

INDEX

Subject	Page
General Information	
Generator	06- 3
Circuit Description	06- 3
Diagnosis and Testing	
Recommended Accessory Wiring	06- 4
Recommended Generator Wiring.....	06- 5
Voltage Regulator and Back of Governor.....	06- 5
Visual Inspection	06- 6
Generator Output Test	06- 6
Generator Voltage Test.....	06- 6
Battery - Drain Test	06- 6
Symptom Chart	06- 8
Pinpoint Test A: Generator Output Voltage.....	06- 9
Pinpoint Test B: Voltage Output High.....	06- 11
Pinpoint Test C: Indicator Lamp ON, Engine Running	06- 12
Removal and Installation	
Generator - Removal.....	06- 13
Generator - Installation.....	06- 13
Regulator - Removal	06- 13
Regulator - Installation	06- 14
Specifications	
Torque Specifications.....	06- 15
Generator Parts Cross-Reference.....	06- 15
Special Tools.....	06- 15

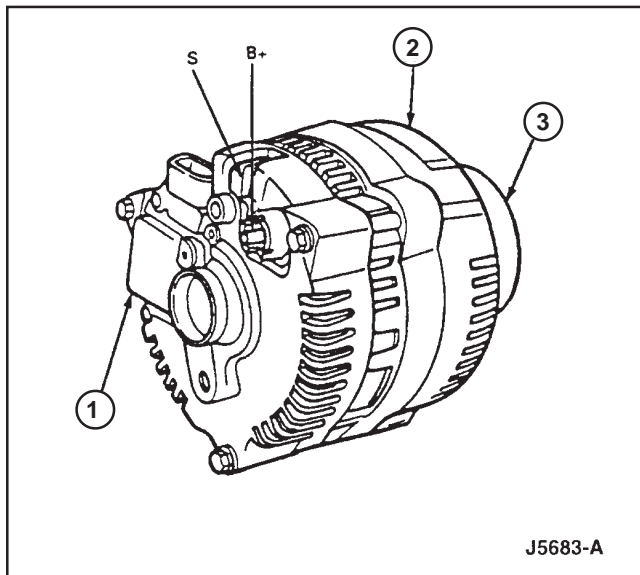
GENERAL INFORMATION

Generator

With the key in the RUN position, voltage is applied through the charge indicator lamp “I” circuit to the voltage regulator. This turns the voltage regulator on allowing current to flow from the battery sense “A” circuit to the generator field coil. When the engine (6007) is started, the generator (10346) begins to generate alternating (AC) current which is converted to direct (DC) current by the rectifier internal to the generator. This current is then supplied to the electrical system through the Battery Positive Voltage (B+) terminal located on the rear of the generator.

Once the generator begins generating current, a voltage signal is taken from the stator and fed back to the voltage regulator “S” circuit, turning off the charge indicator/lamp.

With the system functioning normally, the generator output current is determined by the voltage at the “A” circuit. This voltage is compared to a set voltage internal to the voltage regulator, and the voltage regulator controls the generator field current to maintain proper generator output. The set voltage will vary with temperature and is typically higher in the winter than in the summer, allowing for better battery recharge.



J5683-A

- ① Generator Regulator 10316
- ② Generator 10346
- ③ Generator Pulley 10344

Circuit Description

Battery Positive Voltage (B+) Output

The generator output circuit 38 (BK/O) is supplied through the battery positive voltage (B+) output connection to the battery and electrical system. The B+ circuit is hot at all times. This circuit is protected by a 12 gage fuse link.

“I” Circuit

The “I” circuit, or ignition switch (11572), circuit 904 (LG/R) is used to turn on the voltage regulator. This circuit is closed with the ignition switch in the RUN position. This circuit is also used to turn the charge indicator lamp on if there is a fault in the charging system operation or associated wiring circuits.

