Chapter 12
Chassis electrical system

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1 General information

The electrical system is a 12-volt, negative ground type. Power for the lights and all electrical accessories is supplied by a lead/acid-type battery, which is charged by the alternator.

This Chapter covers repair and service procedures for the various electrical components not associated with the engine. Information on the battery, alternator and starter motor can be found in Chapter 5.

It should be noted that when portions of the electrical system are serviced, the negative battery cable should be disconnected from the battery to prevent electrical shorts and/or fires.

2 Electrical troubleshooting - general information

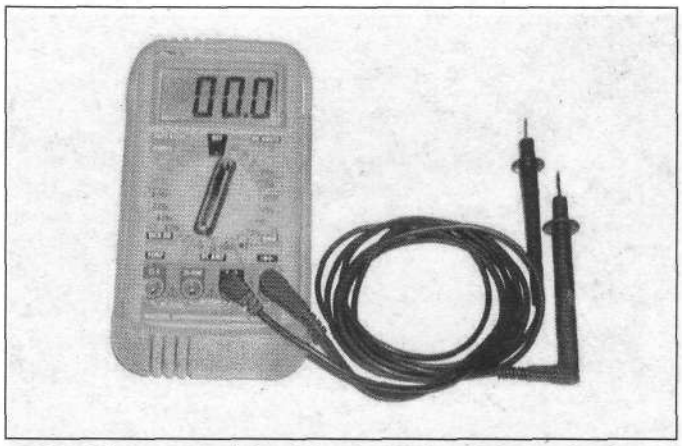
Refer to illustrations 2.5a and 2.5b

1 A typical electrical circuit consists of an electrical component, any switches, relays, motors, fuses, fusible links or circuit breakers related to that component and the wiring and connectors that link the component to both the battery and the chassis. To help you pinpoint an electrical circuit problem, wiring diagrams are included at the end of this Chapter.

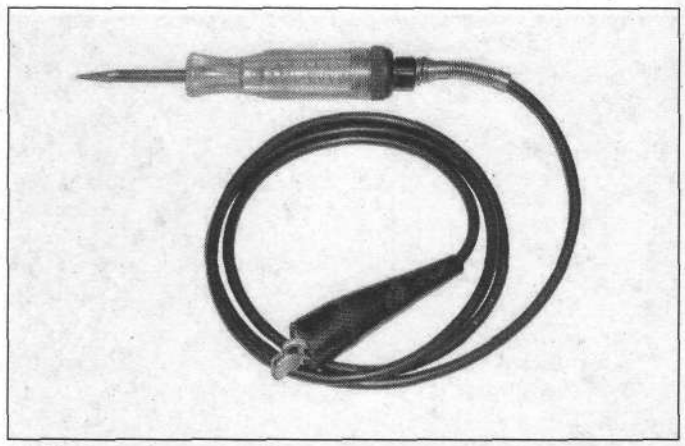
2 Before tackling any troublesome electrical circuit, first study the appropriate wiring diagrams to get a complete understanding of what makes up that individual circuit. Trouble spots, for instance, can often be narrowed down by noting if other components related to the circuit are operating properly. If several components or circuits fail at one time, chances are the problem is in a fuse or ground connection, because several circuits are often routed through the same fuse and ground connections.

3 Electrical problems usually stem from simple causes, such as loose or corroded connections, a blown fuse, a melted fusible link or a failed relay. Visually inspect the condition of all fuses, wires and connections in a problem circuit before troubleshooting the circuit.

4 If test equipment and instruments are going to be utilized, use the diagrams to plan ahead of time where you will make the necessary connections in order to accurately pinpoint the trouble spot.



2.5a The most useful tool for electrical troubleshooting is a digital multimeter that can check volts, amps, and test continuity



2.5b A simple test light is a very handy tool for testing voltage

5 The basic tools needed for electrical troubleshooting include a circuit tester or voltmeter (a 12-volt bulb with a set of test leads can also be used), a continuity tester, which includes a bulb, battery and set of test leads, and a jumper wire, preferably with a circuit breaker incorporated, which can be used to bypass electrical components **(see illustrations)**. Before attempting to locate a problem with test instruments, use the wiring diagram(s) to decide where to make the connections.

Voltage checks

Refer to illustration 2.6

6 Voltage checks should be performed if a circuit is not functioning properly. Connect one lead of a circuit tester to either the negative battery terminal or a known good ground. Connect the other lead to a connector in the circuit being tested, preferably nearest to the battery or fuse **(see illustration)**. If the bulb of the tester lights, voltage is present, which means that the part of the circuit between the connector and the battery is problem free. Continue checking the rest of the circuit in the same fashion. When you reach a point at which no voltage is present, the problem lies between that point and the last test point with voltage. Most of the time the problem can be traced to a loose connection. **Note:** *Keep in mind that some circuits receive voltage only when the ignition key is in the Accessory or Run position.*

Finding a short

7 One method of finding shorts in a live circuit is to remove the fuse and connect a test light in place of the fuse terminals (fabricate two jumper wires with small spade terminals, plug the jumper wires into the fuse box and connect the test light). There should be voltage present in the circuit. Move the suspected wiring harness from side-to-side while watching the test light. If the bulb goes off, there is a short to ground somewhere in that area, probably where the insulation has rubbed through.

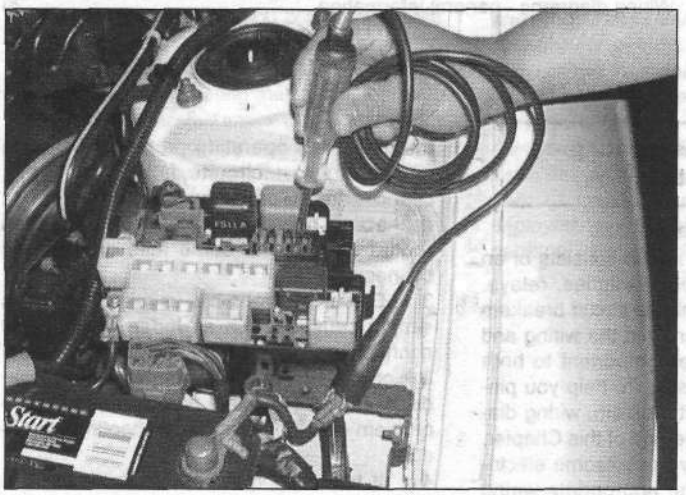
Ground check

8 Perform a ground test to check whether a component is properly grounded. Disconnect the battery and connect one lead of a continuity tester or multimeter (set to the ohm scale), to a known good ground. Connect the other lead to the wire or ground connection being tested. If the resistance is low (less than 5 ohms), the ground is good. If the bulb on a self-powered test light does not go on, the ground is not good.

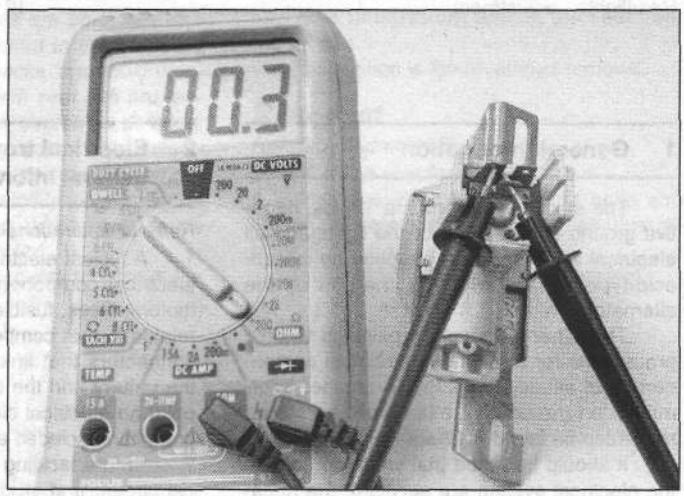
Continuity check

Refer to illustration 2.9

9 A continuity check is done to determine if there are any breaks in a circuit - if it is passing electricity properly. With the circuit off (no power in the circuit), a self-powered continuity tester or multimeter can be used to check the circuit. Connect the test leads to both ends of the circuit (or to the "power" end and a good ground), and if the test light comes on the circuit is passing current properly **(see illustration)**. If the resistance is low (less than 5



2.6 In use, a basic test light's lead is clipped to a known good ground, then the pointed probe can test connectors, wires or electrical sockets - if the bulb lights, the circuit being tested has battery voltage



2.9 With a multimeter set to the ohm scale, resistance can be checked across two terminals - when checking for continuity, a low reading indicates continuity, a high reading or infinity indicates high resistance or lack of continuity

ohms), there is continuity; if the reading is 10,000 ohms or higher, there is a break somewhere in the circuit. The same procedure can be used to test a switch, by connecting the continuity tester to the switch terminals. With the switch turned to ON, the test light should come on (or low resistance should be indicated on a meter).

Finding an open circuit

10 When diagnosing for possible open circuits, it is often difficult to locate them by sight because the connectors hide oxidation or terminal misalignment. Merely wiggling a connector on a sensor or in the wiring harness may correct the open circuit condition. Remember this when an open circuit is indicated when troubleshooting a circuit. Intermittent problems may also be caused by oxidized or loose connections.

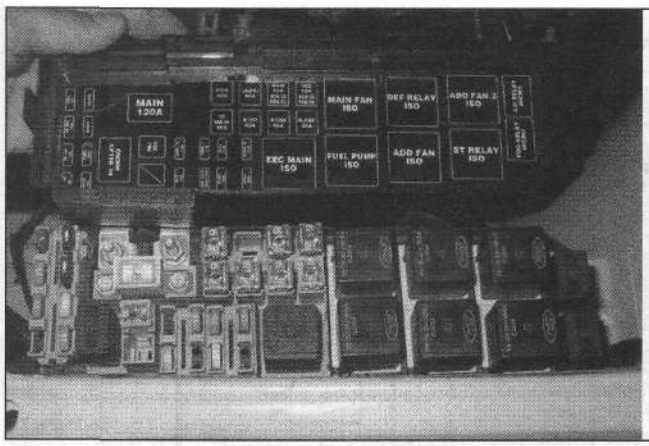
11 Electrical troubleshooting is simple if you keep in mind that all electrical circuits are basically electricity running from the battery, through the wires, switches, relays, fuses and fusible links to each electrical component (light bulb, motor, etc.) and to ground, from which it is passed back to the battery. Any electrical problem is an interruption in the flow of electricity to and from the battery.

Connectors

12 Most electrical connections on these vehicles are made with multiwire plastic connectors. The mating halves of many connectors are secured with locking clips molded into the plastic connector shells. The mating halves of large connectors, such as some of those under the instrument panel, are held together by a bolt through the center of the connector.

13 To separate a connector with locking clips, use a small screwdriver to pry the clips apart carefully, then separate the connector halves. Pull only on the shell, never pull on the wiring harness as you may damage the individual wires and terminals inside the connectors. Look at the connector closely before trying to separate the halves. Often the locking clips are engaged in a way that is not immediately clear. Additionally, many connectors have more than one set of clips.

14 Each pair of connector terminals has a male half and a female half. When you look at the end view of a connector in a diagram, be sure to understand whether the view shows the harness side or the component side of the connector. Connector halves are mirror images of each other, and a terminal that is shown on the right side end-view of one half will be on the left side end view of the other half.



3.1a The fuse/relay box is mounted on the left side of the engine compartment; it contains diodes (for the starter relay and for the air conditioning compressor clutch), fuses and relays, all of which are listed by location and function on the underside of the fuse/relay box cover

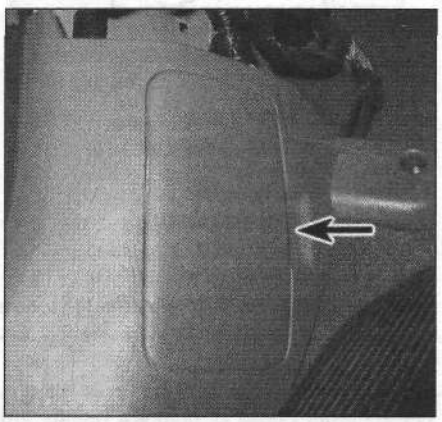
3 Fuses and fusible links - general information

Fuses

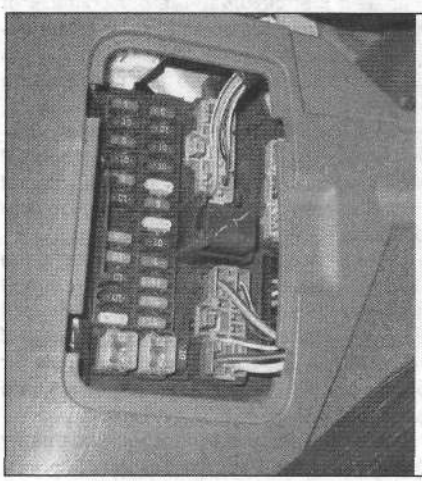
Refer to illustrations 3.1a, 3.1b, 3.1c and 3.3

The electrical circuits of the vehicle are protected by a combination of fuses, circuit breakers and fusible links. Fuse blocks are located under the instrument panel and in the engine compartment **(see illustrations)**. Each of the fuses is designed to protect a specific circuit, and the various circuits are identified on the fuse panel cover. If the fuse panel cover is difficult to read, or missing, you can also refer to your owner's manual, which includes a complete guide to all fuses and relays in both fuse/relay boxes.

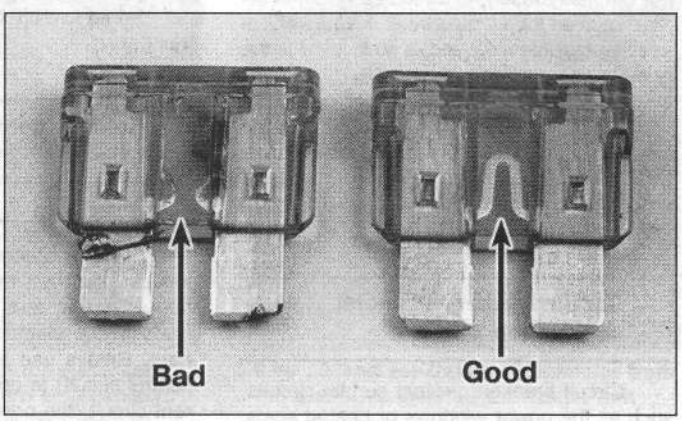
Miniaturized fuses are employed in the fuse blocks. These compact fuses, with blade terminal design, allow fingertip removal and replacement. If an electrical component fails, always check the fuse first. The best way to check a fuse is with a test light. Check for power at the exposed terminal tips of each fuse. If power is present on one side of the fuse but not the other, the fuse is blown. A blown fuse can also be confirmed by visually inspecting it **(see illustration)**.



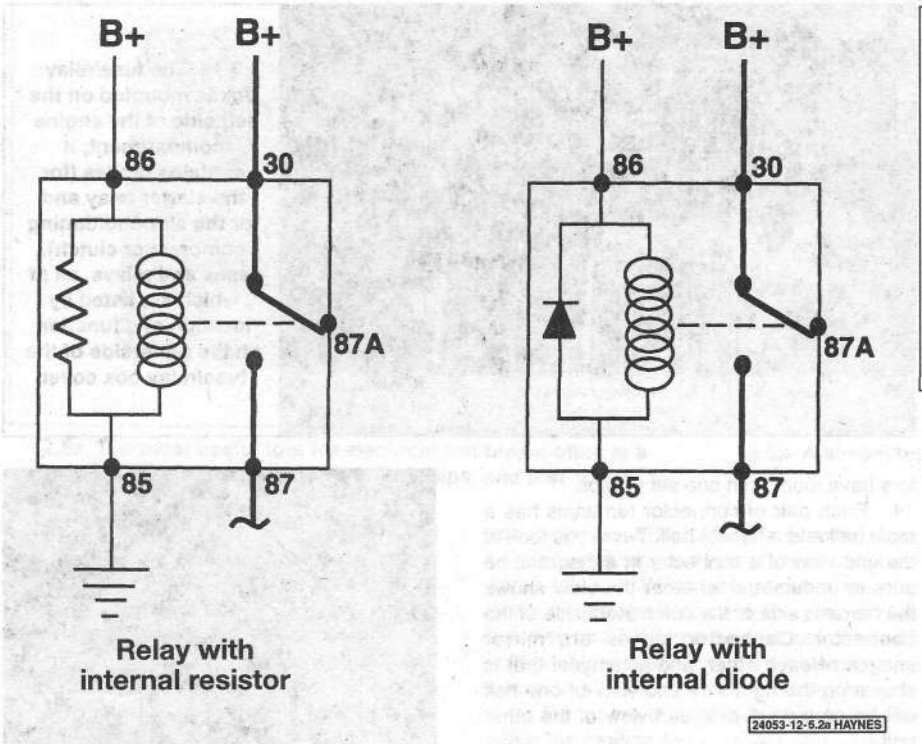
3.1b To open the fuse panel cover from the left kick panel, pull here, then disengage the two cover locator tabs and remove the cover



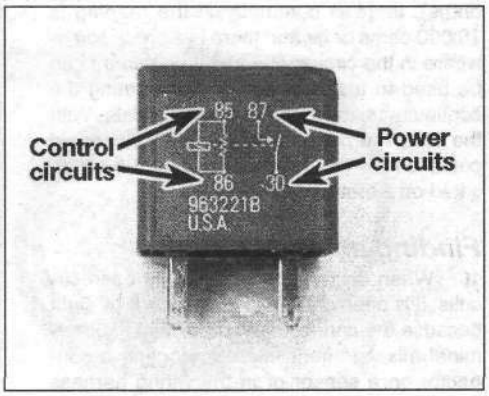
3.1c The passenger compartment fuse/relay box is located either in the left kick panel as shown, or on the right-hand side of the center console. It contains fuses and relays



3.3 When a fuse blows, the element between the terminals melts - the fuse on the left is blown, the fuse on the right is good



5.2a Typical ISO relay designs, terminal numbering and circuit connections



5.2b Most relays are marked on the outside to easily identify the control circuits and the power circuits - four terminal type shown

Be sure to replace blown fuses with the correct type. Fuses of different ratings are physically interchangeable, but only fuses of the proper rating should be used. Replacing a fuse with one of a higher or lower value than specified is not recommended. Each electrical circuit needs a specific amount of protection. The amperage value of each fuse is molded into the fuse body.

If the replacement fuse immediately fails, don't replace it again until the cause of the problem is isolated and corrected. In most cases, this will be a short circuit in the wiring caused by a broken or deteriorated wire.

Fusible links

Some circuits are protected by fusible links. The links are used in circuits which are not ordinarily fused, or which carry high current, such as the starter circuit. If your vehicle uses any fusible links, they'll be located in the engine compartment fuse/relay box. Cartridge-type fusible links are similar in appearance to a large fuse. After disconnecting the cable from the negative battery terminal (see Chapter 5, Section 1), simply unplug (or unbolt) and replace a fusible link with one of the same amperage.

4 Circuit breakers - general information

Circuit breakers protect certain circuits, such as the power windows or heated seats. Depending on the vehicle's accessories, there may be one or two circuit breakers, located in the fuse/relay box in the engine compartment.

Because the circuit breakers reset automatically, an electrical overload in a circuit-breaker-protected system will cause the circuit to fail momentarily, then come back on. If the circuit does not come back on, check it immediately.

For a basic check, pull the circuit breaker up out of its socket on the fuse panel, but just far enough to probe with a voltmeter. The breaker should still contact the sockets.

With the voltmeter negative lead on a good chassis ground, touch each end prong of the circuit breaker with the positive meter probe. There should be battery voltage at each end. If there is battery voltage only at one end, the circuit breaker must be replaced.

Some circuit breakers must be reset manually.

5 Relays - general information and testing

General information

1 Several electrical accessories in the vehicle, such as the fuel injection system, horns, starter, and fog lamps use relays to transmit the electrical signal to the component. Relays use a low-current circuit (the control circuit) to open and close a high-current circuit (the power circuit). If the relay is defective, that component will not operate properly. Most relays are mounted in the engine compartment fuse/relay box, with some specialized relays located above the interior fuse box in the dash **(see illustrations 3.1a and 3.1c)**. If a faulty relay is suspected, it can be removed and tested using the procedure below or by a dealer service department or a repair shop. Defective relays must be replaced as a unit.

Testing

Refer to illustrations 5.2a and 5.2b

2 Most of the relays used in these vehicles are of a type often called "ISO" relays, which refers to the International Standards Organization. The terminals of ISO relays are numbered to indicate their usual circuit connections and functions. There are two basic layouts of terminals on the relays used in these vehicles **(see illustrations)**.

3 Refer to the wiring diagram for the circuit to determine the proper connections for the relay you're testing. If you can't determine the correct connection from the wiring diagrams, however, you may be able to determine the test connections from the information that follows.

4 Two of the terminals are the relay control circuit and connect to the relay coil. The other relay terminals are the power circuit. When the relay is energized, the coil creates a magnetic field that closes the larger contacts of the power circuit to provide power to the circuit loads.

5 Terminals 85 and 86 are normally the control circuit. If the relay contains a diode, terminal 86 must be connected to battery positive (B+) voltage and terminal 85 to ground. If the relay contains a resistor, terminals 85 and 86 can be connected in either direction with respect to B+ and ground.

6 Terminal 30 is normally connected to the battery voltage (B+) source for the circuit loads. Terminal 87 is connected to the circuit leading to the component being powered. If the relay has several alternate terminals for load or ground connections, they usually are numbered 87A, 87B, 87C, and so on.

7 Use an ohmmeter to check continuity through the relay control coil.

a) Connect the meter according to the polarity shown in the illustration for one check; then reverse the ohmmeter leads and check continuity in the other direction.

b) If the relay contains a resistor, resistance will be indicated on the meter, and should be the same value with the ohmmeter in either direction.

c) If the relay contains a diode, resistance should be higher with the ohmmeter in the forward polarity direction than with the meter leads reversed.

d) If the ohmmeter shows infinite resistance in both directions, replace the relay.

8 Remove the relay from the vehicle and use the ohmmeter to check for continuity between the relay power circuit terminals. There should be no continuity between terminal 30 and 87 with the relay de-energized.

9 Connect a fused jumper wire to terminal 86 and the positive battery terminal. Connect another jumper wire between terminal 85 and ground. When the connections are made, the relay should click.

10 With the jumper wires connected, check for continuity between the power circuit terminals. Now, there should be continuity between terminals 30 and 87.

11 If the relay fails any of the above tests, replace it.

6 Turn signal and hazard flasher - check and replacement

Refer to illustrations 6.1, 6.4a, 6.4b and 6.4c

Warning: *The models covered by this manual are equipped with Supplemental Restraint systems (SRS), more commonly known as airbags. Always disarm the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag, which could cause personal injury* (see Section 25).

1 The turn signal and hazard flashers are controlled from a single electronic flasher unit which is mounted to the left of the steering column under the instrument panel **(see illustration)**.

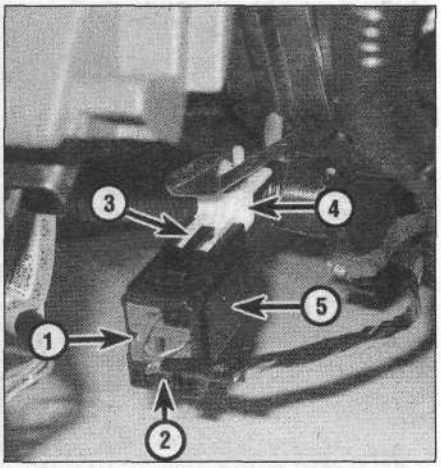
2 When the flasher unit is functioning properly, an audible click can be heard during its operation. If the turn signal indicator (on the instrument panel) on one side of the vehicle flashes much more rapidly than normal, a faulty turn signal bulb is indicated.

3 If both turn signals fail to blink, the problem may be due to a blown fuse, a faulty flasher unit, a broken switch or a loose or open connection. If a quick check of the fuse box indicates that the turn signal fuse has blown, check the wiring for a short before installing a new fuse.

4 To replace the flasher, remove the flasher from its mounting bracket and then disconnect the electrical connector **(see illustrations)**. (It's easier to detach the flasher unit first, and *then* disconnect the electrical connector.)

5 Make sure that the replacement unit is identical to the original. Compare the old one to the new one before installing it.

6 Installation is the reverse of removal.



6.1 The turn signal/hazard flasher unit is located under the instrument panel, to the left of the steering column

1 Electrical connector
2 Electrical connector release (located underneath the flasher unit, not visible in this photo)
3 Mounting tab (lift up with a small pocket screwdriver to release)
4 Plastic mounting bracket (it's not necessary to remove this part, but if you have difficulty releasing the mounting tab, you can pull the bracket down to separate it from the metal bracket above)
5 Turn signal/hazard flasher unit

7 Ignition switch and key lock cylinder - replacement

Warning: *All models covered by this manual are equipped with a Supplemental Restraint System (SRS), more commonly known as airbags. Always disarm the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag, which could cause personal injury* (see Section 25).

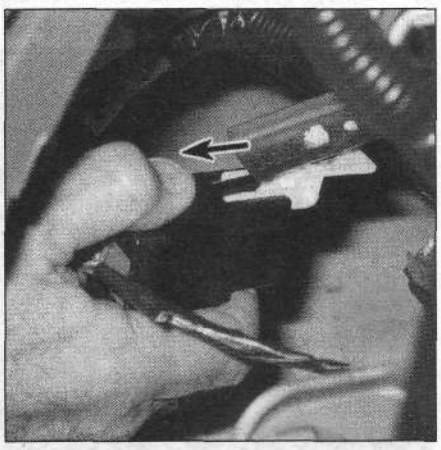
Key lock cylinder

Refer to illustrations 7.3a, 7.3b, 7.3c, 7.4a and 7.4b

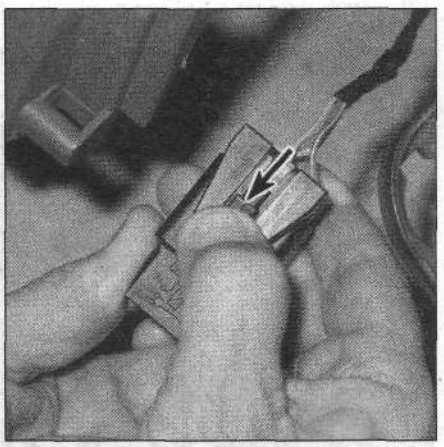
1 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

2 Turn the ignition key lock cylinder to the ON position.

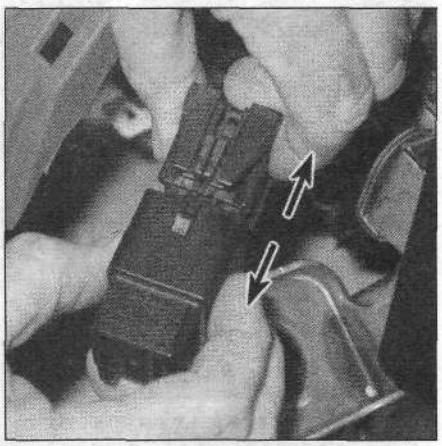
3 Insert a 1/8-inch awl or punch through the hole in the lower steering column cover, insert it through the hole in the steering column housing and then simultaneously depress the release button on the lock cylinder and pull the lock cylinder out of the steering column housing **(see illustrations)**.



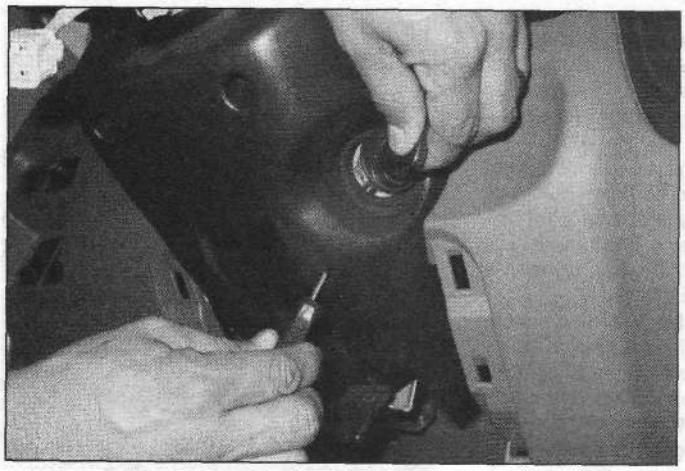
6.4a To detach the turn signal/hazard flasher unit from its mounting bracket, press down here with your thumb to release the locking tab and pull the flasher unit to the rear



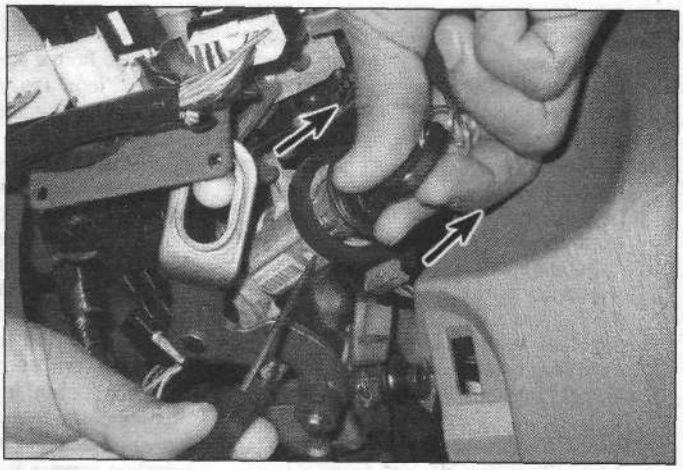
6.4b To disconnect the electrical connector from the turn signal/hazard flasher unit, depress this locking tab with your thumb . . .



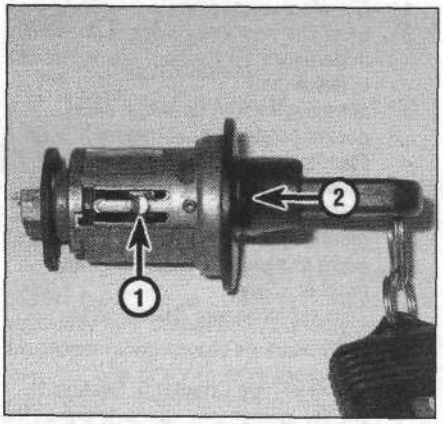
6.4c . . . and separate the connector from the turn signal/hazard flasher unit



7.3a To release the key lock cylinder from the steering column assembly, insert a 1/8-inch awl or punch through this hole in the steering column cover . . .

