

NOVENCO[®] NovAx[™]

Axial fans ACN-ARN Smoke

Installation and maintenance

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NovAx™ smoke exhaust fan types ACN-ARN smoke

1. Application

2. Handling

- 2.1 Marking
- 2.2 Weight
- 2.3 Transport

3. Storage

4. Installation

- 4.1 Preparing for installation
- 4.2 Installation
- 4.3 Support frames and dampers
- 4.4 Duct connection
- 4.5 Electric connection
- 4.6 Thermal motor protection

5. Start of operation

- 5.1 Before start-up
- 5.2 Motors with Y/Δ starting
- 5.3 Start-up procedure

6. Maintenance

- 6.1 Before maintenance
- 6.2 Fan casing
- 6.3 Rotor
- 6.4 Motor
- 6.5 Dismounting of motors
- 6.6 Mounting of motors
- 6.7 Blade pitch adjustment
- 6.8 Fault localisation

7. Inspection and test

8. Sound

9. Safety

10. Spare parts

11. Patents and trademarks

12. Quality management

13. Warranty

14. Declaration of conformity

1. Application

NovAx smoke exhaust fans type ACN-ARN are sturdy axial flow fans designed for both the daily ventilation requirements under normal conditions and smoke or heat exhaustion in the event of a fire in all kinds of commercial and industrial buildings.

The ACN-ARN smoke fans are tested and approved to meet the requirements

for smoke exhaust in classes F300 (300°C for 60 minutes) and F400 (400°C for 120 minutes) according to standard EN 12101-3.

2. Handling

2.1 Marking

The ACN-ARN smoke fans are provided with standard nameplates with Novenco Building & Industry A/S' name and address.

It also mentions type and size, e. g. ACN 1000/380, number of blades, year of production, weight, serial number or order number (production number). Furthermore, it mentions maximum temperature and working period in minutes and if the fan is supplied with approval number, class or category are also mentioned as well as test standard applied (EN 12101-3). Fan pressure, air quantity, output and maximum speed per minute are also on the fan nameplates.

The fan is also provided with a motor nameplate with relevant motor data including insulation class of the motor.

2.2 Weight

The total weights shown in table 1 apply to axial flow fans type ACN-ARN smoke. The total weight is determined on the basis of type or size of fan and maximum motor size employed.

2.3 Transport

When transporting the fans take care that no water, f.x. rain, gets into the motor or other sensitive components. Fans type ACN-ARN smoke are delivered on pallets or bearers to allow for forklift transport.

The forks of the forklift truck must lift underneath the frame. Set down the fan as slowly as possible and on a soft foundation. Vibrations, shocks, and falls may result in imbalance and deformation and may damage the motor bearings.

	Fan size	Motor sizes [WEG make]									
		-90	-100	-112	-132	-160	-180	-200	-225	-250	-280
Hub diameters 160, 230, 280, 330 and 380	400	27	27								
	500	37	38	42	42						
	560	49	55	52	55	55					
	630	50	60	60	60	60	57				
	710	57	73	73	83	73	73				
	800	68	82	82	82	82	82				
	900	95	98	98	98	98	98				
Hub diameters 403	1000	131	135	134	134	121	134				
	900				117	116					
	1000				119	118	154				
	1120			127	127	133	167				
	1250			148	148	141	184				
Hub diameters 578	1400				203	202	208				
	900					149	153				
	1000				157	157	192	192			
	1120				167	175	209	220	219		
	1250				192	191	260	242	240	269	
	1400					269	269	280	279	318	329
	1600							306	335	355	366
Motor sizes [WEG make]		-90	-100	-112	-132	-160	-180	-200	-225	-250	-280
Max. motor weight [kg]		25	38	46	81	132	197	260	382	510	570

Table 1. Max. fan weights excl. motors and accessories (upper table) and max. motor weights (lower table) for ACN-ARN smoke [kg] ¹

1. ARN fans are up to 10 kg heavier than ACN fans.

3. Storage

The ACN-ARN smoke fans can stand outdoor storage for 1 month provided the packing is intact. Fans with no or broken packing must be stored in sheltered locations.

