elmeco group
SERVICES BELGIUM

8

AIR CONDITIONING

AIR CONDITIONING

CHOOSING THE COOLING SYSTEM

The cabinet heat exchange must first of all be calculated in order to identify the most appropriate cooling system.

HEAT EXCHANGE CALCULATION

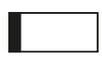
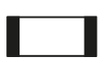
Calculating the heat load to be dissipated represents the essential step when choosing a cooling system, and four factors should be considered: the heat dissipated by the equipment inside the panel, the temperature in the room where the panel is installed, the temperature to be maintained inside the panel, the control board sizes and set-up conditions. Concerning the quantity of heat produced by the inner components, the data on the technical sheets of the components themselves must be checked and evaluated. No need to say that the possibility that several units may work simultaneously should be taken into consideration when making this calculation.

Also, as already mentioned, the temperature of the room where the electrical cabinet is installed must be carefully evaluated. In fact, an exchange takes place among the panel surfaces and the environment. If the outside temperature is lower than the inner one, the heat is transferred from inside to outside, and must be subtracted from the heating load produced by the components; if, on the contrary, the outside temperature is higher than the inside one the opposite will occur, hence the heat absorbed must be added to the heat dissipated by the equipment.
On s/s surfaces, 5.5 W/m²K are transmitted per each square meter of cabinet surface.

The calculation of the over-temperature inside the cabinet must comply with CEI 17/43 standard, according to the cabinet operating conditions.
The relevant calculation sheet in Microsoft® Excel format is available for easier calculation of the thermal exchange according to the above mentioned standard.

An approximate calculation is however possible following the method below:

TYPE OF INSTALLATION (DATA DERIVED FROM TABLE 3 OF CEI 17/43 STANDARD)			
	• Ae = 1.8 x H x (L+P) + 1.4 x L x P		• Ae = 1.4 x H x (L+P) + 1.4 x L x P
	• Ae = 1.4 x L x (H+P) + 1.8 x P x H		• Ae = 1.8 x L x H + 1.4 x L x P + P x H
	• Ae = 1.4 x P x (H+L) + 1.8 x L x H		• Ae = 1.4 x L x (H+P) + P x H
	• Ae = 1.4 x P x (H+L) + 1.8 x L x H		• Ae = 1.4 x L x H + 0.7 x L x P + P x H
	• Ae = 1.4 x H x (L+P) + 1.4 x L x P		

KEY		
L = CABINET WIDTH (m)	H = CABINET HEIGHT (m)	P = CABINET DEPTH (m)
 Detached, exposed on all sides	 Back panel close to a wall	 Left side close to a wall
 Right side close to a wall	 Left side and back panel close to a wall	 Right side and back panel close to a wall
 Right and left side close to a wall	 Embedded with sides and back panel close to a wall	 Fully embedded with top side covered

The following formula shall be used to calculate the cooling or heating power:

$Pe = PV - (k \times Ae \times \Delta t)$

where Ae is the cabinet actual surface derived from Table 1 above, Δt is the algebraic value of the gap between the required inner temperature and the cabinet outside temperature and k is the heat transmission coefficient (approx. 5.5 W/Km²), PV is the actual power dissipated by the equipment inside the cabinet, while Pe is the required cooling or heating power.
Reference to Table "HEAT PRODUCED COMPARED TO ABSORBED POWER" is possible for an approximate calculation of the PV power."

HEAT PRODUCED COMPARED TO POWER ABSORBED	
Electric/electronic component	Heat produced in W
Trasformers – Inverter - Drives	5% of the power
Feeders of electronic components	10% of the power
Coils of relays and counters	5% of the power
Glow lamps	95% of the power
PLC	150 W
Numerical controls	200 W

The data in the table are approximate mean values that require checking according to the equipment actually in use

The following example can facilitate understanding:
In a control board with a total surface of 5.3 m² have been installed a 15000 W transformer running at full capacity, a 1000 Watt lamp, a PLC and a 20000 W inverter running at 80%. Basing on the table, we will have the following total load:

HEAT PRODUCED COMPARED TO POWER ABSORBED		
Trasformer 15000 x 5/100	750 W	Total power transformed into heat PV = 1795 W
Lamp 100 x 95/100	95 W	
PLC	150 W	
Inverter 2000 x 80/100 x 5/100	800 W	

Assuming that the above panel is installed in a room with 40°C temperature and that its temperature is kept at 30°C (-10°C), these data must be are related to the total surface of the panel itself.
The thermal power transmitted to the inside will be as follows:

