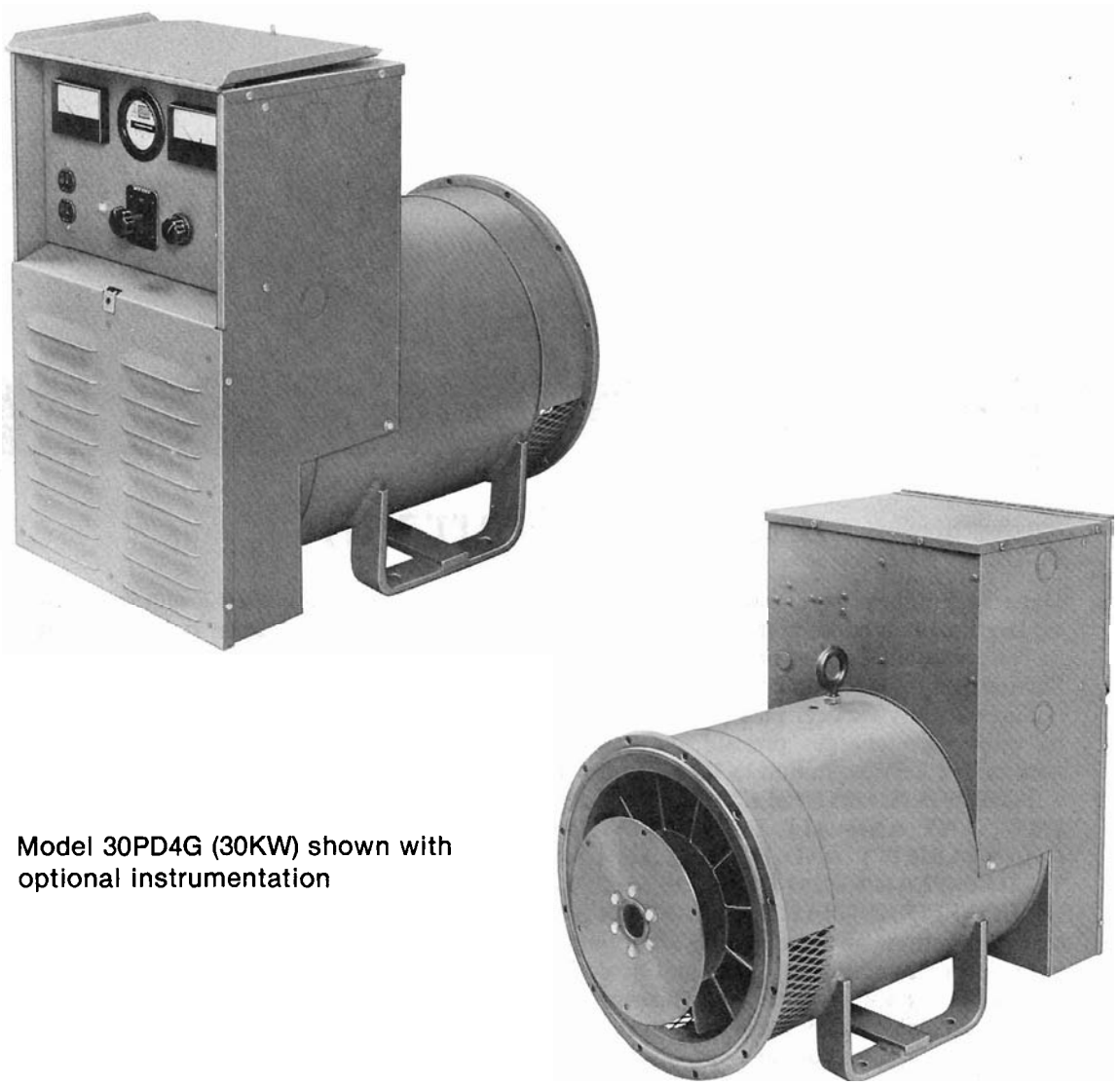
DYNA

# GENERATORS TYPE "XTR" EXTERNALLY REGULATED

## SERVICE INFORMATION, ASSEMBLY and OPERATING INSTRUCTIONS



Model 30PD4G (30KW) shown with optional instrumentation

DOM-74-1

DYNA

*Manufactured by*
***DYNA TECHNOLOGY, INC.*** *Minneapolis, MN 55420*

IM-D79

## Index



# Limited Warranty

Dyna Technology, Inc., warrants that for one year from date of shipment it will repair or replace for the original user the whole or any part of the product found upon examination at its factory at 225 South Cordova Street, LeCenter, Minnesota, or by any Factory-Authorized Service Station to be defective in material or workmanship under normal use and service.

