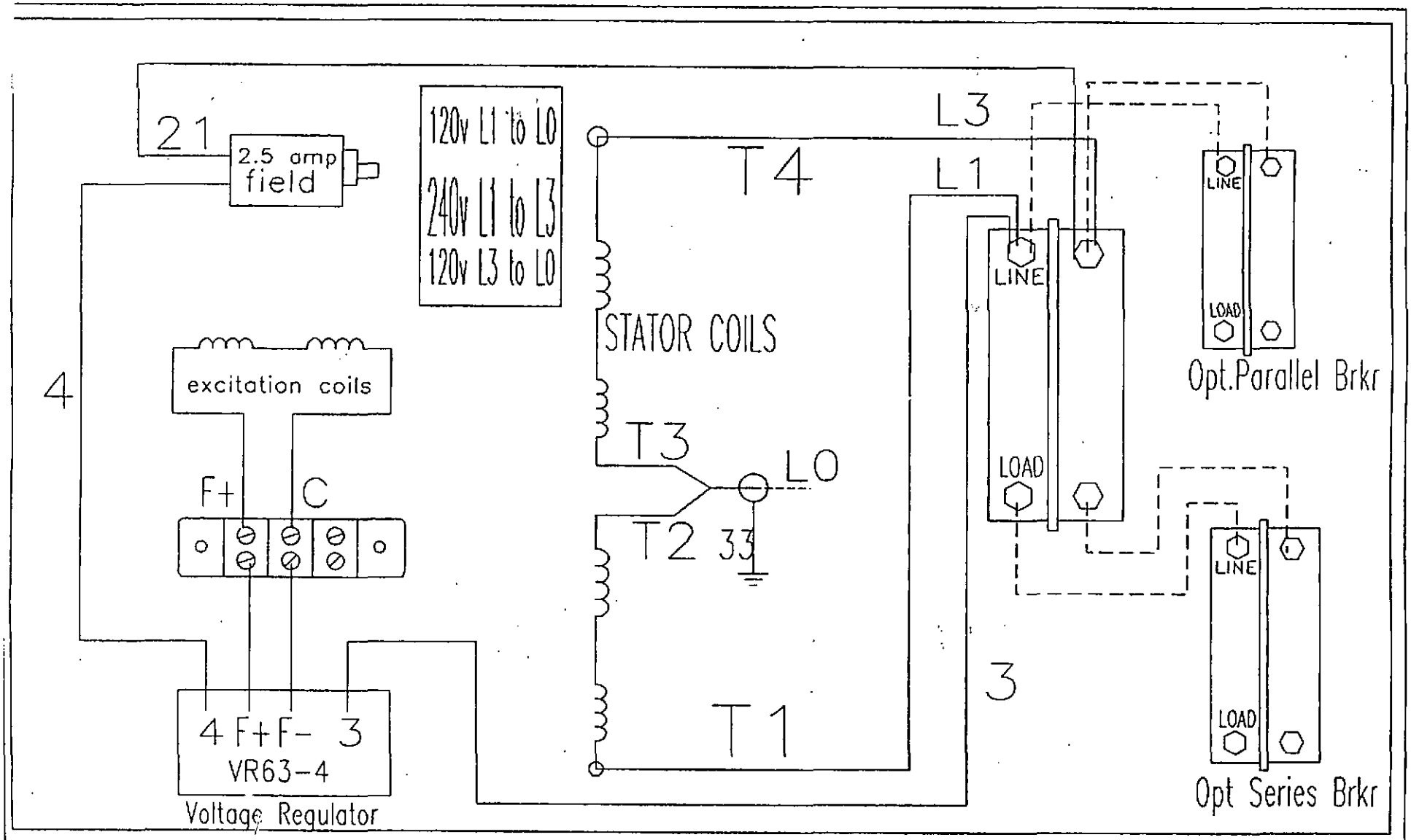
