

AXIAL FAN

User manual

NT-01-C (03-2022)



COMPLIANCE WITH MACHINERY DIRECTIVE 2006/42/CE
COMPLIANCE WITH ELECTROMAGNETIC COMPATIBILITY DIRECTIVE 2014/30/UE

Z.I. - Chemin des Aisières - 45500 SAINT BRISSON-sur-LOIRE

Tel: +33 (0)2 38 36 71 05 - Fax: +33 (0)2 38 36 70 65


www.arem.fr

Table of contents

1. Safety notes	3
a. Definition and warning	3
b. General information	3
2. Packaging and handling	4
a. Packaging and unloading	4
b. Unpacking and handling	5
3. Installation and commissioning	7
a. Installation	7
b. Connection	8
c. Commissioning	8
d. Operation with a speed controller	8
4. AREM axial fan	9
a. Technical terms	9
b. Air flow convention	10
c. Coupling type	10
d. Motor coupling notion	11
5. Mechanical components	13
a. Impeller removal	13
b. Motor removal	14
c. Belt tension	15
d. Tightening torque	17
e. Maintenance and cleaning	17
f. Problems encountered	18

1. Safety notes

a. Definition and warning

 DANGER	Failure to comply with this warning leads directly to death or to serious bodily harm.
WARNING	Failure to comply with this warning potentially leads to death or to serious bodily harm.
IMPORTANT	Failure to comply with this warning potentially leads to moderate injuries.
NOTES	For the entire document, "NOTES" is to draw attention on useful information or of concerned elements.

b. General information

CAUTION	<p>This device is using electricity for working. The non-respect of warning or instruction contained in this manual could lead to serious injuries or important material damages.</p> <p>Only trained or qualified personnel having a perfect knowledge of security and safety rules is allow to work on this device.</p> <p>The correct functioning of this device is supposed that the handling, installation, usage and maintenance are with respect to the rule.</p>
WARNING	This device must be used as conditions specified by AREM. All unauthorized modifications and usages of spares parts, ancillaries, which are not sold or recommended by AREM could lead to fire, failure, electric shock and its consequences.
IMPORTANT	<p>This manual must be kept with the device and permanently available at the place of use. All operating and measuring tests on the working device must be carry out with safety rules in respect to the country where this device is installed.</p> <p>It is recommended to use appropriate tool for any intervention or operation. Before the installation and using this device, please read the following safety and security instruction of the manual. Additionally, please refer to all warning labels present on the device. Warning labels must not be hidden and must be replaced when damaged or invisible.</p>
Qualified staff	In this manual, a "qualified personnel" refers to a person who is familiar with the installation, the assembling, the startup and operating of the device with the risk generated.

2. Packaging and handling

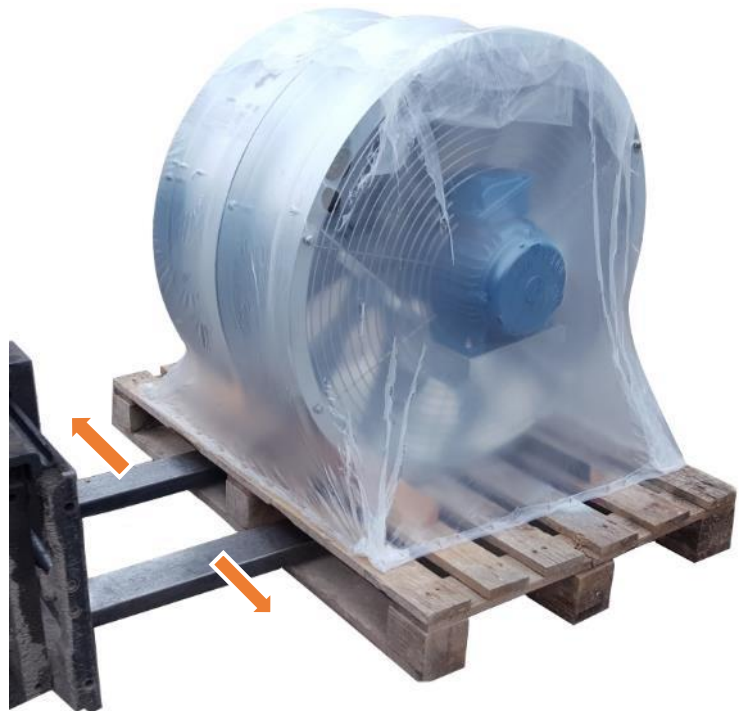
a. Packaging and unloading

The fan is generally protected by a plastic film during packaging. Fragile devices feature “FRAGILE” labels on their packaging. They are to be handled cautiously to avoid damaging the packaged product. No item may be laid or stored on the fan.

In the event of an on-site transfer, the fan must be appropriately wedged and protected in the transport truck. It is necessary to handle it with caution in order to avoid any accident during the transfer. The handling is to be made with adequate means. Before performing transfers, the forks should be spread as much as possible and the hoisting stability should be checked in order to avoid toppling.



Packaging with plastic film protection



Example of a pallet pick-up with forks lift

IMPORTANT:

The one-year guarantee of this equipment is valid as of the delivery date and covers defects which can be attributed to bad manufacturing or a material defect.

Upon receiving the equipment, the number of parts and their condition should be checked. Non-compliances resulting from bad transport conditions should be specified immediately on the shipping note, confirmed by registered letter with recorded delivery addressed to the haulier and reported to us.

b. Unpacking and handling

The plastic film can be removed with a cutting tool or knife. The operation should be carried out with caution in order to avoid scratching the surface of the fan or the paint. Before removing the fan from the pallet, remove the straps as well as the screws, bolts, etc. holding the device.