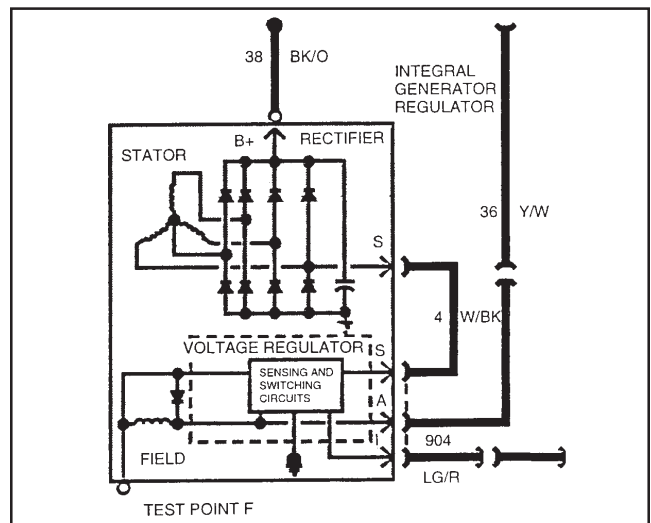
“A” Circuit

NOTE: The “A” circuit is electrically hot at all times.

The “A” circuit, or battery sense circuit, circuit 36 (Y/W) is used to sense the battery voltage. This voltage is used by the voltage regulator to determine the output. This circuit is also used to supply power to the field coil. This circuit is recommended to be protected by a 15 amp fuse or a fuse link.

“S” Circuit

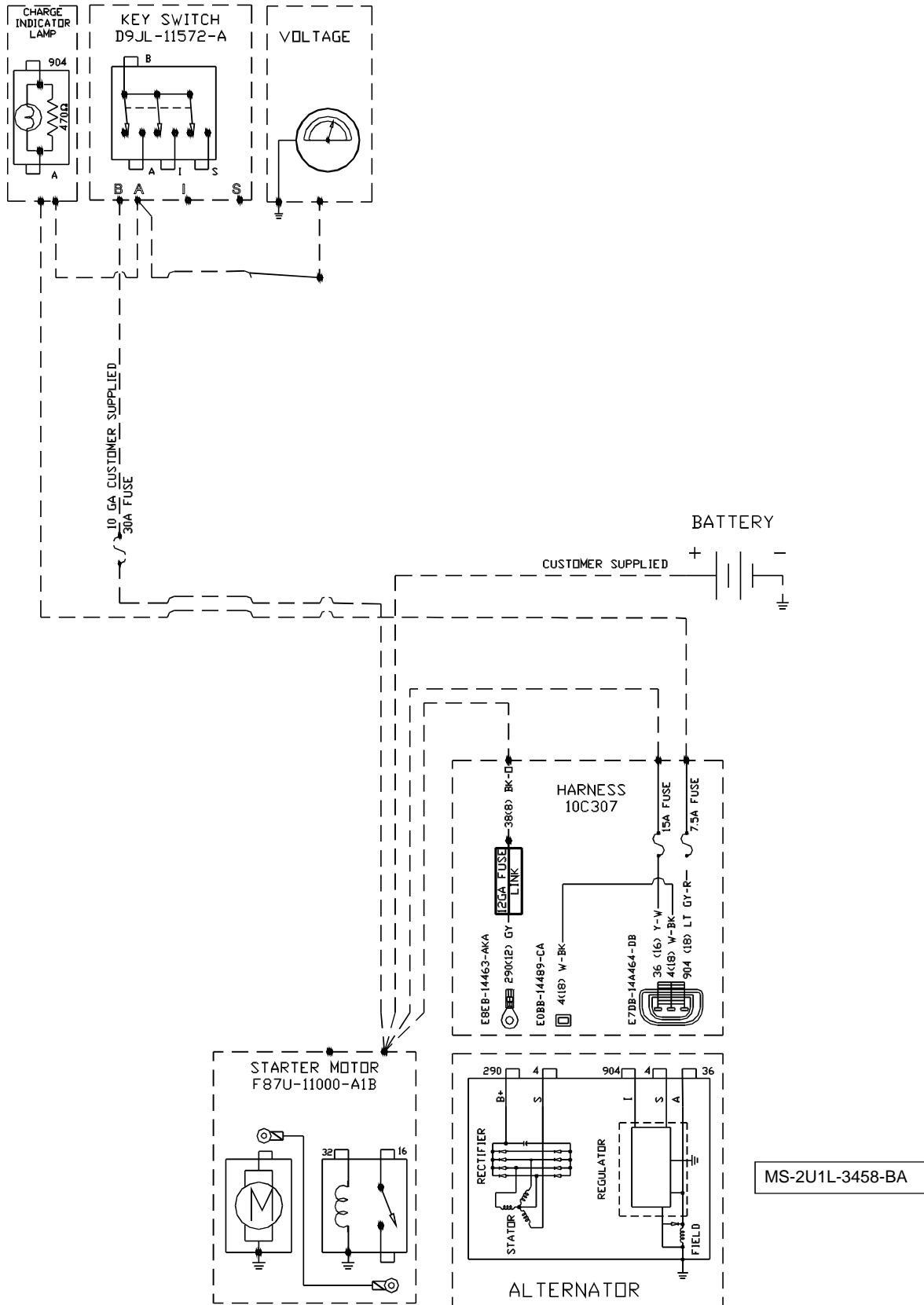
The “S” circuit, or stator circuit, circuit 4 (W/BK) is used to feed back a voltage signal from the generator to the voltage regulator. This voltage, typically 1/2 battery voltage when the generator is operating, is used by the voltage regulator to turn off the charge indicator lamp.



