### Column A
Current AGRSS Standard sections and language that requires instruction from the retention system provider to help ensure AGR technician compliance. Note that only those sections of the Standard pertaining to the required support of the retention system provider are listed.

### Column B
Retention System Provider instruction response to Column A
(List the response that an AGR Technician should provide in order to match the instructions your company provides pertaining to the subject identified in Column A)

### Column C
Identify the location within your current, written, comprehensive training instructions where your instruction response from Column B can be identified.
(Document name, page and paragraph)

#### 4.0 Vehicle Assessment before Replacement

| 4.1 Those engaged in automotive glass replacement shall not undertake or complete such installation when any related condition would compromise the retention system and the owner/operator shall be so notified. | If conditions that would prevent a safe installation are observed prior to glass installation, the job shall not be completed until the condition is corrected. The customer/owner/operator must also be notified. | Refer to: Page 3, DuPont Fixed Glass Installation Guide Ver. 6.1 (2021) |

**Optional:** DuPont provides a Fixed Glass Replacement Record – Appendix FGTP Version 6.1 this may be used document conditions observed prior to completing the glass installation

#### 5.0 Selection of Glass and Retention Systems

| 5.1 Those engaged in automotive glass replacement shall use retention systems that are produced under the ISO 9001 standard or any standard that contains the entire text of ISO 9001. | DuPont products are manufactured and packaged in IATF 16949:2016, ISO 9001 and ISO 14001:2004 certified facilities. | Refer to: Page 3, Sidebar in the Dupont Fixed Glass Installation Guide Ver. 6.1 (2021) |

| 5.3 Those engaged in automotive glass replacement shall use either an OEM approved retention system or equivalent retention system as certified in writing by the equivalent retention system manufacturer directly or through a private labeler. | Adhesive systems from DuPont have passed specification testing for Ford, GM, Fiat Chrysler and all manufacturers globally. Test specifications include, but are not limited to, physical properties and adhesion durability testing (accelerated weathering and outdoor exposure). When used as directed, DuPont adhesives meet or exceed OEM strength requirements outlined in glass bonding specifications | Refer to: Page 8, Sidebar & Page 9, Section 2 in the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021) |
5.4 Those engaged in automotive glass replacement shall obtain and follow written comprehensive and current application instructions from the retention systems manufacturer or private labeler. These instructions shall include at least the proper use of the retention system storage specifications, minimum drive-away time charts containing temperature and humidity variables if applicable, and any special procedures required for adverse weather conditions.

DuPont regularly updates and distributes training manual and product brochures. These contain:

- **Application details and requirements**
  - Drive-away time charts with temperature and humidity variables
  - Step-by-step installation instructions
  - Safety precautions
  - Storage and shelf life information

*Exceptions and explanations to statements in the instruction sheets are minimal and will be listed in column B below.*

### 1. GLASS CLEANING:

- Product requirements
- Application requirements
- Storage requirements
- Shelf-life (opened & unopened)
- Adverse weather conditions
- Additional requirements

DuPont offers our customers a variety of different forms of application instructions:

- DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)
  - Adhesives - Pages 30-36
  - Primers – Pages 13-15
  - Cleaners – Page 12
- Installation instructions are also included in the box along with all products
- Product sell sheets also include application instructions
- Instructions can also be found at www.BETASEALARG.com

NOTE: DuPont Fixed Glass Installation Guide 6.1 is launching in January 2022 with the addition of 2 new products, BETASEAL U-428+HV / BETASEAL™ U-838HV and transition from BETABRADE to new glass cleaning procedure. Transition time is needed for the new training to be proliferated to all customers. Until then, DuPont Fixed Glass Installation Guide 6.0 will still be acceptable as none of the installation instructions have changed. New products and glass cleaning procedure are documented in 6.1. Some customers may still be using BETABRADE and they are covered under FGIG 6.0.

NOTE: for customers on FGIG 6.0 that are using melamine foam sponge or ScotchBrite pads to clean glass, DuPont Technical Bulletin dated 10-01-2020 documents proper use.

### 1. GLASS CLEANING:

Refer to: Page 12 for glass cleaning in the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)

All EZ Kit Packaged adhesives include current instructions for use in box

Individual product brochures also contain product application information on Page 3
### 2. GLASS PREP/PRIMING:

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product requirements</td>
<td>- DuPont or any other glass cleaner containing water should not be used at freezing temperatures or below without following special cold weather steps</td>
</tr>
<tr>
<td>Application requirements</td>
<td>- DuPont Automotive Instructions recommend the use of “lint-free” paper towels. This is a goal, not a specific requirement. Many paper towels that might be considered “lint-free” are not labeled as such and some labeled as “lint-free” are not.</td>
</tr>
<tr>
<td>Storage requirements</td>
<td>- BETABRADE F1 MAY be used instead of “wet-scrubbing” glass &amp; fritted bonding surfaces when contamination is visibly detected</td>
</tr>
<tr>
<td>Shelf-life (opened &amp; unopened)</td>
<td>- At the time of this revision, DuPont offers 2 glass primers: BETAPRIME 5504G, and BETAPRIME Clear Advanced.</td>
</tr>
<tr>
<td>Adverse weather conditions</td>
<td>- BETAPRIME CLEAR Advanced can be used only with BETASEAL Express+</td>
</tr>
<tr>
<td>Additional requirements</td>
<td>- BETAPRIME 5504G is compatible with all adhesives.</td>
</tr>
<tr>
<td>- Used Glass</td>
<td>- BETASEAL U-400HMNC and BETASEAL Xpress30 must be used with BETAPRIME 5504G glass primer</td>
</tr>
<tr>
<td>- Pre-primed glass</td>
<td>- BETASEAL U-418, U-418HV, 428plus / 838, U-428HV / U-838HV do not require glass primer, but can be used with BETAPRIME 5504G for additional cosmetic appearance and/or extra UV protection.</td>
</tr>
<tr>
<td>- PAAS</td>
<td>- Shelf life of primers is up to and including the expiration date marked on the package.</td>
</tr>
<tr>
<td>- Non-traditional contamination</td>
<td>- Open life on BETAPRIME 5504G in cans is 14 days when properly sealed after use and stored according to the requirements on the specific product.</td>
</tr>
<tr>
<td></td>
<td>All EZ Kit Packaged adhesives include current instructions for use in box</td>
</tr>
<tr>
<td></td>
<td>Also refer to the product brochures Page 3 for current instructions.</td>
</tr>
</tbody>
</table>
- When bonding to previously installed glass, as long as the new adhesive is being applied to freshly cut, well bonded, uncontaminated cured urethane on both the body and glass, DuPont will allow the use of “used” glass.

- Glass pre-primed by an OEM manufacturer should be re-primed with BETAPRIME 5504G

- “Double-dipping” of daubers in BETAPRIME 5504G All-in-One Primer is not encouraged as it could slightly reduce open life of the primer. It is NOT a compliance problem if the technician does “double-dip” when priming glass or encapsulation and will not compromise the bond.

**BETAPRIME 5504G**
Compatible with all products
Check the expiration date on the container
Shaking is not required, but won’t have a negative effect on the primer

For any fritted glass (internal or external), PAAS, Encapsulation, Gasket:

1) Apply BETAPRIME™ 5504G All-in-One Primer with a clean wool dauber or primer stick an even, wet coat
2) Allow the primer to dry for 2 minutes at 20° F (-7°C) and above. From 20° F (-7°C) down to 0°F (-18°C), allow the primer to dry for 6 minutes.
3) Surfaces primed with BETAPRIME™ 5504G are good for 24 hours after priming. If not used within 24 hours, apply another coat of BETAPRIME™ 5504G to reactivate.
   Maximum of 1 re-prime

For laminated glass without any frit:

1) Apply BETAPRIME™ 5504G All-in-One Primer with a clean wool dauber or primer stick an even, wet coat.
2) Allow the primer to dry for 2 minutes at 20° F (-7°C) and above. From 20° F (-7°C) down to 0°F (-18°C), allow the primer to dry for 6 minutes.
3. PINCHWELD PREP/PRIMING:

- Product requirements
- Application requirements
- Storage requirements
- Shelf-life (opened & unopened)
- Adverse weather conditions
- Additional requirements
  - Corrosion treatment
  - Gasket Sets

3) Apply a second coat of BETAPRIME™ 5504G and allow to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes.

**BETAPRIME Clear Advanced**

Compatible with BETASEAL Express+ ONLY

For use on fritted glass only (internal or external)

Check the expiration date on the container

Shaking is not required, but won’t have a negative effect on the primer

1. Slowly draw the applicator around the glass/frit surface to be primed to get an even wet coat
2. Apply twice around the bonding surface (no wait time in between)
3. One stick for both applications – discard after use
4. Allow to dry for two (2) minutes at 0°F (-18°C) and above

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**3. PINCHWELD PREP/PRIMING:**

Refer to:
DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)
Pinchweld prepping – 18-23
BETAPRIME 5504G – Page 20

All EZ Kit Packaged adhesives include current instructions for use in box

Also refer to the product brochures Page 3 for current instructions.
- Reference to trimming existing adhesive to a height of 1-2 mm is a recommendation but a layer of uncontaminated, well bonded, freshly cut urethane as thin as 1/64” is acceptable.

- Recommendation to “avoid” priming existing urethane is not mandatory as BP 5504G is acceptable as a PAAS Primer.

- Priming moldings with BP 5504G is a recommendation only and has no effect on a safe installation.

- “Double-dipping” of daubers after it touches the body of the vehicle is not encouraged or recommended with BETAPRIME 5504G All-in-One Primer as it could introduce contamination that could be transferred when priming glass or frit.

- Recommendation to not use BETAPRIME 5504G SA on body side is to help protect the car from spilled primer. Use of BETAPRIME 5504G SA is discouraged, but is not a safety issue.

**BETAPRIME 5504G**
Compatible with all products
Check the expiration date on the container
Shaking is not required, but won’t have a negative effect on the primer

**For clean dry surfaces – no bare metal:**

1) Apply BETAPRIME™ 5504G All-in-One Primer with a clean wool dauber or primer stick an even, wet coat

2) Allow the primer to dry for 2 minutes at 20° F (-7°C) and above. From 20° F (-7°C) down to 0°F (-18°C), allow the primer to dry for 6 minutes.

3) Surfaces primed with BETAPRIME™ 5504G are good for 24 hours after priming. If not used within 24 hours, apply another coat of BETAPRIME™ 5504G to reactivate. Maximum of 1 re-prime

**For bare metal, corrosion must be removed and surface must be clean and dry:**

1) Apply one coat of BETAPRIME™ 5504G All-in-One Primer with a clean
### 4. URETHANE APPLICATION:

- Product requirements
- Application requirements
- Storage requirements
- Shelf-life
- Adverse weather conditions
- Additional requirements
  - SDAT identification
  - Non-conductive considerations
  - High modulus considerations
  - Other

| 2) When priming large areas of bare metal, only apply a maximum of 8 to 12 linear inches per dauber. This ensures the dauber has enough primer to apply a thick enough coat to protect the bare metal. 
3) Allow primer to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes. 4) Apply a second coat of BETAPRIME™ 5504G and allow primer to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes. |
|---|

**4. URETHANE APPLICATION:**

- References to application of adhesive at a 90° angle is a recommendation and a means of giving perspective to the term “vertical” with regards to the applicator. Application of adhesive at lower angles is not considered a safety issue.

- References to application of adhesive in a triangular bead or a “V” bead are a strong recommendation. There are installations where the adhesive is used to seal (ex. sealing around the glass in a gasket set) where a triangular bead is not needed.

- Recommendation to “back paddle” urethane after setting the glass is to minimize leaks and is not required for a safe installation.

- All DuPont packaging is being updated to match current literature. Some packaging shows incorrect storage recommendations.

- BETASEAL Xpress 30 has capability to be heated / used like a hot applied adhesive (instructions on pg 31 of FGIG)

- All BETASEAL™ adhesives can be warmed to ease dispensing in cold weather.

---

**Refer to:** DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)

Urethane Application – Pages 24-27
BETASEAL Xpress 30 – Pages 30-31
BETASEAL Express+ - Page 32
BETASEAL U-400HMNC – Page 33
BETASEAL U-418HV / 418 – Page 34
BETASEAL U-428+HV / 838HV Page 35
BETASEAL U-428+ / 838 – Page 36

MDAT info can be found on page 42

All EZ Kit Packaged adhesives include current instructions for use in box

Also refer to the product brochures Page 3 for current instructions.
| 5.5 Those engaged in automotive glass replacement shall **only use retention systems that have** lot numbers and expiration dates printed on appropriate products. | ALL DuPont Automotive Product sticks, bottles, cartridges and sausages have lot numbers and expiration dates printed on the individual package as well as the box it is packed in. G-EZ Kit packaging includes Master Lot Code Stickers that record all primer lot codes and adhesive lot code from the EZ Kit and have a place to record DOT number from glass.  
**Optional:** DuPont provides a Fixed Glass Replacement Record – Appendix FGTP Version 6.1 this **may be used** document lot numbers and expiration dates of material used for glass installation.  
**Refer to:** Page 3 side bar of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021) |

| **6.0 Installation Standards- Adhesive Bonded** | DuPont regularly updates and distributes training manual and product brochures. These contain:  
- **Application details and requirements**  
- Drive-away time charts with temperature and humidity variables  
- Step-by-step installation instructions  
- Safety precautions  
- Storage and shelf life information  
*DuPont offers our customers a variety of different forms of application instructions:*  
  Primers – Pages 13-15  
  Cleaners – Page 12  
- Installation instructions are also included in the box along with all products  
- Product sell sheets also include application instructions  
- Instructions can also be found at [www.BETASEALARG.com](http://www.BETASEALARG.com)  
*Refer to:* DuPont Fixed Glass Installation Guide Ver. 6.1 (2021) |

