GROUP

BATTERY AND CHARGING SYSTEM 14

(10000)

SECTION 14-00 Battery and Charging System—Service

VEHICLE APPLICATION

Capri.

DESCRIPTION AND OPERATION

The generator charging system is a negative ground system consisting of a generator with an integral regulator, a charge indicator lamp, a storage battery, and associated wiring.

The integral regulator is solid-state. It is mounted onto the rear of the generator and contains the generator brushes.

DIAGNOSIS AND TESTING

Battery and charging system trouble is frequently due to physical rather than electrical factors including loose or corroded wiring connections, damaged wiring, slipping drive belts, dirty battery surfaces and terminals, or poor maintenance.

Thoroughly inspect the system.

1. Make sure battery terminals and cable connections are clean and tight. Refer to Section 14-01.
2. Inspect battery cable connections to starter and engine ground for surface dirt or foreign matter.

DIAGNOSIS AND TESTING (Continued)

3. Check generator drive belt for glazing or cracking which may have been caused by belt slippage. If sides of belt are shiny or feel slick, replace them. Check belt tension. Refer to Section 03-05 for belt replacement or tension adjustment.
4. Make sure that top surface of battery is clean and free of moisture or foreign matter.

Charging system troubles such as low generator output, no generator output (indicated by the indicator lamp being on while the engine is running), or generator output voltage too high, require testing of both the generator and the voltage regulator.

Voltage regulator failures are usually not recognized except by the direct affect on the generator output, and eventual battery discharge. The voltage regulator is the control valve for the generator. It protects the battery by preventing excessive voltage output.

Discharge of the battery to ground through the generator is prevented by the diodes of the generator which permit current flow in one direction (to the battery) only.

A discharged battery is not always due to a problem in the charging system. Excessive use of lamps and accessories while the engine is either off or running at low idle, corroded battery cables and connectors, low acid level in the battery, or prolonged disuse of the battery, which would permit self-discharge are all possible reasons which should be considered when a battery is run down or low in charge.

NOTE: Always determine the cause of failure as well as servicing the concern.

1. **Polarity and Connections:** The generator is for use on negative ground electrical systems only. Polarity cannot be reversed and any attempt to do so will damage the generator.
2. **Installing Vehicle Battery:** Reversed battery connections will damage the generator rectifiers. When installing, first connect the positive connector to the battery positive terminal and then connect the negative connector to the negative battery terminal.
3. **Battery Charging:** Disconnect the battery negative cable to isolate the generator from the battery and external charging equipment.
4. **Battery Connections:** Never disconnect the battery while the engine is running. Damage to the rectifier and / or other electrical components may occur. Using a slave battery to start the engine and then reconnecting the original battery while the engine is running must not be attempted. Do not break or make any other connections in the generator circuit while the engine is running.
5. **Generator Main Output Cable:**
   - The cable connecting the generator and the battery has constant battery voltage even when the engine is not running. Care must be taken not to ground this cable if it should ever be removed, or damage to the cable will occur.
   - Never run the generator with the main output cable disconnected either at the generator or battery end while the field remains energized or the rectifiers may be damaged.
6. **Arc Welding:** Isolate the control box and generator by disconnecting their wiring connectors prior to performing any arc welding on the vehicle.
7. **Lamps and Fuses Fail Prematurely, Short Battery Life:** Other systems covered under this heading are: battery uses excessive amount of water; high battery charging rate. Check all charging system wiring connections including the voltage regulator ground and battery sensing wire. Tighten or service as required. Check the generator voltage limiter setting. Replace if not to specification.
8. **Generator Noisy:** When diagnosing the complaint of generator noise, isolate the noise area and make sure that the generator is at fault rather than the generator belt, water pump, or another part of the vehicle. Start the engine and use a stethoscope or similar tool to isolate the noise. A generator bearing, water pump bearing or belt noise is usually evident by a squealing sound.

   A generator with a shorted diode will normally whine (magnetic noise) and will be most noticeable at idle speeds. Perform the generator output tests. If the output is approximately 10 amperes less than that specified, a shorted diode is usually indicated.

   To eliminate the belt(s) as the cause of noise, check the belt(s) for bumps, apply a light spray of water to the belt(s). If the generator belt is at fault, adjust the belt to specification, or replace the belt if necessary.

   If the belt(s) is satisfactory and the noise is believed to be in the generator or water pump, remove the generator belt. Start the engine and listen for the noise to be sure that the noise is not caused by another component. Use this test and the sound detector test to isolate the noisy component. If the noise is traced to the generator, remove it and check bearings for play or roughness.
9. **Charge Warning Indicator Lamp Flickers:** This condition may be caused by loose or damaged connections in the charging system wiring harness, worn brushes, or improper brush tension.

On-Vehicle Charging System Tests

Generator Load Test

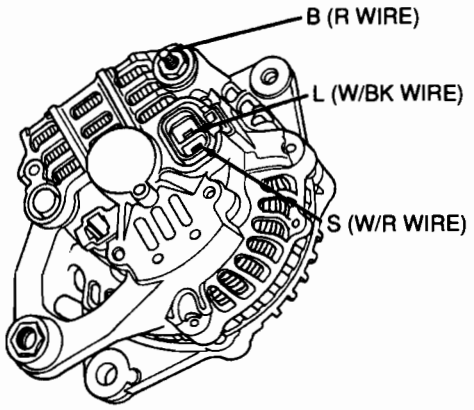
1. Start the engine and verify that the charge warning indicator lamp goes out. If the indicator goes, out, refer to Step 6. IF the indicator does not go out, refer to Step 2.

   CAUTION: Do not ground the B- terminal.

DIAGNOSIS AND TESTING (Continued)

2. With the ignition switch in the ON position and the engine not running, verify that the voltage at the generator wiring connector terminals are as follows:
   - B-terminal = Battery Voltage
   - L-terminal = Approximately 1 volt
   - S-terminal = Battery Voltage
3. Start engine.
4. With the engine running and at normal curb idle, verify that the voltage at the generator wiring connector terminals are as follows:
   - B-terminal = 14.1 - 14.7 volts
   - L-terminal = 14.1 - 14.7 volts
   - S-terminal = 14.1 - 14.7 volts

Generator Terminal	Ignition ON/ Engine OFF	Engine at Idle
B	Approximately 12 volts	14.1-14.7 volts
L	Approximately 1 volts	14.1-14.7 volts
S	Approximately 12 volts	14.1-14.7 volts



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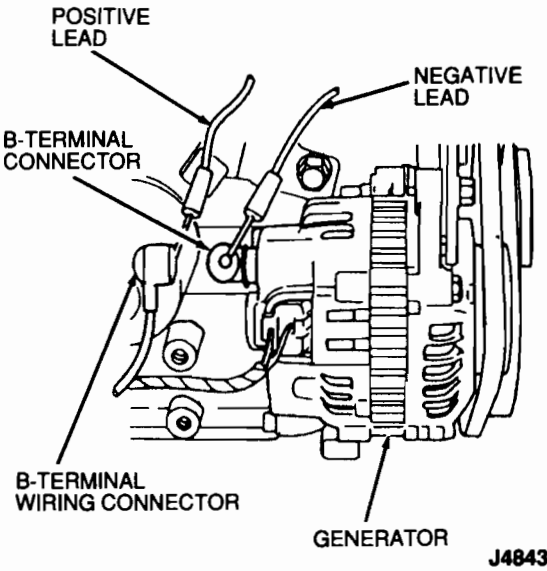
5. If the voltages are as specified, check the wiring harness between the battery and B-terminal. If the voltages are below specification, check the wiring harness. If wiring harness is in good condition, service or replace the generator.
6. Using Rotunda Starting / Charging Tester 078-00005 (VAT-40) or equivalent, connect the positive lead to the generator B-terminal connector and the negative lead to the B-terminal wiring connector.



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7. Switch the tester to the ammeter function.
8. Connect Rotunda Inductive Dwell-Tach-Volts Ohms Tester 059-00010 or equivalent.
9. With the engine running, turn on all lamps, lights, accessories and press the brake pedal.
10. With an engine speed of 2500-3000 rpm check that the generator output current is 70 amps or more. If output current is as specified, the charging system is functioning properly. If the output current is below specification, check the accessory belt. Refer to Section 03-05. If the belt tension is at specification, service or replace the generator.

CONDITION CHART—CHARGING SYSTEM

CONDITION	POSSIBLE SOURCE	ACTION
• Battery Does Not Stay Charged—Engine Starts OK	• Battery.	• Test battery, replace if necessary. Refer to Section 14-01.
	• Loose or worn generator belt.	• Adjust or replace belt. Refer to Section 03-05.
	• Wiring or cables.	• Service as required. Refer to Section 03-05.
	• Generator.	• Test and / or replace components as required. Refer to Section 14-02.
	• Other vehicle electrical systems.	• Check other systems for current draw. Service as required.

