

STAIRCASE PRESSURIZATION SYSTEM

SMOKE AND HEAT CONTROL SYSTEMS:

**Specification for pressure differential systems NORM:
BS EN 12101-6:2005**

This norm specifies the pressure differential systems designed to hold back smoke at a leaky physical barrier in a building, such as a door or other similarly restricted openings. It covers methods for calculating the parameters of pressure differential smoke control systems as part of the design procedure. It gives test procedures for the systems used, as well as describing relevant, and critical, features of the installation and commissioning procedures needed to implement the calculated design in a building.



CHARACTERISTICS

The STAIRCASE PRESSURIZATION SYSTEM is made of a axial fan box, frequency converter and air sensor pressure.

- Box made from galvanised metal sheet with insulation class **M1**.
 - Thermoplastic impeller with adjustable pitch angle with the exclusive **M.N.S.** system.
 - Motor **class F**, up to 750 W protection **IP 65** more than 750 W **IP 55**.
 - Working temperature: **-30°C to 70°C**.
 - Airflow: motor - impeller.
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- Housing in **ABS, IP 54**.
 - Operating temperature: **-10°C ... +50°C**.
 - Ambient humidity: **0 - 95%**.
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- Powerful and compact sensorless vector control inverter.
 - Enhanced process PID control.
 - Stall prevention, Up/Down, 3-wire operations.
 - Selective v/f, sensorless vector control.
 - **0,7-15 kHz** carrier frequency.
 - Powerful torque at overall speed range.
 - 0,01-400 Hz frequency output.
 - **-15% +10%** input voltage margin.
 - Selectable manual/automatic torque boost.
 - Built-in **RS 485/Modbus RTU** communication.

DATA TABLE

MODEL	CODE	Ø	m ³ /h	A	kW	dB(A)	ACC.	
							PG	PS
KIT SOBREPRESION V1	KSPE00000000V080	400	5.700	0,80	0,18	62	*	*
KIT SOBREPRESION V1 -S	KSPE00000000V08S	400	5.700	0,80	0,18	62	*	*
KIT SOBREPRESION V2	KSPE00000000V120	450	8.500	1,30	0,37	65	*	*
KIT SOBREPRESION V2 -S	KSPE00000000V12S	450	8.500	1,30	0,37	65	*	*
KIT SOBREPRESION A1	KSPE00000000A080	500	11.000	2,20	0,75	69	*	*
KIT SOBREPRESION A1 -S	KSPE00000000A08S	500	11.000	2,20	0,75	69	*	*
KIT SOBREPRESION A2	KSPE00000000A120	560	14.000	2,90	1,10	74	*	*
KIT SOBREPRESION A2 -S	KSPE00000000A12S	560	14.000	2,90	1,10	74	*	*
KIT SOBREPRESION B1	KSPE00000000B080	630	17.000	2,90	1,10	74	*	*
KIT SOBREPRESION B1 -S	KSPE00000000B08S	630	17.000	2,90	1,10	74	*	*
KIT SOBREPRESION B2	KSPE00000000B120	710	24.500	5,05	2,20	78	*	*
KIT SOBREPRESION B2 -S	KSPE00000000B12S	710	24.500	5,05	2,20	78	*	*

*) In the models S, the air pressure sensor includes display.

PG = Gravity shutters.

PS = Back protection.

All the system class must follow the next requirements in all pressurization system.

- In calculating the air supply needed for a pressurization system, assumptions have to be made about the leakage characteristics of the building.
- Air shall be supplied via fans and where necessary ductwork to the pressurized space.
- Each pressurized escape route shall have its own independent air supply.

AIR SUPPLY

- In buildings less than 11 m in high, a single air supply point for each pressurized stairwell is acceptable
- In buildings 11 m or more in height, air supply points shall be evenly distributed throughout the height of the stairwell, and the maximum distance between air supply points shall not exceed three storeys.
- The primary air supply has to have a back-up pressurization unit.
- The supply point shall not be located within 3 m of the final exit doors.

