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1. STANDARDS AND DIRECTIVES

1.1 Applied standards and directives

According to Directive 2014/34/EU and the following standards:

EN 14986: 2017

Design of fans for use in potentially explosive atmospheres

EN IEC 60079-0: 2018

Explosive atmospheres - Part 0: Equipment - general requirements

EN 60079-1: 2014

Explosive atmospheres - Part 1: Equipment protection by pressure-resistant enclosure "d"

EN IEC 60079-7: 2015+A1: 2018

Explosive atmospheres - Part 7: Equipment protection by enhanced safety "e"

EN 60079-11: 2012

Explosive atmosphere Part 11: Equipment protection by intrinsic safety "i"

TR CU 012/2011

The fan satisfies the requirements of the Technical Regulations of the Customs Union "On safety of equipment intended for use in explosive atmospheres".

These operating instructions are available in other languages on our website, www.ebmpapst.com.

2. SAFETY REGULATIONS AND INFORMATION

Carefully read these operating instructions before beginning work on the device and before each use. Observe the safety regulations to prevent malfunctions or danger to persons. These operating instructions are to be regarded as part of the device. Store the instructions - in the vicinity of the product - so that they are accessible to the users at all times. The device is only to be sold or passed on together with the operating instructions. The operating instructions must be accessible to the operating and maintenance staff. These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

2.1 Hazard levels for warnings

These operating instructions use the following hazard levels to indicate potentially hazardous situations and important safety regulations:



DANGER

Indicates an imminently hazardous situation which will result in death or serious injury if the specified actions are not taken. Compliance with the instructions is imperative.

WARNING

Indicates a potentially hazardous situation which can result in death or serious injury if the specified actions are not taken. Exercise extreme caution while working.

CAUTION

Indicates a potentially hazardous situation which can result in minor or moderate injury or damage to property if the specified actions are not taken.

NOTE

A potentially harmful situation can occur and, if not avoided, can lead to property damage.

2.2 Staff qualifications

Only electricians qualified in electrical explosion protection may install the device, perform the test run and work on the electrical system. The device may only be unpacked, serviced, turned on or off, set, used, operated, disassembled, transported or otherwise used by suitably qualified, properly instructed and authorized technical staff.

2.3 Basic safety rules

Before using the device always perform hazard assessment in line with the order on operating safety (BetrSichV). The safety hazards associated with the device must be assessed again following installation in the final product.

Note the following when working on the device:

- ⇒ The device is only to be used in technically proper working order, for the intended purpose, in a safe manner, with attention to potential dangers and in accordance with the operating instructions.
- ⇒ Malfunctions and defects that affect safety must always be corrected immediately.
- ⇒ No modifications, additions or conversions are to be made to the device (for example changes to the guard grille or the attachment of other devices to the fan housing) without the approval of ebm-papst.
- ⇒ Modifications to the device result in loss of Ex approval. ebm-papst Mulfingen GmbH & Co. KG accepts no liability for damage resulting from such modifications.

2.4 Voltage

- ⇒ Check the electrical equipment of the device at regular intervals; see Chapter 7.2 Safety inspection.
- ⇒ Replace loose connections and defective cables immediately.



DANGER

Live terminals and connections even with device switched off

Electric shock, inadvertent triggering of an ignition spark and capacitive residual voltage can cause an ignition spark in the event of a short circuit.

- Before disconnecting the wires in the terminal box, short circuit the wires (L1, L2, L3) and PE outside the explosion hazard area, see Chapter 5.8.2 Switching off the device for maintenance.
- Wait five minutes after disconnecting the voltage at all poles before opening the terminal box

CAUTION

In the event of a fault, the rotor and the impeller will be energized

The rotor and the impeller have basic insulation.

- Do not touch the rotor and impeller once installed.

CAUTION

If control voltage or a stored speed set value is applied, the motor will restart automatically, e.g. after a power failure.

Risk of injury

- Keep out of the device danger zone.
- When working on the device, switch off the line voltage and ensure that it cannot be switched back on.
- After working on the device, remove any tools or other objects from the device.

2.5 Safety and protective features



DANGER

Protective device missing and protective device not functioning

Without a protective device there is a risk of serious injury, for instance if the hands reach or are sucked into the device during operation.

- Operate the device only with a fixed protective device and guard grille.
- The fixed protective device must be able to withstand the kinetic energy of a fan blade that becomes detached at maximum speed. There must not be any gaps which it is possible to reach into with the fingers, for example.
- The device is a built-in component. As the operator, you are responsible for ensuring that the device is secured adequately.
- Stop the device immediately if you notice a missing or ineffective protective device.

2.6 Electromagnetic radiation

Interference from electromagnetic radiation is possible, e.g. in conjunction with open- and closed-loop control devices.

If impermissible radiation levels occur following installation, appropriate shielding measures have to be taken by the user.

NOTE

Electrical or electromagnetic interference after installing the device in customer equipment.

→ Verify that the entire setup is EMC-compliant.

2.7 Mechanical movement



DANGER

Rotating device

Risk of injury to body parts coming into contact with the rotor or the impeller.

- Secure the device against accidental contact.
- Before working on the system/machine, wait until all parts have come to a standstill.

WARNING

Rotating device

Long hair and dangling items of clothing, jewelry and the like can become entangled and be pulled into the device. Injuries can result.

- Do not wear any loose-fitting or dangling clothing or jewelry while working on rotating parts.
- Protect long hair with a cap.

WARNING

Ejected parts

If protective devices are missing, parts can be ejected at high speed and cause injury or impair the ignition protection.

- Take appropriate safety measures. The protective devices must prevent contact with rotating and electrically live parts.

DANGER

The fan is supplied without complete protective equipment.

- Normally the system in which it is installed must be protected against the ingress of objects (IP20 according to EN60529/EN14986).
- To ensure ignition protection, rotating parts throughout the entire production series are to be designed such that the connection systems used always reliably stop parts or material from coming loose. In this context, it must be ensured that loose pieces of metal from the surrounding area cannot ingress into the area of the rotating parts and thus impair ignition protection.
- The suitability of the protective device and its attachment must always be evaluated in connection with the overall safety concept of the system as a whole.

2.8 Emissions

WARNING

Depending on the installation and operating conditions, the sound pressure level may exceed 70 dB(A).

Risk of noise-induced hearing loss

- Take appropriate technical safety measures.
- Protect operating personnel with appropriate safety equipment such as hearing protection.
- Also observe the requirements of local agencies.

2.9 Hot surface



CAUTION

High temperature on electronics housing

Risk of burns

- Ensure sufficient protection against accidental contact.

2.10 Transport

WARNING

Transporting the fan

Injuries from tipping or slipping

- Wear safety shoes and cut-resistant safety gloves.
- The fan is only to be transported in its original packaging.
- The fan is to be transported lying flat, i.e. the motor axis must be vertical.
- Secure the fan(s) e.g. with a lashing strip to stop anything slipping or tipping.



NOTE

Damaged packaging

ebm-papst accepts no liability for packaging damage that is not promptly reported.

- Report damage immediately
- Open the product as soon as it arrives
- Record any damage
- Sign the damage record and have it counter-signed by the delivering party (driver).



