Epsilon Rev

6÷33 kW

General
High efficiency, compact air/water chiller range

Configurations
/LN: silenced unit

Optional hydronic module

Strengths

- Compatible with Ecodesign
- Compact dimensions
- High energy efficiency (EER up to 3.36)
- Flexible installation to comply with various installation requirements
- Standard EC fans (only of specific sizes)

Epsilon Rev

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PRODUCT DESCRIPTION

High efficiency, compact air/water chiller range

BODY

The structure of the unit is made of galvanized sheet-iron coated with polyester powder in RAL 5017/7035 at 180°C, which makes it highly resistant to weather conditions.

REFRIGERANT

The unit is charged with refrigerant R410A, with GWP=2088 (value at 100 years).

COMPRESSORS

Hermetic scroll compressor, complete with thermal overload protection included in the electric motor windings, and rubber vibration damping supports

SOURCE-SIDE HEAT EXCHANGER

It consists of a coil with copper tubes and aluminium fins having a large exchange surface with fin pitch sized to maximize heat exchange and to reduce the noise impact. A wire mesh is fitted to protect the finned pack.

For installations within a kilometre of the coast, the use of Cu/Al coils with anti-corrosion treatment is strongly recommended.

FANS

Axial flow fans directly coupled to the 6-pin electric motor featuring an external rotor, protection level IP56 Each fan is housed in shaped nozzles and includes an accident-prevention grid, pursuant to standard UNI EN 294.

Units from size 6 through 18 fit fans from the EC series. Sizes 21 through 37 feature AC fans instead. The fan speed regulator accessory is supplied standardly with the base unit.

USER-SIDE HEAT EXCHANGER

The heat exchanger is made of braze-welded stainless steel AISI 316 plates and it is insulated with a shell of closed-cell foam material that reduces heat losses and prevents the formation of condensate.

The heat exchanger is provided with a temperature probe for freeze protection, a probe for measuring the temperature of the input and output water and a paddle flow switch that is standardly supplied with it.

REFRIGERANT CIRCUIT

Each refrigerant circuit comprises:

- charging valve
- liquid sight glass
- replaceable solid cartridge dehydrator filter
- thermostatic expansion valve with pressure equalization
- pressure transducer
- high and low pressure switches
- safety valve (with the exception of sizes 6, 8 and 10)

ELECTRICAL CONTROL PANEL

The electrical control panel is supplied with a master disconnector switch, a protection for the auxiliary power circuits, a compressor contactor and an electronic controller for unit registration featuring an interface display that is used to view and to set the machine parameters.

The electrical control panel comprises:

- a master disconnector switch;
- automatic circuit breakers to protect the auxiliary and power circuits (sizes 6, 8 and 10);
- a master disconnector switch and fuses to protect the auxiliary and power circuits (sizes 14 to 37);
- a compressor contactor;
- a fan speed regulator for condensate control;
- pump relays or a motor protector and circuit breaker (sizes 14 through 37, version ST1P or ST1PS);
- general alarm potential free contacts.
- The electronic controller is designed for management of the following functions:
  - inlet control for water temperature regulation;
  - freeze protection;
  - compressor time setting;
  - high pressure alert management (in many cases this is useful to prevent the unit from stopping);
  - alarm signals;
  - alarm resetting;
  - self-adjusting control to enable optimal operation even when the water level in the system is low;
  - digital input for external ON-OFF switching.
- The display shows the following parameters:
  - output water temperature;
  - condensation temperature;
  - temperature and differential setpoints;
  - alarms description.

The unit power voltage is 230V/1~/50Hz for sizes 6 and 8, and 400V/3N~/50Hz for sizes 10 through 37.

