

CHARGING SYSTEM

1E

INDEX

	Page		Page
Alternator Overhaul	1E-11	Operation	1E-2
Alternator Replacement	1E-10	Specifications	1E-15
Components	1E-1	Testing—Off-Vehicle	1E-4
Drive Belt Adjustment	1E-14	Tools	1E-15
General	1E-1	Troubleshooting	1E-3

GENERAL

A Delco charging system is installed on all vehicles. This negative-ground system consists of two primary components: an alternator with an integral regulator and a battery. The non-repairable, non-adjustable regulator is a solid-state device located within the alternator housing.

The standard equipment alternator is rated at 42 amps and the optional, heavy-duty alternators are rated at 55, 63, 70 and 85 amps.

COMPONENTS

Alternator

The alternator (fig. 1E-1) is belt-driven by the engine. Its major components are front and rear housings, stationary windings (stator), rotating field winding (rotor), rectifying diodes and regulator.

The rotor assembly is supported in the front (drive end) housing by a ball bearing and in the rear (slip ring end) housing by a roller bearing. The bearings have sufficient lubricant for the life of the alternator and do

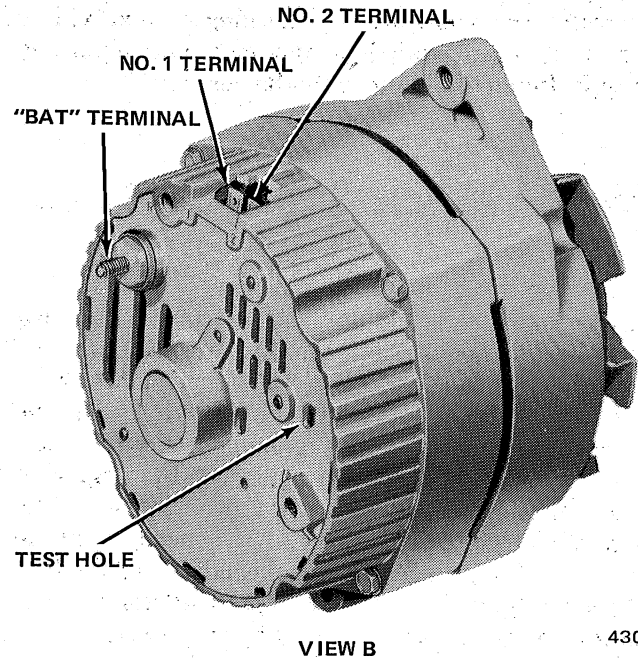
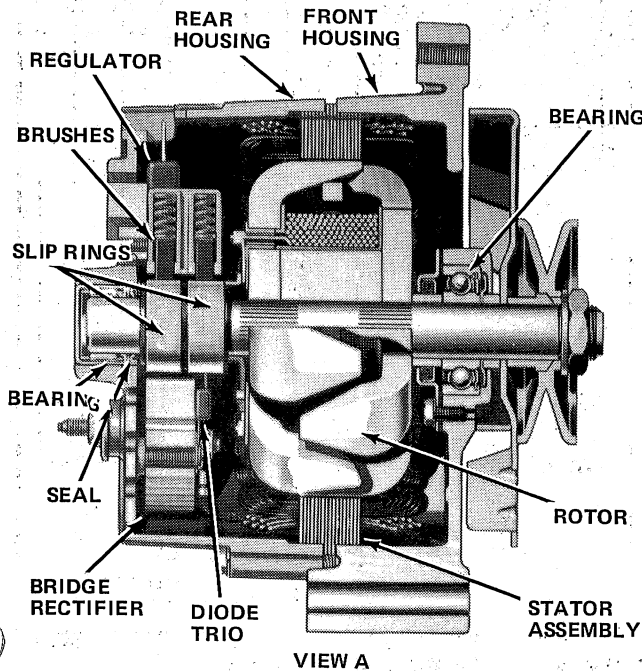


Fig. 1E-1 Delco Alternator—Typical

not require periodic lubrication. Two brushes provide current through two slip rings to and from the field coil. The brushes are designed for long periods of attention-free service. Other than a regularly-scheduled drive belt tension adjustment, the alternator assembly requires no periodic adjustments or maintenance.

The stator windings are wound on the inside of a laminated core that is also part of the alternator frame. The bridge rectifier connected to the stator winding output is comprised of six diodes molded into a single assembly. The bridge rectifier converts the three-phase alternating current output to direct current for the vehicle electrical system.

Battery discharge through the alternator is prevented by the one-way current flow action of the diodes. This eliminates the need for a conventional cutout relay. Alternator field current is supplied through a diode trio that is also connected to the stator windings.

A capacitor, or condenser, located in the end housing, protects the bridge rectifier and diode trio from high surge voltages and suppresses radio interference noise.

NOTE: All bolt and screw threads are in metric dimensions.

Voltage Regulator

The voltage regulator utilizes an integrated circuit to regulate the excitation current supplied to the field (rotor) winding. All regulator components are encapsulated in a solid mold and, along with the brush holder assembly, is attached to the rear housing of the alternator. The voltage regulator is not adjustable or repairable.

Battery

The battery used in conjunction with the alternator and regulator to complete the charging system will be either the standard equipment type or an optional heavy duty type. Refer to Chapter 1D—Batteries.

OPERATION

General

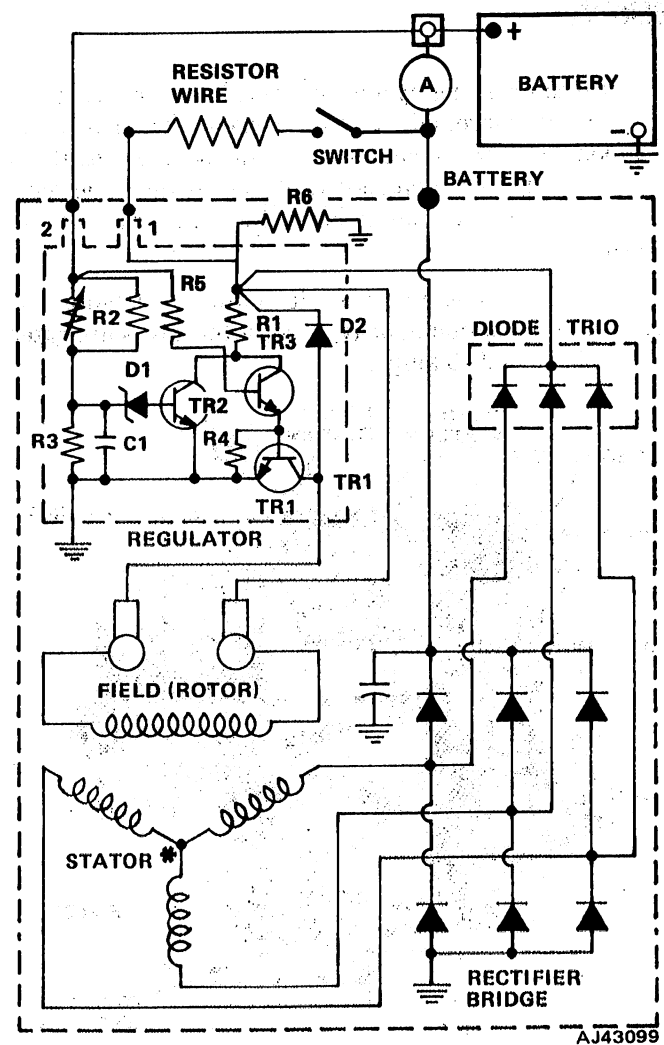
Battery charging is accomplished by current supplied directly from the alternator output terminal (heavy gauge red wire) to the battery. The starter motor solenoid is used as the connection point. The battery positive cable is connected to the heavy gauge red wire at the solenoid. The alternator is grounded to the engine to complete the circuit to the battery negative post. The amount of charge the battery receives depends upon the initial state of charge and internal condition of the battery, proper operation of the voltage regulator and the amount of power being consumed by the electrical load (e.g., heater blower motor, lamps and rear window defogger).

Energizing the System

When the ignition switch is turned to the **On** position (fig. 1E-2), positive battery voltage is applied to the regulator and current flows from ground to the regulator. The regulator controls the amount of excitation current allowed to flow through the field winding. The battery voltage provides the initial excitation that results in a large electromagnetic field around the rotor and a faster build-up of output voltage.

Within the regulator, TR1 and its associated biasing network controls the amount of field excitation current and, in so doing, the amplitude of the output voltage. As long as the rotor is stationary (i.e., no alternator output), all the current flows through the field winding, resistance wire and ammeter to the battery positive terminal. The ammeter will indicate negative (-) current flow (no alternator output).

NOTE: Sometimes, without a battery installed in a vehicle (or if the battery is completely discharged), there will be no alternator output because there will be no



*15-SI Alternator Has Delta Wound Stators

Fig. 1E-2 Charging System Schematic—Typical

energizing excitation current. In most instances the rotor will have sufficient residual magnetism to create a magnetic field and induce a voltage into the stator when the rotor is turned.

