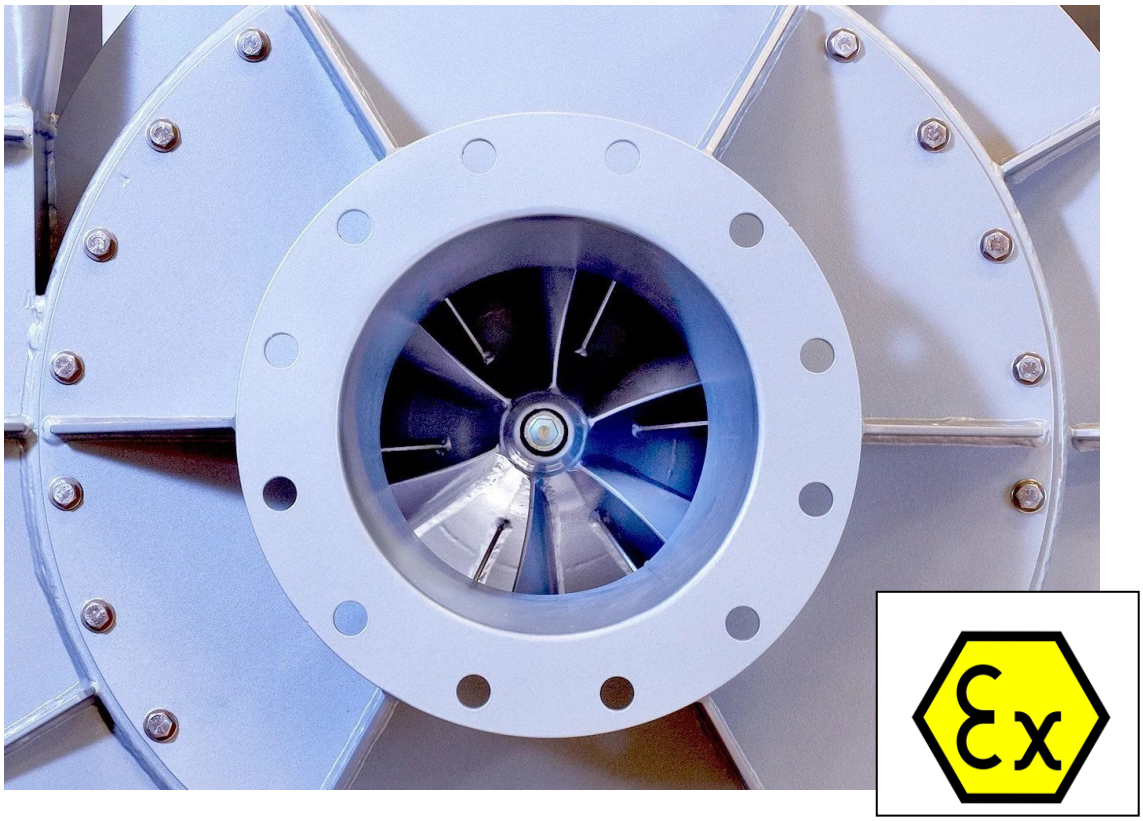
ATEX operating instructions for an incomplete machine



Translation of the original operating instructions (2006/42/EC)

IMPORTANT!

Before using the machine, carefully read the operating instructions.

Keep the operating instructions for future reference.

The operating company is liable for any damage caused by installation or operating errors.

The current version of the operating instructions can be found on our homepage.

Supplementary information

Target group:	Commercial use
Date of the operating instructions:	10.2024
Version of the document:	2.0

Info

Information boxes provide important instructions to ensure that the fan functions properly, facilitate your work or inform you about intended use.

Description of the labelling of text passages

Label	Description
•	Marks instructions without a fixed sequence
▪	Marks instructions within warnings
1)	Marks numbered, serial instructions
-	Marks the listings of contents
►	Marks references to elements or sections within the operating instructions or to contents and documents outside the operating instructions

Fan manufacturer

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Product and performance specific data

The technical data of the fan can be found in the documents supplied separately.

Table of contents

1 Safety information

This product represents an incomplete machine within the meaning of the Machinery Directive 2006/42/EC. Basic functional, safety and health protection requirements cannot yet be met in full, as certain risks arise from the fact that the machine is still incomplete. The client assumes the obligation to establish the industry and application-specific safety and to prove compliance of the fan with the provisions of the Machinery Directive 2006/42/EC.

1.1 Description of the warnings

The following signal words and symbols are used in these operating instructions to indicate dangers and important information:

The general **warning symbol**  is shown in the safety instructions in the highlighted title field to the left of the **signal word** (DANGER!, WARNING!, CAUTION!, NOTICE). Safety instructions with the general warning symbol indicate a risk of **personal injury**.

- Always adhere to these safety instructions to provide protection against **injuries or death**! Safety instructions without a general warning symbol indicate a risk of material damage.

Warning symbols in combination with **signal words** indicate the degree of danger:

DANGER!	Refers to an imminent danger which may result in death or serious injury if the danger is not avoided.
WARNING!	Indicates a potential danger which may result in death or serious injury if the danger is not avoided.
CAUTION!	Indicates a potential danger which may result in minor / slight injuries or material damage if the danger is not avoided.
NOTICE	Indicates a potential danger which may damage the product or the environment if the danger is not avoided.

Warning signs pursuant to DIN EN ISO 7010:2020-07

	W001 General warning sign
	W012 Electricity hazard
	W022 Warning of sharp object
	ATEX symbol for spark-protected fans in accordance with DIN EN ISO 13349

1.2 Safety instructions

These operating instructions...

- ...do not contain detailed information on all product types due to reasons of clarity and cannot take into account every conceivable case of installation or operation.
- ...contain instructions for the entire product life cycle of the fan.
- ...must be read and understood in full before starting any work on and with the fan.
- ... must be strictly followed.

- ► If you have any questions which are not answered in the operating instructions, please contact mdexx fan systems GmbH.
- ► For supplementary information on safe operation, please refer to the additional document supplied: "Technical Terms and Conditions of Delivery mdexx fan systems GmbH".

DANGER!

Danger of death due to electrical voltage

There are high voltages on the electrical equipment of the fan. If the fan is handled incorrectly, these electrical voltages may result in death or serious injuries.

- Work on electrical equipment may only be completed by fully qualified and authorised electricians!

Before starting work on the fan, take the following measures:

1) Ensure that the fan has been isolated from all possible sources of supply.
2) Secure the fan against being switched on again.
3) Check that the fan has been isolated from all possible sources of supply.
4) Do not open the motor connection box until you are sure that it has been isolated from all possible sources of supply.
5) Earth and short-circuit.
6) Cover or shield adjacent live parts.
7) Check all cables for damage before use.
8) After completing the work, cancel the measures taken in reverse order.

Further protective measures against electric shock pursuant to VDE 0100-410

Precaution for basic protection
It prevents direct contact with live (active) parts of electrical systems, e.g. using insulation

(+)

Precaution for fault protection
It prevents hazardous touch voltages from occurring or remaining in the event of a fault, e.g. by shutting down the power supply.

(+)

Precaution for fault protection
It provides some additional protection if the precaution for basic protection fails and / or

- if the precaution for fault protection fails or
- in case of carelessness of the user of the electrical system or
- if there is a particular risk to persons due to special conditions caused by external influences, e.g. due to the use of residual current devices with I ≤ 30 mA.

Protective measures against electric shock pursuant to VDE 0100-410
Section 411: Automatic shutdown of the power supply
Section 412: Double or reinforced insulation
Section 413: Protective separation
Section 414: Low voltage SELV or PELV

Source: Concept of personal protection pursuant to DIN VDE 0100-410 | DKE

DANGER!
Risk of injury if protective devices are missing

Missing protective devices may cause cutting hazards, crushing hazards and electric shocks. This may result in death, serious injury or substantial material damage.

- Operate the fan using suitable protective devices only.
- Do not open or remove covers during operation.
- When installing the protection against contact, comply with the applicable health and safety and accident prevention regulations.
- Ensure protection against contact during operation by means of the system design.
- Before operation, equip fans with protection against contact in accordance with the regulations (see DIN EN ISO 13857).

DANGER!
Risk of injury due to additional loads

Non-observance may lead to deformation and destruction of the fan, possibly resulting in serious injury and material damage.

The fan must not be exposed to any additional loads from other products.

- Avoid adding additional loads to the fan.
- Ensure that the fan is used only for the intended applications.
- Before each start-up, check the load situation of the fan to prevent damage.

DANGER!

Risk of bursting in the event of impermissible vibrations due to external influences

This may result in death, serious injury or substantial material damage.

- Since mdexx fan systems GmbH shall not be responsible for any external influences, e.g. resulting from the use of speed-controlled drivers, the system manufacturer must take suitable measures to protect against resonance. Operation in resonance is generally not permitted.

  In this context, observe the recommendations of E DIN EN 17170 in conjunction with ISO 14694. The most likely way to prevent fan impellers breaking in accordance with the aforesaid standard is to shut down the main motor by means of vibration monitoring.
- The necessity of these safety measures or other monitoring mechanisms must be checked by the system manufacturer or the end user for the respective application and implemented accordingly, if necessary.

WARNING!

Risk of injury due to insufficiently qualified personnel

Improper handling of the fan may result in serious or even fatal injuries.

- The system operator is responsible for checking the qualifications of the personnel.
- Have all work, such as transport, installation, commissioning, decommissioning, maintenance or disposal on and with the fan, carried out by trained, qualified and reliable specialist personnel only.
- Before starting any work with or on the fan, read and understand these operating instructions completely. Strictly adhere to all specifications.

CAUTION!

Risk of injury due to an uncontrolled chain reaction caused by a malfunction

Injuries and material damage may be the result of an uncontrolled chain reaction.

The operating company is not permitted to repair the impeller. Improper repairs may trigger a chain reaction of malfunctions and damage.

- Do not repair the fan yourself.
- If the fan is damaged, contact mdexx fan systems GmbH.

CAUTION!

Risk of injury due to incorrect commissioning and test runs of the fan

Injuries and material damage may be the result of incorrect commissioning and test runs.

