

TROUBLESHOOTING AND SERVICE INFORMATION FOR VOLTMASTER GENERATORS

All troubleshooting and service information is offered for the use of authorized Voltmaster service stations. Repairing Generators is not a "Do it Yourself" task. Exposed electrical wires and rotating parts present a danger for personal injury or death. Always wear safety glasses when servicing the generator and or battery. Only qualified electricians and/or authorized service stations are authorized to service these units.

SUGGESTED REPAIR PROCEDURES FOR A,LA,LV,LR, AB, AR, AE, G,V AND VX SERIES GENERATORS

1. Check engine speed (3690 RPM no load) and frequency 61.5 hertz no load. Important on models A25/40, 3720 RPM and 62 hertz no load.

2. Open end cover with receptacles exposed. See figure 1. Check lead wires 1,2,3 & 4 according to the resistance chart as follows:

Lead wires 1 (black) to lead 2 (white)

Lead wires 3 (white) to lead 4 (black)

Orange to orange (exciter) Disconnect the red wires to the capacitor before checking the resistance in the wires.

Important On some models, lead wire 2(white) and 3 (white) are connected together. See figure 2. To test the stator lead wires and leads 1,2,3 and 4 must not be connected together. See figure 3. When checking lead wires, leads 2 and 3 are connected together (except A25/30) at the factory. You must disconnect these leads when testing resistance of the various coils or you will get incorrect readings.

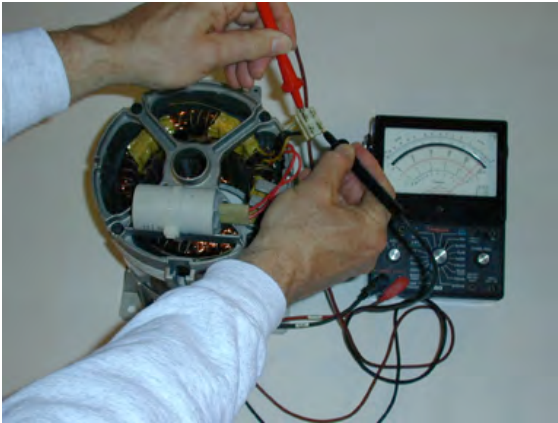


Figure 1

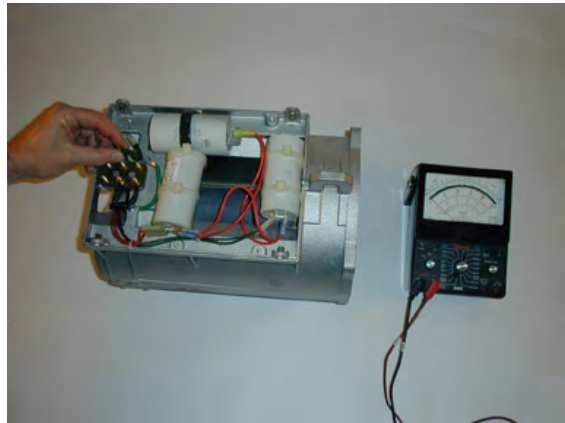


Figure 2



Figure 3



Figure 4

In addition to checking each coil, test each coil to the ground terminal on the aluminum end bracket to see if any winding has gone to ground. If any lead wire indicates positive continuity to the ground, replace the stator.

3. Check the capacitor for the proper micro farand reading with a capacitor tester. If a capacitor tester is not available, use an ohmmeter set at 10k and touch both terminals at the same time. See figure 4. The meter should bounce up with a reading and immediately drop off. If the meter does not indicate anything or remains holding a reading, the capacitor is defective and must be replaced.

4. For a unit that has been out of service for a period of time, flashing the field is recommended. See attached instructions.

