GROUP

CHARGING SYSTEM 31

(10000)

SECTION 31-01 Charging System—Service

VEHICLE APPLICATION

Capri.

DESCRIPTION AND OPERATION

The alternator charging system is a negative ground system consisting of an alternator 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 alternator and contains the alternator brushes.

DIAGNOSIS

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 31-02.
2. Inspect battery cable connections to starter and engine ground for surface dirt or foreign matter.
3. Check alternator 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 27-02 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 alternator output, no alternator output (indicated by the indicator lamp being on while the engine is running), or alternator output voltage too high, require testing of both the alternator and the voltage regulator.

DIAGNOSIS (Continued)

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

Discharge of the battery to ground through the alternator is prevented by the diodes of the alternator 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 making the repair.

1. **Polarity and Connections.** The alternator is for use on negative ground electrical systems only. Polarity cannot be reversed and any attempt to do so will damage the alternator.
2. **Installing Vehicle Battery.** Reversed battery connections will damage the alternator 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 alternator 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 alternator circuit while the engine is running.
5. Alternator Main Output Cable.
   - The cable connecting the alternator 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 alternator with the main output cable disconnected either at the alternator or battery end while the field remains energized or the rectifiers may be damaged.
6. **Arc Welding.** Isolate the control box and alternator 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 regulator ground and battery sensing wire. Tighten or service as required. Check the alternator voltage limiter setting. Replace if not to specification.
8. **Alternator Noisy.** When diagnosing the complaint of alternator noise, isolate the noise area and make sure that the alternator is at fault rather than the alternator belt, water pump, or another part of the vehicle. Start the engine and use a stethoscope or similar tool to isolate the noise. An alternator bearing, water pump bearing or belt noise is usually evidenced by a squealing sound.

   An alternator with a shorted diode will normally whine (magnetic noise) and will be most noticeable at idle speeds. Perform the alternator 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 alternator 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 alternator or water pump, remove the alternator 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 alternator, remove it and check bearings for play or roughness.
9. **Charge Indicator/Warning Lamp Flickers.** This condition may be caused by loose or damaged connections in the charging system wiring harness, worn brushes, or improper brush tension.

DIAGNOSIS (Continued)

CHARGING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE SOURCE	ACTION
• Battery Does Not Stay Charged — Engine Starts OK	• Battery. • Loose or worn alternator belt. • Wiring or cables. • Alternator. • Regulator. • Other vehicle electrical systems.	• Test battery, replace if necessary ②. • Adjust or replace belt ①. • Service as required ①. • Test and/or replace components as required ③. • Test, replace if necessary ④. • Check other systems for current draw. Service as required ④.
• Alternator Noisy	• Loose or worn alternator belt. • Bent pulley flanges. • Alternator.	• Adjust tension or replace belt ①. • Replace pulley ③. • Service or replace alternator③.
• Lamps and/or Fuses Burn Out Frequently	• Wiring. • Alternator/Regulator. • Battery.	• Service as required. • Test, service, replace if necessary ③ • Test, replace if necessary ②.
• Charge Indicator Lamp Flickers After Engine Starts or Comes On While Vehicle is Being Driven	• Loose or worn alternator belt. • Alternator. • Field circuit ground. • Regulator. • Lamp circuit wiring and connector. • Operation at low engine speed (idle) with heavy electrical load — IAR alternator only.	• Adjust tension or replace ①. • Service or replace ③. • Service or replace worn or damaged wiring. • Test, replace if necessary ③. • Service as required. • Test, replace if necessary.
• Charge Indicator Lamp Flickers While Vehicle is Being Driven	• Loose or worn alternator belt. • Loose or improper wiring connections. • Alternator. • Regulator.	• Adjust tension or replace belt ①. • Service as required. • Service or replace ③. • Test, replace if necessary ③.
• Voltmeter Pointer Reads in the Red Area (High or Low)	• Loose or worn alternator belt. • Damaged or worn wiring (battery to alternator for ground or open). • Field circuit ground. • Alternator. • Regulator. • Voltmeter indicator gauge wiring and connections. • Damaged or worn gauge. • Other vehicle electrical system malfunction.	• Adjust tension or replace ①. • Service or replace wiring. • Service or replace wiring. • Service or replace ③. • Test, replace if necessary ③. • Service as required. • Replace gauge. • Service as required.

① Refer to Section 27-02.
② Refer to Section 31-02.
③ Refer to Section 31-17.
④ Refer to procedure in this Section.

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TESTING

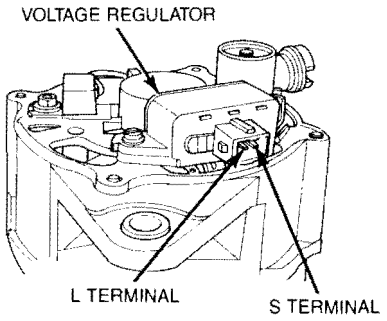
The following system test charts have been arranged in a series to isolate the component or cause of a charging system complaint.

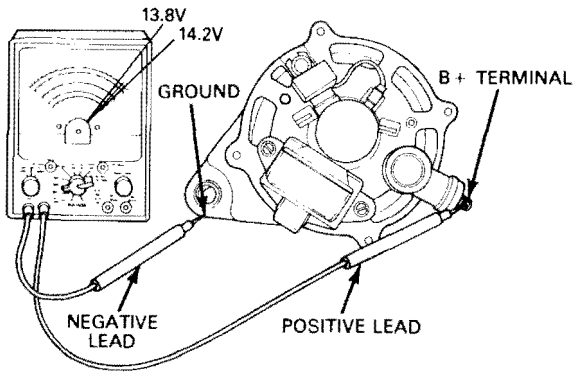
Start at the beginning and continue through the test steps even after the cause of the complaint is found. This will rule out the possibility that the original condition was not caused by more than one charging system problem.

TESTING (Continued)

CHARGING SYSTEM TEST

TEST STEP		RESULT	ACTION TO TAKE
A1	CHARGE LAMP FUNCTION CHECK		
• Without starting engine, turn ignition switch to RUN position. Charge lamp should come on.		Lamp functions properly ▶	GO to **A2.**
• Disconnect voltage regulator at alternator. Charge lamp should go off.		Lamp does not come on ▶	REPLACE lamp fuse or lamp bulb or SERVICE open in lamp feed circuit.
• Ground L terminal of voltage regulator connector to engine. Charge lamp should come on.		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 regulator. REFER to Section 31-17.
NOTE: Alternator shown removed for clarity only. Testing to be performed on wiring harness side.			
A2	BATTERY CONDITION		
• Perform sealed battery voltage/load test. Refer to Section 31-02.		Battery passes load test ▶	GO to **A3.**
		Battery fails load test ▶	REPLACE battery.
A3	B+ WIRING CHECK		
• With ignition switch in OFF position, use a voltmeter, such as Rotunda 014-00407 or equivalent to test for battery voltage at alternator B+ terminal.		Within 0.2 volts ▶	Go to **A4.**
• Voltage should be within 0.2 volts of battery voltage.		Greater than 0.2 volts ▶	SERVICE loose, corroded or damaged B+ wire.
NOTE: Test step must be performed with alternator installed and all wiring connected. Alternator shown removed for clarity only.			





TESTING (Continued)

CHARGING SYSTEM TEST — Continued

TEST STEP	RESULT ▶	ACTION TO TAKE
A4 BATTERY GROUND		
• Use a voltmeter to check voltage drop from battery negative post to ground.	Within 0.2 volts ▶	GO to **A5.**
• Voltage drop should be less than 0.2 volts.	Greater than 0.2 volts ▶	SERVICE loose or corroded connections or damaged ground cable.
A5 ALTERNATOR GROUND		
• Use a voltmeter to check voltage drop from alternator frame to engine ground	Within 0.2 volts ▶	Go to **A6.**
• Voltage drop should not exceed 0.2 volts.	Greater than 0.2 volts ▶	SERVICE excessive resistance in alternator mounting.
A6 BATTERY DRAIN TEST — KEY OFF		
• Turn ignition to OFF position.	Test lamp does not illuminate ▶	Go to **A7.**
• Disconnect battery positive cable.		
• Connect an ammeter or test lamp between battery positive terminal and positive cable.	Test lamp illuminates ▶	CHECK vehicle circuits for drain by pulling fuses from fuse panel one at a time until affected circuit is found. SERVICE as necessary.
• Current draw should be no more than .05 amps (clock draw). Test lamp should not light.		

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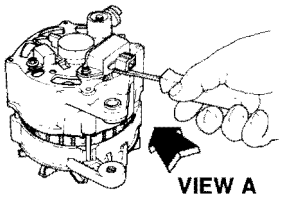
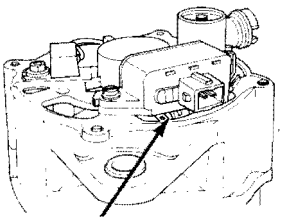
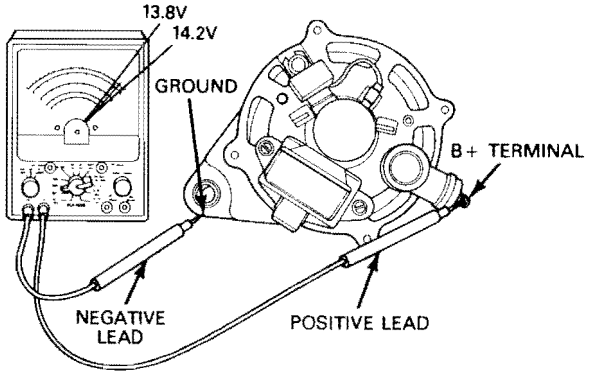
TESTING (Continued)

CHARGING SYSTEM TEST — Continued

TEST STEP	RESULT	ACTION TO TAKE
A7 REGULATOR BYPASS		
• Connect voltmeter across B+ terminal and ground.	16 volts ▶	REPLACE regulator.
• Start engine and run at an idle.	Less than 16 volts ▶	Go to **A8.**
• Use a screwdriver or other similar tool to ground connecting strip between brush assembly and regulator to alternator frame.		
• Increase engine speed slowly while monitoring voltage at B+ terminal.		
• Alternator should be capable of producing 16 volts.		
CAUTION: Do not increase engine speed any more than necessary to produce a 16 volt output. An unregulated alternator can produce excessively high voltage at high speed.		
 VIEW A BRIDGING BRUSH ASSY/ REGULATOR CONNECTING STRIP TO ALTERNATOR FRAME (GROUND)	 BRUSH ASSY/ REGULATOR CONNECTING STRIP VIEW A	
NOTE: Alternator shown removed for clarity only.		
A8 BASE VOLTAGE AND NO-LOAD TEST		
• Connect voltmeter across battery terminals. Read and record voltage (this is base reading).	Voltage increase but less than 2.5 volts ▶	GO to **A9.**
• Start engine, run at 1500 rpm with no electrical load. Voltage should increase from base reading, but not more than 2.5 volts.	No voltage increase or increase greater than 2.5 volts. ▶	SERVICE or REPLACE alternator or regulator. REFER to Section 31-15.
 13.8V 14.2V GROUND B+ TERMINAL NEGATIVE LEAD POSITIVE LEAD		
NOTE: Test step must be performed with alternator installed. Engine should be running at approximately 1500 rpm. Alternator shown removed for clarity only.		

