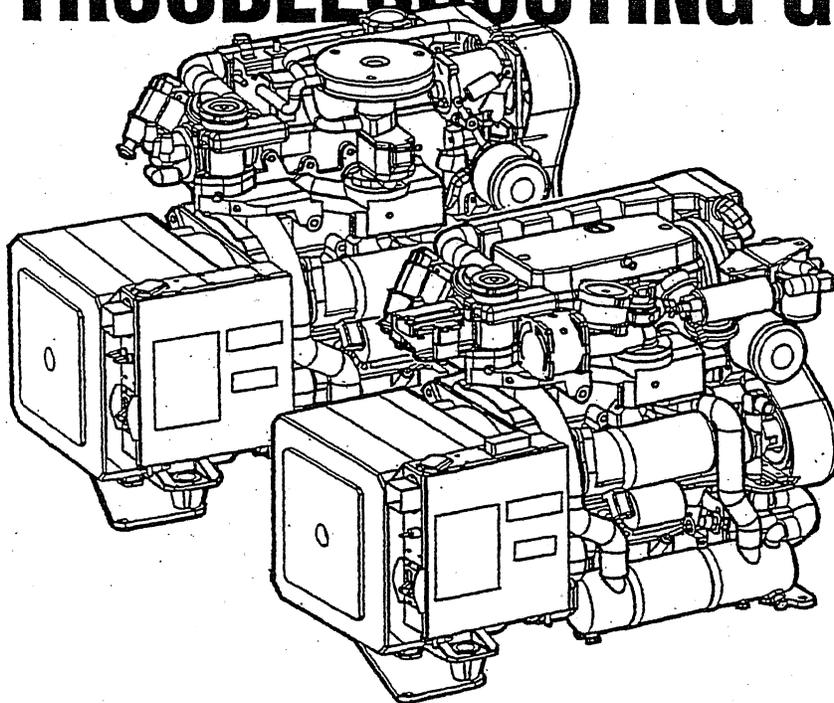




BCGT GENERATORS

AC ELECTRICAL TESTING

and TROUBLESHOOTING GUIDE



 WESTERBEKE

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BCGT GENERATOR ELECTRICAL TESTING

INTRODUCTION

The following test procedures can be used to troubleshoot WESTERBEKES 2 POLE SINGLE CAPACITOR BRUSHLESS GENERATORS. Due to the simplicity of the generator, troubleshooting is relatively easy.

Field testing and repairing can be accomplished with basic tools and repair parts which should include the following:

A quality multimeter [multitester] capable of reading less than one ohm and with a specific diode testing function.

Basic electrical tools including cutters, soldering iron, wire stripper/crimper, terminals connectors, etc.

Repair parts such as diodes suppressors, fuses, bridge rectifier, etc.

PRELIMINARY CHECKING

Before electrical testing check for proper engine speed/hertz adjustment. Low engine speed will cause low AC voltage output, high engine speed-high AC output.

Refer to WESTERBEKES operators manual or service manual for engine speed/hertz adjustment or for other possible engine related problems.

Before testing, get a clear explanation of the problem that exists, be certain it relates to generator components.

WARNING: AC and DC circuits often share the same distributor panel. Be certain to unplug AC power cords and shutdown DC/AC inverters. Simply switching off circuit breakers will not do the job since it will still leave hot wires on the supply side of the panel.

WARNING: Some of the following tests require the generator to be running, make certain the front pulley cover and timing belt covers are in place.

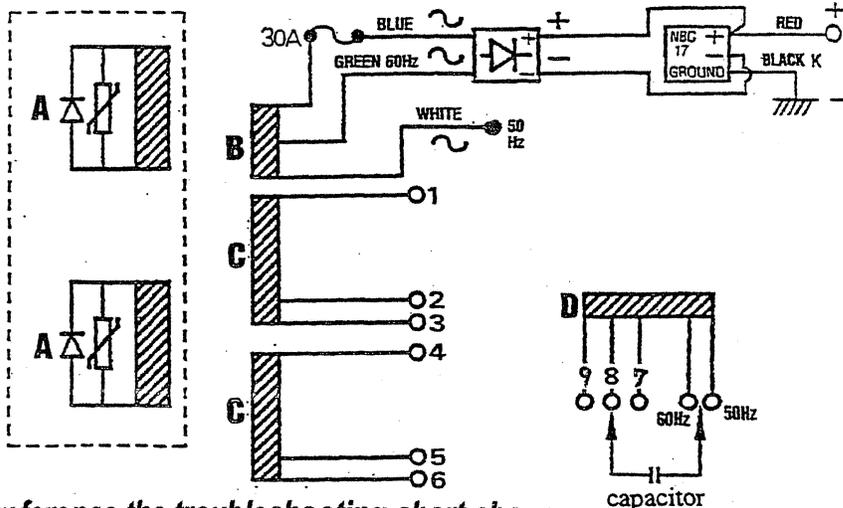
This chart is compiled with the engine operating at the correct speed.

