

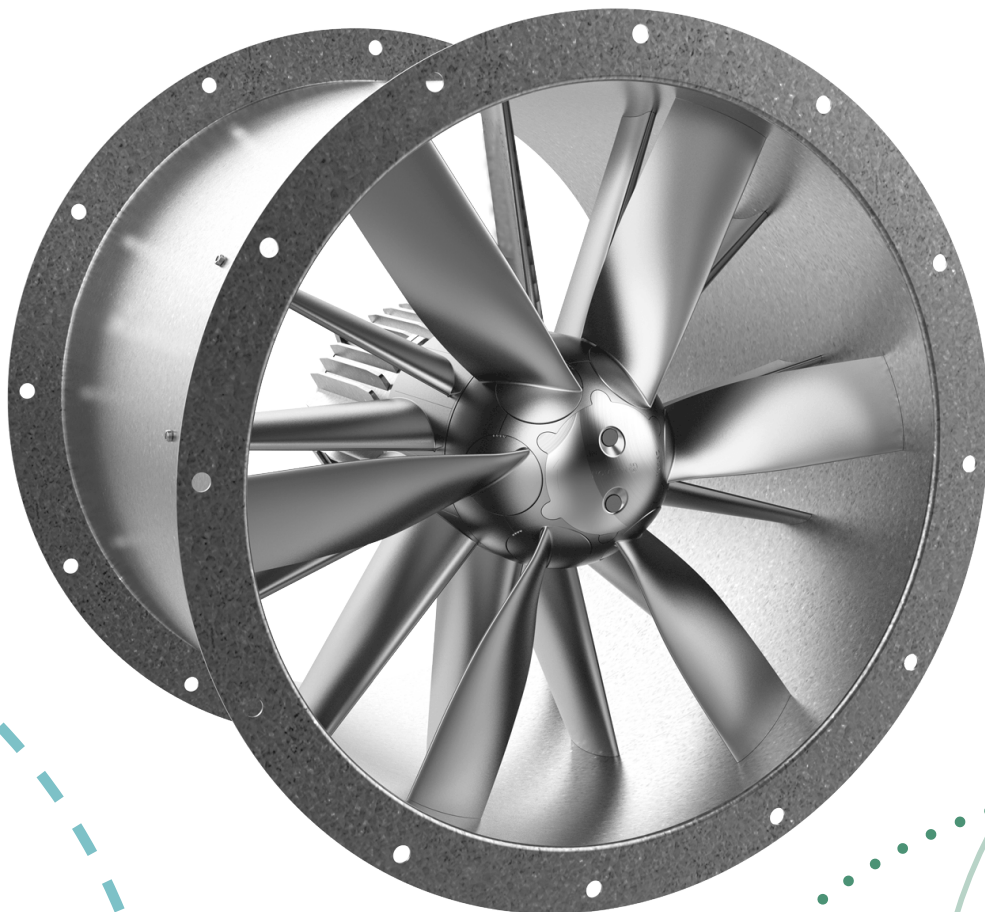
Pure competence in air.

# NOVENCO® ZERAX® FAN TYPES AZL-AZN-AZW INSTALLATION AND MAINTENANCE

Building & Industry

**NOVENCO** 

SCHAKO Group



ENGLISH

922950-0

## Important

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

- Operation in stall area
- Operation with pulsating counter pressure – called pump mode
- Operation with exceedingly starts and stops

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 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 25.

 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 rotors 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 rotors must point downwards.
- **Large fans or fans with large motors**  
Transport and store these on pallets. Store very large fans on suitable bearers.

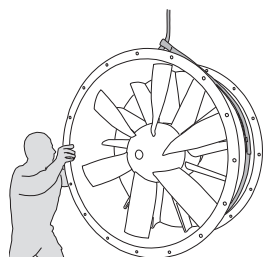


Figure 1. Lift of fan with one strap

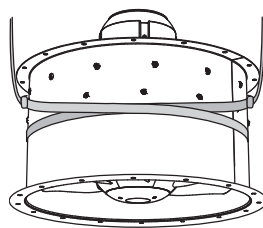



Figure 2. Lift of fan with two straps


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

**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 rotor 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 rotor. Wire guards from Novenco can be installed as close as 120 mm before and after the rotor.

