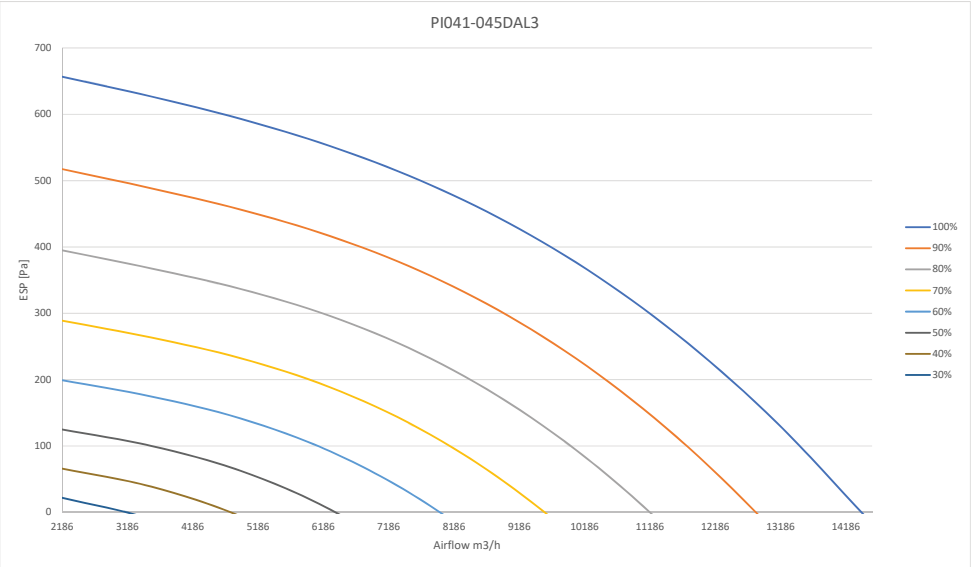
			PI057	PI075	PI044	PI054	PI062	PI074	PI092	PI068	PI082	PI094
FLA	A	Fixed speed	---	---	19	19	22	24	31	22	19+19	19+19
		Variable speed	37,5	44	15,1	18,0	26	31,2	31,2	26	26	31,2
LRA	A	Fixed speed	---	---	98	98	142	142	158	142	98+98	98+98
		Variable speed	[-]	[-]	[-]	[-]	[-]	[-]	[-]	[-]	[-]	[-]

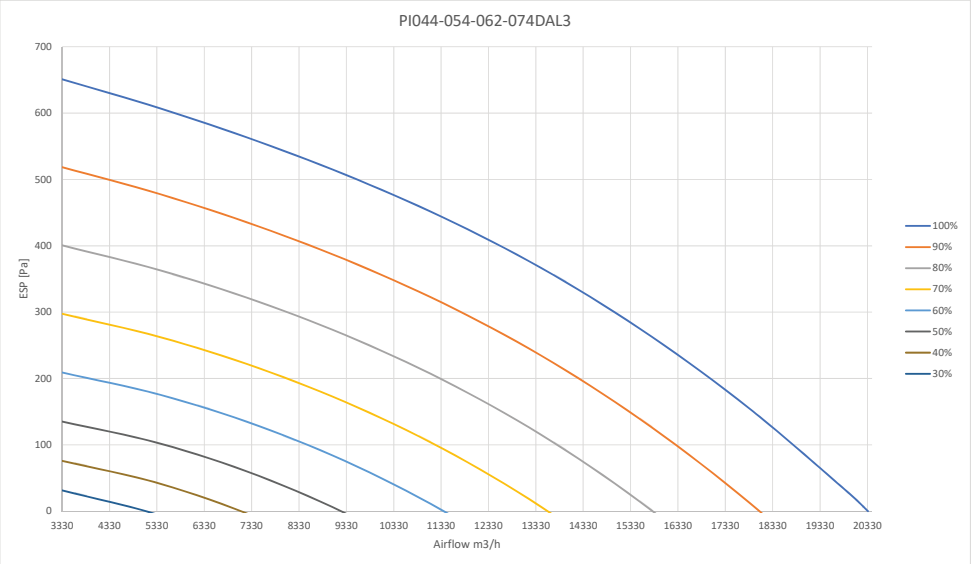
			PI104	PI120	PI150	PI165
FLA	A	Fixed speed	19+19	24+24	31+31	36+36
		Variable speed	37,5	44	44	44
LRA	A	Fixed speed	98+98	142+142	158+158	197+197
		Variable speed	[-]	[-]	[-]	[-]

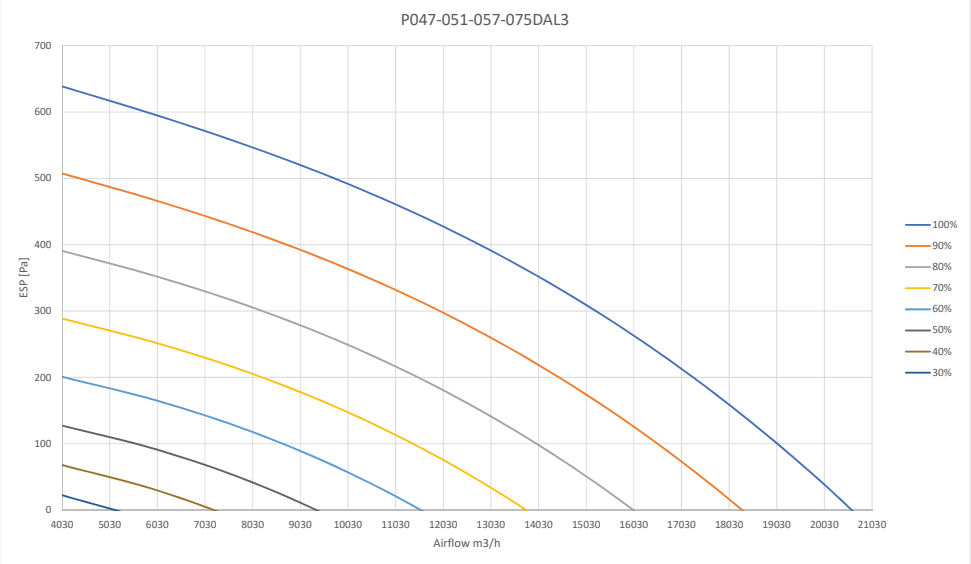
5.3 Fan

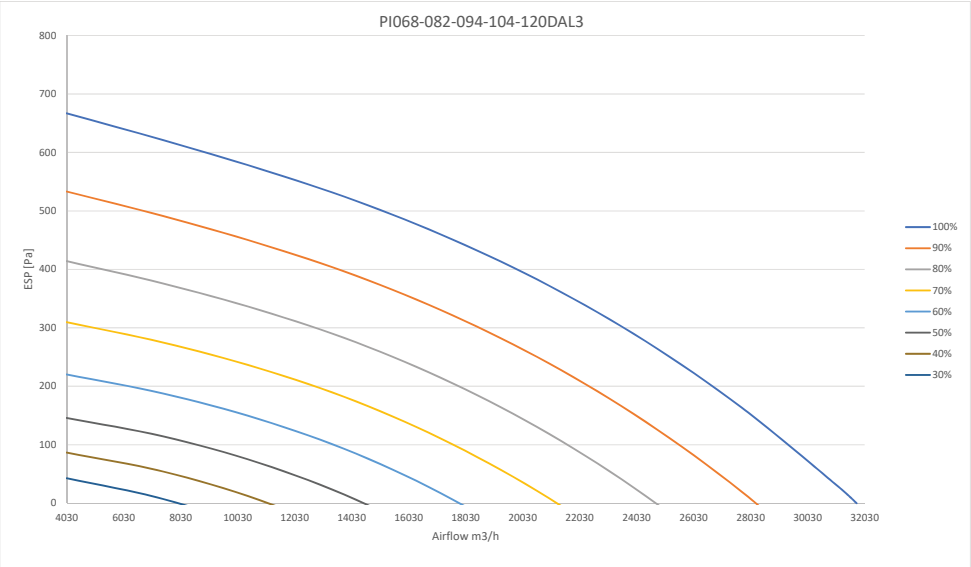
The graphics in this chapter show the fan characteristics for unit equipped with High Power EC Fans (digit 8 = L):

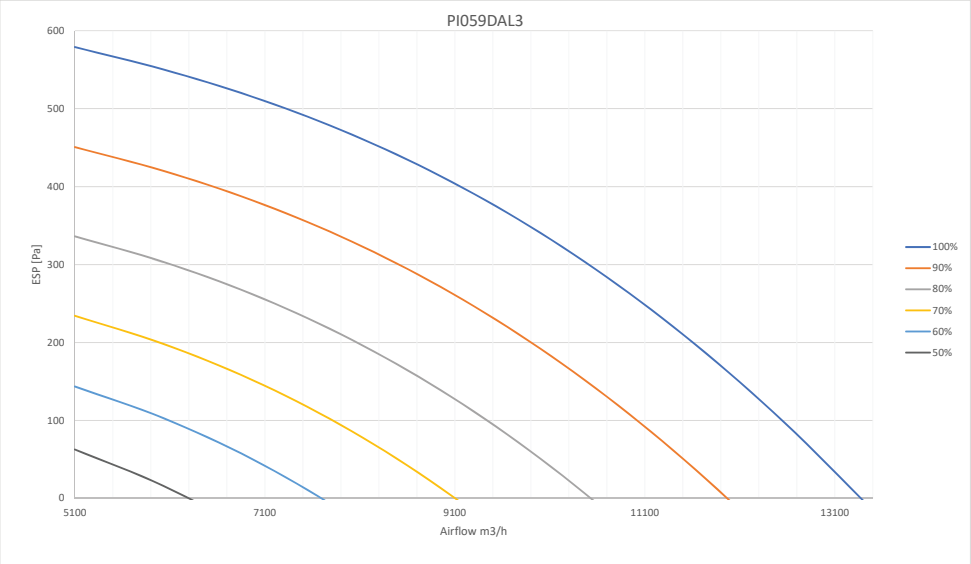


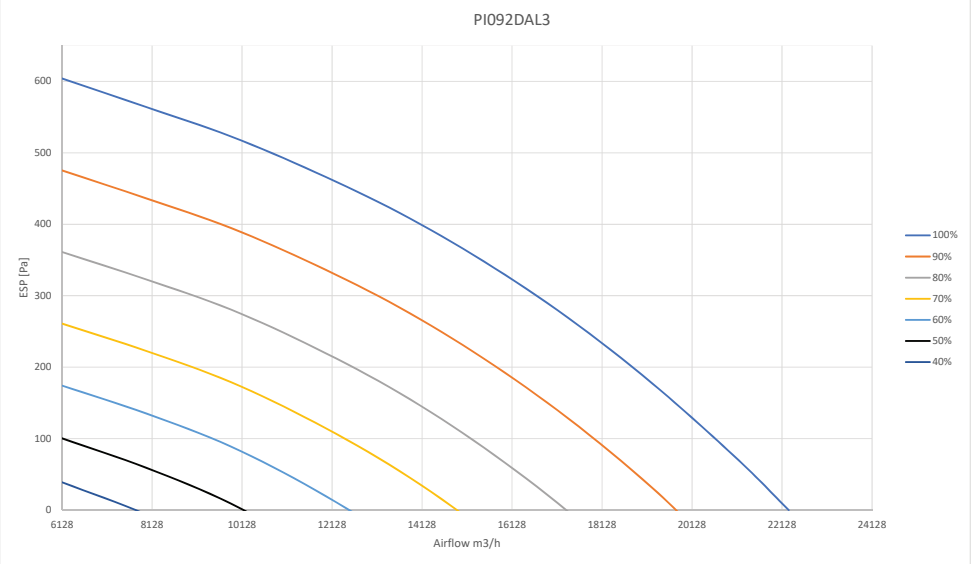

PI041-045DAL3
700
600
500
400
300
200
100
0
ESP [Pa]
2186
3186
4186
5186
6186
7186
8186
9186
10186
11186
12186
13186
14186
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

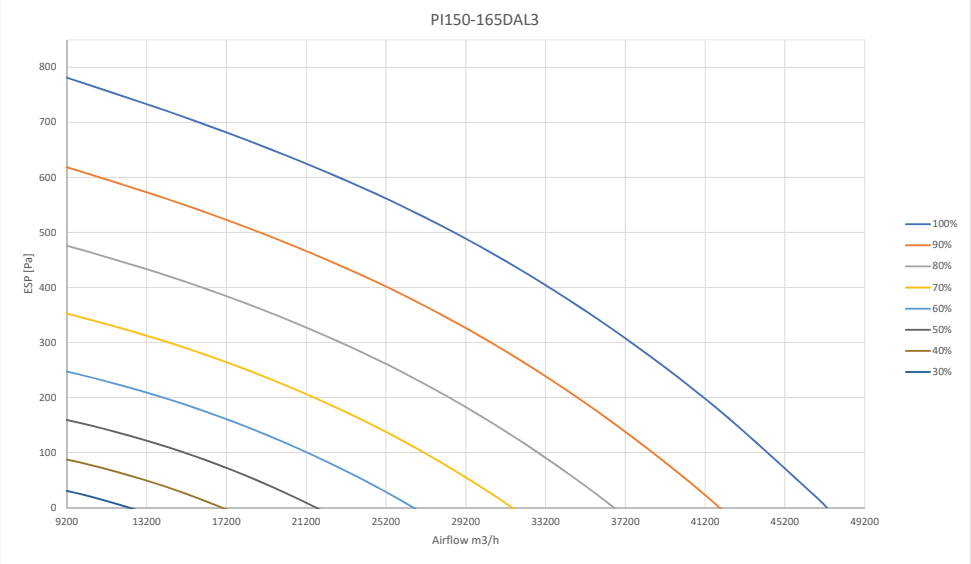

PI044-054-062-074DAL3
700
600
500
400
300
200
100
0
ESP [Pa]
3330
4330
5330
6330
7330
8330
9330
10330
11330
12330
13330
14330
15330
16330
17330
18330
19330
20330
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

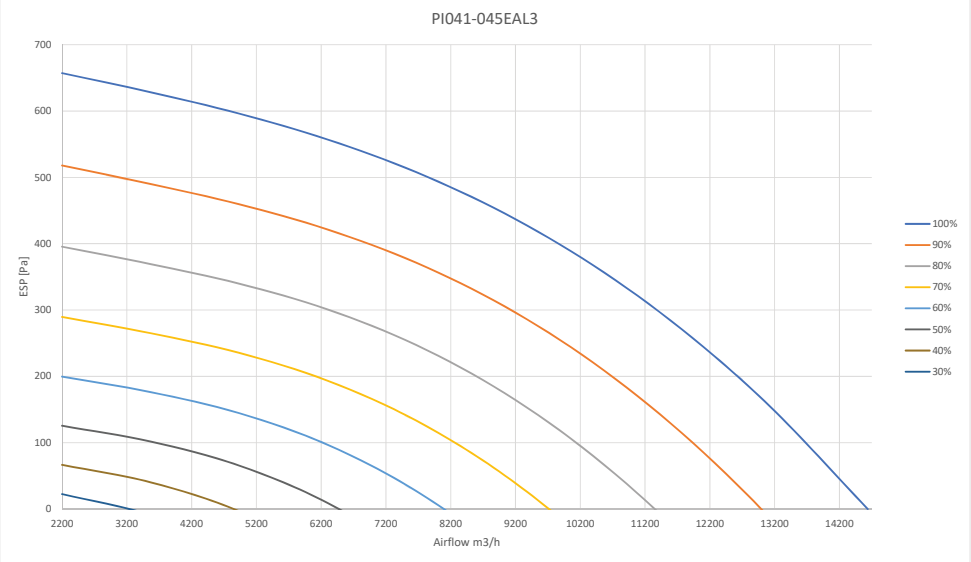

P047-051-057-075DAL3
700
600
500
400
300
200
100
0
ESP [Pa]
4030
5030
6030
7030
8030
9030
10030
11030
12030
13030
14030
15030
16030
17030
18030
19030
20030
21030
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

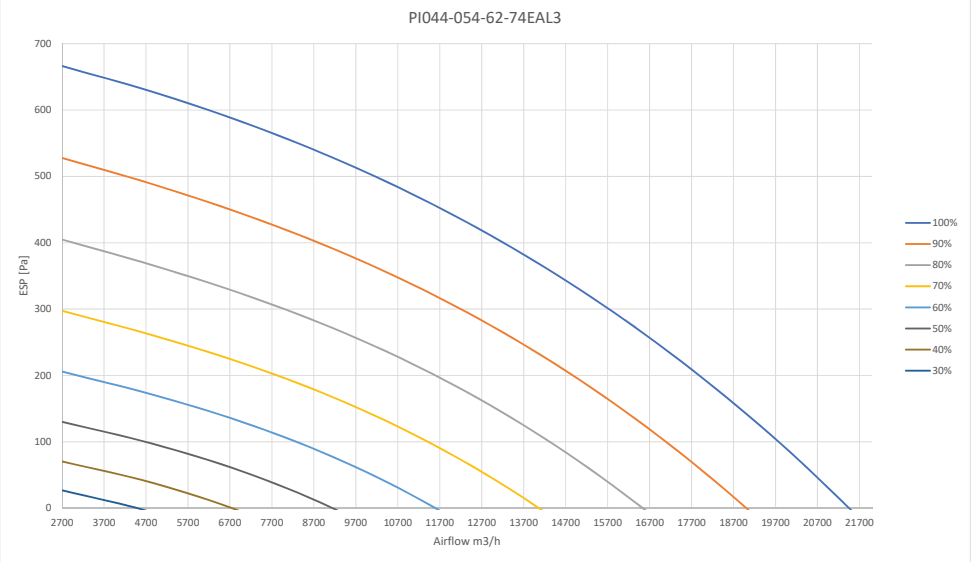

PI068-082-094-104-120DAL3
ESP [Pa]
800
700
600
500
400
300
200
100
0
4030
6030
8030
10030
12030
14030
16030
18030
20030
22030
24030
26030
28030
30030
32030
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

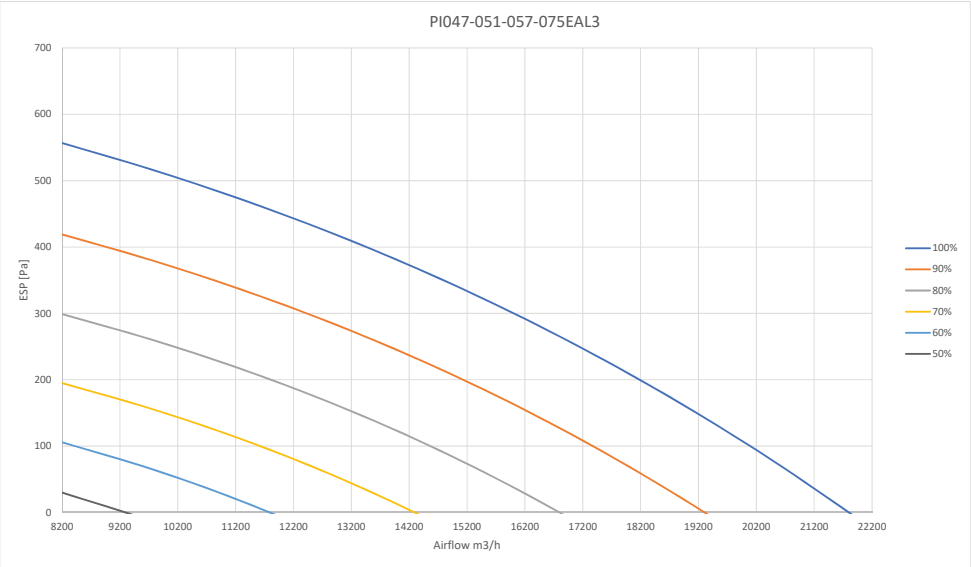

PI059DAL3
ESP [Pa]
600
500
400
300
200
100
0
5100
7100
9100
11100
13100
Airflow m3/h
100%
90%
80%
70%
60%
50%