Letters A,B,C,D, refer to the diagram below.

GENERATOR TROUBLESHOOTING CHART

FAULT	CAUSE	TEST
No AC Output	Shorter Stator	C
	Open Stator	C
	Shorted Suppressors	A
	Shorted Diodes	A
Residual Voltage 7-8 VAC (Hot-N)	Shorted Exciter	D
	Open Exciter	D
Low AC Output (60-100 VAC)	Faulty Rotor	A
	Faulty Diode	A
	Faulty Capacitor	CAP
	Faulty Suppressor	A
High AC Output	Incorrect Voltage tap on capacitor	C
	Incorrect MFD rated capacitor	C
	Incorrect Hertz tap on capacitor	C
Voltage Drop under Motor Load	Faulty Rotor Diode	A
No Battery Charge	Faulty Bridge Rectifier	B
Low Battery Charge	Faulty Integral Controller	B
	Check Fuse	B
	Faulty Winding	B
Unstable Voltage (Refer to Operators Manual)	Check Engine Speed (hertz)	
	Adjust Governor	
	Check Capacitor Connections and AC Terminal Wiring (Refer to Wiring Diagram)	
Noisy Operation	Check Coupling, Check Bearing	

TWO POLE BC GENERATOR INTERNAL WIRING

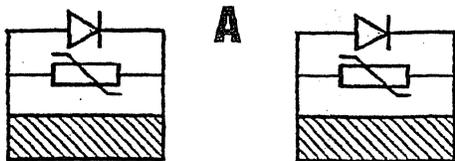


- A** - ROTOR WINDINGS
- B** - BATTERY CHARGE WINDING
- C** - STATOR WINDINGS
- D** - CAPACITOR WINDING

letters reference the troubleshooting chart above

BCGT GENERATOR ELECTRICAL TESTING

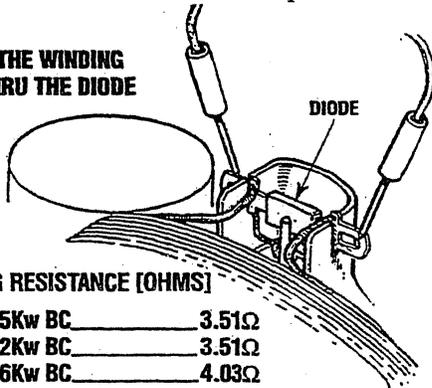
TESTING GENERATOR COMPONENTS



TESTING ROTOR WINDINGS

Assume that the diodes are OK. Test the resistance values of the rotor windings by placing the multimeter leads across the diode as shown and compare to the data below.

TESTING THE WINDING LEADS THRU THE DIODE



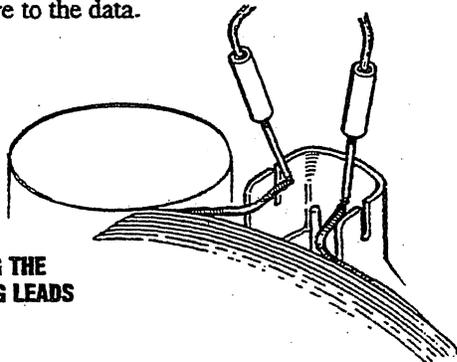
WINDING RESISTANCE [OHMS]

Model 4.5Kw BC	3.51Ω
Model 7.2Kw BC	3.51Ω
Model 9.6Kw BC	4.03Ω

If the data is correct, the problem is NOT in the rotor.

To continue testing, remove the diode/suppressor by unsoldering the two winding leads.

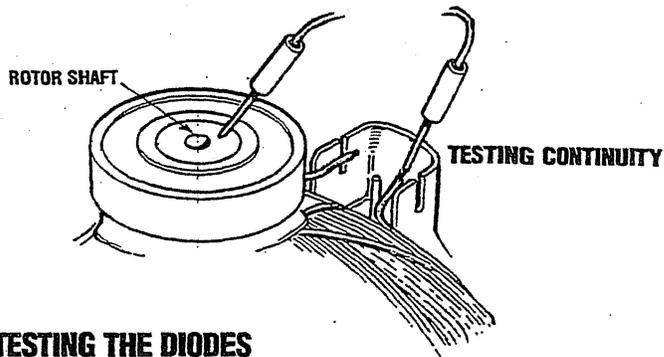
Test for resistance between the two winding leads and again compare to the data.



TESTING THE WINDING LEADS

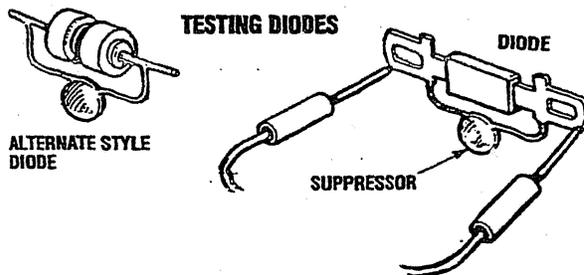
CAUTION: [ON SOLDERING] When soldering, use a large enough soldering iron to get the job done quickly. Excessive heat will damage the diodes. Also make certain no soldering splashes onto the windings as it will melt the insulation.