For warranty service, please return the product within one year from date of shipment, transportation charges prepaid, to the LeCenter factory or to your nearest Factory-Authorized Service Station as listed in the 'Yellow Pages' under Generator-Electric.

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# General Information

### Description and Features

The XTR generator is a brushless, rotating field type generator. It provides 12-lead broad range connections for three phase, 60 Hertz voltages up to 480 volts. The generator can be used for 50 Hertz operation at 5/6 of the three phase 60 Hertz rating and single phase at 2/3 of the three phase rating. Special models are available up to 600 volts. XTR units require an external voltage regulator, such as the optional Basler KR4F, which can provide ±1% voltage regulation from no load to full generator load.

All models meet CSA, IEEE and NEMA standards and have Class F insulation. Rotors are wet wound with fungus proof, thixotropic single component epoxy and then assembled and baked for permanent, rattle-free performance. All units are dynamically balanced during manufacture. Each generator is equipped with an outboard mounted, single coil Lundell exciter, which can be disassembled in a single piece to greatly simplify servicing. The exciter armature is also easily removable, fully exposing the heavy-duty rotor bearing.

All XTR generators are drip proof and come with an end mounted, weather protected control box having knockouts on both sides. The top and vertical front panels are easy to remove and allow complete access to generator for reconnection, testing, or maintenance. The recessed control panel is available blank or can be ordered with a variety of instrumentation.

### Generator Side View

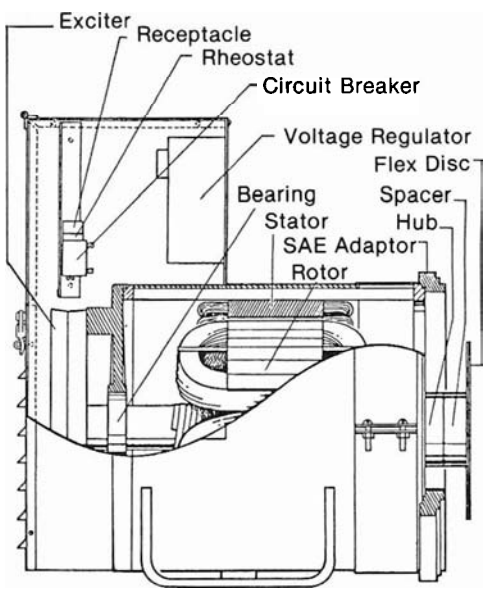



*Figure 1*

### Safety Information

CAUTION: Possible damage to equipment

**CAUTION**

Caution notes indicate any condition or practice, which if not strictly observed or remedied, could result in damage or destruction of the equipment.

WARNING: Personal danger

Warning notes indicate any condition or practice, which if not strictly observed, could result in personal injury or possible loss of life.

### General Safety

1. Avoid contact with live terminals or receptacles.
2. Use extreme caution if operating this unit in rain or snow.
3. Do not make or break receptacle connections under load.
4. Use only grounded receptacles and extension cords.
5. Properly ground the engine-generator set.
6. All drive systems should be provided with safety guards.
7. Keep all guards and shields in place and securely fastened.
8. Provide adequate ventilation and ducting of exhaust gas.
9. Wear hearing protection as needed.
10. Remove oily rags and any other material that may create a fire hazard.

While each generator is built to the highest standards of safety, improper operation, negligent maintenance or carelessness can result in serious personal injury or death. All operation, maintenance and safety instructions should be followed carefully. It is recommended that all service on this generator be performed only by qualified personnel. Install only factory approved replacement parts.

### Unpacking and Inspection

Before accepting shipment from the transportation company, carefully inspect the crating to determine if any damage has occurred during transit. If damage is noted, have the representative of the transportation company write the nature of the damage on the freight bill so that a claim may be filed later if necessary.

Unpack the unit and lift it from the crating by the eyebolt provided. Carefully inspect the generator externally for any obvious damage

which could have occurred in transit. If damage is noted, contact the transportation company immediately and give complete and accurate details of the nature of the damage.

If the generator is to be stored for a period of the time before use, it should be replaced in the crating after inspection and stored in a clean, dry area. If high humidity conditions prevail, place desiccant bags inside the control box. Tag the unit to insure that desiccant bags are removed before use.

