

Alternators & Regulators

MOTORCRAFT WITH SEPARATE REGULATOR

Ford Motor Co.

DESCRIPTION

Alternator is belt driven from engine. Current is supplied from Alternator-Regulator system, to rotating field of alternator through two brushes to two slip rings. Power is produced in form of alternating current which is rectified to direct current by six diodes. Alternator regulator automatically adjusts alternator field current to maintain alternator output voltage within prescribed limits to correctly charge battery. A fuse 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.

Regulator is electronic (100% solid state) and consists of transistors, diodes and resistors. The electronic regulator is used on all charging systems. Two regulators, similar in appearance but not interchangeable, are used. One, color coded black, is used in systems with alternator warning lamps; another, color coded blue, is used in systems with ammeters. No adjustment is required or possible.

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 Identification		
Application	Amperage @15V	Rated Output Speed (Engine RPM)
Orange	40	2900
Green	60	2900
Black (Rear Term.)	65	①
Black (Side Term.)	70	②1640
Red	100	②2900
① - Not available from manufacturer.		
② - Rated cold output.		

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	1/4"
Pulley Nut Torque	60-100 Ft. Lbs.

SERVICE

CAUTION - 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 NOT be connected to negative cable of vehicle battery. Attach instead to engine bolt head or similar clean, grounded contact.

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.

TESTING

NOTE - When performing charging system test with a voltmeter, turn off all lights and electrical components. Be sure battery specific gravity is at least 1.200.

BATTERY VOLTAGE TEST

Connect negative lead of voltmeter to negative battery post and positive lead to positive battery post. Record battery voltage (sometimes called base voltage).

NO LOAD TEST

1) Attach suitable tachometer and start engine. 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. If OK, proceed to Load Test. If more than 2.0 volts increase, proceed to Overvoltage Test. If no increase results, proceed to Undervoltage Test.

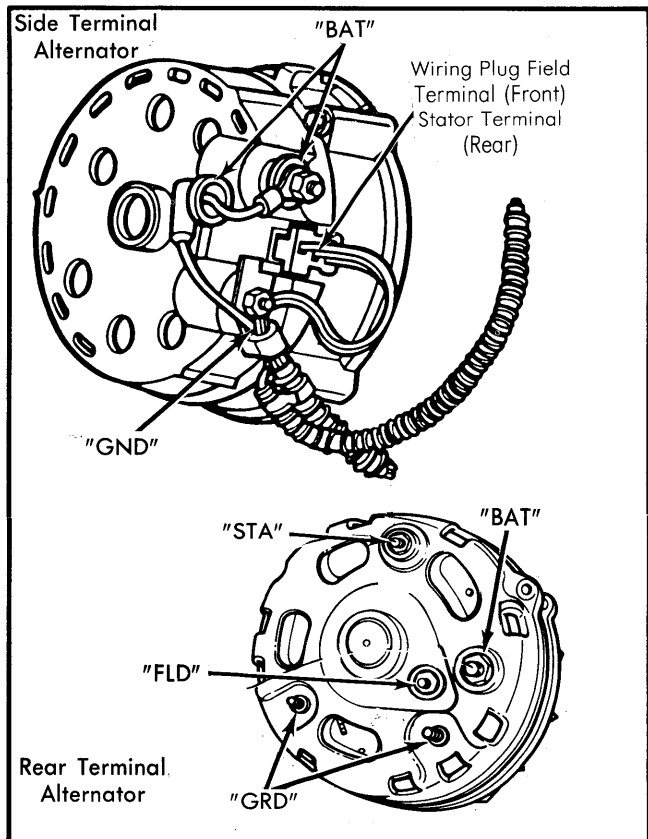


Fig. 1 Terminal Locations for Rear and Side Terminal Alternator

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LOAD TEST

Attach suitable tachometer and start engine. Turn on heater or A/C blower motor to high position and turn on headlights to high beam. Increase engine speed to 2000 RPM. Voltmeter should indicate a minimum of 0.5 volt increase over battery voltage. If system conforms to these readings, alternator operation is normal. If not, 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. If overvoltage condition disappears, check ground connections at regulator and alternator and from firewall to engine and to battery.

2) If overvoltage still exists, disconnect regulator wiring plug and repeat No Load Test. If condition is corrected, replace regulator and repeat No Load Test.

3) 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, then replace voltage regulator and repeat tests with regulator plug connected.