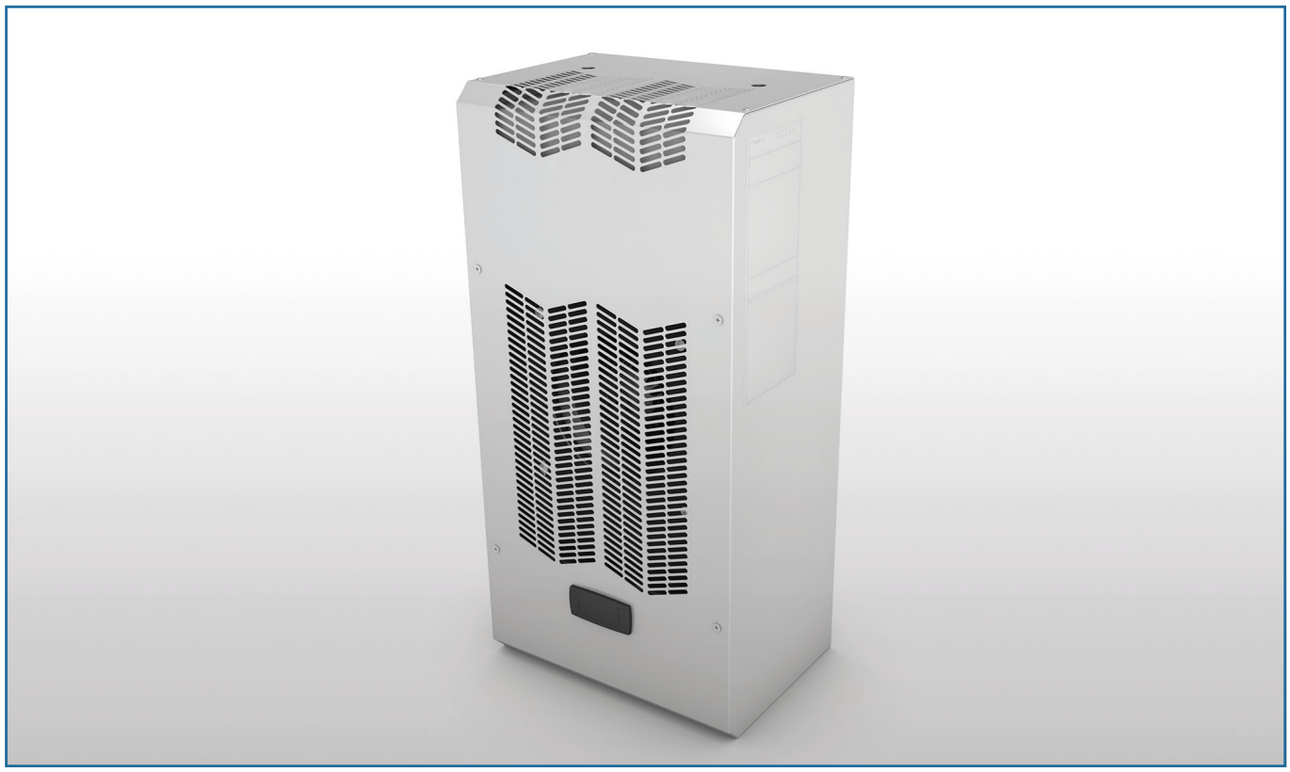
$5.5 \times 5.3 \times -10 = -291.5$ W

The total thermal load will be equal to

$Pe = 1795 - (-291.5) = 2086.5$ W

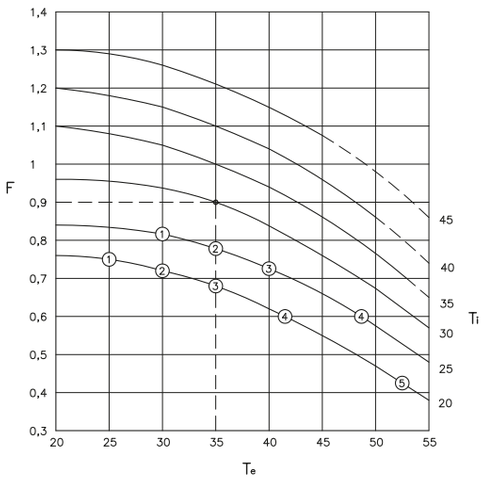
When the irradiating surface of the cabinet cannot dissipate the thermal load produced by the equipment inside it, the most appropriate cooling system between conditioning and ventilation has to be chosen.

AIR CONDITIONING



AIR CONDITIONING

This cooling system is particularly recommended when the temperature inside the Panel has to be maintained equal to or lower than the temperature outside it. To safeguard its reliability, the conditioner should be carefully sized, in order to select a model properly sized to keep the temperature within acceptable limits even in the worst conditions, while avoiding over-sizing. The room temperature must therefore be related to the Panel inside temperature, to obtain the so-called correction factor, i.e. the data necessary to determine the conditioner rated yield.
Graph below can help to determine this factor:



(*) Where:

- The room temperature is shown on the axis of abscissas as Te
- The correction factor F is shown on the axis of the ordinates
- The curves correspond to the temperature inside the Ti board, the dashed section indicating the area that can the air conditioner can cover only for short
- The circled numbers indicate extreme work conditions, as a function of the percentage of the outdoor relative humidity:

1 - 80 %
2 - 60 %
3 - 40 %
4 - 30 %
5 - 20 %

Setting the temperature inside the board to below the values indicated, condensate forms on the electric components as doors are opened, since the dew point is reached.

Example of correction on the yield:
For outside temperature of 35°C and 30°C inside, the correction factor is 0,9. Therefore, to achieve 1.000 W in these conditions, an air conditioner featuring a rated yield (L35L35) of 1.000 / 0,9 = 1,112 W is required. Viceversa, an air conditioner having a 2.000 W rated yield, gives 900 W in these conditions.

Once this value is determined, the actual yield of an air conditioner can be set according to the following formula:

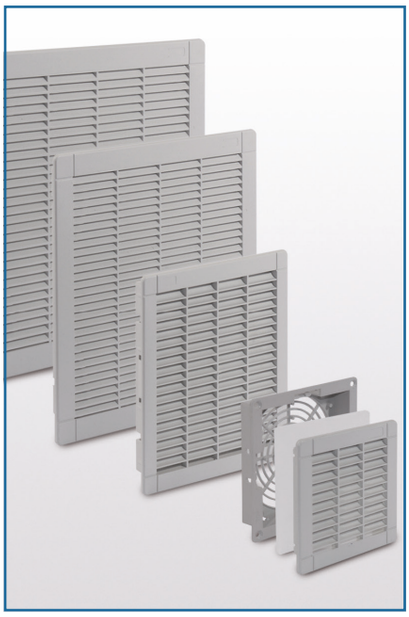
$$\text{Air conditioner rated power} = \frac{\text{Required Cooling Power}}{\text{Correction Factor}}$$

For example, for a 45°C outside temperature and 35°C inside one, the correction factor is 0.85. This means that, in those conditions, an air conditioner with 1000 W rated power yields 850 W and that an air conditioner featuring a 1176 W (1000 W / 0.85) rated yield is required to obtain a 1000W yield.

When the use of an air-cooled air conditioner is decided, the following must be taken into consideration:

- The outside of the air conditioner must be uncluttered, to avoid a poor yield of the same or even the compressor stoppage following the tripping of the protection device.
- A standard air conditioner can run with minimum outside temperature 20° and maximum 55°C.
- The board inside temperature must be maintained between 25°C and 45°. Higher temperatures can be dangerous for both the air conditioner and the components inside the board, while lower temperatures can give rise to condensate on the components following the door opening.
- Certain voltage and frequency values are indicated for each air conditioner, along with the corresponding permitted allowances. We recommend to never exceed such allowances, to avoid jeopardizing the equipment reliability and functionality.
- Always check for the presence of particular substances in the air, which might damage the materials the conditioner is made of. Also advisable check for the presence of any source of heat close to the cooling unit, its possible exposure to atmospheric agents and the presence of stray currents which may cause corrosion. Also, make sure the air does not contain oil or solvent fog, which might damage the standard polyurethane filters.
- Air always contain some steam, and the steam contained in the air inside the board to be conditioned condensates on the cold battery of the conditioner itself. If the cabinet is tight to the outside, once all this steam is removed, no more condensate will form. If, in contrast, the cabinet is open (even in case of small openings) water will form continuously and must be removed through the pipe the air conditioner is equipped with. This tube must be free from clogging and have no air-traps, to avoid condensate from entering the control board after a certain time. Also, a microswitch should be provided on the door of the board, to automatically stop the conditioner running, thus avoiding most of the cooling power from being dissipated to condensate the steam. It is however advisable to not open and close the doors continually, otherwise the compressor inside protection could stop its running.

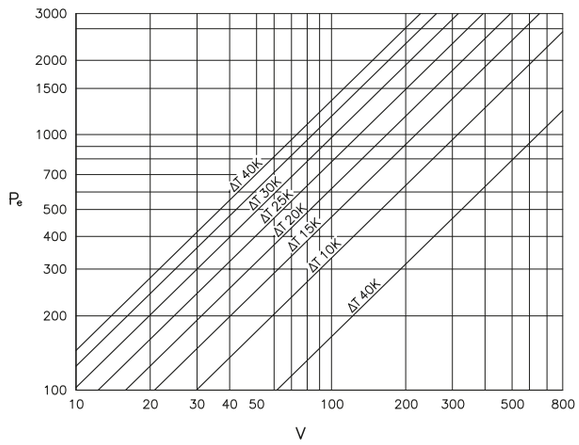
AIR CONDITIONING



VENTILATION

Cooling system recommended when the outside temperature is constantly lower than the inside one. Proper sizing of the fan requires good knowledge of the heat power to be dissipated (see THERMAL CALCULATION Schedule), as well as the difference between inside and outside temperature, while the value of the fan minimum air flowrate will be derived from the chart.
A grid with fan must always be matched with a grid without fan.
This cooling system offers several advantages: easy installation (drilling the cabinet according to the template supplied is all you need to do), limited maintenance and cost much lower than the other refrigerating systems.

