IMPORTANT INFORMATION

The information contained herein is offered in good faith based on Dow Corning’s research and is believed to be accurate. However, because conditions and methods of use of our products are beyond our control, this information shall not be used in substitution for customer’s tests to ensure that Dow Corning’s products are fully satisfactory for your specific applications. Dow Corning’s sole warranty is that the product will meet its current sales specifications. Your exclusive remedy for breach of such warranty is limited to refund of purchase price or replacement of any product shown to be other than as warranted.

DOW CORNING SPECIFICALLY DISCLAIMS ANY OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY. UNLESS DOW CORNING PROVIDES YOU WITH A SPECIFIC, DULY SIGNED ENDORSEMENT OF FITNESS FOR USE, DOW CORNING DISCLAIMS LIABILITY FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES. SUGGESTIONS OF USE SHALL NOT BE TAKEN AS INDUCEMENTS TO INFRINGE ANY PATENT.
Insulating Glass Manual

Contents

Introduction .................................. 3

Dow Corning® Product Offering ............ 4
Insulating Glass Silicone Sealants ........ 4
  Dow Corning 3362
  Insulating Glass Sealant ................. 4
  Dow Corning 3362 HD
  Insulating Glass Sealant ................. 4
  Dow Corning 3793
  Insulating Glass Sealant ................. 4
  Dow Corning 3540
  Insulating Glass Sealant ................. 4
  Dow Corning 3-0117
  Insulating Glass Sealant ................. 4
Structural Glazing Silicone Sealants ...... 5
  Dow Corning 993 Structural
  Glazing Silicone Sealant ............... 5
  Dow Corning 895 Structural
  Glazing Silicone Sealant ............... 5
Weatherproofing Sealants ................ 6
  Dow Corning 756 SMS
  Building Sealant ......................... 6
  Dow Corning 791 Silicone
  Weatherproofing Sealant ............... 6
  Dow Corning 797 Silicone
  Weatherproofing Sealant ............... 6
Cleaners and Primers ..................... 6
  Dow Corning R-40 Cleaner ............... 6
  Dow Corning 3522 Cleaning
  Solvent Concentrated .................... 6
  Dow Corning 1200 OS Primer ............. 6
  Dow Corning Primer C .................... 6
  Dow Corning Primer P .................... 6

Dow Corning Customer Support ............ 7
Dow Corning Project Support .............. 7
Design Review for Structural
Glazing Project ............................. 7
Testing for Structural Glazing Project .... 8
IG Production Support .................... 8

Design and Material Considerations ....... 9
Insulating Glass Components ............. 9
Types of Insulating Glass ................. 10
  Frame Mounted Insulating Glass ......... 10
  Insulating Glass with Uncovered
  Edge Seal .................................. 10
  Insulating Glass with Mechanically
  Retained Edge Seal ....................... 12
Insulating Glass Joint Dimensioning .... 12
  Insulating Glass Joint Dimensioning
  Guidelines ............................... 12
  Insulating Glass Terminology .......... 13
    Sealant Depth .......................... 13
    Sealant Width .......................... 13
  IG Sealant Depth Calculation for Total
  Dynamic Load (Wind Load, Climatic
  Load, Impact Load) ...................... 14
  IG Sealant Depth Calculation for
  Continuous Load .......................... 15
Material Component Considerations for
  Insulating Glass Production ............ 16
  Glass Coatings .......................... 16
    Coating Types .......................... 16
    Glass Enamel ........................... 16
    Metal and Metal Oxide Coating ....... 16
    Polymer Coatings ....................... 17
  Glass Coating Removal .................. 17
    Chemical Removal ...................... 18
    Thermal Removal ....................... 18
    Mechanical Stripping .................. 18
  Spacer System Components ............ 18
    Spacer Profile Types ................. 18
    Aluminum Profiles ..................... 18
    Zinc or Galvanized Steel Profiles .. 18
    Stainless Steel Profiles ............. 18
    Organic Spacer Profile ............... 18
    Rubber Profile with
    Self Adhesive Surface ................. 18
    Thermoplastic Spacer ................. 19
Insulating Glass Manual

Contents

Desiccant ........................................ 19
Primary Seal .................................... 19
Gas Filled Insulating Glass Units ......... 20
Silicone Sealant Use in Glass .......... 20
Filled Insulating Glass Units .......... 20
Design Considerations ................... 21
Workmanship Considerations .......... 22
Insulating Glass with Warm Edge ....... 23

