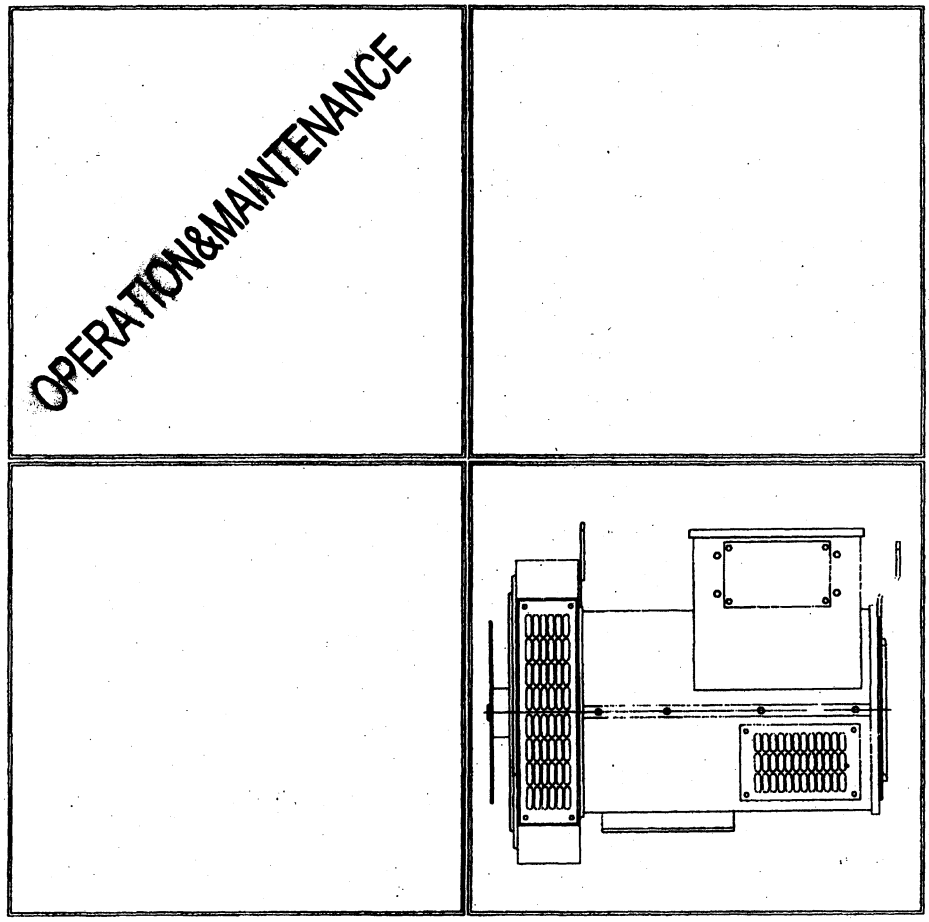

OPERATION&MAINTENANCE MANUAL

TFW&YHG series Brushless 3-phases Synchronous Generator

Safety Precautions

Before operating, please read Generator Sets Manual and Generator Manual so that generators can be safely and properly operated and maintained and can work securely and effectively.

A lot of accidents occurred due to the failure to obey basic rules and introduce protective measures. If the instructions of this manual are not followed, electricity strike can lead to equipment damage and serious human body injure or even death.

Please obey all warning/caution instructions.

- Ensure that operations should meet all applicable safety standards and be conducted by qualified person.
- Do not start up generator while protection cover, maintenance cover or terminal box cover is open.
- Please disconnect the starting circuit of generator before maintenance.
- Please disconnect circuit loop with electricity network or other generators, and place warning sign on circuit breaker to avoid accidental connection.
- Do not use eyebolt of generator to lift the whole generator sets.

Caution ! It means may cause generator or other equipments to be damaged or destroyed.

Caution! It means damage or destruction of generator or its peripheral equipment may be resulted.

Warning ! Safety sign means may cause ordinary human body hazardous

Warning! It means general personal risks may be resulted.

Danger! Safety sign means may cause casualty.

