Bolted-On Exterior Panels - Part 1 (EXT03e)

Textbook

I-CAR®

Version: 5.2

EXT03e-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.

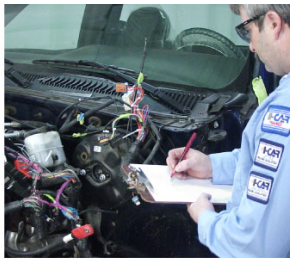
To reduce liability:

- 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.

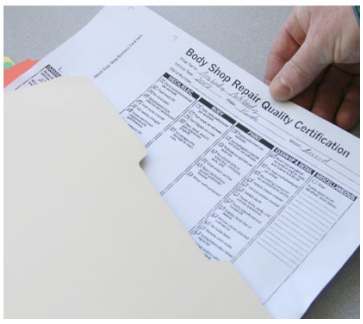
Liability insurance that covers the repair facility may not always cover all damages. For example:

- 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.

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Module 1 - Bolted Exterior Panel Replacement Considerations

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Panel Alignment

Learning objectives for this module include:

- identifying exterior parts.
- identifying exterior panel alignment requirements.
- developing a repair plan.
- identifying tool and equipment requirements.
- organizing fasteners.

The left and right sides of the vehicle are shown.

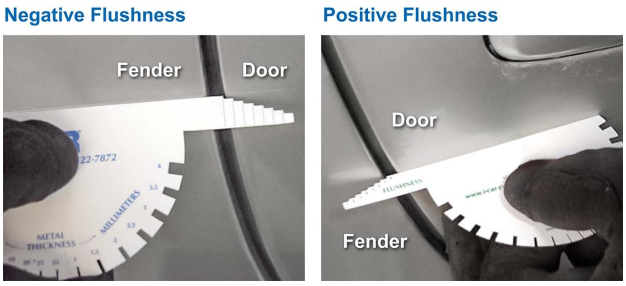
When identifying the exterior panels, the left side is always the driver side of the vehicle, and right side is always the passenger side of the vehicle.

Panel alignment includes gaps and flushness.

Panel alignment plays a number of different roles. If the alignment between panels is incorrect, it may adversely affect the:

- appearance of the vehicle. This includes gaps and flushness. A gap is the width of an opening between panels and flushness is a difference in height between the two panels. This course will use the term positive and negative flush when comparing panels.
- amount of effort required to open and close hoods, doors, and deck lids. If the gap between panels is tight, it may require more opening and closing effort than properly aligned gaps.
- amount of wind noise. Incorrect panel alignment is primarily responsible for leaks and noise.
- condition of the finish. If a door rubs on a fender, an adjacent door, or quarter panel every time it is opened, it will damage the finish.

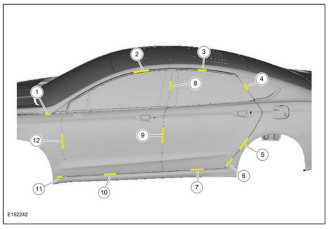
There are gauges available to measure panel gaps and flushness.



Negative flushness is when the fender is in from the door (left). Positive flushness is when the fender is out from the door (right).

Positive and negative flushness are terms used to compare one panel to another. When checking flushness, start with the

forward panel. Positive flushness from the fender to the door would mean that the fender is sticking out from the door. Negative flushness from the fender to the door would mean that the fender is inward from the door.



Item	Description	Margin Specification	Flushness Specification
1	Fender to A-pillar	3.0 mm (0.12 in) ± 1.5 mm (0.06 in)	-
2	Front door to bodyside	9.0 mm (0.35 in) ± 2.7 mm (0.10 in)	1.0 mm (0.04 in) ± 2.7 mm (0.10 in)
3	Rear door to bodyside	9.0 mm (0.35 in) ± 0.5 mm (0.02 in)	0.75 mm (0.02 in) ± 2.0 mm (0.08 in)
4	C-pillar applique to quarter glass	4 mm (0.15 in) ± 1.5 mm (0.06 in)	2.5 mm (0.09 in) ± 1 mm (0.04 in)

Courtesy of Ford Motor Company

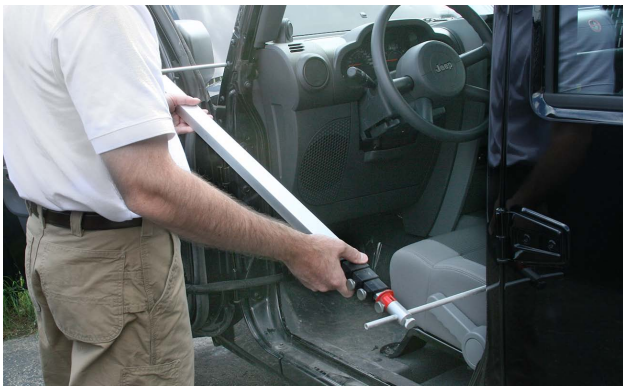
Panel alignment specifications may be found in some body repair manuals.

