



1. Introduction:

Motors for explosive atmospheres are specially designed to comply with official regulations concerning the risk of explosion and are certified by European Notified bodies. These motors should be installed, maintained and repaired (if necessary), strictly in accordance with the relevant standards and codes of practice of the user country. Only trained personnel familiar with these standards should handle these motors. Safety equipments necessary for the prevention of accidents at the installation and operating site must be provided in accordance with local regulations.

The reliability of these motors may be impaired if they are used improperly, badly connected or altered / modified in any way. Such alterations / modifications are not permitted.

The certificates issued apply to motors as originally supplied. In order to maintain validity, it is essential that any servicing / repair be undertaken by authorized personnel.

2. Receipt, Handling and Storage:

Receipt:

Inspect the condition of packaging immediately upon receipt for any damages during transportation. Unpack motor carefully and inspect for any hidden damage or missing parts (not visible before unpacking) before storage. A complete visual inspection of the motor must be performed after removing the package.

▲ All damages must be immediately photographed, documented and reported to the transporter within 24 hours, and to the insurance company and to BBL local office, (through whom the motor is purchased), within 48 hours. This is required to maintain the time limits for filing claims. Failure to comply with this procedure will void the product warranty.

- While reporting damage, please mention motor serial number.
- In this case, installation must not be started, till the problem is solved.
- Check if the delivery of the order is complete. (Spare parts, documents etc.)
- Check the nameplate data corresponds with the application for which, the motor will be used. Make a special point of checking voltage and connection (delta or star).
- Rotate the shaft by hand to check free rotation.

Handling:

▲ Steel cables and hoisting equipment must have capacity to bear the motor weight.

▲ Failure to follow the following instructions, may result in the motor falling over, or slipping in the lifting tackle. The result can be death, serious damage, or material breakage.

▲ During lifting, mounting or maintenance work, all safety considerations shall be in place and special attention is to be taken so that nobody will be subject to lifted load.

- When lifting the motor, the correct hoisting points, the weight of the motor and the operating capacity of the hoisting crane must be matched. Motors packed in wooden crates must always be lifted by their own eyebolts/lifting lugs or by a proper forklift, and must not be lifted by its wooden crates.
- For lifting the motor, only the lifting eye-bolts provided with motor, are to be used. The eyebolts are designed for the motor weight only. Never use the eyebolts to lift the motor with additional loads, such as pumps, gear boxes, fans or any other driven equipment.
- Use all lifting eye-bolts together that are provided, for sharing the load. (If motor is provided with two eye-bolts, use both eye-bolts and not one). Ensure that the eyebolts are fully tightened up to their supporting surface, before lifting.
- The packing (wooden crate with motor) must not be dropped. It is to be carefully placed on the floor without impact to avoid the damage to the bearing. Jerks and jolts must be avoided.
- Do not use any other part of the motor for lifting including shaft.
- Do not use shaft projections for dragging the motor.
- Do not roll or drag the motor on the floor.
- Motors must not be kept in vertical position with external fan cowls as base.
- In vertical lifting, uncontrolled rotation of the motor must be prevented. Do not lift other equipments with motor lifting points only.
- During movement of the motor from one place to other place, the shaft must be locked with the locking device supplied with the motor (if any). The shaft locking device to be removed just before the installation of the motor.

Storage:

- Storage room must be clean, dust free and dry. The room must be properly covered and closed.
- Maintain temperature in the range 20 °C to 50 °C and relative humidity to be 50% or less in the storage room.
- Ensure absence of harmful fumes and vapours, gases such as chlorine, sulphur dioxide and corrosive agents.
- Vibration free area to avoid bearing damage.
- Motors fitted with cylindrical roller and/or angular contact bearings are supplied with locking device mounted on shaft which should be kept in place.
- Factory fitted open bearings use Lithium based grease SKF LGMT3 with recommended shelf life of two years. If stored for longer period, grease needs to be replaced with same grease. Mixing of two greases should be avoided. Shielded bearings have a storage life of five years.
- Space heater must be energized if temperature falls below 10°C or humidity is more than 50% to prevent harmful effects of moisture condensation. Heaters must be isolated while motor is energized, since the heaters if energized, could cause the motor surface temperature to exceed the maximum for which it is certified. This would invalidate the certification and could result in ignition of the surrounding atmosphere. Heaters must be de-energized before opening any part of motor enclosure.
- Ensure that no water dips on motor and no water accumulates under the motor.
- Ensure that all plugs originally provided are in place. (e.g. cable entry hole plugs). If plugs are missing, all the openings to be covered with an adhesive plastic cloth.
- Cover the motor completely in a strong, transparent plastic bag to exclude dirt, dust, moisture, and other

foreign materials. Before sealing this bag, small bags of silica-gel desiccant should be put inside the bag, around the motor.