- Never carry out commissioning/test runs on unsecured fans.
- Carry out commissioning and test runs using suitable safety precautions only.
- Ensure that the fan does not start up if you are working in the workshop area or on complete systems where safety has been temporarily disabled due to maintenance or commissioning work.

NOTICE

Risk of destruction of the impeller due to operation in the unstable range

If a fan is operated in the unstable range of its characteristic for a longer period of time, the impeller may – depending on its design – be damaged or even destroyed.

- Ensure that the air can flow freely onto the impeller.
- Maintain a clearance of at least 1 x impeller diameter in the axial direction.
- Install an inlet nozzle or a cylindrical air duct with a length of at least one impeller diameter at the fan inlet.
- Operate fans only within the stable range of their characteristic. If you are unsure, take suitable measures such as volume flow or vibration monitoring.
- If the fan casing has an integrated inlet nozzle, you do not need to install an additional inlet nozzle. This is a prerequisite for achieving the full flow rate and avoiding vibrations due to an uneven flow of air.

NOTICE

Risk of damage due to foreign matter being drawn in

If foreign matter is drawn in, this may result in damage to the fan or an imbalance

- Look out for signs, such as loud noises and strong vibrations.
- Regularly check the impeller for cracks.
- Ensure that the area around the fan remains free of foreign matter.

1.2.1 Additional safety instructions for ATEX application / explosion protection

The following explanations only apply to fans with a separate ATEX certification.

DANGER!
Deformation of the inlet nozzle

Deformation of the stationary inlet nozzle or the rotating impeller may result in increased heating and breakage of the impeller. This may result in life-threatening injuries and serious material damage.

The impact test demanded by EN ISO 80079-36 could not be performed without significantly deforming the material of the thin inlet nozzle. This would result in the generation of frictional heat, which is a possible ignition source according to the ignition hazard assessment.

- Before commissioning, ensure that the inlet nozzle is not deformed.
- Ensure that there is a sufficient gap between the inlet nozzle and the impeller.
- To prevent deformation, take additional protective measures.

Marking example for the "non-electrical part" according to ATEX:

CE Ex II 2 G Ex h IIB+H_2 T4 Gb X

Ex = Ex sign to avoid explosions

II = device group

2 = protective category 2 (device category)

G = Gas / D = Dust.

Ex h = type of ignition protection for fan components (without a motor)

IIB+H_2 = explosion group II B of the conveyed substances

T4 = temperature class = 135 °C max. surface temperature of all components

Gb = Equipment Protection Level

X = Special conditions which the operating company must take into account to ensure safe operation

Explanations on type of ignition protection "Ex h": constructive safety "c" as described in DIN EN ISO 80079-37.

Explanation of "X" (special conditions):

An extended temperature limit of the ambient conditions of -20 °C to +60 °C applies to the non-electrical part (= fan, without motor).

- The operating company must ensure that the inlet nozzle, in front of the rotating impeller, is not damaged or deformed by impacts or shocks. In these cases, contact between stationary and rotating parts would be possible.

  A safety measure using a protective grille, a separate protective casing or alternative contact protection variants would be conceivable. The operator must check separate safety instructions for the entire assembly and supplement them if necessary. An impact strength test, as demanded by DIN EN ISO 80076-36:2016-12 Chapter 8.3.1, is not possible for the thin walls of the inlet nozzle and impeller.

- Furthermore, the operating company must ensure that heat radiation, for example from a hot pipe or an adjacent device (i.e. from heat sources without direct connection), is taken into account when determining the maximum ambient temperature at the installation location of the explosion-proof device.

- The operating company must ensure that the maximum surface temperature is maintained if the temperature increase depends not only on the explosion-proof device itself, but also on the internal or directly connected operating conditions (for example, temperature increases of process gases).

Limits of the application area for this process air fan

- This device is not approved for use in mining/surface/underground operations or for dust explosion hazardous areas.
- The product is designed exclusively for conveying gaseous media.
- The explosion group is limited to IIB, but extended by H_2 from gas group IIC. A general gas extension to gases of group IIC, especially acetylene or carbon disulphide from group IIC, is prohibited.
- The maximum surface temperature is limited to T4 = 135 °C. In addition to the actual measured temperature, this value includes all safety margins and tolerances from the measuring system and measuring environment as well as all other influencing variables which must be taken into account from the process.

- Severe environmental pollution and environmental corrosivity can lead to ignition risks due to aluminothermic reactions, such as a thermite reaction. Such reactions must be prevented through regular cleaning and maintenance.

1.3 Qualified personnel

Qualified personnel are persons who, on the basis of their training, experience and instruction as well as their knowledge of relevant standards, regulations, accident prevention regulations and operating conditions, have been authorised by the person responsible for the safety of the component or system to carry out the required activities and are able to recognise and avoid potential hazards (for a definition of qualified personnel, see also IEC 364).

Further, qualified personnel must also be knowledgeable of first aid measures and local rescue facilities.

1.4 Protective equipment

The following protective equipment is required when working with and on the fan:

- Protective gloves
- Safety shoes S3
- Protective goggles
- Tight-fitting work clothes
- Hearing protection

The following applies to all work on the fan:

- *Observe the ESD protection in accordance with DIN EN 61340.*
- *Do not carry out any welding work on the fan.*

1.5 Intended use

- The fan may be used only to convey process air under the ambient conditions defined in the agreed specification.
- The fan is intended for further installation in the customer's machines.
- The fan may be used only in industrial areas.

Intended use also includes:

- Correct and qualified handling of the fan, including regular maintenance.
- Operating the fan in compliance with the safety regulations.
- Suitable transport and storage conditions.

Other uses are considered improper and constitute misuse of the fan.

1.6 Improper use

Improper uses include:

- Operating conditions that do not comply with the agreed specification requirements stipulated in the data sheet.
- Conveying media containing abrasive particles or corrosive components.
- Conveying air with a high dust content.
- Operation with dirt deposits on the impeller that could result in unbalances.
- Operation within or near potentially explosive atmospheres, unless the fan has undergone a conformity assessment with the entire device independently of mdexx fan systems GmbH, or has been expressly approved as an ATEX fan.
- Operation with safety devices which have been dismantled or tampered with or unapproved attachments which bypass safety measures.
- Disregard of quality assurance measures.

In the event of improper use or modifications to the fan, no claims for defects or liability or other consequential costs can be asserted.

2 General description of the fan

Fans from mdexx fan systems GmbH are customised and individually developed to achieve tailor-made solutions with the best possible efficiency for a wide range of applications such as rail vehicles, compressors, power transformers, wind turbines, car washes, industrial drying systems and many other areas. Different basic types, determined by a specific type code, form the foundation for this purpose. The general description therefore refers to the essential positions of the fan types. The terminology and classification for fans is in line with EN ISO 13349:2010.

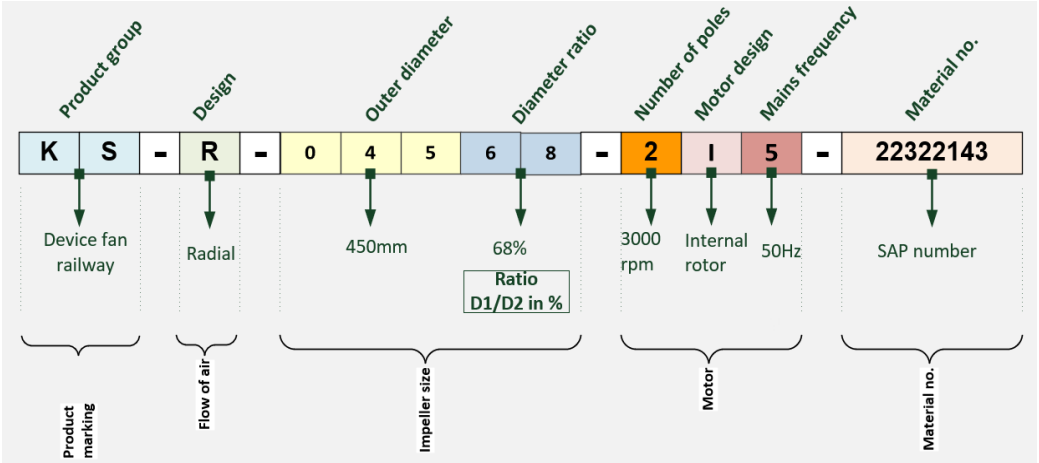
The fan is supplied as a unit complete with motor.

Quality assurance pursuant to DIN ISO 9001 ensures consistent manufacturing quality.

2.1 Description of the type designation

> *The type designation can be found on the rating plate of the machine*

Description of the **TSN** (Typen-Schlüssel-Nummer - translates to Type Code Number)



I	-	II	-	III	IV	-	V	VI	VII	-	VIII

The Roman numerals I – VIII denote the different areas of the TSN. In the following sections you will find a breakdown of the individual areas.

I. Product group

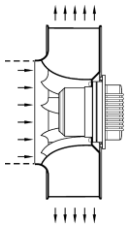
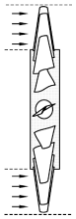
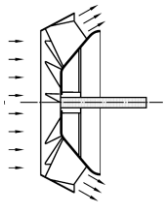
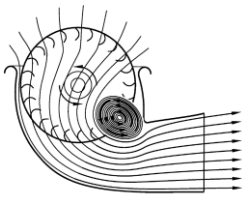
The product group describes the intended application of the fan. This is defined by a letter combination.