NOTE

Packaging intact, contents damaged

In the event of concealed transportation damage, you must furnish proof that the damage actually occurred during transport and not afterwards.

- Notify the delivering party and ebm-papst of the damage in writing within 5 working days.
- Keep the damaged goods and the packaging until the situation has been clarified.
- The operation of damaged devices is prohibited.

2.11 Storage (including spare part stocks)

- ⇒ Store the device, partially or fully assembled, in a dry place, protected against the weather and free from vibration, in the original packaging in a clean environment.
- ⇒ Protect the device against environmental influences and dirt until final installation.
- ⇒ Protect the device against unauthorized access, e.g. by non-authorized personnel.

- ⇒ We recommend storing the device for no longer than one year in order to guarantee trouble-free operation and the longest possible service life.
- ⇒ Even devices explicitly intended for outdoor use are to be stored as described prior to commissioning.
- ⇒ Maintain the storage temperature, see Chapter 4.5 Transport and storage conditions.

**DANGER**

Danger of explosion, ingress of dirt and moisture into the motor

The degree of protection decreases.

- Store the device in a completely assembled state only (cable gland and terminal box cover are sealed)

2.12 Disposal

Comply with all relevant local requirements and regulations when disposing of the device.

3. INTENDED USE

The device is exclusively designed as a built-in device for conveying air according to its technical data.

Note

- ⇒ The motor satisfies the requirements of category II 2G Ex db eb ib IIB T3 Gb. Devices of this category are intended for use in areas where an explosive atmosphere of air, gases and vapors or mist is likely to occur (category 2G). Even in the case of frequent system malfunctions or fault conditions that usually must be taken into account (foreseeable malfunctions), the device-related explosion protection measures of this category must provide the required level of safety. The individual risks of the complete system are to be evaluated and the necessary explosion protection measures are to be taken into account.

Any other usage above and beyond this does not conform with the intended purpose and constitutes misuse of the device. Customer equipment must be capable of withstanding the mechanical and thermal stresses that can arise from this product. This applies for the entire service life of the equipment in which this product is installed. When used in the intended manner, explosion-proof motors cannot ignite explosive gases or vapors. The manufacturer who installs ebm-papst devices is responsible for ensuring operation in accordance with the intended use, operational safety, proper installation, and EMC properties when installed. The fan is designed for 40,000 hours of operation; after that period, it must be replaced. ebm-papst accepts no liability for subsequent modifications to the fan.

Intended use also includes

- Using the device only in power systems with grounded neutral (TN/TT power systems).
- Conveying air at an ambient air pressure between 750 mbar and 1050 mbar.
- Using the device within the permitted ambient temperature range; see Chapter 4.2 Nominal data and Chapter 4.5 Transport and storage conditions.
- The device is to be protected against exposure to weather at the installation site.
- Operating the device with all protective devices.

- Using the device only in Zones 1 and 2 with Ex categories IIA and IIB and temperature classes T1 to T3.
- Using the device only in stationary systems.
- Using the device only in speed ranges without resonance to avoid sparking.
- Punctual, complete performance of all maintenance; see Chapter 7.3 Maintenance interval.
- Following the operating instructions.

Improper use

In particular, operating the device in the following ways is prohibited and could be hazardous:

- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Conveying of gas atmosphere above upper explosive limit.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Devices that are designed for use with salty air and are protected appropriately constitute an exception. The same applies to all other corrosive substances.
- Conveying solids in the flow medium.
- Conveying air with high dust exposure, e.g. sawdust, flour dust suction system or the like.
- Conveying air that contains iron and rust particles, e.g. using the device in a welding shop.
- Operation (also when stopped) with external vibrations.
- Operation in unstable airflow conditions (oscillation).
- Operation in very dirty conditions (see maintenance instructions).
- Installation and operation of the device exposed to weather.
- Using the device as a safety component or to perform safety-related functions.
- Operation in medical equipment with a life-sustaining or life-support function.
- Operation with vibrations that are transferred to the fan from external machines or attachments.
- Operation with mechanical loads which are introduced from external sources and are higher than permitted.
- Opening the terminal box during operation, see Chapter 4.1 Product drawing.
- Painting the fan.
- Standing or walking on the fan or ventilation unit.
- Operation with completely or partially disassembled or manipulated or inadequate protective devices.
- Connections (e.g. screws) coming loose during operation.
- Upstream connection of variable frequency drives.
- Connecting attachments to the rotor bell.
- Flow medium and ambient conditions that do not correspond to the Ex marking.
- In addition, all applications not listed among the intended uses.