Voltage Output

When the rotor starts turning, the rotating electromagnetic field is cut by the stator windings. This action induces an AC voltage into the stator windings. The induced stator voltage is higher than the battery voltage and becomes the primary voltage source for excitation current flow through the field winding. The diode trio rectifies the current that flows from ground through TR1 and the field winding to the stator windings.

The six diodes in the bridge rectifier convert the stator AC voltage to DC output voltage. As alternator rotor rpm increases, increased power is generated for charging the battery and operating the electrical accessories. Because the voltage amplitude is higher on the alternator side of the ammeter, the current will flow through the ammeter to the alternator BAT terminal. The ammeter will indicate positive (+) current flow (charge).

Regulation

The No. 2 terminal on the alternator is always connected to the battery, but the discharge current is limited to a negligible value by the high resistances of R2 and R3.

As the alternator rotor rpm and stator voltage increase, the voltage across R3 increases to a level that causes zener diode D1 to conduct. Transistor TR2 is forward biased and conducts, and TR3 is reverse biased Off, which turns TR1 Off. With TR1 Off, the field current and system voltage decrease. When the voltage across R3 decreases, D1 stops conducting. Transistor TR2 is then reverse biased Off and transistors TR3 and TR1 forward biased On. In turn, the field current and output voltage increase. This cycle repeats many times per second to limit the alternator output to a preset value.

Capacitor C1 prevents abrupt voltage changes across R3, R4 prevents excessive back current through TR1 at high temperatures, and D2 protects TR1 by preventing a high induced voltage in the field winding when TR1 is turned Off. Resistor R2 is a thermistor that causes the regulated voltage to vary inversely with temperature, providing the optimum voltage over a wide temperature range for charging the battery.

TROUBLESHOOTING

Close adherence to the following procedures in the order presented will result in locating and correcting charging system malfunctions in the shortest possible time.

Figure 1E-3 depicts a basic wiring diagram for the charging system.

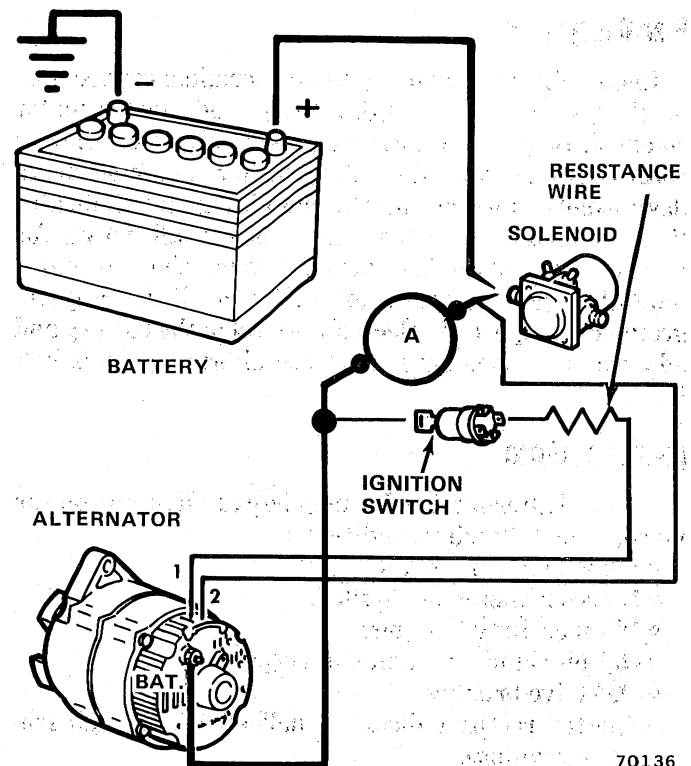


Fig. 1E-3 Basic Wire Connections

70136

To avoid damage to the charging system, always observe the following precautions:

- Do not attempt to polarize the regulator.
- Do not short across or ground any of the terminals in the charging system except as specifically instructed.
- NEVER drive the alternator with the engine when the output terminal circuit is open and No. 1 and No. 2 wire terminals are connected to the alternator.
- Ensure the alternator and battery have the same ground polarity.
- When connecting a charger or a booster battery to the battery, connect negative to negative and positive to positive.

NOTE: An ammeter is used on Cherokee, Wagoneer and Truck models to indicate the charging rate. CJ models are equipped with a voltmeter.

Malfunction of the charging system is usually indicated by one or more of the following symptoms:

- Faulty ammeter (or voltmeter) operation.
- An undercharged battery, indicated by slow engine cranking and battery electrolyte having low specific gravity.
- An overcharged battery, indicated by excessive water usage.

Prior to performing any electrical tests, visually inspect all charging system components and wiring for obvious discrepancies.

Visual Inspection

Inspect for clean and tight cable terminal connections at the battery posts, engine block, and starter motor solenoid. Inspect for corrosion and loose wire terminal connections at the alternator, starter motor solenoid, dash panel connector and the charging system indicator (i.e., ammeter or voltmeter). Inspect all wires for cracked or broken insulation. Ensure the alternator mounting screws are tight and that it is properly grounded. Inspect the electrolyte level in the battery and add water if necessary. Test the alternator drive belt tension.

Alternator Noise

Unusual alternator noise may be caused by any one or more of the following conditions:

- Loose mounting bolts.
- Loose or misaligned pulley.
- Worn or dirty bearings.
- Out-of-round or rough slip rings.
- Defective brushes.
- Shorted rectifier diode(s) (indicated by a high frequency whine).

Noise from the cooling system can also sound like alternator noise. Disconnect and plug the heater hoses to eliminate the possibility of the alternator bracket reproducing heater core noises.

Faulty Ammeter or Voltmeter Operation

Diagnosis of the instrumentation circuits is described in Chapter 1L—Power Plant Instrumentation.

Overcharged/Undercharged Battery

For battery undercharged-overcharged diagnosis, refer to DARS charts 1 and 2.

Battery Discharge Through Alternator

If the alternator is suspected of discharging the battery because of excessive current leakage, perform the following test procedure with a No. 158 bulb and bulb socket with attached jumper wires.

WARNING: Failure to disconnect battery negative cable before disconnecting alternator output wire can result in injury.

(1) Disconnect battery negative cable. Disconnect output wire (red) from alternator.

(2) Connect test bulb jumper wires in series with output wire and alternator output terminal. Connect battery negative cable. Bulb should not light. If bulb lights (even dimly), replace bridge rectifier.

(3) Disconnect battery negative cable and remove jumper wires.

(4) Disconnect wires from No. 1 and 2 terminals of alternator.

(5) Connect test bulb jumper wires in series with No. 1 terminal at alternator and the battery positive post. Connect battery negative cable. Bulb should not light. If bulb lights (even dimly), test diode trio. If diode trio is not defective, replace voltage regulator.

(6) Connect test bulb jumper wires in series with No. 2 terminal at alternator and battery positive post. Bulb should not light. If bulb lights (even dimly), replace voltage regulator.

TESTING—OFF-VEHICLE

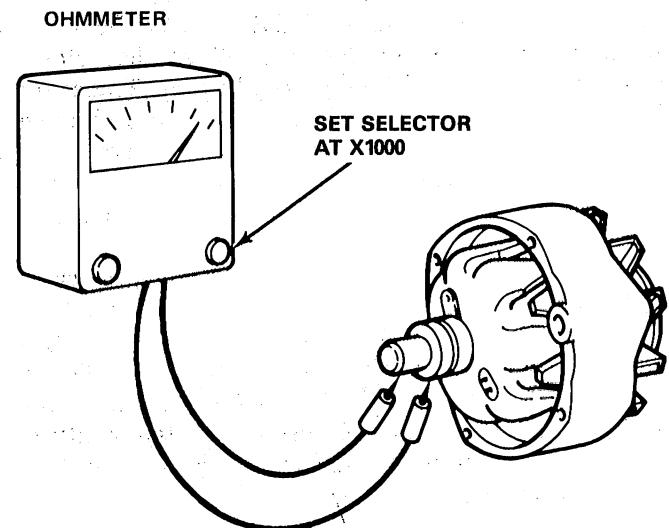
Rotor (Field) Winding Short-to-Ground Test

To perform this test, remove the rotor and front housing assembly from the stator and rear housing assembly. Refer to Alternator Overhaul for procedure. Perform the test with an ohmmeter set for the x1000 ohm scale or with a 110-volt test lamp.

Touch one test lead probe to rotor shaft and touch other probe to one slip ring (fig. 1E-4). Repeat with the other slip ring. In each test, the ohmmeter should indicate infinite resistance (no pointer movement) or the test lamp should not light.