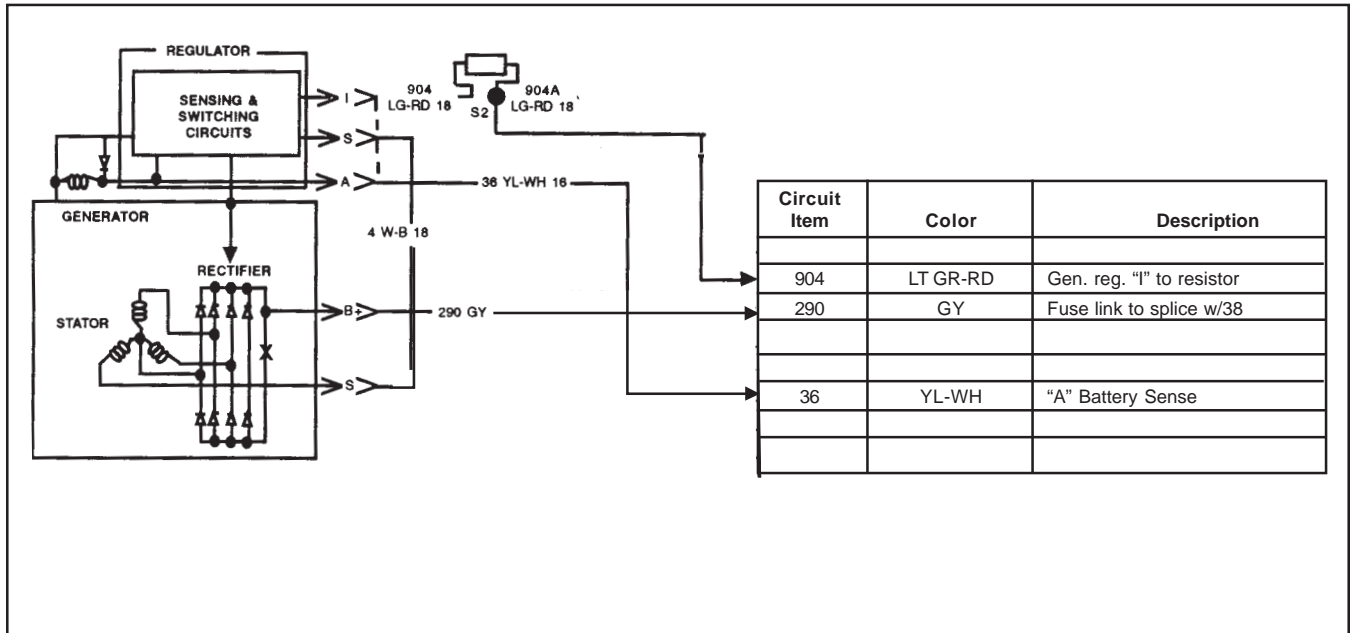
DIAGNOSIS AND TESTING

Recommended Accessory Wiring

NOTE: Dashed wire lines are CUSTOMER SUPPLIED!!



