Intro To Vehicle Parts Terminology - Part 2

Textbook

I-CAR®

Version: 14.2

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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 damage report.
- follow proper procedures.
- use quality replacement parts and materials.
- 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.

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.

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.

Intro To Vehicle Parts Terminology - Part 2

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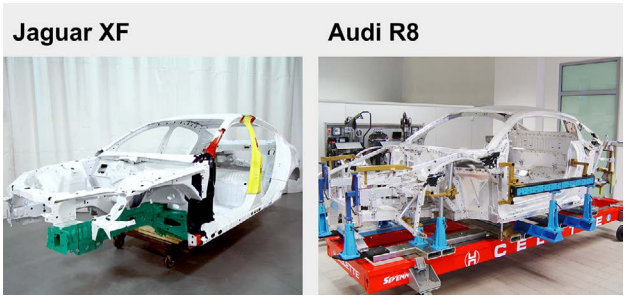
Front Unibody Structures And Full Frames

Learning objectives for this module include:

- identifying various vehicle designs.
- identifying front parts of a unibody structure.
- identifying parts of a full-frame assembly.



This Jaguar XF unibody shows the inner structure with the outer panels and trim removed (left). This is the space frame for an Audi R8 (right).

There are two basic types of vehicle structures, a unitized structure and body-over-frame.

Unitized structures include most passenger cars and some sport-utility vehicles (SUVs). Some pickup trucks may also be designed as a unitized structure, rather than a full-frame.

Unibody

There are two types of unitized structures, a unibody and a space frame.

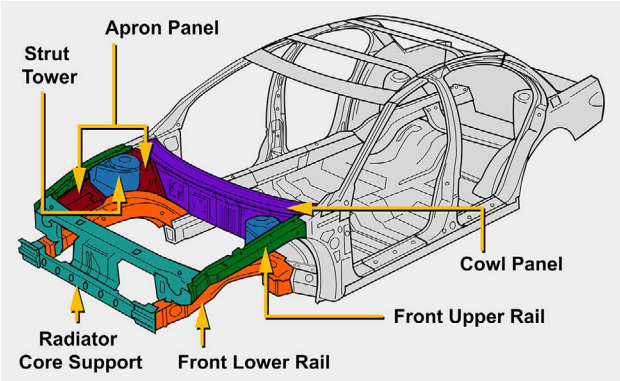
A unibody is a single structure built by attaching multiple parts of sheet metal with spot welds or adhesives, or a combination of both.

Exterior body panels, such as the quarter panel and roof, are considered part of the unitized structure on unibody vehicles.

Space Frame

A space frame vehicle is similar to a unibody, but is less dependent on outer body panels for structural integrity.

Space frame vehicles are built more like a race car cage.



Front parts of a unibody structure include:

- a radiator core support.
- front upper rails.
- front lower rails.
- strut towers.
- apron panels.
- a cowl panel.

Video: Radiator Core Support

Radiator Core Support
The radiator core support serves as the front-end cross structure, helping maintain the rigidity of the front body structure.

A basic radiator core support has an upper and lower tie bar, and some may even have side supports. However, some do not have a lower tie bar.

This radiator core support is made up of steel and composite materials. However, some may be made of aluminum or magnesium.

Video: Front Lower Rails

Front Lower Rails
Front lower rails, seen here in green, are the lower structures that run alongside the engine compartment. They may hold the engine mounts and the engine cradle.

Front lower rails may be made up of an inner and outer portion that is welded together. The inner rail is the portion that is closest to the engine compartment.

This set of formations on the end of the lower rail is called a crush zone. These are designed into the structure to allow the front portion of the rail to crush in this area during a frontal collision.

Video: Engine Cradle

Engine Cradle
An engine cradle, or subframe, on a unibody vehicle is usually a four-sided structure that holds the engine in place and attaches to the front lower rails.

An engine cradle may also contain a part of the front suspension or steering system.

On unibody vehicles that don't contain a subframe, or engine cradle, the engine mounts and other parts mount to the lower rails.

