BRINKMANN PUMPS

Brinkmann low voltage electric motors

Operating manual

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1. Notice

This manual must be followed to ensure proper and safe installation, operation and maintenance of the motor. Products must be handled by qualified personnel, and health and safety requirements and national legislation must be observed. Ignoring these instructions will invalidate all applicable warranties of Brinkmann Pumps.

1.1 Identification of safety instructions in the operating manual

Safety instructions given in this manual non-compliance with which would affect **safety** are identified by the following symbol:

 Safety sign according with ISO 3864 – B.3.1

or where **electrical safety** is involved, with:

 Safety sign according with ISO 3864 – B.3.6

The signal word **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

The signal word **CAUTION i**ndicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The signal word **ATTENTION** indicates a hazardous situation which, if not avoided, may cause a risk to the machine and it's function.

1.2 Allgemeine Informationen

This manual concerns the following types of standard low voltage induction motors from Brinkmann Pumps: 6MOTOxAA-H05xxx.

All motors are manufactured in accordance with IEC/EN 60034- 1 and IEC/EN 60072 unless otherwise specified.

Motors are rated as standard for the ambient temperature range of -20°C to +40°C and site altitudes up to 1000 m above sea level. Low voltage motors are components for installation in machinery. The motors are CE marked according to the Low Voltage Directive 2014/35/EU.

ATTENTION

The motors are to be operated within their design limits. Applications outside of these limits are not approved. The manufacturer is not responsible for any damages resulting from use of the motors in such applications.

1.3 Unauthorized modes of operation

– Motor may not be used in potentially explosive environments. **Risk of explosion!**

1.4 Remaining Risk

Risk of Injury!

– Risk of squeezing or crushing body parts when installing or removing the motor exists.
– Proper and secured lifting tools must be used.

Risk of burns!

– The motor must have cooled down sufficiently prior to commencing any repair, maintenance or installation.

1.5 Safety instructions

WARNING

Electric shock!

All service work must be carried out by qualified service personnel. Motor must be disconnected from the power source and all rotating parts must stand still. Reassure that motor is disconnected from power source and cannot be switched on**.**

Verify that there is no voltage at the terminal board!

Personnel who commission, transport, maintain or install motors should have obtained qualified training and safety knowledge. Safety equipment is necessary to prevent accidents. Local regulations and requirements must also be observed. Failure in operation can cause injury to personnel and damage to the motor.

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WARNING

Electric shock!

Tension voltage and frequency must correspond with the shown specification on the nameplate.

To avoid dangerous situations and the risk of injury or damage, the data and recommendations provided must be observed.

1.5.1 Operation

For safe operation it must be ensured that no external parts interfere with the rotating shaft.

The shaft key must be securely fastened in the keyway before the motor is started. If the motor is run for no-load testing, the key must be fixed in the keyway or removed.

The motor must be handled and operated properly to avoid accidents during operation. If the motor is not running properly, switch off the power supply. The power supply must be switched off when troubleshooting.

Maintenance is required and must be done on a regular basis to prevent failures.

1.5.2 Lifting

WARNING

Risk of clamping and crushing when lifting the motor!

For safety reasons all Brinkmann motors with frame size 100 or larger are equipped with eyebolts for lifting. Before lifting the motor, ensure that the eyebolts are undamaged and screwed tight. When lifting the motor, make sure that the motor is not attached to any equipment or mounted by the feet, shaft or flange. Only use the main eyebolts on the motor frame to lift the motor. Do not use damaged eyebolts. If crane slings are used, prevent them from slipping and maintain full control when lifting the motor.

1.5.3 Transport

WARNING

Danger of clamping, crushing and cutting when transporting the motor!

The motor must be fixed on a pallet (by ropes, cables, bolts, etc.) during transport. This means it must be secured so it cannot move or be damaged during transport. Broken equipment and unstable machines can cause serious injuries.

2. Receipt, transport and storage

2.1 Receipt and transport

Upon receipt and for transport:

- Use transport locks for all transport operations.
- Avoid moisture and shocks during transport.
- Check the motor for external damage.
- If damage is found, inform the sales representative of Brinkmann Pumps.
- Check all nameplate data and compare it with the requirements for the motor.
- Remove transport locks if present.
- Turn the shaft by hand to check for free rotation.

