BUILDING SCIENCE

SSG Manual

Structural Sealant Glazing Technical Manual — ASIA

DOW®

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1. Introduction

Silicone structural glazing is a method utilizing a silicone adhesive to attach glass, metal, or other panel material to the structure of a building. Windload and other impact loads on the façade are transferred from the glass or panel, through the structural silicone sealant to the structure of the building. The silicone sealant must maintain adhesive and cohesive integrity as the façade is subjected to windload and thermal stresses.

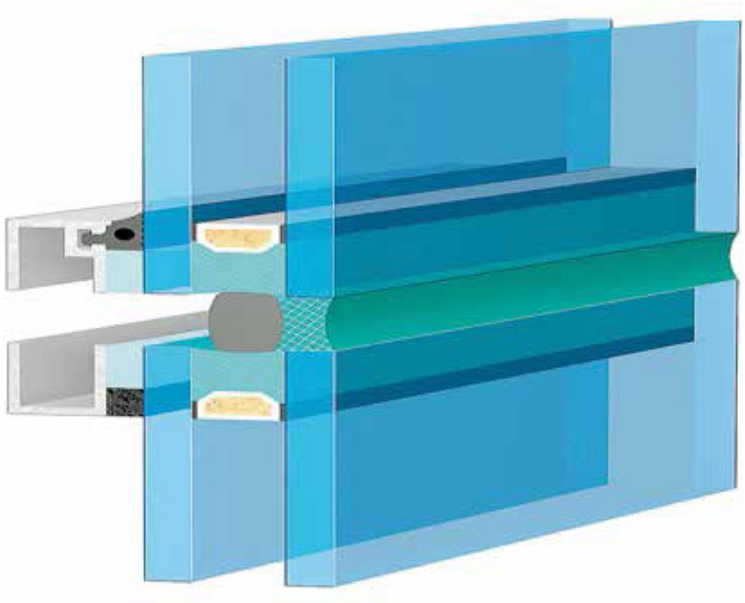


Figure 1: Structural silicones are bonding the exterior glass lites of IGU and whole IGU to the supporting frame.

Structural Sealant Glazing (SSG) is a high-performance application and not all silicone sealants are suitable for this use. Only silicone sealants which have been developed and tested specifically for structural glazing applications should be used. The Dow structural glazing sealants recommended for this application are identified in the next section of this manual.

This manual is intended to give guidance on the proper design and use of Dow silicone sealants in structural glazing applications. The recommendations made in this manual are based on the experience of Dow supporting structural glazing projects for over 40 years. Because structural glazing projects differ in building design, environment and customer requirements, this manual cannot address all possible situations. Dow technical service engineers are available to assist you in your specific project needs.

The success of every silicone structural glazing project is dependent on a partnership between the design professional, sealant user and Dow.

A very important part of this partnership is the implementation and use of the Dow project management service which is detailed below.

1.1 Product Management Service

Because joint designs and materials may vary considerably Dow offers a range of technical services commonly referred to as project management service which allow these variations to be considered prior to the sealant application. Successful structural glazing projects management service contains the following elements:

1.1.1 Print Review

Dow has professional chemists and engineers that are available for consultation on sealant design requirements and product selection. Detailed drawings should be submitted together with project design details (panel size, windload, etc.) in order that a print review can be completed. The structural bite & glueline thickness will be recommended together with comments on weatherseals or other details as required for each project in a written print review report.

Dow must review and approve the structural joint design on every project before commencement of sealant application.

1.1.2 Substrate Testing and Material Approval

Substrates samples to which the structural and weathersealing silicone sealants are required to adhere, including glass, aluminium and stone, should be submitted for adhesion testing. An adhesion report detailing surface preparation and sealant recommendations will be provided.

Glazing accessories which are in direct contact with the silicone sealants, including spacers, gaskets & setting blocks, should be submitted for compatibility testing. A report will be issued detailing whether tested materials are compatible or not.

Note: The supplier of each structurally glazed substrate and spacer must be contacted to approve the use of its material in structural applications. Dow verifies only the adhesive characteristics and compatibility of the silicone sealant to those materials through laboratory testing. A sealant recommendation will be based on this review and results of our laboratory testing. Details of laboratory tests can be refer to clause 3.1.2 in this manual.

1.1.3 Quality Assurance

Dow technical service engineers are also available to conduct training sessions covering all aspects of structural glazing from technical considerations through to sealant application techniques, quality control procedures and glazing quality assurance checks and evaluation. Dow will also assist the sealant user in the development of a comprehensive quality control program as required.

1.1.4 Documentation

Quality control procedures and results must be documented in an easily retrievable fashion. Quality control log templates are provided in the Documentation section of this manual. In subsequent sections of this manual, each of these important elements will be discussed in detail.

1.1.5 Warranty

Subject to satisfactory completion of testing, compliance with recommendation, and satisfactory in house quality assurance, a performance warranty can be issued for structural sealant glazing applications or projects.

2. Dow Product Offering

Dow offers a full range of high-performance structural silicone sealants. Each sealant is developed and tested for a specific application and should only be used as intended unless specifically approved by Dow. Specific product information is available at **dow.com/buildingscience**.

2.1 Structural Glazing Silicone Sealants

When compared to conventional one-component silicone sealants, the fast cure properties of Dow two-component silicone sealants allow for increased production of structurally glazed curtain wall units.

The following Dow silicone sealants are offered for structural glazing applications:

2.1.1 DOWSIL™ 983 Structural Glazing Sealant

DOWSIL™ 983 Structural Glazing Sealant is a two-component, fast-cure, neutral-curing silicone sealant intended for structural bonding of glass, metal and other panel materials. It is a high-modulus sealant with excellent adhesion to a wide range of materials.

DOWSIL™ 983 Structural Glazing Sealant has been tested and passed to ASTM C1184 and GB16776-2025 Structural Sealant Specifications and it has ±25% movement capability in accordance with ASTM C719 test. This higher movement ability allows it to be used for both factory-glazed structural and weatherseal joint applications. It is available in both black and grey colours.

2.1.2 DOWSIL™ 993N Structural Glazing Sealant

DOWSIL™ 993N Structural Glazing Sealant is a two-component, fast-cure, neutral-curing silicone sealant intended for structural bonding of glass, metal and other panel materials. It is a high-modulus sealant with excellent adhesion to a wide range of materials.

DOWSIL™ 993N Structural Glazing Sealant has been tested and passed ASTM C1184, ETAG-002 and GB16776-2025 Structural Sealant Specifications and it has ±25% movement capability in accordance with the ASTM C719 test. This higher movement capability allows it be used for both factory-glazed structural and weatherseal applications. It is available in both black and grey colours.

Figure 2: Two-component sealant (i.e. DOWSIL™ 983 Structural Glazing Sealant or DOWSIL™ 993N Structural Glazing Sealant) requires (adequate air-seal dispense) specialized dispensing equipment to mix the material prior to use. Application is usually limited to factory applied environments.

2.1.3 DOWSIL™ 795 Structural Glazing Sealant

DOWSIL™ 795 Structural Glazing Sealant is a one-component, neutral-curing silicone sealant intended for structural bonding of glass, metal and other materials. It is a medium-modulus structural sealant with excellent adhesion to a wide range of materials. DOWSIL™ 795 Structural Glazing Sealant has been tested and passed ASTM C1184 Structural Sealant Specification and it has ±50% movement capability in accordance with the ASTM C719 test. It is available in black, white, bronze and grey colours.

Figure 3: One component sealants (i.e. DOWSIL™ 795 Structural Glazing Sealant or DOWSIL™ 995 Silicone Structural Sealant) can be used in both factory and jobsite applications

2.1.4 DOWSIL™ 995 Silicone Structural Sealant

DOWSIL™ 995 Silicone Structural Sealant is a one-component, neutral-curing silicone sealant intended for structural bonding of glass, metal and other materials. It is a medium-modulus structural sealant with excellent adhesion to a wide range of materials. DOWSIL™ 995 Silicone Structural Sealant has been tested and passed ASTM C1184 and GB16776-2025 Structural Sealant Specifications and it has ±50% movement capability in accordance with the ASTM C719 test.

When used in a properly design system, it also passed missile impact test and bomb-blast test in accordance with the related test method for protective glazing applications. The available colours are black, white and grey.

2.2 Insulating Glass Silicone Sealants

Dow insulating glass silicone sealants are recommended for insulating glass units which are structurally glazed with Dow structural glazing silicones. Dow insulating glass silicone sealants are designed and intended for insulating glass applications only and should never be used as structural glazing adhesives. For more information on the correct use of silicone sealants in insulating glass applications, please refer to the *Dow Insulating Glass Manual* which is available at **dow.com/buildingscience**.

The following Dow silicone sealants are offered for structurally glazed insulating glass applications:

2.2.1 DOWSIL™ 982 Silicone Insulating Glass Sealant

DOWSIL™ 982 Silicone Insulating Glass Sealant is a two-component, fast-cure, neutral-curing silicone sealant intended for use as a secondary seal in dual or triple glazed insulating glass units.

DOWSIL™ 982 Silicone Insulating Glass Sealant has been tested and passed ASTM C1369 Standard Specification for Secondary Edge Sealants for Structurally Glazed Insulating Glass Units.

2.2.2 DOWSIL™ 3362N Insulating Glass Sealant

DOWSIL™ 3362N Insulating Glass Sealant is a two-component, fast-cure, neutral-curing silicone sealant intended for use as a secondary seal in dual or triple glazed insulating glass units. DOWSIL™ 3362N Insulating Glass Sealant has been tested and passed GB16776-2025 Structural Sealant Specifications, GB24266-2009 and EN1279 Parts 4, the China and Europe standards respectively for insulating glass sealants.

2.2.3 DOWSIL™ 3-0117 Silicone Insulating Glass Sealant

DOWSIL™ 3-0117 Silicone Insulating Glass Sealant is a one-component, neutral-curing silicone sealant intended for use as a secondary seal in dual sealed IG units. DOWSIL™ 3-0117 is appropriate for use in IG units used in structural glazing applications.

2.3 Weatherproofing Sealants

Dow offers a full range of high-performance sealants for weatherproofing applications. Following is a brief description of Dow weatherproofing sealants. These sealants are designed and intended to weatherseal building joints and should never be used as structural glazing or insulating glass adhesives. For more information on the correct use of silicone sealants in weatherproofing applications, please refer to the *Building Envelope Weatherproofing Manual* which is available at your local Dow offices.

2.3.1 DOWSIL™ 991 Silicone High Performance Sealant

DOWSIL™ H.P sealant is a one-component, high-movement capability, neutral-curing silicone sealant designed specifically for weathersealing of sensitive substrates such as natural stone and aluminium panels systems where the aesthetic performance of the sealant is important. Based upon numerous project experiences and in house laboratory testing we are able to confirm this sealant has a much lower potential of staining natural stone and to attract less dirt and atmospheric contaminants that conventional silicone building. It is available in black, white, grey, bronze, limestone and charcoal colours. Custom colour is possible. Please check with Dow representative for details.

2.3.2 DOWSIL™ 791 Weatherproofing Sealant

DOWSIL™ 791 Weatherproofing Sealant is a one-component, high-movement capability, neutral-curing silicone sealant with an excellent unprimed adhesion to most building substrates and is suitable for general weathersealing applications. Available in a wide variety of colours.

2.3.3 DOWSIL™ 790 Silicone Building Sealant

DOWSIL™ 790 Silicone Building Sealant is a one-part, high-movement capability, neutral-curing silicone sealant for use in high movement weathersealing applications. It has excellent primerless adhesion to concrete and most porous substrates. Available in a wide variety of colours.

2.3.4 DOWSIL™ 789 Silicone Weatherproofing Sealant

DOWSIL™ 789 Silicone Weatherproofing Sealant is a one-component, medium-modulus, neutral-curing silicone sealant for general weathersealing applications that has small expected joint movement. This product is mainly marketed in India and Korea. Available in a wide variety of colours.

2.3.5 DOWSIL™ 688 Glazing and Cladding Sealant

DOWSIL™ 688 Glazing and Cladding Sealant is a one-component, high-modulus, neutral-curing silicone sealant for general weathersealing applications that has small expected joint movement. Available in semi-translucent and other pigmented colours.

2.3.6 DOWSIL™ 977 Silicone High Performance Sealant

DOWSIL™ 977 Silicone High Performance Sealant is a one-component, medium-modulus, neutral-curing silicone sealant with an excellent unprimed adhesion to most building substrates and is specifically designed for weatherproofing sensitive porous substrates to reduce substrate staining potential caused by fluid bleed.

2.4 Cleaners and Primers

Dow offers a range of primers that are developed specifically for use with Dow sealants. In some instances, a specific cleaner or primer will be required for the silicone sealant to achieve optimal adhesion to a specific substrate. The following Dow Cleaner and Primers are offered for this purpose.

2.4.1 DOWSIL™ 3522 Cleaning Solvent Concentrated

DOWSIL™ 3522 Cleaning Solvent Concentrated is a cleaner designed for the purging of two-component meter mix equipment used in structural glazing and IG production. The product does not contain halogenated solvent and has been specifically developed to digest cured silicone sealant present in equipment hoses and mixers.

2.4.2 DOWSIL™ 1200 OS Primer

DOWSIL™ 1200 OS Primer is a one-part chemical treatment primer designed for use with Dow sealants in a variety of applications to promote sealant adhesion. It is formulated for low toxicity and meets VOC emission regulation around the world. With newly UV tracer added to this primer it will help the QA inspector visually check the correct application of the priming with the use of a 365nm long waves UV lamp. Please contact Dow for the UV lump details. Note the UV-tracer will be visible for some days and will automatically disappear with time.

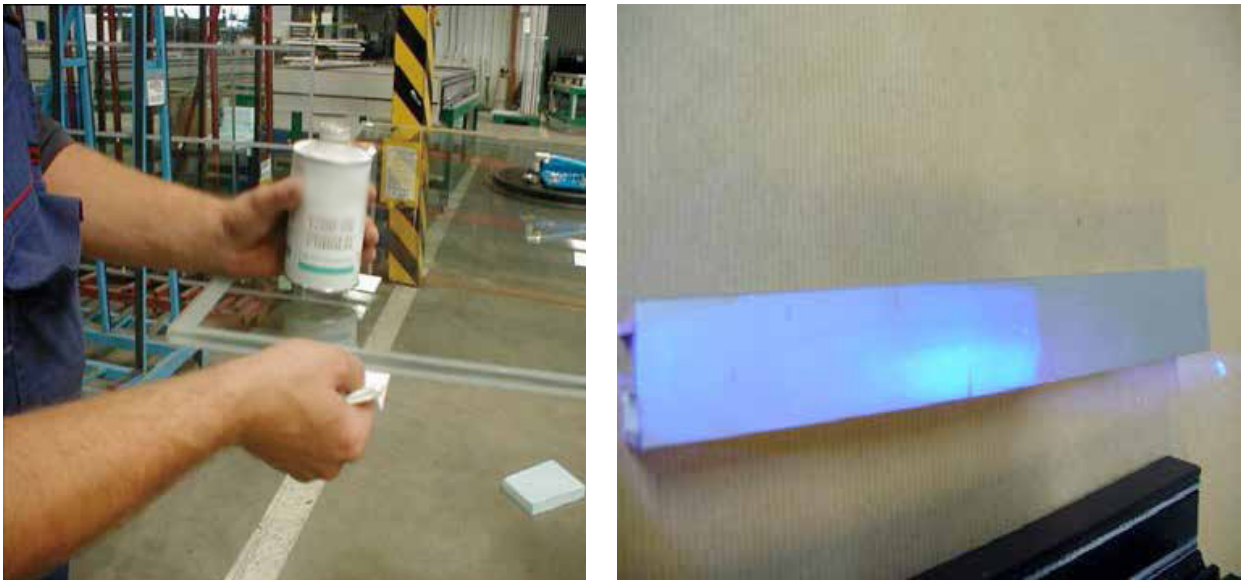


Figure 5: DOWSIL™ 1200 OS Primer or DOWSIL™ Primer-C OS is applied by cloth wiping onto the substrate.
With proper UV lamp which can help the QA inspector visually check the correct application of the UV traceable priming.

2.4.3 DOWSIL™ Primer-C and DOWSIL™ Primer-C OS

DOWSIL™ Primer-C and DOWSIL™ Primer-C OS are a one-part chemical treatment primer designed for painted and plastic surfaces to promote sealant adhesion development. DOWSIL™ Primer-C is manufactured in Japan and DOWSIL™ Primer-C OS is manufactured in the US. Adhesion development was consistently faster with these Primers. DOWSIL™ Primer-C OS VOC content meets the green building norm and it had a UV tracer that allows a QA inspector to visually check the correct application of the priming with the use of a 365nm long waves UV lamp.

DOWSIL™ Primer-C or DOWSIL™ Primer-C OS is not recommended for EIFS as the carrier solvent (ethyl acetate or methyl acetate) dissolves the EP board beneath the EIFS basecoat. It is also not suitable for the substrates without organic coated finish such as clear glass, tinted glass, natural anodized aluminium, stainless steel or galvanized mild steel.