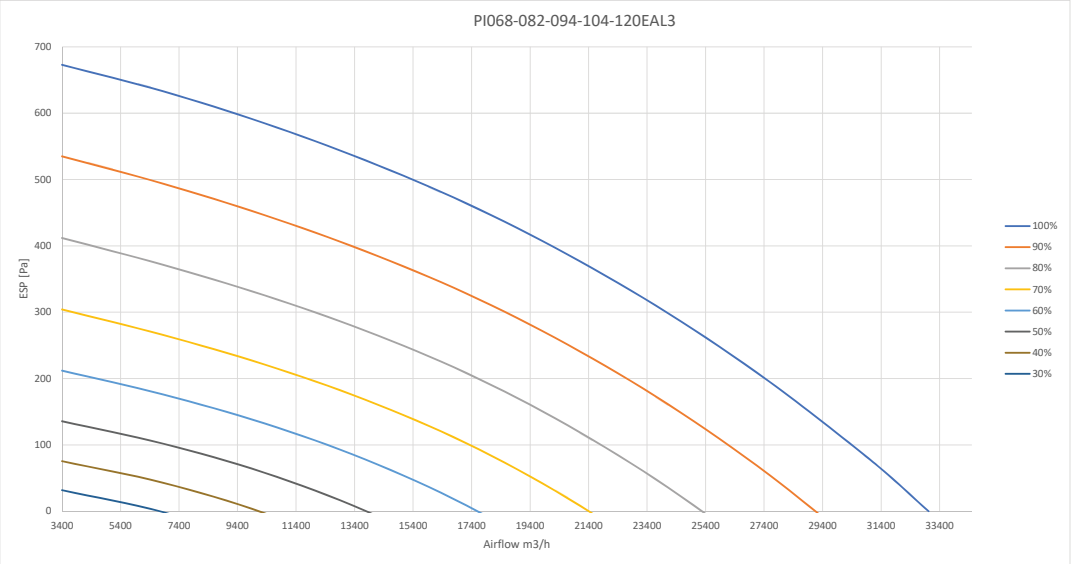

PI092DAL3
ESP [Pa]
600
500
400
300
200
100
0
6128
8128
10128
12128
14128
16128
18128
20128
22128
24128
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%

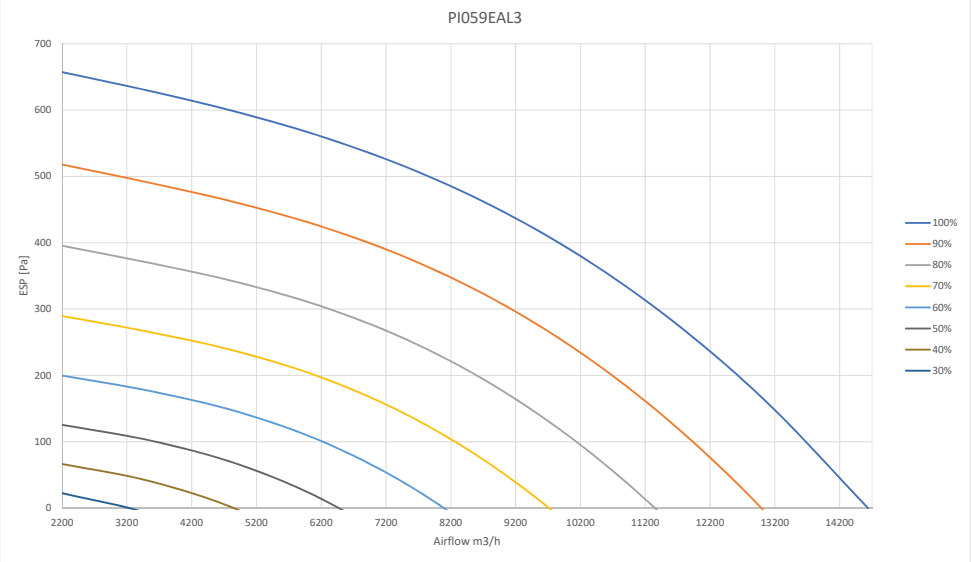

PI150-165DAL3
ESP [Pa]
800
700
600
500
400
300
200
100
0
9200
13200
17200
21200
25200
29200
33200
37200
41200
45200
49200
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

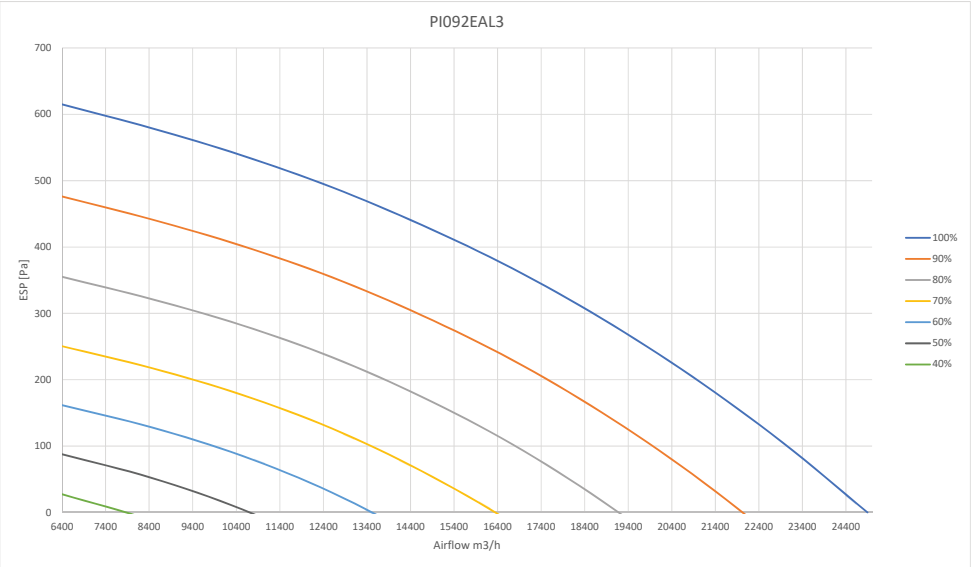

PI041-045EAL3
ESP [Pa]
700
600
500
400
300
200
100
0
2200
3200
4200
5200
6200
7200
8200
9200
10200
11200
12200
13200
14200
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

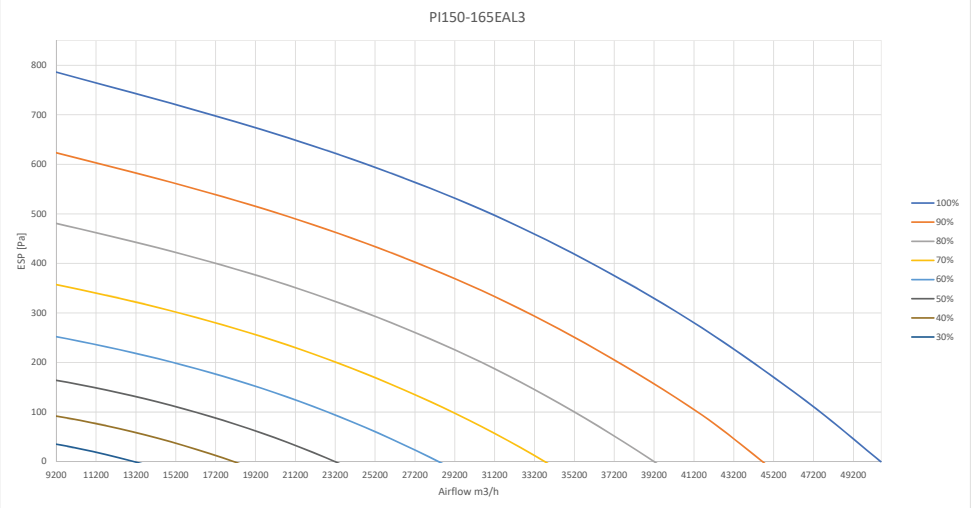

PI044-054-62-74EAL3
ESP [Pa]
700
600
500
400
300
200
100
0
2700
3700
4700
5700
6700
7700
8700
9700
10700
11700
12700
13700
14700
15700
16700
17700
18700
19700
20700
21700
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

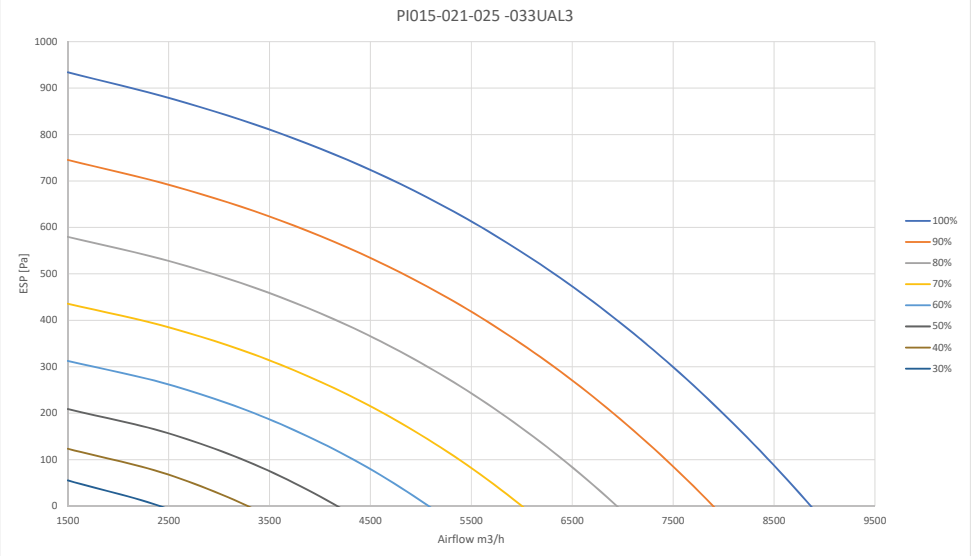

PI047-051-057-075EAL3
ESP [Pa]
Airflow m3/h
100%
90%
80%
70%
60%
50%

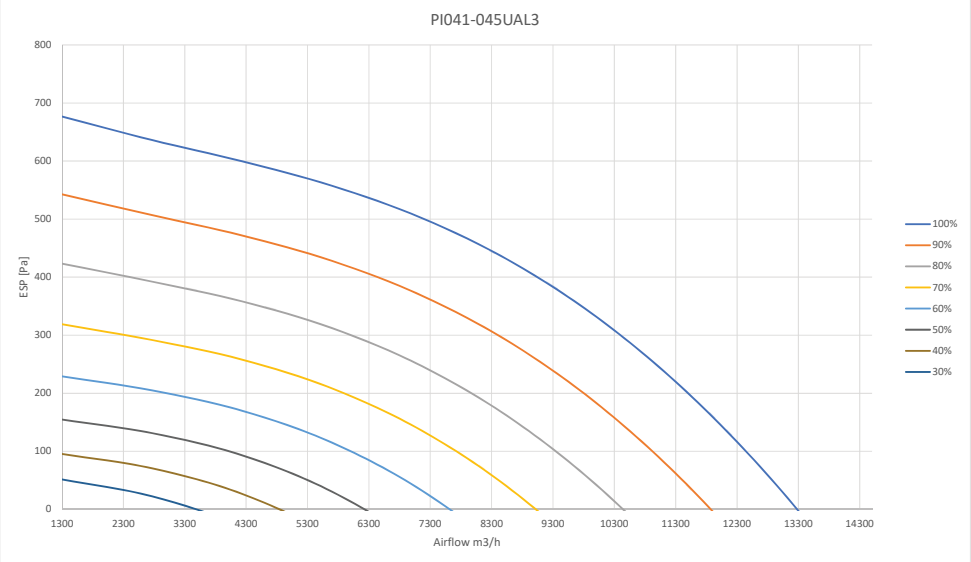

PI068-082-094-104-120EAL3
ESP [Pa]
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

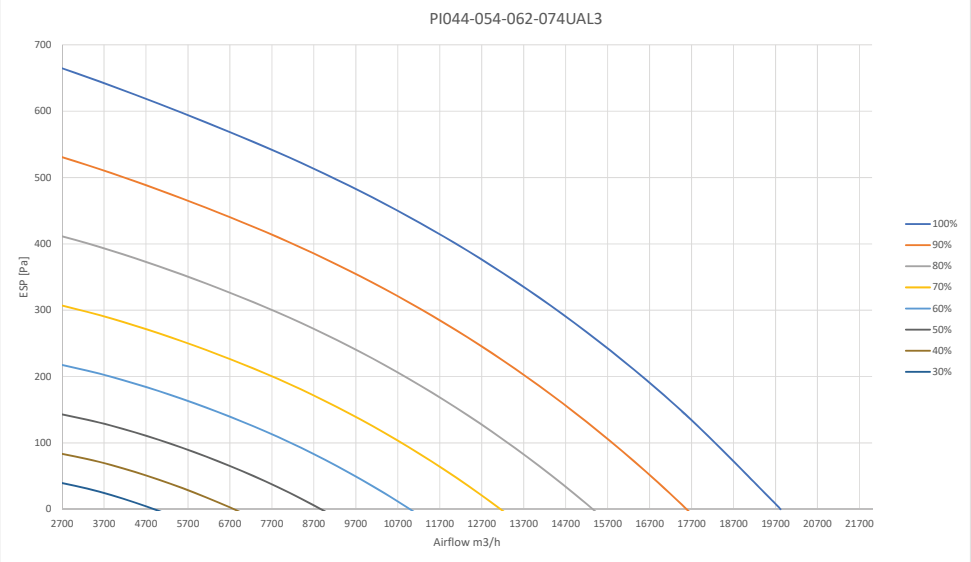

PI059EAL3
ESP [Pa]
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

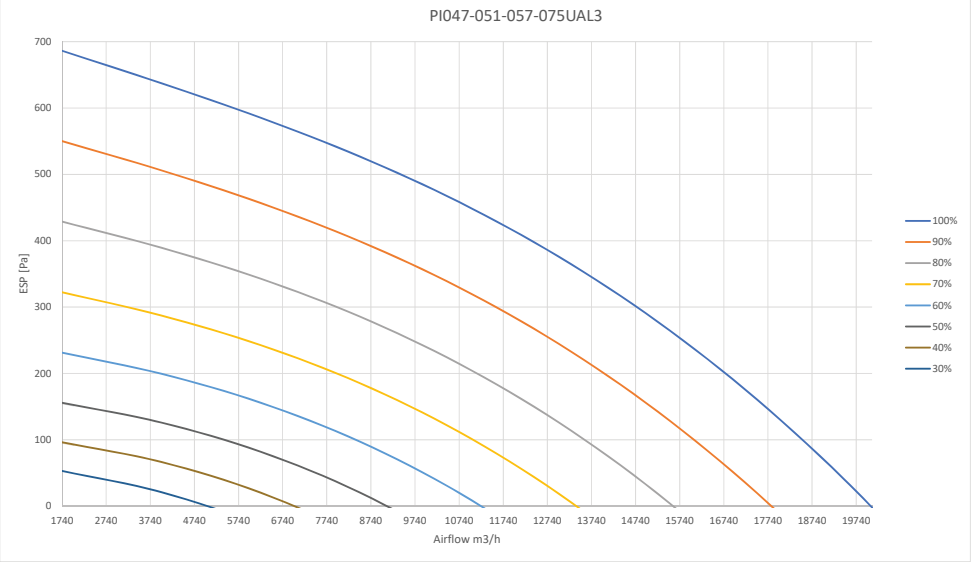

PI092EAL3
700
600
500
400
300
200
100
0
ESP [Pa]
6400 7400 8400 9400 10400 11400 12400 13400 14400 15400 16400 17400 18400 19400 20400 21400 22400 23400 24400
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%

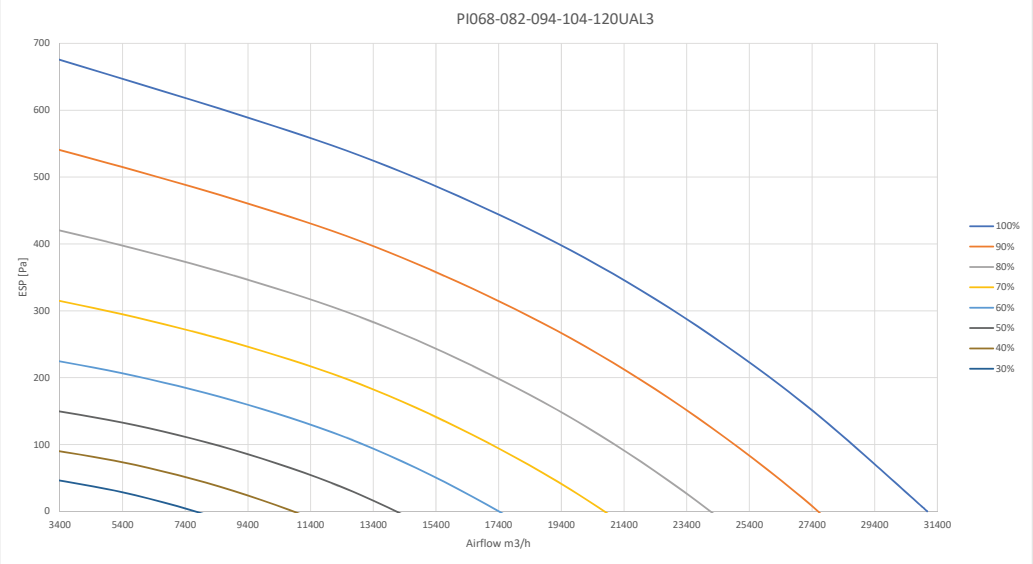

PI150-165EAL3
800
700
600
500
400
300
200
100
0
ESP [Pa]
9200 11200 13200 15200 17200 19200 21200 23200 25200 27200 29200 31200 33200 35200 37200 39200 41200 43200 45200 47200 49200
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

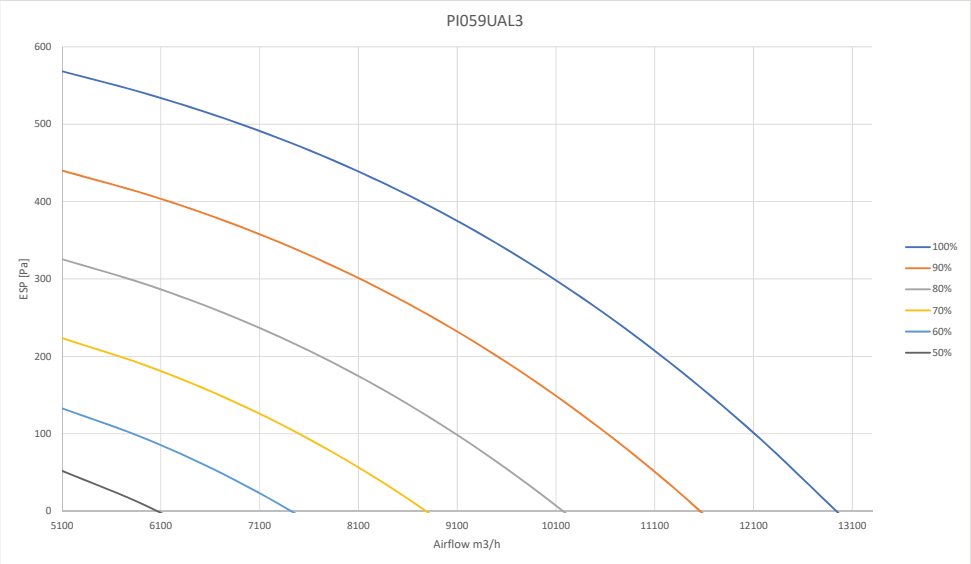

PI015-021-025 -033UAL3
1000
900
800
700
600
500
400
300
200
100
0
ESP [Pa]
1500 2500 3500 4500 5500 6500 7500 8500 9500
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%

