

**SECTION 2A**

**FRAME AND BUMPERS**

**CAUTION:** This vehicle has a Supplemental Inflatable Restraint (SIR) System. Refer to the SIR Component and Wiring Location view in order to determine whether you are performing service on or near the SIR components or the SIR wiring. When you are performing service on or near the SIR components or the SIR wiring, refer to the SIR On-Vehicle Service information. Failure to follow the CAUTIONS could cause air bag deployment, personal injury, or unnecessary SIR system repairs.

**NOTICE:** Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

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### GENERAL DESCRIPTION

Proper frame alignment is critical to ensure normal life and function of many parts on the vehicle. If the vehicle has been involved in a fire, collision, or has been overloaded, check the frame alignment. If for any other reason alignment is suspected, it should be checked. Refer to "Checking Frame Alignment," in this Section.

It is possible that certain conditions make the frame appear to be out of alignment when, in fact, it is not. These conditions are described under "Checking Frame Alignment," in this Section.

Terms used in this section are briefly defined below:

1. **SECTION MODULUS** is a measure of the strength of a frame based on height, width, thickness, and shape of the side rails. It does not account for the strength of the material used in the frame.
2. **YIELD STRENGTH** is a measure of the strength of the material from which the frame is made. It is the

maximum load that can be placed on a material and still have it return to its original shape. It is measured in kPa (psi).

3. **RESISTANCE TO BENDING MOMENT (RBM)** is a single measure of frame strength that accounts for both section modulus and the strength of the material used.
4. **COLLAPSE** refers to the condition that occurs when buckles appear on more than one surface of the box section of the side rail, or when a section of the underbody or frame structure has been shortened in length (Figure 1).
5. **DIAMOND** refers to the condition where one side of the frame has been moved forward or rear causing the frame structure to be out of square (Figure 2).
6. **SAG** refers to a vertical misalignment resulting in an incorrect datum line. When both sides are equally misaligned, this condition is known as kick-up (Figure 3).
7. **SIDESWAY** refers to a section of the frame that is positioned to the left or right of centerline, when compared to the rest of vehicle (Figure 4).
8. **TRACKING** refers to the alignment of the vehicle axles with each other. A misaligned frame can cause improper tracking. If the vehicle is tracking correctly, all axles will be parallel to each other and perpendicular to the centerline of frame.
9. **TWIST** refers to the condition where the sides of the underbody plane (datum) are not parallel. One rail will slope up while the other rail will slope down (Figure 5).
10. **WEB** refers to the vertical part of a channel-type frame rail.
11. **DATUM** Refers to the plane of the underbody of frame from which all vertical measurements originate.
12. **TRAM LENGTH** Refers to measurements that are two dimensional and parallel to the datum line.

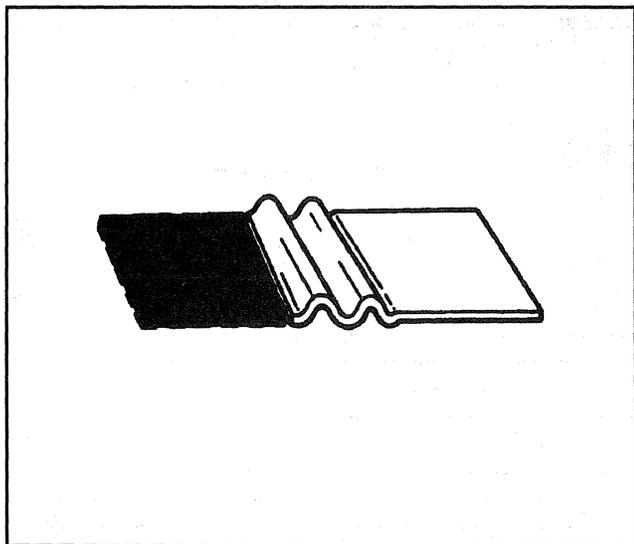


Figure 1—Collapse (Damage Condition)

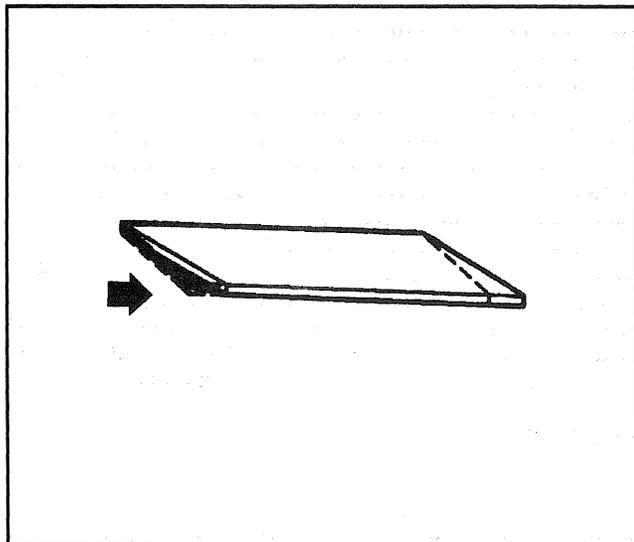


Figure 2—Diamond (Damage Condition)

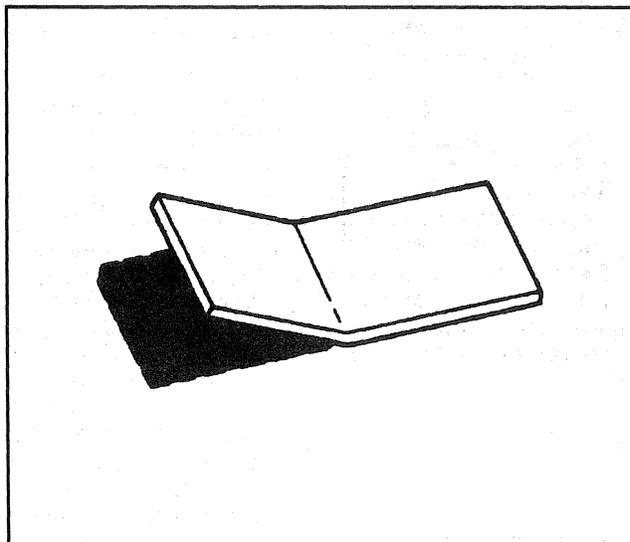
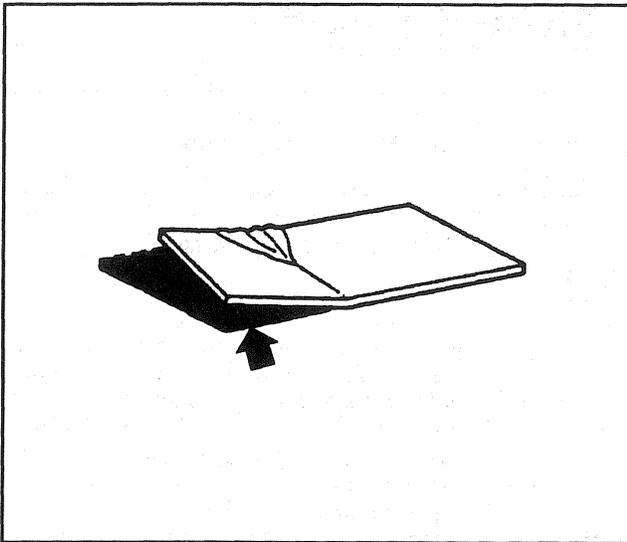
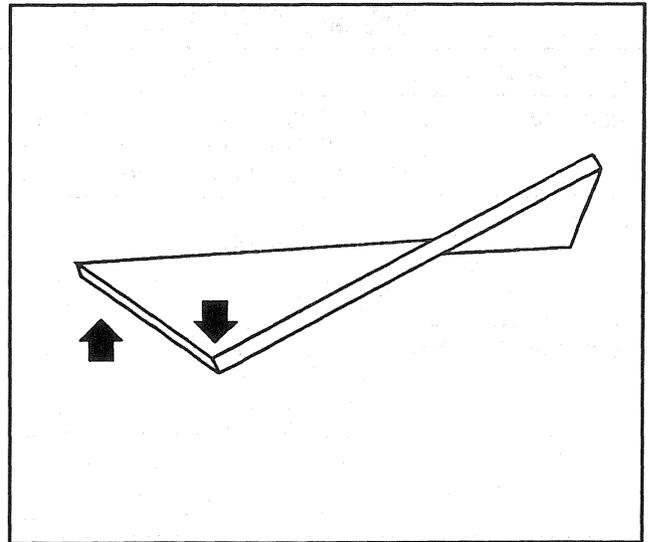


Figure 3—Sag (Damage Condition)



**Figure 4—Sidesway (Damage Condition)**



**Figure 5—Twist (Damage Condition)**

**DIAGNOSIS OF THE FRAME**

PROBLEM	POSSIBLE CAUSE	CORRECTION
<b>Sag</b>	<ol style="list-style-type: none"> <li>1. Loads greater than the frame is designed to carry.</li> <li>2. Uneven load distribution.</li> <li>3. Abrupt changes in section modulus.</li> <li>4. Improper body, or accessory, mounting:                             <ul style="list-style-type: none"> <li>— Holes drilled in the flange of the frame rail.</li> <li>— Too many holes in the web section of the rail.</li> <li>— Holes in the web section which are too close to each other.</li> <li>— Four or more holes in the same vertical line of the rail web.</li> <li>— Welds on the flange, particularly across the flange or along its edge.</li> <li>— Cutting holes in the rail with a torch.</li> <li>— Cutting notches anywhere on the rails.</li> </ul> </li> <li>5. A fire involving the vehicle.</li> <li>6. A collision involving the vehicle.</li> <li>7. The use of equipment for which the frame has not been designed or reinforced.</li> </ol>	<ol style="list-style-type: none"> <li>1-7. Straighten and reinforce the frame. See Straightening Frames.</li> </ol>
<b>Buckle</b>	<ol style="list-style-type: none"> <li>1. Using equipment such as snow plows for which the frame was not designed.</li> <li>2. A collision involving the vehicle.</li> <li>3. A fire involving the vehicle.</li> <li>4. In addition to these causes, refer to possible causes 3 and 4 under Sag.</li> </ol>	<ol style="list-style-type: none"> <li>1-4. Straighten and reinforce the frame. See Straightening Frames.</li> </ol>
<b>Sidesway</b>	<ol style="list-style-type: none"> <li>1. A collision involving the vehicle.</li> <li>2. A fire involving the vehicle.</li> <li>3. The use of equipment such as snow plows for which the frame was neither designed nor properly reinforced.</li> <li>4. In addition to these causes, refer to possible causes 3 and 4 under Sag.</li> </ol>	<ol style="list-style-type: none"> <li>1-4. Straighten and reinforce the frame. See Straightening Frames.</li> </ol>

## 2A-4 FRAME AND BUMPERS

### DIAGNOSIS OF THE FRAME (cont'd)

PROBLEM	POSSIBLE CAUSE	CORRECTION
<b>Diamond</b>	<ol style="list-style-type: none"> <li>1. A collision involving the vehicle.</li> <li>2. Towing another vehicle with a chain attached to one corner of the frame.</li> </ol>	<ol style="list-style-type: none"> <li>1-2. Straighten and reinforce the frame. See Straightening Frames.</li> </ol>
<b>Twist</b>	<ol style="list-style-type: none"> <li>1. An accident or collision involving the vehicle.</li> <li>2. Operating the vehicle in very rough terrain.</li> </ol>	<ol style="list-style-type: none"> <li>1-2. Straighten and reinforce the frame. See Straightening Frames.</li> </ol>
<b>Improper Tracking</b>	<ol style="list-style-type: none"> <li>1. Frame is out of alignment.</li> <li>2. Front or rear axle has shifted.</li> <li>3. Incorrect wheel alignment.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace or weld and reinforce rail. Ream bolt holes and replace with larger bolts if necessary. Retighten bolts.</li> <li>2. Replace or weld and reinforce the rail. See the appropriate heading, later in this section.</li> <li>3. Refer to SECTION 3A.</li> </ol>
<b>Cracks in Web of Rails</b>	<ol style="list-style-type: none"> <li>1. Loose crossmember attaching bolts.</li> <li>2. Concentration of stress that may result from many different factors. (See Sag under "Diagnosis" previously described in this chart. Also see Minimizing Frame Damage and Reinforcements (later in this section).</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace or weld and reinforce rail. Ream bolt holes and replace with larger bolts if necessary. Retighten bolts.</li> <li>2. Replace or weld and reinforce rail as explained later in this section.</li> </ol>

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### MINIMIZING FRAME SERVICE

Generally, frame service can be minimized or eliminated by minimizing the concentration of stress in small areas of the frame.

1. Vehicles should be used only for those purposes for which they were designed.
  - Do not overload.
  - Load evenly; localized loads should be avoided.
  - Do not operate the vehicle on extremely rough terrain.
  - Take into account the forces that will be placed on a frame from the operation of equipment (such as snow plows) when picking a frame for a new vehicle or reinforcing a frame.
2. Follow recommended practices when repairing a frame or mounting a body or equipment on a frame.
  - Avoid sudden changes in the section modulus.
  - Do not drill holes in the frame rail flanges.
  - Space holes in the web section of a rail at least 13 mm (1/2 inch) from one another.
  - Use existing holes whenever possible.
  - Do not cut holes with a torch.
  - Do not overheat the frame rails.
  - Avoid welding on the flanges.
  - Do not allow four or more holes to exist on the same vertical line of the web.

### CHECKING FRAME ALIGNMENT

The main components of a frame are the side rails and crossmembers. The rails carry the load and the crossmembers stabilize the rails.

Types of frame misalignment can be divided into five groups. The five groups are; sag, collapse, diamond, sidesway, and twist.

A misaligned frame rail may have moved forward from, up or down from, or to the side of where it should be. These possibilities must be checked.

The easiest way to check frame alignment is with tramming gages and universal measuring systems made for this purpose. Detailed instructions are normally supplied with the equipment at the time of purchase. Therefore, instructions for equipment usage are not given in this manual.

Whether alignment is checked with or without gages, the vehicle must be parked on a level section of floor.

Certain conditions call for preliminary checks before actually checking the frame. Suspension or axle problems may make it appear that the vehicle frame is out of alignment. If an axle has shifted, a "Diamond" or "Sidesway" may appear to exist when, in fact, they do not. A weak spring may make the vehicle appear to have a "twisted" frame.

A visual inspection of the top and bottom flanges of each rail may reveal the specific area where sag or buckle exists. In the case of sag, wrinkles may appear on the top of the upper flange. Wrinkles on the bottom of the lower flange are definite evidence of buckle.

**Determining the Frame Centerline**

Centerline length measurements are three dimensional measurements. These three dimensions are:

1. Length (distance between two points when height is parallel to center plane)
2. Height (measurement is parallel to datum plane)
3. Width (measurement is parallel to center plane)

When reading dimension charts, horizontal width and length dimensions of the underbody are shown as viewed from the bottom of the underbody. Vertical dimensions are shown from the side of the underbody and use the datum plane as a base for all vertical (height) measurements.

1. Move the vehicle to a level, well-lighted section of the floor.
2. Make a diagram of the frame on the floor beneath the vehicle as follows:
  - A. Using a plumb bob, transfer points 1, 2, 11, and 12 from the inside of the web to the floor. Mark the points (Figure 6).
  - B. Using a plumb bob, transfer the remaining points from the outside of the web to the floor. Mark the points. The actual placement of these points is not so important as is the fact that the points must be taken from the same place on both the right and left frame rail.
3. Move the vehicle away from the points on the floor.
4. Measure the distance from the outer edge of each frame rail at points 1 and 2. This distance should be 866 mm (35.31 inches).
5. Measure the distance from the dead center of each frame rail at points 11 and 12. This distance should be 860 mm (33.85 inches).
6. Make a mark on the floor exactly halfway between points 1 and 2. Make a similar mark between points 11 and 12.
7. Use a chalk line to mark a line through the points. This is the centerline of the frame.

**Horizontal Check**

1. Measure the distance between the frame rails, and the centerline at points 3-10. Each pair of corresponding points should be an equal distance from the centerline within 3 mm (1/8 inch). Example: Points 3 and 4 should measure equally from the centerline as should points 5 and 6, 7 and 8, and points 9 and 10.
2. Measure diagonally from point 1 to point 6, and from point 2 to point 5. Mark the floor where the diagonals pass the centerline. The diagonals should measure the same distance within 5 mm (3/16 inch), and should cross at the centerline. If the frame is within specifications, the frame within these points is properly aligned.
3. Repeat Step 2 on other pairs of diagonals until the entire frame has been checked. Example: Point 3 to point 10 and point 4 to point 9 or point 5 to point 12 and point 6 to point 11, etc.

4. Refer to "Straightening Frames" in this section to repair any damage that is found.

**Datum Plane**

A datum (Figure 7) is an imaginary horizontal plane that runs below and parallel to the vehicle. Height dimensions are calculated at right angles from the datum to a given control or reference point on the underbody.

The company that develops height dimensions determines the location of the datum based on the equipment being used. Therefore, different datum lines are established for the same vehicle. You can add or subtract an equal amount from all height dimensions and create a new datum line for your usage.

**Center Plane**

A centerline (Figure 8) is an imaginary vertical plane that is perpendicular to the length of the datum plane through the center of the vehicle. The centerline is any line drawn through the center of the vehicle's datum. The symbol for centerline is CL.

**Centerline Length**

Centerline length measurements are three dimensional measurements. These three dimensions are:

1. Length (distance between two points when height is parallel to center plane).
2. Height (measurement is parallel to datum plane).
3. Width (measurement is parallel to center plane).

When reading dimension charts, horizontal width and length dimensions of the underbody are shown as viewed from the bottom of the underbody. Vertical dimensions are shown from the side of the underbody and use the datum plane as a base for all vertical (height) measurements.

**Vertical Body Zero Line**

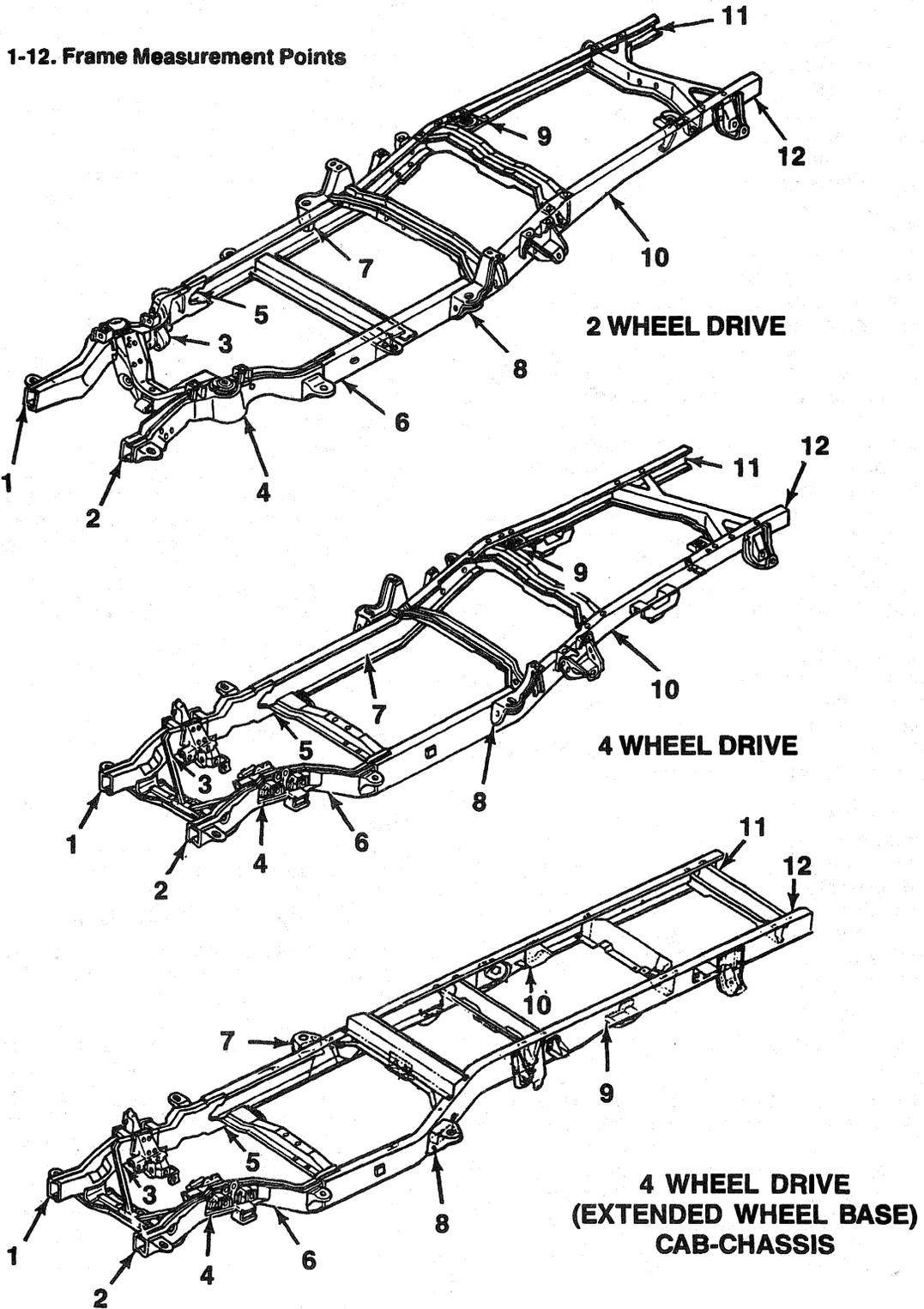
The vertical Body Zero Line (Figure 9) is a line drawn through the frame either at the forward or rearward torque box area of the frame. This is the starting point for determining length measurements.

**STRAIGHTENING FRAMES**

Frame straightening can be complicated and usually requires special equipment. It should be attempted by qualified technicians only.

A complete analysis of the condition of the frame should be made before any steps are taken to straighten it. Analyzing the cause of failure will help determine the correct sequence of steps in the repair. (Refer to "Possible Causes" under "Diagnosis" and "Minimizing Frame Service" in this section.) Use corrective procedures to reverse the flow of the damaging forces. In many instances, to reverse the flow of forces, pressure must be applied from different directions at the same time.

## 2A-6 FRAME AND BUMPERS



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Figure 6—Frame Measuring Points

Careful use of controlled heat is critical. Too much or too little heat, or the improper application of heat, is a major source of trouble. Frame heating should be done with a large sized (multi-hole) heating tip, and a neutral flame should be used (oxygen adjustment opened just enough to remove the feathers or stringers from the blue center at tip of torch). Heat the area that will be stretched as the frame is straightened. Heat the area **AFTER SUFFICIENT PRESSURE HAS BEEN EXERTED** to cause a slight checking, or silvery cracks, to appear on the surface of the metal. Gradually increase the pressure while heating. Do not heat beyond 606° C (1200° F). A red glow indicates that the material is overheated. Overheating will cause distortion and stretching, as well as a change in the characteristics of the metal.

**REPAIRING CRACKS**

Two common types of cracks are shown in Figure 10. The straight crack will normally start from the edge of a flange. It will go across the flange and through the web

section of a rail. Finally, it will continue through the other flange. This type of crack may result from high concentrations of stress in small areas of the frame, excessive bending movement, and torsional loading. Refer to "Minimizing Frame Service," in this section.

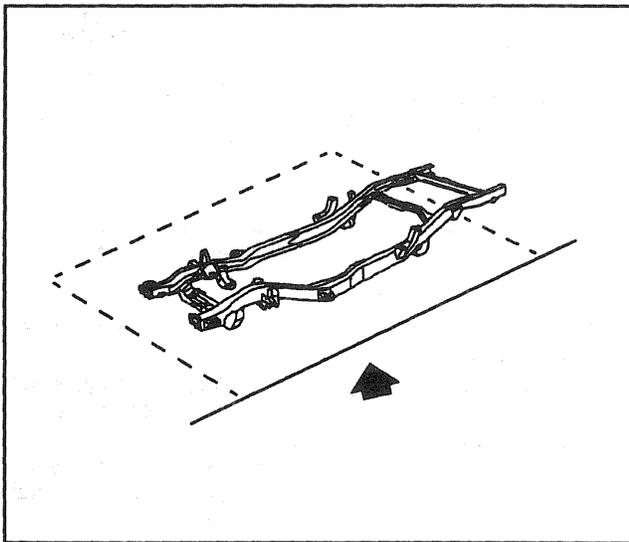
Sunburst crack(s) will radiate outward from a hole in the web section of a rail or crossmember. They are caused by high loads being applied at a mounting bracket or crossmember which is not securely or properly attached to the rail.

If cracks occur to both the rail and reinforcement at a particular area of the frame, they must be repaired separately. The flanges must react independently to prevent localized stress concentration. Use a copper spacer between the flanges of cracked base rail flanges and reinforcement flanges.

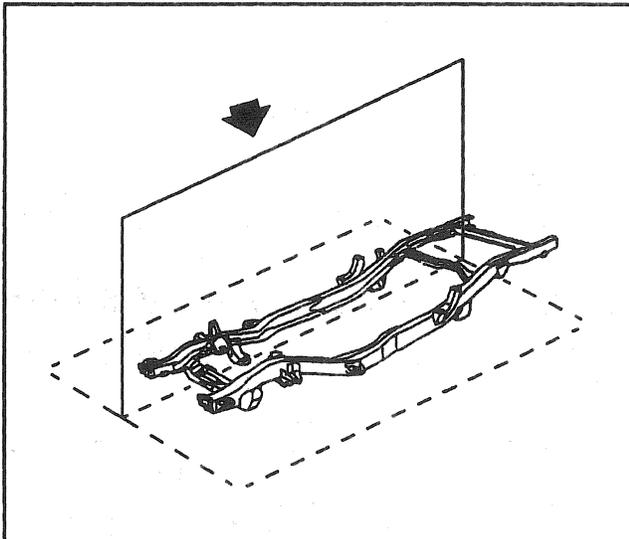
Crossmember mounting flange cracks may be repaired in the same manner as side rail cracks. However, a weld bead should be built up to provide a good, smooth radius. If a crossmember is badly damaged, replace it.