<p>| 6.2 Products must be stored and controlled according to manufacturers' requirements as | |</p>
<table>
<thead>
<tr>
<th>Paragraph</th>
<th>Additional Information</th>
</tr>
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</table>
| provided directly or through a private labeler.                         | Maximum shelf life, is achieved when the product is stored at an ambient temperature that does not continuously exceed 110°F (43°C).  
|                                                                             | NOTE: We are currently working to align storage temperature recommendations listed on packaging. There may be instances where storage temperatures listed on the package do not align with the statement above. The statement above will SUPERSEDE any other statements. We are working to gain proper alignment with all of our packages. |
| Page 29 Bottom section labeled “Shelf Life”                             | Shelf life data is also printed in product brochures.                                    |
| 6.3 No automotive glass replacement shall be undertaken using an adhesive glass retention bonding system that would not achieve minimum drive-away strength by the time the vehicle may be reasonably expected to be operated. | DuPont regularly updates and distributes training manual and product brochures. These contain:  
|                                                                             | • Application details and requirements  
|                                                                             | • Drive-away time charts with temperature and humidity variables  
|                                                                             | • Step-by-step installation instructions  
|                                                                             | • Safety precautions  
|                                                                             | • Storage and shelf life information  
| 6.4 The vehicle owner / operator shall be notified prior to and after the installation process of the minimum drive-away time under the circumstances of the replacement. | Notify the customer/owner/operator of the appropriate safe minimum drive away time referenced in the last section of the adhesive specific instructions in each adhesive brochure or in the appendix of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)  
|                                                                             | Also found on the DuPont Replacement Record Form in the Appendix in the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)  
| 6.5 Adhesive shall be applied so that the finished bead cross section profile and dimensions meet or exceed original equipment configuration or recommendation of adhesive system manufacturer. | A triangle or V-shaped bead is recommended. The height of the bead should match the height of the roofline at the pinchweld to ensure a bead tall enough to make contact with the glass when decked and prevent any gaps.  
| 6.6 If the OEM installation was polyurethane, then the glass shall be replaced with polyurethane or an equivalent adhesive | Always use urethane to match existing bonding adhesive and use urethane to upgrade installations of other adhesives to urethane bond unless in conflict with current OEM specification  
| 6.3 No automotive glass replacement shall be undertaken using an adhesive glass retention bonding system that would not achieve minimum drive-away strength by the time the vehicle may be reasonably expected to be operated. | DuPont regularly updates and distributes training manual and product brochures. These contain:  
|                                                                             | • Application details and requirements  
|                                                                             | • Drive-away time charts with temperature and humidity variables  
|                                                                             | • Step-by-step installation instructions  
|                                                                             | • Safety precautions  
|                                                                             | • Storage and shelf life information  
| 6.4 The vehicle owner / operator shall be notified prior to and after the installation process of the minimum drive-away time under the circumstances of the replacement. | Notify the customer/owner/operator of the appropriate safe minimum drive away time referenced in the last section of the adhesive specific instructions in each adhesive brochure or in the appendix of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)  
|                                                                             | Also found on the DuPont Replacement Record Form in the Appendix in the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)  
| 6.5 Adhesive shall be applied so that the finished bead cross section profile and dimensions meet or exceed original equipment configuration or recommendation of adhesive system manufacturer. | A triangle or V-shaped bead is recommended. The height of the bead should match the height of the roofline at the pinchweld to ensure a bead tall enough to make contact with the glass when decked and prevent any gaps.  
| 6.6 If the OEM installation was polyurethane, then the glass shall be replaced with polyurethane or an equivalent adhesive | Always use urethane to match existing bonding adhesive and use urethane to upgrade installations of other adhesives to urethane bond unless in conflict with current OEM specification  
<p>|</p>
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Bonding system. If the OEM installation was butyl, polysulfide, or other non-polyurethane, and the vehicle is licensed for highway use, adhesive bonded stationary glass installations shall be performed using polyurethane or an equivalent retention system unless in conflict with current OEM specifications.</td>
</tr>
<tr>
<td>6.7</td>
<td>All adhesive system component lot numbers shall be traceable to each job. ALL DuPont Automotive Product sticks, bottles, cartridges and sausages have lot numbers and expiration dates printed on the individual package as well as the box it is packed in. G-EZ Kit packaging includes Master Lot Code Stickers that record all primer lot codes and adhesive lot code from the EZ Kit and have a place to record DOT number from glass. Optional: DuPont provides a Fixed Glass Replacement Record – Appendix FGTP Version 6.1 this may be used document lot numbers and expiration dates of material used for glass installation. Refer to: Page 3 side bar of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
<tr>
<td>6.9</td>
<td>No product that has exceeded the manufacturer or private labeler’s stated expiration date, open shelf life, or active shelf life shall be used. All products feature a printed date of expiration and can be used up to and including the date if unopened. Bottled BP 5504G may be used for up to 14 days after opening if within shelf life printed on product container. Optional: DuPont provides a Fixed Glass Replacement Record – Appendix FGTP Version 6.1 this may be used document lot numbers and expiration dates of material used for glass installation. Refer to: Page 3 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
<tr>
<td>6.11</td>
<td>When inappropriate replacement materials or methods are detected, those engaged in automotive glass replacement shall report their findings to the vehicle owner/operator. If inappropriate replacement materials or methods are detected prior to glass installation, the job shall not be completed until the condition is corrected. The customer/owner/operator must also be notified. Optional: DuPont provides a Fixed Glass Replacement Record – Appendix FGTP Version 6.1 this may be used document vehicle pre-inspection and any conditions observed prior to glass replacement. Refer to: Page 3 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
<tr>
<td>6.12</td>
<td>When those engaged in automotive glass replacement correct inappropriate glass installations, they shall remove any inappropriate materials that would compromise the retention system. They shall fully correct Adverse glass installation related condition(s) caused by the use of inappropriate materials or Refer to: Page 3 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
<tr>
<td>Any adverse glass installation related condition(s) caused by the use of inappropriate materials or methods, and they shall use appropriate methods described elsewhere within Section 5 of this document.</td>
<td>methods shall be fully corrected and appropriate methods described elsewhere within Section 6 of this document shall be adhered to. The customer/owner/operator must also be notified.</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td><strong>Optional:</strong> DuPont provides a Fixed Glass Replacement Record –Appendix FGTP Version 6.1 this may be used document vehicle pre-inspection and any conditions observed prior to glass replacement.</td>
<td></td>
</tr>
<tr>
<td><strong>6.13 When sealing air or water leaks within a polyurethane retention system, only compatible polyurethane adhesive shall be used. (No silicone or butyl may be used).</strong></td>
<td><strong>When sealing air or water leaks make sure compatible polyurethane adhesive is used. Do not use silicone or butyl unless specified by the OEM.</strong></td>
</tr>
<tr>
<td><strong>NOTE:</strong> may be in conflict with existing OEM service bulletins</td>
<td><strong>Refer to:</strong> Page 26 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
<tr>
<td><strong>6.14 Only the full cut method should be used for polyurethane retention systems.</strong></td>
<td><strong>Trim existing urethane bead down to 1-2 mm.</strong></td>
</tr>
<tr>
<td><strong>Note:</strong> 1-2 mm is a recommendation. Trimmed original adhesive height as thin as 1/64” is acceptable</td>
<td><strong>Refer to:</strong> Page 20 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
<tr>
<td><strong>Installation instructions on Page 2, section 5, point B of each appropriate brochure</strong></td>
<td><strong>All EZ Kit Packaged adhesives include current instructions for use in box</strong></td>
</tr>
<tr>
<td><strong>7.0 Installation Standards- Rubber Gasket</strong></td>
<td></td>
</tr>
<tr>
<td><strong>7.1 If the OEM utilizes the combination of a rubber gasket and polyurethane as a retention system, an equivalent adhesive bonding system must be used in the installation. In cases when the OEM didn’t include polyurethane or an equivalent adhesive system, such systems shall be used if later production models included the addition of adhesive systems without body style modification.</strong></td>
<td><strong>For installations where the OEM used gasket and urethane, the glass must be replaced with urethane. In cases where there is no urethane (or equivalent adhesive), urethane can be used if later production models included the addition of adhesive systems without body style modification.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Refer to:</strong> Page 17 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
<tr>
<td><strong>7.2 If the OEM gasket installation did not include adhesive and the vehicle is licensed for highway use and is less than 10,000 lbs. Gross Vehicle Weight</strong></td>
<td>If the OEM gasket installation did not include adhesive and the vehicle is licensed for highway use and is less than 10,000 lbs. Gross Vehicle Weight</td>
</tr>
<tr>
<td></td>
<td><strong>Refer to:</strong> Page 17 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
<tr>
<td><strong>Vehicle Weight (GVW)</strong>, the installation shall include polyurethane or an equivalent adhesive bonding system. The following are permissible exceptions: egress applications, antique or classic vehicle restorations, or in cases in which this practice conflicts with current vehicle manufacturer specifications.</td>
<td></td>
</tr>
<tr>
<td>(GVW), the installation shall include urethane or an equivalent adhesive bonding system. The following are permissible exceptions: egress applications, antique or classic vehicle restorations, or in cases in which this practice conflicts with current vehicle manufacturer specifications.</td>
<td></td>
</tr>
<tr>
<td><strong>7.3 When sealing air or water leaks within a rubber gasket/polyurethane ADHESIVE SYSTEM only compatible polyurethane shall be used. (No silicone or butyl may be used).</strong></td>
<td></td>
</tr>
<tr>
<td>When sealing air or water leaks within a rubber gasket/urethane ADHESIVE SYSTEM only compatible urethane shall be used bond unless in conflict with current OEM specification. (No silicone or butyl may be used).</td>
<td></td>
</tr>
<tr>
<td>Refer to: Page 17 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
<td></td>
</tr>
</tbody>
</table>
### 8.0 Additional Requirements

<table>
<thead>
<tr>
<th>8.4 Whenever OEM retention systems are modified on later production models without body style modification, the most current retention system shall be used in the replacement unless otherwise specified by the OEM.</th>
<th>Whenever OEM retention systems are modified on later production models without body style modification, the most current retention system shall be used in the replacement unless otherwise specified by the OEM.</th>
<th>Refer to: Page 3 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8.5 Notification of defective product:</strong>&lt;br&gt;- A failure or defect in any product used or intended for use in the automotive glass replacement process that could jeopardize customer safety shall be reported promptly to the manufacturer or supplier of the product.&lt;br&gt;- Any product installed by those engaged in automotive glass replacements that is discovered to be defective or which is determined could jeopardize customer safety shall be immediately reported to the customer with an offer to remedy the situation.</td>
<td>Notify adhesive, vehicle or glass manufacturer if a product failure is observed when working on a vehicle. Also notify the owner/operator of the vehicle. Immediately notify customer if any product used during the installation is discovered to be defective or determined could jeopardize customer safety. Optional: DuPont provides a Fixed Glass Replacement Record – Appendix FGTP Version 6.1 this may be used document vehicle pre-inspection and any conditions observed prior to glass replacement along with product lot numbers to ensure traceability.</td>
<td>Refer to: Page 3 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
<tr>
<td><strong>8.6 Those engaged in automotive glass replacement shall not introduce any chemical agents, such as cleaners, solvents, lubricants, release agents, or utilize any installation practice, which will adversely affect the glass retention system.</strong></td>
<td>Those engaged in automotive glass replacement shall not introduce any chemical agents, such as cleaners, solvents, lubricants or release agents, or utilize any installation practice, which will adversely affect the glass retention system.</td>
<td>Refer to: Page 3 sidebar of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
<tr>
<td><strong>8.7 Those engaged in automotive glass replacement shall create and retain records of each auto glass replacement for a period of at least three years from the date the work was completed sufficient to demonstrate compliance with this standard. Records, either electronic or hard-copy, shall be legible, easily identifiable and readily available. Such three year period may be temporarily shortened for specific, clear and substantial reasons but shall be adhered to when such reasons no longer exist.</strong></td>
<td>12. Record all lot numbers of primers and adhesives used, as well as the U.S. Department of Transportation (DOT) number and part number of all glass parts installed. Installation records should be maintained for 3 years. Optional: DuPont provides a Fixed Glass Replacement Record – Appendix FGTP Version 6.1 this may be used document vehicle pre-inspection and any conditions observed prior to glass replacement along with product lot numbers to ensure traceability.</td>
<td>Refer to: Page 3 of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
</tbody>
</table>
## Retention System Provider Deliverables:

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Retention System Provider Response</th>
<th>Is Documentation Included: (Yes, No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Those engaged in automotive glass replacement shall use retention systems that are produced under the ISO 9001 standard or any standard that contains the entire text of ISO 9001.</td>
<td><strong>DuPont response:</strong> DuPont products are manufactured and packaged in IATF 16949:2016, ISO 9001 and ISO 14001:2004 certified facilities.</td>
<td>Refer to: Page 3 sidebar of the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)</td>
</tr>
</tbody>
</table>

**Identify your organization's current quality assurance standard and how this should be identified by your glass shop customers.**

| 5.3 Those engaged in automotive glass replacement shall use either an OEM approved retention system or equivalent retention system as certified in writing by the equivalent retention system manufacturer directly or through a private labeler. | **DuPont response:** Adhesive systems from DuPont have passed specification testing for Ford, GM, Fiat Chrysler and all manufacturers globally. Test specifications include, but are not limited to, physical properties and adhesion durability testing (accelerated weathering and outdoor exposure). When used as directed, DuPont adhesives meet or exceed OEM strength requirements outlined in glass bonding specifications. | Refer to: Page 9 Sidebar & Page 9, Section 2 in the DuPont Fixed Glass Installation Guide Ver. 6.1 (2021) |

**Provide validation to this requirement and how your glass shop customers’ would demonstrate your compliance to this section of the Standard.**

| 5.4 Those engaged in automotive glass replacement shall obtain and follow written comprehensive and current application instructions from the retention systems manufacturer or private labeler. These instructions shall include at least the proper use of the retention system storage specifications, minimum dive-away time charts containing temperature and humidity variables if applicable, and any special procedures required for adverse weather conditions. | **DuPont response:** DuPont regularly updates and distributes training manual and product brochures. These contain:  
• Application details and requirements  
• Drive-away time charts with temperature and humidity variables  
• Step-by-step installation instructions  
• Safety precautions  
• Storage and shelf life information | **DuPont offers our customers a variety of different forms of application instructions:**  
• DuPont Fixed Glass Installation Guide Ver. 6.1 (2021)  
  Adhesives - Pages 30-36  
  Primers – Pages 13-15  
  Cleaners – Page 12  
• Installation instructions are also included in the box along with all products  
• Product sell sheets also include application instructions  
• Instructions can also be found at www.BETASEALARG.com |

**Identify the name and publish date of the document(s) fitting the description of “current, comprehensive, written application instructions” that are to be on hand and utilized by your company's glass shop customers.**

NOTE: DuPont Fixed Glass Installation Guide 6.1 is launching in January 2022 with the addition of 2 new products, BETASEAL U-428-HV / BETASEAL™ U-838HV and transition from BETABRADE to new glass cleaning procedure. Transition time is
needed for the new training to be proliferated to all customers. Until then, DuPont Fixed Glass Installation Guide 6.0 will still be acceptable as none of the installation instructions have changed. New products and glass cleaning procedure are documented in 6.1. Some customers may still be using BETABRADE and they are covered under FGIG 6.0.

NOTE: for customers on FGIG 6.0 that are using melamine foam sponge or scotchbrite pads to clean glass, DuPont Technical Bulletin dated 10-01-2020 documents proper use.

<table>
<thead>
<tr>
<th>6.3 No automotive glass replacement shall be undertaken using an adhesive glass retention bonding system that would not achieve minimum drive-away strength by the time the vehicle may be reasonably expected to be operated.</th>
</tr>
</thead>
</table>
| **DuPont response:** DuPont regularly updates and distributes training manual and product brochures. These contain:  
  - Application details and requirements  
  - Drive-away time charts with temperature and humidity variables  
  - Step-by-step installation instructions  
  - Safety precautions  
  - Storage and shelf life information |
| **DuPont offers our customers a variety of different forms of application instructions:**  
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  - Product sell sheets also include application instructions  
  - Instructions can also be found at [www.BETASEALARG.com](http://www.BETASEALARG.com) |

Identify the drive-away-time chart to be utilized by your company's glass shop customers in order to be compliant with this requirement.

<table>
<thead>
<tr>
<th>9.1 Technicians installing replacement automotive glass shall be fully qualified for the tasks they are required to perform. Such qualifications shall include, at a minimum, completion of a comprehensive training program with a final exam and an ongoing education component. The program shall include, among other things: AGR safety issues, an understanding of OEM installation standards and procedures, relevant technical specifications, Adhesive System Manufacturer specific comprehensive retention system training and the opportunity to apply and demonstrate the skills technicians learn.</th>
</tr>
</thead>
</table>
| **DuPont response:** DuPont has offered its industry-leading Fixed Glass Installation Training Program, and customized training programs for almost 30 years. More than 30,000 technicians have received certificates of program completion like the sample on page 5 of our Fixed Glass Installation Guide, which we update and distribute regularly.  
  At the completion of the training, technicians take a comprehensive written test to demonstrate knowledge. Upon successful completion of the training, technicians receive an identification card. Certificates of program completion are |
| **Refer to:** Page 5, DuPont Fixed Glass Installation Guide Ver. 6.1 (2021) for examples of the certificate of training and identification card. |
certificates provided and the frequency of such training and/or continuing education.

mailed shortly after the information is logged into the DuPont system.

The DuPont Fixed glass Training Program was registered with AGSC in 2008 thru current

9.2 Training with respect to the content and requirements of the current version of this standard shall be required for all personnel directly involved in the automotive glass replacement process (examples: scheduling, purchasing, installing, customer service, quality control, management). Records of this training detailing content, date, participants and acknowledgement of the participant’s successful completion of the training and receipt of a printed copy of the current standard shall be maintained.

DuPont supports comprehensive training for all personnel involved in the automotive glass replacement process to the AGRSS standard. No

IF YOUR COMPANY DOES PROVIDE TRAINING, identify the document provided to record the required items mentioned above relating to this training.

