
AREM
THE VENTILATION PERFORMANCE
CATALOG

AREM is one of the largest French manufacturers of fans known throughout Europe.

AREM is especially known for its experience in making axial fans. Belt-driven and direct-driven, with short or long casings, with or without venturi, they are all designed in accordance with the specifications for the numerous applications for which they are intended.

Centrifugal fans using forwards or backwards inclined blades have just joined this range, which is one of the most extensive on the market.

AXIALS AREM

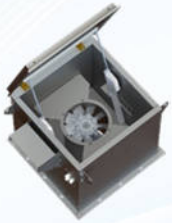
THE VENTILATION PERFORMANCE

	SMOKE EXTRACTION	GENERAL VENTILATION	EXPLOSIVE ATMOSPHERES	COOLING	DRYING	INDUSTRIAL VENTILATION
AXUS RANGE : AX BX CX EX	✓	✓	✓	✓	✓	✓
PAF HATCH	✓	✓	✓	✗	✗	✗
TH TV TD	✓	✓	✓	✓	✓	✓
JFA CFD STUDY	✓	✓	✗	✗	✗	✗
DA DA ECM	✗	✓	✗	Available on request	Available on request	Available on request
AXUS EC RANGE : AX BX CX EX	✗	✓	✗	✓	✓	✓

Direct-driven...

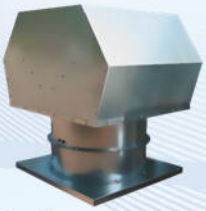
...Belt-driven

Soundproof plenum box...



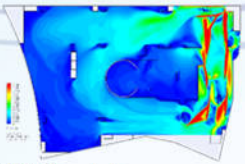
...With motorized opening

Roof fan - Horizontal discharge



Roof fan -Vertical discharge

Jet fan (Accelerator)



CFD Simulation

Wall-mounted

... With ECM

Axus with EC motors

...Specific with EC motors

CENTRIFUGALS

AREM
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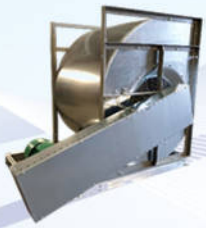
	SMOKE EXTRACTION	GENERAL VENTILATION	EXPLOSIVE ATMOSPHERES	COOLING	DRYING	INDUSTRIAL VENTILATION
BACKWARD CURVED FAN : G Series R Series V Series Z Series VRD/VRDGT RL/RM EC	✓	✓	✓	Available on request	✓	✓
FORWARD CURVED FAN : C Series VAD TDA TMD	✓	✓	✓	Available on request	✗	✗
CELN **CELN EC** **VGND** **VGNT**	✓	✓	✗	Available on request	✗	✗
JFC **CFD STUDY**	✓	✓	✗	✗	✗	✗
TCH **TCV** **TCO** **TCVP**	✗	✓	✓	✓	✓	✓
SMALL DIAMETER : CP CB	✗	✓	✓	✗	✗	Available on request

Direct-driven...

...Belt-driven

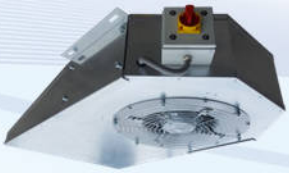
Direct-driven...



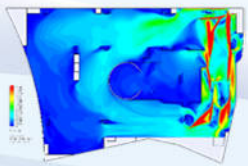
...Belt-driven

Plenum box – backwards inclined blades

Plenum box – forwards inclined blades



Jet fan (Accelerator)



CFD Simulation

Roof fan with horizontal discharge

Roof fan with vertical discharge

Plastic casing...

...Steel casing

CONTENTS

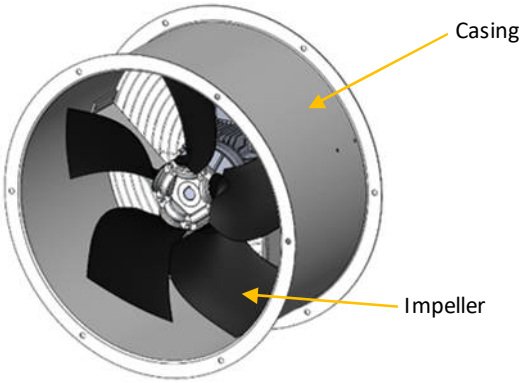
STANDARDS – RULES – CONVENTIONS

AREM makes axial and/or centrifugal fans for industrial and tertiary applications. The impeller may be driven directly or by a belt.

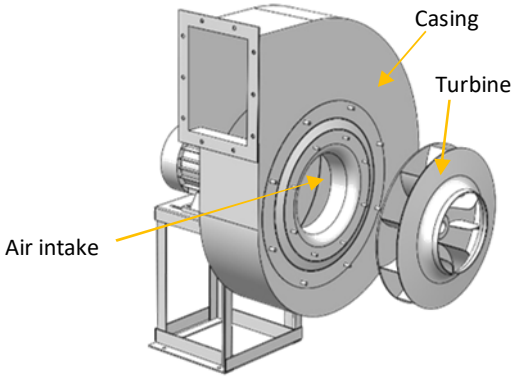
These basic elements of the fan are available in several ranges:

- Axial fans:
  - direct-drive with short or long casing
  - belt-drive (system of pulleys and belt)
- Centrifugal fans:
  - direct-drive with single inlet
  - direct-drive with double inlet
  - belt-drive
- Plenum boxes:
  - with forward or backwards inclined blades
  - with acoustic insulation
  - with motorized opening and closing
- Centrifugal and axial roof fans:
  - with horizontal discharge
  - with vertical discharge
- Jet fans (accelerators or thrusters):
  - centrifugal jet fan (with backwards inclined blades))
  - axial jet fan

Axial fan



Centrifugal fan



These products are dedicated to multiple applications are subject to construction rules. In the first part of this catalog, you will find information on standards, rules or AREM conventions to ensure correct understanding of the technical elements of our products.

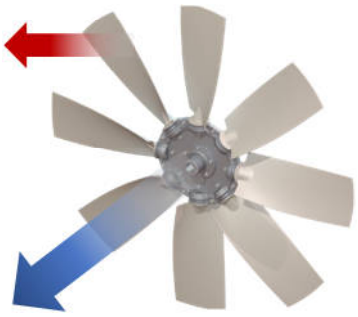
If you cannot find what you are looking for,  **reach out to your sales contact.**

AREM CONVENTIONS – AXIALS

Direction of rotation / Air direction

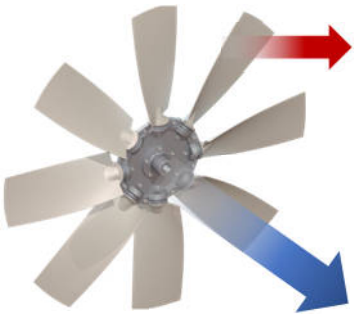
- When facing the air flow, the rotation of the impeller to the L (left) or R (right) is represented as follows:

Rotation **L**



Air flow

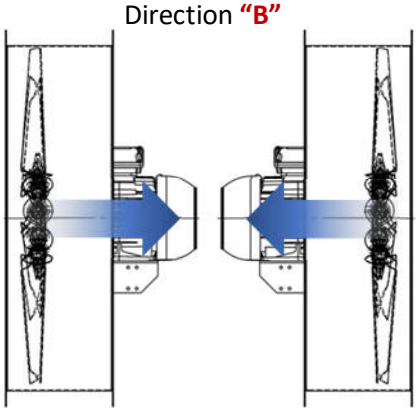
Rotation **R**



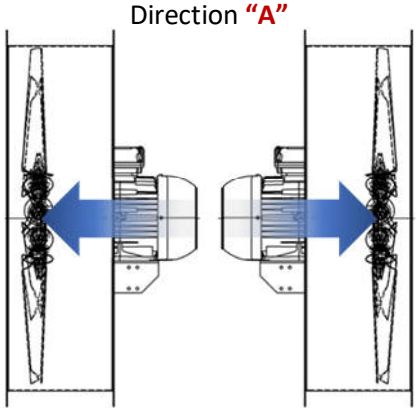
Air flow

- When the air flow is unidirectional, the air can flow either in direction A (the air circulates from the motor to the impeller) or in direction B (the air circulates from the impeller to the motor):

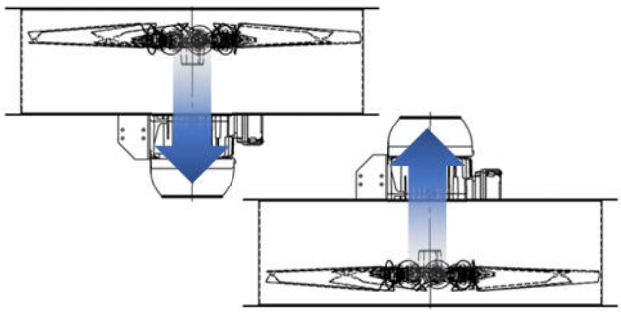
HORIZONTAL flow
Direction **"B"**



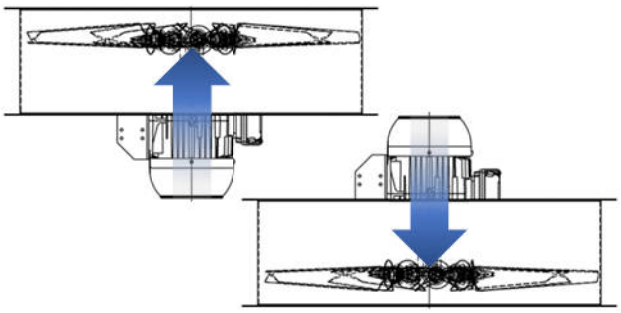
HORIZONTAL flow
Direction **"A"**



VERTICAL flow
Direction **"B"**



VERTICAL flow
Direction **"A"**



Comments

For a belt-driven fan, the equivalent of the motor mark is the transmission shaft (protective housing for the pulley-belt assembly).