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 to ground. Ohmmeter should indicate more than 3 ohms (4-250 ohms). If less than 3 ohms, repair grounded field circuit, replace regulator and repeat Load Test.

2) If field circuit is satisfactory (more than 3 ohms), disconnect regulator wiring plug at regulator and connect jumper wire between "A" and "F" terminals on regulator wiring plug. Repeat voltmeter Load Test. If more than 0.5 volt increase above battery voltage, regulator or wiring harness is defective. Perform regulator "S" and "I" circuit test.

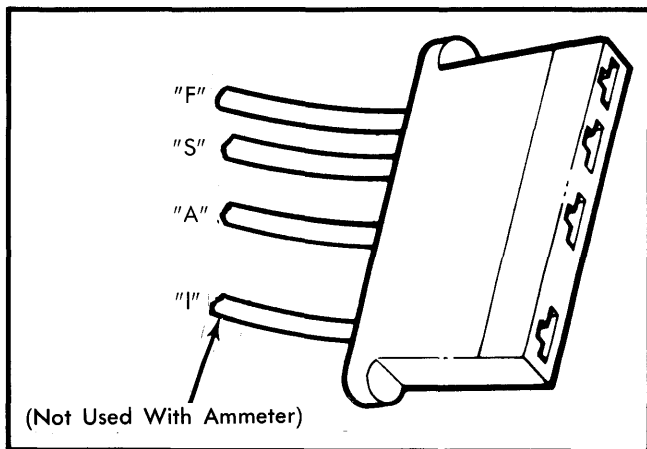


Fig. 2 Regulator Plug Wire Connections

3) If problem of undervoltage still exists, remove jumper wire at regulator plug and leave plug disconnected from regulator. Connect jumper wire to "FLD" and "BAT" terminals on alternator. Repeat voltmeter Load Test.

4) If results are now satisfactory (0.5 volt above battery voltage), repair wiring harness from alternator to regulator. If voltmeter Load Test still indicates undervoltage, move positive lead of voltmeter to "BAT" terminal. If battery voltage now exists, repair or replace alternator. If 0 volts, repair "BAT" wire to starter relay.

REGULATOR "S" AND "I" CIRCUIT TESTS

"S" Circuit With Ammeter - 1) Connect positive voltmeter lead to regulator wiring plug "S" terminal and negative lead to ground. Turn ignition "ON", but do not start engine. Voltmeter should indicate battery voltage. If OK, but problem has not been resolved, replace regulator. If there is no voltage at "S" terminal, the "S" wire to ignition switch is open.

2) Connect positive voltmeter lead to positive battery terminal. Connect regulator wiring plug to regulator and repeat Load Test.

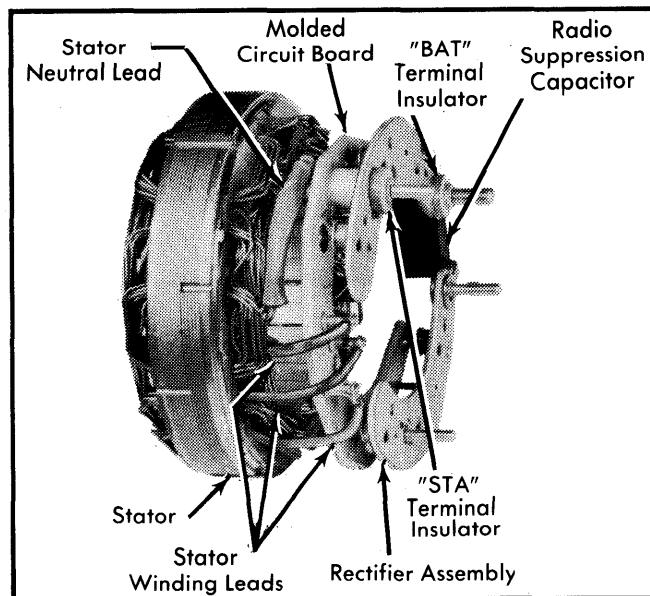


Fig. 3 Stator Components and Lead Connections (Rectifier with Exposed Diode Shown)

"S" & "I" Circuit With Indicator Light - 1) Disconnect regulator wiring plug and install a jumper wire between terminals "A" and "F". With engine idling, connect positive lead of voltmeter to "S" terminal and then to "I" terminal of regulator wiring plug. Negative lead should be grounded.

