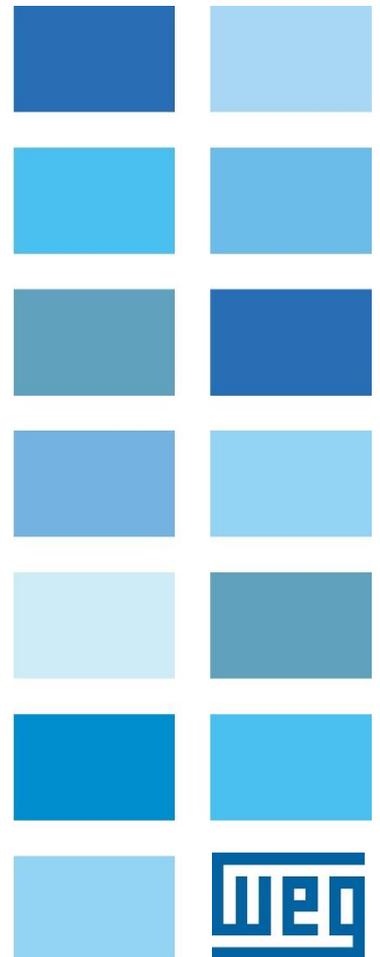
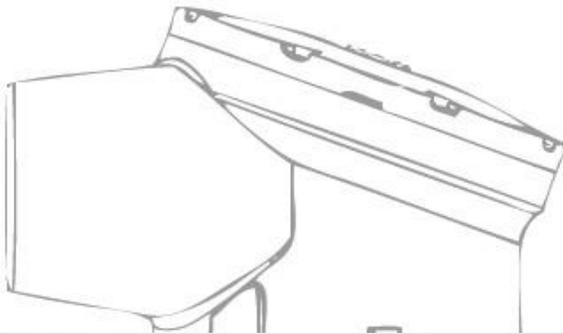


W22Xd – Flameproof Motors

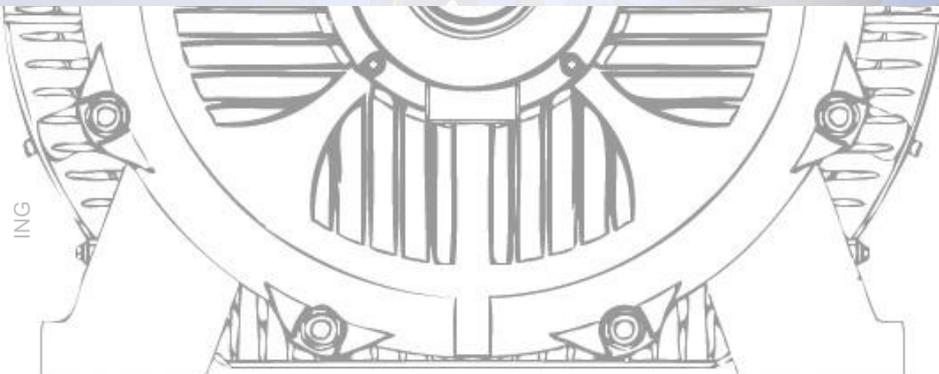
Installation, Operation and Maintenance Manual

- Rib-cooled
- Tube-cooled



110.22 Rev.01 04/2016

ING



Dear Customer,

Thank you for acquiring a WEG motor. This is a product developed with levels of quality and efficiency that ensure an excellent performance.

Since electric motors play an important role in comfort and wellbeing, they need to be identified and treated as driving machines, whose features include certain handling procedures such as storage, installation, and maintenance.

All efforts were employed in order to ensure that all of the information provided in this manual is accurate regarding the configurations and applications of the motor.

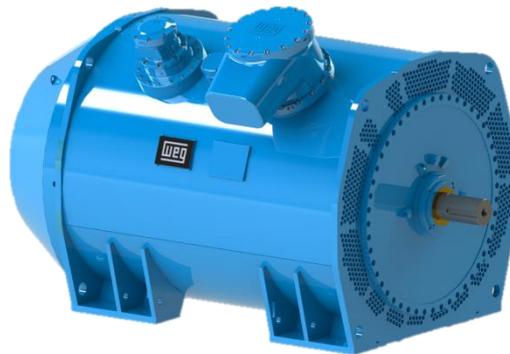
Therefore, careful reading of this manual before proceeding with the motor installation, operation or maintenance is highly recommended in order to ensure safe and continuous motor operation, ensuring its safety and that of its installations. In case of any remaining doubts, please contact WEG.

Maintain this manual close to the motor at all times so it can be consulted whenever necessary.

W22Xd - Rib-cooled



W22XdT – Tube-cooled



This manual is also applicable for BFGC4 line motors.

ATTENTION



1. Following the procedures provided in this manual is mandatory to maintain a valid product warranty;
2. Motor installation, operation, and maintenance procedures must be performed only by qualified personnel.

---- IMPORTANT ----

READ CAREFULLY THE INSTRUCTIONS INCLUDED IN THIS MANUAL IN ORDER TO ENSURE A SAFE AND CONTINUOUS OPERATION OF THE EQUIPMENT



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1. GENERAL INFORMATION

1.1. INTRODUCTION

This Manual is intended to supply and clarify important topics that must be followed accordingly - including storage, operation and maintenance of WEG motors used in **explosive atmospheres**. Therefore, we recommend reading it carefully, together with the Instructions Manual and all specific documents (data sheet, general arrangement drawing, connection diagrams, curves, etc.) delivered with the motor, before performing any installation service or before operating the electric motor.

Once these WEG motors have been designed for explosive atmospheres, all safety information described in item 1.2 below should be followed carefully.

1.2. SAFETY INFORMATION



ATTENTION

When any motor or equipment is used out of the industrial area, it is the enduser's responsibility to provide all safety and protection information while installing the motor (for example, to avoid that people come close to the motor and others).



ATTENTION

The motors referenced in this manual go through constant improvement so the information contained here may be changed without prior notice.



DANGER

During operation, such equipment has energized or rotating parts that may present high temperature. Opened terminal boxes, unprotected couplings or incorrect handling may cause serious accidents to people and/or material damage.

The people responsible for installation safety should ascertain that:

- Only qualified personnel perform installation and operation services on the equipment;
- This personnel must carry this Manual along with other documents supplied with the motor, and the works should be performed in accordance with specific standards and documentation for this product;
- Unqualified personnel should never perform any work on electric equipment;
- If installation and safety instructions are not followed accordingly, warranty may be void.



ATTENTION

QUALIFIED PERSONNEL are those people who based on their education, experience, knowledge of standards and service conditions required are duly authorized to perform any service on the motor. Furthermore, these people should know how to carry out first aid procedures.

If further doubts exists about this, especially in reference to specific product information, WEG is willing to provide such information via its network of authorized service agents and/or representatives.



ATTENTION

We recommend that all services related to installation plan as well as all transportation activities, storage, assembly, installation, start-up, maintenance and repairs should be carried out only by qualified personnel. Special attention should be paid to:

- Technical data referred to allowed applications (assembly conditions, connections and installation conditions), included in this Manual, Purchase Order documentation, operation instructions, manuals and other documents;
- Instructions and specific conditions for installation on site;
- The use of proper tools and equipment: for handling and transportation;
- That all protection devices of each component are removed before installation.

Additionally, all individual parts must be stored in vibration-free rooms to avoid sudden failure, knocking or damage to parts and causing injury to people.

For practical reasons, it is not possible to include in this Manual detailed information that covers all constructive variables, nor covering all possible assembly, operation or maintenance alternatives.

For this reason, the present Manual only includes required information that allow qualified and trained personnel to carry out the work.

In order to allow WEG to provide a prompt service when requested, within technical standards, the motor serial number that is available on the identification nameplate should be supplied.



ATTENTION

If this Installation and Maintenance Manual gets lost, WEG may provide an additional sample. WEG is prepared to solve any further doubt you may require. In this case, motor serial number should be also supplied.

Aiming a satisfactory motor performance, we suggest to make the installation plan, commissioning, start up and maintenance in conjunction with WEG Service Department people.



ATTENTION

To prevent from eventual motor operating problems, we recommend that all maintenance and revision services described in this Storage, Installation, Operation and Maintenance Manual be carried out by duly trained personnel. Changes of rated operating characteristics, such as excess demand of energy, increase in temperature, noise level, abnormal smell and tripping of protections are the first signs of any abnormal occurrence. In this case, to avoid material damage or injury to people, maintenance people should be immediately informed about such circumstances.



DANGER

In case of doubt, switch off the motor immediately!



EX ATMOSPHERE INFORMATION

We recommend that all personnel responsible for the application of electric motors in hazardous areas have been duly trained for such purpose.



ATTENTION

Safety and start up instructions meet the following standards:

- IEC 60034-1 Electric Rotating Machines
- IEC 60079-0 – General Standard for Explosion Proof Equipment
- IEC 60079-1 – Standard for Ex "d" Protection
- IEC 60079-7 – Standard for Ex "e" Protection
- IEC 60079-31 – Standard for Ex "tb" Protection
- IEC 60079-14 – Electrical installations design, selection and erection in explosive atmospheres.
- IEC 60079-17 – Electrical installations inspection and maintenance in explosive atmospheres.



NOTE

WEG states that all information included in this Manual make part of the contract and motor warranty.



ATTENTION

Failure to observe the procedures recommended in this warning may result in equipment damage.

2. GENERAL INSTRUCTIONS

2.1. MOTOR APPLICATION

Based on the above mentioned Standards, WEG motors are intended for industrial applications.



NOTE

It is not allowed to use standard design motor in explosive atmospheres if they have not been specifically certified for such purpose.



NOTE

This provides important information for correct understanding and proper operation of the product.



EX ATMOSPHERE INFORMATION

This provides important information for correct understanding and proper operation of the Ex Certified product.



EX ATMOSPHERE INFORMATION

This symbol indicates that the present paragraph contains important information about explosive atmospheres, which must be strictly followed to avoid damages and risks.

2.2. TRANSPORTATION

WEG motors equipped with cylindrical-roller, angular contact or sleeve bearings are supplied with a shaft locking device on DE side (in some cases, shaft locking device on NDE side can also be applied, for example in sea transportation). Corrosion resistant protection is applied on all machined surfaces as well.

A visible warning is placed on the motor whenever this is equipped with a shaft locking device on the NDF side.

Prior to shipment, motors are factory-tested and dynamically balanced.

If a customer makes special requirements, he will be then responsible to provide safety measures. The ambient parameters for WEG standard motors are the following:

- Temperature: $-20^{\circ}\text{C} \leq T \leq +40^{\circ}\text{C}$;
- Altitude: ≤ 1000 masl;

In environments containing water and dust, motor installation will only be allowed if such motor is specifically designed for such purpose with instructions on its nameplate.

2.1.1. SAFETY WARNINGS IN THE MANUAL

During installation, operation and maintenance, the following symbols must be considered:



DANGER

Failure to observe the procedures recommended in this warning may result in death, serious injuries and extensive equipment damage.



ATTENTION

Shaft locking device must be removed before putting the motor into operation.



ATTENTION

Whenever motor is transported, reuse shaft locking device.



ATTENTION

To avoid accidents and damages to the motor, it should be always lifted with proper cables and devices.





ATTENTION

Motor should only be lifted by the eyebolts. These eyebolts have been designed to hold motor weight only. So avoid lifting additional loads.

Special care should be taken with the motor package so as to avoid any damage to it.

WARNING

**REMOVE SHAFT LOCKING DEVICE
BEFORE PUTTING THE MOTOR
INTO SERVICE**



**REMOVE THIS STICKER BEFORE PUTTING THE
MOTOR INTO SERVICE**

Figure 2-1 - Warning stamp for NDE locking device removal.

2.3. RECEIVING INSPECTION

When receiving the motor, check if any damage has occurred during transportation. Then remove the shaft locking device and keep it in a safe room once it needs to be used on future transportation.

If anything has been noticed, notify immediately the carrier, the insurance company and WEG.



EX ATMOSPHERE INFORMATION

Failure in giving notice to the carrier, to the insurance company and to WEG may result in losing the warranty.

When lifting the boxes, it is important to observe the appropriate locals for this purpose as well as to check the weight of the box and the hoist capacity.

The motors shipped in wooden boxes must be always lifted by the eyebolts or by forklift machines and never by the shaft. The box must never be turned around. Lifting and lowering of such boxes

must be done gently in order to avoid damage to the bearings.

After being removed from the package, a complete visual inspection on the motor should be made.

Do not remove the existing protecting grease from the shaft end, nor the stoppers or plugs that close the terminal box holes, if any. These protection items must be kept in place until the final installation has been concluded.

For motors supplied with roller bearings, shaft should be rotated manually a few times for a uniform grease distribution.



ATTENTION

To ensure the degree of protection, the connection box should be kept closed. Before energise the motor, check the cleanliness and moisture condition inside of the terminal box.

3. STORAGE

3.1. INDOOR STORAGE

When motors are not unpacked immediately after receiving, they should be maintained in places protected from humidity, vapors, sudden heat changes and rodents. To avoid bearing damage, motor should also be storage in places free of vibrations. Any painting damage and protecting grease absent areas should be fixed so as to avoid future rusting.

For maintenance purposes, please refer to Table 3-4.

3.2. OUTDOOR STORAGE

A dry storage location, safe from flooding, dust-free and free from vibrations, should be chosen. Repair any damage to the packing before putting the equipment in storage to ensure proper storage conditions. Position machines, devices and crates on pallets, wooden beams or foundations that guarantee protection against ground dampness. It also prevents the equipment from sinking into the ground and allows the circulation of air underneath the equipment.

Covers or tarpaulins used to protect the equipment against the weather must not make contact with the surfaces of the equipment. Ensure adequate air circulation by positioning wooden spacer blocks between the equipment and such covers.

For maintenance purposes, please refer to Table 3-5.



3.3. VERTICAL MOTORS STORAGE

Vertical motors should be stored in the position as they were initially transported. Usually they can be stored in vertical or horizontal position but this needs always to be prior validated with WEG Service Team.

3.4. OTHER CARES DURING STORAGE

For motors fitted with space heaters, these accessories must be kept switched-on.

If painting has suffered any damage, this must be repainted to avoid rusting. The same applies to the machined surfaces when protecting grease has been wasted.

3.5. INSULATION RESISTANCE



EX ATMOSPHERE INFORMATION

Be sure that no potentially explosive atmosphere is present before any measuring of Insulation Resistance.



DANGER

Before measuring insulation resistance, the machine must be at standstill and all windings and frame must be grounded for a time to remove all residual electrostatic charge (connect all winding to the frame and this one to the ground). Capacitors (if any) must also be grounded before disconnecting and separating the terminals to measure the insulation resistance.

The non observation of these precautions may result in injury to personnel.

When a motor is not immediately installed, it should be then protected against moisture, heat and dirt so as to avoid deterioration of the insulation. The winding insulation resistance must be measured before operating the motor.

If the ambient contains high humidity, a periodical inspection is recommended during storage. It is difficult to determine rules for the actual insulation resistance value of a motor as the resistance varies according to type, size, rated voltage, condition of the insulating material used and method of construction of the motor. A lot of experience is required to decide when a motor is ready for operation. Periodical records will help to take such decision.



DANGER

Disconnect motor from power supply before making any insulation measurement.

The insulation resistance should be measured using a Megohmmeter. The test voltage for the motors windings should be according the table below in accordance with the standard IEEE 43.

Table 3-1 – Insulation resistance test voltage

Winding rated voltage (V)	Insulation resistance test direct voltage (V)
≤ 1000	500
1001 – 2500	500-1000
2501 – 5000	1000 – 2500
5001 - 12000	2500 – 5000
≥ 12001	5000 – 10000

The test voltage for space heaters, other accessories and thermal protectors is 500Vcc.

If the test is performed at a different temperature, it is necessary to correct the resistance reading to 40°C by using an insulation resistance variation curve in relation to temperature, given by the motor itself. If this curve is not available it is possible to use an approximate correction given by the curve of Figure 3-1, as per IEEE 43 Standard.

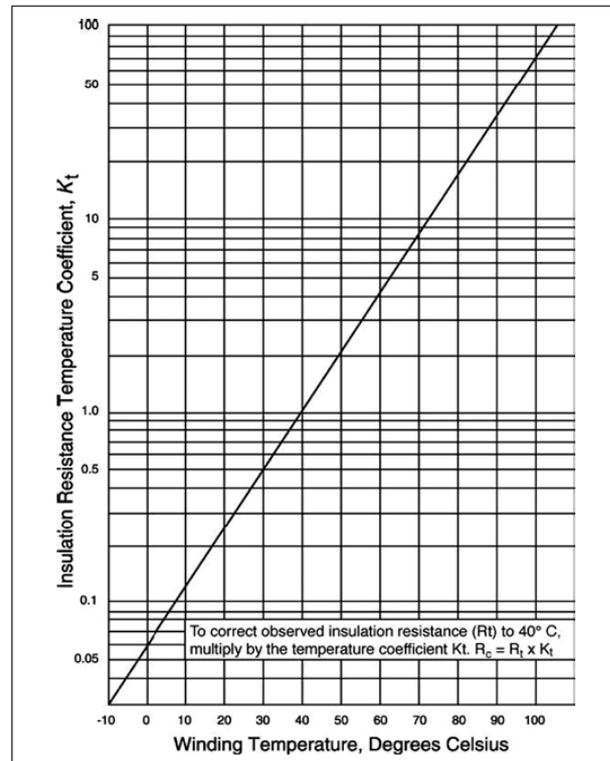


Figure 3-1 – Insulation resistance variation with temperature



ATTENTION

On motors still in operation higher values may be obtained compared to new motors. On new motors lower values can be obtained, as solvents are present in the insulating varnishes which become volatile in a later stage during normal operation. This does not necessarily mean that the motor is not suitable for operation once the insulation resistance will increase after a period of operation. The comparison with values obtained from previous tests on the same motor under identical load, temperature and humidity conditions will be a better indication of the insulation conditions in comparison to the value obtained from a single test. Any sudden or high reduction of the value requires careful attention.

Minimum resistance value should be above 25MΩ. Table 3-2 provides insulation resistance values measured under operation.

Table 3-2 - Reference limits for insulation resistant of electric motors

Insulation Resistance Value	Insulation Level
≤ 2MΩ	Bad
< 50MΩ	Dangerous
50...100MΩ	Abnormal
100...500MΩ	Good
500...1000MΩ	Very Good
> 1000MΩ	Excellent

MINIMUM INSULATION RESISTANCE

If the insulation resistance measured is smaller than 100 MΩ, the winding must be dried according to the procedure below before starting the motor:

- Disassemble the motor, removing the rotor and the bearings;
- Take the frame with stator winding to an oven and warms it to a temperature of 130°C, keeping this temperature for at least 8 hours. For bigger machines (above IEC frame 630), it can be necessary to stay for at least 12 hours).

Double check the insulation resistance to verify if it has reached the acceptable values, according to Table 3-2, otherwise refers to WEG for instructions.

3.6. POLARIZATION INDEX

The polarization index (P.I.) is traditionally defined as a ratio of the 10 min. insulation resistance (IR₁₀)

to the 1 min. insulation resistance (IR₁), tested at a relatively constant temperature.

Through the polarization index, the user can evaluate the motor insulation conditions, according to the table bellow:

Table 3-3 - Polarization index

Polarization Index	Insulation Level
1 or smaller	Bad
< 1,5	Dangerous
1,5 to 2,0	Abnormal
2,0 to 3,0	Good
3,0 to 4,0	Very Good
> 4,0	Excellent



EX ATMOSPHERE INFORMATION

To avoid electric discharge risks, discharge the terminals right after performing the measurement.



DANGER

In order to avoid injuries to personnel, the winding must be grounded immediatly after measuring the insulation resistance.

3.7. PROLONGED STORAGE

3.7.1. INTRODUCTION

The instructions for long term storage described as follows are valid for motors to be long term stored and/or long periods of standstill before the commissioning.

3.7.2. GENERALITIES

The existing tendency, especially during the construction of the plant, of storing the motors for several years before commissioning or to install immediatly some units, results that the motors are exposed to influences that cannot be evaluated in advance for this time's period.

