Stationary Glass (GLA02e)

Textbook

I-CAR®

Version: 4.2

GLA02e-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.

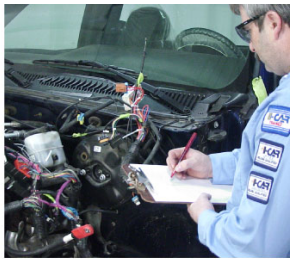
To reduce liability:

- 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.

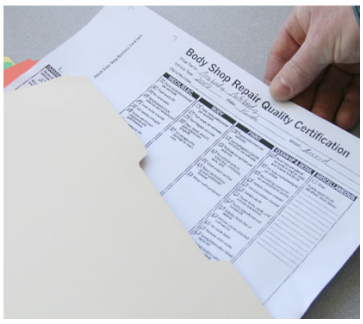
Liability insurance that covers the repair facility may not always cover all damages. For example:

- 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 - Stationary Glass Issues

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Role of Stationary Glass

Learning objectives for this module include:

- recognizing how stationary glass reinforces a vehicle structure.
- recognizing the motor vehicle safety standards that apply to stationary glass installations.
- determining the different types of glass.
- recognizing the properties of urethane adhesive required for stationary glass installations.

This windshield, bonded with urethane adhesive, contributes to the structural strength of the vehicle.

Stationary glass, combined with the urethane adhesive system:

- is a structural part of the vehicle.
- contributes to the strength of the roof and pillars.
- provides bracing to make the structure more rigid.
- helps manage collision energy. For example in a frontal collision, a urethane-bonded windshield helps direct energy through the A-pillars and over the roof, away from the passenger compartment.

The glass is bonded to the vehicle on the pinchweld. A pinchweld is formed where two mating flanges are welded together. The first windshield that was bonded with urethane adhesive was the 1973 Oldsmobile Cutlass. This was done to help prevent leaks that were occurring with gasket-set installations.

Stationary glass that is not bonded with urethane adhesive is not considered a structural part of the vehicle, but all stationary glass plays a role in maintaining rigidity and strength.

Refer to "Video: Structural Role Of Stationary Glass" in the presentation. This video shows how stationary glass, especially the windshield, plays a structural role in the video.

Some passenger airbags use the windshield for proper deployment.

Another role for the windshield is to work with the passenger airbag. A deploying passenger airbag may:

- deflect off the glass.
- use the windshield to deflect the deployment in the proper direction.
- be rendered ineffective by loosening or forcing the windshield out of the opening if it is a poor installation.

The strong plastic inner layer in a windshield holds the glass together when broken and helps to retain occupants during a collision.

Stationary glass also keeps unrestrained occupants inside. Severe injuries or fatalities can occur when the occupant is ejected from the vehicle.

One function of the windshield is to keep rain from entering the vehicle.

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.

Most consumers believe that this is the only role of stationary glass.

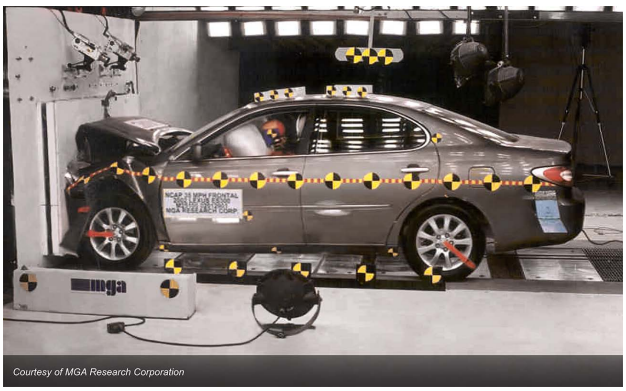
Safety Standards

There are several crash tests done to test the performance of OEM stationary glass, primarily the windshield.

Several Federal Motor Vehicle Safety Standards (FMVSS) issued by the U.S. National Highway Traffic Safety Administration (NHTSA) relate to OEM installations for stationary glass. These standards:

- are performance standards. The standards do not refer to how a stationary glass installation is done, or the strength of adhesives or other materials, but how the entire vehicle performs with the glass installed.
- are used to test OEM installations only. There is no testing for aftermarket installations, though adhesive makers and other groups use similar tests, based on the federal standard, to test the performance of aftermarket products.
- are pass / fail only. The vehicle either passes or it does not.
- include FMVSS 212, 208, and 216. Two other standards that relate to glass are FMVSS 205 and FMVSS 219. FMVSS 205 governs the type of glass that can be used for all automotive glass. FMVSS 219 says that no object can enter the vehicle from the outside through the windshield in a 30 mph collision.

More detailed information on each of these FMVSS tests can be found at the NHTSA website: www.nhtsa.gov. The full text of the standards is not available at the website, but a search for each standard will produce more information, such as standard summaries and excerpts.



The windshield retention test requires the windshield to remain bonded to the vehicle during a frontal collision into a stationary barrier.

FMVSS 212 tests how the windshield is retained in a collision. This standard requires that:

- the windshield perimeter be retained during a 30 mph front-end collision into a stationary barrier.
- 50% of the windshield must remain intact if the front seat occupants are not wearing a seat belt, or 75% if the front seat occupants are wearing a seat belt.

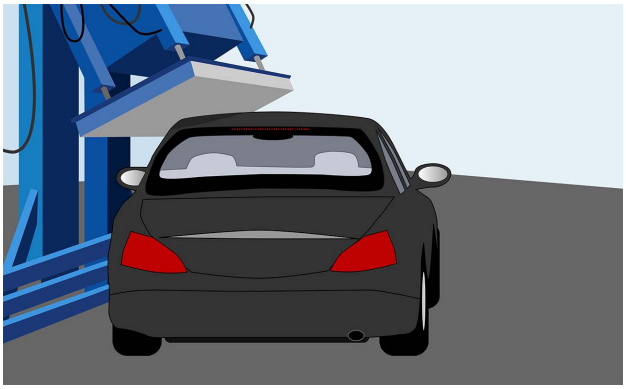
Even though the government does not require it, most vehicle makers require 100% retention.

FMVSS 212 was implemented for passenger cars in 1970, three years before urethane adhesive began to be used for stationary glass installations.

Airbags must properly deploy to meet the FMVSS 208 standard.

FMVSS 208 is the occupant crash protection standard. With FMVSS 208:

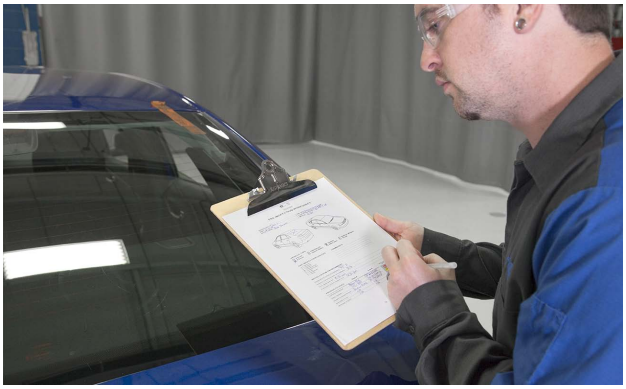
- the vehicle is tested for the proper performance of safety devices such as airbags and seat belts. Crash dummies are used as the occupants.
- if the windshield is improperly installed, the standard may not be met. This is because with some vehicles, the passenger airbag uses the windshield for proper deployment. Also the proper installation of the windshield is integral to the crush zones performing correctly and the airbag timing.



A steel slab moving downward on the corner of the roof is designed to simulate a rollover for the FMVSS 216 test.

FMVSS 216 is the roof crush resistance standard. This standard:

- tests the resistance of the roof to crushing during a rollover.
- uses a steel slab to apply downward force at the front of the A-pillar. This is used so that the test is repeatable.
- requires that by the time the downward force equals three times the weight of the vehicle, the test device should not have moved more than 5 inches. Some vehicles, particularly in the 1970s and 1980s, passed the roof crush test without the windshield in the vehicle.



When doing a stationary glass installation, keep a record of the products and specific procedures used.

Stationary glass must be installed correctly. An installer, and the facility that contracted an installer, can be held liable if the glass is improperly installed and a vehicle occupant is injured. To prove that the installation was done correctly, document the installation. Document the:

- glass part that was replaced.
- product maker's procedures used.
- products used, including the adhesive lot number, primers, cleaners, etc. List expiration dates, if applicable.
- ambient conditions at the installation site, including the temperature and humidity, and whether the glass was replaced inside a facility or outside. List the driveaway time of the adhesive based on these conditions.
- vehicle owner information and vehicle identification number (VIN).
- time when the vehicle was released.

Save the installation record. Installation record forms are available in brochures from adhesive makers.

AUTO GLASS SAFETY COUNCIL™

This is the logo for the Auto Glass Safety Council, which has a mission to promote the safe installation of auto glass.

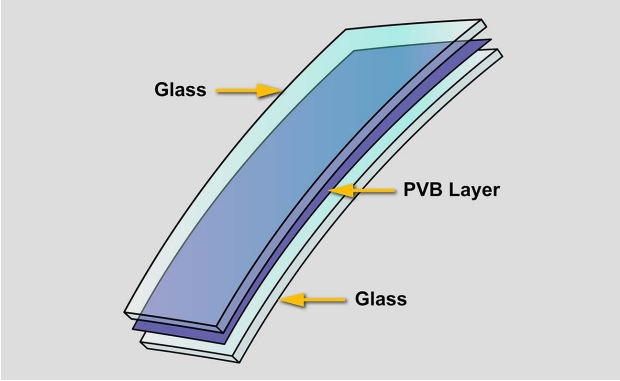
The Auto Glass Safety Council (AGSC):

- is a not-for-profit organization dedicated to the safe replacement of auto glass.
- was founded and is supported by companies in the auto glass replacement industry that keep safe installation as their primary goal.
- certifies auto glass technicians. The certification examinations are delivered online. Among requirements to be eligible for the exam, is 3-plus years experience in the auto glass industry.
- does onsite company accreditation. The accreditation is conducted by independent third party auditors. If the accreditation is successful, the company becomes a Registered Company, recognized by the AGSC.
- maintains a stationary auto glass replacement safety standard (AGRSS). All certified glass techicians must adhere to this standard when replacing

stationary glass. The steps and guidelines in this I-CAR course are consistent with this standard, as the goal of this course is the same as the AGSC: the safe replacement of auto glass. Download the standard for free off the AGSC website: www.agsc.org.