Video: Front Upper Rails

Front Upper Rails
Front upper rails are the upper structures alongside of the engine compartment. They extend forward of the passenger compartment and contain mounting points for the fenders.

Video: Aprons And Strut Towers

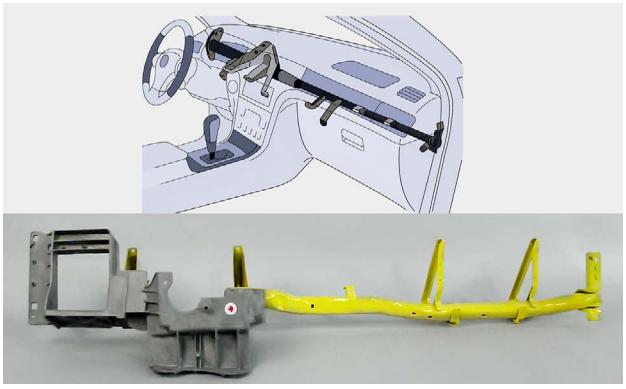
Aprons And Strut Towers
The aprons connect to the upper and lower front rails, as well as the strut towers.

The strut tower is the raised portion of the apron assembly, which is used for attaching the top of the front suspension on some vehicles.

The strut tower may be formed as part of the stamping of the apron, or a separate welded part to the apron, such as we see here.

Video: Cowl Panel

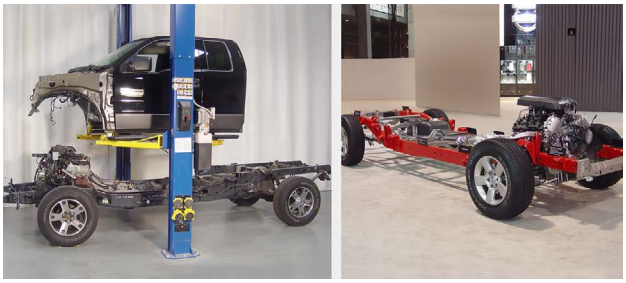
Cowl Panel
The cowl is an assembly that separates the engine compartment and passenger compartment. Holes are designed into the cowl so that mechanical parts and wiring can pass through.



The location of the instrument panel frame is shown here (top). This is an instrument panel frame removed from a vehicle (bottom).

An instrument panel frame is located under the instrument panel, attached to each side of the vehicle. An instrument panel frame may also be called a cross-car beam.

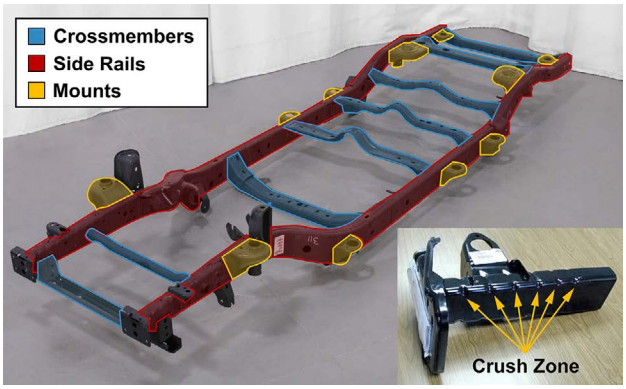
The instrument panel frame serves a structural role, in that it helps in the rigidity of the vehicle and preventing collapse of the passenger compartment in a side collision.



The unitized structure is lifted above the frame (left). The engine and suspension are mounted to the frame (right).

A full-frame, or body-over-frame, vehicle has an independent frame with a separate unitized structure bolted to it. A unitized structure on a full-frame vehicle may include a radiator core support and front upper rails.

The engine, drivetrain, and suspension are all mounted to the frame.



Parts of a full-frame assembly are called out (top). This front frame tip has a designed-in crush zone (inset).

Parts of the frame assembly on a full-frame vehicle include:

- left and right frame rails that extend from the front to the rear of the vehicle.
- front frame tips. These are parts, similar to a unibody crush box, designed to absorb collision energy. They may be able to be replaced as separate parts.
- front, center, and rear crossmembers. Crossmembers on full-frame vehicles connect the two side frame rails.
- mounts for the suspension, engine, and body.

