Automotive Foams

Textbook

I-CAR®

Version: 7.3

FOM01-STMAN1-E

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Contents

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Introduction

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Obligations To The Customer And Liability

The collision repair industry has an obligation to correctly repair the customer's vehicle. Collision repairs must be performed using:

- recommended or tested procedures from vehicle makers, I-CAR, and other research and testing organizations.
- quality replacement parts and materials.
- repair processes and parts as written and agreed upon in the repair order. If items on the repair agreement are not consistent with the repair order, it can be considered fraud.

Performing proper collision repairs requires using parts and procedures that keep remaining warranties intact.

Collision repairs must restore:

- safety.
- structural integrity.
- durability.
- performance.
- fit.
- finish.

Throughout the damage analysis and repair process the repairer and insurer must:

- communicate with each other.
- maintain constant communication with the customer.
- be in agreement with each other and the customer on how repairs will be performed.
- inform the customer of any changes in the repair plan from the original repair agreement, and explain the changes and why they have to be made.

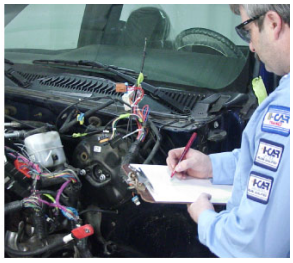
To reduce liability:

- make sure that all repairs are performed thoroughly, correctly and as listed in the damage report.
- follow proper procedures.
- have documentation of required repairs with detailed record keeping available for customers.

Technicians are considered the experts and are expected to be knowledgeable on how to perform a quality repair.

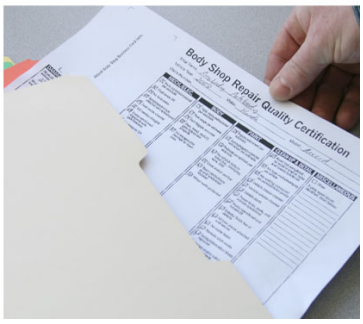
Liability insurance that covers the repair facility may not always cover all damages. For example:

- the policy may not cover faulty repairs, leaving liability responsibility completely on the facility.
- a shop owner may find that repair facility liability coverage may not cover the full amount awarded in a lawsuit. The shop owner would have to pay the difference.



It is difficult to reduce the risk of liability exposure. The part that the repairer can control is the chance of being found at fault. Chances can be minimized by:

- using recommended or tested procedures from the vehicle makers, I CAR, or other research and testing organizations.
- using quality replacement parts and materials that restore fit, finish, durability, and perform at least as well as the original.
- keeping thorough records.



Keeping thorough records includes more than recording the date, mileage, and pre-existing damage. Record keeping also includes:

- making sure all notes are legible.
- verifying the repairs that were made or not made.
- having the customer sign a waiver for repairs that they do not want performed. Repairers must determine their liability on not repairing safety systems such as restraint and anti-lock brake systems.
- keeping computer printouts or worksheets on file showing wheel alignment readings or vehicle dimensions before and after repairs.
- keeping scan tool printouts and records of computer codes for airbag, anti-lock brake, emission, and powertrain control module (PCM) systems.

- attaching the OEM or other tested procedure printout to the vehicle repair order.
- keeping receipts for all sublet work performed.

Refer to "Video: Topics Off Limits" in the presentation. This video identifies topics that should not be brought up in class.

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Module 1 - Overview Of Automotive Foams

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Foam Uses

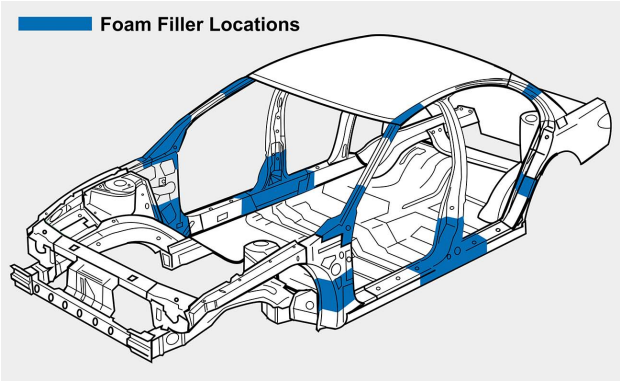
Learning objectives for this module include:

- explaining why foam is used in vehicles.
- identifying where foam may be located.
- identifying the different types of foam used in vehicles.
- explaining the uses of each type of foam.

Foam can be used to reduce noise, vibration and harshness caused by road conditions.

Foam is used in vehicles to:

- reduce noise, vibration and harshness (NVH). NVH may be caused by vehicle design, texture of the driving surface, or air passing along the vehicle.
- repair water leaks.
- stiffen the body structure and help control twisting and flexing of the vehicle.
- provide collision energy management.
- provide additional crash protection for occupant safety.



There are no standard locations where foam is used on a vehicle.

Foam may be located virtually anywhere on a vehicle. Some of the more common locations include:

- A-, B-, C-, and D-pillars.
- rocker panels and roof rails.
- frames and rails.
- crossmembers.
- between the roof skin and roof bows.
- between the door skin and intrusion beams.
- quarter panels.

Different types of foam may be used in a single location on a vehicle.

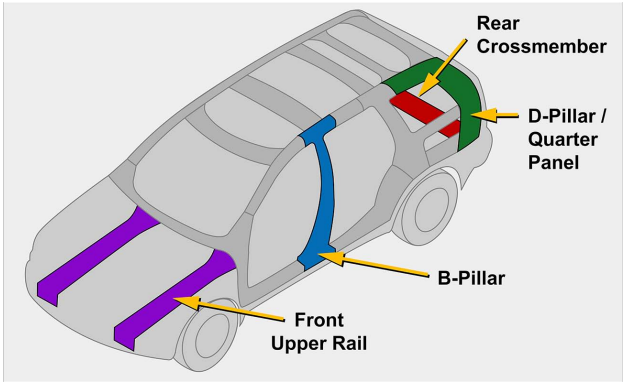
Vehicle Protection

NVH foam is combustible and will begin to melt and produce toxic fumes when heated excessively.

Expandable foam is used to block and absorb sound waves from entering the cabin of a vehicle. Typically, the softer the foam, the better it absorbs sound. Foam is also used to fill and seal cavities to reduce wind noise, and to hold panels in place to prevent flutter or vibration.

Foam is used between an intrusion beam and door skin (left). Foam is used between outer and inner rocker panel assemblies (right).

Expandable foam that is used for NVH control is commonly located at multiple areas within a vehicle chassis. Areas where the vehicle maker installed foam should be noted during repair so the correct locations receive the proper amount of replacement foam. These foam installation locations are critical for controlling noise. NVH foam is not designed to affect the structural integrity of a vehicle.



Structural foam may be found in various body locations.

Structural foam has limited applications. Structural foam is used for collision energy management and is very dense. The location where structural foam is used varies depending on the needs of the vehicle makers. Common structural foam locations include:

- rails.
- pillars.
- full-frame torque box areas.

Replacement parts typically have the structural foam already installed. Product makers have largely discontinued making structural foam for the repair industry. Technicians need to verify repair procedures for the specific vehicle maker regarding structural foam replacement.

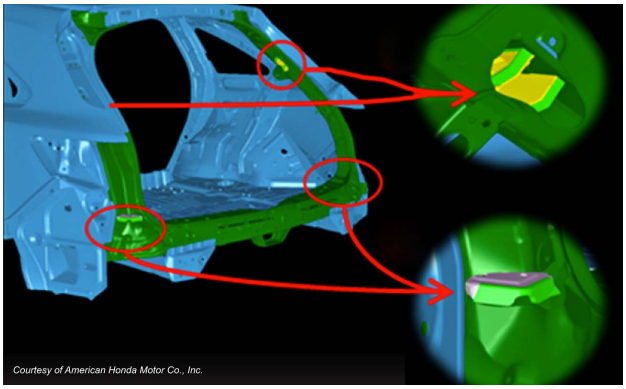
2014 Acura MDX

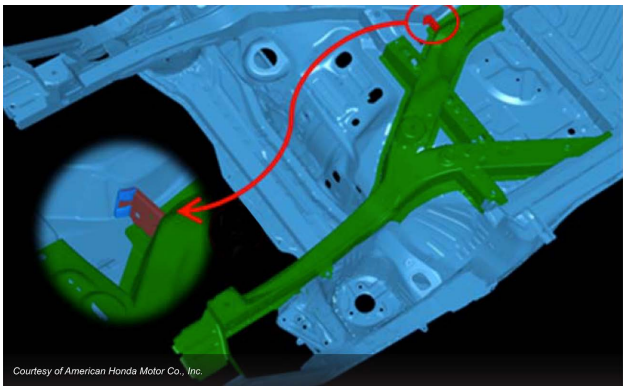
The 2014 Acura MDX uses structural foam and includes either the replacement material with the service part or includes the foam in the part.