- Rodents, insects and other animals, like to house inside motors in search of warm surroundings or food. Some of them attack the insulating materials. Their access to the motor must be avoided.
- Do not remove the corrosion protection from the machined surfaces like shaft and flange. These protections must remain in place until the final assembly.
- Any damage to the painting or to the rust protections on the machined surfaces must be corrected.

Specific Conditions of Use!!!

- ▲ ***Stringent gaps than those required by the standard are maintained. Refer BBL before carrying out any repairs or refurbishment to the equipment.***
- ▲ ***Space heaters (if provided) shall be energized only after disconnecting main supply of motor.***
- ▲ ***When PTC thermistors are used, they shall be connected into a control circuit such that the motor is disconnected from the supply in the event of a winding reaching the temperature rating of the thermistor.***
- ▲ ***The fastening screws shall be of high tensile carbon steel socket head cap screws of property class 8.8 with minimum yield stress of 640 MPa.***

3. Installation and commissioning:

Accurate and careful installation of the motor is of utmost important.

- ▲ ***Read the safety instructions in full before doing any activity of installation.***
- ▲ ***Rotating parts such as pulleys, couplings and shaft extensions must be permanently guarded.***
- ▲ ***Disconnect the power supply before working on motor or driven equipment.***

The nameplate gives the technical data and defines the limits of usage of the motor.

- Inspect the nameplate data and ensure that the voltage and frequency correspond to the available voltage and frequency at site.
- Kilowatt rating and rpm of the motor must correspond to the requirement of the driven equipment.
- Motor protection, atmosphere and zone are compatible.
- Ensure that the motor is not damaged.
- Remove any shaft locking device and store it for future use.
- Slowly rotate the shaft to ensure free rotation. Any foreign matter in the air gap must be removed.
- Remove the anti corrosion agent on shaft, with petrol/white spirit/kerosene/thinner. Do not use sandpaper or scrapper.
- If the storage is more than two months, check the grease condition in the bearings.
- Mixing of two different greases to be avoided.
- Replace the grease in the bearings if the motor has been stored for more than 18 months. This is not applicable where sealed bearings (ZZ/ ZZ) are used
- Ensure all covers are installed before starting installation.
- Motors must be installed in such a way, that those are accessible at all times.
- The area around and above the motor must be sufficient for its inspection, maintenance or handling. A person must have enough room to carry out cleaning services. This helps in periodic maintenance to be easier and easy removal of the motor from services, in case of major maintenance work.
- The site must be clean and well- ventilated. If the air contains dust, moisture or corrosive gases, the motor must be appropriately protected, or otherwise supplied with clean air through pipes or ducts.
- The fan covers must be cleaned at regular intervals to ensure free air circulation.

- Other equipment or building wall must not block the motor ventilation. The motor must be installed, where it can get adequate ventilation and clean dry air.
- The clearance between the fan cover (air inlet for motor cooling) and any wall / barrier must be minimum 50% of the air inlet diameter of the fan cover.
- The cable and ducts must be arranged to facilitate the connection of cable to motor.

Insulation resistance

▲ *In order to measure the insulation resistance, the motor must be shutdown.*

▲ *The winding terminals to be grounded to remove electrostatic charges prior to test. Noncompliance may result in electric shock and personnel injuries.*

▲ *Ensure no explosive atmosphere is present while executing insulation resistance check procedure.*

Measure insulation resistance before commissioning and when winding dampness is suspected. If an insulation resistance observed value is lower than 10 mega ohms at 40 degree centigrade, the winding must be dried out by heating up to 130 deg. C for at least 8 hours.

Thermal Protection

When PTC thermistors are located in stator windings, they must be connected to a suitable control circuit, such that the motor is disconnected from the mains supply in the event of a winding reaching the temperature rating of the thermistor.