Danger! It means casualty may be resulted.

The published information in this manual will be changed with our technical improvements. We reserve our rights to change specifications without notice. Please contact us in case of any doubt.

Preface

The Manual helps users know how to correctly install, use, maintain and repair YHG generators. Lack of protection or incorrect operation may damage equipment and/or hurt human body. Warning/ caution signs will be clearly identified at special areas. It is very important to read and understand all the contents in the manual before operating generator.

Our after-sale service staff, salesmen and engineers are ready to provide service and visit to the company is welcome.

Warning!

Incorrect installation, operation, maintenance or replacement of parts may cause casualty and/or equipment damage. Maintenance personnel should be certified for electrical and mechanical service.

The Manual applies to AC alternator mounted on the Diesel Sets.

The A.C. Generator is a newly-designed product, drawing upon successful experience of the world's top generator manufacturers, using advanced technology and incorporating strict quality control.

We would like to draw your attention to the contents of this manual. By following certain important instructions during installation, usage and maintenance of your alternator, you can expect many years of trouble-free operation.

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Chapter 1 Brief Introduction

1.1 Brief Introduction

TFW&YHG Series Generator is three-phase brushless synchronous generator with rotating magnetism construction. It's maximum voltage is 400V, 50Hz (1500rpm) or 480V, 60Hz (1800rpm).

1.2 Check

First please check if the Generator is damaged or not during transportation when you receive the generator. If you find any evident mark of impact, you should contact transportation company. After appearance checking you can diagnose if the generator has faults or not by rotating shaft with hand (for double-bearing generator).

1.3 Nameplate

You can distinguish Generator by nameplate data on the frame.Please confirm the nameplate data of generator are the same as ordered.

1.4 Dimension

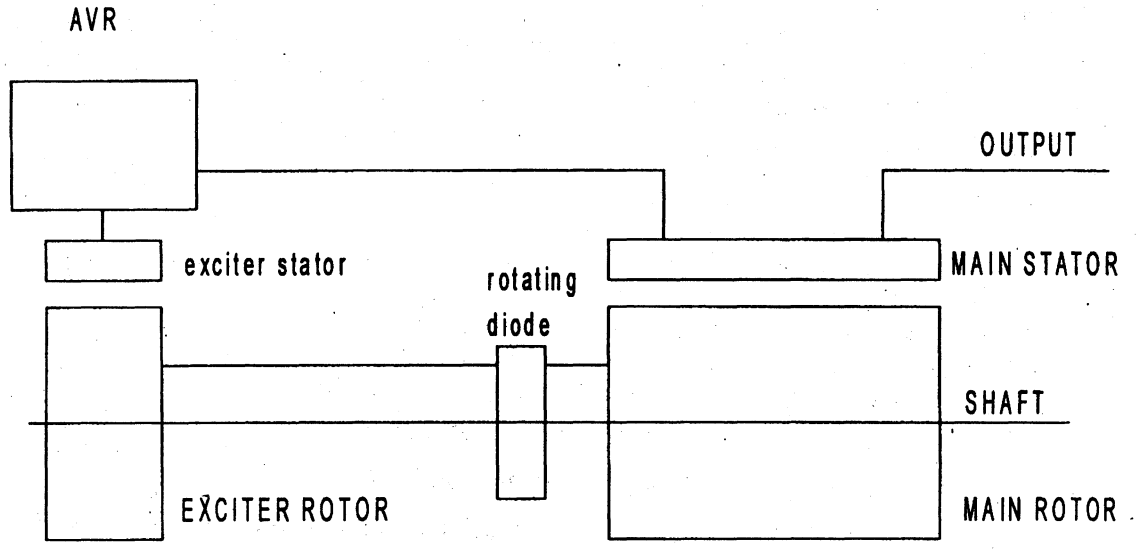
Refer to the catalogue for mounting dimension of generator.

1.5 Storage

Please store the generator properly during generator stop or before installation. The place should be clean, dry and with small change of temperature and humidity.

Chapter 2 Working Principle

TFW&YHG Series Generator is AVR self-exciting system generator. The working principle is indicated in the following picture 1.