CONTROLS AND SAFETY DEVICES

All the units are fitted with the following control and safety components:

- Anti-freeze probe causing anti-freeze alarm to trigger (automatic resetting at short intervals)
- High pressure switch (with manual reset)
- Low pressure switch (with automatic reset and limited interventions)
- Mechanical vane type flow switch included in the standard supply
- Condensation pressure control by means of speed regulator for operation at low external temperatures
- High pressure safety valve (with the exception of sizes 6, 8 and 10)
- Protection against compressor overtemperature

TESTING

All the units are factory-tested and supplied complete with oil and refrigerant.

OPTIONS

/LN: silenced unit

The unit featuring the /LN option requires that the compressor be covered with a fully noise-proof shroud made of noise absorbing and self-extinguishing material in expanded polyurethane with a density equal to 30 kg/m3 and a thickness of 13 mm on the compressor side and 5 mm on the sheath side.

A rubber, 2 mm thick noise-insulating sheet is interposed between the two layers of expanded polyurethane.

Max. total thickness 20mm

HYDRAULIC MODULES

1P

Unit with pump

The unit includes:

- a circulator (sizes 6 through 18) or a circulation pump (sizes 21 through 37);
- Expansion vessel
- a water drain valve from the hydraulic circuit;
- a safety valve set to 6 bar, which corresponds to the maximum allowable operating pressure.

1PS

Unit with pump and tank

In addition to the components of the /ST 1P unit, this unit includes: an inertial, insulated accumulation tank.

TECHNICAL SPECIFICATIONS

EPSILON REV

			6	8	10	14	16	18
EPSILON REV								
Cooling (A35; W7)								
Refrigeration capacity	(1)	kW	6,7	7,5	10	13,3	14,8	17,2
Total absorbed power	(1)	kW	2,3	2,6	3,2	4,2	4,7	5,3
EER	(1)		2,9	2,92	3,11	3,12	3,11	3,23
EER energy class (Eurovent)	(1)		C	B	A	A	A	A
Compressors								
Compressors/Circuits		n°/n°	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1
Minimum capacity reduction step		%	0-100	0-100	0-100	0-100	0-100	0-100
Refrigerant charge (CH + CuAl)	(6)	kg	2,0	2,2	2,3	3,3	3,2	4,2
Fans								
Type			Axial EC fans	Axial EC fans	Axial EC fans	Axial EC fans	Axial EC fans	Axial EC fans
Quantity		n°	1	1	1	2	2	2
Total air flow rate		m³/h	3900	3900	3600	7800	7800	7200
User-side heat exchanger								
Quantity		n°	1	1	1	1	1	1
Water flow rate (CH) (A35; W7)	(1)	m³/h	1,1	1,3	1,7	2,3	2,5	3
Head loss (CH) (A35; W7)	(1)	kPa	10	10	14	32	25	28
Noise levels								
Sound power level cooling	(3)	dB(A)	65	67	68	70	72	75
Sound pressure level cooling	(4)	dB(A)	34	36	37	39	41	44
Sound power level of vers. LN cooling	(3)	dB(A)	63	65	66	68	70	73
Sound pressure level of vers. LN cooling	(4)	dB(A)	32	34	35	37	39	42
Dimensions and weights**								
Length		mm	925	925	925	925	925	925
Depth		mm	375	375	375	375	375	375
Height		mm	700	700	700	1350	1350	1350

