

# Chapter 5 Engine electrical systems

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## Specifications

### Ignition coil

|                            |                     |
|----------------------------|---------------------|
| 1990 and earlier models    |                     |
| Primary resistance .....   | 1.35 to 1.65 ohms   |
| Secondary resistance ..... | 11.0 to 14.5 k-ohms |
| 1991 and later models      |                     |
| Primary resistance .....   | 0.72 to 8.88 ohms   |
| Secondary resistance ..... | 10.2 to 14.0 k-ohms |

### Distributor

|  |                                   |
|--|-----------------------------------|
| 1990 and earlier models                          |                                   |
| Igniter (pickup coil) resistance .....           | 130 to 190 ohms                   |
| Signal rotor air gap .....                       | 0.008 to 0.016 in (0.2 to 0.4 mm) |
| 1991 and later models (igniter continuity check) |                                   |
| Tracker and Sidekick                             |                                   |
| No voltage applied to G and IB terminals .....   | No continuity                     |
| Voltage applied to G and IB terminals .....      | Continuity                        |
| Samurai .....                                    | Specifications not available      |

### Alternator

|                                 |                    |
|---------------------------------|--------------------|
| Standard charging voltage ..... | 14.2 to 14.8 volts |
| Brush length                    |                    |
| Samurai                         |                    |
| Standard .....                  | 0.43 in (11 mm)    |
| Minimum .....                   | 0.20 in (5 mm)     |
| Sidekick/Tracker                |                    |
| Standard .....                  | 0.63 in (16 mm)    |
| Minimum .....                   | 0.08 in (2 mm)     |

## 1 General Information

The engine electrical systems include all ignition, charging and starting components. Because of their engine-related functions, these components are covered separately from chassis electrical devices such as the lights, instruments, etc. (which are included in Chapter 12).

Always observe the following precautions when working on the electrical systems:

- Be extremely careful when servicing engine electrical components. They're easily damaged if checked, connected or handled improperly.
- Never leave the ignition switch on for long periods of time with the engine off.
- Don't disconnect the battery cables while the engine is running.
- Maintain correct polarity when connecting a battery cable from another vehicle during jump starting.
- Always disconnect the negative cable first and hook it up last or the battery may be shorted by the tool being used to loosen the cable clamps.

It's also a good idea to review the safety-related information regarding the engine electrical systems located in the Safety first! Section near the front of this manual before beginning any operation included in this Chapter.

## 2 Battery – emergency jump starting

Refer to the Booster battery (jump) starting procedure at the front of this manual.

## 3 Battery – removal and installation

Refer to illustration 3.2

**Caution:** Always disconnect the negative cable first and hook it up last or the battery may be shorted by the tool being used to loosen the cable clamps.

- Disconnect both cables from the battery terminals.
- Remove the battery hold down clamp or strap (see illustration).
- Lift out the battery. Be careful – it's heavy.
- While the battery is out, inspect the carrier (tray) for corrosion (see Chapter 1).



3.2 Unscrew the nuts (arrows), then pull the hold down clamp off the battery

5 If you're replacing the battery, make sure you get one that's identical to the original, with the same dimensions, amperage rating, cold cranking rating, etc.

6 Installation is the reverse of removal.

## 4 Battery cables – check and replacement

1 Periodically inspect the entire length of each battery cable for damage, cracked or burned insulation and corrosion. Poor battery cable connections can cause starting problems and decreased engine performance.

2 Check the cable-to-terminal connections at the ends of the cables for cracks, loose wire strands and corrosion. The presence of white, fluffy deposits under the insulation at the cable terminal connection is a sign the cable is corroded and should be replaced. Check the terminals for distortion, missing mounting bolts and corrosion.

3 When removing the cables, always disconnect the negative cable first and hook it up last or the battery may be shorted by the tool used to loosen the cable clamps. Even if only the positive cable is being replaced, be sure to disconnect the negative cable from the battery first (see Chapter 1 for further information regarding battery cable removal).

4 Disconnect the old cables from the battery, then trace each of them to their opposite ends and detach them from the starter solenoid and ground terminals. Note the routing of each cable to ensure correct installation.

5 If you're replacing either or both of the cables, take the old ones along when buying new cables. It's very important to replace the cables with identical parts. Cables have characteristics that make them easy to identify: positive cables are usually red, larger in cross-section and have a larger diameter battery post clamp; ground cables are usually black, smaller in cross-section and have a slightly smaller diameter clamp for the negative post.

6 Clean the threads of the solenoid or ground connection with a wire brush to remove corrosion. Apply a light coat of battery terminal corrosion inhibitor, or petroleum jelly, to the threads to prevent future corrosion.

7 Attach the cable to the solenoid or ground connection and tighten the mounting nut/bolt securely.

8 Before connecting a new cable to the battery, make sure it reaches the battery post without having to be stretched.

9 Connect the positive cable first, followed by the negative cable.

## 5 Ignition system – general information and precautions

The ignition system includes the ignition switch, the battery, the coil, the primary (low voltage) and secondary (high voltage) wiring circuits, the distributor and the spark plugs.

When working on the ignition system, take the following precautions:

- Don't keep the ignition switch on for more than 10 seconds if the engine won't start.
- Always connect a tachometer by following the manufacturer's instructions. Some tachometers may be incompatible with the ignition system. Consult a dealer service department before buying a tachometer.
- Never ground the ignition coil terminals. Grounding the coil could result in damage to the igniter and/or the ignition coil.
- Don't disconnect the battery when the engine is running.
- Make sure the igniter is properly grounded.

## 6 Ignition system – check

1 Attach an inductive timing light to each plug wire, one at a time, and crank the engine.

- If the light flashes, voltage is reaching the plug.
- If the light doesn't flash, proceed to the next Step.

2 Inspect the spark plug wire(s), distributor cap, rotor and spark plug(s) (see Chapter 1).



**7.3a** With the primary wiring electrical connector (arrow) unplugged, check the resistance across the primary terminals (1990 and earlier models)



**7.4** When measuring the secondary coil resistance, insert a probe into the coil tower and connect the other lead to the positive (+) primary terminal (1990 and earlier models)

- 3 If the engine still won't start, check the ignition coil (see Section 7).
- 4 If the coil is functioning properly, proceed to check the igniter and generator (Section 11).

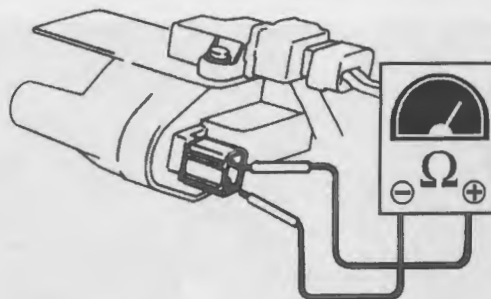
## 7 Ignition coil – check and replacement

Refer to illustrations 7.3, 7.4 and 7.8

### Check

**Note:** These checks should be done when the engine is cold so the coil is also cold.

- 1 Disconnect the cable from the negative terminal of the battery.
- 2 On 1990 and earlier models, follow the primary wiring harness from the ignition coil up to the electrical connector, then unplug the connector. If you can't find the electrical connector, detach the wires right at the coil by removing the nuts from the terminals. On 1991 and later models disconnect the electrical connector at the coil. On all model, disconnect the high tension lead from the coil tower.
- 3 Using an ohmmeter, measure the resistance across the primary terminals (see illustrations) and compare it to the figures listed in this Chapter's Specifications. If the resistance is not as specified, replace the coil.
- 4 Now measure the secondary resistance of the coil. Insert a pointed metal tool into the coil tower and attach one of the ohmmeter leads to it (see the accompanying illustration or illustration 7.3b). Connect the other lead to the positive primary terminal on the coil and read the meter. Compare the results to this Chapter's Specifications. If it isn't within the specified range, replace the coil.
- 5 Inspect the area around the coil tower for carbon tracking, which looks like fine pencil-drawn lines. This indicates an electrical shorting condition – if any carbon tracking is found, the coil must be replaced and the secondary wiring should be checked for excessive resistance (see Chapter 1).