It is difficult to evaluate the different forms of stress (atmospheric, chemical, thermal, and mechanical) imposed to the motor, which might happen during storage maneuvers, assembly, initial tests and storage until the commissioning.

Other essential factor is the transportation, for example, the general contractor may transport the motor or the complete unit with motor as joint transportation to the installation location.



The motor internal gaps (air gap, bearings and interior of connection box) are exposed to the atmospheric air and temperature fluctuations. Due to the air humidity, it is possible the liquid condensation and, depending on the kind and air contamination degree, aggressive substances may penetrate into these spaces.

As a consequence, after long periods the internal components such as the bearings might get rust, the insulation resistance can decrease to under the admissible values and the grease lubricant capacity in the bearings is adversely affected. This influence increases the damage risk before commissioning of the plant.

The flameproof joints of terminal boxes that were exposed during storage, for example to allow the measuring of the insulation resistance, before assembling and bolting, should be properly protected against corrosion with a thin layer of grease from one type recommended by WEG in section 3.7.8.

**NOTE**

To keep manufacturer's warranty, it should be insured that the described preventive measures in this instructions are followed and registered: constructive aspects, preservation, packing, storage and inspections.

3.7.3. STORAGE PLACE**3.7.3.1 INDOOR STORAGE**

In order to ensure the best storage conditions to the motor during long standstill periods, the storage location should obey rigorously the criteria described as follow:

- Closed storage room with roof;
- The location must be protected against humidity, vapors, aggressive fumes discharge, fast heat changes, gnawing and insects;
- It must not present corrosive gases such as chlorine, sulfur dioxide or acid;
- It must not present continuous or intermittent vibrations;
- It should have ventilation system with filter;
- It must not present quickly changes of temperature;
- Ambient temperature ($5^{\circ}\text{C} < T < 60^{\circ}\text{C}$);
- Relative air humidity $< 50\%$;
- It should have prevention against dirt and dust deposits;
- It should have fire detection system;

- Electrical supply for space heater and illumination must be provided.

If some of these requirements can not be attended by the storage environment, WEG suggests that additional protections be incorporated in the motor packing during the storage period, like follows:

- Closed wooden or similar box with electrical installation, enable to the space heaters supply;
- Closed wooden box or similar with installation that allows the space heaters be energized;
- If there is a risk of fungus infestation and formation, the packing must be protected in the storage location by spraying or painting it with appropriated chemical agents;
- Preparation of packing must be done with greatest care by an experienced person. A reliable packing company must take over of the packing.

3.7.3.2 OUTDOOR STORAGE

The outdoor storage of the motor is not recommended.

If the external storage cannot be avoided, the motor should be packed in specific packing for this condition, as described bellow.

- For outdoor storage, besides the packing recommended above, we recommend to cover completely this packing with a protection against dust, humidity and other strange materials.
- Place the packing in pallets, wooden bunches or foundations that guarantee the protection against the soil humidity.
- Prevent the packing sink itself in the soil.
- After covering the machine, a shelter should be build to protect it against rain, snow and excessive sun heat.

**ATTENTION**

It is recommendable to check the storage local conditions and the motors condition according to the maintenance plan for long term storage, described in this manual.

3.7.4. SPARE PARTS

If parts have been supplied separately (terminal boxes, endshields, covers, etc...) these ones must be packed as described above.

The air relative humidity inside the packing should not exceed 50% until unpacking the machine.



3.7.5. SPACE HEATERS

The space heaters installed in the motor must be energized during the storage period to avoid the moisture condensation inside the motor and this way keeping the winding insulation resistance within acceptable levels.



ATTENTION

The space heaters of the motor must be mandatorily energized when the motor is stored in local with temperature < 5 °C and relative air humidity > 50%.

3.7.6. INSULATION RESISTANCE

During the storage period, the winding insulation resistance of the motor should be measured according to item 3.5 of this manual and registered every 3 months and before the motor installation.

Eventual drops in the insulation resistance level must be investigated.

3.7.7. EXPOSED MACHINED SURFACES

At factory, all exposed surfaces (for example, the shaft edge and flanges) are protected with a temporary protective agent (rust inhibitor).

This protective coating should be reapplied every 6 months at least. When this coating is removed and/or damaged, the same preventive action must be done.

RECOMMENDED PRODUCTS

- Anticorit BW 366, Manufacturer: FUCHS.
- Dasco Guard 400 TX AZ, Manufacturer: D.A.Staurt.
- Tarp, Manufacturer: Castrol.
- Tectyl 511-M, Manufacturer: Valvoline.

3.7.8. FLAMEPROOF JOINTS

For motors with protection “d”, all the surfaces of flameproof joints shall be verified with special care to assure that all the machined surfaces of flameproof joints are properly protected with a corrosion inhibiting grease.

Before the assembly of any part of motor or terminal box enclosures, the surfaces of flameproof joints shall be protected against corrosion with protective grease.

AUTHORIZED PRODUCTS

- Polyrex EM, Manufacturer: MOBIL.
- Molycote 33, Manufacturer: Dow Corning Corporate.
- Lumomoly PT/4, Manufacturer: Lumobras.

3.7.9. BEARINGS

3.7.9.1 ANTIFRICTION BEARINGS LUBRICATED BY GREASE

The bearings are lubricated at the factory to perform the motor tests.

During the storage period, every two months is necessary to remove the shaft locking device and turn the shaft manually to conserve the bearing in good conditions. After perform the shaft rotation, this one shall be turned at 45° from the original position.

After 6 months of storage and before starting in operation, the bearings should be regreased, as item 8.2.7 of this manual.

If motor is kept in storage for approximately 2 years or more, the bearings must be inspected and regreased according to item 8.2 of this manual.

3.7.9.2 SLEEVE BEARINGS

Motors with sleeve bearings are always transported without oil inside the bearings.

The motor must be stored in its original operation mounting position and with oil inside the bearings (see oil quantities in the Table 8-19).

The oil level should be respected, remaining in the middle of the oil sight glass.

During the storage period, every two months is necessary to remove the shaft locking device and rotate at about 30 rpm for the oil circulation and to conserve the bearing in good conditions.

If it is not possible to rotate the shaft of the motor, the follow procedure should be used to protect internally the bearing and the contact surfaces against corrosion:

- Drain the whole bearing oil;
- Dismantle the bearing, following the procedure described in the item 8.2.10.3 of this manual;
- Clean the bearing;
- Apply the anti-corrosive (ex.: TECTIL 511 or equivalent) inside the bearing, bearing line (top and bottom half) and in the shaft contact surface of the motor;
- Assemble the bearing, following the procedure described in the item item 8.2.10.4 of this manual;
- Close all tapped holes with screw plugs;
- Seal the gaps between the shaft and bearing seal, and between bearing seal and bearing housing by using self-adhesive permanent tape;
- Connecting flanges (Ex.: Oil inlet and outlet) must be covered with blank plates.
- Remove the bearing top sight glass and spray the corrosion inhibitor on the bearing.
- Put some desiccant (silica gel) inside of the bearing. The desiccant absorbs the humidity and prevents the formation of moisture and water condensation inside the bearing.



- Close the bearing tightly with the top sight glass.

In case the standstill period is **longer than 6 months**:

- Repeat the procedures described above.
- Replace the desiccant (silica gel) into the bearing each six months.

In case the standstill period is **longer than 2 years**:

- Dismantle the bearing;
- Preserve and store the bearing parts.



ATTENTION

By using either a chain block or a jack, raise the end of the rotor at which the work is being done approximately 0.1 to 0.3mm so as to remove the weight from the bottom half of the bearing and not damage the flameproof labyrinth.

3.7.10. CONNECTION BOX

When the winding insulation resistance of the motor is verified, the main terminal box and the auxiliary terminal boxes must also be inspected, observing the following aspects:

- The interior should be dry, cleaned and free of any dust accumulation.
- The contact elements cannot present corrosion.
- The machined surfaces of explosion proof terminal boxes with protection “d” which functions as flamepath joints should be perfectly clean, without any deformation, damage or scratches. Before reassembling the covers of these terminal boxes apply a corrosion inhibiting grease (ex.: Polyrex EM or Molycote 33 or Lumomoly PT/4) to avoid the corrosion of the machined surfaces.
- The motors with protection “de” are equipped with terminal boxes with protection “e” that constructively can be the same used for protection “d”. In this case, machined surfaces don't function as flamepath joints but it's very important to maintain them in good conditions applying also a corrosion inhibiting grease (ex.: Polyrex EM or Molycote 33 or Lumomoly PT/4) to avoid the corrosion of the machined surfaces.
- The cables inlet should be correctly sealed.
- The cable entrances into the terminal boxes must be done using certified cables glands with the same, or higher, protection of the motor (Ex d IIB, Ex d IIC, Ex e, Ex d I or Ex e I) indicated in the motor nameplate.

If any of these items are not in proper condition, an adequate maintenance should be performed and, if necessary, the damaged parts should be replaced.



EX ATMOSPHERE INFORMATION

The use and assembling of the appropriate cable glands is responsibility of the motor installer.

3.7.11. INSPECTIONS AND RECORDS DURING STORAGE

The stored motor must be inspected periodically and inspection records must be filled.

The following points must be inspected:

- Physical damages;
- Cleanliness;
- Signs of water condensation;
- Protective coating conditions;
- Paint conditions;
- Signs of aggressive agents;
- Satisfactory operation of space heaters. It is recommended that a signaling or alarm system be installed in the location in order to detect power interruption on the space heaters;
- Record the ambient temperature and relative humidity around the motor, the winding temperature (using RTDs), the insulation resistance and the polarization index;
- Record vibrations, in horizontal, vertical and axial directions at Drive End and Non Drive End sides to guarantee that motor is not being subjected to harmful values;
- Storage site, so that it complies with the criteria described in sub-section 3.7.3.

3.7.12. PREPARATION FOR SERVICE AFTER LONG TERM STORAGE

3.7.12.1 CLEANING

- The machine interior and exterior should be free of oil, water, dust and dirt.
- Remove the corrosion inhibitor of the exposed surfaces with a cloth soaked in petroleum based solvent.
- Be sure that the bearings and cavities used to lubrication are free of dirt and the plugs on the holes are correctly sealed and tighten. Oxidations and marks on the bearings seats and shaft should be carefully removed.
- Be sure that the flameproof joints that were exposed during storage are free of any corrosion, scratches or deformations and are properly protected against corrosion.



3.7.12.2 BEARINGS LUBRICATION

Use the lubricant specified for bearing lubrication. This information is indicated on the bearings nameplate, and the lubrication must be done as described in chapter 8-MAINTENANCE of this Manual, always considering the type of bearing.



ATTENTION

Inspection to the rolling bearing must be performed. If there are corrosion signals or races marks, the bearing must be replaced.



NOTE

Sleeve bearings, where was applied internally the protection product against corrosion and desiccant, should be disassembled as the procedure described in the item 8.2.10.3 of this manual, washed for remove the anti-corrosive agent and the desiccants.

Assemble again the bearings, as the procedure described in the item 8.2.10.4 of this manual and proceeds the re-lubrication.

3.7.12.3 INSULATION VERIFICATION

RESISTANCE

Before starting in operation the insulation resistance must be verified, according to the section 3.5 of this manual.

3.7.12.4 OTHER

Follow the further procedures described in the chapter 5-INSTALLATION of this manual, before putting the machine in operation.



3.7.13. MAINTENANCE PLAN FOR STORAGE

During the storage period, the motor maintenance must be executed and registered according to the plan described in the table below:

Table 3-4 - Maintenance plan for indoor storage

Inspection / Periodicity	1M	2M	6M	2Y	BS
Storage					
Cleanliness		X			X
Humidity and Temperature		X			
Check for signs of insect infestation		X			
Vibration Levels	X				
Packaging					
Physical Damages			X		
Relative Humidity inside Motor		X			
Replace Dehumidifier Bag			X		
Space Heaters					
Check operation conditions	X				
Complete Motor					
Perform External Cleaning			X		X
Tube cooling exchanger			X		
Check Painting Conditions			X		
Check Oxidation Inhibitor on Exposed Machined Parts			X		
Replace the Oxidation Inhibitor			X		
Windings					
Measure Insulation Resistance		X			X
Measure Polarization Index		X			X
Terminal Box and Grounding Terminals					
Clean the boxes inner parts				X	X
Inspect Seals and Sealing				X	X
Bearings					
Rotate the Shaft		X			
Lubricate the Bearings			X		X
Disassemble / Clean Bearings				X	
Sleeve Bearings					
Rotate the Shaft ¹⁾		X			
Apply Anticorrosive and Dehumidifier			X		
Clean / Lubricate Bearings					X
Disassemble / Store Bearing Parts				X	

¹⁾After rotate, positioning the shaft at 45° from the original position.

- 1M All inspections that must be performed and recorded on a monthly basis;
- 2M All inspections that must be performed and recorded every two months;
- 6M All inspections that must be performed and recorded every six months;

Table 3-5 - Maintenance plan for outdoor storage

Inspection / Periodicity	1M	2M	6M	2Y	BS
Storage					
Cleanliness	X				X
Humidity and Temperature	X				
Check for signs of insect infestation	X				
Vibration Levels	X				
Packaging					
Physical Damages		X			
Relative Humidity inside Motor	X				
Replace Dehumidifier Bag		X			
Space Heaters					
Check operation conditions	X				
Complete Motor					
Perform External Cleaning		X			X
Tube cooling exchanger		X			
Check Painting Conditions		X			
Check Oxidation Inhibitor on Exposed Machined Parts		X			
Replace the Oxidation Inhibitor		X			
Windings					
Measure Insulation Resistance	X				X
Measure Polarization Index	X				X
Terminal Box and Grounding Terminals					
Clean the boxes inner parts			X		X
Inspect Seals and Sealing			X		X
Bearings					
Rotate the Shaft	X				
Lubricate the Bearings		X			X
Disassemble / Clean Bearings			X		
Sleeve Bearings					
Rotate the Shaft ¹⁾		X			
Apply Anticorrosive and Dehumidifier			X		
Clean / Lubricate Bearings					X
Disassemble / Store Bearing Parts				X	

¹⁾After rotate, positioning the shaft at 45° from the original position..

- 2Y All inspections that must be performed and recorded after 2 years;
- BS All inspections that must be performed and recorded before Start-up;



4. HANDLING

Use only the existing eyebolts to lift the motor. Never lift the motor by the shaft. Check the motor weight. Lifting and lowering must be done gently in order to avoid damage to the bearings.

4.1. HANDLING RIBBED COOLED MOTORS

4.1.1. HORIZONTAL MOTORS

The eyebolts attached to endshields, fan cover, etc, should be used to handle these specific components only. The complete motor should be lifted only by the eyebolts in the frame.

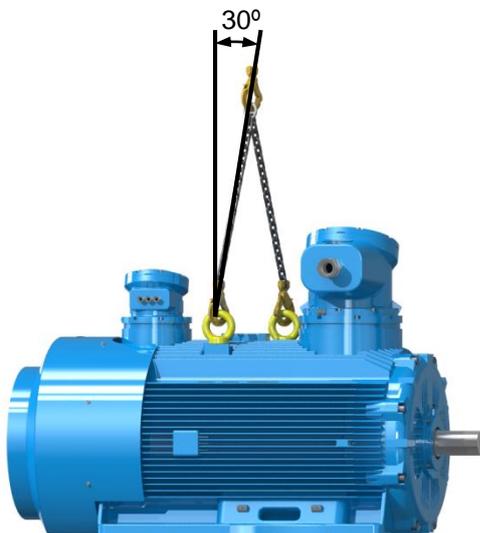


Figure 4-1 - W22Xd LINE – horizontal ribbed cooled motors

1. Lifting lugs on the frame are designed for lifting machine only. Do not use for lifting coupled equipment such as pumps, compressors, gears or other equipment;
2. The chains or handles of hoisting must have on maximum angle of 30° with regard to vertical line;
3. Use all of eyebolts fixed in the frame, supplied together with the motor;
4. Failure to observe these precautions may result in damage to the equipment, injury to personnel or both.
5. When the risk of motor damage exists by the lifting chains, special tools must be predicted by the customer.

4.1.2. VERTICAL MOTORS



Figure 4-2 - W22Xd LINE – vertical ribbed cooled motors

The handling of the vertical ribbed cooled motors must be done as showed in the Figure 4-2.

Always use the 2 eyebolts for motors movement in vertical position, therefore the lifting chains or cables can also stay in the vertical position avoiding thus awful efforts to the eyebolts.

4.2. HANDLING TUBE COOLED MOTORS

4.2.1. HORIZONTAL MOTORS

The eyebolts attached to endshields, fan cover, etc, should be used to handle these specific components only. The complete motor should be lifted only by the eyebolts in the frame.

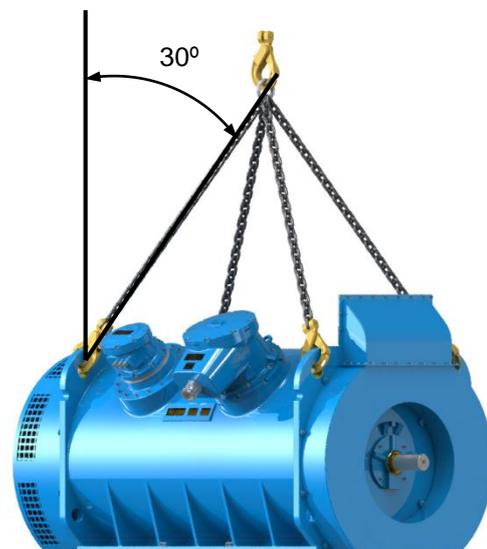


Figure 4-3 - W22XdT LINE – horizontal tube cooled motors



4.2.2. VERTICAL MOTORS



Figure 4-4 - W22XdT LINE – vertical tube cooled motors

The handling of the WEG vertical motors must be done as shown in the Figure 4-4.

Always use the 4 eyebolts for motors movement in vertical position, therefore the lifting chains or cables can also stay in the vertical position avoiding thus awful efforts to the eyebolts.

4.2.3. VERTICAL TUBE COOLED MOTORS POSITIONING

The WEG tube cooled motors are supplied with 8 eyebolts for lifting, being 4 at the front part and 4 at the back of the motors.

Some motors are carried in the horizontal position and need to be moved to the running position.

The procedure below should be followed when handling vertical mounting motors from the horizontal to vertical position and vice-versa.

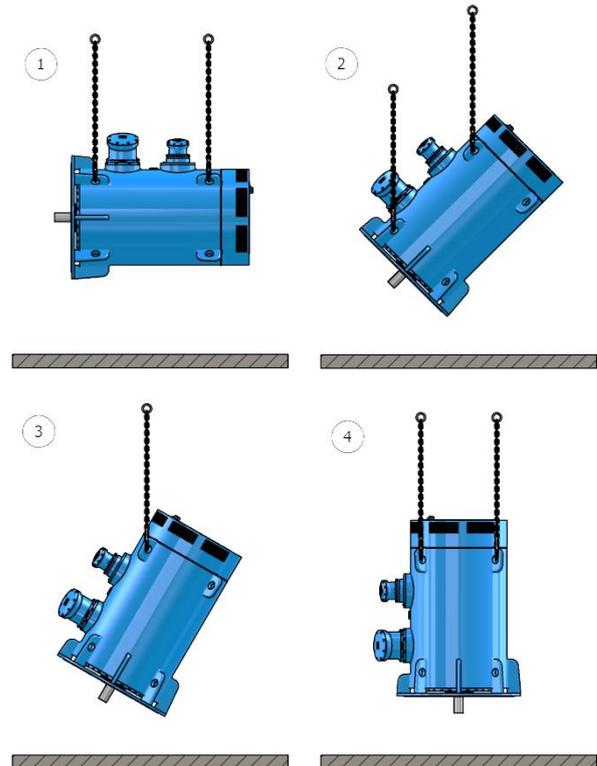


Figure 4-5 - Lifting of vertical motor

1. Lift the motor through the 4 lateral eyebolts using 2 cranes;
2. Lower the crane that is fixed in the motor drive end side and simultaneously lift the crane that is fixed in the motor non drive end side until the motor reaches the balance.
3. Loosen the crane that is fixed in the motor drive end and turn it 180° to allow the fixation of the crane previously loosen in the other 2 eyebolts located in the motor non drive end.
4. Fasten the loosen crane in the other 2 eyebolts on the motor non drive end and lift it until the motor gets the vertical position.