<table>
<thead>
<tr>
<th>Contact Information:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Your Company’s Name:</strong></td>
</tr>
<tr>
<td><strong>Your Company’s Address:</strong></td>
</tr>
<tr>
<td><strong>Your Name:</strong></td>
</tr>
<tr>
<td><strong>Your Title:</strong></td>
</tr>
<tr>
<td><strong>Your Phone Number:</strong></td>
</tr>
<tr>
<td><strong>Your Email Address:</strong></td>
</tr>
<tr>
<td><strong>Your Mailing Address:</strong></td>
</tr>
</tbody>
</table>
DuPont Transportation and Industrial
Fixed Glass Installation Guide

BETASEALarg.com

Version 6.1 Updated December 2021
<table>
<thead>
<tr>
<th>Part</th>
<th>Pre-Treatment Process</th>
<th>Primer Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic Coat Frit/Inner Frit</td>
<td>Wet-Scrub/BETACLEAN GC-800</td>
<td>BETAPRIME 5504G</td>
</tr>
<tr>
<td>Clear Laminated Glass No Frit</td>
<td>Wet-Scrub/BETACLEAN GC-800</td>
<td>BETAPRIME 5504G - 2 coats</td>
</tr>
<tr>
<td>Encapsulated Parts</td>
<td>Wet-Scrub/BETACLEAN GC-800</td>
<td>BETAPRIME 5504G</td>
</tr>
<tr>
<td>PAAS</td>
<td>Lightly Wet-Scrub/BETACLEAN GC-800</td>
<td>BETAPRIME 5504G</td>
</tr>
<tr>
<td>Metal Frame PVC Slider</td>
<td>Wet-Scrub/BETACLEAN GC-800</td>
<td>BETAPRIME 5504G</td>
</tr>
<tr>
<td>Gasket Set Parts</td>
<td>Wet-Scrub/BETACLEAN GC-800</td>
<td>BETAPRIME 5504G</td>
</tr>
<tr>
<td>OEM Pre-Primed Parts (Black)</td>
<td>BETACLEAN GC-800</td>
<td>BETAPRIME 5504G</td>
</tr>
<tr>
<td>Any Bare Metal (Nicks and Scratches)</td>
<td>BETACLEAN GC-800</td>
<td>BETAPRIME 5504G - 2 coats</td>
</tr>
<tr>
<td>Corroded Bare Metal</td>
<td>Remove Surface Corrosion</td>
<td>Clean Bare Metal with 100% Acetone or Heptane.</td>
</tr>
<tr>
<td>Body Side Paint</td>
<td>BETACLEAN GC-800</td>
<td>BETAPRIME 5504G</td>
</tr>
</tbody>
</table>
DuPont – world class products and support

More than 1 billion vehicles worldwide have been assembled using DuPont windshield adhesives. These trusted products are also available to the automotive aftermarket.

Safety

Safety is always the bottom line at DuPont. All our aftermarket products are crash proven to rigorous OEM standards and also stand up to robust durability testing.

Innovation

DuPont leads the field in technology and innovation. Our R&D team is dedicated to finding ways to improve polyurethane technology for all automotive aftermarket glass replacements. For example, DuPont’s newest adhesives, BETASEAL™ Xpress30 and BETASEAL™ Express+ feature short drive-away times powered by DuPont’s RPM technology. RPM adhesive technology allows for short drive-away times to get the customer back on the road faster, but also offers optimized body that holds the glass firmly in place once decked. Updated BETASEAL™ U-428Plus HV/U-838HV offers an improved viscosity formulation with better decking and resistance to glass movement.

Support

When you choose aftermarket products from DuPont, you not only get the best products available, you partner with an industry leader. DuPont Field Sales and Technical Service team members are 100% dedicated to support our aftermarket customers. DuPont offers top-class in person and on-line training for technicians and promptly responds to your needs and concerns to give you world-class support. DuPont also offers a comprehensive mobile Web site that puts critical installation information in the palm of your hand. Visit www.BETASEALarg.com from your mobile device for more information.

Quality

You can trust the quality of all our products. We pride ourselves on products that are free of defects and retain batch-to-batch consistency. All cleaners, primers and adhesives are optimized for value – they ensure peace of mind for customers, while keeping your material costs low and making your workdays go easier and faster.

If found, please return to:
DuPont Transportation and Industrial
1250 Harmon Road
Auburn Hills, MI 48326 USA
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**Introduction**

Direct glazing is the primary bonding method used on virtually all vehicles manufactured worldwide. It is where glass is bonded directly to the vehicle body using a high-strength adhesive. Direct glazing restores the structural integrity of the passenger compartment to ensure the safety of vehicle occupants. This method places greater structural design demands on the windshield, which, in turn, puts greater demands on the knowledge and skills of the installer.

DuPont is concerned about the safety of passengers and the need to establish standards for the Automotive Replacement Glass (ARG) industry. In response to these concerns, DuPont developed a “Code of Practice” and seeks your endorsement.

"**Code of Practice**"

**Code introduction**

The "Code of Practice" establishes a framework and set of guidelines to ensure the ARG industry provides consumers with high-quality service and products.

Compliance with the "Code of Practice" helps ensure:

1. Customers are treated fairly and all products and services meet OEM standards and specifications.

2. The products and services offered by participants are provided in a safe and efficient manner, in accordance with fair business practices and relevant health and safety regulations.

Many of the principles and provisions in the "Code of Practice" are a restatement of time-tested methods and practices observed by reputable participants in the industry.

The "Code of Practice" demonstrates the high standard of business practices and services adopted by participants. It is a tool by which services may be measured and judged. This results in advantages for and protection of customers who elect to use the products and services offered by participants.

The principles set out in the "Code of Practice" are not intended to qualify, supplement or interpret any existing laws or regulations applicable to the industry. They should be used as practical, reasonable guides.

The ANSI/AGSC/AGRSS current standard is the first and only North American standard detailing the steps and procedures installers should take to provide safer automotive glass replacement. It is one of the most significant safety developments in the automotive glass industry in the past 50 years.

The standard explains what steps should be followed for safer replacements and also sets up procedures for handling difficult or problem installations. It was developed by a dedicated group of automotive glass industry professionals under the auspices of ANSI/AGSC/AGRSS. The entire development process followed the procedure of the American National Standards Institute (ANSI) to ensure that it was open and complete. As a result, the auto glass industry has a standard that is compiled by the industry, not just one group or company.

It is important that every single person and company involved in the ARG industry be familiar with the ANSI/AGSC/AGRSS Standard. Visit www.agsc.org for more information.
Objectives
The objectives of the “Code of Practice” are to help you:

- Comply with ANSI/AGSC/AGRSS current standards in all installations
- Ensure vehicles are restored to the OEM design specifications for structural integrity and aesthetics
- Assure compliance with the Motor Vehicle Act that mandates all vehicles be repaired and restored to original strength and safety. The Motor Vehicle Act, Section 1397 (a2a) states: No ... dealer ... or repair business shall knowingly render inoperative, in whole or in part, any device or element of design installed on or in a motor vehicle
- Satisfy Federal Motor Vehicle Safety Standards (FMVSS) 208, 212, 216a, 219 and 111
- Promote the use of the most current, technologically advanced products, materials, methods and processes
- Promote the use of glass replacement parts that meet ANSI Z26.1 (as specified by FMVSS 205) and are so marked
- Encourage and develop high standards of workmanship and business ethics within the industry
- Create awareness of safety issues
- Establish and maintain a good reputation and standing in the ARG industry

Scope
The “Code of Practice” includes the following:

Principles: product origin, quality and standards
All products and processes used conform to ANSI/AGSC/AGRSS standards, include the following.

Glass components will:
- Conform to ANSI/AGSC/AGRSS standards
- Be of a quality or standard to restore the structural integrity of consumers’ vehicles

Adhesives will:
- Conform to Original Equipment Manufacturer (OEM) specifications for automotive glass bonding or be endorsed by OEM

Other products (rubber, clips, cleaners, etc.) will:
- Be fit for their purpose or approved by the OEM

Methods and techniques
Participants will use methods and techniques consistent with the "Code of Practice" in order to ensure:
- Structural integrity of the customer’s vehicle is restored to OEM specifications following the replacement of any automotive glass component
- Aesthetics of the customer’s vehicle is equivalent to OEM-specified appearance (allowing for reasonable deterioration due to vehicle age)

Installation standards and procedure
Installation standards and procedures must be adequately documented and accessible by users at all times through an information system. Information must be kept up-to-date as new vehicles are released.
Follow the recommended installation procedures:

1. Prior to commencement of work, inspect vehicle for pre-existing damage or conditions that would prevent a safe installation. Report any unsafe conditions or damage to the vehicle’s owner and record on the DuPont Fixed Glass Replacement Record or other work documents. Notify customer of MDAT under the circumstances of the installation.
   a. If any conditions that would prevent a safe installation (inappropriate replacement materials, methods, excessive corrosion, etc.) are observed prior to glass installation, the job shall not be completed until the condition is corrected, and the customer should be notified.

2. Properly protect the customer’s vehicle by utilizing hood, seat and door covers and other protective shields.

3. Assess if the vehicle deploys any Advanced Driver Assist Systems (ADAS.) If the vehicle has ADAS that require calibration, make sure to communicate to the customer your company’s policy/plan to calibrate or not.

4. Inspect replacement parts thoroughly for defects before starting work. (Optional step: dry fit glass to ensure a proper fit in pinchweld prior to applying adhesive.)

5. Verify that all primers and adhesives are within current shelf life and have been stored according to the adhesive manufacturer’s specified recommendations on product brochure.
   a. All DuPont products feature a printed date of expiration and can be used up to and including the date if unopened.
   b. Bottled BETAPRIME™ 5504G may be used up to 14 days after opening if within shelf life printed on product container

6. Use adhesives equivalent to those used during manufacture (e.g., urethane adhesive for urethane adhesive).
   a. If OEM retention systems are modified on later production models without body style modification, the most current retention system shall be used in the replacement unless otherwise specified by the OEM.
   b. Always use urethane to match existing bonding adhesive and use urethane to upgrade installations of other adhesives to urethane bond unless in conflict with current OEM specification.

7. Make sure that all mechanically fastened parts are replaced according to OEM specifications.

8. Only use external mirror replacements that meet FMVSS 111.

9. Promptly notify adhesive, vehicle or glass manufacturer if a product failure or defect is observed when working on a vehicle. Also, notify the owner/operator of the vehicle. If any DuPont product problems are found, contact DuPont at +1-800-453-3779 or email betasealarg@dupont.com.

10. Test for water leaks and wind noise after installation.

11. Inspect the vehicle to ensure: a. All trim fits neatly and there are no gaps or exposed edges. b. All accessories (i.e., wiper arms, rear glass defroster and radio/telephone antennas) are properly reconnected. c. The installed glass has been properly cleaned and is streak free. d. All broken glass, dirt, debris and adhesives or sealants are cleaned from interior and/or exterior of vehicle.

12. Record all lot numbers of primers and adhesives used, as well as the U.S. Department of Transportation (DOT) number and part number of all glass parts installed. Installation records should be maintained for 3 years.
   a. DuPont’s Fixed Glass Replacement Record is provided on page 43 of this manual.

Those engaged in automotive glass replacement shall not introduce any chemical agents, such as cleaners, solvents, lubricants or release agents, or utilize any installation practice, which will adversely affect the glass retention system.

DO NOT mix DuPont products with components from other adhesive suppliers. Adhesives and primers are designed to work together, mixing components from other adhesive suppliers may lead to adhesive system failures and compromise the safety of the installation.

Lot numbers and expiration dates are printed on all DuPont product containers (sticks, bottles, cartridges and sausages), as well as on the container’s box. G-EZKit packaging includes master lot code stickers that record all primer lot codes and adhesive lot codes from the G-EZKit and have a place to record the replacement glass DOT number.

13. Make sure consumers understand their responsibility and precautions for minimum drive-away time. Place an information card in a visible, noticeable location in the vehicle. Installation procedures for direct-glazed, urethane-set windshields are detailed later in this guide.

Direct-glazed automotive glass

All products and processes used should conform to OEM specifications, including:

- Urethane adhesives that meet all applicable OEM standards
- Glass preparation products and/or primers (as determined by adhesive system) to chemically prepare the glass bonding surface and reduce bond degradation, which may be partially caused by ultra-violet (UV) light penetration through the ceramic frit over time
- Body preparation – for example, small bare metal areas. The primer must be applied to the clean metal surfaces of the car body to both promote adhesion and provide corrosion resistance of the glass to the body. This ensures the structural integrity of the vehicle (which conforms to OEM specifications).
- Perform all direct-glazed installations using the “OEM method”

Commonly used terms

“Code of Practice” refers to guidelines that establish the minimum requirements for the industry.

Participants refers to all groups or individuals committed and prepared to comply with all aspects of the “Code of Practice”.

Industry refers to any organization, company, group, individual or partnership supplying, replacing or repairing any glass component in the ARG industry in accordance with local, state and federal statutory requirements.

Product safety

Symbols in this guide

Throughout this manual, paragraphs containing particularly important information are marked with the symbols Note, Caution and Warning.

Safety precautions

This safety information is provided in good faith, but does not replace the worker’s obligation to be familiar with all products, Safety Data Sheets (SDS) in the United States, Workplace Hazardous Materials Information Systems (WHMIS) in Canada and to exercise due care and caution in auto glass installation, materials handling and equipment operation.

Safety can never be overemphasized. Good safety practices are the best means of preventing personal injury or damage to property.

The safe use of chemicals

It is a common misconception that chemicals can only enter the body through the mouth. Some chemicals can enter the body via other means and present a greater hazard. For example, the skin’s resistance to chemicals is reduced if it is bruised or cut; the eye offers little resistance to chemicals because of its composition.
The following safety tips are recommended when handling chemical products:

- Always read the SDS (WHMIS) for more instructions
- Always wear protective gear such as chemically resistant gloves and safety glasses
- Avoid prolonged or repeated skin contact
- Never smoke, eat or drink when using chemicals, even if they are not flammable
- Always read the instructions on containers and observe precautions given
- Always store chemicals in their approved and labeled containers
- Always keep the container sealed when not in use
- Never sniff or inhale vapors. It can impair judgment and may cause adverse medical effects.
- Keep flammable chemicals away from flame and ignition sources

**The safe use of electrical equipment, including applicators and battery chargers**

Respect electrical equipment for your protection.

- Make sure the power cord is properly connected to outlet and that outlet is grounded
- Use a Ground Fault Interrupter (GFI) when working mobile or in a wet or damp area
- Do not use worn or frayed electrical wiring or a faulty electrical plug

**General first aid recommendations**

**Skin contact:** promptly wipe off excess material, then wash skin thoroughly with soap and water.

**Eye contact:** immediately flush with water for at least 15 minutes. Contact a physician if any symptoms persist.

**Inhalation:** move to fresh air and contact a physician.

**Ingestion:** contact a physician or poison control center immediately.

**Clothing:** remove contaminated clothing and launder before reuse.

**Occupational safety and health**

All participants and employers will provide a safe workplace and environment for the community in accordance with government requirements. All participants, employers and employees will adhere to government laws and regulations applying to the supply, installation and/or repair of automotive glass in motor vehicles. Additionally, the participants will need to ensure the proper disposal of unused materials or containers.

**Training and skill qualification**

All participants will provide structured training for their employees or access to a structured training program. This will help ensure installers are adequately skilled to perform automotive glass replacement and/or repairs in accordance with the "Code of Practice".

- All skills obtained by technicians will be documented and recorded by their employers, trainers or assessors using an easily accessible records retrieval system
- Where applicable, all training will conform to industry standards
- Employers and employees will take advantage of continuing education available at trade shows, seminars and electronically via the Internet

**Note**

Always read the SDS (WHMIS) prior to working with any new product. Review this information on a regular basis.
Minimum equipment/facility specification

Workshop facilities will be equipped to meet local, state and/or federal legal requirements and will include the following equipment:

- First aid kit
- Fire extinguishers
- Vacuum cleaners for all work sites
- Workbench
- Electric- or pneumatic-driven cut-out tool and accessories
- Electric drill and selection of drill bits
- Bench grinder
- Individual tool kit and personal protective equipment for employees. See next two subsections.

Personal protective equipment

For each employee, provide the following minimum required protective equipment:

- Eye protection (glasses/goggles)
- Foot protection (safety shoes/boots)
- Ear protection (ear muffs/plugs)
- Respiratory protection (respirator/face mask)
- Body protection (apron)
- Hand and wrist protection
- Cut-resistant gloves
- Disposable chemical-resistant gloves
- Anti-vibration gloves
- Cut-resistant forearm protectors

Note

State and local occupational, safety and health regulations may require additional protective gear.