BS	Railway technology
CS	Chemical industry (Safe Area)
CX	Chemical industry (ATEX-compliant fan with ATEX-certified motor)
Cy	Chemical industry (fan without ATEX declaration of conformity for the non-electrical part. End customers have to carry out the overall conformity assessment for use in a potentially explosive atmosphere on their own responsibility).
FS	Food technology
HS	Wood drying
IS	Industry (Safe Area)
IX	Industry (ATEX-compliant fan with ATEX-certified motor)
IY	Industry (fan without ATEX declaration of conformity for the non-electrical part. End customers have to carry out the overall conformity assessment for use in a potentially explosive atmosphere on their own responsibility).
KS	Compressor technology (Safe Area)
KX	Compressor technology (ATEX-compliant fan with ATEX-certified motor)
KY	Compressor technology (fan without ATEX declaration of conformity for the non-electrical part. End customers have to carry out the overall conformity assessment for use in a potentially explosive atmosphere on their own responsibility).
LS	Subcontracting
MS	Medical technology
SS	Spinning technology
TS	Transformer cooling (Safe Area)
TX	Transformer cooling (ATEX-compliant fan with ATEX-certified motor)
TY	Transformer technology (fan without ATEX declaration of conformity for the non-electrical part. End customers have to carry out the overall conformity assessment for use in a potentially explosive atmosphere on their own responsibility).
WS	Laundry technology

II. Design

R	Radial
A	Axial
D	Diagonal
Q	Cross-flow
E	Spare part for fan (e.g. motor or impeller)

The direction of flow determines the design of the fan.

			
R = Radial	A = Axial	D = Diagonal / or semiaxial	Q = Cross-flow

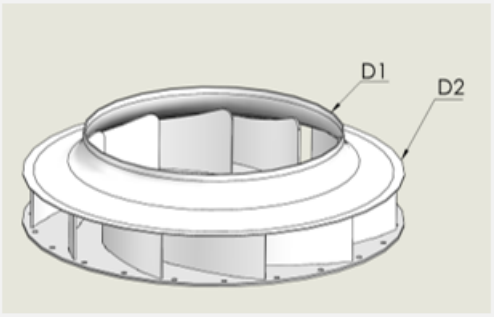
Principle sketches pursuant to EN ISO 13349:2010

III. Impeller diameter

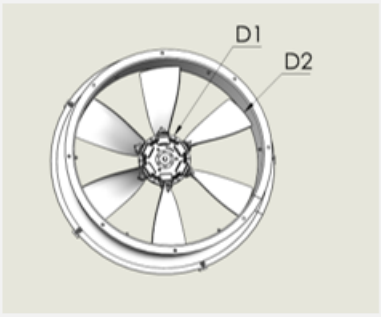
If a "0" is added to the specified 3 digits, the rotation diameter of the impeller through which the media flows is obtained in mm.

IV. Diameter ratio

The following two digits represent the ratio between the inner suction mouth diameter and outer diameter (radial impellers) or hub diameter and blade edge diameter (axial impellers).



D1 = Suction mouth diameter
D2 = Outer diameter



D1 = Hub diameter
D2 = Blade edge diameter

Example: Outer diameter x 68%/100 = suction mouth diameter

V. Number of poles

The digit at position "V" stands for the number of poles and thus for the maximum speed of the asynchronous motor.

Number of poles	Mains frequency in Hz	max. speed in rpm
4	50 Hz	1500 rpm
4	60 Hz	1800 rpm
2	50 Hz	3000 rpm
2	60 Hz	3600 rpm

VI. Motor design

In an internal rotor, the stator is firmly connected to the outer motor casing. In an external rotor, the stator is located inside the motor. The motor casing with cupped magnets is the stator.

I = Internal rotor motor

A = External rotor motor

E = Electrically commutated motors (EC motors)

VII. Mains frequency

The mains frequency of 50 Hz is described by a "5".

The mains frequency of 60 Hz is described by a "6".

VIII. SAP material number

The end of the type code number is followed by the internal material number, which is automatically assigned by the SAP system as a sequential number for each new fan type. This number uniquely specifies each fan.

3 Transport and long-term storage

Ambient conditions during transport and storage of the fans

Permitted temperature range: -20 °C to +40 °C

- *Transport and store the fan only in dry ambient conditions.*
- *Do not expose the fan to a dusty atmosphere or direct sunlight during storage and transport.*

3.1 Transport

DANGER!

Danger to life and risk of injury due to improper load and transport securing measures

Overturning and falling loads may result in serious or even fatal injuries. Uneven lifting of loads may also result in an uncontrolled loading process.

When the fan is lifted, it may suddenly overturn according to its centre of gravity. This may result in people being struck or trapped.

If not all the lifting eye bolts are involved in the lifting process, this may result in a lifting point being overloaded.

- Never stand under suspended loads!
- Ensure that the load-bearing capacity of the lifting gear and load-carrying equipment is at least equal to the weight of the fan.
- Load the attachment points for lifting evenly with vertical tensile forces.
- Lift the fan only at the designated and labelled lifting points.
- Observe the load and transport securing measures of the trade associations.

- On receipt of the goods, check the consignment immediately for completeness in accordance with the scope of the order and delivery note as well as for intactness.
- Inform the transport company and report any damage identified on the casing or impeller.
- Observe the load-bearing capacity of the industrial truck used. The load-bearing capacity must exceed the weight of the transported object.
- Pay attention to the centre of gravity of the fan to prevent it from unintentionally overturning.

WARNING!

Risk of injury due to improper handling of the fan

Non-observance may result in serious injuries.

If the fan overturns or falls, this may result in cuts, crushing injuries and broken bones.

Sharp edges of the fan may cause cuts.

Manually lifting heavy loads may result in injuries.

- When transporting the fan, always wear personal protective equipment.
- Use suitable aids for lifting heavy loads.

► See chapter "Protective equipment"

Depending on the type of fan, transport at the customer facility takes place in various ways: If the transport is handled manually, always observe the aforesaid weight limits.

When using a crane, please pay attention to the specially marked attachment points.

- Pay attention to lifting point.
- Stand clear of suspended load.

Lifting eye bolts on the motor, eyelets on the casing, on the motor bracket, or straps looped around the fan casing are suitable attachment points for lifting the fan.

- To avoid damaging the fan, always use all available marked lifting eyes.
- Never lift the fan by the impeller or motor alone or place a load on the impeller.
- If paint damage is detected during transport, you should touch it up using a suitable touch-up pen.

► Please refer to the order confirmation for the colour code of the paint.

NOTICE

Impacts against the impeller may result in material damage.

Non-observance of the instructions may result in material damage.

When unloading the fan or during further internal transport, it is essential to avoid impacts against the impeller or the casing.

- To prevent deformation and the resulting impeller imbalance, use slinging gear for unloading in such a way that they do not come into contact with the impeller.

3.2 Long-term storage

- Seal the intake and exhaust openings airtight.

For storage, we recommend storing the fan in the position in which it was delivered. This can be found in the fan-specific information.

To ensure that storage for periods of more than 4 years under favourable storage conditions (i.e. storage in dry, dust-free and vibration-free rooms at room temperature) does not result in storage damage, perform regular commissioning (for at least 30 minutes running time every 6 months).

4 Installation

DANGER!
Risk of injury due to improper handling of the fan

Improper handling of the fan may result in serious or even fatal injuries.

- ► Before working on the fan, always read and understand all the safety instructions in the chapter "Safety".

DANGER!
Danger of death due to electrical voltage

If cables or electrical components are damaged, residual currents can cause death or serious personal injury.

- Install the fan in such a way that the electrical equipment cannot be damaged by external influences. In particular, the supply lines must be routed safely, for example using cable ducts or similar.

WARNING!
Risk of injury due to incorrect installation or connection to a machine casing

If people are in the vicinity of an incorrectly installed machine, this may result in serious or even fatal injuries.

This may result in increased vibrations, excessive noise development, bearing damage and bursting of the impeller.

- To ensure safe operation, ensure that any installation which deviates from the information and instructions in this chapter is agreed with mdexx fan systems GmbH.

- Install the fan isolated from all possible sources of supply. Install the fan on a level surface (evenness <1 mm).
- The system manufacturer is responsible for ensuring that the system-related installation and safety instructions comply with the applicable standards and regulations, in particular DIN EN ISO 12100 and 13857.
- The installation position of the fan depends on the agreement in the order. The fan may be operated only in the position or positions for which it was ordered.

4.1 Tightening torques

> *The system operator must ensure that the fan is installed using correctly dimensioned bolts and the corresponding tightening torques.*

If no other values are available, the following tables apply. For non-electrical connections, strength class 8.8 in accordance with DIN 25201 is assumed. Furthermore, the following tightening torques from DIN EN ISO 898-1 apply without the use of lubricants. The addition of lubricants changes the coefficient of friction considerably and leads to undefined tightening torques.

In the case of stainless steel threaded connections (A2-70 / A4-70), individual thread turns (approx. 5) can be lightly coated with copper paste to prevent the threaded connections from seizing up. However, ensure that the screw head support and nut support remain free of lubricant. Especially with stainless steel threaded connections, do not use impact wrenches, as the increased frictional heat may cause the bolts to seize up.

Tightening torques according to VDI2230
Steel screws 8.8 with μ=0.14

Thread	[Nm]
M4	4
M5	7
M6	12
M8	28
M10	54
M12	93
M16	230

Tightening torques according to Reyher
Stainless steel, A2 and A4-70

Thread	[Nm]
M4	2
M5	4
M6	7
M8	17
M10	33
M12	56
M16	136

4.2 Electric power supply

Make the electrical connection as follows:

- *In accordance with the relevant VDE or national regulations of the respective place of use.*
- *In accordance with the respective applicable national, local and system-specific regulations and requirements.*
- *In accordance with the regulations of the utility company applicable to the installation site.*

- *Observe the information on the rating plate.*

The conditions at the place of use must correspond fully to the information on the rating plate.

Cable glands and protective earthing must be fitted to the terminal box if they have not already been pre-installed.

Proceed as follows:

- Select a cable gland which is suitable for the cable diameter.
- Insert this cable gland into the opening of the terminal box and use a reducer if required.
- Screw on the cable gland, making sure no moisture, dirt, etc. can enter the terminal box. Connect and arrange the terminal strip according to the circuit diagram in the terminal box.
- Connect the protective earthing conductor to the terminal displaying this symbol:

M005

Connect an earth terminal to the ground!

(exemplary view of an earthing connection)

5 Commissioning

WARNING!

Risk of injury due to improper handling of the fan during commissioning

Improper handling of the fan during commissioning may result in serious or even fatal injuries.

- ► Before commissioning the fan, read the safety instructions and rule out potential hazards. Otherwise, do not work on or with the fan.