The AGSC was formerly known as the Auto Glass Replacement Safety Standards (AGRSS) Council. The technician certifications were formerly administered by the National Glass Association (NGA), which is no longer associated with automotive glass.

Stationary Glass Construction



Laminated glass has a plastic inner layer that holds the glass together if it is broken.

Stationary glass can be laminated or tempered. Laminated glass:

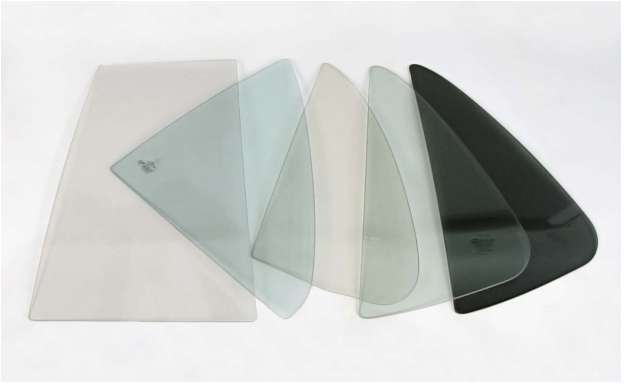
- is made of two sheets of glass with a plastic inner layer. The plastic inner layer is polyvinyl butyral (PVB).
- holds together when broken due to the inner plastic laminate. This helps retain occupants. Even though the glass holds together when broken, small sharp slivers of glass break off. These must be cleaned up and vacuumed out of vent ducts during repairs.
- may have a thick PVB layer, which serves as a sound deadener and is called "acoustic glass.
- is used today on some stationary glass, including the windshield, some side glass, glass roofs, and even the backglass on some premier vehicles.
- can be repaired, to a limited extent.

This label in the corner of the glass indicates this is tempered glass.

Tempered glass:

- is heat treated to increase impact resistance. The glass is heated to about 1,100°F, then rapidly cooled.
- is brittle, and will shatter if cut, drilled, or ground. The shattered pieces are not as sharp as laminated glass slivers. If previously damaged or stressed, the glass can shatter at a later time.

- cannot be repaired.
- may be layered with two sheets of tempered glass.
- may be used anywhere but the windshield, at least in the U.S.



These are common tint colors for vehicle glass. The glass on the far right has a privacy tint.

OEM glass is often tinted. 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 B-pillar because it reduces the driver’s vision if used for the windshield or front door glass.

The frit is designed primarily to protect the urethane adhesive from deteriorating due to UV ray exposure.

The frit is the black band around the perimeter of most stationary glass. The frit:

- helps prevent UV rays from deteriorating the urethane adhesive.
- is made of ink and ground glass.
- if lightly scratched, can be covered with black ink or even a black felt-tip marker

Shading across the top of some windshields is designed to help keep the sun out of the driver's eyes.

Shading on glass is:

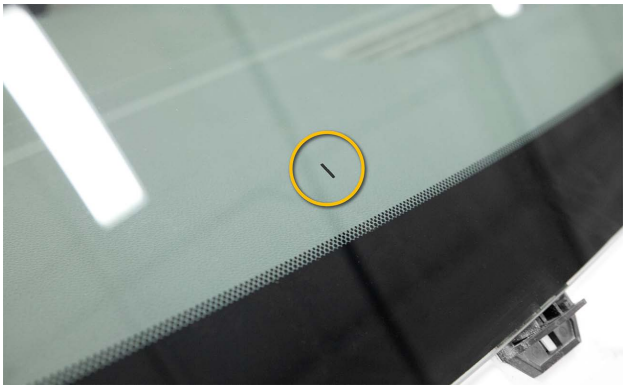
- a tinted, horizontal band across the top.
- used on some windshields, though a larger frit is more common.
- made by darkening the plastic inner layer, not the glass.

The AS1 code indicates a laminated glass windshield, with the proper light transmittance below the arrow.

Codes printed on glass indicate that the glass has passed American National Standards (AS). These standards require that the windshield and front seat area allow at least 70% visible light. The codes include:

- the Department of Transportation (DOT) number. This number is the identifier for the glass part and is required on all documentation. If the replacement glass is defective for some reason, it is the DOT number that is referenced.
- AS1 on the windshield. The AS1 code is only for the laminated windshield. Besides the 70% light transmittance requirement, AS1 has additional requirements for certain amounts of distortion and a specified penetration resistance. The code is below the top shading, with an arrow pointing down, indicating that the 70% light transmittance standard is met only below the shading. The code also helps glass makers align the shading on the inner plastic laminate.
- AS2 code on side glass and the backlite. The AS2 code is used for both tempered and laminated glass, anywhere but the windshield.
- AS3 for darkly tinted or privacy glass. AS3 is used for both tempered and laminated glass. If the glass does not meet the 70% light transmission requirement, it is coded AS3.

The “bug” or label on the lower corner of the glass contains the DOT number, AS code, and may indicate if the glass is tempered or laminated. On windshields, the label may be on the bottom middle of the glass. It is called a "bug" because from a distance, the label has the appearance of a dead bug remnant on the glass.



The small printed mark near the windshield bottom indicates where the wipers are parked in the resting position.

Windshield park indicators are:

- indicators where the windshield wipers should be parked when in a resting position.
- printed near the bottom of windshields.
- a guide for reinstalling the windshield wipers.

The molding on the edge of this quarter glass is a permanent part of the glass, formed onto the glass when the glass was made.

Encapsulated glass has a polyurethane plastic molding permanently attached to the edge. The molding is installed when the glass is made. Encapsulated glass:

- is designed to help the automated installation of glass on the assembly line. A robot can simply position the glass in place without a need to install a separate molding.
- can be any glass part, but it is mostly found on just side glass and backglass.

If it is difficult to determine whether the glass is encapsulated, try pulling the molding off when the glass is out of the vehicle. If the glass is encapsulated, the molding will not come off the glass when pulled. If it does come off, the molding is either bonded on or a separate molding.

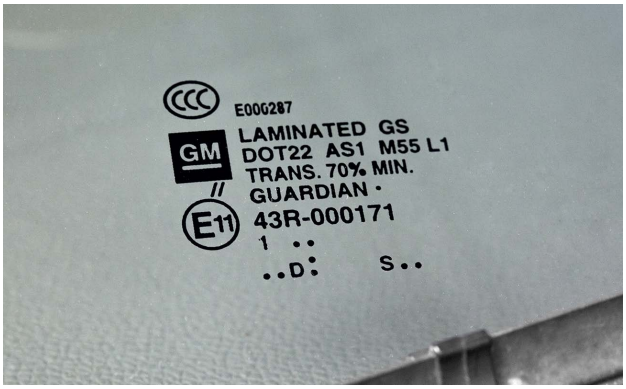
Volkswagen / Audi uses a Pre-Applied Adhesive System (PAAS), which has a layer of urethane applied to the glass when the glass is made. When the replacement glass is installed, an activator is applied to the pre-applied urethane before adding another layer of urethane just before the installation.

This mount for a telecommunications antenna comes already attached to the glass.

There are more conveniences and accessories being added to glass every model year. These accessories may be integrated directly into the glass. These include:

- a telecommunications system antenna. The antenna housing may be separate or part of the glass. If part of the glass, this must be specified when ordering the glass.
- the radio antenna.
- defroster grids on not only the backglass but also the windshield.
- rain sensors. If the sensor is bonded to the original glass, it generally cannot be transferred to a replacement glass. The replacement glass must be ordered with the new sensor attached. If the sensor is mechanically attached to the glass or the rearview mirror, it generally can be transferred to a replacement glass. Rain sensors on Lexus vehicles have a filament as part of the windshield. If the sensor is removed for transferring to a replacement glass, the filament can easily distort.
- cameras or other sensors in or near the rearview mirror.

The wiring and connectors for these features must be taken into account when replacing the glass.



Some of the information for ordering glass can be found in the label on the glass itself.

A stationary glass part can be ordered by calling a parts department at a dealership and asking for the glass part by the vehicle make, model, year, and VIN. Features of the glass, such as tint, shading, and special attachments, also need to be specified, as each feature gets a different number.

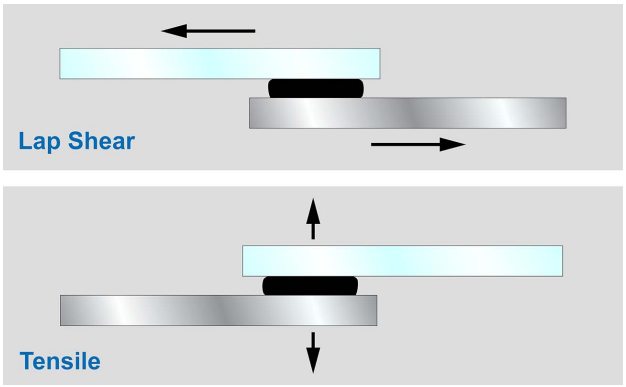
There is also a standard code and numbering system for ordering replacement glass from glass makers. The code and number for each type of glass are created by National Auto Glass Specifications (NAGS), and are copyrights of NAGS. The codes and numbers are listed in NAGS Catalogs, Calculators, and in the NAGS database GLASSMATE®.

Stationary Glass Adhesive

The technician is applying urethane adhesive to the trimmed-off existing bead.

Urethane adhesive specifically made for stationary glass installation:

- helps maintain the structural integrity of the installed glass.
- when pulled laterally (lap shear), has a strength from 500 - 1,200 psi. This is much stronger than other adhesives and sealants. Lap shear is one of the forces that a windshield is subjected to in a collision.
- has the consistency of tire rubber.
- maintains vehicle stiffness and rigidity. Some vehicles require a stiffer adhesive than others.