Check for continuity between each of these leads and the rotor shaft. Continuity would indicate a short in the rotor.



TESTING THE DIODES

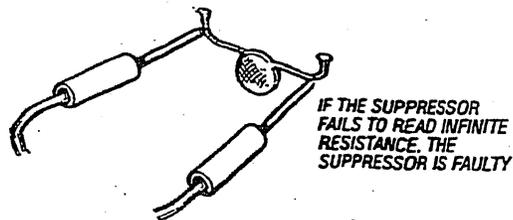
With the diodes removed, measure the resistance (as shown) using a multimeter (with a diode testing capability). If the meter measures resistance in one direction, it should indicate infinity in the other.



Both diodes should measure the same resistance value. If one measures lower than the other, it is presumed faulty. Replace both.

TESTING THE SUPPRESSOR

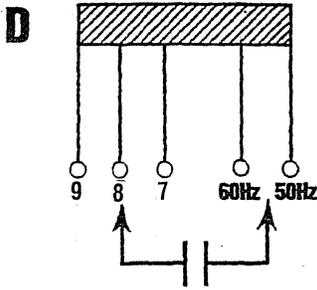
Unsolder the suppressor from the diode and check for infinite resistance.



A shorted suppressor will often turn black when shorted out.

Repeat the same test procedures to the opposite side rotor windings.

BCGT GENERATOR ELECTRICAL TESTING



TESTING THE EXCITER WINDINGS

An AC voltage is induced in these windings by the rotating field. Checking the residual voltage output from this winding can determine the condition of the winding when troubleshooting.

RESIDUAL VOLTAGE

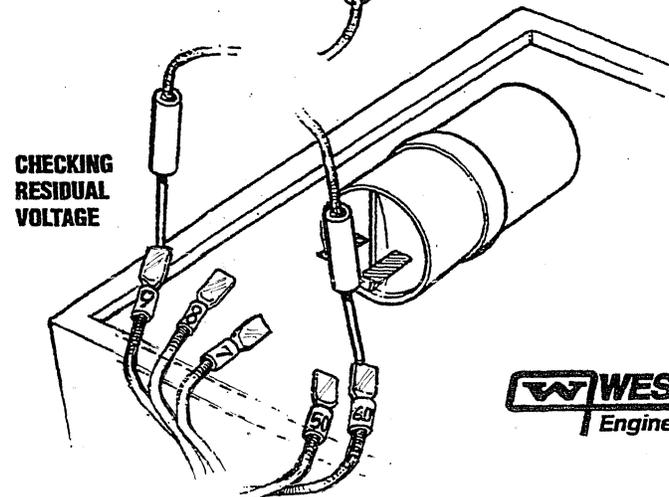
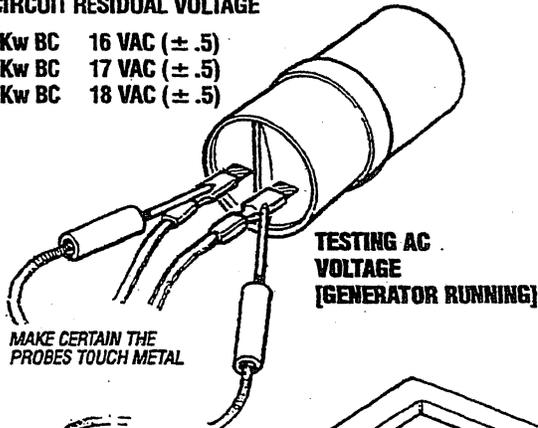
Single Capacitor Model 16 - 18 VAC from each winding

AC voltage can be measured across the capacitor while the generator is operating. This voltage may be as high as 400 to 500 volts AC. This voltage buildup is accomplished as the exciter windings charge the capacitor and the capacitor discharges back into the exciter windings. This AC voltage reading is taken between the #60 Hertz connector and the number connection plugged into the capacitor while the generator is operating at its rated Hertz (61.5 - 62.0). This flow of saturating AC in the exciter windings produces a phase-imbalance type of field that effects the auxillary windings: a beneficial result that produces good motor starting characteristics for this type of generator.

NOTE: Position the meter correctly for AC voltage so as not to damage the meter.

EXCITER CIRCUIT RESIDUAL VOLTAGE

Model 4.5Kw BC	16 VAC (± .5)
Model 7.2Kw BC	17 VAC (± .5)
Model 9.6Kw BC	18 VAC (± .5)



MEASURING RESISTANCE

To measure the resistance value of the exciter windings, locate #9 and the #50 Hertz capacitor connections.