It may be necessary to align the frame and level the rails before repairing the frame.

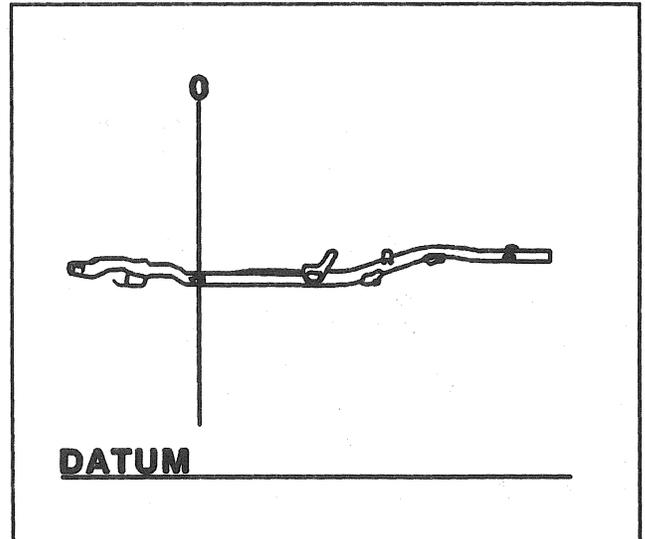
1. Remove any equipment that will interfere with access to the crack.
2. Locate the extreme end of the crack and drill a 3 mm (0.12 inch) hole.
3. "V" grind the entire length of the crack from the starting point to the 3 mm (0.12 inch) hole at the extreme end.
4. Open up the bottom of the crack 2 mm (1/16 inch) to allow good penetration of the weld. (A hacksaw blade may be used for this).
5. Weld with proper electrode and proper welding techniques. Refer to "Welding" in this section for tips on welding.
6. Grind the weld smooth on both the inside and the outside of the rail or crossmember. Be extremely careful to eliminate weld buildup or notches on the edge of the flange.



**Figure 7—Datum Plane**



**Figure 8—Centerline Plane**



**Figure 9—Vertical Body Zero Line**

## 2A-8 FRAME AND BUMPERS

### WELDING

Using improper welding techniques causes many weld and/or frame failures. The following information points out potential areas of difficulty and provides some general guidelines for successful frame welding.

Most weld failures occur at the end of the weld in areas of the frame that are under high stress. By eliminating the ends of a weld, failures can be reduced. This can be done by making a hole or slot in the part to be attached and then using a fillet weld around a slot or plug weld. Do not leave a notch at the end of a weld.

Over-welding can be harmful, especially if it is in an area of the frame that receives high concentrations of stress.

Small cracks in a crossmember may be welded. (Refer to "Repairing Cracks" in this section).

#### When Welding:

1. Disconnect the battery. Refer to SECTION 6D1.
2. The frame is covered with a protective wax coating. Use a wire brush to remove any concentration of wax before welding. When finished, re-coat the area with new wax.
3. Do not use oxyacetylene welding equipment.
4. Whenever possible, use smaller diameter electrodes and make several passes; this is preferred to using a large diameter electrode and making fewer passes.
5. Do not use more heat than is necessary to give good penetration.
6. Do not run more passes than necessary.
7. Make sure the weld is free from craters, undercuts, slag inclusion, and porosity.
8. Make sure scale is removed from each successive pass.
9. If repairing a crack, grind the surface of the weld flush with the parent material.
10. When mounting accessories, do not weld across, or within 19 mm (3/4 inch) of a flange.
11. Do not weld up to the edge of a part being welded to a frame. Leave 6 mm (0.25 inch) between the end of the weld and the edge of the part.

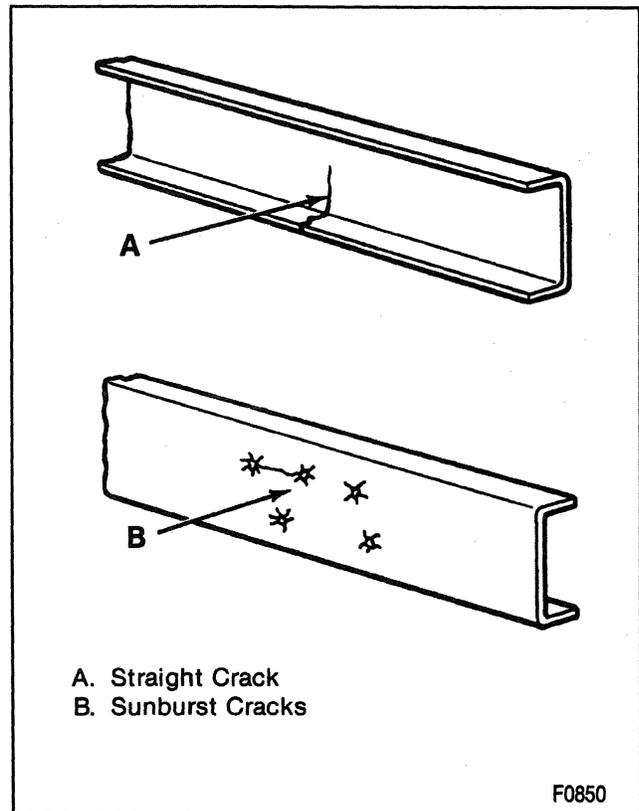


Figure 10—Types of Frame Cracks

12. Do not weld cast brackets to the frame.
13. Do not weld the flanges of cracked reinforcements and base rails together.
14. Do not attach the ground cable to the engine. Connect the welding machine ground cables as close to the working area as possible.
15. Do not get the welding cables near the vehicle wiring. Avoid direct contact between the welding cables and any part of the vehicle.

## ON-VEHICLE SERVICE

### FRONT AIR DEFLECTOR REPLACEMENT



Remove or Disconnect (Figure 11)

1. Deflector to the bumper bolts.
2. Deflector from the vehicle.



Install or Connect (Figure 11)

**NOTICE:** Refer to "Notice" on page 2A-1.

1. Deflector to the vehicle.

2. Deflector to the bumper bolts.



Tighten

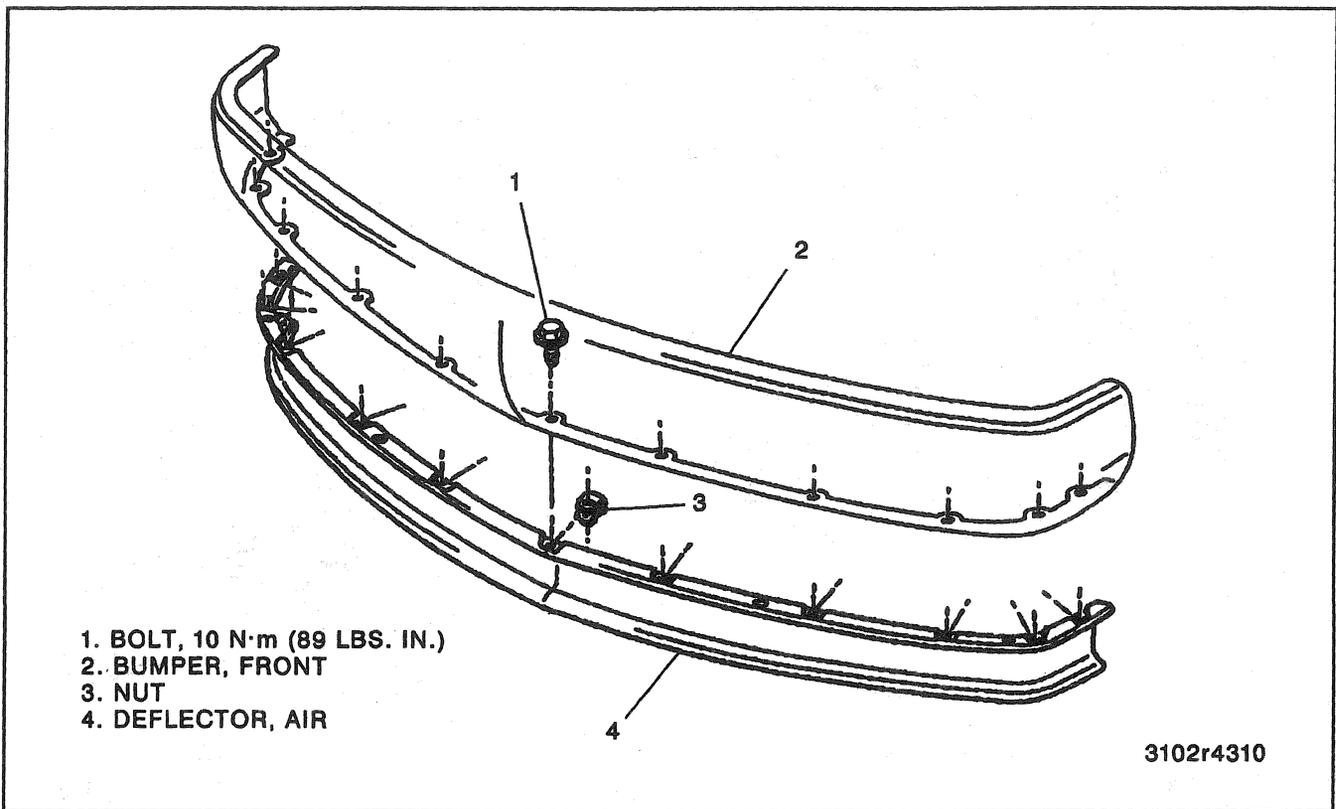
- Deflector to the bumper bolts to 10 N·m (89 lb in).

### FRONT BUMPER REPLACEMENT

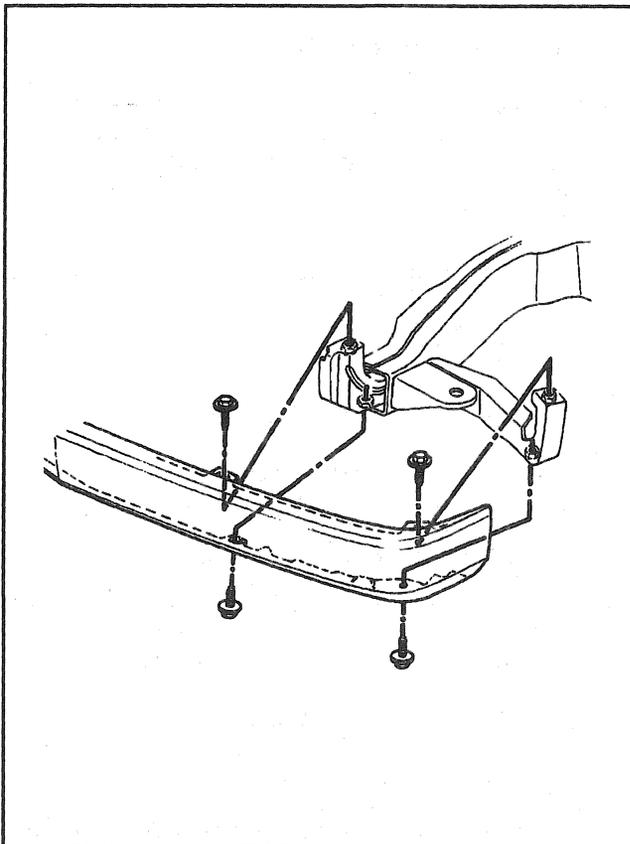


Remove or Disconnect (Figures 12 and 13)

1. Grille. Refer to SECTION 2B.
2. Bumper to brace bolts and washers (Figure 12).
3. Bumper to bracket bolts and washers.
4. Bumper from the vehicle.
5. Guards from the bumper (if equipped) (Figure 13).



**Figure 11—Front Air Deflector**



**Figure 12—Front Bumper**

6. Air deflector from the bumper (if equipped). Refer to "Front Air Deflector Replacement" in this section.

**↔** Install or Connect (Figures 12 and 13)

**NOTICE:** Refer to "Notice" on page 2A-1.

1. Air deflector to the bumper. Refer to "Front Air Deflector Replacement" in this section.
2. Guards to the bumper with nuts (if equipped).

**⌚** Tighten

- Guard to the bumper nuts to 25 N·m (18 lb ft).
3. Bumper to the vehicle.
  4. Bumper bolts and washers to the bracket.
  5. Bumper bolts and washers to the brace.
    - Align the bumper laterally to the grille area.

**⌚** Tighten

- Bumper to the bracket and the brace bolts to 112 N·m (83 lb ft).

**FRONT BUMPER FILLER CENTER PANEL REPLACEMENT**

**↔** Remove or Disconnect (Figure 14)

1. Grille. Refer to SECTION 2B.
2. Filler panel to the radiator support screws.

## 2A-10 FRAME AND BUMPERS

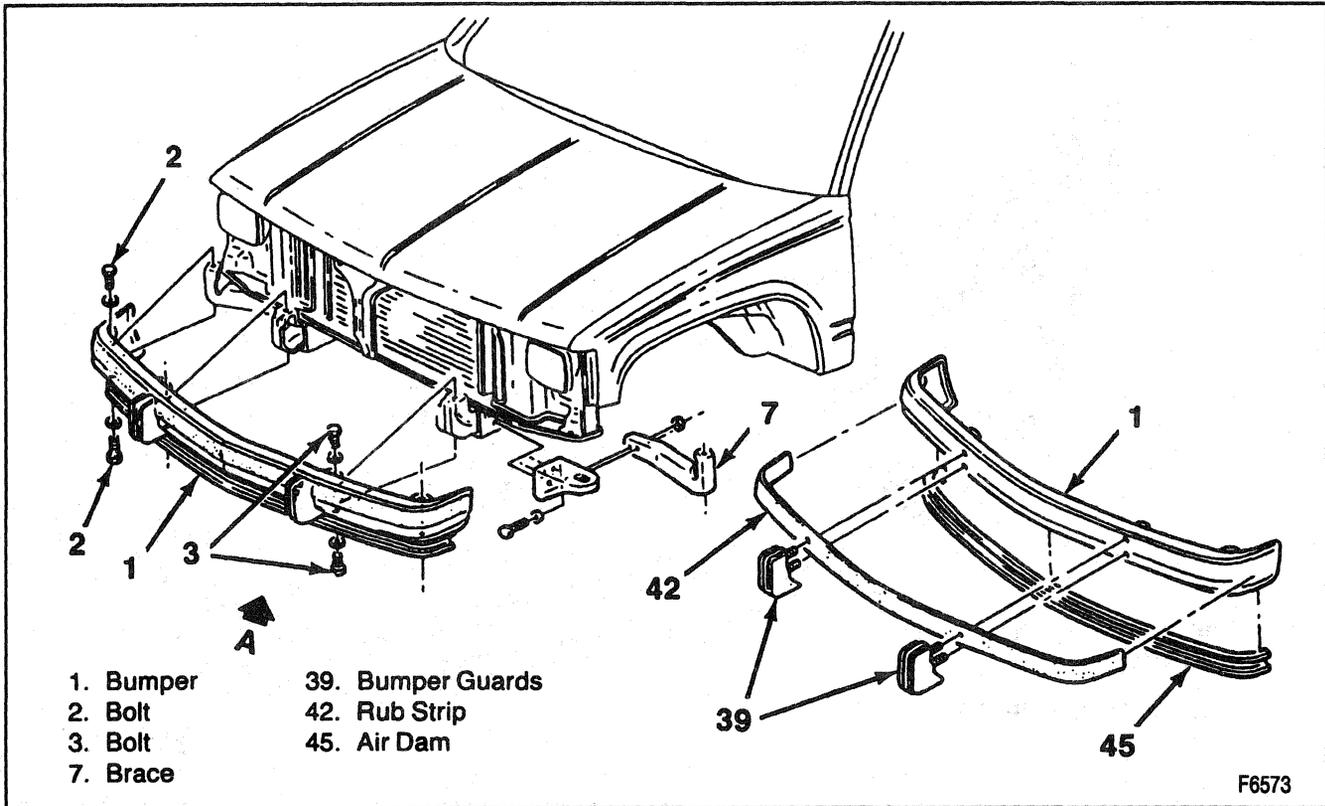


Figure 13—Bumper Assembly Components

3. Filler center panel from the vehicle.

**↔ Install or Connect (Figure 14)**

1. Filler panel to the vehicle.
2. Filler panel to the radiator support screws.
3. Grille to the vehicle. Refer to SECTION 2B.

### FRONT BUMPER FILLER SIDE PANEL REPLACEMENT

**↔ Remove or Disconnect (Figure 14)**

1. Grille. Refer to SECTION 2B.
2. Filler panel to the fender bolts.
3. Filler side panel.

**↔ Install or Connect (Figure 14)**

1. Filler side panel.
2. Filler side panel to the fender bolts.
3. Grille. Refer to SECTION 2B.

### FRONT LICENSE PLATE BRACKET REPLACEMENT

**↔ Remove or Disconnect (Figure 15)**

1. License plate bracket to the bumper nuts.
2. License plate bracket to the bumper bolts.

3. License plate bracket.

**↔ Install or Connect (Figure 15)**

1. License plate bracket.
2. License plate bracket to the bumper bolts.
3. License plate bracket to the bumper nuts.

**Tighten**

- License plate bracket to the bumper bolts to 13 N·m (115 lb in).

### TOW HOOKS

**↔ Remove or Disconnect (Figure 16)**

1. Tow hook bolts from the frame rail.
2. Tow hook and plate from the vehicle.

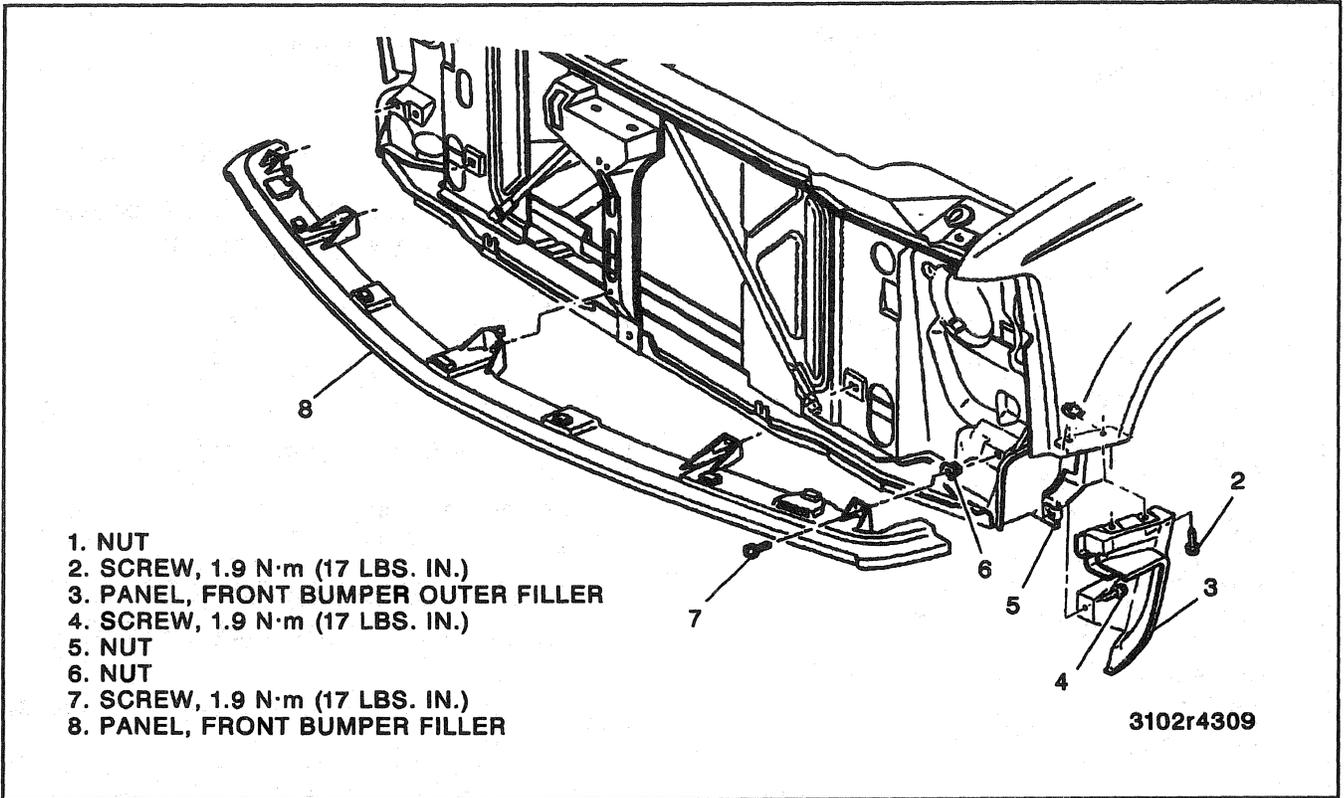
**↔ Install or Connect (Figure 16)**

**NOTICE:** Refer to "Notice" on page 2A-1.

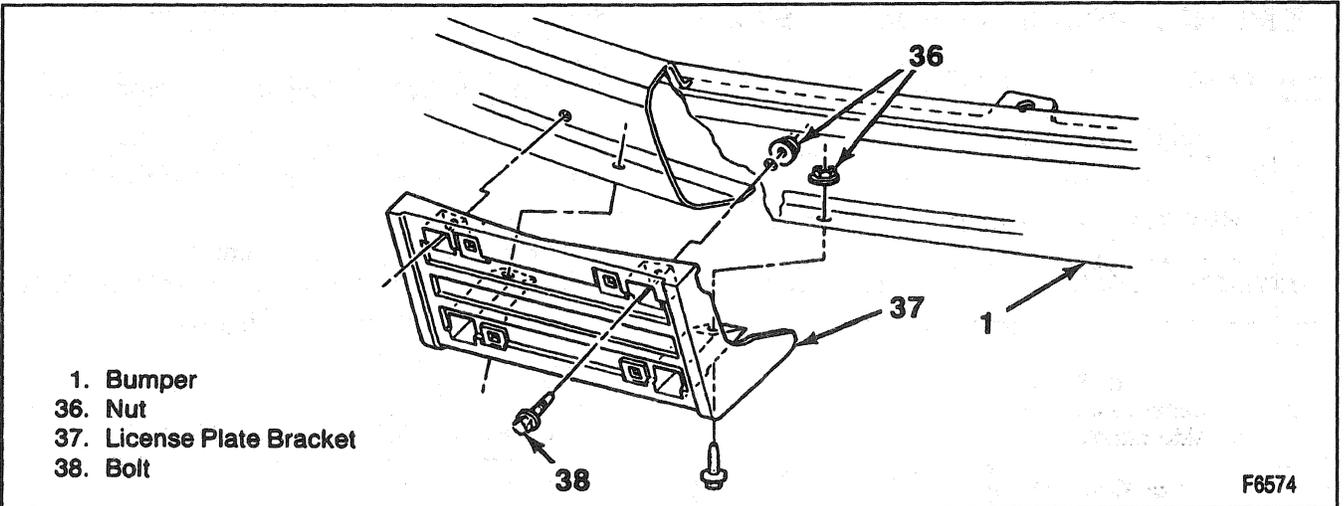
1. Tow hook and plate to the frame rail.
2. Frame rail to the tow hook bolts.

**Tighten**

- Frame to the tow hook bolts to 60 N·m (44 lb ft).



**Figure 14—Front Bumper Filler Panels**



**Figure 15—Front License Plate Bracket**

## 2A-12 FRAME AND BUMPERS

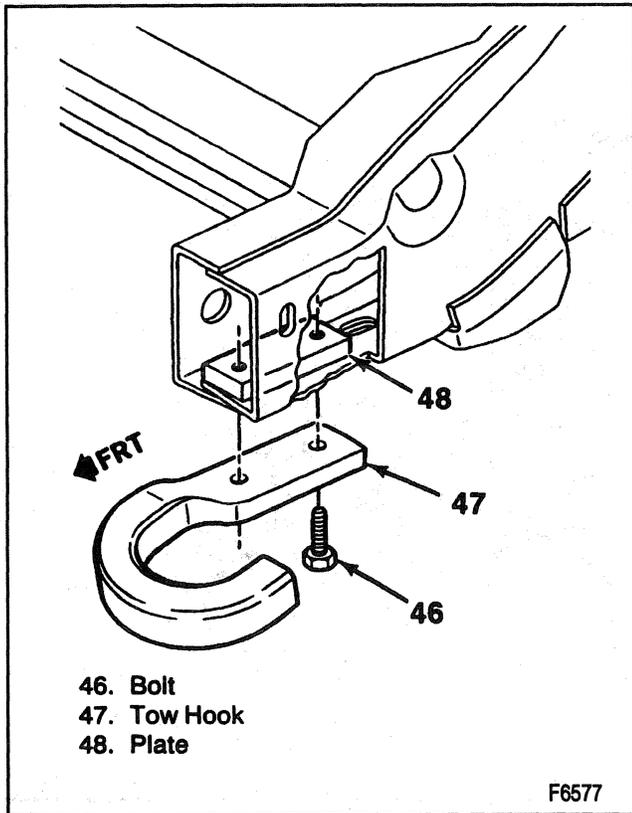


Figure 16—Tow Hooks

### ENGINE PROTECTION SHIELD

↔ Remove or Disconnect (Figure 17)

1. Four frame to shield bolts.
2. Shield from vehicle.

↔ Install or Connect (Figure 17)

**NOTICE:** Refer to "Notice" on page 2A-1.

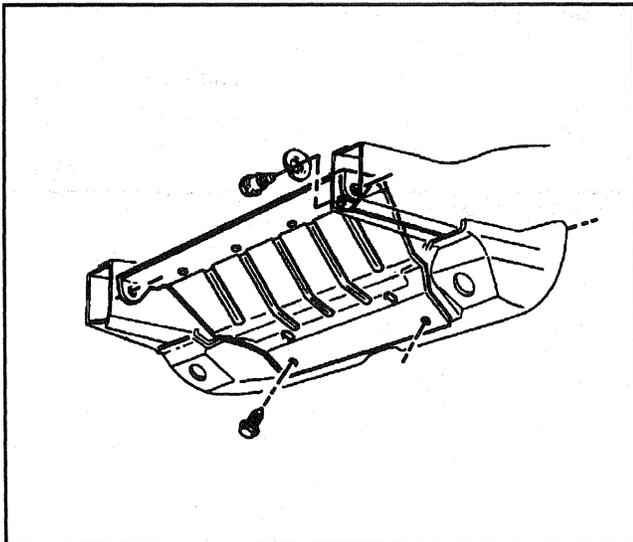


Figure 17—Engine Protection Shield

1. Shield to vehicle.
2. Four frame to shield bolts.

⌚ Tighten

- Frame to shield bolts to 35 N.m (26 lb ft).

