Operating and Maintenance Manual

KOEL GREEN

KOEL Green Brushless AC Generators
Reliable | Efficient | Compact

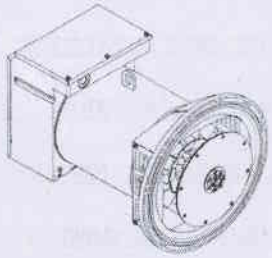
Contents Page No.

1.0 GENERAL

This manual covers in detail, most of the aspects of KOEL Green Brushless AC Generators for standard Voltage of operation i.e., 415V Three Phase, 240V single Phase as mentioned in the operating parameters as per part given in 3.1. The details included help the personnel concerned for proper installation, commissioning and maintenance of KG AC generators. The sectional views included in this manual illustrate the mechanical design of AC Generator and its components for better understanding of the product.

1.1 MACHINE DESCRIPTION

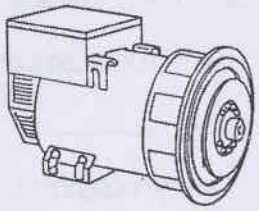
The alternators are brushless, self-regulating and incorporate a rotating inductor with damper cage winding and a fixed stator with skewed slots.



The stator windings have a shortened pitch to reduce the harmonic content of the output waveform.

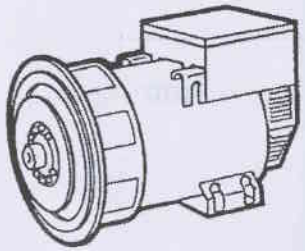
The alternators are made in compliance with the 2006/42, 2006/95, 2004/108 CEE directives and their amendments, and the CEI 2-3, EN 60034-1, IEC 34- 1, VDE 0530, BS4999-5000.

Tests to verify the electromagnetic compatibility have been carried out in the foreseen conditions by the standards with the neutral connected to the earth.



On customer's request alternators can be manufactured according to different specifications.

The robust mechanical construction gives good access to the generator output connections, and allows the user to inspect the various components with ease.



The casing is made of steel, the shields of cast iron, and the shaft of C45 steel and it has a keyed fan.

The mechanical protection level meets standard IP23 (upon request higher levels of protection can be supplied).

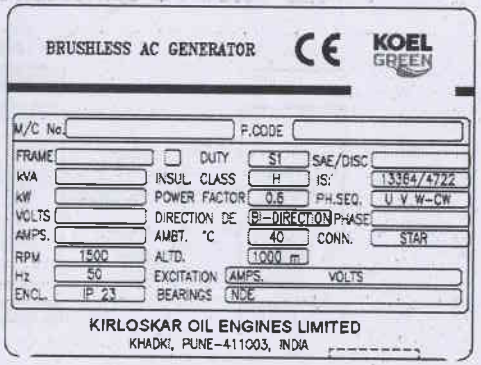
Insulation materials meet Class H requirements, and all rotating components are epoxy resins impregnated; higher voltage parts, such as the stators, are Dip Impregnated (special treatments are available on request).

The alternators comply with the EEC 2006/42, 2006/95, 2004/108 directives and their amendments; therefore they pose no danger to the operator if they are installed, used and maintained according to the instructions given by Manufacturer and provided the safety devices are kept in perfect working conditions.

Therefore a strict observance of these instructions is required.

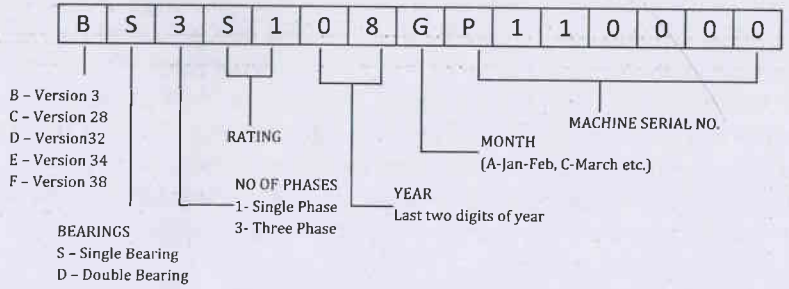
1.2 MACHINE IDENTIFICATION

Always indicate the generator type and code when contacting Manufacturer or the authorized after sales service centers



It is extremely important to properly identify the machines when requesting parts or service. Always have the Generator model number and serial number when requesting information from factory. We will be able to help you only with this information.
For example Machine No: BS3S108GP110000

Alternator Sr. No. Nomenclature for AC Generator Rating 5 kVA to 650 kVA.

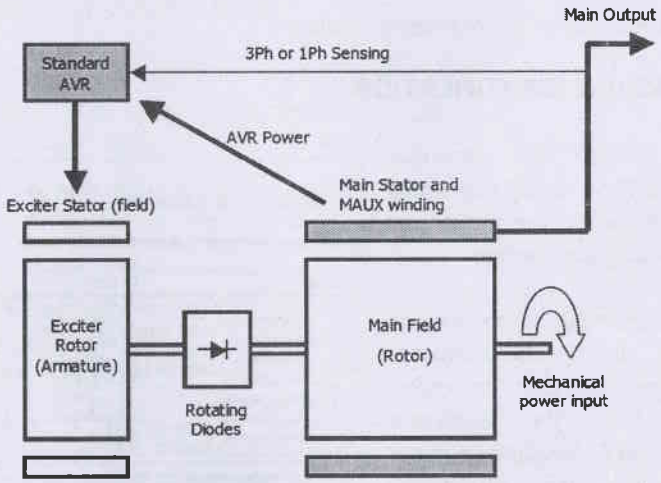


1.3 INSPECTION ON DELIVERY

When the alternator is delivered, check that unit conforms with the delivery note and ensure that there are no damaged or defective parts; should there be any, please inform the forwarding agent, the insurance company, the seller or Manufacturer immediately.

2.0 PRINCIPLE OF OPERATION:

STANDARD BRUSHLESS AC GENERATOR



SCHEMATIC DIAGRAM

1. Here the excitation Power is derived from main output winding. Referring to schematic diagram, initiallythe machine builds up voltage with the help of residual magnetism.
2. The Automatic Voltage regulator (AVR) will sense this low voltage and compare it with the 'set reference' voltage level and provide such power as is available from Main stator winding in order to establish the exciter field.
3. The Power from the main output winding is rectified in the AVR and added to residual voltage level of exciter to produce a greater magnetic field strength. This in turn increases output voltage from the exciter Rotor.
4. The output from the exciter Rotor is rectified by the rotating diodes which adds to the field strength and increases the output voltage from the main stator.

5. The AVR senses this increase, compares it with the 'set reference 'and uses the increased power from the Main Stator to further increase the exciter field excitation as required.

In this way the main stator voltage is progressively built up until the 'sensed' Voltage is the same as the 'set reference' voltage.

The fault current support requirement is met by using an auxiliary winding in Three Phase AC Generators to provide positive power to the automatic voltage regulator (AVR). The auxiliary winding is a separate single phase winding which is inserted into the main stator alongside of the main output winding. By design, the mutual inductance with the main winding is minimized. The auxiliary winding picks up the third harmonic to power the AVR. Because of this and in conjunction with smart regulator design, waveform distortions in the main winding due to non-linear loads will not affect AVR performance.

Advantages of the MAUX system compared to the standard PMG:

- The auxiliary winding is built into all Three Phase generators. The MAUX system provides in excess of 300% fault current on all models for up to 20 seconds. This is twice the amount of time that most PMG systems will provide short circuit maintenance.
- The auxiliary winding does not add length or weight to the generator thus providing for a compact design.
- Just like with a PMG, motor starting capability is significantly enhanced as the AVR has a positive power supply. After the initial transient response, the system voltage recovers extremely quickly allowing for electric motors to come up to speed much faster. The generator can tolerate higher voltage dips at the stator output while still being able to supply very high currents.
- SingleAVR is needed to power our entire line of industrial products. Most PMG systems require a different AVR than their standard non-PMG systems use.
- If for any reason the auxiliary winding should fail, the AVR can be reconnected to take power from the main generator output leads. You lose the fault current support and increased motor start capability, but you do not lose the generator function. In many PMG systems, should the PMG fail you will not be able to power the AVR from the main stator output and thus the system goes down until repair personnel can visit the site to fix the problem.
- Changing the rotating diodes is easy with the MAUX system as there is no PMG to interfere with servicing.

3.0 OPERATING PARAMETERS:

3.1 VOLTAGE

Generators suitable for following voltages are manufactured depending on the customer requirement

50 Hz – 3ph – 415, 400 & 380 Volts, 1ph – 240, 230 & 220 Volts
60 Hz – 3ph – 480, 460 & 440 Volts, 1ph – 277,265 & 254 Volts.

3.2 FREQUENCY

Generators are suitable for 50 Hz/60 Hz i.e. 1500 rpm/1800 rpm.

3.3 POWER FACTOR

Standard machines are designed suitable for 0.8pf (lag) for lower power factor refer to manufacturer. For higher power factors from 0.8pf (lag) to 1 (UPF) please check for engine capabilities while loading.

3.4 ENVIRONMENT

Generators are suitable for 40°C ambient temperature and altitudes upto 1000 meters above sea level. For operations beyond this limitation please refer to manufacturer.

3.5 MOTOR STARTING CAPACITY

Suitable for motor starting current upto 3 times of the AC generator rated current.

3.6 OVERLOAD

The AC Generators are designed to withstand 10% overload for one hour in every 6 hours of rated load operations and 50% over load for 30 seconds as specified in relevant standards.

3.7 SHORT CIRCUIT

AC Generators are designed to withstand the short circuit current of three times the rated current for 20 seconds. The exciter is liberally designed to cater to the excitation requirement under such conditions.

3.8 MECHANICAL FEATURES

- Degree of protection IP 23, cooling IC 01.
- B 15 mounting with SAE-3, SAE-2, SAE-1, SAE-0 single bearing type, B3 for double bearing type.
- Suitable for bi-directional rotation.

- Top mounted terminal box with a provision for customer cable termination on both sides.
- Plastic/Aluminium fan for reliable and efficient cooling.
- Dynamically balanced rotor to minimize vibration.
- Long-life sealed lubricated/ externally lubricated bearings.
- Over speed @ 1.2 times rated rpm for 2 minutes.
- Rotor with damper winding for stability.

3.9 INSULATION

- Stator and rotor windings are with class 'H' insulation and class 'H' temperature rise i.e. 125°C by resistance method over an ambient 40°C with optimum designed body temperature can reach upto 90°C .
- Grey Varnish coat on Overhangs allows relative humidity up to 95%.

3.10 HARMONICS

- THD less than 3% @ no load.
- 2/3 chording to reduce harmonics.

3.11 OUTPUT TERMINALS

- 4 leads for 3 phase or 2 leads for 1 Phase dedicated Alternators are brought to terminals.
- Twelve lead reconnectable facility – optional.

3.12 OPTIONAL ACCESSORIES

- Space heaters (anti condensation heaters) and RTD type Winding Temp. Detectors (WTD),
- Bearing Temp. Detector (BTD) on 180 kVA and above.
- Coat of Black Flexible compound on overhangs.
- CT for parallel operation, for400 kVA and above standard.
- PMG for 180 kVA and above for lower rating refer to manufacturer.
- Metering CT's.

3.13 VOLTAGE REGULATION

The steady state voltage accuracy will be ± 1% at 0.8 to unity p.f. from no load to full load and this is independent of the temperature, voltage, load and power factor within the limits specified. The voltage regulator will keep the generator voltage constant without undue overheating of its component and under consideration of speed drop to the extent of 4% of rated speed. The response time of regulation is less than 75 milliseconds.

4.0 SAFETY REQUIREMENTS

Before any cleaning, lubrication or maintenance operation, ensure that the generator is stationary and disconnected from the power supply.

When stopping the generator, ensure the compliance with the procedures for stopping the prime mover.

The generator, in fact, has no Emergency Stop, but is controlled by the device arranged by the installer.

In consulting this use and maintenance manual, you will find several symbols, which have a specific meaning, as illustrated below.

IMPORTANT

This symbol warns the personnel concerned that the described operation may cause damages to the machine if it is not carried out according to the safety standards.

