Operating instructions

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1. SAFETY REGULATIONS AND INFORMATION

Read these operating instructions carefully before starting work on the device. Observe the following warnings to prevent malfunctions or danger to persons.
These operating instructions are to be regarded as part of the device. The device is only to be sold or passed on together with the operating instructions.
These operating instructions may be duplicated and distributed to inform about potential dangers and their prevention.

1.1 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.

1.2 Staff qualifications

The device may only be transported, unpacked, installed, operated, maintained and otherwise used by suitably qualified, trained and authorized technical staff.
Only authorized specialists are permitted to install the device, to carry out a test run and to perform work on the electrical installation.

1.3 Basic safety rules

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:

⇒ Do not perform any modifications, additions or conversions on the device without the approval of ebm-papst.

1.4 Voltage

⇒ Check the device's electrical equipment at regular intervals; see Chapter 5.2 Safety inspection.

⇒ Replace loose connections and defective cables immediately.



DANGER
Electrically charged device
Risk of electric shock

→ When working on an electrically charged device, stand on a rubber mat.

WARNING
Live terminals and connections even with device switched off
Electric shock

Translation of the original operating instructions

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

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
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ 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.

→ Install the externally wired thermal overload protector in the control circuit so that following a malfunction the motor does not switch on again automatically after cooling off.

1.5 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.

1.6 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.

1.7 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.

1.8 Hot surface



CAUTION
High temperature on motor housing
Risk of burns

→ Ensure sufficient protection against accidental contact.

1.9 Transport

NOTE
Transporting the device

→ Transport the device in its original packaging only.

→ Secure the device so it cannot slip, e.g. by using a lashing strip.

1.10 Storage

⇒ Store the device, partially or fully assembled, in a dry and weatherproof manner in the original packaging in a clean environment.

⇒ Protect the device against environmental effects and dirt until final installation.

⇒ 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 3.6 Transport and storage conditions.

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2. INTENDED USE

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

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 3.6 Transport and storage conditions and Chapter 3.2 Nominal data.
- Operating the device with all protective devices.
- Following the operating instructions.

Improper use

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

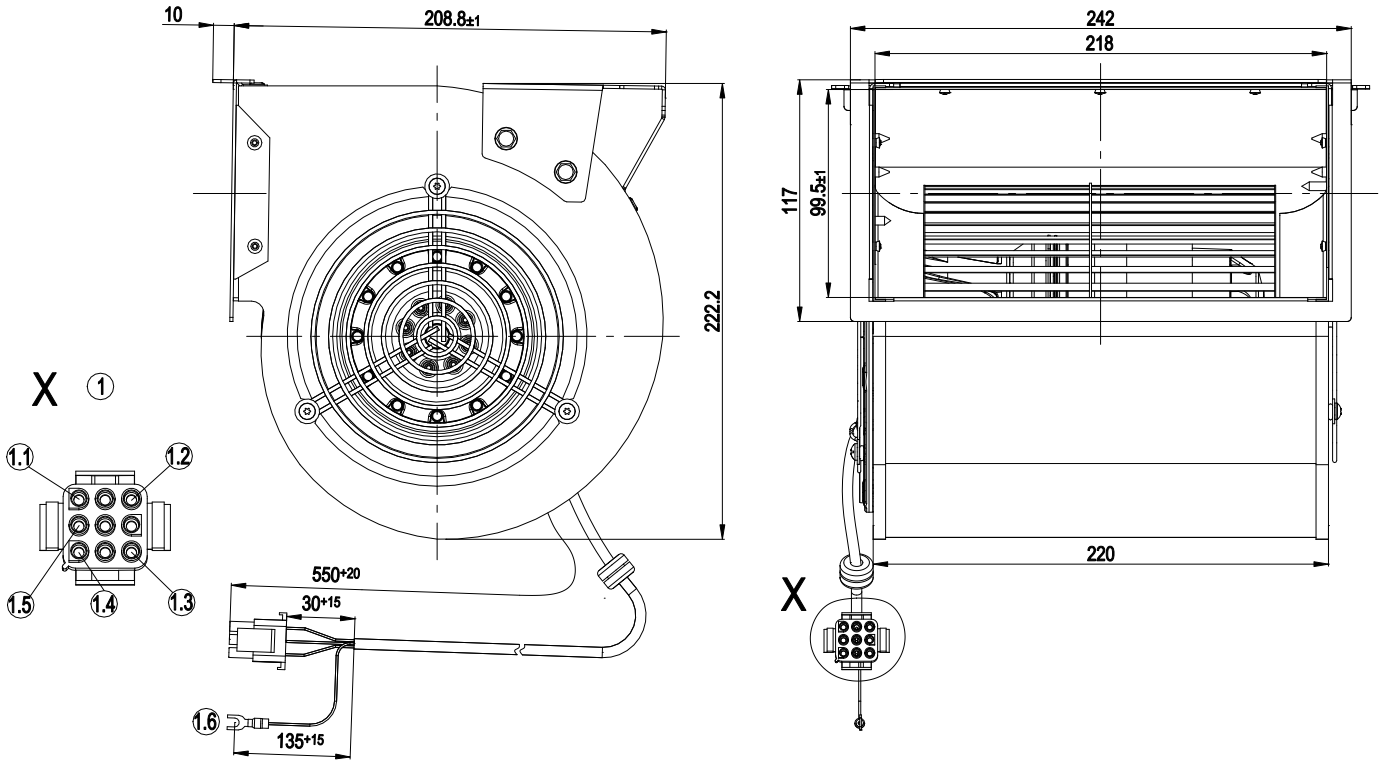
- Operating the device in an unbalanced state, e.g. due to dirt deposits or ice formation.
- Conveying air that contains abrasive particles.
- Conveying highly corrosive air, e.g. salt spray. Exception: devices designed for salt spray and correspondingly protected.
- Conveying air with high dust content, e.g. suctioning off sawdust.
- Operating the device close to flammable materials or components.
- Operating the device in an explosive atmosphere.
- Using the device as a safety component or to perform safety-related functions.
- Operation with completely or partially disassembled or manipulated protective devices.
- In addition, all applications not listed among the intended uses.