Panel alignment specifications from the vehicle maker:

- vary from part to part. There may be a different specification for the fender-to-hood gap when compared to the fender-to-door gap.
- may be found in a vehicle-specific body repair manual or service manual.
- are typically 3 - 8 mm for panel gaps and 0 - 2 mm for flushness. Some gap recommendations may be larger.

If there is no vehicle maker recommendation for panel gaps or flushness, compare the:

- panels to the opposite side of the vehicle.
- gaps from panel to panel. The gap between the front fender and front door should be similar to the gap between the front door and rear door or quarter panel.

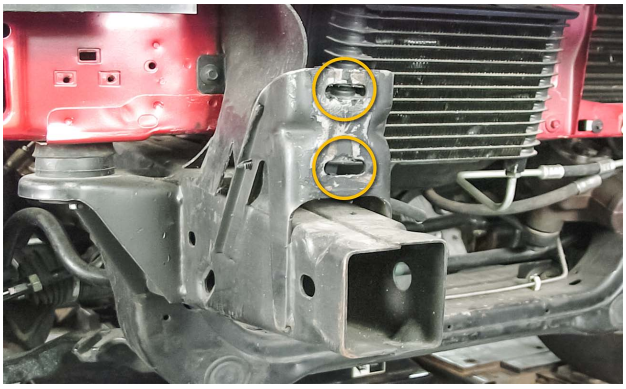


Measuring the upperbody will verify that the structure is correctly aligned.

It is important to correctly diagnose the cause of the panel misalignment. The misalignment will either be caused by an out-of-specification vehicle structure or by the panel being installed out of alignment. To properly align panels, the vehicle structure must be correct. If the structure is not dimensionally correct, it will be difficult or impossible to achieve correct panel alignment.

A body-over-frame vehicle may have a bolted radiator core support. A unibody core support is usually welded to the vehicle structure.

If a bolted radiator core support is misaligned on a body-over-frame vehicle, it may give the appearance that the fender and hood are misaligned, but the hood to cowl is properly aligned. There may be no hood or fender adjustments that can be made to correct the condition. The radiator core support will most likely need to be repositioned.



The bumper mounting brackets on this truck are slotted for side-to-side adjustment.

Some of the different types of adjustments for bolted exterior panels include:

- slotted or elongated holes. These will be found on the parts or the hinges and allow for front-to-back adjustments on the vehicle structure and sometimes side-to-side adjustments.
- threaded mounting plates. These may also be called cage nuts. Threaded mounting plates are contained in an enclosed structure with some adjustment room available. When a fastener is threaded and tightened into the mounting plate, it secures the hinge and the part together.
- adjustable stops. These are used for flushness alignment, particularly on hoods and deck lids. They are usually threaded and can be lowered or raised.
- shims. Shims are typically used for making height adjustments.

The lack of finish on this door hinge (left) can help during alignment.

Note the finish condition around the mounting location. Because the vehicle was most likely finished with the panels attached, there will not be a finish under the original mounting location. This will apply to the bracket mounting location on the vehicle and the fastener mounting location on the mounting bracket.

A Torx driver is used to remove this door striker.

Before installing replacement exterior panels, it may be helpful to remove the striker. Before removing the striker, check to make sure the attachment nut will not drop into the pillar. Removing the striker will allow the panel to open and close freely. This is not a required step, but may be beneficial. To align mechanically attached exterior panels:

- start with the panel closest to an undamaged welded panel when adjusting multiple panels.
- adjust multiple gaps on the same panel simultaneously. While fasteners are loosened, adjust forward-and-back, side-to-side, and top-to-bottom gaps whenever possible.

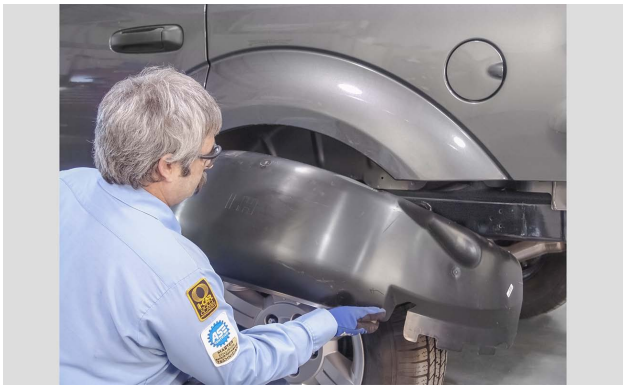
The opening and closing effort is checked to verify proper alignment.

To determine the correct amount of opening and closing effort, compare the effort required to the effort required on:

- the undamaged opposite side of the vehicle whenever possible.
- another undamaged vehicle.

When checking the opening and closing effort on a door, watch for the door dropping down or jumping up off of the striker.

Repair Preparation



This plastic wheelhouse is removed to access hidden fasteners.

Before beginning repairs determine:

- if there are any undamaged adjacent panels that require complete or partial removal.
- which trim and hardware must be removed.
- if there are any other parts or accessories that require removal and installation (R & I) such as wiring inside of a door.
- if the panel requires removal for repair. This will be most common on a plastic part that requires a two-sided repair but has limited or no access to the panel backside.

