Bolted-On Exterior Panels - Part 1 (EXT03e)

Self-study Narrations

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Module 1 - Bolted Exterior Panel Replacement Considerations

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Learning Objectives

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.

Exterior Panel Parts Identification

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 Considerations

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 flushness when comparing panels.

The amount of effort required to open and close hoods, doors, and deck lids is another role of panel alignment. If the gap between panels is tight, it may require more opening and closing effort than properly aligned gaps.

Incorrect panel alignment is primarily responsible for leaks and noise. In addition, damage to the finish may also occur if a panel is misaligned. 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.

Positive And Negative Flushness

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.

Panel Alignment Specifications

Panel alignment specifications from the vehicle maker may 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. Specifications are usually found in a vehicle-specific body repair manual or

service manual. Although some gap recommendations may be larger, they are typically 3 to 8 millimeters for panel gaps and 0 to 2 millimeters for flushness.

If there is no vehicle maker recommendation for panel gaps or flushness, compare the panels to the opposite side of the vehicle or 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.

Determining The Source Of Misalignment

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.

Body-Over-Frame Vs. Unibody Considerations

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.

Types Of Adjustments

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, also referred to as cage nuts, are also used. 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 parts together. Adjustable stops are used for flushness alignment, particularly on hoods and deck lids. They are usually threaded and can be lowered or raised. Shims are typically used for making height adjustments.

Alignment Tip

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.

Panel Adjustment Sequence

Before installing replacement exterior panels, it may be helpful to remove the striker. Before removing the striker, check to make sure that 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 fasteners are loosened, adjust forward-and-back, side-to-side, and top-to-bottom gaps whenever possible.

Opening And Closing Effort
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. If this is not possible, check this on another undamaged vehicle. Watch for the door dropping down or jumping up off of the striker.

Developing A Repair Plan
Before beginning repairs, determine if there are any undamaged adjacent panels that require complete or partial removal, and which trim and hardware items must be removed. Also determine if there are any other parts or accessories that require removal and installation such as wiring inside of a door and 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.

When removing doors, determine the location of side airbags and side airbag impact sensors, if equipped.

Part Removal Considerations
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 damage.

Protecting Undamaged Adjacent Panels
One way to protect undamaged, adjacent panels is to carefully remove 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. Blankets can be used to cover glass when removing adjacent parts such as hoods and deck lids.

When storing vehicles outside, cover any openings that may expose the interior with plastic. If parts are stored inside of the vehicle, it is critical that the seats be protected before placing the parts inside.

Replacement Part Considerations
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.

Recycled Part Considerations

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. Verify 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. Repair any minor damage and take the appropriate steps to restore the corrosion protection. Inspect for any improper previous repairs and inspect the mounting locations for any cracks. This is especially important on composite parts. Composite parts with damaged mounting locations should NOT be installed. Determine what steps will be required to prepare the replacement part for refinishing. Also consider which anti-theft laws and record-keeping requirements apply for installing recycled parts. These vary between each state or province. Check with local authorities for record-keeping requirements.

Tools And Equipment

The tools and equipment required for removal of most bolted exterior panels typically include trim removal tools, a socket set, and screwdrivers. In addition, Torx and inverted Torx drivers may also be needed. Trim removal tools and screwdrivers are necessary to remove door panels and interior trim that may need to be removed for access to fasteners or for wiring harness removal. Most panels are attached with hex-head bolts or nuts and will require a socket set for removal, but Torx fasteners are being used more frequently. Storage containers ensure that the correct fastener is reinstalled in the correct place. Help from an assistant may be required for removal of some parts to avoid damaging adjacent panels and glass.

Parts And Storage Racks

There are a variety of parts racks available for part storage. Some of these include utility racks, parts caddies, bumper stands and stations, door holders, and truck bed stands.

Fasteners

Some common types of fasteners that are used for exterior panel installation include flange bolts and nuts, plastic retaining clips and push pins, and sheet metal screws.

Fastener Organization

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 or storage bins to separate fasteners, using masking tape to label the fastener, or installing the removed fastener in the part that was removed. Since fasteners may be damaged during a collision, it may be beneficial to have an inventory of common replacement fasteners.