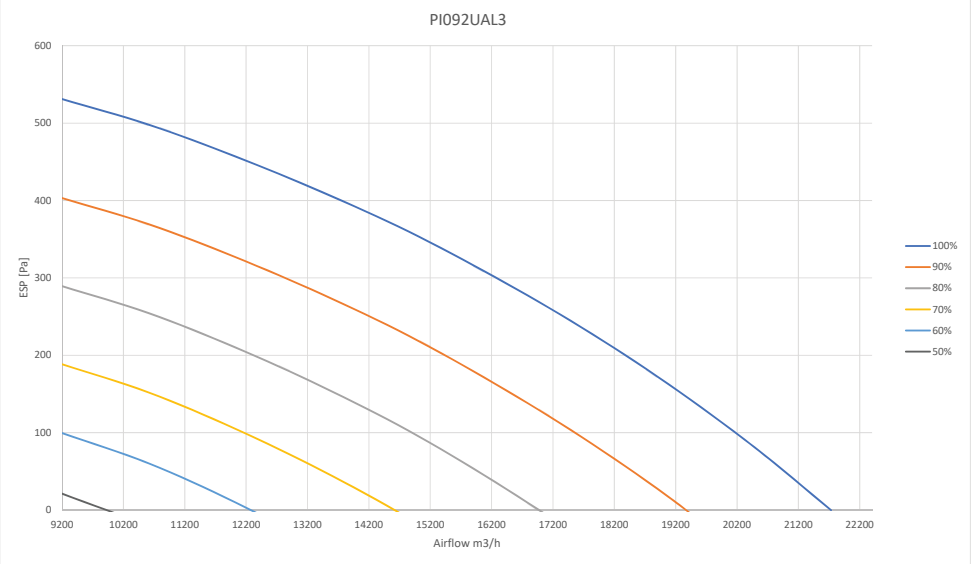

PI041-045UAL3
ESP [Pa]
800
700
600
500
400
300
200
100
0
1300
2300
3300
4300
5300
6300
7300
8300
9300
10300
11300
12300
13300
14300
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%


PI044-054-062-074UAL3
ESP [Pa]
700
600
500
400
300
200
100
0
2700
3700
4700
5700
6700
7700
8700
9700
10700
11700
12700
13700
14700
15700
16700
17700
18700
19700
20700
21700
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%


PI047-051-057-075UAL3
ESP [Pa]
700
600
500
400
300
200
100
0
1740
2740
3740
4740
5740
6740
7740
8740
9740
10740
11740
12740
13740
14740
15740
16740
17740
18740
19740
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%


PI068-082-094-104-120UAL3
ESP [Pa]
Airflow m3/h
100%
90%
80%
70%
60%
50%
40%
30%


PI059UAL3
ESP [Pa]
Airflow m3/h
100%
90%
80%
70%
60%
50%


PI092UAL3
ESP [Pa]
Airflow m3/h
100%
90%
80%
70%
60%
50%

Fans electrical data

Unit model	High Power EC fans			EC fans		
	Motor Size [kW]	FLA @50 Hz [A]	FLA @60 Hz [A]	Motor Size [kW]	FLA @50 Hz [A]	FLA @60 Hz [A]
PI015	2,6	4,2	3,3	1,9	3,2	2,5
PI021	2,6	4,2	3,3	1,9	3,2	2,5
PI025	2,6	4,2	3,3	1,9	3,2	2,5
PI031	2,6	4,2	3,3	1,9	3,2	2,5
PI033	2,6	4,2	3,3	1,9	3,2	2,5
PI041	3,5	5,6	4,4	2,7	4,1	3,2
PI045	3,5	5,6	4,4	2,7	4,1	3,2
PI059	3,5	5,6	4,4	2,7	4,1	3,2
PI047	3,5	5,6	4,4	3,5	5,6	4,4
PI051	3,5	5,6	4,4	3,5	5,6	4,4
PI057	3,5	5,6	4,4	2,7	4,1	3,2
PI075	3,5	5,6	4,4	2,7	4,1	3,2
PI044	3,5	5,6	4,4	3,5	5,6	4,4
PI054	3,5	5,6	4,4	3,5	5,6	4,4
PI062	3,5	5,6	4,4	2,7	4,1	3,2
PI074	3,5	5,6	4,4	2,7	4,1	3,2
PI092	3,5	5,6	4,4	2,7	4,1	3,2
PI068	3,5	5,6	4,4	3,5	5,6	4,4
PI082	3,5	5,6	4,4	3,5	5,6	4,4
PI094	3,5	5,6	4,4	3,5	5,6	4,4
PI104	3,5	5,6	4,4	3,5	5,6	4,4
PI120	3,5	5,6	4,4	2,7	4,1	3,2
PI150	4,6	7,4	6,0	3,7	5,7	4,5
PI165	4,6	7,4	6,0	3,7	5,7	4,5

NOTE *Values given for each single fan. The model is the same both for 50 Hz and 60 Hz.*

5.4 Refrigerant Connections

NOTE *Data valid for equivalent length up to 100 m and R410A refrigerant.*
For the connections between indoor unit and condenser please consider following table

			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059	PI047	PI051
Gas line outlet	Variable speed circuit	mm	16	18	22	22	22	22	28	28	28	28
	Fixed speed circuit	mm	---	---	---	---	---	---	---	---	---	---
Liquid line inlet	Variable speed circuit	mm	12	16	18	22	22	22	22	22	22	22
	Fixed speed circuit	mm	---	---	---	---	---	---	---	---	---	---

			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059	PI047	PI051
Gas line outlet	Variable speed circuit	mm	16	18	22	22	22	22	28	28	28	28
	Fixed speed circuit	mm	---	---	---	---	---	---	---	---	---	---
Liquid line inlet	Variable speed circuit	mm	12	16	18	22	22	22	22	22	22	22
	Fixed speed circuit	mm	---	---	---	---	---	---	---	---	---	---

			PI015	PI021	PI025	PI031	PI033	PI041	PI045	PI059	PI047	PI051
Gas line outlet	Variable speed circuit	mm	16	18	22	22	22	22	28	28	28	28
	Fixed speed circuit	mm	---	---	---	---	---	---	---	---	---	---
Liquid line inlet	Variable speed circuit	mm	12	16	18	22	22	22	22	22	22	22
	Fixed speed circuit	mm	---	---	---	---	---	---	---	---	---	---

For the connections inside the unit instead please consider the table below:

	1 BAY					1,5 BAY		
	PI015A	PI021A	PI025A	PI031A	PI033A	PI041A	PI045A	PI059A
IL1	12	16	16	18	18	18	18	22
IL2	/	/	/	/	/	/	/	/
OG1	12	16	16	22	22	22	22	22
OG2	/	/	/	/	/	/	/	/

	2 BAY								
	PI047A	PI051A	PI057A	PI075A	PI044A	PI054A	PI062A	PI074A	PI092A
IL1	18	18	22	22	18	18	18	18	22
IL2	/	/	/	/	16	16	18	18	18
OG1	22	22	22	22	18	18	22	22	22
OG2	/	/	/	/	16	16	22	22	22

	3 BAY					4 BAY	
	PI068A	PI082A	PI094A	PI104A	PI120A	PI150A	PI165A
IL1	18	22	22	22	22	22	22
IL2	18	18	18	22	22	22	22
OG1	22	28	28	28	28	28	28
OG2	22	22	22	22	22	28	28

6. Sound Pressure Level

Content of this chapter

6.1 Introduction

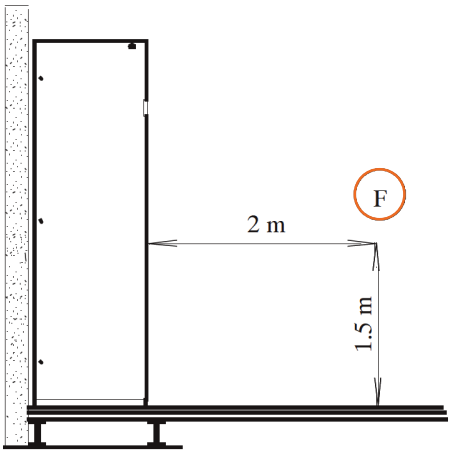
Liebert® PDX units have been designed with particular care for sound and vibration problems.

Highest ventilation efficiency combined with the lowest sound emission have been obtained by the following design criteria:

- optimization of the aeraulic circuit by accurate researches made in our thermodynamic laboratories, with special focus on coils and filters
- complete mechanical insulation of the ventilating section

6.2 Sound Emission Spectra

Test conditions



The noise levels refer to free field conditions.

The instrument is placed at point [**F**] as shown in the figure.

The operating conditions are the following:

- Downflow unit with underflow air discharge and 30 Pa available external static pressure.
- Upflow unit with ducted air discharge and 30 Pa available external static pressure.
- Maximum air flow with clean ePM10 50% filters.
- High power EC Fan Module
- Variable speed cooling system @100% cooling capacity.

All tests are performed in our laboratories.

Key for tables reading

The tables in this chapter show sound levels for every octave band frequency.

The sound levels (both global and for each octave band) are expressed in dB with a tolerance of (- 0/+2) dB.

The data are referred to the main used configurations; for different configurations consult Hirating software.

The following keys are used:

PWL	Sound Power Level calculated according to ISO 3744 procedure method
SPL	Sound Pressure Level measured in free field conditions according to ISO 3744 average method
Mode (1)	Only ventilation, measured as explained in *Test conditions* above
Mode (2)	Working compressor, measured as explained in *Test conditions* above
Mode (3)	Working compressor, measured on discharge side: - in a plenum or duct on top of the unit for Upflow units - measured in the raised floor for Downflow units

6.2.1 Upflow configuration

"Measurement conditions: Inverter scroll cooling system@100% cooling capacity, High power EC fan module, max airflow"

Sound Power Level [dB] - Upflow configuration, Inverter scroll cooling system @100% cooling capacity, High power EC fan module, max airflow

Unit model	Model	Level	Octave band frequency (Hz)									Sound level [dB(A)]
	Mode		31,5	63	125	250	500	1000	2000	4000	8000	
PI015	(1)	SPL	63,7	63,7	66,8	73,2	66,3	57,7	54,9	54,4	50,7	68,1
	(2)	SPL	63,7	63,7	66,8	73,2	66,3	57,9	56,8	55,2	51,5	68,3
	(3)	PWL	65,9	65,9	72,4	81,7	77,0	74,9	71	67,9	66,2	80,1
PI021	(1)	SPL	63,6	63,6	66,7	73,1	66,2	57,6	54,8	54,3	50,6	68
	(2)	SPL	63,6	63,6	67,2	73,1	66,3	58,3	57,8	56,5	52,2	68,5
	(3)	PWL	65,8	72,5	79,4	88,2	83,6	81,9	78,7	75,9	73,5	87,2
PI025	(1)	SPL	63,7	63,7	66,8	73,2	66,3	57,7	54,9	54,4	50,7	68,1
	(2)	SPL	63,7	63,7	67,3	73,2	66,4	58,4	57,9	56,6	52,3	68,6
	(3)	PWL	65,9	72,6	79,5	88,3	83,7	82,0	78,8	76	73,6	87,3
PI031	(1)	SPL	63,6	63,6	66,7	73,1	66,2	57,6	54,8	54,3	50,6	68
	(2)	SPL	63,6	63,6	66,7	73,1	66,3	60,2	58,8	56,9	54,9	69
	(3)	PWL	65,8	72,5	78,9	88,2	83,6	83,8	79,7	76,3	76,2	88,1
PI033	(1)	SPL	63,7	63,7	66,8	73,2	66,3	57,7	54,9	54,4	50,7	68,1
	(2)	SPL	63,7	63,7	66,9	73,2	66,4	58,2	57,2	55,3	54,2	68,5
	(3)	PWL	65,9	72,6	79,1	88,3	83,7	81,8	78,1	74,7	75,5	87,1
PI041	(1)	SPL	54,1	54,1	65,1	62,1	64,1	63,1	62,1	60,1	52,1	68,5
	(2)	SPL	54,1	54,1	66,5	62,2	64,1	63,1	62,7	60,1	55,2	68,8
	(3)	PWL	71,2	71,2	84,8	80,4	82,2	81,4	82,4	79,2	75,3	87,8
PI045	(1)	SPL	53,9	53,9	64,9	61,9	63,9	62,9	61,9	59,9	51,9	68,3
	(2)	SPL	53,9	53,9	66,3	62,0	63,9	63,1	61,9	59,9	55,9	68,5
	(3)	PWL	71	71,0	84,6	80,2	82,0	81,2	82,2	79	75,1	87,6
PI059	(1)	SPL	51,1	51,1	62,1	59,1	61,1	60,1	59,1	57,1	49,1	65,5
	(2)	SPL	51,1	51,9	65,3	61,2	62,6	62,4	61,4	59,7	51,6	67,8
	(3)	PWL	84,1	70,9	86,6	81,5	82	82	80,4	78,5	71,5	87,1
PI047	(1)	SPL	51,4	54,3	65,3	62,3	64,3	63,3	62,3	60,3	52,5	68,7
	(2)	SPL	53,6	54,3	65,3	62,3	64,4	63,4	63,1	60,9	54	69,2
	(3)	PWL	91,4	87,5	79,1	77,6	79,9	80,4	77,7	73,7	71,1	84,5
PI051	(1)	SPL	51	53,9	64,9	61,9	63,9	62,9	61,9	59,9	52,1	68,3
	(2)	SPL	53,2	53,9	64,9	61,9	64,1	63,3	62,3	60,6	54,3	68,8
	(3)	PWL	91	87,1	78,7	77,2	79,6	80,3	76,9	73,4	71,4	84,2
PI057	(1)	SPL	50,9	54,0	65,0	62,0	64,0	63,0	62	60	52	68,4
	(2)	SPL	53,1	55,7	66,7	63,7	64,1	63,6	62,8	61,2	52,5	69,2
	(3)	PWL	90,9	88,7	80,3	78,8	79,4	80,4	77,2	73,8	69,6	84,4
PI075	(1)	SPL	51	54,1	65,1	62,1	64,1	63,1	62,1	60,1	52,1	68,5
	(2)	SPL	55,8	55,8	66,8	63,8	64,5	63,7	63,2	62,1	53,1	69,6
	(3)	PWL	93,6	88,8	80,4	78,9	79,8	80,5	77,6	74,7	70,2	84,7
PI044	(1)	SPL	47	50,1	61,1	58,1	60,1	59,1	58,1	56,1	48,1	64,5
	(2)	SPL	49,2	51,8	62,8	59,8	60,4	59,5	59	58,5	51,2	65,6
	(3)	PWL	87	84,8	76,4	74,9	75,7	76,3	73,4	71,1	68,3	80,7
PI054	(1)	SPL	51	54,1	65,1	62,1	64,1	63,1	62,1	60,1	52,1	68,5
	(2)	SPL	53,2	55,8	66,8	63,8	64,2	63,7	62,9	61,3	52,6	69,3
	(3)	PWL	91	88,8	80,4	78,9	79,5	80,5	77,3	73,9	69,7	84,5
PI062	(1)	SPL	51	54,1	65,1	62,1	64,1	63,1	62,1	60,1	52,1	68,5
	(2)	SPL	53,2	55,8	66,8	63,8	64,2	64,5	62,7	62,8	53,5	69,8
	(3)	PWL	91	88,8	80,4	78,9	79,5	81,3	77,1	75,4	70,6	85
PI074	(1)	SPL	51	54,1	65,1	62,1	64,1	63,1	62,1	60,1	52,1	68,5
	(2)	SPL	53,2	54,1	65,1	62,1	64,4	65,2	62,7	62,3	53,9	69,9
	(3)	PWL	91	87,1	78,7	77,2	79,7	82,0	77,1	74,9	71	85,2

Unit model	Model	Level	Octave band frequency (Hz)									Sound level [dB(A)]
	Mode		31,5	63	125	250	500	1000	2000	4000	8000	
PI092	(1)	SPL	51,9	55	66	63	65	64	63	61	53	69,4
	(2)	SPL	54,1	55	66	63	65,3	66,1	63,6	63,2	54,8	70,8
	(3)	PWL	91,9	88	79,6	78,1	80,6	82,9	78	75,8	71,9	86,1
PI068	(1)	SPL	56,1	59,1	70,1	67,1	69,1	68,1	67,1	65,1	57,1	73,5
	(2)	SPL	56,1	59,1	70,1	67,1	69,3	69,6	67,8	67,8	58,5	74,8
	(3)	PWL	92,1	92,1	83,7	82,2	84,6	86,4	82,2	80,4	75,6	90
PI082	(1)	SPL	56,1	59,1	70,1	67,1	69,1	68,1	67,1	65,1	57,1	73,5
	(2)	SPL	56,1	59,1	70,1	67,1	69,2	69,5	67,8	67,8	58,5	74,8
	(3)	PWL	92,1	92,1	83,7	82,2	84,5	86,3	82,2	80,4	75,6	89,9
PI094	(1)	SPL	56,1	59,1	70,1	67,1	69,1	68,1	67,1	65,1	57,1	73,5
	(2)	SPL	56,1	59,1	70,1	67,1	69,4	70,2	67,8	67,2	58,9	74,9
	(3)	PWL	92,1	92,1	83,7	82,2	84,7	87,0	82,2	79,8	76	90,2
PI104	(1)	SPL	54,9	57,9	68,9	65,9	67,9	66,9	65,9	63,9	55,9	72,3
	(2)	SPL	54,9	57,9	68,9	65,9	68,1	67,7	67,2	66,1	56,6	73,4
	(3)	PWL	90,9	90,9	82,5	81,0	83,4	84,5	81,6	78,7	73,7	88,5
PI120	(1)	SPL	56,1	59,1	70,1	67,1	69,1	68,1	67,1	65,1	57,1	73,5
	(2)	SPL	57,3	59,1	70,1	67,1	69,2	68,8	67,9	66,1	57,6	74,2
	(3)	PWL	93,3	92,1	83,7	82,2	84,5	85,6	82,3	78,7	74,7	89,4

6.2.2 Downflow Up configuration

Sound Power Level [dB] - Downflow up configuration, Inverter scroll cooling system @100% cooling capacity, High power EC fan module, max airflow

Unit model	Model	Level	Octave band frequency (Hz)									Sound level [dB(A)]
	Mode		31,5	63	125	250	500	1000	2000	4000	8000	
PI015	(1)	SPL	63,8	63,8	66,9	73,3	66,4	57,8	55	54,5	50,8	68,2
	(2)	SPL	63,8	63,8	66,9	73,3	66,4	58,0	56,9	55,3	51,6	68,4
	(3)	PWL	66	66,0	72,5	81,8	77,1	75,0	71,1	68	66,3	80,2
PI021	(1)	SPL	63,6	63,6	66,7	73,1	66,2	57,6	54,8	54,3	50,6	68
	(2)	SPL	63,6	63,6	67,2	73,1	66,3	58,3	57,8	56,5	52,2	68,5
	(3)	PWL	65,8	72,5	79,4	88,2	83,6	81,9	78,7	75,9	73,5	87,2
PI025	(1)	SPL	63,7	63,7	66,8	73,2	66,3	57,7	54,9	54,4	50,7	68,1
	(2)	SPL	63,7	63,7	67,3	73,2	66,4	58,4	57,9	56,6	52,3	68,6
	(3)	PWL	65,9	72,6	79,5	88,3	83,7	82,0	78,8	76	73,6	87,3
PI031	(1)	SPL	63,7	63,7	66,8	73,2	66,3	57,7	54,9	54,4	50,7	68,1
	(2)	SPL	63,7	63,7	66,8	73,2	66,4	60,3	58,9	57	55	69,1
	(3)	PWL	65,9	72,6	79,0	88,3	83,7	83,9	79,8	76,4	76,3	88,2
PI033	(1)	SPL	63,7	63,7	66,8	73,2	66,3	57,7	54,9	54,4	50,7	68,1
	(2)	SPL	63,7	63,7	66,9	73,2	66,4	58,2	57,2	55,3	54,2	68,5
	(3)	PWL	65,9	72,6	79,1	88,3	83,7	81,8	78,1	74,7	75,5	87,1
PI041	(1)	SPL	53,9	53,9	64,9	61,9	63,9	62,9	61,9	59,9	51,9	68,3
	(2)	SPL	53,9	53,9	66,3	62,0	63,9	62,9	62,5	59,9	55	68,6
	(3)	PWL	86,9	86,9	79,9	77,1	79,2	79,7	76,9	72,5	72,1	83,9
PI045	(1)	SPL	53,9	53,9	64,9	61,9	63,9	62,9	61,9	59,9	51,9	68,3
	(2)	SPL	53,9	53,9	66,3	62,0	63,9	63,1	61,9	59,9	55,9	68,5
	(3)	PWL	86,9	86,9	79,9	77,1	79,2	79,9	76,3	72,5	73	83,8
PI059	(1)	SPL	51,1	51,1	62,1	59,1	61,1	60,1	59,1	57,1	49,1	65,5
	(2)	SPL	51,1	51,9	65,3	61,2	62,6	62,4	61,4	59,7	51,6	67,8
	(3)	PWL	84,1	70,9	86,6	81,5	82	82	80,4	78,5	71,5	87,1
PI047	(1)	SPL	51,5	54,4	65,4	62,4	64,4	63,4	62,4	60,4	52,4	68,8
	(2)	SPL	53,7	54,4	65,4	62,4	64,5	63,5	63,2	61	54,1	69,3
	(3)	PWL	91,5	87,6	79,2	77,7	80,0	80,5	77,8	73,8	71,4	84,7