5. INSTALLATION

Electric motors should be installed in locations of easy access for inspection and maintenance. If the surrounding atmosphere contains humid, corrosive or flammable substances or particles, it is essential to ensure an adequate degree of protection. The installation of motors in ambient where there are vapours, gases or dusts, flammable or combustible materials, subject to fire or explosion, should be done in accordance with EN/IEC 60079-14 Standards.

Under no circumstances, motors can be enclosed in boxes or covered with materials which may impede or reduce the free circulation of cooling air. Motors fitted with external cooling must be located at least 50mm from the ground to permit free air circulation. The air inlet and outlet should never be obstructed or reduced by conductors, pipes or other objects. The installation site should permit conditions of air renewal at a rate of 30m³ per minute for each 100kW motor output.

5.1. MECHANICAL ASPECTS

5.1.1. MOUNTING

In order to ensure the adequate operation, in addition to a stable foundation, the motor must be precisely aligned with the coupled equipment and the components mounted on the shaft end must be properly balanced.

As requirement, the motor base must be flat and follow the guidelines of standard DIN 4024-1: "Machines Foundations – Flexible Structures that Support Machines with Rotating Elements".

NOTICE:

With the machine mounted and coupled, the relation between the foundation natural frequency and:

- The motor speed frequency;
- The double speed frequency;
- The double line frequency.

Must be as specified according described below:

Foundation natural frequency of the 1st order:

- $\geq +25\%$ or $\leq -20\%$ in relation to the above frequencies.

Foundation frequency of higher order:

- $\geq +10\%$ or $\leq -10\%$ in relation to the above frequencies.



ATTENTION

The customer must guarantee that the foundation respects the frequencies defined in this manual.

5.1.2. FOUNDATIONS

The motor base must be level and free from vibrations. For this reason, concrete foundation is recommended.

The type of base to be built will depend on the nature of the soil at the installation site or on the floor capacity.

When designing the motor foundation, it must be taken into consideration the fact that the motor might, occasionally, be submitted to a torque higher than the rated torque. If such designing is not correctly made, vibration problems can occur to the unit (foundation, motor and driven machine).



NOTE

On the concrete base, a metallic plate to support the leveling bolt must be provided.

Based on Figure 5-1, the forces over the foundation can be calculated by the following formulas:

$$F_1 = +0.5.m.g. + \frac{(4C \max)}{(A)}$$

$$F_2 = +0.5.m.g. - \frac{(4C \max)}{(A)}$$

Where:

*F*₁ and *F*₂ - Forces on the base (N).

g - Gravity acceleration (9.81m/s²).

m - Motor mass (kg).

*C*_{max} – Maximum torque (Nm).

A - Taken from motor dimensional drawing (m).

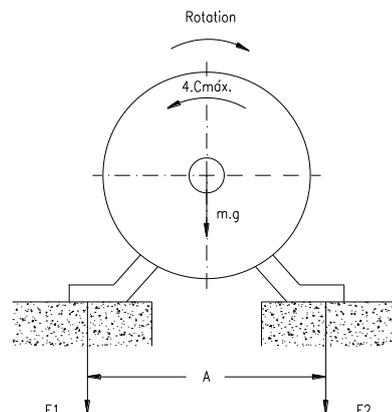


Figure 5-1 - Schematic of foundation loads



NOTE

The drawing above shows the forces over the motor when running clockwise. For counter clockwise rotation, forces are reversed (F1, F2, 4.Cmax.)

Steel or iron blocks, plane surfaces blocks with anchorage devices can be fitted in the concrete foundation to fix the motor feet, (as suggested in Figure 5-2 and Figure 5-3). It is important that all the structure equipment is made in such a way that they can transmit any force or torque which may occur during the operation.



ATTENTION

WEG will not be responsible for the design and foundation of the base.

5.1.3. TYPES OF BASES

5.1.3.1 CONCRETE BASES

Concrete bases are the most commonly used for the installation of electric motors.

The type and size of the foundation - as well as other fixing devices for this purpose will depend on the type and size of the motor.

The motors can be mounted on a concrete base with four foundation blocks. See dimensions of the installation components in the following tables.

Table 5-1 – Fixation dimensions (example of installation)

Hole diameter in the motor feet	Foundation block		Fastening bolts (DIN 933)		Tapered pins (DIN 258)	
	Number	Dimension	Number	Dimension (*)	Number	Dimension
28	4	M24	4	M24 x L	2	14 x 100
36	4	M30	4	M30 x L	2	14 x 100
42	4	M36	4	M36 x L	2	14 x 100
48	4	M42	4	M42 x L	2	100

(*) Length “L” depending of the height of motor feet. The minimum engagement depth for coarse threads should be respected.

Table 5-2 - Anchorage dimensions (example of installation)

Thread	Mounting dimensions				
	s	t	u	v	w
M24 and M30	50	450	220	265	315
M36	70	539	240	300	350
M42	70	600	270	355	400



Installation and examples:

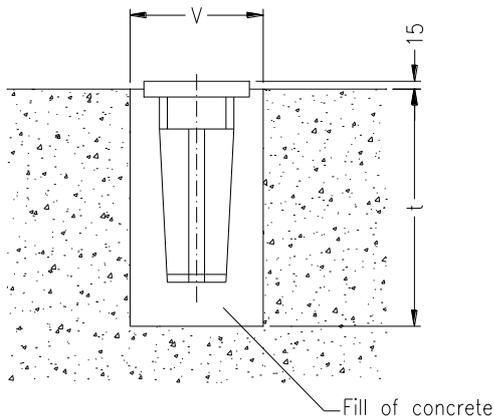


Figure 5-2 - Example 1

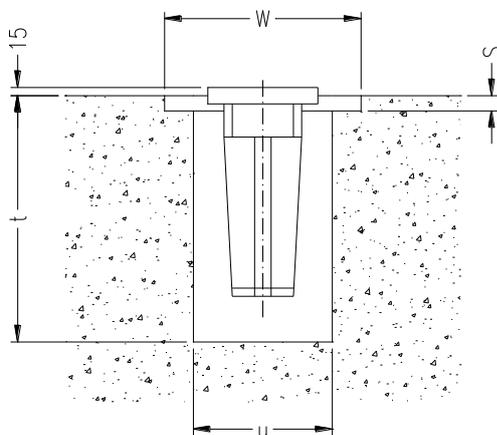


Figure 5-3 - Example 2

EXAMPLES OF PREPARATION

Remove all dirt from the foundation blocks in order to ensure a perfect anchorage between the foundation blocks and the motor. Fix the foundation blocks at the motor feet by means of bolts.

Using shims of different thickness (total tickness of about 2mm) between the motor feet and the foundation base an accurate vertical alignment can be obtained.

Inside the feet holes, the fastening bolts must be covered with a metal sheet or presspan in order to center the foundation blocks exactly to the feet holes and perform an accurate alignment horizontally.

Place shims or leveling bolts under the foundation blocks in order to obtain a perfect motor leveling and alignment between the motor and the driven machine. After introducing the concrete, make an accurate control of the alignment. Eventually small corrections can be done by washers or metal plates or by means of a new adjustment of the fastening bolt clearances. Tighten now firmly all fastening bolts.

Make sure that all motor feet surfaces are supported uniformly without damaging motor frame. After completing the test, introduce two tapered pins for correct fastening. For this purpose, use the pre-dilled holes in the feet.

5.1.3.2 SLIDE RAILS

When drive system is done by pulleys, the motor should be mounted on slide rails and the lower part of the belt must be pulling.

The nearest rail to the drive pulley is positioned in such a way that the adjusting bolt (1) is between the motor and the driven machine. The other rail must be positioned with the bolt on the opposite side (diagonally opposite (2)), as shown in Figure 5-4. The motor is bolted to the rails and set on the base.

The drive pulley is then aligned in such a way that its center be in the same level of the driven pulley center.

Motor and driven machine shafts must be in a parallel position.

The belt should not be excessively stretched, see Figure 5-14. After the alignment, rails must be fixed.

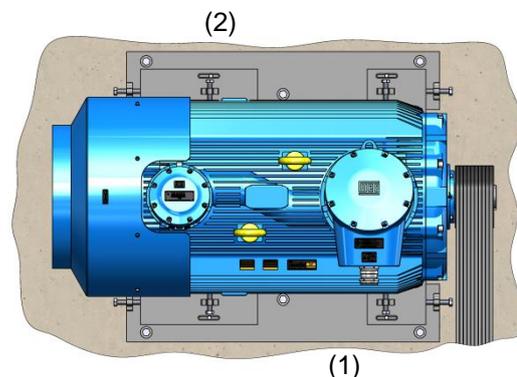


Figure 5-4 - Rail mounting

5.1.3.3 METALLIC BASES

The metallic bases must have a flat surface under motor feet in order to avoid frame deformation.

Motor should not be removed from their common metallic bases for alignment; the metallic bases should be leveled on the actual foundation.

When a metallic base is used to adjust the height of the motor shaft end with the machine shaft end, it should be leveled on the concrete base.

After the base has been leveled, foundation studs tightened, and the coupling checked, the metal base and the studs are then cemented.



5.1.4. ALIGNMENT/LEVELLING

Especially in cases of direct couplings, motor shaft must be aligned axially and radially with the driven machine shaft.

Incorrect alignment can lead to bearing damage, vibrations or even cause shaft rupture.

Correct alignment can be ensured with the use of dial gauges, as shown in Figure 5-5, Figure 5-6 and Figure 5-7.

If considering a complete shaft turn, misalignment should not exceed 0.03 mm.

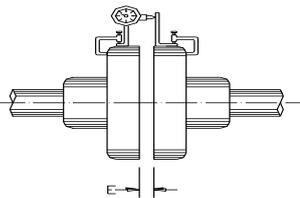


Figure 5-5 - Axial reading (parallelism)

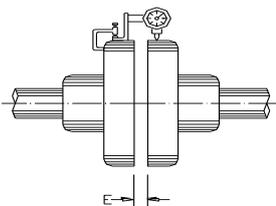


Figure 5-6 - Radial reading (concentricity)

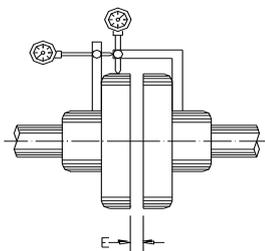


Figure 5-7 - Axial and radial reading combined.

The axial alignment (dimension “E”) between the half couplings should be performed in accordance with its manufacturer recommendations.

When performing the alignment/leveling, the influence of the temperature on the motor and driven machine should be taken into consideration.

Expansion effect of the components may change the alignment/leveling conditions during motor operation.

After the set (motor and base) is perfectly aligned either at cold or at hot condition, motor must be bolted, as shown in Figure 5-8. There are instruments which use visible laser ray added by specific computer programs that can perform and ensure high precision alignment.

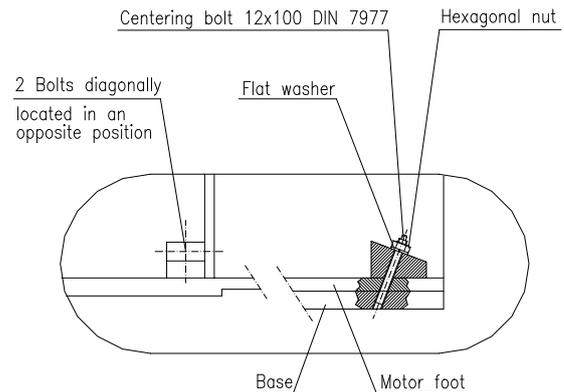


Figure 5-8 - Alignment of motor and base



NOTE

Bolts, nuts and washers can be supplied with the motor, if required.



ATTENTION

The motor feet must have a perfect contact with the base. Soft-foot verification shall be performed and, if necessary, use shims.



ATTENTION

If required, WEG can offer its personnel duly trained, as well as a laser equipment to make the alignment/leveling of the motor and driven machine.

5.1.5. COUPLINGS



ATTENTION

As standard, WEG motors are factory balanced with half key. This means that couplings, pulleys, tooth wheels, etc must also be balanced with half key.





ATTENTION

An improper key can result in a significant system unbalance, which can cause the vibration to be above acceptable limits.

If the key length exceeds the length of the coupling hub the part extending beyond the coupling hub must be removed by machining to the shaft diameter.

5.1.5.1 DIRECT COUPLING

Whenever possible, it is recommended to use direct coupling due to lower cost, less space required, no belt slippage and lower accident risk.

Also in cases where gear boxes are applied, preference should be given to direct coupling.



ATTENTION

Always use flexible couplings; rigid couplings require special bearing arrangement as well as axial and radial alignment of the shafts.

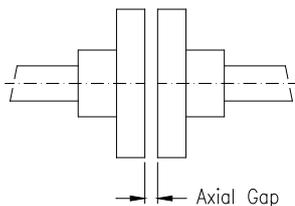


Figure 5-9 - Axial clearance of the coupling



ATTENTION

Align carefully the shaft ends using, whenever possible, flexible coupling, tolerating a minimum clearance (Axial gap) of 3mm between the couples as shown Figure 5-9.

5.1.5.2 GEARBOX COUPLING

Poorly aligned gearbox couplings normally cause jerking motions which provoke vibration to the coupling and to the motor. Therefore, due care must be given to correct shaft alignment, perfectly parallel in cases of straight gears, and at the correct angle for bevel or helical gears.

Perfect gear arrangements can be checked by inserting a strip of paper on which the teeth marks will be traced after a single rotation.

5.1.5.3 BELT AND PULLEY COUPLING

Belt transmission is the most commonly used when a speed ratio is required.

The couplings used must be suitable to withstand radial and axial vibrations during operation. Special care must be taken to avoid that the allowable load and speed limits given by the catalogs are not exceeded.

ASSEMBLY OF PULLEYS: the assembly of pulleys on shafts featured with keyway and threaded hole must be done by inserting it halfway up to the keyway merely by manual pressure.

On shafts without threaded hole it is recommended to heat up the pulley to about 80°C (Figure 5-10).

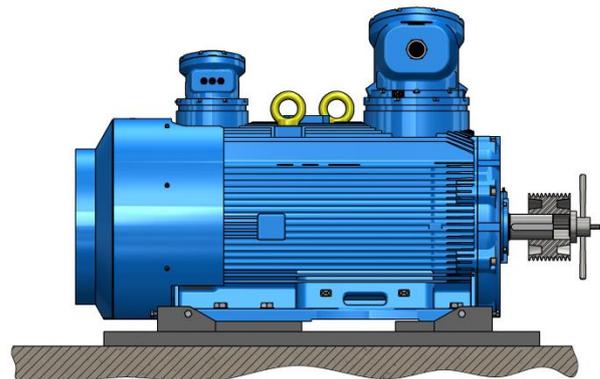


Figure 5-10 - Assembly of pulleys

The couplings used must be suitable to withstand radial and axial vibrations during operation. Special care must be taken to avoid that the allowable load and speed limits given by the catalogs are not exceeded.

DISASSEMBLY OF PULLEYS: for pulleys disassembly it is recommended to use the devices shown in Figure 5-11 in order not to damage the key neither shaft surface.

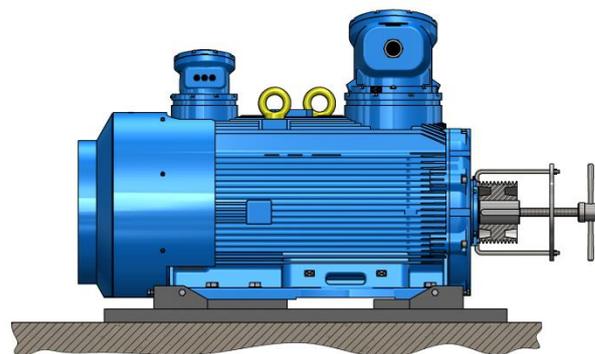
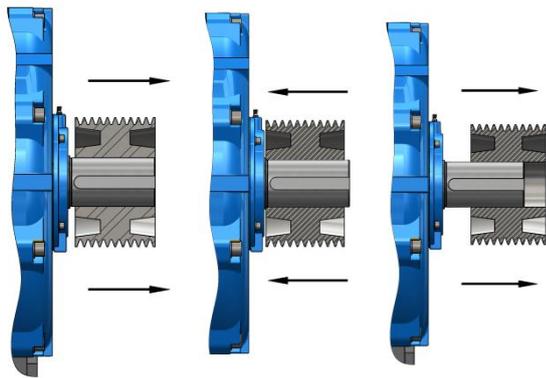


Figure 5-11 - Disassembly of pulleys

Hammers should be avoided when fitting pulleys and bearings. The fitting of bearings with the aid of hammers causes spots in the bearing races. These initially small spots increase with usage and can develop to a stage that completely damages the bearing. The correct positioning of a pulley is shown in Figure 5-12.



Incorrect Correct Incorrect

Figure 5-12 - Correct assembly of pulleys



ATTENTION

While mounting and dismounting a pulley, never make pressure or knock on the bearings.



EX ATMOSPHERE INFORMATION

In case of belt couplings, belts can not be affected electro statically.

Laterally misaligned pulleys, when running, transmit alternating knocks to the rotor and can damage the bearing housing. Belt slippage can be avoided by applying a resin for this purpose.

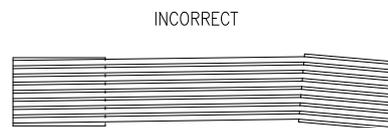
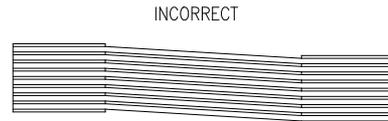
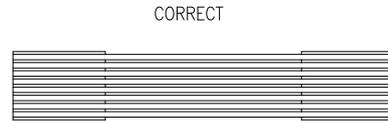


Figure 5-13 - Correct pulley alignment

Belt tension is only required to avoid slippage during operation (see Figure 5-14)

RUNNING: Avoid unnecessary thrusts on the bearings by ensuring that the shafts are parallel and the pulleys perfectly aligned (Figure 5-13).

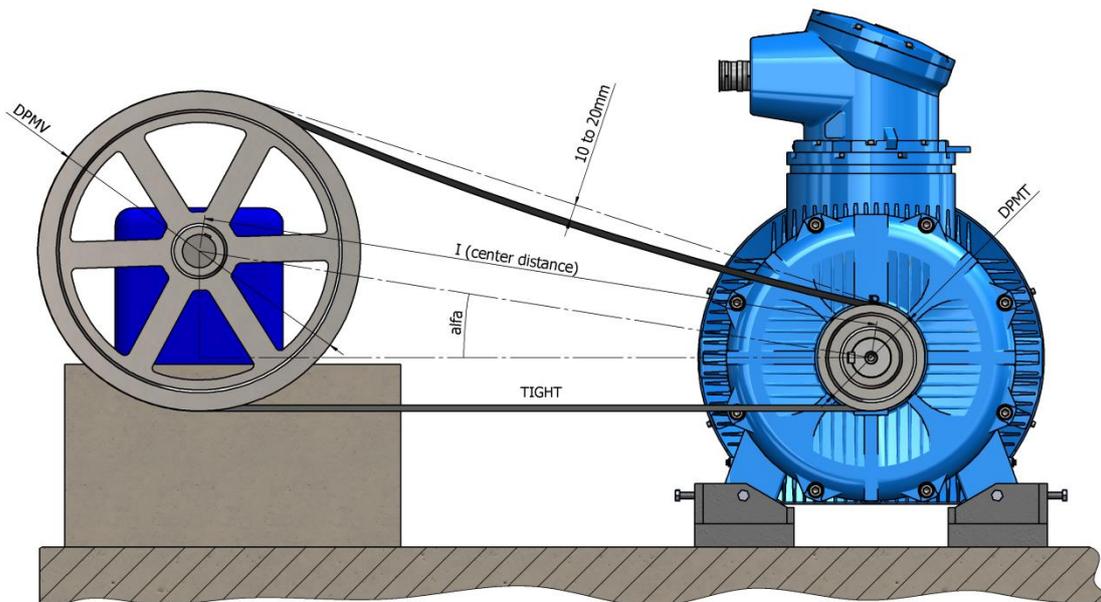


Figure 5-14 - Belt tension



NOTE

A belt with excessive tension increases the force on the shaft end causing vibrations and fatigue leading to a possible shaft rupture.

