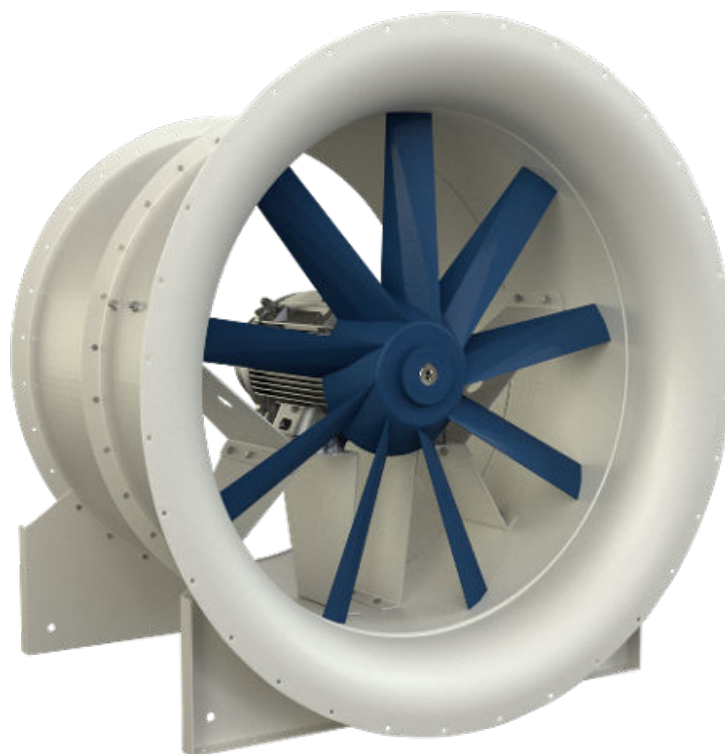




# Axial fans

**AXO/BVAXO; AXN/BVAXN; ZAXN/  
BVZAXN**

Fire gas versions checked according to EN 12101-3



**TROX<sup>®</sup> TECHNIK**

The art of handling air

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05/2023

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## 1 General

### 1.1 About this manual

This manual enables safe and efficient working with the unit. The manual must be kept near the unit to be available for use at all times. It is essential that these individuals read and fully understand this manual before starting any work. The basic prerequisite for safe working is to comply with the safety notes and all instructions in this manual. The local regulations for health and safety at work and general safety regulations also apply. Illustrations in this manual are mainly for information and may differ from the actual unit design.

In addition to this manual, the operating manuals of the integrated components in the appendix also apply. The instructions in the manuals – particularly safety notes – must be observed!

### 1.2 Explanation

#### Safety instructions

Symbols are used in this manual to alert readers to areas of potential hazard. Signal words express the degree of the hazard.

Comply with all safety instructions and proceed carefully to avoid accidents, injuries and damage to property.

#### **DANGER!**

Imminently hazardous situation which, if not avoided, will result in death or serious injury.

#### **WARNING!**

Potentially hazardous situation which, if not avoided, may result in death or serious injury.

#### **CAUTION!**

Potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

#### **EXPLOSION PROTECTION!**

*Failure to comply with these notes leads to loss of explosion protection and may result in serious injury and death.*

#### **NOTICE!**

Potentially hazardous situation which, if not avoided, may result in property damage.

#### **ENVIRONMENT!**

Environmental pollution hazard.




#### Tips and recommendations



*Useful tips and recommendations as well as information for efficient and fault-free operation.*





#### Specific safety notes

The following symbols are used in safety notes to alert you to specific hazards:

Warning signs	Type of danger
	Warning – high-voltage.
	Warning – suspended load.
	Warning – danger zone.

#### Other markers

The following markers are used to highlight instructions, results, lists, references and other elements in this manual:

Labelling	Explanation
 1., 2., 3. ...	Step-by-step instructions
	Results of actions
	References to sections in this manual and to other applicable documents
	Lists without a defined sequence
[Push button]	Control elements (e.g. push buttons, switches) or display elements (e.g. LEDs)
'Display'	Screen elements (e.g. buttons or menus)

### 1.3 Limitation of liability

The information in this manual has been compiled with reference to the applicable standards and guidelines, the state of the art, and our expertise and experience of many years.

The manufacturer does not accept any liability for damages resulting from:

- Non-compliance with this manual
- Incorrect use
- Operation or handling by untrained individuals
- Unauthorised modifications
- Technical changes
- Use of non-approved replacement parts



*Please observe our commissioning and maintenance instructions in Chapters ↪ 6 'Installation' on page 26 and ↪ Chapter 10 'Maintenance' on page 45.*

The actual scope of delivery may differ from the explanations and illustrations provided in this manual for special versions, the use of additional order options or as a result of recent technical changes. The obligations agreed in the order, the general terms and conditions, the manufacturer's terms of delivery, and the legal regulations in effect at the time the contract is signed shall apply. We reserve the right to make technical changes.

## 1.4 Copyright

This manual is protected by copyright and is exclusively for use in your company by authorised personnel. Violators will be held liable for any damage. The right to further claims remains reserved.

## 1.5 Replacement parts



### WARNING!

#### **Safety risk caused by incorrect replacement parts!**

Counterfeit or faulty replacement parts may affect safety, and cause damage, malfunctions or total failure.

Therefore:

- Only use original replacement parts provided by the manufacturer.

Buy replacement parts from an authorised supplier or from the manufacturer. See address on page 2.

The lists of replacement parts can be found in Chapter ↪ Chapter 12.2 'BVAX replacement parts' on page 50.

## 1.6 Liability for defects

The terms and conditions of the liability for defects are described in *Section VI* of the general delivery and payment terms. The provisions can be viewed on our website at [www.trox-xfans.de](http://www.trox-xfans.de) under "Delivery and payment terms".

## 1.7 Customer service

Our customer service team is available to provide any technical information. Information about the responsible contact person is always accessible over the phone, by fax, by email or over the Internet; see the manufacturer's address on page 2. We offer the following services:

- Assembly, commissioning and maintenance of the fans
- Measurement, analysis and evaluation of all the data required for operation (e.g.: pressure, volume, sound, vibrations)
- Operational balancing
- Replacement parts service
- Individual advice and help placing orders

## 2 Safety

### 2.1 Introduction

This section provides an overview of all the important safety issues for the best possible protection of personnel as well as for safe and fault-free operation. Failure to comply with the instructions and safety notes listed in this manual can lead to serious hazards.

### 2.2 System owner's responsibility

The unit is intended for commercial use. The system owner is therefore subject to the legal obligations of occupational health and safety regulations. In addition to the safety notes in this manual, the applicable regulations for safety, accident prevention and environmental protection must also be complied with. In particular:

- The system owner must be aware of the applicable occupational health and safety regulations and carry out a risk assessment to determine any additional hazards that may exist or result from the specific working conditions at the installation location of the unit. The system owner has to create operating instructions for the unit that reflect the results of this risk assessment.
- The system owner must ensure, throughout the unit's entire operating period, that the operating instructions they create comply with the applicable standards and guidelines and must adapt them as required.
- The system owner must clearly regulate and define the responsibilities for assembly / installation, operation, maintenance and cleaning.
- The system owner has to ensure that all individuals who handle or use the unit have read and understood this manual.  
The system owner must regularly provide training for the personnel and inform them of any dangers.
- The system owner must provide the employees with the required personal protective equipment.

The system owner is also responsible for ensuring that the unit is always in a technically perfect condition. The following therefore applies:

- The system owner must ensure that the maintenance intervals specified in this manual are observed.
- The system owner must have all safeguards tested regularly to ensure that they are functional and complete.

### 2.3 Personnel requirements

#### 2.3.1 Qualifications



#### **WARNING!**

#### **Danger of injury due to insufficiently qualified individuals!**

Incorrect use may cause considerable injury or damage to property.

Therefore:

- Only specialist personnel must carry out work.

The following degrees of qualification are required for the work described in the operating manual:

#### **Instructed person**

The instructed person has been instructed by the system owner with regard to the tasks delegated to them and potential hazards in the event of inappropriate behaviour.

#### **Skilled qualified electrician**

Skilled qualified electricians are individuals who have sufficient professional or technical training, knowledge and actual experience to enable them to work on electrical systems, understand any potential hazards related to the work under consideration, and recognise and avoid any risks involved.

The qualified electrician is trained especially for the field in which they work and is familiar with the relevant standards and regulations.

#### **Specialist personnel**

Specialist personnel are individuals who have sufficient professional or technical training, knowledge and actual experience to enable them to carry out their assigned duties, understand any potential hazards related to the work under consideration, and recognise and avoid any risks involved.

Only persons who can be expected to perform their work reliably are acceptable as personnel. Individuals whose reaction time is delayed due to alcohol, drugs or other medication must not carry out any work.

- The age-specific and occupational regulations applicable at the operation site must be observed when appointing personnel.

### 2.3.2 Unauthorised persons

#### **WARNING!**

##### **Danger for unauthorised persons!**

Unauthorised persons who do not fulfil the requirements specified here are usually not aware of the dangers in the work area.

Therefore:

- Keep unauthorised persons away from the work area.
- Instruct these persons to leave the hazardous area or work area.
- Stop work while unauthorised persons are present in the work area.

### 2.4 Correct use

#### **The unit is designed and constructed only for the intended use described here:**

- The ventilation fan is only designed to convey normal, dust-free and conditioned air, and other non-aggressive, non-explosive gases.
- The smoke exhaust fan is also designed to convey fire gases in accordance with its temperature and time specifications.  
**Replace fan after use in the event of a fire!**
- The explosion-proof fan is designed to convey explosive media and/or for installation in potentially explosive atmospheres according to its labelling.

Other intended uses approved by the manufacturer and derived from the optional fan equipment are detailed in the customer specifications.

#### **WARNING!**

##### **Danger due to incorrect use!**

Any use that extends beyond the correct use and/or different use of the unit can lead to hazardous situations.

Therefore:

- Only use the unit for its correct use.
- Strictly comply with all of the information in this operating manual.

Claims of any type for damages resulting from incorrect use will not be accepted.  
The system owner is solely responsible for all damages resulting from incorrect use.

### 2.5 Explosion protection

#### **ATEX Product Directive 2014/34/EU (ATEX 95)**

The aim of the Directive is to protect individuals who work in potentially explosive atmospheres. The Directive contains the essential health and safety requirements that the manufacturer must observe and that must be verified by means of appropriate conformity assessments. Since 30 June 2003, only units, components and protective systems which comply with the ATEX Product Directive 2014/34/EU can be used.

The deliverable version options are highlighted below:

#### **Equipment groups**

Equipment group	For use in....
I	Units for use in mining
II	Units for use in the other areas

#### **Classification**

Zone	Category	EPL	Safety
0	1	Ga	Very high level of safety
1	2	Gb	High level of safety
2	3	Gc	Normal operation

#### **Atmosphere**

**G = Gases**

**D = Dusts**

#### **Explosion group (gas group)**

Gases and vapours are split into three explosion groups (IIA, IIB and IIC) based on their particular flammability. The danger increases from explosion group IIA to IIC. (The higher explosion group includes the lower ones.)



### Temperature class

Six temperature classes (T1 to T6) have been defined for the permissible surface temperatures. Certain combustible gases and vapours can be assigned to these temperature classes based on the relevant ignition temperatures.

The following table provides an overview of the maximum permissible surface temperatures on the units and some associated gases that apply to the temperature classes.

Group	Temperature class (surface temperature)					
	T1 (<450°C)	T2 (<300°C)	T3 (<200°C)	T4 (<135°C)	T5 (<100°C)	T6 (<85°C)
I	Methane					
IIA	Ammonia methanol	n-butyl alcohol n-butane	Benzine diesel / heating oil	Acetaldehyde		
IIB	Town gas	Ethylene alcohol, eth- ylene		Ethyl ether		
IIC	Hydrogen	Acetylene				Carbon disul- phide

### Correct use

Fans designated as “explosion-proof” are subject to the legal requirements in force with regard to the Explosion Protection Regulation and Directive 2014/34/EU. They are part of equipment group II and are suitable for conveying class IIA and IIB gases from zones 1 and 2. The fans are also suitable for installation in an explosive atmosphere in the above-mentioned zones.

### Labelling

In accordance with Directive 2014/34/EU – known as ATEX 95 – only units that conform to this Directive can be used in potentially explosive atmospheres since 1 July 2003.

The fans are suitable for conveying potentially explosive media and/or for installation in rooms with potentially explosive media.

Special provisions according to A ‘Commissioning report’ on page 54 and B ‘Maintenance report’ on page 56 must be observed during commissioning and maintenance.

### EXPLOSION PROTECTION!

Unit components that comply with Directive 2014/34/EU include additional information on the rating plate.

II 2G Ex h IIB T4 Gb

Fig. 1: Marking according to ATEX

- CE mark
- Unit is certified for Ex area.
- II Equipment group (not for use in mining)
- 2G Unit category and atmosphere
- h Type of protection (non-electrical)
- IIB Gas group
- T4 Temperature class
- Gb EPL (equipment protection level)

### Operating conditions

#### WARNING!

The inlet temperature of the flow medium must be between -20°C and +40°C. The manufacturer must be consulted if higher temperatures are required.

#### WARNING!

The maximum operating speed specified on the fan rating plate must be observed.



## Vibration monitoring



*It is recommended that the system owner install a permanent vibration monitoring system to prevent sparks from being generated as a result of the impeller striking against parts of the casing following imbalance during operation. A permanent vibration monitoring system is obligatory if mist or dust is being conveyed.*

### EXPLOSION PROTECTION!

*Ignition sources, such as sparks, naked flames and hot surfaces, can lead to explosions in potentially explosive atmospheres. The following therefore applies to all work on units in the Ex area:*

- *Get written permission before you start the work.*
- *Only perform work if there are no dust deposits or a potentially explosive atmosphere.*
- *Use only tools that have been approved for use in areas with potentially explosive atmospheres.*

*Additionally:*

- *It must be ensured that sufficient cooling air is supplied to the fan drive motor at all times.*
- *Motors with a cover must be used if fans with a vertical motor shaft are installed.*
- *Servicing and maintenance work on explosion-proof fans must only be carried out by qualified personnel with the relevant explosion protection qualifications using original replacement parts*

*Failure to comply with these notes leads to loss of explosion protection and may result in serious injury and death.*

### EXPLOSION PROTECTION!

*If a component or device is to be installed in a system intended for use in potentially explosive atmospheres according to 2014/34/EU, the system owner has to ensure compliance of the entire system with that directive. Non-compliance may lead to an explosion.*

## 2.6 Personal protective equipment

Personal protective equipment must be worn for any work in order to reduce health or safety hazards to the minimum.

- Wear the protective equipment necessary for the respective work for as long as the work takes.
- Observe instructions relating to personal protective equipment that are displayed in the work area.

Special protective equipment is required when carrying out specific work. This is referred to separately in the individual chapters of this manual.

### Hearing protection



To prevent hearing damage.

### Protective clothing



is close fitting, with low tear resistance, close fitting sleeves, and no projecting parts. It prevents entanglement in moving machinery. Do not wear rings, chains or any other jewellery.

### Protective gloves



Protective gloves are used to protect hands from friction, abrasions, punctures, deep cuts and direct contact with hot surfaces

### Safety helmet



for protection from falling and flying parts and materials.

### Safety shoes



for protection from heavy, falling parts and from slipping on slippery surfaces.

## 2.7 Specific hazards

### Electric current

**DANGER!**

**Danger of death due to electric current!**

Danger of electric shock! Do not touch any live components! Damaged insulation or damaged parts are a life threatening hazard.