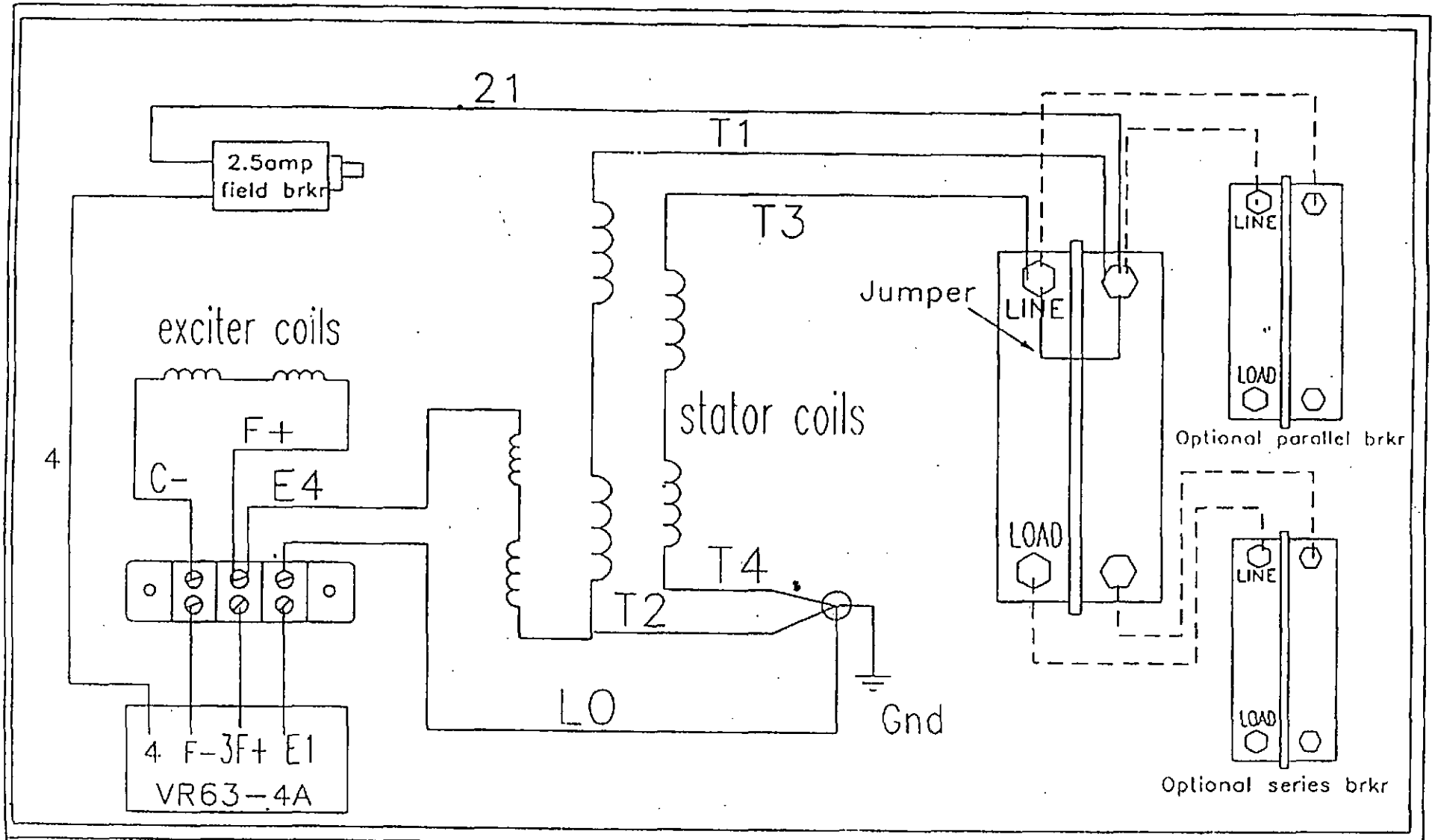