			21	25	28	31	37
EPSILON REV							
Cooling (A35; W7)							
Refrigeration capacity	(1)	kW	19,3	21,1	24,9	29,6	33,2
Total absorbed power	(1)	kW	6	6,7	7,4	9,2	10
EER	(1)		3,18	3,16	3,36	3,22	3,32
EER energy class (Eurovent)	(1)		A	A	A	A	A
Compressors							
Compressors/Circuits		n°/n°	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1
Minimum capacity reduction step		%	0-100	0-100	0-100	0-100	0-100
Refrigerant charge (CH + CuAl)	(6)	kg	3,9	3,8	5,8	5,9	7,2
Fans							
Type			Axial AC fans	Axial AC fans	Axial AC fans	Axial AC fans	Axial AC fans
Quantity		n°	2	2	2	2	2
Total air flow rate		m³/h	14000	14000	13000	18000	17000
User-side heat exchanger							
Quantity		n°	1	1	1	1	1
Water flow rate (CH) (A35; W7)	(1)	m³/h	3,3	3,6	4,3	5,1	5,7
Head loss (CH) (A35; W7)	(1)	kPa	31	27	28	29	29
Noise levels							
Sound power level cooling	(3)	dB(A)	76	76	76	76	77
Sound pressure level cooling	(4)	dB(A)	45	45	45	45	46
Sound power level of vers. LN cooling	(3)	dB(A)	74	74	74	74	75
Sound pressure level of vers. LN cooling	(4)	dB(A)	43	43	43	43	44
Dimensions and weights**							
Length		mm	1105	1105	1105	1305	1305
Depth		mm	675	675	675	695	695
Height		mm	1385	1385	1385	1585	1585
Weight in function CH	(5)	kg	212	233	233	367	367

(1) Outside air temperature 35°C; evaporator inlet-outlet water temperature 12/7°C. Values compliant with standard EN 14511

(3) Unit operating at rated capacity, with no accessories of any kind - external air temperature 35°C and water input/output temperature from/to heat exchanger and user equal to 12/7°C. Values taken by measurements made in accordance with standard ISO 3744 and the Eurovent certification programme, where applicable. Binding values See NOISE LEVELS section.

(4) Values obtained from the sound power level (conditions: note 3), related to a distance of 10 m from the unit in free field with directivity factor Q=2. Non-binding values See NOISE LEVELS section.

(5) The weight refers to the unit without any accessory. The introduction of a few accessories such as copper/aluminum coils, hydraulic modules or the recovery exchangers can lead to weight increased that can exceed 10%. For further details refer to the specific drawing of the selected configuration.

(6) The indicated refrigerant charge is calculated. The refrigerant charge can vary according to different versions/accessories and product updates.

** Basic unit without included accessories

ECODESIGN

INTRODUCTION

The Ecodesign/ErP Directive (2009/125/EC) lays down new standards for more efficient energy use.

The Directive contains various regulations; as regards chiller products and heat pumps, the regulations of interest are the following:

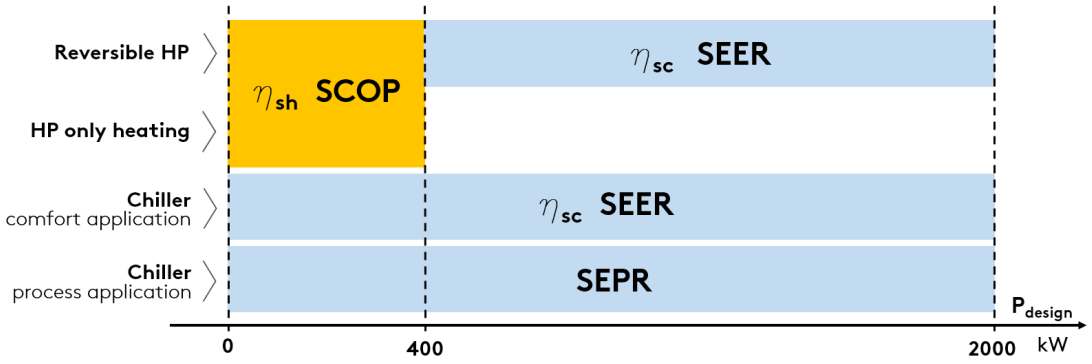
- Regulation 2013/813, for small heat pumps (Pdesign ≤ 400 kW)
- Regulation 2016/2281, for chillers and heat pumps with Pdesign > 400 kW
- Regulation 2013/811, for heat pumps with Pdesign ≤ 70 kW.

