DESCRIPTION

There are 2 types of alternators used with external regulators. One type is a rear terminal and the other is a side terminal. Current is supplied from alternator-regulator system to rotating field of alternator through 2 brushes to 2 slip rings. Power is produced in form of alternating current which is rectified to direct current by 6 diodes.

Alternator regulator automatically adjusts alternator field current to maintain alternator output voltage within prescribed limits to correctly charge battery. A fusible link is incorporated into the wiring harness between the starter relay and alternator to prevent damage should the harness become grounded or a booster battery be used with incorrect polarity.

The external electronic voltage regulator consists of transistors, diodes, and resistors. The 2 systems utilize 2 regulators. The first, with connector color coded Black, is used in systems with an indicator warning light. The second, with Neutral colored connector, may be used in indicator warning light or ammeter equipped systems. A 500-ohm, 1/4-watt resistor is used on models with an indicator warning light. Resistor is located on back of instrument cluster.

ON-VEHICLE TESTS

BATTERY VOLTAGE TEST

Connect negative lead of voltmeter to negative battery post and positive lead to positive battery post. Record battery base voltage for comparison with other test results.

NO LOAD TEST

1) Attach tachometer to engine. Start engine and operate at 1500 RPM with no electrical load (foot off brake and doors closed).
2) Voltmeter reading should be taken when needle stops moving. This may require a few minutes. Voltmeter reading should increase 1-2 volts above battery voltage.
3) If voltage increases properly, proceed to LOAD TEST. If voltage increases more than 2 volts, proceed to OVERVOLTAGE TEST. If no voltage increase results, proceed to UNDervoltage TEST.

LOAD TEST

1) Attach tachometer to engine. Start engine and turn on A/C-heater blower motor to high position. Turn headlights on to high beam. Increase engine speed to 2000 RPM.
2) Voltmeter should indicate a minimum of 0.5 volt increase over battery voltage. If system conforms to these readings, alternator operation is normal. If less than 0.5 volts, proceed to UNDervoltage TEST.
OVERVOLTAGE TEST

1) If voltmeter reading indicates overvoltage (more than 2.0 volts above battery voltage), connect a jumper wire between regulator base and alternator frame. Repeat NO LOAD TEST.
2) If overvoltage condition disappears, check ground connections at regulator, alternator, from firewall to engine, and from engine to battery.
3) If overvoltage still exists, disconnect regulator wiring plug and repeat NO LOAD TEST. If condition is corrected, replace regulator.
4) If overvoltage still exists with regulator disconnected, a short is indicated in wiring harness between alternator and regulator ("A" and "F" circuits). Repair short circuit and reconnect voltage regulator plug.

UNDERVOLTAGE TEST

1) If voltmeter does not indicate more than 0.5 volt above battery voltage, disconnect wiring plug from regulator and connect an ohmmeter from "F" terminal of plug to battery ground.
2) Ohmmeter should indicate more than 2.4 ohms. If less than 2.4 ohms, repair grounded field circuit and repeat LOAD TEST.
3) If field circuit is satisfactory (more than 2.4 ohms), disconnect regulator wiring plug at regulator and connect jumper wire between "A" and "F" terminals on regulator wiring plug. Repeat LOAD TEST.
4) If more than 0.5 volts above battery voltage, regulator or wiring harness is defective. Service regulator or wiring as necessary. Perform REGULATOR "S" & "I" CIRCUIT TEST.
5) If undervoltage problem still exists, remove jumper wire at regulator plug and leave plug disconnected from regulator. Disconnect wire from "FLD" terminal on alternator. See Fig. 1.
6) Connect a jumper wire to "FLD" and "BAT" terminals on alternator. Repeat LOAD TEST. If results are now satisfactory (0.5 volts above battery voltage), repair wiring harness from alternator to regulator.
7) If voltmeter still indicates undervoltage, move positive lead of voltmeter to "BAT" terminal. If battery voltage now exists, repair or replace alternator. If reading is zero volts, repair "BAT" wire to starter relay.
REGULATOR "S" & "I" CIRCUIT TEST
1) Disconnect regulator connector. Install a jumper wire between terminals "A" and "F". See Fig. 2. With engine idling, connect positive voltmeter lead to regulator wiring plug "S" terminal and negative lead to ground.

2) Check voltage. Disconnect positive lead. Connect positive lead to "I" terminal. Voltage of "S" terminal should read approximately one-half of "I" terminal reading.