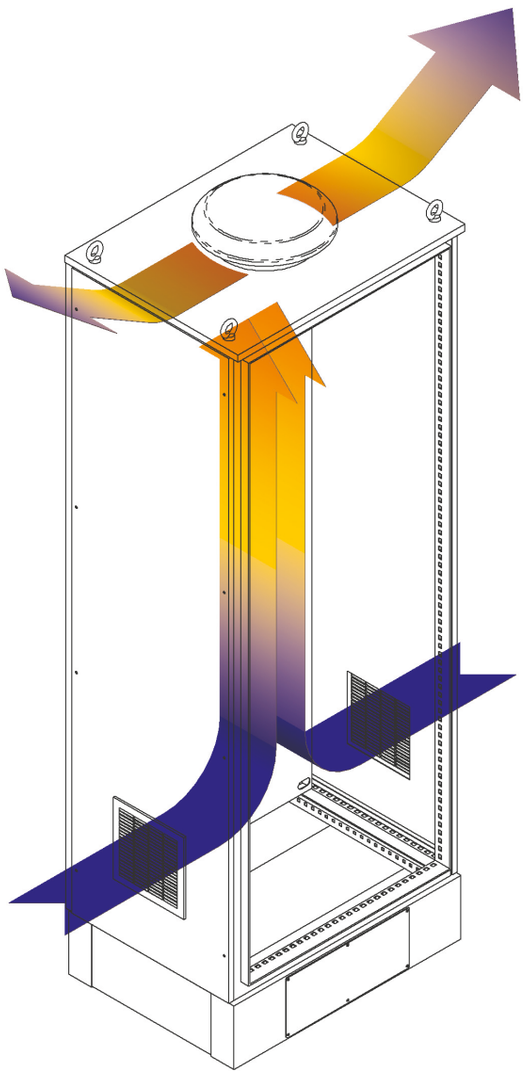
Troubles and damages can be avoided:
– Making sure the outside temperature is always lower than the inside one
– Cleaning the filters regularly, and replacing them, if the need be (which can be done also while the fan is running)
– Choosing a fan slightly oversized compared to the theoretical calculations: a flow greater than required will cause no damage while providing a certain safety margin.

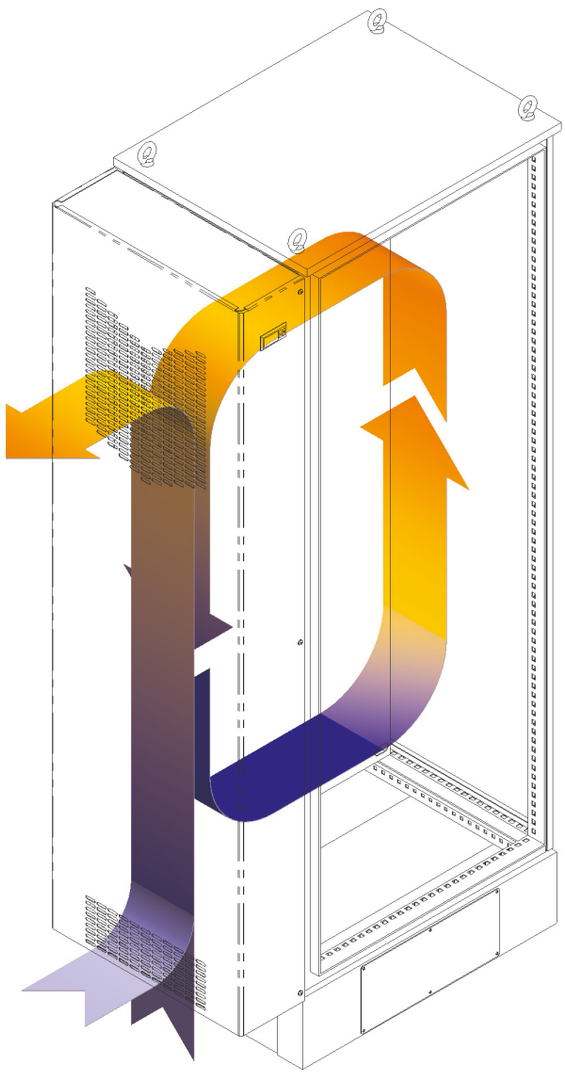


Pe = Dissipated thermal power as Watt
V = Air flow (m³h)

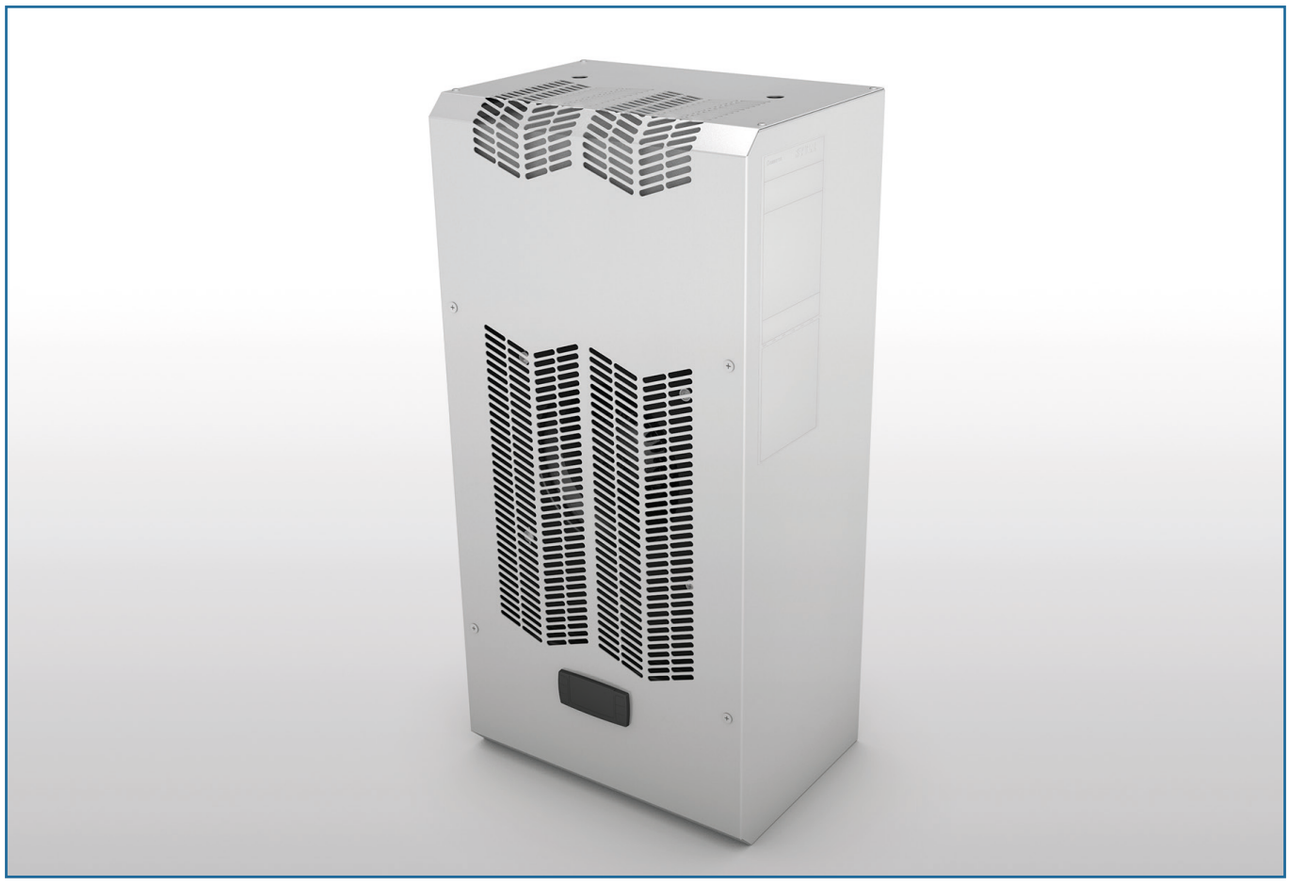
- The following is to be determined in advance:
  – The thermal power dissipated by the electric equipment.
  – The maximum temperature admitted inside the cabinet.
  – The maximum room temperature expected outside the cabinet.