Structural foam is used to add rigidity and strength to the upper or lower areas of the vehicle. This limits the amount of twisting and flexing of an area, which helps control cracking and other damage from work hardening. This can also change the way a vehicle will perform in a collision.

2014 Acura MDX

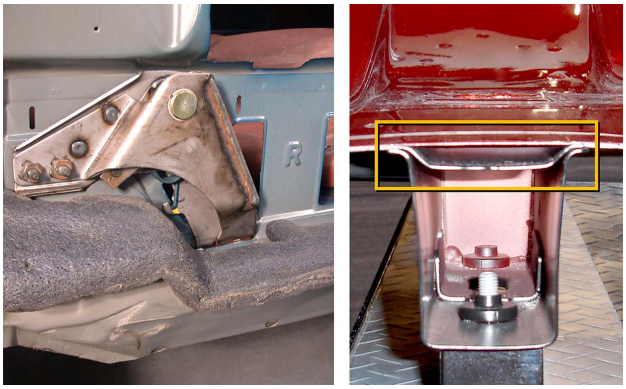
Acura MDX uses structural foam in bulkheads, the rear crossmember, and center frames.





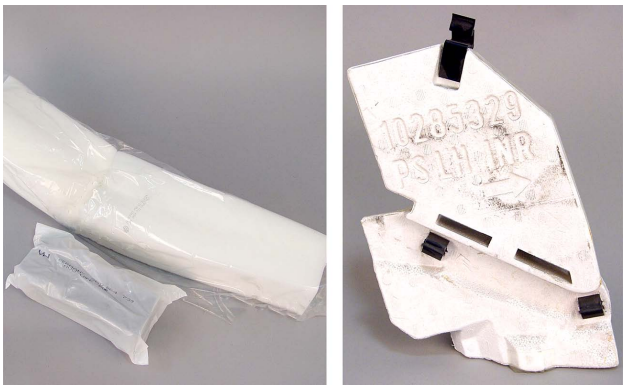
Structural foam can change the characteristics of a vehicle. Structural foam:

- increases strength and adds less weight than if additional steel were used.
- is typically used between engineering changes. With the use of structural foam, there is minimal disruption to the assembly process.
- is a highly dense material.
- has minimal expansion.
- may be included in the replacement part or the material is provided by the vehicle maker.



This type of foam is used for noise control (left). This type of foam is used to add strength to structural parts (right).

When comparing structural foam to NVH foam, NVH foam absorbs sound but it is not designed to provide crash protection. Structural foam is not designed for sound control, but provides crash protection.



These foam blocks are the type typically used inside a door assembly.

Some vehicle makers use pre-shaped foam blocks. These blocks are typically:

- soft, compressible blocks that are stuffed into various locations for sound control. If a soft foam block is used, it is typically enclosed in a plastic bag to reduce the absorption of moisture.
- energy absorbing blocks that are used in doors for crash protection.
- replaced when found to be damaged.

Some vehicle makers allow repairs on energy absorbers, while others recommend replacing with new because it is more cost effective.

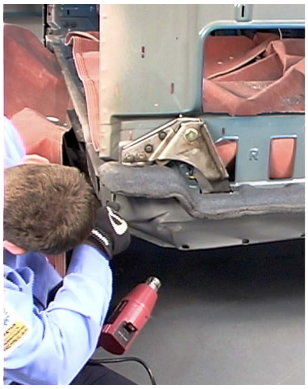
Solid foam blocks are used to absorb collision energy. These blocks may be found in door shells or behind bumper covers.

Vehicle makers typically provide foam blocks and energy absorbers as a service parts, rather than providing a repair procedure.

Damaged foam should be replaced.

A few years ago, General Motors updated a previous bulletin (63-20-02) regarding the repair of damaged foam energy absorbers using hot-melt glue. The current bulletin (07-08-63-001) states, “Because the energy absorbers are relatively low in cost to replace, it is now more cost efficient to replace the energy absorbers whenever they are damaged.”

Vehicle Maker Application and Curing Methods



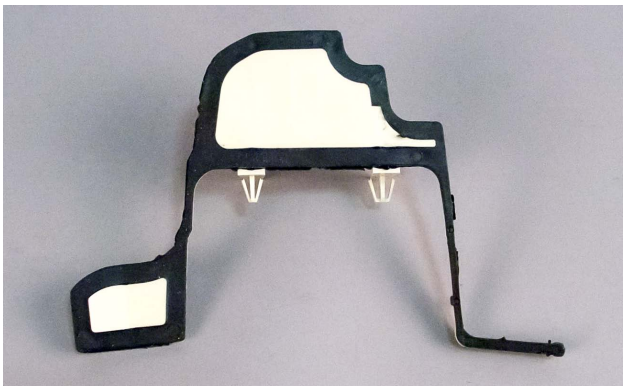
This is vehicle maker installed foam (left). This is an example of a dam used to restrict where the foam is located in a vehicle (right).

During vehicle assembly, foam may be installed in different ways. These include:

- drop-in, heat-activated material.
- two-part expandable foam that is pumped into locations and expands and cures by a chemical reaction. Two-part materials may be held in place by dams.

Some door-mounted energy absorbers are set-in position parts.

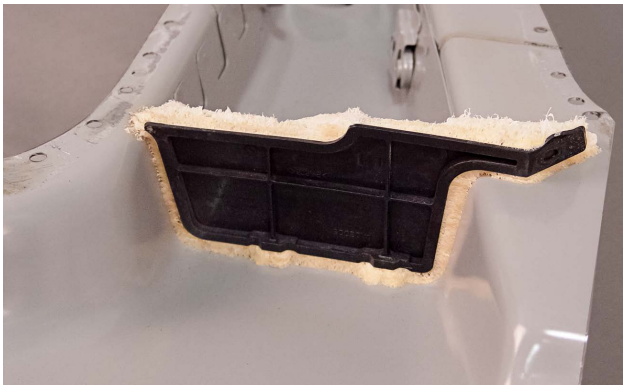
Set-in position foam consists of two types. The first type is a solid material that is set into position and clipped or bolted to the door shell assembly. The other type of set-in position foam is flexible foam block. These blocks are typically encased in a plastic bag so they do not absorb water. Depending on the vehicle maker's design, these blocks may be located anywhere on the vehicle. Flexible foam parts may also be called stuffers.



Heat-activated foam may be applied to service parts that are used as dams.

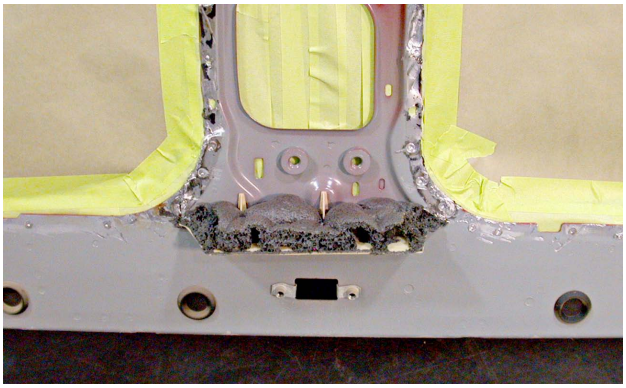
Heat-activated foams look like a putty-type material that expands during the E-coat baking cycle which is typically 425°F. Depending on the type of foam material used, this expansion may occur at temperatures between 100 - 300°F.

When installed, these materials may be placed between reinforcements and outer panels.



Reuse foam carriers for dams when possible.

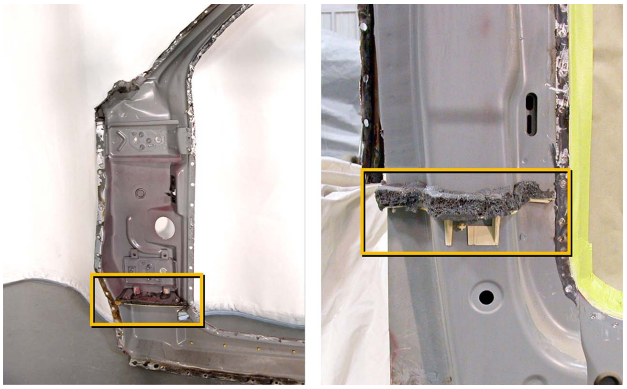
Heat-activated foam may be held in place by parts called carriers. These carriers may be snapped into adjacent panels where it would be difficult to access later in the vehicle assembly process. Depending on the vehicle maker, application, and material used, the expansion of heat-activated foam may be as much as 10 times its original size. Whenever possible, retain the carriers to reuse as dams when applying two-part expandable foam.



This foam carrier is being left in place for reuse.

Heat-activated foam is used for a variety of reasons. Some of these reasons include:

- delayed activation. With heat-activated foam, there is no foam time to worry about because it will not expand until it is activated by heat. Foam time or work time is how long it takes for the foam to begin expanding and curing.
- precise placement. Without having to worry about foam time, these materials can be placed exactly where they are required.
- control over the amount of material being used.
- the ability to install the material at different points during the chassis assembly process.



