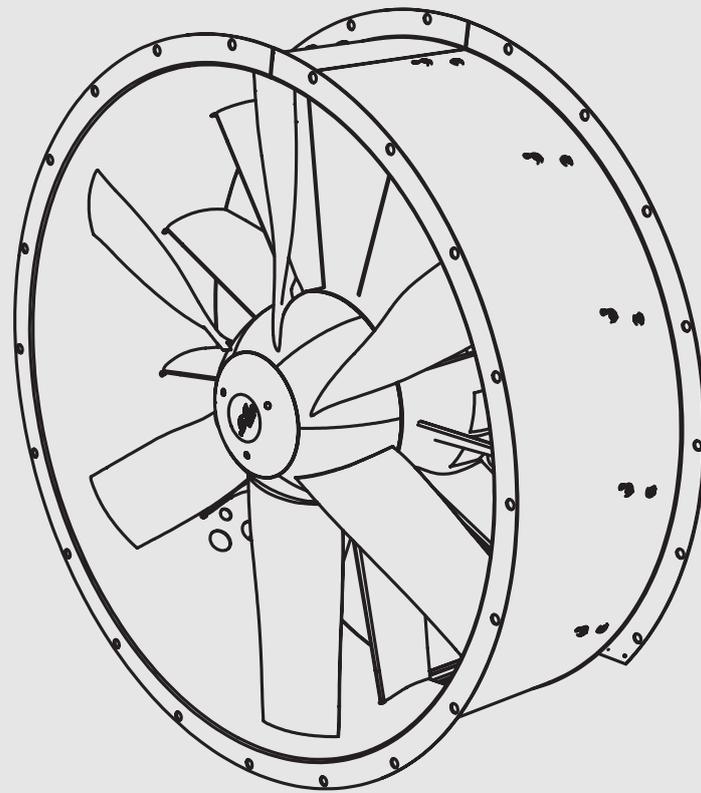


Building & Industry



SCHAKO Group



NOVENCO[®] ZerAx[®]

Axial fans AZL-AZN-AZW

Installation and maintenance

Important

This document is provided 'as is'. Novenco Building & Industry A/S reserves the right to changes without further notice due to continuous product development.

The fans are designed for continuous operation. The following kinds of operation may cause fatigue break in the impellers and endanger people.

- Operation in stall area
- Operation with pulsating counter pressure – called pump mode
- Operation with repeated start and stop

If in doubt, Novenco should be contacted to assess the suitability of the fans.

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1. Application

The high performance Novenco® ZerAx® axial flow fans types AZL-AZN-AZW are for applications within land-based industries and marine sectors. All types are for duct connection. The AZL type has a free inlet and connects to duct on the outlet side.

1.1 Reading guide

Please read this complete guide, before beginning installation or maintenance.

Icons	Descriptions
	Risk of injuries and damage to equipment
	Risk of injury or death
	Installation tip

Table 1. Icons in guide

2. Handling

 Avoid exposure of fans and motor parts to shocks, as these can result in imbalance and deformations. Motor bearings and fan components are vulnerable parts.

2.1 Marking

The AZL-AZN-AZW fans have nameplates on the fans and motors.

Fan nameplate information

- Manufacturer information
- Product type, e.g. AZN 1000/350
- Serial no.
- Fan speed
- Year of manufacture
- Weight

Motor nameplate information

- Manufacturer information
- Power consumption and efficiency
- Voltages
- RPMs
- Weight
- Terminal connections
- Lubrication and service info.

2.2 Weights

The total weight depends on the fan size, casing thickness, motor size and accessories.

Refer to the technical fan specifications from Novenco AirBox program for further information and weights of specific fan solutions.

2.3 Design conditions

The AZL-AZN-AZW fans are designed for operation at standard temperatures from -20 to +50 °C. With reduced fan speed and increased blade clearance the temperature range can be extended from -40 to +120 °C. Contact Novenco for further information.

2.4 Transport and lifting

The fans are delivered on pallets or bearers to allow for forklift transport.

Transport and lifting must be done with care, as the fans are vulnerable to vibrations and shocks. These can result in imbalance and deformations.

Refer to the weights in the shipping papers, on the motor and fan casing nameplates and in appendix "Appendix - A. Max. fan casing weights" on page 23.

 Any transport or lifting of the fans must be in accordance to current directives, regulations and guidelines for safety. Pay attention to limitations and direction for use of lifting gear.

 Verify that the fans and accessories are undamaged upon receipt. Also, spin the impellers by hand to see they rotate freely in the fan casings. Inform the carrier and Novenco immediately of damages.

Further transport depends on the fan size and the fitted accessories.

Transport

- **Fans mounted on support frames**
Transport and store these on pallets. Leave in the transport rods for fans with vibration dampers.
- **Fans without support frames**
Transport fans resting on the inlet flanges or cones. The impellers must point downwards.
- **Large fans or fans with large motors**
Transport and store these on pallets. Store very large fans on suitable bearers.

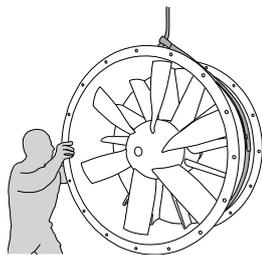


Figure 1. Lift of fan with one strap

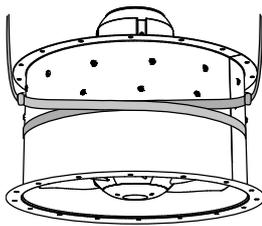


Figure 2. Lift of fan with two straps

 Eyebolts on motors are unsuited for lifting the fans.

Lifting

- **With straps – horizontal fans**
Lift with a single strap around the fan casing at the centre of gravity. Avoid lifting fans in the flange holes. Novenco recommends lift of fans with straps.
- **With straps – vertical fans**
Lift with two straps around the fan casing. Support the fan to control the rotation especially for horizontal fan installations.
- **In flange holes – horizontal fans only**
Lift in a minimum of three holes – two in the outlet flange and one in the inlet. On fans with inlet cones, remove the bolt in the topmost position and use the hole as the third point for lifting. Reinsert and tighten the bolt once the fan is in place. Deformation of the flanges must be avoided.

3. Storage

Correct storage conditions are important for the function and durability of the fans.

 Damages due to incorrect storage void the warranty.

Conditions	Specifications	Comments
Outdoor	One month	<ul style="list-style-type: none"> • Packaging must be intact
Indoor or sheltered	Max. six months	<ul style="list-style-type: none"> • For unprotected fans with no or broken packaging • Ventilated location • No condensation
Prolonged	Max. two years	<ul style="list-style-type: none"> • Indoor • Remove packaging • Ventilated location • No condensation • Turn impeller 20 times every six months • Add additional anti-corrosive coating on motor shaft • Change motor ball bearings after two years of storage
Vibrations	No	<ul style="list-style-type: none"> • Location must be vibration free
Temperatures	-20 to 50 °C	<ul style="list-style-type: none"> • Constant temperature, preferably 20 °C • Ventilated • No condensation
Humidity	Below 70%	<ul style="list-style-type: none"> • Avoid condensation • Exceedance requires airtight packaging of complete fan and use of a moisture absorbent agent such as silica gel

Table 2. Storage recommendations

4. Installation

4.1 Before installation

Complete the below checklist to ensure a safe work environment and fan functionality. See also the checklists in the appendices.