AIR RELEASE

- For lift shafts one injection/supply point shall be provided for each lift Shaft up to 30 m in height.
- Each lobby shall be provided with one injection/supply point.
- For double-leaf doorsets the effective area of the open door shall be assumed to be a single leaf of the open doorway
- Increase 15% allowance for ductwork losses.
- The anticipated leakage via all paths other than the open doors shall be multiplied by a factor of at least 1,5 to take account of uncertainties in identified leakage paths.

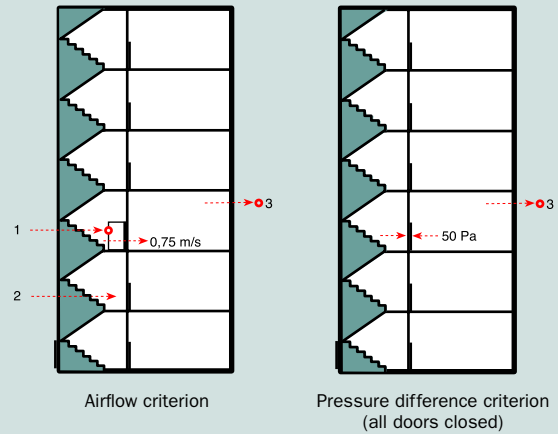
REQUIREMENTS FOR STAND-BY FANS AND DRIVE MECHANISMS

- When the pressure system equipment provides air under pressure to the only escape route within a building, a duplicate fan complete with its motor shall be provided. If a set of fans is used for this escape route, then only the fan with the highest capacity need be duplicated.
- The air intake shall always be located away from any potential FIRE hazards. Air intakes shall be located on or near ground level to avoid contamination by rising smoke. If this is not possible, air intakes shall be positioned at roof level.

SYSTEM CLASS	EXAMPLES OF USE
CLASS A SYSTEM	For means of escape. Defend in place
CLASS B SYSTEM	For means of escape and fire fighting
CLASS C SYSTEM	For means of escape by simultaneous evacuation. Example: Office
CLASS D SYSTEM	For means of escape. Sleeping risk. Example: Hotels
CLASS E SYSTEM	For means of escape by phased evacuation. Examples: Hospitals
CLASS F SYSTEM	Fire fighting system and means of escape

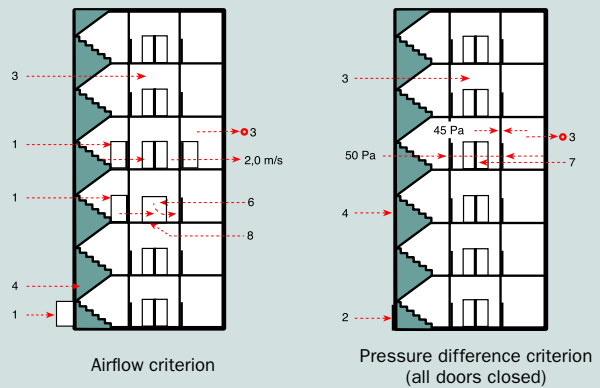
CLASS A SYSTEM

- The airflow through the doorway between the pressurized stair and the lobby/corridor shall not be less than **0,75 m/s**.
- The pressure difference across a closed door between the pressurized stair and the lobby/corridor shall not be less than **50 ± 10 Pa**.
- The open door can indicate an open flow path through a simple lobby.



CLASS B SYSTEM

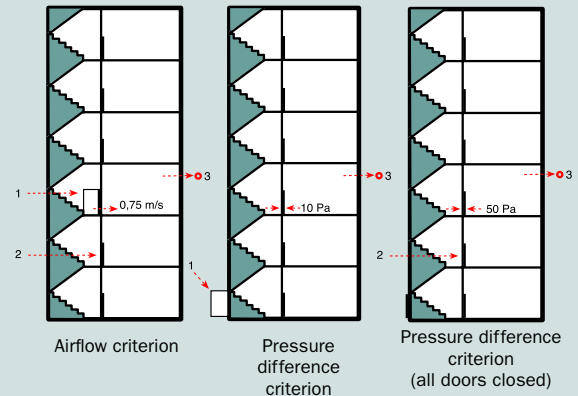
- The air supply shall be sufficient to maintain a minimum airflow of **2 m/s**.
- The pressure difference across a closed door between the pressurized stair and the lobby/corridor shall not be less than **50 ± 10 Pa**.
- The open door can indicate an open flow path through a simple lobby