2) Voltage of "S" circuit should be about 1/2 that of "I" circuit. If no voltage is present, repair wiring circuit at fault. Reconnect positive voltmeter lead to positive battery cable terminal. If circuit tests are satisfactory, install new regulator. Remove jumper wire from regulator wiring plug, connect plug to regulator and repeat Load Test.

BENCH TESTS

Rectifier Shorted or Grounded and Stator Grounded Test

1) Using an ohmmeter set in the x10 range, connect one probe to alternator "BAT" terminal (red insulator) and other probe to "STA" terminal (black insulator - rear blade terminal on side terminal alternators). Then reverse terminal probes and repeat test. Ohmmeter should read about 60 ohms in one direction and infinity (no needle movement) when probes are reversed.

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2) 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" or "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. Infinite reading (no needle movement) in all four probe positions in the preceding tests indicates an open "STA" terminal lead connection inside alternator. If no needle movement is indicated in one direction, but high resistance (considerably more than 60 ohms) in the other direction, a bad connection exists between stator lead and stator bolt head.

Field Open or Short Circuit Test — 1) Set ohmmeter in x1 range. Contact alternator "FLD" terminal (orange insulator) with one probe. Contact "GND" terminal with other probe. Spin alternator pulley.

2) Ohmmeter should read between 2.4 and 100 ohms, and should fluctuate while pulley is spinning. 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 to x10 range. To test one set of diodes, contact one ohmmeter probe to terminal bolt and contact each of three stator leads with other probe. Reverse probes and repeat test. All diodes should show readings of approximately 60 ohms in one direction and infinite readings with probes reversed.

2) 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 Open or Grounded Test — 1) Following tests are to determine if stator coil is operating properly. Disassemble stator from alternator. Set ohmmeter in x1000 range.

2) Connect one ohmmeter probe to one stator lead and other probe to stator laminated core. Ohmmeter reading should be infinity. If meter needle moves, stator winding is shorted to core and must be replaced. Repeat test for each one of stator leads.

NOTE — Do not touch hands to metal probes or to stator leads or incorrect readings will result.

Rotor Open or Short Circuit Test — 1) Disassemble front housing and rotor from rear housing. Set ohmmeter to x1 range. Contact each probe to a rotor slip ring. Meter should read 2.0-3.5 ohms. Higher readings indicate damaged slip ring solder connection or broken wire.

2) Lower readings indicate shorted wire or slip ring. Replace rotor if damaged. Contact one ohmmeter probe to slip ring and other probe to rotor shaft. Ohmmeter reading should be infinity (no needle movement). Readings other than infinity indicate rotor is shorted to shaft. If so, replace shorted rotor.

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

ADJUSTMENTS

ALTERNATOR REGULATOR

Electronic Type — Electronic regulator is used on all charging systems and is factory calibrated and cannot be adjusted.

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. Remove brush springs from rear housing brush holder. Remove all nuts, washers and insulators from terminals on back of rear housing. Note color and location of insulators for later reassembly.

2) Remove stator and rectifier assembly from rear housing. Remove brush holder, brushes, brush terminal insulator and press bearing from rear housing.

3) Clamp front housing in vise using protective jaws. Remove drive pulley nut from rotor shaft using suitable tool (T65P-10300-B). Remove lock washer, drive pulley, fan and fan spacer from rotor shaft. Remove rotor from front housing and release housing from vise.

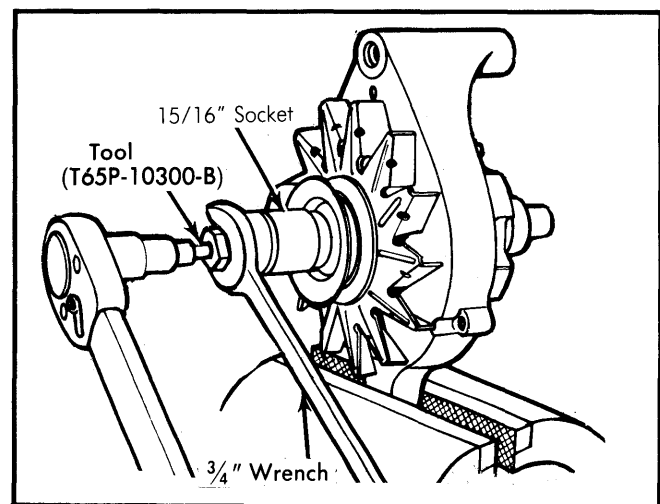


Fig. 4 View Showing Proper Tools for Removing Pulley

4) Remove front bearing spacer from rotor shaft. Do not remove stop ring from rotor shaft unless it is damaged. Remove bearing retainer and bearing from front housing. Press bearing out if necessary. Remove radio suppression capacitor and battery terminal insulator from rectifier assembly.