A vertical installation must be specified when ordering as it may require certain adjustments (e.g. avoid water inlets, etc.).

AREM CONVENTIONS – CENTRIFUGALS

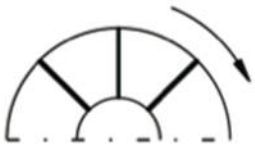
Direction of rotation / Air direction / Outlet positions

- When facing the rear flange of the motor, the rotation of the impeller in direction RD (right) or LG (left) is defined as follows:

RD Rotation
BACKWARD curved blades

RD Rotation
FORWARD curved blades

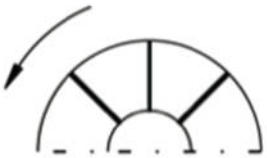
RD Rotation
STRAIGHT blades



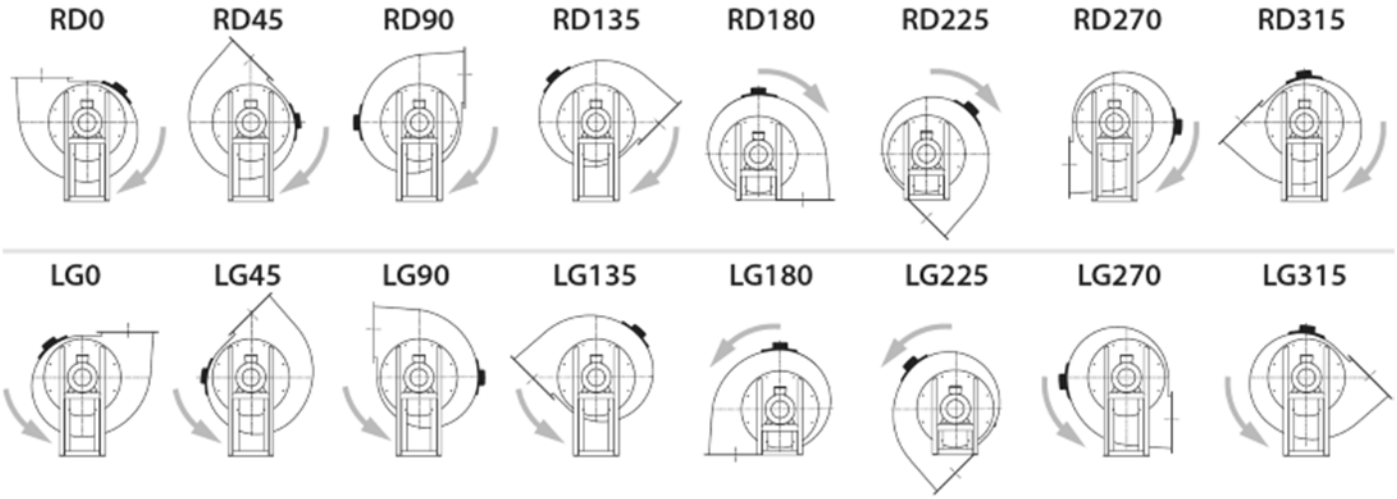
LG Rotation
BACKWARD curved blades

LG Rotation
BACKWARD curved blades

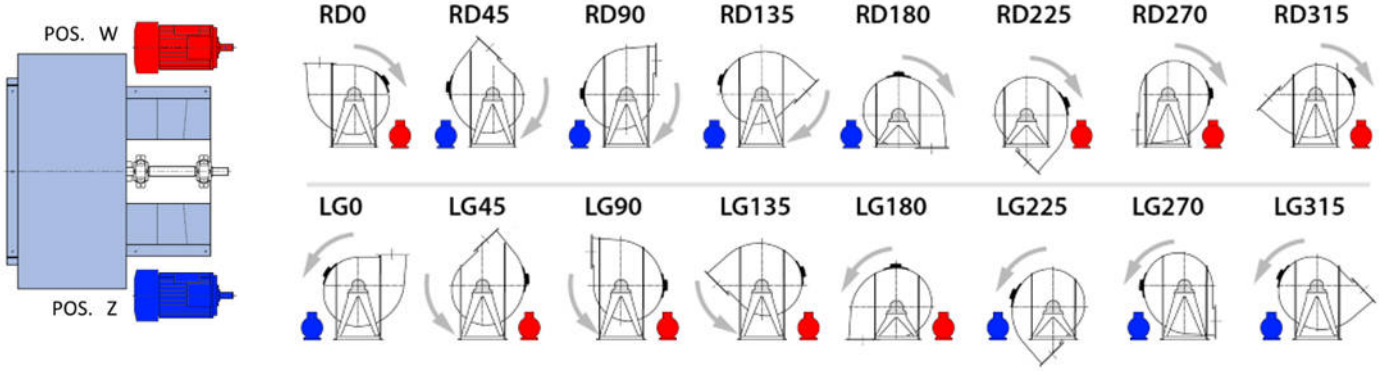
LG Rotation
BACKWARD curved blades



- The casing can generally be orientated in steps of 45° (reference 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°) as in the representations below:



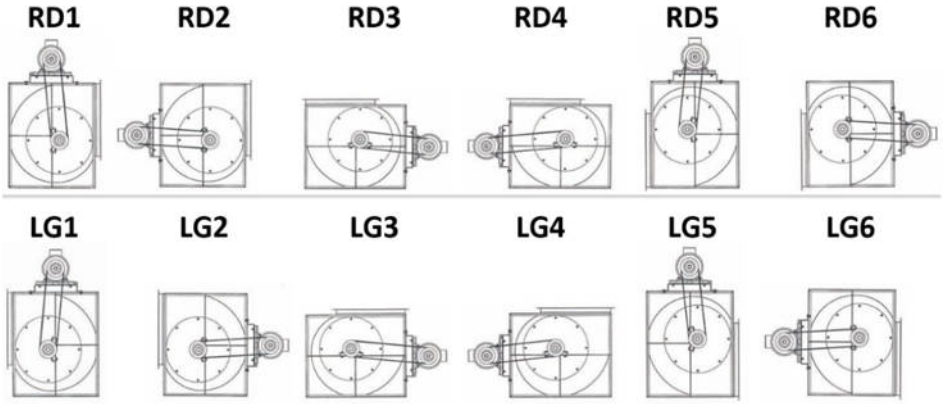
- Position of the motors for belt-driven fans depending on the orientation:



AREM CONVENTIONS – CENTRIFUGALS

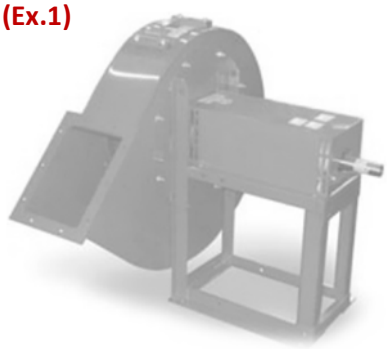
Outlet positions / Executions

- Specific positioning for VAD / VRD fans type:



- Standard executions:

Execution 1 (Ex.1)

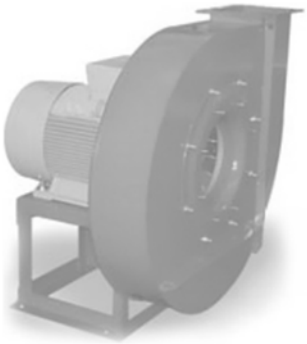


Wheel mounted on the transmission shaft
Mounting on bearings

Execution 8 (Ex.8)