3) If readings are okay, remove jumper wire. Replace regulator. If there is no voltage, repair wiring circuit. Connect positive voltmeter lead to positive battery cable. Remove jumper wire. Connect voltage regulator connector. Repeat LOAD TEST.

---

**Fig. 2: Voltage Regulator Connector**  
Courtesy of Ford Motor Co.

**BENCH TESTS**
RECTIFIER SHORTED OR GROUNDED & STATOR GROUNDED TEST

1) Set ohmmeter on x1 scale. Connect one probe to alternator "BAT" terminal (Red insulator) and other probe to "STA" terminal (Black insulator; rear blade terminal on side terminal alternators).
   2) Reverse ohmmeter probes and repeat test. Ohmmeter should read about 6 ohms in one direction and infinity when probes are reversed. A reading in both directions indicates a bad positive diode, a grounded positive diode plate, or a grounded "BAT" terminal.
   3) Perform same test using "STA" and "GND" terminals of alternator. Readings in both directions indicate either bad negative diode, grounded stator winding, grounded stator terminal, grounded positive diode plate, or grounded "BAT" terminal.
   4) If no needle movement is indicated in one direction, but high resistance (considerably more than 6 ohms is indicated) in the other direction, a bad connection exists between stator lead and stator bolt head.

FIELD OPEN OR SHORT CIRCUIT TEST

1) Set ohmmeter on x1 scale. Contact alternator "FLD" terminal (Orange insulator) with one probe. Contact "GND" terminal with other probe and spin alternator pulley.
   2) Ohmmeter should read between 2.1-100 ohms (2.4-100 ohms on side terminal alternators) and should fluctuate while pulley is spinning. An infinite reading indicates an open brush lead, worn or stuck brushes, or bad rotor assembly.
   3) A reading of less than 2.1 ohms (2.4 ohms on side terminal alternators) indicates grounded brush assembly, grounded field terminal, or a bad rotor.

DIODE TEST

1) Remove rectifier assembly from alternator. Set ohmmeter on x1 scale. To test one set of diodes, contact one ohmmeter probe to terminal bolt and contact each of 3 stator lead terminals with other probe.
   2) Reverse probes and repeat test. All diodes should show readings of approximately 6 ohms in one direction and infinite readings with probes reversed.
   3) Repeat test for other set of diodes, moving first probe to other terminal screw. If meter readings are not as specified, replace rectifier assembly.

STATOR COIL GROUNDED TEST

1) Remove stator from alternator. Set ohmmeter on x1000 scale. Connect one ohmmeter probe to one stator lead and other probe to stator laminated core. Ohmmeter reading should be infinity.
   2) If meter needle moves, stator winding is shorted to core. Stator must be replaced. Repeat test for each stator lead. Do not touch hands to metal probes or to stator leads or an incorrect reading will result.

STATOR COIL OPEN TEST

Remove stator from alternator. Set ohmmeter on x1 scale. Connect one ohmmeter probe to a stator lead and the other to another stator lead. If no meter movement occurs, stator coil is open. Stator must be replaced. Repeat tests with other stator leads. On 100-amp alternators having a "delta" connected stator, a single open phase
**ROTOR OPEN OR SHORT CIRCUIT TEST**

1) Remove rotor from alternator. Set ohmmeter on x1 scale. Contact each probe to a rotor slip ring. Reading should be 2.0-3.5 ohms (2.3-2.5 ohms on side terminal alternators). A higher reading indicates damaged slip ring solder connection or broken wire.

2) A lower reading indicates a shorted wire or slip ring. Replace rotor if damaged. Contact one ohmmeter probe to slip ring and other probe to rotor shaft.

3) Ohmmeter reading should be infinity. Readings other than infinity indicate that rotor is shorted to shaft. If so, rotor must be replaced. Damaged slip ring terminals or solder touching rotor shaft will cause shorted condition.

**OVERHAUL**

**REAR TERMINAL ALTERNATORS**

**Disassembly**

1) Mark end housings and stator frame with scribe for reassembly reference. Remove through bolts. Separate front housing and rotor assembly from stator and rear housing.

2) Remove brush springs from rear housing brush holder. Remove all nuts, washers, and insulators from terminals on back of rear housing. See Fig. 3. Note color and location of insulators for reassembly.

3) Remove stator and rectifier assembly from rear housing. Remove brush holder, brushes, and brush terminal insulator. Remove bearing from rear housing with an arbor press.