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 25 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.

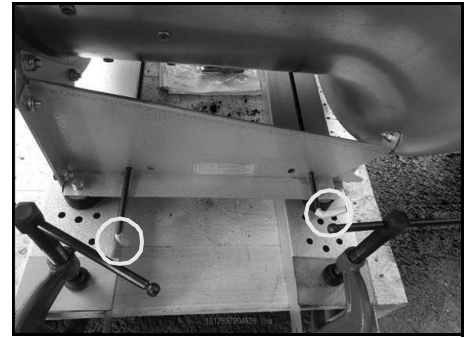
### Connect fans

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 rotors 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

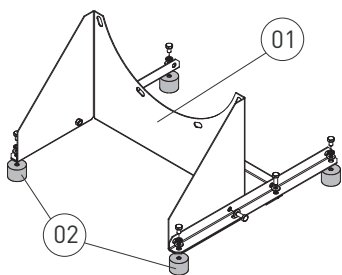
### 4.3 Support frames

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

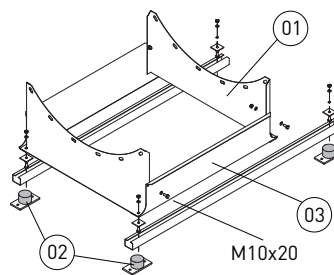
All ZerAx fan types can be fitted with support frames for horizontal installation. In figure 4, support frame types 1 and 2 are for horizontal installation of the AZL. The type 2 can furthermore be mounted on rails transversally to the airflow for easy incorporation in AHUs. Support frames type 3 are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

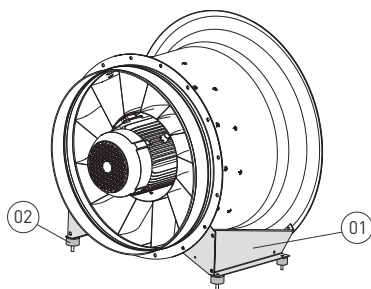


**Type 1 - Horizontal frame for AZL**

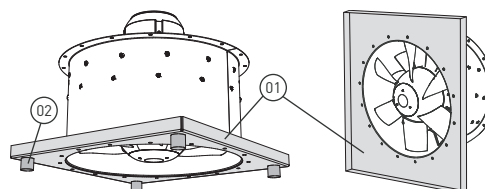


**Type 3 - Horizontal frame for AZN and AZW**

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.

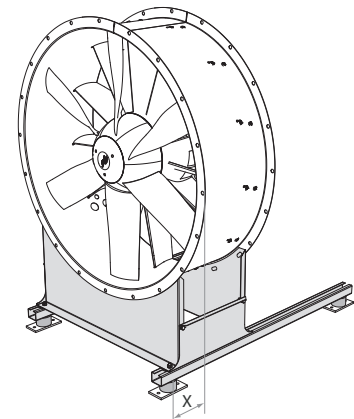




Figure 5. AZN-AZW on support frame

 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.