A trailer hitch may be welded or bolted to the frame.

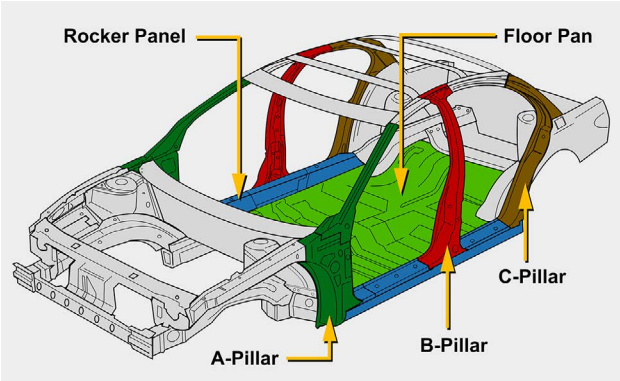
Topics discussed in this module included:

- vehicle designs.
- front parts of a unibody structure.
- parts of a full-frame assembly.

Side And Rear Unibody Structures

Learning objectives for this module include:

- identifying side parts of a unibody structure.
- identifying center parts of a unibody structure.
- identifying rear parts of a unibody structure.



Side and center parts of a unibody structure include:

- A-pillars.
- B-pillars.
- C-pillars.
- rocker panels.
- the floor pan.

Video: Pinchweld Flanges

Pinchweld Flanges

Pinchweld flanges are located along the edges of stamped body panels, such as on this A-pillar. During the manufacturing process, the multiple layers are spot welded together along the flange, joining them, creating the pinchweld.

We can also see pinchweld flanges along this door opening and rocker panel.

Video: A-Pillars

A-Pillars

A-pillars extend from the top portion of the vehicle to the lower portion, and may also be called windshield pillars. The lower portion is sometimes referred to as a hinge pillar. A-pillars form the forward

corner of the passenger compartment and support the front door hinges, windshield, cowl, and front corner of the roof.

There are generally multiple layers, including outer and inner panels, an upper reinforcement, seen here in red, and a lower reinforcement, seen here in blue.

Video: B-Pillars

B-Pillars

B-pillars are the pillars located near the middle of the vehicle that support the roof rail, as well as protect the vehicle occupants. They contain the front door strikers and the hinges for the rear doors.

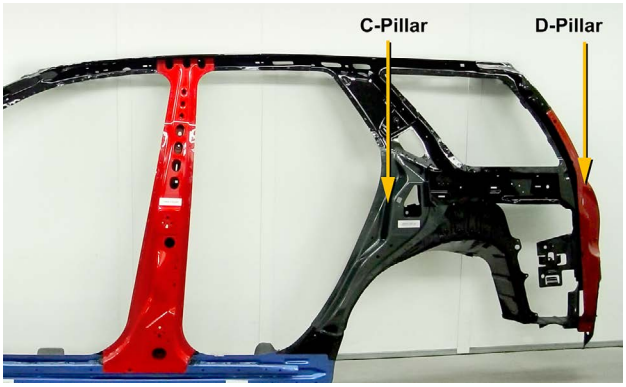
B-pillar construction typically includes an outer panel, inner panel, and one or more reinforcements. This cutaway allows us to see the multiple layers. The outer and inner panels are colored in white, while the primary B-pillar reinforcement is seen here in yellow. An additional reinforcement can be seen here in red.

Video: C-Pillars

C-Pillars

The C-pillars are located rearward of the B-pillars. On this four-door structure, the C-pillars are part of the rear door opening and support the strikers for the rear doors. The lower area of the C-pillar that merges with the rocker panel is commonly called the dogleg.

C-pillars may be designed differently on a two-door vehicle. In this example, the C-pillar contains the opening for the quarter panel glass.



The C- and D-pillars are called out here.

D-pillars are the pillars rearward of the C-pillars that support the roof, as in station wagons, vans, and some SUVs.

D-pillar designs may include the rear gate or hatch frame, and the side panel or quarter panel.

Some D-pillars are complex multiple structures with an inner, outer, and several reinforcements.

