

Chapter 5 Engine electrical systems

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Specifications

Ignition system

Firing order	1-2-3-4-5-6
Rotation	counterclockwise
Ignition coil primary voltage	12 volts

Alternator

Hitachi type (turbo)	LR170-701B
normal rating	12V-70A
regulated output voltage	14.4 to 15.0 volts
Mitsubishi type (turbo)	A2T48195
normal rating	12V-70A
regulated output voltage	14.1 to 14.7 volts

Torque specifications

	Kg-m	Ft-lbs
Distributor hold-down bolt	0.5 to 0.63	3.6 to 4.6
Alternator adjusting bolt	1.4 to 1.7	10 to 12
Alternator (Mitsubishi)		
through bolt	0.40 to 0.55	2.9 to 4.0
pulley nut	6.0 to 7.5	43 to 54
Alternator (Hitachi)		
through bolt	0.32 to 0.40	2.3 to 2.9
pulley nut	4.0 to 6.0	29 to 43
Solenoid to starter bolts	0.65 to 0.80	4.7 to 5.8
Starter housing through bolts	0.50 to 0.65	3.6 to 4.7

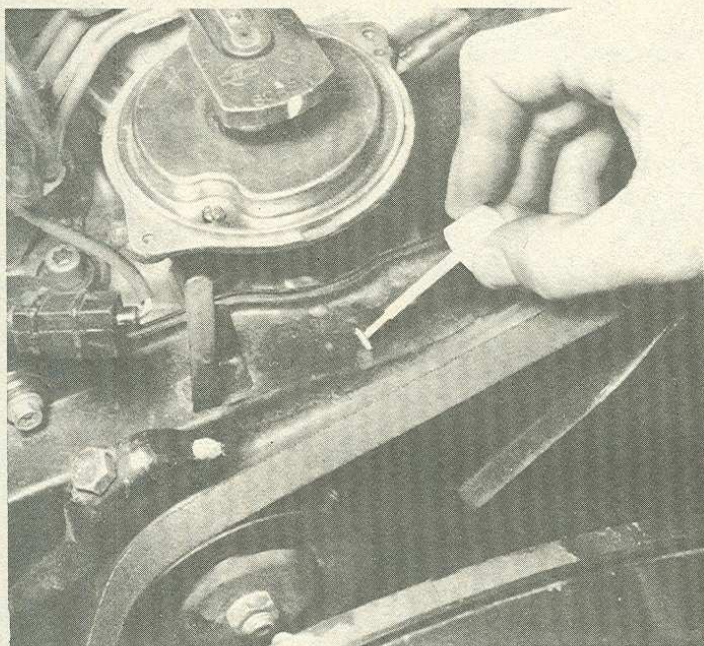
1 Ignition system — general information

In order for the engine to run correctly it is necessary for an electrical spark to ignite the fuel/air mixture in the combustion chamber at exactly the right moment in relation to engine speed and load. The ignition system is based on feeding low tension voltage from the battery to the coil, where it is converted to high tension voltage. The high tension voltage is powerful enough to jump the spark plug gap in the cylinders many times a second under high compression pressures, pro-

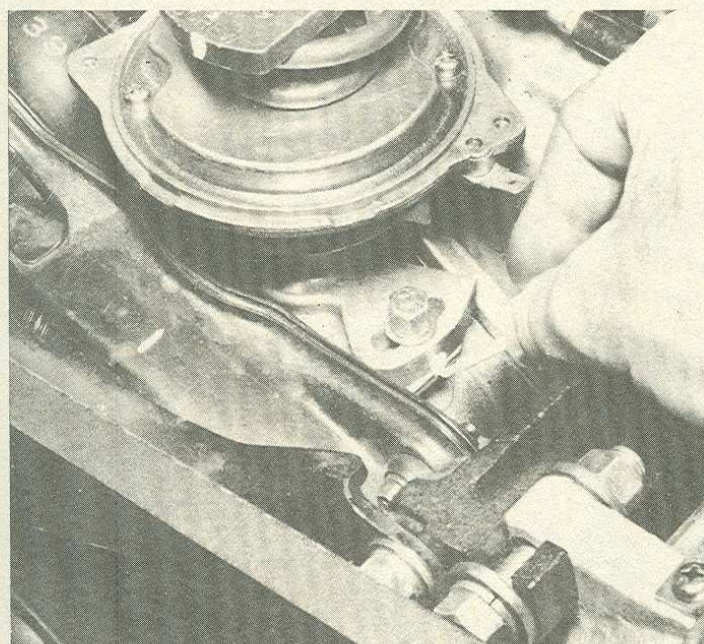
viding that the system is in good condition and that all adjustments are correct.

The low tension (primary) circuit consists of the ignition switch, ignition and accessory relay, the primary windings of the ignition coil, the transistorized IC (integrated circuit) ignition unit, the pick-up assembly in the distributor and all connecting wires.

The high tension circuit consists of the secondary windings of the ignition coil, the heavy ignition lead from the center of the coil to the center of the distributor cap, the rotor, the spark plug leads and spark plugs.



