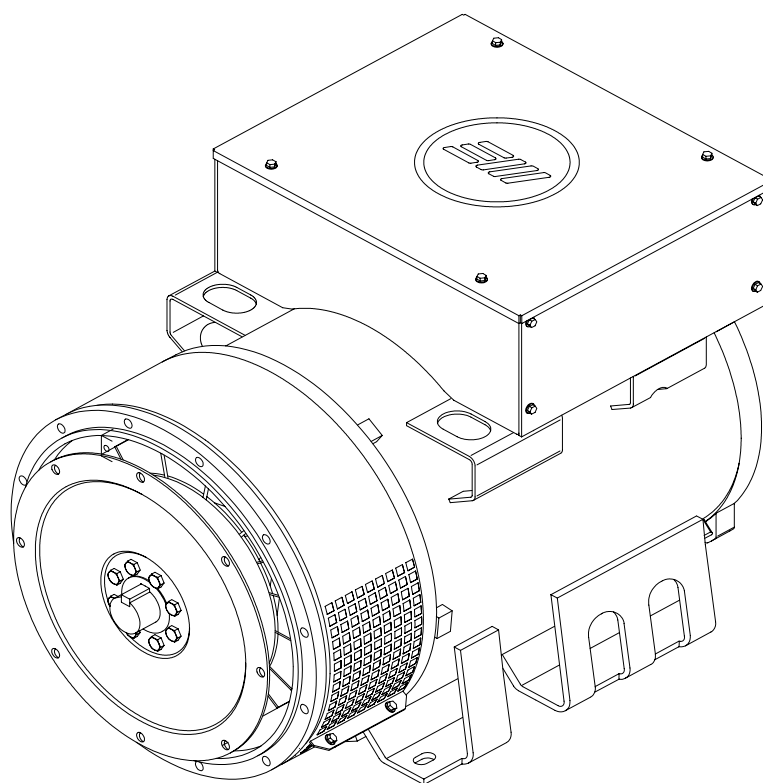


**Trefas synkron generator**

# **MJB 250-315-355**

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**Instruksjoner og sikkerhetsinformasjon (Engelsk)**



**MarelliGenerators**

## 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. If you encounter any difficulties please do not hesitate to contact Marelli Motori, specifying:

- the type of machine
- the full code number of the generator
- the serial number.

**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.**

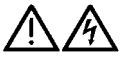
**ATTENTION!** This is referred to controls and operations that can cause damages to the product, accessories or to connected components.



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 and 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.



**WARNING:** 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.

## 1. 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 anticondensation heaters, thermistors, etc.

## 2. 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 and to MarelliMotori



**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 endshield are to the alignment of the generator during the fase of coupling to the engine.

Following are the weight of the generators:

Average weight of the generators						
Size	Pack length					
	SA4	SB4	MA4	MB4	LA4	LB4
MJB 250	/	/	530 Kg	590 Kg	660 Kg	710 Kg
MJB 315	830 Kg	920 Kg	1060 Kg	1200 Kg	/	/
MJB 355	1250 Kg	1550 Kg	1800 Kg	2030 Kg	/	/

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. 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.

## 3. INSTALLATION AND COMMISSIONING

### 3.1 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.

### 3.2. Insulation test

If the alternator has been kept in storage for a long period of time, it is a good practice to test the stator windings for ground insulation before starting up.

Before doing this test, it is necessary to disconnect the voltage control system (AVR or similar devices).

If this test, performed using a ohmmeter or another similar instrument, shows that ground resistance is below 5 Mohm, it is necessary to dry the generator and then the test should be repeated.