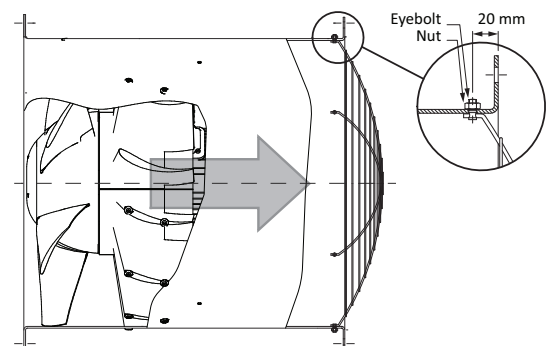



Figure 6. In-pipe installation of wire guard

## 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.

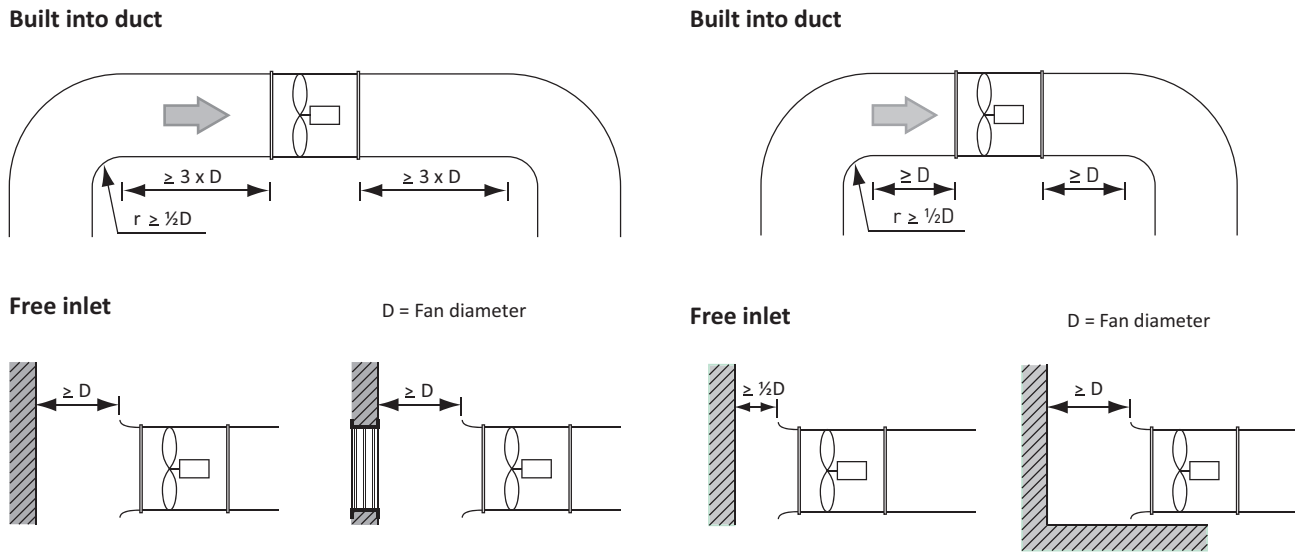


Figure 7. Installation spaces in ducts – optimal (left) and reduced

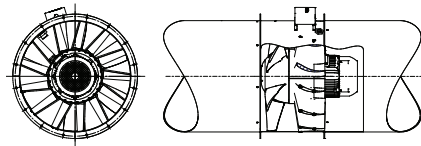


Figure 8. Installation in duct

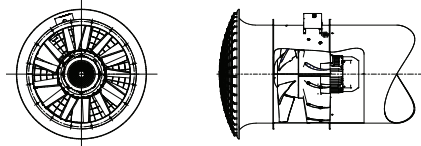


Figure 9. Installation in duct

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 <sup>1 2</sup> |         |         |
|-------------------|--------------------|--------------------|---------|---------|
|                   |                    | 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 installation documentation. Refer also to the Novenco document "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
- Order specification
- Appendices D, E and F on wiring on page 28

Verify that the rotational direction of the rotor 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 connections.



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 rotor 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 “Configuration of frequency converters for Novenco fans”.

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 minimum 0.1x motor shaft diameter (min. 2 mm, max. 13 mm) all around the rotor circumference.  
The axial distance between the rotor 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 rotor.

## 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 [kgm<sup>2</sup>]
- $I_m$  : Polar moment of inertia for motor [kgm<sup>2</sup>]

## 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 rotors and endanger people.

- Operation in stall area, i.e. with counter pressure that pulsates - called pump mode
- Operation with uninterrupted and repeated starts and stops
- Uneven flow velocity through the fans

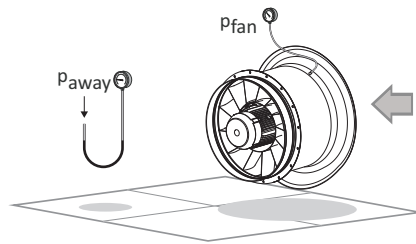
Ask Novenco if in doubt.

