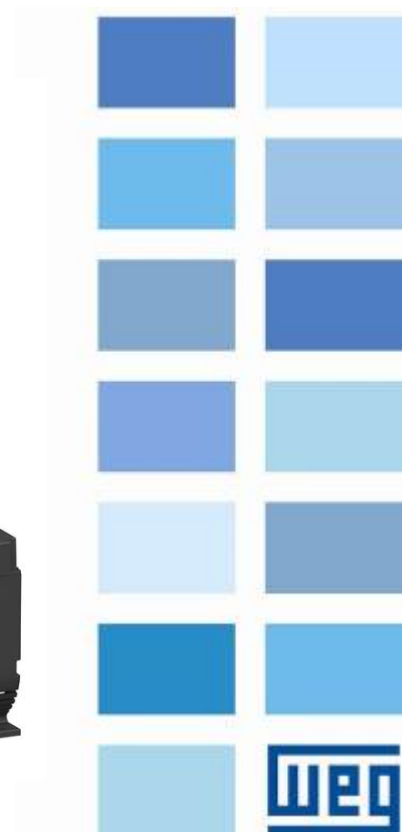


Synchronous Alternators

Line G

Line AG10

Assembly and Disassembly Procedures





Assembly and Disassembly Procedures

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1 INTRODUCTION

This documents aims to illustrate the disassembly and assembly procedures of alternators WEG lines G and AG10. Alternators with specialties can be provided with specific documents (drawings, connection diagram, characteristic curves, etc.). These documents shall be carefully evaluated along with these procedures, before preceding the alternator maintenance.

Consult WEG in case there is need of any additional clarification. All the procedures and standards inserted in this document shall be followed to guarantee good working of the alternator and the safety of the professional concerned with its operation. Observing these procedures is equally important to assure the validity of the alternator guarantee. Therefore, we recommend the comprehensive reading of this document before the maintenance of the alternator.

These procedures are complementary to the installation manual, generator maintenance and operation and do not substitute in case of the product's guarantee evaluation.



WARNING

In case of replacement of parts mentioned in these disassembly and assembly procedures, manufacturing date of the alternator shall be observed in relation to the manual review date.

It is indispensable to follow the procedures contained in this document so that the guarantee is valid;

The installation, operation and maintenance procedures of the alternator shall be carried out by qualified people.



DANGER

During operation, such equipment has energized or rotating exposed parts, which can present high voltage or high temperatures.

Before operating the equipment, guarantee that the safety procedures were adequately employed to avoid accident risks.

The operation with open terminal boxes, non-protected couplings, of wrong handling, without considering operation standards, can cause severe personal accidents and material damages.



NOTE

The reproduction of information from this document, in the whole or partially, is allowed, since the source is mentioned.

1.1 SAFETY WARNINGS

In this document the following safety warnings are used:



DANGER

Non consideration of procedures recommended in this warning can cause considerable material damages, severe injuries or death.



WARNING

Non consideration of the procedures recommended in this warning can cause material damages.



NOTE

The text with this warning has the goal of providing important information for the correct understanding and good working of the product.

2 ALTERNATORS DRAWINGS OF WEG GTA/AG10 FOR REFERENCE

2.1 ALTERNATOR WEG GTA 160

2.2 ALTERNATOR WEG GTA 200



Figure 2.1: GTA 160 B15T-G



Figure 2.4: GTA 200 B15T-G



Figure 2.2: GTA 160 B35T-G



Figure 2.5: GTA 200 B35T-G



Figure 2.3: GTA 160 B3T-G



Figure 2.6: GTA 200 B3T-G

2.3 ALTERNATOR WEG GTA 250

2.4 ALTERNATOR WEG GTA 315



Figure 2.7: GTA 250 B15T-G



Figure 2.10: GTA 315 B15T-G



Figure 2.8: GTA 250 B35T-G



Figure 2.11: GTA 315 B35T-G



Figure 2.9: GTA 250 B3T-G



Figure 2.12: GTA 315 B3T-G

2.5 ALTERNATORS WEG AG10 250 / 280 / 315



Figure 2.13: AG10 B15T-G



Figure 2.14: AG10 B35T-G



Figure 2.15: AG10 B3T-G

3 ALTERNATOR VISUAL CHECKING

Conditions of preservation and visual aspects shall be observed, such as beat, scratch, deformation marks, non-corresponding to the product in condition of new product, in the following parts:

3.1 SHAFT END



Figure 3.1: Shaft end B3



Figure 3.2: Shaft end B35

3.2 COUPLING DISC AND FLANGE



Figure 3.3: GTA 160



Figure 3.4: GTA 200 / 250 / 315



Figure 3.5: AG10 250 / 280 / 315

3.3 FANS



Figure 3.6: Aluminum fan



Figure 3.7: Plastic fan

3.4 TERMINAL BOXES, COVERS AND SHUTTERS



Figure 3.8: Terminal box, covers and shutters



Figure 3.9: Terminal box, covers and shutters

3.5 TERMINAL BLOCKS

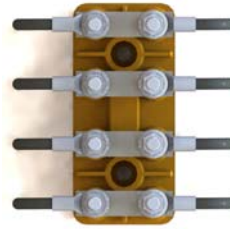


Figure 3.10: 8-pin terminal block

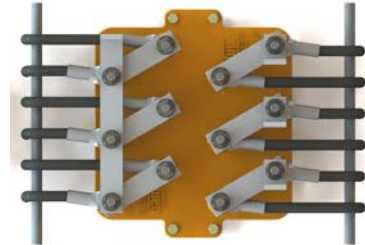


Figure 3.11: 12-pin terminal block

3.6 SHAFT LOCK

Shaft shall be blocked and in the generators with single bearing it shall be with fixed shaft in the radial clearance center between the stator and the rotor (air-gap). It can be locked with rigid support or nylon clamp, according to Figure 3.12 and Figure 3.13.



Figure 3.12: Alternator GTA single bearing with locked shaft with rigid support



Figure 3.13: Alternator GTA single bearing with locked shaft with clamps

4 LIFTING AND HANDLING OF ALTERNATOR

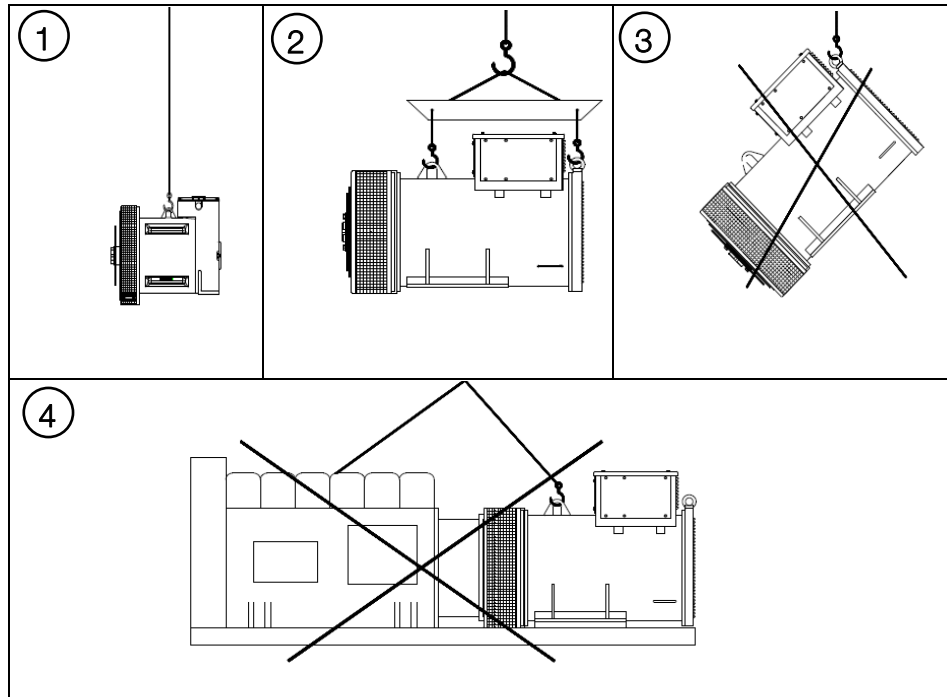


Figure 4.1: Handling of alternator Line G

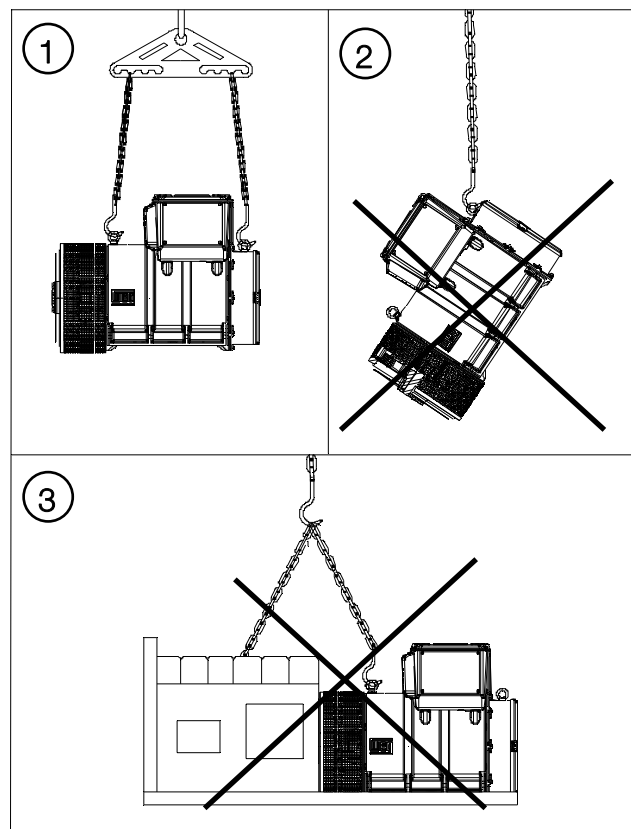


Figure 4.2: Handling of alternators Line AG10

- Alternator was designed with eyebolt for its lifting and are provided for lifting only the alternator;
- All the lifting points shall be used, according to the tables 1 and 2 of Figure 4.1 and table 1 of Figure 4.2;
- It is not allowed to lift additional loads, according to table 4 Figure 4.1 and table 3 of Figure 4.2;
- It is not allowed to lift only by the front or back of the alternator, according to table 3 of Figure 4.1 and table 2 of Figure 4.2.



NOTES

- Lifting cables and devices shall be appropriate.
- Observe the weight indicated.
- Do not lift nor place the alternator on the ground suddenly to avoid damage to the bearings.
- To lift the alternator, use only its eyebolts. If necessary, use a crossbar to protect alternators parts.
- Eyebolts on the covers, bearings, terminal boxes, etc., serve only to handle these component parts.
- Never use the shaft to lift the alternator.
- To move the alternator, it shall be with the shaft locked with the lock device supplied with the alternator.
- After the withdrawal of the safety device from the front side, when lifting the alternator, it shall not be bent with the front part to downwards due to the risk of rotor falling.



WARNING

Steel cable, clay tiles and lifting equipment shall be appropriate and shall support the alternator weight, to avoid accidents, damage to the alternator or personal damages.