NOTE: Three numbered capacitor connections exist: #7, #8, and #9; and two Hertz connections, #50 and #60.

Unplug any other connections from the capacitor noting their position on the capacitor. Place one lead of the multimeter on plug connection #9 and the other lead on plug connection #50 Hertz. Measure the resistance value of the exciter windings.

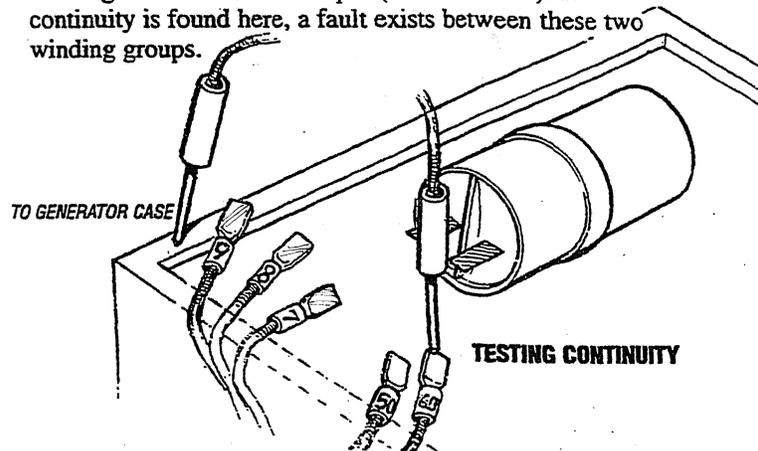
WINDING RESISTANCE [OHMS]

Model 4.5Kw BC	4.55Ω
Model 7.2Kw BC	3.96Ω
Model 9.6Kw BC	3.71Ω

NOTE: Lower residual voltage along with a lower winding resistance will confirm a faulty winding.

CHECKING CONTINUITY

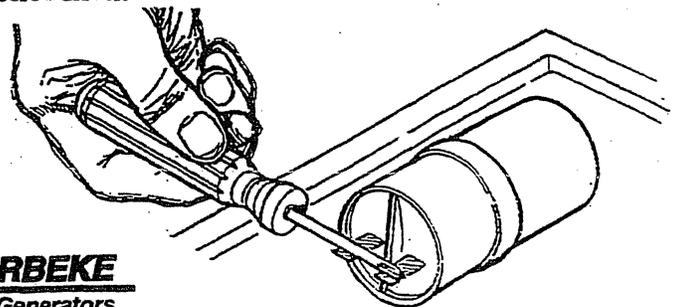
Check to make sure there is no continuity to the ground/generator case from either of the two leads. Also check that no continuity exists between either the #60 Hertz plug or the #8 plug and any of the main stator winding leads on the AC output (not illustrated). If continuity is found here, a fault exists between these two winding groups.



DISCHARGING THE CAPACITORS

CAUTION: Capacitors must be discharged before testing. Capacitors store electricity and can pack a lethal punch even when disconnected from the power source.

Discharge the capacitor by bridging the terminals with a screwdriver.



BCGT GENERATOR ELECTRICAL TESTING

TESTING THE CAPACITORS

Connect a multimeter (highest ohm scale) to the capacitor terminals. The meter should go to zero ohms and slowly return to high. Discharge the capacitor again and reverse the leads, the same results should be obtained.

If the meter goes down and stays at zero ohms, the capacitor is faulty (shorted).

If the meter fails to go down to zero, the capacitor is faulty (open circuited).

Indications of a defective capacitor:

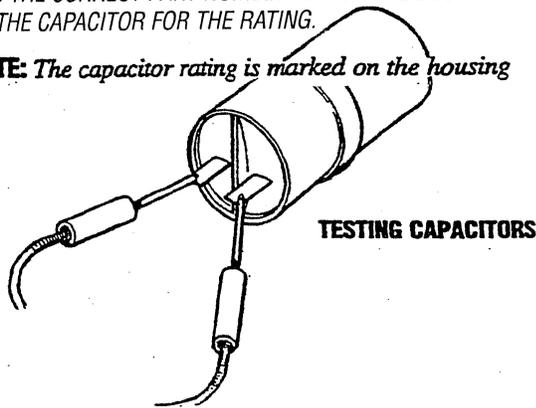
- Infinite resistance, or no rise in resistance (shorted capacitor)
- Infinite resistance (open capacitor)

CAPACITOR RATINGS / PART NUMBERS

Model 4.5 Kw BC	25 mfd	Pn#035985
Model 7.2 Kw BC	31.5 mfd	Pn#035978
Model 9.6 Kw BC	35 mfd	Pn#041199

NOTE: MAKE CERTAIN A REPLACEMENT CAPACITOR HAS THE CORRECT PART NUMBER. CHECK THE BODY OF THE CAPACITOR FOR THE RATING.