Video: Rocker Panels

Rocker Panels

Rocker panels are located below the doors, and serve as the lower support for the pillars, as well as the side support for the floor pan.

Similar to pillar construction, rocker panels may be a multi-part assembly, consisting of an outer panel, inner panel, and reinforcements. The inner panel may or may not be part of the floor pan. We can see that it is a separate piece on this vehicle structure.

Rocker panels may also have one or more reinforcements. We can see the front portion of the rocker panel reinforcement here, colored in orange, and it extends rearward along the inside of the rocker panel.

The roof rails extend from front to back on each side of the vehicle (top). A replacement roof panel has been fit onto the vehicle (bottom left). The foam beads applied to the roof bows reduce noise and vibration between the roof bows and outer roof panel (bottom right).

Roof Panel

The roof panel:

- is the cover panel for the top of the passenger compartment.
- in combination with the roof rails and roof bows, serves a structural role, especially in the event of a rollover.

Roof Rails And Roof Bows

The roof rails connect the pillars from front to back, and help form the structure to attach the sides of the windshield and backglass.

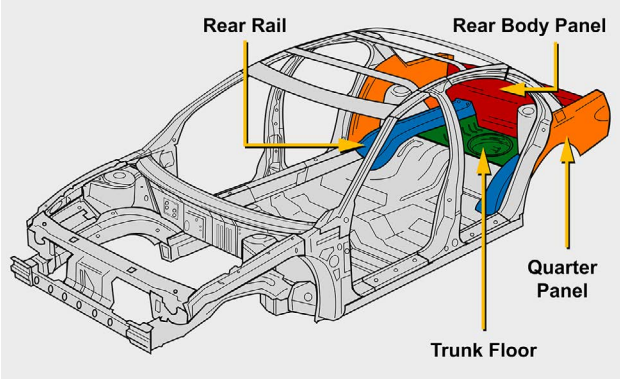
There may be roof crossmembers at the front, between the upper A-pillars, and at the rear, between the rear pillars, to help form the interior structure.

Two or three roof bows across the roof panel add rigidity.

Video: Floor Pan Assembly

Floor Pan Assembly
The floor pan assembly consists of the floor of the vehicle inside the passenger compartment. Depending on the vehicle design, the floor pan may be multiple sections.

Crossmembers on unitized structures serve as structural or stiffening parts across the width of the vehicle. There may be crossmembers over or under the floor pan that run between the rocker panels. Floor pan crossmembers may include mounting points for the seats. Floor pan crossmembers may run the entire width of the floor pan, or be two separate pieces that connect to the raised center section, such as we see here.



Rear parts of a unibody structure may include:

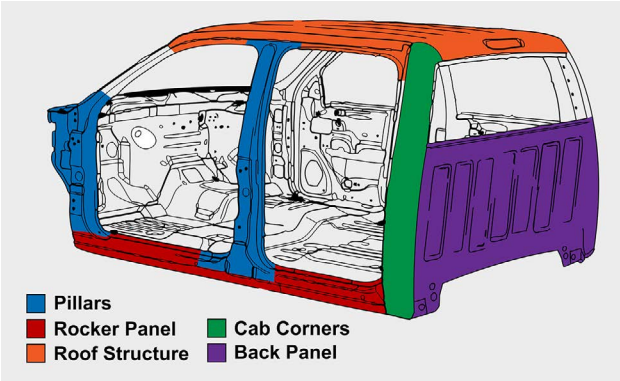
- quarter panels.
- rear rails.
- a trunk floor.
- the rear body panel.

The highlighted area indicates what is considered the quarter panel.

Quarter panels are the rear side panels that make up the rear quarter structure.

Quarter panels may include an inner shield, outer panel, inner panel, wheelhouse, and sail panel. The quarter panel may also contain a glass panel, and the fuel filler door and opening.

Depending on the type of vehicle, a quarter panel may include the outer C- and/or D-pillars.



Parts of a full-frame unibody structure are called out.

The unibody structure on a full-frame pickup truck is similar to a unibody on a passenger car. Parts of the unibody on a full-frame pickup truck include:

- pillars.
- rocker panels.
- a roof structure.
- a back panel. cab corners. The cab corners are similar to quarter panels on a passenger car.