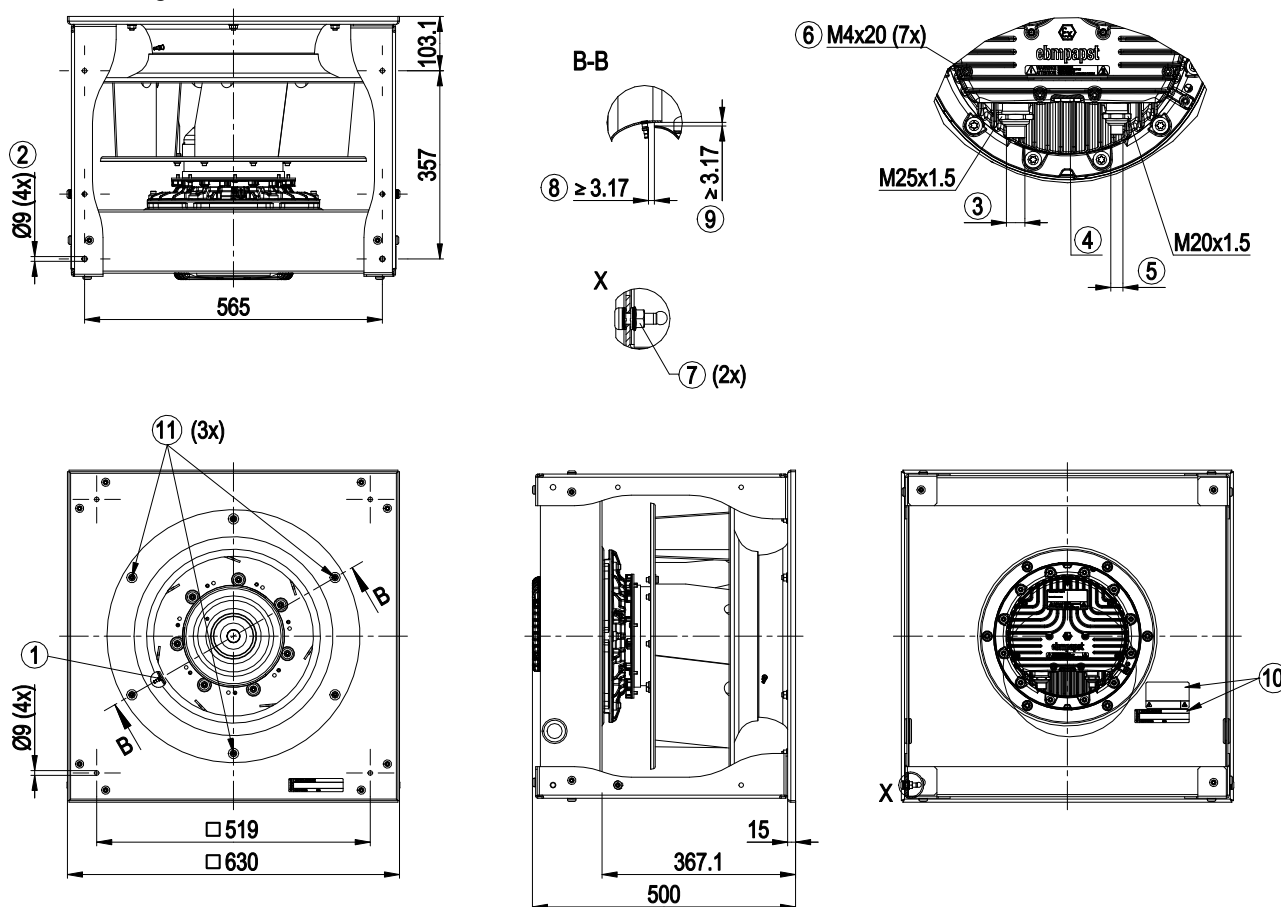


DANGER

Potential dangers in the event of non-compliance include personal injury and property damage due to shaft breakage, fatigue failure, reduced bearing service life or explosions caused by elevated surface temperatures or sparking.

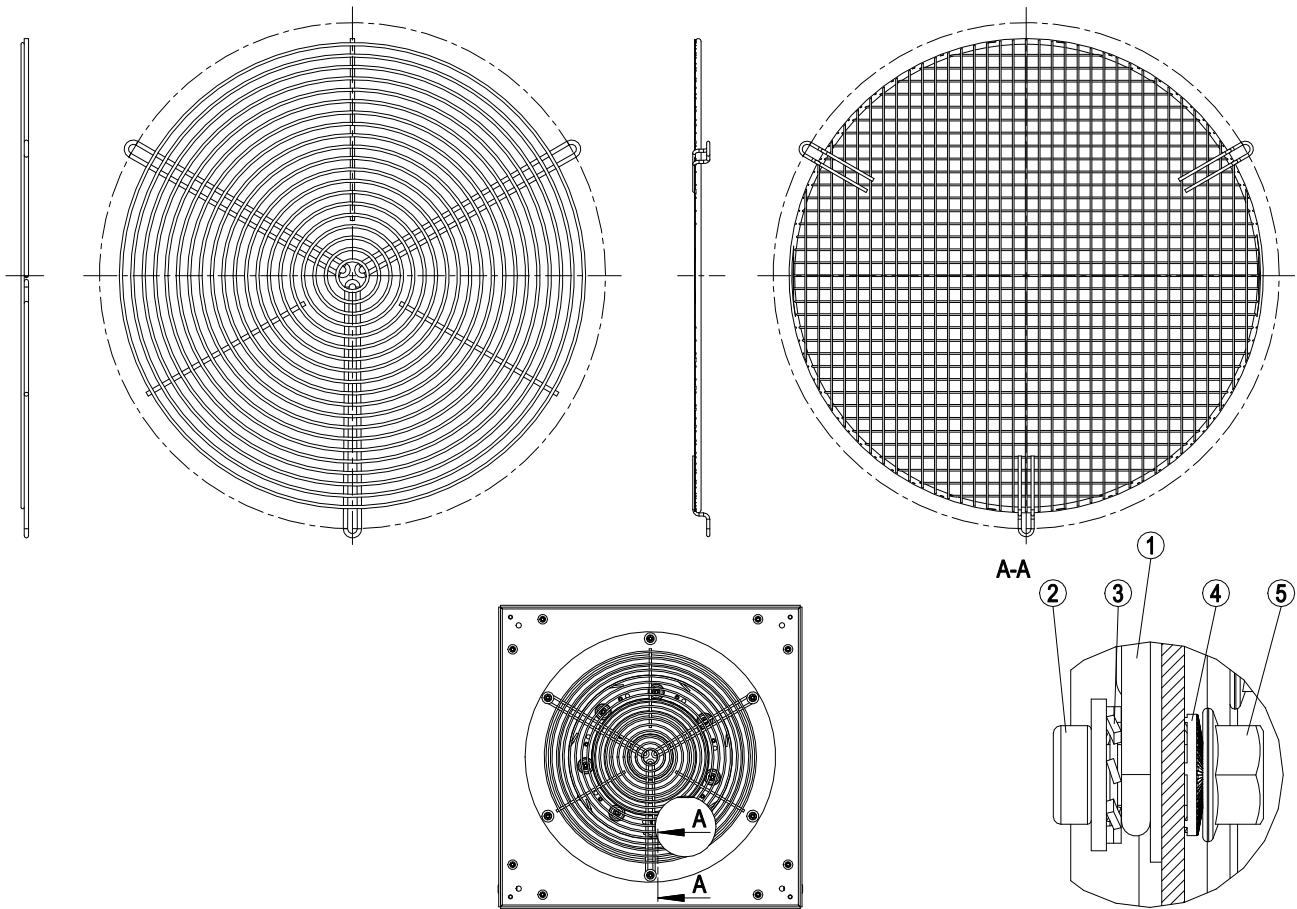
4. TECHNICAL DATA

4.1 Product drawing



All dimensions in mm.

1	Inlet ring with pressure tap
2	Mounting position for vibration-absorbing elements
3	Cable diameter min. 10 mm, max. 16 mm, tightening torque 6 ± 0.6 Nm; standard value depending on cable
4	Screw plug M20 x 1.5
5	Cable diameter min. 10 mm, max. 14 mm, tightening torque 6 ± 0.6 Nm; standard value depending on cable
6	Terminal box fastening screws, tightening torque 3.5 ± 0.5 Nm
7	Ground connection point M8 (functional ground for electrostatic discharge, no protective earth), do not unfasten the nut provided, contact is established by way of another nut.
8	Axial gap dimension
9	Radial gap dimension
10	Additional nameplate and warning sticker in Russian
11	Fastening points for the optionally available guard grill (78139-2-4039 (guard grill); 79500-2-4039 (mesh guard grill))



All dimensions in mm.

	This drawing shows how to install the guard grille with the article numbers specified in the product drawing. The necessary bolts, nuts and washers are available from ebm-papst.
1	Guard grill for protection against accidental contact (ring- or mesh guard grill version, depending on scope of delivery)
2	Bolt M8x18 micro-encapsulated
3	Toothed lock washer
4	Contact washer (only necessary on one screw, only with painted housing)
5	Nut M8
	Attention! To mount the guard grill, only loosen and unscrew the three screws marked in the product drawing.
	The other bolts must not be loosened!
	Used screws and nuts must be disposed of.
	Use the fastening components available from ebm-papst for assembly.
	If the housing is painted, the contact washer (4) must also be inserted between the housing and the nut for one screw.
	Tighten the bolts to a torque of 20 Nm $\pm$ 3 Nm.
	If a guard grille other than that specified in the product drawing is installed, the operator must ensure proper installation according to the ATEX directive. In particular, it must be ensured that the necessary distance from rotating parts is observed and that static charge that arises is safely dissipated. If you have any questions, please contact ebm-papst.