Product Quality ......................... 24
General considerations .................. 24
Material storage and handling .......... 24
Shelf life .................................. 24
Joint Preparation and Sealant Application .................. 24
Quality Control .......................... 24
One-Component Sealants .............. 25
Storage Temperature and Conditions .............. 25
Skin-over time/elastomeric test ......... 25
Two-Component Sealants .............. 26
Storage Temperature and Conditions .............. 26
Two-Component Dispensing Equipment Guidelines .................. 26
Surface Preparation and Sealant Application .................. 28
Substrate Cleaning Procedure ........ 29
Non-Porous Substrates ................. 29
Solvent Consideration ................. 29
Masking .................................. 29
Two-cloth cleaning method ............ 29
Substrate Priming Procedure .......... 30

Sealant Application and Quality Control Procedures ............ 31
Sealant Application Procedure ........ 31
Sealant Cure Requirements .......... 31
Factory Glazing Cure Requirements .. 31
Quality Control Test Procedures ....... 33
General Considerations ............... 33
Sealant Production Quality Control .... 33
Glass Test ................................ 34
Butterfly Test ............................ 35
Snap Time Test ............................ 36
Mixing Ratio Test ....................... 37
Adhesion and Cure Quality Control Tests ............ 38
Peel Adhesion Test ...................... 39
H-Piece Test ............................ 41
Butterfly Adhesion Test ............... 43

Documentation ......................... 44
Production and Quality Control Audit ..... 45
Production Facility Operations and Safety ............ 45
Quality Control ........................ 45
Sealant Production Quality Control Log .................. 46
Sealant Adhesion Quality Control Log (Peel Adhesion Test) ............ 47
Sealant Cure Quality Control Log (H-Piece Test, Butterfly Adhesion Test & Elastomeric Test) ............ 48

Dow Corning Construction Sales Offices .................. 50
Introduction

Insulating glass is a key component of modern façade construction. Insulating glass brings many benefits to curtainwall functionality. With today’s high cost of energy, the thermal performance of a building façade has become very important. The use of insulating glass in façade construction allows the design profession to construct buildings with large vision areas that are aesthetically appealing as well as thermally efficient.

Insulating glass (IG) units consist of two or more glass panes which are separated along the perimeter by a spacer and sealant system. The cavity between the panes of glass may be filled with dry air or an inert gas. Many types of glass can be used including laminated glass, coated glass or spandrel glass. These components are selected to meet the specific coloration, reflectivity, light transmission and sound transmission requirements of the IG unit.

Insulating glass is also used in silicone structural glazing which is a method utilizing silicone adhesive to attach glass to the structure of a building. The performance of insulating glass in structural glazing applications is critical due to the loads, stresses and extreme environmental factors impacting the façade. For these requirements to be fulfilled, both the construction of IG units and the manufacturing of the individual components must meet very high standards of quality. From the glass production and coating application, through the manufacturing of spacer bars and sealants, to the final assembly of insulating glass products, quality must be consistently maintained through the implementation of special application and quality control procedures.

The selection of the proper materials is a key element of successful IG performance. Dow Corning® provides high performance silicone sealants which are specifically designed for the production of insulating glass.

The Dow Corning Insulating Glass Manual is intended to provide guidelines and considerations for the IG manufacturers, not only for the use of Dow Corning insulating glass sealants, but also as a source of additional information about IG production. No claim is made as to its completeness or accuracy of the statements made in this manual. It was prepared by Dow Corning based on the company’s best current knowledge and experience in sealant manufacturing and IG production. Dow Corning makes no claim as to the performance of IG units based on information provided in this document.
Dow Corning® Product Offering

Dow Corning offers a full line of high performance silicone sealants. Each sealant is developed and tested for a specific application and should only be used as intended unless specifically approved by Dow Corning. Specific product information is available at www.dowcorning.com.

Insulating Glass Silicone Sealants
The Dow Corning® Silicone Sealants offered for insulating glass applications are described below. These products are intended for IG production only and are not approved for use as structural glazing sealants. A typical structural glazing application would be the attachment of glass to a metallic frame.