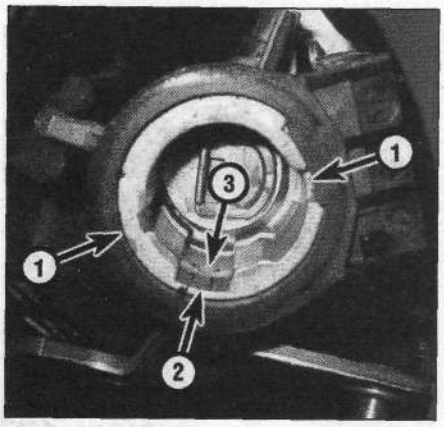


7.3b . . . through this hole in the steering column housing, then depress the release button on the lock cylinder and pull out the lock cylinder (steering column cover removed for clarity)



7.3c Key lock cylinder removal and installation details

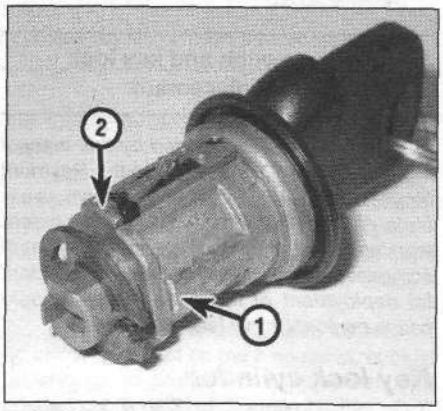
1 Release button
2 When installing the key lock cylinder, align the edge of the key with the release button to put the key in the ON position



7.4b Key lock cylinder receptacle in steering column housing

1 Narrow grooves
2 Wide groove
3 Release button locating hole in steering column housing

4 To install the lock cylinder, make sure that the ignition key is still in the ON position **(see illustration 7.3c)**, then insert the lock cylinder into the steering column housing with the wide ridge and two narrow ridges on the lock cylinder aligned with the wide groove and narrow grooves inside the lock cylinder receptacle **(see illustrations)**.



7.4a Key lock cylinder installation details

1 Narrow ridge (other narrow ridge, on other side of cylinder, not visible)
2 Wide ridge

5 Rotate the key back to the OFF position. This will allow the release button to extend itself back into the locating hole in the steering column housing.

6 Turn the lock to ensure that operation is correct in all positions.

7 Reconnect the cable to the negative battery terminal.

8 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

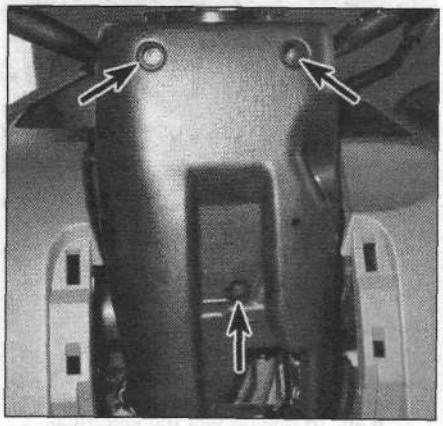
Ignition switch

Refer to illustration 7.11a, 7.11b, 7.12a, 7.12b, 7.14a, 7.14b and 7.14c

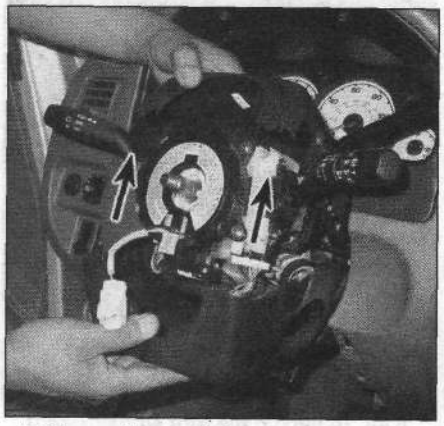
9 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

10 Remove the key lock cylinder (see Steps 1 through 3).

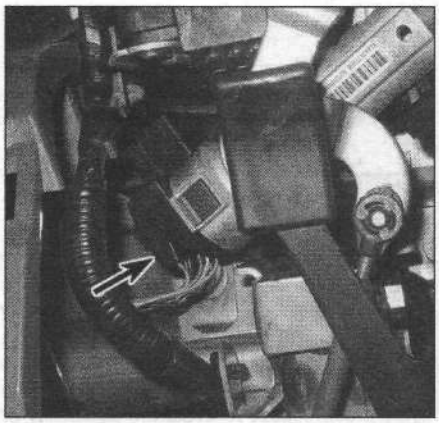
11 Remove the upper and lower steering column covers **(see illustrations)**.



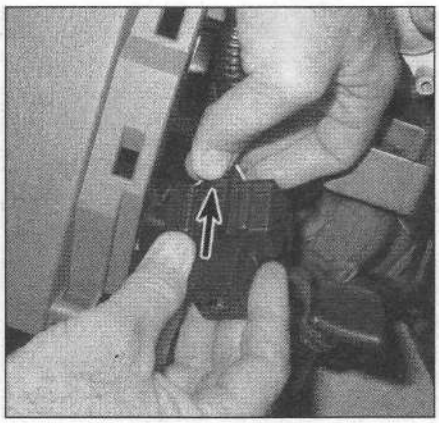
7.11a To detach the steering column covers, remove these three screws . . .



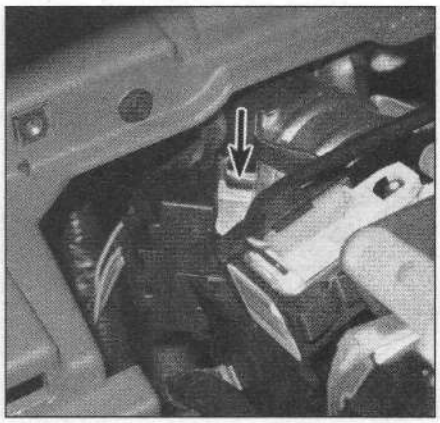
7.11b . . . then pull the upper and lower halves of the steering column cover apart and remove them (steering wheel removed for clarity)



7.12a To disconnect the electrical connector from the ignition switch . . .



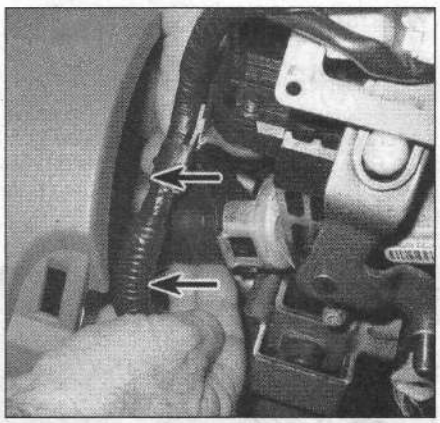
7.12b . . . depress this lock and pull out the connector



7.14a To remove the ignition switch from the steering column housing, release this button on top . . .

12 Disconnect the ignition switch electrical connector **(see illustrations)**.
13 Lower the steering column to its lowest tilt position.
14 Remove the ignition switch **(see illustrations)**.
15 Installation is the reverse of removal.
16 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).
17 Verify that the ignition switch operates correctly in the LOCK, ON, START and ACC positions.

7.14b . . . and this button on the bottom . . .



7.14c . . . then pull the ignition switch to the left to disengage it from the steering column housing

8 Steering column switches - replacement

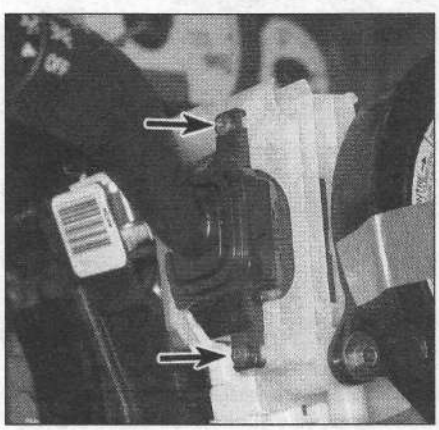
Warning: *The models covered by this manual are equipped with Supplemental Restraint systems (SRS), more commonly known as airbags. Always disarm the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag, which could cause personal injury* (see Section 25).

Multi-function switch

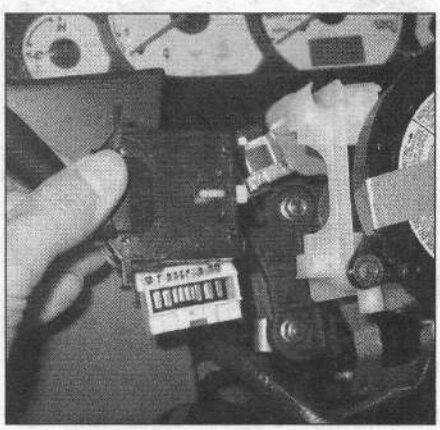
Refer to illustrations 8.4, 8.5a and 8.5b

1 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).
2 Remove the key lock cylinder (see Section 7).
3 Remove the steering column covers **(see illustrations 7.11a and 7.11b)**.
4 Disconnect the electrical connector from the multi-function switch **(see illustration)**.
5 Remove the multi-function switch retaining screws, then detach the switch from the steering column **(see illustrations)**.
6 Installation is the reverse of removal.
7 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

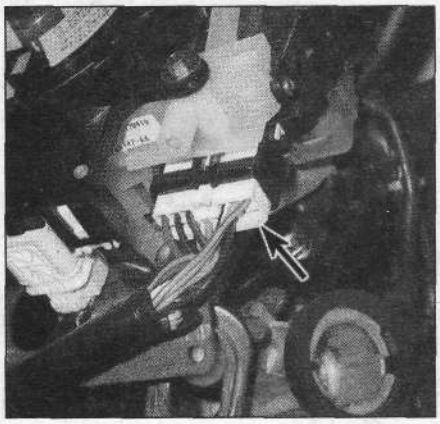
8.4 Disconnect the electrical connector from the multi-function switch



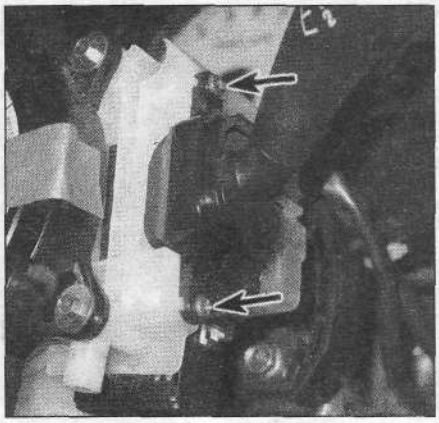
8.5a To detach the multi-function switch, remove these two screws . . .



8.5b . . . then remove the switch from the steering column assembly



8.10 Disconnect the electrical connector from the windshield wiper/washer switch



8.11a To detach the windshield wiper/washer switch, remove these two retaining screws . . .

Windshield wiper/washer switch

Refer to illustrations 8.10, 8.11a and 8.11b

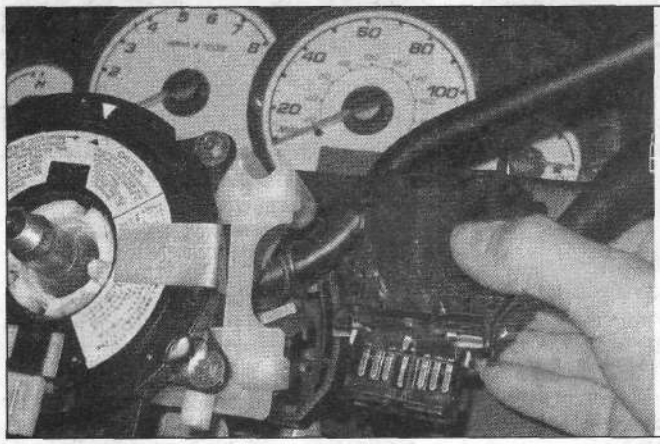
8 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

9 Remove the key lock cylinder (see Section 7) and the steering column covers **(see illustrations 7.11a and 7.11b)**.

10 Disconnect the electrical connector from the windshield wiper/washer switch **(see illustration)**.

11 Remove the windshield wiper/washer switch retaining screws, then detach the switch from the steering column **(see illustrations)**.

12 Installation is the reverse of removal.



8.11b . . . then remove the switch from the steering column

13 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

9 Instrument panel switches - replacement

Warning: *The models covered by this manual are equipped with Supplemental Restraint systems (SRS), more commonly known as airbags. Always disarm the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag, which could cause personal injury* (see Section 25).

Left/right power mirror adjustment switch

Refer to illustrations 9.2 and 9.3

1 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

2 Carefully pry the power window switch from the instrument panel **(see illustration)**.

3 Disconnect the electrical connector **(see illustration)** and remove the switch.

4 Installation is the reverse of removal.

5 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

Instrument panel dimmer switch

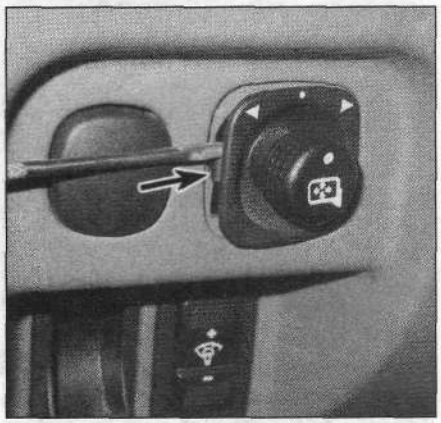
Refer to illustrations 9.7 and 9.8

6 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

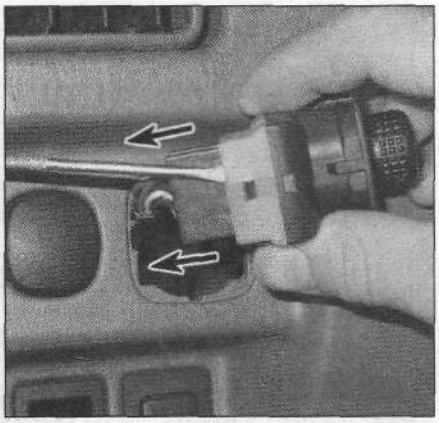
7 Carefully pry the switch from the instrument panel **(see illustration)**.

8 Disconnect the electrical connector **(see illustration)** and remove the switch.

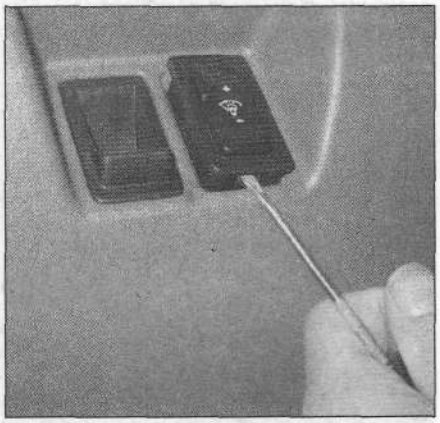
9 Installation is the reverse of removal.



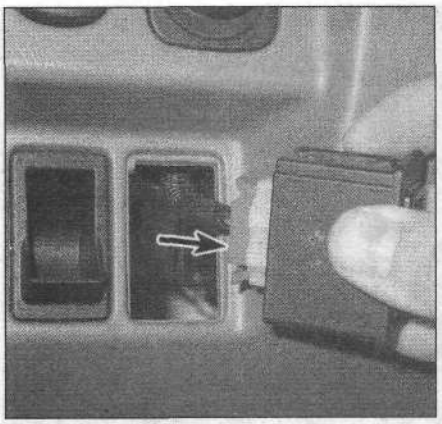
9.2 Carefully pry the left/right power mirror adjustment switch from the dash with a small screwdriver (the switch is secured to the dash by a small metal tab on each side)



9.3 Disconnect the electrical connector from the left/right power mirror adjustment switch; if the connector is difficult to separate from the switch, use a small screwdriver to carefully pry it loose



9.7 Carefully pry the instrument panel dimmer switch from the dash



9.8 Disconnect the electrical connector from the instrument panel dimmer switch and remove the switch

10 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

Hazard flasher switch

Refer to illustrations 9.12, 9.13, 9.14a and 9.14b

11 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

12 Pry the center trim panel loose from the dash **(see illustration)**. (It's not necessary to actually remove it.)

13 Disconnect the hazard flasher electrical connector **(see illustration)**.

14 To remove the hazard flasher switch, squeeze the two locking tangs **(see illustrations)** and push the switch out of the center trim panel.

15 Installation is the reverse of removal.

16 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

Rear window defogger switch

17 The rear window defogger switch, which is located to the left of the hazard flasher switch, is removed and installed exactly the same way as the hazard flasher switch (see Steps 11 through 16).

Cigarette lighter

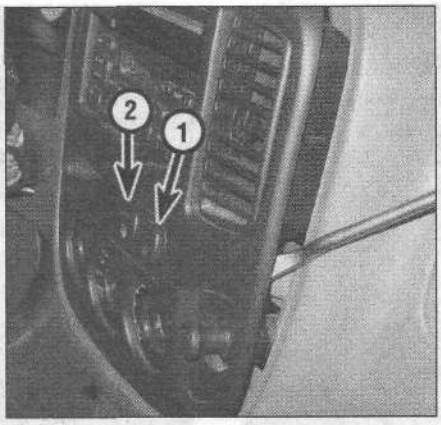
Refer to illustrations 9.20a and 9.20b

18 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

19 Remove the center trim panel (see Chapter 11).

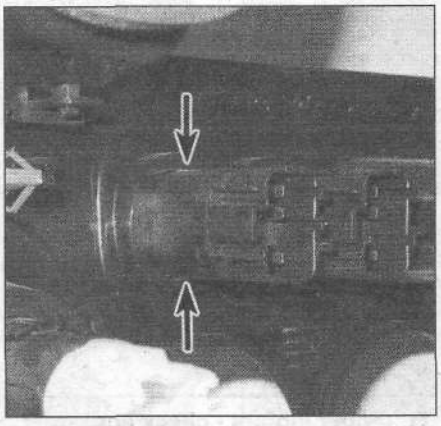
20 Pry open the two locking tangs and push the cigarette lighter out of the trim panel **(see illustrations)**.

21 When installing the cigarette lighter in the center trim panel, be sure to push the lighter into the trim panel until it snaps into place, indicating that it's fully seated.



9.12 Carefully pry the center trim panel loose (it's not necessary to remove it)

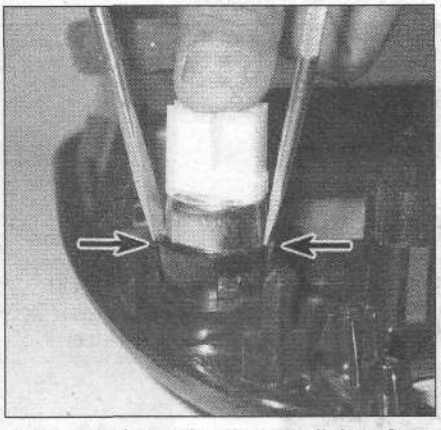
1 Hazard flasher switch
2 Rear window defogger switch



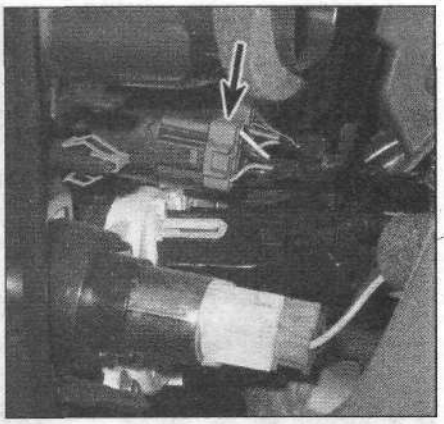
9.14a To detach the hazard flasher switch from the center trim panel, squeeze these two locking tangs . . .

22 Installation is otherwise the reverse of removal.

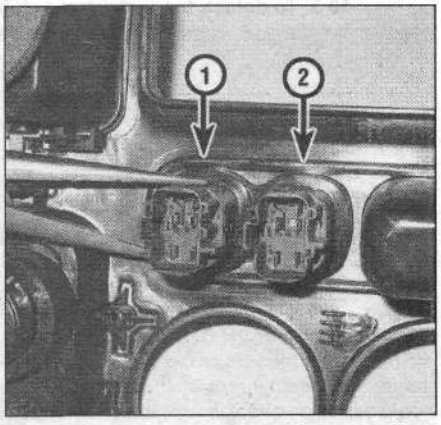
23 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).



9.20a To release the cigarette lighter from the center trim panel, pry these two locking tangs out . . .

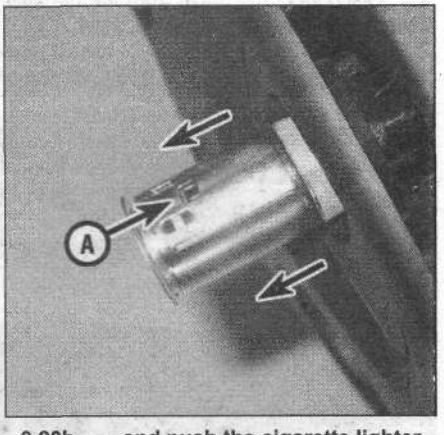


9.13 Disconnect the electrical connector from the hazard flasher switch

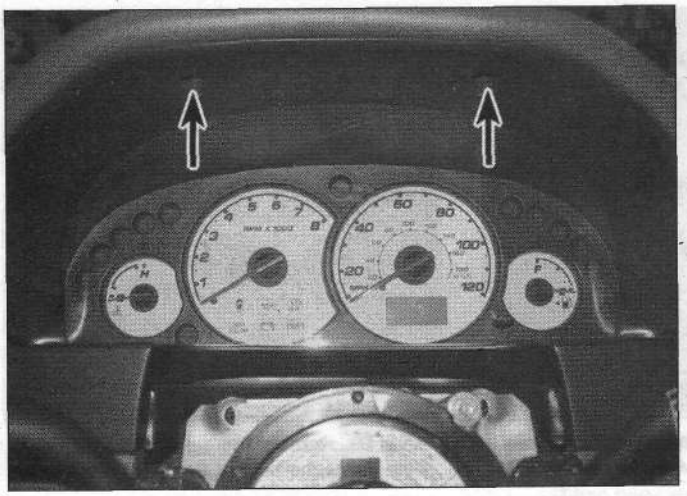


9.14b . . . with a pair of needle-nose pliers and push the switch out of the trim panel; push it out *from the rear side*; don't try to push the switch through the trim panel from the front (center trim panel removed for clarity)

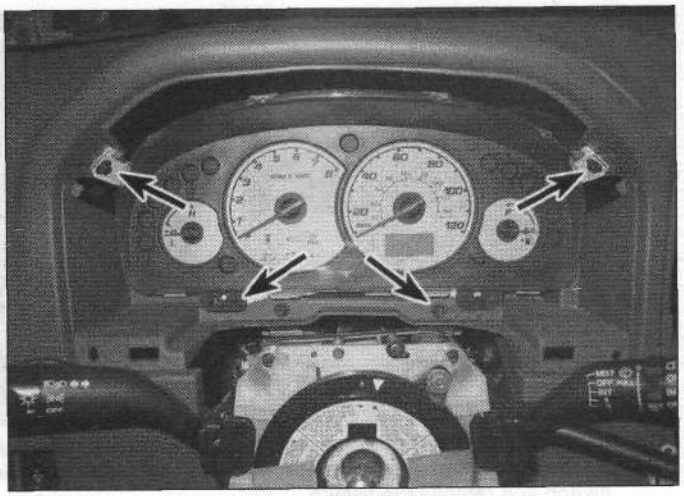
1 Hazard flasher switch
2 Rear window defogger switch (remove the same way)



9.20b . . . and push the cigarette lighter out of the trim panel from the back side; when installing the cigarette lighter, make sure that the dimpled area (A) on each side of the lighter is aligned with a locking tang, or the lighter won't be securely fastened to the trim panel



10.3 To detach the instrument cluster finish panel, remove these two screws



10.4a To detach the instrument cluster, remove these four screws . . .

10 Instrument cluster - removal and installation

Refer to illustrations 10.3, 10.4a and 10.4b

Warning: *The models covered by this manual are equipped with Supplemental Restraint systems (SRS), more commonly known as airbags. Always disarm the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag, which could cause personal injury* (see Section 25).

Note: This procedure is intended for removing the instrument cluster for access to other components (such as during instrument panel removal) only. If the instrument cluster requires replacement, the job will have to be performed at a dealer service department or other qualified repair shop equipped with the special scan tool that is required to upload the module configuration data and download this data into the new cluster.

1 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

2 Tilt the steering wheel to its lowest position and move the transaxle shift lever out of the way.

3 Remove the instrument cluster finish panel screws **(see illustration)** and remove the cluster finish panel.

4 Remove the instrument cluster retaining screws **(see illustration)**, then pull out the cluster and disconnect the electrical connectors from the back side **(see illustration)**.

5 Installation is the reverse of removal.

6 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

11 Wiper motors - check and replacement

Wiper motor circuit check

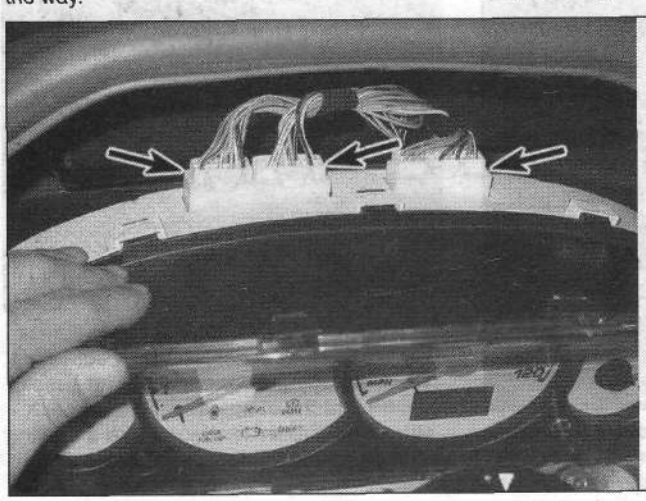
Note: *Refer to the wiring diagrams at the end of this Chapter for wire colors in the following checks. When checking for voltage, probe a grounded 12-volt test light to each terminal at a connector until it lights; this verifies voltage (power) at the terminal. If the following checks fail to locate the problem, have the system diagnosed by a dealer service department or other properly equipped repair facility.*

1 If the wipers work slowly, make sure the battery is in good condition and has a strong charge (see Chapter 5). If the battery is in good condition, remove the wiper motor (see below) and operate the wiper arms by hand. Check for binding linkage and pivots. Lubricate or repair the linkage or pivots as necessary. Reinstall the wiper motor. If the wipers still operate slowly, check for loose or corroded connections, especially the ground connection. If all connections look OK, replace the motor.

2 If the wipers fail to operate when activated, check the fuse (see Section 3). If the fuse is OK, connect a jumper wire between the wiper motor's ground terminal and ground, then retest. If the motor works now, repair the ground connection. If the motor still doesn't work, turn the wiper switch to the HI position and check for voltage at the motor.

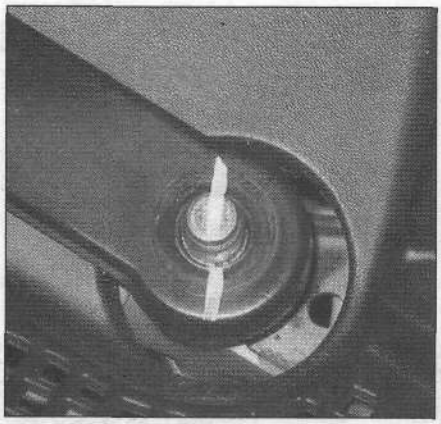
Note: *The cowl cover will have to be removed to access the electrical connector* (see Steps 7 and 8).

3 If there's voltage at the connector, remove the motor and check it off the vehicle with fused jumper wires from the battery. If the motor now works, check for binding linkage

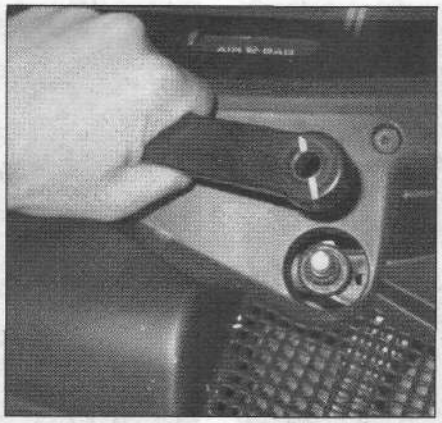


10.4b . . . pull out the cluster and disconnect the electrical connectors from the back side

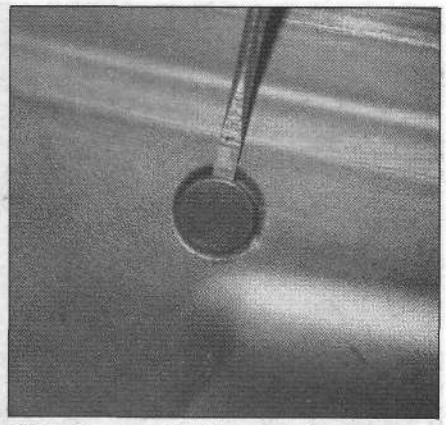
11.7a Remove each windshield wiper arm retaining nut . . .



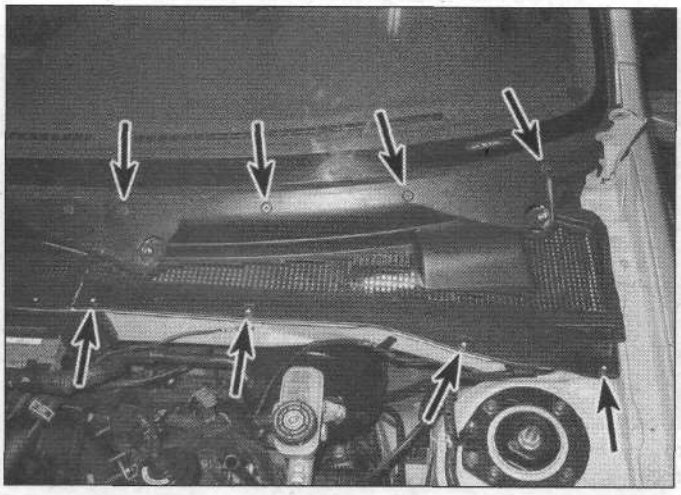
11.7b . . . mark the relationship of the wiper arm to the shaft . . .