### 3.3. Balancing

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

### 3.4. Installation conditions

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.**

### 3.5. 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.

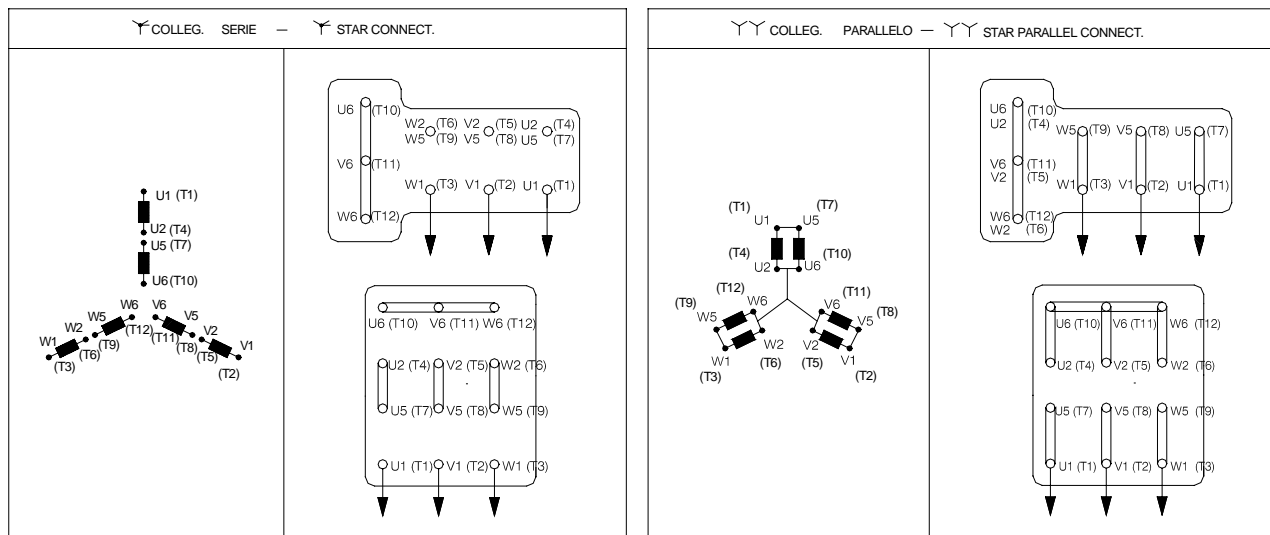
### 3.6. Electrical connection

Standard generators are supplied with 12 leads (9 terminals).

The entry of the terminal cables in the terminal box is on the right.

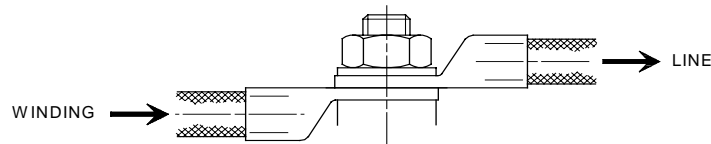
Terminals arrangement permits star series and star parallel connection: it is anyway necessary, when changing the connection from star series to star parallel, to check and modify the connection to the voltage regulator, according applicable diagrams.

#### Wiring diagram for standard generators



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.



### 3.7. Commissioning

Before starting up check insulation resistance:



**THE GENERATOR HAS NOT TO BE OPERATED IF INSULATION RESISTANCE IS BELOW 5 MEGAOHM**

Before first starting up, check:

- If fixing bolts are securely fixed
- that the alignment and coupling is correct
- that the ventilation air is sufficient
- 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.

## 4. 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.**

### 4.1 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. 500 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.

### 4.2. Maintenance of bearings

The D.E bearing is of the prelubricated type, with sufficient grease quantity for a long operating time.

The lubrication interval time is, in case of normal operating condition, of about 20000 hours for this bearings; quantity of grease to be used is 50 grams.

In case of complete overhaul of genset, remove the used grease and wash the bearing with solvent, before regreasing.

Following types of grease are to be recommended for normal application:

MOBIL OIL:	MOBILUX 3
SHELL:	ALVANIA 3
AGIP:	GR MW 3
ESSO:	BEACON 3

**Mixing of different greases (thickeners, basic oil), reduce the quality of the grease and therefore has to be avoided. An excessive lubrication or wrong quality may cause overheating of bearings.**

The N.D.E. bearing is sealed type (life lubrication): the life expected time is, in case of normal operating condition, of about 20.000 hours.

In case of complete overhaul of genset, the bearing of the generator should be changed.

### 4.3. 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.**

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.

For two bearing generators:

- remove the half coupling from shaft extension and remove the key (223)
- remove the bolts fixing the inner D-end bearing cap (131) to the shield.
- 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 (5) to the frame and dismantle the shield

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. endshield: 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.

#### 4.4. Reassembly operations

Carry out the operations described above for dismantling in reverse order. If the end-shield have been removed, the fixing screws have to be fixed with LOCTITE type 242 (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 °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:

**Tightening torques in Nm**

Application	Thread diameter								
	M 5	M 6	M 8	M 10	M 12	M 16	M 20	M 24	M 27
Fixing of electrical connections	2.5	4	8	12	20	40	/	/	/
Fixing of components (endshields, bearing caps, etc). Fixing of feet or flange.	5	8	22	45	75	180	350	620	900

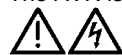
#### 5. VOLTAGE REGULATOR “MARK I” ( M40FA640A )

The generators are provided with automatic voltage regulator (AVR) “MARK I” (M40FA640A).

The AVR is provided with potentiometers to adapt the characteristics of the AVR to the 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 excitation system of the generator.