The last-mentioned regulation (2013/811) regards the labelling (Ecolabel certification) of small heat pumps.
The other two regulations (2013/813 and 2016/2281) set seasonal efficiency targets that the products must comply with to be sold and installed in the European Union (essential requirement for CE marking).
These efficiency limits are defined through ratios, which are respectively:

- ηsh (SCOP), with reference to regulation 2013/813
- ηsc (SEER) for comfort applications and SEPR for process applications, with reference to regulation 2016/2281.

As regards regulation 2016/2281, with effect from 1st January 2021, the required minimum efficiency limit will be raised (Tier 2) from the current threshold (Tier 1).

The figure below schematically illustrates the correspondence between product and reference energy ratio.



Some notes and clarifications:

For comfort applications, regulation 2016/2281 sets the ηsc (SEER) ratio in two different operating conditions:

- SEER calculated with machine inlet/outlet water temperature of 12/7°C (low temperature application),
- SEER calculated with machine inlet/outlet water temperature of 23/18°C (medium temperature application).

The minimum efficiency requirement is the same, but can be met at condition 12/7°C or at condition 23/18°C, depending on the application envisaged for the machine.

Regulation 2013/813 distinguishes two different types: at low temperature and at medium temperature.
The following refer to the application at low temperature: (low temperature application) all heat pumps whose maximum delivery temperature for heating purposes is lower than 52°C with source at temperature of -7°C and -8°C wet bulb (air-water unit) or inlet 10°C (water-water unit), at the reference design conditions for an average climate.For these, the efficiency ratio is "low temperature application" (outlet water temperature 35°C).
For all the other heat pumps, the efficiency ratio is related to "medium temperature application" (outlet water temperature 55°C).
The ratios must be calculated according to the reference European heating season in average climatic conditions.

The minimum efficiency requirements set by the regulations are indicated below.

REGULATION 2016/2281, comfort application

TYPE OF UNIT		MINIMUM REQUIREMENT			
		Tier 1		Tier 2 (2021)	
SOURCE	**Pdesign**	**ηsc [%]**	**SEER**	**ηsc [%]**	**SEER**
air	< 400kW	149	3,8	161	4,1
air	≥ 400kW	161	4,1	179	4,55
water	< 400kW	196	5,1	200	5,2
water	≥ 400kW and < 1500kW	227	5,875	252	6,5
water	≥ 1500kW	245	6,325	272	7

REGULATION 2016/2281, process application

TYPE OF UNIT		MINIMUM REQUIREMENT	
		Tier 1	Tier 2 (2021)
SOURCE	**Pdesign**	**SEPR**	**SEPR**
air	< 400kW	4,5	5
air	≥ 400kW	5	5,5
water	< 400kW	6,5	7
water	≥ 400kW and < 1500kW	7,5	8
water	≥ 1500kW	8	8,5

REGULATION 2013/813

SOURCE	APPLICATION	MINIMUM REQUIREMENT	
		ηsh [%]	**SCOP**
air	low temperature application	125	3,2
water	low temperature application	125	3,325
air	medium temperature application	110	2,825
water	medium temperature application	110	2,95

The conformity of the product must be checked according to the type of application, whether comfort or process, and at the required outlet water temperature.

The two schematic tables below, respectively for comfort application and for process application, indicate the reference of the required conformity according to the type of product and the set point temperature (reference to regulations 2016/2281 and 2013/813).

Important note: for mixed comfort and process applications, the reference application for conformity is the comfort application.

COMFORT APPLICATION

PRODUCT	OUTLET WATER TEMPERATURE	COMPLIANCE INDEX	REGULATION
Chiller	< 18°C	SEER/ηsc low temperature application	2016/2281
	≥ 18°C	SEER/ηsc medium temperature application	2016/2281
Heat pumps (reversible and only heating) Pdesign≤400kW		SCOP/ηsh	2013/813
Reversible heat pumps Pdesign>400kW	< 18°C	SEER/ηsc low temperature application	2016/2281
	≥ 18°C	SEER/ηsc medium temperature application	2016/2281
Heat pumps only heating Pdesign>400kW		-	-

- = exemption from Ecodesign

PROCESS APPLICATION

PRODUCT	OUTLET WATER TEMPERATURE	COMPLIANCE INDEX	REGULATION
Chiller	≥ +2°C , ≤ 12°C	SEPR	2016/2281
	> 12°C	-	-
	> -8°C , < +2°C	-	-

- = exemption from Ecodesign

Some specifications and notes follow.