5. If the first four steps show no failures, remove the stator from the generators. With the stator removed, the diodes must be checked. To test each diode without disconnecting it from the circuit, use a 12-volt battery and a 45-watt light bulb (automotive type) as shown in illustration 950204. The light should turn on in one direction, as shown. If you cannot test the diodes as previously indicated, you must disconnect the copper wires from one end of the diode. You must also disconnect the varister (surge suppressor) from the diode. With the wire removed use an ohmmeter set to 10K and touch both terminals of the diode. Diodes pass current in one direction only. If you do not get a reading, reverse the terminals of the meter. If you do not get any readings or if you get readings in both directions, the diode is defective. Be sure to check both diodes. If you have only one defective diode, it is strongly recommended to replace both diodes. If the positions of the diodes are reversed, you will block the current flow and get no output from the generator. Pay careful attention to the marking to the current direction of each diode.

6. To check the winding on the rotor you must remove one end the diodes and varister. With an ohmmeter check the readings for each coil. The rotor coils are identical. See chart for the various ohm readings. Prior to testing resistance in each coil, be sure to zero out your ohm meter. All readings must be within 20% or less of the published ohms and be consistent (either at slightly higher or slightly lower, not some higher and some lower).

Out of Use for a Long Period

If the generator set has not been used in over 6 months and the generator worked properly when last used, it is very likely that the capacitor is discharged. The capacitor needs to be "flashed" or reenergized.

On A, AB, LA, G, and V units, open the end cover where the receptacles are located. See picture #1. The capacitor is connected to the aluminum casting and has 2 red or orange wires from the generator exciter windings. Partially slide the 2 wires back exposing the metal contacts on the capacitor. **Caution!** *Exposed generator wires present a danger and great care must be taken to not touch any exposed wires of the generator or electrical shock may occur. Be certain the ground surface is dry.* Start the engine with no load and apply 12 volts DC from a car battery to both terminals. There is no polarity issue so it does not matter which terminals you touch. Danger-once you touch the capacitor terminals voltage will start and you have live wires exposed. There will be a small arcing when you touch the capacitor and you will hear a grunt sound from the generator. Stop the engine. Carefully slide the 2 wires completely back on the capacitor. Replace the end cover on the generator. Be sure the wires are away from the ball bearing and rotor screw in the center of the casting and retighten the screw. Start the engine again and check the voltage from each receptacle for proper voltage (120/240 volts for 60 Hz and 110/220 for 50 Hz). Note- If, the generator does not produce voltage a day or two after flashing the capacitor, you must replace the capacitor.

LR and LV Models

These units have the capacitor on the side of the generator. See figure #2.

TROUBLE SHOOTING

FOR A, AB, AE, AR, LA, LE, LR, LV, G, V AND VX SERIES

PROBLEM	CAUSES	REMEDIES
No Voltage	<ol style="list-style-type: none"> 1. Low speed 2. Faulty capacitor 3. Faulty windings 4. Out of Service many months 5. Faulty Circuit Breaker 	<ol style="list-style-type: none"> 1. Check RPM of engine 3600 RPM 2. Check and replace 3. Check winding resistance 4. Flash capacitor (See Instructions) 5. Check and replace.
(AB/AE/AR series only)	6. Not enough eng. HP	6. Consult factory for proper engine HP
(AB/AE/AR series only)	7. Improper pulley ratios	7. Correct pulley sizes-consult factory
High no load Voltage	<ol style="list-style-type: none"> 1. Speed too high 2. Capacitor with high capacity 	<ol style="list-style-type: none"> 1. Check and adjust to 3600 RPM 2. Check and replace
Low no load Voltage	<ol style="list-style-type: none"> 1. Speed to low 2. Faulty diodes 3. Winding breakdown 4. Capacitor with low capacity 	<ol style="list-style-type: none"> 1. Check and adjust to 3600 RPM 2. Check & replace diodes 3. Check winding resistance 4. Check and replace
Voltage on 120 volt Side is 60-90 volts	<ol style="list-style-type: none"> 1. One defective diode 	<ol style="list-style-type: none"> 1. Replace both diodes and varisters
Circuit breaker trips	<ol style="list-style-type: none"> 1. Overload on circuit 2. Shorted electric load 3. Defective breaker 	<ol style="list-style-type: none"> 1. Reduce electric load 2. Repair short in device 3. Replace breaker
Proper no load Voltage But Low loaded Voltage	<ol style="list-style-type: none"> 1. Low loaded speed 2. Load too heavy 3. Diodes shorted 4. Engine governor 	<ol style="list-style-type: none"> 1. Check & adjust engine RPM 2. Check & reduce load 3. Check & replace 4. Adjust or repair governor
Proper no load but High loaded voltage	<ol style="list-style-type: none"> 1. Excessive RPM 	<ol style="list-style-type: none"> 1. Check & adjust
Unstable voltage	<ol style="list-style-type: none"> 1. Loose contacts 2. Uneven rotation 3. Loose rotor 	<ol style="list-style-type: none"> 1. Check connections at receptacles and circuit breakers 2. Check engine RPM 3. Tighten rotor screw
Noisy Generator	<ol style="list-style-type: none"> 1. Broken bearing 2. Poor coupling 3. Broken fan 	<ol style="list-style-type: none"> 1. Replace 2. Check & repair 3. Replace
Ground Fault Receptacle trips	<ol style="list-style-type: none"> 1. Receptacle too sensitive 2. Extension Cord 	<ol style="list-style-type: none"> 1. Replace 2. Replace extension cord
Voltage for a few Minutes then no Voltage	<ol style="list-style-type: none"> 1. Cracked windings 	<ol style="list-style-type: none"> 1. Replace rotor or stator