This lock cylinder is removed in preparation for refinishing.

It may be necessary to remove undamaged, adjacent parts to access hidden fasteners. It may also be necessary to remove moldings and door handles to allow for proper refinishing of parts that are being repaired. When removing undamaged, adjacent parts, store them in a clean, dry place to avoid damaging them.

Tape is used on the door panel edge to prevent paint chipping when the fender is removed.

One way to protect undamaged, adjacent panels is to carefully remove them and store them. Since this is not always practical:

- adjacent part edges should be masked to avoid damage during part removal.
- use spark deflection paper to protect glass from any welding or cutting procedures. Glass damage by sparks will require replacement.
- use fender covers when leaning over the fender to access underhood parts or hinges.
- use blankets to cover glass when removing adjacent parts such as hoods and deck lids.

Replacement Parts

A recycled fender is temporarily installed for test-fitting.

When a replacement part is delivered, it must be inspected to verify that the correct part was ordered and shipped. This should be done before removing damaged parts whenever possible and before any edging operations are performed. Verifying the proper part includes comparing the replacement part with the damaged part for the same design, mounting locations, and any holes or openings for parts such as an antenna, side marker lamps, and emblems. Also inspect the replacement part for any shipping damage.

Before installing a replacement part, determine if the proper fasteners were provided with the part.

Do not install recycled parts if there are signs of pitting from corrosion or cracks at mounting locations.

There are additional considerations for installing recycled parts. This includes:

- inspecting for any corrosion. Do not install recycled parts with corrosion that has caused pitting.
- verifying which parts can be transferred from the original part to the replacement part. This is important when installing recycled doors with different options than the original vehicle.
- repairing any minor damage and taking the appropriate steps to restore the corrosion protection.
- inspecting for any improper previous repairs.
- inspecting mounting locations for any cracks. This is especially important on composite parts. Composite parts with damaged mounting locations should not be installed.
- determining what steps will be required to prepare the replacement part for refinishing.
- anti-theft laws and record keeping requirements for installing recycled parts. These vary between

each state or province. Check with local authorities for record keeping requirements.

Tools And Storage

These tools can be used to remove a door interior trim panel.

The tools and equipment required for removal of most bolted exterior panels typically include:

- trim removal tools. This is especially true when removing doors. The door wiring must first be removed, which may require removal of the door interior trim panel.
- a socket set. The most common fasteners used for exterior panels are some type of hex-head bolts and/or nuts.
- screwdrivers. Although screwdrivers may not be used for removing a panel, they will be required for trim and hardware removal such as door interior trim panels and fender flares.
- Torx and inverted Torx drivers. Torx fasteners are becoming more common for many panel attachments.
- fastener storage containers. It is important to properly mark and store fasteners to ensure that they are replaced in the proper location.

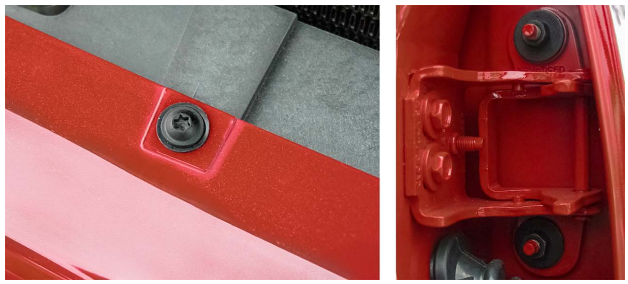
An assistant may be required for removal of some parts to avoid damaging adjacent panels and glass.

When disassembling a vehicle, a parts storage rack will help keep fasteners and parts organized.

There are a variety of parts racks available for part storage. Some of these include:

- a utility rack. There are a few different types of utility racks available. Some may be stationary such as a folding utility rack. Others may be adjustable with arms that can be rotated and moved in and out. These types can be adjusted to fit a number of different parts.
- a parts caddy. These can be used to store a variety of parts as well as any tools required for removal. There may also be fastener containers available that

can be attached to the parts caddy for fastener storage.
- bumper stands. Bumper stands are commonly used for refinishing bumpers off of the vehicle. Bumper stands can be used when repairing bumpers that require a two-sided repair. Bumper stands can also be used when refinishing panels off of a vehicle.
- bumper stations. Bumper stations can store multiple bumpers.
- a door rack or door hanger. These can be used for removal and installation of door shells when there is not an assistant available. These also work well when aligning doors following installation.
- truck bed stands. These can be used to hold a truck bed while it is removed from the vehicle.



A washered Torx bolt is used to fasten this bumper cover to the headlamp-mounting panel (left). Flange nuts are used to attach this door shell to the hinge (right).

Some common types of fasteners that are used for exterior panel installation include:

- flange bolts that are threaded into either a stationary or movable threaded backing plate.
- flange nuts that are threaded onto a stationary threaded stud.
- plastic retaining clips and push pins. These are usually used to install bumper covers.
- sheet metal screws.