DIAGNOSIS AND TESTING (Continued)

CONDITION CHART—CHARGING SYSTEM (Continued)

CONDITION	POSSIBLE SOURCE	ACTION
• Generator Noisy	• Loose or worn generator belt. • Bent pulley flanges. • Generator.	• Adjust tension or replace belt. Refer to Section 03-05. • Replace pulley. Refer to Section 14-02. • Service or replace generator. Refer to Section 14-02.
• Lamps and/or Fuses Burn Out Frequently	• Wiring. • Generator. • Battery.	• Service as required. • Test, service, replace if necessary. • Test, replace if necessary. Refer to Section 14-01.
• Charge Warning Indicator Lamp Flickers After Engine Starts or Comes On While Vehicle is Being Driven	• Loose or worn generator belt. • Generator. • Field circuit ground. • Lamp circuit wiring and connector.	• Adjust tension or replace. Refer to Section 03-05. • Service or replace. Refer to Section 14-02. • Service or replace worn or damaged wiring. • Service as required.
• Charge Warning Indicator Lamp Flickers While Vehicle is Being Driven	• Loose or worn generator belt. • Loose or improper wiring connections. • Generator.	• Adjust tension or replace belt. Refer to Section 03-05. • Service as required. • Service or replace. Refer to Section 14-02.
• Voltmeter Pointer Reads in the Red Area (High or Low)	• Loose or worn generator belt. • Damaged or worn wiring (battery to generator for ground or open). • Field circuit ground. • Generator. • Voltmeter indicator gauge wiring and connections. • Damaged or worn gauge. • Other vehicle electrical system malfunction.	• Adjust tension or replace. Refer to Section 03-05. • Service or replace wiring. • Service or replace wiring. • Service or replace. Refer to Section 14-02. • Service as required. • Replace gauge. • Service as required.

The following pinpoint tests have been arranged in a series to isolate the component or cause of a charging system complaint.

Start at the beginning and continue through the test steps even after the cause of the complaint is found. This will rule out the possibility that the original condition was not caused by more than one charging system condition.

PINPOINT TEST A—CHARGING SYSTEM DIAGNOSIS

TEST STEP		RESULT ▶	ACTION TO TAKE
A1	CHECK CHARGE LAMP FUNCTION		
	• Without starting engine, turn ignition switch to RUN position. Charge warning indicator lamp should come on. • Key OFF. • Disconnect the generator connector. • Key ON. • Ground L terminal of generator connector. Charge warning indicator lamp should come on. NOTE: Testing to be performed on wiring harness side.	Lamp functions properly ▶	GO to **A2.**
		Lamp does not come on ▶	REPLACE meter fuse or lamp bulb or SERVICE open in lamp feed circuit.
		Lamp does not go off ▶	SERVICE short to ground in lamp feed circuit.
		Lamp comes on only with L-terminal grounded ▶	SERVICE open circuit. CHECK rotor, brushes, or voltage regulator. Refer to bench tests. Section 14-02.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A—CHARGING SYSTEM DIAGNOSIS (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
A2	CHECK BATTERY CONDITION		
	• Perform sealed battery voltage/load test. Refer to Section 14-01. • **Does battery pass load test?**	Yes ▶ No ▶	GO to **A3.** REPLACE battery.
A3	CHECK B+ WIRING		
	• With ignition switch in OFF position, use a voltmeter, such as Rotunda Digital Volt-Ohmmeter 014-00407 or equivalent to test for battery voltage at generator B+ terminal. • **Is voltage within 0.2 volts of battery voltage?** NOTE: Test step must be performed with generator installed and all wiring connected.	Yes ▶ No ▶	GO to **A4.** SERVICE loose, corroded or damaged B+ wire.
A4	CHECK BATTERY GROUND		
	• Use a voltmeter to check voltage drop from battery negative post to ground. • Voltage drop should be less than 0.2 volts.	Within 0.2 volts ▶ Greater than 0.2 volts ▶	GO to **A5.** SERVICE loose or corroded connections or damaged ground cable.
A5	CHECK GENERATOR GROUND		
	• Use a voltmeter to check voltage drop from generator frame to engine ground. • Voltage drop should not exceed 0.2 volts.	Within 0.2 volts ▶ Greater than 0.2 volts ▶	GO to **A6.** SERVICE excessive resistance in generator mounting.
A6	PERFORM BATTERY DRAIN TEST—KEY OFF		
	• Turn ignition switch to OFF position. • Disconnect battery positive cable. • Connect an ammeter or test lamp between battery positive terminal and positive cable. • Current draw should be no more than .05 amps (clock draw). Test lamp should not light. • **Does test lamp illuminate?**	Yes ▶ No ▶	CHECK vehicle circuits for drain by pulling fuses from fuse panel one at a time until affected circuit is found. SERVICE as necessary. GO to **A7.**
A7	PERFORM BASE VOLTAGE AND NO-LOAD TEST		
	• Connect a voltmeter across battery terminals. Read and record voltage (this is base reading). • Start engine, run at 1500 rpm with no electrical load. Voltage should increase from base reading, but not moe than 2.5 volts. NOTE: Test step must be performed with generator installed. Engine should be running at approximately 1500 rpm.	Voltage increase but less than 2.5 volts ▶ No voltage increase or increase greater than 2.5 volts. ▶	GO to **A8.** SERVICE or REPLACE generator. REFER to this Section.
A8	PERFORM LOAD TEST		
	• Increase engine speed to 2000 rpm. • Turn A/C, blower and headlamps on HIGH. • The voltage should read a minimum of 0.5 volt over the base voltage.	Increases 0.5 volt or more ▶ Increases less than 0.5 volt ▶	The concern is not in the charging system. CHECK other vehicle systems for a constant or intermittent current overdraw by repeating the battery drain test with various auxiliary circuits on. REPLACE or SERVICE generator for shorted or open stator and field windings or diodes breaking down under load. REFER to Bench Tests as outlined.

DIAGNOSIS AND TESTING (Continued)

Whenever the generator assembly is removed from the vehicle and disassembled, a thorough inspection of the components should be performed as outlined in the Component Visual Inspection chart.

NOTE: Clean all parts thoroughly before inspecting. **Do not** wash the rotor, stator, voltage regulator, rectifier or bearings in cleaning solvent.

GENERATOR
COMPONENT VISUAL INSPECTION CHART

COMPONENT	CHECK FOR
ROTOR	• Thread stripped or damaged at pulley end. • Scored bearing surfaces indicating the bearing has spun on the shaft. • Scuff marks on the pole fingers indicating a bent shaft which allows the rotor to rub against the stator frame. • Dirty or contaminated slip rings. • Slip rings can be cleaned using a No. 400 silicon carbide paper and finish polished using crocus cloth (DO NOT USE EMERY PAPER). The best cleaning method is to spin the rotor in a lathe or drill press to prevent flat spots.
STATOR	• Burned or discolored windings indicating insulation breakdown from excessive heat. • Scuff marks on the inside of stator frame indicating a bent rotor shaft. • Damage to the stator frame.
HOUSINGS	• Cracked or damaged mountings. • Scoring in the bearing bores indicating the bearings have spun in the housing. • Lubricant in the bearing bores indicating damaged bearings.
DRIVE PULLEY	• Bent, broken or cracked pulley groove. • Wear or damage to the pulley bore which could prevent a tight fit on the shaft.

(Continued)

GENERATOR
COMPONENT VISUAL INSPECTION CHART (Cont'd)

COMPONENT	CHECK FOR
BRUSHES	• Burn spots or discoloration indicating arcing. • Dirt or contamination. • Wear • If brush length is less than 5mm (3/8 inch), replace the brushes.
BEARINGS	• Roughness or flat spots: • To determine this condition, slowly rotate the bearing on the shaft or between fingers. A flat spot will appear as a sudden tightening and then loosening of the outer race. Roughness will have a general uneven feel as the bearing is rotated. • Leakage of lubricant past the bearing seals. • Scoring on the inner or outer races, indicating the bearing has spun on the shaft or in the housing.