2.3 Mark the relationship of the rotor to a fixed point on the engine

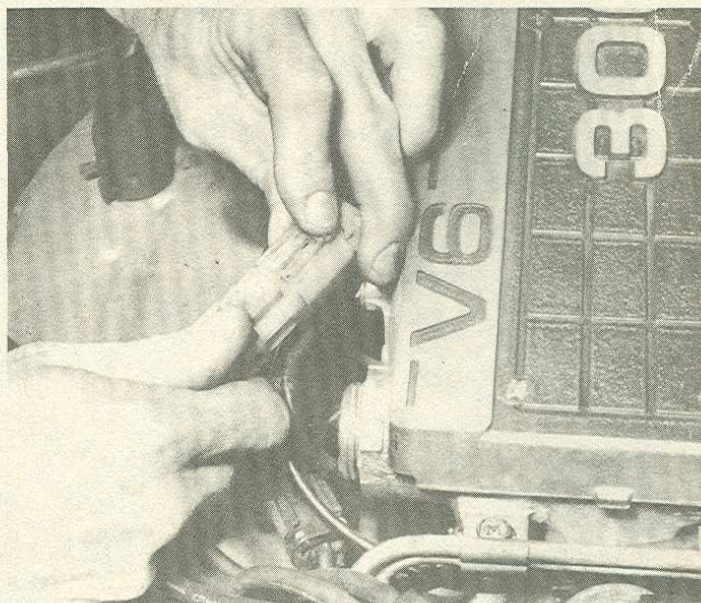


2.6 To keep the timing as close as possible mark the location of the distributor before removing the distributor

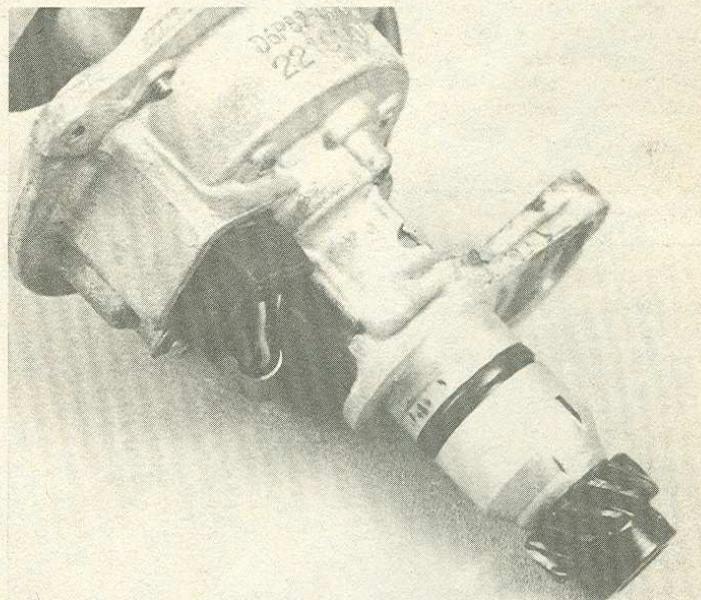
The primary circuit of the ignition system is integrated with the ECCS fuel injection/turbocharging system, described in detail in Chapter 4.

The engine speed and position of the pistons are monitored by a crank angle sensor, which, in this system, combines with the control unit to replace the distributor pick-up assembly, mechanical and vacuum advance. The necessary information is passed from the crank angle sensor to the control unit, which electronically determines the optimum spark timing and triggers the spark.

Because of the complexity of the ECCS system, if an ignition problem develops which cannot be isolated to the high tension circuit, the vehicle should be taken to a Nissan dealer or other specialist for proper diagnosis and correction. **Warning:** *Because of the high voltage generated by the electronic ignition system, extreme caution should be taken whenever an operation is performed involving ignition components. This not only includes the distributor, coil, control module and ignition wires, but related items which are connected to the system as well, such as the plug connections, tachometer and any testing equipment.*