- Have work on the electrical system carried out only by skilled qualified electricians.
- Have work on the electrical system carried out only by skilled qualified electricians.
- If the insulation is damaged, disconnect the power supply immediately and have the insulation repaired.
- Before you start working on electric systems and equipment, switch off the supply voltage and secure it against being switched on accidentally. Comply with the 5 safety rules:
  - Disconnect.
  - Secure it against being switched on accidentally.
  - Ensure that no voltage is present.
  - Connect to the earth; short circuit connection.
  - Either cover nearby parts that carry a voltage or install barriers.
- Do not bypass or disable any circuit breakers. Be sure to maintain the correct current rating when you replace a circuit breaker.
- Ensure that live parts do not come into contact with moisture. Moisture can cause a short circuit.

### Noise

**WARNING!**

**Hearing damage due to noise!**

The noise level in the work area can cause severe hearing damage.

- Always wear hearing protection while working.
- Only remain in the hazardous area if absolutely necessary.

### Moving components

**WARNING!**

**Risk of injury due to moving components!**

Moving components can cause serious injuries.

- Do not reach into or handle moving components during operation.
- Never open covers during operation.
- The fan does not stop immediately! Check that no components are moving before you open the covers.
- Wear tight-fitting clothing with low tear resistance in the hazardous area.

### Rotating parts

**WARNING!**

**Risk of injury from rotating parts!**

Rotating parts in the fan can cause serious injuries.

- Do not reach into or handle the moving impeller wheel during operation.
- Do not open covers and maintenance covers during operation.
- Ensure that the impeller wheel is not accessible during operation.
- The fan does not stop immediately! Ensure that none of the components are still moving before opening the covers for maintenance purposes.
- Switch off the unit and secure it against being switched back on again before starting any work on moving fan components. Wait until all parts have come to a standstill.

### Vibrations

**WARNING!**

**Risk of injury due to strong vibrations!**

Strong vibrations can result in serious injury and chronic health impairments in the long term. The source of the vibration can be decoupled from the surrounding area using a vibration damper.

- Do not deactivate the vibration damper.
- Do not remain in the vibrating area during operation.

### Suspended loads

**⚠ DANGER!**

**Danger of death due to suspended loads!**

Falling loads may cause serious injury or death.

Therefore:

- Never walk under suspended loads.
- Only move loads under supervision.
- Observe the specifications for the intended lashing points.
- Do not attach the lifting gear to protruding machine parts or lugs on attached components
- Ensure that the lifting gear is secure.
- Only use approved hoisting devices and lifting gear with with sufficient load-bearing capacity.
- Do not use any frayed or worn ropes and belts.
- Do not place ropes or belts near sharp edges or corners; do not knot or twist.
- Place the load on the ground before leaving the workplace.

**i IMPORTANT!**

For further information on the position of the safeguards, see Chapter 4 'Parts and function' on page 18.

### Isolator (optional)



Fig. 2: Isolator

Some fans are equipped with an isolator.

### Falling materials

**⚠ WARNING!**

**Risk of injury due to falling materials!**

During operation, material can fall in an uncontrolled manner or be ejected and cause serious injuries.

- Do not enter the hazardous areas during normal operation.
- Wear an industrial safety helmet, safety shoes and protective clothing when entering the hazardous area (e.g. during setting mode).

**⚠ WARNING!**

**Danger of death due to uncontrolled reactivation!**

Uncontrolled reactivation can lead to serious personal injury or death!

Therefore:

- Before reactivation, ensure that all of the safeguards are assembled and fully functional.
- Ensure that nobody is in the hazardous area.

## 2.8 Safeguards

**⚠ WARNING!**

**Risk to life from defective safeguards!**

Safety is only assured if the safeguards are intact.

Therefore:

- Before starting work, check whether the safeguards are fully functional and installed correctly.
- Never deactivate safeguards.
- Ensure that safeguards such as the emergency stop push-button, trip cords, etc., are accessible at all times.

### Secured isolator



Fig. 3: Secured isolator

The isolator can be locked in the “0” position with a padlock to prevent reactivation.

### Additional smoke exhaust fan option

The isolator can also be locked in the “1” position with a padlock to prevent deactivation in order to guarantee the smoke extract function.

#### **DANGER!**

##### **Danger of death due to impermissible activation and deactivation!**

Individuals can enter the hazardous area if the isolator has been locked with a padlock to prevent activation. Activation could cause life-threatening injuries to these individuals.

If the fan has been secured with a padlock to prevent it from being deactivated, it can be equipped with an automatic start-up feature in the event of a fire. Deactivation ensures that the fan is not ready for operation in the event of a fire and cannot transport fire gases.

Therefore:

- Never remove the padlock without authorisation.
- Before removing the padlock, ensure that there are no more individuals in the hazardous area.

### Integration in an emergency stop concept required

The unit is designed for use within a system. It does not have its own control and there is no autonomous emergency stop function.

Before the unit is started up, install emergency stop equipment for the unit and connect it to the system control's safety chain.

**This does not apply to smoke exhaust fans.**

Connect the emergency stop equipment in such a way that any hazardous situations for individuals and property are excluded in the event of the power supply being interrupted or the power supply being activated following an interruption.

The emergency stop equipment must be freely accessible at all times.

## 2.9 Behaviour in the event of hazardous situations or accidents

### Preventive measures

- Always be prepared for accidents or fire!
- Keep first aid equipment (first aid kit, blankets, etc.) and fire extinguishers close at hand.
- Familiarise personnel with accident reporting, first aid and rescue equipment.
- Keep access paths for rescue vehicles clear.

### Measures in the event of accidents

- Trigger an emergency stop immediately, and put the isolator into the “0” position if necessary.
- Implement first aid measures.
- Rescue individuals from the hazardous area.
- Inform the responsible person at the operation site.
- Notify the emergency services.
- Clear access paths for rescue vehicles.

## 2.10 Labelling

The following symbols and signs are usually found in the work area. They apply to the very location where they are found.

#### **WARNING!**

##### **Risk of injury due to illegible symbols!**

Over time, stickers and signs can become dirty or otherwise illegible.

Therefore:

- Ensure that all of the safety, warning and operating information is clearly legible.
- Replace illegible signs or stickers immediately.



*Fig. 4: Terminal box*

The ( Fig. 4 /1) “Danger of death due to electric current” symbol is attached to the terminal box.

## 3 Technical data

### 3.1 Labelling

**i IMPORTANT!**

By selecting the design version, each axial fan from the AX and BVAX series is adjusted to the requirements at the operation site. Additional options available upon request.

#### 3.1.1 Type codes for axial fans

The type code is a distinctive and unique product designation. This code helps you find the product's technical data in the TROX X-FANS catalogue or product configurator.

**BV AX N 8/ 56/ 900/ M-D**

Fig. 5: Type code for axial fan

- BV BV = smoke exhaust fan (fire gas), Z = double (two series-connected fan units)
- AX Axial fan (standard)
- N N = with outlet guide vanes, O = without guide vanes
- 8/ Number of blades
- 56/ Hub ratio
- 900/ Size
- M-D Types of actuator (M = motor coupled directly, R = belt drive) – airflow direction (D = motor in outlet)

#### 3.1.2 Additional labelling

The temperature classification of smoke exhaust fans (BV) is based on EN 12101-3:

- F200 = temperature of 200°C, minimum operating time of 120 minutes
- F300 = temperature of 300°C, minimum operating time of 60 minutes
- F400 = temperature of 400°C, minimum operating time of 90/120 minutes
- F600 = temperature of 600°C, minimum operating time of 60 minutes
- F842 = temperature of 842°C

### 3.2 Connection values

The connection values are dependent on the type of electric motor that is installed (electric motor's rating plate, see Fig. 13 ).

### 3.3 Noise emission values

The fans' characteristic noise values are specified in the characteristic curve sheets in the catalogue / product configurator. The characteristic values are dependent on the operating point.

### 3.4 Series

#### 3.4.1 Series - AXO / BVAXO

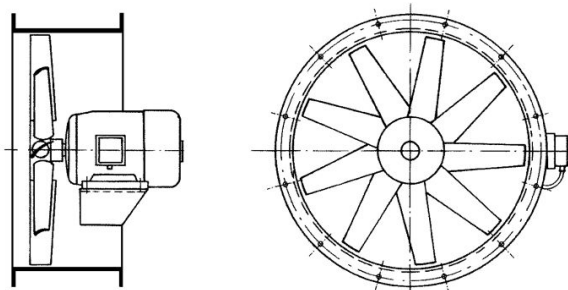


Fig. 6: AXO / BVAXO series – An extension duct is required depending on the size of the electric motor

The **AXO** type is a special axial fan variant. This series is used for low to medium total pressure differences.

The **BVAXO** is a special axial fan variant suitable for use in temperatures up to 300°C. This series is used for low to medium total pressure differences.

#### 3.4.2 Series - AXO / BVAXO 9/27

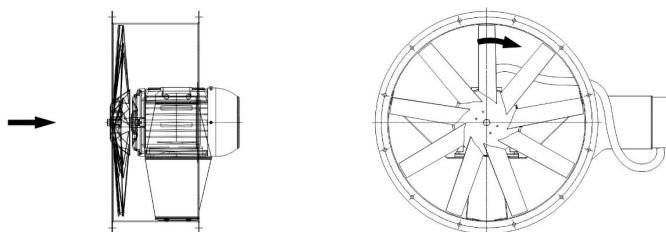


Fig. 7: AXO 9/27 – BVAXO 9/27 series – An extension duct is required depending on the size of the electric motor

The **AXO 9/27** type is a special axial fan variant. This series is used for low to medium total pressure differences.

The **BVAXO 9/27** is a special axial fan variant suitable for use in temperatures up to 400°C. This series is used for low to medium total pressure differences.



### 3.4.3 Series - AXO / BVAXO 10/50

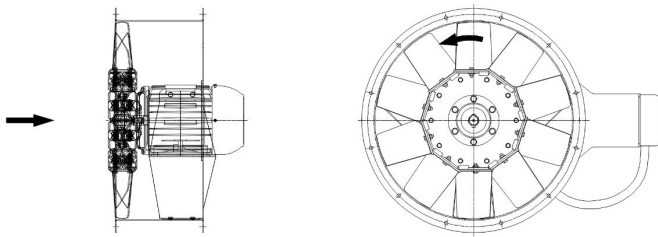


Fig. 8: AXO 10/50 – BVAXO 10/50 series – An extension duct is required depending on the size of the electric motor

The **AXO 10/50** type is a special axial fan variant. This series is used for low to medium total pressure differences.

The **BVAXO 10/50** is a special axial fan variant suitable for use in temperatures up to 400°C. This series is used for low to medium total pressure differences.

### 3.4.4 Series AXN / BVAXN

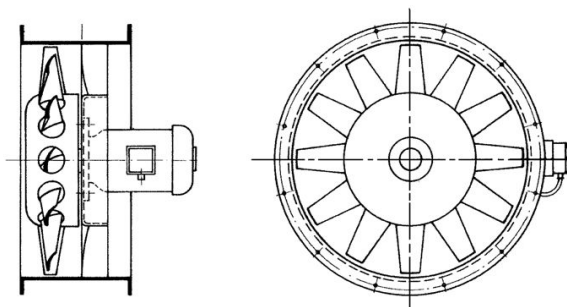


Fig. 9: AXN / BVAXN series – An extension duct is required depending on the size of the electric motor

The **AXN** type is a special axial fan variant. This series has outlet guide vanes and is suitable for medium to high total pressure differentials.

The **BVAXN** is a special axial fan variant suitable for use in temperatures up to 400°C. This series has outlet guide vanes and is suitable for medium to high total pressure differentials.

### 3.4.5 Series - ZAXN / BVZAXN

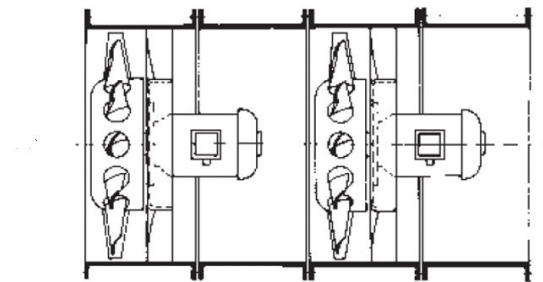


Fig. 10: ZAXN / BVZAXN series – An extension duct is required depending on the size of the electric motor

Two-stage axial fans of the **ZAXN** series (with outlet guide vanes) are used for garage exhaust air in large garages, but also as ventilation fans to overcome larger total pressure differences.

Two-stage axial fans of the **BVZAXN** series (with outlet guide vanes) for temperatures up to 400°C are used for garage exhaust air in large garages, but also as ventilation fans to overcome larger total pressure differences.



## 3.5 Operating conditions

### 3.5.1 Series

#### AXO / AXN series <sup>1)</sup>

Data	Value	Unit
Min./max. flow medium temperature	-20/+60	°C
Min./max. ambient temperature	-20/+60	°C
Max. operating time according to DIN EN 60034-1	24	hrs/day
Smoke extract	None	-
Installation location	Horizontal / vertical	-

<sup>1)</sup> Other values optional (see customer specifications)

#### BVAXO / BVAXN series

Data	Value	Unit
Min./max. flow medium temperature	-20/+60	°C
Min./max. ambient temperature	-20/+60	°C
Max. operating time according to DIN EN 60034-1	24	hrs/day
Smoke extract	<sup>2)</sup>	-
Installation location	Horizontal / vertical	-

<sup>2)</sup> Temperature/time category according to EN 12101-3 (see [Chapter 3.1.2](#) 'Additional labelling' on page 14)

#### ATEX

Data	Value	Unit
Min./max. flow medium temperature	-20/+40 <sup>3)</sup>	°C
Min./max. ambient temperature	-20/+40	°C
Max. operating time	24	hrs/day
Smoke extract	None	-
Installation location	Horizontal / vertical	-

<sup>3)</sup> Other values upon request

### 3.6 Rating plate




 <p><b>TROX® TECHNIK</b> The art of handling air</p>		TROX X-FANS GmbH Heinz-Trox-Straße 1 D-36251 Bad Hersfeld +49 (0)6621 950-0 E-Mail: info@trox-llt.de Made in Germany		
		job number:	123456789 12345678901234567890	year
item number:	123456789012345678901234		01/17	
type designation:	123456789012345678901234567890			
$q_v$	100.000 / 75.000 / 50.000	m <sup>3</sup> /h	$\Theta$	-25 – 60 °C
$p_f$	1.500 / 1.250 / 1.000	Pa	$\Theta_a$	50 °C
$p_{st}$	1.500 / 1.250 / 1.000	Pa	$\rho$	1,2 kg/m <sup>3</sup>
$P_f$	55,0 / 32,0 / 15,0	kW	$m$	500 kg
$N$	3.000 / 1.500 / 1.000	rpm	$N_{max}$	3.000 rpm
$\eta_e / \eta_s$	0,75 / 0,66		$SFP$	1234 Ws/m <sup>3</sup>
installation category (ISO 5801)	B		$F$	75 / 10 N
$\eta_e / \eta_s$ (opt.)	0,80 / 0,70		$F_{rev}$	45 / 5 N
$\eta_e / \eta_s$ (ERP2015)	0,80 / 0,70		$VME$	0,52 / 0,25 - / m <sup>2</sup>
	2014/35/EU, 2014/30/EU, 2006/42/EC, 2011/65/EC			
	ATEX 2014/34/EU  II 2/2 G cb IIB+H2 T4			
	operation only with frequency converter			
Note				

Fig. 11: Fan's rating plate

$q_v$	Volume flow rate
$p_f$	Fan pressure
$p_{st}$	Fan pressure, static
$n$	Operating speed
$\rho$	Fan inlet density
$P_r$	Nominal power (crankshaft)
$SFP$	Specific fan powers (Pelectr/q)
ISO 5801	Installation orientation in accordance with ISO 5801 (A, B, C or D)
$\eta_e / \eta_s$	Efficiency at operating point (total/static)
$\eta_e / \eta_s$ opt.	Efficiency at best operating point (total/static)
$\eta_e / \eta_s$	Minimum efficiency according to the Eco-design Directive (EU) 327/2011 (total/static)
$n_{max}$	Maximum permitted mechanical speed
$VME$	With volume flow rate measuring unit (correction factor/surface area)
$\Theta$	Flow medium temperature (min/max)
$\Theta_a$	Ambient temperature
$m$	Weight
$FL$	Forward movement
$F_{rev}$	Backward movement