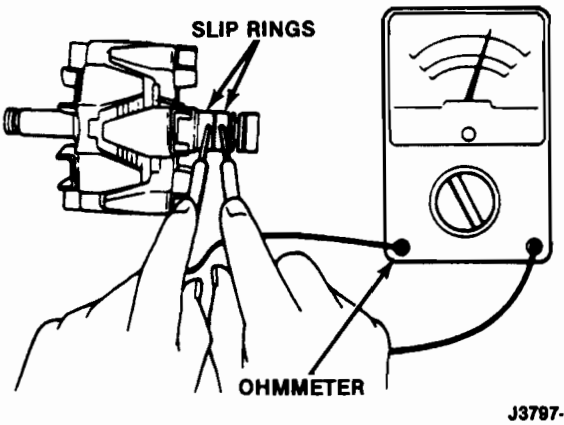
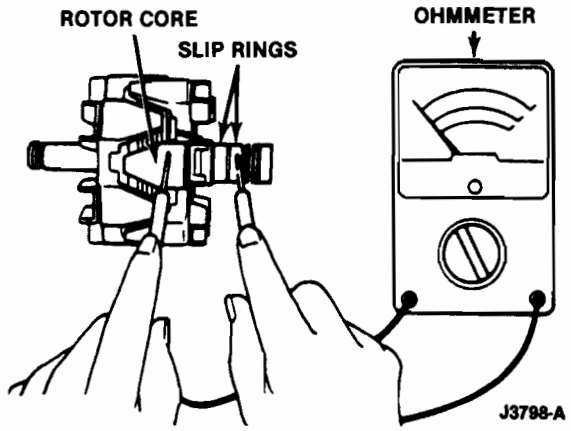
Generator and voltage regulator testing is broken down into on-vehicle testing and bench testing. Refer to On-Vehicle Charging System Tests before proceeding to On-Bench testing.

On-Bench Testing

In order to perform the component testing in the following charts, it will be necessary to partially or completely disassemble the generator as outlined. Use Rotunda Inductive Dwell-Tach-Volts-Ohms Tester 059-00010 for on-bench testing procedures.

DIAGNOSIS AND TESTING (Continued)

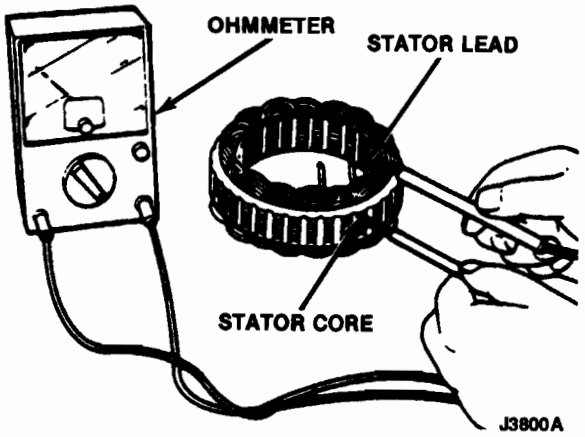
PINPOINT TEST B—GENERATOR COMPONENT DIAGNOSIS AND TESTING

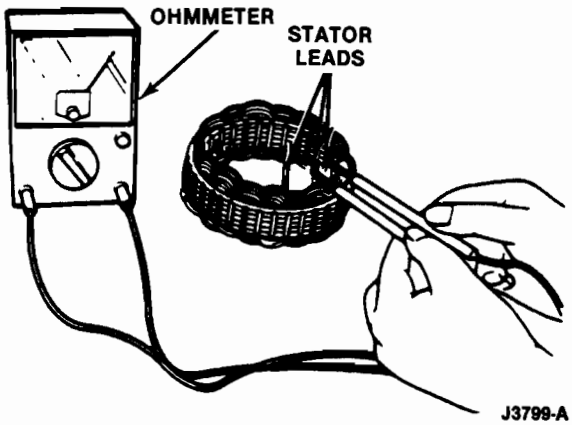
TEST STEP		RESULT	ACTION TO TAKE
B1	CHECK ROTOR COIL RESISTANCE		
	• Set ohmmeter on XI scale. Connect meter leads across rotor slip rings. Resistance should be 2-6 ohms. 	Rotor coil resistance 2-6 ohms Rotor coil outside specified tolerance	▶ Rotor coil OK. GO to **B2.** ▶ REPLACE rotor.
B2	CHECK ROTOR COIL GROUND		
	• Set ohmmeter on XI scale. Place one meter test lead on rotor slip ring, and the other meter lead on a rotor pole. Repeat for other rotor slip ring. Ohmmeter reading should be infinite. 	Resistance infinite Continuity between slip ring and rotor pole	▶ Rotor coil OK. GO to **B3.** ▶ REPLACE rotor assembly.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST B—GENERATOR COMPONENT DIAGNOSIS AND TESTING (Continued)

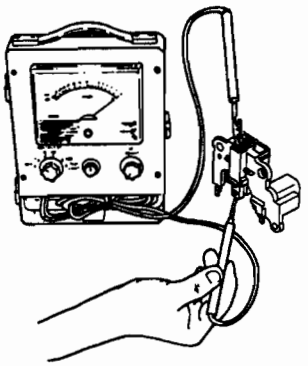
TEST STEP		RESULT	ACTION TO TAKE
B3	CHECK STATOR WINDING GROUND		
	• Set ohmmeter on XI scale. Clip one meter lead to a stator lead. Place other meter lead on stator frame. Resistance should be infinite.	Resistance infinite ▶	Stator coil OK. GO to **B4.**
		Continuity between frame and stator lead: windings grounded ▶	REPLACE stator.
B4	CHECK OPEN STATOR WINDINGS		
	• Set ohmmeter on XI scale. Clip one meter lead to a stator lead. Place other meter lead on each of remaining three stator leads. There should be continuity in all three positions.	Continuity in all three positions ▶	Stator windings OK. GO to **B5.**
		Infinite resistance in any of three positions: shorted stator windings. ▶	REPLACE stator.
	NOTE: SHORTED STATOR WINDINGS. An internal short between adjacent windings is difficult to locate without laboratory equipment. If all other test results are normal and generator fails to supply rated output, shorted stator windings are probable.	Shorted stator windings ▶	REPLACE stator.





DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST B—GENERATOR COMPONENT DIAGNOSIS AND TESTING (Continued)

TEST STEP		RESULT	ACTION TO TAKE
B5	CHECK BRUSH CIRCUIT CONTINUITY		
	• Set ohmmeter on XI scale. Touch one meter lead to brush. Touch other meter lead to brush terminal. Check inner and outer terminals using this method. There should be continuity in both positions.  J4444-B	Continuity in both positions ▶ Infinite resistance in either position: brush circuit open ▶	Brush circuits OK. GO to **B6.** REPLACE brush and voltage regulator as an assembly.
B6	CHECK NEGATIVE RECTIFIERS		
	• Set ohmmeter on XI scale. Clip one meter lead to negative diode heat sink. Touch other meter lead to each negative rectifier pin. Reverse ohmmeter leads and repeat test. Rectifier should show continuity in one direction only.	Continuity in one direction only ▶ Continuity in both directions on any one rectifier: rectifier shorted ▶ No continuity in either direction on any one rectifier:rectifier open ▶	Negative diodes OK. GO to **B7.** REPLACE rectifier assembly. REPLACE rectifier assembly
B7	CHECK POSITIVE RECTIFIERS		
	• Set ohmmeter on XI scale. Clip one meter lead to positive diode heat sink. Touch other meter lead to each positive rectifier pin. Reverse ohmmeter leads and repeat test. Rectifier should show continuity in one direction only.	Continuity in one direction only ▶ Continuity in both directions on any one rectifier: rectifier shorted ▶ No continuity in either direction on any one rectifier:rectifier open ▶	Positive diodes OK. REPLACE rectifier assembly. REPLACE rectifier assembly.

SPECIFICATIONS

Electrical Specifications

Description	Specification
Ground Polarity	Negative
Nominal Voltage	14 Volts
Nominal DC Output	85 amps
Stator Phases	3
Stator Winding Connection	Star
Number of Poles	12
Resistance of Rotor Windings	2.6 ± .13 ohms
Resistance of Stator Windings	.037 + 10% ohms
Brush Length (Protrusion) New	9.8mm (0.39 inch)
Minimum	3.8mm (0.15 inch)
Minimum Diameter of Slip Rings	26.7mm (1.05 inch)

CJ3485-A

SPECIAL SERVICE TOOLS

ROTUNDA EQUIPMENT

Model	Description
014-00407	Digital Volt-Ohmmeter
059-00010	Inductive Dwell-Tach-Volts Ohms Tester
078-00005	Starting/Charging Tester (VAT-40)

SECTION 14-01 Battery

VEHICLE APPLICATION

Capri.

DIAGNOSIS AND TESTING

Tests are made on a battery to determine the state of charge and also its capacity or ability to crank an engine. The ultimate result of these tests is to show that the battery is good, needs recharging, or must be replaced.

Before attempting to test a battery, it is important to give it a thorough examination to determine if it has been damaged.

WARNING: ALWAYS DISCONNECT THE BATTERY CABLE WHEN CHARGING THE BATTERY OR ARC WELDING ON THE VEHICLE. KEEP ALL FIRE AWAY FROM THE TOP OF THE BATTERY WHEN CHARGING THE BATTERY.