2.4 Disconnect the distributor electrical connector located on the right side of the engine

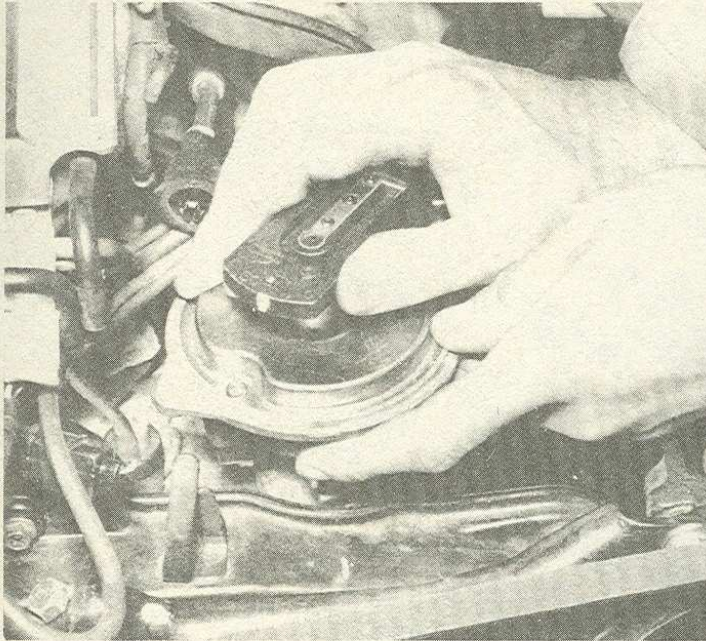


2.8 Replace the rubber O-ring if necessary before installing the distributor

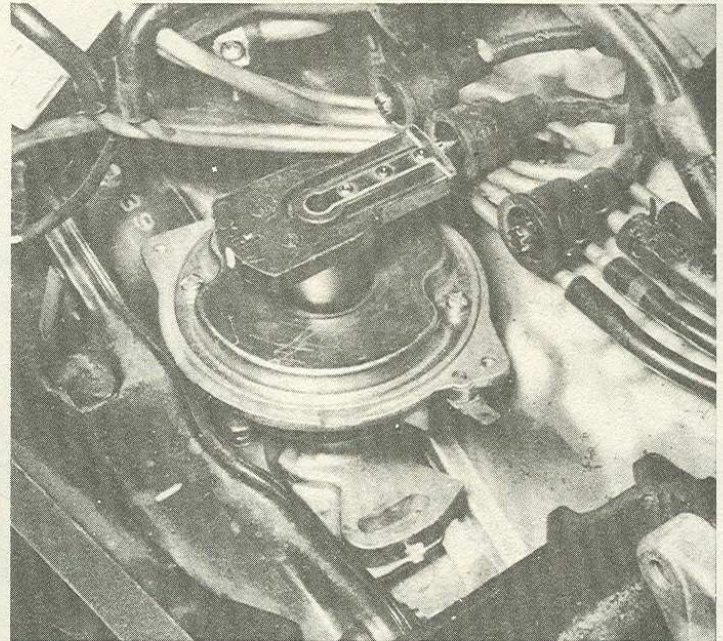
2 Distributor — removal and installation

Refer to illustrations 2.3, 2.4, 2.6, 2.8, 2.9a, 2.9b, 2.12 and 2.13

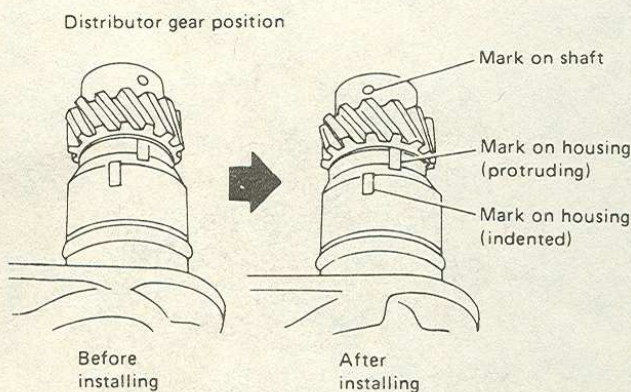
- 1 Disconnect the negative battery cable at the battery. Place the cable out of the way so it cannot accidentally come in contact with the negative terminal of the battery, as this would once again allow power into the electrical system of the vehicle.
- 2 Remove the two retaining screws, remove the distributor cap and position the cap out of the way.
- 3 Mark the relationship of the rotor to a fixed point on the engine (see illustration).
- 4 Disconnect the distributor electrical connector on the right side of the engine (see illustration) and work the wire from under the intake collector.
- 5 Disconnect the ground wire on the side of the distributor.
- 6 Mark the relationship of the distributor housing to the engine block (see illustration) and remove the distributor hold-down bolt.
- 7 Lift straight up on the distributor to remove it from the vehicle.
- 8 Before installing the distributor check the rubber O-ring on the shaft and replace it if it is not soft and pliable (see illustration).



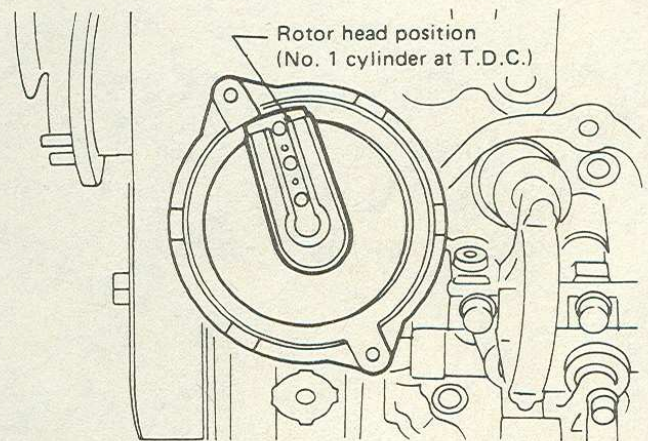
2.9a Insert the distributor with the rotor about 45° from the alignment marks



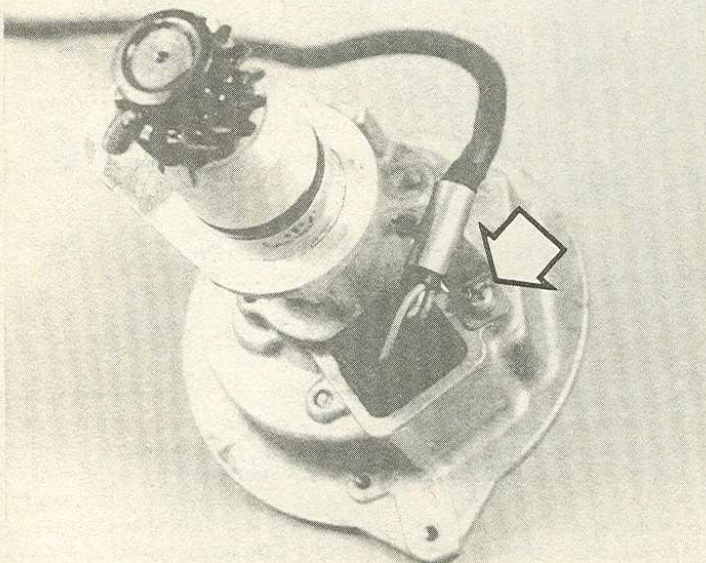
2.9b When the distributor gear engages fully with the drive gear the marks should line up



2.12 Before installing the distributor align the bottom mark on the shaft with the protruding mark just above the drive gear



2.13 With the distributor installed the rotor should point towards the number one cylinder



3.3 Disconnect the electrical connector by removing the retaining screw (arrow) and unplugging the connector from the distributor

- 9 Insert the distributor with the rotor about 45° from the alignment marks (see illustration) so the distributor will line up with the mark when the distributor gear meshes into the drive gear (see illustration).
- 10 Reverse the remaining removal procedures for installation.