2.2 Storage

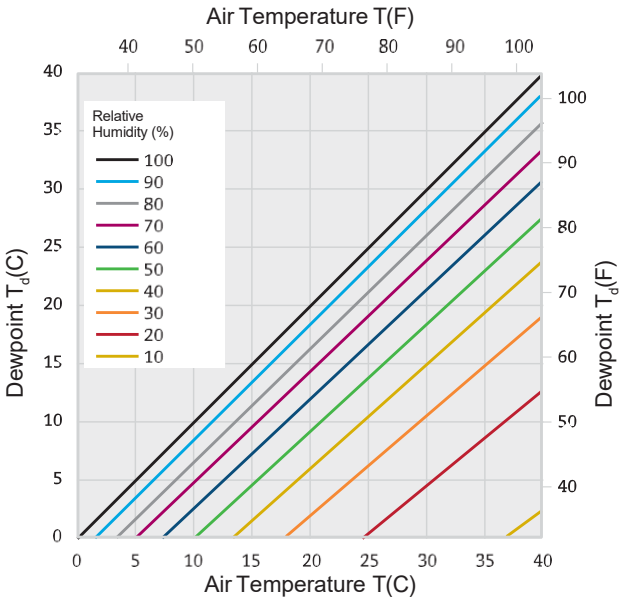
ATTENTION

- Ensure the use of correct lifting lugs. Lifting lugs are dimensioned for the weight of the motor.
- Do not apply extra weight.
- If necessary, use suitable special equipment such as lifting gear and ropes.
- Store in a dry, dust-free and vibration-free location.
- Carefully consider long-term storage procedures.

Short-term storage (less than 2 months)

The motor should be stored in a place with a controllable environment. A good warehouse or storage location has:

- Measure the insulation resistance and temperature of the windings to check whether the motor has been stored im- properly, even for a short time.
- A stable temperature, preferably in the range from 10°C (50°F) to 50°C (120°F). If the anti-condensation heaters are energised and the surrounding air is above 50°C (120°F), ensure that the motor is not overheated.
- Low air humidity, preferably below 75%. The motor temperature must be kept above the dew point shown in the figure to prevent water vapour from condensing inside the motor. If the motor is equipped with anti-condensation heaters, they should be energised. Proper operation of the anti-condensation heaters must be checked periodically. If the motor is not equipped with anti-condensation heaters, other methods of heating the motor must be used to prevent water vapour from condensing in the motor.
- A stable support free from excessive vibration and shocks. If vibration levels are expected to be too large, the motor should be isolated by placing suitable rubber blocks under the motor feet.
- Air that is ventilated, clean and free from dust and corrosive gases
- Protection against harmful insects, vermin and chemicals.



Longterm storage (more than 2 months)

In addition to the measures described for short-term storage, the following actions are necessary:

- Measure the insulation resistance and temperature of the windings to check whether the motor has been stored im- properly, even for a short time.
- Check the condition of the paintwork every three months. If corrosion is seen, remove it and apply a new coat of paint.
- Check the condition of the anti-corrosion coating on bare metal surfaces every three months. If corrosion is seen, remove it gently with emery cloth and apply an anti-corrosion coating.
- Provide small ventilation openings if the motor is stored in a wooden crate. Prevent water, dust and insects from entering the crate.
- For engines in long-term storage, the bearings must be replaced according to the following provisions, depending on the storage period, engine size and bearing type:
  - Closed bearings (all engine sizes): The bearings must be replaced if the engine has been stored for more than 5 years.

Outdoor storage

If the motor must be stored outdoors, never leave the motor as is in the standard transport packaging. Instead the motor must be:

- Taken out of its plastic wrap.
- Covered to completely prevent rain from entering the motor. The cover should allow ventilation of the motor.
- Placed on at least 100 mm (4”) high rigid supports, to ensure that no moisture can enter the motor from below.
- Protected against harmful insects and vermin.
- Packed in special outdoor packaging.

3. Installation and commissioning

3.1 General

WARNING

Electric shock!

Tension voltage and frequency must correspond with the shown specification on the nameplate.

– The motor must be wired so that a solid longterm electrical connection is ensured.

To ensure correct protection and connection of the motor, check the nameplate data before installation and commissioning. Be- fore working on the motor, disconnect and lock out the power supply. Before starting the motor, remove the transportation bracket and clean the shaft, feet and flange to remove the protective coating.

When performing installation and commissioning, make sure that the motor is earthed. When making insulation resistance measurements for commissioning, short the winding terminals before disconnecting the test leads to avoid the risk of electric shock. If the motor windings have been in contact with sea water, they must be inspected (contact Brinkmann Pumps).

Avoid resonances with a rotational frequency at twice the mains frequency due to assembly. Turn the rotor and listen for abnormal rubbing noises. Check the direction of rotation with the motor uncoupled. When mounting or removing couplings or other drive elements, cover them with a touch guard.

For a test run with the motor uncoupled, secure or remove the key(s) on the rotor shaft. Avoid excessive radial and axial bearing loads.

Rotor balance:

- Half key as standard: Couplings must be half key balanced. If part of the shaft key is visible, be sure to perform mechanical balancing.
- Full key (non-standard): Couplings must be balanced without a key.

ATTENTION

Ensure the required ventilation and clearance from other objects; see section 8.3. Do not obstruct ventilation openings and ensure that exhaust air from other equipment is not drawn into the ventilation openings. Otherwise the motor may overheat.

3.2 Support and alignment

The end-user is fully responsible for construction of the support. The contact surface for the motor feet or flange must be free of paint, dirt and other objects. Otherwise the motor height may be incorrect or the motor may be misaligned.

Mount the motor on a sturdy, clean and flat support. It must be sufficiently rigid to withstand short circuit forces. It is important to ensure that the mounting conditions do not cause resonance at the rotational frequency or twice the supply frequency.