ATTENTION

Excessive belt tension may cause bearing damage and lead to shaft rupture.

BELT TENSION: In general, proper belt tensions should be the lowest possible at which the belts will not slip at peak load conditions.

Maintaining the proper belt tension is very important. If tension is too high, the drive could overload bearings and pull shafts out of alignment. Belt tensions must be measured with a tension tester.

The belt should be monitored regularly during the first hours of operation.

Correct tension of the drive may be obtained if the belt tension is measured, set and checked using one of the following methods:

MEASURING BELT TENSION BY DEFLECTION

Force deflection method – The belt tension is determined, with a tensiometer or other spring scale type tester, by measuring the required force to deflect the center of the belt a given distance. Tensiometers may be obtained through belt manufacturers or distributors.

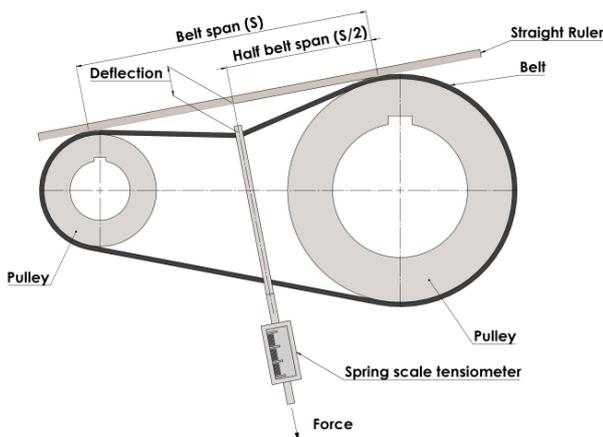


Figure 5-15 - Belt span length.

With a tensiometer or other spring scale type tester press the opposing end of the equipment to the midpoint of the belt span and apply a force on the equipment to obtain a desired belt deflection of 0.4mm for every 26mm of belt span. For example,

if the span length is 1000mm (1m), the desired belt deflection is 16mm.

For a single belt drive, the deflection observed in the tensiometer should be lined up with the bottom of a straight edge placed on the outside diameters of the two sheaves. For a multiple belt drive, the belt deflection is lined up with the top of the next belt. Take a reading from each belt for an average.

The tensiometers instructions for use and belt tension measurement are supplied with the equipment and they are very simple, allowing the installers or end users to perform a correct belt tensioning adjustment taking into account the recommendations of the equipment manufacturers.

MEASURING BELT TENSION BY FREQUENCY

An electronic tensiometer is used to measure the vibration of the belt span and instantly it converts the vibration frequency into belt static tension. By measuring the natural frequency of the tensioned belt, the tension of the belt can be calculated.

To determine the status of the belt, the force obtained by the deflection or frequency methods should be compared with the values of tension forces recommended in the tables of the belt manufacturers.

Excessively small pulleys should be avoided; these cause shaft flexion as belt traction increases with the decrease of pulley size.

NOTE

When specific pulleys are required, contact WEG in order to insure a correct designing.

Due to the existing tensions on the belts, there is a reaction acting as radial load over the motor shaft end.

The data to calculate such reaction (radial force) are:

- Output transmitted [kW] (P);
- Motor speed [rpm] (RPM);
- Diameter of driven pulley [mm] (DPMV);
- Diameter of driver pulley [mm] (DPMT);
- Distance between centers [mm] (I);
- Friction coefficient [-] (MI) - (normally 0.5);
- Slip coefficient [-] (K);
- Belt contact angle on smaller pulley [rad] (alfa);
- Radial force applied to the shaft end [N] (FR).



$$\alpha = \pi - \left(\frac{DPMV - DPMT}{I} \right)$$

$$K = 1.1 \times \left[\frac{e^{(M \times \alpha)} + 1}{e^{(M \times \alpha)} - 1} \right]$$

$$FR = \frac{18836,25 \times N}{DPMT \times RPM} \times \sqrt{\frac{K^2 \times [1 - \cos(\alpha)] + 1.21 \times [1 + \cos(\alpha)]}{2}}$$

- Bearing axial clearance which is shown on the table below for each bearing size.
- Axial displacement of the driven machine, if any.
- Maximum axial clearance allowed by the coupling.

Table 5-3 – Standard clearances applied to sleeve bearings

Clearances applied to sleeve bearings for flameproof motors supplied by WEG	
Bearing size	Axial clearance in mm
9	3 + 3 = 6 ⁽¹⁾
11	
14	

(1) This is a standard value. Other values can be used according to the motor project.

The motor must be coupled in such a way that the arrow attached to the bearing frame be positioned exactly on the central mark while motor is in operation.

During motor starting or even under operation, rotor should move freely between the two external slots if the driven machine creates any axial force on the motor shaft. Under no circumstance, motor can operate continuously with axial force on the bearing.

NOTE
 This is a general calculation. Consult the belt's manufacturer for an accurate value.

NOTE
 Always use pulleys duly balanced. Avoid, in all cases, oversized keys as these can cause unbalancing. In case these instructions are not followed accordingly, vibration levels will occur.

5.1.5.4 COUPLING ARRANGEMENT FOR SLEEVE BEARING - AXIAL CLEARANCE

Motors fitted with sleeve bearings should be directly coupled to the driven machine or even using a gearbox. Pulley/belt coupling is not recommended.

These sleeve bearing motors have three identification marks on the shaft drive end. The central mark is the indication of the magnetic center; the other two outer marks indicate the allowable limits for the rotor axial displacement.

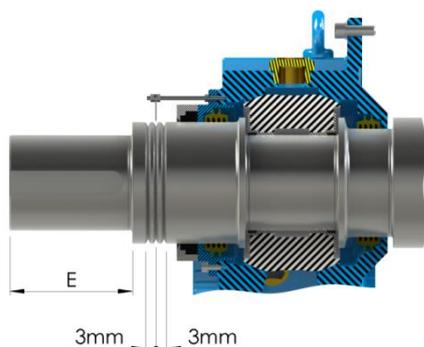


Figure 5-16 - Sleeve bearing shaft alignment

The Figure 5-16 shows part of the bearing frame where the arrow indicates the magnetic center and the three marks on the shaft.

When coupling the motor, the following aspects must be considered:

ATTENTION
 Rotor is not self aligned.

Sleeve bearings normally used by WEG are not designed to withstand axial forces continuously. The driven machine should have its axial end play limited as necessary to prevent applying any axial load to the motor sleeve bearings.

The Figure 5-17 shows part of the drive end bearing highlighting a basic configuration of the shaft/bearing set as well as axial clearances.

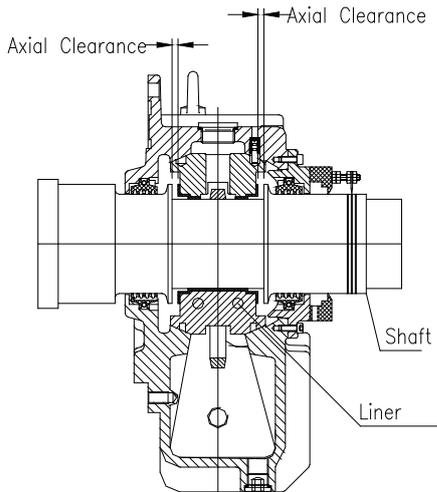


Figure 5-17 - Drive end sleeve bearing

5.1.6. COOLING

During installation, all cooling conditions should be considered. The recommended installation distance between air inlet into the motor and the wall should be at least ¼ of the air inlet diameter. A person should also be able to move between the motor and the wall to carry out cleaning services on the air inlet screen.

Machines that are cooled with ambient air, air inlet screens or tubes must be cleaned at regular intervals so as to ensure free passage of air. The warm air can not be sucked again by the motor.

- Vertically mounted motors with air inlet on top: the air opening must be protected by a proper cover so as to avoid dropping of foreign materials vertically into the motors.
- All protections provided for transportation and storage of the machine should be removed right before the installation.
- Considering that direct sun heat causes increase in temperature, externally installed motors should be always protected against weathering.
- A good housekeeping for ribs and tubes must be guaranteed to avoid dust or other corps deposition.

5.1.7. VIBRATION / BALANCE

All WEG motors and generators are dynamically balanced with half key;

They are balanced and are in conformity with vibration limits established by IEC 60034-14 standard (except when the purchasing agreement specified different values).

At factory, vibration measurements are performed on the drive and non-drive end bearings, vertically, horizontally and axially.

When a customer supplies the half coupling sleeve to WEG, the motor is balanced with this half sleeve mounted to the shaft. When this is not the case, based on the above standards motor is balanced with half key (that is, the key way is fulfilled with a piece of metal of identical width, thickness and height of the keyway).

The maximum allowable vibration levels recommended by WEG for motors in operation are according to ISO 10816-3 Standard. This standard classifies the support class as rigid: *if the lowest natural frequency of the combined machine and support system in the direction of measurement is higher than its main excitation frequency (this is in most cases the rotational speed/frequency) by at least 25% then the support system may be considered rigid in that direction. All other support systems may be considered flexible.*

The maximum allowable vibration levels recommended by WEG for motors in operation are given on the table below. These values are generic and serve as a guideline. Specific application conditions must be taken into consideration.

Table 5-4 - ISO 10816-3 vibration limits

Support class	Zone Boundary	Velocity (mm/s R.M.S.)	
		160mm < H < 315mm	H ≥ 315mm
Rigid	Alarm	3,5	5,5
	Trip	4,5	7,1
Flexible	Alarm	5,5	8,8
	Trip	7,1	11,0

Vibration causes most frequently found on the field are:

- Misalignment between motor and driven machine;
- Incorrect motor fastening to the base, with “loose shims” underneath one or more motor feet and studs incorrectly fastened;
- Improper base, or not firmly built;
- External vibrations caused by other equipment.

Operate the motor with vibration values above those described in the Table 5-4 can damage its lifetime and/or its performance.

5.1.8. SHAFT VIBRATION LIMITS

In motors equipped or foreseen for installation of proximitor sensor (normally used in sleeve bearing) the shaft surfaces are prepared with special finishing in the adjacent areas of the bearings, so as to ensure the correct shaft vibration measurement.

The shaft vibration in these motors is measured and must comply with IEC 60034-14 Standard.



The alarm and tripping values of the Table 5-5 represent values of permissible shaft vibration for coupled electric machines. These values are below ISO 7919-3 Standard.

They are generic values and serve as a guideline, where specific application conditions must be taken into consideration, mainly diametric clearance between shaft and bearing.

Table 5-5 - WEG limits for shaft vibration

Shaft vibration (μm peak to peak)				
Sleeve bearing size	Rated speed (rpm)			
	1800		3600	
	Alarm	Trip	Alarm	Trip
9-80	86	115	85	114
9-90	97	129	97	129
9-100	108	144	108	144
11-100	108	144	108	144
11-110	101	135	101	135
11-125	125	167	125	167
14-125	125	167	125	167
14-140	125	167	125	167
14-160	144	192	171	215
14-180	163	218	187	220

ATTENTION

Operate the motor with shaft vibration values close to alarm and tripping values can damage bearing liners.

The main reasons to cause increase of vibration are:

- Unbalance coupling problems and others that can affect the machine;
- Shaft manufacturing problems, which are minimized during the manufacturing;
- Residual voltage or magnetism on the shaft surface where measurement is made;
- Scratches, knocks or vibrations when finishing the shaft where measurement is made.

5.2. ELECTRICAL ASPECTS

5.2.1. POWER SUPPLY

Make sure the motor is connected to the correct power supply.

Proper electric power supply is very important. All the wires and protection system must ensure an excellent quality of electric power supply on the motor terminals.

The WEG motors are constructed in accordance with IEC 60034-1 and, unless otherwise stated on motor data-sheet, they are designed for a rated voltage of more or less than 10% in relation to rated value (zone “B” in Figure 5-18).

For rated frequency, a variation of 95% to 103% (zone “B”) is allowed.

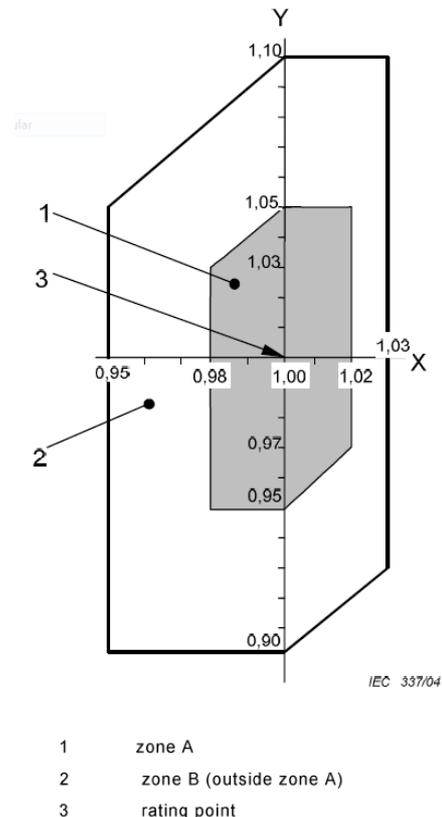


Figure 5-18 - Voltage and frequency variation limits (IEC 60034-1)

The motor must be able to perform its main function (supply torque) continuously at Zone A, but it does not have to fully meet its performance characteristics at rated voltage and frequency (refer to the point with rated characteristics in Figure 5-18), and it may present some deviations. The temperature rises values when the motor is working in the Zone A may be higher than those obtained at rated voltage and frequency.

The motor must also be able to perform its main function in Zone B, but it may present greater deviations of its performance at rated voltage and frequency than in Zone A. The temperature rises may be higher than those observed at rated voltage and frequency and, most likely, will be higher than those in Zone A.

Prolonged operation in the periphery of Zone B is not recommended.

For motors with increased safety terminal box, voltage and tolerances are limited by IEC/EN 60079-7 standard that imposes a maximum allowed voltage of $10\text{kV} \pm 10\%$.



5.2.2. CONNECTIONS

	<p>ATTENTION</p> <p>Analyze the electrical connection diagram supplied with the motor carefully before beginning the connection of the power, grounding and accessory cables.</p>
--	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Open the terminal box and check pertinent details, if required. Check if the rated voltage is the same as that given on the motor nameplate. Specify connection cables to meet motor rated current taking into consideration environment factors (such as ambient temperature, installation type, etc).

Supply cables must be selected for an ambient temperature of 80°C or above if indicated on a motor nameplate.

Make sure the cross section and insulation of connection cables are suitable for the motor current and voltage.

As standard, W22Xd motors are prepared in accordance with:

LOW VOLTAGE: $\leq 1,1kV$

Table 5-6 - Terminal box entry holes and cables cross section (Low voltage)

Terminal boxes with protection Ex d or Ex e		
Current	No. of entrance holes/Dimension	Máx. cables cross section ⁽¹⁾
$I \leq 900A$	2 x M63 x 1.5	300 mm ²
$900 < I \leq 1900A$	4 x M63 x 1.5	300 mm ²

⁽¹⁾ Armoured cable, XAV, Copper, etc.

MEDIUM VOLTAGE: $1,1 < U_n \leq 6,6kV$

Table 5-7 - Terminal box entry holes and cables cross section (Medium voltage)

Terminal boxes with protection Ex d or Ex e		
Current	No. of entry holes/Dimension	Máx. cables cross section ⁽¹⁾
$\leq 315A$	1 / M63x1.5	120 mm ²
$315 < I \leq 400A$	3 / M63x1.5	500 mm ²
$400 < I \leq 630A$	3 / M63x1.5	
$630 < I \leq 800A$	6 / M63x1.5	
$630 < I \leq 1260A$	6 / M63x1.5	

⁽¹⁾ Armoured cable, XAV, Copper, etc.



EX ATMOSPHERE INFORMATION

Pay attention to minimum insulation distance between terminals or clamps when making the connection in terminal boxes with protection Ex e.

Before closing the terminal box, make sure all terminal nuts and grounding connections are duly fastened. Also make sure that all lead outlets sealing that are certified are in perfect conditions and installed correctly.

EX ATMOSPHERE INFORMATION

Any opening not used must be closed with certified plugs accordingly to the motor certification.

5.2.4. PROTECTIONS

5.2.4.1 WINDINGS PROTECTIONS

As standard the Low Voltage motors are supplied with thermal protectors PTC, one per phase (triple set) connected in the main terminal box.

The Medium Voltage and High Voltage motors are supplied with temperature detectors Pt100, two per phase (3 wires) connected in the auxiliary terminal boxes, for just measurement of the temperature, or either, to monitor the temperature in overload case, sub-voltage or fan fail, etc.

Under request the motors can be supplied with temperature detectors with certification “Ex e” and/or “Ex i” connected to the auxiliary terminal box through the interior of the motor. The references of the respective certificates must be considered.

Table 5-10 - Windings thermal protections

Voltage	Type of protection	Number per phase
LV	PTC	1
MV	Pt100	2
HV	Pt100	2

5.2.4.2 BEARINGS PROTECTIONS

As standard the Medium and High voltage motors are supplied with one Pt100 per bearing (3 wires) connected in the auxiliary terminal box. Under request the motors can be equipped with temperature detectors with certification ATEX and/or IECEx with protection “Ex e” and/or “Ex i”. The thermal protectors are connected directly to the motor terminal boxes or to connection heads with ATEX and/or IECEx certification mounted in

the motor endshields. The references of the respective certificates must be considered.

EX ATMOSPHERE INFORMATION

When the motors are equipped with thermal protectors (Pt100, thermocouples) with Intrinsic Safety Protection (Ex i), the safety parameters of the measurement or monitoring system connected to these devices should be in accordance with the certificates of the thermal sensors and should have the same protection.

The connectors for intrinsic safety (Ex i) circuits are separated from the connectors of circuits which are not for intrinsic safety and are in blue color to be distinguished from the non intrinsic safety circuits.

When the motor is equipped with Intrinsic Security (Ex i) components, the input parameters of these components are supplied with the motor Instructions Manual, to define the Zener barrier of Intrinsic Safety Security.

The cables are taken from the motor terminal box to a temperature detector which must be installed in control panel.

When requested by the customer for special application conditions, motor can also be supplied with several thermal sensors for winding and/or bearing protections and others.

The temperature of the Pt100 calibrated resistance may be calculated with the formula given below:

$$T = \frac{R - 100}{0,385}$$

R = Resistance measured in the Pt100 in Ω (Ohm).

T = Temperature in °C.

WEG recommends the connection and control of all installed thermal probes. The maximum setting temperatures in W22Xd standard motors shall be as follows:

Table 5-11 - Temperature values for alarm and tripping

Component	Alarm	Tripping
Winding Rib-cooled motors	140°C	155°C
Winding Tube-cooled motors	130°C	140°C
Bearings	110°C	120°C
Sleeve Bearings	100°C	110°C

Alarm and tripping values can be defined based on the application, however, that can not exceed the above table.

**ATTENTION**

If required by the application, other protection devices than those given above may be installed.

**DANGER**

Any service on electric machines should only be carried out when it is completely stop and all phases disconnected from the power supply.

5.2.5. ADJUSTMENT OF MOTOR PROTECTION DEVICES**EX ATMOSPHERE INFORMATION**

Motor protection devices for explosive atmospheres must be always switched-on, and the adjustments should be done in accordance with standards EN/IEC 60079-14. If there is no other indication, motors are then designed for S1 service duty (continuous).

**EX ATMOSPHERE INFORMATION**

All protections, including the overcurrent ones, must be adjusted based on the rated motor conditions. This protection must also protect the motor in case of short-circuit (that is, in case of locked rotor).

Winding with Delta connection must be protected against single phase. To do that, connect the relay in series with the winding phases and adjust at 0.58 times the rated current.

**ATTENTION**

All winding and bearing protections must be always switched-on and correctly adjusted.

5.2.6. ELECTRIC CONNECTION CHECKING

- Check periodically if all connections and terminals inside the terminal box are firmly made;
- Check if leads passage in the terminal box, cable gland and terminal box sealing;
- Remove all dust and dirt from terminal box, if any.

