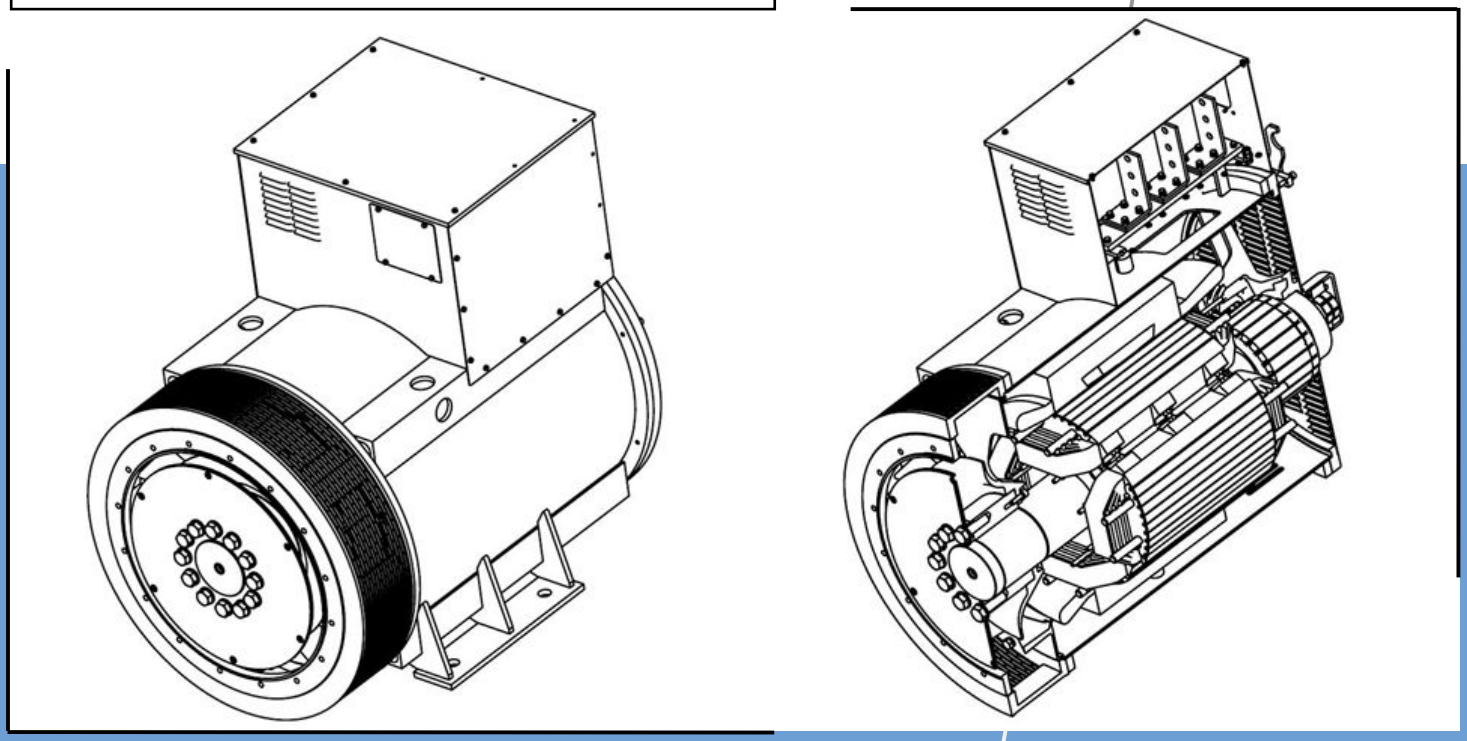
SK 400/450

soga energyteam

4 POLES
BRUSHLESS
ALTERNATORS

USE AND MAINTENANCE MANUAL



800 – 1600kVA / 1500 RPM
960 – 1920kVA / 1800 RPM

SINCRO®

1. SAFETY RECOMMENDATIONS

We thank you for having chosen a **Sincro** product, and we are sure that it will satisfy all your expectations in high standards and performance.
The "**User and Maintenance Manual**" included with the generator provides important indications regarding safety, installation, use and maintenance. This product complies with recognized standards in good engineering and provisions related to safety.

When contacting **Sincro Srl**, always quote the generator type and code, found on the label attached to the packing. What's more, in the event of malfunction or any other kind of machine fault that should require our Aftersales Service, please specify **the serial number (SN)**.

Caution! **An incorrect installation or improper use of the product may cause damage to persons and objects.**

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- Strictly observe the instructions given in the "User and Maintenance Manual" that is provided to indicate the correct conditions for installation, use and maintenance, in order to prevent malfunctions in the generator and avoid hazardous situations for the user.
- Dispose of all packing material (i.e. plastic, cardboard, polystyrene, etc.) according to statutory regulations.
- Keep the instructions with the technical folder and for future consultation.
- This product has been designed and constructed solely for the applications indicated in this manual. Any use not specified in this manual may cause damage to the product and become a source of hazard.
- **Sincro S.r.l.** declines all liability arising from any use whether improper or differing from its original concept and specified in this manual.
- Do not install the product in a potentially explosive atmosphere.
- The plant component elements must comply with European Directives. To ensure good safety levels, these standards should also be observed in non-EEC countries, in addition to the country specific statutory regulations.
- The installation must comply with European Directives and must be carried out solely by qualified specialists.
- Do not start up the generator if the protective covers, the access panels or the terminal box cover have been removed.
- Before starting any maintenance work shut off the motor power circuit.
- Shut off the actuator circuits and/or place warning decals on all circuit breakers normally used for connecting the mains or other generators, in order to prevent them from being switched accidentally.
- Only use genuine parts for any maintenance or repair. Failure to observe this recommendation shall free **Sincro S.r.l.** from all responsibility related to the generator safety and good operation.

- Train the plant operator in the management, use and maintenance of the generator.
- Anything not expressly prescribed in these instructions is prohibited.

This manual uses various symbols and terms that have a precise meaning. These are clearly defined below.

Important! **This refers to risk conditions or to hazardous procedures that could cause damage to the product or connected equipment.**

Caution! **This refers to risk conditions or hazardous procedures that could cause damage to the product or injury to persons.**

Exclamation mark symbol: This symbol signals risk conditions or hazardous procedures that could cause severe injury or death.

Lightning symbol: This symbol signals risk conditions or hazardous procedures that will cause severe injury or death.

Important! **This refers to risk conditions or to hazardous procedures that could cause damage to the product or connected equipment.**

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This symbol signals risk conditions or hazardous procedures that COULD cause severe injury or death.

This symbol signals risk conditions or hazardous procedures that WILL cause severe injury or death.

2. CONFORMITY DECLARATION

All **SK400/450** generators are supplied with a declaration of incorporation in accordance with European rules and regulations as provided in final pages of this manual.
According to the EC Machine Directive, it is the electricity generating set constructor's responsibility to ensure that the generator serial and identification numbers are indicated on the cover page of this manual.