Plastic bags and a marker will help keep fasteners organized.

Fastener organization is one aspect of panel replacement that is sometimes overlooked even though it is very important. Good fastener organization can increase productivity and reduce frustration when installing new parts or reinstalling parts that have been removed during repair procedures. Poor fastener organization can lead to extra or insufficient fasteners following repairs as well as the potential for installing fasteners in the incorrect position. Some ways to store reusable fasteners include:

- using plastic bags. The plastic bags can then be marked accordingly for ease of identification.

- attaching the fastener to a part, if possible. If a bolt or nut is removed and reinstalled on the part, there is no doubt about its correct placement.
- using storage bins and labeling the bin accordingly.
- using masking tape to identify fastener use.

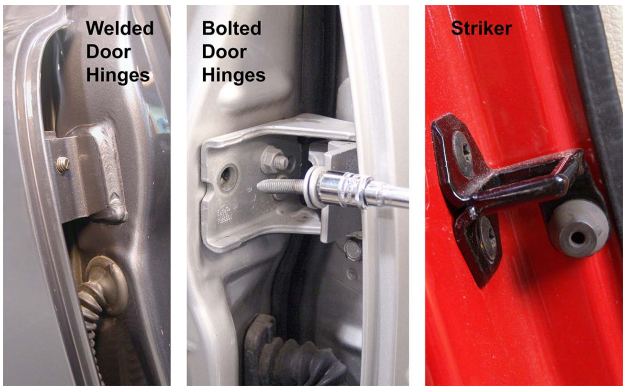
Since fasteners may be damaged during a collision or during collision repairs, it may be beneficial to have an inventory of common replacement fasteners.

It is helpful to have an inventory of common replacement fasteners.

Some fastener considerations that must be taken into account include:

- the use of one-time use fasteners.
- refinishing replacement or reinstalling painted fasteners in the proper location to duplicate the original appearance.
- the fact that some fasteners may require paint touch-up following installation.
- the torque specification. The service manual may have the recommended torque specifications for bolted exterior panels.
- missing fastener considerations. Missing fasteners should be replaced with the same type and size as the original.
- composite panel attachment concerns, such as thermal expansion and torque sequence.

Door Hinges



Hinge types may vary depending on the vehicle make.

Hinges used to fasten movable exterior body panels to the body structure may have:

- replaceable pins and bushings.
- rivets that cannot be replaced.

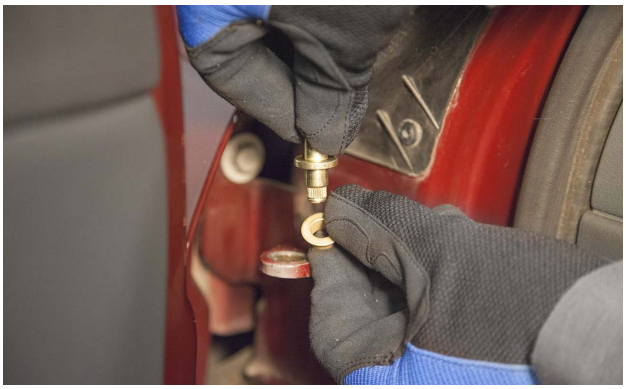
Hinges that use a rivet as a pivot point are bolted to the panel and body structure. Generally, these hinges are not repairable and must be replaced when damaged or worn.

Hinge pins and bushings may be replaceable on some vehicles.

On vehicles with replaceable pins and bushings, the hinge may be:

- bolted to the panel.
- bolted to the vehicle structure.
- welded to the panel.
- welded to the vehicle structure.

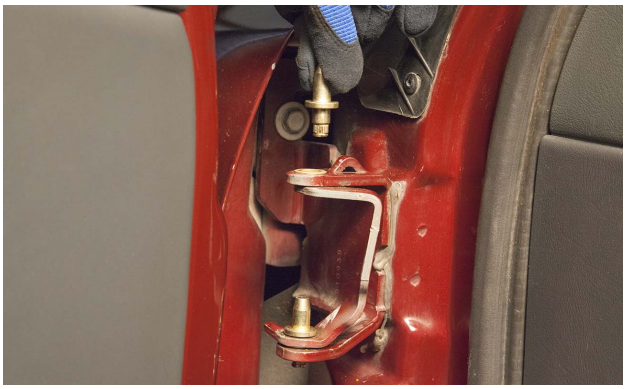
The pins and bushings are a pivot point that allows the panel to open and close. Depending on the amount of use, pins and bushings may be a wear item. Routine maintenance such as lubrication can prevent premature failure.



A worn bushing is being replaced on this hinge.

When the door pins and bushings need to be replaced, the panel will usually drop off of the striker, indicating that the pins and bushings are worn. When replacing pins and bushings:

- it may be necessary to remove the door spring.
- the panel should be supported.
- the adjacent panels should be protected to prevent damage.
- the pin can be driven out with a pin driver.
- the panel can be removed from the vehicle structure. It may also be necessary to disconnect the wiring to give enough room to replace the bushings.
- the worn bushings can be driven out of the hinges.