This is an example of factory applied two-part material behind the hinge pillar.

Heat-activated foam is only used during new vehicle assembly because a repair facility is not able to safely reach foam activation temperatures in a spraybooth. Trying to reach these temperatures may damage parts of the vehicle and jeopardize the safety of people in the surrounding area of the repair facility.

This is an example of factory applied two-part material behind the hinge pillar.

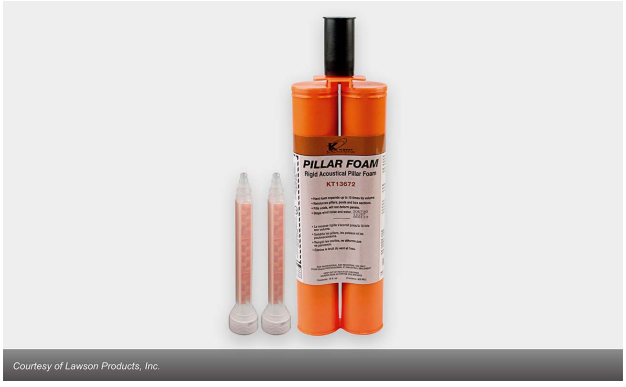
Chemical-cure foams used during the vehicle assembly process:

- are two-part materials that mix together as they are dispensed.
- do not commonly require heat to cure.
- change state and expand while curing.
- fill voids for NVH control and structural enhancement.

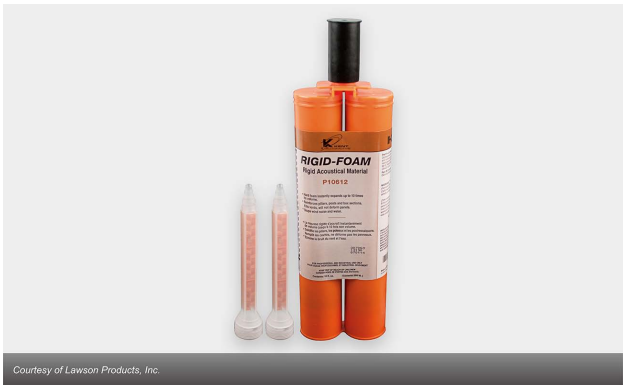
3Ms pillar foam.

Fusor 130 rigid foam.

IES Inter-Foam 10 rigid urethane foam.



Kent Automotive rigid pillar foam.



Kent Automotive rigid material.

Fusor 121 flexible foam.

3M flexible foam.

IES Inter-Foam 5 flexible urethane foam.

Crest Flexi-Foam urethane foam.

Kent Automotive Ure-Foam flexible urethane foam.

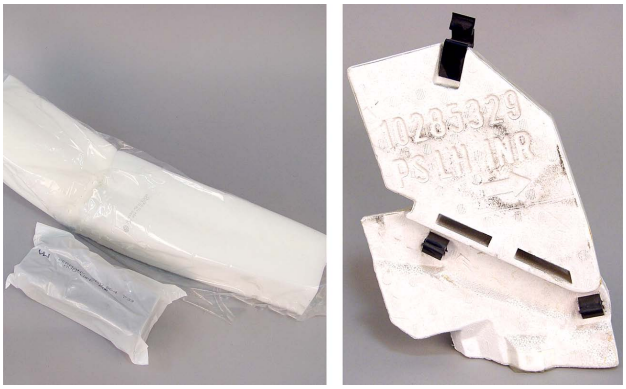
Kent Automotive Ure-Foam flexible foam in smaller cartridge.

SEM flexible urethane foam.

SEM Panel Viration Control Material.

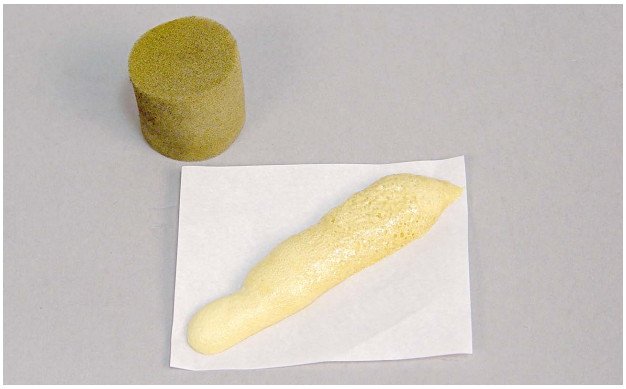
Foams used by vehicle makers during the assembly process:

- are epoxy-based if the foam is a structural material.
- are typically urethane if the foam is an NVH material.
- may not be identifiable as to whether the material is an epoxy or urethane.
- are closed cell. Closed cell materials are waterproof. Two-part expandable foam is closed cell until it is torn or cut.



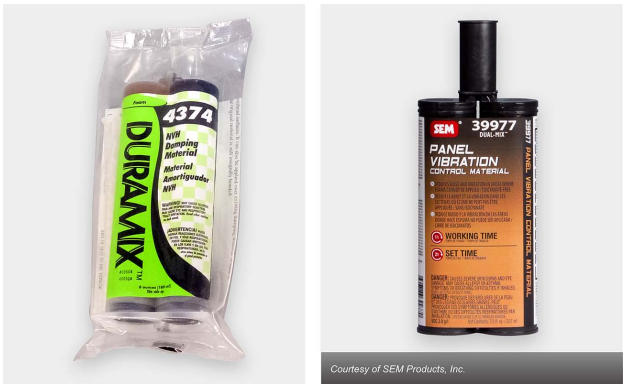
These are example of set-in soft parts

This is an example of replaceable hard parts.



This shows a vehicle maker replacement material (top) and a two-part replacement material (bottom).

These are examples of rigid foam products.



These are examples of sound dampening material products.

These are examples of NVH foam products.

These are examples of NVH foam products.

When using vehicle maker replacement materials, these materials may be:

- set-in position soft parts such as pre-cut foam.
- replaceable hard parts such as filler blocks where two-part foam is installed.
- a two-part material, either epoxy or urethane that cures by a chemical reaction.
- retained in position by dams. Dams are used to contain foam in specific locations.

Service parts may have structural foam already installed.

At least one vehicle maker uses a service part that reduces the amount of foam required to fill a location.

Module Wrap Up

Topics discussed in this module included:

- why foam is used in vehicles.
- where foam may be located.
- different types of foam used in a vehicle.
- uses of each type of foam.

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Module 2 - Automotive Replacement Foam Types

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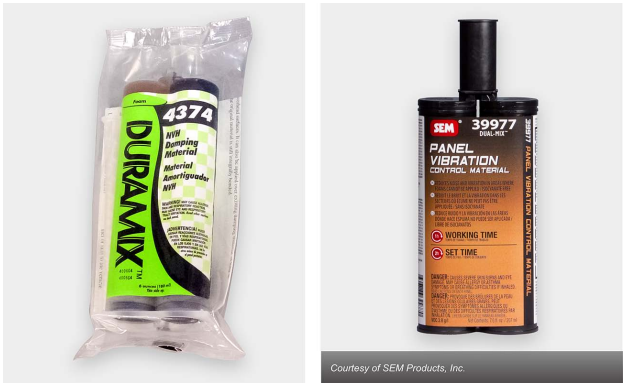
Collision Repair Foam Materials

Learning objectives for this module include:

- identifying the differences between various foam types available for collision repairs.
- describing the uses for sound dampening material.
- explaining the difference between flexible and rigid foam.

These are examples of urethane-based rigid foam products.



These are examples of urethane-based sound dampening foam products.

These are example of urethane-based NVH foam products.

These are example of urethane-based NVH foam products.

The chemistry of foam used for collision repair is similar to the material chemistry used by vehicle makers. These include:

- urethane-based foam. If a urethane-based material is opened and resealed, the shelf life of the material will be shorter than unopened material.
- closed cell.

Some product makers list the product chemistry on the material label.

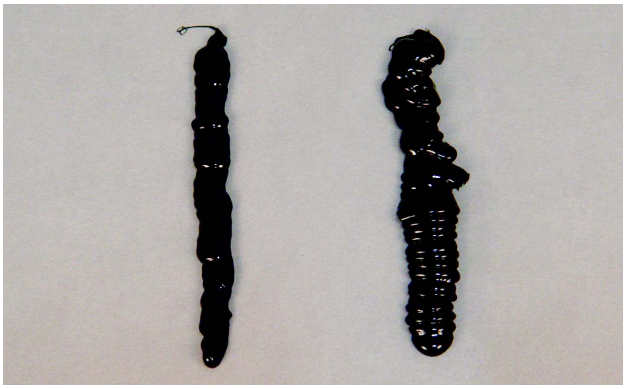
Two-part foam is designed to flow to a location and then expand. Each product maker has different flow rates and expansion times.

Collision repair foams are typically flow-grade, two-part materials that are dispensed and allowed to flow into a location where they expand and cure.

Non-Expanding NVH Material

Small areas on a vehicle can be filled using sound dampening material.