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3. TECHNICAL DATA

3.1 Product drawing



All dimensions in mm.

1	Connector housing AMP Universal Mate-N-Lok 350720-1, pluggable with 350782-1
1.1	black
1.2	brown
1.3	blue
1.4	gray
1.5	gray
1.6	PE

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3.2 Nominal data

Motor	M2D068-GA			
Phase	3~	3~	3~	3~
Nominal voltage / VAC	400	400	440	480
Nominal voltage range / VAC	380 .. 440	380 .. 480	380 .. 440	380 .. 480
Wiring	Y	Y	Y	Y
Frequency / Hz	50	60	50	60
Method of obtaining data	ml/ce	ml/ce	ml/ce	ml/ce
Valid for approval/ standard	CE	UL 507	CE	UL 507
Speed (rpm) / min^{-1}	2580	2700	2650	2960
Power consumption / W	350	500	430	560
Current draw / A	0.6	0.78	0.65	0.76
Min. back pressure / Pa	290	315	300	385
Min. ambient temperature / °C	-25	-25	-25	-25
Max. ambient temperature / °C	60	60	60	60

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

Subject to change

3.3 Data according to ErP Directive

	Actual	Req. 2015
01 Overall efficiency η_{es} / %	35.6	33.5
02 Measurement category	A	
03 Efficiency category	Static	
04 Efficiency grade N	46.1	44
05 Variable speed drive	No	
06 Year of manufacture	The year of manufacture is specified on the product's rating label.	
07 Manufacturer	ebm-papst Mulfingen GmbH & Co. KG Amtsgericht (court of registration) Stuttgart · HRA 590344 D-74673 Mulfingen	
08 Type	D2D146-BG03-14	
09 Power consumption P_e / kW	0.22	
09 Air flow q_v / m³/h	705	
09 Pressure increase total p_{sf} / Pa	416	
10 Speed (rpm) n / min^{-1}	2750	
11 Specific ratio*	1.00	
12 Recycling/disposal	Information on recycling and disposal is provided in the operating instructions.	
13 Maintenance	Information on installation, operation and maintenance is provided in the operating instructions.	
14 Additional components	Components used to calculate the energy efficiency that are not apparent from the measurement category are detailed in the CE declaration.	

* Specific ratio = 1 + p_{fs} / 100 000 Pa

Data obtained at optimum efficiency level. The ErP data is determined using a motor-impeller combination in a standardized measurement setup.