4) Lightly clamp rotor in vise using protective jaws. Remove drive pulley nut from rotor shaft. Remove lock washer, drive pulley, fan, and fan spacer from rotor shaft.

5) Separate rotor and front housing. Release rotor from vise. Remove front bearing spacer from rotor shaft. Do not remove stop ring from rotor shaft unless it is damaged.

6) Remove bearing retainer and bearing from front housing. Press bearing out with an arbor press if necessary. Remove radio
suppression capacitor and battery terminal insulator from rectifier assembly.

7) Using a 100-watt soldering iron, unsolder stator leads from rectifier assembly. Do not permit rectifiers to overheat. Unsolder stator lead terminals from molded circuit board terminals. Use needle nose pliers to pull stator lead terminals away from rectifier assembly. Shake molten solder from terminals while hot.

8) Disconnect stator phase lead from flat type rectifiers by removing stator terminal screw, pressing it straight out of rectifier. Do not turn terminal screw during removal, as this will destroy retaining serrations.

9) On stacked type rectifiers (with exposed diodes), remove stator terminal screw by turning it 1/4 turn to unlock it. Ground screw can be removed in similar manner, depending on type of rectifier.

Reassembly

1) Never use solvent to clean rotor or stator. Wipe parts off with clean cloth. Install bearing in front housing, pressing on outer race only. Install bearing retainer.

2) If stop ring was removed from rotor shaft, install new ring by sliding it over end of shaft and into groove. Do not open stop ring with snap ring pliers. Install bearing spacer on rotor shaft with recessed side against stop ring.

3) Install rotor in front housing and clamp in vise. Install fan spacer, fan, drive pulley, lock washer, and nut on rotor shaft. Remove rotor and housing assembly from vise.

4) Press bearing onto rear housing, providing support close to bearing boss. Bearing should be flush with housing. Position brush wiring connector over brush terminal and install insulator. Install springs and brushes in holder. Use stiff wire to hold brushes in place. See Fig. 4.

Fig. 4: Brush Holder Assembly with Wire Inserted Through Holes for Retaining Brushes in Place
Courtesy of Ford Motor Co.

5) Install brush holder in rear housing and install attaching
screws. Press holder firmly against housing while tightening. Be sure ground brush wiring connector is positioned under screw before tightening.

6) Connect stator phase lead to rectifiers. On flat rectifier assembly, position stator terminal insulator and stator phase lead on rectifier assembly. Insert terminal screw and press into position. Phase lead terminal should not move if screw is pressed to proper depth. See Fig. 5.

7) On stacked rectifier assembly, place stator phase lead and dished washer on rectifier assembly. Insert terminal screw and rotate it 1/4 turn to lock it in place. See Fig. 6.

8) If ground screw was removed, install in same manner as other screws, depending on type of rectifier. Wrap stator winding leads around terminals of rectifier assembly and solder them, using 100-watt soldering iron and resin core electrical solder.

9) Install radio suppression capacitor and battery terminal insulator on rectifier assembly. Install insulator on stator terminal screw. Align terminal screws on rectifier assembly with holes in back of rear housing and install stator rectifier assembly in rear housing.

10) Install insulators, washers, and nuts on proper terminals. Black insulator goes on "STA" terminal, Red on "BAT" terminal, and Orange on "FLD" terminal. Ensure terminal insulators are seated in their recesses.

11) Wipe rear end bearing surfaces on rotor shaft with clean rag. After placing rear housing and stator assembly over rotor, align scribe marks made during disassembly.

12) Seat machined portion of stator core into stop in each end housing. Install and tighten through bolts. Remove stiff wire from brush holder.

---

Fig. 5: Flat Rectifier Assembly
Courtesy of Ford Motor Co.

SIDE TERMINAL ALTERNATORS
Disassembly
1) Mark both end housings and stator with a scribe for reassembly reference. Remove through bolts and separate front and rear housings. Do not separate rear housing from stator at this time.
2) Lightly clamp rotor in vise using protective jaws. Remove drive pulley nut, lock washer, pulley, fan, and fan spacer from rotor shaft. Pull rotor and shaft from front housing. Remove spacer from rotor shaft.
3) Remove 3 screws retaining bearing in front housing. Press bearing out of housing. Unsolder and remove 3 stator leads from rectifier, using care not to overheat rectifier. Lift stator from rear housing.
4) Unsolder and remove brush holder lead from rectifier. Remove screw attaching capacitor lead and 4 screws securing rectifier to rear housing. Remove 2 terminal nuts, insulator from outside housing, and rectifier from rear housing.
5) Remove brush holder assembly. Remove any sealing compound from rear housing and brush holder. Remove capacitor. Remove rear bearing, if necessary, by supporting housing close to bearing boss.