5 WINDING INSULATION RESISTANCE



DANGER

Before carrying out insulation resistance measurement, alternator shall be stopped and disconnected from the load and the voltage regulator disconnected. Winding under test shall be connected to the frame and ground for a period until removing the residual electrostatic load. Non observation of these procedures can result in personal damages.

5.1 GENERAL CONSIDERATIONS

When the alternator is not put immediately into operation, it shall be protected from moisture, high temperature and dirt, therefore avoiding that the insulation resistance is affected. Windings insulation resistance shall be measured before getting into operation. If the environment is very humid, there is need of periodic checking during storage. It is difficult to prescribe fixed rules for the insulation resistance actual value of a machine, since it varies with the environmental conditions (temperature, moisture), machine cleaning conditions (dust, oil, grease, dirt) and quality and conditions of the insulation material used. Follow-up periodic records evaluation is useful to get to the conclusion whether the alternator is apt to operate. Regardless the handling devices, insulation resistance shall be measured in the alternator terminals and with the outgoing cables disconnected.



NOTE

Insulation resistance shall be measured using a **MEGOHMMETER**.

5.2 STATOR WINDING MEASUREMENT

Test voltage for alternators stator windings shall be according to Table 5.1, according to standard IEEE43.

Table 5.1: Voltage for insulation resistance measurement

Winding rated voltage (V)	Insulation resistance test DC voltage (V)
< 1 000	500
1 000 - 2500	500 – 1 000
2 501 - 5000	1 000 – 2 500
5 001 – 12 000	2 500 – 5 000
> 12 000	5 000 – 10 000

Before carrying out stator winding measurement, check the following:

- If all the load cables are disconnected;
- If the voltage regulator is disconnected;
- If the non-measured alternator frame and the windings are disconnected and grounded;
- If all the temperature sensors are disconnected and grounded.

Stator windings insulation resistance measurement shall be carried out in the main terminal box. Measuring device (megohmmeter) shall be connected between the alternator frame and the winding. Frame shall be grounded and the stator winding three phases is kept connected in neutral point, according to Figure 5.1 and Figure 5.2.

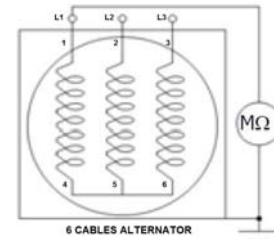


Figure 5.1: Measurement in the three phases (6 cables Alternator)

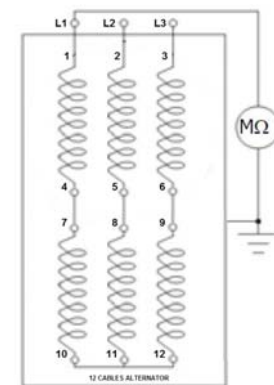


Figure 5.2: Measurement in the three phases (12 cables Alternator- Series connection)

When possible, each phase shall be insulated and tested separately. Separate test allows the comparison between the phases. When a phase is tested, the other two phases shall be grounded in the same ground of the frame, according to Figure 5.3 and Figure 5.4.

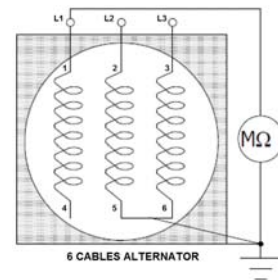


Figure 5.3: Measurement in separate phases (6 cables Alternator)

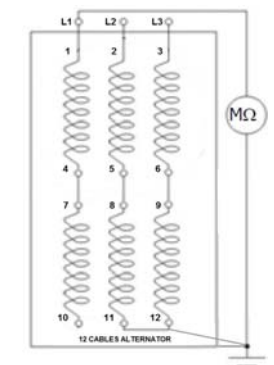


Figure 5.4: Measurement in separate phases (12 cables Alternator- Series connection)

5.3 MEASUREMENT IN ROTOR WINDING

- Disconnect the rotor cables from the diode assembly;
- Connect the insulation resistance measurer (megohmmeter) between the rotor winding and the alternator shaft. Measurement current cannot pass by the bearings.

5.4 MAIN EXCITER STATOR WINDING MEASUREMENT

- Disconnect the power supply cables from the exciter, F+ and F-;
- Connect the insulation resistance measurer (megohmmeter) between the exciter stator winding F+ and the alternator frame. Cable F- shall be disconnected in the measurement moment.

5.5 MAIN EXCITER ROTOR WINDING MEASUREMENT

- Disconnect the exciter rotor cables of the diode assembly;
- Connect the insulation resistance measurer (megohmmeter) between the rotor winding and the alternator shaft. Measurement current cannot pass by the bearings.



WARNING

Test voltage for rotor, main exciter, auxiliary exciter and heating resistance shall be 500 Vcc and the remaining accessories 100 Vcc. It is not recommended the insulation resistance measurement of thermal protectors.

In machines that are already into operation, insulation resistance upper values can be obtained, compared to the commissioning initial values. Comparison with values obtained in previous essays in the same machine, in similar conditions of load, temperature and moisture serves as a better indication of the insulation conditions than the value obtained in a single essay, and any sudden reduction is considered suspicious.

Table 5.2: Guide thresholds of insulation resistance in electric machines

Insulation Resistance Value	Insulation Evaluation
2 MΩ or smaller	Dangerous
< 50 MΩ	Bad
50...100 MΩ	Regular
100...500 MΩ	Good
500...1000 MΩ	Very Good
> 1000 MΩ	Great

5.6 MINIMUM INSULATION RESISTANCE

If the insulation resistance measured is smaller than 100 MΩ at 40 °C, windings shall be carefully checked, cleaned and, whether necessary, dried according to the following procedure, before the machine gets into operation:

- Disassemble the alternator withdrawing the rotor and bearings;
- Put the component parts which have winding with low insulation resistance in an oven and warm it up to a temperature of 130 °C, keeping in this temperature at least for 08 hours;
- Check if the insulation resistance reached is within the acceptable values according to Table 5.2, otherwise consult WEG.

5.7 CONVERSION OF VALUES MEASURED

If the essay is carried out in different temperature, it will be necessary to correct the reading to 40 °C, using an insulation resistance variation curve due to the temperature, raised with the machine itself. If there is no curve, the approximate correction provided by the curve of Figure 5.5, can be applied according to NBR 5383 / IEEE43.

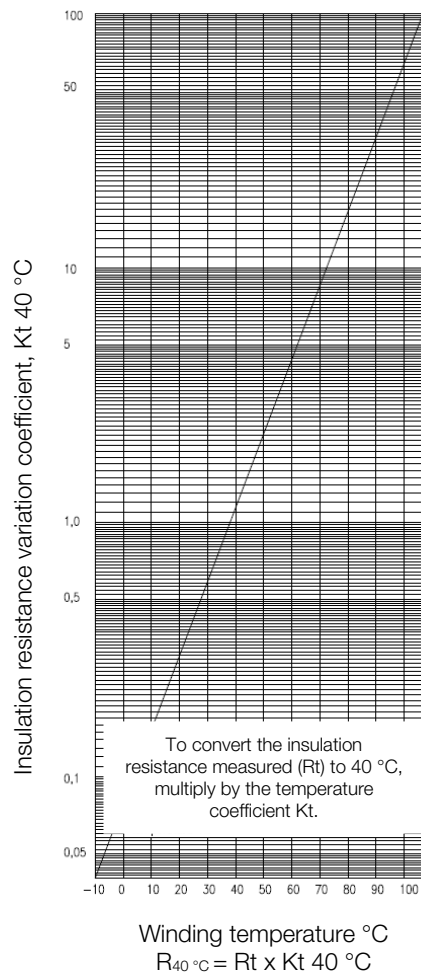


Figure 5.5: Insulation resistance variation coefficient with the temperature

6 SPACE HEATERS INSTALLATION

6.1 CERAMIC RESISTANCE 55 W

To install space heaters type ceramic 55 W, proceed according to the steps described as follows:



NOTE

This procedure is valid for all the models of alternators WEG.

1. Disassemble the alternator back fan cover;
2. Disconnect cables F+ and F- of the voltage regulator inside the terminal box;
3. Remove the alternator rotor using the removal device;
4. Remove the alternator back cover to access the place where the space heaters will be installed;
5. Carry out the frame drilling and attaching of 04 clamps with rivets, according to Figure 6.1;

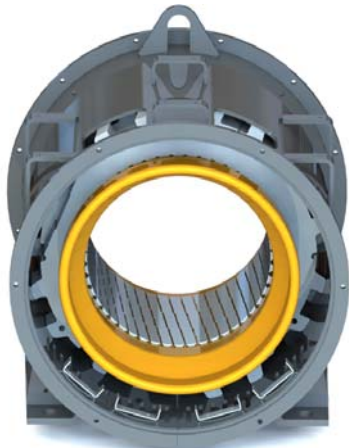


Figure 6.1: Ceramic resistances clamps attached internally in the back side of alternator

6. Attach the ceramic resistance in the metal clamps, according to Figure 6.2;

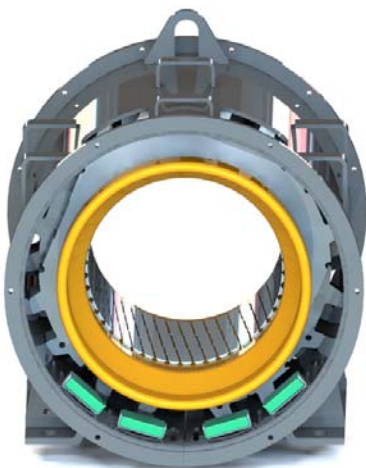


Figure 6.2: Ceramic resistances attached in clamps

7. Attach the rail with blocks in the internal part of the terminal box according to Figure 6.3. To attach the rail, use drilling with drill bit tip M4;



Figure 6.3: Position for the blocks rule



8. Carry out resistances electric installation, according to Table 6.1, according to the resistances association corresponding to the alternator model.

Table 6.1: Ceramic Resistors

FRAMES ABNT/IEC	TOTAL VOLTAGE OF HEATING (W) ± 10%	CERAMIC RESISTORS				
		POWER SUPPLY				
		110 V	220 V	440 V		
		TYP E	CONNECTING DIAGRAM	CONNECTING DIAGRAM	TYP E	CONNECTING DIAGRAM
160 up to 200	108	ZF 225 Ω - 50 w ITEM 0323.0902			ZF 450 Ω - 30 W ITEM 0323.2000	
225 up to 250	215				ZF 225 Ω - 50 w ITEM 0323.0902	
280 up to 450	430					ZF 225 Ω - 50 w ITEM 0323.0902

9. Bind the resistance cables with the generator power cable, in the coil head closing;

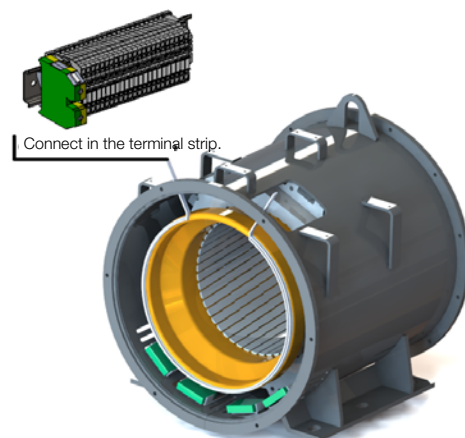



Figure 6.4: Binding of the resistances cables

10. Pass the cables up to the terminal box and carry out the connection in the terminal strip.

6.2 TUBULAR RESISTANCE 50 W E 100 W

To carry out the space heater tubular type 50 W and 100 W, proceed according to the steps described below:

1. Disassemble the alternator back fan cover;
2. Disconnect voltage cables F+ and F- of the regulator inside the terminal box;
3. Remove alternator back cover to access the exciter stator;



WARNING

Removal of generator back cover shall be performed carefully to avoid dragging between exciter stator and rotor.