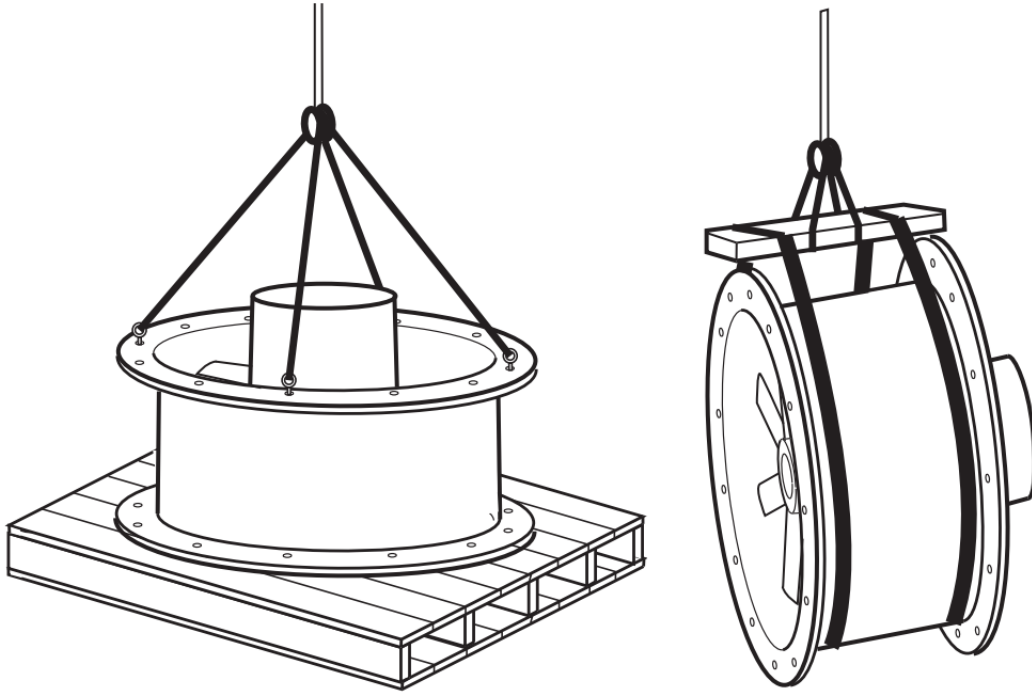


If lifting rings are available, they should be used to lift and handle the fan.



Fan with lifting rings

If lifting rings are not available, the fan can be lifted safely using slings, as shown on the figures below:



Lifting method example: lifting by the flange (left) or lifting by the outer fan case (right)

IMPORTANT:

The installer is in charge of the handling means. The equipment should be maintained in good working condition, and checks should be made to ensure there is no risk of dysfunction or damage. Failing this, no handling should take place. The equipment should be checked by the relevant department.

The fan must never be lifted by its motor or impeller, but only using the holes in the flanges in order to distribute the weight. The fan should not be lifted by the bellmouth side.

Avoid impacts which could damage rotating elements and therefore deteriorate the fan balance. The fan should be rebalanced if required.

For roof fans: never lift the fan by the hood and use adequate handling means (chassis, slings, etc.).

NOTES:

The fan should be stored inside of a local, protected from dust, impacts and bad weather, in its original packaging.

Likewise, it is recommended to refrain from storing it near a source of vibration in order to preserve the integrity of the bearings.

The fan should be stored at temperatures ranging from -10°C to +45°C and humidity should remain below 90%.

For long stay storage lasting several weeks, the impeller should be rotated manually in order to avoid the marking of bearings.

3. Installation and commissioning

WARNING:

The installation should be carried out by qualified professionals or staff. AREM declines all responsibilities in case of non-compliance with these instructions.

The following points should be checked before the installation takes place:

- Ensure the motor characteristics match the network characteristics.
- Ensure there are no hard points in the bearings by rotating the propeller manually.
- Check the tightening of the assembly screws by paying particular attention to the tightening of the propeller on its shaft.

a. Installation

Fans equipped with anti-vibration pads should be laid on a rigid and flat surface. Check the tightening of the screws or fixing elements and ensure the installation complies with applicable standards.

The extract or insufflate airflow by the fan may be horizontal or vertical. There are four types of standardised connections of the fan inlet-outlet:

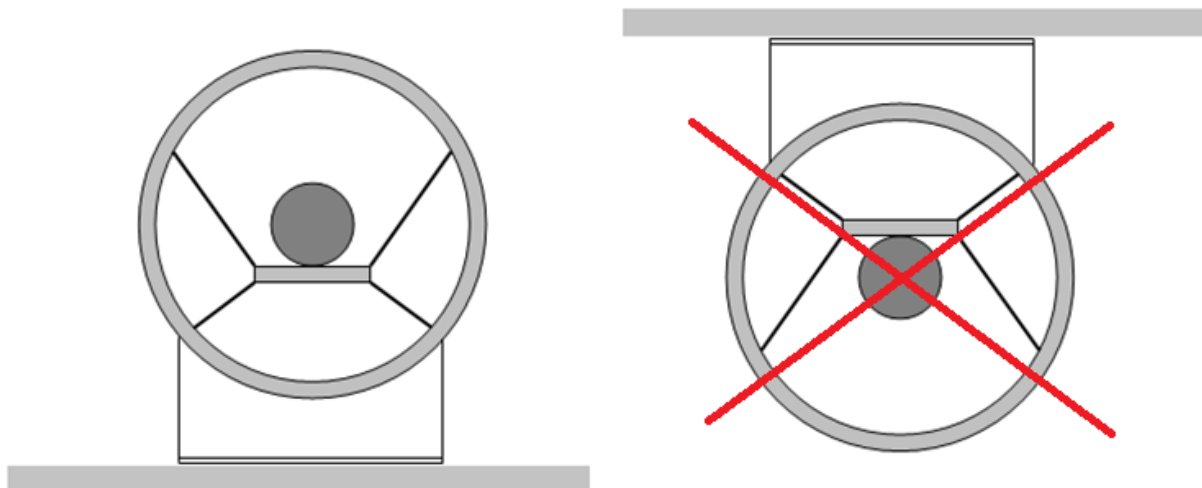
- Type A: free at the inlet / free at the outlet
- Type B: free at the inlet / connected at outlet
- Type C: connected at the inlet / free at the outlet
- Type D: connected at the inlet an outlet

Recommendations:

- Type A: mount a protection guard at the inlet and outlet
- Type B: mount a protection guard at the inlet
- Type C: mount a protection guard at the outlet
- Check the inlet and outlet fan connection to avoid leakage
- In hazardous area (ATEX), take normative restrictions into account

IMPORTANT:

Axial fans with standard feet are designed to be placed on rigid platform. They are not suitable for mounting in suspension (such as from the ceiling).