**Note for all 50 hertz generators the engine RPM should be 3000.

TROUBLE SHOOTING EASY IDLERS ON LM, LEI, LVI, LR AND LRI UNITS

With the generator set operating at normal speed (3600 RPM) and no load on the generator, turn on the idler switch on the control box. If the engine does not slow down:

- A. Disconnect the two wires that are connected to the solenoid with the idler switch turned on. The voltage should be 12V DC to 18V DC.
- B. If there is voltage (12V DC to 18V DC) check the two .25 inch tabs on the solenoid to assure good contact.
- C. Turn engine off, apply a 12Volt DC load to the solenoid to see if solenoid will pull plunger level into the solenoid housing. If the solenoid pulls into the housing, the black adjuster bracket holding the solenoid to the engine needs to be readjusted by loosening the two allen screws and pushing the solenoid away from the engine.
- D. Adjust the solenoid so that the frequency on the generator is at least 45 hertz under no load condition (at least 90 volts on 120 volt line).
- E. If the solenoid will not react to any 12-volt DC load, replace the solenoid.
- F. If there is no voltage to the solenoid, first check if the AC circuits are producing 120V and 240 V, then open up from the panel of the control box. Carefully start the engine. **CAUTION!** There are live 120 volt and 240 volt wires inside control panel. At both switch connections check wires to read 12 volts DC to 18 volts DC. If there is voltage to the switch but not running through the switch, replace the switch. If there is no voltage to the switch, replace idler module. **IMPORTANT!** Note wiring diagrams indicating that lead wires T1 and T4 from generator go through sensing torridol coil in opposite directions on the idler module.
- G. Some models feature a delay on the idler. This delay maintains normal operating speed (3600RPM) for 10-15 seconds after all loads have been removed before slowing down the engine speed.