NOTE: The capacitor rating is marked on the housing



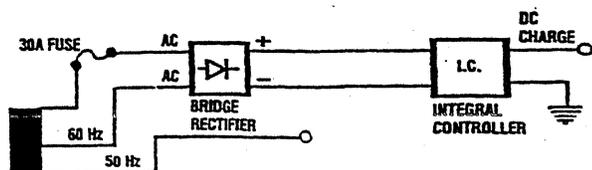
12 VOLT EXCITATION

The generator may be excited using 12 volts DC taken from the engine's starting battery. This voltage is applied across the #50 and #9 leads of the exciter circuit windings (unplugged) with any other numbered leads unplugged from the capacitors. The generator's reaction during flashing will help determine its fault.

12 VOLT EXCITATION, OUTPUT RANGE IS 22 TO 26 VAC.

- A slight rise in the output voltage with the loading of the engine and/or a growling noise from the generator end will indicate a fault in the main stator windings.
- No rise or a very slight rise in the output voltage will indicate a fault in the excitor windings.
- Normal output voltage as specified above, check excitor circuit.

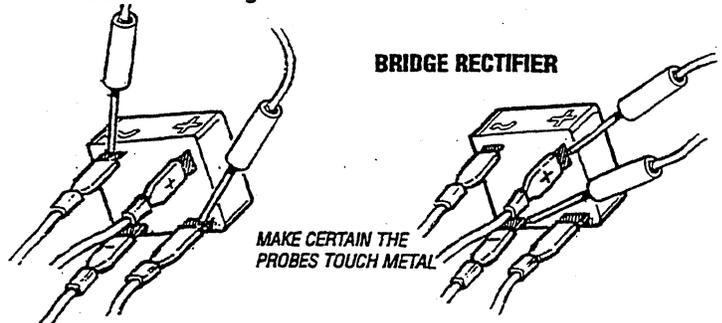
TESTING THE BATTERY CHARGING CIRCUIT



Normal AC voltage running to the rectifier (while the engine is operating at 3600 rpm) is measured across the two AC connections on the bridge rectifier.

AC VOLTAGE TO THE BRIDGE RECTIFIER (APPROXIMATELY):

No-load off the generator	16.0 volts AC
Full-load off the generator	17.5 volts AC

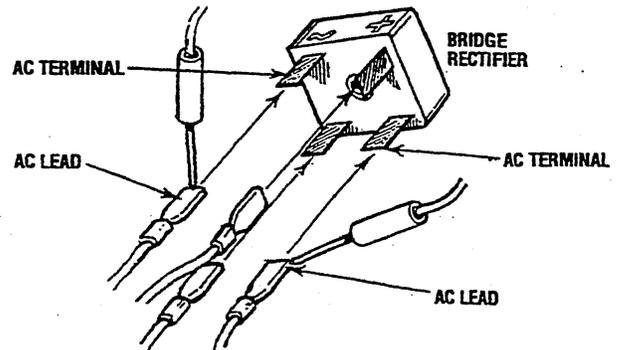


Normal DC voltage running out of the rectifier (in volts DC) is measured across the two DC connections of the bridge rectifier, that is + and -.

DC VOLTAGE FROM THE BRIDGE RECTIFIER (APPROXIMATELY):

No-load off the generator	17.0 volts DC
Full-load off the generator	18.5 volts DC

Lift the two AC wire leads off the bridge rectifier and measure the resistance between these two leads. It should measure 0.14 ohm. No continuity should exist between these two leads and the ground or the main stator windings.



RESISTANCE MEASUREMENT

Model 4.5Kw BC @ 60Hz	.157Ω	Blue to Blue	
Model 7.2Kw BC @ 60Hz	.094Ω	Blue to Green	
	@ 50Hz	.116Ω	Blue to White
Model 9.6Kw BC @ 60Hz	.084Ω	Green to Blue	
	@ 50Hz	.106Ω	Blue to White

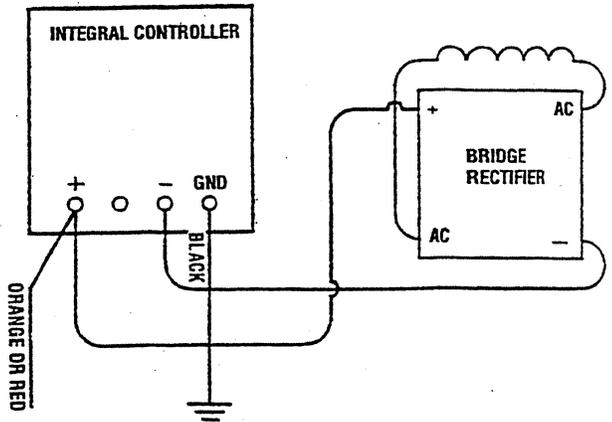
BCGT GENERATOR ELECTRICAL TESTING

TESTING THE BRIDGE RECTIFIER

(meter used - FLUKE multimeter)

