

Alternators & Regulators

MOTORCRAFT ALTERNATORS

Ford

DESCRIPTION

Ford light trucks use 2 similar alternators, a rear terminal model and a side terminal model. See Figs. 1 and 2. Rated outputs range from 40 to 100 amps, depending upon model used. Some models are equipped with indicator lights, others with ammeters.

Alternator is belt driven from engine. Current is supplied from Alternator-Regulator system to rotating field of alternator through 2 brushes to 2 slip rings. Power is produced in the 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. Charging systems are equipped with a fuse link between starter relay and alternator "BAT" terminal.

IDENTIFICATION & SPECIFICATIONS

Alternator is color-ink stamped with "Motorcraft" trademark. Color stamp is code for rated amperage output. Rated amperage is also stamped on end frame (40A, 60A, etc.). Color code is as follows:

ALTERNATOR OUTPUT

Application	Amperage @ 15V	Rated Output (Engine RPM)
Orange	40	2900
Green	60	2900
Green	65	2900
Black	70	1640
Red	100	2900

¹ — Rated cold output.

ALTERNATOR SPECIFICATIONS

Alternator	Specification
Field Current at 12 Volts (All)	4.0 Amps
Slip Rings (All)	
Minimum Diameter	1.22"
Maximum Runout0005"
Brush Length Wear Limit	
40 Amp.	5/16"
60 Amp.	5/16"
65 Amp.	3/16"
70 Amp.	1/4"
100 Amp.	1/4"
Pulley Nut Torque (All)	60-100 ft.lbs. (8-136 N.m)

ADJUSTMENT

ALTERNATOR REGULATOR

An electronic regulator is used on all charging systems. It is factory calibrated and cannot be adjusted.

TESTING

TESTING PRECAUTIONS

When testing or servicing alternator or regulator, take following precautions to avoid damage to components.

Battery

Do not reverse battery connections. Negative terminal must be connected to ground. When charging battery, cables must be disconnected from battery before connecting charger. Do not use charger as a booster for starting engine. If booster battery is used to start engine, negative cable of booster must be connected to negative cable of vehicle battery.

Alternator

Do not ground field circuit between alternator and regulator, or operate alternator on an open circuit with field winding energized. Do not ground output terminal or attempt to polarize alternator as polarization is not required.

Regulator

Turn ignition switch off when working on regulator. Use care to prevent a short circuit between regulator relay and regulator base while working on components. Use insulated tools when making adjustments.

VOLTMETER TEST PROCEDURES

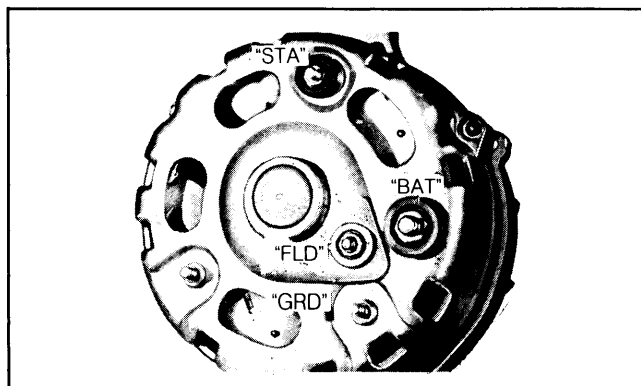
NOTE: When performing charging system test with a voltmeter, turn off all lights and electrical components. Be sure battery specific gravity is at least 1.230.

1) Connect negative lead of voltmeter to negative battery post and positive lead to positive battery post. Record battery voltage.

2) Attach tachometer and start engine. Operate at 1500 RPM with no electrical load. Voltmeter reading should increase 1-2 volts above battery voltage. Reading should be taken when voltmeter needle stops moving.

3) With engine operating, turn on heater or A/C blower motor to "HIGH" position. Turn on headlights to high beam. Increase engine speed to 2000 RPM. Voltmeter should indicate a minimum of .5 volt increase over battery voltage. If system conforms to these readings, operation is normal.