AREM offers multiple solutions for suspension purposes. We strongly recommend to review and assess technical points with AREM in order to avoid unwanted results or dysfunctions during installation.

b. Connection



DANGER:

Before any intervention is carried out, it is necessary to ensure that the device is switched off and that nobody can restore power without authorisation from the maintenance operations manager. Comply with indications located on the motor data plate as well as on the connection diagram.

To carry out the electric connection, the following operations should be carried out:

- Open the terminal box.
- Refer to the cabling diagram located inside the box.
- Adopt the coupling mode and connection suitable for the network voltage.
- Use cables with sufficient cross-section according the current.
- Do not pass the cables on sharpened edges that could damage the sheathing.
- Do not place any washers or nuts between the terminals of the power cable.
- At the terminal box inlet, cable should be curved slightly in order to avoid any water infiltration through the cable gland.
- Check that the terminals are not interconnected.
- Close the terminal box and ensure the seal is well positioned.

IMPORTANT:

The installation should imperatively be grounded. The cable type should be appropriate for its use, such as with high temperatures (e.g. for smoke extraction).

c. Commissioning

WARNING:

Ensure no object or person is located at the point of extraction or expulsion of the fan before its commissioning. The commissioning may only be carried out by qualified staff.

The fan should be activated for 1 to 2 seconds in order to ensure the impeller rotation direction and air direction are correct.

The impeller turns in the wrong direction:

- Stop the fan immediately and carry out the required modifications: polarity change.

The impeller rotates in the right direction; check the following points:

- Check the absorbed intensity (it should not exceed 10% of the nominal intensity mentioned on the motor plate).
- Ensure there is no abnormal noise or vibrations.

If the below conditions are met, let the fan rotate for 30 minutes. Perform a second check before letting the fan operate continuously.

d. Operation with a speed controller

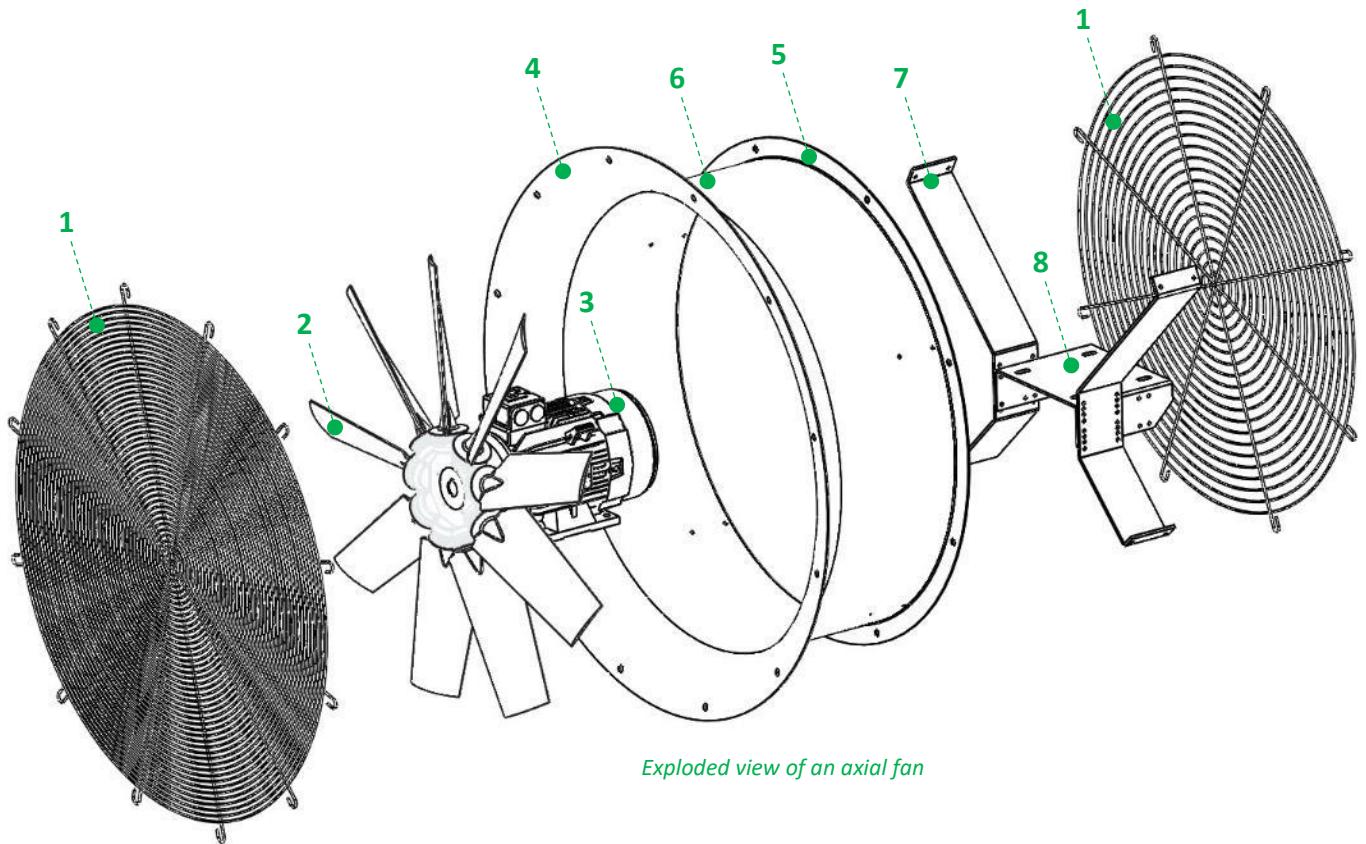
WARNING:

The use of a frequency controller involves searching for any resonance frequencies in order to shunt the relevant speeds and avoid premature mechanical fatigue or failure.