CAUTION

Danger of clamping and cutting!

Always use suitable tools to mount or remove drive components. Do not hit the drive components with a hammer, as this can damage the bearings or degrade the balancing. The rotors are balancing with a half key for G2.5 according to ISO 21940-

11. Make sure that the drive components are the same. Correct alignment is essential to avoid bearing failure, shaft failure and vibration failure. Use only suitable alignment methods. Re-check the alignment after final tightening of the bolts or studs. Check that drain holes and plugs face downwards and are fully functional and unobstructed. With a motor that is installed outdoors or that does not run continuously, open the drain hole so the motor housing is ventilated. This keeps the motor dry if a heater is not fitted in the motor or not energised.

Check these measurements before adjusting the alignment
- not all variants are covered:

- Vertical positioning: To avoid motor tipping and bending, use shims to stabilize the motor.
- Horizontal positioning: Fix the motor axial position and make sure the axial gap is uniform.
- Stable support: Vibration free, accurate machine alignment and balanced drive.
- Foot/Foot-flange mounting: Mount the motor with the right bolts and tightening torques. Make sure the motor feet and/or flange bolts are in full contact with the mounting surface.

3.3 Measure the insulation resistance

ATTENTION

Before commissioning, check the datasheet and measure the insulation resistance without any supply wires connected, as they can distort the measurement. If the measured insulation resistance is less than 10 MΩ at 25°C, the winding must be oven dried. The nominal value is typically 100 MΩ. If the measured value is less than 2 MΩ, the insulation resistance is not acceptable. When oven drying the windings, set the oven temperature to ap- proximately 85°C for 10 to 18 hours, followed by 100°C for 7 to 9 hours. The nominal insulation resistance drops by 50% for every 20°C rise in motor temperature. Measuring equipment must always be calibrated at least every year. Note that drain plugs or valves must be open during heating. After heating, make sure the plugs are fitted again.

4. Electrical connection and cabling

The motors are designed to operate with supply variations con- forming to IEC 60034-1, Zone A: ±5% voltage and ±2% frequency. The motors will operate with greater variations according to Zone B of IEC 60034-1 section 7.3, but with larger variation in performance.

ATTENTION

The motors are to be operated within their design limits. Applications outside of these limits are not approved. The manufacturer is not responsible for any damage resulting from use of motors in such applications.

Three-phase motors manufactured by Brinkmann Pumps are designed according to IEC 60038 and IEC 60034-1 and can operate with the rated power and torque load within the mains volt- age and frequency variations of zone A and, for a short time, of zone B.

Single-phase Brinkmann Pumps motors can operate under these conditions with mains voltage and frequency variations of ±5% and ±1%, respectively. If the voltage variation is greater, single-phase motors can only be operated with the torque load adjusted in pro- portion to the voltage dip.

Earthing must be carried out according to local regulations be- fore the motor is connected to the supply voltage.

4.1 Direction of rotation

Motors are supplied as standard with clockwise rotation as seen from the drive end. The phase sequence is L1, L2, L3 as connect- ed to the terminals shown in Figure 1. To change the direction of rotation, change the phase sequence by (for example) swapping L1 and L2. If the motor is unidirectional, make sure the shaft rotates in the same direction as the marked arrow.

4.2 Terminal box and terminal board

WARNING

Electric shock!
All service work must be carried out by qualified service personnel. Motor must be disconnected from the power source and all rotating parts must stand still. Reassure that motor is disconnected from power source and cannot be switched on.

– **Verify that there is no voltage at the terminal board!**

The terminal box contains the earthing terminal, terminal board and terminals for heating elements and temperature sensors (PTC and Pt100). Other auxiliary devices may also be located in the terminal box. Hoyer motors are equipped with three PTC sensors as standard.

Before working on the motor or attached machinery:

- Ensure that all supply voltages are switched off and pro- tected against reactivation.
- Switch off auxiliary power circuits for accessories such as anti-condensation heaters.
- Check the supply voltage and frequency by comparing them with the rated data on the nameplate and the data sheet.
- Ensure that the terminal box is clean and dry.
- Close unused cable glands with blind caps.
- Check the terminal box cover gasket before refitting.

Always use suitable cable lugs for connection of all main supply cables and cables for auxiliary devices and ensure that cables are corrected to the correct terminals.

Unless otherwise stated, motors are only intended for fixed installation. Cable glands/blind caps for entry points are metric. If cable glands or blind caps are replaced, the replacements must be at least the same IP class as the existing items.

Connection diagrams for the main supply and accessories such as PTC sensors or heaters are located inside the terminal box or cast in the terminal box cover.
All crimped connections should be made according to IEC 60352-2.

