## Index

### BODY STRUCTURE
- Window Cutouts ................................................................. 1
- Side Wall Structure ............................................................ 2
- Roof Structure ...................................................................... 2
- Floorpan ............................................................................... 3

### WEATHERSTRIPPING
- Weatherstrip Installation ..................................................... 4
- Weatherstrip Inspection Process ........................................... 5

### BODY EXTERIOR COMPONENTS
- Ladders, Spare Tire Carriers and Luggage Racks ................. 5
- Lower Body Treatments ....................................................... 6
- Running Boards .................................................................... 6

### BODY INTERIOR COMPONENTS
- Headliner System ............................................................... 7
- Sun Visors ............................................................................. 7
- Floor Covering ...................................................................... 8
  - Carpeting ............................................................................ 8
  - Sound Absorber and Deadener ......................................... 8
- Interior Trim Panels ............................................................. 8
- Plastic Trim Components ..................................................... 8
- Wood Trim Components ...................................................... 8

### RESTRAINTS AND SEAT ASSEMBLIES
- Installation/Torque Specifications ......................................... 9

(continued on next page)
# Index

**FASTENERS**

- Metal Fasteners ................................................................. 10
- Plastic Fasteners ................................................................. 11
- Squeaks and Rattles ............................................................... 11

**APPENDIX I**

- Welding Guidelines and Precautions ........................................ 12
- Welding Precautions .............................................................. 12
  - Electrical System ............................................................. 13

**APPENDIX II**

- General Fastener ................................................................. 14
  - Reference ........................................................................... 14
  - Fastening to Thin Sheet Metal ............................................. 14

**APPENDIX III**

- Design Principles to Eliminate Squeak & Rattle Reference ............ 22
  - Squeak & Rattle-Free Design Checklist ................................ 22
  - General Principles ............................................................. 22
  - Instrument Panel & Dash .................................................... 26
  - Electrical ........................................................................... 36
  - Interior Trim ....................................................................... 41
  - Body & Exterior Trim .......................................................... 44
  - Seat & Seat Belt .................................................................. 47
Window Cutouts

When installing additional windows during the conversion process, it is important to implement practices that will not compromise the quality of the OEM vehicle. Additionally, standard procedures help to obtain consistent results. General Motors recommends the following:

- Use templates and fixtures when locating side windows. Use pre-existing features, such as the drip rail or body opening line, as reference points to locate templates and fixtures. (See Figures 1 and 2.)

- When preparing raw metal edges, eliminate all sharp edges so metal preservative will adhere properly (Figure 3). Apply rust inhibitor around all body cutouts and holes drilled through exterior painted body panels. See the Upfitter Integration Paint and Sealing Guideline Manual.
Body – Structure (cont'd)

Side Wall Structure

It is necessary to assure that the strength of the modified sidewall structure is equal to or greater than that supplied with the OEM vehicle.

Install additional structures by bolting or welding them to the basic members of the body structure such as the roof rail, floor pan, wheel house, pillars or horizontal and vertical strainers.

Refer to the Appendix I for general welding guidelines.

Roof Structure

General Motors recommends the following guidelines for modifying G-Van and M/L Van roof structures (see the incomplete vehicle document):

- When adding a raised roof, do not remove the OEM roof structure forward of the B-pillar.
- To maintain cross-body stability, do not remove the last roof crossbow forward of the D-pillar.
- Replace the original roof and roof bows only with structures of equal or greater strength.
- Before installing interior trim, conduct a water test to assure that there are no roof to body leaks.
- Refer to the Incomplete Vehicle Document for guidelines on excessive roof console vertical heights which will obscure the vision through the rearview mirror.

- With a high-powered vacuum remove all metal debris (i.e., chips, ribbons, slivers, etc.) from the interior of the vehicle. This process eliminates potential damage to electrical wires and moving parts. It also helps to prevent premature rusting of the vehicle body.
- When adding exterior components, choose only those made of non-corrosive or properly plated materials.

Also, consider the corrosive effect of mating dissimilar metals when selecting materials. (See Paint manual for specific metal corrosion recommendations.)

Conduct water testing to check for any leaks between the newly installed windows and the body, which may occur from the conversion process.

Consult the Incomplete Vehicle Document for recommended locations for installing side body windows.

All SVM-installed window and sunroof glass must meet FVMSS and appropriate state regulations, including those governing the use of shaded glass. Certification markings for any upfitter-installed glass must be visible on the vehicle. The SVM is responsible for recertifying the vehicle when installing non-OEM glass.
Some conversion procedures require perforating or otherwise modifying the floorpan. Use extreme caution when working near fuel lines, fuel tank, exhaust system, heat shields and moving chassis parts.

Use templates to accurately locate holes and drill stops to limit the drilling depth.

- Do not place floor covering, such as carpeting, so that it extends past the engine cover seal area or interferes with engine cover mounting clamps to eliminate CO intrusion, water leaks and noise intrusion. (Figure 4.)

Floorpan

- Seal all holes in the floorpan to prevent carbon monoxide and water from entering the vehicle’s interior. Conduct appropriate occupant compartment pressure testing to assure the effectiveness of floorpan seals.

See the Upfitter Integration Paint and Sealing Guideline Manual.

![Figure 4]

![Figure 5]

Take particular care in performing the above procedures to assure that vehicle occupants are not exposed to exhaust fumes and carbon monoxide.

(continued on next page)
Do not remove any body insulation, including thermal or underbody heat shields, provided by General Motors. OEM insulation protects the vehicle body and passengers from excessive heat and reduces noise levels. The floorpan of the finished vehicle must be covered by the OEM thermal insulation mat or equivalent replacement. The SVM must certify that all applicable materials installed inside the passenger compartment comply with the FMVSS 302 flammability standard.

Weatherstrip Installation

To properly install weatherstrip (door opening seal), follow the procedure below:

1. Install weatherstrip at corner A (Figure 6). Seat weatherstrip onto body flange on each side of the corner.
2. Drape and install weatherstrip at dot areas B through F.

Attach the weatherstrip to the body flange in six areas to equally distribute weatherstrip length around the door opening.

3. Seat remaining weatherstrip onto the flange by hand between the installation points.
4. Final installation may require using a rubber mallet in thick flange areas, and in corners to fully seat the weatherstripping.

