THREE-PHASE SYNCHRONOUS GENERATORS
Type MJB160-200

Instructions and safety information
1. GENERAL SAFETY WARNING

The generators which are the subject of these “instructions” are components designed for use in industrial areas (machines/plants) and therefore cannot be treated as retail goods.

This documentation consequently contains information that is only suitable for use by qualified personnel. It must be used in compliance with the regulations, laws and technical Standards in force and cannot under any circumstances take the place of plant standards or additional prescriptions, including any which are not legally enforceable, which have been issued for the purpose of ensuring safety.

Machines built to customer specifications or with constructional differences may differ in detail from the generators described herein.

Some operations described in this manual are preceded with symbols that are added to alert for the possible risk of accidents. It is important to understand the following symbols.

ATTENTION! This is referred to controls and operations that can cause damages to the product, accessories or to connected components.
This is referred to the procedures and operations that can cause serious injury or death.

This is referred to the electrical dangers that can cause death.

**DANGER**

Electric rotating machines have dangerous parts: when operating they have live and rotating components. Therefore:

- improper use
- the removal of protective covers
- the disconnection of protection devices
- inadequate inspection and maintenance
can result in severe personal injury or property damage.

The person responsible for safety must therefore ensure that the machine is transported, installed, operated, maintained and repaired by qualified personnel only, that must have:

- specific training and experience
- knowledge of applicable standards and laws
- knowledge of the general safety regulations, national and local codes and plant requirements
- the skill to recognise and avoid possible danger.

All maintenance and inspection operations must be carried out only with the authorisation of the person responsible for safety, with the machine at a standstill, disconnected from the supply (including the auxiliary circuits such as the anti-condensation heaters).

As the electric machine is a product to be installed in industrial areas, additional protective measures must be taken and assured by the person responsible for the installation, if stricter protection conditions are required.

As the electric generator is a component to be coupled to another machine, it is the responsibility of the installing engineer to ensure, during operation, proper protection against the risk of contact with bare rotating parts and to prevent people or things from approaching the machine.

If the machine shows deviations from the normal performance (excessive or too low voltage, increase in temperature, noise and vibrations) promptly advise the personnel responsible for maintenance.

**ATTENTION!:** Here enclosed with this “instructions manual” there are self adhesive leaflets which are reporting symbols for security: the self adhesive leaflets are to be applied to the generator surface, at the customer’s charge, according the instructions presented on the sheet of the self-adhesive.

## 2. DESCRIPTION

These instructions refer to three-phase synchronous generators series MJB. Technical data and constructive details are given in the catalogue. In order to obtain the proper working of the generator it is necessary to read carefully all included instructions.

The generators MJB are synchronous generators, brushless type, self excited and self regulated, manufactured according to the standards indicated on the name plate (IEC 34-1).

### Degree of protection - characteristics

The protection degree of the generators and the rated data are shown on the name plate.

### Frequency

The generators are suitable for operation at 50 and 60 Hz, according to the data reported on the name-plate: for correct operation for 50 or for 60 Hz, it is necessary to verify that the settings of the voltage regulator are proper for the required operation and that the use of the generator is in accordance with the values on the name-plate.

### Accessories

According to the customer’s order the generators can be equipped with accessories, such as anti-condensation heaters, thermistors, etc.

## 3. TRANSPORT AND STORAGE

The generator is shipped ready for installation. It should be carefully inspected on arrival in order to verify if damage has occurred during transport; if any, they should be referred directly to the haulier (writing one note on the document of transport) and to Marelli Manufacturing Asia, if possible with photographic documentation.

**For lifting and handling the purpose made eyebolts must be used.**
The lifting eyes are designed to support only the weight of the generator and they are not to be used for lifting the complete gen-set that incorporates the generator. Check that the lifting means available are suitable for the movement of all parts which have to be handled. Check also that all the working conditions are suitable to operate without dangers for safety of personnel.

The eyebolts on the end - shield are to the alignment of the generator during the phase of coupling to the engine.

Following are the weight of the generators:

<table>
<thead>
<tr>
<th>Size</th>
<th>XA4</th>
<th>SA4</th>
<th>SB4</th>
<th>SC4</th>
<th>MA4</th>
<th>MB4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MJB 160</td>
<td>106 Kg</td>
<td>117 Kg</td>
<td>125 Kg</td>
<td>136 Kg</td>
<td>152 Kg</td>
<td>168 Kg</td>
</tr>
<tr>
<td>MJB 200</td>
<td>/</td>
<td>247 Kg</td>
<td>254 Kg</td>
<td>/</td>
<td>278 Kg</td>
<td>325 Kg</td>
</tr>
</tbody>
</table>

If the generator is not put into operation immediately, it should be stored in a covered area or in a clean, dry and vibration-free place.

For periods of inactivity for periods of longer than three months, perform the tasks for “prolonged periods of storage” (available on request).

If it is stored in a damp ambient, the windings should be dried before using it.

The rolling contact bearings do not require maintenance during storage; periodic rotation of the shaft will help to prevent contact corrosion and hardening of the grease.

4. INSTALLATION AND COMMISSIONING

Check before installation

Before installing the generator
- make sure that name plate data corresponds to the power supply and operating conditions and that the installation complies with the manufacturer’s recommendations
- clean any protecting varnish from all connecting surfaces (such as surface of couplings and flanges and shaft extension for two-bearing generators).

The single support generators come supplied with a bracket that holds together the coupling flange and the adapter flange or with a bolt that blocks the rotor to the non drive side endshield. Before installation, remove the bracket and/or the bolt.

Install the generator in a ventilated room. If installed in closed areas the alternators should have a possibility to exchange the cooling air directly with atmosphere. Air outlet and inlet openings should not be obstructed: provisions should be taken to prevent obstacles from obstructing ventilation openings. The inlet of warm air should be avoided.