Fig. 1: Rear View Showing Alternator Terminal Location on Rear Terminal Models



Do not ground field circuit between alternator and regulator.

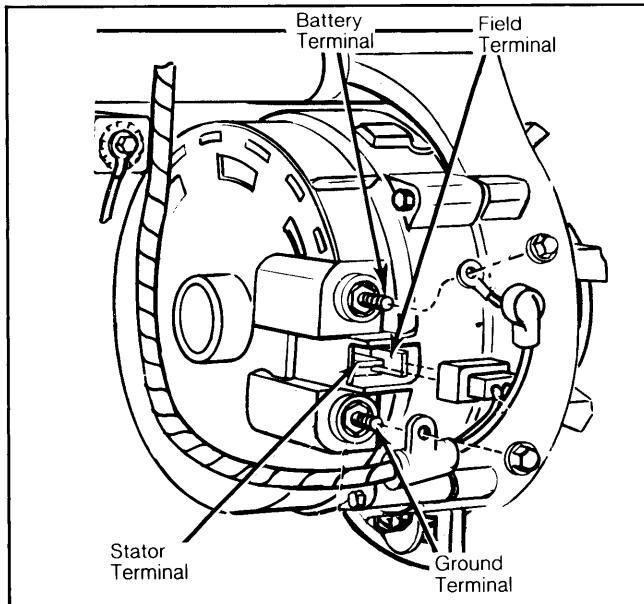
TEST RESULTS

1) If voltmeter reading indicates over-voltage (more than 2 volts above battery voltage), shut off engine

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and check ground connections between regulator and alternator and/or regulator and engine. Clean and tighten connections and repeat test.

Fig. 2: Side View Showing Alternator Terminal Location on Side Terminal Models



Connections must be clean and tight.

2) If over-voltage condition still exists, disconnect regulator wiring plug and repeat steps 2) and 3) of "Voltmeter Test Procedures". If condition is corrected, replace regulator and repeat test.

3) If over-voltage still exists with regulator disconnected, a short is indicated in wiring harness between alternator and regulator (Circuits "A" and "F"). Repair short circuit, and then replace regulator, repeating tests with regulator plug connected.

UNDER VOLTAGE & FIELD CIRCUIT TESTS

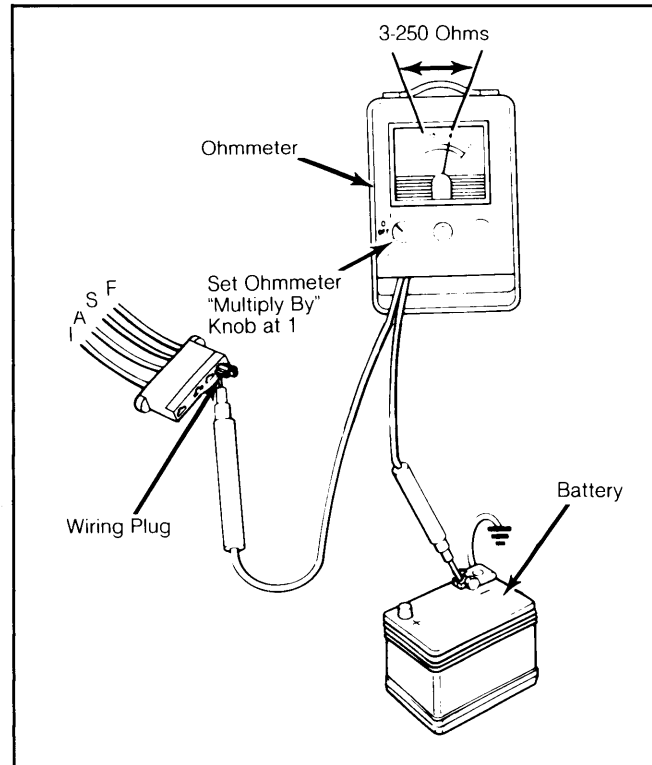
1) To determine if jumping procedure is safe, field circuit should be checked with regulator wiring plug disconnected and ohmmeter connected from "F" terminal of wiring plug to battery ground. Ohmmeter should indicate 3-250 ohms. See Fig. 3.