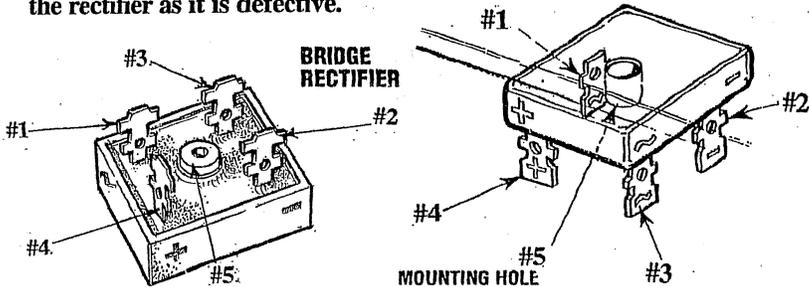
- Set the meter on Ohms scale.
- Connect the positive (+) lead from the meter to point #4. Taking the negative (-) lead, momentarily touch points #1, #2, #3, and #5. There should be no Ohm value registered on the meter.
- Remove the positive (+) lead from point #4 and connect the negative (-) lead to it. Momentarily touch points #1, #2 and #3. the Ohm meter should register an arbitrary Ohm value at each point it touches.
- Leaving the negative (-) lead on point #4, touch point #5 with the positive (+) lead. The meter should register no Ohm value.
- Place the positive (+) lead on point #1 and the negative (-) lead on point #3. The meter again should register no Ohm value. Reverse these connections and the meter should register no Ohm value.

If the rectifier fails any of the previous tests B through E, replace the rectifier as it is defective.



TESTING THE INTEGRAL CONTROLLER

To test the battery charger, put a multimeter between the positive (+) and negative (-) leads to the battery. It should indicate 13.5V to 14V with the engine running. If only the battery voltage is indicated, check that the battery charger terminal connections are tight. With the unit running, test between the (+) and (-) terminals for 13.5V to 14V. If no charge is indicated, replace the charger.



when viewed from the top

NOTE: Different types and/or brands of test meters may produce opposite test results.

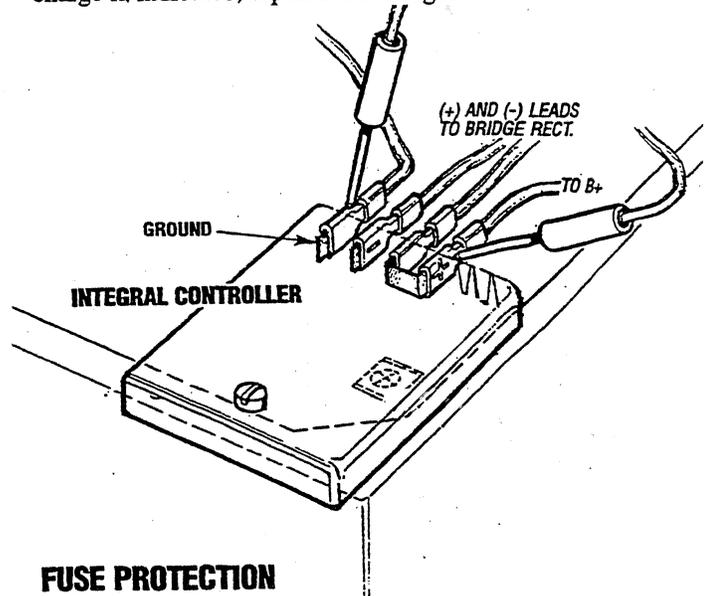
INTEGRAL CONTROLLER

The Integral Controller (I.C.) is an encapsulated, solid-state unit that supplies a DC charging voltage to the generator's starting battery while the generator is operating.

Charging Voltage 13.0 - 14.0 volts DC
Charging Amperage 0 - 17.0 amps DC

A separate group of stator windings supplies AC voltage to a bridge rectifier which converts the AC current to supply the I.C. unit. The I.C. unit senses the needs of the starting battery and supplies a DC charge when one is needed. If you suspect that the I.C. unit is faulty (that is, if the battery's charge is low), check the charging circuit and it's components as described in the following text. Check all connections for cleanliness and tightness including the ground before replacing the I.C. unit.

NOTE: When the generator is first started, the I.C. unit will produce a low charging rate. This charging rate will rise as the generator is operated.

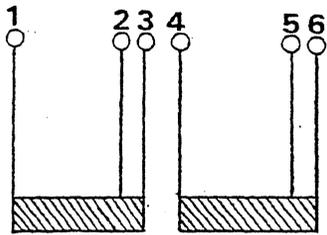


FUSE PROTECTION

A 30 amp fuse protects the windings from a failure of the bridge rectifier or integral controller (high amperage or a short).