4. With the cover disassembled, remove both lower fixing screw from the exciter stator, according to figure 6.5;

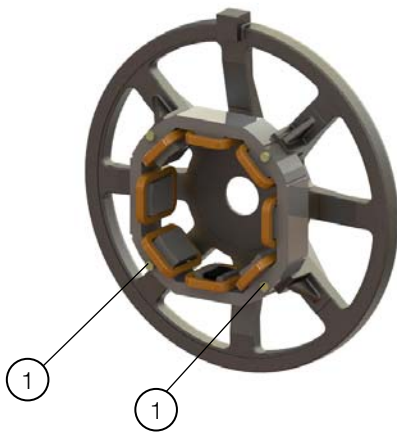


Figure 6.5: Tubular resistance support fixing points

Key of Figure 6.4:

1. Exciter stator fixing screws.

5. Fasten the space heater support with the exciter stator screws, according to figure 6.6 and 6.7;

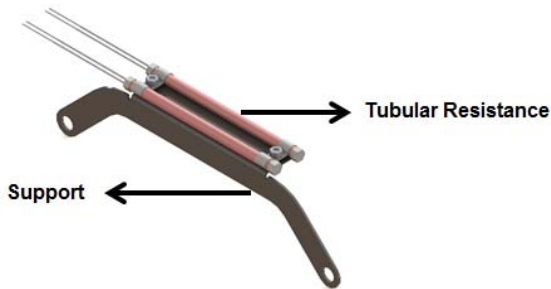


Figure 6.5: Support and tubular resistance

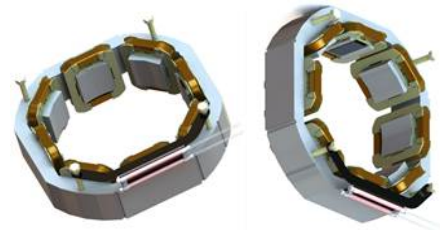


Figure 6.6: Fastening of tubular resistance

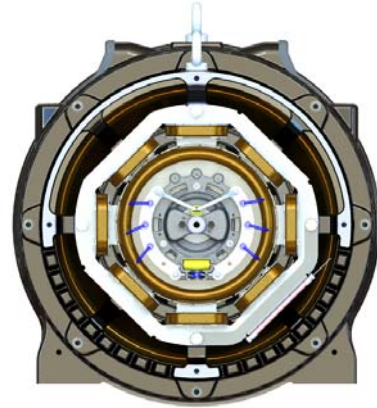


Figure 6.7: Support and tubular resistance installed in the exciter stator

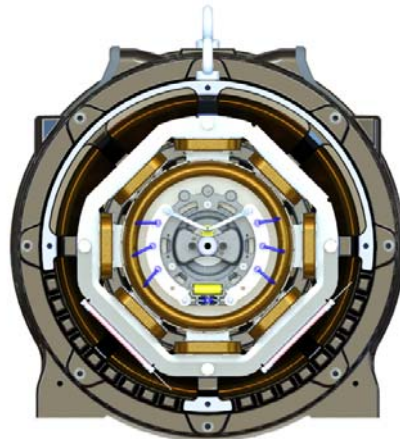


Figure 6.8: Support and tubular resistance installed in the exciter stator


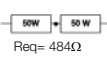





6. Fasten the rail with the strips in the internal side of the terminal box according to Figure 6.9. To fasten the rail, use drilling with drill tip 3.2 mm for screw thread M4;



Figure 6.9: Position for terminal strip

7. Perform the electric installation of the resistances according to Table 6.2, in accordance with the resistances association corresponding to the alternator model;

Table 6.2: Tubular resistors

TUBULAR RESISTORS CONNECTION DIAGRAM					
FRAMES IEC	POWER (W) ±10%	MATERIAL	QUANT	POWER SUPPLY	
				110 V	220 V
160-200	100	13103726	1	 Req= 121 Ω	 Req= 484Ω
225	200		2	 Req= 60.5Ω	 Req= 242Ω
250			13105040	1	 Req=60.5Ω
280-400	400	2		 Req= 30.25Ω	 Req= 121Ω

8. Bind the resistance cables with the F+ and F- cables of the exciter stator;
9. Pass the cables up to the terminal box and carry out the connection in the terminal strips.

7 FLANGES REPLACEMENT

7.1 ALTERNATOR GTA160

Alternator GTA160 has 4 pull rods that fasten the flange to the back cover, according to Figure 7.1. In this alternator model, the liquid chemical lock (Loctite 271) shall be used in the flange thread, to guarantee flange fixing to the alternator frame.

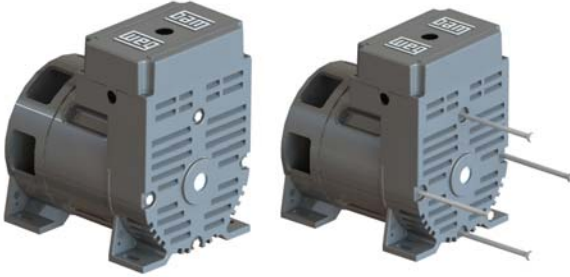


Figure 7.1: Position of the pull rods head in the back cover

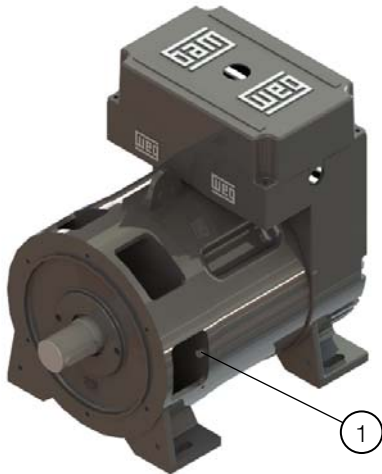


Figure 7.2: Pull rod tip in the flange

Key to Figure 7.2:

1. Position of the rod tip in the flange



NOTE

By removing the pull rods, the black cover and the flange will be loose and can fall, in case they are not sustained.

7.2 ALTERNATORS GTA200 / 250 / 315 E AG10 250 / 280 / 315

1. Remove the flange currently installed in the alternator;
2. Fit the new flange in the assembly position and fit the screws. Each screw shall have a pressure washer between the flange and the screw head;

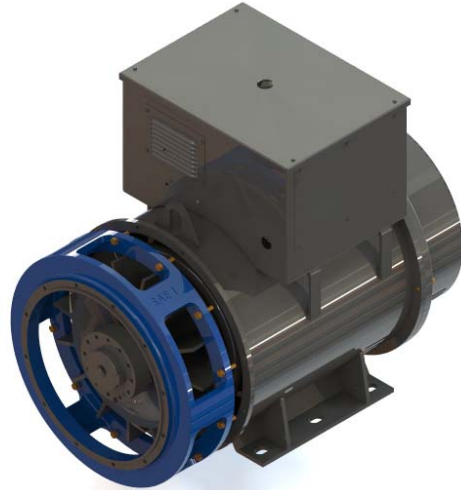


Figure 7.3: Flange fitting position

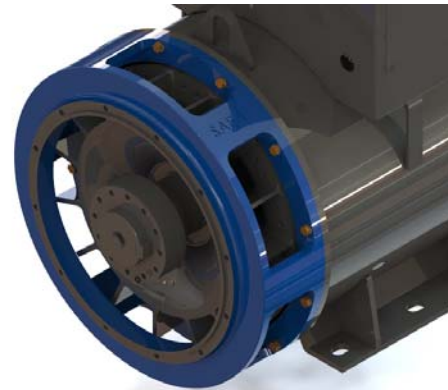


Figure 7.4: Screws positioning with pressure washers

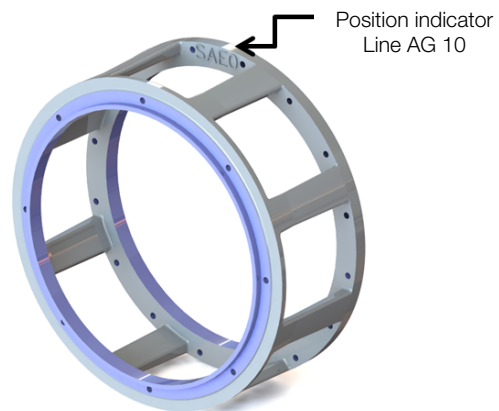


Figure 7.5: Position indicator for line AG10

Fasten the screws gradually forming an "X" according to the number sequence suggested in Figure 7.6;

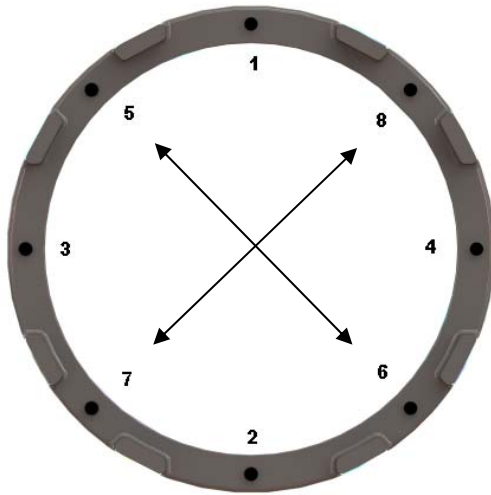


Figure 7.6: Sequence of screws fastening

Follow the fastening torque according to each screw as shown in Table 7.1.

Table 7.1: Fastening torque according to the screw line GTA/AG10

Screw	Maximum torque (Nm)
M10	49
M12	84
M16	206

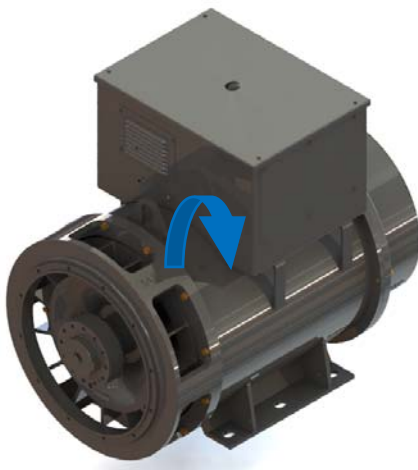


Figure 7.7: Application of torque



NOTE

- Screws diameter and quantity which fasten the flange can be different according to the alternator model and design.
- Observe the flange assembly position, according to the coupling between generator and diesel motor.
- When replacing the flange, observe if the screen length existent is compatible with the new flange diameter.

8 COUPLING DISCS REPLACEMENT

When single bearing alternators coupling discs replacement is needed, its distance must be checked related to the flange. This distance, identified as “G Quota”, determines its axial clearances for diesel motor of generator group (see item 9).