WARNING: BATTERIES NORMALLY PRODUCE EXPLOSIVE GASES WHICH CAN CAUSE PERSONAL INJURY. THEREFORE, DO NOT ALLOW FLAMES, SPARKS OR LIGHTED TOBACCO TO COME NEAR THE BATTERY. WHEN CHARGING OR WORKING NEAR A BATTERY, ALWAYS SHIELD YOUR FACE AND PROTECT YOUR EYES. ALWAYS PROVIDE VENTILATION.

WHEN LIFTING A PLASTIC-CASED BATTERY, EXCESSIVE PRESSURE ON THE END WALLS COULD CAUSE ACID TO SPEW THROUGH THE VENT CAPS, RESULTING IN PERSONAL INJURY. LIFT WITH A BATTERY CARRIER OR WITH YOUR HANDS ON OPPOSITE CORNERS.

WARNING: KEEP OUT OF REACH OF CHILDREN. BATTERIES CONTAIN SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES, CLOTHING AND VEHICLE. ALSO, SHIELD YOUR EYES WHEN WORKING NEAR THE BATTERY TO PROTECT AGAINST POSSIBLE SPLASHING OF THE ACID SOLUTION. IN CASE OF ACID CONTACT WITH SKIN OR EYES, FLUSH IMMEDIATELY WITH WATER FOR A MINIMUM OF 15 MINUTES AND GET PROMPT MEDICAL ATTENTION. IF ACID IS SWALLOWED, CALL A PHYSICIAN IMMEDIATELY.

Battery Voltage Check

1. With the ignition OFF and no electrical loads on, connect the negative (-) lead of Rotunda Inductive Dwell-Tach-Volts Ohms Tester 059-00010 or equivalent to the negative battery cable clamp.

   NOTE: The range setting on the voltmeter should be at least 0 to 15.

2. Connect the positive (+) lead of the voltmeter to the positive battery cable clamp.
3. If the voltmeter reading is over 12.4 volts at 21°C (70°F) the battery voltage is acceptable. If the reading is 12.4 volts or less, the battery needs charging.

BATTERY TESTING PROCEDURE

TEST STEP		RESULT ▶	ACTION TO TAKE
A1	PERFORM VISUAL INSPECTION		
	• Remove negative battery cable, then positive cable. • Check for dirty or corroded connections. • **Are cable connections OK?**	Yes ▶ No ▶	GO to **A2.** CLEAN terminals and clamps. GO to **A2.**

DIAGNOSIS AND TESTING (Continued)

BATTERY TESTING PROCEDURE (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
A2	CHECK BATTERY POST		
	• Check for loose battery post. • **Are battery posts OK?**	Yes ▶ No ▶	GO to **A3.** REPLACE battery.
A3	CHECK BATTERY COVER		
	• Remove battery holddowns and shields. • Check for broken / cracked battery case or cover. • **Is battery OK?**	Yes ▶ No ▶	GO to **A4.** REPLACE battery.
A4	PERFORM BATTERY CAPACITY TEST		
	• Use a high rate discharge tester with a variable rate control or a fixed rate tester with meter compensation for different battery electrical sizes. Follow instructions supplied with tester for the battery capacity test. If necessary, refer to the battery capacity test in this Section. • **Does battery pass the capacity test?** • Recommended Discharge Rates:	Yes ▶ No ▶	GO to **A5.** CHARGE battery for 20 minutes at 35 amps. REPEAT **A4** (if battery fails second check, replace battery.)

Battery Capacity (Cold Cranking Amps)	Discharge Rate (Amperes)
460 CCA (Maintenance Free)	230

• Voltage reading at 15 seconds for good battery.

Approximate Battery Temp.	Minimum Voltage
21°C (70°F)	9.6
15°C (60°F)	9.5
10°C (50°F)	9.4
4°C (40°F)	9.3
-1°C (30°F)	9.1
-7°C (20°F)	8.9
-12°C (10°F)	8.7
-18°C (0°F)	8.5

A5	CHECK BATTERY VOLTAGE		
	• Measure open circuit voltage of battery with a digital voltmeter capable of reading 1 / 100 volt. • **Is voltage greater than 12.4 volts?**	Yes ▶ No ▶	Battery OK. CHARGE battery.

Battery Capacity Test

A high rate discharge tester (Battery-Starter), such as Rotunda Starting and Charging Tester (VAT-40) 078-00005 or equivalent 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 10 or 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 approximately three times the ampere hour rating of the battery. For example, a 48 ampere hour battery should be tested at 150 amperes load.

   CAUTION: Avoid leaving the high discharge load on the battery for periods longer than 15 seconds.
5. With the ammeter reading the required load for 15 seconds, note the voltmeter reading.
6. If the voltmeter reading is 9.6 volts at 21°C (70°F) or more, the battery has a good output capacity and will readily accept a charge, if required.

DIAGNOSIS AND TESTING (Continued)

7. If the voltage reading obtained during the capacity test is below 9.6 volts at 21°C (70°F), and the battery is fully charged, the battery is damaged and must be replaced. If unsure about the battery's state of charge, charge the battery.
8. After the battery has been charged, repeat the capacity test. If the capacity test battery voltage is still less than 9.6 volts at 21°C (70°F), replace the battery. If the voltage is 9.6 or more at 21°C (70°F) the battery is satisfactory for service.
9. If the battery is discharged only, check for a loose fan belt, loose electrical connection, charging system performance, and perform a battery drain test.

Battery Charging

Before recharging a discharged battery, check the charging system for the following conditions and service as necessary:

1. Loose generator belt.
2. Pinched or grounded generator wiring harness.
3. Loose harness connections at the generator.
4. Loose or corroded connections at battery, starter relay and/or engine ground.
5. Excessive battery drain due to hood, glove compartment and courtesy lamps remaining energized (damaged or misadjusted switch, glove compartment left open, etc.).

Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm up to approximately 5°C (40°F) before charging. This may require four to eight hours at room temperature depending on the initial temperature and battery size.

A battery which has been completely discharged may be slow to accept a charge initially, and in some cases may not accept a charge at the normal charger setting. When batteries are in this condition, charging can be started by using the dead battery switch on chargers so equipped.

Completely discharged batteries, which have been discharged for a prolonged period of time (over one month) or which have a voltage of less than two volts, may show no indication of accepting a charge even when the dead battery switch is used. The initial charge rate accepted by batteries in this condition is so slow that the ammeter on some chargers will not show any indication of charge for up to 10 minutes.

Follow charger manufacturer's instructions for use of dead battery switch. If dead battery switch is the spring loaded type, it should be held in the ON position for up to three minutes.

After releasing dead battery switch and with charger still on, measure battery voltage. If it shows 12 volts or higher, the battery is accepting a charge and is capable of being recharged. However, it may require up to two hours of charging with cold batteries, below 5°C (40°F), before the charge rate is high enough to show on the charger ammeter. It has been found that all non-damaged batteries can be charged by this procedure. If a damaged battery cannot be charged by this procedure it should be replaced.

Once it has been determined that the battery has begun to accept a charge, it can be charged to a serviceable state or a full state of charge by one of two methods.

- The **first method** is to use the AUTOMATIC setting on chargers so equipped. This setting maintains the charging rate within safe limits by adjusting the voltage and current to prevent excessive gassing and spewing of electrolyte. Approximately 2 to 4 hours will be required to charge a completely discharged battery to a serviceable state. If a full state of charge is desired, the charge can be completed by a low current rate of 3 to 5 amps for several additional hours.
- The **second method** is to use the MANUAL or constant current setting on the charger. Initially set the charging rate for 30 to 40 amps and maintain this setting for approximately 30 minutes or as long as there is no excessive gassing and electrolyte spewing. If gassing results, the charge rate must be reduced to a level where gassing will stop. Excessive gassing will result in non-replaceable loss of electrolyte, thus shortening battery life.

The total charge required will vary with battery size and its initial state of charge. In general, to bring a discharged battery to a serviceable state of charge, current-time input should equal the battery amp-hour capacity. For example, a 48 AH battery will require 15 amps of charge for 3.2 hours or 10 amps of charge for 4.8 hours. Again, if a full state of charge is desired, the charge can be completed by a low constant current of 3 to 5 amps for several hours.

If the battery has failed or is low in charge, it may be necessary to refer to Section 14-00 for diagnosis.

REMOVAL AND INSTALLATION

Battery

Removal

NOTE: The illustrations used in the following procedures show typical battery locations and connections.

1. Remove battery cables from battery terminals (negative first).
2. Clean cable terminals with an acid neutralizing solution and terminal cleaning brush.
3. Remove hold-down clamps.

REMOVAL AND INSTALLATION (Continued)

4. Test battery and determine if it should be:
   - Placed back in service.
   - Recharged before placing back in service.
   - Replaced with a new Motorcraft or equivalent battery.