 Provision should be taken to make inspection and maintenance easy when the generator is installed or during operation.

4.1 Insulation test

On the premises of the constructor of the group, if the alternator has remained inactive for a long period of time (more than one month) it is opportune to execute an insulation test towards ground of the windings of the main stator, before putting it into service. Before executing this test, it is necessary to disconnect the connections leading to the regulation devices (Voltage regulator or other devices).

The insulation resistance of windings to heart should be measured using a suitable DC instrument (“Megger” instrument or a similar one), which output voltage (test voltage) is equal to 500 V for low voltage generators and not less than 1000 V for medium voltage generators.

Reading of insulation resistance will be done after having applied Megger output for 1 minute to winding.

For a new generator, the stator winding insulation resistance larger of 100 MΩ represent one of essential safety requirements.

Do not touch power terminals during and immediately after the insulation resistance check because the winding is in voltage.
To measure the insulation resistance, proceed in the following way:

Concerning the windings of the **main stator (see diagram)**, the insulation resistance measurement must be conducted taking care to detach the connections leading to the regulation devices (voltage regulator or other devices) or to any other group devices. The measurement is taken between one phase and ground with the remaining two phases also connected to ground (the operation must be conducted on all three phases).

Concerning the **exciter-stator**, detach the + and – cables from the regulator and measure the insulation resistance between one of these two terminals of the winding and ground.

Concerning the **rotor windings**, measure the insulation resistance between one terminal of the winding of the main rotor on the rectifier bridge and the rotor ground (shaft).

The values measured are recorded. If in doubt, also measure the **polarisation index**. (§ 4.8)

**In order to prevent risks of electric shock, connect the windings briefly to the ground immediately after measurement.**

In order to be able to make a correct comparison of the measured insulation resistance values, they are referred to 20°C.

A correction coefficient is applied for different temperatures:

\[
(R_{isol})_{20°C} = K_c \cdot (R_{mis})_T
\]

<table>
<thead>
<tr>
<th>Twinding (°C)</th>
<th>T</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kcorrection</td>
<td>Kc</td>
<td>0.69</td>
<td>1</td>
<td>1.42</td>
<td>2</td>
<td>2.82</td>
<td>4</td>
</tr>
</tbody>
</table>

Example: \( R_{mis} = 50 \, \Omega \) at the winding temperature of 30°C; \( (R_{isol})_{20°C} = K_c \cdot (R_{mis})_{30°C} = 2 \cdot 50 = 100 \, \Omega \)

**4.2 Balancing**

Unless otherwise indicated the rotor is balanced dynamically with a half-key fitted on the shaft extension, in compliance with IEC 34-14.

**4.3 Assembly of adaptors and discs for MJB 160**

For the MJB 160 type only, in case the assembly of adaptors and discs is carried out directly on the shaft-end, proceed as follows:

- Deeply clean the machined surfaces for the coupling of the adaptor and frame, and make sure that they are not damaged.
- Fit the adaptor up on the frame with n°6 screws M10X50 (cl 8.8), washers and nuts. Put on the screws some drops of LOCTITE® 243 (picture 1), and cross-tighten them through a 48Nm torque wrench (picture 2).
- Deeply clean the shaft-end by means of a detergent.
- Make sure that the disc’s contact surface is not damaged.
- Insert the spacer “A” in the shaft, the coupling disc and the washer “B”. Tighten the parts with n°6 screws M10 class 12.9 supplied in the kit (picture 3), put on the screws some drops of LOCTITE® 243 (picture 1), and cross-tighten them through a 75Nm torque wrench (picture 4).
4.4 Alignment

⚠️ Carefully align the generator and the driving machine.
Inaccurate alignment may lead to vibrations and damage of the bearings.
It is also necessary to verify that the torsional characteristics of generator and driving machine are compatible. In order to allow torsional analysis calculation (at customer’s charge); MarelliMotori can provide rotor drawings for torsional analysis purposes.
For single bearing generators it is further necessary to verify all dimensions of the flywheel and flywheel housing. Furthermore it is necessary to check the dimensions of the coupling and of the flange on the generator.

For double bearings generators, to check the alignment is necessary to verify with a thickness caliper that the distance “S” between the half-couplings is the same all the way around and check with a comparator or a rule that the external surface of the half-couplings are coaxial.

![Diagram showing alignment and torsional characteristics](image)

The check must be performed in 4 diametrically opposite points, the alignment errors should be in the limits stated by the coupling manufacturer and corrected by side displacement or using shims placed between the feet and the base.
Always double-check alignment after tightening fixing bolts.

Perform the control of the vibrations of the generator installed in the group, with this latter operating both with and without a load.

4.5 Electrical connection

Standard generators are supplied with 12 leads (9 terminals).
The entry of the terminal cables in the terminal box is on the right (see to drive end) for the MJB 160 and on the right or on the left for the MJB 200.
Terminals arrangement permits star series and star parallel connection: it is anyway necessary, when changing the connection from star series to star parallel, to check and modify the connection to the voltage regulator, according applicable diagrams.

Wiring diagram for standard generators

![Wiring diagrams for standard generators](image)

Internal connection diagrams are shown last pages for standard generators (12 leads, with AVR only).
The output cables have to be fixed to the terminal board as indicated in the following figure.

Direction of rotation
Generators are normally supplied to operate correctly when rotating clockwise (looking from shaft end side).

Grounding
⚠️ ⚠️ Inside the terminal box there is a terminal for grounding, and a second terminal is on a foot of the generator. Grounding has to be carried out using a copper wire of suitable size, in compliance with applicable standards.

4.6 Single phase loads
The standard three phase generators of this series can be used as single phase if the following instructions are followed:

The generator should be used for a maximum power equivalent to 0.6 times the power indicated on the nameplate for three phase load.