Fastener Considerations

Some fastener considerations that must be taken into account include the use of one-time use fasteners, duplication of the original appearance, composite panel fastener considerations such as torque specifications, and the use of the correct fastener if one needs to be replaced.

Hinge Types

Hinges used to fasten movable exterior body panels to the body structure may have replaceable pins and bushings or 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.

Hinges With Replaceable Pins And Bushings

On vehicles with replaceable pins and bushings, the hinge may either be bolted or welded to the panel or 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.

Replacement Of Pins And Bushings

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 with a door stand or with help from an assistant. Adjacent panels should be protected to prevent damage caused by the panels rubbing together. Next, the pin can be driven out with a pin driver and the panel can be removed from the vehicle structure. It may be necessary to disconnect the wiring harness to give enough room to replace the bushings. With the panel removed, the worn bushings can be driven out of the hinges.

Replacement Of Pins And Bushings (cont'd)

When replacing pins and bushings, the new bushings are installed with a bushing driver. Next, the panel is reinstalled by driving the new pins into the hinge. The new pins may come with a pin retainer clip that must be installed to prevent the pin from falling out of the hinge. The door spring can now be installed.

Module Summary

Topics discussed in this module included:

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

Module 2 - Doors

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Learning Objectives
Learning objectives for this module include:

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

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

Doors
Door types include front-mounted hinges, rear-mounted hinges and sliding doors. Most doors have a steel shell with a steel skin, but increasing in popularity is a composite skin that is bolted to a steel shell. There are also vehicles that have a composite door shell and a composite skin that is generally bonded with an adhesive.

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.

Door Attachments
Common door attachments include moldings, cladding, and emblems. The side-view mirror may be attached to the front door on some vehicles. The inside of the door shell may contain movable glass with the attaching hardware, and wiring harnesses that control power accessories. On the inside edge of the door will be the interior trim panel and weatherstripping.

Door Attachments (cont'd)
Other door attachments include door handles and associated hardware, including the lock cylinder and linkage and latch mechanism.

Most doors have an intrusion beam constructed of high-strength steel to protect occupants in a side impact collision. Damaged door intrusion beams should not be repaired. Bolted intrusion beams can usually be replaced. Damaged welded intrusion beams may require replacement of the door shell. Another safety item that may be in a door shell is 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. Also, there may be materials to prevent noise and vibration.

Door Handles

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, bolts, rivets, screws, or clips.

Door Locks

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 manually controlled. The lock cylinder may be installed in the door handle or it may be held in the door skin with a retainer clip.

Door Handle And Lock Linkages

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 and locks to the latch, and cables with a ball on the end. These are similar to a hood release cable.

Door Handle Removal

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 door handle. Remove the interior trim panel and moisture seal and undo the linkage from the outer handle. Remove the fasteners and then the door handle.

Door Lock Removal And Installation

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.

Door Handle Installation

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.

Verify the latch and linkages are operational with the door open. If the door latching mechanism is not working correctly and the door is closed, it may be difficult to get the door opened.

Door Latches

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 with the striker and the latched position will secure the door in the closed position.

Child Lockout Mechanism

A child lockout mechanism prohibits opening the door from inside the vehicle. There is a clip on the door latch that, when activated, will prevent the inside door handle from operating the latch. This reduces the chance of a young child opening the door and becoming injured.

Door Wiring

Many of the accessories that are located in a door shell will have wiring connected to the vehicle computers. The amount of door wiring varies depending on the accessories in the door. Even doors with limited electronic accessories may have a complete wiring harness in the shell. Before removing any wiring from the door shell, make note of the wire routing and the location of attachment clips. It may not be necessary to mark the wires for identification, since most door wiring is cut to length based on the location of the accessory and because of the numerous styles of connectors that are used to prevent improper installation. With the door wiring removed, closely inspect for any damage and repair or replace it as required.

Label Wiring

Although not always required, it may be necessary to label some door wiring in situations where a similar style clip is used. When labeling wiring, masking tape and a marker can be used or there are specialty tapes designed for this purpose.