Unit model	Model	Level	Octave band frequency (Hz)									Sound level [dB(A)]
	Mode		31,5	63	125	250	500	1000	2000	4000	8000	
PI051	(1)	SPL	51,5	54,4	65,4	62,4	64,4	63,4	62,4	60,4	52,4	68,8
	(2)	SPL	53,7	54,4	65,4	62,4	64,6	63,8	62,8	61,1	54,8	69,3
	(3)	PWL	91,5	87,6	79,2	77,7	80,1	80,8	77,4	73,9	72,1	84,7
PI057	(1)	SPL	51,1	54,2	65,2	62,2	64,2	63,2	62,2	60,2	52,2	68,6
	(2)	SPL	53,3	55,9	66,9	63,9	64,3	63,8	63	61,4	52,7	69,4
	(3)	PWL	91,1	88,9	80,5	79,0	79,6	80,6	77,4	74	69,8	84,6
PI075	(1)	SPL	51,1	54,2	65,2	62,2	64,2	63,2	62,2	60,2	52,2	68,6
	(2)	SPL	55,9	55,9	66,9	63,9	64,6	63,8	63,3	62,2	53,2	69,7
	(3)	PWL	93,7	88,9	80,5	79,0	79,9	80,6	77,7	74,8	70,3	84,8
PI044	(1)	SPL	50,1	53,2	64,2	61,2	63,2	62,2	61,2	59,2	51,2	67,6
	(2)	SPL	53,3	55,9	66,9	63,9	64,5	63,6	63,1	62,6	55,3	69,7
	(3)	PWL	91,1	88,9	80,5	79,0	79,8	80,4	77,5	75,2	72,4	84,8
PI054	(1)	SPL	51,1	54,2	65,2	62,2	64,2	63,2	62,2	60,2	52,2	68,6
	(2)	SPL	53,3	55,9	66,9	63,9	64,5	63,7	63,2	62,8	55,5	69,8
	(3)	PWL	91,1	88,9	80,5	79,0	79,8	80,5	77,6	75,4	72,6	84,9
PI062	(1)	SPL	51,1	54,2	65,2	62,2	64,2	63,2	62,2	60,2	52,2	68,6
	(2)	SPL	53,3	55,9	66,9	63,9	64,3	64,6	62,8	62,9	53,6	69,9
	(3)	PWL	91,1	88,9	80,5	79,0	79,6	81,4	77,2	75,5	70,7	85,1
PI074	(1)	SPL	51,1	54,2	65,2	62,2	64,2	63,2	62,2	60,2	52,2	68,6
	(2)	SPL	53,3	54,2	65,2	62,2	64,5	65,3	62,8	62,4	54	70
	(3)	PWL	91,1	87,2	78,8	77,3	79,8	82,1	77,2	75	71,1	85,3
PI092	(1)	SPL	51,6	54,7	65,7	62,7	64,7	63,7	62,7	60,7	52,7	69,1
	(2)	SPL	53,8	54,7	65,7	62,7	65	65,8	63,3	62,9	54,5	70,5
	(3)	PWL	91,6	87,7	79,3	77,8	80,3	82,6	77,7	75,5	71,6	85,8
PI068	(1)	SPL	56,2	59,2	70,2	67,2	69,2	68,2	67,2	65,2	57,2	73,6
	(2)	SPL	56,2	59,2	70,2	67,2	69,4	69,7	67,9	67,9	58,6	74,9
	(3)	PWL	92,2	92,2	83,8	82,3	84,7	86,5	82,3	80,5	75,7	90,1
PI082	(1)	SPL	56,2	59,2	70,2	67,2	69,2	68,2	67,2	65,2	57,2	73,6
	(2)	SPL	56,2	59,2	70,2	67,2	69,3	69,6	67,9	67,9	58,6	74,9
	(3)	PWL	92,2	92,2	83,8	82,3	84,6	86,4	82,3	80,5	75,7	90
PI094	(1)	SPL	56,2	59,2	70,2	67,2	69,2	68,2	67,2	65,2	57,2	73,6
	(2)	SPL	56,2	59,2	70,2	67,2	69,5	70,3	67,9	67,3	59	75
	(3)	PWL	92,2	92,2	83,8	82,3	84,8	87,1	82,3	79,9	76,1	90,3
PI104	(1)	SPL	55	58,0	69,0	66,0	68,0	67,0	66	64	56	72,4
	(2)	SPL	55	58,0	69,0	66,0	68,2	67,8	67,3	66,2	56,7	73,5
	(3)	PWL	91	91,0	82,6	81,1	83,5	84,6	81,7	78,8	73,8	88,6
PI120	(1)	SPL	56,2	59,2	70,2	67,2	69,2	68,2	67,2	65,2	57,2	73,6
	(2)	SPL	57,4	59,2	70,2	67,2	69,3	68,9	68	66,2	57,7	74,3
	(3)	PWL	93,4	92,2	83,8	82,3	84,6	85,7	82,4	78,8	74,8	89,5
PI150	(1)	SPL	66,5	66,5	72,1	70,2	70,6	68,8	68	66	58,8	74,6
	(2)	SPL	66,5	66,5	72,1	70,2	70,8	69,2	68,4	66,6	59	75
	(3)	PWL	66,1	86,6	92,2	90,2	90,9	89,2	88,4	86,6	79	95
PI165	(1)	SPL	67,2	67,2	72,8	70,9	71,3	69,5	68,7	66,7	59,5	75,3
	(2)	SPL	67,2	67,2	72,8	70,9	71,4	69,8	69,2	67,5	59,7	75,7
	(3)	PWL	66,8	87,3	92,9	90,9	91,5	89,8	89,2	87,5	79,7	95,7

6.3 Plenum with Silencing Cartridges (Accessory)

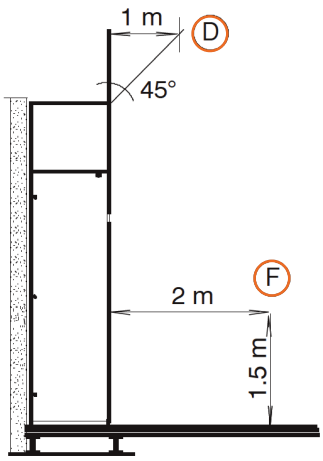
An optional plenum can be installed on top of the unit.
The plenum contains one row of special cartridges made of self-extinguishing material with a high noise attenuation capacity.
These cartridges are guaranteed against disintegration and release of particles do to friction of the air.
The plenum provides a remarkable sound level reduction, while the additional pressure drop is small.
The plenum height is 600 mm.
See also *Annex D - Accessories - 9 - Plenum with silencing cartridges*.

6.3.1 Features

Dimensions of the cartridges [mm]	500 x 195 x 500
Plenum height [mm]	600
Free section [mm]	400 x 100

Unit models	Number of cartridges per unit
PI 015-021-025-031-033	4
PI 041-045-059	7
PI 047-051-057-075-044-054-062-074-092	11
PI 068-082-094-104-120	16

6.3.2 Noise attenuation



The following tables show Sound Pressure Level reduction for units with one row of silencing cartridges compared to the same units without silencing cartridges.
The measurements are made at the positions [**D**] and [**F**] as shown in the figure.

	SPL reduction	
Unit configuration	position D	position F
Downflow up	-7,0 dB	-4,0 dB
Upflow	-12,0 dB	-7,5 dB

Frequency band [Hz]	Attenuation on discharge PWL for one row of cartridges [dB]'
63	1
125	4
250	7
500	15
1 000	26
2 000	28
4 000	27
8 000	14

6.3.3 Pressure drop

Air flow [m^3/s]	0,2	0,3	0,4	0,5	0,6
Pressure drop [Pa] for one row of cartridges	1	2	4	7	9

7. Heat Rejection

Content of this chapter

7.1 Introduction

The condenser is directly connected to the main unit via Modbus communication.

The unit is able to optimize the system by managing everything through a single control, then combines the advantages of EC fans with system management.

It is possible to install an external temperature probe in the condenser in order to have a control on the external conditions.

The system allows to adjust the system pressure (head pressure setpoint).

The pressure transducer is present and wired inside the indoor unit.

7.2 Coupling of PDX Units with Remote Condensers

Remote condensers models

NOTICE

The remote condenser(s) must be purchased separately.

Each unit can be connected only to the matching condenser(s) given in the following tables.

The size of the condenser also depends on the installation configuration

7.2.1 Coupling with Liebert® HCR condensers

Unit model	Fixed speed circuit				Variable speed circuit			
	t < 35°C	35°C < t < 40°C	40°C < t < 45°C	t > 45°C	t < 35°C	35°C < t < 40°C	L40°C < t < 45°C	t > 45°C
PI015	---	---	---	---	HCR24	HCR24	HCR33	HCR43
PI021	---	---	---	---	HCR24	HCR33	HCR43	HCR51
PI025	---	---	---	---	HCR33	HCR43	HCR51	HCR59
PI031	---	---	---	---	HCR33	HCR51	HCR59	HCR76
PI033	---	---	---	---	HCR43	HCR59	HCR76	HCR88
PI041	---	---	---	---	HCR43	HCR59	HCR76	HCR88
PI045	---	---	---	---	HCR59	HCR76	HCR88	HCR99
PI059	---	---	---	---	HCR76	HCR88	HCR99	HCRX3
PI047	---	---	---	---	HCR51	HCR59	HCR76	HCR88
PI051	---	---	---	---	HCR51	HCR59	HCR76	HCR88
PI057	---	---	---	---	HCR59	HCR76	HCR88	HCR99
PI075	---	---	---	---	HCR76	HCR88	HCR99	HCRX3
PI044	HCR24	HCR33	HCR43	HCR59	HCR24	HCR33	HCR43	HCR59
PI054	HCR33	HCR43	HCR43	HCR59	HCR33	HCR43	HCR43	HCR59
PI062	HCR43	HCR51	HCR59	HCR76	HCR43	HCR51	HCR59	HCR76
PI074	HCR51	HCR59	HCR76	HCR88	HCR51	HCR59	HCR76	HCR88
PI092	HCR59	HCR76	HCR88	HCR99	HCR59	HCR76	HCR88	HCR99
PI068	HCR43	HCR59	HCR76	HCR88	HCR43	HCR59	HCR76	HCR88
PI082	HCR59	HCR59	HCR76	HCR88	HCR59	HCR59	HCR76	HCR88
PI094	HCR59	HCR76	HCR88	HCR99	HCR59	HCR76	HCR88	HCR99
PI104	HCR59	HCR76	HCR88	HCR99	HCR59	HCR76	HCR88	HCR99
PI120	HCR76	HCR88	HCR99	HCR99	HCR76	HCR88	HCR99	HCR99
PI150	HCR88	HCR99	HCRX3	HCRX8	HCR88	HCR99	HCRX3	HCRX8
PI165	HCR88	HCR99	HCRX3	HCRX8	HCR88	HCR99	HCRX3	HCRX8

7.2.2 Coupling with Liebert® MC condensers

Unit model	Fixed speed circuit				Variable speed circuit			
	t < 35°C	35°C < t < 40°C	40°C < t < 45°C	t > 45°C	t < 35°C	35°C < t < 40°C	L40°C < t < 45°C	t > 45°C
PI015	---	---	---	---	MCS028	MCS028	MCM040	MCM040
PI021	---	---	---	---	MCS028	MCS028	MCM040	MCM040
PI025	---	---	---	---	MCS028	MCL040	MCL055	MCL055
PI031	---	---	---	---	MCS028	MCM040	MCL055	MCL055
PI033	---	---	---	---	MCM040	MCL055	MCM080	MCM080
PI041	---	---	---	---	MCM040	MCL055	MCM080	MCM080
PI045	---	---	---	---	MCM040	MCL055	MCM080	MCM080
PI059	---	---	---	---	MCL055	MCM080	MCL110	MCL110
PI047	---	---	---	---	MCM040	MCL055	MCM080	MCM080
PI051	---	---	---	---	MCL055	MCM080	MCL110	MCL110
PI057	---	---	---	---	MCL055	MCM080	MCL110	MCL110
PI075	---	---	---	---	MCL055	MCM080	MCL110	MCL110

PI044	MCS028	MCM040	MCL055	MCL055	MCS028	MCM040	MCL055	MCL055
PI054	MCS028	MCM040	MCL055	MCL055	MCS028	MCM040	MCL055	MCL055
PI062	MCS028	MCM040	MCL055	MCL055	MCS028	MCM040	MCL055	MCL055
PI074	MCM040	MCL055	MCM080	MCM080	MCM040	MCL055	MCM080	MCM080
PI092	MCM040	MCL055	MCM080	MCM080	MCM040	MCL055	MCM080	MCM080
PI068	MCM040	MCL055	MCM080	MCM080	MCM040	MCL055	MCM080	MCM080
PI082	MCM040	MCL055	MCM080	MCM080	MCM040	MCL055	MCM080	MCM080
PI094	MCM040	MCL055	MCM080	MCM080	MCM040	MCL055	MCM080	MCM080
PI104	MCL055	MCM080	MCL110	MCL110	MCL055	MCM080	MCL110	MCL110
PI120	MCL055	MCM080	MCL110	MCL110	MCL055	MCM080	MCL110	MCL110
PI150	MCM080	MCL110	MCL165	MCL165	MCM080	MCL110	MCL165	MCL165
PI165	MCM080	MCL110	MCL165	MCL165	MCM080	MCL110	MCL165	MCL165

7.3 Condensers Technical Data and Performance

7.3.1 Liebert® HCR condensers

Model		Total Heat Rejection * R410A	Air Volume	Noise Level **	Power Input	Current Absorption	FLA
		[kW]	[m3/h]	[dB(A)] @5m	[kW]	[A]	[A]
HCR24	**230/1/50**	24,07	8.400	47,20	0,43	1,85	2.53
HCR33		32,86	7.448	47,00	0,44	1,91	2.53
HCR43		47,20	16.810	50,00	0,86	3,70	2x2.53
HCR51		50,41	16.360	50,00	0,87	3,77	2x2.53
HCR59		59,91	15.740	50,00	0,90	3,87	2x2.53
HCR76		74,61	25.217	52,00	1,28	5,53	3x2.53
HCR88		90,47	23.600	52,00	1,33	5,71	3x2.53
HCR99		123,20	31.470	53,00	1,79	7,71	4X2.53
HCR24	**400/3/50**	25,30	8.986	48,50	0,43	0,69	1.10
HCR33		34,21	7.968	47,80	0,48	0,77	1.10
HCR43		48,44	17.983	51,30	0,86	1,39	2x1.10
HCR51		50,35	17.982	51,30	0,86	1,39	2x1.10
HCR59		62,42	16.909	50,70	0,92	1,47	2x1.10
HCR76		77,08	26.976	52,80	1,29	2,08	3x1.10
HCR88		94,29	25.363	52,20	1,38	2,21	3x1.10
HCR99		127,30	33.816	53,30	1,84	2,95	4x1.10

Total Heat Rejection* @ R410A; Delta (Tsaturated condensing - Tair inlet)=15K; Tcoil air inlet = 35°C; Liquid subcooling = 3K; Installation height = 0m above the sea level; clean exchange surfaces
Noise Level ** Sound Pressure Level measured with horizontal installation in the same operative conditions, referred to 5 m far from the unit, in a free field over a reflecting plane (according to EN13847).

7.3.2 Liebert® MC condensers

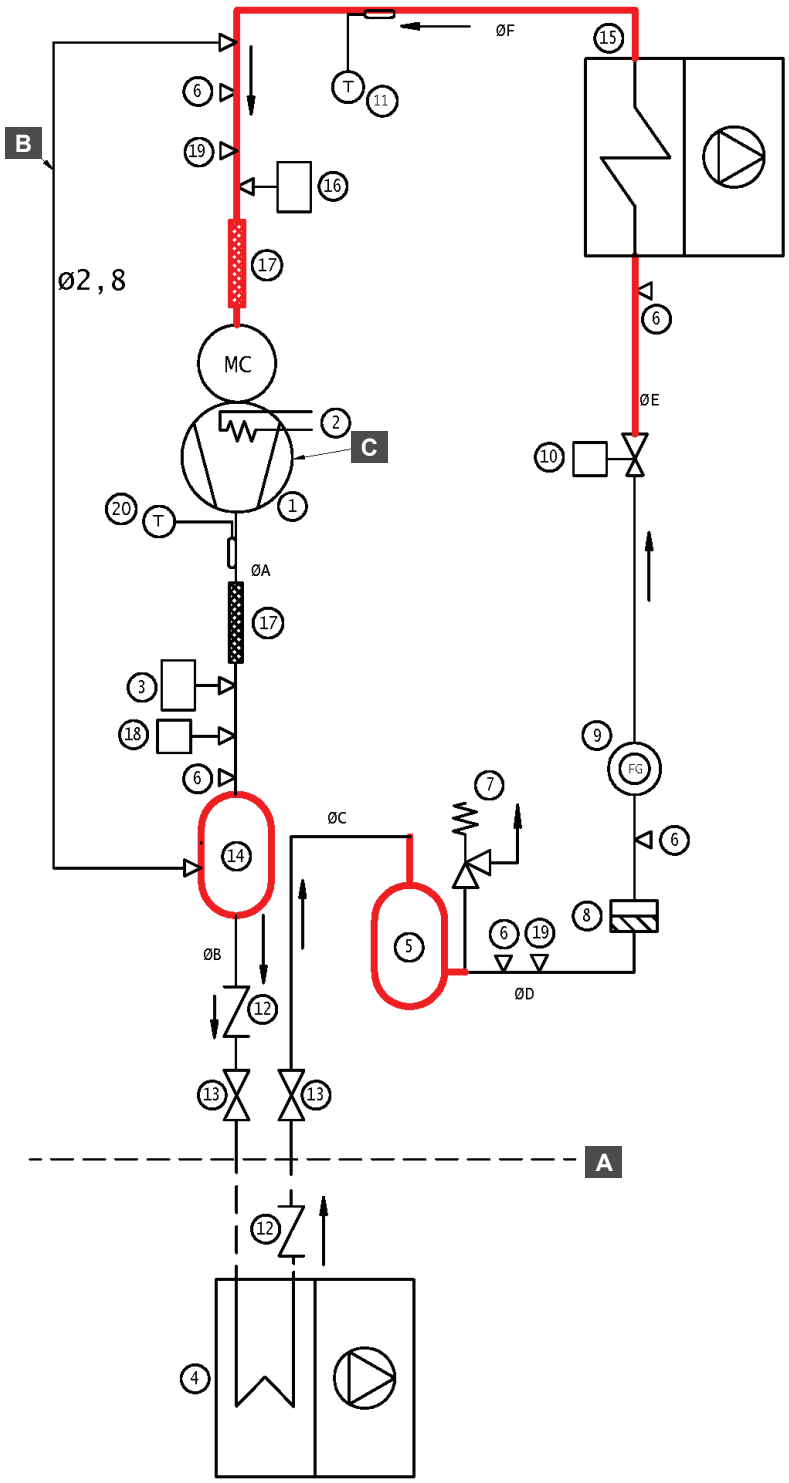
Model		Power supply	Total Heat Rejection * R410A	Air Volume	Noise Level **	Power Input	Current Absorption	FLA
		[V/Ph/Hz]	[kW]	[m3/h]	[dB(A)] @5m	[kW]	[A]	[A]
MCS028	Controlled by Indoor Unit	230/1/50	37,8	10244	53	0,69	3	4,3
MCM040		400/3/50	43,2	11856	56	0,72	1,19	1,3
MCM080		400/3/50	86,2	23700	59	1,45	2,39	2,7
MCL055		400/3/50	65,9	18860	61,1	1,78	2,75	4,6
MCL110		400/3/50	131,9	37720	64,1	3,53	5,45	9,2
MCL165		400/3/50	197,7	56580	65,9	5,31	8,37	13,8

Total Heat Rejection* @ R410A; Delta (Tsaturated condensing - Tair inlet)=15K; Tcoil air inlet = 35°C; Liquid subcooling = 3K; Installation height = 0m above the sea level; clean exchange surfaces
Noise Level ** Sound Pressure Level measured with horizontal installation in the same operative conditions, referred to 5 m far from the unit, in a free field over a reflecting plane (according to EN13847).

