



## Dow Performance Silicones

# DOWSIL™ Window Bonding Application Manual

## DOWSIL™ 776 InstantFix



### Fenestration

The design and fabrication of windows in a high-quality and cost-effective manner has never been so important. There is a continual demand for higher thermal performance and lower air infiltration coupled with great aesthetics and a great-value product from the market.

Bonding glass into frames, whether they are sashes, casement, fixed units or door elements, can enable better performance, sleeker aesthetics and higher production throughput to be achieved.

Thanks to bonding, it is possible to look at alternative designs of the profile itself, which could lead to a significant reduction in the height of the profile, which in turn leads to more incoming light, slimmer profiles, less raw material used, lighter windows and more.

This document takes you through the considerations and quality control recommendations for making window bonding successful with DOWSIL™ 776 InstantFix.

### Products

#### DOWSIL™ 776 InstantFix

DOWSIL™ 776 InstantFix is a one-part silicone adhesive specifically designed for window and door bonding. It provides

instant grab directly after application, enhancing the production process with limited waste.

DOWSIL™ 776 InstantFix exhibits primerless adhesion to a variety of substrates typically used for window and door applications. It is suitable for both manual and automated processes and provides excellent long-term performance.

#### DOWSIL™ R-40 Universal Cleaner

DOWSIL™ R-40 Universal Cleaner is a clear material that has been formulated specifically for the cleaning of adhesion surfaces like glass and frames in order to achieve structural adhesion. This cleaner is able to remove recently applied adhesive from frames and glass.

#### DOWSIL™ Primers

Dow has a range of high-performance primers. Primers are used to enhance adhesion of the adhesive to specific substrates. Because of the productivity requirements of window and door manufacturing, all DOWSIL™ fenestration adhesives have been designed to have excellent adhesion to common unprimed substrates. In certain instances, if testing shows a need for enhanced adhesion on a substrate, your Dow Application Sales Engineer or Technical Service Professional can assist you in choosing a primer.

## Glossary

**Bite:** Bite is the minimum width or contact surface of the silicone adhesive on both the glass pane and the frame. The design windload, glass pane dimensions, impact loads, deadload and thermal dilatation stresses must be considered in the determination of the bite dimension.

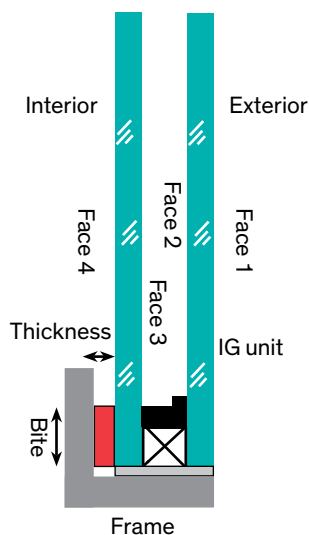
**Thickness:** Thickness is the distance from the pane to the frame. Proper thickness facilitates the installation of the adhesive and allows reduced adhesive stress from differential thermal movement between the glass pane and frame. Thickness in a silicone bond is often referred to as glue-line thickness.

**Backbedding:** Bonding procedure whereby the adhesive is applied on the frame or the insulating glass unit before assembling the window.

**Injection:** Bonding procedure whereby the frame is assembled around the insulating glass unit. Once the window is completed, the adhesive is injected between the frame and the glass faces. This bonding procedure is typically used for wooden and aluminium windows.

**Insulating glass unit:** The four faces of the insulating glass unit are labeled from 1 to 4, starting from the external pane and going towards the internal pane.

**Figure 1:** Typical window bonding detail with indication of the joint dimensions (bite and thickness) and the different faces of the insulating glass (face 1 on the external side to face 4 on the internal side of the window).



## Sealant Joint Design

A bonding glazing joint must be properly designed for the sealant to function as intended and resist all loads undergone by the window.