##### Radio interference suppressor

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

##### Fuse



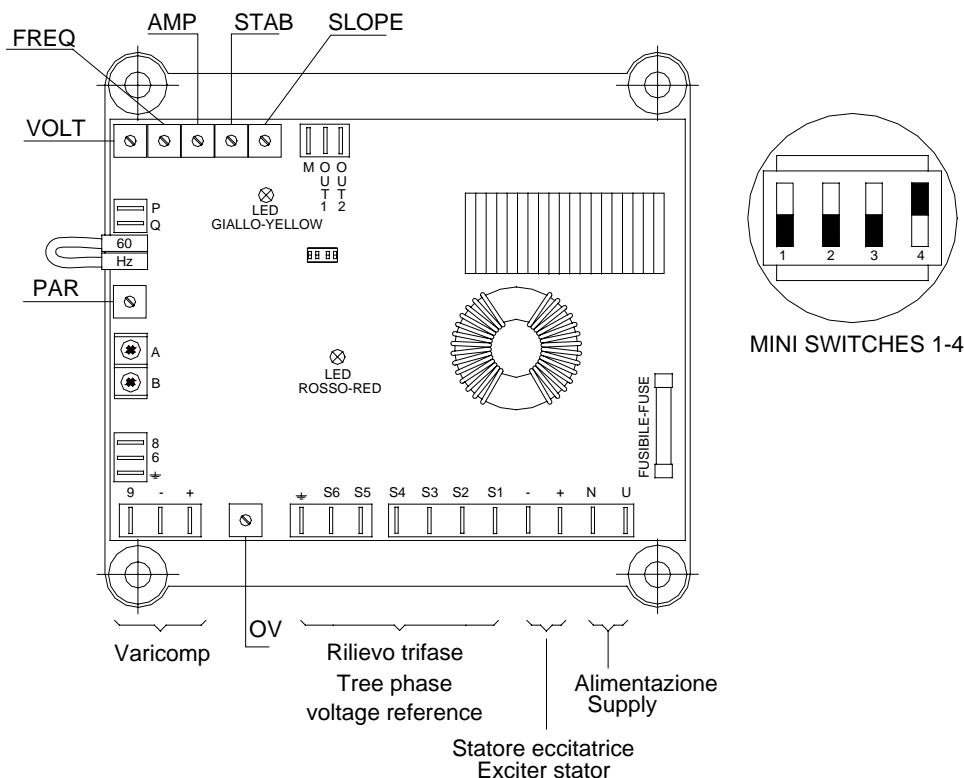
On the AVR there is a protecting fuse. In case it should be necessary to replace it, high speed fuses should be used; in addition they should have high breaking resistance with a rated voltage of 500V, and rated current of 10A.

##### Connection of AVR

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



**ATTENTION!:** when changing generator wiring diagram, it is advisable to pay attention to connection of AVR, in order to avoid AVR damages.



### USE OF POTENTIOMETERS

**VOLT** - Potentiometer for adjusting the output voltage of the generator.

It allows a wide range of voltage setting (i.e. between 350 and 450 V; or between 170 and 270 V depending on winding connections). In case of resetting this potentiometer the voltage has to be set within 5% of 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 (see paragraph 5.2).

⌚ ⇒ increase voltage

⌚ ⇒ decrease voltage

**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 terminals "60-Hz", the low speed protection acts properly for 60 Hz. In case of intervention, red led switch on.

⌚ ⇒ decrease frequency of intervention

⌚ ⇒ increase frequency of intervention

**AMP** - Potentiometer for changing the overexcitation limit device.

The limitation of overexcitation is an aid to protect the excitation system. This device intervenes (the yellow LED is switched on) with a delay that does not regard the transitory condition. This protection device does not substitute the external protection device.

⌚ ⇒ increase the overexcitation threshold

⌚ ⇒ decrease the overexcitation threshold

To calibrate, bring the generator to the velocity, voltage, nominal load and rotate the AMP trimmer in an anticlockwise direction until the protection is activated. (the yellow LED is switched on with a 10 sec delay). At this point rotate the trimmer in a clockwise direction while not reaching a stable output voltage with the yellow LED switch on. Rotate again the trimmer in a clockwise sense making sure the LED has not been switched off. In this position the protection acts when the overload is 15%.



**In the workshop the potentiometer is set in the way the said limitation comes into operation only under extreme overexcitation.**

**STAB** - Potentiometer for stability adjust.

By rotating it clockwise stability increases, but response time becomes larger.

⌚ ⇒ increase response time, increase stability

⌚ ⇒ decrease response time, decrease stability

### Use of microswitches


To change the stability characteristics of the regulator, it is possible to use the microswitches.

In such a way it is possible to insert capacitors on electronic stability circuit, then obtaining step changes in the transient response of the regulator.

dip 1

pos.ON  ⇒ speed response becomes slower


**dip 2**


pos.ON  ⇒ speed response becomes slower

**dip 3**

pos.ON  ⇒ speed response becomes slower


**dip 4**


pos.ON  ⇒ standard low speed protection

pos.OFF  ⇒ proportional low speed protection V/f (see "SLOPE" potentiometer)

**SLOPE** - Potentiometer for changing the slow speed protection characteristic slope.

With this potentiometer, we can increase or decrease the under speed ramp slope, and set the voltage droop for a fixed reduced speed. Setting with SLOPE is possible only with dip 4 OFF.

 ⇒ increase voltage droop

 ⇒ decrease voltage droop


**PAR** - Potentiometer for changing the droop


In order to obtain a correct sharing of reactive power, when two or more generators are required to operate in parallel, it is necessary to verify that the no load voltage is the same, that the bridge between "A-B" is open and the voltage droop is the same for all generators when loaded.

When this unit is inserted the output voltage should show a 4% voltage droop when passing from no load to full load 0.8 p.f.

If the voltage is increasing as the load increases, it is necessary to reverse the leads of the current transformer at the terminals "A-B". If necessary, the voltage droop can be reset by acting on the internal potentiometer.


In single operation the terminals A and B have to be shorted.