- Before commissioning, check thoroughly whether the fan has been installed correctly and whether it is ready for safe operation.

Before commissioning, check the motor, the impeller and the casing for external damage. If damaged, do not put the fan into operation. In the event of damage, it cannot be ruled out that the damage has changed the balance condition of the impeller.

- ► For work on electrical machines, see also the hazard instructions in the chapter "Safety instructions".

Factory settings could have changed, for example, due to improper transport, assembly or other reasons up to the time of commissioning.

- ► In this context, observe the correct gap settings and the instructions in the chapter "Checking the gap between impeller and inlet nozzle"

5.1 Check direction of flow and rotation

WARNING!

Risk of injury due to operation against the intended direction of rotation

Operating the fan in the wrong direction of rotation may result in serious or even fatal injuries.

An incorrect direction of rotation can lead to the impeller being destroyed.

- Ensure that you operate the fan only in the intended direction of rotation.

The following applies to radial fans:

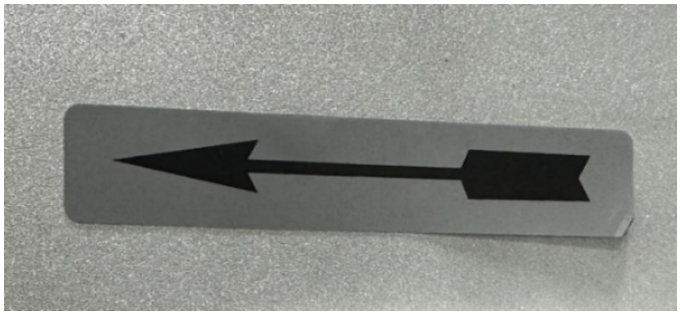
The fan draws in air axially and blows it out radially.

The following applies to axial fans:

The fan draws in air axially and blows it out axially.

The intended direction of rotation of the motor shaft and the impeller is indicated by an arrow on the fan.

- Note the direction of rotation of the fan. The correct direction of rotation is indicated by an arrow on each impeller and fan.



Example illustration for a direction of rotation arrow

- If the direction of rotation is incorrect, check the wiring and replace the connections to the overall system if required.

WARNING!

Impeller breakage due to impermissible vibrations

There is a risk of the impeller breaking due to impermissible vibrations. There is a risk of serious injuries from the parts of the broken impeller.

Furthermore, in this case the motor could be overloaded and overheated due to increased current consumption, possibly resulting in destruction of the fan.

- Operate fans only in the correct direction of rotation.
- Before initial commissioning, check the direction of rotation of the fans.

5.2 Preparing a commissioning/maintenance report

Before commissioning the fan, carry out a test run and document the measurement results in a report.

WARNING!

Risk of injury or material damage due to inadequate commissioning and test run

Possible consequences of non-observance are risk of injury or material damage.

If a documented test run and documented commissioning are omitted and measurement results are not recorded, defects may remain undetected which may subsequently endanger persons or cause material damage.

- Always carry out a documented test run during commissioning.
- Carrying out test runs and commissioning is relevant to safety. If these safety obligations are not fulfilled and not properly carried out and recorded by the operating company, this may result in invalidation of the operating permit and warranty claims.

► An example of a maintenance and commissioning report is attached to these operating instructions.

Inspections prior to commissioning

The following list of required checks prior to commissioning may be incomplete. Further inspections depend on special, system-specific conditions and are, therefore, additionally required. Since this product is an incomplete machine, the further, system-specific tests are to be performed by the respective system manufacturer.

Commissioning/maintenance reports are used as supporting documents for service enquiries.

Maintenance and commissioning reports are indispensable tools when it comes to reconstructing changes that occurred during a process. If they are unavailable or incomplete, the causes of changes are difficult to comprehend and require a great deal of analysis.

The fan was specially designed and manufactured to meet the technical specifications stipulated by the customer. To ensure safe operation for many years to come, special emphasis must therefore be placed on correct handling and professional maintenance and commissioning. Please note that only qualified

personnel may be authorised to carry out measurements. In particular, the measurement and assessment of vibration values require special qualifications.

NOTICE

Potential material damage due to non-observance of the operating company's safety obligations

If the operating company fails to comply with the safety obligations, this may result in material damage, exclusion of the warranty and may invalidate the operating permit and warranty claims.

Trial runs and commissioning activities are safety relevant. If they are not carried out and recorded properly, it may lead to the expiry of the operating permit and any warranty claims.

- Carry out test runs and commissioning properly and record them.
- Ensure that fans are equipped with protection against contact in accordance with the regulations.

In preparation for the test run, observe the following requirements in accordance with "E DIN EN 17170":

- Specify the required tests of the settings in a test report prepared in advance and make records of these tests and measurements.
- Check that the mechanical and electrical protective devices have been correctly fitted and installed.
- Check the fan casing and connected cables for foreign objects. Ensure that no foreign objects get into the system and in particular into the impeller area.
- Ensure that the type, voltage and frequency of the power supply for the driver motor and control system have been designed in accordance with the relevant directives and standards.
- Check that the control device is functioning as intended.
- Test the function of the sensory safety devices and alarm protocols.
- Ensure that nobody has access to the fan connections on the suction and discharge sides and all moving and live parts during operation. If required, use separating protective devices which ensure protection against contact but do not impair the free flow of air.
- Install and align the fan correctly. Ensure that there is an even gap all round between the impeller and the inlet nozzle and that no grinding noises can be heard.

- Firmly tighten all fastening elements and electrical connections.
- Connect proper earth and bonding leads to the mains.
- Eliminate obstructions to the air flow caused by missing cover flaps, covers or similar.
- Align vibration dampers properly and check them for ageing.
- Document the required tests of vibration velocity, power and current consumption, direction of rotation and speed with the test run and attach the recordings to the fan documentation. Keep the written records of these tests, including settings and measurements, for future reference.
- During production operation, check the fan using a suitable measuring device if unusually loud noises occur which indicate vibration changes due to bearing wear or other system influences. Document the measured values. If the limit values are exceeded, shut down the system and contact mdexx fan systems GmbH.
- Observe the standards of ISO 14694 in conjunction with ISO 10816-3 for the limit values of the alarm signal and the safety shutdown, depending on the respective application.
- Ensure that the fan rotates in accordance with the direction of rotation arrow on the fan.
- Before switching on for the first time, rotate the impeller by hand to ensure that it moves freely without coming into contact with the inlet nozzle. Briefly switch the motor on and off to compare the direction of rotation of the fan with the direction of rotation arrow on the fan.
- Check the relevant speeds and operating points of the fan before operation. Pay attention to excessive current consumption or heat generation of the motor.

Changes to the vibration behaviour may occur if decisive operating parameters (speed, mains frequencies, etc.) and the connection of several system components to each other are taken into account. When using frequency converters, check, in particular, the resulting feedback. The system supplier must take suitable structural measures, if necessary.

6 Operation

WARNING!

Risk of injury from the fan during operation

Improper handling of the fan during operation may result in serious or even fatal injuries.

- Before operating the fan, read the safety instructions in the "Safety" chapter. Otherwise, you are not permitted to carry out any work with or on the fan!
- Please also note the contents of standard E DIN EN 17170.

Information on safety requirements for fans can be found in standard E DIN EN 17170, among others.

It deals with the significant hazards, hazardous situations and events, as defined in DIN EN ISO 12100:2010, Annex B, which are relevant for fans during transport, assembly and installation, commissioning and use.

- Check the safety devices and, if required, the alarm logs for proper functionality at regular intervals.

As with commissioning or the test run, the limit values of the alarm signal and the safety shutdown depend on the respective application and must be determined by the system manufacturer in cooperation with the operating company.

► Pay attention to the standards of ISO 14694 in conjunction with ISO 10816-3.

During operation, the fan must not be subjected to any impermissible vibrations from the overall process or from adjacent components which in total exceed the permissible limit values in accordance with ISO 14694.

If exceedance of the limit value cannot be ruled out, the system manufacturer must ensure that an emergency shutdown is carried out using a vibration sensor in accordance with DIN EN 17170.

Operate the fan only at previously tested operating points and speeds.

7 Decommissioning

Observe the same precautions for decommissioning as for commissioning.

- ► See also chapter "Commissioning"
- Ensure that the fan has been isolated from all possible sources of supply and check this using a suitable measuring device.
- Take measures to protect moving or live parts against contact.
- Write a note on the fan indicating the reason for decommissioning.

8 Maintenance

CAUTION!
Risk of injury due to a chain reaction of malfunctions

Improper handling or use contrary to the intended purpose may lead to a chain reaction of errors possibly resulting in numerous injuries.

- ► Also observe the information in the enclosed motor operating instructions from the motor manufacturer.
- Under no circumstances should you insert a mechanical lever, such as a piece of pipe, between the impeller blades.
- After installing the fan but before commissioning, check that there is an even gap between the impeller and the inlet nozzle.
- Under no circumstances load the bearings by striking the wheel or the motor shaft.

If the fan is not used for more than six months, put it into operation briefly to prevent the balls of the rolling bearing being displaced and condensation forming in the motor and to ensure constant lubrication of the bearings.

- ► See also chapter "Long-term storage"
- Open the screw(s) on the motor to drain condensation water.
- ► Also refer to the motor operating instructions for the positions of the screws.

DANGER!
Danger of death and risk of injury due to imbalance on the impeller

Imbalances may result in increased vibrations, high noise emissions or bursting of the impeller. This may result in material damage, injuries or death.

- It is essential to prevent anything which may cause an impeller to become unbalanced. This includes, for example, striking the motor bearings, levering the impeller, wrapping and lifting the impellers with a crane as well as collisions and impacts during transport.

WARNING!

Danger due to settling or creeping of threaded connections

Loosened threaded connections could result in serious and fatal injuries.

When utilising soft material combinations, such as stainless steels or aluminium materials, the pre-load force can trigger flow processes in areas close to the surface. Vibrations, on the other hand, lead to settling of threaded connections. Both processes lead to a loss of pre-load force in threaded connections.

- After installation and commissioning, check that the screws are tight and then mark them with a pen.
- Use thread-locking varnish or threadlocker and regularly check the position of the screws.