4. AREM axial fan

a. Technical terms

The main elements constituting an AREM axial fan are indicated below:



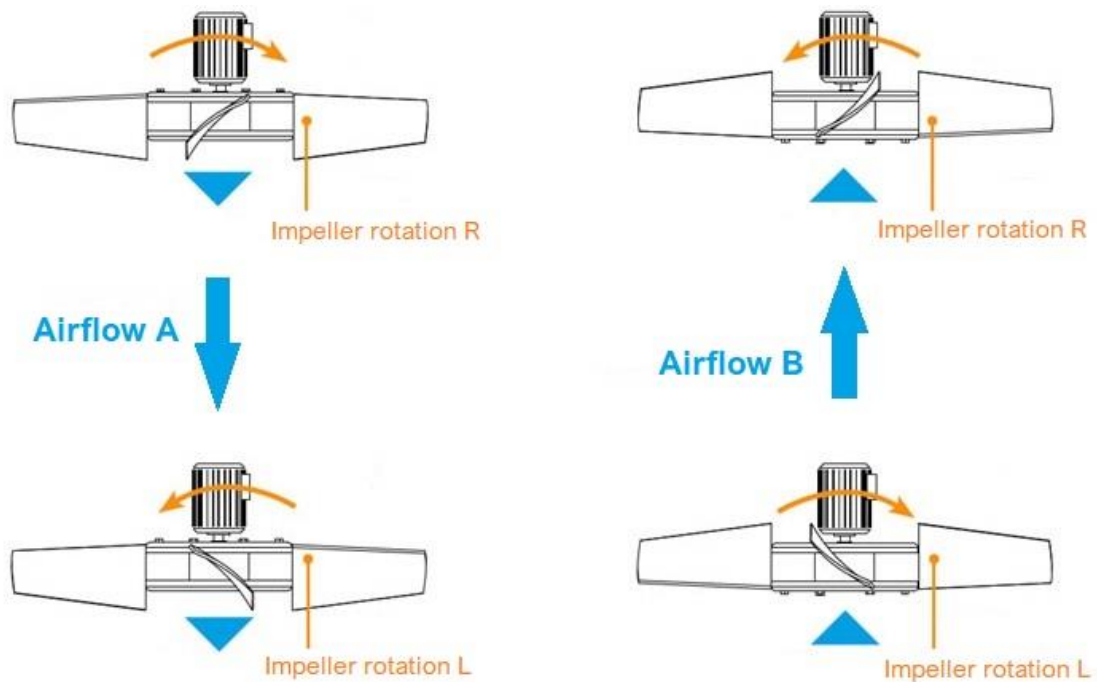
Exploded view of an axial fan

- 1) Protection grid on the impeller/motor side (the mesh is generally tighter on the impeller side)
- 2) Impeller (blades mounted on flanges + hub for attachment to the motor shaft)
- 3) Electric motor
- 4) Conical flange (optional)
- 5) Straight flange
- 6) Case (with or without an access cover)
- 7) Support arm
- 8) Motor bracket
- 9) Engine side protection grid

Standard fan diameters range from Ø265mm to Ø2400mm, the case can be short or long and the available materials are:

- Pre-galvanized steel
- Hot Dip galvanized steel
- Painted steel
- Aluminium
- Stainless steels (304L / 316L)

b. Air flow convention

**NOTES:**

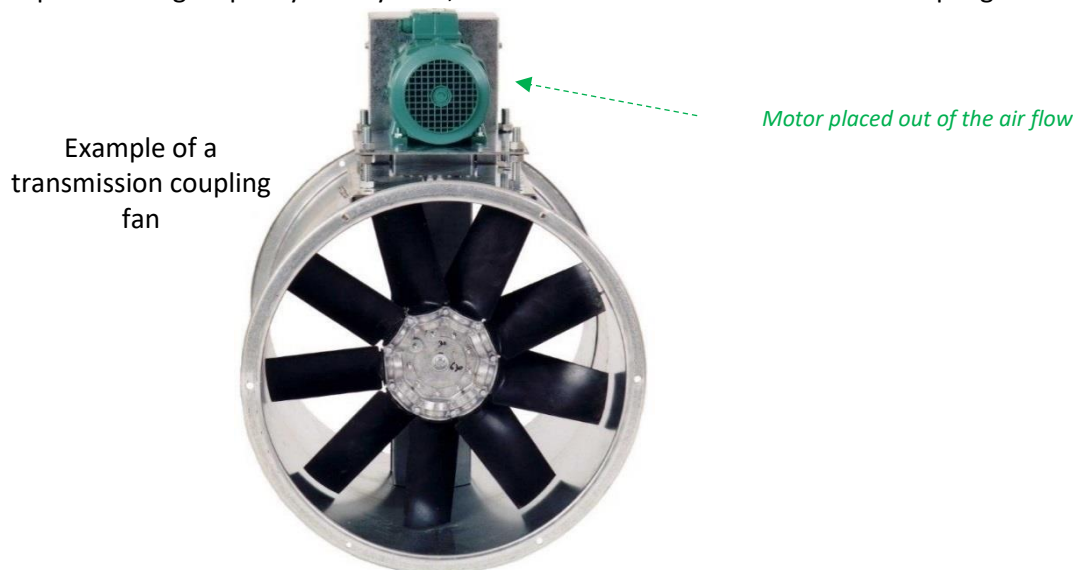
A label is always affixed to the fan in order to indicate the Impeller rotation direction and air flow direction. This should always be checked.

There are two propeller rotation directions, R (right) and L (left). Place yourself in front of the expulsion outlet in order to note the rotation direction. The air flow direction is defined according to the following convention:

- Direction A: air direction, from the motor towards the impeller.
- Direction B: air direction, from the impeller towards the motor

c. Coupling type

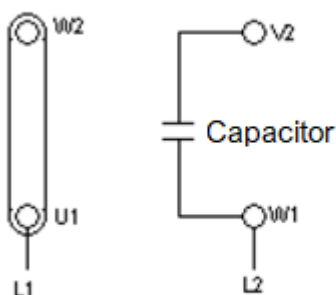
One refers to direct coupling when the impeller is driven directly by the motor shaft. Some applications require the placement of the motor away from airflow, protected from corrosive steam, excessive temperatures... etc. The rotation generally takes place through a pulley-belt system, which is referred to as transmission coupling.