2) If load voltage did not increase 1/2 volt above base voltage, connect a jumper wire across "A" and "F" terminals of wiring plug and repeat test procedures.

3) If voltage is still under base voltage, remove jumper wire from wiring plug and leave plug disconnected from regulator. Connect jumper wire to "FLD" and "BAT" terminals on alternator and repeat test. If voltage increases more than 1/2 volt above battery voltage, repair wiring harness or replace regulator.

4) If voltmeter still indicates under voltage, stop engine and move positive voltmeter lead to "BAT" terminal. If voltmeter now indicates base voltage reading, repair alternator. If voltmeter indicates zero volts, repair "BAT" wire or replace fuse link.

Fig. 3: Test Wiring Connections for Field Circuit Test



Field circuit should be checked with regulator wiring plug disconnected.

REGULATOR CIRCUIT TESTS

"S" Circuit With Ammeter

Connect positive voltmeter lead to regulator wiring plug "S" terminal position. Turn ignition "ON", but do not start engine. Voltmeter should indicate battery voltage. If there is no voltage, "S" wire lead from ignition switch is open. Repair and retest system.

"S" & "I" Circuit With Indicator Light

Disconnect regulator wiring plug, and install a jumper wire between "A" and "F" terminals. With engine idling, connect negative lead of voltmeter to ground. Connect positive voltmeter lead, in turn, to "S" and then "I" terminals of regulator wiring plug. Voltage of "S" circuit should be about 1/2 that of "I" circuit. If no voltage is present, repair alternator or wiring circuit at fault. If circuit tests are satisfactory, install a new regulator. Remove jumper wire from regulator wiring plug, connect plug to regulator, and repeat "Voltmeter Test Procedures" No Load test.

DIODE TEST (ON VEHICLE)

1) Disconnect electric choke (if equipped) and voltage regulator plug. Connect jumper wire between "A" and "F" terminals of voltage regulator wiring plug. Connect voltmeter to battery posts, start and run engine at idle speed, record voltmeter reading.

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2) Move positive voltmeter lead to "S" terminal of alternator and note voltmeter reading. If meter reads $\frac{1}{2}$ of battery voltage, alternator has an open positive diode. If meter reads about 1.0-1.5 volts more than $\frac{1}{2}$ battery voltage, alternator has an open negative diode. Reconnect electric choke (if equipped) back into circuit after test is completed.

BENCH TESTS

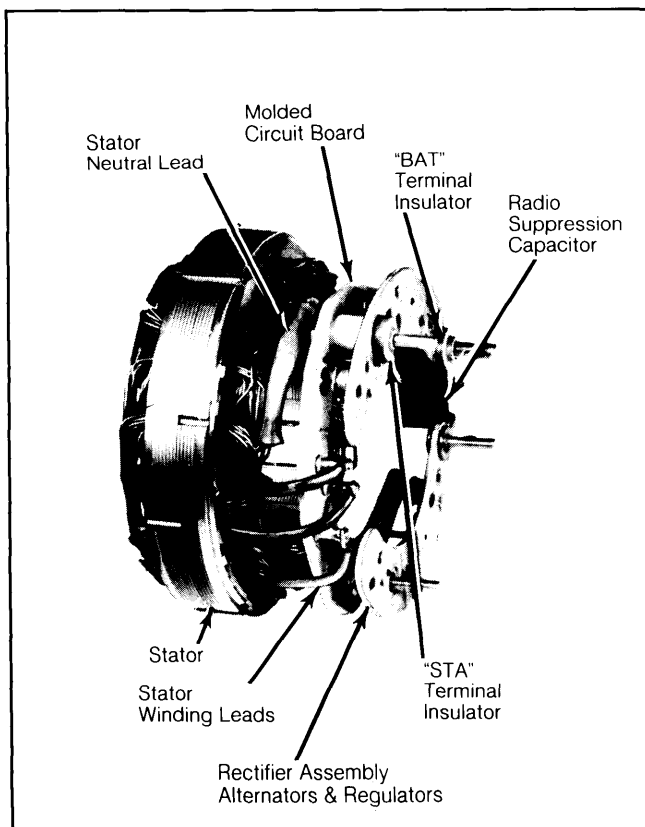
Rectifier Shorted or Grounded & Stator Grounded Test

