Stationary Glass (GLA02e)

Self-study Narrations

I-CAR®

Version: 4.2

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Module 1 - Stationary Glass Issues

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Learning Objectives
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.

Structural Role Of Stationary Glass
Stationary glass, especially the windshield, that is bonded to the vehicle with urethane adhesive system, is a structural part of the vehicle. Stationary glass contributes to the strength of the roof and pillars, providing bracing to make the structure more rigid. Stationary glass also 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.

Works With Passenger Airbags
Another role for the windshield is to work with the passenger airbag. A deploying passenger airbag may deflect off the glass or use the windshield to deflect the deployment in the proper direction. If the windshield was not installed properly, the deploying passenger airbag can be rendered ineffective by loosening or forcing the windshield out of the opening.

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

Wind And Water Shield
All glass on a vehicle, stationary and movable, protects occupants from wind, weather, and debris while driving. Glass allows the driver and occupants a view of the road and traffic. Most consumers believe that this is the only role of stationary glass.

Federal Motor Vehicle Safety Standards
Several Federal Motor Vehicle Safety Standards or FMVSS, issued by the U.S. National Highway Traffic Safety Administration, or NHTSA, relate to OEM installations for stationary glass, primarily the windshield. These standards are performance standards. They 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. These standards are used to test OEM installations only. These standards are pass / fail only. The vehicle either passes or it does not.

The main standards referred to 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.

FMVSS 212 Windshield Retention
FMVSS 212 tests how the windshield is retained in a collision. This standard requires that the windshield perimeter be retained during a 30 mile per hour, front-end collision into a stationary barrier. 50-percent of the windshield must remain intact if the front seat occupants are not wearing a seat belt. 75-percent of the windshield must remain intact 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.

FMVSS 208 Occupant Crash Protection
FMVSS 208 is the occupant crash protection standard. Using crash dummies, the vehicle is tested for the proper performance of safety devices such as airbags and seat belts. Since the passenger airbag may use the windshield for proper deployment, if the windshield is improperly installed, this 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.

FMVSS 216 Roof Crush Resistance
FMVSS 216 is the roof crush resistance standard. This standard tests the resistance of the roof to crushing during a rollover. A steel slab is used to apply downward force at the front of the A-pillar. This is used so that the test is repeatable. The test 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.

Document The Installation
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 and the product maker's procedures used. Document the products used, including the adhesive lot number, primers, cleaners, etc. List expiration dates, if applicable. List the 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.

Also document the vehicle owner information and vehicle identification number, or VIN. Document the time when the vehicle was released. Save the installation record.

Installation record forms are available in brochures from adhesive makers.

Auto Glass Safety Council

The Auto Glass Safety Council (AGSC) is a not-for-profit organization dedicated to the safe replacement of auto glass. The AGSC was founded and is supported by companies in the auto glass replacement industry that keep safe installation as their primary goal. The council 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.

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. 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.

Laminated Glass

Stationary glass can be laminated or tempered. Laminated glass is made of two sheets of glass with a polyvinyl butyral (PVB) inner layer. This plastic layer holds the glass together when the glass breaks, helping to 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.

Laminated glass may have a thick PVB layer, which serves as a sound deadener and is called "acoustic glass. Laminated glass is used today on all stationary glass, including the windshield, some side glass, glass roofs, and even the backglass on some premier vehicles. Small breaks or stone chips in laminated glass can be repaired.

Tempered Glass

Tempered glass is heat treated to increase impact resistance. The glass is heated to about 1,100°F, then rapidly cooled. Tempered glass 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, tempered glass can shatter at a later time. Tempered glass is usually one layer, but may be layered with two sheets. Tempered glass is used anywhere but the windshield.

Tinting

O-E-M glass is often tinted. Common tint colors include blue, green, bronze, and 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.

Frit

The frit is the black band around the perimeter of most stationary glass. The frit helps prevent U-V rays from deteriorating the urethane adhesive. A frit is made of ink and ground glass. If lightly scratched, a non-lead-based frit can be covered with black ink or even a black felt-tip marker.

Shading

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

Glass Coding

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.

The windshield will have an AS1 code. 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.

An AS2 code is for side glass and the backglass. The AS2 code is used for both tempered and laminated glass, anywhere but the windshield.

AS3 is 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.

Windshield Park Indicators
Windshield park indicators are indicators where the windshield wipers should be parked when in a resting position. The indicators are printed near the bottom of windshields, and serve as a guide for reinstalling the windshield wipers.

Encapsulated Glass
Encapsulated glass has a 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.

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.

