Driving efficiency and sustainability

Three-Phase Synchronous Generators

GTK line

Installation, Operation and Maintenance Manual

Installation, Operation and Maintenance Manual

Model: GTK

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Dear Customer,

Thank you for purchasing a WEG generator. Our products are developed with the highest standards of quality and efficiency which ensures outstanding performance.
Since electric generators play a major role in the comfort and well-being of mankind, it must be identified and treated as a driving machine with characteristics that involve specific care, such as proper storage, installation and maintenance
All efforts have been made to ensure that the information contained in this manual is faithful to the configurations and applications of the generator.
Therefore, we recommend that you read this manual carefully before proceeding with the installation, operation or maintenance of the generator in order to ensure safe and reliable operation of your equipment and facility. If you need any further information, please contact WEG.
Always keep this manual close to the generator, so that it can be consulted whenever necessary.

ATTENTION

1. It is imperative to follow the procedures contained in this manual for the warranty to be valid;
2. The generator installation, operation and maintenance procedures must be performed only by qualified personnel.

NOTES

1. The total or partial reproduction of information supplied in this manual is authorized, provided that reference is made to its source. If this manual is lost, an electronic PDF file is available at www.weg.net or another printed copy may be requested.

WEG EQUIPAMENTOS ELÉTRICOS S.A.

INDEX

1 INTRODUCTION

This manual contains information regarding the three-phase synchronous generators type GTK .
Generators with special features can be supplied with specific documents (drawings, connection diagram, characteristic curves etc.). Those documents, together with this manual, must be thoroughly evaluated before proceeding with the installation, operation or maintenance of the generator.
In order to use a frequency inverter, it is mandatory to follow the instructions contained in the specific technical documentation of the generator and in the manual of the frequency inverter.
If any additional explanation about generators with major special features is necessary, consult WEG. All procedures and standards contained in this manual must be observed in order to ensure proper operation of the generator and the safety of the personnel involved in its operation. Following these procedures is also important to ensure the validity of the generator warranty. Thus, we recommend the careful reading of this manual before the installation and operation of the generator. If any further information is still necessary, consult WEG.

1.1 SAFETY WARNINGS IN THE MANUAL

In this manual, the following safety warnings are used:

DANGER

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

ATTENTION

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

NOTE

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

EX

Additional information about generators for explosive atmospheres.

2 GENERAL INSTRUCTIONS

All the personnel involved with the assembly, operation or maintenance of electrical installations must be permanently informed and updated on the standards and safety instructions that guide the job and are advised to strictly comply with them. Before beginning any job, the person in charge must make sure that all points have been duly observed and warn the respective personnel about the danger inherent to the task to be performed.
Improper application, inadequate handled or maintenance of the generator may cause serious injuries and/or material damages.
Therefore, it is highly recommended that these services be always performed by qualified personnel.

2.1 QUALIFIED PERSONNEL

The term qualified personnel means those who, because of their training, experience, education level, and knowledge of the applicable standards, specifications, accident prevention, safety standards and operating conditions, have been authorized by the persons in charge to execute the necessary tasks, and who are able to recognize and avoid any possible danger.
Such qualified personnel must also know and be able to provide first aid procedures if necessary.
The entire start-up, maintenance and repair tasks must only be performed by qualified personnel.

2.1.1 Explosive atmospheres

EX

It is recommended that the persons responsible for the application of generators in hazardous areas be properly trained on their correct application.

2.2 SAFETY INSTRUCTIONS

DANGER

During normal operation of this equipment, a hazard associated with energized or rotating components with high voltage or elevated temperatures exists.
Thus, the operation with open terminal boxes, unprotected couplings, improper handling, or failure to comply with the operating standards, may cause severe personal injuries and material damages.

ATTENTION

When devices and equipment are used outside the industrial environment, the user must ensure the safety of the equipment by adopting proper protection and safety measures during installation (for example, keep people away, avoid contact of children, etc.).

Those responsible for the safety of the installation must ensure that:
- Only qualified personnel install and operate the equipment;
- They have this manual and all other documents supplied with the generator at hand, as well as that they perform the tasks in strict compliance with the service instructions, relevant standards and specific product documentation;

ATTENTION

Failure to comply with installation and safety standards may void the product warranty. Firefighting equipment and first aid notices must be available in visible and easily accessible locations at the work site.

Qualified personnel must also observe:
- All the technical data regarding the allowed applications (operating conditions, connections and installation environment), included in the catalog, in the purchase order documents, in the operating instructions, in manuals and all other documentation;
- The specific regulations and conditions for the local installation;
- The use of suitable tools and equipment for handling and transportation;
- That the protective devices of the individual components are removed shortly before installation.

Individual parts must be stored in vibration-free environments, avoiding falls and ensuring their protection against aggressive agents and/or that they do not jeopardize people.

2.3 GENERATORS APPLIED IN EXPLOSIVE ATMOSPHERES

EX

Generators specified to operate in hazardous areas have additional safety features, which are defined in specific standards for each kind of hazardous area, according to their classification.

The general requirements for equipment that operate in hazardous areas are described in the following standards:
- **EN/IEC 60079-0** - Electrical Apparatus for Explosive Gas Atmospheres - Part 0: General Requirements;
- **ABNT NBR IEC 60079-0** - Atmosferas Explosivas - Parte 0: Equipamentos - Requisitos Gerais;
- **EN/IEC 60034-1** - Rotating Electrical Machines - Part 1: Rating and Performance;
- **EN/IEC 60079- 2** - Electrical Apparatus for Explosive Gas Atmospheres. Part 2: Pressurized Enclosures 'p';
- **ABNT NBR IEC 60079-2** - Atmosferas Explosivas - Parte 2: Proteção de Equipamento por Invólucro Pressurizado ‘p’;
- **EN/IEC 60079- 7** - Electrical Apparatus for Explosive Gas Atmospheres - Part 7: Increased Safety 'e';
- **ABNT NBR IEC 60079-7** - Atmosferas Explosivas - Parte 7: Proteção de Equipamentos por segurança Aumentada "e";
- **ABNT NBR IEC 60079-11** – Atmosferas Explosivas – Parte 11 - Proteção de equipamento por segurança intrínseca "i";
- **EN/IEC 60079-11** - Explosive atmospheres - Part 11: Equipment protection by intrinsic safety “I”;

- **ABNT NBR IEC 60079-14** – Atmosferas Explosivas – Parte 14 - Seleção e montagem de instalações elétricas;
- **EN/IEC 60079-14** – Electrical apparatus for gas explosive atmospheres – Part 14 – Electrical installation in hazardous areas (others than mines);
- **ABNT NBR IEC 60079-14** – Equipamentos elétricos para atmosferas explosivas – Parte 14 – Instalação elétrica em áreas classificadas (exceto minas);
- **EN/IEC 60079-15** - Explosive Atmospheres - Part 15 - Protection by Type of Protection 'n';
- **ABNT NBR IEC 60079-15** - Equipamentos Elétricos para Atmosferas Explosivas - Parte 15: Construção, Ensaio e Marcação de Equipamentos Elétricos com Tipo de Proteção 'n';
- **EN/IEC 60079-17** - Explosive Atmospheres - Part 17: Electrical Installations Inspection and Maintenance
- **ABNT NBR IEC 60079-17** - Atmosferas Explosivas - Parte 17: Inspeção e Manutenção de Instalações Elétricas;
- **EN/IEC 60079-19** - Explosive atmospheres - Part 19: Equipment repair, overhaul and reclamation.
- **ABNT NBR IEC 60079-19** – Atmosferas Explosivas – Parte 19 - Revisão e recuperação de equipamentos.

2.3.1 General Precautions

Before performing the installation, operation or maintenance of electric generators in hazardous areas, the following precautions must be taken:

- Study and understand the standards listed in section 2.3, according to the equipment degree of protection;
- Comply with all the requirements established by the applicable standards.

2.3.2 Additional Precautions

- Shut down the generator and wait until it comes to a complete stop before performing any maintenance, inspection or repair.
- All the existing protections must be installed and properly adjusted before starting the generator.
- Make sure the generator is properly grounded;
- The terminals must be properly connected in order to prevent any kind of poor contact that may cause heating or sparking.

NOTE

Observe all other instructions regarding storage, handling, installation and maintenance contained in this manual and applicable to the relevant generator type.

2.4 STANDARDS

The generators are specified, designed, manufactured and tested according to the standards described in Table 2.1. The applicable standards are specified in the commercial contract, which may indicate other national or international standards, depending on the application or installation location.

Table 2.1: Applicable standards

	IEC / NBR	NEMA
Specification	IEC60034-1 / NBR 17094	MG1-1,10,20
Dimensions	IEC60072 / NBR 15623	MG1-4,11
Tests	IEC60034-2 / NBR 5383	MG1-12
Levels of protection	IEC60034-5 NBR IEC 60034-5	MG1-5
Cooling	IEC60034-6 NBR IEC 60034-6	MG1-6
Mounting	IEC60034-7 NBR IEC 60034-7	MG1-4
Noise	IEC60034-9 NBR IEC 60034-9	MG1-9
Mechanical Vibration	IEC60034-14 NBR IEC 60034-14	MG1-7
Terminal marking	IEC60034-8 /NBR 15367	MG1-2
Mechanical Tolerances	ISO286 / NBR6158	MG1-4
Balancing	ISO1940	MG1-7

2.5 ENVIRONMENTAL CONDITIONS

The generator was designed according to the specific environmental conditions (temperature and altitude) of your application and are described on the nameplate and in the datasheet of the generator.

ATTENTION

For the use of water-cooled generators in ambient temperatures below +5°C, antifreeze additives must be added to the water.

2.5.1 Application in explosive atmosphere

EX

The application of generators in explosive atmospheres is only allowed when they were designed, built and certified for such application.

2.6 OPERATING CONDITIONS

In order for the product warranty to be valid, the generator must be operated according to nominal data indicated on its nameplate, observing all applicable standards and information contained in this manual.

2.6.1 Special application conditions

EX

The "X" symbol next to the certificate number, informed on the generator nameplate, indicates that it requires special installation, application and/or maintenance conditions, which are described in the Conformity Certificate. For reference, the conformance certificate is provided with this manual. Failure to comply with these requirements jeopardizes the safety of the product and of the installation.

3 RECEIVING, HANDLING AND STORAGE

3.1 RECEIVING

All generators were tested and are in perfect operating conditions. The machined surfaces are protected against corrosion. The package must be inspected upon receipt for occasional damages during transportation.

ATTENTION

Any damage must be photographed, documented and reported immediately to the carrier, the insurer and WEG. The non-communication of this damage will void the warranty.

ATTENTION

Parts supplied in additional packages must be checked upon receipt.

- When lifting the package (or container), the proper hoisting points, the weight indicated on the package or on the nameplate and the operating capacity and conditions of the hoisting equipment must be observed;
- Generators packed in wooden crates must always be lifted by their own lifting lugs or by a proper forklift; they must never be lifted by the package;
- The package can never be overturned. Place it on the floor carefully (without impact) in order to avoid damage to the bearing;
- Do not remove the grease for protection against corrosion from the shaft end, or the closing plugs present in the terminal box holes. These protections must remain in place until the moment of the final assembly.
- A complete visual inspection of the generator must be carried out after removing the package;
- The shaft locking system must be removed just before the installation and stored to be used in future transportation of the generator.

