Ford

Power Products

ALTERNATOR SERVICE MANUAL

FORD MOTOR COMPANY
INDUSTRIAL ENGINE OPERATIONS

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Foreword

This manual is intended as a comprehensive guide for those concerned with servicing Ford and Leece-Neville alternators installed on Ford Industrial Engines. Included are complete instructions on Diagnosis, Testing and Adjustments. In addition, complete service Specifications are listed after each section.

The instructions contained herein are written for the use of a minimum of test equipment. If specialized alternator testing equipment is used, the instructions of the equipment manufacturer should be followed.

An identification plate is affixed to each alternator. The plate contains all the pertinent information, including the type and serial number. When ordering parts, or carrying on correspondence concerning the alternator system, all information on the identification plate should be mentioned.

We at Ford Motor Company are pleased that you selected a Ford unit for your engine requirements. Should you require additional information or encounter any problems at any time, feel free to consult your Ford Power Products Distributor, or write directly to us.

PARTS AND SERVICE

Replacement parts can be obtained through the local Ford Power Products Distributors and Dealers or by writing directly to:

INDUSTRIAL ENGINE OPERATIONS

General Description

ALTERNATOR CHARGING SYSTEM

Energy needed to operate the starting system is stored in the storage battery, but the source of this energy is the charging system. When the engine is running, the ignition system, and accessories receive their power from the charging system, up to the point where electrical power demands exceed the charging system output. Should the demand exceed the charging system output, the additional energy would be supplied by the battery.

Charging system diagnosis and service are not difficult since relatively simple components and circuits are involved.

The most important factors in diagnosing trouble in the charging system are a clear understanding of how the system works and the ability to interpret the readings of a few test instruments.

The alternator charging system is a negative (-) ground system and consists of an alternator, a regulator, a battery, and a charge indicator light or an ammeter. These units are connected by means of cables, wires, and parts of the engine itself.

The alternator is belt driven from the engine. The mechanical construction of the alternator differs from a generator in that the field rotates, and the generating windings are stationary. Energy is supplied to the rotating field through two brushes and slip rings. The slip rings are mounted on the rotor shaft and are connected to the field coil.

The alternator produces power in the form of alternating current, rectified to direct current by diodes. The direct current is then used for changing the battery and supplying power to the electrical system.

The output of the alternator is controlled by a simplified regulator. The regulator is composed of two control units, a field relay and a voltage limiter, mounted as an assembly. A cutout relay is not needed as the alternator diodes block reverse current when the engine is not running. In addition, the alternator is self current limiting, thus a current limiter is not needed.

The system diagrams shown in Figs. 1 and 2 illustrate the hook-up for Ford Alternators. The hook-up for Leece-Neville alternators is identical except for the identifying markings used on the alternator and regulator wiring attaching terminals. A comparison of both the Ford and Leece-Neville identifying markings is shown on page 5.

When a charge indicator light is used in the charging system, the regulator terminals are connected as shown, and a wire is connected between the regulator ground and the alternator ground. The field relay is activated as the regulator output reaches a specified output.

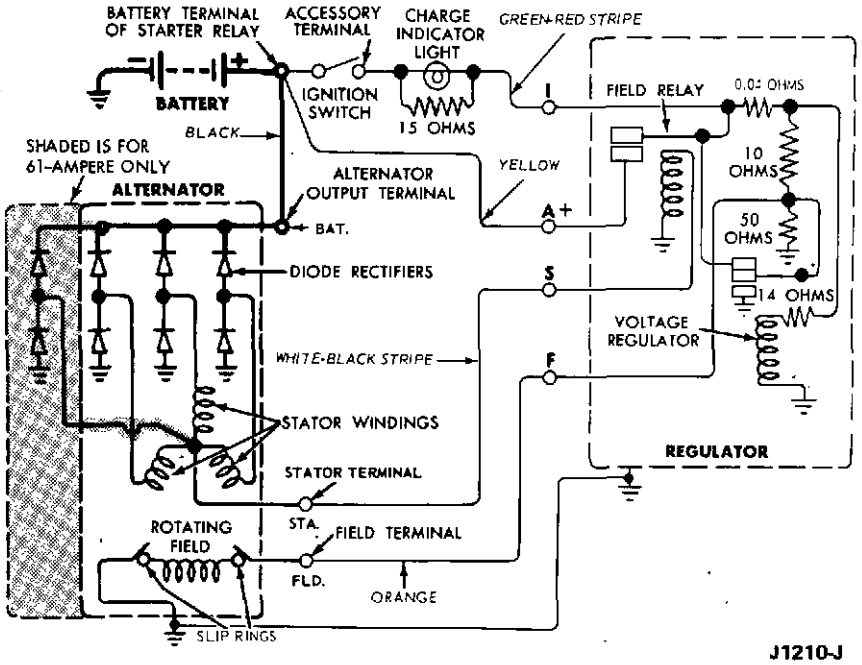

Fig. 1 – Ford Alternator System Diagram With Charge Indicator Light

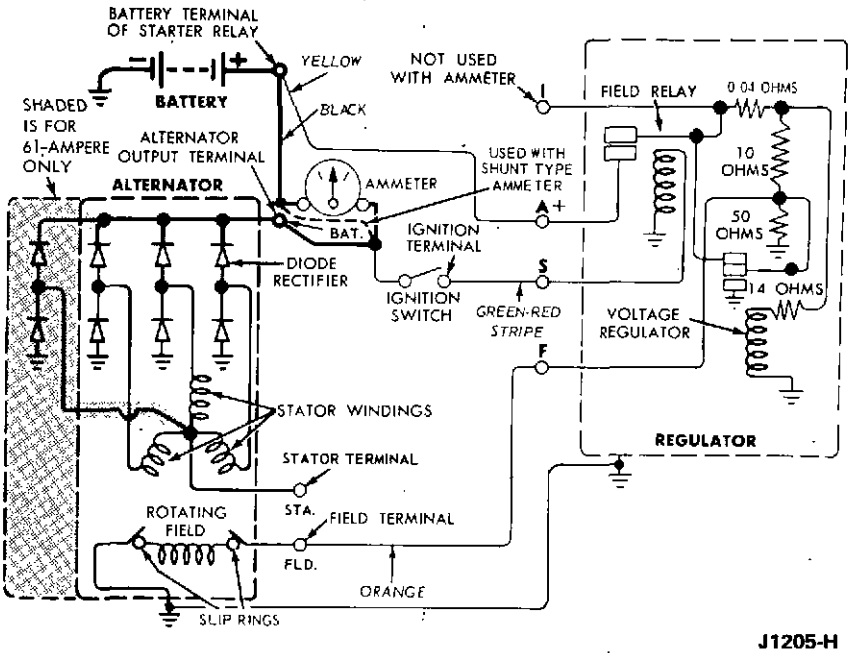

Fig. 2 – Ford Alternator System Diagram With Ammeter

GENERAL DESCRIPTION

Alternator output is controlled by the regulator, so that adequate current is supplied without injury to the alternator, the battery, or any other electrical units served by the supply system.

Whenever the alternator is not supplying current and the battery is discharging, a charge indicator light or ammeter shows this condition.

To test and diagnose the charging system intelligently, it is necessary to know how the system operates, where to make the tests, how to make the tests, and what the tests mean in relation to the performance of the system.

An examination of the charging circuit will reveal the circuit connecting points and locate the test areas.

ALTERNATOR

Alternator Terminal	Ford Autolite Marking	Leece-Neville Marking
Battery	BAT	BAT
Stator Neutral	STA	NEUT
Field	FLD	F
Ground	GRD	GRD

REGULATOR USED WITH CHARGE LIGHT

Regulator Terminal	Ford Autolite Marking	Leece-Neville Marking
To Charge Light	I	LAMP
To Battery	A+	BAT
To Alternator Stator	S	NEUT
To Alternator Field	F	FLD
Ground	–	–

Diagnosis and Testing

TROUBLE DIAGNOSIS

Charging system troubles are about the same whether a generator or an alternator is used to supply the current for the system. Trouble will probably show up first in the area of poor battery performance, as evidenced by slow cranking, hard starting, and/or headlights dim at idle speeds.

The problem will be in one of the following areas: a defective battery, excessive resistance in the charging circuits, a defective alternator, or a defective regulator.

A good diagnosis of the charging system should include:

- Visual Inspection
- Battery Capacity Test
- Alternator Output Test
- Voltage Drop Test
  Alternator-to-Battery Positive Terminal
  Alternator-to-Battery Ground Terminal
- Regulator Voltage Limiter Test
- Field Relay Test

On alternator equipped units, always adhere to the following safety precautions whenever testing or servicing the charging system or battery. Failure to do so can result in damage to the alternator or regulator.

CAUTION

ALTERNATOR INSTALLATION

DO NOT connect the battery cables until all wiring harness connections have been made and properly tightened.

If accidentally grounded, the lead to the battery terminal of the alternator will burn the wiring harness.

DO NOT pry against the steel center-section (stator), the rear housing, or the through bolts when adjusting drive belt tension. Always place the pry bar against the front housing.

Prying against the wrong parts will bend the through bolts and cause alternator assembly misalignment.

DO NOT attempt to polarize the alternator. It can damage the voltage regulator and is not necessary.

DO NOT connect battery terminals in reverse polarity. This will burn out the alternator diodes. Connect positive (+) to positive and negative(-) to negative.

DO NOT disconnect alternator wires before disconnecting battery cables. Accidental grounding will burn the wiring harness.

DO NOT connect a battery charger to the battery before disconnecting the battery cables. When connecting the battery charger, connect positive (+) to positive and negative (-) to negative.

DO NOT use an electric welder on machine unless both battery cables and alternator wires are disconnected.

DO NOT ground the field circuit, either at regulator or alternator.

DO NOT operate alternator with the rotor winding energized unless it is connected to an external load.

ALWAYS use a recommended diode tester to check diodes.

VISUAL INSPECTION

If the battery is not securely clamped, material can shake loose on the inside, or the cables may become worn and broken. Dirt on the battery can cause the battery to self-discharge. A cracked battery case will allow the electrolyte to leak out, and constant refilling with water will reduce the acid strength. Corroded terminals create resistance in the connections.

A loose belt causes the alternator to run at lowered speeds, thereby reducing the output. Glazed, frayed, or worn spots on the belt will result in a reduced output. A cracked belt must be replaced. A belt must be in good condition so that the proper tension can be maintained for proper performance of the alternator.

Connections must be clean and tight to maintain a good conductive path for the flow of electricity without excessive resistance. Broken wire strands or loose connections cause open circuits.

Damaged parts include such items as pinched wires. Wires are sometimes pinched under sheet metal edges or under screw heads. Worn insulation is common where the wire is loose and is rubbing against a rough metal surface or the threads of a screw. A cracked alternator housing may allow the rear bearing to move out of alignment and cause the rotor to rub on the stator core. A broken bracket may cause the alternator to become misaligned with the belt and cause a noisy condition or low output.

NOTE: All tests conducted in this text are made with Ford Rotunda test equipment.

ALTERNATOR SYSTEM DIAGNOSIS GUIDE

SYMPTOM	PROBABLE CAUSE AND REMEDY
BATTERY LOW IN CHARGE	BROKEN, LOOSE OR SLIPPING ALTERNATOR BELT • Replace and/or adjust belt. CORRODED, LOOSE OR DAMAGED CIRCUIT WIRING AND/OR CABLES • Inspect all connections, wire and cables. Service or replace as necessary. BATTERY NEEDS REPLACEMENT • Perform a battery Capacity Test as outlined in this section. Replace the battery if test indicates it is worn out or under capacity. ALTERNATOR SYSTEM NOT FUNCTIONING PROPERLY • Test alternator system, starting with "Alternator Output Test" in this section. Service or replace components as required.
BATTERY WON'T HOLD CHARGE	UNWANTED EXTERNAL LOAD • Disconnect battery ground cable. Connect voltmeter between battery negative post and cable. With all circuits off, meter should read zero. If voltage is indicated, check for improper wiring connection. BATTERY NEEDS REPLACEMENT • Perform a battery Capacity Test as outlined in this section.
CHARGE INDICATOR LIGHT STAYS ON AMMETER SHOWS CONSTANT DISCHARGE ALTERNATOR HAS NO OUTPUT ALTERNATOR HAS LOW OUTPUT	DRIVE BELT, WIRE, CABLE AND/OR BATTERY NOT WITHIN SPECIFICATIONS • Replace, and/or adjust drive belt. • Inspect all connections, wire and cables. Service or replace as necessary. • Perform a battery Capacity Test as outlined in this section. ALTERNATOR OUTPUT LOW OR NO OUTPUT • Test alternator system starting with "Alternator Output Test" in this section. Service or replace components as directed.

SYMPTOM	PROBABLE CAUSE AND REMEDY
ALTERNATOR NOISY	First try to localize the noise to make sure the alternator is at fault, and not the belt, water pump or other part of the engine. A shorted diode will cause a whine (magnetic noise) at idle speed. Check alternator output; if approximately 10 amps less than normal, a shorted diode is indicated. If noise is traced to the alternator, and the cause cannot be determined, remove the alternator and inspect the bearings.
SHORT BATTERY LIFE BATTERY USES EXCESSIVE WATER DISTRIBUTOR POINTS OR COIL BURN OUT	FAULTY WIRING^ CONNECTION IN CHARGING SYSTEM – INCLUDING REGULATOR GROUND WIRE • Inspect all wiring and connections. Tighten or repair as necessary. ALTERNATOR REGULATOR VOLTAGE LIMITER NEEDS ADJUSTMENT • Check voltage limiter setting. If within specifications, set at low end. If setting is too high, inspect contacts. If burned, replace regulator. If in good condition, adjust setting to specifications. See "Regulator Voltage Limiter Test," this section.
WARNING LIGHT FLICKERS OR AMMETER NEEDLE FLUCTUATES	DIRTY OR OXIDIZED REGULATOR CONTACTS • Clean contacts or replace regulator. LOOSE OR DAMAGED WIRES AND/OR CABLES • Tighten connections and/or replace wiring. WORN ALTERNATOR BRUSHES OR IMPROPER BRUSH TENSION • Remove alternator and replace brushes.
FLASHING OF WARNING LIGHT AND OIL LIGHT WITH SWITCH OFF	SHORTED POSITIVE DIODE • Remove alternator and test diodes. Replace as necessary.

BATTERY CAPACITY TEST

Tests are made on a battery to determine the state of charge and also the condition. The ultimate result of these tests is to show that the battery is good, needs recharging, or should be replaced.

If a battery has failed, is low in charge, or requires water frequently, good service demands that the reason for this condition be found. It may be necessary to follow trouble shooting procedures to locate the cause of the trouble.