2.4.4 DOWSIL™ Construction Primer P

DOWSIL™ Construction Primer P is a one-part film forming primer designed for use on porous substrates (i.e. Concrete or stone) in weathersealing applications.

Figure 6: DOWSIL™ Construction Primer P is a film forming primer which can be applied onto concrete substrates with a brush.

3. Project Management Service

Dow professionals are available to assist you in selecting the best sealant for your specific application. All silicone structural glazing applications using DOWSIL™ adhesive or sealants must be reviewed on a project-specific basis by our technical service staff prior to any product selection. The review and testing must be successfully completed, along with factory or site QA documentation, before Dow will issue a warranty. A project submission form is included with this manual for your use. Additional forms are available from any Dow representative. The following services are offered by Dow. For an overview of the process steps, please refer to the "3.4 Dow Project Management Service Workflow Diagram" later in this section.

3.1 Product Recommendation

Dow will make a project specific product recommendation once the following steps have been taken:

3.1.1 Print Review

Dow must review all structural details before approving the use of our structural sealants in all structural glazing applications. Typical horizontal and vertical details, plus any non-typical details should be submitted for review. Also provide elevation drawings indicating glass dimensions and design windload values for the building. Dow has found that a few underlying principles are critical to consider in virtually all joint designs using silicone sealants. Dow will review joints for compliance with these underlying design principles, provide suggestions or changes and/or identify limitations of the designs. It will also allow Dow's technical staff to check that all components that will need to be tested as part of the project review have been supplied. This will include bonding substrates, spacers, setting blocks, gaskets etc.

The joint design data can be provided either through a fill-in hardcopy Project Checklist or enter it through the Dow Construction On-Line (COOL) system which can be accessed through Dow's premier website. Please contact your local Dow construction office for more information.

Dow will review your Project Checklist (refer to "5.4 Documentation" of this manual) and structural joint dimensioning within 14 working days if provided electronically or through Dow COOL system described above. 7 working days respond time is committed for our Quality Bond™ customers.

3.1.2 Substrate Testing and Material Approval

Dow must approve the use of our sealants on all substrates and materials which contact the structural silicone sealant. The supplier of each structurally glazed substrate and spacer must be contacted as well to approve the use of its material in structural applications. Dow verifies only the adhesive characteristics and compatibility of the silicone sealant to those materials through below laboratory testing.

3.1.2.1 Adhesion Testing

Dow will evaluate the adhesion of our product to materials representative of those to be used on the project (i.e., glass, metal, masonry, composites, etc.) using a modified ASTM C794 peel adhesion test. All samples submitted for testing should be a minimum of 200 mm in length. For example, for aluminum extrusions, supply one 200 mm sample for each sealant to be tested. For glass, one standard 300 mm by 300 mm sample is sufficient. Upon completion of testing, Dow will provide a written product recommendation, surface preparation and priming recommendations. Testing takes four (4) weeks from receipt of samples.

3.1.2.2 Compatibility Testing

Chemically incompatible glazing accessories (gaskets, spacers, setting blocks, etc.) can lead to sealant discolouration and/or loss of sealant adhesion to the substrate. To ensure a product's suitability, Dow tests the compatibility of job site representative accessory materials with its silicone sealants using ASTM C1087. For each sealant to be tested, supply 100 mm minimum length of the gasket, spacer or setting block. Results of the compatibility test will be forwarded in writing. Testing takes four (4) weeks from receipt of samples.

3.1.2.3 Non-stain Testing

If natural stone is being used on the project, Dow can test and evaluate the performance of its sealants to determine if fluid in the sealant has the potential to migrate into porous substrates such as granite, marble, travertine and limestone. Job site representative samples of the stone need to be tested using a modified ASTM C1248 procedure. For each stone type and sealant to be tested, supply two samples of the dimension 25 mm by 75 mm. Larger samples should be cut to proper size for testing to avoid testing delay. Testing takes six (6) weeks from receipt of samples.

3.1.2.4 Other Laboratory Testing

Dow may provide non-standard testing such as analytical testing or H-piece testing of production samples. In such cases, a service fee may be charged. Prior to beginning the project, please contact your local Dow construction office for a service fee schedule.

3.1.2.5 Sample Submission

For prompt processing of all testing requests, enter materials for testing through Dow Construction On-Line System (COOL) which can be accessed through Dow premier website. Please contact your local Dow construction office for more information. A *Structural Glazing Project Testing Submission* form is available in this document under "5.4 Documentation" of this manual. Testing samples should be sent to the following location at your convenience:

Dow (China) Holding Co, Ltd
1077 Zhangheng Road Zhangjiang Hi-Tech Park
Pudong District, Shanghai
Attention: Construction Sealants Testing Lab

Dow India Private Limited
6th Floor, Scorpio House Opp Galleria Hiranandani Business Park
Powai, Mumbai 400076 Maharashtra. INDIA

3.2 Quality Assurance

Dow performs extensive quality assurance testing in our manufacturing facilities in accordance with rigid ISO 9000 standards. Product COA (certification of Analysis) done by our Dow quality assurance engineer is available when requested by an end user to enable traceability of each batch of silicone sealants that we supplied.

Dow also provides applicator and quality assurance training plus any routine sealant enquires throughout the project. In order for a silicone sealant to perform as designed it must adhere to the building substrates. It is recommended that regular jobsite adhesion testing be performed to confirm that good adhesion is obtained consistently on actual job site substrates. Information and literature on field adhesion testing and Dow application procedures are also covered in this manual in the later section.

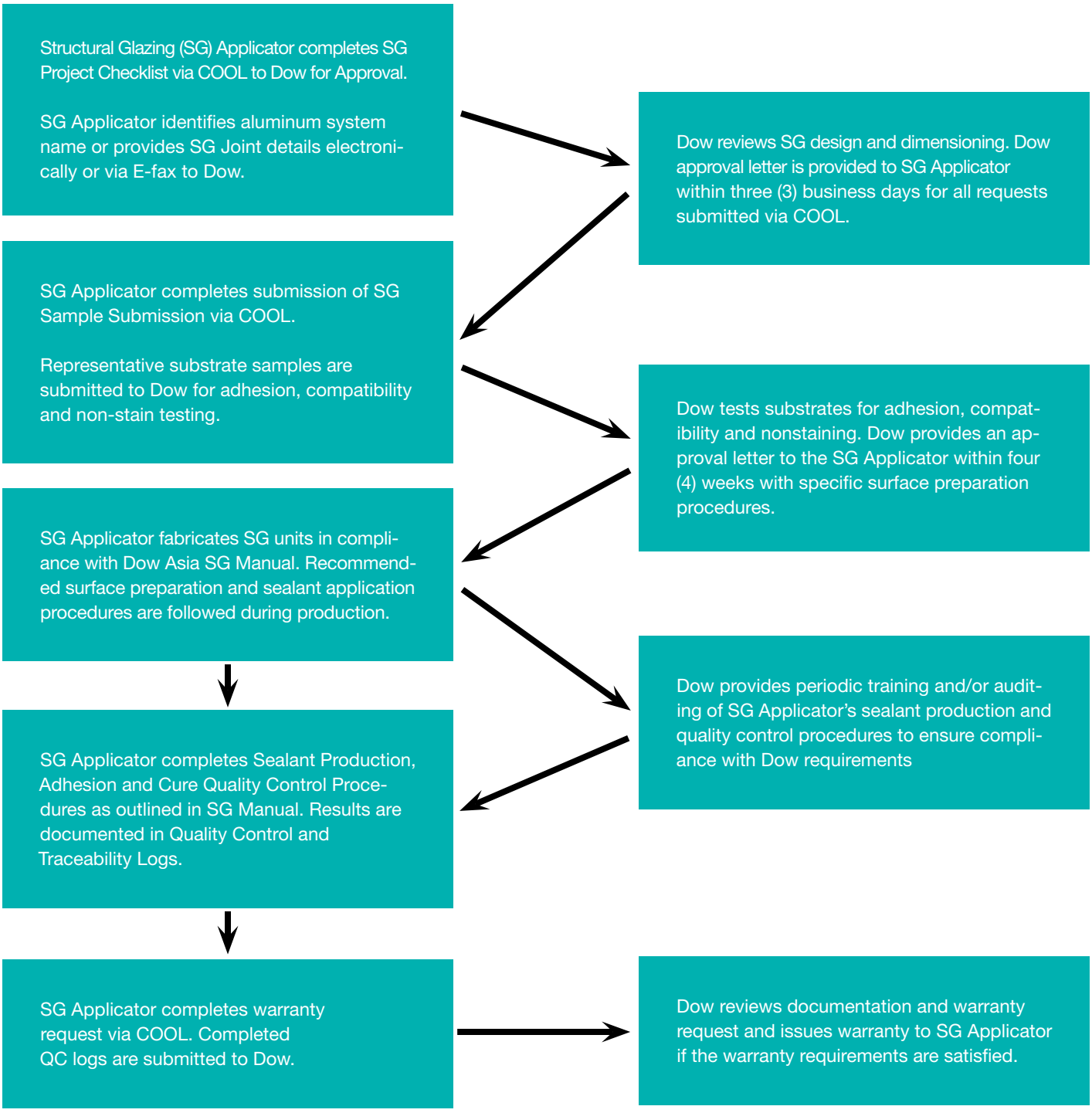
Additionally, throughout the project, Dow suggests that random deglazing be carried out to confirm that good adhesion and joint fill are achieved in practice. A deglaze involves cutting through the cured structural silicone sealant in order that the glass and frame can be separated. This allows adhesion to both glass and aluminium frame to be tested, and the structural bite and sealant glueline joint dimensions to be measured. This quality assurance test is particularly important at the start of the project to identify any workmanship, application or substrate issues. Details of deglaze testing is mentioned in the "5.0 Quality Control" section later in this manual.

3.3 Warranty

Dow offers a project specific Structural Adhesion Limited Warranty for projects using Dow structural glazing silicone sealants. Please contact your Dow construction office for more information on the warranties available. To obtain a warranty, the following steps must be completed:

1. Dow must approve in writing all materials which contact the Dow structural glazing sealant for adhesion and compatibility.
2. Dow must approve in writing the structural glazing joint design.
3. All daily quality control logs must be submitted and approved by Dow.
4. The sealant users must fill-in and submit the warranty request form to your local Dow contact or enter such request through Dow COOL system.

3.4 Project Management Service Workflow Diagram



3.5 Quality Bond™ Program

Quality Bond™ is designed to enhance your partnership with Dow, bringing tangible business benefits to you. Quality Bond members will be fabricators and OEM's of structural and insulating glazing who will be expected to employ best practice and quality workmanship through high level support from Dow in terms of training, audits and certification.

A key objective of Quality Bond is that members will be able to differentiate themselves in the market through the use of the tools that Quality Bond will provide. First launched in Europe and then in Korea, India, Greater China and in ASEAN.

The table below gives a brief introduction to some of the benefits.

Quality Bond™ Element	Before Quality Bond™	After Quality Bond™
1. Raising Industry Standards-know how	Experience gained on each job remains with OEM	Formal training by Dow once a year to ensure transfer of best practices
2. Safety	Product review only upon request	OEM must pass mandatory annual formal audit to maintain certification
3. Project testing	Minimum standard met	Improved quality assurance through more rigorous testing protocol
4. Reliability	Standard Warranty	Includes production and application coverage
5. Promotion at specifier level	Limited	Active promotion of certified Quality Bond™ members
6. Specific marketing support	Dispersed	Focus on members and featured projects

To become a Quality Bond™ member there is a need to pass an audit which is carried out at the OEM's premises. Prior to which training will be given on all aspects of the audit which will include but will not be limited to quality assurance, traceability and application. The audit is typically conducted through the use of an audit checklist, which will be the basis for an official evaluation report accompanied by comments and potential suggestions for improvement.

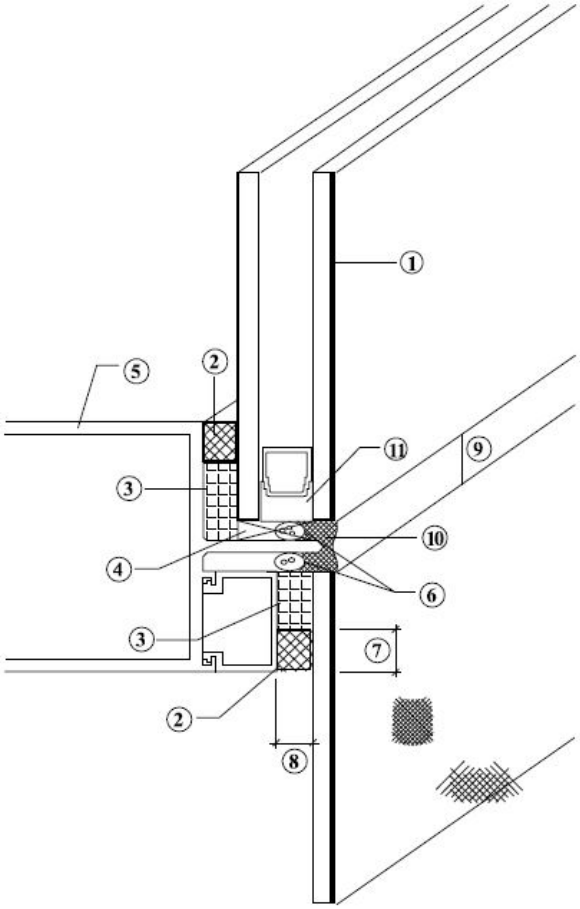
If the audit is not passed, there will be a re-audit based upon suggestions within this report for improvement. Certification will follow a successful audit, valid for one year. At least 2 audits generally will be conducted by Dow in order to validate this one year certification.

For more information about Quality Bond please contact your Dow local representatives or visit **qualitybond.com**.

4. Structural Glazing Design and Material Considerations

4.1 Structural Glazing Design

A structural glazing joint must be properly designed for the sealant to function as intended. If a joint is improperly designed, the sealant stresses may be excessive potentially causing failure. Therefore, all Silicone Structural Sealant Glazing (SSG) joint dimensioning must be approved by Dow.



1. Insulating Glass
2. Structural Silicone Sealant
3. Spacer
4. Setting Block
5. Transom
6. Back-up Material
7. Structural Bite
8. Glueline Thickness
9. Weatherseal Width
10. Weatherseal (Silicone)
11. Insulating Glass Sealant

Figure 7: Joint Composition

4.1.1 Structural Glazing Terminology

4.1.1.1 Structural Bite

Structural bite, shown in above and following Figures 7 and 8, is the minimum width or contact surface of the silicone sealant on both the glass panel and the frame. The design windload, glass panel dimensions, impact loads, dead load and thermal dilatation stresses must be considered in the determination of the structural bite dimension.

4.1.1.2 Glueline Thickness

Glueline thickness, as shown in above and following Figures 7 and 8, is the distance from the panel to the frame. Proper thickness facilitates the installation of the sealant and allows reduced sealant stress from differential thermal movement between the glass panel and frame. Thickness in a structural silicone joint is often referred to as glueline thickness.

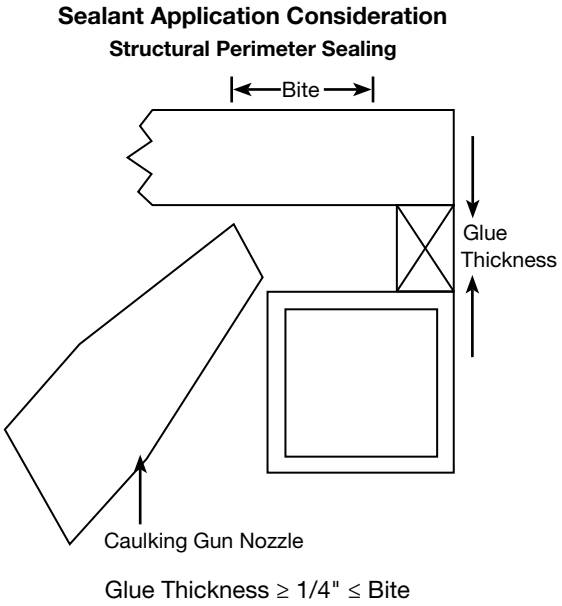


Figure 8: Sketch showing structural sealant bite and glue line thickness.

4.1.1.3 Factory Glazing vs. Site Glazing

Factory glazing refers to the construction of the structurally glazed components within a controlled environment which is protected from the weather and site debris. This is generally referred to as a unitized glazing system. Glass (or other) panels are bonded to a frame within the factory; then the frames are transported to site after full cure and are mechanically fastened to the curtainwall.

Site glazing refers to a curtainwall system that panels are glazed on to mullions and transoms which are already fixed to the building frame. The fixing method can be by mechanical support in glazing channels or by bonding with silicone sealant or a combination of both.