Dow Corning® 3362 Insulating Glass Sealant
Dow Corning 3362 Insulating Glass Silicone Sealant is a two component, fast cure, neutral-curing silicone sealant intended for use as a secondary seal in dual sealed IG units. Dow Corning 3362 Insulating Glass Sealant has been granted a “European Technical Approval” (ETA) based on independent testing in accordance with the current European structural glazing guideline ETAG-002. Dow Corning 3362 Insulating Glass Sealant is appropriate for use in IG units used in structural glazing applications. The product has been granted a CE-label based on this approval. The sealant is available in three different curing agent viscosity types: Standard, HV and HV/GER. For more information, please refer to the product data sheet.

Dow Corning® 3362 HD Insulating Glass Sealant
Dow Corning 3362 HD Insulating Glass Silicone Sealant is a special higher modulus grade of sealant specifically designed for IG units. The higher modulus properties of the sealant limit the deflection of the primary seal of the IG unit increasing the probability for the IG system to pass gas loss tests (e.g. EN 1279/3). This product is available in the same package and with the same curing agents as Dow Corning 3362 Insulating Glass Sealant.

Dow Corning® 3793 Insulating Glass Sealant
Dow Corning 3793 Insulating Glass Sealant is a one component, neutral curing silicone sealant intended for use as a secondary seal in dual sealed IG units. Dow Corning 3793 Insulating Glass Sealant is appropriate for use in IG units used in structural glazing applications.

Dow Corning® 3540 Insulating Glass Sealant
Dow Corning 3540 Insulating Glass Sealant is a one component, neutral curing silicone sealant intended for use as a secondary seal in dual sealed IG units. Dow Corning 3540 is not appropriate for use in IG units used in structural glazing applications but is appropriate for use in UV edge exposed non structural IG unit.

Dow Corning® 3-0117 Insulating Glass Sealant
Dow Corning 3-0117 Insulating Glass Sealant is a one component, neutral curing silicone sealant intended for use as a secondary seal in dual sealed IG units. Dow Corning 3-0117 is appropriate for use in IG units used in structural glazing applications.
**Dow Corning® Product Offering**

### Structural Glazing Silicone Sealants

The following *Dow Corning* silicone sealants are offered for structural glazing applications. Only the *Dow Corning* Structural Glazing Silicone Sealants indicated below are permitted for use as structural glazing adhesives. For more information on the proper use of silicone sealants in structural glazing applications, please refer to the “*Dow Corning* Silicone Structural Glazing Manual” which is available at www.dowcorning.com. Structural glazing sealants may also be used as insulating glass sealants. Please contact your *Dow Corning* Technical Service Engineer for more information.

**Dow Corning® 993 Structural Glazing Silicone Sealant**

*Dow Corning* 993 Structural Glazing Silicone Sealant is a two-component, fast-cure, neutral-curing silicone sealant intended for structural bonding of glass, metal and other panel materials. When compared to conventional one-component silicone sealants, the fast cure properties of *Dow Corning* 993 allow increased production of structurally glazed curtainwall units. *Dow Corning* 993 is a high modulus sealant with excellent adhesion to a wide range of materials. *Dow Corning* 993 has been granted a “European Technical Approval” (ETA) based on independent testing in accordance with the current European structural glazing guideline ETAG-002. The product has been granted a CE-label based on this approval.

**Dow Corning® 895 Structural Glazing Silicone Sealant**

*Dow Corning* 895 Structural Glazing Silicone Sealant is a one component, neutral-curing silicone sealant intended for structural bonding of glass, metal and other materials. *Dow Corning* 895 is a high modulus sealant with excellent adhesion to a wide range of materials. *Dow Corning* 895 has been granted a “European Technical Approval” (ETA) based on independent testing in accordance with the current European structural glazing guideline ETAG-002. The product has been granted a CE-label based on this approval.
Dow Corning® Product Offering

Weatherproofing Sealants

Dow Corning offers a full line of high performance sealants for weatherproofing applications. Following is a brief description of Dow Corning 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 proper use of silicone sealants in weatherproofing applications, please refer to the “Dow Corning® Building Envelope Weatherproofing Manual” which is available at www.dowcorning.com.

Dow Corning® 756 SMS Building Sealant

Dow Corning 756 SMS Building Sealant is a one component, low modulus, 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. This sealant is designed to be non-staining on natural stone and to attract less dirt and atmospheric contaminants than conventional silicone building sealants.