5) Using a 100 watt soldering iron, unsolder stator leads from rectifier assembly. Do not permit rectifiers to overheat. On 65 amp. alternators, use care not to cut stator lead wires. Unsolder stator lead terminals from molded circuit board terminals. Use needle nose pliers to pull stator lead terminals upwards from rectifier assembly. Shake molten solder from terminals while hot.

6) Disconnect stator neutral lead from flat type rectifiers by removing stator terminal screw, pressing it straight out of

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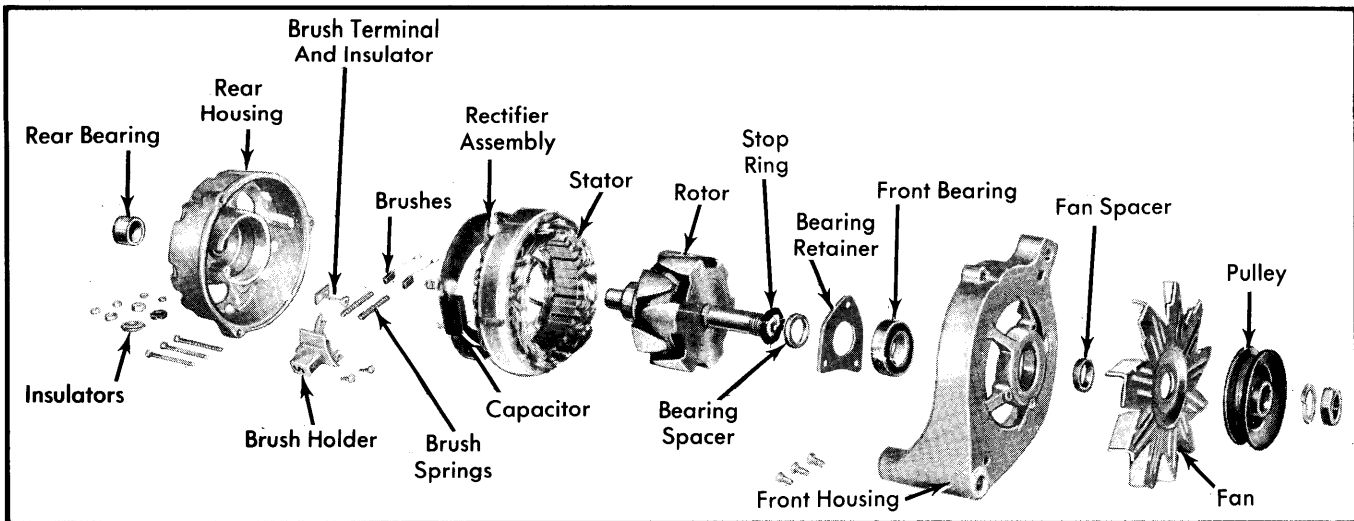


Fig. 5 Exploded View of Rear Terminal Alternator

rectifier. Do not turn terminal screw during removal, as this will destroy retaining serrations. On stacked type rectifiers (with exposed diodes as contrasted with built-in diodes of flat type rectifiers), remove stator terminal screw by turning it $\frac{1}{4}$ 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, stator or bearings. Wipe parts off with suitable 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 or stop ring will be permanently deformed. Install bearing spacer on rotor shaft with recessed side against stop ring.

3) Install rotor in front housing and clamp housing 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 in rear housing, providing support close to bearing boss. Bearing should be flush with housing. Position brush wiring connector over brush terminal and install in-

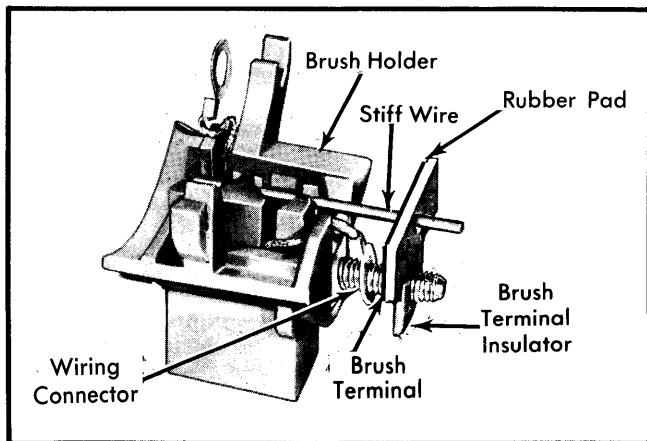


Fig. 6 Brush Holder Assembly with Wire for Retaining Brushes in Place Inserted Through Holes

solator. Install springs and brushes in holder. Use toothpick or stiff wire to hold brushes against spring tension.