Tests for glass urethane include lap shear strength (top), and tensile strength (bottom).

Urethanes are tested for different properties, including:

- tensile and lap shear strength. With both of these tests, two coupons are bonded. Tensile strength testing pulls apart the coupons vertically. Lap shear strength testing pulls apart the two laterally. Lap shear and tensile strengths are used because those are the forces applied to a windshield in a collision. There are forces to both push the glass out (tensile) during the initial impact, and slide upward (lap shear) when the vehicle is collapsing.
- peel strength. The urethane should resist being peeled off easily like tape.
- viscosity, or the thickness of the body of the adhesive when applied. Most urethane adhesives made today are high-viscosity, which helps support the glass at the proper level while curing without the need for a dam.
- modulus, or how rigid the adhesive is when cured.

- elasticity, or how much the cured adhesive can stretch and come back to its original shape.
- conductivity, or how much the adhesive can conduct electricity.

These are examples of moisture-cure urethanes.

This is an example of a primerless urethane, which means primerless to the glass.

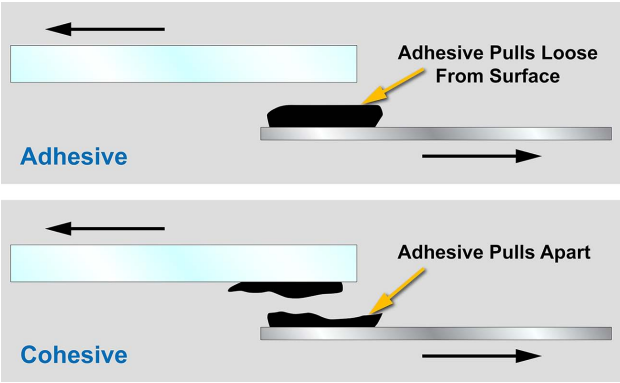
This is an example of a fast-cure urethane.

This is an example of a high modulus, nonconductive urethane.

Different types of glass urethane include:

- conventional moisture-cure, high viscosity.
- fast-cure, that set much quicker than moisture-cure regardless of temperature and humidity.
- primerless, which does not require a primer be applied to the glass. Primer is still required on areas of the pinchweld where there is no existing urethane.
- high modulus, which has an extra rigid cured bead.
- nonconductive. This is required on some vehicles where there are antenna grids, defroster grids, and other electronic systems integrated into the glass. The bus bars on the side of the glass may contact the urethane, which draws power and weakens the signal. Nonconductive urethane may be required on some aluminum pinchwelds. Follow the recommendations from the vehicle maker.

High modulus and nonconductive characteristics are often combined into the same adhesive material. However, the two terms refer to totally different and unrelated properties. The reason why the properties are combined into one adhesive is because many vehicles that require high modulus adhesive also require nonconductive qualities. There are vehicles, however, that require nonconductive urethane that do not require high modulus.



If the adhesive fails by completely pulling off one surface, it is adhesive failure (top). If the adhesive bead breaks, leaving part on each surface, it is cohesive failure (bottom).

When an adhesive is put under stress, there are two ways it can fail. Adhesive failure is when the adhesive pulls loose from the surface it is bonded to. Cohesive failure is when the body of the adhesive pulls apart. A cohesive failure is often due to an adhesive being used after its expired shelf life. This can also cause adhesive failure.

During testing, there must be cohesive failure, not adhesive failure.

The break in the urethane bead on this pinchweld shows where adhesive failure occurred.

When the adhesive pulls loose from the surface it was bonded to, there could be a number of reasons, including:

- contamination on one of the bonding surfaces.
- corrosion on the pinchweld flange.
- ambient conditions during installation, such as freezing temperatures.
- material incompatibility. All products used should be from the same manufacturer.
- expired products.

Driveaway With Passenger Side Airbag				
RH / TEMP	> 70%	> 50%	> 30%	> 10%
> 85°F	1.5 hrs	2 hrs	3 hrs	8 hrs
> 73°F	2 hrs	2 hrs	4 hrs	10 hrs
> 60°F	3 hrs	3 hrs	5 hrs	16 hrs
> 50°F	5 hrs	5 hrs	12 hrs	24 hrs
> 40°F	9 hrs	9 hrs	18 hrs	30 hrs

This chart shows the time required until minimum driveaway time for one brand of moisture-cure adhesive.

Driveaway With Passenger Side Airbag				
RH / TEMP	> 70%	> 50%	> 30%	> 10%
> 85°F	1 h	1 h	1 h	1 h
> 73°F	1 h	1 h	1 h	1 h
> 60°F	1 h	1 h	1 h	1 h
> 50°F	1 h	1 h	1 h	1 h
> 40°F	1 h	1 h	1 h	1 h

This chart shows the time required until minimum driveaway time for one brand of a fast-cure adhesive.

There is a time specification that the glass industry has agreed on when a vehicle that has had a stationary glass replacement can be released to the customer. This is called minimum driveaway time. Driveaway time:

- is when the adhesive has achieved enough strength to pass FMVSS 212 and 208.
- may be as little as 30 - 60 minutes for fast-cure products.
- 2 - 8 hours, and longer, for conventional moisture-cured products. The shortest driveaway time for moisture-cured products is based on 75°F and 50% relative humidity. Lower temperature and / or humidity requires a longer time. The time will be specified on the performance data sheet that comes with the product.

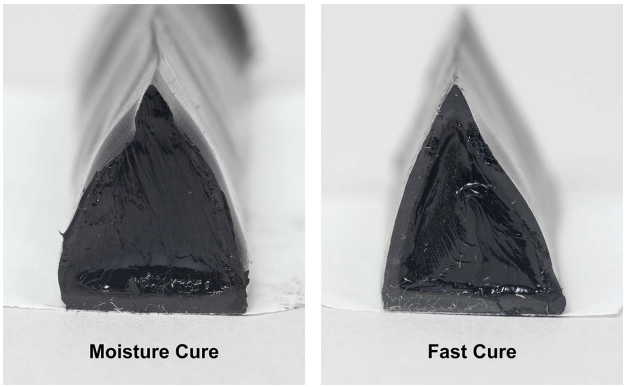
Glass urethane may take 24 hours to reach full strength, and longer for full cure. Some vehicle makers have specific recommendations regarding stationary glass installation. For example, Chrysler states 24 hours. Ford states to not release the vehicle until full cure has been achieved. Full cure time will also be specified on the performance data sheet that comes with the product.

As a best practice, install stationary glass as early in the repair process as possible. Information regarding minimum driveaway time and full cure time should be communicated to the vehicle owner.

Working time is how long the glass installers have to get the glass installed after the urethane was applied.

As with any adhesive, working time is also a factor that must be considered. Working time is:

- how long the technician has, after laying down the adhesive bead, before the glass must be installed in place.
- a consistent time with fast-cure products, usually 18 minutes.
- based on temperature and humidity with moisture-cured products. This becomes an issue if the temperature and humidity levels are very high, such as in southern states. The working time may be as little as 3 minutes in some situations.
- listed on the performance data sheet for the product.



After the same time period, the moisture-cure adhesive (left) is still all liquid while the fast-cure adhesive (right) has developed an outer skin.

Urethane adhesives generally cure from the outside-in. After a stated minimum time, there will be an outer skin that holds the glass to the body, but there will still be a liquid center. If a cut is made through a bead of moisture-cure adhesive and fast-cure adhesive after a few hours, the:

- fast-cure adhesive will show an outer skin with a liquid center.
- moisture-cure adhesive will show no outer skin beginning to form.

Total cure time of the two adhesives also differ, but both types are dependent on temperature and humidity for full cure. For example, the full cure time of Betaseal One, a fast-cure product that achieves driveaway time in one hour even at 0°F, is stated to take 24 hours to reach full cure at 72°F and 50% relative humidty.

This new pinchweld is being masked before the application of basecoat / clearcoat in order to prevent a possible weak link.

The steps performed to bond stationary glass can be thought of as links of a bonding chain. An improper step is a weak link in that chain, which alone could cause the entire bond to fail. To prevent weak links:

- ensure the proper condition of the pinchweld. Avoid dirt, fingerprints, and incompatible chemicals on the pinchweld. If there is corrosion on the pinchweld, completely remove the adhesive and coatings

down to bare metal in that area and remove the corrosion.
- stay with one product line. Do not use a primer from one product line and an adhesive from another product line.
- do not generalize information. What might be the proper information for one product maker is not necessarily the same for another.
- follow all of the steps required by the product maker, without skipping any steps.
- follow the proper priming steps as outlined by the adhesive maker.

Foam Tape

The foam strip on the inside of this pinchweld is from the OEM, and must be kept intact or be replaced during glass replacement.

M-seal is a foam-core butyl required by Ford for some installations.

Open-cell foam tape:

- should be replaced if it was used in the original installation. Several vehicle makers use foam tape.
- is primarily for sound deadening. The foam reduces wind noise and vibration around the glass. If it is not replaced, the vehicle will have a different sound as it travels along the road, resulting in a customer comeback.
- helps provide the look of a finished installation. From the inside, the clean line of foam is more aesthetic than an uneven bead of urethane.

Foam tape is available in two sizes: 6 mm and 7 mm. Follow the vehicle maker's recommendation for the proper size.

Ford uses a foam-core butyl called "M-seal" for some installations. On Ford and Lincoln vehicles, foam-core butyl must be replaced with the same product. Do not substitute butyl tape for foam-core butyl.

Module Wrap-Up

Topics discussed in this module included:

- how stationary glass reinforces a vehicle structure.
- the motor vehicle safety standards that apply to stationary glass installations.
- different types of glass.
- properties of adhesive required for stationary glass installations.