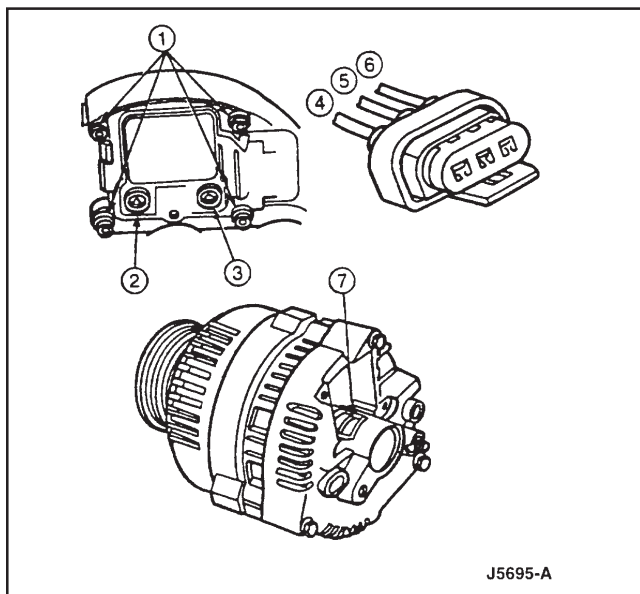
Recommended Generator Wiring



Before performing generator tests on the unit, note conditions such as: slow cranking, dead battery, charge indicator lamp stays on with engine running, etc. This information will aid in isolating the part of the system causing the symptom.

Voltage Regulator and Back of Governor

Item	Part Number	Description
1	-	Mounting Screws (Ground Connection) (4 req'd). Tighten to 1.7-2.8 Nm (15-25 In-Lb) (Part of 10316).
2	-	Brush Holder Screw (Test Point "F") (Part of 10316).
3	-	Brush Holder Screw (Test Point "A") (Part of 10316).
4	-	I Circuit 904 (Part of 14305).
5	-	S Circuit 4 (part of 14305).
6	-	A Circuit 36 (Part of 14305).
7	10328	Rotor Slip Ring.



Visual Inspection

Preliminary checks to the charging system should be made regardless of the fault condition. These checks include:

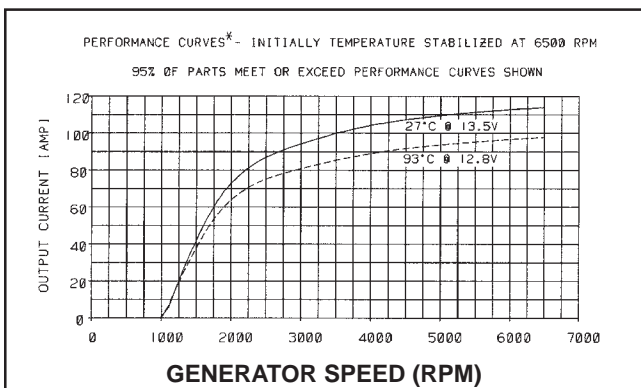
1. Check battery posts and cable terminals for clean and tight connections. Clean the posts and the cables to ensure good electrical contact.
2. Check for secure connections at the generator output, regulator, and engine ground. Also check the connection at the load distribution point (starter relay).
3. Check the fuses/fuse links and wiring to the generator to ensure that they are not burned or damaged. This condition, resulting in an open circuit or high resistance, can cause erratic or intermittent charging system concerns.
4. Check the battery voltage. If the voltage is less than 12.3 volts with the engine and all accessories off, charge battery before proceeding.

In order to check the generator, the use of Rotunda Starting and Charging System Tester 078-00005 (VAT-40) [Rotunda Tools (1-800-578-7375)] or equivalent, is recommended.

Generator Output Test

NOTE: Refer to the test equipment user's manual for complete directions on examining the charging system.

1. Switch the tester to ammeter function.
2. Connect the positive and negative leads of the tester to the battery.
3. Connect current probe to generator B+ output lead Circuit 38 (BK/O) (to measure generator output).
4. With the engine running at 2000 rpm, adjust the VAT-40 or equivalent load bank to determine the output of the generator. Generator output should be greater than values given in graph below. If not, refer to symptom chart in this Section.



Generator Voltage Test

1. Switch the tester to the voltmeter function.
2. Connect the positive lead to the generator A- terminal connector and the negative lead to ground.
3. Turn off all electrical accessories.
4. With the engine running at 2000 rpm, check the generator voltage.
5. Voltage should be between 13.0-15.5 volts.

NOTE: If voltage is **not** within specifications, refer to symptom chart.

Battery — Drain Test

WARNING: DO NOT ATTEMPT THIS TEST ON A LEAD-ACID BATTERY THAT HAS RECENTLY BEEN RECHARGED. EXPLOSIVE GASES MAY CAUSE PERSONAL INJURY. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

CAUTION: To prevent damage to the meter, do not crank the engine or operate accessories that draw more than 10A.

NOTE: No accessory system should have more than a 50 mA (0.050 amp) draw.