Dow Corning® 791 Silicone Weatherproofing Sealant

Dow Corning 791 Silicone Weatherproofing Sealant is a one component, low modulus, neutral-curing silicone sealant with a faster skinning time for general weathersealing applications.

Dow Corning® 797 Silicone Weatherproofing Sealant

Dow Corning 797 Silicone Weatherproofing Sealant is a one component, low modulus, neutral-curing silicone sealant with a longer tooling time for general weathersealing applications.

Cleaners and Primers

Dow Corning offers a line of cleaners and primers that are developed specifically for use with Dow Corning sealants. In some instances, a specific cleaner or primer will be required for the silicone sealant to achieve optimal adhesion to a specific substrate. For general substrate cleaning and priming recommendations, please refer to the “Dow Corning® Europe Adhesion/Compatibility Guide” which is available at www.dowcorning.com.

Dow Corning® R-40 Cleaner

Dow Corning R-40 Cleaner is a specially formulated solvent blend designed to clean glass and metal profiles used in structural glazing applications.

Dow Corning® 3522 Cleaning Solvent Concentrated

Dow Corning 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.

Dow Corning® 1200 OS Primer

Dow Corning 1200 OS Primer is a one-part chemical treatment primer designed for use with Dow Corning sealants in a variety of applications.

Dow Corning® Primer C

Dow Corning Primer C is a one-part chemical treatment primer designed for painted and plastic surfaces to promote sealant adhesion development.

Dow Corning® Primer P

Dow Corning Primer P is a one-part film forming primer designed for use on porous substrates in weathersealing applications.
Dow Corning® Customer Support

Dow Corning offers a broad range of products and services to assist manufacturers in the production of insulating glass. Dow Corning can assist the IG manufacturer in the design of the secondary seal joint dimensioning. Dow Corning technical service engineers can assist in the design, evaluation and component selection of the insulating glass system, considering the special requirements related to gas permeability. Dow Corning can assist the IG manufacturer in the development of a comprehensive quality control program that can help to ensure proper sealant application and quality control. A further description of these customer support elements is provided in the following sections of the Dow Corning Insulating Glass Manual.

Dow Corning Project Support

Every structural glazing project using Dow Corning Structural Glazing Sealants must be reviewed and approved by Dow Corning. Please refer to the Dow Corning Silicone Structural Glazing Manual for a description of the guidelines that must be followed. In support of our structural glazing products, Dow Corning will review insulating glass joint dimensioning to ensure compliance with European and industry standards. Dow Corning will provide a recommendation letter supporting the use of Dow Corning Insulating Glass Sealants for a specific project. Approval is based on production in compliance with the guidelines provided by Dow Corning in this manual.

Since the silicone secondary sealant of the IG unit is only one element of the final product, it alone cannot determine the successful performance of the IG units. Many elements including the spacer type, butyl primary seal type and application, glass type, material performance, product application and workmanship will affect the overall performance of the IG unit. It is the responsibility of the IG producer to select the appropriate materials and construction of their manufactured IG units. The IG producer is ultimately responsible for the overall performance of the IG units produced.

Design Review for Structural Glazing Project

All structural glazing projects must be reviewed and approved by Dow Corning on project by project basis. Guidelines for the appropriate design of structural glazing are described in the Dow Corning Silicone Structural Glazing Manual. For structural glazing projects that use insulating glass, the silicone secondary seal on the IG unit must be an approved silicone sealant. When Dow Corning Insulating Glass Sealants are selected for this application, Dow Corning offers to review IG joint dimensions to ensure compliance with Dow Corning and relevant industry standards. Please submit project information or the “Project Checklist” by the procedures described in the Dow Corning Silicone Structural Glazing Manual. Please include information such as glass dimensions, sealant joint dimensions, total dynamic loads and a cross-section detail of the IG unit edge design.
**Testing for Structural Glazing Project**

For all structural glazing projects, the materials which contact the *Dow Corning* Structural Silicone Sealant must be tested for adhesion and compatibility by *Dow Corning*. Guidelines for material selection and testing are described in the *Dow Corning* Structural Glazing Manual. When *Dow Corning* Insulating Glass Sealants are used, *Dow Corning* recommends that any material which has not been previously tested and approved by *Dow Corning* for adhesion and compatibility should be tested by *Dow Corning* prior to use. Please refer to the *Dow Corning* Europe Adhesion/Compatibility Guide for current standard recommendations. If a material needs to be tested, please refer to the *Dow Corning* Silicone Structural Glazing Manual for information on submitting samples for testing to *Dow Corning*.