## 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 m<sup>3</sup>/s. Multiply by 3,600 to convert to m<sup>3</sup>/h, or by

2188.88 to convert from m<sup>3</sup>/s to CFM.



**Figure 10.** Measurement of pressure difference

| Fan sizes | Constant, k | Fan sizes | Constant, k |
|-----------|-------------|-----------|-------------|
| 250/160   | 0.0510      | 900/350   | 0.7204      |
| 280/160   | 0.0694      | 1000/350  | 0.9001      |
| 315/160   | 0.0917      | 1120/350  | 1.2019      |
| 355/160   | 0.1183      | 1250/350  | 1.5636      |
| 400/160   | 0.1502      | 1000/560  | 0.871       |
| 450/160   | 0.1894      | 1120/560  | 1.129       |
| 500/160   | 0.2343      | 1250/560  | 1.441       |
| 500/350   | 0.1921      | 1400/560  | 1.844       |
| 560/350   | 0.2537      | 1600/560  | 2.453       |
| 630/350   | 0.3324      | 1800/560  | 3.142       |
| 710/350   | 0.4329      | 2000/560  | 3.913       |
| 800/350   | 0.5603      |           |             |

**Table 3.** Constants for calculation of air volumes for ZerAx fans

- $q = k \times \sqrt{dps}$   
 $q$  : Air volume [m<sup>3</sup>/s]  
 $k$  : A constant, see table 3.  
 $dps$  : Difference between  $p_{away}$  and  $p_{fan}$  [Pa]  
 $p_{fan}$  : Static pressure at fan inlet [Pa]  
 $p_{away}$  : Static pressure away from fan [Pa]

For the fan types AZN and AZW with wire guards, the constant in table 3 must be reduced by up to 10%. For these fan types without wire guards, the constant is used directly.

For the AZL with wire guards, the constant must be reduced by up to 20%. For this fan type without wire guards, the constant must be reduced by 10%.

Free inlet cones are integrated on the AZL and is an accessory for the AZN and AZW.

The suction must be directly from the suction chamber.

Fans with low blade angles can make noise at high pressures, which affects the measurement. Operation close to the stalling area produces poor results also.

## 6. Maintenance

In the following, please also see “Appendix - G. Checklists” on page 29.

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

**Table 4.** Maintenance intervals

- 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.
- The motor manufacturer’s recommendations may call for shorter lubrication intervals. See section “6.6 Motors” on page 16. Please note that fans with permanent magnet motors are lubricated for life.
- Intervals for cleaning depend on the operating conditions and environment. See section “6.2 Cleaning” on page 15.



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 rotor and motor.

For fans with PM motors, make sure the motor axles cannot rotate during service, e.g. by blocking the fan rotors. 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.

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

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



Fan vibration levels depend on installation type and fan speed.

Vibrations have significant effect on fan life and efficiency.



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

## 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 Rotors

The rotors are carefully balanced and the rotor blades are set at precise angles in the production. The rotors 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.
  - **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 | 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 5.** Grease amounts and intervals for WEG W22 TEFC motors – ball bearings

| Motor size | 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  |
| 280        | 6     | 14000                         | 12000 |
|            | 8     | 19000                         | 17000 |

**Table 6.** Grease amounts and intervals for WEG W22 TEFC motors – roller bearings

## 6.7 Motor removal



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

For fans with PM motors, make sure the motor axles cannot rotate during service, e.g. by blocking the fan rotors. 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 26.