NOTE: Many modules draw 10 mA (0.010 amp) or more continuously.

NOTE: Use an in-line ammeter between the battery positive or negative post and its respective cable.

NOTE: Typically, a drain of approximately one amp can be attributed to a lamp staying on continually. Other component failures or wiring shorts may be located by selectively pulling fuses to pinpoint the location of the current drain. When the current drain is found, the meter reading will fall to an acceptable level. If the drain is still not located after checking all the fuses, it may be due to the generator.

NOTE: To accurately test the drain on a battery, an in-line digital ammeter must be used. Use of a test lamp or voltmeter is not an accurate method.

WSG-1068 CHARGING SYSTEM

Check for current drains on the battery in excess of 50 milliamps (0.050 amp) with all the electrical accessories off and the engine off. Current drains can be tested with the following procedure:

1. Make sure the junction box/fuse panels are accessible without turning on auxiliary components.
2. Operate the engine at least five minutes and exercise systems.
3. Allow the engine to sit with the key OFF for at least 40 minutes to allow modules to time out/power down.
4. Connect a fused jumper wire between the negative battery cable and the negative battery post to prevent modules from resetting and to catch capacitive drains.
5. Disconnect the negative battery cable from the post without breaking the connection of the jumper wire.

NOTE: It is very important that continuity is not broken between the battery and the negative battery cable when connecting the meter. If this happens, the entire procedure must be repeated. Connect the tester between the negative battery cable and the post. The meter must be capable of reading milliamps and should have a 10amp capability.

NOTE: If the meter settings need to be switched or the test leads need to be moved to another jack, the jumper wire must be reinstalled to avoid breaking continuity.

6. Remove the jumper wire.

NOTE: Amperage draw will vary from engine to engine depending on the equipment package. Compare to a similar engine for reference.

NOTE: No engine application should have more than a 50 mA (0.050 amp) draw.

7. If the draw is found to be excessive, pull fuses or disconnect suspected draws one at a time and note the current drop. Do not reinstall the fuses or connections until you are finished testing.
8. Check the wiring for any auxiliary circuits that run from the battery. Disconnect these circuits if the draw is still excessive.

Symptom Chart

SYMPTOM	POSSIBLE CAUSE	ACTION
Batter is discharged (battery voltage less than 8 volts)	<ul style="list-style-type: none"> • Corroded terminal(s). • Loose connection(s). • High key-off current drain(s). • Battery. • Generator. 	<ul style="list-style-type: none"> • Go to Pinpoint Test A
The charge system warning indicator is on with the engine running (the system voltage does not increase)	<ul style="list-style-type: none"> • Circuitry. • Voltage regulator. • Generator. 	<ul style="list-style-type: none"> • Go to Pinpoint Test C
The system overcharges (battery voltage greater than 15 volts)	<ul style="list-style-type: none"> • Circuitry. • Voltage regulator. • Generator. 	<ul style="list-style-type: none"> • Go to Pinpoint Test B
The charging system warning indicator flickers or is intermittent	<ul style="list-style-type: none"> • Corroded terminal(s). • Circuitry. • Voltage regulator. • Generator. • Fuse(s). 	<ul style="list-style-type: none"> • Go to Pinpoint Test A
The generator is noisy	<ul style="list-style-type: none"> • Bolts or brackets. • Drive belt. • Generator or pulley. 	<ul style="list-style-type: none"> • Inspect accessory drive components

Pinpoint Test A: Generator Output Voltage

Inspection and Verification

1. Visually inspect for obvious signs of terminal corrosion and electrical harness damage.
2. Inspect fusible links and generator connector for bent or backed-out connector pins, or damage to wiring.
3. Visually inspect for and note auxiliary system connections not shown on the **Recommended Customer Connections Wiring Schematic**.

Normal Operation

With voltage applied to the generator I circuit, the regulator is activated, allowing current to flow from the sense A circuit to generator field coil. The generator then generates an internal AC current, which is converted to a DC output by the rectifier assembly internal to the generator, and is supplied to the battery through the B+ terminal. The S (stator) circuit is used to feed back a voltage signal from the generator to the regulator. This voltage (typically half battery voltage) is used by the regulator to turn off the charge indicator.