**7.3b** Measuring the coil primary resistance on 1991 and later models (Sidekick/Tracker shown, Samurai similar) – to measure secondary resistance, measure between one of the primary terminals shown here and the secondary terminal (the terminal where the coil-to-distributor cap wire connects)



**7.8** The coil is attached to the firewall with two screws (1990 and earlier models)

### Replacement

- 6 Disconnect the cable from the negative battery terminal.
- 7 Label and disconnect the primary wires from the coil. Pull the high tension lead out of the coil tower.
- 8 Remove the coil bracket-to-firewall screws (see illustration) and detach the coil.
- 9 To install the coil, reverse the removal procedure. If the new coil doesn't come with a bracket, loosen the clamp screw on the old bracket and slide it off the coil. Slide the new coil into the bracket and tighten the clamp screw securely. When mounting the coil on the firewall, be sure to install the condenser, if equipped, under the upper mounting screw.

## 8 Distributor – removal and installation

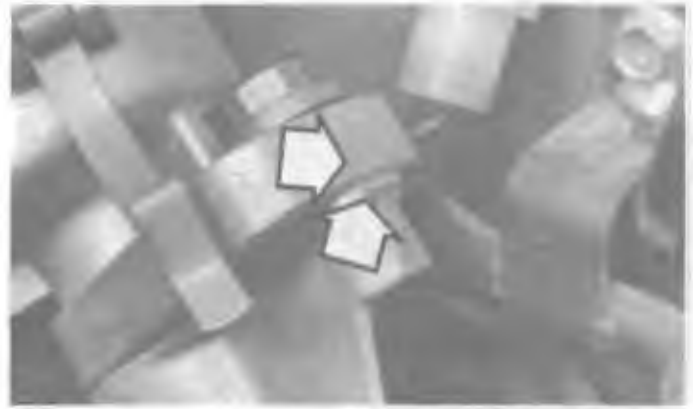
Refer to illustrations 8.5a and 8.5b

### Removal

- 1 Unplug the distributor primary lead wire (from the coil).
- 2 Unplug the electrical connector for the igniter. Follow the wires as they exit the distributor to find the connector.
- 3 Look for a raised "1" on the distributor cap. This marks the location for the number one cylinder spark plug wire terminal. If the cap doesn't have a mark for the number one terminal, locate the number one spark plug and trace the wire back to the terminal on the cap.
- 4 Remove the distributor cap (see Chapter 1) and turn the engine over until the rotor is pointing at the number one spark plug terminal (refer to the locating TDC procedure in Chapter 2).
- 5 Make a mark on the edge of the distributor body directly below the rotor tip and in line with it (see illustration). Also, mark the distributor base



**8.5a** Before removing the distributor, use chalk or a felt-tip pen to make an alignment mark on the edge of the distributor base directly beneath the rotor tip – DO NOT use a lead pencil



**8.5b** Mark the relationship of the distributor to the gear case as well



**9.3** Use a vacuum pump to check the operation of the vacuum advance unit

and the gear case to ensure the distributor is reinstalled correctly (see illustration).

**6** Remove the distributor hold down bolt and clamp, then pull the distributor straight out to remove it. **Caution:** DO NOT turn the crankshaft while the distributor is out of the engine – if you do, the alignment marks will be useless.

### Installation

**Note:** If the crankshaft has been moved while the distributor is out, the number one piston must be repositioned at TDC. This can be done by feeling for compression pressure at the number one plug hole as the crankshaft is turned. Once compression is felt, align the ignition timing zero mark with the pointer.

**7** Insert the distributor into the engine in exactly the same position it was when removed.

**8** To mesh the helical gears on the camshaft and distributor, it may be necessary to turn the rotor slightly. Recheck the alignment marks on the distributor base and gear case to verify the distributor is in the same position it was before removal. Also check the rotor to see if it's aligned with the mark on the edge of the distributor base.

**9** Place the hold down clamp in position and loosely install the bolt.

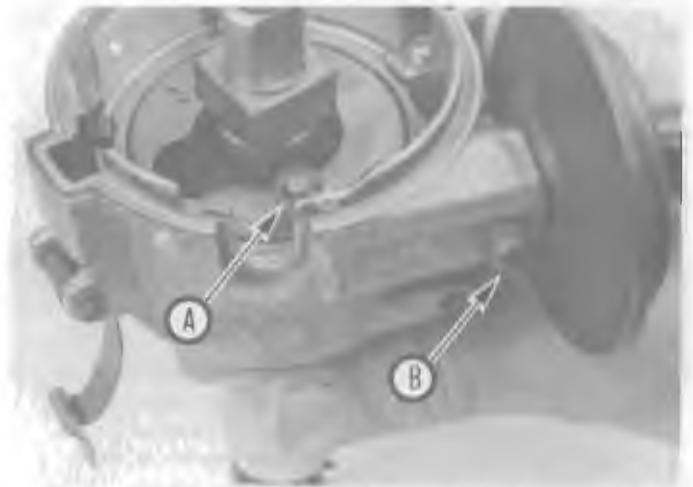
**10** Install the distributor cap.

**11** Plug in the electrical connectors.

**12** Reattach the spark plug wires to the plugs (if removed).

**13** Connect the cable to the negative terminal of the battery.

**14** Check the ignition timing (refer to Chapter 1) and tighten the distributor hold down bolt securely.



**9.5** The vacuum advance arm is secured to the pin on the generator base plate with an E-clip (Internal distributor components removed for clarity)

A E-clip

B Advance mechanism mounting screw

### 9 Vacuum advance unit – check and replacement (1990 and earlier models)

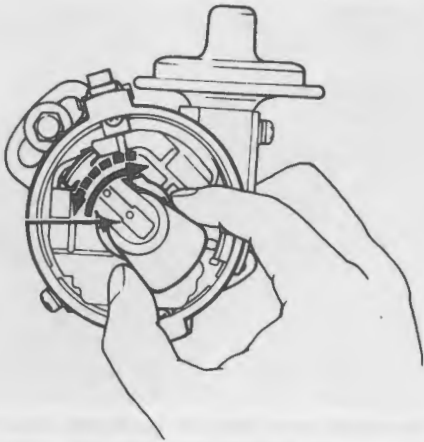
Refer to illustrations 9.3 and 9.5

#### Check

- 1 Disconnect the cable from the negative terminal of the battery.
- 2 Remove the distributor cap.
- 3 Disconnect the vacuum hose from the vacuum advance unit and connect a hand-held vacuum pump (see illustration). Apply vacuum and watch the generator base plate – it should rotate counterclockwise slightly. The needle on the vacuum pump gauge should also remain steady, indicating the diaphragm inside the advance unit is in good condition.
- 4 If the generator base plate doesn't move and the vacuum diaphragm doesn't hold vacuum, replace the advance unit. If the generator base plate doesn't move but the advance unit does hold vacuum, disconnect the advance unit arm from the pin on the generator base plate and attempt to turn the plate. If it moves smoothly, replace the advance unit. If the plate is stuck or doesn't move smoothly, replace it (Section 13).