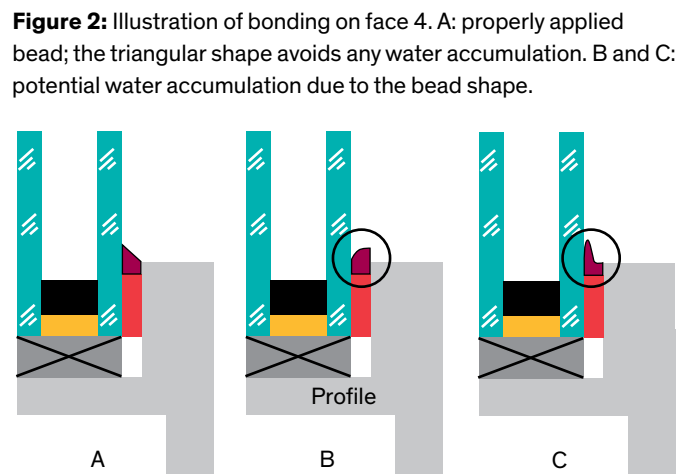
All windows that are glazed undergo repeated expansion and contraction when the temperature changes. This is due to differences in thermal coefficients for the various materials making up the window (e.g., glass and PVC). The thickness must be properly designed to accommodate these movements and reduce stress on the sealant joint and interface resulting from daily and seasonal temperature changes. Furthermore, the joint bite needs to accommodate dynamic loads due to wind or normal operation conditions of the window. Finally, in opened state, the bond will be subjected to a static load that needs to be accommodated by the bond bite.

If a joint is improperly designed, the sealant stresses may be excessive, potentially causing failure. Therefore, all bonding joint dimensioning should be assessed by Dow.

Experimental research has demonstrated that by using DOWSIL™ 776 InstantFix and a bite of 10 mm, it is possible to support a 6-12-6 glass pane on a window of 1.5 m by 1.5 m with a 5 kg weight on the handle for one year in opened position.

To ensure watertightness and airtightness of the profile, it can be considered to include a rebate in the profile.

Care should be paid to the shape of the bead that can be obtained depending on the profile design. The overall shape of the bead after curing is essential to avoid water accumulation and ease drainage. Figure 2 shows a properly applied sealant bead, as well as two examples showing potential for water accumulation.



Proper glue-line thickness facilitates the installation of sealant and allows reduced stress on the sealant joint and interfaces resulting from differential thermal movement.

Joint Property	DOWSIL™ 776 InstantFix
Thickness	3 mm
Bite	6 mm

The glue-line bite shall be determined by considering the deadload, windload, line load and glass dimension. The bite should respect the above minimal values regardless of other calculations.

- The minimal bite requirement is necessary to accommodate torsion effects in opened window position, which are not included in the calculations.
- The bond must be able to be filled using standard sealant application procedures.
- The bond design must allow the sealant to be exposed to air so that it can cure and achieve full physical properties.

After the design process, critical attention should be given to the application process to verify that a uniform, consistent bead is applied around the entire perimeter of the window with no skips, thin spots or shallow areas. If the application equipment is not robust enough to ensure a consistently applied width and thicknesses per the design calculations, a factor of safety should be applied that increases the overall bead size so that the minimum conditions are met in the worst-case scenario.

Currently, Dow recommends bonding with DOWSIL™ 776 InstantFix on face 1 or face 4 of the insulating glass unit. Bonding can be done by injection or backbedding. Depending on the chosen option, the bonding procedure will be different, as detailed in the next sections.



ALUMINIUM



PVC



WOOD



## Quality Requirements for Adhesive, Materials and Process

The quality control procedures of this manual should be followed to guarantee a high-quality bond is achieved.

During the production or repair of bonded units, it is good practice to periodically monitor sealant performance. These tests can detect potential quality issues, which may have occurred due to poor workmanship (e.g., improper cleaning/priming, slow curing, etc.). Quality issues could be a result of a change in the substrate, an introduction of contamination or a variety of other factors that occur as processes change.