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Module 2 - Removing And Installing A Windshield

I-CAR®

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Preliminary Steps

Learning objectives for this module include:

- preparing the vehicle for a windshield replacement.
- identifying hand or power tools used for windshield removal.
- preparing the pinchweld and glass for a windshield installation.
- working with a repaired pinchweld for a windshield installation.
- applying urethane adhesive.
- installing a windshield.
- leak-testing a windshield installation.

Different types of replacement procedures include replacing the glass (left) and reusing the existing glass (right).

There are different types of replacement procedures based largely on the condition of the pinchweld. There is either:

- glass damage only and no pinchweld damage, where the windshield is removed and replaced.
- pinchweld or adjacent part damage but no glass damage, where the windshield is removed, the pinchweld or adjacent part is repaired or replaced, and the same windshield is reinstalled.
- pinchweld and glass damage, where the windshield is removed, the pinchweld is repaired, and the windshield is replaced.

When cleaning the interior, vacuum the seats and use a brush to help pick up slivers from broken laminated glass.

Before removing the windshield, clean and vacuum the vehicle interior to clean up any broken glass. As part of this process:

- vacuum the defroster vent with the blower on. This will remove any broken glass from the vent.
- remove loose glass parts and slivers from all interior surfaces.

Personal Safety

Wear safety glasses and leather gloves to protect yourself against glass slivers

that may blow out of the vents. Put on the safety glasses before turning the blower on.

When replacing a windshield, always tape over the vents to prevent slivers from the laminated glass from getting inside.

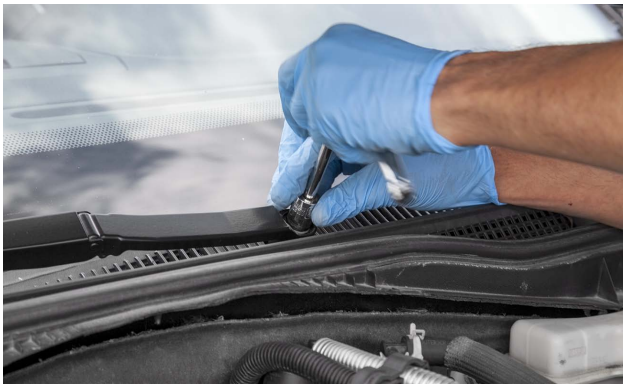
Whenever removing the windshield, take steps to protect the vehicle from glass slivers and the removal tools, including:

- covering the interior upholstery wth a blanket or plastic cover.
- taping or covering the defroster vent.
- taping or removing interior and exterior trim.
- covering the hood.

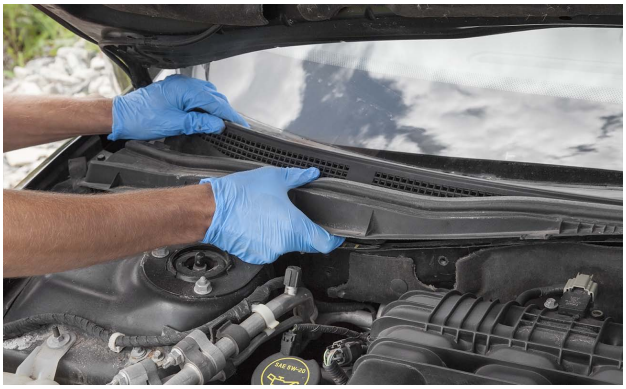
The rearview mirror is often attached to a spade that is part of the windshield.

Begin by removing the parts to access the urethane. Interior parts that may require removal include the:

- rearview mirror. The mirror may be installed on a mounting pad on the windshield interior or come down from the headliner. If mounted on the glass, the mirror usually comes off but the mounting pad, or spade, remains on the glass.
- A-pillar trim and other necessary trim.
- sun visors.
- wiring, if there are accessories that connect to the glass or mirror such as a navigation antenna, heating grids, or a radio antenna.
- headliner, which on rare occasions needs to be loosened at the front to access the upper pinchweld.



The wipers always must be removed when replacing a windshield.



The cowl trim panel typically must be removed when replacing a windshield.

Exterior parts that may require removal for access to the urethane include the:

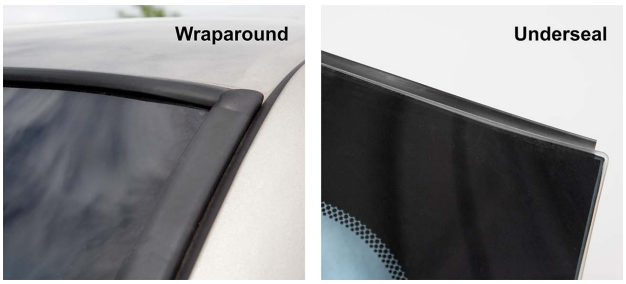
- wipers.
- cowl trim panel.
- other trim, such as the exterior A-pillar trim panel.
- antenna, if it is in the way of properly removing or installing the urethane or glass.

Also, the hood may need to be opened.

Setting blocks are handy for setting the windshield on when installing.

There may be setting blocks fastened to the base of the glass opening. These blocks:

- are designed to keep the glass at the proper height from the cowl.
- can be seen when the cowl trim panel is removed.
- should not be damaged during glass removal, if possible, as they will help position the glass at the correct height.



The two most common types of windshield molding are wraparound (left) and underseal (right).

The molding that surrounds the windshield may be:

- an underseal molding, which can be seen on the edge and is lightly bonded to the inside surface.
- a wraparound type, which is attached to the glass perimeter.
- provided with the replacement glass part, or comes as a separate part which must be attached before installing the glass.
- able to be reused, depending on the type of molding, how it was removed, and how brittle the molding is. The temperature at the time of removal and the age of the molding will determine how brittle it is.

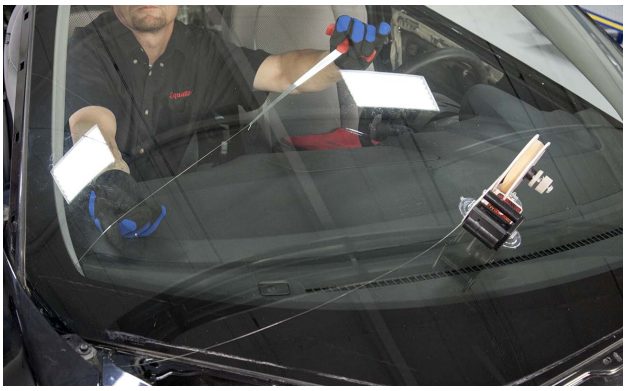
Windshield Removal

Refer to "Video: Using A Viper Wire Tool" in the presentation. This video shows how to set up a wire tool for glass removal.

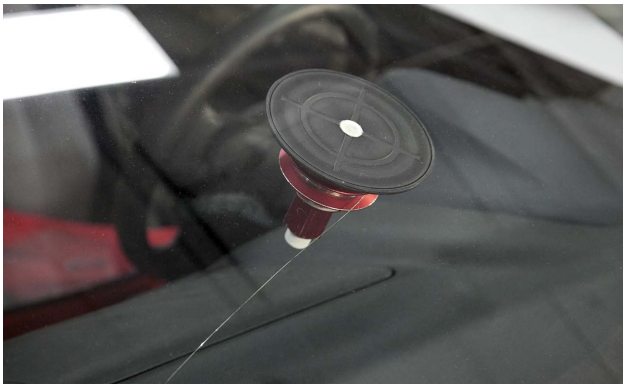
A wire tool slices through the urethane with the help of a pulley mechanism on the inside pulling the wire from a spool attached to the outside.

The wire spool is first attached to the outside of the glass.

The insert tool is pushed through the urethane so the wire can be threaded into the interior.



The wire is attached to the insert tool and the tool is withdrawn, pulling the wire into the interior.



The wire is attached to the pulley part of the tool and the pulley is attached to the interior of the glass.

A plastic shield is part of the tool kit for protecting the dash and other parts from damage.

The pulley is ratcheted around to pull in the wire, drawing the wire around the perimeter of the glass while cutting through the urethane.

The wire line may be wire (right), a threaded cord (left) or a plastic line (not shown).

Some of the key points when setting up a wire tool, such as the Viper, include:

- securing the wire spool to the outside of the glass.
- inserting the wire starter as close to the glass as possible, usually in a lower corner.
- threading the wire onto the pulley mechanism, which is attached to the inside of the glass.

The wire may not be wire at all, but a braided cord or plastic line to make the cutout less aggressive. However, it is difficult to cut through the setting pins on the top of the windshield with a non-wire line. The setting pins are there for robotic installation, and are always cut out when replacing the windshield. The pins may be able to be cut off with a power cutter blade, used alone without the cutting tool, rather than trying to cut through them with the wire.

Wire tools used to be just a wire connected between two handles. The tool cut through the urethane using a sawing action, which often required two technicians to reach the middle of the glass.

Other removal tools include (clockwise from left) a cold knife, long knife, and power cutters.

Besides a wire tool, other tools for removing a windshield include:

- a cold knife, which has a 90-degree blade that is inserted under the urethane, and a handle which is used to pull the knife around the glass perimeter. Once the main tool, a cold knife is not used as often anymore because it is difficult to save the glass and moldings and prevent from scratching the pinchweld. Modern windshield installations are flatter to the body with tighter gaps. A cold knife is still a go-to tool for some technicians if the glass is already damaged and there is no need to save the molding.
- a long-blade knife, which is used typically for reaching the urethane on the bottom of the windshield where it attaches to the cowl.
- power cutters, the most typical being a reciprocating tool with a wide blade. Unless this tool is used very carefully, it is difficult to prevent scratching the pinchweld and damaging the molding.

Personal Safety

Glass removal tools are sharp. Wear safety glasses and leather gloves to protect yourself whenever using tools to remove stationary glass.

Suction cups are essential for moving the glass without touching the edges.

A glass stand is essential for setting the windshield on while working on it.

This plastic stick is for paddling the urethane after it is applied.

This tool cuts the V-notch in the applicator tip if the pre-cut nozzle is not the right size.

This tool is specfically for final-trimming the urethane just before installation.