Replacing worn pins and bushings can help restore proper hinge operation.

When the door pins and bushings need to be replaced, the panel will usually drop off of the striker, indicating that the pins and bushings are worn. When replacing pins and bushings:

- the new bushings are installed with a bushing driver.
- the panel is reinstalled.

- the new pins are installed. The new pins may come with a pin retainer that must be installed also.
- the door spring is reinstalled.

Module Wrap Up

Topics discussed in this module included:

- exterior parts identification.
- exterior panel alignment requirements.
- developing a repair plan.
- tool and equipment requirements.
- fastener organization.

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Module 2 - Doors

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Door Assemblies

Learning objectives for this module include:

- replacing door handles.
- replacing doors.
- replacing door hinges.
- replacing composite door skins.
- aligning doors.
- replacing sliding doors.

With the door panel removed the various parts of the door, such as the intrusion beam, linkage, and latch mechanism can be seen.

It is important to be able to identify the key parts of a door.

Front-mounted hinges are the most common location on doors.

Vehicle Protection

If a vehicle is equipped with an undeployed door-mounted side airbag, follow the vehicle maker's recommendation for disabling the airbag system before beginning repairs.

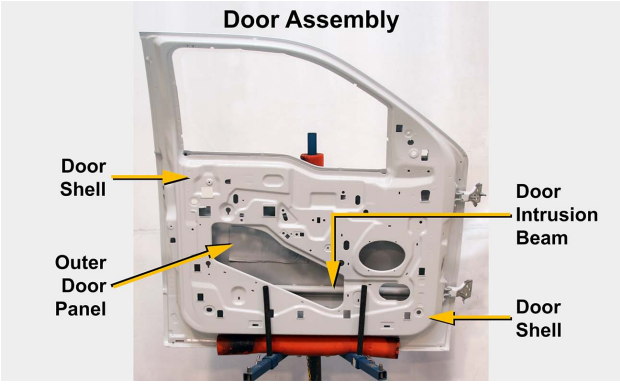
Types of doors include:

- doors with front-mounted hinges. This is the most common hinge location.
- doors with rear-mounted hinges. These are most common on trucks with a third or fourth door.
- sliding doors, such as those found on minivans.
- steel doors that have a steel shell and steel skin.
- steel door shells with a composite skin. The composite skin will usually be bolted or screwed to the door shell.
- composite door shell with a composite skin. The composite skin will usually be adhesively bonded to the composite door shell.

Most vehicles have a rearview mirror attached to the door shell.

Common door attachments include, but are not limited to:

- moldings, cladding, and emblems.
- side-view mirrors on the front doors.
- interior trim panels.
- movable and stationary glass and associated hardware such as a motor and run channels.
- wiring inside the door shell for such things as automatic windows and locks.
- weatherstripping around the door.



This door intrusion beam is welded to the door shell.

Other door attachments include:

- door handles and associated hardware, including the lock cylinder and linkage.
- the door latch mechanism. These are similar to hood latches and may have a child-lockout mechanism.
- intrusion beams. Intrusion beams are usually made from UHSS and offer occupant protection in side impact collisions. Damaged door intrusion beams should be replaced. Bolted intrusion beams can usually be replaced. Damaged weld-on intrusion beams may require replacement of the door shell.
- energy absorbing foam. Energy absorbing foam offers occupant protection in side impact collisions. Damaged energy absorbing foam requires replacement. At least one vehicle maker requires replacement of energy absorbing foam if it is removed from the door for access.
- noise, vibration, and harshness (NVH) materials inside the door shell.

Outer door handles are connected to the latch mechanism by rods and clips or by cables.

Inner and outer door handles are connected to the latch mechanism by rods and clips or by cables. Door handles may be attached to the shell or skin by:

- flange nuts and a threaded stud. The threaded stud may be a part of

the handle, or it may be a part of the shell.
- rivets.
- bolts. If the door handle has a threaded insert, a flange bolt may be used to attach the handle to the shell.
- screws and / or clips. Screws and clips are used for inner door handle attachment only.

This door lock cylinder is installed in the outer door handle.

Door locks prevent the latch from operating when activated. The door lock is connected to the latch with rods or cables. Door locks may be:

- electric, vacuum, or manual. Some electric locks can be operated with a remote control. Information on programming remote controls may be found in the vehicle service manual.
- may be part of the door handle or may be separate.
- attached to the door handle or shell with a retainer clip.

Inner and outer door handles are connected to the latching mechanism.

The door handle and lock linkages connect the inner and outer door handles and the lock button or cylinder to the latching mechanism. Types of linkages include:

- rods that run from the handle or locks to the latch. These connect to the latch and the handle or lock with a retainer.
- cables with a ball on the end. These are similar to a hood release cable.

Removing the outer door handle fasteners was necessary to remove this outer door handle from the door.