CAUTION

This symbol warns the personnel concerned that the described operation may cause damages to the machine and/or injures to the personnel if it is not carried out according to the safety standards.

WARNING

This symbol warns the personnel concerned that the described operation may cause serious injuries or death to the personnel if it is not carried out according to the safety standards.

DANGER

This symbol warns the personnel concerned that the described operation may immediately cause serious injuries or death to the personnel if it is not carried out according to the safety standards.

HANDLER

This symbol identifies the type of operator in charge of the Operation described. This qualification requires a complete knowledge and understanding of the information contained in the manufacturer's instruction manual as well as specific skills about the hoisting means, slinging methods and features and safe handling procedures.

MECHANICAL SERVICE MAN

This symbol identifies the type of operator in charge of the operation described.

This qualification requires a complete knowledge and understanding of the information contained in the manufacturer's instruction manual as well as specific skills necessary to perform installation, adjustment, maintenance, cleaning and/or repair operations.

ELECTRICAL SERVICE MAN

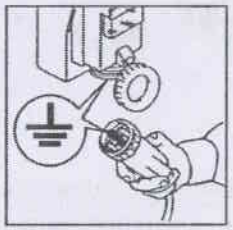
This symbol identifies the type of operator in charge of the operation described.

This qualification requires a complete knowledge and understanding of the

information contained in the manufacturer's instruction manual as well as specific skills necessary to perform electrical operations such as connections, adjustment, maintenance and/or repair.

The electrical service man must be able to work even in case electrical cabinets and panels are live.

In case of exceptional operations and upon written request of servicing operations please apply to Manufacturer authorized centers.

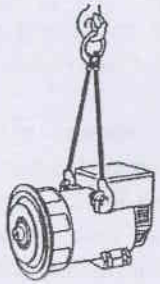


Before installing the generator, arrangements must be made to earth the machine.

This is the reason why you must make sure that the grounding system is in good conditions and in compliance with the regulations of the country where the generator will be installed.

CAUTION

THE FINAL INSTALLER IS RESPONSIBLE FOR THE INSTALLATION OF ALL THE PROTECTIONS (SECTIONING DEVICES, PROTECTIONS AGAINST DIRECT AND INDIRECT CONTACTS, OVERCURRENT AND OVERVOLTAGE PROTECTIONS, EMERGENCY STOP, ETC.) NECESSARY FOR THE MACHINE TO COMPLY WITH THE EXISTINGINTERNATIONAL/ EUROPEAN SAFETY REGULATIONS.

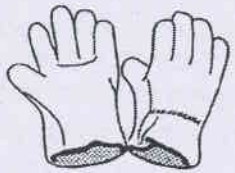


For handling the unpacked generators, always use the special eyebolts only; use ropes having a suitable carrying capacity and do not lift the generator too much from the floor (max 30 cm.).

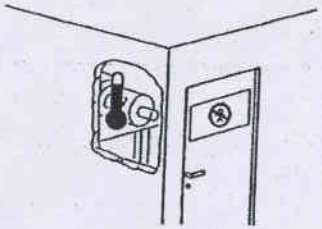
When the machine is worn cut, contact the companies in charge of the disposal of ferrous material and do not throw away its parts into the environment.

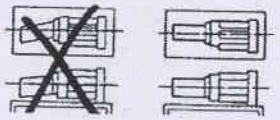
The operators in charge of the installation, operation and maintenance of the generators must be skilled technicians who know the characteristics of the generators.

The people in charge of the handling must always wear work gloves and safety shoes. In case the generator or the whole plant must be lifted from the floor, the operators must wear a safety helmet.



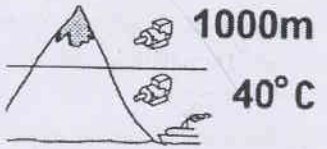
The generator must be installed in an airy room. If there is not enough air, a malfunction or an overheating may occur. All entry doors into generator room should be clearly marked "Authorized persons only". Make sure that Genset foundations and base frame are suitable to bear the combined weight of the alternators and prime mover.





The installer is responsible for the correct coupling of the generator to the engine and for the performance of all precautions necessary to guarantee the correct operation of the generator and avoid abnormal stress, which could damage the generator (such as vibrations, misalignment, strange noises or vibrations, etc.)

The machine was designed to guarantee the nominal power in environments with a maximum temperature of 40° C, at altitudes lower than 1000 m asl (EN60034-1),

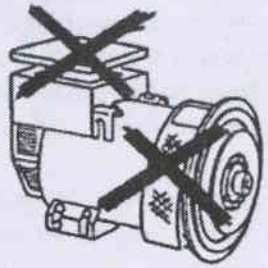


Unless otherwise specified; for different operating conditions, see the commercial catalogue (brochure).

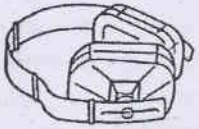
No person must wear fluttering clothes (such as scarves, etc.) near the machine and any garment must be fastened with elastic bands at its ends.

The generators must never and for no reason run with following guards removed:

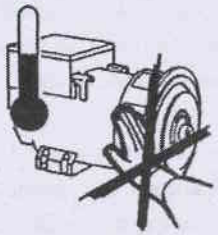
- Terminals cover
- Front covers
- Fan guards.



During assembling and disassembling operations, hold carefully both ends of the protection grid as the related material elasticity can be harmful.



The generators are noisy even if the sound level is certainly lower than that of the prime motor, they must be installed in soundproof rooms (room, engine room, etc.) where it is necessary to wear anti-noise protectors.



Even if all the machine components are protected, keep away from the machine. Do not lean or sit on the generator for whatever reason.

Do not remove the labels for whatever reason; on the contrary, if necessary, replace them.

DANGER OF SHORT CIRCUIT

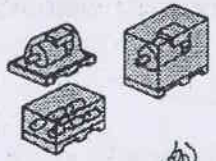
The degree of protection of the generator is IP23; therefore it is made prohibition to use whichever type of hydro cleaner and to spray liquids over the parts containing electrical components.

In case of replacement of spare parts, use original spare parts only.

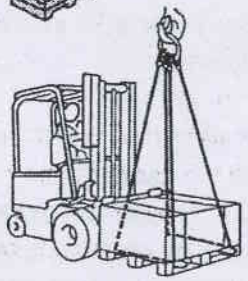
For the replacement of worn parts, carefully follow the maintenance instructions; these operations must be carried out by skilled technicians.

5.0 TRANSPORT AND STORAGE

Alternators will be packed for shipment in a manner suitable to their mode of transport and final destination.



Prior to handling goods, please ensure that lifting equipment is of sufficient capacity. Under lifting conditions machinery should be elevated to a minimal distance from the ground.

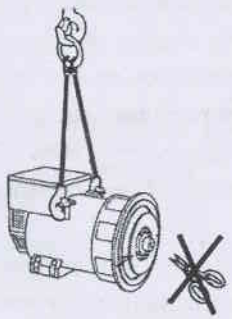


When lifting or moving goods by forklift apparatus, care should be taken to ensure that forks are correctly positioned to prevent slipping or falling of pallet or crate.

Both packed and unpacked alternators shall be stored in a cool and dry room, and shall never be exposed to the inclemency of the weather.

With regard to single bearing alternators (form MD35) please ensure that the rotor fixing clamps is in place. Failure to do so may lead to slippage or assembly.

When installing the alternators, always lift them by using their eyebolts

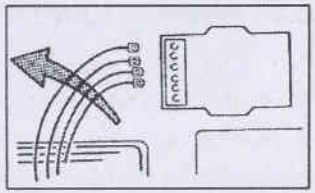


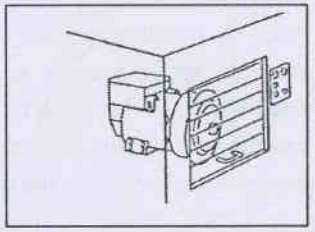
IMPORTANT:

AFTER PROLONGER STORAGE OR IF THE MACHINES SHOW SIGNS OF CONDENSATION, ALL WINDINGS SHOULD BE SUBJECTED TO INSULATION TESTS PRIOR TO OPERATING.

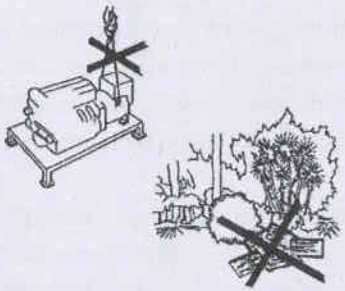
THE INSULATION TEST SHALL BE MADE BY SKILLED PERSONNEL.

BEFORE CARRYING OUT THE TEST, THE VOLTAGE REGULATOR MUST BE DISCONNECTED; IF THE TEST RESULTS ARE TOO LOW (LOWER THAN 1 MΩ)(EN60204-1) THE ALTERNATOR MUST BE DRIED IN AN OVEN AT 50-60° C.





Once the generator is coupled with an engine, mounted on a base frame, or installed on a complete generating set, it cannot be lifted by its lifting bolts. The relevant instructions for lifting complete generating set should be followed.



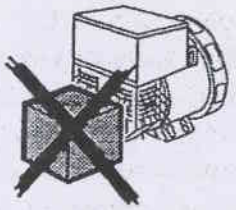
Any packing materials should be disposed of via correct waste disposal methods. Do not discard waste materials into the environment.

6.0 MECHANICAL COUPLING

For transit and storage purposes the generator flange spigot and the generator end shaft (for the generators in B3-B14 construction form) have been coated with rust preventer that can be removed easily. This MUST BE removed before assembling to the engine.

The mechanical coupling is under the sole responsibility of the final user, and has to be done at his discretion (for tightening torque see tab. 2 page 56).

A bad alignment may cause vibrations and bearing damages. It is advisable to verify the compatibility of the engine / generator torsional characteristics (by the customer).
The necessary data for this verification are available on the concerning documentation.

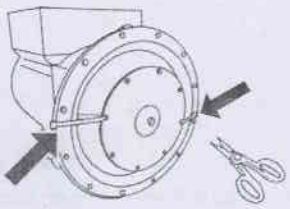


Warnings:
BEFORE STARTING THE ALTERNATOR, CHECK THAT THE AIR INLETS AND OUTLETS ARE FREE FROM ANY OBSTRUCTIONS.

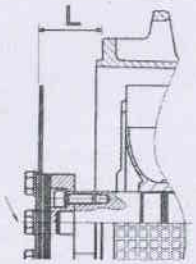
THE AIR INLETS SHOULD NOT BE NEAR ANY HEATING SOURCES. IN ANY CASE, IF NOT SPECIFICALLY REQUESTED, THE COOLING AIR TEMPERATURE MUST BE EQUAL TO THE ENVIRONMENT TEMPERATURE AND NEVER HIGHER THAN 40°C.

DURING ASSEMBLING AND DISASSEMBLING OPERATIONS, HOLD CAREFULLY BOTH ENDS OF THE PROTECTION GRID AS THE RELATED MATERIAL ELASTICITY CAN BE HARMFUL.

BEFORE MECHANICAL COUPLING OF SINGLE BEARING ALTERNATORS, REMOVE THE ROTOR SECURING DEVICE, IF FITTED, PLACED THERE TO PREVENT ROTOR FROM SLIPPING.

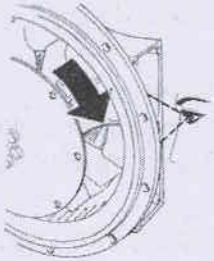


INSTRUCTIONS FOR THE ASSEMBLING OF GENERATORS WITH MD35 FORM



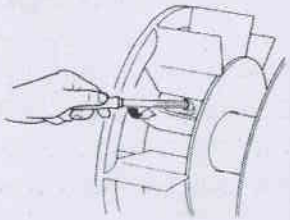
A bad alignment may cause vibrations and bearing damages. It is advisable to verify the compatibility of the engine / generator torsional characteristics (by the customer).

The necessary data for this verification are available on the concerning documentation.



For the coupling of a generator with MD35 form, proceed as follows:

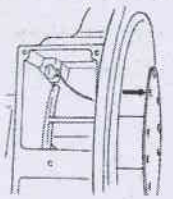
a) According to the type of the coupling, verify the correct placement of the discs (dimension "L") (table 2 page 56); if necessary restore the "L" dimension moving gently and axially the rotor. In the right position the clearance of rear bearing should be from 0.5 to 2 mm.