⚠️ ⚠️ The generator can be connected to star parallel (voltage of 220 Volt 50Hz or 220 – 240 Volt at 60 Hz) and single phase load should be connected to terminals U1/T1 and V1/T2.

⚠️ ⚠️ The generator can also be connected to zig zag (voltage of 220 – 240 Volt 50Hz or 220 – 240 Volt at 60 Hz) and single phase load should be connected to terminals U1/T1 and V1/T2.
Supply of leading loads only

It is possible to supply symmetrical leading three phase loads for a maximum (in KVAR) equivalent to 0.25 times the power (in KVA) indicated on the nameplate.

4.7 Commissioning

Before putting into service it is necessary to check the insulation with a Megger at 500 Vdc after 1 minute of the application of the test voltage.

For a new generator, the stator winding insulation resistance larger of 100 MΩ represent one of essential safety requirements.

**ALREADY OPERATING GENERATORS OR AFTER PROLONGED PERIODS OF INACTIVITY THE MACHINE MUST NOT BE OPERATED IF THE INSULATION RESISTANCE IS LESS THAN 30 MΩ AT THE TEMPERATURE OF 20°. In this case, it is suggested to dry the winding previously to the generator star-up.**

**THE MACHINE MUST NOT BE OPERATED IF THE POLARISATION INDEX IS LESS THAN 1,5. (§ 4.8)**

In order to prevent risks of electric shock, connect the windings briefly to the ground immediately after measurement.

**BEFORE INITIAL START-UP, MAKE THE FOLLOWING CHECKS:**

**Mechanical checks**
Verify that:
- If fixing bolts are securely fixed.
- That the alignment and coupling is correct.
- That the ventilation air is sufficient and that no impurities are drawn in.
- That the protection grids are in place.
- For single bearing generators, that the bolts of the disks are fixed with the correct torque.

**Electrical checks**
Verify that:
- The plant is provided with the correct electrical protection devices, according to applicable standards.
- That the connection to the terminal block is correctly performed (bolts of terminals properly tightened).
- That no misconnection or short-circuits are present between generator and external breakers: the generator is normally not protected against short circuits on the connection between generator and external breaker.

**In order to avoid any damage to current transformers and to the generator, all current transformers installed on the generator have to be connected to proper loads: in case the current transformers were not used, they must be shortcircuited.**

4.8 Stator winding insulation check through Polarisation Index

Qualitative insulation resistance versus time curves:

![Insulation resistance graph](image)

It is possible to check the generator insulation condition by measuring the polarization index, according to IEEE 43. Execute the insulation resistance measure and insulation resistance registration at ambient temperature and in different times: T1', T2', ..., T10'. Space the measures of a conventional time (one minute for example).

Insulation resistances have to be measured leaving the 500V DC of “Megger” instrument applied for the full duration of 10 minutes. The comparison between 10 minutes insulation resistance ($R_{isol20°C T10'}$) and 1 minute insulation resistance ($R_{isol20°C T1}$) may be used to evaluate the condition of the machine winding insulation.
The ratio between those insulation resistances is called polarisation index (PI):

\[
PI = \frac{R_{\text{isol} 20^\circ C T1'}}{R_{\text{isol} 20^\circ C T1}}
\]

<table>
<thead>
<tr>
<th>POLARISATION INDEX</th>
<th>INSULATION LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI ≤ 1</td>
<td>Bad</td>
</tr>
<tr>
<td>1 &lt; PI &lt; 1.5</td>
<td>Dangerous</td>
</tr>
<tr>
<td>1.5 &lt; PI &lt; 2</td>
<td>Uncertain</td>
</tr>
<tr>
<td>2 &lt; PI &lt; 3</td>
<td>Good</td>
</tr>
<tr>
<td>PI &gt; 3</td>
<td>Very good</td>
</tr>
</tbody>
</table>

The slope in insulation resistance versus time curve indicates the dryness and cleanliness of a winding.

Winding insulation could be considered GOOD if the diagram obtained is similar to the curve A. Winding insulation could be considered UNSATISFACTORY if the diagram obtained is similar to the curve B. In that case insulation is affected by moisture or dirt and should be dried-out and cleaned.

4.9 Removal of moisture from windings

An increase of insulation resistance between phase and earth is normally obtained by removing the moisture. Several methods can be followed for this scope:

- **Stator winding drying by internal heat source.**
  Heaters have to be distributed below the generator main winding stator.

- **Stator winding drying-out by self heating method.**
  The stator can be heated with the circulation of low voltage DC current (i.e. obtained by an industrial welding set) through the windings. A current of about 25% of the full load current, as marked on the generator rating plate, should be used. If both phase terminals are available, generator winding can be re-connected to adjust its internal resistance, in order to suit the direct current supply available. A thermometer should be placed inside the stator windings. Temperature should not be allowed to exceed 80°C.

Could be useful to cover the machine to conserve the heat. In case it is possible have to be unclosed all the openings on frame, if available. Those openings if positioned on the top of the generator (i.e. removing terminal box cover or removing end shields for vertical constructions) can improve moisture escape.

- **Drying of stator with oven heating**
  You brings the oven to 110 – 150°C maximum, the drying of winding for generators MJB 160 – 200 could continue for 2 – 4 hours depending on the starting condition insulation resistance. If the insulation resistance doesn’t reach at least the recommended value, it’s possible that the cause is a solid contamination. It will be in this case necessary to clear the winding once more and then repeat the drying process.

5. MAINTENANCE

⚠️⚠️ For safety purposes it is necessary that any testing or maintenance carried out on electrical machine are performed by qualified and authorised personnel, and all operation must be performed when the machine is stopped, at ambient temperature and disconnected from any supply source (including the auxiliary circuits such as the anti-condensation heaters). **Furthermore all measures must be taken to avoid restarting of gen-set during maintenance.**

The environment in which the generator is put to work must be clean and dry. In order to block the screws use Loctite® 243 thread-lock, ensuring that they are not dirty with oil/grease (if necessary use Loctite® 7063 or equivalent solvent).