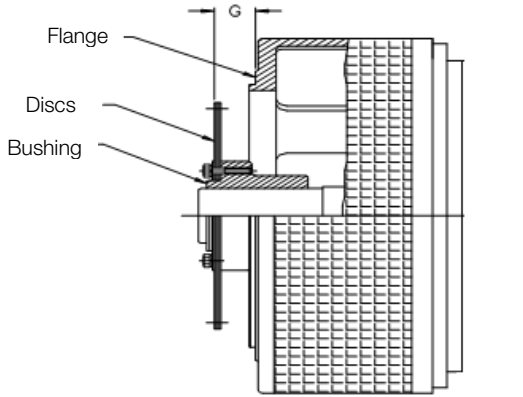


Figure 8.1: Identification of “G Quota”



NOTE

All the assembly component parts shall be dry for the chemical lock application. Complete dry of chemical lock will occur 24 hours after the application.



NOTE

This procedure is valid for all WEG alternators models.

1. Withdraw the shaft block device (if installed);
2. Withdraw the fan protection screen installed on the flange (if installed);
3. Remove the front ring and the coupling discs;



NOTE

At factory, coupling bushing screws fastening, it was used a chemical lock that can offer extra resistance for the screws removal.

4. Position the space rings between the bushing and the coupling discs according to the adjustment need of “G Quota”;
5. Assemble the coupling discs according to adjustment need of “G Quota”;
6. Apply chemical lock (Loctite 271) lengthwise in the screw thread;
7. Fasten the screws according to the torque value specified in Table 8.1.

Table 8.1: Fixing screws fastening torque

Fixing screws (Class 12.9)	Fastening torque
M12x1.75	119 to 126
M10x1.25	68 to 72
M12x1.5	119 to 126
M20x2.5	566 to 595

9 CHECKING OF “G QUOTA”

1. Withdraw the shaft lock device;
2. Guarantee the back bearing fitting in the bearing bottom, in the back cover seat;
3. Use a vernier caliper and a rule to check the measuring between the coupling disc face and the flange face, according to Figure 9.1.

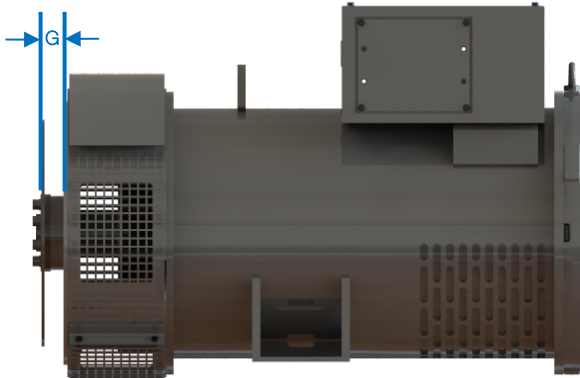


Figure 9.1: Measuring of “G Quota”



Figure 9.2: Measuring of “G Quota”



NOTE

To meet the alternator coupling “G Quota” to diesel motor, it can be necessary the flange replacement, discs and space rings, according to the combinations presented in the alternators catalogue WEG.

In Table 9.1 factory standard “G Quotas” are presented.

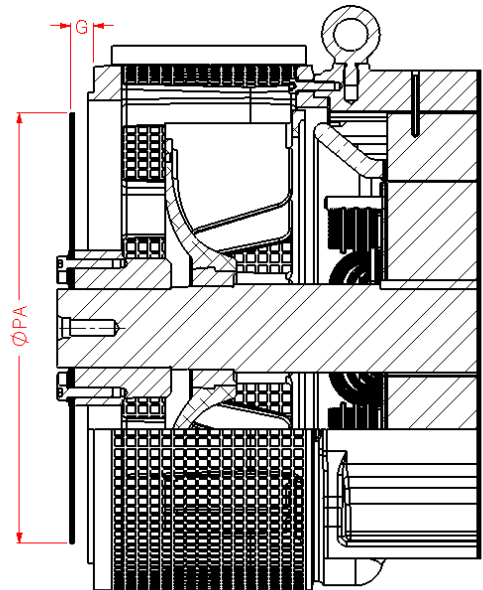


Figure 9.3: G Quota

Table 9.1: Standard G Quotas

ØPA (mm)	Coupling disc (SAE)	G Quota (mm)
241.3	7.5	30.2
263.4	8	61.9
314.2	10	53.9
352.3	11.5	39.6
466.6	14	25.4
517.5	16	15.7
571.4	18	15.7
673.1	21	0.0
733.4	24	0.0



NOTES

- Measuring ØPA has tolerance of 0.13 mm.
- The bearing seat measure varies from 1 to 4 mm.
- In case G quota has value above the established in the table and the tolerance, back bearing may not be positioned correctly in the back cover hub.

10 MAIN ROTOR REPLACEMENT

Using the alternators drawing presented in item 2 of this document, proceed according to the following procedure.

10.1 ALTERNATORS GTA 160 / 200 / 250

10.1.1 Disassembly

1. Place the alternator in vertical position, with the coupling discs upwards;

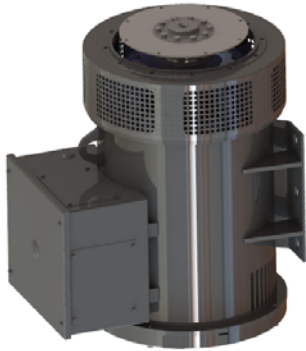


Figure 10.1

2. Withdraw the coupling discs;

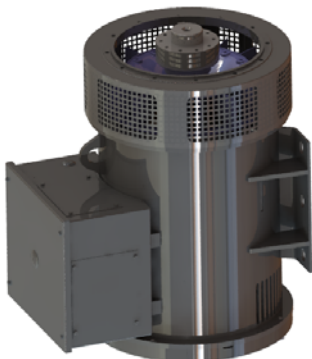


Figure 10.2

3. Screw an eyebolt that has the same hole thread of the rotor shaft tip center;



Figure 10.3

4. Lift the rotor carefully with the help of a hoist, avoiding mechanical shocks in the stator and rotor coils not to damage its insulation.

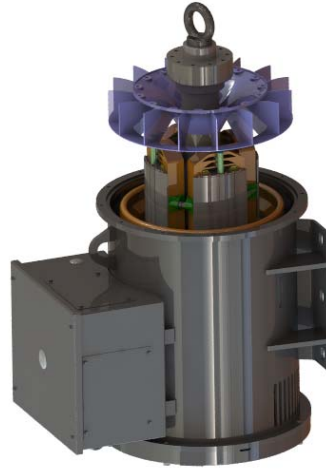


Figure 10.4

10.1.2 Assembly

1. Position the O'ring in the back bearing channel to the bearing fitting;
2. Insert the complete rotor in the vertical direction into the stator carefully with the help of a hoist, avoiding mechanical shocks in the stator and rotor coils not to damage its insulation;
3. Fit the bearing in the back bearing to the complete rotor seat;
4. Install the coupling discs;
5. Put the alternator in the horizontal position.



NOTE

Eyebolt and hoist used shall support the alternator rotor weight.

10.2 ALTERNATORS GTA 315 E AG10 250 / 280 / 315

10.2.1 Disassembly

1. Withdraw the coupling discs;
2. Withdraw the coupling flange;
3. Withdraw the exciter cover;
4. Release the main rotor cables, connected in the exciter rotor diode wheel;
5. Withdraw the exciter rotor mechanical lock and withdraw the exciter rotor.



Figure 10.5: Front view of exciter rotor GTA / AG10

6. Withdraw the main rotor from the alternator front side, with the help of a pendulum device to compensate the unbalance of the rotor shaft tip mass.



Figure 10.6: Removal of the main rotor with the pendulum device



NOTE

This disassembly shall be performed carefully, avoiding mechanical shocks in the stator and rotor coils not to damage its insulation.

10.2.2 Assembly

1. Position the O'ring in the back bearing channel to the bearing fitting;
2. Insert the complete rotor in the horizontal direction into the stator carefully, with the pendulum device;



NOTE

This assembly shall be performed carefully, avoiding the mechanical shocks in stator and rotor coils not to damage its insulation.

3. Fit the bearing in the back bearing to the complete rotor seat;
4. Install the coupling flange;
5. Install the coupling discs;
6. Manually fit the exciter rotor in the shaft and fasten the appropriate screws along with the mechanical lock;
7. Fold the mechanical lock tips on the screw head;
8. Connect the main rotor cables in the diode wheel terminals in the exciter rotor;
9. Install the exciter cover.

11 BEARINGS REPLACEMENT

11.1 ALTERNATORS GTA 160 / 200 / 250

11.1.1 Disassembly

1. Place the alternator in vertical position, with the coupling discs upwards;
2. Withdraw the coupling discs;
3. Screw an eyebolt that has the same hole thread of the rotor shaft tip center;
4. Lift the rotor carefully with the help of a hoist, avoiding mechanical shocks in the stator and rotor coils not to damage its insulation;
5. Remove the bearing attached in the back shaft tip with the help of a bearing withdrawing device (Figure 11.1). By removing the bearing, it shall be discarded.



NOTA

Eyebolt and hoist used shall support the alternator rotor weight.

11.1.2 Assembly

1. Assemble the new bearing in the back shaft tip;
2. Position the O'ring in the back bearing channel (back cover) to the bearing fitting;
3. Insert the complete rotor in the vertical direction into the stator carefully with the help of a hoist, avoiding mechanical shocks in the stator and rotor coils not to damage its insulation;
4. Fit the bearing in the back bearing to the complete rotor seat.

11.2 ALTERNATORS GTA 315 E AG10 250 / 280 / 315

11.2.1 Disassembly

1. Withdraw the back fan cover;
2. Disconnect the voltage regulator cables F+ and F-, located in the alternator terminal box;
3. Release the main rotor cables, connected in the rectifier bridge of the exciter rotor;
4. Withdraw the back cover screws fastened in the frame and withdraw this cover along with the exciter stator;
5. Remove the exciter rotor according to item 13.2.2 of this document;
6. Remove the bearing attached to the back shaft tip with the help of a bearing extractor device, illustrated in Figure 11.1. By removing the bearing, it shall be discarded;

11.2.2 Assembly

1. Assemble the new bearing in the back shaft tip;
2. Position the O'ring in the back bearing channel (back cover) to the bearing fitting;
3. Install the exciter rotor according to item 13.2.3 of this document;
4. Position the back lid and fasten the 4 assembly screws;
5. Connect the cables F+ and F- in the voltage regulator positioning in the alternator terminal box and attach them with clamps in the main stator terminal box;
6. Fasten the back fan cover.

11.3 EXTRACTOR DEVICE TO WITHDRAW THE BEARING

Extractor clips shall be applied on the bearing internal ring side face to be disassembled or on the adjacent part. Before the new bearings assembly, the shaft seats shall be cleaned and lightly lubricated.

Bearings shall be warmed up at a temperature between 50 °C and 100 °C to make assembly easier.

Bearings shall not be submitted to beats, falling, storage with vibration or moisture, because they can cause marks in the internal tracks or in the spheres, reducing their life time.