SK400/450 type generators are supplied on the following basis:

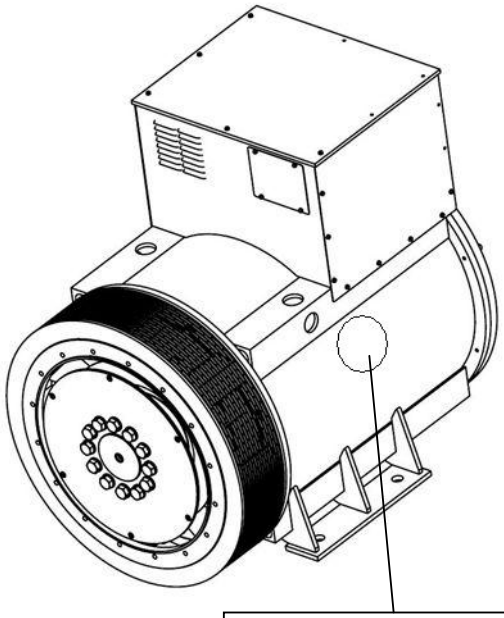
- They shall be used as power generators or for related functions.
- They shall be used in one of the following applications:

  - Mobile (without housing - for temporary power supplies);
  - Mobile (with housing - for temporary power supplies);
  - Onboard below deck (marine use) - after certification;
  - On commercial vehicles (freight transport / cold storage, etc.);
  - On rolling track (auxiliary power);
  - On industrial vehicles (earth handling, hoisting, etc.);
  - Stationary installation (industrial, factory / plant);
  - Stationary installation (residential, commercial and light industry, house / office / hospital);
  - Energy management (cogeneration, peaks in consumption);
  - Alternative energy schemes;

- The standard generators are designed to satisfy "industrial" emissions and immunity standards. In the event that generators have to comply with emission

limitations for residential, commercial and light industrial zones, some additional accessories may be necessary.

- The installation wiring diagram requires that the generator housing is connected to the earth conductor, using an adequately sized cable with a minimum length possible.
- The use of any spare parts that are not genuine or not expressly authorized shall free Sincro from any warranty liability and any responsibility concerning conformity to regulations and relevant consequences.
- Installation, aftersales assistance and maintenance must be carried out by adequately trained staff with a knowledge of the provisions of EC directives.



Generator label position

Caution! **For electrical connection other than series, consult the specific section and wiring diagrams given in this manual.**

3. INTRODUCTION

On delivery inspect the generator to check it has not been damaged during transport or that no parts are missing.

3.1 Control of ID plate

The generators in the **SK400/450** range can be identified by their **ID plate**. This should be controlled and checked against the order specifications on delivery in order to ascertain eventual errors in shipment or configuration.

3.2 Position of plate with electrical specifications and serial number

A plate is supplied on which are printed the data, the electrical specifications and the serial number, which is different for each machine.
The plate is positioned in such a way as to be easily legible; the serial number is an item that is an integral part of the procedures, to be quoted when requesting assistance.

Caution! **For electrical circuits other than series, consult the specific section and wiring diagrams given in this manual.**

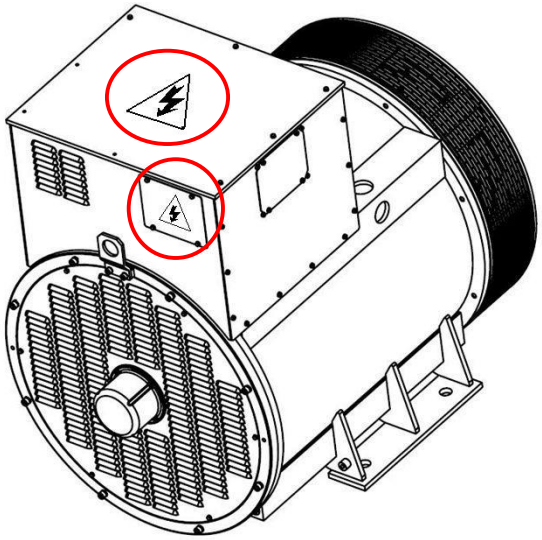
The **Sincro Technical Office** is always available for any clarification.

4. OPERATING PRINCIPLE AND CHARACTERISTICS OF THE VOLTAGE REGULATOR SYSTEM

The **AVR**, powered by a **PERMANENT MAGNET GENERATOR** (later in the text – **PMG**) that is assembled on the non-drive side of the generator, acts on the exciter stator indirectly controlling the field generated by the main rotor by means of the sequence exciter rotor - diode bridge - main rotor. The digital voltage regulator controls and keeps constant the average voltage of all three phases. A frequency control progressively deactivates the machine when the drive motor speed drops below a pre-set, adjustable threshold, preventing over-excitement at low operating speeds and abating the load engage effects on the motor.

5. GENERAL MECHANICAL AND ELECTRICAL SPECIFICATIONS FOR COUPLING WITH MOTOR

As an independent unit, designed to be built into an electricity generating set, it is impossible to apply all the signal decals on the generator during production. These decals, indicating a potential hazard or risk due to live components are supplied loose and have to be applied by the constructor of the electricity generating set in the positions indicated in the figure to the side once assembly of the whole set has been completed.



The generators in the **SK400/450** range are designed to operate at a maximum temperature of 40°C and a maximum altitude above sea level of 1000m.a.s.l. The nominal performance indicated on the plate refers to operation within these temperature and altitude limits. At temperatures over 40°C and/or altitudes above 1000 m.a.s.l. a loss of performance should be expected (see table). The Sincro Technical Office should be advised of any environmental conditions that worsen the above limits.

The generators are fitted with a ventilation system, protective guards and drip-proof covers; they are not suitable for outdoor installation unless an adequate shelter is provided. When under storage, awaiting installation or in standby, it is advisable to use anticondensation heaters to protect the windings from damp.

Before the initial start-up or after long shutdowns check the insulation resistance towards earth of all windings (always remember to unhook the voltage regulator before carrying out this test): the results must be over 2MOhm. If this is not the case, the alternator should be oven dried at 80 - 100°C for 4 hours. Before carrying out this operation remove the voltage regulator.

In the event of installation inside a closed housing, make sure that the cooling air temperature for the generator does not rise above standard. The housing must be constructed so that the motor air vent in the housing is separate from the generator vent especially if the air inlet in the housing has to be supplied by the cooling fan. What's more, the generator air vent should be constructed to prevent damp from entering by fitting a suitable filter. The housing should be designed so that there is a minimum clearance of 50mm between the generator air vent and any flat surface.

Important! A drop in cooling airflow or inadequate protection of the generator can lead to damage and/or malfunction of the windings.

The generator's rotor assembly is factory balanced dynamically with full key (dual bearing version).

The motor induces quite complex vibrations, including overtones that, when added to the generator vibrations, can cause substantial vibration levels damaging for the electricity generating set's operation. Therefore the plant engineer must take all necessary measures to ensure alignment and provide a firm base and supports in order to prevent vibrations from exceeding the standard.

CORRECTION FACTORS					
AMB. TEMP.	25 °C	40 °C	45 °C	50 °C	55 °C
	1,045	1,0	0,96	0,92	0,88
ALTUTUDE	1000m	1500m	2000m	2500m	3000m
	1,00	0,96	0,93	0,90	0,86
cosφ	1,0	0,8	0,7	0,6	0,5
	1,00	1,00	0,93	0,88	0,84

Important! **A drop in cooling air flow or inadequate protection of the generator can lead to damage and/or malfunction of the windings.**

Dual bearing generators require a rigid frame to support the motor/generator so that a good base is established for a precise alignment. This frame should be anchored to the base with antivibration plugs. In order to minimize twist oscillations, it is advisable to use a suitably sized flexible joint. If a different coupling system is required please contact the **Sincro Technical Office**.