To remove the inner and outer door handles:

- raise the door glass into the closed position.
- unfasten the inner door handle to access the linkage. Remove the linkage and remove the inner handle.
- remove the interior trim panel and moisture seal.
- undo the linkage from the outer handle.
- remove the outer door handle fasteners and remove the door handle.

A steel retainer clip holds this lock cylinder in position.

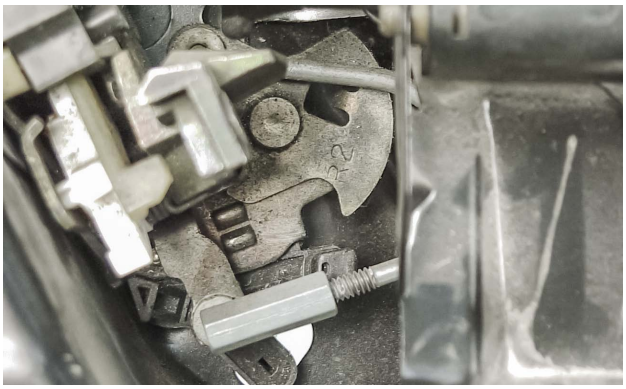
Because the door lock rod may be part of the inner door handle, it may require removal before removing the trim panel. If the vehicle is equipped with electric locks, the lock button connector will have to be disconnected from the trim panel. With the door trim panel removed, the lock cylinder can be removed by disconnecting the linkage and removing it from the lock cylinder. Next, the retaining clip is removed and the lock cylinder can be removed from the door skin. To install the connecting rod and lock cylinder, reverse the removal procedure and verify the operation.

This door handle is being positioned to reinstall the fasteners.

Before installing a door handle, refinish it as required. After refinishing, the handle can be positioned and the fasteners installed. Connect the linkage and verify the operation of the door handle before continuing. If the door handle works, install the interior trim panel followed by the inner door handle and linkage. Before repairs are complete, recheck to verify that all handles, linkages, and locks are operational.

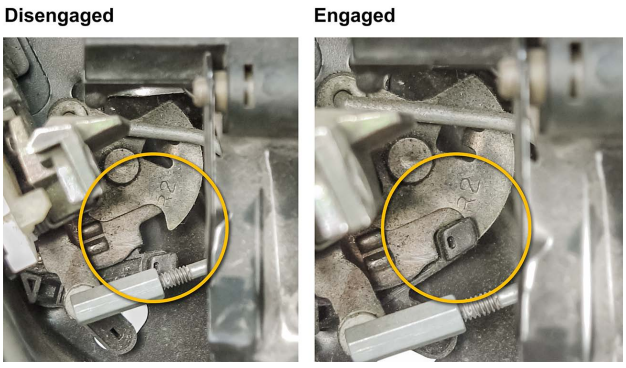
Refer to "Video: Static Test Of A Latch And Door Handle" in the presentation.

This video shows a static test of a latch and door handle.



This latch is equipped with a child lockout mechanism.

Similar to hoods, doors are secured in the closed position to the vehicle structure, usually the B- or C-pillar, with a latch and striker. The latch is connected to the door handles and lock linkages in the door shell. The door latch usually has two positions, pre-latched and latched. The pre-latched position will line the door up with the striker and the latched position will secure the door in the closed position.



Child lockout mechanisms prevent the rear doors from being opened from inside of the vehicle.

A child lockout mechanism:

- prohibits opening the door from inside of the vehicle. This reduces the chance of a young child opening the door and becoming injured.
- is part of the latch assembly.
- when engaged, is essentially a clip that blocks the inner door linkage from operating the latch.

Door wiring harnesses use connectors to provide power to the door accessories.

Many of the accessories that are located in a door shell have wiring connecting them to the vehicle computers.

The amount of door wiring will vary depending on the accessories. Even doors with limited electronic accessories may have a complete wiring harness in the shell. Before removing any wiring from the door shell, make a note of the routing and location of the clips that attach the wiring to the door. It may not be necessary to mark the wires for identification. This is because most door wiring is cut to length based on the accessory location and there are numerous styles of connectors that prevent improper installation.

With the door wiring removed from the door, closely inspect it for any damage and repair or replace as required.

A wire loom is labeled with numbered tape for identification during installation.

Although not always required, it may be necessary to label some door wiring in situations where a similar style clip is used in a similar location. It will be beneficial to mark wiring that is not used due to the accessories not being installed at the factory. When labeling wiring, masking tape and a marker can be used or there are specialty tapes designed for this purpose.

This door hinge is bolted to the pillar.

The door hinges connect the door to the pillar and allow the door to be opened and closed. Types of hinges include:

- front mounted.
- rear mounted.

Hinges that are discussed in this course are fastened using:

- bolts that are tightened into a threaded hole or cage nut.
- flange nuts that are threaded onto a stud mounted on the door shell or pillar.
- a combination of flange nuts and bolts.

This is one example of a check strap.

Check straps are located between the two hinges on the pillar. Check straps:

- have a dual purpose. The check strap holds the door open at the midway point to prevent the door from closing. Check straps also prevent the door from opening too far.
- may be a slide type that is bolted to the pillar and slides in and out of the door.