#### Replacement

- 5 Using a small screwdriver or scribe, pry off the E-clip that retains the vacuum advance arm to the generator base plate (see illustration). Lift up on the advance arm and turn the generator base plate to disconnect the arm from the plate.



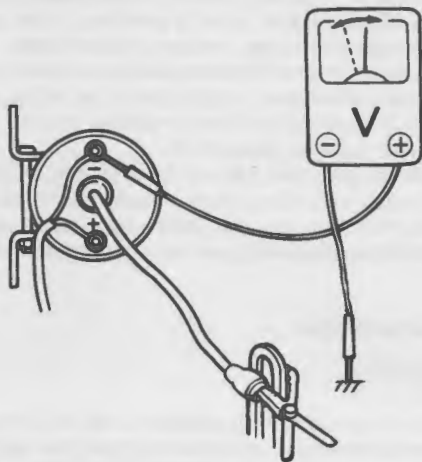
**10.3** If the centrifugal advance mechanism is functioning properly, the rotor should snap back to its original position after being turned clockwise

- 6 Remove the screw that secures the advance unit to the distributor body (see illustration 9.5). Slide the advance unit out of the distributor body, using a twisting motion if it's stuck.
- 7 Installation is the reverse of the removal procedure.

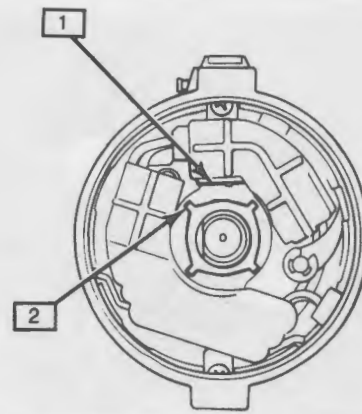
#### 10 Centrifugal advance mechanism – check (1990 and earlier models)

Refer to illustration 10.3

- 1 Disconnect the cable from the negative terminal of the battery.
- 2 Remove the distributor cap.
- 3 Turn the rotor clockwise and see if it snaps back (see illustration). It should turn smoothly, but you should be able to feel some spring resistance. If the distributor has been removed, you'll have to hold the distributor drive gear.
- 4 If the rotor won't turn, snap back to its original position or if it's sticky, the distributor must be replaced (individual centrifugal advance parts aren't available separately, at least not at the time of this writing – check with a dealer parts department or a parts store before removing any parts).



**11.2** Connect a voltmeter to the coil as shown, unplug the coil wire from the distributor cap and ground it, . . .



**11.1** The teeth on the signal rotor must be positioned as shown, in relation to the terminal on the Igniter, when testing the ignition primary circuit (1990 and earlier models)

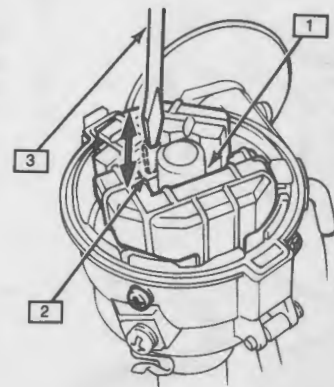
- 1 Igniter (pickup coil)      2 Signal rotor tooth

#### 11 Igniter, pick-up assembly and generator – check and replacement

##### 1990 and earlier models

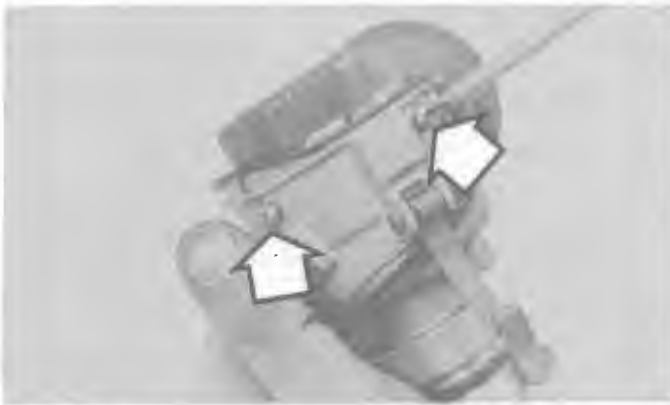
Refer to illustrations 11.1, 11.2, 11.3, 11.5, 11.6, 11.7 and 11.8

- 1 Remove the distributor cap and rotor and look at the relationship of the signal rotor to the igniter terminal. For the purposes of this test, the terminal on the igniter should be pointing between two of the teeth on the signal rotor (see illustration). If it isn't, turn the crankshaft until it is.
- 2 Connect the positive lead of a voltmeter to the negative terminal on the coil. Connect the negative terminal of the voltmeter to a good ground. Disconnect the high tension coil wire from the distributor and clip it to a good ground also (see illustration).
- 3 Turn the ignition switch to the On position, but don't crank the engine. Pass a standard screwdriver between the igniter terminal and a tooth on the signal rotor several times while looking at the voltmeter (see illustration). The needle on the meter should fluctuate a little bit – about 0.5 to 1 volt – from normal battery voltage. If it does, the generator and igniter are working properly.
- 4 If there's no voltage fluctuation, remove the distributor (Section 8).



**11.3** then pass a screwdriver between the Igniter and a tooth on the signal rotor – the voltage on the meter should fluctuate if the primary circuit is functioning properly (1990 and earlier models)

- 1 Signal rotor      3 Screwdriver  
2 Igniter



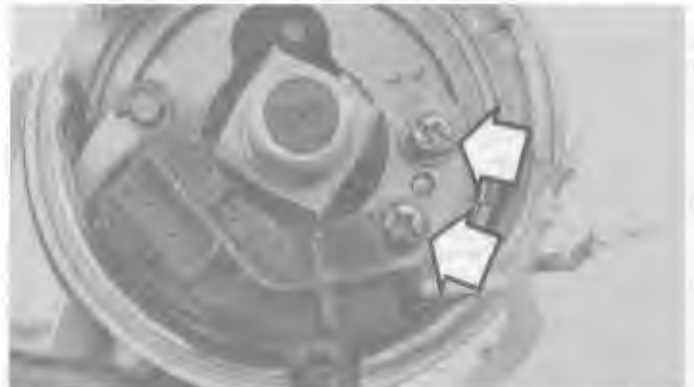
11.5 Remove the two screws (arrows) to detach the generator from the distributor body (1990 and earlier models)



11.6 Detach the plastic cover from the generator, then remove the screws that secure the igniter wires to it – the red or orange wire goes to the positive terminal and the white wire goes to the negative terminal (mark them if there's any uncertainty) (1990 and earlier models)