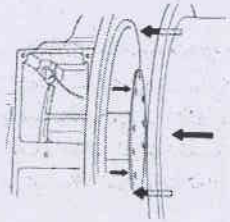
b) (For series 28) through one of the two lateral openings, and by manually rotating the rotor, detect the relevant clamp screw on the fan hub

c) (For series 28) let the fan be free to rotate by slackening the M8 screw by means of an hexagonal wrench, possibly having an articulated head

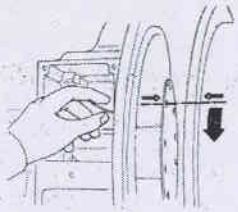
d) (For series 28) position one of the disk holes near the upper part of one of the side openings and place the slit that is on one of the fan blades, in the same position



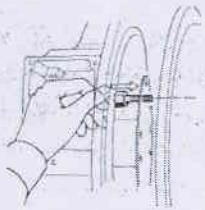
e) Move the generator close to the coupling engine



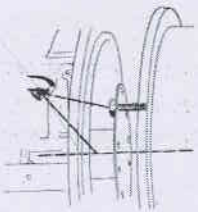
f) Align one of the flywheel disk fastening holes with the holes of the previously positioned **discs (point "d")**



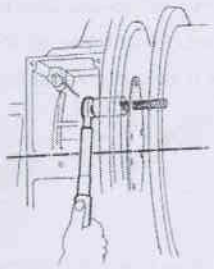
g) Insert and partially tighten the screws that lock the disks to the flywheel. Keeping the fan still (Version 28), turn the flywheel until another two holes are in the same position and partially tighten the screw.



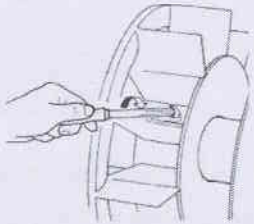
Repeat this operation for all the other holes



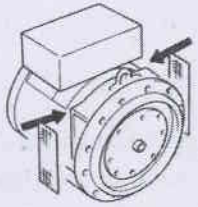
h) After inspecting the correct centering of the disks on the engine flywheel, the screws must be completely tightened



i) (For series 28) once the clamping of the disks is over, stop the fan once again by tightening the screw with a torque wrench setting adjusted at 20 Nm ± 10%; the radial position of the fan is not binding for the correct operation of the system

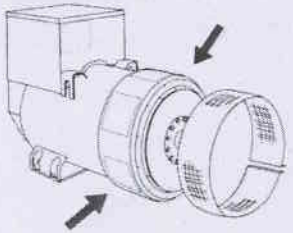


j) Fix the protection grids supplied with the generator.



Compliance with items "i" and "l" is of the utmost consequence in order to avoid serious damages to the generator or hazardous situations for people or objects.

Only after a correct mechanical coupling, proceed with the electrical connections



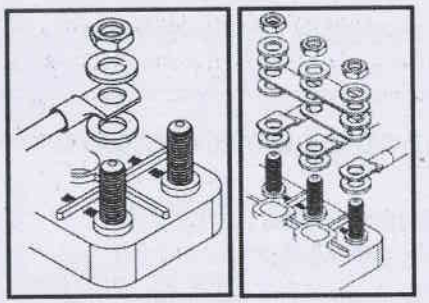
7.1 ELECTRICAL CONNECTIONS

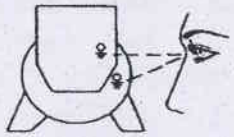
All electrical output connections are the responsibility of, and are at the discretion of, the end user.

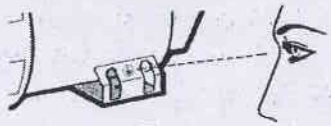
When making terminal box connections, all cable and terminal lugs should meet the relevant standards of the country of final destination.

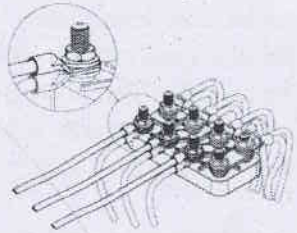
WINDINGS CONNECTION

All alternators feature star with neutral (Y) connections.The alternator must always be earthed by sufficiently rated cable, using one of the inside or outside terminals. For the electrical connections use wires suitable for the power of the generator. After completing output connections (for tightening torque see tab. 2 page. 56).









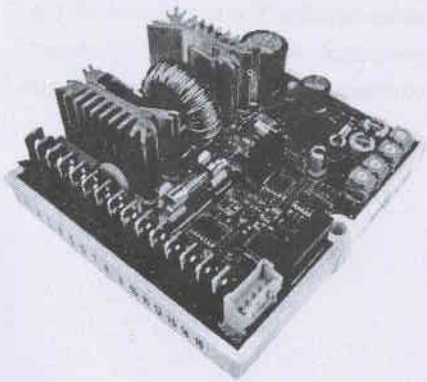
Ensure that the terminal box cover is securely in place.

IMPORTANT: frequency variations.

A standard production machine wound for 50 Hz can also function at 60 Hz (and vice versa) by resetting the A.V.R. voltage potentiometer to the new nominal voltage value. When changing from 50 to 60 Hz the alternator power, and nominal voltage will increase by 20%, but the current does not change from 50 Hz value. Should voltage stay at 50 Hz nominal value, then the output power may be increased by 5% due to improved ventilation. For machines wound for 60 Hz, changing to 50 Hz, the voltage and power values have to decrease by 20% of 60 Hz value.

7.2 DSR DIGITAL REGULATOR

INSTALLATION



Upon receipt of the digital regulator, perform a visual inspection to ensure that no damage has been sustained during transportation and movement of the equipment. In the event of damage, advise the shipper, the insurance company, the seller or Manufacturer immediately. If the regulator is not installed immediately, store it in its original packaging in a dust and humidity-free environment.

The regulator is normally installed in the generator terminal box. It is fixed with two M4x20 or M4x25 screws and must be installed in a location where the temperature does not exceed the environmental conditions foreseen.

CONNECTIONS

The digital regulator connections depend on the application and excitation system. An error in connection may have serious consequences for the unit. Carefully check to make sure that all connections are precise and in accordance with the attached drawings, before turning on the power.

TERMINALS FOR 12 WIRE

The connections must be made using cables having a minimum diameter:

- 1.5 mm² for power cables on terminals 1, 2, 3 and 9 (Exc-, Aux/exc+, Aux)
- 0.5 mm² for signal cables

TABEL 1 : CONNECTION CN1

Terminal [1]	Name	Function	Specification
1	Exc-	Excitation	Continuous Rating : 4Adc max Transitory Rating : 12Adc peak
2	Aux/Exc+		
3	Aux/Exc+	Power	Frequency : from 12Hz to 72Hz Range: 40Vac - 270Vac
9	Aux/Neutral		
4	F_phase	Sensing	Range: 140Vac - 280Vac Burden : <1VA
5	F_Phase		
6	H_phase	Sensing	Range: 70Vac - 140Vac Burden : <1VA
7	H_phase		
8	Aux/Neutral		
10	Vext/Pext	Input for remote voltage control	Type: Not isolated Range: 0 - 2.5 Vdc or Potentiometer 10K
11	Common		
12	50/60Hz	Jumper Input 50/60Hz	Max length: 30m Type: Not isolated
13	Common		
14	A.P.O.	Active protections output	Max length: 3m Type: Open collector not isolated Current : 100mA Voltage: 30V Max length: 30m[2]
15	Common		

Note 1) the terminals are connected to each other on the board: 2 with 3, 4 with 5, 6 with 7, 8 with 9, 11 with 13 and 15.

Note 2) with external EMI SDR 128/K filter (3m without EMI filter)

Note 3) starting from revision 10 of the Firmware. It is convenient do not exceed ±10%

TERMINALS FOR 4 WIRE 3 PHASE & 2 WIRE 1 PHASE

The connections must be made using cables having a minimum diameter:

- 1.5 mm² for power cables on terminals 1, 2, 3 and 5 (Exc-, Aux/exc+, Aux)
- 0.5 mm² for signal cables

TABEL 2 : CONNECTION FOR 4 WIRE 3 PHASE

Terminal[1]	Name	Function	Specification
1	Exc-	Excitation	Continous Rating : 4Adc max Transitory Rating : 12Adc peak
2	Aux/Exc+		
3	Aux/Exc+	Power	Frequency : from 12Hz to 72 Hz Range : 40Vac - 270Vac
4	F_phase	Sensing	Range : 140Vac -280Vac Burden : <1VA
9	Neutral		
8	Aux/Neutral		
10	Vext/Pext	Input for remote voltage control	Type Not isolated Range: 0 - 2.5 Vdc or Potentiometer 10K
11	Common		
12	50/60Hz	Jumper Input 50/60Hz	Max length: 30m Type Not isolated
13	Common		
14	A.P.O	Active protection output	Max length: 3m Type: Open collector not isolated Current : 100mA Volatge: 30V Max length: 30m[2]
15	Common		

Note 1) the terminals are connected to each other on the board: 2 with 3, 4 with 5,8 with 9, 11 with 13 and 15.

Note 2) with external EMI SDR 182/K filter (3m without EMI filter)

Note 3) starting from revision 10 of the Firmware. It is convenient do not exceed ±10%

Note: For dedicated Single Phase Machines : Terminal 3, 4 to be connected inloop and 5 , 8 are sensing.

DSR regulator, on board of new generators, is already calibrated; in case of loose regulators (ie spare parts) or in case of wiring modifications or adjusting, to guarantee its correct working, it must be accurately set.

Basic settings can be done directly on the regulator by its four trimmers (VOLT - STAB - Hz - AMP), the jumper 50/60 and the Vext input. More detailed settings or measures can be done exclusively by software using for example the Manufacturer communication interface DI1 with the program DSR_Terminal, DSR_ReaderORDI Visual unit.

Vext Input

The Vext input (connector CN1 - terminals 10 and 11) permits analogical remote control of output voltage through a 10Kohm potentiometer with a programmable variation range through parameter 16 with respect to the value set (by default the setting is ±14% starting from revision 10 of the Firmware); if you want to use continuous voltage, it will be effective if it is in the range between 0V and +2,5V. The input tolerates voltages from -5V to +5V, but for values exceeding the limits of 0V / +2,5V (or in the event of disconnection), two options are possible: not to take the set point of external input (default configuration) and return to regulation to the voltage value set with the trimmer (if enabled) or with parameter 19, or keep the minimum (or maximum) value of voltage that can be reached. The two options can be set with the RAM Voltage CTRL flag in the Configuration menu corresponding to the bit B7 of the configuration word P [10].

NOTE: The DC voltage generator must be able to sink at least 2mA. In making adjustments it is recommended not to exceed the nominal value of voltage of the alternator beyond ± 10%

50/60 Signal

A jumper is located on the 50/60 input (connector CN1, terminals 12 and 13); it provokes the commutation of the under speed protection threshold from 50·(100%-αHz%) to 60·(100%-αHz%), where αHz% represents the position relative to the Hz trimmer.

APO Contact

The acronym APO stands for Active Protection Output: (connector CN1 - terminals 14 and 15) 30V-100mA non-insulated open collector transistor, normally opened, is closed (with a delay that can be programmed by software from 1 to 15 seconds) when, among all the alarms, one or more of the active ones can be selected separately by software.

FOR 12 WIRE SYSTEM: VOLT trimmer allows adjustment from about 70V to about 140V when using for sensing terminals 4 and 5, or from about 140V to about 280V when using terminals 6 and 7.

FOR 4 WIRE 3 PHASE & 2 WIRE 1 PHASE SYSTEM :VOLT trimmer allows adjustment from about 140 V to about 280 V when using for sensing terminals 4 or 5and 8 or 9.

The STAB trimmer adjusts the dynamic response (statism) of the alternator under transient conditions.