Alignment of single bearing generators is critical because it may give rise to vibrations along the coupling between motor and generator. For this purpose special attention must be given to the alternator to motor assembly, providing a solid base and implementing anti-vibration plugs to support the motor/alternator assembly. The terminal box contains the insulated terminals for connecting the line and neutral and for the earth connection.

The neutral is NOT connected to the housing.

Warning! The generator is supplied without a connection to earth; to make this connection refer to relevant local regulations. An inefficient earth connection or safety cutout can cause injury or death.

Warning! An error in installation, use, maintenance or replacement of parts can cause severe injury or death, not to mention damage to the machinery. All work on electrical and/or mechanical parts must be carried out by a qualified specialist.

DANGER!

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6. INSTALATION

6.1 Lifting

Lift and handle the generator with suitable equipment either on a pallet or by the lifting lugs located on the generator in the positions indicated in the figure.

When lifting the generator use equipment with a load bearing capacity of at least 3000kg.

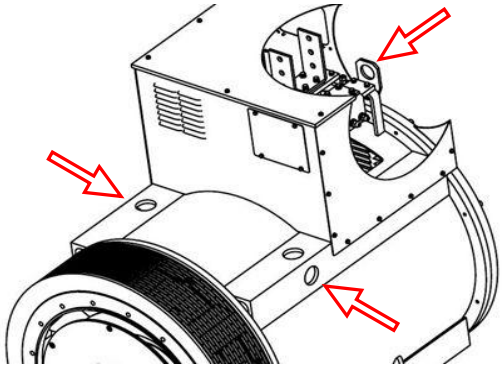
Caution! An insufficient loadbearing capacity can cause severe injury and damage.

Caution! The lifting lugs on the generator have been designed for lifting only the generator and not the whole electricity generating set.

When lifting and handling single bearing generators they must be kept horizontal in order to avoid, if operations should go wrong, the rotor from slipping out and being damaged and possibly causing severe injury.

Caution! **An insufficient loadbearing capacity can cause severe injury and damage.**

The lifting lugs on the generator have been designed for lifting only the generator and not the whole electricity generating set.



6.2 Mounting on motor

6.2.1 Assembly format SAE

Caution! Before assembly, check that the coupling seats (both on generator and motor) are in order and perfectly clean.

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Caution! Before assembly, be sure that the transit bar that holds rotor in position during transport, is removed.

- Remove the transport bar from the generator.
- Remove the protective grille on the bell.
- Make sure the diameter of the disk (3) corresponds with the diameter of the seat of the flywheel (2).
- Anchor the generator to the motor by locking the SAE bell (1), making sure that the holes in disk and flywheel are aligned.
- Check that the disk is in contact with the flywheel. • Lock the disk onto the flywheel.
- Support the assembly on antivibration plugs making sure that motor and generator are level.
- Replace the grille.

6.2.2 Dismantling format SAE

For dismantling follow in reverse the instructions given at section 6.2.1.

Caution! Inadequate protection and/or bad alignment of the generator can cause injury and/or damage to equipment.

Caution! Be sure that the transit bar that holds rotor in position is placed before any transport of the generator.

6.3 Earthing

The generator housing has to be soundly connected to earth on the base of the electricity generating set. If flexible antivibration supports are mounted between the generator housing and its base, an earth conductor should be connected in parallel through the flexible support and be adequately sized (usually half the section of the main line cables).

By the feet on the housing there is an M12 threaded hole to simply earthing of the housing (see figure).

Warning! Make sure the earthing procedure is carried out properly.

6.4 Preliminary Controls

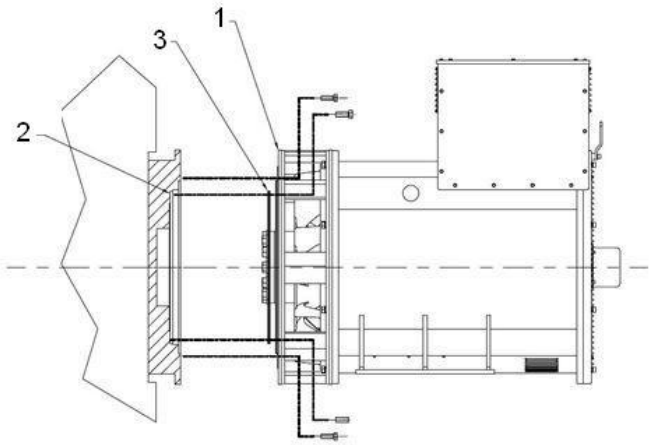
6.4.1 Control of electrical insulation

Before starting up the electricity generating set or after long shutdowns, check the insulation resistance of the windings to earth.

Caution! Unhook the AVR voltage regulator before carrying out this test.

The results must be over 2MOhm. If this is not the case, the alternator alone should be oven dried at 80 - 100°C for 4 hours. Before carrying out this operation remove the voltage regulator.

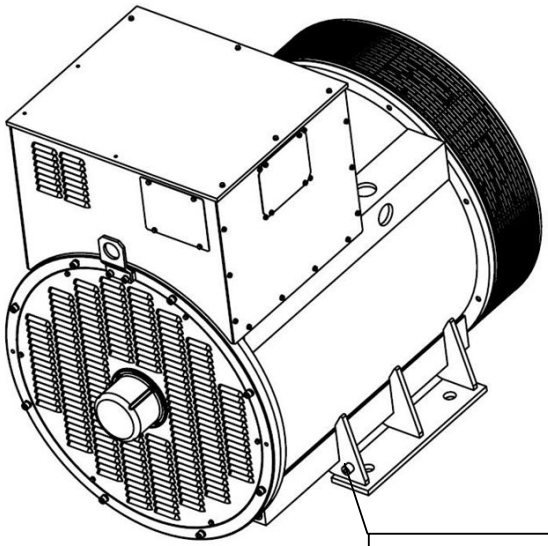
Caution! **Before assembly, be sure that the transit bar that holds rotor in position during transport, is removed.**



DANGER!

Inadequate protection and/or bad alignment of the generator can cause injury and/or damage to equipment.

Be sure that the transit bar that holds rotor in position is placed before any transport of the generator.



Earthing position

WARNING!

Make sure the earthing procedure is carried out properly.

Caution! **Unhook the AVR voltage regulator before carrying out this test.**

Important! **The windings are tested under high tension during production. Additional high tension tests can weaken the insulation thereby reducing the working lifespan. If a high tension test should prove necessary for customer approval, these tests should be carried out at lower voltages.**

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6.4.2 Direction of rotation

Machines with format SAE and format B3 are equipped with one-way fan and can therefore operate in only clockwise direction of rotation. The generator is supplied with clockwise rotation, viewed from the coupling side (unless otherwise specified on order) to produce a U-V-W phase sequence. If rotation has to be reversed after delivery ask the **Sincro Technical Office** for the relevant wiring diagrams.

6.4.3 Control of voltage and frequency

Control that the voltage and frequency levels required by the electricity generating set correspond to the generator data plate.

WARNING!

The generator leaves the production line with a star connection (unless otherwise specified on order) which are used as reference for its nominal data. In the event of any subsequent changes the installer must undertake to mark the new connection used on the machine data plate located inside the terminal box. To change connection consult the diagrams in the appendix of this manual.

All changes in connection must be carried out solely by a qualified specialist.

