

Fenestration Technical Manual

Dow Americas



DOWSIL™


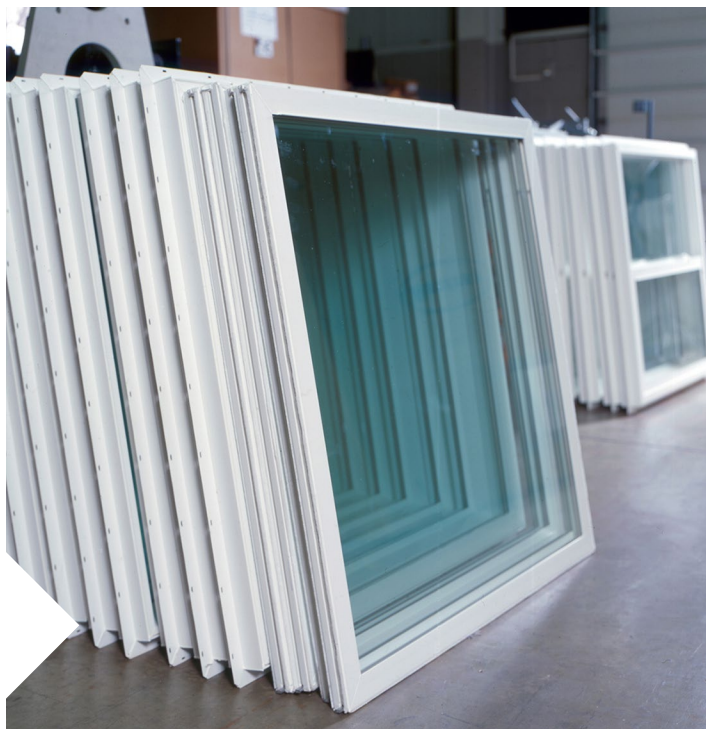
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Introduction

This manual is intended to provide guidance on sealant choice and proper application procedures for the DOWSIL™ brand fenestration sealant line. This manual will aid in developing a basic quality assurance program around the use of sealants in window and door manufacturing. As window and door products vary in many aspects, such as design, customer requirements, manufacturing environments, and end-use environments, this manual cannot be considered a comprehensive guide for every situation.

Technical Information Center

The Dow Technical Information Center provides a process and the resources to manage customers' product and technical information inquiries. These include, but are not limited to:

- Environmental Health and Safety information
- Product recommendations
- Product troubleshooting
- Application assistance

Inquiries are received via: www.dow.com/construction

Fenestration Product Offering

Dow offers a variety of sealants to meet your specific application needs. These sealants can be used in different applications in the window and door industry and some are better suited for specific applications than others. See *Appendix* for joint configuration designs and a list of suggested sealants for particular applications.

DOWSIL™ 1199 Silicone Glazing Sealant

DOWSIL™ 1199 Silicone Glazing Sealant is a one-part, medium-modulus, neutral curing silicone sealant for use in general back-bedding and weather sealing applications. It is ideally suited for automated glazing systems. Because of its adhesion to a wide variety of substrates, it is well suited to numerous other sealing applications such as corner joinery, cap, toe, and heel beading, and seam sealing. It has a movement capability of $\pm 25\%$ and is available in a wide variety of colors.

DOWSIL™ 899 Silicone Glazing Sealant

DOWSIL™ 899 Silicone Glazing Sealant is a one-part, high-modulus, neutral-curing silicone sealant for use in general back-bedding and weather sealing applications. It has a movement capability of $\pm 25\%$ and is available in clear and gray.

DOWSIL™ 9-1350 Silicone Sealant

DOWSIL™ 9-1350 Silicone Sealant is a one-part, high-modulus, neutral curing silicone sealant for general back-bedding applications. It can also be used in cap, toe, and heel bead applications. It offers the highest green strength of the ambient-applied fenestration sealants offered by Dow. It has a movement capability of $\pm 25\%$ and is available in black, gray, and white.

DOWSIL™ 791 Weatherproofing Sealant

DOWSIL™ 791 Weatherproofing Sealant is a one-part, medium-modulus, neutral-curing silicone sealant for general weather sealing applications. It is ideal for perimeter and installation applications but can also be used for back-bedding. It has a movement capability of $\pm 50\%$ and is available in a wide variety of colors.

DOWSIL™ 995 Silicone Structural Sealant

DOWSIL™ 995 Silicone Structural Sealant is a one-part, medium-modulus, neutral curing silicone sealant with superior unprimed adhesion for structural glazing applications and glazing applications for hurricane or impact-rated windows and doors. It has a movement capability of $\pm 50\%$ and is available in black, gray, and white.

DOWSIL™ 758 Silicone Weather Barrier Sealant

DOWSIL™ 758 Silicone Weather Barrier Sealant is a one part, neutral cure silicone sealant, designed for adhering to low energy surfaces common in sheet or peel and stick weather resistant barriers. Primerless adhesion to LDPE, anodized aluminum, vinyl, powder coated aluminum, Kynar coated aluminum.



DOWSIL™ 778 Silicone Liquid Flashing

DOWSIL™ 778 Silicone Liquid Flashing is a single component silicone sealant for weatherproofing at window and door openings and other building transitions. Compatible with DOWSIL™ DEFENDAIR 200.

DOWSIL™ InstantGlaze Window Assembly Sealant

DOWSIL™ InstantGlaze Window Assembly Sealant is a patented, neutral-cure hot-melt silicone ideal for automated back-bedding applications. When used with standard hot-melt dispensing equipment and an automated X-Y glazing table, DOWSIL™ InstantGlaze becomes part of a total productivity solution – a solution that enables the window manufacturer to produce windows and doors faster, better, and more economically than other technologies available on the market. It has a movement capability of $\pm 50\%$, and comes in crystal clear, or can be pigmented for high-volume applications.