The AMP trimmer adjusts the excitation overcurrent protection intervention threshold.
Use the following procedure in order to calibrate the overload protection:
1) Rotate the Hz trimmer entirely in the counter clockwise direction
2) Apply the nominal load to the alternator.
3) Decrease the speed by 10%
4) Rotate the AMP trimmer completely in the counter clockwise direction.
5) After a few seconds, there should be a decrease in the voltage value of the generator and alarm 5 should come on (visible due to a change in the flashing indicator light).
6) Under these conditions, rotate the AMP trimmer slowly in the clockwise direction, until the output voltage value is 97% of the nominal value: alarm 5 is still activated.
7) Return to the nominal speed; alarm 5 should disappear in a few seconds and the generator voltage should increase to the nominal value.
8) Re-adjust the trimmer as indicated in the following paragraph.

The Hz trimmer allows to calibrate the threshold of the intervention of the under frequency protection up to -20% with respect to the nominal speed value set by jumper 50/60 (at 50 Hz the threshold can be calibrated from 40 Hz to 50 Hz, at 60 Hz the threshold can be calibrated from 48 Hz to 60 Hz).
The intervention of this protection reduces the output generator voltage and, to calibrate it, uses the following procedure:
1) Rotate the Hz trimmer entirely in the counter clockwise direction.
2) If the machine has to operate at 60 Hz, ensure that the bridge is inserted between terminals 12 and 13 of the CN1 connector. 3) Bring the generator to 90% of the nominal speed.
4) Slowly turn the "Hz" trimmer, rotating it clockwise until the generator voltage begins to drop and ascertain that the indicator light simultaneously begins flashing rapidly.

5) By increasing speed, the generator voltage will normalise and the alarm will disappear. 6) Set the speed to the nominal value.
During normal operation and a duty cycle of 50% an indicator light mounted on the board flashes every 2 seconds; it flashes differently in the event of intervention or alarm, as indicated in figure 1.

NOTE: Notwithstanding DSR maintains the voltage regulation, it goes in shutdown mode if the frequency decreases under 20Hz.

The reset needs the Gen-Set switching off.

N.	Description of event	Action
1	Checksum EEprom	Reset default, Blockage
2	Overvoltage	APO
3	Undervoltage	APO
4	Short circuit	APO, Maximum current, Blockage
5	Excitation overcurrent	APO, Reduction of excitation current
6	Underspeed	APO, Ramp V/F
7	Overspeed	APO

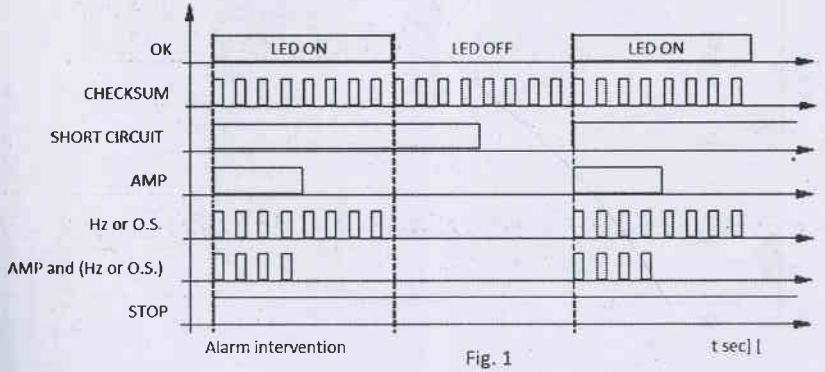
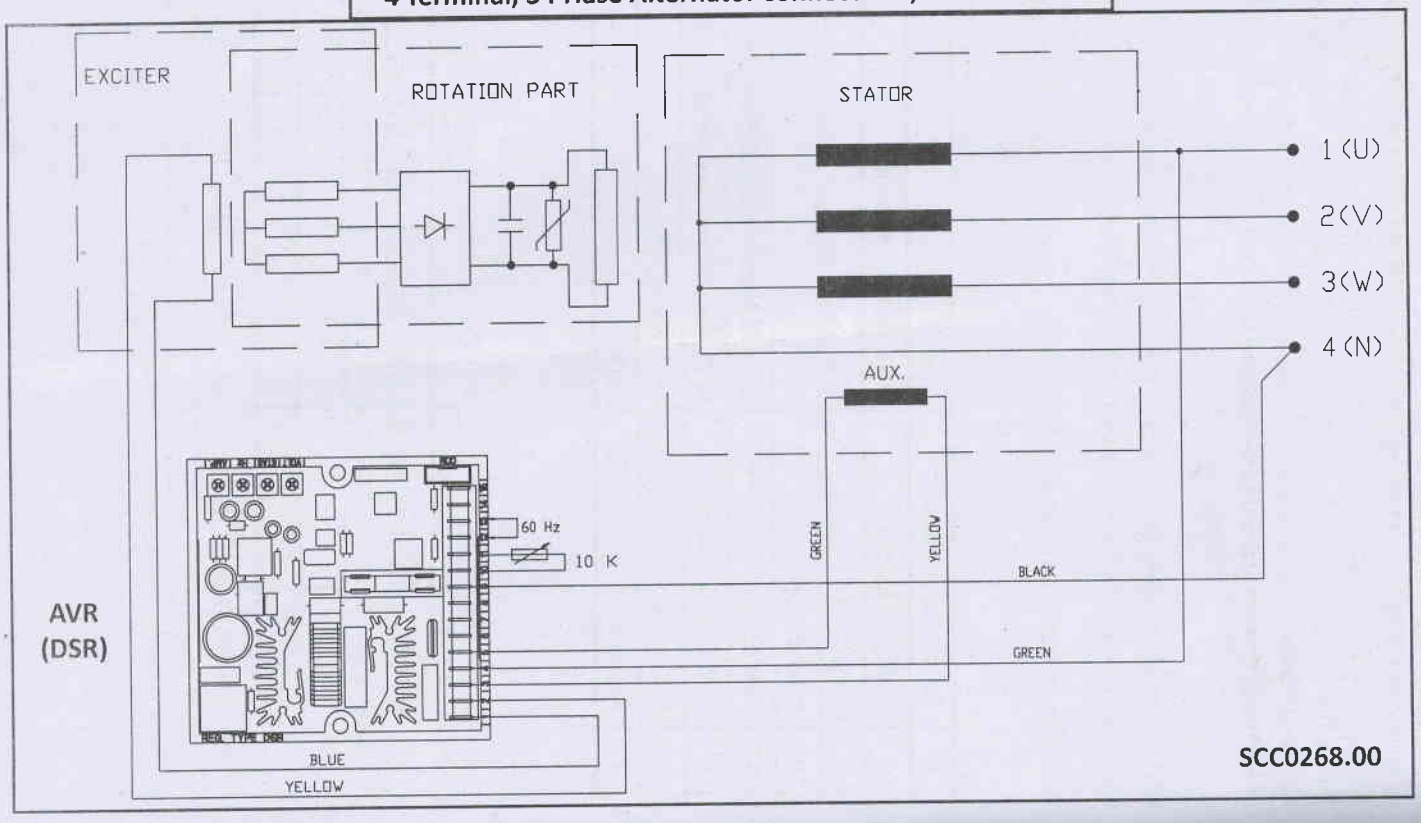
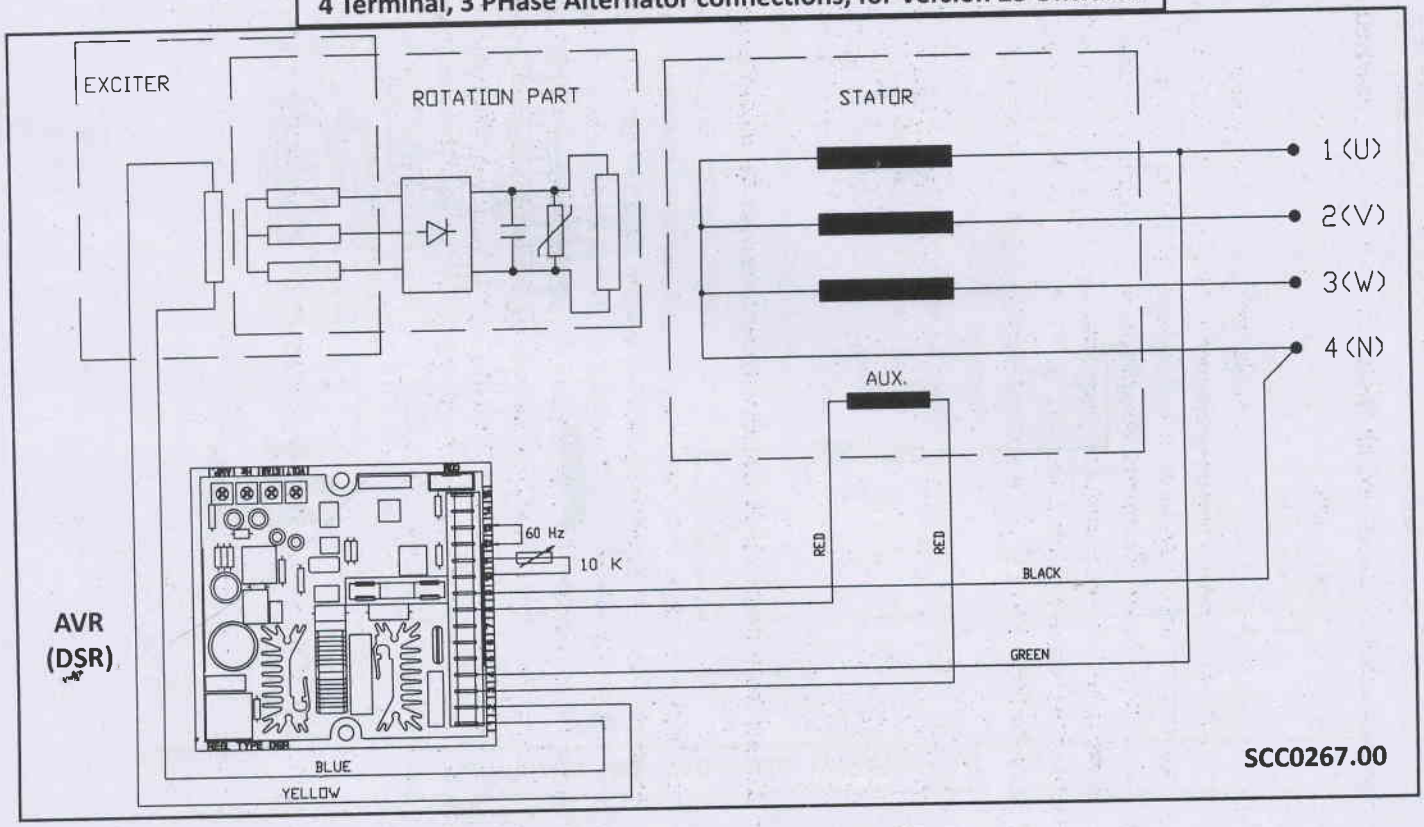