If the fans are stored indoors under well-ventilated conditions with no risk of condensation the storage period may be extended to 6 months. The storage place must not be exposed to vibrations likely to damage the motor bearings.

If the storage period exceeds 3 months, it is recommended to turn the rotor regularly by hand.

4. Installation

4.1 Preparing for installation

Follow the directions below to ensure a safe work environment and fan functionality.

Checklist prior to installation

- The rotor must rotate freely in the casing and have equal blade tip distances to the casing around the circumference.
- For outdoor installations the fans must be sheltered. Fans, motors and frequency drives must be installed so they are not exposed to rain or dripping water.
- Avoid static electricity by grounding the fan during installation. For instance by assembly on non-conducting vibration dampers and foundations.

Important: 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.

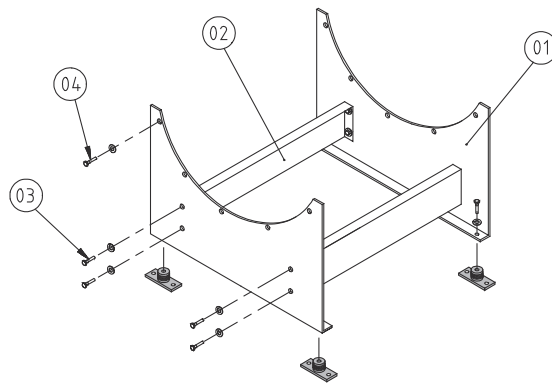


Figure 2. Assembly of horizontal support frame for ACN-ARN

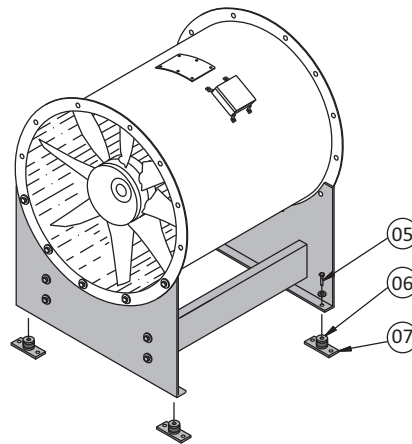


Figure 3. ACN mounted on horizontal support frame with anti-vibration dampers

- **Stiff suspension:** Fan is fastened to a duct or a stiff wall through holes in the flanges. 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 guarantee.

4.2 Installation

Fans must always be installed so that the rotating parts cannot be touched. The fan must be provided with wire guards on the inlet and outlet sides. If ducts are con-

nected, they should be provided with wire guards on the inlet side.

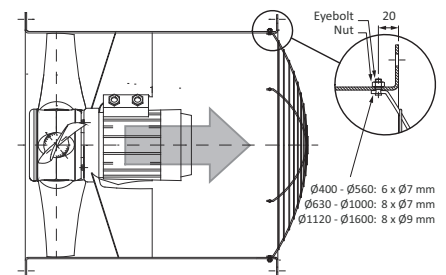


Figure 1. Mounting of wire guard (optional accessory) in flanged outlet

The fan is provided with an arrow-plate denoting the direction of airflow through the fan casing. See during installation that the fan is oriented so as to provide the desired direction of airflow in the system.

The best way of installing the fan is with a support frame (optional accessory), but it may also be suspended in the fan casing flanges or in special carriers.

The carriers must not hamper the free inlet and outlet of air.

When the fan has been finally secured make sure that the rotor rotates freely in the casing.

If the motor is provided with drain holes for condensed water the fan must be oriented so that the holes turn downwards (lowest point).

Generally, it is of the utmost importance for the performance and sound level of an axial flow fan that the airflow is unimpeded and free from eddies.

4.3 Support frames and dampers

Important: Support frames must be grounded to prevent electrical shocks.

The ACN-ARN smoke fans can all be fitted with either horizontal or vertical support frames.

Horizontal support frames consist of two mounting plates (see fig. 2, item 01), which are joined with stiffeners and screws (items 02 and 03). The stiffeners are used with fan sizes Ø630 and up. Vertical support frames are mounting plates onto which the fans are flange mounted.

