

Liebert
HIROSS



High Performance Air Conditioning

Hiline Slim

Product Documentation

Internal

Packaged Unit for

Air Filtration

Indoor Ventilation

Cooling

Heating

Freecooling with Outdoor Fresh Air

also with emergency power supply

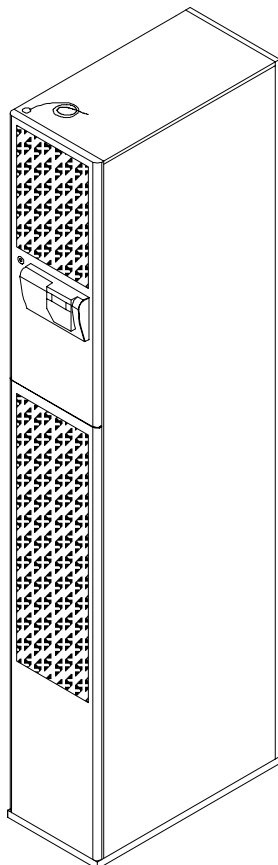
English

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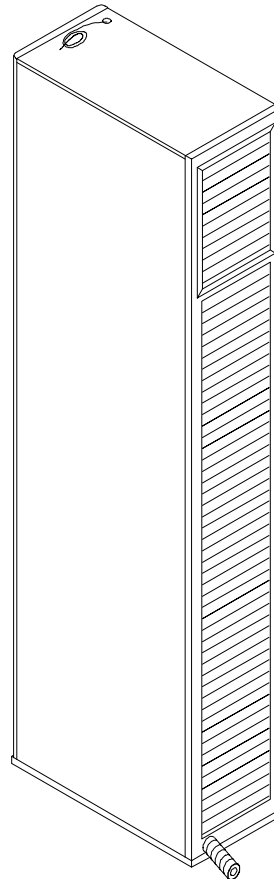
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FRONT VIEW



REAR VIEW



1 – The series

Subject

HILINE PKS3, PKS4

- package air conditioners
- direct expansion units
- built-in air cooled condenser
- internal wall mounted.

1.1 – Main features

Functions

Vertically shaped air conditioners to be installed internal wall-mounted, mainly for electronic equipped shelters, process centres, telecommunicationssites from 3.5 a 4.5 kW of nominal cooling capacity.

The system provides air filtration, indoor ventilation, cooling, heating, freecooling with outdoor fresh air to assure the useful climate in the site. The unit can accept emergency power supply of 48 Vcc, assuring indoor ventilation and freecooling.

1.2 – Accessibility

Easy Servicing

In models PKS3 and PKS4, accessibility for the maintenance of the following standard components is granted from the outdoor front: air filter , compressor, evaporating section side fans, heaters, electrical panel with microprocessor control.

The electrical connections are provided from the roof of the unit.

Accessibility for the maintenance of the condensing side and Freecooling filter is granted from the external back panel .

1.3 – Metal cabinet

Compactness

The reduced external dimensions are the most remarkable characteristics of the Hiline Slim serie: the footprint size is 600x295 mm only.

Hiline Slim frame consists of riveted steels, treated with powder coating colour “pearl white” (RAL7032). The unit is designed to be installed in communication to outdoor and resist to worst weather conditions. The screws are hermetic and antivandalism (they can be removed only with specific tools) and allow the removing of the panel and rear grille.

The condenser air enter is through the rear metallic grille. The air conditioned delivery is the middle position on the front panel (see the operation diagram): a metal safety grid prevents contact with the fans.

The compressor is located in the lower part of the unit, separated from the air flow.

The insulation of the panels is 10 mm thick, with ELIOCELL AU 20.

An important result which has been achieved, is the compactness of the unit: a great cooling capacity with reduced dimensions on a small encombrement. For instance, we have a ratio between the capacity and the volume of the unit of 11.4 kW/m³ at standard conditions of 24 °C, 50% RH, 35 °C ambient.

1.4 – Refrigeration circuit

Efficiency

There is a single refrigeration circuit with a hermetic compressor.

An internal thermal protection against overheating of the motor is provided as standard.