CLASS C SYSTEM

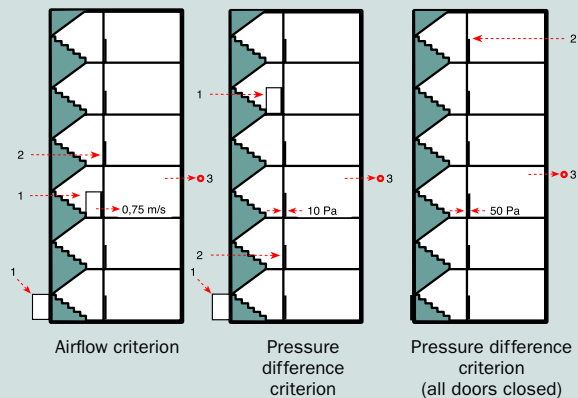
- The airflow velocity through the doorway between the pressurized space and the accommodation shall be not less than **0,75 m/s**.
- The pressure difference across a closed door between the pressurized space and the accommodation area shall not be less than **50 ± 10 Pa**.

* In the event of simultaneous evacuation it is assumed that the stairways some smoke leakage can be tolerated. The airflow due to the pressurization system shall clear the stairway of this smoke.



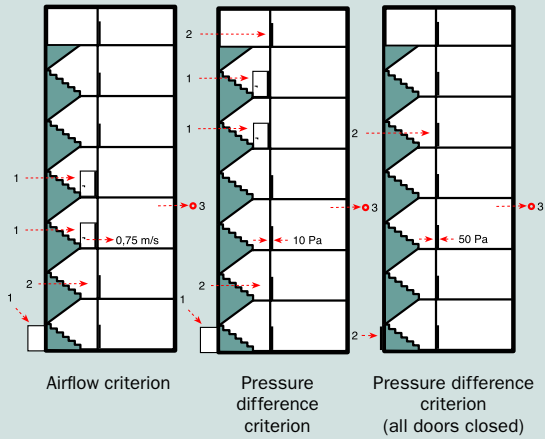
CLASS D SYSTEM

- The airflow velocity through the doorway between the pressurized space and the accommodation shall be not less than **0,75 m/s**.
- The pressure difference across the door between the pressurized space and the accommodation area on the fire storey shall not be less than **50 ± 10 Pa**.



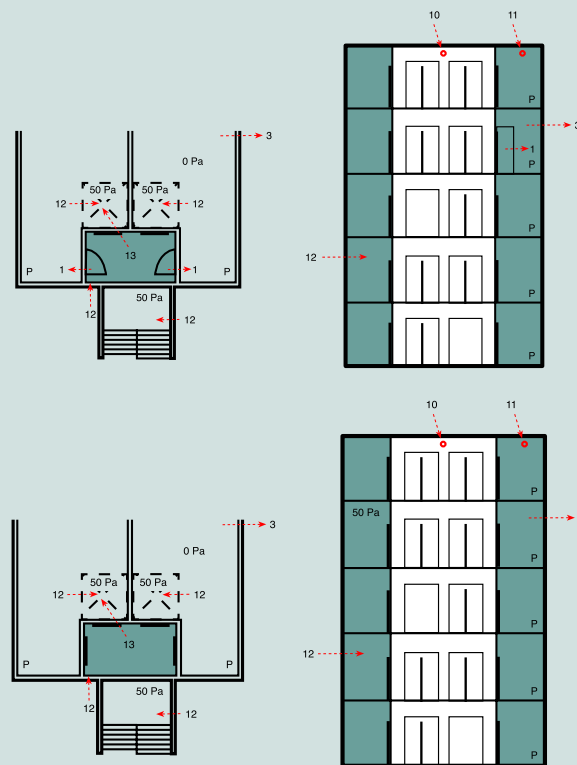
CLASS E SYSTEM

- The airflow velocity through the doorway between the pressurized space and the accommodation shall be not less than **0,75 m/s**.
- The pressure difference across the door between the pressurized space and the accommodation on the fire storey shall not be less than **50 ± 10 Pa**.