3.4 Technical description

Weight	5.7 kg
Fan size	146 mm
Rotor surface	Painted black
Impeller material	Sheet steel, painted black
Housing material	Sheet steel, hot-dip galvanized
Guard grille material	Steel, phosphated and coated with white-aluminum plastic (RAL 9006)
Motor suspension	Motor mounted with brackets on one side
Direction of rotation	Counterclockwise, viewed toward rotor
Degree of protection	IP55
Insulation class	"F"
Moisture (F) / Environmental (H) protection class	F5
Ambient temperature note	Determined on the basis of delta t = 90 k, measured in customer device (size 12), operating point at 400 V/50 Hz = 1050 m³/h at 290 Pa; thermal design in accordance with the following standards: 50 Hz: EN 60034, 60 Hz: UL 1004 (temperature rise in accordance with UL507 thermocouple method); ambient temp. for 60 Hz data records is only valid without speed control, i.e. at maximum speed
Installation position	Shaft horizontal
Condensation drainage holes	None
Mode	S1
Motor bearing	Ball bearing
Touch current according to IEC 60990 (measuring circuit Fig. 4, TN system)	<= 3.5 mA
Motor protection	Thermal overload protector (TOP) with basic insulation
with cable	Axial
Protection class	I (with customer connection of protective earth)
Conformity with standards	EN 60335-1; CE
Approval	CCC; CSA C22.2 No. 100; UL 1004-1

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.

3.5 Mounting data

For screw clearance, see Chapter 3.1 Product drawing

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

Strength class of screws	8.8

Any further mounting data required can be taken from the product drawing.

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3.6 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 °C

4. CONNECTION AND STARTUP

4.1 Mechanical connection



CAUTION
Cutting and crushing hazard when removing blower from packaging



→ Carefully remove the blower from its packaging, touching only the housing. Strictly avoid shocks.

→ Wear safety shoes and cut-resistant safety gloves.

⇒ Check the device for transport damage. Damaged devices are not to be installed.

⇒ Install the undamaged device in accordance with your application.



CAUTION
Possible damage to the device
If the device slips during installation, serious damage can result.

→ Ensure that the device is securely positioned at its place of installation until all fastening screws have been tightened.

4.2 Electrical connection



DANGER
Voltage on the device
Electric shock

→ Always connect a protective earth first.

→ Check the protective earth.



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 be touched by any rotating parts.

CAUTION
Voltage
The device is a built-in component and has no disconnecting switch.

→ Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

→ When working on the device, secure the system/ machine in which the device is installed so as to prevent it from being switched back on.

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.



Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

4.2.1 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.
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. Ensure that the minimum cable cross-section is at least
AWG 26 / 0.13 mm².

Ground conductor contact resistance according to EN 60335

Compliance with the impedance specifications according to EN 60335 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.

4.2.2 Voltage control



With speed control using transformers or electronic voltage regulators (e.g. phase control), excessive current may occur. In addition, depending on how the device is installed, noises can occur with phase control.

4.2.3 Variable frequency drive

Please use a variable frequency drive only after consultation with ebm-papst.



For operation with variable frequency drives, install sinusoidal filters that work on all poles (phase-phase and phase-ground) between the drive and the motor.
During operation with variable frequency drives, an all-pole sine filter protects the motor against high-voltage transients that can destroy the coil insulation system, and against harmful bearing currents.

Heating of the motor due to use of a variable frequency drive must be checked in the application by the customer.

4.3 Plug connection

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4.3.1 Preparing cables for connection

The cables, including the customer interface, are subject to the specifications for internal wiring.
Ensure conformity with applicable standards and check the degree of protection in the final product after installing the ebm-papst device.

⇒ Connect the cables to the mating connectors.

4.3.2 Making supply connections

⇒ Check your connector's pin assignment.

⇒ Connect the built-in connector with the mating connector.

⇒ Ensure that the connector is properly engaged.

4.3.3 Motor protection

CAUTION
Voltage
The device is a built-in component and has no disconnecting switch.

→ Connect the device to a suitable tripping unit.

→ Only connect the device to circuits that can be switched off with an all-pole disconnection switch.

→ When working on the device, secure the system/ machine in which the device is installed so as to prevent it from being switched back on.

NOTE
Lack of motor protection
Without motor protection, the motor can overheat and suffer damage.

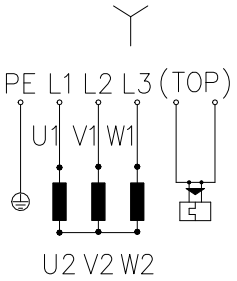
→ Connect the thermal overload protector installed in the winding.

The motors are equipped with thermal overload protectors to protect the devices.
Check to make sure that the thermal overload protector is correctly connected before each operation.
Failure to connect the thermal overload protector correctly will invalidate your warranty claim.