- Picture 1 –

Exciting current is automatically controlled by AVR, whereby the output voltage of generator is auto-adjusted. AVR's power is supplied by output voltage of generator. Moreover, these AVRs have low frequency protection features. It can automatically decrease output voltage of generator which work under frequency lower than rated one. In so doing, it can prevent generator and AVR from damage caused by over-current produced in low frequency.

Chapter 3 **Installation**

Warning!

Incorrect lift or lifting capacity isn't enough may cause serious casualty or equipment damage Lifting capacity must be more than weight of generator sets The eyebolt of generator can't be used to lift whole generator sets

3.1 Lift

There are two eyebolts on generator for lifting. Lifting hook may consist of a semicircle and a bolt. Steel wire used for lifting must have proper length and lifting capacity. Although lifting position is designed possibly near to generator's center of gravity, incline of generator may occur due to its structure. So the lift must be operated carefully to avoid injury or equipment damage. Correct lifting operations are clearly indicated on the lifting plate near eyebolt.

The Generator should be installed in a clean and dry place with sound ventilation and convenient for examination, repair and maintenance. While assembling the generator with engine, in terms of generator set arrangement and workshop design, the allocation of exhaust and heating parts of engine should have a minimal impact on Generator and AVR.

3.2 Installation

3.2.1 Double Bearing Generator

Double bearing generator is assembled by connecting an elastic coupling and adaptor to the flywheel cover and flywheel of engine. Elastic coupling and adaptor will not be supplied along with double-bearing generator, unless requested by customer (detailed installation dimension of engine should be provided to generator factory). The assembly procedure is as follows:

--- Check to find out whether or not concentricity of generator and engine is in conformity with technical requirements. Tolerance should not exceed 0.1mm;
--- Fit elastic coupling and adaptor onto generator;
--- Locate the generator with proper lifting device; connect the elastic coupling to flywheel of engine and adaptor to flywheel cover.
--- Fix, with bolts, the adaptor onto flywheel cover of the engine;
--- Fix generator to frame base of generating sets through the holes on generator foot.

Caution!

Incorrect installation of protection device of adaptor Or incorrect center of generator will cause serious human body casualty and/or equipment damage

3.2.2 Single Bearing Generator

Single bearing generator is assembled by coupling the adaptor and connecting disc of generator with flywheel cover and flywheel of engine. The assembly procedure is as follows:

--- Check to find out whether or not the dimension between SAE adaptor and SAE connecting disc of generator is the same as that between flywheel cover and flywheel of engine;
--- Install locating dowel on the flywheel of generator; fix generator with suitable lifting device to make connecting disc of the generator and flywheel of engine fit with each other.
--- Remove locating dowel and fix, with bolts, the connecting disc of generator onto the flywheel of engine.
--- Fix, with bolts, the adaptor onto flywheel cover of engine.

--- Fix generator onto frame base of generating sets through the holes on generator foot.

3.3 Grounding

The neutral line isn't connected to frame while generator is sold. There is a grounding terminal near main terminals in the terminal box。 End users need to connect neutral line terminal with grounding terminal with a conductor (the section area is half of cable area) if neutral line grounding is necessary.

Caution!	***Please reference to local regulations of electricity and assure safety and correct grounding***

3.4 Check before start-up

3.4.1 Electrical Check

Please check winding insulation resistance before starting up generator sets.

Please disconnect AVR during electrical check.

Check winding resistance with 500V megameter or other similar testing instruments. Please disconnect all conductors between neutral line and groundings in the first place. Then measure winding resistance of U、V、W phase to ground. The resistance should be more than 5MΩ. It means windings are damp or dirty or grounding short circuit if winding resistance is lower than 5MΩ.

Generator coils have been tested by high-voltage. Another voltage test will decrease insulation lifetime. Test voltage must be decreased to 0.8 (2×Rated voltage+1000) if high-voltage test is required by customer.