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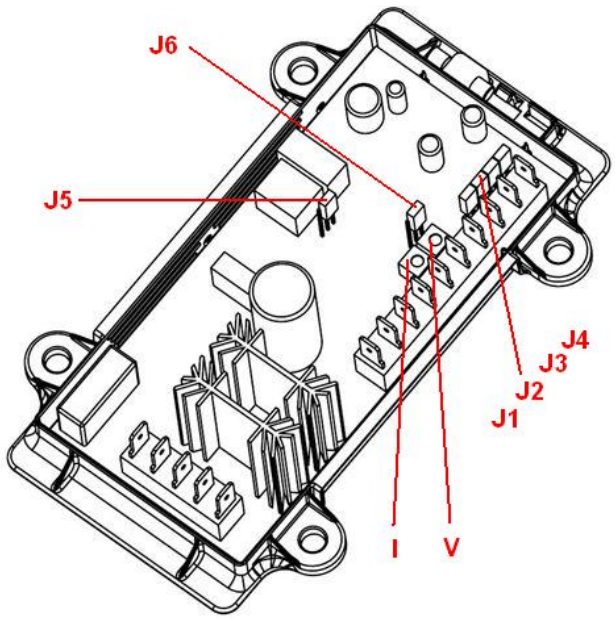
Warning! **All changes in connection must be carried out solely by a qualified specialist.**

6.4.4 AVR board settings

To select the **AVR** settings access the control board after removing the cover. Most adjustments are factory set to ensure satisfactory results in the operating tests on commissioning. Further adjustments may be necessary to ensure optimum operation under specific working conditions.



There are 6 jumpers for configuring the **AVR.** The first (**J1**) identifies the frequency (50 or 60Hz), the 2nd (**J2**), 3rd (**J3**) and the 4th (**J4**) jumpers configuration together with connection of sensing identifies the type and the sensing voltage according to the table on the next page.
The 5th jumper (**J5**) is used for different AVR supply voltage (on all SK400/450 generator series must be always in ***1μ*** position). In case that the external potentiometer is used for voltage adjustment, the 6th jumper (**J6**) should be in "VOLT" position.

The generator that is equipped with this **AVR** is capable to work in **parallel** with another generator. For details refer to the *AVRDBL1 specifications*.

The trimmer "**V**" should be used for generator voltage adjustment. With trimmer "**I**" the current sensitivity for parallel drop operation can be adjusted in case of parallel operation of two generators.

Depend on the generator voltage and frequency, the AVR frequency and sensing jumpers should be configurated according the following table:

AVR SENSING JUMPERS CONFIGURATIONS						
J1	J2	J3	J4	VOLTAGE / FREQ.	PHASES	
▭				50Hz		FREQU-ENCY
••				60Hz		
	▭	▭	▭	400V	3p	THREE PHASE SENSING
	▭	••	••	430V	3p	
	▭	••	▭	230V	3p	
	••	▭	••	115V	3p	
	▭	▭	▭	430V	1p	SINGLE PHASE SENSING
	••	▭	▭	400V	1p	
	▭	••	▭	280V	1p	
	••	••	▭	230V	1p	
	••	▭	••	115V	1p	

Caution: If the voltage is set any higher than its maximum limit the generator may be damaged.

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For an extended adjustments and use of AVR management software for regulator configuration refer to the *AVR management software manuals*.

6.4.5 Wiring diagrams for different circuits

In the appendix of this manual there are diagrams for any connections other than the factory star-series connection (standard unless otherwise specified on order).

6.4.6 Initial start-up

Before starting up the electricity generating set check that all external connections are in order and that the protections are in place. The various generator parameters are factory set before testing: so no further adjustments on the machine should be necessary; in the event that the covers need to be removed for the adjustments and live electrical contacts are left bare, it is important that this operation be carried out solely by qualified specialists in electrical plant maintenance. During the initial start-up pay particular attention for any unusual noises that might signal an incorrect alignment between motor and generator.

Warning! Do not touch the generator while in operation and straight after the generating set has stopped, since certain parts may still be very hot.

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Generators are rotating electrical machines that involve potentially hazardous live or moving parts, therefore the following is strictly prohibited:

- an improper use;
- removal of covers and disconnection of safeties.

The lack of routine check-ups and poor maintenance can cause severe damage to persons and/or objects.

The maintenance and fault diagnostic procedures involve risks that may cause severe injury or even death. These procedures should therefore be carried out solely by qualified electrical and mechanical specialists. Before any maintenance and cleaning work make sure that there are no live parts, that the generator housing has cooled to ambient temperature, that the electricity generating set can not be accidentally started up and that all procedures are strictly observed.

Warning! **The lack of routine check-ups and poor maintenance can cause severe damage to persons and/or objects.**

Due to these inherent hazards, all work of an electrical or mechanical nature must be carried out by qualified specialists.

7. AFTERSALES ASSISTANCE AND MAINTENANCE

Warning! **The maintenance and fault diagnostic procedures involve risks that may cause severe injury or even death. These procedures should therefore be carried out solely by qualified electrical and mechanical specialists. Before any maintenance and cleaning work make sure that there are no live parts that the generator housing has cooled to ambient temperature, that the electricity generating set cannot be accidentally started up and that all procedures are strictly observed.**

7.1 Control and check procedures

7.1.1 Control of windings and electrical insulation

The condition of the windings can be checked by measuring their electrical resistance to earth. While running this test disconnect the voltage regulator. It is usually sufficient to control the main winding.

The readings should give a measurement of at least 2MOhm. If the insulation resistance is below this threshold, the alternator alone should be oven dried at 80 ÷ 100°C for 4 hours. Before carrying out this operation remove the voltage regulator.

7.1.2 Control of rectifier diodes

This check can be performed with multimeter. The lead of each diode has to be removed from the connections with rotor exciter. With this, diodes don't have to be removed from the aluminium plates that carry them. When measuring resistance, the faulty diode will have high (theoretically infinite) resistance in both directions. Meanwhile the good diode will have small resistance in forward direction and high in other (reverse) direction.

7.1.3 Control of the surge suppressor

This element that is connected between two rectifier poles is meant to suppress high voltage peaks on the main rotor winding and save rectifiers diodes from damaging. Normally, if good, this element will have high(infinite) resistance in both directions. When damaged, in most cases it can be noticed by visual inspection.

7.1.4 Control of bearings

The bearings are sealed and maintenance free.

During maintenance control the condition of the bearings and check that no grease has leaked; the lifespan of the bearings depends on the vibrations and axial strains they undergo (vibrations can increase considerably with a bad alignment) and on the working conditions. So check for any unusual signs: vibrations, unusual noises, clogged air vents.
If undue vibrations or noises appear after long-term usage, these could be due to a worn bearing that, if damaged, has to be replaced

The bearing should always be replaced after 20.000 working hours.

Important! A bearings lifespan is closely linked to the working conditions and environment.

Important! Long periods of sustained vibrations can damage the bearing balls and their seat. Too high humidity can emulsify the grease and encourage corrosion.

Important! Intense vibrations caused by the motor or bad alignment of the components in the electricity generating set put the bearing under stresses that will reduce its lifespan.

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7.2 Removal and replacement of components and component assemblies

7.2.1 Removal and re-assembly of PMG

- Remove generator end-shield cover;
- Disconnect the connector of the PMG;
- Unscrew the four screws that hold the PMG stator on generator end-shield;
- Pull the stator out of the rotor (take care due to the strong magnetic force that can attract the stator and cause destruction of the stator windings or even cause operator injury).
- Unscrew the three screws that holds PMG rotor to the main generator shaft.