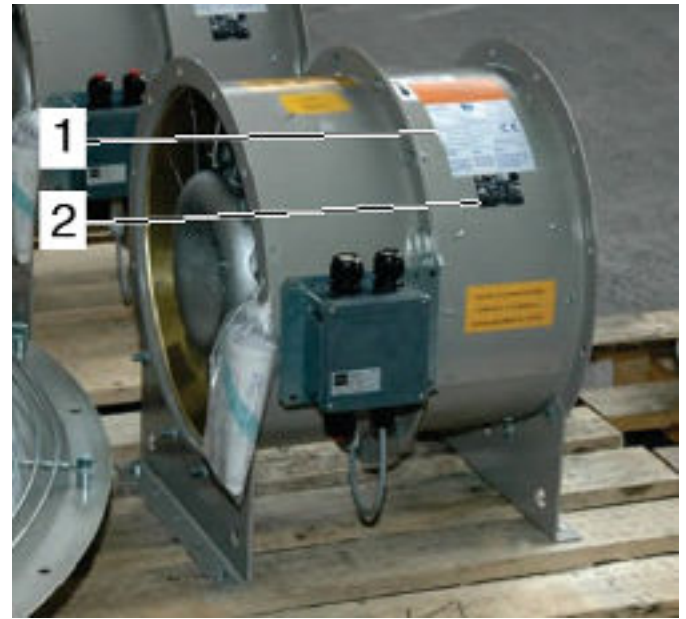


Fig. 12: Arrangement of the rating plates on axial fans

The rating plate of the explosion-proof fan also includes the following information:

- Explosion protection mark
- Category

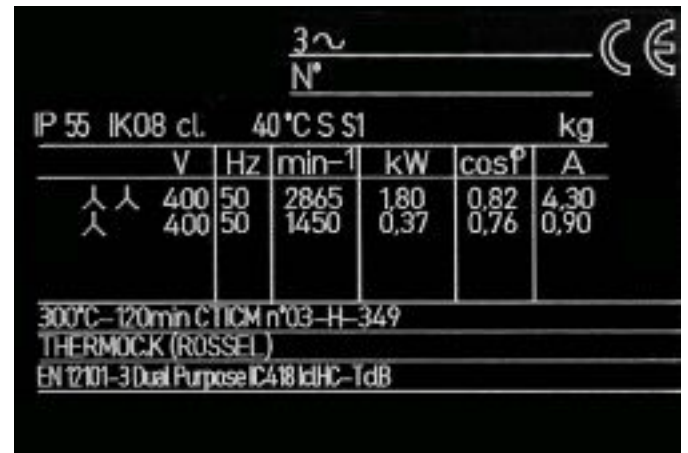


Fig. 13: Electric motor's rating plate

The electric motor's rating plate ( Fig. 13 , Fig. 12 /2) is located on the outside. For information on this rating plate, refer to the electric motor operating manual.

## 4 Parts and function

### 4.1 Overview

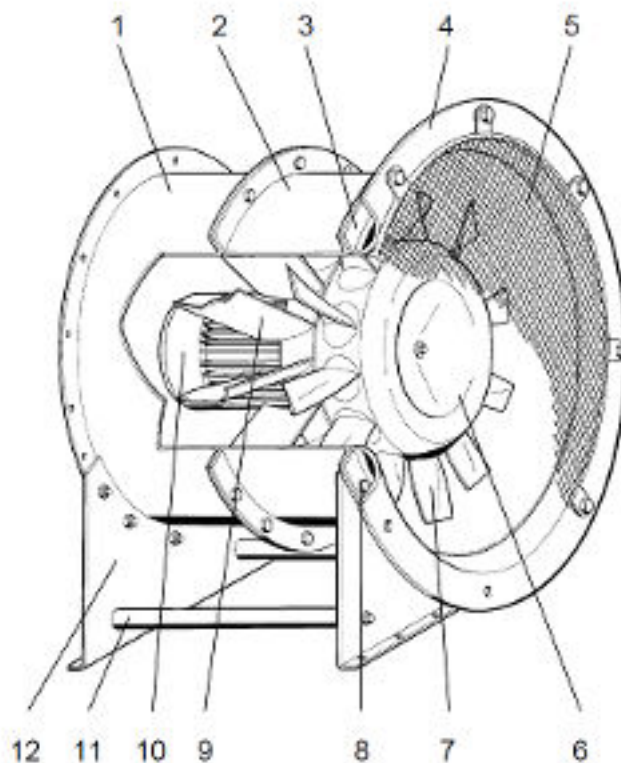


Fig. 14: Structure of the axial fan

- |   |                              |    |                          |
|---|------------------------------|----|--------------------------|
| 1 | Extension duct (accessories) | 7  | Impeller blade           |
| 2 | Duct casing                  | 8  | Flange holes             |
| 3 | Flange                       | 9  | Outlet guide vanes (AXN) |
| 4 | Bellmouth                    | 10 | Electric motor           |
| 5 | Cover grille                 | 11 | Threaded pipe            |
| 6 | Impeller hub                 | 12 | Mounting foot            |

Due to the rotating impeller ( Fig. 14 /6+7), the axial fan intakes air via the bellmouth ( Fig. 14 /4) or from a pipe on the intake side and conveys it to the outlet side in an axial direction via the electric motor ( Fig. 14 /10). The airflow cools the electric motor. The axial fan is part of a ventilation system. No operations are executed on the axial fan.

## 4.2 Description of the sub-assembly

### 4.2.1 Casing

The casing for axial fans comprises a duct casing and a motor block. The casing can optionally comprise outlet guide vanes and a motor mount.

#### Outlet guide vanes

The axial fan is optionally equipped with outlet guide vanes to achieve uniform air distribution downstream of the impeller within a pipework system.

#### Motor mount

The motor mount is provided to install the electric motor.

#### 4.2.2 Impeller - BVAXO



Fig. 15: BVAXO impeller, installed

With 5, 6, 8, 9, 10 or 12 blades depending on the required output.

The impeller hub is made of aluminium.

Blades made of plastic aluminium (BVAXO).

Depending on the version, the impeller blades from a nominal size of 500 can be adjusted in increments of 5°, 2.5° or 1°. The impeller must be disassembled for this purpose. Balancing must be completed after this process, so that the vibration velocities required in [☞ on page 62](#) are maintained.

The impeller blades are not adjustable on impellers with a nominal size of less than 500. The blades are set at the factory based on the operating point and cannot be changed.

#### 4.2.3 Impeller - BVAXO .../27 F...

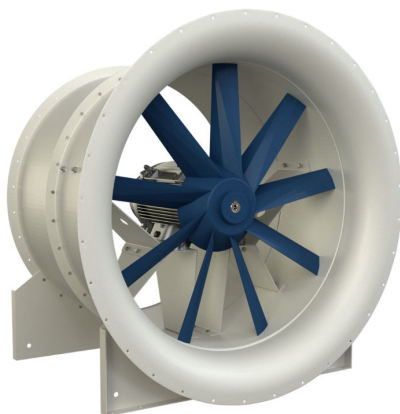


Fig. 16: BVAXO 9/27 impeller, installed

For temperature categories F300 and F400.

With 3 – 9 blades which are welded onto the hub at the calculated blade angle in accordance with the desired output. The impeller blades are not adjustable.

#### 4.2.4 Impeller - BV(Z)AXN .../56 F...



Fig. 17: BV(Z)AXN 12/56 impeller, installed

With 6, 9 or 12 blades depending on the required output.

For temperature categories F200, F300 and F400.

The impeller blades are continuously adjustable when at a standstill. The impeller does not have to be disassembled for this purpose (exception: BV(Z)AXN .../56/... F400 without adjustable blades).

- One scale mark corresponds to a 5° blade setting angle.
- Clockwise rotation: increases the airflow.
- Anti-clockwise rotation: decreases the airflow.
- Up to size 1000: blade can be adjusted with a mandrel and hammer.
- From size 1120: adjust after loosening the hexagon socket screws around the circumference of the impeller hub (1 – 2 revolutions).

#### ! NOTICE!

The power change via the blade adjustment must be within the power limits of the motor! Therefore, this may only be carried out in coordination with X-FANS Service.

Impeller gaps must be complied with following blade adjustment according to [☞ Appendix C.4 'Impeller gap table'](#) on page 63 .

After reassembly of the impeller, a vibration check must be carried out. For this purpose, observe [☞ C.3 'Table of permissible vibration velocities'](#) on page 62 . Rebalancing may be necessary!

## 4.2.5 Mounting

### Mounting feet



Fig. 18: Axial fan with mounting feet

Axial fans that are operated with horizontal air distribution are equipped with at least 2 mounting feet. These are fitted to the casing's flange with screws and screw locking elements. Depending on the size, threaded pipes are screwed in between the mounting feet for stabilisation purposes.

- Intake opening
- Outlet opening
- Centred, can be aligned in both directions

### ! NOTICE!

#### IMPORTANT

For axial fans which are installed vertically, it must be ensured that the possibility of rain or snow penetration is excluded!

### Wall mounting plate



Fig. 20: Axial fan with wall mounting plate

Axial fans that are installed in a wall can be assembled on a wall mounting plate designed for this purpose. A casing with a self-powered multileaf damper is assembled on the external wall.

### ! NOTICE!

#### IMPORTANT

- Do not detach the shaft feet from the fan!
- Do not reposition the shaft feet!
- Do not twist the fan around the axis of the airflow direction!

### Mounting brackets

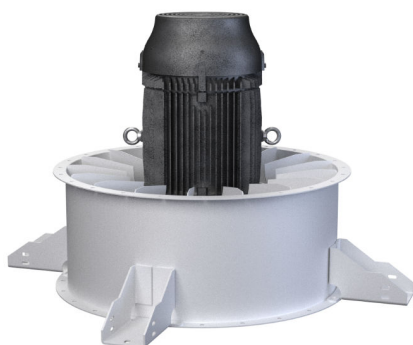


Fig. 19: Axial fan with brackets

Axial fans operated with vertical air distribution are equipped with fixing brackets on the duct casing.

Depending on the fan configuration, the fixing brackets can be attached in the following positions on the duct casing:

## 4.2.6 Actuator

### Electric motor

Axial fans are equipped with electric motors from different manufacturers and of different sizes. Motor characteristics are provided on the electric motor's rating plate Fig. 13 .

In the case of the explosion-proof version, the axial fan is equipped with an explosion-proof electric motor.



**Isolator***Fig. 21: Isolator*

The isolator is assembled on a console on the fan. If the isolator is supplied separately, it must be installed by a qualified electrician.

**Terminal box (standard)***Fig. 22: Terminal box on the axial fan*

The terminal box, including the electrical connections, is assembled on the flange of the fan duct.

An Ex version of the terminal box is used for axial fans in the explosion-proof version.

**4.2.7 Additional equipment**

(→ TROX X-FANS catalogue or product configurator)

**Flexible connector***Fig. 23: Flexible connector*

Flexible connector units are installed between the axial fan and pipe to prevent the transmission of vibrations. The temperature resistance corresponds to the relevant axial fan's temperature class.

Note: The material of the flexible connectors wears during operation due to mechanical loads, environmental influences and material aging, so its service life can deviate from that of the fans depending on the load.

Refer to Chapter ↗ Chapter 6.4 'Installation specifications' on page 29 for installation.

**Bellmouth and cover grille (optional)***Fig. 24: Axial fan with bellmouth and cover grille***Bellmouth:**

A bellmouth must be attached to guarantee an uninterrupted airflow in the case of a free inlet.

**Cover grille:**

Provided to guarantee operational safety and to protect against foreign matter in the case of a free inlet. Depending on the speed of the flow rate, cover grilles cause an additional pressure loss and slightly increased air-regenerated noise.

## VD fan diagnostic system (or shock pulse measurement)

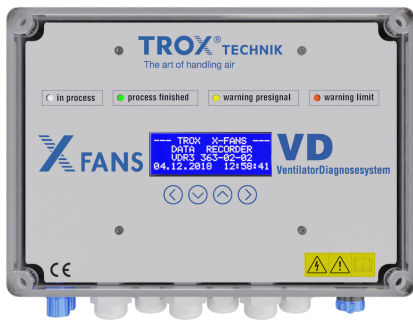


Fig. 25: VD-R2

Monitors the state of the fan by measuring physical characteristics. This facilitates maintenance of the fans. The replacement intervals for components and motors are extended.

## Volume flow rate measuring unit VME

Determines the operating volume flow rate and enables quick and affordable fan regulation.

## Duct with self-powered shut-off damper



Fig. 26: Self-powered shut-off damper

Closes the axial fan at standstill. Minimises thermal losses and prevents back flows. Depending on the speed of the flow rate, shut-off dampers cause an additional pressure loss and slightly increased air-regenerated noise.

Versions:

- For horizontal installation
- For an airflow direction from bottom to top
- For an airflow direction from top to bottom

## Acoustic and thermal insulation



Fig. 27: Axial fan with acoustic and thermal insulation

Easy-to-install shell structure for acoustic and thermal insulation.

## Vibration isolators

Reduction of the transmission of vibrations from the fan to the installation location (depending on the weight as a spring or rubber vibration isolator).

## (BV)AX roof cowl DAX

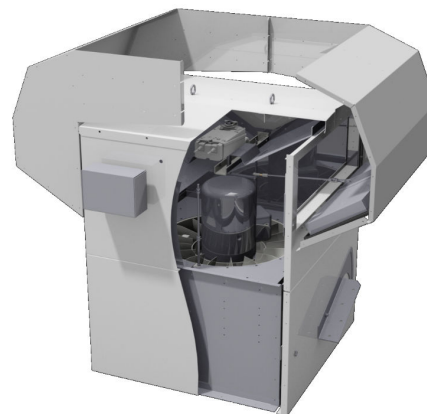


Fig. 28: (BV)AX roof cowl DAX

Accessories for mounting (smoke extract) axial fans on a roof so that they are thermally insulated. **See the separate document *Safety and assembly information DAX!***



## 5 Transport, packaging and storage

### 5.1 Safety notes regarding transport

#### Suspended loads



#### **DANGER!**

#### **Danger of death due to suspended loads!**

Falling loads may cause serious injury or death.

Therefore:

- Never walk under suspended loads.
- Only move loads under supervision.
- Observe the specifications for the intended lashing points.
- Do not attach the lifting gear to protruding machine parts or lugs on attached components
- Ensure that the lifting gear is secure.
- Only use approved hoisting devices and lifting gear with sufficient load-bearing capacity.
- Do not use any frayed or worn ropes and belts.
- Do not place ropes or belts near sharp edges or corners; do not knot or twist.
- Place the load on the ground before leaving the workplace.

#### Improper transport equipment



#### **NOTICE!**

#### **Damage due to improper transport!**

A significant amount of property damage can be caused by improper transport.

Therefore:

- Be careful when unloading the packages upon delivery and during internal transport, and pay attention to the symbols and information on the packaging.
- Only use the intended lashing points.
- Do not remove the packaging until immediately before assembly.

### 5.2 Checking delivered goods

Check the delivery for transport damage and to ensure that it is complete as soon as it arrives.

#### Transport damage

If there is any visible damage, proceed as follows:

- Either do not accept the delivered items, or accept them with reservations.
- Note down the damage on the shipping documents or on the shipping company's delivery note.
- File a complaint.



*File a complaint as soon as you detect any damage. Claims for damages can only be filed within the applicable complaint periods.*



#### **EXPLOSION PROTECTION!**

*Goods damaged while in transit are unsuitable for use in potentially explosive atmospheres.*

Therefore:

- *Do not commission the unit if any transport damage is visible. Contact the manufacturer.*

*Failure to comply with this note leads to loss of the explosion protection!*

### 5.3 Packaging

#### Information on packaging

The individual packages are packed in accordance with the expected transport conditions. Only environmentally-friendly materials have been used for the packaging.