Hydrogen and oxygen gases are produced during normal battery operation. This gas mixture can explode if flames or sparks are brought near the vent openings of the battery. The sulphuric acid in the battery electrolyte can cause a serious burn if spilled on the skin or spattered in the eyes. It should be flushed away with large quantities of clear water.

Particular care should be used when connecting a booster battery in *order to prevent sparks.* *Be certain to connect positive terminal to positive* terminal and negative terminal to negative terminal.

Before attempting to test a battery, it is important that it be given a thorough visual examination to determine if it has been damaged. The presence of moisture on the outside of the case and/or low electrolyte level in one or more of the cells are indications of possible battery damage.

Motorcraft batteries have a single one-piece cover which completely seals the top of the battery and the individual cell connectors. This cover must not be pierced with test probes to perform individual cell tests.

TESTS USING THE ROTUNDA CELL ANALYZER (SRECA-200)

The Rotunda Cell Analyzer (SRECA-200) measures the individual cell voltages by inserting probes into the cell openings. Follow the instructions provided with the unit.

A battery can also be tested by determining its ability to deliver current. This may be determined by conducting a Battery Capacity Test. Fig. 3 shows the battery capacity test in outline form.

Battery Capacity Test

A high rate discharge tester (Rotunda Battery-Starter Tester ARE 16-31) in conjunction with a voltmeter is used for this test.

1. Turn the control knob on the Battery-Starter Tester to the OFF position.

2. Turn the voltmeter selector switch to the 20-volt position.

3. Connect both positive test leads to the positive battery post and both negative test leads to the negative battery post. **The voltmeter clips must contact the battery posts and not the high rate discharge tester clips. Unless this is done, the actual battery terminal voltage will not be indicated.**

4. Turn the load control knob in a clockwise direction until the ammeter reads three times the ampere hour rating of the battery. (A 45 ampere-hour battery should be tested at 135 amperes load).

5. With the ammeter reading the required load for 15 seconds, note the voltmeter reading. **Avoid leaving the high discharge load on the battery for periods longer than 15 seconds.**

6. If the voltmeter reading is 9.6 volts or more, the battery has good output capacity and will readily accept a charge, if required. Check the specific gravity. If the specific gravity reading is 1.230 or below, add water if necessary and charge the battery until it is fully charged (Fig. 3). **Always disconnect the battery ground cable when charging the battery.**

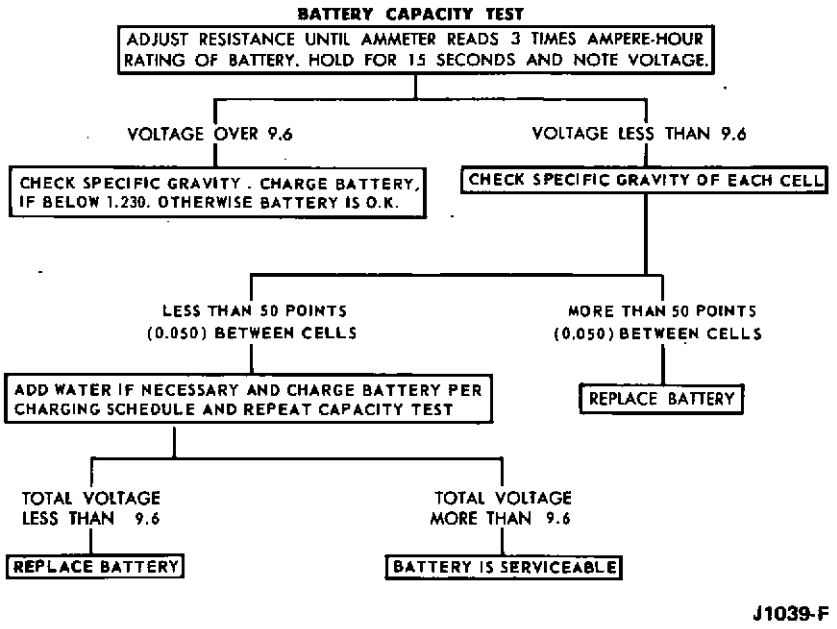

Fig. 3 – Battery Capacity Test Outline

The battery is fully charged when the cells are all gassing freely and the specific gravity ceases to rise for three successive readings taken at hourly intervals. Additional battery testing will not be necessary after the battery has been properly charged.

7. If the voltage reading obtained during the capacity test is below 9.6 volts, check the specific gravity of each cell.

8. If the difference between any two cells is more than 50 points (0.050), the battery is not satisfactory for service and should be replaced.

9. If the difference between cells is less than 50 points (0.050), the battery should be charged according to the charging schedule in Fig. 4. In some cases the electrolyte level may be too low to obtain a specific gravity reading. In such cases water should be added until the electrolyte level just covers the ring in the filler well, then charge the battery at 35 amperes for the maximum charging time indicated in Fig. 4 for the capacity of the battery being tested.

Specific Gravity Reading	Charge Rate Amperes	Battery Capacity – Ampere Hours				
		45	55	70	80	85
1.125–1.150 ①	35	65 min.	80 min.	100 min.	115 min.	125 min.
1.150–1.175	35	50 min.	65 min.	80 min.	95 min.	105 min.
1.175–1.200	35	40 min.	50 min.	60 min.	70 min.	75 min.
1.200–1.225	35	30 min.	35 min.	45 min.	50 min.	55 min.
Above 1.225	5	②	②	②	②	②

① If the specific gravity is below 1.125, use the indicated high rate of charge for the 1.125 specific gravity, then charge at 5 amperes until the specific gravity reaches 1.250 at 80° F.

② Charge at 5 ampere rate only until the specific gravity reaches 1.250 at 80° F.

At no time during the chargine operation should the electrolyte temperature exceed 130° F.

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Fig. 4 – Allowable Battery High Rate Charge Time Schedule

10. After the battery has been charged, repeat the capacity test. If the capacity test battery voltage is still less than 9.6 volts, replace the battery. If the voltage is 9.6 volts or more, the battery is satisfactory for service.

11. If the battery is found to be discharged only, check for a loose fan belt, loose electrical connections and charging system performance.

SPECIFICATIONS

BATTERIES

Allowable Battery High Rate Charge Time Schedule						
Specific Gravity Reading	Charge Rate Amperes	Battery Capacity – Ampere Hours				
		45	54 & 55	70 & 73	80	85
1.125–1.150 ①	35	65 min.	80 min.	100 min.	115 min.	125 min.
1.150–1.175	35	50 min.	65 min.	80 min.	95 min.	105 min.
1.175–1.200	35	40 min.	50 min.	60 min.	70 min.	75 min.
1.200–1.225	35	30 min.	35 min.	45 min.	50 min.	55 min.
Above 1.225	5	②	②	②	②	②

① If the specific gravity is below 1.125, use the indicated high rate of charge for the 1.125 specific gravity, then charge at 5 amperes until the specific gravity reaches 1.250 at 80° F.

② Charge at 5 ampere rate only until the specific gravity reaches 1.250 at 80° F.

③ At no time during the charging operation should the electrolyte temperature exceed 130° F.

Battery Freezing Temperatures			
Specific Gravity	Freezing Temp.	Specific Gravity	Freezing Temp.
1.280	–90°F	1.150	+ 5°F
1.250	–62°F	1.100	+19°F
1.200	–16°F	1.050	+27°F

Battery Ampere Hours	Number of Plates
45	54
54	66
55	66
70	78
73	78
80	78
85	90

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ALTERNATOR TESTING

Check the alternator drive belt and adjust it to specification (see page 22) before proceeding with any tests. Check and tighten all connectors at the starter relay and battery.

TESTS USING THE ROTUNDA ARE 20-22 ALTERNATOR REGULATOR TESTER

The general procedure is to connect the tester (Fig. 5) to the charging system, start the engine, make two tests, and then compare the pattern of lights that appear on the tester to each set of patterns shown in Figs. 6 and 7. Follow the instructions given with the ARE 20-22 tester.

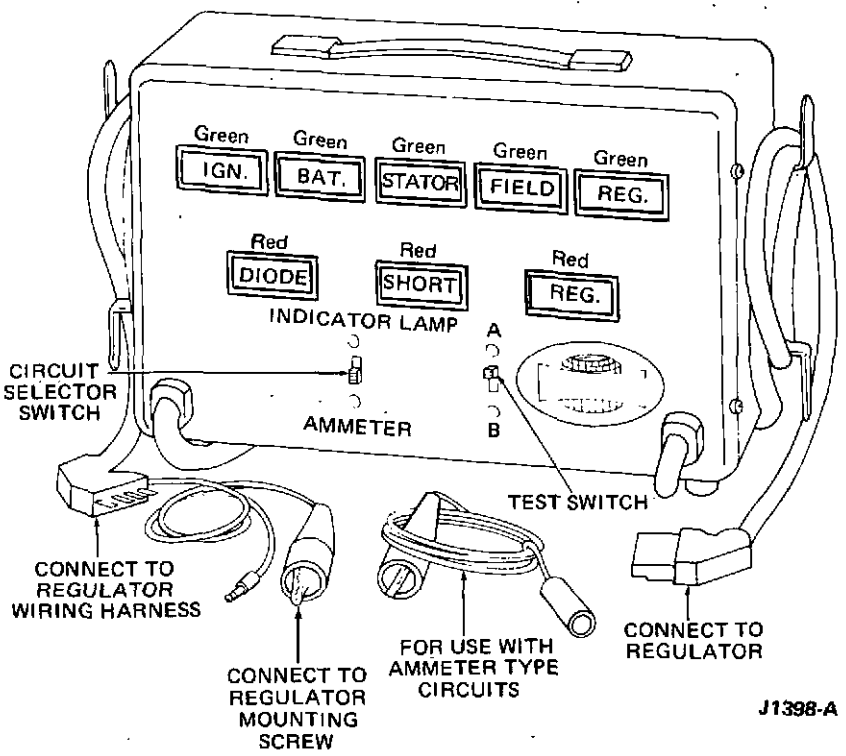


Fig. 5 – ARE 20-22 Tester

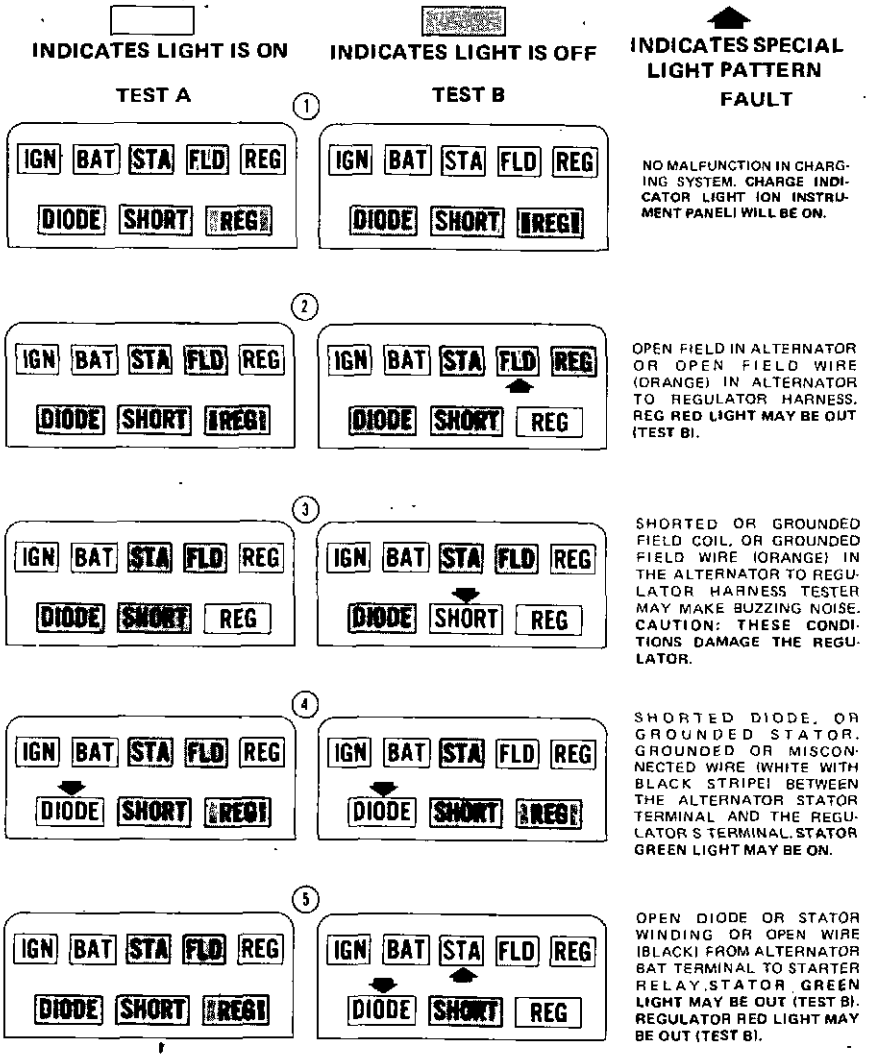
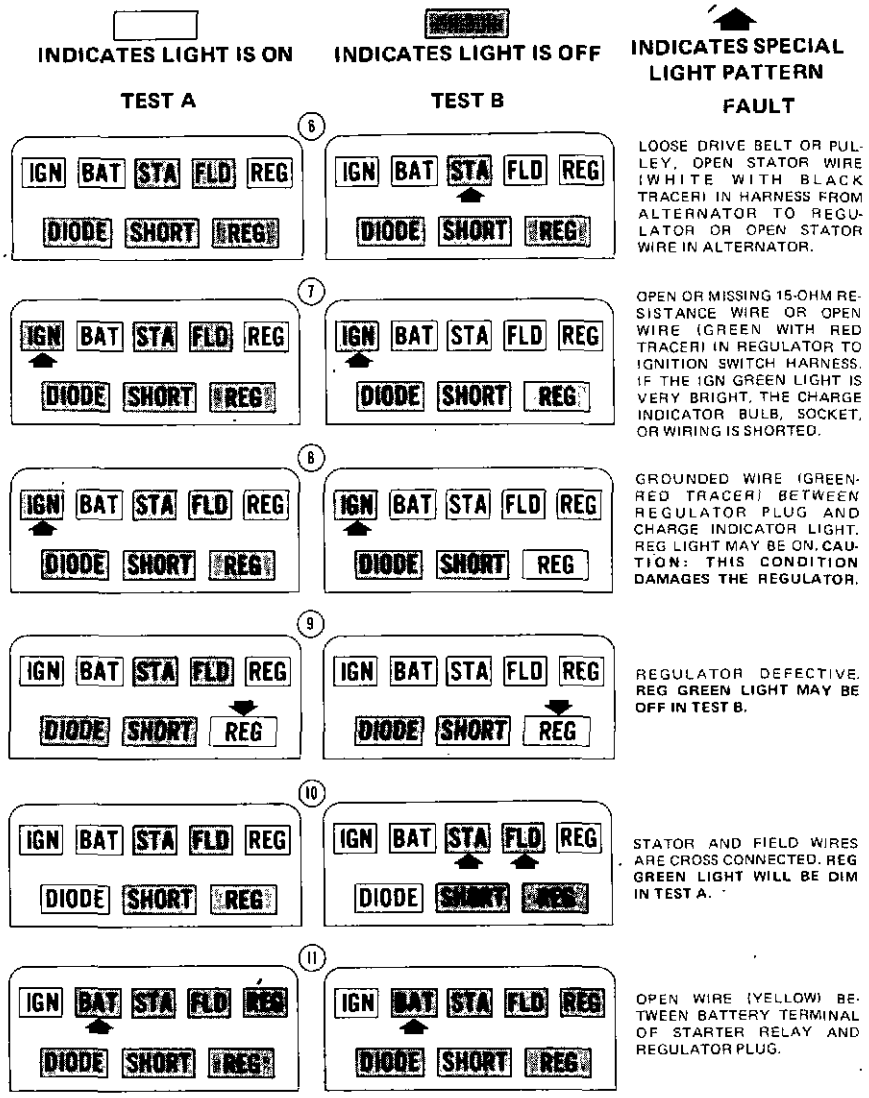


Fig. 6 -- ARE 20-22 Test Chart



NOTE: ALWAYS REPAIR MALFUNCTION AND RETEST.