### Motor removal

1. Dismount any ducts on the inlet and outlet sides.
2. Remove the screws (figure 12, comp. 1) that hold the hub cap and remove the cap (figure 12, comp. 2).
3. Remove the rotor centre bolt and washers (figure 12, comp. 3).
4. **Fans with hub clips:** Remove the hub clip, screws and washers (figure 12, comp. 4).
5. Dismount the rotor with a puller fastened in the threaded holes of the hub boss (figure 12, comp. 5). See also figure 13. "Mounting of puller in Ø350 hubs with hub clips" on page 27
6. Disconnect the motor cable from the motor.
7. Support the motor. See the technical fan 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, comp. 7a and 7b) for hub sizes Ø350 and Ø560, or bolts and washers (figure 12, comp. 7b and 7c) for hub sizes Ø160.

**Notice:** Access nuts holding motors mounted in rear motor shells through the front motor shells.

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

## 6.8 Mounting of motor

The component numbers in the below procedure refer to figure 12 on page 26.



Replace lock washers and nuts during assembly.

### Mounting of motor

- Remount the motor (comp. 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. The pins must be replaced with new ones when re-mounting the motors.
- Insert and tighten the nuts and bolts (comp. 7a and 7b) to the prescribed torques for hub sizes Ø350 and Ø560, or bolts and washers (comp. 7b and 7c) for hub sizes Ø160. See table 9 on page 26.



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

- Notice:** Access nuts holding motors mounted in rear motor shells through the front motor shells.
- Mount the rotor (comp. 6) on the motor shaft with a tool fastened in the threaded hole of the motor shaft. The rotor hub must rest against the motor shaft collar.
  - Use a feeler gauge to check that the blade tip clearance between the rotor blade tips and fan casing is the same throughout the circumference.
  - Adjust the motor position. See step 5.
  - Mount the centre washers and bolt (comp. 3).
  - Fans with hub clips:** Mount the hub clip, screws and washers (comp. 4).
  - Mount the hub cap (comp. 2) and screws (comp. 1).
  - Connect the motor cable to the motor and the power cables in the terminal box.
  - Reconnect any ducts.

| Hub, [mm] | Rotor, ØD [mm] | Min. [mm] | Hub, [mm] | Rotor, 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       |           |                |           |

**Table 7.** 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 rotor blade angles are the result of careful calculations to achieve a specific and sometimes delicate 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 in performance. Call for service, if problems persist.

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

### Lack in performance

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

### Noises and vibrations

- Motor bearings defective
- Rotors out of balance
- Rotors damaged or worn
- Bolts or components loose
- Wrong rotor blade pitch 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
  - Rotors
  - 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.

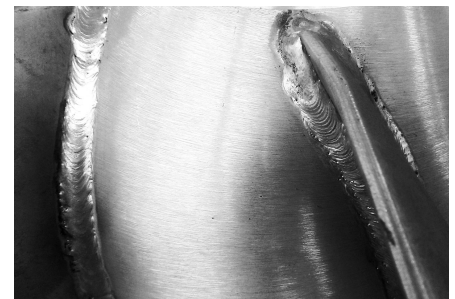
## 14. Warranty

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 Rotor weldings

First generation ZerAx fans have the rotor 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 rotor strength and should not be reported as a quality issue. It will not be accepted as a basis for a warranty case.



**Figure 11.** Rotor weldings

## 15. Spare parts

Contact Novenco for information about and ordering of spare parts.

## 16. Classifications and certifications

### 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  
Industrivej 22  
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. They comply with the below standards and regulations.

### EU directives

- ECO design 2009/125/EU and energy labelling regulation 2017/1369/EU
- EMC 2014/30/EU
- LVD 2014/35/EU
- Machinery 2006/42/EU
- MED 2014/90/EU

### UK regulations

- Ecodesign for ErP 2010 and Energy Information 2011
- Electrical Equipment (Safety) 2016
- EMC 2016
- Marine equipment 2016
- Supply of Machinery (Safety) 2008