NOTICE

Risk of imbalance or thread seizure

The use of impact wrenches may cause stainless steel screws (CrNi screws) in particular to expand and get stuck in the thread due to the large number of turns. This may result in an imbalance and thread seizure. Material damage may be the result.

- Do not use an impact wrench.

WARNING!

Risk of impact or jamming when lifting the fan

When lifting the fan out of the fan casing, the fan may overturn according to its centre of gravity position. As a result, people may be seriously injured by impacts or jamming.

- ► Observe the load handling regulations.
- ► See also chapter "Transport"

All filtering components must be regularly inspected, maintained and cleaned.

- Cleaning intervals must be defined by the operator.

8.1 Vibrations

DANGER!
Danger of death and injury due to vibrations

Continuous and impermissibly high vibrations may result in serious injuries or even death.

Continuous and impermissibly high vibrations may result in increased noise emissions, vibrations and bursting of the fan.

- Regularly check the vibration levels of the fan.
- Regularly check the fan for wear.
- Ensure that all fastenings are properly tightened and maintained.
- Use suitable vibration dampers and insulation.
- Operate the fan only within the operating parameters.
- If unusual vibrations occur, stop operation immediately and eliminate the cause of the vibrations.

One of the main reasons for fan failure is resonance which may result in material fatigue of the rotating impellers. These vibrations and unbalances cause increased wear of the motor bearings, rotating elements and machine frame right down to the foundations in the immediate vicinity.

Agreed vibration limits in accordance with ISO 14694 are documented prior to despatch and are guaranteed up to the point in time in accordance with Incoterms, EXW or DAP. mdexx fan systems GmbH cannot be held responsible for subsequent changes to the vibration limits, as the causes of this can be very varied and difficult to determine.

Alternatively, sensors with magnetic holders can be positioned as close as possible to the motor bearing. If no threaded holes are available, steel plates can be affixed to the cast iron casing for the magnetic sensors.

Sensors designed to measure vibration velocity are very sensitive to external influences, e.g. due to a strained structure, additional natural resonances from the installation environment of the overall system, repeatability of the measuring positions, stability of the power supply, contact between sensor and surface, correct measuring positions, etc.

- ▶ For correct measuring positions, see also the figure "Measuring positions for vibration sensors" later in the chapter.

Vibration sensors should never be placed on the sheet metal cover hood, but always directly on the cast iron casing of the bearing shield. The soft cover plate would provide incorrect results.

Vibration measurements may only be carried out by experienced and trained experts who are familiar with the highly specialised measuring equipment. Such measurements are not required during maintenance. However, they must be scheduled after each installation / replacement and before each recommissioning.

Fan application category

Anwendung Application	Beispiel Example	Antrieb-sleistung Driver power (kW)	Ventilator Kate-gorie Fan category (BV)
Residential	Ceiling fans	≤ 0.15 > 0.15	BV-1 BV-2
HVAC and agri-culture	Air conditioning	≤ 3.7 > 3.7	BV-2 BV-3
Transportation and marine	Locomotive, trucks, au-tomotive	≤ 15 > 15	BV-3 BV-4
Transit / Tunnel	Subway emergency fans, tunnel jet fans	≤ 75 > 75 None	BV-3 BV-4 BV-4
Petrochemical	Hazardous gases	≤ 37 > 37	BV-3 BV-4
Computer chip manufacture	Clean rooms	None	BV-5

Condition	Application category	Rigid installation r.m.s	Flexible installation r.m.s
Start-up	BV-1	10	11.2
	BV-2	5.6	9.0
	BV-3	4.5	6.3
	BV-4	2.8	4.5
	BV-5	1.8	2.8
Alarm	BV-1	10.6	14.0
	BV-2	9.0	14.0
	BV-3	7.1	11.8
	BV-4	4.5	7.1
	BV-5	4.0	5.6
Emergency shutdown	BV-1	Notice 1	Notice 1
	BV-2	Notice 1	Notice 1
	BV-3	9.0	12.5
	BV-4	7.1	11.2
	BV-5	5.6	7.1

Notice 1: The shutdown stages for fans in the fan application classes above should be determined using historical data.

(Source of the values: ISO 14694:2003-03)

When installed, the limit values stated in the tables above must not be exceeded. Contractually defined limits take precedence.

Alarm: A warning is output as soon as a set vibration limit has been reached or a significant change has occurred and remedial action is necessary. If an alarm

situation occurs, operation may continue until the reasons for the change in vibration have been identified and remedial measures have been determined.

Shutdown: Occurs if the vibration limit is above the value after which continued operation of the machine may cause damage. If the shutdown limit is exceeded, measures must be taken immediately to reduce the vibration exposure or the machine should be shut down.

Determining the alarm limit. The alarm limits can vary at different machines. Usually, the selected values are related to a base value that results from experience gained at the measuring locations and measuring directions of the respective machine.

Determining the shutdown limit. The shutdown limits generally result from the requirement that the machine must not sustain any mechanical damage. They also depend on specific design features that are intended to make the machine resistant to unusual changing forces.

> *In principle, a fan which is mounted on a large rigid concrete foundation is classified as rigidly installed. In contrast, vibration dampers represent a flexible installation. Machine walls or steel frames, on the other hand, can be classified in any category.*
>
> *The weight and rigidity of the overall system, in which the fan is installed, influence the vibration level in the fan environment. Pursuant to ISO 14694, pg.15, the fan manufacturer is not responsible for vibration behaviour in the overall system if the actual fan complies with the vibration limits stipulated in Table 5 of ISO 14694.*

- The vibration values measured by mdexx can be found in the attached measurement report from the laboratory.

The vibration velocity is expected to increase over time due to wear and other accumulated effects during operation.

In general, an increase in vibration levels is appropriate and safe as long as the alarm level of 11.8 mm/s for flexibly fixed fans and 7.1 mm/s for a rigid connection is not reached. Above this threshold, a prompt inspection should be carried out.

Emergency shutdown must occur at 12.5 mm/s and at 9.0 mm/s for a flexible and a rigid attachment, respectively.

Due to the manufacturer's obligation to study the market and the experience of the end customer (user) the standard recommendations may be somewhat excessive in specific sectors or applications. In these cases, the limit values must be redefined individually.

If the fan is operated at variable speed, individual resonance ranges may occur within the speed spectrum due to the influence of stiffness from the overall system. Another reason for this may be bearing wear during the service life phase.

The system manufacturer must ensure that the system control passes through these frequency ranges quickly with a safety margin of at least +/- 7 Hz.

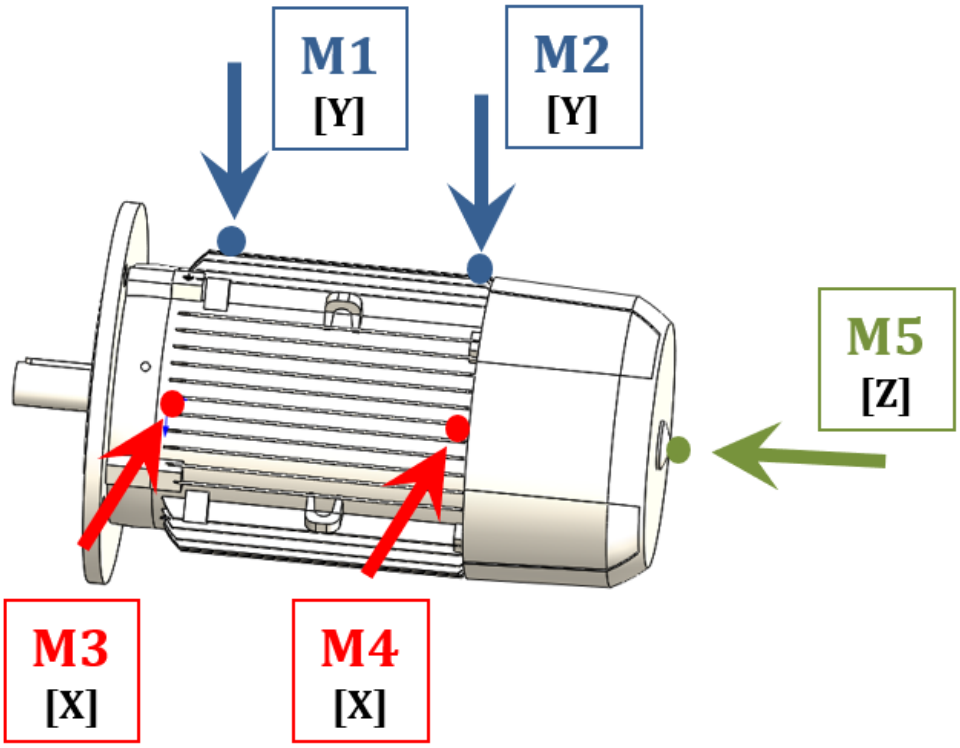
Further, changes to the vibration behaviour may occur due to feedback from the flow behaviour. In this case, structural measures must be taken after prior system analysis.

Preparation of the measurements

Protective measures and rules of conduct

- Cordon off the work area to prevent unauthorised access. Use barrier tapes, for example.
- Cover live parts.
- Design a clearly arranged test set-up.
- Warning Hazardous Voltage.
- Do not touch.
- To carry out the measurements, fix the sensors at the marked points M1 to M5.

> *Do not mount sensors on metal sheets, but on solid points of the casing, as close as possible to the motor bearing.*



Measuring positions for vibration sensors

Protective measures and rules of behaviour when carrying out measurements

- To prevent unauthorised access, cordon off the work area, for example with barrier tape.
- Cover live parts.
- Organise the test setup clearly.
- Do not stand in the range of rotating parts, as there is a risk of parts being ejected.

If operational balancing is required, e.g. the Vibroport 80 measuring device from Brüel & Kjaer can be used (see following illustration).

DANGER!

Risk of bursting on fans which are susceptible to vibrations

Depending on the degree of pre-existing damage, in exceptional cases parts of the rotating impeller may come loose during commissioning or during a damage analysis and cause serious or even fatal injuries.