Installation if the engine was rotated

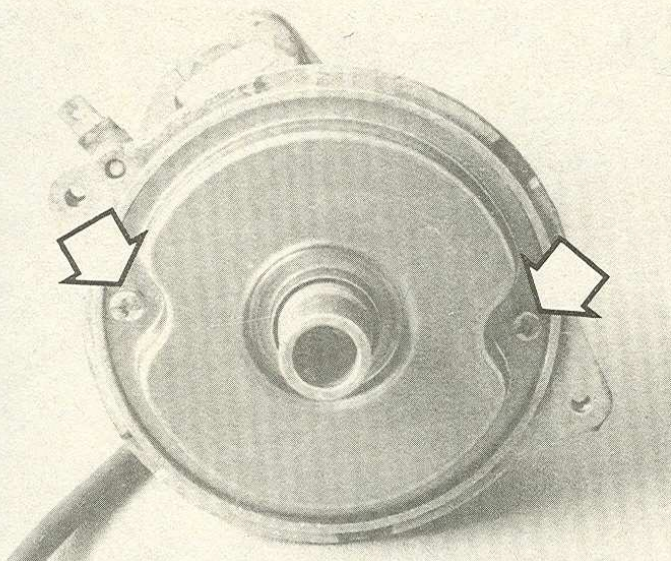
- 11 Set the engine at TDC for the number one piston. Refer to Chapter 2 if necessary.
- 12 Locate the alignment marks on the rotor shaft above and below the drive gear. Align the bottom mark with the protruding mark just above the drive gear and insert the distributor (see illustration).
- 13 Once the distributor is installed and the rotor is in place the rotor should be pointing toward the number one cylinder (see illustration). Confirm this and tighten the distributor hold-down bolt.

3 Crank angle sensor — removal and installation

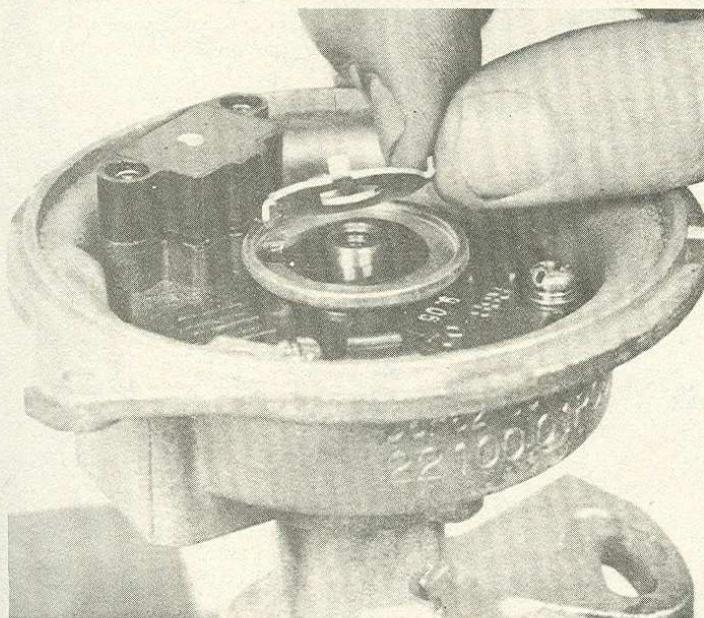
Refer to illustrations 3.3, 3.4, 3.7, 3.8 and 3.9

Note: A general description of the crank angle sensor can be found in Chapter 4.

- 1 Remove the distributor.
- 2 Remove the rotor retaining screw and remove the rotor.
- 3 Disconnect the electrical connector retaining screw and disconnect the connector from the distributor (see illustration).



3.4 Remove the screws retaining the crank angle sensor dust cover (arrows)

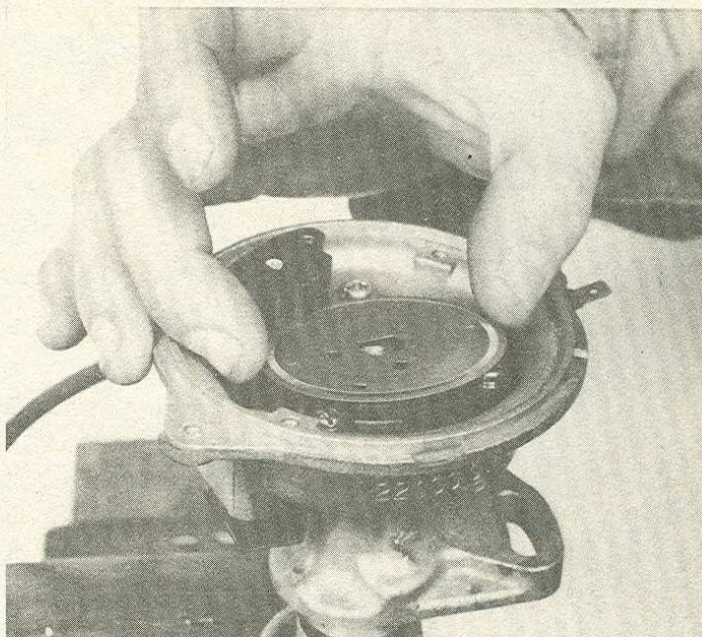


3.8 Lift the rotor plate positioner and note the sequence of the wavy washer and base plate, then remove all three as an assembly