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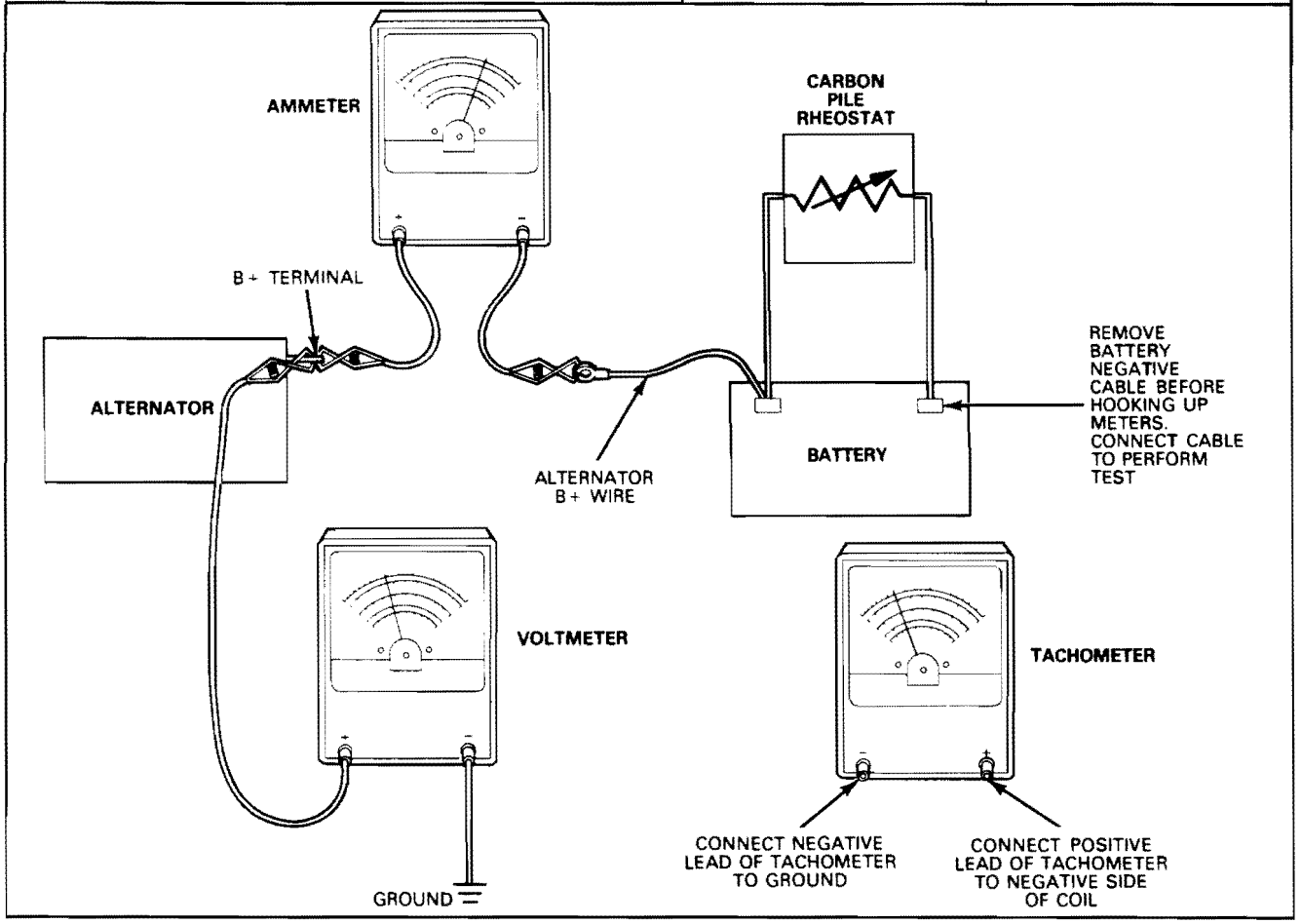
TESTING (Continued)

CHARGING SYSTEM TEST — Continued

TEST STEP		RESULT	ACTION TO TAKE
A9	LOAD TEST		
• Disconnect battery ground cable and alternator B + lead. • Connect a 100-amp ammeter between the alternator B + terminal and the B + lead. • Connect a carbon pile load rheostat across the battery terminals. Turn carbon pile to OFF or NO-LOAD before connecting. • Connect a voltmeter from B + terminal to ground.		Within limits ▶	Problem is not in charging system. CHECK other vehicle systems for a constant or intermittent current overdraw by repeating battery drain test with various auxiliary circuits tuned on.
• Start engine and run at an idle. Adjust carbon pile until the voltmeter reads 13.5 volts. Record ammeter reading. Repeat test step at 1000 and 2000 rpm. • Compare results with the following: ENGINE SPEED — OUTPUT CURRENT AT 13.5 VOLTS IDLE . . . . . 30-40 AMPS 1000 . . . . . 55-65 AMPS 2000 . . . . . 80-90 AMPS		Out of limits ▶	REPLACE or SERVICE alternator for shorted or open stator and field windings or diodes breaking down under load.



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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

SECTION 31-02 Batteries

VEHICLE APPLICATION

Capri.

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. AVOID CONTACT OF SULFURIC ACID WITH SKIN, EYES, CLOTHING AND VEHICLE.

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, OR CLOTHING. 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 Voltmeter 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.

TESTING (Continued)

BATTERY TESTING PROCEDURE

TEST STEP	RESULT	ACTION TO TAKE
A0 VISUAL INSPECTION		
• Remove negative cable, then positive cable. • Check for dirty or corroded connections.	Connections dirty or corroded.	CLEAN terminals and clamps. GO to **A1.**
	Connections clean.	GO to **A1.**
A1 LOOSE BATTERY POST		
• Check for loose battery post.	Battery post loose.	REPLACE battery.
	Battery post secure.	GO to **A2.**
A2 CRACKED BATTERY COVER		
• Remove holddowns and shields. • Check for broken/cracked case or cover.	Case cracked/broken.	REPLACE battery.
	Case is not cracked/broken.	GO to **A3.**
A3 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. RECOMMENDED DISCHARGE RATES Battery Capacity (Cold Cranking Amps) 460 CCA (Maintenance Free) — Discharge Rate (Amperes) 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	Below voltage limit.	CHARGE battery for 20 minutes at 35 amps. REPEAT **A3,** (if battery fails second check, replace battery.)
	At or above voltage limit.	GO to **A4.**
A4 VOLTAGE CHECK		
• Measure open circuit voltage of battery with a digital voltmeter capable of reading 1/100 V.	Over 12.4 V.	Battery OK.
	12.4 V or less.	CHARGE battery.

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TESTING (Continued)

Battery Capacity Test

A high rate discharge tester (Battery-Starter), such as Rotunda 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.
5. With the ammeter reading the required load for 15 seconds, note the voltmeter reading. Avoid leaving the high discharge load on the battery for periods longer than 15 seconds.
6. If the voltmeter reading is 9.6 volts at 21°C (70°F) or more, the battery has a good output capacity and will readily accept a charge, if required.
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 for the following conditions and service as necessary:

1. Loose alternator belt.
2. Pinched or grounded alternator / voltage regulator wiring harness.
3. Loose harness connections at the alternator and / or voltage regulator.
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 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.

TESTING (Continued)

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 31-01 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.
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

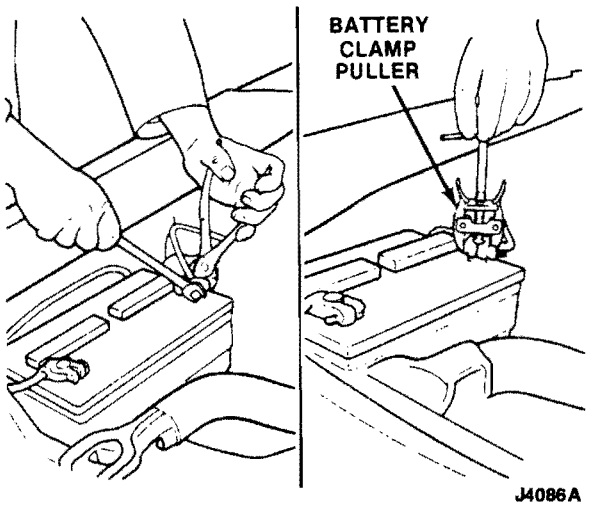
Tools

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.



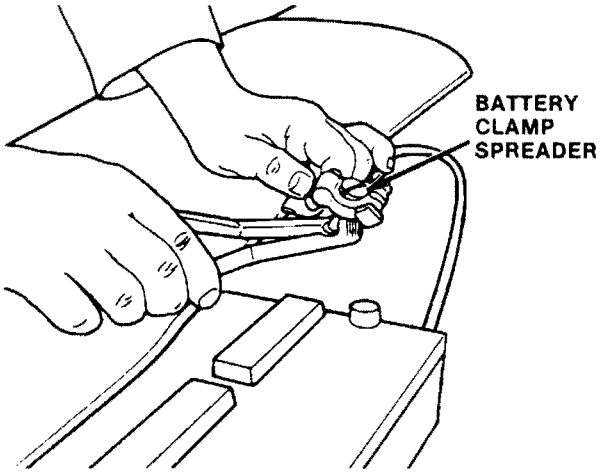
Battery Cable Puller

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.