1) Use an ohmmeter, set knob at "10", and calibrate as directed by manufacturer. Connect 1 ohmmeter probe to alternator "BAT" terminal and other probe to "STA" terminal and note reading. Reverse probes and note reading.

2) A reading of 60 ohms should be observed in 1 direction and no movement with terminals reversed. A reading in both directions indicates a bad positive diode, grounded positive diode plate, or grounded "BAT" terminal.

3) Perform same test using "STA" and "GRD" terminals. Readings in both directions indicate either bad negative diode, grounded stator winding, grounded stator terminal, grounded positive diode plate, or grounded "BAT" terminal. Infinite reading (no needle movement) in all 4 probe positions in the preceding tests indicates an open "STA" terminal lead connection inside alternator. See Fig. 4.

Fig. 4: Internal View Showing Stator Lead Connections on Rear Terminal Models



Be sure all connections are tight.

Field Open or Short Circuit Test

1) Set ohmmeter knob at "1" and calibrate meter as directed by manufacturer. Contact alternator "FLD" terminal with 1 probe and "GND" terminal with other probe, spin alternator pulley wheel. Ohmmeter should read between 2.4 and 100 ohms, and should fluctuate while pulley is spinning.

2) Infinite reading (no needle movement) indicates open brush lead, worn or stuck brushes, or bad rotor assembly. Meter reading of less than 2.4 ohms indicates grounded brush assembly, grounded field terminal, or bad rotor.

Diode Test

1) Remove rectifier assembly from alternator. Set ohmmeter knob at "10". Calibrate meter. To test 1 set of diodes, contact 1 probe to terminal bolt and contact each of 3 stator lead terminals with other probe. Reverse probes and repeat test.

2) All diodes should show readings of about 60 ohms in 1 direction, and infinite readings with probes reversed. 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

Set ohmmeter knob at "1000". Contact meter probes to 1 of stator leads and to stator laminated core. Meter should show infinite reading (no needle movement). If meter needle moved, stator winding is shorted to core and must be replaced. Repeat test for each 1 of stator leads.

Rotor Open or Short Circuit Test

1) Disassemble front housing and rotor from rear housing. Set ohmmeter knob at "1" and calibrate meter. Contact each probe to a rotor slip ring. Meter reading should be 2.0-3.5 ohms. Higher reading indicates damaged slip ring solder connection or broken wire. Lower reading indicates shorted wire or slip ring. Replace rotor if damaged.

2) Contact 1 meter probe to slip ring and other probe to rotor shaft. Meter reading should be infinite (no needle deflection). Reading other than infinite indicates rotor is shorted to shaft. Replace rotor if shorted and beyond repair.

NOTE: Slip ring terminals or solder touching rotor shaft will cause shorted condition.

OVERHAUL

REAR TERMINAL MODELS

Disassembly

1) Mark both housings and stator with scribe for reassembly. Remove through bolts and separate front housing and rotor from stator and rear housing. Remove all nuts and insulators from rear housing. Remove rear housing from stator and rectifier assembly. See Fig. 5.