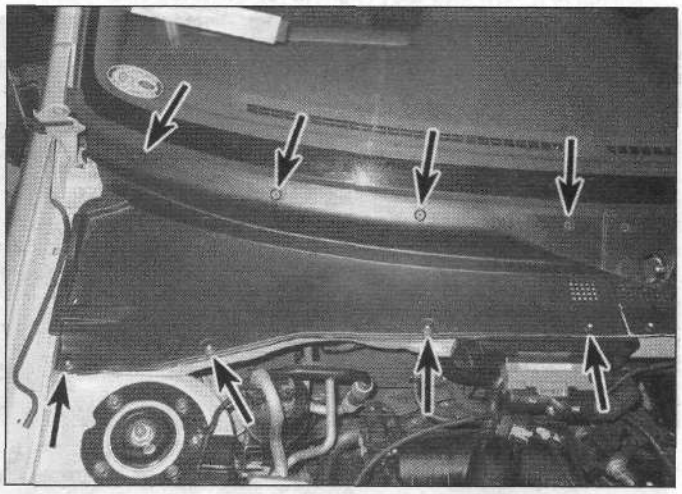
11.7c . . . then pull the windshield wiper arm off the shaft



11.8a Remove the trim caps that cover up the rear cowl fasteners (the ones nearer the windshield)



11.8b To detach the left cowl vent panel, remove these fasteners (the rear fasteners are Phillips screws; the front fasteners are pin-type retainers, also referred to as pop fasteners)

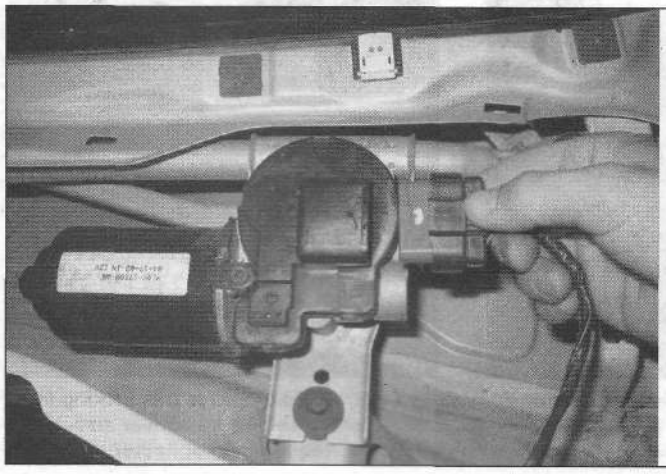


11.8c To detach the right cowl vent panel, remove these fasteners (the rear fasteners are Phillips screws; the front fasteners are pin-type retainers, also referred to as pop fasteners)

(see Step 1). If the motor still doesn't work, replace it. If there's no voltage to the motor, check for voltage at the wiper control relays. If there's voltage at the wiper control relays and no voltage at the wiper motor, have the switch tested. If the switch is OK, the wiper control relay is probably bad. See Section 5 for relay testing.

4 If the interval (delay) function is inoperative, check the continuity of all the wiring between the switch and wiper control module.

5 If the wipers stop at the position they're in when the switch is turned off (fail to park), check for voltage at the park feed wire of the wiper motor connector when the wiper switch is OFF but the ignition is ON. If no voltage is present, check for an open circuit between the wiper motor and the fuse panel.



11.9 Disconnect the electrical connector from the windshield wiper motor

Wiper motor replacement

Windshield wiper motor

Refer to illustrations 11.7a, 11.7b, 11.7c, 11.8a, 11.8b, 11.8c, 11.9, 11.10 and 11.12

6 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

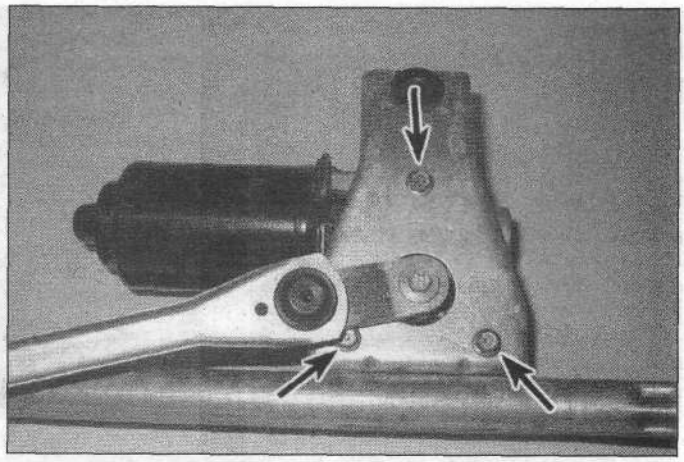
7 Remove the windshield wiper retaining nuts **(see illustration)**. Mark the positions of the wiper arm on the windshield, then remove the wiper arm **(see illustrations)**.

8 Remove the windshield cowl cover **(see illustrations)**. Store all the trim caps, Phillips screws and pin-type retainers in a plastic bag.

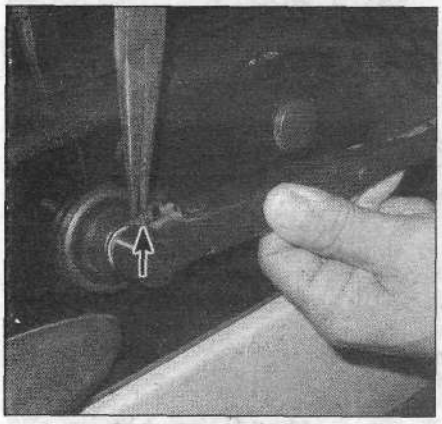
9 Disconnect the wiper motor harness connector from the windshield wiper motor **(see illustration)**.

10 Remove the windshield wiper motor/linkage assembly mounting bolts **(see illustration)**.

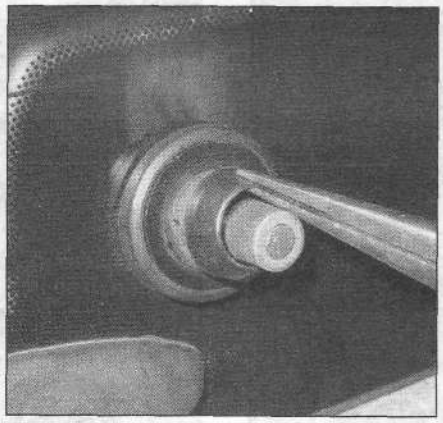
11.10 To detach the windshield wiper motor from the vehicle, remove these bolts



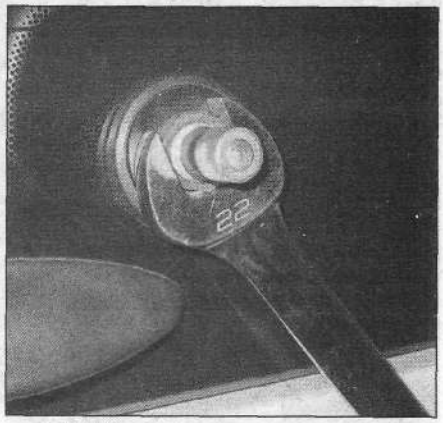
11.12 To detach the windshield wiper motor from its mounting bracket, remove these three bolts



11.16 To detach the rear window wiper arm from the shaft, pull this locking tab straight up with a pair of needle-nose pliers, then pull the wiper arm straight off the shaft



11.17a Remove this protective cover for the rear window wiper motor shaft nut . . .



11.17b . . . then unscrew the nut

11 Lift the windshield wiper motor assembly from the cowl area.

12 Remove the windshield wiper motor mounting bolts **(see illustration)** and separate the motor from its mounting bracket.

13 Installation is the reverse of removal. Be sure to align the marks you made on the windshield wiper arms and the wiper arm shafts.

14 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

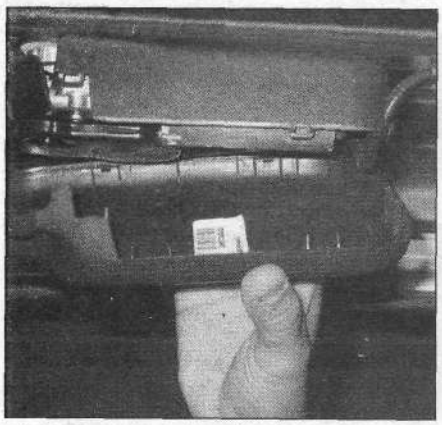
Rear window wiper motor

Refer to illustrations 11.16, 11.17a, 11.17b, 11.18, 11.19a, 11.19b and 11.20

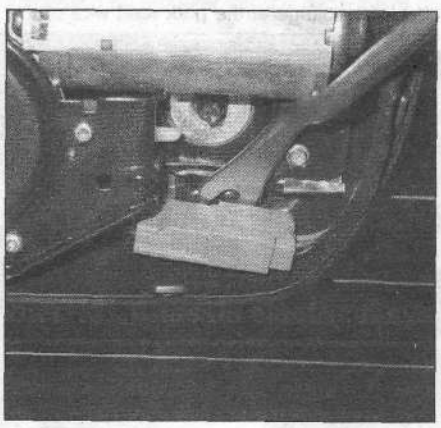
15 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

16 Remove the rear window wiper arm **(see illustration)**.

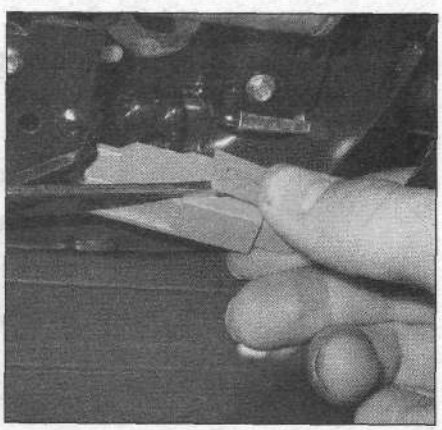
17 Remove the protective cover for the rear window wiper motor shaft nut, then remove the nut **(see illustrations)**.



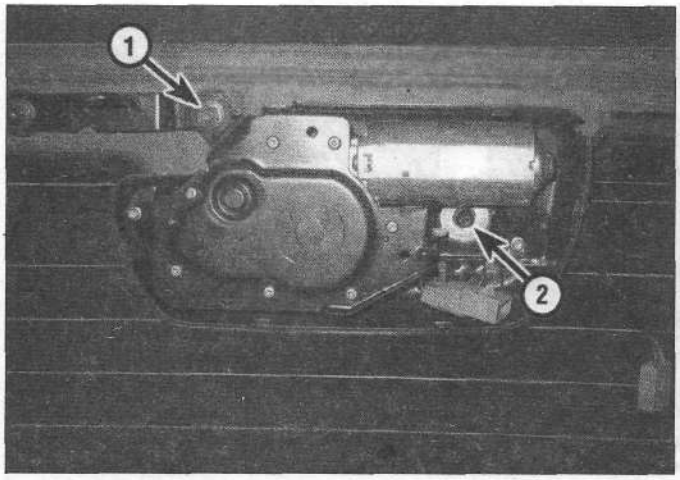
11.18 To remove the plastic cover for the wiper motor, simply pop it off



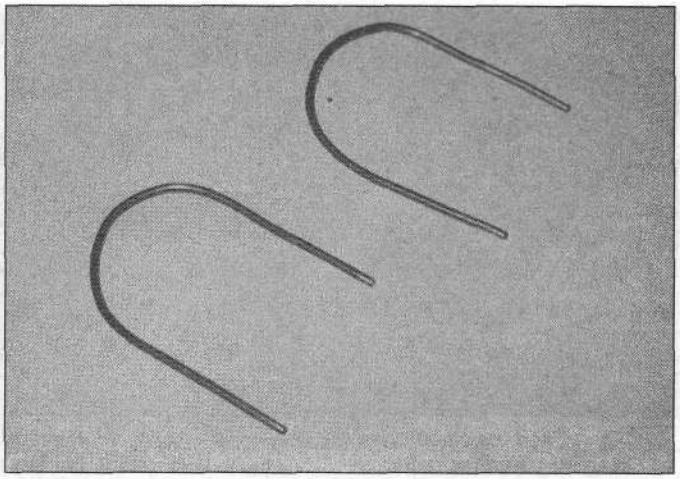
11.19a Using a panel removal tool or a screwdriver, detach the electrical connector from its bracket . . .



11.19b . . . then release this locking tab with a small screwdriver and unplug the connector



11.20 To detach the rear window wiper motor from the rear window, remove the mounting nut (1) and bolt (2)



12.2a You'll need a pair of special radio removal tools (available at most auto parts stores) or make your own from a couple of pieces of coat hanger wire bent into a U-shape as shown

12.2b Insert the special radio removal tools into the holes at each end of the radio as shown, then push them in until you feel the internal clips release

12.3 Push outward on both radio removal tools and simultaneously pull out the radio

18 Open the liftgate and remove the plastic cover for the rear window wiper motor **(see illustration)**.

19 Disconnect the electrical connector from the rear window wiper motor **(see illustrations)**.

20 Remove the mounting nut and bolt **(see illustration)** and remove the rear window wiper motor.

21 Installation is the reverse of removal.

22 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

12 Radio and speakers - removal and installation

Warning: *The models covered by this manual are equipped with Supplemental Restraint systems (SRS), more commonly known as airbags. Always disable the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag, which could cause personal injury* (see Section 25).

Radio

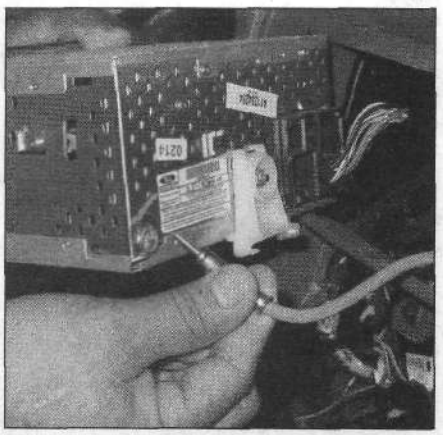
Refer to illustration 12.2a, 12.2b, 12.3, 12.4a and 12.4b

1 Disconnect the cable from the negative battery terminal (see Chapter 5, Section 1).

2 For theft protection, the radio receiver is retained in the instrument panel by special clips. Releasing these clips requires the use of a pair of special radio removal tools, available at most auto parts stores, or two short lengths of coat hanger wire bent into U-shapes **(see illustration)**. Insert the tools into the holes at the corners of the radio assembly **(see illustration)**. Insert the tools until you feel the internal retaining clips release.

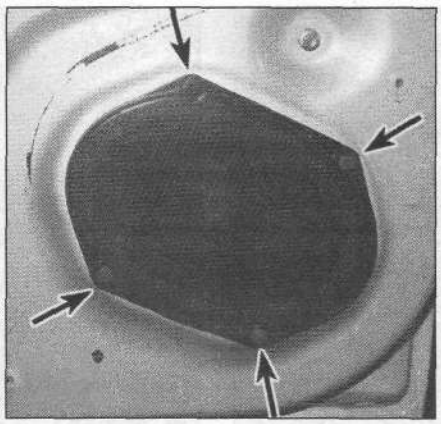
3 Push outward on both removal tools and simultaneously pull the radio assembly out of the instrument panel **(see illustration)**.

4 Disconnect the antenna and the electrical connector from the back of the radio **(see illustrations)** and remove the radio from the vehicle.

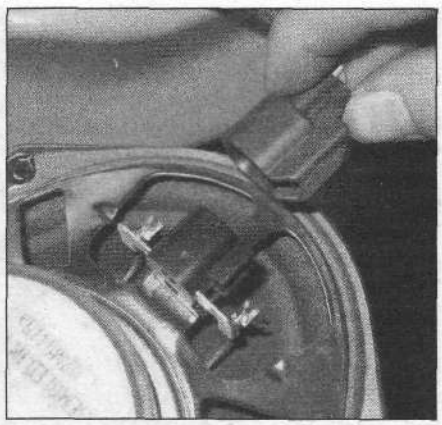


12.4a When the radio has been pulled out far enough to access the back side, disconnect the antenna cable . . .

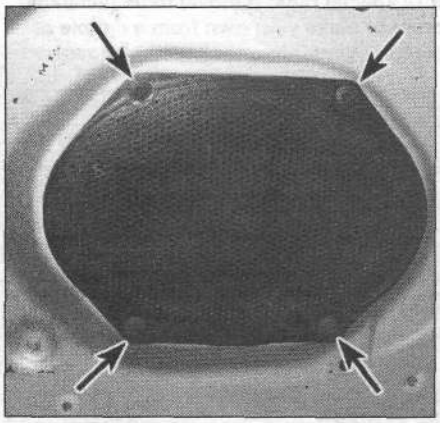
12.4b . . . and the electrical connector from the radio



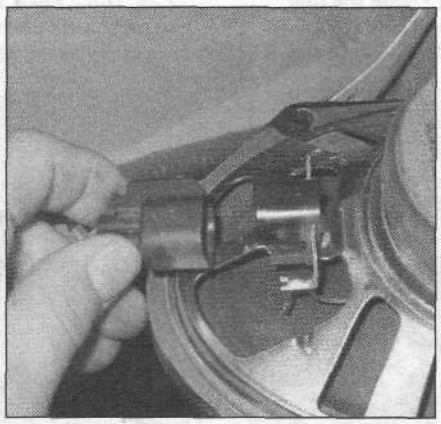
12.8 To detach a speaker from a front door, remove these four screws



12.9 Before removing the speaker from the front door, disconnect the electrical connector



12.12 To detach a speaker from a rear door, remove these four screws



12.13 Before removing the speaker from the rear door, disconnect the electrical connector

5 Installation is the reverse of removal. After reconnecting the electrical connector and antenna cable, insert the radio into the dash and slide it into place until you feel and/or hear the retaining clips snapping into place.

6 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

Speakers

Front door speakers

Refer to illustrations 12.8 and 12.9

7 Remove the door trim panel (see Chapter 11).

8 Remove the speaker mounting screws **(see illustration)** and pull the speaker out of its receptacle in the door.

9 Disconnect the electrical connector **(see illustration)** and remove the speaker from the vehicle.

10 Installation is the reverse of removal.

Rear door speakers

Refer to illustrations 12.12 and 12.13

11 Remove the door trim panel (see Chapter 11).

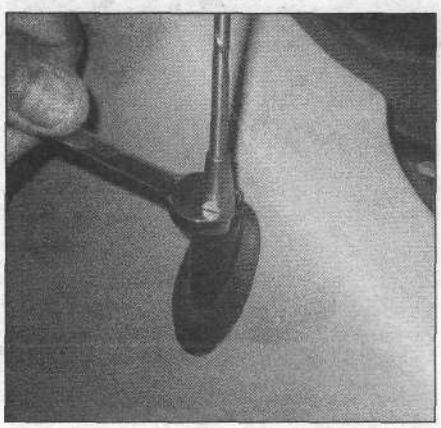
12 Remove the speaker mounting screws **(see illustration)** and pull the speaker out of its receptacle in the door.

13 Disconnect the electrical connector **(see illustration)** and remove the speaker from the vehicle.

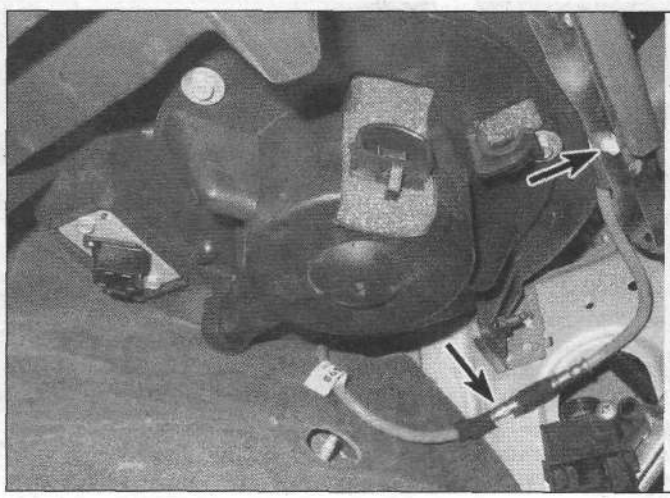
14 Installation is the reverse of removal.

13 Antenna and cable - removal and installation

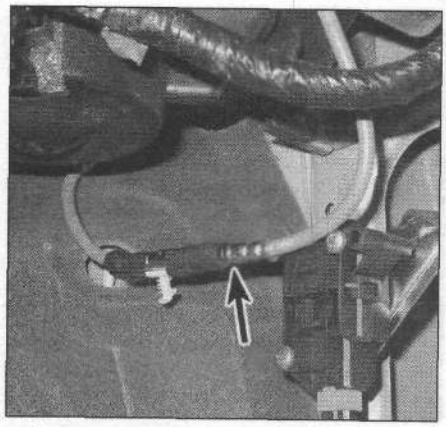
Warning: *The models covered by this manual are equipped with Supplemental Restraint systems (SRS), more commonly known as airbags. Always disable the airbag system before working in the vicinity of any airbag system component to avoid the possibility of accidental deployment of the airbag, which could cause personal injury* (see Section 25).



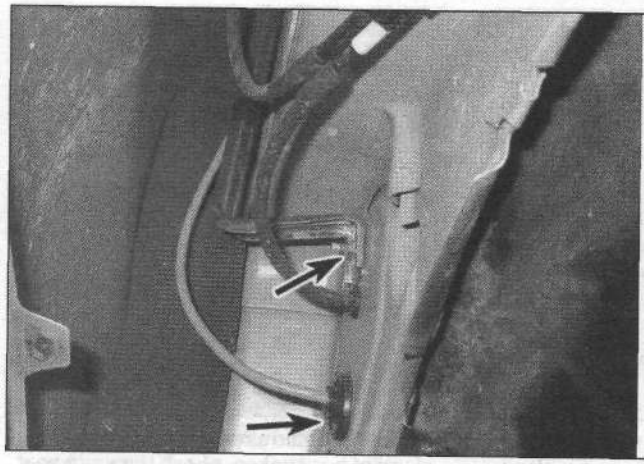
13.1 Unscrew the antenna mast with a 10 mm wrench



13.3a Detach these two cable clips . . .



13.3b . . . and disconnect the antenna cable connector



13.6 Remove the antenna cable grommet, pull the antenna cable into the fender area, remove the antenna support bracket nut, then pull the antenna mounting base down through its hole in the fender and remove the mounting base, support bracket and antenna cable as a single assembly

Antenna (and outside antenna cable)

Refer to illustrations 13.1, 13.3a, 13.3b and 13.6

Note: *The antenna cable actually has two sections. This procedure describes the removal procedure for the antenna mast, the antenna mounting base and the outside part of the antenna cable, which begins at the connector below the blower motor housing and extends to the antenna mounting base in the right fender. For the removal procedure for the rest of the antenna cable (the part from the connector to the back of the radio,* see Step 9*).*

1 Remove the antenna mast **(see illustration)** from its mounting base.

2 Remove the right scuff plate and the right lower A-pillar trim panel (see "Instrument panel - removal and installation" in Chapter 11).

3 Working under the right end of the dash, detach the two antenna cable clips and disconnect the antenna cable connector **(see illustrations)**.

4 Loosen the right front wheel lug nuts. Raise the vehicle and place it securely on jackstands. Remove the right front wheel.

5 Remove the right inner fender splash shield (see "Front fender - removal and installation" in Chapter 11).

6 Working inside the fender area, remove the antenna cable grommet **(see illustration)**, pull the antenna cable into the fender area, remove the antenna support bracket nut, then pull the antenna mounting base down through its hole in the fender and remove the mounting base, support bracket and antenna cable as a single assembly

7 Remove the electrical tape securing the antenna cable to the support bracket and discard the old antenna base and cable.

8 Installation is the reverse of removal.

(Inside) antenna cable

Refer to illustrations 13.12 and 13.13

Note: *This procedure describes the removal procedure for the rest of the antenna cable, which begins at the connector shown in illustration 13.3b and extends to the back of the radio. If you want to remove the outside part of the antenna cable, refer to Steps 1 through 8 above.*

9 Remove the radio (see Section 12).

10 Remove the right scuff plate and kick panel (see "Front fender - removal and installation" in Chapter 11), then disconnect the inside part of the antenna cable from the outside cable **(see illustrations 13.3a and 13.3b)**.

11 Remove the glove box (see Chapter 11).

12 Detach the three pin-type retainers that secure the cable to the horizontal support brace located on the lower edge of the glove box recess **(see illustration)**.

13 There are two more pin-type retainers **(see illustration)** securing the antenna cable to the vertical support brace that's located on the right side of the radio recess. Detach both of them.

14 Remove the inside antenna cable.

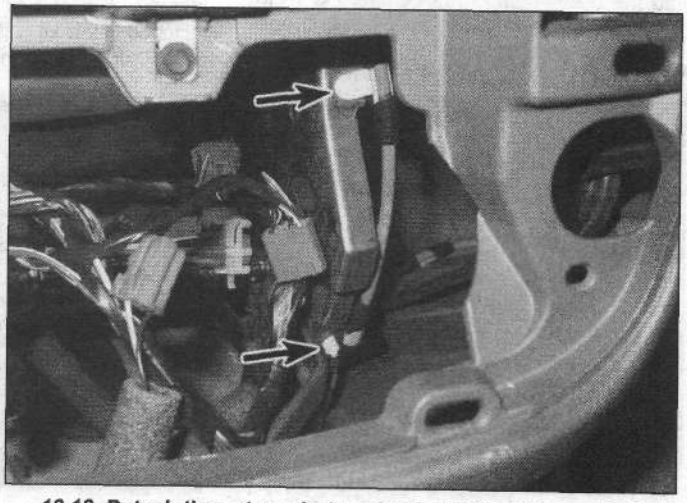
15 Installation is the reverse of removal.

14 Rear window defogger - check and repair

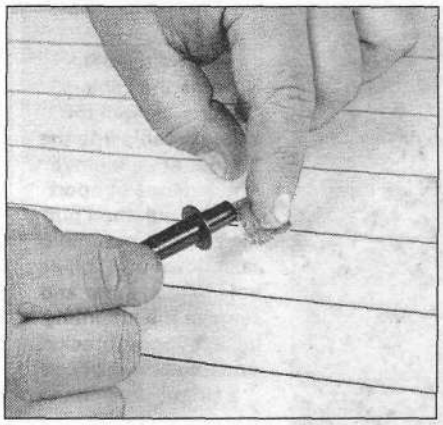
1 The rear window defogger consists of a number of horizontal elements baked onto the glass surface.

2 Small breaks in the element can be repaired without removing the rear window.

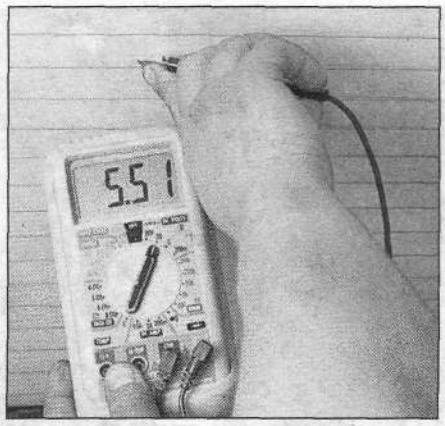
13.12 After removing the glove box, detach these three pin-type retainers from the support brace running along the lower edge of the glove box recess



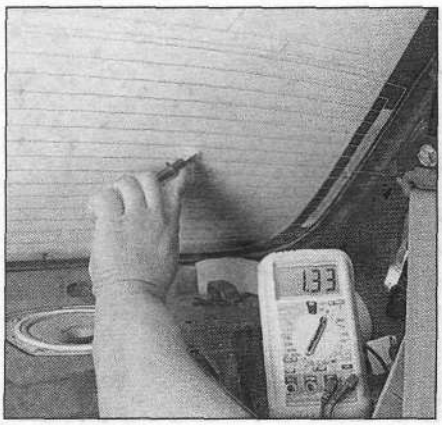
13.13 Detach these two pin-type retainers from the vertical support brace located at the right side of the radio recess



14.4 When measuring the voltage at the rear window defogger grid, wrap a piece of aluminum foil around the positive probe of a voltmeter and press the foil against the wire with your finger



14.5 To determine whether a heating element has broken, check the voltage at the center of each element; if the voltage is five or six volts, the element is unbroken, but if the voltage is 10 or 12 volts, the element is broken between the center and the ground side; if there's no voltage, the element is broken between the center and the positive side



14.7 To find the break, place the voltmeter negative lead against the defogger ground terminal, place the voltmeter positive lead with the foil strip against the heating element at the positive terminal end and slide it toward the negative terminal end; the point at which the voltmeter reading changes abruptly is the point at which the element is broken

Check

Refer to illustrations 14.4, 14.5 and 14.7

3 Turn the ignition switch and defogger system switches to the ON position. Using a voltmeter, place the positive probe against the defogger grid positive terminal and the negative probe against the ground terminal. If battery voltage is not indicated, check the fuse, defogger switch and related wiring. If voltage is indicated, but all or part of the defogger doesn't heat, proceed with the following tests.

4 When measuring voltage during the next two tests, wrap a piece of aluminum foil around the tip of the voltmeter positive probe and press the foil against the heating element with your finger **(see illustration)**. Place the negative probe on the defogger grid ground terminal.

5 Check the voltage at the center of each heating element **(see illustration)**. If the voltage is 5 or 6-volts, the element is okay (there is no break). If the voltage is zero, the element is broken between the center of the element and the positive end. If the voltage is 10 to 12-volts the element is broken between the center of the element and ground. Check each heating element.

6 Connect the negative lead to a good body ground. The reading should stay the same. If it doesn't, the ground connection is bad.

7 To find the break, place the voltmeter negative probe against the defogger ground terminal. Place the voltmeter positive probe with the foil strip against the heating element at the positive terminal end and slide it toward the negative terminal end. The point at which the voltmeter deflects from several volts to zero is the point at which the heating element is broken **(see illustration)**.

Repair

Refer to illustration 14.13

8 Repair the break in the element using a repair kit specifically recommended for this purpose, available at most auto parts stores. Included in this kit is plastic conductive epoxy.

9 Prior to repairing a break, turn off the system and allow it to cool off for a few minutes.

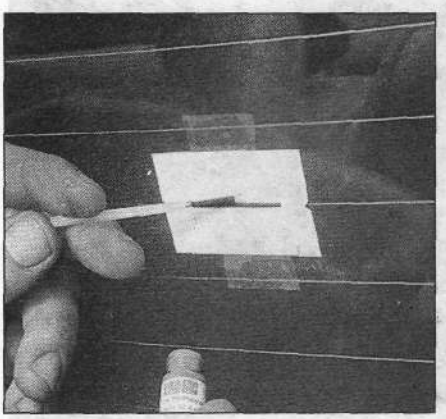
10 Lightly buff the element area with fine steel wool, then clean it thoroughly with rubbing alcohol.