For reassembling perform PMG repeat the above procedure in reverse. Take care that before assembling the stator PMG, the rotor PMG is cleaned of metal particles.

7.2.2 Extracting and inserting the shaft

The following procedures presume the alternator has been separated from the motor.

Dual bearing version

- Remove the PMG from the non-drive end of the generator following procedure described in 7.2.1.
- Unscrew the 8 M16 screws that fasten the shield to the flange.
- Hammer the shield evenly until it comes away from the rotor.
- Remove the back grille and hammer the back of the rotor, so that the bearing comes free.
- Sustain the rotor with a sling on the coupling side.
- Continue to drive the rotor out of the stator, gradually adapting the sling so that the winding is not damaged.

SAE single bearing version

- Remove the PMG from the non-drive end of the generator following procedure described in 7.2.1.
- Unscrew the 8 M16 screws that fasten the shield to the flange (for the SAE 1 version this is not necessary).
- Remove the end-shield cover and hammer the back of the rotor so that the bearing comes free (take care not to damage the shaft).
- Sustain the rotor with a sling on the coupling side.
- Continue to drive the rotor out of the stator, gradually adapting the sling so that the winding is not damaged.

Insert the shaft following in reverse the instructions at section 7.2.2.

Caution! Before extracting the rotor turn it so that during extraction the rotor rests on the pole shoe while inside the stator.

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7.2.3 Changing the bearing

The bearing can be changed without extracting the rotor:

- Unscrew the 8 screws that fasten the end-shield to the housing.
- Hammer the shield evenly until it comes away from the rotor.
- Remove the snap ring.
- Remove the bearing using a standard extractor.
- Take the new bearing and use a heater to warm it so its diameter dilates before sliding it into position on the shaft.
- Replace the snap ring.
- Position the shield remembering to insert the snap ring and fit the screws leaving them loose.
- Hammer the shield evenly until the bearing and section of housing are in place.
- Tighten the screws on the shield.

7.2.4 Changing rotating diodes

The diode bridge can be changed by merely removing the back shield as described in Changing the Bearing. Proceed as follows:

- Slacken the shield screws so that it can be moved by a few millimeters to give access to the diode bridge between the spokes (if necessary remove the shield completely, being careful not to harm the stator and exciter rotor windings).
- Unhook the diode bridge.
- Unscrew the screws and remove the diode bridge.
- Fit the new diode bridge by locking the screws with adhesive and hook up the terminals.
- Push the shield back in place and fasten it with the screws.

7.2.5 Replacing components and component assemblies

When assembling after changing a part repeat the above operations in reverse.

7.3 Troubleshooting

ELECTRICAL FAULTS		
FAULT	**POSSIBLE REASON**	**CHECK / REMIDY**
NO VOLTAGE	Faulty AVR	• Check the fuse • Replace the AVR
	Faulty permanent magnet generator (PMG)	• Disconnect the PMG from AVR and check the PMG voltage at rated speed (135VAC / 50Hz; 160VAC / 60Hz)
	Faulty rectifier bridge AND/OR surge suppressor	• Check rectifier bridge
	Faulty stator exciter	• Check if the stator exciter circuit is open
	Main winding fault	• Check stator windings resistances • Check stator windings insualtion resistance
	Broken connections	• Check all connections
LOW VOLTAGE	Reference voltage is not seted at desired value	• Adjust voltage with potentiometer «V» on the AVR;
	Under-frequency protecton not properly adjusetd	• Check / adjust, with AVR menagment software, the value of under-frequency protection (47Hz for 50Hz nominal frequency)
	Engine speed low	• Check the engine speed(voltage frequency)
	Faulty AVR	• Replace the AVR
HIGH VOLTAGE	Reference voltage is not seted at desired value	• Adjust voltage with potentiometer «V» on the AVR
	Sesensing supply open circuit	• Check the sensing connections
	Faulty AVR	• Replace the AVR
VOLTAGE OSCILATIONS	AVR stability incorectly setted	• Adjust stability with AVR menagment software (for details refer to the AVR managment software manuals)
	Engine speed unstable	• Check with the frequencymeter if there are oscilations in engine speed
	Faulty AVR	• Replace the AVR

Any kind of cleaning work must be carried out with the generating set shutdown and the mains power shut off for the risk of severe hazard for persons and objects.

Never and for no reason whatsoever use fluids or water. Do not use compressed air to clean internal electrical parts since this could cause short circuits or related problems.

Only use authorized specialists.

8. CLEANING AND LUBRICATION

Warning! **Any kind of cleaning work must be carried out with the generating set shutdown and the mains power shut off for the risk of severe hazard for persons and objects.**

Make sure that the electricity generating set is shutdown and the mains power is shut off before cleaning the outside of the generating set with compressed air.

Warning! **Never and for no reason whatsoever use fluids or water. Do not use compressed air to clean internal electrical parts since this could cause short circuits or related problems.**

9. DISMANTLING AND DISPOSAL

Warning! **Only use authorized specialists.**

All material should be eliminated in compliance with statutory regulations. The generator does not present any particular risks or hazards during dismantling. To aid recovery of the material, it is best to classify it by type (i.e. electrical parts, copper, aluminium, plastic, etc.).

10. SPARE PARTS AND AFTERSALES

10.1 Aftersales procedure and contact addresses

Our Aftersales Service provides a comprehensive technical advice service. When requesting assistance under warranty make sure that the generator identification data is on hand including its serial number and production lot as shown on the adhesive label whose position is given in section 3.2 of this manual. The list of authorized aftersales assistance centers can be found on our homepage: **http://www.sogaenergyteam.com/**

11. WARRANTY

Sincro S.r.l. guarantees the own alternators for a period of 12 months starting from the invoice date. We confirm that warranty is directed only to **Sincro** customers to which we respond. **Sincro** does not grant warranty to those who have not directly purchased the product from the factory, in spite of the possession of it.
Within the above mentioned terms, **Sincro** commits itself to supply free of charge those spare parts that, according to its judgment or to the one of an authorized representative, appear with manufacturing or material defects or, always to its judgment, to directly or through an authorized center carry out the repairing without undertaking transport costs.
We anyhow exclude forms of responsibility or obligation for other costs, damages and direct or indirect loss caused by total or partial usage or impossible usage of the products.
The repairing or the substitution will not extend or renew the warranty duration.
Warranty will not be granted: whenever break-downs or problems may appear because of lack of experience, usage over the nominal performances, if the product had been modified or should return incomplete, disassembled or with modified nameplate data.

11.1 Procedure

Whenever any Sincro machine malfunctions, the client is invited to contact our “Assistance Service” by calling ++39 0445 450500. If the decision is made to return the product, we will provide you with an **“Authorized Material Return” (RMA)** number that must be included both in the delivery document that accompany material. Products that have been returned without following the procedure above will be returned to sender.
In order to obtain coverage under warranty, **Sincro** must be contacted exclusively by its authorized dealer. Requests for repairs received directly from final user clients will be considered outside the terms of warranty coverage. Prior to performing repair, an estimation will be provided and authorization must be received from the authorized dealer before proceeding with the repair.