3.1.1 Additional Precautions

EX

In order to ensure the protection degree, the terminal box must be kept closed. Before putting the generator into operation, check the cleanliness and moisture conditions inside the terminal box.

3.2 HANDLING

- This generator is fitted with eyebolts for lifting purposes. These eyebolts are intended to lift only the generator. Additional loads are not allowed.
- Cables and lifting devices must be appropriated to prevent accidents and damages to the generator or personnel injury.
- Pay attention for correct generator weight.
- Lifting and lowering must be done gently.
- Never lift the generator by the shaft.

NOTES

- Observe the indicated weight. Do not lift the generator causing jolts or put it down abruptly on the floor, because this can cause damage to the bearings;
- Never use the shaft to lift the generator;
- The frame lifting lugs are intended to lift only the generator. Never use them to lift the generator-driven machine set.

ATTENTION

- In order to move or transport the generator, the shaft must be locked with the locking device supplied with the generator.
- Lifting equipment and devices must be able to withstand the generator weight.

3.3 STORAGE

If the Generator is not installed immediately after reception, it must remain inside the package and stored in a location protected against moisture, vapors, sudden changes in temperature, rodents and insects.
The generator must be stored in vibration-free locations in order to avoid bearing damage.

ATTENTION

Space heaters must remain powered during storage in order to avoid moisture condensation inside the generator.
Any damage to the paint or corrosion protection of the machined parts must be repaired.

3.3.1 Outdoor storage

The generator must be stored in a dry location, free of flooding and vibrations.
Repair any damages on the package before storing the generator, which is needed to ensure proper storage conditions.
Place the generator on platforms or foundations that ensure protection against humidity from the ground and prevent it from sinking into the soil. Free air circulation underneath the generator must be assured.
The cover used to protect the generator against the bad weather must not be in contact with its surfaces. In order to ensure free air circulation between the generator and such covers, place wooden blocks as spacers.

3.3.2 Extended storage

When the generator is stored for a long period of time (two months or more) before start-up, it is exposed to external agents, such as temperature variations, moisture, aggressive agents, etc.
The empty spaces inside the generator – such as rolling bearings, terminal boxes, and windings – are exposed to humidity, which can cause condensation, and, depending on the degree of air contamination, aggressive substances may also penetrate these empty spaces.
Consequently, after long periods of storage, the winding insulation resistance may drop below the acceptable values, internal components, such as rolling bearings, may oxidize, and the lubricant power of the lubricant agent in the bearings may be adversely affected.
All of these influences increase the risk of damages before starting the generator.

ATTENTION

To assure that the generator warranty be valid, it is necessary to make sure that all preventive measures described in this manual, such as constructive aspects, maintenance, packaging, storage, and periodical inspections, are followed and recorded.

The extended storage instructions are valid for generators that remain stored for long periods (two months or more) before start-up or generators already installed that are in a prolonged stoppage, considering the same period.

3.3.2.1 Storage location

In order to ensure the best storage conditions for the generator during long periods, the chosen location must strictly meet the criteria described in sections 3.3.2.1.1 and 3.3.2.1.2.

3.3.2.1.1 Indoor storage

In order to ensure better storage conditions for the generator, the storage site must comply strictly with the criteria described below:

- The storage site must be closed, covered, dry, free of air contaminants (moisture, vapor, dust, particles and aggressive fumes) and free of flooding;
- The site should be protected against sudden temperature variations, humidity, rodents and insects;
- Vibration-free location, to avoid damaging to the generator bearings;
- The floor must be of leveled concrete with resistant structure to support the generator weight;
- Must have system to fire detection and extinguishing;
- Be provided with electricity for supplying the space heaters with power failure detection system;
- Exclusive site to store electrical machines (do not mix with other equipment and/or products that could prejudice the correct generator storage);
- Site with facilities of cargo handling services, suitable to allow the generator handling and removal;
- There must be no gas present, such as chlorine, sulfur dioxide or acids;
- Must have prevention against dirt and dust deposition;
- The generator should be stored on a suitable metal base that prevents the absorption of moisture from the floor.

If any of these requirements is not met in the storage site, WEG suggests that additional protections be added to the generator package during the storage period, as follows:

- A closed wooden crate or the like with an electrical installation that allows the energization of the space heaters;
- If there is a risk of infestation and fungus formation, the package must be protected in the storage place by spraying it or painting it with appropriate chemicals;
- The package preparation must be prepared carefully by an experienced person.

3.3.2.1.2 Outdoor storage

ATTENTION

Outdoor storage of the generator is not recommended.

In case outdoor storage is unavoidable, the generator must be packed in specific packaging for such conditions, as follows:

- For outdoor storage (exposed to the weather), besides the packaging recommended for indoor storage, the package must be covered with protection against dust, moisture and other odd materials, using resistant canvas or plastic.
- The package must be placed on platforms or foundations that ensure protection against dirt and moisture and prevent it from sinking into the soil;
- After the package is covered, a shelter must be erected to protect it against direct rain, snow and excessive sun heat.

ATTENTION

In case the generator remains stored for long periods (two months or more), it is recommended to inspect it regularly as specified in the section Maintenance plan during storage of this manual.

3.3.3 Preservation during the storage

3.3.3.1 Space heater

Space heaters must remain powered during storage to avoid moisture condensation inside the generator and ensure that the winding insulation resistance remains within acceptable levels.
The space heaters drive circuit must be unique and the voltage and current of this circuit must be measured and recorded monthly.
It is recommended that a signal be installed near the generator to indicate that the space heaters are energized.

3.3.3.2 Insulation resistance

During the storage period, the insulation resistance of the generator windings must be measured and recorded every two months, and before the generator installation or eventually if there is any change in the preservation process (E.g. prolonged lack of electricity).
The measurement procedures and the criteria for acceptance of the results shall be according to IEEE-43 Standard.
Any insulation resistance reduction must be investigated.

3.3.3.3 Exposed machined surfaces

All exposed machined surfaces (e.g., shaft end and flanges) are protected at the factory with a temporary protective agent (rust inhibitor).
This protection coating must be reapplied at least every six months or when removed and/or damaged.
Recommended Product: Protective agent Anticorit BW
Supplier: Fuchs

3.3.3.4 Sealing

The rubber seals, gaskets, plugs and cable glands of the generator shall be inspected annually and replaced, if necessary.

3.3.3.5 Bearings

3.3.3.5.1 Grease-lubricated rolling bearing

- The rolling bearings are lubricated at the factory for the generator tests.

ATTENTION

In order to keep the bearings in good condition during the storage period, **the shaft locking device must be removed every two months, and the generator rotor must be rotated at least 10 complete turns at 30 rpm** to circulate the grease and preserve the internal parts of the bearings.

- Before putting the generator into operation, the rolling bearings must be lubricated;
- If the generator remains stored for a period exceeding two years, the rolling bearings must be disassembled, washed, inspected and relubricated.

3.3.3.6 Cleanliness and conservation of the generator during storage

- The generator should be free of oil, water, dust and dirt.
- The generator outside must be cleaned with compressed air under reduced pressure;
- Remove the removable rust signs with a clean cloth soaked in petroleum solvent.
- Check that the bearings and lubrication hollows are free of dust and dirt and if the bearing plugs are properly tightened.
- Risks, marks or rust on the shaft-end should be carefully removed.

3.3.3.7 Inspections and records during storage

The stored generator must be inspected periodically and inspection records must be filed.
The following items must be inspected:

1. Check the generator for physical damages and repair it, if necessary;
2. Inspection of the cleanliness conditions;
3. Check for signs of water condensation inside the generator;
4. Check of the protective coating conditions of the exposed machined parts;
5. Check the paint conditions, and repair if necessary;
6. Check for aggressive agents signs;
7. Check the operation of the space heaters;
8. Measure and record the ambient temperature and relative humidity around the generator;
9. Measure and record the temperature, insulation resistance and polarization index of the stator winding;
10. Make sure that the storage location complies with the criteria described in section 3.3.2.1.

3.3.3.8 Predictive / preventive maintenance

WEG recommends that, every 3 years of storage, the stored generator be sent to a WEG Authorized Repair Shop or to WEG own factory, in order to perform a complete predictive maintenance.
The complete predictive maintenance procedure comprises disassembling the complete generator for inspection and, after assembly, performing a routine test in the laboratory.

3.3.3.9 Maintenance plan during storage

During the storage period, the generator maintenance must be performed and recorded according to the plan described in Table 3.1.

Table 3.1: Storage plan

	Monthly	2 months	6 months	2 years	Before start-up	Notes
STORAGE LOCATION						
Inspect the cleanliness conditions		X			X	
Inspect the humidity and temperature conditions		X				
Inspect for insect infestation signs		X				
PACKAGE						
Inspect for damage			X			
Check the internal relative humidity		X				
Replace the desiccant in the package (if any)			X			Whenever necessary.
SPACE HEATER						
Check the operating conditions	X					
Measure the circuit voltage and frequency	X					
Check the function of the signal system (if any)			X			
WHOLE GENERATOR						
Perform external cleaning			X		X	
Check the painting conditions			X			
Check the rust inhibitor on the exposed machined parts			X			
Reapply the rust inhibitor			X			
Inspect the rubber seals and gaskets			X			
Complete predictive maintenance						According to section 3.3.3.8
WINDINGS						
Measure the winding temperature		X			X	
Measure the insulation resistance		X			X	
Measure the polarization index		X			X	
ROLLING BEARINGS						
Rotate the shaft		X				
Relubricate the bearing					X	
Disassemble and clean the bearing						If the storage period exceeds 2 years.

3.3.4 Preparation for commissioning

3.3.4.1 Cleaning

- The internal and external parts of the generator must be free of oil, water, dust and dirt.
- Remove the rust inhibitor from the exposed surfaces with a cloth damped in a petroleum-based solvent;
- Make sure that the bearings and cavities used for lubrication are free of dirt and that the cavity plugs are correctly sealed and tightened. Oxidation and marks on the bearing seats and on the shaft must be carefully removed.

3.3.4.2 Insulation resistance verification

Before putting the generator into operation, the insulation resistance must be measured according to section 3.3.3.2 of this manual.

3.3.4.3 Others

Follow the other procedures described in section 6 of this manual before putting the generator into operation.

4 INSTALLATION

4.1 INSTALLATION SITE

Electric generators must be installed in easily accessible places, allowing periodic inspections, on-site maintenance and, if necessary, removal for external services.
The following environmental conditions must be ensured:

- Clean and well-ventilated location;
- The installation of other equipment or walls must not block or hinder the generator ventilation;
- The area around and above the generator must be sufficient for maintenance or handling;
- The environment must be in accordance with the generator protection degree.

4.2 ROTATION DIRECTION

The generator rotation direction is indicated by a plate affixed to the frame on the drive end and in the generator specific documentation.