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Fig. 7 – ARE 20-22 Test Chart (Continued)

TESTS USING THE ROTUNDA ARE 27-38 VOLT-AMP-ALTERNATOR TESTER

The following test procedures make use of the Rotunda Volt-Amp-Alternator Tester ARE 27-38.

Use care when connecting any test equipment to the alternator system, as the alternator output terminal is connected to the battery at all times.

Alternator Output Test On Engine

When the alternator output test is conducted off the vehicle, a test bench must be used. Follow the procedure given by the test bench equipment manufacturer. **When the alternator is removed from the vehicle for this purpose, always disconnect the battery ground cable as the alternator output connector is connected to the battery at all times.**

To test the output of the alternator on the vehicle, proceed as follows:

Test Procedure

1. Check the alternator drive belt tension. Place the transmission in neutral or park **and supply the parking brake.** Make the connections and tester knob adjustments as shown in Fig. 8 (Output Test). Be sure that the field rheostat knob is at the OFF position at the start of this test.

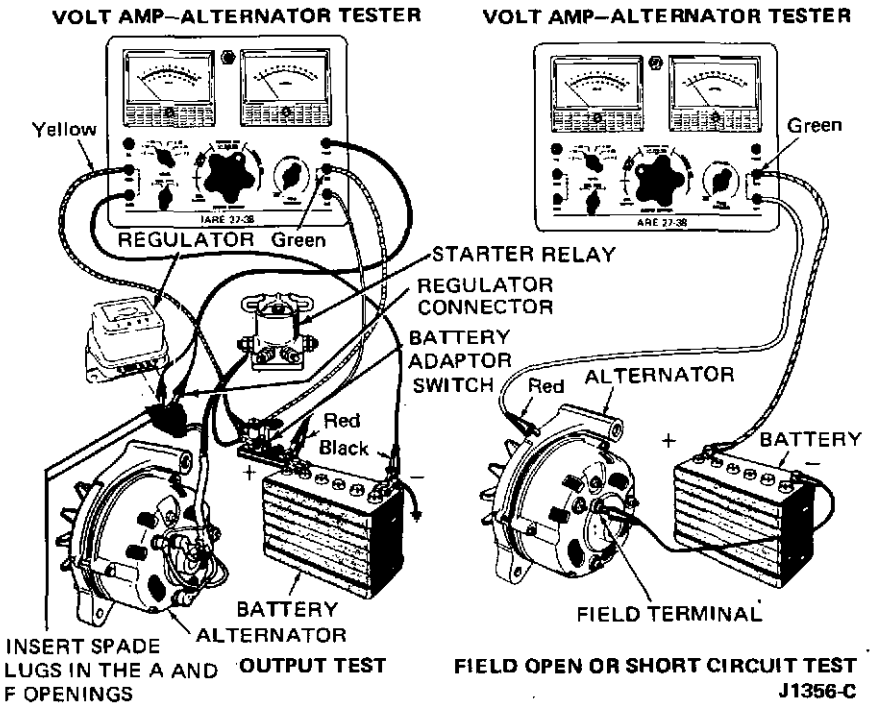

Fig. 8 – Alternator Tests

2. Close the battery adapter switch. Start the engine, then open the battery adapter switch.

3. Increase the engine speed to approximately 2000 rpm (use a tachometer). Turn off all lights and electrical accessories.

4. Turn the field rheostat clockwise until 15 volts is indicated on the voltmeter upper scale. Turn the master control clockwise until the voltmeter indicates between 11 and 12 volts. Holding the master control in this position, turn the field rheostat clockwise to its maximum rotation. Turn the master control counterclockwise until the voltmeter indicates 15 volts. Observe the ammeter reading. Add 2 amperes to this reading to obtain alternator output. If rated output (see Specification Chart - page 36) cannot be obtained, increase the engine speed to 2900 rpm and repeat this step.

5. Return the field rheostat knob to OFF, release the master control knob, and stop the engine. Disconnect the test equipment, if no further tests are to be made.

If the alternator output is not O.K., it will be necessary to remove the alternator from the vehicle and perform the necessary bench tests to locate the defect.

An output of 2 to 5 amperes below specification usually indicates an open alternator diode. An output of approximately 10 amperes below specification usually indicates a shorted alternator diode. An alternator with a shorted diode will usually whine, which will be most noticeable at idle speeds.

Ford Stator Neutral Voltage Test – On Engine

The Ford alternator STA terminal is connected to the stator coil neutral or center point of the alternator windings. The voltage generated at this point is used to close the field relay in the Motorcraft charge indicator light system.

To test for the stator neutral voltage, disconnect the regulator connector plug from the regulator. Make the connections and tester knob adjustments as shown in Fig. 9.

Start the engine and run it at 1000 rpm (use a tachometer). Turn off all lights and accessories. Rotate the field rheostat clockwise until at least 6 volts is indicated on the voltmeter upper scale. If 6 volts or more is not obtained, remove the alternator and perform the diode and stator tests to determine which part of the alternator is damaged.

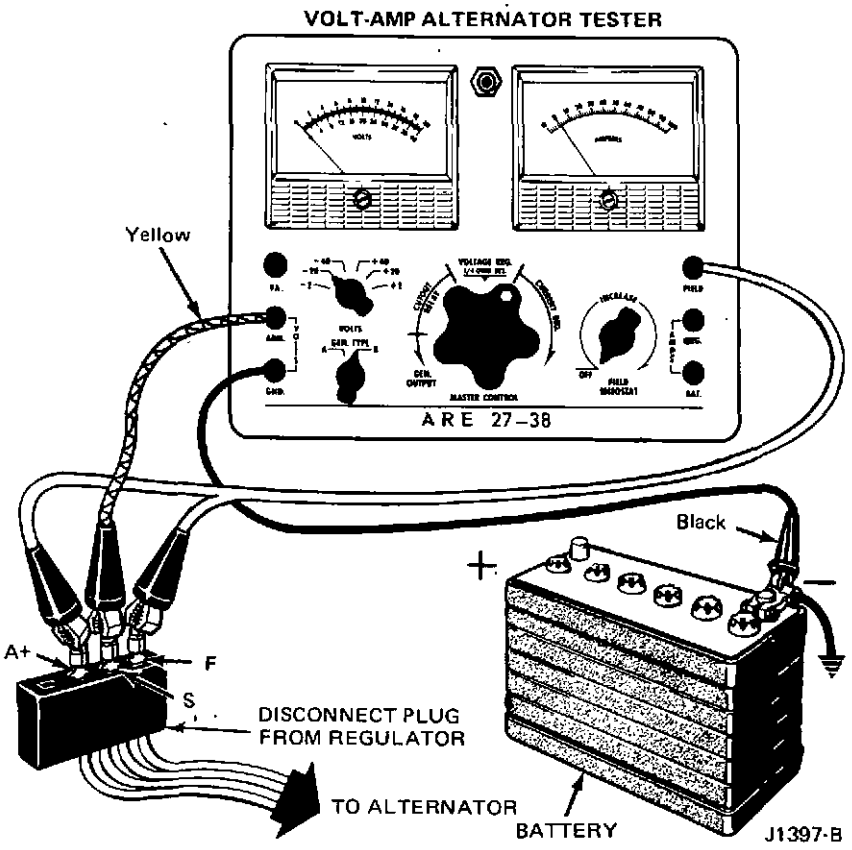

Fig. 9 – Stator Neutral Voltage Test

Field Open or Short Circuit Test – On Bench

The first part of this test will determine if the alternator portion of the field coil system, consisting of the field coil, the field coil slip rings and the field coil brush assembly is satisfactory. The second part of the test will indicate (in case of a field coil system malfunction), which of the above items is causing the malfunction.

Test Procedure

Make the connection as shown in Fig. 8 (Field Open or Short Circuit Test). The current draw, as indicated by the ammeter, should be to specification (see Specification Chart - page 36). If there is little or no current flow, the field or brushes have a high resistance or are open. A current flow considerably higher than that specified above indicates shorted or grounded field turns or brush leads touching. If the tests shows that the field is shorted or open, determine if the field brush assembly or slip rings are at fault.

Disassemble the front housing and rotor from the rear housing and stator and check the resistance of the rotor with the Rotunda ARE 27-42 ohmmeter. Set the ohmmeter multiply-by knob at 1 and calibrate the ohmmeter as indicated inside the ohmmeter cover.

Contact each ohmmeter probe to a slip ring. The resistance should be 4 or 5 ohms. A higher reading indicates a damaged slip ring soldered connection or a broken wire. A lower reading indicates a shorted wire or slip ring assembly. Replace the rotor if it is damaged and cannot be repaired.

Contact one ohmmeter probe to a slip ring and the other probe to the rotor shaft. The resistance should be infinite. Any reading other than infinite indicates a short to ground. Inspect the slip ring soldered terminals to make certain that they are not bent and touching the shaft, or that excess solder is not grounding the rotor coil. Replace the rotor if it is damaged and cannot be repaired.

If the rotor checks indicate that it is in proper operating condition but the overall Field Open or Short Circuit Test (Fig. 8) indicates trouble, the brushes or brush assembly are the cause. Replace damaged parts.

Diode Tests – On Bench

Disassemble the alternator (see Removal & Installation - page 22). Disconnect the rectifier assembly from the stator and make the test connections as shown in Fig. 10 or 11. To test one set of diodes, contact one probe to the diode plate as shown and contact each of the three stator lead terminals with the other probe. Reverse the probes and repeat the test. Test the other set of diodes in the same way. On 61-ampere alternators, test the two additional diodes as shown in Fig. 12.

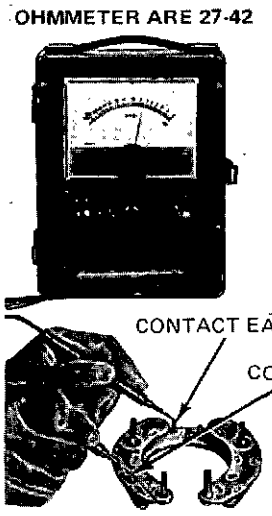

Fig. 10 – Alternator Diode

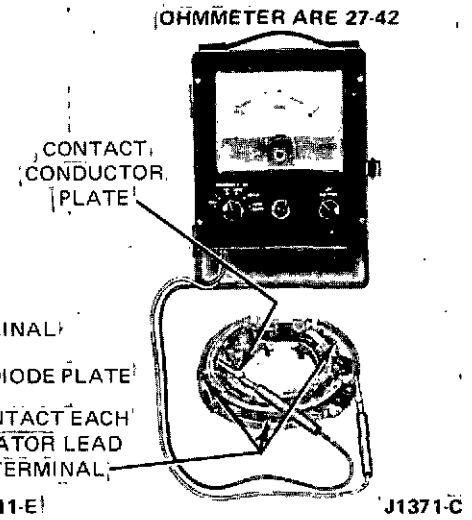

Fig. 11 – 65-Ampere Alternator Diode Test

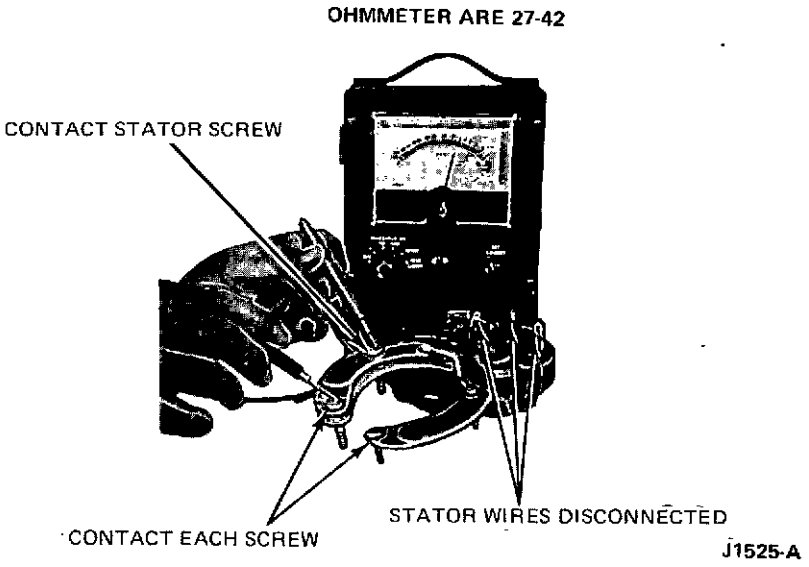

Fig. 12 – 61-Ampere Alternator Booster Plate Diode Test

All 6 tests (8 tests on 61-ampere alternator) should show a low reading of approximately 60 ohms in one direction and an infinite reading (no needle movement) with the probes reversed. **Be sure to use the Rotunda ohmmeter with the multiply-by knob set at 10, and calibrate the ohmmeter as indicated inside the ohmmeter cover.**

Open or Grounded Stator Coil Tests – On Bench

These tests are made to determine if the stator coil is operating properly. Disassemble the stator from the alternator and rectifier assembly (see Disassembly - page 24) for these tests.

Open Stator Test – On Bench

Set the Rotunda ohmmeter multiply-by knob at 1. Connect the ohmmeter probes between each pair of stator leads (Fig. 21). If the ohmmeter does not show equal readings between each pair of stator leads, the stator is open and must be replaced.

Grounded Stator Test – On Bench

Set the Rotunda ohmmeter multiply-by knob at 1000. Connect the ohmmeter probes between one of the stator leads and the stator core. Be sure that the test lead makes a good electrical connection to the core. The ohmmeter should not show any continuity (no reading). If it does show a reading, the stator winding is grounded and must be replaced.