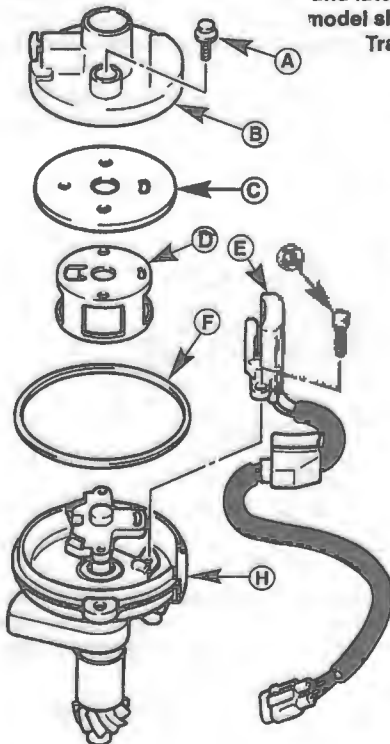


11.7 Measure the resistance of the igniter – if it isn't as specified, replace it (1990 and earlier models)



11.8 The igniter is held to the generator base plate with two screws (1990 and earlier models)

11.11 An exploded view of the distributor used on 1991 and later models (Samurai model shown, Sidekick and Tracker similar)



- A Rotor screw
- B Rotor
- C Shield cover
- D Signal rotor
- E Pick-up assembly
- F Seal
- G Screw
- H Distributor housing

5 Remove the two screws that retain the generator to the distributor body (see illustration), push the rubber grommet on the wiring harness up and out of the groove, then lift the generator out of the distributor.

6 Unclip the plastic cover on the generator, then remove the screws that secure the igniter wiring to the generator (see illustration).

7 Using an ohmmeter, measure the resistance across the igniter terminals (see illustration). If the reading doesn't fall within the range listed in this Chapter's Specifications, the igniter is defective. If the resistance reading is within the specified range, the generator is at fault.

8 To replace the igniter, remove the two screws that secure it to the generator base plate (see illustration). Attach the igniter to the base plate with the two screws, but don't tighten them completely until after the signal rotor air gap has been adjusted (Section 12).

9 When installing the generator, connect the orange (or red) wire from the igniter to the positive (+) terminal on the generator and the white wire to the negative (-) terminal, then snap the plastic cover into place.

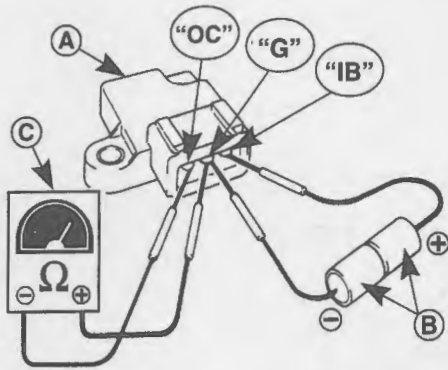
10 Install the distributor (Section 8) and adjust the ignition timing (see Chapter 1).

### 1991 and later models

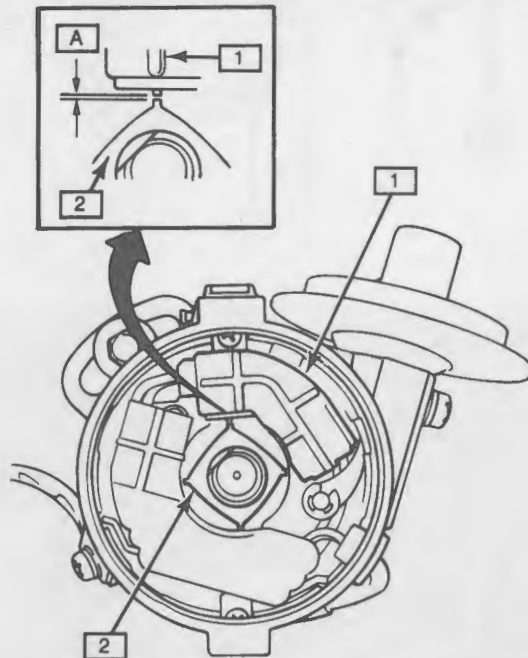
#### General Information

Refer to illustration 11.11

11 1991 and later models are equipped with a Hall-effect-type pick-up assembly that senses the passing of a shutter-type signal rotor that is attached to the distributor shaft (see illustration). The pick-up assembly senses the passing of each of the four shutters of the signal rotor (one for each engine cylinder) and sends a signal to the igniter and ECM that triggers ignition. The igniter amplifies the pick-up assembly's signal. It is mounted externally and is normally attached to the ignition coil.



11.14 Checking the igniter on 1991 and later models with two 1.5-volt batteries and an ohmmeter (Sidekick and Tracker models)



12.2 Align a tooth on the signal rotor with the igniter terminal and insert a brass feeler gauge between them to check the air gap

A Air gap  
1 Igniter terminal  
2 Signal rotor



12.3 The air gap can be adjusted by loosening the two igniter screws, inserting a screwdriver into the slot in the igniter and turning the screwdriver to pry the igniter toward or away from the signal rotor

### Check (igniter only)

Refer to illustration 11.14

**Note:** The following procedure applies to Sidekick and Tracker models only. On 1991 and later Samurai models, take the vehicle to a dealer service department or other qualified shop. Also, checking the pick-up assembly on all 1991 and later models is beyond the scope of the home mechanic. Take the vehicle to a dealer service department or other qualified shop.

12 Disconnect the electrical connector from the igniter, which is attached to the ignition coil.

13 Remove the igniter from the coil bracket.

14 Connect two 1.5 volt batteries in series so that their total output voltage is around 3 volts. Connect the positive terminal of an ohmmeter to the G terminal of the igniter and the negative terminal to the OC terminal. Apply the 3 volts between the G and IB terminal and make sure that there is continuity on the ohmmeter (see illustration). With no voltage applied, there should be no continuity. If the continuity is not as specified, replace the igniter.

### Replacement

15 To replace the igniter, disconnect the electrical connector, remove the mounting screws and lift the igniter from the coil bracket. Installation is the reverse of removal.

16 To replace the pick-up assembly, remove the distributor cap and rotor, lift off the shield cover or dust cover, then remove the signal rotor. If the signal rotor is damaged or bent, replace it.

17 Disconnect the electrical connector, remove the mounting screw and lift off the pick-up assembly. Installation is the reverse or removal.

### 12 Signal rotor air gap – adjustment (1990 and earlier models)

Refer to illustrations 12.2 and 12.3

1 Any time you replace the igniter – or remove it to get at the generator base plate – be sure to adjust the air gap before reinstalling the generator.

2 Remove the generator and loosen the igniter mounting screws. Place a BRASS feeler gauge of the specified thickness between one of the four projections on the signal rotor and the igniter (see illustration).

3 Gently pry the igniter toward the signal rotor until it's a snug – not tight – fit against the feeler gauge (see illustration).

4 Tighten the igniter mounting screws.

5 Check the adjustment by noting the amount of drag on the feeler gauge when you pull it out of the gap between the signal rotor and igniter. You should feel a slight amount of drag. If you feel excessive drag on the gauge, the gap is probably too small. If you don't feel any drag on the gauge when you pull it out, the air gap is too large.

6 Install the generator.

### 13 Distributor – disassembly and reassembly (1990 and earlier models)

Refer to illustrations 13.5a, 13.5b, 13.5c and 13.6

**Note:** On 1991 and later models, the manufacturer does not recommend disassembling the distributor. If the distributor is damaged or the shaft is worn, replace the distributor as a unit.