Before installation

- Unpack the fan with care.
- Check that the impeller rotates freely in the fan casing with equal blade tip distances to the casing around the circumference.
- **Outdoor installations:** Make sure the installation location is sheltered. Fans, motors and frequency converters must be protected from rain and water that drips.
- Ground the fan before installation to avoid static electricity. For example, by assembly on non-conductive vibration dampers and foundations.
- Clear the fan installation location to ensure free and unimpeded airflows for the inlet and outlet. The free area in front of the fan inlet must be at least 1x the fan diameter, D, or ½D for optimal or reduced performance, respectively. Optimal airflow from all sides removes risk of stall, gives best performance and keeps sound levels down.
- Secure the installation to at least IP20, i.e. protect people and surroundings against solid objects up to 12 mm.

Also, install wire guards on fans where there is direct access to the impeller. Wire guards from Novenco can be installed as close as 120 mm before and after the impeller.
 See section “4.7 Duct connection” for minimum distances for undisturbed airflow.

 The vibration level of the installation depends on how the fans are installed, the operational conditions and the natural frequency of the foundation and supports. Follow the below guidelines to avoid resonance.

- **Soft suspension:** Fan is fixated through springs or dampers. The natural frequency [Hz] of the system should be at least 20% below fan speed. Soft suspensions are available from Novenco.
- **Stiff suspension:** Fan is fastened to a duct or a hard surface. The natural frequency of this system should be at least 20% above fan speed.
- **Elastic structure:** Fan is fastened to an elastic structure. The natural system frequency should be at least 20% higher or lower than fan speed.

The owner is responsible for compliance with the above requirements. Non-compliance affects the product warranty.

4.2 Set up fans

Prepare fans for installation

1. Fit the support options needed for mounting the fan. This may include the following.
 - Special carriers
 - Support frame (recommended)
 - Mounting plate
 - Vibration dampers (recommended)

Proper support ensures safety and installation stability. See sections “4.3 Support frames” and “4.4 Vibration dampers”.

The fan support must be strong enough to support the fan weight and any fitted accessories. See “Appendix - A. Max. fan casing weights” on page 23 and the *Total weight of installation* in the technical fan specifications from AirBox.

2. **Optional:** Install flexible connections on the fan flanges.
 See section “4.5 Flexible connections” on page 9.
3. **Optional:** Install wire guards on one or both sides of the fan casing.
 See section “4.6 Wire guards” on page 9.

Connect fans

1. Check that the fan motor drain holes point downward and are in the lowest possible location. Adjust the fan position, if necessary.
2. Unplug the fan motor drain holes.
3. Place and orient the fan in accordance with the airflow. Refer to the arrows on the fan casing.
 - **Duct fans:** These can be installed horizontally or vertically as part of duct works or connected to duct openings as supply or exhaust fans. The installation space must at least meet the reduced requirements and preferably those for optimum installation space. See section “4.7 Duct connection” on page 9.

 The motor drain holes must point downwards at the lowest point as the installation environment and operation conditions may cause condensation in the fan motors. Fan motors mounted at angles typically have the drain holes in the back covers. Contact Novenco if the drain holes are missing.

- **Fans on support frames and AHU incorporation:** Fans mounted on support frames can be connected to wall openings, duct works or incorporated in AHUs. Remove the transport rods in the support frames for fans delivered on support frames and with vibration dampers. The handles are marked with a strong colour. See section “4.7 Duct connection” on page 9 for installation space requirements.

4. Check that the fan impellers rotate freely once the fans are in position.
5. Connect fan to duct or similar mounting point in the fan flange.
6. Connect fan electrically. See section “4.8 Electrical connection” on page 11.

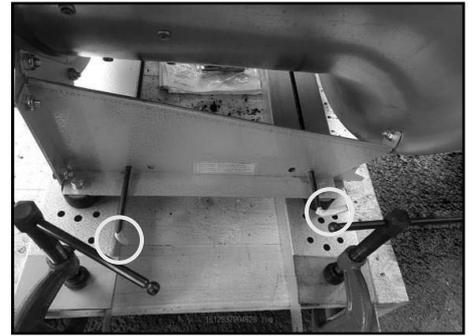


Figure 3. Transport rods in AZL support frame

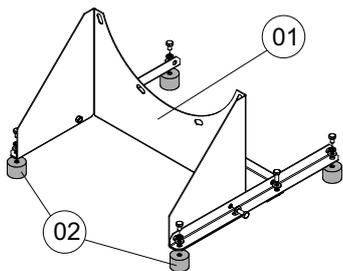
4.3 Support frames

Support frames are optional extras and recommended for most fan installations.

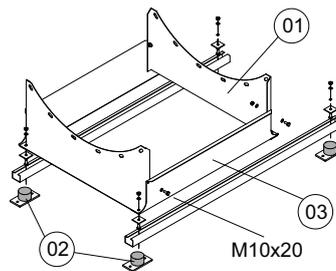
All ZerAx fan types can be fitted with support frames for horizontal installation. In figure 4, support frame types 1 and 2 are for horizontal installation of the AZL. The type 2 can furthermore be mounted on rails transversally to the airflow for easy incorporation in AHUs. Support frames type 3 are for horizontal installation of the AZN and AZW.

For vertical fan installations, the type 4 is available for the AZL and AZN. The AZW cannot be installed vertically.

STOP Support frames must be grounded to prevent electrical shocks.

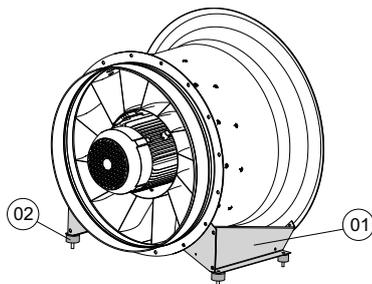


Type 1 - Horizontal frame for AZL

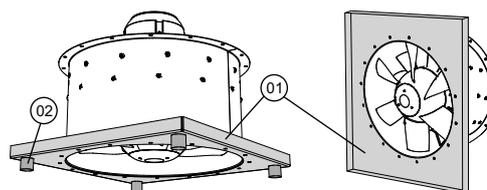


Type 3 - Horizontal frame for AZN and AZW

1. Frame plates
2. Vibration dampers (optional)
3. Stiffeners



Type 2 - Compact horizontal frame for AZL and suited for incorporation in AHUs



Type 4 - Vertical frame for AZL and AZN with (left) and without vibration dampers

Figure 4. Novenco ZerAx support frames

4.4 Vibration dampers

Secure vibration dampers to the support frames by means of bolts. Mount base plates between the rubber elements and the foundation.

The vibration dampers help ensure the natural frequency of the system is below 10 Hz and that the damping is at least 80%.

Ensure an even load of the vibration dampers by placement of the fan the distance X from the centre of the front damper element to fan front flange. See figure 5. The distance is in the technical fan specifications from the AirBox program.

The load of the dampers depends on air pressure.

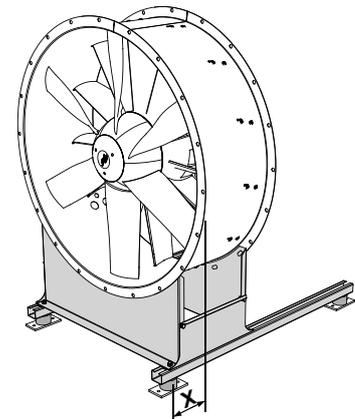


Figure 5. AZN-AZW on support frame

 Uneven damper loading strains and reduces damper functionality.

4.5 Flexible connections

 The natural frequency of the support must lie at least 20% from the fan speed.

To prevent spread of vibrations to the surroundings, it is recommended, in addition to vibration dampers, also to install flexible connections in the ducts before and after the fans. These accessories are available as optional extras from Novenco.