The circuit incorporates a capillary tube which controls the refrigerant flow to the evaporator.

A filter dryer is provided in the liquid line to eliminate all moisture for maximum efficiency and an increased working life.

The compressor is equipped with two pressure switches for protection against high condensing and low evaporating pressures. The low pressure switch features automatic reset and a delay for winter operation, whilst to avoid compressor cycling at high discharge pressures. The high pressure switch is equipped with manual reset.

1.5 – Evaporating section

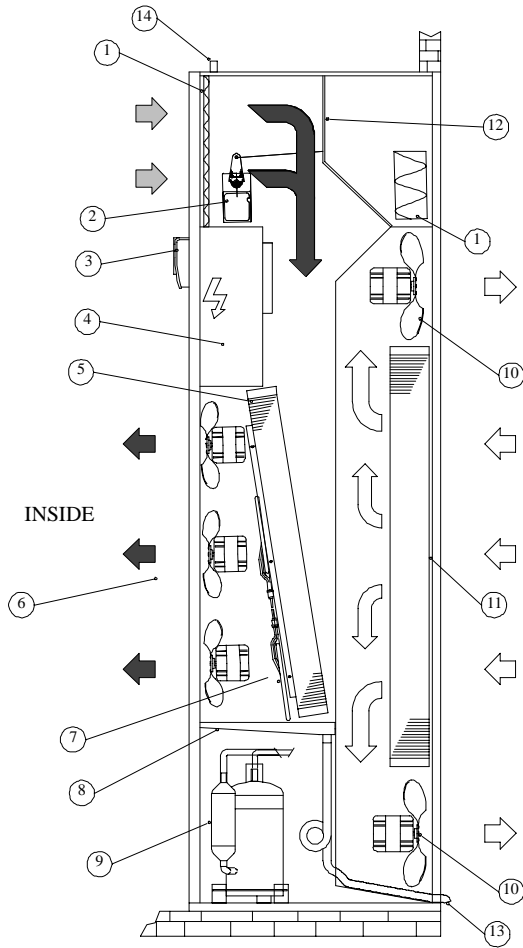
Cooling capacity

1.5.1 – Heat transfer coil

This consists of a plate coil in copper tubes with aluminium fins and with a large face area so as to increase the SHR and optimise the EER; this is achieved by reducing the air pressure drop and turbulence and increasing the evaporating temperature, thus the efficiency, of the compressor. A galvanized steel basin is provide for the drainage water.