DOWSIL™ InstantGlaze II Assembly Sealant

DOWSIL™ InstantGlaze II Assembly Sealant is designed for use as a backbedding sealant in the assembly of windows and doors. It is used with high-speed XY glazing equipment to improve manufacturing productivity and window performance. It can be used on most common window materials (wood, PVC, Aluminum, Fiberglass) for standard and impact-resistant glazing. It is also compatible with most common insulating glass sealants. DOWSIL™ InstantGlaze II is offered as a softer, more compressible version of DOWSIL™ InstantGlaze.

DOWSIL™ InstantGlaze III Assembly Sealant

Neutral-cure hot-melt silicone for automated assembling of windows. DOWSIL™ Instant Glaze III Assembly Sealant is designed for use as productivity enhancer in the assembly of windows and doors. It is used with various types of high-speed automatic equipment (robots, XY tables, etc.) to improve manufacturing productivity and window performance. It can be used on most common window materials (wood, PVC, aluminum, fiberglass) without the need for any primer. DOWSIL™ Instant Glaze III Assembly Sealant is also compatible with most common insulating glass sealants.

DOWSIL™ 2400 Silicone Assembly Sealant

DOWSIL™ 2400 Silicone Assembly Sealant is designed for use as a primerless bonding and sealing solution in the assembly of windows and doors. It is used with various types of high-speed automated equipment including XY tables and robots. It can be applied on most common fenestration materials for standard and impact glazing, and is also compatible with most insulating glass sealants.

For more information on these unique products, please see the *DOWSIL™ InstantGlaze Technical Manual*.

Primers

Dow has a full line of high-performance primers for sealants. Primers are used to enhance adhesion of sealants to specific substrates. Because of the productivity requirements of window and door manufacturing, all DOWSIL™ brand fenestration sealants 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.

Dow Test Lab Summary

The Dow test lab located in Midland, Michigan, offers a wide variety of test capabilities to help ensure that the sealant you choose for your fenestration application will perform as your design requires. Following is a description of the most common tests performed at the Dow test lab.

Substrate Suitability and Adhesion

Window and door manufacturers utilize a wide variety of substrates, treatments of substrates, and coatings on substrates. All of the fenestration line sealants are designed for robust adhesion to many surfaces, but all substrates should be tested before the proper sealant is chosen. Dow will evaluate the adhesion of our products to materials representative of those being used on your job using a modified ASTM C794 peel adhesion test. Contact your Dow Application Sales Engineer to arrange for this testing.

When substrates change or a non-typical finish is specified, the customer should contact Dow for specific advice.

Material Compatibility

In addition to suitability of substrates for adhesion, setting blocks, weather stripping, gasket, and other accessory materials must be compatible with DOWSIL™ sealants. Installation materials such as flashing should also be tested for compatibility with DOWSIL™ sealants that may be used as perimeter sealants.

Based on historical testing, materials such as silicone, Alcryn, polyurethane foam tape, and many vinyl extrusions are found to be compatible with silicones with no discoloration or cure inhibition.

Other materials, such as EPDM, neoprene, Santoprene, Kraton, and other similar organic materials are found to cause slight discoloration of light-colored sealant. These materials are usually approved for incidental contact with glazing-type silicones of all colors, but darker silicones may be preferable if the sealant line is visible.

Compatibility testing can be arranged through your Dow Application Sales Engineer or Dow Technical Service Professional.

Other Test Requirements

Dow can accommodate special, non-standard testing requirements with appropriate lead times. Please consult your Dow Application Sales Engineer with your request. Dow may charge a service fee for non-standard testing.

AAMA Verified Component List for DOWSIL™ Brand Fenestration Sealants

All DOWSIL™ fenestration sealants are AAMA approved and on the AAMA Verified Components List. For the most recent version of the approved components list, visit the AAMA website.

AAMA Designation and Description	DOWSIL™ brand Fenestration Sealants
AAMA 802.3-16 Type I (Ductile Back Bedding Compound)	DOWSIL™ 791 Weatherproofing Sealant DOWSIL™ 899 Silicone Glazing Sealant DOWSIL™ 1199 Silicone Glazing Sealant DOWSIL™ 9-1350 Silicone Sealant
AAMA 802.3-16 Type II (Ductile Back Bedding Compound)	DOWSIL™ 791 Weatherproofing Sealant DOWSIL™ 899 Silicone Glazing Sealant DOWSIL™ 9-1350 Silicone Sealant DOWSIL™ InstantGlaze III Assembly Sealant
AAMA 803.3-16, Type I (Narrow Joint Seam Sealer)	DOWSIL™ 1199 Silicone Glazing Sealant
AAMA 805.2-16, Group A (Bonding Back Bedding Compound)	DOWSIL™ InstantGlaze Window Assembly Sealant DOWSIL™ InstantGlaze II Assembly Sealant
AAMA 805.2-16, Group C (Bonding Back Bedding Compound)	DOWSIL™ 791 Weatherproofing Sealant DOWSIL™ 899 Silicone Glazing Sealant DOWSIL™ 995 Silicone Structural Sealant DOWSIL™ 1199 Silicone Glazing Sealant DOWSIL™ 9-1350 Silicone Sealant DOWSIL™ InstantGlaze III Assembly Sealant DOWSIL™ 2400 Silicone Assembly Sealant DOWSIL™ 794F Alkoxy Sealant

Quality Assurance of Material

Dow performs extensive quality assurance testing in our manufacturing facilities in accordance with rigid ISO 9000 standards. This section is intended to provide the end-user with simple screening tests to verify that the material, as received, has not been abused or damaged in transit. The following procedure outlines a series of steps to ensure that the quality of DOWSIL™ one-part sealants will perform adequately.