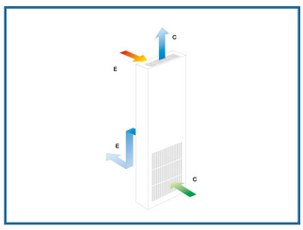
- Calculate Δt as the difference between the two temperatures.
- Cross the horizontal line corresponding to the dissipated thermal power with the diagonal of temperature difference (Δt). The crossing point between the two variables determines a vertical line corresponding to the air flow in m3/h necessary for the dissipation required.
- Choose the suitable fan.

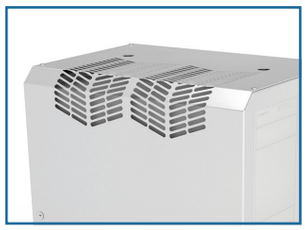




AIR CONDITIONING





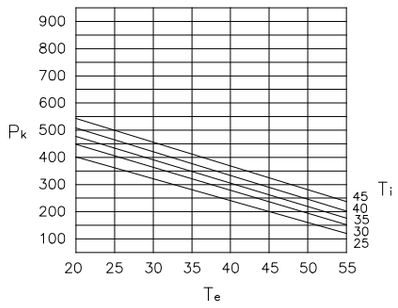


AIR CONDITIONERS FOR WALL OR DOOR MOUNT SERIES **KJ**

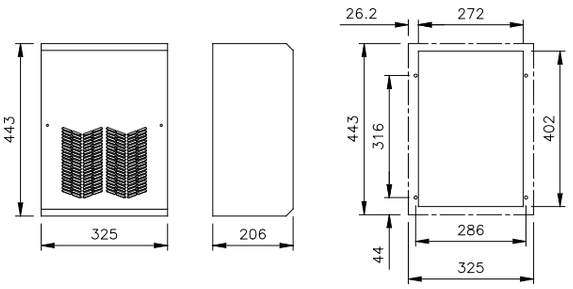
STANDARD FEATURES AND EQUIPMENT:

– Optional grid and filter, easy to install
– Assembling from the outside
– Display on the whole range
– Outside enclosure made of TYPE 304 s/s finely satin-finished and protected
– Inside frame made of sendzimir steel, with cut-proof sheet
– Easy connection by electrical connector
– Steam trap flanged to the inner structural frame, set on the bottom, outwards
– Anti-drip net
– IP 54 seal between conditioner and cabinet, according to CEI EN 60529 (CEI 70/1)
– Condensing battery with cleaning action
– Eco-coolant R134a
– Use and maintenance Manual
– Operating at 50/60 Hz

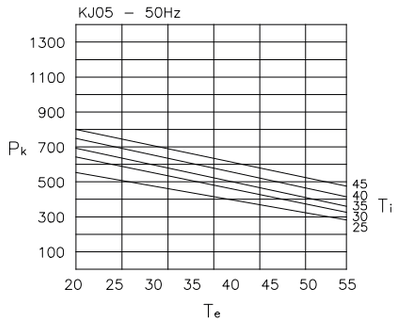
KJC04 – 50Hz



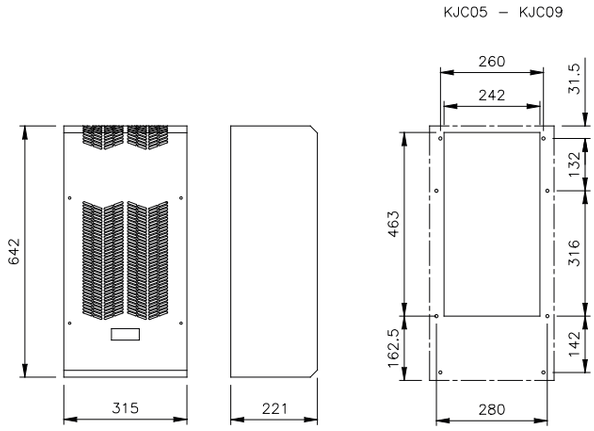
KJC4



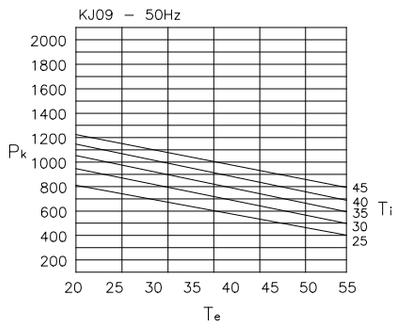
KJ05 – 50Hz



KJC05 – KJC09



KJ09 – 50Hz

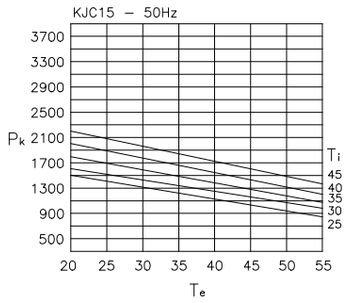


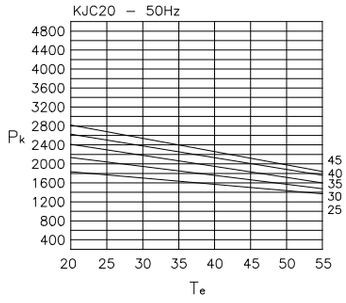
Detailed drawings of drilling are available on the website www.ilinox.com

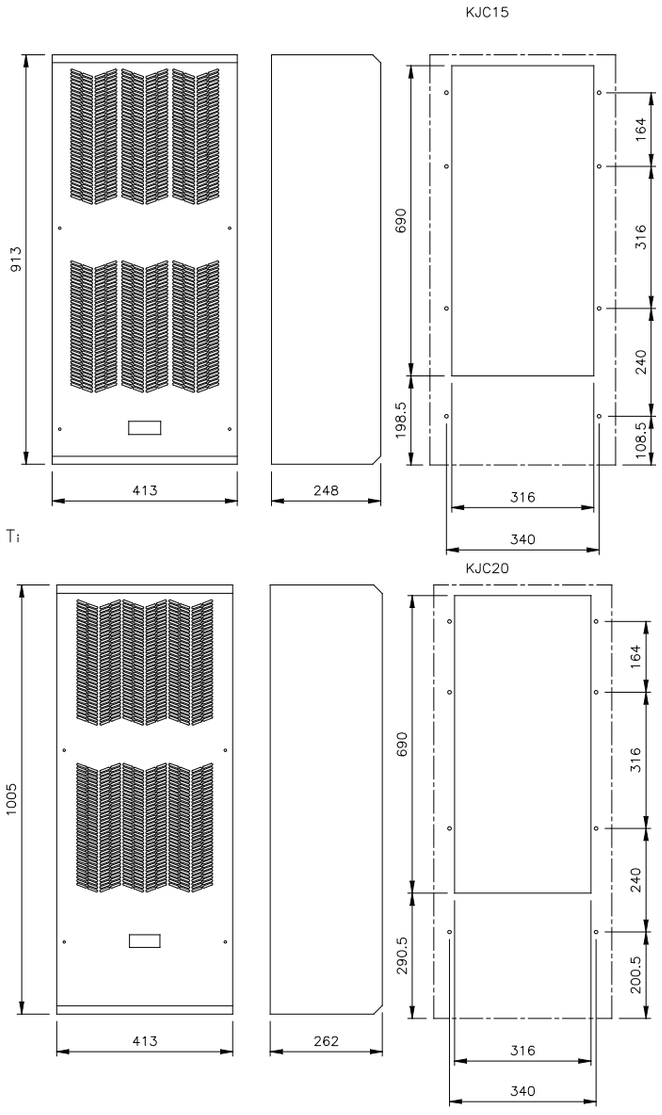
ITEM	REFRIGERATING YIELD DIN3168 W		ABSORBED POWER W		SUPPLY V	STARTING CURRENT A	FUSES GG A	NOISE DB	WEIGHT KG	FOR DEPTH SIDE
	50HZ	60HZ	50HZ	60HZ						
KJC04-230	360	380	190	220	230 V - 50/60 Hz single-phase	9,8	4	55	17	500
KJC05-230	560	580	310	340	230 V - 50/60 Hz single-phase	15	4	61	26	500
KJC09-230	850	900	420	600	230 V - 50/60 Hz single-phase	20	6	65	26	500