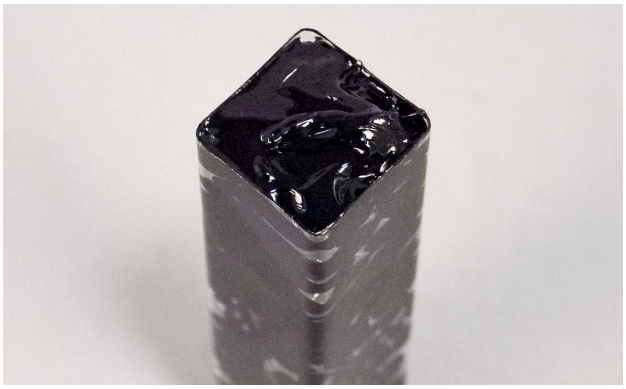
Two product maker examples of NVH foam.



Dispensed NVH foam showing no expansion.

Sound dampening material:

- does not expand like a two-part foam. Although commonly called foam, sound dampening material is more like a sealant and low-grade adhesive for use between parts.
- can be used as an adhesive to attach existing NVH foam to replacement panels.
- is designed to be applied to small gaps.
- has little or no expansion.
- has a longer work time than traditional two-part expanding foam.



Due to the material's viscosity, air pockets may be created when filling areas with sound dampening material.

Sound dampening material:

- is usually black.
- looks like windshield urethane because it is usually the same color and has no visible cell structure.
- has a smooth surface texture when dispensed.
- has limited compression.
- is flexible.

Though similar in appearance, mixing tips from different products should not be interchanged.

Sound dampening material:

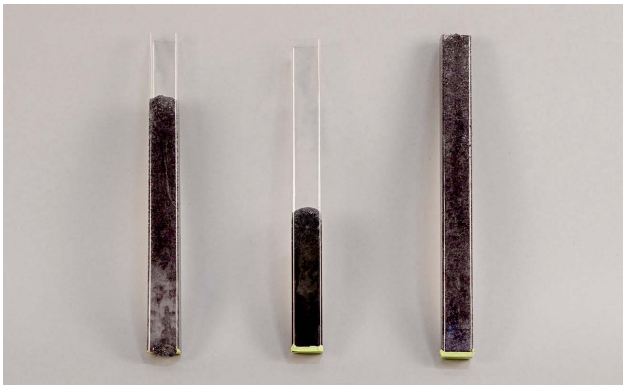
- may require a special mixing tip.
- is not designed to be used in applications where cavities require filling.

Apply sound dampening material to cut or damaged foam to seal the cells.

Sound dampening material may be used:

- to reattach original foam that is being reinstalled. Some of these applications include reattaching the foam between a door skin and an intrusion beam, or roof skin and roof bows.
- between the quarter panel and the fuel-fill pocket.
- to fill small gaps, up to 1/2".

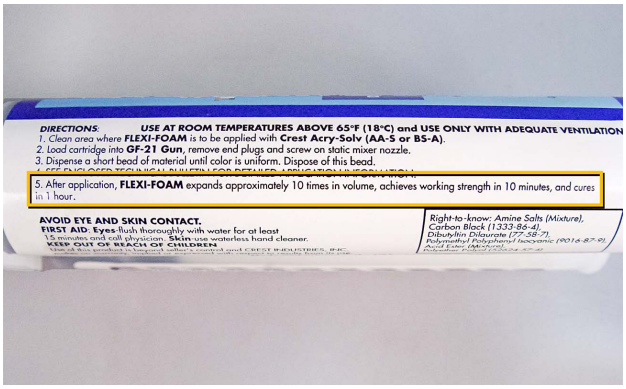
Flexible NVH Foam



Foam reacts differently depending on temperature.

Flexible NVH foam is:

- low strength, with a high compression rate.
- extremely flexible, and does not permanently deform when compressed.
- able to expand up to 10 times its liquid volume. Expansion rate is dependent on temperature.



Characteristics of foam are specific to each product maker.

Flexible NVH foam:

- is combustible. Care must be taken when repairing with foam.
- is typically urethane based.
- has a short foam time. This time may range from a few seconds up to about 20 seconds.
- has no structural enhancement capabilities.
- is commonly referred to as anti-flutter foam.
- has a visible cell structure.

Flexible foam can be used to fill an area to help absorb and control sound.

Other uses for flexible foam include controlling panel flutter, absorbing and controlling sound, and blocking air movement. Another use for flexible foam includes filling large voids.

Product makers may list unique uses for their material.

Some uses for flexible foam include sealing out dust and repairing water leaks. Flexible foam can be used for repairing water leaks because the material does not absorb water and seals tight to the surrounding area.

2015 Ford F-150

NVH foam location varies for each vehicle maker.

Some locations where flexible foam may be found include:

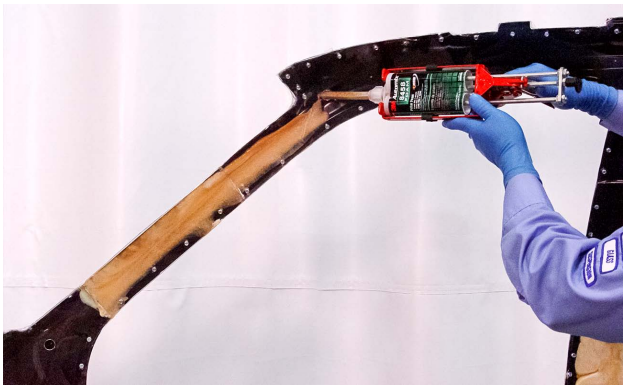
- where the roof skin attaches to the crossbeams and where it attaches to the roof side rails.
- between the door skin and the intrusion beam.
- inside any of the pillars.
- behind the quarter panels at the:
  - fuel fill pockets.
  - wheelhouse and quarter panel.
  - dog legs of the C- or D-pillar.
  - rear body panel-to-quarter panel joint.
  - door striker inner plate area.
- inside rocker panels.
- inside upper rails.

Rigid NVH Foam

A viewable cross-section may be helpful when choosing a replacement material.

Rigid NVH foam:

- is packaged under many different names. These names include semi-rigid, pillar, and rigid foam. Rigid foams are urethane based.
- is more rigid than flexible foam.
- minimal flexibility.
- will permanently deform when compressed.
- has a limited compression rate before it permanently deforms.



Some foams can flow an extended distance before expanding.

Rigid NVH foam:

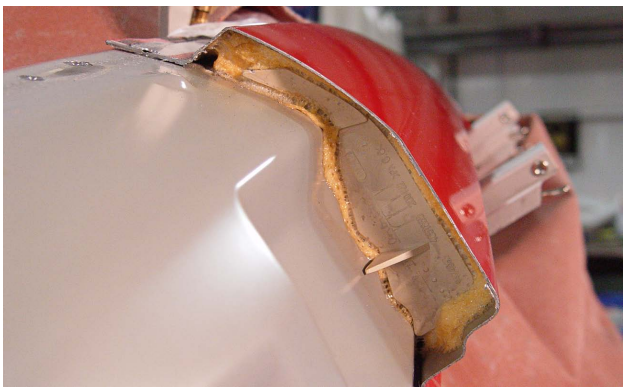
- such as pillar foam, has an extended foam time. This allows pillar foam to flow down into the parts before expanding.
- may expand up to 10 times its non-expanded volume.
- provides limited chassis reinforcement.
- typically has a visible cell structure.

Rigid NVH foam absorbs sound, blocks air, and helps control body panel movement.

Rigid NVH foam is commonly used for:

- NVH control, such as absorbing sound, blocking air, and helping control movement of body parts and panels.
- cushioning adjacent parts. An example of this type of application is using this product between the inner and outer B-pillar on the 2005 Volvo S40. This material limits sound and, because of close its proximity, eliminates the two parts from rattling against each other.

Rigid foam must NEVER be considered a replacement material for structural foam.



Rigid foam in this roof rail absorbs sound and controls movement.

Though not used for structural enhancement or to change crash characteristics, rigid foam may be used to stiffen the vehicle structure to minimize twisting and flexing.

2014 Dodge Dart

Rigid foam, like flexible foam, may be used anywhere on a vehicle.

Common locations where rigid foam may be found includes:

- pillars.
- rocker panels.
- dog legs.
- quarter panels.
- rails.
- roof bows.

One-Part Foam

Exposed consumer foam looks like two-part foam, but in airtight areas the material does not expand and creates voids in the material.

Consumer foam should not be used for any automotive applications. Consumer foams are a one-part material and require moisture to cure. The aerosol, one-part urethane cures by absorbing moisture from the air and can continue to absorb water. In an enclosed area, such as inside a body panel, it may never cure completely. This may cause corrosion problems, inadequate filling on an area, and inadequate NVH control. This means that if a one-part material is injected into a part and there is no moisture to help it cure, the material will dissolve and create hollow spots. Another negative characteristic of consumer foams is its open cell structure, meaning it will absorb water.