Test Results

If the ohmmeter indicates other than an infinite resistance or test lamp lights, a short to the rotor shaft exists. Inspect the soldered connections at the slip rings to ensure they are secure and not shorted to the rotor shaft, or that excess solder is not shorting rotor winding to the shaft. Replace the rotor if defective.



70155

Fig. 1E-4 Rotor (Field) Winding Short-to-Ground Test

Rotor (Field) Winding Open Test

To perform this test, remove the rotor and front housing assembly from the stator and rear housing assembly. Refer to Alternator Overhaul for procedure.

Perform the test with an ohmmeter set for the x1 scale or with a 110-volt test lamp.

Touch one test lead probe to one slip ring and the other test lead probe to the other slip ring (fig. 1E-5). The ohmmeter should indicate 2.2 to 3.0 ohms or test lamp should light.

Test Results

If the ohmmeter indicates infinite resistance or the test lamp fails to light, the rotor winding is open.

Rotor (Field) Winding Internal Short Test

To perform this test, remove the front housing and rotor from the stator and rear housing assembly. Refer to Alternator Overhaul for procedure. This test is performed with a 12-volt battery and an ammeter.

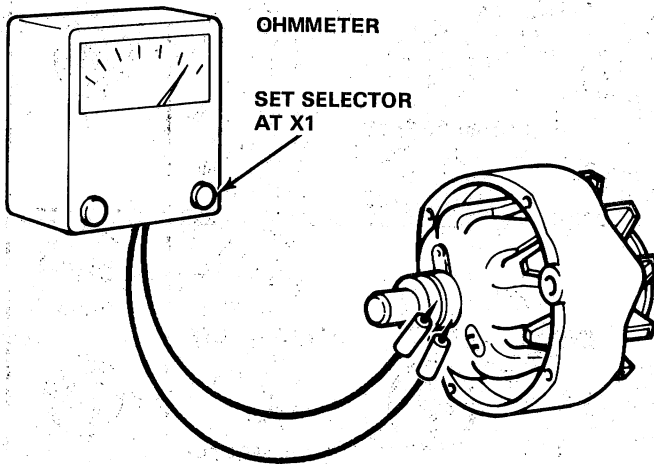


Fig. 1E-5 Rotor (Field) Winding Open Test

Connect battery and ammeter in series with the slip rings (fig. 1E-6). The field current at 12 volts applied at 80°F (27°C) should be between 4.0 and 5.0 amps.

Test Results

Current flow exceeding 5.0 amps indicates a shorted winding.

NOTE: The winding resistance and ammeter indication will vary slightly with winding temperature changes. A current flow that is less than the specified value indicates excessive winding resistance. An alternate test method is to determine the resistance of the field winding by connecting an ohmmeter to the two slip rings. If the resistance is less than 2.2 ohms at 80°F (27°C), the winding is shorted. If the resistance is more than 3.0 ohms at 80°F (27°C), the winding has excessive resistance.

Stator Windings Short-to-Ground Test

To perform this test, separate the rear housing and stator from the rotor and front housing assembly. Dis-

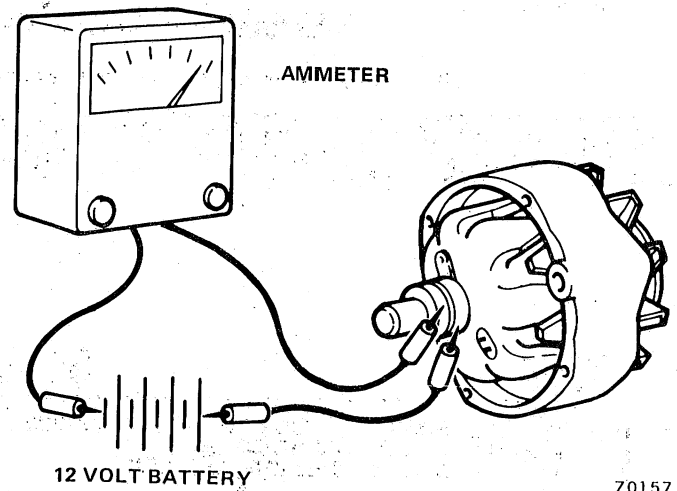


Fig. 1E-6 Rotor (Field) Winding Internal Short Test

connect the stator windings from the rectifier terminals. Refer to Alternator Overhaul for procedure. The test is performed with an ohmmeter set for the x1000 scale or with a 110-volt test lamp.

Touch one test lead probe to the bare metal surface of the stator core and the other test lead probe to the end of one stator winding (1E-7). Because all three stator windings are soldered together, it is not necessary to test each winding. The ohmmeter should indicate infinite resistance (no pointer movement) or test lamp should not light.

Test Results

If the ohmmeter indicates other than an infinite resistance or test lamp lights, the stator windings are shorted to the core and must be replaced.

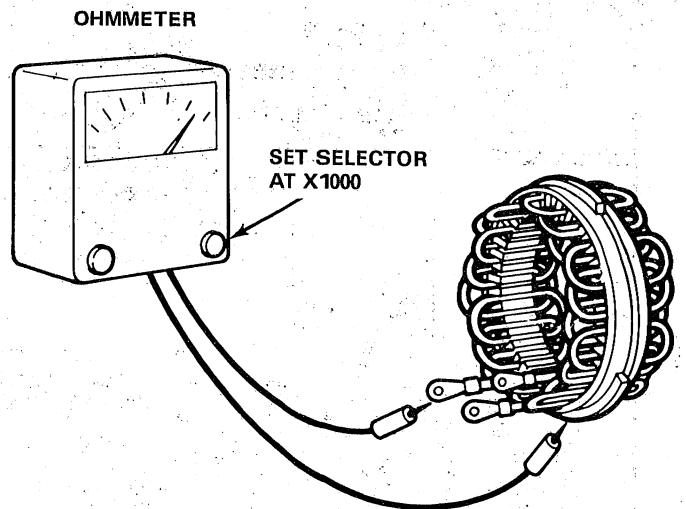


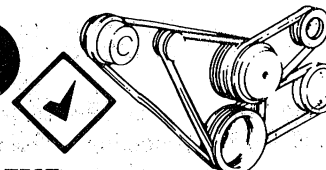
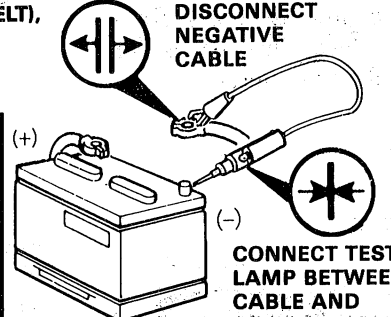
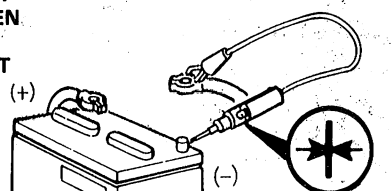
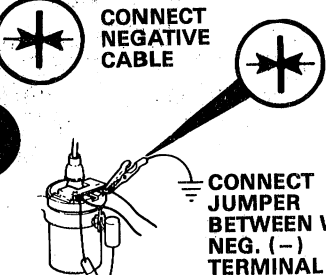
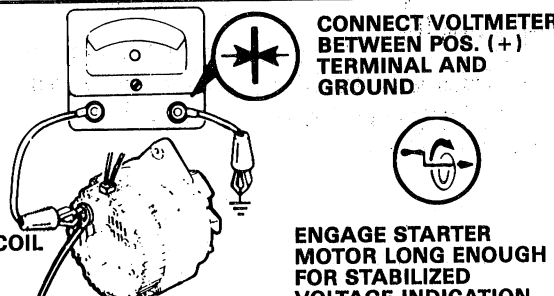
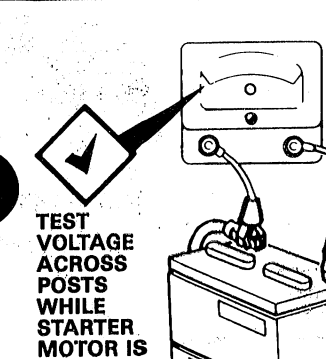
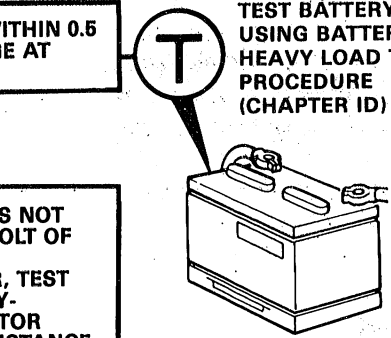
Fig. 1E-7 Stator Windings Short-to-Ground Test

DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHARTS

NOTE: Refer to Chapter A – General Information for details on how to use this DARS chart.