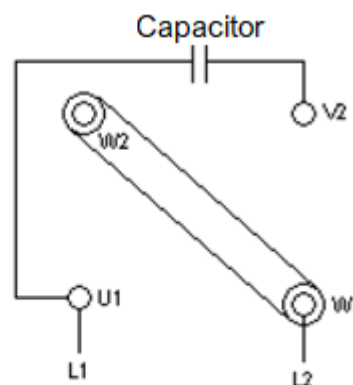
d. Motor coupling notion

DANGER:

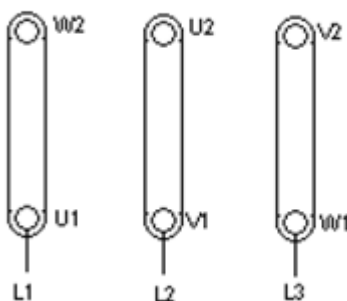
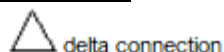
Before any intervention is carried out, it is necessary to ensure that the device is switched off and that nobody can restore power without authorisation from the maintenance operations manager. Regardless of the motor, the indications on the its data plate and connection diagram should be complied with imperatively. The below diagrams may also be referred to according to the type of motor:

- **Single phase motor 230V:**

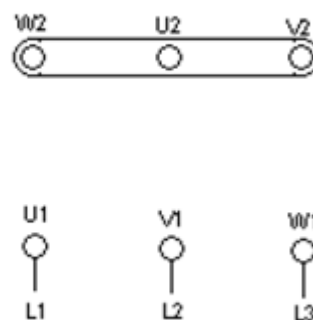
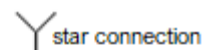
Rotation R (to the right)



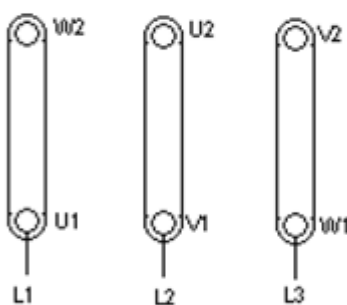
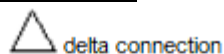
Rotation L (to the left)

- **1 speed motor, 3phases 230/400V:**

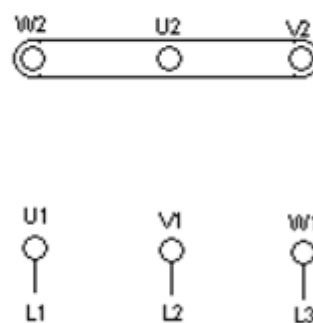
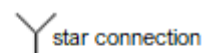
Inferior voltage: 230V