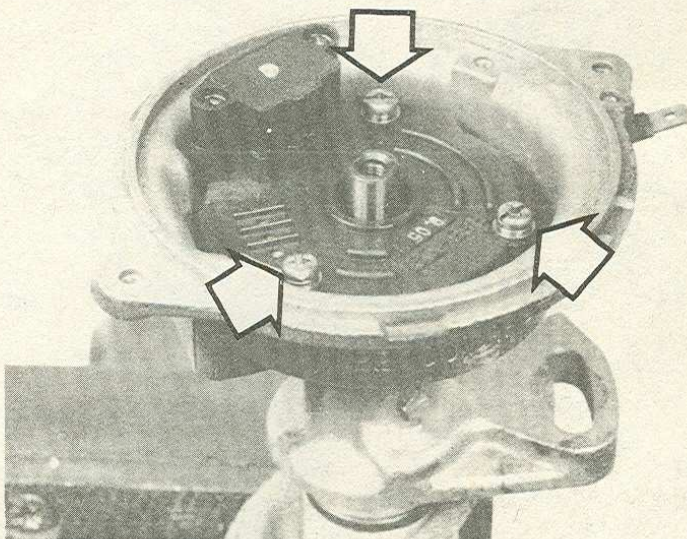
- 4 Remove the crank angle sensor dust cover retaining screws (see illustration) and lift off the cover.
- 5 Wrap the distributor gear with a rag and place the distributor in a vise. **Caution:** Apply just enough vise pressure to hold the distributor.
- 6 Insert a screwdriver into the rotor shaft and remove the retaining screw and shaft.
- 7 Carefully lift the rotor plate from the distributor (see illustration).
- 8 Lift the rotor plate positioner and note the wavy spring located between the positioner and the rotor plate base plate (see illustration). Set the rotor plate positioner back onto the assembly and lift the complete assembly off the distributor.
- 9 Remove the three retaining screws and remove the crank angle sensor from the distributor (see illustration).
- 10 Reverse the removal procedure for installation.

4 Ignition coil — removal and installation

- 1 Disconnect the negative battery cable at the battery. Place the cable out of the way so it cannot accidentally come in contact with the negative terminal of the battery, as this would once again allow power



3.7 Carefully lift the rotor plate from the distributor



3.9 Remove the crank angle sensor by removing the three retaining screws (arrows)

- into the electrical system of the vehicle.
- 2 Unplug the high tension lead from the coil.
- 3 Disconnect the ignition coil electrical connector.
- 4 Remove the coil retaining screws and remove the coil.
- 5 Reverse the removal procedure for installation.

5 Starting system — general information

The starting system is composed of a starting motor, solenoid and battery. The battery supplies the electrical energy to the solenoid, which then completes the circuit to the starting motor.

All ZX models use a reduction gear type starter motor. This starter operates in a similar manner to a conventional type except that increased torque is provided through a reduction gear located between the armature and pinion gear.

An overrunning clutch is attached to the starter motor to transmit the driving torque and to prevent the armature from overrunning when the engine starts.

The solenoid and starting motor are mounted together at the right rear of the engine. No periodic lubrication or maintenance is required for the starting system components.

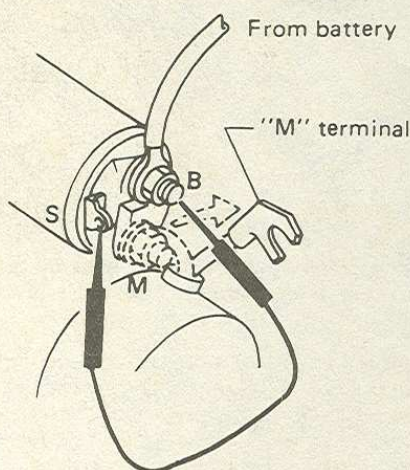
The electrical circuitry of the vehicle is arranged so that the starter motor can only be operated on automatic transmission models when the lever is in Park or Neutral.

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. Excessive cranking can cause overheating, which can seriously damage the starter.