CLASS F SYSTEM

- The air supply shall be sufficient to maintain an airflow of **2 m/s** through the open door between the staircase and the lobby at the fire affected storey with the air release path on the fire floor is open.
- The minimum pressure difference across lift well and accommodation area, stairway and accommodation area shall not be less than **50 ± 10 Pa** and across closed doors between each lobby and accommodation



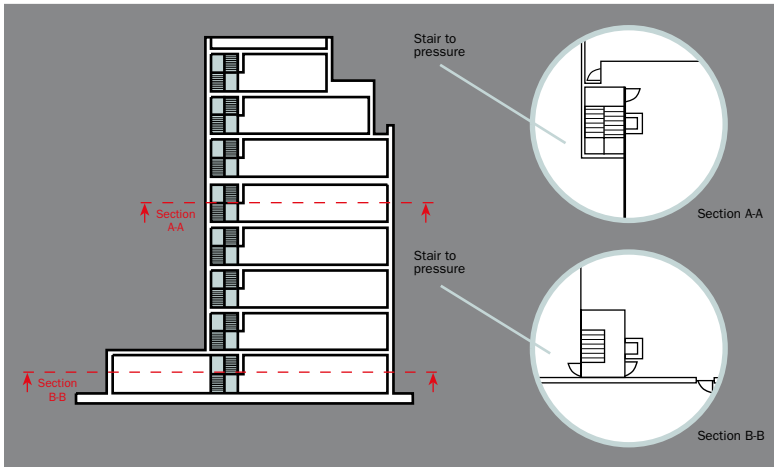
1) open door, 2) closed door, 3) air release path from building, 4) fire fighting stair, 5) fire fighting lobby, 6) door open (fire fighting lobbies), 7) door closed (fire fighting lobbies), 8) air flow from fire fighting lift shaft, 9) stair, 10) lobby, 11) accommodation, 12) supply air, 13) lift Car

Table 1: Air leakage data from doors

TYPE OF DOOR	LEAKAGE AREA (m ²)	PRESSURE DIFFERENTIAL (Pa)	AIR LEAKAGE (m ³ /s)
Single-leaf opening into a pressurized space	0,01	10	0,024
	0,01	50	0,060
Single-leaf opening outwards from a pressurized space	0,02	10	0,058
	0,02	50	0,120
Double-leaf	0,03	10	0,085
	0,03	50	0,180
Lift landing door	0,06	10	0,160
	0,06	50	0,350

SAMPLE OF CALCULUS FOR SMOKE AND HEAT CONTROL IN AN OFFICE BUILDING

The first step is to define the class system. In this case, it is an office then the class system is C.



Once that the system is defined, we will apply the airflow and pressure difference criterion.

- The airflow velocity through the doorway between the pressurized space and the accommodation shall be not less than **0,75 m/s**.
- The pressure difference across a closed door between the pressurized space and the accommodation area shall not be less than **50 ± 10 Pa**.

In the event of simultaneous evacuation it is assumed that the stairways some smoke leakage can be tolerated. The airflow due to the pressurization system shall clear the stairway of this smoke. The data from air leakage doors will be taken from Table 1.