Since structural glazing applications can also take place at the building site, environment conditions must be suitable at the time of glazing. Panels that are structurally glazed to the curtainwall or window frame must be secured mechanically until the structural joint has fully cured and adhered.

4.1.1.4 L-Joint vs. Split Joint

There are two popular joint designs the first being a split joint and the second an L-joint. Whilst both designs are acceptable their performance in structural application is not.

By definition split joints are defined as structural joints where the structural joint is separated from the weather seal on the glass edge by either a glazing tape, spacer or backing rod. (Refer to Figure 9) In a L-joint the structural joint and weatherseal are a continuous joint around the edge of the glass panel, (Refer to Figure 10).

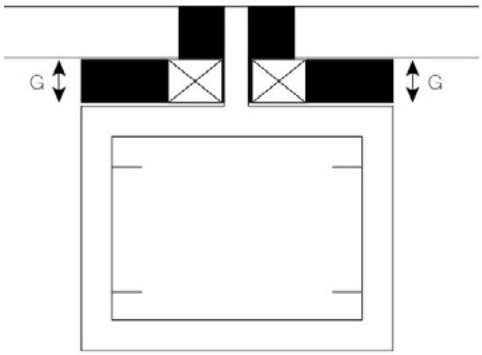


Figure 9: Split joint configuration design

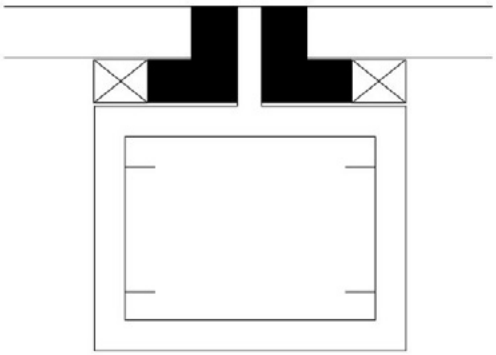


Figure 10: L-Joint configuration

L-joints are not a good joint configuration especially for insulating glass units and hence are not recommended. Firstly, the joint is deep and difficult to completely fill with structural silicone.

Secondly, the movement of the insulating glass unit is limited and the long-term performance of insulating glass unit may be affected when additional stress is induced by direct contact with another sealant. This is why many insulating glass unit manufacturers recommend that the weatherseal do not or only partially contact the secondary seal. If the system designer requires the use of an L-joint with insulated glass units they must consult with the insulated glass manufacturer to confirm that their warranty will not be affected.

4.1.2 Structural Glazing Joint Dimensioning Guidelines

Following are guidelines that apply for all Structural Glazing projects. Dow must review and approve all Structural Sealant Glazing (SSG) joint dimensioning. All exceptions must be handled on a project-specific basis and documented in writing by the Dow Technical Service Representative.

- The structural bite must be a minimum of 6 mm.
- The glueline thickness must be a minimum of 6 mm.
- The bite-to-thickness ratio should be between 1:1 and 3:1 See Figure 11.
- The structural bite must be equal to or greater than the glueline thickness. See Figure 12.
- The SSG joint must be able to be applied and tooled using standard sealant application procedures.
- The SSG joint design must allow the sealant exposure to air so that it can cure and achieve full physical properties.
- Medium/High-modulus neutral-curing silicone sealant is more suitable for the SSG use. See Figure 12.

The above guidelines are minimum requirements and exclude any application tolerances.

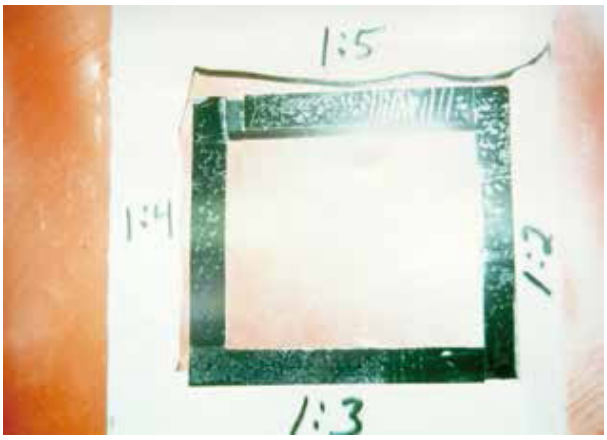


Figure 11 indicates Structural Bite: Glueline Thickness from 1:2 (right) to 1:3 (bottom) will allow for ease of access to ensure a complete joint fill. The poor joint fill for 1:4 & 1:5 can be seen in the above figure.

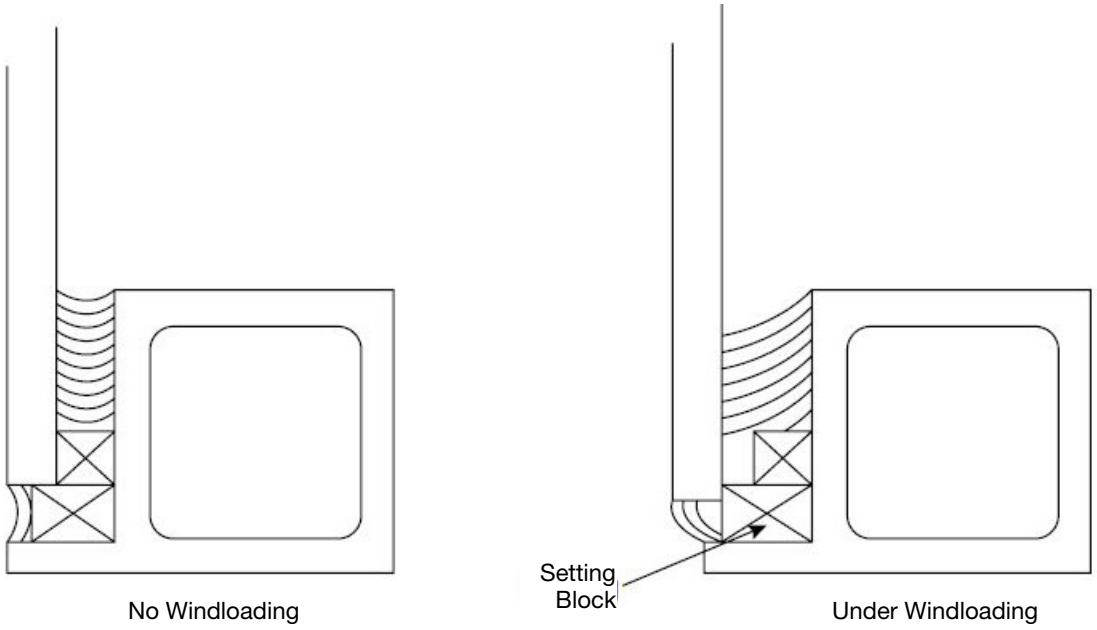


Figure 12: Low-modulus Sealant has excess movement and could lead to the glass jumping out the support frame underneath, this is why Medium/High-modulus sealant is more suitable for the Structural Sealant Glazing (SSG) use.

4.1.3 Windload and Glass Dimension

The structural bite requirement is directly proportional to the windload on the building and the dimension of the glass. The higher the windload and the larger the dimensions of the glass are, the greater the amount of structural bite required. The structural bite must be sized appropriately to allow the windload on the glass or panel to be transferred to the structure. The structural bite for windload (live load) is calculated using the specified windload, glass or panel dimension and sealant design strength of 20 psi (or 138 kPa).

4.1.4 Structural Bite Calculation for Windload

$$\text{Minimum Structural Bite (mm)} = \frac{\text{Glass Short Span Dim. (mm) x Windload(kPa) x 0.5}}{\text{138 kPa or 140 kPa}}$$

Glass Short Span Dimension (SSD) is the shorter of the two dimensions of the rectangular glass panel for example, on a 1.5 m by 2.5 m glass panel, the SSD is 1.5 m.

- Windload shall conform to industry rule or regulation from project countries. The value is provided by the design professional to DOW.
- Typical design strength for live load is 138kPa (140kPa). Dow can support the use of 210kPa for tensile live load design strength provided that the following are met:
- The minimum structural sealant bite is 12mm, that is, if the bite calculated after using 210kPa design strength is less than 12mm, use 12mm. Otherwise, use the calculated sealant bite.
- High performance sealants are used such as:
  - o DOWSIL™ 983 Structural Glazing Sealant
  - o DOWSIL™ 795 Structural Glazing Sealant
  - o DOWSIL™ 993N Structural Glazing Sealant
  - o DOWSIL™ 121 Structural Glazing Sealant
  - o DOWSIL™ 995 Silicone Structural Sealant
- There is evidence of engineering. i.e. The customer has confirmed that proper engineering has been employed in the design of other elements of facade, like the glass and aluminum.

4.1.5 Structural Bite Calculation for Deadload

In unsupported Structural Sealant Glazing (SSG) designs, the deadload weight of the panel is supported by the structural silicone joint, see Figure 13. This situation commonly occurs when structural glazing is used on monolithic glass. Dow Silicone Structural Glazing sealants can support the weight of the glass provided stresses do not exceed the allowed design stress for deadload.

Provided the horizontal frame members are as rigid as the vertical members, Dow will consider both the vertical and horizontal or long edges of the frame in the deadload calculation. If the horizontal frame members will not support the glass under windload, only consider the vertical frame members in the calculation.

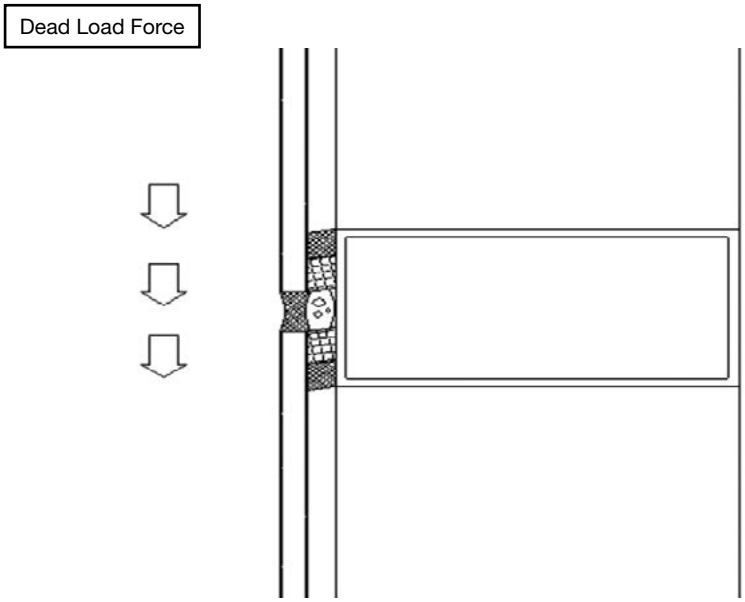


Figure 13: The deadload weight of the upper glass panel is supported by the structural silicone joint.

Structural Bite Calculation for Deadload

$$\text{Minimum Bite (m)} = \frac{2{,}500\ \text{kg/m}^3 \times 9.81\ \text{m/s}^2 \times \text{Glass Thickness (m)} \times \text{Glass Cross Area (m}^2\text{)}}{[2 \times \text{Height (m)} + 2 \times \text{Width (m)}] \times \text{Allowable Design Stress (Pa) for DL}}$$

- 2,500 kg/ m^3 is the specific mass of float glass corresponding to approximately 25,000 N/m3 of specific weight.
- 9.81 m/s^2 is a factor for gravity.
- The max allowable design stress for deadload for DOWSIL™ 983 Structural Glazing Sealant, DOWSIL™ 993N Structural Glazing Sealant, DOWSIL™ 795 Structural Glazing Sealant, and DOWSIL™ 995 Silicone Structural Sealant are 7,000 Pa.
- If the horizontal frame members will not be supporting the glass or will deflect under the deadload of the glass, just consider 2 x Height (m) in the denominator of the calculation.

For example, a 1.219 meter by 2.438 meter lite of monolithic glass at a weight of 14.8 kg/m^2 will have a weight of 43.97 kg and a glass perimeter of 7.314 meters. Based on 7,000 Pa (or 703 kg/m^2) deadload design strength, a bite of 9 mm is required.

4.1.6 Glueline Thickness

Proper glueline thickness facilitates the installation of sealant and allows reduced stress on the structural joint resulting from differential thermal movement. A minimum glueline of 6 mm is required, but as the structural bite increases, the glueline should be increased to allow the sealant to be applied easily and the panel to expand and contract when subjected to thermal movement. If structural bite requirements exceed 19 mm, the glueline thickness should be increased to a dimension greater than 6 mm. To facilitate filling of the structural joint, the bite to glueline thickness ratio should be maintained at 3 to 1 or less.

All panels that are structurally glazed undergo repeated expansion and contraction due to variation in temperature. See below Figure 14. Glueline thickness must be properly designed to accommodate these movements. The thermal movement can be calculated for any panel or framing member if the length of the material, material type, (e.g. glass, aluminum) and coefficient of thermal expansion (CTE) is known.

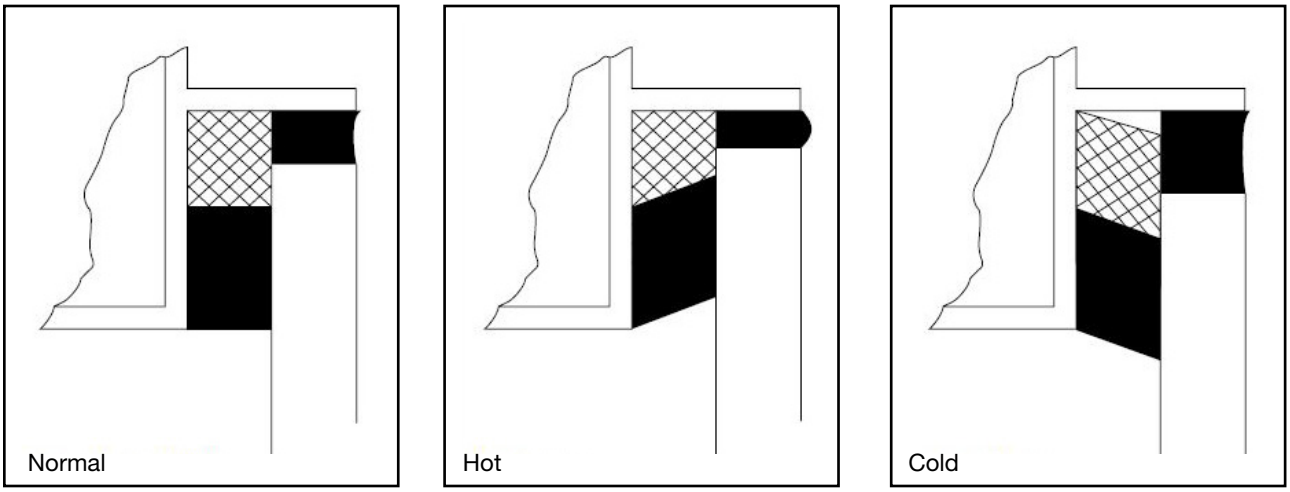


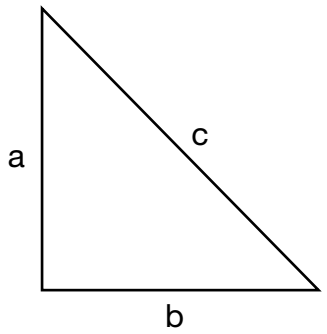
Figure 14: Panel expansion/contraction due to temperature variation. The resulting joint distortion induces shear stress in the structural sealant.

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

Movement (mm) = Panel Length (mm) x CTE (mm./mm./°C) x Temperature Change (°C)

For example, for a 2000 mm by 2000 mm high lite of glass fixed at the sill and a temperature change of 60°C, glass with a CTE of 9 x 10^{-6} will show movement of 1.08 mm. Aluminum with a CTE of 23.2 x 10^{-6} will move 2.78 mm Differential movement between the glass and aluminum will be 2.78 mm minus 1.08 mm or 1.7 mm.

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



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

where a = original glueline
b = joint movement
c = new glueline after joint movement

For the example discussed above where differential movement of 1.7 mm (b) is expected, and the sealant has an original glueline thickness of 6 mm (a), the sealant will elongate to a new glueline thickness of 6.236 mm (c). Extension of the sealant from 6 mm to 6.236 mm will be 4%.

For DOWSIL™ 795 Structural Glazing Sealant, DOWSIL™ 995 Silicone Structural Sealant, DOWSIL™ 983 Structural Glazing Sealant, DOWSIL™ 993N Structural Glazing Sealant, maximum extension from thermal expansion are 15% in any structural silicone joints. The lower allowable movement capability in structural joints is due to the joint design, where the joint width, or glueline is less than the joint depth or structural bite. This is the reverse situation to weatherseals, which have higher movement capability.

NOTE: 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 glass panel or in the case of an unsupported system where the thermal movement can be taken by the glass in both directions. This will need to be taken into consideration when designing the sealant joint dimensions.