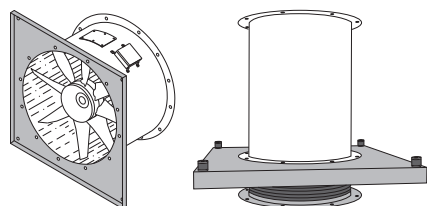


Figure 4. ACN with vertical support frame (left) and with flexible connection and anti-vibration dampers

Anti-vibration dampers with base plates (accessories) prevent spread of vibrations from the fans to the surroundings. See fig. 3, items 06 and 07 and fig. 4. With the dampers the natural system frequency is kept below 10 Hz. The damping is at least 80% at 1500 RPM.

Important: The natural frequency of the support must be min. 20% from the fan speed.

The anti-vibration dampers install between the fans and the supporting foundation. Installation of base plates (item 07) between the dampers and foundation is optional, but recommended depending on the type of surface. Secure anti-vibration dampers to the support frames by means of bolts.

Flexible connections (accessory) may be fitted in the ducts before and after the fans. See for example fig. 4.

4.4 Duct connection

In order to achieve the capacities stated on the performance curves the fans must be provided with ducts as shown in fig. 5 and fig. 6.

The duct or inlet cone on the fan inlet side must be designed to ensure smooth and undisturbed airflow. ACN-ARN smoke fans are prepared for circular duct connection on both inlet and outlet sides. Flanges supplied as standard for type ACN-ARN comply with Eurovent 1/2. Systems with higher vibration levels or more exacting performance requirements must be provided with expansion joints between fan and duct. Ducts must not be supported by the fan.

It is important to allow for free areas to facilitate mounting and dismantling as well as maintenance.

4.5 Electric connection

Important: The electric installation of fans intended for smoke exhaust that are fitted with frequency drives, must be designed to bypass the frequency drives and run the fans at nominal speed in the event of fire.

Important: The installation and connection to the supply network must be done by authorised personnel and in accordance with current legislation.

Fans with frequency drives must be installed in accordance with the EU standard for electromagnetic compatibility (EMC). The shielding and connection to ground eliminate interference and protect the fan motor bearings and windings. Refer to the motor documentation for methods to avoid impairment of the mains power quality. Prescribed methods may involve installation of rectifiers, filters etc.

Connection to the mains is effected directly in the motor terminal box or in the terminal box mounted on the outside of

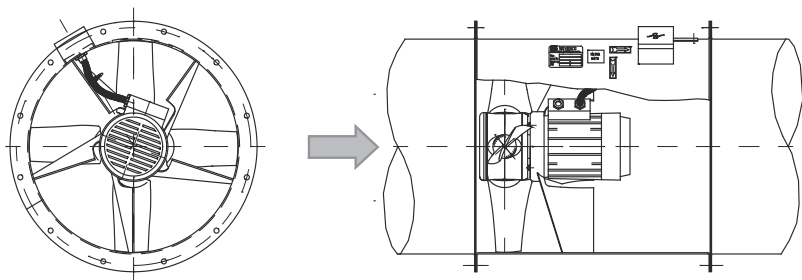


Figure 5. Installation in duct system

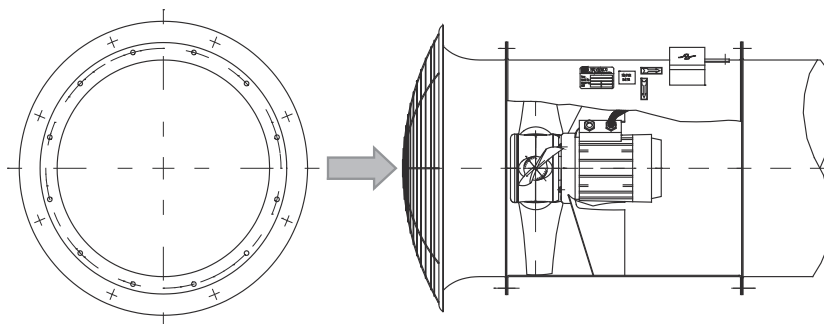


Figure 6. Inlet cone for connection to duct

the fan casing (see fig. 8). Connection is made according to the connection diagram in the terminal box cover.