**ATTENTION!** In the case of electrical connections, the Loctite® must not cover the electrical contact surfaces!

5.1 Inspection and maintenance intervals

Inspection and maintenance should take into account the importance of the plant ambient conditions (dust etc.) and operating conditions.

As a general rule, the machine should be subjected to a first inspection after approx. 100 operating hours (in any case not more than 1 year) and subsequent inspections when performing maintenance on prime mover.

When performing inspection check that:

- The generator operates smoothly, without noise or irregular vibrations due to bearing deterioration.
- The operating data complies with that detailed on the rating plate.
- The air inlet openings are not obstructed.
- The supply cables show no signs of deterioration and connections are firmly tight.
- The electrical connections are in perfect condition (undamaged).
- Screws and nuts are firmly tightened.

For the above inspections it is not necessary to dismantle the generator, dismantling is only necessary when the bearings are cleaned or replaced and in that occasion the following additional checks are required:

- Alignment.
- Insulation resistance.
- Tightening of all fixing bolts, screws and nuts.
Particular inspections should be carry out at given time steps.

<table>
<thead>
<tr>
<th>Operation and tasks</th>
<th>Daily</th>
<th>Every 2 Months 1000</th>
<th>Every 4 Months 2000</th>
<th>Every 12 Months 4500</th>
<th>Check dedicated sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise level</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventilation</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibrations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fastening of screw elements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminals connections (terminal block, TA, TV, AVR)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General clearance</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full inspection</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulating resistance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bearing lubrication</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Bearing replace</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

⚠️ Any deviations or changes found during inspection must be corrected immediately.

### 5.2 Maintenance of bearings

The lifetime of bearings is determined by multiple factors and specifically by:
- The lifetime of the grease.
- The environmental conditions and working temperature.
- The external loads and vibrations.

The bearings (D.E. and N.D.E. side are prelubricated sealed type (life lubrication), with sufficient grease quantity for a long operating time.

**The life expected time is, in case of normal operating condition, of about 30.000 hours for all bearings.**
In case of complete overhaul of genset, the bearing of the generator should be changed.

### 5.3 Dismantling operations

⚠️⚠️ Before dismantling the machine, examine the views in cross-section.

**Check that the lifting means available are suitable for the movement of all parts which have to be handled.**

**Check also that all the working conditions are suitable to operate without dangers for safety of personnel.**

On disassembly, mark the components if believed necessary, in order to identify their correct positions during successive assembly.

Then uncouple the generator from the prime mover, removing the bolts securing the flange and feet; remove the bolts fixing the coupling and disconnect the terminals of the power leads on the terminal board.

Next, remove the generator from the prime mover.

Disconnect the leads whites (+) and (-) connecting the exciter stator to the voltage regulator, and take the clamps off.

**For two bearing generators:**
- Remove the half coupling from shaft extension and remove the key (223).
- Remove the bolts fixing the shields (4-5) to the frame.
- Then remove the shields having care to sustain the rotor in order it will not fall heavily on the stator.
- Using proper lifting means, remove the rotor (3) from the main stator, through the D.E. side, taking special care to avoid any damage to the windings.

**For single bearing generators:**
- Remove the bolts fixing the N.D.E. shield to the frame.
- Remove the shields having care to sustain the rotor in order it will not fall heavily on the stator. The rotor can be extracted from the stator, from D.E. side.

**ATTENTION!** It should be remembered that the exciter stator is fixed to the N.D.E. shield: special care should be taken to avoid any damage to its windings when removing the N.D.E. shield; furthermore be sure the connections or the exciter stator are free to slide out from terminal box.

**If a bearing needs to be replaced, remove it with a suitable puller.**
5.4 Reassembly operations

Carry out the operations described above for dismantling in reverse order.
- Place the pre-loading spring into on the N.D.E. shield and fixing it by some grease.
- The fixing screws have to be fixed with LOCTITE type 243 (on the threaded surface).
- If a bearing was removed, always install a new one.
- To make assembly easier, the bearings should be heated to about 80 - 90°C.

ATTENTION!: Bearings should be assembled with the utmost care in order not to damage them.

If a locking element has to be replaced, make sure that the new one is of the same type and same resistance class of the original.

The following table indicates the tightening torques valid for locking screws and nuts:

<table>
<thead>
<tr>
<th>Application</th>
<th>M 6</th>
<th>M 8</th>
<th>M10 (cl.8.8)</th>
<th>M10 (cl.12.9)</th>
<th>M12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixing of electrical connections</td>
<td>10</td>
<td>22</td>
<td>/</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>Fixing of components (shields, bearing caps, etc.)</td>
<td>11</td>
<td>26</td>
<td>48</td>
<td>/</td>
<td>85</td>
</tr>
<tr>
<td>Fixing of feet or flange.</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>75</td>
<td>/</td>
</tr>
<tr>
<td>Assembly of discs is carried out directly on the shaft-end (on MJB 160 only)</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>/</td>
</tr>
</tbody>
</table>

6. VOLTAGE REGULATOR “MARK V” (M16FA655A)

The generators are provided with automatic voltage regulator (AVR) MARK V.
The AVR is provided with potentiometers to adapt the characteristics of the AVR to different operating conditions.
The AVR is provided with adjustable stability circuitry to allow operations in a wide range of applications.
The AVR is equipped also with protecting circuit allowing the generator to operate underspeed if not loaded.

ATTENTION!: it is not advisable to have the generator operating loaded when the frequency (speed) is below the rated value: this kind of operation is an overload for the whole generator excitation system.