The packaging should protect the individual components from transport damage, corrosion and other damage until they are assembled. Therefore, do not destroy the packaging and only remove it immediately before assembly.

### 5.4 Symbols on the packaging

#### Handling packaging materials

Properly dispose of packaging material.



#### **ENVIRONMENT!**

#### **Environmental damage due to improper disposal!**

Packaging materials are valuable raw materials and can, in many cases, be reused or properly reconditioned and recycled.

Therefore:

- Dispose of packaging materials in an environmentally sound manner.
- Observe the applicable local disposal regulations. If necessary, employ a specialist disposal company to dispose of the packaging.

### 5.5 Factory settings



Fig. 29: Example of an axial fan

The fan is delivered as a fully assembled unit.

The packaging selected is suitable for transport to the intended destination. Fans are delivered packaged on pallets ( Fig. 29 /2) or unpacked.

A control chart is provided with every fan. It is used to document the performance data measured on the manufacturer's premises. On delivery, the control chart is sealed in waterproof packaging and attached to the outside of the fan.( Fig. 29 /1).

Required accessories, replacement parts and the operating manual are packed separately and enclosed.

### 5.6 Transport

#### Lashing points

Depending on the size of the fan, it can be fitted with transport lugs ( Fig. 30 /1).

#### Transporting packages with a crane



Fig. 30: Axial fan with transport lugs

The fan can then be transported directly with a crane, under the following conditions:

The crane and hoisting devices must be designed for the weight of the fan.

The operator must be authorised to operate the crane.

#### Lashing:

1. ▶ Lash ropes, belts or multiple-point suspension gear to the transport lugs in accordance with ( Fig. 30 /1).
2. ▶ Ensure that the package is hanging straight and observe the offset centre of gravity if necessary.
3. ▶ Start transport.

#### Transporting pallets with a crane

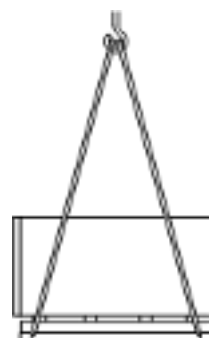


Fig. 31: Transport with a crane

Packages that are attached to pallets can be transported with a crane, under the following conditions:

The crane and hoisting devices must be designed for the weight of the packages.

The operator must be authorised to operate the crane.

#### Lashing:

1. ▶ Lash ropes, belts or multiple-point suspension gear to the pallet in accordance with ( Fig. 31 ).
2. ▶ Check to ensure that the packages are not being damaged by the lifting gear. Use different lifting gear if necessary.
3. ▶ Start transport.

**i Note!**

*Packages may contain additional important information on storage requirements. These must be observed accordingly.*

### Transporting pallets with a forklift



*Fig. 32: Carrying load with a forklift*

Fans that are attached to pallets can be transported with a forklift under the following conditions:

- The forklift must be designed for the weight of the transport unit.
- The driver must be authorised to drive the forklift.

#### Lashing:

1. ▶ Drive the forklift with the forks between or under the struts of the pallet ( Fig. 32 ).
2. ▶ Push the forks through until they protrude on the opposite side.
3. ▶ Ensure that the load cannot tip.
4. ▶ Lift the package and start transport.

## 5.7 Storing packages

- If you have to store packages temporarily:
  - Store in a dry and dust free place.
  - Do not expose to any aggressive gases or liquids.
  - Avoid mechanical shocks.
  - Manually turn the impeller by 5 whole revolutions once a month.
- If a unit has to be stored for more than 3 months, regularly check the general condition of all parts and of the packaging. Refresh corrosion protection, if necessary.

## 6 Installation

### 6.1 Safety instructions

 **IMPORTANT!**

*Assembly / installation and commissioning is either completed by the manufacturer or instructed personnel.*

 **WARNING!**

**Danger due to improper assembly / installation and commissioning!**

Errors during assembly / installation can lead to potentially fatal situations or cause considerable property damage.

Therefore:

- Only allow the manufacturer's employees or authorised personnel to carry out assembly / installation and commissioning.

#### Personnel

- Assembly / installation and commissioning must only be carried out by instructed personnel or by the manufacturer.
- Work on the electrical system must only be carried out by qualified electricians.

#### Personal protective equipment

Wear the following protective equipment during all installation and initial commissioning work:

**Protective equipment:**

- Protective clothing
- Safety helmet
- Safety shoes
- Protective gloves

#### Electrical system

 **DANGER!**

**Danger of death due to electric current!**

Danger of electric shock! Do not touch any live components! Damaged insulation or damaged parts are a life threatening hazard.

- Have work on the electrical system carried out only by skilled qualified electricians.
- Have work on the electrical system carried out only by skilled qualified electricians.
- If the insulation is damaged, disconnect the power supply immediately and have the insulation repaired.
- Before you start working on electric systems and equipment, switch off the supply voltage and secure it against being switched on accidentally. Comply with the 5 safety rules:
  - Disconnect.
  - Secure it against being switched on accidentally.
  - Ensure that no voltage is present.
  - Connect to the earth; short circuit connection.
  - Either cover nearby parts that carry a voltage or install barriers.
- Do not bypass or disable any circuit breakers. Be sure to maintain the correct current rating when you replace a circuit breaker.
- Ensure that live parts do not come into contact with moisture. Moisture can cause a short circuit.

**Explosion protection** **EXPLOSION PROTECTION!**

*Ignition sources, such as sparks, naked flames and hot surfaces, can lead to explosions in potentially explosive atmospheres. The following therefore applies to all work on units in the Ex area:*

- Get written permission before you start the work.
- Only perform work if there are no dust deposits or a potentially explosive atmosphere.
- Use only tools that have been approved for use in areas with potentially explosive atmospheres.

*Additionally:*

- It must be ensured that sufficient cooling air is supplied to the fan drive motor at all times.
- Motors with a cover must be used if fans with a vertical motor shaft are installed.
- Servicing and maintenance work on explosion-proof fans must only be carried out by qualified personnel with the relevant explosion protection qualifications using original replacement parts

*Failure to comply with these notes leads to loss of explosion protection and may result in serious injury and death.*

**Smoke extract** **NOTICE!**

During installation, the relevant standards and guidelines (EN 12101-3, VDMA 24177, DIN 18232-5) must be adhered to with regard to installation requirements and distances from combustible building materials.

**Smoke extract takes precedence over all other functions of the fan!**

In smoke extract situations, you should therefore use suitable switchgear for the following purposes:

- Switch on the fan!
- Shunt/switch off all thermal and electrical monitoring elements!
- Switch the fan to projected speeds!

Make sure that the fan stays on after an automatic activation!


Operation with frequency inverter (FI) in case of smoke extract is generally possible:

- The speed specified for the respective smoke extract case must be observed!
- It is not permissible to control the fan speed in the event of smoke extract!
- Frequency inverters must only be used in one of the combinations of smoke exhaust fan and FI certified in accordance with EN 12101-3! For more information, see the TROX X-FANS product range.

 **WARNING!****Risk of injury due to improper installation, initial commissioning and troubleshooting!**

Improper installation and initial commissioning can result in serious personal injury or property damage.

Therefore:

- Before you start, make sure that there is sufficient clearance for the work you have to complete.
- Handle open, sharp-edged components with care.
- Keep the work area tidy and clean. Parts and tools that are loosely stacked or left lying around are a source of accident.
- Assemble components properly. Comply with the specified screw tightening torques (see  C 'Tables' on page 59 in the appendix).
- Secure components so that they do not fall down or topple over.



**Note!**

We do not assume any liability for any damage or defects caused by inappropriate or improper use, improper assembly or commissioning by our customers or third parties commissioned by the customer, natural wear (wear and tear), improper or negligent operation, unsuitable operating fluids, inadequate construction work, corrosive effects or electrical connections unless we are responsible for said circumstances. Also see: TROX X-FANS GmbH's General Conditions of Sale and Delivery, Section VI, Para. 5.

## 6.2 Assembly of the fan

**Personnel:**

- Instructed person
- Skilled qualified electrician

**Preparations**

Before starting assembly work, check:

- All of the required documents are available.
- Completeness and perfect condition of the required tools and auxiliary materials.
- Compliance with the local safety regulations.
- Mandatory compliance with installation specifications: ↪ 6.4 'Installation specifications' on page 29
- Implement installation recommendations: ↪ 6.5 'Installation recommendations' on page 33
- Observe installation details: ↪ 6.6 'Installation information' on page 36

**Procedure**

1. ▶ Fix the fan to the base or steel structure either rigidly or flexibly using anti-vibration elements.

**! NOTICE!**  
**IMPORTANT**

- Do not twist the fan. Assemble compensator blocks if required.
- Observed the agreed installation orientation.
- Mount fans with brackets vertically only. ↪ 'Mounting brackets' on page 20
- Mount fans with shaft feet horizontally only. Twisting around the axis of the airflow direction is not permitted! ↪ 'Mounting feet' on page 20

2. ▶ Fix the fan to the duct system.

**! NOTICE!**

Use a screw-locking device

Vertically installed axial fans:

**! NOTICE!**  
**IMPORTANT**

Rain and snow must be prevented from falling into the fan.

## 6.3 Electrical installation of the fan

**Personnel:**

- Skilled qualified electrician

**Preparations**

Check before starting electrical installation:

- All of the required documents are available.
- Completeness and perfect condition of the required tools and auxiliary materials.
- The local energy supply is the same as the one given on the rating plate and in the technical data.
- Compliance with the local safety regulations.
- ↪ Chapter 6.3.1 'Frequency inverter operation' on page 29
- ↪ Chapter 6.3.2 'Motor protection' on page 29

**Tools**

- Stripping tool
- Pressing tool
- Screwdriver set
- Open-end spanner set
- Torque wrench

**Procedure**

1. ▶ Insert cables into the terminal box. Use cable glands with the appropriate protection class for the application:
  - Metal cable glands must be used with certified smoke exhaust fans.
  - Appropriate EMC cable glands must be used for shielded cables.
  - Use a separate cable gland or a suitable multiple sealing insert for each cable.
  - Strain relief of the cable is ensured by the cable gland.
  - Carefully close off any unused cable glands to protect against dust and moisture.
2. ▶ For direct switch-on or frequency inverter operation, the operating jumpers must be inserted in accordance with the motor rating plate and the enclosed connection diagram.

- 3. ▶ Establish a professional electrical connection in accordance with the connection technology suitable for the equipment.

**! NOTICE!**  
Thermistor cables and power cables must be routed separately.

- 4. ▶ Tighten the clamping bolts and screw terminals.

**! NOTICE!**  
Observe the torque in ↪ *Appendix C.2 'Table of tightening torques for electrical components' on page 61!*

- 5. ▶ Tighten the cover screws of the connection means.

**! NOTICE!**  
Observe the torque in ↪ *Appendix C.2 'Table of tightening torques for electrical components' on page 61!*

- 6. ▶ The fan must be connected to the local earth bar by a qualified electrician during installation. Equipotential bonding prevents electrostatic ignition hazards.

**! NOTICE!**  
**Smoke exhaust fans**  
The energy supply as well as the activation and control of smoke exhaust fans must correspond to the building regulations.  
If function maintenance cables are used, the specifications of the General Technical Approvals valid for this must be complied with. (Cable trays / installation type / bending radii / etc.).  
It is impermissible to install function maintenance cables through the fan casing, because it is impermissible to fit cables on the fan casing and the installation type does not correspond to the function maintenance check as documented in the general building inspectorate licence.

### 6.3.1 Frequency inverter operation

- When operating with frequency inverters, suitable motor cables with shielding must be provided.
- The shielding must be applied over the entire surface on both sides.
- Motor protection must be provided (see ↪ 6.3.2 'Motor protection' on page 29).

- The fan must be operated at a minimum frequency of 10 Hz.
- Only frequency inverters tested and certified by TROX X-FANS according to DIN EN 12101-3 are to be used for smoke extract applications (available as accessories).
- The design point of the fan must be observed.

### 6.3.2 Motor protection

- The motor must be secured against overload.
- Thermistor monitoring is mandatory for speed-controlled fans.
- If a thermistor or thermal contact is installed, it must be evaluated in ventilation mode. Tripping must result in the fan being switched off.
- If no thermistor is used, the motors must be monitored with motor protection switches or motor protection relays.  
These components must be set to the rated current of the fan. Tripping must result in the fan being switched off.
- In the event of a fire, all protective devices must be bypassed.
- For systems used exclusively for smoke extract purposes, a motor protection device must be provided for the regularly recurring maintenance run.

## 6.4 Installation specifications

### Overview of installation situations

The table shows possible installation situations of a (smoke exhaust) axial fan:

Situation	Installation specification
Connection between shaft base and floor	↪ 6.4.1 Page: 30
Connection between shaft base and steel structure/ rail	↪ 6.4.2 Page: 30
Connection between shaft base and anti-vibration element	↪ 6.4.3 Page: 30
Connection between anti-vibration element and floor	↪ 6.4.4 Page: 30
Connection between anti-vibration element and steel structure/rail	↪ 6.4.5 Page: 31
Installation of anti-vibration element	↪ 6.4.6 Page: 31
Connection between support bracket and anti-vibration element	↪ 6.4.7 Page: 31



Situation	Installation specification
Connection between support bracket and steel structure/rail	↪ 6.4.8 Page: 31
Connection of flexible connector	↪ 6.4.9 Page: 32
Connection of flexible connector, rectangular/circular	↪ 6.4.10 Page: 32
Ceiling suspension with profiled rails	↪ 6.4.11 Page: 32

## 6.4.1 Connection between shaft base and floor

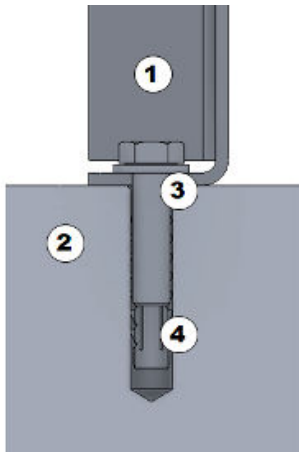


Fig. 33: Connection between shaft base and floor

Shaft base ① on floor ②: wallplugs approved by customer ④, generally technically approved fasteners ③.

## 6.4.2 Connection between shaft base and steel structure/rail

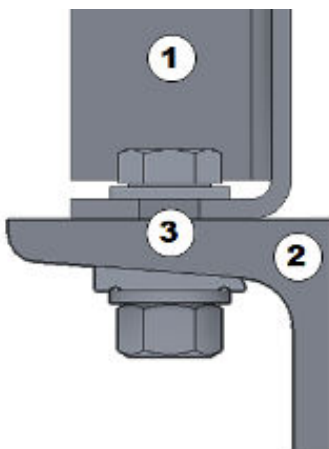


Fig. 34: Connection between shaft base and steel structure/rail

Shaft base ① on steel structure/rail ②: generally technically approved fasteners, wedge-shaped washer according to DIN 434) ③.

## 6.4.3 Connection between shaft base and anti-vibration element

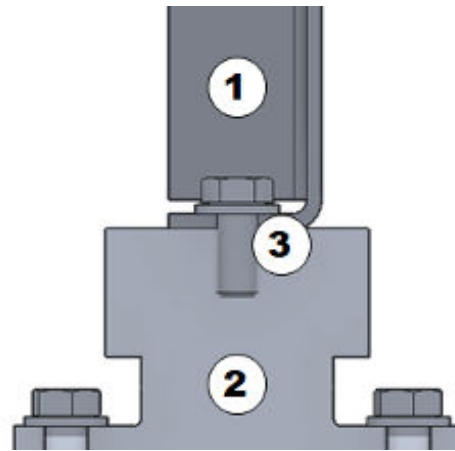


Fig. 35: Connection between shaft base and anti-vibration element

Shaft base ① on anti-vibration element ②: generally technically approved fasteners ③.