Annex A - Refrigerating Circuit Diagrams

Content

1 - PI015 – PI021 – PI025 – PI031 – PI033 – PI041 – PI045 – PI047 – PI051

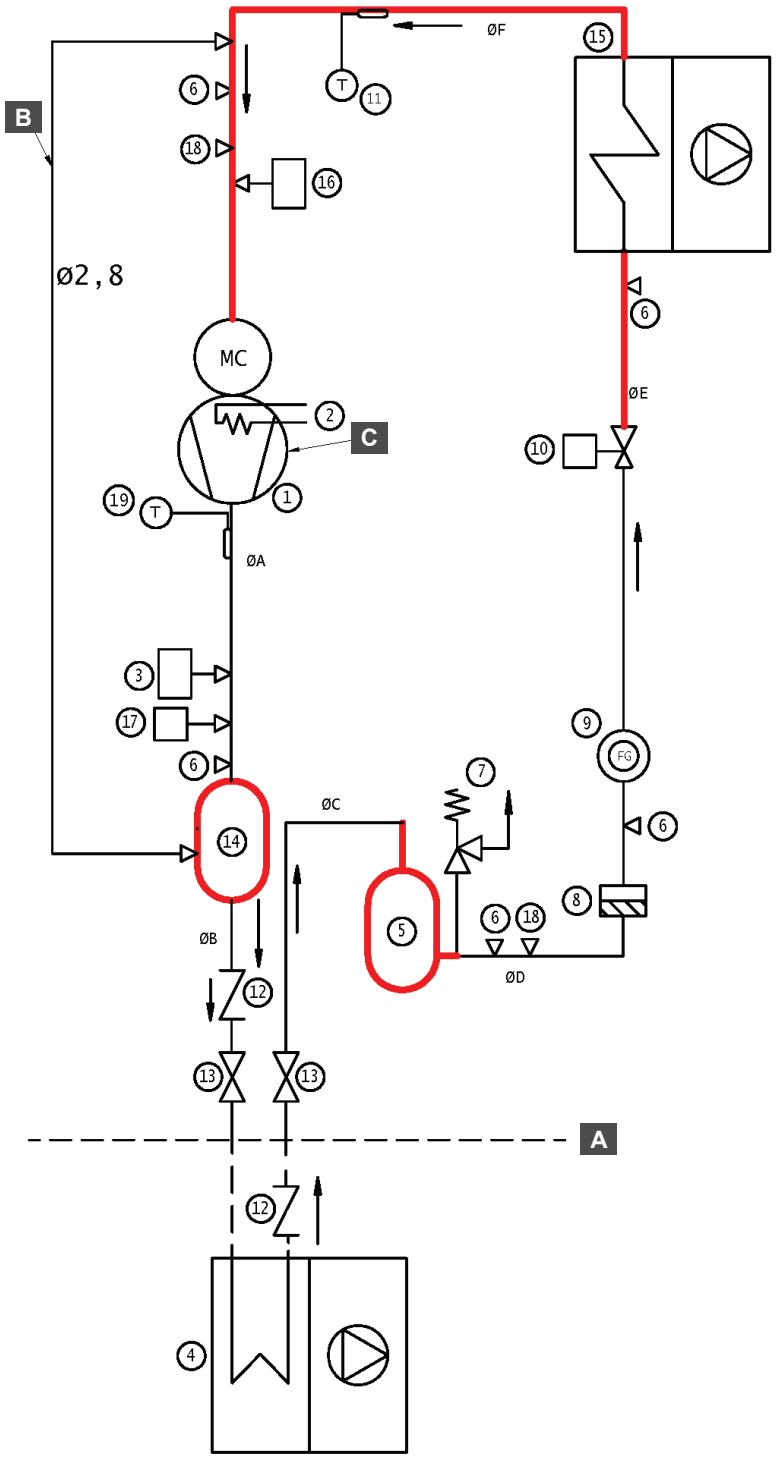


Ref.	Description
1	Compressor
2	Not assigned
3	High pressure switch
4	Air cooled condenser
5	Liquid receiver
6	Access valve 5/16”
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
11	Fast reading temperature sensor for EEV
12	Check valve
13	Shut-off valve
14	Oil separator
15	Evaporator
16	Low pressure transducer EEV
17	Vibration absorber
18	High pressure transducer
19	Access valve 1/4”
20	High temperature sensor

A	Supply limit
B	Flexible pipe for oil return line
C	Variable speed compressor (with inverter)

Thermal insulation

2 - PI057 – PI075 – PI059

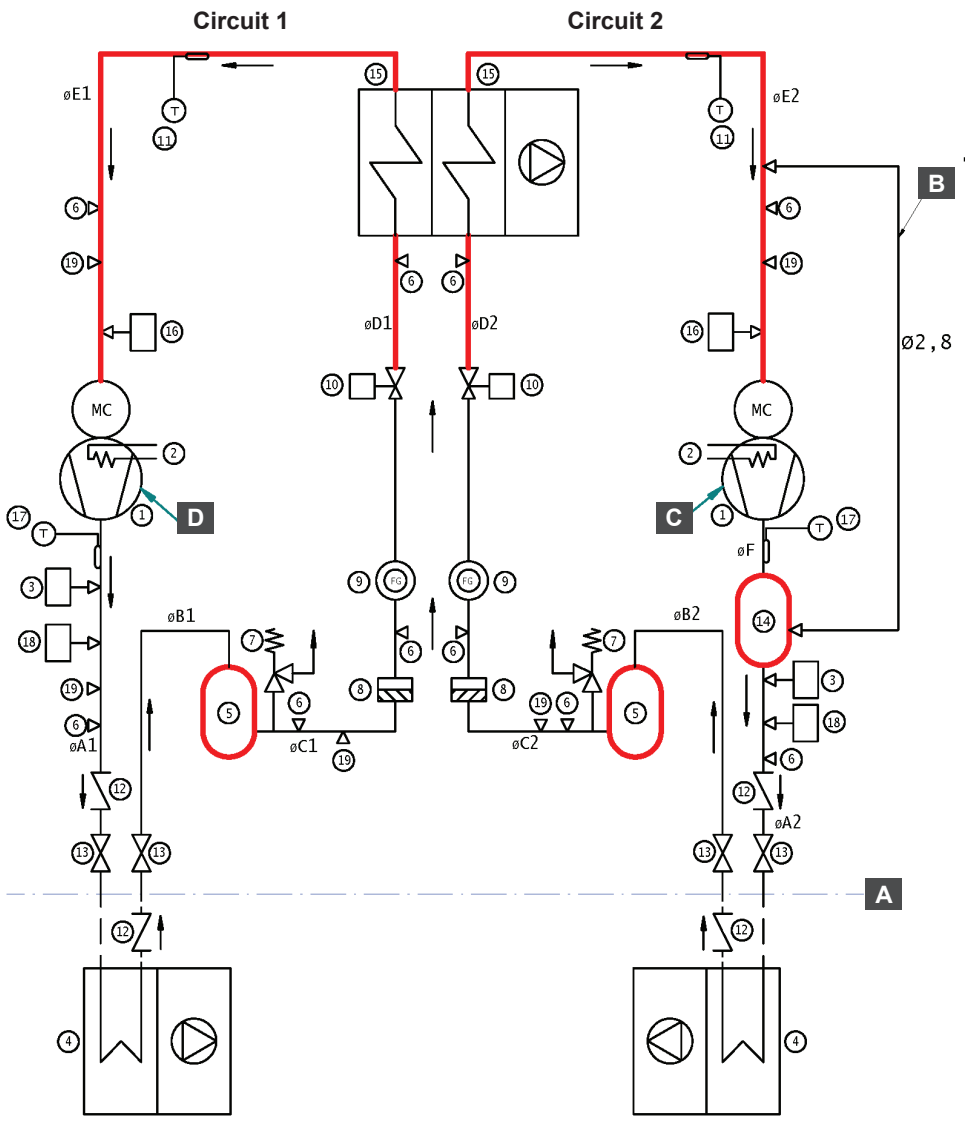


Ref.	Description
1	Compressor
2	Not assigned
3	High pressure switch
4	Air cooled condenser
5	Liquid receiver
6	Access valve 5/16”
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
11	Fast reading temperature sensor for EEV
12	Check valve
13	Shut-off valve
14	Oil separator
15	Evaporator
16	Low pressure transducer EEV
17	High pressure transducer
18	Access valve 1/4”
19	High temperature sensor

A	Supply limit
B	Flexible pipe for oil return line
C	Variable speed compressor (with inverter)

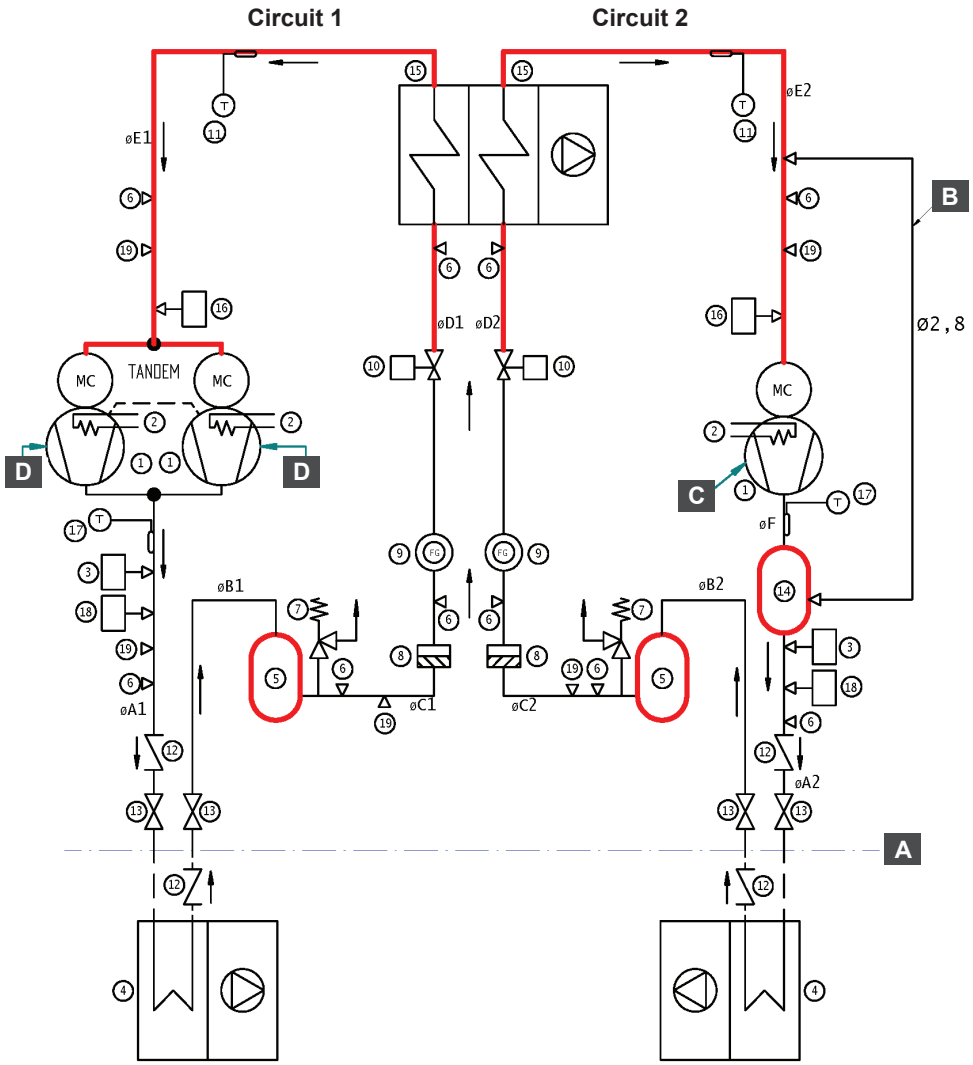
Thermal insulation

3 - PI044 – PI054 – PI062 – PI074 – PI092 – PI068



Ref.	Description
1	Compressor
2	Crankcase heater
3	High pressure switch
4	Air cooled condenser
5	Liquid receiver
6	Access valve 5/16”
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
11	Fast reading temperature sensor for EEV
12	Check valve
13	Shut-off valve
14	Oil separator
15	Evaporator
16	Low pressure transducer EEV
17	Temperature discharge sensor
18	High pressure transducer
19	Access valve 1/4”
A	Supply limit
B	Flexible pipe for oil return line
C	Variable speed compressor (with inverter)
D	Fixed speed compressor
	Thermal insulation

4 - PI082 – PI094 – PI104 – PI120 – PI150 – PI165



Ref.	Description
1	Compressor
2	Crankcase heater
3	High pressure switch
4	Air cooled condenser
5	Liquid receiver
6	Access valve 5/16”
7	Safety valve
8	Filter dryer
9	Sight glass
10	Electronic expansion valve (EEV)
11	Fast reading temperature sensor for EEV
12	Check valve
13	Shut-off valve
14	Oil separator
15	Evaporator
16	Low pressure transducer EEV
17	Temperature discharge sensor
18	High pressure transducer
19	Access valve 1/4”
A	Supply limit
B	Flexible pipe for oil return line
C	Variable speed compressor (with inverter)
D	Fixed speed compressor

Thermal insulation

Annex B - Dimensions and Weights

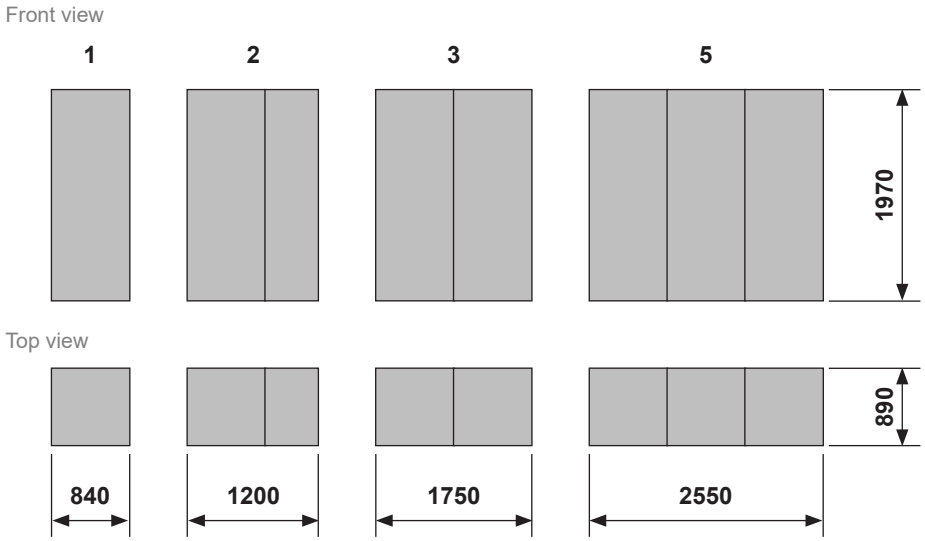
Content

1 - Overview

Identify the model and air distribution of your unit	See *1. Digit Nomenclature*
Identify the type of frame of your unit	See *4.2 Structure*
Find the overall dimensions for the unit frame, without accessories	See in this annex: *2 - Overall dimensions* *3 - Height from the floor*
Check which accessories are mounted on the unit	See *Annex D - Accessories*
Find the dimensions of the accessories Calculate the total height of the unit	See in this annex: *4 - Height of the accessories at bottom* *5 - Height of the accessories on top*
Check if there is enough free space at top and bottom of the unit	See in this annex: *6 - Free space from the floor* *7 - Free space from the ceiling*
If you are going to install a Downflow unit: find the dimensions of the hole in the raised floor	See in this annex: *8 - Hole in the floor for Downflow Up units* *9 - Hole in the floor for Downflow Down units*
Check if there is enough free space for service in front of the unit	

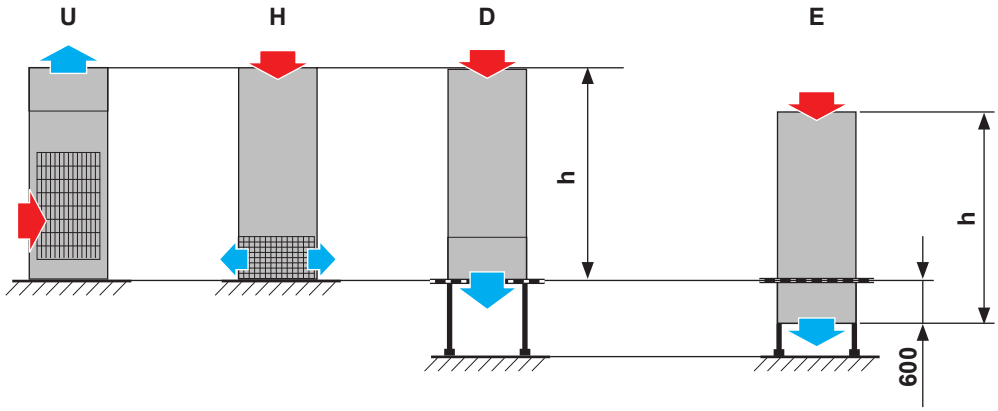
2 - Overall dimensions

Standard units



The figure above shows the dimensions of the standard units, by frame type, without any accessory.

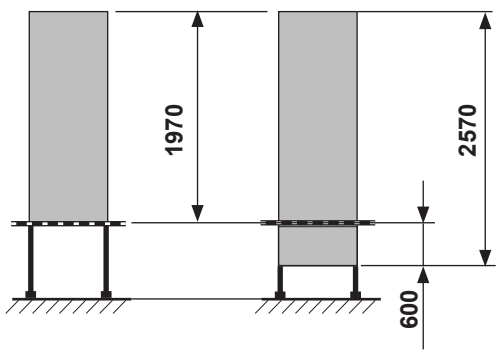
3 - Height from the floor



Standard h = 1970 mm

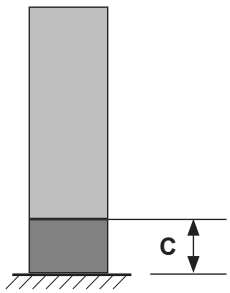
Extended h = 2570 mm

The figure above shows the height from the floor for each air distribution configuration.



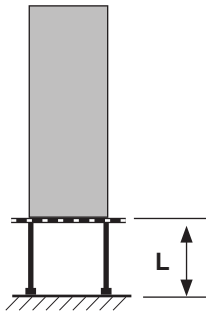
NOTE *The top of an extended unit placed under a raised floor will be at the same height as the top of a standard unit placed on the floor*

4 - Height of the accessories at bottom



U - Upflow / **H** - Downflow Frontal

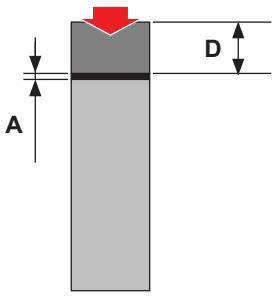
Base module	Height [**C**]: - 200 mm
Base module H 600/300 mm with rear air intake	Height [**C**]: - 600 mm for rear/bottom air intake - 300 mm for bottom air intake



D - Downflow Up / **E** - Downflow Down

Legs kit	The height [**L**] is adjustable within the following ranges: - 30–370 mm - 370–570 mm - 570–800 mm
Base frame	The height [**L**] is adjustable within the following range: - 120–800 mm

5 - Height of the accessories on top



H - Downflow Frontal

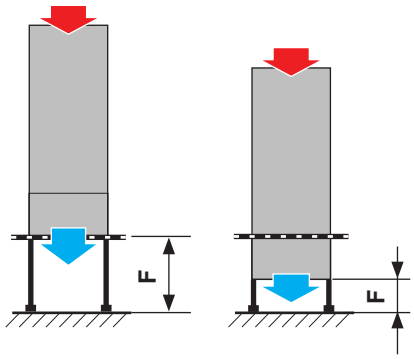
D - Downflow Up

E - Downflow Down

Connecting flange (accessory needed to mount other accessories on top of the unit)	Height [**A**] 50 mm
Accessory on top of the unit	Height [**D**]: see the table below.