### REAR BUMPER STEP PAD REPLACEMENT

↔ Remove or Disconnect (Figure 18)

1. Step pad to bumper nuts.
2. Step pad.

↔ Install or Connect (Figure 18)

1. Step pad to bumper.
2. Step pad to bumper nuts.

### REAR BUMPER, BRACE AND BRACKET REPLACEMENT

↔ Remove or Disconnect (Figures 19 through 21)

1. License plate lamp harness. Refer to SECTION 8B.
2. Brace to bumper nuts and bolt assemblies.
3. Bracket to bumper nuts, washers and bolts.
4. Bumper from the vehicle.
5. Brace and bracket nuts, washers and bolts.
6. Braces and brackets from the frame.

↔ Install or Connect (Figures 19 through 21)

**NOTICE:** Refer to "Notice" on page 2A-1.

1. Braces and brackets to the frame.
2. Brace and bracket bolts, washers and nuts.

- Be sure the harness is in place, if used.

⌚ Tighten

- Brace and bracket bolts to 90 N.m (66 lb ft).
- Front bracket nut to 47 N.m (35 lb ft).

3. Bumper to the vehicle.
4. Bracket to the bumper bolts, washers and nuts.

- Align the bumper (Figure 19).

⌚ Tighten

- Bracket to the bumper bolts to 90 N.m (66 lb ft).

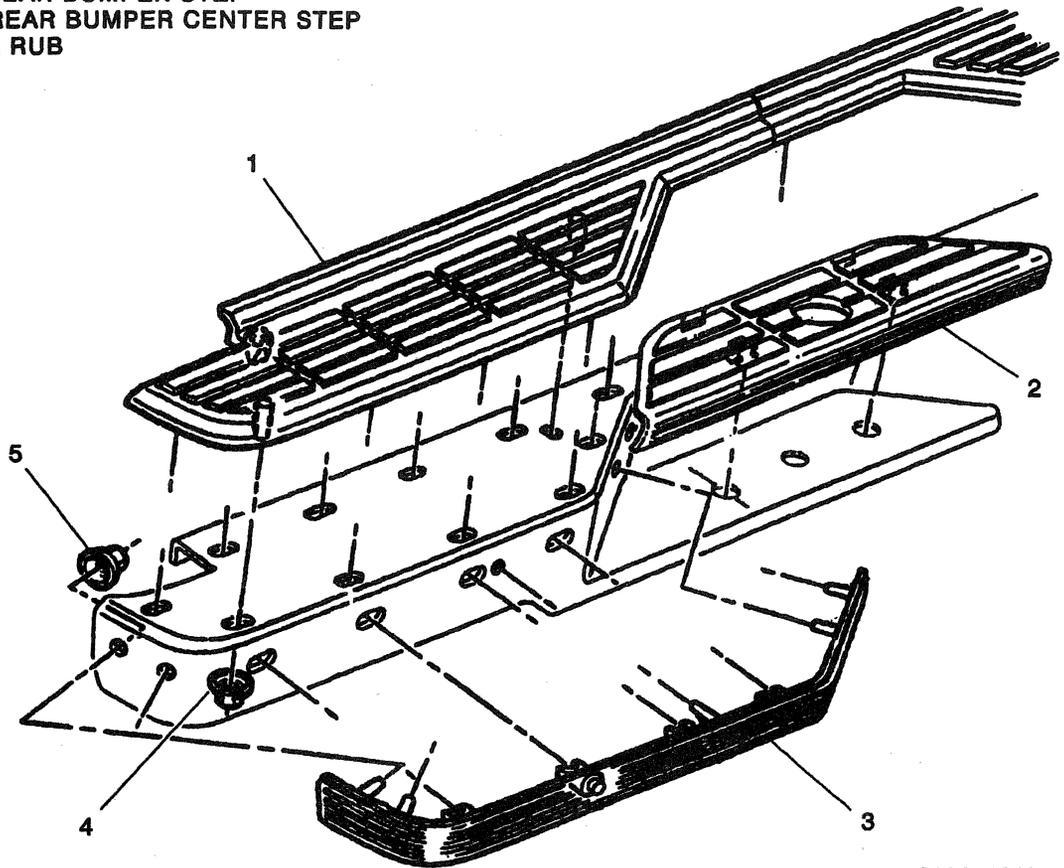
5. Brace to bumper bolts, and nuts.

⌚ Tighten

- Brace to the bumper bolts to 90 N.m (66 lb ft).

6. License plate lamp harness. Refer to SECTION 8B.

- 1. PAD, REAR BUMPER STEP
- 2. PAD, REAR BUMPER CENTER STEP
- 3. STRIP, RUB
- 4. NUT
- 5. NUT



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**Figure 18—Rear Bumper Step Pads and Rub Strips**

### **HITCH PLATFORM and LICENSE PLATE BRACKET REPLACEMENT**

**←→ Remove or Disconnect (Figures 22 and 23)**

1. Bracket plate to hitch platform bolts and nuts (Figure 22).
2. License plate bracket assembly from hitch platform.
3. Bolts, washers, and nuts from the hitch platform and frame rail.
4. Hitch platform from the vehicle.

**→← Install or Connect (Figures 22 and 23)**

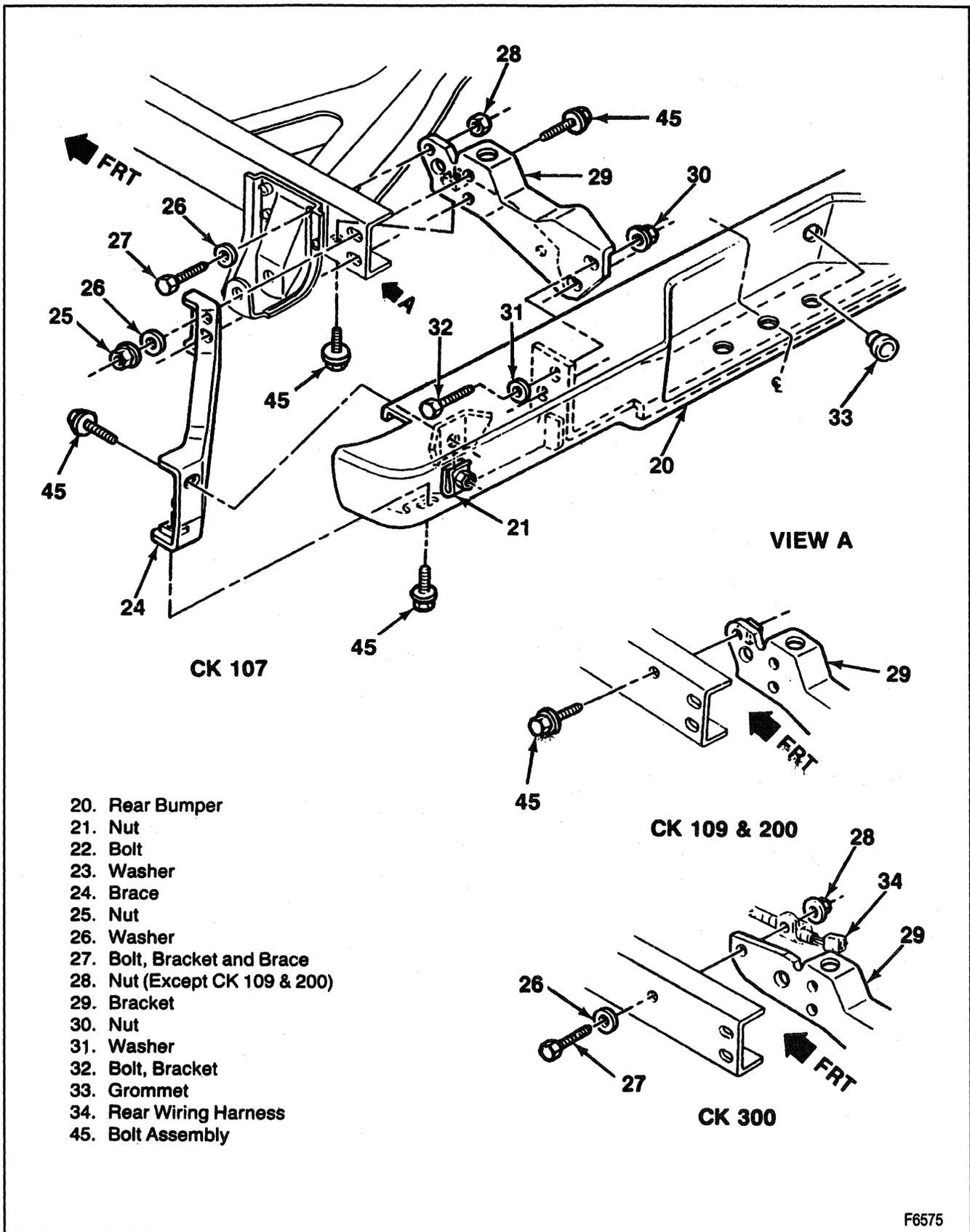
**NOTICE:** Refer to "Notice" on page 2A-1.

1. Hitch platform to the vehicle.
2. Hitch bolts and washers through the frame rails with nuts.

**⌚ Tighten**

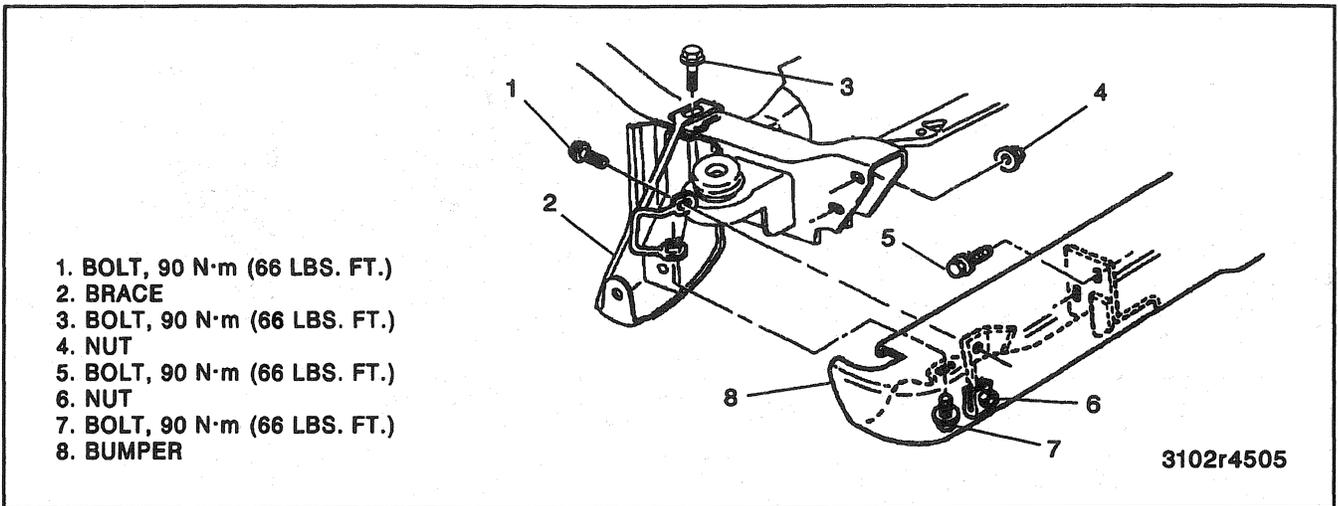
- Hitch to the frame bolts to 100 N.m (74 lb ft).
3. License plate bracket assembly to the hitch platform.
  4. Bolts and nuts.

## 2A-14 FRAME AND BUMPERS

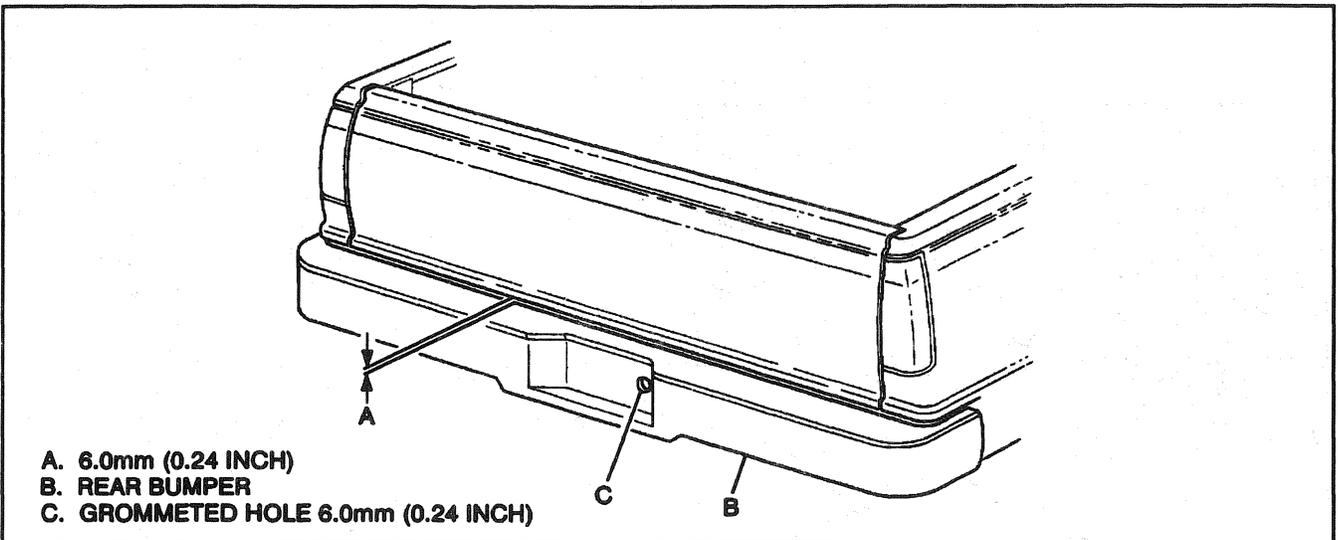


F6575

Figure 19—Rear Step Bumper



**Figure 20—Rear Bumper**



**Figure 21—Rear Bumper Alignment**

## 2A-16 FRAME AND BUMPERS

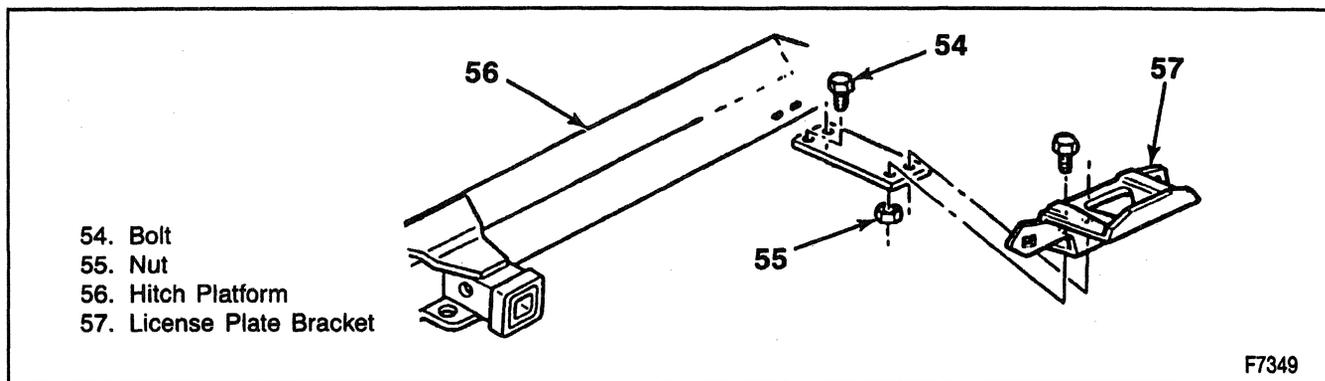


Figure 22—Hitch Platform License Plate Bracket

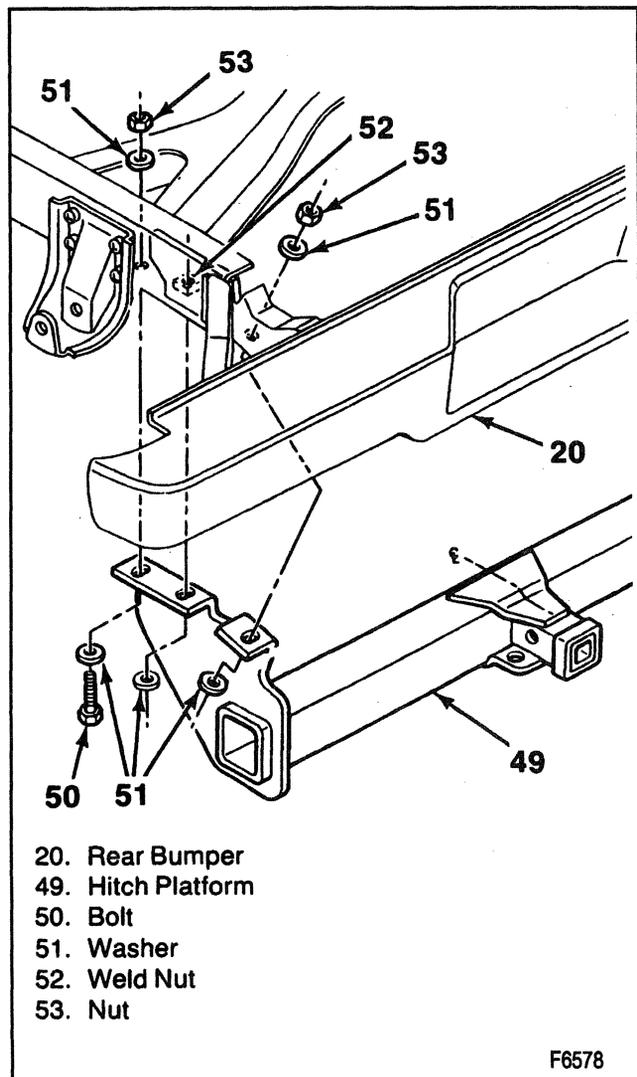


Figure 23—Weight Distribution Hitch Platform

**SPECIFICATIONS****FASTENER TIGHTENING SPECIFICATIONS**

<b>Application</b>	<b>N.m</b>	<b>Lb ft</b>	<b>Lb in</b>
Air Deflector to Bumper Bolts	10	—	89
Bumper Filler Panel to Radiator Support Screws	2	—	18
Bumper Guard to Bumper Nuts	25	18	—
Bumper Side Filler Panel to Fender Screws	2	—	18
Engine Protections Shield to Frame Rail Bolts	35	26	—
Front Bumper to Brace Bolts	112	83	—
Front Bumper to Bracket Bolts	112	83	—
License Plate Bracket to Front Bumper Bolts	13	—	115
Platform Hitch to Frame Rail Bolts	100	74	—
Rear Bumper Brace to Bracket Bolts	90	66	—
Rear Bumper Bracket to Frame Nut	47	35	—
Rear Bumper to Brace Bolts	90	66	—
Rear Bumper to Bracket Bolts	90	66	—
Tow Hook to Frame Rail Bolts	60	44	—

## SECTION 2B

# SHEET METAL

**CAUTION:** This vehicle has a Supplemental Inflatable Restraint (SIR) System. Refer to the SIR Component and Wiring Location view in order to determine whether you are performing service on or near the SIR components or the SIR wiring. When you are performing service on or near the SIR components or the SIR wiring, refer to the SIR On-Vehicle Service Information. Failure to follow the CAUTIONS could cause air bag deployment, personal injury, or unnecessary SIR system repairs.

**NOTICE:** Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. General Motors will call out those fasteners that require a replacement after removal. General Motors will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

**NOTICE:** Many aluminum components are used in present models. Aluminum in contact with steel may corrode rapidly if not protected by special finishes or isolators.

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**ON-VEHICLE SERVICE**

**HOOD REPLACEMENT**

**CAUTION:** When a hood hold open device is being removed or installed provide alternate support to avoid the possibility of damage to the vehicle or personal injury.

**↔ Remove or Disconnect (Figure 1)**

- Raise and support the hood at the front and rear.
  - Place protective coverings over the cowl and fenders.
1. Bolt holding the hinge to the link assembly.
    - Lower the hood and support.
  2. Outboard sections of the cowl vent grille.
  3. Pivot bolt.
  4. Hood from the vehicle.

**→ Install or Connect (Figure 1)**

1. Hood to the vehicle.
2. Pivot bolts.

**⌚ Tighten**

- Hood to fender bolts to 25 N.m (18 lb ft).
3. Outboard section of the cowl vent grille.
    - Raise the hood.
  4. Bolt holding the hinge to the link assembly.

**⌚ Tighten**

- Link assembly bolts to 25 N.m (18 lb ft).
- Lower the hood.

**HOOD INSULATOR REPLACEMENT**

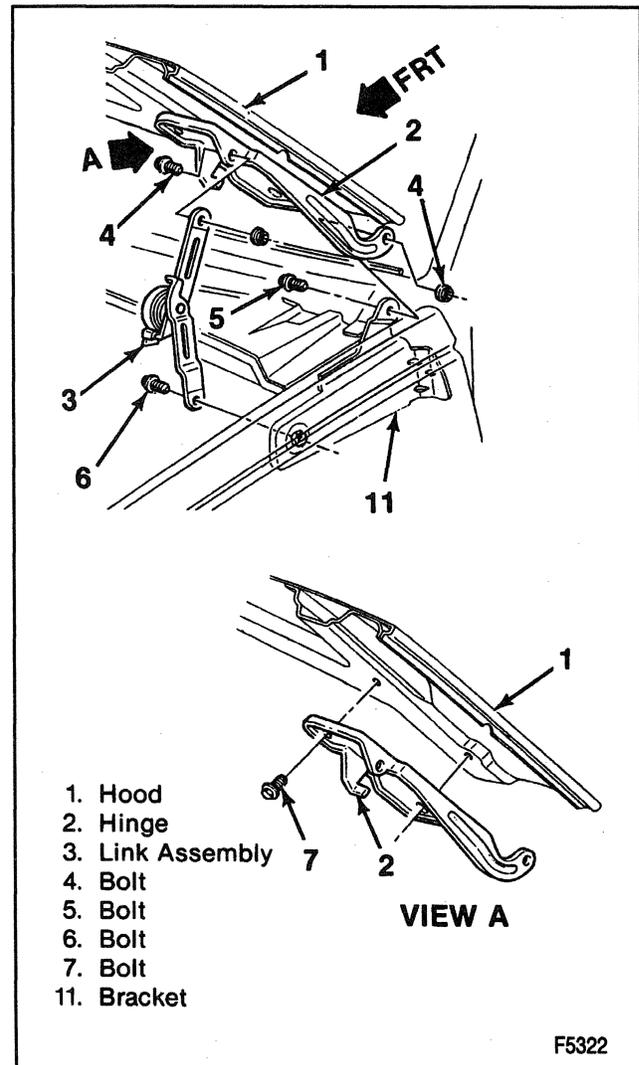
Tool Required:  
J 38778 Door Trim Pad and Garnish Clip Remover.