### Substrate Suitability and Adhesion Approval

Window and door manufacturers utilize a wide variety of substrates, treatments and coatings on substrates. DOWSIL™ adhesives are designed for robust adhesion to many surfaces, but all substrates should be tested for adhesion before one adhesive can be chosen. Dow can evaluate the adhesion on related substrates. Only apply the adhesives on substrates that have been recommended for use. Ensure conformity between the tested substrates and the ones used in production; both materials need to be identical with respect to their chemical composition.

### Material Compatibility

In addition to suitability of substrates for adhesion, setting blocks, weather strips, gasket, PVB laminates, IG secondary and primary seal, and other accessory materials must be compatible with the selected DOWSIL™ adhesive. Incompatibility between the above-mentioned glazing accessories and the bonding material may cause chemical interaction and could lead to failure. These materials are usually approved for incidental contact. Dow can approve all glazing accessory material.

Dow will typically request that representative samples of each material be provided to the Dow sealant testing laboratory for compatibility testing. After testing, Dow will provide a compatibility certificate.

If the same adhesive is used for the repair as for the original bonding of the window, and the compatibility tests were already performed, then there is no need to repeat testing – as long as no elements of the window have been replaced with different materials. In general, it is recommended during the repair procedure to maintain a thin layer (approximately 1 mm thickness) of the previous adhesive. In this case, the compatibility between silicones of the same chemistry will not be an issue. Care should be taken to avoid damaging the frame

when removing the adhesive. When the frame is damaged, the surface conditions will change, and compatibility tests should be performed to ensure full adhesion of the repair.

### Manufacturing Conditions and Process

Manufacturing temperatures (for both bonding and repairs) should stay within a range of 10°C to 40°C for one-part silicone adhesives. In colder temperatures, cure rate and adhesion development will be slower. At higher temperatures, working time will be shorter.

Surface temperatures of glass and frame must not fall substantially below the specified manufacturing temperature (i.e., they must reach at least 10°C). Lower temperatures may lead to condensation or wet surfaces, which can prevent polymerization. The environment should be dust-free.

During manufacturing, it is important to adhere to usage instructions:

- Ensure the quality of the adhesive before proceeding to bonding.
- If applicable, follow Dow's recommendations with respect to priming/ cleaning requirements for frames and glass.
- Ensure that the specified minimum joint dimensions of the adhesive during application of the adhesive are respected.
- The adhesive must be applied carefully and without defects (e.g., cavities, bubbles).
- The adhesive should only be applied by personnel having had access to Dow training material.
- The curing time of the adhesive should be followed.

### Sealant Storage Conditions

DOWSIL™ 776 InstantFix adhesive containers must be stored at temperatures below 30°C. If a sealant container is kept in a production facility at a temperature greater than the temperature indicated in the technical data sheets, replace the material, as storage at high temperatures may significantly shorten the shelf life of the product. Adhesives should be stored in their original unopened containers.

The following procedures are intended as general instructions for the application of DOWSIL™ silicone adhesives. Implementation of these recommendations ensures optimum quality and best possible performance of DOWSIL™ 776 InstantFix. The order is not to be seen as chronological and will depend on the specific window design (e.g., bonding on face 4 vs. bonding on face 1 or 2).

- 1. Quality Control:** Inspect substrates and materials prior to use. Conformity between the materials used in production and the materials that have been tested and approved by Dow must be ensured.
- 2. Surface Preparation:** Care must be taken to not contaminate cleaned or primed surfaces during any step of production. If contamination occurs, surfaces must be recleaned and primed if necessary.
- 3. Sealant Application:** Select the appropriate dispensing equipment for your application. Respect the recommended bead size. Apply sealant onto the frame. The bead must be completely homogeneous. Sealant shall be applied after respecting the appropriate ventilation time of cleaner and primer. Sealant should be applied as soon as possible after the surface preparation in order to avoid dust contamination. If the process does not allow sealant application directly after the surface preparation, please contact Dow Technical Service for approval.
- 4. Glass Manipulation:** Place the glass or panel to the frame while respecting the maximum open time of the sealant.
- 5. Bead Dimensioning:** In automated applications, the robot and the pump should be set up accordingly to ensure the required bead size, and if appropriate, the equipment should also ensure a constant bead height during production of the window.
- 6. Quality Control:** Inspect the finished bonded windows. Ensure that all recommended quality tests are being performed.