Skin-over Time/Elastomeric Test

For one-part sealants, a skin-over and elastomeric test should be performed once per week and on every new lot of sealant used. The purpose of this test is to check the sealant's working time and to ensure the sealant cures fully. Any excessive variation in the skin-over time may indicate a sealant that has been affected by environmental conditions or is potentially out-of-shelf-life.

This test is performed as follows:

Note: This test does not apply to DOWSIL™ InstantGlaze, which demonstrates properties that are not applicable to this test. Refer to the DOWSIL™ InstantGlaze technical manual for quality control (QC) procedures on that product.

1. Spread a bead of sealant into a 0.04-inch (1-mm) thick film on a sheet of polyethylene.

2. Every few minutes, touch the sealant film lightly with a clean tool or folded-over piece of polyethylene.
3. When the sealant does NOT adhere to the tool, the sealant is said to have skinned over. Note the time required to reach this point. If a skin has not formed within 3 hours, do not use this material and contact your Dow representative.
4. Allow the sealant to cure for 24 hours. After 24 hours, peel the sealant from the polyethylene sheet. Stretch the sealant slowly to verify complete cure. Release the stretch and check to see that it returns to approximately the original length. If the sealant has not cured, or the sample does not demonstrate typical elastic behavior, contact your Dow representative.

Shelf Life and Storage Considerations

It is important to use DOWSIL™ silicones within their shelf life. The "use by" date is clearly displayed on all product packaging. Order supply quantities according to usage rate and minimize in-house safety stock. Sealants should be stored in clean, dry conditions below 32°C (90°F).

DOWSIL™ Sealant	Shelf Life (months)
DOWSIL™ 995 Silicone Structural Sealant	18
DOWSIL™ 1199 Silicone Glazing Sealant DOWSIL™ 899 Silicone Glazing Sealant, DOWSIL™ 791 Weatherproofing Sealant DOWSIL™ 758 Silicone Weather Barrier Sealant DOWSIL™ 778 Silicone Liquid Flashing DOWSIL™ InstantGlaze Window Assembly Sealant DOWSIL™ InstantGlaze II Assembly Sealant DOWSIL™ InstantGlaze III Assembly Sealant DOWSIL™ 2400 Silicone Assembly Sealant	12
DOWSIL™ 9-1350 Silicone Sealant	9

Sealant Design Considerations

Structural vs. Non-structural

Dow markets sealants that are classified as structural and non-structural. The testing requirements for warranty vary for the two classifications of sealants. DOWSIL™ 995 Silicone Structural Sealant and DOWSIL™ 983 Silicone Glazing and Curtainwall Adhesive/Sealant are the only structural sealants in the fenestration line. Their use in window and door applications is considered non-structural, so extra testing is not required for warranty.

By Dow definition, a structural application of a silicone means that the silicone is the only component in the window system that holds the glass. In other words, if the silicone were not there, the glass would fall out of the frame with no pressure applied.

In most window and door applications, if the silicone were removed, the glass would remain captured within the frame. The silicone in window and door applications is therefore defined as non-structural, although it does add strength to the window or door system allowing the units to hold up to weather conditions and pass design pressure testing. In many cases, silicone-glazed

windows and doors pass very high design pressures thanks in part to the silicone providing strength to the system as a component of the overall design.

In addition to adding strength to a window or door application, the silicone serves a primary purpose as a weatherseal that keeps air and water out. The sealant absorbs movement between the frame and the glass to reduce glass stress by wind and thermal movements.

Determining and Maintaining Glue-line Profiles

It is the responsibility of the window manufacturer to determine an appropriate bead size, sealant bite, and sealant thickness (glue-line thickness) for their window design, joint configuration, and application based on performance properties listed on the specific material data sheet of the DOWSIL™ sealant selected. Additionally, window manufacturers validate their design by performing the necessary testing on the various window types.

As a basis to establish a starting point for determining glue-line profiles, window manufacturers have used a nominal bead diameter of 1/8". This provides a typical bite of approximately 1/4" (0.25 inch) and a compressed silicone sealant thickness of no less than 0.040 inch. Variations above this bead size are commonly found, whereas variations below this bead size are rarer, but do occur. Dow recommends that glue-line thickness be evaluated by performing movement capability and/or finite element analysis for all window designs.

After the design process, critical attention should be given to the application process to verify a uniform, consistent bead is applied around the entire perimeter of the glazing leg with no skips, thin spots, or shallow areas. If the application equipment is not robust enough to ensure a consistently applied minimal glue-line profile in 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 at the worst case situations or locations.

Care should also 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 installs and the installation of opposite-side glazing beads can cause the glue-line thickness to be reduced to a level in which movement may exceed the sealant's movement capability. Wood, vinyl, and fiberglass window profiles commonly have glazing dams that help establish and maintain design glue-line thicknesses. Aluminum windows differ in that it is not desirable for the glass to make contact with the aluminum frame. Tapes and bumpers are occasionally used in aluminum windows to ensure and maintain appropriate glue-line thickness. Regardless of the method of maintaining glue-line thickness, the main take-away should be that some thickness is important so that the material performs as a sealant and not simply as an adhesive.

Glue-line Thickness and Joint Movement

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

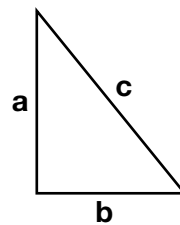
All windows that are glazed undergo repeated expansion and contraction due to variation in temperature. Glue-line thickness must be properly designed to accommodate these movements. The thermal movement can be calculated for any IG unit or window frame if the length of the material, material type (e.g., glass, aluminum), and coefficient of thermal expansion (CTE) is known.