Accessory	Height D [mm]	+ Height A of connecting flange [mm]
Vertical flow extension hood	500 - 600 - 700 - 800 - 900	50
Hood with high efficiency air filter	600 - 900	50
Plenum with silencing cartridges	600 - 900	50
Horizontal hood with grid	600	50
Air economizer	850	50

6 - Free space from the floor



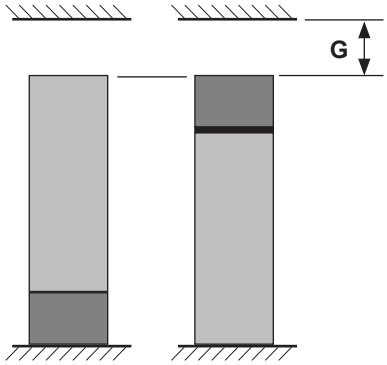
D - Downflow Up

E - Downflow Down

Free space [**F**] between the bottom of the unit and the floor

- Maximum: 800 mm, which is the maximum available height for the base frame or legs kit (see above).
- Minimum to obtain the declared performances: 600 mm
- Minimum allowable to obtain the minimum working conditions: 300 mm

7 - Free space from the ceiling

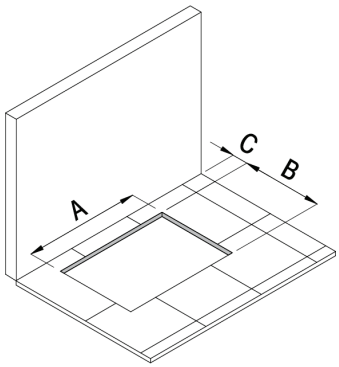


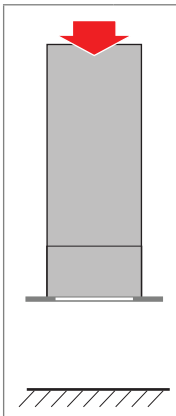
H - Downflow Frontal / **D** - Downflow Up /
E - Downflow Down

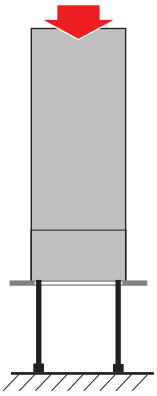
Free space [**G**] between the ceiling and the unit top, including any accessory mounted on top or bottom

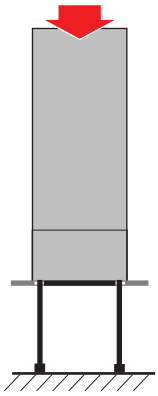
- Minimum to obtain the declared performances: 600 mm
- Minimum allowable to obtain the minimum working conditions: 300 mm

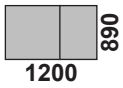
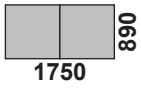
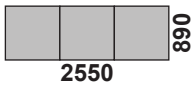
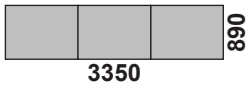
8 - Hole in the floor for Downflow Up units





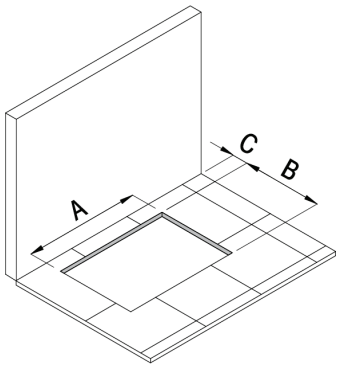


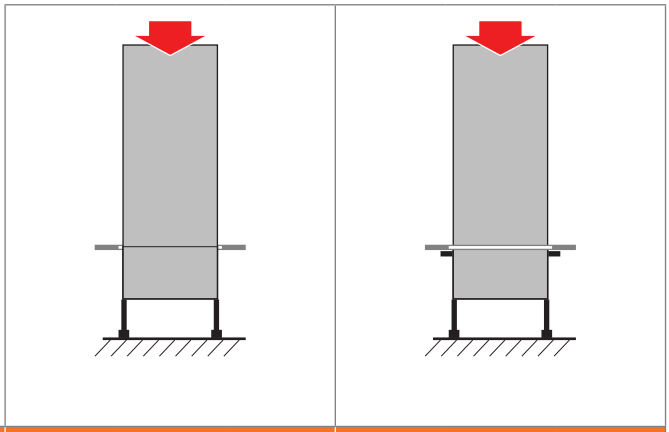


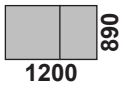
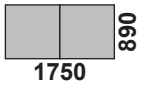
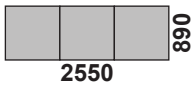
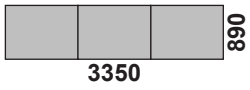
Frame type	No accessories for support			With legs kit			With base frame		
	A [mm]	B [mm]	C [mm]	A [mm]	B [mm]	C [mm]	A [mm]	B [mm]	C [mm]
1 	740	760	70	Not available			804	830	30
2 	1 100	760	70	1 156	820	30	1 176	840	30
3 	1 650	760	70	1 706	820	30	1 726	840	30
5 	2 450	760	70	2 506	820	30	2 526	840	30
7 	3 250	760	70	3 306	820	30	3 326	840	30

NOTE *[C] is the minimum free space between the unit at its final position and any back wall or obstacle. You might need more space for assembly or installation operations. In that case, do the assembly or installation operation nearby and then place the unit at the final position.*

9 - Hole in the floor for Downflow Down units





Frame type	No accessories for support			With floor tiles support kit		
	A [mm]	B [mm]	C [mm]	A [mm]	B [mm]	C [mm]
1 	Not available			Not available		
2 	1 182	846	20	1 220	885	50
3 	1 732	846	20	1 770	885	50
5 	2 532	846	20	2 570	885	50
7 	3 332	846	20	3 370	885	50

NOTE *[C] is the minimum free space between the unit at its final position and any back wall or obstacle. You might need more space for assembly or installation operations. In that case, do the assembly or installation operation nearby and then place the unit at the final position.*

10 - Weights

Table 04 - Unit weight

Unit Model	Unit Weight [kg]	Packaging Weight [kg]
PI015	315	19
PI021	316	19
PI025	336	19
PI031	358	19
PI033	358	19
PI041	471	23
PI045	472	23
PI059	452	23
PI047	640	28
PI051	641	28
PI057	688	28
PI075	754	28

Unit Model	Unit Weight [kg]	Packaging Weight [kg]
PI044	671	28
PI054	682	28
PI062	723	28
PI074	730	28
PI092	611	28
PI068	935	42
PI082	957	42
PI094	967	42
PI104	987	42
PI120	1006	42
PI150	1091	58
PI165	1139	58

Table 05 - Fan module weight

Type	Model	Unit Weight [kg]	Packaging Weight [kg]
Base Frame	**BFX12**	91	26
	BFX17	150	35
	BFX33	325	78
Base Module	**BMX12**	132	26
	BMX17	200	35
	BMX33	405	78
Fan Top Plenum	**TPX12**	132	26
	TPX17	200	35
	TPX33	---	---

Annex C - Connections

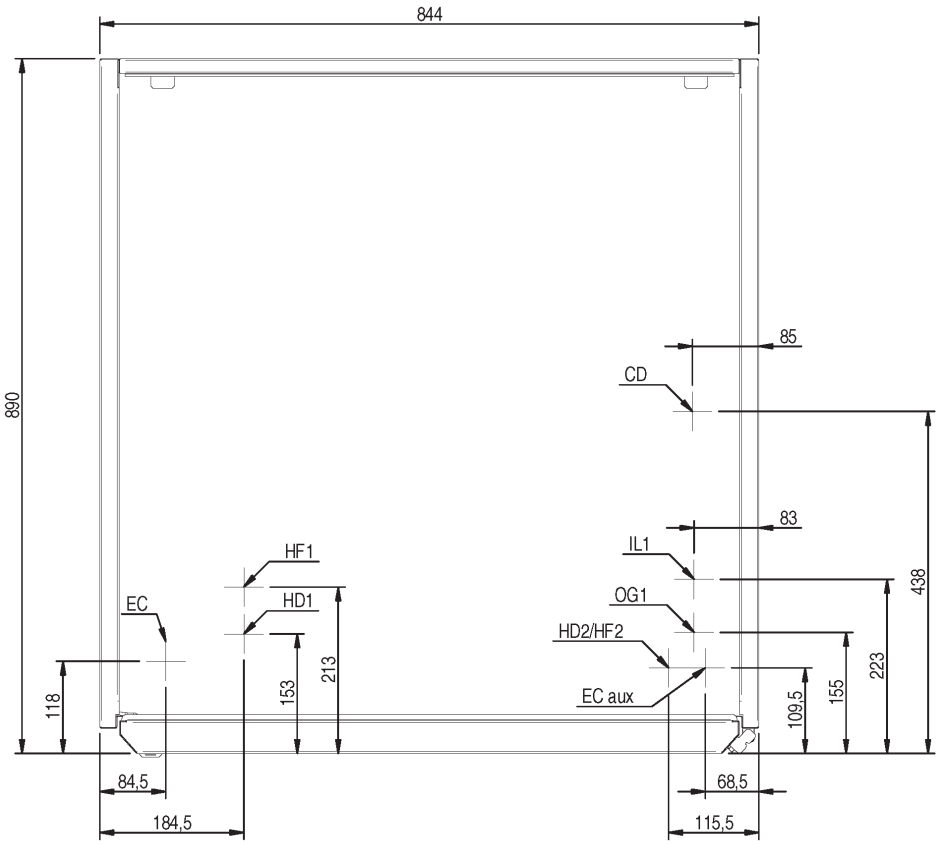
Content

Key to symbols

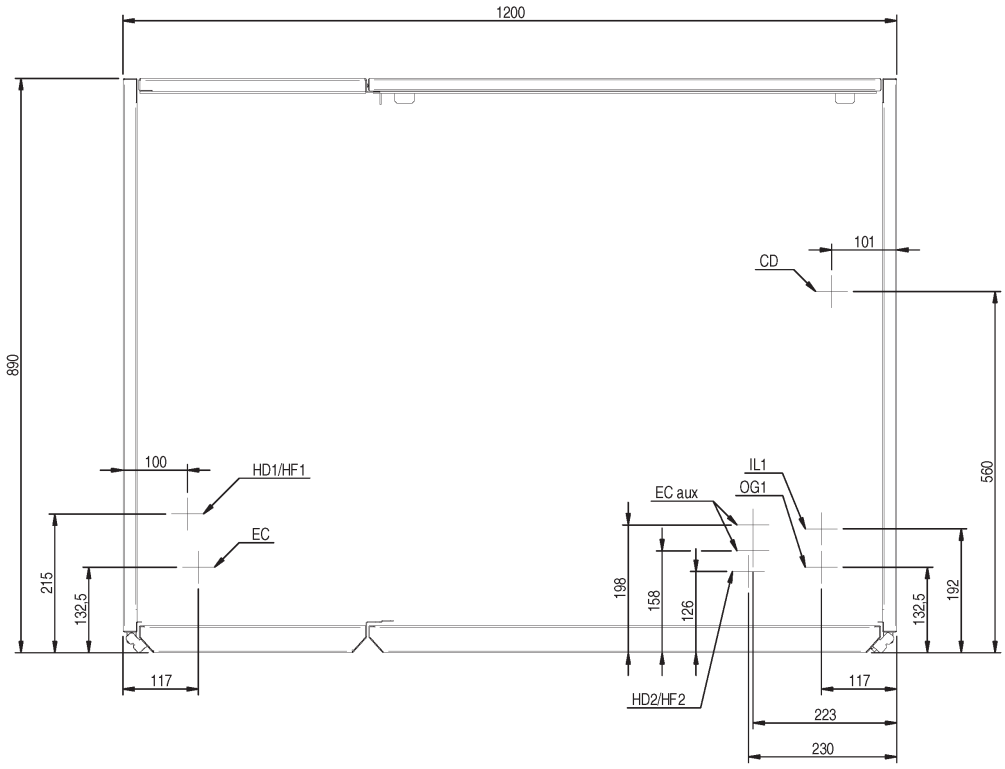
Symbol	Description
IL1	Refrigerant liquid line inlet circuit 1
IL2	Refrigerant liquid line inlet circuit 2
OG1	Refrigerant gas line outlet 1
OG2	Refrigerant gas line outlet 2
HF	Humidifier feed
HD	Humidifier drain
EC	Electrical power supply
EC aux	Low voltage cables
CD	Condensate Drain

NOTE *All the dimensions are in millimeters*

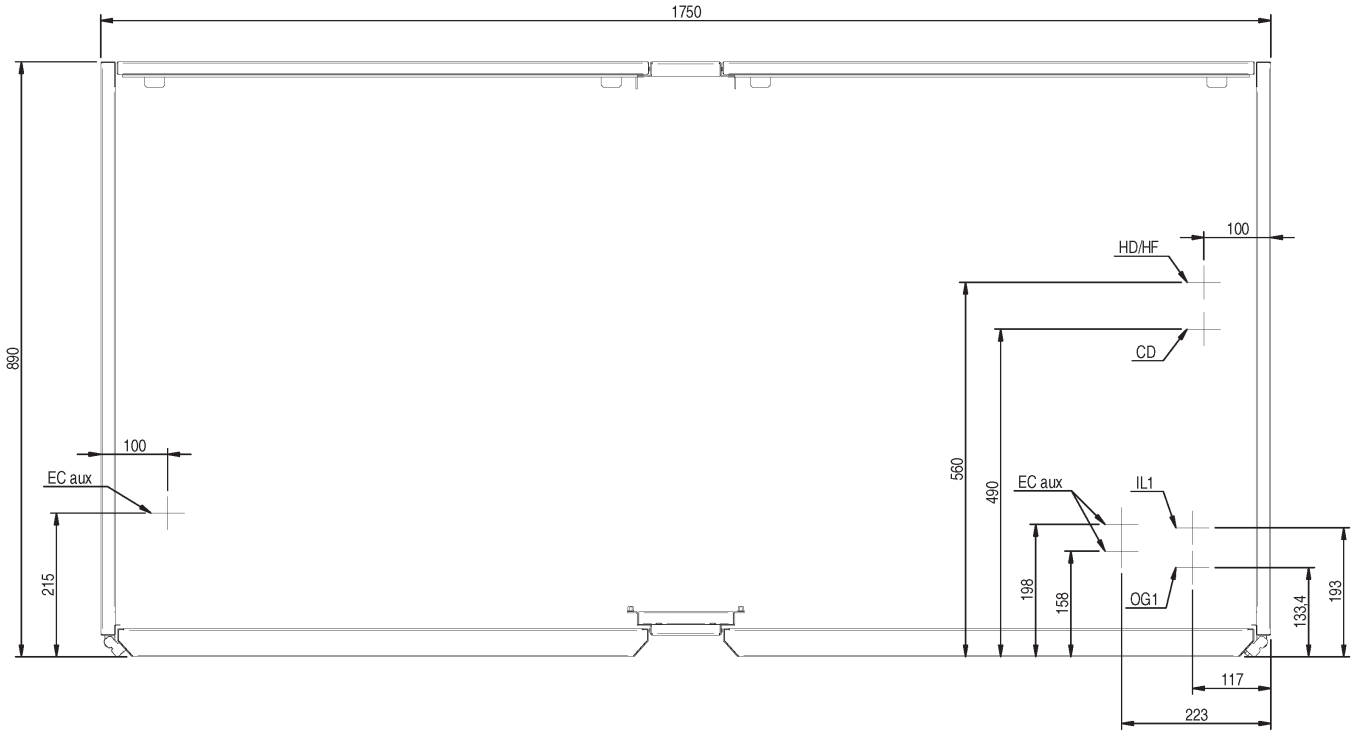
1 - PI015A - PI021A - PI025A - PI031A - PI033A