**IG Production Support**

*Dow Corning* professionals offer their experience and expertise to any insulating glass manufacturer who selects *Dow Corning* Insulating Glass Sealants for their IG production. *Dow Corning* Technical Service Engineers are available to review the IG production elements including material selection, production procedures, workmanship, quality control procedures and documentation. *Dow Corning* can also provide recommendations to IG producers who would like to receive a CE Mark or to comply with any other regional norms. *Dow Corning* can assist in particular with achieving compliance according to gas filled IG Sealant standard EN- 1279 part 3. Many *Dow Corning* customers have successfully passed EN-1279-3 gas loss requirements using *Dow Corning* Insulating Glass Sealants. We can help you achieve similar results. These issues are discussed further in subsequent sections of the *Dow Corning* Insulating Glass Manual.
Design and Material Considerations

Many elements will help to determine the successful performance of an IG unit. In this section, we will discuss types of insulating glass, IG joint dimension and the components of an IG unit and how these components affect the overall performance of an IG unit. We will also consider how these elements relate to satisfying European standards.

Insulating Glass Components

An IG unit, whether used in a structural glazing system or in a mechanically captured or frame mounted glazing system, is intended to offer the building occupant an aesthetically pleasing, thermally efficient façade element which requires minimal maintenance during the expected life of the unit. Typical IG units are comprised of two (or occasionally three) panes of glass with a cavity between the panes. The panes of glass are sealed around the perimeter with a spacer and sealant system which ensures that the units are hermetically sealed and sufficiently stable to withstand thermal and windload stresses on the unit. For a typical “dual-sealed IG unit”, a polyisobutylene (PIB) or “butyl” primary seal between the metal spacer and glass provides low vapour permeability and a silicone secondary seal provides structural integrity for the panes of glass.

For insulating performance, the space between the panes of glass is filled with dry air or more commonly filled with an inert gas which provides enhanced thermal insulating performance. To maintain the long term insulating performance of the unit, the glazed perimeter of the IG unit must have low vapour permeability to resist an ingress of moisture which can cause fogging of the IG unit. To absorb incidental moisture that may enter the void, a desiccant is commonly used in the spacer element. All of these elements must work synergistically to provide the expected performance of the IG unit. Below is a diagram showing a typical IG unit and the common elements of the design.
Design and Material Considerations

Types of Insulating Glass
Depending on the specific assembly and mounting support of the façade, insulating glass can be classified into three different types. The three types of insulating glass are described in the following section.

Frame Mounted Insulating Glass
Frame mounted insulating glass is secured on all four sides by a frame that completely covers the edge seal. The insulating glass may be placed inside a fixed frame or the insulating glass could be set on the frame then secured continuously by a pressure bar. Typical applications include curtainwall facades or windows constructed of wood, plastic or aluminum. In these designs, there is no restriction on the type of spacer bar system or sealant type used. Silicone insulating glass sealants which are recommended for non-structural and structural applications can be used effectively in these designs.

Insulating Glass with Uncovered Edge Seal
For insulating glass with an uncovered edge seal, there are additional demands on the primary and secondary seals of the IG unit. Ultra-violet (UV) rays from the sun travel readily through glass and can damage the edge seal of the IG unit. The sealants selected for insulating glass with uncovered edge seals must be tested in accordance with EN 1279 requirements. Only silicone sealants are stable after long term exposure to UV light. Current European structural glazing standards such as ETAG 002 (Guidelines for European Technical approval for Structural Glazing Systems (SSGS) Part 1) accept only silicone sealants for structural glazing applications. Organic sealant such as polysulphide and polyurethane do not provide long term resistance to UV light and are not recommended for this application.