Tightening torques for terminal board studs:

Thread	M4	M5	M6	M8	M10	M12	M14	M16	M20
G (Nm)	1.8	2.5	3.5	7.0	12	18	35	55	80

Table 1: Terminal board tightening torques

Tightening torques for terminal box cover:

Thread	M4	M5	M6	M8	M10	M12
G (Nm)	1,1 - 1,3	1,1 - 1,3	6 - 8	15,5 - 17,5	31 - 35	56 - 60

Table 2: Terminal box cover tightening torques

To comply with EMC requirements and provide proper earthing, cables must be shielded and EMC cable glands are recommended. All incoming parts must have the same potential as the motor.

Cable glands and seals in cable entries must be suitable for the type and diameter of the cable concerned (clamping range). It is recommended that cables are mechanically protected and clamped close to the terminal box to fulfil the requirements of IEC 60079 and local requirements.

4.3 Connection diagram

As standard all three-phase motors are suitable for 400 V connection, unless otherwise stated.

- Motors with nameplate data D/Y 230/400V are connected as star (Y).
- Motors with nameplate data D/Y 400/690V are connected as delta (D).

The connection diagram is labelled inside the terminal box.

Generally, power to motors must be supplied and protected through protective devices such as RCDs, fuses, MCBs, MCCBs, etc. The connection diagram for Y/D is shown in Figure 1.

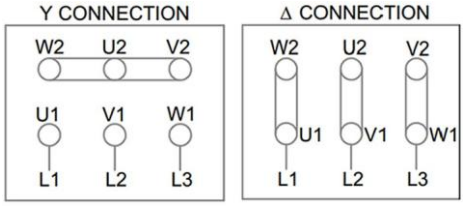


Figure 1: Connection types Y/D

Star-delta starting

Brinkmann standard motors are suitable for star-delta starting. The starting current and torque in Y mode are approximately one- third of the starting current and torque in D mode. Make sure there is enough starting torque to accelerate the total load with star connection.

5. Thermal protection

Thermal protection is used to prevent motor overheating, and to monitoring purposes.

5.1 Thermal protection with thermistors (PTC)

All standard motors (IE1 and IE2 only from 160 and up) have PTC thermistors located in the stator windings.

It is recommended to connect the PTC thermistors to the variable speed drive or other protective equipment by appropriate means.

PTC thermistors are used to protect the motor from overheating. PTC thermistors are provided in sets of three, fitted in each phase, unless otherwise stated. The PTC resistance is 60 to 750 Ω at 20°C. The resistance rises in proportion to the temperature. At the peak temperature the resistance approaches infinity. This type of sensor is used in combination with a PLC or a relay for motor protection.

Attention! Potential Risk of Burning!

Surface temperatures above 50°C do occur during regular operation, i.e. on the surfaces of the motor and bearing housing.

It must be insured that the motor has cooled down sufficiently prior to performing any repair or maintenance work.

6. Motor data and parts

6.1 Exploded view of motor and cross-section view

Figure 2 below shows an exploded view of a cast iron motor. Figure 3 shows a cross-section view of an aluminium motor. Note that the bearing retainer plate is secured on the inside at the drive end.