4.6 Wire guards

Fans must always be installed so that parts that rotate cannot be touched or fly off in case of material failure. It is therefore recommended to fit wire guards on the inlet and outlet sides. If ducts are connected, these can alternatively be provided with wire guards.

Novenco offers wire guards for in-pipe installation on outlets. Drill holes in the pipe and fixate with the bolts and nuts included in the kit.

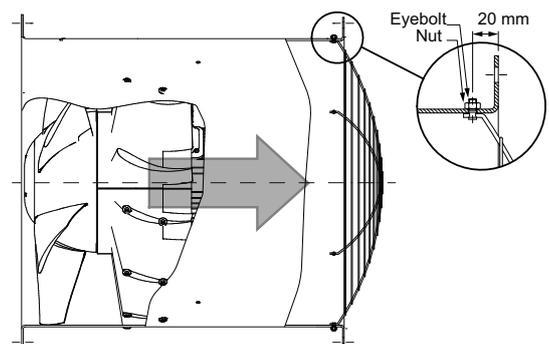


Figure 6. In-pipe installation of wire guard

4.7 Duct connection

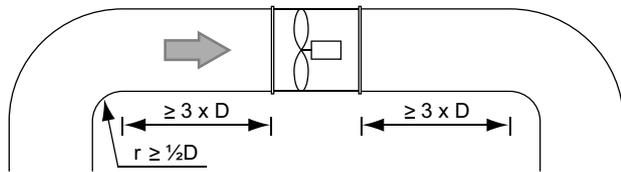
Install the fans with optimal conditions in mind to ensure smooth and undisturbed airflows. The space before and after the fans should preferably meet the optimal requirements in the below figure.

Allow for free areas to facilitate assembly and disassembly as well as maintenance.

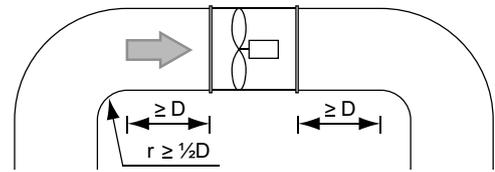
 The fans cannot be used as structural elements, e.g. for duct or building support.

Flexible connections can be placed as close as $\frac{1}{2}D$ before the fan inlet.

Built into duct

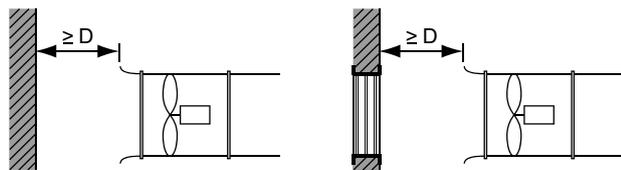


Built into duct



Free inlet

D = Fan diameter



Free inlet

D = Fan diameter

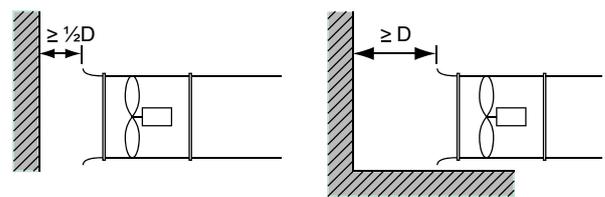


Figure 7. Installation spaces in ducts – optimal (left) and reduced

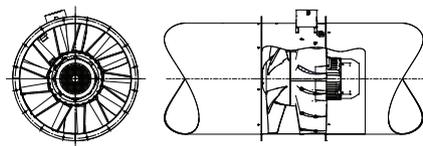


Figure 8. Installation in duct

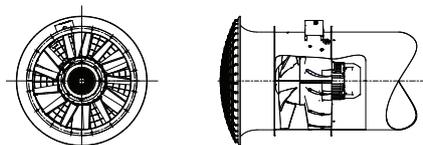


Figure 9. Installation in duct

AZN-AZW fans are for circular duct connections with flanges on both inlet and outlet sides. The AZL has a flange on the outlet side only.

Flanges on AZL-AZN fans are as standard according to Eurovent 1/2. Fan type AZW has flanges of type DIN 24154 row 4 as standard.

Systems with high vibration levels or more exacting performance requirements must be provided with expansion joints between fan and duct.

	Fan size, ØD, [mm]	RPM ^{1 2}		
		Maximum	Optimal	Reduced
Hub diameters 160	250	4919	—	—
	280	4747	—	—
	315	4570	—	—
	355	4408	—	—
	400	4269	—	—
	450	4145	—	—
Hub diameters 350	500	4086	—	—
	500	3660	3660	3483
	560	3460	3460	3286
	630	3238	3238	3059
	710	3000	3000	2804
	800	2751	2751	2523
Hub diameters 560	900	2498	2498	2217
	1000	2270	2270	1918
	1120	2029	1900	1568
	1250	1809	1500	1201
	1000	2034	2034	1904
	1120	1893	1893	1727
Hub diameters 560	1250	1751	1751	1552
	1400	1599	1599	1371
	1600	1419	1419	1166
	1800	1262	1262	1002
	2000	1130	1130	878

Table 3. Max. allowable speed at 20 °C

1. Fan speeds depend on the installation space.
2. Fans with Ø160 hubs can run at maximum RPMs irrespective of the installation conditions.

4.8 Electrical connection



The installation and connection to the supply network must be done by authorised personnel and according to current legislation, e.g. the EU standard for electromagnetic compatibility (EMC).

Connection of the fans to the supply network depends on the drive type, i.e. if frequency converters are to control the fan motors.

Connection of drive types

- **Fixed speed (Direct On Line)**
 - Connect the supply voltage directly in the terminal box.
- **Frequency converter (AC and PM motors)**
 - Connect the supply voltage to the frequency converter and the converter to the terminal box.



ZerAx fans with permanent magnet (PM) motors require connection through frequency converters. Direct connection of the supply voltage in the terminal boxes on PM motors ruins the motors and voids the warranty.

The terminal box is on the outside of the fan casing. Connection diagrams are inside the box lid.

The cable run must be in accordance with current regulations, e.g. the EU standard for electromagnetic compatibility (EMC).

Frequency converters must be installed in accordance to the manufacturer's guidelines. Refer also to the Novenco guide "Configuration of frequency converters for Novenco fans".

Shield and connect the fans electrically to ground to eliminate interference and protect the motor bearings and windings.

Refer to the motor documentation for methods to avoid impairment of the supply voltage quality, among them distances between supply and signal cables. Methods may involve installation of rectifiers, filters etc.

Connection references

- Connection diagram in terminal box lid on fan
- Motor nameplate (delta or star)
- Order specification
- Appendices D, E and F on wiring on page 26

Verify that the rotational direction of the impeller complies with the arrow on the outside of the fan casing. Flick the fan power briefly On, then Off. If the direction is wrong, disconnect the main power supply and check the electrical connections and wiring.



Only fans with steel inner hubs may be run in reverse and this for short periods at speeds up to the max. allowable of normal direction. The airflow is reduced to approx. 50% of normal for the same system resistance. The pressure is reduced to 25%.

Reversible operation increases the risk of stall and shortens fan life.

The impeller must be completely stationary, before restart of the fan for directional change of rotation. It is recommended to install a time delay for this purpose.

5. Start of operation

 Fans fitted with frequency converters must have the control unit set up, before start of operation. Refer to the Novenco document “Frequency converters Danfoss® FC 101 and FC 102 – Novenco configuration user guide”.

Perform the below steps every time the fans have been stopped.