Superior voltage: 400V

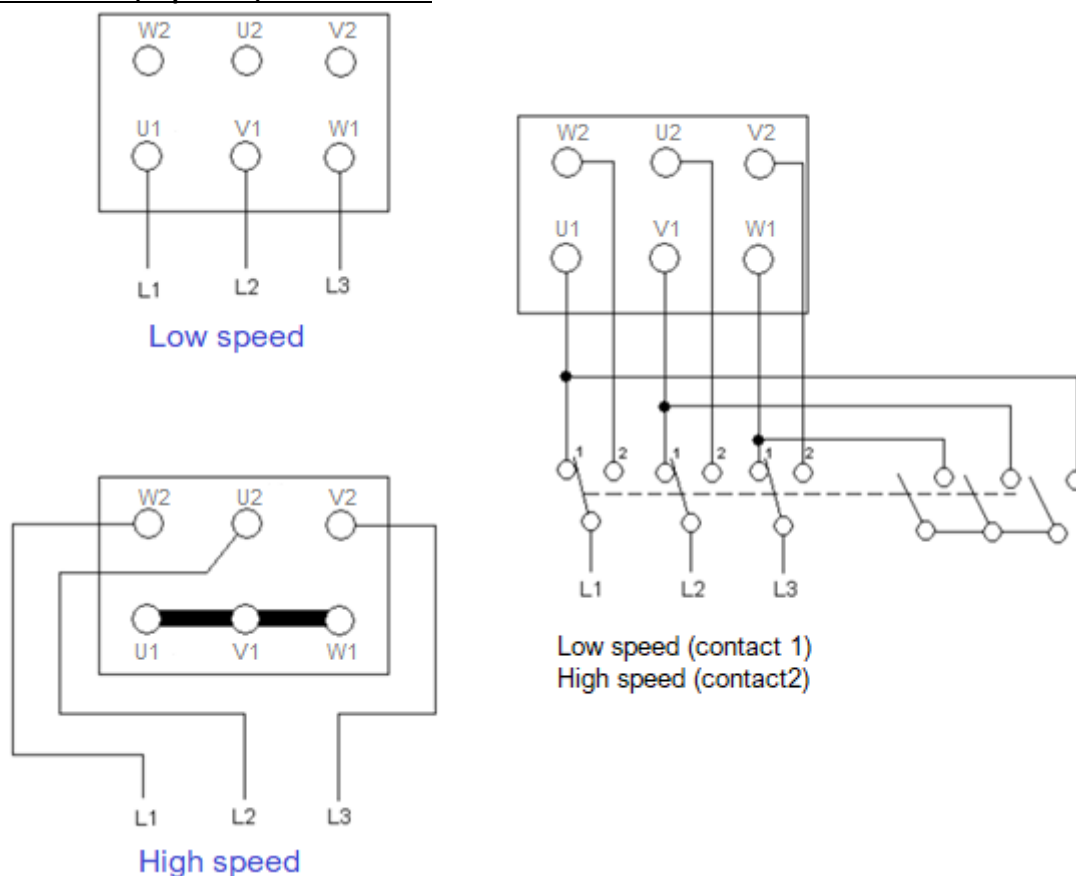
- **1 speed motor, 3 phases 400/690V:**

Inferior voltage: 400V

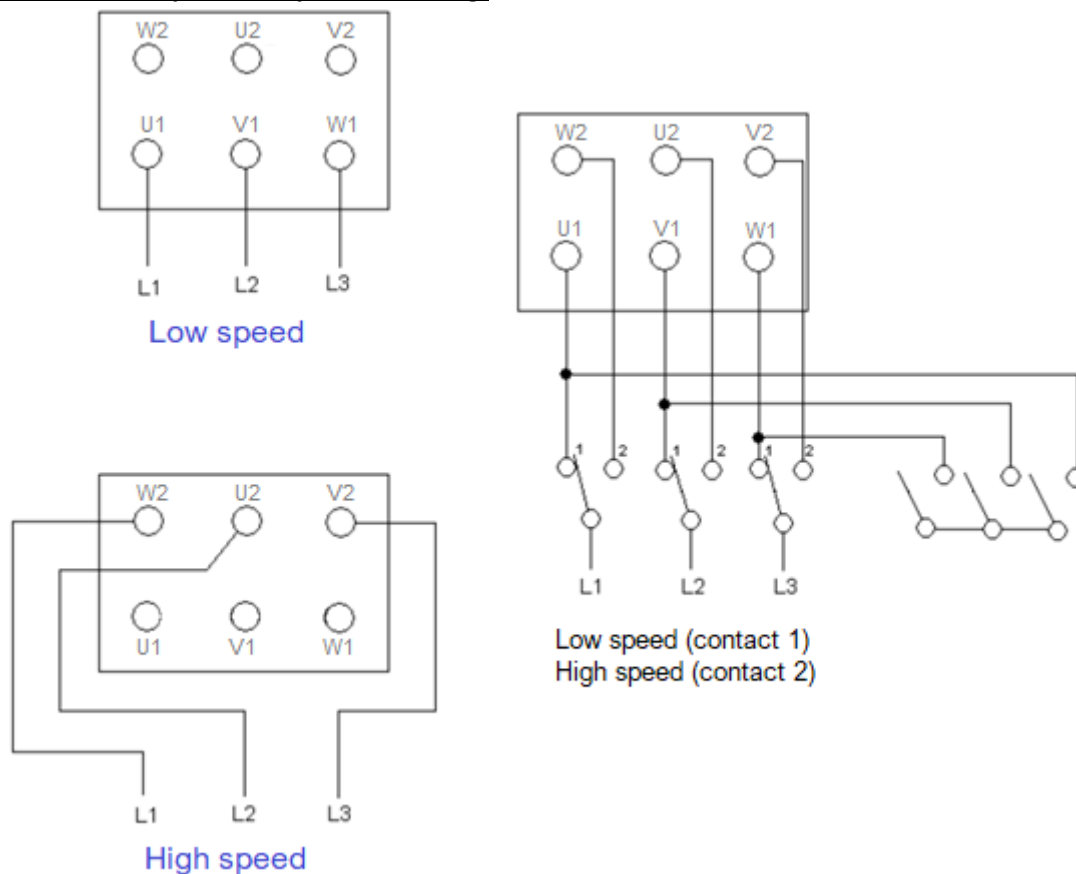


Superior voltage: 690V

- **2 speeds motor, 3 phases, DAHLANDER:**



- **2 speeds motor, 3 phases, separate winding:**



5. Mechanical components

a. Impeller removal

WARNING:

This operation should be carried out by qualified staff after ensuring that the motor is switched off and that nobody can restore power without being authorised by the maintenance operations manager.

- Boss hub and shaft end screw:

1) Loosen and remove the shaft end screw.

2) The impeller should be removed by holding the flange. Do not hold the blades



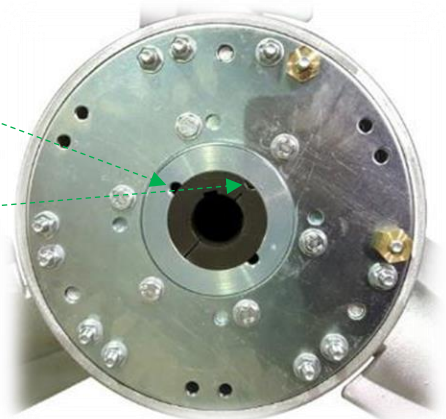
- TAPER LOCK® hub:

1) Remove the front cover after removing the screws.

2) Loosen the two hexagon socket screws from the TAPER LOCK® hub.

3) Insert one of the screws in the third available hole and screw in order to loosen the hub.

4) Remove the hub and the impeller.



IMPORTANT:

To mount the impeller again, follow these operations in reverse order. We recommend cleaning and lubricating the motor shaft before assembly.

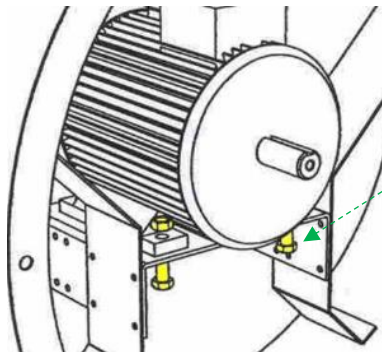
Do not use impact equipment (hammer, mallets...) to insert the impeller. To insert the impeller properly, the rotation axes (motor-Impeller shaft) should remain parallel and not be braced.

The tightening torque should be followed by referring to the tightening torque tables (cf. infra). Failing to follow the torque can lead to screw unloosening or breakage according to applied forces.

b. Motor removal

WARNING:

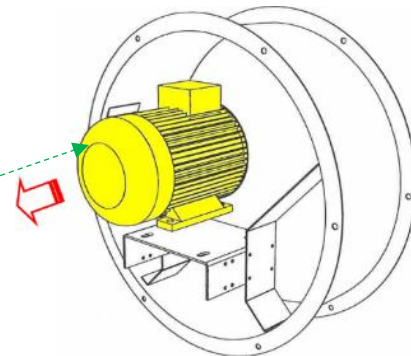
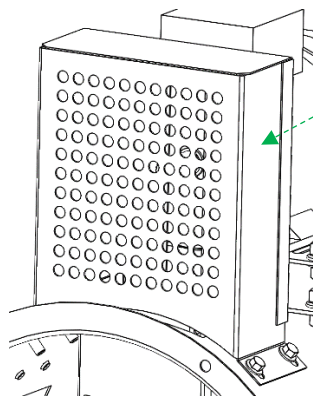
This operation should be carried out by qualified staff after ensuring that the motor is switched off and that nobody can restore power without being authorised by the maintenance operations manager.

- **Direct coupling:**

1) Remove the Impeller (cf. supra).

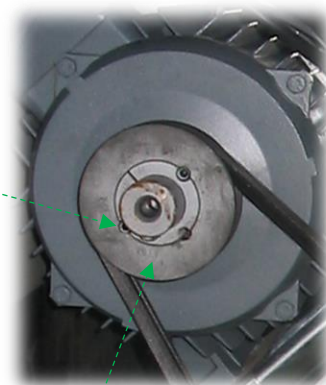
2) Remove the four nuts attaching the motor to its support.

3) Remove the motor.

- **Transmission coupling:**

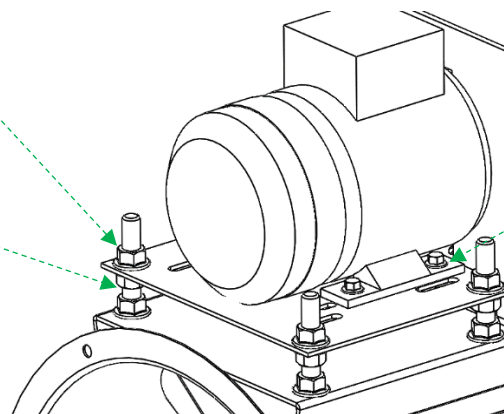
1) Remove the protection cover by loosening the attachment screws.