ADJUSTMENTS

BELT ADJUSTMENT

1. Loosen the alternator mounting bolt to a snug position and loosen the adjusting arm bolts.
2. **Apply pressure on the alternator front housing only** and tighten the adjusting arm to alternator bolt.
3. Check the belt tension using tool T63L-8620-A. Adjust the belt for specified tension.
4. Tighten all mounting bolts.

REMOVAL AND INSTALLATION

REMOVAL

1. Disconnect the battery ground cable.
2. Loosen the alternator mounting bolts and remove the adjustment arm to alternator attaching bolt. Disengage the alternator belt.
3. Remove the electrical connectors from the alternator. The stator and field connectors are the push-on type. They should be pulled straight off the terminal studs to prevent damage to them.
4. Remove the alternator mounting bolt, and remove the alternator.

INSTALLATION

1. Install the alternator wiring harness (Figs. 13 and 14). Position the alternator to the engine, and install the spacer (if used) and the alternator mounting bolt. Tighten the bolt only finger-tight.
2. Install the adjustment arm to alternator attaching bolt.
3. Adjust the belt tension using tool T63L-8620-A. **Apply pressure on the alternator front housing only, when tightening the belt.**

   Tighten the adjusting arm bolts and the mounting bolt.
4. Connect the battery ground cable.

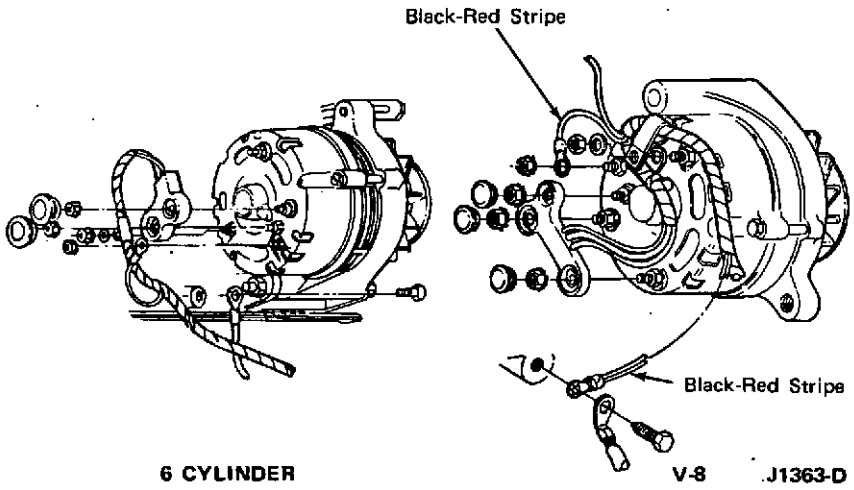

Fig. 13 – Wiring Harness Connections – Typical Except 65-Ampere Alternator

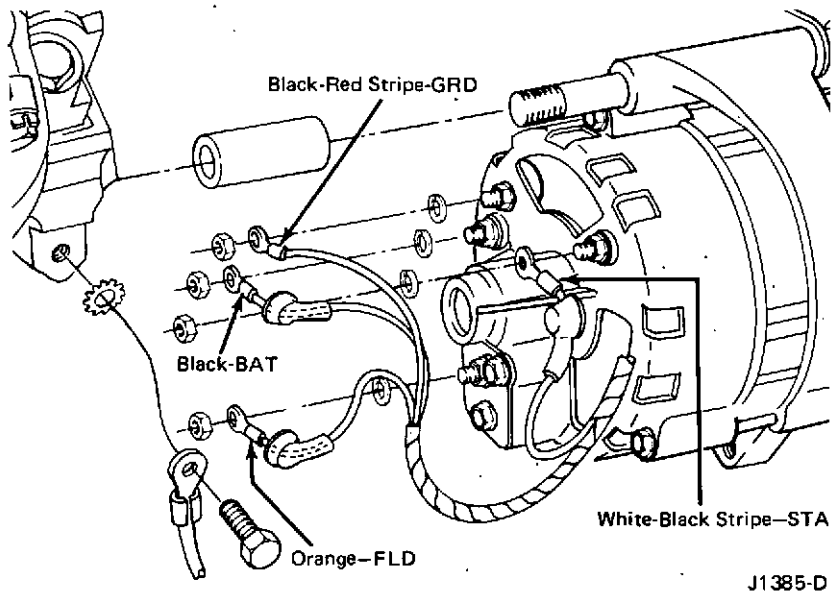

Fig. 14 – Wiring Harness Connections 65-Ampere Alternator

MAJOR REPAIR OPERATIONS

FORD ALTERNATOR EXCEPT 65-AMPERE ALTERNATOR

Disassembly

Fig. 15 shows a disassembled view of the alternator.

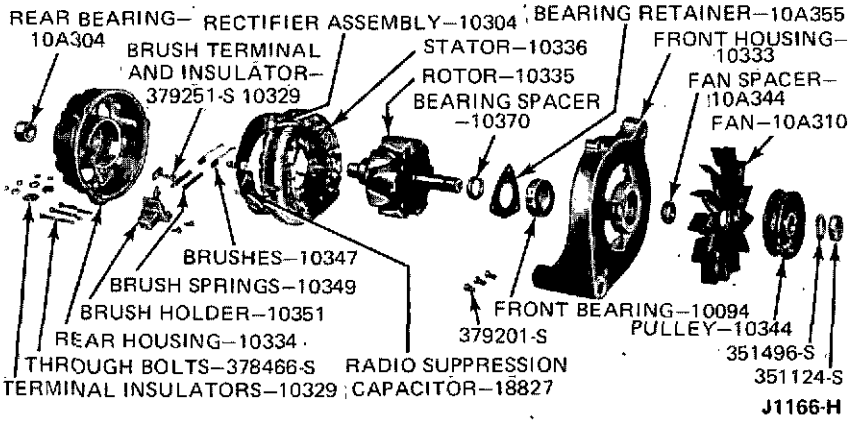

Fig. 15 – Disassembled Alternator

1. Mark both end housings and the stator with a scribe mark for assembly.

2. Remove the three housing through bolts.

3. Separate the front housing and rotor from the stator and rear housing.

4. Remove all the nuts and washers from the rear housing and remove *the rear housing from the stator and rectifier assembly.*

5. Remove the brush holder mounting screws and remove the holder, brushes, brush springs, insulator and terminal.

6. If replacement is necessary, press the bearing from the rear housing, supporting the housing on the inner boss.

7. If the rectifier assembly is being replaced, unsolder the stator leads from the printed-circuit board terminals, and separate the stator from the rectifier assembly. Use a 100-watt soldering iron.

8. Original production alternators will have one of three types of rectifier assembly circuit boards (Fig. 16); one has the circuit board spaced away from the diode plates with the diodes exposed. Another type is a single circuit board with built-in diodes. The third type circuit board has built-in diodes with an additional booster diode plate containing two diodes. This circuit board is used only on the 61-ampere alternator.

   If the alternator rectifier has an exposed diode circuit board, remove the screws from the rectifier by rotating the bolt heads 1/4 turn clockwise to unlock them and then remove the screws (Fig. 16).

Push the stator terminal screw out on a rectifier with the diodes built into the circuit board (Fig. 16). Avoid turning the screw while removing to make certain that the straight knurl will engage the insulators when installing. Do not remove the grounded screw (Fig. 17).

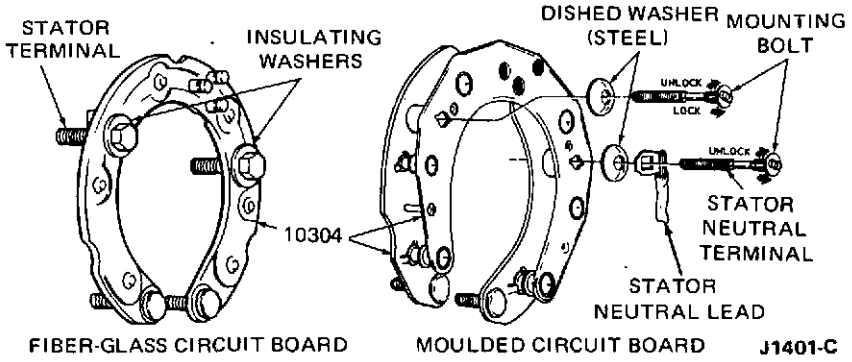

Fig. 16 – Rectifier Assembly

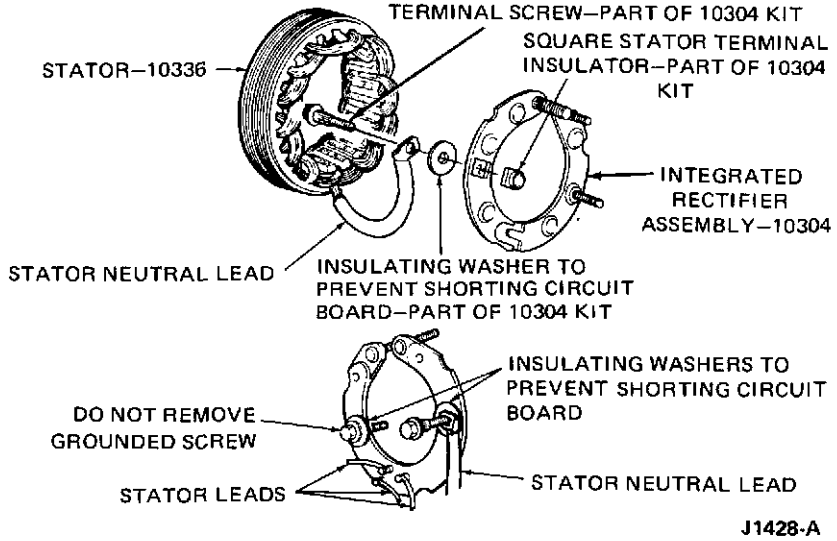

Fig. 17 – Stator Terminal Installation – Integral Rectifier Circuit Board

On 61-ampere alternator rectifier, press the stator terminal screw from the circuit board as shown in Fig. 18. When the terminal screw has moved about 1/4 inch, remove the nut from the end of the screw and lift the screw from the circuit board. **Do not twist the screw in the circuit board.**

9. Remove the drive pulley nut with the tool shown in Fig. 19. Then, pull the lockwasher, pulley, fan, fan spacer, rotor and rotor stop from the rotor shaft.

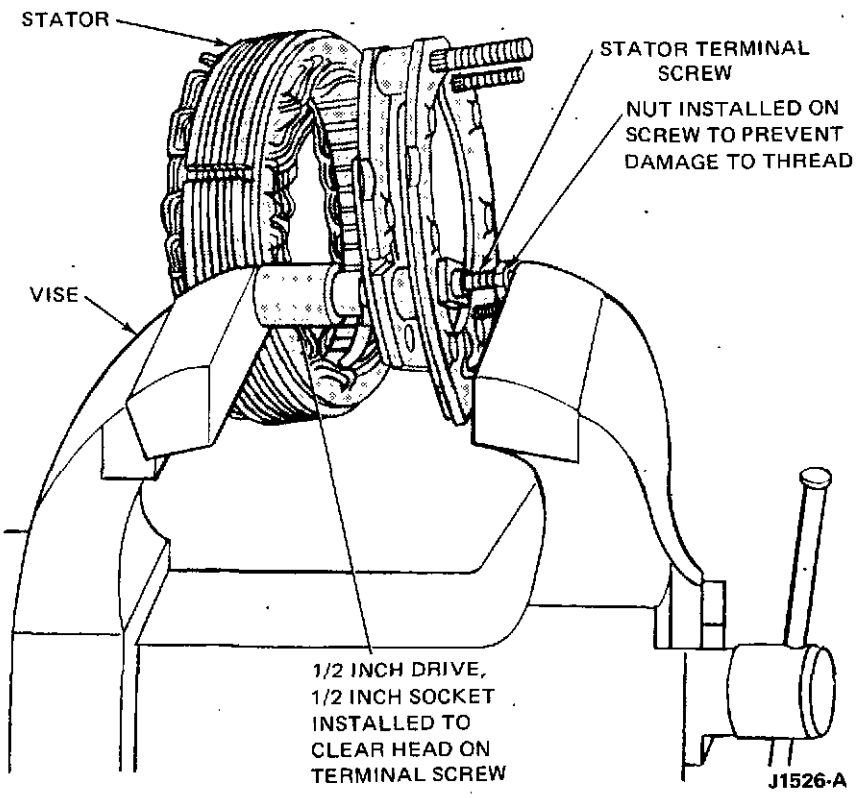

Fig. 18 – Stator Terminal Screw Removal 61-Ampere Alternator

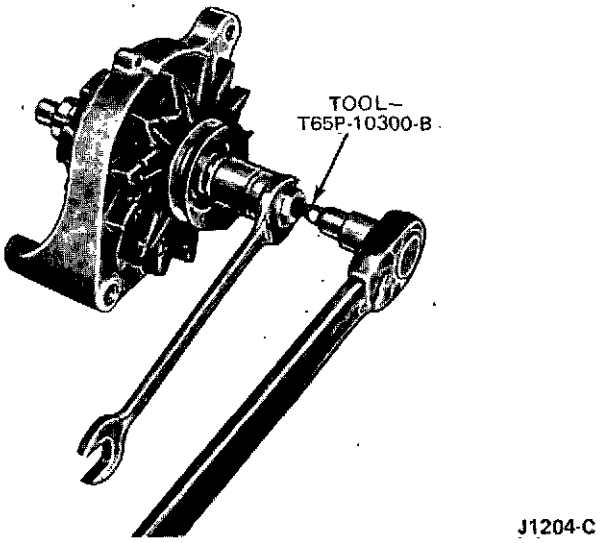

Fig. 19 – Pulley Removal

10. Remove the three screws that hold the front end bearing retainer, and remove the retainer. If the bearing is damaged or has lost its lubricant, support the housing close to the bearing boss and press out the old bearing from the housing.

11. Perform a diode test and a field open or short circuit test (see pages 19 and 20).

Cleaning and Inspection

1. The rotor, stator and bearings must not be cleaned with solvent. Wipe these parts off with a clean cloth.

2. Rotate the bearing on the drive end of the rotor drive shaft. Check for any scraping noise, looseness or roughness that will indicate that the bearing is excessively worn. Look for excessive lubricant leakage. If any of these conditions exist, replace the bearing.

3. Inspect the rotor shaft at the rear bearing surface for roughness or severe chatter marks. Replace the rotor assembly if the shaft is not smooth.

4. Place the rear bearing on the slip-ring end of the shaft and rotate the bearing on the shaft. Make the same check for noise, looseness or roughness as was made for the front bearing. Inspect the rollers and cage for damage. Replace the bearing if these conditions exist, or if the lubricant is lost or contaminated.