There are three methods that may make insulation resistance return to normal。

1) Dry generator in the 110℃ conditioning oven for 24 Hr. (Without AVR).
2) Blow heat air into intake of generator, and make generator rotate while generator is disconnected with exciter。
3) Short circuit of main stator (without AVR):
   - ---- First, disconnect AVR with F+ and F- terminals of exciter, and connect a 12V DC power between the two terminals.
   - ---- Short-circuit output leads of main stator.
   - ---- Start the generator up to its rated speed, and adjust voltage of DC power to control short-circuit current of main stator to 80% of rated current.
   - ---- Measure winding insulation resistance every hour until it is ok.

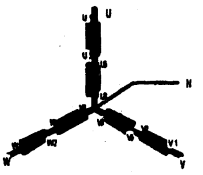
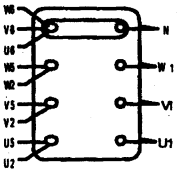
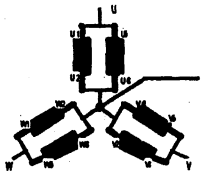
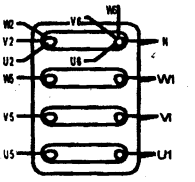
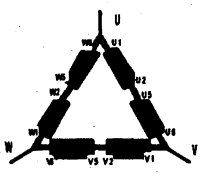
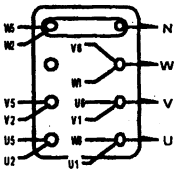
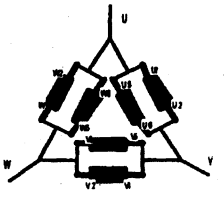
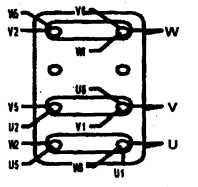
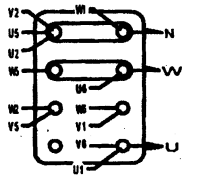
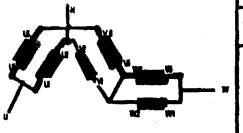
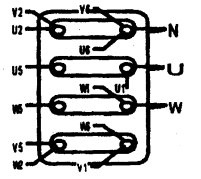
3.4.2 Mechanical checks

Before the first time of starting up the generator, please check:

-- All fixing bolts and screws are tight。
-- Cooling air can flow in freely。
-- The protecting cover and frame are correctly installed.
-- The standard direction of rotation is clockwise as seeing from the DE (phase sequence is 1-2-3)。
   For anti-clockwise rotation, swap the phase sequence of phase 2 and 3。
-- The winding connection corresponds to the operating voltage (see Section 3.5)

3.5 Electrical diagram

The generators have 12 leads. Such generators could be connected as Series Y type, Parallel Y type, △ type etc. So it can make generator to be used on a wider range of voltage. The connecting lines can be easily altered by changing the position of connecting plates on terminals. The stator connection type is specified on the nameplate. Electrial diagram sees next page.

Connection diagram	L.L Voltage		Factory connection
	50Hz	60Hz	
	380－415	380－480	
	－	380－416	
	Star type series,three phase four lines, Terminals (U,V,W,N)		NDE
	50Hz	60Hz	
	190-208	190-240	
	－	190-208	
	Star type prarllel, three phase four lines, Terminals (U,V,W,N)		NDE
	50Hz	60Hz	
	220-240	220-240	
	－	220-240	
	Delta type series, three phase four lines, Terminals (U,V,		NDE
	Hz	60Hz	
	0-120	120	
	－	110-120	
	Delta type parallel, Terminals (U,V,W)		NDE
	50Hz	60Hz	
	220-240	220-240	
	－	220-240	
	Double Delta type, single phase three lines, Terminals (U,W,N)		NDE
	50Hz	60Hz	
	220-240	220-240	
	－	220-240	
	"之" type PARALLEL, single phase three lines, Terminals (U,N,W)		NDE

Ndte "N" dosen't mean "middle" only.

Any reconnection or checks on the generator terminals should be conducted while the generator is stopped.

3.6 Running

The Generator can be started up and put into use after being adjusted and installed according to the manual.