4.1.7 Structural Silicone Used in Shear

Structural silicone can be used in shear for live load applications at the same design strength (138 kPa) as it is used in tension. This application encompasses Total Vision Systems (Fin Glazing), some skylight designs and the use of the silicone to reinforce the structure through diaphragm loading. The modulus of the structural silicone in shear is lower than in tension (consider the calculations through the Pythagorean Theorem from the “Glueline Thickness” section of this manual). Therefore, combinations of shear and tension loading cannot be added without understanding the stress-strain relationship of each joint. Contact Dow technical service for more information.

4.1.8 Splice Joints in Curtainwalls

Splice joints in aluminum curtainwall framing are the highest-movement, fastest-moving joints on a curtainwall system. Splice joints absorb the thermal expansion of 4 m to 5 m of aluminum framing exposed to the building’s exterior on a daily basis. Field-installed stick curtainwalls use splice joints to also absorb building deflection, live loads and wind sway.It is best to avoid splice joints within a structural joint. Placing 4 m to 5 m of aluminum frame thermal movement and live load deflection of the floor into the shearing of a 6 mm wide structural silicone joint will:

1) Exceed the design stress of the silicone, causing fatigue;

2) Place excessive loading onto glass, causing possible failure; or 3) cause premature fogging of the insulating glass unit.

If splice joints cannot be avoided within a structural silicone joint due to the requirements of field-applied structural silicone in a stick system, then the splice joint should be applied to within 25 mm of the head of a piece of glass. If silicone failure occurs due to excessive joint movement, a minimum of forces will be placed onto the glass due to the placement.

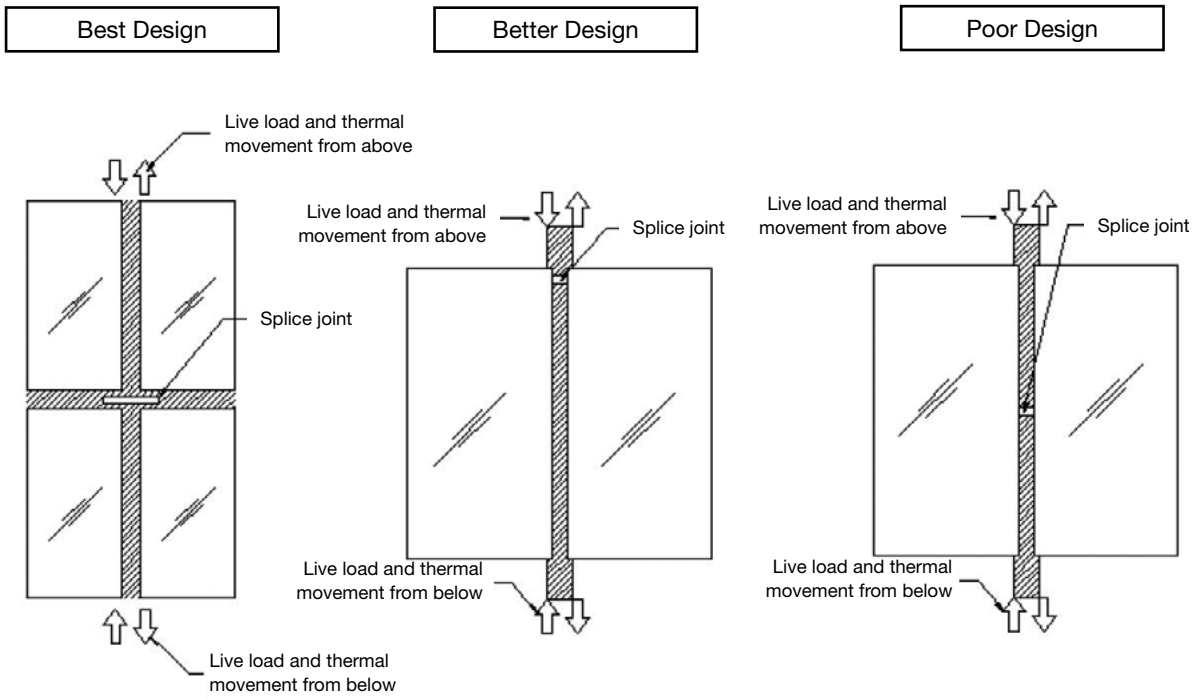


Figure 15: Splice joints in curtains walls

4.1.9 International Structural Sealant Glazing Design Guidelines

Below are international standards or guideline that related to Structural Sealant Glazing design:

- ASTM C1401-14 Standard Guide for Structural Sealant Glazing
- ASTM C1249-06a (2010) Standard Guide for Secondary Seal for Sealed Insulating Glass Units for structural Sealant Glazing Applications

- ETAG002 – 2005 Guideline For European Technical Approval For Structural Sealant Glazing Kits (SSGK)
- EN13022-1 Glass in Building – Structural Sealant Glazing – Part 1: Glass Products For Structural Sealant Glazing Systems for Supported and Unsupported monolithic and multiple glazing
- EN13022-2 Glass in Building – Structural Sealant Glazing – Part 2: Assembly rules
- EN15434 Glass in Building – Product Standard for Structural and/or ultra-violet resistant sealant (for use with structural sealant glazing and/or insulating glass units with exposed seals
- JGJ102-2013 Technical Code For Glass Curtain Wall Engineering
- Hong Kong Architectural Service Department General Specification For Building, 2012 version: Section 16 Curtain Wall & Section 20 Glazing
- ISO 28278-1: 2011 Glass in Building – Glass Products For Structural Sealant Glazing – Part 1: Supported and Unsupported monolithic and multiple glazing
- ISO 28278-2: 2010 Glass in Building – Glass Products For Structural Sealant Glazing Part 2: Assembly Rules
- ASTM C1564-04 (Reapproved 2009) Standard Guide for Use of Silicone Sealants for Protective Glazing Systems
- ASTM C1392-00 (Reapproved 2014) Standard Guide for Evaluating Failure of Structural Sealant Glazing
- ASTM C1394-03 (Reapproved 2012) Standard Guide for In-situ Structural Silicone Glazing Evaluation
- ASTM C1487-02 (Reapproved 2012) Standard Guide for Remedying Structural Silicone Glazing
- ASTM C1564-04(2009) Standard Guide for Use of Silicone Sealants for Protective Glazing Systems

4.1.10 Finite Element Analysis of Structural Sealant Glazing Design

Finite Element Analysis (FEA) is commonly used as an engineering tool for many industries. Benefits of FEA include increased accuracy, enhanced design and better insight into critical design parameters, virtual prototyping with increased productivity and reduced design risk.

In a structural simulation, FEA allows detailed visualization of where structures bend or twist, and indicates the distribution of stresses and displacements that allows entire designs to be constructed, refined, and optimized before the design is manufactured. This powerful design tool has significantly improved both the standard of engineering designs and the methodology of the design process in many industrial applications.

Dow first published an FEA study back in 1998, titled *Finite Element Analysis of a Structural Silicone Shear Bead used in Skylight Applications*. In that article, FEA (ANSYS) 3D and 2D models were used in predicting stresses and strains in a 6 mm x 6 mm DOWSIL™ 795 Structural Glazing Sealant structural silicone joint on the edge of a glass skylight.

In recent years, FEA model were used in supporting many special construction applications or projects with Dow construction products such as cold bent glass sealant joint stress evaluation, U-type bonding joint, trapezoidal silicone joint geometry, seismic Structural Sealant Glazing (SSG) performance and crystal clear silicone adhesive point bonding studies.

Please contact Dow local office or Dow representative should you have any questions related to above studies or FEA application with structural sealant joint design.

4.2 Structural Glazing System Types

There are many different types of structural glazing systems available. Common to all of these systems are that structural silicone sealant is used to structurally attach glass or another material to the building structure. Some of the more common types of systems are discussed in this section.

4.2.1 Four (4) Sided Structural Glazing

4-sided structural glazing is the most common and usually most cost efficient type of structural glazing system used in Asian countries where glass is supported on all four edges of the glass with structural silicone. See Figure 16. 4-sided SSG systems are typically fabricated in a production facility and erected at a jobsite.

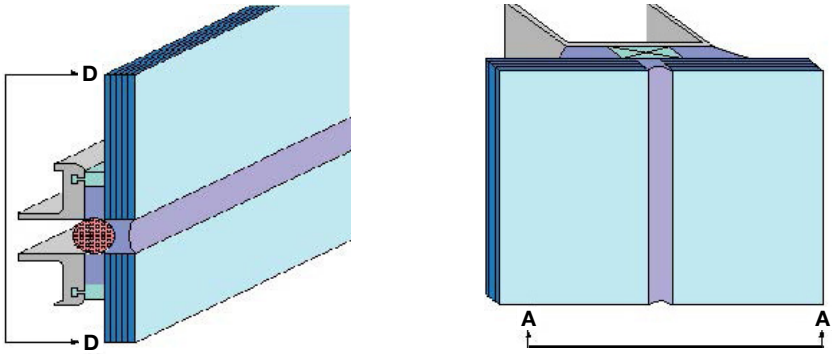


Figure 16: Typical Four (4) sided structural glazing transom and mullion details.

4.2.2 Two (2) Sided Structural Glazing

2-sided structural glazing systems use structural silicone on two of the four sides of the glass. The other two sides of the glass are either mechanically supported or are not structurally supported by a frame. 2-sided Structural Sealant Glazing (SSG) systems are fabricated in a production facility or at the jobsite.

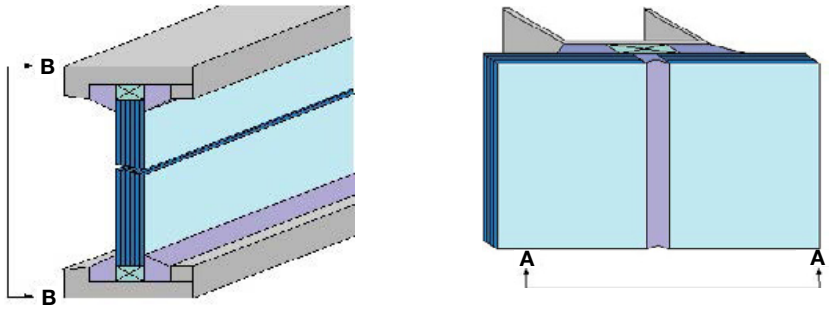


Figure 17: Typical two (2) sided structural glazing system where mullion details (right side) using structural sealant glazing with mechanical captive at glass head/sill.

4.2.3 Sloped Glazing

Sloped glazing is a form of structural glazing used in skylights and similar non-vertical applications. Conventional structural glazing guidelines can be followed for slope glazing with few modifications. The structural glazing calculation takes into account the weight of the glass counteracting the negative design windload on the building (inward sloping). The flatter the slope of the glazing system the greater the reduction in the windload effect on the structural joint.

Glass that is sloped outward from vertical, such as is common in airport control towers, imposes a deadload upon the glazing that must be added to the windload when there is intimate contact with setting blocks. If the outward slope is greater than 15 degrees from vertical, it is prudent to perform your calculations as if the entire weight of the glass is supported by the silicone. If there are no setting blocks, the entire lite is supported by the structural silicone. The design load on the silicone for live and deadload must be determined and the bite dimension sized appropriately. For these designs, contact your Dow construction professional for further information.

4.2.4 Stepped Glass

Many SSG systems install the SSG joint on the internal surface of the outboard pane. In these systems, the insulating glass units are produced in a step fashion which allows glazing to the outboard pane, as shown in Figure 18. More traditional SSG systems install the structural joint to the internal surface of the inboard pane of the insulating glass unit. Please refer to Figure 15 “Typical Structural Glazing Detail” for an example of a typical stepped glass structurally glazed system.

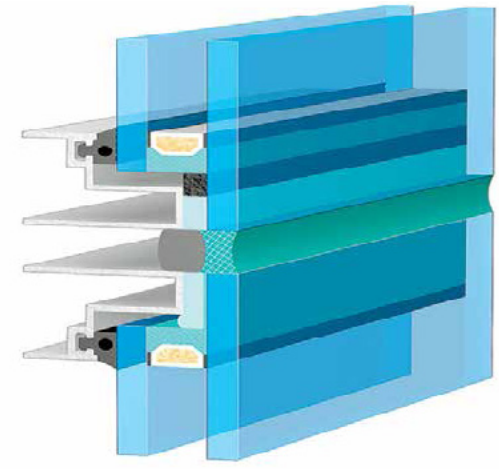


Figure 18: Stepped IGU structural glazing design that structural silicone is used to bonding outer longer glass lite.

4.2.5 U-profile Channel Systems

There are many proprietary systems that allow insulating glass units to be attached mechanically to the structure by a U-profile in the cavity between the two panes of glass. See Figure 19 an example of U profile channel system. Depending on the nature of the system, the silicone sealant may or may not be performing as a structural glazing sealant in the design. These unique systems must be approved by Dow technical service engineers on a system specific basis.

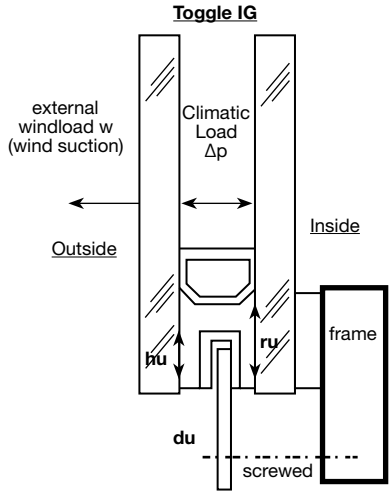


Figure 19: An example of U-profile channel system

4.2.6 Total Vision Systems

Total Vision Systems, which are commonly used at the front of a building to maximize vision area, use a glass fin to structurally support the vision glass. In such cases, the 2-sided Structural Sealant Glazing system may use the structural silicone in shear from the glass edge to the glass fin. Dow permits shear beads to perform structurally provided they are independent of a tension bead. DOWSIL™ 795 Structural Glazing Sealant or DOWSIL™ 995 Silicone Structural Sealant is our preference products used in this structural application, note that translucent colour is not available in these two products.

Figure 20: Typical Total Vision System at building lobby

In a Total Vision System (TVS) or glass wall the glass fin or mullion is normally 90 degrees to the face glass, as shown in Figure 22 is one of most often TVS joint designs for reference. Variations of up to 10 degrees from 90 degrees (90˚±10˚ or 80˚ to 100˚) are acceptable. Larger angles require additional support, as the degree of stiffening provided by the glass mullion decreases, as the angle increase. The glass manufacturer should be asked to comment this. Our requirement is that the load on the silicone sealant should not exceed 138 kPa. Also for optimum performance a structural joint should be as close as possible to rectangular.

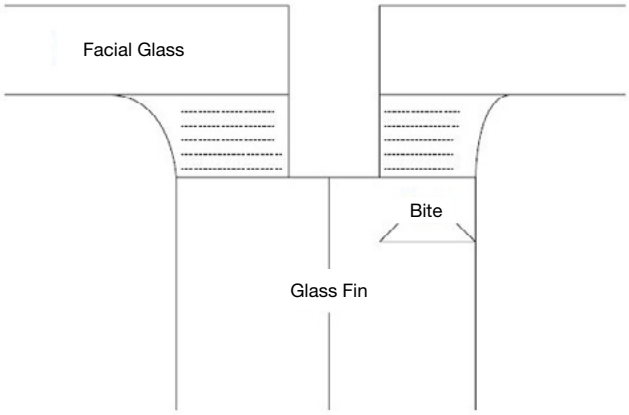


Figure 21: First example of TVS Design — Glass Fin Set Behinds the Facial Glass Units

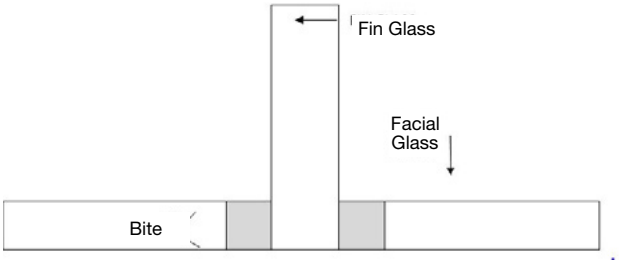


Figure 22: 2nd example of TVS Design — Glass Fin Set between Facial Glass Units

4.2.7 Point Bonding Systems

Transparent Silicone Structural Adhesive is a crystal clear film adhesive recently invented by Dow that allows for point bonding of the glass panel, that can improve both aesthetic and thermal efficiency of glass façade by facilitating a sleek design without the need to drill holes on the glass. Its use therefore in Insulated glass units will greatly improve the longevity and durability of the units. For detail product and design information please contact your local Dow offices.

Figure 23: Crystal clear silicone adhesive tape is used in point bonding the glass units that gives un-interrupted, uniform & sleek facade design.

4.2.8 Structural Attachment of Non-glass Materials

Structural silicone sealant can be used to attach materials other than glass. Dow must test and approve these materials on a material specific basis. Examples of such materials include aluminium composite materials, metal panels and epoxy-backed thin stone panels.