TROUBLE SHOOTING THE LV150 With automatic voltage regulators

PROBLEM	CAUSE	REMEDIES
Alternator does not Excite	<ol style="list-style-type: none"> 1. Interrupted fuse 2. Insufficient residual voltage 3. No residual voltage 4. Bad capacitor 	<ol style="list-style-type: none"> 1. Replace fuse 2. Increase speed by 15% 3. For an instant apply on the + and – terminals of the electronic regulator a 12-volt battery voltage with a 30W resistor in series respecting the polarities 4. Replace capacitor
After being excited Alternator does not Excite	<ol style="list-style-type: none"> 1. Connections are interrupted 	<ol style="list-style-type: none"> 1. Check connection cables as per attached drawings
Low voltage at no load	<ol style="list-style-type: none"> 1. Voltage potentiometer out of setting 2. Intervention of protection 3. Winding failure. 	<ol style="list-style-type: none"> 1. Reset voltage 2. Check RPM 3. Check windings
High Voltage at No load	<ol style="list-style-type: none"> 1. Voltage potentiometer out of setting 2. Failed regulator 3. Engine RPM too high 	<ol style="list-style-type: none"> 1. Reset voltage 2. Replace regulator 3. Adjust RPM
Lower than rated Voltage at load	<ol style="list-style-type: none"> 1. Voltage potentiometer out of setting 2. Intervention by protection 3. Failed regulator. 4. Rotating bridge failure 5. Engine RPM too low 	<ol style="list-style-type: none"> 1. Reset voltage potentiometer. 2. Current too high, power factor lower than 0.8; speed lower than 4% of rated speed 3. Replace regulator 4. Check diodes, disconnect cables. 5. Adjust RPM
Higher than rated Voltage at load	<ol style="list-style-type: none"> 1. Voltage potentiometer out of setting 2. Failed regulator 3. Capacitor value too high 	<ol style="list-style-type: none"> 1. Reset voltage potentiometer 2. Replace regulator 3. Replace capacitor
Unstable voltage	<ol style="list-style-type: none"> 1. Speed variation in engine 2. Regulator out of setting 	<ol style="list-style-type: none"> 1. Check uniformity of rotation 2. Regulate stability of regulator by acting on "STABILITY" potentiometer with light bulb plugged into 120 volt receptacle

Troubleshooting EC3 and ECO Series Generators

1. There are 12 wires numbered 1 through 12 connected together on 6 terminals in the control box. First mark the numbers and locations of the various connections. Next, with an ohm meter read the main stator windings with all of the wires disconnected and loose connections. 1-2, 3-4, 5-6, 7-8, 9-10, 11-12 See resistance chart.

Next test each wire to the aluminum housing for ground, which means nothing should read on the ohm meter. Any reading to ground means a defective stator.

2. At the automatic voltage regulator disconnect terminals 1 and 3 with the blue and yellow wires. These wires should read 15.71 ohms. Also check these wires for ground to the aluminum housing and there should be no reading on the ohm meter. Any reading to ground means the stator is defective.

3. Check on the automatic voltage regulator if the fuse is still functional with an ohm meter if defective replace the fuse with the same amperage fuse. To test the SR7 voltage regulator with the generator not operating, connect a 12 volt DC battery with the negative terminal on terminal 1 of the regulator. You must have a 30 ohm resistor in series resistance on this terminal. Connect the positive battery terminal to voltage regulator terminal 3. Start the generator and connect only for a moment the two wires previously connected to the automatic voltage regulator. Make certain you have the correct connections. Check the voltage of the generator. If the unit does not excite the generator, the regulator may be out of adjustment, raise or lower the potentiometer or the stability adjustment may be in error.

4. Check each and the exciter rotor coil per the ohms chart. Testing these coils involves complete disassembly of the generator. If the main stator windings and the exciter stator windings are good and the automatic voltage regulator is good, the problem is definitely in the main rotor or exciter rotor. The most likely problem is in the exciter rotor in the diode bridge assembly. To test each diode, you must disconnect one wire from each diode and with an ohm meter you should get a reading in one direction on the diode and be reversing the test leads from the ohm meter you should not get a reading. If one or more diodes are defective, it is strongly recommended to replace all of the diodes. Important- Diodes only operate in a single direction and MUST be installed in the proper direction or they will not function properly. Do not remove diodes without carefully noting the direction and markings on the diodes.

5. All resistance reading from your ohm meter must be within at least 20% of what is noted above and must be consistent. If you have some readings high and some low, you have a defective product.

REPAIR PROCEDURES FOR PTO GENERATORS(PTO15/12 & PTO30/25)

1. RPM input to transmission must be 540 RPM. PTO shaft is 1 3/8" 6 spline.
2. Check that oil level in transmission is up to indicator level & fill as required. Do NOT overfill. Use gear oil 80-120 weight.
3. If transmission is defective or leaks, do NOT attempt repairs. Call the factory for replacement.
4. Open the black end cover on the generator. Check lead wires 1,2,3 & 4 according to the resistance chart as follows:

Lead wires 1 (black) to lead 2 (white)
Lead wires 3 (white) to lead 4 (black)
Orange to orange (exciter)

Important! When checking lead wires, leads 2 and 3 are connected together at the factory. You must disconnect these leads when testing resistance of the various coils or you will get incorrect readings.