11 Use masking tape to mask off the area being repaired.

12 Thoroughly mix the epoxy, following the instructions provided with the repair kit.

13 Apply the epoxy material to the slit in the masking tape, overlapping the undamaged area about 3/4-inch on either end **(see illustration)**.

14 Allow the repair to cure for 24 hours before removing the tape and using the system.

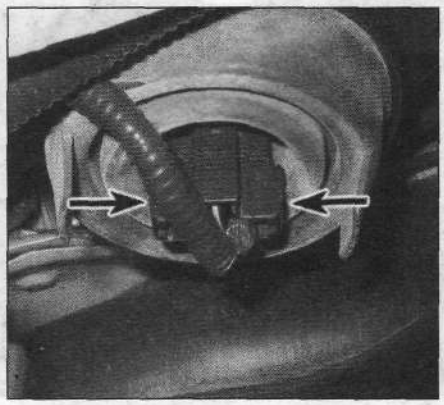


14.13 To use a defogger repair kit, apply masking tape to the inside of the window at the damaged area, then brush on the special conductive coating

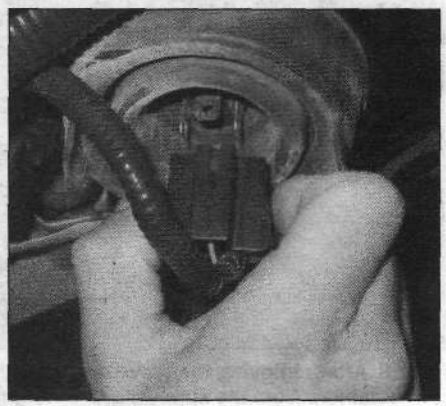
15 Headlight bulb - replacement

Refer to illustration 15.2a, 15.2b, 15.3, 15.4, 15.5, 15.6 and 15.7

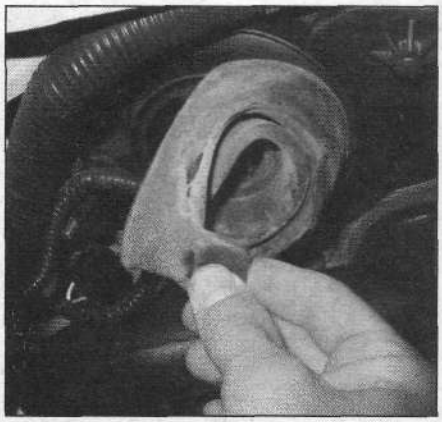
Warning: *Halogen gas filled bulbs are under pressure and may shatter if the surface is scratched or the bulb is dropped. Wear eye*



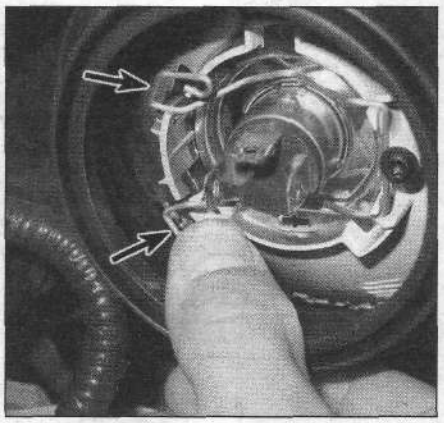
15.2a To disconnect the electrical connector from the headlight, squeeze the two locking tabs on the side . . .



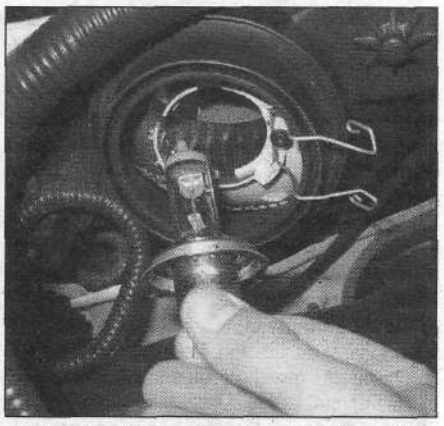
15.2b . . . and pull off the connector



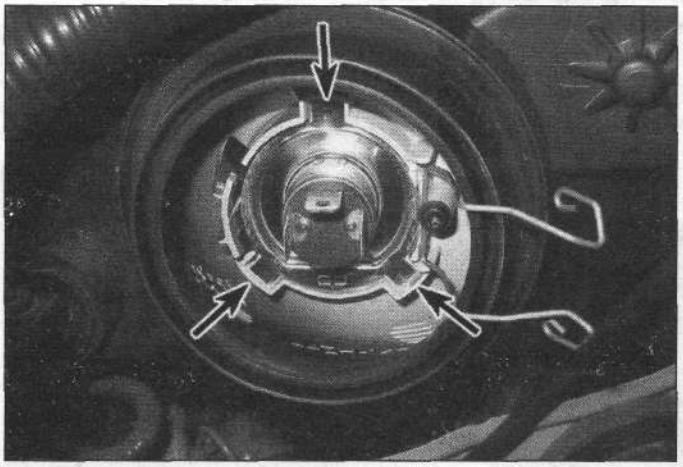
15.3 Remove the protective rubber boot from the headlight assembly



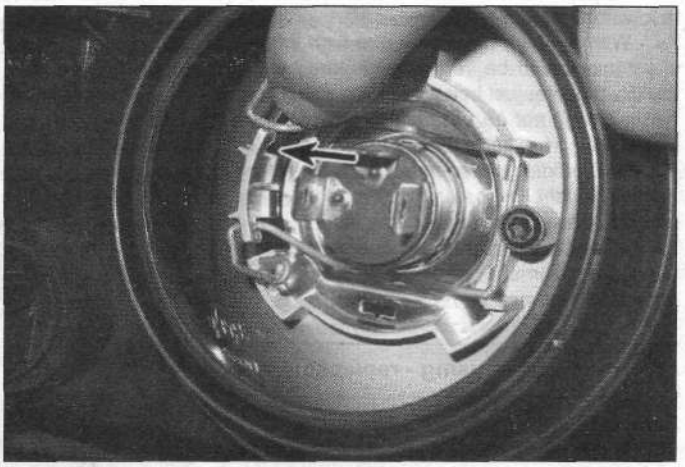
15.4 To disengage the bulb retainer spring, press each end of the spring forward and unhook it, then swing the retainer out of the way



15.5 Carefully remove the bulb from the headlight assembly



15.6 When installing the new bulb, make sure that the three metal tabs on the new bulb are aligned with the three grooves in the plastic base, and that the bulb's metal base is fully seated against the plastic base, before securing it with the spring retainer



15.7 When reconnecting the spring retainer, make sure that the retainer ends are correctly engaged with the hooks

protection and handle the bulbs carefully, grasping only the base whenever possible. Do not touch the surface of the bulb with your fingers because the oil from your skin could cause it to overheat and fail prematurely. If you do touch the bulb surface, clean it with rubbing alcohol.

1 Make sure that the headlight switch and the ignition switch are both turned off, then open the hood.

2 Disconnect the electrical connector from the headlight assembly **(see illustrations)**.

3 Remove the rubber boot from the headlight assembly **(see illustration)**.

4 Disengage the headlight bulb retainer spring **(see illustration)**.

5 Remove the bulb from the headlight assembly **(see illustration)**.

6 Without touching the glass part of the new bulb with your bare fingers, insert the bulb into the headlight assembly. Make sure that the three metal tabs on the new bulb are aligned with the three grooves in the plastic base **(see illustration)**, then push the bulb into the headlight assembly until the bulb's metal base is fully seated against the plastic base.

7 Swing the spring retainer back into place and engage the spring ends with their respective hooks on the headlight assembly **(see illustration)**.

8 Install the protective rubber boot on the headlight assembly.

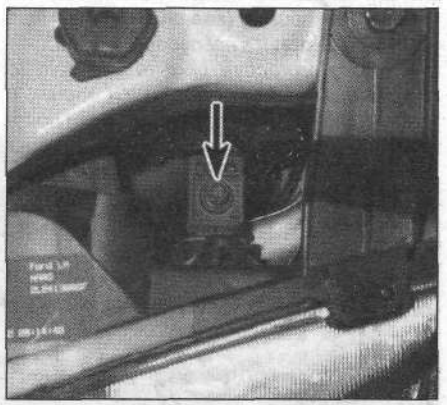
9 Plug in the electrical connector.

10 Test the headlight operation, then close the hood.

16 Headlights - adjustment

Refer to illustrations 16.1 and 16.3

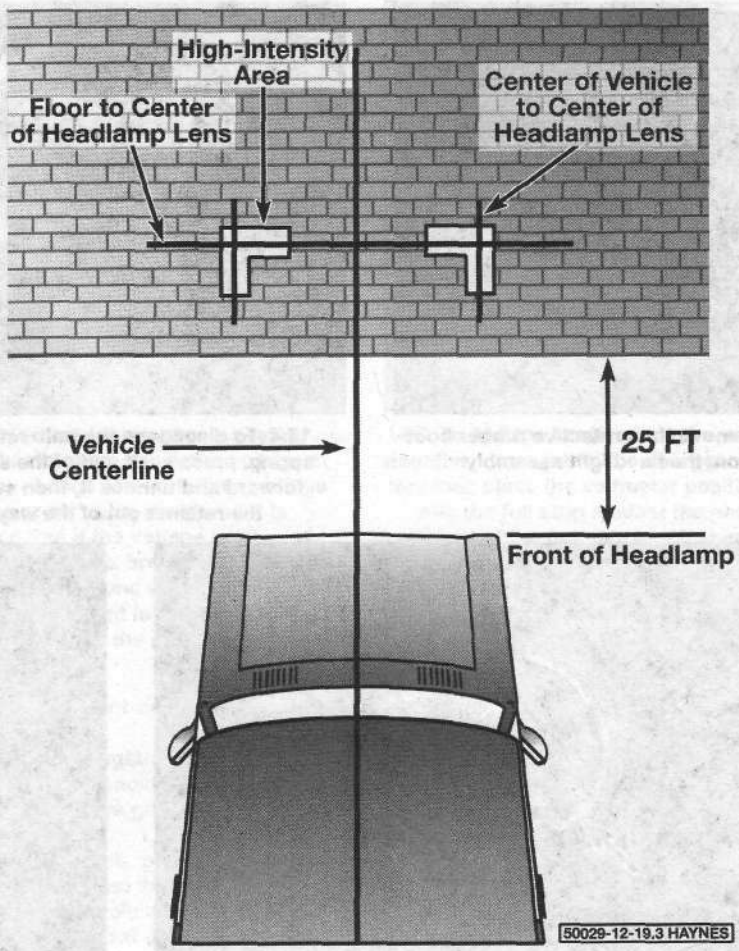
Note: *The headlights must be aimed correctly. If adjusted incorrectly they could blind the driver of an oncoming vehicle and cause a serious accident or seriously reduce your ability to see the road. The headlights should be checked for proper aim every 12 months and any time a new headlight is installed or front end body work is performed. It should be emphasized that the following procedure is only an interim step that will provide temporary adjustment until the headlights can be adjusted by a properly equipped shop.*



16.1 Headlight vertical adjustment screw location (there is no horizontal adjustment screw)

1 The vertical adjustment screws are located behind each headlight **(see illustration)**. (There are no horizontal adjustment screws.)

2 There are several methods for adjusting the headlights. The simplest method requires masking tape, a blank wall and a level floor.
3 Position masking tape vertically on the wall in reference to the vehicle centerline and the centerlines of both headlights **(see illustration)**.
4 Position a horizontal tape line in reference to the centerline of all the headlights. **Note:** *It may be easier to position the tape on the wall with the vehicle parked only a few inches away.*
5 Adjustment should be made with the vehicle parked 25 feet from the wall, sitting level, the gas tank half-full and no heavy load in the vehicle.
6 Starting with the low beam adjustment, position the high intensity zone so it is two inches below the horizontal line. Adjustment is made by turning the adjusting screw clockwise to raise the beam and counterclockwise to lower the beam.
7 With the high beams on, the high intensity zone should be vertically centered with the exact center just below the horizontal line. **Note:** *It may not be possible to position the headlight aim exactly for both high and low beams. If a compromise must be made, keep in mind that the low beams are the most used and have the greatest effect on safety.*
8 Have the headlights adjusted by a dealer service department or service station at the earliest opportunity.



16.3 Headlight adjustment details

17 Headlight housing - replacement

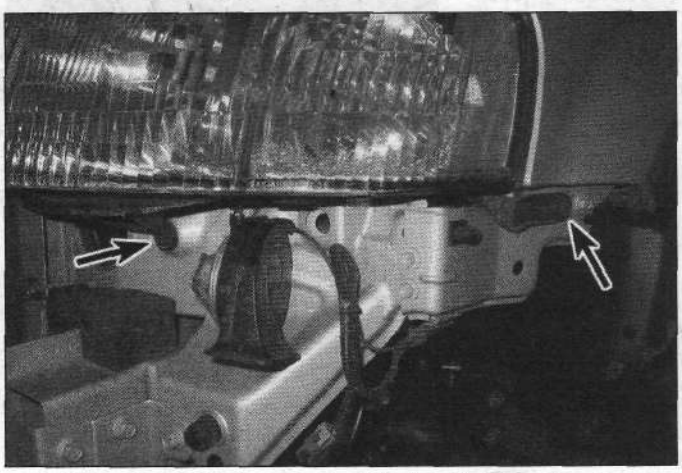
Refer to illustrations 17.4, 17.5 and 17.6

1 Make sure that the headlight switch and the ignition switch are turned off.
2 Remove the front bumper cover (see Chapter 11).
3 Disconnect the electrical connector from the headlight housing **(see illustrations 15.2a and 15.2b)**. **Note:** *It's not necessary to remove the rubber protective boot or the bulb to remove the headlight housing. Of course, if you're planning to replace the headlight housing, and therefore need to remove the boot and bulb, it's easier to do so after you have removed the headlight housing.*
4 Remove the two lower headlight housing mounting bolts **(see illustration)**.
5 Remove the upper headlight housing mounting bolt and nut **(see illustration)**.
6 Remove the headlight housing **(see illustration)**.
7 Installation is the reverse of removal.

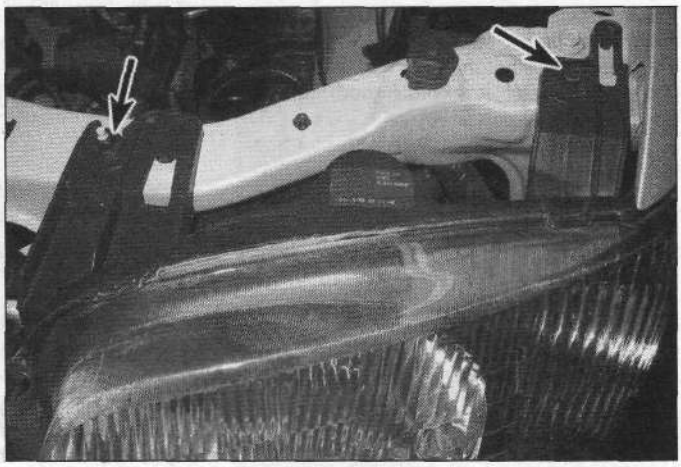
18 Horn - replacement

Refer to illustration 18.3

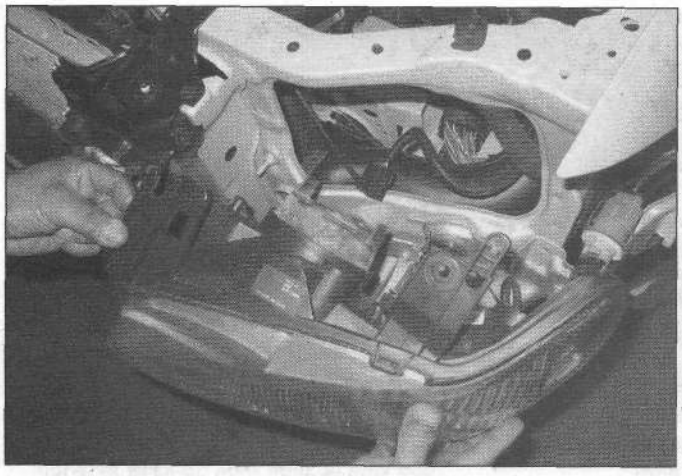
1 Loosen the left front wheel lug nuts. Raise the vehicle and secure it on jackstands. Remove the left front wheel.
2 Remove the front bumper cover (see Chapter 11).



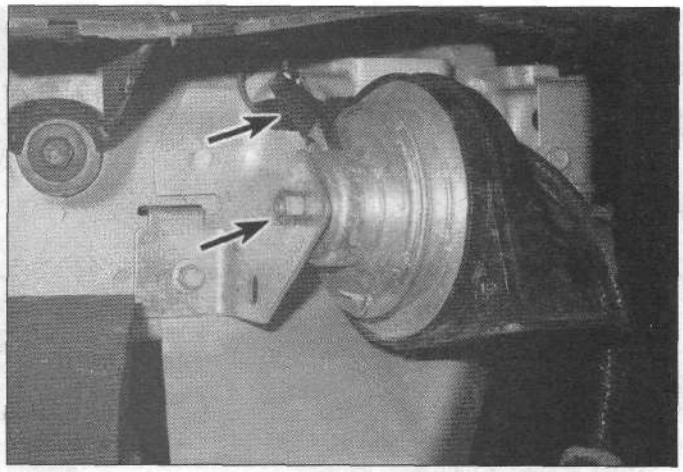
17.4 To detach the lower part of the headlight housing from the vehicle, remove these two bolts



17.5 To detach the upper part of the headlight housing from the upper radiator crossmember, remove this bolt and nut

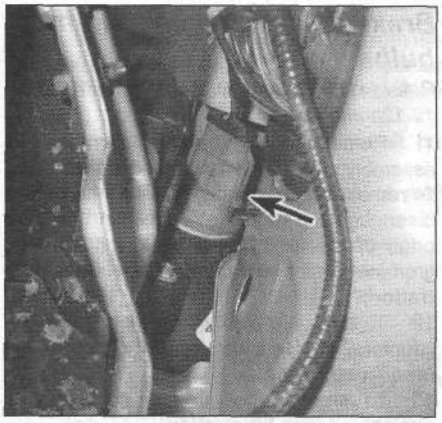


17.6 Carefully remove the headlight housing from the vehicle



18.3 To remove the horn, disconnect the electrical connector and remove the mounting nut

3 Disconnect the electrical connector from the horn **(see illustration)**.
4 Remove the horn mounting nut and separate the horn from its mounting bracket.
5 Installation is the reverse of removal.



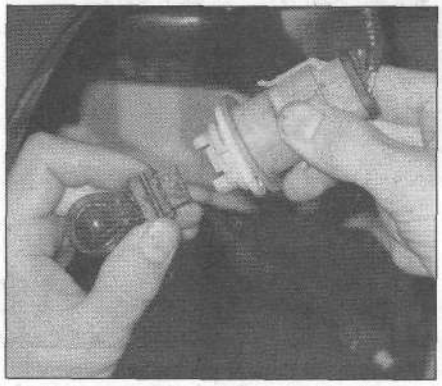
19.3 To remove the turn signal bulb holder, turn it counterclockwise 1/4-turn and pull it out of the front turn signal housing

19 Bulb replacement

Front turn signal bulbs

Refer to illustrations 19.3 and 19.4

1 Loosen the left or right front wheel lug nuts. Raise the front of the vehicle and place it securely on jackstands. Remove the left or right front wheel.



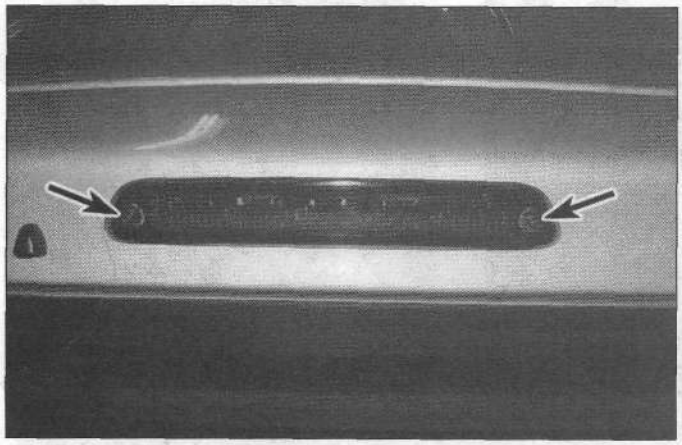
19.4 To remove the turn signal bulb from the bulb holder, pull it straight out of the holder

2 Remove the left inner fender splash shield (see "Front fender - removal and installation" in Chapter 11).
3 Locate the turn signal bulb holder **(see illustration)**. To remove the bulb holder, simply turn it counterclockwise 1/4-turn and pull it out of the front turn signal assembly. (It's not necessary to disconnect the electrical connector from the bulb holder.)
4 Remove the turn signal bulb from the bulb holder **(see illustration)**.
5 Installation is the reverse of removal.

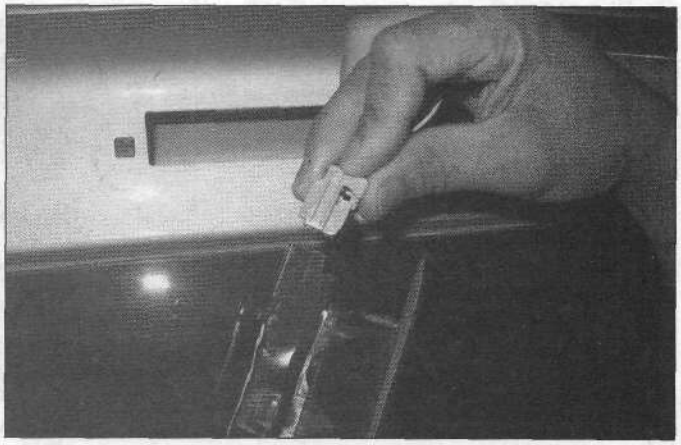
High-mount brake light bulbs

Refer to illustrations 19.6a, 19.6b, 19.7a, 19.7b and 19.8

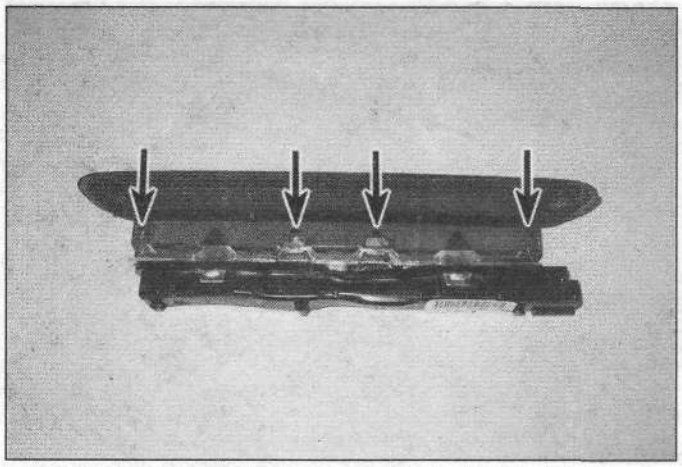
6 Remove the high-mount brake light assembly mounting screws **(see illustration)** and washers, pull the assembly out and disconnect the electrical connector **(see illustration)**. Then place the high-mount brake light assembly on a work bench. **Note:** *The manufacturer recommends that you discard the old mounting screws and washers.*



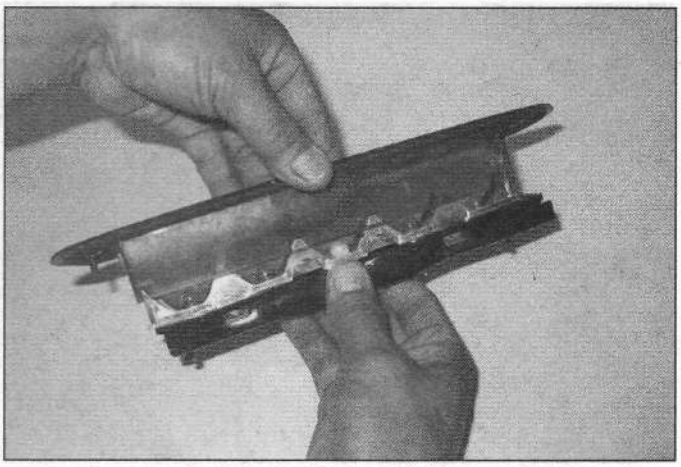
19.6a To detach the high-mount brake light assembly from the roof, remove these two screws and washers; discard the old screws and washers and use new ones when you install the high-mount brake light unit



19.6b Pull out the high-mount brake light assembly and disconnect the electrical connector



19.7a To separate the high-mount brake light bulb holder assembly from the lens, use a small screwdriver to disengage all six retaining snaps (two, on other side, not visible) . . .



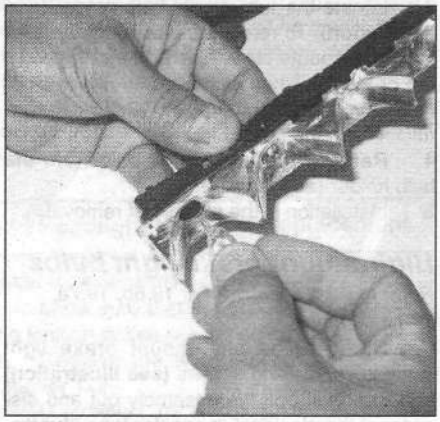
19.7b . . . then pull the bulb holder assembly out of the lens

7 Separate the bulb holder assembly from the lens **(see illustrations)**, then remove the bulb assembly from the housing.

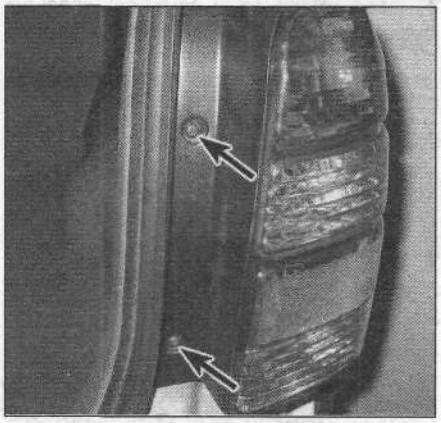
8 To replace a bulb, simply pull it straight out of the bulb holder **(see illustration)**.

9 To install a new bulb, push it straight into the bulb holder.

10 Installation is the reverse of removal. The manufacturer recommends that you use new mounting screws and washers.



19.8 To replace a high-mount brake light bulb, simply pull it straight out of the bulb holder



19.11a To detach the brake/tail/turn/back-up light assembly from the rear quarter panel, remove these two screws

Brake/tail/turn/back-up light bulbs

Refer to illustrations 19.11a, 19.11b, 19.12a, 19.12b and 19.13

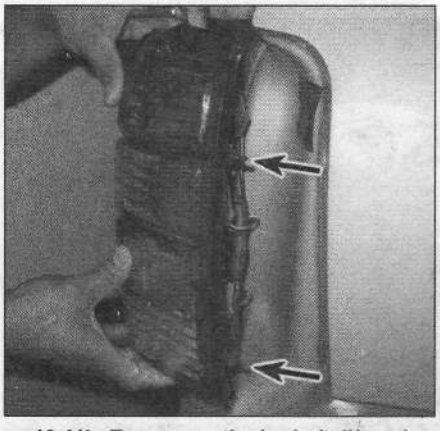
11 Remove the two brake/tail/turn/back-up assembly mounting screws **(see illustration)**. To remove the assembly, pull it to the rear to disengage the two locator pins on the outer edge of the lens from their corresponding grommets in the rear quarter panel **(see illustration)**.

12 To replace a bulb, rotate the bulb socket counterclockwise and remove the bulb socket **(see illustrations)**.

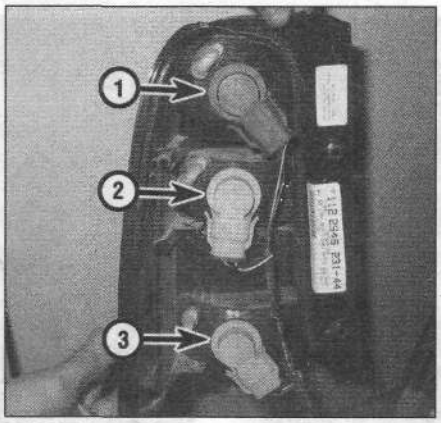
13 To remove a bulb from its socket, pull it straight out **(see illustration)**.