1 Disconnect the cable from the negative terminal of the battery.

2 Remove the distributor (Section 8).

3 Remove the generator and igniter (Section 11).

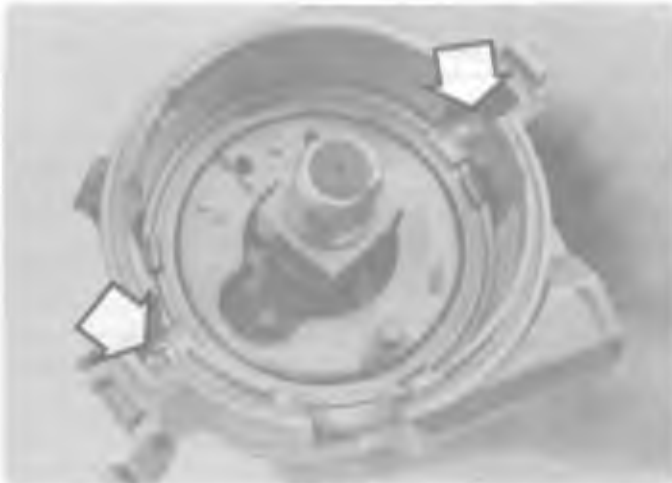
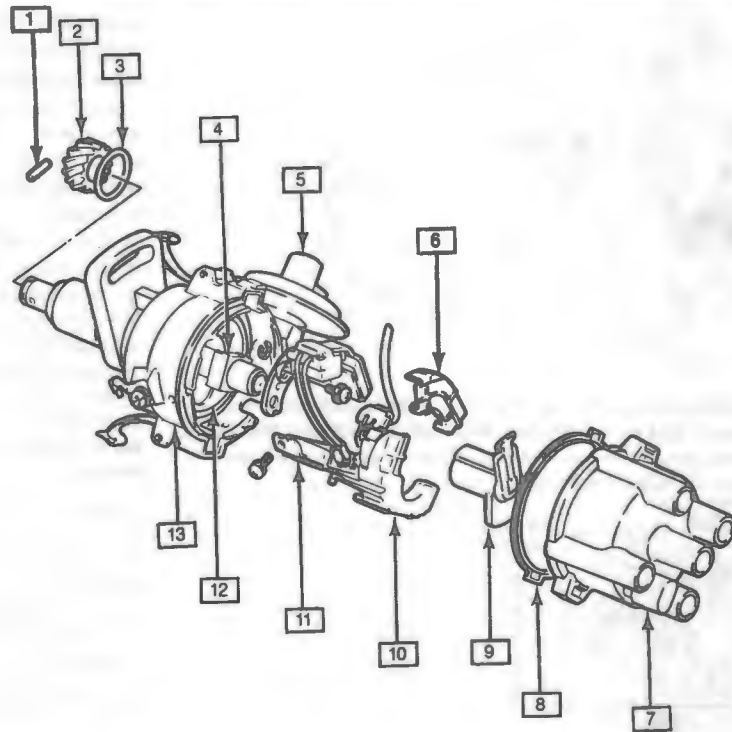
4 Remove the vacuum advance unit (Section 9).

5 Remove the two screws that retain the generator base plate to the distributor body, then lift the plate out (see illustrations). Check the plate for smooth rotation – if it's stuck or doesn't turn smoothly, replace it.

6 To remove the distributor drive gear, grind off the ends of the set pin (see illustration), then knock the pin out with a hammer and punch. The gear should now slide off the shaft. If it's stuck, a small gear puller can be used to remove it.

### 13.5a Exploded view of the distributor components

- 1 Set pin
- 2 Distributor drive gear
- 3 O-ring
- 4 Signal rotor
- 5 Vacuum advance assembly
- 6 Generator dust cover
- 7 Distributor cap
- 8 Seal
- 9 Rotor
- 10 Igniter dust cover
- 11 Igniter
- 12 Generator base plate
- 13 Distributor housing



**13.5b** When removing the generator base plate screws, be careful not to lose the small hold down plates

7 To install the gear, slide it onto the distributor shaft and align the set pin holes. Tap the new pin into place, thenpeen each end of the pin by hitting it with a hammer and punch while the other end is resting against a solid surface. This will prevent the pin from working its way out during engine operation.

8 Install the generator base plate—the four spring clips around the outer edge of the plate must line up with the four grooves in the distributor housing before the plate will drop down into position. Make sure the pin for the vacuum advance arm is located properly.

9 To reassemble the remainder of the distributor, reverse the disassembly sequence. Don't forget to adjust the signal rotor air gap following the procedure in Section 12.



**13.5c** When lifting the generator base plate out of the distributor body, be careful not to nick the signal rotor teeth



**13.6** Before attempting to knock the drive gear set pin out, grind off the ends

## 14 Charging system – general information and precautions

The charging system includes the alternator, an internal voltage regulator, a charge indicator, the battery, a fusible link and the wiring between

all the components. The charging system supplies electrical power for the ignition system, lights, radio, etc. The alternator is driven by a belt at the front of the engine.

The purpose of the voltage regulator is to limit the alternator's output



**15.6** If the charging voltage is low, insert a metal tool into the test hole in the rear of the alternator and take a voltage reading at the B+ terminal on the alternator – if the voltage rises, the regulator is faulty (alternator removed for clarity)

to a preset value. This prevents power surges, circuit overloads, etc., during peak voltage output.

The fusible link is a short length of insulated wire integral with the engine compartment wiring harness. The link is four wire gauges smaller than the wire in the circuit it protects. Production fusible links and their identification flags are identified by the flag color. See Chapter 12 for additional information on the fusible links.

The charging system doesn't ordinarily require periodic maintenance. However, the drivebelt, battery and wires and connections should be inspected at the intervals outlined in Chapter 1.

The dashboard warning light should come on when the ignition key is turned to Start, then go off immediately. If it remains on, there's a malfunction in the charging system (see Section 15). Some vehicles are also equipped with a voltmeter. If the voltmeter indicates abnormally high or low voltage, check the charging system (see Section 15).

Be very careful when making electrical test connections on a vehicle equipped with an alternator and note the following:

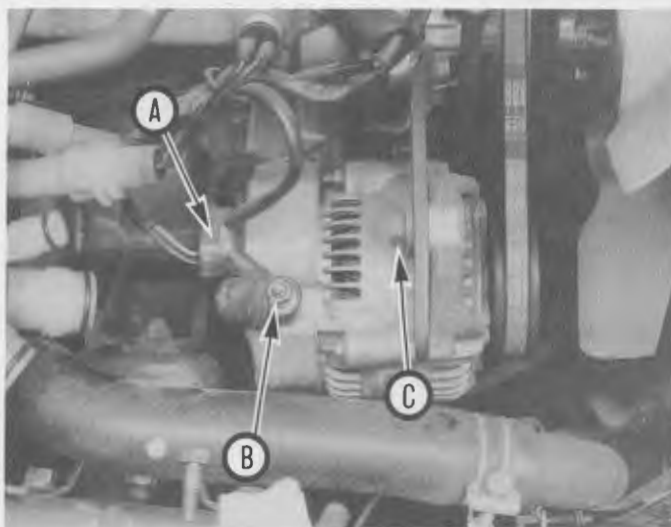
- a) When reconnecting wires to the alternator from the battery, be sure to note the polarity.
- b) Before using arc welding equipment to repair any part of the vehicle, disconnect the wires from the alternator and the battery terminals.
- c) Never start the engine with a battery charger connected.
- d) Always disconnect both battery cables before using a battery charger.
- e) The alternator is turned by an engine drivebelt which could cause serious injury if hands, hair or clothes become entangled in it with the engine running.
- f) Because the alternator is connected directly to the battery, it could arc or cause a fire if overloaded or shorted out.
- g) Wrap a plastic bag over the alternator and secure it with rubber bands before steam cleaning the engine.
- h) Never disconnect the battery while the engine is running.