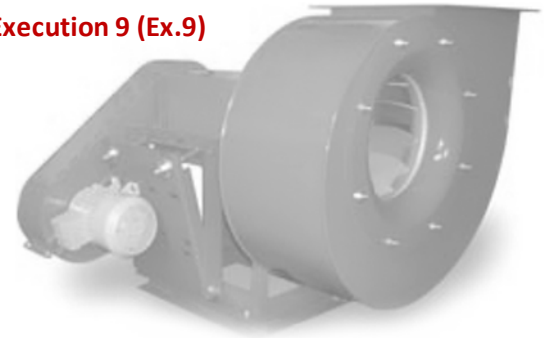
Semi-flexible coupling
Foot-mounted motor

Execution 4 (Ex.4)



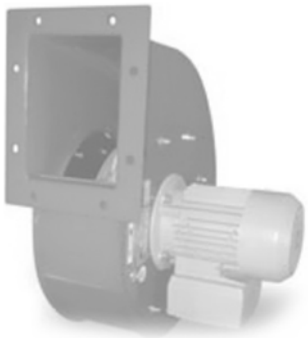
Direct coupling
Stand-mounted motor

Execution 9 (Ex.9)



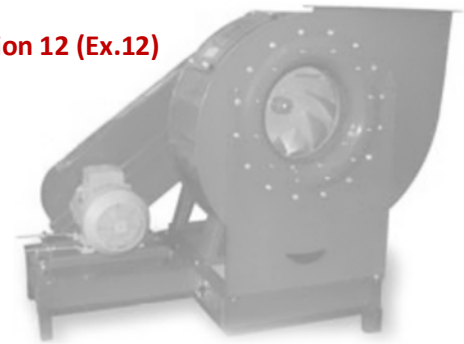
Belt drive (system of pulleys and belts)
Side-mounted motor

Execution 5 (Ex.5)



Direct coupling
Flange-mounted motor

Execution 12 (Ex.12)



Belt drive (system of pulleys and belts)
Frame-mounted motor

MATERIALS

Applications and temperature limits

Our impellers are mainly made of plastic, aluminium or steel components. The temperature limits are suitable for continual use. For short-term use, these limits will be revised.

Type	Description	Application	Temperature
PPG	Glass reinforced polypropylene	General	-10°C to +90°C
PAG	Glass reinforced polyamide	Alternating mechanical load. Frequent start-ups	-40°C to +120°C
PAGAS	Anti-static glass reinforced polyamide	Explosive atmosphere	-40°C to +110°C
AL	Aluminium (EN AC-Al Si12 Cu1 (Fe)	Industrial process	-60°C to +150°C

Different materials can be used for the housings (casings):

Type	Description	Application	Temperature
S235	General construction steel	General	-60°C to +350°C
S235 + GC	Hot-dip galvanized steel	Corrosive environment	-60°C to +350°C
S235 + RAL	Painted steel according to RAL "x"	Corrosive environment	-60°C to +130°C
Z275	Pre-galvanized steel	General	-60°C to +350°C
AL 5754	AW-AlMg3 aluminium, the composition is according to EN573-1 H111 sheet metal, the mechanical strength is according to EN485-2	Food or industrial process	-60°C to +150°C
304L	304L ASTM stainless steel (1.4307, Europe)	Industrial process	-60°C to +425°C
316L	316L ASTM stainless steel (1.4404, Europe)	Food or industrial process	-60°C to +425°C

Recommendation for corrosive environments:

Class	Indoor environment	Outdoor environment	Material
C1	Office, shop, school, hotel, etc.	Dry or cold environment with low level of impurities	Z275
C2	Warehouse, sports hall, etc.	Rural environment	Z275
C3	Production site, laundry, brewery, dairy, etc.	Urban environment	Hot-dip galvanized steel
C4	Chemical site, swimming pool, boat cabin	Industrial zone, low-saline environment	Hot-dip galvanized steel
C5	Constant condensation, high level of impurities	Industrial zone with high level of mildew and aggressive atmosphere	316L or C5 paint
CX	Constant condensation, high level of impurities	Saline environment	316L or C5M paint

- Polarity - Speed:

In direct-drive, the fan is generally fitted with an asynchronous motor with one or two rotation speeds characterized by the number of poles. Depending on the polarity, the theoretical synchronous speeds are:

One speed (single speed): rpm	Two speeds (dual speed): rpm
2 poles = 3000	2 / 4 poles = 3000 / 1500
4 poles = 1500	4 / 8 poles = 1500 / 750
6 poles = 1000	4 / 6 poles = 1500 / 1000
8 poles = 750	6 / 8 poles = 1000 / 750
12 poles = 500	6 / 12 poles = 1000 / 500

With the use of belt drives, direct-drive variable speed drives or electronically commutated motors, we can adjust the speeds over a wide rotation range.

- Voltage - Frequency:

The motor's electrical power supply voltage can be single-phase or three-phase. The most common voltages are 230V (single-phase or three-phase), 400V or 690V (three-phase).

The electrical networks can differ between countries, 50Hz or 60Hz (or other). In the majority of cases, a voltage multiplied by 1.2 is used when switching from 50Hz to 60Hz but in some geographical areas, the ratio does not change:

Initial: 50Hz	Switch to 60Hz (ratio 1.2)	Switch to 60Hz (ratio 1)
230V	276V	230V
400V	480V	400V
690V	828V	690V

It is essential to let us know the power supply network in order to define the optimal motor according to requirements.

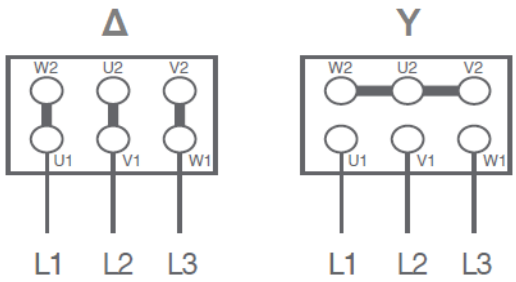
- One speed motor coupling:

As a rule, the motors are designed to work with two potential voltage sources, lower (delta connection) or higher (star connection). For example, for a motor plate indicating 230V/400V, the lower voltage is 230V and the higher is 400V. Depending on the voltage supplied by the customer network, it will be necessary to:

- If the network supplies 230V: Make a delta connection (symbol Δ)
- If the network supplies 400V: Make a star connection (symbol Y)

U1-V1-W1 and U2-V2-W2 are the motor connection terminals

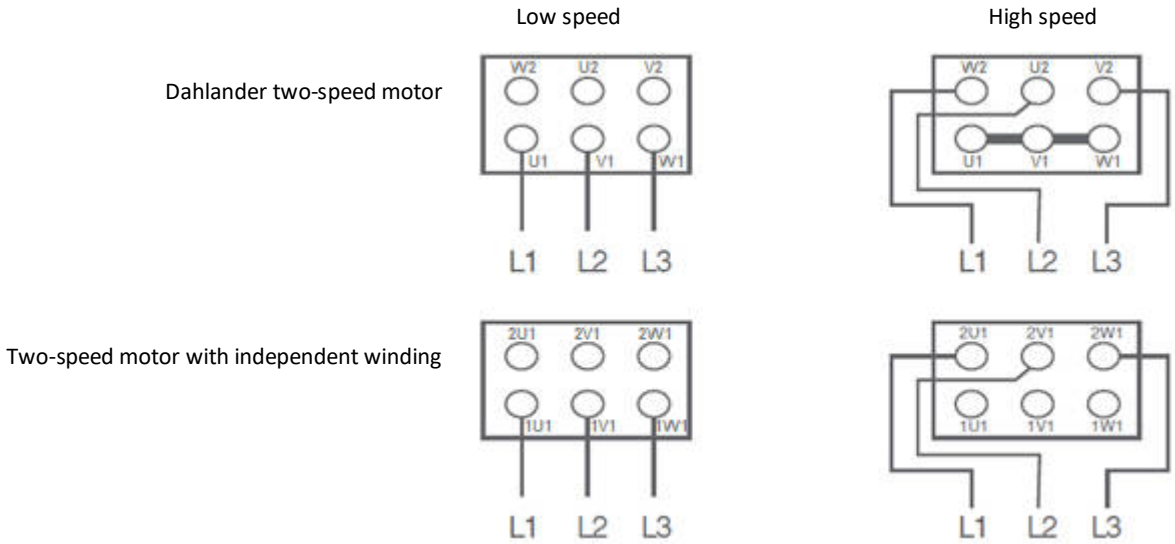
L1, L2 and L3 are the phases of the electricity network



In France, professional installations are generally supplied in 380-400V/50Hz.