5.1 Before start-up

Check the fans and installation location in accordance to the below checklist and correct and improve as necessary. See also the checklists in the appendices.

Checklist

- **Safe operation**
 The blade clearance must be min. 0.1x motor shaft diameter (min. 2 mm, max. 13 mm) on the impeller circumference. The axial distance between the impeller hub and stator must be min. 3.5 mm. Wire guards should be mounted on the inlet and outlet sides.
- **Transport rods**
 Fans on support frames and with vibration dampers have transport rods in the support frames, which must be removed before start of operation. The handles are marked with a strong colour.
- **Clean ducts**
 The fans and duct connections must be clean and free from tools and objects that can affect the airflow.
- **Electrical connections**
 The electrical connections must be correct and in accordance to the prescribed requirements. Switch the fan power briefly On, then Off, to check the rotational direction of the impeller.

5.2 Motors with Y/Δ–start

Set the relay for start of the fans to the Start-up time from the technical specifications from the AirBox program. Alternatively, calculate the value with the formula.

The motor torque can vary within the below limits and affect the start-up time.

- M_s : -15% to +25% of catalogue value
- M_k : -10% to 0% of catalogue value

Calculation of start-up time

$$t_s = \frac{0.24 \times n^2 \times (I_m + I_v)}{10^4 \times P \times \left(\frac{M_s}{M} + \frac{M_k}{M} - \frac{P_v}{P} \right)}$$

- t_s : Start-up time [s]
- P : Rated output of motor [kW]
- P_v : Required power of fan [kW]
- n : Fan speed [RPM]
- $\frac{M_s}{M}$: Ratio between the start and the nominal motor torque
- $\frac{M_k}{M}$: Ratio between maximum and nominal motor torque
- I_v : Polar moment of inertia for fan [kgm²]
- I_m : Polar moment of inertia for motor [kgm²]

5.3 Start-up procedure

Refer to the motor manual and the technical specifications from the AirBox program for specific information and procedures.

Start-up procedure

1. Start the fan.
2. Check that no abnormal noises are present.
3. Check that the vibration levels are acceptable.
See section "6.3 Vibration levels".
4. Check that the fan operates normally after 30 minutes of operation.



The fans are designed for continuous operation. The below kinds of operation may cause fatigue breaks in the impellers and endanger people.

- Operation in stall area
- Operation with pulsating counter pressure – called pump mode
- Operation with repeated start and stop

Contact Novenco for fan evaluation.

5.4 Air volumes for free inlet fans

For fans with measuring pipes and free inlets, the air volume can be calculated as shown below. The measuring pipes are optional accessories and fitted close to the fan inlet.

The below formula gives the air volume in m³/s. Multiply by 3600 to convert to m³/h, or by 2188.88 to convert from m³/s to CFM.

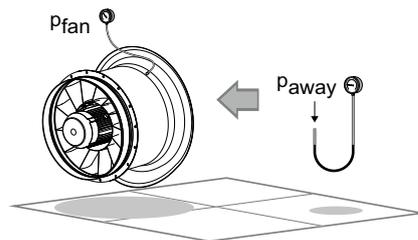


Figure 10. Measurement of pressure difference

$$q = k \times \sqrt{dps}$$

- q : Air volume [m³/s]
- k : Air volume constant, see table 4.
- dps : Difference btw. p_{away} and p_{fan} [Pa]
- p_{fan} : Static pressure at fan inlet [Pa]
- p_{away} : Static pressure away from fan [Pa]

Reduce the constants for fans with wire guards; by 10% for AZN and AZW and by 11.11% for AZL.

Inlet cones are part of the fan type AZL, and accessories for fan types AZN and AZW.

Measure p_{away} on the suction side.

Fans with low blade angles can make noise at high pressures and affect measurement. Operation in stall-area produces poor results.

Fan sizes	Constant, k	Fan sizes	Constant, k
AZN-AZW		AZL	
250/160	0.0510	250/160	0.0459
280/160	0.0694	280/160	0.0625
315/160	0.0917	315/160	0.0825
355/160	0.1183	355/160	0.1065
400/160	0.1502	400/160	0.1352
450/160	0.1894	450/160	0.1705
500/160	0.2343	500/160	0.2109
500/350	0.1921	500/350	0.1729
560/350	0.2537	560/350	0.2283
630/350	0.3324	630/350	0.2992
710/350	0.4329	710/350	0.3896
800/350	0.5603	800/350	0.5043
900/350	0.7204	900/350	0.6484
1000/350	0.9001	1000/350	0.8101
1120/350	1.2019		
1250/350	1.5636		
1000/560	0.871		
1120/560	1.129		
1250/560	1.441		
1400/560	1.844		
1600/560	2.453		
1800/560	3.142		
2000/560	3.913		

Table 4. Air volume constants for ZerAx fans without accessories

6. Maintenance

In the following, please also see “Appendix - G. Checklists” on page 27.

Fan types	Bearing types	Test and inspection ¹	Service and lubrication ²	Cleaning ³	Bearings
Standard temperature	Sealed for life	6 months	6 months	3 months	3 months
	Lubricated				
Smoke	—	Weekly +			
ATEX and EX	—	6 months			

Table 5. Maintenance intervals

1. The site operator may have set other test intervals. Smoke control fans and other fans, which run infrequently or in case of emergencies, must be run tested every week, for example during normal operation.
2. The motor manufacturer’s recommendations may call for shorter lubrication intervals. Please note that fans with permanent magnet motors are lubricated for life.
3. Intervals for cleaning depend on the operating conditions and environment.



Repair and maintenance of Novenco fans must be carried out by authorised personnel and in accordance with Novenco instructions. Keep records signed by the competent personnel for all services, tests and changes performed.

6.1 Before maintenance



Switch off the power and disconnect the motor cable in the terminal box, before beginning work on the impeller and motor.

For fans with PM motors, make sure the motor axles cannot rotate during service, e.g. by blocking the fan impellers. PM motors can generate high voltages when the motor axles rotate, even though the power is disconnected.

6.2 Cleaning

Clean the fans at least quarterly. The intervals may have to be adjusted, dependent on the operation and operational conditions. Corrosive and dust filled atmospheres typically shorten the intervals. Please note that deposits of dust can be ignited by high surface temperatures and constitute a safety risk.

6.3 Vibration levels

After installation and also in connection with regular inspection and cleaning, the vibration levels must be measured and be less than or equal to max. 6.3 mm/s.

Measure the levels at operational fan speed, radially at two points with a 90° offset and at the free shaft end of the motor.



Fan vibration levels depend on installation type and fan speed. Vibrations have significant effect on fan life and efficiency.

Fans that exceed the limits usually require cleaning or balancing of the impellers. Alternatively, the causes must be investigated and removed. Refer to ISO 14694.



Shut down fans with vibration levels that exceed 12.5 mm/s RMS.

For variable speed fans the vibration level limits are likely to be exceeded at certain speeds. Continuous operation at these speeds must be avoided.

6.4 Fan casings

The fan casings require no other maintenance than ordinary cleaning.

Check painted casings regularly and keep them in good condition.

6.5 Impellers

The impellers are carefully balanced and the impeller blades are set at precise angles in the production. The impellers are thereby optimised for vibration free operation at the desired operation point with regard to pressure, airflow and fan speed.

Vibrations that occur in operation may be due to accumulation of dust and dirt on the hubs and blades. If vibrations persist after cleaning, expert assistance should be called for immediately. Continued operation with vibrations shorten the life of the fan and motor bearings.