When using a rubber mallet, be sure to hit the weatherstrip squarely to the flange. Doing otherwise may cause undesirable spreading of the carrier, resulting in reduced retention.
If using door seals to retain the trim material, make sure the trim adheres to the flange and is closely trimmed on the outer surface of the flange to eliminate wicking water into passenger compartment. See Figure 7.

![Diagram](TRIM MATERIAL)

**CUT TRIM HERE SEAL EDGE**

**SECTION CUT AT DOT F (FIGURE 6)**

Figure 7

After installation is complete, inspect the weatherstrip for adherence to the following guidelines:

- **Corner fit** — The continuous corner should match the corner radius. Any rotation of the corner indicates that the fit is improper.
- **Proper seating** — The weatherstrip should be seated completely onto the flange in all areas, allowing the vinyl trim to lie smoothly around the entire door opening without waviness.
- **Carrier distortion** — Make sure that the carrier is free from distortion or spreading which may occur if it is hit improperly by a rubber mallet.
- **Secondary bulb** — The secondary sealing bulb should be continuously compressed on the body and door surfaces. Any areas of the weatherstrip with the bulb under the vinyl carrier should be removed and reinstalled.

### Ladders, Spare Tire Carriers And Luggage Racks

When installing exterior components, it is important to align them properly. Include mounting pads to avoid damaging the paint or finish of the mounting surfaces. The following assembly procedures are recommended:

- **CAUTION**

Mating dissimilar metals may have a corrosive effect on the assembly. Always consider this condition when selecting materials that will have direct contact with the vehicle body.

- **CAUTION**

Do not attach spare tire carrier or ladders to vehicle’s rear door. The door hinges are not designed to withstand this additional weight.

- **CAUTION**

Include proper labeling and instructions for the use of SVM-installed accessories with the finished vehicle.
Body – Exterior Components (cont'd)

Lower Body Treatments

To assure minimum OEM ventilation requirements were met for the exhaust and brake systems, conduct heat transfer testing and analyses to be certain that added air dams or running boards do not degrade the vehicle's airflow characteristics.

Do the same process to assure engine cooling and HVAC performance is within OEM minimum requirements.

Additional recommendations are:

- In order to provide sufficient clearance for steep driveway slopes, consider approach, departure and brakeover angles when designing lower body treatments.
- Do not remove or alter existing heat shields located on vehicle’s underbody.
- Do not place mounting attachments for lower body treatments in locations that would affect the integrity of the fuel or braking systems during normal use or a collision.
- Fasten added components or attachment brackets to structural members, not to sheet metal. This reduces squeaks and rattles, and the possibility of distorting class “A” exterior body panels.
- Be sure to allow adequate clearances for OEM moving parts and exhaust system when designing or installing lower body treatments.
- Mount road and fog lamps to the underbody structure, not to fascia material. Doing so increases mounting stability and reduces vibration, noise and glare.

Running Boards

Strength and corrosive properties are key considerations in the selection of materials for runningboards.

Running boards should be capable of supporting a minimum static load of 500 pounds with less than 5mm of deflection. Installing components of lesser strength could result in damage to the supporting structure and human injury.

- Apply a protective coating to the running board attachment points to prohibit the corrosion.

General Motors also recommends the following:

- Attach the running board to a structural member of the body only, not to the frame. A combined frame and body mounting system will cause frame noise, vibration, and harshness transfer into the body.
- Conduct the appropriate checks to assure sufficient clearance between the wheel and running board (i.e., on bumpy roads and sharp turns). This is especially important when running boards are integral with the wheel opening lip.
- When installing a running board to the body of a pickup truck, a two-piece construction should be used. Attach the front piece to the cab and the rear piece to the box.
- When installing a step bar to the frame of a pickup truck, a one-inch minimum clearance should be maintained to the body.
The purpose of added interior components is twofold: to provide occupant convenience as well as a visually appealing environment.

It is the SVM's responsibility to assure that all added interior components comply with FMVSS standards 201 (occupant protection in interior impact) and 302 (flammability of interior materials).

Additional recommendations are:
- Attach all load-bearing interior hardware to the body structure to assure mounting strength.
- Do not install components with sharp edges or protrusions that may potentially harm vehicle occupants.

The minimum radius for corners on interior components is 3.2mm (International Standard).
- Consider the range of hand and finger motion when designing and selecting locations for passenger convenience items.
- Aim added interior lighting for optimum passenger convenience, maximum lighting effectiveness and to avoid disturbing the driver's vision.
- Include maintenance and operating instructions for all added interior components with the finished vehicle.

For information on practices recommended by the Society of Automotive Engineers, refer to SAE documents J1048 (Symbols for Motor Vehicle Controls, Indicators and Tell-Tales) and J1139 (Driver Hand Control Locations for Passenger Cars).

Headliner System
The headliner system is a high visibility item and must meet or exceed all customer expectations for fit, finish, function and quality. As previously noted, headliner systems must conform to FMVSS standards 201 and 302 for occupant safety and flammability. General Motors expects SVMs to implement processes that guarantee product consistency and those that drive continuous improvement.

- The design should avoid gaps between the headliner and B-pillar and C-pillar garnish moldings, and roof garnish moldings.
- To assure mounting integrity, attach all loadbearing interior hardware (e.g., overhead console) to sheet metal that is well supported.

Avoid placing hidden sharp edges between the headliner and the roof panel. Doing so may result in injury to passengers and damage to the headliner.

Headliner system components should be serviceable without damage to the headliner. Refer to GM service manuals for recommended disassembly procedures.

Sun Visors
General Motors recommends using the OEM visors in the upfitted vehicle. SVMs may, however, retrim the original visor to match the vehicle's interior. Sun visors must comply with FMVSS 101, 201 and 302. Be sure to add appropriate label to sunshades.

Refer to GM Specification 2746M for materials suitable for retrimming the sun visor.
**Floor Covering**

The floor covering system, which consists of carpeting, absorber and deadener material, must conform to FMVSS 302 (flammability of interior materials).

**Carpeting**

- Install carpeting with a minimum weight of 18 oz. (i.e., 18 oz. Twilight). The minimum thickness for adequate carpet retention is 0.8" (20mm).
- Choose carpeting that is free of loose threads, wrinkles, bubbles, frayed edges or attachment depressions. Also select materials that will lie flat against mating surfaces. Use only adhesives that are compatible with mating parts.

**Sound Absorber and Deadener**

- Install sound-absorbing material wherever floor carpeting is added to a conversion vehicle.
- Use an insulator (deadener) with a sufficient thermal rating when it is exposed to higher exhaust system temperatures (see GM Specification 2714M).
- Use a thermal cotton sound absorber to enhance interior acoustics (see GM Specification 2213M).