## 15 Charging system – check

Refer to illustration 15.6

1 If a malfunction occurs in the charging system, don't automatically assume the alternator is causing the problem. First check the following items:

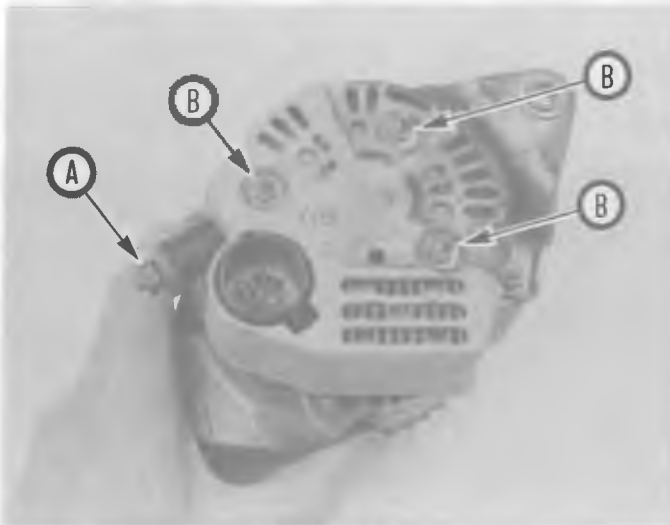
- a) Check the drivebelt tension and condition (Chapter 1). Replace it if it's worn or deteriorated.



**16.3** Alternator mounting details (Samurai shown, others similar)

- |   |                      |   |  |
|---|----------------------|---|--|
| A | Electrical connector | C | Adjusting bolt (pivot bolt on underside of alternator isn't visible in this photo) |
| B | B+ terminal          |   |  |

- b) Make sure the alternator mounting and adjustment bolts are tight.
- c) Inspect the alternator wiring harness and the connectors at the alternator. They must be in good condition and tight.
- d) Check the fusible link (if equipped) located between the battery and the alternator. If it's burned, determine the cause, repair the circuit and replace the link (the battery won't charge and/or the accessories won't work if the fusible link blows). Sometimes a fusible link may look good, but still be bad. If in doubt, remove it and check it for continuity.
- e) Start the engine and check the alternator for abnormal noises (a shrieking or squealing sound indicates a bad bearing).
- f) Check the specific gravity of the battery electrolyte. If it's low, charge the battery (doesn't apply to maintenance free batteries).
- g) Make sure the battery is fully charged (one bad cell in a battery can cause overcharging by the alternator).
- h) Disconnect the battery cables (negative first, then positive). Inspect the battery posts and the cable clamps for corrosion. Clean them thoroughly if necessary (see Chapter 1). Reconnect the cable to the negative terminal.
- i) With the key off, connect a test light between the negative battery post and the disconnected negative cable clamp.
  - 1) If the test light doesn't come on, reattach the clamp and proceed to Step 3.
  - 2) If the test light comes on, there's a short (drain) in the electrical system of the vehicle. The short must be repaired before the charging system can be checked.
  - 3) Disconnect the alternator wiring harness.
    - (a) If the light goes out, the alternator is bad.
    - (b) If the light stays on, pull each fuse until the light goes out (this will tell you which circuit is shorted).
- 2 Using a voltmeter, check the battery voltage with the engine off. It should be approximately 12-volts.
- 3 Start the engine and check the battery voltage again. It should now be approximately 14-to-15 volts.
- 4 Turn on the headlights. The voltage should drop, and then come back up, if the charging system is working properly.
- 5 If the voltage reading is more than the specified charging voltage, replace the voltage regulator (refer to Section 17). If the voltage is less, the alternator diode(s), stator or rectifier may be bad or the voltage regulator may be malfunctioning.
- 6 To isolate the problem component, insert a scribe or small screwdriver into the test hole in the rear of the alternator (see illustration), then start the engine. Measure the output voltage at terminal B (the large threaded



17.2 The alternator rear end cover is attached to the frame with three nuts (Samurai)

A B+ terminal (nuts must be loosened and insulator pulled away from the cover)      B Nuts

terminal on the alternator) – if the indicated voltage is higher than the standard charging value, replace the regulator.

7 If the indicated voltage is less than the standard charging value, the problem lies elsewhere in the alternator. It would be cheaper and easier to replace the alternator with a rebuilt unit rather than attempt to repair the problem.

## 16 Alternator – removal and installation

Refer to illustration 16.3

- 1 Detach the cable from the negative terminal of the battery.
- 2 Detach the electrical connectors from the alternator.
- 3 Loosen the alternator adjustment and pivot bolts and detach the drivebelt (see illustration).
- 4 Remove the bolts and separate the alternator from the engine.
- 5 If you're replacing the alternator, take the old one with you when purchasing a replacement unit. Make sure the new/rebuilt unit looks identical to the original. Look at the terminals – they should be the same in number, size and location as the terminals on the old alternator. Finally, look at the identification numbers – they'll be stamped into the housing or printed on a tag attached to the housing. Make sure the numbers are the same on both alternators.
- 6 Many new/rebuilt alternators DO NOT have a pulley installed, so you may have to switch the pulley from the old unit to the new/rebuilt one. When buying an alternator, find out the shop's policy regarding pulleys – some shops will perform this service free of charge.
- 7 Installation is the reverse of removal.
- 8 After the alternator is installed, adjust the drivebelt tension (see Chapter 1).
- 9 Check the charging voltage to verify proper operation of the alternator (see Section 14).

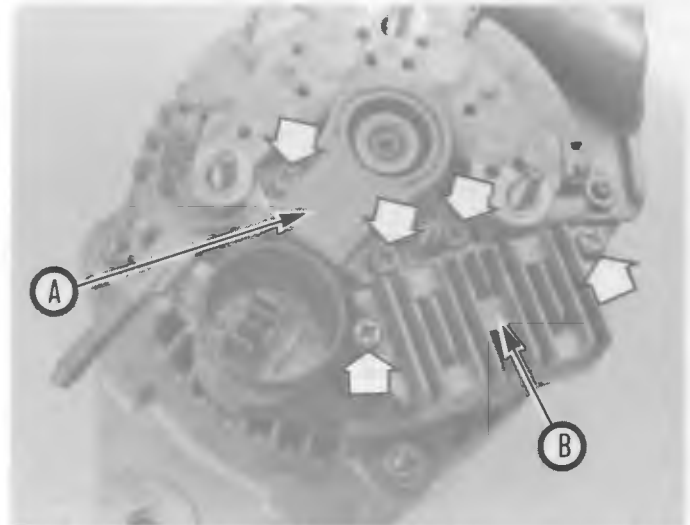
## 17 Voltage regulator and brushes – replacement

- 1 Remove the alternator from the vehicle (see Section 16).