SERVICE (Continued)

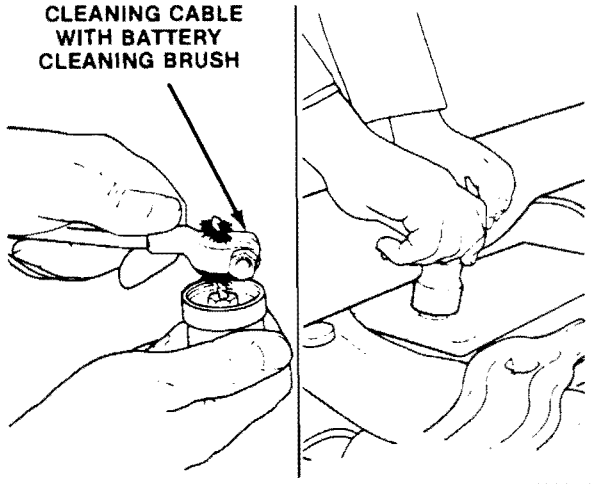
Battery Cable Clamp Spreader

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.



Terminal Cleaning Brush

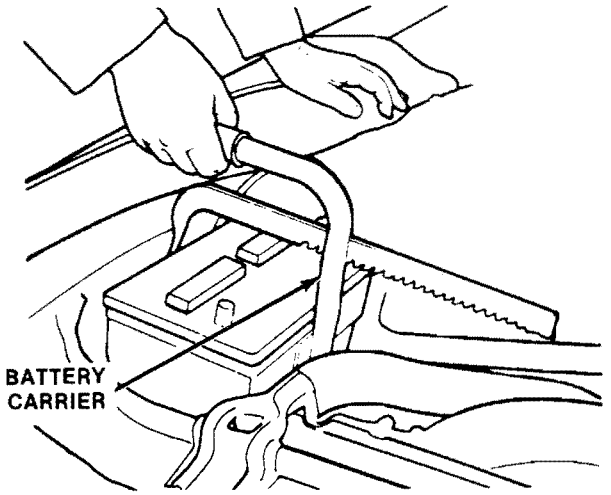
The terminal cleaning brush is designed with two parts to clean both the tapered battery terminal and the mating surface of the cable clamp.



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 Long-Life Lubricant C1AZ-19590-BA or equivalent grease to each battery post to help prevent corrosion.

MAINTENANCE (Continued)

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 Long-Life Lubricant C1AZ-19590-BA or equivalent grease to each battery post to help prevent corrosion.

J4088A

Jump Starting

Refer to Section 28-02.

SPECIAL SERVICE TOOLS

ROTUNDA EQUIPMENT

Model	Description
059-00010	Inductive Dwell-Tach-Volts Ohms Tester
078-00005	Starting and Charging Tester

SECTION 31-17 Alternator—Integral Regulator—External Fan Type

VEHICLE APPLICATION

Capri.

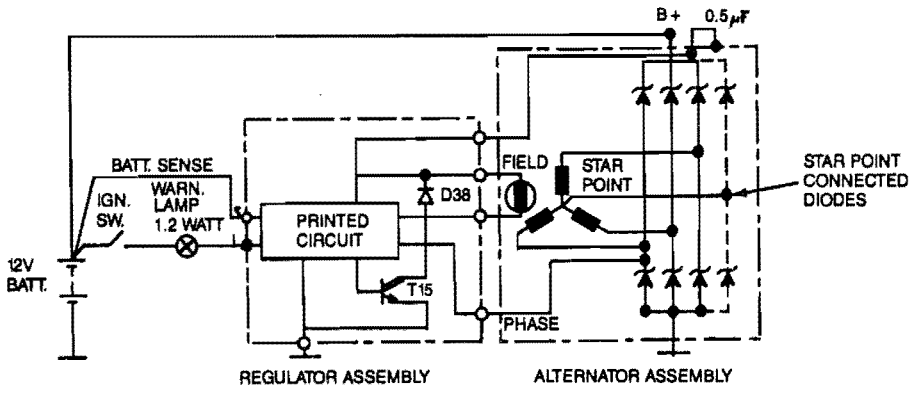
DESCRIPTION

The alternator is a 85-amp Bosch model. It is driven by a single V-belt and is mounted on the RH side of the engine.

The electronic voltage regulator is mounted on the back of the alternator with two retaining screws. The regulator and brush set are a single assembly.

The alternator is a conventional design with the rotor magnetic field spinning within the stationary stator windings. The rotor is supported in the housing on ball bearings which are pressed onto the shaft. Field current is supplied through the brush set that rides against the rotor slip rings. The cooling fan and pulley are attached to the rotor shaft with a nut and lock washer. The rotor bearings and stator are supported in a two-piece housing joined by four through bolts.

Because the voltage induced in the "Wye" wound stator produces alternating current, a rectifier assembly is installed between the stator and alternator output terminal. The rectifier assembly contains four positive and four negative silicon diodes that allow only the positive side of the alternating current to reach the alternator output terminal. The three-phase stator windings and rectifier assembly eliminate the pulsating AC current to produce a steady, positive DC current.



ADJUSTMENTS

Drive Belt Tension

Refer to Section 27-02 for drive belt adjustments.

REMOVAL AND INSTALLATION

Drive Belts

Refer to Section 27-02 for drive belt replacement procedure.

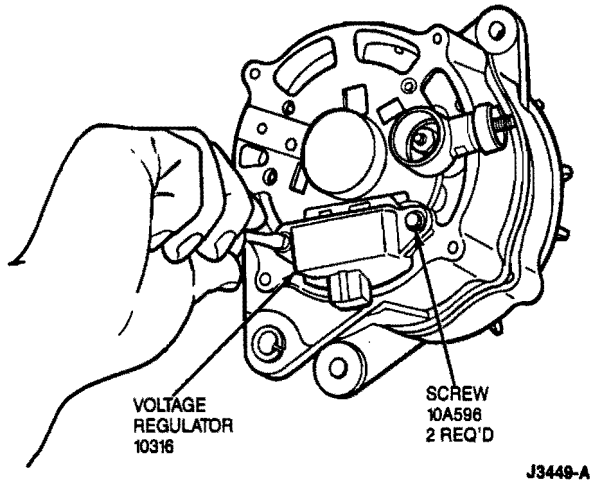
Voltage Regulator

Removal

1. Disconnect battery ground cable.
2. Raise vehicle on hoist.
3. Disconnect electrical connector from voltage regulator.
4. Remove voltage regulator retaining screws and regulator.

Installation

1. Position voltage regulator.
2. Hold regulator in position against brush spring tension. Install and tighten screws to 2.2-2.8 N·m (19-25 lb-in).
3. Connect electrical connector to voltage regulator.
4. Lower vehicle.
5. Connect battery ground cable.



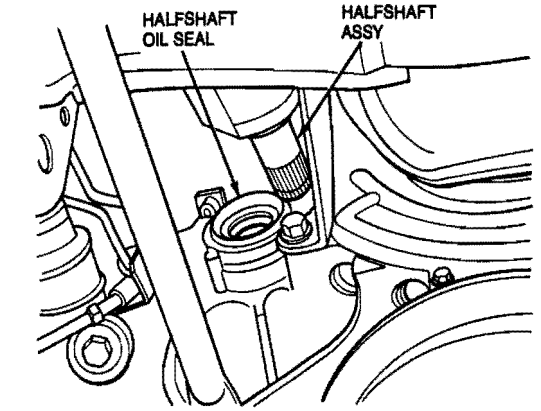
J3449-A

Alternator

Removal

1. Disconnect battery ground cable.
2. Remove alternator drive belt. Refer to Section 27-02.
3. Remove upper adjusting bolt.
4. Remove connector from B+ terminal by removing retaining nut.
5. Raise vehicle on a hoist. Refer to Section 10-04.
6. Disconnect voltage regulator connector.
7. On naturally aspirated vehicles, perform the following:
   a. Remove RH wheel and tire assembly.
   b. Remove RH ball joint clamp bolt.
   c. Separate knuckle from ball joint.
   d. Pull halfshaft out of transaxle and position as shown.

   CAUTION: Use care not to damage oil seal.

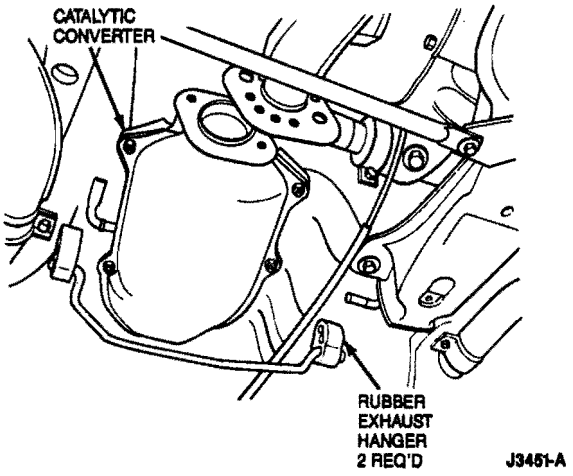


NOTE: POSITION HALFSHAFT ABOVE OIL SEAL.

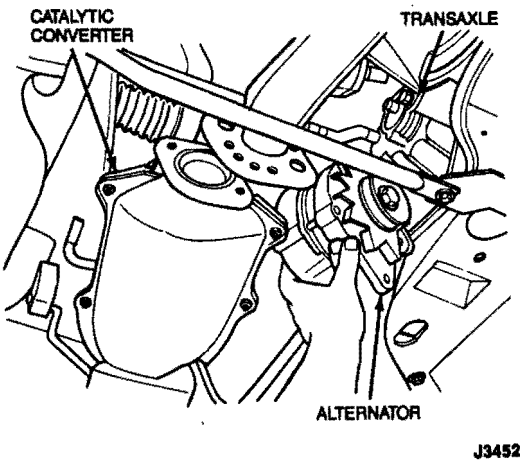
J3450-A

REMOVAL AND INSTALLATION (Continued)

8. Remove retaining nuts and separate catalytic converter from front exhaust pipe. Disconnect two rubber exhaust hangers and lower exhaust assembly. Wire exhaust assembly into position as shown.