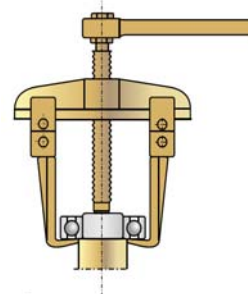


Figure 11.1: Device to withdraw bearing

12 DIODE WHEEL REPLACEMENT

To access the diodes and be able to perform replacement, it is necessary:

- To withdraw the whole rotor (alternators GTA160);
- To withdraw the back inspection cover (alternators GTA200);
- To withdraw back fan cover (alternators GTA315 and AG10 250-280-315).

Position of the diode wheel in alternators WEG:

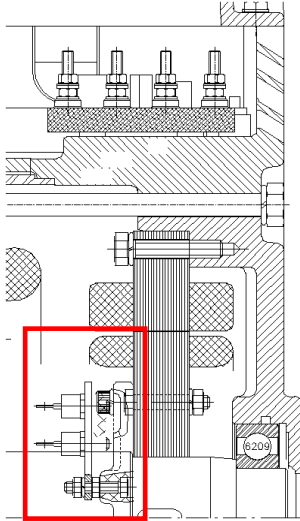


Figure 12.1: Position of the diodes wheel in alternator GTA160

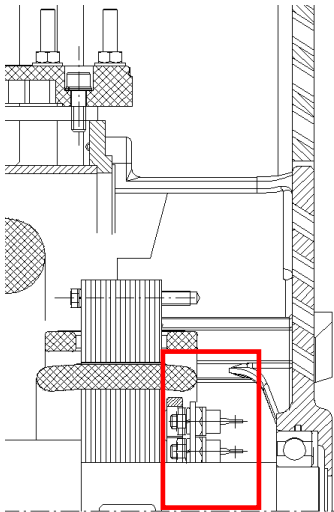


Figure 12.2: Position of the diodes wheel in alternator GTA200-250

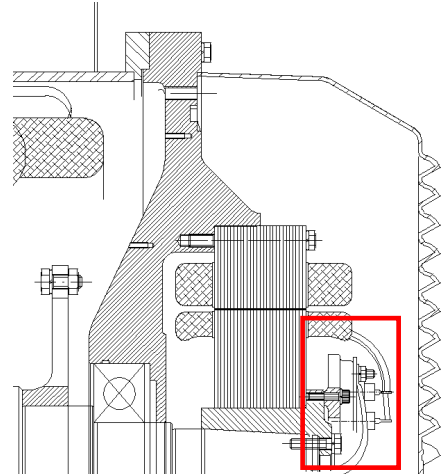


Figure 12.3: Position of the diodes wheel in alternator GTA315

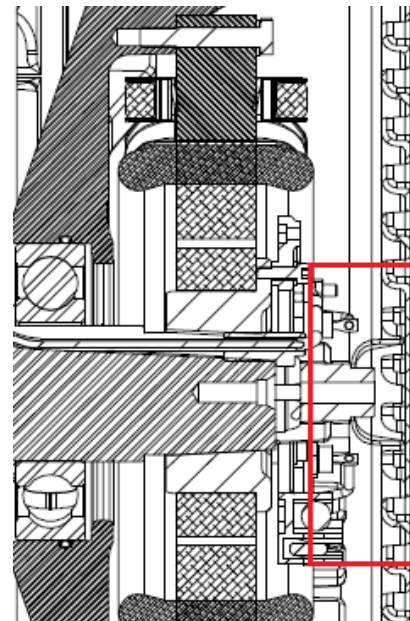


Figure 12.4: Position of the diodes wheel in alternators AG10 250-280-315



NOTE

For special models, consult WEG.

12.1 DISASSEMBLY

To perform disassembly of diodes wheel, proceed according to the steps described below:

1. Withdraw the main rotor power supply cables, connected to the diodes wheel, according to Figure 12.5;

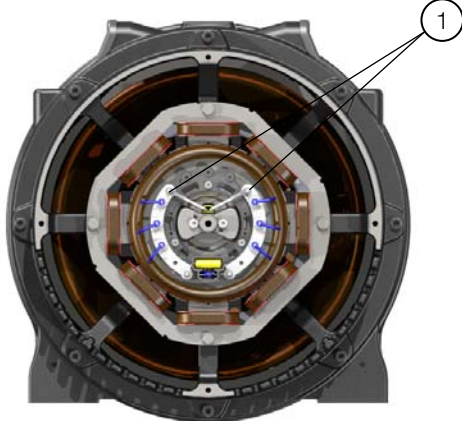


Figure 12.5: Connection of the power supply cables of the main rotor

Key of Figure 12.5:

1. Main rotor supply cables.

2. Undo the bind (tin weld) of the 6 diodes with the exciter rotor, according to Figure 12.6.
3. Use a tinning device to preserve the cable tip, so avoiding the need of patches;

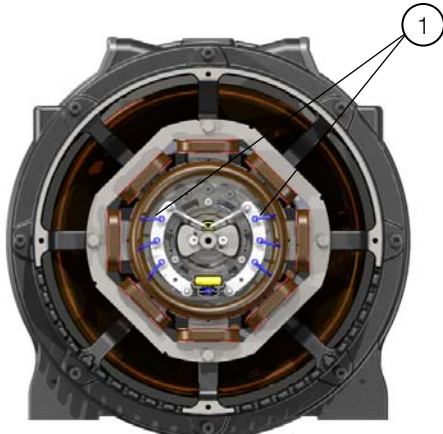


Figure 12.6: Diodes connection

Key of Figure 12.5:

1. Diodes connection with the exciter rotor.

4. Withdraw the diodes support of the exciter rotor;
5. Replace the component parts which are damaged: diodes, varistor and capacitor, identified in Figure 12.7.

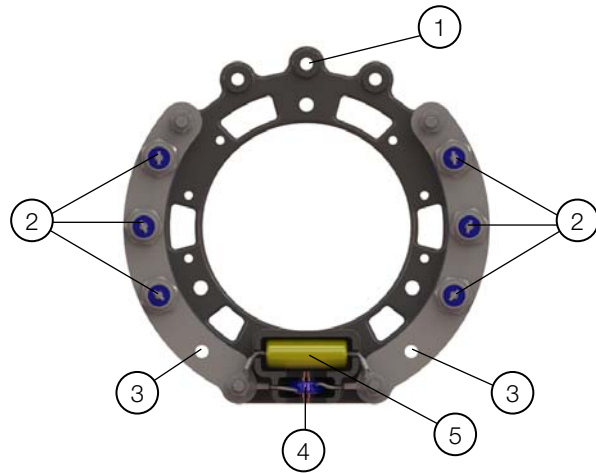


Figure 12.7: Complete diodes wheel

Key of Figure 12.7:

1. Diodes support;
2. Diodes;
3. Diodes bridge;
4. Capacitor (when installed);
5. Varistor.

Torque for fastening the diodes is indicated in Table 12.1, according to the frame and diodes model.

Table 12.1: Specification and fastening torque of diodes

Frame	Designation WEG	Technical Specification	Fastening Torque (Nm)
160	DS4	AND Diode thread M6 20A / 1200V AND	2
		CTD Diode thread M6 20A / 1200V CTD	2
200 - 315	DS6	AND Diode thread M8 45A / 1200V AND	4
		CTD Diode thread M8 45A / 1200V CTD	4

13 EXCITER REPLACEMENT

13.1 ALTERNATORS GTA160 / 200 / 250

13.1.1 Exciter stator disassembly

1. Disconnect voltage regulator cables F+ and F-, placed in the alternator terminal box;
2. Release the generator back cover screws;
3. Remove the 4 fixing screws of the exciter stator, according to Figure 13.1;
4. Displace the exciter stator using a rubber hammer, taking the due cares not to beat the coils.



NOTE

By releasing the back cover, carefully displace the bearing, avoiding beating the main rotor in the main stator.



Figure 13.1: Exciter stator GTA

13.1.2 Exciter rotor disassembly

1. Remove the power supply cables of the main rotor connected in the diodes wheel;
2. Remove the bearing using the extractor device, according to item 11.3;
3. Remove the exciter rotor using the extractor device, similar to the procedure of withdrawing the bearing.



NOTE

As the exciter rotor is pressed with interference in the shaft, after its removal it is not recommended to reuse it, and it shall be replaced by a new one.



Figure 13.2: Exciter rotor GTA

Due to the assembly position of the exciter rotor, it can be necessary to withdraw the alternator main rotor. To

perform this step, follow the procedure of main rotor disassembly according to item 10.1.

13.1.3 Exciter rotor assembly

1. Disassemble the diodes wheel, withdrawing the assembly plastic support;
2. Pre-heat the exciter rotor, using an inductive heater at the maximum temperature of 120 °C, to dilate the lamination core and make fitting easy in the shaft;
3. Manually fit the exciter rotor to the fitting seat in the shaft;
4. Remove the diodes wheel in the exciter rotor;
5. Connect the main rotor cables in the exciter rotor.

13.1.4 Exciter stator assembly

1. Place the exciter stator on the back cover and fasten the 4 assembly screws;
2. Fasten the back cover to the alternator frame;
3. Connect the F+ and F- cables in the voltage regulator positioning in the alternator terminal box and fasten them with clamps in the main stator flexible cables.

13.2 ALTERNATORS GTA 315 E AG10 250 / 280 / 315

13.2.1 Exciter stator disassembly

1. Remove the back fan cover of the generator;
2. Disconnect the F+ and F- cables of the voltage regulator, located in the alternator terminal box;
3. Remove the 4 fixing screws of the exciter stator according to Figure 13.3;
4. Displace the exciter stator using a rubber hammer, taking the due cares not to beat the coils.

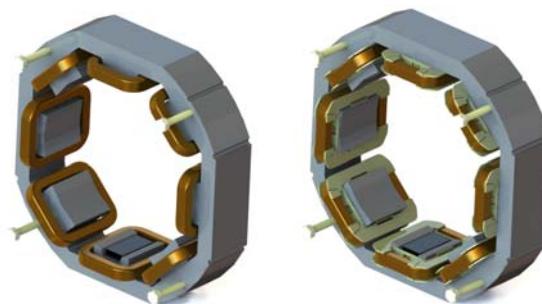


Figure 13.3: Exciter stator GTA / AG10

13.2.2 Exciter rotor disassembly

1. Remove the power supply cables of the main rotor;
2. Remove both fixing screws of the exciter rotor, according to Figure 13.5;
3. Place the screws removed in the holes indicated in Figure 13.5;
4. Fasten the screws gradually to the rotor to displace it from the shaft.

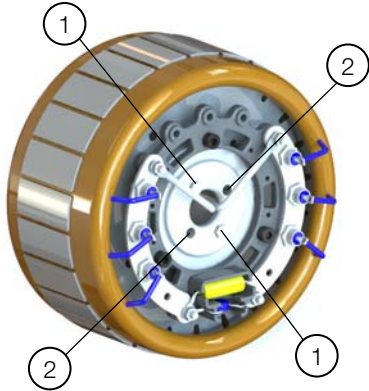


Figure 13.4: Exciter rotor GTA

Key of Figure 13.4:

1. Fixing screws;
2. Holes;



Figure 13.5: Exciter rotor AG10

13.2.3 Exciter rotor assembly

1. Manually fit the exciter rotor in the shaft and fasten it with the appropriate screws;
OBS: Fitting of exciter rotor is easier due to the shaft cone shape;
2. Fold the half-moon plate on the screws head, to lock them mechanically;
3. Connect the main rotor cables in the exciter rotor.