Signs of pre-existing damage to the fan include:

- Loud noises (e.g. humming).
- Strong vibrations (resonances).
- Decreasing air flow rates.
- Increased motor and fan temperatures.
- High vibration velocities.

▪ Never switch on fans which have signs of pre-existing damage.

▪ Have further tests carried out exclusively by mdexx fan systems GmbH in a special protective chamber.

NOTICE

Take special care with fans that are susceptible to vibrations!

Even during commissioning, test runs and maintenance, the speeds must be increased slowly when starting up the speed-controlled fans instead of immediately switching to nominal speed. This is the only way to ensure that rising resonance fields are detected and the test run can be cancelled in good time.

- The safety devices and, if applicable, the alarm logs must be checked for proper functioning at regular intervals.
- Vibration measurements or checks may be carried out only by specially trained personnel who have undergone a separate training course at mdexx fan systems GmbH and received a qualification certificate. Without this qualification, vibration tests are prohibited.

8.2 Causes of vibrations

To avoid vibrations, the following causes of vibration must be ruled out during maintenance.

Possible causes of vibration due to incorrect maintenance work

- Damage to the impeller, driver shaft or bearings due to improper maintenance work.
- Replacement of the motor or motor bearing without performing subsequent system balancing of the entire fan within the system
- Improper cleaning of the impeller and uneven deposits on the impeller or blades.
- Deformations due to impermissible impacts on the impeller.
- Bent shaft seat.
- Incorrect blade installation.
- Loose, sloping hub seat.
- Local corrosion.
- Thermal deformation.
- Deformation due to incorrect transport.
- Deformation of the impeller caused by using the impeller to lift the fan.
- Wear caused by solids.
- Fan not screwed down correctly.
- Incorrect direction of rotation of the fan.
- Installation of the fan deviates from the planned method.
- Fan unit exposed to constant stress due to incorrect installation.

Possible causes of vibration due to operational reasons

- Missing balancing weights.
- Missing, defective or worn vibration dampers beneath the fan casing.
- Material fatigue cracks, especially in the weld seam area.
- Thermal stress.
- Deformation due to centrifugal force, blade deformation.
- Changes to the original balance condition due to grinding or wear effects.
- Wear caused by solids.
- Independent loosening of threaded connections.
- System control or through speed-controlled drivers or system-related resonances.
- Shifting imbalances.
  Shifting unbalances change their positions and cannot be balanced. The imbalance changes position during operation.
- Local corrosion.

- Peeling coatings.
- Heavily stressed or deformed fan unit due to incorrect installation.
- Uneven support surface for the fan (tilting effect).

8.3 Threadlocker

To prevent threaded connections from working loose, use spring washers, Nord-lock lock washers or threadlocker.

- Whenever the threaded connections work loose, replace the screw locking devices.

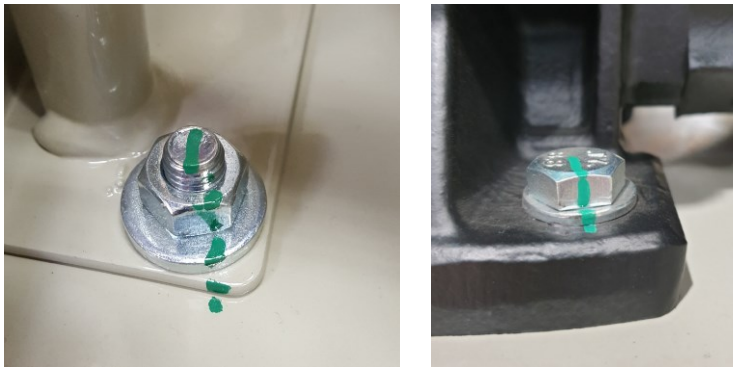


Figure: Bolt markings, visual inspection

Basic principle: If the coloured marking between the nut, washer and component does not line up, this would be an indication that the threaded connection has become loose.

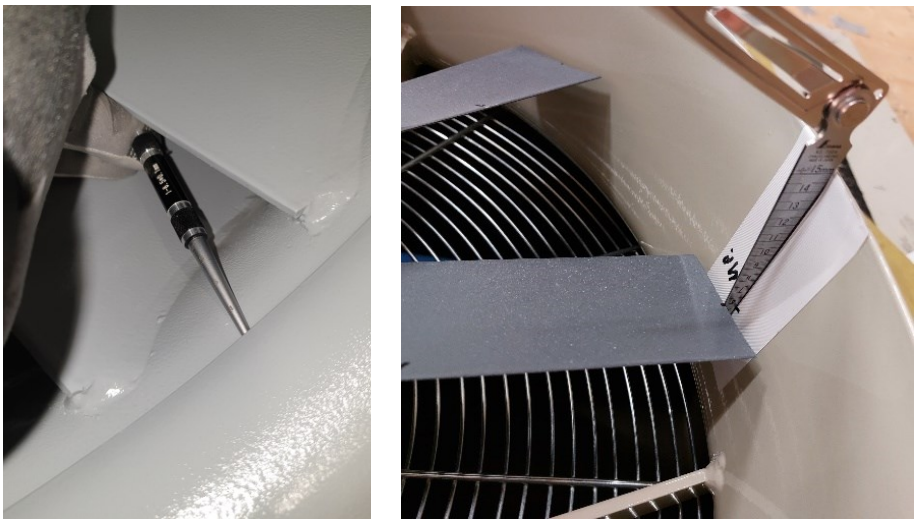
Figure: Basic principle: Secure the balancing weights with coloured marking ink (Loctite SF 7400, or SF 7240 thread-locking varnish).

8.4 Checking the gap between impeller and inlet nozzle

Suitable tools for measuring the gap: Bore gauge or conical measuring wedge.

Due to manufacturing inaccuracies, the gap may not be the same all the way around. Ensure there is no contact between the rotating impeller and the fixed inlet nozzle at any point.

> *The gap must be checked during every maintenance and additionally every 20,000 operating hours at the latest.*
>
> *The gap must be at least 2 mm after deduction of all tolerances. The following applies: 0.005 * diameter of the suction mouth. (See following figure). However, at least 2 mm.*



Example of gap check between inlet nozzle and radial impeller (on left) or between casing wall and blade tip of an axial impeller (on right)

8.5 Lubrication

The fan motor is equipped with lifetime lubricated bearings or with a re-lubrication device depending on its actual design. The permanently lubricated rolling bearings must be replaced by the manufacturer after 40,000 operating hours at the latest or after five years. At motors equipped with a re-lubrication device, remember to take the re-lubrication intervals into account. The re-lubrication intervals, quantities of grease and the types of grease are indicated on the motor type plate.

Longer periods of operation, special high-performance greases for extreme ambient temperatures or food applications, etc. must be agreed individually in the specification and are listed separately.

8.6 Use of rubber vibration dampers

If rubber vibration dampers have been installed, we recommend inspecting them for ageing or brittleness at least twice a year and replacing them every four years at the latest.

- If cracks in the rubber or signs of peeling are visible, replace the vibration dampers immediately.
- Secure the connection of the vibration dampers to the fan using new lock washers.
- When re-establishing the connection to the overall system, observe the screw locking measures provided by the system operator.

8.7 Cleaning/inspecting the impeller

The impeller and casing are designed in accordance with EN 1127-1 to minimise the accumulation or deposition of dust under normal conditions (see also DIN EN 14986:2017-04; 4.13).

If the fan is disconnected from the rest of the system for maintenance purposes, always clean the impeller.

In addition to the impeller all filtering components must also be regularly inspected maintained and cleaned.

- Cleaning intervals must be defined by the operator.

> *Cleaning cycles depend on the ambient conditions but must be carried out after two years at the latest.*
>
> *mdexx fan systems GmbH shall not be liable for any motor damage caused by dirt deposits on the impeller and motor.*

NOTICE

Material damage due to inadequate cleaning of impeller and motor.

Extreme dirt and dust deposits on the impeller and motor may disrupt the function of the fan and result in material damage.

- To minimise the ignition hazard, do not use cleaning cloths made of synthetic materials to clean the impeller.
- Take care to clean the impeller evenly, as irregular deposits could result in imbalances.
- Visually inspect the balancing weights. Secure them against working loose using a coloured threadlocker.
- If the impeller of a fan without ATEX certification is exposed to temperatures higher than 65 °C, please use the following threadlocker: (Resbond 907TS-1R / www.polytec-pt.com). For ATEX impellers and fans as a whole, a maximum permissible ambient temperature of 60 °C applies under all circumstances.

8.8 Maintenance schedule/Maintenance cycles

- ► Inspect the motor in accordance with the motor supplier's separate documentation which is enclosed with the fan documentation.

The maintenance interval is 4000 operating hours. After this period of time, perform the following maintenance activities:

1) Open the maintenance hatch and check the impeller for damage. If there is no maintenance hatch, the impeller can be inspected through the inlet nozzle.
2) Clean the impeller and the inlet nozzle evenly and remove all deposits.
3) Check that the balancing weights are seated correctly.
4) Carry out a test run according to the instructions in the "Test run" chapter.

8.9 Trial run

WARNING!

Danger due to inadequate commissioning and inadequate test run after maintenance

Possible consequences of non-observance are risk of injury or material damage.

If a documented test run and documented commissioning are omitted and measurement results are not recorded, defects may remain undetected which may subsequently endanger persons or cause material damage.

- Always carry out a documented test run and documented commissioning.
- Carrying out test runs and commissioning is relevant to safety. If these safety obligations are not fulfilled and not properly carried out and recorded by the operating company, this may invalidate the operating permit and warranty claims.

► In the appendix to the operating instructions you will find an example of a "Maintenance and commissioning report".

8.9.1 Test run after maintenance

The following list of inspections prior to commissioning after maintenance cannot be exhaustive. Further inspections depend on special, system-specific conditions and are, therefore, additionally required. As this product is an incomplete machine, the further, system-specific tests must be performed by the respective operating company.

Commissioning/maintenance reports are used as supporting documents for service enquiries.

Maintenance and commissioning reports are indispensable tools when it comes to reconstructing changes that occurred during a process. If they are unavailable or incomplete, the causes of changes are difficult to comprehend and require a great deal of analysis.