CALCULATION FOR PRESSURE DIFFERENCE CRITERION (ALL DOORS CLOSED)		PLANTA	ESCALERA
Based on Table 1 and 50 Pa and all doors closed: $QD = 1,08 \text{ m}^3/\text{s} = 3.888 \text{ m}^3/\text{h}$ The total airflow will need to be multiplied by a factor of at least 1,5 to take account of uncertainties in identified leakage paths. $Qs = 1,5 * 3.888 = 5.832 \text{ m}^3/\text{h}$ * See right table		P7	0,12
		P6	0,12
		P5	0,12
		P4	0,12
		P3	0,12
		P2	0,12
		P1	0,12
		PB	0,12 + 0,12
		TOTAL	1,08

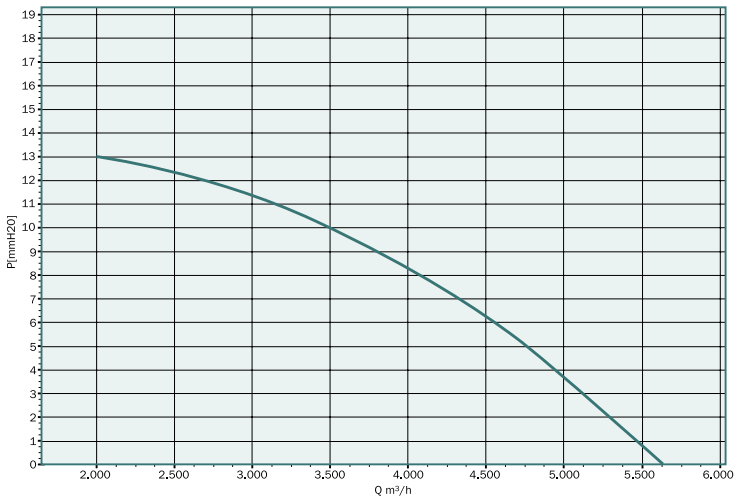
CALCULATION FOR AIRFLOW CRITERION	
The Class C System will consider a minimum of 0,75 m/s airflow velocity through the doorway between the pressurized space and the accommodation. $QDO = V \times S = 0,75 \times 1,6 = 1,2 \text{ m}^3/\text{s} = 4.320 \text{ m}^3/\text{h}$ The total airflow will consider the number of doors opened and increase 15% allowance for ductwork losses. $QSDO = 1,15 * 4.320 = 4.968 \text{ m}^3/\text{h}$ * Section door (0,80 x 2 m)	

CÁLCULO DE DIFERENCIA DE PRESIÓN PUERTA PRINCIPAL ABIERTA		FLOOR	STAIRS
Según Tabla 1 y 10 Pa, con puerta principal abierta tendremos: $QD = 0,464 * \text{m}^3/\text{s} = 1670 \text{ m}^3/\text{h}$ Se calcula el caudal de aire total a aportar, incrementando en un 50% para cubrir eventuales fugas no comprendidas en las valoraciones previas Qs. $QS = 1,5 * 1670 = 2.505 \text{ m}^3/\text{h}$ * See right table		P7	0,058
		P6	0,058
		P5	0,058
		P4	0,085
		P3	0,085
		P2	0,085
		P1	0,085
		PB	0,058 + 0 (open)
		TOTAL	0,464

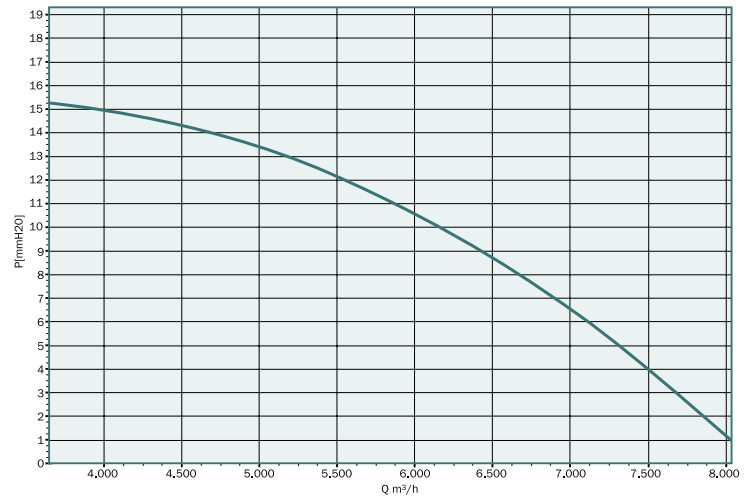
Q TOTAL MAXIMUM AIRFLOW = 2.505 m³/h + 4.968 m³/h = 7.473 m³/h