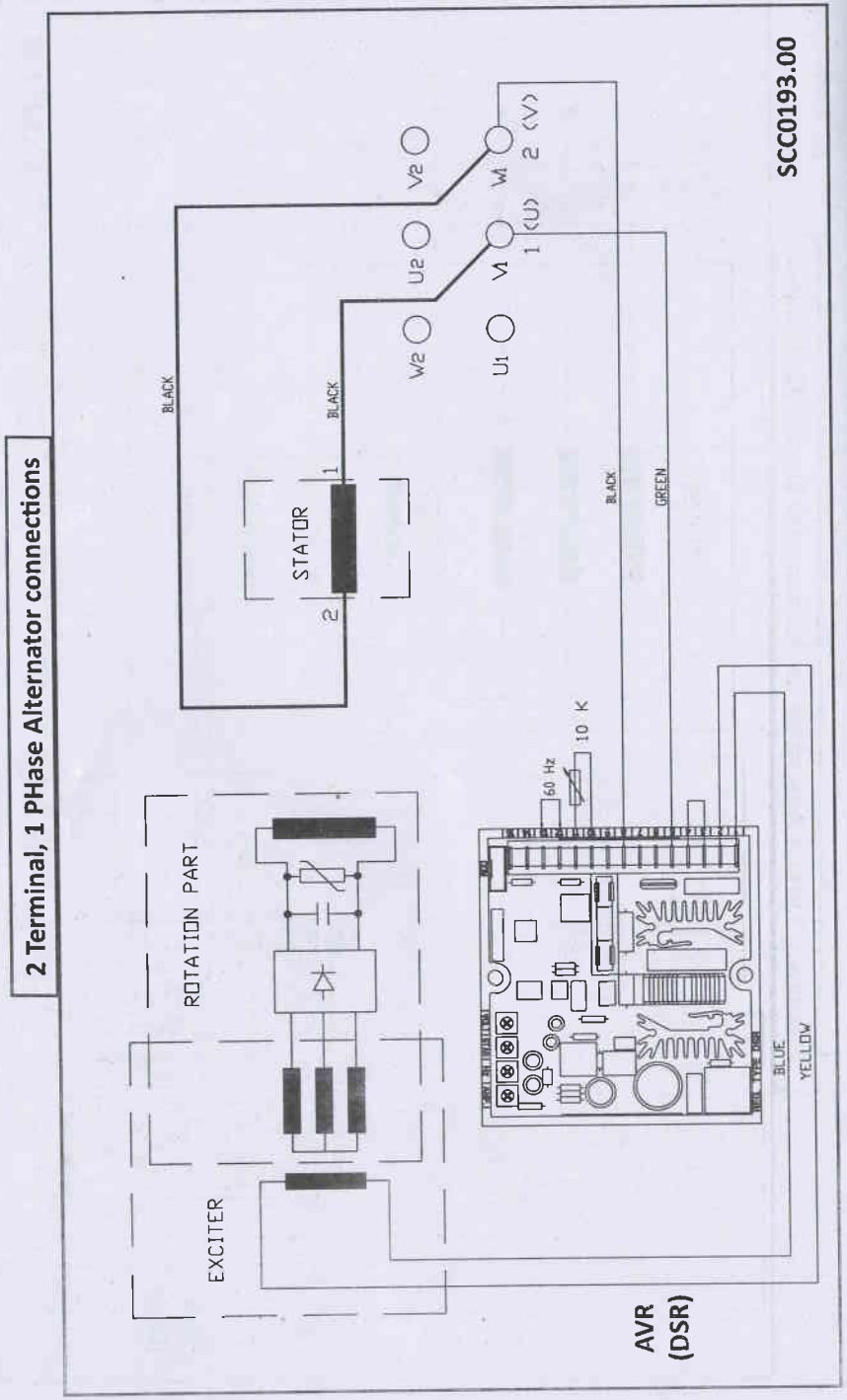
Fig. 1

4 Terminal, 3 PHase Alternator connections, for Version 3

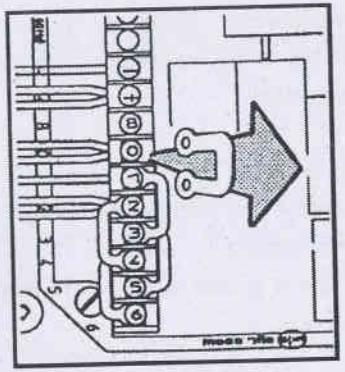


4 Terminal, 3 PHase Alternator connections, for Version 28 Onwards





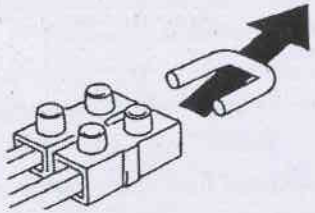
8.0 PARALLAL OPERATION



Should the alternators be required to operate in parallel, it is necessary to add a paralleling device to ensure equal droop of generator output voltages. Parallel

This ensures that if the machines are operated separately, the voltage droop (4% approx.) is equal when switching from no-load to full load.

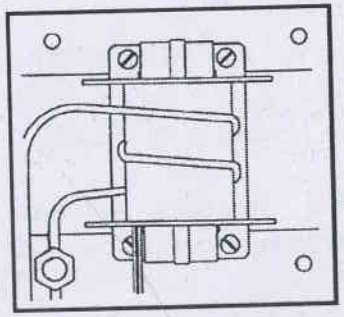
The parallel device is fitted as standard on 40 - 43 - 46 models, therefore when two or more of these units must function in parallel, it is sufficient to remove the bridge which short circuits the secondary winding of the parallel device.



On smaller models this device is mounted on request or it can be added (except for Version 28/4) by the client himself for more instructionsplease contact supplier.

After the device has been mounted, check whether the connection has been properly made; make sure that there is a voltage drop of approximately 4% in the machines when they function individually switching at rated speed and cosα 0.8 from no-load to full load operation.

HOW TO MOUNT THE PARALLEL DEVICE

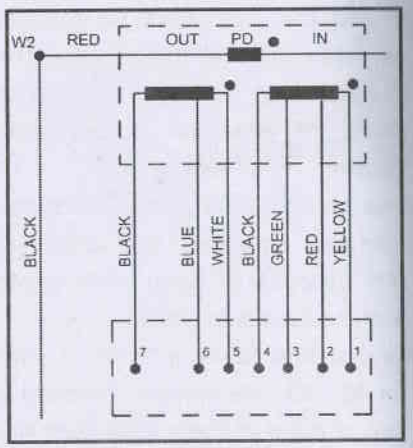


Mount parallel device as indicated.

Connect the power turns in series with phase.

The numbers of turns to be wound on the transformer will be indicated in the instruction accompanying the transformer itself.

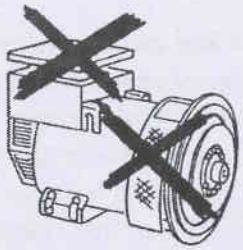
The secondary winding of the parallel transformer must be connected in series to the sensing of the electronic regulator.



In order to activate the parallel device remove the bridge which short circuits the secondary winding of the device itself as shown in the above mentioned tables.

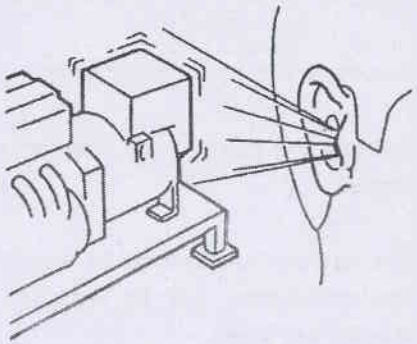
NOTE:
When requesting a parallel device, it is necessary to indicate the nominal data of the alternator on which the device will be applied.

After all the electric connections have been made and only **after all the protections have been put in place,** the system can be started.



9.0 STARTING AND STOPPING THE OPERATIONS

All the instrumentation for starting, running and stopping the system shall be provided by the installer.



THE STARTING, RUNNING AND STOPPING OPERATIONS MUST BE CARRIED OUT BY SKILLED PERSONNEL WHO HAVE READ AND UNDERSTOOD THE SAFETY INSTRUCTIONS AT THE BEGINNING OF THIS MANUAL.

REGULATOR CONNECTION SCHEME FOR USE WITH 2 PHASE SENSING REGULATOR – DSR/L

TERMINALS FOR 4 WIRE

The connections must be made using cables having a minimum diameter:
- 1.5 mm² for power cables on terminals 1, 2, 3 and 9 (Exc-, Aux/exc+, Aux)
- 1.0 mm² for signal cables

FUSE
The Regulator is equipped with 5A fast acting protection fuse.

TABEL 1 : CONNECTION CN1

Terminal [1]	Name	Function	Specification
1	Exc-	Excitation	Continuous Rating : 4Adc max Transitory Rating : 12Adc peak
2	Aux/Exc+		
3	Aux/Exc+	Power	Frequency : from 12Hz to 72Hz Range: 40Vac - 270Vac
9	Aux/Neutral		
4	F_phase	Sensing	Range: 220Vac - 440Vac Burden : <1VA
5	F_Phase		
6	H_phase	Sensing	Range: 110Vac - 220Vac Burden : <1VA
7	H_phase		
8	Aux/Neutral		
10	Vext/Pext	Input for remote voltage control	Type: Not isolated Range: 0 - 2.5 Vdc or Potentiometer 10K
11	Common		
12	50/60Hz	Jumper Input 50/60Hz	Max length: 30m Type: Not isolated
13	Common		
14	A.P.O.	Active protections output	Max length: 3m Type: Open collector not isolated Current : 100mA Voltage: 30V Max length: 30m [2]
15	Common		

Note 1) the terminals are connected to each other on the board: 2 with 3, 4 with 5, 6 with 7, 8 with 9, 11 with 13 and 15.
Note 2) with external EMI SDR 128/K filter (3m without EMI filter).
Note 3) starting from revision 10 of the Firmware. It is convenient do not exceed ±10%.

TERMINALS FOR 4 WIRE 3 PHASE & 2 WIRE 1 PHASE

The connections must be made using cables having a minimum diameter:

- 1.5 mm² for power cables on terminals 1, 2, 3 and 5 (Exc-, Aux/exc+, Aux)
- 1.0 mm² for signal cables

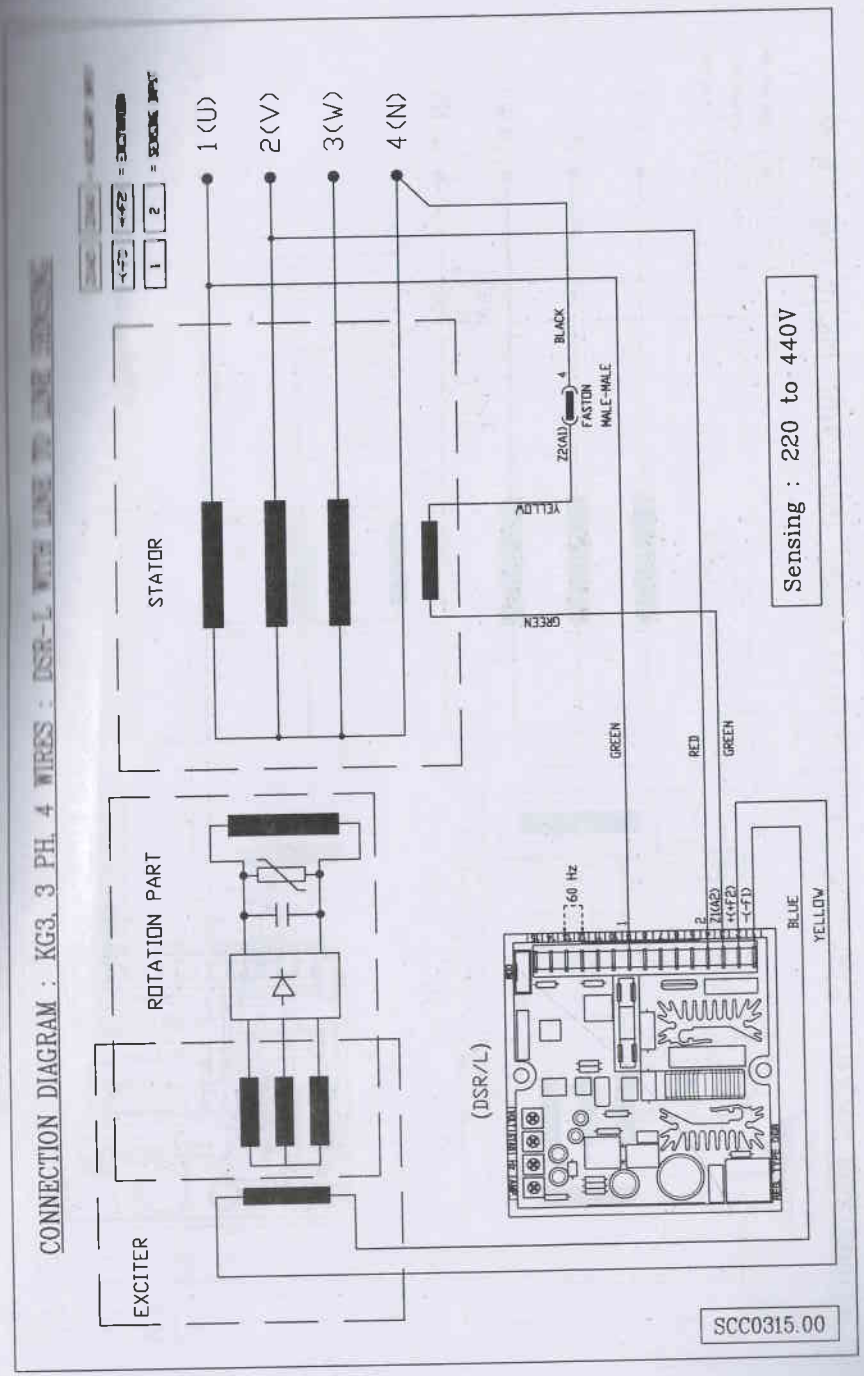
TABEL 2 : CONNECTION FOR 2 WIRE / 4 WIRE 3 PHASE