The unibody structure on a full-frame sport-utility vehicle (SUV) is nearly identical to the unibody on a passenger car with all of the same parts.

This is an example of a replacement uniside.

A uniside is a one-piece outer structure forming seamless front and rear door openings. The structure includes the pillars, roof rail, and rocker panel.

Uniside construction may or may not include the quarter panel.

There may be both an outer and inner uniside.

Video: Rear Rails And Trunk Floor

Rear Rails And Trunk Floor

The rear rails, seen here in green, together with the crossmembers, form the rear underbody structure of a unibody vehicle. They also support the floor pan and trunk floor.

This set of formations on the end of the rear rails is called a crush zone. These are designed into the structure to allow the rearward portion of the rail to crush in this area during a rear-end collision.

The rear rails may be closed out on the rear end by a bumper bracket, rear body panel, or a simple closeout panel that serves only that purpose.

The trunk floor is commonly a separate floor panel and may be formed to hold the spare tire.

Video: Rear Body Panel

Rear Body Panel

The rear body panel serves as the rear cross structure of the vehicle. It connects the rear rails and quarter panels. It is also attached to the rear of the trunk floor.

The rear body panel can be a closeout panel for the rear rails on some designs, such as we see here.

The panel is typically located behind the rear bumper cover and can only be seen once the bumper cover is removed.

Topics discussed in this module included:

- side parts of a unibody structure.
- center parts of a unibody structure.
- rear parts of a unibody structure.

Interior

Learning objectives for this module include:

- identifying an instrument panel.
- identifying controls and switches on the interior.
- identifying a rearview mirror. identifying a center console.
- explaining manual and electronic seats.
- identifying a headliner.
- identifying other interior parts.

The instrument panel contains the passenger airbag, the glove box, and several controls for the driver (left). An instrument cluster is shown here (right).

The instrument panel, or dash panel, is an interior panel located in front of the driver and passenger. It is bolted to brackets between the A-pillars. The instrument panel houses the instrument cluster, where various gauges and indicator lamps are located.

Also contained in the instrument panel are a fuse box, the dash pad, passenger airbag, and glove box, among other parts.

Video: Controls

Controls

Controls include the electrical switches and mechanical levers within the reach of the driver. This may include the multifunction switch, which is located on the steering column. This switch will typically run the lights, turn signals, and may also include other features such as windshield wipers. Also typically on the steering column or steering wheel are the cruise control settings, the horn button, and buttons to control the radio.

Other controls on this vehicle to the left of the steering wheel include a switch for the headlamps and fog lamps, a dimmer switch for the illumination light on the instrument panel, and a button to open the trunk.

Some vehicles have electrical switches to adjust the seat as well.

Electrical controls on the door include the door mirror position adjuster, the power window settings, and the door locks.

On the instrument panel of this vehicle, we have controls for the hazard warning flashers, various controls for the radio, and controls for the heating, ventilation and air conditioning systems.

Controls also include the gear shifter on the center console, and the interior lamps on the overhead console.

On this Ford vehicle, there is a SYNC connection which links a smart phone, for example, to the vehicle. A phone call can be made using this speaker in the headliner.

There may be several accessories in the rearview mirror.

The rearview mirror is the interior mirror attached to the overhead console or the top of the windshield. There may be accessories in the rearview mirror, such as a dimmer for the headlamps, courtesy lamps, moisture sensor for automatic windshield wipers, compass, and thermometer.

Some vehicles also have a communication system located in the mirror, such as the General Motors OnStar system.

The center console often contains the emergency brake lever and the gear shifter.

The center console is the platform or compartment between the front seats that may contain the gear shifter and other controls, convenience items, and storage.

A seat is primarily for comfortably sitting in a vehicle, but there are several safety options in a seat (left). These are controls for climate-controlled seats (right).

Automotive seating provides numerous comfort and safety options. There are seat heaters and coolers, power lumbar adjustment controls, and some even have massage settings. Seat positions adjust either mechanically or electrically. The electrical settings may have a memory device. Some minivans and SUVs have entertainment centers and screens located in the back of the headrests.