**Selected equipment: Class C and Door 0,8
KIT SOBREPRESION A1-S from NOVOVENT.**

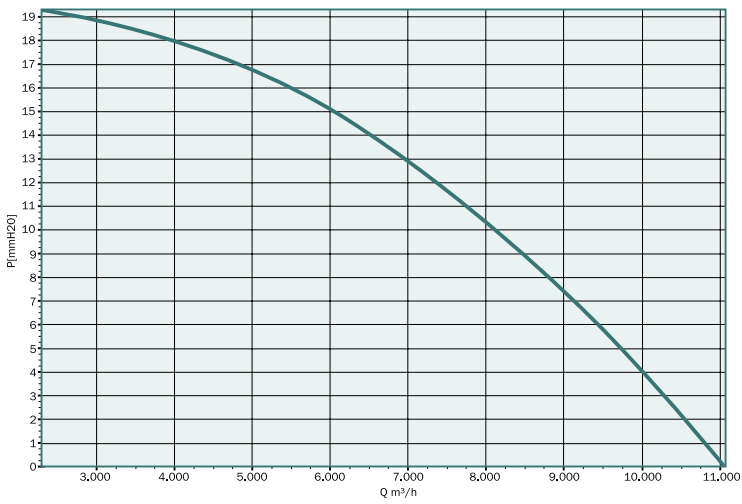
KIT SOBREPRESIÓN V1 / V1-S



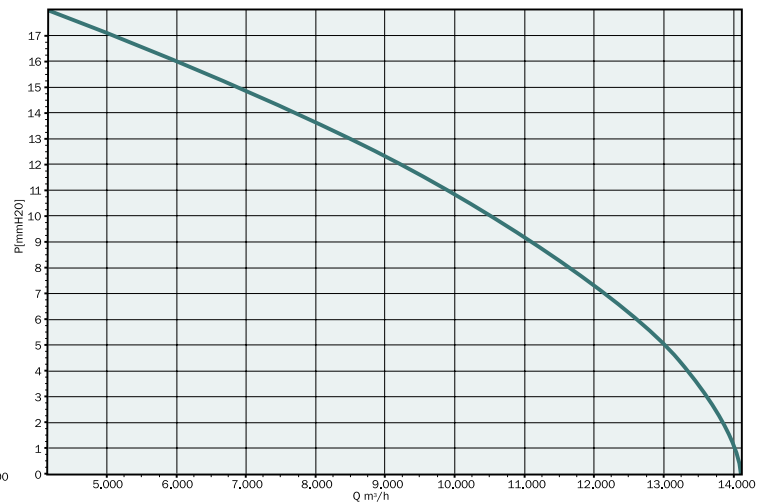
KIT SOBREPRESIÓN V2 / V2-S



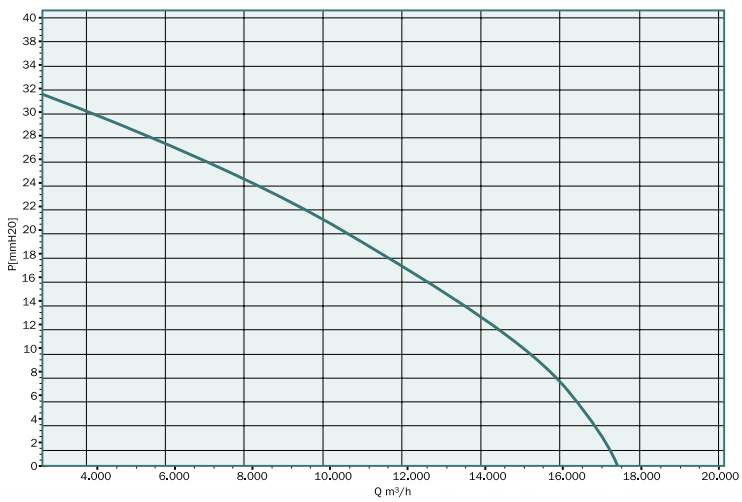