4.3 INSULATION RESISTANCE

4.3.1 Safety Instructions

DANGER

In order to measure the insulation resistance, the generator must be turned off and stopped. The winding being tested must be connected to the frame and grounded until all residual electrostatic charges are removed. Capacitors (if any) must also be grounded before disconnecting and separating the terminals to measure the insulation resistance.
Failure to comply with these procedures may result in personal injury.

4.3.2 General considerations

When the generator is not immediately put into operation, it must be protected against moisture, high temperatures, and dirt, thus avoiding impacts on the insulation resistance.
The winding insulation resistance must be measured before putting the generator into operation.
If the environment is too humid, the insulation resistance must be measured periodically during storage. It is difficult to establish fixed rules for the actual value of winding insulation resistance, as it varies according to the environmental conditions (temperature, humidity), machine cleanliness conditions (dust, oil, grease, dirt) and quality and condition of the insulating material used.
The evaluation of the periodical follow-up records is useful to conclude whether the generator is able to operate.

4.3.3 Measurement on the stator windings

The insulation resistance must be measured with a megohmmeter. The testing voltage for the generator windings must be in accordance with Table 4.1 and IEEE43 standard.

Table 4.1: Voltage for the winding Insulation resistance test

Winding rated voltage (V)	Insulation resistance test - continuous voltage (V)
< 1000	500
1000 - 2500	500 - 1000
2501 - 5000	1000 - 2500
5001 - 12000	2500 - 5000
> 12000	5000 - 10000

Before measuring the stator winding insulation resistance:

- Disconnect all connections to the stator terminals;
- Disconnect and insulate all CTs and PTs (if any);
- Ground the generator frame;
- Measure the winding temperature;
- Ground all temperature sensors;
- Check the humidity.

The insulation resistance measurement of the stator windings must be done in the main terminal box.
The megohmmeter must be connected between the generator frame and the winding.
The frame must be grounded and the three phases of the stator winding must remain connected to the neutral point, according to Figure 4.1:

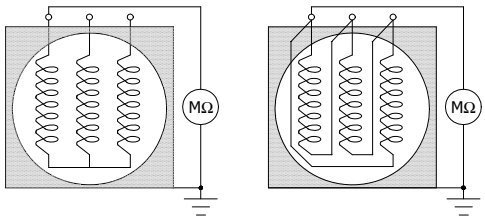


Figure 4.1: Megohmmeter connection

Whenever possible, each phase must be isolated and tested separately. The separate test allows the comparison between the phases. When a phase is tested, the other two phases must be grounded to the same ground of the frame, according to Figure 4.2:

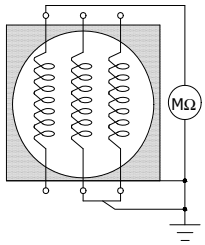


Figure 4.2: Connection of the megohmmeter to separate phases

If the total winding measurement presents a value below the recommended, the neutral connections must be opened and the insulation resistance of each phase must be measured separately.

ATTENTION

Much higher values may be frequently obtained from generators in operation for long periods of time. Comparison with values obtained in previous tests on the same generator - under similar load, temperature and humidity conditions – may be an excellent parameter to evaluate the winding insulation conditions, instead of using the value obtained in a single test as the basis. Significant or sudden reductions are considered suspicious.

4.3.4 Additional Information

ATTENTION

After measuring the insulation resistance, ground the tested winding in order to discharge it.
The testing voltage to measure the insulation resistance of the space heater must be 500 Vdc and for the other accessories, 100 Vdc.
It is not recommended to measure the insulation resistance of thermal protectors.

4.3.5 Conversion of the measured values

The insulation resistance measured on the windings shall be converted to 40 °C using the correction factor provided in Figure 4.3 (IEEE43 standard) and applying the following formula:

$$R_C = Kt \, . \, Rt$$

Where:
R40 = referred insulation resistance at 40 °C;
Kt = Insulation resistance correction factor as a function of temperature, as shown in Figure 4.3;
Rt = measured insulation resistance.

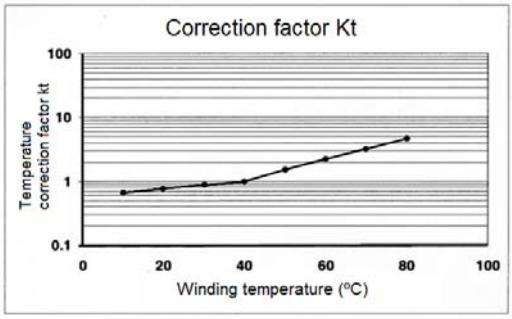


Figure 4.3: Insulation resistance correction factor due to temperature

The values used to generate the curve of Figure 4.3 are shown in Table 4.2.

Table 4.2: Correction factors (Kt) due to temperature

t (ºC)	Correction factors (kt)
10	0,7
20	0,8
30	0,9
40	1,0
50	1,5
60	2,3
70	3,3
80	4,6

4.3.6 Polarization Index (P.I.)

The polarization index is defined by the ratio between the insulation resistance measured in 10 minutes and the insulation resistance measured in 1 minute. This measurement procedure is always carried out at relatively constant temperatures.
The polarization index allows the assessment of the generator insulation conditions.

DANGER

In order to avoid accidents, the winding must be grounded immediately after measuring the insulation resistance.

4.3.7 Recommended Minimum Values

According to IEEE-43 Standard, the recommended minimum values for winding insulation resistance (R.I.) and Polarization Index (I.P.) are shown in Table 4.3:

Table 4.3: Minimum R.I. e I.P values

Winding voltage	Minimum R.I. (converted to 40ºC)	Minimum I.P.
Up to 1000 V	5 MΩ	Not applicable
Greater than 1000 V	100 MΩ	2

4.4 PROTECTIONS

Generators used in continuous duty must be protected against overloads by means of a generator integral device, or an independent protection device, which is generally a thermal relay with rated or adjustable current equal to or below the value obtained by multiplying the full load generator supply current by:

- 1.25 for generators with service factor equal to or above 1.15;
- 1.15 for generators with service factor equal to 1.0.

Generators also have protection devices against overheating (in cases of overloads, locked rotor, low voltage, lack of generator ventilation).

4.4.1 Protections – explosive atmospheres

Protection devices for explosive atmosphere generators must always remain switched on and adjusted according to EN 60079-14, DIN VDE0165 and NBR5410 standards. If not indicated otherwise, the generators are designed for S1 duty (continuous).
All protections, including those for overcurrent, must be set based on the generator rated conditions. This protection must also protect the generator in case of short-circuit (i.e., in case of locked rotor).
Windings in delta (Δ) connection must be protected against phase loss. To do so, connect the relay in series with the winding phases and set it for 0.58 times the rated current.
All the winding and bearing protections must always be on and adjusted correctly.
Heavy starts: generators that will be submitted to conditions with acceleration time > 1.7 x t_E time must be protected with an overcurrent protection device as the indications in the certificate of conformity.

EX

For explosive atmosphere generators, the maximum tripping time of the protection device must not, in case of overload or locked rotor, exceed the time indicated in the certificate of conformity and the t_E time indicated on the generator nameplate.

4.4.2 Thermal protections

The over-temperature protections devices are installed on the main stator, bearings and other parts that require temperature monitoring and thermal protection.
These sensors must be connected to an external temperature monitoring and protection system.
The type of temperature sensor, the connection terminals and the setting temperatures for alarm and shutdown are given in the generator CONNECTION DIAGRAM.

4.4.2.1 Temperature sensors for explosive atmospheres

EX

Generators for explosive atmospheres are supplied with Pt100 sensors in order to accurately measure and monitor the temperature of the windings, bearings and other parts of the generator, as needed.
The references from the respective certificates of conformity must be considered.
When used in the generator protection circuit, the thermal protections must be connected as simple apparatus in intrinsically safe circuits.

4.4.2.2 Temperature limits for the windings

The temperature of the hottest spot of the winding must be kept below the limit of the insulation thermal class. The total temperature is obtained by the sum of the ambient temperature and the temperature rise (T), plus the difference between the average temperature of the winding and the hottest spot of the winding.
The ambient temperature must not exceed 40 °C, in accordance with NBR IEC60034-1 standard. Above this temperature, the working conditions are considered special and the generator specific documentation must be consulted.
Table 4.4 shows the numerical values and the composition of the acceptable temperature at the hottest spot on the winding.

Table 4.4: Insulation class

Insulation class		B	F	H
Ambient temperature	°C	40	40	40
T = temperature rise (temperature measurement method by resistance variation)	°C	80	105	125
Difference between the hottest spot and the average temperature	°C	10	10	15
Total: temperature of the hottest point	°C	130	155	180

ATTENTION

If the generator operates with winding temperatures above the limits of the insulation thermal class, the lifespan of the insulation, and hence that of the generator, will be significantly reduced, or it may even result in the generator burnout.

4.4.2.3 Alarm and trip temperatures

The generator alarm and trip temperatures must be set at the lowest possible value. These temperatures can be determined based on the factory tests or through the generator operating temperature.
The alarm temperature can be set 10 ºC above the machine operating temperature at full load, always considering the highest ambient temperature on site.

ATTENTION

The alarm and trip values may be determined as a result of experience, but they must not exceed the values indicated in the generator wiring diagram.

ATTENTION

The generator protection devices are listed in the WEG drawing – Wiring diagram.
Not using these devices is the sole responsibility of the user and, in case of damage to the generator, it will void the warranty.

4.4.2.4 Temperature and ohmic resistance of the PT100 thermoresistance

Table 4.5 shows the temperature as a function of the ohmic resistance measured across PT100 RTDs.

Formula: $\frac{\Omega - 100}{0.386} = °C$

Table 4.5: Temperature X Resistance (Pt100)

° C	0	1	2	3	4	5	6	7	8	9
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51
10	103.90	104.29	104.68	105.07	105.46	105.95	106.24	106.63	107.02	107.40
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.28
30	111.67	112.06	112.45	112.83	113.22	113.61	113.99	114.38	114.77	115.15
40	115.54	115.93	116.31	116.70	117.08	117.47	117.85	118.24	118.62	119.01
50	119.40	119.78	120.16	120.55	120.93	121.32	121.70	122.09	122.47	122.86
60	123.24	123.62	124.01	124.39	124.77	125.16	125.54	125.92	126.31	126.69
70	127.07	127.45	127.84	128.22	128.60	128.98	129.37	129.75	130.13	130.51
80	130.89	131.27	131.66	132.04	132.42	132.80	133.18	133.56	133.94	134.32
90	134.70	135.08	135.46	135.84	136.22	136.60	136.98	137.36	137.74	138.12
100	138.50	138.88	139.26	139.64	140.02	140.39	140.77	141.15	141.53	141.91
110	142.29	142.66	143.04	143.42	143.80	144.17	144.55	144.93	145.31	145.68
120	146.06	146.44	146.81	147.19	147.57	147.94	148.32	148.70	149.07	149.45
130	149.82	150.20	150.57	150.95	151.33	151.70	152.08	152.45	152.83	153.20
140	153.58	153.95	154.32	154.70	155.07	155.45	155.82	156.19	156.57	156.94
150	157.31	157.69	158.06	158.43	158.81	159.18	159.55	159.93	160.30	160.67

4.4.2.5 Space heater

When the generator is equipped with a space heater to prevent internal water condensation during long periods out of operation, it must be assured that the space heater is energized shortly after turning the generator off, and that it is de-energized before the generator is put into operation.
The values of the space heater supply voltage and power are informed in the connection diagram and in the specific plate affixed to the generator.