 ⇒ increase droop

 ⇒ decrease droop

**OV** - Potentiometer for changing the overvoltage protection threshold.

In the event a overvoltage for the sensing loss or the SCR failure occurs, the A.V.R. is able to detect such overvoltage (red led switch on ) and a low level is provided by an Open Collector output "OUT1". This device helps to monitor the excitation system. The time delay is about 10 seconds. It has no automatic effect on the generator excitation system.

 ⇒ increase the overvoltage threshold

 ⇒ decrease the overvoltage threshold



**In factory the potentiometer is calibrated in order to exclude the overvoltage protection threshold. This control device also if correctly calibrated has to be combined with an external protection system.**

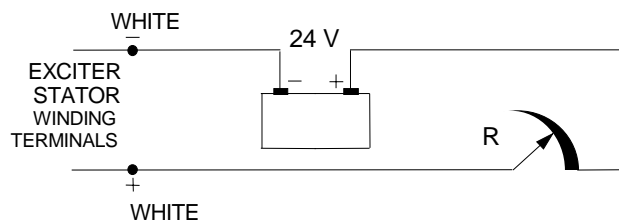
### 5.1. Rheostat for remote voltage setting

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 0.5W, resistance about 100Kohm.

### 5.2. 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:

Generator	I max [A]	Max. resistance of rheostat [Ω]
MJB 250 – 315	5	80
MJB 355	6	80

## 6. TROUBLE SHOOTING AND REPAIRS

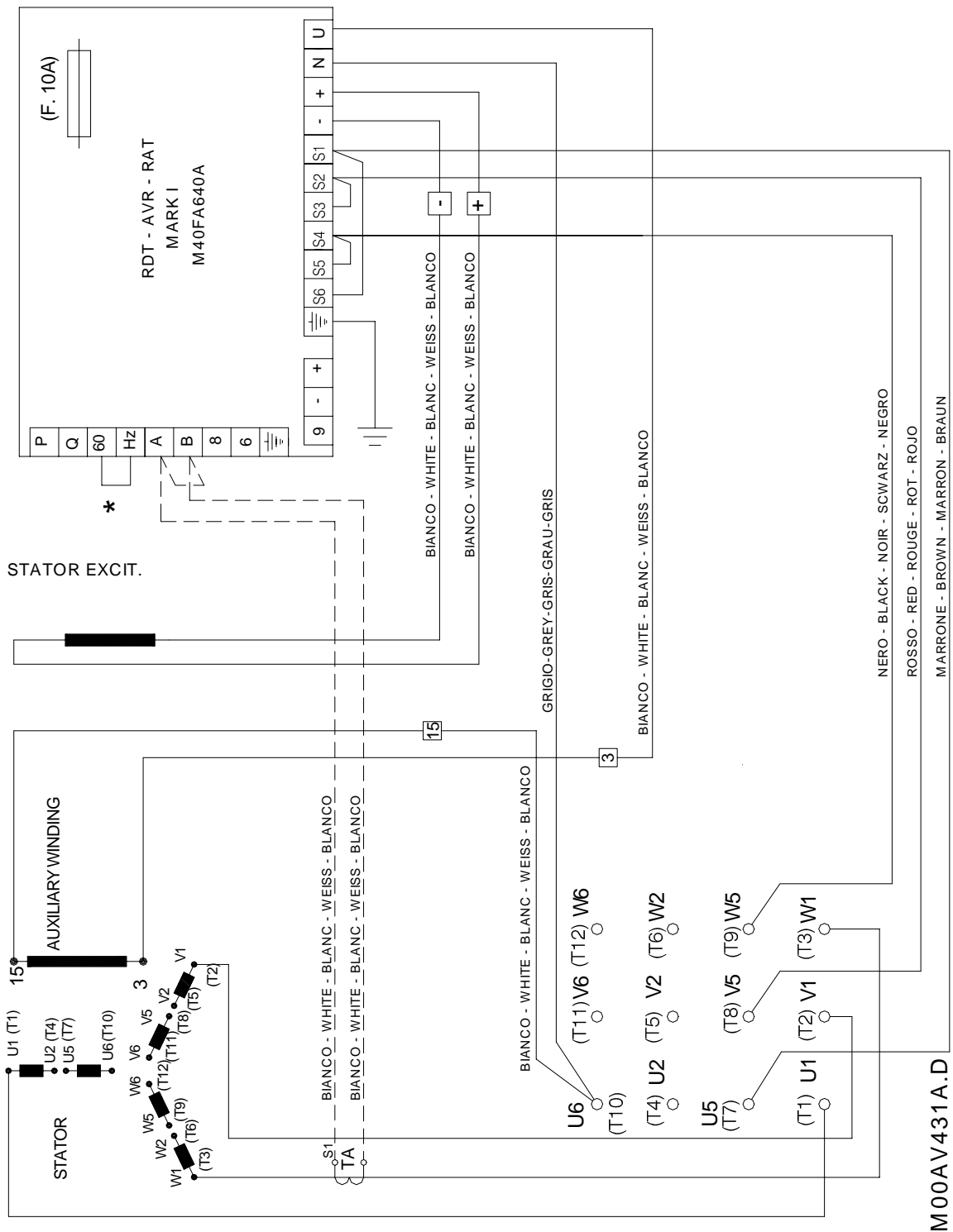
TROUBLE	POSSIBLE CAUSE	REMEDY (always to be done with the machine switched off)  
The alternator will not energise (no load voltage below 10% of rated voltage).	a) Loose connections. b) Rotating diodes or surge suppressor broken. c) Excitation circuit shorted or interrupted. d) Insufficient residual voltage	a) Check and repair. b) Check the diodes and change in case they are open or shortcircuited. 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. b) Faulty regulator.	a) Check rpm uniformity. Check the diesel engine governor. b) Act on AVR's stability potentiometer. b) Replace AVR.