11.2 Shipment

All products to be repaired are shipped at the risk and expense of the client regardless of whether warranty coverage will be claimed or not. The client must make sure that the machines sent for repair are in good order, clean, and that the oil in the overgear system has been drained. We recommend returning the products in adequate packaging that ensures protection against impact.

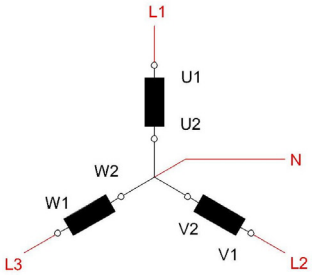
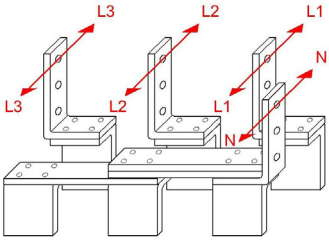
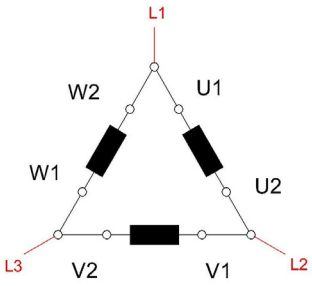
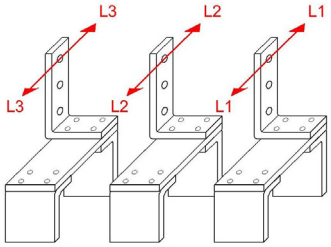
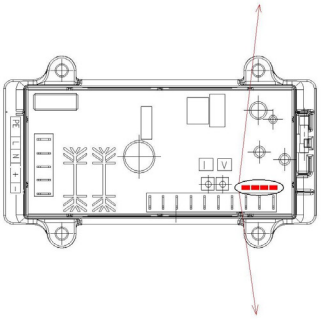
12. APENDIX

12.1 Generator resistances

SK400 / 450 THREE PHASE	MODEL		RESISTANCES* AT 20ºC				
			STATOR 400V - 50Hz PHASE	ROTOR	STATOR EXCITER	ROTOR EXCITER LINE	PMG
			mOhm	Ohm	Ohm	Ohm	Ohm
	SK400	SX	4,82	2,05	14,1	0,16	3,5
		SS	3,86	2,21	14,1	0,16	3,5
		SM	3,49	2,28	14,1	0,16	3,5
		MS	2,85	2,46	17,0	0,25	3,5
		MM	2,00	2,84	17,0	0,25	3,5
	SK450	SS	1,52	3,19	17,0	0,25	3,5
		SM	1,30	3,43	17,0	0,25	3,5

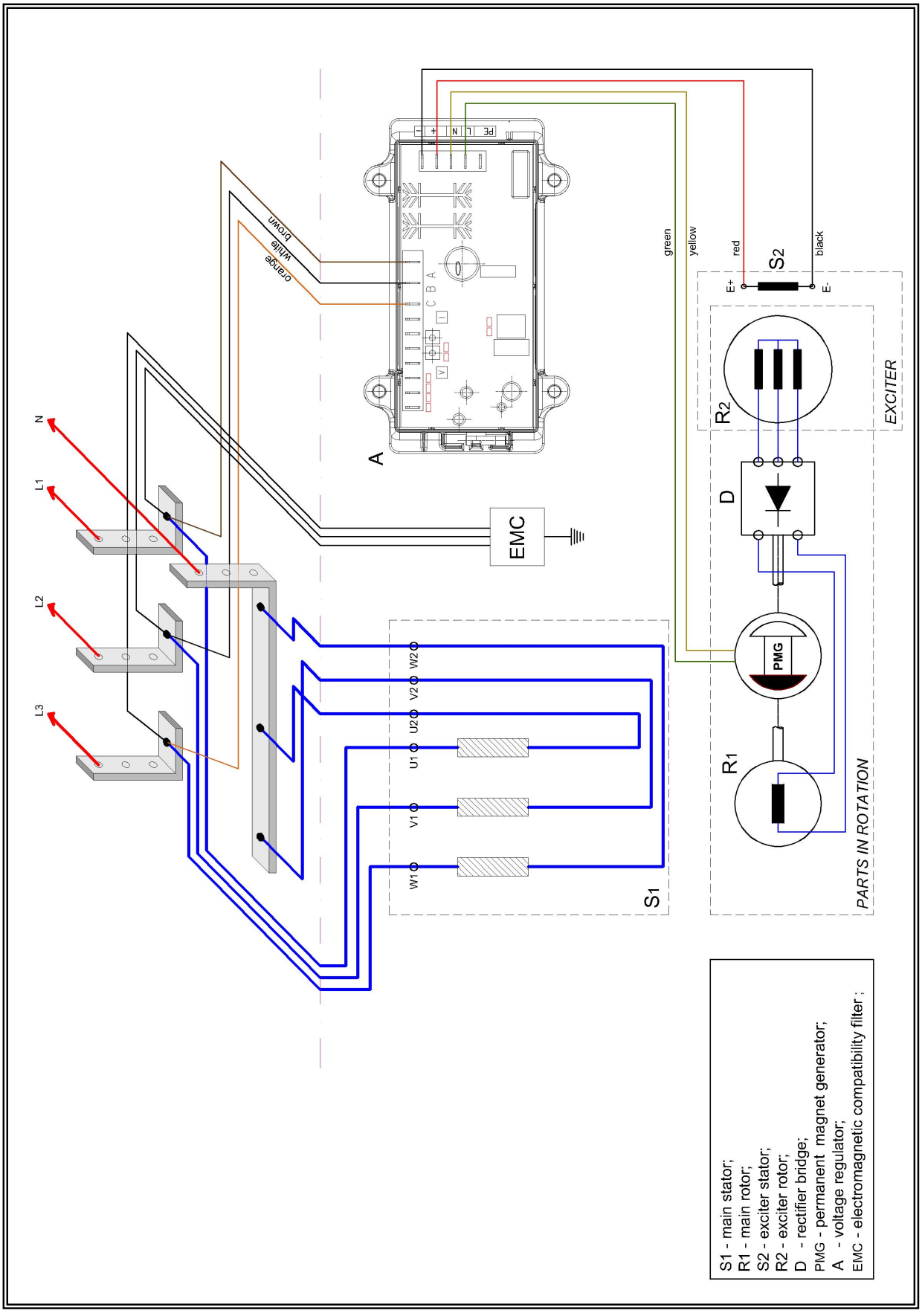
* - please contact the Sincro Techical Office in case of generators with non-standard winding.