**Interior Trim Panels**

- Provides closeout for structural panels
- Secures other interior components
- Enhances the vehicle’s interior styling

- Modifications should conform to the restrictions shown in “Incomplete Vehicle Document” in order to meet FMVSS occupant performance requirements. Like other interior components, trim panels must meet FMVSS standards governing flammability (FMVSS 302).

Upfitters should also reference FMVSS 201, “Occupant Protection in Interior Impacts” for direction concerning interior fittings.

---

**WARNING**

Select plastic trim that is free of burrs, flash, mold-parting lines and sink marks. If plastic trim is grained, match the grade and grain direction of the components that are related to it.

**Plastic Trim Components**

- Round all wood-trim corners to eliminate sharp edges or protrusions that may result in passenger injury. The minimum radius for interior trim corners is 3.2mm.
- Avoid installing wood trim in areas exposed to direct sunlight. Over time, the sun’s ultraviolet rays will degrade the finish of the wood. All SVM-added decorative wood components should conform to GM Specification 2210M.
Seating components and restraint systems must comply with all applicable FMVSS standards (FMVSS 201, 202, 207, 208, 209, 210, 302). Refer to the Incomplete Vehicle Document for additional information and requirements related to the systems and components discussed in this section.

The OEM restraint systems are designed to function properly with seating reference points and seat travel of the original equipment seats only. The non-OEM seats and belt systems that are installed by the SVM must be certified for compliance to FMVSS and CMVSS regulations.

**Installation/Torque Specifications**

To assure compliance to federal regulations, torque all added seat and seat belt fasteners to specification. Avoid altering shoulder belt attachment zones (location and the surrounding structure). Such modifications require FMVSS recertification.

Additional precautions:

- **For driver and front passenger seats and belts**
  - Place seating reference points in locations identical to those specified in the “Incomplete Vehicle Document.”
    - If, for any reason, it is necessary to remove OEM factory-installed front seat belts, reinstall them in their original positions using the proper tools. Torque all bolts to specification (see “Incomplete Vehicle Document”).
  - When drilling fastener holes through the floorpan, make sure that the fuel tank or fuel lines are not contacted. Use drill stops.
    - Properly reinforce the floorpan at all fastener locations to avoid pull-through.
    - Install backup washers under nuts at all locations.
  - Do not attach seat pedestals or seat belts through a layer of mat or carpeting. Doing so will cause compression of the material and result in a loss of torque.
  - All seat belt fasteners must be certified for compliance with FMVSS requirements.
The term “fastener” refers to bolts, nuts, washers, screws, rivets, pins, staples and other commonly used attaching parts. Most fasteners are metric, but are very close in dimension to common English system fasteners. Consideration should be given to the full range of available fasteners to assure the appropriate selection. This will help to reduce problems with squeaks, rattles, corrosion, fit and cosmetic appearance.

**Metal Fasteners**

Always use fasteners that match the correct nominal diameter, thread pitch and strength of the mating part.

Original equipment metric fasteners, except “beauty” bolts (e.g., bumper bolts, cross-recess head screws), bear a marking on the head (Figure 8). This mark indicates the strength of the material making up the fastener.

1. Grade 2 (GM 200-M)
2. Grade 5 (GM 280-M)
3. Grade 7 (GM 290-M)
4. Grade 8 (GM 300-M)
5. Manufacturer's Identification
6. Nut Strength Identification
7. Identification Marks (Posidriv Screw Head)

![Figure 8](image)

Metric cross-recess screws are identified as “Posidriv” or “Type 1A.” Either a Phillips or Type 1A cross-recess screwdriver can be used in Posidriv recess screw heads, but Type 1A cross-recess screwdrivers perform better.

General Motors recommends the following fastener process guidelines:

- **WARNING**

  Purchase fasteners by part number rather than description to assure meeting the desired specifications.

  - Use metric tapping screws incorporating Posidriv features on cross-recess heads.
  - Use Posidriv nuts and bolts. They are designed to promote higher torquing ability and prevent slippage.
  - Use metric, rather than English, fasteners. Never intermix metric and English fasteners (i.e., do not use English bolts with metric nuts, or vice versa). Also, use either all metric or all English fasteners within a vehicle system.
  - Use self-drillers with milled (rather than forged) tips.
  - Use hardened washers to assure consistent bearing surfaces. This allows positive sealing and is especially important in areas where gas and water may otherwise enter the vehicle.

  Use a torque-control gun to install seat and seat belt bolts. Doing so will provide optimum control and proper torque.

For specific information on fasteners, refer to Industrial Fasteners Institute publication, METRIC FASTENER STANDARDS. Industrial Fastener Institute (1505 East Ohio Building, Cleveland, Ohio 44114; telephone 216-241-1482). See Appendix II for “General Fastener.”
Plastic Fasteners

Although there are many types, only three make up about 80 percent of all commonly used plastic fasteners. They are:

- **Trees** — Not recommended because of service issues that occur after reinstallation. They have a tendency to come loose and cause squeaks and rattles after service. This type of fastener is made up of “branches” (or arms), a “trunk” (stem) and a base (head). Trees can vary greatly from one another with different stems, different kinds of points and especially, different types of heads.

- **Grommets** — Sometimes called a nut or screw grommet, the grommet is installed in a hole or slot in one panel. The second component is then fastened by a screw through the second component into the grommet hole. Grommets are labeled according to the type of hole they fit (i.e., square, oval or round). They can be two- or four-legged. Always consider hole size and grip range when selecting grommets.

- **Pushpins** — Recommended fastener. Pushpins are basically grommets with a wedge attached to them and come in three types: basic pushpins, screw rivets and Rivet-RLØks. They are used by inserting the pushpin through the hole and then pushing the pin through to expand the legs and wedge it into place. Pushpins may be either crossed or noncrossed, depending on whether the legs are attached to each other at the tip. Screw rivets are similar to pushpins except they can be removed by unscrewing. Hole size and grip range are also important criteria when selecting this type of fastener.

Squeaks and Rattles

Because squeaks and rattles contribute greatly to customer dissatisfaction, it is important to recognize their possible causes and identify ways of eliminating them. The guidelines below can assist the SVM to develop designs that minimize or eliminate squeaks and rattles.