The other function of seats is for safety. Some contain side airbags and an anti-whiplash system for rear impacts.

Rear seats in many vehicles are split. The backrest will fold down on either or both parts of the seat to provide additional cargo space.

This is a stiff headliner that keeps its form outside the vehicle.

The headliner is the fabric or other material trim covering the roof on the interior. It is typically a one-piece, foam-backed fabric material.

Parts integrated with the headliner may include the sun visors, rearview mirror, dome lamps, and overhead console. Side

curtain airbags are typically contained within the headliner. There are also grab handles located at the edge of the headliner. The grab handles bolt through the headliner into the roof structure. Side curtain airbags are commonly located along the edge of the headliner.

This A-pillar trim panel is being removed.

The pillars, which make up the side structure, are covered with trim panels on the interior. There are trim panels covering the interior of each of the A-, B- and C-pillars, and D-pillars if applicable. These trim panels are usually plastic or fabric-covered plastic. They are usually attached with clips and screws so they can be removed for repair access.

This is the carpeting in the front by the pedals with the backing partly showing on top.

Carpeting in a vehicle has a backing, and a foam pad beneath the backing to help with noise, vibration, and harshness control. The padding may have a variable thickness or density. The padding may be separate or attached to the back of the carpeting.

This package tray, without the trim cover, shows some of the parts that are located on this back shelf.

The package shelf is the raised surface behind the rear seats on most cars. The shelf may be fabric-covered, may serve as the mounting panel for rear speakers and high-mount brake lamps, and may be an anchoring location for the rear seat belts and child safety seat tethers. There is typically access to the backside of the package shelf from inside the trunk.

Topics discussed in this module included:

- the instrument panel.
- controls and switches on the interior.
- the rearview mirror. the center console.
- manual and electronic seats.
- the headliner.
- other interior parts.

Glass

Learning objectives for this module include:

- identifying the difference between laminated and tempered glass.
- identifying various accessories that may be integrated with stationary glass.
- identifying parts of movable glass assemblies.
- explaining the operation for various types of glass lifting mechanisms.

Glass protects occupants from wind, weather, and debris while driving, and allows the driver and occupants a view of the road and traffic.

All glass on a vehicle, stationary and movable:

- protects occupants from wind, weather, and debris while driving.
- allows the driver and occupants a view of the road and traffic.

The windshield is shown here (top left). Quarter glass is shown here (top right). The backglass is being removed from this vehicle (bottom).

Examples of stationary glass include:

- the windshield.
- side glass, which may be attached to side body panels or doors.
- quarter glass.
- the backglass. This is the glass at the rear of the vehicle.

This glass has an inner laminate that holds the glass together when broken (left). Tempered glass shatters into many pieces when broken (right).

Glass can be laminated or tempered.

Laminated glass:

- is made of two sheets of glass with a plastic inner layer.
- holds together when broken due to the inner plastic laminate. This helps prevent the occupants from being ejected from the vehicle during a collision.
- is used in all windshields.

Tempered glass:

- is a single layer of glass.
- is brittle, and will shatter if cut, drilled, or ground. The shattered pieces are not as sharp as laminated glass slivers.
- may be used anywhere but the windshield.

Video: Breaking Glass

Breaking Glass

This windshield is a typical piece of laminated safety glass. Let's attempt to break it by striking it with a pointed punch. Notice the toughness of the glass as the first hit fails to break it. The second strike breaks the glass into large pieces that are held intact by the inner plastic laminate layer. This type of damage is typical of laminated safety glass.

Next, let's see how a piece of tempered safety glass breaks. This minivan quarter panel vent glass is placed in a plastic bag for safety reasons before the glass is broken. It's struck with the same punch that was used to break the laminated windshield glass. Notice how the glass explodes into small fragments. While the tempering process toughens the glass, it also places it in tension. Once the hardened outer skin of the glass is penetrated, the glass shatters. This is the typical type of damage that results.