### Samurai

Refer to illustrations 17.2, 17.3 and 17.4

- 2 Loosen the nuts on the B+ terminal and remove the three nuts that secure the rear end cover to the alternator end frame (see illustration). Lift off the cover.



17.3 The brush holder and voltage regulator are attached to the rear end frame with screws (Samurai)

A Brush holder      B Voltage regulator



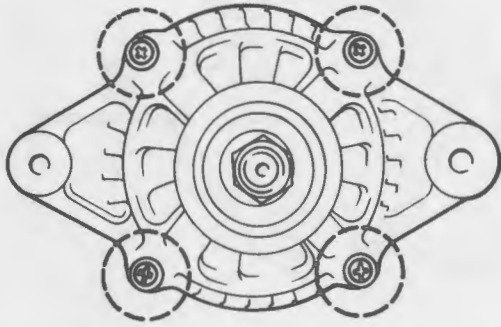
17.4 If the brushes are worn down below the minimum length, replace them with new ones

- 3 Remove the screws securing the voltage regulator and brush holder to the rear end frame (see illustration), then remove the regulator and brush holder.
- 4 Measure the length of each brush (see illustration). If they're worn below the minimum length listed in this Chapter's Specifications, replace the brush and holder assembly.
- 5 Installation of the components is the reverse of the removal procedure.

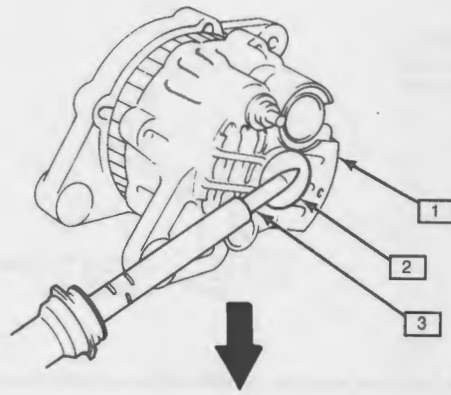
### Sidekick/Tracker

Refer to illustrations 17.7, 17.8a, 17.8b, 17.10, 17.11 and 17.13

- 6 Mark the relationship of the end frames to ensure they're reassembled correctly.
- 7 Remove the four housing screws (see illustration).
- 8 Using a 200 watt soldering iron, apply heat to the bearing box area on the alternator rear housing (see illustration). When the temperature

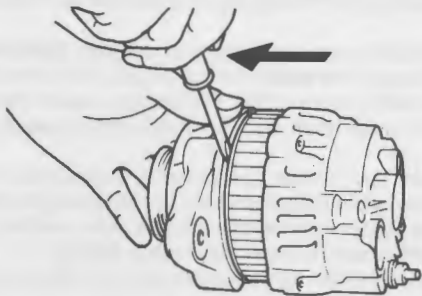


17.7 The two halves of the alternator are held together with these four screws (Tracker/Sidekick)



17.8a The alternator rear bearing must be heated before separating the two halves (Tracker/Sidekick)

- |   |                |   |                       |
|---|----------------|---|-----------------------|
| 1 | Rear end frame | 3 | Soldering iron (200W) |
| 2 | Bearing box    |   |                       |



17.8b Once the bearing box is hot enough, pry the two halves of the alternator apart (Tracker/Sidekick)

reaches 122-to-140 degrees F, pry the front housing from the stator core (see illustration).

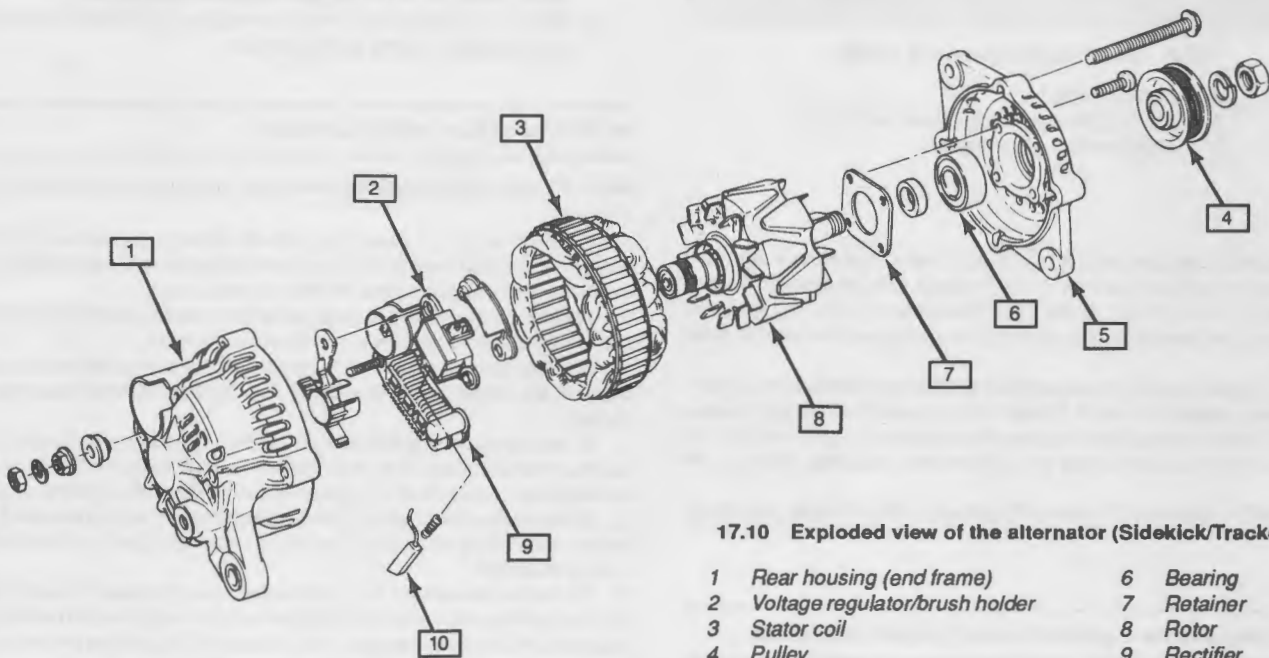
9 Remove the nut from the B+ post, remove the stator-to-rear frame screws and detach the stator from the rear frame.

10 Separate the regulator/brush holder from the end frame (see illustration). Remove the wire cover from the brush holder, then unsolder the leads from the brushes. Measure the brushes as described in Step 4 (replace them if they're worn excessively).

11 Install the brushes by reversing the removal procedure. Make sure the brushes are installed in the correct relationship to the slip rings (see illustration).

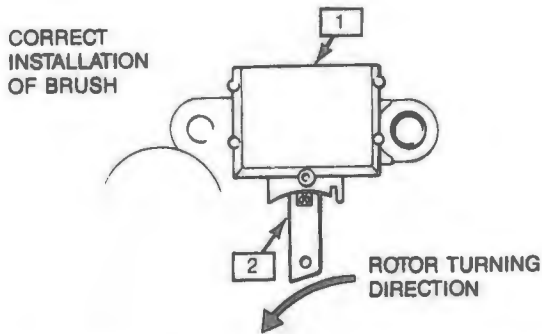
12 If the regulator is faulty, replace it along with a new set of brushes. Set the new regulator/brush holder in position, lower the stator into the end frame and install the screws.