POWER TECHNOLOGY SOUTHEAST INC.	120/240 connection exciter generator	by J Fudge DATE 1\12\93



POWER TECHNOLOGY SOUTHEAST INC.	120v connection exciter type	by J Fudge DATE 1/11/93

PRINCIPLE OF OPERATION
The exciter pole pieces contain residual magnetism, setting up lines of force across the air gap to the exciter armature. When the exciter armature begins to rotate a voltage is induced and current flow is initiated in the exciter armature AC windings. This voltage is fed to the rotating rectifier assembly, rectified and fed to the alternator field coils. This DC voltage is sufficient to magnetize the laminated alternator field which will set up lines of force across the air gap to the alternator stator. As the generator rotor rotates a voltage will be induced and current will flow in the alternator stator windings and to the output circuit.

A static type voltage regulator is connected to the generator output. The regulator will rectify part of the output voltage to provide a DC voltage to the exciter field coils. This will increase the density of the lines of force in the exciter increasing the voltage induced into the exciter armature windings, and therefor, to the rotating rectifiers.

The rotating rectifier output will be increased which will increase the alternator field strength and the generator output will build up to its rated voltage.

Adjustment of the generator output to the rated voltage level is accomplished by controlling the current fed to the exciter field coils.

Regulation is automatic with the static type voltage regulator. An additional voltage adjustment range is provided if desired by operating the voltage adjust rheostat.

ROTATING FIELD ASSEMBLY (ROTOR)
The rotating field assembly consists basically of four members; the shaft assembly, the core assembly, field coil damper windings and balance lugs to provide a high degree of static and dynamic balance. The exciter rotor and rotting rectifier-hub assembly are separate units which are head shrunk onto the generator shaft.

CORE ASSEMBLY
The core assembly consists of once piece electrical steel laminations which are stacked on the shaft assembly.

FIELD COIL
Field coils of heavily insulated wire are "wet" wound directly onto the poles. Field coil leads are brought out to the rectifier assembly for connection to the source of DC excitation voltage.

SHAFT
Shaft is made of forged high strength steel, which is turned to close tolerance and then ground to a close tolerance.

FOR OPERATION AT AMBIENT TEMPERATURES ABOVE 40° C DERATE KW RATING 1 PERCENT FOR EACH DEGREE C. ABOVE 40° C. FOR OPERATION AT HIGH ALTITUDES ABOVE SEA LEVEL, RATINGS MUST BE DERATED 2 PERCENT FOR EACH 1000 FEET ABOVE SEA LEVEL

GENERAL DESCRIPTION
The revolving field type generators have a DC field revolving within a stationary AC winding called the stator. AC power is distributed from the generator through leads connected to the stator windings. There are no sliding contacts between the AC winding and the load, therefore, great amounts of power by be drawn from this generator.

VOLTAGE CONNECTIONS:
Generator may be connected at the terminal board to deliver 120/240 volts to a 3-wire grounded neutral system, or 120

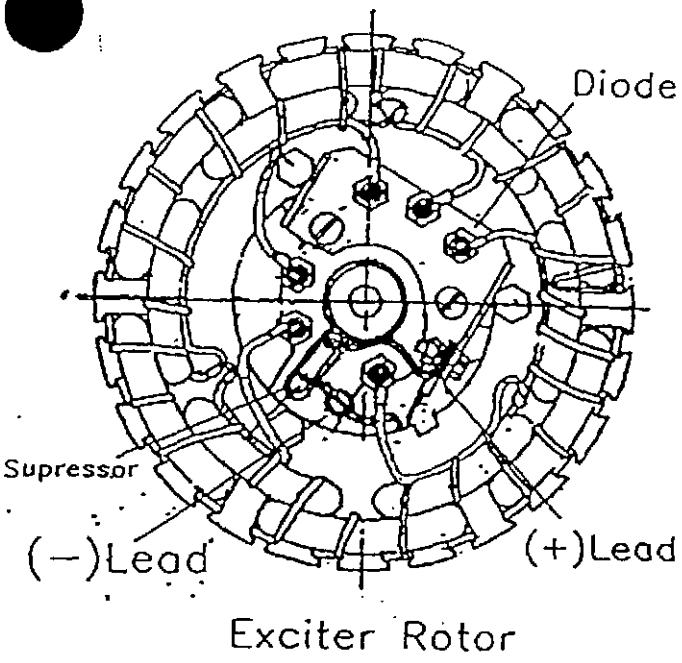


Figure 1

EXCITER FIELD
The exciter field on the high frequency exciter consists of laminated segments of high carbon steel which are fitted together to make up the field poles. the field coils are placed into the slots of the filed poles.

EXCITER FIELD COIL VOLTAGE SOURCE
Field coil DC voltage is obtained by rectifying the voltage from phase to neutral line of the generator output, or other appropriate terminal to provide the needed voltage reference.

The rectifier bridge is an integral part of the static regulator. The static regulator senses a change in the generator output and automatically regulates current flow in the exciter field coil circuit to increase or decrease the exciter field strength. An adjust rheostat sized to be compatible with the regulator is used to provide adjustment the regulator sensing circuit.