In addition to checking each coil, test each coil to the ground terminal on the aluminum end bracket to see if any winding has gone to ground. If any coil has continuity with the ground, replace the stator or rotor.

5. Check the capacitor for the proper micro farad reading with a capacitor tester. If a capacitor tester is not available, use an ohmmeter set at 10K and touch both terminals at the same time. The meter should bounce up with a reading and immediately drop off. If the meter does not indicate anything or remains holding a reading, the capacitor is defective.
6. For a unit that has been out of service for a period of time, flashing the field is recommended. With the end cover open and the capacitor exposed, start the engine. Using a 12-volt DC battery, carefully touch both terminals of the capacitor. A small spark will occur. Be sure no load is applied when this procedure is happening. Be certain that no combustible material is near the generator set when flashing the field. Exposed generator wires present a danger and great care MUST be taken to not touch any exposed wires of the generator or electrical shock may occur.
7. If the first six steps show no failures, remove the stator from the generator. With the stator removed, the diodes must be checked. To test each diode without disconnecting it from the circuit, use a 12-volt battery and a 45-watt light bulb (automotive type) as shown in illustration 950204. The light should turn on in one direction, as shown. If you cannot test the diodes as previously indicated, you must disconnect the copper wires from the one end of the diode. On some models, you must also disconnect the varister (surge suppressor) from the diode. With the wires removed use an ohmmeter set to 10K and touch both terminals of the diode. Diodes pass current in one direction only. If you do not get a reading, reverse the terminals of the meter. If you do not get any readings or if you get readings in both directions, the diode is defective. Be sure to check both diodes. If you have only one defective diode, it is strongly recommended to replace both diodes. If the positions of the diodes are reversed, you will block the current flow and get no output from the generator. Pay careful attention to the marking of the current direction of each diode.
8. To check the windings on the rotor you must remove the diodes and varister. With an ohmmeter check the readings for each coil. The rotor coils are identical. See chart for the various ohm readings. Prior to testing resistance in each coil, be sure to zero out your ohmmeter. All readings must be within 20% or less of the published ohms and be consistent (either all slightly higher or slightly lower, not some higher and some lower).

RESISTANCE IN OHMS FOR VOLTMASTER GENERATORS AT 20° C

<i>MODEL</i>	<i>MAIN WINDINGS</i>	<i>EXCITER WINDINGS</i>	<i>ROTOR</i>	<i>CAPACITOR</i>
G25/26	2.35	8.25	2.2	16MF
V25, VX25	1.47	4.2	8.76	16MF
A25/26	1.2	6.7	2.83	10MF
G44/50	.8	2.4	3.1	16MF
V50, VX50	.98	3.9	10.0	20MF
A50	.57	3.129	2.584	20MF
G60/65	.45	1.2	.59	50MF
LR50/60	.54	2.24	2.97	2-25MF
V & VX60/65	.45	1.2	.59	50MF
A60	.36	2.446	2.926	31.5MF
G80	.25	.72	.62	2-35MF
V & VX80	.25	.72	.62	2-35MF
LR70/80	.49	4.41	2.85	2-16MF
LV80	.286	2.6	3.51	25MF
LV105	.161	2.2	4.03	35MF
LR105, AR100	.109	1.30	4.67	2-31.5MF
M50/60*	.4	2.6	13.4	----
Choke/transformer For M50/60		7.2	----	----
LV150	.512	15.7	9.4	----
LR150,	.075	1.05	5.23	2-35MF
PTO15/12	.075	1.05	5.23	2-35MF
A25-5 (50 HZ)	1.23	6.27	2.83	31.5MF
A50-5 (50HZ)	.81	2.85	3.55	41MF
A60-5 (50HZ)	.52	1.47	4.02	41MF
LV80E-5 (50HZ)	.318	2.6	3.51	41MF
LV105E-5(50HZ)	.211	2.2	4.03	63MF
AE100/LE105E	.31	1.3	5.0	3-31.5
LE80E	1.1	.75	----	90MF
PTO30/25	.06	.22	1.7	2-45MF,1-40MF
AR250	.06	.22	1.7	2-45MF,1-40MF

* Positive cable on meter MUST be connected to green lead as there is a diode across these two leads.