6.6 Motors

Refer to the motor manufacturer's documentation and the nameplates for how to service the motors.

Motor maintenance

- Inspect the motor for wear signs and damaged parts.
- Clean the motor casing, motor cooling fan and motor shell.
- Drain the motor of condensed water.
- Check supply cables and electrical connections for impairments.
- Check terminal box seals and cable glands.

• Lubricate bearings

Refer to the motor manual for service information such as lubrication intervals, grease amounts, when to replace bearings etc. Observe differences between motor Drive End (DE) and Non-Drive End (NDE).

- **Permanent magnet motors** are lifetime lubricated. Bearings may, however, need replacement. Wear signs to look for in bearings include excessive play and excessive vibrations.
- **AC motors** up to size 132 have lifetime-lubricated bearings. Motor sizes 160 to 280 require lubrication according to the manufacturer's instructions. Fans with motor sizes 225 to 280 have nipples on the outer fan casings. For fans with motor sizes 160 to 200, nipples on the outer fan casings are optional. Refer to the motor nameplates for recommended grease type, amount and interval.



Use a manual grease gun for lubrication. Excess grease causes bearings to overheat and results in failure.

Motor size ¹	Poles	Lubrication intervals [hours]	
		50 Hz	60 Hz
160	2	22000	20000
	4		
	6	25000	25000
	8		
180	2	17000	14000
	4		
	6	25000	25000
	8		
200	2	15000	12000
	4		
	6	25000	25000
	8		
225	2	5000	4000
	4	14000	12000
	6	20000	17000
	8	24000	20000
250	2	4000	4000
	4	13000	10000
	6	18000	16000
	8	20000	20000

Table 6. Intervals for WEG W22 TEFC motors – ball bearings

Motor size ¹	Poles	Lubrication intervals [hours]	
		50 Hz	60 Hz
160	2	16000	12000
	4		
	6	25000	25000
	8		
180	2	11000	8000
	4		
	6	25000	25000
	8		
200	2	9000	6000
	4		21000
	6	25000	25000
	8		
225	4	11000	9000
	6	16000	13000
	8	20000	19000
	250	4	9000
6		14000	12000
8		19000	17000

Table 7. Intervals for WEG W22 TEFC motors – roller bearings

1. See grease amounts on motor nameplates and in manufacturer's documentation.

6.7 Motor removal



Switch off the power and disconnect the motor cable in the terminal box, before beginning work on the impeller and motor.

For fans with PM motors, make sure the motor axles cannot rotate during service, e.g. by blocking the fan impellers. PM motors can generate high voltages when the motor axles rotate, even though the power is disconnected.

The below procedure is with reference to figures 12 and 13 beginning on page 24.

Motor removal

1. Dismount any ducts on the inlet and outlet sides.
2. Remove the impeller hub cover (figure 12, pos. 1 and 2).
3. Remove the impeller centre bolt and washers (figure 12, pos. 3).
4. **Fans with hub clips:** Remove the hub clip, screws and washers (figure 12, pos. 4).
5. Dismount the impeller with a puller fastened in the threaded holes of the impeller hub (figure 12, pos. 5). See also figure 13. "Mounting of puller in Ø350 hubs with hub clips" on page 25
6. Disconnect the motor cable from the motor.
7. Support the motor. See the weight in the technical specifications from the AirBox program.



Avoid exposure of fans and motor parts to shocks, as these can result in imbalance and deformations. Motor bearings and fan components are vulnerable parts.

- Detach the motor from the motor shell by removing the nuts and bolts (figure 12, pos. 7a and 7b) for hub sizes Ø350 and Ø560, or bolts and washers (figure 12, pos. 7b and 7c) for hub sizes Ø160.

Notice: Nuts in rear of motor shells are accessed through the front.

- Remove the motor (figure 12, pos. 8).

6.8 Mounting of motor

The component numbers in the below procedure refer to figure 12 on page 24.

 Replace lock washers and nuts during assembly.

Mounting of motor

- Remount the motor (pos. 8) and make sure the motor shaft is centred in the fan casing. A centring tool is available as an accessory from Novenco.
- Fans with Ø350 hubs and motor sizes 160 or 180:** These motors are mounted with pins, which must be replaced when re-mounting the motors.
- Insert and tighten the nuts and bolts (pos. 7a and 7b) to the prescribed torques for hub sizes Ø350 and Ø560, or bolts and washers (pos. 7b and 7c) for hub sizes Ø160. See table 10 on page 24.

 Consult Novenco if the replacement motor weight exceeds the original specifications. Refer to the technical specifications from the AirBox program.

Notice: Nuts in rear of motor shells are accessed through the front.

- Mount the impeller (pos. 6) on the motor shaft with a tool fastened in the threaded hole of the motor shaft. The impeller hub must rest against the motor shaft collar.

- Use a feeler gauge to check that the blade tip clearance between the impeller blade tips and fan casing is the same throughout the circumference.

Hub [mm]	Impeller, ØD [mm]	Min. [mm]	Hub [mm]	Impeller, ØD [mm]	Min. [mm]
Ø160	250	0.5	Ø560	1000	0.8
	280	0.5		1120	0.9
	315	0.5		1250	1.0
	355	0.5		1400	1.1
	400	0.5		1600	1.3
	450	0.5		1800	1.4
Ø350	500	0.5	Ø350	2000	1.6
	500	0.5		900	0.9
	560	0.6		1000	1.0
	630	0.6		1120	1.1
	710	0.7		1250	1.3
	800	0.8			

- Adjust the motor position. See step 5.
- Mount the centre washers and bolt (pos. 3).
- Fans with hub clips:** Mount the hub clip, screws and washers (pos. 4).
- Mount the impeller hub cover (pos. 2) and screws (pos. 1).
- Connect the motor cable to the motor and the power cables in the terminal box.
- Reconnect any ducts.

Table 8. Blade tip clearances at standard temperatures

Follow the procedure in section “5. Start of operation” to start the fan.

6.9 Blade angles

The fan impeller blade angles are the result of careful calculations to achieve a specific point of operation. The mount on the hub and balancing are therefore closely related to the angles and cannot be changed. Please contact Novenco for further information.

7. Troubleshooting

Check for the below faults in case of breakdowns or lack of performance. Call for service, if the problems persist.

 Fans that operate in the stall area are more likely to break down.

Lack of performance

- Blocked
 - Inlets
 - Outlets
 - Dampers
 - Coils
- Supply air reduced
- Motors defective
- Motors disconnected
- Wrong rotation direction

Noises and vibrations

- Motor bearings defective
- Impellers out of balance
- Impellers damaged or worn
- Bolts or components loose
- Wrong blade angles

8. Inspection and test

It is recommended to test and inspect the fans at regular intervals with regard to operability and operation conditions.

Inspect the fans twice a year to ensure satisfactory function and long product life. Fans with inspection hatches allow for inspection through these.

Extent of inspection

- Measure power consumption
- Verify torques of fixation bolts
- Cleaning
 - inside with pressurised air
 - outside with a lint-free cloth with a mild soapy water solution
- Visual inspection
 - Impellers
 - Fan casings
 - Electrical connections

Novenco recommends keeping a log of all values and observations regarding the fans.

9. Sound

The sound emissions depend on the installation and operation conditions, hence no general data can be given.

Refer to the technical specifications from the AirBox calculation program for specific emissions and to the product catalogue for more general data.

10. Safety

The installation must be in accordance to Novenco's, the current and the local safety regulations. At a minimum these include EN 13850.

It is recommended to review and revise safety procedures regularly.