4.2 Nominal data

Motor	M3G150-FF
Phase	3~
Nominal voltage / VAC	400
Nominal voltage range / VAC	380 .. 440
Frequency / Hz	50/60
Method of obtaining data	ml
Status	prelim.
Speed (rpm) / min ⁻¹	2040
Power consumption / W	2950
Current draw / A	4.5
Min. ambient temperature / °C	-40
Max. ambient temperature / °C	50

ml = Max. load · me = Max. efficiency · fa = Free air
cs = Customer specification · ce = Customer equipment

Subject to change

Occasional start-up at temperatures between -40 °C and -25 °C is permitted. For continuous operation at ambient temperatures below -25 °C (such as refrigeration applications), a fan design with special low-temperature bearings must be used.

4.3 Technical description

Weight	57.5 kg
Size	450 mm
Motor size	150
Rotor surface	Painted black
Electronics housing material	Die-cast aluminum, painted black
Impeller material	Sheet aluminum
Inlet nozzle material	Sheet aluminum
Support structure material	Sheet steel, galvanized
Number of blades	7
Direction of rotation	Clockwise, viewed toward rotor
Degree of protection	IP44
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	H1
Ambient temperature note	Occasional start-up at temperatures between -40°C and -25°C is permitted. For continuous operation at ambient temperatures below -25°C (such as refrigeration applications), use must be made of a fan design with special low-temperature bearings.
Installation position	Shaft horizontal (base mounting only) or rotor on bottom; rotor on top not permitted
Condensation drainage holes	On rotor side
Mode	S1
Motor bearing	Ball bearing

Technical features	- Output 10 VDC, max. 10 mA - Output 20 VDC, max. 50 mA - Output for slave 0-10 V - Operation and alarm display - Input for sensor 0-10 V or 4-20 mA - External 24 V input (parameter setting) - External release input - Alarm relay - Integrated PID controller - Motor current limitation - PFC, passive - RS-485 MODBUS-RTU - Soft start - Control input 0-10 VDC / PWM - Temperature derating - Thermal overload protection for electronics/motor - Line undervoltage / phase failure detection
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	≤ 3.5 mA
Electrical hookup	Terminal box
Motor protection	Reverse polarity and locked-rotor protection
Protection class assignment	I; If a protective earth is connected by the customer This component for installation may have several local protection classes. This information relates to this component's basic design. The final protection class is based on the component's intended installation and connection.
Conformity with standards	EN 14986; EN 60079-0; EN 60079-1; EN 60079-7; EN 60079-11; EN 61800-5-1; CE
Approval	II 2G; EAC



With regard to cyclic speed loads, note that the rotating parts of the device are designed for a maximum of one million load cycles. If you have special questions, consult ebm-papst for support.

4.4 Mounting data

⇒ Secure the screws against unintentional loosening (e.g. use self-locking screws).

Strength class of screws	10.9
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Any further mounting data required can be taken from the product drawing.

4.5 Transport and storage conditions

⇒ Use the device in accordance with its degree of protection.

Max. permitted ambient temp. for motor (transport/storage)	+80 °C
Min. permitted ambient temp. for motor (transport/storage)	-40 / -55 °C

4.6 Electromagnetic compatibility

EMC immunity to interference	According to EN 61000-6-2 (industrial environment)
EMC interference emission	According to EN 61000-6-4 (industrial environment)



If several devices are switched in parallel on the supply side so that the line current of the arrangement is in the range of 16-75 A, then this arrangement conforms to IEC 61000-3-12 provided that the short-circuit power S_{sc} at the connection point of the customer system to the public power system is greater than or equal to 120 times the rated output of the arrangement. It is the responsibility of the installation engineer or operator/owner of the device to ensure, if necessary after consultation with the network operator, that this device is only connected to a connection point with a S_{sc} value that is greater than or equal to 120 times the rated output of the arrangement.

4.7 Ex areas

The device may only be used according to the specifications in the operating instructions; see Chapter 3. Intended use.

Zone classification

The zones describe how long an explosive atmosphere may be present. Zones 1 and 2 permit only gases, vapors and mist (no dust) which occur occasionally to seldom in normal operation.

Equipment categories

The device is approved for Category 2 of Equipment Group II. The categories define the level of safety.

4.8 The nameplate



Fig. 1: Specifications on the nameplate

Serial number

Designation	Explanation
YY	Year Year, e.g. 11 for production in 2011
WW	Week Week, calendar week in year of production
Six-digit number, e.g. 000003	Sequential serial number

Ex marking

Ex II 2G Ex db eb ib IIB T3 Gb

Element	Explanation
Ex	Ex marking according to 2014/34/EU
II	Equipment group (II → use above ground (not mining))
2	Category 2 → Zone 1, Category 3 → Zone 2
G	Ex atmosphere (G → Gas) (no dust exposure permissible)
Ex db eb ib	Ignition protection type (db → flameproof enclosure, eb → enhanced safety, ib → intrinsic safety with protection level)
IIB	Explosion group (for gases in Group IIB)
T3	Temperature class T3, see EN 60079-0
Gb	Equipment protection level

Certificate number IBExU14ATEX1123 X /xx

Element	Explanation
IBExU	Certification body
14	Year of approval
ATEX	according to the ATEX Product Directive 2014/34/EU
1123	Certificate number
X	The "X" symbol after the certificate number indicates special conditions for safe use of the motors, which can be found in these operating instructions.
\xx	Supplement to EU prototype test certificate for the respective type

Special conditions for safe use

- Flameproof joints are only to be repaired in accordance with the manufacturer's design specifications. Repairs based on the values in EN 60079-1 are not permissible.
- The cable glands employed are only to be used for fixed installation. Ensure appropriate strain relief when fitting.
- When replacing cable and wire entries, note that they must be suitable for long-term service temperatures between -55°C and +80°C.
- For ambient temperatures below -20°C, the cables must be suitable for the corresponding usage temperature.

5. CONNECTION AND STARTUP

Before starting the tasks, perform the measures for worker protection specified in your hazard assessment.
In addition to the generally valid installation regulations for low-voltage electrical equipment, the special requirements for installing electrical equipment in explosion hazard areas must be observed.

5.1 Mechanical connection



DANGER
Insufficient grounding
Electric shock

- The fan must be grounded in the motor terminal box. A further connection is provided on the outside of the motor. The grounding points on the fan frame or housing are no substitute for the protective grounding in the terminal box (only for discharge of static electricity)



CAUTION
Risk of cutting and crushing when removing device from packaging



- Carefully remove the device from the packaging by grasping hold of the frame. Never subject to any impact.
- Wear safety shoes and cut-resistant safety gloves.

CAUTION
Heavy load when unpacking device

Risk of physical injury, such as back injuries.

- Two people should work together to remove the device from its packaging.

NOTE
Imbalance

Shortening of device service life

- Do not grasp or transport the device by the blades. Move the device with a crane using ropes or cloth straps.
- After installation, make sure the fan impeller moves easily and that the blades are not deformed or bent and do not catch at any point.