4.5 ELECTRICAL ASPECTS

4.5.1 Electrical connections

ATTENTION

Analyze the electrical connection diagram supplied with the generator carefully before beginning the connection of the main cables and those of the accessories. For the electrical connection of auxiliary equipment, refer to their specific manuals.

4.5.1.1 Main electrical connections

The location of stator terminal box is identified in the specific generator DIMENSIONAL DRAWING.
The location of stator terminal box is identified in the specific generator DIMENSIONAL DRAWING.
Make sure the cross section and insulation of the main connection cables are suitable for the generator current and voltage.
The generator must rotate in the rotation direction specified on the nameplate and on the sign arrow affixed to the generator drive end.

NOTE

The rotation direction is, by convention, determined looking to the shaft end at the generator drive end.
Generators with a single rotation direction must only rotate in the indicated direction.
In order to operate the generator in the rotation direction opposite to the specified, consult WEG.

ATTENTION

Before making the connections between the generator and the power supply, it is necessary to perform a careful measurement of the winding insulation resistance.

In order to connect the generator main power supply cables, unscrew the cover of the stator terminal box, cut the sealing rings (standard generators without cable gland) according to the diameter of the cables to be used and insert the cables in the sealing rings. Cut the power supply cables to the necessary length, strip the ends and mount the cable lugs that will be used.

4.5.1.2 Additional information

EX

Generators for explosive atmospheres must be fitted with proper cable lugs and spring washers. Observe the minimum isolation distance between the cables during the connection.
Before closing the terminal box, make sure that all nuts on the terminals and the ground connections are well tightened and that all the seals, including the certified ones, of the cable outlets are in perfect conditions and correctly installed.
The wire gauge of the connection cables must be in accordance with the generator documentation.
Cable inlets not used in the terminal box must be properly closed with certified plugs, according to the protection type for the hazardous area, the EPL (equipment protection level, according to IEC 60079-0 and 60079-14 standards) and the degree of protection indicated on the generator nameplate.
Main connection cable inlets, as well as those for control, must use components (cable glands, conduits, etc.) that comply with the standards and regulations in force in each country.

EX

Check the rated characteristics on the generator nameplate.
Dimension the power cables according to the generator rated current, considering the environmental factors (such as ambient temperature, type of installation, etc.).

In order to dimension the generator connection cables and make the installation in a correct and safe way, the local installation standards must be consulted.

Table 4.6: Low voltage, three-phase cables insulated with PVC ≤ 1kV

Current	Number of Cables	Cable Cross Section
> 600...≤ 800 A	2	300 mm^2
> 400...≤ 600 A	2	185 mm^2
> 300...≤ 400 A	1	300 mm^2
> 200...≤ 300 A	1	185 mm^2
≤ 200 A	1	95 mm^2

Table 4.7: Medium voltage, three-phase cables insulated with PVC

Current	Number of Cables	Cable Cross Section
> 200...≤ 315 A	1	240 mm^2
> 100...≤ 200 A	1	120 mm^2
≤ 100 A	1	35 mm^2

4.6 MECHANICAL ASPECTS

4.6.1 Alignment

The generator must be accurately aligned with the driven machine, particularly in cases of direct coupling.
An incorrect alignment can cause bearing damage, vibrations and shaft breaking.
The best way to ensure correct alignment is to use dial indicator placed on each coupling half, one reading radially and the other axially.
In this way, simultaneous readings can be informed and one can check any parallel (Figure 4.4) or concentricity deviations (Figure 4.5) by rotating the shaft. The dial indicator should not exceed 0.05mm. If the operator is sufficiently skilled, he can obtain alignment with clearance gauge and a steel ruler, providing that the couplings be perfect and centered (Figure 4.6).
A measurement at 4 different points of the circumference should not give a reading difference higher than 0.03mm.

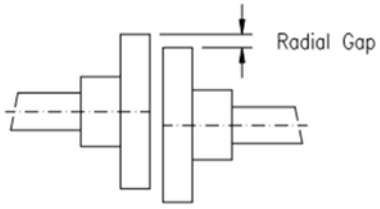


Figure 4.4: Radial clearance (concentricity)

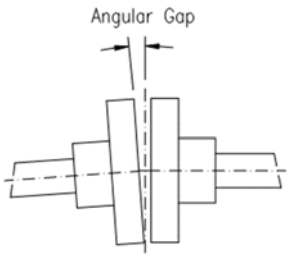


Figure 4.5: Angular clearance (parallelism)

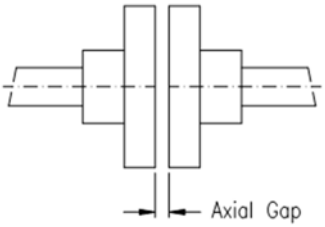


Figure 4.6: Axial clearance

On the alignment/leveling it is important to take in consideration the different expansion levels of the coupled machines can modify the alignment/leveling during generator operation.
There are instruments which use visible laser ray added by specific computer programs that can perform and ensure high precision alignment.

NOTE

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

4.6.2 Coupling

4.6.2.1 Direct coupling

Only appropriate couplings should be used, suitable exclusively for the torque transmission without causing transversal forces. Shaft centers of generators and drive machine, must be absolutely aligned either for flexible or any other type of coupling. The flexible coupling is used to absorb vibrations and to compensate small assembly misalignments. All types of coupling arrangements must be assembled or disassembled using proper devices and never using hammer.

4.6.2.2 Belt and pulley coupling

When a speed relation is necessary, the transmission with belt is more frequently used. The pulley diameter should not be lower than 2/3 of the generator frame diameter. The width of the pulley should not exceed the shaft end length. The maximum diameter is limited by the weight and by the admissible peripheral speed. The peripheral speed for belt type V is 33m/s.

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 80ºC (Figure 4.7).

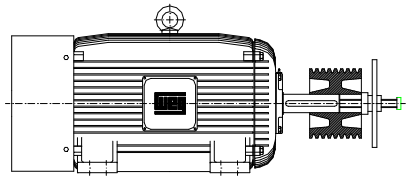


Figure 4.7: Assembly of pulleys

DISASSEMBLY OF PULLEYS: for disassembly of pulleys, it is recommended to use the devices shown in Figure 4.8 in order not to damage the key neither shaft surface.

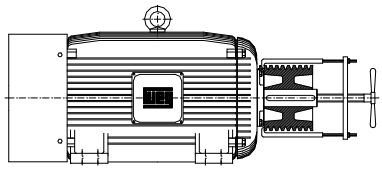


Figure 4.8: Disassembly of pulleys

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 up to a stage that causes complete damage to the bearing.

The correct positioning of a pulley is shown in Figure 4.9.

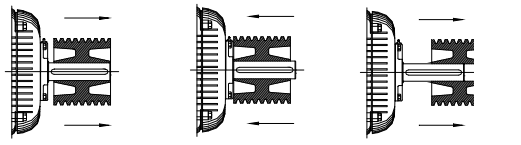


Figure 4.9: Correct positioning of the pulley

RUNNING: Avoid unnecessary thrusts on the bearings by ensuring that the shafts are parallel and the pulleys perfectly aligned according to the Figure 4.10).

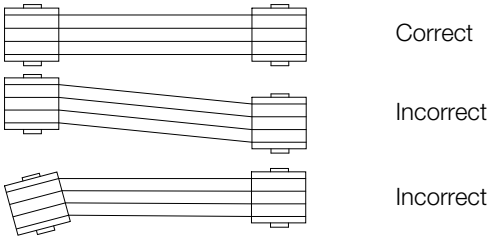


Figure 4.10: Belt drive

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 type material such as rosin.
Belt tension is only required to avoid slippage during operation according to the Figure 4.11:

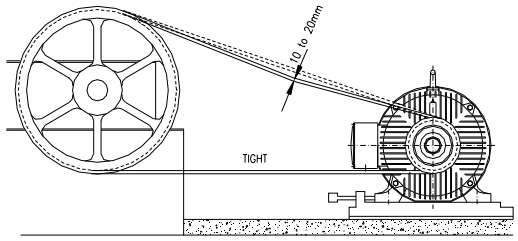


Figure 4.11

NOTE

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

Excessively small pulleys should be avoided; these cause shaft flexion as belt traction increases with the decrease of pulley size.
When specific pulleys are required, contact WEG in order to insure a correct designing.

5 COMMISSIONING

When the generator is started for the first time or after a prolonged standstill, several aspects must be considered besides the regular operation procedures.

ATTENTION

- Avoid any contact with electric circuits;
- Even low-voltage circuits may be life threatening;
- In any electromagnetic circuit, overvoltage may occur under certain operating conditions;
- Do not open an electromagnetic circuit suddenly, because the presence of an inductive discharge voltage may break the insulation or injure the operator;
- In order to open those circuits, disconnect switches or circuit breakers must be used.

5.1 PRELIMINARY INSPECTION

Before the first generator start or after long periods out of operation, the following items must be inspected:

1. Check if all the generator fastening bolts are tightened;
2. Measure the winding insulation resistances, making sure they are within the specified values;
3. Check if the generator is clean and if the packages, measuring instruments and alignment devices were removed from the generator operating area;
4. Check if coupling connecting components are in perfect operating conditions, duly tightened and greased, where necessary;
5. Check if the generator is correctly aligned;
6. Check if the bearings are properly lubricated. The lubricant must be of the type specified on the nameplate;
7. Inspect the cable connections of accessories (thermal protectors, grounding, space heaters, etc.);
8. Check if all electrical connections comply with the generator connection diagram;
9. Check if the generator is properly grounded;
10. The cables connected to the stator and rotor main terminals must be properly tightened in order to prevent their short-circuit or loosening;
11. Inspect the cooling system. In water-cooled generators, inspect the operation of the radiator water supply system. In generators with independent ventilation, check the rotation direction of the fans;
12. Generator air inlets and outlets must be unobstructed;
13. The moving parts of the generator must be protected to prevent accidents;
14. The terminal box covers must be correctly fastened;
15. Check if the power supply voltage and frequency comply with the data on the generator nameplate;
16. Check if the purge and pressurization device (if any) is correctly installed and adjusted according to its nameplate.