6. MECHANICAL INSTALLATION CHECKING

- Check if all motor fixing bolts are duly fastened;
- Guarantee that flameproof joints are in good condition (perfectly clean without any deformation, scratches, marks, etc.) before closing terminal boxes covers, fixing gland plates and/or threading cable glands. Flameproof joints are protected against corrosion by grease application. Ensure that this film is kept after exposing a flameproof joint. See section 3.7.8;
- Check coupling eccentricity, measure axial and radial clearance and compare such values with maximum specified values;
- Measure machine vibration levels periodically and compare results with values given by Table 5-5.

**ATTENTION**

If motor will remain in stock for long periods of time without having the space heater switched-on, water inside the motor may become condensed.

**EX ATMOSPHERE INFORMATION**

Under request the motors may be equipped with certified drain and breather valves to avoid the accumulation of condensed water inside the motor.

6.1. SPACE HEATERS

When motors are fitted with space heaters to avoid water condensation during long periods of standstill, the space heaters must be connected so that they are energized immediately after the motor is switched-off and are de-energized immediately before the motor is switched-on. The values of the space heater supply voltage and power are informed in the connection diagram and in the specific plate affixed to the motor.



7. NOISE LEVEL

To ensure a low noise level operation, the source of noise must be identified and how such noise is transmitted through the ambient. The following motor components may generate noises within an audible range:

- Cooling system;
- Bearings;
- Magnetic circuit.

The noise level of an electric motor, however, depends mainly on its size, cooling system, speed and degree of mechanical protection (enclosure). Cooling system is airborne and usually affects only the noise level in the area where motor is installed. This noise level may be reduced by using mufflers. Noises caused by bearings or the magnetic circuit are originated from mechanical vibrations of individual parts or the motor set, and they are transmitted through the foundation, walls and machine cooling tubes. This type of noise can be reduced by installing the motor on suitable designed anti-vibration dampers. It is important to note that incorrect dampers may even increase vibrations.

8. MAINTENANCE

A well-programmed maintenance of electric motors can be summed up as a periodical inspection of insulation levels, temperature rise (winding and bearings), wears, bearing lubrication and useful life, occasional checking of fan air flow and vibration levels.

For a flameproof motor enclosure and flameproof joints condition, vigilance and external housekeeping must also be in the maintenance program.

In case one of the above items is not followed accordingly, unexpected stops of the equipment may occur. Inspection cycles depend on the type of the motor and conditions under which it operates.

Frame must be kept clean, free of dust, dirt or oil in order to make the cooling process easier.



ATTENTION

On any transportation, motors fitted with roller, angular contact ball bearings or sleeve bearings must have their shaft locked in order to avoid bearing damage.

To lock the shaft use the shaft locking device shipped together with the motor. See section 2.2.

8.1. CLEANLINESS

Motors should be kept clean, free of dust, dirt and oil. Soft brushes or clean cotton rags should be used to clean the motors. A jet of compressed air should be used to remove non-abrasive dust from the fan cover and any accumulated grime from the fan and cooling fins.

Oil or damp impregnated impurities can be removed with rags soaked in a suitable solvent.

The heat exchanger tubes (if any) must be kept clean and free of any obstructing object to facilitate the air circulation.

For the cleanliness of the tubes, a stick with a round brush at the ends can be used which, inserted in such tubes, remove all accumulated dirt. In order to affect this cleanliness, remove the DE noise suppressor and insert the stick with the brush into the tubes to remove all the accumulated dust. If necessary, remove also the fan cover.

Terminal boxes should also be cleaned; their terminals should be free of oxidation, in perfect mechanical condition, and all unused space dust-free.



EX ATMOSPHERE INFORMATION

Before perform any cleaning operation make sure that no potentially explosive atmosphere is present.

8.1.1. PARTIAL CLEANING

- Drain the condensed water.
- Clean the inside of the terminal boxes.
- Clean the ribs in the frame for ribbed cooled motors.
- Clean the heat exchanger for tube cooled motors.
- All flameproof joints, after have been exposed shall be covered with a corrosion inhibiting grease (guarantee that they are free of rust corrosion).

8.1.2. COMPLETE CLEANING

- Clean the dirty windings with a soft brush.
- Grease, oil and other impurities which adhered on the winding can be removed with a rag soaked in alcohol. Dry the windings with a jet of compressed air.
- A jet of compressed air should be used to clean the bearings and the air ducts in the stator and rotor cores.
- Drain the condensed water and clean the inside of the terminal boxes.
- Measure the insulation resistance (see Table 3-1).



- Clean the ribs in the frame for ribbed cooled motors.
- Clean the heat exchanger for tube cooled motors.
- All flameproof joints, after have been exposed shall be covered with a corrosion inhibiting grease (guarantee that they are free of rust corrosion).

 **DANGER**

In any circumstance, flameproof motors can be operated in a potentially explosive gas atmosphere with an external surface temperature above the certification limit (ex. T4)

 **DANGER**

In any circumstance, flameproof motors for mining can be operated in a potentially explosive atmosphere with an external surface temperature above 150 °C (on any surface where coal dust can form a layer) or 450° (where coal dust is not likely to form a layer).

 **DANGER**

In any circumstance, flameproof motors can be operated in a potentially explosive dust atmosphere with an external surface temperature above the certification limit (ex. T135°C).

 **ATTENTION**

Bearing temperature control is also part of routine maintenance. Max. absolute temperature shall not exceed 100°C (Absolute temperature = temperature rise + ambient temperature). For an ambient temperature of 40°C, the temperature rise of the bearings should not exceed 60K

Constant temperature control can be done by means of external thermometers or by embedded thermal elements.

 **ATTENTION**

Alarm and tripping temperatures for ball and roller bearings must be set for 110°C and 120°C respectively.

 **ATTENTION**

Alarm and tripping temperatures for sleeve bearings must be set for 100°C and 110°C respectively.

 **ATTENTION**

The alarm temperature should be set at 10°C above the working temperature, not exceeding the limit of 110°C.

8.2. LUBRICATION

8.2.1. GREASE LUBRICATED BEARINGS

The purpose of this maintenance is to lengthen bearing life.

Depending on the application, load, speed, temperature conditions and size, WEG motors may be supplied with antifriction bearings lubricated by grease.

Motor noise should be measured at regular intervals from one to four months in order evaluate the bearings conditon. A well-tuned ear is perfect capable of distinguishing unusual noises, even with rudimentary tools such as a screwdriver, etc. For a more reliable analysis of the bearings, sophisticated equipment is required.

WEG motors are normally supplied with grease lubricated ball or roller bearings.

Bearings should be lubricated to avoid metallic contact of the moving parts, and also for protection against corrosion and wear. In the course of time and due to mechanical operation there is deterioration of the lubricant properties and, furthermore, all lubricants are subject to contamination under working conditions. For this reason, lubricants must be renewed or replaced from time to time.

 **NOTE**

Protect the environment! The old grease shall be correctly disposal.



8.2.2. TYPE AND GREASE CHARACTERISTICS

For standard temperature range, WEG ribbed cooled motors, 2, 4 or more poles and tube cooled motors 2 poles are supplied with POLYREX EM 103 grease (Supplier: Esso).

Tube cooled motors of 4 poles and more are supplied with STABURAGS N12MF grease

(Supplier: Klüber), enough for the operating time period indicated on the data sheet and on the bearing identification nameplate. When the motors are to be applied in negative ambient temperatures they are supplied with grease AEROSHELL 22 (Supplier: Shell).

Characteristics of greases used on WEG motors:

Table 8-1 - Greases for motors with bearings.

GREASES FOR MOTORS WITH BEARINGS					
Supplier	Grease	Thickeners	Base oil	Temperature range (°C)	Application
Esso	Polyrex EM103	Polyurea	Mineral	-30 up to +170	Normal
Shell	Albida RL2	Lithium complex	Mineral	-20 up to +150	Normal
Klüber	Staburags N12MF	Sodium complex	Mineral	-10 up to +120	Normal
Shell	Aeroshell 22	Microgel	Sinthetic hydrocarbon	-65 up to +204	Low temp.
Klüber	Isoflex NBU 15	Barium Complex	Mineral + ester + Synthetic Hydrocarbon	-35 up to +90	High speed > 3600 rpm

ATTENTION

For correct lubrication, always use the type of lubricant indicated on the motor nameplate.

ATTENTION

The bearings data, amount of grease to use, type of grease and lubrication intervals are informed in the nameplate attached to the motor. We recommend the carefully verification of these data before carry out the bearings lubrication procedure.

8.2.3. LUBRICATION INTERVALS

Lubrication intervals depend on the motor speed, working temperature, type of grease used and working conditions.

The lubrication interval and type of bearings are indicated on the motor nameplate.

Operational safety of these motors will depend on the compliance of the lubrication intervals.

ATTENTION

Motors kept in stock should be relubricated every six months. Once each 2 moths, shaft must be rotated in order to have the grease homogenized.

ATTENTION

Lubrication intervals and amount of grease given in the tables below should only be taken as advisory information. For relubrication, follow the intervals and grease amounts indicated on the identification nameplate.



Lubrication intervals for horizontal mounted ribbed cooled and tube cooled motors (50Hz and 60Hz) operating at an ambient temperature range -20°C up to +40°C or -55°C up to +40°C are present in the Table 8-2.

Table 8-2 – Ball bearings lubrication intervals for horizontal mounting

BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
6314	2	4500	3200	26
6316	2	3600	2300	33
	4	4500	4500	
	6			
	8			
6318	2	2800	1700	41
6319	4	4500	4500	45
	6			
	8			
6322	4	4500	4500	60
	6			
	8			
6324	4	4500	4300	72
	6		4500	
	8			
6326	4	4500	3700	81
	6		4500	
	8			
6328	4	4500	3200	93
	6		4500	
	8			
6330	4	4100	2700	104
	6	4500	4500	
	8			
6332	4	3600	2300	116
	6	4500	4500	
	8			

As an option, horizontal motors can be equipped with roller bearings. Lubrication intervals for horizontal mounted ribbed cooled and tube cooled motors (50Hz and 60Hz) operating at an ambient temperature range -20°C up to +40°C or -55°C up to +40°C are present in the Table 8-3:

Table 8-3 – Roller bearings lubrication intervals for horizontal mounting

ROLLER BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
NU218	2	1200	1000	24
NU220	2	1000	-	31
NU319	4	3500	2500	45
	6	4500	4500	
	8			
NU322	4	2400	1600	60
	6	4500	3500	
	8		4500	
NU324	4	2000	1300	72
	6	3900	3000	
	8	4500	4500	
NU326	4	1700	1000	81
	6	3500	2600	
	8	4500	4000	
NU328	4	1400	1000	93
	6	3000	2200	
	8	4400	3500	

Lubrication intervals for horizontal mounted ribbed cooled and tube cooled motors (50Hz and 60Hz) with special mounting of two (2) bearings (one (1) roller bearing and one (1) ball bearing) operating at an ambient temperature range -20°C up to +40°C or -55°C up to +40°C are present in the Table 8-4:

Table 8-4 – Roller and Ball bearings lubrication intervals for horizontal mounting

ROLLER BEARING + BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
NU220+6020	2	1000	-	31+18
NU234+6034	4	1000	1000	81+55
	6	2600	1800	
	8	3900	3000	
NU238+6038	4	1000	1000	94+68
	6	2100	1400	
	8	3300	2500	
NU328+6328	4	1400	1000	93+93
	6	3000	2200	
	8	4400	3500	

Lubrication intervals for vertical mounted ribbed cooled motors (50Hz and 60Hz) operating at an ambient temperature range -20°C up to +40°C or -55°C up to +40°C are present in the Table 8-5 and Table 8-6:



Table 8-5 - Angular bearings lubrication intervals vertical mounting rib cooled motors

ANGULAR CONTACT BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
7316	2	1800	1100	33
7318	2	1400	1000	41
7319	4	4300	3300	45
	6	4500	4500	
	8			
7324	4	3000	2100	72
	6	4500	3900	
	8		4500	
7326	4	2600	1800	81
	6	4100	3500	
	8	4500	4500	
7328	4	2300	1600	93
	6	3800	3200	
	8	4500	4100	

Table 8-6 - Ball bearings lubrication intervals vertical mounting rib cooled motors

BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
6314	2	2300	1600	26
6316	2	1800	1100	33
	4	4500	4200	
	6		4500	
	8			
6318	2	1400	1000	41
6319	4	4300	3300	45
	6	4500	4500	
	8			
6322	4	3400	2500	60
	6	4500	4300	
	8		4500	
6324	4	3000	2100	72
	6	4500	3900	
	8	4500	4500	
6326	4	2600	1800	81
	6	4100	3500	
	8	4500	4500	
6328	4	2300	1600	93
	6	3800	3200	
	8	4500	4100	

Lubrication intervals for vertical mounted tube cooled motors (50Hz and 60Hz) operating at an ambient temperature range -20°C up to +40°C or -55°C up to +40°C are present in the Table 8-7 and Table 8-8:

Table 8-7 - Ball bearings lubrication intervals vertical mounting tube cooled motors

BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
6330	4	4100	2700	104
	6	4500	4500	
	8			
6332	4	3600	2300	116
	6	4500	4500	
	8			
6234	4	3900	2600	81
	6	4500	4500	
	8			
6238	4	3200	2000	81
	6	4500	4500	
	8			

Table 8-8 - Angular bearings lubrication intervals vertical mounting tube cooled motors

ANGULAR CONTACT BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
7328	4	4500	3200	93
	6	4500	4500	
	8			
7332	4	3600	2300	116
	6	4500	4500	
	8			
7234	4	3900	2600	81
	6	4500	4500	
	8			

8.2.4. LUBRICATION INTERVALS FOR HIGH TEMPERATURE

ATTENTION

Lubrication intervals and amount of grease given in the tables below should only be taken as advisory information. For relubrication, follow the intervals and grease amounts indicated on the identification nameplate.

Lubrication intervals for horizontal mounted ribbed cooled and tube cooled motors (50Hz and 60Hz) operating at an ambient temperature range -20°C up to +55°C are present in the Table 8-9:



Table 8-9 - Ball bearings lubrication intervals horizontal mounting

BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
6314	2	2300	1600	26
6316	2	1800	1100	33
	4	4500	4200	
	6		4500	
	8			
6318	2	1400	1000	41
6319	4	4300	3300	45
	6	4500	4500	
	8			
6322	4	3400	2500	60
	6	4500	4300	
	8		4500	
6324	4	3000	2100	72
	6	4500	3900	
	8		4500	
6326	4	2600	1800	81
	6	4100	3500	
	8	4500	4500	
6328	4	2300	1600	93
	6	3800	3200	
	8	4500	4100	

As an option, horizontal motors can be equipped with roller bearings. Lubrication intervals for horizontal mounted ribbed cooled and tube cooled motors (50Hz and 60Hz) operating at an ambient temperature range -20°C up to +55°C are present in the Table 8-10:

Table 8-10 - Roller bearings lubrication intervals horizontal mounting

ROLLER BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
NU218	2	1000	1000	24
NU220	2	1000	-	31
NU319	4	1700	1200	45
	6	2800	2300	
	8	3500	3100	
NU322	4	1200	1000	60
	6	2200	1700	
	8	2900	2500	
NU324	4	1000	1000	72
	6	1900	1500	
	8	2600	2200	
NU326	4	1000	1000	81
	6	1700	1300	
	8	2400	2000	
NU328	4	1000	1000	93
	6	1500	1100	
	8	2200	1700	

Lubrication intervals for horizontal mounted ribbed cooled and tube cooled motors (50Hz and 60Hz) with special mounting of two (2) bearings (one (1) roller bearing and one (1) ball bearing) operating at an ambient temperature range -20°C up to +55°C are present in the Table 8-11:

Table 8-11 – Roller and Ball bearings lubrication intervals horizontal mounting

ROLLER BEARING + BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
NU220+6020	2	1000	-	31+18
NU234+6034	4	1000	1000	81+55
	6	1300	1000	
	8	1900	1500	
NU238+6038	4	1000	1000	94+68
	6			
	8	1600	1200	
NU328+6328	4	1000	1000	93+93
	6	1500	1100	
	8	2200	1700	

Lubrication intervals for vertical mounted ribbed cooled motors (50Hz and 60Hz) operating at an ambient temperature range -20°C up to +55°C are present in the Table 8-12 and Table 8-13:

Table 8-12 - Angular bearings lubrication intervals vertical mounting rib cooled motors

ANGULAR CONTACT BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
7316	2	1000	1000	33
7318	2	1000	1000	41
7319	4	2100	1600	45
	6	2800	2600	
	8	3100	3000	
7324	4	1500	1000	72
	6	2200	1900	
	8	2600	2400	
7326	4	1300	1000	81
	6	2000	1700	
	8	2500	2200	
7328	4	1100	1000	93
	6	1900	1600	
	8	2300	2000	



Table 8-13 - Ball bearings lubrication intervals vertical mounting rib cooled motors

BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
6314	2	1100	1000	26
6316	2	1000	1000	33
	4	2600	2100	
	6	3200	3000	
	8	3500	3300	
6318	2	1000	1000	41
6319	4	2100	1600	45
	6	2800	2600	
	8	3100	3000	
6322	4	1700	1200	60
	6	2400	2100	
	8	2800	2600	
6324	4	1500	1000	72
	6	2200	1900	
	8	2600	2400	
6326	4	1300	1000	81
	6	2000	1700	
	8	2500	2200	
6328	4	1100	1000	93
	6	1900	1600	
	8	2300	2000	

Lubrication intervals for vertical mounted tube cooled motors (50Hz and 60Hz) operating at an ambient temperature range -20°C up to +55°C are present in the Table 8-14 and Table 8-15:

Table 8-14 - Angular bearings lubrication intervals vertical mounting tube cooled motors

ANGULAR CONTACT BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
7328	4	2300	1600	93
	6	3800	3200	
	8	4500	4100	
7332	4	1800	1100	116
	6	3200	2600	
	8	4100	3500	
7234	4	1900	1300	81
	6	3400	2800	
	8	4300	3700	

Table 8-15 - Ball bearings lubrication intervals vertical mounting tube cooled motors

BALL BEARING				
Bearing	Poles	Operating Hours (h)		Grease Quantity (g)
		50Hz	60Hz	
6330	4	2000	1300	104
	6	3500	2800	
	8	4400	3800	
6332	4	1800	1100	116
	6	3200	2600	
	8	4100	3500	
6234	4	1900	1300	81
	6	3400	2800	
	8	4300	3700	
6238	4	1600	1000	81
	6	2900	2300	
	8	3800	3300	

For motors working in ambient temperatures between -20°C and +60°C, a derating factor of 0.8 must be applied to the values indicated in the Table 8-9 to Table 8-15.

8.2.5. QUALITY AND QUANTITY OF GREASE

The relubrication can only be made with compatible grease and in the amount indicated on the motor nameplate as lacking of grease or excessive grease affects the bearings.

Excessive grease causes overheating due to high resistance caused by rotating parts resulting in damage to grease properties.

Additionally, excess of grease may cause leakage with the grease penetrating into the motor winding.

ATTENTION
Use only the type and quantity of grease indicated on the motor nameplate.

8.2.6. COMPATIBILITY

The incompatibility of different types of grease can create occasional problems. When the properties of the mixture remain within the individual property range of the greases, we can say the greases are compatible.

To avoid any possible incompatibility grease problem, we recommend performing an appropriate lubrication which can be summarized as follows: after removing the old grease and carrying out a complete cleanliness of the grease cavity, new grease must be pumped in. When this procedure is not allowed, pump in new grease by pressure. This must be repeated until new grease is drained out through the grease relief.



As a general rule, greases with the same thickener type are compatible, but depending of the mixing proportion, may be incompatible. Therefore, is not recommended mixing different types of grease, without first consulting the grease supplier and/or WEG. The following tables show the compatibility results relating the structural stability of the greases mixture. It should be used carefully considering its

limitations. True compatibility of greases is also affected by the operation conditions.

Same and basic oils can not be mixed as they will not produce a homogeneous mixture. In this case, either a hardening or a softening (or drop of the resulting mixture melting point) can occur.