Joint movement for a particular unit can be calculated as follows:

$$\text{Movement (inches)} = \text{Unit Length (inches)} \times \text{CTE (inches/inches/°F)} \times \text{Temperature Change (°F)}$$

For example, for a 2' by 3' high lite of glass fixed at the sill and a temperature change of 140°F, glass with a CTE of 5.1×10^{-6} will show movement of 0.026". Aluminum with a CTE of 13.2×10^{-6} will move 0.067". Differential movement between the glass and aluminum will be 0.067" minus 0.026", which is 0.041".

The dimension of glue-line required (a) for the differential movement (b) can be calculated using the Pythagorean Theorem. Likewise, the allowable movement (b) for a particular glue-line dimension (a) can also be calculated. The new glue-line thickness (c) is limited by the movement capability of the sealant in shear in joint configuration.



c = New Glue-line After Joint

$a^2 + b^2 = c^2$ where:

a = Original Glue-line

b = Joint Movement

For the example discussed above where differential movement of 0.041" (b) is expected, and the sealant has an original glue-line thickness of 0.055" (a), the sealant will elongate to a new glue-line thickness of 0.068" (c). Extension of the sealant from 0.055" to 0.068" will be 24.5%. Consult the data sheet for the movement capability of the material you are designing for to determine if this glue-line thickness is appropriate for your design.

The direction of the panel movement would also need to be considered. Consider whether thermal movement will take place in one direction due to the setting blocks preventing any downward movement of the IG unit or in the case of an unsupported system where the thermal movement can be taken by the glass in both directions. The prior case is more restrictive, and results in higher movements; the latter is a more forgiving design.

Sealant Application

Regardless of your application, some method of sealant delivery will be employed. These delivery methods can be as simple as cartridge or sausage guns, and as complicated as multi-station pumping stations. Listed below are a few items in consideration of this.

Caulk Guns

The most commonly used method of delivering sealant to the desired location is a caulk gun. These guns come in all shapes and sizes and are used to deliver sealant from either tubes (high recycle volume) or sausage (reduced recycle volume). Caulk guns are irreplaceable for their portability and their relative ease of use. Caulk guns are often used on job sites where it is difficult to get pumping equipment and the necessary utilities (electrical, air) to operate the pump. Caulk guns, however, are often over-used because of their relatively low cost. Because most caulk guns are hand-operated, they require a certain amount of repetitive motion, which can lead to some occupational health conditions. At the very least, if the job is large enough, an investment in a high-quality heavy-duty caulk gun is recommended. Should a company find certain areas of their operation where they are using an abundance of tube and/or sausage supplied sealant, they might consider an investment in a sealant pump that can deliver sealant from either 5-gallon pails or 55-gallon drums.

Nozzles

Nozzles should be cut (tubes and sausages) or sized (hand guns) to deliver material consistently and at the desired flow-rate. Nozzles cut too small will require the operator to either apply sealant too thin or to move too slowly. Conversely, nozzles cut too large will lead to unnecessary squeeze-out, tooling, and clean-up. Operators should be trained to apply sealant consistently, and their applications should periodically be monitored to ensure the sealant is consistently applied.

Hoses

Hoses are often the most over-looked component of a pump and gun delivery system. Hoses should be designed to be as short as necessary, and as small in diameter as possible. Hoses that are too long and of larger diameter can make maneuvering the gun difficult. Hoses that are too long reduce the flow-rate of the sealant, especially where a small diameter hose has been selected. Care should be made to optimize the area where the sealant is going to be applied first, and then selecting the appropriate hose length and diameter.

Pumps

Where sealant usage is high enough, the best method of sealant delivery is a pumping system. Pumps can be as simple as a pail unloader, or as complex as a two-part mixing unit. There are many pump manufacturers who can help size a pumping system that is best for your application, and Dow is willing to work with you to assist you in defining these systems. Contact your Dow sales representative for further assistance.

Designing Pumping Systems

When sizing pumping systems, it is important to know viscosity characteristics of the sealants the system is sized for. Following is a chart that provides approximate dynamic viscosities of the DOWSIL™ sealants.

Note: The higher viscosity values listed in the second column represent a static viscosity and correlate to a start-up condition. Once flowing, the non-Newtonian silicone will demonstrate the viscosities on the latter two columns.

DOWSIL™ Sealant	Viscosity cP @ 10 1/sec 25C	Viscosity cP @ 100 1/sec 25C	Viscosity cP @ 1000 1/sec 25C
DOWSIL™ 899 Silicone Glazing Sealant	143,000	43,000	18,000
DOWSIL™ 995 Silicone Structural Sealant	180,000	140,000	57,000
DOWSIL™ 1199 Silicone Glazing Sealant	130,000	48,000	22,000
DOWSIL™ 9-1350 Silicone Sealant	158,000	82,000	35,000
DOWSIL™ 791 Weatherproofing Sealant	190,000	98,000	40,000

In-shop Sealant Application

Sealants can be applied in numerous ways during window and door manufacturing. Higher volume applications typically utilize drum unloaders in 5-gallon or 55-gallon sizes in conjunction with hand application guns or automated equipment. Overhead piping systems can be utilized throughout a manufacturing environment. Dow can provide engineering assistance for the design of a delivery system. Contact your Dow sales representative to learn more about this solution service.

Automated glazing tables are the most efficient way to apply glazing sealants with minimal waste. Automated glazing tables apply sealant in the most consistent manner but problems do occur. Preventative maintenance and routine operator monitoring can help ensure consistent bead profile.

All fenestration sealants, with the exception of DOWSIL™ InstantGlaze Window Assembly Sealant and DOWSIL™ InstantGlaze II Assembly Sealant, are available in cartridges, which can be used at individual workstations within a manufacturing plant. A caulk gun that has a “no drip” feature is suggested.