**↔ Remove or Disconnect (Figure 2)**

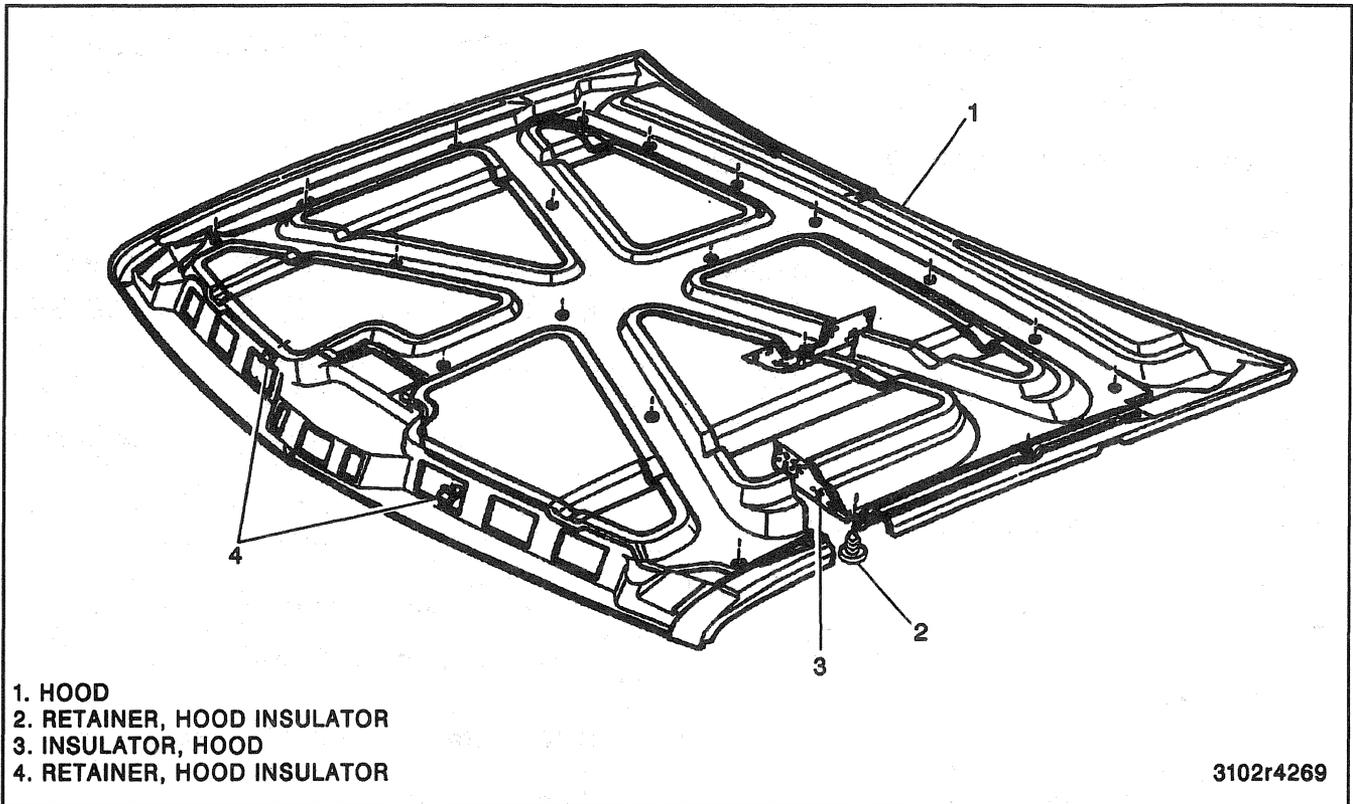
1. Insulator from hood retainers using J 38778.
2. Insulator from the hood.

**→ Install or Connect (Figure 2)**

1. Insulator to the hood.
2. Insulator to the hood retainers.



**Figure 1—Hood Hinge Components**



**Figure 2—Hood Insulator**

**HOOD HINGE REPLACEMENT**

**↔ Remove or Disconnect (Figures 1 and 6)**

1. Outboard section of the cowl vent grille.
2. Hinge to fender bracket bolt.
  - Raise and support the hood at the front and rear.
3. Link assembly to the hinge bolt.
4. Hood seals from over the hinges.
5. Hinge to the hood bolts.
6. Hinge from the hood.

**↔ Install or Connect (Figures 1 and 6)**

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Hinge to the hood with bolts.

**Tighten**

- Hinge to the hood bolts to 25 N.m (18 lb ft).
2. Hood seals over the hinges.
  3. Link assembly to the hinge bolt.

**Tighten**

- Link assembly bolts to 25 N.m (18 lb ft).
  - Lower the hood.
4. Hinge to fender bracket bolts.

**Tighten**

- Hinge to fender bolts to 25 N.m (18 lb ft).
5. Outboard section of the cowl vent grille.

**LINK ASSEMBLY REPLACEMENT**

**↔ Remove or Disconnect (Figure 1)**

- Raise and support the front of the hood.
1. Link assembly from the hinge bolts.
  2. Link assembly from the fender bolts.
  3. Link assembly from the vehicle.

**↔ Install or Connect (Figure 1)**

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Link assembly to the vehicle.
2. Link assembly to the fender bolts.

**Tighten**

- Link assembly to the fender bolts to 25 N.m (18 lb ft).
3. Link assembly to the hinge bolts.

**Tighten**

- Link assembly to the hinge bolts to 25 N.m (18 lb ft).

## 2B-4 SHEET METAL

### PRIMARY HOOD LATCH AND/OR BRACKET REPLACEMENT

#### Remove or Disconnect (Figure 3)

- Raise the hood.
1. Hood latch release cable from the latch. Refer to "Hood Release Cable Replacement" in this section.
  2. Bracket to hood latch bolts.
  3. Hood latch from the vehicle.
  4. Bracket to radiator support bolts.
  5. Bracket from the vehicle.

#### Adjust

- Front hood bumpers, so that the top of the hood is flush with the fenders.

#### Install or Connect (Figure 3)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Bracket to the radiator support.
2. Bracket to support bolts loosely.
3. Primary hood latch to the bracket.
4. Latch to bracket bolts loosely.
5. Hood latch release cable to the latch.

#### Adjust

- Hood latch bracket left and right until the striker in the hood easily engages the primary latch.
- Raise the hood.

#### Tighten

- Bracket to radiator support bolts to 25 N·m (18 lb ft).

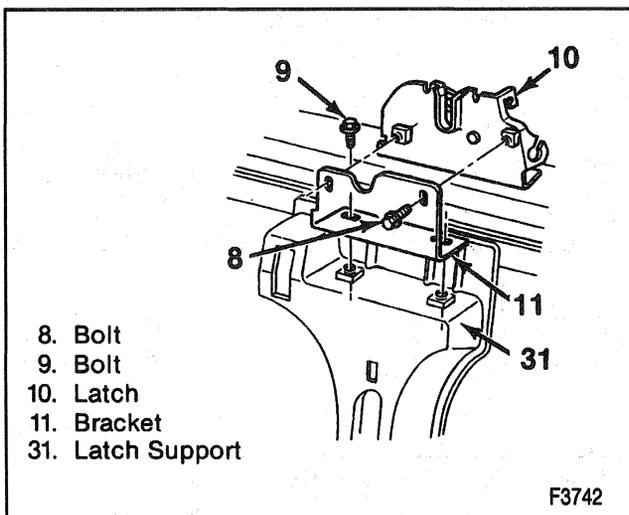


Figure 3—Primary Hood Latch Components

1. Hood latch height so that when the hood is closed, the hood is held securely against the front hood bumpers. Mark this height.

- Raise the hood.

#### Tighten

- Bracket to hood latch bolts to 25 N·m (18 lb ft).

### SECONDARY HOOD LATCH AND/OR SPRING REPLACEMENT

#### Remove or Disconnect (Figure 4)

- Mark the position of the secondary hood latch on the hood.

1. Secondary hood latch to hood bolts.
2. Secondary hood latch from the vehicle.
3. Spring from the hood.

- Twist the spring from the reinforcement.

#### Install or Connect (Figure 4)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Spring to the hood.
  - Twist the spring into the reinforcement.
2. Secondary hood latch to the vehicle.

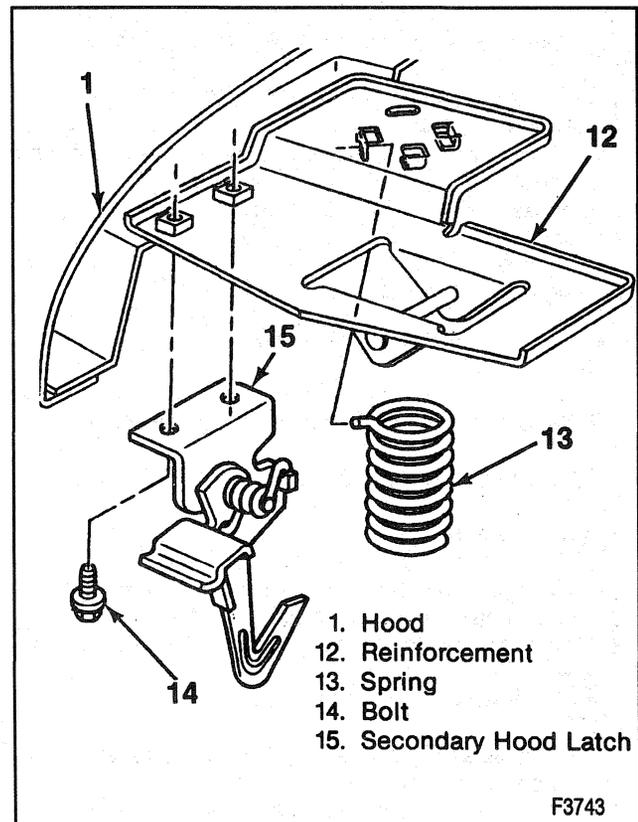


Figure 4—Secondary Hood Latch Components

3. Secondary hood latch to hood bolts.



- Latch to hood bolts to 25 N.m (18 lb ft).

**HOOD RELEASE CABLE REPLACEMENT**

**↔ Remove or Disconnect (Figure 5)**

- If the cable is broken, release the hood by pressing the primary latch tab on the left side of the lock assembly. Use a rod to press the tab.
  - Raise the hood.
1. Cable from the primary latch.
    - Insert a screwdriver into the clip, and lift the cable from the lock, then carefully pry the cable grommet from the lock flange.
  2. Five upper radiator grille screws.
  3. Move grille forward to access cable.
  4. Cable from the radiator support and from the wheelhouse retaining clips.
  5. Two bolts from under the instrument panel inside the cab retaining the hood release handle.
    - Push the cable and grommet into the cab from the engine compartment.
  6. Cable from the vehicle.

**→← Install or Connect (Figure 5)**

1. Cable to the vehicle.
2. Cable from the driver's side of the cowl.
  - Push the cable and the grommet into the engine compartment.
3. Two bolts holding the hood release handle to the bottom of the instrument panel.
  - Seat the grommet.
4. Cable through the retaining clips and the radiator support.
5. Five screws into the upper radiator grille.
6. Cable to the primary latch.

**COWL VENT GRILLE REPLACEMENT**

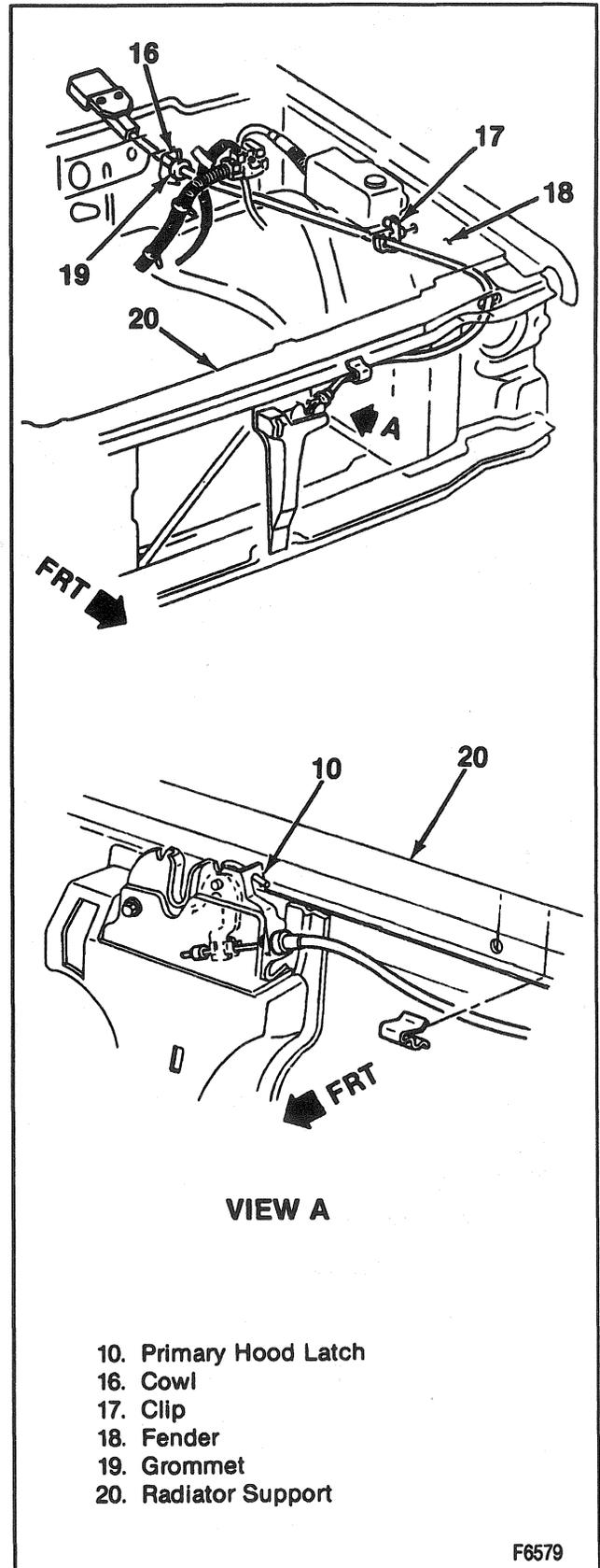
Tool Required:  
J 8966 Windshield Wiper Arm Remover and Installer

**↔ Remove or Disconnect (Figure 6)**

1. Wiper arms. Refer to SECTION 8E.
2. Cowl weatherstrip.
3. Cowl vent grille panel screws.
4. Windshield washer hoses and nozzles.
5. Three cowl vent grille panels from the vehicle.

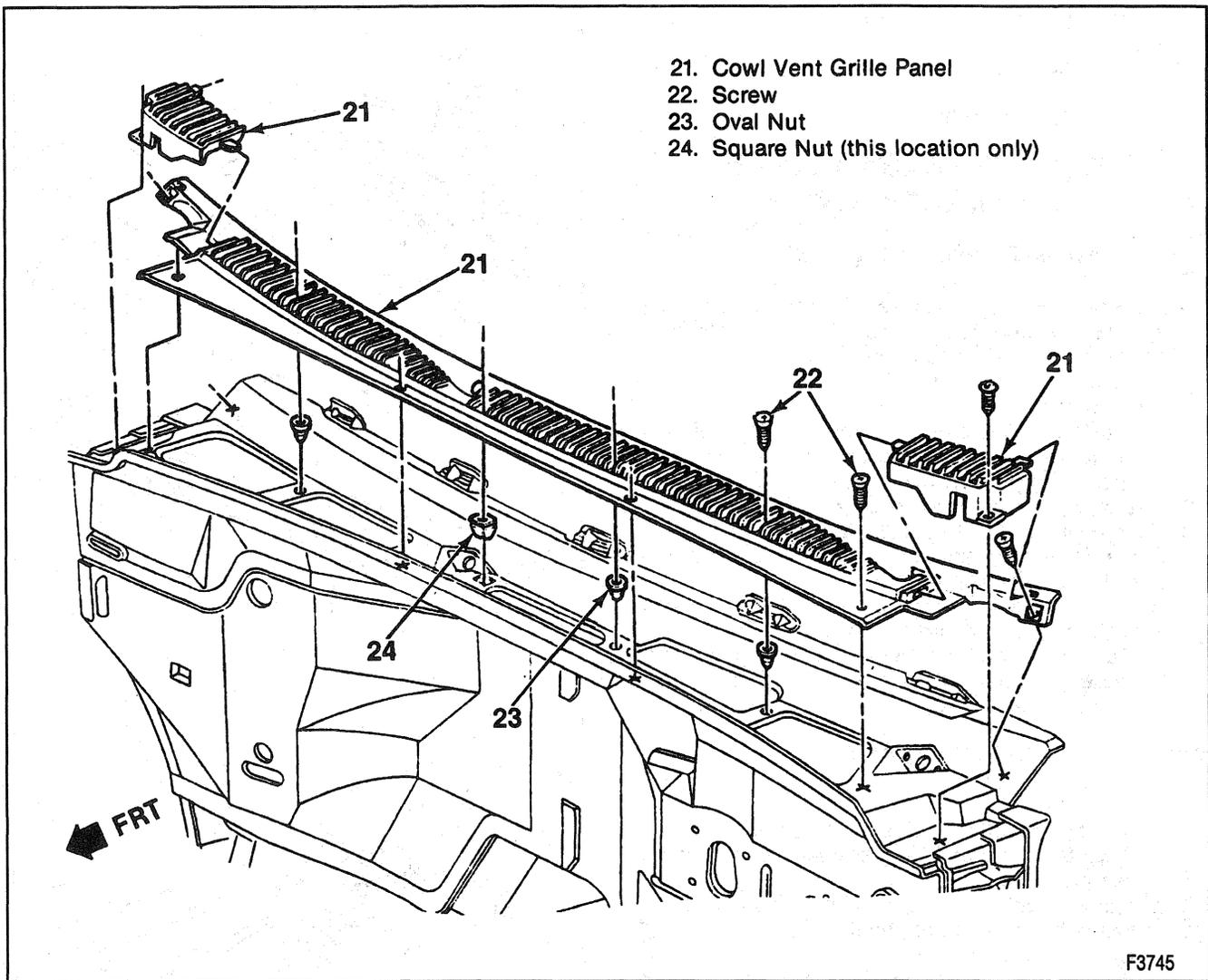
**→← Install or Connect (Figure 6)**

1. Windshield washer hoses and nozzles to the cowl vent grille.
2. Three cowl vent grille panels to the vehicle.



F6579

Figure 5—Hood Release Cable



**Figure 6—Cowl Vent Grille Components**

F3745

3. Cowl vent grille panel screws.
  - Be sure the nuts below the center panel are in place with the square nut second from the right.
4. Cowl weatherstrip.
5. Wiper arms. Refer to SECTION 8E.

**RADIATOR GRILLE REPLACEMENT**

**↔ Remove or Disconnect (Figure 7)**

1. Bolts holding the grille to the vehicle.
  - Screw holding the grille to the latch support.
  - Screws holding the grille to the radiator support.
2. Grille from the filler panel and the vehicle by unsnapping.

**→ Install or Connect (Figure 7)**

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Grille to the vehicle and the filler panel by snapping into place.
2. Grille and filler panel to the vehicle with bolts.
  - Screws holding the grille to the radiator support.
  - Screw holding the grille to the latch support.

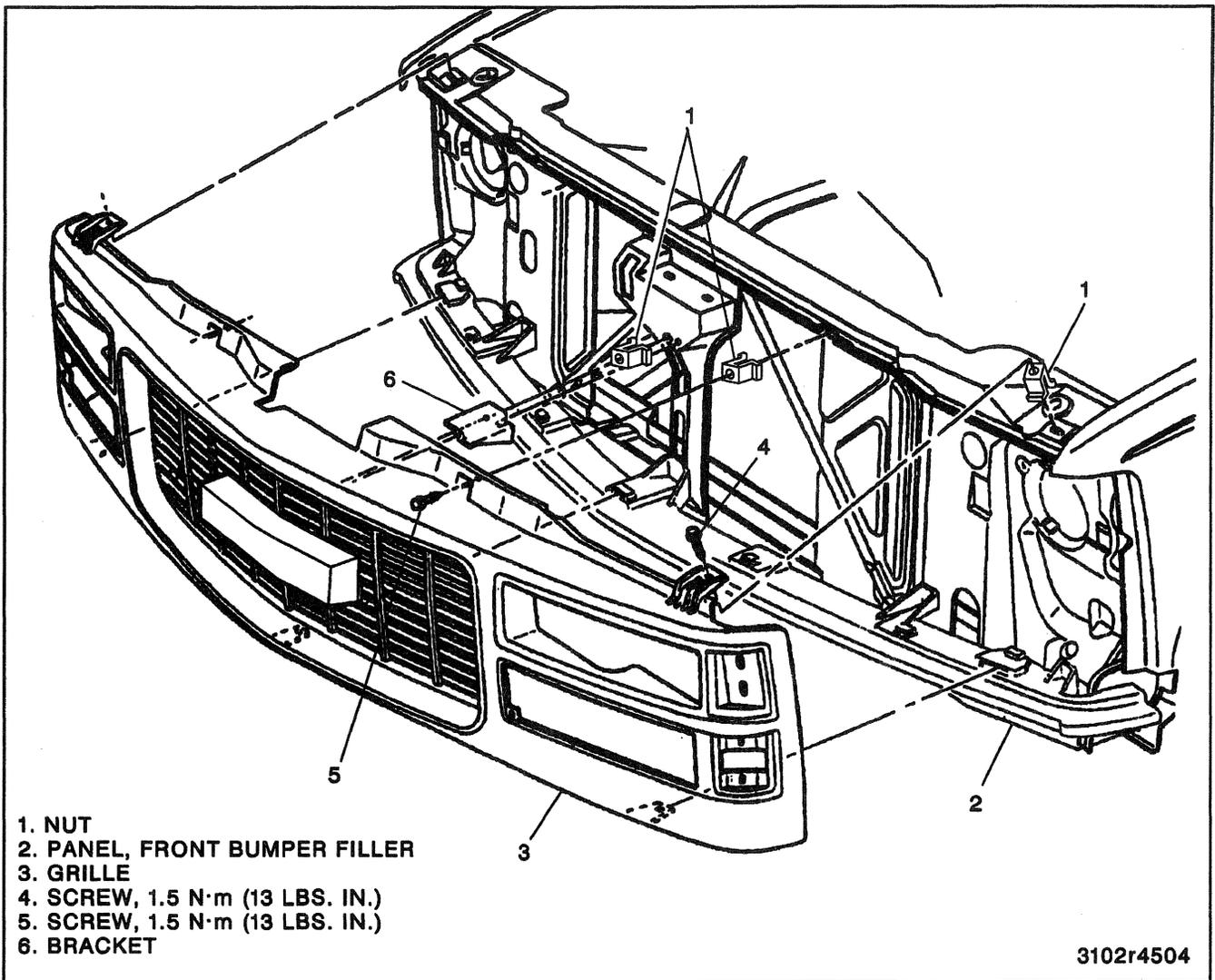
**⊞ Tighten**

- Grille screws to 2 N.m (18 lb in).
3. Parking lamps and sidemarkers with screws.

**LOWER GRILLE REPLACEMENT (C 3500HD ONLY)**

**↔ Remove or Disconnect (Figure 8)**

1. Radiator grille. Refer to "Radiator Grille Replacement" in this section.
2. Five screws retaining lower grille to core support.
3. Three screws in each front fender well retaining lower grille to fender extension.
4. Lower grille.



- 1. NUT
- 2. PANEL, FRONT BUMPER FILLER
- 3. GRILLE
- 4. SCREW, 1.5 N·m (13 LBS. IN.)
- 5. SCREW, 1.5 N·m (13 LBS. IN.)
- 6. BRACKET

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**Figure 7—Typical Radiator Grille Components**



**Install or Connect (Figure 8)**

- 1. Lower grille.
- 2. Three screws in each front fender well in order to retain lower grille to fender extension.
- 3. Five screws to retain lower grille to core support.
- 4. Radiator grille.

- 8. Battery and battery tray.
- 9. Forward air inlet duct assembly from the fender.

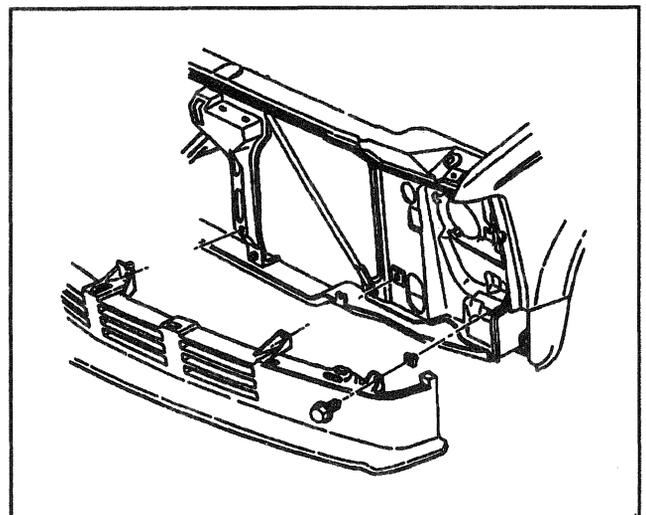
## **FENDER REPLACEMENT**

### **Right Fender**



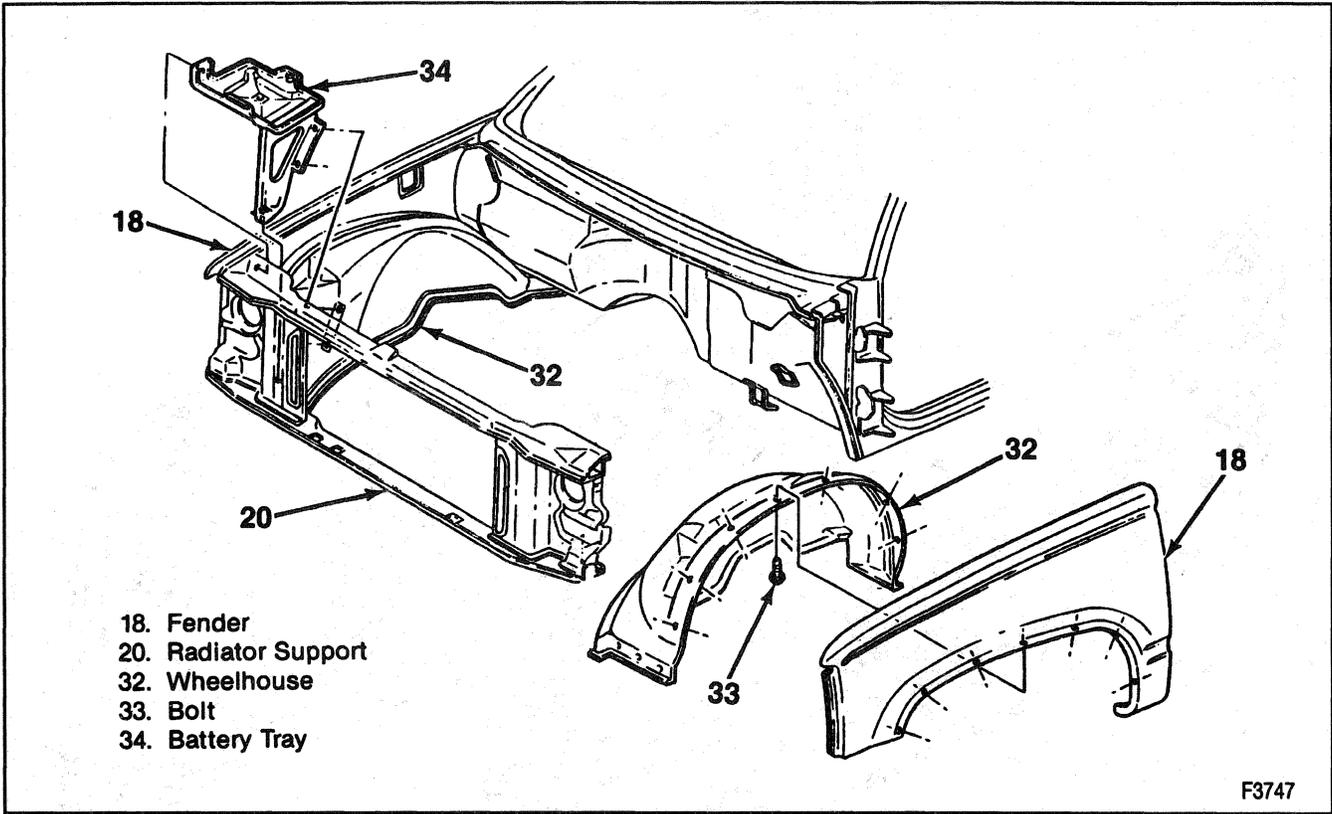
**Remove or Disconnect (Figures 9 through 11)**

- 1. Negative battery cable. Refer to SECTION 6D1.
- 2. Hood link assembly from the fender. Refer to "Link Assembly Replacement" in this section.
- 3. Hinge to fender bolt and outboard cowl section.
- 4. Hood. Refer to "Hood Replacement" in this section.
- 5. Radio antenna from the fender.
- 6. Wiring inside the fender.
- 7. Air cleaner hose from the fender in the engine compartment.