CONNECTION OF AVR
The AVR is connected to the terminals of the generator and to exciter FAST-ON terminals.

USE OF POTENTIOMETERS

P1/VOLT - Potentiometer for adjusting the output voltage of the generator; it allows a wide range of voltage setting (i.e. between 350 and 470 V; or between 170 and 260 V depending on winding connections). When resetting the potentiometer, the voltage has to be set in the range +5%, -5% around the rated voltage of the machine. In order to obtain a finer regulation, or to adjust the voltage from control panel or to limit the voltage range, it is possible to insert an external potentiometer.

⇒ increase voltage
⇒ decrease voltage

P2/FREQ - Potentiometer for changing the low speed protection. Usually it is set in order to reduce the excitation when the speed is 10% below the rated value at 50 Hz. By removing the bridge which is normally shorting the auxiliary terminals 60-Hz of the regulator, the low speed protection acts properly for 60 Hz.

⇒ increase frequency of intervention
⇒ decrease frequency of intervention

P3/STAB - Potentiometer for stability adjust. By rotating it clockwise the stability of the regulator increases, but the response time becomes longer.

⇒ increase response time, increase stability
⇒ decrease response time, decrease stability

P4/AMP - Potentiometer for changing the overexcitation limit device. The overexcitation limit device helps to protect the excitation system. This device is delayed to avoid transitory conditions (in case of overexcitation).

⇒ increase response time, increase stability
⇒ decrease response time, decrease stability
In the workshop the potentiometer is set in the way the said limitation comes into operation only under extreme overexcitation.

Radio interference suppressor
The voltage regulator is internally provided with radio interference suppressor, in order to limit the radio interference from the generators MJB among levels stated by C.E. standards for industrial areas.

Fuse
On the AVR there is a protecting fuse. Should it be necessary to replace it, high speed fuses should be used; in addition they should have high breaking resistance with a rated voltage of 500 V, and rated current of 5A.

6.1 Rheostat for remote voltage setting
For all generators, that rheostat can be inserted between the auxiliary terminals P and Q (FAST-ON terminals). The external rheostat has to be inserted with its wiper in intermediate position and then the internal potentiometer of AVR (P1) has to be reset to obtain about the nominal voltage. Rheostat features must be minimum rating 0,5 W, resistance about 100 Kohm.

6.2 Instructions for manual control of generators
If the voltage regulator (AVR) breaks down, a manual control system can be used, when a 24 V D.C. power supply is available.

This source could consist of a bank of batteries or of a voltage transformer and a rectifier unit connected at the alternator output.
- disconnect the two exciter stator terminals (whites wire + and -) from AVR;
- apply the D.C. power supply to these two wires;
- set the rheostat R to adjust the alternator output voltage.

ATTENTION! Compensate by manually increasing excitation as the load increases. Before removing the load, reduce the excitation current.

Use the following table to select the rheostat:

<table>
<thead>
<tr>
<th>Generator</th>
<th>I max [A]</th>
<th>Max. resistance of rheostat [Ω]</th>
</tr>
</thead>
<tbody>
<tr>
<td>MJB 160 – 200</td>
<td>5</td>
<td>80</td>
</tr>
</tbody>
</table>
# 7. TROUBLE SHOOTING AND REPAIRS

## 7.1 Electric anomaly

<table>
<thead>
<tr>
<th>TROUBLE</th>
<th>POSSIBLE CAUSE</th>
<th>REMEDY (always to be done with the machine switched off)</th>
</tr>
</thead>
</table>
| The alternator will not energise (no load voltage below 10% of rated voltage). | a) Loose connections.  
  b) Rotating diodes or surge suppressor broken.  
  c) Excitation circuit shorted or interrupted.  
  d) Insufficient residual voltage. | a) Check and repair.  
  b) Check the diodes and change in case they are open or short circuited.  
  c) Check the continuity and repair.  
  d) Apply for a while a 12 Volt battery voltage connecting the – terminal to – of AVR and + terminal to + of AVR by means of a diode. |
| The alternator will not energise (no load voltage 20-30% of rated voltage). Voltage insensitive to AVR potentiometer's rotation. | a) Fuse (on AVR’s supply line) blown.  
  b) Connection's cut on the exciter stator.  
  c) Incorrect connections of exciter stator. | a) Replace the fuse with the spare. If the fuse blows again check if the exciter stator is short circuited. If everything is correct, change the AVR .  
  b) Check the continuity and repair.  
  c) Reverse the two wires from the exciter stator. |
| Voltage lower then rated (output voltage between 50 and 70%). | a) Speed less than rated.  
  b) Voltage potentiometer unset.  
  c) Fuse blown.  
  d) Faulty regulator.  
  e) Overexcitation limitation intervention. | a) Check rpm (frequency).  
  b) Rotate the potentiometer until the voltage reaches the rated value.  
  c) Replace the fuse with spare.  
  d) Disconnect AVR and replace it.  
  e) Re-set the potentiometer for excitation limitation (AMP). |
| Voltage too high. | a) Potentiometer V unset.  
  b) Faulty regulator. | a) Rotate the potentiometer until the voltage reaches the rated value.  
  b) Replace AVR. |
| Unstable voltage. | a) Diesel engine rpm variations.  
  b) Stability potentiometer unset.  
  c) Faulty regulator. | a) Check rpm uniformity. Check the diesel engine governor.  
  b) Act on AVR’s stability potentiometer.  
  c) Replace AVR. |
7.2 Mechanical anomaly