5. Check the pulley and fan for excessive looseness on the rotor shaft. Replace any pulley or fan that is loose or bent out of shape. Check the rotor shaft for stripped or damaged threads. Inspect the hex hole in the end of the shaft for damage.

6. Check both the front and rear housings for cracks. Check the front housing for stripped threads in the mounting ear. Replace damaged housings.

7. Check all wire leads on both the stator and rotor assemblies for loose soldered connections, and for burned insulation. Resolder poor connections. Replace parts that show burned insulation.

8. Check the slip rings for nicks and surface roughness. Nicks and scratches may be removed by turning down the slip rings. Do not go beyond the minimum diameter limit of 1.22 inches. If the slip rings are badly damaged, replace the rotor.

9. Replace any parts that are burned or cracked. Replace brushes and brush springs that are not to specification.

Assembly

1. Press the front bearing in the front housing bearing boss (put pressure on the outer race only), and install the bearing retainer (Fig. 15).

2. If the stop-ring on the rotor drive shaft was damaged, install a new stop-ring. Push the new ring on the shaft and into the groove. **Do not open the ring with snap ring pliers as permanent damage will result.**

3. Position the rotor stop on the drive shaft with the recessed side against the stop-ring.

4. Position the front housing, fan spacer, fan, pulley and lock washer on the drive shaft and install the retaining nut. Tighten the retaining nut with tool shown in Fig. 19 to the specified torque (see Specification Chart - page 36).

5. If the rear housing bearing was removed, support the housing on the inner boss and press in a new bearing flush with the outer end surface.

6. Place the brush springs, brushes, brush terminal and terminal insulator in the brush holder and hold the brushes in position by inserting a piece of stiff wire in the brush holder as shown in Fig. 20.

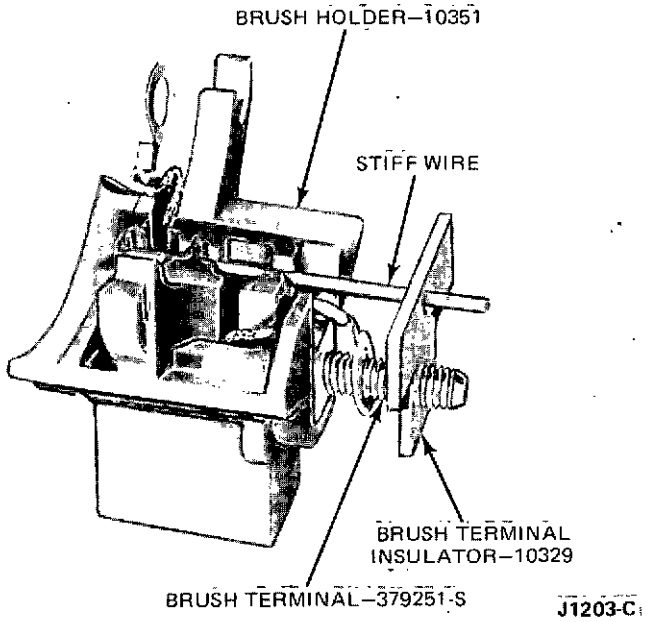

Fig. 20 – Brush Holder Assembly

7. Position the brush holder assembly in the rear housing and install the mounting screws. Position the brush leads in brush holder as shown in Fig. 21.

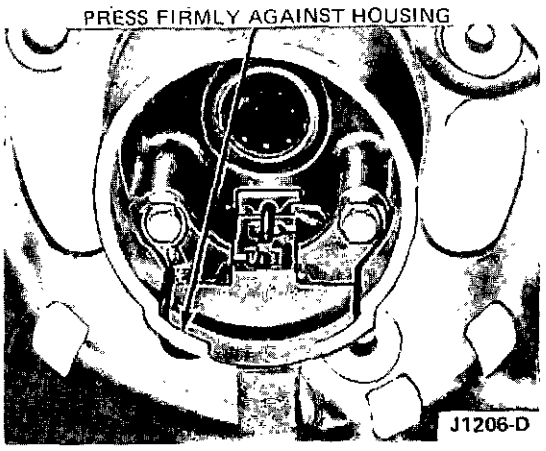

Fig. 21 – Brush Lead Positions – Typical

8. Wrap the three stator winding leads around the circuit board terminals and solder them. Use a 100-watt soldering iron and rosin-core solder. Position the stator neutral lead eyelet on the stator terminal screw and install the screw in the rectifier assembly (Fig. 22).

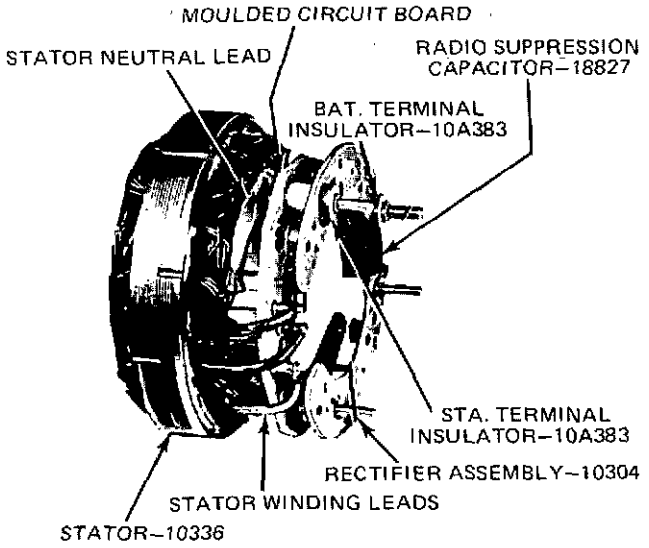

Fig. 22 – Stator Lead Connections – Except 61-Ampere Alternator

9. For a rectifier with the diodes exposed, insert the special screws through the wire lug, dished washers and circuit board (Fig. 16). Turn them 1/4 turn counterclockwise to lock them. For single circuit boards with built in diodes, insert the screws straight through into the holes (Fig. 17).

   The dished washers are to be used on the molded circuit board only. If they are used on the fiber circuit boards, a short circuit will occur. A flat insulating washer is to be used between the stator terminal and the board when a fiber circuit board is used (Fig. 17).

10. For a rectifier with a booster diode plate (61-Ampere Alternator only), proceed as follows:

    a. Position the stator wire terminal on the stator terminal screw and position the screw into the rectifier. Position the square insulator over the screw and into the square hole in the rectifier (Fig. 23).

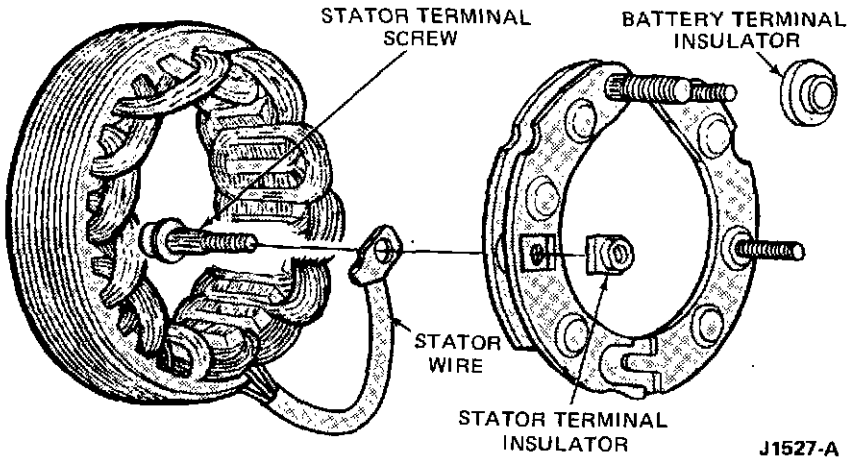

Fig. 23 – Stator and Rectifier Assembly 61-Ampere Alternator

    b. Rotate the terminal screw until it locks in position. Then, press the screw in finger tight.

    c. Position the stator wire as shown in Fig. 24. The, press the terminal screw into the rectifier and insulator as shown in Fig. 25.

11. Position the radio noise suppression capacitor on the rectifier terminals. On the molded circuit board install the STA and BAT terminal insulators (Fig. 22). On the fiber circuit board position the square stator-terminal insulator in the square hole in the rectifier assembly (Fig. 17). Position the BAT terminal insulator (Fig. 26).

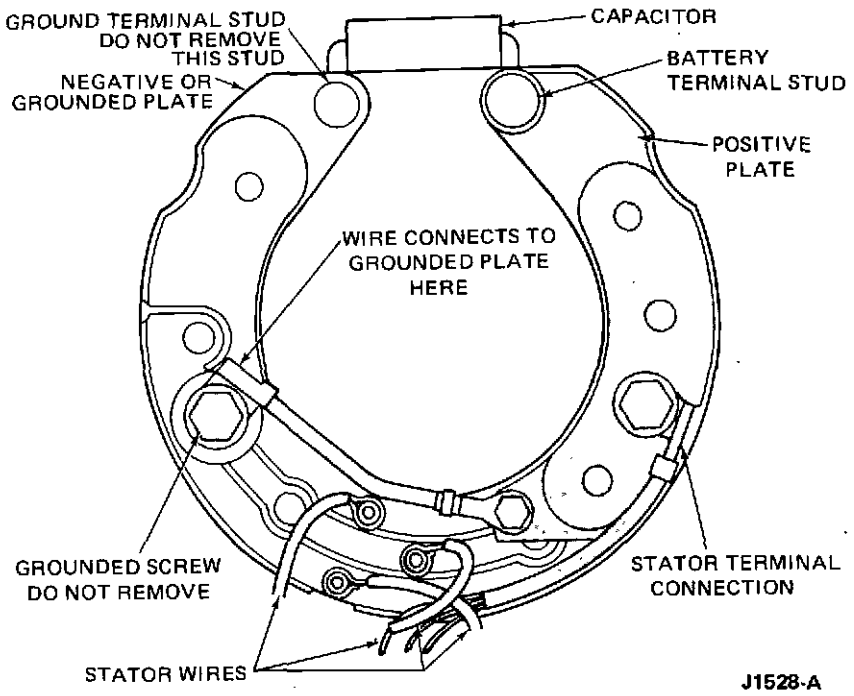

Fig. 24 – Rectifier Terminal Locations 61-Ampere Alternator

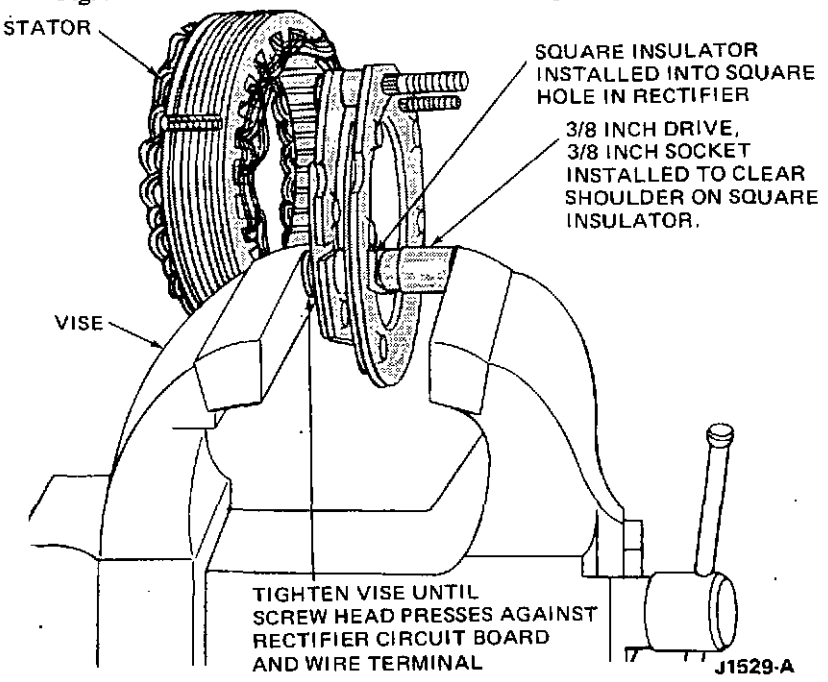

Fig. 25 – Stator Terminal Screw Installation 61-Ampere Alternator

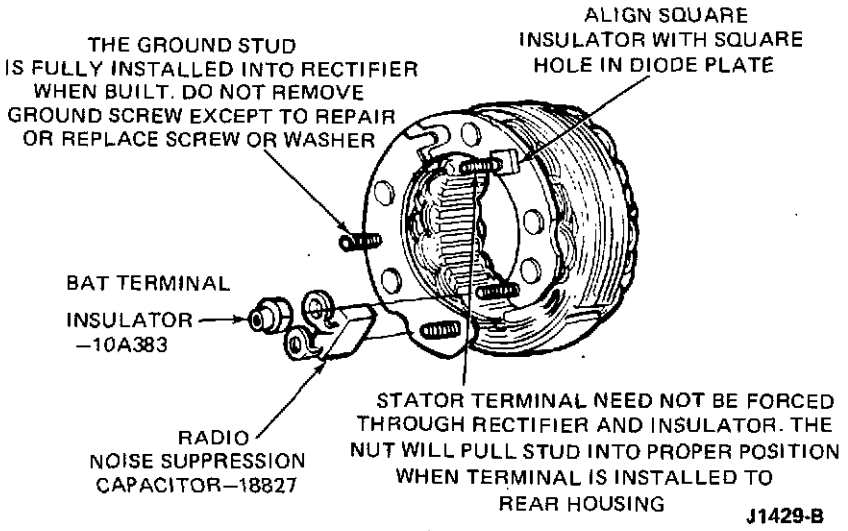

Fig. 26 – Terminal Insulators – Fiber-Glass Circuit Board

Position the stator and rectifier assembly in the rear housing. Make certain that all terminal insulators are seated properly in the recesses (Fig. 22). Position the STA (Black), BAT (red) and FLD (Orange) insulators on the terminal bolts, and install the retaining nuts (Fig. 27).

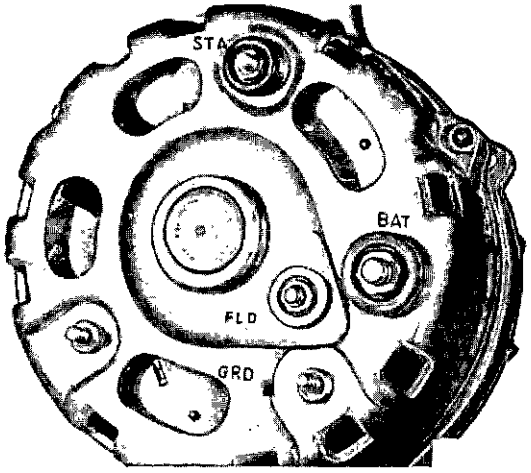

Fig. 27 – Alternator Terminal Locations

12. Wipe the rear end bearing surface of the rotor shaft with a clean lint-free rag.

13. Position the rear housing and stator assembly over the rotor and align the scribe marks made during disassembly. Seat the machined portion of the stator core into the step in both end housings. Install the housing through bolts. Remove the brush retracting wire, and put a daub of water-proof cement over the hole to seal it.