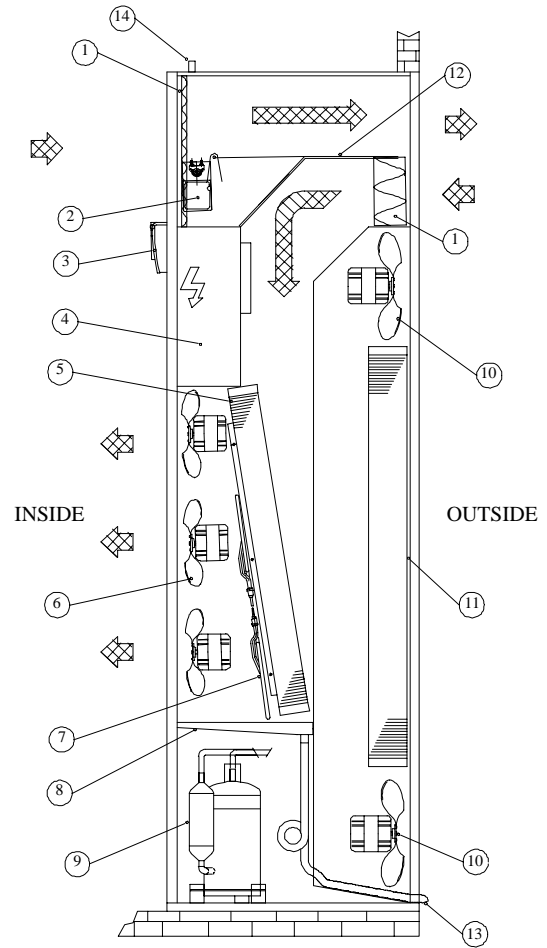
Operation diagram: Hiline Slim PKS3

AIR CONDITIONING



- COOLED AIR
- CONDENSER SECTION AIR
- AIR TO BE COOLED

FREECOOLING – ECONOMIC COOLING



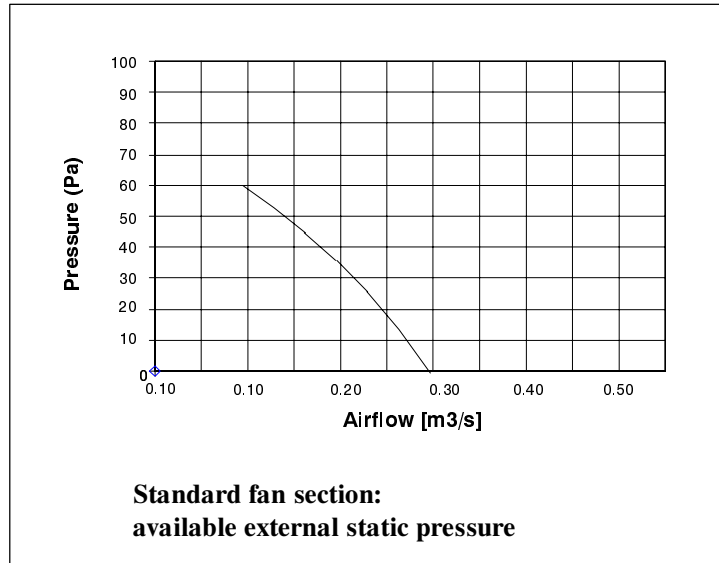
- FREECOLING AIR

POS.	DESCRIPTION	POS.	DESCRIPTION
1	Air filter	8	Condensate drain tank
2	Damper motor	9	Compressor
3	Electronic control	10	Condenser fan
4	Electrical board	11	Condenser
5	Evaporator	12	Freecooling damper
6	Evaporator fans	13	Condensate drain
7	Electric heaters (optional)	14	Supply cable inlet

1.5.2 – Fan features

The units are equipped with three axial fans with integral motor and individual thermal protection. The impellers are statically and dynamically balanced with lifetime lubricated bearings for quiet, vibration-free operation.

The motor is single-phase, IP23, B-class insulation.



1.6 – Condensing section

Reliability

1.6.1 – Heat transfer coil

The air condensing coil is designed in rolled copper tubes with turbulence-enhancing aluminium fins and sized to allow operations up to 45 °C outdoor air temperature.

1.6.2 – Fan features

The units are equipped with two compact axial fans with integral motor and individual thermal protection, IP44/F-class. An On-Off thermostat, acting on the fans, keeps the condensing pressure and temperature into the normal range.

1.7 – Air filter section

Air Purity

The filter section is placed vertically before the evaporating coil and provides filtration of the recirculated or the fresh air to obtain the required degree of air cleanliness in the room. The filters can be removed from the front of the unit by simply opening the relevant panel. They feature 12 mm thick, are in spongy material, specially designed to minimise the pressure drop and improve the efficiency. The standard filter class is EU3, according to Eurovent EU4/5 standard).

1.8 – Electric board

Power Supply with Safety

The electrical board is housed in a compartment isolated from the air stream and protected by a hinged panel.

The electrical board is built in accordance with IEC 204-1 recommendations. It is easily accessible thanks to quick locking doors. The Hiline Slim units are designed for 230 V/1 ph/50 Hz power supply.

One circuit breaker with thermal protection against short circuits is supplied for the electrical apparatus. A single phase transformer for power supply to the 24 V to the electronic control and to a secondary circuit is provided for maximum safety. Automatic restart is provided after a power failure.

1.9 – Electronic control

Clever Control

1.9.1 – Microface control

The units are equipped with the Microface micro–processor control. Its main characteristics are power and versatility.

User interface. The user interface is a 3–digit backlighted display. The unit setup is organised in a menu–tree. The setup access is subjected to password; the selected parameters are displayed as a code that can be easily found in the service manual.