Some sealants are available in sausages, which are equivalent to approximately two 10.3 oz cartridges. A benefit to sausage packaging is the reduced waste from packaging (i.e., a compressed empty sausage has less volume than an empty cartridge) and a reduced change-over of packaging. This requires sausage caulking guns, which are available in either manual or pneumatic configurations from glazing equipment suppliers such as CR Laurence or local distributors.

Regardless of application method, it is always good practice to have a compatible sealant available in cartridge form to address glazing reworks, or add material to thinly applied areas of the glazed unit

prior to installing the glass.

Sealant Cure Requirements/Cure Time

One of the most commonly asked questions regarding glazing sealants is:

“How long does it take for the sealant to completely cure?”

As a rule of thumb, expect 21 days (± 7 days) for windows back-bedded with silicone to completely cure. This rule will apply for a large percentage of all window types, but it is not 100% inclusive. For example, silicone injection in areas such as corner keys can take considerably longer, as can windows with tight clearances that can be restrictive of airflow and therefore moisture permeation. Ultimately, it is important to determine if the sealant within a window is completely cured prior to structural testing. Therefore, the 21-day period mentioned above should only be used as a guideline to determine when verification of cure, as described below, should begin.

All DOWSIL™ brand single-component fenestration sealants are moisture curing. The rate of cure depends on how quickly atmospheric moisture can permeate through the interface of exposed sealant within the sealant joint. The rate of moisture penetration is affected by a multitude of factors:

1. The dimensions of the sealant joint
2. The joint configuration
3. The materials within the joint
4. Environmental conditions such as air flow and relative humidity

As previously mentioned, silicone within closed joints such as corner keys will take a much longer time to cure than a comparatively open glazing joint. Conversely, curing of a glazing joint in a humid environment will occur more quickly than when the air is dry. Taken alone, hot and cold air does not significantly accelerate or inhibit cure; instead, it is the amount of available moisture within the air (relative humidity) in combination with the factors listed above that will determine how quickly a joint will cure. Therefore, cure time is not 100% predictable from one window design to the next.

Cure time can be best approximated by fabricating several small samples that replicate the joint design of the units. These test specimens should be cured along with regular window units. As time elapses, these samples are cut apart to determine the degree of cure as a function of time. Additionally, the samples can be used to check the adhesion of the sealant to the substrates. Full window unit deglazing is the best method of determining time to full cure and additionally provides information on sealant adhesion and joint fill. It is suggested these types of tests be run during all seasons and on all joint designs to determine environmental and design effects on cure time.

In-shop Quality Assurance

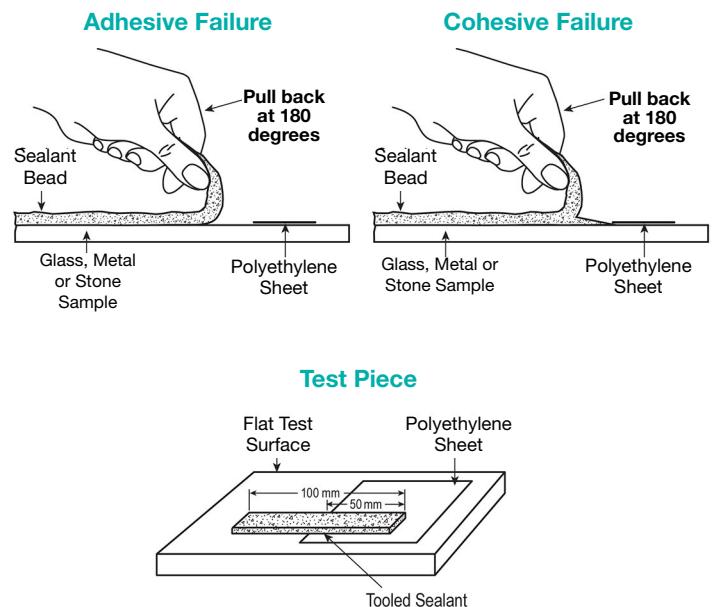
During the production of units, it is good practice to periodically monitor sealant performance. These tests are good practice because they can catch a potential quality issue prior to a large quantity of units being manufactured. Quality issues could be

attributed to the sealant, but also could be a result in a change in the substrate; an introduction of contamination; or a variety of other factors that occur as processes change.

Peel-in-Adhesion Test Procedure

Peel-in-adhesion tests are a means to verify sealant adhesion on production materials. Quality control adhesion tests are not a substitute for unit deglazing but only provide an ongoing means to continuously monitor adhesion in a nondestructive manner.

1. Clean the surface per typical surface preparation methods.
2. Place a piece of polyethylene sheet or bond breaker tape across the flat test surface.
3. Apply a bead of sealant and tool it to form a strip approximately 8' (200 mm) long, 1' (25 mm) wide and 1/8" (3 mm) thick. At least 2' (50 mm) of the sealant should be applied over the polyethylene sheet or bond breaker tape.
4. After cure of the sealant pull the sealant perpendicular to the substrate until failure. Record the mode of failure (adhesive or cohesive) of the test sealant.



The sealant should be applied to each representative substrate. Sealant samples should be peeled back after 24 hours.¹ If the sealant has not cured after this time has elapsed, it may be necessary to re-run the test at 48 and 72 hour intervals. If the sealant has not cured after 72 hours, contact your Dow representative.

Note: If performing peel adhesion tests with DOWSIL™ InstantGlaze products, failure will often occur adhesively but with corresponding extreme elongation and force necessary to produce the failure. Dow lab peel adhesion testing results show that DOWSIL™ InstantGlaze Sealants and DOWSIL™ 2400 Silicone Assembly Sealant will in most cases demonstrate approximately 50 pli regardless of substrate.²

Deglazing

Deglazing is a method of quality inspection used to confirm good adhesion and proper fill of the glazing joint. Deglazing involves completely detaching the lite from the frame after sealant cure

has occurred. The silicone sealant should be inspected for adhesion to both the lite and the frame. To obtain the best inspection, the surface of the lite and/or frame should not be damaged.