Terminal [1]	Name	Function	Specification
1	Exc-	Excitation	Continuous Rating : 4Adc max Transitory Rating : 12Adc peak
2	Aux/Exc+		
3	Aux/Exc+	Power	Frequency : from 12Hz to 72 Hz Range : 40Vac - 270Vac
4	F_phase	Sensing	Range : 220 Vac -440 Vac Burden : <1VA
9	Neutral		
8	Aux/Neutral		
10	Vext/Pext	Input for remote voltage control	Type Not isolated Range: 0 - 2.5 Vdc or Potentiometer 10K
11	Common		
12	50/60Hz	Jumper Input 50/60Hz	Max length: 30m Type Not isolated
13	Common		
14	A.P.O	Active protection output	Max length: 3m Type: Open collector not isolated Current : 100mA Voltage: 30V Max length: 30m [2]
15	Common		

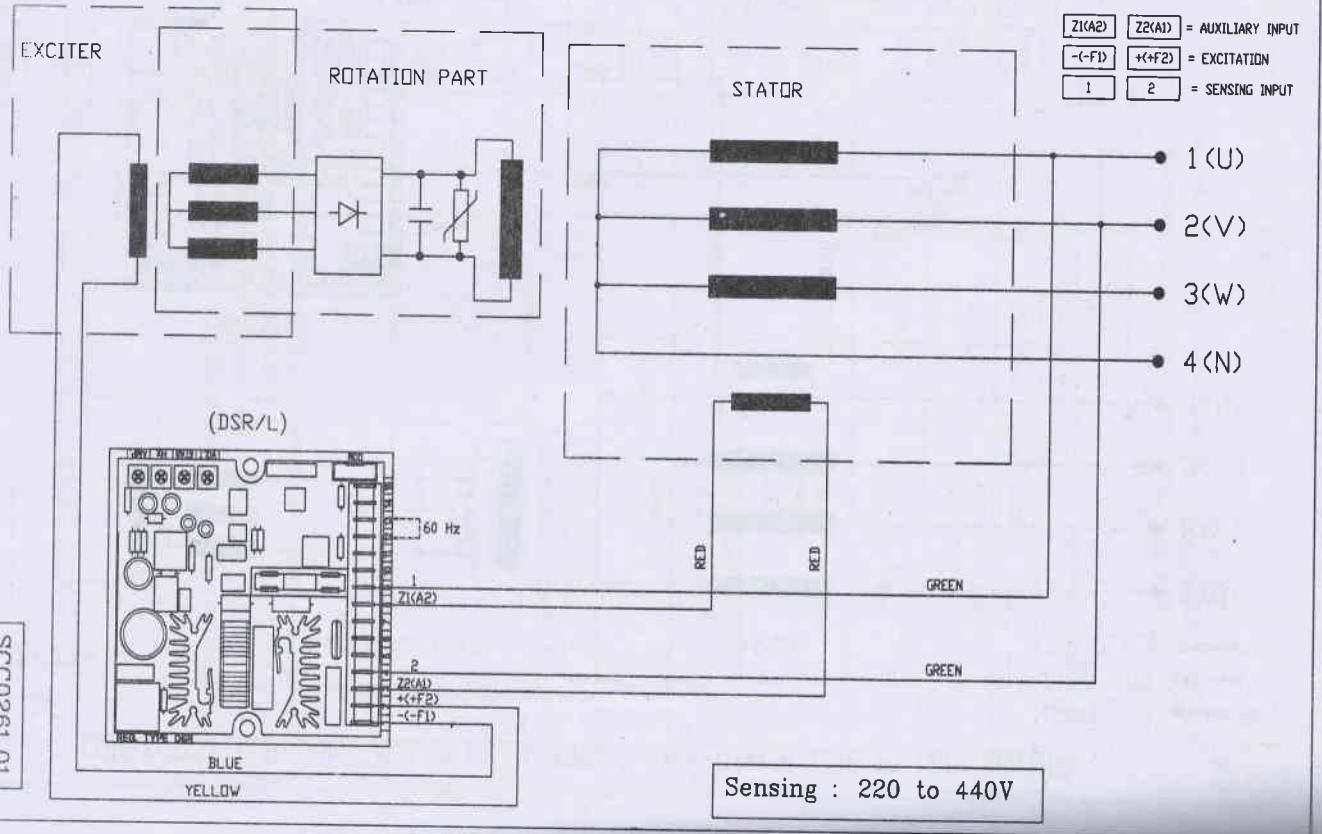
Note 1) the terminals are connected to each other on the board: 2 with 3, 4 with 5, 8 with 9, 11 with 13 and 15.
Note 2) with external EMI SDR 182/K filter (3m without EMI filter).
Note 3) starting from revision 10 of the Firmware. It is convenient do not exceed ±10%.
Note : For dedicated Single Phase Machines : Terminal 3, 4 to be connected in loop and 5 , 8 are sensing.

Note: For all the other details please refer to section 7.2 of Operating and Maintenance Manual.

Operating and Maintenance Manual



CONNECTION DIAGRAM : KG28, KG32 & KG34, 3 PH, 4 WIRES : DSR-L WITH LINE TO LINE SENSING



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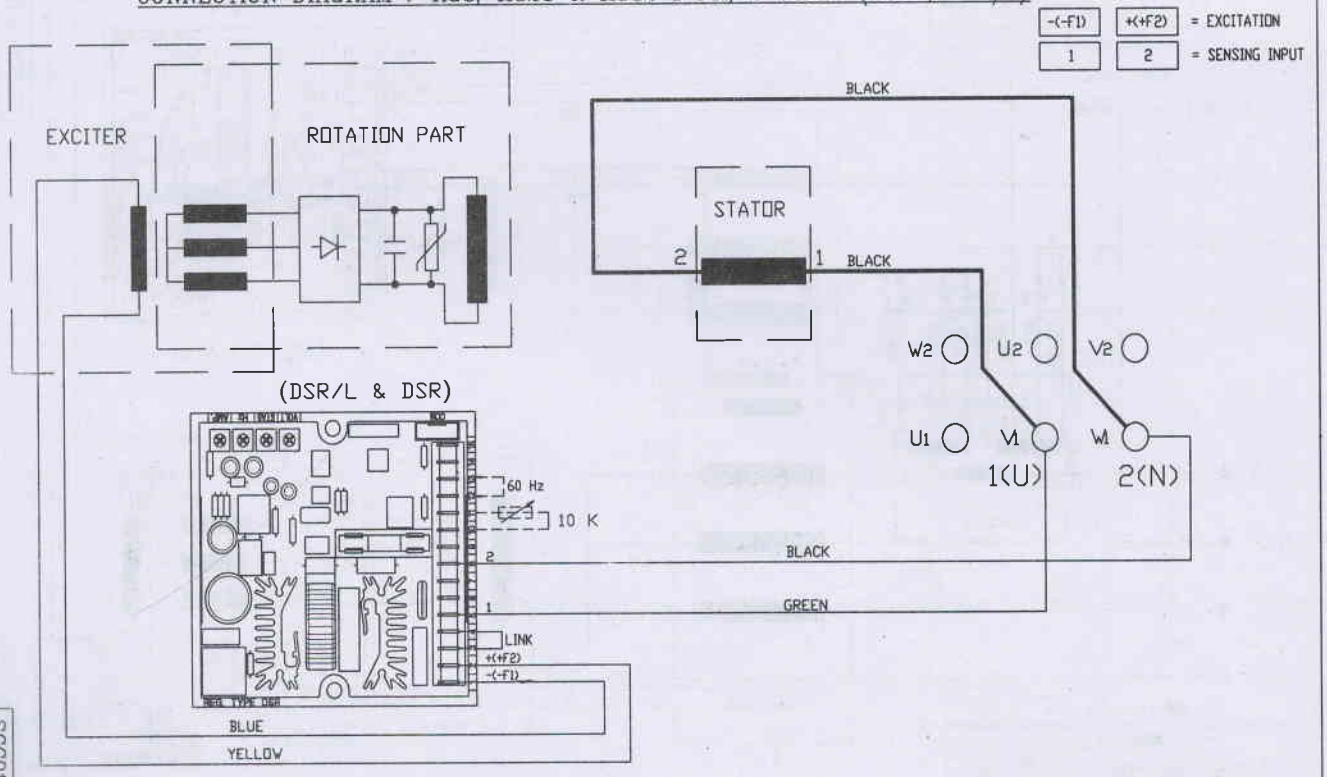
CONNECTION DIAGRAM : KG3, KG28 & KG32 1 PH, 2 WIRES (DSR , DSR/L)



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Operating and Maintenance Manual

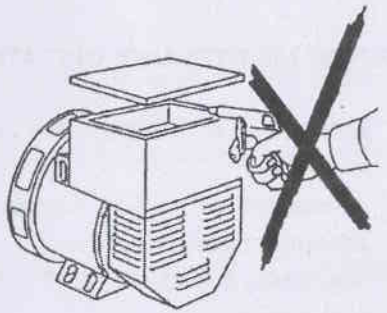
NOTES:

IMPORTANT:

When the system is set to work for the first time, which has to be done at a reduced speed, the operator shall check that no anomalous noises can be detected.
If an anomalous noise is detected, stop the system immediately and improve the mechanical coupling.

10.0 CLEANING AND LUBRICATION

Prior to approaching or touching the alternator, ensure that it is not live and it is at room temperature; at this stage it is possible to clean it on the outside using compressed air.



NEVER USE LIQUIDS OR WATER.

DO NOT CLEAN THE INSIDE ELECTRIC COMPONENTS WITH COMPRESSED AIR, BECAUSE THIS MAY CAUSE SHORT-CIRCUITS OR OTHER ANOMALIES.

11.0 MAINTENANCE

The alternators are designed to give a long maintenance free working life.

BEFORE PERFORMING THIS OPERATION, READ THE SAFETY REQUIREMENTS AT THE BEGINNING OF THIS MANUAL CAREFULLY.

Maintenance operations on thegenerators can be divided into routine and extraordinary maintenance operations; in both cases, all operations must be

authorised by the safety representative and they must be carried out when the machine is turned off and insulated from the electric installation or from the power mains.
High qualified mechanical or electrical technicians must carry out maintenance operations and any fault search since all operations described hereunder could put personnel in serious danger.
It is also highly recommended to take all the necessary precautions so as to prevent an inadvertent starting of the machine during maintenance and fault search operations.

ROUTINE MAINTENANCE OPERATIONS:

a) Assessment of windings conditions after long periods of storage or inactivity
b) Assessment of correct functioning on a regular basis (absence of abnormalnoises or vibrations)
c) Mechanical inspections on all fastening bolts and, in particular, on electric connections.
d) External cleaning of generator

a) Assessment of windings conditions after long periods of storage or inactivity.

Measuring the insulating earth resistance can assess the condition of the windings. This measurement can be carried out with a "Megger" device, or similar, with a 500V direct-current voltage. It is very important to disconnect the voltage regulator (fig. a), the rotating diode bridge (fig. b) and the radio-interference filter (fig. c), as well as any other device connected to the windings to be checked, before carrying out the measurement.

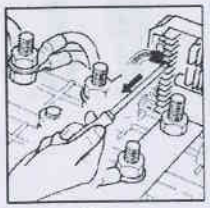


Fig. a

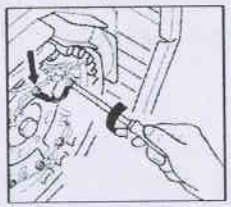


Fig. b

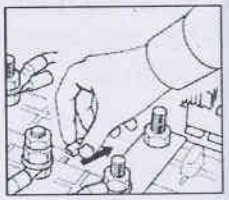
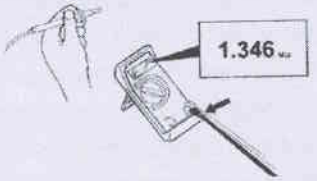


Fig. c

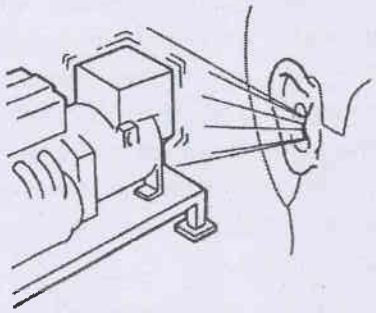
The figure resulting from the measurement of the windings' earth resistance must be over 1MΩ.