**Drive Requirements**

The standard 60 Hertz generator is designed to operate in the 1800 RPM range. When determining the engine size, bear in mind that the power rating of the engine varies with its RPM and that it must maintain a nearly constant drive speed for the generator. Approximately 1.6 to 2.0 horsepower, based on engine rating and design, should be allowed for every 1000 watts of generator capacity.

Since all engines have a tendency to slow down when a load is applied, the governor on the engine must be sensitive enough to hold the speed constant within 5%. Variations in speed affect not only the level but also the frequency of the output voltage. Slight frequency variation has no appreciable effect on motors, lights and most appliances, but electronic equipment and clocks will be affected unless the generator is turning at exactly 1800 RPM.

**Preparation for Use**

Although the generator has been carefully inspected and tested before leaving the factory, it is recommended that the unit be thoroughly inspected before use. Mechanical and electrical soundness of all terminal connections should be inspected and all bolts and fasteners checked for tightness. Remove all packing material, blocks and skids used to prevent vibration and movement during shipment.

## *Assembly and Installation*

**Hardware**

A single bearing generator is ordered to match a particular SAE housing, flywheel size and offset, depending upon the type, size and brand of engine. The generator will come equipped with all necessary mating adaptors and drive discs to assemble the engine and generator into a single unit. However, certain small hardware, such as common bolts and washers, are not provided. All bolts should be at least SAE grade five and lock washers and/or locking compound must be used in all applications.

**Assembly Instructions**

NOTE: Prior to assembly insure dimensions A, B, and G in Figure 2 are correctly matched.

All lifting equipment must be of sufficient capacity to handle the combined engine-generator weight. Never position hands, feet, etc. under suspended units. Do not use the generator lifting eye to handle the entire engine-generator set.

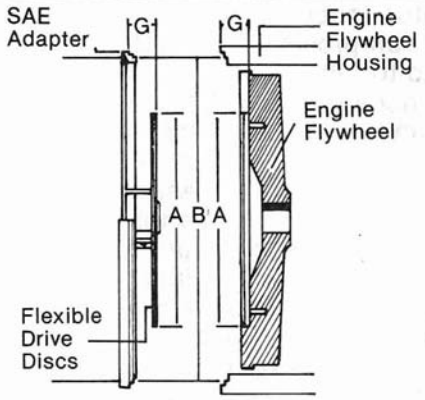



*Figure 2*
**SAE Adapter Sketch**

It is suggested that assembly take place on a solidly supported surface. The following general assembly procedures may be used on most engine-generator combinations. Units may be assembled directly upon a trailer bed.

1. Loosen or remove the two retaining bolts and slide back or remove generator sheet metal impeller cover.
2. Rotate engine flywheel so that one flywheel bolthole is in the 12 o'clock position.
3. Make a locating pin by cutting the head from a 1" bolt of the correct type. Grind the shank to a slight taper and cut a slot in the end.
4. Thread the locating pin ¼" into the top flywheel bolt hole.

**CAUTION** To avoid rubbing the rotor against the stator on single bearing units, lift the drive end of the rotor when turning.

5. Rotate the generator drive disc and rotor so that one bolt hole is in the 12 o'clock position.
6. Using the locating pin as a guide, bring the engine and generator together.

**CAUTION** The rotor should be raised slightly for the drive discs to enter the inset in the flywheel. Exercise caution to avoid bending the drive discs.

7. Assemble the generator to the engine and the drive discs to the flywheel. Use new lock washers and/or thread locking compound and torque uniformly. Use SAE torque specifications for the SAE bolt grade and size used. *Refer to Table 1.* On some applications it may be necessary to use a universal socket to tighten the flywheel bolts.
8. Bolt engine-generator set to base and shim as required to distribute the load evenly.