Check the fan rotation direction once the motor is connected. Do this by briefly flicking the fan power on and off. It must comply with the arrow on the fan casing. If the direction is wrong, disconnect the main power supply and check the connections.

Reversible fans must be fitted with time delays to allow the rotor to become stationary, before reversing the direction.

Important: Only fans with inner hubs of steel may be run in reverse. Reversible operation increases risk of fan stalling. If the fan stalls, the service life is shortened.

Important: The NovAx fans can run in reverse for shorter 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 fans must be fitted with time delays to ensure that the rotor is completely stationary before reversing direction. Running the fans in reverse increases the risk of stall and shortens fan life.

4.6 Thermal motor protection

The motor may have thermal protection (optional accessory) in the form of a thermistor or bimetallic sensor.

If the thermal protection is set to switch off at unexpected temperature rises, it must be connected to the security system. The system must identify if the motor is working on emergency duty or not. Alternatively, leave the thermal protection disconnected.

5. Start of operation

5.1 Before start-up

After installation of the axial flow fans their correct installation, operation and interaction must be established through an approval test.

The person responsible for the operation of the system must take the initiative for this test.

The approval test must be confirmed by the person responsible for the operation of the system and the documentation must be kept and produced whenever asked for.

Prior to start of operation check that the fan and duct connections are clean and free from tools and foreign objects.

Also, check that the electric connections meet the prescribed requirements, that wire guards fitted on the fan inlet or outlet side are correctly mounted and that the direction of rotation of the fan complies with the arrow-plate (check by short-time operation).

5.2 Motors with Y/ Δ starting

The relay must be set to the calculated time.

5.3 Start-up procedure

- Start the fan
- Check that no abnormal noise is present.
- Check that the vibration level is

acceptable. The vibration level at the fan operating speed must not exceed 7 mm/s RMS, measured radially at 2 points, 90° offset and at the free shaft end of the motor.

Otherwise, the fan must be balanced. Operation at vibration levels exceeding 11 mm/s RMS* is not allowed for fixed fan positions. Operation at vibration levels exceeding 18 mm/s RMS* is not allowed for fans on support frames or anti-vibration dampers.

* ISO 2954, Requirements for instruments for measuring vibration severity.

- After 30 minutes of operation check that the fan operates normally.

Important: The fan is designed for continuous operation. The following kinds of operation may cause fatigue breaks in the rotor and endanger people.

- Operation in stall area - operation with pulsating counter pressure - called pump mode
- Operation with repeated starting and stopping.
- Uneven flow velocity through fan.

If in doubt Novenco should be contacted to assess fan suitability.

6. Maintenance

Keep the NovAx ACN-ARN fans in good operational condition to ensure satisfactory function and service life.

6.1 Before maintenance

When the fan is out of operation for reasons of inspection or maintenance, the electric system must be switched off and protected so that the fan cannot cut in.

6.2 Fan casing

The fan casing requires only ordinary cleaning.

Painted casings should be checked regularly and surfaces repaired if necessary.

6.3 Rotor

From the factory, the rotor is supplied with blades adjusted to the pitch corresponding to the desired operating point (pressure and airflow) at the fan speed in