Step	Action	Values	Yes	No
1	1. Determine if the battery can hold a charge and is OK for use. Is the battery OK?	12.53-15.2 volts	GO to Step 2	Install a new battery and RETEST the system for normal operation.
2	1. Measure the voltage at the B+ terminal on the back of the generator. Is the voltage at B+ terminal equal to battery voltage?		GO to Step 3	Check the fusible links and replace if required. If OK inspect for open circuits.
3	1. Measure voltage at test point A on the voltage regulator. Is the voltage at test point A equal to battery voltage?		GO to Step 4	Check the fusible links and replace if required. If OK inspect for open circuits.
4	1. Measure voltage at test point F. Is the voltage at test point A equal to battery voltage?		GO to Step 5	GO to Step 11
5	1. KOEO. 2. Note: Voltage regulator must be connected to wiring harness for this test. Measure the voltage at wiring harness I terminal circuit 904. Is the voltage greater than 1 volt?		GO to Step 6	REPAIR the circuit(s) in question. TEST the system
6	1. Measure the voltage drop between test point A on the voltage regulator and the positive (+) battery post. Is the voltage drop less than 0.25 volts?		Go to Step 7	Inspect auxiliary wiring connections for an excessive current draw. Check the fusible links and replace if required. REPAIR the circuit(s) in question. TEST the system
7	1. Measure the voltage at test point F on the voltage regulator. Is the voltage at test point F less than 2 volts?		Go to Step 8	Refer to the Fuel Systems Manufacturing Information and Test

WSG-1068 CHARGING SYSTEM

8	<ol style="list-style-type: none"> 1. Remove the one-pin S connector from the generator. 2. Measure for voltage between the S terminal on the back of the generator and ground. <p>Is the voltage reading greater than 1 volt?</p>		Replace the generator.	Go to Step 9
9	<ol style="list-style-type: none"> 1. Install the S connector. 2. Start the engine. 3. Turn on any accessory. 4. With the engine running at 2000 RPM, measure the voltage drop between the B+ terminal on the back of the generator and the positive (+) battery post. <p>Is the voltage drop greater than 0.5 volts?</p>		Go to Step 10	<p>Inspect wiring for auxiliary connections for an excessive current draw. REPAIR the circuit(s) in question. TEST the system</p>
10	<ol style="list-style-type: none"> 1. Connect a jumper wire from test point A on the voltage regulator to the battery negative post 2. Perform the Generator Output Test. <p>Is generator output greater than the minimum output specified?</p>		Replace the Voltage Regulator	Replace the Generator
11	<ol style="list-style-type: none"> 1. Remove the generator. 2. Remove the voltage regulator. 3. Measure the resistance between the generator slip rings. <p>Is the resistance greater than 10 ohms or less than 1 ohm?</p>		Replace the Generator	<p>Check for worn brushes (less than 8mm long) or open brush leads and replace if required</p>

Pinpoint Test B: Voltage Output High

Inspection and Verification

1. Visually inspect for obvious signs of terminal corrosion and electrical harness damage.
2. Inspect for poor ground connections or backed-out connector pins, or damage to wiring.
3. Visually inspect for and note auxiliary system connections not shown on the **Recommended Customer Connections Wiring Schematic**.

Step	Action	Values	Yes	No
1	<ol style="list-style-type: none"> 1. KOEO. 2. Measure the voltage drop between test point A on the voltage regulator and the positive (+) battery post. <p>Is the voltage drop less than 0.25 volt?</p>		GO to Step 2	Inspect auxiliary wiring connections for an excessive current draw. Check the fusible links and replace if required. REPAIR the circuit(s) in question. TEST the system
2	<ol style="list-style-type: none"> 1. NOTE: Voltage regulator must be connected to wiring harness for this test. 2. Measure the voltage at wiring harness I terminal circuit 904 LG/RD. <p>Is the voltage greater than 1volt?</p>		GO to Step 3	Inspect auxiliary wiring connections for an excessive current draw. Check the fusible links and replace if required. REPAIR the circuit(s) in question. TEST the system
3	<ol style="list-style-type: none"> 1. Check for poor ground connections between voltage regulator and the generator. 2. Check for poor ground connection between the engine and battery. <p>Are all ground connections clean and tight?</p>		GO to Step 4	CLEAN or REPAIR grounds as required
4	<ol style="list-style-type: none"> 1. Key OFF 2. Measure voltage at test point F on the voltage regulator.. <p>Is the voltage at test point F equal to battery voltage?</p>		Generator is OK, Replace the voltage regulator	GO to Step 5
5	<ol style="list-style-type: none"> 1. Remove the generator. 2. Remove the voltage regulator. 3. Measure the resistance between each generator slip ring to the generator housing. <p>Is the resistance between each ring and the generator housing less than 200 ohms?</p>		If grease or dirt has accumulated near the slip rings, CLEAN the slip rings and RECHECK resistance. If still less than 200 ohms, Replace the generator.	Replace the voltage regulator