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4.4 Connection diagram



Y	Star connection
L1	black
L2	blue
L3	brown
U1	black
V1	blue
W1	brown
U2	green
V2	white
W2	yellow
TOP	gray

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4.5 Checking connections

⇒ Ensure isolation from supply (all phases).

⇒ Make sure a restart is impossible

⇒ Check the cables for proper fit.

4.6 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.



WARNING
Hot motor housing
Risk of fire

→ Ensure that no combustible or flammable materials are located close to the blower.

⇒ 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.

4.7 Switching off the device

⇒ Disconnect the device from the power supply at the supply line's main switch.

⇒ When disconnecting, be sure to disconnect the ground connection last.

5. MAINTENANCE, MALFUNCTIONS, POSSIBLE CAUSES AND REMEDIES

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

WARNING
Live terminals and connections even with device switched off
Electric shock

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

CAUTION
The motor restarts automatically when operating voltage is applied, e.g. after a power failure.
Risk of injury

→ Keep out of the device's danger zone.

→ 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.

→ Install the externally wired thermal overload protector in the control circuit so that following a malfunction the motor does not switch on again automatically after cooling off.



If the device is out of use for some time, e.g. when in storage, we recommend switching it on for at least two hours to allow any condensation to evaporate and to move the bearings.

Malfunction/fault	Possible cause	Possible remedy
Impeller not running smoothly	Imbalance in rotating parts	Clean the device; replace it if imbalance persists after cleaning. Make sure no weight clips are 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.
	Faulty connection	Isolate from supply, correct connection; see connection diagram.
	Thermal overload protector activated	Allow motor to cool off, locate and rectify cause of error, release restart lockout if necessary
	Impermissible point of operation	Check point of operation
Motor overtemperature	Ambient temperature too high	Reduce ambient temperature if possible
	Deficient cooling	Improve cooling

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

5.1 Cleaning

NOTE
Damage to the device during cleaning
Malfunction possible

→ Do not clean the device using a high-pressure cleaner.# Do not use acid, alkali or solvent-based cleaning agents.

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

5.2 Safety inspection

What to check	How to check	How often	What action?
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
Fastening the protective earth terminal	Visual inspection	At least every 6 months	Fasten
Insulation of cables for damage	Visual inspection	At least every 6 months	Replace cables
Impeller for wear/deposits/ corrosion and damage	Visual inspection	At least every 6 months	Clean or replace impeller

5.3 Disposal

For ebm-papst, environmental protection and resource preservation are top priority corporate goals.
ebm-papst operates an environmental management system which is certified in accordance with ISO 14001 and rigorously implemented around the world on the basis of German standards.
Right from the development stage, ecological design, technical safety and health protection are fixed criteria.
The following section contains recommendations for ecological disposal of the product and its components.

5.3.1 Country-specific legal requirements

NOTE
Country-specific legal requirements
Always observe the applicable country-specific legal regulations with regard to the disposal of products or waste occurring in the various phases of the life cycle. The corresponding disposal standards are also to be heeded.

5.3.2 Disassembly

Disassembly of the product must be performed or supervised by qualified personnel with the appropriate technical knowledge.
The product is to be disassembled into suitable components for disposal employing standard procedures for motors.

WARNING
Heavy parts of the product may drop off. Some of the product components are heavy. These components could drop off during disassembly.
This can result in fatal or serious injury and material damage.

→ Secure components before unfastening to stop them falling.

5.3.3 Component disposal

The products are mostly made of steel, copper, aluminum and plastic. Metallic materials are generally considered to be fully recyclable.
Separate the components for recycling into the following categories:

- Steel and iron
- Aluminum
- Non-ferrous metal, e.g. motor windings
- Plastics, particularly with brominated flame retardants, in accordance with marking
- Insulating materials
- Cables and wires
- Electronic scrap, e.g. circuit boards

Only ferrite magnets and not rare earth magnets are used in external rotor motors from ebm-papst Mulfingen GmbH & Co. KG.

⇒ Ferrite magnets can be disposed of in the same way as normal iron and steel.

Electrical insulating materials on the product, in cables and wires are made of similar materials and are therefore to be treated in the same manner.
The materials concerned are as follows:

- Miscellaneous insulators used in the terminal box
- Power cables
- Cables for internal wiring
- Electrolytic capacitors

Dispose of electronic components employing the proper procedures for electronic scrap.

→ Please contact ebm-papst for any other questions on disposal.

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