Installation

1. Clean cable terminals and hold-down with a wire brush. Replace all cables or parts that are worn or frayed.
2. Clean battery tray with a wire brush and scraper.
3. Place battery in tray with positive and negative terminals in same position as previous battery. Assemble and tighten hold-down hardware so battery is secure. Do not over-tighten.

SERVICE

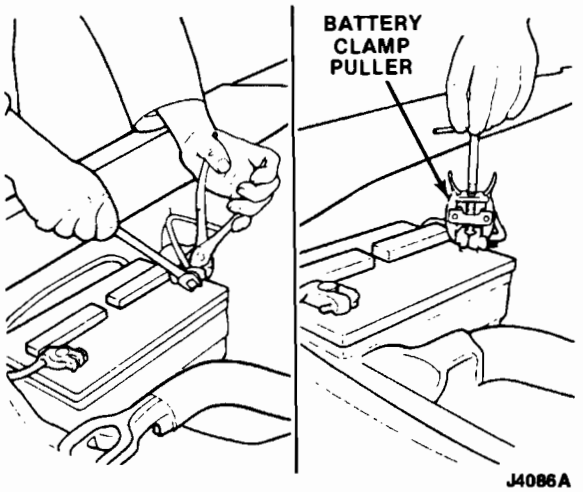
Tools

Anyone working with a battery needs the proper tools. Using the right tools will prevent damage to the battery, battery cables and hold-down bracketry, and personal injury.

Tools and equipment manufactured for servicing batteries have insulated parts to help prevent arcing, should the tool be dropped or placed accidentally between a terminal and some other contact surface.

Battery Pliers

Battery pliers have jaws specifically designed for gripping cable clamp bolts securely. Care should be taken when removing or replacing the cable clamp bolts so that the battery terminal is not subjected to any excessive lateral or twisting forces. Such forces could cause major damage to the internal components of the battery, and leakage at the terminals.

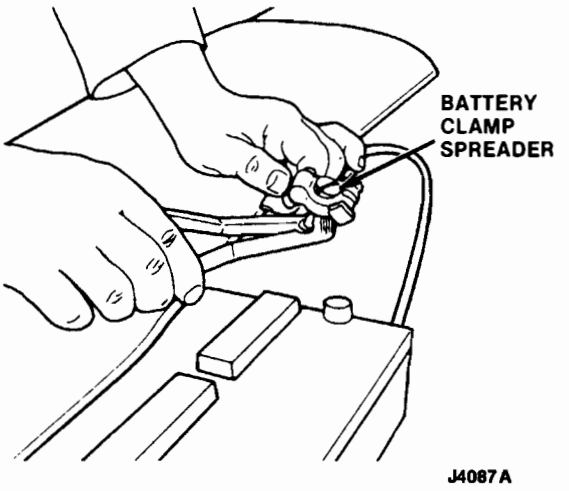


Battery Cable Puller

Use a cable puller to remove a cable clamp from the battery terminal. With the jaws gripping the underside of the cable clamp, pull the clamp up by means of pressure exerted against the top of the battery terminal. Proper use of this tool avoids the damaging lateral or twisting forces that result when using a pry bar or plier. Refer to the illustration shown under Battery Pliers.

Battery Cable Clamp Spreader

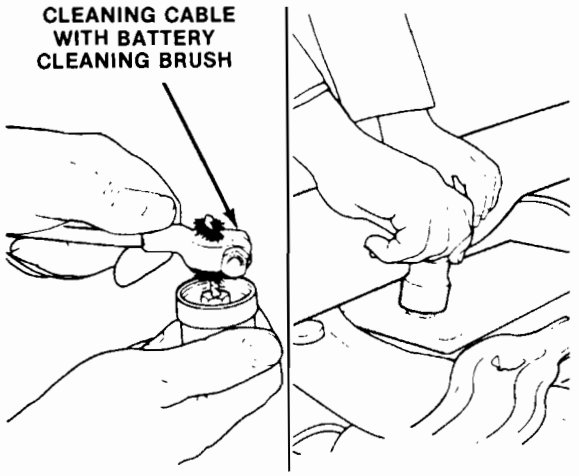
The spreader is used to expand the cable clamp after it has been removed from the terminal and the clamp bolt has been loosened. The cable clamp can then be easily placed in its correct position completely on the terminal.



SERVICE (Continued)

Terminal Cleaning Brush

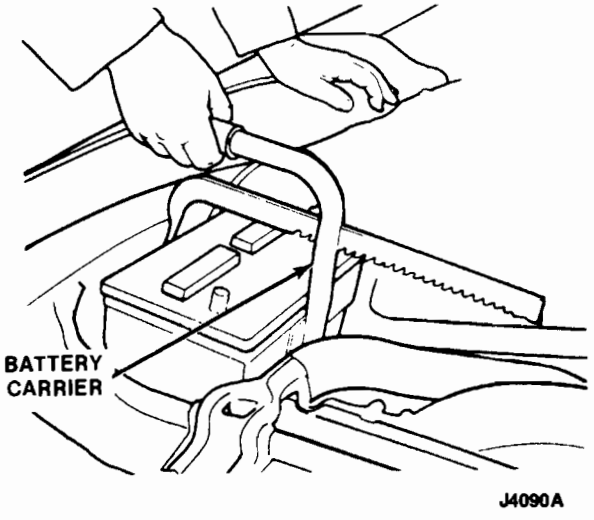
The terminal cleaning brush is designed with two parts to clean both the tapered battery terminal and the mating surface of the cable clamp.



Battery Carrier

Use a suitable battery carrier for lifting and transporting the battery. The illustration shows a clamp-type carrier used to grip the sidewalls of the container just below the lip of the cover. The carrier is used on the sidewalls, rather than the endwalls, since the sidewalls have additional strength from the inner cell partitions. This is particularly important with the polypropylene cased battery which has endwalls that are flexible.

CAUTION: Gripping the endwalls on this type of battery could cause electrolyte to spew from some of the cells, and possibly cause damage to some of the internal components.

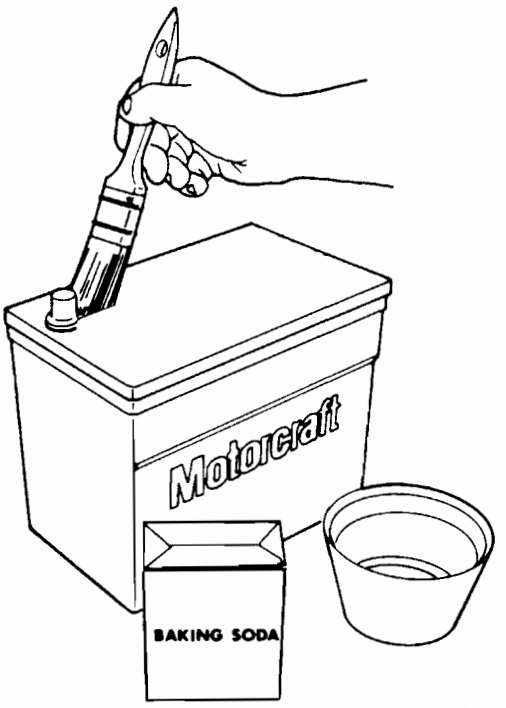


MAINTENANCE

Keep the battery and the surrounding parts, particularly the top, clean and dry. If electrolyte is evident on top of the battery, it should be cleaned off immediately, as even a weak electrolyte will quickly attack and corrode the cable connections, clamp plates and bolts. Neutralize any corrosion with a solution of baking soda and water. After installing cables, apply a small quantity of Premium Long-Life Grease XG-1-C (ESA-M1C75-B) or equivalent grease to each battery post to help prevent corrosion.

Battery Cleaning

Keeping the battery top clean and dry reduces the need for service and extends battery life. Also, make certain the cable clamps are tightly fastened to the battery posts. If corrosion is found, disconnect the cables and clean clamps and posts with a wire brush. Neutralize the corrosion with a solution of baking soda and water. After installing cables, apply a small quantity of Premium Long-Life Grease XG-1-C (ESA-M1C75-B) or equivalent grease to each battery post to help prevent corrosion.



Jump Starting

Refer to Section 03-06.

SPECIAL SERVICE TOOLS

ROTUNDA EQUIPMENT

Model	Description
059-00010	Inductive Dwell-Tach-Volts Ohms Tester
078-00005	VAT-40

SECTION 14-02 Generator, Integral Voltage Regulator — Internal Fan and Regulator Type

VEHICLE APPLICATION

Capri.

DESCRIPTION

Charging System

The electrical charging system is a negative ground system consisting of an integral generator (10300) / voltage regulator (IGR), charge indicator, storage battery and the necessary wiring and cables. Refer to the Electrical and Vacuum Troubleshooting manual for schematics and locations of components and wiring.

Generator

The integral generator / regulator (IGR) is belt-driven from the engine. Field current is supplied from the generator's internally mounted voltage regulator, to the rotating field of the generator through two brushes and two slip rings.