Aids for helping a technician replace stationary glass include:

- suction cups to get a handle on the glass without having to touch the edges. These are handy both when removing and installing the glass.
- a glass stand to set the glass flat. These should be covered with foam to protect the glass. This can be used to both clean and prime the replacement glass.
- a urethane trimming tool for final-trimming the urethane on the pinchweld just before installation.
- paddle sticks, made of hard plastic, to paddle the start and stop seams once the urethane is applied.

This "Lil Buddy" tool allows one technician to safely remove and install a windshield.

This is another version of a tool allowing a technician to do a solo install of a windshield.

Another tool that enables a technician to remove and install a windshield alone is a one-person installment aid, which:

- is a swing-out rack that attaches to the side glass with suction cups.
- when swung around to face the glass opening, enables the windshield to be gently lifted out of the opening, and carefully

installed once the urethane has been applied.
- is available from at least two manufacturers, the "Lil Buddy" from Equalizer and the "Solo II Glass Installer" from Aegis.

Refer to "Video: Removing A Windshield" in the presentation. This video shows the steps for proper removal of a windshield using a wire tool.

The technician is using his free hand instead of his head to hold the top of the windshield out when cutting the urethane on the dash panel with a long knife.

Steps to keep in mind when removing a windshield include:

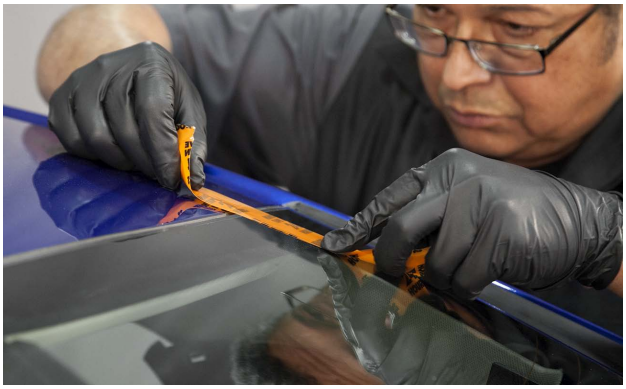
- try not to scratch the pinchweld. This is most easily avoided using a wire tool.
- it may be difficult accessing the bottom urethane bead when using a cold knife or power cutters. It will be easier to see if the glass is pushed forward at the top. Do not use your head for this, as personal injury can result. Instead, use your free hand to hold the glass out. If two hands are needed to cut the urethane on the bottom, stuff a foam block or pillow in the top to hold the glass out.
- if using a power cutters, occasionally wet the cutting blade with water to prevent the urethane from getting too hot and smoking. Smoke from hot urethane is toxic and should not be inhaled.
- if there is corrosion on the pinchweld, all of the existing adhesive should be removed from that area, the corrosion removed, and the pinchweld primed for corrosion protection.

One starting and stopping point at the bottom of the windshield is strong evidence of an original installation.

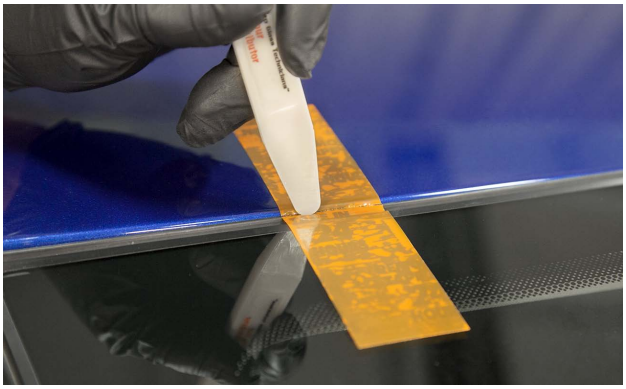
Once the glass is removed, it can be determined whether the installation was original or if the glass was previously replaced. Indications that the installation is original include:

- one starting and stopping point, usually at the bottom and usually in the middle. This is how a robot applies urethane. A technician must stop and start again when adjusting the applicator gun, usually on the corners and in the top middle. These stop and start points will be obvious.
- a straight bead of urethane around the entire opening. A technician's applied bead will likely have some waves, especially near the corners.
- the presence of setting pins at the top. As stated earlier, these are for robotic installation only and are cut off when the glass is replaced.
- no sign of aftermarket primer added to the pinchweld outside of the bonding area.

If the installation is not original, look carefully to make sure there is a tight bond and no points of corrosion.



The technician is applying tape on the windshield at the roof line to help line up the glass when the urethane is on the pinchweld.



This tape has perforated breaks, so the technician only needs a plastic stick to break the tape where the glass and roof line meet.

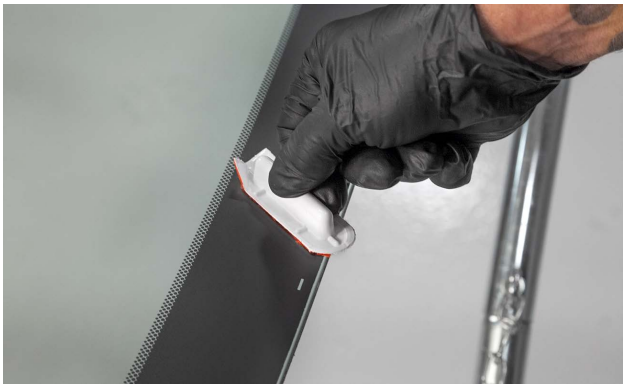
If installing a new replacement glass, dry-set the glass before final-trimming any urethane and before cleaning and preparing the new glass. Dry setting is done to:

- ensure that the glass opening is dimensionally correct.
- look for even gaps from side-to-side.
- mark the proper position with tape. Slit the tape so that part is on the glass and part is on the glass opening, marking the position.

This will be helpful for alignment during final glass installation.

Preparing The Glass

Refer to "Video: Preparing An Existing Glass" in the presentation. This video shows the procedures for preparing an existing windshield for reinstallation.



The Sika Aktivator primer is also the primer for new glass.

Most adhesive makers have a primer that can serve as an activator for existing urethane, if for some reason there has been too long of a delay after final-trimming the existing urethane. The activator will reopen the pores on the existing urethane, allowing for a better bond.

For some adhesive makers, this is the same primer as glass primer. Sika Aktivator Pro and Dinitrol Activator Plus are used as glass primers. Dow includes the activator properties in its All-in-One primer, which also serves as a pinchweld primer, glass primer, and bare metal body primer.

The best bond to urethane is freshly trimmed urethane. An activator primer provides another tool in the arsenal for the situations when the existing bead of urethane has been exposed too long.

The existing urethane on the glass is getting a final trim to expose a fresh surface.

The best bond to urethane is urethane, so when reinstalling the same windshield, a thin layer of the existing urethane is left on the glass and pinchweld bonding areas. When trimming the existing urethane bead on the glass:

- trim down to 1 - 2 mm. This is most easily done with a tool designed for the purpose.
- do not do this step until just before the reinstallation. If it is done hours before, the pores of the

freshly trimmed bead could close. The surface can be reactivated with an activator, but the other problem is that contaminants can fall on the freshly trimmed bead, affecting the bond.

Refer to "Video: Preparing A New Glass" in the presentation. This video shows the steps for preparing a new glass for windshield replacement.

Adhesive maker's glass cleaner displaces where there is contamination on the bonding area.

Key considerations when preparing a new replacement windshield for installation include to:

- clean the bonding area, ideally with glass cleaner in the same product line as the urethane being used. These products create a foam when applied, and where the foam separates, contaminants are present. Contaminants include fingerprints where the glass was carried. These may need to be scrubbed with an abrasive pad before reapplying the glass cleaner. At least one product maker, Sika, has a special foam pad that is used to scrub the bonding area if there are contaminants. Dow has a product called Betabrade for cleaning the frit bonding area.
- clean the rest of the glass surface with the same glass cleaner.
- apply primer to the bonding area, unless the urethane is primerless. This may be the same primer used on the pinchweld.

Personal Safety

Primers used with glass replacement and adhesives are skin and eye irritants. Wear safety glasses and chemical-resistant gloves, such as nitrile gloves, whenever handling these products.

Pinchweld Preparation

Brush off contaminants from the pinchweld before trimming the urethane down.

After the glass is out and before final trimming of the urethane on the pinchweld:

- use a brush, towel, or vacuum to remove any loose dirt or dust from the pinchweld. Cut off any loose urethane strips.
- remove contaminants from the pinchweld. A solvent-based cleaner can be used now, but not after doing the final trim.
- look for any signs of corrosion on the pinchweld. If there are any signs of corrosion, the adhesive and coatings must be completely removed from that area, the corrosion removed, and the bare metal primed for corrosion protection.

Pulling on the urethane during final trim helps assure the existing urethane is bonding well.

In most cases, there is a thick bed of existing urethane on the vehicle after the glass is cut out. Keep this on the pinchweld until the glass is ready to be installed. The existing bed serves as masking to protect the bonding area from dust, applied coatings, and sunlight. Just before installation, final-trim the urethane by:

- cutting the bead to a height of 1 - 2 mm.
- keeping the thin bead as flat and even as possible. Minor differences in the bead height are not a problem.

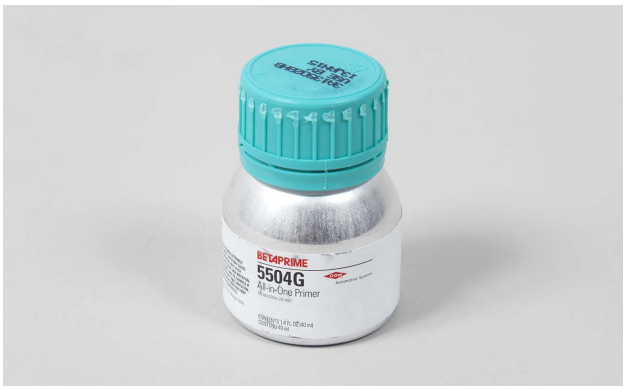
Clean after the final trim only if necessary, and only with water. Distilled water is best. Do not use tap water. Urethane will absorb any chlorine, which will not evaporate out. Minerals in tap water weaken the bond.