Safety check

- Test if safety procedures and the installation work correctly.
- Check for changes in safety regulations and revise the installation accordingly.
- Consider additional measures to improve the safety of the installation.

11. Reference documentation

Please refer to the below documents for further information about the fans.

- Catalogue
ZerAx axial flow fans standard, ATEX and EX
- Novenco configuration user guide
Frequency converter Danfoss FC101
- Technical specifications

12. Disposal

Dispose of fans suitable for scrapping in environmentally safe ways and in accordance to current regulations.

The fans and especially the electric motors contain recyclable materials. Make sure worn-out motors and fan parts are disassembled and recycled for the benefit of the environment.

13. Quality management

Novenco Building & Industry A/S is ISO 9001 and 14001 certified. All fans are inspected and tested in the production.

14. Warranty

Novenco Building & Industry A/S provides the statutory 12 months warranty from the factory, which covers materials and defects from the manufacture. Wear parts are not covered.

Extended warranty can be agreed upon.

14.1 Impeller weldings

First generation ZerAx fans have the impeller blades welded onto the hubs. The weldings may look uneven or have small pores, which is due to the use of robot-welding. The production method is verified by high-speed tests, which confirm the maximum allowable speed with a large safety margin. The appearance of the weldings has no impact on impeller strength and should not be reported as a quality issue. It will not be accepted as a basis for a warranty case.



Figure 11. Impeller weldings

15. Spare parts

Contact Novenco for information about and ordering of spare parts.

16. Classifications

Calculation software

- Novenco AirBox certified by TÜV

Flange standards

- Eurovent 1/2
- **Marine fans:** DIN 24154 R4

Marine motor classification

- Refer to AirBox program

Temperature ranges

- **Standard:** -20 to 50 °C
- **Max.:** -40 to 120 °C

UL listed

- ZerAx, size Ø1600

17. Product lifetime

The fans, excluding the motors and frequency converters, have product lifetimes of 20 years. Storage, installation and maintenance must be in accordance with Novenco's instructions, which include this installation and maintenance guide as well as any referenced documentation and written agreements.

Product lifetimes of the motors and frequency converters appear from the manufacturers' documentation.

18. Declaration of conformity

Novenco Building & Industry A/S
 Oeverup Erhvervsvej 50-52
 4700 Naestved
 Denmark

hereby declares that the axial flow fans type AZL-AZN-AZW have been manufactured in accordance to the below legislation of the European Council and of the United Kingdom.

EU directives and regulations

Ecodesign directive 2009/125/EC •
 Ecodesign regulation 327/2011 •
 EMC directive 2014/30/EU • Energy labelling
 regulation 2017/1369 • LVD directive 2014/
 35/EU • Machinery regulation 2023/1230 •
 MED directive 2014/90/EU

UK regulations

Ecodesign for ErP 2010 • Energy Information
 2011 • Electrical Equipment (Safety) 2016 •
 Electromagnetic Compatibility 2016 •
 Merchant Shipping (Marine Equipment) 2016
 • Supply of Machinery (Safety) 2008

Guidelines

IACS F29:2005: Non-sparking fans

Applied standards and regulations

ANSI/AMCA 210-16 • AMCA 211-13 • ANSI/AMCA 300-14 • EU regulation 327/2011 •
 DS 447:2021 • BS/DS/EN ISO 1461:2009 • BS/DS/EN 1751:2014 • BS/DS/EN 1886:2007 •
 BS/DS/EN 1993-1-1:2005 + AC:2007 • BS/EN/ISO 5136:2009 • BS/DS/EN ISO 5801:2017 •
 BS/DS/EN ISO 9001:2015 • BS/ISO 10816-3:2009 + A1:2017 • BS/DS/EN ISO 12100:2010 •
 BS/DS/EN 12101-6:2005 + AC:2006 • BS/DS/EN ISO 12499:2008 • DS/ISO 12759-2:2019 •
 BS/DS/EN ISO 12759-4:2019 • BS/DSF/FprEN ISO 12759-5:2021 (draft) •
 BS/DS/EN ISO 12944-2:2017 • BS/DS/EN 13053:2019 • BS/DS/ISO 13347-1:2004 •
 BS/DS/ISO 13347-2:2004 • ISO 13348:2007, class AN3 • DS/EN ISO 13349:2010 •
 BS/DS ISO 13349-1:2022 • BS/DS/EN ISO 13350:2015 (jet fans) • BS/DS/EN ISO 13857:2019 •
 BS/DS/EN ISO 14001:2015 • BS/DS/EN ISO 14118:2018 • DS/ISO/TR 14121-2:2012 •
 BS/ISO 14694:2003 + A1:2010 • BS/DS/ISO 14695:2003 + Corr1:2009 •
 BS/DS/EN 16798-1:2019 • BS/DS/EN 16798-3:2017 • BS/DS/EN ISO 20607:2019 •
 BS/DS/ISO 21940-11:2016 + A1:2022 • BS/DS/ISO 21940-14:2012 •
 BS/DS/EN/IEC 60034-7:2020 ED3 • BS/DS/EN IEC 60034-14:2018 •
 PD/DS/IEC TS 60034-30-2:2016 • BS/DS/EN 60204-1:2018 • BS/DS/EN IEC 61000-6-1:2019 •
 BS/DS/EN IEC 61000-6-2:2019 • BS/DS/EN 61000-6-3:2007 + A1:2011 •
 BS/DS/EN IEC 61000-6-4:2019 • BS/DS/EN 61800-3:2018

This declaration is valid for installations and products that comply with the instructions in this guide or that Novenco Building & Industry provides.

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Naestved, 01.03.2024



Peter Holt
Technical director
Novenco Building & Industry A/S



Appendices

Appendix - A. Max. fan casing weights

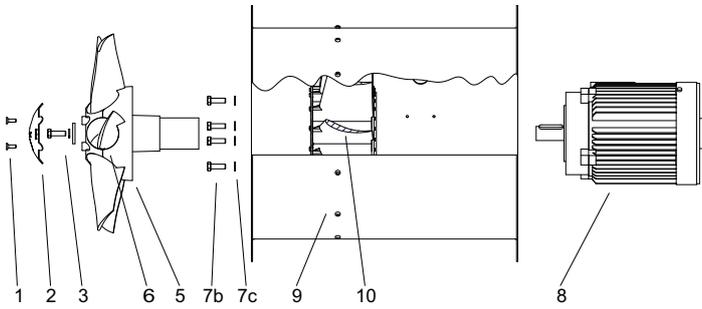
	Fan sizes. ØD [mm]	Fan types		
		AZL	AZN	AZW
Hub diameter 160 ¹	250	7	10	
	280	9	11	
	315	10	13	
	355	12	15	
	400	13	17	
	450	15	19	
	500	17	21	
Hub diameter 350 ¹	500	52	47	93
	560	62	61	105
	630	72	71	117
	710	85	78	130
	800	97	87	144
	900	115	96	160
	1000	130	104	175
	1120		113	201
Hub diameter 560	1250		123	222
	1000		213	288
	1120		239	378
	1250		239	411
	1400		307	452
	1600		353	512
	1800		383	566
	2000		425	619

Table 9. Max. fan casing weights, excl. motors and accessories [kg]

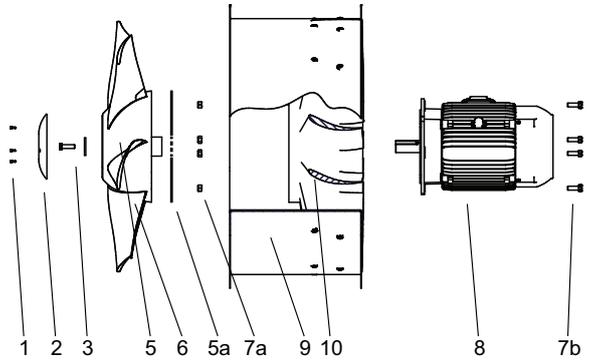
1. Weights of AZL fans are the top values in cells with two values.