## 7.SPARE PARTS NOMENCLATURE

Pos.	Part name	Type / Code		
		MJB 250	MJB 315	MJB 355
201	D side (D:E) bearing	6218 C3 / 346110114	6319 C3 / 346151095	6322 C3 / 346151110
202	N side (N.D.E.) bearing	6313 2Z C3 / 346114065	6315 2Z C3 / 346114075	6317 2Z C3 / 346114085
6	Voltage regulator	MARK I M40FA640A		
7	Fuse (6.3x32 10A – 500V)	963823010		
309	Rotating diode (inverse)	41 HFR 80 / 963821112	71 HFR 120 / 963821170	
310	Rotating diode (direct)	41 HF 80 / 963821113	71 HF 120 / 963821171	
311	Surge suppressor	M16FA864A	M40FA990A	
119	Complete rotating rectifier	M25FA648B	M40FA500A	

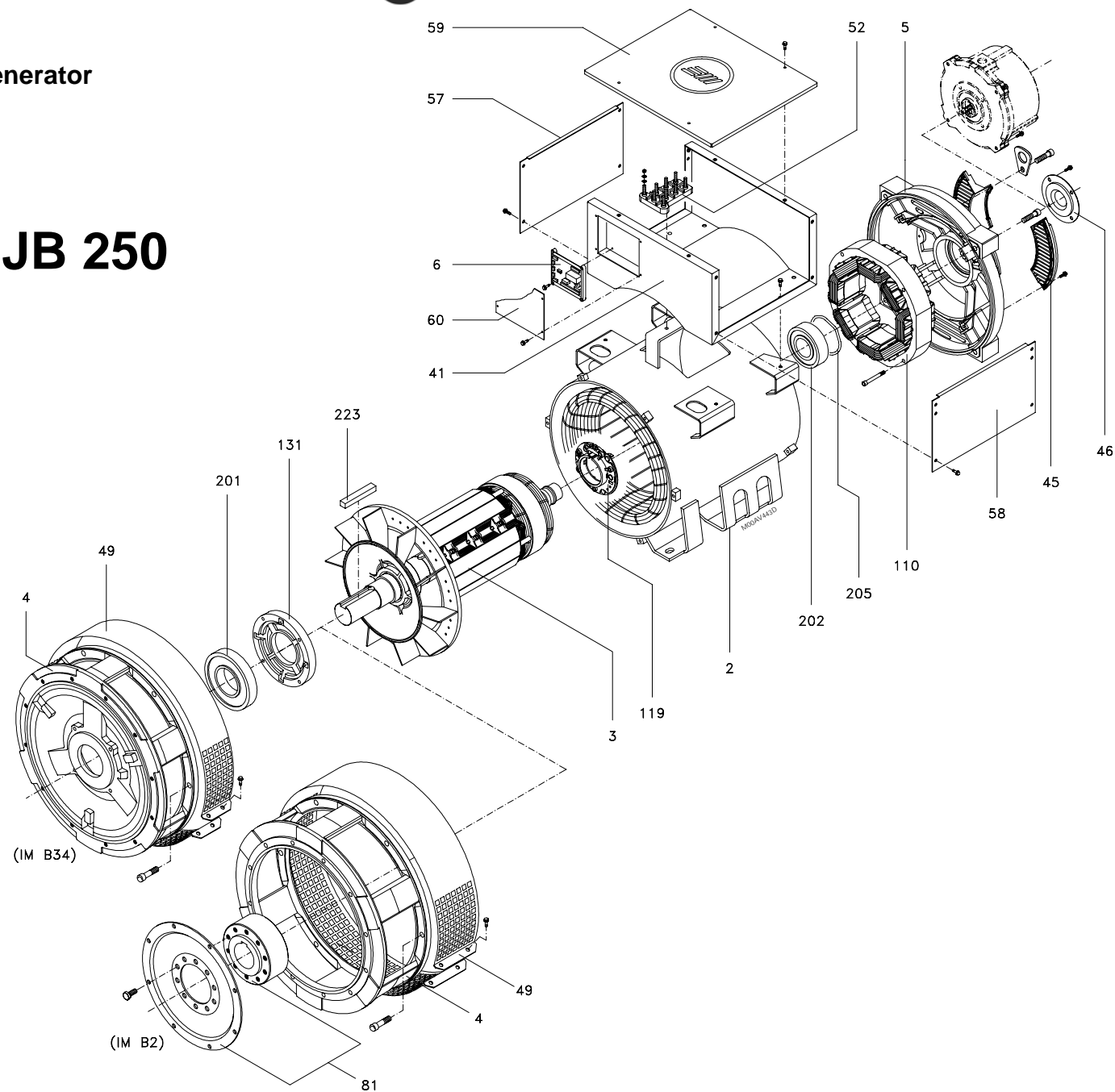
## Wiring diagram for 12 terminals standard generators

FOR 60 Hz OPERATION, THE ORANGE WIRE  
BRIDGE OF A.V.R HAS TO BE REMOVED.