<table>
<thead>
<tr>
<th>TROUBLE</th>
<th>POSSIBLE CAUSE</th>
<th>REMEDY (always to be done with the machine switched off)</th>
</tr>
</thead>
</table>
| Winding temperature raised. Air cooling temperature raised. | a) High ambient temperature.  
b) Hot air reflow.  
c) Source of heat in the proximity.  
d) Plant of defective cooling.  
e) Loopholes of the air obstructed.  
f) Air filter very dirty.  
g) Reduced air flow.  
h) Speed less than rated.  
i) Defective of measurement System.  
j) Overload.  
k) Load with cosfi below to 0.8. | a) Ventilate in order to reduce the ambient temperature.  
b) Create sufficient free space around to the machine.  
c) Remove the heat sources.  
d) Inspect conditions system and correct assembly.  
e) Clean up the loopholes from eventual detritus.  
f) Clear or substitute the filter.  
g) Remove the loopholes, assure that the air flow is enough.  
h) Check rpm (frequency).  
i) Check the thermodetectors.  
j) Eliminate the overload. To cool the genset before restarting it.  
k) Verify the values of the load, cosfi must be 0,8 or to reduce the load. |
| Noise, high vibrations. | a) Insufficient base structure or not suitable antivibration, incorrect fixing to the basement.  
b) Defective coupling.  
c) Defective cooling Fan, unbalanced rotor.  
d) Excess of unbalanced load, Single phase loads.  
e) Malfunctioning bearing. | a) Strengthen the basement, replace the antivibration, cross again the screw on the base.  
b) Review the alignment, the fixing of the disc on they fly motor and of the D-end shield on the first motor.  
c) Check and to repair the cooling fan, clean the rotor and rebalancing.  
d) Check that the load is conforming to the requisite.  
e) Replace bearing. |
| Bearings temperature raised. | a) Malfunctioning bearing.  
b) Axial or radial load too high. | a) Replace bearing.  
b) Check the alignment and check the coupling of the genset. |

---

8. SPARE PARTS – NOMENCLATURE

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Part name</th>
<th>Type / Code</th>
</tr>
</thead>
</table>
| 201  | D side (D:E) bearing        | MJB 160: 6310 2RS C3 / 346245050  
MJB 200: 6313 2RS C3 / 346245065 |
| 202  | N side (N.D.E.) bearing     | MJB 160: 6309 2RS C3 / 346245045 |
| 6    | Voltage regulator           | MJB 160: MARK V M16FA655A  
MJB 200: |
| 7    | Fuse (6.3x32  5A – 500V)    | MJB 160: 963823065 |
| 52   | Terminal block              | MJB 160: M16EV010B  
MJB 200: |
| 119  | Complete rotating rectifier | MJB 160: M16FA648B  
MJB 200: |
9. DISPOSAL
Packaging - All packaging materials are ecological and recyclable and must be treated in accordance with the regulations in force.
Generator to be scrapped - The generator is made of quality recyclable materials. The municipal administration or the appropriate agency will supply addresses of the centers for the salvaging of the materials to be scrapped and instructions for the correct procedure.

9. SMALTIMENTO
Imballo - Tutti i materiali costituenti l’imballo sono ecologici e riciclabili e devono essere trattati secondo le vigenti normative. Generatore dismesso - Il generatore dismesso è composto da materiali pregati riciclabili. Per una corretta gestione contattare l’amministrazione comunale o l’ente preposto il quale fornirà gli indirizzi dei centri di recupero materiali di rottamazione e le modalità di attuazione del riciclaggio.

9. ENTSORGUNG
Verpackung - Sämtliches Verpackungsmaterial ist ökologisch und recycelbar. Es muss entsprechend dem geltenden Recht aufbereitet bzw. entsorgt werden. Generatorverschrottung - Der Generator besteht aus hochwertigen recyclabilen Materialien. Die Gemeindeverwaltung oder die zuständige Behörde kann Ihnen Adressen für die Wiederaufbereitung und Entsorgung der Materialien bzw. für die korrekte Verfahrensweise nennen.

9. RECYCLAGE
Emballage - Tous les matériels utilisés pour l'emballage sont écologiques et recyclables. Ils doivent être traités selon les normes en vigueur. Alternateur détruit - L’alternateur détruit est composé de matériaux à nature recyclable. Contacter les services communaux ou l'organisme concerné qui vous fourniront les adresses des centres de récupération d'épaves et les modalités de fonctionnement du recyclage.

9. RECI CLAGE
Embalaje - Todos los materiales que componen el embalaje son ecológicos y reciclables y deben ser tratados según la normativa vigente. Generador desechado - El generador desechado está compuesto de materiales de valor reciclables. Para una correcta gestión, contactar con la administración o entidad correspondiente, la cual proporcionará las direcciones de los centros de recuperación de materiales, de chatarras, y la forma de actuar con el reciclaje.

This manual is printed on recycled paper: Marelli Manufacturing Asia contribution to the safeguarding of the environment.

Questo manuale è stampato su carta riciclata: un contributo Marelli Manufacturing Asia alla salvaguardia dell’ambiente.


Ce manuel est imprimé sur papier recyclé: une contribution de Marelli Manufacturing Asia pour la sauvegarde de l’environnement.

Este manual ha sido impreso en papel reciclado: una contribución de Marelli Manufacturing Asia para la salvaguardia del medio ambiente.

Marcado “CE” : de acuerdo con la Directiva Baja Tensión (73/23/CEE, 93/68/CEE).