2) Remove brush holder mounting screws, holder, brushes, springs, insulator and terminal. If replacement is necessary, press bearing from rear housing, supporting housing on inner boss. If rectifier assembly is being replaced, unsolder stator leads from rectifier terminals and separate stator from rectifier assembly.

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NOTE: Use 100 watt soldering iron.

3) Original production alternators will have one of two types of rectifier assembly boards; one has circuit board spaced away from diode plates with diodes exposed. The other type is single circuit board with built-in diodes. If alternator rectifier has exposed diode board, remove screws from rectifier by rotating bolt heads ¼ turn clockwise to unlock, and remove screws.

4) Push stator terminal straight out on a rectifier with diodes built into circuit board. Avoid turning screw while removing to make certain straight knurl will engage insulators when installing. Do not remove grounded screw.

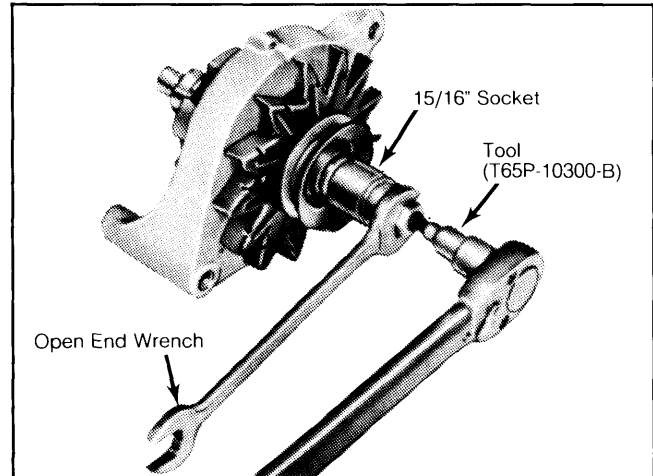
5) Remove drive pulley nut, using Alternator Pulley Remover (T63L-8620-A). Pull lock washer, pulley, fan and spacer from rotor shaft. Remove rotor from front housing, and remove front bearing spacer. Do not remove rotor stop ring from shaft unless it is damaged.

6) Remove 3 screws holding front end bearing retainer and remove retainer. If bearing has lost lubricant or is damaged, support housing close to bearing boss and press out old bearing.

Reassembly

1) Rotor, stator and bearing must not be cleaned with solvent. Wipe these parts off with a clean, lint