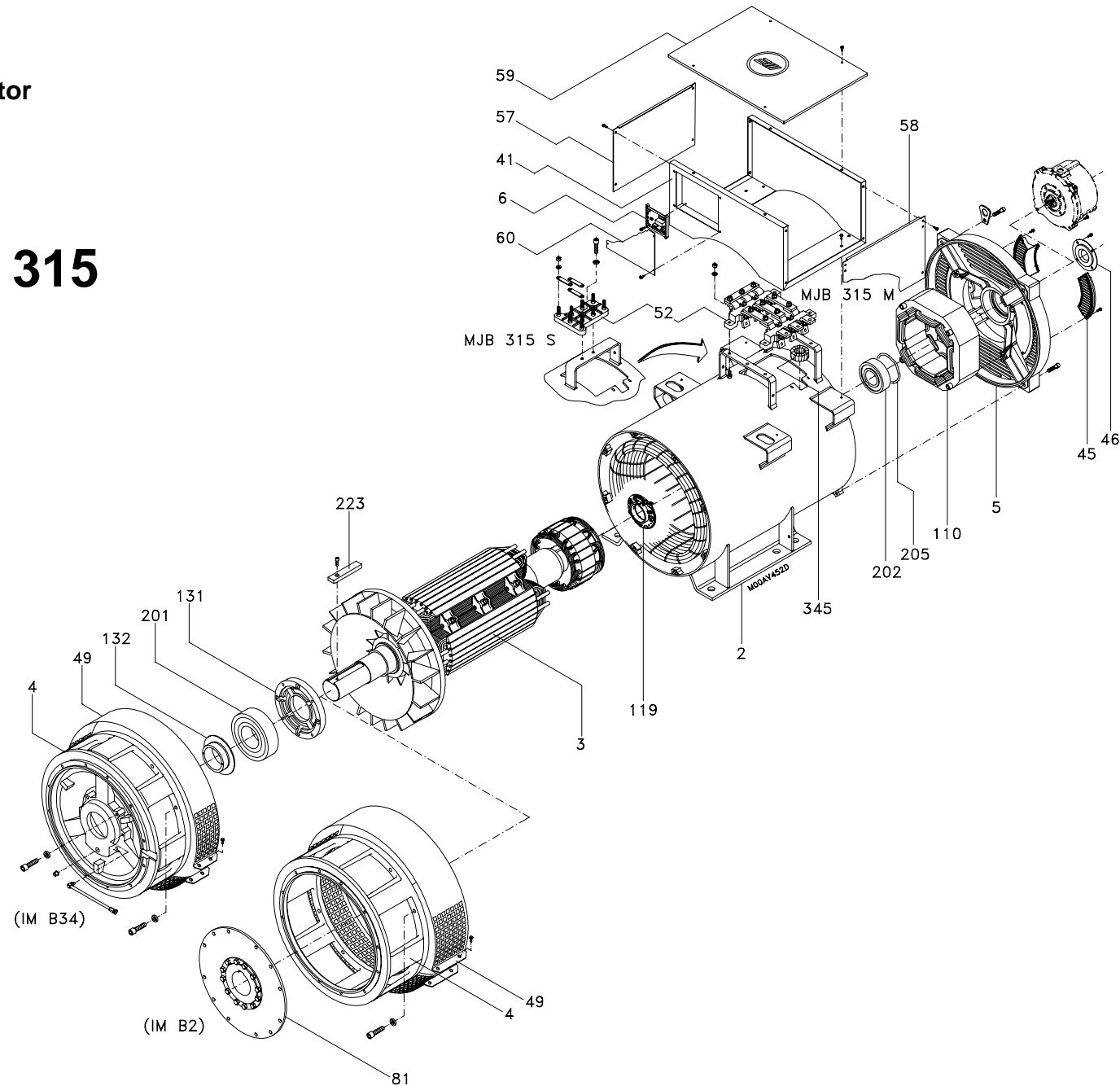
Trefase synkron generator

# MJB 250

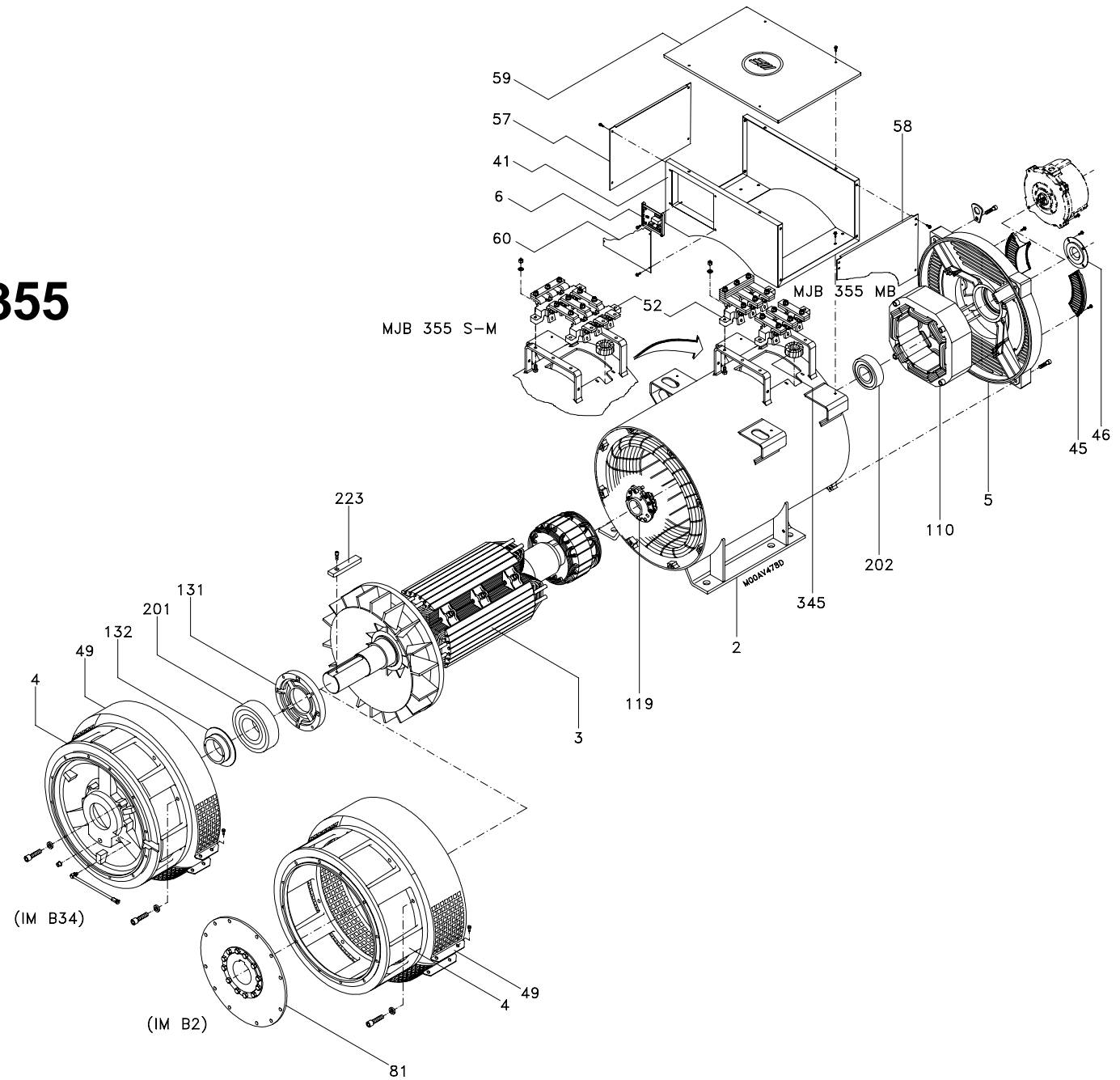


Trefase synkron generator

# MJB 315







PART NAME	
-----------	--

	<b>Two bearing construction</b>	
2	Main stator	
3	Main rotor	
4	D-end endshield (D.E.)	
5	N-end endshield (N.D.E.)	
6	Voltage regulator	
41	Terminal box (sheets 57-58-59)	
45	N - end screen protective	
46	N – end endshield protective	
49	D-end screen protective	
52	Terminal block	
60	Régulation panel cover	