Wear appropriate safety equipment when replacing auto glass.
DuPont recommends the following tools:

Individual tool kit per employee for mobile and in-shop installations:

- Windshield stand
- Vacuum cleaner (industrial strength)
- Molding release tools
- Wire cutout tool
- Channel scraper
- Headliner tool
- Locking strip tool (truck)
- Long-nose pliers
- Adhesive applicator
- Masking tape
- Vacuum cups
- Ball peen hammer
- Wiper arm remover tool
- Hood covers
- Seat covers
- Mirror bracket adhesive
- Single-edged razor blades and holder
- Torx bit set

- Nozzle notching tool
- Utility knife with heavy-duty blades
- Replacement blades (as required)
- Phillips screwdriver set
- Small rubber mallet
- Riveter and rivets
- Combination pliers
- Nut drivers
- Door handle tool
- Door trim pad remover
- Channel chisel
- Allen key sets (Metric and English)
- Power cutout tools
- Drill (electric/battery)
- Socket sets (Metric and English)
- Standard screwdriver set
- Digital camera

Safe material disposal

Participants shall be responsible for compliance with all applicable federal, state/provincial and local statutes regarding the management, use, handling, treatment, storage, disposal and transportation of hazardous wastes and materials. Participants with compliance questions shall contact their local, state/provincial or federal environmental regulatory agency.

Participants shall read the appropriate SDS (WHMIS) for all adhesive, primer, preparation and cleaning products.

Participants shall contact the appropriate emergency response team in the event of a chemical accident involving a spill, leak, fire or explosion.
Urethane chemistry

Introduction
Urethane is the only adhesive technology used in high-performance auto glass bonding. This is because urethane is capable of withstanding high levels of deformation with little loss of adhesive strength and performance. Urethanes are tough and abrasion resistant. BETASEAL™ urethane adhesives are formulated to be durable enough to withstand long-term weather exposure.

Why not butyl?
For many years, butyl provided adequate sealing, but little strength. When automobile designs changed, adhesive technology improved to provide high structural strength, as well as a moisture seal. Butyl is now considered a contaminant and should be completely removed to ensure 100% bond strength for glass originally installed with urethane adhesive.

Windshield retention and roof crush requirements
The most common cause of death during an accident is being thrown from a vehicle. In 1970, federal legislation was enacted requiring the windshield to remain intact during a 30 mph frontal impact (FMVSS 212). In 1973, similar legislation was enacted requiring the passenger car roof to withstand roof collapse during a rollover accident (FMVSS 216a). Due to fuel economy and other concerns, automotive manufacturers chose not to reinforce the roof pillars to meet this standard, instead using the windshield as an integral part of the car body.

Today, most cars manufactured in North America use urethane adhesive to bond the windshield and car body into a single unit. Manufacturers are required to verify strength and performance by crash and crush testing each make and model before it can go to market. Urethane adhesive is also applied in backlight and many fixed sidelite installations.

Adhesive strength
Safety is the bottom line – auto manufacturers, insurance companies and aftermarket professionals are all concerned about passenger safety. BETASEAL™ urethane adhesives have been developed to protect occupants in crashes and rollover accidents. They are formulated to:

- Become a structural part of the vehicle body
- Provide replacement glass bond strength equal to that of the original vehicle
- Meet original auto manufacturer FMVSS certification standards

Who determines what is safe?
The DOT mandates all new vehicles pass the FMVSS performance tests. These actual destructive tests ensure that vehicles maintain a minimum safety standard. The standard does not allow substitution of laboratory tests for the destructive crash tests.
FMVSS performance standards

FMVSS 212 measures windshield retention in a barrier crash. Automobiles equipped with passive restraints must retain 50%. Vehicles not equipped with passive restraints must have at least 75% retention. Some vehicle manufacturers require 100% retention in this severe crash test.

FMVSS 208 occupant crash protection specifies equipment requirements for active and passive restraints, including air bags. There can be no separation of load-bearing safety assemblies in a 30 mph barrier crash. This pertains to the windshield because the passenger side air bag deploys off the windshield in order to perform its safety function.

FMVSS 216a is the roof crush performance test. It measures the structural strength required to protect occupants in the event the vehicle rolls over. Three times unloaded vehicle weight under 6,000 lbs. and one and one-half times the unloaded vehicle weight between 6,000 and 10,000 lbs. of force is applied at an angle to the roof. Five inches of deflection or less is required to pass.

FMVSS 219 windshield intrusion test measures the windshield’s ability to keep a 15 lb. object traveling at 30 mph from entering the vehicle cabin. The glass and adhesive bond protects occupants from intrusion of external objects. The windshield can displace no more than one-quarter inch to pass.

The urethane solution

BETASEAL™ polyurethane adhesives are subjected to lab, impact and crash tests prior to full production to verify adhesion to new and old paint and ceramic frits. DuPont collaborates with OEMs, universities and suppliers worldwide in order to formulate and manufacture adhesives that exceed OEM specifications and applicable safety standards. Adhesive systems from DuPont have passed specification testing for Ford, GM, Fiat Chrysler and all manufacturers globally. Test specifications include, but are not limited to, physical properties and adhesion durability testing (accelerated weathering and outdoor exposure).

BETASEAL™ Adhesives are developed exclusively for automotive glass bonding. Tensile and lap shear strengths measure a material’s resistance to being pulled or torn apart. Cohesive failure occurs when the adhesive sticks to the glass and aperture, but the body of the adhesive is torn apart. Adhesive failure is a measurement of the urethane’s effectiveness to adhere to the substrate (e.g., ceramic frit band and pinchweld). An adhesive failure of 100% means the polyurethane pulled loose from the substrate without leaving material, failing OEM standards. BETASEAL™ polyurethane adhesives are approved for use by all automotive vehicle manufacturers.

DuPont certified to comply

DuPont has supplied urethane adhesive to automakers since 1973. More than 600 million vehicles in North America are glazed with BETASEAL™ urethane adhesives (more than 1 billion worldwide). DuPont offers the same approved products to the aftermarket.

Shelf life

Maximum shelf life, as stated on product packaging, is achieved when the product is stored at an ambient temperature that does not continuously exceed 110°F (43.3°C).

Note

Not all brands of urethane adhesives meet the OEM minimum durability requirement. Auto manufacturers continuously evaluate multi-year fleet test data and environmental tests to verify durability.
Urethane adhesive chemistry
There are a variety of urethane products with diverse characteristics. Common to all urethanes is the use of compounds that contain nitrogen-carbon-oxygen groups. These compounds react readily with a wide variety of other chemical groups.

Molecular crosslink
For proper molecular bonding to occur between the glass, urethane adhesive and auto body, all surfaces must be properly cleaned and prepared. The glass must be cleaned with an effective glass and surface cleaner. The glass and frit must be prepared for bonding to create active molecular sites for urethane bonding. The primer is designed to react with the surface molecules on the glass (fritted and clear). After appropriate flash time, the primer develops a strong bond to the glass and creates a surface that is ready for adhesive bonding.

When brought together, the adhesive creates short connections or bridges, commonly known as crosslinks, with neighboring chains of atoms in the chemical layers. This “sandwich” fuses by molecular crosslinking into a strong cohesive unit to retain the windshield in the event of a crash. The interlocking geometries along surface areas and substrates represent active sites for molecular bonding. The metal pinchweld must be checked for corrosion and large areas of bare metal. If found, they must be cleaned with an approved cleaner and primed with an appropriate metal priming system.

Primer use and compatibility
BETAPRIME™ 5504G All-in-One Primer is the only primer needed for all auto glass installations. It can be used to prime glass, ceramic frit, encapsulations, pinchweld, bare metal areas and all other common automotive substrates. BETAPRIME™ 5504G means the correct primer is used every time, avoiding costly and time-consuming mistakes.

DuPont also sells BETAPRIME™ CLEAR Advanced fritted glass primer in our G-EZKit with BETASEAL™ Express+. BETAPRIME™ CLEAR Advanced is only compatible with BETASEAL™ Express+ and should not be used with other adhesives.

100% bond strength
Both chemical and mechanical compatibility are essential. All chemicals are part of a unit. The chemical layers fuse into strong cohesive units when properly applied. The result is 100% bond strength.

The effect of relative humidity on cure
Relative humidity (RH) is the amount of moisture the air holds compared with the maximum amount it could hold at a given temperature. This means at a RH of 50% and temperature of 95°F (35°C), the amount of moisture in the air is 3 grams. At 60°F (15.5°C) and a RH of 50%, it is 1 gram. This means the cure rate of any conventional-cure urethane adhesive is significantly affected by a small change in temperature even though the RH has remained constant.

The effect of temperature on cure
Temperature also plays a role in the cure of the adhesive. At higher temperatures, the chemical reactions that cure the adhesive occur at a faster rate. At lower temperatures, these chemical reactions slow down. Because of this, it is critical for installers to document temperature and humidity at the time of the installation and consult minimum drive-away times charts (included in the Appendix of this guide) before releasing vehicles to customers.
Adhesive types
There are three types of adhesives for auto glass replacement: conventional-cure, advanced-cure and chemical-cure systems.

Conventional-cure urethane adhesives
Conventional-cure, one-component systems are simple to use. The urethane adhesive is applied with a caulking gun and then allowed to cure. Conventional-cure systems rely on atmospheric moisture for the chemical reaction cure to occur. The lower the moisture content in the air, the slower the adhesive cure rate. Colder air cannot physically hold as much moisture as warmer air.

Primerless auto glass urethane technology
DuPont offers conventional-cure adhesives that are also primerless-to-glass. These adhesives differ from traditional adhesive systems because the functionality of auto glass primer is built into the adhesive. DuPont’s primerless-to-glass adhesives are designed to form the same chemical bonds to glass frit as the primer does. Once applied to clean glass, DuPont primerless-to-glass adhesives form strong cross-linked bonds to the glass, without the primer. With these products, it is important to make note of temperature and humidity during the installation and consult minimum drive-away charts referenced in the appendix of this guide.

Advanced-cure urethane adhesives
Advanced-cure urethane adhesives are one-component materials that contain enhanced chemical crosslinking to speed bonding. Advanced-cure adhesives need less moisture to cure and create uniform, reinforced properties throughout the adhesive. The chemical structure is the same in every direction. They absorb and dissipate crash stresses better than conventional-cure adhesives and develop high initial green strength to enable faster drive-away times.

RPM technology
Recently, DuPont developed the next step in advanced-cure adhesive technology, Reinforced Polyisotropic Micronetworked adhesive (RPM). RPM is an evolution of past DuPont crosslinking technology. It offers the same highly crosslinked adhesive that allows it to absorb and dissipate crash stresses more effectively than conventional formulations. RPM also takes the technology a step further by shortening the distance between chemical bonds, allowing the adhesive to develop strength even faster. The result is an adhesive that features excellent body and rheological characteristics with the fast drive-away times that customers demand. RPM technology is used exclusively in BETASEAL™ Xpress30 and BETASEAL™ Express+.

Chemical-cure urethane adhesives
Chemical-cure urethane adhesives rely on mixing of two separate components to drive a chemical reaction that cures the adhesive. These adhesives can solve special time, temperature and humidity problems. For more information on chemical-cure adhesives, consult your local DuPont representative for more details.
Glass preparation: cleaning

Not all surface contaminants are visible, the presence of oil, wax and manufacturing or packaging residue are good indicators that contamination is present. DuPont recommends a thorough decontamination process on all glass to remove both visible and “invisible” contamination. Lab testing and field trials have shown that wet scrubbing glass with a BETACLEAN™ Easy-Go Cleaning Sponge or with an abrasive pad, along with glass cleaner, does an effective job at removing contaminants found on glass.

Removing silicone

Silicone residue, deposited in the manufacturing process, interferes with adhesive bonding and it isn’t always easy to identify. When present, it can prevent adhesives from bonding properly, often leading to windshield replacements that leak. DuPont Technical Service recommends a decontamination process for every installation when contamination is present.

BETACLEAN™ GC-800 Glass and Surface Cleaner

- BETACLEAN™ GC-800 has an aggressive formulation that cuts through glass contaminants
- Evaporates quickly to save time and ensure a dry, residue-free bonding surface
- Sprays on and wipes off
- Foams for best dirt, road film and grease cleanup
- Does not run
- Available individually or as part of a BETASEAL™ G-EZKit
- May be used as a cutout lubricant

BETACLEAN™ Easy-Go Cleaning Sponge

- Abrasive melamine sponge used in tandem with BETACLEAN™ GC-800 to aggressively remove contaminants in the bonding area
- One-time use only
- Available in bulk 160 count box

Cleaning preparation for most replacement glass:

1. Inspect the replacement glass for defects, damage or signs of contamination.
2. Spray glass with BETACLEAN™ GC-800 (Figure 1).
3. Use a BETACLEAN™ Easy-Go Cleaning Sponge or an abrasive pad to abrade the surface:
   a. This is a mechanical abrasion step, make sure to use some pressure.
   b. Ensure the entire bonding surface is treated.
4. While the glass cleaner is still wet, wipe surface with clean paper towel.
5. Spray glass again with BETACLEAN™ GC-800:
   a. If contamination is visible, repeat steps 1 through 3.
   b. If no contamination is visible, proceed to glass priming step.
6. Avoid re-using any BETACLEAN™ Easy-Go Cleaning Sponge or pad. It could carry contaminants to your next job.

Cold weather glass cleaning procedure:

For mobile jobs, once the windshield has been removed from the van, and exposed to cold temperatures, it must be cleaned in less than four (4) minutes. If the cleaning process takes longer than four (4) minutes, or the glass cleaner (BETACLEAN™ GC-800) freezes on the glass surface, the glass should be returned to a warmer environment and existing glass cleaner (BETACLEAN™ GC-800) must be removed using a lint-free towel. REPEAT STEPS 4 through 6.

Caution

Always carefully clean glass to remove contaminants from glass surface.

Note

When choosing an abrasive pad or melamine foam sponge, avoid using any that come with additives or cleaners. Any additives or cleaners could interfere with the adhesive system bonding to the glass.
Glass preparation: priming

Primerless auto glass urethane technology

DuPont currently offers the following primerless-to-glass adhesives: BETASEAL™ U-418, BETASEAL™ U-418HV, BETASEAL™ U-428Plus, BETASEAL™ U-838, BETASEAL™ U-428Plus HV* and BETASEAL™ U-838HV*.

Primerless auto glass urethane systems differ from traditional adhesive systems because the functionality of auto glass primer is built into the adhesive. DuPont’s primerless-to-glass adhesives are designed to form the same chemical bonds to glass and ceramic frit as the primer does. Once applied to clean glass, BETASEAL™ quick-cure, primerless-to-auto-glass urethane adhesives form strong cross-linked bonds to the glass, without the primer.

Warning
Quickly close primer bottle with inner seal and cap when finished with use.

Warning
Always check the expiration date to ensure the product still has shelf life. If using bottles, secure all caps immediately.

Warning
Never use butyl primers with urethane adhesives. They are not compatible and will cause bond failure. Use the same brand of glass cleaner, urethane prep, primer and adhesive to ensure compatibility.

Note
Primerless-to-glass urethane adhesives require the use of BETAPRIME™ 5504G Primer on non-glass surfaces.

Removing key links is dangerous

Removing a key link in any adhesive system is dangerous. It can greatly reduce the overall ability of the system to perform its safety functions. Any part left out or incorrectly applied could cause adhesive bond failure. Skipping an element produces inadequate crosslinking and risks possible bond failure.

Warning
BETASEAL™ adhesive systems (except BETASEAL™ U-418HV and BETASEAL™ U-418) require glass primers. Any part left out of the system can lead to adhesive failure. Never use any other manufacturers’ primers, cleaners or other chemicals in conjunction with any BETASEAL™ adhesive system.

Evaporation working time

Primers are very moisture sensitive. Close the containers, using both the inner and outer caps, immediately after every use to preserve contents. Primers can have an open life of up to fourteen (14) days. Unopened product is considered within shelf life up to and including the expiration date marked on the product. BETAPRIME™ 5504G All-in-One Primer has an open life of fourteen (14) days. When in doubt, throw it out. Always mark the opening date or end of open life date on the can when opening it for the first time. If using single-application primer sticks, check the expiration date printed on the stick, use, then discard.

*New in 2022
BETAPRIME™ 5504G All-in-One Primer

BETAPRIME™ 5504G All-in-One Primer is easy to use and can be used to prime glass, ceramic frit, encapsulations and PAAS. The system chemically alters the glass surface to ensure adhesive compatibility and proper bonding. Use with all BETASEAL™ adhesive bonding systems requiring primers.