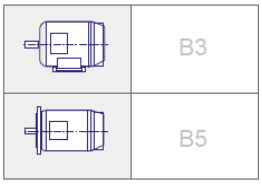
- Two speed motor coupling:

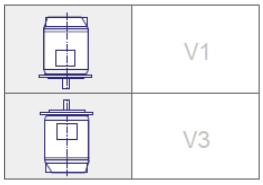
Two-speed motors of the Dahlander type or with independent winding are common. On a servo system, changing from a low to high speed requires the use of a switching system following the principle below:

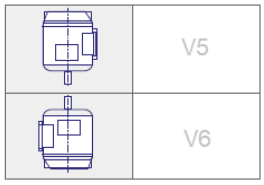


- Type of assembly:

The working position of a motor is very varied; standard IEC 60034-7 defines mounting arrangements. The most common positions are:







B3: Horizontal on foot
B5: Horizontal on flange on motor shaft side
V1: Vertical on flange, motor shaft down
V3: Vertical on flange, motor shaft up
V5: Vertical on foot, motor shaft down
V6: Vertical on foot, motor shaft down

- Our connection rules:

We can make the motor's electrical connection to an On-Off switch connector or a junction box. Depending on the choice requested, the cables used are:

- 4-strand or wire cable (4G): For a 1-speed motor in general:
  → By default, the motor coupling will be made to operate at 3x 400V.
- 7-strand or wire cable (7G): For 2-speed motor or 1-speed motor with start-up Y/Δ (on request)
  → Each motor terminal block (U1, V1, W1, U2, V2, W2) is connected to the switch terminal blocks or the junction box terminal blocks; no connection in the motor will be made.

- Anti-condensation devices

For fans operating in a damp zone or with high temperature variations (hot/cold), we recommend the use of motors with drain holes in accordance with the working positions. Water formation and stagnation in the motor must be avoided to minimize malfunctions.

Heating resistors integrated into the motor can also be used in **COOLING** applications to raise the motor's internal temperature before start-up and/or to avoid the formation of condensates.

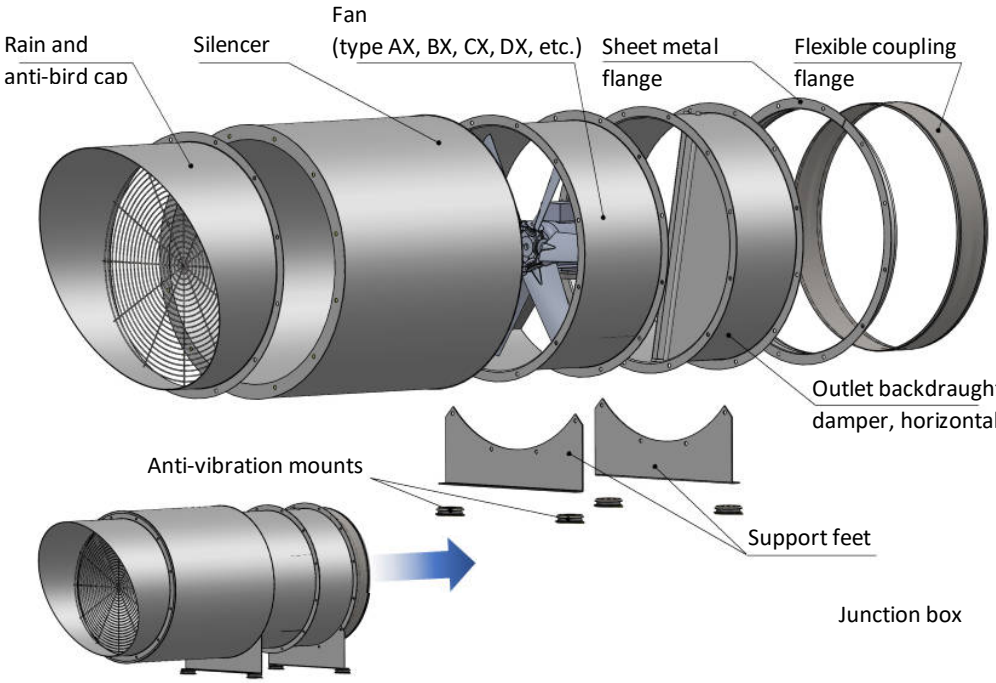
For efficiency and to avoid degrading the average duration of use, the devices must be monitored and serviced regularly. These operations and their frequencies are the responsibility of the user and the maintenance team. Specific treatment may be required for every use.

ANCILLARIES

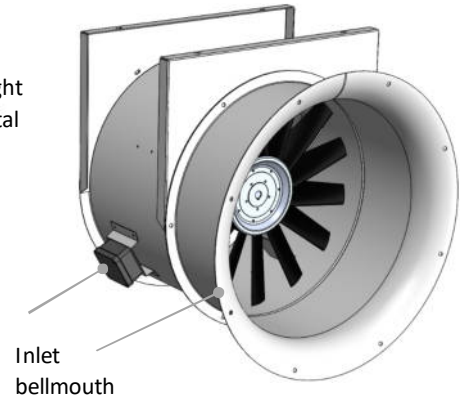
General

An axial or centrifugal fan can be fitted with ancillaries according to requirements and assembly types. Below are typical representations using different components:

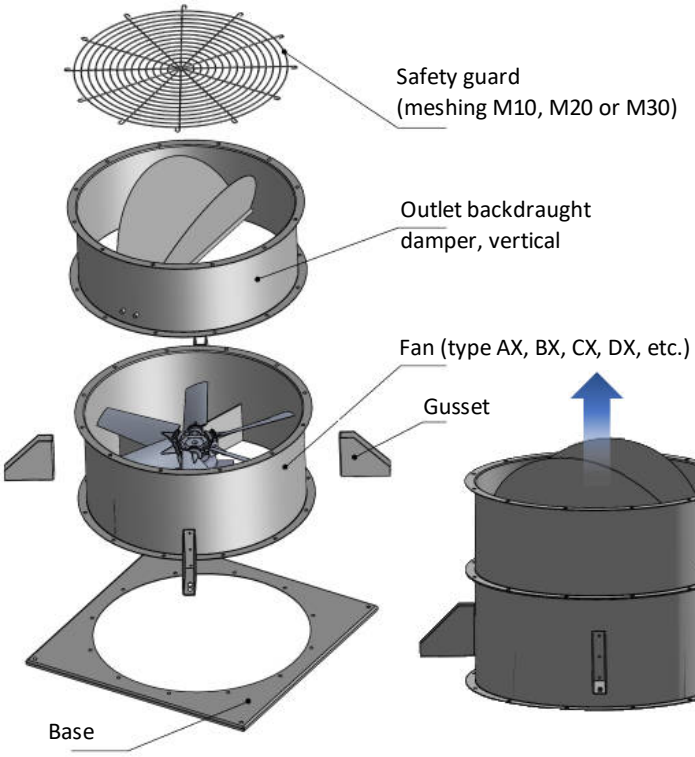
- Ancillaries for horizontal mounting (H)



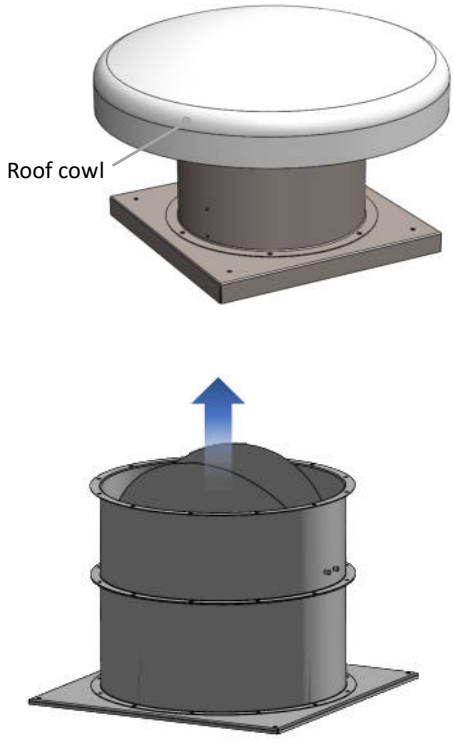
Suspended horizontal mounting



- Ancillaries for vertical mounting (V)



Roof-mounted fan



There are many ancillaries that are not represented here that you will find in the **ANCILLARIES** of this catalog. We have limited the representation for axial fans but the equivalents exist for centrifugal fans.