## 6.4.4 Connection between anti-vibration element and floor

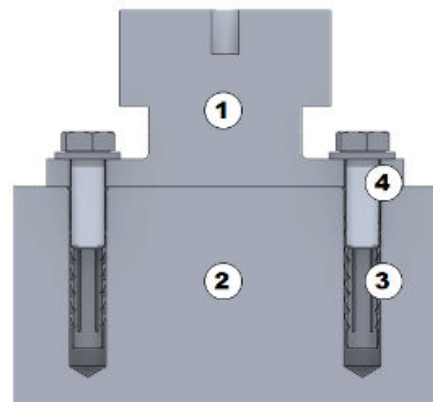


Fig. 36: Connection between anti-vibration element and floor

Anti-vibration element ① on floor ②: wallplugs approved by customer ④, generally technically approved fasteners ③.

**6.4.5 Connection between anti-vibration element and steel structure/rail**

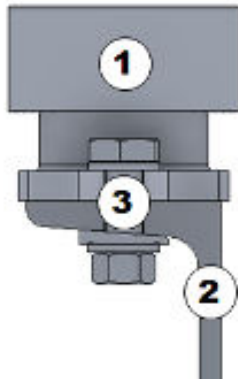


Fig. 37: Connection between anti-vibration element and steel structure/rail

Anti-vibration element ① on steel structure/rail ②: generally technically approved fasteners, wedge-shaped washer according to DIN 434) ③.

**6.4.6 Setup of anti-vibration element**

(only for BVAX... smoke exhaust fans from a temperature class of F300 when installed in a fire area)

Assemble the fan on the vibration isolators with all of the attachments. Lay the relevant number of plates ① under one of the sides on each damping element. These are used as a stop in the event of the isolator failing. Observe the height dimension for this (see table and ↪ on page 31 )

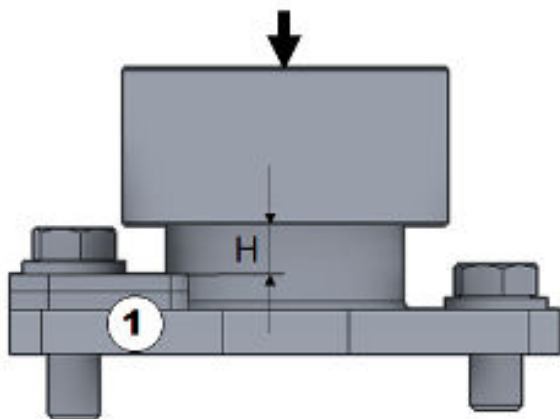


Fig. 38: Vibration isolator with spacing plates

Nominal size of BVAX...	H
315 - 450	5 - 8
500 - 800	8 - 11
900 - 1250	10 - 15
From 1400	12 - 20

**6.4.7 Connection between bracket and anti-vibration element**

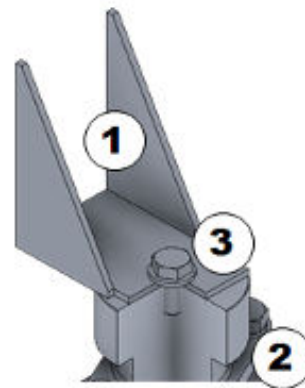


Fig. 39: Connection between bracket and anti-vibration element

Bracket ① on anti-vibration element ②: generally technically approved fasteners ③.

**6.4.8 Connection between bracket and steel structure/rail**

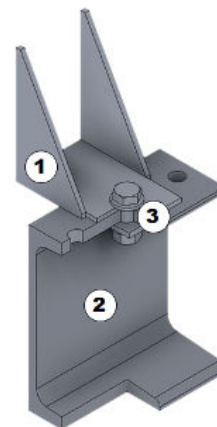


Fig. 40: Connection between bracket and steel structure/rail

Bracket ① on steel structure/rail ②: generally technically approved fasteners, wedge-shaped washer according to DIN 434) ③.

## 6.4.9 Connection of flexible connector



Fig. 41: Connection of flexible connector

Installed length: 90 mm (600°C)

Installed length: 200 mm (standard)

- Flexible connectors must be installed according to the installation length without any offset. Incorrect installation results in reduced output and increases the amount of noise.
- Flexible connectors are not designed to compensate for assembly-related inaccuracies.
- When securing with loose flanges, ensure that the separating points of the flange are offset by approx. 180°.
- Only remove the protective and spacing packaging after assembly (for connectors up to 400°C).

## 6.4.10 Connection of flexible connector, rectangular/circular

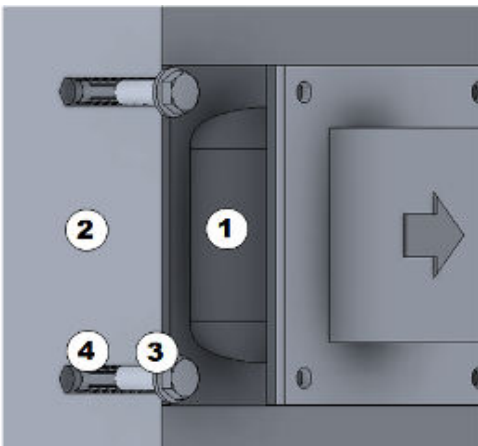


Fig. 42: Connection of flexible connector, rectangular/circular

Connection of flexible connector, rectangular/circular ① to concrete wall ②: wallplugs approved by customer ④, generally technically approved fasteners ③.

## 6.4.11 Ceiling suspension with profiled rails

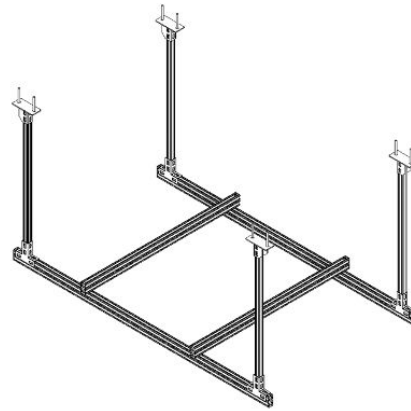


Fig. 43: Ceiling suspension with profiled rails

Smoke extract fans of the BVAXN, BVAXO, BVREH and BVW-A and BVW-R type can also be mounted on suspended profile rails instead of on the floor, brackets or fixed steel structures. The fastening itself is carried out as described there. The rigid suspension made of profile rails must be suitable for the respective application (installation area, temperature) and proof thereof must be provided. Tubes or ductwork must be connected via canvas spigots.

A vibration-damped installation is recommended.

Smoke extraction ducts must be suspended separately.

Suspension systems longer than 1.5 m require fire-resistant insulation.

### Size of threaded rods

Thread	M8	M10	M12	M14	M16	M20
Fmax [N] per threaded rod	219	348	505	690	942	1470
Maximum loading [kg] per threaded rod	22	35	52	70	96	150

**Fixing to the ceiling**

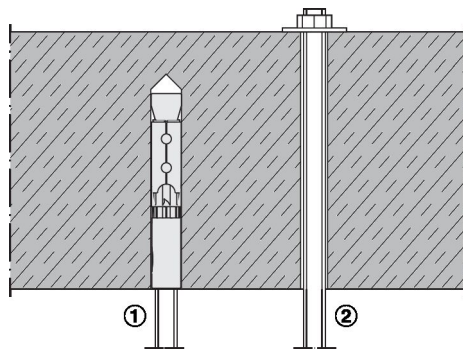


Fig. 44: Fixing to the ceiling

- 1 Fastening with fire safety dowels
- 2 Push-through installation

According to the ceiling design, use only fire safety dowels with suitability certificate. Alternatively, suspensions without dowels can be done as push-through installation, in which case the threaded rods are fastened with nuts and washers.

The voltage in the fastening parts must not exceed the limit values specified in DIN 4102-4, Table 11.1.

**Suspension of the fan**

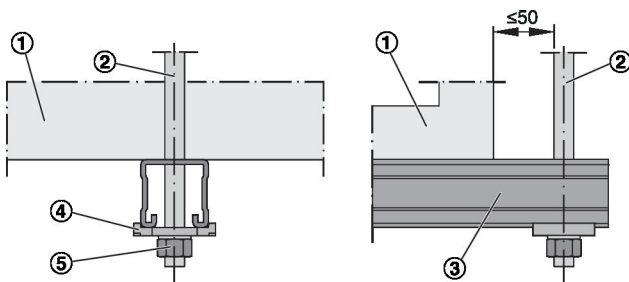


Fig. 45: Suspension of the fan (by others)

- ① Fan
- ② Threaded rod M8-M20
- ③ Fire protection proven rail
- ④ Fire protection proven retaining clip
- ⑤ Nut, M8-M20, galvanised steel

**6.5 Installation recommendations**

**Overview of installation recommendations**

The table shows recommendations for the efficient installation of a (smoke exhaust) axial fan:

Type	Installation recommendation
Air inlet	☞ 6.5.1 33
Air outlet	☞ 6.5.2 35
Installation location	☞ 6.5.3 35

Type	Installation recommendation
Acoustic and thermal insulation	☞ 6.5.4 35

**6.5.1 Air inlet**

A uniform, swirl-free air inlet velocity distribution must be guaranteed.

Installation in ducts and pipes	
	An inflow and outflow distance of 2.5 x D (fan diameter) must be provided.
Ideal inflow and outflow distance	

Inflow from a smaller duct:	
Incorrect	Correct
Inflow from a smaller duct results in power losses and increases the noise level. Increased vibration levels can be excited.	If the installation of ideal inflow distance is not possible, a transition piece and a pipe with a length of 2.5 x D (fan diameter) must be used.

Straight inflow from a larger duct:	
Incorrect	Correct
Inflow from a larger duct results in power losses and increases the noise level.	Fit an optimised suction nozzle in conjunction with a flexible connector. Size flexible connectors so that they are two nominal sizes bigger than the fan's nominal size.  If the installation of ideal inflow distance is not possible, a transition piece and a pipe with a length of $2.5 \times D$ (fan diameter) must be used.

Lateral inflow from a larger duct:	
Incorrect	Correct
Lateral inflow from a larger duct leads to power losses and increases the noise level.	Install baffle plates: <ul style="list-style-type: none"> <li>■ cWidth (2) = <math>0.6 \times</math> spacing (1)</li> <li>■ Number: min. 5</li> </ul> Use reverse dampers in the intake duct.  Install a flexible connector to further improve the inflow. Size flexible connectors so that they are two nominal sizes bigger than the fan's nominal size.

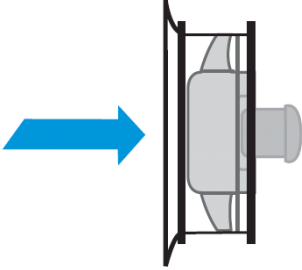
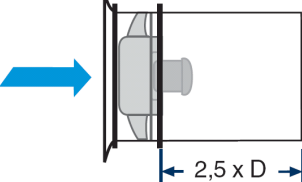
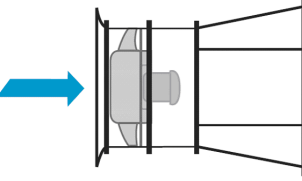
Bent ducts and pipes:	
Incorrect	Correct

Bent ducts and pipes:	
A bent inflow distance results in power losses and increases the noise level.	Install baffle plates.

Free inflow:	
Incorrect	Correct
A free inflow results in power losses and increases the noise level.	Install an optimised intake nozzle. <b>⚠ DANGER!</b> <b>Risk of injury due to rotating parts</b>  Rotating parts in the fan can cause serious injuries. This is why a cover grille must be fitted before the intake nozzle on a free inflow.

### 6.5.2 Air outlet

An optimum air outlet with minimal impact losses must be guaranteed to prevent power losses, turbulences and excessive noise development.

	<p><b>Free outlet: Maximum impact loss</b> due to the dynamic pressure on the fan's ring surface</p>
	<p><b>Rectified flow: 50% less impact loss</b> following installation of an outflow pipe with an ideal length of 2.5 x fan diameter</p>
	<p><b>With diffuser: 70% less impact loss</b></p>

### 6.5.3 Installation location

The axial fan may need to be removed for it to be maintained and repaired. The following conditions must be maintained at the installation location:

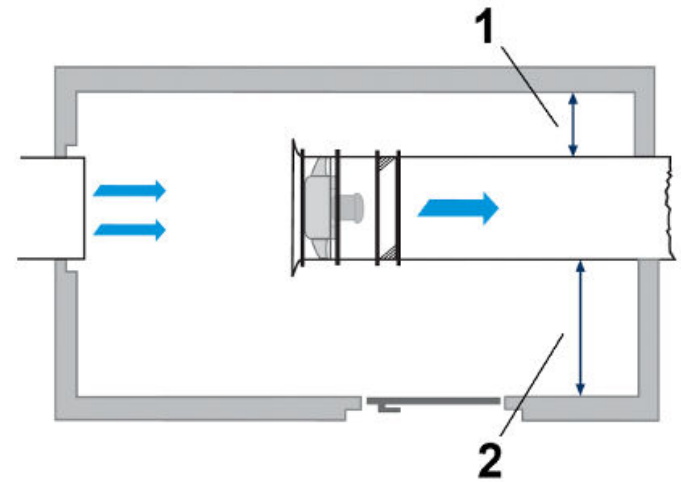


Fig. 46: Space requirements of the axial fan

- In the case of plenum installation, clearance of the following size to the side of the axial fan: (1) fan nominal size x 0.5 (2) fan nominal size + 1 m
- The axial fan must be accessible without hindrance at all times.
- Sufficient space of this size must be provided in the case of roof assembly.
- Space for a mounting frame must be kept free above and around the axial fan.

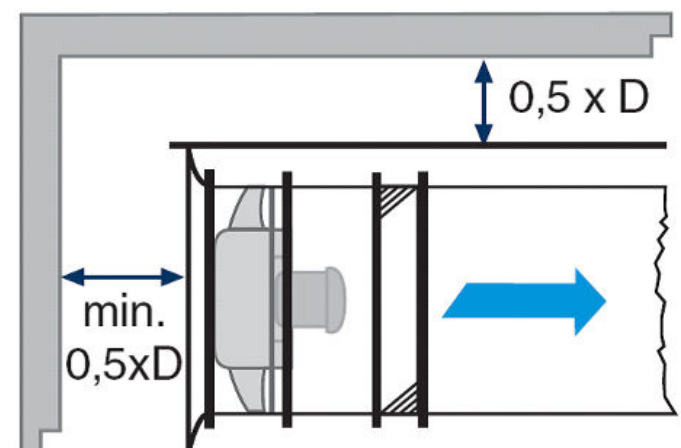


Fig. 47: Minimum distance

- The minimum distance between the axial fan and the walls and neighbouring axial fans must be at least 0.5 x the fan size.

### 6.5.4 Acoustic and thermal insulation (optional)

The acoustic insulation consists of mineral wool insulation that reduces the casing's acoustic emissions.



**! NOTICE!**

**SMOKE EXTRACT!**

**Thermal insulation must be provided on smoke exhaust fans that are installed inside the building and outside of the fire area!**

The thermal insulation on smoke exhaust fans is designed to limit the amount of heat emitted to the surrounding area. In accordance with EN 12101-3, it also prevents the external surface temperature of a thermally insulated unit from increasing by more than 180°C for each individual value.

The insulation layer to be used as thermal insulation may be applied subsequently in one layer. It must correspond to an insulation layer for fire-resistant ducts with fire resistance class L120 according to DIN 4102-4.

This also applies to all connecting parts (pipes, ducts, etc.).

## 6.6 Installation information

### Overview of installation details

The table shows further information for the efficient installation of a (smoke exhaust) axial fan:

Situation	Installation information
Penetration of precipitation	↪ 6.6.1 36
Formation of condensation	↪ 6.6.2 36
Stability	↪ 6.6.3 36
Penetration of foreign matter	↪ 6.6.4 36

### 6.6.1 Penetration of precipitation

Axial and radial fan types that are installed in a horizontal or vertical installation arrangement are suitable for use in standard weather conditions that normally occur, as long as the penetration of precipitation in the vicinity of the intake and outlet openings is prevented with suitable measures.