PROBLEM: BATTERY UNDERCHARGED

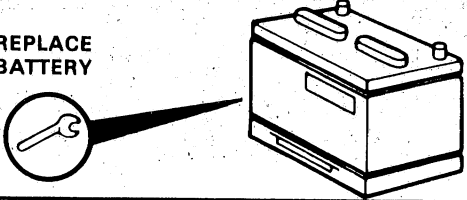
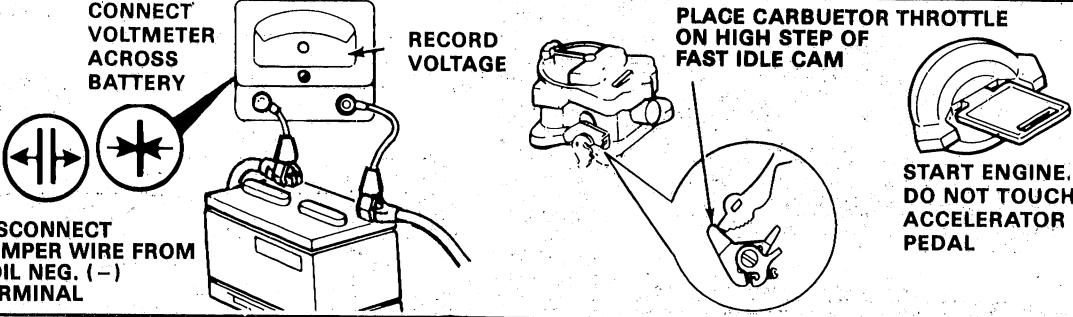
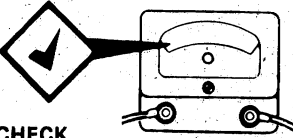
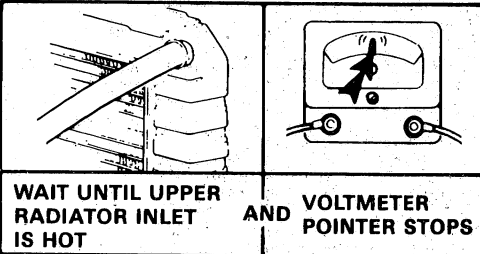
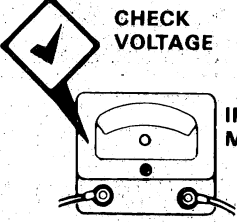
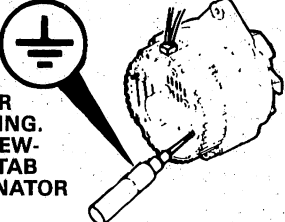
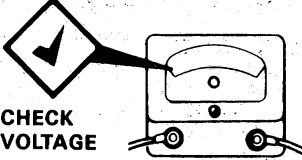
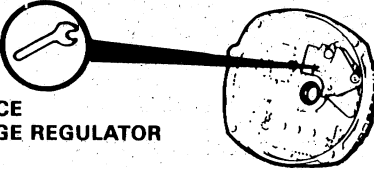

Chart 1

STEP	SEQUENCE	RESULT
<p>1</p> <p>TEST ALTERNATOR BELT TENSION</p> 	<p>ADJUST TENSION TO 90-115 LBF (V-BELT), 140-160 (SERPENTINE BELT) REPLACE BELT IF NECESSARY</p> <p>MAKE SURE NO ACCESSORIES ARE ON, IGNITION OFF, DOORS CLOSED, UNDER HOOD LIGHT DISCONNECTED</p> <p>DISCONNECT NEGATIVE CABLE</p> <p>CONNECT TEST LAMP BETWEEN CABLE AND BATTERY POST</p> 	<p>TEST LAMP ON → 2</p> <p>TEST LAMP OFF - NO DRAIN ON BATTERY → 3</p>
<p>2</p> <p>TRACE AND CORRECT CONTINUOUS DRAIN ON BATTERY</p>	<p>CONNECT TEST LAMP BETWEEN CABLE AND BATTERY POST</p> 	<p>TEST LAMP OFF → STOP</p> <p>TEST LAMP ON → 3</p>
<p>3</p> <p>CONNECT NEGATIVE CABLE</p> 	<p>CONNECT JUMPER BETWEEN WIRE COIL NEG. (-) TERMINAL AND GROUND</p> <p>CONNECT VOLTMETER BETWEEN POS. (+) TERMINAL AND GROUND</p> <p>ENGAGE STARTER MOTOR LONG ENOUGH FOR STABILIZED VOLTAGE INDICATION</p> 	<p>POINTER ABOVE 9.0V → 6</p> <p>POINTER BELOW 9.0V → 4</p>
<p>4</p> <p>TEST VOLTAGE ACROSS POSTS WHILE STARTER MOTOR IS ENGAGED</p> 	<p>IF VOLTAGE IS WITHIN 0.5 VOLT OF VOLTAGE AT ALTERNATOR → T</p> <p>IF VOLTAGE IS NOT WITHIN 0.5 VOLT OF VOLTAGE AT ALTERNATOR, TEST FOR BATTERY-TO-ALTERNATOR CIRCUIT RESISTANCE</p> <p>TEST BATTERY USING BATTERY HEAVY LOAD TEST PROCEDURE (CHAPTER ID)</p> 	<p>BATTERY OK CHARGE ACCEPTABLE AS SPECIFIED IN TEST PROCEDURE → 6</p> <p>BATTERY NOT OK → 5</p>

STEP

SEQUENCE

RESULT

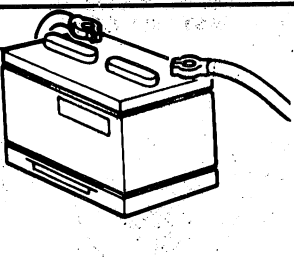

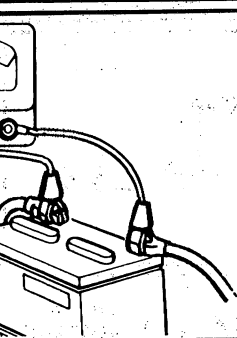

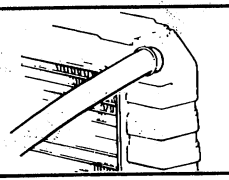
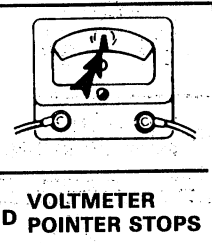


<p>5</p>	<p>REPLACE BATTERY</p> 	<p>6</p>								
<p>6</p>	<p>CONNECT VOLTMETER ACROSS BATTERY</p> <p>DISCONNECT JUMPER WIRE FROM COIL NEG. (-) TERMINAL</p> <p>RECORD VOLTAGE</p> <p>PLACE CARBUETOR THROTTLE ON HIGH STEP OF FAST IDLE CAM</p>  <p>START ENGINE. DO NOT TOUCH ACCELERATOR PEDAL</p>	<p>7</p>								
<p>7</p>	<p>TURN ON ACCESSORIES</p> <table border="1" data-bbox="467 760 782 966"> <tr> <td>HEADLIGHTS - HI</td> <td></td> </tr> <tr> <td>A/C - HI</td> <td></td> </tr> <tr> <td>RADIO</td> <td></td> </tr> <tr> <td>BLOWER-TYPE DEFROSTER</td> <td></td> </tr> </table> <p>CHECK VOLTAGE</p>  <p>IF VOLTAGE IS LOWER THAN IN STEP 6 → 9</p> <p>IF VOLTAGE IS HIGHER THAN IN STEP 6 → 8</p>	HEADLIGHTS - HI		A/C - HI		RADIO		BLOWER-TYPE DEFROSTER		<p>9</p> <p>8</p>
HEADLIGHTS - HI										
A/C - HI										
RADIO										
BLOWER-TYPE DEFROSTER										
<p>8</p>	<p>TURN OFF ACCESSORIES</p> <p>WAIT UNTIL UPPER RADIATOR INLET IS HOT AND VOLTMETER POINTER STOPS</p>  <p>CHECK VOLTAGE</p>  <p>IF VOLTAGE IS LESS THAN 12.5V → 9</p> <p>IF VOLTAGE IS MORE THAN 15.5V → 10</p> <p>IF VOLTAGE IS 12V TO 15.5V SEE NOTE BELOW → STOP</p>	<p>9</p> <p>10</p> <p>STOP</p>								
<p>9</p>	<p>GROUND ALTERNATOR FIELD WINDING. TOUCH SCREW-DRIVER TO TAB AND ALTERNATOR BODY</p>  <p>CHECK VOLTAGE</p>  <p>IF VOLTAGE IS HIGHER THAN IN STEP 6 → 10</p> <p>IF VOLTAGE IS LOWER THAN IN STEP 6 → 11</p>	<p>10</p> <p>11</p>								
<p>10</p>	<p>REPLACE VOLTAGE REGULATOR</p> 	<p>STOP</p>								
<p>11</p>	<p>OVERHAUL ALTERNATOR</p> 	<p>STOP</p>								

NOTE: IF NO FAULT HAS BEEN FOUND, EXCESSIVE IDLING AND SLOW OR SHORT DISTANCE DRIVING, WITH ALL ACCESSORIES ON, MAY HAVE CAUSED HEAVY DRAIN ON BATTERY - RESULTING IN UNDERCHARGED CONDITION.