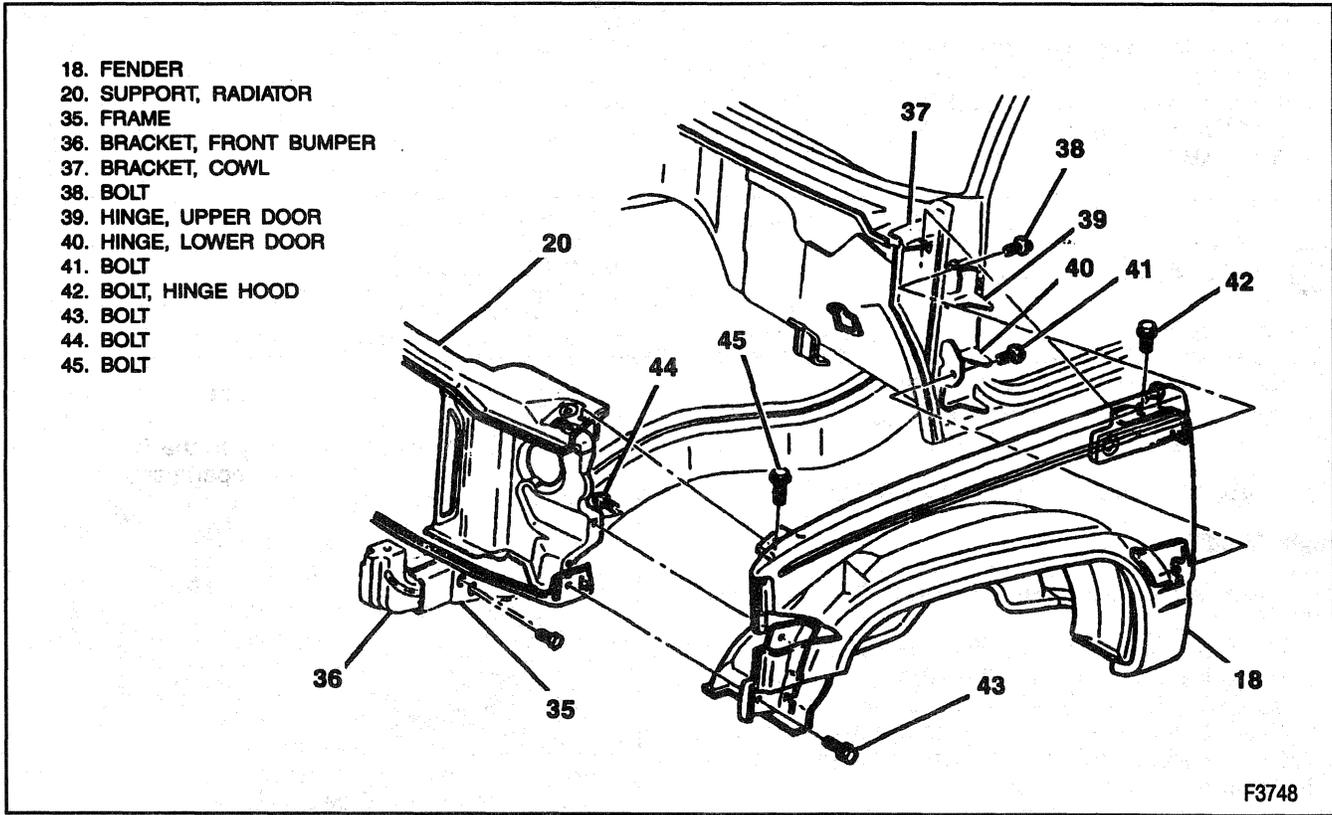


**Figure 8—Lower Grille Assembly**

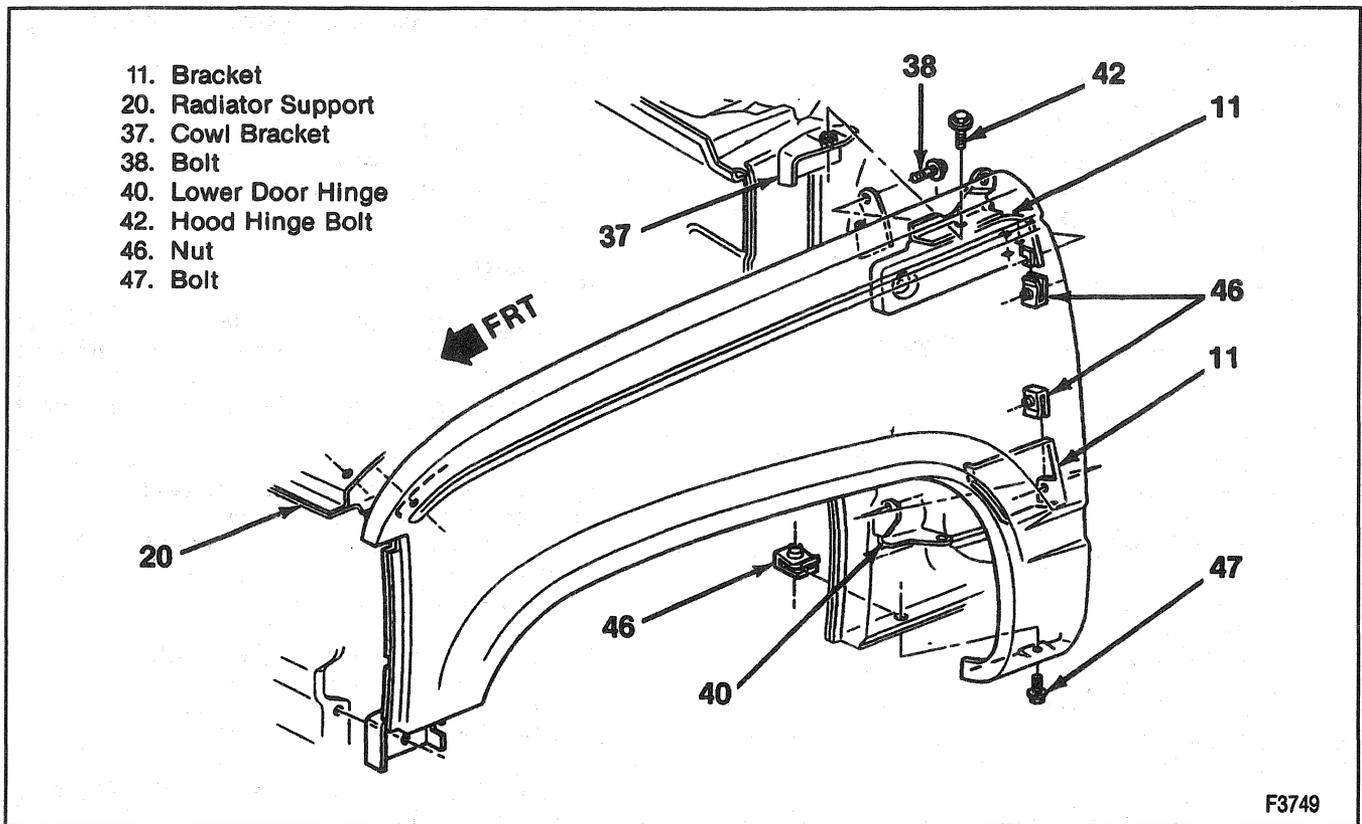
**2B-8 SHEET METAL**



**Figure 9—Fender and Wheelhouse Assemblies**



**Figure 10—Fender to Vehicle Attachment**



F3749

Figure 11—Fender Assembly

- 10. Wiring from the clips.
- 11. Underhood lamp (if present).
- 12. Bolt from inside the engine compartment.
- 13. Bolts holding the fender to the wheelhouse (Figure 9).
- 14. Bolt by reaching up behind the wheelhouse (Figure 10).
- 15. Bolt holding the fender to the cab assembly (Figure 11).
  - Open the door.
- 16. Bolts holding the fender to the door hinges (Figure 11).
- 17. Bolt holding the fender to the radiator support.
- 18. Fender from the vehicle.

**→← Install or Connect (Figures 9 through 11)**

**NOTICE:** Refer to "Notice" on page 2B-1.

- 1. Fender to the vehicle.
- 2. Bolt from inside the engine compartment (Figure 9).

 **Tighten**

- Fender bolts to 25 N.m (18 lb ft).

- 3. Bolt to the radiator support.

 **Tighten**

- Fender to radiator support bolts to 25 N.m (18 lb ft).

- 4. Bolts and nuts holding the fender to the door hinges.

 **Tighten**

- Fender to door hinge bolts to 25 N.m (18 lb ft).

- 5. Bolt and nut from the fender to the cab assembly (Figure 11).

 **Tighten**

- Fender to cab bolts to 25 N.m (18 lb ft).

- 6. Bolt by reaching up behind the wheelhouse (Figure 10).

- 7. Bolts through the wheelhouse to the fender (Figure 9).

- 8. Forward air inlet duct assembly to the front section of the fender in the engine compartment.

- 9. Battery tray and battery.

 **Tighten**

- Tray bolts to 25 N.m (18 lb ft).

- 10. Air cleaner hose to the fender.

- 11. Wiring inside the fender.

- 12. Radio antenna into the fender.

- 13. Wiring into clips.

- 14. Underhood lamp (if present).

- 15. Hood link assembly. Refer to "Link Assembly Replacement" in this section.

- 16. Hood hinge to the hood.

## 2B-10 SHEET METAL



### Tighten

- Hinge to hood bolts to 25 N.m (18 lb ft).
17. Outboard cowl grille to vehicle.
  18. Hood to the vehicle. Refer to "Hood Replacement" in this section.
    - Check the fender for proper clearance. Refer to "Sheet Metal Adjustments" in this section.
  19. Negative battery cable.

### Left Fender



### Remove or Disconnect (Figures 1 and 9 through 11)

1. Negative battery cable. Refer to SECTION 6D1.
2. Link assembly from the fender. Refer to "Link Assembly Replacement" in this section.
3. Hinge to fender bolt.
  - Outboard cowl grille section (Figure 6).
4. Hood. Refer to "Hood Replacement" in this section.
5. Battery and battery tray (if present).
6. Windshield washer reservoir.
  - Electrical connector.
  - Four retaining bolts.
7. Four washer reservoir bracket bolts from fender.
8. Hood release cable from the clip on the fender.
9. Wiring harness from the clips.
10. Auxiliary battery relay (if present).
11. Bolts holding the fender to the wheelhouse (Figure 9).
12. Bolt by reaching up behind the wheelhouse (Figure 10).
13. Bolt holding the fender to the cab assembly (Figure 11).
  - Open the door.
14. Bolts holding the fender to the door hinges (Figure 10).
15. Bolt holding the fender to the radiator support.
16. Bolt from inside the engine compartment.
17. Fender from the vehicle.



### Install or Connect (Figures 1 and 9 through 11)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Fender to the vehicle.
2. Bolts from inside the engine compartment (Figure 10).



### Tighten

- Bolts to 25 N.m (18 lb ft).
3. Bolts to the radiator support.



### Tighten

- Fender bolts to 25 N.m (18 lb ft).
- Open the door.

4. Bolts and nuts holding the fender to the door hinges.



### Tighten

- Fender bolts to 25 N.m (18 lb ft).
5. Bolt and nut from the fender to the cab assembly (Figure 11).



### Tighten

- Fender bolts to 25 N.m (18 lb ft).
6. Bolt by reaching up behind the wheelhouse (Figure 10).
  7. Bolts through the wheelhouse to the fender (Figure 9).
  8. Auxiliary battery relay.
  9. Wiring harness into the clip on the fender.
  10. Hood release cable into the clips.
  11. Four windshield washer bracket to fender bolts.
  12. Reservoir to bracket.
  13. Battery and tray (if present).
  14. Link assembly.
  15. Outboard cowl grille section (Figure 6).
  16. Hood hinge to the vehicle.



### Tighten

- Hood hinge to vehicle bolts to 25 N.m (18 lb ft).
17. Hood to the vehicle.
  18. Negative battery cable.

## STEPSIDE FENDER REPLACEMENT



### Remove or Disconnect (Figures 12 through 15)

1. Pads from the fender steps (Figure 12).
2. Fender to brace screws (Figure 13).
3. Brace to support bolts.
4. Fender to support bolts (Figure 14).
5. Taillamp side panel screws.
6. Fender to bracket screws.
7. Fender to side panel screws.
8. Fender.
9. Fender supports and bolts.



### Install or Connect (Figures 12 through 15)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Fender supports and screws.



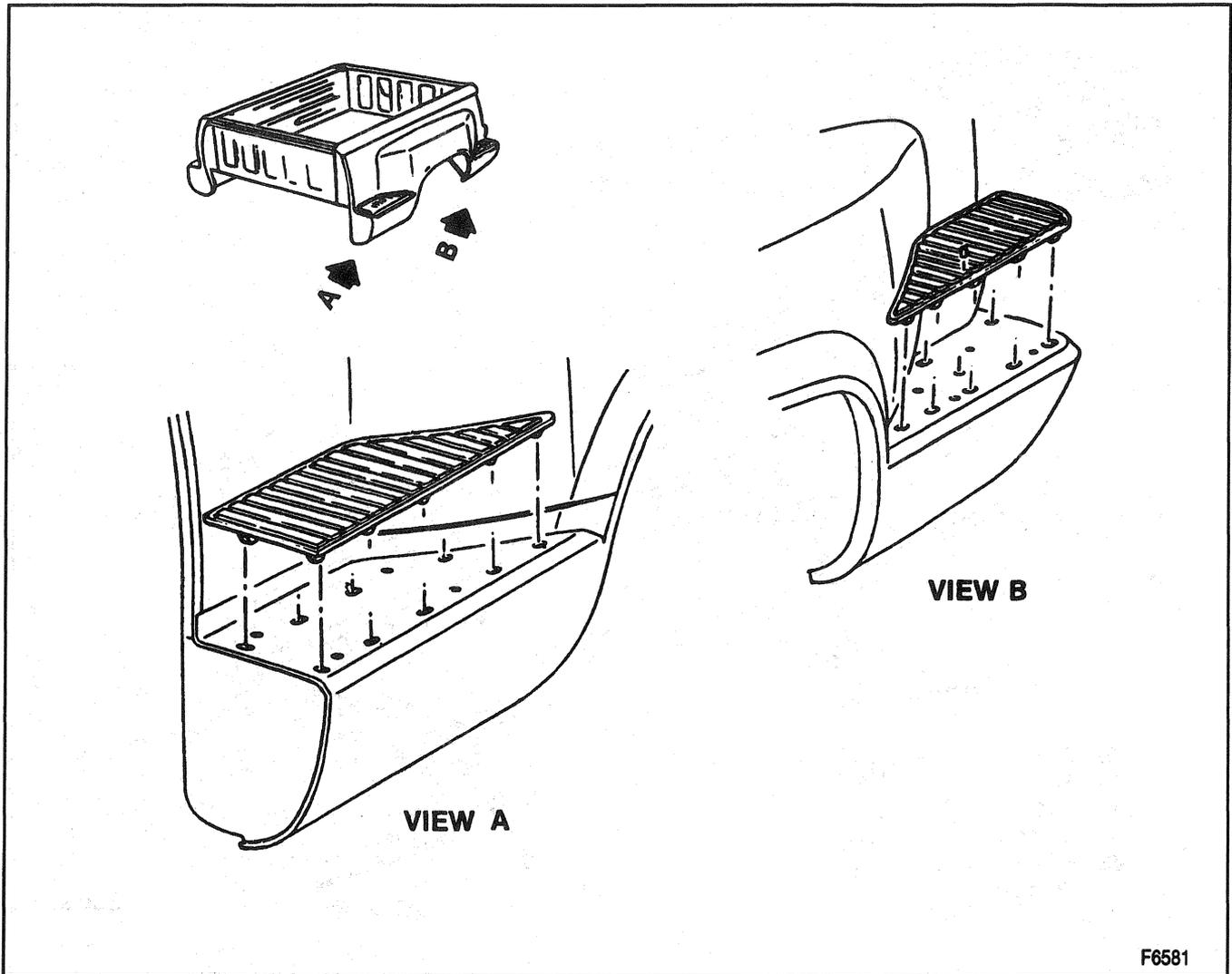
### Tighten

- Stepside support screws to 18 N.m (13 lb ft).
2. Fender to the pickup box with screws.



### Tighten

- Fender to pickup box screws to 18 N.m (13 lb ft).



F6581

**Figure 12—Step Pads**

3. Fender to side panel screws. Do not tighten screws until the lower mounting screws are installed.

 **Tighten**

- Fender to the side panel screws to 18 N.m (13 lb ft).

4. Fender to bracket screws.

 **Tighten**

- Stepside fender to the bracket screws to 18 N.m (13 lb ft).

5. Side panel screws and taillamp.

 **Tighten**

- Side panel screws to 18 N.m (13 lb ft).

6. Fender to support screws.

 **Tighten**

- Fender to support screws to 18 N.m (13 lb ft).

7. Brace to support screws.

 **Tighten**

- All other screws to 18 N.m (13 lb ft).

8. Pads to the fender steps.

## **REAR FENDER REPLACEMENT (DUAL WHEEL)**

 **Remove or Disconnect (Figure 16)**

1. Wiring connector to the sidemarker.
2. Fender to side panel bolts.
3. Fender to brace bolts.
4. Wheelhouse filler panel and bolts.
5. Nuts from the fender studs.
6. Fender from the side panel.

 **Install or Connect (Figure 16)**

**NOTICE:** Refer to "Notice" on page 2B-1.

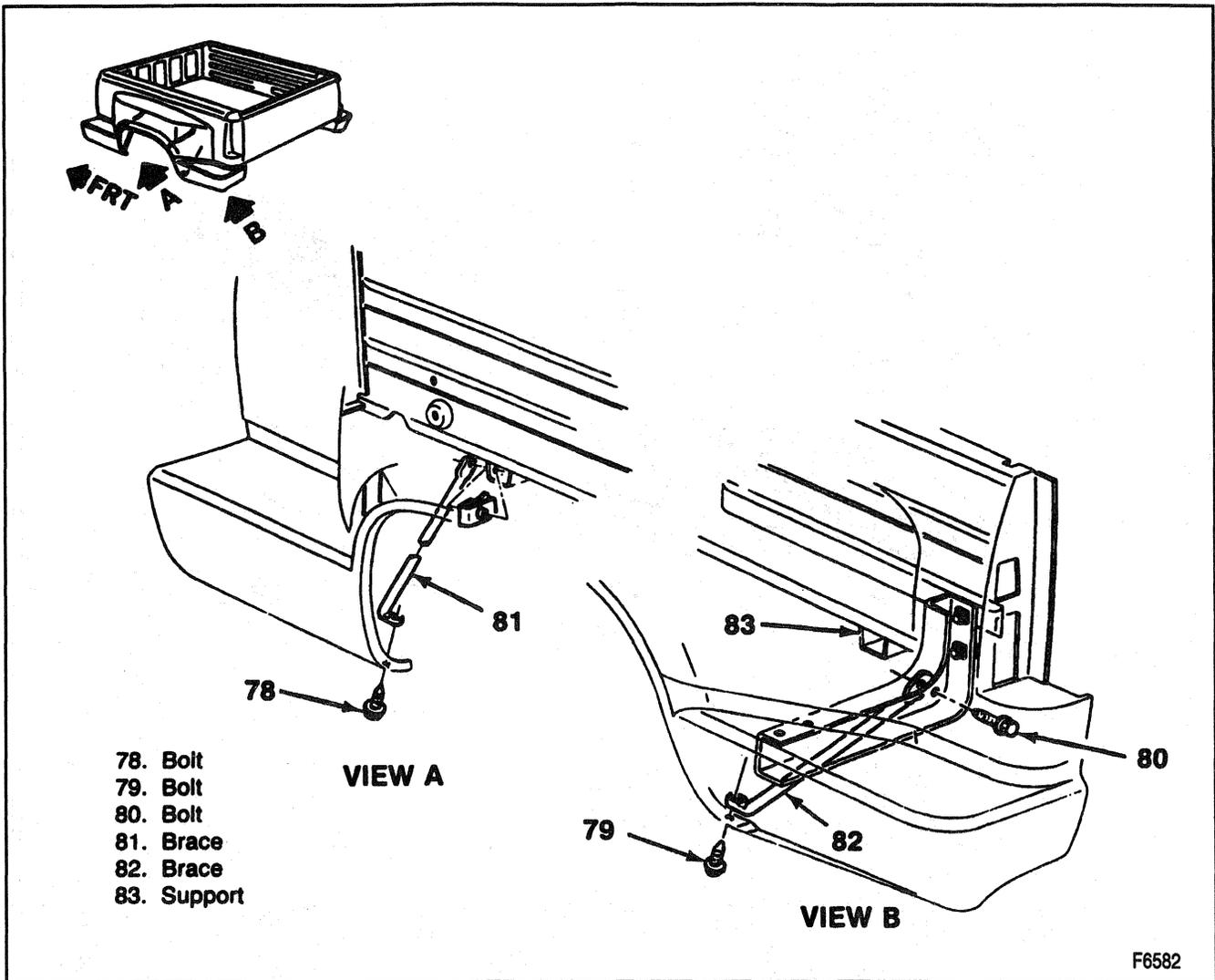


Figure 13—Fender Braces

1. Fender to the side panel with bolts.

 Tighten

- Fender to the side panel bolts to 25 N.m (18 lb ft).

2. Nuts to the fender studs.

 Tighten

- Nuts to fender studs to 25 N.m (18 lb ft).

3. Wheelhouse filler panel with bolts.

4. Fender to brace bolts.

 Tighten

- Fender to the brace bolts to 25 N.m (18 lb ft).
5. Wiring connector to the sidemarker.

## WHEELHOUSE PANEL REPLACEMENT

### Right Panel Replacement

 Remove or Disconnect (Figures 17 and 18)

- Raise the hood.
1. Battery cables. Refer to SECTION 6D1.
  2. Battery and battery tray. Refer to SECTION 6D1.
  3. Heater hoses from the clip on the wheelhouse.
  4. Air cleaner hose bracket.
  5. Air conditioning evaporator tube from the clip.
    - Raise and support the vehicle.
  6. Right front tire and wheel assembly.
  7. Fender to wheelhouse bolts.
  8. Two bolts holding the wheelhouse to the cowl mounting brackets (Figure 17).
  9. Three wheelhouse to radiator support bolts.
  10. Wheelhouse panel from the vehicle.
    - Tilt the panel out of the vehicle.