Appendix - B. Fan assembly

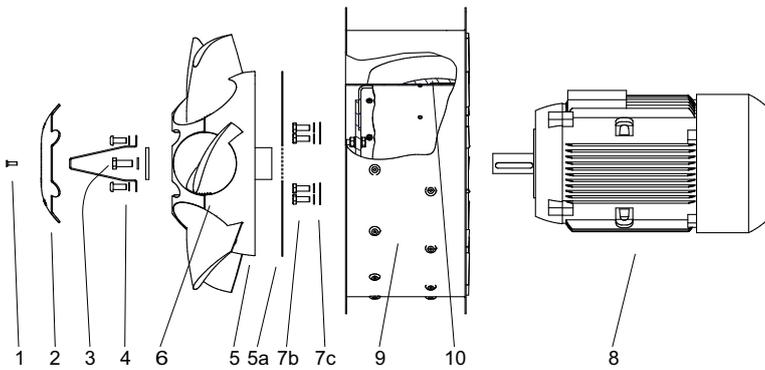
Ø160 hubs With centre bolt



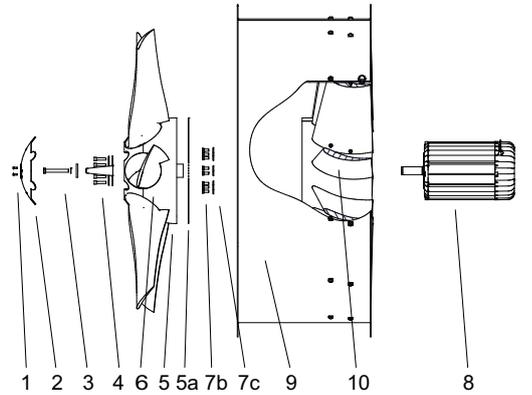
Ø350 hubs Welded



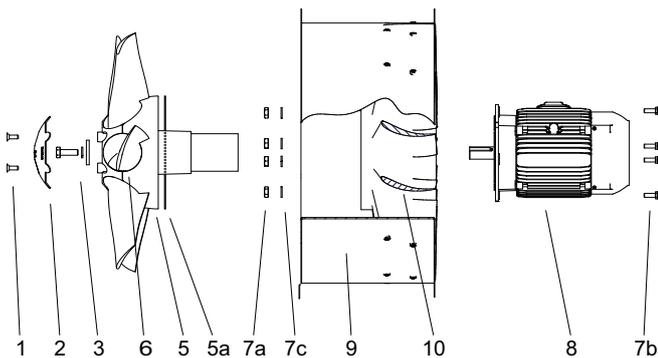
Ø350 hubs With hub clip



Ø560 hubs With hub clip



Ø560 hubs No hub clip



Components

- | | |
|-------------------------------------|-----------------|
| 1. Screws | 7a. Nuts |
| 2. Impeller hub cover | 7b. Bolts |
| 3. Centre bolt and washers | 7c. Washers |
| 4. Hub clip with screws and washers | 8. Motor |
| 5. Impeller hub | 9. Fan casing |
| 5a. Hub cover ¹ | 10. Guide vanes |
| 6. Impeller | |

Size	Torques [Nm]	
	Motor bolts (7b)	Centre bolt (3)
M6	9	6
M8	23	12
M10	45	20
M12	78	20
M16	190	25
M20	370	25