The technician is applying a one-shot pinchweld primer to bare metal on the vehicle bonding area.

These are two examples of one-shot pinchweld primer.

Key points to remember about pinchweld primer are that it:

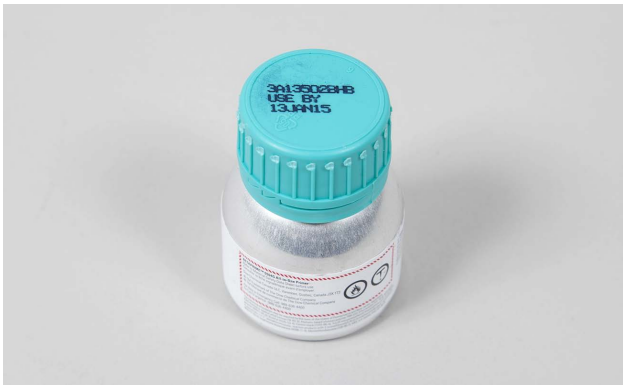
- must be from the same manufacturer as the urethane adhesive being applied.
- must be applied to product maker specifications, and this is different with every product maker. Most must be shaken before application, but some differences include that some must be applied twice after a flash time between. At least one, "Betaprime 5504G All-in-One Primer" by Dow, is the same product as the glass primer and urethane activator.
- is also applied to scratches that are down to metal or primer or E-coat. Urethane will not adhere well to E-coat, or any coating other than existing urethane or the pinchweld primer specific to the adhesive system being used.



This is the All-in-One Primer by Dow that can be used as a pinchweld primer, activator, bare metal primer, and glass primer.

Other points about pinchweld primer are that it is applied:

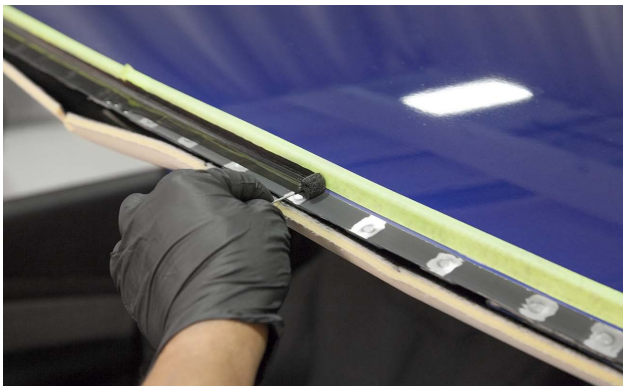
- in one direction, not back and forth, which can spread contaminants.
- with a dauber on larger areas, or a cotton swab on smaller areas. Avoid dipping the dauber or cotton swab into the primer bottle more than once, which may contaminate the primer.
- to scratches up to about 1/2 inch square. A larger area requires an application of corrosion-resistant primer first.



Do not use the pinchweld primer after the expiration date printed on the bottle.

It is important to pay attention to the shelf life for any products, including pinchweld primers. Generally:

- the shelf life for pinchweld primers is 6 - 9 months.
- once opened, the pinchweld primer must be used within 7 days whether the bottle is opened again or not.
- one-time applicators must be used in about 3 minutes once opened.



This particular bare metal primer is also used as a pinchweld primer, so it is being applied over the E-coat as well as the exposed metal.

If the bare metal areas on the pinchweld are larger than 1/2 - 1 inch, depending on the adhesive maker, there are body primers available in the system. These body primers:

- allow technicians to stay in the same adhesive system, instead of applying another brand of self-etching or epoxy primer that is not in the same system.
- are not for direct urethane adhesion. Pinchweld primer must still be applied over the body primer. An exception to this is the "Betaprime 5504G All-in-One Primer" by Dow, that can be used both for scratches and large bare metal areas and as a pinchweld primer.

Treating A Repaired Pinchweld

Refer to "Video: Working With A Repaired Pinchweld" in the presentation. This video shows the steps to take for a windshield installation when part of the pinchweld has been repaired or is new.

The tape that covered the new pinchweld bonding area is being pulled off after applying basecoat / clearcoat.

Where there is a new pinchweld, some key points to keep in mind include to:

- mask the bonding area on the repaired pinchweld area from basecoat / clearcoat. Even after baking the refinish in a spraybooth, solvents still need to escape. The bond of the new refinish will not be at full strength.
- if necessary, trim the existing urethane down to 1 - 2 mm just before the glass installation. If the urethane was cut too close to the pinchweld when the glass was removed, and hours go by before the replacement glass installation, an activator primer can be used on the existing urethane.
- apply tape to the pinchweld wall if there is a chance the pinchweld primer will show above underseal molding.
- apply the adhesive maker's bare metal body primer to bare metal areas on the new pinchweld. With some adhesive systems, a separate pinchweld primer is applied over this body primer.

Applying The Adhesive

Refer to "Video: Windshield Installation" in the presentation. This video shows the steps for installing a windshield.

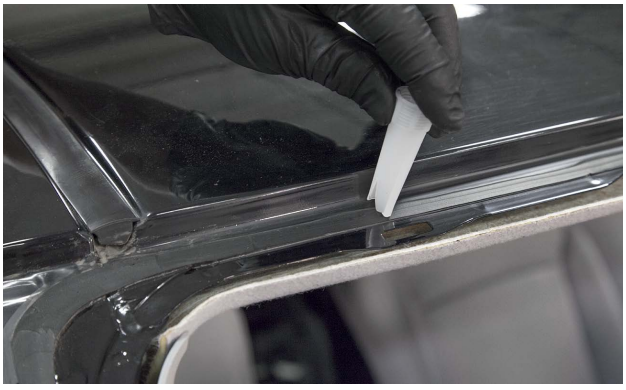
Powered applicators make it easy to apply an even urethane bead.

Applicator guns for applying the urethane:

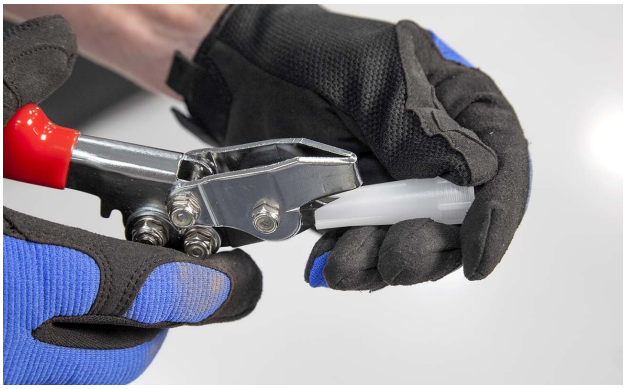
- are typically battery-powered, though pneumatic and electrically powered guns are also available.
- can be manually triggered, though this makes it difficult to dispense the high-viscosity adhesives used today without fatigue and the potential for developing carpal tunnel syndrome. With manual

guns, it is also difficult to control the volume of adhesive being dispensed, and to keep an even bead.

Applicator nozzles come pre-cut (top) and not pre-cut (bottom).



The technician is holding the pre-cut nozzle up to pinchweld wall to see if the triangle peaks just over the roof line.



When the V-notch needs to be increased, this tool does it in one step.

Points to keep in mind with the applicator tip include:

- cut off the tab on the applicator tip if not applying urethane to the glass. The tab is for guiding along the edge of the glass when applying the adhesive. It will get in the way when applying the urethane to the pinchweld.
- hold the tip with a pre-cut "V" against the pinchweld wall to determine if it is the correct height. The tip of the "V" should be slightly higher than the top of the pinchweld. If it is too small, cut the "V" groove more. If it is too short, make a "V" cut in a tip that is not pre-cut with a "V" groove.

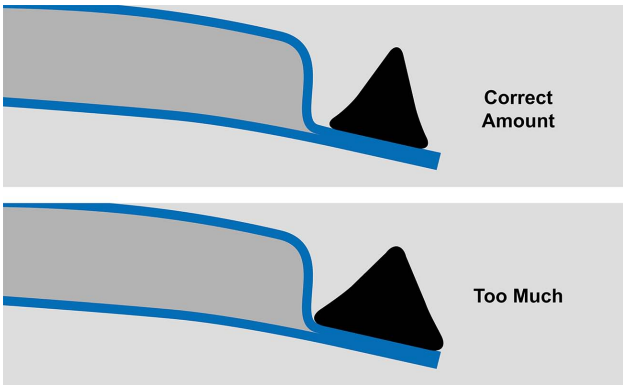
This technician is applying the urethane to the glass.

The applicator gun is held straight out so the top of the triangular bead sticks stright up.

Key points to remember when applying the urethane include:

- typically applying the urethane to the pinchweld, not the glass. It is often difficult to determine exactly where on the glass the bead contacts the pinchweld, especially on the bottom along the cowl panel.
- keep the applicator gun as close to 90° as possible. This helps force the adhesive into irregularities on the surface, and points the triangular shape of the bead straight up.
- try to make the bead as consistent as possible.

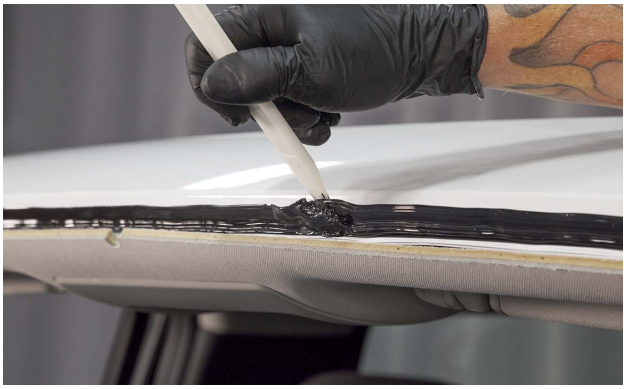
Most pinchwelds require 1 1/2 - 2 regular-size cartridges.



Too much urethane will block the channel on the inside of the pinchweld, preventing water from draining and lead to the forming of corrosion.