The generator has been tested and set in factory. Please ensure that drive speed is correct and stable at the first No-Load Run. Otherwise, the generator settings may be altered in the event of abnormal operation（Resetting should follow adjustment procedure in section 3.7）. The malfunction must exist if the generator still runs abnormally (see section 4.4)。

3.7 Settings

The various adjustment during the test must be made by a qualified engineer。

WARNING

Check to find out whether the drive speed specified on the nameplate is achieved or not before adjustment: 1500RPM/50Hz or 1800RPM/60Hz。Do not try to set voltage if the frequency or speed isn't correct（Otherwise irreparable rotor damage may occur as a result）.

Replace all operation panel or cover after operation test is finished。

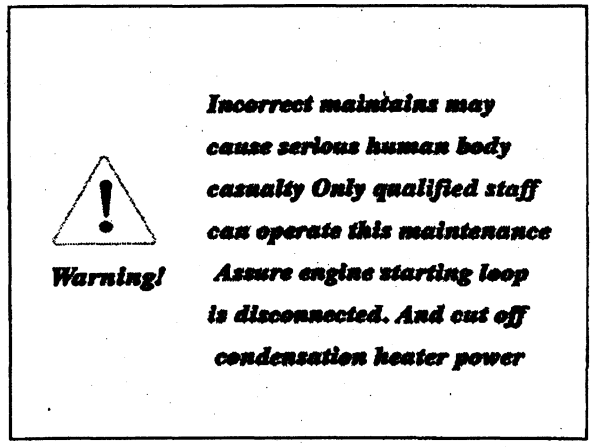
AVR should be used for any adjustment to the generator。

3.7.1 AVR settings。

VOLT Voltage Level Regulator : VOLT has been adjusted to be the best while leaving factory. Please increase voltage by rotating knob in clockwise and decrease it in counterclockwise if necessary。

STAB Voltage Stability Regulator: STAB has been adjusted to be the best condition while leaving factory. Please adjust it in the following way if necessary: adjust voltage to be unstable in clockwise , then adjust voltage to be stable in counterclockwise。

Chapter 4 Maintenance and service



A regular check of windings (especially when the generator is not used for a long time) and bearings (See Section 4.1 and 4.2) is suggested as a part of routine maintenance.

4.1 Winding Conditions

Winding conditions can be checked by measuring its insulation resistance to ground.

Special attention is required if windings are too humid or dirty. The insulation resistance can be measured with a 500V megohmmeter. For manual check, it is suggested to rotate the handle slowly when it starts up. Refer to Section **3.4.1 (Electrical Check)** for specific measures of check and maintenance..

4. 2 Bearing

All bearings supplied are sealed. It is our suggest to check bearing noise and overheat regularly during its lifetime. If excessive vibration occurs after a certain time, it is probably caused by bearing abrasion, where a check of bearing condition is necessary, or by lack of grease. The bearing could be replaced when necessary.

In any case, bearing should be replaced after running for 40,000 hours.

Important! The lifetime of bearing is closely related to working conditions and working environment.

Important! Long-term exposure to a vibration environment may cause bearing abrasion, where bearing balls will deform and indention may appear. Exposure to a humid climate or environment may emulsify grease and the bearing may be eroded as a result.

4.3 Mechanical faults

Fault		Actions
Bearing	③ Overheating of one or both bearings (Bearing temperature is 50℃ higher than surrounding temperature) . ③ With or without abnormal noise.	③ Change the bearing if the bearing has turned blue or the grease has turned black. ③ Bearing not fully locked (abnormally installed in the bearing housing)。 ③ The two ends is incorrectly aligned。
Abnormal Temperature	③ Overheating of generator frame	③ Block of air flow (inlet-outlet) or cycling of hot air from the generator or engine. Remove the block. ③ Generator is running at a too high temperature (>105% of rated voltage on load) . ③ Generator overloaded.
Vibration	③ Too much vibration	③ Misalignment (Coupling)。 ③ Unqualified mounting or assembly with engine. ③ Rotor balancing fault (engine—generator).
	③ Excessive vibration and humming noise coming from the machine	③ Phase voltage imbalance。 ③ Stator short-circuit。
Noise	③ Generator damaged by a significant impact, followed by humming and vibration.	③ System short-circuit ③ Parallel Fault Possible consequences: ③ Coupling broken or damaged ③ Shaft end broken or bent ③ Deformation or short-circuit of rotor ③ crack on fans or loose on shaft ③ Irreparable damage to rotating diodes or AVR