Table 10. Tightening torques

1. Hub covers are optional and available for hub sizes Ø350 and Ø560.

Figure 12. Fan disassembly and assembly

Appendix - C. How to mount puller

1. Remove impeller hub cover



– puller –



2. Remove hub clip



3. Mount puller in hub

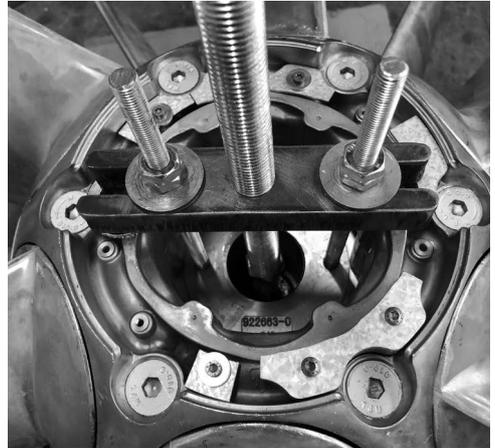


Figure 13. Mounting of puller in $\varnothing 350$ hubs with hub clips

Appendix - D. Wiring – six-leads motor – no frequency converter

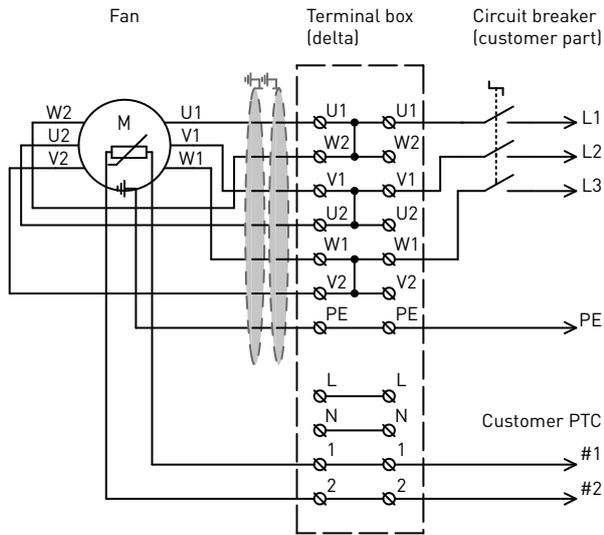


Figure 14. Terminal box delta-connection

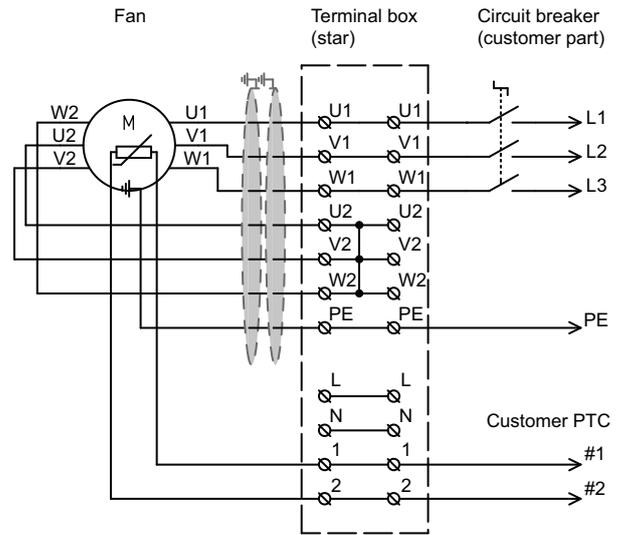


Figure 15. Terminal box star-connection

Appendix - E. Wiring – terminal box to frequency converter

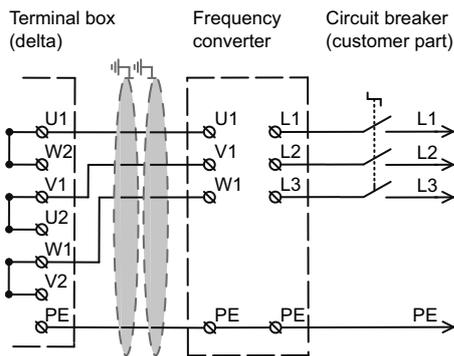


Figure 16. Terminal box delta-connection

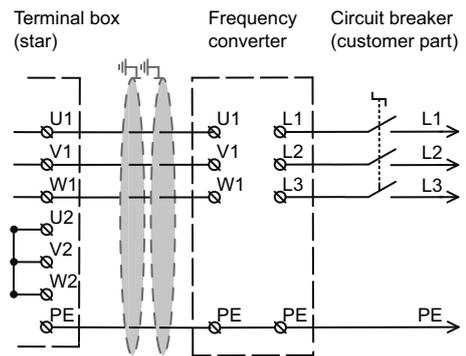


Figure 17. Terminal box star-connection

Appendix - F. Wiring – three-leads motor – with frequency converter

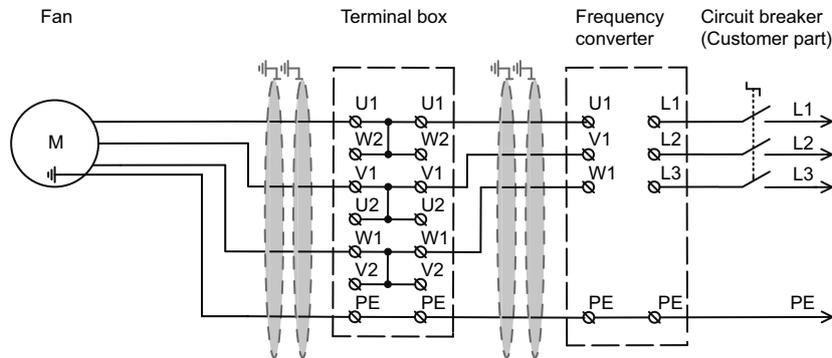


Figure 18. Frequency converter connection for all motors

Appendix - G. Checklists

Before installation

- Turn impeller by hand - it must turn freely
- Outdoor installations:** Location must be sheltered
- Ground fan to remove static electricity
- Clear installation location to ensure free airflows
- Install wire guards on front and back of fan (IP20)

Before start-up

- Turn impeller by hand - it must turn freely
- Remove transport rods from support frame
- Clear fans and airflow ways
- Inspect wire guards
- Turn fan on briefly to verify rotational direction

Start-up

- Power on fans
- Check for abnormal sounds and vibrations
- Measure vibrations – see “Vibration levels” on page 14
- After 30 min. operation – check for abnormal sounds

Before inspection and maintenance

- Turn off power for fans
- Disconnect power supply
- Lock power switches

Inspection and maintenance

Inspection

- Measure power consumption at ½ and full speeds
- Verify torques of fixation bolts
- Measure vibrations on fan casing
- Visual inspection – impeller, casing, silencers and electric connection

Maintenance

- See “Before inspection and maintenance”
- Clean the fans
- Service fans - drain motor, check electrics
- Replace broken parts
- Lubricate motor bearings
- Turn fan on briefly to verify rotational direction

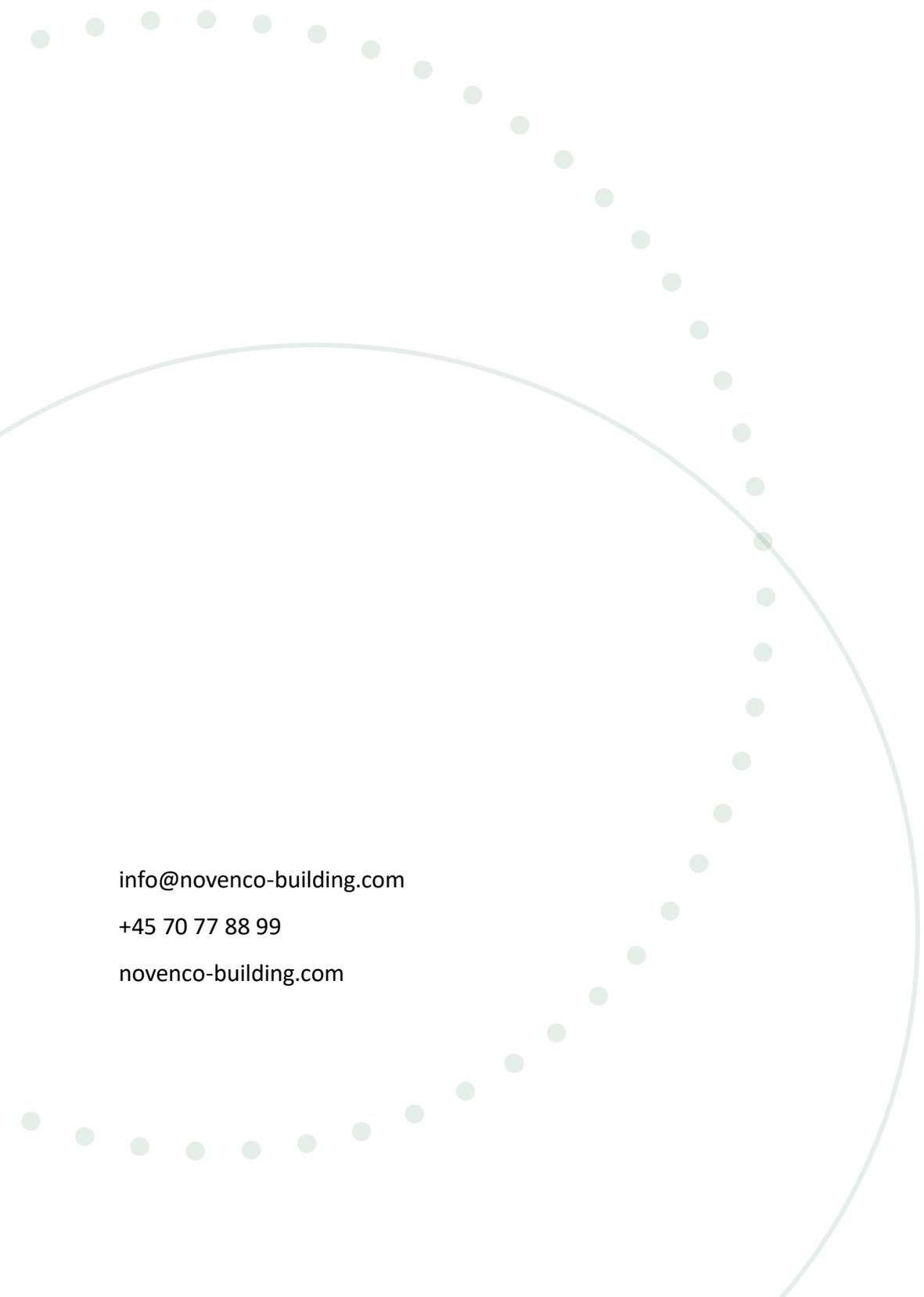
Troubleshooting

Lacking performance

- Inlet or outlet blocked
- Auxiliary fans stopped
- Motor defective
- Motor disconnected
- Electric connection defective
- Wrong rotational direction of impeller

Noise and vibrations

- Motor bearings defective
- Impeller imbalance
- Impeller worn or damaged
- Loose components
- Wrong impeller blade pitch angles
- Fan operates in stalling area



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