UL certification to be requested with the order

AIR CONDITIONING







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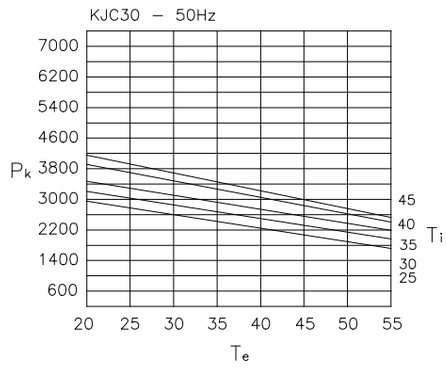
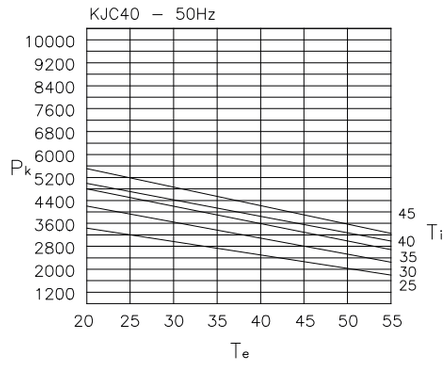
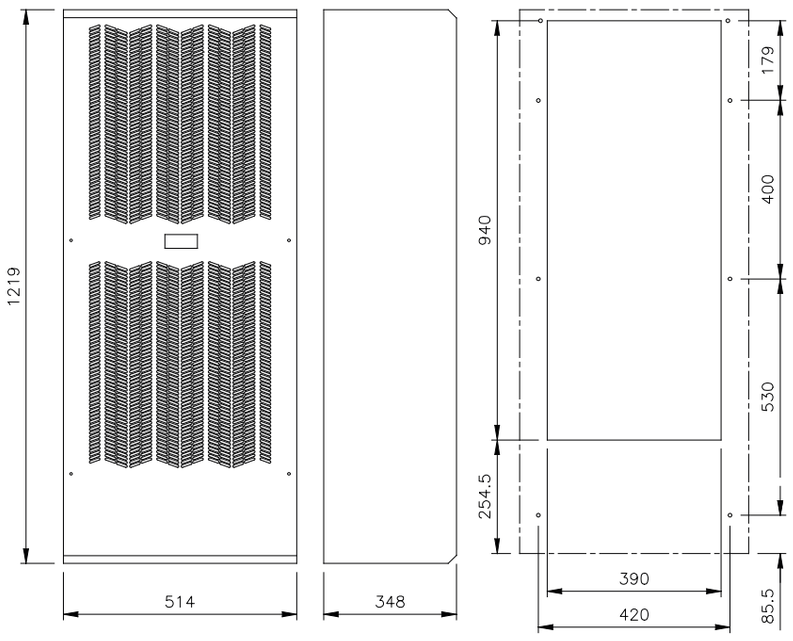
ITEM	REFRIGERATING YIELD DIN3168 W		ABSORBED POWER W		SUPPLY V	STARTING CURRENT A	FUSES GG A	NOISE DB	WEIGHT KG	FOR DEPTH SIDE
	50HZ	60HZ	50HZ	60HZ						
KJC15-230	1500	1600	750	825	230 V - 50/60 Hz single-phase	28	8	65	42	500
KJC20-400	2000	2100	1120	1240	400V / 460V - 50/60 Hz 3-phase	18	6	68	44	500

UL certification to be requested with the order







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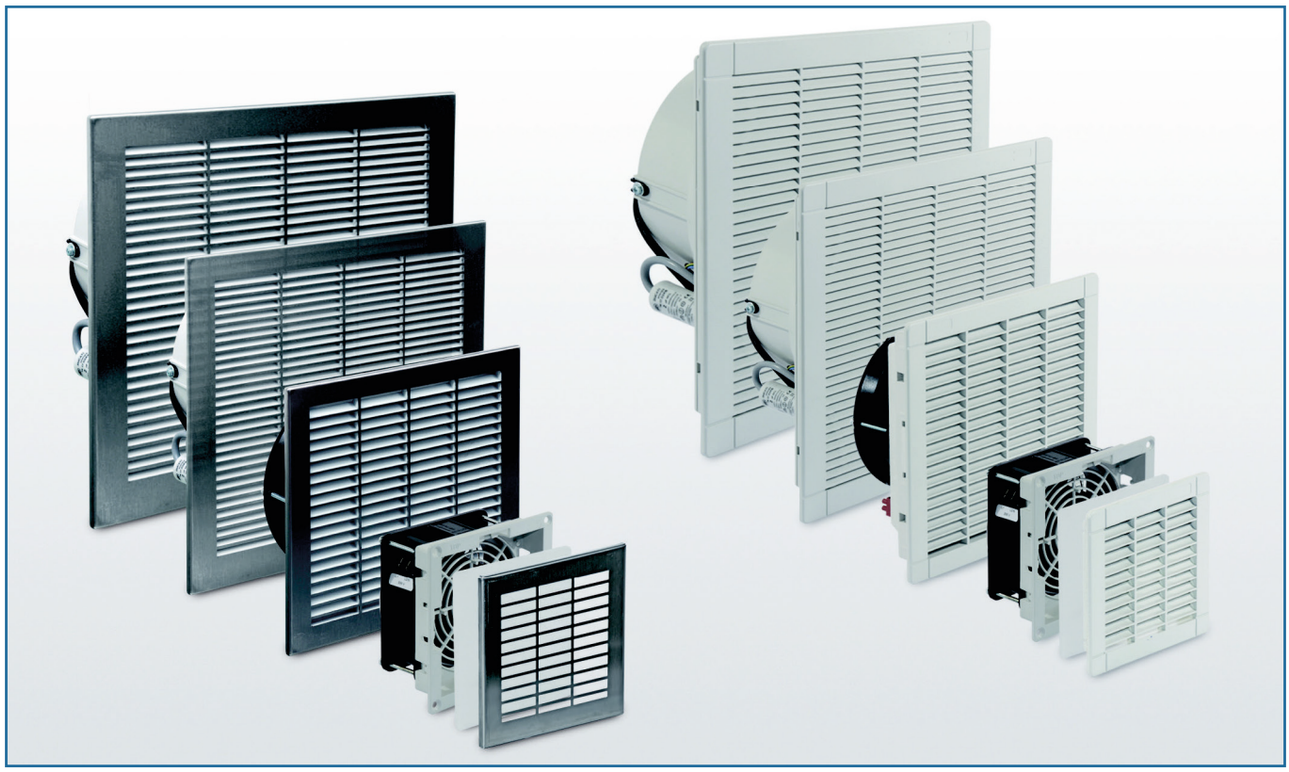
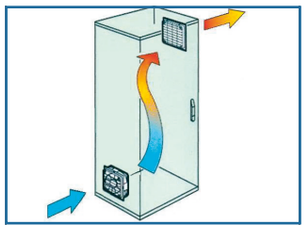
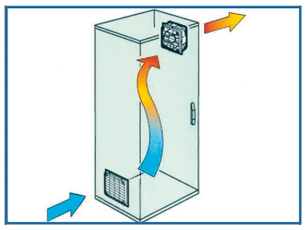
ITEM	REFRIGERATING YIELD DIN3168 W		ABSORBED POWER W		SUPPLY V	STARTING CURRENT A	FUSES GG A	NOISE DB	WEIGHT KG	FOR DEPTH SIDE
	50HZ	60HZ	50HZ	60HZ						
KJC30-400	2850	3000	1370	1510	400V / 460V - 50/60 Hz 3-phase	35	6	70	86	600
KJC40-400	4000	4100	1730	1950	400V / 460V - 50/60 Hz 3-phase	25	8	70	86	600