5.2 FIRST STARTING

5.2.1 Starting procedure

After all preliminary inspections have been carried out, proceed according to the directions presented next in order to perform the first start of the uncoupled generator:

1. Turn off the space heater;
2. Set the protections in the control panel;
3. In oil-lubricated bearings, check the oil level;
4. In bearings with forced lubrication, start the oil circulation system and check the level, flow and pressure of the oil, making sure that they comply with the data on the nameplate.
5. If the system has oil flow detection equipment, it must be waited until the flow return signal from the oil circulation system of both bearings is received, which makes sure that the oil has reached the bearings;
6. Start the industrial water-cooling system checking the required flow and pressure (generators with air-water heat exchanger);
7. Turn on the fans (generators with forced ventilation);
8. Switch on the high-pressure oil injection system (if any), keeping it on as informed in the generator technical documentation until the bearings get the lubrication by self-pumping;
9. Rotate the generator shaft slowly in order to check that no part is being dragged or any abnormal noises are occurring;
10. After the previous steps have been adequately completed, it is possible to proceed with the generator starting sequence;
11. Start the generator with no load, making sure it rotates smoothly without strange noises;
12. Check the rotation direction with the generator uncoupled;
13. In order to invert the rotation direction, just invert the connections of any two phases;

ATTENTION

In order to invert the rotation direction of generators with single direction, it is necessary to consult WEG.

14. Keep the generator rotating at rated speed and write down the bearing temperatures at 1-minute intervals until they become constant. Any sudden increase in bearing temperature indicates lubrication or friction surface abnormality;
15. Monitor the temperature, the oil level of the bearings, and the vibration levels. If there is a significant variation of any value, interrupt the generator starting, identify possible causes and make the necessary corrections;

16. When the bearing temperatures stabilize, it is possible to proceed to the other generator operation steps.

ATTENTION

The noncompliance with the procedures described in section 5.2 may impair the generator performance, cause damages and even lead to its burnout, voiding the warranty.

5.3 OPERATION

The operating procedures vary considerably depending on the generator application and the type of control equipment used.
The general procedures are described in this manual. For the control system operating procedures, refer to the specific manual of this equipment.

5.3.1 General

After a first successful starting test, couple the generator to the driven load, and then the starting procedure can be reinitiated, as follows:

- Start the generator coupled to the load until its temperature stabilizes and check for unusual noises, abnormal vibrations or excessive heating. If significant vibration variations occur regarding the initial operation condition until the condition after reaching thermal stability, then it is necessary to check the alignment and the leveling.
- Measure the current consumption and compare it to the value given on the nameplate.
- In continuous duty, without load variation, the measured current must not exceed the value indicated on the nameplate multiplied by the service factor;
- All the instruments and devices for measurement and control must be permanently monitored to detect occasional alterations, determine their causes and make the proper corrections.

5.3.2 Temperatures

- The temperatures of the bearings, stator winding and cooling system must be monitored while the generator is operating.
- These temperatures must stabilize within 4 to 8 hours of operation.
- The stator winding temperature depends on the machine load; therefore, the driven load must also be monitored during the generator.

5.3.3 Bearings

The system start, as well as the first hours of operation, must be monitored carefully.
Before putting the generator into operation, verify:

- If the high-pressure oil injection system (if any) is ON;
- If the external lubrication system (if any) is ON;
- If the used lubricant complies with the specifications;
- The lubricant characteristics;
- The oil level (oil-lubricated bearings);
- If the bearing alarm and trip temperatures are set;
- During the first start, it is important to pay attention to unusual vibrations or noises;
- If the bearing is not working silently and smoothly, the generator must be shut down immediately;
- In case of overheating, the generator must be shut down immediately for the inspection of bearings and temperature sensors, and the correction of possible causes;
- The generator must operate for several hours until bearing temperatures stabilize within the specified limits;
- After the bearing temperatures stabilize, check if there are no leaks through the plugs, gaskets or shaft end.

5.3.3.1 High-pressure oil injection system

In bearings which have the option for shaft lifting when starting or stopping by means of oil pressure, the activation of this system is done by means of an external oil pump, and the following procedure must be observed:

ATTENTION

The high-pressure oil injection system must be switched on before putting the generator into operation and during the shutdown procedure, as informed in the generator technical documentation.

5.3.4 Radiators

During the operation of generators with air-water heat exchanger, it is necessary:

- Controlling the temperature at the radiator inlet and outlet and, if necessary, correcting the water flow;
- Adjusting the water pressure just to overcome the resistance in the pipes and in the radiator;
- In order to control the generator operation, it is recommended to install thermometers at the radiator air and water inlets and outlets and record these temperatures at certain time intervals;
- When installing the thermometers, recording or signaling instruments (siren, lights) can also be installed in certain places.

Verification of the radiator performance

- For operation control purposes, it is recommended that water and air temperatures at the radiator inlets and outlets be measured and recorded periodically;
- The radiator performance is expressed by the temperature difference between cold water and cold air during normal operation. This difference must be checked periodically. If an increase in this difference is observed after a long period of normal operation, verify the need for radiator cleaning.
- The accumulation of air inside the radiator can lead to a performance reduction or to its damage. In this case, a deaeration of the radiator and the pipes may solve the problem;
- The water pressure differential can be considered an indicator of the need for cleaning the radiator.
- It is also recommended to measure and record the difference between the water pressure before and after the radiator. Periodically, the values measured must be compared to the original value, and an increase of the pressure differential indicates the need for cleaning the radiator.

5.3.5 Vibration

The generators are balanced at the factory in compliance with the vibration limits established by IEC60034-14, NEMA MG1 – Part 7 and NBR 11390 standards (except when the purchase contract specifies different values).
The vibration measurements are carried out on the NDE and DE bearings, in the vertical, horizontal and axial directions. When the customer sends the half coupling to WEG, the generator is balanced with the half coupling mounted on the shaft. Otherwise, according to the standards above, the generator is balanced with half-key (i.e., the key slot is filled with a bar of the same width,

thickness and height of the key slot during the balancing operation).
The maximum vibration levels met by WEG for running generators are given in the wiring diagram.
The main vibration causes are:
- Misalignment between the generator and the driven equipment;
- Improper fastening of the generator to the base, with “loose shims” under one or more generator feet, and loose fastening bolts;
- Improper or insufficiently rigid base;
- External vibrations proceeding from other equipment.

ATTENTION

Operating the generator with vibration above the values contained in its wiring diagram may impair its useful life and/or performance.

5.3.6 Shaft vibration limits

In generators equipped with or prepared for the installation of proximity sensors (normally used on sleeve bearings), the surfaces of the shaft are prepared with special finishing in the areas adjacent to the bearings, in order to assure the correct measurement of the shaft vibration.
The shaft vibration measured in these generators must comply with the IEC 60034-14 or NEMA MG 1 standard.
The alarm and trip values of Table 5.1 represent the acceptable shaft vibration values for coupled electrical machines according to the ISO7919-3 standard.
These values are generic and for guidance, and the specific application conditions must always be considered, especially the diametrical clearance between the shaft and the bearing.

Table 5.1: Shaft vibration

Rated Speed (rpm)	Shaft Vibration (µm peak-to-peak)			
	Frame	280 and 315	355 to 450	> 450
1800	Alarm	110	130	150
	Tripping	140	160	190
3600	Alarm	85	100	120
	Tripping	100	120	150

ATTENTION

Operating the generator with shaft vibration values within the alarm or tripping range may cause damages to the bearing shell.

The main causes for increase in shaft vibration are:
- Coupling unbalance issues or other problems that may also generate machine vibration;
- Shaft shape problems in the measurement region, minimized during manufacturing;
- Residual magnetism or voltage on the shaft surface where the measurement is done;
- Scratches, dents or variations on the shaft finishing in the measurement region.

5.3.7 Shutdown

In order to shut down the generator, proceed as follows:
- Reduce the load of the driven equipment, if possible;
- Open the main circuit breaker;
- Switch on the high-pressure oil injection system (if any);

After the generator stops completely:
- Switch off the high-pressure oil injection system (if any);
- Switch off the oil circulation system of the bearings (if any);
- Switch off the hydraulic unit (if any);
- Shut down the industrial water system (if any);
- Switch off the forced ventilation system (if any);
- Switch on the space heaters. They must be kept ON until the next generator operation.

DANGER

Even after switching the generator off, while the rotor is rotating, there is danger to life by touching any of the generator active parts.

ATTENTION

The terminal boxes of generators equipped with capacitors must not be opened before their full discharge.
Discharge time of the capacitors: five minutes after shutting down the generator.

6 MAINTENANCE

6.1 GENERAL

A proper maintenance program for electric generators includes the following recommendations:

- Keep the generator and the associated equipment clean;
- Measure the winding insulation resistance periodically;
- Measure the temperature of windings, bearings and cooling system periodically;
- Check the wear, operation of the lubrication system and useful life of the bearings;
- Measure the generator vibration levels;
- Inspect the cooling system;
- Inspect associated equipment;
- Inspect all the generator accessories, protections and connections, ensuring that they are operating properly;

ATTENTION

Noncompliance with the recommendations of section 6.1 may cause undesired stoppages of the equipment.
The frequency of such inspections depends on the local application conditions.
Every time that it becomes necessary to transport the generator, the shaft must be properly locked to prevent damages to the bearings. Use the device supplied with the generator to lock the shaft.
If the generator requires reconditioning or replacement of any damaged part, consult WEG.

6.2 GENERAL CLEANING

- Keep the frame clean, without external accumulation of oil or dust, in order to facilitate the heat exchange with the environment;
- The inside of the generator must also be kept clean, free of dust, debris and oils;
- For cleaning, use brushes or clean cotton cloths. If the dust is not abrasive, the cleaning must be done with an industrial vacuum cleaner, “aspiring” the dirt from the fan cover and the dust accumulated on the fan blades and on the frame;
- Debris impregnated with oil or moisture can be removed with a cloth soaked in appropriate solvents;
- Clean the terminal boxes when necessary. Terminals and connectors must be kept clean, free of rust and in perfect operating conditions. Avoid the presence of grease or verdigris in the connection parts.

6.2.1 Electrostatic charge

DANGER

Generators that have potential risk of electrostatic charge accumulation, supplied properly identified, must be cleaned carefully, with a damp cloth, for instance, in order to prevent the generation of electrostatic discharges.

6.3 WINDING MAINTENANCE

To obtain more satisfactory operation and a longer life of the generator, the windings should be inspected and cleaned annually.

6.3.1 Winding inspection

Yearly, the windings must be submitted to a complete visual inspection, recording and repairing all and every damage or defect observed.
The winding insulation resistance measurements must be done at regular intervals, especially during humid weather and after prolonged generator stoppages.
Low values or sudden variations in the insulation resistance must be investigated.
The windings must be submitted to complete visual inspections at frequent intervals, recording and repairing all and every damage or defect observed.
The winding insulation resistance can be increased up to an adequate value in the points where it is low (as a result of excessive dust and moisture) by means of the dust removal and by drying the winding moisture.

6.3.2 Winding cleaning

In order to obtain a more satisfactory operation and a longer useful life of the insulated windings, it is recommended to keep them free of dirt, oil, metal dust, contaminants, etc.
Therefore, it is necessary to inspect and clean the windings periodically, according to the recommendations of the "Maintenance Plan" of this manual. If reimpregnation is necessary, consult WEG.
The windings may be cleaned with an industrial vacuum cleaner with a non-metallic crevice tool or just a dry cloth.
For extreme dirt conditions, it may be necessary to use a proper liquid solvent for cleaning. This cleaning must be quick to prevent prolonged exposure of the windings to the solvent effects.
After being cleaned with solvents, the windings must be completely dried.
Measure the insulation resistance and the polarization index in order to assess the winding insulation conditions.
Winding drying time after cleaning varies depending on the weather conditions such as temperature, humidity, etc.