Once glass is clean, follow these priming steps:

1. Check the expiration date on the container.
2. If using BETAPRIME™ 5504G All-in-One Primer in bottle, open cap and use the loose cap to pry up the inner seal in a circular motion containing the inner seal in the cap or by pulling gently on the grab ring in the inner seal.
   - If using BETAPRIME™ 5504G SA stick, slide breaker bar over date code on the tube with the prongs facing the foam. While holding the applicator with the foam facing up, press down on the breaker bar with the thumb until the inner container breaks releasing the contents. Point the foam head down toward surface to be primed. Allow the primer to saturate the foam head. Gently squeezing the tube will allow the foam head to saturate faster. Apply light pressure to the foam head (too much will damage the foam during application). Slowly draw the applicator around the surface to be primed to get an even glossy primer film. Apply in one, even, wet coat, moving in the same direction. **NOTE: DO NOT BREAK THE AMPOULE BY SQUEEZING WITH BARE HANDS.**

For any fritted glass, including internal frit glass where the frit band is on the inside of the glass (on the 2 or 3 surface of laminated parts):

3. Apply BETAPRIME™ 5504G All-in-One Primer with a clean wool dauber or single-application stick in one, even, wet coat, moving in the same direction.
4. Allow primer to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes.

For laminated glass without any frit:

3. Apply BETAPRIME™ 5504G All-in-One Primer with a clean wool dauber or single-application stick in one, even, wet coat, moving in the same direction.
4. Allow primer to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes.
5. Apply a second coat of BETAPRIME™ 5504G and allow to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes. **When using BETAPRIME™ 5504G SA primer stick on clear glass (glass without frit), two sticks may be required for proper application.**

**Warning**

Avoid inhalation of solvent vapors and eye contact. Always use primers in well-ventilated areas. Observe health and safety procedures.

**BETAPRIME™ 5504G** has an open life of fourteen (14) days.

**Note**

In cold temperatures, BETAPRIME™ 5504G may have a wet appearance – this is normal as long as proper dry times are followed.

**Warning**

Quickly close primer bottle with inner seal and cap when finished with use.

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External frit glass has frit baked on the exterior of the glass facing the pinchweld.

Internal frit glass has the frit band on the inside of the glass (on the 2 or 3 surface of laminated parts).
BETAPRIME™ CLEAR Advanced

BETAPRIME™ CLEAR Advanced is available exclusively as part of a BETASEAL™ Express+ G-EZKit. Use it to prime windshields with ceramic frit (either internal or external frit).

- Glass and ceramic frit primer
- The primer stick does not need to be shaken
- To open, point BETAPRIME™ CLEAR Advanced stick pad down toward the surface to be primed and pinch tube once between thumb and forefinger where it is marked on the stick to break internal vial and release the primer
- Allow the pad to saturate – it is not necessary to squeeze the tube
- Slowly draw the applicator around the glass/frit surface to be primed to get an even glossy primer film in one direction
- Apply twice around the bonding surface
- One stick for both applications – discard after use
- Allow to dry for two (2) minutes at 0°F (-18°C) and above
- Maximum open time = 24 hours. After 24 hours, one (1) re-prime is allowed
- Available only as part of a BETASEAL™ G-EZKit
- BETAPRIME™ CLEAR Advanced is only compatible with BETASEAL™ Express+.
  Do not use with BETASEAL™ Xpress30 or BETASEAL™ U-400HMNC.

Used glass

- In these guidelines, all previously installed glass parts are considered “Used Glass”. The current ANSI/AGSC/AGRSS Standard states that “All adhesive system component lot numbers must be traceable to each job”. This is the basis for the following best practices for reinstalling adhesive bonded used glass.
- The part to be reinstalled must be removed by the installing company or known to be removed according to industry practices as to avoid chemical contamination and degradation of the original bond between the existing adhesive/primer system and the glass part.
- The original adhesive/primer on the glass part must be left intact until the time when the part is to be installed. The part will then be prepared in a fashion similar to body preparation and the new adhesive will be applied to freshly cut, uncontaminated, well bonded adhesive.
- OEM installed glass parts may use the vehicle identification number as a traceable path to the original installation, along with the lot numbers of the new products used. Aftermarket parts lacking a traceable path (lot numbers and known application practices) to the original installation do not appear to meet the previously mentioned ANSI/AGSC/AGRSS Standard requirements.
- The new adhesives and primers applied in accordance with normal DuPont Fixed Glass Installation Practices will bond to OE or equivalent aftermarket adhesive, but the aftermarket adhesive system may not stay bonded to the glass part. Any recall of product for the previously used aftermarket adhesive system cannot be traced without the appropriate lot numbers.

Pre-primed glass

When OEM pre-primed glass is to be installed, the glass should be cleaned and BETAPRIME™ 5504G All-in-One Primer should be applied according to standard installation instructions. Black primer should be re-primed only with black primer. DuPont has done extensive testing to confirm compatibility with DuPont supplied OEM pre-primed glass. When glass has been pre-primed with any unknown aftermarket primer, it should not be used. Some glass suppliers have started to include the following instructions attached to pre-primed glass.

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Caution

BETAPRIME™ CLEAR Advanced is for use with BETASEAL™ Express+ only. Do not use with other adhesives.

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This Windshield has come pre-primed with OEM grade DuPont BETASEAL™ glass primers.
To ensure a good bond for aftermarket applications, use the following procedure:
1. Clean bonding area with BETACLEAN™ GC-800 glass cleaner and wipe off with a clean lint free cloth
2. Allow 1 minute to dry
3. Apply BETAPRIME™ 5504G glass primer to the bonding area.
4. Allow 2 minutes to flash in temperatures above 20°F
5. Allow 6 minutes to flash in temperatures from 0°F to 20°F
6. Apply Dow Automotive BETASEAL™ Urethane adhesive within 24 hours
If you have any questions, contact your local DuPont Sales representative
www.BETASEAL.org.com form your mobile device
Encapsulation and PAAS windshields

Some bonded glass parts require special preparation due to the use of encapsulating materials such as PVC or reaction injection molding (RIM).

All encapsulations require special preparation.

Cleaning RIM, PVC or PAAS encapsulated bonding surfaces:
1. Spray encapsulation with BETACLEAN™ GC-800 Glass and Surface Cleaner.
2. Scrub area vigorously with a BETACLEAN™ Easy-Go Cleaning Sponge or an abrasive pad, then wipe clean with a lint-free paper towel (scrub lightly on PAAS).

Once replacement glass part is clean, follow these priming steps:
1. Check the expiration date on the container.
2. The primer bottle and SA applicator no longer require shaking.
3. Apply BETAPRIME™ 5504G All-in-One Primer with a clean wool dauber in one, even, wet coat, moving the dauber in the same direction on fritted glass or encapsulation.
4. Allow primer to dry for two (2) minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes.
5. Apply a fresh bead of urethane adhesive to prepared site and install glass as normal.

Cold weather glass preparation:
- Keep glass at 60°F (15.6°C) or warmer during transportation
- Clean glass within four (4) minutes of removing glass from van
- If cleaning takes longer, or BETACLEAN™ GC-800 freezes on the glass surface, return glass to warmer environment and remove BETACLEAN™ GC-800 from the glass

Cold weather vehicle preparation:
- Do not spray BETACLEAN™ GC-800 directly onto bonding surface at temperatures below 40°F (-4.4°C)
- Apply BETACLEAN™ GC-800 directly to a lint-free paper towel and wipe along bonding surface until the surface is clean and dry
- Limit the cleaning area to 24 inches or less at a time to further reduce chance of ice formation
- BETACLEAN™ GC-800 freezing on bond surfaces can prevent the adhesive from bonding properly

Note
If the PAAS bead requires the bonding surface to be trimmed to allow for application of the new urethane, trim PAAS bead. Apply adhesive directly to freshly trimmed PAAS just like application to a cut bead on the body of the car.

Warning
The manufacturing process to make many encapsulated parts can introduce contamination on the surface of the part. If this contamination is not removed prior to applying the adhesive system, it can interfere with bonding. Make sure to follow the wet scrubbing steps in this manual to ensure a good bond to these parts.
Gasket set installations

The following instructions should be used to replace glass for gasket set installations unless in conflict with OEM replacement instructions.

Cleaning gasket bonding surfaces:
1. Spray gasket with BETACLEAN™ GC-800 Glass and Surface Cleaner.
2. Wet scrub all bonding areas vigorously with an abrasive pad, then wipe clean with a lint-free paper towel.
3. Spray gasket (both glass and body channels) with BETACLEAN™ GC-800 again and wipe clean with a lint-free paper towel.

Clean the glass normally (procedure on page 12).

Prime any areas where the glass would sit in the gasket according to normal glass priming procedures (page 14).

Once the gasket and glass are clean, follow these steps to prime the gasket:
1. Check the expiration date on the container.
2. Apply BETAPRIME™ 5504G All-in-One Primer with a clean wool dauber in one, even, wet coat, moving the dauber in the same direction.
3. Allow primer to dry for two (2) minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes.
4. Apply a fresh bead of urethane to bond gasket to body.
5. Apply additional bead of adhesive in the gasket to seal the glass if necessary.
6. Follow appropriate MDAT for temperature/humidity for adhesive used. Alternatively, BETASEAL™ U-418 can be used without primer to bond and seal properly cleaned gaskets. When using BETASEAL™ U-418, allow a minimum of 16 hours cure before allowing vehicle to return to the road.

Notes:
• For installations where the OEM used gasket and urethane, the glass must be replaced with urethane. In cases where there is no urethane (or equivalent adhesive), urethane can be used if later production models included the addition of adhesive systems without body style modification.
• If the OEM gasket installation did not include adhesive and the vehicle is licensed for highway use and is less than 10,000 lbs. Gross Vehicle Weight (GVW), the installation shall include urethane or an equivalent adhesive bonding system. The following are permissible exceptions: egress applications, antique or classic vehicle restorations, or in cases in which this practice conflicts with current vehicle manufacturer specifications.
• When sealing air or water leaks within a rubber gasket/urethane, ADHESIVE SYSTEM only compatible urethane shall be used to bond unless in conflict with current OEM specification. (No silicone or butyl may be used.)
Bonding to the vehicle body
Always try to apply urethane adhesive directly to the freshly cut OEM urethane bead. OEM and aftermarket paint and clear coats create difficult surfaces for aftermarket bonding. Each layer of the OEM paint process builds and connects with the next to form a strong chain of materials.

It helps to understand the original painting process so technicians are aware of the complex surface to which the original adhesive bonds.

The first step in the OEM painting process is the hot-water wash. The hot water washes away oils and then a zinc phosphate wash preps the metal. The metal is immersed in an electro-chromic dip of e-coat by applying a charge to the metal part that is opposite to the charge of the bath of paint particles. These paint particles are drawn to the metal and the paint is evenly deposited on all areas of the part.

The part is then baked in an e-coat oven at 300°F to 400°F (150°C to 200°C) for approximately 30 minutes. This forms a thin, strong base surface for the next material. Some manufacturers apply urethane body primer directly to this layer and then extrude polyurethane adhesive on top of it. Other manufacturers apply color and clear coats, then bake to form a strong bond. Urethane primer is then applied to the cured color and clear coats.

The most recent OEM trend is primerless-to-paint adhesives. Primerless-to-paint technology eliminates the need for a pinchweld primer and enables the specially formulated adhesive to bond directly to the paint. This technology does not affect the aftermarket when bonding directly to the OEM urethane. Do not attempt to bond directly to paint without body primer, as most aftermarket urethanes are not formulated to bond primerless to the paint.

New urethane adhesive bonds best to freshly cut, uncontaminated and well-bonded original urethane. When working on a vehicle that is having body work done, do not trim the existing bead of original urethane until it is time to apply the new urethane. Once the adhesive is trimmed, it will remain fresh for 2 hours. After 2 hours, retrim the adhesive again to expose a fresh surface for bonding. If retrimming is not possible, the surface may be refreshed with BETAPRIME™ 5504G All-in-One Primer. Trimmed urethane left exposed to any environment will become contaminated. Contaminated urethane should be removed to expose fresh, uncontaminated material for bonding.

Chemical contamination on body
Chemicals or sealants such as butyl or silicone are not compatible with the polyurethane system and will cause chemical contamination. Chemical contamination is difficult to remove with other chemicals – it must be removed by mechanical scraping or abrading. Removing all the contamination is required to ensure a top-quality installation.

If all paint is removed, but e-coat is left intact, BETAPRIME™ 5504G All-in-One Primer is required. If all the paint and e-coat is removed down to bare metal, follow the instructions for priming bare metal with BETAPRIME™ 5504G (page 21). This process also applies to any installation that requires the installer to correct previous substandard work or contamination.

Fiberglass/polycarbonate/acrylic bonding
DuPont has done limited testing on fiberglass, Lexan® (polycarbonate) and Plexiglas® (acrylic) materials. Based on the testing that has been performed, BETAPRIME™ 5504G All-in-One Primer works best. Prior to application, take an abrasive pad and lightly scrub (rough up) the application area before applying the BETAPRIME™ 5504G. Once the BETAPRIME™ 5504G has been applied and allowed to flash off (dry), then apply the urethane adhesive.

Note
Carbon fiber bonding
More and more automakers are looking to reduce the weight of the vehicle by adding carbon fiber to replace heavier steel panels. DuPont has worked with many of the OEMs and tier suppliers on programs using carbon fiber. For aftermarket glazing where carbon fiber is in the bond line, BETAPRIME™ 5504G works the best. Prior to application, take an abrasive pad and lightly scuff up the bonding area before applying BETAPRIME™ 5504G. Once the BETAPRIME™ 5504G has been applied and allowed to flash off, then apply the urethane adhesive.

Note
Plastic glazing will expand far greater than glass or metal. A broad, thin bead will be extremely rigid. It is best to make the bead no wider than it is tall.
Painting precautions
Many new paint finishes use a clear-coat finish over the color coat to resist chemicals and maintain a glossy finish. This may cause a bonding problem if fresh color and clear coat are in the bonding area. The pinchweld should be masked off with tape prior to any color coat and/or clear coats being applied. The original urethane should be left intact during painting and body repair. Trim the urethane adhesive down to the recommended 1 to 2 mm final thickness just prior to installing the new glass. The new bead of urethane can then be applied directly to the freshly trimmed bead of original urethane.

Vehicle care and tools
Take every precaution to protect the customer’s vehicle from accidental damage while work is in progress. The following steps are recommended:

1. Inspect vehicle. List any dents, scratches, missing parts or other pre-existing conditions that could prevent a safe installation on the pre-inspection section of the DuPont Fixed Glass Replacement Record or company document. Also notify the vehicle owner/operator.

2. Cover the hood, roof, trunk area, instrument panel, defroster vents, floor area, seats, sills or whatever is necessary with an appropriate padded cover material or paint-safe protective tape.

3. Make sure the proper tools are available and ready for use before starting the job.

Caution
Primers, cleaning solvents and urethane adhesives may permanently adhere to and stain an interior or exterior surface if spilled or dripped on the customer’s vehicle. You may be unable to remove these materials without damaging a surface.
Body preparation: cleaning and priming

Cleaning the vehicle body:
1. Remove all trim and moldings.
2. Remove glass using the preferred method.
3. Clean any dirty areas on the bonding surface with a clean towel sprayed with BETACLEAN™ GC-800 Glass and Surface Cleaner or water to remove as much dirt and debris as possible.
4. Trim existing urethane bead down to 1-2 mm.
5. Thoroughly inspect the pinchweld for any scratches or bare metal areas, both inside and outside the bonding area.

See pages 21-22 for preparation of bare metal areas.

Once body surface is clean and dry, follow these priming steps.
1. Check the expiration date on the container.

For priming scratches and large areas of bare metal to prevent corrosion:
2. Apply one coat of BETAPRIME™ 5504G All-in-One Primer with a clean wool dauber to any scratches in the paint or large areas of bare metal. When priming large areas of bare metal, only apply a maximum of 8 to 12 linear inches per dauber. This ensures the dauber has enough primer to apply a thick enough coat to protect the bare metal.
3. Allow primer to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes.
4. Apply a second coat of BETAPRIME™ 5504G and allow primer to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes.

For priming painted bonding surfaces (no bare metal):
2. Apply one coat of BETAPRIME™ 5504G All-in-One Primer with a clean wool dauber to the painted area where original adhesive may have peeled off or to extend the bonding area when applying adhesive to the glass part.
3. Allow primer to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes.