13.2.4 Exciter stator assembly

1. Position the exciter stator on the back cover and fasten the 4 assembly screws;
2. Connect the F+ and F- cables in the voltage regulator positioning in the alternator terminal box and fasten them with clamps in the main stator flexible cables;
3. Fasten the back fan cover.

14 PMG KIT INSTALLATION



DANGER

Before starting the installation service of the auxiliary exciter (PMG) in the alternator, be sure that it cannot be driven by any manual or automatic system, isolating completely the alternator, disconnecting it mechanically and electrically.

This procedure step shows how to transform GTA in GPA – change for installing PMG, altering the excitation model. Table 14.1 presents the fastening torques of screws recommended for assembly of PMG kit.

Table 14.1: Screws fasten torque

Screw	Maximum torque (Nm)
M03	1.3
M04	3.0
M05	6.0
M06	10
M08	25
M10	49
M12	84
M16	206

14.1 ALTERNATOR GTA 200 / 250

14.1.1 Disassembly



Figure 14.1: GTA 200

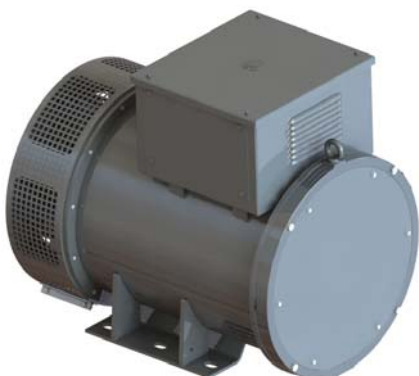


Figure 14.2: GTA 250



Figure 14.3: Back inspection cover

1. Withdraw the back inspection cover that is fastened by screws.

2. Withdraw the upper cover of the terminal box which is fastened by screws. Release all the voltage regulator cables and withdraw the box, as the current voltage regulator is not apt for the PMG KIT. Be sure that F+ and F- cables are completely loose, as they are attached in the exciter stator, which will be removed with the back cover.



Figure 14.4: Terminal box upper cover

3. Withdraw the back cover which is fastened to the frame by four screws, carefully not to damage the stator and the exciter cables when the cover is being removed.

- In the side not coupled, a threaded rod shall be installed (M20) in the shaft center hole, to support and sustain the rotor suspended in the center of its radial clearance, making disassembly of generator back cover possible. Figure 14.5 indicates the installation point of the shaft support rod.

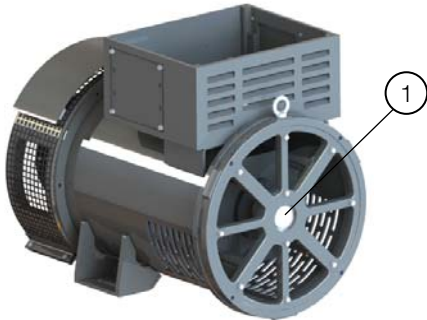


Figure 14.5: Installation of threaded rod

Key of Figure 14.5:

1. Rod installation point

- Withdraw carefully the exciter stator of the current cover, which is attached by four screws.



Figure 14.6: Exciter stator and back cover

14.1.2 Assembly

- Place carefully the current exciter stator in the new back cover and fasten the exciter stator with the four screws which were already used to fasten it, applying the recommended torque. Evaluate the current bearing and replace, if necessary.
- Fasten the new cover to the frame, avoiding collisions with the exciter stator. Check when placing the back cover, if the hub where the cover bearing is, the O'ring did not get out of its housing. With attention to the details above, put the cover in place and fasten the four screws, applying the recommended torque.

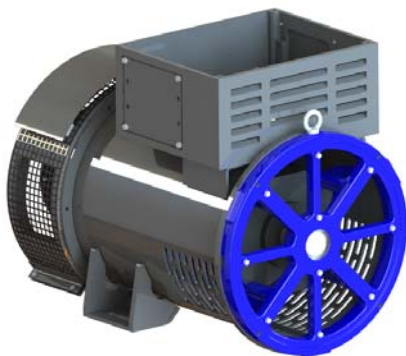


Figure 14.7: Back cover

- Place the PMG rotor (auxiliary exciter) in the shaft back tip fitting. To attach the rotor, use the screw with pressure washer supplied with the rotor. Apply chemical lock (recommendation WEG "Loctite 271 anaerobic adhesive") in the screw threaded section, and following apply the recommended torque.

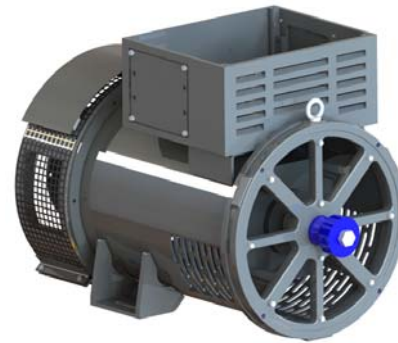


Figure 14.8: PMG rotor installation

- Fasten the PMG stator support (auxiliary exciter) in the alternator back cover. Pass cable (AC1, AC2, AC3) of the auxiliary exciter stator by the first opening below and fasten with clamps by the cover arms which follow up to the terminal box where the voltage regulator is. Let them ready in the terminal box, waiting for the new voltage regulator.

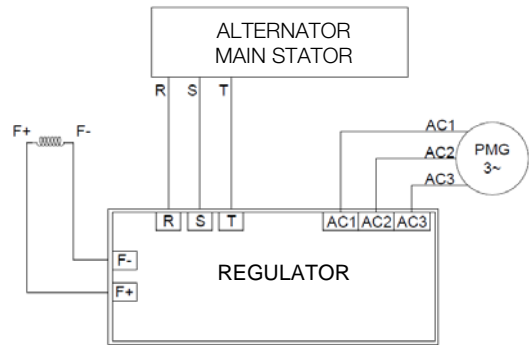


Figure 14.9: PMG Three-phase connection



NOTE

When PMG is single-phase connection cables are E1 and 4.

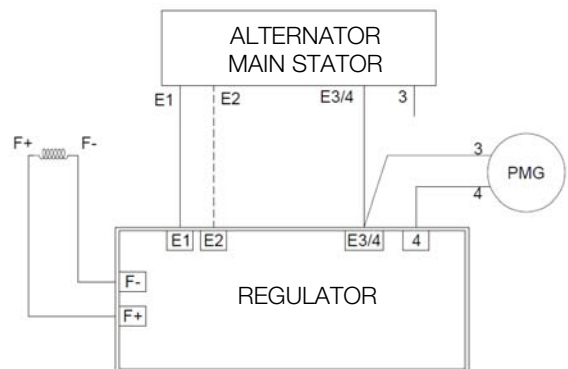


Figure 14.10: PMG single-phase connection



Figure 14.11: PMG cover

5. Place the new back inspection cover with the overture to the PMG in the back cover, fasten it with the six screws and apply the recommended torque. Pay attention to the opening for passage of the cables of the auxiliary exciter stator, it must be at the bottom where the support opening is;



Figure 14.12: Back inspection cover



Figure 14.13: Back inspection cover and PMG cover

6. Place the new voltage regulator apt for PMG and connect all the cables, according to the electric diagram;



Figure 14.14: Voltage regulator installation

7. Check that no cables are leaning against any live corner, dragging or next to the rotating parts;

8. Place the upper cover in the terminal box and fasten with the four screws. Apply the recommended torque.



Figure 14.15: Terminal box cover

14.2 ALTERNATORS GTA 315

14.2.1 Disassembly



Figure 14.16: GTA 315

1. Remove the inspection cover of the exciter and terminal box cover, according to Figure 14.17 and Figure 14.18;



Figure 14.17: Exciter inspection cover

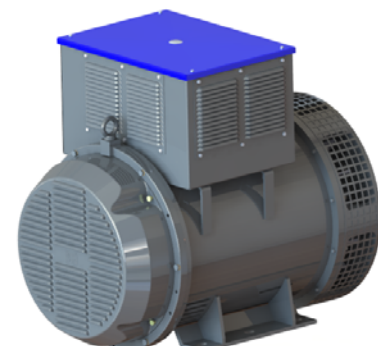


Figure 14.18: Terminal box cover

- Remove the diodes wheel, according to Figure 14.19;

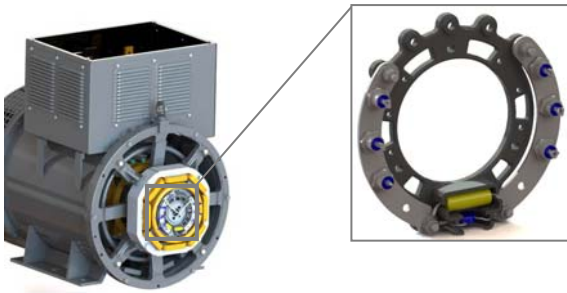


Figure 14.19: Diodes wheel

- Remove the exciter stator and the back cover, according to Figure 14.20;



Figure 14.20: Exciter stator and back cover

- Remove the exciter rotor. Use the fixing screws to withdraw the exciter rotor, through the holes indicated in Figure 14.22, and withdraw the current exciter rotor bushing;
- In the non-coupled side it shall be installed a threaded rod (M20) in the shaft center hole, to support and sustain the rotor suspended in the radial clearance center, making disassembly of the generator back cover possible.