BCGT GENERATOR ELECTRICAL TESTING

C



TESTING THE MAIN STATOR WINDINGS

Residual voltage measured between the hot and neutral leads will be 7-8 volts AC. This would be an indication that the stator windings are okay. Check exciter windings and artificially excite the generator.

Residual Voltage Check

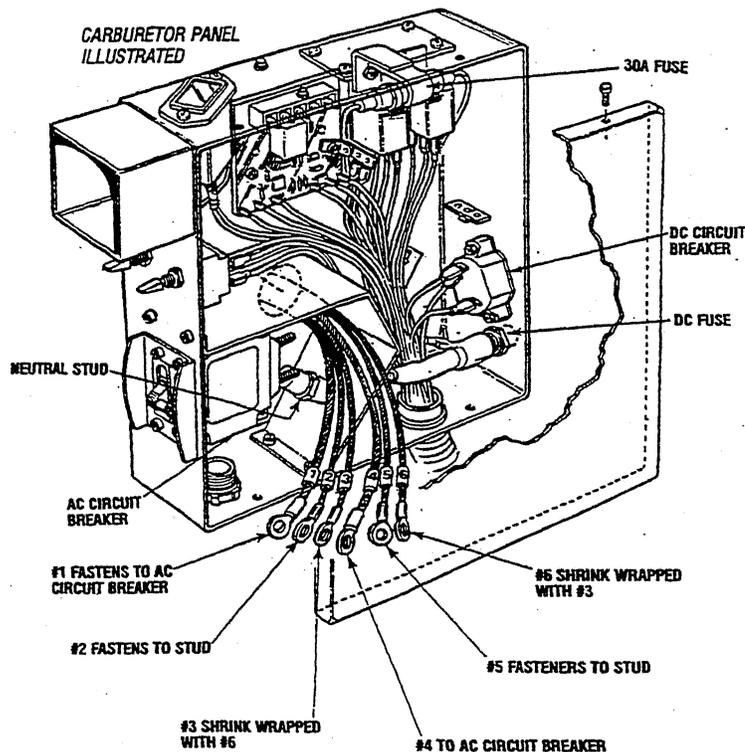
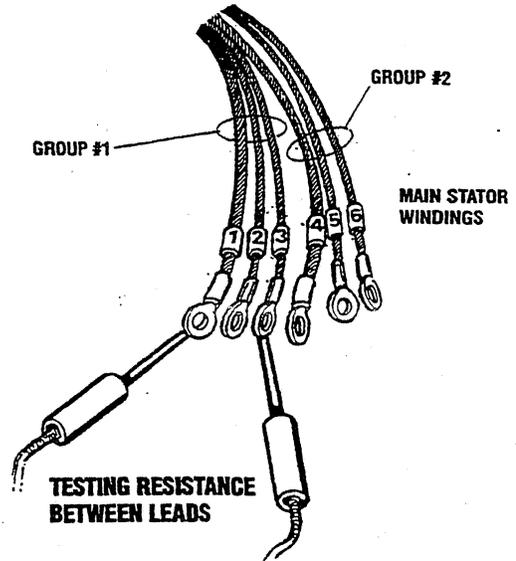
Measure between hot [#1 and #4] and neutral [#2 and #5].

Model 4.5Kw BC	8 VAC (± .5)
Model 7.2Kw BC	7.5 VAC (± .5)
Model 9.6Kw BC	7 VAC (± .5)

Group #1 - Measure resistance value between terminal with lead #1 and terminal with lead #3. (Check that there is no continuity of Group #1 windings to the case ground).

Group #2 - Measure resistance value between terminal with lead #4 and terminal with lead #6. (Check that there is no continuity of group #2 windings to the case ground).

Check for a possible short between the two groups of stator windings by placing one lead of the multitester on the terminal with the stator #3 and the other lead on the terminal with stator lead #6. There should be no continuity between the two groups of stator windings.



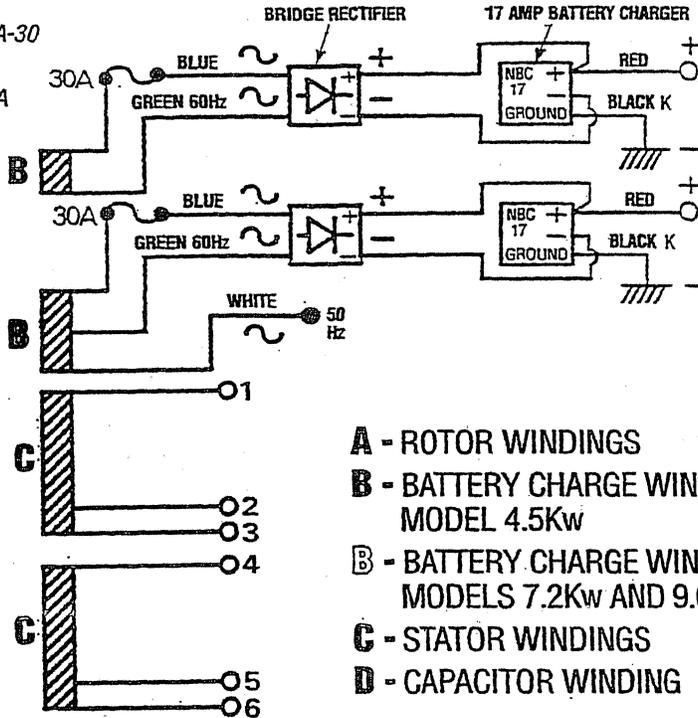
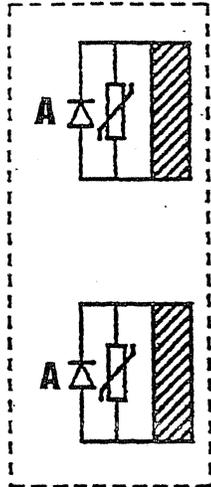
TESTING RESISTANCE BETWEEN THE MAIN STATOR WINDINGS