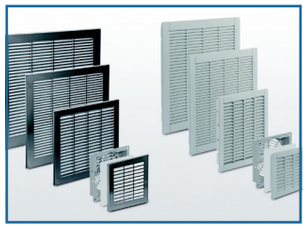
UL certification to be requested with the order

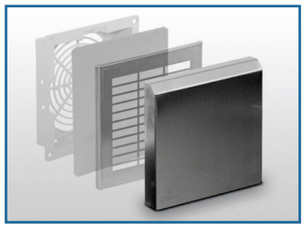
AIR CONDITIONING











VENTILATION UNITS **KV - KG**

STANDARD FEATURES AND OUTFITTING

- Protection degree IP54.
- Grid inner body made of ABS plastic, self-extinguishing according to UL 94V-O, resistant to temperatures ranging from -10°C a +70°C, colour RAL7035.
- Outside grids with shutters type slot for condensate drainage; available both in EN 1.4307 (TYPE 304L) s/s finely satin-finished and protected, and ABS plastic self-extinguishing according to UL 94V-O, resistant to temperatures from -10°C a +70°C, colour RAL 7035.
- Filters: fit for retaining powders of granulometry up to 10 micron.
- Axial fans with conveyor, grids and filter, working in intake and extraction mode (see table).
- Motor set on ball bearings, non-stop running for 30.000 h.
- Compliant with CEI 17-13/1 (IEC439-1), CEI 61-28 (IEC342-1).

ITEM	OPRATION	VOLTAGE (V)	FREQUENCY (HZ)	POWER (W)	ABROPTION (A)	NOISE (DB)	REVOL. (RPM)	AIR FLOW FREE (M3/H)	AIR FLOW W/FILTER (M3/H)	MATERIAL
KV10P/220	Intake/Extraction	220	50/60	13	0,10	30	2400	24	14	ABS
KV10P/110	Intake/Extraction	110	50/60	13	0,14	30	2400	24	14	ABS
KV10P/24	Intake/Extraction	24	DC	4	0,16	35	2400	24	14	ABS
KV10A/220	Intake/Extraction	220	50/60	13	0,10	30	2400	24	14	ABS+INOX
KV10A/110	Intake/Extraction	110	50/60	13	0,14	30	2400	24	14	ABS+INOX
KV10A/24	Intake/Extraction	24	DC	4	0,16	35	2400	24	14	ABS+INOX
KV12P/220	Intake/Extraction	220	50/60	22	0,14	43	2850	55	40	ABS
KV12P/110	Intake/Extraction	110	50/60	22	0,26	43	2850	55	40	ABS
KV12P/24	Intake/Extraction	24	DC	13	0,37	45	2850	55	40	ABS
KV12A/220	Intake/Extraction	220	50/60	22	0,14	43	2850	55	40	ABS+INOX
KV12A/110	Intake/Extraction	110	50/60	22	0,26	43	2850	55	40	ABS+INOX
KV12A/24	Intake/Extraction	24	DC	13	0,37	45	2850	55	40	ABS+INOX
KV14P/220	Intake/Extraction	220	50/60	40	0,17	53	2800	230	180	ABS
KV14P/110	Intake/Extraction	110	50/60	40	0,34	53	2800	230	180	ABS
KV14P/24	Intake/Extraction	24	DC	26	1,08	61	2800	230	180	ABS
KV14PM/220I	Intake	220	50/60	70	0,40	65	2775	370	250	ABS
KV14PM/220E	Extraction	220	50/60	70	0,40	65	2775	370	250	ABS
KV14A/220	Intake/Extraction	220	50/60	40	0,17	53	2800	230	180	ABS+INOX
KV14A/110	Intake/Extraction	110	50/60	40	0,34	53	2800	230	180	ABS+INOX
KV14A/24	Intake/Extraction	24	DC	26	1,08	61	2800	230	180	ABS+INOX
KV14AM/220I	Intake	220	50/60	70	0,40	65	2775	370	250	ABS+INOX
KV14AM/220E	Extraction	220	50/60	70	0,40	65	2775	370	250	ABS+INOX
KV20P/220I	Intake	220	50/60	70	0,40	65	2775	500	370	ABS
KV20P/220E	Extraction	220	50/60	70	0,40	65	2775	500	370	ABS
KV20P/110I	Intake	110	50/60	70	0,55	65	2775	500	370	ABS
KV20P/110E	Extraction	110	50/60	70	0,55	65	2775	500	370	ABS
KV20PM/220I	Intake	220	50/60	130	0,55	72	2685	630	470	ABS
KV20PM/220E	Extraction	220	50/60	130	0,55	72	2685	630	470	ABS
KV20A/220I	Intake	220	50/60	70	0,40	65	2775	500	370	ABS+INOX
KV20A/220E	Extraction	220	50/60	70	0,40	65	2775	500	370	ABS+INOX
KV20A/110I	Intake	110	50/60	70	0,55	65	2775	500	370	ABS+INOX
KV20A/110E	Extraction	110	50/60	70	0,55	65	2775	500	370	ABS+INOX
KV20AM/220I	Intake	220	50/60	130	0,55	72	2685	630	470	ABS+INOX
KV20AM/220E	Extraction	220	50/60	130	0,55	72	2685	630	470	ABS+INOX

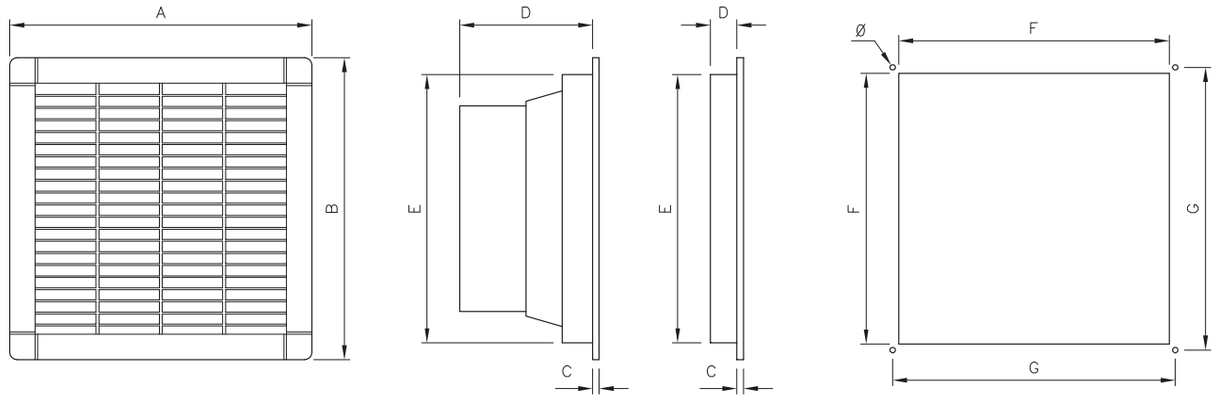
Note: with counter doors the useful space for applying fans is minor.