Integrated Accessories
There are conveniences and accessories being added to glass every model year. These accessories may be integrated directly into the glass. These include a navigation 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. Other common accessories in the glass are a radio antenna and defroster grids. Rain sensors are becoming common. 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.

The rearview mirror is getting more features each model year, including the navigation system receiver.

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

Ordering Glass

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.

Glass Urethane Adhesive

Urethane adhesive specifically made for stationary glass installation helps maintain the structural integrity of the installed glass. When pulled laterally, in a strength test called lap shear, urethane has a strength from 500 to 12-hundred psi. This is much stronger than other adhesives and sealants. Urethane adhesive has the consistency of tire rubber. There's also some flex in cured urethane, to cushion the glass slightly from bumps in the road. Some vehicles require a stiffer adhesive than others.

Adhesive Tests

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.

Adhesives are tested for peel strength. The urethane should resist being peeled off easily like tape. Viscosity is 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 is how rigid the adhesive is when cured. Elasticity is how much the cured adhesive can stretch and come back to its original shape. And conductivity is how much the adhesive conducts electricity.

Types Of Glass Urethane

Different types of glass urethane include conventional moisture-cure and fast-cure, that sets much quicker than moisture-cure regardless of temperature and humidity. Primerless

urethanes do not require a primer be applied to the glass. Primer is still required on areas of the pinchweld where there is no existing urethane. There are high modulus urethanes, which have an extra rigid cured bead. There is nonconductive urethane, which 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.

Types of Adhesive Failures
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.

Causes Of Adhesive Failures
When the adhesive pulls loose from the surface it was bonded to, there could be a number of reasons. These include contamination on one of the bonding surfaces, corrosion on the pinchweld flange, freezing conditions during installation, material incompatibility, or expired products.

Minimum Driveaway Time
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. Minimum driveaway time may be as little as 30 - 60 minutes for fast-cure products, or 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. The 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

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. It is a consistent time with fast-cure products, usually 18 minutes. With moisture-cured products, it is based on temperature and humidity. 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.

Working times are listed on the performance data sheet for the product.

Moisture Vs. Fast Cure

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. The 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.

Preventing Weak Links

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. For example, cure times can vary from one primer and adhesive to another. Follow all of the steps required by the product maker, without skipping any steps.

Foam Tape

Open-cell foam tape should be replaced if it was used in the original installation. Several vehicle makers use foam tape. The 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.

Foam tape also 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 Summary

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

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Learning Objectives
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.

Types of Replacement Procedures
There are different types of replacement procedures based largely on the condition of the pinchweld. If there is glass damage only and no pinchweld damage, the windshield is replaced. If there is pinchweld or adjacent part damage but no glass damage, the windshield is removed, the pinchweld or adjacent part is repaired or replaced, and the same windshield is reinstalled. If there is pinchweld and glass damage, the windshield is removed, the pinchweld is repaired, and the windshield is replaced.

Clean Interior
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.

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.

Vehicle Protection Steps
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, and covering the hood.

Interior Part And Trim Removal
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. The A-pillar trim and other necessary trim may need to be removed. The sun visors may need to be removed. Wiring is a consideration, if there are accessories that connect to the glass or mirror such as a navigation antenna, heating grids, or a radio antenna.

On rare occasions, the front of the headliner needs to be loosened to access the upper pinchweld.

Exterior Part And Trim Removal

Exterior parts that may require removal for access to the urethane include the wipers, cowl trim panel, and other trim, such as the exterior A-pillar trim panel. Remove the 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

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. They can be seen when the cowl trim panel is removed. If possible, do not damage these blocks during glass removal, as they will help position the glass at the correct height.

Windshield Trim Moldings

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. The molding may also be a wraparound type, which is attached to the glass perimeter. Moldings may be provided with the replacement glass part, or come as a separate part which must be attached before installing the glass.

Whether the molding will be able to be reused, depends 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.

Wire Tool Highlights

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, then inserting the wire starter as close to the glass as possible, usually in a lower corner. The wire is then threaded 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.

Other Removal Tools

Tools for removing a windshield include a cold knife. 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 is still used, especially for reaching parts of the urethane on the bottom where it attaches to the cowl. Power cutters are still available, 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.

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

Click on each of the photos for a short demonstration video.

Windshield Removal Accessories

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 is almost necessary, to set the glass flat. These should be covered with foam to protect the glass, and can be used to both clean and prime the replacement glass. A urethane trimming tool is handy for final-trimming the urethane on the pinchweld just before installation. Paddle sticks, made of hard plastic, are used to paddle the start and stop seams once the urethane is applied.

One-Person Installment Aid

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, the tool enables the windshield to be gently lifted out of the opening, and carefully installed once the urethane has been applied.