6 Starting system — testing

Refer to illustration 6.10

- 1 If the starter motor does not rotate when the switch is operated on an automatic transmission model, check that the shifter is in the Neutral or Park position.
- 2 Check that the battery is well charged and all cables, both at the battery and starter solenoid terminals, are secure.
- 3 If the motor can be heard spinning but the engine is not being cranked, then the overrunning clutch in the starter motor is slipping and the assembly must be removed from the engine and replaced.
- 4 Often when the starter fails to operate, a click can be heard coming from the starter solenoid when the ignition switch is turned to the Start position. If this is heard, proceed to Step 12. If this click is not heard, disconnect the ignition wire (usually black and yellow) from the starter solenoid.
- 5 Connect a test light between this lead and the negative battery terminal.
- 6 Have an assistant turn the key, and note whether the test light comes on or not. If the light comes on, proceed to Step 12.
- 7 If the test light does not come on, connect a voltmeter between the positive battery terminal and the bayonet connector at the solenoid. The black and yellow wire should be connected.
- 8 Disconnect the ignition coil wire from the distributor cap and ground it to the engine.
- 9 Have an assistant attempt to crank the engine and note the reading on the voltmeter. If less than 1.5 volts is shown, there is an open circuit in the starter, and it should be replaced with a new or rebuilt unit.
- 10 If the voltmeter shows more than 1.5 volts, connect a jumper wire between the positive battery terminal and the S terminal on the solenoid (see illustration).



6.10 Connect a jumper wire between the battery positive terminal and the S terminal on the solenoid

- 11 Turn the ignition switch to the Start position and listen for a click from the solenoid. If there still is no click and the starter does not turn, both the solenoid and starter are defective and should be replaced. If a click is heard and the starter turns, then there is an open circuit in the ignition switch, inhibitor switch or relay (on automatic transmission models) or in the wires or connectors.
- 12 If a click was heard when the ignition switch was turned to the Start position in Step 4, or if the starter turns then the starter current should be tested. Disconnect the positive battery cable at the starter.

13 Connect an ammeter (set in the 500A range) between this cable and its terminal on the starter.

14 Remove the ignition coil wire from the distributor cap to keep the engine from starting.

15 Have an assistant crank the engine and note the reading on the ammeter and the speed at which the starter turns.

16 If the ammeter reading is less than 150 amps and the starter speed is normal, the starter is okay and the problem lies elsewhere.

17 If the ammeter reading is less than 150 amps but the starter turns slowly, test for a voltage drop in the starter positive circuit.

18 Connect a voltmeter so the positive lead is on the positive battery post and the negative lead is connected to the M solenoid terminal (this is the terminal with the braided copper strap leading to the starter motor).

19 Remove the ignition coil wire from the distributor cap and ground it on the engine.

20 Have an assistant crank the engine and note the reading on the voltmeter. If less than 1 volt is shown, proceed to Step 23.

21 If more than 1 volt is shown, connect the negative voltmeter lead to the solenoid terminal (this is the terminal which connects to the battery).

22 Have an assistant crank the engine and note the reading on the voltmeter. If more than 1 volt is shown, then the problem is a bad connection between the battery and the starter solenoid. Check the positive battery cable for looseness or corrosion. If the reading indicated less than 1 volt, then the solenoid is defective and should be replaced.

23 If the voltmeter test in Step 20 shows less than 1 volt, test for a voltage drop in the starter ground circuit.

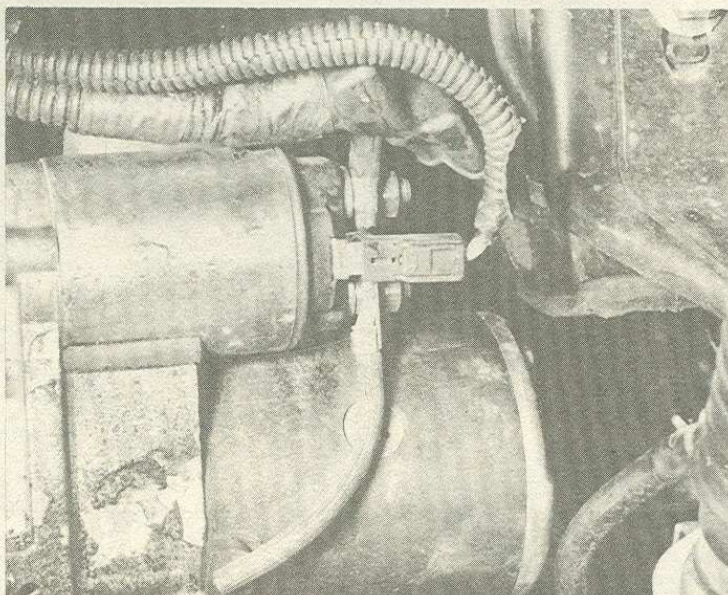
24 Connect the negative lead of the voltmeter (set on the low scale) to the negative battery terminal and hold the positive voltmeter lead to the starter housing. Be sure to make a good connection.

25 Have an assistant crank the engine and note the voltmeter reading. If the reading shows more than 0.5 volts, then there is a bad ground connection. Check the negative battery cable for looseness or corrosion. Also check the starter motor ground connections and the tightness of the starter motor mounting bolts.