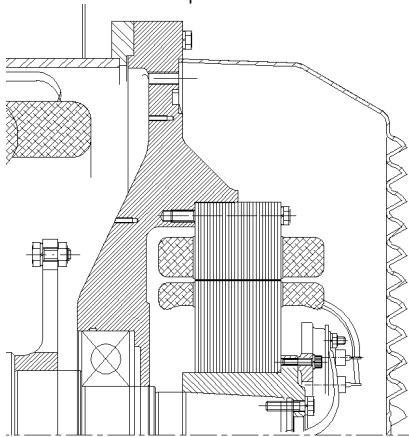


Figure 14.21: View of the GTA excitation assembly

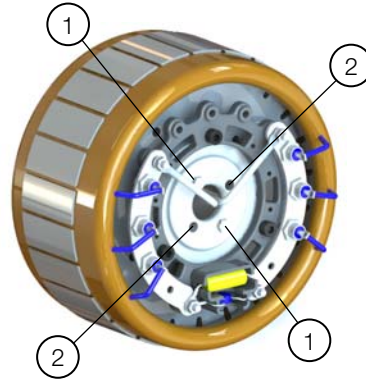


Figure 14.22: Fastening and holes to withdraw the exciter rotor

Key of Figure 14.22:

- 1. Fixing screws;
- 2. Holes;

14.2.2 Assembly

- Place a new back cover model GPA and fasten it with the screws, applying the torque recommended in Table 14.1;

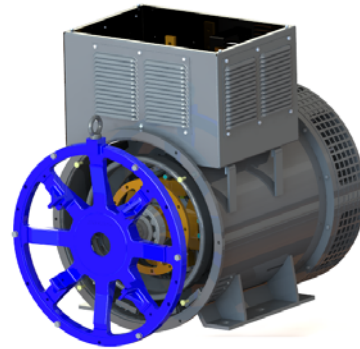


Figure 14.23: Back cover

- Assemble the exciter rotor and the PMG rotor with the new bushing, according to Figure 14.24;

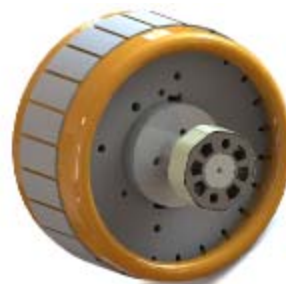


Figure 14.24: Exciter rotor and PMG Rotor

- Assemble the exciter stator and fasten it with the screws, applying the torque recommended in Table 14.1;



Figure 14.25: Exciter stator

4. Assemble the diodes wheel and fasten it with the screws, applying the torque recommended;

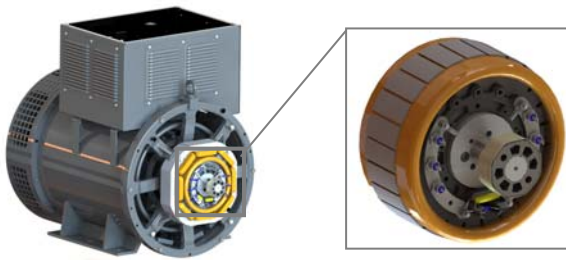


Figure 14.26: Diodes wheel

5. Assemble the PMG stator support cover and fasten it with the screws, applying the torque recommended in Table 14.1.

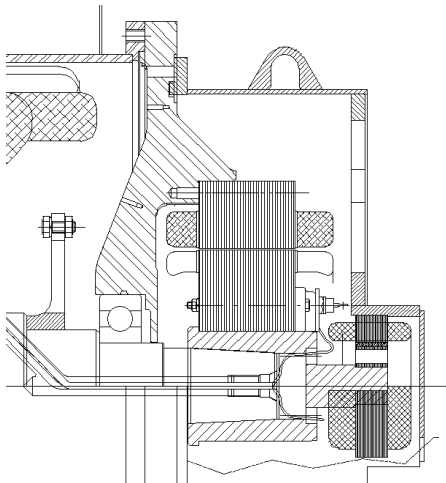


Figure 14.27: View of the GPA excitation assembly

6. Fasten the PMG stator support (auxiliary exciter) in the alternator back cover. Pass the cables (AC1, AC2, AC3) of the auxiliary exciter stator by the first opening below, and fasten with clamps by the cover arms that follows up to the terminal where the voltage regulator is. Let them ready in the terminal box, waiting for the new voltage regulator.

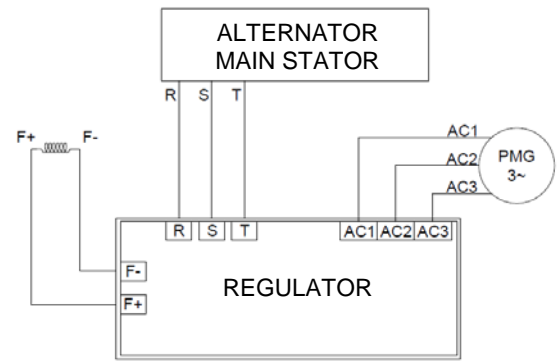


Figure 14.28: PMG three-phase connection

**NOTE**

When PMG is single-phase the cables are E1 and 4.

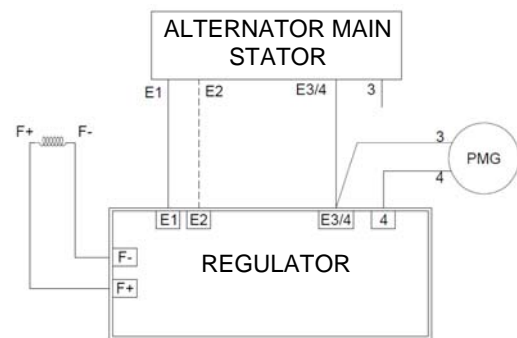


Figure 14.29: PMG single-phase connection



Figure 14.30: Voltage regulator support installation

7. Assemble PMG cover and alternator shutter and fasten them with the screws, applying the torque recommended in Table 14.1.



Figure 14.31: PMG cover and Alternator shutter

8. Place the new voltage regulator apt for PMG in case of three-phase connection and connect all the cables, according to the electric diagram.

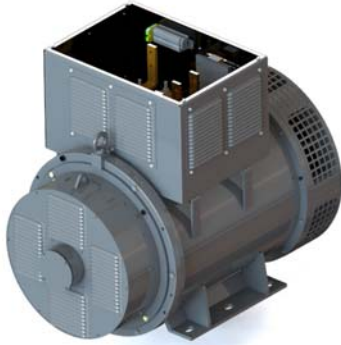


Figure 14.32: Voltage regulator installation

9. Check that no cables are leaned against any live corner, dragging or next to rotating parts.
10. Place the upper cover in the terminal box and fasten them with the screws, applying the torque recommended in Table 14.1.



Figure 14.33: Terminal box upper cover

14.3 ALTERNATORS AG10

All AG10 line alternators standard model have forecasting for installation of auxiliary exciter (PMG). PMG installation shall be performed in the alternator back side.



DANGER

Before starting the installation service of the auxiliary exciter (PMG) in the alternator, check that it cannot be driven by any manual or automatic system, isolating completely the alternator, disconnecting it mechanically and electrically.

14.3.1 Mechanical assembly of PMG

To assemble the PMG in the alternator, proceed according to the steps described below:

- 1) Withdraw the alternator exciter cover, to have access to the exciter rotor coupling bushing, according to Figure 14.34;

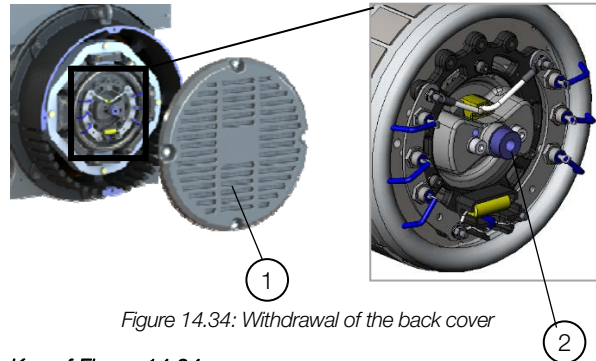


Figure 14.34: Withdrawal of the back cover

Key of Figure 14.34:

1. Exciter cover
2. Coupling bushing

- 2) Fit the PMG rotor in the main exciter rotor coupling bushing and fasten it through the internal hexagon headed screw M12 with torque of 120 a 140 Nm and anaerobic chemical lock, according to Figure 14.35;

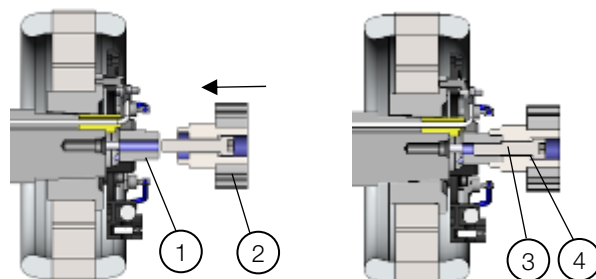


Figure 14.35: PMG rotor coupling

Key of Figure 14.35:

1. Coupling bushing
2. PMG rotor
3. Internal hexagon headed screw M12
4. Lock washer (NORD-LOCK)

Figure 14.36 shows PMG rotor installed.

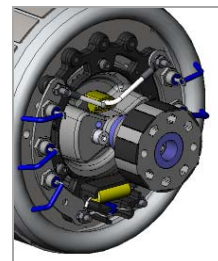


Figure 14.36: PMG rotor installed

- 3) Withdraw the exciter cover shutter cover with PMG, withdrawing the 08 hexagon headed screws M6, according to Figure 14.37;

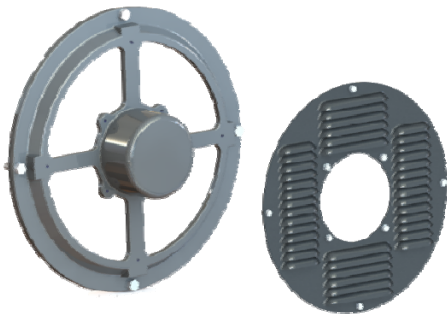


Figure 14.37: Withdrawal of shutter cover

- 4) Bind the connecting cables (3 and 4) of PMG with the polyamide clamp 6.6 in the back cover, according to Figure 14.38.

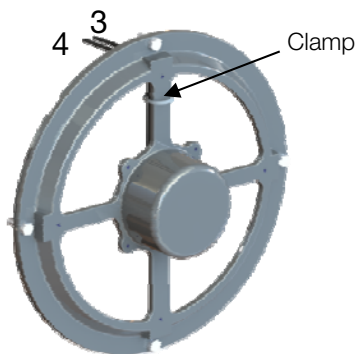


Figure 14.38: PMG cables binding

- 5) Assemble and fasten the exciter cover with PMG through the 4 hexagon headed screws M10 with torque of 40 to 49 Nm, according to Figure 14.39;

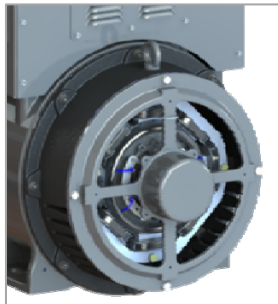


Figure 14.39: Installation of cover with PMG

**NOTE**

PMG connection cables tips (3 and 4) shall be taken to the alternator terminal box to make the voltage regulator connection.

- 6) Turn the alternator rotor with the hand to check that the installation is correct and that there is no part dragging.
- 7) Perform the PMG electrical connection, according to the instructions and connection diagram shown in item 14.3.2 of this document.
- 8) Install the shutter cover, fastening it through 08 hexagon headed screws M6 with torque of 8 to 10 Nm, according to Figure 14.40;

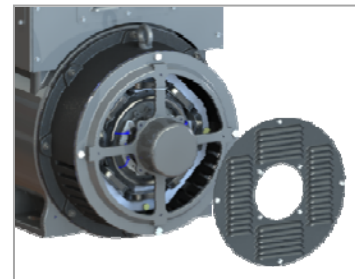


Figure 14.40: Installation of shutter cover

- 9) Complete alternator with auxiliary exciter (PMG). Check the fastening torque of the screws according to the recommendations of the previous items.