12.2 Generator connection diagram

<table>
<tr><th></th><th>CONNECTION TYPE</th><th>TERMINALS CONFIGURATION</th><th colspan="2">AVR CONFIGURATION</th></tr>
<tr><th></th><th></th><th></th><th>VOLTAGE / FREQUENCY</th><th>JUMPERS CONFIGURATION</th></tr>
<tr><td>STAR</td><td> 
</td><td> 
</td><td>400V / 50Hz</td><td>  </td></tr>
<tr><td rowspan="3">DELTA</td><td rowspan="3"> 
</td><td rowspan="3"> 
</td><td>480V / 60Hz</td><td>  </td></tr>
<tr><td colspan="2">AVR DBL1
  </td></tr>
<tr><td>230V / 50Hz</td><td>  </td></tr>
<tr><td></td><td>277V / 60Hz</td><td>  </td></tr>
</table>

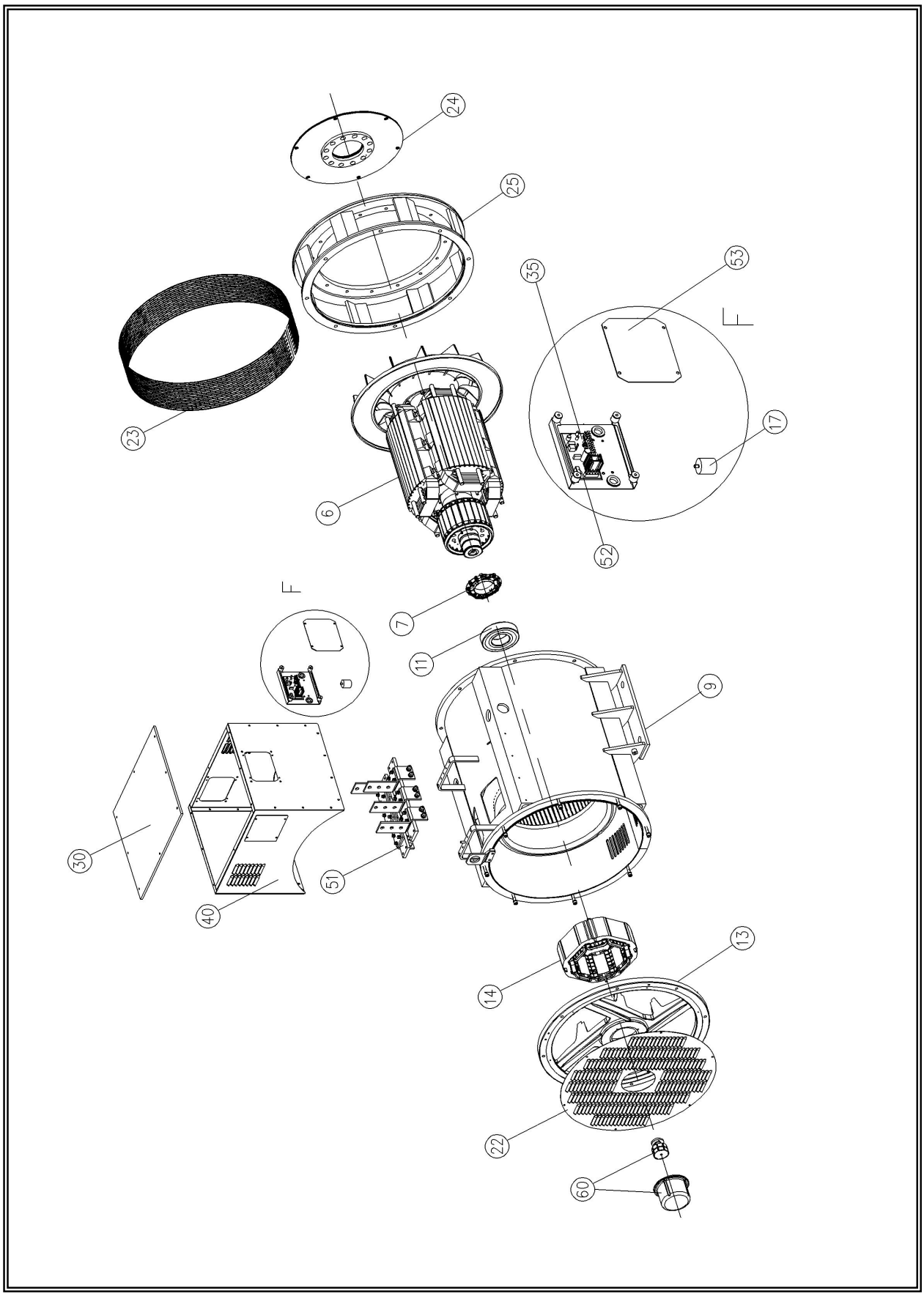
* - please contact the Sincro Techical Office for other types of connections in in case of generators with 12 leads.

12.3 Generator wiring diagram



* - please contact the Sincro Techical Office for wiring diagrams in case of the generators with 12 leads

12.4 Generator exploded view



Parti di ricambio - Spare parts list - Ersatzteilliste - Pieces detachees - Piezas de recambio - SK400/450

Pos.	Descrizione	Description	Beschreibung	Description	Descripción	Code:
6	Rotore SK400/450 avvolto (1)	Wound rotor SK400/450 (1)	Rotor SK400/450 gewickelt (1)	Rotor SK400/450 bobiné (1)	Rotor SK400/450 bobinado (1)	* Rotor
7	Ponte diodi rotore eccitatrice	Exciter rotor rectifier	Diodenbrücke Erreger-Rotor	Pont á diodes rotor excitatrice	Puente diodes del rotor excitatriz	Z53892
9	Statore + cassa	Stator + housing	Stator + Gehäuse	Stator SK400/450 + boîtier	Estator SK400/450 + caja	" Stator
11	Cuscinetto 6318-2RS1/C3	Bearing 6318-2RS1/C3	Lager 6318-2RS1/C3	Roulement 6318-2RS1/C3	Cojinete 6318-2RS1/C3	Z75256
13	Scudo posteriore	Rear shield	Hinterer Schild	Bouclier arrière	Escudo posterior	Z56088
14*	Statore eccitatrice SK400	Stator exciter SK400	Erreger-Stator SK400	Stator excitatrice SK400	Estator excitatriz SK400	' St.exc.
17	Filtro EMC	EMC filter	EMC filter	EMC filtre	EMC filtro	Z56535
22	Griglia posteriore	Rear shield cover	Hinteres Gitter	Grille arrière	Rejilla posterior	Z57635
23*	Griglia campana SAE IP20	Front SAE flange cover - IP20	Gitter Glocke SAE IP20	Grille carter SAE IP20	Rejilla campana SAE IP20	Z59125
	Griglia campana SAE IP23	Front SAE flange cover - IP23	Gitter Glocke SAE IP23	Grille carter SAE IP23	Rejilla campana SAE IP23	Z59149
24*	Disco SAE	SAE discs	Scheibe SAE	Disque SAE	Disco SAE	" Discs
25*	Flangia campana SAE	SAE flange	Flansch Glocke SAE	Bride carter SAE	Brida campana SAE	$ Flange
30	Coperchio	Terminal box cover	Deckel	Couvercle	Tapa	Z56148A
35	Scheda elettronica AVRDBL1	AVR - voltage regulator	Elektronische Karte AVRDBL1	Carte èlectronique AVRDBL1	Tarjeta electrónica AVRDBL1	300802301
40	Scatola terminali nera	Terminal box	Schwarz Verbindern Schachtel	Boîte connecteurs	Caja conectores	§ Scatola
51	Morsettiera	Terminal board	Klemmenbrett	Borne	Caja de bornes	Z56289
52	Fusibile 20x5 - 4A - F	Fuse 20x5 - 4A - F	Sicherung 20x5 - 4A - F	Fusible 20x5 - 4A - F	Fusible 20x5 - 4A - F	30430104
53	Coperchio regulatore	AVR cover	Deckel auf der Reglerseite	Couvercle côté régulateur	Tapa lado regulador	S51997
60	PMG	PMG	PMG	PMG	PMG	Z58340

Statore eccitatrice Stator exciter Erreger-Stator Stator excitatrice Estator excitatriz	' St.exc.
SK400 SX-4	Z59126
SK400 SS-4	
SK400 SM-4	
SK400 MS-4	Z59127
SK400 MM-4	
SK450 SS-4	
SK450 SM-4	