KIT SOBREPRESIÓN A1 / A1-S



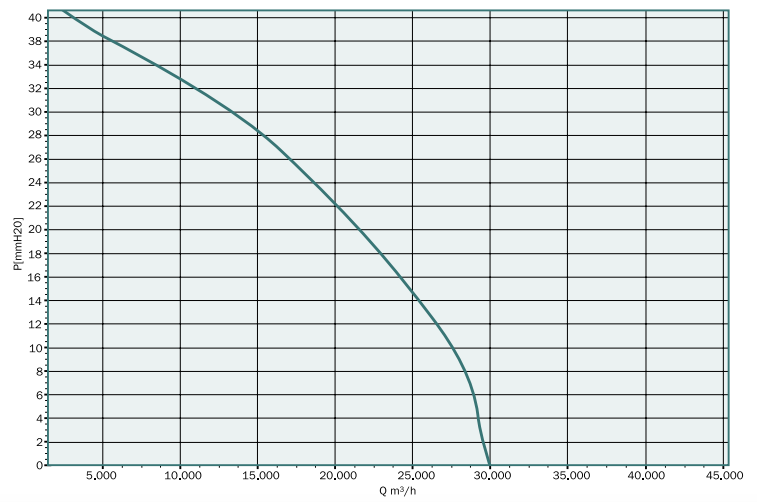
KIT SOBREPRESIÓN A2 / A2-S



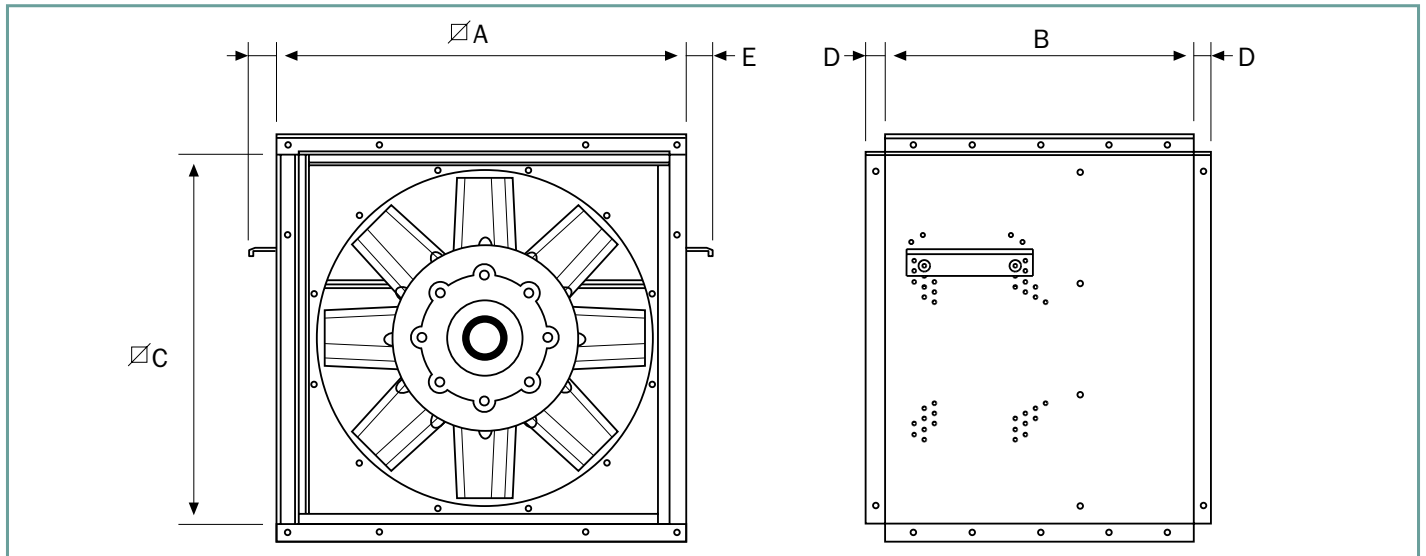
KIT SOBREPRESIÓN B1 / B1-S



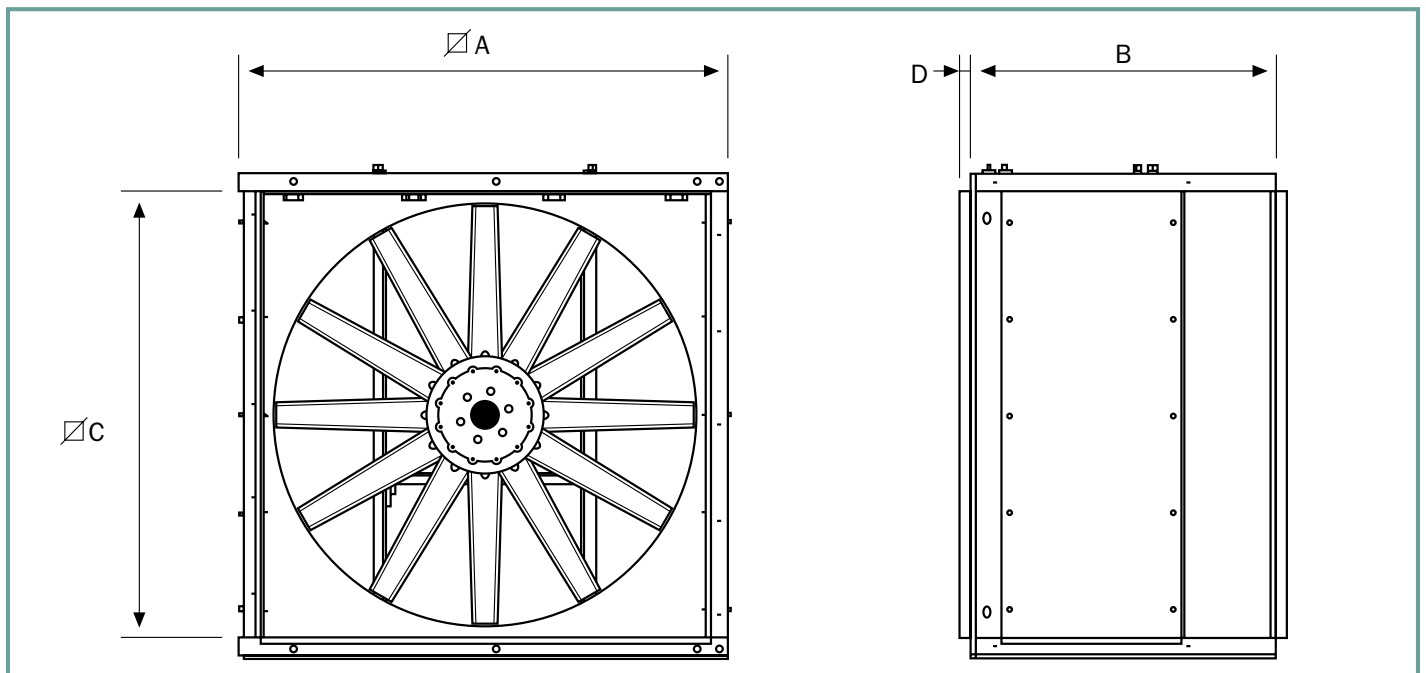
KIT SOBREPRESIÓN B2 / B2-S



	A	B	C	D	E
V1 / V1-S	554	522	465	30	40
V2 / V2-S	565	522	465	30	40
A1 / A1-S	654	530	560	30	40
A2 / A2-S	695	530	630	30	40
B1 / B1-S	790	600	725	30	40



	A	B	C	D
B2 / B2-S	873	650	800	30



H.V.A.C. SYSTEMS

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