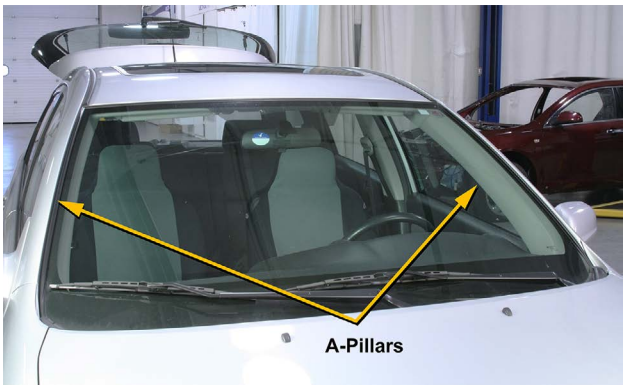
Video: Urethane Adhesive

Urethane Adhesive

Stationary glass may either be bolted to the vehicle structure or bonded with urethane adhesive. Urethane adhesive is dispensed from a tube using either a manual or powered dispensing gun.

When the adhesive is cured, it is flexible like rubber. It is also very strong. The cure time must be observed before the vehicle is driven.

Glass, such as a windshield, is commonly bonded to the vehicle on a pinchweld flange. A pinchweld is formed where two mating flanges are welded together.



The windshield helps support the A-pillars and roof.

Stationary glass that is bonded to the vehicle with urethane adhesive, especially the windshield: is a structural part of the vehicle. contributes to the strength of the roof and pillars.

Passenger Airbag

The windshield may also be designed to work with some types of passenger airbags. A deploying passenger airbag may use the windshield to deflect the deployment in the proper direction.

The label indicates that the glass has a solar tint (top left). This door glass has a green tint (top right). The top portion of this windshield is shaded to reduce glare (bottom).

Tinting

Glass is often tinted over the entire surface of the glass. Tint for tempered glass is made into the glass when it is formed. Aftermarket window tint is a film installed on the inner surface of the glass. Common tint colors include:

- blue.
- green.
- bronze.
- gray.

Extremely dark tinting that covers the entire glass is called "privacy" glass. Privacy glass can only be used behind the driver's field of vision in certain states. Other states do not allow privacy glass.

Shading

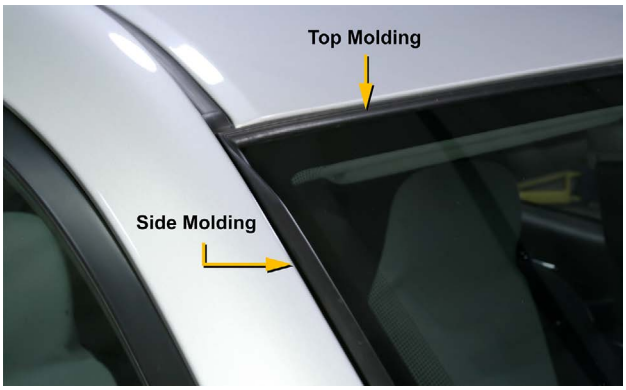
Shading on glass is:

- the tinted, horizontal band across the top of the windshield to reduce glare.
- made by darkening the plastic inner layer, not the glass.

Solar Glass

Solar glass:

- absorbs and reflects most of the infrared and ultraviolet rays of the sun. Ultraviolet rays cause interiors to fade and urethane adhesive to break down.
- is more effective than tinting in preventing fading and allowing air conditioning to work more efficiently.



Exterior molding surrounds this glass.

Exterior trim or moldings may surround stationary glass.

The molding that surrounds the windshield may be T-shaped, sometimes called "push-in molding," around the glass perimeter.

This side glass has an antenna (top left). This head-up display projects the speed and RPMs onto the windshield (top right). The defroster grids lines can be seen on this backglass (bottom).

There are conveniences and accessories being added to glass every model year. Some accessories may be attached to or integrated with the glass. Examples of accessories related to stationary glass include:

- a telecommunications system antenna.
- the radio antenna.
- rain sensors.
- defroster grids on not only the backglass but also the windshield. features in the rearview mirror, including the navigation system receiver.
- head-up display. A head-up display reflects projected images, such as a vehicle speedometer, onto the windshield. A special type of glass is used on vehicles that have this type of accessory.