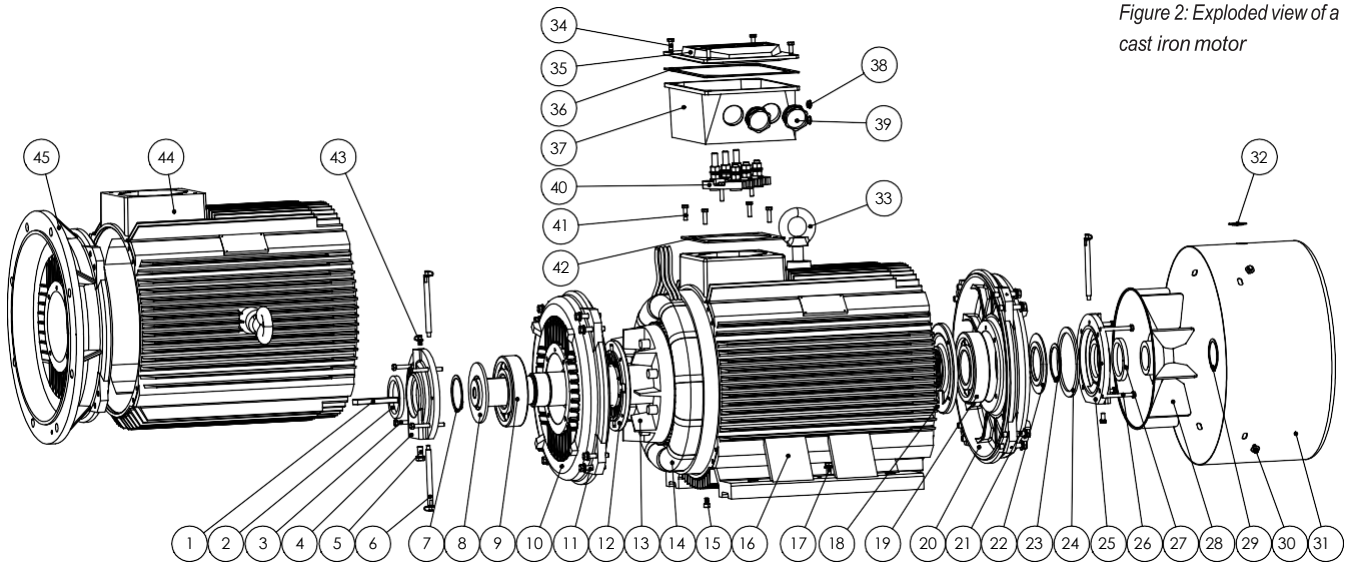


Figure 2: Exploded view of a cast iron motor

Item Nr.	Part name	Item Nr.	Part name
1	Key	24	Spring wave washer
2	Sealing ring_De	25	Outer bearing cap_NDE
3	Bolt	26	Bolt
4	Outer bearing cap_DE	27	Sealing ring_NDE
5	Bolt & O-ring	28	Fan
6	Grease pipe	29	Circlip
7	Circlip	30	Bolt & Washer
8	Oil slinger	31	Fan cover
9	Bearing_DE	32	Rubber plug
10	B3 and shield_DE	33	Eye bolt
11	Bolt & Washer	34	Bolt
12	Inner bearing cap_DE	35	Terminal box cover
13	Rotor with shaft	36	Gasket
14	Stator	37	Terminal box base
15	Bolt & O-ring	38	Blind cap
16	B3 housing	39	Cable gland
17	Bolt & Washer	40	Terminal board
18	Inner bearing cap_NDE	41	Bolt
19	Bearing_NDE	42	Gasket
20	B3 end shield_NDE	43	Grease nipple
21	Bolt & Washer	44	B5 housing
22	Oil slinger	45	B5 flange
23	Circlip		

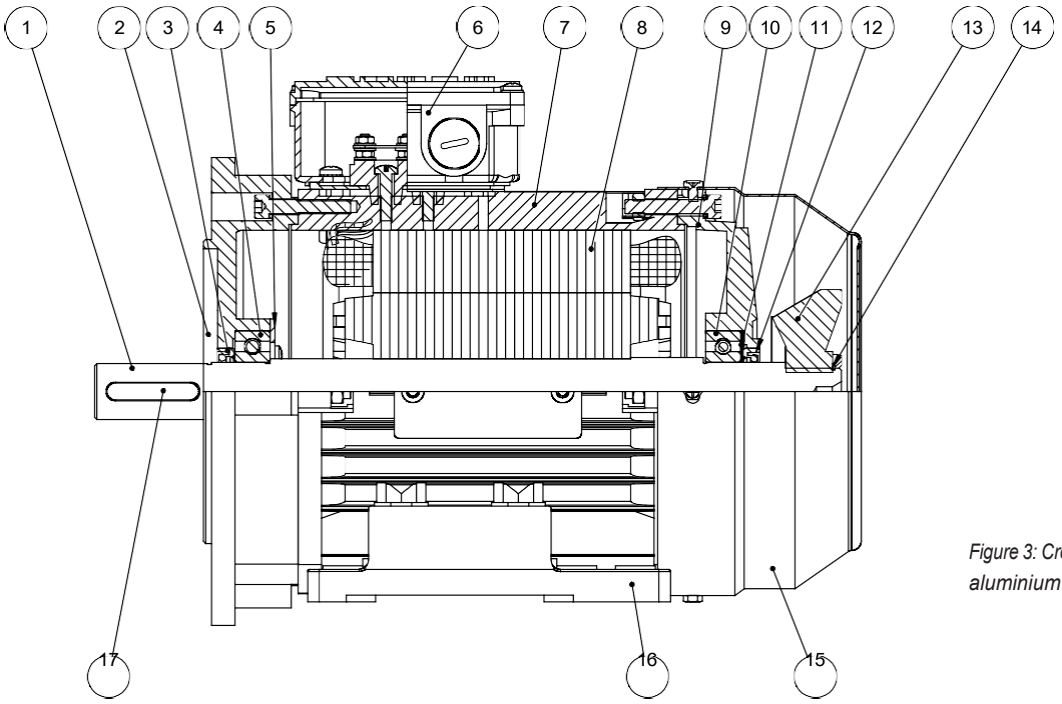


Figure 3: Cross-section view of an aluminium motor

Parts list					
1	Rotor withshaft	7	Motor housing	13	Fan
2	DE flange	8	Stator	14	Retaining ring
3	DE oil seal	9	NDE shield	15	Fan cover
4	DE bearing	10	NDE bearing	16	Feet
5	Bearing retainer plate (secured)	11	Preload washer	17	Key
6	Terminal box	12	NDE Sealing ring		

6.2 Bearing types for motor sizes

The general bearing types and sizes for the various motor sizes and IE classes are shown in Table 3 for classes IE1 to IE4, respectively. Type 2Z and 2RS bearings or equivalent closed bearings are greased for life. Always ensure that the shaft seals are intact. Note that differences are possible between the bearing size and the actual frame size.

Motors with re-greaseable bearings must be greased according to the greasing data plate on the motor. In case of doubt, contact Brinkmann Pumps.