Module Wrap Up

Topics discussed in this module included:

- differences between various foam types supplied by the aftermarket industry.
- uses for sound dampening material.
- the difference between flexible and rigid foam.

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Module 3 - Foam Safety And Repair

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Safety When Working With Foam

Learning objectives for this module include:

- identifying the proper safety equipment that should be worn when working with foam.
- explaining safety considerations when working around foam with heat.
- identifying foam that is installed by the vehicle maker.
- comparing vehicle maker foam to replacement foam samples.
- making foam samples for comparison.

Chemical resistant gloves protect skin from irritation, a paint suit will protect clothing, eye protection will protect eyes from splashing material, and a respirator protects the lungs from harmful vapors.

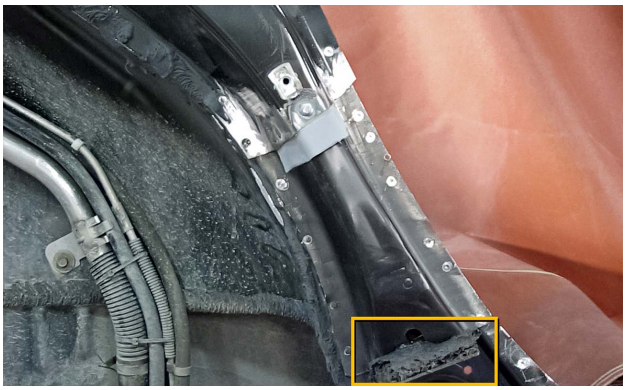
The SDS gives specific information for each product covered.

Personal protection begins with the proper safety equipment.

When working with expandable foam, specific safety equipment that should be used includes:

- a respirator. From the time foam is dispensed until it expands and is cured, there are chemicals released which are harmful. Choose a respirator that is designed to filter out fumes from uncured foam. When working with two-part expandable foams, an organic vapor respirator should be worn. This respirator is color-coded with a black filter cartridge.
- chemical resistant gloves. Chemical resistant gloves protect

bare skin from contacting the foam. Unprotected skin contact with foam can cause irritation or burns.
- paint suit. A paint suit protects clothing from uncured foam.
- a fire extinguisher. When doing repairs that require heating near foam, keep a fire extinguisher nearby. Because foam is a chemical-based product, a class B fire extinguisher should be used.
- safety goggles, glasses, or a face shield.
- SDS. The SDS will provide product maker specifics on the makeup of the foam.
- technical data sheet. The technical data sheet sheet provides the proper installation instructions to protect the technican when handling the foam.



Always be aware of foam locations on a vehicle.

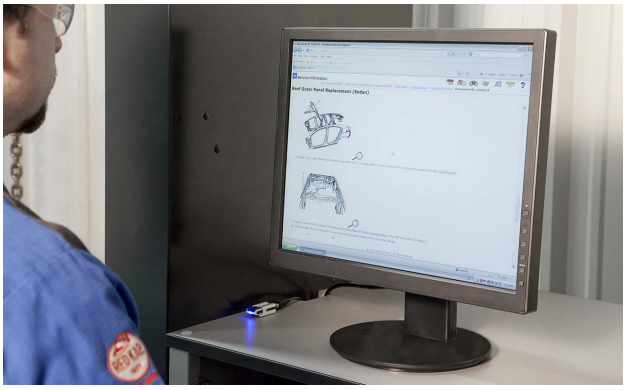
When working near areas on a vehicle that may have foam:

- know where the foam is located. This information may be identified in a body repair manual or other repair information provided by the vehicle maker.
- do not heat with an open flame. Foam is combustible and will burn. If the foam begins to smolder or burn, the fumes are toxic, and smoke or fire damage may occur to the vehicle or part being worked on.

Burning foam will release harmful chemicals.

Do not weld near foam filler. Foam should be removed from areas near the weld zone. Foam has a high flammability risk. When cured foam begins to burn or melt, it generates toxic chemicals, including carbon monoxide and cyanide gas. Foam inside a part will not melt when cut with a saw. A heat gun should be used for releasing foam from a part.

Identifying Vehicle Maker Foam

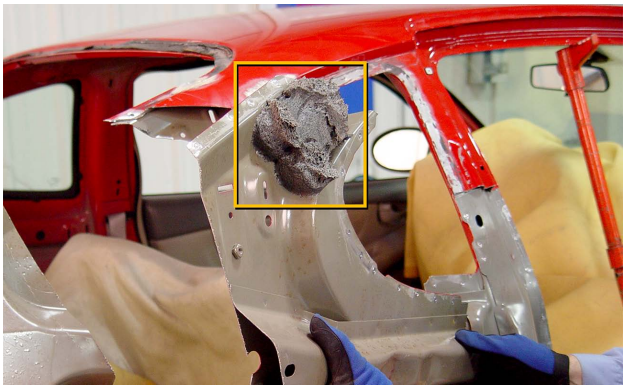


Some vehicle makers will specifically refer to which replacement material should be used.

Vehicle makers may identify the location and type of foam used in a vehicle. This information may be located:

- in specific vehicle repair information, such as body repair manuals or service manuals.
- in a technical service bulletin (TSB).
- online within vehicle maker service information.
- by calling the vehicle maker's technical information hotline.

Determining foam type from vehicle maker information may not be possible. There may be situations where the type of foam and its use is not identified.



Leave vehicle maker foam in place for physical property assessment.

Some ways of identifying foam that has been installed by the vehicle maker include:

- visually inspecting the material cell structure.
- identifying the material. This includes identifying the texture, brittleness, and compression resistance of the foam.

This cutaway reveals vehicle maker flexible foam that shows the open cell structure.

When identifying a vehicle maker's flexible foam, it will:

- be soft, easily torn, and easy to compress without permanent deformation.
- have a visible cell structure when torn. Flexible foams typically have a visible cell structure.

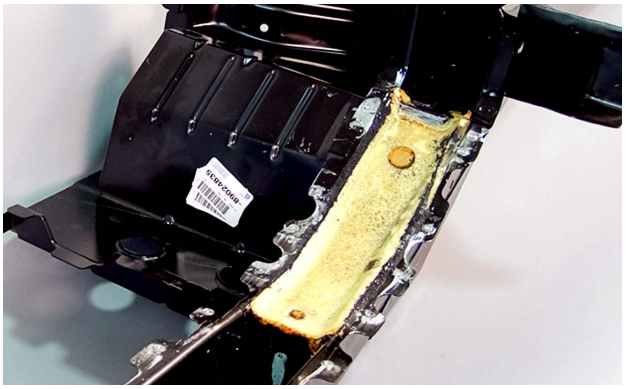
When reusing foam, use a heat gun to minimize the damage when removing the foam.

This A-pillar is filled with rigid-type foam.

When identifying a vehicle maker's rigid foam, it will:

- be hard and brittle, and will break or crack when flexed.
- not re-close where it was pierced. When pierced, it will permanently deform.
- have a visible cell structure when cut or broken.
- permit a limited amount of compression. Compared to flexible foam, rigid foam has an increased compression resistance.

This cutaway of structural foam shows no cell structure and is a hard and brittle foam that does not compress.



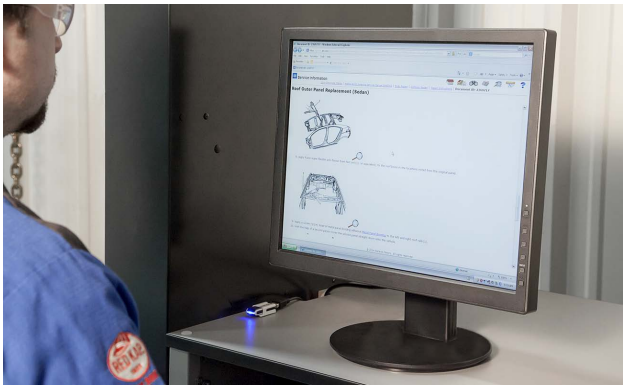
This is a service part with structural foam.

When identifying a vehicle maker's structural foam, it may:

- be a high-density material. Depending on the vehicle maker and the type of material used, there may be no visible cell structure. Gray structural foam is a solid and hard plastic-like material. The orange structural foam has a small cell structure, and is not quite as solid as the gray material.
- be hard and brittle. Structural foam is a material that is brittle. It will break, but depending on the material, cannot be pierced.

- have no compression without breaking. Structural foam has the greatest compression resistance when compared to flexible or rigid foam.

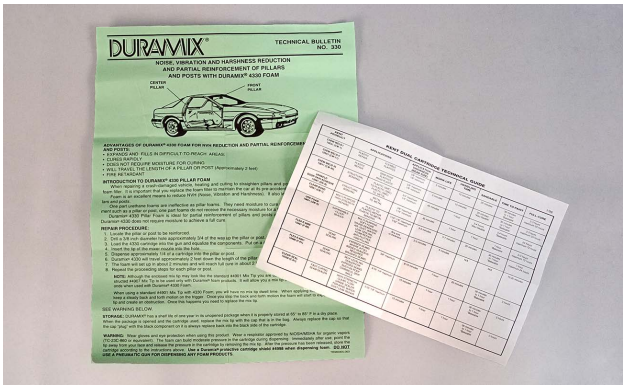
Determining Replacement Materials



This technician is verifying the vehicle maker recommendations.