Partly completed machinery

The term partly completed machinery refers to all units without a user-side or source-side heat exchanger, and therefore to all LC, LE, LC/HP and LE/HP versions. Since these are "non-complete" machines, conformity with Ecodesign depends on combination with the remote heat exchanger.

All the partly completed machinery is CE marked and accompanied by a declaration of conformity. Installation in European Union countries is therefore allowed; correct selection and installation of the remote heat exchanger must be ensured, in accordance with the above cases.

EC fans:

The only option that positively affects the performance of the unit, by increasing its seasonal energy efficiency ratio, is the VEC accessory.

A unit equipped with EC fans has a higher SEER (ηsc) than the configuration with standard fans.

EPSILON REV RANGE

Regulation 2016/2281 applies specifically to the Epsilon Rev range.

The tables below give information on the conformity of the units and the seasonal energy performance ratios with regard to the reference regulation.

EPSILON REV

			6	8	10	14	16	18
REGULATION 2016/2281								
Pdesign	(1)	kW	6,7	7,5	10	13,3	14,8	17,2
Compliance 12/7								
Compliance	(1)		Y	Y	Y	Y	Y	Y
ηsc	(1)	%	149	151	149	149	149	149
SEER	(1)		3,8	3,84	3,8	3,81	3,81	3,8
Compliance Tier 2 (2021)	(1)		N	N	N	N	N	N
Compliance 23/18								
Compliance	(2)		Y	Y	Y	Y	Y	Y
ηsc	(2)	%	-	-	-	-	-	-
SEER	(2)		-	-	-	-	-	-
Compliance SEPR								
Compliance	(3)		Y	Y	Y	Y	Y	Y
SEPR	(3)		4,91	4,97	4,94	5,30	5,23	5,06

			21	25	28	31	37
REGULATION 2016/2281							
Pdesign	(1)	kW	19,3	21,1	24,9	29,6	33,2
Compliance 12/7							
Compliance	(1)		Y	Y	Y	Y	Y
ηsc	(1)	%	150	149	150	150	150
SEER	(1)		3,82	3,82	3,81	3,82	3,83
Compliance Tier 2 (2021)	(1)		N	N	N	N	N
Compliance 23/18							
Compliance	(2)		Y	Y	Y	Y	Y
ηsc	(2)	%	-	-	-	-	-
SEER	(2)		-	-	-	-	-
Compliance SEPR							
Compliance	(3)		Y	Y	Y	Y	Y
SEPR	(3)		5,09	5,06	5,10	5,03	5,10

Y = unit in compliance with Ecodesign at the indicated condition.

N = unit not in compliance with Ecodesign at the given condition: it can be installed only in non-EU countries.

- = value not necessary: conformity is already provided at the most restrictive condition (1).

(1) User-side heat exchanger water inlet/outlet temperature 12/7°C (low temperature application), with reference to regulation 2016/2281 and standard EN 14825.

(2) User-side heat exchanger water inlet/outlet temperature 23/18°C (medium temperature application), with reference to regulation 2016/2281 and standard EN 14825.

(3) User-side heat exchanger water inlet/outlet temperature 12/7°C, with reference to regulation 2016/2281 and norm EN 14825.