2) Loosen the 6 hexagon socket screws



3) Loosen the 4 locknuts on the threaded rods.

4) Loosen the bolts located below the motor support frame to slacken the belts.



5) Remove the driving pulley.

6) Loosen and remove the 4 nuts attaching the motor to its frame.

7) Remove the motor from its support.

IMPORTANT:

To mount the motor again, follow these operations in reverse order. We recommend cleaning and lubricating the motor shaft before assembly.

The tightening torque should be applied by referring to the tightening torque tables (cf. infra). Failing to follow the torque can lead to screw loosening or breakage according to applied forces.

c. Belt tension

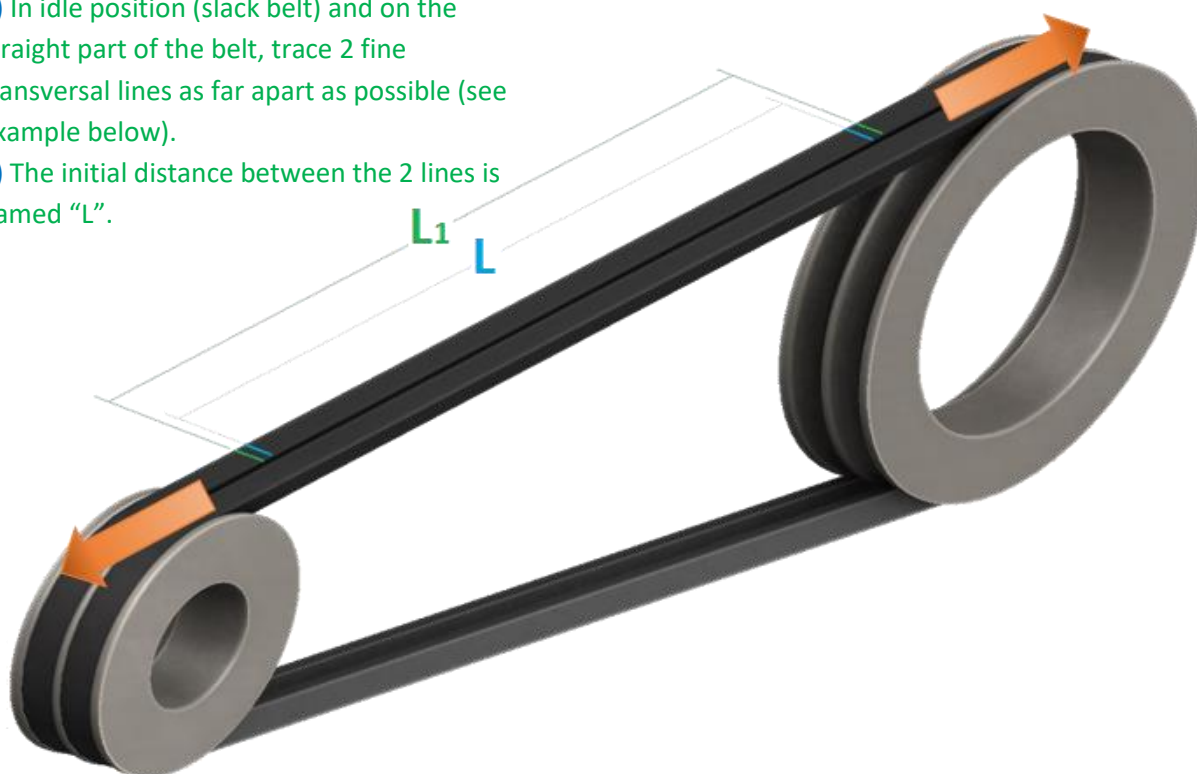
WARNING:

This operation should be carried out by qualified staff after ensuring that the motor is switched off and that nobody can restore power without being authorised by the maintenance operations manager.

- **Controlling method by elongation:**

To be used preferably for high-power transmissions or with large centre-to-centre distances (pulley centre-to-centre distances measuring over 1,000mm). This method is simple and can be implemented quickly without the need for specific tools.

- 1) In idle position (slack belt) and on the straight part of the belt, trace 2 fine transversal lines as far apart as possible (see example below).
- 2) The initial distance between the 2 lines is named "L".



- 3) Check the belt type and choose the extension percentage according to the load pressure (uniform, variable or very variable) of the motor according to the below table:

		Motor torque and uniform loading	Motor torque or variable loading	Motor torque or very variable loading
Effective average elongation in %	Narrow belts Type SPZ, SPA...XPZ, XPA...	0.6	0.8	1
	Classic belts type Z, A	0.5	0.6	0.8

- 4) The extension percentage choice produces an "L1" computed length.
- 5) Tension the belts progressively until the "L1" length is obtained.

Example with narrow belts:

An "L" distance of 1,000mm between the points of reference will be changed by the tension slack, and as the case may be, to:

- 1006mm (if +0.6% extension)
- 1008mm (if +0.8% extension)
- 1010mm (if +1% extension)

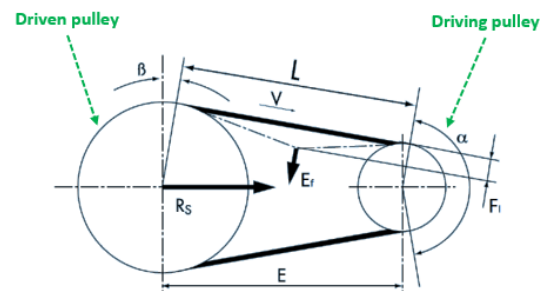
- Controlling method by deflection

To be used preferably for low-power transmissions or with small centre-to-centre distances (pulley centre-to-centre distances measuring up to 1,000mm). This method allows for the bending force as well as other parameters to be determined according to the characteristics of the pulleys and belts used. AREM can provide a calculator on request, please refer to the example below:

Table 1: Input datas			Table 2: Belts datas					Table 3: Calculated values		
Primitive diameter of driven pulley	D	224 mm	Belt type	Linear mass (g/m)	Belt width W (mm)	Belt height T (mm)	Coef. k	Ratio of diam.differential/center dist.	(D-d)/E	0,134
Primitive diameter of driving pulley	d	106 mm	SPZ	68	9,7	8	0,065	Driving pulley contact arc	α	172,2 °
Motor nominal power	Pnom	5,5 kW	SPA	120	12,7	10	0,114	Contact arc coefficient factor	a	0,979
Rotation speed of the driving pulley	nd	1450 tr/min	SPB	194	16,3	13	0,184	Inclined angle	β	3,9 °
Center distance of the pulleys	E	879,8 mm	SPC	375	22	18	0,356	Belt contact distance	L	877,8 mm
Number of belts	Nbc	2	XPZ	69	10	8	0,066	Static tensile force per belt	Ts	339 N
linear mass of the belts "k" coefficient	k	0,114	XPA	123	13	10	0,117	Belts linear speed	V	8,0 m/s
			XPB	195	16,3	13	0,185	Bending force per belt	Er	14 N
			XPC	334	23	18	0,317	Deflection	F _i	8,8 mm
								Static reaction force on the shaft	R _s	1353 N
								Belt natural frequency	f	31,1 Hz

INSTRUCTION: Only fill up the cells in grey

- 1) Identify the belt type (see marking or reference on the belt).
- 2) Report the "k" coef. value into Table 1 using Table 2.
- 3) Indicate the primitive diameter of the driving pulley (marking on the pulley).
- 4) Indicate the primitive diameter of the driven pulley (marking on the pulley).
- 5) Indicate the motor nominal power (reading on the motor nameplate).
- 6) Indicate the rotation speed of driving pulley (reading on the motor nameplate).
- 7) Measure center distance of the pulleys then fill up its value.
- 8) Check or set the belts tensile according to calculated bending force and deflection.
- 9) In the case of using sonic tension meter, compare it the reading value to the calculated belt natural frequency.



Manual or digital tensiometers (natural frequency analysis of the tensioned belt) may be used to check the proper tension of the belts by referring to the values computed by the calculator.



Manual tensiometer



Digital tensiometer

IMPORTANT:

AREM applies belt tension guidelines as recommended by the manufacturers in order to obtain optimal power transmission. During the initial commissioning of the fans, we strongly recommend checking the tension of the belts after two or three running-in hours. We also recommend not applying too much tension to the belts, by following the above-mentioned methods, in order to preserve the bearings and shaft lines.

The belts have an average life span of 24,000 hours, after which they should be replaced. During replacement operations, the installer is responsible for complying with pulley alignment recommendations and tensioning the belts properly.

d. Tightening torque

- Hexagon socket screws of the removable hubs

Type	1210	1610	2012	2517	3020
Torque (N.m)	20	20	30	50	90

- General screws and nuts

Diameter	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24
Torque (N.m)	3	6	10	25	49	88	140	210	305	425	570	720

e. Maintenance and cleaning

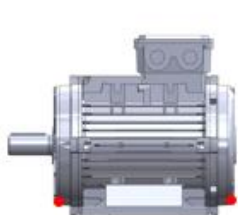
WARNING:

The fan should be maintained on a regular basis in order to ensure optimal use. Ensure the fan is switched off before each maintenance operation.

The user is responsible for setting the frequency or maintenance schedule according to use. You will find a few recommendations below:

- Tightening the fixed and rotating parts:
Check the tightening of screws while paying particular attention to the propeller attachment to its shaft. In case of doubt, tighten the screws or nuts according to the recommended tightening torques (cf. supra).
- Cleaning:
For applications in dusty environments, the Impeller can become clogged up at various frequencies, which can affect the performance of the air flow and its balance. Check the Impeller regularly for clogging up and clean it if required. Use brushes with extensions to access difficult locations.
The access allows the user, among other things, to check and clean the propeller as well as the inside of the case. To access it, remove the cover screws.
- Lubrication:
Motors featuring permanently lubricated bearings do not require any specific maintenance. For motors or bearings (for transmission impeller) featuring lubricators, the varied uses do not allow for a predefined lubricating frequency, and the frequency is to be defined by the user. According to uses, the user should perform checks and lubricate as required.
- Drain holes:
Generally, motors are completely closed and protected against dust and low-pressure water jets according to the protection index IP55.
To prevent condensation problems, motors can be equipped with drain holes. When the fan is used in humid environments or if there is a risk of condensation, these holes should be opened according to the positioning of the engines, as illustrated in the figures below:

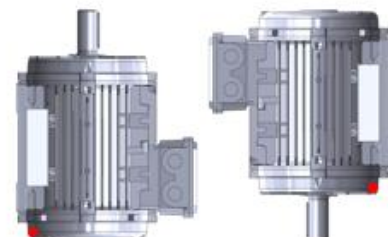
Horizontal position



Tilted position



Vertical position



f. Problems encountered

NOTES:

The user is responsible for checking the power, proper operation and calibration of devices.

Anomalies	Possible cause	Check and correction if required
Insufficient flow	Underestimated load loss, network clogging, etc.	Check the general network and any clogging of the air flow system (valve flap opening, etc.). If the motor power allows it, increase the Impeller angle. Change the fan for a more powerful model.
	Air leakages at the connections	Ensure the sheaths are properly connected and clog leaking areas.
	Improper motor speed	Check the engine power voltage and connections.
	Impeller rotating in the wrong direction	Check the impeller rotation direction.
Excessive flow	Overestimated load loss	Reduce the angle or change the impeller. Change the fan for a less powerful model
	Improper motor speed	Check the impeller rotation frequency is appropriate. If required, reduce the motor speed.
Abnormal air flow noise	Impeller rotating in the wrong direction	Check the Impeller rotation direction.
	Impeller damaged or unbalanced	Check the condition of the blades as well as the balance weights. If required, change the impeller.
Mechanical noise and vibration	Damaged bearing	Rotate the impeller when stopped and check the condition of the bearings. If required, carry out a standard motor swap.
	Propeller friction	Check the presence of any friction between the propeller and the case.
	Inadequate assembly plan	Reinforce the support on which the device is placed. Determine the cause of the problem and insulate the fan, such as by adding anti-vibration pads.
	Loosening fixation elements	Check the tightening of the screws and nuts (flanges, motor, support, etc.).