Certain materials such as plastics may have high coefficients of thermal expansion that may cause undue stress on the structural silicone and/or bowing of the panels. Dow must review all designs whether glass or non-glass materials where its sealants are used as structural adhesives.

For aluminum composite materials that are mechanically attached around the perimeter and the sealant is used to attach an aluminum stiffener, Dow permits glueline thickness dimensions of less than 6 mm. In this application, there is a negligible amount of differential movement between the two aluminum components and shear stress on the sealant is minimal.

4.2.9 Protective Glazing

Structural silicone sealants are commonly used in window systems which are designed to mitigate the effects of bomb blasts or storms. In some cases, these systems are also structurally glazed. The use of structural glazing in bomb blast protective window designs is appropriate and has been done successfully on numerous projects.

In these designs, the sealant is only one element of a complex glazing system which includes the frame, glass and laminate. The structural silicone sealant plays an important role by “anchoring” the laminate glass in the frame during a bomb blast or missile impact. Due to the unique physical and chemical properties of silicone (i.e. viscoelastic properties, long-term adhesion and durability) which organic sealants do not provide, high-performance structural silicone sealants are the material of choice for these applications. For assistance in protective glazing designs, please contact your Dow technical service engineer.

Figure 24: Protective Glazing bomb blast test photos (left) Glass units after Bomb blast testing in UK (right)

4.3 Substrates and Materials for Structural Glazing Applications

It is important in the design of an Structural Sealant Glazing (SSG) system that the proper materials be used. Although Dow requires approval of substrates and materials on a project by project basis, certain general recommendations can be provided during the design phase of the project.

4.3.1 Aluminium Profiles

When selecting aluminum substrates for structural glazing, the joint design and adhesion of the structural silicone must be considered. A flat surface with no gasket races, key slots, serrations or other irregularities is required. Some off-the-shelf extrusions may not be suitable for all structural glazing applications. The width of the extrusion must be adequate to achieve the calculated minimum structural bite with a suitable spacer attached.

Extruded mill finish aluminum is not an appropriate surface for structural silicone application due to poor adhesion. The graphite lubricant used in the extrusion process causes a highly variable surface to which adhesion is not always predictable. Therefore, aluminum must have a minimum of a chromate finish for structural glazing applications. There are several commercial Chromium-free conversion coatings in the market currently, however, due to insufficient information and lack of durable study on its long-term performance we are still in doubt and not able to support this coating for structural sealant glazing unless adhesion build up sufficient satisfactory laboratory test and coating durable test data. Please contact Dow technical department for details. Anodizing and thermal set paints such as fluorocarbon and polyester powder coat are also suitable aluminum finishes.

4.3.2 Stainless Steel

Stainless steel has been used successfully as a structural glazing substrate. The stainless steel must be of an architectural grade quality and should be submitted to Dow for adhesion and compatibility testing.

4.3.3 Laminated Glass

Laminated glass with polyvinyl butyrol (PVB) interlayer may delaminate at the edges. This phenomenon is only an aesthetic concern and does not affect the performance of laminated glass in structural glazing applications. For specific compatibility results and recommendations, please refer to the Dow adhesion/compatibility guide which is available at **dow.com/buildingscience** or contact your laminated glass supplier.

4.3.4 Insulated Glass

Insulating glass units are widely used in structurally glazed facades to improve the thermal performance of a facade. When using IG units in any structurally glazed façade, specifically developed silicone IG sealants should be used and proper bite contact must be given to meet maximum windload effect.

4.3.5 Coated, Spandrel and Tinted Glass

There are many types of coated, spandrel and tinted glass materials available to the systems designer. There are many important considerations for the selection of glass. Following are a few of the general recommendations:

- Soft coating must be completely removed from all glass surfaces to receive structural silicone sealant. These coatings do not provide adequate strength and durability for long term stability of the structural bond. Soft coatings are often very difficult for silicone sealant to adhere to. Residual soft coating on the glass surface may cause sealant adhesion failure initially or after ageing (silver corrosion).
- Hard coatings are acceptable surfaces for structural glazing if these products have demonstrated long-term stability and sealant adhesion has been verified through testing.
- Ceramic enameled spandrel coatings which are baked onto the glass during glass production and which meet required surface quality criteria are acceptable surfaces for structural glazing. Some patterned glasses are difficult to adhere to and must be submitted for laboratory testing by Dow prior to use.
- Tinted glass, clearfloat glass, tempered glass and heat-strengthened glass, are acceptable for structural glazing. Sandblasted or acid-etched glass may be difficult to adhere to and must be submitted to Dow for testing prior to use.

4.3.6 Self-cleaning and Easy-to-Clean Glass

These newer glass types provide lower maintenance solutions for the building owner and have grown in popularity in recent years. For current recommendations on these glass types, please ask the glass manufacturer and refer to the Dow adhesion/ compatibility guide or contact your Dow technical service engineer.

4.3.7 Gaskets and Rubber Materials

There are many types of rubber materials that are available for use in a window or curtain wall design and some may not be appropriate for structural glazing applications. An incompatible rubber material may be formulated with excessive levels of plasticizers that may leach into the structural silicone and cause discolouration, softening and potentially sealant adhesion loss to a substrate. Dow recommends testing and approval of materials on a project-by-project basis. Some Structural Sealant Glazing systems have qualified and pretested their specific rubber materials. Historically, certain material types have proven to be appropriate for structural glazing.

Following are some general guidelines for gaskets and rubber materials:

- A structural spacer material in direct contact with the structural silicone must be fully compatible. Materials such as silicone extrusions, polyurethane or polyethylene foam tape as well as certain high quality vinyl and PVC materials have been tested and found to be acceptable for this application. 100% silicone polymer extrusions and gaskets provide the best overall compatibility with silicone sealants.
- Highly plasticized gaskets and extrusions which cause sealant adhesion loss will not be approved for any contact with Dow structural silicone sealants.
- Gaskets and setting blocks made of neoprene or EPDM typically discolour lighter coloured silicone weatherseal sealants. These materials should not be used in full contact with the structural silicone but may have incidental contact without having an impact on the performance of the sealant. Project specific compatibility testing will determine the suitability of these materials for the application.

4.3.8 Steel

Carbon steel and galvanized steel are not appropriate surfaces for structural silicone glazing due to substrate durability concerns when exposed to corrosive agents. Painted steel is generally not acceptable for silicone structural glazing for the same reason. On an exception basis, steel components painted with high-performance industrial-grade coatings have been approved upon testing and review by Dow, the substrate manufacturer and the coating manufacturer.

5. Product Quality

This section of the manual is intended to provide the sealant user with procedures and recommendations for the proper storage, handling, use and quality control of DOWSIL™ structural glazing silicone sealants. As a sealant user, you must read, understand and closely follow the procedures and recommendations set forth in this section of the manual. If you have any questions regarding any of the following procedures or recommendations, please contact your local Dow construction office or your Dow technical service engineer prior to using the DOWSIL™ sealant.

5.1 General Considerations

5.1.1 Material Storage and Handling

DOWSIL™ sealants must be stored at the recommended temperature and environment. Excessive temperatures or moisture may cause a sealant to be damaged. Sealant cure, adhesion and physical properties could be harmed if the sealant is not handled and stored properly. The sealant user must understand and follow the recommendations on the proper use of dispensing equipment for two-component silicone sealants.

5.1.2 Shelf Life

DOWSIL™ sealants must be used within their stated shelf life. Sealant that is used beyond its stated shelf life may not cure properly to its full physical properties and must not be used.

5.1.3 Joint Preparation and Sealant Application

Specific procedures and recommendations on joint preparation and sealant application are made later in this section. These procedures and recommendations will help to ensure proper sealant adhesion, cure and joint fill. Ignoring or skipping a step in the process could have an adverse effect on the performance of the structural silicone. These procedures should be understood and completely followed by the sealant user.

5.1.4 Factory vs. Site Glazing

Structural Glazing fabrication may occur in a production facility or at the job site. Two-component structural silicone sealants are typically applied in the controlled environment of a production facility. One-component structural silicone sealants may be used in a production facility environment or at the job site. All parties involved with a project, including the architect, engineer and control bodies must support site glazing for a specific project. Specific local requirements may not permit site glazing in some instances. Cure requirements and considerations for site glazing are discussed later in this section.

5.2 Quality Control

A comprehensive quality control program is the most critical element of a successful structural glazing project. Dow provides procedures and recommendations that must be completely understood and followed by the sealant user. These procedures are proven to be effective and reliable. In the Documentation section of this manual, Dow provides quality control logs which can be used by the sealant user. Dow will assist you in the development of a comprehensive quality control program. Dow will also audit a production facility and make recommendations for improvement if necessary.

5.2.1 One-component Sealants

The following procedure outlines a series of steps to ensure that the quality of the DOWSIL™ 995 Silicone Structural Sealant or DOWSIL™ 795 Structural Glazing Sealant is adequate for structural sealant applications.

5.2.1.1 Storage Temperature and Conditions

DOWSIL™ 795 Structural Glazing Sealant and DOWSIL™ 995 Silicone Structural Sealant must be stored at temperatures as stated in product data sheet. An expiry date is clearly marked on the product packaging. Sealant should only be used if it is within the expiry date shown on the package. The sealant should be kept in its original unopened package until the sealant is to be used. Sealant should be stored indoors in a dry environment.

5.2.1.2 Skin-over Time/Elastomeric Test

A skin-over time and elastomeric test should be performed once per day and on each new lot of sealant to be used. The purpose of this test is to ensure that the sealant cures fully and has typical elastomeric properties. Any variation such as excessively long skin-over time may indicate that the sealant is out of shelf life or has been stored at excessively high

temperature. Skin-over time will vary with temperature and humidity. Higher temperature and higher humidity will cause the sealant to skin-over and cure faster.

The following procedure must be performed before any material is used in production. Production quality control procedures, such as adhesion tests on production materials, are described later in this section.

Skin-over Time Test Procedure:

1. Spread a 1 mm thick layer of sealant on a polyethylene sheet.

2. Every few minutes, touch the sealant film lightly with your finger.

3. When the sealant no longer adheres to your finger, the skin-over time has been reached. If the skin-over time is greater than 3 hours, do not use this material and contact your local Dow office.

Sealant not formed skin yet hence will adhere to finger.

Good condition sealant should formed a skin and not adhere to the finger within 3 hours after application.

Elastomeric Test Procedure:

1. Allow the sealant to cure for 24 hours. After 24 hours, remove the sealant from the polyethylene sheet. Stretch the sealant slowly to determine whether it has cured to normal elastomeric properties. A control sample of “good sealant” can be used for comparison. If the sealant has not cured properly, do not use the material and contact your local Dow office.
2. Record results in your quality control log. A sample quality control log is available in the "5.4 Documentation" section of this manual. The completed log should be retained and be available for review by Dow upon request.

5.2.2 Two-component Sealants

5.2.2.1 Storage Temperature and Conditions

DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant must be stored at temperatures below those stated in product data sheet. An expiry date is clearly marked on the product packaging for the curing agent and base. The sealant should only be used if it is within the expiry date shown on the package. The sealant should be kept in its original unopened packages until the sealant is to be used.

Sealant should be stored indoors in a dry environment. Containers of curing agent and base are not lot-matched. For practical purposes it is best to use the oldest container of material first.

When opening a new pail of catalyst, check for any dents that may prevent the follower plate from working properly, also check for any clear fluid separation on the top. If present, this fluid should be lightly remixed with a long spatula in a motion from bottom to top, similar to how a paint is remixed. The remixing should take 1 to 2 minutes to complete for a homogeneous catalyst. Place the pail immediately underneath the follower plate of the pail pump and bleed off any residual air according to pump instructions. Do not leave opened for extended period of time, because the catalyst will react with air and moisture and start to form a cured crust. Pumps that sit idle for greater than 7 days should have the pail of curing agent inspected for separation and remixed by the above method if separation occurred.

When opening a new drum of base, remove the top plastic disc or film prior to placing underneath the follower plate of the drum pump and bleed off any residual air according to pump instructions. There is no need to remix the base. An opened drum of base alone will not cure but may become dirty on the top surface.

It is recommended that DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant be applied between temperatures of 12 to 35˚C. In winter, the product should not be used in unheated shops if temperature is below 12˚C. If this is the case the material should be brought inside and warmed for a few days before using to help maintain consistency of cure and adhesion times. Cold base and cold catalyst will cure slower even if the shop temperatures are warm.

During production, several quality control procedures have to be carried out to ensure the two-component sealant is being properly mixed at the correct ratio. These tests and their recommended frequency are shown in the following table:

Sealant Production Quality Control Test	Frequency of Test		
	After Each Pump Start-up	After Each Container Change	Diagnostic Investigation
Glass Test	Required[1]	Required[1]	Required
Butterfly Test	Required[1]	Required[1]	Required
Snap Time Test	Required	Required	Required
Snake Test	Not Required	Not Required	Required
Mixing Ratio Test	Not Required	Not Required	Required

[1] Either the glass test or butterfly test must be performed at the scheduled frequency. It is not required that both tests be performed.

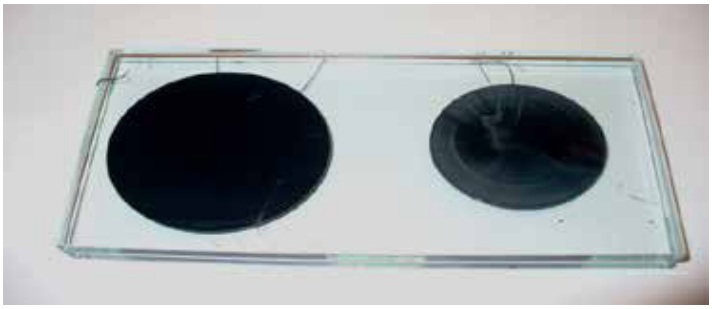
With both DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant black is the most common colour but they are also available in grey. If required, performing the glass test and butterfly test will be slightly more difficult and so please refer to the section related to this below. Please contact a Dow technical engineer for any sealant specific quality control recommendations with regards to DOWSIL™ 983 Structural Glazing Sealant or 993N Structural Glazing Sealant grey.

5.2.2.2 Glass Test

The glass test is a procedure used to evaluate the mix of DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant. This test is performed each time a pump starts-up and after either the curing agent or base containers are changed. The purpose of this test is to determine whether the two-component dispensing equipment is adequately mixing the sealant base and curing agent.

For standard DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant Black, the sealant base is white and the curing agent is black. When properly mixed, the finished sealant is uniform black, with no grey or white streaks. Improper mixing can be the result of a damaged check valve, a clogged hose, a clogged mixer etc. Regular equipment maintenance will help to ensure proper sealant mixing. Please consult with your dispensing equipment manufacturer for maintenance guidelines. If grey coloured DOWSIL™ 983 Structural Glazing Sealant or 993N Structural Glazing Sealant is being used, please contact your Dow technical service engineer for recommendations.

To perform the glass test method, apply a bead of sealant to a clean, clear glass sample which is approximately 100 mm x 100 mm. Place another clean, clear glass sample on top of the silicone, pressing the two pieces of glass together. Please refer to the diagram on this page. The resulting sandwiched sealant should then be visually inspected for grey or white streaks. The sealant should appear completely uniform and black. If results are negative, perform the test again after additional material is processed through the machine. If the results are negative again, equipment maintenance may be required. If additional assistance is required, please contact your Dow technical service engineer.



Glass test indicated proper mixing (left) and improper mixing (right side)

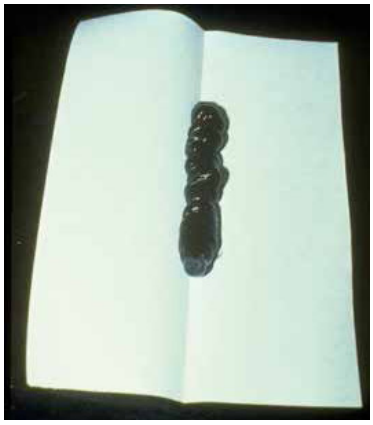
5.2.2.3 Butterfly Test

The butterfly test is a procedure that is similar to the glass Test. This test is performed at each pump startup and after either the curing agent or base containers are changed. The purpose of this test is to determine whether the two-component dispensing equipment is adequately mixing the sealant base and curing agent. For standard DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant Black, the sealant base is white and the curing agent is black. When properly mixed, the finished sealant is uniform black, with no grey or white streaks. Improper mix can be the result of a damaged check valve, a clogged hose, a clogged mixer, etc. regular equipment maintenance will help to ensure proper sealant mixing. Please consult with your dispensing equipment manufacturer for maintenance guidelines.

If grey coloured DOWSIL™ 983 Structural Glazing Sealant or DOWSIL™ 993N Structural Glazing Sealant is being used, please contact your Dow technical service engineer for recommendations.