**CAUTION** Be sure to remove the locating pin and replace with a bolt and lockwasher.

***Table 1***
**Capscrew Torque Values**

| Capscrew Diameter and Ultimate Tensile Strength (PSI)[4] | To ¾—120,000 PSI<br>To 1—115,000 PSI | | |
|---|---|---|---|
| SAE Grade Number | 5 | | |
| Capscrew Head Markings | | | |
| Capscrew Body Size (Inches)—(Thread) | Torque Ft-Lb (N-m) | | |
| | Dry[1] | Oiled[2] | Plated[3] |
| 1/4-20 | 8 (11) | 7 (9) | 6 (8) |
| -28 | 10 (14) | 9 (12) | 8 (11) |
| 5/16-18 | 17 (23) | 15 (20) | 14 (19) |
| -24 | 19 (26) | 17 (23) | 15 (20) |
| 3/8-16 | 31 (42) | 28 (38) | 25 (34) |
| -24 | 35 (47) | 32 (43) | 28 (38) |
| 7/16-14 | 49 (66) | 44 (60) | 39 (53) |
| -20 | 55 (75) | 50 (68) | 44 (60) |
| 1/2-13 | 75 (102) | 68 (92) | 60 (81) |
| -20 | 85 (115) | 77 (104) | 68 (92) |
| 9/16-12 | 110 (149) | 99 (134) | 88 (119) |
| -18 | 120 (163) | 108 (146) | 96 (130) |
| 5/8-11 | 150 (203) | 135 (183) | 120 (163) |
| -18 | 170 (230) | 153 (207) | 136 (184) |
| 3/4-10 | 270 (366) | 243 (329) | 216 (203) |
| -16 | 295 (400) | 266 (361) | 236 (320) |
| 7/8-9 | 395 (535) | 356 (483) | 316 (428) |
| -14 | 435 (590) | 392 (531) | 348 (172) |
| 1-8 | 590 (800) | 531 (720) | 472 (640) |
| -14 | 660 (895) | 594 (805) | 528 (746) |

NOTES:
1. Based on use of clean, dry threads.
2. Torque reduced by 10% when engine oil is used as a lubricant.
3. Torque reduced by 20% if new plated capscrews are used.
4. Capscrews threaded into aluminum may required reductions in torque of 30% or more.

**Start-Up Procedures**
This manual is intended to cover only the generator—not the engine or drive motor. Refer to the engine manufacturer's operation and maintenance manuals for any problems pertaining to the engine or its performance. Before starting any engine, be sure to fill the crankcase with the proper grade and weight of motor oil and the coolant system with anti-freeze. Use the proper grade of fuel and take every precaution to prevent dirt from entering the fuel system. Always use an adequate battery in a fully charged condition.

When the engine-generator set is assembled and the engine is prepared for use, the following procedure is suggested for first time start-up.

1. Insure the engine-generator set is firmly anchored and the generator impeller cover and all guards are in place.
2. Turn all electrical circuit breakers to the "off" position.
3. Turn the generator Field Circuit Breaker to the "off" position.
4. Start the drive motor or engine.

Exhaust must be vented to the outside to prevent dangerous build-up of carbon monoxide gas.

5. Turn on the generator Field Circuit Breaker and set the voltage with the Voltage Adjust rheostat. If the generator output voltage does not build up, refer to the Maintenance Procedures, "Flashing the Exciter Field."
6. Adjust the engine governor to provide 61.5 Hertz at a no load condition.

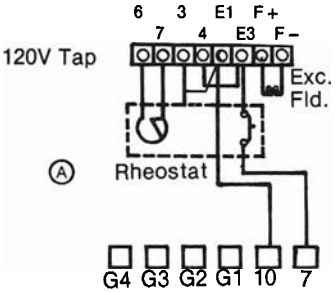
## *Preventive Maintenance*

Timely preventive maintenance can keep costly repairs and generator down-time to a minimum. Compliance with the following list will insure long life for your generator.