- Ideally, the part should not rattle when shaken. However, if the component’s function makes this impossible, hide or relocate the part and use sound-deadening material to isolate it.

- Design attachment brackets and adjacent parts with the following considerations:
  - rigidity
  - ability to self align during assembly
  - clearance or interference fit
  - temperature and environmental conditions
  - surface and surrounding materials

As much as possible, avoid cantilevered designs and components that cannot be positively attached.

- Preload moveable parts to restrict their movement.
- Secure components tightly in static state.

See APPENDIX III for related design and assembly principles that eliminate unwanted noise.

For information on appropriate fasteners, refer to Industrial Fasteners Institute publication, METRIC FASTENER STANDARDS.
Welding Guidelines and Precautions

When welding anywhere on the vehicle, it is important to take precautionary measures to assure the safety of the technician and prevent damage to the vehicle or its systems, especially the electrical system wiring. General Motors recommends the following safety precautions:

- Every operator performing welding or cutting should wear goggles or masks designed for oxyacetylene work. Light from the oxyacetylene flame causes serious injury to the eyes, if unprotected.
- Use a friction lighter to light a welding torch. Never use matches, as doing so may result in burns, especially to the hand.
- Do not weld near or over cans, closed or empty. Flame from the welding torch can come into contact with fumes from the cans and result in an explosion.
- Never lay down a torch until the gases have been properly shut off.
- Hang torches only from hangers provided for that purpose.
- Keep the flame from coming into contact with hoses, regulators, cylinders, piping or any equipment. Failure to do so may result in fire.
- Do not set a hot piece of welding rod down where it can be picked up, stepped on or sat upon.
- When using a rod, bend the end over to eliminate any sharp points that may cause injury.
- To prevent leaks, make sure that regulators are firmly attached. Also take particular notice of the position of the thumbscrew and back it off until it spins with ease. When fastened to tanks or a line, regulators should be placed so that they do not interfere with valve operation in case of emergency.

Never use oil or grease on any part of the equipment or cylinders. Oil or grease, when combined with oxygen under pressure, will cause a violent explosion.

Additional welding precautions are:

- Before welding, remove or adequately shield any parts or components which could be damaged by excessive temperatures. Disconnect battery cables at the battery.
- Clean the area to be welded and the surrounding area of all frame-protective coating before welding.
- Place ground clamps as near as possible to the weld. This will eliminate stray current to vehicle components. Also use heavy gauge ground wire to a good building ground when welding.
- Open oxygen cylinder valves slowly so that the high-pressure gauge needle rises gradually, not with a jump. Continue to open the cylinder valve as far as it will go. Acetylene valves need only be opened to one-half turn.
- The hose’s rubber covering burns easily. It is, therefore, important to keep the hose from coming into contact with hot, previously welded areas.
- After welding, allow parts to cool. Then carefully inspect wiring and electrical components for shortages or other damage which could draw excessive currents or cause an electrical system short when the battery is reconnected. Apply protective coating to areas from which coating was removed.

(continued on next page)
Welding Guidelines and Precautions (cont'd)

Electrical System

See the Upfitter Integration Electrical Guideline Manual: Electrical System Precautions section.

To avoid damaging the OEM electrical system or components during welding procedures, GM recommends the following precautionary measures:

- Do not route welder electrical cables on, near or across any vehicle electrical wiring or components while welding is in progress.

- Remove or adequately shield any electrical or electronic components which can be damaged by excessive temperatures created by the welding operation.

- Protect all wiring and electrical components from damage that can be caused by welding flash (sparks).

- Make sure that the welder ground clamp is of an adequate size and placed as close as possible to the area being welded. Never use a vehicle suspension component as a welding ground point.

- Prior to any welding, disconnect all negative (ground) cable(s) from all battery(ies).

- Disable the air bag system as outlined in the “Disabling the Air Bag System” section of the Upfitter Integration Electrical Guideline Manual — Section: Electrical System Precautions.

- Disconnect any electrical/electronic computer modules located near the area to be welded. After welding is complete, carefully inspect any electrical wiring or components in the weld area for degradation or damage.
Fastening To Thin Sheet Metal

Tapping screws have been a standard sheet metal attachment method for years. With the introduction of thinner gauges for cost and weight savings, new concerns became evident. Screws were stripping and loosening because the gauge now only allowed for 1/2 of a thread engagement. Extrusions did not help much because the extrusion wall, due to its thinness, would cut off instead of threading. The practical solution was the release of a new type of tapping screw, one which self extruded and rolled its own thread. This worked well but has shown itself to be somewhat operator sensitive. With the use of plant tooling at its present level of technology, this type of screw has had only moderate success.

Several other thin metal attachment fastening methods have been suggested. “Pop” rivets have always been a cost effective, fairly foolproof method of attaching joints that are in shear. The negative side is that the plants cannot seem to be able to install the parts effectively. Also loose mandrels are a common squeak and rattle complaint. Maintenance of the tool, proper pulling adjustment and periodic replacement of pulling jaws are usual reasons for poor performance of the tools.

The use of U-nuts, another often suggested method of attachment, is not always desirable. Clearance for the legs, installation slots or nearness to a flat edge, ergonomic considerations such as push-on effort, parts count increase, parts falling off or moving aside, are some of the problems encountered when using U-nuts in attachments. While the parts are used today, their shortcomings are carefully considered.

Various snap-ins, plastic as well as steel, do not function well in sheet metal joints, which are mostly in shear. Welding is a possibility, but leaves unsightly appearances. Even when weld attachments are done prior to paint, the weld depression is not acceptable on most visible surfaces. Adhesives are not up to this state of the art yet; although some work is being done at attaching body sheet metal at Ford and Audi/VW.

An analysis of the root cause of the problem indicates that the correct solution is to thicken the attachment point. This can be done with the use of welded nuts (negatives are high cost of assembly, energy, labor, handling, poor tolerancing); pierce nuts installed in the stamping process (cost effective, but needs space for the physical dimensions of the part and installation tool clearances); the use of tapping plates (cost of energy, tolerances may be a concern); or the use of a snap-in type spring nut. The snap-in type spring nut, when used with a tapping screw, has been shown to be an effective, high-strength joint requiring little physical space, easily installed and relatively inexpensive.