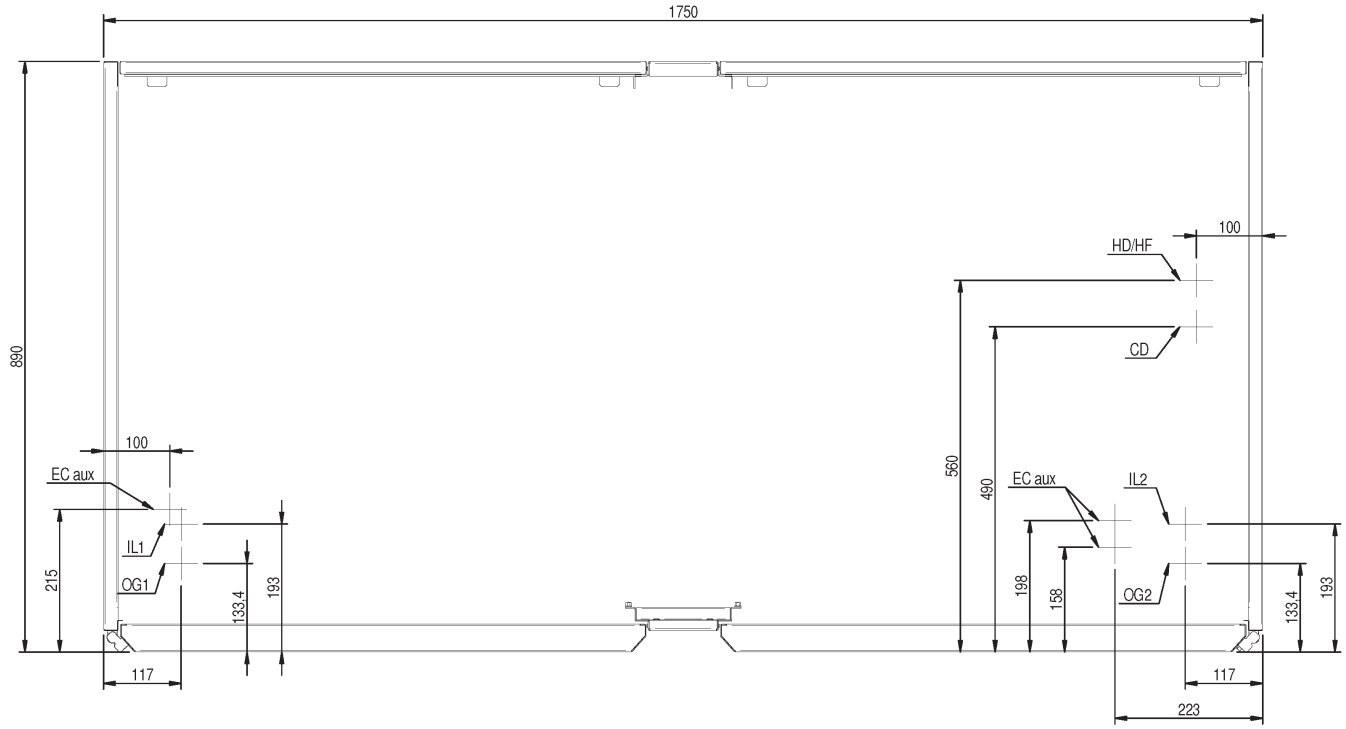
2 - PI041A - PI045A - PI059A



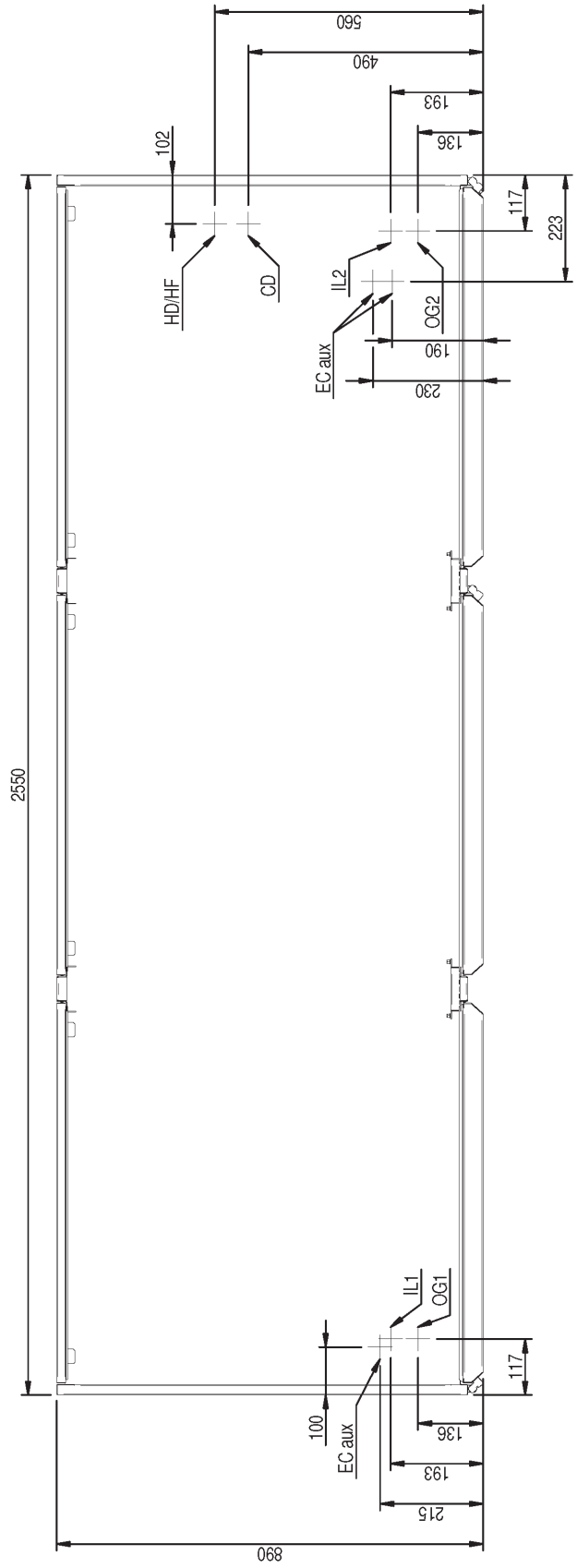
3 - PI047A - PI051A - PI057A - PI075A



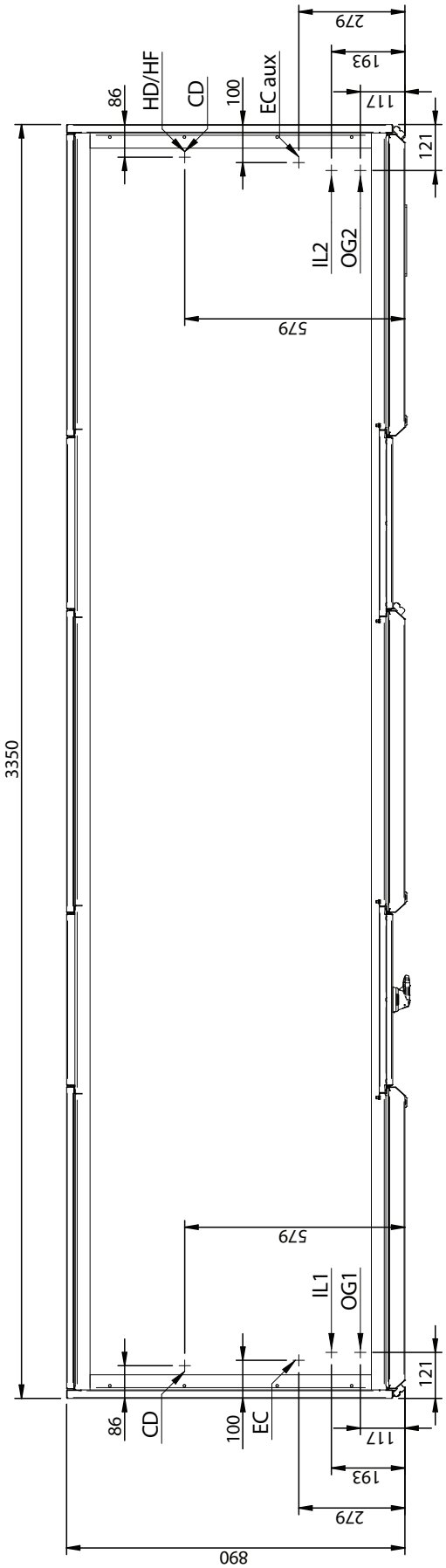
4 - PI044A - PI054A - PI062A - PI074A - PI092A



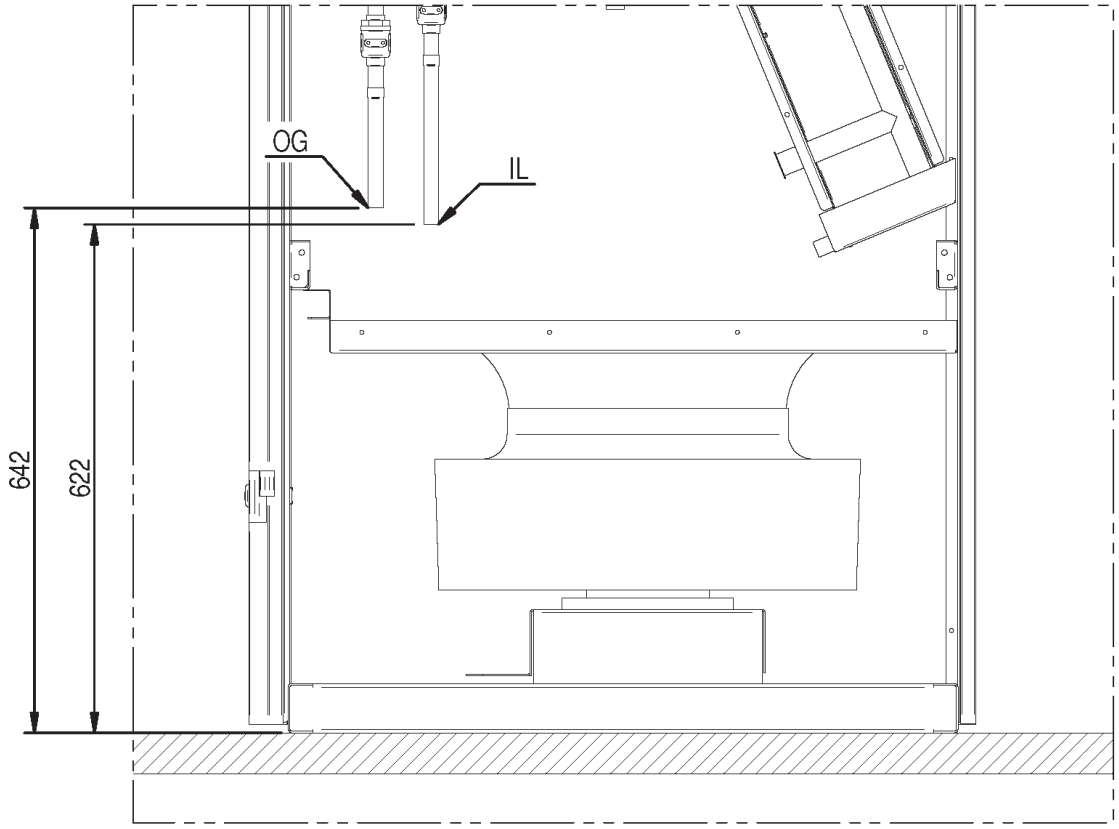
5 - PI068A - PI082A - PI094A - PI104A - PI120A



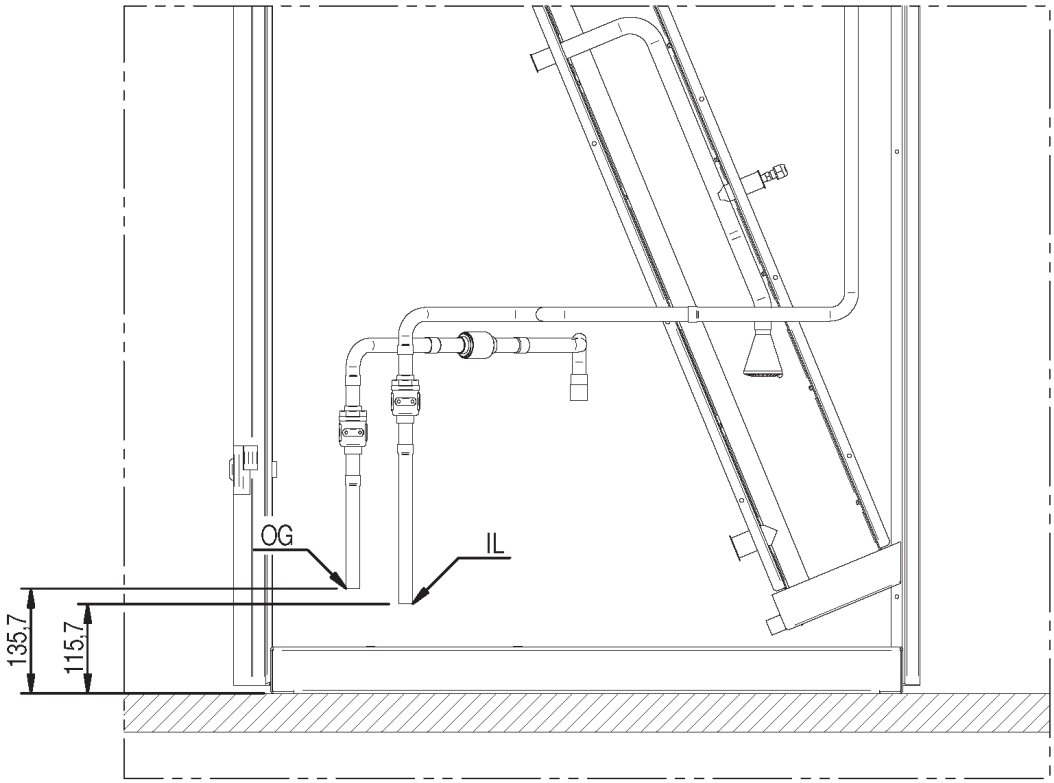
6 - PI150-PI165



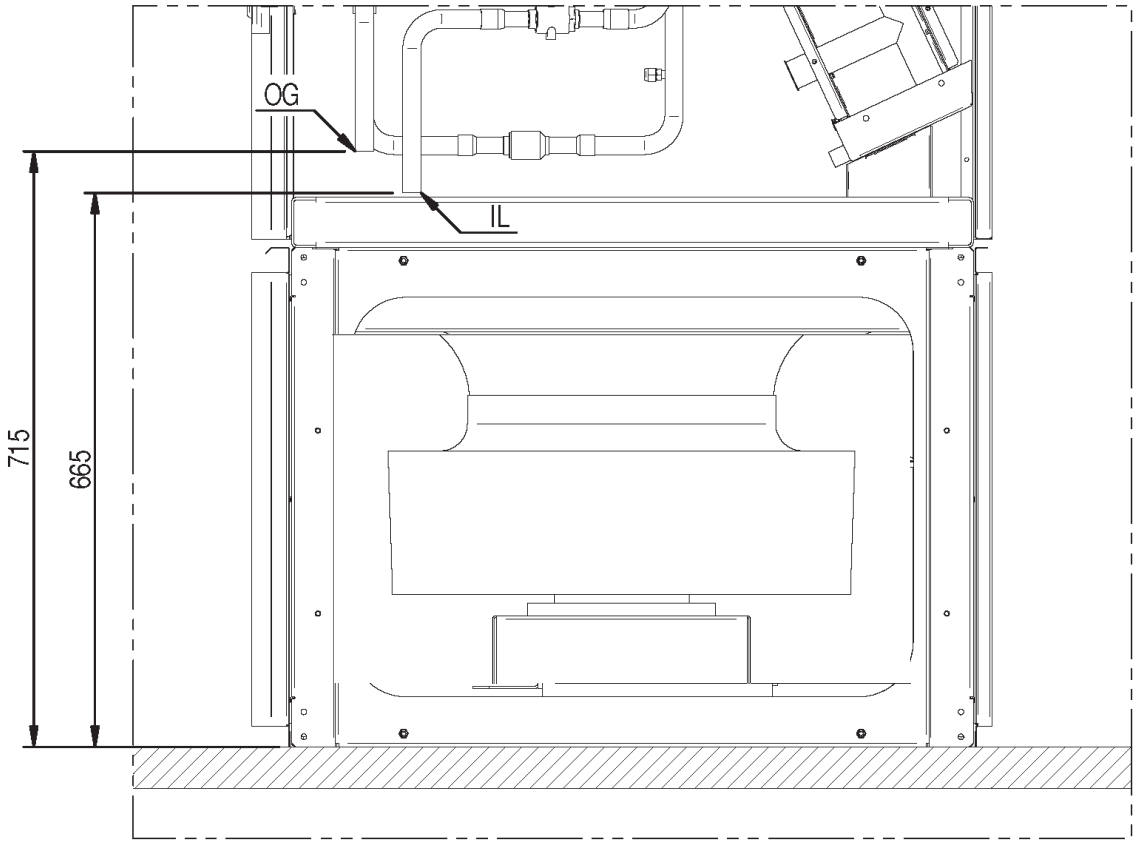
7 - PI015A TO PI033A DOWN



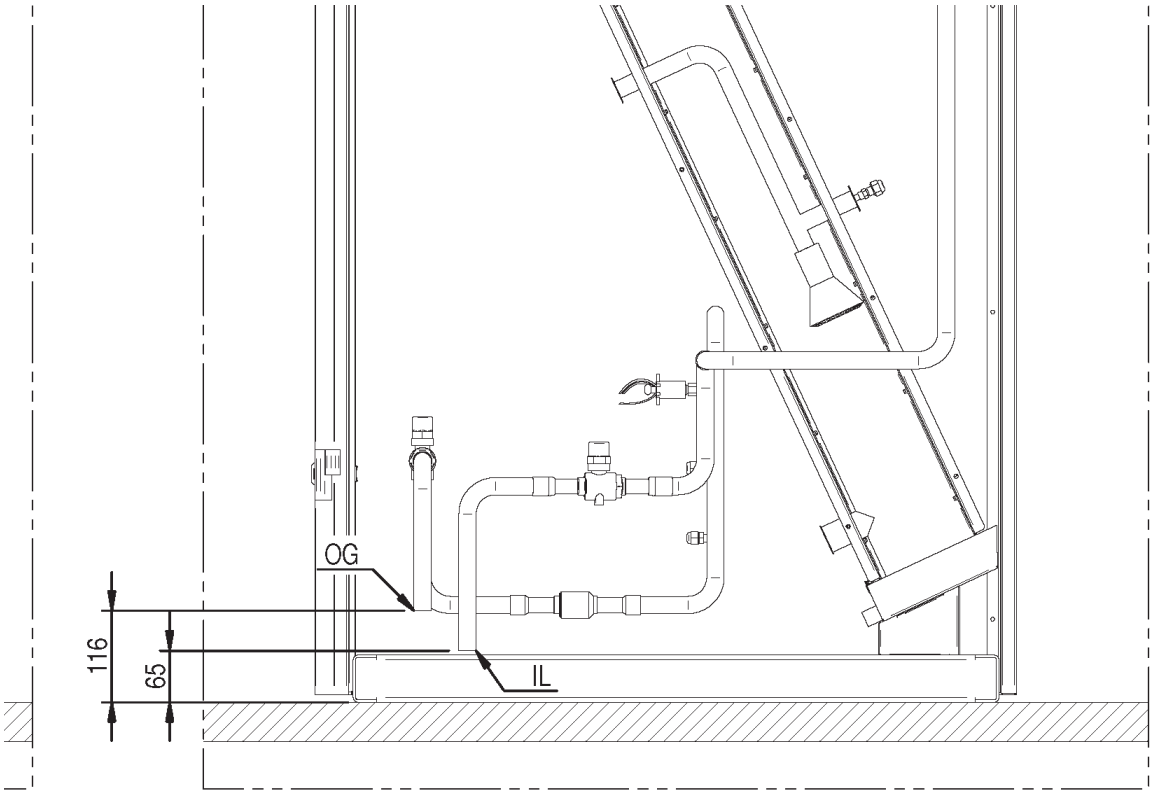
8 - PI015A TO PI033A UP



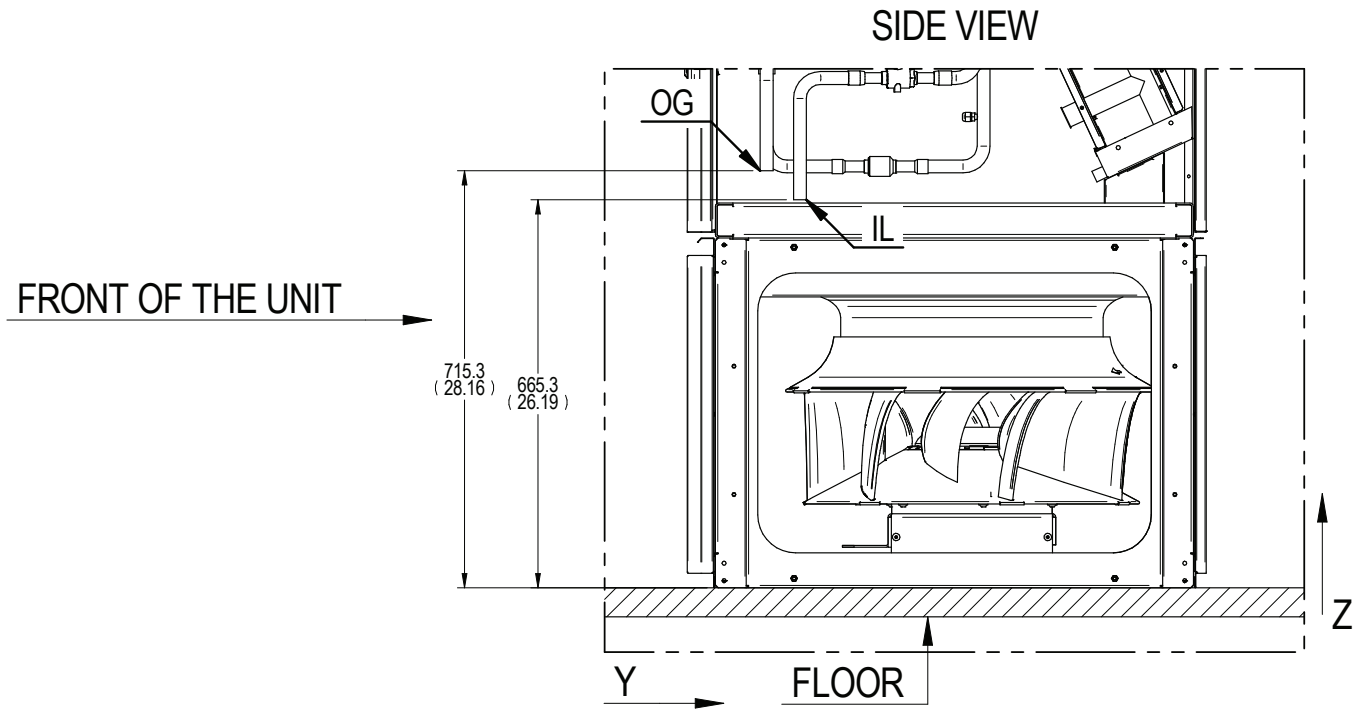
9 - PI041A TO PI120A DOWN

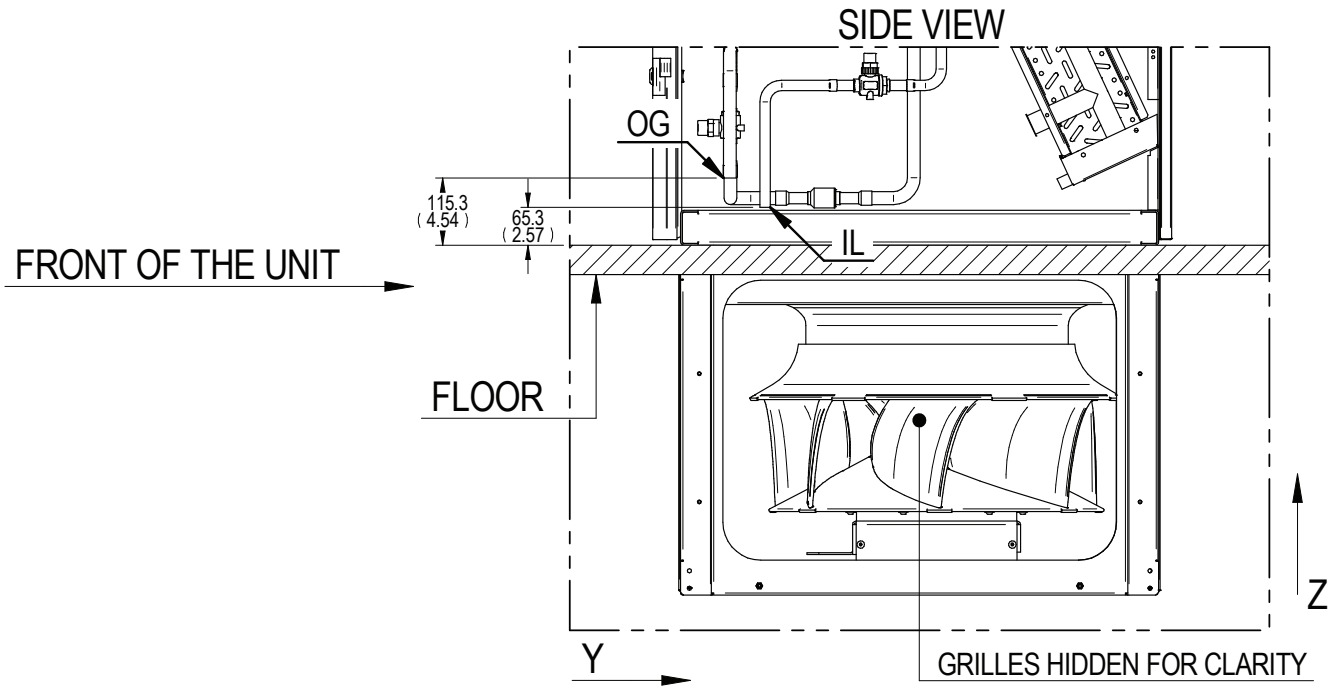


10 - PI041A TO PI120A UP



11 - PI150-PI165

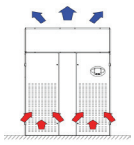
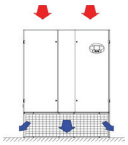
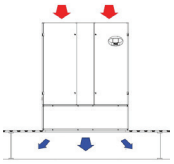
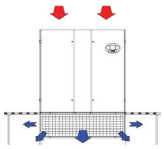