14 To install a bulb in its socket, push it straight into the socket.

15 Installation is the reverse of removal.

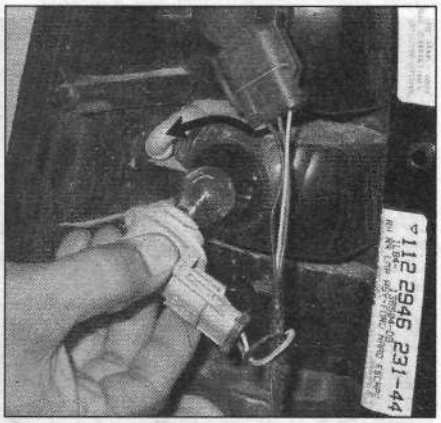


19.11b To remove the brake/tail/turn/back-up light assembly from the rear quarter panel, pop loose these two locator pins from their respective grommets in the rear quarter panel

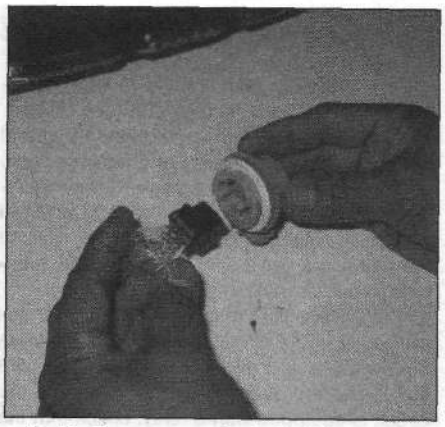


19.12a Brake/tail/turn signal/back-up light assembly

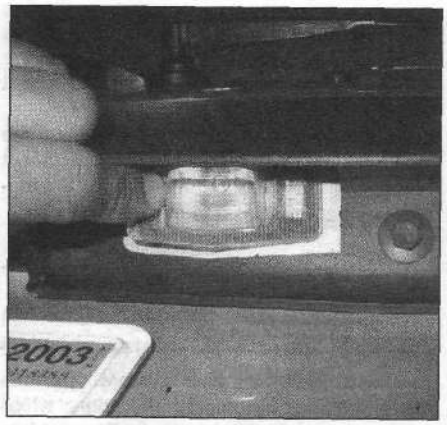
1 Brake/tail light bulb
2 Turn signal light bulb
3 Back-up light bulb



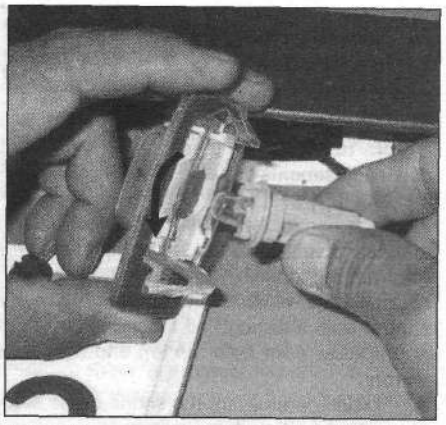
19.12b To remove a brake/tail light, turn signal or back-up light bulb socket, turn it counterclockwise 1/4-turn and pull it out



19.13 To remove a brake/tail light, turn signal or back-up light bulb, simply pull it straight out of the socket; to install a bulb, simply push it straight into the socket until it stops



19.16 Pry the license plate light assembly from the liftgate



19.17 To remove the bulb socket from the license plate light assembly, turn it counterclockwise a 1/4-turn and pull it out

License plate light bulbs

Refer to illustrations 19.16, 19.17 and 19.18

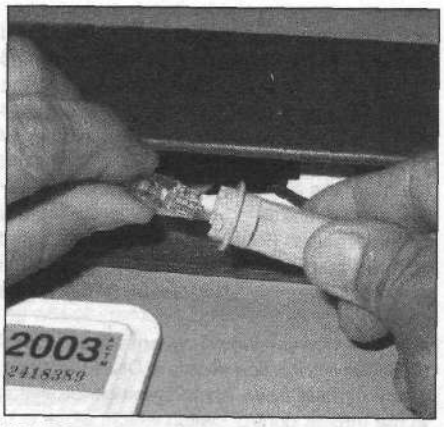
16 Pry the license plate light assembly from the liftgate **(see illustration)**.

17 To remove the bulb socket from the license plate light assembly, turn it counterclockwise a 1/4-turn and pull it out **(see illustration)**.

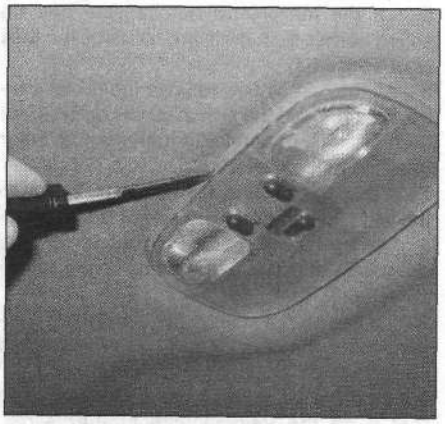
18 To remove the bulb from the socket, pull it straight out **(see illustration)**.

19 To install a new bulb in the socket, push it straight into the socket.

20 Installation is the reverse of removal.



19.18 To remove the bulb from the socket, pull it straight out



19.21 To remove the interior/map reading light lens, carefully pry it off with a small screwdriver inserted into this slot, which is provided for this purpose (prying off the lens elsewhere might damage or scratch the housing)

Interior/map reading light

Refer to illustrations 19.21 and 19.22

21 Carefully pry the interior/map reading light lens loose from the light assembly **(see illustration)**.

22 To replace one of the light bulbs in the interior/map reading light assembly, simply pull it out **(see illustration)**.

23 Installation is the reverse of removal.

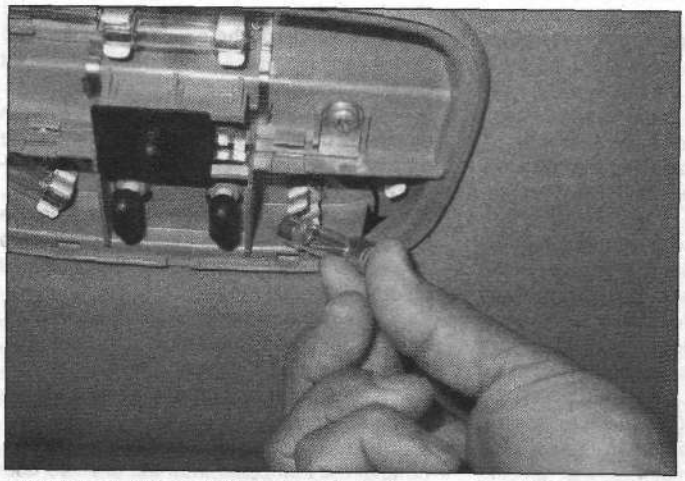
Cargo light

Refer to illustration 19.25

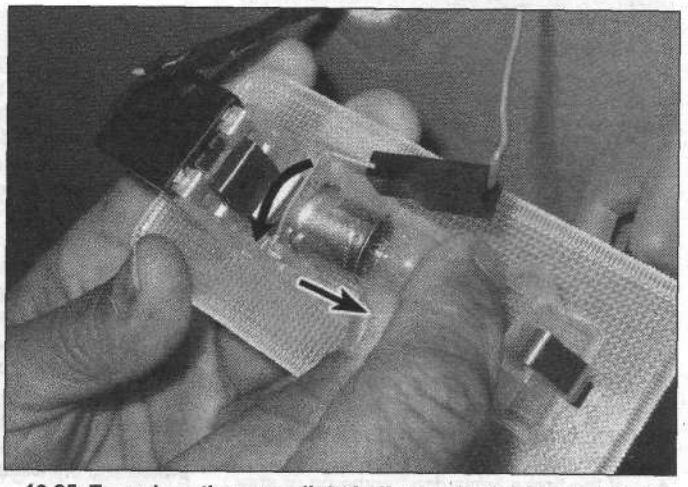
24 To remove the cargo light assembly from the headliner, simply pry it loose. Be careful not to damage the headliner.

25 To remove the cargo light bulb **(see illustration)**, turn it counterclockwise a 1/4-turn and pull it out. To install a new bulb, insert it into the bulb holder and turn it clockwise until it locks into place.

26 Installation is the reverse of removal.



19.22 To replace a bulb in the interior/map reading light assembly, simply pull it out



19.25 To replace the cargo light bulb, turn it counterclockwise and pull it out; to install a new bulb, insert it into the bulb holder and turn it clockwise until it locks into place

20 Electric side view mirrors - description

1 Most electric rear view mirrors use two motors to move the glass; one for up and down adjustments and one for left-right adjustments.
2 The control switch has a selector portion that sends voltage to the left or right side mirror. With the ignition ON but the engine OFF, roll down the windows and operate the mirror control switch through all functions (left-right and up-down) for both the left and right side mirrors.
3 Listen carefully for the sound of the electric motors running in the mirrors.
4 If the motors can be heard but the mirror glass doesn't move, there's a problem with the drive mechanism inside the mirror.
5 If the mirrors do not operate and no sound comes from the mirrors, check the fuse (*see Section* 3).
6 If the fuse is OK, remove the mirror control switch. Have the switch continuity checked by a dealership service department or other qualified automobile repair facility.
7 Test the ground connections. Refer to the wiring diagrams at the end of Chapter 12.
8 If the mirror still doesn't work, remove the mirror and check the wires at the mirror for voltage.
9 If there's not voltage in each switch position, check the circuit between the mirror and control switch for opens and shorts.
10 If there's voltage, remove the mirror and test it off the vehicle with jumper wires. Replace the mirror if it fails this test.

21 Cruise control system - description

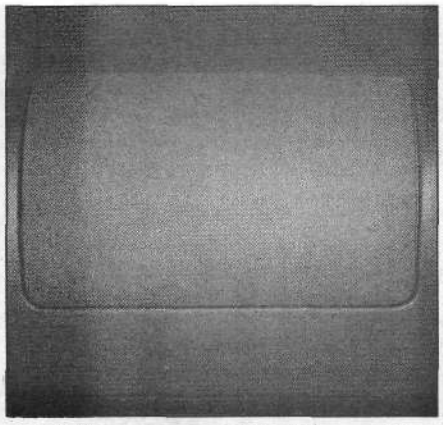
1 The cruise control system maintains vehicle speed with an electrically-operated motor located in the engine compartment, which is connected to the throttle body by a cable. The system consists of the Powertrain Control Module, the speed control actuator, the speed control cable, the speed control indicator light, the speed control actuator switches, the Brake Pedal Position (BPP) switch, the Clutch Pedal Position (CPP) switch (models with a manual transaxle) or the Transmission Range (TR) sensor (models with an automatic transaxle). The cruise control system requires diagnostic procedures that are beyond the scope of this manual. Listed below are some general procedures that may be used to locate common problems.
2 Check the fuses (see Section 3).
3 Have an assistant operate the brake lights while you check their operation (voltage from the brake light switch deactivates the cruise control).
4 If the brake lights don't come on or stay on all the time, correct the problem and retest the cruise control system.
5 Visually inspect the control cable between the cruise control motor and the throttle linkage for free movement. Replace it if necessary.
6 Test drive the vehicle to determine if the cruise control is now working. If it isn't, take it to a dealer service department or an automotive electrical specialist for further diagnosis.

22 Power window system - description

1 The power window system operates electric motors, mounted in the doors, which lower and raise the windows. The system consists of the control switches, the motors, regulators, glass mechanisms and associated wiring.
2 The power windows can be lowered and raised from the master control switch by the driver or by remote switches located at the individual windows. Each window has a separate motor, which is reversible. The position of the control switch determines the polarity and therefore the direction of operation.
3 The circuit is protected by a fuse and a circuit breaker. Each motor is also equipped with an internal circuit breaker, this prevents one stuck window from disabling the whole system.
4 The power window system will only operate when the ignition switch is ON. In addition, many models have a window lockout switch at the master control switch which, when activated, disables the switches at the rear windows and, sometimes, the switch at the passenger's window also. Always check these items before troubleshooting a window problem.
5 These procedures are general in nature, so if you can't find the problem using them, take the vehicle to a dealer service department or other properly equipped repair facility.
6 If the power windows won't operate, always check the fuse and circuit breaker first.
7 If only the rear windows are inoperative, or if the windows only operate from the master control switch, check the rear window lockout switch for continuity in the unlocked position. Replace it if it doesn't have continuity.
8 Check the wiring between the switches and fuse panel for continuity. Repair the wiring, if necessary.
9 If only one window is inoperative from the master control switch, try the other control switch at the window. **Note:** *This doesn't apply to the driver's door window.*
10 If the same window works from one switch, but not the other, check the switch for continuity.
11 If the switch tests OK, check for a short or open in the circuit between the affected switch and the window motor.
12 If one window is inoperative from both switches, remove the trim panel from the affected door and check for voltage at the switch and at the motor while the switch is operated.
13 If voltage is reaching the motor, disconnect the glass from the regulator (see Chapter 11). Move the window up and down by hand while checking for binding and damage. Also check for binding and damage to the regulator. If the regulator is not damaged and the window moves up and down smoothly, replace the motor. If there's binding or damage, lubricate, repair or replace parts, as necessary.
14 If voltage isn't reaching the motor, check the wiring in the circuit for continuity between the switches and motors. You'll need to consult the wiring diagram for the vehicle. If the circuit is equipped with a relay, check that the relay is grounded properly and receiving voltage.

23 Power door lock system - description

1 A power door lock system operates the door lock actuators mounted in each door. The system consists of the switches, actuators, a control unit and associated wiring. Diagnosis can usually be limited to simple checks of the wiring connections and actuators for minor faults that can be easily repaired.
2 Power door lock systems are operated by bi-directional solenoids located in the doors. The lock switches have two operating positions: Lock and Unlock. When activated, the switch sends a ground signal to the door lock control unit to lock or unlock the doors. Depending on which way the switch is activated, the control unit reverses polarity to the solenoids, allowing the two sides of the circuit to be used alternately as the feed (positive) and ground side.
3 Some vehicles may have an anti-theft system incorporated into the power locks. If you are unable to locate the trouble using the following general Steps, consult a dealer service department or other qualified repair shop.
4 Always check the circuit protection first. Some vehicles use a combination of circuit breakers and fuses.
5 Operate the door lock switches in both directions (Lock and Unlock) with the engine off. Listen for the click of the solenoids operating.
6 Test the switches for continuity. Remove the switches and have them checked by a dealer service department or other qualified automobile repair facility.
7 Check the wiring between the switches, control unit and solenoids for continuity. Repair the wiring if there's no continuity.
8 Check for a bad ground at the switches or the control unit.
9 If all but one lock solenoids operate, remove the trim panel from the affected door (see Chapter 11) and check for voltage at the solenoid while the lock switch is operated. One of the wires should have voltage in the



25.1 The passenger side airbag module is located inside the dash, right above the glove box

Lock position; the other should have voltage in the Unlock position.

10 If the inoperative solenoid is receiving voltage, replace the solenoid.

11 If the inoperative solenoid isn't receiving voltage, check the relay for an open or short in the wire between the lock solenoid and the control unit. **Note:** *It's common for wires to break in the portion of the harness between the body and door (opening and closing the door fatigues and eventually breaks the wires).*

24 Daytime Running Lights (DRL) - general information

The Daytime Running Lights (DRL) system illuminates the headlights whenever the engine is running. The only exception is with the engine running and the parking brake engaged. Once the parking brake is released, the lights will remain on as long as the ignition switch is on, even if the parking brake is later applied.

The DRL system supplies reduced power to the headlights so they won't be too bright for daytime use, while prolonging headlight life.

25 Airbag system - general information and precautions

General information

Refer to illustration 25.1

1 All models are equipped with a Supplemental Restraint System (SRS), more commonly known as airbags. This system is designed to protect the driver, and the front seat passenger, from serious injury in the event of a head-on or frontal collision and side impacts. It uses an electronic crash sensor, which is referred to by the manufacturer as the Restraints Control Module (RCM) and a side-impact sensor in each B-pillar. The airbag assemblies are mounted on the steering wheel and inside the passenger's side of the dash **(see illustration)**, and in the side of each front seat back. Some 2001 models and all 2002 and later models are equipped with seat belt pre-tensioners. These are pyrotechnic devices controlled by the Restraints Control Module (RCM) that reduce the slack in the seat belts during an impact of sufficient force to trigger the airbags.

Airbag module

Driver's airbag

2 The airbag inflator module contains a housing incorporating the cushion (airbag) and inflator unit, mounted in the center of the steering wheel. The inflator assembly is mounted on the back of the housing over a hole through which gas is expelled, inflating the bag almost instantaneously when an electrical signal is sent from the system. A "clockspring" on the steering column under the steering wheel carries this signal to the module. This clockspring assembly can transmit an electrical signal regardless of steering wheel position. The igniter in the airbag converts the electrical signal to heat and ignites the powder, which inflates the bag.

3 For information on how to remove and install the driver's side airbag, refer to "Steering wheel - removal and installation" in Chapter 10.

Passenger's airbag

4 The airbag is mounted above the glove compartment. It consists of an inflator containing an igniter, a reaction housing/airbag assembly and a trim cover.

5 The passenger's side airbag is considerably larger than the steering wheel-mounted unit and is supported by the steel reaction housing. The trim cover is textured and painted to match the instrument panel and has a molded seam, which splits when the bag inflates.

Side impact airbags

6 These airbags are mounted on the outboard side of the front seat back frames. In the event of a side impact of sufficient force they inflate, ripping open the front seat back trim covers and deploy to protect the occupant.

Restraints Control Module (RCM)

7 This unit supplies the current to the airbag system (and seat belt pre-tensioners, on models so equipped) in the event of the collision, even if battery power is cut off. It checks this system every time the vehicle is started, causing the "SRS" light to go on, then off, if the system is operating properly. If there is a fault in the system, the light will go on and stay on, or it will flash or the dash will make a beeping sound. If this happens, take the vehicle to your dealer immediately for service.

Disarming the system and other precautions

Refer to illustration 25.10

Warning 1: *Failure to follow these precautions could result in accidental deployment of the airbag and personal injury.*

Warning 2: *Never probe the connectors of the SRS. Do not move or remount from the original position any SRS component. Never Move an SRS component with the key in the ON position. Do not use any memory saver devices.*

8 Whenever working in the vicinity of the steering wheel, instrument panel or any of the other SRS system components, the system must be disarmed. To disarm the system:

2004 and earlier models

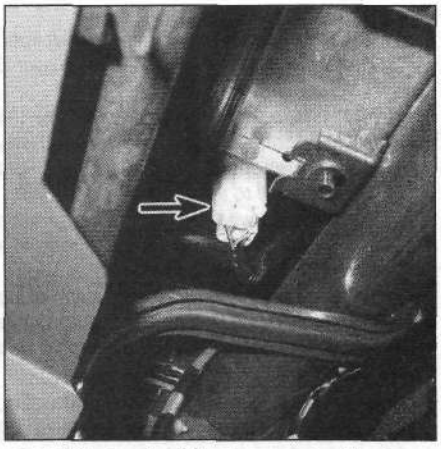
a) *Point the wheels straight ahead and turn the key to the Lock position.*
b) *Disconnect the cable from the negative battery terminal. Refer to Chapter 5, Section 1 for the disconnecting procedure.*
c) *Wait at least two minutes for the back-up power supply to be depleted.*

2005 and later models

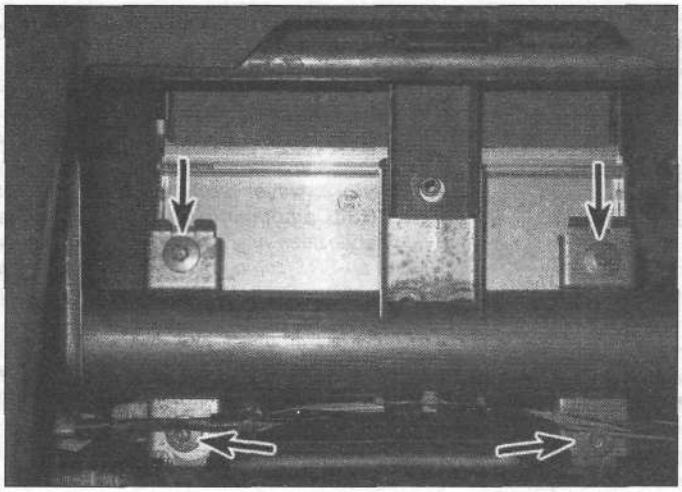
De-powering procedure

Note: *The airbag warning lamp illuminates when the Restraint Control Module fuse is removed and the ignition switch is ON. This is normal operation and does not indicate a fault in the SRS.*

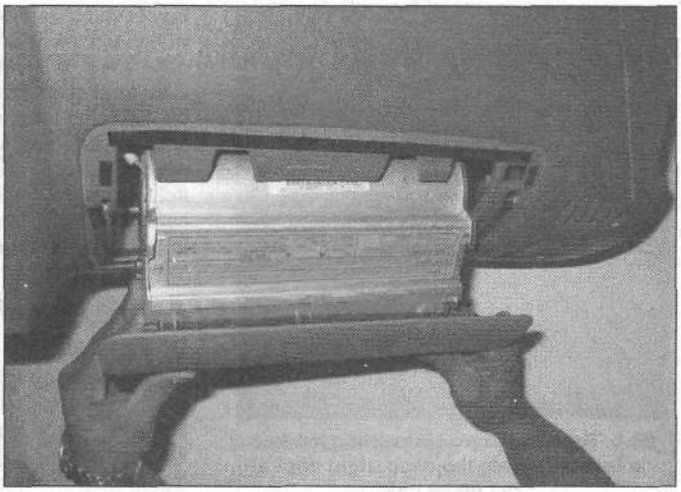
a) *Turn all accessories OFF.*
b) *Turn the ignition to OFF.*
c) *At the Smart Junction Box, located at the right side of the center console, remove the cover.*
d) *With the cover off, locate and remove the Restraints Control Module (RCM) fuse.*
e) *Turn the ignition ON and monitor the airbag warning light for a minimum of 30 seconds. If the correct RCM fuse has*



25.11 The electrical connector for the passenger's side airbag is located above the glove box recess, to the left of the airbag module (glove box removed for clarity)



25.17 To detach the passenger side airbag from the dash, remove these four bolts, then carefully but firmly push on the airbag module to disengage the trim cover from the top of the dash



25.18 Pull the trim cover and the airbag from the dash as a single assembly. Be sure to keep your body positioned to the side of the airbag

been removed the light will remain lit continuously without flashing. If the airbag warning light does not remain lit continuously, STOP and remove the correct fuse and monitor the light as outlined.

f) Turn the ignition switch OFF.

g) Disconnect the cable from the negative terminal of the battery and wait at least one minute before proceeding.

Re-powering procedure

Warning: *Make sure that there is no one in the vehicle and that nothing is blocking any airbag module while performing the Re-power procedure.*

a) Turn the ignition switch from OFF to ON

b) Reinstall the RCM fuse in the Smart Junction Box, then install the cover

c) Connect the cable to the negative terminal of the battery.

d) Check the system by turning the ignition switch from ON to OFF.

e) Wait 10 seconds, then turn the key back to the ON position.

f) Visually monitor the airbag warning light. The light should remain lit for about 6 seconds, then turn off.

g) It may take 30 seconds or more for the RCM to complete the self tests. If any fault is present in the system, the light will either fail to light, remain lit or flash.

h) If the airbag warning light is inoperative and a fault exists, a chime will sound in a series of 5 sets of 5 beeps.

i) If there is any fault in the system, bring the vehicle to a professional automotive repair facility for proper diagnosis and repair.

9 Whenever handling an airbag module, always keep the airbag opening (the trim side) pointed away from your body. Never place the airbag module on a bench or other surface with the airbag opening facing the surface. Always place the airbag module in a safe location with the airbag opening facing up.

10 Never measure the resistance of any SRS component or use any electrical test equipment on any of the wiring or components. An ohmmeter has a built-in battery supply that could accidentally deploy the airbag.

11 Never use electrical welding equipment on a vehicle equipped with an airbag without first disconnecting the airbag electrical connectors, located behind a panel on the underside of the steering wheel (driver's airbag) (see Chapter 10) and above the glove box (passenger's airbag) **(see illustration)** and under each front seat (side-impact airbags). On models with seat belt pre-tensioners, the pre-tensioner electrical connectors are also located under the seats.

12 Never dispose of a live airbag module or seat belt pre-tensioner. Return it to a dealer service department or other qualified repair shop for safe deployment and disposal.

Airbag module removal and installation

Driver's airbag module and clockspring

13 Refer to Chapter 10, "Steering wheel - removal and installation", for the driver's side airbag module and clockspring removal and installation procedures.

Passenger's airbag module

Refer to illustrations 25.16 and 25.17

14 Disarm the airbag system as described previously in this Section.

15 Remove the glove box (see "Instrument panel - removal and installation" in Chapter 11).

16 Disconnect the electrical connector **(see illustration 25.11)**.

17 Remove the airbag module mounting bolts **(see illustration)**. After removing the bolts, carefully but firmly push up on the airbag module to disengage the trim cover from the top of the dash (the airbag module and trim cover are attached and are removed as a single assembly). Do NOT try to pry open the trim cover from up top, or you will damage the surface of the dash and/or the trim cover.

18 Working from above, pull the airbag trim cover and airbag module out of the dash **(see illustration)**. Be sure to heed the precautions outlined previously in this Section.

19 Installation is the reverse of the removal procedure. Tighten the airbag module mounting bolts securely.

20 After you've reconnected the battery, the Powertrain Control Module (PCM) must relearn its idle and fuel trim strategy for optimum driveability and performance (see Chapter 5, Section 1 for this procedure).

Side-impact airbag

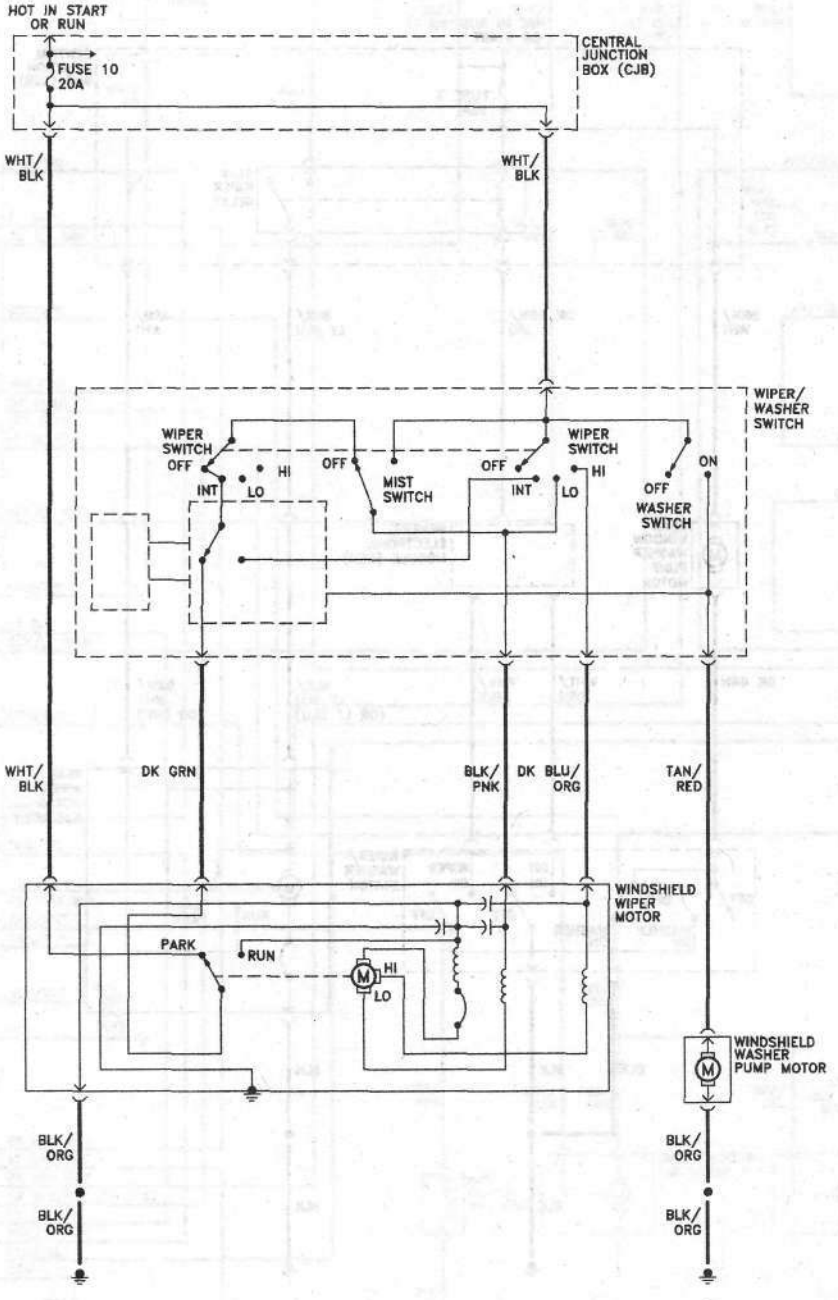
21 Under normal circumstances there would never be a reason to remove a seat airbag. However, if it has been determined that there is a problem with the side-impact airbag module, the work must be left to a dealer service department or other qualified repair shop.

26 Wiring diagrams - general information

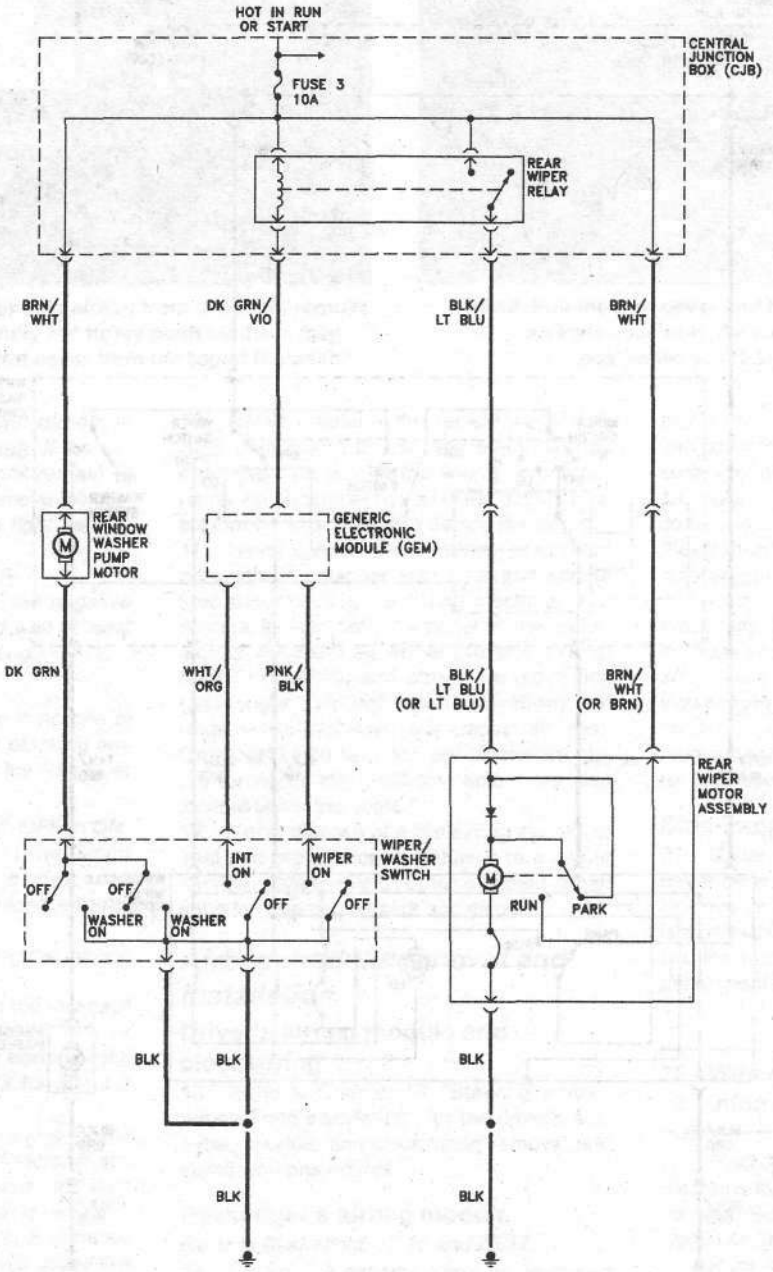
Since it isn't possible to include all wiring diagrams for every year covered by this manual, the following diagrams are those that are typical and most commonly needed.