NOTE: Refer to Chapter A — General Information for details on how to use this DARS chart.

PROBLEM: BATTERY OVERCHARGED (USES TOO MUCH WATER)

Chart 2

STEP	SEQUENCE	RESULT
<p>1</p> <p>T</p> <p>PERFORM BATTERY HEAVY LOAD TEST PROCEDURE (CHAPTER ID)</p>	 <p>BATTERY OK → 2</p> <p>BATTERY NOT OK → REPLACE BATTERY → 2</p>	<p>2</p> <p>2</p>
<p>2</p> <p></p> <p>CONNECT VOLTMETER ACROSS BATTERY</p>	 <p>PLACE CARBUJETOR THROTTLE ON HIGH STEP OF FAST IDLE CAM</p>  <p>START ENGINE. DO NOT TOUCH ACCELERATOR PEDAL</p>	<p>3</p>
<p>3</p> <p>TURN OFF ALL ACCESSORIES</p>	 <p>WAIT UNTIL UPPER RADIATOR INLET IS HOT</p>  <p>VOLTMETER AND POINTER STOPS</p> <p>CHECK VOLTAGE</p> <p>VOLTAGE IS 12.5V to 15.5V → STOP</p> <p>VOLTAGE IS NOT 12.5V to 15.5V → 4</p>	<p>STOP</p> <p>4</p>
<p>4</p> <p></p> <p>CHECK FOR GROUNDED BRUSH LEAD CLIP</p>	<p>IF GROUNDED → REPAIR → STOP</p> <p>IF NOT GROUNDED → REPLACE VOLTAGE REGULATOR → 5</p>	<p>STOP</p> <p>5</p>
<p>5</p> <p></p> <p>CHECK FOR SHORTED FIELD WINDINGS AS CAUSE OF VOLTAGE REGULATOR FAILURE</p>	<p>OHMMETER</p> <p>IF SHORTED → REPLACE ROTOR → STOP</p> <p>IF NOT SHORTED → STOP</p>	<p>STOP</p> <p>STOP</p>

Stator Windings Continuity Test

NOTE: The optional 70 and 85 amp alternators (Delco 15-SI) have delta wound stator windings that cannot be tested for open windings with an ohmmeter or test lamp. However, if the results of all other tests are normal and the alternator fails to supply the rated output, open stator windings are probable.

To perform this test, remove the stator and rear housing assembly from the rotor and front housing assembly. Refer to Alternator Overhaul for procedure. An ohmmeter set for the x1 scale is used to perform the test.

Touch ohmmeter lead probes to any two stator windings and note the resistance (fig. 1E-8). Test all the stator windings in this manner. Equal indications should be obtained for each pair of windings tested.

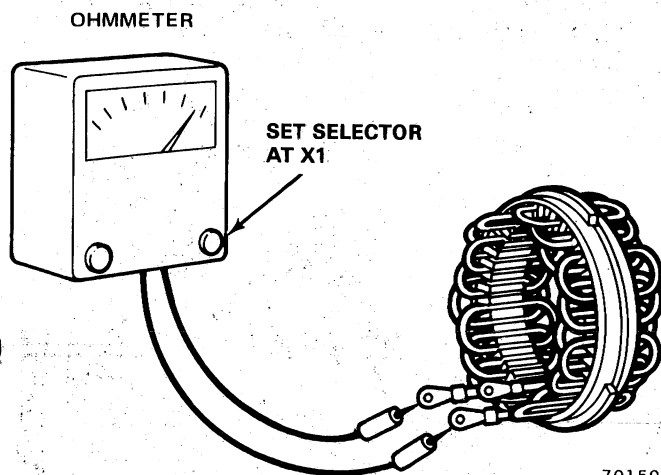


Fig. 1E-8 Stator Windings Continuity Test

Test Results

An infinite resistance (no pointer movement) indicates an open winding. Inspect the neutral junction splice for a poor solder connection. Resolder the connection even if it appears to be good. Retest the continuity. If an open still exists, replace the stator windings.

An indication of more than 1 ohm indicates a possible cold solder joint. Inspect the neutral junction splice and resolder if necessary.

Stator Internal Short Circuit Test

An internal short (e.g., between adjacent windings) is difficult to locate without laboratory test equipment. If all other electrical checks are normal and the alternator fails to supply the rated output, shorted stator windings are probable.

Diode Trio Short Circuit Test

The diode trio is tested in two ways: when installed in the rear housing and when removed from the rear housing.

CAUTION: Do not use high voltage, such as a 110-volt test lamp, to test the diode trio.

Test with Diode Trio Installed

(1) Before removing diode trio, connect ohmmeter, with lowest range scale selected, from brush lead clip to rear housing (fig. 1E-9) and note resistance.

(2) Reverse test lead probe connections. If both indications are zero, inspect for grounded brush lead clip caused by absence of insulating washer, absence of insulating sleeve over screw, or damaged insulation (fig. 1E-14).

(3) Remove screws to inspect washers and sleeves. If screw assembly is correct and both ohmmeter observations are same, replace voltage regulator.

Test with Diode Trio Removed

(1) Remove diode trio from rear housing assembly.

(2) Connect ohmmeter having 1-1/2 volt cell to brush terminal and one stator winding terminal (fig. 1E-10). Observe resistance on lowest range scale.

(3) Reverse probes at same two terminals.

(4) Replace diode trio if both resistances are identical. Good diode trio will give one high and one low resistance.

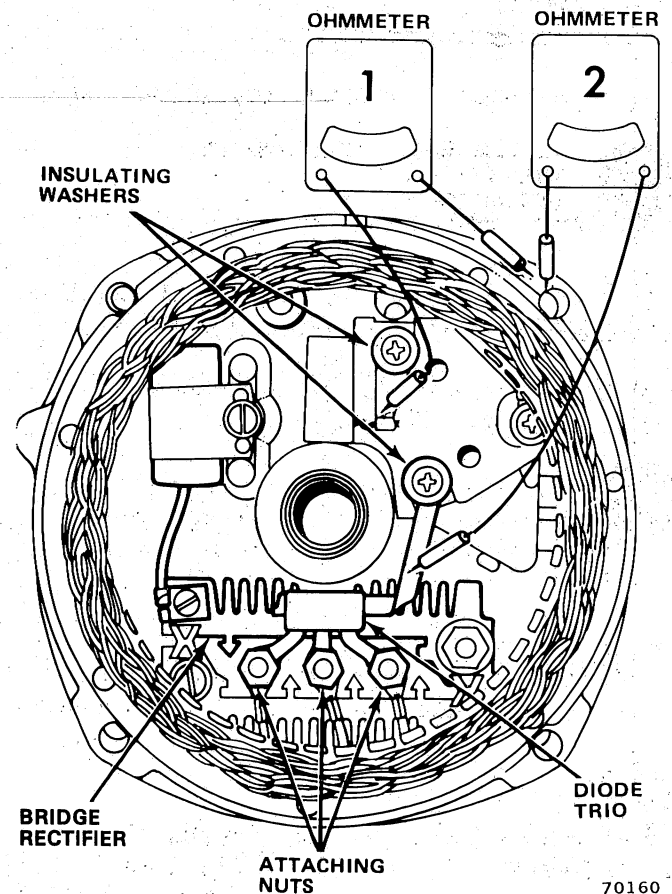


Fig. 1E-9 Rear Housing Assembly

(5) Repeat steps (2), (3), and (4) for each stator winding terminal of diode trio.

(6) Connect ohmmeter to any two stator winding terminals. If resistance is zero, open diode is indicated. Replace diode trio. Repeat test for each combination of stator winding terminals.

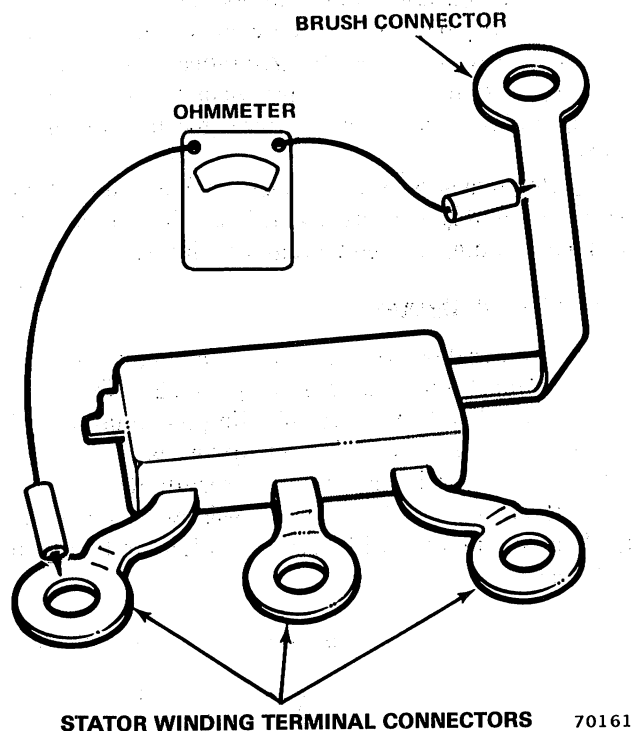


Fig. 1E-10 Testing Diode Trio

Bridge Rectifier Test

The bridge rectifier contains six diodes. If one diode is defective, the entire bridge rectifier must be replaced.