65-AMPERE FORD ALTERNATOR

Disassembly

Fig. 28 shows a disassembled view of the 65-ampere alternator.

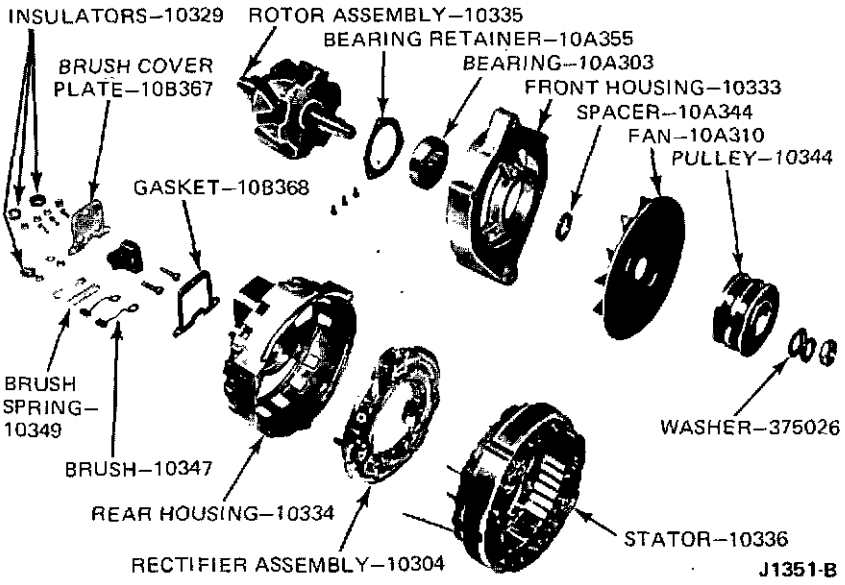

Fig. 28 – Disassembled 65-Ampere Alternator

1. Remove the brush holder and cover assembly from the rear end housing.

2. Mark both end housings and the stator with a scribe mark for assembly.

3. Remove the three housing through bolts.

4. Separate the front housing and rotor from the stator and rear housing.

5. Remove the drive pulley nut, lockwasher, flat washer, pulley, fan, fan spacer and rotor from the front housing (Fig. 19).

6. Remove the three screws that hold the front bearing retainer, and remove the retainer. If the bearing is damaged or has lost its lubricant, support the housing close to the bearing boss and press out the bearing from the housing.

7. Remove all the nut and washer assemblies and insulators from the rear housing and remove the rear housing from the stator and rectifier assembly.

8. If replacement is necessary, press the bearing from the rear housing, supporting the housing on the inner boss.

9. Unsolder the three stator leads from the rectifier assembly, and separate the stator from the assembly. Use a 200 watt soldering iron.

10. Perform a diode test and an open and grounded stator coil test.

Cleaning and Inspection

Nicks and scratches may be removed from the rotor slip rings by turning down the slip rings. Do not go beyond the minimum diameter limit of 1.22 inches. If the slip rings are badly damaged, the entire rotor must be replaced as it is serviced as an assembly. The rectifier is also serviced as an assembly.

Assembly

1. If the front bearing is being replaced, press the new bearing in the bearing boss putting pressure on the outer race only. Then, install the bearing retainer, and tighten the retainer screws until the tips of the retainer touch the housing.

2. Position the rectifier assembly to the stator, wrap the three stator leads around the diode plate terminals and solder them (Fig. 29). Use a 200 watt soldering iron.

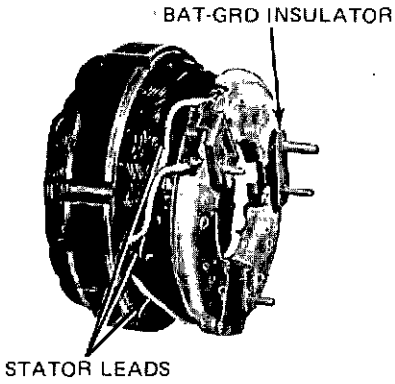

Fig. 29 -- Stator Lead Connections

3. If the rear housing bearing was removed, press in a new bearing from the inside of the housing, putting pressure on the outer race only.

4. Install the BAT-GRD insulator (Fig. 29), and position the stator and rectifier assembly in the rear housing.

5. Install the STA (purple) and BAT (red) terminal insulators on the terminal bolts and install the nut and washer assemblies. **Make certain that the shoulders on all insulators both inside and outside of the housing are seated properly before tightening the nuts.**

6. Position the front housing over the rotor and install the fan spacer, fan, pulley, flat and lock washers and nut on the rotor shaft (Fig. 19).

7. Wipe the rear bearing surface of the rotor shaft with a clean lint free rag.

8. Position the rotor with the front housing into the stator and rear housing assembly, and align the scribe marks made during disassembly. Seat the machined portion of the stator core into the step in both housing, and install the through bolts.

9. If the field brushes have worn to less than 3/8 inch, replace both brushes. Hold the brushes in position by inserting a stiff wire in the brush holder (Fig. 30).

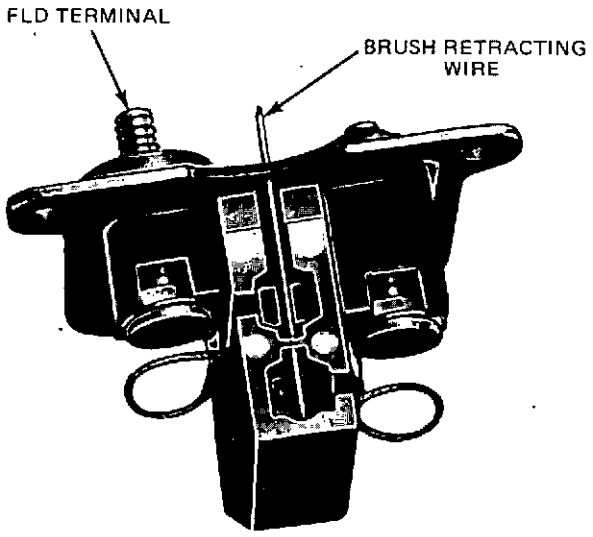

Fig. 30 – Field Brush Assembly

10. Position the brush holder assembly into the rear housing and install the three mounting screws. Remove the brush retracting wire and put a daub of water-proof cement over the hole to seal it.

Brush Replacement

1. Remove the brush holder and cover assembly from the rear housing.

2. Remove the terminal bolts from the brush holder and cover assembly, and remove the brush assemblies.

3. Position the new brush terminals on the terminal bolts and assemble the terminals, bolts, brush holder washers and nuts (Fig. 30). The insulating washer mounts under the FLD terminal nut. The entire brush and cover assembly is also available for service.

4. Depress the brush springs in the brush holder cavities and insert the brushes on top of the springs. Hold the brushes in position by inserting a stiff wire in the brush holder as shown in Fig. 30. Position the brush leads as shown in Fig. 30.

5. Install the brush holder and cover assembly to the rear housing. Remove the brush retracting wire and put a daub of water-proof cement over the hole to seal it.

SPECIFICATIONS

ALTERNATOR

Supplier	Stamp Color	Rating		Field Current Amps	Cut-In Speed	Rated Output Speed (Engine rpm)		Slip Ring Turning (Inches)		Brush Length (Inches)		Pulley Nut Torque (Ft-Lbs)	Belt ① Tension (Lbs)
		Amperes @ 15V	Watts @ 15V	@ 12V	(rpm)	Cold	Hot	Min. Dia.	Max. Runout	New	Wear – Limit		
Ford	Purple	38	570	2.4	400	2000	2900	1.22	0.0005	1/2	5/16	60-100	70-110
Ford	Orange	42	630	2.9	400	2000	2900	1.22	0.0005	1/2	5/16	60-100	70-110
Ford	Red	55	825	2.9	400	2000	2900	1.22	0.0005	1/2	5/16	60-100	70-110
Ford	Green	61	915	2.9	400	2000	2900	1.22	0.0005	1/2	5/16	60-100	70-110
Ford	Black	65	975	2.9	360	1640		1.22	0.0005	5/8	3/8	60-100	70-110

①Used Belt. New Belt 140. A used belt is one that has been in operation more than 10 minutes. If belt tension is out of specification, or belt has been removed, reset to 110 lbs.

SPECIAL TOOLS

Ford Tool No.	Former No.	Description
T63L-8620-A	8620 BT-33-73-F	Belt Tension Gauge
T65P-10300-B		Alternator Pulley Remover

Ford Tool No.	Former No.	Description
ARE-16-31		Battery Starter Tester
ARE-20-22		Alternator-Regulator Tester
ARE-27-38		Volt-Amp. Regulator Tester
ARE-27-42		Ohmmeter

CJ1446-B

Leece Neville Alternators

DESCRIPTION AND OPERATION

The operation and general electrical description of the 65-ampere Leece-Neville alternator is the same as that for the Ford alternator. The field brushes of the 65 ampere alternator are mounted in a sealed brush holder on the brush housing. Two sealed ball bearings support the rotor in both end housings.

TESTING

TEST USING THE ROTUNDA VOLT-AMP ALTERNATOR TESTER ARE 27-38

The following test procedures make use of the Rotunda Volt-Amp Alternator Tester ARE 27-38.

***Use care when connecting any test equipment to the alternator system,* as the alternator output terminal is connected to the battery at all times.**

Alternator Output Test – On Engine

When the alternator output test is conducted off the vehicle, a test bench must be used. Follow the procedure given by the test bench equipment manufacturer. **When the alternator is removed from the vehicle for this purpose, always disconnect a battery cable as the alternator output connector is connected to the battery at all times.**

To test the output of the alternator on the vehicle, proceed as follows:

1. Place the transmission in neutral or park **and apply the parking brake. Make the connections and tester knob adjustments as shown in Fig. 31 (Output Test). Be sure that the field rheostat knob is at the OFF position at the start of this test.**

2. Close the battery adapter switch. Start the engine, then open the battery adapter switch.

3. Increase the engine speed to approximately 2000 rpm (use a tachometer). Turn off all lights and electrical accessories.

4. Turn the field rheostat clockwise until 15 volts is indicated on the voltmeter upper scale. Turn the master control clockwise until the voltmeter indicates between 11 and 12 volts. Holding the master control in this position turn the field rheostat clockwise to its maximum rotation. Turn the master control counterclockwise until the voltmeter indicates 15 volts. Observe the ammeter reading. Add 2 amperes to this reading to obtain alternator output. If rated output (see Specification Chart - page 43) cannot be obtained, increase the engine speed to 2900 rpm and repeat this step.

5. Return the field rheostat knob to OFF, release the master control knob, and stop the engine. Disconnect the test equipment, if no further tests are to be made.

   An output of 2 to 5 amperes below specification usually indicates an open alternator diode. An output of approximately 10 amperes below specification usually indicates a shorted alternator diode. An alternator with a shorted diode will usually whine.

Field Open or Short Circuit Test – On Bench

Make the connection as shown in Fig. 31 (Field Open or Short Circuit Test). The current draw, as indicated by the ammeter, should be to specification (see Specification Chart - page 43). If there is little or no current flow considerably higher than that specified, indicates shorted or grounded field turns or brush leads touching. If the test shows that the field is shorted or open and the field brush assembly or slip rings are not at fault, the entire rotor must be replaced.

If the alternator has output at low rpm and no output at high rpm, centrifugal force may be causing the rotor windings to short to ground. Put the alternator on a test stand and repeat the preceding test. Run the alternator at high speed during the test.

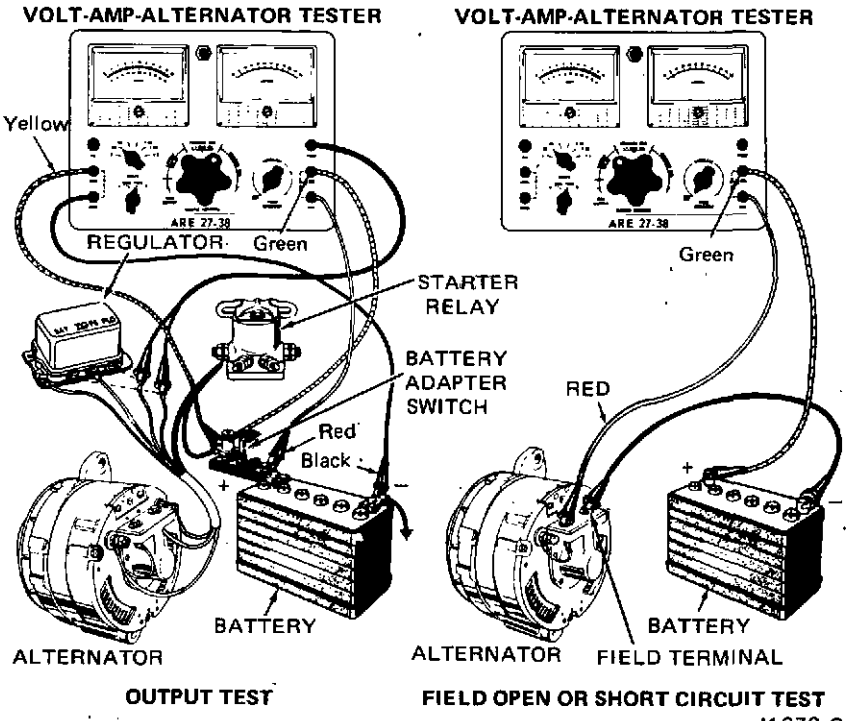

Fig. 31 – Alternator Tests – Leece-Neville

Diode Test – On Bench

Disassemble the alternator (see Removal & Installation - page 40), and disconnect the diode assembly from the stator. Make the test connections as shown in Fig. 32.

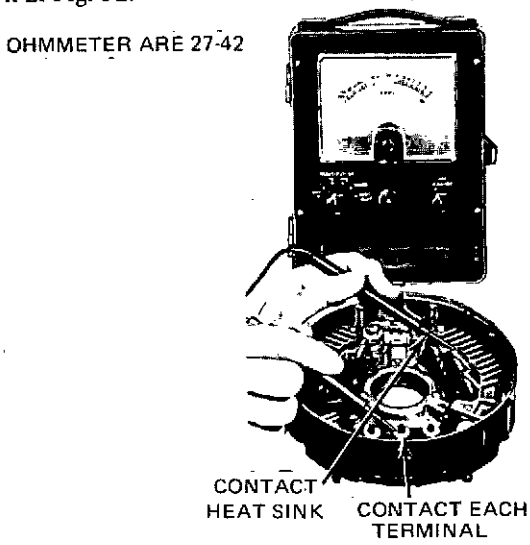

Fig. 32 – 2 65-Ampere Leece-Neville Diode Test

To test one set of diodes, contact one probe to the diode plate as shown and contact each of the three stator lead terminals with the other probe. Reverse the probes and repeat the test. Test the other set of diodes in the same way.