4.4 Electrical faults

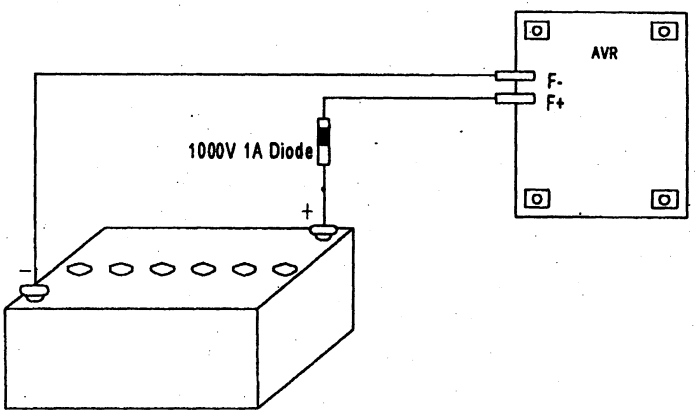
Fault	Actions	Effect	Check/Cause
No Voltage at No-load when Start Up	Connect a new battery of 4-12V to Terminals F+ and F-. Keep the connection for 2-3 seconds. Mind the polarity.	Voltage is created and is correct when the battery is removed	③ Lack of residual magnetism。
		Voltage is created but does not reach the rated value when the battery is removed	③ Check the connection of the voltage signal line to the AVR ③ Fault of diode ③ Short circuit of armature
		Voltage is not created when the battery is removed	③ Fault of AVR ③ Open circuit of exciter windings (check winding) ③ Open circuit of main rotor winding (check the resistance)
Voltage is too low	Check the drive speed	Correct speed	③ Check AVR connections (possible AVR failure) ③ Field windings short-circuited ③ Rotating diodes burnt out ③ Main rotor winding short-circuited (check the resistance)
		Speed is too low	③ Increase the drive speed (do not adjust the AVR VOLT Regulator before running at the correct speed)
Voltage is too high	Adjust AVR Voltage Level Regulator	Adjustment ineffective	③ Fault of AVR
Voltage Fluctuation	Adjust AVR Voltage Stability Regulator	If ineffective	③ Check the speed: possibility of non-periodic fluctuation ③ Loose connections ③ Fault of AVR ③ Speed is too low on Load
Voltage is correct At no load and too low at on-Load	Run at No-Load and check the voltage between F+ and F- on AVR	DC Voltage between F+ and F-: <10V	③ Check the speed
		DC Voltage between F+ and F-: >15V	③ Fault of rotating diodes ③ Short-circuit in the main rotor windings; check the resistance ③ Fault of exciter armature; check the resistance
Voltage disappears during running	Check AVR、piezo-resistance 、Rotating diodes, and replace any defective parts。	The voltage doesn't return to the rated value	③ Exciter winding open circuited ③ Fault of exciter rotor ③ Fault of AVR ③ Main rotor open circuited or short circuited

4.5 Check voltage of remaining magnetism

Remove the cover of AVR and disconnect wires between F+ and F- when the generator set is stopped. The generator can work well if measured voltage is more than 5V . If the voltage is under 5v, please operate as follows:

Use DC 12V Battery. Connect the negative pole with F- terminal of AVR and positive pole with F+ terminal by a diodes (see the below picture).

Important! To avoid AVR damage, diode used must be the same as shown in the following picture.



- Picture 2 -

Important! The neutral line of main stator can't ground if magnetism is recharged it with storage battery.