CAUTION: Do not use high voltage, such as a 110-volt test lamp, to test bridge rectifier.

- (1) Connect ohmmeter to grounded heat sink and any one of three terminals (fig. 1E-11). Note resistance.
- (2) Reverse ohmmeter test probe connections to grounded heat sink and same terminal. Note resistance.
- (3) Repeat steps (1) and (2) for remaining two terminals.
- (4) In same manner as described above, test between insulated heat sink and each of three terminals.

Test Results

Each combination of terminal and heat sink tested should have one high and one low resistance. Replace bridge rectifier if any one pair of resistance indications is the same.

ALTERNATOR REPLACEMENT

Removal

NOTE: All bolt and screw threads are in metric dimensions.

WARNING: Failure to disconnect the battery negative cable before disconnecting the red wire from the alternator can result in injury.

- (1) Disconnect battery negative cable.
- (2) Disconnect two-terminal plug and red wire at back of alternator.
- (3) Remove mounting and adjusting bolts, washers and nuts.
- (4) Remove alternator drive belt from alternator pulley and remove alternator from mounting bracket.
- (5) Remove pulley and fan from alternator.

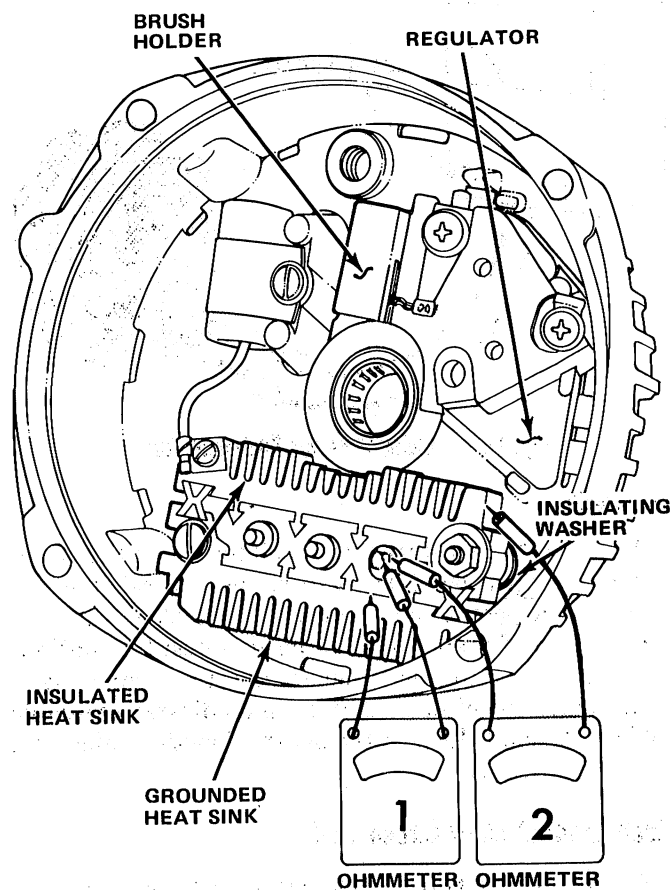


Fig. 1E-11 Testing Bridge Rectifier

Installation

- (1) Install original pulley and fan on replacement alternator.
- (2) Attach alternator to mounting bracket with washers and bolts. Tighten bolts finger-tight only.
- (3) Install alternator drive belt.

(4) Tighten belt to specified tension. Refer to Drive Belt Adjustment for correct belt tightening procedure.

(5) Tighten bolt at sliding slot bracket with 20 foot-pounds (27 N•m) torque. Tighten remaining bolts with 30 foot-pounds (41 N•m) torque.

(6) Install two-terminal plug and red wire on alternator.

(7) Connect battery negative cable.

ALTERNATOR OVERHAUL

Disassembly

CAUTION: *As the rotor and drive end housing assembly is separated from the slip ring housing assembly the brushes will spring out onto the rotor shaft and come in contact with lubricant. Immediately clean brushes that contact shaft to avoid contamination by lubricant, otherwise, they will have to be replaced.*

NOTE: *All bolt and screw threads are in metric dimensions.*

(1) Scribe across front housing, stator frame and rear housing for assembly reference.

(2) Remove four through-bolts that connect rear housing to front housing (fig. 1E-12).

(3) Separate front housing and rotor assembly from rear housing and stator assembly by prying housings apart with screwdriver.

NOTE: *After disassembly, cover the rear housing bearing with tape to prevent entry of dirt and other foreign material. Also, cover the rotor shaft on the slip ring end with tape. Use pressure-sensitive tape and not friction tape, which would leave a gummy deposit on the shaft. If the brushes are to be reused, clean with a soft, dry cloth.*

CAUTION: *Avoid excessive tightening of the rotor in the vise to prevent rotor distortion.*

(4) Place rotor in vise and tighten vise only enough to permit removal of pulley nut.

(5) Alternate pulley nut removal procedure requires use of Allen wrench to prevent rotor from turning while loosening nut with wrench (fig. 1E-13).

(6) Remove pulley nut, lockwasher, pulley, fan, and collar.

(7) Separate front end housing from rotor shaft.

(8) Remove three stator winding attaching nuts and washers and remove stator windings from bridge rectifier terminals.

(9) Separate stator from rear housing.

(10) Remove diode trio strap terminal attaching screw from brush holder and remove diode trio.

(11) Remove capacitor holddown screw.

(12) Disconnect capacitor wire terminal from bridge rectifier. Remove capacitor.

(13) Remove bridge rectifier attaching screws and battery wire terminal screw.

(14) Remove bridge rectifier. Note insulator located between heat sink and rear housing.

(15) Remove two brush holder screws (fig. 1E-14). Note position of all insulator washers to facilitate correct assembly.

(16) Remove brush holder and brushes. Carefully note position of parts for assembly.

(17) Remove voltage regulator.

(18) Remove front bearing retainer plate screws, retainer plate and inner collar.

(19) Press out front bearing and slinger from front housing with suitable tube or collar.

NOTE: *If the bearing is in satisfactory condition, it may be reused.*

(20) Press out rear bearing using tube or collar that fits inside rear housing. Press from inside of housing toward outside.

NOTE: *Replace the bearing in the rear housing if its lubricant supply is exhausted. Do not attempt to lubricate and reuse a dry bearing.*

Cleaning and Inspection

CAUTION: *Do not clean rotor with a degreasing solvent.*

(1) Clean rotor poles by brushing with oleum spirits, or equivalent.

(2) Inspect slip rings for dirt and roughness. Clean with solvent. If necessary, clean and finish slip rings with commutator paper, or 400 grit polishing cloth. **Do not use metal-oxide paper.** Spin rotor in lathe or other support while holding abrasive against rings.

NOTE: *When using an abrasive, support the rotor while spinning to clean slip rings evenly. Cleaning slip rings without support may result in flat spots on slip rings. This will cause brush noise and premature brush wear.*