### Applied standards and regulations

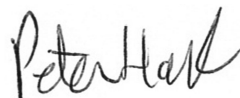
- ANSI/AMCA 300-14
- EU regulation 327/2011
- DS 447:2021
- BS/DS/EN ISO 1461:2009
- BS/DS/EN 1886:2007
- BS/DS/EN 1993-1-1:2005 + AC:2007
- BS/DS/EN ISO 5801:2017
- BS/DS/EN ISO 9001:2015
- BS/ISO 10816-3:2009 + A1:2017
- BS/DS/EN ISO 12100:2010
- BS/DS/EN 12101-6:2005 + AC:2006
- BS/DS/EN ISO 12499:2008
- 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
- BS/DS/EN ISO 13350:2015
- 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/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
- 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, provided that the installation and maintenance instructions are followed. Changes to the product without prior consultation with Novenco Building & Industry A/S invalidates the declaration and voids warranty.

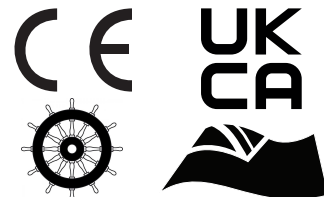
### UK representative

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Naestved, 01.08.2022

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Peter Holt  
Technical director  
Novenco Building & Industry A/S



## Appendices

### Appendix - A. Max. fan casing weights

|                                  | Fan sizes.<br>ØD [mm] | Fan types |     |     |
|----------------------------------|-----------------------|-----------|-----|-----|
|                                  |                       | AZL       | AZN | AZW |
| Hub diameter<br>160 <sup>1</sup> | 250                   | 7         | 10  |     |
|                                  | 280                   | 9         | 11  |     |
|                                  | 315                   | 10        | 13  |     |
|                                  | 355                   | 12        | 15  |     |
|                                  | 400                   | 13        | 17  |     |
|                                  | 450                   | 15        | 19  |     |
|                                  | 500                   | 17        | 21  |     |
| Hub diameter<br>350 <sup>1</sup> | 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<br>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 |

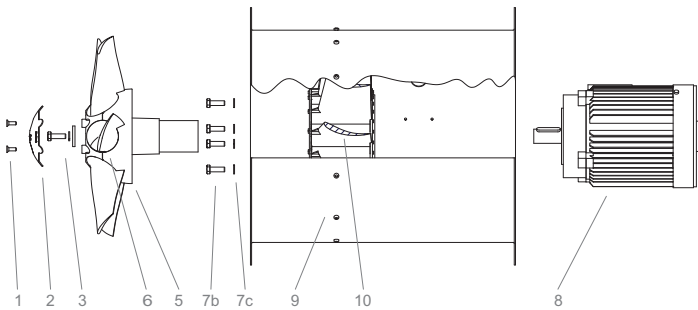
**Table 8.** Max. fan casing weights, excl. motors and accessories [kg]