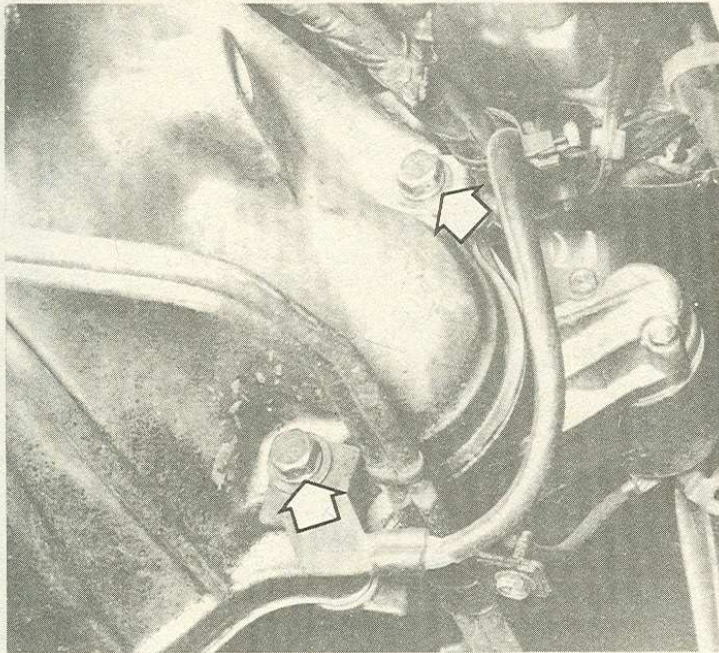
7 Starter motor — removal and installation

Refer to illustrations 7.3 and 7.4

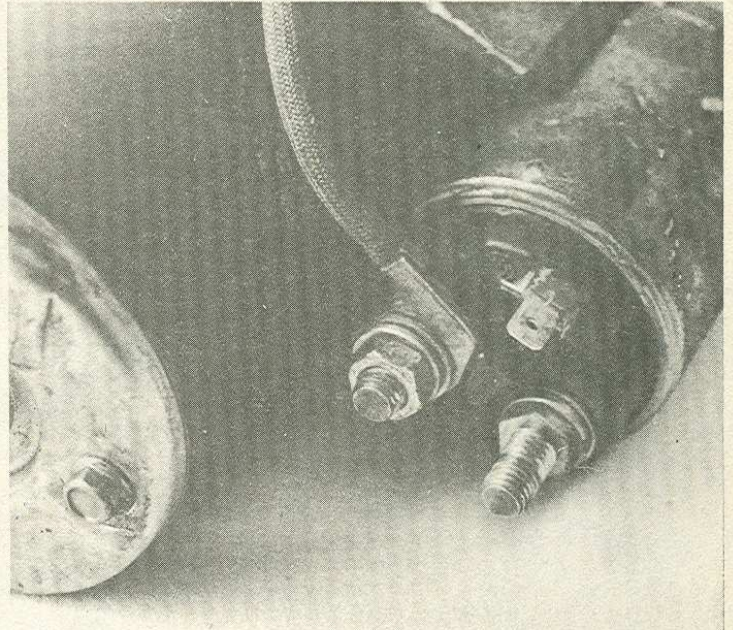
- 1 Disconnect the negative battery cable from the battery. Place the cable out of the way so it cannot accidentally come in contact with the negative terminal of the battery, as this would once again allow power into the electrical system of the vehicle.
- 2 Lift the vehicle and support it securely on jackstands.
- 3 Unplug the ignition switch wire connector to the solenoid and remove the battery cable by removing the retaining nut (see illustration).



7.3 Unplug the ignition switch wire connector to the solenoid and remove the battery cable wire by removing the retaining nut



7.4 Remove the the two starter retaining bolts (arrows)



8.2 Remove the nut securing the braided copper wire to the solenoid

- 4 Remove the two starter retaining bolts (see illustration).
- 5 Disengage the starter/solenoid assembly from the flywheel/driveplate and remove the assembly from the vehicle.
- 6 Installation is the reverse of the removal procedure.

8 Starter solenoid — removal and installation

Refer to illustrations 8.2 and 8.3

- 1 Remove the starter motor as described in Section 12.
- 2 Remove the nut holding the braided copper strap to the solenoid (see illustration).
- 3 Remove the two solenoid mounting bolts (see illustration) and lift the solenoid from the starter motor.
- 4 Installation is the reverse of the removal procedure. **Note:** During installation be sure to engage the solenoid plunger with the starter motor shift lever.

9 Charging system — general information

The charging system is made up of the alternator, voltage regulator and the battery. These components work together to supply electrical power for the engine ignition, lights, radio, etc.

The alternator is turned by a drivebelt at the front of the engine. When the engine is operating, voltage is generated by the internal components of the alternator to be sent to the battery for storage.

The alternator uses a solid state regulator that is mounted inside the alternator housing. The purpose of this voltage regulator is to limit the alternator voltage to a preset value. This prevents power surges, circuit overloads, etc., during peak voltage output. The regulator voltage setting cannot be adjusted.

The charging system does not ordinarily require periodic maintenance. The drivebelts, electrical wiring and connections should, however, be inspected during normal routine maintenance.

10 Charging system — testing

- 1 Where a faulty alternator is suspected, first check to be sure that the battery is fully charged.
- 2 Visually inspect all wires and connections to make sure they are clean, tight and in good condition.
- 3 Turn the ignition switch to the On position and check that the alternator warning light in the instrument cluster illuminates. If it does, proceed to Step 6.