Disco SAE Disk SAE Scheibe SAE Disque SAE Disco SAE	" Discs (with the screws)
14"	Z59190
18"	Z59195
21"	Z59196

Flangia Flange Flansch Bride Brida	$ Flange
SAE 1	Z59180
SAE 0,5	Z56696
SAE 0	Z58286
SAE 00	Z58287

Scatola terminali Terminal box Verbindern Schachtel Boîte connecteurs Caja conectores	§ Scatola
Front side	Z56150A
Back side	Z56149A
Left side	Z56151A
Right side	Z56152A

Tipo Type Typ Type Tipo	* Rotor	" Stator
SK400 SX-4	Z58996	Z58990
SK400 SS-4	Z59016	Z59010
SK400 SM-4	Z59036	Z59030
SK400 MS-4	Z59056	Z59050
SK400 MM-4	Z59076	Z59070
SK450 SS-4	Z59096	Z59090
SK450 SM-4	Z59116	Z59110

(*) - Includere nella richiesta di pezzi di ricambio la descrizione dell+oggetto, il codice, il numero di matricola e le caratteristiche della macchina (rilevabili dalla targhetta).
(*) - When ordering spare parts, please indicate the alternator code-number and machine serial number and characteristics (they are available on the label).
(*) - In den Ersatzteilanfrage sind die Gegenstandbeschreibung, die Materialnummer, die Kennummer und die Eigenschaften der Maschine (vom Schild zu entnehmen) anzugeben.
(*) - Nous vous prions d'indiquer, dans vos commandes de pièces de rechange, la description de la pièce, le numéro de code et de série et les caractéristiques de la machine.
(*) - Solicitar las piezas de recambio siempre indicando la descripción del objeto, el código, el número de matricula y las caracteristicas de la máquina (descritas en la placa de identificación.

(1) - Comprende i particolari 7+11.
(1) - 7+11 item is included.
(1) - Teils 7+11 inbegriffen.
(1) - Comprend les pièce 7+11.
(1) - Incluye el particular 7+11.

12.6 Conformity certificate

La società	The company	Die Firma	La sociètè	La sociedad

SINCRO S.r.l.
Via Tezze, 3 – Loc. Cereda – 36073 Cornedo Vicentino (VI) - Italy

dichiara sotto la propria responsabilità che i generatori:	declares under its own resposibility that the generators:	erklärt unter der eigenen Verantwortung, daß der Bau und die Abnahme der Generatoren:	déclare sous sa propre responsabilité que les generateurs:	Declara bajo la propia responsabilidad que los generatores:

Serie **SK400/450 –** Series **SK400/450 –** Baureihe **SK400/450 –** Série **SK400/450 –** Serie **SK400/450**

sono costruiti e collaudati in accordo alle norme di seguito indicate:	Have been manufactured and tested in compliance with the following standards:	den nachstehenden Vorschriften entspricht:	sont construits et testés dans le respect des normes indiquées ciaprés:	han sido fabricados y probados siguiendo la normativa que se detalla a continuación:

CEI EN 60034-1 (IEC 60034-1)

e risultano conformi:	and thereby conform to:	darüberhinaus erfüllen sie:	et sont conformes:	y cumplen:
1) ai requisiti generali di sicurezza stabiliti dalla **Direttiva Bassa Tensione** de 19 Febrario 1973 (73/23 CEE), recepita in Italia con la legge nº 791 del 18 Ottobre 1977.	1) all General Safety Requirements as provided by the **EEC Low voltage Directive** dated 19 February 1973 (73/23 EEC).	1) die allgemeinen Sicherheits anforderungen der **Richtlinie fur Niderspannung** vom 19 Februar 1973 (73/23 CEE), in Italien mit dem Gesetz Nr.791 vom 18 Oktober 1977 aufgenommen.	1) Aux conditions générales de sécurité établies par la **Directive relative à la basse tension** du 19 Février 1973 (73/23 CEE), adoptée par l'Italie par promulagation de la loi nº791 du 18 Octobre 1977.	1) las prescripciones que sobre seguridad quedan definidas en la **Norma sobre la Baja Tension** del 19 de Febrero del 1973 (73/23 CEE), introducida en Italia con la ley n°791 del 18 Octubre del 1977.
2) alla **Direttiva 89/336 CEE** (mod. dalla 93/68 CEE), riguardante il ravvicinamento delle legislazioni degli Stati membri in materia di compatibiltà elettromagnetica. La verifica di compatibilità è stata condotta in base alle seguenti norme:	2) all principal safety requirements specified by the Committee for Adapting Member States Legal Regulation on Electromagnetic Compatibility (89/336 EEC, 93/68 EEC). The following standards were used to evaluate the electromagnetic compability:	2) die **Richlinie 89/336 CEE** (Mod. der 93/68 CEE) bezüglich der Annäherung der Gesetzgebungen der Mitgliedsstaaten in Sachen elektromagnetischer Kompatibilität. Die Kompatibilitätsprüfung wurde mit Zugrundelgung folgender Normen ausgeführt:	2) A la **Directive 89/336 CEE** (et modifications suivantes 93/68 CEE) concernant l'harmonisation des législations des états membres en matiére de compatibilité électromagnétique: La vérification de compatibilté a été effectuée conformément aux normes suivantes:	2) la Norma 89/336 CEE (y sucesiva modificación 93/68 CEE) sobre la compatibilidad electromagnética. La prueba de compatibildad se ha realizado en base a las siguientes normas:

EN 61000-6-2
EN 61000-6-3

I generatori oggetto della presente dichiarazione sono da interdersi come componenti; pertanto vige il divieto di messa in servizio prima che le macchine in cui saranno incorporati siano dichiarate conformi alle direttive riguardanti la sicureza (98/37/CE) e la compatibilità elettromagnetica.	The generators covered by this certificate must be considered as components and therefore prohibited from being placed in operation before the machine in which they will be used has been certificated for conformity to safety directives (98/37/CE) and for electromagnetic compatibility.	Die Generatoren, Gegenstand dieser Erklärung, sind als Komponenten zu verstehen; daher irst ihre Inbetriebnahme verboten, bevor nicht die Maschinen, in die sie integriert werden, mit den Richtlinien bezüglich Sicherheit (98/37/CE) und elektrischer Kompatibilität für konform erklärt werden.	Les generateurs objets de la présente déclaration doivent être considérés comme étant des composants. En conséquence, la mise en service de ces derniers est interdite, avant la mise en conformité des machines auxquelles ils seront incorporés. Les dites machines devront être déclarées conformes aux directives regardant la sécurité (98/37/CE) et la compatibilité électromagnétique.	Los generatores objeto de la presente declaración han de entenderse como componentes; por lo tanto se prohibe su puesta en servicio antes de que las máquinas a las cuales se acopláran no se declaren conformes a las normas sobre seguridad (98/37/CE) y sobre compatibilidad electromagnética.

Sincro s.r.l.
L'Amministratore Delegato
The Managing Director
Delegierter des Verwaltungsrats
L'administrateur délégué
El Adminstrador Delegado

Flavio Pistollato

Cereda di Cornedo,
li 11/09/2008

soga energyteam

Sincro srl reserves the right to change the data in order to update or improve its products without prior notice

SINCRO srl

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