With the ignition key in the RUN position, voltage is applied through the charge indicator 'I' circuit to the voltage regulator. This turns on the regulator and the indicator. When the engine is started, the generator begins to generate alternating (AC) current which is converted to direct (DC) current by the rectifier assembly internal to the generator. This current is then supplied to the vehicles electrical system through the generator B+ connection located on the rear of the generator.

Once the generator begins generating current, a voltage signal is taken from the generator stator and fed back to the regulator warning circuit, turning off the charge indicator.

With the system functioning normally, the generator output current is determined by the voltage of the 'A' circuit (battery sense voltage). The 'A' circuit voltage is compared to a set voltage internal to the regulator, and the regulator controls the generator field current to maintain proper generator output. The set voltage will vary with temperature and is typically higher in the winter than in the summer, allowing for better battery recharge in the winter and reducing the chance of overcharging the battery in the summer.

Circuit Description

B+ Output

The generator output is supplied through the B+ output connection to the battery and electrical system.

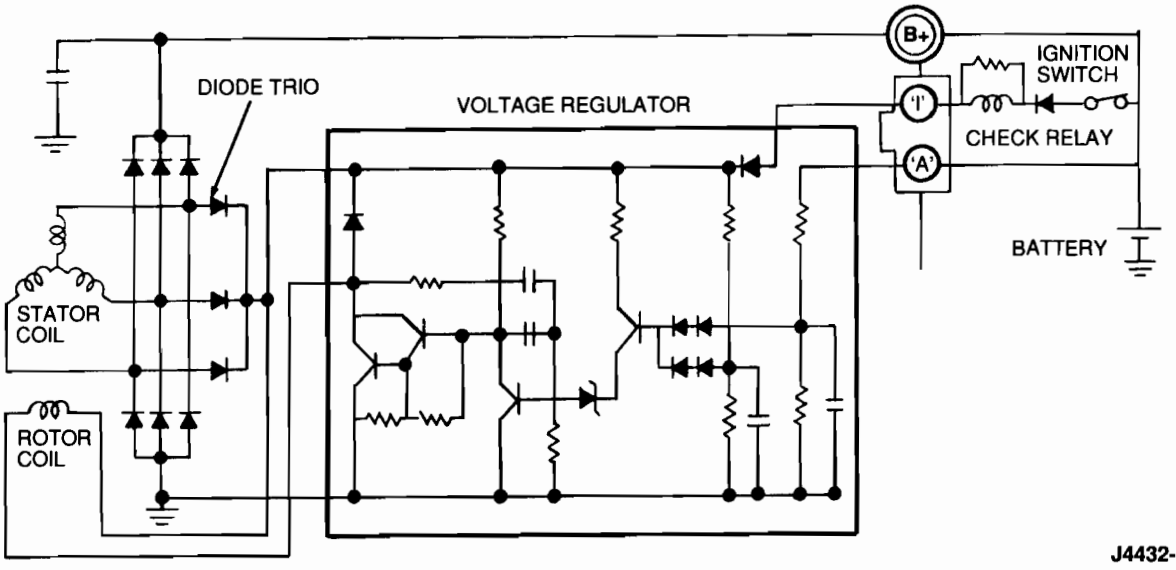
'I' Circuit

The 'I' circuit, or ignition circuit, is used to turn on the voltage regulator. This circuit is powered up with the ignition key in the RUN position. This circuit is also used to turn the indicator on if there is a fault in the charging system operation or associated wiring circuits.

DESCRIPTION (Continued)

'A' Circuit

The 'A' circuit, or battery sense circuit, is used to sense the battery voltage. This voltage is used by the regulator to determine the generator output. This circuit is connected back to the load distribution point and is a protected circuit.

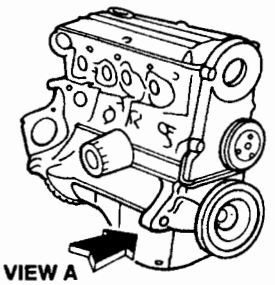


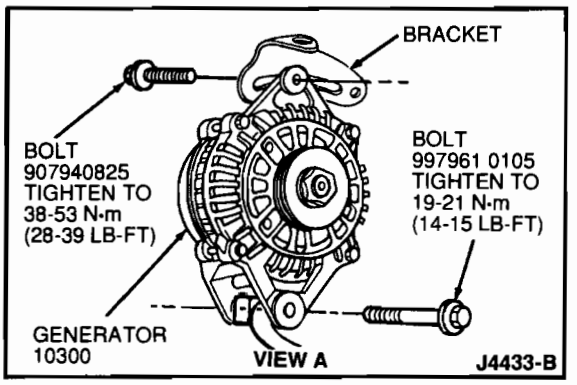
REMOVAL AND INSTALLATION

Generator

Removal and Installation

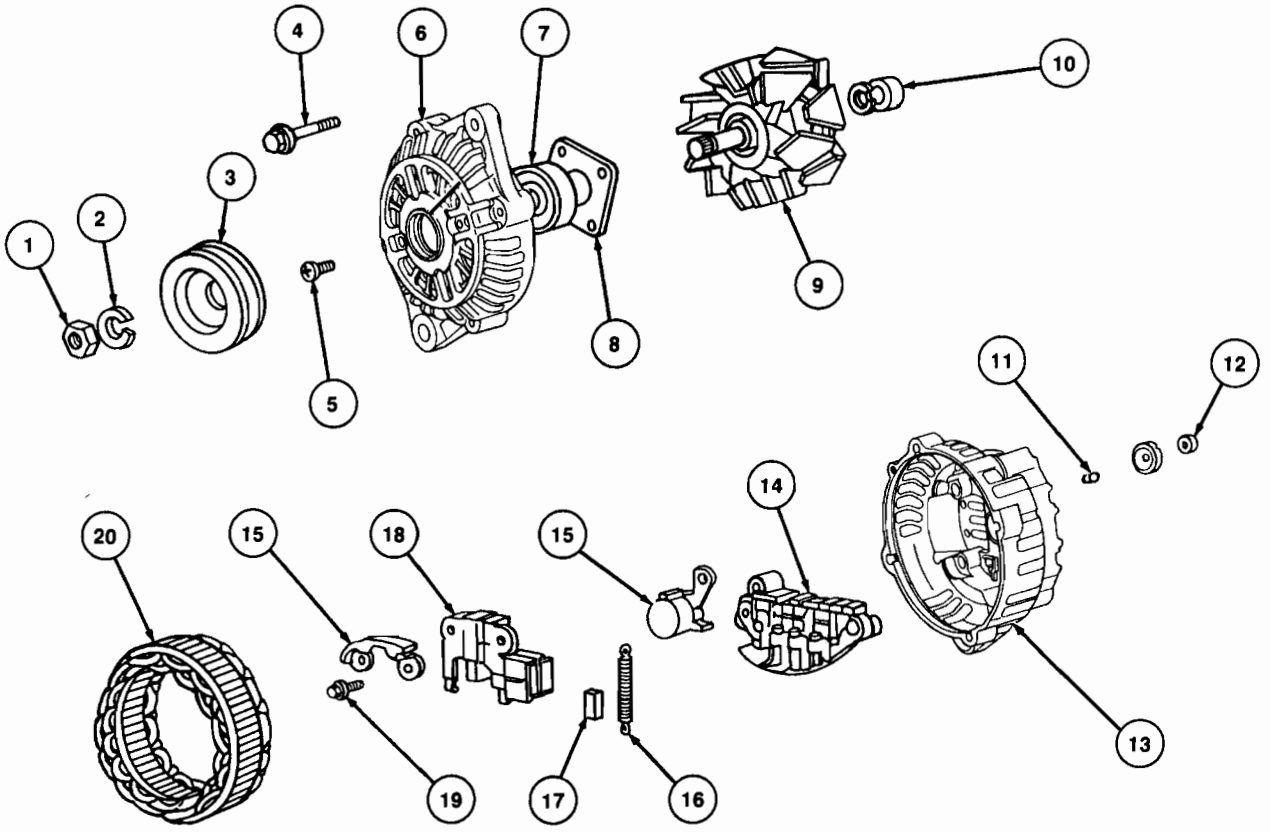
1. Disconnect battery negative cable.
2. Remove nut and eyelet connector from 'B' terminal.
3. Disconnect electrical connector.
4. Remove adjustment bolt from top of generator.
5. Remove pivot bolt from bottom of generator and remove generator.
6. To install, reverse Removal procedure. Adjust bolt tension. Refer to Section 03-05.





DISASSEMBLY AND ASSEMBLY

NOTE: All of the following Disassembly Steps may not be necessary to perform a particular test or service. Perform only those steps that apply. The following illustration is a disassembled view of the integral generator / regulator assembly.