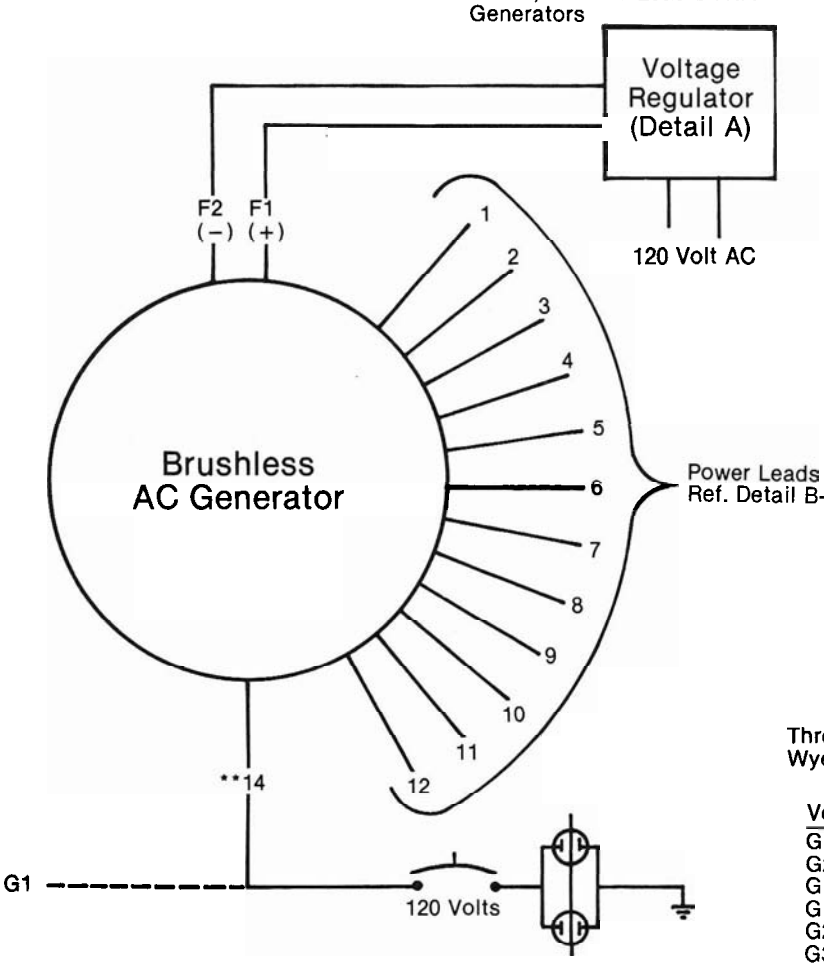
1. Adequate cooling air is very important for long life and correct operation of the generator. Check regularly to insure that air intakes and vents are clear of any obstruction.
2. As a precaution against moisture and dust collecting in the generator and to keep the engine properly lubricated, the engine-generator set should be operated at least once a week. Engine-generator exercising may be required more frequently in areas of high humidity or blowing sand.
3. Check drive components and generator regularly for loose nuts, bolts and fasteners.
4. The bearings used are factory lubricated and double sealed and require no maintenance under normal conditions. Bearings should be checked if the generator is disassembled for other maintenance and should be replaced if worn.

## Generator and Voltage Regulator Lead Connections

The electrical connections should be made using the diagram below.



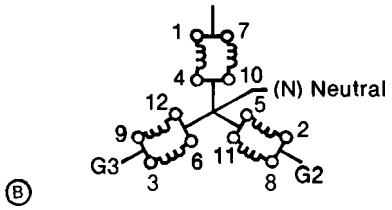

Voltage Regulator Connection For All 3 Phase 8 Single Phase, 12 or 13 Lead DYNA Generators

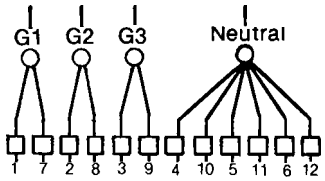



** Shown connected for-18 277/480 Volt
--- Disconnect wire #14 and Cap. connect circuit breaker to G1 on all other voltage combinations.
* The connection is specified in the model number.

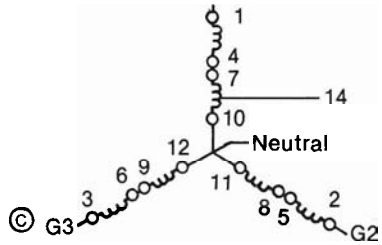
Example: A35CS-4/BLP

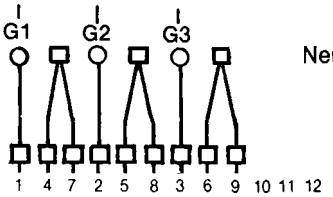
- Insulated connection
- Output connection
- Neutral connection




Three Phase 120/208 or 139/240 Volts at 60 Hertz Wye (Star) Connection (–4 Conn.*)

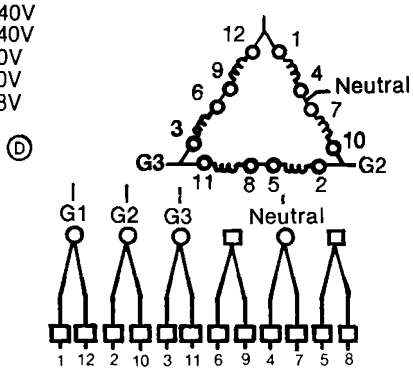



Three Phase 240/416 or 277/480 volts at 60 Hertz Wye (Star) Connection (–18 Conn*)

Volts at 60 Hertz

G1-G2 = 240V
G2-G3 = 240V
G1-G3 = 240V
G1-N = 120V
G2-N = 120V
G3-N = 208V




Three Phase 120/240 Volts at 60 Hertz Delta Connection (–17 Conn*)

## Operation

Unlike the conventional or rotating armature type generator which picks the output voltage from the armature slip rings through brushes, the brushless, rotating field type generator's output voltage is produced in the stationary windings.