Although tapping screws present some difficulties, their use cannot be totally eliminated. When used with metal-to-metal interfaces such as the snap-in nuts or other joint “thickeners” (i.e., tapping plates), they can effectively be a robustly designed attachment.
**METRIC U SHAPE MACHINE THREAD SPRING NUTS**

**WIDE RANGE**

**FINISH:** GM711M (GREY)

GM Engineering Standards Ref: Section E-70

<table>
<thead>
<tr>
<th>Size</th>
<th>Style I Type C</th>
<th>Style IM Type CL</th>
<th>Leg</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6 x 1</td>
<td>11507067</td>
<td>11516372</td>
<td>Flat</td>
</tr>
<tr>
<td>M8 x 1.25</td>
<td>11516149</td>
<td>11516201</td>
<td>Curved</td>
</tr>
</tbody>
</table>

Panel Range: 0.80 - 4.00 2.00 - 5.00

The free spinning Multi-Threaded or "BARREL" style is recommended over the single thread style for improved attachment integrity.

**DESIGN INFORMATION:**

Refer to Gm Engineering Standards Page E-70.505 for detailed information on panel configurations and clearances.

<table>
<thead>
<tr>
<th>Size</th>
<th>Panel Clearance Hole Recommended Range</th>
<th>Recommended Punch Size *</th>
<th>Distance - Panel Edge to Hole Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>9.9 - 10.7 mm</td>
<td>10.5 mm</td>
<td>11.5 - 12.5</td>
</tr>
<tr>
<td>M8</td>
<td>11.3 - 12.1 mm</td>
<td>12.0 mm</td>
<td>12.5 - 13.5</td>
</tr>
</tbody>
</table>

* From GM Engineering Standards, Pages Y-91.101 and Y91.105

New 5/93
**METRIC HEX HEAD MACHINE SCREW**

**AND TYPE H REGULAR CONICAL SPRING WASHER ASSEMBLIES**

**WITH DOG POINT**

**FOR USE AGAINST STEEL**

<table>
<thead>
<tr>
<th>Nom Screw Size</th>
<th>A</th>
<th>B</th>
<th>E</th>
<th>C</th>
<th>Washer Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>M6</td>
<td>1.0</td>
<td>6.00</td>
<td>3.31</td>
<td>10.00</td>
<td>9.76</td>
</tr>
<tr>
<td>M8</td>
<td>1.25</td>
<td>8.00</td>
<td>7.04</td>
<td>13.00</td>
<td>12.33</td>
</tr>
<tr>
<td>M10</td>
<td>1.5</td>
<td>10.00</td>
<td>8.86</td>
<td>15.00</td>
<td>14.73</td>
</tr>
</tbody>
</table>

**METRIC HEX HEAD MACHINE SCREWS**

**AND FLAT WASHER ASSEMBLIES**

**WITH DOG POINT**

**FOR USE AGAINST PLASTIC**

<table>
<thead>
<tr>
<th>Nom Screw Size</th>
<th>A</th>
<th>B</th>
<th>E</th>
<th>C</th>
<th>Washer Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>M6</td>
<td>1.0</td>
<td>6.00</td>
<td>3.21</td>
<td>10.00</td>
<td>9.78</td>
</tr>
<tr>
<td>M8</td>
<td>1.25</td>
<td>8.00</td>
<td>7.04</td>
<td>13.00</td>
<td>12.33</td>
</tr>
<tr>
<td>M10</td>
<td>1.5</td>
<td>10.00</td>
<td>8.86</td>
<td>15.00</td>
<td>14.73</td>
</tr>
</tbody>
</table>

**DOG POINTS FOR METRIC MACHINE SCREWS**

<table>
<thead>
<tr>
<th>Nominal Screw Size</th>
<th>P</th>
<th>Q</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>M6</td>
<td>4.48</td>
<td>4.38</td>
<td>5.0</td>
</tr>
<tr>
<td>M8</td>
<td>4.15</td>
<td>4.06</td>
<td>6.5</td>
</tr>
<tr>
<td>M10</td>
<td>7.32</td>
<td>7.42</td>
<td>8.0</td>
</tr>
</tbody>
</table>

*The chart is provided for dimensional reference only*
### Metric Hex Nuts

**Style 1**

<table>
<thead>
<tr>
<th>Nominal Thread Size</th>
<th>Thread Pitch</th>
<th>Minor Diameter</th>
<th>Hexagon Width</th>
<th>Length</th>
<th>Chamfer Diameter</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4</td>
<td>1.75</td>
<td>5.111</td>
<td>4.817</td>
<td>10.46</td>
<td>9.78</td>
<td>11.55</td>
</tr>
<tr>
<td>M6</td>
<td>1.25</td>
<td>6.912</td>
<td>6.447</td>
<td>13.80</td>
<td>12.77</td>
<td>15.01</td>
</tr>
<tr>
<td>M8</td>
<td>1.05</td>
<td>8.476</td>
<td>8.276</td>
<td>15.00</td>
<td>14.73</td>
<td>17.32</td>
</tr>
<tr>
<td>M10</td>
<td>0.75</td>
<td>10.461</td>
<td>10.106</td>
<td>18.00</td>
<td>17.72</td>
<td>20.66</td>
</tr>
<tr>
<td>M12</td>
<td>0.70</td>
<td>12.106</td>
<td>11.845</td>
<td>21.00</td>
<td>20.66</td>
<td>23.80</td>
</tr>
</tbody>
</table>

**Style 2**

<table>
<thead>
<tr>
<th>Nominal Thread Size</th>
<th>Thread Pitch</th>
<th>Minor Diameter</th>
<th>Hexagon Width</th>
<th>Length</th>
<th>Chamfer Diameter</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>1.75</td>
<td>5.111</td>
<td>4.817</td>
<td>10.46</td>
<td>9.78</td>
<td>11.55</td>
</tr>
<tr>
<td>M8</td>
<td>1.25</td>
<td>6.912</td>
<td>6.447</td>
<td>13.80</td>
<td>12.77</td>
<td>15.01</td>
</tr>
<tr>
<td>M10</td>
<td>1.05</td>
<td>8.476</td>
<td>8.276</td>
<td>15.00</td>
<td>14.73</td>
<td>17.32</td>
</tr>
<tr>
<td>M12</td>
<td>0.75</td>
<td>10.461</td>
<td>10.106</td>
<td>18.00</td>
<td>17.72</td>
<td>20.66</td>
</tr>
</tbody>
</table>

All dimensions are in mm.

Nov '92

The chart is provided for dimensional reference only.