Pinpoint Test C: Indicator Lamp ON, Engine Running

Inspection and Verification

1. Visually inspect for obvious signs of terminal corrosion and electrical harness damage or a bulb failure.
2. Inspect fusible links and generator connector for bent or backed-out connector pins, or damage to wiring.
3. Visually inspect for and note auxiliary system connections not shown on the **Recommended Customer Connections Wiring Schematic**.

Normal Operation

With voltage applied the high side of a charge warning indicator lamp, the generator will momentarily will pull the warning lamp to ground and illuminate the indicator until the regulator is activated. The S (stator) circuit is used to feed back a voltage signal from the generator to the regulator. This voltage (typically half battery voltage) is used by the regulator to turn off the charge indicator.

Step	Action	Values	Yes	No
1	<ol style="list-style-type: none"> 1. Disconnect the three-pin generator connector. 2. KOEO <p>Is the charge indicator ON?</p>		Inspect the auxiliary wiring for a short to ground. REPAIR the circuit(s) in question. TEST the system	GO to Step 2
2	<ol style="list-style-type: none"> 1. KOEO 2. Jumper the generator harness connector I terminal, circuit 904 LT GY/RD to ground. <p>Does the charge indicator illuminate?</p>		GO to Step 3	Inspect the warning bulb and circuit 904 for an open circuit. REPAIR the circuit(s) in question. TEST the system
3	<ol style="list-style-type: none"> 1. Reconnect the three-pin generator connector. 2. Remove the one-pin S connector. 3. Jumper the S terminal circuit 4 WH/BK to battery voltage. <p>Is the charge indicator ON?</p>		Remove the jumper wire. GO to Step 4	Remove the jumper wire. GO to Step 5
4	<ol style="list-style-type: none"> 1. Key Off. 2. Disconnect the three-pin generator connector. 3. Measure the resistance between the one-pin S connector and the S (center) pin of the voltage regulator connector. <p>Is the resistance greater than 1 ohm?</p>		Repair open or excess resistance in circuit 4 WH/BK. TEST the system	CHECK for a loose or bent pin in the voltage regulator or connector. If OK, replace the voltage regulator.
5	<ol style="list-style-type: none"> 1. Reconnect the one-pin S connector. 2. Start the engine. 3. Measure the voltage at the one-pin S connector. <p>Is the voltage at least ½ of the battery voltage?</p>		GO to Step 6	GO to Pinpoint Test A to find the cause of low generator output.

REMOVAL AND INSTALLATION

Generator - Removal

1. Disconnect battery ground cable (14301).
2. Remove snow/ice shield.
3. Disconnect the generator voltage regulator wiring (14305) to the voltage regulator.
4. Remove wiring connector bracket.
5. Relieve the tension of the drive belt tensioner (613209) and remove the drive belt.
6. Remove the bolts holding the generator to the generator bracket (10A313).
7. Remove the generator from the generator bracket.