NOTE
Installing peripheral components

- When installing peripheral components or similar attachments, take care to use a suitable material (at points or areas of contact) between rotating and stationary parts.
- When installing such parts, you as the system manufacturer are responsible for maintaining the safety clearance, for example between the impeller and the housing, in accordance with EN 14986.

NOTE

Shortened service life due to extreme stresses

Examples of extreme stresses include the effects of moisture, aggressive chemical substances and vibrations. Examples of extreme climatic stress include extreme heat or cold or high humidity.

- Avoid extreme stresses.



NOTE

Damage to the device from vibration

Bearing damage, shorter service life

- The fan must not be subjected to force or excessive vibration from sections of the installation.
- If the fan is connected to air ducts, the connection should be isolated from vibration, e.g. using compensators or similar elements.
- Ensure stress-free attachment of the fan to the substructure.

- ⇒ Check the device for transport damage. Damaged devices are not to be installed.
- ⇒ Install the undamaged device in accordance with your application.
- ⇒ The system may not introduce any forces into the device that place stress on the frame structure and that affect the Ex-relevant gap (e.g. uneven mounting level, air duct connections, or the like).
- ⇒ During installation, take care not to bend or pry the device so as to avoid mechanical strain.
- ⇒ Verify that all rotating parts can move freely. The device must be installed in such a way that the shaft is horizontal or vertical with the rotor facing downwards.
- ⇒ During installation, take note of the device's direction of rotation.
- ⇒ Use suitable fasteners for installation.
- ⇒ Remove any objects in the fan's exhaust zone or near its blades.
- ⇒ After installation, make sure the screws have been firmly tightened.
- ⇒ The system must not transmit any impermissibly high vibration levels to the device (vibration measurement according to Chapter 7.4 Vibration check is required during startup and regular maintenance).



If multiple ebm-papst fans are installed in one system, please allocate serial numbers to the project and write them down so that accurate information can be provided about the range of devices affected in the event of a malfunction.

5.1.1 Gap dimension



Radial gap dimension

The gap dimension between the fan impeller and the inlet nozzle is set by ebm-papst and is at least 1% of the contact diameter (see Chapter 4.1 Product drawing).



Axial gap dimension

The axial clearance between the pressure tap and the fan impeller must be at least 1% of the contact diameter; (see Chapter 4.1 Product drawing).

- Be sure to check this clearance in axial and radial direction on start-up and when performing regular inspections in accordance with Chapter 7.3 Maintenance interval.
- Operating the device below the minimum gap dimension is not allowed.

5.2 Electrical connection



DANGER
Voltage on the device
Electric shock

- Always connect a protective earth first.
- Check the protective earth.



DANGER
Explosion hazard

- To dissipate electrostatic charges, the fan must be grounded via the grounding point on the fan housing.
- Operation of the fan without grounding to dissipate electrostatic charges is not permitted.



NOTE
The minimum permissible temperature for connection of the cables to the terminals is -35°C.
The terminals may be damaged.

- Only connect the cables at temperatures above -35°C.



DANGER
Faulty insulation

Risk of fatal injury from electric shock

- Use only cables that meet the specified installation regulations for voltage, current, insulation material, capacity, etc.
- Route cables so that they cannot come into contact with rotating parts.
- Only use cables that are designed for the current level indicated on the nameplate and approved for use in potentially explosive atmospheres.

CAUTION

Voltage

The fan is a built-in component and has no disconnecting switch.

- Only connect the fan to circuits that can be switched off with an all-pole disconnection switch.
- When working on the fan, secure the system/machine in which the fan is installed so as to prevent it from being switched back on.

NOTE

Device malfunctions possible

Route the device's control lines separately from the supply line.

- Maintain the greatest possible clearance.
Recommendation: clearance > 10 cm (separate cable routing)

NOTE

Water ingress into wires or cables

Water ingress at the customer end of the cable can damage the device.

- Make sure the end of the cable is connected in a dry environment.

5.2.1 Requirements

- ⇒ Check whether the data on the nameplate match the connection data.
- ⇒ Before connecting the device, make sure the power supply matches the device voltage.
- ⇒ Only use cables designed for the current level indicated on the nameplate; see Chapter 5.3.3 Connecting wires to terminals. For determining the cross-section, note the sizing criteria according to EN 61800-5-1. The protective earth must have a cross-section equal to or greater than that of the phase conductor. We recommend the use of 105 °C cables.
- ⇒ Only use cables approved for the corresponding ambient temperature.
- ⇒ Do not subject the cables to impermissible strain.
- ⇒ Establish a safe protective earth connection.

- ⇒ Ensure that the degree of protection is maintained. The seals in the terminal box from ebm-papst have been inspected for suitability.

The motor must be connected in accordance with EN 60079-14.

Ground conductor contact resistance according to EN 61800-5-1

Compliance with the impedance specifications according to EN 61800-5-1 for the protective earth connection circuit must be verified in the end application. Depending on the circumstances of installation, it may be necessary to connect an additional protective earth conductor to the extra protective earth terminal on the device. The protective earth terminal is on the housing and has a ground conductor symbol and a bore hole.

5.2.2 Supply connection and fuses

Assignment of supply cable cross-sections and their required fuses (line protection only, no equipment protection).

Nominal voltage	Fuse		Automatic circuit breaker	Wire cross-section	Wire cross-section
	VDE	UL	VDE	mm²	*AWG
3/PE AC 380-440 VAC	16 A	15 A	C16A	1.5	16
3/PE AC 380-440 VAC	20 A	20 A	C20A	2.5	14
3/PE AC 380-440 VAC	25 A	25 A	C25A	4.0	12

* AWG = American Wire Gauge

5.2.3 Reactive currents



Because of the EMC filter integrated for compliance with EMC limits (interference emission and immunity to interference), reactive currents can be measured in the supply line even when the motor is at a standstill and the line voltage is switched on.

- The values are typically less than 250 mA.
- At the same time, the effective power in this operating state (operational readiness) is typically < 5 W.

5.2.4 Residual current circuit breaker (RCCB)



Only universal residual current devices (type B or B+) are allowed. As with variable frequency drives, residual current devices cannot provide personal safety while operating the device.

When the device's power supply is switched on, pulsed charging currents from the capacitors in the integrated EMC filter can lead to the residual current devices tripping without delay. We recommend the use of residual current circuit breakers with a trip threshold of 300 mA and delayed tripping (super-resistant, characteristic K).



5.2.5 Leakage current



For asymmetrical power systems or if a phase fails, the leakage current can increase to a multiple of the nominal value.

5.3 Connection in terminal box

5.3.1 Terminal box as supplied

The terminal box of the fan supplied by ebm-papst is equipped with the following cable glands.

Wire	Outer diameter of wire	Terminal area of terminal strip	Manufacturer part number (Hugro)
Supply connection M25 x 1.5	Ø 10 mm to Ø 16 mm	1.5 mm ² to 4 mm ²	154.2516.37
Control wire M20 x 1.5	Ø 10 mm to Ø 14 mm	0.5 mm ² to 1.5 mm ²	154.2014.37
Screw plug M20 x 1.5	-	-	548.20.14

5.3.2 Preparing cables for connection

Optionally, cables with or without shielding can be used. The two illustrations that follow show the lengths to which the cables must be cut. For correct wiring, note Chapter 5.3.3 Connecting wires to terminals. Strip the cable only as much as necessary, and ensure that the cable gland is sealed and there is no strain on the connections. For tightening torques, see Chapter 4.1 Product drawing.