Fig. 6 Motorcraft Pulley Removal Procedure

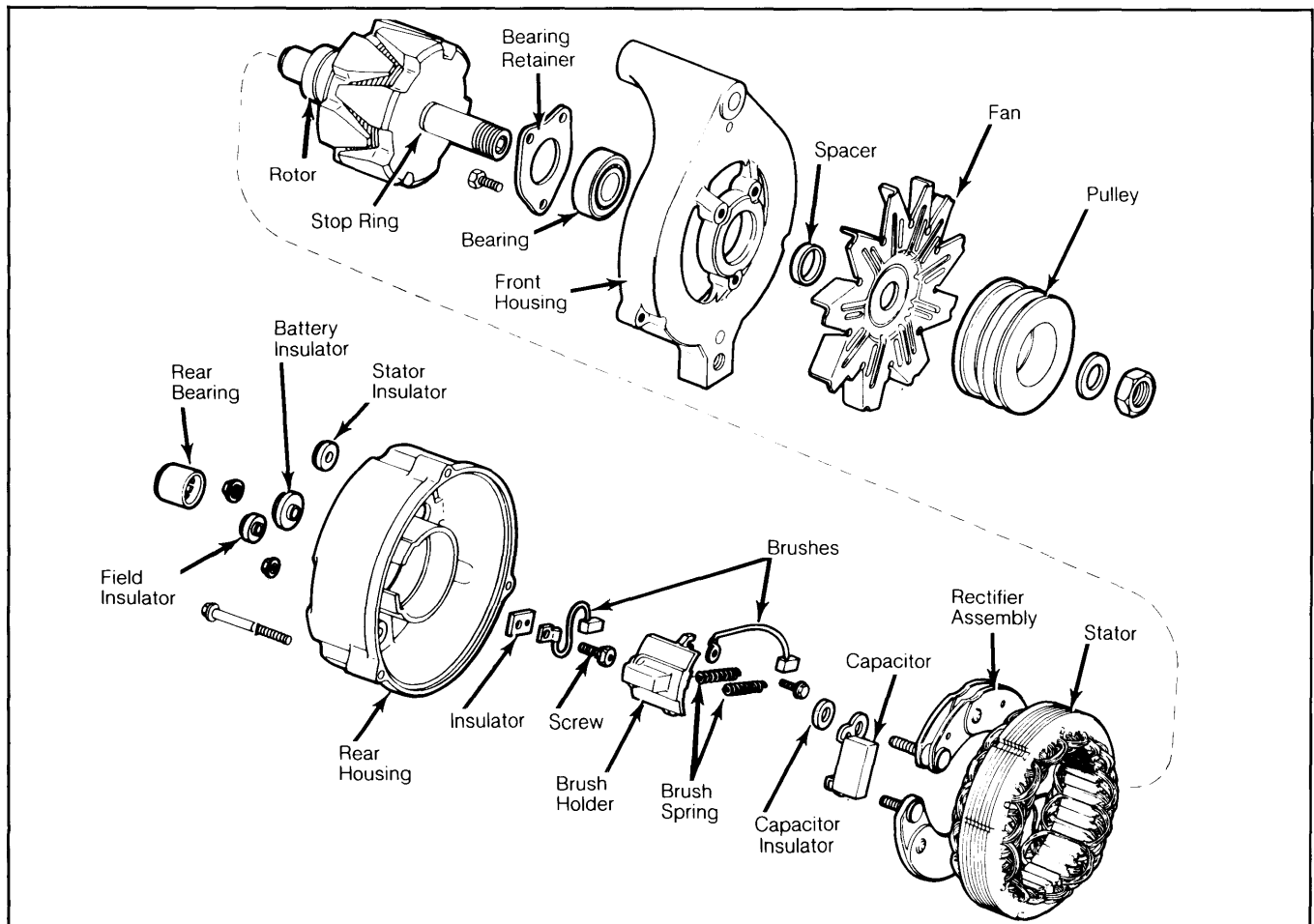


Remove by using open end wrench, 15/16" socket and puller (T65P-10300-B).

free cloth. Press front bearing in front housing bearing boss, putting pressure on bearing outer race only.

2) Install bearing retainer. If stop-ring on rotor drive shaft is damaged, install new stop-ring. Push new ring on shaft and into groove.

Fig. 5 Exploded View of Motorcraft Rear Terminal Alternator Assembly



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NOTE: Do not open ring with snap ring pliers, as permanent damage will result.

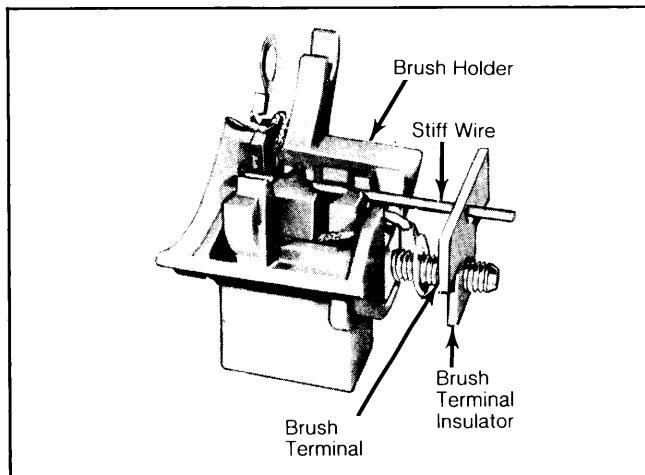
3) Position bearing spacer on rotor shaft with recessed side against stop ring. Position front housing, fan spacer, fan, pulley and lock washer on rotor shaft and install retaining nut. Tighten nut.