Table 8-16 – Generic miscibility of base oils

Thickener	Lithium	Lithium complex	Aluminum complex	Barium complex	Calcium complex	Bentonite	Polyurea	Clay
Lithium		C	I	C	I	C	C	I
Lithium complex	C		C	M	I	C	M	I
Aluminum complex	I	C		C	M	I	C	-
Barium complex	C	M	C		M	C	C	-
Calcium complex	I	I	M	M		M	M	M
Bentonite	C	C	I	C	M		C	M
Polyurea	C	M	C	C	M	C		I
Clay	I	I	-	-	M	M	I	
C: Compatible			M: Moderately Compatible (Consult grease supplier or WEG)			I: Incompatible		

Table 8-17 – Generic miscibility of thickeners (Base oils should be miscible).

Oil	Mineral	Synthetic	Ester	Polyglycol	Silicone (methyl)	Perfluoro-alkylether	Silicone (Phenyl)	Polyphenylether
Mineral		C	C	I	I	I	M	C
Synthetic	C		C	I	I	I	I	C
Ester	C	C		C	I	I	C	C
Polyglycol	I	I	C		I	I	I	I
Silicone (methyl)	I	I	I	I		I	M	I
Perfluoro-alkylether	I	I	I	I	I		I	I
Silicone (Phenyl)	M	I	C	I	M	I		C
Polyphenylether	C	C	C	I	I	I	C	
C: Compatible			M: Moderately Compatible (Consult grease supplier or WEG)			I: Incompatible		



8.2.7. LUBRICATING INSTRUCTIONS

The lubrication system was designed to allow, when regreasing, the removal of all grease from the bearings races through a grease relief which at the same time avoid the entry of dust or other contaminants harmful to the bearing.

This grease relief also avoids injury to the bearings from the already known problem of over-greasing. It is advisable to relubricate while the motor is running so as to allow the renewal of grease in the bearings housing.

If this procedure is not possible due to existing parts near to the nipple (pulleys, etc), which can be harmful to the operator, the following procedure should be followed:

- Inject about half the estimated amount of grease and run the motor at full speed for approximately one minute;
- Switch off the motor and inject the remaining grease.

As a rule, motors should be greased with the motor in operation. Otherwise, the grease, instead of going through the bearing area, will penetrate into the motor through the internal seal of the bearing housing.

NOTE
Grease fittings and surrounding areas must be clean before greasing the motor in order to avoid entry of any foreign bodies into the bearing.

For lubrication, use only a manual grease gun.

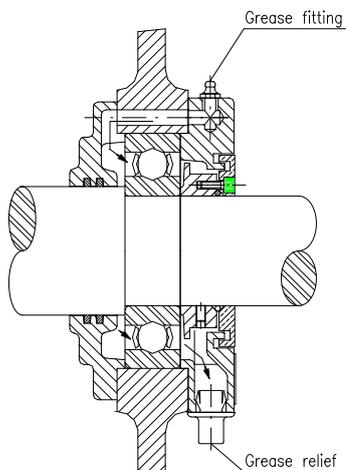


Figure 8-1 - Bearings and lubrication system

8.2.8. BEARING LUBRICATION STEPS

1. Remove the grease relief cover, if any;
2. Clean the area around the grease fitting using a clean cotton fabric;

EX ATMOSPHERE INFORMATION
Be sure that the material used for the cleaning operation does not create dangerous static electricity buildup.

3. With the motor running, add the amount of grease indicated on the motor nameplate;
4. Leave the motor running for 1 to 2 hours to allow drain of the excess of grease. Replace the grease relief fitting, if any;
5. During lubrication, increase in bearing temperature may be noticed. However, after one hour of operation, motor should achieve normal operating temperature. See Figure below.
6. Check bearing temperature to make sure there has not been any major variation.

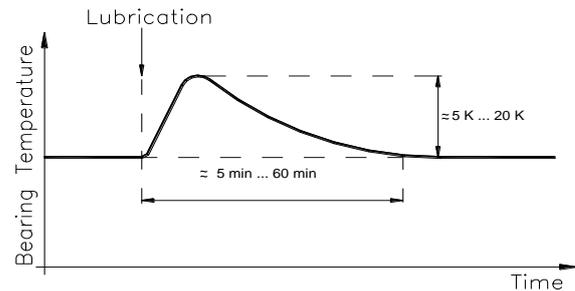


Figure 8-2 - Bearing temperature



8.2.9. AUTOMATIC LUBRICATION

When requested, bearing regreasing intervals can be extended using automatic lubricators. These shall be mounted near the bearing itself and automatically provide the grease substitution. They are certified to be used in hazardous areas (ATEX/IECEX approvals Ex ia for Gas, Dust and Mines) with ambient temperatures from -20 to +60 °C. Automatic lubricators for rolling bearings shall be mounted on the machine frame and activated at start up following the instructions:

1. Clean the lube-point;
2. Completely fill up grease feeding line to bearing by pumping (with the same grease contained in the unit or with a compatible one);
3. Remove the protection cover of the lubricator and attach the control unit;
4. Activate the lubricator by screw the control unit onto lubricator unit;
5. Select the time setting on the number corresponding to dispense time (see lubrication plate or data-sheet) from 1 to 12 months;
6. Write activation/exchange date on the lubricator unit label;
7. Clean the lube-point;
8. Attach the new unit hand tight;
9. Is recommended to check the general condition of the bearing and lubricator operation every quarter of the dispense time.



ATTENTION

Effective emptying time must not exceed 12 months.



ATTENTION

Maximum storage time lasts for 2 years from the production date printed on the lubricator.

Recommended storage temperature is 20 °C.



Figure 8-3 - Automatic lubricator



8.2.10. SLEEVE BEARINGS

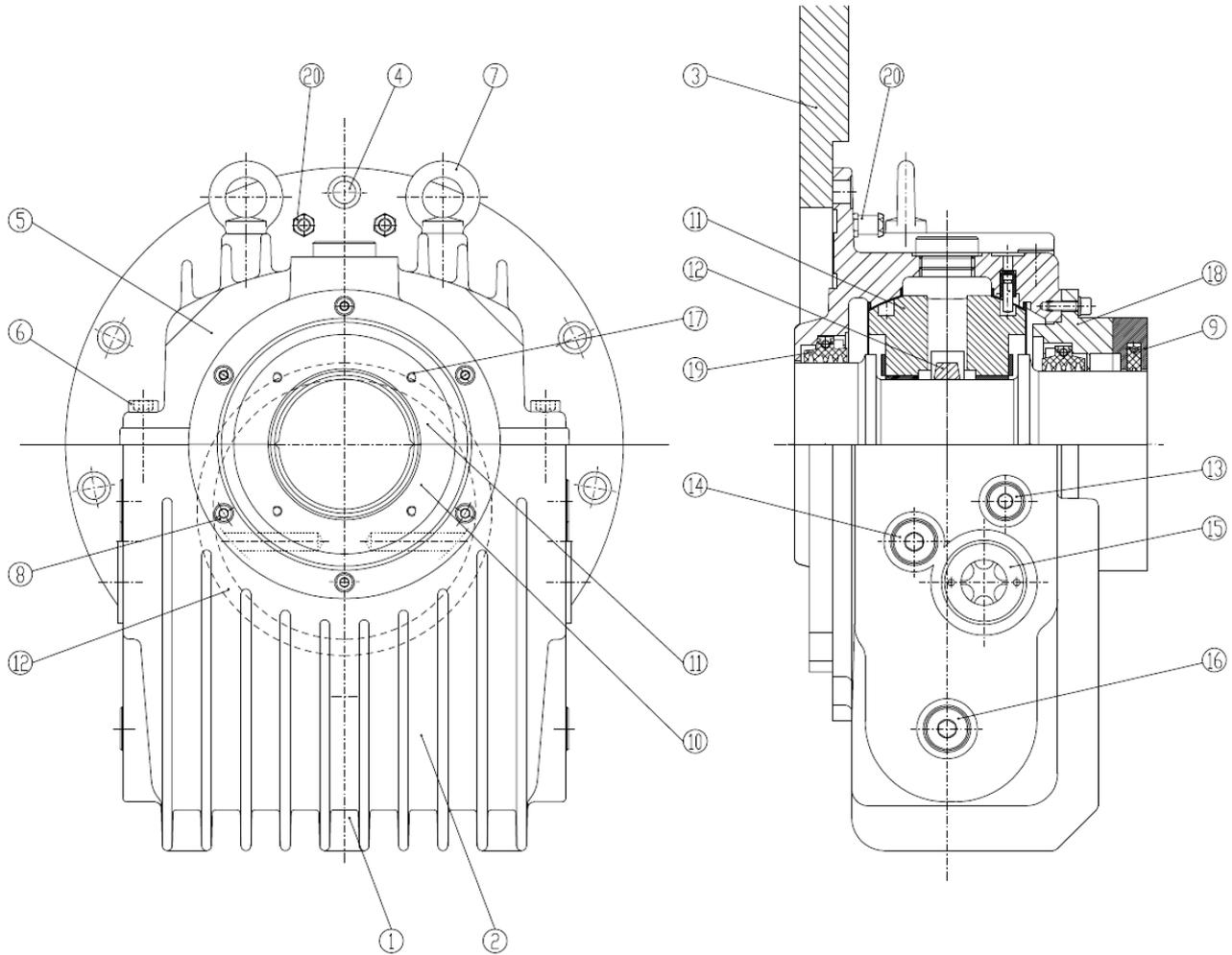


Figure 8-4 - Sleeve bearing assembly

- | | |
|-----------------------------------------|--------------------------------------------------------------|
| 1) Drain plug; | 12) Oil ring; |
| 2) Bottom half of the bearing housing; | 13) Oil inlet; |
| 3) Motor endshield; | 14) Connection for temperature sensor; |
| 4) Fixing bolts; | 15) Oil sight glass or oil outlet for circulating oil system |
| 5) Top half of the bearing housing; | 16) Tapped hole for oil sump temperature measurement; |
| 6) Bearing housing cap split line bolt; | 17) Stationary baffle bolt; |
| 7) Lifting eyebolt; | 18) Labyrinth seal carrier (outboard); |
| 8) External cover bolts; | 19) Labyrinth seal carrier (inboard) – bearing – housing; |
| 9) External cover; | 20) Breathing device (Ex certified). |
| 10) Bearing liner – bottom half; | |
| 11) Bearing liner – top half; | |



8.2.10.1 GENERAL INSTRUCTIONS

Sleeve bearing performance is dependent on proper installation, lubrication and maintenance. Before assembling the bearing carefully read all instructions contained herein to become familiar with the complete bearing assembly procedure.

A proper maintenance of sleeve bearings includes periodical checking of the level and actual condition of the lubricating oil, checking of noise level and vibration of the bearings, follow-up of the operating temperature, and fastening of the fixing and assembly bolts. The frame must be kept clean, free from dust, oil and dirt to facilitate cooling system.

Threaded holes for connecting the thermometer, oil sight glass, oil inlet, and immersion heater, or cooling coil (for oil sump thermometer or circulating pump with adapter) are provided on either side, so that all connections can be made on the right or left side of the bearing housing as required.

The oil drain plug is located centrally on the underside of the bearing housing.

In case of circulating oil lubrication, the outlet connection should be screwed into the threaded hole of an oil sight glass.

If the bearing is electrically insulated, the spherical liner seat surfaces in the housing are lined with a non-conducting material.

Do not remove this lining.

The antirotation pin is also insulated and the shaft seals are manufactured from a special non-conducting material.

Temperature monitoring instruments with contact to the bearing liner should be insulated appropriately (i.e., insulated protection tubes, synthetic fittings, etc.)

Water-cooled bearings are provided with the cooling coil installed. Care must be taken to protect the connections from damage when handling the housing prior to installation.

	DANGER
	Do not remove the breathing devices (20) when the motor is in operation.

8.2.10.2 OIL TYPE AND CHARACTERISTICS

Table 8-18 - Oil specification and characteristics

Polarity	Lubricant Specification	Viscosity Range	
		ISO 40°C [cSt]	SSU 100°F [s]
2 poles	Mineral oil ISO VG32	28.8 – 35.2	137 – 164
4+ poles	Mineral oil ISO VG46	41.4 – 50.6	193 – 235

8.2.10.3 DISASSEMBLY OF THE SLEEVE BEARING SYSTEM (TYPE "EF")

To disassemble the bearing liner and all associated parts from the bearing housing, carry out the following instructions. Carefully store all disassembled parts in a safe location (see Figure 8-4)

Drive end side:

- Thoroughly clean the exterior of the bearing housing. Loosen and remove the oil drain plug (1) at the bottom of the bearing housing. Drain the oil from the bearing housing.
- Loosen and remove the bolts (4) that connect the top half of the bearing housing (5) to the motor frame cover (3).
- Loosen and remove the bolts (6) that join the top and bottom half of the bearing housing (2 and 5).
- Use the lifting eyebolts (7) to lift (by hand or hoist) the top half of bearing housing (5) straight up, so that the cap is completely disengaged from the lower halves of the stationary baffle (9) labyrinth seals, labyrinth seal carrier (18) , and the bearing liner (10).
- Pull the top bearing housing forward out of and away from the bearing area. Loosen and remove the bolts (17) securing the top half of the stationary baffle. Loosen and remove the bolts (8) securing the upper half of the seal carrier (18).
- Lift (by hand or hoist) the upper half of the bearing liner (11) and remove it.
- Loosen and remove the bolts at the split line of the oil ring (12). Carefully disengage the dowels holding the oil ring halves together and remove the oil ring.
- Remove the garter springs that encircle the labyrinth seals and remove the top half of each seal. Rotate the bottom half of each seal out of the grooves in the seal carrier and bearing housing and remove them.
- Disconnect and remove RTD's, thermocouples, or any other temperature detecting instruments that enter the lower half of the bearing liner.
- Using a hoist or jack, raise the shaft slightly so that the lower half of the bearing liner can be rolled out of the bearing housing.



ATTENTION

To make that feasible it is necessary that bolts 4 and 6 of the other bearing half be loose.

- Roll out (be careful not to use excessive force) the lower half of the bearing liner and remove it.



ATTENTION

By using either a chain block or a jack, raise the end of the rotor at which the work is being done approximately 0.1 to 0.3mm so as to remove the weight from the bottom half of the bearing and not damage the flameproof labyriths.

- Loosen and remove the bolts (17) securing the bottom half of the stationary baffle (9) to the seal carrier. Loosen and remove the bolts (8) securing the bottom half of the seal carrier (18) to the bearing housing. Remove the seal carrier.
- Loosen and remove the bolts (4). Remove the bottom bearing housing (2).
- Remove the frame cover (3).
- Thoroughly clean and inspect all individual parts which have been removed. Clean the interior of the bearing housing.
- To reassemble the bearing system, follow the preceding instructions in the reverse order.



NOTE

Fastening torque of the bearing fixing bolts to the motor = 10 Kgfm.

Non drive end side:

- Thoroughly clean the exterior of the bearing housing. Loosen and remove the oil drain plug (1) at the bottom of the bearing housing. Drain the oil from the bearing housing.
- Loosen and remove the bolts (17) and remove the external cover (9).
- Loosen and remove the bolts (4) that fix the top bearing housing (5) to the motor frame cover (3).
- Loosen and remove the bolts (6) that join the top and bottom half of the bearing housing (2 and 5).
- Use the lifting eyebolts (7) to lift (by hand or hoist) the top half of the bearing housing (5) straight up, that the cap is completely disengaged from the lower halves of the bottom bearing housing (2) and the bearing liner (10).
- Lift (by hand or hoist) the top half of the bearing liner (11) and remove it.
- Loosen and remove the bolts at the split line of the oil ring (12). Carefully disengage the dowels

holding the oil ring halves together and remove the oil ring.

- Remove the garter spring that encircles the labyrinth seal. Remove the top half of the seal, then rotate the bottom half of the seal out the groove in the bearing housing and remove it.
- Disconnect and remove RTD's, thermocouples, or any other temperature detecting instruments that enter the lower half of the bearing liner.
- Using a hoist or jack, raise the shaft slightly so that the lower half of the bearing liner (10) can be rolled out of the bearing housing.
- Roll out (be careful not to use excessive force) the bottom half of the bearing liner (10) and remove it.



ATTENTION

By using either a chain block or a jack, raise the end of the rotor at which the work is being done approximately 0.1 to 0.3mm so as to remove the weight from the bottom half of the bearing and not damage the flameproof labyriths.

- Loosen and remove the bolts (4) and remove the bottom bearing housing (2).
- Remove the motor frame cover (3).
- Thoroughly clean and inspect all individual parts which have been removed. Clean the interior of the bearing housing.

To reassemble the Bearing System, follow the preceding instructions in the reverse order.



NOTE

Fastening torque of the bearing fixing bolts to the motor = 10 Kgfm.

8.2.10.4 SLEEVE BEARING ASSEMBLY

Check contact face and mounting recess of the bracket making sure it is clean and properly machined. Inspect shaft to ensure it is smooth (R_a 0.4, equivalent to 32 micro-inch finish, or better), within the dimensions and tolerances given by the bearing manufacturer and is free of burr or any rough spots.

After removing the upper part of the housing (2) and the bearing liner (10 and 11) the interior of the housing and the running surfaces of the liner are to be cleaned thoroughly and checked for any damage caused in transit.

With the shaft slightly, locate the bearing base into the mounting recess of the machine end shield and bolt into position.

Apply oil to spherical seats in the housing base and the shaft and rotate the bottom liner half (10) into position. Special care must be taken so that the



axial surfaces of the locating bearing are not damaged.

After the split faces of the bottom liner half and the housing base are aligned, lower the shaft into place. With a slight hammer blow against the housing base settle the liner into its seating so that the liner axis and shaft axis are parallel. The slight hammer blow produces a high frequency vibration which reduces the static friction between the liner and the housing and allows the correct adjustment of the liner. The self-alignment feature of the bearing is to compensate for normal shaft deflection during the assembling procedure only.

The loose oil ring is installed next. The ring must be handled with special care as safe operation of the bearing is also dependent on the effective and safe functioning of the oil ring. The bolts must be tightly fastened. Split misalignment must be avoided and any burrs or edges carefully removed in order to ensure smooth running of the ring. In any maintenance care must be taken that the ring is not distorted and its geometrical shape is maintained.

The outside of the two liner halves is stamped with identification numbers or marks near the split line. Make sure that these marks align and the split faces are clean when placing the top liner half into position. Incorrect fitting may lead to heavy damage to the bearing liners.

Check to ensure that the loose oil ring can still rotate freely on the shaft. With the top liner half in place, install the seal on the flange side (see paragraph "Shaft Seals").

After coating the split faces with a non-hardening sealing compound, place the housing cap into position. Care must be taken that the seal fits properly into the groove. Ensure also that the anti-rotation pin is seated without any contact with the corresponding hole in the liner.



ATTENTION
Housing or liner may be interchanged as complete assemblies only. Individual halves are not interchangeable.

8.2.10.5 SETTING OF THERMAL PROTECTIONS (PT100)

Each bearing is fitted with a Pt100 temperature detector installed directly in the bearing liner near the point where the load is applied. This device must be connected to a controlling panel with the purpose of detecting overheating and protect the bearing when operating under high temperature.



ATTENTION
Alarm and tripping temperatures for bearings system must be set for 110°C and 120°C respectively.



ATTENTION
The alarm temperature should be set at 10°C above the working temperature, not exceeding the limit of 110°C.

8.2.10.6 WATER COOLING SYSTEM

When using water cooling system, the oil reservoir at the bearing is equipped with cooling coils through which the water circulates. This circulating water must present at the bearing inlet a temperature smaller or equal to the ambient temperature in order to make the cooling possible.

The water pressure must be 0.1 bars and the water flow must be 0.7 L/s. The pH must be neutral.



ATTENTION
When connecting the cooling coils, leaks in or on the bearings housing and oil reservoir must be avoided so that lubricating oil is not contaminated.