Readings 15-20% different than those listed above indicate a defective winding.

RESISTANCE IN OHMS FOR VOLTMASTER 4-POLE GENERATORS AT 20°C

Models produced in 2006 and later

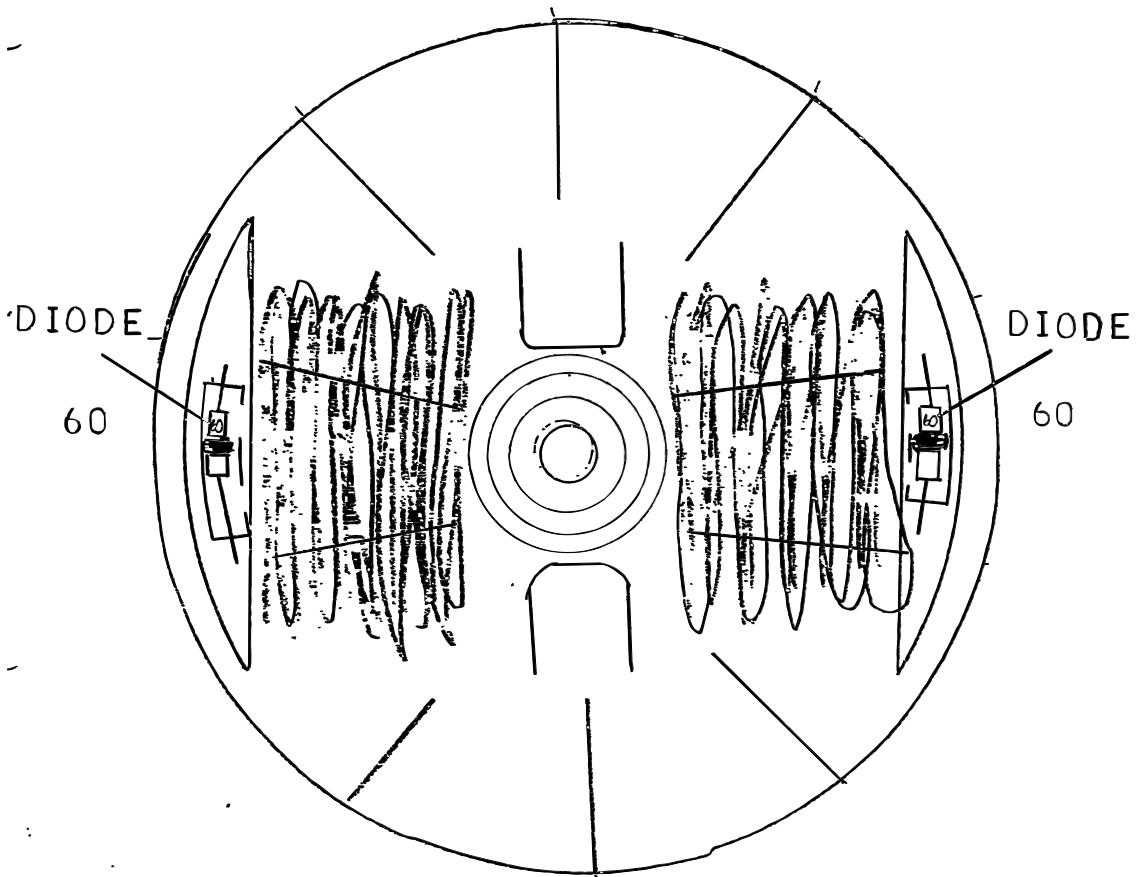
<i>Model</i>	<i>Main Stator</i>	<i>Aux. Winding</i>	<i>Main Rotor</i>	<i>Stator</i>	<i>Exciter Rotor</i>	<i>AVR</i>
EC8-3,EC7-1	1.084	2.02	7.325	15.71	1.453	SR7
EC13-3,EC11-1	0.443	1.542	9.81	15.71	1.453	SR7
EC15-3,EC12.5-1	0.283	4.06	1.26	10.6	0.39	SR7
EC29-3, EC24-1	0.1	2.17	1.86	10.6	0.39	SR7
EC40-3, EC30-1 PT040-1,PT055-3	0.078	0.929	2.163	10.6	0.39	SR7
EC50-3, EC40-1 PT050-1, PT055-3	0.061	0.993	2.473	11.35	0.47	SR7
EC65-3, EC50-1 PT065-1,PT070-3	0.035	0.79	3.171	11.35	0.47	SR7
EC80-3, EC67-1 PT075-1,PT090-3	0.03	0.965	2.477	15.28	0.41	SR7
EC100-3,EC83-1	0.02	0.838	2.951	15.28	0.41	SR7
EC120-3,EC100-1 PT0110-3	0.018	0.796	3.165	15.28	0.41	SR7
EC145-3,EC120-1	0.015	0.914	3.577	15.28	0.41	SR7
EC176-3,EC145-1	0.0131	0.79	3.96	15.28	0.41	UVR
EC215-3,EC180-1	0.009	0.635	5.035	15.28	0.41	UVR
EC240-3, EC200-1	0.0075	0.633	5.525	15.28	0.41	UVR
EC325-3, EC270-1	0.0042	0.622	7.095	15.28	0.41	UVR