### 6.6.2 Formation of condensation

Uninsulated building penetrations are generally avoided and should be insulated by others. Uninsulated fan parts or accessory parts which can have different external and internal temperatures and which cannot exclude the formation of condensation must be insulated by others following assembly (min. 20 mm-thick insulation e.g. made of mineral wool or comparable insulation materials). The fire safety engineering requirements must be observed.

### 6.6.3 Stability

Particular installation conditions and locations, such as near the coast or freestanding buildings, may require certain safety measures for flexible installation. (stability, prevention of proper motion). The safety measures can be implemented by means of displacement limiters or suitable restraints.

### 6.6.4 Penetration of foreign matter

Generally speaking, corresponding protective equipment (e.g. cover grille) must be attached to free-outlet and free-inlet fans.

The protective equipment and fixing of the same must be evaluated together with the overall system's safety concept.

### Foreign matter

**⚠ EXPLOSION HAZARD!**

*The penetration of foreign matter can cause explosions.*


*Therefore:*

- *The system owner must use structural and technical controls to ensure that no foreign matter can penetrate.*

**Note: Failure to comply with this note leads to loss of the explosion protection!**

## 7 Commissioning

### 7.1 Procedure and checklist

- Initial commissioning must always be performed in the ventilation scenario.
- Commission the fan according to the commissioning report and checklist. ↪ *Appendix A 'Commissioning report' on page 54*
- Briefly (< 1 s) supply the fan with supply voltage.
- Compare the direction of rotation of the impeller with the direction arrow  of the fan. In the event of an incorrectly rotating impeller, two live wires must be interchanged.
- Measure the current consumption under a full load. The current consumption must not deviate from the rating plate data.
- Measure the supply voltage at the connecting device. This may deviate a maximum of +/- 5% from the rating plate data.
- The supply voltage must comply with the quality characteristics of EN 50160 and the defined standard voltages of IEC 60038.

#### DANGER!

##### Risk of injury from rotating parts!

There is a considerable risk of injury when activating the free-intake fan without cover grille.

Therefore:

- Remove foreign matter from the fan area.
- Assemble a cover grille (accessories) or shut off the fan.

Note: If installed in a duct network, the protective measure must be implemented by others.

### 7.2 Operating modes

#### 7.2.1 S1 continuous operation

The fans are designed for continuous operation (S1 operating mode according to DIN EN 60034-1).

#### 7.2.2 S9 speed-controlled operation

##### General

Fans are speed-controlled to adjust the operating point to the system and utilisation requirements.

##### Speed control, maximum speed

The maximum speed specified on the rating plate must not be exceeded.

#### Measures in the case of natural frequencies

Mechanical components have natural frequencies that can cause the components to fail if accelerated to impermissibly high vibrations. There is a possibility that casing parts, bearings, crankshafts, attachments and impellers can be damaged.

Excitation frequencies are, for example, caused by the impeller's rotary frequency, the blades' frequency, the blades' rotational frequency, the motor's rotary frequency or aerodynamically.

If the excitation frequency is exactly or practically the same as a component's natural frequency, resonance frequencies that can cause the component to fail will occur. The excitation forces are dependent on the components' balancing condition, true running characteristics, aerodynamic forces and damping features.

#### DANGER!

##### Danger due to resonance frequencies!

The fan must not be operated in the higher speed range in which increased vibration values occur. These areas must be skipped or removed for the operation. The areas must be passed through so quickly that the permissible vibration values in the resonance frequency are not engaged or exceeded.

A permanent vibration monitoring system is recommended for speed-controlled fans to ensure the long-term, safe operation of the fan.

After commissioning speed-controlled fans, it is common practice to initially start them with short maintenance intervals, and if no damage occurs, to gradually adjust the maintenance intervals to the intervals specified in the operating manual.

#### Commissioning of speed-controlled fans

During commissioning, the fan vibrations must be checked over the entire speed control range of the fan. During this process, the vibrations on the casing and bearing must be determined and evaluated in accordance with DIN ISO 14694 depending on the installation and motor rating. Refer to the "Vibration velocities" table in the appendix of the operating manual for the permissible vibration velocities.

The amplitude of the vibration velocities is dependent on different factors.

The type of installation, the upstream and downstream conditions, the characteristics of the supporting structure/foundation, fan operating point, attachments and accessories influence the quiet running of the machine and can therefore only be evaluated for correct operation when installed.



Testing must be completed by specialist personnel or can be contracted out to TROX X-FANS.

## Speed control, special provisions

By changing the speed, additional acceleration forces are applied to the fan components:

- Changes to the speed during controlled operation must not cause the permissible motor temperatures and bearing loads to be exceeded.
- The run-up time should therefore be approx. 60 seconds.
- Changes to the speed to adjust process variables (controlled operation) should be max. 16.7 rev/sec (1.75 rad/sec), except when running through resonance frequencies.
- The fans' service life can be increased by quickly running through resonance frequencies.
- The operating manuals from the control unit manufacturer must be observed.
- The EMC Directive 2014/30/EU must be complied with.

## General notes

- The motor and transformer must be positioned as close to one another as possible
- Cables must be sheathed and shielded
- Cables, cable ends, the frequency inverter and the motor must be earthed.
- It is advisable to use all-pole sine filters.

### 7.2.3 Smoke extract

During smoke extract operation, the fans only extract smoke gases in the event of a fire to remove the smoke from the fire compartments.

## CE marking of smoke exhaust fans (BV)

		TROX TLT GmbH Inno-Tec-Strabe 1 GER-30251Bad Harzburg +49 03921950-0 www.tlx.de	
		0761 - MPA Braunschweig	
EN 12101-3: 2015	BVAXN 12/56 F400		
DoP BVAXN 12/56 F400		14	
intended to be installed as a part of a general smoke and heat control ventilation system			
response delay			
- opening under wind load within a given time:		NPD	
- opening under snow load within a given time:		NPD	
operational reliability			
- application category:		dual purpose	
- motor rating:		H, 50 K	
effectiveness of smoke / hot gas extraction			
- gas flow and pressure maintenance during smoke and heat extraction test:		4 B% / 4 20%	
resistance to fire		T <sub>30</sub> , T <sub>60</sub> , T <sub>90</sub>	
ability to open under environmental conditions			
- opening under wind load within a given time:		NPD	
- opening under snow load within a given time:		NPD	
durability of operational reliability		H, 50 K	

Fig. 48: CE marking

The rating plate of the smoke exhaust fans (BV) also contains information about the application and permissible temperature / time category.

In addition, a CE mark as per EN 12103, Part 3, is attached to demonstrate product conformity.

## 7.3 Special requirements

### 7.3.1 System with inductor / return smoke control dampers

Dampers that can completely stop the airflow must be connected in such a way that the fan is switched off immediately after they are closed. Otherwise, impermissible heating of the fan and impermissible vibrations caused by flow separation can occur.

### 7.3.2 Multiple fan operation

In the case of parallel connection, it must be noted that the flow will cause the fans that are not in operation to rotate freely in the opposite direction as resistance rotors. During activation, this can cause the network and/or motor to be overloaded and rotating components to be damaged. During maintenance work: note that the impellers must be mechanically blocked before any work is performed on the fan!

### 7.3.3 Stall / characteristic curve stabiliser

Operation of the fan during a stall is not permissible. Fans that are equipped with a characteristic curve stabiliser can briefly be operated in the event of an incident or can quickly be run through the unstable characteristic curve range.

**! NOTICE!****CAUTION!**

Even with a characteristic curve stabiliser, prolonged operation during a stall is impermissible!

### 7.3.4 Reversing the direction of rotation

A sudden change in the direction of rotation due to switching over the power supply, for example, can damage the impeller and must therefore be avoided and/or is impermissible under all circumstances. The fan should be started when the impeller is at a standstill.

### 7.3.5 Explosion-proof fans

Special care and attention is absolutely essential. In addition to all of the guidelines, it must be ensured that build-up of electrostatic charges is prevented by earthing the components if necessary. Special care must be taken to ensure that the safety distances between rotating and fixed parts are observed and that the drive motors are not overloaded under any circumstances.

** EXPLOSION PROTECTION!**

*Ignition sources, such as sparks, naked flames and hot surfaces, can lead to explosions in potentially explosive atmospheres. The following therefore applies to all work on units in the Ex area:*

- *Get written permission before you start the work.*
- *Only perform work if there are no dust deposits or a potentially explosive atmosphere.*
- *Use only tools that have been approved for use in areas with potentially explosive atmospheres.*

*Additionally:*

- *It must be ensured that sufficient cooling air is supplied to the fan drive motor at all times.*
- *Motors with a cover must be used if fans with a vertical motor shaft are installed.*
- *Servicing and maintenance work on explosion-proof fans must only be carried out by qualified personnel with the relevant explosion protection qualifications using original replacement parts*

*Failure to comply with these notes leads to loss of explosion protection and may result in serious injury and death.*

## 8 Operation

### 8.1 Safety notes

**⚠ WARNING!**

**Risk of injury from incorrect operation!**

Incorrect operation can result in serious injury or property damage.

Therefore:

- Complete all of the operating steps according to the information provided in this operating manual.
- Before starting, ensure that all of the covers and safeguards have been installed and are working properly.
- Never deactivate safeguards during operation.
- Any existing inspection flaps must only be opened when the fan is at a standstill.

### 8.2 Software use

#### Operation as an individual unit

1. ▶ Ensure that there is no foreign matter located within or in the direct vicinity of the unit.



Fig. 49: Isolator

2. ▶ Switch the fan with isolator on and off ( Fig. 49 ).

#### Operation in a plant system

When the fan is installed in a plant system, it is operated via the plant system rather than on the unit.

### 8.3 Stopping in an emergency

In hazardous situations, the machine movements must be stopped as quickly as possible and the energy supply must be disconnected.

#### Stopping in an emergency

Proceed as follows in a hazardous situation:

1. ▶ Immediately initiate an emergency stop.
2. ▶ Inform the responsible person at the operation site.
3. ▶ Alert a doctor and the fire service.
4. ▶ Rescue individuals from the hazardous area and perform first aid.
5. ▶ Switch off the mains isolator and secure it against being switched back on again.
6. ▶ Keep access paths for rescue vehicles clear.

#### After the rescue measures have been implemented

7. ▶ Inform the responsible authorities if required by the severity of the emergency.
8. ▶ Task specialist personnel with troubleshooting.

**⚠ WARNING!**

**Danger of death due to early reactivation!**

During reactivation, there is a danger of death for all persons in the hazardous area.

Therefore:

- Before reactivation, ensure that persons are no longer in the hazardous area.

9. ▶ Before recommissioning the plant, check and ensure that all of the safeguards are installed and fully functional.



## 9 Faults


### 9.1 General information

#### **WARNING!**

##### **Risk of injury due to improper installation, initial commissioning and troubleshooting!**

Improper installation and initial commissioning can result in serious personal injury or property damage.

Therefore:

- Before you start, make sure that there is sufficient clearance for the work you have to complete.
- Handle open, sharp-edged components with care.
- Keep the work area tidy and clean. Parts and tools that are loosely stacked or left lying around are a source of accident.
- Assemble components properly. Comply with the specified screw tightening torques (see  C 'Tables' on page 59 in the appendix).
- Secure components so that they do not fall down or topple over.

The following chapter describes possible causes of faults and the work required to eliminate them. If faults occur more frequently, reduce the maintenance intervals in accordance with the actual load. Contact the manufacturer if any of the faults cannot be eliminated using the following information; see the service address on page 2.

### 9.2 Safety instructions

#### Staff

- Unless specified otherwise, the troubleshooting work described here must be carried out by the operator (user).
- This is specified separately in the description of the individual faults.
- Work on the electrical system must only be carried out by qualified electricians as a matter of principle.
- Repair work (particularly welding) on the impeller and on load-bearing and connecting structures must only be carried out by the manufacturer.
- The impeller must only be rebalanced by the manufacturer or a specialist company.

#### **EXPLOSION HAZARD!**

*Use only tools that have been approved for use in areas with potentially explosive atmospheres.*

### Electrical system

#### **DANGER!**

##### **Danger of death due to electric current!**

Danger of electric shock! Do not touch any live components! Live electrical components may execute uncontrolled movements and cause serious injury.

Therefore:

- Before starting work, switch off the electrical supply and secure it against being switched back on again.

### Securing the unit against being switched on accidentally

#### **DANGER!**

##### **Danger of death due to unauthorised reactivation!**

During troubleshooting work, there is a risk of the power supply being switched back on without authorisation. There is therefore a danger of death for the persons in the hazardous area.

Therefore:

- Before starting work, switch off all of the power supplies and secure them against being switched back on again.

### 9.3 Behaviour in the event of faults

Please note:

1. ▶ If faults that pose an immediate danger to persons or property occur, immediately trigger the emergency stop function.
2. ▶ Determine the cause of the fault.
3. ▶ If troubleshooting requires work to be performed in the hazardous area, switch off the system and secure it against being switched back on again.
4. ▶ Immediately inform the responsible person at the operation site of the fault.
5. ▶ Depending on the type of fault, ensure that it is eliminated by authorised specialist personnel or rectify it yourself.

#### **IMPORTANT!**

*The fault table below sets out who is authorised to rectify which fault.*



## 9.4 List of faults

Fault description	Cause	Remedy	Personnel
Fan does not start	Motor connected incorrectly	Check the connections	Skilled qualified electrician
	No power	Check the power supply	Skilled qualified electrician
	One or two live phases have failed	Check the power consumption	Skilled qualified electrician
	Belt not assembled correctly	Ensure that the belt is positioned correctly	Instructed person
Electric motor switches off	Electric motor is too warm, thermal contact triggers	<i>Flow medium too warm?</i> Allow the electric motor to cool down. Depending on the control module, the fan either automatically starts up again or it has to be restarted.	Skilled qualified electrician
		<i>Impeller sluggish? Bearing damaged?</i> Replace the impeller or motor bearing if necessary	Instructed person
	Electrical connection is faulty	<i>Are all of the phases loaded equally and connected?</i> Check the power consumption / direction of rotation	Skilled qualified electrician
	Motor is overloaded	<i>Does the operating point match the design?</i> Replace the motor with a more efficient one	Skilled qualified electrician
Fan does not reach the nominal speed	Motor's starting torque is too low for ramping up	Replace the motor or provide a start-up system	Skilled qualified electrician
Airflow is not correct	Fan's direction of rotation is incorrect	Change the direction of rotation by switching two phases on the terminals	Skilled qualified electrician
	Fan assembled incorrectly	<i>Either the impeller is not connected to the motor shaft correctly, or the entire fan is installed incorrectly in the system!</i> Switch off the axial fan and correct improper assembly (impeller or complete fan).	Instructed person
	Impeller blocked	Switch off the fan and remove the blockage. Observe the accident prevention regulations.	Instructed person
	Impeller defective	Switch off the fan. Dismantle the impeller and replace it with a new one.	Instructed person
	The impeller's speed is not correct	<i>Motor speed incorrect?</i> Check the motor or belt drive, replace if necessary	Instructed person
		<i>Frequency inverter set incorrectly?</i> Change the frequency inverter's parameter settings	Skilled qualified electrician
	The duct system's pressure losses are higher than expected / calculated	<i>What operating point is the fan working in?</i> Change the duct construction or use baffle plates to avoid turbulence.	Instructed person

Fault description	Cause	Remedy	Personnel
Airflow is not correct	The duct system's pressure losses are higher than expected / calculated	Increase the fan speed (note: do not exceed the motor limit rating or the max. fan speed)	Instructed person
		<i>Is the operating point in the unstable range?</i> Reconfigure and replace the fan Open the bypass Reduce pressure losses in the duct	Instructed person
	Dampers or grilles in the system are closed	Open the dampers or grilles	Instructed person
	An object is obstructing the airflow in the duct	Clean the duct / remove the obstruction	Instructed person
	Vane controls are (partially) closed	Open the vane controls	Instructed person
	Filter is dirty	Clean or replace the filter	Instructed person
Fan is pumping	Fan is working in an unfavourable characteristic curve range	Reduce the system resistances.	Instructed person
Increased vibrations	Impeller imbalance due to deposits	<i>Please note that the system, consisting of the impeller and motor, always has a residual imbalance, even if all of the components are balanced!</i> Clean and rebalance the impeller	Instructed person
	Vibration isolators are assembled or positioned incorrectly	<i>Incorrectly selected vibration isolators can result in destruction of the fan!</i> Configure and assemble vibration isolators correctly	Instructed person
	Vibration isolators are the wrong size	Replace the vibration isolators	Instructed person
Air noises	Direction of rotation is incorrect	Change the direction of rotation by switching two phases on the terminals	Skilled qualified electrician
	Pulsating volume flow rate	<i>Have the standard rules for the installation of fans been complied with? See Chapter 6.5 'Installation recommendations' on page 33</i> Increase the cross sections to improve the passage of air Install baffle plates	Instructed person
		<i>Is the operating point in an unstable area?</i> Implement measures to reduce the overall pressure loss	Instructed person
Mechanical noises	Contamination on the casing or impeller	Clean the casing / impeller	Instructed person
	Impeller is grinding	<i>Caused by a misaligned connection duct due to deformation of the casing, for example.</i> Check the impeller gap Realign the fan	Instructed person

Commissioning once a fault has been rectified

Fault description	Cause	Remedy	Personnel
Mechanical noises	Impeller is grinding	Readjust the impeller	Instructed person
	Bearing noises	<i>Some bearings make clicking noises that can be disregarded!</i> Check the bearings and replace them if necessary	Instructed person
	Bearing running dry		Instructed person
Electrical noises	The frequency inverter's clock frequency is too low	Increase the clock frequency	Skilled qualified electrician

## 9.5 Commissioning once a fault has been rectified

Once the fault has been rectified, work through the following steps for recommissioning:

1. ▶ Reset the emergency stop equipment.
2. ▶ Acknowledge the fault on the control.
3. ▶ Ensure that nobody is in the hazardous area.
4. ▶ Start in accordance with the information in the chapter entitled “ ⚡ 8 ‘Operation’ on page 40 ”.