DANGER

Most solvents currently used are highly toxic and/or flammable.
Solvents must not be used in the straight parts of the coils of high-voltage generators, because they may affect the protection against corona effect.

6.3.3 Inspections

The following inspections must be carried out after the windings are carefully cleaned:

- Check the insulations of the winding and connections;
- Check if spacers, bindings, slot wedges, bandages and supports are properly fixed;
- Check for breaks, faulty welds, short-circuit between turns and against the frame in the coils and connections. In case any fault is detected, consult WEG.
- Ensure that all cables are properly connected and that terminal fixation components are duly tightened. Retighten, if necessary.

6.3.4 Reimpregnation

If any layer of resin on the windings is damaged during cleaning or inspection, such parts must be corrected with adequate material (in this case, consult WEG).

6.3.5 Insulation Resistance

The insulation resistance must be measured after the completion of all of the maintenance procedures.

ATTENTION

Before putting the generator back into operation, it is essential to measure the winding insulation resistance and ensure that the measured values meet the specifications.

6.4 ELECTRICAL CONNECTION INSPECTION

- Periodically, check that all the connections and terminals of the terminal box are tight;
- Check the passage of the cables in the terminal box, the seals of the cable glands and the seals in the terminal boxes;
- Remove all the dust and dirt from the inside of the terminal box, if necessary.

DANGER

Service on electrical machines can only be performed when they are stopped and all the phases disconnected from the power supply.

6.5 MECHANICAL INSTALLATION INSPECTION

- Check if all of the generator fastening bolts are tightened;
- Evaluate the coupling run out, measure the axial and radial clearance and compare the results to the maximum specified values;
- Periodically, measure the vibration levels of the machine and compare the results to the values indicated in the table of the “Vibration” chapter.

6.6 VIBRATION

Any evidence of increase in the unbalance or vibration of the generator must be investigated immediately.

ATTENTION

After torquing or disassembling any machine screw, it is necessary to apply Loctite.

6.7 BEARING MAINTENANCE

6.7.1 Bearings

The generators GTK are endowed of ball bearings, whose characteristics are indicated in the table below:

FRAME	Side	Bearing	Estimated Life (hours)
160	Front	6309 ZZ	20000
	Rear	6207 ZZ	20000
180	Front	6311 Z	20000
	Rear	6211 Z	20000
200	Front	6312 C3*	20000
	Rear	6212 Z	20000
225	Front	6314 C3*	20000
	Rear	6314 C3*	20000
250	Front	6314 2RS	20000
	Rear	6314 2RS	20000
280	Front	6318 C3*	20000
	Rear	6216 C3*	20000
315	Front	6320 C3*	20000
	Rear	6320 C3*	20000

* Relubricated bearings. The lubrication interval and quantity of grease for these bearings are described in the lubrication nameplate fastened in the generator frame.

6.7.2 Bearings Replacement

A bearing should only be removed from the shaft when absolutely required;
Firstly, remove the bearings external caps and generator covers.
The complete rotor should be removed of the stator carefully in direction to the drive end side.
The extractor grips must be applied to the sidewall of the inner ring to be stripped, or to an adjacent part.
To remove the bearings should be used an extractor with 3 grips and must be applied to the sidewall of the inner ring to be stripped, or to an adjacent part.
Before mounting the new bearings (according to specified), the seats in the shaft should be clean and slightly lubricated.

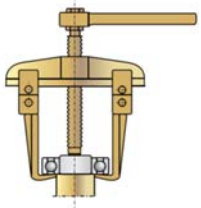


Figure 6.1: Tool for bearing extraction

The bearing for mounting should be pre-heated (+/-80ºC) and cased in position perfectly centered with the shaft.
The bearings should not be submitted the bumps or shocks neither the deficient storages where there are humidity and vibration, because can arise marks in the tracks provoking noisy operation and fast waste of the bearings.

6.8 REFRIGERATION

The generator GTK is self-ventilated endowed of an axial fan mounted in the shaft in the non-drive end side and protected for a cast iron cover with aspiration wide area guiding the air on the finned frame.

6.9 DIRECTION OF ROTATION

The generator GTK can operate in both direction of rotation, however, the phase's sequence is adjusted for the clockwise rotation (seen in the drive end side). According to the standard VDE 0530, the generators terminals are marked of such a form, that terminals sequence 1, 2 and 3 (R, S, and T) coincides with the phase's sequence, when the rotation direction is clockwise.
In generators that need to operate anticlockwise, the phase's sequence should be changed (if need). Recommend verifying the rotation direction and the phases sequence necessary before the putting the generator in operation.

ATTENTION

The wrong phase's sequence can cause damages in the machines used to the generator as well as serious problems in the attempt of synchronization with another generator or with the grid.

6.10 DIODES REPLACEMENT

When damage occurs on one of the rotating diodes, it is also required to check the conduction characteristics of the remaining diodes. The set of diodes makes part of the field excitation circuit of the synchronous machine. To verify in the diodes, it is enough removing the shutter fastened in the rear cover and done the necessary measuring. To change some diodes is necessary to remove the rear cover (unscrewing of the frame and disconnecting the cables that go out from exciter stator and are connected in the voltage regulator). Electrically, this circuit presents the following configuration:

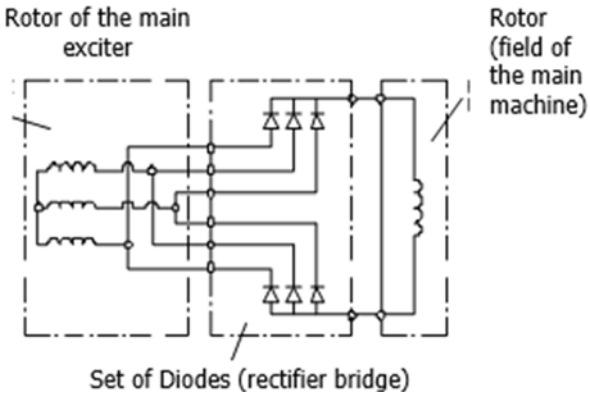
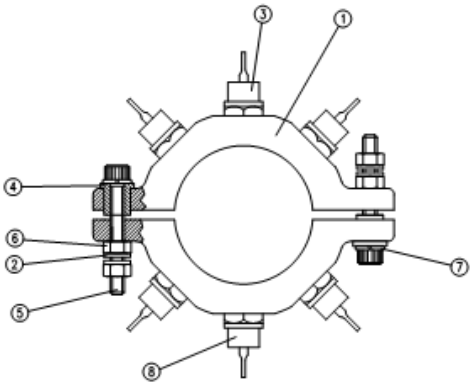


Figure 6.2: Field excitation circuit

NOTE

From here on, the following abbreviations will be used:
AND – anode in the frame;
CTD – cathode in the frame.

6.11 DIODES REPLACEMENT



Pos.	Description	Qtd.
8	Diode DS4 Catode	03
7	Washer	02
6	Screw-nut	04
5	Screw internal sixfold	02
4	Insulated buje	02
3	Diode DS4 Anode	03
2	Smooth washer 6x11	04
1	Diodes support	02

Placement of the diodes in the supports:

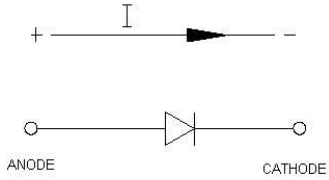
- Fasten one of the supports in the bench vise with protection in the mordant, so that the side for the placement of the diodes (side with finishing), be accessible.
- Put three diodes with same polarity (AND or CTD) in the support. Tighten with torquemeter obeying mounting torques described in the following table:
- Fasten the other support in the bench vise, in the same way that the previous support.
- Put, in this support, three diodes with contrary polarity to of the three previous diodes (AND or CTD).
- Use torquemeter obeying the table for mounting torques.

Rectifier base thread (mm)	Torquemeter (mm)	Mounting torque (Nm)
M6	11	2
M8	17	4
M12	24	10
M16	32	30

ATTENTION

It is fundamentally important that the torque indicated be respected to avoid damage to rectifiers while mounting

Conduction of current should occur only from anode to cathode, that is, on the direct polarization condition.



Frame	Quant.	Technical characteristics
160 a 225	03	SKN 26/12 DS4 AND
	03	SKR 26/12 DS4 CTD
250 a 315	03	SKN 52/12 DS6 AND
	03	SKR 52/12 DS6 CTD

6.12 DRYING OF WINDINGS

It is recommended that this task be undertaken carefully and by qualified personnel.
Disassemble the generator and carries only the frame with the stator winding or the rotor without the bearings.
The complete drying is done during 7 hours in an oven at 150 ºC.
During drying process, temperature should be controlled carefully.
In the beginning of such process, the insulation resistance will decrease due to temperature increase, and will then increase as the insulation is dehumidified.
The drying process should continue until successive measurements of the insulation resistance show a constant insulation resistance which should exceed the minimum specified value.
The winding is effectively dried through a warm air flow.
To ensure that the warm air is dry, a certain number of fans must be uniformly placed on the air inlet side.
In case the humidity level is excessively high, space heaters should be provided between the fans and the winding, or use forced ventilation heaters.
It is extremely important to provide satisfactory ventilation inside the generator during the drying process ensuring removal of the moisture.
The dehumidifying heat can also be obtained energizing the generator space heaters or circulating current through the windings being dehumidified.

7 GENERATOR DISASSEMBLY AND ASSEMBLY

ATTENTION

All the repair, disassembly and assembly services must be performed only by properly qualified and trained professionals; otherwise, equipment damage and personal injury may occur. If any further explanations are necessary, consult WEG.
The disassembly and assembly sequences depend on the generator model.
Always use proper tools and devices. Any damaged part (cracks, dents on machined parts, faulty threads) must be replaced, avoiding restorations.

7.1 QUALIFIED PROFESSIONAL

EX

The repair services on generators applied in explosive atmospheres must be carried out only by qualified professionals authorized by WEG to perform such jobs.

7.2 DISASSEMBLY

The following precautions must be taken when disassembling the electric generator:

1. Always use proper tools and devices to disassemble the generator;
2. Disconnect the generator electrical connections and those of the accessories;
3. Remove the bearing temperature sensors and the grounding brush;
4. In order to prevent damages to the rotor and coil heads, support the shaft on both drive and non-drive ends;
5. In order to disassemble the bearings, follow the procedures described in this manual;
6. The removal of the rotor from the generator must be done with a suitable device and with extreme care so that the rotor does not drag on the stator laminated core or coil heads, thus preventing damages.