Figure 14.41: PMG assembled

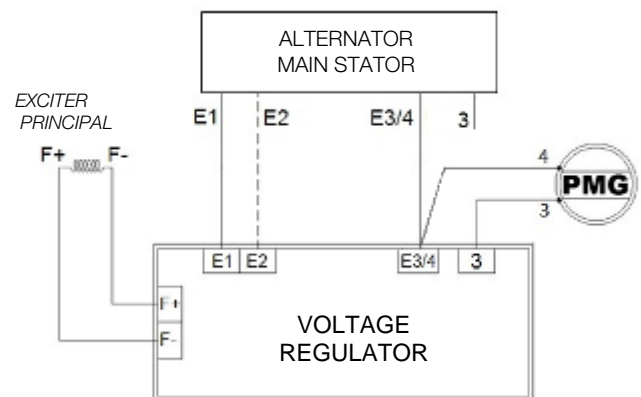
14.3.2 PMG electric connection

Figure 14.42: PMG electric connection

Voltage regulator connection terminals
F+ and **F-** - Main exciter field
E1 or **E2** - Single-phase voltage feedback.
E3/4 - Common terminal of power circuit supply and single-phase feedback of voltage regulator.
3 - Power circuit supply of the voltage regulator.

To perform the auxiliary exciter (PMG) electric connection it is necessary to:

- Disconnect the voltage regulator terminal 3 auxiliary coil cable 3;
- Connect PMG terminal 3 in voltage regulator terminal 3;
- Connect PMG terminal 4 in the voltage regulator terminal E3/4 along with the alternator main stator cable E3/4.

**WARNING**

It is not necessary to replace the voltage regulator for another model when installing the PMG assembly.

14.3.3 Excitation system operation with PMG

Permanent magnet generator (PMG) added to the alternator supplies the voltage regulator with alternate voltage that is independent from the alternator main winding.

As a result, the alternator has a significant increase of capability of short-circuit current for heavy loads start-up. Voltage regulator monitors and corrects the alternator output voltage, adjusting the excitation current.

15 VOLTAGE REGULATOR REPLACEMENT



DANGER

Before performing the voltage regulator replacement, check that the alternator is out of operation (stopped), and will not be driven during the process.
Non observation of this procedure can result in personal damages.

1. Disconnect the voltage regulator which will be replaced;
2. By disconnecting the alternator voltage regulator, the cables will be available Figure 15.1;
3. Identification of alternators cables is identical to the voltage regulators terminals identification.

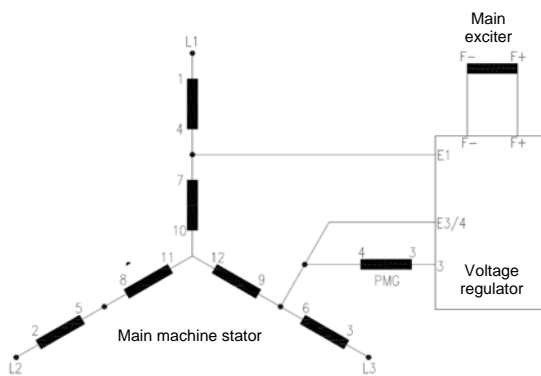


Figure 15.1:
Cables diagram – Series connection (Alternator)

Alternator operation can be in simple way, when only one alternator is supplying the load, or in parallelism way, when it operates in parallel with other alternator or a power supply.

For operation in parallelism mode, it is necessary an analogic input in the voltage regulator, to which is connected the Current Transformer (CT) for the parallelism control (non-supplied with alternator WEG).

15.1 VOLTAGE REGULATORS FOR OPERATION IN PARALLELISM MODE

GRT7-TH4E – Manufacturer: Grameyer
GRT7-TH4 R2 5A / 7A E9 Manufacturer: Grameyer
AVC63-7 – Manufacturer: Basler
EA08A-WG – Manufacturer: Kutai

To use the voltage regulator model GRT7-TH4E Grameyer, connect the alternator cables following the identification in the voltage regulator terminals, according to the indication of Figure 15.3:

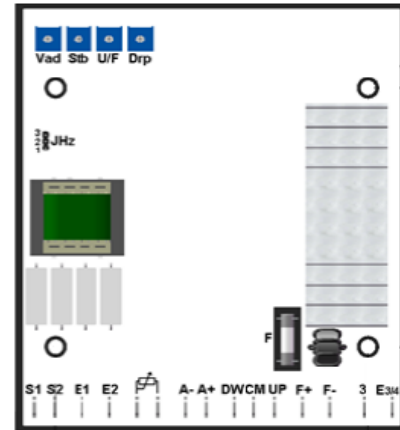


Figure 15.2: Voltage Regulator – Model: GRT7-TH4 R2 5A / 7A Grameyer

To use the voltage regulator model GRT7-TH4 R2 5A / 7A E9 Grameyer, connect the alternator cables following the identification in the voltage regulator terminals, according to the indication of Figure 15.2:

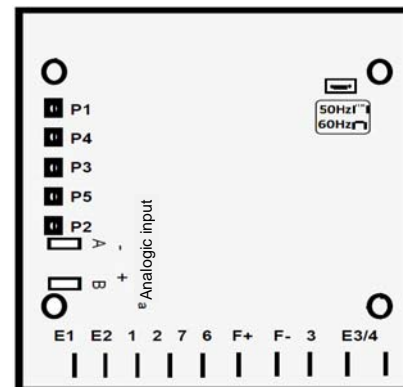


Figure 15.3: Voltage Regulator – Model: GRT7-TH4E Grameyer

To use the voltage regulator model AVC63-7 Basler, connect the alternator cables following the identification in the voltage regulator terminals, according to the indication of Figure 15.4:

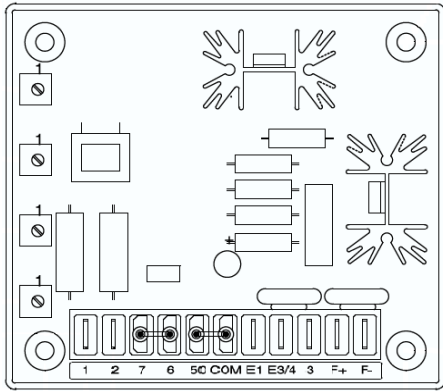


Figure 15.4: Voltage Regulator – Model: AVC63-7 Basler

To use the voltage regulator model EA08A-WG Kutai, connect the alternator cables following the identification in the voltage regulator terminals, according to the indication of a Figure 15.5:

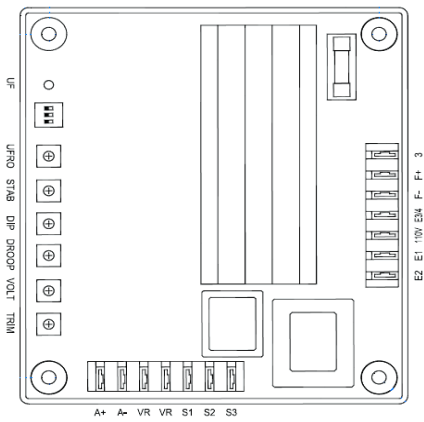


Figure 15.5: Voltage Regulator – Model: EA08A-WG Kutai

15.2 VOLTAGE REGULATORS FOR OPERATION IN SINGLE MODE

WRGA-01 – Manufacturer: Grameyer

K38L – Manufacturer: KVA

EA05A-WG – Manufacturer: Kutai

To use the voltage regulator model WRGA-01 Grameyer, connect the alternator cables following the identification in the voltage regulator terminals, according to the indication of Figure 15.6:

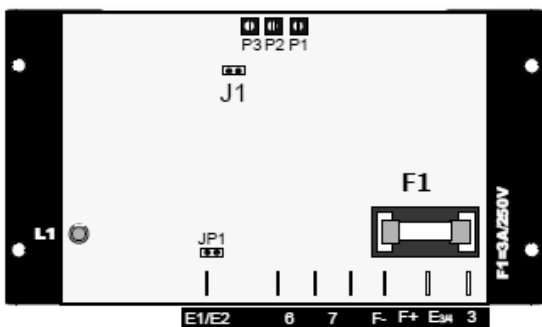


Figure 15.6: Voltage Regulator – Model: WRGA-01 Grameyer

To use the voltage regulator model K38L KVA, connect the alternator cables following the identification in the voltage regulator terminals, according to the indication of Figure 15.7:



Figure 15.7: Voltage Regulator – Model: K38L KVA

To use the voltage regulator model EA05A-WG Kutai, connect the alternator cables following the identification in the voltage regulator terminals, according to the indication of Figure 15.8:

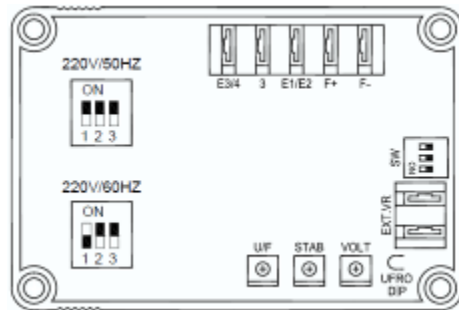


Figure 15.8: Voltage Regulator – Model: EA05A-WG Kutai



NOTES

- For other voltage regulator models, the manufacturer manual shall be consulted.
 - When replacing the voltage regulator originally installed in the alternator for a new voltage regulator of another model, the new voltage regulator manual shall be referred to for performing the other adjustments, as rated voltage, frequency, current transformer relation, etc.
- In cases that the voltage regulator originally installed in the alternator for another model non-mentioned in this manual, consult WEG (factory).

16 ALTERNATOR FREQUENCY CHANGING



DANGER

Before performing the voltage regulator substitution, check that the alternator is out of operation (stopped), and will not be driven during the process. Non-observation of this procedure can result in personal damages.



NOTE

Images contained in this procedure refer to the voltage regulator Grameyer model GRT7-TH4

- To change the alternator frequency from de 50 Hz to 60 Hz, first of all it is necessary to locate the frequency jumper of the voltage regulator, according to Figure 16.1:



Figure 16.1: Jumper of frequency

- After locating the jumper, check the jumper position, which originally shall be in 50 Hz, according to Figure 16.2:



Figure 16.2: Jumper in 50 Hz

- Jumper shall be in the position of 60 Hz, according to Figure 16.3:



Figure 16.3: Jumper in 60 Hz

- After changing the jumper position, change the driving machine rotation, from 1,500 rpm to 1,800 rpm. To do so, consult the generator group maintainer and/or the driving machine manufacturer. To make sure about the frequency

value, it is recommended the use of a frequency meter.

- Following, turn on the generator group and adjust the alternator voltage through the voltage trimpot, which is located in the voltage regulator and identified as Vad.

Trimpot location is shown in Figure 16.5 and Figure 16.4:

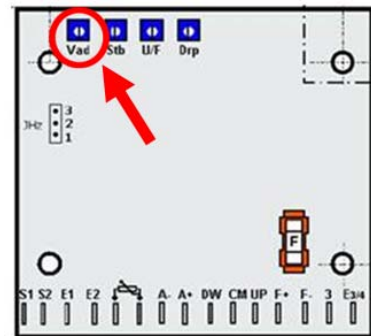


Figure 16.4: Position/Place of Trimpot



Figure 16.5: Position/Place of Trimpot

- Turning the voltage trimpot (Vad) counterclockwise, voltage decreases and turning clockwise, voltage increases. To be sure of the voltage value in the alternator output cables, it is recommended the use of a voltmeter.
- After changing the frequency jumper from 50 Hz to 60 Hz, increase the driving machine rotation from 1,500 rpm to 1,800 rpm and perform the voltage adjustment, alternator is apt to operate in 60 Hz.



NOTE

Consult the manufacturer manual of the voltage regulator for additional references.



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