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

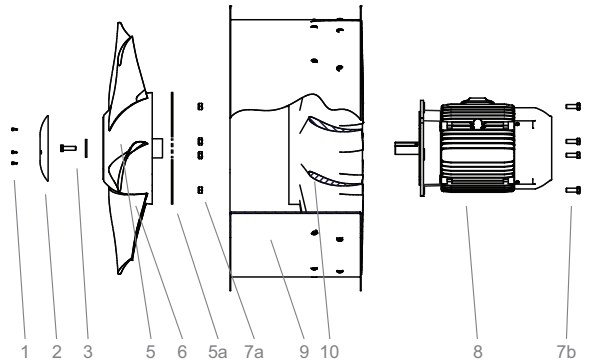


## Appendix - B. Fan assembly

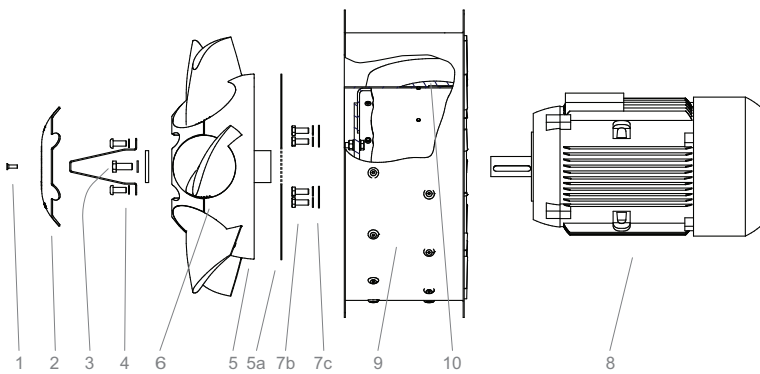
### Ø160 hubs With centre bolt



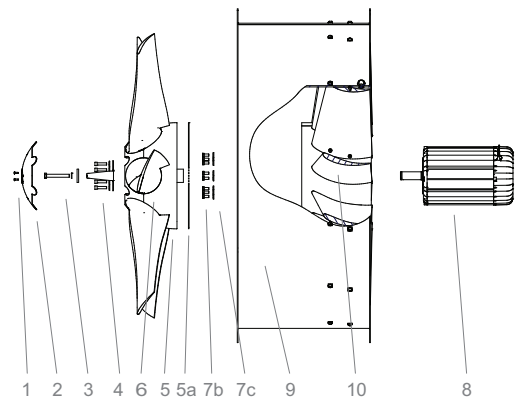
### Ø350 hubs Welded



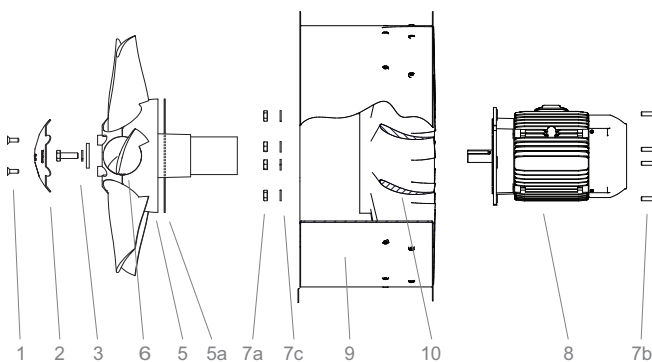
### Ø350 hubs With hub clip



### Ø560 hubs With hub clip



### Ø560 hubs No hub clip



### Components

- |                                     |                 |
|-------------------------------------|-----------------|
| 1. Screws                           | 7a. Nuts        |
| 2. Hub cap                          | 7b. Bolts       |
| 3. Centre bolt and washers          | 7c. Washers     |
| 4. Hub clip with screws and washers | 8. Motor        |
| 5. Hub boss                         | 9. Fan casing   |
| 5a. Hub cover <sup>1</sup>          | 10. Guide vanes |
| 6. Rotor                            |                 |

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

| 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 9.** Tightening torques

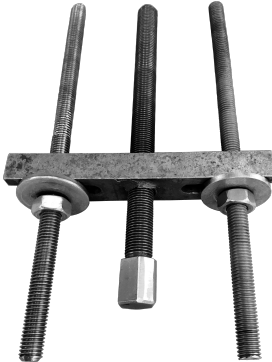
**Figure 12.** Fan disassembly and assembly