DIMENSIONS

General tolerances

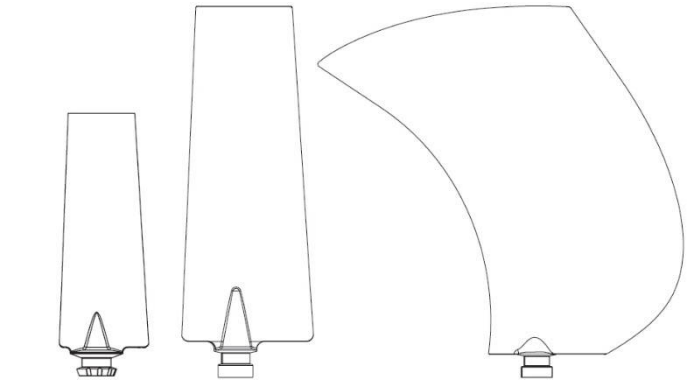
- General dimensions

Unless otherwise indicated, the dimensions indicated in this catalog are given with the following tolerances:

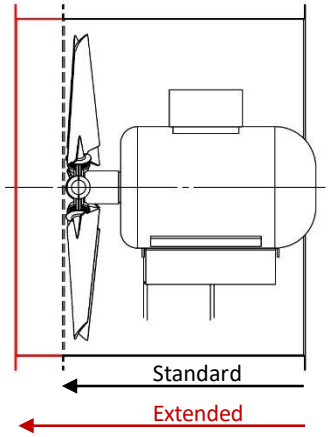
Title	Tolerance
Casing inner diameter	+/-2mm
Flange outer diameter	+/-5mm
Centering diameter for fixing	+/-3mm
Casing length	+/-5mm

- Extended casing

For applications with wide blades, the casing lengths can be increased by +100mm.

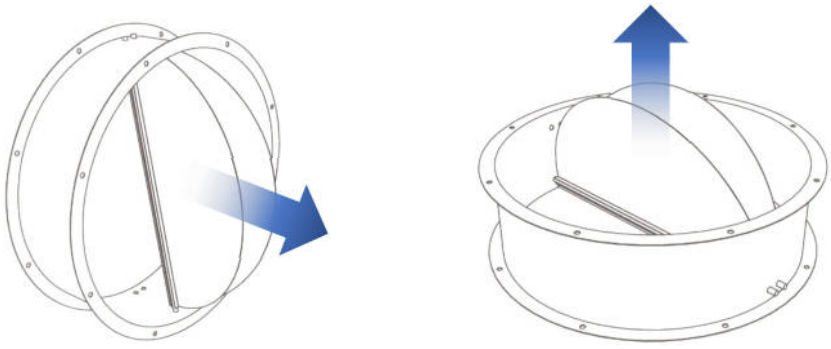


Narrow blade Wide blade Wide inclined blade



- Extended backdraught damper

A backdraught damper can be used to prevent horizontal or vertical air return. It is positioned at the fan's outlet. The shutters may extend beyond the length of the casing at the opening. If a safety guard has to be fitted behind the backdraught damper, then an extended backdraught damper will have to be used. See also the **ANCILLARIES.**



- Matching flange

A matching flange enables the fan to be connected to flexible ducting. Up to 1000 mm in diameter, the part to be covered is dimpled (collar ring). Beyond 1000 mm, this part is smooth. A guard can be installed inside the flange on request. See also **ANCILLARIES.**

Without collar ring **With collar ring**

PHYSICAL UNITS

Conversion of imperial and metric units

The physical units may differ between countries. The conversion table below will help you convert the common values.

LENGTH		
Multiply	by	To Obtain
ft	12	in
	0,3048	m
	304,8	mm
in	0,0833	ft
	0,0254	m
	25,4	mm
m	3,2808	ft
	39,37	in
	1000	mm
mm	0,003281	ft
	0,03937	in
	0,001	m

AREA		
Multiply	by	To Obtain
in^2	0,006944	ft^2
	0,0006452	m^2
	645,16	mm^2
ft^2	144	in^2
	0,0929	m^2
	92903	mm^2
m^2	10,76	ft^2
	1550	in^2
	1000000	mm^2

VOLUME		
Multiply	by	To Obtain
ft^3	1728	in^3
	28,317	l
	0,02832	m^3
in^3	0,000579	ft^3
	0,01639	l
	0,0000164	m^3
l	0,03531	ft^3
	61,024	in^3
	0,001	m^3
m^3	35,315	ft^3
	61024	in^3
	1000	l

MASS		
Multiply	by	To Obtain
lb	16	oz
	453,59	grams
	0,45359	kg
oz	0,0625	lb
	28,35	grams
	0,0283	kg
grams	0,002205	lb
	0,03527	oz
	0,001	kg
kg	2,2046	lb
	35,274	oz
	1000	grams

VELOCITY		
Multiply	by	To Obtain
fpm	0,0167	fps
	0,2	in/s
	0,00508	m/s
	0,3048	m/min
fps	60	fpm
	12	in/s
	0,3048	m/s
	18,288	m/min
in/s	5	fpm
	0,0833	fps
	0,00254	m/s
	1,524	m/min
m/s	196,85	fpm
	3,2808	fps
	39,37	in/s
	60	m/min
m/min	3,2808	fpm
	0,05468	fps
	0,65617	in/s
	0,0167	m/s

VOLUME FLOW		
Multiply	by	To Obtain
cfm	0,0004719	m^3/s
	0,02832	m^3/min
	1,699	m^3/h
	0,47195	l/s
	28,317	l/min
m^3/s	2118,9	cfm
	60	m^3/min
	3600	m^3/h
	1000	l/s
	60000	l/min
m^3/min	35,315	cfm
	0,0167	m^3/s
	60	m^3/h
	16,667	l/s
	1000	l/min
m^3/h	0,58858	cfm
	0,0167	m^3/min
	0,0003	m^3/s
	0,2778	l/s
	16,667	l/min
l/s	2,1189	cfm
	0,001	m^3/s
	0,06	m^3/min
	3,6	m^3/h
	60	l/min
l/min	0,03531	cfm
	0,000016	m^3/s
	0,001	m^3/min
	0,06	m^3/h
	0,0167	l/s

PRESSURE		
Multiply	by	To Obtain
psi	27,728	in-wg
	2,036	in-Hg
	6894,8	Pa
	704,28	mm-wg
	51,715	mm-Hg
	0,06805	atm
in-wg	0,03607	psi
	0,07343	in-Hg
	248,66	Pa
	25,4	mm-wg
	1,8651	mm-Hg
	0,002454	atm
in-Hg	0,49115	psi
	13,619	in-wg
	3386,4	Pa
	345,91	mm-wg
	25,4	mm-Hg
	0,03342	atm
Pa	0,000145	psi
	0,004022	in-wg
	0,0002953	in-Hg
	0,10215	mm-wg
	0,007501	mm-Hg
	0,0000099	atm
mm-wg	0,00142	psi
	0,03937	in-wg
	0,002891	in-Hg
	9,7898	Pa
	0,07343	mm-Hg
	0,0000966	atm
mm-Hg	0,01934	psi
	0,53616	in-wg
	0,03937	in-hg
	133,32	Pa
	13,619	mm-wg
	0,001316	atm
atm	14,696	psi
	407,48	in-wg
	29,921	in-Hg
	101300	Pa
	10350	mm-wg
	760	mm-Hg

DENSITY		
Multiply	by	To Obtain
lb/ft^3	16,02	kg/m^3
kg/m^3	0,06243	lb/ft^3

TEMPERATURE
°F = 1,8*(°C)+32
°C = 0,5556*(°F-32)

POWER		
Multiply	by	To Obtain
hp	33000	ft-lb/min
	550	ft-lb/s
	745,7	W
	0,7457	kW
	76,04	kg-m/s
ft-lb/min	0,0000303	hp
	0,0167	ft-lb/s
	0,0226	W
	0,0023	kg-m/s
ft-lb/s	0,0018	hp
	60	ft-lb/min
	1,3558	W
	0,1388	kg-m/s
W	0,00134	hp
	44,254	ft-lb/min
	0,73756	ft-lb/s
	0,1019	kg-m/s
kg-m/s	0,01	hp
	434,78	ft-lb/min
	7,2	ft-lb/s
	9,81	W

TORQUE		
Multiply	by	To Obtain
lb-in	0,083	lb-ft
	0,11298	N-m
lb-ft	12	lb-in
	1,3558	N-m
N-m	0,73756	lb-ft
	8,8507	lb-in

ROTATING SPEED		
Multiply	by	To Obtain
rpm	0,0167	rps
	0,0167	Hz
rps	60	rpm
	1	Hz
Hz	60	rpm
	1	rps

MOMENT OF INERTIA		
Multiply	by	To Obtain
$lb\text{-}in^2$	0,0069	$lb\text{-}ft^2$
	0,0002926	$kg\text{-}m^2$
$lb\text{-}ft^2$	144	$lb\text{-}in^2$
	0,04214	$kg\text{-}m^2$
$kg\text{-}m^2$	23,73	$lb\text{-}ft^2$
	3417,2	$lb\text{-}in^2$

Definition of imperial and metric units

°C : Celsius degrees
cfm : cubic feet per minute
°F : degrees Fahrenheit
ft : feet
fpm : feet per minute
g : gram
Hg : mercury
Hp : horse power
in : inch
kg : kilogram
Pa : Pascal
l : litre
lb : pound
m : meter
min : minute
mm : millimeter
Nm : Newton meter
oz : ounce
psi : pound per square inch
rpm : revolution per minute
s : second
W : Watts
wg : water gauge
N : Newton

The field of ventilation uses a large normative reference system that is linked to the applications concerned. The most common standards are mentioned below.