Prior to troubleshooting any circuits, check the fuse and circuit breakers (if equipped) to make sure they're in good condition. Make sure the battery is properly charged and check the cable connections (see Chapter 1).

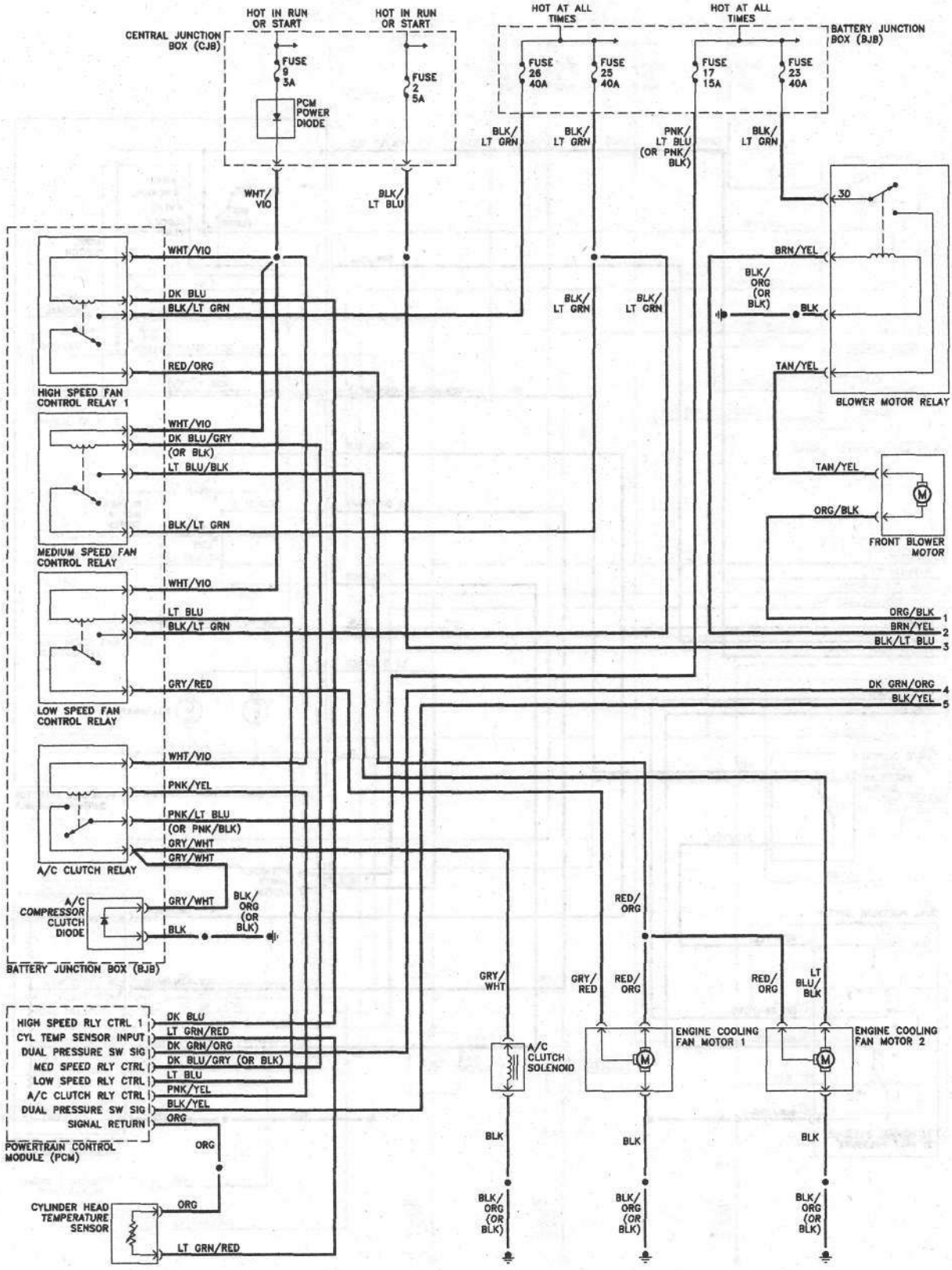
When checking a circuit, make sure that all connectors are clean, with no broken or loose terminals. When unplugging a connector, do not pull on the wires. Pull only on the connector housings themselves.



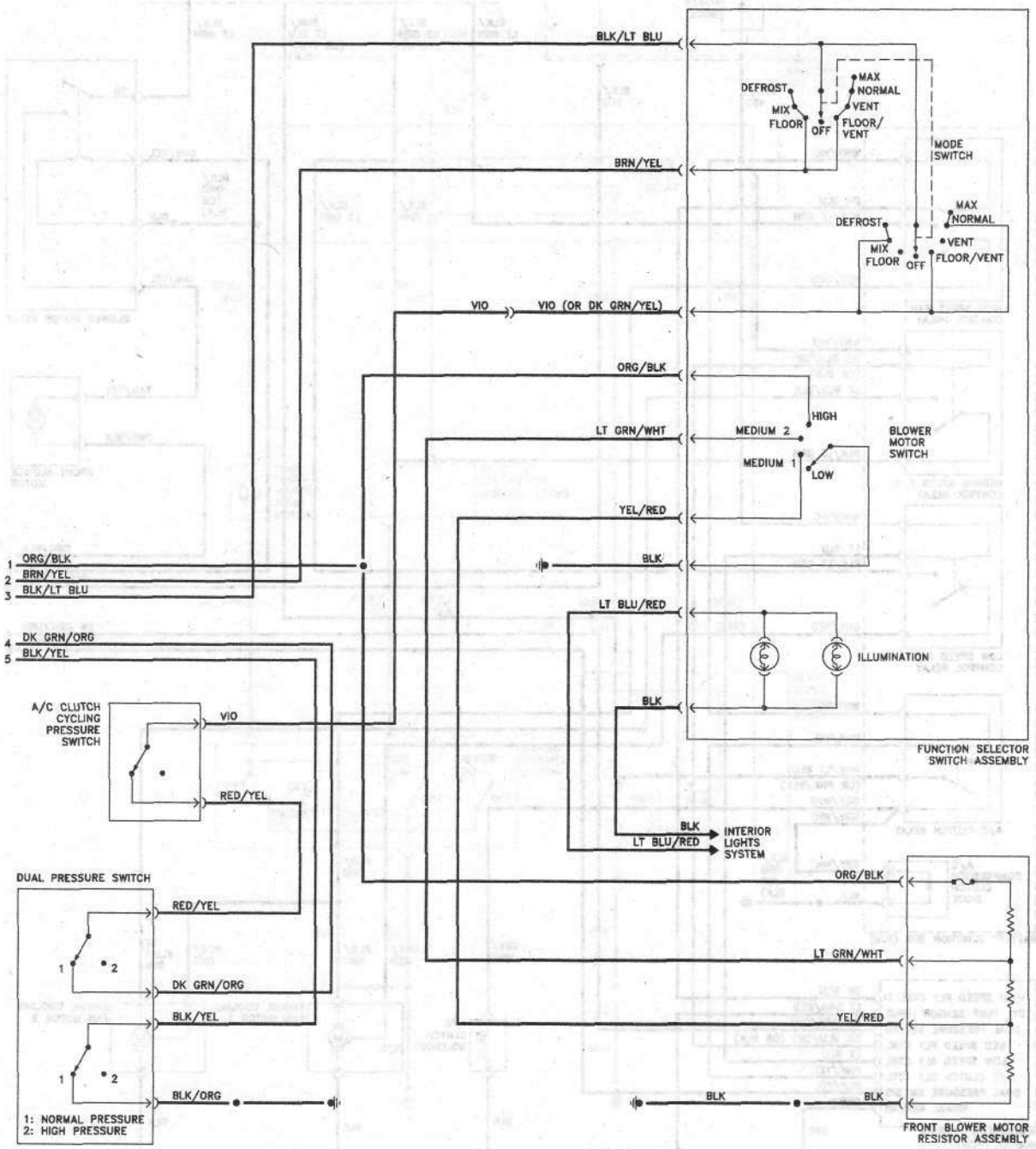
Front wiper/washer system



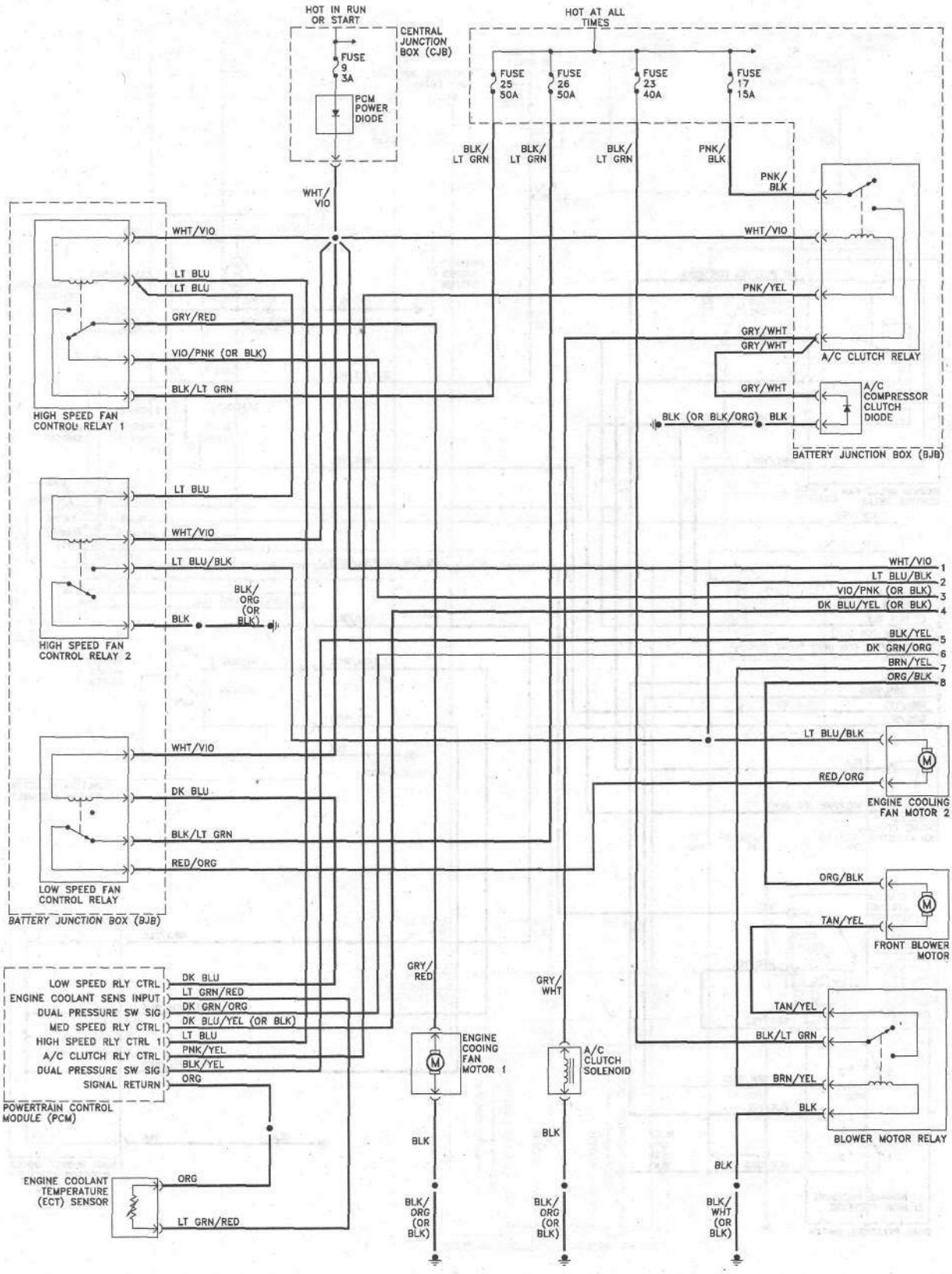
Rear wiper/washer system



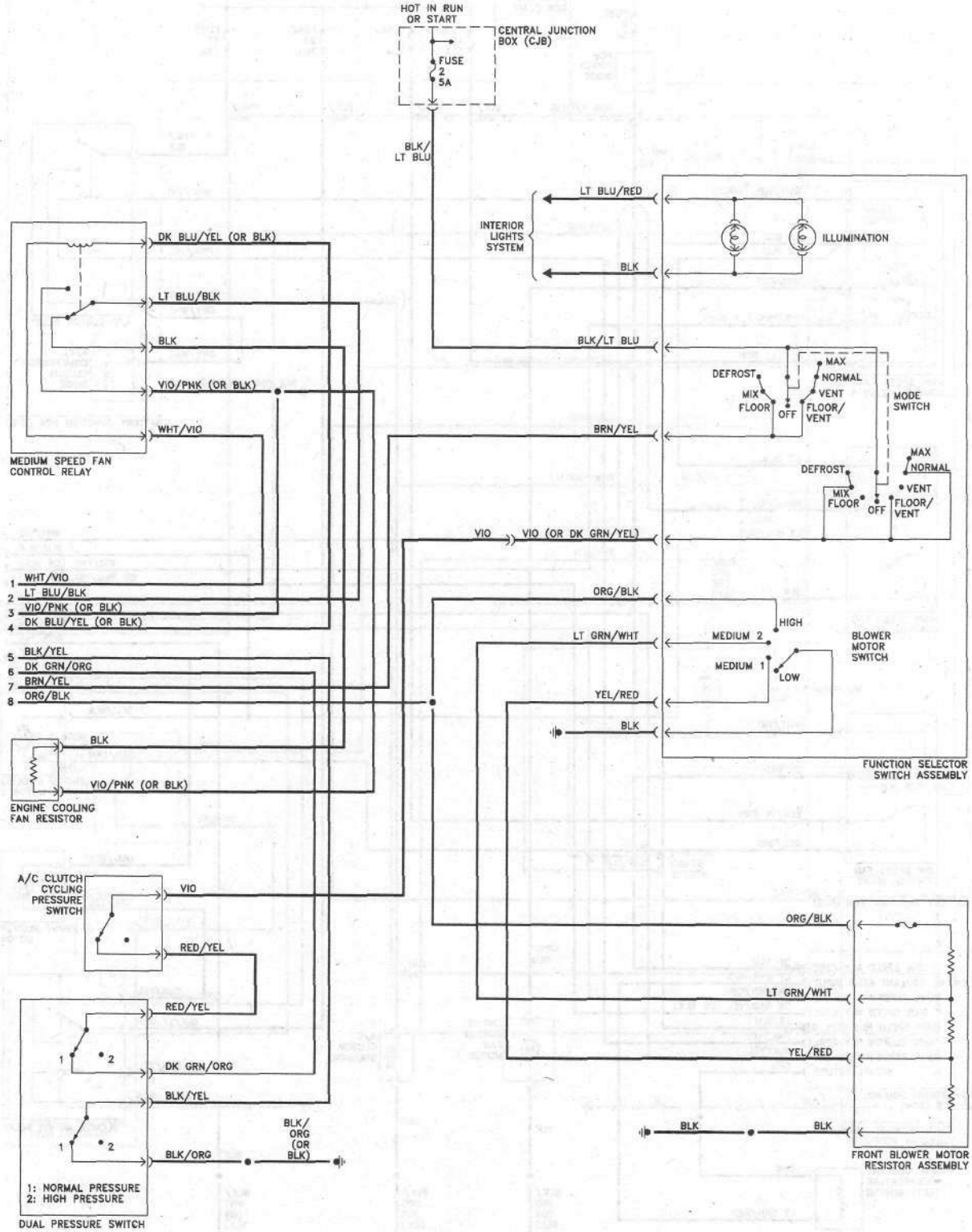
Air conditioning system - four-cylinder models (1 of 2)



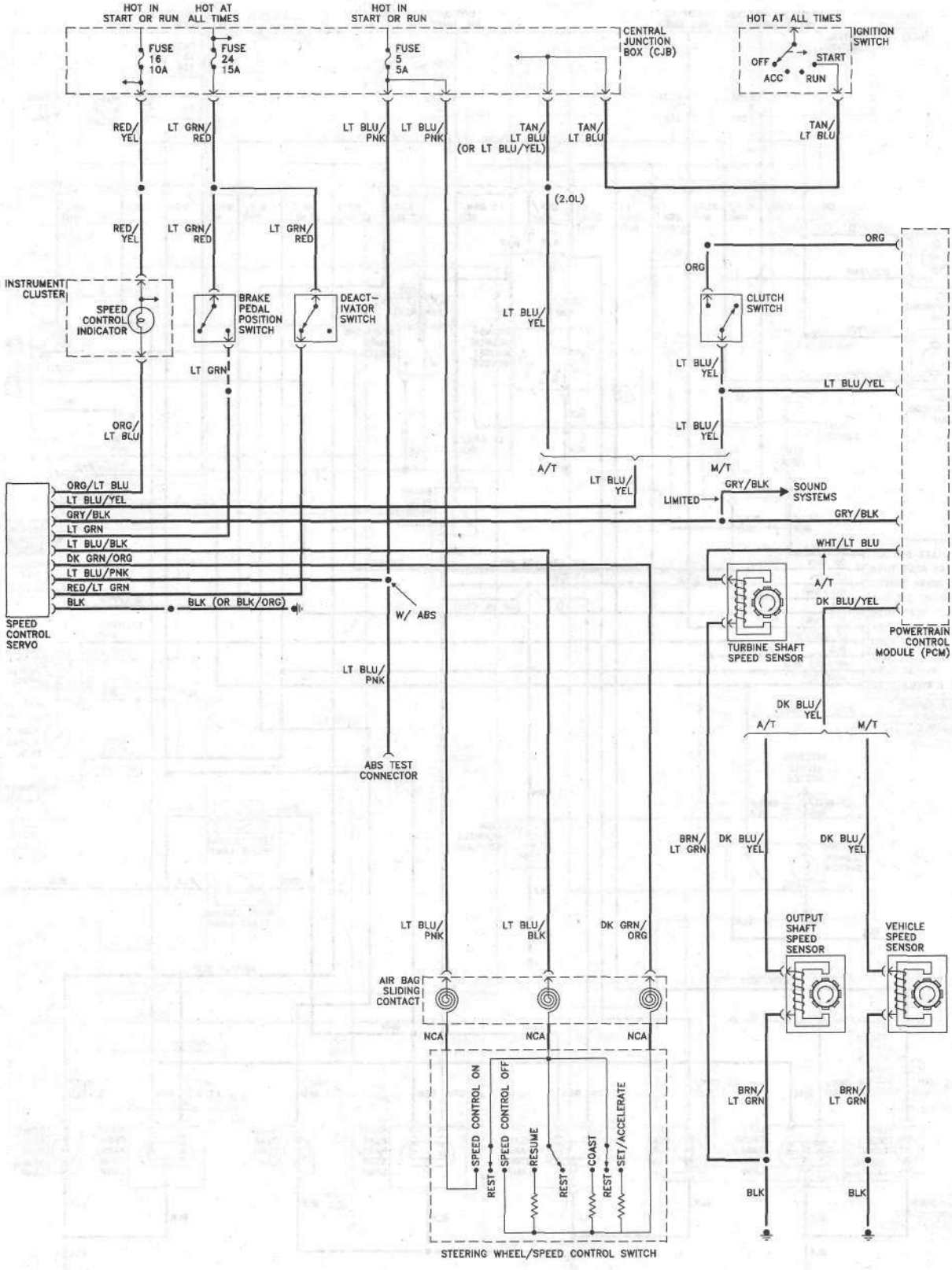
Air conditioning system - four-cylinder models (2 of 2)



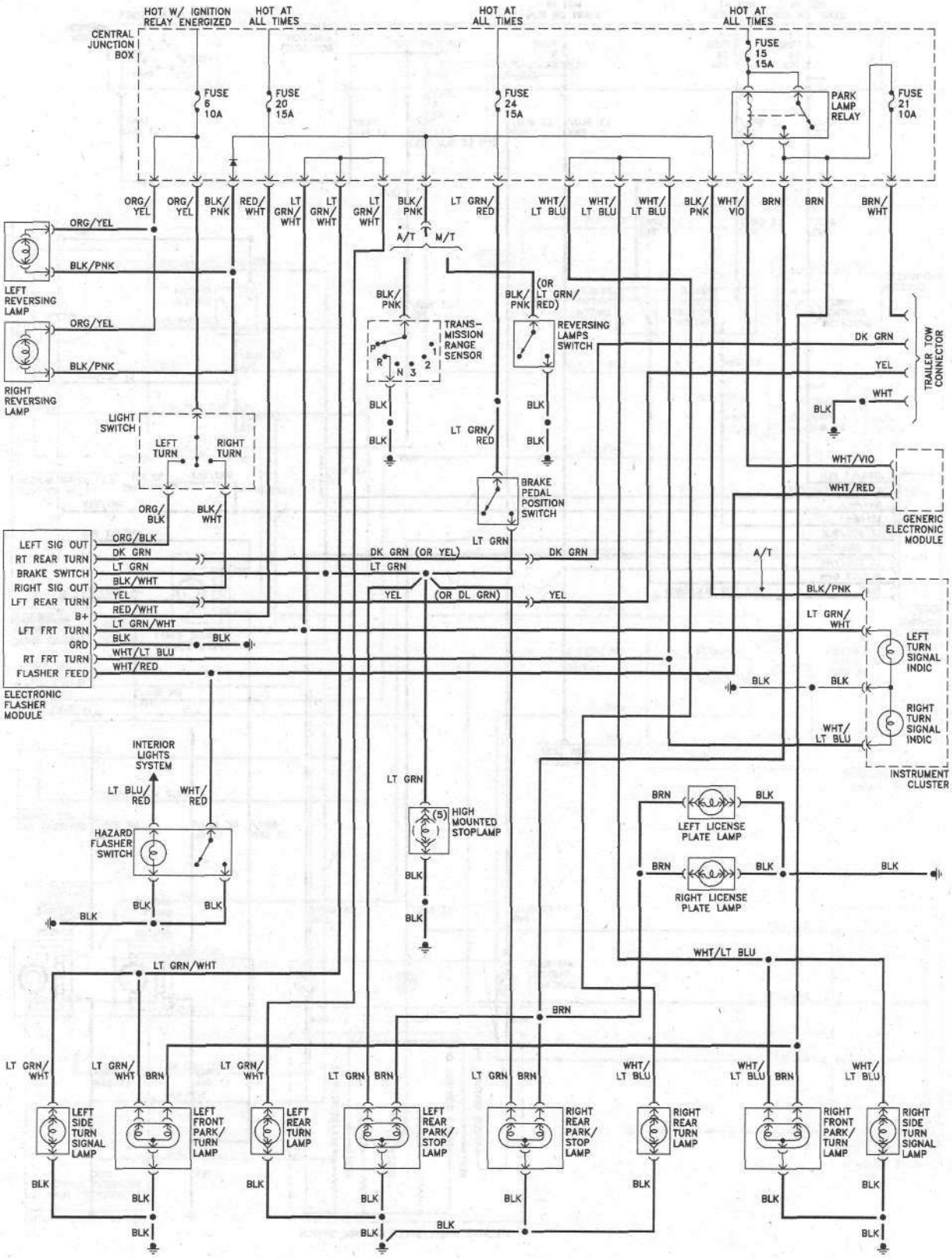
Air conditioning system - V6 models (1 of 2)



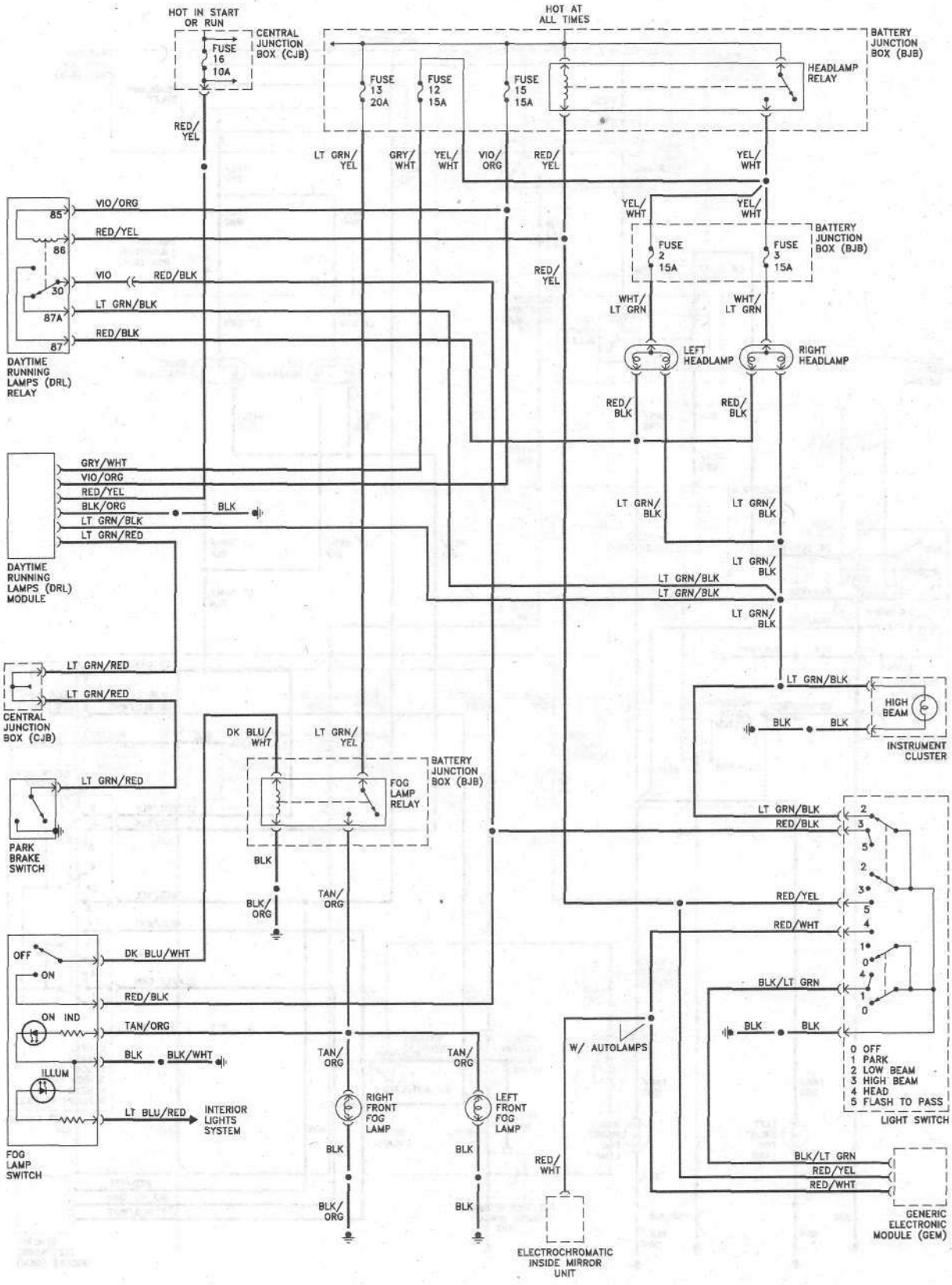
Air conditioning system - V6 models (2 of 2)