Should the figure be smaller than the above mentioned one, the windings must be adequately dried up. This can be done by directing a jet of hot air of about 50-60°C into the generator's air inlets or outlets; alternatively, the stator's windings can be electrically connected and a voltage can be passed through them by means of a directcurrent power supply. The amount of current in the windings depends on the generator size, even though it must be fixed according to the nominal values stated on the plate.

b) Assessment of correct functioning (absence of abnormal noises or vibrations).

We recommend users to check regularly the correct functioning of the generator, and to verify that there are no anomalous noises or vibrations; their presence might indicate damage of bearings.

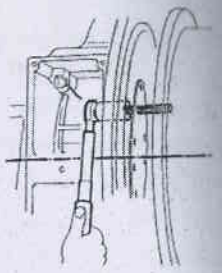


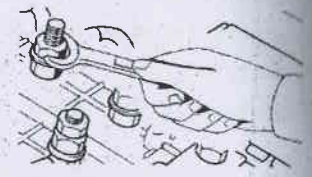
Please be advised that the alternator itself has no particular vibration since the rotating parts are perfectly balanced. Provided that the rotor balancing has not been altered and that the rotor's bearings have not been damaged, vibrations in the generator set may occur due to alignments of couplings, due to stress upon the combustion engine, or to vibration mounts.

We also recommend checking of performance data which must comply with the data on the generator's plate.

b) Mechanical checks of all fastening bolts and, in particular, of electric connections.

We recommend a regular check of all fastening bolts, which must be perfectly tightened up. Special attention should be paid to all electric connections; this inspection must be carried out in the complete absence of voltage. To choose the correct tightening wrenches suitable for the different sizes of the bolts, see generator manual.





c) Internal and external cleaning of the generator.

For the external cleaning of the generator, you can use compressed air. The use of hydro cleaners and detergent fluids is strictly forbidden. The standard protection degree of the generator is IP23; therefore, use of fluids could cause anomalies or even short-circuits.

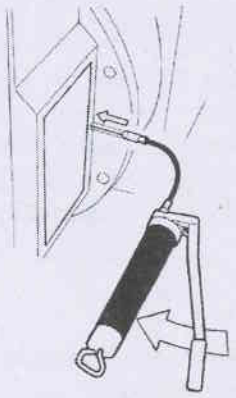
EXTRAORDINARY MAINTENANCE OPERATIONS:

a) Maintenance and replacement (if necessary) of bearings
b) Cleaning of air filters (if available)
c) Cleaning of windings.
d) Replacement of Diode Bridge
e) Replacement of exciter

f) Replacement of voltage regulator
g) Check of residual voltage

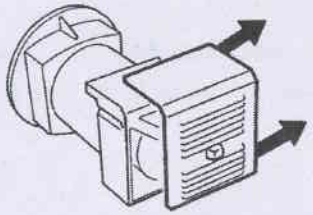
a) Maintenance and replacement (if necessary) of bearings.

During the assembling phase, all bearings are greased with SKF LGMT2 grease, or similar.
All generators are equipped with sealed bearings; for this kind of bearing, no maintenance is required for the total operating time (estimated: 20,000 hours).
During the operating time, checks to detect presence of either overheating, or noises, must be carried out on a regular basis.
If the bearing is worn off, it can cause excessive vibrations. In such a case, the bearing must be removed, examined, and if necessary, replaced.



For Generator version: 3

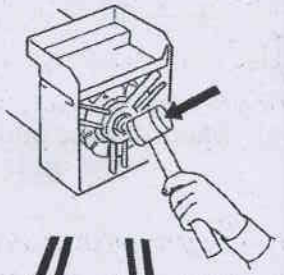
In order to disassemble the alternator series ECP3, follow the following instructions:



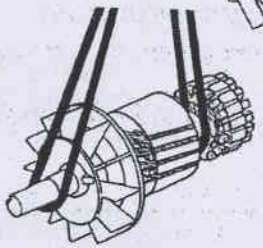
Remove the rear panel.

To remove the front shield, unscrew the four fixing nut

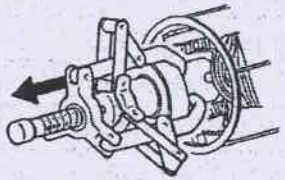
Tapping with an appropriate rubber-hammer on the shaft (opposite of coupling side).



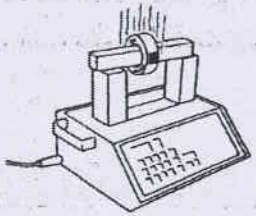
Extract the rotor using a hoisting mechanism with soft ropes of sufficient strength. Slowly and carefully extract the rotor and place it in the work area which has been previously prepared.



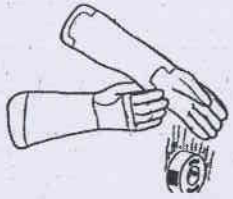
To replace the bearing/s, use a puller of the type shown in the figure.



To reassemble the bearing, heat it with a special magnetic device of the type shown in the figure.

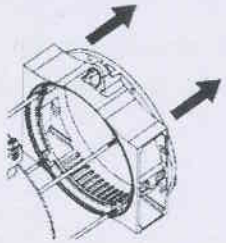


Wear special anti-scorch gloves, reassemble the bearing/s.

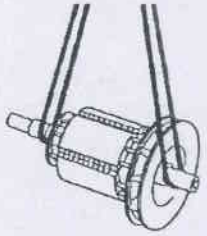


For Generator versions: 28-32-34.

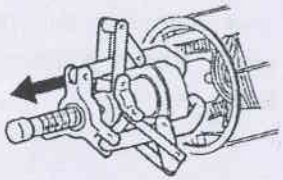
To disassemble alternator versions 28-32-34, follow these instructions:



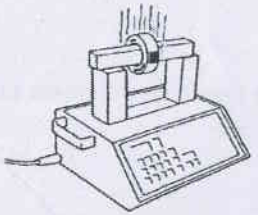
-) Remove front cover



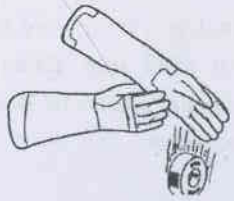
-) Use a lifting device equipped with soft ropes of an adequate lifting capacity to extract rotor. Make sure that the lifting devices are suitable for the weight of the parts to be shifted



-) To pull the bearing out, use a puller



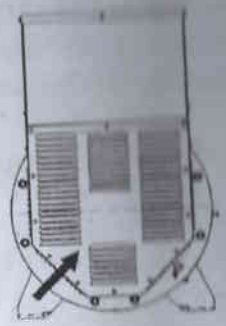
-) To insert new bearing, heat it with a suitable magnetic device



-) Put on safety gloves and insert bearing into its place

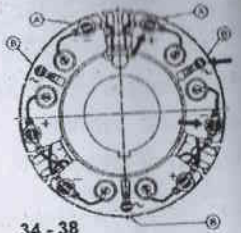
For Generator versions: 38onwards

To disassemble alternator versions 38, remove exciter as follows:



-) Remove rear seal

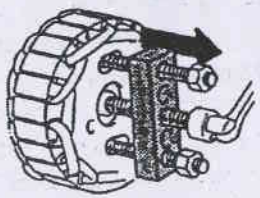
-) Disconnect the five wires of the rotating diode bridge "A" and "B".



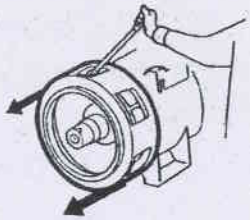
34 - 38

-) when dealing with versions 38, remove clamp screws from the diodes area of the rotating bridge.

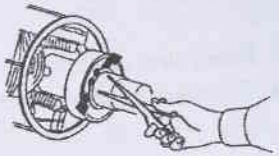
-) insert an adequate puller to pull out exciter rotor

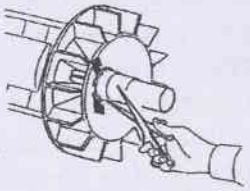


-)Pull out rotor from the drive end side; should the front lead diameter be smaller than the impeller's external diameter, remove lid to pull out rotor

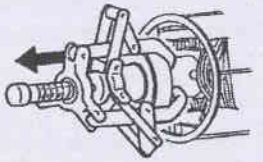


-) use a pair of suitable pliers to remove seeger rings





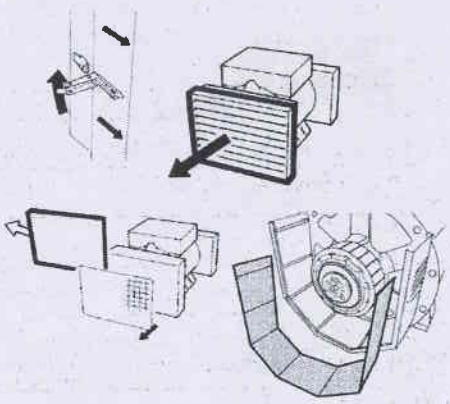
-) use a suitable puller to remove bearing



-) to insert new bearing, heat it with a suitable magnetic device

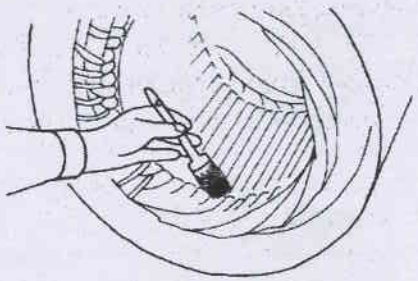
-) Put on safety gloves and insert bearing into its place

b) Cleaning of air filters (if available)



Air filters are optional parts that are supplied upon request; these devices must be cleaned on a regular basis; inside these filters there is a mesh net that has to be kept clean in order to ensure a good performance of the filter. The time interval between each cleaning operation depends on the conditions of the installation site. A frequent inspection of these parts will establish if any cleaning is required. Make sure you turn off the generator set when performing cleaning operations of such parts as their removal entails contact with live parts.

c) Cleaning of windings



Both windings and generator will last longer with a correct maintenance and cleaning; an inspection and a maintenance schedule should be established by keeping in mind that the frequency of these inspections depends on the conditions of the site where the generator is being used.

If the generator is used in a dry and clean environment, an inspection a year is enough; in case of severe conditions, inspections must be carried out more frequently.

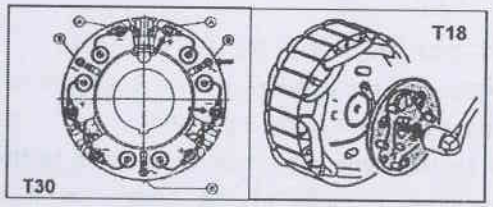
However, we recommend that a check should be done, regardless of the schedules, in the following cases:

-) in case of rust
-) in case of corrosion

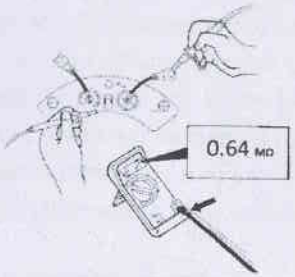
-) when the insulation is damaged
-) when there is dust on the surface of the windings

To clean windings, use solvents like oil of turpentine or "Solvesso" solvent. Cleaning with such substances, which contain a high evaporation level, will not damage the insulation level of the windings. When cleaning is over, please look out for any overheating or carbonisation signs.
We also recommend drying up of windings at 60-80°C and if you notice that the varnish of windings is not in good shape, then have them varnished again.

d) Replacement of Diode Bridge



The diode bridge varies according to the model of the generator. It can have three separate sectors with two diodes fixed on each sector (T30), or one circular body (T18) with 6 diodes. The first type (T30) is used in the alternator models 34-38, whereas the second one (T18) is used in the 40, 43 and 46 versions.