EN 12101: Smoke and heat control systems
The AREM F200 to F400 smoke and heat extractor fans designed for use in a mechanical ventilation system to extract and control smoke and heat in all kinds of structures are standardized in accordance with EN12101.

DIRECTIVE 2009/125/CE: Eco-design requirements for energy-related products (ErP)
The motor-driven fans with input electrical power of between 125 W and 500 kW are subject to this directive (with the exception of: high temperature, explosive environments, etc.). AREM applies EU regulations 327/2011 and 1253/2014 resulting from this directive defining minimum performance thresholds.

DIRECTIVE 2014/34/EU: Equipment and protective systems intended for use in potentially explosive atmospheres.
All manufacturers concerned with making, using or distributing materials must comply with the essential health and safety requirements provided by the directive. We also lean on EN 1127 and EN 14986 for prevention, protection and design while remaining compliant with the Directive. Below, the shaded areas are the ATEX fan zones/categories that we cover under the INERIS file number:

Appliances for surface finishing industries GROUP II: INERIS EQEN 032696/17						
Zone	0	20	**1**	**21**	**2**	**22**
Appliance category	1		**2**		**3**	
Type of atmosphere (G=Gas; D=Dust)	G	D	**G**	**D**	**G**	**D**
Notion of risk	Permanent presence		**Intermittent presence**		**Episodic presence**	

IEC 60034: Rotating electrical machinery
In Europe, the majority of our fans have electrical motors that comply with standard IEC 60034. This standard gives us consistency in terms of performance criteria, energy performance, cooling methods, insulation and protection classes, acoustic levels, fastening methods, dimensions, etc., of our motors. For other continents and depending on the destination, we can meet standards NEMA, UL, CSA.

ISO 5801: Performance testing using standardized airways
Connecting a duct to a fan's inlet and/or outlet affects its performance. We refer to this standard for our performance testing. We have testing methods that use standard AMCA 210 corresponding to standard ISO 5801. Concerning the acoustic part, AMCA 300 is often used to characterize a fan's power and sound pressure levels.

ISO 1940: Balance quality requirements for rotors in a constant (rigid) state
The balancing of our impellers depends on the specifications provided in this standard. G6.3 is the AREM standard balance quality. On specific request, we can provide G2.5.

ISO 14694: Industrial fans — Specifications for balance quality and vibration levels

Fans with power below 300kW must comply with the balance specifications and thresholds in accordance with standard ISO 14694. For power above 300kW, ISO 10816 is applied. AREM appliances are provided with a BV-3 standard vibration level and balance grade G6.3. Tables 1 to 3 allow requirements to be correctly defined.

Table 1: example of application category

Application	Examples	Installed power limits (kW)	Category of fan application, BV
Residential	Ceiling fan, CMV, wall-mounted	≤0.15 >0.15	BV-1 BV-2
HVAC and agriculture	Tertiary ventilation and air conditioning; commercial premises	≤3.7 >3.7	BV-2 BV-3
Process industry and power plants	Filtration, purification, mines, conveyor-belts, boilers, combustion, pollution control, wind tunnels	≤300 >300	BV-3 See ISO 10816-3
Transport and marine	Locomotive, trucks, automotive	≤15 >15	BV-3 BV-4
Transit / Tunnel	Emergency ventilation of metro systems, car park tunnels, accelerators	≤75 >75	BV-3 BV-4
Petrochemical processes	Dangerous gas extraction, process fan	≤37 >37	BV-3 BV-4
Micro-processor manufacturing	Clean rooms	Not specified	BV-5

Table 2: category of application and equivalent balance level

Category of fan application, BV	Balance quality level of the impellers/rotors
BV-1	G16
BV-2	G16
BV-3	G6.3
BV-4	G2.5
BV-5	G1.0

Table 3: Displacement limit in mm/s (average effective value)

Condition	Application category	Rigid assembly Peak / R.M.S		Flexible assembly Peak / R.M.S	
IN NORMAL OPERATION	BV-1	14	10	15.2	11.2
	BV-2	7.6	5.6	12.7	9.0
	BV-3	6.4	4.5	8.8	6.3
	BV-4	4.1	2.8	6.4	4.5
	BV-5	2.5	1.8	4.1	2.8
ALERT	BV-1	15.2	10.6	19.1	14.0
	BV-2	12.7	9.0	19.1	14.0
	BV-3	10.2	7.1	16.5	11.8
	BV-4	6.4	4.5	10.2	7.1
	BV-5	5.7	4.0	7.6	5.6
STOP	BV-1	Determine / past readings		Determine / past readings	
	BV-2	Determine / past readings		Determine / past readings	
	BV-3	12.7	9.0	17.8	12.5
	BV-4	10.2	7.1	15.2	11.2
	BV-5	7.6	5.6	10.2	7.1

AREM STANDARD USES

General information

We make fans with optional components or ancillaries depending on requirements. The mounting rules that we use are:

- Access to the external junction box

Fans with long casings (type AX, etc.) are fitted with a removable inspection hatch to access the external junction box and carry out maintenance. This hatch is held in place with sheet metal screws, unless a specific request is made (insert, bolting, etc.). For short casings (type BX, etc.), there is no hatch, therefore the external junction box is accessed by removing the safety guard (if there is one).

- Motor cabling

By default, the motors are not wired in the factory and connection remains an option. On request, we can connect the motor to an on-off switch or a junction box depending on the choice.

If the motor does not have an external junction box but has wires at the output, we recommend adding the connection option with an on/off switch or a junction box in order to facilitate installation.

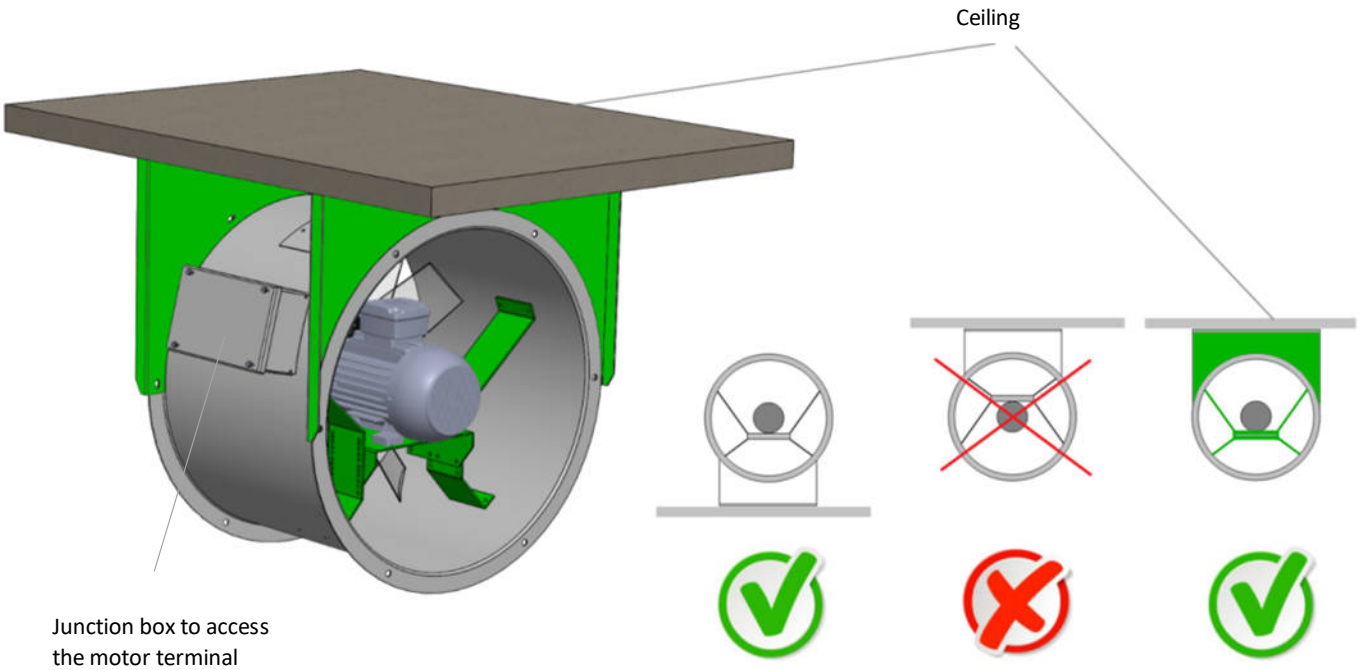
- Safety guard

Unless there are exceptional circumstances (ATEX, etc.), the safety guard is optional. In general, fans with long casings are designed to be connected to the network. In this case, it is not necessary to add safety guards.