Standard SG Detail with IG Unit
Insulating Glass Manual

Design and Material Considerations

Typical examples of insulating glass with uncovered edge seal include:

- Silicone structural glazing where the IG unit is structurally glazed on the inner pane of glass. In these designs, the IG secondary seal is structurally attaching the outer pane of glass. A design is considered “structurally glazed” if 1, 2, 3 or 4 edges of the glass are supported by structural silicone sealant and there is no mechanical attachment of the glass along the edge. A silicone insulating glass sealant approved for structural glazing projects must be used. Organic sealants are not permitted in these applications according to European standards.

- Silicone structural glazing where the insulating glass is produced as a “stepped glass” and the structural silicone is applied to the inner surface of the outer pane of glass. In this design, the secondary seal of the IG unit is typically not acting structurally. Nevertheless, due to the high UV exposure of the edge seal of the IG unit, only UV-stable silicone insulating glass sealants are recommended for this application. Please see the figure below.

- Structural glass systems which are point supported or bolted to the structure. Structural glass systems often have the appearance of a structurally glazed facade. These systems are not structural glazing unless the glass fixation is done only on the interior pane of glass. The insulating glass edge is typically uncovered in these designs.

![Stepped Glass Insulating Glass Unit Diagram]

Stepped Glass Insulating Glass Unit

Secondary Seal

Dow Corning® 3362
Dow Corning® 3793

Silicone Profile Section

Metal Profile Section, i.e. Anodised Aluminium, Stainless Steel

Glass

Polyisobutylene
(Primary Seal)

Double-Side Adhesive Tape

Structural Glazing Silicone

Dow Corning® 993
Dow Corning® 895
Design and Material Considerations

**Insulating Glass with Mechanically Retained Edge Seal**

Many proprietary systems have been introduced where the inner pane of an IG unit is mechanically retained to the structure. These designs commonly use a metallic U-profile channel applied into the silicone secondary seal of the IG units. The IG unit is attached to the structure of the building by mechanical retention along the cavity of the U-profile channel. Some designs have a continuous U-profile channel and some are positioned periodically along the perimeter of the glass. Some designs use a combination spacer and U-profile in one extrusion. These designs are considered as structural glazing since the outer pane of glass is structurally attached to the profile and not the inner pane of glass.

Since these designs are proprietary to the system designer, Dow Corning reviews and approves these designs on a system by system basis. Although the designs may appear similar, variation on the design will determine whether Dow Corning considers the design a “structural glazing” or an “insulating glass” application.

All mechanically retained IG systems must be reviewed and approved by Dow Corning Technical Service Engineers. Upon completion of this review, Dow Corning will determine whether a design is considered “insulating glass with mechanical retention” or “structural glazing to a U-profile channel”.

**Insulating Glass Joint Dimensioning**

Proper dimensioning of the secondary seal of an IG unit is critical to the ultimate performance of the unit. Many factors affect the performance of the IG unit including wind, climatic and impact loads. Dow Corning offers to review the joint dimensioning of an IG secondary seal and will make recommendations based on the following guidelines. Ultimately the IG manufacturer is responsible for the joint dimensioning and performance of their IG units.

**Insulating Glass Joint Dimensioning Guidelines**

Following are guidelines that apply for the use of Dow Corning Insulating Glass Sealant.

- A minimum joint depth of 6 mm is required if the edge seal of the IG unit provides any structural function such as for structural glazing.
- When used for structural function, the IG secondary seal shall be as determined by the IG Sealant Depth Calculation for Total Dynamic Load (Wind Load, Climatic Load, Impact Load)
- When used for structural function and the IG unit is subjected to permanent shear or tension load, the IG secondary seal shall be as determined by the IG Sealant Depth Calculation for Continuous Load.
- The above guidelines are minimum requirements and exclude any application tolerances
Insulating Glass Manual

Design and Material Considerations

Insulating Glass Terminology

**Sealant Depth**
The sealant depth is the minimum dimension from the spacer to the outer edge of the silicone secondary seal. This dimension may also be referred to as the “bite” or “height” of the insulating glass sealant.

**Sealant Width**
The sealant width is the dimension between the panes of glass. The sealant width may also be referred to as the “cavity” or “air space” of the IG unit.

---

**Structural Glazing in Insulating Glass Unit**
IG Sealant Depth Calculation for Total Dynamic Load (Wind Load, Climatic Load, Impact Load)

The sealant depth requirement is based on the total dynamic loads applied to the IG unit. The loads may be from the wind, climate or impact. Higher wind loads and larger dimensions of the glass require greater sealant depth. Climatic loads are determined by the change in temperature and pressure on the IG unit. Climatic loads on the secondary seal are greater for smaller glass dimensions in most situations. Dow Corning considers the effect of climatic loads during the joint dimensioning of an IG unit. Additional loads such as impact loads or point loads can also be considered in the determination of total dynamic load.