The fan was specially designed and manufactured to meet the technical specifications stipulated by the customer. To ensure safe operation for many years to come, special emphasis must therefore be placed on correct handling and professional maintenance and commissioning.

Please note that only qualified personnel may be authorised to carry out measurements. The measurement and assessment of vibration values, in particular, require special qualifications.

Exclusion of warranty in case of non-observance of the operator's safety obligations.

Fans must be equipped with protection against contact in accordance with the relevant regulations.

- To prepare for the test run, follow the points to be observed in accordance with E DIN EN 17170 from the chapter "Preparing a commissioning/maintenance report".

8.10 Additional ATEX maintenance instructions

To reduce the risk of ignition, it is essential to observe the contents of this chapter when carrying out maintenance work on an ATEX fan.

- The distance between the rotating elements and the casing part must be at least 0.5% of the relevant contact diameter. This distance must not be less than 2 mm in the axial or radial direction (even during operation).
- Carry out maintenance with particular care to avoid inadvertently damaging the sheet metal edges of the rotating impeller and the fixed inlet nozzle. This could be caused unintentionally, either by putting down the individual components roughly, by improper handling, by foreign bodies or by tool impacts. In this context, the operator must take special precautions during maintenance work to avoid deformation due to shocks or impacts. Deformed edges could lead to sliding contact between the rotating impeller and the inlet nozzle and thus to impermissible frictional heat.
- All impellers, bearings, pulleys, cooling discs, etc. must be secured in position. The type of securing method, e.g. threadlocker, in conjunction with a coloured marking depends on the application.
- The fan design prevents ignition hazards caused by electrostatic discharges. Also comply with the relevant requirements of CLC/TR 60079-32-1 when performing maintenance work.
- Ensure that sparking is prevented in the event of contact between the rotation body and the casing. This is prevented by using suitable material combinations.

Sparks may be caused by the unintentional introduction of foreign bodies into the rotation area. The system manufacturer and the operator are responsible for proper operation.

DANGER!
Danger of death from bursting due to defective bearings

The bursting of the fan may result in serious or even fatal injuries.

Defective motor bearings may result in increased vibrations and loss of grease. Excessive vibrations and inadequate lubrication also result in an uncontrollable increase in bearing and motor temperature. The increased motor temperature could reach ignition temperature. Or the vibrations could destroy the impeller.

During normal operation, the temperature of the bearing is negligible and a malfunction is equal to a rare malfunction pursuant to DIN EN 14986:2017-04 in conjunction with ISO 80079-37 "c".

- The motor must be inspected in accordance with the specifications in the motor operating instructions.

► See the motor manufacturer's operating instructions.

- The rotating unit must have a balance quality in accordance with ISO 14694 BV3 or BV4.
- Regularly check the system for proper cable connections to avoid sparking caused by contact malfunctions/loose contacts.

DANGER!
Danger of death due to bursting

Serious or even fatal injuries due to burst processes caused by dust deposits on the impeller blades.

Dust deposits result in an additional imbalance and therefore wobbling movements which may result in burst processes.

- Monitor category 2D fans using vibration sensors in accordance with DIN EN 14986, Chapter 5.3.
- Regularly inspect and clean the impeller blades.

Coatings / Surface repairs

- When repairing coatings or minor damaged areas in the paintwork, these must be conductive with a surface resistance $<10^9$ Ω.
- Alternatively, for gas group IIC, the paint thickness is limited to max. 0.2 mm and for gas group IIB to max. 2 mm.

DANGER!
Ignition hazard due to static charge

Non-observance may result in serious or even fatal injuries.

The use of synthetic fibre cloths to clean the fan may result in static charging of the surface coating. This static charge may pose an ignition hazard.

- To avoid static charging of the surface coating, do not wipe it with a synthetic fibre cloth.
- Only use damp cotton cloths to clean the fan.

Optional silencer unit

- Metallic parts of silencers must be included in the equipotential bonding measure.
- Non-conductive parts are subject to the area restrictions pursuant to DIN EN 60079-0 or must not be chargeable or must alternatively have a conductive design.

Optional filter unit

- Filters must not become dangerously electrostatically charged by the air flow being conveyed.
- In an Ex-proof zone, only use filters for which a test report or a component certificate pursuant to RL 2014/34/EU is available.
- The filter must be used as intended and electrostatically earthed.
- In the device documentation / operating instructions, the manufacturer must clearly stipulate that only filter media approved for the respective application may be used.

Device casing

- The metallic parts of equipment to be operated in potentially explosive atmospheres must be included in the local equipotential bonding measure (e.g. connection to foundation earth electrodes) to avoid electrostatic charging.
- To avoid the ignition hazard of electrostatic discharges, the limit values for paint thickness must be observed. This also applies to repair work. Electrostatic charges can occur in places where surfaces are cleaned with synthetic fibre cloths or where a particle transport by the air flow brushes the surface and charges it electrostatically. Cleaning with synthetic fibre cloths is therefore expressly prohibited.
    - Plastic parts located in an Ex-zone must comply with the area restrictions in accordance with DIN EN ISO 80079-36:2016 (Non-electrical equipment for explosive atmospheres), Section 6.7.5 Group II equipment, Table 8, be electrostatically conductive with a surface resistance < 10^9 Ω or be subjected to a charging test in accordance with DIN EN ISO 80079-36:2016, D.4.2 "Determination of the most efficient charging method".
- In case of decoupled frame and structural parts, pay special attention to the discharge capacity.

DIN EN ISO 80079-37:2016 (Protection through constructional safety "c", control of ignition sources "b", liquid immersion "k")

- Also check maintenance hatches and covers for electrical contact. Equipotential bonding conductors must be used here.
- The fire load of a fan should be as low as possible in order to minimise the fire hazard and its consequences in the event of an explosion. In this respect, observe DIN EN 1886, Chapter 10.

- The fan is an incomplete machine. Therefore, the risk assessment must be carried out for the entire system. The system manufacturer is responsible for this.

8.11 Corrosion

> *Despite taking the greatest possible care during the manufacturing process and using only recommended materials, corrosion formation cannot be completely ruled out. There is no reliable corrosion protection.*

The choice of suitable materials can only influence the probability of corrosion which in turn depends heavily on additional factors, such as the use of cleaning agents, humidity / salty atmosphere, constant exposure to water, etc.

Corner thinning effect on coated round steel parts, purchased parts, metal sheets, motors as well as indentations of threaded elements in the coating surface or minor flaking of the coating cannot be avoided.

Preparation grades pursuant to DIN EN ISO 8501-3 cannot be observed for thin metal sheets.

Production-related limit values for weld seam imperfections (see ISO 6520-1) correspond to evaluation group C in accordance with DIN EN ISO 5817.

The period of protection specified pursuant to ISO 12944-1 is therefore not to be understood as a warranty period. mdexx fan systems GmbH cannot guarantee complete corrosion resistance.

The same applies to aluminium materials. Aluminium materials which are exposed only to splash water without chemical additives usually do not require additional corrosion protection if the smallest points of attack are approved.

Special corrosion protection and limits for offshore applications

Sheet metal coatings for offshore applications comply with DIN EN ISO 12944-5:2008 with corrosivity category C5. They consist of a galvanised base coating followed by a three-coat finish.

Depending on the customer's wishes and order, the engine will receive a state-of-the-art CX coating, including a paint report, if ordered separately.

Uncoated, stainless materials (e.g. connecting/screwing elements or balancing blocks) are made of the steel materials 1.4301 or 1.4571.

On request, materials with a higher corrosion resistance class can be selected in consultation with mdexx fan systems GmbH (in accordance with DIN EN 1993-1-4:2015-10 / Eurocode 3).

For reasons of standardisation, spark-protected fans at mdexx fan systems GmbH are coated with a conductive paint with a corrosivity category of C5-H, RAL 7032.

Corrosivity category	Examples of typical environments (informative only)	
	Outdoors	**Indoors**
C1 Very low	----	Heated buildings with clean atmospheres, e.g. offices, schools, shops, hotels
C2 Low	Atmospheres with low level of pollution: Mostly rural areas	Unheated buildings where condensation may occur, e.g. storehouses, depots, sports halls
C3 Medium	Urban and industrial atmosphere with moderate sulphur dioxide pollution; coastal atmosphere with low salinity	Production rooms with high humidity and some air pollution, e.g. food processing plants, laundries, breweries, dairies
C4 High	Industrial atmosphere and coastal atmosphere with moderate salinity	Chemical plants, swimming pools, coastal shipyards and boatyards
C5 Very high	Industrial areas with high humidity and aggressive atmosphere and coastal atmosphere with high salinity	Buildings or areas with almost permanent condensation and high pollution
CX Extreme	Offshore areas with high salinity and industrial areas with extreme humidity and aggressive atmosphere, as well as subtropical or tropical atmospheres	Industrial areas with extreme humidity and aggressive atmosphere

DIN EN ISO 12944-2:2018-04
see: Table 1 — Corrosivity categories for atmospheric environmental conditions and examples of typical environments

9 Malfunctions

Malfunction description	Possible cause	Remedy
Fan does not run quietly	Impeller blades soiled	Clean impeller ► See also chapter "Cleaning/inspecting the impeller"
	Impeller deformed/damaged	Replace fan
	Uneven fan base	Loosen the fastening and ensure a flat base (<1 mm). Then re-attach the fan
	Loose fastening on the fan / balancing weights	Check threaded connections for completeness and correct torques
Grinding noises on the fan	Components colliding	Check gap dimensions. Check components for deformation
	Motor bearing defective	Replace fan
Fan does not start	Motor connected incorrectly	Check connection
	Starting current too high	Incorrect voltage
	Motor defective	Check motor and contact mdexx fan systems GmbH if required
	Motor too warm	Allow the motor to cool down and check the thermal circuit breaker if required
Fan causes loud humming/vibrating	There are many reasons, possibly in the overall system. Typical causes of increased vibration values follow this table	Contact mdexx fan systems GmbH

Typical causes of increased vibration values would be, for example:

- Poor inflow to the fan.
- Operation with clogged cooler or filter elements. This may result in operation in the unstable characteristic range, particularly with axial fans.
- Superposition of the natural resonances between the fan and the components in the immediate installation environment.
- Vibrations which act on the fan from outside due to frequency-controlled operation. Periodic, wave-like flows may amplify the vibrations of the fan or the system and therefore amplify the vibrations. Unsteady operating conditions may cause undesirable pumping effects inside the fan. In addition, the instability of the air flow results in increased vibrations of the fan and the overall system.