Minimum water content in the system

For correct operation of the unit, it is necessary to ensure a buffering on the system such as to comply with the minimum operating time considering the greater between the minimum OFF time and the minimum ON time. In short, these contribute to limiting the number of times the compressors are switched on per hour and to preventing undesired deviations from the set point of the delivered water temperature.

$$V_{min} = \frac{P_{tot} \cdot 1.000}{N} \cdot \frac{300}{\Delta T \cdot \rho \cdot c_p} + P_{tot} \cdot 0{,}25$$

where
Vmin is the minimum water content of the system [l]
Ptot is the total cooling capacity of the machine [kW]
N: number of capacity reduction steps
ΔT: differential allowed on the water temperature. Unless otherwise specified, this value is considered to be 2.5K
ρ: density of the heat-carrying fluid. Unless otherwise specified, the density of water is considered
cp: specific heat of the heat-carrying fluid. Unless otherwise specified, the specific heat of water is considered
Considering the use of water and grouping together some terms, the formula can be re-written as follows:

$$V_{min} = \frac{P_{tot}}{N} \cdot 17{,}2 + P_{tot} \cdot 0{,}25$$

N is equal to the number of compressors installed in the unit.

Installation site

To determine the best installation site for the unit and its orientation, you should pay attention to the following points:

- compliance with the clearance spaces indicated in the official dimensional drawing of the unit must be guaranteed so as to ensure accessibility for routine and non-routine maintenance operations
- you should consider the origin of the hydraulic pipes and their diameters because these affect the radiuses of curvature and therefore the spaces needed for installing them
- you should consider the position of the cable inlet on the electrical control panel of the unit as regards the origin of the power supply
- if the installation includes several units side by side, you should consider the position and dimensions of the manifolds of the user-side exchangers and of any recovery exchangers
- if the installation includes several units side by side, you should consider that the minimum distance between units is 3 metres
- you should avoid all obstructions that can limit air circulation to the source-side exchanger or that can cause recirculation between air supply and intake
- you should consider the orientation of the unit to limit, as far as possible, exposure of the source-side exchanger to solar radiation
- if the installation area is particularly windy, the orientation and positioning of the unit must be such as to avoid air recirculation on the coils. If necessary, we advise making windbreak barriers in order to prevent malfunctioning.

Once the best position for the unit has been identified, you must check that the support slab has the following characteristics:

- its dimensions must be proportionate to those of the unit: if possible, longer and wider than the unit by at least 30 cm and 15/20cm higher than the surrounding surface
- it must be able to bear at least 4 times the operating weight of the unit
- it must allow level installation of the unit: although the unit is installed on a horizontal base, make slopes in the support surface to convey rain water or defrost water to drains, wells or in any case to places where it cannot generate an accident hazard due to ice formation.

The units are designed and built to reduce to a minimum the level of vibration transmitted to the ground, but it is in any case advisable to use rubber or spring anti-vibration mounts, which are available as accessory and should be requested when ordering.

The anti-vibration mounts must be fixed on before positioning the unit on the ground.

In the event of installation on roofs or intermediate floors, the pipes must be isolated from the walls and ceilings.

It is advisable to avoid installation in cramped places, to prevent reverberations, reflections, resonances and acoustic interactions with elements outside the unit.

It is essential that any work done to soundproof the unit does not affect its correct installation or correct operation and, in particular, does not reduce the air flow rate to the source-side exchanger.

Installations that require the use of treated coils

If the unit has to be installed in an environment with a particularly aggressive atmosphere, coils with special treatments are available as options.

- pre-painted aluminium coils
- coils with anti-corrosion treatment

A description of the individual accessories is available in the “Description of accessories” section.

The type of coil treatment should be chosen with regard to the environment in which the unit is to be installed, through observation of other structures and machinery with exposed metal surfaces present in the destination environment.

The cross observation criterion is the most valid method of selection currently available without having to carry out preliminary tests or measurements with instruments. The identified reference environments are:

- coastal/marine
- industrial
- urban with a high housing density
- rural

Please note that in cases where different conditions co-exist, even for short periods, the choice must be suitable for preserving the exchanger in the harsher environmental conditions and not in conditions between the worst and best situation.