J4435-A

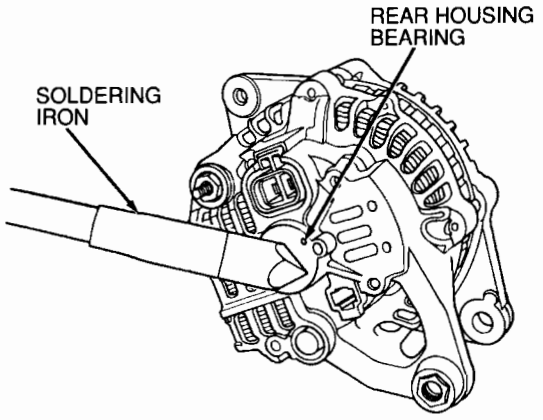
Item	Part Number	Description	Item	Part Number	Description
1	10B304	Nut	11	10B304	Plug
2	10B304	Washer	12	10K330	Nut and Terminal Insulator
3	10344	Pulley	13	10334	Rear Housing
4	10A396	Through Bolt (4 Req'd)	14	10304	Rectifier Assy
5	10A355	Screw (4 Req'd)	15	10316	Shield
6	10333	Front Housing	16	10347	Brush Spring (2 Req'd)
7	10334	Front Bearing	17	10347	Brush (2 Req'd)
8	10A355	Bearing Retainer	18	10316	Regulator
9	10335	Rotor	19	10316	Screw (2 Req'd)
10	10A304	Rear Bearing	20	10336	Stator

DISASSEMBLY AND ASSEMBLY (Continued)

Disassembly

1. Place a soldering iron (200W class) on rear housing bearing recess for three or four minutes to heat to about 50-60°C (122-144°F).

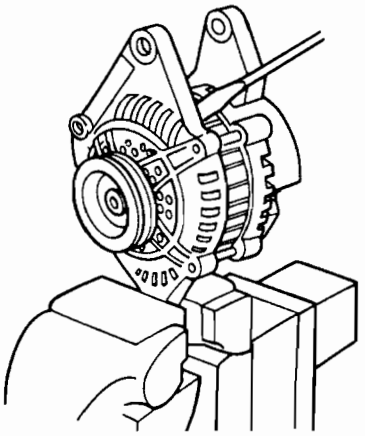
   NOTE: If the rear housing is not heated, the bearing may not be pulled out, because the rear bearing and rear housing fit together very tightly.



J4436-A

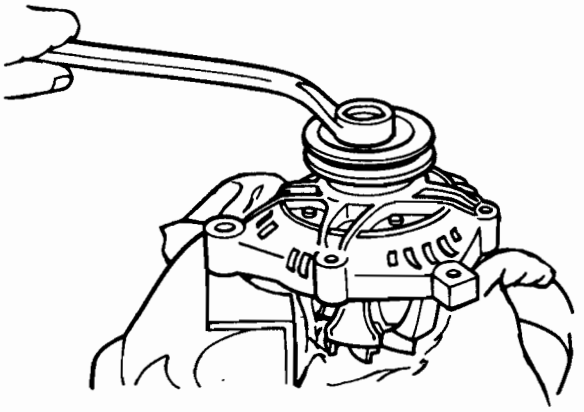
2. Remove four through-bolts, and insert a flat-tip screwdriver between the stator core and front housing and separate them.

   NOTE: Be careful not to force screwdriver in too far, because stator may be scratched.



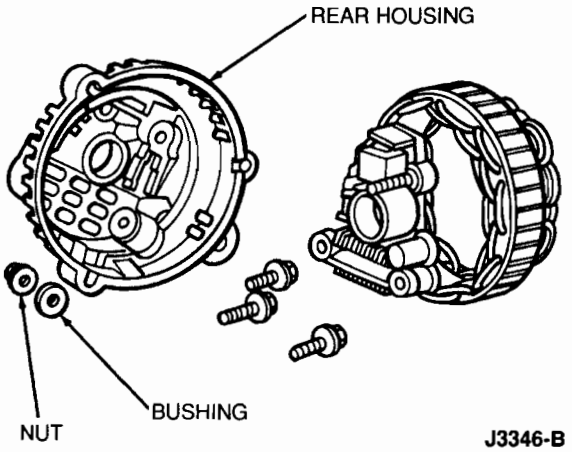
J4437-B

3. Remove locknut, pulley, rotor and front housing.



J3345-A

4. Remove the following rear bracket housing and stator parts:
   - Nut on 'B' terminal
   - Insulation bushing
   - Rectifier retaining screws
   - Brush holder retaining screw

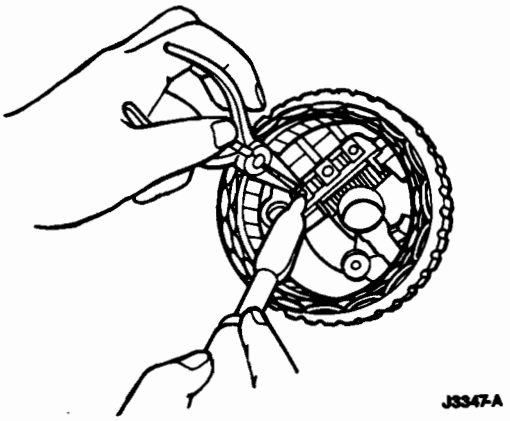


J3346-B

DISASSEMBLY AND ASSEMBLY (Continued)

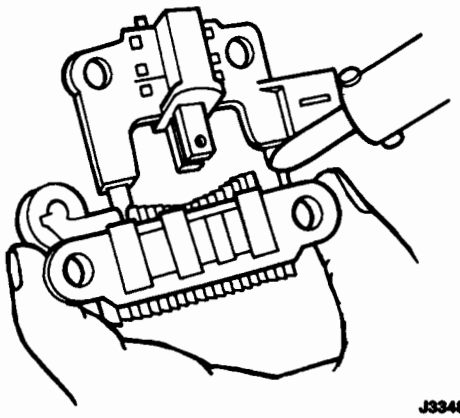
5. Use a soldering iron to remove solder from rectifier and stator lead.

   CAUTION: Disconnect quickly. Use the soldering iron no more than about five seconds, because the rectifier may become damaged if it is overheated.



J3347-A

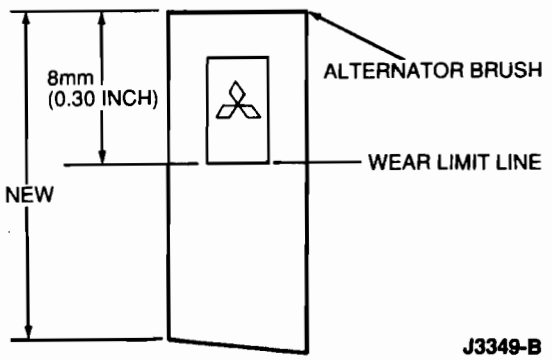
6. Use a soldering iron to remove regulator from rectifier.



J3348-A

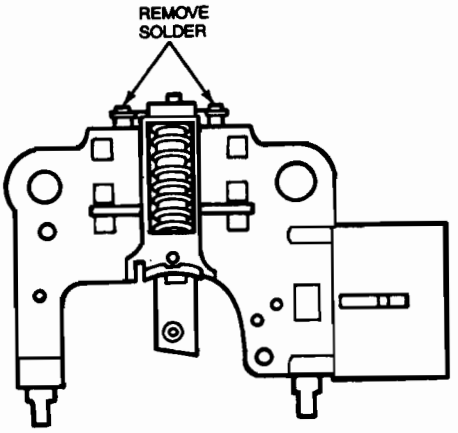
Brush Replacement

1. Replace brushes if they are worn at or near wear line as shown.



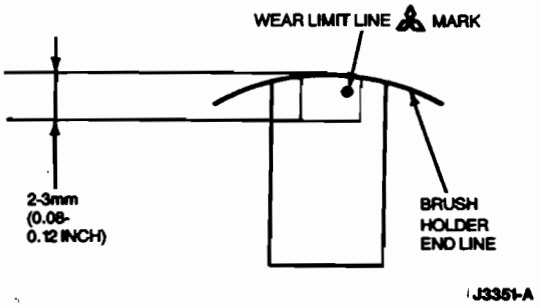
J3349-B

2. If it is necessary to replace brushes, remove solder from brush pigtails at points shown. Remove brushes.



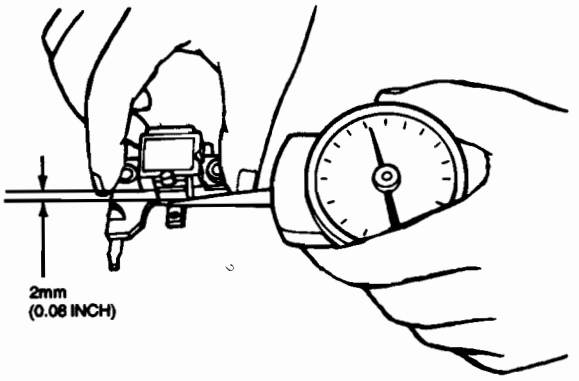
J3350-A

3. When soldering brush, solder pigtail so that wear limit line of brush projects **2 or 3mm (0.08-0.12 inch)** out from end of brush holder.