Stand–by. The connection between 2 or more units is possible thanks to an integrated system that activates the units in stand–by (slave) when the main units (master) are in an alarm status or when more refrigerating power is required (CASCADE function).

Rotazione automatica. The exchange of rôles between the master and slave units connected in a stand–by system is automatic, so all units have more or less the same running time.

Alarms. In the base version a “clean” alarm contact (HP, LP, control disease or probes disease) and a “clean” signal contact (HT, LT, heaters’ safety thermal switches) are at disposal . In case of alarm, the unit is stopped.

1.9.2 – Microface control plus Hiromatic Graphic (optional)

Microface is a *Hi–Tech solution* that enables the connection of the display for Hiromatic Graphic, for the temperature record over the last 24 hours and the alarm report functionality. The Microface (if connected with Hiromatic Graphic) also records the number of working hours of the main components (fan, compressor, heating elements), controls the starts and stops of the compressor cleverly, shows the alarms available in the unit, and allows the setting of the important parameters covered by 3 password levels. The thermoregulation can occur according to the typical algorithms P, P+I or by the new algorithm produced by Liebert HIROSS and called “Liebert HIROSS Energy Saving”. This makes a real energy saving possible without giving up adjustment accuracy.

Also with a serial port 422, available as option, in the Hirolink Graphic, we can link together in a network by the Hirolink accessory the Hiwall units located in different sites. So we can monitorize with a personal computer all the installed conditioners.

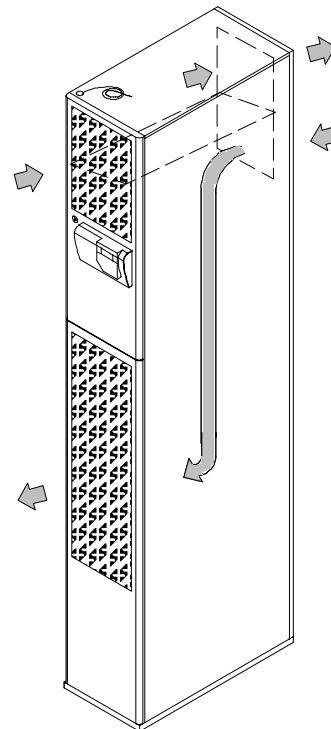
1.10 – Freecooling (optional)

All units can be made available with FC freecooling option. Please see the concept diagram. In this way we save energy and achieve better reliability, for the lower number of compressor starts and stops, and the shorter running time.

One internal damper modulates his position from 0 to 100% of fresh air, just to achieve the required cooling capacity. Through the unit the exhaust air is discharged outdoor.

The consensus to FC is given when the difference between the indoor and outdoor air temperatures is higher than a set value. No freecooling and mechanical cooling are allowed at the same time.

Energy Saving



1.11 –Electric heater (optional)

Heating

The heating option is available with two electric heaters for a total of 3 kW capacity. There is one stage, one contactor and ON–OFF temperature control. Each heater is fitted with safety thermostat, with a manual reset.

1.12 –Condensing temperature control with variable fan speed (optional)

Continuous running

The condensing fan speed is smoothly regulated in order to maintain constant the condensing temperature and therefore the pressure. Two kind of advantages. Higher reliability for less start/stops of the compressor, and lower noise disturbance because the fans are running at a lower speed, mainly during night time, and with less discontinuity.

1.13 –Emergency cooling (optional)

Ventilating Without Interruption

The unit is optionally equipped with an emergency cooling system that allows to supply the indoor fans, the control and the motor damper, if fitted with 48 and 24 Vdc power supply. When it is required to guarantee the air circulation inside the shelter even when the main electric supply is missing. An inverter can be placed into the unit. The unit is placed, allowing to use the 24Vdc or 48Vdc battery, that is generally installed inside the shelter to provides emergency energy to the electronics.

The emergency cooling consists of the inverter and the transformer 24 Vdc/230 Vac or 48 Vdc/230 Vac. When there is no problems with the main supply line the inverter is like a by–pass. When the main supply fails, the system taking energy from the coil, supplies the evaporator fan, the electronic control and, as option, the damper motor for the Freecooling. The compressor is not powered. So, in this way, the control is energised, the air recirculation inside the shelter is ensured and also the freecooling, if fitted, is working.