## 10 Maintenance

### 10.1 Introduction

Maintenance can be completely subdivided into the following basic measures: servicing, inspection, maintenance and improvement. It includes:

- Consideration of internal and external requirements
- Coordination of the maintenance targets with the corporate objectives
- Adherence to the relevant maintenance strategies

### 10.2 Safety

#### Personnel

- The maintenance work must only be carried out by instructed persons or by the manufacturer.
- Work on the electrical system must only be carried out by qualified electricians as a matter of principle.

#### Personal protective equipment

Wear the following protective equipment during all maintenance work:

#### Protective equipment:

- Safety helmet
- Hearing protection
- Protective gloves
- Safety shoes
- Protective clothing



#### **IMPORTANT!**

*Other protective equipment that has to be worn for certain work is indicated separately in the warnings included in this chapter.*

#### Electrical system



#### **DANGER!**

#### **Danger of death due to electric current!**

Danger of electric shock! Do not touch any live components! Damaged insulation or damaged parts are a life threatening hazard.

- Have work on the electrical system carried out only by skilled qualified electricians.
- Have work on the electrical system carried out only by skilled qualified electricians.
- If the insulation is damaged, disconnect the power supply immediately and have the insulation repaired.
- Before you start working on electric systems and equipment, switch off the supply voltage and secure it against being switched on accidentally. Comply with the 5 safety rules:
  - Disconnect.
  - Secure it against being switched on accidentally.
  - Ensure that no voltage is present.
  - Connect to the earth; short circuit connection.
  - Either cover nearby parts that carry a voltage or install barriers.
- Do not bypass or disable any circuit breakers. Be sure to maintain the correct current rating when you replace a circuit breaker.
- Ensure that live parts do not come into contact with moisture. Moisture can cause a short circuit.

#### Securing the unit against being switched on accidentally



#### **DANGER!**

#### **Danger of death due to impermissible activation and deactivation!**

During maintenance work, there is a risk of the power supply being switched back on without authorisation. There is therefore a danger of death for the persons in the hazardous area.

Therefore:

- Before starting work, switch off all of the power supplies and secure them against being switched back on again.

## Explosion protection

### **EXPLOSION PROTECTION!**

Ignition sources, such as sparks, naked flames and hot surfaces, can lead to explosions in potentially explosive atmospheres. The following therefore applies to all work on units in the Ex area:

- Get written permission before you start the work.
- Only perform work if there are no dust deposits or a potentially explosive atmosphere.
- Use only tools that have been approved for use in areas with potentially explosive atmospheres.

Additionally:

- It must be ensured that sufficient cooling air is supplied to the fan drive motor at all times.
- Motors with a cover must be used if fans with a vertical motor shaft are installed.
- Servicing and maintenance work on explosion-proof fans must only be carried out by qualified personnel with the relevant explosion protection qualifications using original replacement parts


Failure to comply with these notes leads to loss of explosion protection and may result in serious injury and death.

### **WARNING!**

#### **Risk of injury from incorrect maintenance!**

Incorrect maintenance can result in serious injury or property damage.

Therefore:

- Maintenance work must only be carried out by qualified personnel who have been authorised by the system owner.
- Before you start, make sure that there is sufficient clearance for the work you have to complete.
- If components have been replaced, ensure that they are assembled correctly, reinstall all of the fixing elements, and tighten all screws with the correct tightening torque (see  C 'Tables' on page 59 in the appendix).
- Before reactivation, ensure that all of the covers and protective devices are installed correctly and are working properly.

### **WARNING!**

#### **Risk of injury from rotating parts!**

Rotating parts in the fan can cause serious injuries.

Therefore, before performing any maintenance work:

- Bring the fan to a proper standstill and disconnect it from the power supply.
- Never reach into the running fan.
- Wait for the impeller to come to a standstill.
- Do not stop the impeller manually.
- Secure the fan against being switched back on again.

### **ENVIRONMENT!**

Observe the following notes on environmental protection during maintenance work:

- At all lubricating points that are supplied with lubricant manually, remove the escaping, used or excess grease and dispose of it in line with the applicable local regulations.

## 10.3 Maintenance

The following sections describe the maintenance jobs required to ensure efficient and fault-free operation.

If increased wear is detected on individual components or functional groups during regular checks, the required maintenance intervals must be reduced based on the actual signs of wear. The intervals are dependent on the conveyed media and the other operating conditions that differ in each case.

If the check indicates even a slight amount of wear, clean the individual parts in good time and replace if necessary.

The impeller and casing suffer from natural wear due to the carried dust, acidic and corrosive vapours and gases that are added to the flow rate. The type and concentration of the dust, gases and vapours result in deposits, erosion and corrosion on the impeller and casing.

This natural wear can damage the material in such a way that it no longer withstands the loads.

Deposits on the impeller that are never distributed evenly have an imbalance and thus cause irregular running which damages the motor bearing.

Deposits in the casing narrow the free cross section or roughen the inside of the casing and thus have an adverse effect on the fan's performance data.

A component's surface protection must be checked on a regular basis and maintained if necessary. Note that stones, dust abrasion or chemical loads, for example, can cause mechanical damage to the surface. Even stainless steel can be affected by surface corrosion, for example if salts or aggressive gases are present in a very moist atmosphere.

It should be noted in this regard that surface corrosion generally does not impair the fan's characteristics and cannot, therefore, be classed as a warranty claim. Instead, it must be repaired or eliminated by taking suitable maintenance measures even during the warranty period. Typically, the corrosion can be stopped by cleaning the surface and implementing suitable surface preservation.

If you have any questions about the maintenance work and intervals, contact the manufacturer (service address on page 2).

### **IMPORTANT!**

*Document commissioning and maintenance (functional check) with the relevant report templates ( ↵ A 'Commissioning report' on page 54 ) and maintenance report ( ↵ B 'Maintenance report' on page 56 in appendix).*

## 10.3.1 Use of monitoring systems

The use of monitoring systems simplifies the required maintenance work and checks.

Maintenance of the fans is limited to a simplified check as prescribed by the maintenance plan and maintenance report.

Bearing replacement times do not apply and are instead based on the condition.

The use of the relevant monitoring system does not release the user from carrying out the maintenance work listed in the TROX X-FANS maintenance report. The system owner bears full responsibility for any maintenance work that deviates from this or that is not performed in full.

### 10.3.1.1 TROX X-FANS VD fan diagnostic system

The TROX X-FANS fan status monitoring system monitors the state of the fan by measuring physical characteristics.

Following the prescribed functional and test runs, the general functional state of the fan is displayed on the fan data recorder (VDR) or a remote display unit using a traffic light function (green = OK, yellow = warning, red = alarm). If yellow or red is displayed, the fan must be maintained and the fault may need to be eliminated.

It is recommended to analyse the measurement data saved in the fan data recorder, as this may simplify the troubleshooting process. During commissioning, the first functional check is completed as a reference run.

### 10.3.1.2 Bearing status monitoring systems

Prüftechnik or SPM monitoring systems must be used.

The measured characteristics (including the total vibration velocity in the 10 – 1000 Hz range) must be evaluated by the system owner or the specialist company it commissions, and this work must be carried out in accordance with ISO 14694 (2003) (see ↵ C.3 'Table of permissible vibration velocities' on page 62 in the appendix).

## 10.4 Maintenance

### 10.4.1 Lubrication

The bearing is lubricated for life. Therefore, it does not need to be relubricated.

If specifically requested by the customer, the fan can be equipped with a relubricating device. In this case, relubrication must take place according to the maintenance plan.

Refer to the separate electric motor documentation for the location of the relubricating device and the required greases.

### 10.4.2 Replacing the motor bearings

Work on the electric motor must only be carried out by a qualified electrician or a suitable motor winding company.

## 10.5 Repair

### 10.5.1 Replacing the impeller and electric motor

#### 10.5.1.1 Disassembly

##### Personnel:

- Specialist personnel

##### Protective equipment:

- Protective gloves

### **WARNING!**

#### **Risk of injury from rotating parts!**

Rotating parts in the fan can cause serious injuries.

Therefore, before disassembly:

- Bring the fan to a proper standstill and disconnect it from the power supply.
- Never reach into the running fan.
- Wait for the impeller to come to a standstill.
- Do not stop the impeller manually.



Measures following maintenance work

## Disassembly of the cover grille (optional)

- ▶ Remove the screws from the cover grille and take off the cover grille.

## Disassembly of the impeller

1. ▶ Loosen the hub lock.
2. ▶ Remove the impeller from the motor shaft using the extractor tool.



### IMPORTANT!

Handle the impeller with care: do not roll or place the impeller on its blades. Avoid impacts on the impeller.

## Disassembly of the electric motor

1. ▶ Remove the connection cable from the motor terminal box.
2. ▶ Secure the electric motor against falling out.
3. ▶ Loosen the fixing screws.
4. ▶ Remove the electric motor.



### IMPORTANT!

Note series-specific work instructions (see in the appendix).

### 10.5.1.2 Installation

## Assembly of the electric motor

1. ▶ Insert the electric motor.
2. ▶ Screw in the electric motor using fixing screws and washers. Comply with the specified screw tightening torques (see ↗ Appendix C.1 'Table of screw tightening torques' on page 60 in the appendix).
3. ▶ Connect the motor cable in accordance with the connection diagram.

## Assembly of the impeller

1. ▶ Lightly grease the shaft end.
2. ▶ Assemble the impeller using the mounting tool. (Threaded hole in the front side of the crankshaft according to DIN 332)
3. ▶ Align the impeller. Maintain the minimum clearance (within the tolerance) from the table below.

4. ▶ Secure the impeller on the crankshaft (using the parts supplied: pressure disk, hexagon screw, screw locking device). Comply with the specified screw tightening torques (see ↗ Appendix C.1 'Table of screw tightening torques' on page 60 in the appendix).

## Assembly of the cover grille (optional)

- ▶ Fix the cover grille to the fan casing with fixing screws, washers and nuts. Comply with the specified screw tightening torques (see ↗ Appendix C.1 'Table of screw tightening torques' on page 60 in the appendix).

## 10.6 Measures following maintenance work

Carry out the following steps after completing the maintenance work and before activation:

1. ▶ Check that all of the screw connections loosened previously are secure.
2. ▶ Check whether all of the protective devices and covers removed previously have been reinstalled properly.
3. ▶ Ensure that all of the tools, materials and other equipment used have been removed from the work area.
4. ▶ Clean the work area and remove any spilled substances such as liquids, processing materials or similar products.
5. ▶ Ensure that all of the system's safeguards work properly.



### IMPORTANT!

The valid technical guidelines and building regulations on the commissioning / maintenance and installation of ventilation systems must be observed. Ensure that nobody is in the hazardous area.

## 11 Decommissioning

### 11.1 General

Once the period of use of the device has expired, the device must be removed and disposed of in an environmentally friendly manner.

### 11.2 Safety

#### Personnel

- Disassembly must only be carried out by specially trained specialist personnel.
- Work on the electrical system must only be carried out by qualified electricians.

#### Electrical system

#### DANGER!

##### **Danger of death due to electric current!**

Danger of electric shock! Do not touch any live components! Live electrical components may execute uncontrolled movements and cause serious injury.

Therefore:

- Before starting disassembly work, switch off the power supply and disconnect it permanently.

#### Explosion protection

#### EXPLOSION PROTECTION!

*Ignition sources, such as sparks, naked flames and hot surfaces, can lead to explosions in potentially explosive atmospheres. The following therefore applies to all disassembly work carried out on the unit in the Ex area:*

- *Get written permission before you start the work.*
- *Only perform disassembly work if there is no potentially explosive atmosphere..*
- *Use only tools that have been approved for use in areas with potentially explosive atmospheres.*

*Failure to comply with these notes leads to loss of explosion protection and may result in serious injury and death.*

#### WARNING!

##### **Risk of injury due to incorrect disassembly!**

Stored residual energy, angular components, sharp edges and corners on and in the unit or on the required tools can cause injuries. Therefore:

Therefore:

- Before starting the work, ensure that there is enough space.
- Handle open, sharp-edged components with care.
- Disassemble components properly. Be aware that some components are very heavy. Use hoisting devices if necessary.
- Secure components so that they do not fall down or topple over.
- Consult the manufacturer if anything is unclear.

### 11.3 Disassembly

Before starting disassembly:

- Switch off the unit and secure it against being switched back on again.
- Physically disconnect the unit from the power supply and discharge any residual energy.
- Remove any operating materials, auxiliary materials and residual processing materials, and dispose of them in an environmentally-friendly manner.

Then professionally clean sub-assemblies and components and dismantle them in accordance with local occupational safety and environmental protection regulations.

### 11.4 Disposal

If no return or disposal agreement is in place, any disassembled components should be recycled:

- Scrap the metals.
- Take plastic parts to be recycled.
- Dispose of other components in a suitable manner, i.e. depending on their material properties.

#### ENVIRONMENT!

##### **Environmental damage due to improper disposal!**

Electronic waste, electronic components, lubricating and other auxiliary materials must be treated as hazardous waste and must only be disposed of by approved specialist companies!

The local municipal authority or specialist disposal companies provide information about environmentally-friendly disposal.

## 12 Replacement parts

### 12.1 General

#### ! NOTICE!

Incorrect or faulty replacement parts and components from other manufacturers can cause severe damage. Any warranty and service claims shall lapse without prior notification if non-approved replacement parts are used.