The brushless, rotating field generator consists of a stator, rotor, rectifier assembly, and an exciter generator. The exciter generator is made up of a stationary field coil of the Lundell type and a rotating armature which produces the AC excitation voltage. This voltage is rectified in the rotating rectifier assembly. The rectified voltage is applied to the rotor field windings setting up an electromagnetic field. When this rotating electromagnetic field cuts the stationary windings (stator) current is produced. The voltage to the stationary exciter field coil is controlled externally by an electronic voltage regulator. The sensing voltage for this regulation is taken from the generator stator windings.

**Simplified Schematic**

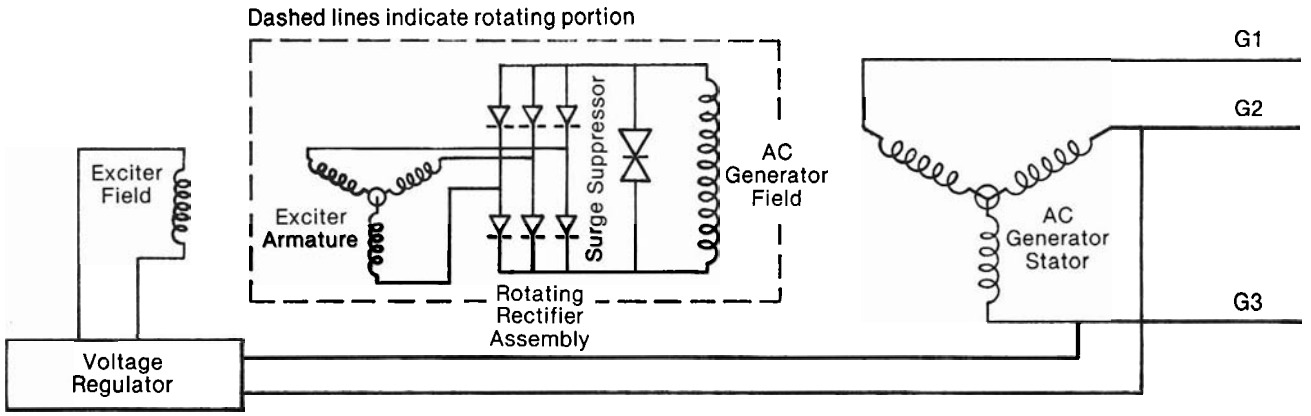



*Figure 3*

## Trouble Shooting

As with any machine, trouble can develop in engine-generator sets and their associated control equipment. The following trouble shooting chart lists various symptoms of poor generator operation as well as possible causes and what corrective action can be taken. Engine-generator sets are under continuous vibration while running; therefore, it is advisable to check for loose wires or connectors whenever the generator control box is opened.

The following minimum test equipment should be on hand for field trouble shooting and maintenance. (See the section on test procedures when the problem area is pin-pointed.)

1. Volt-ohmmeter—20,000 ohms per volt
2. Frequency Meter—58 to 62 Hertz (cycles per second)
3. Clamp-on Ammeter—0 to 100 ampere range

The trouble shooting chart lists the following malfunctions and their possible causes and corrections.

1. No Output Voltage
2. Low Output Voltage
3. High Output Voltage
4. Fluctuating Voltage
5. Generator Overheating
6. Generator Noise and Vibration