The inspection should include the following:

1. Measured size of silicone bite
2. Adhesion of silicone sealant with lite and frame
3. Joint type/condition of sealant applied
4. Appearance of the sealant/uniformity of color, presence of bubbles, etc.

Procedure

Windows backbedded with DOWSIL™ sealants can be deglazed using standard deglazing tools. When used as a quality control procedure, units should sit for the prescribed cure time before deglazing to check for bead quality. (See section on “Sealant Cure Requirements/Cure Time” to determine cure time).

Deglazing requires cutting the glass out of the unit using appropriate deglazing tools typically used in the industry.

An operator/glazer should stand in such a position as to be able to easily insert the blade and move it around the window without reaching well above or below his/her range of motion. Additionally, personal protective equipment such as safety glasses, Kevlar gloves and sleeves, and fall protection (for field deglazing) are highly recommended.

To deglaze a window, insert the blade between the glazing leg on the frame and the glass. Working the blade between these two surfaces is the most critical step; it is possible to break the glass if too much pressure is applied. Once the blade is cleanly between the glass and the glazing leg, move it slowly around the window, cutting the sealant line to free the IG unit. Additionally, a light solvent, such as isopropyl alcohol (IPA) or DOWSIL™ OS-20 Fluid, can be used to soften the material prior to and during cutting. Using a wash bottle type dispenser, spray the IPA or DOWSIL™ OS-20 Fluid around the blade as you are cutting. This will soften the sealant, make it easier to cut through, as well as provide a lubricant for the tool. A few passes around the unit, in which the material is not cut completely through on the first couple of passes, may aid in deglazing the unit. Disassemble the opposite side glazing beads (if present) and remove the IG unit.

Other Tools

Putty knives and spatulas with a very finely ground, sharp blade have also been successfully used to deglaze windows manufactured using DOWSIL™ sealants.

Deglazing Frequency

Deglazing is a unit test and it is up to the window or door

manufacturer to determine frequency based upon the manufacturer's quality control principles. One unit, per glazing line, per week, would be a recommendation as a place to start.

Field and Installation Sealant Application Procedures

Fenestration sealants may be used in the field for either window and door installations or reglazing applications. The major considerations in field application are weather conditions and substrate cleanliness. Although substrates are generally not cleaned or primed for in-shop glazing, field conditions can be much dirtier. A cleaning procedure is recommended; see “Substrate Cleaning Procedure,” below.

For field application, temperature consideration and the understanding of the effects of extreme temperature conditions are important. 10-35°C (50-95°F) is the optimum application temperature range.

1. For applications below 10°C (50°F), the potential for dew and frost exists and must be considered. Do not apply sealants to wet or frosty surfaces.
2. For applications in higher temperatures, sealant must not be applied when substrate temperatures are in excess of 50°C (122°F).

Although any of the fenestration sealants can be used for field applications, if clear sealant is required, DOWSIL™ 1199 Silicone Glazing Sealant is commonly chosen. If clear sealant is not a requirement, DOWSIL™ 791 Silicone Weatherproofing Sealant is the easiest fenestration sealant to work with in the field because it has the longest working time of the fenestration sealants and also has ±50% movement capability, which is a useful property in many field joint applications.

Substrate Cleaning Procedure

This section provides information on cleaning solvents and general cleaning procedures for porous and non-porous substrates. One of the key requirements of good sealant adhesion is a clean surface. Residential window and door applications are typically non-structural, so the sealant is not the only component holding the glass in the frame. Non-structural applications do not have the same stringent requirements as structural applications but guidelines for cleaning substrates are included in this section and can be useful for field work, particularly when substrates are dirtier than shop conditions. Proper cleaning is accomplished through the use of the “two-cloth” cleaning method. Always confirm with the supplier of each substrate that the cleaning procedures and solvents are compatible with their material.

Organic Solvent Usage

The proper use of solvents is an important part of the surface preparation requirements for substrates that are to be bonded. Solvents all differ in their effectiveness in removing certain contaminants. Dow will test with the specific solvents selected, and cleaning and priming recommendations will be based on the use of this solvent.

¹This differs from the previously mentioned 21-day cure (See “Sealant Cure Requirements/Cure Time”) in that the sealant is not being applied within the application, but instead is allowed to remain open to atmosphere, and will cure significantly faster.

²Testing performed on common fenestration substrates (glass, wood, aluminum, vinyl, and fiberglass). For unique substrates, contact Dow for peel adhesion testing.

Be aware that certain aggressive solvents can adversely affect finishes such as polyester powder-coated aluminum. Therefore, milder solvents such as IPA (isopropyl alcohol) or high-quality white spirit (greater than 98% pure) can be used without damaging the substrate surface. Check with the substrate supplier for solvent compatibility with their materials.

Always follow the solvent manufacturer's safe handling recommendations and local, state, and national regulations regarding solvent usage.

Non-porous Substrate—Solvent Considerations

Non-porous surfaces must be cleaned with a solvent before the sealant is applied. The solvent used will depend on the type of dirt or oil to be removed and the substrate to be cleaned. Non-oily dirt and dust can usually be removed with a 50% solution of isopropyl alcohol (IPA) and water, pure IPA, or methylated spirit. Oily dirt or films generally require a degreasing solvent such as xylene or white spirit.

Porous Substrates—Solvent Considerations

Porous stone substrates such as granite or marble might not be sufficiently cleaned by solvent cleaning. Depending on the condition of the surface, porous substrates may require abrasion cleaning, solvent cleaning or both. Laitance and surface dirt must be completely removed.