Cold weather vehicle preparation:
- Do not spray BETACLEAN™ GC-800 directly onto bonding surface at temperatures below 40°F (4.4°C)
- Apply BETACLEAN™ GC-800 directly to a lint-free paper towel and wipe along bonding surface until the surface is clean and dry
- Limit the cleaning area to 24 inches or less at a time to further reduce chance of ice formation
- BETACLEAN™ GC-800 freezing on bond surfaces can prevent adhesive from bonding properly
- In cold temperatures, BETAPRIME™ 5504G All-in-One Primer may have a wet appearance – this is normal as long as proper dry times are followed.

Advanced formulation BETAPRIME™ 5504G no longer requires shaking. However, shaking will not have a negative effect on the performance.

Note
BETAPRIME™ 5504G primed surfaces are good for 24 hours after priming. If not used in 24 hours, apply another coat of BETAPRIME™ 5504G to reactivate. This can only be done one time.

Warning
Avoid inhalation of solvent vapors and eye contact. Always use BETAPRIME™ 5504G in ventilated areas. Observe health and safety procedures.

Caution
Do not reinsert (double dip) the dauber into the primer bottle if it has touched the body of the vehicle. This could contaminate the remaining primer in the bottle.

Note
Scratches well outside of the bonding area do not have to be completely dry at the time of installation.

A triangle or V-shaped bead of adhesive applied to glass will wet out into the trimmed adhesive but may not line up exactly with the full width of the trimmed adhesive bead, reducing surface contact. Make sure to carefully prime any painted or metal areas that could come in contact with adhesive.
Body preparation: preventing corrosion

Preventing corrosion

Manufacturers protect a vehicle’s pinchweld from corrosion by covering bare metal with e-coat and/or paint. Auto glass technicians can inadvertently expose bare metal on the pinchweld during glass removal. Exposing bare metal to oxidants (air and water) causes corrosion.

Cut-out and utility knives can damage painted metal in areas that may be difficult to treat or impossible to see. Knowing how and where damage is likely to occur helps you find scratched metal and treat it before corrosion can develop.

Automotive pinchweld
- Deep penetration with knife blade can damage pinchweld bottom
- Adjust blade to ensure it cannot reach metal

Glass removal
- Scratches in paint are often hidden by urethane
- Untreated scratches can develop corrosion
- Trimming back old urethane with knife can nick sidewalls of pinchweld
- Adjust blade to ensure it cannot reach metal
- Once the trimming cut is complete, inspect bottom and sides of pinchweld to ensure paint/e-coat is not scratched
- Treat scratches with BETAPRIME™ 5504G All-in-One Primer

Release of bond
- Corrosion travels beneath paint/e-coat to weaken bond strength
- During a crash, corrosion can cause paint/e-coat and adhesive to separate from the pinchweld
- The windshield could dislodge, compromising air bag safety system and passengers

Heavy corrosion can lead to bond failure.
Body preparation: treating corrosion

Corrosion treatment

Corrosion (rust) must be removed before replacing a windshield. If it isn’t removed, it can compromise the safety of the vehicle. Where present on the pinchweld, surface rust (exhibiting no loss of metal thickness) can be removed with an abrasive wheel, grinding stone or by media blasting. When rust destroys or reduces the metal’s strength and thickness, take the vehicle to an auto body repair facility to have the rusted area restored to its original condition.

Customer service and documentation

Inspect the area around the glass for existing damage or signs of corrosion. Discuss corrosion treatment with the vehicle owner before starting the job. If you detect any problem areas, photograph and document the visible extent of corrosion damage. Notify the vehicle owner and discuss corrosion treatment options. Inform the vehicle owner of the importance and value of proper corrosion treatment for safety and vehicle durability. Once the owner agrees to the corrosion treatment, determine who is responsible for payment and begin the job.

Body preparation: levels of corrosion

Levels of corrosion and treatment

The four levels of corrosion are:

1. **Light oxidation** – light metal discoloration, orange in color. Remove with an abrasive wheel or grinding stone.

   ![Light oxidation](image)

2. **Moderate** – some red spots. Remove with an abrasive wheel, grinding stone or by media blasting.

   ![Moderate](image)

3. **Severe** – deep pitting. Dark red spots with raised edges. Remove with an abrasive wheel, grinding stone or by media blasting.

   ![Severe](image)

4. **Perforation** – varies from holes in metal to loss of metal. Replace panel.

   ![Perforation](image)

**Note**
Images are from scratched, OEM e-coated metal samples.

**Warning**
Coarse abrasive wheels or grinding stones may remove too much metal and weaken the part. They can also cause warping due to intense heat on the thin sheet metal. Wire brushes should not be used on any corrosion more severe than light oxidation. Take care to avoid possible paint damage. Only repair areas with good adhesion.
Removing surface corrosion
Mechanically remove surface corrosion, taking care to remove as little uncorroded metal as possible. Clean bare metal with 100% acetone or heptane and wipe adjacent trimmed adhesive with clean towel dampened with BETACLEAN™ GC-800 Glass and Surface Cleaner or water. It's best to avoid priming trimmed adhesive and be sure to adhere to proper dry times and temperatures.

Priming bare aluminum or steel with BETAPRIME™ 5504G All-in-One Primer
For priming scratches and large areas of bare metal to prevent corrosion:
1. Apply one coat of BETAPRIME™ 5504G All-in-One Primer with a clean wool dauber to any scratches in the paint or large areas of bare metal (Figure 1). When priming large areas of bare metal, only apply a maximum of 8 to 12 linear inches per dauber. This ensures the dauber has enough primer to apply a thick coat to protect the bare metal.
2. Allow primer to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes.
3. Apply a second coat of BETAPRIME™ 5504G and allow primer to dry for 2 minutes at 20°F (-7°C) and above. From 20°F (-7°C) down to 0°F (-18°C), allow primer to dry for 6 minutes.

<table>
<thead>
<tr>
<th>Tool Description</th>
<th>Pro</th>
<th>Con</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandpaper or abrasive pad</td>
<td>Light - medium abrasive. Good on wide but light damage. Manual or use of power tool.</td>
<td>May not follow “high and low” contour of pinchweld. May take too much metal on “high” areas, while attempting to abrade “low” areas. May not fit well into the “V” at the base of the pinchweld on all vehicles.</td>
</tr>
<tr>
<td>Wire wheel</td>
<td>Light abrasive. Good on wide but light damage. Electric powered; air powered with regulator to govern maximum RPM.</td>
<td>Does not always get to the “bottom” of corrosion. Stray wires may damage headliner or roof paint. Can be more difficult to control. Ineffective on corrosion beyond level 1.</td>
</tr>
<tr>
<td>Abrasive wheels</td>
<td>Medium abrasive. Good on wider areas as well as level 2 and level 3 damage. Air or electric powered.</td>
<td>Does not follow “high and low” contour of pinchweld. May take too much metal on high areas while attempting to abrade low areas. Can be more difficult to control. May not fit well into the “V” at the base of the pinchweld.</td>
</tr>
<tr>
<td>Media blasting</td>
<td>Medium abrasive. Good on wider areas as well as level 2 and level 3 damage.</td>
<td>Requires substantial air supply. Requires extra protection of vehicle. May require extra clean up.</td>
</tr>
<tr>
<td>Grinding stones or mounted points</td>
<td>Medium abrasive. Good on narrow cut-lines and wider areas. Good control. Near-precision abrasion to damaged areas only. Air or electric powered.</td>
<td>Softer stones are sacrificial and will not last as long. May not fit well into the “V” at the base of the pinchweld on all vehicles.</td>
</tr>
<tr>
<td>1/8˝ Carbide burrs (1/4˝ carbide burrs are excessively aggressive)</td>
<td>Excellent for cut-lines and smaller areas. Fits well into “V” at the base of the pinchweld. Good control. Air or electric powered.</td>
<td>Can be aggressive. Must use care to not remove excessive metal thickness. Good for smaller areas and cut-lines only.</td>
</tr>
</tbody>
</table>

Figure 1: Using a clean, unused dauber, apply an even coat of BETAPRIME™ 5504G.

**Note**
BETAPRIME™ 5504G is moisture sensitive. Replace the inner plug and close cap immediately after every use to preserve contents.

**Warning**
Avoid inhalation of solvent vapors and eye contact. Always use BETAPRIME™ 5504G in ventilated areas. Observe health and safety procedures. BETAPRIME™ 5504G has an open life of fourteen (14) days.

**Caution**
Do not reinsert (double dip) the dauber into the primer bottle if it has touched the body of the vehicle. This could contaminate the remaining primer in the bottle.

**Caution**
All appropriate safeguards for the protection of the technician and the vehicle should be taken prior to any corrosion procedures that are performed. These safety precautions would include, but are not limited to, safety glasses, dust masks, gloves and clothing for the technician and protective coverings for the vehicle. Abrading corrosion requires skill and care and should not be attempted without education and training of all tools, abrasives and materials which will be used.
Adhesive application

BETASEAL™ urethane adhesives do not need additional heating to apply. They are all easy to use with professional dispensers. All BETASEAL™ Adhesive systems may be warmed to ease dispensing in cold weather.

After cleaning and priming the pinchweld, encapsulation, glass and other necessary areas, apply adhesive using the following instructions.

First choose whether you apply adhesive to the glass or the pinchweld.

**For glass application:**
1. For best application results, hold the applicator in a vertical position (at 90° to the surface) and dispense the adhesive with a continuous motion in a uniform V-shaped bead.
2. Apply adhesive to the glass on top of the bond line.
3. Make sure the bead is uniform and has no gaps; add material or tool joints if necessary.

**For pinchweld application:**
1. For best application results, hold the applicator in a vertical position (at 90° to the surface) and dispense the adhesive with a continuous motion in a uniform V-shaped bead. This is to ensure that the nozzle tip sits flush to the cut urethane so the V-shaped bead dispensed makes good contact. For applications on the body where maintaining the applicator 90° to the surface is difficult due to the need for an extended reach, it might be useful to cut a bit of an angle to the tip (not more than 30°). This will allow the tip to remain flush with the cut urethane and the V-shaped bead will make good contact.
2. Apply adhesive to the pinchweld perimeter directly on top of the freshly cut original equipment urethane.
3. Make sure the bead is uniform and has no gaps; add material or tool joints if necessary.

**Install the glass:**
1. Place the glass in the body opening.
2. Adjust glass to precise alignment.
3. Lightly press into position.
4. Avoid slapping or smacking the glass.

**Clean up:**
1. Any excess uncured urethane should be cleaned up immediately. DuPont recommends using commercially available hand towels. Always test a small inconspicuous area before cleaning to ensure there are no compatibility issues.
2. Clean the newly installed glass with BETACLEAN™ GC-800 Glass Cleaner.

**Note**
Ensure all surfaces the urethane will contact are properly primed, including the glass, vehicle body, bare metal, and any nicks and scratches in the paint. Improper priming could lead to bond failure.
Adhesion: bead shape

Round bead
A round bead lays on top of the trimmed adhesive (Figure 1). This exposes the bead of new adhesive to curing of the surface, preventing penetration and wet out to the bonding surfaces.

A round bead after application of glass has minimal penetration into rough surface, as well as having a high potential for trapping air pockets between the glass and new adhesive (Figure 2).

![Figure 1](image1.png)  ![Figure 2](image2.png)

Triangle or V-shaped bead
A triangle or V-shaped bead applied to trimmed adhesive has superior penetration into the rough surface (Figure 3).

A triangle or V-shaped bead wets out as glass is pressed or decked into the new adhesive, while avoiding creation of air pockets (Figure 4). This bead most closely duplicates the original OEM adhesive application.

![Figure 3](image3.png)  ![Figure 4](image4.png)

A triangle or V-shaped bead on glass
A triangle or V-shaped bead applied to glass will penetrate and wet out into the trimmed adhesive when decked (Figure 5).

A triangle or V-shaped bead applied to glass will penetrate and wet out into the trimmed adhesive when decked and squeeze out potential air pockets (Figure 6).

A triangle or V-shaped bead applied to glass will wet out into the trimmed adhesive but may not line up exactly with the full width of the trimmed adhesive bead, reducing surface contact.

A triangle or V-shaped bead applied to glass may require application of appropriate primer to area outside of trimmed adhesive area to promote full adhesion of new adhesive (Figure 7).

![Figure 5](image5.png)  ![Figure 6](image6.png)  ![Figure 7](image7.png)

**Note**
Reuse of nozzles may trap a small amount of air between the adhesive in the nozzle and the new adhesive in the cartridge or sausage leading to a bubble in the adhesive bead.
Use the right amount of urethane – more is not always better – and save time, materials and improve installations.

The average domestic windshield requires about one and one-half cartridges of urethane for a “full cut” installation. Many installers report using two, or even three, cartridges to install a windshield. DuPont recommends using only enough adhesive to do the job correctly. Using too much adhesive creates extra cleanup, wastes material and time and can affect drive-away times.

The best surface to bond BETASEAL™ urethane adhesive is freshly trimmed, uncontaminated and well-bonded, original equipment urethane. If too much adhesive is applied, it may flow past the original bead and into the contaminated, unprimed pinchweld sidewall. This can reduce bond strength and create areas that trap water next to the glass and pinchweld.

DuPont drive-away times for all moisture-cure adhesives (adhesives that cure from the outside in) depend on cured urethane bonding to the pinchweld and glass. While a full cure may not be required for minimum drive away, a sufficient amount of the urethane bead needs to be cured to provide adequate bond strength. If too much adhesive is used, the bead may flow out from under the glass to the edge of the windshield. This slows the building of strength because the cured portion of the bead is not supporting the windshield.

When using “push in” type moldings, apply a small amount of additional urethane at the space between the glass and the body. Allow the fins on the molding to push through the additional adhesive to leave an air/water channel around the perimeter of the glass.
**High-modulus and non-conductive adhesives**

Sensitive electronic encapsulated glass demands a specialized adhesive, known as a high-modulus, non-conductive (HMNC) adhesive. High-modulus and non-conductivity are distinctly different and unrelated properties. However, the two properties may be combined to solve two engineering criteria at once.

**When to use a high-modulus, non-conductive urethane adhesive**

Glass installers may compromise the electronic systems encapsulated in windshields and backlites of automobiles when replacing the glass with regular, current-conducting urethane adhesives. Sensitive electronic signals require specialized non-conductive adhesive to maintain optimal operating levels.

Many European vehicles (such as Mercedes-Benz, BMW and Jaguar) currently use the technology to encapsulate radio antennas into their windshields or backlites. Cell phone, global positioning system and other electronic antenna encapsulations are the next generation. Automakers mandate use of non-conductive, high-performance adhesives in replacements to maintain the integrity of the systems. Traditional urethane adhesives, including most BETASEAL™ products, are conductive. They contribute to electrical interference and may impede radio and navigational signals.

**What is high-modulus?**

High-modulus adhesives have a much higher tolerance to stress. This characteristic enables them to stiffen the vehicle body to improve handling and overall stability in vehicles designed to use this advanced technology. High performance vehicle manufacturers specify and use high-modulus adhesives because they can be used as structural elements to stabilize the vehicle to improve the ride and reduce rattles, vibrations and other vehicle noises.

Vehicle designers place greater demands on high-modulus adhesives. The adhesives bear much more of the pushes, pulls and twists associated with everyday driving. High-modulus adhesives must have a higher elastic limit than normal adhesives or they deform or rupture under the increased stress.

**What is non-conductive?**

Conductive refers to the electrical insulating properties of urethane adhesives. All materials conduct electricity. Materials that are least conductive are used to insulate electrical wires from unwanted leakage of electrical current. In antennas, the voltages are so low that any loss may severely degrade incoming or outgoing signals.

Urethane adhesives used to bond antenna-encapsulated glass must prevent the flow of electricity between the glass and metal. AM-FM radio antennas operate in the frequency ranges of 1 to 150 MHz. The antenna busbars mounted to the stationary glass often contact the adhesive during the assembly or replacement process. This causes impedance and power loss, which leads to a reduction in the signal strength.

**Don't all rubber-like adhesives insulate?**

Contrary to popular belief, flexible, rubber-like plastic materials do conduct electricity. Glass manufacturers, automakers and replacement shops try to keep the antenna and the adhesive separated. But due to manufacturing and installation variations, contact is inevitable.