Following is the procedure for performing a butterfly test:

1. Fold a sheet of stiff, white A4 paper in half.
2. Apply a bead of sealant to the fold in the paper.
3. Press the sheet of sealant into a thin film.
4. Pull the paper apart and visually inspect the sealant for indications of mixing
5. Apply



Apply a sealant bead onto paper

Homogeneous mixing

Inhomogeneous mixing

5.2.2.4 Snap Time Test

Once proper mixing of the sealant is established by the glass test and/or butterfly test, a snap time test must be performed. This test is performed each time a pump starts-up and after either the curing agent or base containers are changed. The snap time test helps to determine if the mix ratio is correct and whether the sealant is curing properly.

Following is a procedure for the snap time test:

1. Fill a small container with mixed DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant.
2. Place a small stick or spatula into the sealant. Record the time.

Every few minutes, pull the stick out of the sealant. Do not stir or agitate the sealant. As the sealant becomes more cured, the sealant will become stringy. Once the sealant tears cohesively and snaps back once it is pulled, this is the “snap time”. Note the snap time in a log or record onto the label of sample.

The snap time test will vary depending on temperature and humidity. Higher temperatures and higher humidity will cause the sealant to snap faster. Colder temperatures and lower humidity conditions will slow the snap time.

Snap time will also vary from tester to tester depending on how the results are interpreted. Also, there will be variation from lot to lot of material and as the sealant ages. However, in general, snap time should be no less than 20 minutes even when tested in summer. Too short a snap time would not only imply a shorter working time but also that excessive catalyst is being included in the mixing of the material.

Note the most important determination from snap time is that the sealant does cure. If the sealant does not cure, then further investigation is required.

5.2.2.5 Mixing Ratio Test

The mixing ratio test is not required by Dow on a daily basis. This test is useful to determine whether the sealant is mixing at the recommended ratio. For instance mix ratio of DOWSIL™ 983 Structural Glazing Sealant should be 10:1 to 13:1 by weight (or 8:1 to 10:1 by volume), and and DOWSIL™ 993N Structural Glazing Sealant should be 9:1 to 12:1 by weight (or 7.5:1 to 9.5:1 by volume). Most two-component silicone dispensing machines provide a set of valves which allow the mixing ratio to be checked.

Property	DOWSIL™ 993N Structural Glazing Sealant	DOWSIL™ 983 Structural Glazing Sealant
Mix ratio (by volume)	7.5:1 - 9.5:1	8:1 - 10:1
Mix ratio (by weight)	9:1 - 12:1	10:1 - 13:1
Snap time	30-40 minutes*	40-50 minutes*

*Snap time data listed above is based on 12:1 mix ratio by weight under 23°C and 50% relative humidity

Following is a procedure to perform the mixing ratio test:

1. Pressure valves must be adjusted in such a way that the pressure is equalized for both components.
2. Hold a disposable cup underneath each valve outlet on the pump. Open the valve for 10 seconds or at least 3 strokes of both the base and curing agent pump.
3. Weigh the two cups, minus the weight of the cup itself. The weight ratio between the two-component should be within the above listing.

The mix ratio test should be carried out whenever there are concerns with either the mixing of the sealant or with variations outside of the allowable limits for the snap time. When combined with the butterfly and snap time test it becomes a very useful diagnostic test that can assist with the investigation of equipment problems. Dow technical service engineers are available to assist you if there is concern with mixing or cure of DOWSIL™ 983 Structural Glazing Sealant or DOWSIL™ 993N Structural Glazing Sealant.

5.2.2.6 Pump Seal Maintenance Check (Snake Test)

Worn seals on the volumetric (dual-action) catalyst displacement cylinders can cause an inconsistent cure and should be checked when a pump is started up for the first time or if soft spots are noticed in the sealant bead. When cylinder seals wear, they can allow an inconsistent amount of catalyst to be mixed into the sealant. This typically occurs as the catalyst volumetric cylinder cycles from one direction to the other and allows back pressure to let catalyst escape from one side. This is a typical maintenance item that should be added to the overall quality control program.

1. Turn on the pump and lay a continuous bead back and forth in a “snake-like” pattern on a piece of cardboard. Allow the pump to extrude for 3 to 5 minutes so that 2 complete cycles of the catalyst cylinder are completed.
2. Let the sealant cure for 3 hours.
3. Check the entire bead by pressing your finger into the surface every 2" to 3" and ensuring the entire sealant bead is fully cured along the entire length.

If soft spots are present, it is likely the problem needs to be addressed with a pump technician who will replace the pump seals. The soft spots will typically occur in a consistent fashion (or specified length) along the extruded bead of sealant. Some pump inspector also uses this test method to check sealant full length mixing is homogeneous or not (like butterfly).

Snake test to help identify if pump mixing quality is consistently good or not

5.2.2.8 Peel Adhesion Test

Peel adhesion test is the most effective daily test to verify sealant adhesion to a substrate. This simple screening test should be used as the daily test to verify adhesion of sealant to a substrate. This test should be performed on all substrates to which the sealant is expected to have adhesion at the following intervals:

- After each pump start-up or after extended breaks
- After a change of the curing agent or base container
- For each new lot of substrate

Following is a description of the peel adhesion test:

1. Clean and prime the substrate as recommended by Dow.
2. Place a piece of polyethylene sheet or bond breaker tape across the flat surface.
3. Apply a bead of sealant and tool it to form a strip approximately 200 mm long, 15 mm wide and 6 mm thick. At least 40 mm of the sealant should be applied over the polyethylene sheet or bond breaker tape.
4. It is best to imbed a wire mesh halfway within the body of the sealant. For best results, solvent clean and prime the screen to ensure good adhesion to the wire mesh. If wire mesh is not available, reliable results can still be achieved.
5. After sealant cure, grasp the 4 cm tab of sealant which overlays the polyethylene sheet. Pull the sealant at a 180° angle. Peel back only 10 to 20 mm of sealant leaving the remainder in place for additional testing.
6. If the sealant tears within itself and remains fully bonded to the substrate, this is called “cohesive failure”. 100% cohesive failure is desirable since this indicates that the strength of adhesion is greater than the strength of cohesion.
7. If the sealant releases from the substrate, the sample indicates 100% adhesive failure (or 0% cohesive failure) since sealant adhesion develops over time, repeat the test after an additional 24 hours of cure. Continue until 100% cohesive failure is achieved. If adhesion does not develop as expected, contact your local Dow construction office.

Photo left hand side demo a daily adhesion test performed on the off cut aluminium frames, right hand side photo shown a sealant bead applied onto a hidden area of glazed unit for verifying adhesion can be build up or not.

Following are some additional recommendations for peel adhesion testing:

- Peel adhesion tests must be run on production samples from the exact same lot of substrate or profile.
- The substrate should be cleaned exactly the way the production units are cleaned.
- The peel adhesion samples must be cured in the same temperature and humidity that the production units are stored.
- Samples should be tested periodically, for example 1, 2, 3 days cure for DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant. Testing can conclude once the peel adhesion test shows full adhesion or 100% cohesive failure. For DOWSIL™ 795 Structural Glazing Sealant or DOWSIL™ 995 Silicone Structural Sealant, peel adhesion tests should be performed at 7 day intervals.
- For the wet adhesion test required for the adhesion on anodized aluminium substrate, no specific reconditioning required before the peel test.
- Local authorities may required specific and additional testing procedure such as: Once samples achieve full adhesion, immersed them in room temperature water for one day to seven days and test them again for cohesive failure.
- Important: Structural Sealant Glazing production units can only be shipped to the jobsite once full adhesion has been verified by successful peel adhesion tests under dry and wet conditions (for anodized aluminium). 100% cohesive failure required.

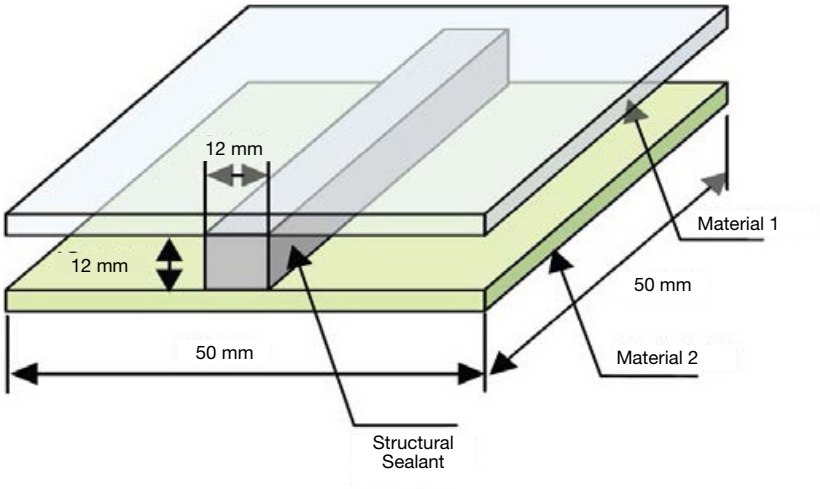
5.2.2.7 H-piece Test

The H-piece test is the primary test used to evaluate sealant cure properties. This test should be performed once for every combination of base and curing agent. If a container is changed, an H-piece test should be used to confirm that the sealant cure properties are acceptable. In some instances, Dow may not require H-piece testing as a part of a comprehensive quality control program if other procedures such as peel adhesion and deglaze testing are performed at an appropriate frequency and if local standards and regulations do not require H-piece testing. The H-piece test can be used as a daily adhesion quality control test but because the peel test is less complicated to perform, the peel test is the recommended daily adhesion quality control test.

Every time a container is changed, two H-piece test samples should be produced. Samples should be made using actual production substrates (aluminium profile and glass, typically). The substrates should be cleaned and primed in the same manner as production units are prepared. The test samples should be stored in the same temperature and humidity environment as the actual production units.

The first H-piece sample should be tested when production units are to be shipped to the jobsite. The peel adhesion tests should be used to verify full adhesion (100% cohesive failure). Full adhesion typically occurs after 1 to 3 days of cure for DOWSIL™ 983 Structural Glazing Sealant/DOWSIL™ 993N Structural Glazing Sealant and 7 to 14 days for DOWSIL™ 795 Structural Glazing Sealant/DOWSIL™ 995 Silicone Structural Sealant, depending on joint geometry, spacer type, temperature and humidity. DOWSIL™ 795 Structural Glazing Sealant or DOWSIL™ 995 Silicone Structural Sealant must have full adhesion and cure in the actual production units before the units are shipped to the jobsite. If properly cured, the sealant should have a minimum strength of 0.70 MPa with 100% cohesive failure. If results are not acceptable, a second H-piece is available for additional testing.

Below is a detail of showing the dimensions of an H-piece sample:



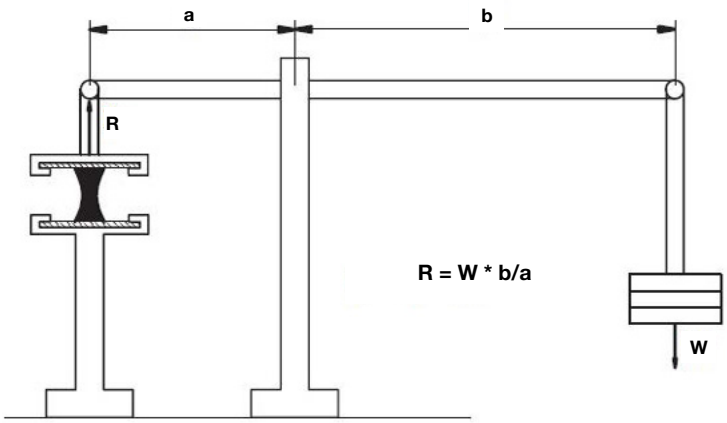
Test samples can be prepared using a wooden block which has been cut to allow a cavity to be filled with sealant in the dimension shown. The wooden block should be pre-treated with a soap solution or paraffin wax to provide a bond-broken surface for the sealant. Alternatively, a polyethylene bondbreaker tape can be applied to the wooden surfaces to contact the sealant. A polyethylene U-channel specifically designed for this test method can also be used.

Two H-piece samples should be produced for every combination of curing agent and base used in production. Test samples should be stored in the same conditions as the actual production units. One sample should be tested at the same time that production units are to be shipped to the jobsite. Separately, peel adhesion testing should verify full adhesion (100% cohesive failure) at the same time.

H-piece samples can be tested with either a instron tensile tester or through the use of a “Roman Scale”. A Roman Scale as represented below will allow the silicone user to test sealant cure and adhesion with a low cost piece of equipment.

The weight applied to the silicone joint is equal to the weight (W) on the Roman Scale plate times the ratio of b/a. The H-piece sample should be tested to rupture. The tensile strength at rupture should be a minimum of 0.70 MPa. This value corresponds to strength of 12 * 50 * 0.7 = 420 N applied to the test piece. This strength corresponds to a load of 42 kg. If the Roman Scale is designed to have a b/a ratio of 10, a weight of 4.2 kg should be applied to the plate (W). The load should be applied for a maximum of 10 seconds with no adhesive or cohesive failure of the H-piece. If no rupture occurs, incrementally add 0.5 kg to the scale until the H-piece ruptures. Record the load at rupture and percent cohesive failure observed on the test sample.

In absence of local standards, H-piece testing of DOWSIL™ 795 Structural Glazing Sealant, DOWSIL™ 995 Silicone Structural Sealant, DOWSIL™ 983 Structural Glazing Sealant, or DOWSIL™ 993N Structural Glazing Sealant should meet a minimum strength of 0.70 MPa with 100% cohesive failure to actual production substrates. Results of H-piece testing should be recorded in a quality control log. A sample copy of a Structural Glazing quality control log is included in the "5.4 Documentation" section of this manual.

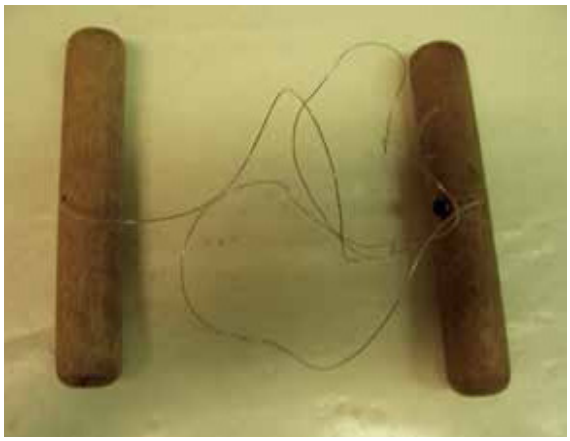


Roman Scale

5.2.2.9 De-glaze Test

Deglazing is a method of quality inspection used to confirm sealant adhesion, joint fill and quality in actual Structurally Glazed production units. Once the glass or panel is removed, the silicone sealant is inspected for cure, mix, uniformity of fill, lack of bubbles or air entrapment and most importantly, to verify sealant adhesion. Deglazing is very useful to production personnel as a form of feedback on their performance. Production personnel should be present during the inspection.

Deglaze Tool — Glazer



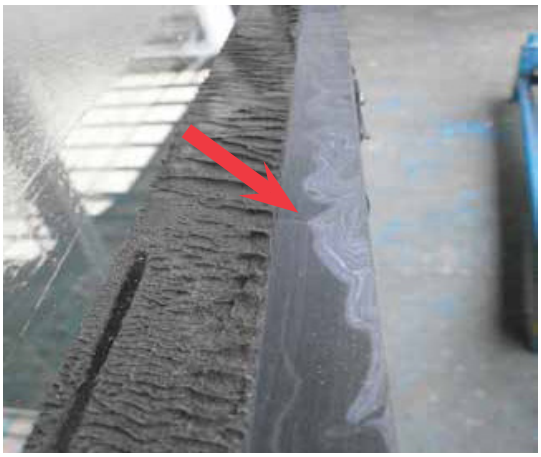
Deglaze Tool — Steel wire with handles


Workers put steel wire to glazed structural joint through cut open weatherseal joint (L-joint design). If structural joint can be access directly then knife or glazer can be used in cut open the sealant joint right photo).


Workers using steel wire to cut open the glazed structural sealant and glaze tape (weatherseal need to remove first with knife). It can be operated at either way (both on top or one top one down)

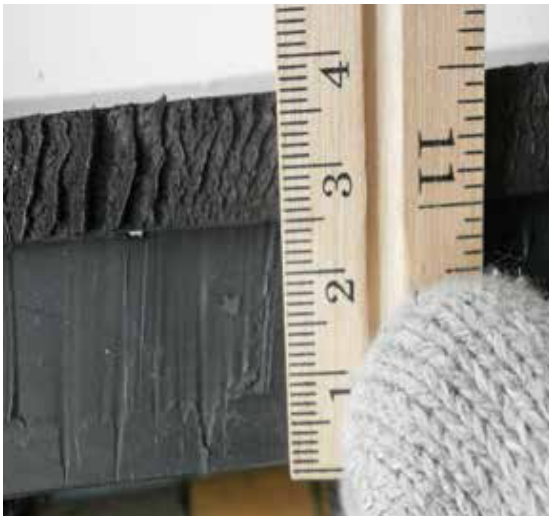

After structural joint cut open the un-glazed glass can be removed from the support frame. Right side photo shown the glass was removed then the joint fill (right photo showing excellent joint fill) and sealant mix quality can be visually check.