BALANCE
The rotor assembly is precision balanced to a high degree of static and dynamic balance. Balance is achieved with the balance lugs on the field pole tips. Although the balance will remain dynamically stable at speed in excess of the design frequencies, the prime mover should be adequately governed to prevent excessive overspeed. High centrifugal forces at excessive overspeed can damage the damper windings and field coils.

BEARING
The generator rotor assembly is suspended on shielded, factory lubricated ball bearings. They are greased for life and should not require regreasing.

STATOR ASSEMBLY
The stator assembly consists of laminations of steel mounted in a rolled steel frame. Random wound stator coils are fitted into the insulated slots.

STANDBY UNITS
Generators used as an auxiliary power source in case of commercial power failure must be isolated from the commercial line before being placed in operation.

CAUTION: MAKE SURE UNIT IS COMPLETELY SHUT DOWN AND FREE OF ANY POWER SOURCE BEFORE ATTEMPTING ANY REPAIR OR MAINTENANCE ON THE UNIT.

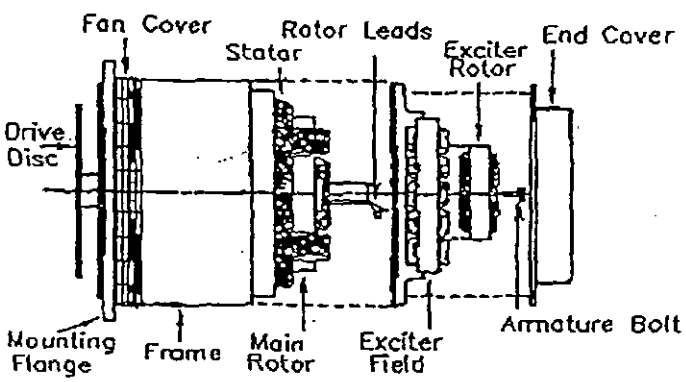


Figure 2

vice with the least expense; and more important, to determine the cause of the failure and take steps to prevent a recurrence.

PRECAUTIONS
GENERATOR WINDINGS (DRYING)
Generators that have been in transit or storage for long periods may be subjected to extreme temperatore and moisture changes. This can cause excessive condensation, and the generator windings should be thoroughly dried out before bringing the generator up to full nameplate voltage. If this precaution is not taken, serious damage to the generator can result. The following steps should be taken to effectively dry the generator windings:

1. Short circuit the generator lead wires. Start the generator and separately excite exciter with DC battery power of approximately 50 volts to produce rated AC nameplate current. To accomplish this excitation, the leads (F+ and C-) must be disconnected from the voltage regulator. Nameplate current can be measured with a clip-on ammeter at the generator leads. Make sure the AC current does not exceed the nameplate rating. Be sure to reconnect the leads F+ and C- to the proper terminals on voltage regulator after drying exercise.

2. Another procedure would be to put the generator in a hot room or to moderately heat with a heat source.

Experience has shown that it is necessary to take these precautions in locations such as seaboard installations and other highly humid areas. Some installations will be in atmospheres that are much more corrosive than others. A little precaution along the lines outlined here could eliminate an unnecessary repair job.

Each generator was subjected to a standard NEMA insulation test, which means 1000 volts plus twice the highest voltage for which the generator is rated was impressed between the windings and frame. All machines are insulated with a high safety factor for the class of insulation used. The latest and newest in insulation and baking techniques are used.

The finest insulation job can be very quickly broken down by carelessly applying high voltage to windings in a moisture saturated condition. Mishandling in this respect can easily cause a break-down, making it necessary to return the generator to the factory for repair, and consequent expense and loss of time.

WARNING: HIGH VOLTAGE (DIELECTRIC) TESTING MUST NOT BE PERFORMED TO THE MACHINE WITHOUT FIRST OBSERVING NEMA RULES. THE INSULATION OF THIS GENERATOR WINDING MAY BE SAFELY CHECKED BY USING A MEGGER. A HIGH MEGGER READING INDICATES LOW INSULATION LEAKAGE.

FIELD FLASHING
The direct current (DC) necessary to magnetize the alternator field is obtained from the exciter. Initially, upon starting the generator, current flow and voltage are induced into the exciter armature by the magnetic lines of force set up by the residual magnetism of the exciter field poles.