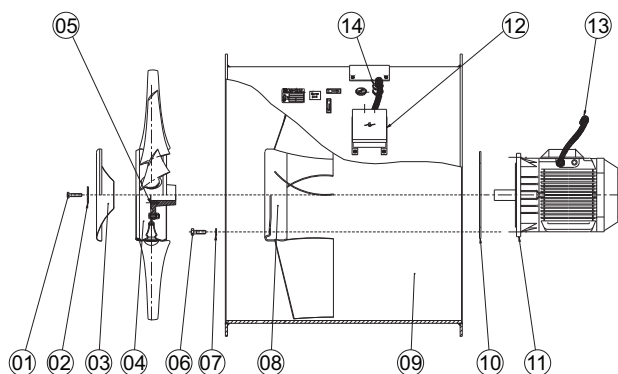


Figure 7. Dismounting and mounting of axial flow fan

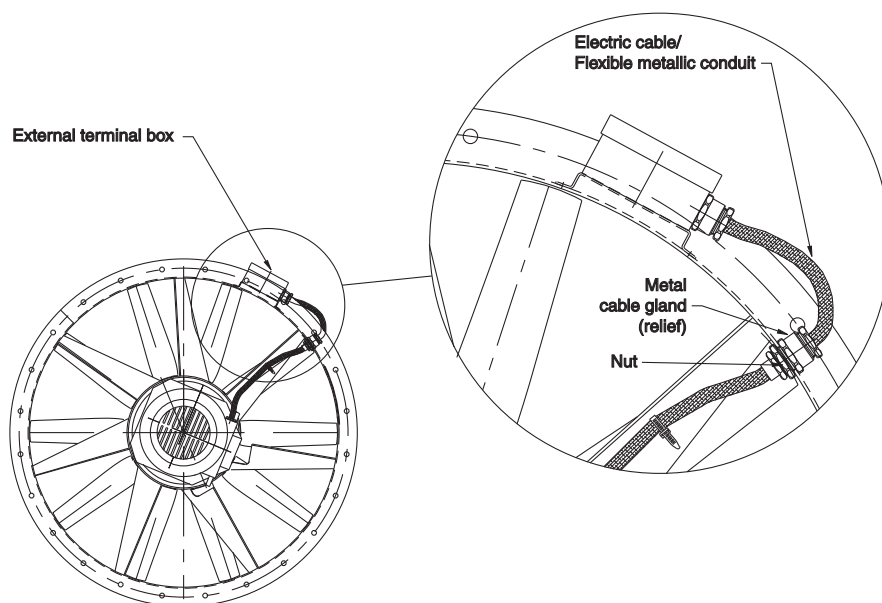


Figure 8. Electric connection through fan casing to external terminal box

question. To ensure vibration free operation, the rotor has been carefully balanced in this position.

Vibrations occurring during operation will normally be due to accumulations of dust or dirt on the hub and blades, and will disappear after cleaning. If vibrations persist, the fans should be taken off-line and expert assistance called immediately, as continued vibrations shorten the service life of the motor bearings.

6.4 Motor

Refer to the motor maintenance instructions for service information. Usually, motor bearings are the most exposed parts and require maintenance as described in the aforementioned instructions.

6.5 Dismounting of motors

Prior to commencing the work, switch off the current and disconnect the motor cable. Next, dismount any ducts on the fan inlet and outlet sides. Remove the rotor centre screw (fig. 7, item 01), centre disc (item 02) and hub cover (item 03). Dismount the rotor by means of a puller fastened in the two threaded holes of the hub boss or threaded holes for puller (item 05).

Detach the motor by loosening the screws in the motor shell (item 06). Now the motor (item 11) and motor flange (item 10) can be removed.

In dismounting and disassembling the fan be careful not to expose the individual parts to shocks etc. likely to damage

the motor bearings or other fan components.

6.6 Mounting of motors

After servicing, when remounting the motor, take care that the motor flange (fig. 7, item 10) is correctly located and that the motor shaft is concentrically placed in the fan casing before tightening the bolts (item 06).

Mount the rotor (item 04) on the motor shaft by means of a tool fastened in the threaded hole of the motor shaft.

Fix the rotor hub to rest against the motor shaft collar.

Check the blade clearance with a feeler gauge. The clearance between the blade tips and fan casing must be the same throughout the circumference. If necessary, adjust the motor location in the suspension arrangement.

Fan size ØD [mm]	Clearance [mm]	
	300 °C	400 °C
400	1.7	2.3
500	1.8	2.8
560	2.0	2.9
630	2.3	3.4
710	2.7	4.0
800	3.1	4.6
900	3.7	5.1
1000	4.2	5.3
1120	4.6	5.8
1250	5.1	6.8
1400	5.8	7.8
1600	6.6	8.3

Table 2. Minimum blade tip clearance

Now mount centre screw (item 01), centre disc (item 02), and hub cover (item 03). Replace lock washers or lock nuts during fan assembly. Finally connect motor cable (item 13) in terminal box (item 12) and ducts, if any.

To start the fan follow the procedure described in section 5. Start of operation.

6.7 Blade pitch adjustment

The blade pitch has been adjusted in the factory with a special tool (mounting fixture) to deliver the performance required by the customer on delivery.