Applying too much urethane is as bad as applying too little. Applying too much urethane:

- can block the channel between the bead of urethane and the sidewall of the pinchweld. This channel is necessary for air circulation to assist in curing. The channel also allows excess water to drain from the perimeter of the glass, helping prevent corrosion from forming.
- allows some of the bead to contact an area of the pinchweld that is not primed. This reduces the bond strength.
- may slow the curing time with some products.



Paddling the urethane seals the start and stop points to prevent leaks.

After applying the urethane and before installing the glass, use a paddling stick to paddle the urethane:

- at the stop and start seams, making the seams a smooth transition.
- on both sides of the urethane bead.
- to prevent leaks.

When installing the glass, push down on the bonding areas to help make the seal.

Points to keep in mind when installing the glass include:

- avoid touching the primed area, even with gloves on. Use suction cups.
- try setting it in the proper position and flat the first time. Removing and repositioning the glass may cause a leak. Use setting blocks and the tape indicators applied earlier to position the glass properly.
- press down to the desired height, trying to level it as evenly as possible. Do not slap on the glass, which may push the glass down too quickly and create air pockets in the adhesive bead.
- until the adhesive cures, keep the door glass slightly open. Shutting doors with the door glass shut may cause outward pressure on the stationary glass and weaken the bond.

Personal Safety

A back support will help reduce back injuries when lifting a windshield or backglass. If possible, have a helper assist with the installation, or use a one-person installment aid.

Troubleshooting

Refer to "Video: Leak Checking" in the presentation. This video shows how to check for leaks after a stationary glass installation.

An ultrasonic sound tool is the only method of checking for leaks.

Points to keep in mind with leak checking include:

- doing the leak check shortly, if not immediately after the glass installation.
- an ultrasonic tester should be used.
- if any leaks are found, press down on the glass in that location and check again. If the leak is still there, extra urethane could be applied in that area.

Water should not be used to test for leaks, because if water enters the passenger compartment there is no way to fix the leak.

Module Wrap-Up

Topics discussed in this module included:

- preparing the vehicle.
- hand or power tools used for windshield removal.
- preparing the pinchweld and glass.
- working with a repaired pinchweld.
- applying urethane adhesive.
- installing a windshield.
- leak-testing a windshield installation.

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Module 3 - Glass Repair And Other Stationary Glass Installations

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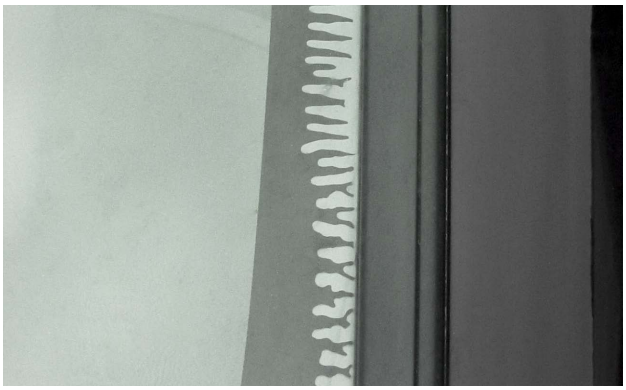
Glass Repair

Learning objectives for this module include:

- repairing damaged laminated glass.
- replacing stationary side glass.
- replacing a backglass.
- repairing a defogger grid and terminal.



This is a delamination problem within the glass and cannot be repaired.

Defects in stationary glass, usually on the edge of laminated glass, include:

- chips in one of the outer laminates.
- lamination separation, indicated by white streaks or spots.
- burrs, or raised bumps.
- distortion, due to uneven layers.
- dirt or hair between the laminations.
- gaps in bonded moldings.

Refer to "Video: Laminated Glass Repair" in the presentation. This video shows repair of laminated glass using one repair system.

Laminated Glass Repair

(Gilbert Gutierrez) What I'm going to do is I'm going to start by cleaning the area of the break. I want to make sure that if there's any contamination, I want to remove that so this way when I put my apparatus on the surface of the glass it will stick at a very good rate. It's not going to move around on me. It's going to stay in place. So what I'm going to do, is I'm going to place one finger over the break and just give it a little wisp. And then I'm going to clean around that area really good, not getting any moisture into the break.

The first step that I'm going to do is apply a reflective mirror on the inside, so I can see the break when the apparatus is on top of the break itself. First thing I'll do is I'll get some lubricant, apply it to the suction cup. Tighten that up. Place it on the inside. And because I lubricated the cup it allows me to move the mirror in any direction. So when I apply the apparatus on top of the glass, I'll no

longer be able to see the break but I can see the reflection on the mirror.

The next step that I'm going to do is I'm go in and use my probe to remove any broken particles that are still left on the break. So I want to make sure that I don't pull those into my resin. And also to make sure there isn't any obstruction that is loose. In the case if I have to drill into the break, obviously this one has an entry. But if I have to drill into it, I want to drill into the first layer of glass and not go to the lamination. If I get into the lamination, then I've ruined the break. I just want to open the break slightly.

The next thing that I'm going to do is I'm going to apply a lubricant on the suction cup and on the rubber tips on our adjustment platform. This allows us to tilt the platform. It also allows me to make good adhesion and to move around the apparatus if I need to. So I'm going to go ahead and put it in its place. And adjust it. The O-ring is level. Before I tilt it, it could be a little more on one side than it is on the other so I want to level it off.

Then, I'm going to go ahead and get my plunger. And I'm going to lubricate my plunger with a pit filler. The pit filler, because it is a heavier resin, becomes a good seal. I've done that. Then I'm going to put 3 - 5 drops of resin down the barrel. I want to make sure that I open this valve. Open so this way the air, as I'm pushing the barrel down into the reservoir, the trapped air comes to the surface but no resin comes spitting out at you. So I'm just going to give it a couple turns. I'm going to align the channel with the tab. Push it straight down, tighten it up. And I'm going to pull vacuum. And I'm going to pull vacuum for one minute.

The next thing I'm going to do is I'm going to check the break to see, after one minute of vacuum, if it's doing what I want it to do and that's pull the air that is trapped in there. This break looks very good, so I would go to the next step, which is 2 minutes of pressure. I'm going to come in here and I'm going to release the screw and I'm going to create pressure. Once I hold it in place, release it, and let it sit for 2 minutes.

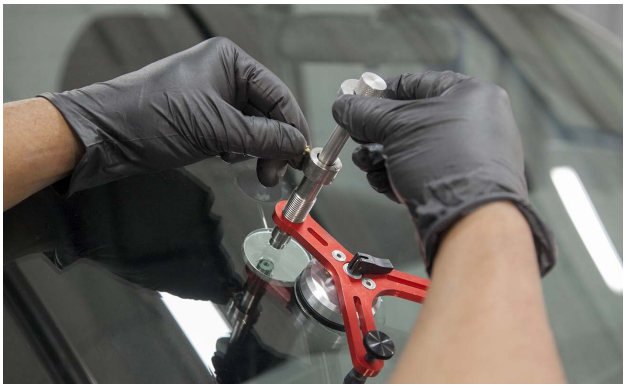
After the pressure phase what we'll do next is we'll remove the apparatus. First thing we'll do is release the pressure, release the knob. Release the tension on the probes on the legs. Then we will wipe clean the resin. We're going to get our pit filler and we're going to apply a drop right over the break. And we're going to lay our mylar square over it. This is going to keep it from getting air and it's going to help it cure the resin.

Now we're going to turn on the UV light, and we're going to place it right over the break. We're going to let it cure for 3 minutes.

After 3 minutes are up we're going to go ahead and take the ultraviolet light away. We're going to take off the mylar square. And I'm going to shoot some glass cleaner over the break. And I'm going to use a razor blade and I'm going to scrape away

the resin. Wipe that away. And you'll see a dull spot right where the break was. And what I'm going to do next is I'm going to use my pit polish, which is a high sheen polish for plastics. And I'm just going to rub it in and it's going to make that surface clear and glossy. So now it's made that dull resin clear. Now I'll take my mirror off. And if you look really close, you'll see where the break was, but it's no longer open to where the crack could continue. It is now sealed. It's got a good bond., and it'll keep it from running.

This bullseye break is a good candidate for a laminate glass repair.



The bullseye is centered under the guide so resin can be inserted.

A UV lamp is used to cure the resin.

Key points regarding laminated glass repair include that:

- repairs are only possible if the damage is contained to the outer laminate.
- repairs cannot be made in the driver's direct view. This is generally the area covered by the driver side windshield wiper.
- repairs are possible because the visible damage is mostly air trapped between the outer layer of glass and the plastic laminate. The air can be drawn out and replaced with resin, making the damage nearly invisible.
- the damage is still present after the repair, but not as visible without the trapped air.
- proper equipment and training is required.

A windshield exposed to fire damage should be replaced. A windshield exposed to excessive heat will have a shortened life cycle and may not perform as it should in a collision. Also, laminated glass is more susceptible to delaminating when exposed to fire.

Stationary Side Glass

Video Title
Refer to "Video: Removing Stationary Side Glass" in the presentation. This video shows the steps for removing a stationary side glass using a wire tool.

Removing Stationary Side Glass
(Jason Horne) On this car, the quarter panel needs to be replaced. So in order to do that, we need to take the quarter glass out, and we need to do that without breaking it, or causing any damage to the encapsulation, which is on this type quarter glass. This is the encapsulation, which actually is part of the glass. You cannot get this separate. So when you order the glass, this actually comes on the glass. Another challenge we're going to find with these quarter glasses is a lot of new cars will have factory setting pins in either two or three or possibly four locations, which makes it more difficult to try and cut out, especially with the wire. However, when using the wire, we run a lot less risk of damaging this encapsulation, versus if we were to use a power tool, we could actually cut through the encapsulation into the outside, therefore ruining the glass.