With short casings, we recommend adding a safety guard at the inlet and/or outlet depending on use. Depending on the distance of the impeller, the meshing pitch will be 10, 20 or 30mm.

- Mounting with feet

The support feet option is available depending on requirements and is designed to work in compression, resting on the ground. If the fan has to be suspended (on the ceiling, for example), it shall be clearly stated so that it can be fitted with the right feet for this purpose. **It is not authorized to turn the fan over.**



ELEMENTARY FAN AIR PERFORMANCES LAWS

General information

- Dynamic, static and total pressure

When the impeller of a fan is rotated, it moves a volume of air from one point to another. Under the effect of speed, this movement generates dynamic pressure "**Pd"**. This pressure is expressed according to the following relations:

- Flow rate Q (in m^3/s): **$Q = V*S$** (S is the surface in m2; V is the velocity in m/s)
- Dynamic pressure Pd in Pascal (Pa): **$Pd = (1/2)*\rho*V^2$** (ρ is the density in kg/m^3)

If the volume moved is in a circuit or enclosure, the fluid exerts force on the walls in all directions (example of a duct or a plenum box) thus creating static pressure "**Ps**", measurable with a Pitot sensor or another type of sensor.
Dynamic pressure is always positive while static pressure can be positive (at the fan's outlet) or negative (at the fan's inlet). The total pressure "Pt" of the fan is by definition equal to the sum of the dynamic and static pressure:

- Total pressure Pt (Pa): **$Pt = Pd+Ps$**

- Duty point

The elements that make up an air supply circuit or an installation (length of the ducts, bends, connections, grills, reducers, increases, plenum boxes, filters, sound traps, etc.) are called "system".
These elements generate "pressure losses" under the dynamic pressure of a fan. It is important to determine theoretically or experimentally the sum of pressure losses translated into pressure in order to size the duty point required, i.e. the pressure necessary to offset the pressure losses from the system and to obtain the required flow rate.

- Ventilator laws

The fan is generally selected to deliver a fixed flow rate-pressure duty point. Some applications require a variation in flow by using variable speed drives or other systems. We use air flow laws to calculate the new duty point.
With "N (rpm)" being the speed of rotation of the impeller, we can determine the values of the new point (2) by knowing the values of the current point (1). The calculations can be made according to the following equations:

- Flow rate Q: **$Q_2 = Q_1*(N_2/N_1)^1$**
- Pressure P: **$P_2 = P_1*(N_2/N_1)^2$**
- Absorbed power W: **$W_2 = W_1*(N_2/N_1)^3$**

- Influence of temperature and density

The fan curves presented in our technical documents are based on air temperature "T" at 20°C and density "ρ" of $1.2kg/m^3$. If a fan has to deal with temperature or density modifications, the formulas below will be used to calculate the new values:

- Flow rate Q: **$Q_2 = Q_1$**
  The volume of air is invariable, the volumetric flow is therefore constant
- Pressure P: **$P_1/P_2 = \rho_1/\rho_2 = T_2/T_1$**
  The pressure evolves proportionally to density and in reverse proportion to temperature
- Power W: **$W_1/W_2 = \rho_1/\rho_2 = T_2/T_1$**
  The power evolves proportionally to density and in reverse proportion to temperature

ELEMENTARY FAN NOISES LAWS

General information

- Level of acoustic (or sound) power and pressure

Our technical documentation contains the sound characteristics of a fan expressed according to the level of acoustic power "Lw" or pressure "Lp" in decibels dB. The Lw and Lp levels are obtained by logarithmic comparison of a sound source in relation to a reference W_0 and P_0, which are respectively the sound power and pressure. The relations are therefore:

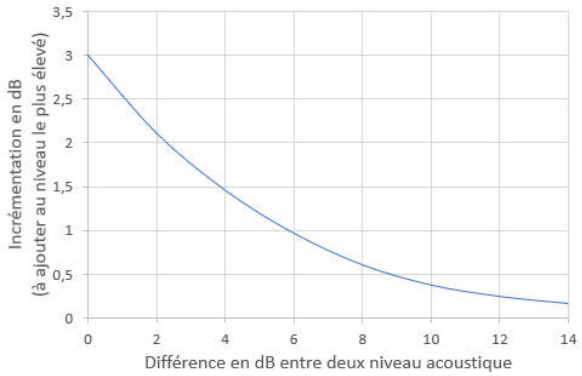
- Acoustic power (in dB): $\mathbf{L_W = 10*LOG_{10}(W/W_0)\ dB}$, with $W_0 = 10^{-12}$Watts
- Acoustic pressure (in dB): $\mathbf{L_P = 20*LOG_{10}(P/P_0)\ dB}$, with $P_0 = 2*10^{-5}$Watts

The acoustic level expressed by an equivalent value is insufficient to characterize a fan. These values change according to the propagation of waves at different frequencies. Research has shown that the human ear is more sensitive to certain frequencies than to others. "Weighting A" adjustment values are used to correct this effect in order to remain on the same amplitudes. The standard uses the octave bands in the following table:

Octave bands	1	2	3	4	5	6	7	8
Frequency range (Hz)	45 to 90	90 to 180	180 to 355	355 to 700	710 to 1400	1400 to 2800	2800 to 4600	5600 to 11200
Central frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Weighting "A" (dB)	-26	-16	-9	-3	0	+1	+1	-1

- Add two levels of acoustic pressure

Two sources of the same acoustic level increase the overall level by 3dB. The graph below allows for a quick calculation if we know the difference between two sources.



- Propagation

A fan is often supplied with an acoustic spectrum emitted in free field. According to the directivity "Q" of the field, the acoustic impact will be higher. For the same volume, we can apply the following rules:

Propagation	dB to add
Q=1 (spherical, free field)	+0
Q=2 (1/2 spherical, a reflective surface)	+3
Q=1 (1/4 spherical, two reflective surfaces)	+6
Q=1 (1/8 spherical, three reflective surfaces)	+9

- Fans laws

The change of motor velocity or impeller diameter affects the fan's acoustic level. We can determine the level of the new point (2) by knowing the current level (1). The calculations can be made according to the following equations:

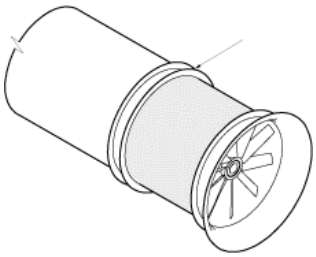
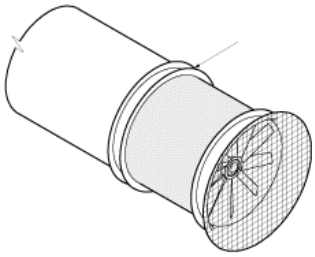
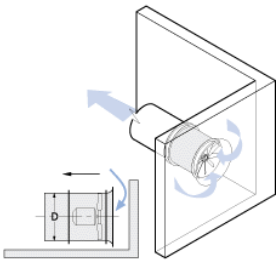
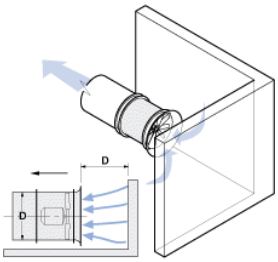
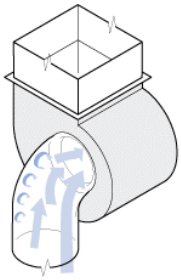
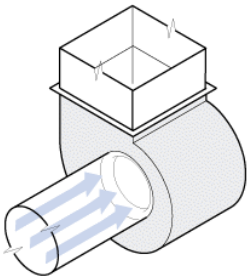
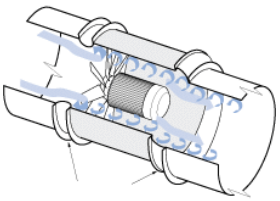
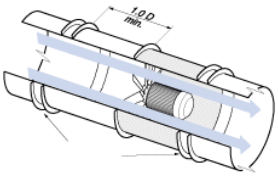
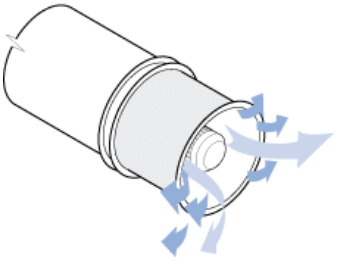
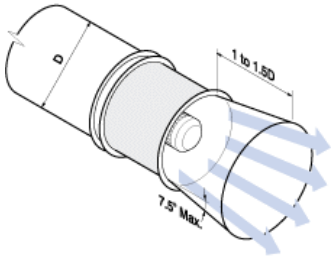
- Variation in speed: $\mathbf{L_{W2}=L_{W1}+X*LOG_{10}\ (N_2/N_1)+22*LOG_{10}(\rho_2/\rho_1)}$
- Variation in diameter: $\mathbf{L_{W2}=L_{W1}+X*LOG_{10}((N_2*D_2)/(N_1*D_1))+20*LOG_{10}(D_2/D_1)+22*LOG_{10}(\rho_2/\rho_1)}$

with X=50 for a centrifugal fan and X=55 for an axial fan.