4. Electrical Connections:

- The connection diagram is provided in the terminal box. The cables used should be capable of carrying the full load current of the motor without overheating or undue voltage drop.
- All motors are equipped with metric threaded terminal blocks with three or six studs and all necessary nuts, washers to make electrical connection(Y or Δ).
- The phase conductor ends must be equipped with cable lugs suitable for fitting to the stud thread size.
- For mounting the cable lugs by solder or crimping, use applicable tools and follow the recommendation of cable lug supplier.
- Unless otherwise specified, cable entries are provided with metric threads. Motor is dispatched with plastic plugs into the cable entry holes. These plugs must be removed prior to commissioning and suitable certified cable glands shall be used. Unused cable entry holes must be plugged with a certified stopping plug. The protection class and IP class of the cable gland and plug must be at least the same as those of the motor thereby ensuring that the motor certification and protection are not compromised.
- Cables should be mechanically protected and clamped close to the terminal box to fulfill the appropriate requirements of EN/IEC 60079-0 and local installation standards.
- Wiring should be carried out or checked by a qualified electrician.
- Earthing must be carried out according to local regulations.
- The earth terminal on the frame has to be connected to PE (protective earth) with a cable as shown in Table 5 of IEC/EN 60034-1

Minimum cross-sectional area for protective conductors

| Cross-sectional area of phase conductors, $S \text{ mm}^2$ | Minimum cross-sectional area of the corresponding PE conductor, $S_p \text{ mm}^2$ |
|--|--|
| $S \leq 16$ | S |
| $16 < S \leq 35$ | 16 |
| $S > 35$ | $0.5S$ |

- In addition, earthing or bonding connection facilities on the outside of an electrical apparatus must provide an effective connection of a conductor with a cross-sectional area of at least 4 mm^2 .
- ▲ ***Do not open the motor or the terminal box while the motor is still warm and energized when an explosive atmosphere is present.***
- ▲ ***All motors for explosive atmospheres must be protected against overloads. Refer installation standards EN/IEC 60079-14 and local installation requirements.***
- ▲ ***The operating temperatures at the conduit or cable entry may exceed 70°C and at the branching point of the conductors may exceed 80°C under rated conditions. Cable glands to be selected accordingly.***

5. Operation:

The motors are designed for following conditions unless otherwise stated on the rating plate:

- Motors are to be installed in fixed installations only.
 - Refer marking plate for ambient temperature range.
 - Maximum altitude is 1000 m above sea level.
 - The variation of the supply voltage and frequency may not exceed the limits mentioned in relevant standards. Tolerance for supply voltage is $\pm 5\%$ and for frequency $\pm 2\%$ according to figure 4 (EN/IEC 60034-1, paragraph 7.3, Zone A). Both extreme values are not supposed to occur at the same time.
 - Particular attention must be paid to corrosive atmospheres. Ensure that the paint protection is suitable for the ambient conditions as corrosion can damage the explosion proof enclosure.
- ▲ ***Ignoring any instructions or maintenance of the apparatus may jeopardize safety and thus prevent the use of motor in explosive atmosphere.***

6. Maintenance:

- ▲ ***Standards EN/IEC 60079-17 and EN/IEC 60079-19 which are related to repair and maintenance of electrical apparatus in explosive atmospheres must be taken into consideration during the activity.***
- ▲ ***Only competent personnel acquainted with these standards should handle the activity.***
- ▲ ***Stringent gaps than those required by the standard are maintained . Refer BBL before carrying out any repairs or refurbishment to the equipment.***
- Isolate power supply to motor before commencing cleaning or maintenance work.
 - Dust should not be allowed to accumulate on the outside of the motor. It should be removed at intervals such that it does not cover the motor in a layer which is sufficiently thick so as to affect cooling.

- Keep the motor clean and ensure free ventilation air flow. If the motor is used in a dusty environment, the ventilation system must be regularly checked and cleaned.
- Check the conditions of shaft seals and replace it if necessary with identical make and size.
- The machined joint faces shall not be refinished, tampered, damaged or coated with varnish or paint.
- A thin coat of grease should be applied on all motors joints.
- When replacing screws and bolts, care should be taken to use only those recommended by manufacturer. A minimum grade of 8.8 with yield stress of 640 Mpa is required. Thread form and length shall exactly be identical to original one.
- All screws, bolts used for fixing parts of flame-proof enclosure are to be provided with spring washers to prevent them from getting loose due to shocks and vibrations during operation.
- All gaps between mating parts of joints forming flame-proof enclosure are to be checked with feeler gauge to ensure that gap clearances are within 0.08 mm.

Bearing:

Bearing types are specified in the product catalogue and on the rating plate of motor. Bearings are usually permanently greased bearings of 2Z type for 80 to 200 frames. From 225 frames onwards, open type bearings are provided.

Bearings are fully charged with grease when dispatched from the factory. Shielded bearings have sufficient grease for an operating life of 40,000 hours provided there is no grease leakage.

Motors with open type bearings are provided with re-lubrication facilities. Re-lubrication amount and interval is mentioned on rating plate. We recommend to use either SKF make LGMT3 grease or ESSO make UNIREX N3 grease.