AIR CONDITIONING

FILTERS

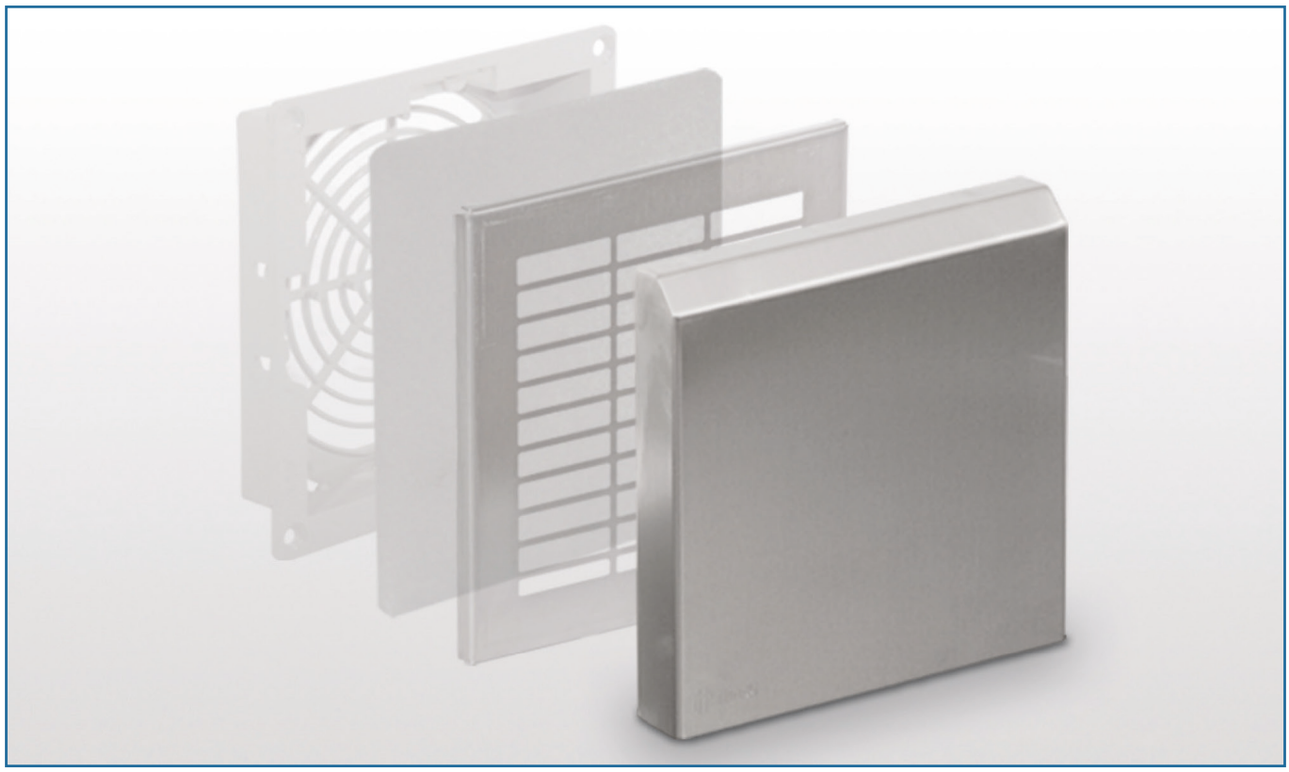
STANDARD FEATURES AND OUTFITTING

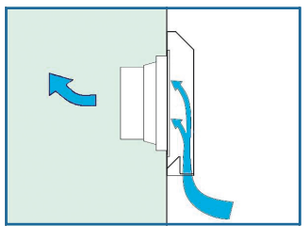
- Protection degree IP54
- Grid inner body made of ABS plastic, self-extinguishing according to UL94V-0, resistant to temperatures ranging from -10°C a +70°C, colour RAL7035.
- Outside grids with shutters type slot for condensate drainage; available both in EN 1.4307 (TYPE 304L) s/s finely satin-finished and protected, and ABS plastic self-extinguishing according to UL94V-0, resistant to temperatures from -10°C a +70°C, colour RAL 7035.
- Filters: fit for retaining powders of granulometry up to 10 micron.
- Compliant with CEI 17-13/1 (IEC439-1), CEI 61-28 (IEC342-1).

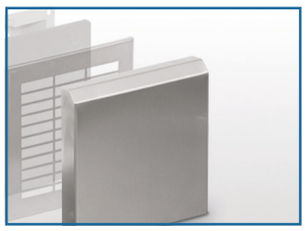


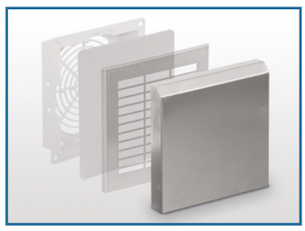
FAN DIMENSIONS DATA									
MODEL	A	B	C	D	E	KG.	F	G	ø
KV10P....	114	114	4	53	90	0,3	92	-	-
KV10A....	116	116	4	53	90	0,38	92	-	-
KV12P....	150	150	5,5	71	124	0,78	125	131	4,5
KV12A....	152	152	5,5	71	124	0,78	125	131	4,5
KV14P....	250	250	5,5	118	220	1,6	224	234	4,5
KV14A....	252	252	5,5	118	220	1,6	224	234	4,5
KV20P....	325	325	6,5	145	284	3	291	302	4,5
KV20A....	327	327	6,5	145	284	3	291	302	4,5

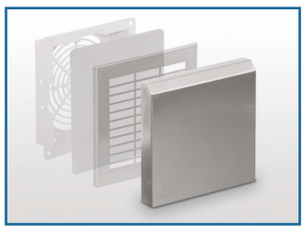
FILTERING UNIT DIMENSIONS DATA									
MODEL	A	B	C	D	E	KG.	F	G	ø
KCGEP10P	114	114	4	13	90	0,06	92	-	-
KCGEP10A	116	116	4	13	90	0,22	92	-	-
KCGEP12P	150	150	5,5	25	124	0,16	125	131	4,5
KCGEP12A	152	152	5,5	25	124	0,35	125	131	4,5
KCGEP14P	250	250	5,5	25	180	0,42	224	234	4,5
KCGEP14A	252	252	5,5	25	180	0,91	224	234	4,5
KCGEP20P	325	325	6,5	25	284	0,64	291	302	4,5
KCGEP20A	327	327	6,5	25	284	1,47	291	302	4,5





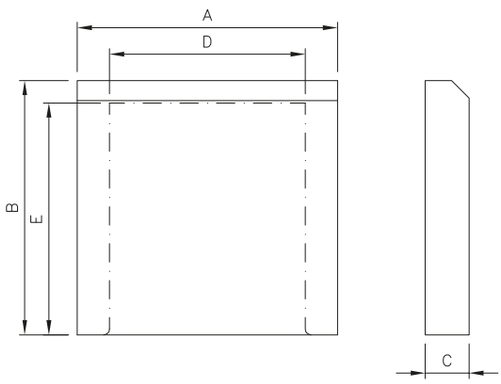






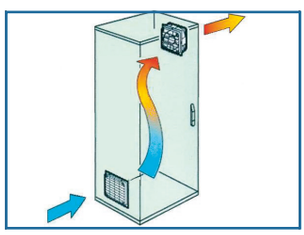
STAINLESS STEEL LABYRINTH CASING **KL**

EN 1.4307 (TYPE 304L), s/s casing, upward air inflow, for application on grids, thus assuring improved splash protection. A kit to achieve protection degree IP55 is included in the package.