Left side photo shown incomplete joint fill (big cavity between glaze tape and sealant). Right side photo had complete joint fill (no cavity).




Sealant poor mixing (white streaking pattern) found in the deglazed units.


Good adhesion was found between structural sealant onto alum. frame and glass surface. Right side photo shown a large area of sealant lost adhesion onto alum frame.



Sealant can be tested by durometer to see its cure status (shore A hardness should fall into 20-50 reasonable range), Measured sealant bite (both on the aluminum frame and glass surface) and check whether match as design bite and minimum bite requirement as stated in written print review report. Note that durometer test is very subjective but can be used as an indicator if sealant hardness reading is out of 20-50 range.

An example of deglaze report or form listed below can be used as reference.

Dow Deglaze Inspection Form

Project Number/Name: _14-00123_ABC Building, Central, Hong Kong

Deglaze Date:_2014-03-20_ **Deglaze place:** Customer factory at South China

Glazing System Description:☐ 2-sided ☐4-sided ☐Other

Frame Description: Silver Grey PVDF coated Alum extrusion_

Glass Description:_ 8mm+12mm air+8mm IGU _(Unit 53#-5UN-068)_ ☐Vision ☐Spandrel ☐ Other

Glass Description:_12mm monolithic glass (Unit 53#-5UN-057)_☐Vision ☐ Spandrel ☐ Other

Temperature/Humidity During Curing: 19°C, 62%RH

Primer (lot number): _ Primer 1200OS (0007182665) **Cleaning Solvent:** MEK

Dispensing Pump Type:☐ CYH ☐ Graco ☐Reinhardt ☐Lisec ☐ H&G ☐ Other

Frame ID	Panel Size (mm)	Dow Product	Lot Number	Structural Sealant Application Date	Measured Structural Bite (frame) (mm)	Measured Structural Bite (glass) (mm)	Measured Glueline (mm)
53#-5UN-068	1470x2254	DOWSIL™ 983 Structural Glazing Sealant	B: 0007622971 C: 0007489014	2014-3-14	29 mm	29 mm	8 mm
29#-5UN-057	1522x2254		B: 0007622971 C: 0007489014	2014-3-14	29 mm	29 mm	8 mm

Comments on Adhesion, Joint Fill, Sealant Cure Uniformity and Air Entrapment or Bubbles and Other Observations:

1. Good adhesion and joint fill was found at both tested units (refer to photos #2 to #4 for unit 53#-5UN-068 and photos #10 to #12 for unit 29#-5UN-057 in appendix A).
2. Adequate sealant hardness of shore A 32 and 34.5 was found respectively, please refer to photos #7 for unit 53#-5UN-068 and photo # 16 for unit 29#-5UN-057 in appendix A.
3. Mixing quality of the sealant was found adequate. Refer to photo #8 in appendix A for butterfly test and snap time test. No micro bubble presented in the snap time sample and two glazed units.

Fabricator Name/Representative:_____ **Dow Representative:**_____

Distributor: N/A **Report Issue Date:** 2014-03-23

During De-glaze inspection, the following elements should be evaluated:

- Measured dimension of the structural bite. The minimum structural bite as determined in the project review must be satisfied. An underfilled joint may affect the performance of the Structural Sealant Glazing (SSG) system.
- Measured dimension of the glueline thickness.
- Adhesion of the structural sealant to the substrate and panel.
- Sealant uniformity of cure and sealant mix.
- Lack of air entrapment and bubbles in the sealant.
- Substrates details (colour and coating type of alum, glazing accessory…etc) should be reviewed to ensure they are representative samples and been tested to verify suitability for structural glazing application.

Any deficiencies observed should be reported in the structural glazing quality control log.

Deglazing should be performed as a regular quality control procedure in a production operation. This test can be performed randomly on any production sample. Additionally, this test should always be performed on units where the glass is damaged or for some other reason needs to be replaced. When replacing the glass, a deglaze inspection can easily be performed. Glass can be effectively removed using a knife or piano wire. It is best to cut the sealant mid-way in the joint so that enough sealant is left on the frame and panel to allow an adhesion test to be performed. A peel adhesion test, as described earlier in this manual, can be performed on the remaining sealant.

Following is a recommended frequency for deglaze testing to be performed on a project:

First Deglaze	1 unit out of first 10 units manufactured (1/10)
Second Deglaze	1 unit out of next 40 units manufactured (2/50)
Third Deglaze	1 unit out of next 50 units manufactured (3/100)

Through the remainder of the project, 1 unit of every 100 units manufactured. Additional units (previous or following units made at the same date will be preferred) may be deglazed if previously inspected units show any signs of concern. This could helps identify if the quality issue or concern is incidental or a continuous defect. Please be aware of Dow requires satisfactory de-glaze test log to be submitted prior to issue structural performance warranty.

For the field applied structural sealant glazing projects, de-glaze test or an alternative non-total destructive field adhesion test (similar to ASTM C1521 Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints) should be performed to verify good adhesion and joint fill are obtained in practice. The minimum one test per elevation per floor is recommended. Please contact Dow technical engineer for details.

5.2.2.10 Two-component Dispensing Equipment Guidelines

DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant are high-performance materials, which is certificated and approved by official authorities and test institutes for structural glazing applications. Properly applied, the sealant provides excellent long-term adhesion and durability, which is necessary for structural glazing applications.

DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant requires correct pumping and mixing by the sealant user to achieve its intended performance. State of the art technology for the application of two-component sealants uses a sophisticated pumping, metering and mixing machine with either a dynamic or static mixer. There are several different suppliers for such equipment. The dispensing machines available in the market are all different in design, so therefore Dow strongly recommends that the sealant user follow the guidelines provided by the equipment supplier regarding the proper use and maintenance of the dispensing equipment. In addition to the guidelines from the equipment supplier, Dow recommends that the sealant user understands and complies with the following best practices:

- Sealant must be dispensed free from exposure to air. DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant must be processed in a closed system free from exposure to air. Air incorporated into the sealant may have a severe detrimental effect on the adhesion and performance of the sealant. Air trapped during the change of sealant containers must be completely bled out or flushed out of the system prior to use.

- Regularly inspect and maintain components of the dispensing equipment. Air can be incorporated into the sealant if the pump is defective or gaskets have hardened or are damaged allowing air ingress into the system. When using high pressure pumping equipment with a follower plate system, regularly check the follower plate to ensure that it is moving smoothly and will not be blocked by a damaged drum or pail or by a damaged or brittle gaskets. Proper maintenance and cleaning of the mixer helps to ensure properly mixed sealant. Filters and gaskets should be regularly inspected and replaced as necessary.
- Ensure that there is no contamination of sealant components. Sealant must not come in contact with machinery oils from the equipment. Pumps must be checked for tightness and oil should not be used on the follower plates.
- When using a solvent such as DOWSIL™ 3522 Cleaning Solvent Concentrated for cleaning or flushing of the mixing line, the sealant lines must be completely closed against the solvent lines to avoid contamination of the sealant with solvent. All gaskets must be compatible with the cleaning solvent.
- Regularly maintain gaskets. Some gaskets, especially those in direct contact to the sealant components, could become brittle or will show a volume increase after prolonged exposure. Deteriorated gaskets must be immediately replaced. Please request from your equipment supplier gaskets and other components, which are compatible and recommended for use with DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant. The equipment supplier should also provide a schedule for regular replacement of gaskets. Please contact your Dow technical service engineer if you need specific recommendations.

5.3 Surface Preparation and Sealant Application

Every structural glazing project requires a diligent and thorough procedure to ensure that substrates are properly cleaned prior to sealant application. The following procedures should be followed for every structural glazing application. Further description of the cleaning, priming and placing procedures are included in the subsequent section.

1. **Inspect** substrates and materials prior to use. The materials used in production must be representative of the materials that were tested and approved by Dow. The substrates, i.e. aluminium profiles, should be in good condition and not damaged by outdoor weathering.
2. **Clean** substrates as recommended in the Dow written approval for the project. Joint surfaces must always be clean, dry, dust-free and frost-free. Moisture or contaminants on the surface may have an adverse effect on sealant adhesion to a substrate.
3. **Prime** the surface to receive sealant if required by the Dow written approval for the project.
4. **Place** the glass or panel to be glazed. Care must be taken to not contaminate cleaned surface during any phase of production. If contamination occurs, surfaces must be recleaned.
5. **Apply** sealant into the structural glazing joint cavity. The joint must be completely filled with sealant by “pushing the bead” of sealant into the joint in a continuous manner, air entrapment can be avoided.
6. **Tool** or strike the sealant joint surface with a tooling device such as a spatula. The sealant must be pushed into the joint with a tool. Scooping excess sealant from the joint is not acceptable tooling. Tooling helps to ensure that the sealant wets out the joint surfaces and completely fills the joint without air entrapment.
7. **Inspect** the finished structurally glazed units. Determine whether the entire structurally glazed joints have been properly filled and tooled. Determine whether the structurally glazed units are stored in proper way in racks or by other means and inspect whether the sealant is curing properly. Ensure that all of the recommended quality control tests are being performed.

5.3.1 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. Proper cleaning is accomplished through the use of the “two-cloth” cleaning method, see later section for details. Always confirm with the supplier of each substrate that the cleaning procedures and solvents are compatible with their material.

The proper use of solvents is an important part of the surface preparation requirements for substrates that are to be structurally 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. Dow recommends caution when using denatured alcohol due to potential contamination from the denaturants.

Please be aware that certain aggressive solvents can adversely affect finishes such as polyester powder coated aluminum. However, milder solvents such as IPA (isopropyl alcohol) may not effectively remove the wax of coating hence it could lead to poor adhesion. Always check with the substrate supplier for solvent compatibility with their materials and sealant supplier's solvent recommendation for optimum adhesion prior to sealant application.

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

5.3.1.1 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 (or 75/25 Ethanol with water mixture) or methylated spirit. Oily dirt or films generally require a degreasing solvent such as xylene or methyl ethyl ketone (MEK).

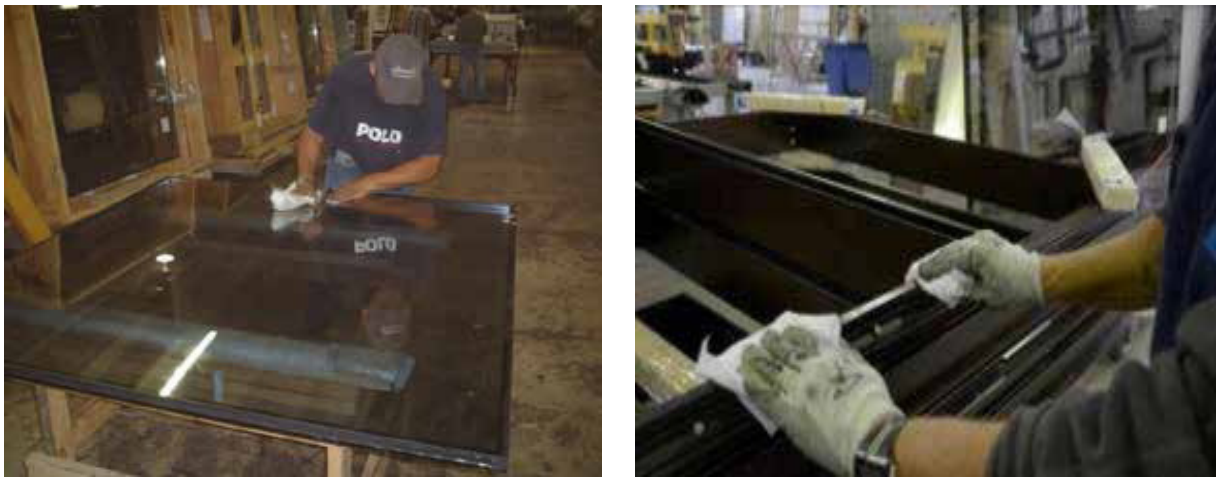
5.3.1.2 Porous Substrates – Solvent Considerations

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 may absorb water or solvents after cleaning or priming. Hence, water or solvents used for cleaning must be allowed to evaporate completely before sealant is applied.

5.3.1.3 Two-cloth cleaning method

The "two-cloth" cleaning method consists of a solvent wipe followed by a dry cloth wipe to lift and remove the solvent and contaminants suspended in the solvent. See below photo. Note that multiple cleanings may be required to properly clean a substrate.



Applicator demo two-cloth cleaning method

Following is the procedure described in greater detail:

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.
4. Visually inspect the second cloth to determine if 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.

A solvent resistant buffer container should be used for substrate cleaning.

5.3.2 Substrate Priming Procedure

DOWSIL™ primer sometimes is required to optimize sealant adhesion for an application which has been confirmed as a result of Dow adhesion testing or customer testing.

The following procedure describes how to properly prime surfaces with DOWSIL™ primer:

1. Before using, verify that the DOWSIL™ 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 water-like in appearance. If the primer is milky-white in appearance, do not use the primer. Red coloured primer is also available to give a visual identification for priming work.
2. Joint surface must first be clean and dry. 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 re-cleaned prior to priming.
3. Pour a small amount of primer into a clean, dry container. Do not pour more than a 10 minute supply of primer into the working container. Replace and tighten the cap on the container immediately after dispensing the primer. Excessive exposure of the primer to atmospheric moisture will cause it to deteriorate and turn milky-white in the container.
4. Pour a small amount of primer from the working container onto a clean, dry, lint-free cloth and gently wipe a thin film on all joint surfaces requiring primer. Apply only enough primer to wet the surface. Overpriming can cause adhesion loss between the sealant and the substrate. If too much primer is applied, a powdery white film will form on the substrate. Over-priming is not an acceptable practice and should be stopped immediately. Over-primed surfaces must be re-cleaned and primed in a proper manner.

5. Allow the primer to dry until all of the solvent evaporates. This typically takes from 5 to 30 minutes depending on temperature and humidity.
6. Inspect the surface for dryness and for the appearance of over-priming. A primed non-porous surface will have a slight haze. If red coloured primer is used, the primed surfaces will appear red in colour. Some newly formulated primer (DOWSIL™ 1200 OS Primer and DOWSIL™ C OS Primer) contains UV indicator that allows for inspection to trace the priming condition by 365 nm long waves UV lamp. You can contact Dow technical engineer for the UV tracer details. 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.

Primer with UV tracer indicator can be easily identified by UV Lamp. The upper area has primed and a blue mark confirms this when in the presence of long waves UV.

5.3.3 Masking

If aesthetics are important, surface adjacent to the Structural Sealant Glazing (SSG) joint can be protected by masking. Prior to sealant installation, a masking tape can be applied to the surface adjacent to the joint. Test the tape prior to use to ensure that it can be easily removed and does not damage the substrate. During application of the tape, do not apply the tape to joint surfaces since residual adhesive from tape may harm sealant adhesion. Immediately after the sealant has been applied and tooled, remove the tape.

5.3.4 Placing the Panel

The glass or panel can be placed once the profiles have been cleaned and primed if necessary. The same cleaning and priming procedures should also be performed at the same time to the glass or panel. Care must be taken to not contaminate cleaned and primed surfaces that are to be sealed. Finger prints can cause adhesion loss. Dow recommends the use of powder free latex gloves to handle glass panels if there is concern about physical contact with the joint surfaces.

The size and number of setting blocks required to support the glass weight should be advised by the glass supplier. It is normal to use setting blocks in most glazing designs, but it is possible to use the silicone sealant in the weatherseal as a “liquid setting block”. Please be aware of that if the silicone is used as a setting block the sealant must be 100% cured in the horizontal before shifting to vertical racks. If not fully cured the weight of the glass will cause sealant to deform.

5.3.5 Site Glazing Considerations

Most of the substrate cleaning and priming procedures described above apply to both site glazing and factory glazing. Key considerations for structural glazing on site include:

- Sealant must be stored away from excessive heat. Exposure of the sealant to high temperatures would cause the sealant to degrade and cure improperly.
- An application temperature range of 10°C to 35°C is recommended. At lower temperatures, the substrate must be kept free of condensation or moisture. Substrate temperatures in excess of +50°C will adversely affect the cure and adhesion of the sealant to the substrate.

- Because environmental conditions cannot be controlled on a jobsite, joint surfaces must be cleaned and primed and the panels must be placed and sealed in one (1) hour or less.
- Temporary fasteners must be used to keep the structurally glazed joint stable during cure of the sealant. DOWSIL™ 795 Structural Glazing Sealant/DOWSIL™ 995 Silicone Structural Sealant requires 1 to 4 weeks or longer for full cure. Sealant cure rate is influenced by the Structural Sealant Glazing (SSG) joint geometry, spacer tape type (open or close cell) temperature and humidity. Temporary fasteners may only be removed once the sealant has developed full cure and adhesion.
- A comprehensive quality control program which includes the skin-over time, elastomeric test, peel adhesion test and deglaze test must be followed. Dow can assist in the development of a comprehensive quality control program for structural glazing on site.