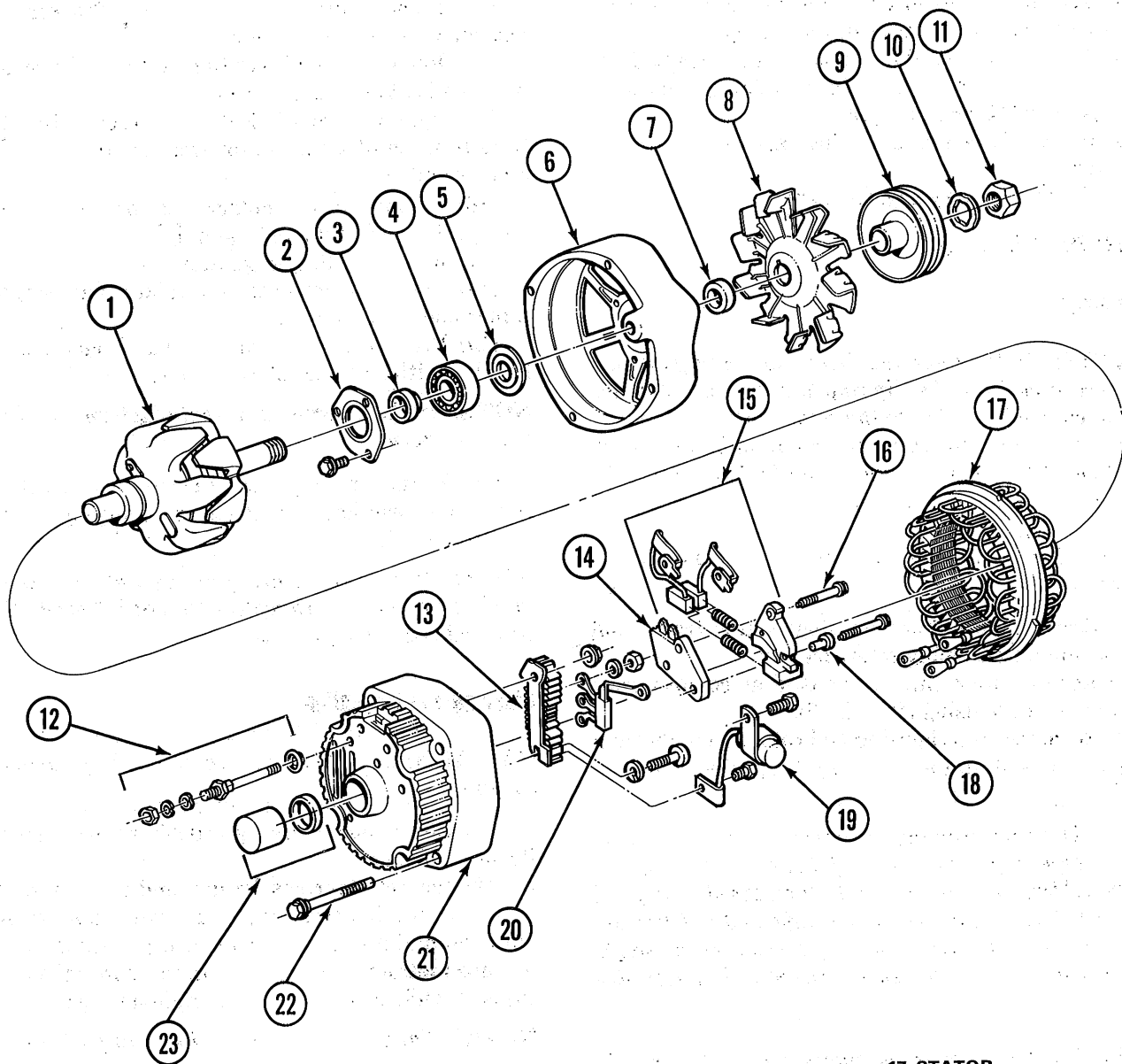
(3) True rough or out-of-round slip rings in lathe to 0.002 inch (0.051 mm) maximum indicator reading. Remove only enough material to make rings smooth and round. Finish with commutator paper, or 400 grit polishing cloth, and blow away all dust.

CAUTION: *Do not clean stator in degreasing solvent.*

(4) Clean stator by brushing with oleum spirits, or equivalent.

(5) Inspect brush springs for evidence of damage or corrosion. Replace springs if there is any doubt about their condition.

(6) Inspect brushes for wear or contamination. If brushes are to be reused, clean with soft, dry cloth until completely free of lubricant.



- 1. ROTOR
- 2. FRONT BEARING RETAINER PLATE
- 3. COLLAR (INNER)
- 4. BEARING
- 5. SLINGER
- 6. FRONT HOUSING
- 7. COLLAR (OUTER)
- 8. FAN

- 9. PULLEY
- 10. LOCKWASHER
- 11. PULLEY NUT
- 12. TERMINAL ASSEMBLY
- 13. BRIDGE RECTIFIER
- 14. REGULATOR
- 15. BRUSH ASSEMBLY
- 16. SCREW

- 17. STATOR
- 18. INSULATING WASHER
- 19. CAPACITOR
- 20. DIODE TRIO
- 21. REAR HOUSING
- 22. THROUGH-BOLT
- 23. BEARING AND SEAL ASSEMBLY

Fig. 1E-12 Alternator Components

43105

(7) Inspect condition of brush holder screw insulating washers for broken or cracked insulation (fig. 1E-14).

Assembly

CAUTION: *Overfilling may cause the bearing to overheat.*

(1) Fill cavity between retainer plate and bearing one-quarter full with Delco lubricant 1948791, or equivalent.

(2) Assemble bearing and slinger into front housing (fig. 1E-15).

Fig. 1E-15 Front Housing Bearing Assembly 43111

(3) Press bearing in with suitable tube or collar that fits over outer bearing race.

NOTE: *Install a replacement retainer plate if the felt seal in the retainer plate has hardened.*

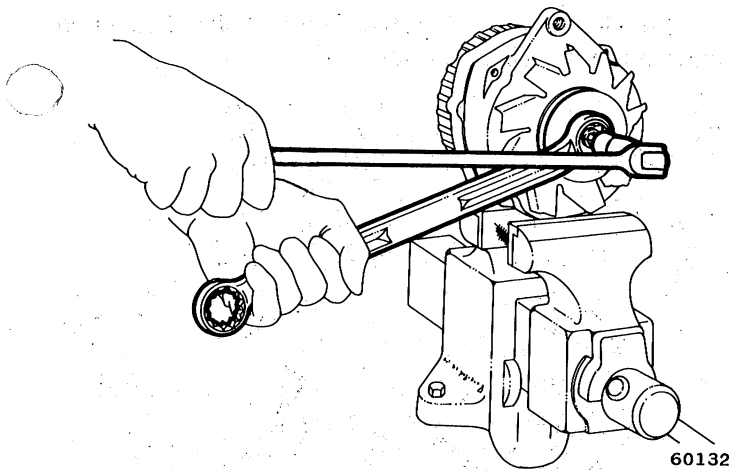


Fig. 1E-13 Removing Pulley Nut

- (4) Install inner collars, retainer plate and screws.
- (5) Position housing, outer collar, fan, pulley and washer on rotor shaft and install pulley nut.
- (6) Place rotor in vise. Tighten vise only enough to permit tightening of pulley nut. Tighten nut with 50 foot-pounds (68 N•m) torque.
- (7) Alternate method of tightening pulley nut requires use of Allen wrench to prevent rotor from turning while tightening nut with wrench (fig. 1E-16).

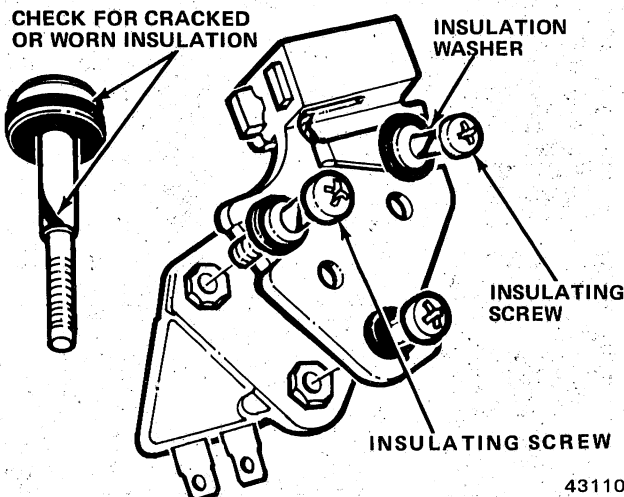


Fig. 1E-14 Brush Holder Assembly

- (8) If rear bearing was removed, support inside of rear housing with hollow cylinder.

CAUTION: Use extreme care to avoid misalignment or placing undue stress on bearing.

- (9) Place flat plate over bearing and press bearing into housing from outside until bearing is flush with housing.

- (10) Install replacement bearing seal. Lightly oil lip to facilitate installation of rotor shaft. Press seal in with lip away from bearing.

- (11) Install springs and brushes into brush holder. Brushes should slide in and out of brush holder without binding.

NOTE: Should any of the brush holder assembly parts require replacement, it is necessary to replace the entire brush holder assembly. Individual parts are not serviced.

- (12) Insert straight wooden or plastic toothpick (to prevent scratching brushes) into hole at bottom of holder to retain brushes.

- (13) Install voltage regulator.