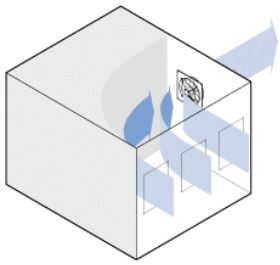
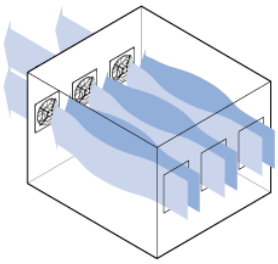
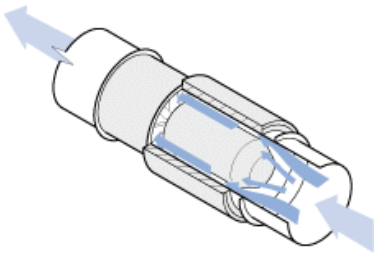
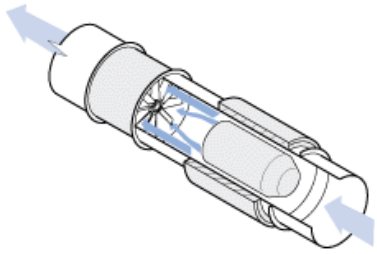
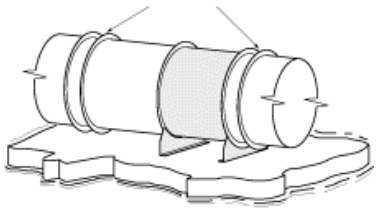
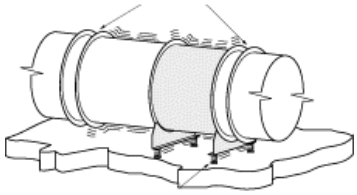
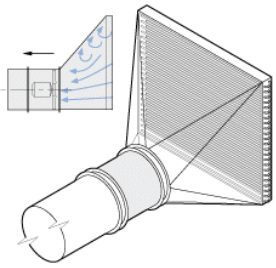
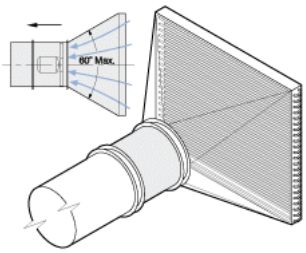
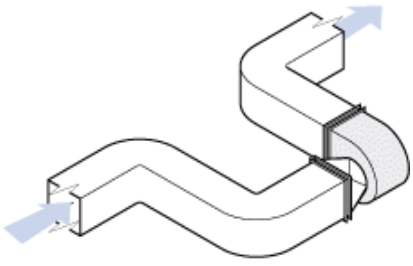
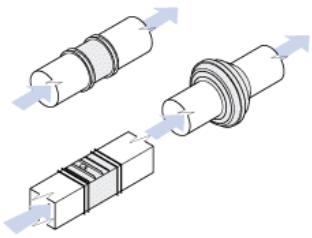
PRACTICAL TIPS

Installation rules 1

The system effect plays an important role in the fan's operation. The flow rate may be affected if the fan is not correctly installed or connected following the rules. Here are some errors to avoid:

Examples	DON'T	DO
Safety guard: The fan may or may not be connected depending on the installation network. Always fit a safety guard to avoid intrusions.		
Inlet or outlet obstacle: Leave a distance of at least 1x the diameter of the fan to avoid affecting its operation.		
Inlet and outlet bend: The connection from a duct to the input must be straight. A bend connected directly to the inlet or outlet impairs the fan's performance.		
Connection of flexible flanges: It is recommended to insert a rigid flange upstream and downstream of the fan before connecting the flexible flanges to avoid turbulence on the periphery.		
Diffuser cone: Fans not connected to the outlet may be fitted with a diffuser cone to convert dynamic losses into static regain thanks to gradual diffusion of the air speeds.		

Source: Fantech

Examples	DON'T	DO
Air stagnation zone: Air stagnation zones should be avoided in order to improve scavenging. In some cases, carry out a fluid simulation study to optimize the installation.		
Silencer with bulbs: Leave a space between the fan and the silencer to improve air circulation and avoid turbulence that would reduce performance.		
Wave propagation: Do not attach the fan directly to the vibration-sensitive structure or platform. Use anti-vibration mounts and flexible flanges to isolate the unit and avoid wave propagation.		
Transition parts: The use of round-square symmetrical transition parts is preferred. Asymmetric parts degrade the fan's suction or discharge conditions.		
Radial suction and discharge: In a linear network, this type of fan must be avoided. It is preferable to opt for an in-line fan or plenum box to optimize the circuit.		

Source: Fantech

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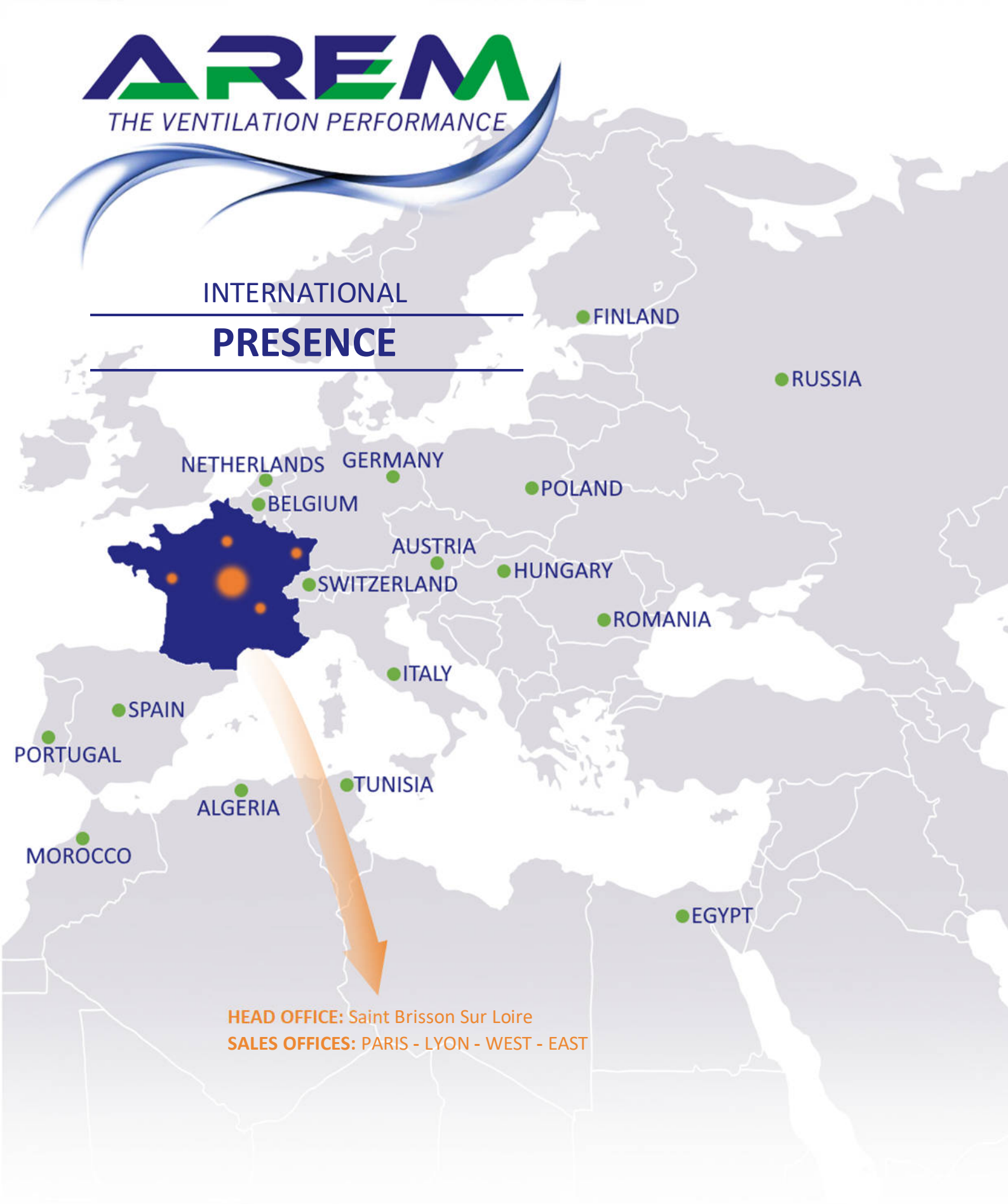
THE VENTILATION PERFORMANCE

INTERNATIONAL PRESENCE



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