	Resistance Values [ohms]	
Model 4.5Kw BC Between leads	#1 and #2	.515Ω
	#1 and #3	.585Ω
	#4 and #5	.516Ω
	#4 and #6	.585Ω
Model 7.2Kw BC Between leads	#1 and #2	.294Ω
	#1 and #3	.330Ω
	#4 and #5	.293Ω
	#4 and #6	.331Ω
Model 9.6Kw BC Between leads	#1 and #2	.179Ω
	#1 and #3	.200Ω
	#4 and #5	.179Ω
	#4 and #6	.201Ω

TWO POLE BC GENERATOR INTERNAL WIRING

FUSE - INTEGRAL CONTROLLER
 WINDING: NO TIME DELAY
 Pn#43634 30A 250V MDA-30

FUSE - ENGINE PROTECTION
 (NOT SHOWN) Pn#33769 8A
 250V MTH-8 (TIME DELAY)

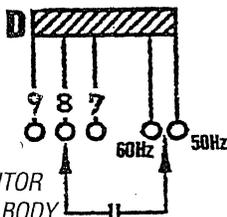


- A** - ROTOR WINDINGS
- B** - BATTERY CHARGE WINDING
MODEL 4.5Kw
- B** - BATTERY CHARGE WINDING
MODELS 7.2Kw AND 9.6Kw
- C** - STATOR WINDINGS
- D** - CAPACITOR WINDING

CAPACITOR RATINGS / PART NUMBERS

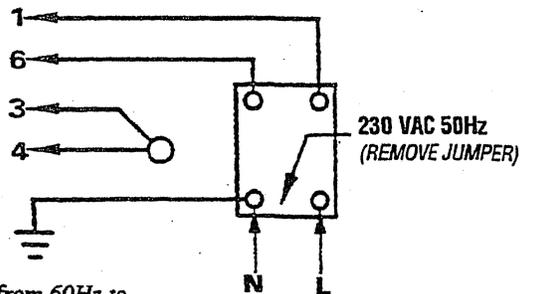
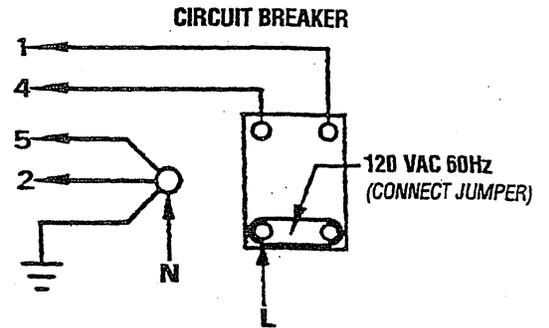
Model 4.5 Kw BC	25 mfd	Pn#035985
Model 7.2 Kw BC	31.5 mfd	Pn#035978
Model 9.6 Kw BC	35 mfd	Pn#041199

NOTE: MAKE CERTAIN A REPLACEMENT CAPACITOR HAS THE CORRECT PART NUMBER. CHECK THE BODY OF THE CAPACITOR FOR THE RATING.



CONNECT FOR THE
 REQUIRED FREQUENCY
 AND OUTPUT VOLTAGE.

AC CONNECTIONS



NOTE: When changing from 60Hz to 50Hz, make certain the ground wire is properly repositioned according to this diagram.

WINDING RESISTANCE VALUES IN OHMS

MODEL	WINDING	RESISTANCE (OHMS)
MODEL 4.5Kw	A ROTOR	3.51Ω
	B CHARGER	0.14Ω
	C STATOR	0.58Ω
	D EXCITER	2.3Ω
MODEL 7.2Kw	A ROTOR	3.51Ω
	B CHARGER	0.14Ω
	C STATOR	0.29Ω
	D EXCITER	2.2Ω
MODEL 9.6Kw	A ROTOR	4.03Ω
	B CHARGER	0.14Ω
	C STATOR	0.17Ω
	D EXCITER	1.9Ω