## *Trouble Shooting Table*

| Symptom | Possible Cause | Correction |
|---|---|---|
| No output voltage | Load circuit breaker open | Reset/Replace |
| | Field circuit breaker open | Reset/Replace |
| | Voltage adjust rheostat dirty | Rotate knob back and forth, then reset. Test/Replace |
| | Loss of initial exciter residual magnetism | Flash the exciter field |
| | Loose or shorted wires in control box | Check all wiring and repair as needed |
| | Defective electronic voltage regulator | Carefully follow test procedure. Replace |
| | Defective rectifier | Carefully follow test procedure. Replace |
| | Shorted or open exciter field coil | Measure exciter field coil resistance for open or short. Replace |
| | Shorted or open exciter armature | Measure exciter armature resistance for open or short. Replace |
| | Shorted or open rotor | Measure rotor resistance for open or short. Replace |
| | Shorted or open stator | Measure stator resistance for open or short. Replace |
| Low output voltage | Engine speed too low | Check no load engine speed with a frequency meter and adjust governor to give 61.5 Hertz |
| | Generator overloaded | Calculate load being run and compare with name plate rating. With 3-phase generators, the load on each leg should be as evenly balanced as possible and should not exceed the rated current on any leg. |
| | Defective electronic voltage regulator | Carefully follow test procedure. Replace |
| | Defective rotating rectifier | Carefully follow test procedure. Replace |
| | Defective rotor winding | Measure resistance between rotor leads and compare with the unit's Technical Data Sheet. Replace |
| | Defective stator winding | Measure resistance between stator leads and compare with the unit's Technical Data Sheet. Replace |
| High output voltage | Engine speed too high | Check no load engine speed with a frequency meter and adjust governor to give 61.5 Hertz |
| | Defective electronic voltage regulator | Carefully follow test procedure. Replace |
| Fluctuating voltage | Erratic engine speed | Refer to the engine manufacturer's maintenance manual |
| | Loose terminal or load connection | Make better mechanical and electrical connection |
| | Voltage regulation unstable | Carefully follow electronic voltage regulator test procedure. Replace |
| | Intermittent short in exciter field coil | Measure exciter field coil resistance for short. Replace |
| Generator overheating | Air vents obstructed | Clear obstruction |
| | Inadequate ventilation | Provide adequate compartment ventilation. Provide a fresh air inlet duct. |
| | High intake air temperature | Improve ventilation. Allow at least two feet clearance around generator. |
| | Generator overloaded or unbalanced | Calculate load being run and compare with name plate rating. With three-phase generators, the load on each leg should be as evenly balanced as possible and should not exceed the rated current on any leg. |
| | Shorted turns in either rotor or stator | Measure rotor and stator resistance for short. Replace |
| Generator noisy and/or vibrates | Loose sheetmetal | Check hold-down fasteners. Tighten |
| | Rotor or impeller rubbing | Repair or replace defective part |
| | Bearing defective | Replace bearing |
| | Rotor unbalanced | The rotor should have small balancing washers or bars attached at one or both ends. If these are missing, contact the distributor. |
| | Drive engine unbalanced | Refer to the engine manufacturer's maintenance manual |

## *Testing Procedures*

Test procedures should be carefully followed when it has been learned from the Trouble Shooting Chart that symptoms point to a particular problem area. It should be noted that most maintenance and testing will require removal of the control box top and/or the louvered front cover.

> High voltage test equipment should not be used. All tests should be conducted using a volt-ohm meter.

**Exciter Assembly**

1. **Testing the Exciter Field:** The exciter field is checked for shorts and opens. Disconnect exciter field leads F1 and F2 from the voltage regulator. The resistance between F1 and F2 should be about 25 ohms. Resistance between either F1 or F2 and ground should be infinite. Replace the exciter field coil and ring assembly if resistance readings are incorrect.
2. **Separate Excitation of the Exciter Field:** Disconnect the F1 (positive) and F2 (negative) leads from the voltage regulator. Connect a 12 volt DC power source with Off/On switch in series with the F2 exciter field lead. Maintain polarity of positive to F1 and negative to F2.

> **CAUTION** Insulate connections so they cannot short against other components or against the control box itself.

Restart the unit and close the switch to the 12 volt DC power source. Voltage should build up with near normal voltage being measured at output terminals. If voltage builds to the correct level, continue to "tests of the electronic voltage regulator." If voltage does not build, continue to the next test.

3. **Testing the Exciter Armature:** The exciter armature is checked for shorts and opens. Disconnect the three exciter armature leads from the rotating rectifiers. Connect an ohmmeter lead to one lead of the armature and the other ohmmeter lead to each of the remaining armature leads in turn. The resistance measured should be too small to read on most test equipment. Resistance between each exciter armature lead and the rotor shaft should be infinite.
4. **Testing Rotating Rectifiers and Surge Suppressors:** *See Figure 4.* Disconnect the positive lead and one AC lead from the rectifier to be tested. Mark if necessary for identification. Place one ohmmeter lead on the positive terminal and the other lead on each AC terminal in turn. These readings should be the same whether high or low. Reverse the ohmmeter leads and repeat the test. These readings should be opposite. Repeat these tests between the negative terminal and each AC terminal in turn. If resistance readings are incorrect, replace the rectifier.