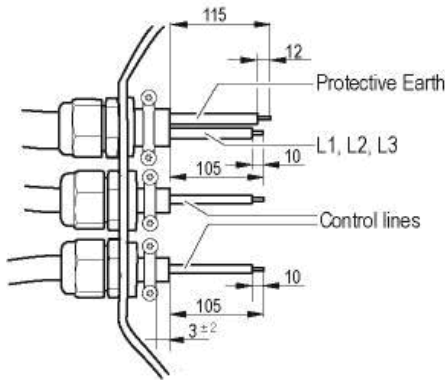


Fig. 2: Recommended stripped lengths in mm (inside terminal box) for unshielded cables. In this illustration, all cable glands are used by way of example. The illustration may differ from the actual device design.

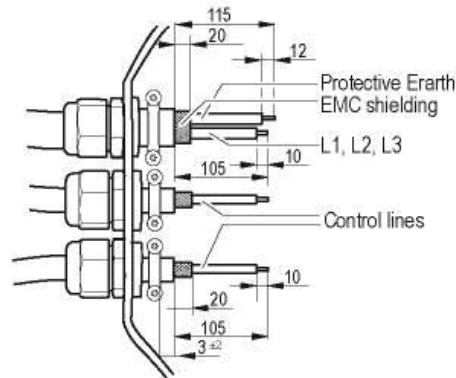


Fig. 3: Recommended stripped lengths in mm (inside terminal box) for shielded cables. In this illustration, all cable glands are used by way of example.

5.3.3 Connecting wires to terminals

- ⇒ Open the terminal box.
- ⇒ To do so, unscrew the seven screws; for tightening torque, see Chapter 4.1 Product drawing.



Take care when opening the terminal box cover. Do not damage the terminal box seal by using tools to open it. A protective earth is installed on the terminal box cover. This connection must not be broken.

If the original screws of the terminal box cover have been lost, use metric and corrosion-resistant screws; for size see Chapter 4.1 Product drawing.

- ⇒ Remove the cap from the cable gland.



Use is only to be made of screw plugs with Ex e approval. Any other form of sealing, e.g. by cables, is impermissible.

- ⇒ Use one sheathed cable for each cable gland.
- ⇒ Use copper wires only.
- ⇒ Check that the wires are clean.
- ⇒ Route the wire(s) (not included in scope of delivery) into the terminal box.



The supply line (PE and L1 - L3) must always be routed separately and must not be routed together with the control line. Pay attention to the cross-sections of the strands and cable glands.



If using shielded cables, the shielding has to be folded back over the wire sheath and fixed under the strain relief clamps; see the illustration "Strain relief for shielded cables".

- ⇒ First connect the "PE" (protective earth).
- ⇒ Connect the wires to the corresponding terminals.

Use a screwdriver to do so.

When connecting, ensure that no wire ends fan out.

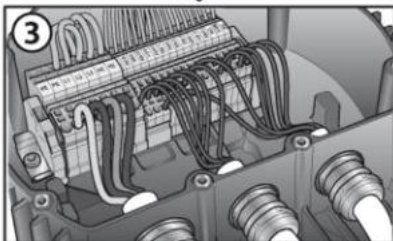
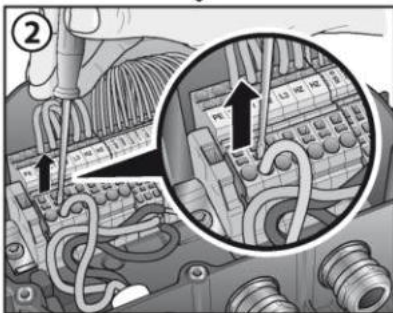
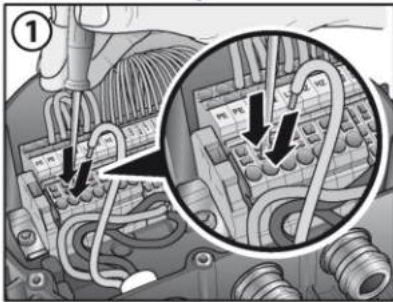
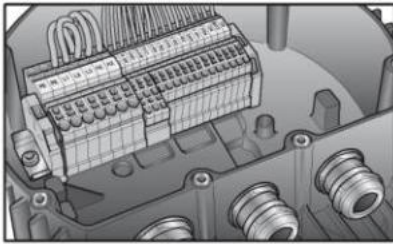


Fig. 4: Connecting wires to terminals (example)

There must be no mechanical stress acting between the terminal and the cable gland. The cable must be relieved of strain.

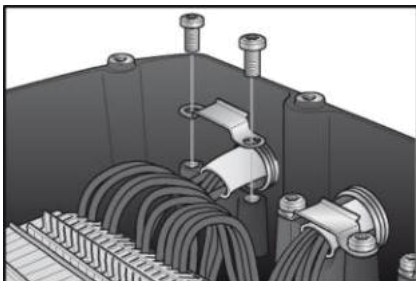


Fig. 5: Secure the brackets (included in terminal box) for strain relief of the wires

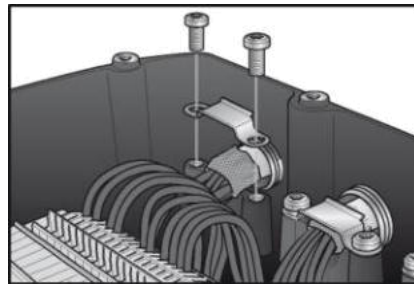


Fig. 6: Strain relief for shielded wires



The strain relief acts on the cable sheath, eliminating strain on the leads.



DANGER

Risk of explosion due to poorly sealed terminal box.

The terminal box cover, its seal and the contact surface on the housing must not be soiled or damaged.

→ Clean the contact surfaces if soiled; heed the section on cleaning.

→ If the device is damaged, send it to ebm-papst for repair or replacement.



The terminal box is only properly sealed if the terminal box screw connections and cable glands have been tightened to the specified torque.

5.3.3.1 Replacement of cable glands and screw plugs

If you would like to replace cable glands or screw plugs, for example because they have been lost or become worn out, they must have the following characteristics.



CAUTION

Required properties for cable glands and screw plugs:- Ex e approval

- Usage temperature -40°C to 85°C
- Connection thread M20 x 1.5 mm or M25 x 1.5 mm
- Sizing corresponding to cable diameter
- Material: Nickel-plated brass or stainless steel

5.3.4 Cable routing

Water must be prevented from reaching the cable gland along the cable. To relieve strain on the cables, we recommend fastening the cables at intervals of 10 cm.

Fans installed lying flat

Make sure the cables are routed in a U-shaped loop.

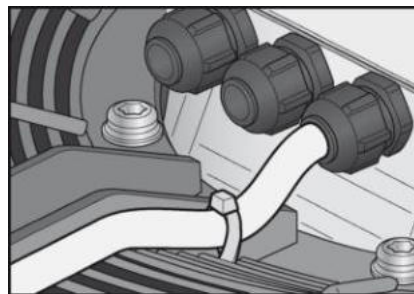


Fig. 7: Fan installed lying flat, cable routed in a U-shaped loop.