When determining which replacement material to use, the vehicle maker may have recommendations. If these recommendations exist, they may be:

- listed in the vehicle maker service manual. Service procedures or parts may call for a specific foam to be used.
- listed in a TSB.
- available on the vehicle maker's website
- available from information listed in the parts ordering system.



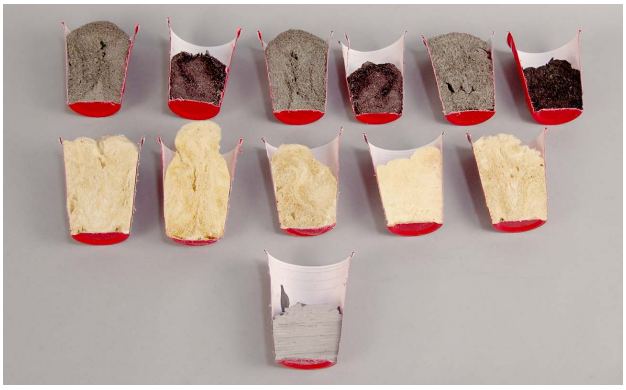
Technical data sheets describe how a product should be used.

When deciding which replacement material to use, the foam maker may have specific recommendations or tips on how the material will react when dispensed. If these recommendations or tips exist, they may be:

- listed on the tech sheet.
- available through most product maker websites.
- acquired by calling the product maker's tech line.
- identified by inquiring from a product maker's distributor or representative.

Comparing samples to the vehicle maker products can be helpful.

If not identified by the vehicle maker, compare replacement samples to the material installed by the vehicle maker. When doing this, duplicate what the vehicle maker installed as best as possible. Though the type of foam is important, the color is not.

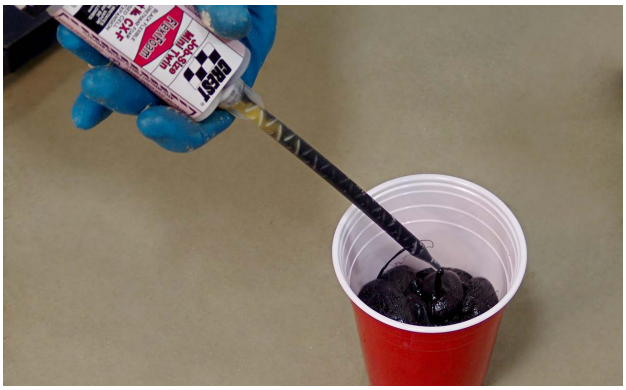


Foam products will typically yield identical results as the sample.

When comparing foam samples, consider:

- compression. When comparing the compression characteristics, determine if the foam will compress and how much force is required to do this. Also, determine if the foam remains permanently deformed after it has been compressed or if it springs back to its original shape after the force is removed.
- density. When determining the density of a material, evaluate the type of cell structure and weight of the material. A material with a large cell structure will typically be less dense than a small cell structure material.
- texture.
- cell structure.

Try to find a replacement material that is a near exact match to the material used by the vehicle maker.



Disposable cups work for making foam samples.

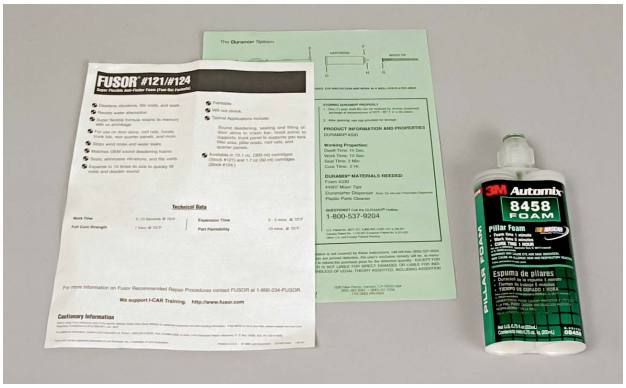
Examples of foam samples.

When making foam samples:

- it may be necessary to create multiple foam samples from multiple foam makers.
- a sample of each type of replacement material may be necessary to ensure the closest match.
- disposable containers, such as plastic drinking cups or paper bowls, work well.

- cut the sample to create a viewable cross section.

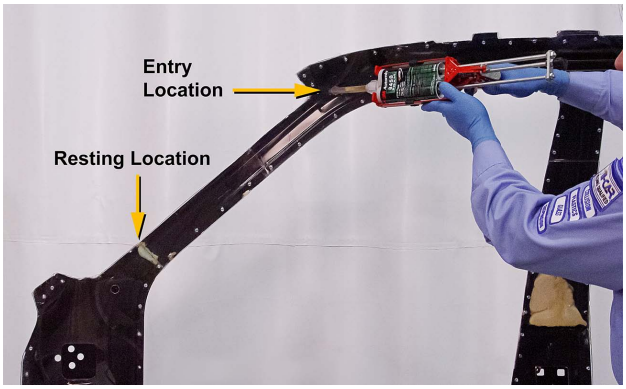
Refer to “Video: Making Foam Samples” in the presentation. This video discusses making foam samples.



When selecting a two-part foam, know the material’s characteristics.

When choosing a replacement material, ensure it can be installed into locations where the vehicle maker installed the original material. Considerations for this include:

- flow rate. Flow rate refers to the viscosity of the material and how it will flow or move down an angled or vertical surface.
- foam time. Foam time or work time is how long it takes for the foam to begin expanding.



Properly positioning foam can be a challenge.

When choosing a replacement material, there is a relationship between the location the material is introduced into the part and the intended location. This relationship will have an influence regarding which material should be used and the procedure for installation. For example, if a material is required to be at the bottom of a part and the only access location is at the top of the part, a material with a fast flow rate and a long foam time will be the best choice. Suspending a foam midway in a part may be easier using a material with a slower flow rate and a faster foam time.

It is important to cover any holes or openings in the part where foam is applied. As the foam expands, it will expand through any unsealed opening. This will increase labor time spent removing excess foam and potential product waste.

Measuring the dimensions of a part can help determine how much foam should be installed.

When determining how much material to use in a part, some considerations for expandable foam include the:

- expansion rate of the material.
- volume of the part being filled. The volume can be calculated using the approximate length, width, and height of the part. Knowing the length, width, and height of a part can allow a technician to estimate how much foam is required to fill a part.

If the approximate volume of the area to be filled, and the expansion rate of the material used is known, an estimate can be made of how much unexpanded material is required. From this estimated amount, it can be determined how much of the tube, or how many tubes of material are required.

Refer to Module 3, “Activity: Shapes Of Voids” in the presentation for an exercise on how to determine the volume of different shapes.

Module Wrap Up

Topics discussed in this module included:

- the proper safety equipment that should be worn when working with foam.
- considerations when working around foam with heat.
- foam installed by the vehicle maker.
- comparing foam samples.
- vehicle maker foam to replacement foam sample comparison.

Module 4 - Preparing Parts For Foam

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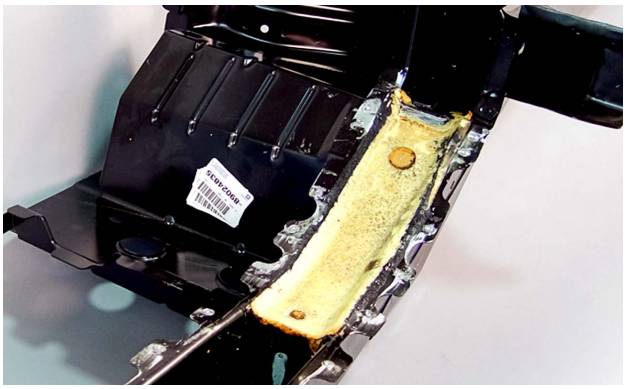
Part Preparation

Learning objectives for this module include:

- explaining tools and techniques used to remove foam.
- preparing a new part for foam installation.
- preparing parts with existing foam for new foam installation.
- reattaching foam that is being reused.
- explaining which materials can be used for making dams.
- explaining expansion rate variables for foam.



Foam may need to be removed when attaching or welding a service part.

When preparing a part for installation:

- new or existing foam may require installation before attaching the part to the vehicle.
- partial or complete removal of the existing foam before new foam is installed may be required. This is the case when welding is required in an area where foam is located or in an area where foam is damaged. If foam is crushed and no longer adhered to the part, it should be removed.

Use the appropriate primer before applying foam.

When preparing a part for foam:

- ensure areas that will receive foam are clean and dry.
- prime all bare metal areas to reduce the chance of corrosion. When priming, apply an epoxy or urethane primer. If self-etching primers are used, they must be fully cured before foam is applied.

Ensure damaged foams are removed.