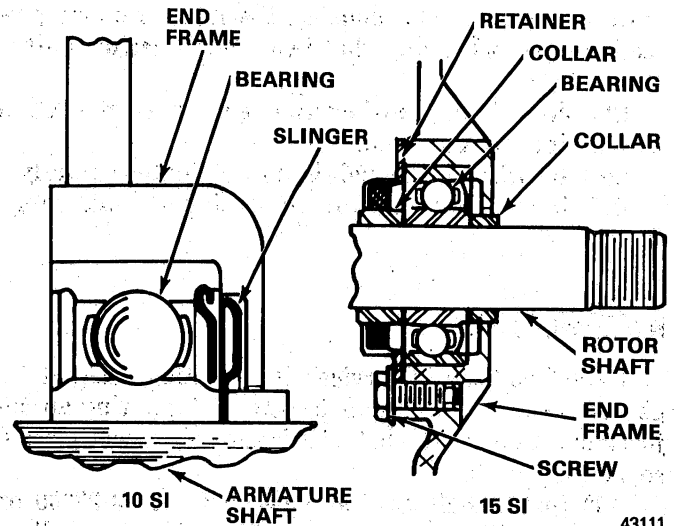


Fig. 1E-15 Front Housing Bearing Assembly

- (14) Attach brush holder to rear housing. Carefully note position of insulating washers (fig. 1E-14). Allow toothpick to protrude through hole in rear housing.

- (15) Install diode trio terminal strap attaching screw and insulating washer.

- (16) Tighten remaining two brush holder screws securely.

- (17) Position bridge rectifier on rear housing with insulator inserted between insulated heat sink and rear housing.

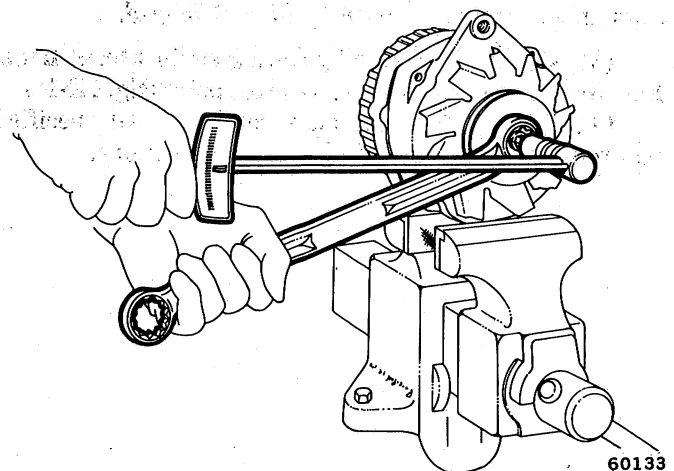


Fig. 1E-16 Tightening Pulley Nut

- (18) Install bridge rectifier attaching screw and battery wire terminal screw.

1E-14 CHARGING SYSTEM

(19) Connect capacitor wire terminal to bridge rectifier and tighten screw securely.

(20) Install capacitor holddown screw.

(21) Position diode trio strap terminals on bridge rectifier terminal studs.

(22) Install stator in rear housing.

(23) Attach stator windings to bridge rectifier terminal studs. Secure with washers and nuts.

(24) Before joining rotor and front housing assembly with stator and rear housing assembly, remove protective tape and ensure that bearing surface of shaft is clean.

(25) Join front housing and rear housing together with scribe mark aligned.

(26) Install four through-bolts and tighten securely.

(27) Remove toothpick from brush holder assembly. Rotate rotor.

DRIVE BELT ADJUSTMENT

If belt has been in service for some time, inspect for general condition of the belt before attempting an adjustment. Replace the belt if it is severely cracked or oil-soaked.

(1) Install Belt Strand Tension Gauge J-23600 on longest accessible span of belt, midway between pulleys (fig. 1E-17).

NOTE: *Eight-cylinder engines with air conditioning use dual drive belts. When testing belt tension, attach Tension Gauge to one belt only. Testing both belts simultaneously will give an inaccurate tension. When using the gauge on a notched belt, position the middle finger of the gauge in the notched cavity of the belt.*

(2) Loosen alternator pivot bolt and adjusting strap bolt.

CAUTION: *Do not pry against the rear housing because the aluminum casting will be damaged.*

(3) Adjust alternator by prying against **front housing**. Use alternator bracket as pivot point (fig. 1E-18).

(4) Rotate alternator on pivot bolt until specified belt tension is obtained. Refer to Specifications.

(5) Tighten adjusting strap bolt and pivot bolt while maintaining specified tension.

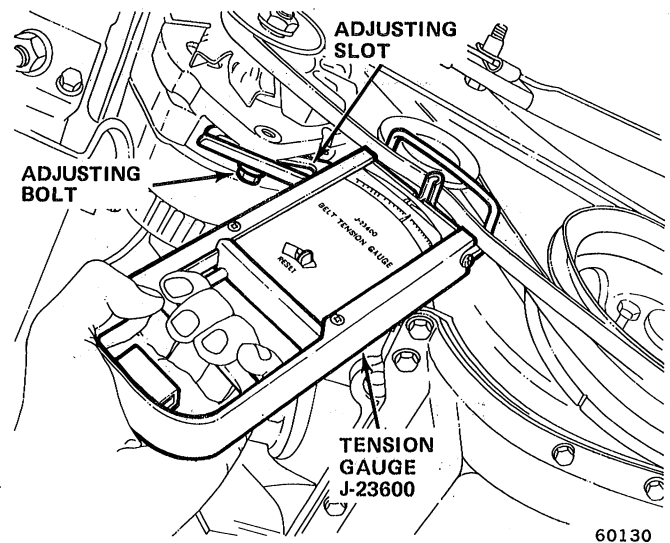


Fig. 1E-17 Testing Belt Tension—Typical

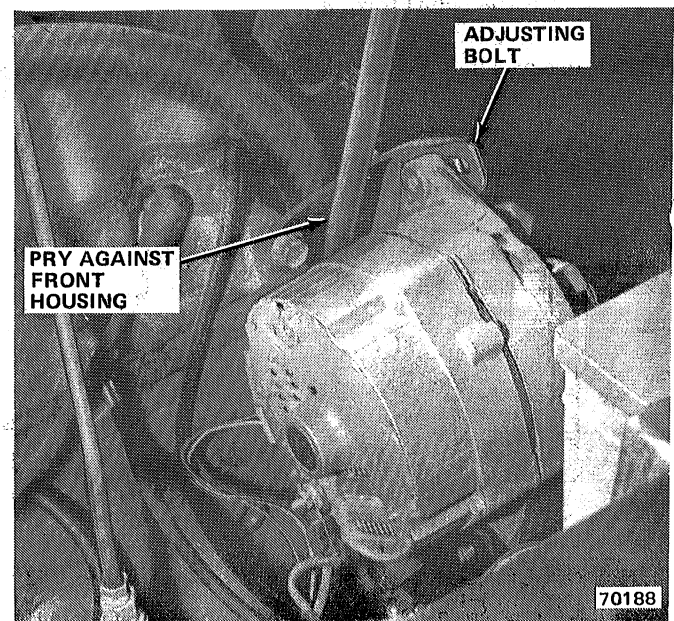


Fig. 1E-18 Adjusting Belt Tension—Typical

SPECIFICATIONS

Delco Charging System Specifications

Alternator

Manufacturer	Delco
Standard (4, 6 and 8 cyl.)	42 amp
Optional (4, 6 and 8 cyl.)	63 amp
Optional (6 and 8 cyl.)	70 amp
Optional (Police)	85 amp
Field Current	4.0 to 5.0 amps at 80° (27°C)
Rotation (Viewing Drive End)	Clockwise
Pulley Size	2.43 in. (6.18 cm)
Belt Tension	
New Belt (V-Belt)	Set to 125-155 pounds-force (559-689 newtons)
Used Belt (V-Belt)	Recheck 90-115 pounds-force (400-512 newtons)
New Belt (Serpentine)	180-200 pounds-force (800-890 newtons)
Used Belt (Serpentine)	140-160 pounds-force (623-712 newtons)

Regulator

Manufacturer	Delco
Model	1116387
Type	Solid State
Adjustment	None
	70138B

Output Voltage Specifications

Ambient Temperature in Degrees Fahrenheit (C)	Acceptable Voltage Range
0-50 (- 18 to 10)	14.3-15.3
50-100 (10 to 38)	13.9-14.9
100-150 (38 to 66)	13.4-14.4
150-200 (66to 93)	13.0-14.1

80807

Torque Specifications

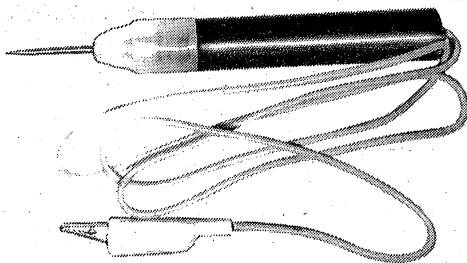
Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-tightened item.

	USA (ft-lbs)		Metric (N·m)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Alternator Adjusting Bolt	18	15-20	24	20-27
Alternator Mounting Strap Bolt	28	23-30	38	31-41
Alternator Pivot Bolt or Nut	28	20-35	38	27-47
Pulley Nut	50	45-55	68	58-78

All Torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

70139

Tools



**J-21008
CONTINUITY
LIGHT**

70271



**AMA 21-317
CIRCUIT TESTER**

NOTES

[Faint, illegible handwritten notes on lined paper]