Fans installed upright

When routing the cable, make sure that the cable glands are located at the bottom. The cables must always be routed downward.

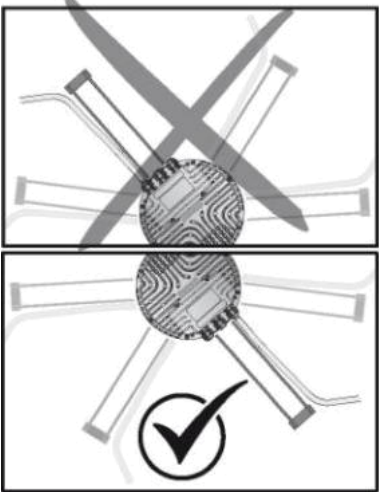


Fig. 8: Cable routing for fans installed upright.

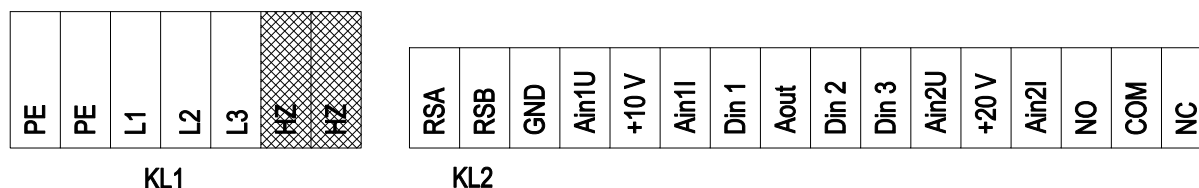
5.4 Factory settings

Factory settings made for the device by ebm-papst.

Mode parameter set 1	PWM control
Mode parameter set 2	PWM control
Fan/device address	1
Max. PWM / %	100
Min. PWM / %	5,1
Save set value to EEPROM	Yes
Set value requirement	Analog (linear)
Direction of action parameter set 1	Positive (heating)
Direction of action parameter set 2	Positive (heating)



5.5 Connection diagram



Drawing preliminary!

Shaded => terminals not used

No.	Conn.	Designation	Function/assignment
1		PE	Ground connection, PE connection
1		L1	Supply connection, power supply 3-phase 380-440 VAC, 50/60 Hz
1		L2	Supply connection, power supply 3-phase 380-440 VAC, 50/60 Hz
1		L3	Supply connection, power supply 3-phase 380-440 VAC, 50/60 Hz
1		HZ	not used (optional: internal heating element)
2		RSA	Bus connection RS485, RSA, MODBUS RTU; double terminal point (SELV)
2		RSB	Bus connection RS485, RSB, MODBUS RTU; double terminal point (SELV)
2		GND	Reference ground for control interface (SELV)
2		Ain1 U	Analog input 1, set value: 0-10 V, Ri = 100 kΩ, adjustable curve, only usable as alternative to input Ain1 I; SELV
2		+10 V	Fixed voltage output 10 VDC, +10 V ±3%, max. 10 mA, short-circuit-proof power supply for external devices (e.g. pot); SELV
2		Ain1 I	Analog input 1, set value: 4-20 mA, Ri = 100 Ω, adjustable curve, only usable as alternative to input Ain1 U; SELV
2		Din 1	Digital input 1: enable electronics, enable: pin open or applied voltage 5-50 VDC disable: bridge to GND or applied voltage < 1 VDC reset function: triggers software reset after a level change to < 1 VDC; SELV
2		Aout	Analog output 0-10 VDC, max. 5 mA, output of current motor modulation level / motor speed adjustable curve; SELV
2		Din 2	Digital input 2: Switching parameter sets 1/2, according to EEPROM setting, the valid or used parameter set can be selected via bus or via digital input DIN2. Parameter set 1: pin open or applied voltage 5-50 VDC Parameter set 2: bridge to GND or applied voltage < 1 VDC; SELV
2		Din 3	Digital input 3: Direction of action of integrated controller, according to EEPROM setting, the direction of action of the integrated controller can be selected as normal/inverse via bus or digital input Normal: Pin open or applied voltage 5-50 VDC Inverse: Bridge to GND or applied voltage < 1 VDC; SELV
2		Ain2 U	Analog input 2, measured value: 0-10 V, Ri = 100 kΩ, adjustable curve, only usable as alternative to input Ain2 I; SELV
2		+20 V	Fixed voltage output 20 VDC, +20 V +25/-10%, max. 50 mA, short-circuit-proof power supply for external devices (e.g. sensors); SELV or: +24 VDC input for parameter setting via MODBUS without line voltage
2		Ain2 I	Analog input 2, measured value: 4-20 mA, Ri = 100 Ω, adjustable curve, only usable as alternative to input Ain2 U; SELV
2		NO	Status relay, floating status contact; make for failure
2		COM	Status relay, floating status contact, common connection, contact rating 250 VAC / max. 2 A (AC1) / min. 10 mA
2		NC	Status relay; floating status contact, break for failure

5.6 Checking connections

- ⇒ Ensure isolation from supply (all phases).
- ⇒ Make sure a restart is impossible
- ⇒ Check the cables for proper fit.
- ⇒ Route the cables in the terminal box so that the terminal box cover closes without resistance. The strands must not be trapped between the terminal box cover and housing.
- ⇒ Screw the terminal box cover back on again. Terminal box tightening torques, see Chapter 4.1 Product drawing.
- ⇒ Use all screw plugs. Insert the screws by hand to avoid damage to the threads.
- ⇒ Make sure the terminal box is completely closed and sealed and that all screws and cable glands have been properly tightened.
- ⇒ The supply lines to the add-on unit, e.g. exchanger, must conform to the IP protection class (see nameplate). Do not route the cables over any sharp-edged objects.

5.7 Switching on the device

The device may only be switched on if it has been installed properly and in accordance with its intended use, including the required safety mechanisms and professional electrical hookup. This also applies for devices which have already been equipped with plugs and terminals or similar connectors by the customer.

- ⇒ Before switching on, check the device for visible external damage and make sure the protective devices are functional.
- ⇒ Check the fan's air flow paths for foreign matter and remove any foreign matter found.
- ⇒ Apply the nominal supply voltage.
- ⇒ Start the device by changing the input signal.



NOTE

Damage to the device from vibration

Bearing damage, shorter service life

- Low-vibration operation of the fan must be ensured over the entire speed control range.
- Severe vibration can arise for instance from inexpert handling, transportation damage and resultant imbalance or be caused by component or structural resonance.
- Speed ranges with excessively high vibration levels and possibly resonant frequencies must be determined in the course of fan commissioning.
- Either run through the resonant range as quickly as possible with speed control or find another remedy.
- Operation with excessively high vibration levels can lead to premature failure.

5.8 Switching off the device

5.8.1 Switch off device during operation

- ⇒ Switch off the device via the control input.
- ⇒ Do not switch the motor (e.g. in cyclic operation) on and off via power supply.

5.8.2 Switching off the device for maintenance

- ⇒ Switch off the device via the control input.
- ⇒ Disconnect the device from the power supply.