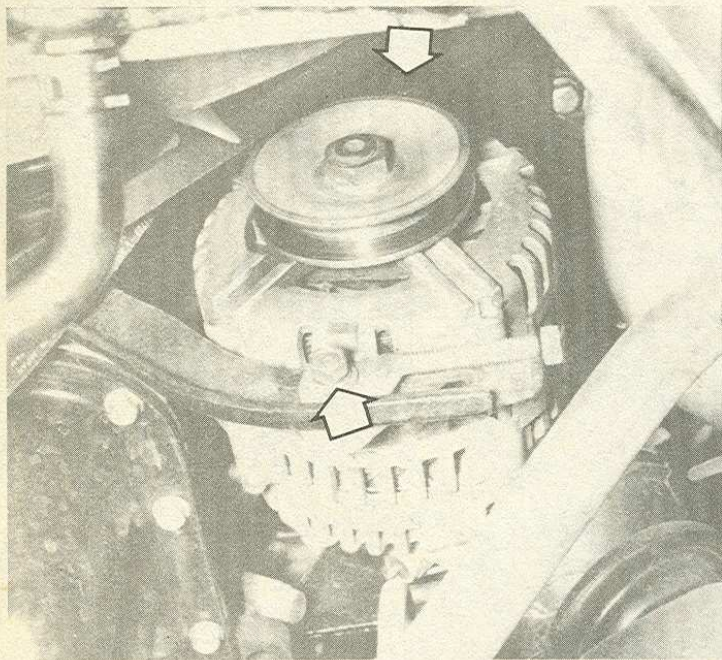
8.3 After removing the two retaining bolts the solenoid can be separated from the starter

ceed to Step 6.

- 4 If the warning light does not come on, check that the warning light bulb is not burned out. To do this, disconnect the S/L connector at the rear of the alternator and ground the L lead wire (brown/white) with a jumper wire. Again, turn the ignition switch to the On position and check the warning light. If the warning light is still off, a burned bulb or loose connection between the alternator and the warning light is indicated.

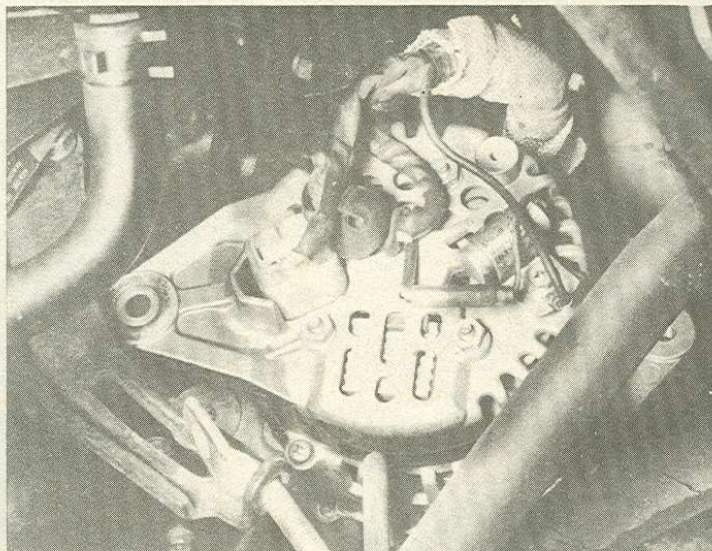
- 5 If the warning light did come on in the previous test, the bulb is in good condition and a faulty alternator or regulator is indicated. To determine which, reconnect the S/L connector and use a jumper wire to ground the F terminal. Turn the ignition switch On and check the warning light. If the light comes on, the voltage regulator is faulty. If the light remains off, the alternator is defective. Replace either component by referring to the appropriate Section of this Chapter.

- 6 If the warning light does come on with the ignition switch in the On position, start the engine and allow it to idle. The light should go out. If it remains on, even dimly or as a flicker, a faulty alternator is indicated. Replace it with a new or rebuilt unit.



11.7 Remove the two front alternator retaining bolts (arrows)

- 7 Slowly increase the engine speed to 1500 rpm.
- 8 Turn the headlights on and again check the alternator warning light. If it remains off, proceed to Step 10.
- 9 If the warning light comes on dimly, lower the engine speed to normal idle. Connect the voltmeter between the B (white) and L terminals and measure the voltage. If more than 0.5 volts is shown, the alternator should be replaced. If less than 0.5 volts is shown, the unit is okay.
- 10 If the warning light remains off when the lights are turned on, maintain the engine speed at 1500 rpm and measure the voltage at the B terminal. Be sure the S terminal (white) is correctly connected.
- 11 If more than 15.5 volts is shown, the IC regulator is defective. Replace the alternator.
- 12 If the voltage reading is between 13 and 15 volts, lower the engine speed to idle.
- 13 Turn the headlights on and again check the alternator warning light in the dash. It should remain off. If the light comes on, a defective alternator is indicated.



11.8 Turn the alternator around and unplug the electrical connectors and remove the two retaining bolts securing the attached wires

11 Alternator — removal and installation

Refer to illustrations 11.7 and 11.8

- 1 Disconnect the negative battery cable. Place the cable out of the way so it cannot accidentally come in contact with the negative terminal of the battery, as this would once again allow power into the electrical system of the vehicle.
- 2 Remove alternator drivebelt.
- 3 Lift the vehicle and support it securely on jackstands.
- 4 Remove sway bar-to-body brackets and let the sway bar hang down.
- 5 Remove the splash shield retaining bolts and remove the shield.
- 6 From the rear of the alternator remove the one retaining bolt securing the alternator to the mounting bracket.
- 7 Remove the two front alternator retaining bolts (see illustration).
- 8 Turn the alternator around and squeeze the electrical connector and pull it from the alternator. Unplug the capacitor by pulling the connector apart. Remove the two retaining bolts and remove the attached wires (see illustration).
- 9 Installation is the reverse of the removal procedure.