RESISTANCE IN OHMS FOR VOLTMASTER 3-PHASE GENERATORS AND WELDERS AT 20°C

Models produced in 2006 and later

<i>Model</i>	<i>Main Stator</i>	<i>Exciter Winding</i>	<i>Rotor Winding</i>	<i>Compound Auxiliary</i>	<i>Compound Exciter</i>
LR50-208, LR80-208	0.14	0.445	9.18	21.3	0.67
LR50-480, LR80-480	0.712	0.445	9.18	109	0.67
LR120-208	0.11	0.474	11.49	19.5	0.67
LR120-480	0.425	0.474	11.49	112.8	0.67
				<i>Impedance Generator</i>	<i>Impedance Auxiliary</i>
W180, W240	0.3	0.022	9.18	0.03	0.83

DIODE DIRECTION



FOR ALL A, AB, AE, AR, LA, LV AND LR DIODE REPLACEMENTS

While looking at the rotor in this position, the numbers and letters on all diodes are readable as shown above. The numbers and letters may be different but all face the same direction in this position.

2. With the stator removed, unsolder one diode and loosen the wires from the copper windings and the varister. Note the direction of the wording on the original diode. Replace with a new varister and diode into the diode holder. Twist the leads from the varister and copper winding around the leads from the diode. Put welding flux on both ends to be soldered. Get the soldering iron very hot, put solder on the tip of the solder iron (strongly suggested to hold a pliers between the diode and connections being soldered to absorb the heat). Do not keep solder gun on new diode leads for more than a few seconds or damage to the diode may occur.

ENGLISH FASTENER TORQUE RECOMMENDATIONS FOR STANDARD APPLICATIONS

TIGHTENING TORQUE N•m (in.lb.) + or – 20%

Size	Grade 2	Grade 5	Grade 8	Grade 2 or 5 into Aluminum
8-32	2.3 (20)	2.8 (25)	-----	2.3 (20)
10-24	3.6 (32)	4.5 (40)	-----	3.6 (32)
10-32	3.6 (32)	4.5 (40)	-----	-----
_20	7.9 (70)	13.0 (115)	18.7 (165)	7.9 (70)
_28	9.6 (85)	15.8 (140)	22.6 (200)	-----
5/16-18	17.0 (150)	28.3 (250)	39.6 (350)	17.0 (150)
5/16-24	18.7 (165)	30.5 (270)	-----	-----
3/8-16	29.4 (260)	-----	-----	-----
3/8-24	33.9 (300)	-----	-----	-----