J3351-A

4. Brush springs may be checked by using a spring pressure gauge to push brush into brush holder until tip of brush projects 2mm (0.080 inch). Read force at this time. Replace spring if the force is less than 2.0N (200g or 7.1 oz). For a new brush the force should be 3 to 4.4N (310-450g or 10.9-15.9 oz).

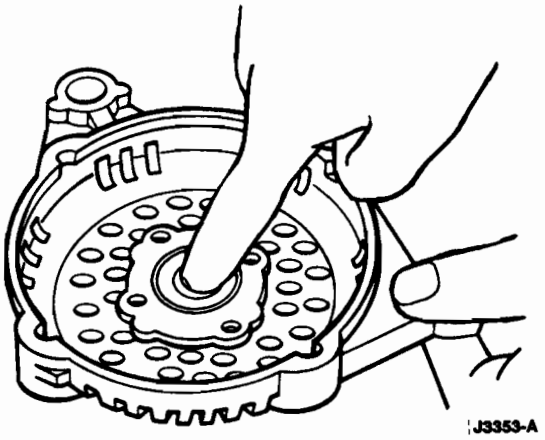


J3352-A

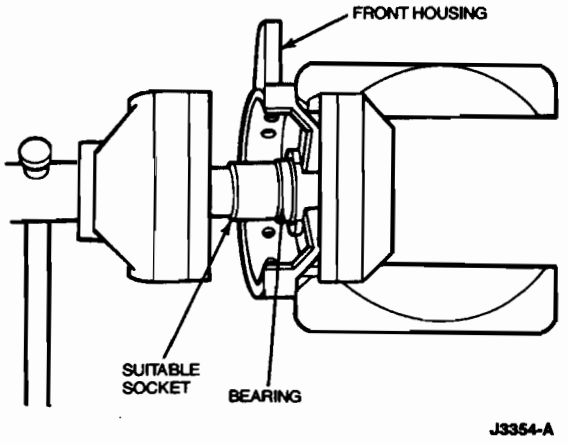
DISASSEMBLY AND ASSEMBLY (Continued)

Bearing Replacement

1. Check front bearing for abnormal noise, looseness, binding or insufficient lubrication. Replace bearing if there is any concern.

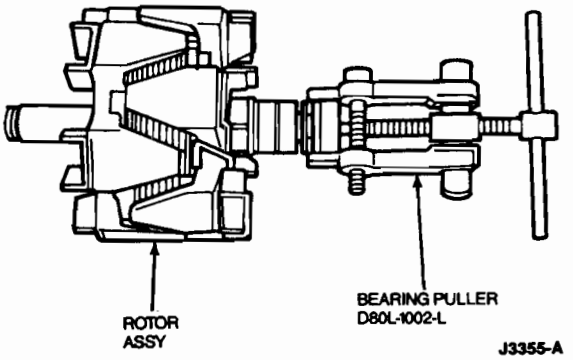

J3353-A

2. To replace generator front bearing, use a socket or driver which fits outer race of generator front bearing, and carefully press a new bearing into generator front housing using a press or vise.



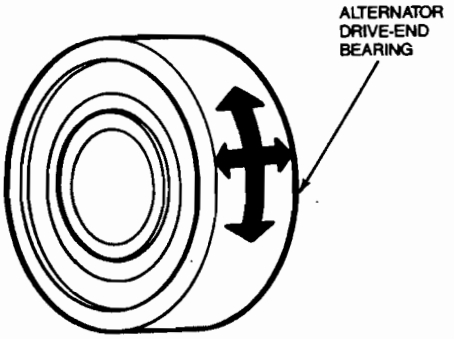
J3354-A

3. Check for rear bearing abnormal noise, looseness, binding, or insufficient lubrication. Replace bearing if there is any concern.
4. To replace the generator rear bearing, first remove the old bearing from the rotor using two-jaw Bearing Puller D80L-1002-L or equivalent as shown.



J3355-A

5. Check the bearings for abnormal noise, looseness or insufficient lubrication. Replace as necessary.



J3356-A

Cleaning and Inspection

CAUTION: When rebuilding an integral generator, use only high-temperature bearings. Use of standard parts will result in generator failure.

1. Wipe the stator, rotor and front bearing with a clean cloth. Do not clean these parts with solvent.
2. Rotate the front bearing on the drive end of the rotor shaft. Check for any scraping noise, looseness or roughness. Look for excessive lubricant leakage. If any of these conditions exist, replace the bearing.
3. Inspect the rotor shaft 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 end of the rotor shaft and rotate the bearing. Make the same check for noise, looseness and roughness as was made for the front bearing. Inspect the rollers and cage for damage. Replace the rear bearing if these conditions exist or if the lubricant is lost or contaminated.
5. Check all wire leads on both the rotor and stator assemblies for loose or broken connections. Check the windings for burned insulation. Replace parts that show signs of burned insulation.

DISASSEMBLY AND ASSEMBLY (Continued)

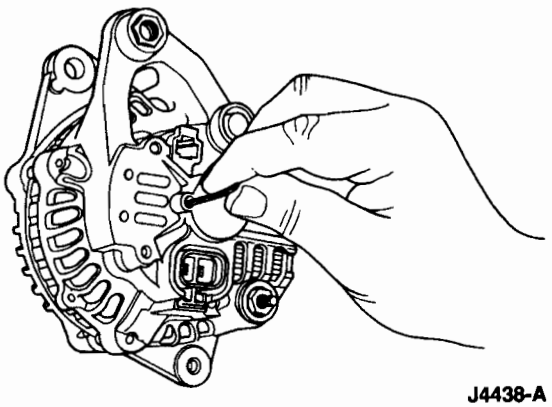
6. Check the pulley and fan for excessive looseness on the rotor shaft and for cracks or other damage. Replace any pulley or fan that is loose, cracked or bent out of shape.
7. Check both the front and rear housings for cracks, particularly in the webbed areas at the mounting ear. Replace a damaged or cracked housing.
8. Replace the brushes if they are at or are worn shorter than the wear limit line, 8mm (0.30 inch).

Assembly

Assembly is in the reverse order of disassembly. There is no lubrication required.

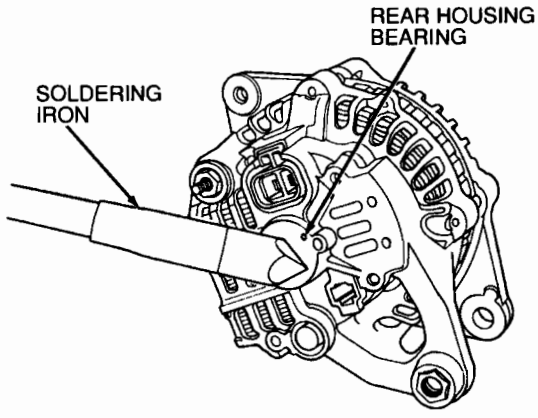
1. Before assembly, push the brush into the brush holder and pass a wire (2 mm, 40-50mm (0.08 inch, 1.6-2.0 inch)) through the hole shown to secure the brush in position.

   NOTE: Be sure to pull the wire out after the assembly is completed.



J4438-A

2. When the rear bearing is pressed into the rear bracket, heat the bracket before pressing it in.



J4436-A

3. After assembly is completed, rotate the pulley manually and check that the rotor turns easily.

   NOTE: Tighten pulley nut to 49-88 N·m (36-65 lb-ft).

ADJUSTMENTS

Refer to Section 03-05 for belt tension adjustment.

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	N·m	Lb-Ft
Ball Joint Clamp Bolt	43-54	32-40
Generator Fan Nut	49-88	36-65
Generator Through Bolts	3.8-5.5	33-49 Lb-In
Rectifier Retaining Screws	1.0-2.5	9-22 Lb-In
Voltage Regulator Retaining Screws	2.2-2.8	19-25 Lb-In
B+ Terminal to Rectifier Nut	8.0-11.0	70-97 Lb-In
B+ Terminal Adapter Nut	7.5-8.5	66-75 Lb-In
Wiring to B+ Terminal Nut	6.0-8.0	53-71 Lb-In
Radio Suppressor Screw	2.9-4.1	25-36 Lb-In
Bearing Plate Retainer Screws	2.1-3.0	18-27 Lb-In

SPECIAL SERVICE TOOLS

Tool Number	Description
D80L-1002-L	Bearing Puller