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.

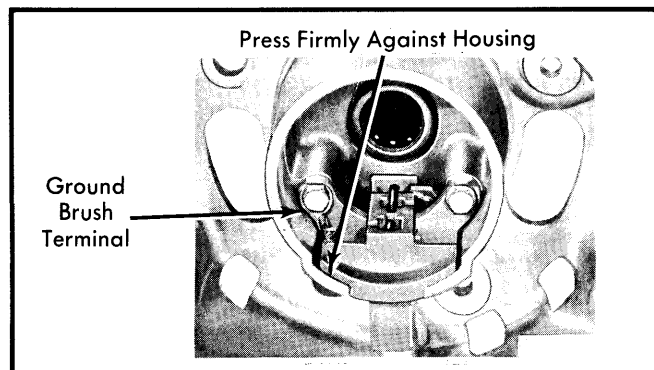


Fig. 7 View Showing Proper Positioning of Brush Leads

6) Connect stator neutral lead to rectifiers. On flat type rectifiers with built-in diodes, position stator terminal insulator and stator neutral lead on rectifier assembly. Insert terminal screw and press into position. Neutral lead terminal should not move if screw is pressed to proper depth.

7) On stacked type rectifiers with exposed diodes, place stator neutral lead and dished washer on rectifier assembly. Insert terminal screw and rotate it $\frac{1}{4}$ turn to lock it in place.

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.

NOTE – On 65 amp. alternators, push stator terminals onto rectifier assembly pins and position as shown in Fig. 8. Solder in place.

9) Install radio suppression capacitor and battery terminal insulator on rectifier assembly. Install insulator on stator terminal

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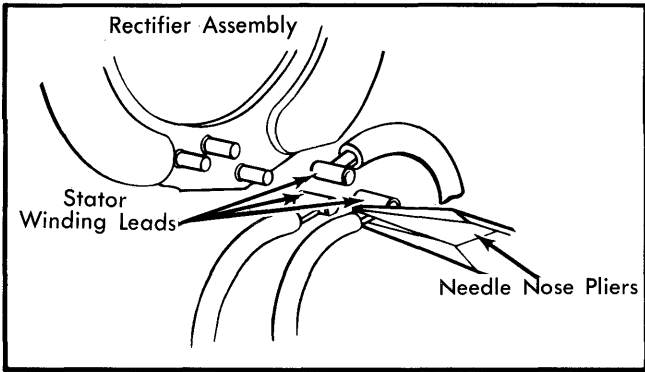


Fig. 8 Installing Stator Leads on Rectifier Pins (65 Amp. Alternator)

screw. Align terminal screws on rectifier assembly with holes in back of rear housing, and install stator rectifier assembly in rear housing.

NOTE — Be sure terminal insulators are seated in their recesses.

10) Install insulators, washers and nuts on proper terminals. Insulators are color coded — black for "STA" terminal; red for "BAT" terminal and orange for "FLD" terminal.

11) Wipe rear end bearing surfaces on rotor shaft with clean rag. Place rear housing and stator assembly over rotor and align scribe marks made during disassembly. Seat machined portion of stator core into stop in each end housing. Install through bolts.

12) Remove toothpick or stiff wire from brush holder.

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) 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.