Re-start the generating sets and record the output voltage of main stator. The voltage should be close to the rated voltage or the voltage of AVR input terminals is between 170V and 250V. Stop the generator and switch off the battery power between F+ and F-. Re-start the generating sets and the generator should run normally. The generator or AVR may have some problems if no voltage is built up. Please check winding, rotating diodes and AVR according to the procedure of disconnection test of exciter and winding.

4.6 Check windings and rotating diodes.

This procedure should be carried out under the following preconditions:

Disconnect leads of F+ and F- from AVR and supply power to the leads of F+ and F- by a 12V DC Battery.

Start up the generating sets and run at rated speed

The measured voltage of U,V,W is balanced and ranges between ± 10% of rated voltage.

The voltage of AVR AC200V terminals is between 170V and 250V.

Main exciting windings or diodes components may have some problems if voltage is balanced but too low. Please check according to the following steps:

Rotating diodes:

A multi-meter can be used to measure diodes on the main rectifier assembly.Disconnect all leads to terminals of diodes and measure backward and forward resistance.A good diode should have an extremely high (infinite) backward resistance and very low forward resistance.Damaged diode is 0 Ω or + ∞ both forward and backward when measured by multi-meter at 10000 Ω scale.A good diode measured by digital meters should have a very low reading and a very high reading at two directions.

Replace damaged diodes:

Rectifier assembly is equipped on two boards. It has positive pole and negative poleTwo boards of main rotor are connected with the assembly. Three diodes are located on each board. Negative pole board has negative offset diodes while positive pole board has positive offset diodes. Pay attention to polarity of diodes installed on corresponding board and make sure it is correct. When installing diodes on the board, make sure sound mechanical and electrical connections are in place and diodes are fixed firmly but not too tight. Recommended fastening torque is 4.06-4.74 Nm (36- 42lb in).

Surge suppresser:

Surge suppresser is a metal oxide resistance which is connected with diode through two commutated boards in order to avoid damage by instant backward voltage from windings.

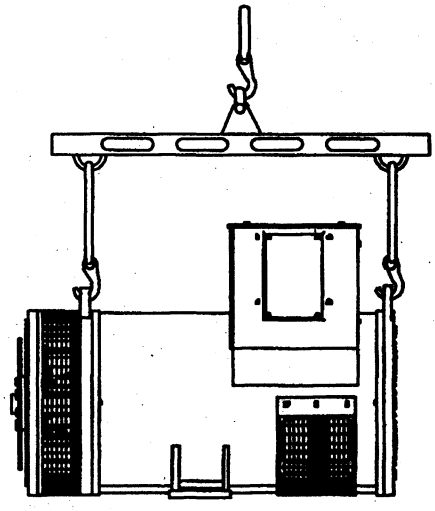
The suppresser does not have polarity. + ∞ will be indicated in both directions when tested by common ohmmeter. Any damage may be checked since it may lead to short circuit or there may be marks of crack. If it is damaged please replace it.

After adjusting and replacing the rectifier assembly, if the output voltage is still too low, please check the windings of main rotor, exciter stator and exciter rotor (see Table of Resistance) and one set of them must have some problems. Resistance of exciter stator can be measured from terminals of F+ and F-. The exciter rotor is connected with six bolts which are also the terminals of diode. The winding of main rotor is connected with two rectifier modules. Please disconnect relevant leads before you read the data.

4.7 Dismantlement &Reassembly

WARNING

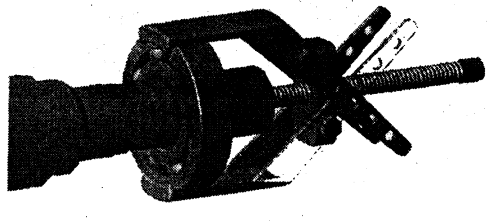
While being handled, the generator should remain horizontal (rotors should not be locked when moving the generator）.



- Picture 3 -

4.7.1 Replacement of NDE bearing on single bearing generators

Open the terminal box cover
Disconnect the exciter wires
Remove the bolts of NDE end-shields
Remove the NDE end-shields
Remove the ball bearing using a puller with a central screw（see picture below）
Fit the new bearing, after heating it by induction to approximately 80℃



- Picture 4 -

WARNING

When dismantling the generators, always change the bearings.