- may be a spring type. The spring is responsible for keeping the door open and the hinge stops prevent the door from opening too far.

There are hinge stops on the hinge that assist the check straps by preventing the door from opening too far.

Door Replacement

A ratchet can be used to remove the hinge-to-pillar fasteners.

To remove a door from the vehicle:

- remove the interior trim panel to access the door wiring.
- disconnect and remove the wiring from the shell.
- unbolt the check strap from the pillar if applicable.
- determine if the hinge will be removed from the door or the pillar. This will depend on access to the fasteners.

To safely remove a door from a vehicle, use a door stand or the help of an assistant.

To remove a door from the vehicle:

- position a door stand in place or have an assistant hold the door.
- unbolt the hinges and remove the door from the vehicle.
- remove the hinge from the door or pillar as required.

Loosen any bolts holding the hinge in place.

Remove the hinge bolt.

The hinge can now be removed.

Remove the hinge from the door or pillar by unbolting it. Some heat may be required to loosen any sealer around the hinge. Once the hinge is removed, inspect it for damage.

Inspecting the finish condition on the mounting area may be helpful when aligning the hinge.

Tighten fasteners only enough to allow for adjustments. Torque once necessary adjustments have been made.

To install a door hinge on the vehicle or the door shell:

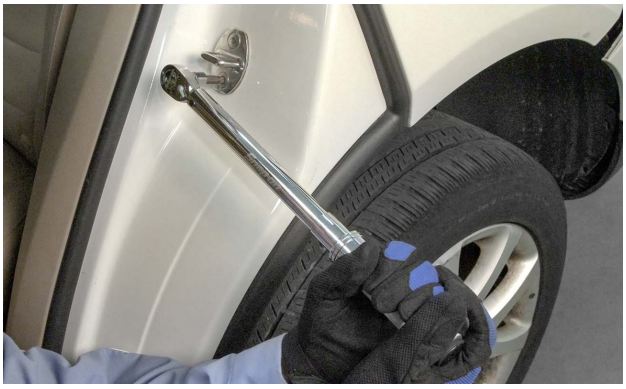
- refinish the hinge before installation, if required.
- position the hinge on the vehicle or shell and temporarily install the fasteners. If the hinge is being installed on an undamaged pillar, inspect the finish in the mounting area to determine approximate hinge location.
- tighten the fasteners, but do not torque them because additional adjustment may be required.

A door stand may be helpful when installing a door.

Before installing a replacement door, refinish the door jamb. To install the door to the vehicle structure:

- transfer any parts that may be easier to install with the door off of the vehicle. The outer door handle should not be installed before refinishing.
- position the door with a door stand or with the help of an assistant. If an assistant is used, the latch of the door can be closed on the striker to help position the door in the door opening.
- temporarily install the fasteners with the door in place. Tighten, but do not torque, the fasteners.

If the striker was removed, align the door on the hinge or pillar without the striker in place.



Torque fasteners to the recommended torque specification.

Complete the door installation by:

- transferring any remaining parts that were not transferred before door installation.
- aligning the door with the fender, rocker panel, roof, and rear door or quarter panel. With the door aligned, torque the fasteners to the recommended torque specification.
- installing the striker and adjusting it as required.
- installing the door wiring and verifying the operation of accessories.
- installing the interior trim panel and other hardware as required. Verify that the door fits properly and that all mechanical parts of the door are operational.

This hinge can be adjusted up and down and forward and rearward.

Pillar-mounted hinges can be adjusted to move the door shell:

- forward or rearward. To move the entire shell forward, loosen the fasteners and move the door forward. To move the entire shell rearward, loosen the fasteners and move the door rearward.
- upward or downward. To move the entire door shell upward,

loosen the fasteners and lift the door shell. To move the door downward, loosen the fasteners, and lower the door shell.

- in multiple directions simultaneously. The entire door shell can be adjusted for height while moving the shell forward or rearward. The door can also be lowered in the front at the top while raising the door in the rear at the bottom. This is done by loosening the hinges and sliding the door forward on the top hinge and sliding the door rearward on the bottom hinge. Reversing this procedure will have the opposite effect.

This door-mounted hinge has adjustments for height and flushness.

Door-mounted hinges can be adjusted to move the door shell:

- upward or downward. To move the entire door shell upward, loosen the fasteners and lift the door shell. To move the door downward, loosen the fasteners, and lower the door shell.
- inward or outward from the vehicle structure. To move the entire door shell outward, loosen the fasteners and pull the door out. To move the entire door shell inward, loosen the fasteners and push the door in.
- in multiple directions simultaneously. The door can be adjusted for height while moving the shell inward or outward. The door can also be moved inward at the top while moving outward at the bottom or vice versa.

When adjusting a door vertically, make the adjustment on the part that the hinges were installed on. For example, if the door was removed from the hinges, make any vertical adjustments on the door-mounted hinges. If the door and hinges were removed from the pillar, make any vertical adjustments on the pillar-mounted hinges.