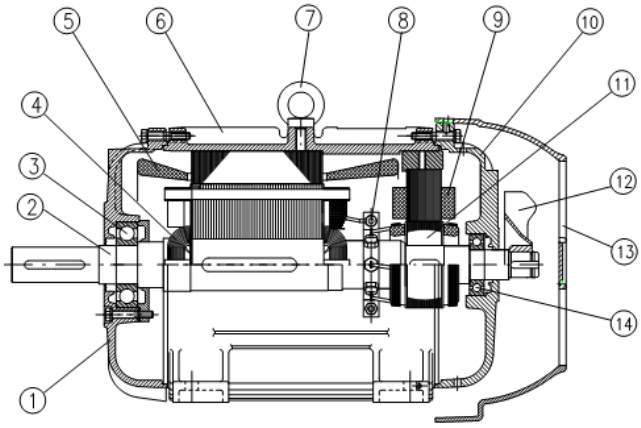
7.3 ASSEMBLY

In order to assemble the generator, follow the disassembly procedures in the reverse order.

7.4 AIR-GAP MEASUREMENT

After disassembling and assembling the generator, it is necessary to measure the air gap in order to check the concentricity between rotor and stator.
The difference between the air-gap measured in two points diametrically opposed must be less than 10% of the average air gap.

7.5 PARTS



Pos.	Description
1	Front cover
2	Shaft
3	Front bearing
4	Rotor winding
5	Stator winding
6	Frame
7	Eyebolt
8	Set of rectifiers
9	Exciter stator
10	Rear cover
11	Exciter rotor
12	Fan
13	Air baffle
14	Rear bearing

7.6 HOW TO ORDER

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

7.7 KEEPING STOCK

It is recommended to keep in stock the following spare parts:

- Bearings;
- Set of rectifiers.

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

8 MAINTENANCE PLAN

The maintenance plan described in Table 8.1 is only referential, and the intervals between each maintenance intervention may vary according to the generator location and operating conditions.
For the associated equipment, such as the water supply unit or control and protection system, it is necessary to refer to their specific manuals.

Table 8.1: Maintenance plan

DAILY	
▪ Whole generator	▪ Inspection of noise, vibration and temperature of the windings and bearings
WEEKLY	
▪ Bearings	▪ Inspection of noise, vibration, oil flow, leaks and temperature
▪ Protection and control equipment	▪ Recording of the measured values
▪ Whole generator	▪ Inspection of noise and vibration
ANNUALLY (FULL INSPECTION)	
▪ Stator winding	▪ Visual inspection, cleaning, verification of terminals, measurement of insulation resistance
▪ Rotor	▪ Visual inspection, cleaning
▪ Bearings	▪ Inspection of the lubricant quality and relubrication when necessary
▪ Protection and control equipment	▪ Operation test
▪ Whole generator	▪ Retightening of the screws
▪ Terminal boxes, grounding	▪ Cleaning of the terminal box ▪ Retightening of the screws
▪ Coupling	▪ Verification of the alignment and retightening of the screws
▪ Whole generator	▪ Retightening of the screws, cleaning of the terminal boxes, retightening of the electrical and grounding connections
▪ Pressurization system (Ex “p” generators)	▪ Inspection according to the installation and maintenance manual of this equipment

INSPECTIONS EVERY 2 YEARS (ACCORDING TO NBR IEC60079-17 STANDARD) Ex GENERATORS		Ex "e"			Ex "ec"			Ex "t"		
CHECK WHETHER:		Degree of inspection[1]								
		D	A	V	D	A	V	D	A	V
A	**EQUIPMENT**									
1	The equipment is appropriate for the requirements of EPL / Installation location zone	x	x	x	x	x	x	x	x	x
2	The equipment group is correct	x	x		x	x		x	x	
3	The equipment temperature class is correct (only for gas)	x	x		x	x				
4	The maximum surface temperature of the equipment is correct							x	x	
5	The equipment protection degree (IP code) is appropriate for the protection level /group/conductivity	x	x	x	x	x	x	x	x	x
6	The identification of the equipment circuit is correct	x			x			x		
7	The identification of the equipment circuit is available	x	x	x	x	x	x	x	x	x
8	The enclosure, the glass parts and seals, and/or glass/metal sealing compounds are satisfactory	x	x	x	x	x	x	x	x	x
9	There are no damages or unauthorized modifications	x			x			x		
10	There are no evidence of unauthorized modifications		x	x		x	x		x	x
11	The screws, cable inlet devices (direct or indirect) and sealing plugs are of the correct type and completely tightened									
	▪ Physical verification	x	x		x	x		x	x	
	▪ Visual verification			x			x			x
14	**The condition of the enclosure gaskets is satisfactory**	x			x			x		
15	**There is no evidence of water or dust ingress into the enclosure, according to the IP degree of protection**	x			x			x		
17	The electrical connections are tightened	x			x			x		
18	Unused terminals are fastened	x			x					
19	The encapsulated switching devices and hermetically sealed devices are not damaged				x					
20	Encapsulated components are not damaged	x			x					
21	Explosion-proof components are not damaged	x			x					
25	Breathers and drains are satisfactory	x	x		x	x				
29	Generator fans have proper clearance from the enclosure and/or covers; the cooling system is not damaged; the generator foundation do not have signs of cracks	x	x	x	x	x	x	x	x	x
30	The cooling air circulation is not obstructed	x	x	x	x	x	x	x	x	x
31	**The insulation resistance (RI) of the generator windings is satisfactory**	x			x			x		
B	**INSTALLATION – GENERAL REQUIREMENTS**									
1	The type of cable is appropriate	x			x			x		
2	There are no evident damages to the cables	x	x	x	x	x	x	x	x	x
3	The sealing of the bundles, ducts and/or conduits is satisfactory	x	x	x	x	x	x	x	x	x
5	The integrity of the conduit system and the interfaces with the mixed systems are maintained	x			x			x		
6	The grounding connections, including any supplementary grounding connections are satisfactory (e.g., the connections are tightened and the conductors have a proper gauge)									
	▪ Physical inspection	x			x			x		
	▪ Visual inspection		x	x		x	x		x	x
7	The impedance of the fault circuit (TN system) or the grounding resistance (IT system) is satisfactory	x			x			x		
8	The automatic electrical protection devices operate within the permitted limits	x			x			x		
9	The automatic electrical protection devices are correctly calibrated (no possibility of auto-reset)	x			x			x		
10	The specific conditions of safe use (if any) are meet	x			x			x		
11	The ends of cables that are not used have proper finishing	x			x			x		
13	The installation of converters with variable voltage/frequency is in accordance with the documentation	x	x		x	x		x	x	
B	**INSTALLATION – HEATING SYSTEM**									
14	The temperature sensors are operating according to the manufacturer documentation	x						x		
15	The safety trip devices operate according to the manufacturer documentation	x						x		
16	The setting of the safety trip device is locked	x	x							
17	The reset of the safety trip device of a heating system is only possible by means of a tool	x	x							
18	The automatic reset is not possible	x	x							
19	The reset of a safety trip device under fault conditions is avoided	x								
20	The safety trip device is independent from the control system	x								
21	The level switch is installed and properly adjusted, if required	x								
22	The flow switch is installed and properly adjusted, if required	x								
	INSTALLATION – GENERATORS									
23	The protection devices operate within the permitted limits of t_E or t_A	x								
C	**ENVIRONMENT**									
1	The equipment is properly protected against corrosion, bad weather, vibration and other adverse factors	x	x	x	x	x	x	x	x	x
2	There is no improper accumulation of dust or dirt	x	x	x	x	x	x	x	x	x
3	The electrical insulation is clean and dry	x			x			x		
[1] Degree of inspection D = Detailed, A = Accurate, V = Visual										
Note: For items B7 and B8, the possibility of the flammable mixture presence in the surroundings of the equipment must be taken into account when using electrical testing equipment										

INSPECTIONS EVERY 2 YEARS (ACCORDING TO NBR IEC60079-17 STANDARD) Ex “p” Generators				
CHECK WHETHER:		Degree of inspection[1]		
		D	A	V
A	**EQUIPMENT**			
1	The equipment is appropriate for the requirements of EPL / installation local zone	x	x	x
2	The equipment group is correct	x	x	
3	The equipment temperature class or the surface temperature is correct	x	x	
4	The identification of the equipment circuit is correct	x		
5	The identification of the equipment circuit is available	x	x	x
6	The enclosure, the glass parts and seals, and/or glass/metal sealing compounds are satisfactory	x	x	x
7	There are no unauthorized modifications	x		
8	There are no visible unauthorized modifications		x	x
B	**INSTALLATION**			
1	The type of cable is adequate	x		
2	There are no evident damages to the cables	x	x	x
3	The grounding connections, including any supplementary grounding connections, are satisfactory (e.g., the connections are tightened and the conductors have proper gauge) ▪ Physical inspection ▪ Visual verification	x	x	x
4	The impedance of the fault circuit (TN system) or the grounding resistance (IT system) is satisfactory	x		
5	The automatic electrical protection devices operate within the permitted limits	x		
6	The automatic electrical protection devices are correctly set	x		
7	The inlet temperature of the protection gas is below the maximum specification	x		
8	The ducts, pipes and enclosures are in good conditions	x	x	x
9	The protection gas is substantially free from contaminants	x	x	x
10	The pressure or flow of the protection gas is adequate	x	x	x
11	The indicators of pressure and/or flow, alarms and interlocks operate properly	x		
12	The conditions of the particle and spark barriers of the gas exhaust ducts, located in hazardous areas, are satisfactory	x		
13	The specific conditions of use (if any) are meet	x		
C	**ENVIRONMENT**			
1	The equipment is properly protected against corrosion, bad weather, vibration and other adverse factors	x	x	x
2	There is no improper accumulation of dust or dirt	x	x	x

[1] Degree of inspection D = Detailed, A = Accurate, V = Visual

NOTE

- Detailed inspection encompasses the aspects covered by the accurate inspection and, furthermore, it identifies defects (loose terminals, for example) which can only be detected by opening the enclosure, and by using, if necessary, testing equipment and tools;
- Accurate inspection encompasses the aspects covered by the visual inspection and, furthermore, it identifies defects (loose screws, for example) which can only be detected with the aid of access equipment, such as ladders and tools;
- Visual inspection identifies, without using access equipment or tools, defects that are evident, such as the absence of a screw.

9 ABNORMALITIES, CAUSES AND SOLUTIONS

NOTE

The instructions of Table 9.1 present only a basic list of abnormalities, causes and corrective actions. In case of questions, consult WEG.