Particular attention must be given in cases where an environment that is not particularly aggressive becomes aggressive as a consequence of a concomitant cause, for example, the presence of a flue outlet or an extraction fan.

We strongly suggest choosing one of the treatment options if at least one of the points listed below is verified:

- there are obvious signs of corrosion of the exposed metal surfaces in the installation area
- the prevailing winds come from the sea towards the unit
- the environment is industrial with a significant concentration of pollutants
- the environment is urban with a high population density
- the environment is rural with the presence of organic discharges and effluents

In particular, for installations near the coast, the following instructions apply:

- for installations between 1 and 20 km from the coast of reversible units or units with Cu/Al coils, we strongly recommend using the accessory "Coil treated with anti-corrosion paints"
- for distances within a kilometre of the coast, we strongly recommend using the accessory "Coil treated with anti-corrosion paints" for all units.

To protect the exchangers from corrosion and ensure optimal operation of the unit, we advise following the recommendations given in the user, installation and maintenance manual for cleaning the coils.

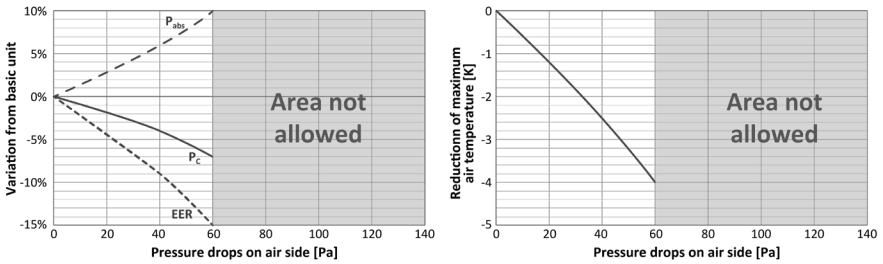
Aeraulic head losses and options available for the ventilating section

Units are designed in such way that the fans operate with no discharge head at the rated air flow rate.

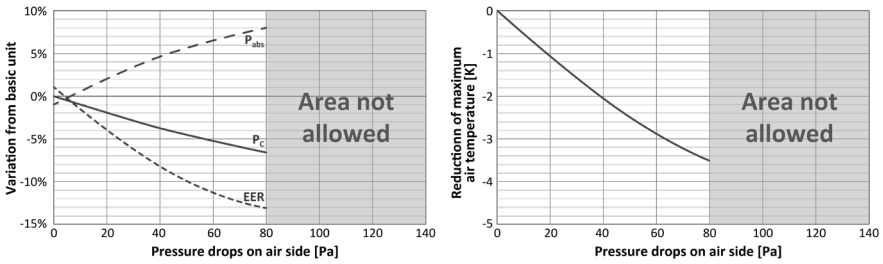
If there are obstacles to free air flow, you should consider the additional aeraulic head losses that will cause a reduction of the air flow rate and a consequent deterioration of performance.

The following diagrams show the trend of cooling capacity (PC), EER, total absorbed power (Pabs) and reduction of the maximum external air temperature in chiller operating mode, depending on the aeraulic head losses that the fans will have to overcome.

AC fans (Ø 630)



EC fans (Ø 630)



The indicated values are for the standard machine, without accessories, with AC fans and in any case in the absence of air recirculation.

Example: supposing you expect there to be obstacles that will generate an estimated aeraulic head loss of 60Pa. In this case, there are 3 possibilities:

- use the unit with standard AC fans: compared to ideal conditions, the output power will be reduced by about 5.5%, the total absorbed power will increase by about 7.5%, the EER will be reduced by about 12.5% and the maximum allowed external air temperature for operation at 100% will be reduced by about 3.4K compared to the nominal limit
- use the unit with EC fans: compared to the unit with AC fans working in ideal conditions, the output power will be reduced by about 5%, the total absorbed power will increase by about 6.5%, the EER will be reduced by about 11.5% and the maximum allowed external air temperature for operation at 100% will be reduced by about 2.8K compared to the nominal limit

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