Inverter features

		AC output	
		voltage	230 V
		output voltage variation, load up to 80%	4%
		output voltage variation, other conditions	7%
DC input		frequency	50 Hz
supply voltage	24 V 48 V	max. frequency variation	1%
max. current	24V dc 21.5 A 48 Vdc 10.4 A	power	400 W
peak current	24 V dc 26 A 48 Vdc 13 A	max. current	1.8 A
protection fuse	25 A with delay	switching time	less than 20 ms
voltage	24 V dc 18 V to 30 V	overload protection	electronic
range	48 Vdc 42 V to 54 V	short circuit protection	electronic control
inverter	24 V dc 18 V		
cut off voltage	48 Vdc 42 V		
other characteristics			
minimum	24 V dc 20 V	working temperature	from –20 to 60 °C
voltage alarm	48 Vdc 44 V		
over temperature cut off	75 °C		

1.14 – Noise level

Silentness

Sound pressure levels, for measurement carried out with fan speed regulator (Variex).

Model		Octave band frequency (Hz)									Sound pressure level [dB(A)]
		31.5	63	125	250	500	1000	2000	4000	8000	
PKS3	Indoor, free field at 2 m in front of the unit	49	56	62	58	55	54	53	53	51	61
	Outdoor, free field at 2 m in front of the unit	50	51	49	54	51	51	47	44	37	55
PKS4	Indoor, free field at 2 m in front of the unit	49	56	62	58	55	54	53	53	51	61
	Outdoor, free field at 2 m in front of the unit	50	51	49	54	51	51	47	44	37	55

1.15 – Packing

Delivery

Standard packing consists of a wooden pallet and cardboard box. Polythene foam protects the unit's painted surface. On request, a cardboard box with an additional wooden crate or wooden case for sea transport can be supplied.

1.16 – Tests and reference norms

Production System Quality

The units are planned, manufactured and tested in compliance to the European directives 89/392 EEC; 91/368/EEC; 93/44/EEC; 93/68/EEC; 73/23/EEC; 89/336/EEC. More deeply, the unit is verified about Electromagnetic Compactibility according to the following standards: EN55022, radiated and conducted emission, class B; ENV 50/40/IEC 801–3 radiated immunity; IEC 801–6: radiated immunity on the supply/signal cables; IEC 801–4 fast transient; IEC 801–2 ESD.



The Quality Management System of Liebert HIROSS S.p.A. High Performance Air Conditioning has been approved by Lloyd's Register Quality Assurance to the quality management system standard ISO 9001: 2000., and the product is the result of activities carried out according to the provisions contained in the Quality procedures and plans..

The product is the result of activities carried out according to the provisions contained in the Quality procedures and plans. According to that, the machine is supplied complete with a test certificate and a certificate of conformity to the European directives. Hiline Slim units are marked "CE".

2 – Technical data and performances

Hiline Slim Model		PKS3	PKS4
POWER SUPPLY	V/ph/Hz	230/1/50	230/1/50
CABINET			
Frame		galvanized steel	
Painting		epoxydic powder	
Insulation type		Eliocell AU 20, 10 mm thick	
OVERALL DIMENSIONS			
Height	mm	2000	
Width	mm	295	
Depth	mm	600	
Weight	kg	117	
COMPRESSOR			
Type		rotary	
Refrigerant		R22	
CONDENSING COIL			
Tubes material / Fins material		copper / aluminium	
CONDENSING SECTION FAN			
Quantity and type		2 / axial	
Poles		2	
Control system		ON–OFF with pressure switch	
Max rotation speed	rpm	2550	
Blades material		coated aluminium	
Driven		direct	
Air flow	m ³ /s	0.50	
EVAPORATING COIL			
Tubes material / Fins material		copper / aluminium	
EVAPORATING SECTION FAN			
Quantity and type		3 / axial	
Poles		2	
Blades material		coated aluminium	
Driven		direct	
Air flow	m ³ /s	0.28	
ROOM AIR FILTER			
Quantity / Type		1 / unwashable	
Efficiency filter class (Eurovent EU 4/5)		G3	
ELECTRIC REHEAT COIL (opt)			
Steps number		1	
Total heating capacity	kW	3.0	
FREECOOLING (opt)			
New air max. flow rate	m ³ /s	0.21	