Frame size	Drive (DE)	Non-drive end (NDE)
80	6204-ZZ/C3	6204-2Z/C3
90	6205-2Z/C3	6205-2Z/C3
100	6206-2Z/C3	6206-2Z/C3
112	6306-2Z/C3	6306-2Z/C3
132	6308-2Z/C3	6308-2Z/C3
160	6309-2Z/C3	6309-2Z/C3
180	6311-2Z/C3	6311-2Z/C3
200	6312/C3	6312/C3

Table 3: Standard bearing sizes in IE3 and IE4 Brinkmann Pumps motors

7. Frequency converter operation

By using a VFD with Brinkmann motors, you get optimal operating conditions of your system. Not only will a VFD-solution increase energy savings, but also reduce application noise and thus give crucial improvements to the surrounding working environment. A VFD will secure a precise motor application control, which ensures optimal application performance and a reduction in mechanical stress on the system, thus extending the system lifetime.

When operating your motor with a frequency converter, please be aware of below.

7.1 Operating speed

Controllable operating speed will most likely lead to an optimized application performance and overall system efficiency. By using VFD control it is possible to drive the motor and application at a wide range of speeds. When controlling the speed of a motor, please take these general conditions into account.

ATTENTION

1) When operating below nominal speed, the cooling capacity of the motor will be reduced and could result in potential overheating.
2) When operating above nominal speed, the output torque will be reduced, which can complicate the dimensioning of the motor for a given application.
3) When operating above nominal speed, the critical speed of the shaft-rotor must be taken into account, especially for larger motors with low pole numbers. For continuous speeds outside the values given in Table 4, please contact Brinkmann Pumps.

Motor size	2-pole
71	6000
80	6000
90	6000
100	6000
112	4500
132	4500
160	4500
180	4500
200	4500

Table 4: Maximum operating speed [RPM]

Please contact Brinkmann Pumps for confirmation of peeds above 60 Hz for continuous operation.

7.2 Winding insulation

ATTENTION

When using a VFD voltage peaks are generated which increases the electrical deterioration of the motor insulation system. To prevent deterioration and to extend the lifetime of the motor insulation system, reinforced insulation systems are recommended for VFD supply voltages above 500 V. In some cases, filters are also recommended at the output of the VFD's.

7.3 Bearing deterioration in relation to VFD

ATTENTION

Utilizing VFD control of an electric motor can introduce in- creased risk of bearing currents. Persistent bearing currents will often result in mechanical deterioration of the motor bearings and must therefore be avoided.

The following factors influence, but are not limited to, the arise of persistent bearing currents:

- Motor sizes and construction.
- Specific application and duty.
- Bearing types.
- VFD switching frequency and mode.
- VFD output filters.
- Grounding of the shaft either through the application or application bearings.
- Overall grounding installation and considerations regarding high frequency currents
- Effectiveness of protection to enhance electromagnetic compatibility (EMC)
- EMC screened equipment suitable for VFD operation is recommended and could, among others, include
- Sufficient cable screening, cable gland connections, suitable high frequency earthing etc.

To reduce the risk of bearing currents and corresponding down- time of the motor application, please see the suggestions for motor applications operated with VFD's in the section 8.4 Brinkmann Pumps VFD application suggestions.

7.4 Additional solutions for limitation of bearing currents

In special cases where bearing current still occurs, or for essential applications where optimized uptime is significant, additional actions may be recommended. Depending on application and installation requirements, the following advanced solution will ensure a high reliability:

- Grounding brushes can be mounted to ensure a good earthing connection between motor housing and shaft.
- Insulated bearing in NDE and DE
- Hybrid bearing with ceramic balls in NDE or DE.
- Combination of Hybrid bearing in NDE and brush in DE.

Grounding brushes are installed outside the motor housing and makes the connection from stator to shaft. Brushes must peri- odically be inspected for wear and tear in order to ensure an optimized protection.

With insulated bearings mounted in drive-end and none-drive- end, the shaft is electrically insulated from the stator, meaning that no bearing current will run from stator to rotor. Bearings with ceramic balls are recommended as the most reliable solution.

Be aware of any bearings in the application, so that the bearing current does not pass through these when the motor bearings are insulated and a grounding brush is not used.

8. Operation

8.1 Considerations

WARNING

Electric shock!
All service work must be carried out by qualified service personnel. Motor must be disconnected from the power source and all rotating parts must stand still. Reassure that motor is disconnected from power source and cannot be switched on**.**

- **Verify that there is no voltage at the terminal board!**

Safety equipment must be used during installation and operation at the site. The motor is only intended for fixed installation and use by qualified personnel. Motors must only be used ac- cording to the rated nominal values on the motor nameplate.

WARNING

Risk of explosion
Motor may not be used in potentially explosive environments. **Risk of explosion**!