110	Exciter stator	
119	Rotating rectifier	
131	Inner D – end bearing cap	

132	Grease slinger D - end	
154	Support voltage regulator	
201	D-end (D.E.) bearing	
202	N-end (N.D.E.) bearing	
205	Preloading spring	
223	Key	
345	C.T. for parallel operation	

<b>PART NAME</b>	
------------------	--

	<b>Single bearing construction</b>	
4	Adaptor	
81	Flexplate coupling	

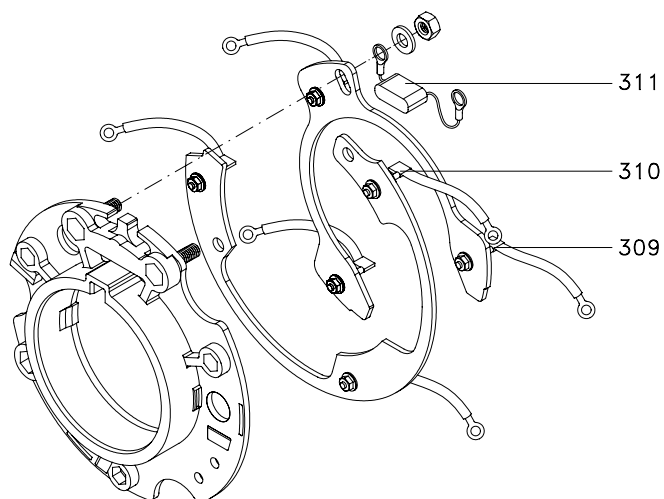
Delivered generators may differ in  
details from those illustrated.