All 6 tests should show a low reading of approximately 60 ohms in one direction and infinite reading (no needle movement) with the probes reversed. **Be sure to use the Rotunda ohmmeter with the multiply-by knob set at 10, and the ohmmeter calibrated as indicated inside the ohmmeter cover.**

Open or Grounded Stator Coil Tests – On Bench

These tests are made to determine if the stator coil is operating properly. Disassemble the stator from the alternator and rectifier assembly (see Specification Chart - page 43) for these tests.

Open Stator Test – On Bench

Set the Rotunda ohmmeter multiply-by knob at 1. Connect the ohmmeter probes between each pair of stator leads (Fig. 35). If the ohmmeter does not show equal readings between each pair of stator leads, the stator is open and must be replaced.

Grounded Stator Test – On Bench

Set the Rotunda ohmmeter multiply-by knob at 1000. Connect the ohmmeter probes between one of the stator leads and the stator core. Be sure that the test lead makes a good electrical connection to the core. The ohmmeter should not show any continuity (no reading), if it does, the stator winding is grounded and must be replaced.

ADJUSTMENTS

BELT ADJUSTMENT

1. Loosen the alternator mounting bolt to a snug position and loosen the adjusting arm bolts.

2. **Apply pressure on the alternator front housing only** and tighten the adjusting arm to alternator bolt.

3. Check the belt tension with tool T63L-8620-A. Adjust the belt to the specified tension (see Specification Chart - page 43).

4. Tighten all mounting bolts.

REMOVAL AND INSTALLATION

ALTERNATOR REPLACEMENT

1. Disconnect the battery ground cable.

2. Loosen the mounting bolts and the adjusting arm to alternator bolt, and remove the drive belt.

3. Remove the mounting bolts and the adjusting arm bolt, disconnect the alternator wires and remove the alternator.

4. Connect the wires to the alternator (Fig. 33). Position the alternator to the mounting bracket and install the mounting bolts and adjusting bracket bolt finger-tight.

5. Adjust the belt tension with tool T63L-8620-A. Tighten the mounting bolts, and check the operation of the alternator.

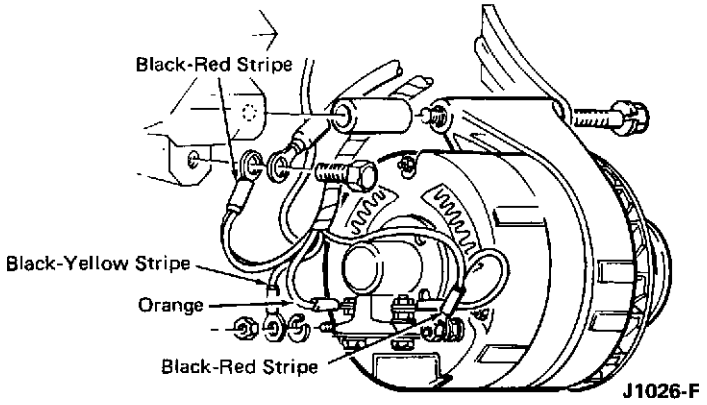

Fig. 33 – Alternator Mounting

MAJOR REPAIR OPERATIONS

A disassembled view of the alternator is shown in Fig. 34.

DISASSEMBLY

1. Remove the pulley nut. Then, remove the pulley with a gear puller, and remove the shaft key and spacer.

2. Remove the brushes and terminal insulator, and remove the brush holder assembly from the brush housing.

3. Remove the through bolts and separate the brush end housing and stator assembly from the alternator.

4. Remove the nuts from the three AC terminals. Remove the stator from the housing.

5. Remove the rotor from the front housing using a gear puller or an arbor press, only if the bearing is damaged and must be replaced.

6. If the bearing is worn or damaged and must be replaced, unsolder the field leads from the slip rings, and remove the slip rings and the bearing from the slip ring end of the rotor shaft. Use a gear puller. **Use care in removing the slip rings, so as not to damage them. If they are cracked or broken during disassembly, they must be replaced.**

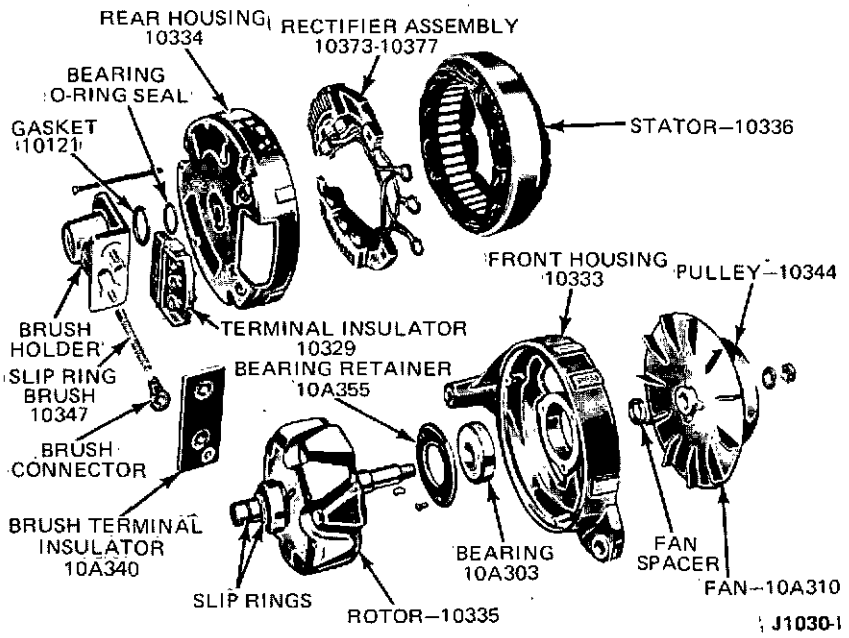

Fig. 34 – Disassembled 65-Ampere Leece-Neville Alternator

7. If the bearing must be replaced, remove the bearing retainer from the front housing and press out the old bearing from the housing.

8. Remove the rectifier assembly mounting bolts, terminals, and insulators and remove the rectifier assemblies. Remove the stator terminal insulator.

PARTS REPAIR OR REPLACEMENT

Nicks and scratches may be removed from the rotor slip rings by turning down the slip rings. Remove only enough to clean up the surface. If the slip rings are badly damaged, they should be replaced.

ASSEMBLY

1. Press the new bearing onto the slip-ring end of the rotor shaft. **Put pressure on the inner race only.** Heat the slip rings so that the insulation will not split, carefully press the slip rings on the shaft and solder the field wires to the rings.

2. Press the new bearing into the front housing, and install the bearing retainer. **Put pressure on the outer race only.**

3. Place the slip-ring end of the shaft firmly on a flat plate in an arbor press, and assemble the front housing and bearing on to the drive end of the shaft. **Use a tube or pipe so as to put pressure on the bearing inner race only.**

4. Install the stator insulator. Put the rectifier insulators in position. Place the rectifier assemblies in the housing and install the mounting screws and terminals. Make certain that the rectifier assemblies are insulated from the end frame. Position the three rectifier terminals to the terminal studs. Position the wires under the tabs extending from each heat sink to prevent interference with the rotor (Fig. 35).

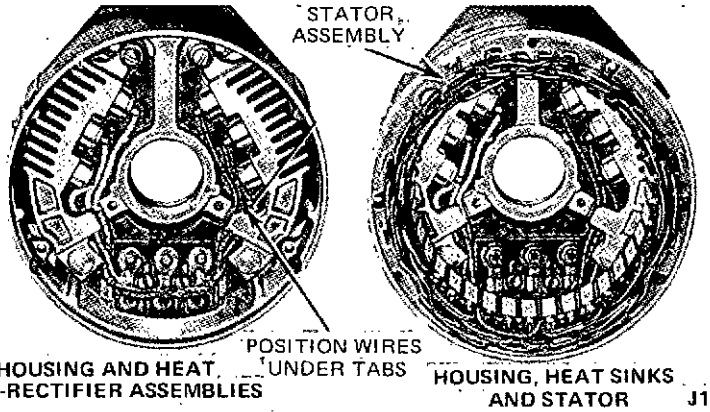

Fig. 35 – Rear Housing, Rectifier and Stator Assembly

5. Place the stator in position (Fig. 35), and line up the housing through bolt holes to match those in the stator. Position the three stator terminals over the three rectifier terminals, and install the terminal nuts (Fig. 35).

6. Place the rear housing and stator assembly into position over the rotor. Use the housing through bolts to line up the two housings and the stator. Tighten the housing through bolts.

7. Install the brush holder with the O-ring between the holder and the frame (Fig. 34). Place the brushes and springs in the holder with the extruded portion of the brush connectors against the terminal screw shoulders. Hold the brush connectors in position with a machinists steel scale until the terminal insulator is installed. Install the brush terminal insulator, and withdraw the steel scale.

8. Install the fan spacer, shaft key, fan, pulley, and lock washer and nut. Tighten the mounting nut to 40 ft-lbs torque.

SPECIFICATIONS

ALTERNATOR

	Rating		Field Current	Cut-In Speed	Rated Output Speed (Engine rpm)		Slip-Ring Turning (Inches)		Brush Length (Inches)		Pulley Nut	Belt①
	Amperes	Watts	Amps	(Engine			Min.	Max.		Wear	Torque	Tension
Supplier	@ 15V	@ 15V	@ 12V	rpm)	Cold	Hot	Dia.	Runout	New	Limit	(Ft-Lbs)	(Lbs)
Leece-Neville	65	975	2.9	400	1600	2000	Light Cut	0.002	1/2	9/32	40–50	70–110

①Used Belt. New Belt 140. A used belt is one that has been in operation more than 10 minutes. If belt tension is out of specification, or belt has been removed, reset to 110 lbs

CJ1450-A

Motorcraft Alternator Regulators

DESCRIPTION AND OPERATION

ELECTRO-MECHANICAL ALTERNATOR REGULATOR

The alternator regulator has been designed to exercise automatic control over the charging system, and also to compensate for seasonal temperature changes. The Ford electro-mechanical regulator is factory calibrated and is not to be adjusted.

The alternator regulator is composed of two control units, a field relay and a voltage limiter, mounted as an assembly (Fig. 36).

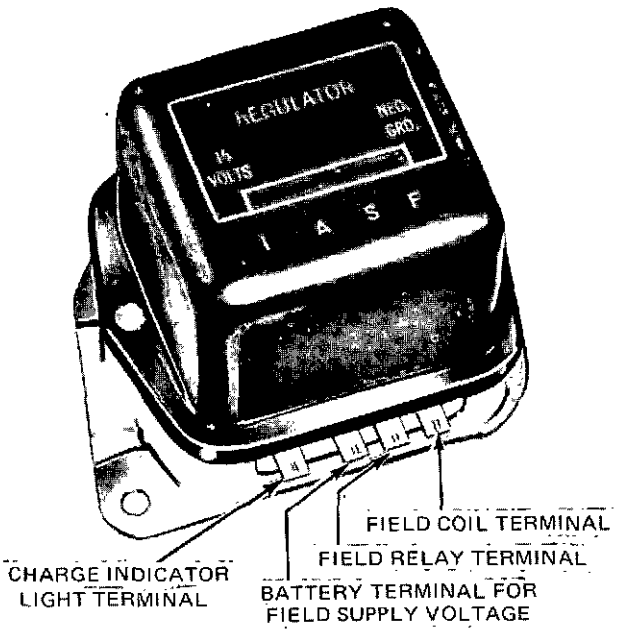

Fig. 36 – Electro-Mechanical Alternator Regulator

Field Relay

The field relay serves to connect charging system voltage to the field circuit when the engine is running.

Charge Indicator/Circuit – Light

When the ignition switch is closed, the charge indicator light, in parallel with a 15-ohm resistor, supplies adequate starting field current.

When the alternator builds up enough voltage to close the field relay contacts, full voltage is applied to the field, and the charge indicator light goes out.

Charge Indicator Circuit – Ammeter

When the ignition switch is closed, the field relay is energized. Closing of the relay contacts connects the battery and alternator output to the field through the voltage limiter contacts.

Voltage Limiter

The temperature compensated voltage limiter is a double contact unit. Voltage limiting is accomplished by controlling the amount of current supplied to the rotating field.

TESTING

Use the Rotunda ARE 20-22 tester to test the electro-mechanical regulator.

Use care when connecting the test equipment to the alternator as the alternator output terminal is connected to the battery at all times. Use the Rotunda ARE 27-38 tester for the following tests.

VOLTAGE LIMITER TEST

Voltage limiter calibration tests must be made with the regulator operating with battery and ignition loads only.

For accurate voltage limiter testing, the battery specific gravity must be at least 1.230. **If the battery is low in charge, either charge it to 1.230 specific gravity or substitute a fully charged battery, before making a voltage limiter test.**

To test the regulator on the vehicle, make the test connections to the battery and tester knob adjustments as shown in Fig. 37 (Voltage Limiter Test).

1. Place the transmission in neutral or park **and apply the parking brake.**

2. Close the battery adapter switch and start the engine. Make sure that all lights and electrical accessories are off. Open the battery adapter switch.

3. Operate the engine at approximately 2000 rpm for 5 minutes. (Use a tachometer).

4. Read the voltmeter on the tester. If the voltage is within specification (see Specification Chart - page 47), the voltage regulator and alternator are functioning normally.

FIELD RELAY

Remove the regulator from the vehicle. Make the connections as shown in Fig. 37 (Field Relay Test). Slowly rotate the field rheostat knob clockwise from the maximum counterclockwise position until the test light comes on. Observe the voltmeter reading at the moment that the test light comes on. This is the relay closing voltage. If the relay closes immediately, even with the field rheostat knob close to the maximum counterclockwise position, push the red button between the two meters and repeat the test. If the closing voltage is not to specification (see Specification Chart - page 47) replace the regulator.