Reassembly
1) Never use solvent to clean rotor or stator. Wipe parts off
with clean cloth. Press new front bearing into housing. Apply pressure on bearing outer race only. Install bearing retaining screws.

2) Place inner spacer on rotor shaft. Insert shaft into front housing and bearing. Install fan spacer, fan, pulley, lock washer, and nut on rotor shaft. Press new rear bearing into housing until it is flush with boss on outer surface.

3) Place brush terminal on brush holder. Install springs and brushes in holder, and secure with stiff wire. Install brush holder in rear housing. Push brush holder toward rotor shaft opening and tighten attaching screws.

4) Install capacitor in rear housing. Place 2 rectifier insulators on bosses inside housing. Place insulator on "BAT" (large) terminal and position rectifier in rear housing. Install outside insulator on "BAT" terminal and install nuts on "BAT" and "GND" terminals (finger tight only).

5) Install 4 rectifier attaching screws loosely. Tighten "BAT" and "GND" terminal nuts outside of housing and then 4 rectifier attaching screws. Attach capacitor lead to rectifier.

6) Press brush holder lead on rectifier pin and solder securely. Do not permit rectifier to overheat. Position stator in rear housing and align scribe marks made during disassembly.

7) Press 3 stator leads on rectifier pins and solder securely. Install rotor and front housing to stator, then install rear housing, by aligning scribe marks.

8) Install through bolts. Tighten 2 opposing bolts and then 2 remaining bolts. Spin fan and pulley to check for binding. Remove brush retaining wire. Place daub of waterproof cement over hole to seal it.

**ALTERNATOR SPECIFICATIONS**

**ALTERNATOR SPECIFICATIONS TABLE**

<table>
<thead>
<tr>
<th>Application</th>
<th>Inches (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brush Length</td>
<td></td>
</tr>
<tr>
<td>New</td>
<td>.48 (12.2)</td>
</tr>
<tr>
<td>Wear Limit</td>
<td>.25 (6.4)</td>
</tr>
<tr>
<td>Slip Rings</td>
<td></td>
</tr>
<tr>
<td>Minimum Diameter</td>
<td>1.2 (31)</td>
</tr>
<tr>
<td>Maximum Runout</td>
<td>.0005 (.013)</td>
</tr>
</tbody>
</table>
## TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS TABLE

<table>
<thead>
<tr>
<th>Application</th>
<th>Ft. Lbs. (N.m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belt Adjustment Bolt</td>
<td></td>
</tr>
<tr>
<td>Rear Terminal</td>
<td>24-34 (33-46)</td>
</tr>
<tr>
<td>Side Terminal</td>
<td>50-70 (68-95)</td>
</tr>
<tr>
<td>Pivot Bolt</td>
<td></td>
</tr>
<tr>
<td>Rear Terminal</td>
<td>40-50 (54-68)</td>
</tr>
<tr>
<td>Side Terminal</td>
<td>50-70 (68-95)</td>
</tr>
<tr>
<td>Pulley Nut</td>
<td>60-100 (81-136)</td>
</tr>
<tr>
<td></td>
<td>INCH Lbs. (N.m)</td>
</tr>
<tr>
<td>Bearing Retainer Screws</td>
<td>25-40 (2.8-4.5)</td>
</tr>
<tr>
<td>Brush Holder</td>
<td>17-25 (2.0-2.8)</td>
</tr>
<tr>
<td>Rectifier Screws</td>
<td>40-50 (4.5-5.6)</td>
</tr>
<tr>
<td>&quot;STA&quot; Terminal Nut</td>
<td>25-35 (2.8-4.0)</td>
</tr>
<tr>
<td>&quot;FLD&quot; Terminal Nut</td>
<td>25-35 (2.8-4.0)</td>
</tr>
<tr>
<td>&quot;BAT&quot; Terminal Nut</td>
<td>30-55 (3.4-6.2)</td>
</tr>
<tr>
<td>Through Bolts</td>
<td>35-60 (4-6.8)</td>
</tr>
</tbody>
</table>