2.1 – Performances

Cooling capacities, absorbed power and current, compressor running mode – PKS3 model

		Outdoor temperature [°C]			
		25 50 Hz	30 50 Hz	35 50 Hz	40 50 Hz
Evaporator fan absorbed power	kW	0.2	0.2	0.2	0.2
Evaporator fan absorbed current	A	1.0	1.0	1.0	1.0
Condenser fan absorbed power	kW	0.3	0.3	0.3	0.3
Condenser fan absorbed current	A	1.2	1.2	1.2	1.2
Indoor conditions: 21°C, 50% r.h.					
Total cooling capacity	kW	3.7	3.5	3.4	3.3
Sensible cooling capacity	kW	3.2	3.1	3.0	3.0
Compressor absorbed power	kW	1.0	1.1	1.2	1.3
Compressor absorbed current	A	4.2	4.7	5.2	5.7
Indoor conditions: 24°C, 50% r.h.					
Total cooling capacity	kW	4.0	3.8	3.7	3.5
Sensible cooling capacity	kW	3.2	3.2	3.1	3.1
Compressor absorbed power	kW	1.0	1.1	1.2	1.4
Compressor absorbed current	A	4.3	4.7	5.3	5.9
Indoor conditions: 27°C, 47% r.h.					
Total cooling capacity	kW	4.2	4.0	3.9	3.8
Sensible cooling capacity	kW	3.5	3.4	3.3	3.3
Compressor absorbed power	kW	1.0	1.1	1.3	1.4
Compressor absorbed current	A	4.4	4.8	5.4	5.9
Indoor conditions: 30°C, 40% r.h.					
Total cooling capacity	kW	4.3	4.2	4.0	3.9
Sensible cooling capacity	kW	3.9	3.8	3.8	3.7
Compressor absorbed power	kW	1.0	1.2	1.3	1.4
Compressor absorbed current	A	4.4	4.9	5.8	5.9

Max cooling capacities, absorbed power and current, freecooling mode – PKS3 model

		Outdoor temperature [°C]		
		≤ 10 50 Hz	15 50 Hz	20 50 Hz
Evaporator fan motor absorbed power	kW	0.2	0.2	0.2
Evaporator fan motor absorbed current	A	1.0	1.0	1.0
Indoor temperature: 21°C				
Sensible cooling capacity	kW	2.0	1.0	0.1
Indoor temperature: 24°C				
Sensible cooling capacity	kW	2.55	1.6	0.75
Indoor temperature: 27°C				
Sensible cooling capacity	kW	3.0	2.2	1.3
Indoor temperature: 30°C				
Sensible cooling capacity	kW	3.6	2.7	1.8

Note: Cooling capacities do not take into account the heat from the fan motors, which must be added to the system heat load.

Cooling capacities, absorbed power and current, compressor running mode – PKS4 model

		Outdoor temperature [°C]			
		25 50 Hz	30 50 Hz	35 50 Hz	40 50 Hz
Evaporator fan absorbed power	kW	0.2	0.2	0.2	0.2
Evaporator fan absorbed current	A	1.0	1.0	1.0	1.0
Condenser fan absorbed power	kW	0.3	0.3	0.3	0.3
Condenser fan absorbed current	A	1.2	1.2	1.2	1.2
Indoor conditions: 21 °C, 50% r.h.					
Total cooling capacity	kW	4.2	4.0	3.9	3.7
Sensible cooling capacity	kW	3.4	3.4	3.3	3.2
Compressor absorbed power	kW	1.3	1.4	1.6	1.7
Compressor absorbed current	A	5.5	6.0	6.7	7.4
Indoor conditions: 24 °C, 50% r.h.					
Total cooling capacity	kW	4.5	4.3	4.2	4.0
Sensible cooling capacity	kW	3.5	3.4	3.4	3.3
Compressor absorbed power	kW	1.3	1.5	1.6	1.8
Compressor absorbed current	A	5.7	6.2	6.8	7.6
Indoor conditions: 27 °C, 47% r.h.					
Total cooling capacity	kW	4.8	4.6	4.4	4.3
Sensible cooling capacity	kW	3.7	3.6	3.6	3.5
Compressor absorbed power	kW	1.4	1.5	1.6	1.8
Compressor absorbed current	A	5.8	6.3	6.9	7.8
Indoor conditions: 30 °C, 40% r.h.					
Total cooling capacity	kW	4.9	4.8	4.6	4.4
Sensible cooling capacity	kW	4.1	4.1	4.0	3.9
Compressor absorbed power	kW	1.4	1.5	1.7	1.8
Compressor absorbed current	A	5.9	6.4	7.0	7.8