9. Remove alternator through bolt.
10. Carefully move alternator to the LH side of the vehicle and remove alternator between transaxle and catalytic converter.



Installation

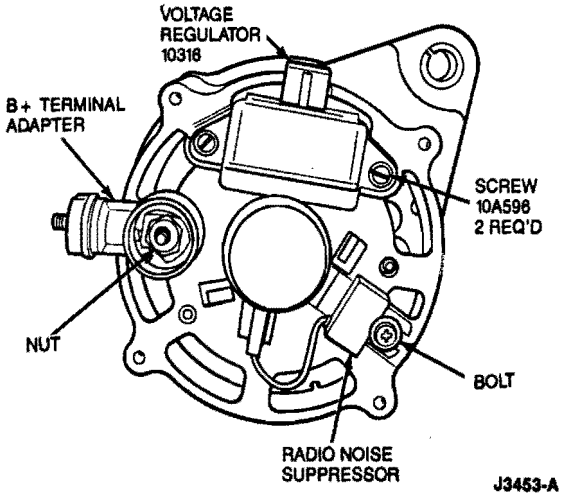
1. Install alternator in vehicle.
2. Install alternator through bolt.
3. Connect voltage regulator connector.
4. Connect catalytic converter to front exhaust pipe. Tighten nuts.
5. Connect rubber exhaust hangers.
6. On naturally aspirated vehicles, perform the following:
   a. Install new circlip on halfshaft.
   b. Position halfshaft into transaxle and align splines.
   c. Push inward on knuckle assembly until halfshaft is fully seated in transaxle.
   d. Position ball joint into knuckle assembly.
   e. Install ball joint clamp bolt. Tighten to 43-54 N·m (32-40 lb-ft).
   f. Install RH wheel and tire assembly.
7. Lower vehicle.
8. Connect B+ terminal and install retaining nut.
9. Install upper adjusting bolt.
10. Install alternator drive belt and adjust tension. Refer to Section 27-02.
11. Connect battery ground cable.

DISASSEMBLY AND ASSEMBLY

Alternator

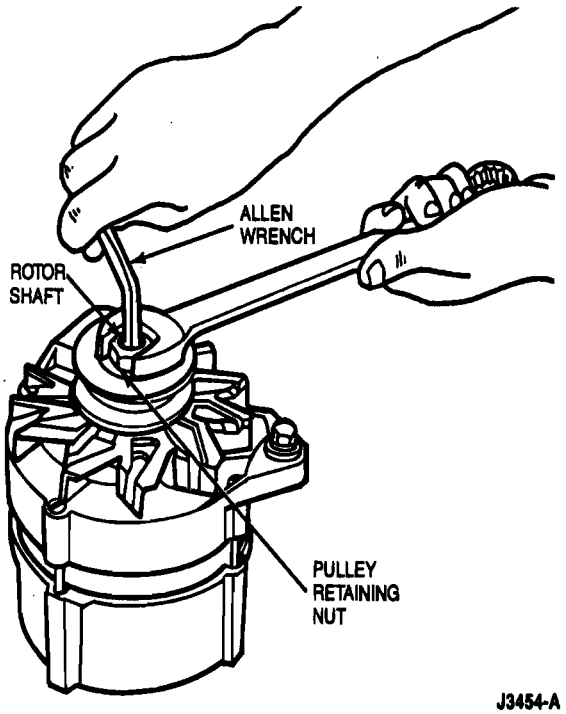
Disassembly

1. Remove B+ terminal adapter.
2. Remove voltage regulator.
3. Remove radio noise suppressor.

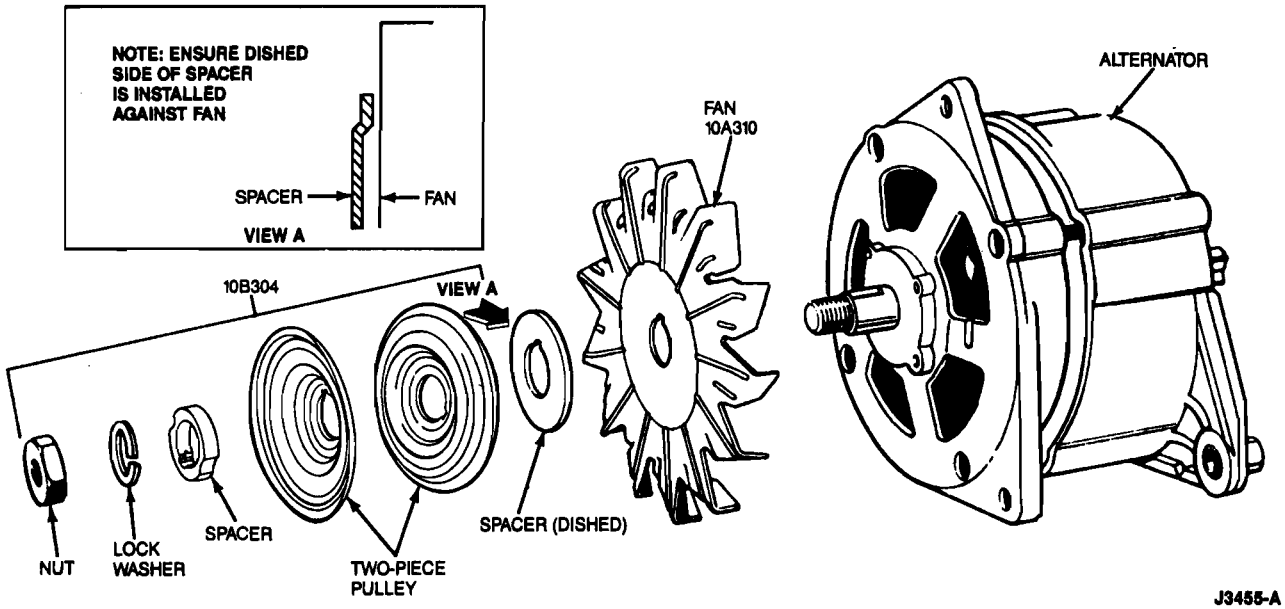


DISASSEMBLY AND ASSEMBLY (Continued)

4. Insert an 8mm Allen wrench in end of rotor shaft. Remove pulley attaching nut using a 24mm wrench.

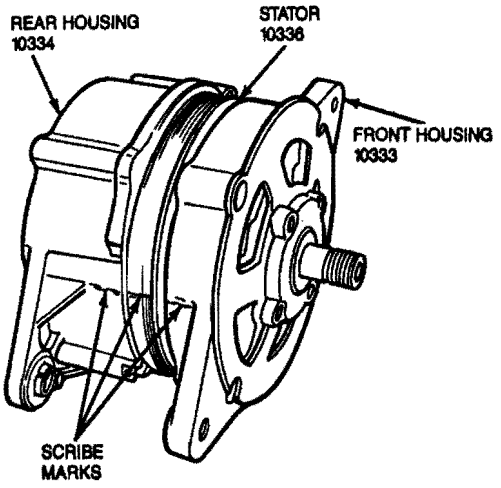


5. Remove two-piece drive pulley, spacer, washer, and fan from rotor shaft.



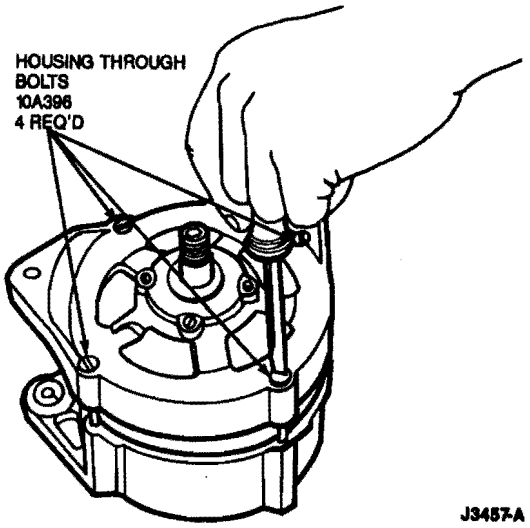
DISASSEMBLY AND ASSEMBLY (Continued)

6. Mark a line across end housing and stator for alignment reference during assembly.



J3456-A

7. Remove four housing through bolts.

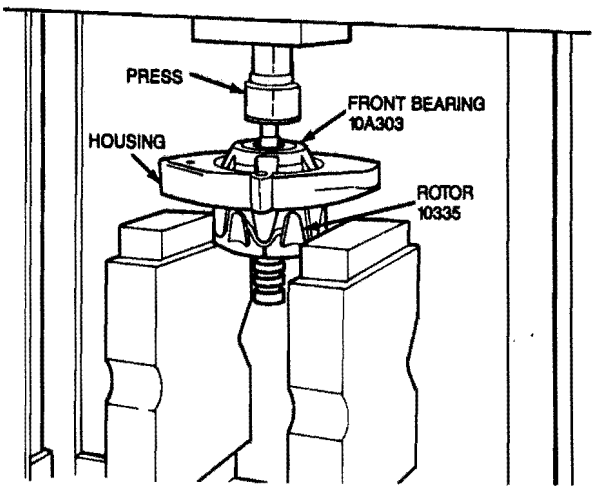


J3457-A

8. Separate front housing and rotor assembly from stator and rear housing assembly.

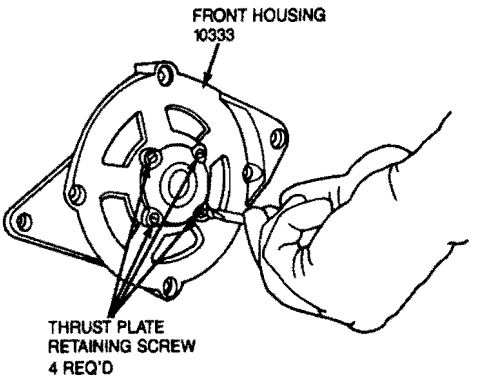
NOTE: Stator must remain with rear housing assembly to avoid damaging stator leads. If necessary, carefully pry front housing from stator frame using a screwdriver.