- If necessary, record the vibration velocity and vibration acceleration over a certain period of operation. The limit values of the pre-message and emergency shutdown must be defined by the system manufacturer or system operator as part of the risk and hazard assessment. Please also observe standard ISO 14694.
- If vibrations are the cause, a decision must be made on site as to whether the fan should be replaced as a preventive measure.

DANGER!

Danger of death due to bursting of the impeller

High vibrations or a defective impeller with cracks in the weld seams may result in a life-threatening burst process. This may result in considerable material damage, serious injuries or death.

If the vibrations are impermissibly high, the burst process of a fan occurs uncontrollably, with high energy, within a few seconds or even fractions of a second.

- Ensure that the fan is exposed only to the permissible vibration level.
- ► See also chapter "Vibrations"
- Ensure that the impeller is properly and regularly inspected, maintained and cleaned, as irregular deposits may result in imbalances and therefore bearing damage or vibrations.

9.1 Malfunctions in ATEX applications / explosion protection

> *The following explanations apply only to fans which have ATEX certification.*

External sources

Fans which are installed in a potentially explosive atmosphere or which convey a potentially explosive atmosphere fall under the scope of the ATEX Directive 2014/34/EU. The information about an existing, potentially explosive atmosphere and therefore the necessity of applying the ATEX Directive must be provided by the purchaser of the fans. mdexx fan systems GmbH designs the fans according to the specifications of the system manufacturer or planner and marks them according to the relevant conformity assessment.

Normally, external ignition sources are irrelevant for the manufacturer of non-electrical devices. Due to the extensive damage potential and its impact on the immediate environment, it is essential to observe the directives for the ATEX area and to prepare risk or hazard analyses accordingly.

Generally expected malfunctions

The following fan malfunctions might occur in practice and must be particularly observed by the operator. (See DIN EN 14986:2017, Chapter 4.1.3.):

- The usual and expected soiling of the fan will result in a malfunction.
- Frictional heat due to faulty installation - gap dimension was not observed.
- Change to the properties or dimensions of the fan unit (e.g. distortion of the casing or the impeller) will result in a malfunction.
- Malfunction or fault in the power supply or other supply equipment.
- Operation unnoticed for a long time with defective bearings and resulting contact between impeller and casing.

Rare malfunction (see DIN EN 14986:2017, Chapter 4.1.3.)

A rare malfunction is a type of malfunction that is possible but only occurs in rare circumstances. Two independent foreseeable malfunctions that do not constitute an ignition hazard on their own, but which do when combined, are considered to be a single rare malfunction.

Examples of rare malfunctions include:

- System failure in conjunction with a defect described above which could result in short-circuit currents.
- System malfunctions in conjunction with bursting.
- Loosening of impeller blades due to prolonged vibrations.
- Vibrations due to dust accumulation on impeller blades.
- Inadequate lubrication and hot-running bearings with bearing failure.
- Inadequate maintenance, clogged filters, insufficient air supply, deposits on the motor surface.
- Improper transport with mechanical damage.
- Contact of the outer blade edge and the inner casing diameter.
- Lack of earthing, different electrical potential, or electrostatic ignition.

Note:

Avoid stray currents, although they may flow in electrically conductive systems or parts of systems. Examples of these are:

- Return currents in power generation systems in the vicinity of large welding systems.
- Consequence of a short circuit or an earth fault due to faults in the electrical installations.
- Consequence of external magnetic induction (e.g. from nearby electrical installations with high currents or high frequencies).
- Consequence of lightning (see suitable standards, e.g. IEC 62305).

10 Disposal

NOTICE

Environmental damage due to incorrect disposal.

The fan contains materials which must be disposed of separately. Improper disposal may result in environmental damage.

At the end of its service life, the fan must be taken out of service and disposed of properly.

- Have the fan disposed of responsibly by a certified waste disposal company.
- Observe currently valid national and regional regulations for legally correct disposal.

Information on § 15 Paragraph 1 VerpackG

We can take back all disposable transport and bulk consumer packaging, which is part of our consignments, free of charge at the place of delivery or in its immediate vicinity in order to recycle it. The return procedure must be agreed in advance with mdexx fan systems GmbH.

The return of disposable packaging is voluntary.

All reusable packaging (e.g. Euro pallets, etc.) must be returned to us.

Disposal of old appliances in Germany

Appliances with the illustrated marking (crossed out wheeled bin logo) do not belong in household waste. The German Electrical and Electronic Equipment Act (ElektroG) guarantees the free return of electrical and electronic equipment to your local municipal collection point. For more information on this issue, please contact us.

11 Appendix

11.1 Standards / Safety requirements

Checks and measures pursuant to DIN EN 17170:2017-10; Table 2				
Safety requirements	**Visual inspection**	**Functional test**	**Measurement**	**Reference to standards**
Cutting, entanglement	x	x	x	EN 13857, EN 349, EN ISO 14120, EN ISO 12499
Inspection hatches	x	x		EN 349, EN ISO 13857, EN ISO 14120
Fluid jet	x	x		EN ISO 4413, EN ISO 12100
Ejection of parts	x			EN ISO 13849-1, EN 62061
Stability		x	x	EN ISO 12100
Slipping, tripping, falling	x			EN ISO 12100
Electrical safety	x	x	x	EN 60204-1, EN 61000-6-4
Control systems	x	x	x	EN 60204-1, EN ISO 4413, EN ISO 4414
Thermal safety		x	x	EN ISO 13732-1, EN ISO 13732-3, EN ISO 19353:2016
Noises		x	x	EN ISO 4871, EN ISO 5136, EN ISO 11688-1, EN ISO 11688-2, ISO 13347
Vibrations			x	EN 13849-1, EN 60204-1, EN 61511-1, ISO 21940-11, ISO 14694
Substances	x	x		EN 1672, ISO 13349
Ergonomics	x	x		EN 60204-1, EN 61310-1
Power supply		x		
Supplementary measures and equipment	x	x		EN 1037, EN 61310-1, EN ISO 13580, EN 60204-1

11.2 Commissioning/Maintenance report

Commissioning/ Maintenance report

Manufacturer:
mdexx fan systems GmbH
Zeppelinstr. 30
D-28844 Weyhe

Operator details:

Plant / location: _____
System: _____
Device no.: _____

Person responsible

Date of test: _____
Shift supervisor / foreman: _____
Fitter: _____

Manufacturer details:

Fan type / TCN: _____
Drawing number: _____
SAP no.: _____
Serial number: _____
Year of manufacture: _____

Contact: info@mdexx.com / +49 421 - 5125 - 0

Operating data according to rating plate

01	Operating frequency		Hz
02	Volume flow		m3/s
03	Static pressure		Pa
04	Total pressure increase		Pa
05	Permissible sound power level		dB(A)
06	Operating speed		rpm
07	Power requirement		kW
08	Insulation class		
09	Circuit	Δ	Y
10	Ambient air		°C
11	Nominal current for Δ		A
12	Nominal current for Y		A
13	Nominal power		kW
14	Motor torque		Nm
15	Degree of efficiency		%
16	Power factor cos(φ)		
17	Ia / In		
18	Efficiency class		

Measured test data during maintenance work

01	Operating speed			
02	Nominal current			A
03	Nominal voltage	Δ	Y	V
04	Winding resistance			Ω
05	Motor temperature in front bearing area			
06	Motor temperature in rear bearing area			
07	Vibration velocity at operating speed			
08	Vibration velocity at 50% operating speed			
09	Vibration velocity at lowest operating speed			
10	Residual imbalance			
11	How was the vibration velocity measured?			
12	a) Rigidly screwed onto solid block (limit: 4.5 mm/s)			☐
13	b) Flexibly on vibration damper (limit: 6.3 mm/s)			☐
14	c) Connection to production plant			☐
15	Check electric signals			

*Limit value in accordance with ISO14694 Category BV-3:

Rigid connection:	Peak = 6.4 mean value = 4.5 mm/s
Flexible / Soft connection:	Peak = 8.8 mean value = 6.3 mm/s

Safety report

- ☐ Determine isolation from all possible sources of supply
- ☐ Secure against reconnection
- ☐ Shield adjacent live areas
- ☐ Check and re-establish earth / bonding leads
- ☐ Automatic shutdown of the power supply
- ☐ Check cable insulation to avoid residual currents
- ☐ Establish protective separation
- ☐ Establish protection against contact / Ensure safety
- ☐ Avoid incorrect installation
- ☐ Tighten screws according to the torque table
- ☐ Apply threadlocker, line marking
- ☐ Impeller and inlet nozzle aligned, uniform gap
- ☐ After switching fan back on, no humming noises detectable
- ☐ Vibration check performed after maintenance.

Confirmation labelling

OK	nOK	
☐	☐	No external damage
☐	☐	No internal damage
☐	☐	No noticeable vibration noises (e.g. humming, vibrating)
☐	☐	Weld seams without visible cracks, if required dye penetrant testing
☐	☐	No deformation on casing or impeller blade
☐	☐	Impeller and casing cleaned
☐	☐	Corrosion protection restored to missing areas of paint.
☐	☐	Uniform gap dimension between inlet nozzle and impeller checked
☐	☐	Balancing weights available / OK
☐	☐	Tightness and completeness of threaded connections checked
☐	☐	Electrical connections and earthing checked
☐	☐	Lubrication performed, if available
☐	☐	Direction of rotation correct
☐	☐	Vibration measurements at the operating points unremarkable

Confirmation of tester

☐ The fan is free of defects and can be put into operation.

The following points were not OK and must be replaced, repaired or checked again.

Name:	Date:
Department:	Signature:

V14.10.2024