Windshield Removal Considerations

When removing a windshield, try not to scratch the pinchweld. This is most easily avoided using a wire tool with a pulley mechanism rather than another 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.

Finally, 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.

Signs Of An OEM 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.

The bead of urethane will be straight and even around the entire opening. A technician's applied bead will likely have some waves, especially near the corners.

Look for 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. Another sign of an OEM installation is 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.

Dry Setting

Dry-set the glass to ensure that the glass opening is dimensionally correct. Look for even gaps from side-to-side.

When the glass is in the proper position, mark the 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.

Activator Primer

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.

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.

Trimming The Existing Urethane On The Glass

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.

New Glass Considerations

Key considerations when preparing a new replacement windshield for installation include first cleaning the bonding area 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. These may need to be scrubbed with an abrasive pad before reapplying the glass cleaner.

Clean the rest of the glass surface with the same glass cleaner, then apply primer to the bonding area, unless the urethane is primerless. This may be the same primer used on the pinchweld.

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.

Cleaning The Pinchweld

After the glass is out and before final trimming of the urethane, use a brush or towel to sweep off any loose dirt or dust from the pinchweld. Remove contaminants from the pinchweld. A solvent-based cleaner can be used now, but not after doing the final trim. Use the utility knife to cut off any loose urethane strips. 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.

Urethane Final Trim

Most of the existing urethane remains on the pinchweld until the glass is ready to be installed. This 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 to 2 millimeters. Keep 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.

Pinchweld Primer

Key points to remember about pinchweld primer are that it must be from the same manufacturer as the urethane adhesive being applied. It must be applied to product maker specifications, and this is different with every product maker. Most primers must be shaken before application. Some differences include that some must be applied twice after a flash time between.

Pinchweld primer is also applied to scratches that are down to metal or primer or E-coat.

Pinchweld Primer (cont'd)

Other points about pinchweld primer are that it is applied in one direction, not back and forth, which can spread contaminants. Apply the primer 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.

Generally, the primer is applied only to scratches up to about 1/2 inch square. A larger area requires an application of corrosion-resistant primer first.

Pinchweld Primer Expiration Dates

It is important to pay attention to the shelf life for pinchweld primers. Generally, the shelf life for pinchweld primers is 6 to 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.

Bare Metal Primers

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 within the adhesive 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. These are generally 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.

Working With A Repaired Pinchweld

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

Types of Applicator Guns

Applicator guns for applying the urethane are typically battery-powered, though pneumatic and electrically powered guns are also available. Applicator guns 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.

Cutting The Applicator Tip

Cut the tab of 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.

Applying The Urethane

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.

Do Not Apply Too Much Urethane

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. Applying too much urethane also allows some of the bead to contact an area of the pinchweld that is not primed, reducing the bond strength. It also slows the curing time.

Paddling The Urethane

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. Paddle the seams on both sides of the urethane bead. This is done to prevent leaks.

Installing The Glass

Points to keep in mind when installing the glass include to avoid touching the primed area, even with gloves on. Use suction cups.

Try setting the glass 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 on the glass 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.

Leak Checking

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 Summary

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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Learning Objectives

Learning objectives for this final module include steps for repairing damaged laminated glass, replacing stationary side glass, replacing a backglass, and repairing a defogger grid and terminal.

Glass Defects

Defects in stationary glass, usually on the edge of laminated glass, include chips, burrs, distortion, dirt or hair between the laminations, or gaps in a bonded molding. There can also be lamination separation, indicated by white streaks or spots.

Laminated Glass Repair

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 Replacement

Key points to keep in mind with stationary side glass replacement include that 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 also be manually cut off before removal, if they can be located.

Stationary Backglass Installation

Stationary backglass is most often installed the same as the windshield. Backglass is usually tempered glass. It is often required to disconnect the terminals for a defroster grid or antenna.

Heating Grid Repair

Some repairs can be made to a heating grid system. This starts by, first identifying a broken grid line. This can be done with a continuity tester. There will be no continuity across a broken grid line.

Clean the glass, then apply tape, from a grid line repair kit, on either side of the break. Apply 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. After waiting the recommended time, and possibly using a heat gun to help dry the paint, peel off the tape and check the continuity once again.

Replacing Terminal Tab

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 the replacement tab onto the epoxy, or solder it in place. If using epoxy, use tape to hold the tab in place while the epoxy cures. Generally, the heating grid should not be used for 3 hours after the repair.

Module Summary

Topics discussed in this module included repair of damaged laminated glass, replacement of stationary side glass, replacement of a backglass, and repair of a defogger grid and terminal.