The urethane adhesive must resist the leakage in or out of electric current. Engineers measure the resistance, capacitance and conductance of the urethane adhesive with an impedance measurement where the current that passes through a sample of cured urethane adhesive is measured.

Non-conductive urethane adhesive contains a special grade of carbon. Ordinarily carbon is conductive, but this special grade of carbon inhibits the flow of electricity. When combined with a high-grade polymer, it produces a strong, HMNC urethane adhesive.

**Note**

Always use high-modulus adhesive to replace a windshield originally installed with a high-modulus adhesive to restore the proper handling and the quiet, comfortable ride associated with high-performance vehicles. Many more vehicles use HM or HMNC than NC only. Consult the NAGS list for vehicles that require HMNC adhesives.
Advanced Driver Assistance Systems

Advanced Driver Assistance Systems (ADAS) are automated systems that enhance vehicle safety and assist in reducing driver error. Some examples of these systems include lane warning, lane departure assist, adaptive breaking, adaptive cruise control, automatic parking, and collision avoidance systems. All of these systems depend on sensors located on the car to provide feedback to electronic systems. When replacing glass on a vehicle with ADAS, the installer should understand that a calibration of the system may be needed. If a calibration of a glass mounted sensor (or camera) is to occur, please follow the instructions below to ensure the glass is properly supported during calibration.

Re-assembly of the vehicle

On vehicles where the windshield has additional OEM designed support (hooks into leaf screen, stops, etc.), re-assembly of the vehicle (including camera/camera housing/rear view mirror) can occur immediately after the glass has been decked.

On vehicles without additional OEM designed support for the windshield, additional support (tape or straps) may be needed to ensure glass movement is minimized.

On vehicles where components might be difficult to reattach, some care must be taken not to use excessive force to push when reattaching. Short taps are preferred over a long pushing motion to ensure that the bond line does not separate.

Static calibration

On vehicles where the windshield has additional OEM designed support (hooks into leaf screen, stops, etc.), static calibration can occur as soon as the vehicle has been re-assembled and glass returned to OEM intended support. On vehicles without additional OEM designed support for the windshield, static calibration can occur as soon as the vehicle has been re-assembled, but additional support (tape or straps) may be needed to ensure glass movement is minimized during calibration.

Any additional support can be removed after the adhesive has reached MDAT.

Dynamic calibration

Vehicle must achieve MDAT before being driven to calibrate.
BETASEAL™ G-EZKits

A good day's work in one box

- Everything you need in a single box – urethane, primer, glass cleaner, nozzles, daubers and more
- Easy-to-use – master lot number for all kit components
- Choose from BETASEAL™ Xpress30 or BETASEAL™ Express+ in cartridge or sausage
- Gun-n-Go – easy application, no heating required

See BETASEAL™ Xpress30 and BETASEAL™ Express+ product brochures for more information.

Everything you need for a good day's work

Each BETASEAL™ G-EZKit contains adhesive (BETASEAL™ Xpress30 or BETASEAL™ Express+), primer, glass cleaner, nozzles, daubers, AGRSS compliant lot numbers and tracking stickers. Everything has one master lot number to make your days easier and more efficient.

G-EZKits

<table>
<thead>
<tr>
<th>Kit</th>
<th>Adhesive</th>
<th>Cleaners</th>
<th>Glass Primer</th>
<th>Body and Encapsulation Primer</th>
<th>Kit Also Includes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETASEAL™ Xpress30</td>
<td>BETASEAL™ Xpress30</td>
<td>BETACLEAN™ GC-800</td>
<td>BETAPRIME™ 5504G</td>
<td>BETAPRIME™ 5504G</td>
<td>Master lot code stickers, Uncut and precut nozzles, 28 small head daubers, 1 streaming nozzle for GC-800 cut-out lubricant use</td>
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<tr>
<td></td>
<td>20 - 10.5 oz (310 ml)</td>
<td>Glass &amp; Surface Cleaner</td>
<td>12 oz (340 g)</td>
<td>All-in-One Primer 40 ml (1.4 oz)</td>
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<tr>
<td>BETASEAL™ Express+</td>
<td>BETASEAL™ Express+</td>
<td>BETACLEAN™ GC-800</td>
<td>BETAPRIME™ CLEAR Advanced SA</td>
<td>BETAPRIME™ 5504G</td>
<td>Master lot code stickers, Uncut and precut nozzles, 28 small head daubers, 1 streaming nozzle for GC-800 cut-out lubricant use</td>
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<td>20 - 10.5 oz (310 ml)</td>
<td>Glass &amp; Surface Cleaner</td>
<td>14 Single Application Sticks</td>
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<td>BETASEAL™ Xpress30BP</td>
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<td>BETAPRIME™ 5504G</td>
<td>BETAPRIME™ 5504G</td>
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<td>Nine - 20 oz (600 ml)</td>
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<td>14 Single Application Sticks</td>
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<td>BETAPRIME™ CLEAR Advanced SA</td>
<td>BETAPRIME™ 5504G</td>
<td>Master lot code stickers, Uncut and precut nozzles, 28 small head daubers, 1 streaming nozzle for GC-800 cut-out lubricant use</td>
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<td>Nine - 20 oz (600 ml)</td>
<td>Glass &amp; Surface Cleaner</td>
<td>14 Single Application Sticks</td>
<td>All-in-One Primer 40 ml (1.4 oz)</td>
<td></td>
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Shelf life

Maximum shelf life, as stated on product packaging, is achieved when the product is stored at an ambient temperature that does not continuously exceed 110°F (43°C).
BETASEAL™ Xpress30
all-application auto glass urethane adhesive

30-minute minimum drive away

- Exclusive RPM adhesive technology
- High modulus, non-conductive
- Excellent pumpability
- Short tails and outstanding decking
- Easy-to-tool
- Single component – 600 ml sausage or 310 ml cartridge
- Requires the use of glass primer (BETAPRIME™ 5504G ONLY)

Application details

- See vehicle manufacturer’s recommendations for additional details. Do not use any other manufacturers’ primers, cleaners or other chemicals in conjunction with any BETASEAL™ adhesive system.
- Apply at air temperatures of 0°F (-18°C) and warmer
- Working time – 8-10 minutes. In extreme heat and humidity, working time may be reduced to 6 minutes.
- Available in cartridge or sausage and in G-EZKits

BETASEAL™ Xpress30 adhesive is especially formulated to help retain the performance of vehicles, including those requiring a HMNC adhesive. DuPont conducted extensive laboratory, crash and long-term testing to promote a safe bond and lasting performance for all applications. BETASEAL™ Xpress30 adhesive enables technicians to simplify replacements by using one adhesive all the time.

30-minute minimum drive away

BETASEAL™ Xpress30 is a cold-applied adhesive with a 30-minute minimum drive-away time in temperatures as low as 0°F (-18°C). That makes BETASEAL™ Xpress30 very versatile and easy to use all year round.

Exclusive RPM technology

BETASEAL™ Xpress30 is an advanced cure, one-component adhesive with enhanced chemical crosslinking to speed bonding for faster minimum drive-away times than conventional-cure adhesives.

BETASEAL™ Xpress30 features DuPont’s newly developed RPM technology. RPM is the next step in advanced-cure adhesive technology. RPM offers the same highly crosslinked adhesive as RINA technology. But, by shortening the distance between chemical bonds, the adhesive develops strength even faster, allowing for even further MDAT reduction.

High-modulus, non-conductive formula

The high-modulus formula enhances a vehicle’s structural integrity and improves passenger comfort by reducing road noise and stiffening the vehicle’s ride. It is also non-conductive for reduced interference with radio, GPS and phone reception in OEM antenna-encapsulated windshields and backlites.

Caution

Some OEMs use HMNC urethane adhesives to achieve enhanced handling and protect electronics integrated into the glass. Make sure to follow adhesive recommendations to maintain OEM designed vehicle performance.

Warning

BETASEAL™ Xpress30 requires BETAPRIME™ 5504G Glass Primer. Any part left out of the system can lead to adhesive failure. Never use any other manufacturers’ primers, cleaners or other chemicals in conjunction with any BETASEAL™ adhesive system.

Warning

BETASEAL™ Xpress30 is compatible only with BETAPRIME™ 5504G All-in-One Primer.
Xpress30 can be heated

DuPont's Aftermarket Research Group has recently validated that BETASEAL™ Xpress30 can also be heated and applied like a hot applied urethane adhesive. When applied hot (temps at or below 194°F (90°C)), BETASEAL™ Xpress30 maintains its superior rheological properties: short string, excellent tooling and firm decking.

To heat BETASEAL™ Xpress30 urethane adhesive, follow the GUIDELINES below:

- BETASEAL™ Xpress30 can be heated for up to 24 hours and up to temperatures of 194°F (90°C)
- Can be heated multiple times (24 hours cumulative max)
- If total exposure to heat goes over 24 hours or 194°F (90°C) dispose

BETASEAL™ Xpress30 urethane applied hot differs from a traditional hot applied adhesive:

- Does not need to be heated for 60 minutes to achieve 30-minute drive away time
- Can be applied at temps less than 167°F (75°C)
- Can be heated to installers personal preference
- Retains excellent feel and body applied hot or cold

- **DOES NOT REQUIRE HEAT TO DISPENSE**
BETASEAL™ Express+

Trusted express formula updated with RPM technology

- Exclusive RPM adhesive technology
- High-modulus, non-conductive
- One-hour minimum drive away in temperatures as low as 0°F (-18°C)
- Gun-n-Go – easy application, no heating required
- Crash proven
- Improved formula is easy to use with superior decking and short cut-off string
- Apply at air temperatures of 0°F (-18°C) and warmer
- Choose from cartridges, foil pack or as part of an G-EZKit
- Working time – 8-10 minutes. In extreme heat and humidity, working time may be reduced to 6 minutes.
- Compatible with BETAPRIME™ 5504G All-in-One Primer and BETAPRIME™ CLEAR Advanced Primer
- Requires the use of glass primer
- No heating required for safe use

For improved productivity and profitability, choose BETASEAL™ Express+. Its Gun-n-Go formula is easy to use and helps get customers back on the road faster. BETASEAL™ Express+ is specially formulated for all standard glass replacements and enables technicians to provide high-quality work, especially in cold weather – as low as 0°F (-18°C).

One-hour minimum drive away at 0°F (-18°C)

A one-hour minimum drive away helps customers get back on the road faster, even on cold days. Yet at these low temperatures, BETASEAL™ Express+ remains easy to gun and doesn’t require heating to use. It is an excellent choice for all standard windshield replacements.

Exclusive RPM technology

BETASEAL™ Express+ is an advanced-cure, one-component adhesive with enhanced chemical crosslinking to speed bonding for faster minimum drive-away times than conventional-cure adhesives.

BETASEAL Express+ features DuPont’s newly developed RPM technology. RPM is the next step in advanced-cure adhesive technology. RPM offers the same highly crosslinked adhesive as past technology. By shortening the distance between chemical bonds, the adhesive develops strength even faster, allowing for even further MDAT reduction.

High-modulus, non-conductive formula

The high-modulus formula enhances a vehicle’s structural integrity and improves passenger comfort by reducing road noise and stiffening the vehicle’s ride. It is also non-conductive for reduced interference with radio, GPS and phone reception in OEM antenna-encapsulated windshields and backlites.

Warning

BETASEAL™ Express+ requires glass primer. Any part left out of the system can lead to adhesive failure. Never use any other manufacturers’ primers, cleaners or other chemicals in conjunction with any BETASEAL™ adhesive system.
BETASEAL™ U-400HMNC

The new modern standard

- High modulus for torsional stiffness to quiet and stabilize the vehicle’s ride
- Non-conductive preserves radio, cellular phone and global positioning system reception in OEM antenna-encapsulated windshields and backlites
- Shorter minimum drive-away time – 2 hours in temperatures as low as 20°F (-7°C)
- Gun-n-Go – easy application, no heating required
- Use with BETAPRIME™ 5504G All-in-One Primer
- Crash proven and value priced OEM adhesive
- Working time – 10-12 minutes
- Available in cartridge or sausage
- Requires the use of glass primer (BETAPRIME™ 5504G ONLY)

BETASEAL™ U-400HMNC is a reliable and easy-to-use aftermarket adhesive. Its roots are entrenched in more than 30 years of proven OEM use.

No heat, quick installation

This urethane adhesive is easy to apply – simply Gun-n-Go, no heating required. It has excellent decking and sag resistance.

Advanced-cure adhesive

BETASEAL™ U-400HMNC is an advanced-cure adhesive. An advanced-cure polyurethane adhesive is a one-component system that can be applied in below freezing conditions. Advanced-cure adhesives absorb and dissipate crash stresses sooner than conventional-cure adhesives and develop a high initial green strength for faster drive-away times. BETASEAL™ U-400HMNC has a minimum drive-away time of two hours in temperatures as low 20°F (-7°C).

Caution

Some OEMs use HMNC urethane adhesives to achieve enhanced handling and protect electronics integrated into the glass. Make sure to follow adhesive recommendations to maintain OEM designed vehicle performance.

Warning

BETASEAL™ U-400HMNC requires BETAPRIME™ 5504G Glass Primer. Any part left out of the system can lead to adhesive failure. Never use any other manufacturers’ primers, cleaners or other chemicals in conjunction with any BETASEAL™ adhesive system.

Warning

BETASEAL™ U-400HMNC is compatible only with BETAPRIME™ 5504G All-in-One Primer.
**BETASEAL™ U-418HV and BETASEAL™ U-418**

**Easy, convenient, primerless**

Primerless-to-glass adhesives – proven and easy to use

BETASEAL™ U-418HV and BETASEAL™ U-418 are primerless-to-glass adhesives. Primerless-to-glass adhesives are designed to form the same chemical bonds to clean glass frit as the primer does. Eliminating the glass priming step saves time and can help to error proof installations.

Conventional-cure adhesives

BETASEAL™ U-418HV and BETASEAL™ U-418 are conventional-cure adhesives, meaning that they rely on the moisture in the air to cure. If the relative humidity is low, the curing time will be longer.

**BETASEAL™ U-418HV – 2-hour MDAT convenience**

- 2-hour MDAT down to 40°F (4.4°C) (see back for complete MDAT)
- Saves time by eliminating glass priming
- High viscosity formulation delivers higher initial (green) strength
- Easy to gun, excellent decking and sag resistance

**BETASEAL™ U-418 – primerless convenience**

- Excellent utility sealant for backlites, quarter glass and other stationary glass
- Saves time and improves productivity by eliminating glass priming
- See page 42 for MDAT

**Utility sealant**

BETASEAL™ U-418 is a medium viscosity sealant that can be used as a utility adhesive for structurally bonded or direct-glazed automotive glass. This includes:

- Windshields
- Backlites
- Quarter glass
- Stationary glass
- Attaching hardware to glass
- Back-filling to install reveal moldings or other trim
- Bonding gaskets
- Sealing leaks and gaps

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**Note**

Primerless auto glass urethane adhesives require the use of BETAPRIME™ 5504G Primer on the pinchweld and encapsulation.

**Caution**

Use of two coats of BETAPRIME™ 5504G Primer is recommended for clear glass (no frit on or in the glass) for additional UV protection and better cosmetic appearance.
New for 2022

**Improved BETASEAL™ U-428Plus HV and BETASEAL™ U-838HV**

**Featuring higher viscosity formulation**

- Shorter MDAT (3 to 4 hours depending on conditions)
- Wider application temperature range – use at temps down to 32°F
- Better decking
- Better sag resistance
- Primerless-to-glass for simplified installations
- Simple three step replacement solution – clean, prime and bond
- Easy to gun, no heating required
- Crash proven
- Available in 600 ml sausage (U-838HV) or convenient cartridge (U-428Plus HV)

**Easy to use**

The same easy application as original U-428Plus/U-838 formulations with the benefit of higher viscosity for better decking and sag resistance. BETASEAL™ U-428Plus HV and BETASEAL™ U-838HV can also be used for backlites, quarter glass or other stationary glass, as well as backfilling to install reveal moldings or other trim.

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**Note**

Primerless auto glass urethane adhesives require the use of BETAPRIME™ 5504G Primer on the pinchweld and encapsulation.