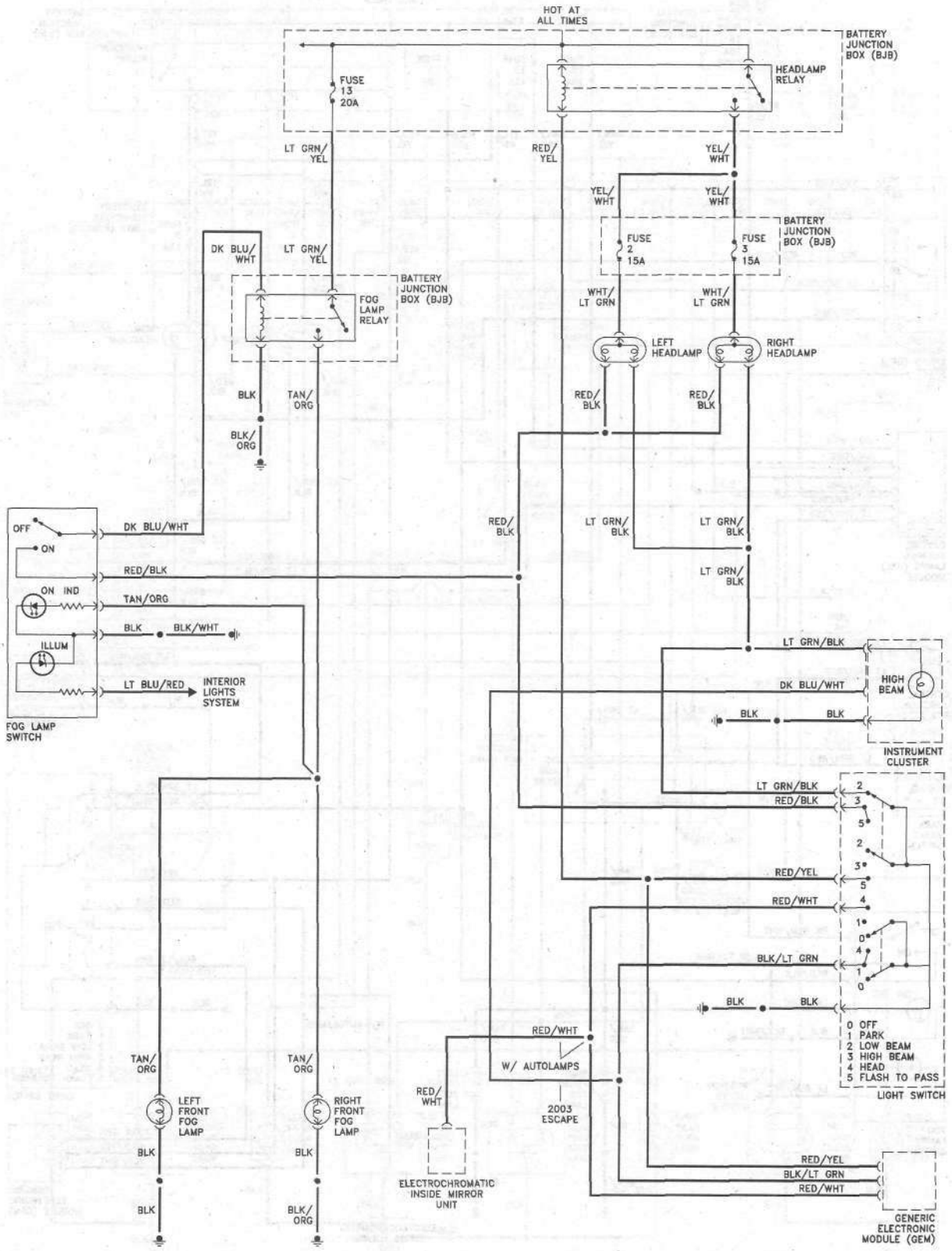
Cruise control system



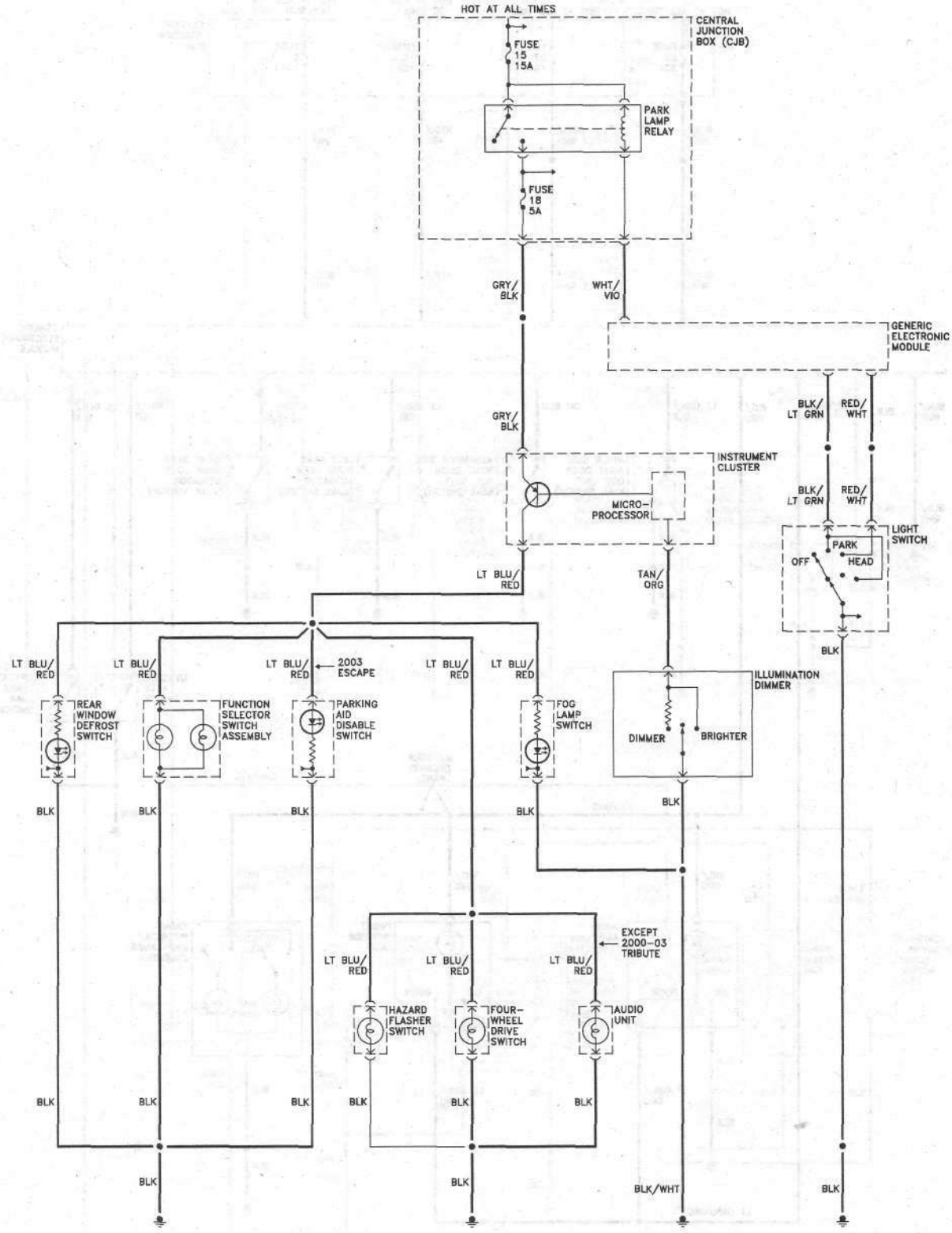
Exterior lighting system (except headlights)



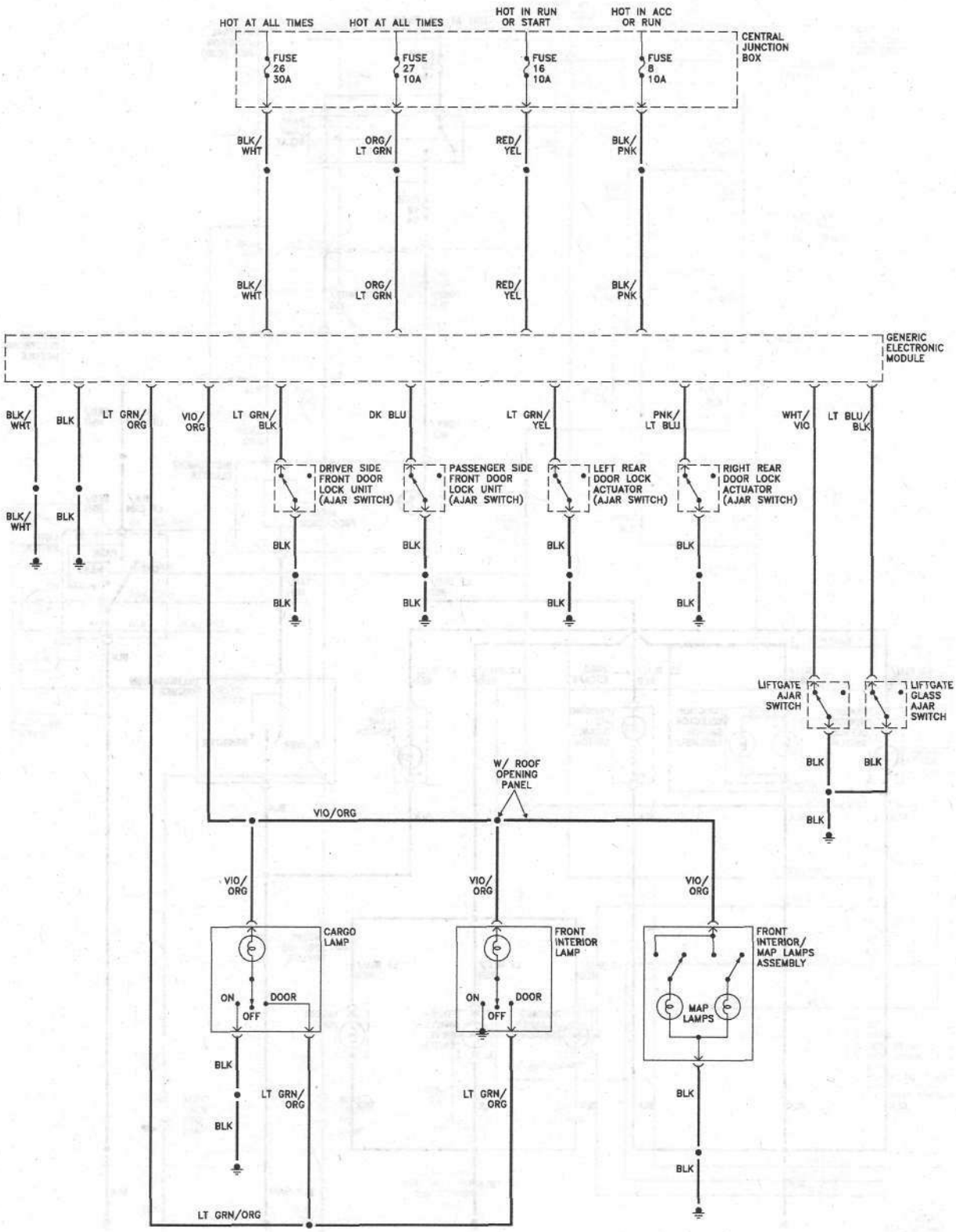
Headlight system (models with Daytime Running Lights)



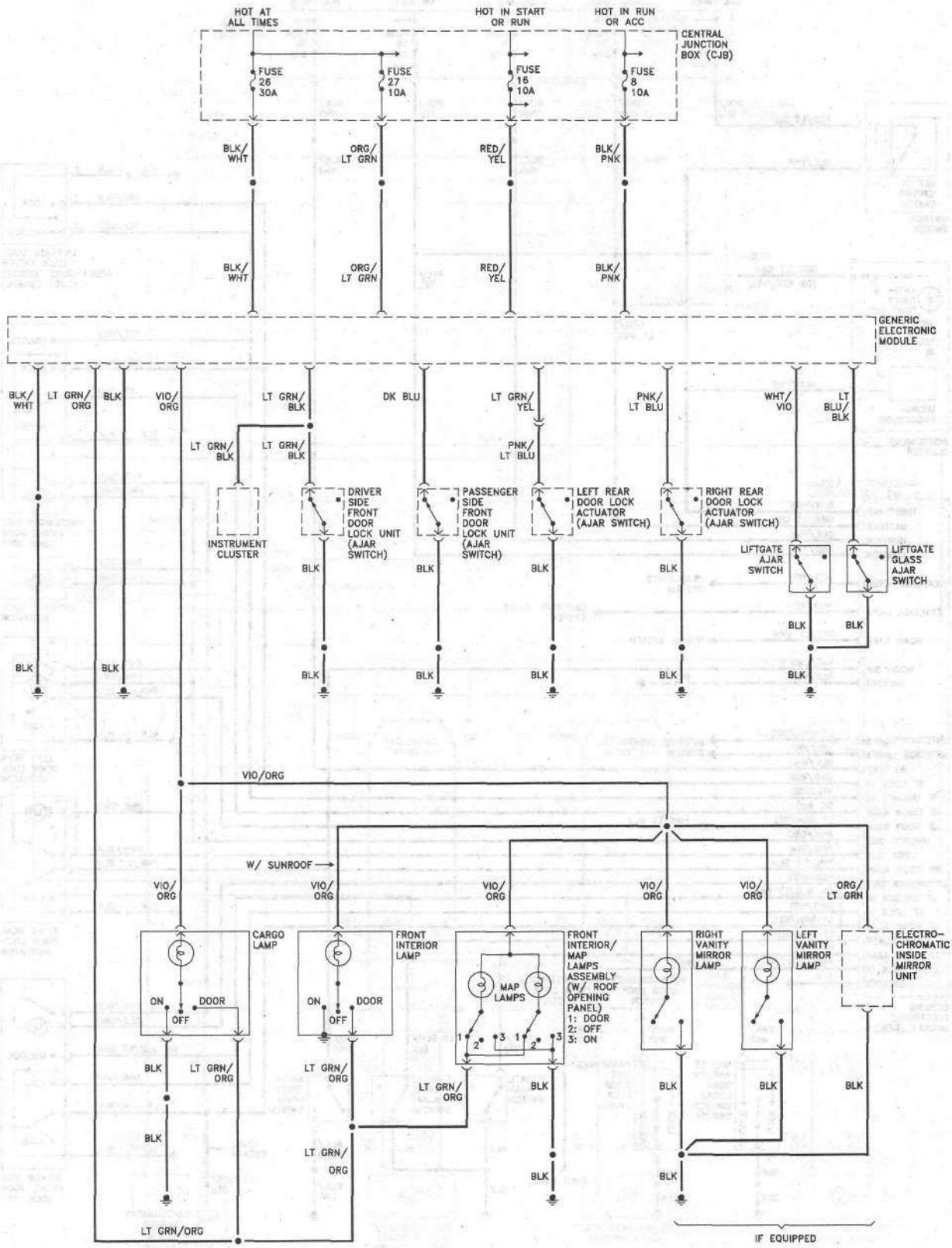
Headlight system (models without Daytime Running Lights)



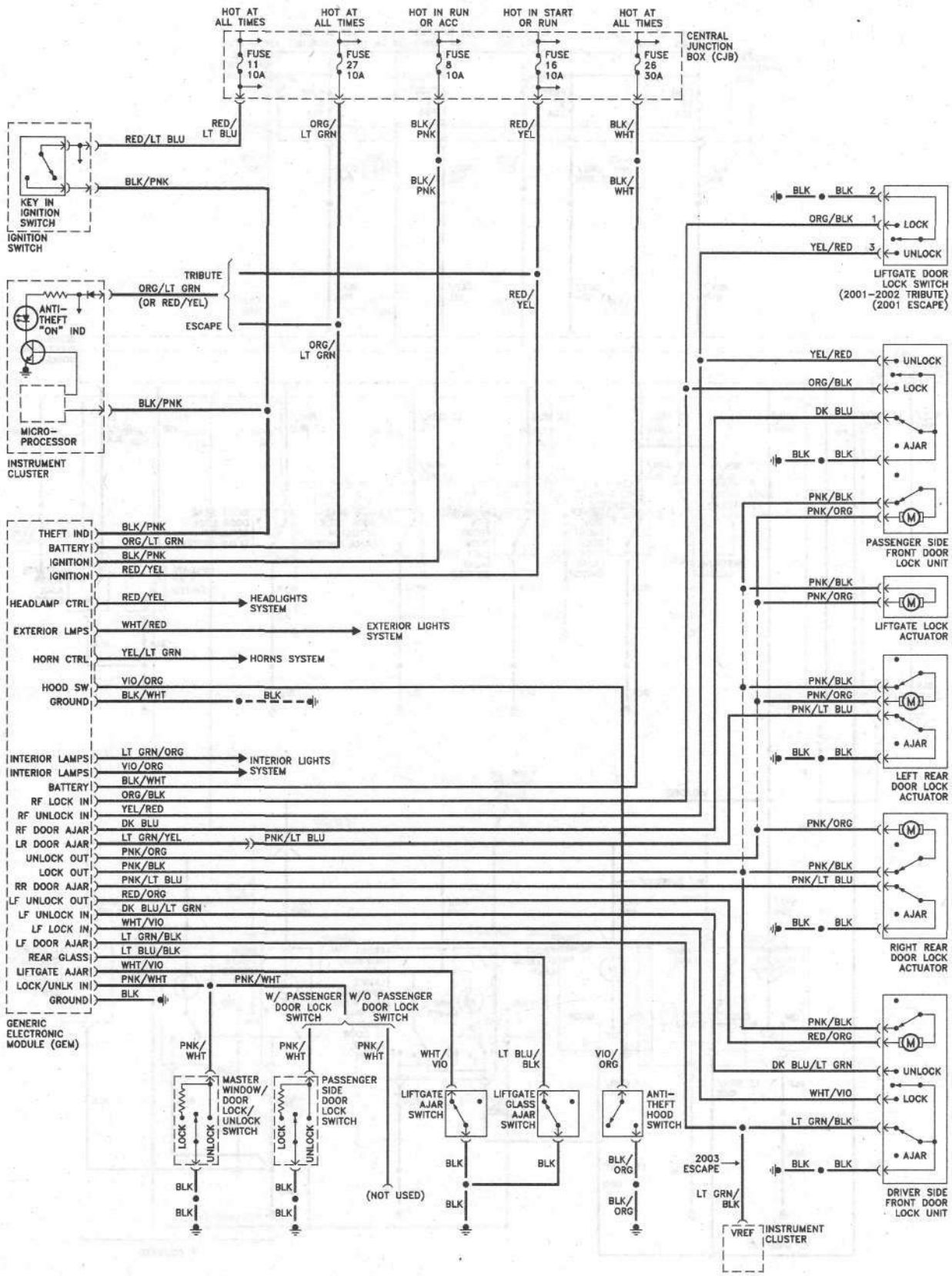
Instrument panel and switch illumination system



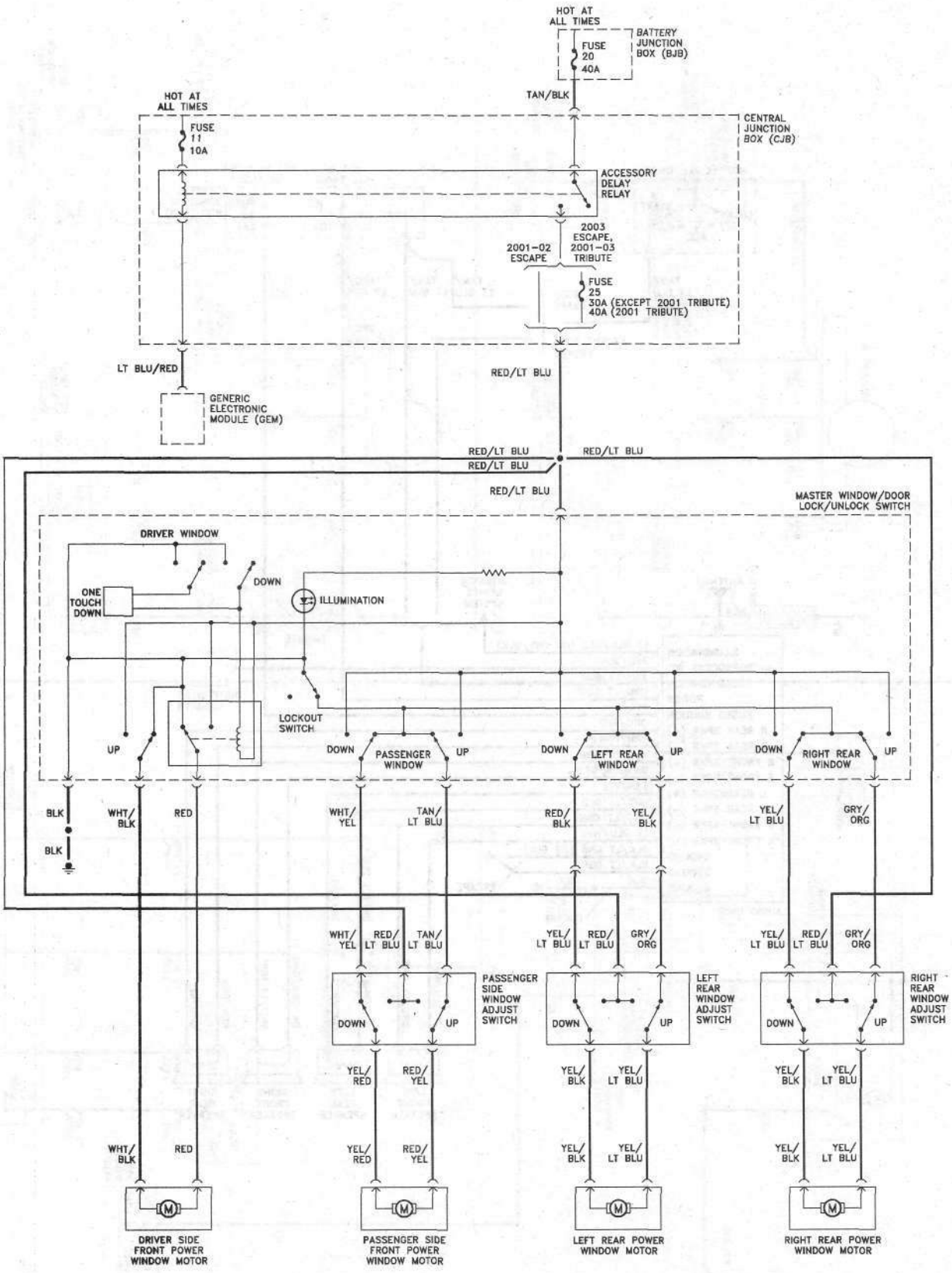
Interior lighting system (2001 and 2002 models)



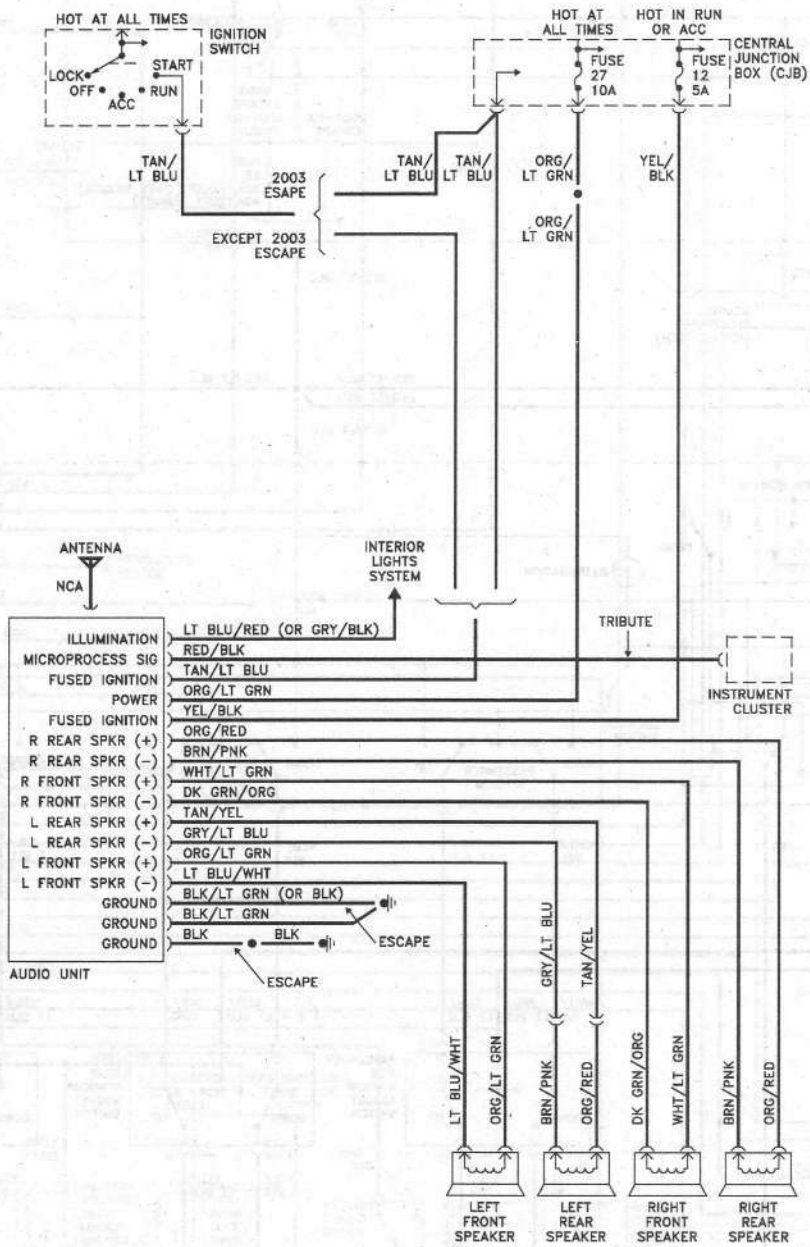
Interior lighting system (2003 models)



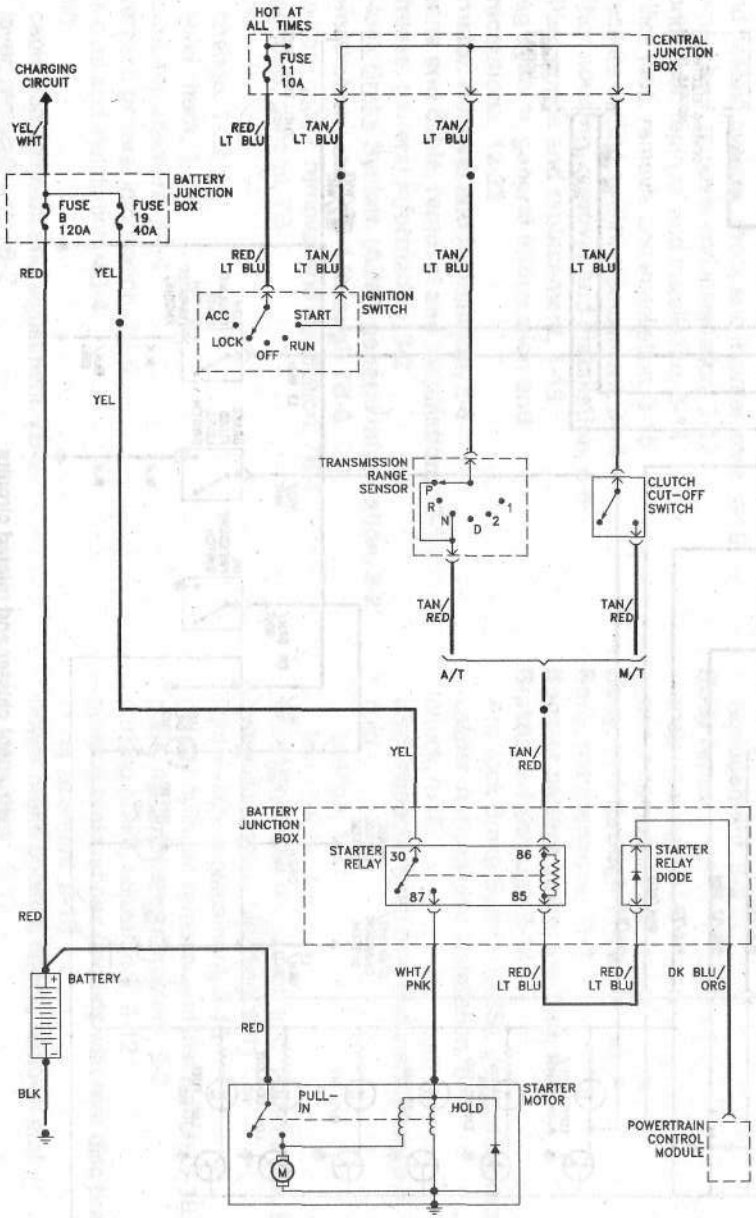
Power door lock system



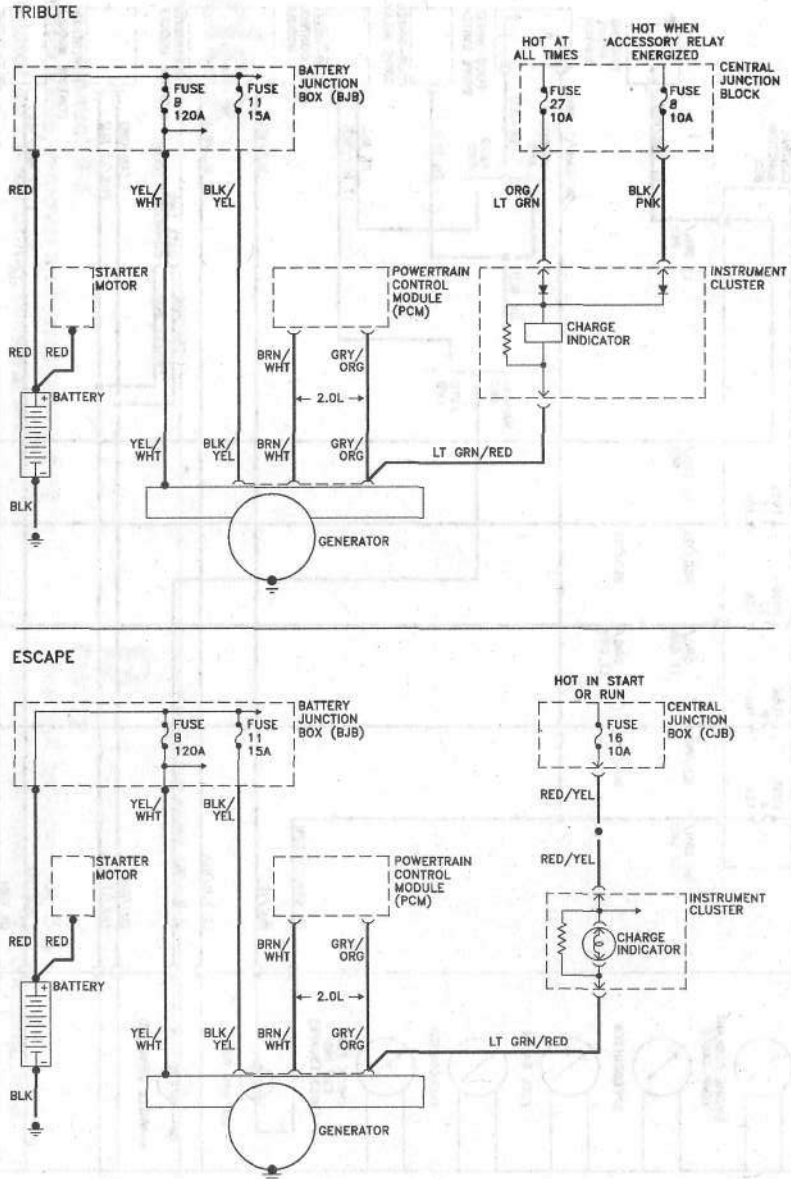
Power window system



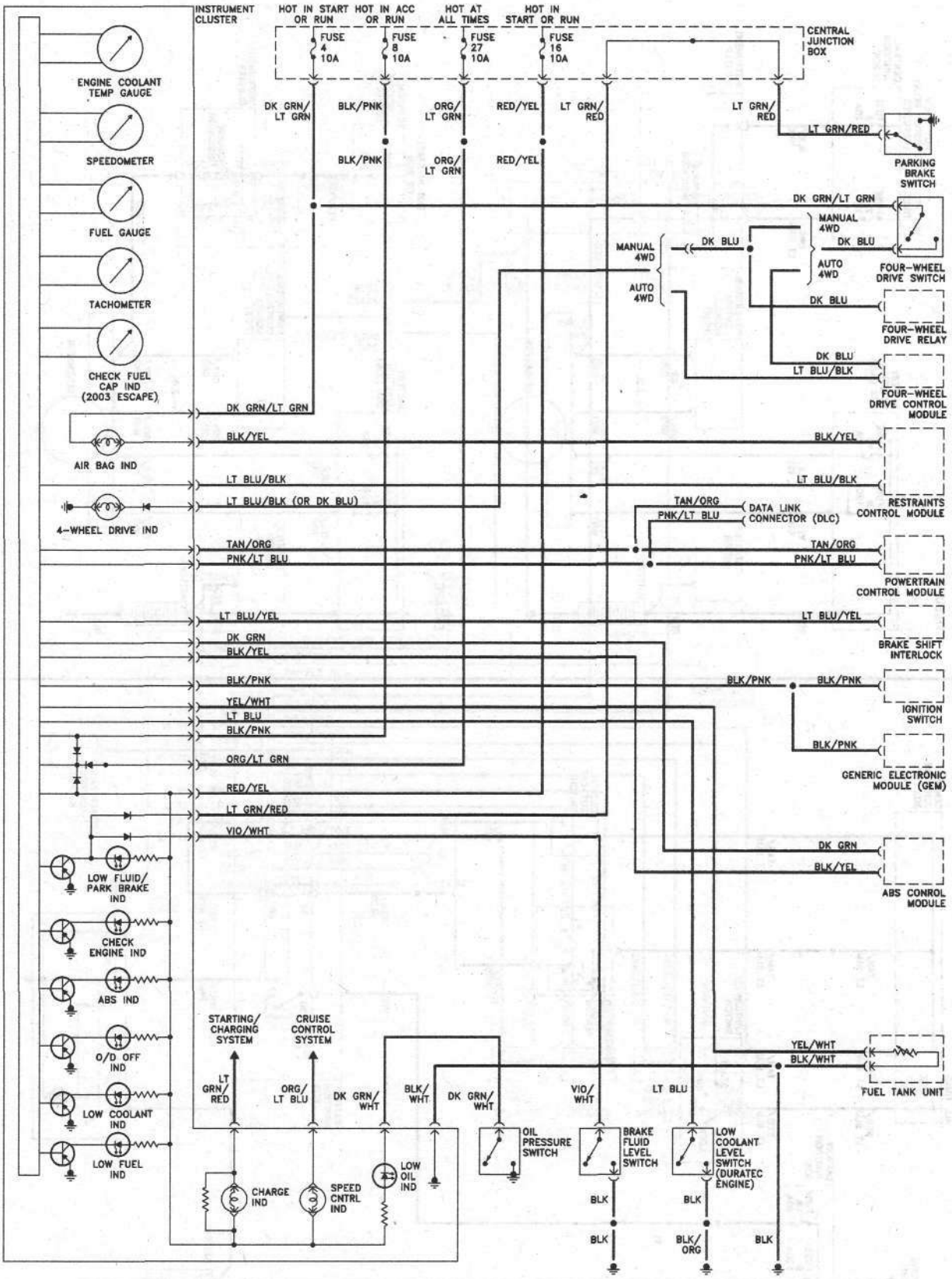
Audio system



Starting system



Charging system



Instrument cluster and related circuits

Haynes Automotive Manuals

NOTE: If you do not see a listing for your vehicle, consult your local Haynes dealer for the latest product information.