Diodes can be easily inspected with a multi-meter: simply disconnect the wire of the particular diode and check its resistance on both directions. A perfectly functioning diode will show a very high resistance in one direction and a very low resistance in the opposite direction. A faulty diode will show either a very low resistance or an infinite resistance in both directions. Once the whole sector, or the whole bridge, is replaced, remember to tighten the screws with suitable tightening wrench and to strictly comply with the polarities and the diagrams indicated by Manufacturer.

Generator versions 3-28-32.

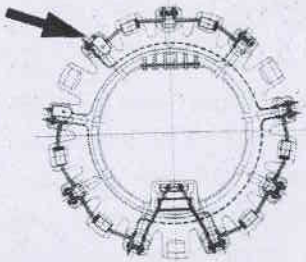
Procedure to check the diodes of the exciter rotor.

Necessary equipment:
- 12V battery
- 12V-21W lamp (or alternatively 6.8Ω-30W Resistance)
- Voltmeter (for instance, multi-meter on scale VOLT d.c.)

Warning: before performing the following actions, it is necessary to disconnect the 2 cables connecting the main rotor to the diode bridge (+and-).

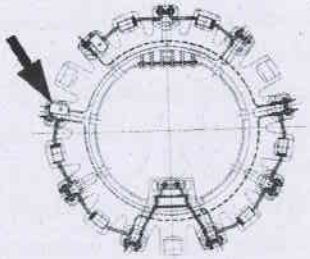
IMPORTANT

TEST OF THE DIODES ON THE "NEGATIVE"



- Connect the equipment, as it is pointed out in the picture A (table 3 page 57)
- Fix the cable connected to the lamp to the negative terminal of the bridge, as it is pointed out in the picture A (table 3 page 57)
- Connect the terminal "Probe" to the point A1 (it is checked the diode 1), then to the point A2 (it is checked the diode 2) and finally to the point A3 (it is checked the diode 3); check the readings on the voltmeter in relation with what is reported on the table (table 3 page 57).

TEST OF THE DIODES ON THE "POSITIVE"



- Connect the equipment, as it is pointed out in the picture B (table 3 page 57)
- Fix the cable connected to the negative terminal of the battery to the positive terminal of the bridge, as it is pointed out in the picture B (table 3 page 57)
- Connect the terminal "Probe" to the point A4 (it is checked the diode 4), then to the point A5 (it is checked the diode 5) and finally to the point A6 (it is

checked the diode 6); check the readings on the voltmeter in relation with what is reported on

INSTRUCTIONS TO REPLACE THE DIODE

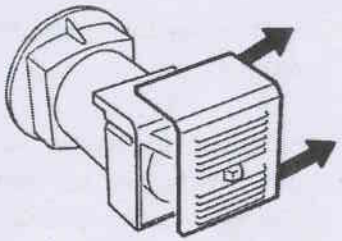
When the values measured point out a diode damaged, it is necessary to replace the component.
For this purpose it is recommended to not pull the rheophores out from their locations, but to cut them near to the body of the component; then fit in the new component respecting the polarity and soft solder accurately the rheophores with the pieces remained in their locations.

e) Replacement of exciter

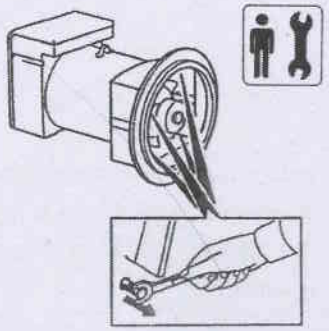
For Generator version: 3

In order to disassemble the alternator series ECP3, follow the following instructions:

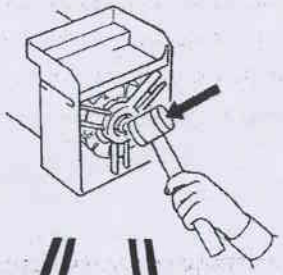
Remove the rear panel.



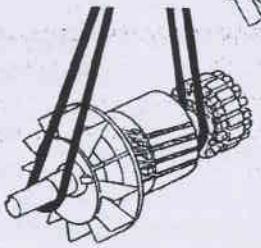
To remove the front shield, unscrew the four fixing nut



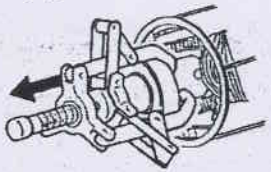
Tapping with an appropriate rubber-hammer on the shaft, opposite coupling side.



Extract the rotor using a hoisting mechanism with soft ropes of sufficient strength. Slowly and carefully extract the rotor and place it in the work area which has been previously prepared.

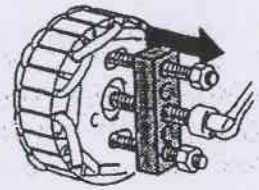


-) Use a puller to pull out bearing

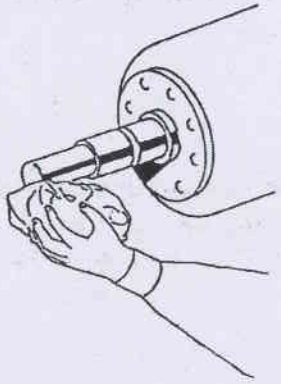


-)Unsolder the two cables of connection of the main rotor

-)To remove the exciter rotor, use a suitable puller, which can be easily constructed or forwarded by the manufacturer upon request.



Before replacing the exciter, clean the shaft seat thoroughly and cover it with a thin layer of "Permabond A022" of Angst-Pfister or a similar product.

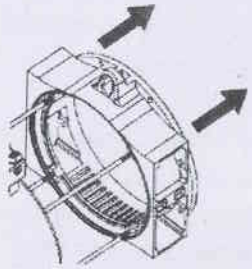


Re-Assemble the exciter following the above-described steps inversely, carefully check that the diode connecting cables are turned toward the outside.

Using a tool similar to the one shown in the figure, reassemble the exciter.

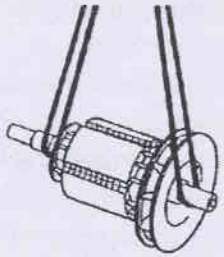
Generator versions 28-32-34.

Follow these instructions to remove exciter of the 28-32-34 versions:

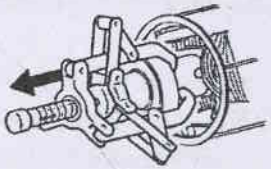


-) remove front lead

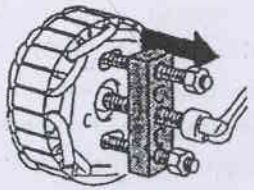
-) Use a lifting device equipped with soft ropes of an adequate lifting capacity to extract rotor. Make sure that the lifting devices are suitable for the weight of the parts to be shifted



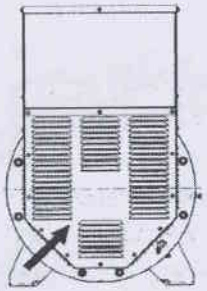
-) Use a puller to pull out bearing



-) To remove the exciter rotor, use a suitable puller, which can be easily constructed or forwarded by the manufacturer upon request.



Generator versions 38

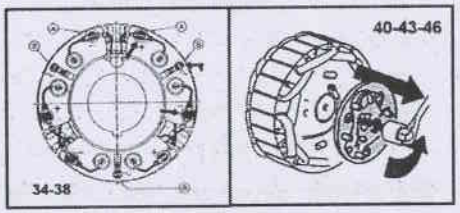


To remove exciter of the 38-40-43-46 versions, there is no need to disassemble the entire Generator; however, you must follow the instructions below:

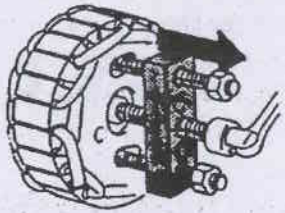
-) Remove real seal

-) Disconnect the five wires of the rotating diode bridge

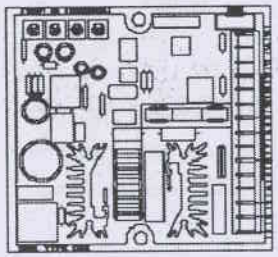
-) When dealing with the 38 versions, remove clamp screws from sectors; whilst when dealing with the 40-43-46 versions, remove clamp bolt and, by pulling it gently, pull out diode bridge



-) To insert exciter rotor, use a suitable puller, which can be easily constructed or forwarded by the manufacturer upon request.

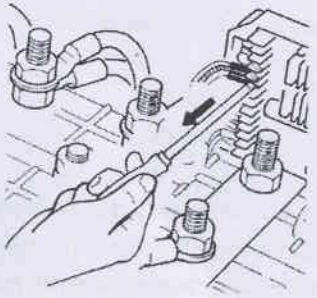


f) Replacement of voltage regulator



All generators are equipped with a digital voltage regulator; depending on the alternator model, electronic regulators can be of two different types. DSR is an integral part of the 28-32-34-38 generators with DER1 as an option.
The DER1 is supplied with the 40-43 and 46 versions. Should some anomalous functioning be detected, please consult our technical manual or contact our technical assistance service.

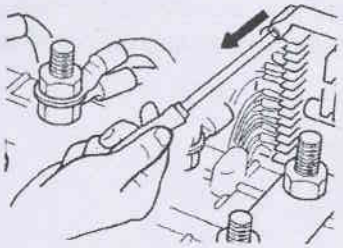
Once it has been ascertained that the regulator needs to be replaced, proceed as follows:



-) Disconnect all terminal board wires

-) Unscrew the 2/4 clamp screws of the regulator

-) Set new regulator in the usual position



-) Tighten the new regulator with the previously unscrewed screws

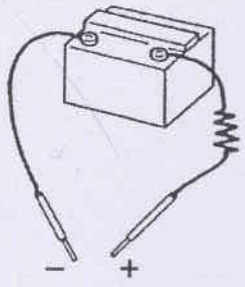
-) Connect again all wires to the terminal board of the regulator. Follow diagrams supplied by Manufacturer, if necessary.

g) Check of residual voltage

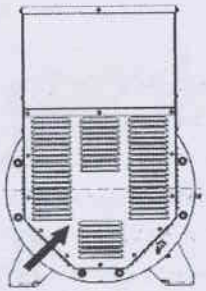
For generators equipped with an electronic regulator, you must perform the following procedure. This must be applied to ensure that the generator is not over-excited (in such a condition, though it still rotates at nominal velocity, no voltage is present in the generator's main terminal board):

-) When the generator is switched off, remove lid from the terminals case

-) Connect two connecting wires to a 12 Vdc battery with a 30Ω in- series resistance



Generator versions 38



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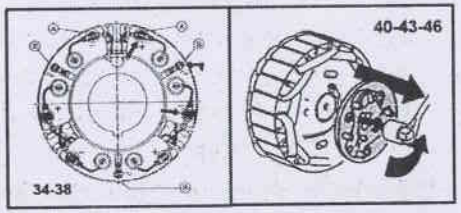
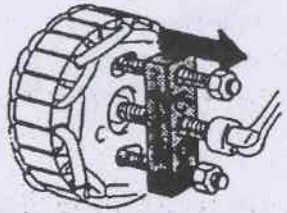
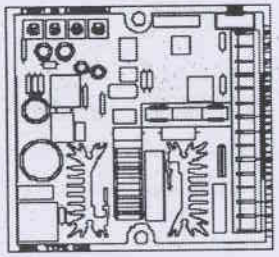


-) To insert exciter rotor, use a suitable puller, which can be easily constructed or forwarded by the manufacturer upon request.



f) Replacement of voltage regulator



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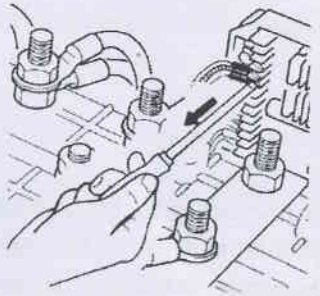
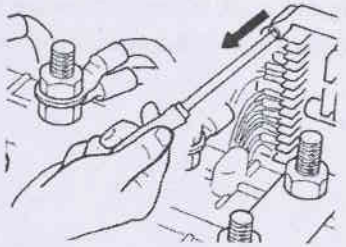


-) Disconnect all terminal board wires

-) Unscrew the 2/4 clamp screws of the regulator

-) Set new regulator in the usual position



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