Annex D - Accessories

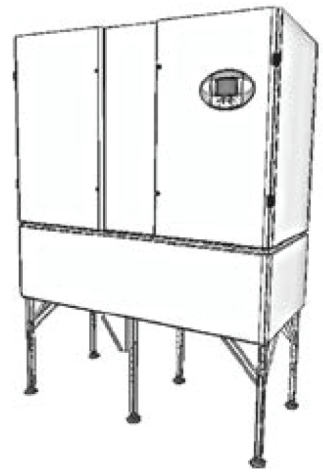
Content

1 - Overview

Accessory	Purpose	Position	U - Upflow	H - Downflow Frontal	D - Downflow Up	E - Downflow Down
						
Legs kit	Support	Bottom	NO	NO	YES	YES
Base frame	Support	Bottom	YES	YES	YES	YES
Base module	Support + piping lay-down	Bottom	YES	YES	NO	NO
Base module 600/300 mm high with rear/bottom air intake	Air flow	Bottom	YES	NO	NO	NO
Fresh air module	Air flow	Fan inlet	YES	YES	YES	YES
Vertical flow extension hood (*)	Air flow	Top	YES	YES	YES	YES
Hood with high efficiency air filter (*)	Better filtering	Top	YES	YES	YES	YES
Plenum with silencing cartridges (*)	Noise reduction	Top	YES	YES	YES	YES
Horizontal hood with grid	Air flow	Top	YES	NO	NO	NO
Air economizer (*)	Air flow	Top	NO	YES	YES	YES
Floor tiles support kit	Support	Bottom	NO	NO	NO	YES
Fans maintenance kit	Maintenance	Bottom	NO	NO	NO	YES
Connecting flange	(*)	Top	NO	YES	YES	YES

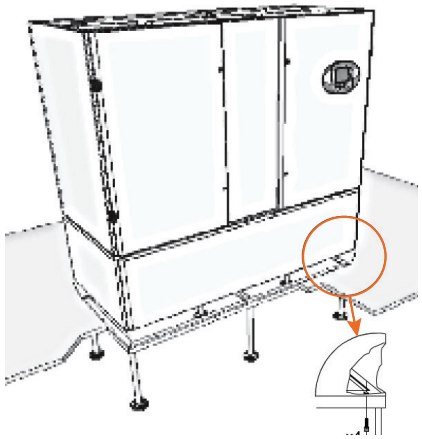
(*) The connecting flange is required to mount the accessory on top of the Downflow units.

2 - Legs kit



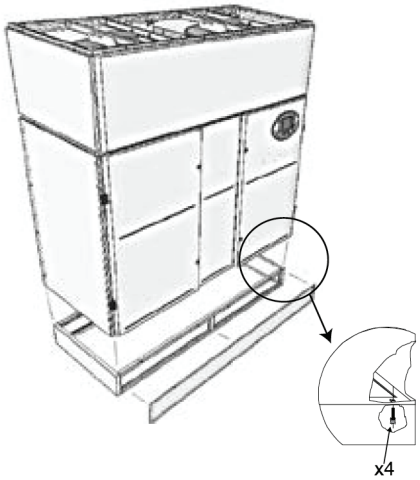
Purpose	To support the unit when installed with a raised floor.
Description	The legs are adjustable and allow to support the unit at different height.
For airflow version	**D** - Downflow Up **E** - Downflow Down
Available height	30–370 mm 370–570 mm 570–800 mm
Assembly	Fix the accessory using the threaded inserts that you find in the fan module frame. You need M8 screws (they are not supplied with the unit).

3 - Base frame



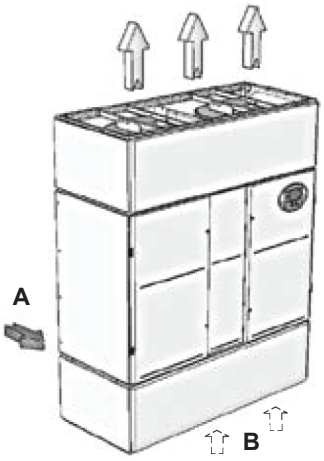
Purpose	To support the unit when installed with a raised floor.
Description	The legs are adjustable and allow to support the unit at different height. A protective grid prevents any contact with the fans from below.
For airflow version	**D** - Downflow Up **E** - Downflow Down **U** - Upflow Frontal
Available height	120–800 mm
Assembly	Fix the accessory using the threaded inserts that you find in the fan module frame. You need M8 screws (they are not supplied with the unit).

4 - Base module



Purpose	To support the unit. Allow the piping to enter the base of the unit when a raised floor is not installed.
For airflow version	**U** - Upflow **H** - Frontal
Available height	200 mm
Assembly	Fix to the unit base by 4 screws (the screws are not supplied with the unit)

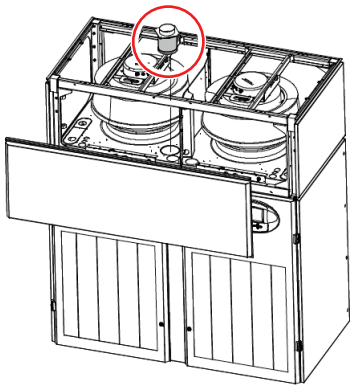
5 - Base module 600/300 mm high with rear air intake



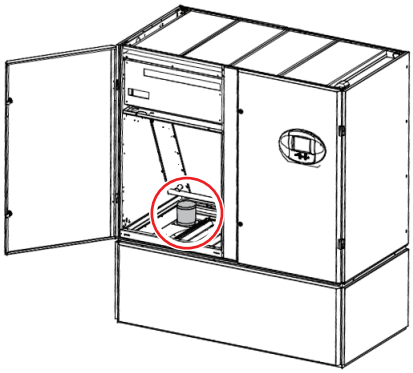
Purpose	To allow an Upflow unit to work with a rear/ bottom or a bottom air intake. Supporting the unit. Allow the piping to enter the base of the unit when a raised floor is not installed.
For airflow version	**U** - Upflow
Available height	[**A**] rear/bottom air intake H=600 mm [**B**] bottom air intake H=300 mm
Assembly	Fix to the unit base by 4 screws (the screws are not supplied with the unit)
NOTE	*The unit must be ordered with a blind front panel and an open basement*

6 - Fresh air module

Upflow



Downflow

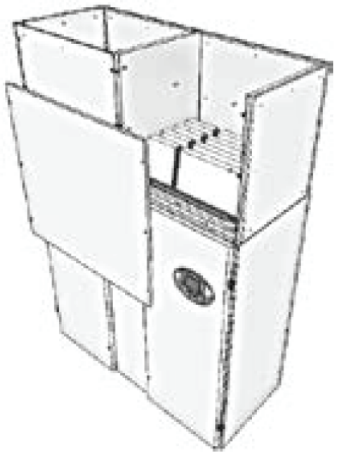


Purpose	To allow filtered fresh air intake from outdoor. The fresh air is mixed with the recirculation air returning from the room.
Description	The kit is made of a G3 class filter with a 100 mm diameter plastic duct.
Available diameter	100 mm
For airflow version	**U** - Upflow **H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Assembly	The kit must be installed on the low pressure side of the fan. • Remove the pre-cut in the plate that separates the fan module from the coil module. • Insert the kit in the hole, paying attention to push the filter into the low pressure side. • Connect the fresh air piping to the kit.

7 - Vertical flow extension hood

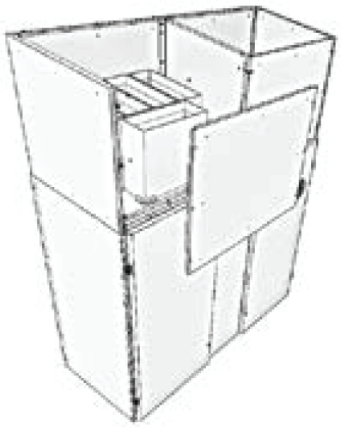
Purpose	Additional duct on the unit top, to simplify the connection to the ceiling or to other equipment.
Description	The hood has the same design as the unit and consists of sandwich panels lined with non-flammable insulation material of class 0 (ISO 1182.2), density 30 kg/m^3.
For airflow version	**U** - Upflow **H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Available heights	500 mm 600 mm 700 mm 800 mm 900 mm
Assembly	For the Downflow units: mount first the connecting high flange on top of the unit (see *14 - Connecting flange*). For all units: fix the accessory to the unit top by screws (the screws are not supplied with the unit).

8 - Hood with high efficiency air filter



Purpose	Optional high efficiency filters, filtration class ePM10 70% in accordance with the ISO/EN 16890 standard.
Description	The filters are made of fiberglass filter media. They are placed in "V" sections with a solid external frame in polypropylene and can withstand remarkable pressure and flow variations. The filters are installed inside an additional duct on the unit top.
For airflow version	**U** - Upflow **H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Available height	600 mm 900 mm
Assembly	For the Downflow units: mount first the connecting high flange on top of the unit (see *14 - Connecting flange*). For all units: fix the accessory to the unit top by screws (the screws are not supplied with the unit).

9 - Plenum with silencing cartridges

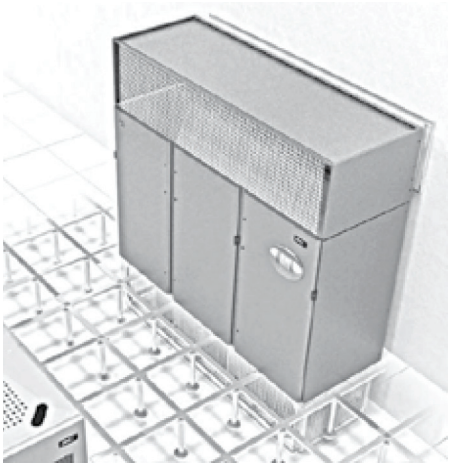


Purpose	Noise reduction
Description	These are special cartridges made of self - extinguishing material with a high noise attenuation capacity. They are guaranteed against disintegration and release of particles do to friction of the air. Despite a small additional pressure drop, these cartridges provide a remarkable sound power level reduction.
For airflow version	**U** - Upflow **H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Available height	600 mm 900 mm
Assembly	For the Downflow units: mount first the connecting high flange on top of the unit (see *14 - Connecting flange*). For all units: fix the accessory to the unit top by screws (the screws are not supplied with the unit).

10 - Horizontal hood with grid

Purpose	Airflow optimization Noise reduction
Description	A supply plenum with horizontal air flow can be installed on top of the unit. The plenum consists of sandwich panels lined with non- flammable insulation material of class 0 (ISO 1182.2), density 30 kg/m^3. It is equipped with a double deflection grill
For airflow version	**U** - Upflow
Available height	600 mm
Assembly	For the Downflow units: mount first the connecting high flange on top of the unit (see *14 - Connecting flange*). For all units: fix the accessory to the unit top by screws (the screws are not supplied with the unit).

11 - Air economizer



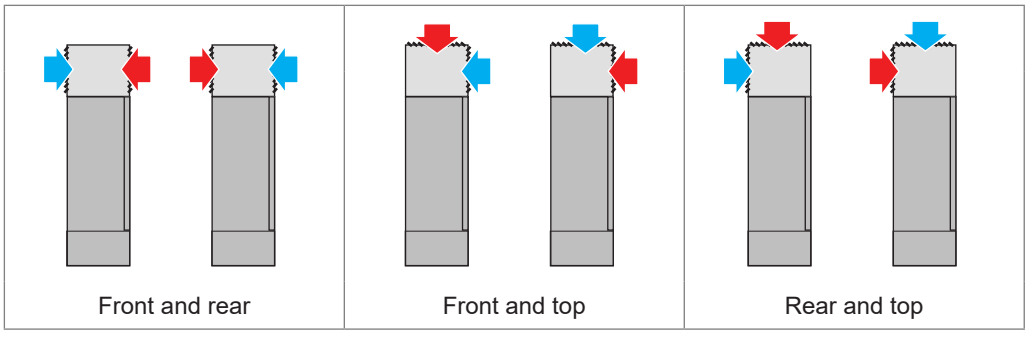
Purpose	High energy savings by reducing the refrigerant circulation. The unit takes cool air from outdoors and uses it for room conditioning.
Description	The air economizer is an extension hood with two dampers and two temperature sensors. A sensor measures the temperature of the outdoor (cold) air. The other sensor measures the temperature of the warm air returning to the unit from the room. When the outdoor temperature is low enough, the control stops the compressor(s) and opens the dampers, one for outdoor air intake, the other for room air intake. The outdoor air is mixed with the room air to adjust the temperature. The air mixture is filtered by flowing through to unit. When the outdoor temperature is too high, the control restarts the compressor(s) and closes the dampers.
For airflow version	**H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Available height	860 mm
Assembly	Mount first the connecting high flange on top of the unit (see *14 - Connecting flange*). Then fix the accessory to the unit top by screws (the screws are not supplied with the unit).
NOTE	*To use the air economizer the building has to be equipped with suitable air ducts for the outdoor air intake.* *The air economizer is supplied with a remote temperature sensor, to be mounted on the outdoor air intake.*

Dampers arrangement

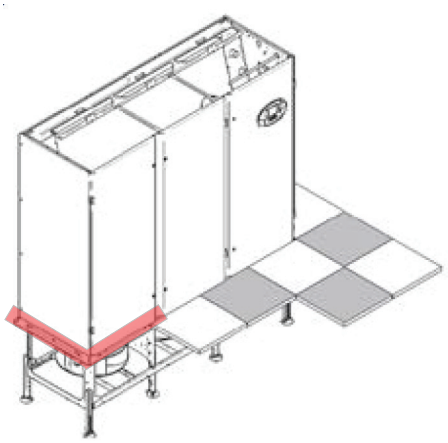
The two dampers can be placed in different positions, to fit best the room and air ducts layout. See below all the possible arrangements.

Outdoor (cold) air

Room (warm) air

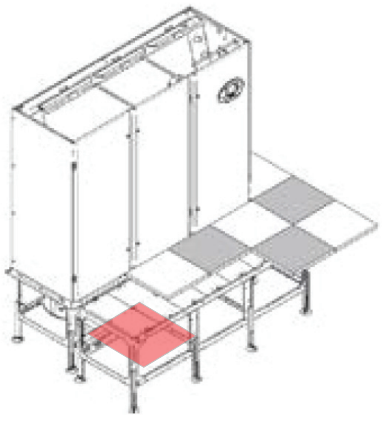


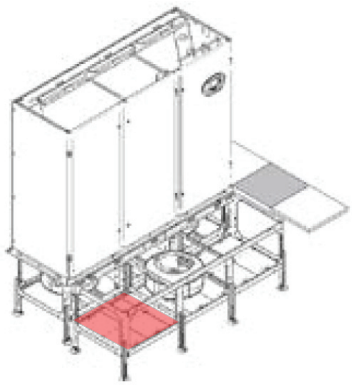
12 - Floor tiles support kit



Purpose	To support the floor tiles around the Downflow Down units when installed with a raised floor.
Description	The floor tiles support is fixed on the fan module frame.
For airflow version	**E** - Downflow Down
Available dimension	For tiles thickness up to 40 mm.
Assembly	Fix the accessory using the threaded inserts that you find in the fan module frame. You need M8 screws (they are not supplied with the unit).
NOTE 1	*With a correct installation, the maximum admitted vertical distributed load on the perimeter is 180 kg/m.* *It means that on the lateral side, which is 870 mm long, the maximum admitted distributed load is 157 kg.*
NOTE 2	*The floor tiles support is earthed with the unit frame.* *Follow local rules for system grounding*

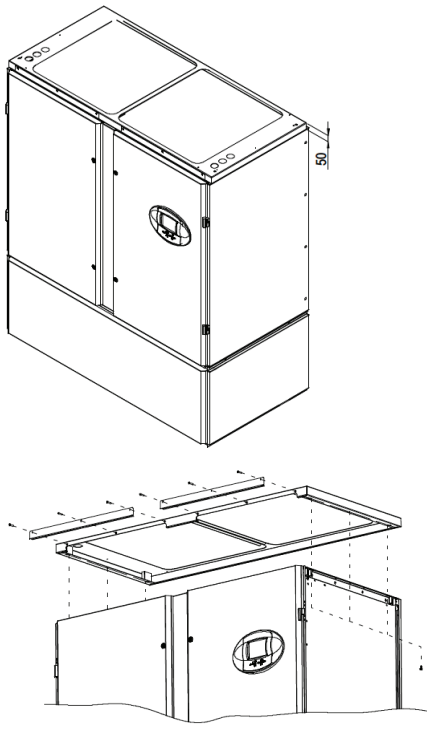
13 - Fans maintenance kit





Purpose	To allow maintenance operations, in particular fans replacement, when the fans are installed below the floor level.
Description	Removing tiles on the frontal area, it is possible to lift some footboards, moving them on the lower level, creating a service volume in the raised floor.
For airflow version	**E** - Downflow Down
Dimension of the footboards	50x50 mm
Assembly	Additional frame to be placed under the raised floor in front of the fan compartment.
NOTE 1	*The footboards are designed to support a maximum vertical distributed load of 600 kg/ m^2 and a maximum concentrated load of 150 kg.*
NOTE 2	*The fans maintenance kit must be earthed following the local rules.*

14 - Connecting flange



Purpose	To allow mounting on top of the unit the following accessories: - Vertical flow extension hood - Hood with high efficiency air filter - Plenum with silencing cartridges - Air economizer
For airflow version	**H** - Downflow Frontal **D** - Downflow Up **E** - Downflow Down
Available height	50 mm
Assembly	If you ordered a unit with the arrangement for the above mentioned accessories, the flange is already mounted on the unit top. Therefore the unit is 50 mm higher. To remove the flange you need to remove the side panel to access the fixing screws.

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