## Quality Control

### General Considerations

Dow performs extensive quality assurance testing in its adhesive manufacturing facilities in accordance with various standards, including ISO 9001.

It is recommended to additionally check the products' performance at regular intervals – particularly where batch production is involved. Quality control is one of the most important elements of successful window bonding. This manual should be reviewed continually by the sealant user.

Results of the quality control tests should be fully documented in writing. Dow provides quality control checklists that can be used for the development of a comprehensive quality control program by the sealant user. If there is a significant deviation of the test results obtained locally from the characteristics listed below, please contact Dow Technical Service immediately for assistance. The product concerned must not be used.

Dow will assist you in the development of a comprehensive quality control program specifically for your organization.

Please also refer to the product technical data sheets and safety data sheets. Dow also can audit a production facility and make recommendations for improvement if necessary.

### Material Quality Requirements

An expiration date is clearly marked on the product packaging of all DOWSIL™ adhesives. For all products to be used, please note: **Do not use products that have exceeded their expiration date!**

### Quality Control Procedures for One-part Adhesives

Sealant Production QC Test	Frequency of Test		
	After Each Pump Start-up	After Each Container Change	Diagnostic Investigation
Skin-over time	Required	Required	Required
Adhesion on substrates	Required	Required	Required

### Skin-over Time

Extrude a small amount of DOWSIL™ 776 InstantFix onto a substrate.

After 45 minutes, the skin of the silicone should be fully cured and leave no visible marks when touched. Please contact Dow Technical Service or your Dow distributor if full cure of the silicone skin is not observed within the stated time frame.

### Adhesion on Substrates

1. Properly clean and prime the test substrate and place a piece of polyethylene sheet or bond breaker tape across the flat surface.
2. Apply a bead of DOWSIL™ 776 InstantFix and tool to form a strip that is approximately 20 cm long, 15 mm wide and 4 mm thick. At least 4 cm of the silicone should be applied on the polyethylene sheet or bond breaker tape.
3. After one (1) week of cure at 20°C and 50% relative humidity, hold firmly a 4 cm tab of the silicone adhesive that overlays the polyethylene sheet and pull at a 180° angle. Peel back 1-2 cm of silicone, leaving the remainder in place for additional testing. If the adhesive tears within itself and remains fully bonded to the substrate, this is called 100% cohesive failure and is desirable, as it indicates that the strength of adhesion is greater than the strength of cohesion.
4. If the adhesive releases from the substrate, the sample indicates 100% adhesive failure. Since silicone adhesion develops over time, repeat the test after an additional 24 to 48 hours of cure. If 100% cohesive failure is not achieved, please consult Dow for advice and do not proceed with application.

## Surface Preparation and Sealant Application

Bonding requires a diligent and thorough procedure to ensure that substrates (glass and frames) are properly cleaned prior to sealant application (i.e., that the substrates are clean; dry; and free of dust, oil and other contaminants).

Substrates such as glass and aluminium or PVC must be cleaned with a solvent prior to application of sealant. Dow recommends the “two-cloth cleaning method” be used to clean these materials. The “two-cloth cleaning method” utilizes DOWSIL™ R-40 Universal Cleaner for solvent-cleaning of substrates. Alternate solvents will be considered. If a solvent other than DOWSIL™ R-40 Universal Cleaner is to be used, please identify the selected solvent. Dow will test with your specific solvent blend. Pure water, soaps and detergent are not acceptable cleaning agents.