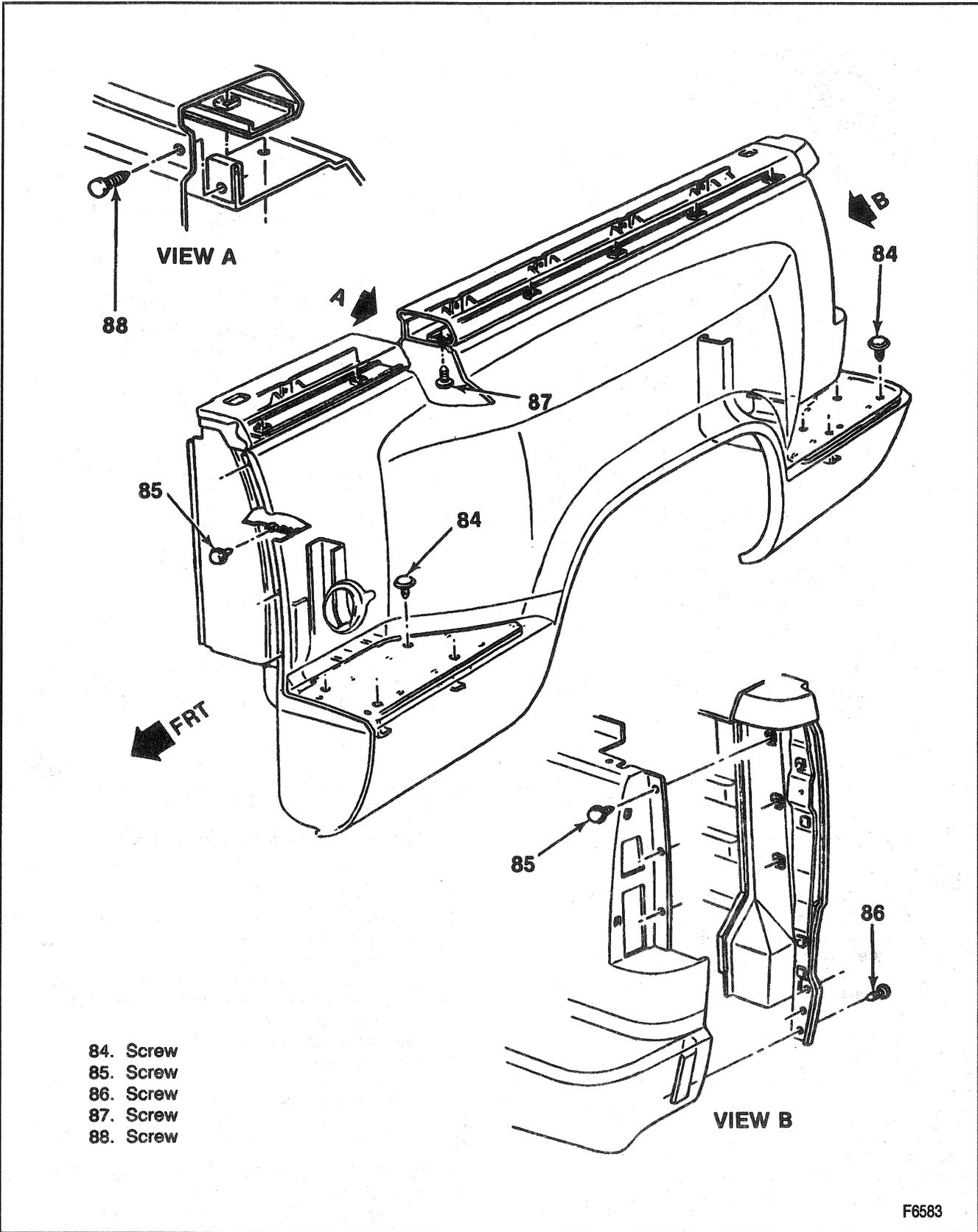


Figure 14—Stepside Fender

## 2B-14 SHEET METAL

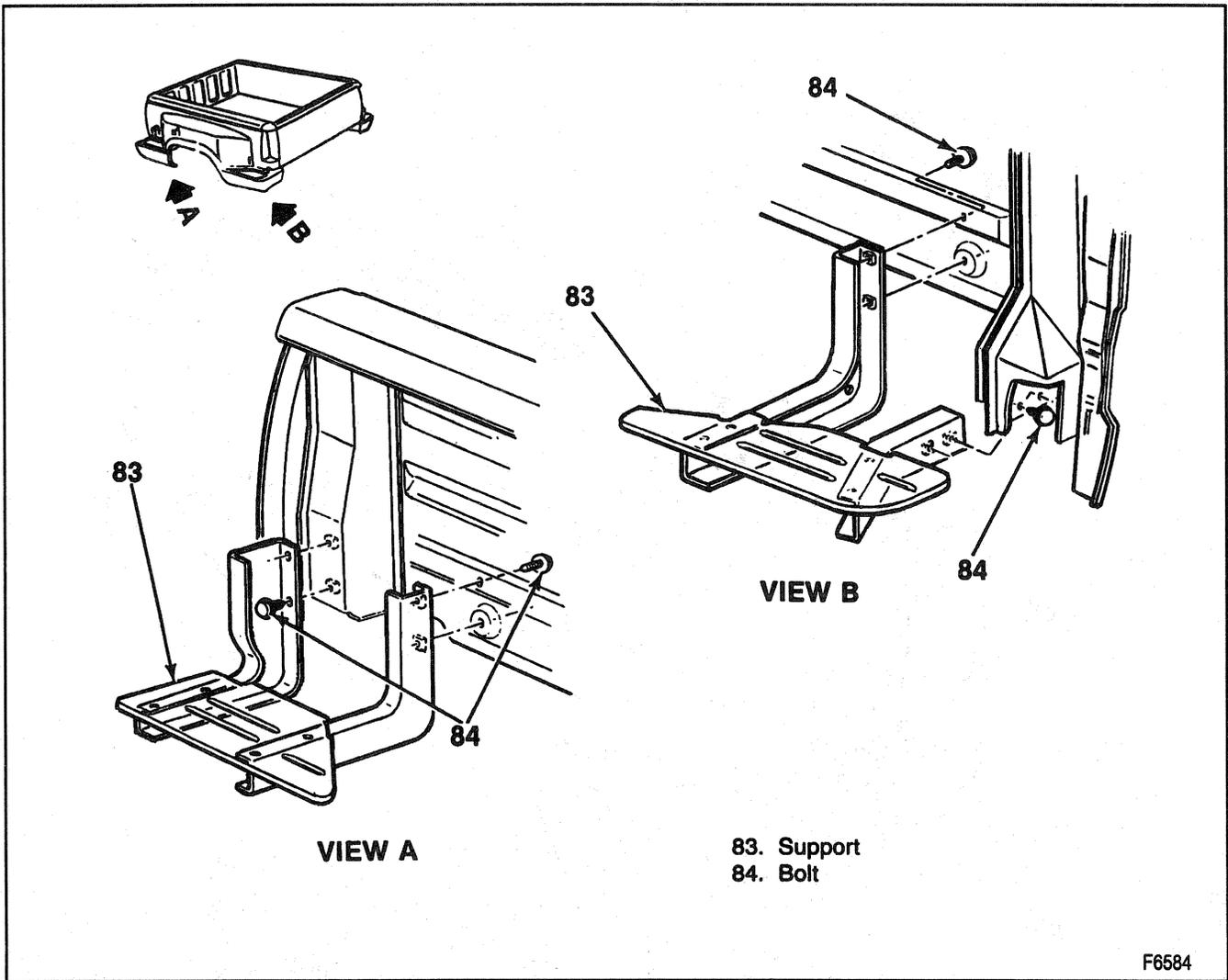


Figure 15—Fender Supports

### Install or Connect (Figures 17 and 18)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Wheelhouse panel to the vehicle.
  - Tilt the panel into the vehicle.
2. Three wheelhouse to radiator support bolts and nuts.

#### Tighten

- Wheelhouse to radiator support bolts to 25 N·m (18 lb ft).
3. Two wheelhouse to cowl mounting bracket bolts.

#### Tighten

- Wheelhouse to cowl bolts to 25 N·m (18 lb ft).

4. Fender to wheelhouse bolts and nuts.

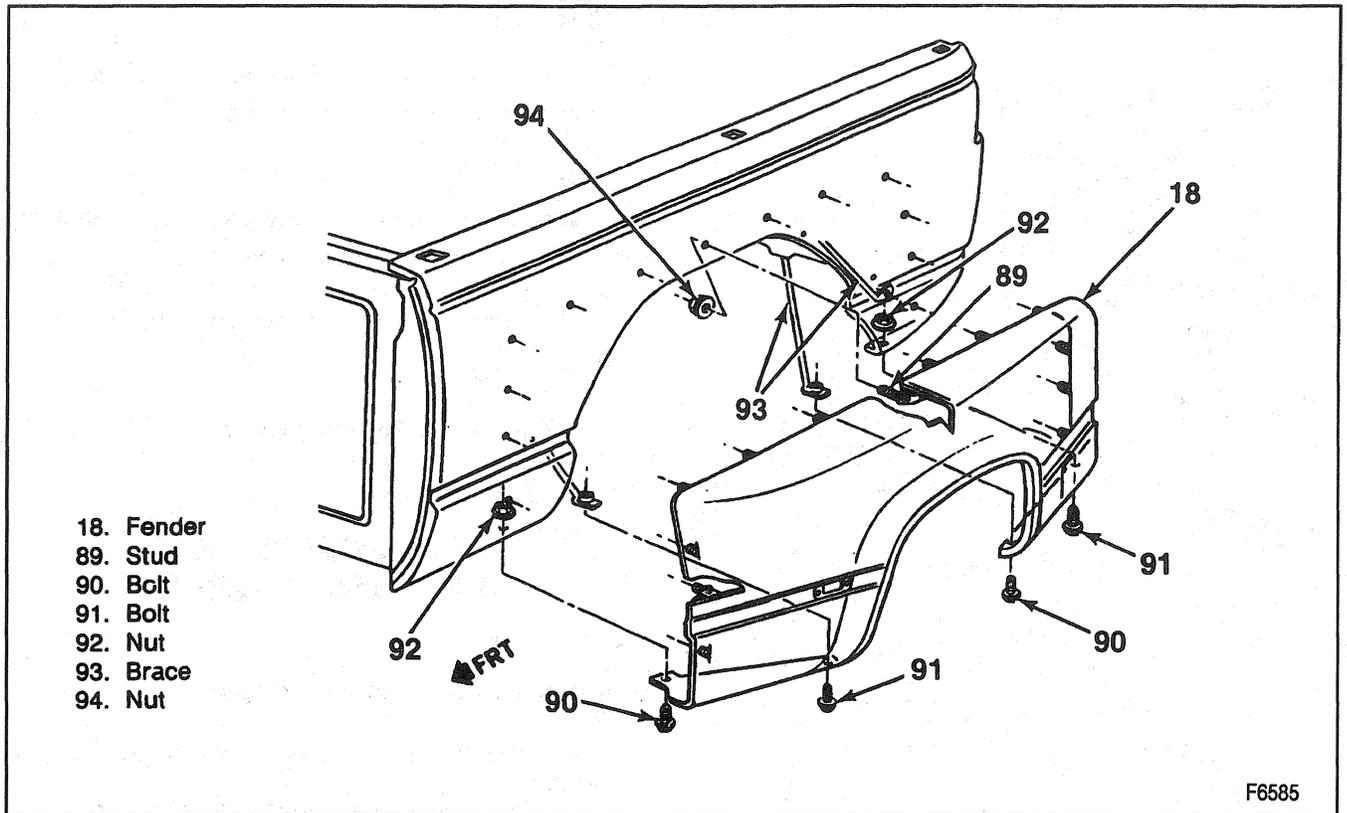
#### Tighten

- Fender to wheelhouse bolts to 25 N·m (18 lb ft).
5. Right front wheel.
    - Lower the vehicle.
  6. Air conditioning evaporator tube into the clip.
  7. Air cleaner hose bracket to the wheelhouse.
  8. Heater hoses into the clip.
  9. Battery tray and battery.
  10. Battery cables.

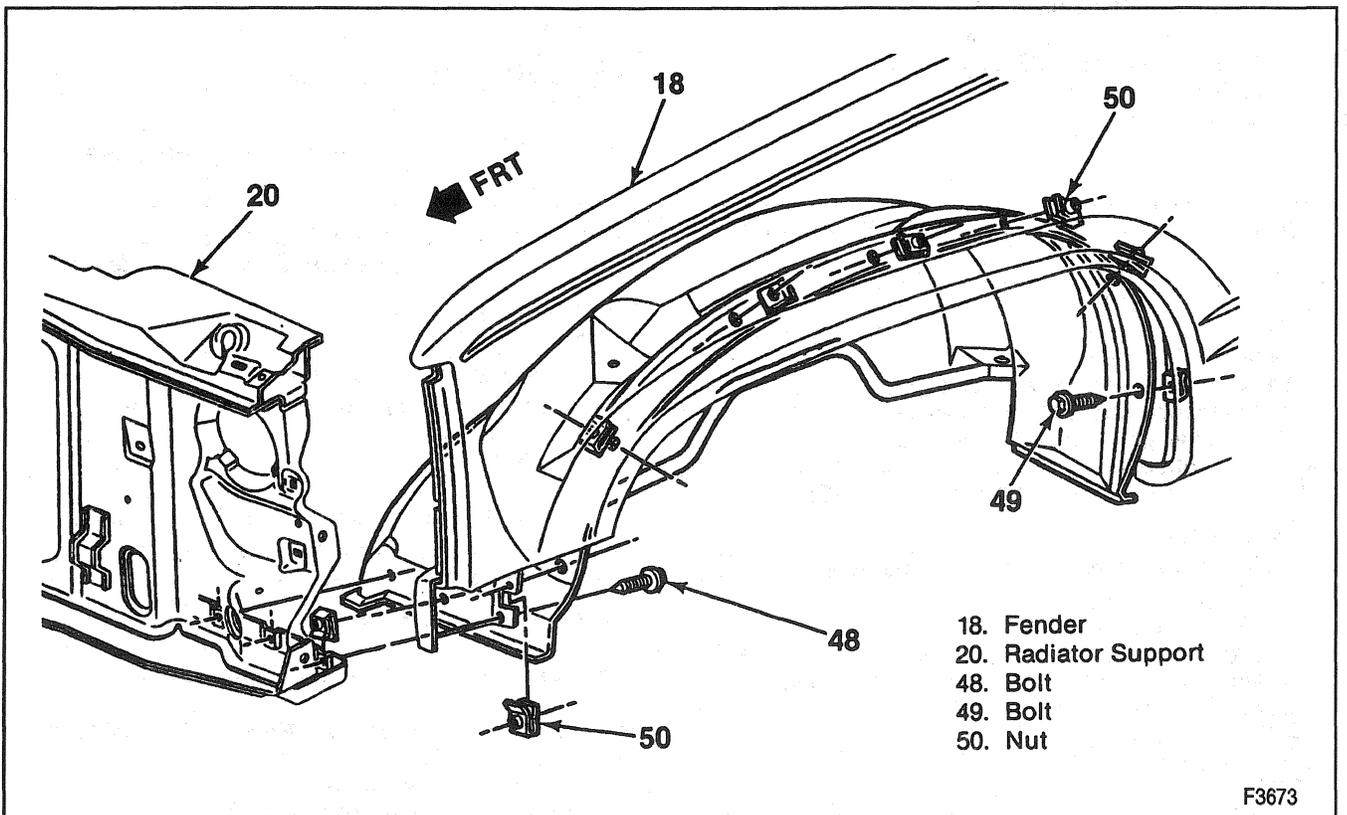
### Left Panel Replacement

#### Remove or Disconnect (Figures 17 and 18)

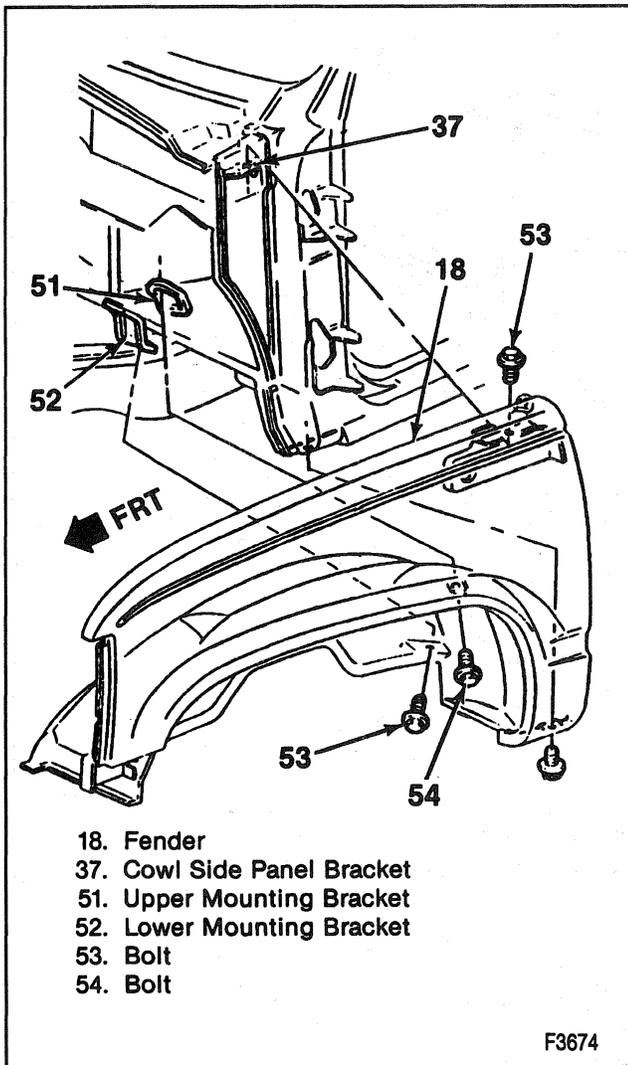
1. Battery cables (diesel models). Refer to SECTION 6D1.
2. Battery and battery tray (diesel models).
  - Raise and support the vehicle.



**Figure 16—Rear Fender (Dual Wheel)**



**Figure 17—Wheelhouse Panel to Radiator Support Attachment**



**Figure 18—Wheelhouse Panel to Cowl Mounting**

3. Left front tire and wheel assembly.
4. Fender to wheelhouse bolts.
5. Two bolts holding the wheelhouse to the cowl mounting brackets.
6. Three wheelhouse to radiator support bolts.
7. Wheelhouse panel from the vehicle.
  - Tilt the panel out of the vehicle.

**→→** Install or Connect (Figures 17 and 18)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Wheelhouse panel to the vehicle.
  - Tilt the panel into the vehicle.
2. Three wheelhouse to radiator support bolts and nuts.

**↻** Tighten

- Wheelhouse to radiator support bolts to 25 N.m (18 lb ft).
3. Two wheelhouse to cowl mounting bracket bolts.

**↻** Tighten

- Wheelhouse to cowl bolts to 25 N.m (18 lb ft).
4. Fender to wheelhouse bolts and nuts.

**↻** Tighten

- Fender to wheelhouse bolts to 25 N.m (18 lb ft).
5. Left front tire and wheel assembly.
    - Lower the vehicle.
  6. Battery and battery tray (diesel models).

**↻** Tighten

- Tray bolts to 25 N.m (18 lb ft).
7. Battery cables (diesel models).
    - Close the hood.

## WHEELHOUSE OPENING FLARES

### Front Fender

**↔** Remove or Disconnect (Figure 19)

1. Fender. Refer to "Fender Replacement" in this section.
2. Flare to fender screws around the wheel opening.
3. Fender to flare nut at each end of the flare inside the fender.
4. Flare.

**↔** Install or Connect (Figure 19)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Flare to the fender.
2. One screw through the flare to fender center.
3. Nuts to the flare at each end inside the fender.

**↻** Tighten

- Flare to the fender nuts to 3 N.m (27 lb in).
4. Flare to fender screws starting at the center.

**↻** Tighten

- Flare to fender screws to 2 N.m (18 lb in).
5. Fender to the vehicle. Refer to "Fender Replacement" in this section.

### Rear Fender (Pickup Models)

**↔** Remove or Disconnect (Figure 20)

1. Tire and wheel assembly. Refer to SECTION 3E.
2. Flare to quarter panel screws.
3. Inner fender water deflector.
4. Access plugs inside quarter panel liner.
5. Quarter panel to flare nuts.
6. Hidden nuts between fender outer panel and inner wall of bed.

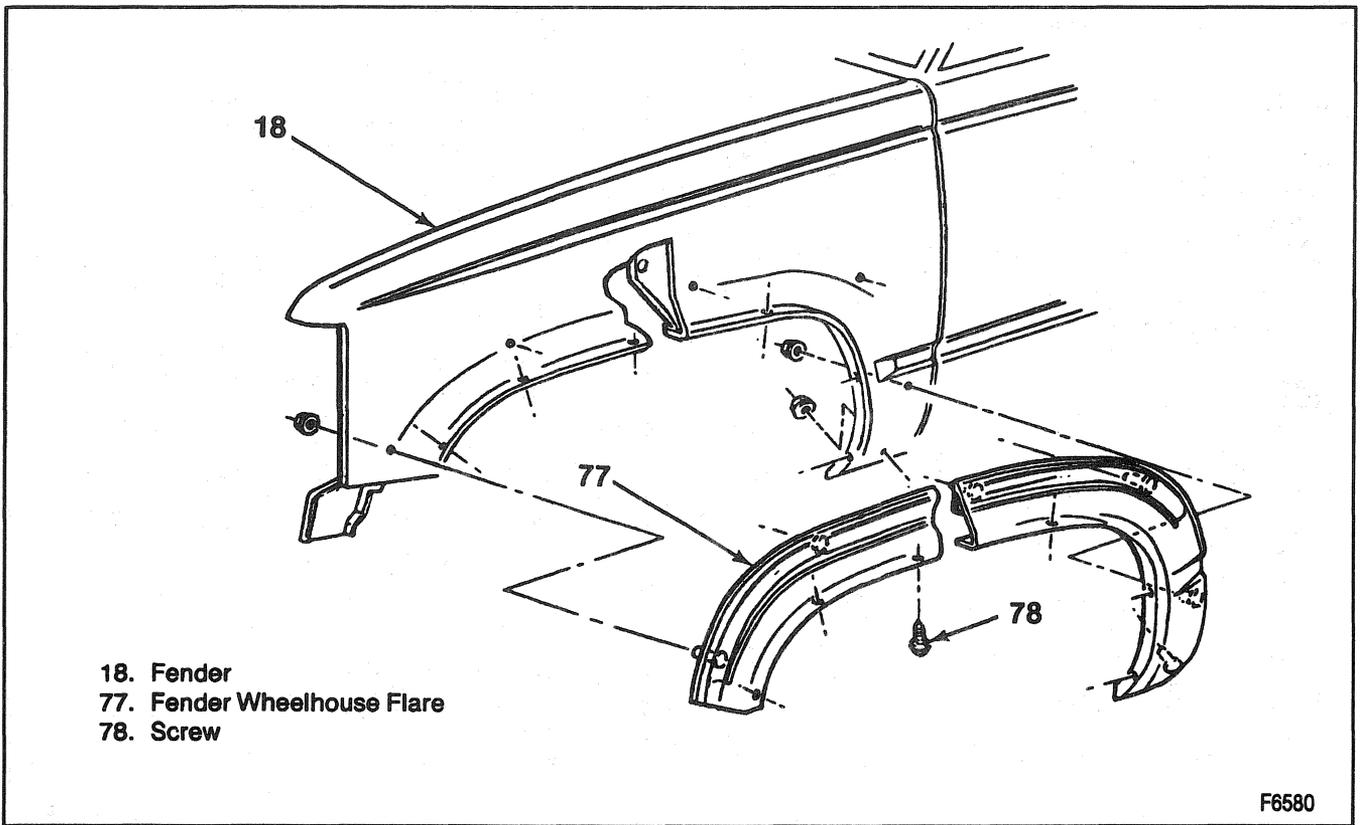


Figure 19—Front Fender Flare

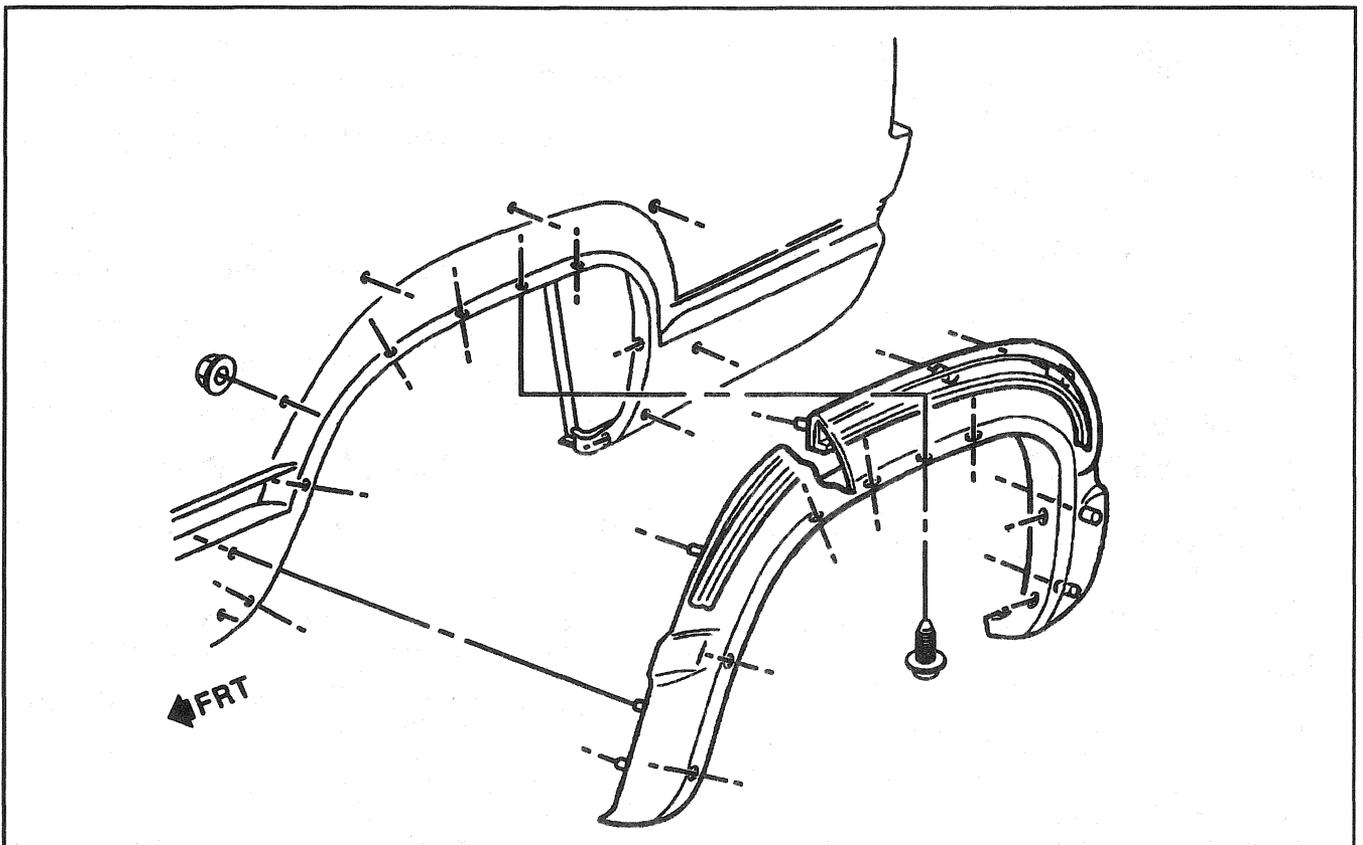


Figure 20—Quarter Panel Flare

## 2B-18 SHEET METAL

### Install or Connect (Figure 20)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Hidden nuts between fender outer panel and inner wall of bed.