Door Hinges

The door hinges connect the door to the pillar and allow the door to be opened and closed. Types include front-mounted and rear-mounted hinges. Hinges that are discussed in this course are fastened using bolts or flange nuts or a combination of both.

Check Straps

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. Depending on the vehicle, the check strap may be a slide type that is bolted to the pillar and slides in and out of the door or it may be a spring type, which keeps the door open and the hinge stops prevent the door from opening too far.

Door Removal

To remove a door from the vehicle, it may be necessary to remove the interior trim panel to access the wiring so that it can be disconnected. Unbolt the check strap from the pillar,

if applicable, and determine if the hinge will be removed from the door or the pillar. This will depend on access to the fasteners.

Door Removal (cont'd)

Continue the door removal by positioning a door stand in place or having an assistant hold the door. Unbolt the hinges and remove the door from the vehicle.

Use caution when removing the wiring harness from the door shell. The sharp edges of the door shell could damage the wiring, leading to electrical problems.

Hinge Removal

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

Hinge Installation

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.

Door Installation

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 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.

Door Installation (cont'd)

Complete the door installation by transferring any remaining parts that were not transferred before door installation. Align the door with the fender, rocker panel, roof, and rear door or quarter panel. With the door aligned, torque the fasteners to the recommended specifications. Install the striker and adjust it as required. Next, install the door wiring and verify the operation of any accessories. The interior trim panel and other hardware can be installed. Ensure that the door fits properly and that all mechanical parts of the door are operational.

Do not install a recycled door with stress cracks around the hinge, latch, or door handle mounting areas, or with corrosion that has caused pitting. Closely inspect the hem flange

area. When aligning the replacement door, temporarily install the door wiring in the door shell to avoid damage.

Door Adjustments - Pillar-Mounted Hinges

Pillar-mounted hinges can be adjusted to move the door shell forward or rearward, up and down, and any combination of these adjustments. Usually, flushness cannot be adjusted on pillar mounted hinges.

Door Adjustment - Door-Mounted Hinges

Door-mounted hinges can be adjusted to move the door shell up or down, in or out, or any combination of these. There usually is no adjustment for forward or rearward on door mounted hinges. 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.

Door Adjustment - Striker

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 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.

Activity: Door Adjustment - Pillar-Mounted Hinges

Sliding Doors

Sliding doors are found on minivans and full-size vans. Sliding doors may be manual or automatic. Manual sliding doors require the occupant to open and close the door. Automatic doors may be opened with a remote control or from a switch near the driver's 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. Sliding doors are usually found on the passenger side of the vehicle but may be found on both sides.

Sliding Doors (cont'd)

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. There are also 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.

Sliding Door Tracks

Sliding door tracks are spot welded or bolted to the vehicle structure. The tracks are usually located in the rocker panel area and the center of the quarter panel below the quarter panel glass or along the roof rail.

Sliding Door Plunger Mechanism

Some sliding doors have a plunger mechanism to connect the electrical accessories to the vehicle wiring. When the door is closed, the pins on the plunger make contact with the contact pad and the electricity can reach the accessory. It is important to have the panel in alignment so that a good connection is made.

Sliding Door Removal

To remove a sliding door, open and support the door with a door stand or with help from 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 and remove the door by sliding it off of the track.

Properly identify and store the removed fasteners for proper reinstallation. Protect adjacent panels to prevent damage when removing and installing sliding doors.

Sliding Door Installation

To install a sliding door, support the door and slide it onto the tracks. Temporarily install the fasteners and reroute and reconnect the door shell wiring, if required. Verify the proper operation of the electrical accessories. The door can be aligned by adjusting the track or door attachment brackets.

Sliding Door Installation (cont'd)

Continue the sliding door installation by torquing the fasteners to the recommended specifications. Recheck the alignment of the door with the front door, roof, rocker panel, and quarter panel. Verify that the door opens and closes smoothly and that all power accessories are in working operation.

Do NOT install recycled sliding doors with stress cracks around the hinges, latch, or door handle mounting area. Verify that the door is equipped with the same accessories as the original door before installation.

Module Summary

Topics discussed in this module included:

- door handle replacement.

- door replacement.
- door hinge replacement.
- door alignment.
- sliding door replacement.

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