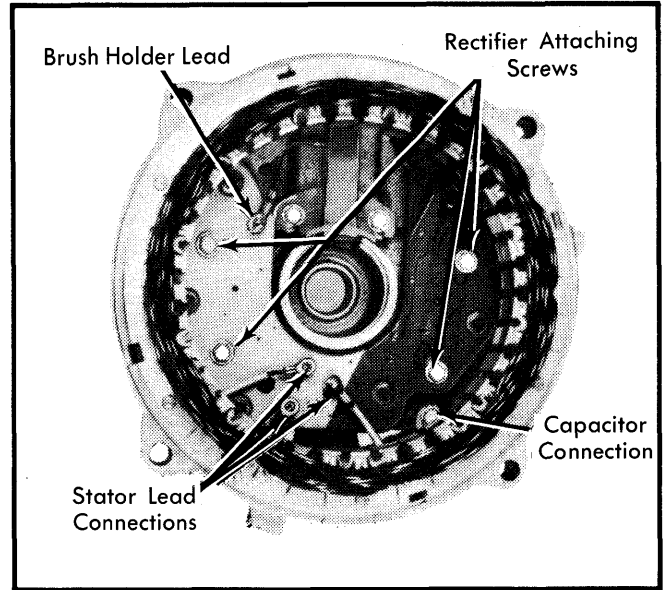


Fig. 10 Side Terminal Alternator Lead Connections

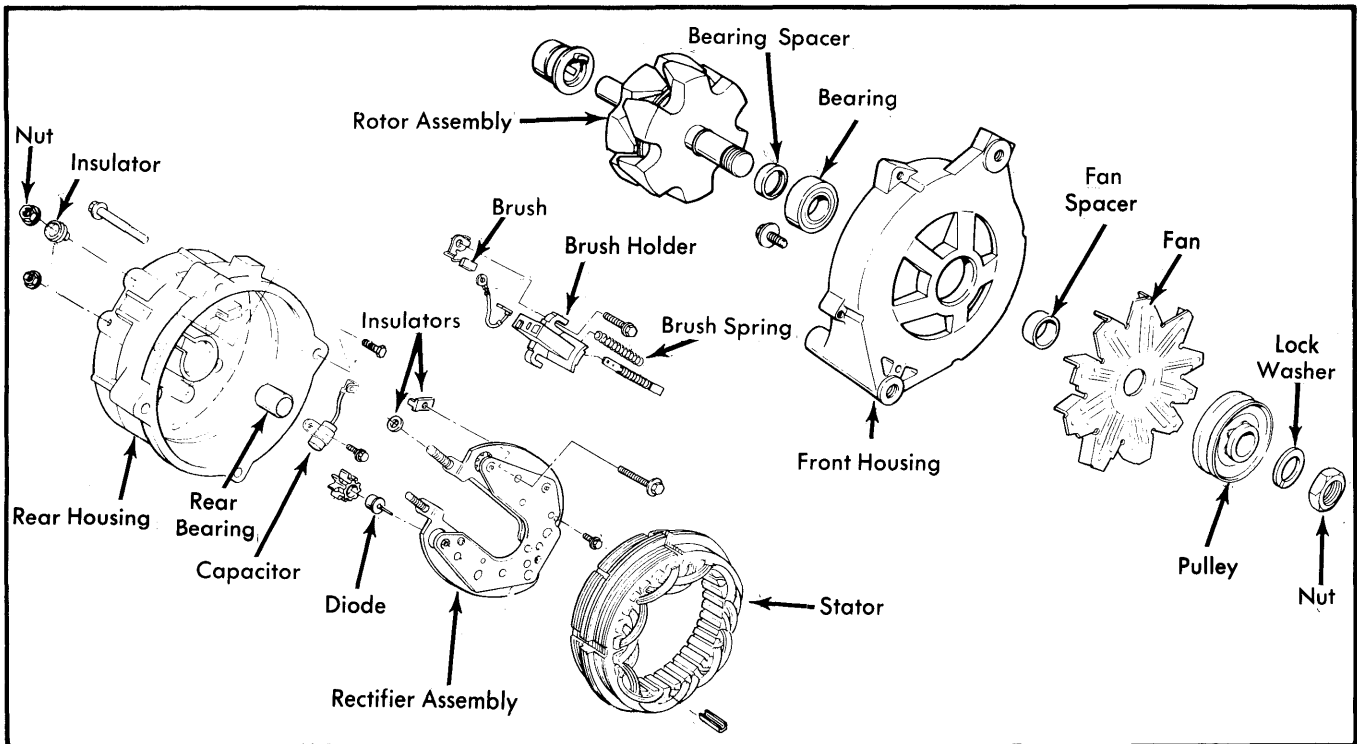


Fig. 9 Exploded View of Side Terminal Alternator

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3) Remove 3 screws retaining bearing in front housing. If damaged or dry of lubricant, press bearing from 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 and insulator from outside housing, and remove 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, supporting housing close to bearing boss.