5



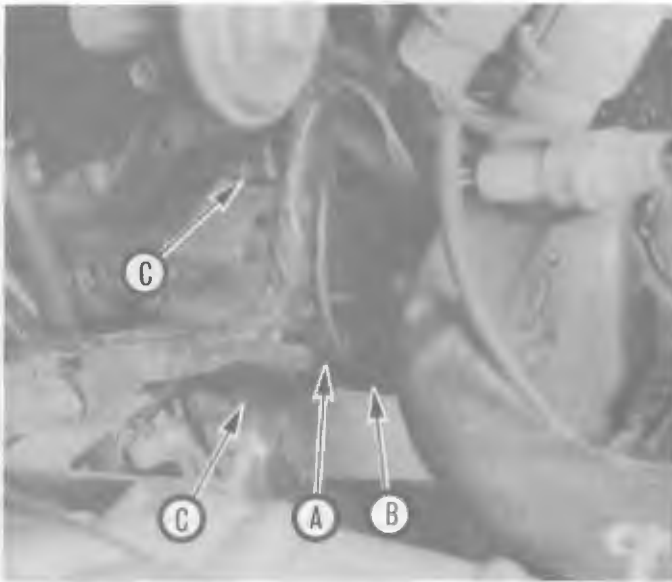
17.10 Exploded view of the alternator (Sidekick/Tracker)

- |   |                                |    |                  |
|---|--------------------------------|----|------------------|
| 1 | Rear housing (end frame)       | 6  | Bearing          |
| 2 | Voltage regulator/brush holder | 7  | Retainer         |
| 3 | Stator coil                    | 8  | Rotor            |
| 4 | Pulley                         | 9  | Rectifier        |
| 5 | Front housing                  | 10 | Brush and spring |



17.11 The brushes must be positioned as shown in order to contact the rotor slip rings properly

1 Brush holder      2 Brush



20.2 Starter motor mounting details

A Battery cable  
B From ignition switch (activates solenoid)  
C Starter motor mounting bolt

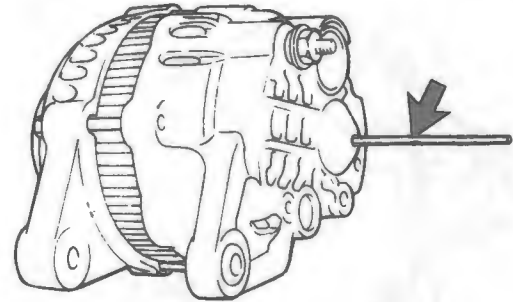
13 Compress the brushes into the brush holder and pass a rigid wire (such as a straightened-out paper clip) through the small hole in the end frame and into the brush holder (see illustration). This will keep the brushes out of the way of the rotor slip rings as the alternator is reassembled.

14 Once again heat the bearing box on the rear end frame with a soldering iron and allow it to reach 122-to-140 degrees F. Assemble the two halves of the alternator, making sure the previously applied marks are aligned. Install the four screws and tighten them securely. Remove the wire.

15 Install the alternator (Section 16) and adjust the drivebelt (see Chapter 1).

## 18 Starting system – general information and precautions

The sole function of the starting system is to turn over the engine quickly enough to allow it to start.



17.13 Retain the brushes in the holder by inserting a wire (arrow) through the small hole in the rear end frame provided for this purpose

The starting system consists of the battery, the starter motor, the starter solenoid and the wires connecting them. The solenoid is mounted directly on the starter motor. The solenoid/starter motor assembly is installed on the lower part of the engine, bolted to the transmission bell-housing.

When the ignition key is turned to the Start position, the starter solenoid is actuated through the starter control circuit. The starter solenoid then connects the battery to the starter. The battery supplies the electrical energy to the starter motor, which does the actual work of cranking the engine.

The starter motor on a vehicle equipped with a manual transmission can only be operated when the clutch pedal is depressed; the starter on a vehicle equipped with an automatic transmission can only be operated when the transmission selector lever is in Park or Neutral.

Always observe the following precautions when working on the starting system:

- Excessive cranking of the starter motor can overheat it and cause serious damage. Never operate the starter motor for more than 30 seconds at a time without pausing to allow it to cool for at least two minutes.
- The starter is connected directly to the battery and could arc or cause a fire if mishandled, overloaded or shorted out.
- Always detach the cable from the negative terminal of the battery before working on the starting system.

## 19 Starter motor – testing in vehicle

**Note:** Before diagnosing starter problems, make sure the battery is fully charged.

- If the starter motor doesn't turn at all when the switch is operated, make sure the shift lever is in Neutral or Park (automatic transmission) or the clutch pedal is depressed (manual transmission).
- Make sure the battery is charged and all cables, both at the battery and starter solenoid terminals, are clean and secure.
- If the starter motor spins but the engine isn't cranking, the overrunning clutch in the starter motor is slipping and the starter motor must be replaced.
- If, when the switch is actuated, the starter motor doesn't operate at all but the solenoid clicks, then the problem lies with either the battery, the main solenoid contacts or the starter motor itself (or the engine is seized).
- If the solenoid plunger can't be heard when the switch is actuated, the battery is bad, the fusible link is burned (the circuit is open) or the solenoid itself is defective.
- To check the solenoid, connect a jumper lead between the battery (+) and the ignition switch wire terminal (the small terminal) on the solenoid. If the starter motor now operates, the solenoid is OK and the problem is in the ignition switch, neutral start switch or wiring.
- If the starter motor still doesn't operate, remove the starter/solenoid assembly for disassembly, testing and repair.

8 If the starter motor cranks the engine at an abnormally slow speed, first make sure the battery is charged and all terminal connections are tight. If the engine is partially seized, or has the wrong viscosity oil in it, it will crank slowly.

9 Run the engine until normal operating temperature is reached, then disconnect the coil wire from the distributor cap and ground it on the engine.

10 Connect a voltmeter positive lead to the positive battery post and connect the negative lead to the negative post.

11 Crank the engine and take the voltmeter readings as soon as a steady figure is indicated. Don't allow the starter motor to turn for more than 30 seconds at a time. A reading of 9 volts or more, with the starter motor turning at normal cranking speed, is normal. If the reading is 9 volts or more but the cranking speed is slow, the motor is faulty. If the reading is less than 9 volts and the cranking speed is slow, the solenoid contacts are probably burned, the starter motor is bad, the battery is discharged or there's a bad connection.

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## 20 Starter motor – removal and installation

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Refer to illustration 20.2

- 1 Detach the cable from the negative terminal of the battery.
- 2 Clearly label, then disconnect the wires from the terminals on the starter solenoid (see illustration).
- 3 Remove the mounting bolts and detach the starter.
- 4 Installation is the reverse of removal.

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## 21 Starter solenoid – removal and installation

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Refer to illustrations 21.3 and 21.4

- 1 Detach the cable from the negative terminal of the battery.
- 2 Remove the starter motor (see Section 20).
- 3 Disconnect the strap from the solenoid to the starter motor terminal (see illustration).
- 4 Remove the screws that secure the solenoid to the starter motor (see illustration).
- 5 Pull the solenoid off the starter body flange.
- 6 Installation is the reverse of removal.



21.3 To separate the solenoid from the starter motor, remove the nut and detach the lead (arrow), . . .



21.4 . . . then remove the solenoid mounting screws (arrows) and pull the solenoid straight off the starter flange