TIGHTENING TORQUE: N•m (ft.lb.) + or – 20%

Size	Grade 2	Grade 5	Grade 8	Grade 2 or 5 into Aluminum
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GENERAL TORQUE VALUES

Metric Fastener Torque Recommendations for Standard Applications

Tightening Torque: N•m (in.lb.) + or – 10%

Size	4.8	5.8	8.8	10.9	12.9	Non-critical fasteners into Aluminum
M4						
M5						
M6						
M8						

Tightening Torque: N•m (ft.lb.) + or – 10%

Size	4.8	5.8	8.8	10.9	12.9	Non-critical fasteners into Aluminum
M10						
M12						
M14						

Torque Conversions

$$\text{N•m} = \text{in.} \cdot \text{lb.} \times 0.113$$

$$\text{N•m} = \text{ft.} \cdot \text{lb.} \times 1.356$$

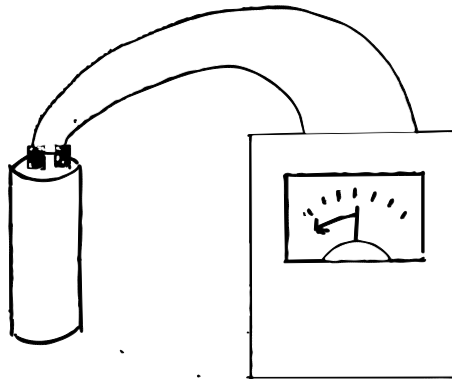
$$\text{In.} \cdot \text{lb.} = \text{N•m} \times 8.85$$

$$\text{Ft.} \cdot \text{lb.} = \text{N•m} \times 0.737$$

CAPACITOR TESTING

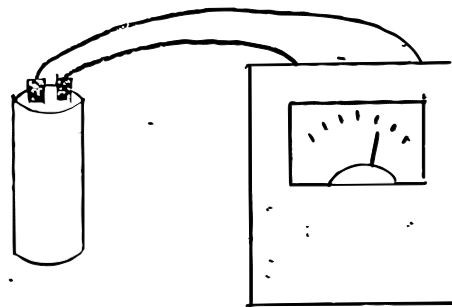
1. The generator should NOT be running. Disconnect the two exciter lead wires to the capacitor. With a capacitor tester connect to the capacitor and read the MFD indicated which should be exactly what is marked MF or UF on the capacitor. There are no polarity concerns when testing a capacitor.
2. If no capacitor tester is available, using multi-meter set in the resistance (Ohms) position at 1K or 10K, connect the lead wires as noted in the drawings below. A good capacitor should make the meter have a momentary reading and then drop off to zero. A defective capacitor will either cause the meter to hold a reading or have no reading at all. You can only do this test a couple of times as you will be discharging the capacitor. Replace defective capacitors with like size MFD 450 volt capacitors.

MULTI-METER IN OHMS POSITION



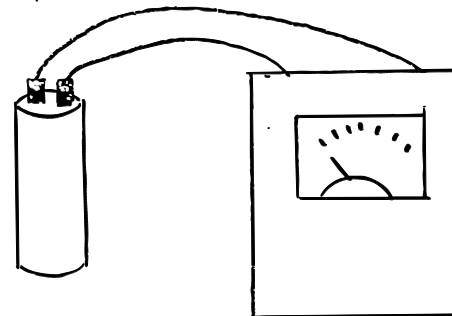
GOOD CAPACITOR

momentary reading then
drops off to zero



DEFECTIVE CAPACITOR

holds a constant
reading



DEFECTIVE CAPACITOR

no reading

SML IND
9802

FIGURE 950204**DIODE TEST WITHOUT REMOVING THE DIODE FROM THE ROTOR**

Connect a 12 volt DC battery and a 45 watt (automobile type) bulb as shown below. The light will turn on in one direction only as shown.