Reassembly - 1) Do not clean rotor, stator or bearings in solvent, but use a clean cloth to wipe these parts. Press new front bearing into housing, if necessary to replace it. Apply pressure on bearing outer race only. Install bearing retaining screws.

2) Place inner spacer on rotor shaft and insert shaft into front housing and bearing. Install fan spacer, fan, pulley, lock washer and nut on rotor shaft. Use suitable tool (T65P-10300-B) to tighten nut.

3) If rear bearing requires replacing, press new bearing in from inside housing until it is flush with boss on outer surface. Place brush terminal on brush holder. Install springs and brushes in holder and secure with stiff wire or toothpick. 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 (fingertight 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.

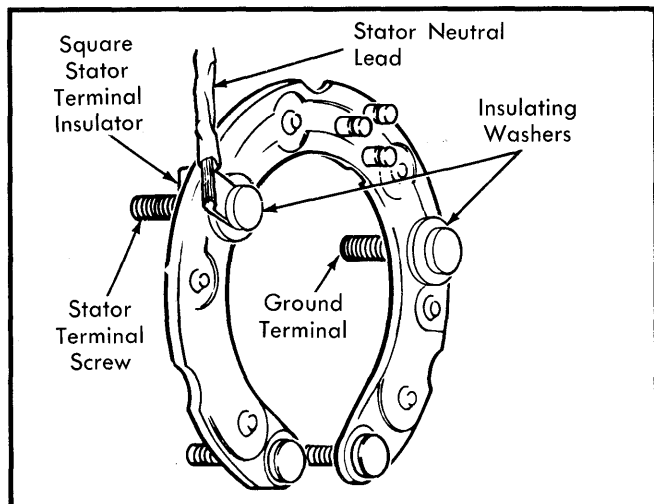


Fig. 11 Flat Type Rectifier Assembly (With Built-in Diodes)

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. Press 3 stator leads on rectifier pins and solder securely.

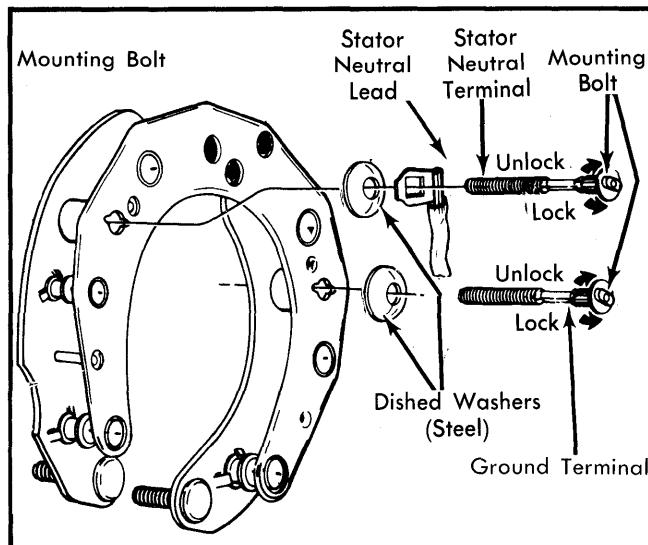


Fig. 12 Stacked Type Rectifier Assembly (With Exposed Diodes)

7) Install rotor and front housing to stator and rear housing, aligning scribe marks.

NOTE - Tighten 2 opposing bolts and then the 2 remaining bolts.

8) Spin fan and pulley to check for binding. Remove brush retaining wire or toothpick. Place daub of waterproof cement over hole to seal it.

BRUSH REPLACEMENT ONLY

1) Mark both end housings and stator with a scribe mark. Remove 4 housing through bolts and separate front housing and rotor from rear housing and stator. Do not separate rear housing and stator.

2) Unsolder and remove brush holder lead from rectifier. Remove brush holder from rear housing. Remove any sealing compound from housing and brush holder.

NOTE - Brushes and springs are serviced as an assembly only.

3) Install brush holder to rear housing, inserting wire to retract brushes through hole in rear housing. Push brush holder toward rotor shaft opening and tighten attaching screws.

4) Press brush holder lead on rectifier pin and solder. Do not allow rectifier to overheat. Align rotor and front housing to stator and rear housing and install through bolts. Spin fan to check for binding. Remove wire from brush holder. Place daub of waterproof cement over hole to seal it.