8.2 Checklist

Check the following before powering on the motor:

- All mechanical and electrical connections are ready for start-up.
- The insulation resistance values correspond to the data in Section 3.3.
- The earthing connection is fitted correctly.
- Couplings and transmissions are sufficiently aligned to allow the machinery to run smoothly.
- The motor is operating within the permissible ambient temperature range.
- The operation data correspondents to the nameplate.
- The monitoring equipment is connected correctly and fully functional.
- Make sure the motor is not running faster than the permissible speed for the application.
- The output power corresponds to the duty type.
- Screws and bolts are fitted and tightened properly.
- The rotor can turn in response to an external force without applied power.
- Protective parts are removed from the motor shaft.
- The external fans rotate in the specified direction.
- All brakes/switches are fully functional.

8.3 Cooling

Check the following with regard to cooling:

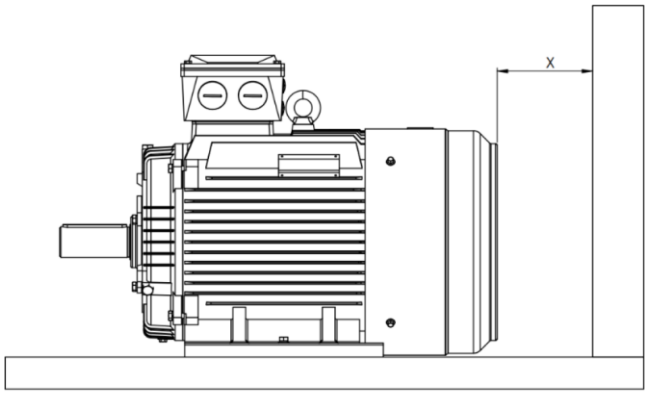
- The motor has sufficient airflow.
- No nearby objects radiate additional heat
- Direct sunlight does not add additional heat.

For flange mounted motors (e.g. B5, B35, V1), make sure that the construction of the machinery allows sufficient air flow along the outer surface of the motor housing. Table 5 shows the mini- mum distance from the motor fan cover to the wall or other objects (see Figure 4 for reference).

Attention! Potential Risk of Burning!

Surface temperatures above 50°C do occur during regular operation, i.e. on the surfaces of the motor and bearing housing.

It must be insured that the motor has cooled down sufficiently prior to performing any repair or maintenance work.



Minimum clearance to the wall

Figure 4: Minimum distance to wall/objects

IEC frame size	Minimum distance from fan cover to wall (X) in mm
63	35
71	35
80	40
90	45
100	50
112	55
132	65
160	80
180	90
200	100

Table 5: Minimum distance from wall or objects

8.4 Motor operation with a VFD

Before operating a motor with a VFD, ensure that the parameters of the VFD have been configured correctly according to the instructions of the VFD manufacturer and the motor parameters. If the motor does not run smoothly or produces abnormal noises, switch off the supply and make sure the motor is de-energized, and then find the root cause of the problem.

8.5 Operating speed

ATTENTION

When operating a motor above its nominal speed, ensure that the motor speed does not exceed the maximum permissible speed for the application and the maximum permissible speed of the motor. Maximum speeds are defined by IEC 60034-1 in Table 6. Higher-speed motors are available upon request; contact Brinkmann Pumps for more information.

Frame number	2 pole
≤ 100	5200
112	5200
132	4500
160	4500
180	4500
200	4500

NOTE: The above values may have to be reduced to meet the requirements of IEC 60079

Table 6: Maximum permissible rotor speeds

9. Maintenance

9.1 Allgemeine Informationen

grade the performance and lifetime of the motor. Proper installation, electrical/thermal protection and correct maintenance of a motor result in optimal motor life.

Inspect the motor at regular intervals, keep the motor clean, ensure a free flow of ventilation air, and check the condition of shaft seals and replace them as necessary. It is important that the shaft seals are always intact. Check the electrical connections and mechanical mounting and tighten terminals and fasteners as necessary.

WARNING

Electric shock!
All service work must be carried out by qualified service personnel. Motor must be disconnected from the power source and all rotating parts must stand still. Reassure that motor is disconnected from power source and cannot be switched on**.**

– **Verify that there is no voltage at the terminal board!**

All maintenance work on motors must be performed by suitably
qualified personnel.

- A motor operating from a VFD can be electrically live even when it is not running.
- Be aware of rotating parts.
- Grease can cause eye and skin irritation. Follow the safety instructions of the grease manufacturer.
- Do not exceed the maximum permissible speed of the motor.
- Do not exceed the maximum operating temperature of the grease and the bearings.

Clean the exterior of the motor at regular intervals, taking the IP rating of the motor into account.

If the motor operates in an environment where the fan cover ventilation openings or the cooling fins can be obstructed, the obstructions must be removed. Any deviation from nominal motor performance or irregular motor operation (e.g. increased motor current, temperature above the permitted value for the stated insulation class, increased vibration, unusual noises, noticeable insulation odour, tripped motor protection devices, etc.) must be investigated carefully to determine the cause.

For spare parts, contact Brinkmann Pumps with the exact motor type and serial number from the motor nameplate.