---

### Retainer - Push On

**Style 1**

<table>
<thead>
<tr>
<th>Nominal Thread Size</th>
<th>Thread Pitch</th>
<th>Style</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>1</td>
<td>1</td>
<td>5.35</td>
<td>5.65</td>
<td>12.95</td>
<td>13.45</td>
</tr>
<tr>
<td>M8</td>
<td>1.25</td>
<td>1</td>
<td>7.29</td>
<td>6.90</td>
<td>16.15</td>
<td>16.65</td>
</tr>
<tr>
<td>M10</td>
<td>1.05</td>
<td>2</td>
<td>9.25</td>
<td>8.95</td>
<td>20.05</td>
<td>20.55</td>
</tr>
</tbody>
</table>

**Style 2**

<table>
<thead>
<tr>
<th>Nominal Thread Size</th>
<th>Thread Pitch</th>
<th>Style</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>1</td>
<td>1</td>
<td>5.35</td>
<td>5.65</td>
<td>12.95</td>
<td>13.45</td>
</tr>
<tr>
<td>M8</td>
<td>1.25</td>
<td>1</td>
<td>7.29</td>
<td>6.90</td>
<td>16.15</td>
<td>16.65</td>
</tr>
<tr>
<td>M10</td>
<td>1.05</td>
<td>2</td>
<td>9.25</td>
<td>8.95</td>
<td>20.05</td>
<td>20.55</td>
</tr>
</tbody>
</table>

Nov '92

The chart is provided for dimensional reference only.
Squeak and Rattle-Free Design Checklist:

1. Part does not rattle when shaken – if constrained by functionality, then the part should be hidden or relocated, and isolated using sound-deadening material.

2. Attachment brackets and adjacent parts are designed with the following considerations:
   A. Non-cantilevered
   B. Positively attached
   C. Rigid
   D. Self-aligned during assembly
   E. Clearance, or interference fit
   F. Temperature and environmental effects
   G. Surface and surrounding materials

3. For moveable parts (in longitudinal or rotational directions), the component has force preload for all degrees of freedom (including directions resulted from build variation).

4. Wiring, routing, and installation are defined in the Upfitter Integration Electrical manual.

5. Component secured tightly in a static state.

6. Component and surrounding system generate no squeak and rattle from the input of on-road tests.

General Principles:

- All wires and tubes must be secured (every 150 to 200 mm depending on stiffness) against a non-squeaky surface – pay particular attention to corner routing.

- Tray and door should have fore-aft as well as lateral preload when opened or closed.

- Large panels need more than 2 or 3 attachment and locating points.

- Adjacent part and trim need to be separated by designed clearance, isolation material, or secured together using tension (not just tension) type fasteners.

- Parts that are designed to rotate or move should be pre-loaded to prevent rattle.

- Avoid contact of parts made with similar surface materials.

- Consider the effect of temperature and load cycling fatigue on part’s tension.

- Fasten the locations must be easily accessible during installation, and guides or locating pins provided to ensure the fasteners or parts are correctly and fully seated.

(continued on next page)
Important General Principles

All wires and tubes must be secured (every 150 to 200 mm depending on stiffness) against a non-squeaky surface – pay particular attention to corner routing.

Tray and door should have fore-aft as well as lateral preload when opened or closed.

Large panels need more than 2 or 3 attachment and locating points.

Adjacent part and trim need to be separated by designed clearance, isolation material, or secured together using tension (not just tension) type fasteners.
Important General Principles (cont'd)

Parts that are designed to rotate or move should be pre-loaded to prevent rattle.

Fasteners locations must be easily accessible during installation, and guides or locating pins provided to ensure the fasteners or parts are correctly and fully seated.
Body – Appendix III – Design Principles To Eliminate Squeaks & Rattles – General Principles (cont'd)

Important General Principles (cont'd)

Avoid contact of parts made with similar surface materials.

Consider the effect of temperature and load cycling fatigue on part's tension.

Avoid contact of parts made with similar surface materials.
Instrument Panel & Dash Checklist:

- Secure wires and cables in channel or conduit.
- Place cable clip along the full length of the cable at 150mm to 200 mm intervals.
- Foam wrap connectors to prevent contact, or apply foam to area of contact.
- Insulating wire is insufficient unless it is also secured.
- Secure wire and cable to non-vibrating surfaces.
- Secure modules with robust attachment (ex: rosebud).
- Provide "dummy" connector attachments for unused connectors.
- Design clearance between windshield and IP pad leading edge should be at least 7mm with build variation considered.
- Clearance of IP pad to pillar molding should be 10mm.
- Forward edge of the IP must have 2mm design gap vertically – use standoff on the cowl as locators and for screw attachments.
- Clearance of IP pad to door trim or pillar molding should be at least 15mm.
- Clearance of IP pad to pillar garnish molding should be at least 3mm
- Trim plates should have tight tolerance to ensure clearance or interface fit.
- Swing-down (or -out) ash trays must be designed with strong spring or detent to hold them in open or closed position.
- Secure heavy loads (such as radio and HVAC controller) with pin locators, shelves or other non-cantilevered supports so that screws would only have to be used to secure them in place (vs. having the fasteners providing all the lifting force).
- Odometer set shafts, clock set shafts (and the like) must have sufficient clearance or be insulated (using rubber grommets) from the cluster face.

(continued on next page)
Instrument Panel & Dash Checklist (cont'd):

- Provide insulating material (foam or anti-itch tape) between surfaces in proximity to prevent rattling or vibration.
- Steering column panels must have large clearances to account for potential variations in steering column location.
- Avoid plastic bosses in the injection molded panel and trim plate in structural application since the plastic will creep under load.
- When two vinyl or plastic panels are required to be attached, a concealed joint line should be designed.
- Snap-in assembly should be reserved for components that are not frequently removed.
- Use spring or rubber to preload latch to prevent rattle.
- Utilize foam as an insulator or a spacer in hollow spaces to prevent oil-canning sound.
- Foam wrap wires that are intended to be long or unsecured for servicing and installation (i.e., HVAC and radio wires).
- Wire and cable emerging from a hole or conduit should be secured with tape or rubber grommet to prevent rattle inside conduit.
- Conduit must be appropriately sized so that cable does not rattle inside.
- Increase trim’s tapered corner (or decrease rib length) to prevent squak or itch.
- Trim should not function as direct loading support.
- Attachment fastener should be in a tension state with the attaching surface.
- IP subframe (if present) should be stiff and attached to the main frame to reduce trim bending and twisting.
- Instead of using snap fit to joint two plastic parts, consider machine screw fastener with U-nut or snap-in for better retention.
- Area around the IP installation roll pin and bracket must be secured and rigid to prevent itching of the pin against the bracket.
- Trims that are designed to preload against each other may lose their tension because of temperature cycling.
Secure wires and cables in channel or conduit.