Max cooling capacities, absorbed power and current, freecooling mode – PKS4 model

		Outdoor temperature [°C]		
		≤ 10 50 Hz	15 50 Hz	20 50 Hz
Evaporator fan motor absorbed power	kW	0.2	0.2	0.2
Evaporator fan motor absorbed current	A	1.0	1.0	1.0
Indoor temperature: 21 °C				
Sensible cooling capacity	kW	2.0	1.0	0.1
Indoor temperature: 24 °C				
Sensible cooling capacity	kW	2.55	1.6	0.75
Indoor temperature: 27 °C				
Sensible cooling capacity	kW	3.0	2.2	1.3
Indoor temperature: 30 °C				
Sensible cooling capacity	kW	3.6	2.7	1.8

Note: Cooling capacities do not take into account the heat from the fan motors, which must be added to the system heat load.

2.2 – Electric features

Standard components PKS3, PKS4	OA	FLA	LRA	Absorbed power (kW)
	50 Hz	50 Hz	50 Hz	50 Hz
Evaporator fan motor	3 x 0.33	–	–	3 x 0.066
Condenser fan motor	2 x 0.5	0.6	–	2 x 0.135
Compressor PKS3	5.9*	10.0	34	1.37*
Compressor PKS4	7.1*	12.0	36.5	1.7*
Heater	–	13.0	–	3.0

*ARI Standard conditions

Differential current protection switch and cable size

Per **PKS3, PKS4**, for 230 Vac
differential current ($I_{\Delta n} = 0.3A$): 20A
Cable size: 4 mm²