The surge suppressor is tested in like manner. Set volt-ohmmeter to RX 10,000. Disconnect the two field leads, marking if necessary to identify which is positive and which negative. Disconnect the negative (-) leads from the two rotating rectifiers. Place an ohmmeter lead on each end of the surge suppressor and then reverse the leads. Readings should be infinite one direction, and a high resistance the other direction. If resistance readings are incorrect, replace the surge suppressor.

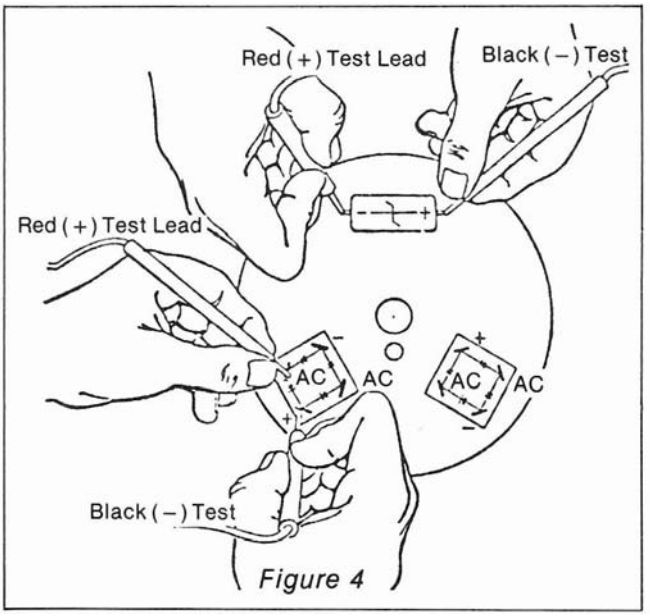


*Figure 4*

**Testing the Rotor**

1. Disconnect both rotor leads. These are connected to the surge suppressor on the rotating rectifier assembly. Measure the resistance between leads. The resistance should measure approximately 2.5 to 5 ohms. If the reading is correct, connect one ohmmeter lead to the rotor shaft and the other ohmmeter lead to one of the rotor leads. The reading should show infinite resistance. If the rotor proves to be defective, it must be returned to the factory for repair or replacement. Do not rewind.

**Voltage Regulator (Optional KR4F/KR4FF)**

1. Testing for Sensing Voltage: Measure the voltage between output leads 7 and 10. The voltage should be approximately 125 volts AC.
2. Regulator Voltage Output to Exciter: Using a voltmeter set to read at least 25 volts DC, connect the positive lead to F1 and the negative lead to F2. The reading should be between 10 and 20 volts DC at no load.
3. Consult voltage regulator instruction manual for testing, trouble shooting and adjustment procedures.

**Testing the Stator**

1. To test the stator for opens and shorts, the windings must be isolated.

> **CAUTION** Mark all leads for correct reconnection.

Disconnect the load leads from G1, G2, and G3. Disconnect the neutral leads. Disconnect the voltage regulator voltage sensing leads. Using a volt/ohmmeter, test the coil groups for continuity, and shorts to ground. If the stator proves defective it must be returned to the factory for repair or replacement.

**Flashing the Field**

1. Disconnect the F1 (positive) and F2 (negative) leads from the electronic voltage regulator. Connect a 12 volt DC power source across the exciter field leads for 1-3 seconds. Battery positive must go to F1 (positive) lead and negative to F2 (negative) lead. Touch F1 lead to F2 lead to neutralize any stored charge. Reconnect F1 and F2 exciter field leads to the electronic voltage regulator. Be careful to maintain F1 to positive and F2 to negative.

**Testing Policy**

Before any generator is shipped from the factory, it is fully checked for performance. The generator is loaded to its full capacity, and the voltage, current, and frequency are carefully checked. A test card with this data is filed by unit serial number for permanent record of performance.

Rated output of generators is based on factory tests of typical units, and is subject to, and limited by, the temperature, altitude, fuel, and other conditions specified by the manufacturer of the applicable engines.

> NOTE: This instruction book covers only the generator, **not** the engine. See the engine manufacturer's operator's manual regarding any problems pertaining to the engine.

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