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Changes reserved
Con riserva di eventuali modifiche
Änderungen vorbehalten
Sous réserve de modifications
Sujeto a modificaciones
10. Wiring diagram for 12 terminals generators with AVR MARK V

Schema di collegamento interno per generatori a 12 terminali con RDT MARK V

Stromlaufplan für Generatoren in 12 Leiter-Ausführung mit AVR MARK V

Schéma de connexion interne des alternateurs à 12 bornes avec RDT MARK V

Esquema de conexión interno para los alternadores de 12 terminales con RAT MARK V
MJB 160

Two Bearing Construction

Generators Bi-Paliers

Construcciones con Dos Aparatos
<table>
<thead>
<tr>
<th>PART NAME</th>
<th>NOMENCLATURA</th>
<th>BEZEICHNUNG DER TABEL</th>
<th>DENOMINACIÓN DE LOS COMPONENTES</th>
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<tbody>
<tr>
<td>Two bearing construction</td>
<td>Costruzione bisupporto</td>
<td>Zweilager - Ausführung</td>
<td>Construcciones con dos apoyos</td>
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<tr>
<td>Main stator</td>
<td>Stato principale</td>
<td>Stator des Generators</td>
<td>Stator</td>
</tr>
<tr>
<td>Main rotor</td>
<td>Rotor principale</td>
<td>Rotor des Generators</td>
<td>Rotor</td>
</tr>
<tr>
<td>2 Bearing shield (N.D.E.)</td>
<td>Scudo lato N</td>
<td>Lagerschild gegenüber der Antriebsseite, B-Seite</td>
<td>Protección superior del Lado-D</td>
</tr>
<tr>
<td>Vibeage shield (D.E.)</td>
<td>Scudo lato D</td>
<td>Lagerschild gegenüber der Antriebsseite, A-Seite</td>
<td>Protección inferior del Lado-D</td>
</tr>
<tr>
<td>Voltage regulator</td>
<td>Regolatore di tensione</td>
<td>Spannungsschalter</td>
<td>Regulador de tension</td>
</tr>
<tr>
<td>Single bearing construction</td>
<td>Costruzione mono supporto</td>
<td>Einlager Ausführung</td>
<td>Construcciones monoapoyo</td>
</tr>
<tr>
<td>Adaptor</td>
<td>Adattatore lato D</td>
<td>Fasch Antriebsseite, A-Seite</td>
<td>Adaptador lato D</td>
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<tr>
<td>110 Exciter</td>
<td>Exciter eccitatrice</td>
<td>Stator der Erregermaschine</td>
<td>Excitador</td>
</tr>
<tr>
<td>154 Support voltage regulator</td>
<td>Supporto RDT</td>
<td>Halterung Spannungsregler</td>
<td>Soporte regulador de tension</td>
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<tr>
<td>201 D-end (D.E.) bearing</td>
<td>Cuscinetto lato D</td>
<td>Lager des A-Seite der Antriebsseite</td>
<td>Cojinete del Lado-D</td>
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<tr>
<td>223 Key</td>
<td>Linguetta</td>
<td>Federung gegenüber der Antriebsseite</td>
<td>Chave</td>
</tr>
</tbody>
</table>

Delivered generators may differ in details from those illustrated.

Les alternateurs délivrés peuvent différer de l’illustration.
### 12. ROTATING RECTIFIER

<table>
<thead>
<tr>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>309 Kit rotating diodes (direct)</td>
</tr>
<tr>
<td>310 Kit rotating diodes (inverse)</td>
</tr>
<tr>
<td>311 Surge suppressor</td>
</tr>
<tr>
<td>119 Complete rotating rectifier</td>
</tr>
</tbody>
</table>

### 12. RADDRIZZATORE ROTANTE

<table>
<thead>
<tr>
<th>Sezione</th>
</tr>
</thead>
<tbody>
<tr>
<td>309 Kit diodi rotanti diretti</td>
</tr>
<tr>
<td>310 Kit diodi rotanti inversi</td>
</tr>
<tr>
<td>311 Scaricatore / Filtro</td>
</tr>
<tr>
<td>119 Raddrizzatore rotante</td>
</tr>
</tbody>
</table>

### 12. ROTIERENDE GLEICHRICHTERSCHEIBE

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<thead>
<tr>
<th>Schnittbild</th>
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<tbody>
<tr>
<td>309 Diodensatz (positiv) direkt</td>
</tr>
<tr>
<td>310 Diodensatz (negativ) invers</td>
</tr>
<tr>
<td>311 Überspannungsableiter / Filter</td>
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<tr>
<td>119 Gleichrichterscheibe</td>
</tr>
</tbody>
</table>

---

### 12. REDRESSEUR TORNANT

<table>
<thead>
<tr>
<th>Vue en coupe</th>
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<tbody>
<tr>
<td>309 Diode tournante directe</td>
</tr>
<tr>
<td>310 Diode tournante inverse</td>
</tr>
<tr>
<td>311 Varistance / Filtre</td>
</tr>
<tr>
<td>119 Redresseur tournant complet</td>
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</table>

### 12. DISCO RECTIFICADOR

<table>
<thead>
<tr>
<th>Seccion</th>
</tr>
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<tbody>
<tr>
<td>309 Diodo giratorio directo</td>
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<tr>
<td>310 Diodo giratorio inverso</td>
</tr>
<tr>
<td>311 Descargador / Filtro</td>
</tr>
<tr>
<td>119 Rectificador giratorio completo</td>
</tr>
</tbody>
</table>

---

**MJB 160 – 200**

---

**Generator rotor**
- Rotore generatore
- Generator Polrad
- Rotor alternateur
- Rotor generador

**Exciter rotor**
- Rotore eccitatrice
- Erregerrotor
- Rotor de l’excitatrice
- Rotor de la excitatriz

---

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SIN.UM.805.0/Alternateur-MJB200-mpvnotice.pdf/mai15
13. INSTRUCTIONS FOR THE APPLICATION OF THE PRESSURE–SENSITIVE NAME PLATE ON THE ALTERNATOR

Inside the terminal box there is an envelope containing the name plate. This name plate has to be put on the alternator as follows:

1. The application of the pressure-sensitive name-plate has to be carried out at ambient temperature higher than 15°C.
2. To clean the involved surface (see picture 1) by using alcohol and await until it is completely dried.
3. To take away the adhesive part from the attached one and apply it, as shown by picture 1, pressing it by mean of a rubber roller, to get a better bond.