▲ *Overfilling the bearing housing to be avoided as this can cause increase in bearing temperature and subsequent bearing failure.*

▲ *The maximum operating temperature of the grease and bearings is +110⁰C. It should not be exceeded.*

▲ *The designed maximum speed of the motor must not be exceeded.*

▲ *Do not mix different types of grease. It may cause bearing damage.*

7. After sale support:

- Spare parts must be original parts or approved by BBL.
- Requirements of EN/IEC 60079-19 must be followed.
- Rewinding work must be carried out by IECEX approved service center.
- When ordering spare parts, the motor's serial number, type reference as mentioned on the rating plate must be specified.
- No modifications / alterations are permitted on the parts that make up the explosion proof enclosure.
- Any repair by end user, unless approved by BBL, releases us from responsibility to conformity.

8. Environmental requirements:

- BBL motors have a sound pressure level well below the limits specified in IEC 60034-1.
- Product packaging materials shall be recycled to the extent possible.

- During servicing of motor, whatever scrap is getting generated shall be disposed/recycled to the extent possible.
- After end of product life cycle, appropriate means, local regulations and laws must be followed.
- The end user to contact BBL if they plan on using the motor in or around aggressive substances and external effects which may affect the motor.
- Motors are robust enough to withstand impact of 7 joules and so can withstand attack from aggressive objects and internal objects and internal thermal stresses.

9. Troubleshooting

▲ **Motor service and any troubleshooting must be handled by qualified persons who have proper tools and equipments.**

Motor troubleshooting chart

| Trouble | Probable cause | Possible remedy |
|---|--|--|
| Motor connected but does not start (No hum or heating) Note: Reset the overload relays, if tripped. Then try to restart the motor. | Faulty starting apparatus (Motor controller will not operate) | Check for proper functioning of the starting apparatus. Replace the defective controller. |
| | No supply voltage (Main supply switched off) | Check main switch. Check fuse and switch contacts and test lines for continuity. Check voltage in all three phases at the motor terminals. If there is no input voltage, locate and correct the problem in the input side. |
| Motor connected but does not start (Just hum and heats up) Note: Immediately switch off the power to prevent motor burning. The overload relays may trip. | a) One phase open due to blown fuse, faulty switch contact or broken lead. (Motor input side single phased i.e. No voltage in one or two phases, can be a temporary condition) b) Voltage too low than rated voltage of the motor | Check main switch. Check fuse and switch contacts and test lines for continuity. Check voltage in all three phases at the motor terminals. If single phase condition exists, correct the problem. |
| | Starting torque required for load too high | For motor with autotransformer starting, change to a higher tap. |
| | Rotor defective | Look for broken bars and/or rings. New rotor may be required as repairs are usually temporary |
| | Poor stator coil connections. Inter turn short in stator coil. | Remove end shields and locate the loose connections with test lamp. For inter turn short, use surge tester. |
| | Mechanical locking in bearing or at air gap | Dismantle and repair. Clean air gap if choked. |
| | Wrong connections | Check with connection diagram supplied by manufacturer. See that connections are right. |

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|--|---|---|
| | Motor may be overloaded. (Rotor and driven load is locked) | Disconnect the motor from driven load, to see if motor starts and achieves full speed in uncoupled condition. If so, then the trouble is with the load. Reduce starting load or install larger motor. If autotransformer is used, try higher tapping. |
| Motor does not come up to speed | Wrong selection / supply | Consult supplier for proper type |
| | Voltage too low at motor terminals because of line drop. | Check voltage at motor terminals. Use higher voltage tap on transformer terminals or reduce load. |
| | Starting load too high | Check the load, motor is supposed to carry at start. |
| | Broken rotor bars | Look for cracks near the rings. Replace the rotor |
| | | New rotor may be required as repairs are usually temporary. |
| | Open primary circuit | Locate fault with testing device and repair. |
| Motor stalls | Wrong application | Change type or size and consult manufacturer |
| | Overloaded motor | Reduce load. |
| | Low motor voltage | See that nameplate voltage is maintained/ available at motor terminals |
| | Open circuit | Replace fuse, check overload relays, starter and push button. |
| Wrong direction of rotation | Wrong sequence of phases | Reverse connections at motor or at switchboard |
| Motor vibrates | Motor misaligned | Realign |
| | Weak support | Strengthen the base |
| | Coupling out of balance | Balance coupling |
| | Defective bearings | Replace bearings |
| Hot bearings | Excessive belt pull | Decrease belt tension |
| | Pulleys too far away from shaft shoulder | Move pulley closer to shaft shoulder |
| | Misalignment | Realign |
| | Insufficient grease | Maintain proper quality and quantity of grease in bearing |
| | Excessive grease | Reduce the quantity of grease. Bearing should not be more than half full. |