Place cable clips along the length of the cable at intervals of 150mm to 200mm.

Foam wrap connectors to prevent contact, or apply foam to area of contact.
Insulating wire is insufficient unless it is also secured.

Secure wire and cable to non-vibrating surfaces.

Secure modules with robust attachments (ex: rosebuds).

Provide "dummy" connector attachment for unused connectors.

When it is uneconomical to use a dummy connector, secure loose module up to the end of the connector (already wrapped with insulation) by taping onto a non-vibrating surface.

Secure modules with robust attachments (ex: rosebuds).
• Design clearance between windshield and IP pad leading edge should be at least 7mm with build variation considered.

• Clearance of IP Pad to pillar molding should be 10mm.

• Forward edge of the IP must have 2mm design gap vertically – use standoff on the cowl as locators and for screw attachments.

• Clearance of IP pad to door trim or pillar molding should be at least 15mm.

• Clearance of IP Pad to pillar garnish molding should be at least 3mm.
Trim plates should have tight tolerance to ensure clearance or interface fit.

Swing-down (or -out) ash trays must be designed with strong spring or a detent to hold them in open or closed position.

Secure heavy loads (such as radio and HVAC controller) with pin locators, shelves or other non-cantilevered supports so that screws would only have to be used to secure them in place (vs. having the fasteners providing all the lifting force).

Odometer set shafts, clock set shafts (and the like) must have sufficient clearance or be insulated (using rubber grommets) from the cluster face.
Provide insulating material (foam or anti-itch tape) between surfaces in proximity from rattling or vibration.

Steering column panels must have large clearance to account for potential variation in steering column location.

Avoid plastic bosses in the injection molded panel and trim plate in structural application since the plastic will creep under load.

When two vinyl or plastic panels are required to be attached together – a concealed joint line should be designed.

Snap-in assembly should be reserved for components that are not frequently removed.

Use spring or rubber to preload latch to prevent rattle.
Utilize foam as an insulator or a spacer in hollow space to prevent oil canning sound.

Foam wrap wires that are intended to be long or unsecured for servicing and installation (i.e., HVAC and radio wires).

Conduit must be appropriately-sized so that cable does not rattle inside.

Wire and cable emerging from a hole or conduit should be secured with tape or rubber grommet to prevent rattle inside conduit.

Increase trim’s tapered corner (or decrease rib length) to prevent squeak or itch.

Trim should not function as direct loading support.
Attachment fastener should be in a tension state with the attaching surface.

IP subframe (if present) should be stiff and attached to the main frame to reduce trim bending and twisting.

Instead of using snap fit to join two plastic parts, consider machine screw fastener with U-nut or snap-in nut for better retention.
• Area around the IP installation roll pin and bracket must be secured and rigid to prevent itching of the pin against the bracket.

• Trims that are designed to preload against each other may lose their tension because of temperature cycling.
• Secure wires and cables in channel or conduit.
• Place cable clip along the full length of the cable at 150mm to 200 mm intervals.
• Foam wrap connectors to prevent contact, or apply foam to area of contact.
• Insulating wire is insufficient unless it is also secured.
• Secure wire and cable to non-vibrating surfaces.
• Secure modules with robust attachment (ex: rosebud).
• Clip around cable must be tight against cable housing.
• Eliminate excess cable or wire to prevent rattle.
• When using rubber, foam insulator, or snap-in plastic tabs, consider the anticipated thermal environment and degradation with time.
• Speaker wire needs to be secured – especially for loose ends.
• If possible, mount components on panel reinforcements or to crossmember to enhance rigidity and noise isolation.
• Support for speaker attachment must be rigid.
• Avoid metal clip holder for metal component – especially for snap-in parts. (The same goes for plastic clip for plastic part.)
• Electrical cable and wire should not be secured with fixed diameter clip.
• Route secured wires against metal surrounding instead of plastic to prevent itch.
• Foam wrap wires that are intended to be long or unsecured for servicing and installation (i.e., HVAC and radio wires).
• Locate vibration devices on one mount that has molded insulation and rubber backing for insulation and cost saving.
• Wire and cable emerging from a hold or conduit should be secured with tape or a rubber grommet to prevent rattle inside the conduit.
• Conduit must be appropriately-sized so that cable does not rattle inside.
• Wire should not be under tension between positive tie downs, clips, or around corners, but not loose to cause wire slapping.
• Consolidate electrical components to reduce wiring between them.
• Stagger adjacent connectors if they cannot be secured against a surface.
• When using conduit with convoluted or graded surface, isolate hard surfaces with a foam patch or other similar materials.
• Rubber clip with rosebud can serve both the functions of securing and isolating tubing – but beware of thermal degradation.
• Do not assume that plastic and mild steel can serve the function of spring to preload heavy or large components, since the tension will decrease after servicing or heavy road input.
Body – Appendix III – Electrical (cont’d)

- Metal casing will buzz during high frequency road input if it is not attached positively using a non-cantilever type bracket.
- Avoid metal clip holder for metal component – especially for snap-in parts. (The same goes for plastic clip for plastic part.)

Secure wire and cables in channel or conduit.

Place cable clip along the full length of the cable at every 150mm to 200mm intervals.

Foam wrap connectors to prevent contact, or apply foam to area of contact.

(continued on next page)
Insulating wire is insufficient unless it is also secured.

Secure wire and cable to non-vibrating surfaces.

Secure modules with robust attachment (ex: rosebud).

Clip around cable must be tight against cable housing.

Eliminate excess cable or wire to prevent rattle.

(continued on next page)
When using rubber, foam insulator, or snap-in plastic tabs, consider the anticipated thermal environment and degradation with time.

If possible, mount components on panel reinforcements or crossmembers to enhance rigidity and noise isolation.

Avoid metal clip holder for metal component – especially for snap-in parts. (The same goes for plastic clip for plastic part.)

Support for speaker attachment must be rigid.

Avoid metal clip holder for metal component – especially for snap-in parts. (The same goes for plastic clip for plastic part.)
Electrical cable and wire should not be secured with fixed diameter clip. Route secured wires against metal surrounding instead of plastic to prevent itch. When using conduit with convoluted or graded surface, isolate hard surfaces with a foam patch or other similar material.