This sliding door glass is in the down position (left). This hinged vent glass allows air to flow into the passenger compartment (right).

Movable glass allows ventilation of the passenger compartment. Movable glass may be:

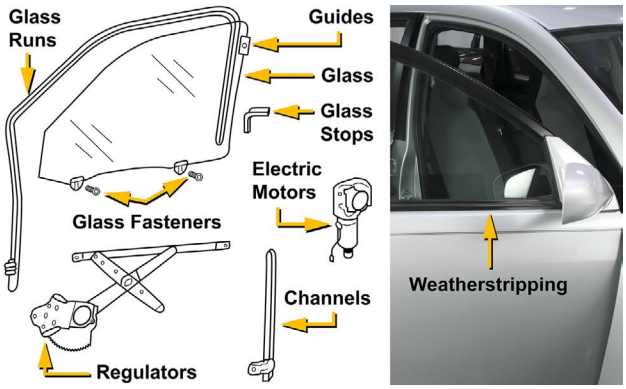
- sliding glass. Sliding glass is common for door glass that rolls up and down.
- hinged. Hinged vent windows are typically found in rear body sides or quarter panels of minivans, SUVs, and extended cab pickup trucks.

Movable glass is typically tempered. However some door and roof glass may be laminated.

This is an example of framed door glass (left). This is an example of frameless door glass (right).

Framed door glass has a frame or portion of the door shell completely surrounding the glass perimeter.

Frameless door glass assemblies have no frame, or part of the door shell surrounding the glass. When the door is opened with the glass rolled up, the edges of the glass are exposed.



Common sliding door glass assembly parts are called out here (left). Weatherstripping for the door glass is called out (right).

Parts of a typical sliding door glass assembly include:

- window regulators to move the glass up and down.
- electric motors to drive power window regulators. glass fasteners to secure the glass to the window regulator.
- window channels or tracks that the glass slides in as it moves up or down.
- rubber glass runs lining the window channels. These cushion the glass as it moves up and down.
- weatherstripping to prevent moisture from running down the glass into the door assembly. There is a piece of weatherstripping attached to the door trim panel, and one attached to the door skin at the belt line.

Video: Window Regulator Operation

Window Regular Operation

There are several different designs of window regulators. Let's first look at the operation of a single-arm, gear-operated window regulator. The spring applies pressure on the lifting arm gear assembly, which reduces the effort needed to raise the window glass.

Another design is the dual-arm, gear-operated window regulator. The arms connect at a pivot joint, and there are additional tracks in the door for the guides to run in. The dual-arm design pushes and pulls the glass from two points instead of one, allowing the force to remain evenly distributed along the glass bottom.

This window is raised and lowered using a cable-and-pulley style window regulator. Two cables run from the drive motor over pulleys to the glass panel. The upper cable is used to pull the glass up and the lower cable pulls the glass down.

The glass on this liftgate has hydraulic struts that hold the glass open.

Rear tailgate or liftgate movable glass is typically a hinged design with hydraulic lifting struts to hold the glass open.

The backglass on this pickup truck can be manually opened by sliding the middle glass (left). This is an example of a power-operated pickup truck backglass on a Toyota Tundra (right).

Movable glass assemblies found in pickup truck cab backs are typically sliding window assemblies. These windows may have both fixed and movable glass. Sliding backglass is typically manually operated, however there may be power-operated versions available on some applications.

This is an example of a power sunroof (left). This is an example of a panoramic roof (right).

Sliding Sunroof
Sliding sunroofs are typically power driven and can fully open.

Hinged Sunroof
Hinged or pop-up sunroofs are typically:

- manually opened and closed.
- removable for an open-air feel.

Panoramic Roof
Panoramic roofs are larger than sunroofs and extend for more view or light.
A panoramic roof may be stationary, movable, or both.

Topics discussed in this module included:

- laminated and tempered glass.
- stationary glass accessories.
- parts of movable glass assemblies.
- glass lifting mechanisms.