1. Thoroughly clean all surfaces of loose debris.
2. Pour a small quantity of cleaning solvent into a working container. A clear plastic solvent-resistant squeeze bottle works best for this purpose. Do not apply solvent directly from the original container.
3. Wipe the joint surfaces with sufficient force to remove dirt and contaminants.
4. Immediately wipe dry the solvent-wet surface of the substrate with a separate clean, dry cloth. The second cloth must wipe the substrate before the solvent has evaporated.
5. Visually inspect the second cloth to determine whether contaminants were effectively removed. If the second cloth remains dirty, repeat the “two-cloth cleaning method” until the second cloth remains clean. For each subsequent cleaning, rotate each cloth to a clean portion of the cloth. Do not clean with the dirty portion of the cloth. For best results, replace used and dirty cloths frequently.
6. Primed surfaces must be sealed within the next four (4) hours. Any surfaces primed and not sealed within four (4) hours must be recleaned and reprimed before applying sealant.

### Primer application

DOWSIL™ 1200 OS Primer is commonly the primer recommended by Dow if primer is needed. The following procedure describes how to properly prime surfaces with DOWSIL™ 1200 OS Primer.

1. Before use, verify that the DOWSIL™ 1200 OS Primer is within its stated shelf life. The primer should be stored

below 25°C in its original unopened container. The primer should be clear and waterlike in appearance. If the primer is milky-white in appearance, do not use the primer.

2. The step of priming should begin within four (4) hours after the cleaning step. If there is a greater time delay, joint surfaces must be recleaned prior to priming.
3. When using larger containers, the primer should be poured into a clean and dry smaller working container (500 ml can) that can be closed with an airtight seal. The lids of all containers must always be closed immediately after use to prevent excessive exposure of the primer to atmospheric moisture, which can cause it to deteriorate and turn milky-white in the container and ultimately affect the performance of the primer.
4. Pour a small amount of primer onto a clean, dry, lint-free cloth or paper (e.g., industrial absorbent paper) and gently wipe a thin film on all joint surfaces. Apply only enough primer to wet the surface. **CAUTION:** Overpriming can cause adhesion loss between the sealant and the substrate. If too much primer is applied, a powdery film will form on the substrate. In this case (or if puddles form on the surface), use a clean, dry, lint-free cloth or paper to remove excessive primer before the adhesive is applied. Overprimed surfaces must be recleaned and primed in a proper manner.
5. Allow the primer to dry until all of the solvent evaporates. Depending on temperature and humidity, this takes at least one minute and can take up to 30 minutes.

### Sealant Application

1. Apply sealant in a continuous operation using an application gun or dispensing equipment. By pushing the sealant into the back of the joint in a continuous manner, air entrapment can be avoided.
2. Care should be taken in the manufacturing of window units to ensure that glue-line thickness is not reduced below the design requirements. Excessive sealant compression during glass installations and the installation of opposite-side glazing beads can cause the glue-line thickness to be reduced to a level at which movement may exceed the sealant's movement capability.
3. Aluminium windows differ in that it is not desirable for the glass to make contact with the aluminium frame. Tapes and bumpers are occasionally used in aluminium windows to ensure and maintain appropriate glue-line thickness.

## Appendix A: Quality Checklist

<b>Manufacturing Plant</b>	
<b>Applicator Name</b>	
<b>Date</b>	
<b>Temperature</b>	
<b>Humidity</b>	

	<b>Morning</b>	<b>Afternoon</b>	<b>Drum Change</b>
Batch Number			
Expiration Date			
Profile Batch Number or Lot Number for profile			
Cleaner Batch Number			
Cleaner Expiration Date			
Primer Batch Number			
Primer Expiration Date			
Fabrication of H-pieces Twice a Week and When Changing a Drum	3 pieces	3 pieces	3 pieces
Peel Adhesion Test (1 per shift/daily)			
Observations/comments			
Name and Signature of the Responsible Manufacturer			

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Dow has sales offices, manufacturing sites and science and technology laboratories around the globe. Find local contact information at **[consumer.dow.com/ContactUs](http://consumer.dow.com/ContactUs)**.

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