High-pressure water blasting is an effective cleaning method, or a bristle brush with running water may suffice. Porous materials will trap water or solvents after cleaning or priming. Hence, water or solvents used for cleaning must be allowed to evaporate completely before sealant is applied.

“Two-cloth” Cleaning Method

Clean, soft, absorbent, lint-free cloths along with the appropriate choice of solvent must be used. The “two-cloth” cleaning method consists of a solvent wipe followed by a dry, clean cloth wipe to lift and remove the solvent and contaminants suspended in the solvent. Multiple cleanings may be required to properly clean a substrate.

1. Pour or dispense an acceptable cleaning-grade solvent onto the cloth. A plastic (solvent-resistant) squeeze bottle works best for organic cleaning solvents. Do not dip the cloth into the container of solvent, as this will contaminate the cleaning agent.
2. Wipe vigorously to remove contaminants. Check the cloth to see if it has picked up contaminants. Rotate the cloth to a clean area and re-wipe until no additional dirt is picked up.
3. Immediately wipe the cleaned area with a separate clean, dry cloth before the solvent has evaporated. This technique will allow dirt and contaminants suspended in the solvent to be lifted and removed with the second dry cloth. Multiple cleanings may be required to adequately clean a substrate.

Organic solvent must be removed with the dry cloth before the solvent evaporates or the cleaning will be less effective. Some surfaces or weather conditions will allow a small amount of residual organic solvent to remain. If this is the case, the surface must be allowed to dry before continuing with the sealant installation.

Primer Application Procedure

Primers are not typically required in window and door applications. However, occasionally a situation occurs where sealant is needed between a sill and a concrete foundation, for instance. Primers should be used for applications such as this.

DOWSIL™ brand primers should be applied in the following manner only to surfaces that have been properly cleaned and are dry and free of frost:

1. Apply masking tape to the surfaces next to the joint to keep excess primer and sealant off areas where they are not intended.
2. Pour primer into a small, clean container and replace and tighten the cap on the primer container to prevent exposure to atmospheric moisture that will contaminate the primer. Do not pour more than a 10-minute supply into the container at a time to ensure that primer does not get contaminated.
3. Depending on the substrate and job conditions, two different methods can be used to apply the primer. The preferred application is to dip a clean, dry, lint-free cloth into the small container of primer and gently wipe a thin film onto the surface. For “hard-to-get-to” areas and rough surfaces, apply the primer in a thin film with a clean brush.
Caution: Over-priming can cause adhesion loss between the sealant and the primer. If too much primer has been applied, a powdery, chalky, dusty film will form on the surface. Excess primer should be removed by dusting the joint with a clean, dry, lint-free cloth or a non-metallic bristle brush.
4. Allow the primer to dry until all the solvent evaporates. This typically takes 5 to 30 minutes, depending upon the temperature and humidity.
5. Inspect the surface for dryness and over-application of primer.
6. The surface is now ready for application of the sealant. Sealant must be applied the same day the surfaces are primed. Any surfaces primed but not sealed on the same day must be covered to prevent contamination or re-cleaned and re-primed before applying sealant.

Field Applied Sealant

After cleaning and priming (if required), the sealant may then be gunned into the sealant joint. It is critical that the sealant fills the entire joint or cavity and firmly contacts all surfaces intended to receive sealant. If the joint is improperly filled, good adhesion will not be achieved, and sealant performance will be weakened.

Sealant should be applied as follows:

1. Masking tape should be used to keep excess sealant from contacting adjacent areas where it is not intended to ensure an aesthetically pleasing job.

2. Apply the sealant in a continuous operation using a caulking gun or pump. A positive pressure, adequate to fill the entire joint width, should be used. This can be accomplished by “pushing” the sealant ahead of the application nozzle. Care must be taken to ensure complete fill of the sealant cavity.
3. Tool the sealant with firm pressure before a skin begins to form (typically 10 to 20 minutes for DOWSIL™ 791 Silicone Weatherproofing Sealant and seven to ten minutes for DOWSIL™ 1199 Silicone Glazing Sealant). Tooling is important as it forces the sealant against the joint surfaces and improves the contact between the sealant and the surfaces.
4. Remove the masking tape before the sealant skins over.

Reglazing/Field Repair

Window and door units glazed with silicone sealants should be reglazed with silicone sealants. Glazing tapes WILL NOT ADHERE to a glazing leg that has had silicone on it. It is recommended to use DOWSIL™ 1199 Silicone Glazing Sealant, Clear or DOWSIL™ 791 Silicone Weatherproofing Sealant Dark, depending on color needs, when reglazing window units in the field. As these sealants are not readily available at big-box building stores, a high-quality, neutral curing silicone specified for window and door usage is recommended in their absence.

Once the glass is removed from the sash, scrape away excess bead of the old silicone sealant using a putty knife or a flat-bladed screwdriver. **It is not necessary to clean the glazing leg with any chemical** or to remove the entire bead. Only enough material must be removed to ensure the glass fits correctly in the sash or frame.

Once the glass is removed and the glazing leg surface is cleaned of the old sealant and is relatively smooth, the specified silicone sealant can be applied to the glazing leg and the IG unit installed. Glazing beads are then re-installed and the window is completed.