8.2.10.7 LUBRICATION

SELF LUBRICATED BEARINGS

Oil change - The change of the oil in the bearings should be made according to the table below, referring the bearing working temperature:

Table 8-19 - Oil change intervals and quantity

Bearing size	Lubrication interval (hours)	Oil quantity (liters)
9	8000	2.8
11		4.2
14		8

FORCED LUBRICATION (EXTERNAL) BEARINGS

The change of the oil in the bearings should be made every **20,000 working hours**, or whenever the lubricant present alterations in its characteristics. The viscosity and pH of the oil should be periodically verified.



NOTE

Oil level must be checked daily which must be kept approximately at the center of the oil level sight glass.

The bearing must be filled with the prescribed type of oil through the oil port after removing the pipe plug.

All holes and threads not used must be closed by pipe plugs. Also check all connections for oil leaks.

Filling the bearing with lubricant beyond the middle of the oil sight glass (II) does not impair the function of the bearing, but there is a possibility that excess oil may leak out through the shaft seals.

ATTENTION

The cares taken with bearing lubrication will determine the life for such bearings as well as the assurance of motor operation. For this reason, it is essential to follow these recommendations:

- The oil selected must have a viscosity suitable for the bearing operating temperature. This must be checked during eventual oil change or during periodical maintenances.
- If the bearing is filled with oil below the required oil level, or if the oil level is not checked periodically, insufficient lubrication may lead to damage to the bearing liner. The minimum oil level is reached when the oil can just be seen in the oil sight glass when the machine is not in operation.

8.2.10.8 SHAFT SEALS

The two halves of the floating labyrinth seal are held together by a garter spring. They must be inserted into the groove of the carrier ring in such a way that the stop pin is always in the corresponding recess in the upper half of the housing or carrier ring. Incorrect installation destroys the seal.

The seal is to be carefully cleaned and coated with a non-hardening sealing compound on the faces in contact with the grooves. The drain holes in the lower part of the seal must be clean and remove obstruction. When installing the bottom half of the seal, press it lightly against the underside of the shaft.

8.2.10.9 OPERATION

The operation of motors fitted with sleeve bearings is similar to motors fitted with roller bearings.

It is recommended that the oil circulating system is carefully accompanied during the first hours of operation.

Before the start-up, check the following:

- If the oil used has been prescribed accordingly.
- Characteristics of the lubricating oil.
- Oil level.
- Alarm and tripping off temperatures set for the bearings.

During the first start-up, check for vibrations or noises. In case bearing operation is not quiet and not uniform, motor should be stopped.

Motor must operate for several hours until the bearing temperature is fixed within the limits previously indicated. If a temperature overheating occurs, motor must be stopped immediately and the temperatures detectors checked.

When bearing operating temperature is reached check for any oil leakage by the plugs joints or by the shaft end.

8.3. AIR GAP CHECKING

As an optional feature, W22Xd motors can have access entries to perform air gap checking. Measure the air gap in all rotor poles in four equidistant points of the stator (e.g. 45°, 135°, 210° and 330°).

The difference between the air gap measured in two points diametrically opposed must be less than 10% of the average air gap.

8.4. PARTIAL DISCHARGE MONITORING

In case of motors equipped with partial discharge monitoring, the terminal box contains the BNC jacks/terminal board for sampling with Iris portable equipment TGA-B (not in WEG scope of supply) indicated in the identification plate with the following design:

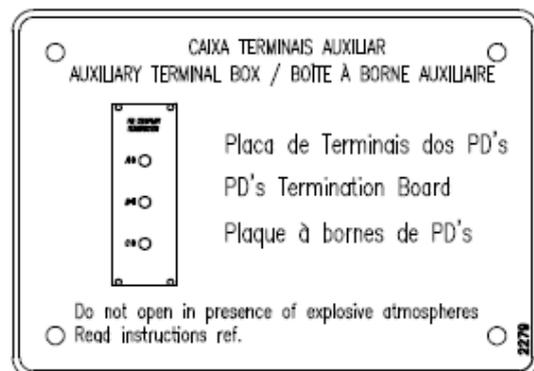


Figure 8-5 – Terminal box identification plate sample



After identifying the correct terminal box as described above please ensure that gas or vapour is not present and is not expected to be present, in quantities which may give rise to flammable concentrations, during the sampling period. All work shall follow the safety measures described on IEC60079-14 (See below extract - Safety Measures for Explosive Gas Atmospheres) and other applicable local standards or guidelines.

STEPS FOR REMOVE THE TERMINAL BOX COVER

If all the above conditions are met please proceed as below:

1. Loose the below highlighted fixing bolts (See Figure 8-6 left), and set safely aside for later use.
2. Remove the terminal box cover (See Figure 8-6 right), and set safely aside for later use.
3. Proceed with sampling following the instructions described in IRIS portable equipment manual.
4. After sampling the removed terminal box cover shall be placed again to respect the respective enclosure certification. If necessary apply the corrosion protection grease in machined joints.
5. Fasten fixing bolts according with the tightening torques indicated in this section on Table 8-20.

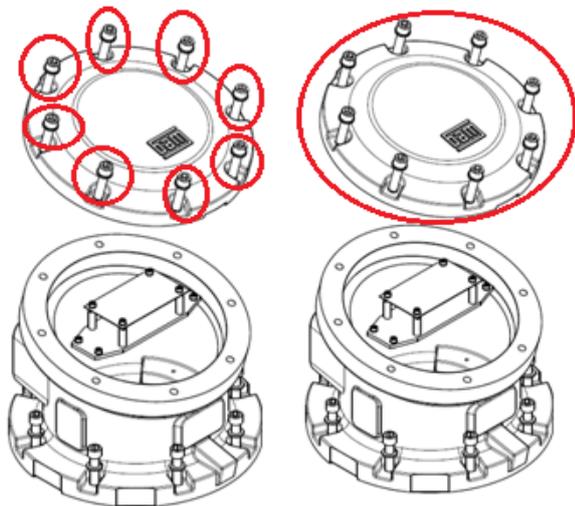


Figure 8-6 – Disassembly of terminal box cover

SAFETY MEASURES FOR EXPLOSIVE GAS ATMOSPHERES

A safe work procedure should be implemented to permit ignition sources to be used in a hazardous area under prescribed conditions.

A safe work permit should be issued when a specific location has been assessed to ensure that gas or vapour is not present and is not expected to

be present, in quantities which may give rise to flammable concentrations, during a specified period. The permit should prescribe continuous or periodic gas monitoring and/or detailed actions to be taken in the event of a release.

CONSIDERATIONS FOR THE ISSUE OF A SAFE WORK PERMIT MAY INCLUDE

- Specifying the start date/time of the permit,
- Defining the location of the activity,
- Specifying the nature of the permitted activity (e.g. Diesel generator, drilling),
- Taking and possible recording measurements to confirm the absence of an ignitable concentration of any flammable gas or vapour,
- Specifying sampling requirements to confirm the continued absence of a flammable gas or vapour,
- Control of possible flammable gas or liquid sources,
- Specifying contingency plans for emergencies,
- Specifying the expiry date/time out of the permit.



ATTENTION

All of these operations shall only be carried out by trained personnel as per IEC60079-14 and other applicable local standards or guidelines.

8.5. MOTORS WITH INTERNAL BEARING TEMPERATURE PROBES

When motor is equipped with total internal bearing temperature probes, the internal connections are as indicated in Figure 8-7.

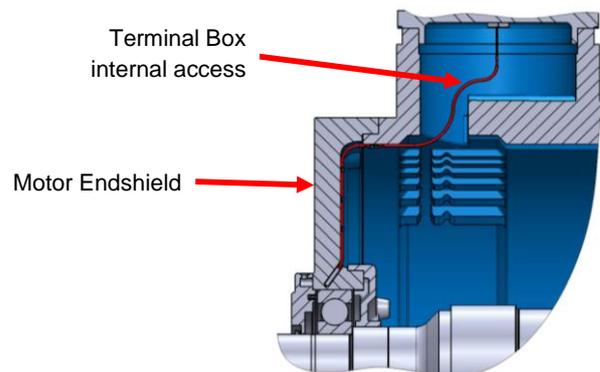


Figure 8-7 - Internal bearing temperature probes

Before removing the endshields it becomes necessary to disconnect the probes, in order to avoid the rupture of the bearing probe cable.



STEPS FOR REMOVING THE ENDSHIELD

Pull the endshield slightly and carefully (see Figure 8-8).

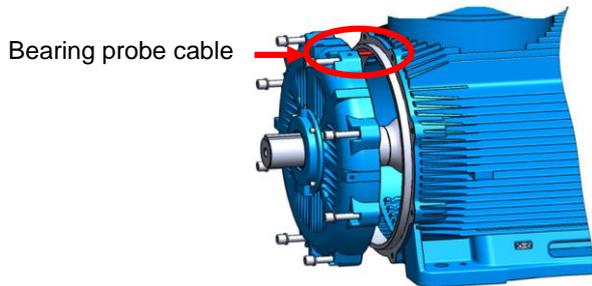


Figure 8-8 - Removing endshield

8.5.1. STANDARD SOLUTION

1. Pull the bearing probe cable until the connecting point.
2. Disconnect the both sides of the connector
3. Remove the endshield completely.

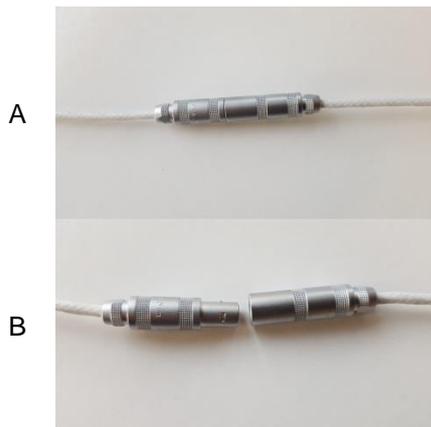


Figure 8-9 – Disconnecting the connector

RE-ASSEMBLY THE ENDSHIELD

When proceeding to the re-assembly, care must be taken with the re-connection of the connectors.

1. Connect both sides of the connector.

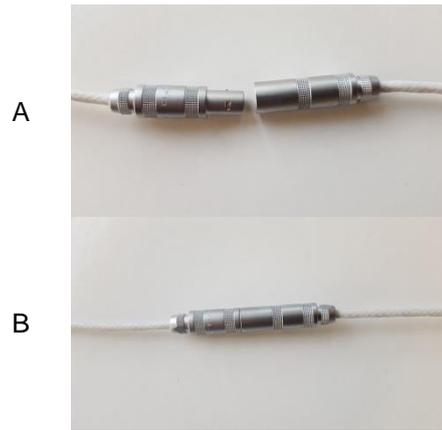


Figure 8-10 – Reconnecting the connectors

2. Complete the endshield assembly.

8.5.2. OPTIONAL SOLUTION

1. Pull the bearing probe cable until the connecting point.
2. Remove the silicone protection sleeve, the Kapton® tape and split the two sides of the terminal.
3. Remove the endshield completely.

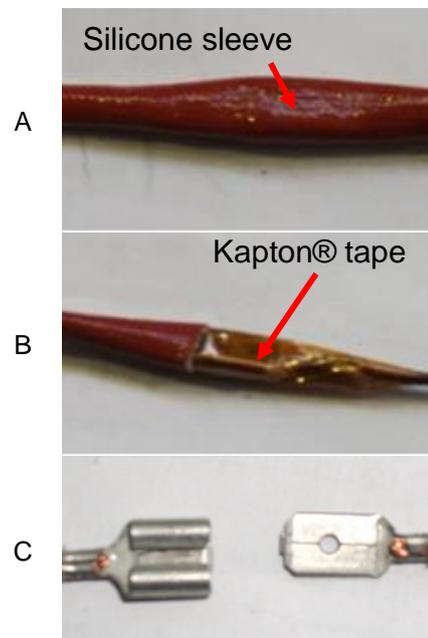


Figure 8-11 – Disconnecting the terminal

RE-ASSEMBLY THE ENDSHIELD

When proceeding to the re-assembly, care must be taken with the re-connection of the terminals.

1. Connect both sides of the terminal.
2. Insulate the connection with two layers of Kapton® tape

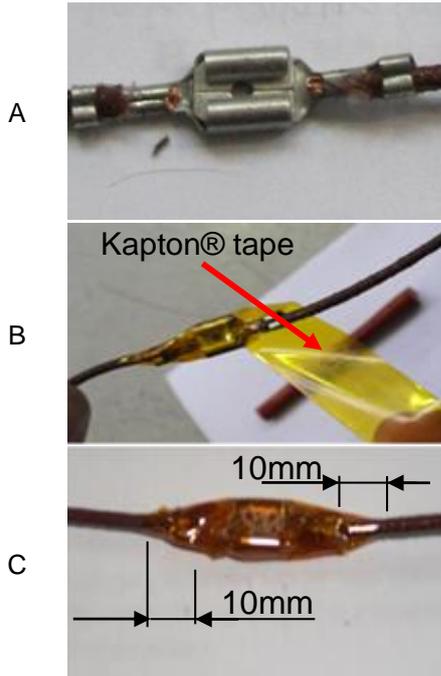


Figure 8-11 - Connecting and insulating the terminal

3. Cover the insulated connection with the silicone sleeve.
4. Complete the endshield assembly.

8.6. POWER TERMINAL BOX ROTATION PROCEDURE

For motors equipped with Power Terminal Box – PTB, located at top of the motor with cable entries from drive end side.

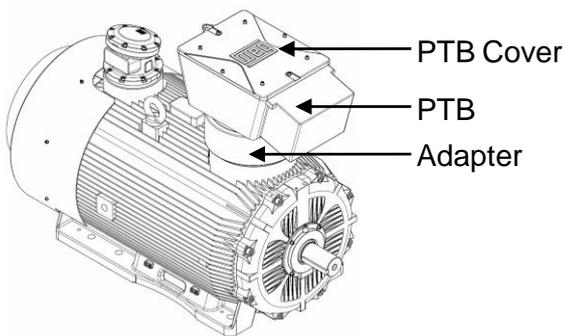


Figure 8-12 - Example of Motor with PTB with cable entries from DE side

Procedure to rotate the Power Terminal Box (example for 90° CCW seen from top of PTB):

1. Remove the PTB cover:
 - a. Unbolt the PTB cover - 8 bolts;
 - b. Install a magnet in the center of PTB cover;
 - c. Pull the magnet to remove the PTB cover;

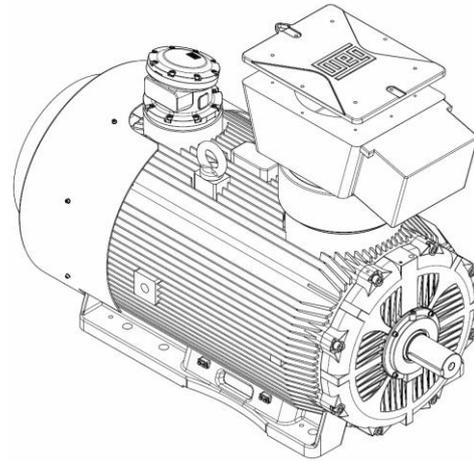


Figure 8-13 - PTB cover removed

2. Rotate the PTB with rotate device;
 - a. Unbolt the PTB – remove the 8 bolts inside terminal box;



Figure 8-14 – Inside view of PTB

- b. Assemble the rotate device in the top of the terminal box fixing the 6 bolts;



NOTE

This device is not supplied as standard. WEG can provide it as option.

- c. Turn the PTB 90° to cable entry at right side seen from DE side;

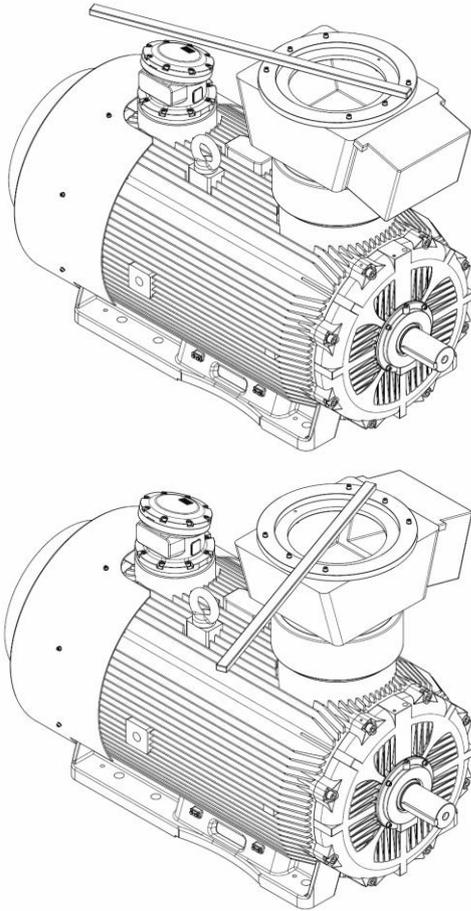


Figure 8-15 - Turn of the PTB with rotate device

- d. Remove the rotate device;
- 3. Reassemble the PTB
 - a. Bolt the PTB to the adapter with the 8 bolts (the same bolts that originally fix the PTB)
- 4. Assemble the PTB cover:
 - a. With the lifting device and magnet, slowly down the PTB cover, assuring that PTB and PTB cover cylindrical joints are centered;
 - b. Bolt the PTB cover to the PTB with the 8 bolts (the same bolts that originally fix the PTB cover).

Rotate the PTB can be difficult due to thermal variations of the Power Terminal Box and Adapter cylindrical joints.

ALTERNATIVE PROCEDURE TO ROTATE THE POWER TERMINAL BOX (EXAMPLE FOR 90° CCW SEEN FROM TOP OF PTB):

- 1. Remove the PTB cover:
 - a. Unbolt the PTB cover - 8 bolts;

- b. Install a magnet in the center of PTB cover;
- c. Pull the magnet to remove the PTB cover;
- 2. Loose the PTB:
 - a. Unbolt the PTB – remove the 8 bolts inside terminal box;
 - b. Fix two eyebolts in the fixing holes of the terminal box;
 - c. Clamp the lifting device in the two eyebolts;
 - d. Lift the PTB 60mm, keeping always horizontal.

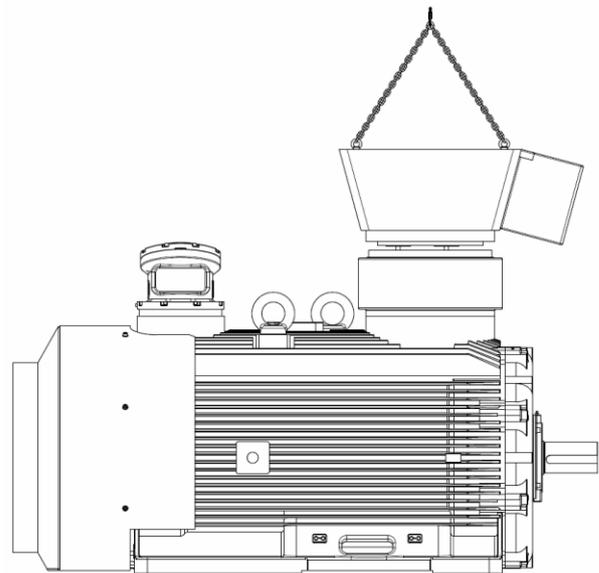


Figure 8-16 - PTB lifted

- 3. Rotate the PTB:
 - a. Carefully rotate the PTB, always horizontal levelled, 90° CCW seen from top of PTB.
- 4. Reassemble the PTB:
 - a. Slowly down the PTB, assuring that PTB and adapter cylindrical joints are centered;
 - b. With the PTB settled in the adapter;
 - c. Bolt the PTB to the adapter with the 8 bolts (the same bolts that originally fix the PTB)
- 5. Assemble the PTB cover:
 - a. With the lifting device and magnet, slowly down the PTB cover, assuring that PTB and PTB cover cylindrical joints are centered;
 - b. Bolt the PTB cover to the PTB with the 8 bolts (the same bolts that originally fix the PTB cover).



8.7. TIGHTENING TORQUE FOR FLAMEPROOF ENCLOSURES BOLTS

Table 8-20 – Tightening torques

Type	Torque (Nm)		
	Class 12.9	Class A2 - 70	Class A4 - 80
M8	41	17	25
M10	83	34	49
M12	145	57	86
M14	230	91	135
M16	355	141	210
M18	485	195	290
M20	690	274	410
M22	930	372	550
M24	1200	474	710

8.8. SPARE PARTS

When ordering spare parts, motor type and serial number must always be given as indicated on the motor nameplate.