If the fan performance is required to be changed it is possible to change the blade pitch. It requires knowledge of the motor load and the max. permissible blade pitch on the graph as related to the motor rating (in case of blade pitch increase). Contact Novenco before any such adjustment of the blade pitch. Novenco can supply special tools for blade pitch adjustment and instructions for rotor balancing. The brochure "Blade Angle Tool" is available on request.

6.8 Fault localisation

In case of breakdowns, the following checklists should be completed, before calling for service.

Lacking performance

- Damper closed
- Ducts clogged
- Supply fan stopped
- Motor defective
- Motor disconnected
- Wrong direction of rotation

Noise and vibrations

- Motor bearings defective
- Rotor out of balance
- Rotor worn or damaged
- Bolts or components loose
- Rotor blades have different pitch angles

Fans operating in the stalling area, may result in breakdowns.

7. Inspection and test

It is recommended to test and inspect the NovAx ACN-ARN fans at regular intervals with regard to operability and operating conditions.

Fans approved for smoke control must be tested and inspected four times a year.

Smoke exhaust fans that double as fans for standard ventilation, must be tested every six months, if these are started at least once a day - for example as a result of connection to a time switch or carbon monoxide alarm.

Extent of inspection

- Measure power consumption
- Measure vibrations on fan casing
- Check torques for fixing bolts and correct if necessary
- Visual inspection of rotor, fan casing and electric connection
- Cleaning
 - inside with pressure air
 - outside with water

It is recommended to enter all values and observations in a log.

8. Sound

The sound generation of the fans depends on installation and operating conditions, which means that no general sound generation data can be given. Refer to the product catalogue, Novenco AirBox computer program and the technical fan specifications.

9. Safety

The NovAx axial flow fans must be installed according to Novenco's, the current and 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 if safety regulations have been changed and if the installation needs revising.
- Consider additional measures to improve the safety of the installation. For example, by mounting wire guards on inlet and outlet.

10. Spare parts

Contact Novenco for information about and ordering of spare parts.

11. Patents and trademarks

Novenco®, 诺文科, 诺万科 and 诺克 are registered trademarks of Novenco A/S or Novenco Marine & Offshore A/S. AirBox™ and NovAx™ are trademarks of Novenco Building & Industry A/S.

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12. Quality management

Novenco Building & Industry A/S is ISO 9001 certified. This means that all fans are inspected and tested, before leaving the production.

13. Warranty

Novenco provides according to law a standard 12 months warranty from the product is sent from the factory. The warranty covers materials and manufacturing defects. Wear parts are not covered. Extended warranty can be agreed upon.

14. Declaration of conformity

The Machinery Directive 2006/42/EU, part 2, A

Novenco Building & Industry A/S
Industrivej 22
4700 Naestved
Denmark

hereby declares that axial flow fans type ACN smoke 400-1600 and ARN smoke 900-1600 have been manufactured in conformity with the Council's directives 2006/42/EU regarding mutual approximation of the machinery laws of the member states.

Directives

- Machinery 2006/42/EU
- ECO design 2009/125/EU
- ECO energy labelling 2010/30/EU
- EMC 2014/30/EU
- LVD 2014/35/EU

Applied standards

EU 327/2011:

Fans driven by motors with electric power between 125 W and 500 kW

EN ISO 12100:2011:

- Safety of machinery
- General principles for design
- Risk assessment and risk reduction

EN 12101-3:

Smoke and heat control systems - Part 3, class 1

EN ISO 13857:

Safety of machinery - Safety distances

EN 60204-1:

Safety of machinery - Electrical equipment of machines Part 1: General Requirements

EN 61000-6-2:

EMC - Part 6-2: Generic standards - Immunity for industrial environments

EN 61000-6-3:

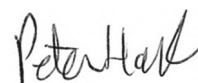
EMC - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments

EN 61800-3, class C2:

Adjustable speed electrical power drive systems, EMC requirements and specific test methods

It is conditioned that Novenco Building & Industry A/S' instructions for installation and maintenance have been followed.

Naestved, 01.05.2018



Peter Holt

Technical director

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