It's going to be similar to the windshield. What I'm going to do, is I'm going to take the wire, put just a small bend in it, insert it into the wire starter. Now what I'm going to do, because it is a quarter glass and I have such tight tolerance, I want to make sure that the end of my wire is folded down. And I also want to make sure that the wire is folded towards me. That way when I push it in, it doesn't come off the wire starter. What I also want to make sure I do, is just give myself enough slack so that when I'm pulling the wire it doesn't run on the edge of the encapsulation.

And now, making sure I pull enough in that I can attach to the Viper. Before I install the Viper, I want to make sure that the glass surface is clean. That way, it gets the best adhesion for the suction cup. Now that I'm ready to install the Viper, I need to cut this bent end off the wire. And now, because I'm cutting in a clockwise motion, I want to wrap it on the Viper in a counterclockwise direction. I'm going to insert it into the hole, go around about 2 - 3 times just like a windshield, and now we're ready to install it.

When installing the Viper, I want to make sure not to come in contact with the frit or logo. What might happen is it will lose vacuum and not hold. Now I want to run the wire, tuck it under the molding around the quarter glass. Unlike the windshield, with this particular model I'm able to push down and forward to get it to tuck in underneath the encapsulation. If I were to have problems, I could take my

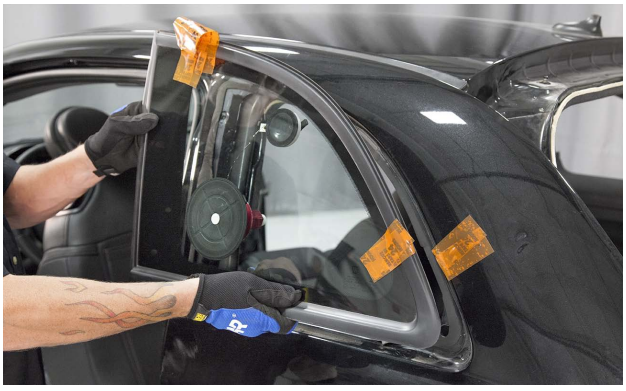
installation stick and gently pry up and tuck under.

Now that I've got the whole way around, I'm going to come past from where I initially started, just like the windshield. And I'm going to tuck it under the corner. And from this point what I'm going to do also is put a piece of tape here, just for extra precaution to protect the encapsulation and also bring the wire up and put a piece of tape on the wire just to hold it in place.

Because this quarter glass has pins, I can at least see at least one of the pins. So what I'm going to do, is attempt to try and cut that pin to make it easier for the wire to go through. As you can see, I was able to cut it. It won't quite come through, but that will give it a little easier chance for the wire to come past the clip and continue cutting. Notice that the interior has been removed. I won't need any protectors for the interior, however, when I do cut I want to make sure that I push against the wire with my hand, making sure obviously that you always wear safety gloves. But when I do this, I'm going to let my hand ride with the wire and not hold it still. And what this is doing, is it's getting it closer to the glass and creating less resistance, and also helps keep it off the body and to avoid running the risk of nicking the wire or actually breaking the wire.

What's happening right now is I've lost my angle of wire towards the urethane. So what I'm going to try and do is I'm trying to get it to just go a little closer and try and gain some of that angle. And once I get to the corner, I've now got my angle, a nice good hard angle, towards the urethane and I'm going to get around the corner and now I'll come up the side and the top. And now at this point, I'll continue to move it. What I'm going to do is I'm going to apply a couple pieces of tape on the glass. So that way when I make the final cut, the window doesn't fall out. What I'm going to do is give myself some extra slack. And now I'm going to make the cut.

Now what I can do is I have most of the glass already cut. I can just slip it in, and now we're ready to anchor on the inside. Now that I have the wire attached, I'm going to attach it to the glass, making sure that my tab is in the direction of where the wire entered through the urethane. And at this time I can just take the Venom off because we no longer need this. Now that it's made the final cut and it's all cut out, I did run into a little problem up here with the setting clip, but after a little bit of work and some maneuvering we were able to get through it.



The side glass has just been cut out with the wire tool and is being removed from the opening.

Key points to keep in mind with stationary side glass replacement include:

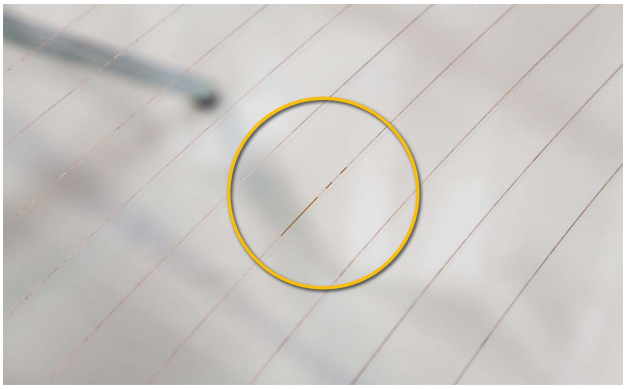
- side glass is typically urethane-set, just like windshields and backglass.
- there are often locator pins on the original glass. These are used on the assembly line to help automated installation. They are not needed for replacing the glass, and may be cut off when removing the glass. These pins generally require use of a wire, instead of a nonwire line, when using a wire tool. The pins can be manually cut off before removal, if they can be located.
- often requires disconnecting the terminals for a defroster grid or antenna.

Backglass

The backglass is being carefully installed in the glass opening.

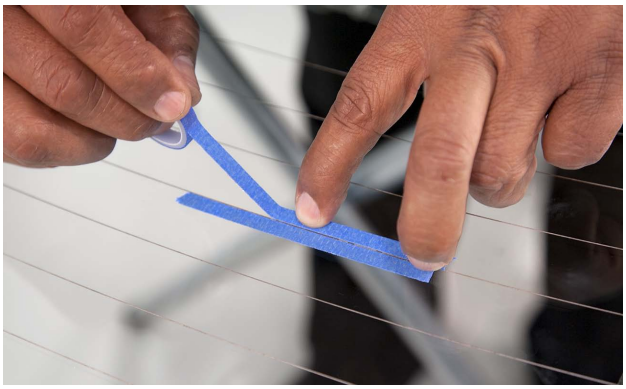
Stationary backglass:

- is most often installed the same as the windshield.
- is usually tempered glass.

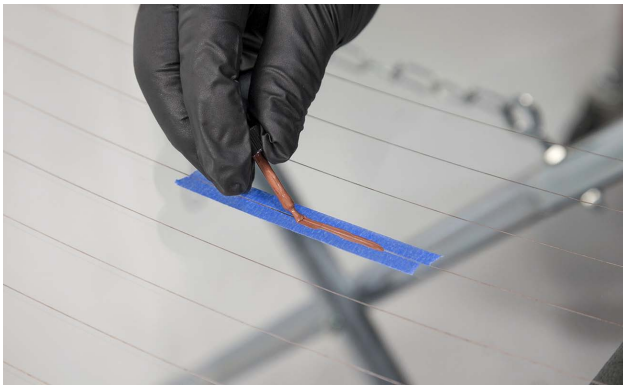


There is a missing part of the grid line on this backglass.

A continuity test shows "out of limits" confirming that there is a break in the grid line.

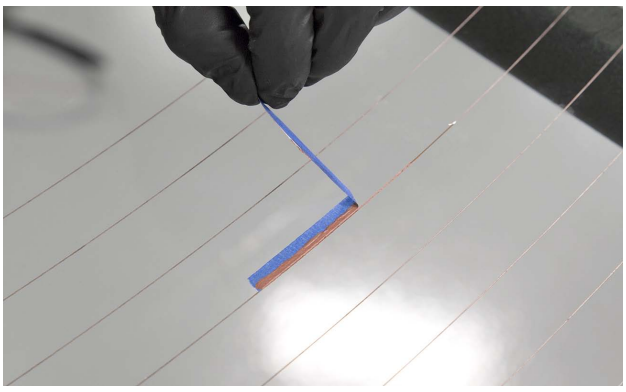


Tape from the kit is applied on either side of the broken line.



The tape makes it easy to apply conductive paint on just the damaged grid line.

A heat gun is used to cure the conductive paint.



The tape is peeled off and the grid line is repaired.

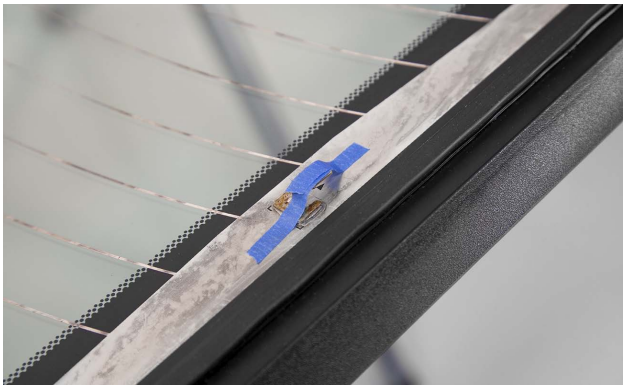
Some repairs can be made to a heating grid system. This may include:

- identifying a broken grid line. This can be done with a continuity tester. There will be no continuity across a broken grid line.
- cleaning the glass.
- applying tape, from a grid line repair kit, on either side of the break.
- applying conductive paint to remake the grid line. The paint is also part of the kit. A second coat may be required, per the kit requirements. Wait until the paint is dry. A heat gun can usually be used to help dry the paint.
- peeling off the tape and checking the continuity once again.

Sand the mounting area and the base for the terminal tab.

The special kit adhesive, an epoxy, is dispensed in the two parts and mixed.

The base of the terminal is coated with the adhesive.



The terminal is held in place with tape for curing.

To replace a broken off heating grid tab:

- clean and scuff the tab location on the glass.
- mix and apply two-part silver epoxy or apply solder paste.
- press replacement tab onto epoxy or solder in place.
- use tape to hold in place while epoxy cures.

Generally the heating grid should not be used for 3 hours after the repair.

Module Wrap-Up

Topics discussed in this module included:

- repair of damaged laminated glass.
- replacement of stationary side glass.
- replacement of a backglass.
- repair of a defogger grid and terminal.