HAYNES XTREME CUSTOMIZING
11101 **Sport Compact Customizing**
11102 **Sport Compact Performance**
11110 **In-car Entertainment**
11150 ***Sport Utility Vehicle Customizing***
11213 **Acura**
11255 **GM Full-size Pick-ups**
11314 **Ford Focus**
11315 **Full-size Ford Pick-ups**
11373 **Honda Civic**

ACURA
12020 **Integra** '86 thru '89 **& Legend** '86 thru '90
12021 **Integra** '90 thru '93 **& Legend** '91 thru '95

AMC
Jeep CJ - *see JEEP (50020)*
14020 Concord/Hornet/Gremlin/Spirit '70 thru '83
14025 **(Renault) Alliance & Encore** '83 thru '87

AUDI
15020 **4000** all models '80 thru '87
15025 **5000** all models '77 thru '83
15026 **5000** all models '84 thru '88

AUSTIN
Healey Sprite - *see MG Midget (66015)*

BMW
18020 **3/5 Series** '82 thru '92
18021 **3 Series** including Z3 models '92 thru '98
18022 **3-Series**, E46 chassis '99 thru '05, Z4 models '03 thru '05
18025 **320i** all 4 cyl models '75 thru '83
18050 **1500 thru 2002** except Turbo '59 thru '77

BUICK
19010 **Buick Century** '97 thru '05
Century (front-wheel drive) - *see GM (38005)*
19020 **Buick, Oldsmobile & Pontiac Full-size (Front wheel drive)** '85 thru '05
19025 **Buick Oldsmobile & Pontiac Full-size (Rear wheel drive)** '70 thru '90
19030 **Mid-size Regal & Century** '74 thru '87
Regal - *see GENERAL MOTORS (38010)*
Skyhawk - *see GM (38030)*
Skylark - *see GM (38020, 38025)*
Somerset - *see GENERAL MOTORS (38025)*

CADILLAC
21030 **Cadillac Rear Wheel Drive** '70 thru '93
Cimarron, Eldorado & Seville - *see GM (38015, 38030, 38031)*

CHEVROLET
10305 **Chevrolet Engine Overhaul Manual**
24010 **Astro & GMC Safari Mini-vans** '85 thru '03
24015 **Camaro V8** all models '70 thru '81
24016 **Camaro** all models '82 thru '92, **Cavalier** - *see GM (38015)*, **Celebrity** - *see GM (38005)*
24017 **Camaro & Firebird** '93 thru '02
24020 **Chevelle, Malibu, El Camino** '69 thru '87
24024 **Chevette & Pontiac T1000** '76 thru '87
Citation - *see GENERAL MOTORS (38020)*
24027 **Colorado & GMC Canyon** '04 thru '06
24032 **Corsica/Beretta** all models '87 thru '96
24040 **Corvette** all V8 models '68 thru '82
24041 **Corvette** all models '84 thru '96
24045 **Full-size Sedans** Caprice, Impala, Biscayne, Bel Air & Wagons '69 thru '90
24046 **Impala SS & Caprice and Buick Roadmaster** '91 thru '96
Lumina '90 thru '94 - *see GM (38010)*
24048 **Lumina & Monte Carlo** '95 thru '05
Lumina APV - *see GM (38035)*
24050 **Luv Pick-up** all 2WD & 4WD '72 thru '82
Malibu - *see GM (38026)*
24055 **Monte Carlo** all models '70 thru '88
Monte Carlo '95 thru '01 - *see LUMINA*
24059 **Nova** all V8 models '69 thru '79
24060 **Nova/Geo Prizm** '85 thru '92
24064 **Pick-ups '67 thru '87** - Chevrolet & GMC, all V8 & in-line 6 cyl, 2WD & 4WD '67 thru '87; Suburbans, Blazers & Jimmys '67 thru '91
24065 **Pick-ups '88 thru '98** - Chevrolet & GMC, all full-size models '88 thru '98; C/K Classic '99 & '00; Blazer & Jimmy '92 thru '94; Suburban '92 thru '99; Tahoe & Yukon '95 thru '99
24066 **Pick-ups '99 thru '06** - Chevrolet Silverado & GMC Sierra '99 thru '06; Suburban/Tahoe/Yukon/Yukon XL/Avalanche '00 thru '06
24070 **S-10 & GMC S-15 Pick-ups** '82 thru '93
24071 **S-10, Sonoma & Jimmy** '94 thru '04
24072 **Chevrolet TrailBlazer & TrailBlazer EXT, GMC Envoy & Envoy XL, Oldsmobile Bravada** '02 thru '06
24075 **Sprint** '85 thru '88, **Geo Metro** '89 thru '01
24080 **Vans - Chevrolet & GMC** '68 thru '96
24081 **Chevrolet Express & GMC Savana Full-size Vans '96 thru '05**

CHRYSLER
10310 **Chrysler Engine Overhaul Manual**
25015 **Chrysler Cirrus, Dodge Stratus, Plymouth Breeze**, '95 thru '00
25020 **Full-size Front-Wheel Drive** '88 thru '93
K-Cars - *see DODGE Aries (30008)*
Laser - *see DODGE Daytona (30030)*
25025 **Chrysler LHS, Concorde & New Yorker, Dodge** Intrepid, **Eagle** Vision, '93 thru '97
25026 **Chrysler LHS, Concorde, 300M, Dodge** Intrepid '98 thru '03
25027 **Chrysler 300, Dodge Charger & Magnum** '05 thru '07
25030 **Chrysler/Plym. Mid-size** '82 thru '95
Rear-wheel Drive - *see DODGE (30050)*
25035 **PT Cruiser** all models '01 thru '03
25040 **Chrysler Sebring/Dodge Avenger '95 thru '05, Dodge Stratus '01 thru '05**

DATSUN
28005 **200SX** all models '80 thru '83
28007 **B-210** all models '73 thru '78
28009 **210** all models '78 thru '82
28012 **240Z, 260Z & 280Z** Coupe '70 thru '78
28014 **280ZX** Coupe & 2+2 '79 thru '83
300ZX - *see NISSAN (72010)*
28018 **510 & PL521 Pick-up** '68 thru '73
28020 **510** all models '78 thru '81
28022 **620 Series Pick-up** all models '73 thru '79
720 Series Pick-up - *NISSAN (72030)*
28025 **810/Maxima** all gas models, '77 thru '84

DODGE
400 & 600 - *see CHRYSLER (25030)*
30008 **Aries & Plymouth Reliant** '81 thru '89
30010 **Caravan & Ply. Voyager** '84 thru '95
30011 **Caravan & Ply. Voyager** '96 thru '02
30012 **Challenger/Plymouth Saporro** '78 thru '83
Challenger '67-'76 - *see DART (30025)*
30013 **Caravan, Chrysler Voyager, Town & Country** '03 thru '06
30016 **Colt/Plymouth Champ** '78 thru '87
30020 **Dakota Pick-ups** all models '87 thru '96
30021 **Durango** '98 & '99, **Dakota** '97 thru '99
30022 **Dodge Durango models '00 thru '03**
Dodge Dakota models '00 thru '04
30023 **Dodge Durango** '04 thru '06, **Dakota** '05 and '06
30025 **Dart, Challenger/Plymouth Barracuda & Valiant** 6 cyl models '67 thru '76
30030 **Daytona & Chrysler Laser** '84 thru '89
Intrepid - *see Chrysler (25025, 25026)*
30034 **Dodge & Plymouth Neon** '95 thru '99
30035 **Omni & Plymouth Horizon** '78 thru '90
30036 **Dodge and Plymouth Neon** '00 thru'05
30040 **Pick-ups** all full-size models '74 thru '93
30041 **Pick-ups** all full-size models '94 thru '01
30042 **Dodge Full-size Pick-ups '02 thru '05**
30045 **Ram 50/D50 Pick-ups & Raider and Plymouth Arrow Pick-ups** '79 thru '93
30050 **Dodge/Ply./Chrysler RWD** '71 thru '89
30055 **Shadow/Plymouth Sundance** '87 thru '94
30060 **Spirit & Plymouth Acclaim** '89 thru '95
30065 **Vans - Dodge & Plymouth** '71 thru '03

EAGLE
Talon - *see MITSUBISHI (68030, 68031)*
Vision - *see CHRYSLER (25025)*

FIAT
34010 **124 Sport Coupe & Spider** '68 thru '78
34025 **X1/9** all models '74 thru '80

FORD
10355 **Ford Automatic Transmission Overhaul**
10320 **Ford Engine Overhaul Manual**
36004 **Aerostar Mini-vans** '86 thru '97
Aspire - *see FORD Festiva (36030)*
36006 **Contour/Mercury Mystique** '95 thru '00
36008 **Courier Pick-up** all models '72 thru '82
36012 **Crown Victoria & Mercury Grand Marquis** '88 thru '06
36016 **Escort/Mercury Lynx** '81 thru '90
36020 **Escort/Mercury Tracer** '91 thru '00
Expedition - *see FORD Pick-up (36059)*
36022 **Ford Escape & Mazda Tribute** '01 thru '03
36024 **Explorer & Mazda Navajo** '91 thru '01
36025 **Ford Explorer & Mercury Mountaineer** '02 thru '06
36028 **Fairmont & Mercury Zephyr** '78 thru '83
36030 **Festiva & Aspire** '88 thru '97
36032 **Fiesta** all models '77 thru '80
36034 **Focus** all models '00 thru '05
36036 **Ford & Mercury Full-size** '75 thru '87
36044 **Ford & Mercury Mid-size** '75 thru '86
36048 **Mustang V8** all models '64-1/2 thru '73
36049 **Mustang II** 4 cyl, V6 & V8 '74 thru '78
36050 **Mustang & Mercury Capri** '79 thru '86
36051 **Mustang** all models '94 thru '04
36052 **Mustang** '05 thru '07
36054 **Pick-ups and Bronco** '73 thru '79
36058 **Pick-ups and Bronco** '80 thru '96
36059 **F-150 & Expedition** '97 thru '03, **F-250** '97 thru '99 **& Lincoln Navigator** '98 thru '02
36060 **Super Duty Pick-up, Excursion** '99 thru '06
36061 **F-150** full-size '04 thru '06
36062 **Pinto & Mercury Bobcat** '75 thru '80
36066 **Probe** all models '89 thru '92
36070 **Ranger/Bronco II** gas models '83 thru '92
36071 **Ford Ranger** '93 thru '05 & **Mazda Pick-ups** '94 thru '05
36074 **Taurus & Mercury Sable** '86 thru '95
36075 **Taurus & Mercury Sable** '96 thru '01
36078 **Tempo & Mercury Topaz** '84 thru '94
36082 **Thunderbird/Mercury Cougar** '83 thru '88
36086 **Thunderbird/Mercury Cougar** '89 thru '97
36090 **Vans** all V8 Econoline models '69 thru '91
36094 **Vans** full size '92 thru '05
36097 **Windstar Mini-van** '95 thru '03

GENERAL MOTORS
10360 **GM Automatic Transmission Overhaul**
38005 **Buick Century, Chevrolet Celebrity, Olds Cutlass Ciera & Pontiac 6000** '82 thru '96
38010 **Buick Regal, Chevrolet Lumina, Oldsmobile Cutlass Supreme & Pontiac Grand Prix** front wheel drive '88 thru '05
38015 **Buick Skyhawk, Cadillac Cimarron, Chevrolet Cavalier, Oldsmobile Firenza Pontiac J-2000 & Sunbird** '82 thru '94
38016 **Chevrolet Cavalier/Pontiac Sunfire** '95 thru '04
38017 **Chevrolet Cobalt & Pontiac G5** '05 thru '07
38020 **Buick Skylark, Chevrolet Citation, Olds Omega, Pontiac Phoenix** '80 thru '85
38025 **Buick Skylark & Somerset, Olds Achieva, Calais & Pontiac Grand Am** '85 thru '98
38026 **Chevrolet Malibu, Olds Alero & Cutlass, Pontiac Grand Am** '97 thru '03
38027 **Chevrolet Malibu** '04 thru '07
38030 **Cadillac Eldorado & Oldsmobile Toronado** '71 thru '85, Seville '80 thru '85, **Buick Riviera** '79 thru '85
38031 **Cadillac Eldorado & Seville** '86 thru '91, **DeVille & Buick Riviera** '86 thru '93, **Fleetwood & Olds Toronado** '86 thru '92
38032 **DeVille** '94 thru '05, **Seville** '92 thru '04
38035 **Chevrolet Lumina APV, Oldsmobile Silhouette & Pontiac Trans Sport** '90 thru '96
38036 **Chevrolet Venture, Olds Silhouette, Pontiac Trans Sport & Montana** '97 thru '05
General Motors Full-size Rear-wheel Drive - *see BUICK (19025)*

GEO
Metro - *see CHEVROLET Sprint (24075)*
Prizm - *see CHEVROLET (24060) or TOYOTA (92036)*
40030 **Storm** all models '90 thru '93
Tracker - *see SUZUKI Samurai (90010)*

GMC
Vans & Pick-ups - *see CHEVROLET*

HONDA
42010 **Accord CVCC** all models '76 thru '83
42011 **Accord** all models '84 thru '89
42012 **Accord** all models '90 thru '93
42013 **Accord** all models '94 thru '97
42014 **Accord** all models '98 thru '02
42015 **Honda Accord models** '03 thru '05
42020 **Civic 1200** all models '73 thru '79
42021 **Civic 1300 & 1500 CVCC** '80 thru '83
42022 **Civic 1500 CVCC** all models '75 thru '79
42023 **Civic** all models '84 thru '91
42024 **Civic** & del Sol '92 thru '95
42025 **Civic** '96 thru '00, **CR-V** '97 thru '01, **Acura Integra** '94 thru '00
Passport - *see ISUZU Rodeo (47017)*
42026 **Civic** '01 thru '04, **CR-V** '02 thru '04
42035 **Honda Odyssey** models '99 thru '04
42037 **Honda Pilot** '03 thru '07, **Acura MDX** '01 thru '07
42040 **Prelude CVCC** all models '79 thru '89

HYUNDAI
43010 **Elantra** all models '96 thru '01
43015 **Excel & Accent** all models '86 thru '98

ISUZU
Hombre - *see CHEVROLET S-10 (24071)*
47017 **Rodeo** '91 thru '02, **Amigo** '89 thru '02, **Honda Passport** '95 thru '02
47020 **Trooper** '84 thru '91, **Pick-up** '81 thru '93

JAGUAR
49010 **XJ6** all 6 cyl models '68 thru '86
49011 **XJ6** all models '88 thru '94
49015 **XJ12 & XJS** all 12 cyl models '72 thru '85

JEEP
50010 **Cherokee, Comanche & Wagoneer Limited** all models '84 thru '01
50020 **CJ** all models '49 thru '86
50025 **Grand Cherokee** all models '93 thru '04
50029 **Grand Wagoneer & Pick-up** '72 thru '91
50030 **Wrangler** all models '87 thru '03
50035 **Liberty** '02 thru '04

KIA
54070 **Sephia** '94 thru '01, **Spectra** '00 thru '04

LEXUS
ES 300 - *see TOYOTA Camry (92007)*

LINCOLN
Navigator - *see FORD Pick-up (36059)*
59010 **Rear Wheel Drive** all models '70 thru '05

MAZDA
61010 **GLC (rear wheel drive)** '77 thru '83
61011 **GLC (front wheel drive)** '81 thru '85
61015 **323 & Protegé** '90 thru '00
61016 **MX-5 Miata** '90 thru '97
61020 **MPV** all models '89 thru '94
Navajo - *see FORD Explorer (36024)*
61030 **Pick-ups** '72 thru '93
Pick-ups '94 on - *see Ford (36071)*
61035 **RX-7** all models '79 thru '85
61036 **RX-7** all models '86 thru '91
61040 **626** (rear wheel drive) '79 thru '82
61041 **626 & MX-6 (front wheel drive)** '83 thru '92
61042 **626** '93 thru '01, **& MX-6/Ford Probe** '93 thru '01

MERCEDES-BENZ
63012 **123 Series Diesel** '76 thru '85
63015 **190 Series** 4-cyl gas models, '84 thru '88
63020 **230, 250 & 280** 6 cyl sohc '68 thru '72
63025 **280 123 Series** gas models '77 thru '81
63030 **350 & 450** all models '71 thru '80

MERCURY
64200 **Villager & Nissan Quest** '93 thru '01
All other titles, see FORD listing.

MG
66010 **MGB** Roadster & GT Coupe '62 thru '80
66015 **MG Midget & Austin Healey Sprite Roadster** '58 thru '80

MITSUBISHI
68020 **Cordia, Tredia, Galant, Precis & Mirage** '83 thru '93
68030 **Eclipse, Eagle Talon & Plymouth Laser** '90 thru '94
68031 **Eclipse** '95 thru '01, **Eagle Talon** '95 thru '98
68035 **Mitsubishi Galant** '94 thru '03
68040 **Pick-up** '83 thru '96, **Montero** '83 thru '93

NISSAN
72010 **300ZX** all models incl. Turbo '84 thru '89
72015 **Altima** all models '93 thru '04
72020 **Maxima** all models '85 thru '92
72021 **Maxima** all models '93 thru '01
72030 **Pick-ups** '80 thru '97, **Pathfinder** '87 thru '95
72031 **Frontier Pick-up** '98 thru '04, **Xterra** '00 thru '04, **Pathfinder** '96 thru '04
72040 **Pulsar** all models '83 thru '86
72050 **Sentra** all models '82 thru '94
72051 **Sentra & 200SX** all models '95 thru '04
72060 **Stanza** all models '82 thru '90

OLDSMOBILE
73015 **Cutlass** '74 thru '88
For other OLDSMOBILE titles, see BUICK, CHEVROLET or GM listings.

PLYMOUTH
For PLYMOUTH titles, see DODGE.

PONTIAC
79008 **Fiero** all models '84 thru '88
79018 **Firebird** V8 models except Turbo '70 thru '81
79019 **Firebird** all models '82 thru '92
79040 **Mid-size Rear-wheel Drive** '70 thru '87
For other PONTIAC titles, see BUICK, CHEVROLET or GM listings.

PORSCHE
80020 **911** Coupe & Targa models '65 thru '89
80025 **914** all 4 cyl models '69 thru '76
80030 **924** all models incl. Turbo '76 thru '82
80035 **944** all models incl. Turbo '83 thru '89

RENAULT
Alliance, Encore - *see AMC (14020)*

SAAB
84010 **900** including Turbo '79 thru '88

SATURN
87010 **Saturn** all models '91 thru '02
87011 **Saturn Ion** '03 thru '07
87020 **Saturn** all L-series models '00 thru '04

SUBARU
89002 **1100, 1300, 1400 & 1600** '71 thru '79
89003 **1600 & 1800** 2WD & 4WD '80 thru '94
89100 **Legacy** models '90 thru '99
89101 **Legacy & Forester** '00 thru '06

SUZUKI
90010 **Samurai/Sidekick/Geo Tracker** '86 thru '01

TOYOTA
92005 **Camry** all models '83 thru '91
92006 **Camry** all models '92 thru '96
92007 **Camry/Avalon/Solara/Lexus ES 300** '97 thru '01
92008 **Toyota Camry, Avalon and Solara & Lexus ES 300/330** all models '02 thru '05
92015 **Celica Rear Wheel Drive** '71 thru '85
92020 **Celica Front Wheel Drive** '86 thru '99
92025 **Celica Supra** all models '79 thru '92
92030 **Corolla** all models '75 thru '79
92032 **Corolla** rear wheel drive models '80 thru '87
92035 **Corolla** front wheel drive models '84 thru '92
92036 **Corolla & Geo Prizm** '93 thru '02
92037 **Corolla** models '03 thru '05
92040 **Corolla Tercel** all models '80 thru '82
92045 **Corona** all models '74 thru '82
92050 **Cressida** all models '78 thru '82
92055 **Land Cruiser** FJ40/43/45/55 '68 thru '82
92056 **Land Cruiser** FJ60/62/80/FZJ80 '80 thru '96
92065 **MR2** all models '85 thru '87
92070 **Pick-up** all models '69 thru '78
92075 **Pick-up** all models '79 thru '95
92076 **Tacoma** '95 thru '04, **4Runner** '96 thru '02, **T100** '93 thru '98
92078 **Tundra** '00 thru '05, **Sequoia** '01 thru '05
92080 **Previa** all models '91 thru '95
92081 ***Prius*** *'01 thru '08*
92082 **RAV4** all models '96 thru '05
92085 **Tercel** all models '87 thru '94
92090 **Sienna** all models '98 thru '02
92095 **Highlander & Lexus RX-330** '99 thru '06

TRIUMPH
94007 **Spitfire** all models '62 thru '81
94010 **TR7** all models '75 thru '81

VW
96008 **Beetle & Karmann Ghia** '54 thru '79
96009 **New Beetle** '98 thru '05
96016 **Rabbit, Jetta, Scirocco, & Pick-up** gas models '75 thru '92 & Convertible '80 thru '92
96017 **Golf, GTI & Jetta** '93 thru '98, **Cabrio** '95 thru '98
96018 **Golf, GTI, Jetta & Cabrio** '98 thru '02
96020 **Rabbit, Jetta, Pick-up** diesel '77 thru '84
96023 **Passat** '98 thru '01, **Audi A4** '96 thru '01
96030 **Transporter 1600** all models '68 thru '79
96035 **Transporter 1700, 1800, 2000** '72 thru '79
96040 **Type 3 1500 & 1600** '63 thru '73
96045 **Vanagon** air-cooled models '80 thru '83

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97010 **120, 130 Series & 1800 Sports** '61 thru '73
97015 **140 Series** all models '66 thru '74
97020 **240 Series** all models '76 thru '93
97040 **740 & 760 Series** all models '82 thru '88

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10333 **Building Engine Power Manual**
10340 **Small Engine Repair Manual**
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10410 **Automotive Brake Manual**
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10425 **Automotive Heating & Air Conditioning**
10430 **Automotive Reference Dictionary**
10435 **Automotive Tools Manual**
10440 **Used Car Buying Guide**
10445 **Welding Manual**
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10452 **Scooters, Automatic Transmission 50cc to 250cc**

SPANISH MANUALS
98903 **Reparación de Carrocería & Pintura**
98904 **Carburadores para los modelos Holley & Rochester**
98905 **Códigos Automotrices de la Computadora**
98910 **Frenos Automotriz**
98913 **Electricidad Automotriz**
98915 **Inyección de Combustible 1986 al 1999**
99040 **Chevrolet & GMC Camionetas** '67 al '87
99041 **Chevrolet & GMC Camionetas** '88 al '98
99042 **Chevrolet Camionetas Cerradas** '68 al '95
99055 **Dodge Caravan/Ply. Voyager** '84 al '95
99075 **Ford Camionetas y Bronco** '80 al '94
99077 **Ford Camionetas Cerradas** '69 al '91
99088 **Ford Modelos de Tamaño Mediano** '75 al '86
99091 **Ford Taurus & Mercury Sable** '86 al '95
99095 **GM Modelos de Tamaño Grande** '70 al '90
99100 **GM Modelos de Tamaño Mediano** '70 al '88
99106 **Jeep Cherokee, Wagoneer & Comanche** '84 al '00
99110 **Nissan Camionetas** '80 al '96, **Pathfinder** '87 al '95
99118 **Nissan Sentra** '82 al '94
99125 **Toyota Camionetas y 4-Runner** '79 al '95

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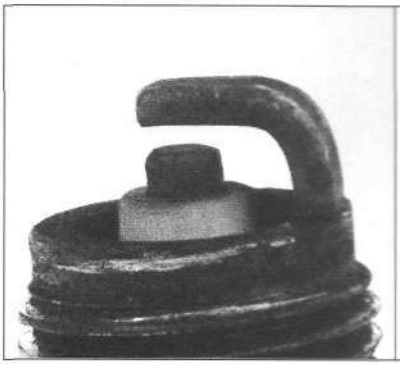
10-07

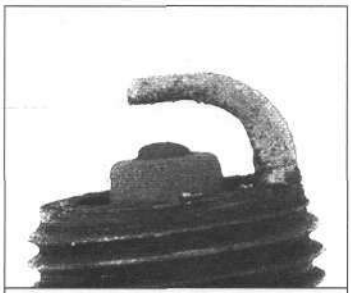
Common spark plug conditions



NORMAL

Symptoms: Brown to grayish-tan color and slight electrode wear. Correct heat range for engine and operating conditions.

Recommendation: When new spark plugs are installed, replace with plugs of the same heat range.



WORN

Symptoms: Rounded electrodes with a small amount of deposits on the firing end. Normal color. Causes hard starting in damp or cold weather and poor fuel economy.

Recommendation: Plugs have been left in the engine too long. Replace with new plugs of the same heat range. Follow the recommended maintenance schedule.

CARBON DEPOSITS

Symptoms: Dry sooty deposits indicate a rich mixture or weak ignition. Causes misfiring, hard starting and hesitation.

Recommendation: Make sure the plug has the correct heat range. Check for a clogged air filter or problem in the fuel system or engine management system. Also check for ignition system problems.

ASH DEPOSITS

Symptoms: Light brown deposits encrusted on the side or center electrodes or both. Derived from oil and/or fuel additives. Excessive amounts may mask the spark, causing misfiring and hesitation during acceleration.

Recommendation: If excessive deposits accumulate over a short time or low mileage, install new valve guide seals to prevent seepage of oil into the combustion chambers. Also try changing gasoline brands.

OIL DEPOSITS

Symptoms: Oily coating caused by poor oil control. Oil is leaking past worn valve guides or piston rings into the combustion chamber. Causes hard starting, misfiring and hesitation.

Recommendation: Correct the mechanical condition with necessary repairs and install new plugs.

GAP BRIDGING

Symptoms: Combustion deposits lodge between the electrodes. Heavy deposits accumulate and bridge the electrode gap. The plug ceases to fire, resulting in a dead cylinder.

Recommendation: Locate the faulty plug and remove the deposits from between the electrodes.

TOO HOT

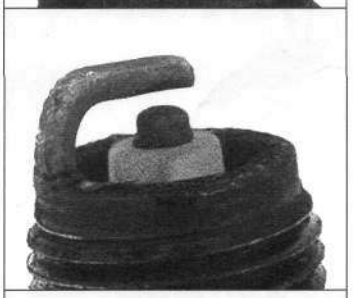
Symptoms: Blistered, white insulator, eroded electrode and absence of deposits. Results in shortened plug life.

Recommendation: Check for the correct plug heat range, over-advanced ignition timing, lean fuel mixture, intake manifold vacuum leaks, sticking valves and insufficient engine cooling.

PREIGNITION

Symptoms: Melted electrodes. Insulators are white, but may be dirty due to misfiring or flying debris in the combustion chamber. Can lead to engine damage.

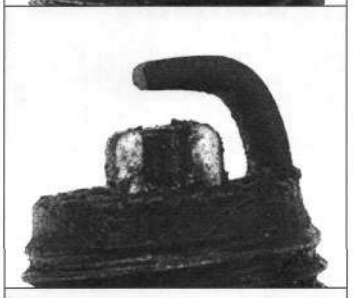
Recommendation: Check for the correct plug heat range, over-advanced ignition timing, lean fuel mixture, insufficient engine cooling and lack of lubrication.



HIGH SPEED GLAZING

Symptoms: Insulator has yellowish, glazed appearance. Indicates that combustion chamber temperatures have risen suddenly during hard acceleration. Normal deposits melt to form a conductive coating. Causes misfiring at high speeds.

Recommendation: Install new plugs. Consider using a colder plug if driving habits warrant.



DETONATION

Symptoms: Insulators may be cracked or chipped. Improper gap setting techniques can also result in a fractured insulator tip. Can lead to piston damage.

Recommendation: Make sure the fuel anti-knock values meet engine requirements. Use care when setting the gaps on new plugs. Avoid lugging the engine.

MECHANICAL DAMAGE

Symptoms: May be caused by a foreign object in the combustion chamber or the piston striking an incorrect reach (too long) plug. Causes a dead cylinder and could result in piston damage.

Recommendation: Repair the mechanical damage. Remove the foreign object from the engine and/or install the correct reach plug.