Residual magnetism of the exciter field poles may be lost or weakened by a momentary reversal of the field connection, a strong neutralizing magnetic field from any source, or if the generator is not operated for a long period of time.

To restore the small amount of residual

ernal causes AFTER THE CAUSE OF THE DIODE FAILURE IS IDENTIFIED AND CORRECTED.

TROUBLESHOOTING PROCEDURE AC BRUSHLESS GENERATOR

As with any machine, trouble may develop in electrical generators. It may be due to long service or neglect of regulator maintenance, servicing, and checking. Should trouble develop, the following instructions will be helpful in tracing the cause and making repairs.

Brushless generators are not complete units without added control equipment; therefore, reference will be made to control components.

VOLTAGE DEVIATIONS

The generator output voltage should be kept as close as possible to the rated age shown on the generator nameplate. gh voltage, low voltage and fluctuating voltage (hunting) may cause serious damage to the generator and its control equipment. A high voltage could damage sensitive equipment and low voltage could cause motors to burn out.

SPEED DEVIATION

The generator speed should be maintained at rated nameplate speed. The frequency of the generator output depends on speed. If the generator runs slower than rated speed, the voltage may drop off. Automatic control equipment may burn out trying to maintain voltage by forcing the field.

VISUAL EXAMINATION

The first step in investigating any generator failure or trouble should be to look for obvious evidence: burned areas, e or open connections, wrong speed, incorrect reassembly and reconnection, etc.

OBSERVE VOLTAGE OF DEFECTIVE GENERATOR

The next step is to carefully measure line-to-line voltage. A voltage about 10 percent of rated voltage (at rated RPM) is probably the residual voltage (determined by residual magnetism in exciter field). A normal residual voltage indicates exciter armature, rotor and stator are all good and that the trouble is probably in the excitation circuit. A very low voltage, or no voltage, indicates either that residual magnetism in the exciter field was lost (generallly by disassembly or by sudden interruption of the exciter field current), or that a generator defect exists in the exciter armature, rotor or stator.

BATTERY EXCITATION

The behaviour of the generator, when the exciter field is connected to a 12 volt battery for excitation current, is a useful guide for locating the generator fault. Disconnect F+ and C- from EVR and open CBI circuit breaker/switch in lead 3 or 4 to EVR (lead for power input to EVR). Connect F(+) to (+) of battery. Connect (-) of battery to C(-). Spin generator 1800 RPM.

A. If residual voltage is normal, 12 volts across lead F+ and C- should cause the generator to deliver a voltage near rated voltage with no load. If 12 volt excitation produces near normal voltage, failure of voltage regulator to provide voltage could mean a defective voltage regulator, or an open circuit in leads to terminals 3 or 4 of electronic regulator. Check switch or circuit breaker in these leads. With 12 volt excitation, connect voltmeter across terminals 3 and 4. Voltage should be 200 to 240 volts with CBI closed.

B. If 12 volt excitation produces no voltage, check exicter field resistance. It should normally be 25-28 OHMs at 77°F. If field is open or shorted, then the exciter field is defective. An open or short in the main rotor behaves similarly, but is also accompanied by a very low line-to-line voltage (residual voltage) without 12 volt battery excitation. If open or shorted rotors suspected, remove "R" lead from #10 base terminal on armature and measure resistance since "Q" lead is

or a short to ground before a fault can be positively identified. Also test each diode separately (-) to each AC terminal, and case to each AC terminal to positively identify which diode is bad. (See Figure 4).

c. Armature with two FULL-WAVE bridge rectifiers.

On some generator models an armature will be supplied with two full-wave bridge rectifiers very similar to the rectifiers used on armatures with one 3-phase FW rectifier.

To test these rectifiers, remove the two rectifier (-) leads at the R (rotor) + terminal and test each rectifier separately, first from + lead (rectifier #10 to any AC terminal, then case to any AC terminal. Then go to rectifier # 2 and test + to any AC terminal, then case to any AC terminal. A failure in the test "case to any AC terminal" could be as bad diode in either FW bridge rectifier. To determine which diode is bad, all AC terminals must be disconnected and each AC terminal of the rectifier tested to both + and to - (case) of that bridge rectifier.