#### Tighten

- Flare to the fender nuts to 3 N.m (27 lb in).
2. Inner fender water deflector.
  3. Fender to flare nuts.

#### Tighten

- Flare to the fender nuts to 3 N.m (27 lb in).
4. Flare to fender screws.

#### Tighten

- Flare to the fender screws to 2 N.m (18 lb in).
5. Access plugs inside fender liner.
  6. Tire and wheel assembly. Refer to SECTION 3E.

### Utility and Suburban Models

### Remove or Disconnect (Figure 20)

1. Flare to fender screws.
2. Rear seat blower motor cover (if equipped). Refer to SECTION 10A4.
3. Spare tire (left side only) (if equipped). Refer to SECTION 3E.
4. Quarter panel interior trim. Refer to SECTION 10A4.
5. Flare to quarter panel nuts from inside wheel well.
6. Flare from the vehicle.

### Install or Connect (Figure 20)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Flare to the vehicle with nuts and screws.

#### Tighten

- Flare to the fender nuts to 3 N.m (27 lb in).
  - Flare to the fender screws to 2 N.m (18 lb in).
2. Quarter panel interior trim. Refer to SECTION 10A4.
  3. Rear seat blower motor cover (if equipped). Refer to SECTION 10A4.

## SHEET METAL SUPPORT

### Remove or Disconnect (Figure 21)

1. Grille. Refer to "Grille Replacement" in this section.
2. Primary hood latch bracket. Refer to "Primary Hood Latch Replacement" in this section.
3. Horn from the sheet metal support.
4. Three sheet metal support to radiator support bolts.
5. Sheet metal support.

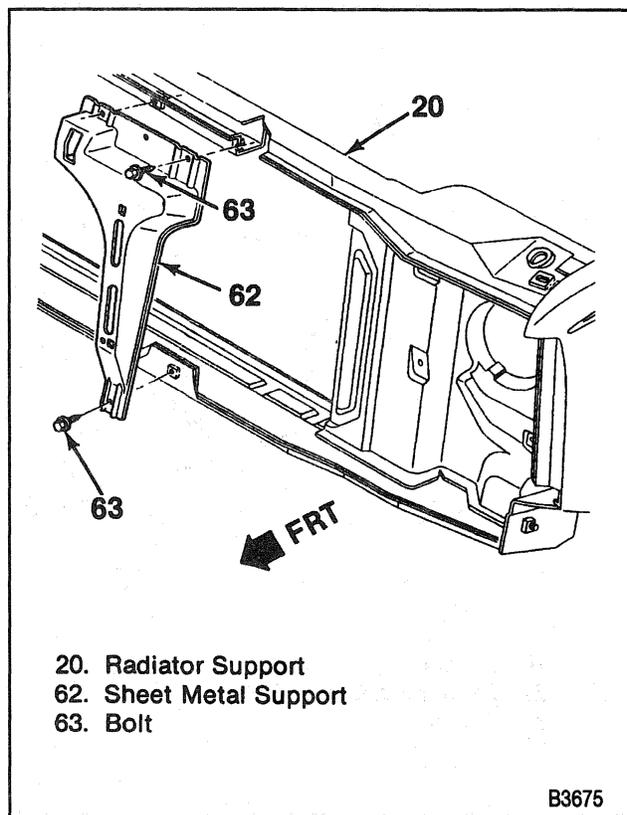


Figure 21—Sheet Metal Support

### Install or Connect (Figure 21)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Sheet metal support to radiator support with three bolts.

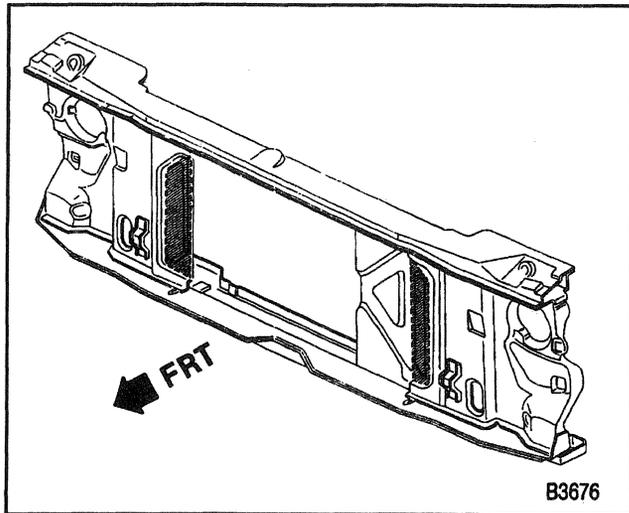
#### Tighten

- Sheet metal support to radiator support bolts to 25 N.m (18 lb ft).
2. Horn to the support. Refer to SECTION 8D.
  3. Primary hood latch bracket. Refer to "Primary Hood Latch Replacement" in this section.
  4. Grille. Refer to "Grille Replacement" in this section.

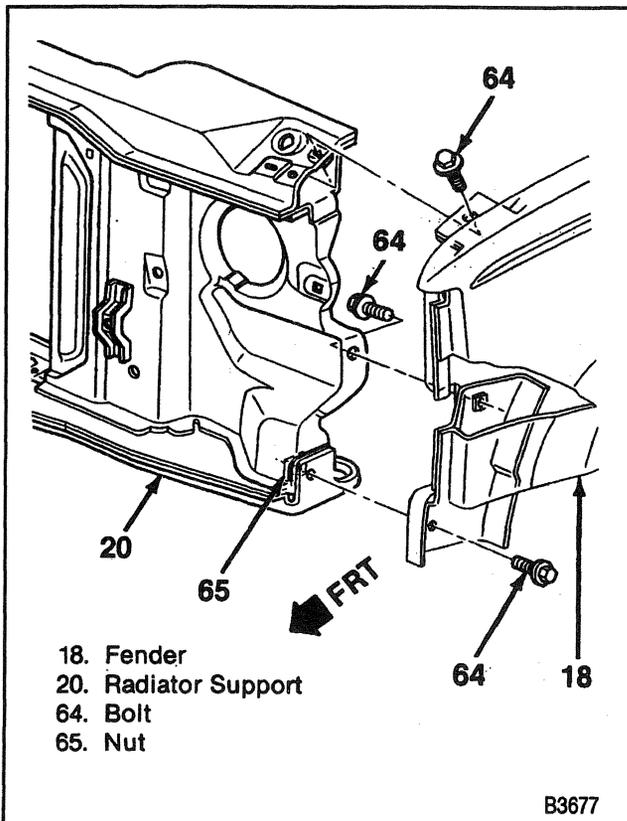
## RADIATOR SUPPORT

### Remove or Disconnect (Figures 17, and 22 through 25)

1. Battery cables. Refer to SECTION 6D1.
2. Battery(ies) and tray(s) from the wheel house(s).
3. Engine cooling fan shroud.
4. Radiator from the vehicle. Refer to SECTION 6B.
5. Radiator grille. Refer to "Radiator Grille Replacement" in this section.
6. Headlamp and parking lamp connectors and harnesses from the radiator support.
7. Wiring harnesses from the clips at the front and back of the support.

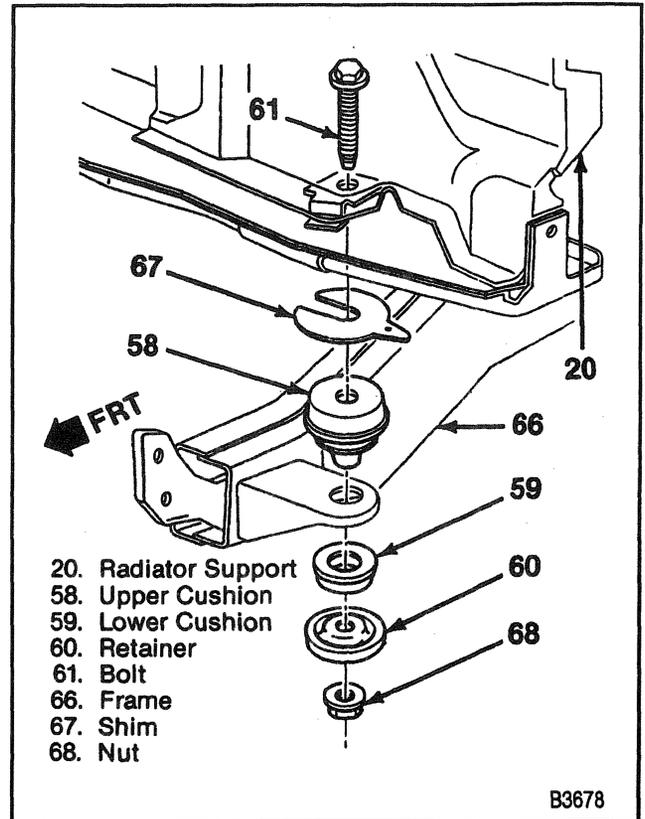


**Figure 22—Radiator Support**



**Figure 23—Fender to Radiator Support Attachment**

8. Ground wires from the support.
9. Primary hood latch cable from the sheet metal support and latch.
10. Headlamps from the vehicle. Refer to SECTION 8B.
11. Fuel vapor canister and lines from the radiator support.
12. Sheet metal support from the radiator support.
13. Auxiliary electric engine cooling fan (if present).



**Figure 24—Radiator Support Mounting**

14. Auxiliary transmission and engine oil coolers (if present).
15. Horn from left rear side of radiator support.
16. Air conditioning condenser and lines, if equipped. Refer to SECTION 1B.
17. Wheelhouse panel to the radiator support bolts (Figure 17).
18. Fender to the radiator support bolts (Figure 23).
19. Air cleaner inlet from the right side of the radiator support.
20. Bolt holding the support mount to the vehicle (Figure 24).
21. Radiator support from the vehicle.
22. Support braces from the support (Figure 25).

 **Install or Connect (Figures 17, and 22 through 25)**

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Braces to the radiator support with bolts.
  - Place the top of the left brace between the support and the right brace (Figure 25).

 **Tighten**

- Brace to the radiator support bolts to 25 N.m (18 lb ft).
2. Radiator support into the vehicle.

## 2B-20 SHEET METAL

3. Upper mounting cushion and shims between the support and the bracket on the frame (Figure 24).

- Level the support by placing shims below the support.
- Shim pack height should not exceed 11 mm (0.43 inch).
- The difference between the left and right shim pack height must not exceed 5 mm (0.19 inch).

4. Bolt through the shims, upper cushion, frame bracket, lower cushion, retainer and nut.

### Tighten

- Radiator support mounting nut to 57 N.m (42 lb ft).

5. Air cleaner inlet to the right side of the radiator support.

6. Fender to the radiator support bolts (Figure 22).

### Tighten

- Fender to support bolts to 25 N.m (18 lb ft).

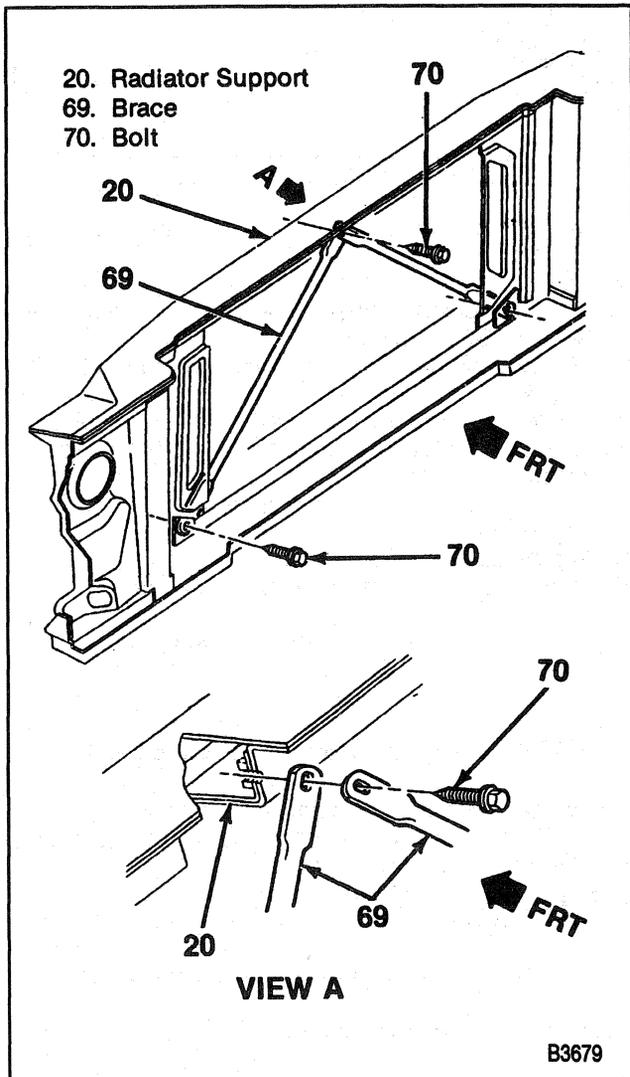


Figure 25—Radiator Support Braces

7. Wheelhouse to the radiator support bolts (Figure 17).

### Tighten

- Wheelhouse to support bolts to 25 N.m (18 lb ft).
- Air conditioning condenser and lines, if equipped. Refer to SECTION 1B.
  - Horn to the sheet metal support. Refer to SECTION 8D.
  - Auxiliary transmission and engine oil coolers (if present).
  - Auxiliary electric engine cooling fan (if present).
  - Fuel vapor canister and lines to the radiator support.
  - Sheet metal support to the front of the radiator support with bolts.

### Tighten

- Sheet metal support to radiator support bolts to 25 N.m (18 lb ft).
- Headlamps. Refer to SECTION 8B.
  - Primary hood latch bracket to the sheet metal support. Refer to "Primary Hood Latch Replacement" in this section.
  - Ground wires to the support.
  - Wiring harnesses into the clips on the front and back of the support.
  - Headlamp and parking lamp connectors to the lamps.
  - Radiator grille. Refer to "Radiator Grille Replacement" in this section.
  - Radiator. Refer to SECTION 6B.
  - Engine cooling fan shroud.
  - Battery tray to the wheelhouse.

### Tighten

- Battery tray to wheelhouse bolts to 25 N.m (18 lb ft).
- Battery(ies) and cables.

## PICKUP BOX REPLACEMENT

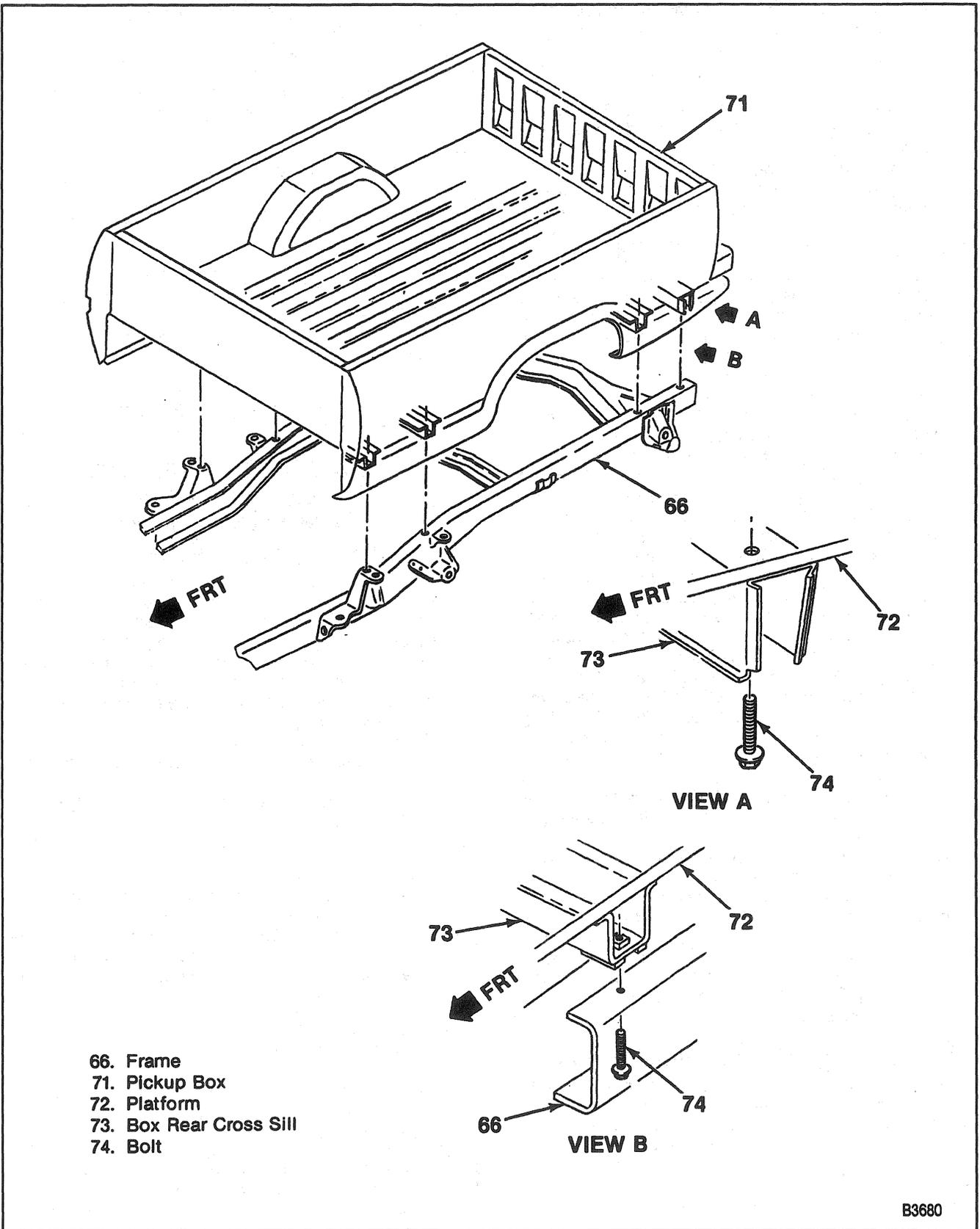
### Remove or Disconnect (Figure 26)

- Taillamp wiring connectors and ground wire under the back of the box.
  - Open the cover to the gas cap.
- Screws holding the neck of the gas filler tube to the side panel.
- Filler neck ground strap.
- Eight bolts holding the box to the frame rails from under the box.
- Pickup box from the vehicle.

### Install or Connect (Figure 26)

**NOTICE:** Refer to "Notice" on page 2B-1.

- Pickup box to the vehicle.



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Figure 26—Pickup Box Mounting

## 2B-22 SHEET METAL

2. Eight bolts holding the box to the frame rails, from inside the frame rails.



### Tighten

- Box to frame rail bolts to 70 N.m (52 lb ft).
3. Neck of the gas filler tube to the side panel with screws.
  4. Filler neck ground strap.
  5. Wiring connectors and ground wire to the taillamp assemblies under the back of the box.

## SHEET METAL ADJUSTMENTS

In order to have the proper operation and appearance of sheet metal components, it is critical that certain fits and gaps between components be maintained. The gaps given in this procedure are suggested as the best alignment for these components (Figure 27).

In aligning sheet metal, it is best to start with the rear most component, and work forward.

1. Starting with the fenders, align the rear edge of each fender to the rocker panel and the door. The gap between these components should be 5 mm  $\pm$  1.0 mm (0.19 inch  $\pm$  0.03 inch). This adjustment should be accomplished by moving the fender forward or rearward. The surface of the fender should be flush with the rocker panel and the door. Add or remove shims to perform this adjustment.
2. Align the left and right edges of the hood so that a gap of 4.0 mm  $\pm$  1.0 mm (0.15 inch  $\pm$  0.03 inch) exists between the hood and fenders. The hood surface should be flush with the fender surface within +0.5 mm -1.5 mm (+0.02 inch to 0.06 inch). If this gap is difficult to obtain, and the hood appears to be cocked in between the fenders, the radiator support may need to be shifted. By shifting the radiator support, the entire front end sheet metal can be aligned as a unit. Loosen the support to the frame bolts, and shift the radiator support to obtain the proper gaps. Then, while holding the support in position, retighten the radiator support to frame bolts.
3. Align the front face of the hood with the radiator grille, so that there is a gap of 1.5 mm  $\pm$  1.0 mm (0.06 inch  $\pm$  0.03 inch) between the leading edge of the hood and the top of the radiator support. There should also be a 4.5 mm  $\pm$  1.0 mm (0.17 inch  $\pm$  0.03 inch) gap between the lower hood surface and the top of the radiator support. Adjust the hood bumpers on top of the radiator support to give the proper gap.

## CAB MOUNT REPLACEMENT

When changing cab mounts, it is important to properly support the frame while changing the mount. If only one mount is to be changed, the side on which the mount is placed must be lowered enough to provide clearance for the mount.



### Remove or Disconnect (Figure 28)

- A. Raise the vehicle slightly on the hoist.
- B. Place jack stands under the cab on the side of the vehicle where the mounts will be replaced.

- C. Loosen mounting bolts on that side.

1. Mounting bolt.
2. Lower cushion retainer.
3. Lower cushion.
  - Lower the hoist enough to leave the cab supported by the jacks.
4. Upper cushion.



### Install or Connect (Figure 28)

**NOTICE:** Refer to "Notice" on page 2B-1.

1. Upper cushion.
  - Raise the frame slightly on the hoist.
2. Lower cushion.
3. Lower cushion retainer.
4. Mounting bolt, and remove the jacks.



### Tighten

- Mounting bolts to 75 N.m (55 lb ft).
- Lower the hoist.

## ADHESIVE-RETAINED MOLDINGS, APPLIQUES, AND EMBLEM REPLACEMENT

These items should be applied in an environment free of dust or dirt that could come in contact with the adhesive backing and prevent proper adhesion.

1. Clean the area where the replacement item is to be mounted (Figure 28). Use a suitable solvent such as flash naphtha or a mixture of 50 percent isopropyl/alcohol and 50 percent water. Dry the area thoroughly.
2. The body area must be a temperature range of 27° to 41° C (80° to 105° F). Heat the area if necessary.
3. The item to be mounted must be at a temperature of 29° to 32° C (80° to 90° F). Carefully apply heat to the item if needed.
4. Remove the protective liner.

### Appliques

- A. Press the molding to the body along its entire length at a pressure of 13.3 to 44.5 N (3 to 10 lbs).
- B. Tape clear plastic, 0.12 mm (0.005 inch) thick, over the item and apply high pressure along the entire area to wet out about 75 percent of the adhesive.