If the device (terminal box cover) has to be opened and disconnected from the supply line, note the following:



DANGER

Electrical charge (>50 µC, 60 µJ) between phase conductor and protective earth connection after switching off supply.

Electric shock, risk of injury

→ **Attention! The terminal box cover may not be opened within a potentially explosive area before the wires (L1, L2, L3) and PE have been short-circuited outside the potentially explosive area (e.g. at the main switch).**

- ⇒ Disconnect the cable at the device.
- ⇒ When disconnecting, be sure to disconnect the ground connection last.

6. INTEGRATED PROTECTIVE FEATURES

The integrated protective functions cause the motor to switch off automatically in the event of the faults described in the table.

Fault	Safety feature description/function
Rotor position detection error	No automatic restart follows.
Blocked rotor	⇒ After the blockage is removed, the motor restarts automatically.
Line undervoltage (line voltage outside of permitted nominal voltage range)	⇒ If the line voltage returns to permitted values, the motor restarts automatically.
Phase failure	A phase of the supply voltage fails for at least 5 s. ⇒ When all phases are correctly supplied again, the motor automatically restarts after 10-40 s.
Overtemperature of motor, electronics interior and power electronics	No automatic restart. Reset the device manually.

7. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

Do not perform any repairs on the device. Send it to ebm-papst for repair or replacement.

When performing maintenance work on the fan, e.g. when cleaning the fan impeller, the fan must be stationary and the electrical circuit must be interrupted and safeguarded against unintentional re-starting.

⇒ Wait until the device comes to a stop.



WARNING

Live terminals and connections even with device switched off

Electric shock

→ When shutting off the device, note Chapter 5.8 Switching off the device.

→ Wait five minutes after disconnecting the voltage at all poles before opening the device.

CAUTION

If control voltage or a stored speed set value is applied, the motor will restart automatically, e.g. after mains failure.

Risk of injury

→ When working on the device, switch off the line voltage and ensure that it cannot be switched back on.

→ Wait until the device comes to a stop.

→ Keep out of the device danger zone.

→ After performing work on the device, remove any tools used or other objects from the fan air paths.



If the device is out of use for over four months, we recommend switching it on for at least three hours at full speed to allow any condensation to evaporate and to move the bearings.

⇒ Carry out inspections and cleaning as appropriate for the Ex marking so that no dirt deposits form.

Malfunction/fault	Possible cause	Possible remedy
Impeller not running smoothly	Imbalance in rotating parts	Clean the device; replace if imbalance persists after cleaning. Make sure no weight clips are moved, damaged or removed during cleaning.
Motor not turning	Mechanical blockage	Switch off, isolate from supply and remove mechanical blockage.
	Line voltage faulty	Check line voltage, restore power supply. Attention! The error message resets automatically. Device restarts automatically without warning.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Broken motor winding	Replace device

	Deficient cooling	Improve cooling. Let the device cool down. To reset the error message, switch off the line voltage for at least 25 s and then switch it on again. Alternatively, reset the error message by applying a control signal of < 0.5 V to Din1 or by shorting Din1 to GND.
	Ambient temperature too high	Reduce the ambient temperature. Let the device cool down. To reset the error message, switch off the line voltage for at least 25 s and then switch it on again. Alternatively, reset the error message by applying a control signal of < 0.5 V to Din1 or by shorting Din1 to GND.
	Impermissible point of operation (e.g. excessive load, back pressure too high)	Correct the operating point. Let the device cool down. To reset the error message, switch off the line voltage for at least 25 s and then switch it on again. Alternatively, reset the error message by applying a control signal of < 0.5 V to Din1 or by shorting Din1 to GND.
Terminal box fastening screws broken while closing		Replace device



In the event of further malfunctions, contact ebm-papst.

7.1 Cleaning

NOTE

Damage to the device during cleaning

Malfunction possible

→ Do not clean the device using a water jet or high-pressure cleaner.

→ Do not use any acid, alkali or solvent-based cleaning agents.

→ Do not use any pointed or sharp-edged objects for cleaning





Regular cleaning of the device prevents imbalance caused by deposits, for example.

7.2 Safety inspection

NOTE

High-voltage test

The integrated EMC filter has Y capacitors. The tripping current is exceeded when AC testing voltage is applied.

→ Test the device with DC voltage when you perform the legally required high-voltage test. The voltage to be used corresponds to the peak value of the AC voltage required by the standard.

7.3 Maintenance interval

What to check	How to check	How often	What action?
Corrosion	Visual inspection	At least every 3 months	When there is heavy corrosion that impairs the explosion protection, e.g. in gap surfaces, replace the device.
Contact protection cover for intactness or damage	Visual inspection	At least every 6 months	Repair or replacement of device
Device for damage to blades and housing	Visual inspection	At least every 6 months	Replacement of device
Fastening the cables	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace wires
Impeller for wear/deposits/corrosion and damage	Visual inspection	At least every 6 months	Clean impeller or replace device
Tightness of cable gland	Visual inspection	At least every 6 months	Retighten, replace if damaged
Condensation drainage holes for clogging, where necessary	Visual inspection	At least every 6 months	Open holes
Welds for crack formation	Visual inspection	At least every 6 months	Replace device
Cable routing (fastening)	Visual inspection	At least every 6 months	Fasten cables
Cleaning and preventive maintenance	Visual inspection	At least every 3 months	Remove dirt, clean device

Ball bearings for smooth and noiseless movement free of play	acoustic and/or manual check by turning rotor when switched off, vibration test	At least every 3 months	Replace the device in the event of noise, stiffness or bearing play. Have motor bearings replaced by ebm-papst.
Vibration test	See Vibration test section	At least every 6 months	Cleaning, repair or replacement of device
Check gap dimensions	See Gap dimensions section	At least every 3 months	Replacement of device

7.4 Vibration check

Regular checks must be made to ensure that the fan is not operated at impermissibly high vibration levels. On the basis of ISO 14694, the maximum permissible vibration velocities are specified as follows:

Fan connected to system with isolation from vibration	Fan connected to system without isolation from vibration
Vibration velocity	Vibration velocity
max. 6.3 mm/s	max. 4.5 mm/s

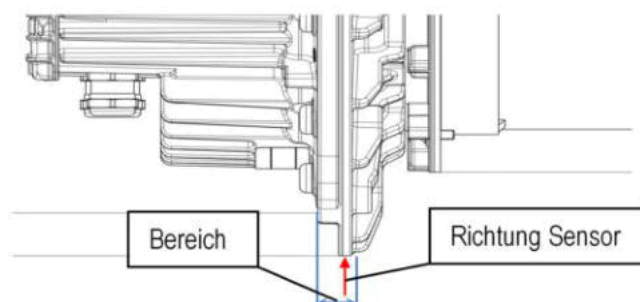


Fig. 9: The vibration velocities are measured in radial direction at the stator bushing.

The motor bearings are provided with permanent lubrication at the factory. Experience has shown that under normal operating conditions the grease therefore only has to be renewed after several years. The motor must be deactivated in the event of bearing noise. To remedy this, the motor has to be exchanged or the defective bearings replaced by the ebm-papst Service department.

A record is to be kept of the routine inspections performed.