VOLTAGE SUPPRESSOR

Voltage suppressor are similar to rectifiers in that they contain in effect a single semiconductor one-way junction. A suppressor should have a high resistance with one polarity of test leads and low but not zero resistance in the opposite direction. Resistance measurements sometimes fail to identify a defective suppressor. The best test is to remove suppressor from circuit. If an obvious improvement in generator is observed, suppressor is bad. Some suppressor have a high resistance in either polarity of applied voltage (if applied voltage is low), but have a low resistance of voltages of 300 to 450 volts.

RESISTANCE OF WINDINGS

Frequently in troubleshooting a generator, a defective component can be identified by measuring the resistance of a winding.

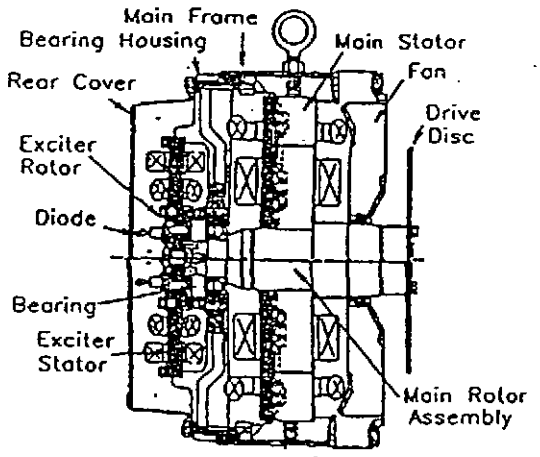
Exciter field, armature, rotor and stator should withstand 1500 volts between winding and ground with less than 0.002 ampere of current between winding and ground. All electronic components such as rectifiers, suppressor and resistors must be disconnected.

GENERATOR RESISTANCE VALUES

Armature: .470-.520 OHMs per phase, 5 -10KW
.650-.720 OHMs per phase, 12.5 - 50KW
Field: 18 - 22 OHMs 5 - 10KW
23 - 28 OHMs 12.5 - 50KW
Stator: OHMs vary with KW rating, but less than 1.0 OHM per phase.

ROTOR:

KWs	8	10	12.5	15	17.5	20	25	30 to 50
OHMs	1.47	1.58	1.73	1.84	2.00	2.1	2.2	2.5 to 3.8



Exciter Type Generator

Figure 4

NO VOLTAGE

CAUSE	CHECK AND REMEDY
Open circuit in exciter field.	Check out continuity of field coils. If open in field coils, remove field assembly and return assembly to factory for repair.
Loss of residual magnetism in exciter field poles.	Flash field by making a flash connection of DC across terminals C- to F + to positive lead of DC source. (See previous instructions).
Open in stator windings.	Check for continuity in windings. Return to factory for repair of open.
*Open in rotating rectifiers.	Check rectifiers per previous instructions, replace if faulty.
Malfunction of automatic voltage regulator.	See troubleshooting of voltage regulator, replace if faulty.
Short circuited.	Clear lead to restore build-up.
*Open in generator field.	Check for continuity and return rotor to factory for repair if field coils are open.
*Shorted rotating rectifiers.	Check for shorts and replace if faulty.
*Shorted exciter armature.	Check for short and replace if faulty. Measure resistance.
*Shorted leads between exciter armature and generator field.	Test and Repair

NOTE: *Designates rotating parts. Generator must be open to test.

FLUCTUATING VOLTAGE

(May be indicated by flickering lights)

CAUSE	CHECK AND REMEDY
Irregular speed of engine.	Check engine for malfunction or load for fluctuation.
Fluctuating speed.	Stabilize load. The addition of a lamp load (resistance load) may conpensate partially for laoad changes caused by intermittent motor operation. Do not overload.
Loose terminal or load connections.	Make better connection mechanically and electronically.
Voltage reulator unstable.	Check regulator. Replace if faulty.
Intermittent short in generator exciter field.	Test field coils for possible short by cheking resistance with an ohmmeter. Return assembly to factory for repair if field coil is shorted.

HIGH VOLTAGE

Excessive speed.	Check engine for malfunction.
Voltage regulator defective.	See troubleshooting for voltage regulator. Replace if necessary.

GENERATOR FRAME PRODUCES SHOCK WHEN TOUCHED

CAUSE	CHECK AND REMEDY
Static charge.	Ground generator frame.
Grounded armature or field coil.	Return to factory for repair.