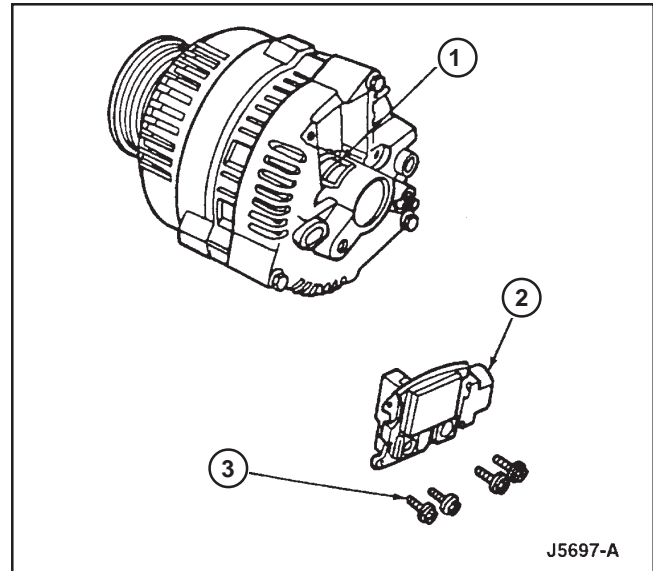
Generator - Installation

1. Position the generator on the generator bracket.
2. Install the bolts and tighten to 40-55 Nm (30 -40 ft-lb).
3. Install the drive belt over the generator pulley.
4. Relieve the tension of the drive belt tensioner and install the drive belt over tensioner.
5. Connect generator voltage regulator wiring to the voltage regulator. Tighten generator Battery Positive Voltage (B+) wire attaching nut to 9-12 Nm (6.5-9 ft-lb).
6. Install wiring connector bracket.
7. Install snow/ice shield.
8. Connect battery ground cable.

Regulator - Removal

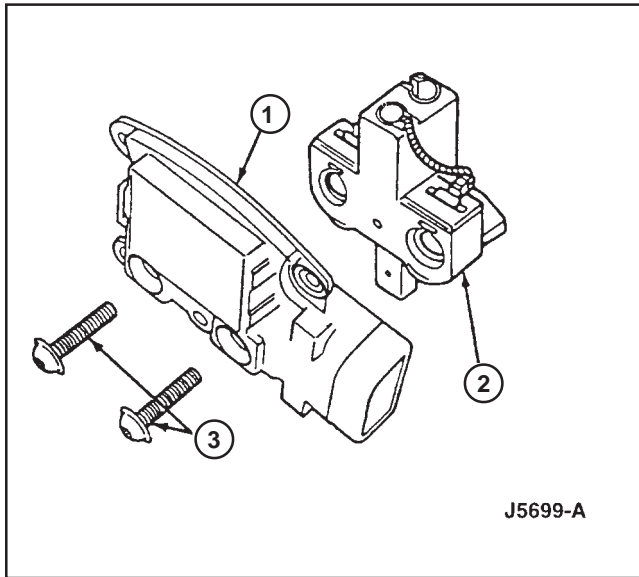
1. **NOTE:** for ease of removal and installation of regulator, remove the generator from engine as described above.

Remove the four screws (T20 Torx type head) attaching the voltage regulator to the generator housing. Remove the voltage regulator with generator brush holder (10351) attached, from the generator.



- ① Slip Rings 10328
- ② Regulator 10316 and Brush Holder Assembly 10347
- ③ Screw 4 Req'd. Tighten to 2.3-3.4 Nm (20-30 In-Lb)

2. Hold the voltage regulator in one hand and pry off the cap covering the "A" screw head with a screwdriver.
3. Remove two screws (T20 Torx type head) attaching the regulator to the generator brush holder. Separate the regulator from generator brush holder.



- ① Voltage Regulator 10316
- ② Generator Brush Holder 10347
- ③ Screw (2 Req'd) Tighten to 2.8-4.0 Nm (25-35 In-Lb)

Regulator - Installation

1. Replace generator brush holder to voltage regulator and install attaching screws.
2. Replace cap on the head of the "A" terminal screw.
3. Depress the generator brushes in the generator brush holder.
 - Hold the generator brushes in position by inserting a standard size paper clip (or equivalent) through both the location hole in the voltage regulator and through the holes in the generator brush holders.
4. Install the voltage regulator and generator brush holder to the generator with attaching screws.
 - Remove paper clip (or equivalent) from the regulator.
5. Install generator following installation in this section.

NOTE: Only the regulator, brush holder and generator pulley are serviceable. If the generator needs further service, it must be replaced as an assembly.

SPECIFICATIONS**Torque Specifications**

Description	N m	Lb-Ft	Lb-In
Mounting Bracket Bolts	40-55	30-40	
Regulator Ground Screw	1.7-2.8	15.25	
Wire Attaching Nut	9-12	6.5-9	
Voltage Reg. Hold Down Bolts	2.8-4.0		25-35

Generator Parts Cross-Reference

Base Part #	Part Name	Old Part Name
6007	Engine	
6B209	Drive Belt Tensioner	
8620	Drive Belt	
10A313	Generator Bracket	Alternator Mounting Parts
10344	Generator Pulley	Alternator Pulley
10346	Generator	Alternator
10351	Generator Brush Holder	
14305	Generator Voltage Regulator Wiring	

Special Tools**Rotunda Equipment**

Tool Number	Description
105-R0057	73111 Automotive Meter