Appendix

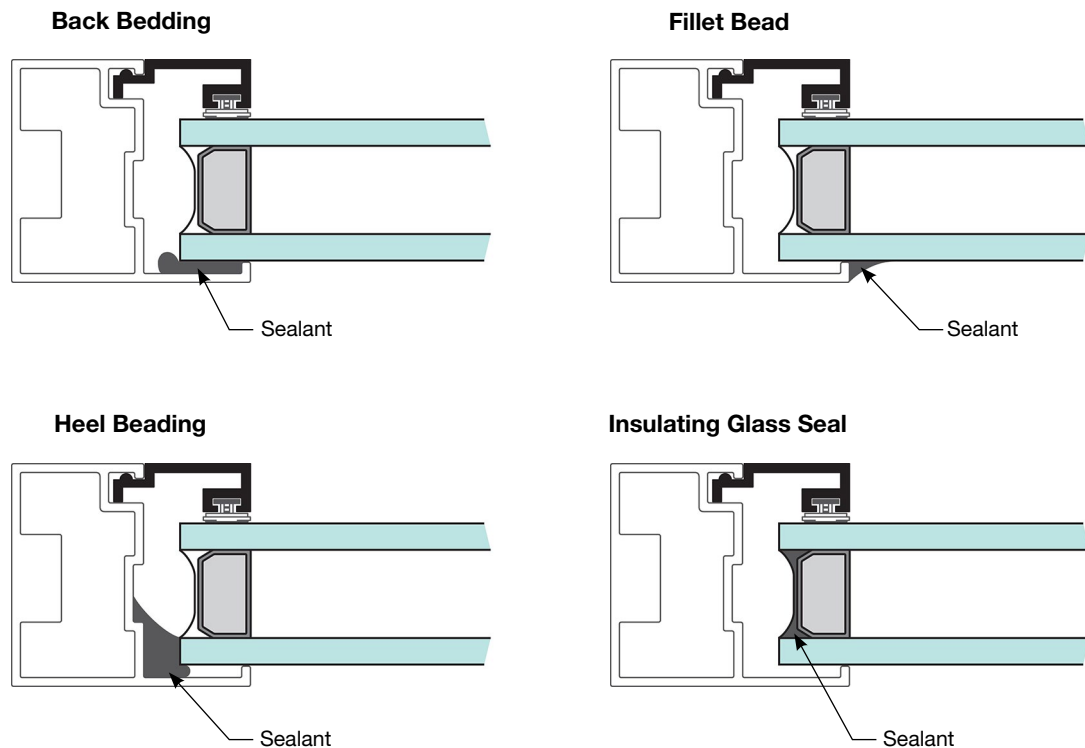
Sealant Selection Table

DOWSIL™ Brand Sealant	Back Bedding	Fillet Beading	Heel Beading	Seam Sealant	Mulling Sealant	Installation Sealant	Structural Sealant ³
DOWSIL™ 1199 Silicone Glazing Sealant	X	X	X	X	X	X	
DOWSIL™ 899 Silicone Glazing Sealant	X	X	X				
DOWSIL™ 9-1350 Silicone Sealant	X	X	X				
DOWSIL™ 791 Weatherproofing Sealant	X	X	X	X	X	X	
DOWSIL™ 995 Silicone Structural Sealant	X		X				X
DOWSIL™ InstantGlaze Window Assembly Sealant	X						
DOWSIL™ InstantGlaze II Assembly Sealant	X						
DOWSIL™ InstantGlaze III Assembly Sealant	X						
DOWSIL™ 2400 Silicone Assembly Sealant	X						
DOWSIL™ 758 Silicone Weather Barrier Sealant						X	
DOWSIL™ 778 Silicone Liquid Flashing						X	

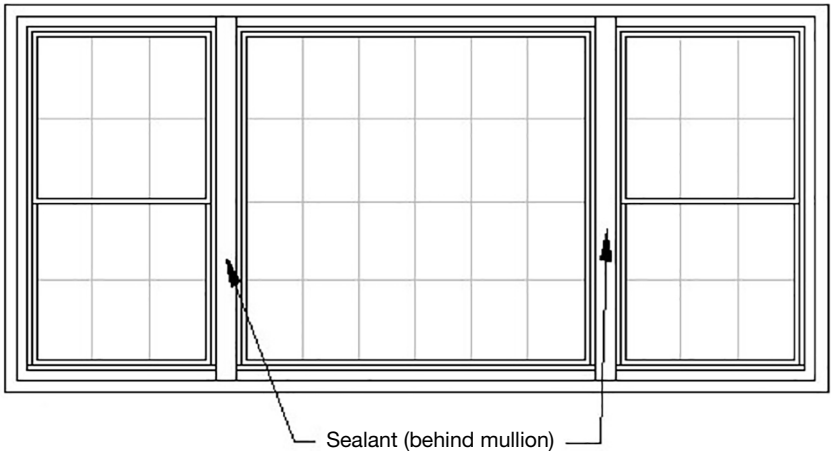
Note: Sealants are shown in the above table in their most common applications. Exceptions and substitutions exist and can be explored based on the customer's needs.

³ Consult the Dow America's Technical Manual for more information on structural applications.

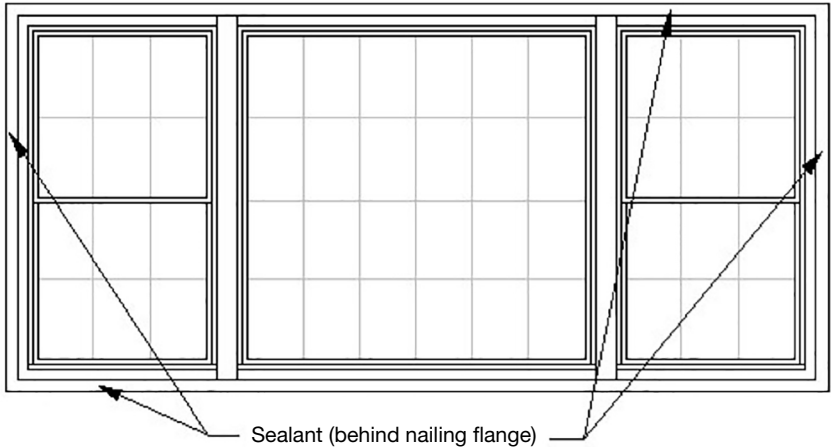
Joint Configurations



Mulling Bead



Installation Seal



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