9. Press rotor from front housing using a suitable press.



J3458-A

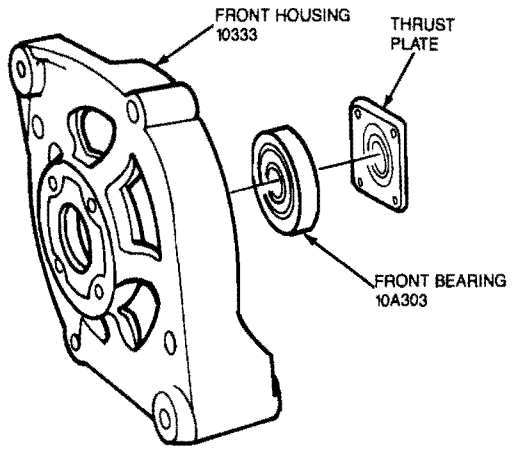
10. Remove four bearing thrust plate retaining screws.



J3459-A

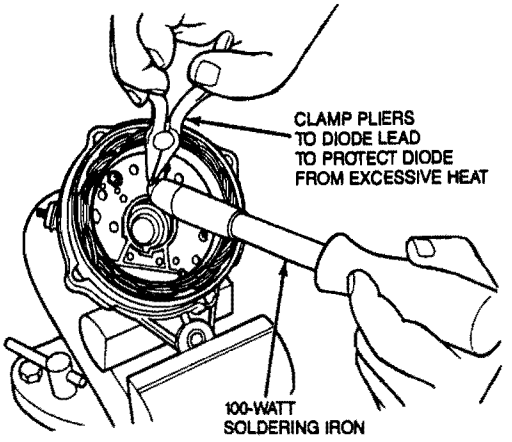
DISASSEMBLY AND ASSEMBLY (Continued)

11. Remove front bearing and thrust plate from front housing.



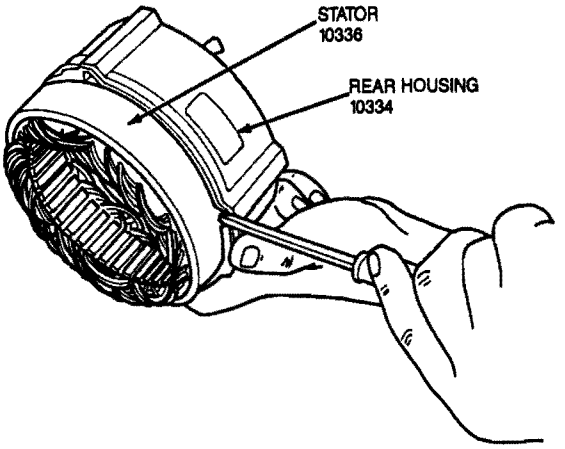
12. Using a 100 watt soldering iron, unsolder stator leads from rectifier assembly.

    NOTE: Do not allow the soldering iron to overheat the diodes. Needle nose pliers clamped to the diode lead can be used as a heat sink to absorb heat which would otherwise damage the diodes.

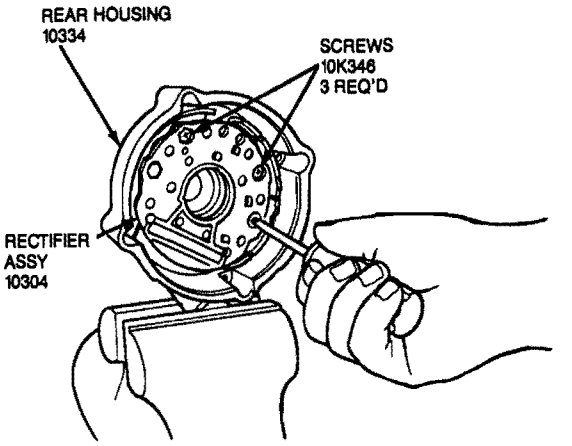


13. Remove stator from rear housing.

    NOTE: If necessary, carefully pry stator out of housing using a screwdriver.

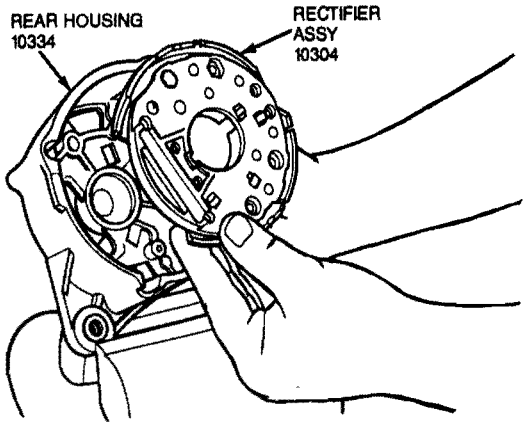


14. Remove three screws retaining rectifier assembly to rear housing.



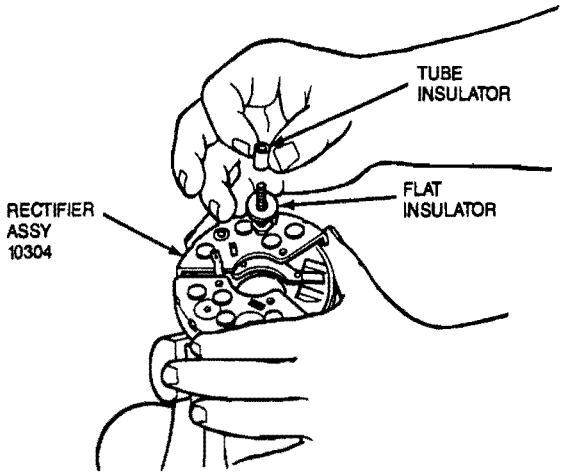
DISASSEMBLY AND ASSEMBLY (Continued)

15. Remove rectifier assembly from rear housing.



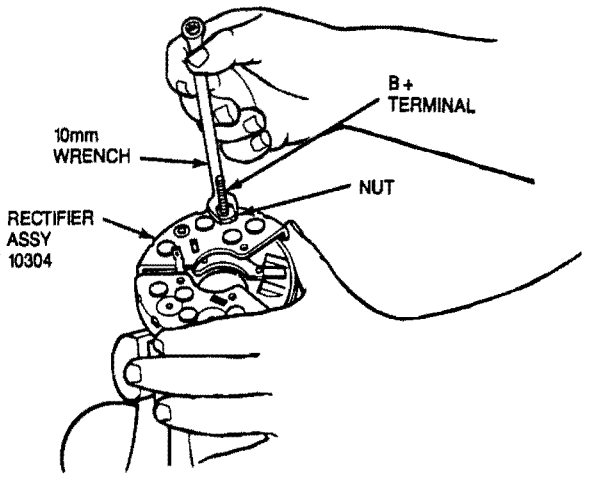
J3464-A

16. Remove insulator washers and insulators from B+ terminal screw.



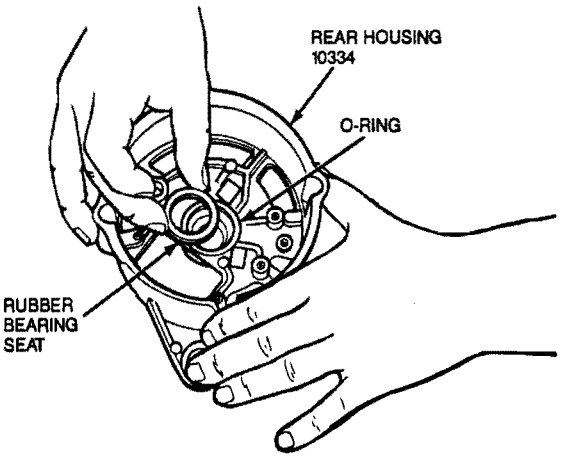
J3465-A

17. If necessary, remove output terminal retaining nut. Then, remove output terminal from stator assembly.



J3466-A

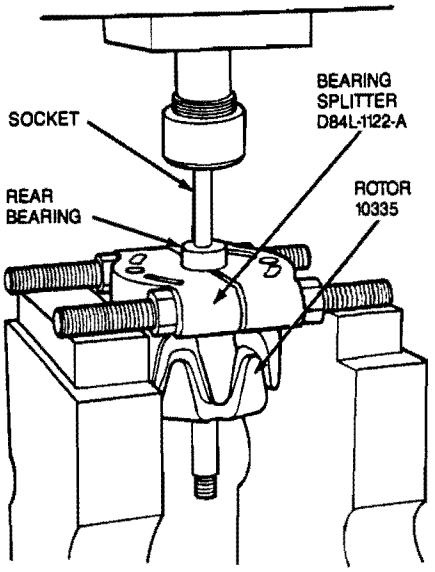
18. If necessary, remove rubber bearing seat from rear housing and inspect O-ring.



J3467-A

DISASSEMBLY AND ASSEMBLY (Continued)

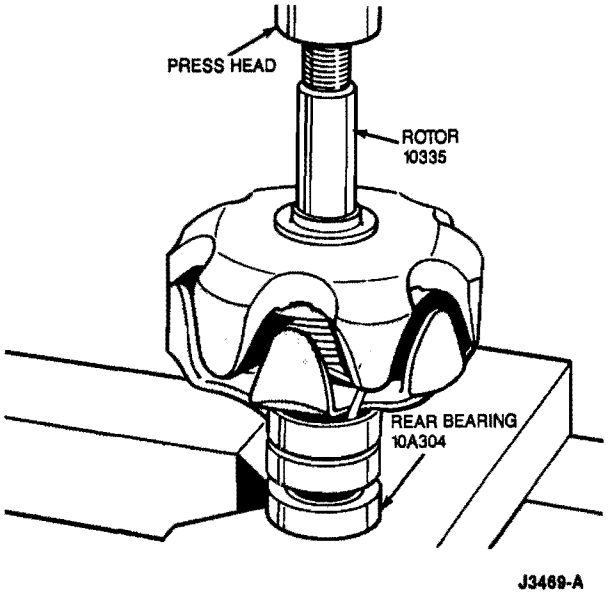
19. Remove rear bearing from rotor shaft using Bearing Splitter D84L-1122-A or equivalent.