## Appendix - C. How to mount puller

### 1. Remove hub cap



– 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

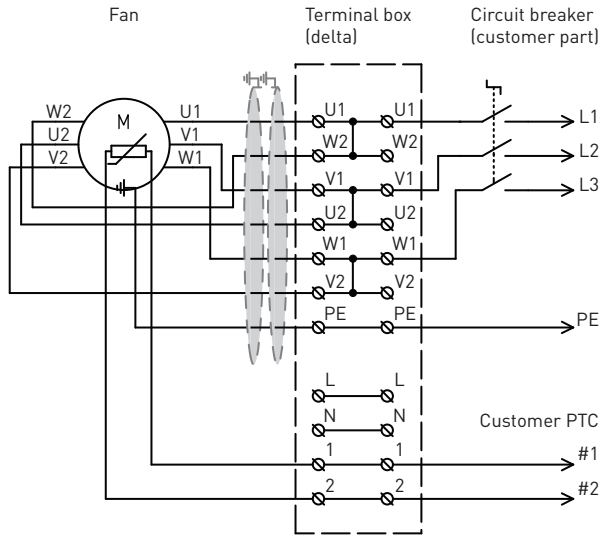


Figure 14. Terminal box delta-connection

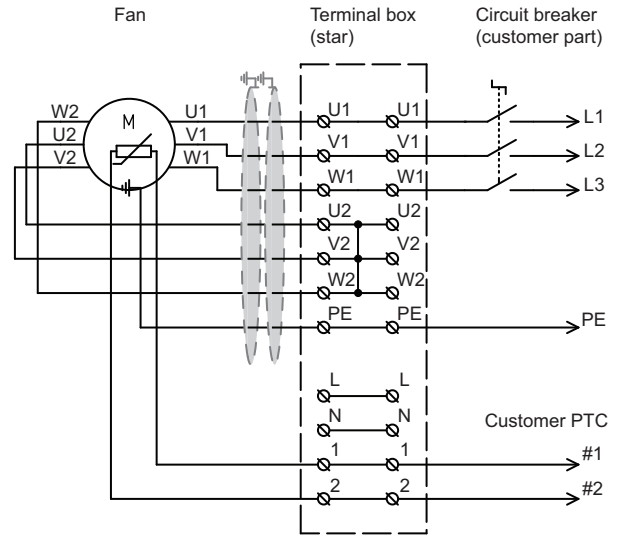


Figure 15. Terminal box star-connection

## Appendix - E. Wiring – terminal box to frequency converter

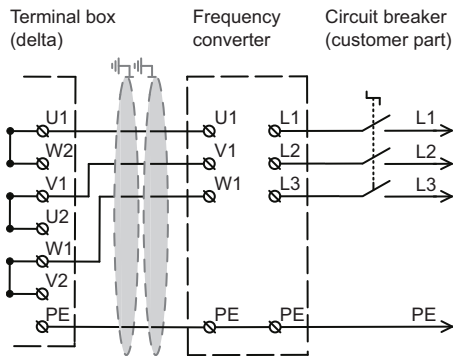


Figure 16. Terminal box delta-connection

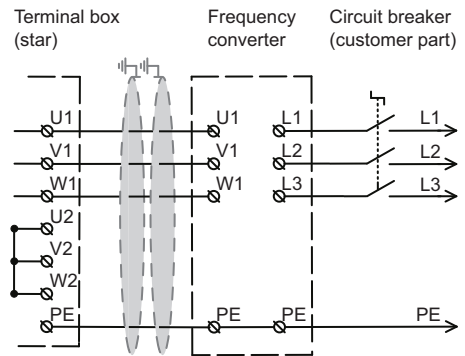


Figure 17. Terminal box star-connection

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

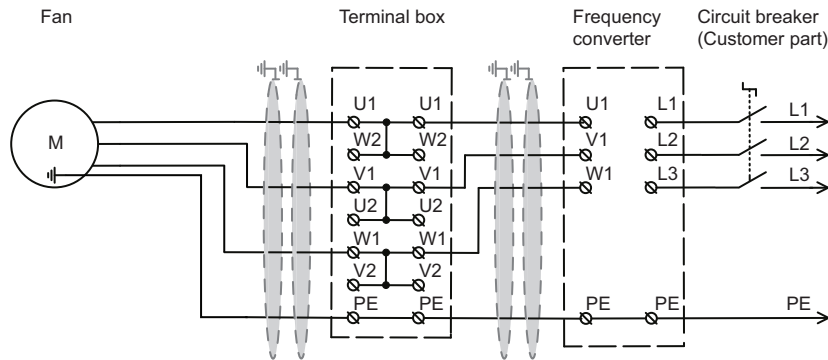


Figure 18. Frequency converter connection for all motors

## Appendix - G. Checklists

### Before installation

- Turn rotor 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 rotor 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 15
- 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 – rotor, 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 rotor

#### Noise and vibrations

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

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