4.7.2 Replacement of DE bearing on two-bearing generators:

Remove the DE cover panel
Remove the DE flange
Remove the ball bearing using a puller with a central screw（see Picture 16）
Fit the new bearing, after heating it by induction to approximately 80℃.

WARNING

When dismantling the generators, always replace the bearings.

4. 7. 3 Complete dismantlement

Remove DE flange as described in section 4.7.2

Remove NDE shield following the instructions in section 4.7.1.

Lift DE of rotor with a strap or a support constructed .

4. 7. 4 End-shield Reassembly

Mount DE flange and NDE shield on the stator.

Tighten screws of DE flange and NDE shield.

Reconnect all the exciter wires

4. 7. 5 Rotor Reassembly

For single bearing generator:

Mount the rotor in the stator; Check if the generator is correctly assembled and that all screws are tightened.

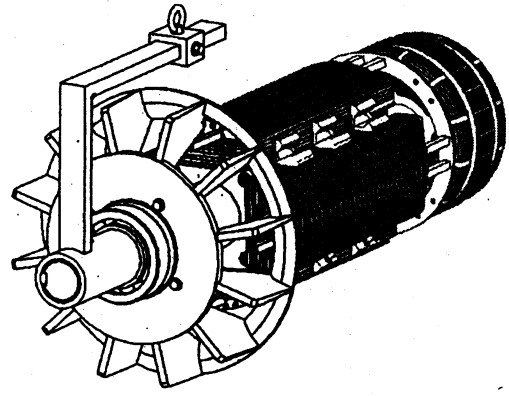
For double bearing generator:

Mount the rotor in the stator; Fix the end-shield on the stator and tighten screws; Check if the generator is correctly assembled and that all screws are tightened.

WARNING

The rotor must be rebalanced when it is dismantled, including changing parts or rewinding.

After operational testing, reassemble all access panels and covers.



- Picture 5 -

Chapter 5 Spare Parts

5.1 **Recommended spare parts:**

Spare parts as follows are recommended for service and maintenance. A set of such spare parts should be prepared for key applications: Rectifier Assembly and surge suppressor、AVR、Bearing.

Warranty of AC Generator

Warranty Period:

All Generators are warranted for 12 months from the notification date of awaiting delivery.

Fault after delivery:

For any product of our company, if it is correctly used yet fault still occurs during the warranty period and the fault is found, through our own test, to be completely caused by manufacturing or materials, we will either repair the product or replace it with a new one at our discretion. Customer should send, at his own cost, the defective parts, with product No. and labels kept intact, back to our authorized service center or our factory.

For all repaired and replaced parts in the warranty period, we will take them back at our own expense (transportation by sea will be used for international delivery).

We will not bear any expense caused by transporting and replacing the parts sent to us for testing or expense for installing replaced parts supplied by us. We have no obligation to bear the cost caused by incorrect mounting or storage that does not follow our " Mounting And Maintenance Manual", or any loss occurred from repairing maintenance and replacement by unauthorized staff. For third-party products or patented products that are supplied, but not manufactured by us, the warranty will be born by manufacturers involved (if any).

Any claim under this warranty must contain detailed explanation of fault, product description, purchase date, name and address of supplier and product serial No. (marked on nameplate of the manufacturer). In case spare parts are involved, order number of the parts is required.

Our decision on claim is final and conclusive. The end user should accept our decision on fault and replacement of parts.

We will fulfill all our responsibilities after the maintenance or replacement of above-mentioned parts. In any case, our liability will not exceed the current price of defective product.

This clause is a supplement of special warranty of quality and special conditions prescribed for AC generators. Apart from it, we have no responsibility for any fault or damage of the products we deliver or any possible losses (including direct or indirect losses caused by fault of the generator), no matter whether the responsibility is based on contract or tort or for other reasons.

Manufacturing No.	