J3468-A

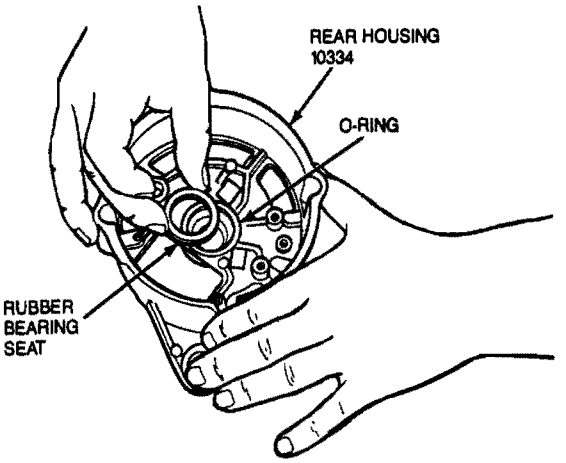
Assembly

1. Install rear bearing on rotor shaft using a suitable press.



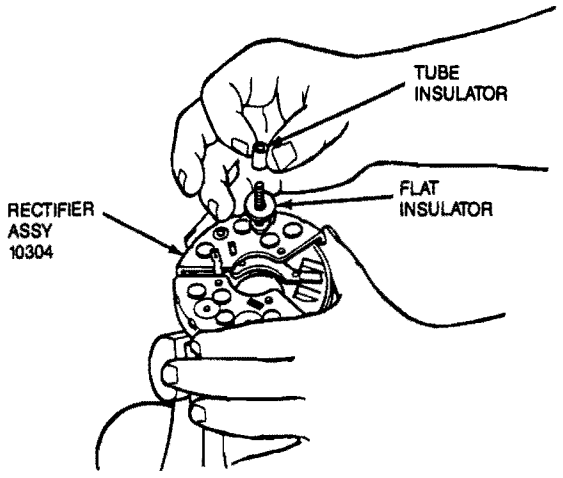
J3469-A

2. If removed, install rubber bearing seat in rear housing.



J3467-A

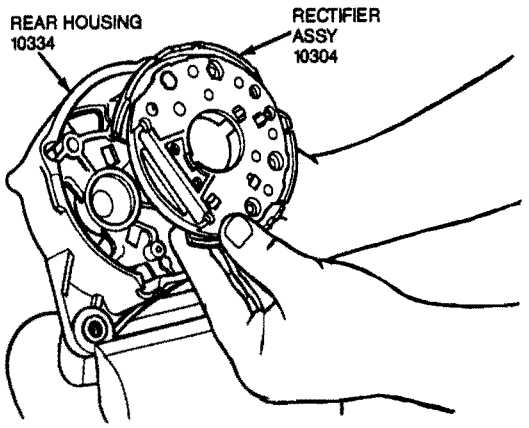
3. Install output terminal, if removed, in the rectifier assembly and tighten retaining nut to 8-11 N·m (70-97 lb-in).
4. Install insulator washers and insulators on B+ terminal screw.



J3465-A

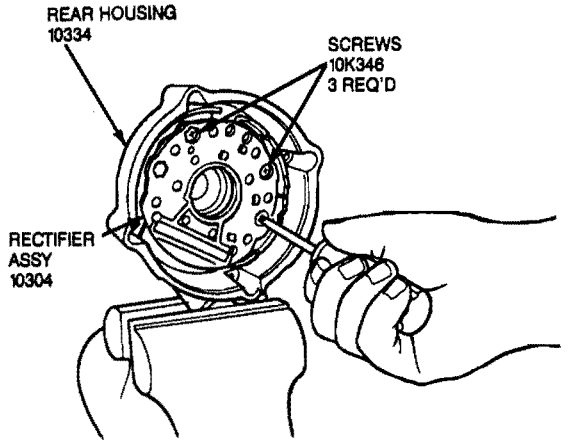
DISASSEMBLY AND ASSEMBLY (Continued)

5. Install rectifier assembly in rear housing.



J3464-A

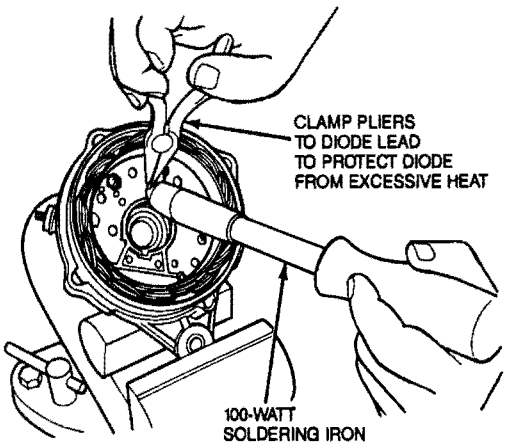
6. Install three rectifier assembly retaining screws and tighten to 1.0-2.5 N·m (9-22 lb-in).



J3463-A

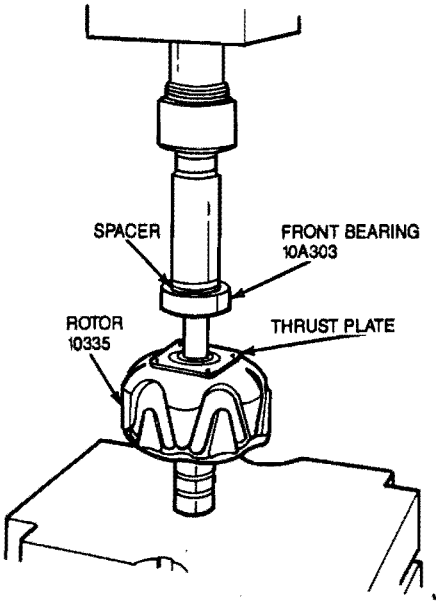
7. Position stator in rear housing. Route and connect stator leads to diodes as shown. Using a 100 watt soldering iron and rosin core solder, solder stator leads to diodes.

NOTE: Do not allow the soldering iron to overheat the diodes. Needle nose pliers clamped to the diode lead can be used as a heat sink to absorb heat which would otherwise damage the diodes.



J3461-A

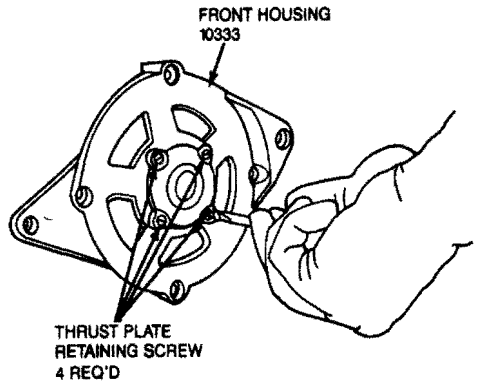
8. Install front bearing and thrust plate on rotor shaft using a suitable press.



J3470-A

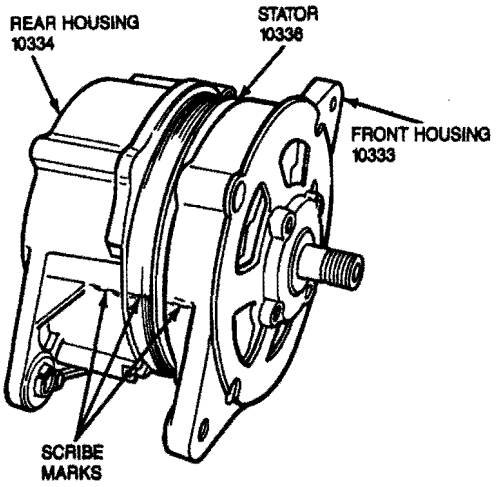
DISASSEMBLY AND ASSEMBLY (Continued)

9. Position front housing over rotor shaft. Install four thrust plate retaining screws and tighten to 2.1-3.0 N·m (18-27 lb-in).



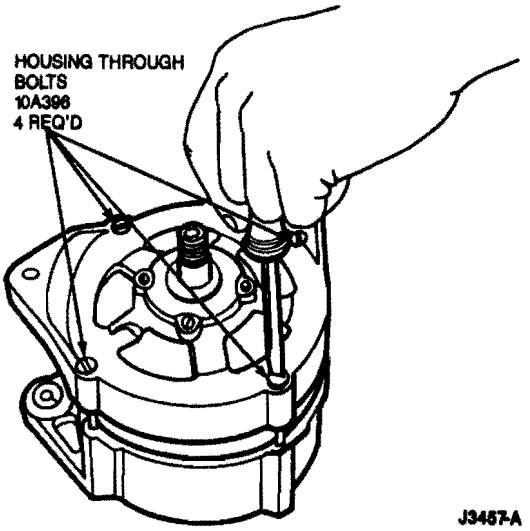
J3459-A

10. Position front housing and rotor assembly on rear housing and stator assembly using marks for alignment reference.



J3458-A

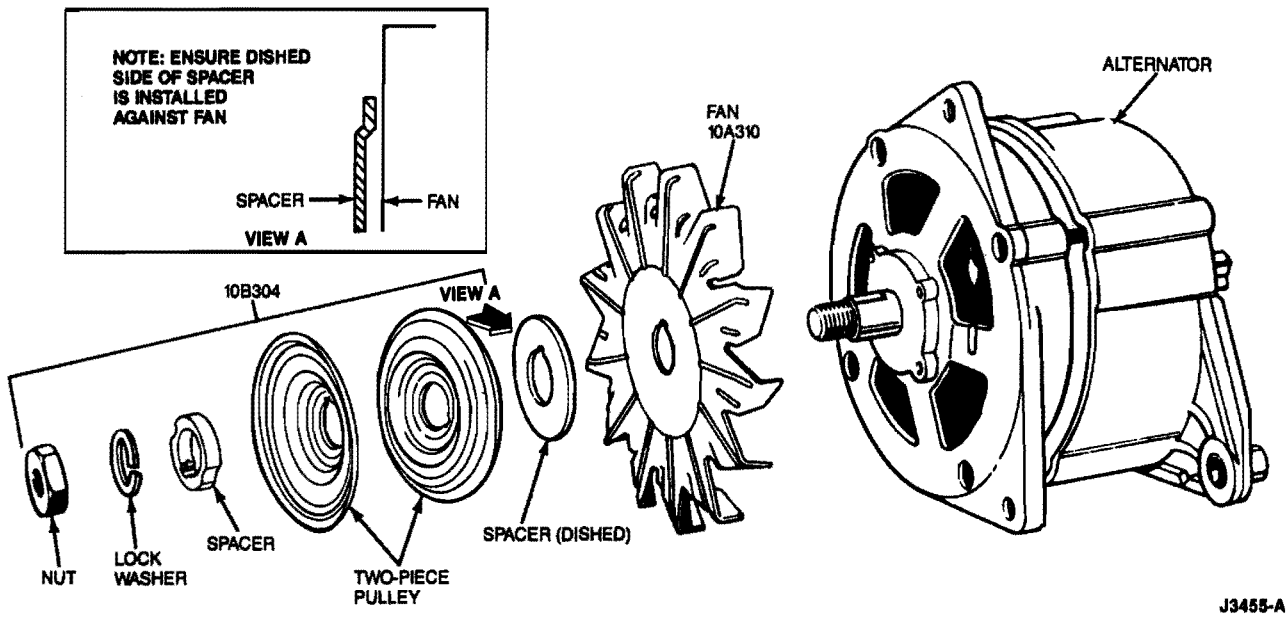
11. Install four housing through bolts. Tighten bolts to 3.8- 5.5 N·m (33-49 lb-in).