The recommend practices for the site glaze application of sealant is to assemble all substrates in their final position, then apply the sealant into the joint. Squeeze glazing or so called delayed glazing techniques, where apply sealant first in the joint then press glass onto the joint, is not recommended unless pre-view by Dow technical service engineer and being verified by satisfactory field deglaze test result.

5.3.6 Sealant Application Procedure

Sealant should only be applied in structural glazing joints which have been cleaned and primed by the recommended procedures. Sealant must be applied to clean, dry, dirt-free and frost-free surfaces and the joint surfaces must be primed if recommended by Dow for the specific project. Sealant adhesion may be harmed by an improperly cleaned or primed structural glazing joint. Sealant must also completely fill the structural glazing joint. The performance of the structurally glazed system is dependent on having appropriate structural bite. An underfilled structurally glazed joint may jeopardize the performance of the structural glazing system.

The following procedures describe the proper procedures to apply sealant:

1. Apply sealant in a continuous operation using an application gun or dispensing equipment. A positive pressure, adequate to fill the entire joint, should be used. By “pushing the bead” of sealant into the joint in a continuous manner, air entrapment can be avoided.
2. Tool the sealant with light pressure before a skin forms on the sealant. This typically occurs within 5 to 10 minutes.
3. Avoid the use of wet tooling aids such as soaps or solvents during tooling. Dry tooling is recommended. Do not scoop sealant as this does not effectively push sealant into the joint causing the sealant to fully wet out the sides of the joint.
4. If the surface adjacent to the SSG joint has been masked, remove the masking at this time.

Note: Pre-coat or skim coat a thin layer of structural sealant on the clear glass to hide the sealant joint or glaze tape; this practice is becoming a more and more popular glazing practice for improving joint appearance. Please note that skim coat at the adhesive tape side will inhibit the tape adhesion to the glass surface. A proper temporary fixing device will be required to ensure good joint fill and to wet out the joint surface in order to achieve optimum sealant adhesion build up and to provide glass fixing prior to the structural sealant being fully cured. Adequate structural sealant must be used in the skim coat and pre-coated sealant surface must be clean prior to applying new structural sealant onto it.

The thickness of skim coat should be 1-3 mm, if one-component structural sealant is used as skim coat (i.e. DOWSIL™ 795 Structural Glazing Sealant grey as skim coat and DOWSIL™ 983 Structural Glazing Sealant black is used rest of the joint), skim coat sealant must be allowed to cure sufficiently (at least 48 hours) prior to applying new structural silicone, otherwise considerably longer time will be required for skim coat sealant curing and adhesion build up.

According to our past experience, it is known that DOWSIL™ 983 Structural Glazing Sealant can bond well to cured DOWSIL™ 795 Structural Glazing Sealant see below photos. However, it may have inconsistent adhesion to pre-coat DOWSIL™ 995 Silicone Structural Sealant. Therefore, please always perform an adhesion test to verify good adhesion can be obtained prior to skim coat application.

5.3.7 Sealant Cure Requirements

All Room Temperature Cure (RTV) silicone sealants whether one-component or two-component require exposure to atmospheric moisture to cure. For one-component structural silicone sealant (i.e. DOWSIL™ 795 Structural Glazing Sealant and DOWSIL™ 995 Silicone Structural Sealant) the material will cure from the area that is exposed to air and throughout the deeper section, since air moisture and sealant by-product need to migrate through the cured layer of sealant; the full cure time will be highly dependent upon the joint size and the ambient temperature and humidify during the cure.

In a closed environment or concealed joint that is not exposed to atmospheric moisture the sealant cure will be slow or may even be nonexistent.

5.3.7.1 Site Glazing Cure Requirements

Temporary support of adjoining materials must be used during the cure of structural sealant for site glazing. The structural sealant glazing joint must be static during cure to prevent stress on the sealant as it cures and develops full adhesion and strength.

The curing time of a one component silicone sealant, such as DOWSIL™ 795 Structural Glazing Sealant, in structural joints, is related to

1. Joint depth
2. Temperature and humidity
3. Spacer type (open cell or close cell)

Cure Time	DOWSIL™ 795 Structural Glazing Sealant	DOWSIL™ 995 Silicone Structural Sealant
1st Day	2.3 mm	2.5 mm
2nd Day	3.1 mm	3.6 mm
3rd Day	4.3 mm	4.5 mm
7 Days	6.1 mm	6.6 mm
14 Days	9.7 mm	9.8 mm

It appears that as the joint depth increases the cure rate decreases. In order to optimize the sealants cured strength to ensure its satisfactory performance, sealant joint depth should be limited to 15 mm and 20 mm for DOWSIL™ 795 Structural Glazing Sealant and DOWSIL™ 995 Silicone Structural Sealant respectively when the sealant is applied on site and exposed to air from one side only. This means if open cell spacer is used a max 30 mm and 40 mm deep joint can be applied respectively. If these products can be used in a shop where glazed units can be stored indoors without heat exposure during sealant cure, a deeper joint may be supported by Dow.

NOTE: When DOWSIL™ 795 Structural Glazing Sealant is used in joints with a sealant bite greater than 12 mm wide then a material quality check as noted in this manual on pages 30-32, clause 5.2, must be performed in advance to confirm that the sealant is in good condition and therefore suitable for this application.

Some regional building codes (i.e. JGJ102) request a sealant bite up to a 24 mm for one-part structural sealant, our maximum 40 mm deep joint design for DOWSIL™ 995 Silicone Structural Sealant stated in the above statement is made based on success project experience and is not to be considered as a contradiction to these building regulation or codes.

5.3.7.2 Factory Glazing Cure Requirements

DOWSIL™ 795 Structural Glazing Sealant and DOWSIL™ 995 Structural Glazing Silicone Sealant typically requires 1 to 4 weeks or longer to cure in a production facility environment. Complete cure time depends on joint geometry, spacer type, temperature and humidity. The structurally glazed units must not be moved to the jobsite until the sealant has fully cured and it can be demonstrated through quality control testing that the sealant has achieved full adhesion (100% cohesive failure).

DOWSIL™ 983 Structural Glazing Sealant and DOWSIL™ 993N Structural Glazing Sealant cures in deep section within 4 to 72 hours (more than 30 mm deep joint) depending on joint geometry, spacer type, temperature and humidity. The sealant generally achieves full adhesion (100% cohesive failure) in 1 to 7 days depend on substrate types and ambient environment. Adhesion build up can be accelerated by using DOWSIL™ 1200 OS Primer, UV Traceable or DOWSIL™ Primer-C/Primer-C OS.

The structurally glazed units must not be moved to the jobsite until the sealant has fully cured and it can be demonstrated through quality control tests that the sealant has achieved full adhesion (100% cohesive failure). Verification of sealant cure and adhesion is done through the use of “peel adhesion” and/or “H-piece” testing. it is the responsibility of the Structural Sealant Glazing (SSG) applicator to perform these tests as prescribed in this manual. These procedures are described in greater detail later in the next section.

5.3.8 Re-glazing Procedures

Glass breakage occurs during all phases of a construction project and even long after the building is completed. How a system will be re-glazed is an important design consideration. The specific procedures will vary from project-to-project. Following are general guidelines for re-glazing.

5.3.8.1 Re-glazing Due to Glass Breakage

The following procedure assumes that a DOWSIL™ silicone structural glazing sealant was originally used on the project and that the original recommendations are available to the contractor performing the repairs. If this information is not available, please contact your Dow construction office.

1. First determine that the existing sealant is well adhered. A peel adhesion test must be performed to confirm that the existing sealant has excellent adhesion (100% cohesive failure) to the frame. If excellent adhesion is not achieved, please contact your Dow office.
2. Remove all existing damaged glass. Depending on the design, the glass may be removed using a cutting blade or piano wire.
3. Cut away the silicone leaving a thin film (1 to 2 mm) of sealant on the frame. Complete removal of the sealant is not necessary. If complete removal of the sealant is preferred, Care must be taken to avoid damage to the finish of the substrate during removal of the sealant.

4. If freshly applied sealant will be applied within 1 hour after cutting the cured sealant, solvent cleaning of the existing silicone surface will not be necessary. Since new silicone sealant fully adheres to cured silicone sealant, no priming is required for silicone sealant to adhere to silicone sealant. If the existing silicone is solvent cleaned, allow the absorbed solvent to evaporate before application of the new sealant.
5. If the existing sealant is completely removed down to the frame, solvent cleaning of the frame will be required. Primer may also be required. Please refer to the original Dow approvals for the project.
6. Clean and prepare the glass or panel before setting on the frame. Replace the spacer if necessary and set the glass. Install temporary fasteners to allow the glass to remain attached as the sealant cures. Mask the joint if necessary.
7. Fill the Structural Sealant Glazing (SSG) joint with a fresh bead of sealant. Tool the joint and remove the masking if used. Please refer to the sealant application procedures described earlier in this section. Inspect the joints to ensure that they are completely filled and properly tooled.
8. After the sealant has fully cured, the temporary clips may be removed. One-component sealant cure may take 1 to 4 weeks or longer depending on the joint geometry, temperature and humidity.
9. Quality control guidelines described later in this manual must be followed completely.

Some SSG systems do not allow easy re-glazing of the damaged glass. These systems are designed to have the entire curtainwall unit, including the frame, removed and replaced together. In such instances, follow the sealant application guidelines for new factory glazing which is described earlier in this section.

In some instances, the structural joint cannot be accessed once the glass has been set. With systems such as this where the frame cannot be removed and the glass must be set in the field, it is acceptable to use the following re-glazing procedure. Please consult with your Dow technical service engineer prior to using this re-glazing procedure.

1. Remove the damaged glass and prepare the substrate as described in steps 1 through 7 above in section “Surface Preparation and Sealant Application”.
2. Apply sealant directly to the frame. Enough sealant must be applied to comfortably overfill the Structural Glazing (SG) joint once the glass is set on the frame. The glass must be set within 10 minutes of sealant application. The glass must compress the sealant so it sufficiently fills the joints with minimal air entrapment or bubbles. If possible, the joint surface should be tooled.

5.3.8.2 Re-glazing Due to System Failure

Although complete system failure of a structural glazed system is very rare, there are situations, particularly with older SG technology or linked to quality problems not associated with the structural silicone, where an entire structurally glazed façade must be replaced. Because these projects can be very complex, please contact your Dow technical service engineer during the investigation and planning phase of the remediation.

5.3.9 Maintenance

DOWSIL™ structural glazing sealants and structural glazing systems in general do not require maintenance. Silicone sealants are inherently resistance to ultra-violet light, moisture, ozone, acid rain and other natural elements. Periodic inspection of the sealant and structural glazing system is recommended. Some local regulations require periodic inspection by an independent party. Please contact your Dow technical service engineer in request of a maintenance program specific for your project when required.

5.4 Documentation

The sealant user is responsible for developing proper quality control documentation for their project. Dow provides in the following pages, sample quality control logs that can be used on their own or as a model for a customized quality control manual. At completion of a project, the quality control logs must be provided to Dow if a warranty is requested. Dow recommends that project documentation be retained for at least the length of the warranty. These documents should be available to Dow or local officials if requested.

A comprehensive quality control manual for an Structural Sealant Glazing (SSG) project should include the following:

- SSG details that were reviewed and approved by Dow
- Dow adhesion and compatibility approval letter(s)
- In-house SSG production and quality control procedures
- Completed sealant production quality control logs, as shown in later section, with glass test, butterfly test, snap time test and mix ratio test results
- Completed sealant adhesion and cure quality control logs, as shown in later section, with peel adhesion test dry and wet conditions and deglaze test results
- Traceability documentation which allows each production unit to be precisely correlated to a specific date, time and location of production. All production units must be numbered so that they can be specifically linked to the quality control logs. The position of each panel on the building should be marked on the elevation drawing so that it can be easily identified if required. This traceability documentation is critical in the event that a problem needs to be investigated on a project.

Dow will assist you in the development of a comprehensive quality control program. During a production and quality control audit, your comprehensive quality control program will be evaluated.

5.4.1 Sealant Production Quality Control Logs

Project Number/Name:	
Caulking Person Name:	
Production Date:	**Temp (ºC)/Humidity:**
C/A (Black) Lot No:	**C/A (Black) Expiry Date:**
Base (White) Lot No:	**Base (White) Expiry Date:**
Primer: DOWSIL™ Primer-C ☐ DOWSIL™ 1200 OS Primer, UV Traceable ☐	**Primer Lot No:** **Expiry Date:**
Cleaner: Xylene ☐ 75/25 Ethanol + Water ☐ MEK ☐ Other (Specify) ☐ (Click)	
Dispensing Pump Type: CYH ☐ Graco ☐ Reinhardt ☐ Lisec ☐ Other ☐	

	Production Sequence	Unit No.	Production Sequence	Unit No.	Production Sequence	Unit No.
Morning	1		8		15	
	2		9		16	
	3		10		17	
	4		11		18	
	5		12		19	
	6		13		20	
	7		14		21	

Remark: Snap time and any sealant pail change should be recorded here.

	Production Sequence	Unit No.	Production Sequence	Unit No.	Production Sequence	Unit No.
Afternoon	1		8		15	
	2		9		16	
	3		10		17	
	4		11		18	
	5		12		19	
	6		13		20	
	7		14		21	

Remark:

5.4.2 Sealant Adhesion Quality Control Log (Peel Adhesion Test)

Company Name and Location:	
Project Name and Location:	
Dispensing Pump Type & Location:	
Cleaning Solvent:	**Primer:**
Substrates:	**Primer Lot Number:**

Date	Time	Temp & Humidity	C/A Lot Number	Base Lot Number	Peel Adhesion Test (% Cohesive Failure)			Tester
					Day 1	Day 2	Day 3	

5.4.3 Sealant Production Quality Control Log (H-Piece Test & Elastomeric Test)

Company Name and Location:										
Project Name and Location:										
Dispensing Pump Type & Location:										
Cleaning Solvent:				**Primer:**						
Substrates:				**Primer Lot Number:**						
Date	**Time**	**Temp & Humidity**	**C/A Lot Number**	**Base Lot Number**	**H-piece Test Dry**		**H-piece Test Wet**		**Elastomeric**	**Tester**
					MPa	%CF	MPa	%CF		

5.4.4 Deglaze Test Report Form

Dow Deglaze Inspection Form

Project Number/Name: _____

Deglaze Date: _____ **Deglaze Place:** _____

Glazing System Description: ☐ 2-sided ☐ 4-sided ☐ Other

Frame Description: _____

Glass Description: _____ ☐ Vision ☐ Spandrel ☐ Other

Temperature /Humidity During Curing: _____

Primer (lot number)**:** _____ **Cleaning Solvent:** _____

Dispensing Pump Type: ☐ CYH ☐ Graco ☐ Reinhardt ☐ Lisec ☐ H&G ☐ Other

Frame ID	Panel size (mm)	Dow Product	Lot number	Structural Sealant Application Date	Measured Structural Bite (frame) (mm)	Measured Structural Bite (glass) (mm)	Measured Glueline (mm)

Comments on Adhesion, Joint Fill, Sealant Cure Uniformity and Air Entrapment or Bubbles and Other Observations:

1. _____
2. _____
3. _____

Fabricator Name/Representative: _____ **Dow Representative:** _____

Distributor: _____ **Report Issue Date:** _____

5.5 Production and Quality Control Audit

Dow will audit the structural glazing production and quality control operations of any user of DOWSIL™ structural glazing silicone sealants. During this audit, the sealant user's production operations, quality control procedures and documentation will be evaluated. Dow will provide recommendations for improvement and establish an action plan with the Structural Sealant Glazing (SSG) applicator. Following are some of the important elements that Dow will be evaluating during an audit:

Production Facility Operations and Safety

- Cleanliness of the production facility
- Production facility temperature and humidity
- Proper sealant storage and handling
- Properly operating and well maintained sealant dispensing equipment
- SSG Design and material approved by Dow
- Proper substrate handling
- Compliance with Dow recommended sealant application procedures: two-cloth cleaning method, priming, sealant application, tooling, etc.
- Storage and handling of production units
- Compliance with reasonable safety procedures including safe handling of flammable materials and use of personal protective equipment

Quality Control

- Compliance with Dow sealant production quality control procedures: glass test or butterfly test, snap time test, mix ratio test
- Properly completed sealant production quality control log
- Compliance with Dow adhesion and cure quality control procedures: peel adhesion test, H-piece test, deglaze test
- Properly completed adhesion and cure quality control log
- Traceability documentation in accordance with Dow recommendations
- Commitment by management to train personnel and implement a comprehensive quality control program

For more information

Learn more about Dow's full range of building solutions, including service and support, at **dow.com/buildingscience.**

Dow has sales offices, manufacturing sites and science and technology laboratories around the globe. Find local contact information at **dow.com/contactus.**

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