4) If rear housing bearing was removed, support housing on inner boss and press a new bearing flush with outer end surface. Place brush springs, brushes, brush terminal and terminal insulator in brush holder.

5) Hold brushes in position by inserting small piece of stiff wire in brush holder. Position brush holder assembly in rear housing and install mounting screws. Position brush leads in holder. See Figs. 7 & 8.

6) Wrap 3 stator winding leads around rectifier terminals and solder using 100 watt soldering iron and resin core solder. On 65 amp models, push terminals of stator wires onto circuit board terminals and solder. Position stator neutral lead eyelet on stator terminal screw and install screw in rectifier assembly. See Fig. 4.

Fig. 7: Assembled View of Brush Holder Assembly



Hold brushes in place with stiff wire.

7) For rectifier with diodes exposed, insert special screws through wire lug, dished washers and circuit board. Turn screws ¼ turn counterclockwise to lock. For single circuit boards with built-in diodes, insert screws straight through wire lug, insulating washer and rectifier, into insulator.

NOTE: Dished washers are to be used only on circuit board with exposed diodes. If dished washers are used on single circuit board, short circuit will occur. Flat insulating washers are to be used between stator terminal and board when single circuit board is used.

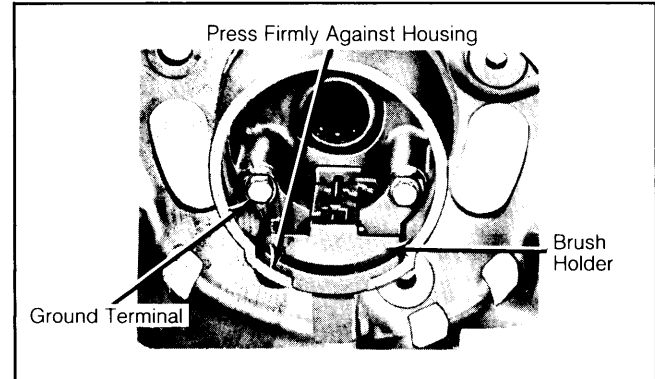
8) Position capacitor on rectifier terminals. On circuit board with exposed diodes, install "STA" and "BAT" terminal insulators. On single circuit board, position square stator terminal insulator in rectifier assembly.

9) Position "BAT" terminal insulator on "BAT" terminal. Position stator and rectifier assembly in rear housing. Make certain all terminal insulators are seated properly in appropriate recesses. Position "STA" (Black),

"BAT" (Red), and "FLD" (Orange) insulators on terminal bolts and install retaining nuts.

10) Wipe rear end bearing of rotor shaft with clean, lint free cloth. Position rear housing and stator assembly over rotor and align scribe marks made during initial disassembly. Seat machined portion of stator core into step in both end housings. Install housing through bolts. Remove brush retracting wire, and put small amount of water-proof cement over hole to seal from moisture.

Fig. 8: View Showing Motorcraft Brush Lead Wire Routing



Wipe rear end bearing of rotor shaft with lint free cloth.

SIDE TERMINAL MODELS

Disassembly

1) Mark both housings and stator with scribe for reassembly. Remove through bolts and separate from housing and rotor from rear housing and stator. Do not separate rear housing from stator at this time. Remove drive pulley nut, remove lock washer, pulley, fan and fan spacer from rotor shaft. See Fig. 9.

2) Remove rotor and shaft from front housing, remove spacer from rotor shaft. Remove 3 screws holding front bearing to housing. If bearing is damaged or has lost lubricant, support housing close to bearing boss and press bearing from housing. Unsolder stator leads from rectifier assembly, using a 100 watt soldering iron.