Stagger adjacent connectors if they cannot be secured against a surface. Rubber clip with rosebud can serve both the functions of securing and isolating tubing—but beware of thermal degradation.
• Locator tab must be short and strong so they will not break off during assembly.
• Look out for molding rattle against weld flange, body panels or against each other.
• Large trim panel requires more locator tabs and securing points for securing because of low stiffness. Or else, use foam insulation to preload panel.
• Trim should be separated by space (at least 2.5mm) or by fasteners.
• Overlapping trim piece should use foam or fastener for insulation.
• All convenience equipment (such as ash trays, storage bucket, etc.) should be attached and secured from rattling.
• Utilize stand-off ribs to create pre-load or clearance between surfaces.
• Vinyl and leather trim should not rub against other components.
• Pre-load trim around manual window crank to prevent rattling of crank.
• All trim pieces should have good clearance from door trims and window glass (at least 5mm).
• Clearance of A-pillar molding to windshield should be 5mm.
• Headliner must be secured and have sufficient gap (5mm) from windshield to prevent itching, vibration, and rattling.
• Fasteners must be stronger than the thread to prevent threading.
• Provide preload to interfacing parts to prevent potential vibrations.
• Support for speaker attachment must be rigid.

• Use foam to separate surfaces that are in close proximity.
• Speaker grill and the attachment area must be rigid to accommodate for more powerful and heavy speakers.
• Trim plates should have tight tolerances to ensure clearance or interface fit.
• Provide insulating material (foam or anti-itch tape) between surfaces in proximity from rattling or vibration.
• Avoid plastic bosses in the injection molded panel and trim plate in structural application since the plastic will creep under load.
• When two vinyl or plastic panels are required to be attached together – a concealed joint line should be designed.
• Snap-in assembly should only be used for components that are not frequently removed in order to preserve the designed tightness.
• Increase trim's tapered corner (for decreased rib length) to prevent squeak or itch.
• Trim should not function as direct loading support.
• Attachment fastener should be in a tension state with the attaching surface.
• Trim that are designed to preload against each other may lose its tension because of temperature cycling.
• Design with common parts, common method and specification for assembly.
• Beware of trim’s rib locations relative to parts in near proximity.
• Locate retractor behind trim (with good separation) and away from the ears location if possible for better sound insulation.
All convenience equipment (such as ash trays, storage bucket, etc.) should be attached and secured from rattling.

Utilize stand-off ribs to create pre-load or clearance between surfaces.

Vinyl and leather trim should not rub against other components.

Pre-load trim around manual window crank to prevent rattling of crank.

All trim pieces should have good clearance from door trims and window glass (at least 5mm).

Headliner must be secured and have sufficient gap (5mm) from windshield to prevent itching, vibration, and rattling.
Locators and fasteners must be designed to reduce build and user variations for secure fit and retention.

Use foam to separate surfaces that are in close proximity.

Speaker grill and the attachment area must be rigid to accommodate for more powerful and heavy speakers.

Trim plates should have tight tolerances to ensure clearance or interface fit.

Provide insulating material (foam or anti-itch tape) between surfaces in proximity from rattling or vibration.

Avoid plastic bosses in the injection molded panel and trim plate in structural application since the plastic will creep under load.

(continued on next page)
Body – Appendix III – Body & Exterior Trim

- Reduce or avoid metal maintenance access panel because of the possible loss, loose or missing screws during assembly.
- Component should not be mounted in the center of large panels that have low structural stiffness.
- Component should be mounted to flanges, at corners, ribs or beads – but need to consider fatigue from stress concentration and component contact.
- Utilize foam as an insulator or a spacer in hollow space to prevent oil canning sound.
- Instead of snap fit to join two plastic parts, consider machine screw fastener with U-nut or snap-in for better retention.

- Most of rattling can be eliminated if the vehicle body or the mounting bracket is stiff against bending and twisting.
- Avoid multiple and overlapping trim pieces due to itch and difficult alignment.
- Window moldings and external trims must be made of materials that will not itch when rubbed against body surfaces (check by rubbing sample against painted panel).
Reduce or avoid metal maintenance access panel because of the possible loss, loose or missing screws during assembly.

Component should not be mounted in the center of large panels that have low structural stiffness.

Component should be mounted to flanges, at corners, ribs or beads – but need to consider fatigue from stress concentration and component contact.

Utilize foam as an insulator or a spacer in hollow space to prevent oil canning sound.

(continued on next page)
Many kinds of rattling can be eliminated if the vehicle body or the mounting bracket is stiff against bending and twisting.

Instead of snap fit to join two plastic parts, consider machine screw fastener with U-nut or snap-in for better retention.

Avoid multiple and overlapping trim pieces due to itch and difficult alignment.

Window moldings and external trims must be made of materials that will not itch when rubbed against body surfaces (check by rubbing sample against painted panel).
Body – Appendix III – Seat and Seat Belt

- Provide preload to interfacing parts to prevent potential vibrations.
- Seat belt trim piece must be secured and not rub against other trim piece or with weather strips.
- Seat mechanism should have good clearance with the seat bottom suspension wires when the seat is occupied.
- Use rubber stop, spring, or seat material to load down latch both in the seat-up and seat-down position.
- Vinyl and leather should not rub against other components or trim.
- Use softer material for retractor and buckle housing.

- There should be minimal movement of latch plane inside the buckle.
- For component that has one attachment point, anti-rotation provision must be designed in.
- When seat belts are not in use, the latch should only be close to sound-deadening type material (ex: carpet) and not rest near hard trim surfaces.
- For removeable seating arrangement, there must be provision for storing the latch plane (of overhead retractor, etc.)
Provide preload to interfacing parts to prevent potential vibrations.

Seat belt trim piece must be secured and not rub against other trim piece or with weather strips.

Seat mechanism should have good clearance when the seat is occupied.
Use rubber stop, spring, or seat material to load down latch both in the seat-up and the seat-down position.

Vinyl and leather should not rub against other components or trim.

Use softer material for retractor and buckle housing.

There should be minimal movement of latch plane inside the buckle.

For component that has one attachment point, anti-rotation provision must be designed in.
When seat belts are not in use, the latch should only be close to sound-deadening type material (ex: carpet) and not rest near hard trim surfaces.

For removeable seating arrangement, there must be provision for storing the latch plate (of overhead retractor, etc.)