## ROTATING RECTIFIER

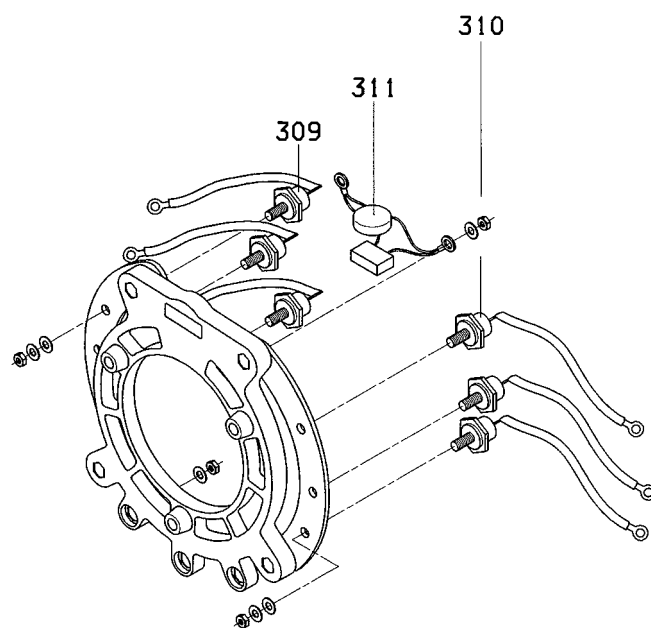
### Section

- 309 Rotating diode (inverse)
- 310 Rotating diode (direct)
- 311 Surge suppressor
- 119 Complete rotating rectifier

**MJB 250**

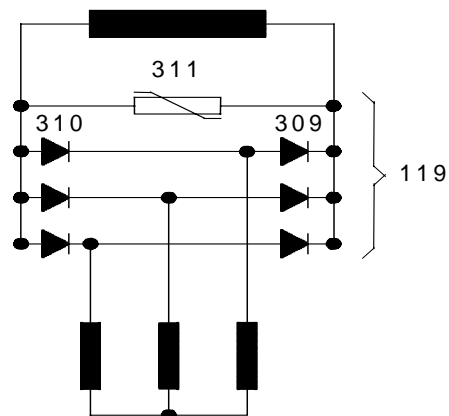


**MJB 315 - 355**



Generator rotor

Exciter rotor

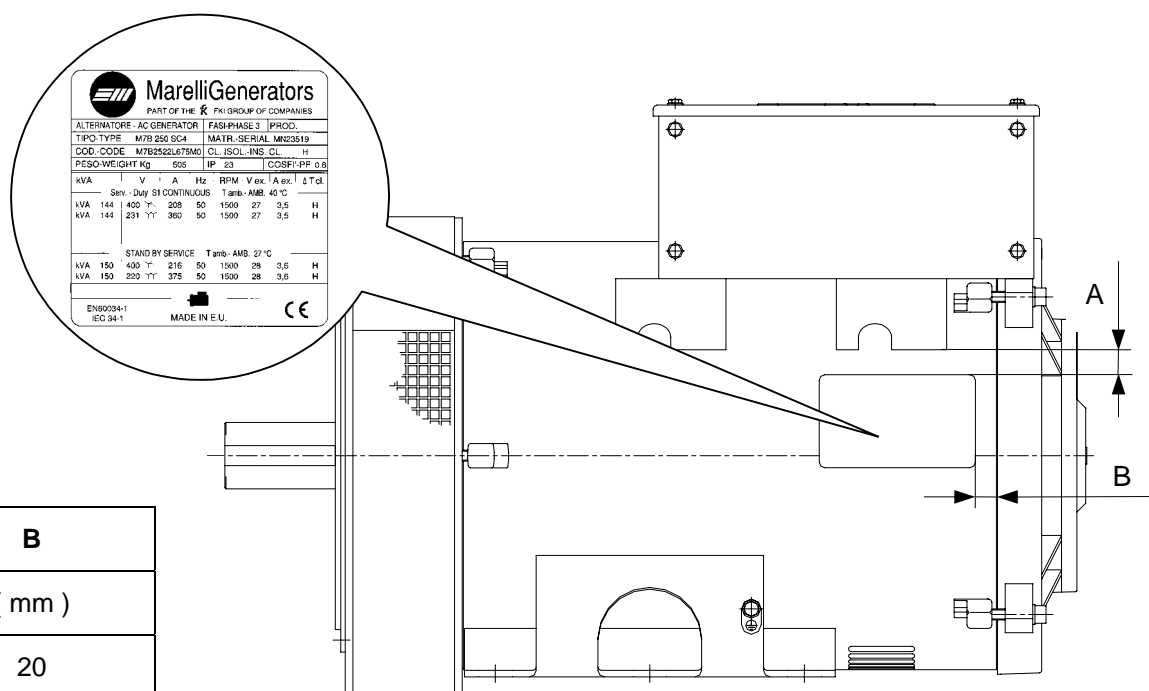


## INSTRUCTIONS FOR THE APPLICATION OF THE PRESSURE-SENSITIVE NAME PLATE ON THE ALTERNATOR

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.



A	B
( mm )	( mm )
20	20