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**Caution**

Use of two coats of BETAPRIME™ 5504G Primer is recommended for clear glass (no frit on or in the glass) for additional UV protection and better cosmetic appearance.
BETASEAL™ U-428Plus and BETASEAL™ U-838 Adhesives

Speed installations by eliminating glass priming step

- Primerless-to-glass for faster applications
- Simple, three-step glass replacement solution – clean, prime and bond
- Easy to gun – easy application, no heating required
- Crash proven
- Improved decking, even in hot weather
- Available in economical 600 ml sausage (U-838) or convenient cartridge (U-428Plus)
- Apply at temperatures of 40°F (4.4°C) and warmer
- MDAT range 4-12 hours depending on temperature and relative humidity

BETASEAL™ U-428Plus and BETASEAL™ U-838 adhesives are one-component, conventional-cure adhesives. They eliminate steps and speed installations by incorporating glass primer into the urethane.

Easy to use

These urethane adhesives are easy to apply – easy to gun, no heating required. Also, they have good decking and sag resistance. BETASEAL™ U-428Plus and BETASEAL™ U-838 can also be used for backlites, quarter glass or other stationary glass as well as backfilling to install reveal moldings or other trim.

Conventional-cure adhesive

BETASEAL™ U-428Plus and BETASEAL™ U-838 are conventional-cure adhesives, meaning that they rely on the moisture in the air to cure. If the relative humidity is low, the curing time will be longer. They are recommended for use at temperatures of 40°F (4.4°C) and above.

Note

Primerless auto glass urethane adhesives require the use of BETAPRIME™ 5504G Primer on the pinchweld and encapsulation.

Caution

Use of two coats of BETAPRIME™ 5504G Primer is recommended for clear glass (no frit on or in the glass) for additional UV protection and better cosmetic appearance.
Appendix:
Glossary of technical terms
ADAS glossary of technical terms
Minimum drive-away times
Fixed Glass Replacement Record

Glossary of technical terms
The following is a list of terms frequently used in this guide with definitions.

A
Accelerated aging – a set of laboratory conditions designed to produce results of normal aging in a short time frame. Factors included are: temperature, light, oxygen and water.
Active life – the time frame in which an applied primer can be bonded to (starts after primer is cured/dry).
Adhesion – when two surfaces cling or stick together, held by forces at their interface.
Adhesive failure – characterized by the ability to pull the adhesive or sealant loose from a surface, similar to peeling tape off a plastic substrate.
Advanced cure – one-component urethane adhesive that contains enhanced chemical crosslinking to speed bonding. Recommended for use below 40°F (4.4°C).
Aging – the progressive change in the chemical and physical properties of a sealant or adhesive.
All-in-one-primer – a primer that can be used on all common aftermarket substrates.

B
Backlite – rear window.
Bead – a sealant or compound applied in a joint irrespective of the application method, e.g., a urethane bead applied to the aperture.
Bite – amount of adhesive overlap between the aperture and windshield.
Block (setting) – small piece of neoprene or other suitable material used to position the glass in the frame or opening.
Bond – the attachment at an interface between substrate and adhesive or sealant.
Bond strength – the force per unit area necessary to rupture a bond.
Busbar – insulated metallic conductor used to carry a current, e.g., to or from an antenna encapsulated in a backlite.
Butyl rubber – a copolymer of isobutene and isoprene. As a sealant, it has good elongation and low recovery but is slow to cure.

C
Capacitance – the ability of a conductor or dielectric to store electric charge and a measure of the ratio of stored charge to electric potential.
Catalyst – a substance added in small quantities to promote a reaction, while remaining unchanged itself.
Caulk (noun) – sealant with a relatively low movement capability.
Caulk (verb) – to fill joint with a sealant.
Ceramic frit – a black, ceramic composite applied to the perimeter of the windshield glass for cosmetic and protective purposes. This ceramic composition protects the urethane adhesive against harmful UV rays responsible for urethane degradation.
Channels – the three-sided, U-shaped openings for car windows.
Chemical cure – curing by chemical reaction, which usually involves the crosslinking of a polymer.
Cohesion – the molecular attraction which holds the body of a sealant or adhesive together. The internal strength of an adhesive or sealant.
Cohesive failure – characterized by the ability to pull the body of the sealant or adhesive apart.
Combustible – any liquid that will ignite at or above 100°F (37.7°C), but below 200°F (93.2°C).
Compression – pressure exerted on a sealant in a joint.
Conductance – the measure of the ability of the circuit to conduct electricity.
Conventional cure (moisture cure) – adhesives that rely on water vapor molecules and time to cure. The water in the air causes a chemical reaction in the adhesive. The adhesive bead cures from the outside to the center as the moisture diffuses into the adhesive. Not recommended for use below 40°F (4.4°C).
Creep – the deformation of a body with time under constant load.
Crosslinked – molecules that are joined side-by-side, as well as end-to-end.
Cure – to set up or harden by means of a chemical reaction.
Cure time – the time required for adhesive to cure at a given temperature and relative humidity.
Curing agent – a chemical added to aid curing in a polymer.
Decking – the ability of a urethane adhesive to support (deck) a windshield in the aperture opening.

Dielectric – matter that serves as an electrical insulator or sustains an electric field with minimum dissipation in power.

Dielectric constant – the measure of a given capacitor filled with a given dielectric compared to the same capacitor with only a vacuum.

E-coat (electro coating) – method of painting which uses electrical current to deposit the paint. An e-coat system applies a direct-current (DC) charge to a metal part immersed in a bath of oppositely charged paint particles. The paint particles are drawn to the metal and paint is deposited on the part, forming an even, continuous film over the entire surface until the coating reaches the desired thickness.

Elastomer – a rubbery material which returns to approximately its original dimensions in a short time after a relatively large amount of deformation.

Exothermic – chemical reaction in which energy is released, such as heat.

Extendibility – the ability of a sealant to stretch under tensile load.

Fatigue failure – failure of a material due to rapid cyclic deformation.

Filler – finely ground material added to a sealant or adhesive to change or improve certain properties.

Flash point – minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when heated.

Frit – see ceramic frit.

Galvanic corrosion – electrochemical corrosion caused by dissimilar metals in an electrolyte.

Gasket – pre-formed shapes, such as strips, grommets, etc., of rubber or rubber-like composition, used to fill and seal a joint or opening either alone or in conjunction with a supplemental application or a sealant.

Green strength – initial strength of material when first applied.

Impedance – measure of the total opposition to current flow in an alternating-current circuit.

Joint – the opening between component parts.

Lap joint – joint in which the component parts overlap so the sealant or adhesive is placed into shear action.

Lap shear – a test sample that measures the force required to pull apart a lap joint fastened with cured adhesive. The pull direction is along the longitudinal axis of the joint test coupon.

Lead-free frit – the ceramic band around the perimeter of the windshield used for UV protection – now typically made from zinc or bismuth-based paint rather than lead-based paint.

Lite – another term for a pane of glass or windshield.

Modulus – the ratio of stress to strain.

Microsiemens (μS) – a unit of conductance.

Moisture cure (conventional cure) – adhesives that rely on water vapor molecules and time to cure. The water in the air causes a chemical reaction in the adhesive. The adhesive bead cures from the outside to the center as the moisture diffuses into the adhesive.

Monomer – a material composed of single molecules. A building block in the manufacture of polymers.

Open life – the allowable time a product can be used after the container/package has been opened for the first time (does not extend past expiration date).

Open time – the time interval between when an adhesive is applied and when it becomes no longer workable.

Oxidation – formation of an oxide. Also the deterioration of rubbery materials due to the action of oxygen or ozone.

PAS (PAAS) – see pre-applied adhesive system.

Peel test – a test of an adhesive or sealant using one rigid and one flexible substrate. The flexible material is folded back (usually 180°) and the substrates are peeled apart. Strength is measured in pounds per inch of width.
Pico farad (pF) – a unit of capacitance.
Polymer – a compound consisting of long chain-like molecules. The building units in the chain are monomers.
Polyisulfide rubber – a synthetic polymer usually obtained from sodium polysulfide. Polyisulfide rubbers make very good sealants.
Pre-applied adhesive system – polyurethane adhesive applied in a specific shape by the glass manufacturer to the edge of the glass. Used as a molding and decorative trim for flush-mounted auto glass. Abbreviated as PAS or PAAS.
Prep – glass etching material that removes contaminants and prepares glass for bonding.
Pressure-sensitive adhesive – adhesive that retains tack after release of the solvent, so it can be bonded by simple hand pressure.
Primer – a preparatory material applied to substrates in order to improve adhesion.
PSI – Pounds per Square Inch – a unit of measure of pressure.
Resilience – measure of energy stored and recovered during a loading cycle, expressed in percent.
Resins – solid organic materials, generally not soluble in water, which have little or no tendency to crystallize, e.g., epoxy and polyester resins.
Resistance – the opposition that a device or material offers to the flow of direct current.
RINA – acronym for Reinforced Isotropic Network Adhesive. Its high-strength copolymer speeds bonding and increases strength in urethane adhesives. The modified internal structure needs less moisture to cure. RINA technology creates uniform and reinforced properties throughout the adhesive that absorb and dissipate crash stresses faster than conventional adhesives.
RPM – acronym for Reinforced Polysotrophic Micro-networked adhesive. RPM offers the same highly crosslinked adhesive as RINA technology previously used in BETASEAL™ advanced cure adhesives. But, by shortening the distance between chemical bonds, the adhesive develops strength even faster, allowing for even further MDAT reduction. Featured only in BETASEAL™ Xpress30 and BETASEAL™ Express+.
Sealant – any material used to seal joints or openings against the intrusion or passage of any foreign substance such as water, gasses, air or dirt.
Shear test – a method of deforming a sealed or bonded joint by forcing the substrates to slide over each other. Shear strength is reported in units of force per unit area (PSI).
Shelf life – the length of time a sealant or adhesive can be stored and still retain its properties.
Shore hardness – the measure of firmness of a compound by means of a Durometer Hardness Gauge. Range of 20 to 25 is about the firmness of an art gum eraser. Range around 90 is about the firmness of a rubber shoe heel.
Shrinkage – the percentage of volume or weight loss under specified conditions.
Sidelite – car side window.
Solvent – a liquid in which another substance can be dissolved.
Substrate – an adherent surface, or surface of a sealant or adhesive.
T
Tackiness – the stickiness of the surface of a sealant or adhesive.
Tear strength – the load required to tear apart a sealant specimen.
Tensile strength – resistance of a material to a tensile force (a stretch). The cohesive strength of a material, expressed in PSI.
Toxic – a material poisonous or dangerous to humans by swallowing, inhalation or contact resulting in eye or skin irritation.
Ultimate elongation – elongation at failure.
Ultraviolet light – part of the light spectrum. UV rays can cause chemical changes in rubbery materials.
Urethane – a family of polymers ranging from rubbery to brittle. Usually formed by the reaction of a disocyanate with a hydroxyl; also called polyurethane.
Viscosity – a measure of the flow properties of a liquid or paste. For example, honey is more viscous than water. Water (the standard of comparison) has a viscosity of 1/100 of a poise.
Vulcanization – improving the elastic properties of a rubber by a chemical change.
Weather-O-Meter – an environmental chamber in which specimens are subjected to water spray and UV light.
Working time – defined as the period of time from when urethane is first extruded to the final placement of glass into the aperture.
ADAS glossary of technical terms

The following is a list of terms frequently used in this guide with definitions.

A

ADAS (advanced driver assist systems) – automated systems that enhance vehicle safety and assist in reducing driver error. Some examples of these systems include lane warning, lane departure assist, adaptive breaking, adaptive cruise control, automatic parking, and collision avoidance systems. All of these systems depend on sensors located on the car to provide feedback to electronic systems.

Active driving assistance – assists with vehicle acceleration, braking and steering. Some systems are limited to specific driving conditions. Driver is responsible for primary task of driving.

Active parking assistance – controls steering and potentially other functions during parking. Driver may be responsible for acceleration, braking and gear position. Some systems are capable of parallel and/or perpendicular parking.

Adaptive cruise control – assists with acceleration and/or braking to maintain a prescribed distance between it and a vehicle in front. Some systems can come to a stop and continue.

Automatic emergency braking – detects potential collision while traveling forward, provides forward collision warning and automatically applies the brakes to avoid or lessen the severity of impact. Some systems include pedestrian or other object detection.

Automatic emergency steering – detects potential collision and automatically controls steering to avoid or lessen the severity of impact. Some systems include pedestrian or other object detection.

Automatic high beams – switches between high and low beam headlamps automatically based on lighting, surroundings and traffic.

1 Also referred to as Level 2 defined by SAE standard J3116.
Backup camera – provides view of area behind vehicle when in reverse. Could include trailer assistance, a system that assists drivers during backing maneuvers with a trailer attached.

Blind spot warning – detects vehicles to rear in adjacent lanes while driving and alerts the driver to their presence.

Dynamic calibration – a calibration that occurs where the vehicle is in motion (dynamic). Usually involving a vehicle being driven at a specific speed for a specific distance to calibrate a camera attached to the windshield.

Forward collision warning – detects impending collision while traveling forward and alerts driver. Some systems include pedestrian or other object detection.

Head-up display – projects image of vehicle data and/or navigational info into the driver’s forward line of sight.

Lane departure warning – monitors vehicle’s position within driving lane and alerts driver as the vehicle approaches or crosses lane markers.

Lane keeping assistance – assists with steering to maintain vehicle within driving lane.

Night vision – aids driver vision at night by projecting enhanced images on instrument cluster or head-up display.

Parking obstruction warning – detects obstructions near vehicle during parking maneuvers.

Rear automatic braking – detects potential collision while traveling in reverse and automatically applies the brakes to avoid or lessen the severity of impact. Some systems include pedestrian or other object detection.

Rear cross traffic warning – detects vehicles approaching from the side and rear of vehicle while traveling in reverse and alerts driver.

Remote parking – parks vehicle without driver being physically present inside the vehicle. Automatically controls acceleration, braking, steering and shifting.

Static calibration – a calibration that occurs with the vehicle static (not moving). Usually involving targets set up at specific distances to calibrate a camera attached to the windshield.

Surround-view camera – uses cameras located around vehicle to present view of surroundings.
Minimum drive-away times – cure times (in hours)

**BETASEAL™ Xpress30**
30-minute minimum drive-away time in all temperatures and humidities down to 0° F (-18°C).

**BETASEAL™ Express+**
1-hour minimum drive-away time in all temperatures and humidities down to 0° F.

**BETASEAL™ U-400HMNC**
2-hour minimum drive-away times in all temperatures and humidities down to 20°F (-7 °C).

**BETASEAL™ U-418HV**
2-hour minimum drive-away times in all temperatures and humidities down to 40°F (4.4°C).

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**BETASEAL™ U-428Plus and BETASEAL™ U-838**

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**BETASEAL™ U-428Plus HV and BETASEAL™ U-838HV**
3-hour minimum drive-away time in all temperatures and humidities above 50°F (10°C).
4-hour minimum drive-away time in all temperatures and humidities between 50°F (10°C) and 32°F (0°C).
Fixed Glass Replacement Record

Inspected by:  
Invoice number:  

VIN:  
License plate number and state:  
Mileage:  

Inspection sticker number:  
Customer signature:  

☐ Passenger Side Air Bag  ☐ Side-Impact Air Bag

Pre-Inspection
S = Scratched  
D = Dented  
C = Chipped  
M = Missing  
R = Rust

Post-Inspection
☐ Vacuum  
☐ Trim secure  
☐ Glass clean  
☐ Wipers OK  
☐ Stickers/tags  
☐ Check radio

Vehicle Type
☐ 2-door  
☐ 4-door  
☐ Hatchback  
☐ Station wagon  
☐ Sport utility  
☐ Mini-van  
☐ Van/truck  
☐ Mini-pickup  
☐ Full-size pickup

Installation Information

Date and time glass was set:  
Vehicle release date and time:  

Customer informed of adhesive MDAT:  
☐ Before installation  
☐ After installation

Temperature at start of curing (degrees F):  
(degrees C):  
Relative humidity at start of curing (percent):  
Does vehicle have ADAS?  
☐

Inform customer of ADAS calibration:  
Vehicle calibrated  
☐ Vehicle requires calibration

Moldings or parts used:

D.O.T. number (on glass – identifies manufacturer):

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<tr>
<td>Glass/Frit Primer</td>
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<tr>
<td>Pinchweld Primer</td>
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Product information available at www.BETASEALarg.com

¹Verify material is not expired; lot number contains expiration-date information