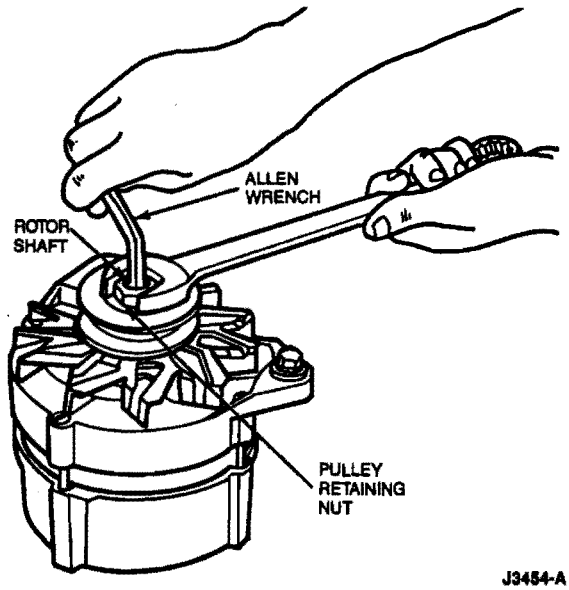
J3457-A

12. Install fan, washer, spacer and two-piece drive pulley retaining nut.

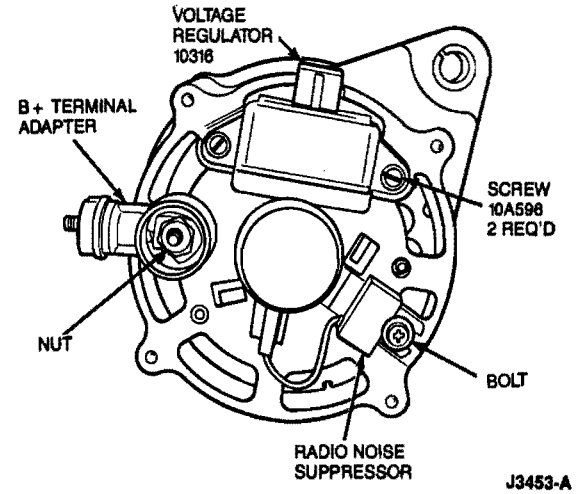
DISASSEMBLY AND ASSEMBLY (Continued)



13. Insert an 8mm Allen wrench into rotor shaft and using a 24mm wrench, tighten retaining nut to 54-68 N·m (40-50 lb-ft).



14. Install radio noise suppressor. Tighten screw to 2.9-4.1 N·m (25-36 lb-in).
15. Install voltage regulator. Tighten screws to 2.2-2.8 N·m (19-25 lb-in).
16. Install B+ terminal adapter. Tighten nut to 7.5-8.5 N·m (66-75 lb-in).



CLEANING AND INSPECTION

Whenever the alternator and regulator assemblies are removed from the vehicle and disassembled, a thorough inspection of the components should be performed as outlined in the component inspection chart.

CLEANING AND INSPECTION (Continued)

ALTERNATOR
COMPONENT VISUAL INSPECTION CHART

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

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.
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.

CJ3471-A

TESTING

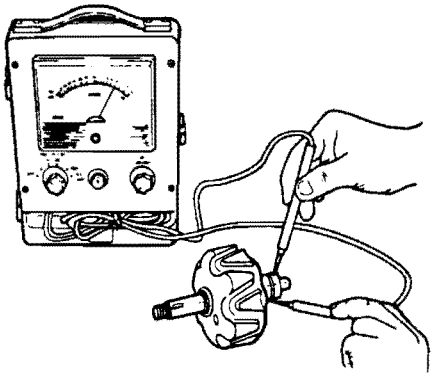
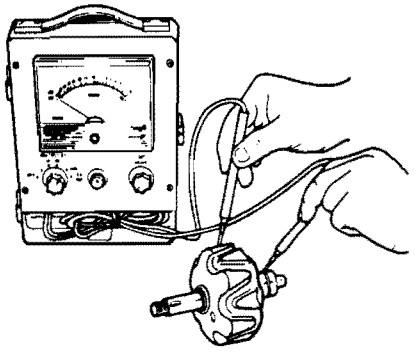
Alternator and regulator testing is broken down into on-vehicle testing and bench testing. Refer to Section 31-01 for all on-vehicle testing before proceeding to the following on-bench testing.

On-Bench Testing

In order to perform the component testing in the following charts, it will be necessary to partially or completely disassemble the alternator as outlined.

TESTING (Continued)

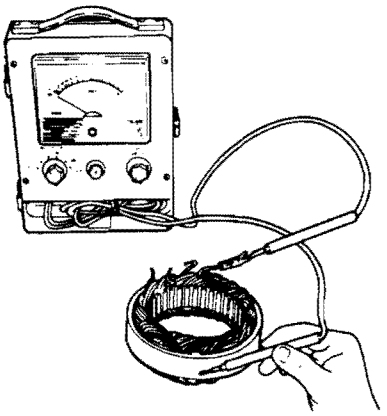
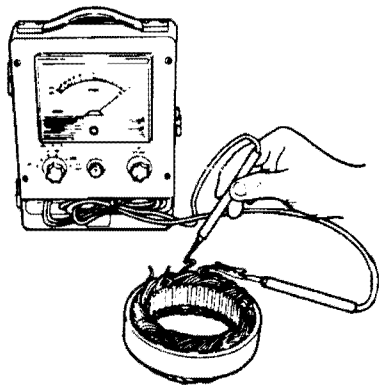
ALTERNATOR COMPONENT DIAGNOSIS AND TESTING

TEST STEP	RESULT	ACTION TO TAKE
A1 ROTOR COIL RESISTANCE		
• Set ohmmeter on XI scale. Connect meter leads across rotor slip rings. Resistance should be 2.8 ohms ± 5%. 	Rotor coil resistance 2.8 ohms ± 5% ▶	Rotor coil OK. GO to **A2.**
	Rotor coil outside specified 5% tolerance ▶	REPLACE rotor.
A2 ROTOR COIL GROUND		
• Set ohmmeter on XI scale. Place one meter test lead on rotor slip ring, other meter lead on a rotor pole. Repeat for other rotor slip ring. Ohmmeter reading should be infinite. 	Resistance infinite ▶	Rotor coil OK. GO to **A3.**
	Continuity between slip ring and rotor pole ▶	REPLACE rotor assembly.

CJ3472-A

TESTING (Continued)

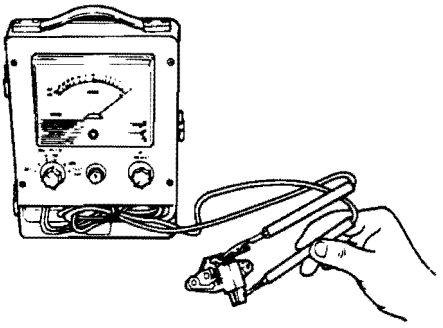
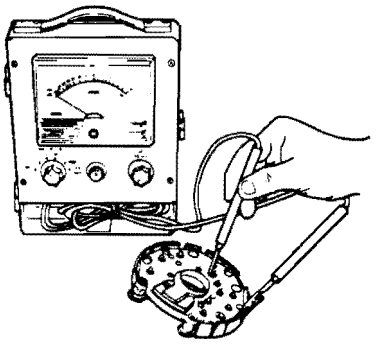
ALTERNATOR COMPONENT DIAGNOSIS AND TESTING — Continued

TEST STEP		RESULT	ACTION TO TAKE
A3	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 **A4.**
		Continuity between frame and stator lead: windings grounded ▶	REPLACE stator.
A4	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 **A5.**
		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 alternator fails to supply rated output, ahorted stator windings are probable. 		Shorted stator windings ▶	REPLACE stator.

CJ3473-A

TESTING (Continued)

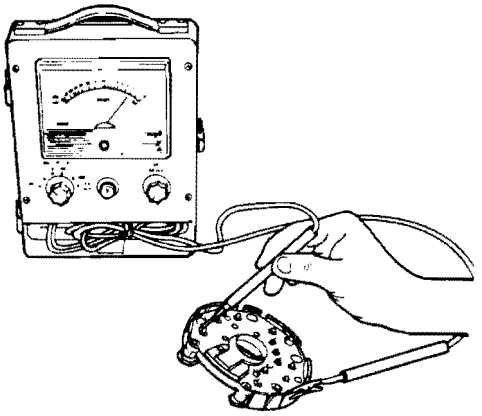
ALTERNATOR COMPONENT DIAGNOSIS AND TESTING — Continued

TEST STEP	RESULT	ACTION TO TAKE
A5 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. 	Continuity in both positions ▶	Brush circuits OK. GO to **A6.**
	Infinite resistance in either position: brush circuit open ▶	REPLACE brush and regulator as an assembly.
A6 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 ▶	Negative diodes OK. GO to **A7.**
	Continuity in both directions on any one rectifier: rectifier shorted ▶	REPLACE rectifier assembly.
	No continuity in either direction on any one rectifier: rectifier open ▶	REPLACE rectifier assembly.

CJ3474-A

TESTING (Continued)

ALTERNATOR COMPONENT DIAGNOSIS AND TESTING — Continued

TEST STEP		RESULT	ACTION TO TAKE
A7	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 ▶	Positive diodes OK.
		Continuity in both directions on any one rectifier: rectifier shorted ▶	REPLACE rectifier assembly.
		No continuity in either direction on any one rectifier: rectifier is open ▶	REPLACE rectifier assembly.