Table 9.1: Basic list of abnormalities, causes and corrective actions

ABNORMALITY	CORRECTION
Interruption in the auxiliary winding circuit; Burn fuse.	▪ Check lead connection of the auxiliary coil at the connection block until getting to the regulator connection block;
	▪ Replace the auxiliary fuse (as specified).
	▪ Provide an external excitation with battery (12 up to 20V) until the excitation starts: ▪ Negative pole at F-; ▪ Positive pole at F+.
	▪ Always disconnect regulator leads to avoid damage. ▪ **Warning:** When using a Diesel start battery, this cannot be grounded.
Incorrect drive speed.	▪ Measure the speeds. Eventually make new regulation.
Interruption on the main excitation circuit.	▪ Check connection of leads F+ and F-;
	▪ Measure all rotating rectifiers; replace defective rectifiers or replace complete set.
Defective relay or another regulator component.	▪ Replace voltage regulator.
External voltage adjusting potentiometer broken or connection interrupted.	▪ Check connections of terminals 11-12 as well as the potentiometer.
Protection varistor, if any, is defective.	▪ If defective, replace it; if replacement parts are not available, remove it temporarily.
Defective rotating rectifiers.	▪ Replace the rectifier set.
Adjustment below the rated level.	▪ Adjust it in the potentiometer, in the regulator or in an external potentiometer.
Feeding voltage of the regulator is not in accordance with the outlet voltage required.	▪ Adjust it in the potentiometer, in the regulator or in an external potentiometer.
Incorrect speed.	▪ Measure the machine speed and adjust it
Significant voltage drops.	▪ Control diesel selector.
Defective rotating rectifiers.	▪ Replace rectifier set.
Defective power thiristor; Defective voltage feeding transformer;	▪ Replace the Regulator / transformer (Check voltage/operating voltage);
Feeding voltage of the regulator is not in accordance with the outlet voltage required.	▪ Remake the connections. Check the Voltage Regulator Manual.
Stability poorly adjusted	▪ Adjust regulator stability in the trimpot.
Speed variations on the drive machine.	▪ Frequent variations are originated from the drive machine and these must be eliminated.
Excessive bearing temperature.	▪ Check bearing, grease and axial clearance.
Excessive generator frame temperature.	▪ Cooling air (inlet and outlet) partially blocked, or warm air is returning to the generator; ▪ Generator overload; ▪ Over-excitation.
Excessive vibration.	▪ Misalignment (coupling); ▪ Mounting defect; ▪ Coupling clearance;
Significant voltage drops with further recovery (blinks).	Causes: ▪ Incorrect stability adjust (adjust); ▪ Generator operating with parallelism connected (Put CT in short-circuit); ▪ Momentary overload (Reduce load).

10 DECLARATION OF CONFORMITY Ex

EU Declaration of Conformity

Manufacturers:
WEG Equipamentos Elétricos S.A.
Av. Prefeito Waldemar Grubba, 3000
89256-900 - Jaraguá do Sul – SC – Brazil
www.weg.net

WEG Industrie (India) PVT. LTD.
Plot n° E-20 (North), SIPCOT Industrial Complex
Phase II – Expansion II.
Mornapalli Village, Hosur 635 109
Tamil Nadu - India
www.weg.net/in

WEG (Nantong) Electric Motor Manufacturing CO., LTD.
No. 128# - Xinkai South Road, Nantong
Economic & Technical Development
Zone, Nantong, Jiangsu Province – China
www.weg.net/cn

WEGeuro – Industria Electrica S.A.
Rua Eng Frederico Ulrich,
4470-605 – Maia – Porto – Portugal
www.weg.net/pt
Contact person: Luís Filipe Oliveira Silva Castro Araújo
Authorised Representative in the European Union
(Single Contact Point)

The manufacturer declares under sole responsibility that:

WEG synchronous and asynchronous motors and their components used for following lines:

M..., W60, HGF, W50 and S...

.....

when installed, maintained and used in applications for which they were designed, and in compliance with the relevant installation standards and manufacturer's instructions, comply with the provisions of the following relevant European Union harmonisation legislation, wherever applicable:

ATEX Directive 2014/34/EU
Machinery Directive 2006/42/EC*
EMC Directive 2014/30/EU (electric motors are considered inherently benign in terms of electromagnetic compatibility)

The fulfilment of the safety objectives of the relevant European Union harmonisation legislation has been demonstrated by compliance with the following standards, wherever applicable:

EN 60079-0:2012 + A11:2013 / EN 60079-2:2014/ EN 60079-7:2015/ EN 60079-15:2010/ EN 60079-31:2014/ EN 60204-1:2006 + A1:2009 + AC:2010 and EN 60204-11:2000 + AC:2010

* Low voltage electric motors are not considered under the scope and electric motors designed for use with a voltage rating higher than 1000V are considered partly completed machinery and are supplied with a

Declaration of Incorporation:

The products above cannot be put into service until the machinery into which they have been incorporated has been declared in conformity with the Machinery Directive.

A Technical Documentation for the products above is compiled in accordance with part B of annex VII of Machinery Directive 2006/42/EC.

We undertake to transmit, in response to a reasoned request by the national authorities, relevant information on the partly completed machinery identified above through WEG authorised representative established in the European Union. The method of transmission shall be electronic or physical method and shall be without prejudice to the intellectual property rights of the manufacturer.

Jaraguá do Sul, March 19th, 2019

DEC3219_Rev00 - English 1/2

EU Declaration of Conformity

The Notified Bodies listed below performed the applicable conformity assessment procedures set out in ATEX Directive and issued the following certificates:

Model/Lines	Marking	Certificate No.	NB/No.
Pressurized Enclosure "p" – Level of Protection "pxb" – EPL Gb (Category 2)			
Frame sizes 400-1250 and NEMA equivalent (M)	II 2G Ex pxb IIB/IIC T4/T3 Gb	TÜV 14 ATEX 7514 X	TÜV Rheinland / 0035
Frame sizes 710-1600 and NEMA equivalent (S)	II 2G Ex pxb IIB/IIC T4/T3 Gb	TÜV 15 ATEX 7755 X	
Frame sizes 355-1000 and NEMA equivalent (W60)	II 2G Ex pxb IIB/IIC T4/T3 Gb	TÜV 17 ATEX 8045 X	
Pressurized Enclosure "p" – Level of Protection "pzc" – EPL Gc (Category 3)			
Frame sizes 400-1250 and NEMA equivalent (M)	II 3G Ex pzc IIB/IIC T4/T3 Gc	TÜV 14 ATEX 7571 X*	TÜV Rheinland / 0035
Frame sizes 710-1600 and NEMA equivalent (S)	II 3G Ex pzc IIB/IIC T4/T3 Gc	TÜV 15 ATEX 7754 X*	
Frame sizes 355-1000 and NEMA equivalent (W60)	II 3G Ex pzc IIB/IIC T4/T3 Gc	TÜV 17 ATEX 8110 X*	
Frame sizes 400-1250 and NEMA equivalent (M)	II 3G Ex pzc IIB/IIC T4/T3 Gc	The manufacturer performed the conformity assessment procedure by the Internal Production Control. **	
Frame sizes 710-1600 and NEMA equivalent (S)	II 3G Ex pzc IIB/IIC T4/T3 Gc		
Frame sizes 355-1000 and NEMA equivalent (W60)	II 3G Ex pzc IIB/IIC T4/T3 Gc		
Increased Safety "e" – Level of Protection "ec" – EPL Gc (Category 3) and Dust Ignition Protection by Enclosure "t" – Level of Protection "tc" – EPL Dc (Category 3)			
Frame sizes 315-630 and NEMA equivalent (HGF/W50)	II 3 G Ex ec IIB/IIC T4/T3 Gc II 3 D Ex tc IIIB/IIIC T125°C/ T160°C Dc	Baseefa 06 ATEX 0349X*	SGS Fimko Oy / 0598
Frame sizes 280-1250 and NEMA equivalent (M)	II 3 G Ex ec IIB/IIC T4/T3 Gc II 3 D Ex tc IIIB/IIIC T125°C/ T160°C Dc	Baseefa 06 ATEX 0348X*	
Frame sizes 355-1000 and NEMA equivalent (W60)	II 3 G Ex ec IIB/IIC T4/T3 Gc II 3 D Ex tc IIIB/IIIC T125°C/ T160°C Dc	Baseefa 14 ATEX 0209X*	
Frame sizes 315-630 and NEMA equivalent (HGF/W50)	II 3 G Ex ec IIB/IIC T4/T3 Gc II 3 D Ex tc IIIB/IIIC T125°C/ T160°C Dc	The manufacturer performed the conformity assessment procedure by the Internal Production Control. **	
Frame sizes 280-1250 and NEMA equivalent (M)	II 3 G Ex ec IIB/IIC T4/T3 Gc II 3 D Ex tc IIIB/IIIC T125°C/ T160°C Dc		
Frame sizes 355-1000 and NEMA equivalent (W60)	II 3 G Ex ec IIB/IIC T4/T3 Gc II 3 D Ex tc IIIB/IIIC T125°C/ T160°C Dc		
Dust Ignition Protection by Enclosure "t" – Level of Protection "tb" – EPL Db (Category 2)			
Frame sizes 315-630 and NEMA equivalent (HGF/W50)	II 2 D Ex tb IIIB/IIIC T125°C/ T160°C Db	Baseefa 10 ATEX 0205X	SGS Fimko Oy / 0598
Frame sizes 280-1250 and NEMA equivalent (M)	II 2 D Ex tb IIIB/IIIC T125°C/ T160°C Db	Baseefa 13 ATEX 0227X	
Frame sizes 355-1000 and NEMA equivalent (W60)	II 2 D Ex tb IIIB/IIIC T125°C/ T160°C Db	Baseefa 14 ATEX 0210X	

* A certificate issued by a Notified Body is not mandatory for Category 3 electrical equipment, even though, a voluntary certificate can be issued.

** The ATEX Directive allows the manufacturer to make self-declaration of conformity for Category 3 electrical equipment, since the applicable conformity assessment procedure is performed by the manufacturer.

The Quality System for the certificates described above is approved by SGS Fimko Oy (NB0598) under the Quality Assurance Notification **SGS ATEX 5886 (Brazil), SGS ATEX 6908 (India)** and **SGS ATEX 3862 (Portugal).**

CE marking in: **1998**

Signed for and on behalf of the manufacturer:
Eduardo de Nobrega
Managing Director

Jaraguá do Sul, March 19th, 2019

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11 ENVIRONMENTAL INFORMATION

11.1 PACKAGE

Electric generators are supplied in cardboard, polymer, wood or metallic material packages. These materials are recyclable or reusable and must be properly disposed according to the current regulations of each country. All the wood used in the packaging of WEG generators comes from reforestation and receives anti-fungal treatment.

11.2 PRODUCT

Electric generators, under the constructive aspect, are manufactured mainly with ferrous metals (steel, cast iron), nonferrous metals (copper, aluminum) and plastic. The electric generator, in general, is a product that has a long useful life; however, when it must be disposed, WEG recommends that the materials of the packaging and of the product be properly separated and sent for recycling.
The non-recyclable materials must be properly disposed according to the environmental regulations, i.e., in industrial landfills, co-processed in cement kilns or incinerated. The service providers for recycling, disposal in industrial landfills, co-processing or incineration of waste must be properly licensed by the environmental agency of each state to carry out these activities.

11.3 HAZARDOUS WASTE

Grease and oil waste used to lubricate the bearings should be disposed, according to the instructions of the relevant environmental agencies, because its improper disposal can cause impacts to the environment.

12 SERVICE NETWORK

To consult the Service Network, access the website www.weg.net.

13 WARRANTY TERM

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 twelve (12) months from start-up date or eighteen (18) months from manufacturer shipment date, whichever occurs first.
However, this warranty does not apply to any product which has been subject to misuse, misapplication, 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 accommodation 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's 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.

LIABILITY

Except as specified in the foregoing paragraph entitled "Warranty Terms for Engineering Products", 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 for Engineering Products"), 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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NOTES

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