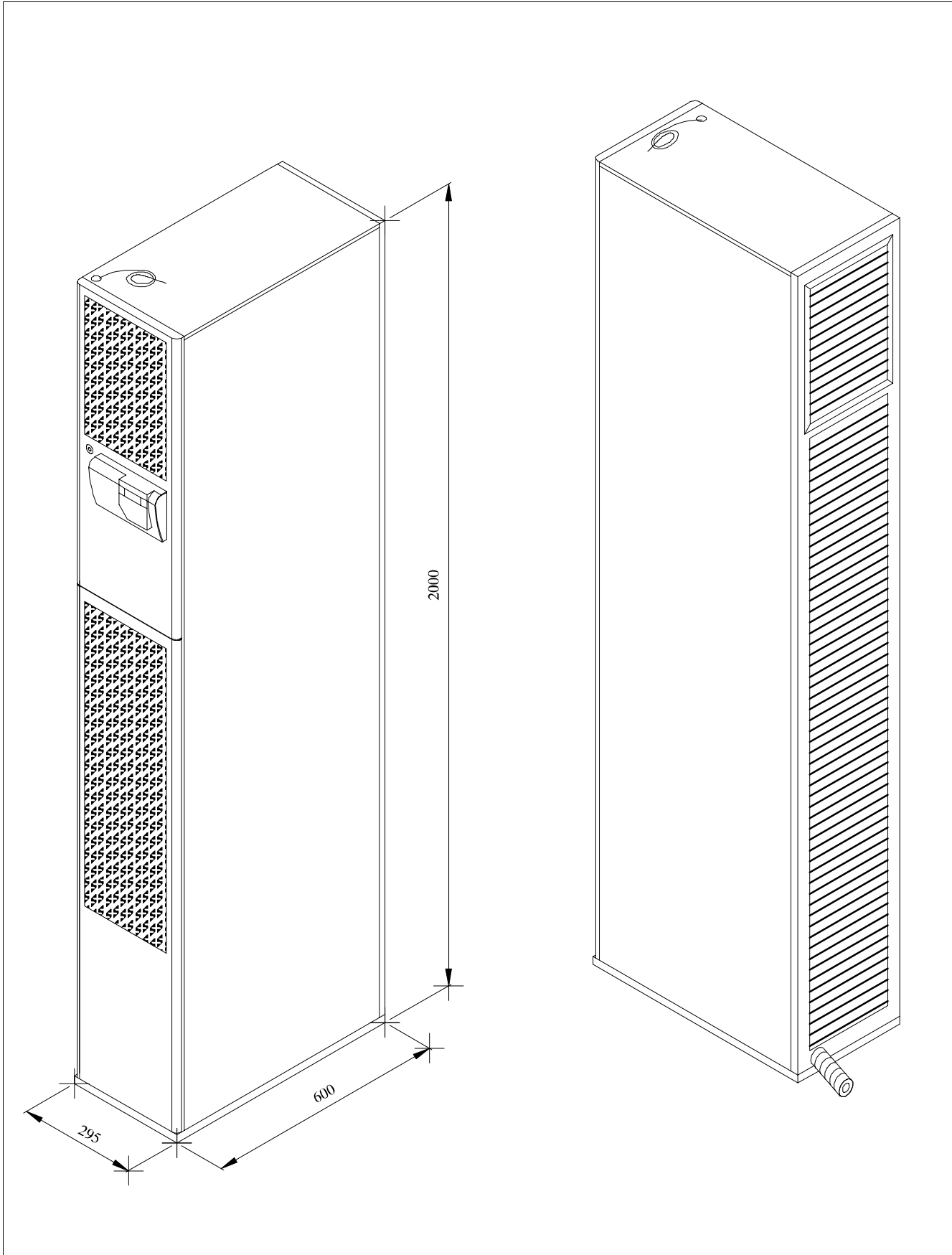
2.3 – Application ranges

The Hiwall units are provided for operation within the following ranges. The limits are intended for new or correctly installed and maintained units.

Room conditions, compressor running	from to	18°C, 30% and 18°C, 80% 35°C, 10% and 35°C, 50%
Ambient conditions, compressor running	from to	–10°C (–30°C with fan speed regulator) 45°C
Power supply		PKS3, PKS4 units 230 V ± 10% / 1 ph+neutral+earth/ 50 Hz 24/48 ± 30% Vdc with emergency cooling (#)
Storage conditions	from to	–25°C, 5% R.H. 55°C, 90% R.H.

(#) Inverter option is requested.

2.4 – Overall dimensions



Il Fabbricante dichiara che questo prodotto è conforme alle direttive Europee:

The Manufacturer hereby declares that this product conforms to the European Union directives:

Der Hersteller erklärt hiermit, dass dieses Produkt den Anforderungen der Europäischen Richtlinien gerecht wird:

Le Fabricant déclare que ce produit est conforme aux directives Européennes:

El Fabricante declara que este producto es conforme a las directivas Europeas:

O Fabricante declara que este produto está em conformidade com as directivas Europeias:

Tillverkare försäkrar härmed att denna produkt överensstämmer med Europeiska Unionens direktiv:

De Fabrikant verklaart dat dit produkt conform de Europese richtlijnen is:

Vaimistaja vakuuttaa täten, että tämä tuote täyttää seuraavien EU-direktiivien vaatimukset:

Produsent erklærer herved at dette produktet er i samsvar med EU-direktiver:

Fabrikant erklærer herved, at dette produkt opfylder kravene i EU direktiverne:

Ο Κατασκευαστής δηλώνει ότι το παρόν προϊόν είναι κατασκευασμένο σύμφωνα με τις οδηγίες της Ε.Ε.:

98/37/CE; 89/336/CEE; 73/23/CEE

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Since the Liebert HIROSS Company has a policy of continuous product improvement, it reserves the right to change design and specifications without previous notice.