CJ3475-A

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Nem	Lb-Ft
Ball Joint Clamp Bolt	43-54	32-40 Lb-In
Alternator Fan Nut	54-68	40-50
Alternator 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
D84L-1122-A	Bearing Puller

ROTUNDA EQUIPMENT

Model	Description
014-00407	Digital Volt-Ohmmeter

SECTION 31-20 Ignition Switch

VEHICLE APPLICATION

Capri.

DESCRIPTION AND OPERATION

The ignition switch is mounted on the lock cylinder housing and is controlled by the lock cylinder through a pin which is part of the actuator assembly.

The lock cylinder also controls the mechanism which provides a positive lock for the steering system. The locking mechanism is located in the lock cylinder housing at the upper end of the steering column.

The lock cylinder positions are ACC, LOCK, OFF, RUN and START. The ACC position operates while the steering and transmission systems remain locked. Turning the key to the OFF position shuts off the engine without locking the steering.

Switch, Blade-Type

The switch has blade-type terminals that engage with one multiple connector. The multiple connector is secured to the switch by integral locking fingers.

A push-button steering wheel lock mechanism is used. This button, on the LH side of the steering column, must be pushed in before the ignition key can be removed.

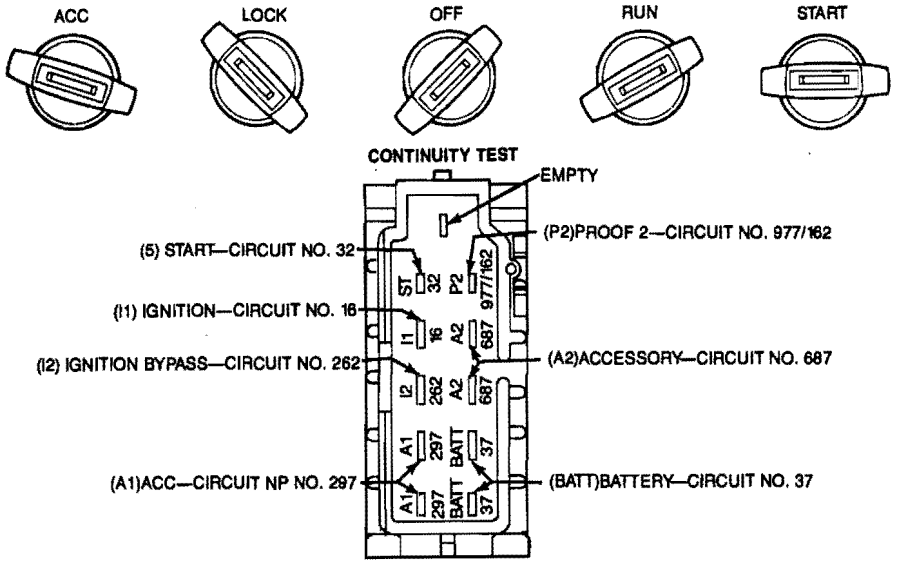
TESTING

Continuity Test

Disconnect the multiple connector by spreading apart the locking fingers on each end of the connector shell while pulling to disengage it from the ignition switch. Test the switch continuity as described in the following illustration. Connect a self-powered test lamp or ohmmeter between the blade terminals indicated on the chart. No continuity between any blade and chassis ground should exist in any switch position except the proof circuits (162 and 977) in the START position only.

For an "engine won't crank" condition, determine if the condition exists with the shift lever in both PARK and NEUTRAL positions before performing the ignition switch continuity tests. If the "no-crank" condition occurs in one shift lever position but not the other, a more probable cause is the neutral start switch located on the transmission.

TESTING (Continued)



SWITCH POSITION	CONTINUITY SHOULD EXIST ONLY BETWEEN
ACC	37 and 297
LOCK	NO CONTINUITY
OFF	NO CONTINUITY
RUN	37-16-687-297
START	977-162 CHASSIS GROUND 37-32-262

NOTE: CIRCUIT PAIRS 37,687 AND 297 ARE CONNCTED TOGETHER INTERNALLY

J3447-A

Mechanical Test

Test the steering column ignition system mechanical operation by rotating the lock cylinder/key through all switch positions. The movement should feel smooth with no sticking or binding. The ignition system should return from the START position back to the RUN position without assistance (spring return). If sticking or binding is encountered, check for the following.

- Burrs on the lock cylinder key.
- Shroud rubbing against lock cylinder.
- Burrs or foreign material around rack-and-pinion actuator in lock cylinder housing.
- Insufficient lube on actuator.
- Binding ignition switch.

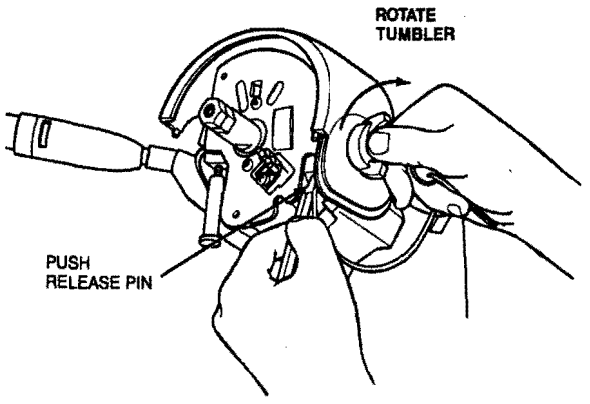
NOTE: Do not apply lubricant to inside of the ignition switch.

REMOVAL AND INSTALLATION

Ignition Lock Tumbler

Removal

1. Disconnect negative battery terminal.
2. Remove lower steering column shroud.
3. With ignition key installed, rotate tumbler while pushing release pin with a 3.17mm (0.125 inch) drift.
4. Remove tumbler assembly by pulling it out of housing.



G5823-A

REMOVAL AND INSTALLATION (Continued)

Installation

1. Install tumbler assembly with ignition key installed. Push release pin and rotate tumbler to install. Make sure tumbler is fully seated.
2. Install lower column shroud.
3. Connect negative battery terminal.
4. Check for proper operation.

Non-Functioning Locks

Removal

NOTE: The following procedure applies to vehicles in which the ignition lock is inoperative and the lock cylinder cannot be rotated due to a lost or broken lock cylinder key, the key number is not known, or the lock cylinder cap is damaged and / or broken to the extent that the lock cylinder cannot be rotated.

1. Remove lower steering column shroud.
2. Using a 1 / 8-inch diameter drill, drill out retaining pin, being cautious not to drill deeper than 12.7mm (1 / 2-inch).
3. Place a chisel at base of ignition lock cylinder cap, and using a hammer, strike chisel with sharp blows to break cap away from lock cylinder.
4. Using a 3 / 8-inch diameter drill, drill out middle of ignition lock key slot approximately 44mm (1-3 / 4 inches) until lock cylinder breaks loose from breakaway base of lock cylinder. Remove lock cylinder and drill shavings from lock cylinder housing.
5. Remove snap ring washer and steering column lock gear. Thoroughly clean all drill shavings and other foreign materials from casting.
6. Carefully inspect lock cylinder housing for damage. If any damage is apparent, housing must be replaced. Refer to Section 13-04.

Installation

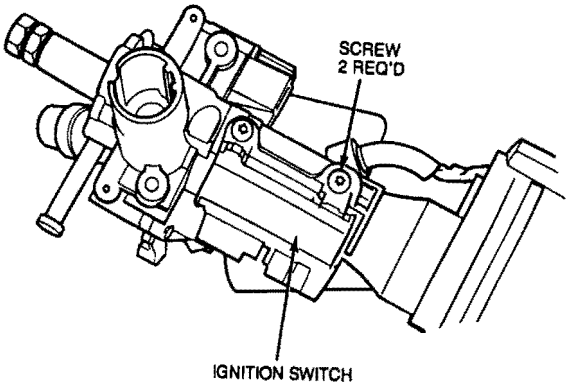
Install tumbler assembly as outlined.

Ignition Switch

Removal

1. Disconnect negative battery terminal.
2. Remove lower steering column shroud.
3. Remove center access panel and trim cover beneath steering column.
4. Remove LH side defroster connector tube.
5. Remove steering column upper retaining bolts. Column will pivot downward and rest on instrument panel brace.

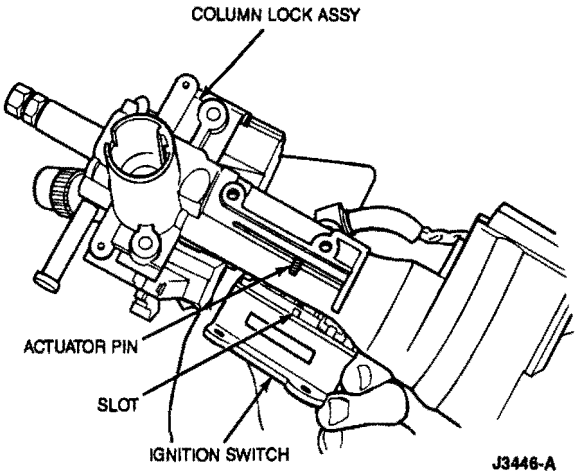
   CAUTION: Ensure that no wiring is pinched beneath the steering column when lowered.
6. Remove ignition tumbler as outlined.
7. Remove upper column cover.
8. Remove column lock shield.
9. Disconnect ignition switch connector.
10. Remove switch retaining screws and switch.



J3445-A

Installation

1. Position ignition switch to column lock assembly. Make sure actuator pin of lock assembly fits into slot in ignition switch.



J3446-A

2. Install switch retaining screws. Tighten to 5.6-7.9 N·m (50-70 lb-in).
3. Connect ignition switch electrical connector.
4. Install column lock shield. Tighten screws and nut to 15-19 N·m (11-14 lb-ft).
5. Install upper column shroud and lock tumbler assembly. Make sure tumbler snaps in place.

REMOVAL AND INSTALLATION (Continued)

6. Raise column and install upper retaining bolts. Tighten to 23-31 N·m (17-23 lb-ft).
7. Install defroster connector tube.
8. Install column lower shroud.
9. Install access panel and trim cover.
10. Connect negative battery terminal.
11. Check for proper operation.

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