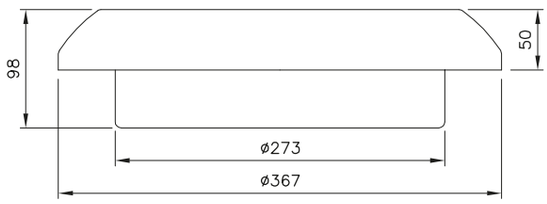
ITEM	A	B	C	D	E
KL10-55	170	180	32	120	160
KL12-55	215	210	36	160	190
KL14-55	320	340	64	265	305
KL20-55	390	400	100	335	365

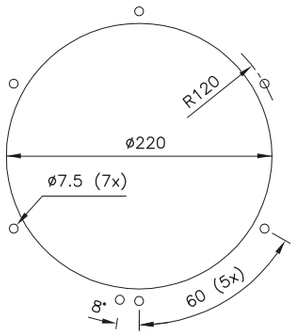
AIR CONDITIONING

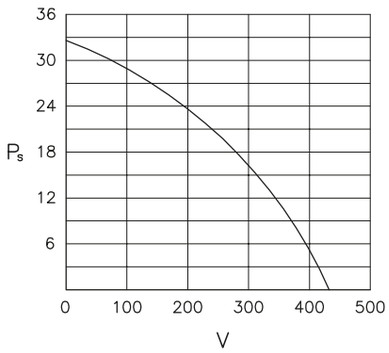


ROOF MOUNT VENTILATING UNITS **KR**

For use when cabinet ventilation through the roof is practical and cost-effective. Extraction mode operation.
Easy installation, except for the filter pack it is accommodated inside the roof unit itself.
The outside casing is made of EN 1.4307 (TYPE 304L) or EN 1.4404 (TYPE 316L) stainless steel, finely satin-finished.
The single phase motor is engineered for high performance but low noise levels.
Centrifual axial fan set on ball bearings, to maintain high efficiency even with high levels of static pressure (poor conditions of filters).
The whole system features IP45 or IP55 protection degree depending on the filter in use, and meets the essential requirements of Directive on Machinery 89/392/CE and the European standards UNI EN 292 parte I, II, UNI EN 294; CEI 44-5 and 6 (IEC 204-1 and 2).







V = volume d'aria in m3/h
Ps = pressione statica in mm. di colonna d'acqua

MODEL		KR20/45	KR20/55
Supply voltage	V	230	230
Frequency	Hz	50/60	50/60
Absorbed current	A	0.25	0.25
Door (free suction)	m3/h	430	430
Rpm	Rpm	2550	2550
Noise	dBA	64	64
Max. temperature	°C	50	50
Protection degree	IP	45	55

ROOF MOUNT EXTRACTION FAN

The unit can be delivered without motor, protection degree IP55, to be used simply as filter.
To increase the air flow and when a high protection degree is not required (max IP23), the filtering units can be avoided.
Without filters it becomes an effective natural aeration system.
Waterproofing is assured by the labyrinth system.

ITEM	FOR ARTICLE	PROTECTION DEGREE
KFKR20/45	KRG20/45 - KR20/45	IP45
KFKR20/55	KRG20/55 - KR20/55	IP55

ITEM	PROTECTION DEGREE
KRG20/45	IP45
KRG20/55	IP55

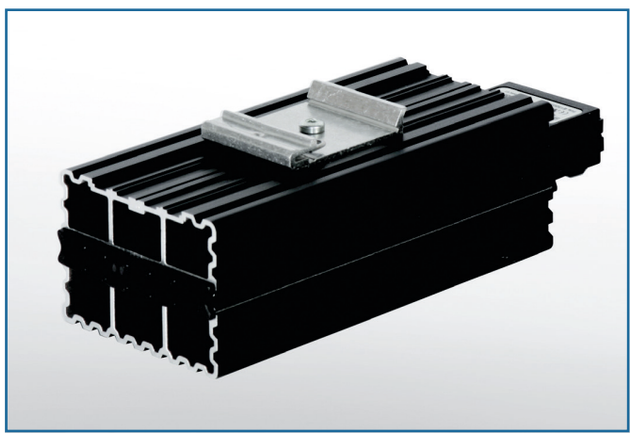
AIR CONDITIONING

ANTI-CONDENSATE HEATERS **RH**

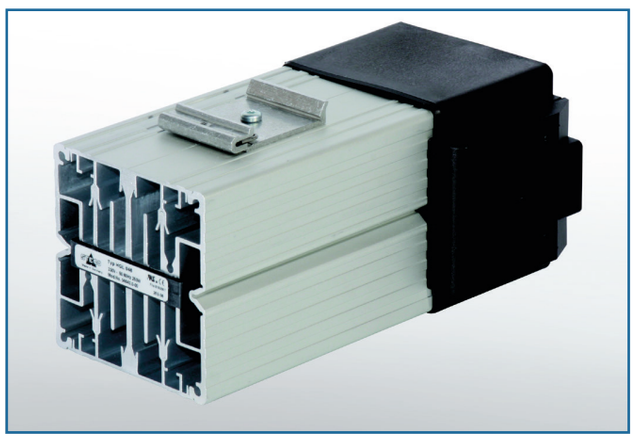
Engineered to prevent condensate building-up inside the control boards and to keep the inside temperature has to be kept higher than the outside one. The heaters featuring capacity 250 and 400 W are equipped with a temperature control device for protection from overheating due to fan failure.
TAll models require vertical setup and are equipped with clips for fixing on 35 mm DIN guide.
The radiator body is made of anodized aluminium section bars.
Certifications: CE, VDE and UL (file N° E150057).
Protection degree IP20.

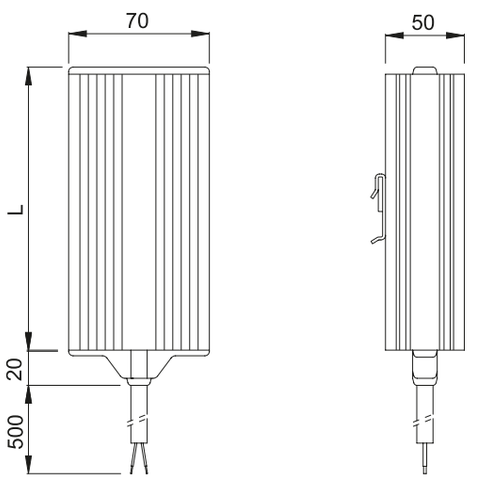
	RH060	RH100	RH150	RH250	RH400
Thermal power	60 W	100 W	150 W	250 W	400 W
Max Amperage	120-240V AC/DC	120-240V AC/DC	120-240V AC/DC	230V AC 50/60 Hz	230V AC 50/60 Hz
Lenght	140	140	220	182	222
Weight	0.40 Kg	0.50 Kg	0.70 Kg	1.10 Kg	1.40 Kg

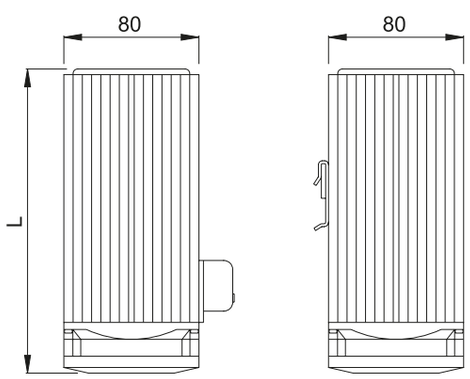
RH060 - RH100 - RH150



RH250 - RH400







THERMOSTATS

Bimetal electro-mechanical thermostats.
Item KS011 has a closing contact and is designed to control the cooling equipment or to provide alarm contacts for maximum temperature, while it. Item KT011 has a NC opening contact and is designed to control heating devices.

- KS011
- KT011

Regulation range:	da 0 a + 60°C
Type of contact	snap
Contact resistance	< 10m
Lifetime	> 100.000 cycles
Max. opening power	250 V AC, 10(2)A
Connection	Flexible wire with 1,5 mm terminal
Electromagnetic compatibility	According to EN 55014-1-2 EN 61000-3-2 EN 61000-3-3
Fixing	on 35mm DIN rail, EN 50022
Sizes	60x33x43
Weight	40g
Protection degree	IP20
Certifications	UL FILE N° E164102