The striker may have some adjustment, but should not be used to adjust door height.

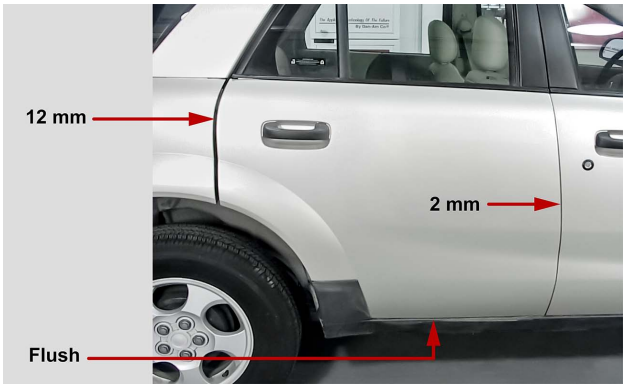
Not all vehicles have an adjustable striker. In most cases, the striker will be located on the pillar. To determine if the striker requires adjustment, watch for the door jumping up or dropping off of the striker

when the door is opened. If the door jumps up and the panel is in alignment with the striker removed, the striker has to be moved upward. If the door drops off of the striker and the panel is in alignment with the striker removed, the striker has to be lowered. If the door gaps are not correct and either of these conditions exists, the problem is misalignment of the hinges.

The rear of the door may be aligned for flushness by moving the striker. There should be little to no positive flushness between the rear of the door and the next adjoining panel. Remember, the latch will have two positions, pre-latched and latched. If the striker is positioned too far in, the door will only latch in the pre-latched position. Verify that the latch closes on both positions when aligning a door.

Refer to "Video: Door Replacement And Adjustment" in the presentation. This video discusses one vehicle maker's procedure for removing and reinstalling a door.

Activity: Door Adjustment - Pillar-Mounted Hinges



Refer to Module 2, "Activity: Door Adjustment - Pillar-Mounted Hinges" in the presentation. This activity presents one example of adjusting doors with pillar-mounted hinges.

Activity: Door Adjustment - Door-Mounted Hinges

Refer to Module 2, "Activity: Door Adjustment - Door-Mounted Hinges" in the presentation. This activity presents one example of adjusting doors with door-mounted hinges.

Sliding Doors

This van has a power sliding door on the driver side.

Sliding doors are found on minivans and full-size vans. Sliding doors may be:

- manual. Manual sliding doors require the occupant to open and close the door.
- automatic. Automatic doors may be opened with a remote control or from a switch near the driver seat. Automatic doors may also assist opening the door manually. If an occupant pulls the door handle, the motor will open or close the door.
- passenger side only.
- dual, both driver and passenger side.

This van is equipped with a power window in the sliding door.

Sliding door parts include:

- stationary and movable glass. Most glass is stationary, although there is at least one vehicle with a roll-down window in the sliding door.
- the electrical connectors that connect the sliding door to the vehicle structure. The connectors may be a plunger design or the door may be hard-wired. The plunger design has one receiver on the door and one on the B-pillar. Those that are hard-wired are mounted along the lower door track.
- the tracks that the door slides on.
- the rollers that run along the tracks.
- the latch and striker mechanism. These are similar to other latches and strikers.

On this van, the sliding door tracks are located at the roof and rocker panel areas.

Sliding door tracks:

- are spot welded or bolted to the vehicle structure.
- will be located in the rocker panel area and in at least one other spot.
- may be located on the quarter panel below the quarter panel glass.
- may be located along the roof rail.

The plunger mechanism carries electricity to the sliding door accessories.

Some sliding doors have a plunger mechanism. The plunger mechanism:

- has one plunger set on the door and one on the B-pillar.
- connects the electrical accessories of the door to the vehicle wiring.
- has different pins for different accessories. A service manual is required to identify the pins.
- must be aligned properly to ensure good contacts between the pins.

This sliding door is removed by removing the stop and rolling the door off of the tracks.

To remove a sliding door:

- open and support the door with a door stand or an assistant.
- remove the trim as required and disconnect and remove the wiring from the sliding door shell. This will not be required if the door is equipped with a plunger pin mechanism.
- remove the fasteners.
- remove the door by sliding it off the track.

The rollers of this sliding door are placed in the door track and the door is rolled into the closed position during installation.

To install a sliding door:

- support the door and slide it onto the tracks.
- temporarily install the fasteners.
- reroute and reconnect the door shell wiring if required. Verify the proper operation of the electrical accessories.
- align the door and the track.

After adjustments have been made, the door alignment is checked.

Continue the sliding door installation by:

- tightening the fasteners to the recommended torque specification.
- rechecking the alignment of the door with the front door, roof, rocker panel, and quarter panel.
- verifying that the door opens and closes smoothly and that all power accessories are in working operation.
- transferring trim and hardware as required.

Module Wrap Up

Topics discussed in this module included:

- door handle replacement.
- door replacement.
- door hinge replacement.
- composite door skin replacement.
- door alignment.
- sliding door replacement.