9.2 Bearings and regreasing

The standard bearing assembly is single row deep-grove ball bearings (ZZ or 2RS) with clearance C3. The bearings (ZZ or 2RS) are lubricated for life. Bearing replacement in the event of failure or noise, or at regular service intervals, must be per- formed with adequate tools and without applying excessive force or hammering.

The following applies in general for lifetime lubricated bearings

- With 60 Hz operation the grease lifetime will be reduced by approximately 20%.
- The values for vertically mounted motors are half of the stated values.
- The grease lifetime is reduced by 50% for every 15 K rise in bearing temperature.
- Operation at higher speeds, e.g. with a variable speed drive, makes shorter regreasing intervals necessary. Doubling the speed will typically reduce the grease lifetime by 50%.

The bearing size and type are shown on the nameplate, and an overview is provided in Section 6.2.

10. Disposal and environmental protection

10.1 RoHS and REACH

All motors from Brinkmann Pumps comply with the RoHS directive and the REACH regulation. Official documents can be down- loaded from the Brinkmann Pumps website www.brinkmannpumps.de

10.2 Electric motors

Electric motors are manufactured from ferrous metals (steel, cast iron), non-ferrous metals (copper, aluminium) and plastics. At the end of their service life, motors must be disposed of according to international and local regulations. Waste handling facilities must be licensed and must comply with the environmental requirements of the member states they are located in. Figure 6 shows the main components of a three-phase motor. Table 7 lists the motor materials.

10.3 Packaging material

The packaging of motors from Brinkmann Pumps consists of card-board, plastic, steel and wood. These materials are recyclable, and Brinkmann Pumps recomments recycling them according to the national regulations.

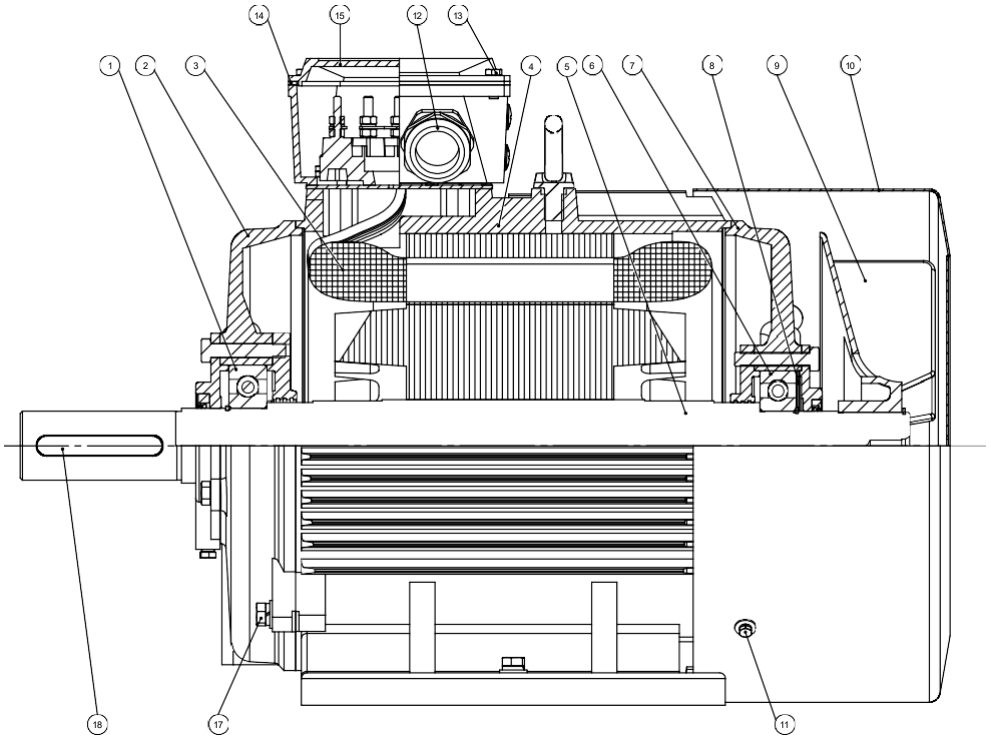


Figure 6: Main components of a three-phase motor

Item	Description	Material
11, 17	Fasteners	Steel
	Mech. seal	Rubber and steel
2, 7	Flanges	Aluminium/cast iron/steel
15	Terminal box cover	Aluminium/cast iron
14	Gaskets	Rubber
16	Nuts, lugs, studs, washers	Brass/steel
16	Terminal board	ABS/ceramic/resin
21	Terminal box	Aluminium/cast iron
12	Cable glands or blind plugs	Brass/steel/plastic
4	Frame	Aluminium/cast iron/steel
3	Stator package	Copper/steel/plastic
8	Preload washer	Steel
18	Key	Steel
5	Rotor assembly	Steel and aluminium
	Shaft	Steel
1, 6	Bearing	Steel/steel and rubber
9	Fan	Plastic/aluminium
10	Fan cover	Steel
19	Feet	Aluminium/cast iron
20	Bearing caps	Cast iron/steel

Table 7: Components of a three-phase motor

Notes

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