---

13. ISTRUZIONI PER L’APPLICAZIONE DELLA TARGA AUTOADESIVA

All’interno della scatola morsetti è presente una busta contenente la targa dati. Questa targa deve essere applicata sull’alternatore come segue:

1. L’applicazione della targa autoadesiva deve essere eseguita ad una temperatura ambiente superiore a 15°C.
2. Pulire la parte interessata (vedi fig. 1) con alcool ed aspettare che sia perfettamente asciutta.
3. Togliere la parte adesiva dal supporto e applicarla come indicato nella fig. 1 facendo pressione con un rullo di gomma per una migliore aderenza.

---

13. ANLEITUNG FÜR DIE ANBRINGUNG DES TYPENSCHILD-AUFKLEBERS AM GENERATOR

Im Inneren des Klemmenkastens des Generator ist die Tüte mit dem Typenschild befestigt. Dieses Typenschild muss auf dem Generator, wie folgt angebracht werden:

2. Säubern der Aufklebestelle mit Alkohol und warten, bis diese vollkommen getrocknet ist.

---

13. INSTRUCTIONS POUR LA POSE DE LA PLAQUE SIGNALETIQUE AUTO-ADHESIVE SUR L’ALTERNATEUR

A l’intérieur de la boîte à bornes, il est prévu une enveloppe contenant la plaque signalétique. Celle-ci doit être posée sur l’alternateur de la façon suivante:

1. La pose de la plaque auto-adhéssive doit s'effectuer à une température ambiante supérieure à 15°C.
2. Nettoyer la surface (voir fig.1) avec de l'alcool, attendre qu'elle soit parfaitement sèche.
3. Oter la partie adhésive de son support et la coller comme indiqué fig.1 en faisant pression avec un rouleau de caoutchouc pour une meilleure adhérence.

---

13. INSTRUCCIONES PARA LA COLOCACION DE LA PLACA ADHESIVA

En el interior de la caja de bornes del Alternador se encuentra el sobre que contiene la placa de características. Dicha placa tiene que ser aplicada en el Alternador tal como se indica en la fig.1 siguiendo las siguientes instrucciones:

1. La aplicación debe hacerse a una temperatura ambiente superior a los 15°C.
2. Limpia con alcohol la superficie donde debe ir adherida (Fig. 1) y esperar a que se seque bien.
3. Separar la parte adhesiva y aplicarla tal cuál se indica en la Fig. 1, haciendo presión con un rodillo de goma para garantizar una mejor adherencia.

---

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
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</tbody>
</table>

Fig. 1 / Abb. 1
14. DIMENSIONS DRAWING

SINGLE BEARING 160 FRAME SIZE

<table>
<thead>
<tr>
<th>MJB 160</th>
<th>XA</th>
<th>SA</th>
<th>SB</th>
<th>SC</th>
<th>MA</th>
<th>MB</th>
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<tbody>
<tr>
<td>L</td>
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<td>471</td>
<td>501</td>
<td>501</td>
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<td>571</td>
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<tr>
<td>CG SAE 5-4</td>
<td>180</td>
<td>190</td>
<td>195</td>
<td>205</td>
<td>225</td>
<td>250</td>
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<tr>
<td>CG SAE 3</td>
<td>175</td>
<td>185</td>
<td>190</td>
<td>200</td>
<td>225</td>
<td>245</td>
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DIMENSIONS [mm]

<table>
<thead>
<tr>
<th>CONNECTING COUPLING (SAE J520)</th>
<th>COUPLING [mm] (SAE J617)</th>
<th>FLANGE [mm] (SAE J520)</th>
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<tbody>
<tr>
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<td>4</td>
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<tr>
<td>6½</td>
<td>215.90</td>
<td>220.02</td>
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<td>7½</td>
<td>241.30</td>
<td>222.25</td>
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<tr>
<td>8</td>
<td>263.52</td>
<td>244.48</td>
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<tr>
<td>10</td>
<td>314.32</td>
<td>295.28</td>
</tr>
<tr>
<td>11½</td>
<td>352.42</td>
<td>333.38</td>
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</table>

DOUBLE BEARING 160 FRAME SIZE

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<th>XA</th>
<th>SA</th>
<th>SB</th>
<th>SC</th>
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<td>651</td>
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<tr>
<td>CG</td>
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<td>200</td>
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SINGLE BEARING 200 FRAME SIZE

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<tr>
<td>L</td>
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<td>280</td>
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<table>
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<td>263,52</td>
<td>244,48</td>
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<td>10</td>
<td>314,32</td>
<td>295,28</td>
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<tr>
<td>11½</td>
<td>352,42</td>
<td>333,38</td>
</tr>
<tr>
<td>14</td>
<td>466,72</td>
<td>438,15</td>
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<table>
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<tr>
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<th>SAE J620</th>
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<th>θ</th>
<th>β</th>
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<td>8</td>
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<td>11</td>
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<td>11</td>
<td>45°</td>
<td>53.8</td>
<td>-</td>
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<td>11</td>
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<table>
<thead>
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<th>SAE J617</th>
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<th>θ</th>
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<th>M</th>
<th>Z</th>
<th>α</th>
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<tbody>
<tr>
<td>5</td>
<td>314,32</td>
<td>440</td>
<td>333.38</td>
<td>8</td>
<td>11</td>
<td>45°</td>
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</tr>
<tr>
<td>4</td>
<td>361,95</td>
<td>440</td>
<td>381.00</td>
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<td>11</td>
<td>30°</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>409,58</td>
<td>451</td>
<td>428.62</td>
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<td>11</td>
<td>30°</td>
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<td>2</td>
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<td>1</td>
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DOUBLE BEARING 200 FRAME SIZE

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