Some tools and techniques used for removing foam include:

- chisels. Using a dull chisel may help reduce the chance of damaging the part during foam removal.
- abrasives for rigid and structural foam.
- heat. Heat is useful when releasing undamaged foam for reuse. Even if the foam is not being reused, heat may help release foam from a part.
- scrapers.
- knives.
- rolling the foam off by hand. Flexible foam can be rolled off the surface of the part by wearing rubber gloves and rubbing.

Use caution with cleaners as they may be wicked into the foam.

These are examples of a water-based cleaner and a solvent-based cleaner.

Cleaning areas for foam installation is similar to cleaning a part for refinishing. Use both a water-based and a solvent-based cleaner, a water-based cleaner to remove water-based contaminants and a solvent-based cleaner to remove solvent-based contaminants.

After cleaning, prime bare metal areas.

Grind rigid foam (left) and remove any damaged foam (right).

When preparing recycled parts for foam:

- avoid applying cleaners to existing foam. Cleaning solutions may be wicked into the foam.
- ensure cleaners have dried or evaporated before installing the part or applying foam.
- remove existing rigid-type foam by grinding.

Seal remaining foam with either a sound dampening material, if no other foam will be added, or the replacement foam.

When working with sections of foam that are damaged, the foam can be removed and the remaining undamaged section left in place.

Damaged foams that are not crushed or separated from a part may be saved. When working with original foam:

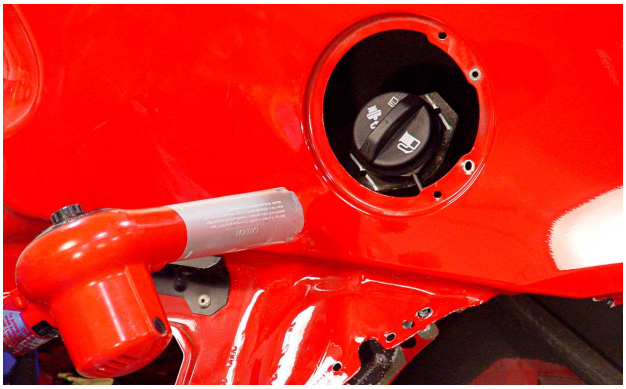
- remove damaged areas of foam back to an area where the foam is not damaged.
- cover the exposed areas of existing foam with replacement foam. This refills the area where foam originally existed. If additional foam will not be installed, cover the damaged areas of the foam with sound dampening material to keep the foam from absorbing water.

Installation

Some service parts are provided with foam attached.

Some service parts are supplied with the foam installed. This foam may be a:

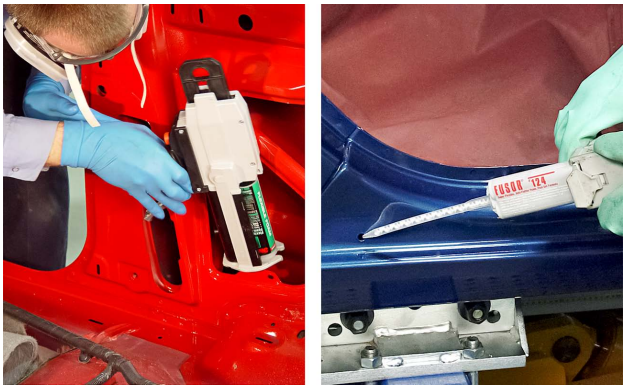
- flexible foam material that has been installed in the same locations as the carrier foam used during initial vehicle construction. Some service part assemblies, such as unisides, may have foam installed with carriers between outer panels and inner reinforcements.
- structural foam used for collision energy management or controlling twisting and flexing of the structure. Vehicle makers typically supply the structural foam with the service part. Structural foam is not available as an aftermarket replacement product.



Heat guns can be used to release flexible foam for reuse.

When replacing parts with flexible foam between adjacent parts, such as a door skin and an intrusion beam, the foam can be left in place and reused. When using original flexible foam:

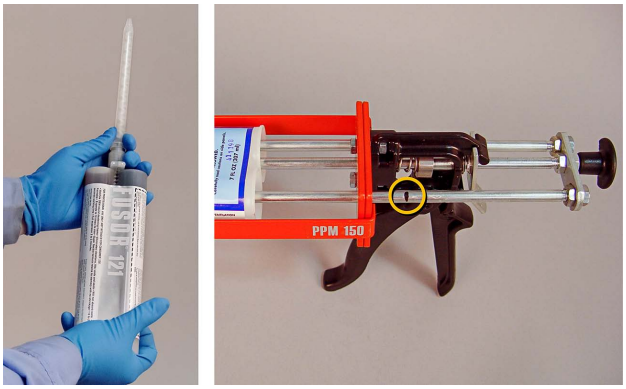
- separate the part from the foam using heat. Ensure that the foam does not become damaged during part removal.
- do not reuse foam that is damaged.
- use urethane adhesive or NVH sound dampening material to attach existing material to replacement parts. Small amounts of replacement flexible foam can be used for reattaching foam.



Foam may be applied through the inner structure of the door (left). Foam may be applied through access holes (right).

When installing foam:

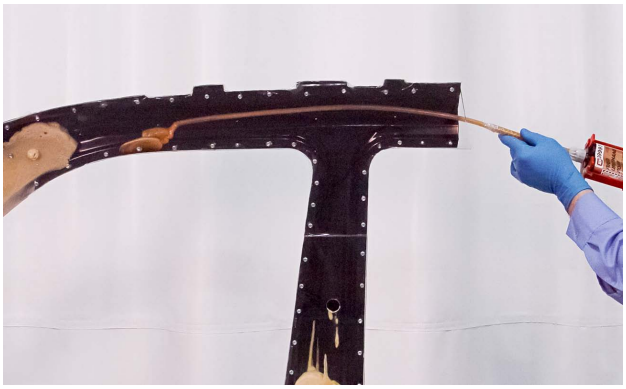
- locate access holes where material can be installed into the part. Do not drill access holes into a part unless directed to do so by the vehicle maker.
- have an estimate of how much material should be installed in the part.
- select the appropriate material for the application and use the appropriate dispenser.
- purge the air from the tubes and level the plungers. This should be done while the cartridge is held with the dispensing end up. For some foam materials, the cartridge cannot be held horizontally because the material is too thin and will run out of the tubes.



Install the correct mixing nozzle onto the product container (left). Mark the plunger rod on the applicator gun for how much product should be dispensed (right).

When installing foam:

- install the mixing nozzle on the cartridge. Use only the nozzle supplied by the product maker for the material being used. These nozzles are shipped with the product and may mix foam at a different rate than adhesives or sealers. Using the incorrect mixing nozzle may over- or under-mix the product. Over-mixing the product may cause it to begin expanding in the mixing tip, and under-mixing the product will cause the product to inadequately expand.
- mark the applicator gun for how much material should be dispensed to adequately fill the area.



An extension tube allows access to hard-to-reach areas.

Foam may require positioning in specific areas. When installing foam:

- consider the shape and volume of the area being filled. Determine the flow rate, foam time, and positioning of the foam by using the product makers technical data sheet.
- dams may be required to retain the foam at the intended location. This may be useful when working with a material that has a high flow rate and slow foam time and requires positioning midway in a part.
- extension hoses on the foam nozzle may be required if a material with a fast foam time and slow flow rate requires positioning away from the access hole. Using an extension hose will allow the material to be dispensed directly to its final location.
- the technique used to dispense the material needs to be considered. A pillar foam with a high flow rate and slow foam time can be dispensed quickly and allowed to run into the bottom of a pillar

before expanding. To suspend foam in a part, the product can be dispensed slowly and allowed to foam as it leaves the nozzle. This technique keeps the material from running down the part and away from the intended location. If the dispense rate is too slow, the foam may begin to expand and cure in the mixing tip.

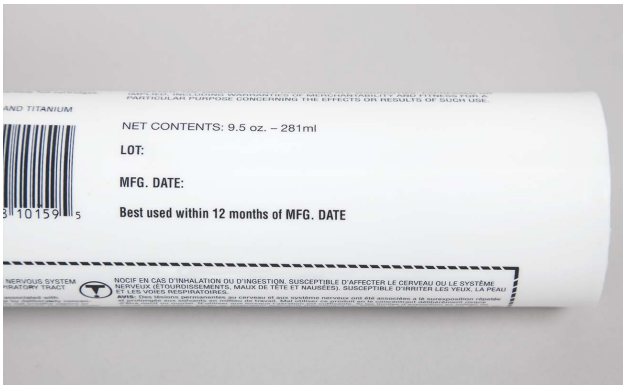
Top-coated steel and sound dampening material can be used for making a dam (left). Balloons can also be used as damming material (right).