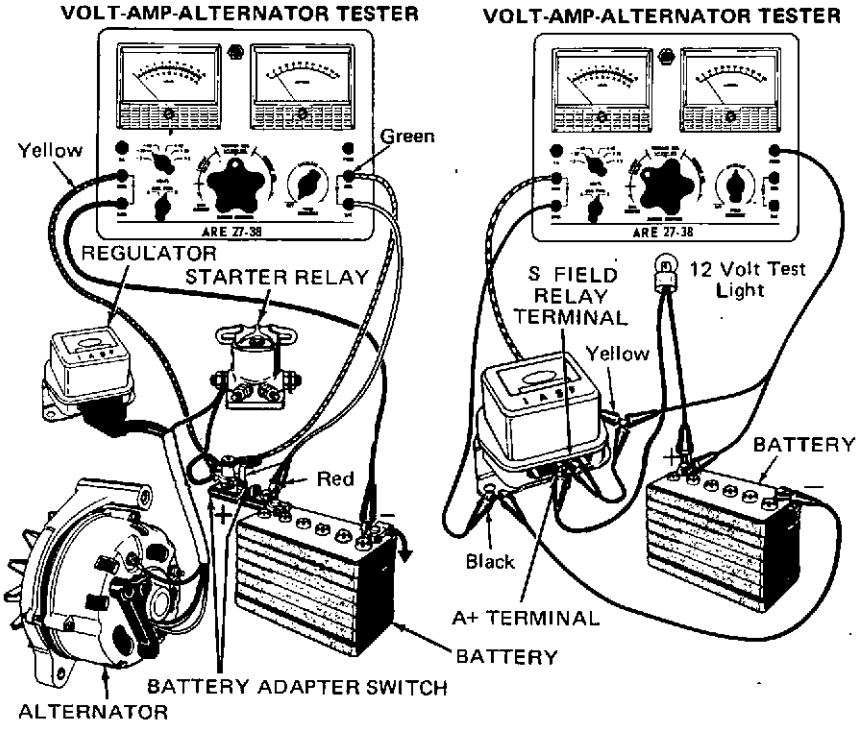

Fig. 37 – Alternator Regulator Tests

ADJUSTMENTS

ELECTRO-MECHANICAL REGULATOR

The Ford electro-mechanical regulator is factory calibrated and sealed and is not to be adjusted. If the regulator is not calibrated within the specified limits (see Specification Chart - page 47) it must be replaced.

REMOVAL AND INSTALLATION

ELECTRO-MECHANICAL REGULATOR

1. Remove the battery ground cable.
2. Remove the regulator mounting screws.
3. Disconnect the regulator from the wiring harness.
4. Connect the new regulator to the wiring harness.
5. Mount the regulator to the regulator mounting plate. The radio suppression condenser mounts under one mounting screw. The ground lead mounts under the other mounting screw.
6. Connect the battery ground cable, and test the system for proper voltage regulation.

SPECIFICATIONS

REGULATOR

Regulator	Current Rating	Voltage Limiter (Volts)		Field Relay Closing Volts	Regulator	Current Rating	Voltage Limiter (Volts)
		Temp °F	Setting				Setting
Ford Electro-Mechanical	Used With All Autolite Alternators①	50° to 125° F	15.3 to 13.5	2.0–4.2	Ford Integral	Used With Ford 55 Ampere Alternator②	15.3 to 13.3

①Silver Stamp Color is used with 38 and 42-ampere alternators. Yellow Stamp Color is used with 55 and 65-ampere alternators.
②Integral regulator retaining nut torque Ground and field terminal 15-25 in-lbs., battery terminal 10-15 in-lbs.

CI1449-A

Leece Neville Alternator Regulators

DESCRIPTION AND OPERATION

ALTERNATOR REGULATOR

The alternator regulators are composed of two control units mounted as an assembly (Fig. 38). The units are similar in operation to those used on the standard alternator regulator and consist of a double-contact voltage limiter and a field relay.

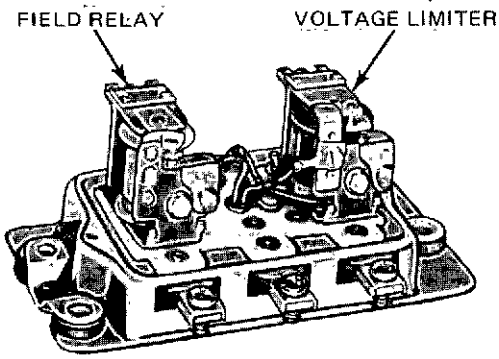

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Fig. 38 – Leece-Neville Alternator Regulator

The regulator used has three terminals, battery (BAT), ignition (IGN), and field (FLD).

Field Relay

The field relay (Fig. 38) is controlled by the ignition switch. The field relay connects the battery to the alternator field through the upper voltage limiter contacts.

Voltage Limiter

The voltage limiter holds the alternator voltage within a predetermined range by controlling the amount of current supplied to the rotating field. The voltage limiter is temperature compensated.

TESTING

Use the Rotunda ARE 27-38 tester for the following tests.

VOLTAGE LIMITER TEST

Voltage limiter calibration tests must be made with the regulator cover in place and with battery and ignition loads only.

For accurate voltage limiter testing, the battery specific gravity must be at least 1.230. **If the battery is low in charge, either charge it to 1.230 specific gravity or substitute a fully charged battery before making a voltage limiter test.**

To test the voltage regulator on the vehicle, make the test connections to the battery and tester knob adjustments as shown in Fig. 39 (Voltage Limiter Test). Turn all accessories off, including door operated dome lights. Close the battery adapter switch and start the engine, then open the adapter switch. Attach a voltage regulator thermometer to the regulator cover. Operate the engine at approximately 2000 rpm for 15 minutes (use a tachometer).

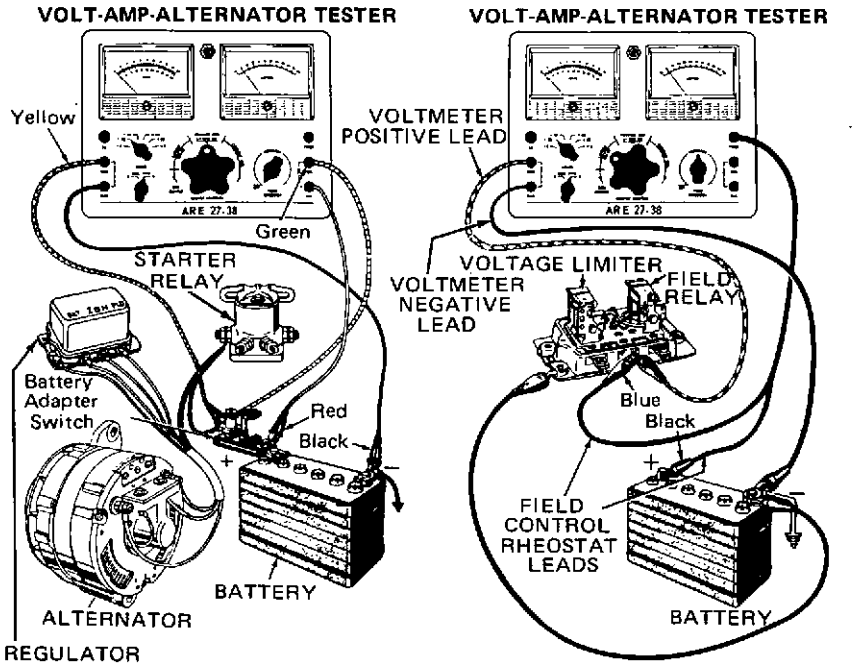

Fig. 39 – Alternator Regulator Test

When the battery is charged and the voltage regulator has been temperature stabilized, the ammeter should indicate less than 10 amperes with the master control set at the 1/4 OHM position.

Cycle the regulator as follows: turn the ignition key to OFF to stop the engine, close the adapter switch, start the engine, and open the adapter switch. Increase the engine speed to 2000 rpm. Allow the battery to normalize for about one minute, then read the voltmeter (upper scale). Read the thermometer and compare the voltmeter reading with the voltage given in Fig. 40 for the ambient temperature indicated on the thermometer.

If the regulated voltage is not within specifications (Fig. 40), remove the regulator. Connect the regulator to an alternator regulator test stand and make a voltage limiter adjustment (see Voltage Limiter - page 51). After each adjustment, be sure to cycle the regulator before each reading. The readings must be made with the cover in place.

Ambient Air Temperature °F	Voltage Limiter Setting (Volts)
50	14.1–15.1
75	13.9–14.9
100	13.7–14.7
125	13.6–14.6

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Fig. 40 – Voltage Limiter Setting Versus Ambient Air Temperature

FIELD RELAY TEST

Remove the regulator from the vehicle. Make the connections as shown in Fig. 37 (Field Relay Test). Slowly rotate the field rheostat control clockwise from the maximum counterclockwise position until the field relay contacts close. Observe the voltmeter reading at the moment that the relay contacts close. This is the relay closing voltage. If the relay closes immediately, even with the field rheostat knob close to the maximum counterclockwise position, push the red button between the two meters and repeat the test. If the closing voltage is not to specification (see Specification Chart - page 53), adjust the relay (see Field Relay - page 52).

ADJUSTMENTS

Final checking of the regulator must be made with the regulator at normal operating temperature and the cover in place. For any of the adjustments given below, remove the cover by removing the two cover mounting screws.

As the regulator is temperature compensated, be sure to use a voltage regulator thermometer for accurate voltage limiter adjustment.

REGULATOR GAP ADJUSTMENTS

Make the regulator gap adjustments with the regulator removed from the vehicle.

Voltage Limiter

Adjust the contact gap first. Loosen the contact gap adjusting arm lock screw (Fig. 41), and adjust the contact gap to specification (see Specification Chart - page 53). Tighten the lock screw. Adjust the core gap with the lower contacts closed. Loosen the core gap lock screw and move the contact insulator up or down until the specified core gap is obtained between the coil core and the armature. Tighten the lock screw.

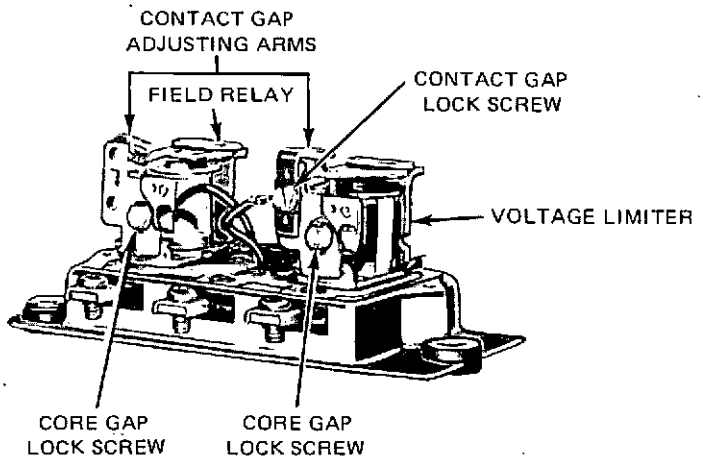

Fig. 41 – Regulator Gap Adjustments

Field Relay

Adjust the core gap first. Loosen the field relay core gap lock screw and move the contact insulator up or down until the specified core gap is obtained between the coil core and the armature. Tighten the lock screw. Put the blade of a small screw driver in the field relay adjusting arm slot (Fig. 41), and bend the arm to obtain the specified contact gap (see Specification Chart - page 53).

REGULATOR VOLTAGE ADJUSTMENTS

Voltage Limiter

To increase the voltage setting, bend the adjusting arm downward. To decrease the voltage setting, bend the adjusting arm upward (Fig. 42). **Before**

adjusting the voltage, and before making a final voltage reading with the cover in place, cycle the regulator. Reduce the alternator speed to zero by turning the ignition switch to OFF. Then, start the engine. This procedure must be repeated each time an adjustment is made.

Field Relay

The field relay cut-in voltage is increased by bending the adjusting arm downward, or decreased by bending the adjusting arm upward (Fig. 42).

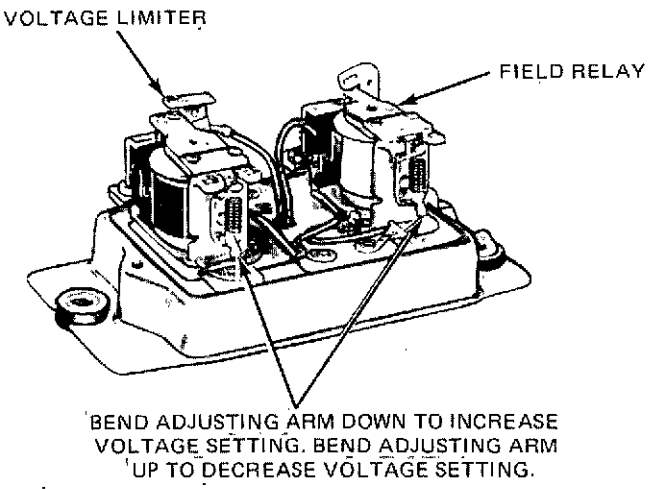

Fig. 42 – Regulator Adjustments

REMOVAL AND INSTALLATION

ALTERNATOR REGULATOR

1. Disconnect the battery ground cable.
2. Remove the wires from the regulator.
3. Remove the regulator attaching screws and the regulator.
4. Position the regulator to the vehicle and install the attaching screws. Position the black-red stripe ground wire lug under the mounting screw at the ground strap end of the regulator (Fig. 43).
5. Connect the remaining regulator wires (Fig. 43).
6. Connect the battery ground cable and check the regulator operation.

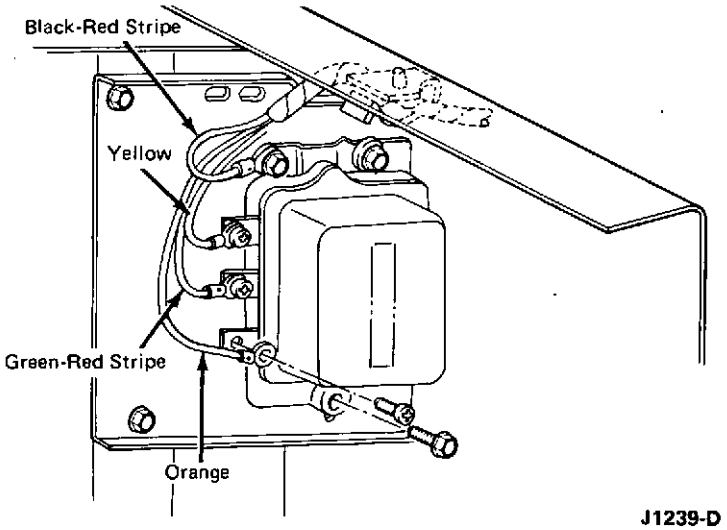

Fig. 43 – Regulator Mounting

SPECIFICATIONS

REGULATOR

Regulator	Current Rating	Voltage Regulation (Volts)		Voltage Limiter		Field Relay		
		Temp °F	Setting	Contact Gap (Inches)	Core Air Gap (Inches)	Contact Gap (Inches)	Core Air Gap (Inches)	Closing Volts
Leece-Neville Ammeter Circuit	Used with 65 Ampere Leece-Neville Alternator	50	14.1-15.1	0.018-0.020 With Lower Contacts Closed	0.042-0.052 With Lower Contacts Closed	0.024-0.026	0.011-0.013 With Contacts Touching	6.2-7.2
		75	13.9-14.9					
		100	13.7-14.7					
		125	13.6-14.6					

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