### Roof Joint Moldings

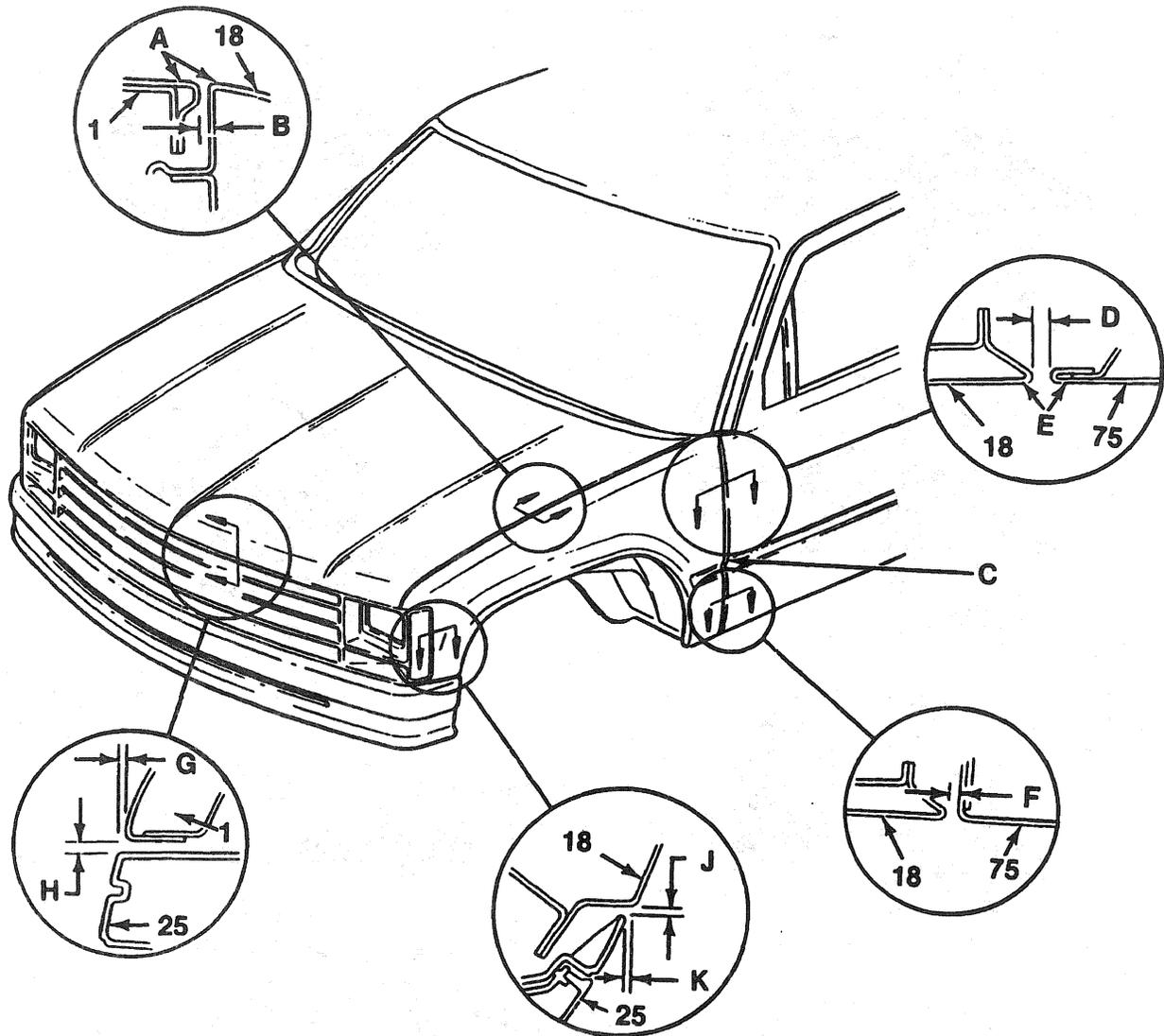
Tool Required:

J 25070 Heat Gun



### Remove or Disconnect (Figure 29)

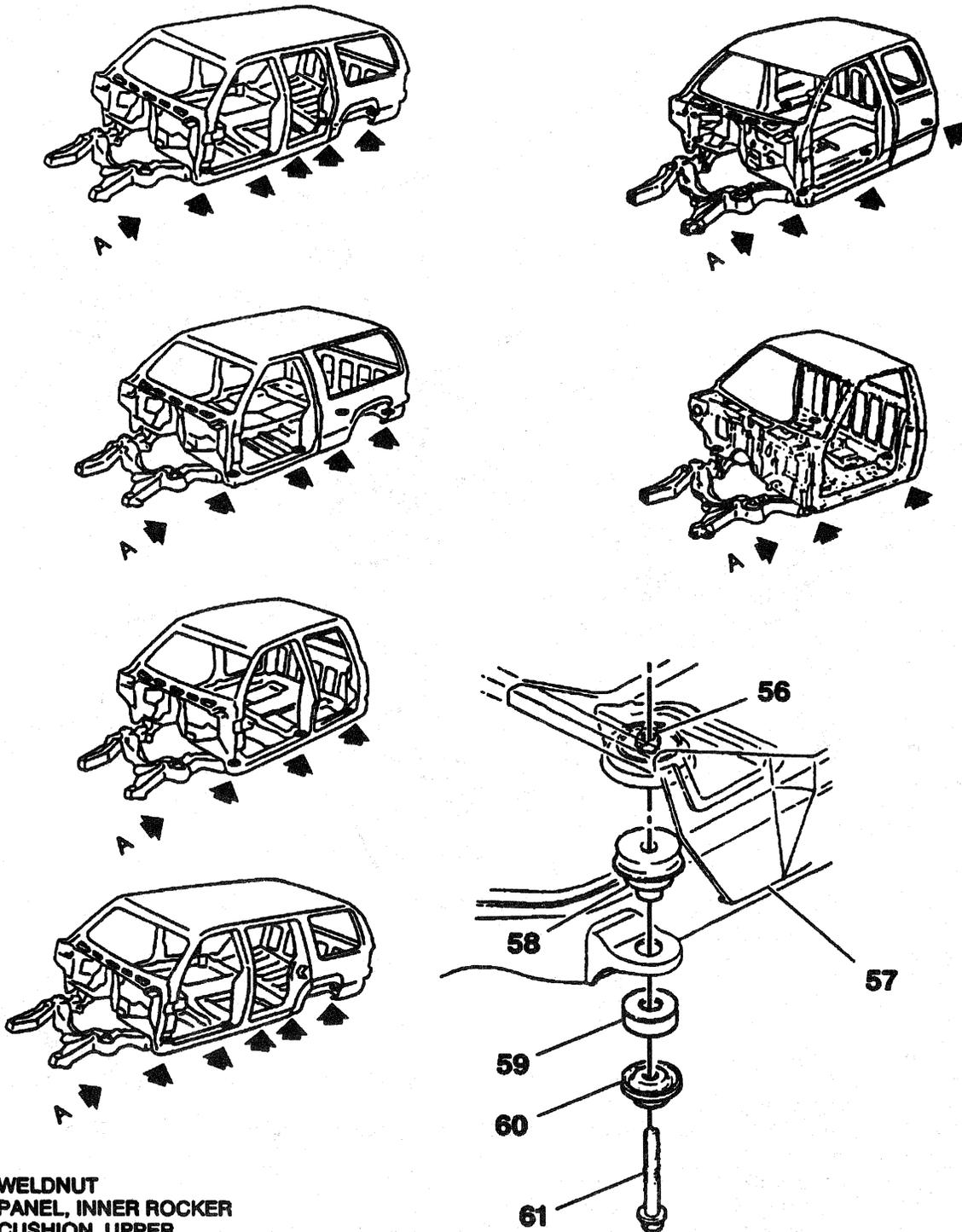
1. Roof joint molding.
  - Using a heat gun, heat molding and surrounding area to approximately 93° C (200° F).
  - Pry off molding between sealer and joint using a flat-blade tool. Pliers or a similar tool may be used for adequately grasping the hot molding to pull it loose. Molding and sealer should come off body together in one piece. Care should be taken to prevent paint damage on cab.



- 1. Hood
- 18. Fender
- 25. Radiator Grille
- 75. Door
- A. Flush  $\pm 1$  mm ( $\pm 0.03$ -inch)
- B. 4 mm  $\pm 1.0$  mm and parallel within 1.0mm (0.15-inch  $\pm 0.03$ -inch and parallel within 0.03-inch)
- C. Features lines flush  $\pm 1.0$  mm ( $\pm 0.03$ -inch)
- D. 5 mm  $\pm 1.0$  mm and parallel within 1.0 mm (0.19-inch  $\pm 0.03$  and parallel within 0.03-inch)
- E. Flush  $\pm 1$  mm ( $\pm 0.03$ -inch)
- F. 5 mm  $\pm 1.0$  mm (0.19-inch  $\pm 0.03$ -inch)
- G. 1.5 mm  $\pm 1.0$  mm (0.06-inch  $\pm 0.03$ -inch)
- H. 4.5 mm  $\pm 1.0$  mm and parallel within 1.0 mm (0.17-inch  $\pm 0.03$ -inch and parallel within 0.03-inch)
- J. 3.0 mm  $\pm 1.0$  mm and parallel within 1.0 mm (0.01-inch  $\pm 0.03$ -inch and parallel within 0.03-inch)
- K. 1.5 mm  $\pm 3.0$  mm and parallel within 1.0 mm (0.06-inch  $\pm 0.01$ -inch and parallel within 0.03-inch)

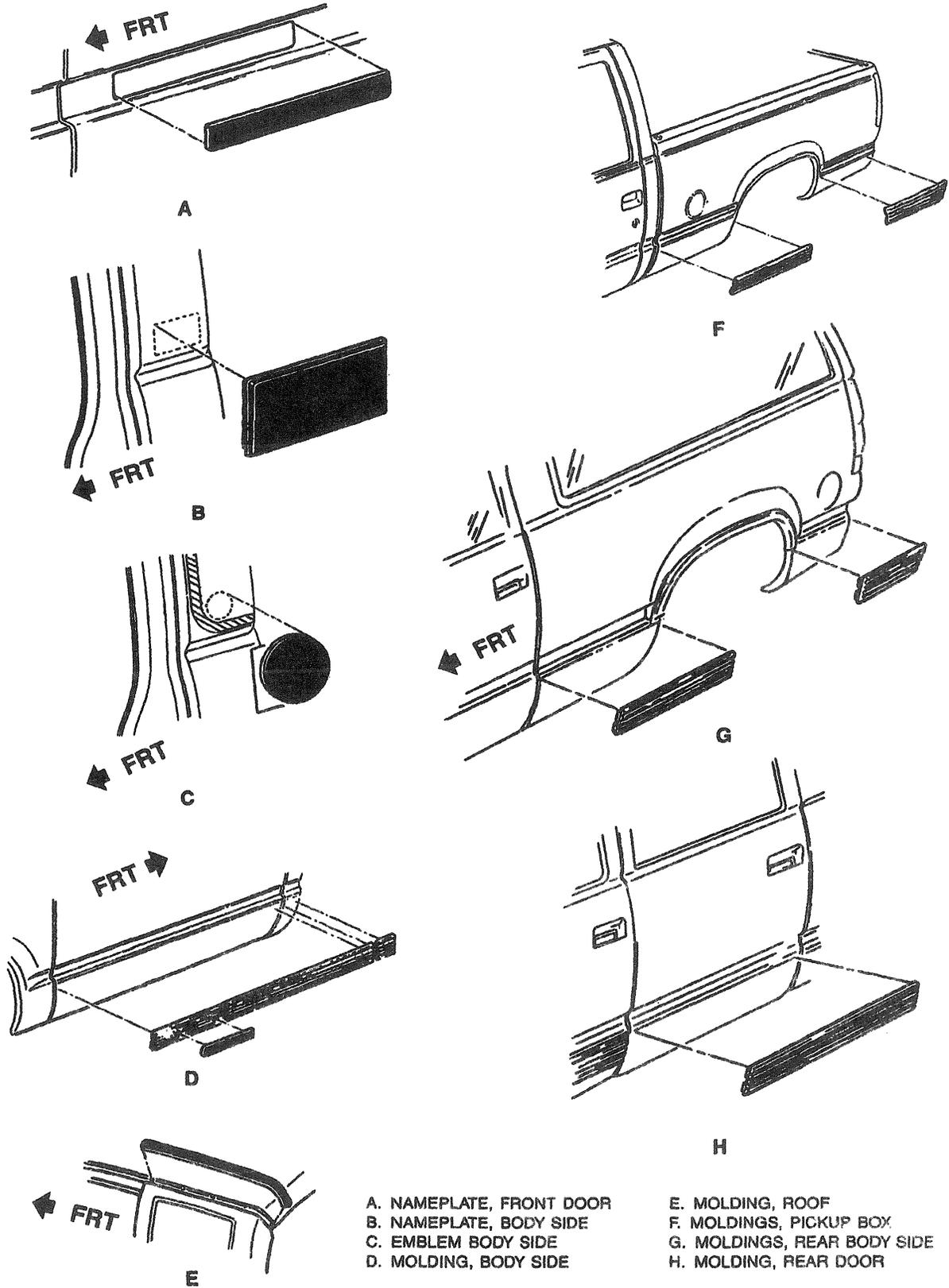
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**Figure 27—Sheet Metal Gap Specifications**



- 56 WELDNUT
- 57 PANEL, INNER ROCKER
- 58 CUSHION, UPPER
- 59 CUSHION, LOWER
- 60 RETAINER
- 61 BOLT, MOUNTING

Figure 28—Cab Mounts



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Figure 29—Moldings and Emblems

## 2B-26 SHEET METAL



### Clean

- Joint to remove any remaining sealer that would interfere with the replacement molding fit.



### Install or Connect (Figure 29)

**NOTICE:** *If molding is painted prior to installation, care should be taken to ensure that paint does not coat bottom of sealer.*

1. Roof joint and molding.
  - Using a heat gun, apply heat to cab in joint area and preheat sheet metal to approximately 93° C (200° F).
  - Install molding into joint area and preheat sheet metal to melt sealer and bond molding into joint. Sealer begins to flow at approximately 93° C (200° F).

### Emblems

- Emblems can be clamped to the body at the center of the emblem. Place foam between the clamp and the emblem to protect it.

## FENDER PROTECTORS

### Application

1. Be sure the fender is clean (Figure 30).
2. Mix a solution of 50 percent isopropyl alcohol and 50 percent water. Spray the solution on the fender where the protector is to be mounted or on the adhesive side of the protector.

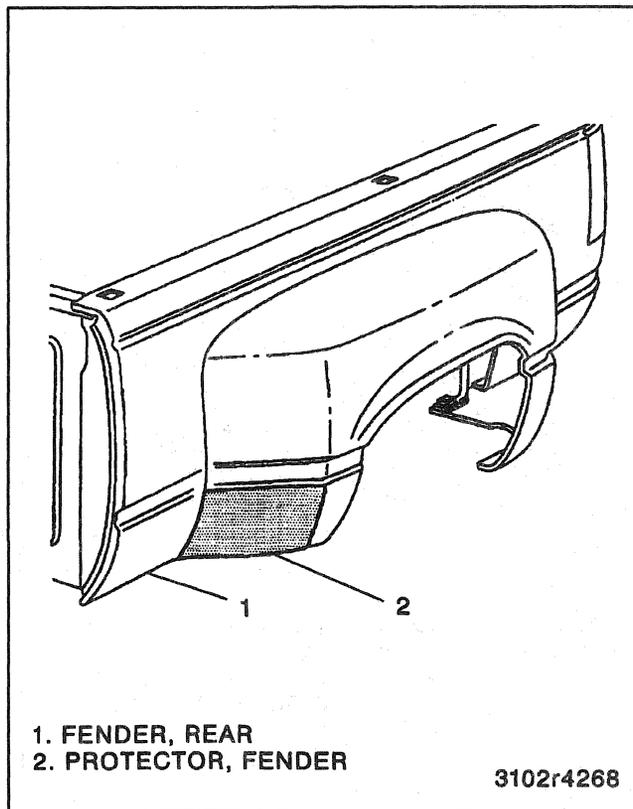


Figure 30—Fender Protectors

3. Mount the protector, working out any wrinkles or bubbles. Be sure the protector does not extend over the edge of the flange.
4. The tape should not be peeled more than 10 seconds prior to usage.

## STRIPE AND DECAL REPLACEMENT

**NOTICE:** *Freshly painted surfaces must be allowed to dry thoroughly before installing stripe or decal. Residual solvents in fresh painted surfaces can lead to subsequent blistering problems if stripe or decal is applied before complete release of solvents.*

**NOTICE:** *To prevent possible vehicle, stripe or decal damage, always refer to manufacturer's packaged instructions.*

Stripes and decals should be applied in a clean environment where dust or fibers will not interfere with proper adhesion.



### Important

- The striping material highlights vehicle surface imperfection. All dings, rough metal, paint defects and uneven two-tone paint breaklines must be eliminated before stripe/decals application can take place.

1. Clean the area where the decal will be mounted. Use a suitable solvent such as flash naphtha or a mixture of 50 percent isopropyl alcohol and 50 percent water. Dry the area thoroughly. If paint in the area is chipped, repaint the area and feather it in.
2. The body surface and the decal must be warmed to 27° to 38° C (80° to 100° F).
3. Most stripes and decals can be applied dry as long as this results in a bubble-free application. Stripes or decals that wrap into body openings or are to be mounted on flexible surfaces must be mounted wet.

### Wet Application

1. Use a wetting agent such as Dupont Duponal WA (or equivalent). Do not use a soap solution. Spray a mist of the solution onto the body area.
2. Remove the backing from the decal by peeling it away. In hot, humid weather, the adhesive back of the decal can be sprayed with a mist of the wetting solution.
3. Using a squeegee and starting at the center of the decal, squeegee the decal onto the body, removing air bubbles and wetting solution.
4. Remove the premask from the decal by pulling it back onto itself. Do not lift the premask straight up.
5. Go over the decal again with the squeegee.
6. If air bubbles are still present, prick them with a pin.

## ANTI-CORROSION TREATMENT

**CAUTION:** When applying sound deadeners or anti-corrosion materials, due care and preventative measures must be exercised to prevent any material from being sprayed into door and quarter panel mechanisms such as door locks, glass run channels, window quarters and seat belt retractors, as well as any moving or rotating mechanical or suspension parts on the underbody, particularly the parking brake cable. After material application, be sure all body drain holes are open. Improper application may limit the operation of moving parts or increase the chance of corrosion damage. Personal injury could result.

This vehicle was designed and built to resist corrosion. Application of additional rust-inhibiting materials is not necessary or required under the 6 year/100,000 mile corrosion coverage.

- Some after-market rustproofing may create a potential environment which reduces the corrosion resistance designed and built into this vehicle.
- Depending upon application technique, some after-market rustproofing could result in damage or failure of some electrical or mechanical systems of the vehicle.
- Repairs to correct damage or malfunctions caused by after-market rustproofing are not covered under any of the GM new vehicle warranties.

## SHEET METAL REPAIR

To help prevent rust, special anti-corrosion materials are used on interior surfaces of metal panels. These materials include special metals such as one-sided and two-sided galvanized, zincrometal and zinc-iron alloy steels. These specially treated metals are used in fenders, doors, quarter panels, rocker panels, floor pans, and other critical areas.

Spray-on materials such as zinc-rich primers and waxes may also be applied to interior surfaces. These are mainly used in areas where moisture might gather. Sealers are applied along exposed joints and moisture-repelling asphaltic sound deadeners are applied inside wheel wells and doors, and on some underbody parts.

If, while repairing damaged areas these special treatments are disturbed, the metals may be left unprotected. This could lead to corrosion; therefore, these surfaces should be re-coated with service-type anti-corrosion materials. Follow these steps in applying the materials.

### 1. Cleanup and Preparation

Depending on the location of the area, sandblasting, scraping, wire brushing, sandpaper, and steel wool can be used to remove residue.

### 2. Applying Primer Coats

Prime all bare metal with an acrylic chromate material.

### 3. Applying Sealers

Seal all flanged joints, overlap joints, and seams with a medium-bodied consistency sealer which stays flexible and is paintable.

All open joints which require bridging of sealer to close a gap should take a heavy-bodied caulking material.

### 4. Applying Color

If areas such as underbody, hem flanges, exposed joints and engine compartment need color, follow conventional refinishing preparation, undercoat buildup, and color application procedures. Rub-out and extensive sanding of the undercoats are not necessary.

### 5. Applying Deadeners

Use a heavy bodied undercoat with a rubberized or asphaltic base. Areas for application can be determined by original production application.

### 6. Applying Anticorrosion Material

Use a light-bodied material designed to penetrate between close metal-to-metal surfaces such as pinch weld joints, hem flanges, and other attaching points where metal surfaces are difficult to coat with conventional materials.

### 7. Conventional Undercoating

Apply to large areas such as doors, hoods, fenders, etc. Use care not to spray material into door hardware such as locks, run channels and window regulator.

On the underbody, the material should not be applied to any moving or rotating parts.

After undercoating, make sure that all body drain holes are open.

## DINGING AND FINISHING

Paint is quickly scuffed off sharp dents leaving metal exposed to rusting and corrosion; therefore, damaged panels should be repaired as soon as possible. Repair damaged panels by forcing outward in the direction opposite to the force which caused the damage. In this way, metal strains that began when the damage occurred, are relieved.

The importance of proper metal finishing to produce a smooth surface should not be underestimated. The application of a hammer directly to the panel tends to stretch the metal and cause a great deal of unnecessary work. Whenever possible, use a spoon under the hammer when bumping a panel.

## ANTI-CHIP COATING REPLACEMENT

An anti-chip coating was applied to the lower portion of the vehicle from behind the front wheels to the back of the vehicle before the color coat application. When these areas are being repaired the anti-chip coating should be applied before the paint.

1. Clean the area with a wax remover.

2. Sand the old paint and anti-chip material away. Feather the edges of the area being treated.

3. If the coating is hard to remove, a heat gun and a putty knife can be used to strip it.

4. Apply primer to the area.

5. Apply the new anti-chip coating following the manufacturer's directions.

**PAINT**

**CAUTION:** Many paint repair systems require additives containing isocyanates. It is essential that all recommendations and warnings listed on the container label for materials selected be followed. It is mandatory that adequate respiratory protection such as air line respirators with a full hood be worn. Such protection should be worn during the entire painting process. Persons with respiratory problems or those allergic to isocyanates must not be exposed to isocyanate vapors or spray mist.

These vehicles have been finished with a basecoat/clearcoat paint process (Figure 31). If repair or repainting is necessary, the technician should use refinishing methods appropriate to this process.

**PAINT CODES**

The following is a list of paint code numbers from various suppliers for the 1997 model year. These colors can be obtained locally.

Dupont refinish paints are available in:

- L - Lucite® - Acrylic Lacquer
- A - Centari® - Acrylic Enamel
- J - Cronar® - Polyoxithane Enamel
- K - Chromabase®
- 350S - Flexible Additive
- 310S - Black 123 Vinyl Lacquer - Chip Resistant
- 330S - White 123 Vinyl Lacquer - Chip Resistant

**! Important**

- Vinyl Resin **MUST** be added to the base color when painting interior components.
  - DuPont Vinyl Resin #304—Instrument Panel
  - DuPont Vinyl Resin #305—All Remaining Interior Parts Except Seats
  - DuPont Vinyl Resin #306—Seats and Vinyl Roofs

When ordering DuPont paint, use "L", "A", "J", "K", 350S or 123 White or 123 Black with the appropriate DuPont code.

PPG (Ditzler) refinish paints are available in:

- DDL-Duracryl-Acrylic Lacquer or Acrylic Basecoat/Clearcoat
- DBU-Deltron-Basecoat/Clearcoat
- DAR-Delstar—Acrylic Enamel
- DAU-Deltron—Acrylic Urethane
- UCV-Vinyl Colors
- DX-369-Flexative-Flexible Finishes
- DX-54 Roadguard—Road Abrasion Protection

When ordering PPG (Ditzler) paint use DDL, DBU, DAR, DAU, UCV, DX-369, or DX-54 with the appropriate Ditzler code.

Sherwin-Williams, Acme, and Martin-Senour are available in acrylic lacquer, acrylic enamel, or acrylic urethane.

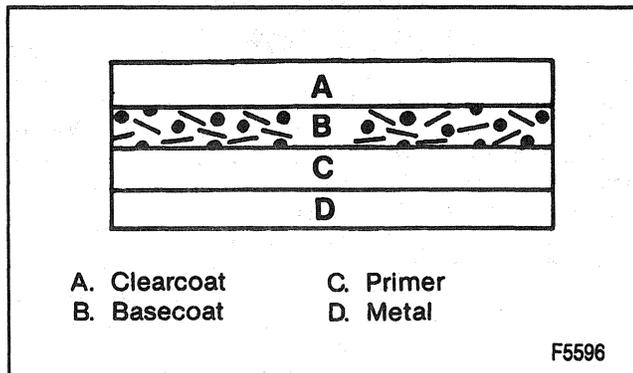
Sherwin-Williams use:

- prefix 34, J4, or L10 for acrylic lacquer
- prefix 35, J5, or F10 for acrylic enamel
- prefix U7 for acrylic urethane in a basecoat/clearcoat system
- prefix USS for acrylic urethane in a single stage system.

Acme Use:

- prefix 84 for acrylic lacquer
- prefix 85 for acrylic enamel
- prefix PB for acrylic urethane in a Basecoat/Clearcoat system
- prefix PS for acrylic urethane in a single stage system.

Martin-Senour: jobber will interchange number shown when acrylic lacquer is needed.



**Figure 31—Basecoat/Clearcoat Finish**

# SPECIFICATIONS

## EXTERIOR COLORS

COLOR	GM CODE	WA NO.
Lt. Opel Blue	24	305D
Bright Blue	25	303D
Laguna Green	35	304D
Black	41	8555
Emerald Green Metallic	43	177B
White	50	8624
Dk Toreador	51	334D
Lt. Autumnwood Metallic	55	228A
Smokey Caramel	65	333D
Victory Red	74	9260
Ultra Silver Metallic	96	8867

## FASTENER TIGHTENING SPECIFICATIONS

Application	N-m	Lb ft	Lb in
Battery Tray Bolts	25	18	—
Bracket to Radiator Support Bolts	25	18	—
Cab Mount Bolts	75	55	—
Dual Wheel Fender Nuts	25	18	—
Fender Bolts	25	18	—
Fender to Bracket Bolts	18	13	—
Flare to Fender Nuts	3	—	27
Flare to Fender Screws	2	—	18
Grille Support Screws	2	—	18
Hinge to Fender Bracket Bolt	25	18	—
Hood Hinge Bolts	25	18	—
Link Assembly Bolts	25	18	—
Pickup Box to Frame Rail Bolts	70	52	—
Primary Hood Latch Bolts	25	18	—
Radiator Support to Frame Mounting Nut	57	42	—
Secondary Hood Latch Bolts	25	18	—
Sheet Metal Support to Radiator Support Bolts	25	18	—
Stepside Fender Screws	18	13	—
Wheelhouse Panel Bolts	25	18	—

**SPECIAL TOOLS**

1.



**J 38778**

2.



**J 8966**

3.



**J 25070**

- 1. DOOR TRIM PAD AND GARNISH CLIP REMOVER
- 2. WINDSHIELD WIPER ARM REMOVER AND INSTALLER
- 3. HEAT GUN

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