When making a dam to retain foam, various materials can be used. These materials include:

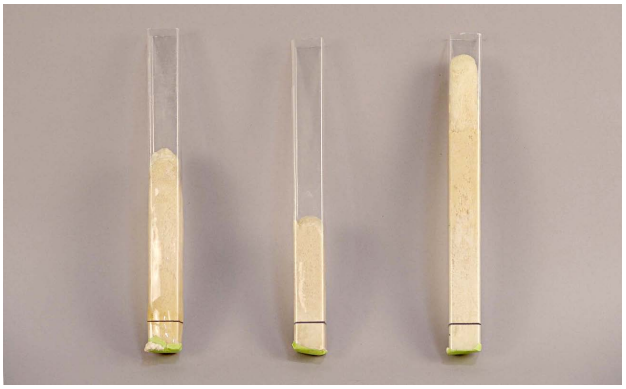
- steel, plastic, or foam blocks for making solid dams. If steel dams are used, ensure they are adequately corrosion protected. To secure solid dams in place, a urethane adhesive or sound dampening material can be used. If a solid foam material is being used, ensure the material will not retain moisture.
- compressible foam, balloons, or two-part foam for making soft dams. Foam blocks can be compressed to fit through small access holes to expand and block an area after final part assembly. Only use foam blocks that are specified by a vehicle maker for this purpose, or materials that will not retain water. Ford Motor Company specifies a compressible foam block as a dam in TSB#01-21-9. Balloons can also be installed and inflated through access holes after final part assembly. If a balloon is used, deflate and remove the balloon before the vehicle is returned to the customer. If two-part foam is used, reuse undamaged pieces of foam and secure them in place with urethane adhesive or sound dampening material.

Some dams may require fitting into parts before final assembly.

Refer to “Video: Making And Installing Dams” in the presentation. This video shows ways of making and installing dams to retain foam.



Observe the expiration dates listed on products.



Temperature can affect how the foam performs.

Expansion rate can be affected by:

- the shelf life of the product. If the product is expired, it may not function the same as fresh product.
- the rate it is dispensed. If a material is dispensed very quickly, the expansion rate may be less than if the material is dispensed at a rate where the material is just beginning to expand as it leaves the mixing tip.
- temperature. If the part or material is cold, the expansion of the material will be less than a material that is at room temperature. Room temperature is between 70 - 75°F. Also, a material that is heated to 100°F or above will expand more than a material dispensed at room temperature.
- chemical design. Depending on chemistry, the material will only expand as designed. The advertised maximum expansion rate of a material may have been determined for each material under different conditions.

Refer to “Video: Expansion Of Foam” in the presentation. This video discusses the expansion of foam.

With practice, foam can be hung on a vertical part.

To suspend foam in a part without the use of a dam:

- dispense the material slowly. By doing this, the foam will begin to expand as it leaves the mixing tip. When the foam contacts the side of the part, it will fill the area faster and drop less because the material has changed from a liquid to a solid.
- a material that has minimal flow rate will help keep the material in the appropriate location. Foam may flow down fast or drop in vertical parts if not dispensed correctly.

Part-Specific Considerations

Follow vehicle maker's directions or place foam prior to assembly.

When installing foam in areas with limited or no access:

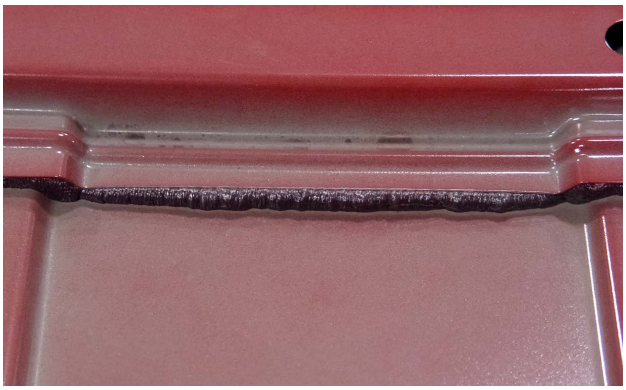
- do not drill access holes into the part unless directed by the vehicle maker.
- one method is to install the foam in the part before it is installed on the vehicle. Test-fit the part and cut the foam to fit into position. After trimming, use urethane adhesive or small amounts of flexible foam to attach the foam to the vehicle body. This works well for areas that are difficult to reach like gas filler areas on a quarter panel or the front edge of some vehicle maker doors.
- when appropriate, heat the foam to keep the original foam in place and reattach with NVH foam.

Applying foam to door skins while in the horizontal position can potentially cause the door skin to become wavy when exposed to changes in temperature.

When applying foam to door skins:

- apply the foam to the area between the door skin and the intrusion beam.
- apply the foam while the door is vertical. Allow the material to foam as it is coming out of the mixing tube, then apply. This will help keep the foam in the intended location and allow the panel to expand and contract without showing imperfections or waviness in the door skin.
- flexible foam is the most common material used. If undamaged foam

is being reused, reattach it using non-flexible NVH foam.
- overfilling the area could distort the panel.



Proper technique is required to hold foam between the roof skin and roof bows.

When applying foam to roof skin bows, leave undamaged foam in place whenever possible. If existing foam is being reused, it can be reattached using small amounts of flexible foam or urethane adhesive.

If foam is being applied to an installed roof skin, dispense slowly so the material is expanding as it exits the mixing nozzle. Applying foam in this manner helps reduce material overflow as it expands.

When applying foam between the door skin and intrusion beam, overfilling the area could distort the panel.

When applying flexible foam to a roof bow, use a drop cloth to protect the inside of the vehicle from any material that may fall. If foam begins to drip or fall, allow the material to cure before cleaning or trimming.

2014 Cadillac CTS

The Cadillac CTS uses strucural foam in the lower rails.

When working with lower rails:

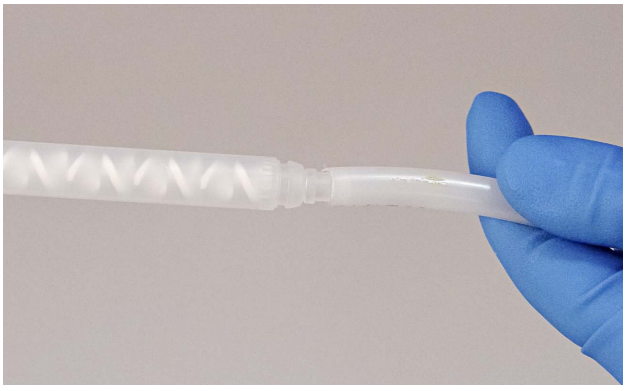
- the material is typically a structural foam.
- the placement of structural foam is critical.
- the service part may contain the structural foam from the vehicle maker. This is because it may not be possible to install the foam after part installation.
- some vehicle makers allow damaged structural foam to be repaired. If the foam is broken loose, it may be secured in place by adding additional non-expanding NVH foam.

The 2004 - 2014 Cadillac CTS uses front lower rails that contain structural foam. These front lower rails have the foam installed in the service part.

Do not over-fill areas with foam.

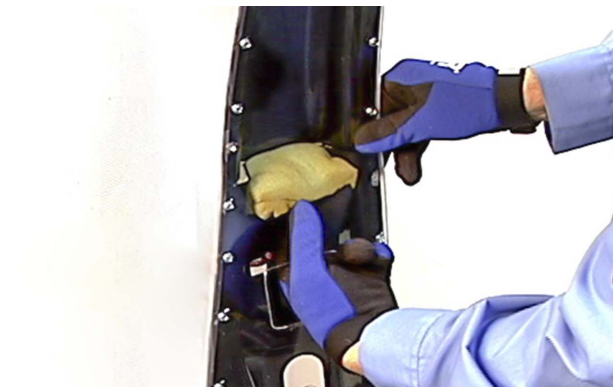
When filling lower pillar areas with foam, follow the vehicle maker's recommendations. When installing foam in lower pillars:

- determine how much foam is required so the area is not over- or under-filled.
- dams may be required to hold the foam in the proper location on the vehicle.
- locate access holes for installing the material. Ensure that foam installed into the lower pillar area reaches the bottom of the pillar.



Fill lower pillars by sliding extension tubes over the mixing nozzle.

Techniques for positioning the material in a lower pillar area include using a product with a high flow rate and a slow foam time or attaching an extension hose to the mixing nozzle. This will ensure the material is properly positioned.



Some compressible foams can be used to suspend foam.

When suspending foam in pillars:

- reuse existing dams whenever possible. If this is possible, it may work best to attach the dam to the vehicle body before attaching the part.
- it may be necessary to make new dams.
- use a dispense technique that allows the material to be positioned where it is applied.

When applying foam to a horizontal area, flexible or rigid NVH material will typically be used.

When installing foam in a horizontal part:

- flexible or rigid NVH material will typically be used.
- dams may be required.
- an extension hose may be required to position the foam properly.

Refer to “Video: Using Foam During Repairs” in the presentation. This video discusses concepts on using foam during repairs.

Module Wrap Up

Topics discussed inthis module included:

- tools and techniques used to remove foam.
- new part preparation.
- recycled part preparation.
- reattaching foam that is being reused.
- materials used for making foam dams.
- expansion rate variables for foam.

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