It is not necessary to acquire spare parts for motors with a continuous duty functioning in the first two years.

The components have an estimated life span, nevertheless their durability can vary with their application. For this reason some parts should be kept in stock.

WEG recommends keeping in stock the following spare parts:

- DE and NDE rolling bearings (for motors equipped with rolling bearings);
- DE and NDE bearings shell (for motors equipped with sleeve bearings);
- Axial or radial seals;
- Gaskets;
- External fan;
- Thermal protections for windings and/or bearings;
- Grease nipples;
- Terminal block;
- Connectors;
- Auxiliary terminals;
- Bearings lubricant.

The spare parts must be stored in clean, dry, well ventilated environments and, if possible, at constant temperature.

Any intervention on the motor may only be performed by a specialized WEG certified technician.

9. MAINTENANCE PLAN

Damaged parts (with cracks, damaged machined parts and defective threads) must be replaced. It is recommended not to repair such parts.

All services described herewith should be carried out by skilled and experienced people so as to avoid damage to the equipment. In case of doubt, contact WEG.



EX ATMOSPHERE INFORMATION

For motors to be used in explosive atmospheres, we do not recommend to repair damaged or worn parts.



EX ATMOSPHERE INFORMATION

Under no circumstances flameproof motors can operate in a potentially explosive atmosphere with a damaged enclosure and/or any damaged flameproof joint.

DETAILED INSPECTION:

Inspection which encompasses those aspects covered by a close inspection and, in addition identifies those defects, such as loose terminations, which will only be apparent by opening the enclosure, and/or using, tools and test equipments.

CLOSE INSPECTION:

Inspection which encompasses those aspects covered by a visual inspection and, in addition, identifies those defects, such as loose bolts, which will be apparent only by the use of access equipment, for example steps, (where necessary), and tools.

VISUAL INSPECTION:

Inspection which identifies, without the use of access equipment or tools, those defects, such as missing bolts, which will be apparent to the eye.

For a safe repair, we recommend to buy original new parts from the factory. So the following plan is recommended:



Table 9-1 - Maintenance plan

DAILY							
Completely motor.	- Check the noise.						
Bearings.	- Check noise and vibration.						
WEEKLY							
Bearings.	- Regrease: follow regreasing intervals based on lubrication instructions.						
Coupling.	- After a week: check alignment and fixation and eventually refasten.						
Monitoring devices.	- Record measured figures.						
ANNUALLY (Complete revision)							
Complete motor	- Refasten bolts						
Stator and rotor winding	- Visual inspection; Measure insulation resistance.						
Terminal box, grounding	- Clean inside of terminal box; - Refasten bolts.						
Coupling	- Check alignment and refasten bolts						
EVERY 2 YEARS (Inspection for Ex"d" and Ex"t" motors, according to the standard IEC 60079-17)							
Grade of inspection D = Detailed, C = Close, V = Visual							
		Ex "d"			Ex "t"		
Check that:		Grade of inspection					
		D	C	V	D	C	V
A	EQUIPMENT						
1	Equipment is appropriate to the EPL/Zone requirements of the location	x	x	x	x	x	x
2	Equipment group is correct	x	x		x	x	
3	Equipment temperature class is correct (only for gas)	x	x				
4	Equipment maximum surface temperature is correct (only for dust)				x	x	
5	Degree of protection (IP grade) of equipment is appropriate for the level of protection/group	x	x	x	x	x	x
6	Equipment circuit identification is correct	x			x		
7	Equipment circuit identification is available	x	x	x	x	x	x
8	Enclosure, glass parts and glass-to-metal sealing gaskets and/or compounds are satisfactory	x	x	x	x	x	x
9	There is no damage or unauthorized modifications	x			x		
10	There is no evidence of unauthorized modifications		x	x		x	x
11	Bolts, cable entry devices (direct and indirect) and blanking elements are of the correct type and are complete and tight						
	- Physical check	x	x		x	x	
	- Visual check			x			x
12	Threaded covers on enclosures are of the correct type, are tight and secured						
	- Physical check	x	x				
	- Visual check			x			
13	Joint surfaces are clean and undamaged and gaskets, if any, are satisfactory and positioned correctly	x					
14	Condition of enclosure gaskets is satisfactory	x			x		
15	There is no evidence of ingress of water or dust in the enclosures in accordance with the IP rating	x			x		
16	Dimensions of flanged joint gaps are:	x					
	- within the limits in accordance with manufacturer's documentation or						
	- within maximum values permitted by relevant construction standard at time of installation or						
	- Within maximum values permitted by site documentation						
17	Electrical connections are tight				x		
18	Breathing and draining devices are satisfactory	x	x				
19	Motor fans have sufficient clearance to enclosure and/or covers, cooling systems are undamaged, motor foundations have no indentations or cracks.	x	x	x	x	x	x
20	The ventilation air flow is not impeded	x	x	x	x	x	x
21	Insulation resistance (IR) of the motor winding is satisfactory	x			x		
B	INSTALLATION						
1	Type of cable is appropriate	x			x		
2	There is no obvious damage to cables	x	x	x	x	x	x
3	Sealing of trunking, ducts, pipes and/or conduits is satisfactory	x	x	x	x	x	x
4	Stopping boxes and cable boxes are correctly filled	x					
5	Integrity of conduit system and interface with mixed system is maintained	x			x		
6	Earthing connections including any supplementary earthing bonding connections are satisfactory (for example connections are tight and conductors are of sufficient cross-section)						
	- Physical check	x			x		
	- Visual check		x	x		x	x
7	Fault loop impedance (TN systems) or earthing resistance (IT systems) is satisfactory	x			x		
8	Insulation resistance is satisfactory						
9	Automatic electrical protective devices are set correctly (auto-reset not possible)	x			x		
10	Automatic electrical protective devices operate within permitted limits	x			x		
11	Specific conditions of use (if applicable) are complied with	x			x		
12	Cables not in use are correctly terminated	x			x		
13	Obstructions adjacent to flameproof flanged joints are in accordance with IEC 60079-14	x	x	x			
14	Variable voltage/frequency installation in accordance with documentation	x	x		x	x	



C ENVIRONMENT							
1	Equipment is adequately protected against corrosion, weather, vibration and other adverse factors	x	x	x	x	x	x
2	No undue accumulation of dust and dirt	x	x	x	x	x	x
3	Electrical insulation is clean and dry					x	

Note: Items B7 and B8 account should be taken of the possibility of an explosive atmosphere in the vicinity of the equipment when using electrical test equipment

EVERY 3 YEARS (Complete revision)	
Complete motor.	- Take motor apart; - Check spare parts.
Stator and rotor winding.	- Clean it; - Check winding and wedges winding; - Measure insulation resistance.
Bearings.	- Clean bearings; - Replace, if require; - Check half coupling and replace it, if required; - Check shaft seat and repair it, if required.
Terminal box; grounding.	- Clean inside and refasten bolts.
Coupling.	- Check alignment and refasten bolts.
Monitoring devices.	- Take apart, if possible and test its operation capacity.
Filter.	- Clean it.
Air-air heat exchanger.	- Clean heat exchanger tubes.



10. MOTOR ABNORMALITIES IN SERVICE

Most of the abnormalities that interfere with the normal operation of electric motors can be avoided with preventive care and measures.

Sufficient ventilation, cleaning and careful maintenance are factors of great importance. Another important factor is to intervene immediately when any such phenomena as vibrations, shaft beatings, permanent decreasing insulation resistance, evidence of smoke and fire, abrupt temperature variations of the bearings are noticed.

The first measure to be taken when mechanical or electric abnormalities occur is to disconnect the motors and examine all the mechanical and electric parts of the installation.

In case of fire, the installation must be isolated from the power supply. This is normally done by turning off the respective switches. Use dry chemical powder or CO₂ to extinguish the fire. Never use water.

10.1. COMMON DAMAGE TO INDUCTION MOTORS

The motors are usually designed for insulation class F (155 °C), temperature rise class B (80K) and ambient temperature of 40 °C. Most of the faults on the windings occur when the limit temperatures are surpassed on all the winding or parts of it due to current overload. This is visible in the darkening or carbonization of the wire insulation.

10.1.1. SHORT CIRCUIT AMONG TURNS

The short circuit among turns may be a consequence of the casual coincidence of two default joints in the insulation of the wires or result from defaults caused simultaneously on two wires placed side by side. In the three phases, different currents appear. The difference according to the circumstances can be so small that the protection of the motor may not react at all. Short circuit among turns, to the ground, or among phases due to insulation defaults rarely occur and even so, almost always in the first moments of operation.

10.1.2. DAMAGE CAUSED TO THE WINDING

10.1.2.1 ONE PHASE OF THE BURNT WINDING

This damage occurs when the motor operates in triangle and there is lack of current on the power supply conductor. The current rises from 2 to 2.5 times on the rest of the winding at the same time

the rotation drops drastically. If the motor stops, the current will rise from 3.5 to 4 times its rated value.

Most of the time, when this default occurs, it's because a protection switch has not been installed or because this switch has received an excessively high regulation.

10.1.2.2 TWO PHASES OF THE BURNT WINDING

This default will occur due to lack of current on a power supply conductor and if the motor winding is connected in star.

One of the winding phases goes without current while the others absorb all the power and conduct an extremely high current. The slip may come to double.

10.1.2.3 THREE PHASES OF THE BURNT WINDING

POSSIBLE CAUSE 1:

The motor is protected only by fuses; overload on the motor will be the cause of the abnormality. The consequence will be the progressive carbonization of the wires and insulation culminating with a short circuit of the turns or a short circuit against the mass. If the motor is preceded by a protection switch this abnormality may be easily avoided.

POSSIBLE CAUSE 2:

The motor is turned on incorrectly. For example: A motor with a winding designed for 220/380V is connected through a star-triangle switch to a 380V power supply. The absorbed current will be so high that the winding will burn in a few seconds if the fuses or a protection switch incorrectly set don't react immediately.

POSSIBLE CAUSE 3:

The star-triangle switch isn't commuted and the motor continues to rotate during some time in star connection with excessive load. Because it develops only 1/3 of its torque, the motor can't reach its rated speed. The emphasizing of the slip means greater Ohmic losses to the motor due to the Joule effect. Because the stator current doesn't surpass the rated value for the triangle connection, depending on the load the protection switch will not react. The motor will heat as a consequence of the increase of losses on the winding and rotor and the winding will burn.

POSSIBLE CAUSE 4:

Thermal overload due to an excessive number of starts at intermittent operation rating or for an excessively long start period will damage the winding. The perfect operating of motors with this rating can be assured if the following values are considered in the specifications of the motor:

- Number of starts per hour;



- Start with or without load;
- Mechanic or reverse current brake;
- Accelerated rotating masses connected to the motor shaft;
- Load due to rotation at the time of acceleration and braking.

Because of the continuous effort of the motor at start at intermittent rating originates more losses which result in a higher heating, in special cases, the possibility the winding of the stator may be damaged with the motor at a standstill as a consequence of the heating of the motor, is not out of question.

10.1.3. DAMAGE TO THE BEARINGS

Damage to the bearings is the most frequent causes of very long stops. Operations with excessive vibration, inappropriate use, non-alignments, unbalanced couplings, radial loads and/or excessive axial loads are the main responsible causes for the damage to the bearings.

10.1.4. SHAFT RUPTURE

Although traditionally the bearings are the most fragile part and the shafts are designed with a wide margin of security, it is not impossible at all for the shafts to rupture due to the unceasing repetition of flexion efforts caused by the excessive belt tension.

The ruptures occur most of the time immediately after the DE bearing.

As a consequence of the alternate flexion efforts that require the shaft in motion, the ruptures get deeper from the outside in until they culminate with the rupture when the resistance of what's still left of the shaft section is no longer sufficient.

Avoid using additional millings on the shaft (holes for fastening bolts, etc.) because this can cause stress concentrations.

The replacement of only one or other parallel belts of a transmission, besides representing a damaging practice frequently causes ruptures in shafts.

If some old belts are kept and consequently dilated in length while the new and shorter ones rotate further away from the bearing, this can cause excessive stress on the shaft as result of flexion.

10.1.5. DAMAGE DUE TO BADLY ADAPTED TRANSMISSION PARTS OR DEFECTIVE ALIGNMENT OF THE MOTORS

Damaged bearings and ruptures on the shaft are, most of the time, the result of pulleys, couplings or pinions not appropriately set on the shaft.

These parts "hit" when rotating. The default can be seen because of the bruising that appears on the shaft. Key slots with their damaged edges due to loose keys inserted may also be the cause of ruptures on shafts. Badly aligned couplings cause beatings and radial and axial trembling to the bearings and, in a short time, lead to the deterioration of the bearings and the widening of the bearing support on the shield on the drive side. In more serious cases, the shaft may rupture.



10.2. TROUBLESHOOTING CHART



NOTE

This troubleshooting chart provides a basic list of unusual cases that may occur during motor operation, possible causes and recommended corrective actions. For further information, contact WEG Service Area.

Table 10-1 - Basic listing of abnormalities, causes and corrective actions

Abnormality	Possible causes	Correction actions
Motor does not start either coupled or uncoupled to the load.	At least two power supply cables are interrupted, without voltage;	Check the command panel, the power supply cables and the terminals;
	Rotor is blocked;	
	Damaged bearing;	Replace the bearing;
Motor starts with no load, but fails when load is applied. Motor starts very slowly and doesn't reach rated speed.	Load torque very high during starting;	Don't apply load on the driven machine on starting;
	Very low power supply voltage;	Measure the power supply voltage, set the correct value;
	Very high voltage drop on the power supply cables;	Check the installation design (transformer, cable section, check relays, circuit breakers, etc.);
	Rotor with interrupted bars;	Check and repair the rotor bars, test the short-circuit device (rings);
	The power supply cable was interrupted after starting;	Check the power supply cables;
Excessive no load current.	Very high power supply voltage;	Measure the power supply voltage and set it to the correct value;
Heating on the stator winding.	Short-circuit among turns;	Rewind;
	Interruption of parallel wires or winding phases of the stator;	
	Defective connection;	Provide reconnection;
Stator winding becomes very hot under load	Insufficient cooling due to dirty air channels;	Open and clean the air channels;
	Fans operating in the wrong direction;	Correct the rotation direction of the fans;
	Overload;	Measure the stator current, decrease the load and analyze the motor application;
	High number of starts or very high moment of inertia;	Reduce the number of starts;
	Very high voltage, leading to iron losses are very high;	Don't exceed the rated voltage by 110% except when specified on the nameplate;
	Very low voltage, leading to current is very high;	Check the power supply voltage and the motor voltage drop;
	Interruption on a power supply cable or on winding phase;	Measure the current in all phases and correct it;
	Rotor drags against the stator;	Check the air-gap, operation conditions (vibration...), bearing conditions;
	The operating condition doesn't correspond to the nameplate data;	Maintain the operation condition according to the nameplate or reduce the load;
	Power supply unbalance (burnt fuse, wrong control);	Check if there is voltage unbalance or operation with two phases and correct it;
	Dirty windings;	Clean;
	Interrupted air tubes;	



Abnormal noise during operation on load.	Mechanical causes;	The noise normally decreases when the rotation drops; see also: " <i>Noisy operation when uncoupled</i> "
	Electric causes;	The noise disappears when the motor is switched-off. Contact WEG;
When coupled noise appears; When uncoupled the noise disappears.	Defect on the transmission components or the driven machine;	Check the power transmission, the coupling and the alignment;
	Defect on the gear transmission;	Align the driven system;
	Base not aligned/leveled;	Realign/level the motor and the driven machine;
	Defective balance of the components or the driven machine;	Perform new balance;
	Defective coupling;	Repair or replace the coupling;
	Wrong rotation direction of the motor;	Invert 2 phase connection.
Noisy operation when uncoupled.	Unbalance;	Noise continues during deceleration after switching-off the voltage;
		Perform new balancing;
	Interruption on one phase of the stator winding;	Measure the current input of all the connecting cables;
	Fastening bolts loose;	Retighten and lock the bolts;
	The rotor balance conditions get worse after coupling assembly;	Balance the coupling;
	Resonance of foundation;	Adjust the foundation;
	Motor frame bending;	Check base flatness;
	Bent shaft;	The shaft may be bent;
		Check the rotor balance and the eccentricity;
Non-uniform air-gap;	Check the shaft bending or the wearing of the bearings;	



10.3. TROUBLESHOOTING CHART ABOUT BEARINGS

NOTE

This troubleshooting chart provides a basic list of unusual cases that may occur on bearings during motor operation, possible causes and recommended corrective actions. For certain cases, bearing manufacturer is required in order to identify the root cause of the defect.

Table 10-2 - Basic listing of problems with bearings

Abnormality	Possible causes	Correction actions
Motor is noisy while in operation.	Damaged bearings;	Replace the bearing;
Moderate noises on the bearing, coloring spots, grooves on the races.	Bearing was assembled in diagonal;	Recover the shaft seat and replace the bearing;
Excessive bearing noise and higher bearing heating.	Corrosion on the squirrel cage, small chips in the grease, failure on the races due to the lack of grease, eventually incorrect bearing clearance;	Clean and regrease according to instructions;
		Replace the bearing;
Bearing overheating	Excess of grease;	Remove the grease drain plug and let the motor run until the excess of grease comes out;
	Excessive axial or radial load;	Decrease the belt-tension;
	Unsatisfactory engagement of connecting gears.	To be reconditioned.
	Bent shaft / excessive vibration;	Correct the shaft and check the rotor balance. Check the source of the vibration and correct it;
	Lack of grease;	Add grease to the bearing;
	Hardening of grease results in locking of rolling elements;	Replace the bearings;
	Foreign body in the grease;	Wash the bearings and lubricate;
Dark spots on one side of the bearing race resulting in further grooves.	Excessive axial force;	Check the drive and coupling ratio;
Dark lines on the races or intensive diagonal grooves; In case of ball bearings, point form marks.	Current circulation through the bearings;	Clean and replace the bearing insulation. Apply insulation, if there isn't any;
		Avoid the current to go through the bearing;
Hits on the races, previously clear. Grooves between rolling elements.	External vibrations mainly when the motor remains at standstill for a long period;	From time to time rotate the rotor of the motor at standstill to another position, mainly if it is a spare motor;
	Lack of maintenance while in storage;	



11. WARRANTY TERMS

Unless otherwise negotiated, these products when operated under the conditions stipulated by WEG in the operating manual for such product, are warranted against defects in workmanship and materials for eighteen (18) months from start-up date and ceases definitively or twenty four (24) months after the date the product is at the Buyer's disposal in the supplier facilities.

However, this warranty does not apply to any product which has been subject to misuse, misapplication or neglect (including without limitation, inadequate maintenance, accident, improper installation, modification, adjustment, repair or any other cases originated from inadequate applications).

The company will neither be responsible for any expenses incurred in installation, removal from service, consequential expenses such as financial losses nor transportation costs as well as tickets and accomodation expenses of a technician when this is requested by the customer.

The repair and/or replacement of parts or components, when effected by WEG within the Warranty period do not give Warranty extension, unless otherwise expressed in writing by Weg.

This constitutes WEG only warranty in connection with this sale and is in lieu of all other warranties, expressed or implied, written or oral.

There are no implied warranties of merchantability or fitness for a particular purpose that apply to this sale. No employee, agent, dealer, repair shop or other person is authorized to give any warranties on behalf of WEG nor to assume for WEG any other liability in connection with any of its products.

In case this happens without WEG's authorization, Warranty is automatically cancelled.

11.1. LIABILITY

Except as specified in the foregoing paragraph entitled "Warranty Terms", the company shall have no obligation or liability whatsoever to the purchaser, including, without limitation, any claims for consequential damages or labor costs, by reason of any breach of the express warranty described therein.

The purchaser further hereby agrees to indemnify and hold the company harmless from any causes of action (other than cost of replacing or repairing the defective product as specified in the foregoing paragraph entitled "Warranty Terms"), arising directly or indirectly from the acts, omissions or negligence of the purchaser in connection with or arising out of the testing, use, operation, replacement or repair of any product described in this quotation and sold or furnished by the company to the purchaser.

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