3) Remove stator from rear housing. Unsolder brush holder from rectifier, using a 100 watt soldering iron. Remove capacitor lead-to-rectifier screw. Remove 4 rectifier-to-rear housing screws. Remove 2 terminal nuts and insulator from outside of housing, remove rectifier assembly from housing.

4) Remove 2 brush holder-to-housing screws, remove brushes and holder. Remove 2 rectifier insulators from bosses in housing. Clean all sealing compound from rear housing and brush holder. Remove capacitor from rear housing. If necessary to replace rear bearing, support rear housing near bearing boss and press bearing out of housing from inside.

Reassembly

1) Rotor, stator and bearings must not be cleaned with solvent. Wipe these parts off with a clean, lint free cloth. Press front bearing into front housing, putting pressure on bearing outer race only.

2) Install bearing retaining screws. Install inner space on rotor shaft and install shaft into front housing and bearing.

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3) Install fan spacer, fan, pulley, lock washer, and nut on rotor shaft. Tighten pulley nut. If rear bearing was removed, press new bearing in until it is flush with boss outer surface.

4) Position brush terminal, springs and brushes in brush holder and hold in position by inserting a small piece of stiff wire in brush holder.

5) Install brush holder to rear housing and install attaching screws. Push brush holder toward rotor shaft opening and tighten screws. Install capacitor to rear housing and install attaching screws.

6) Install 2 rectifier insulators on bosses, inside rear housing. Install insulator on "BAT" terminal of rectifier, position rectifier in rear housing.

7) Install outside insulator on "BAT" terminal, install nuts on "BAT" and "GRD" terminals finger tight. Install 4 rectifier attaching screws, but do not tighten. Tighten terminal nuts on "BAT" and "GRD" terminals, tighten 4 rectifier screws. Secure capacitor lead to rectifier. Press brush holder lead on rectifier pin and solder, using a 100 watt soldering iron.

8) Install stator in rear housing and align scribe marks. Press 3 stator leads onto rectifier pins and solder, using 100 watt soldering iron. Position rotor and front housing into stator and rear housing while aligning scribe marks.

9) Install 4 through bolts and tighten. Spin fan and pulley to ensure nothing is binding inside alternator. Remove brush retracting wire and put small amount of water-proof cement over hole to seal from moisture.

BRUSH REPLACEMENT

70 Amp. Alternator

1) Remove brush holder and cover assembly from rear housing. Remove terminal bolts from brush holder and cover assembly and remove brush assemblies. Position new brush terminals on terminal bolts. Assemble terminals, bolts, brush holder washers and nuts. Insulating washer mounts under "FLD" terminal nut. Entire brush and cover assembly is also available for service.

2) Depress brush springs in brush holder cavities and insert brushes on top of springs. Hold brushes in position by inserting a stiff wire in brush holder. Position brush leads as required. Install brush holder and cover assembly to rear housing. Remove brush retracting wire and seal with small amount of water-proof cement

All Except 70 Amp. Alternator

1) Mark both end housings and stator with a scribe. Remove 4 through bolts and separate front housing and rotor from rear housing and stator. Use a 100 watt soldering iron to detach brush holder lead from rectifier. Remove brush holder attaching screws and remove holder from rear housing. Remove any sealing compound.

2) To install, position holder to rear housing and insert wire, to retract brushes, through hole in rear housing. Install holder attaching screws, push holder toward rotor shaft and tighten screws. Press holder lead on rectifier pin and solder using a 200 watt soldering iron.

3) Install front housing and rotor to rear housing and stator while aligning scribe marks. Install 4 through bolts, spin fan and pulley to ensure nothing binds inside alternator. Remove wire, retracting brushes, and seal with a small amount of water-proof cement.

Fig. 9: Exploded View of Motorcraft Side Terminal Alternator Assembly (100 Amp. Shown)