Therefore:

Only use original replacement parts provided by the manufacturer

- 9 Mounting foot
- 10 Fan terminal box (not displayed)
- 11 Isolator (not displayed)
- 12 Equipotential bonding (not displayed)
- 13 Sound attenuator (not displayed)
- 14 Shut-off dampers (not displayed)
- 15 Diffusor (not displayed)
- 16 Cooling air fan (not displayed)
- 17 Casing acoustic / thermal insulation (not displayed)

Provide the following information when ordering replacement parts from the manufacturer:

- Type <sup>1)</sup>
- Manufacturing number: <sup>1)</sup>

<sup>1)</sup> See rating plate

### 12.2 BVAX replacement parts

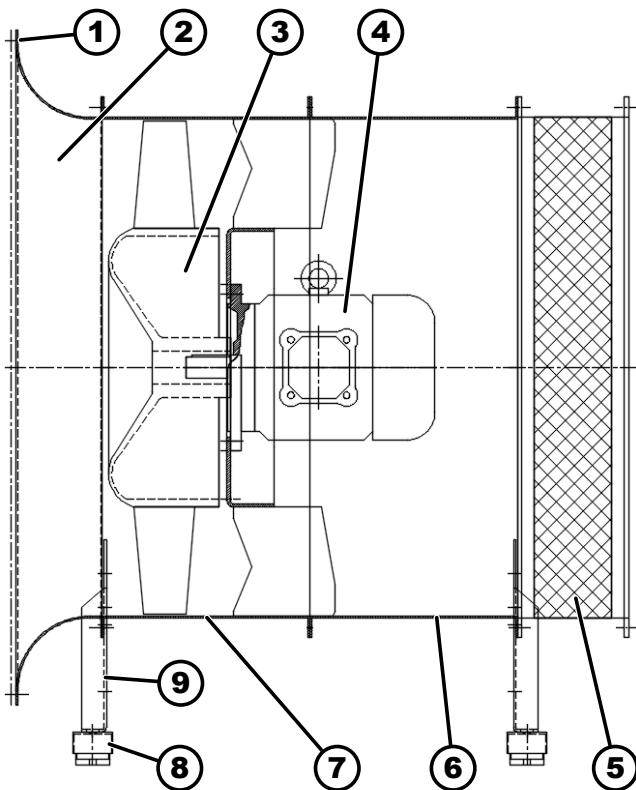


Fig. 50: Overview of replacement parts

- 1 Cover grille
- 2 Bellmouth
- 3 Impeller
- 4 Electric motor
- 5 Flexible connector
- 6 Extension duct
- 7 Casing
- 8 Vibration isolator

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## Appendix



## A Commissioning report

Building:		Date: __ . __ . 20__
Fan type:		
FA number (job number):		
Approval number CE-EN 12101-3 (BV only)		




Rating plate data		
Name	Item	Unit
Volume flow rate		m <sup>3</sup> /h
Speed		rpm
Density		kg/m <sup>3</sup>
Motor type		
Motor no.		
Nominal voltage		V
Nominal current		A
Mains frequency		Hz
Nominal power		kW
Motor speed		rpm

Operating conditions		
Name	Comment / specification	
Operating mode	Operation on demand	<input type="checkbox"/>
	Combined ventilation and smoke extract operation	<input type="checkbox"/>
Flow medium	Clean Air	<input type="checkbox"/>
	Dust-laden air	<input type="checkbox"/>
Other medium		<input type="checkbox"/>
Installation location	Vertical installation location	<input type="checkbox"/>
	Horizontal installation location	<input type="checkbox"/>
	Fan assembled on vibration isolators	<input type="checkbox"/>
	Fan assembled with flexible connectors	<input type="checkbox"/>

Checklist		
<p><b>Before commissioning, the system must be checked using the following checklist. If all the points on the checklist have been met, the fan is ready for commissioning using the control installed on the customer's premises.</b></p>		
No.	Check	
1	Fan is free of foreign matter (tools, dirt, etc.).	<input type="checkbox"/>
2	Impeller rotates freely.	<input type="checkbox"/>
3	Impeller gap corresponds to information provided in ↗ C.4 'Impeller gap table' on page 63 .	<input type="checkbox"/>
4	Screw connections are secure, see ↗ C.1 'Table of screw tightening torques' on page 60 .	<input type="checkbox"/>

**Checklist**

Before commissioning, the system must be checked using the following checklist. If all the points on the checklist have been met, the fan is ready for commissioning using the control installed on the customer's premises.

No.	Check	
5	Cover grilles are mounted and secure (for free suction and or blow-out). See  C.1 'Table of screw tightening torques' on page 60 .	<input type="checkbox"/>
6	Duct system is assembled in full.	<input type="checkbox"/>
7	Pressure side and intake side connecting parts are assembled in full.	<input type="checkbox"/>
8	Inspection hatch is accessible and closed.	<input type="checkbox"/>
9	Electronic protective devices (emergency stop switch, motor overload switch, earth resistance) are installed correctly and are active.	<input type="checkbox"/>
10	Electric motor is connected according to the terminal diagram.	<input type="checkbox"/>
11	Check the electric motor's direction of rotation: <ul style="list-style-type: none"> <li>■ Briefly supply the electric motor (&lt; 1 s) with supply voltage</li> <li>■ Compare the direction of rotation with the arrow on the fan casing.</li> <li>■ Switch the wires if it does not match.</li> </ul>	<input type="checkbox"/>
12	Carry out and log the checks and functional check according to  B 'Maintenance report' on page 56 .	<input type="checkbox"/>
13	In the case of speed-controlled fans, check vibrations throughout the entire operating speed range.	<input type="checkbox"/>
	<p><b>IMPORTANT!</b></p> <p>In the version with VD, the first functional check is automatically saved as the reference run. This is used as a comparison for all subsequent functional checks under the same operating conditions.</p>	

**Notes**

Commissioning carried out by:	Date	Signature
Executor		
System owner		

## B Maintenance report

<b>Building:</b>		<b>Date:</b> __ . __ . 20__
<b>Fan type:</b>		
<b>FA number (job number):</b>		
<b>Approval number</b> CE-EN 12101-3 (BV only)		

Measurements to be performed (according to VDI 2044, DIN EN ISO 5802)				
Variable		Unit	Value measured by UBA	Measuring device
Supply voltage		V		
Operating current <sup>1</sup>	L1	A		
	L2	A		
	L3	A		
Volume flow rate		m <sup>3</sup> /h		
Vibrations, axial		mm/s		
Vibrations, radial		mm/s		
Speed		rpm		
Checklist filled out				

<sup>1</sup> If the current is measured using the current probe on the fan terminal box and star / delta circuit, the measured value must be multiplied by  $\sqrt{3}$  and logged. If the nominal current is exceeded, the cause must be determined and eliminated according to § 9.4 'List of faults' on page 42.

Notes		
Maintenance carried out by:	Date	Signature
Executor		
System owner		

Maintenance report checklist						
Maintenance work to be carried out in the relevant category	Ventilation	ATEX	Smoke exhaust fan			
			Standard	with VD	with VD+VME	with monitoring system
<b>To be carried out every six months by instructed personnel</b>						
Accelerate to the maximum nominal speed and switch off again			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>To be performed annually by instructed personnel</b>						
Visual inspection of the fan's general external condition (incl. accessories), checking for contamination, damage and corrosion, and cleaning if necessary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check flexible connector(s) for damage and ensure stress-free installation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check the cooling air supply for a free cross section (VD monitors the motor temperature) - if present	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>
Check the anti-vibration elements for free movement and damage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Check the electrical fan connection terminal box and cables for damage and correct installation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check the impeller for damage and free movement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Perform a functional check: 20 minutes <sup>2</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check the direction of rotation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Check the electric motor's current consumption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>
Measurement and evaluation of the bearing condition						<input type="checkbox"/>
Read off the VD display (check "traffic lights" and display values) or read out data				<input type="checkbox"/>	<input type="checkbox"/>	
<b>To be performed annually by specialist personnel</b>						
Check the vibration state <sup>3</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			

<sup>2</sup> Note: In the version with VD, the first functional check is automatically saved as the reference run. This is used as a comparison for all subsequent functional checks under the same operating conditions

<sup>3</sup> The values specified in the operating manual must be complied with. The values must be determined according to ISO 14694.

<sup>4</sup> The bearings' service life is generally 20,000 h, but the actual service life can deviate considerably from this depending on the bearing load. The operating instructions provided by the motor manufacturer are available for download from the manufacturer's website.

<sup>5</sup> Recommendation: An annual bearing check should be performed.

Maintenance report checklist						
Maintenance work to be carried out in the relevant category	Ventilation	ATEX	Smoke exhaust fan			
			Standard	with VD	with VD+VME	with moni- toring system
<b>To be performed every 3 years by specialist personnel</b>						
Measure the volume flow rate			<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>
<b>To be performed every three years by the manufacturer or an authorised specialist company from the fifth year following manufacture</b>						
Check the bearings <sup>4</sup>			<input type="checkbox"/>			<input type="checkbox"/>
<b>To be performed by the manufacturer or authorised specialist company according to the condition</b>						
Replace the motor bearings <sup>5</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<sup>2</sup> Note: In the version with VD, the first functional check is automatically saved as the reference run. This is used as a comparison for all subsequent functional checks under the same operating conditions

<sup>3</sup> The values specified in the operating manual must be complied with. The values must be determined according to ISO 14694.

<sup>4</sup> The bearings' service life is generally 20,000 h, but the actual service life can deviate considerably from this depending on the bearing load. The operating instructions provided by the motor manufacturer are available for download from the manufacturer's website.

<sup>5</sup> Recommendation: An annual bearing check should be performed.

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## C.1 Table of screw tightening torques

	Maximum tightening torque $M_A$ in Nm								
	Strength category								
	8.8			10.9			12.9		
	Sliding friction coefficient $\mu^8$								
	0.10	0.15	0.20	0.10	0.15	0.20	0.10	0.15	0.20
<b>M8</b>	20	25	30	30	37	44	35	43	52
<b>M10</b>	40	50	60	59	73	87	69	84	100
<b>M12</b>	69	87	105	100	125	151	120	148	177
<b>M16</b>	170	220	260	250	315	380	290	370	445
<b>M20</b>	340	430	520	490	615	740	570	700	840
<b>M24</b>	590	740	890	840	1050	1250	980	1250	1500

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- $\mu = 0.10$  very good surface, lubricated
- $\mu = 0.15$  good surface, lubricated or dry
- $\mu = 0.20$  surface is black or phosphate-treated, dry

## C.2 Table of tightening torques for electrical components

Local isolator inserts	
Type	Tightening torques in Nm
F400	2.0
MN105	0.8
MN151	1.0
MN251	1.8
MN451	2.2
ML1	1.2
ML2	2.5
ML3	3.0
Earthing screws	2.0

Ceramic terminal blocks	
Type	Tightening torques in Nm
Thermistor protection	1.0
M4	1.2
M5	2.0
M6	3.0
M8	6.0
M10	10.0
M12	15.5
M16	30.0
M20	52.0

Cover screws	
Type	Tightening torques in Nm
Aluminium terminal boxes	2.5
Stainless steel casing	0.9
Sheet steel casing	0.9
Plastic casing	2.0

### C.3 Table of permissible vibration velocities

According to ISO 14694 (2003), Chapter 8.4

State	Dimensioning group	Max. vibration velocity, securely assembled, [mm/s]	Max. vibration velocity, flexibly assembled, [mm/s]
Commissioning	BV-2	5.6	9.0
	BV-3	4.5	6.3
	BV-4	2.8	4.5
Normal operation	BV-2	5.6 – 9.0	9.0 – 14.0
	BV-3	4.5 – 7.1	6.3 – 11.8
	BV-4	2.8 – 4.5	4.5 – 7.1
Alarm	BV-2	9.0 – 12.5	14.0 – 17.5
	BV-3	7.1 – 9.0	11.8 – 12.5
	BV-4	4.5 – 7.1	7.1 – 11.2
Shutdown	BV-2	≥ 12.5	≥ 17.5
	BV-3	≥ 9.0	≥ 12.5
	BV-4	≥ 7.1	≥ 11.2

### Table of the fan rating groups

According to ISO 14694 (2003), Chapter 8.4

Application	Max. drive capacity [kW]	Fan rating group
Building ventilation	≤ 3.7	BV-2
	> 3.7	BV-3
Hazardous gases	≤ 37	BV-3
	> 37	BV-4

## C.4 Impeller gap table

### Axial fans

Size	Impeller gap (+ tolerance) in mm						
	AXN; BVAXN F200	AXO; BVAXO F200/F300	BVAXN F300	BVAXN F400	BVAXN F600	AXN-ex	AXO-ex
250	1.0 (+1.0)	1.0 (+1.0)				2.0 (+1.0)	
280	1.0 (+1.0)	1.0 (+1.0)				2.0 (+1.0)	
315	1.0 (+1.0)	1.0 (+1.0)	1.0 (+1.0)	2.4 (+1.0)		2.0 (+1.0)	2.0 (+1.0)
355	1.5 (+1.3)	1.5 (+1.3)	1.5 (+1.3)	2.5 (+1.3)		2.5 (+1.5)	
400	1.5 (+1.3)	1.5 (+1.3)	1.5 (+1.3)	2.9 (+1.3)	2.0 (+1.3)	3.0 (+1.5)	3.0 (+1.5)
450	2.0 (+1.5)	2.0 (+1.5)	2.0 (+1.5)	2.0 (+1.5)	2.0 (+1.5)	3.0 (+1.5)	
500	2.0 (+1.5)	2.0 (+1.5)	1.5 (+1.5)	2.9 (+1.5)	3.0 (+1.5)	4.0 (+1.5)	4.0 (+1.5)
560	2.0 (+1.5)	2.0 (+1.5)	2.0 (+1.5)	3.1 (+1.5)		3.0 (+1.5)	
630	2.5 (+1.5)	2.5 (+1.5)	2.0 (+1.5)	3.3 (+1.5)	3.5 (+1.5)	4.0 (+1.5)	4.0 (+1.5)
710	3.0 (+2.0)	3.0 (+2.0)	3.0 (+2.0)	3.6 (+2.0)	4.5 (+2.0)	4.5 (+2.0)	
800	3.0 (+2.0)	3.0 (+2.0)	4.5 (+2.0)	4.1 (+2.0)	5.0 (+2.0)	5.0 (+2.0)	5.0 (+2.0)
900	3.5 (+2.5)	3.5 (+2.5)	3.0 (+2.5)	4.6 (+2.5)	6.0 (+2.5)	5.5 (+2.5)	
1000	4.0 (+2.5)	4.0 (+2.5)	4.5 (+2.5)	5.1 (+2.5)	6.5 (+2.5)	6.0 (+2.5)	6.0 (+2.5)
1120	4.5 (+3.0)	4.5 (+3.0)	3.5 (+3.0)	5.7 (+3.0)	7.0 (+3.0)	7.0 (+3.0)	
1250	5.0 (+3.0)	5.0 (+3.0)	5.5 (+3.0)	6.4 (+3.0)	7.5 (+3.0)	8.5 (+3.0)	
1400	5.0 (+3.0)	5.0 (+3.0)	7.5 (+3.0)	6.0 (+3.0)	8.0 (+3.0)	9.5 (+3.0)	
1600	6.0 (+3.0)	6.0 (+3.0)	7.5 (+3.0)	7.0 (+3.0)	9.0 (+3.0)	10.5 (+3.0)	
1800	6.5 (+4.0)	6.5 (+4.0)				11.5 (+4.0)	
2000	7.5 (+4.0)	7.5 (+4.0)				13.0 (+4.0)	
2240	8.0 (+4.0)	8.0 (+4.0)				14.5 (+4.0)	
2500	9.0 (+4.0)	9.0 (+4.0)				16.0 (+4.0)	

**C.5 Installation of the taper-lock clamping bushes, tightening torques**

Bush type	Screw tightening torques in Nm
1008	6
1108	6
1210	20
1215	20
1310	20
1610	20
1615	20
2012	30
2517	49
3020	90
3030	90
3035	115
4040	170
4545	190
5050	270