IG Sealant Depth Calculation for Total Dynamic Load

\[
\text{Minimum Sealant Depth (m)} = \frac{\text{Glass Short Span Dim. (m)} \times \text{Total Dynamic Load (Pa)} \times 0.5}{140,000 \text{ Pa}}
\]

- 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.
- Total Dynamic Load is the difference between the pressure in the cavity of the IG unit and the sum of wind load and atmospheric pressure. The pressure in the cavity is affected by temperature, elevation and atmospheric pressure during production of the IG unit. Impact loads such as line loads or snow loads can be included in the total dynamic load. The stiffness of the glass panes will affect the total dynamic load.
- The maximum wind load in Pascal is based on a return period of 10 years according to EUROCODES and local regulations. This value is provided by the design professional to Dow Corning. 1 Pa = 1 N/m²
- 140,000 Pa (0.14 MPa) is the Maximum Allowable Design Stress for both Dow Corning 3362 and Dow Corning 3793.
- Maximum allowable design stress is based on the Ru,5 value with a safety factor of 6. The Ru,5 value is the probability at 75% that 95% of the population will have a breaking strength above this value.
Design and Material Considerations

IG Sealant Depth Calculation for Continuous Load

The IG secondary seal is subject to continuous load if the outer pane of glass is not supported by horizontal framing members or setting blocks, or is being used in roof glazing or positive sloped glazing. The deadload weight of the glass must be considered in the joint dimensioning of the IG unit. Thicker glass panes will require greater sealant depth of the IG joint. Additional loads such as snow loads will also affect the continuous load on an IG unit and should be considered.

\[
\text{Min. Sealant Depth (m)} = \frac{2,500 \text{ kg/m}^3 \times 9.81 \text{ m/s}^2 \times \text{Glass Thickness (m)} \times \text{Glass Dim (m}^2\text{)}}{2 \times [\text{Height (m)} + \text{Width (m)}] \times \text{Allowable Design Stress for Continuous Load}}
\]

- 2,500 kg/m\(^3\) is the specific mass of float glass corresponding to approximately 25,000 N/m\(^3\) of specific weight.
- 9.81 m/s\(^2\) is a factor for gravity.
- The Glass Thickness and Glass Dimension are determined only for the outer pane of insulating glass unit.
- The Allowable Design Stress for Continuous Load for Dow Corning 3362 and Dow Corning 3793 is 7,000 Pa.
Material Component Considerations for Insulating Glass Production

For the successful performance of IG units, it is important that the proper materials are selected. There are many different types of glass, glass coatings, spacer materials, desiccants, primary seals, etc. to choose from. These products must be tested and found to be compatible with each other. Please refer to the Dow Corning Europe Adhesion/Compatibility Guide for a list of specific recommendations. There are special considerations when using specific components of an IG unit. The following discussion is intended to help the manufacturer of IG units to properly select and handle the components of an IG unit. It is ultimately the decision of the IG producer to select the materials for his or her own IG units.

Glass Coatings

Due to the continual advancement in glass coating technology, a wide range of possibilities are available to the glass processor. All glass coatings should exhibit sufficient resistance to chemicals, maintain adhesion to glass and remain integral. In addition, the Dow Corning Insulating Glass Sealant should be tested for long term adhesion to the specific glass coating. Coatings which do not meet these requirements should be removed from the glass surfaces to be bonded.

Coating Types

Glass Enamel

Glass enamel is a ceramic glass coating that is applied by various means, i.e. spray, roller, screen print, transfer print or dip coating. The inorganic coating is fused to the glass surface by firing the glass at a high temperature (>550°C). For successful performance, the enamel must demonstrate scratch resistance, chemical resistance, smooth surface roughness and a thermal coefficient of expansion similar to glass. In most cases, Dow Corning Insulating Glass Sealants demonstrate excellent adhesion to glass enamel coatings, often requiring a primer.

Metal and Metal Oxide Coating

Metal or metal oxide coatings are either pyrolytically or magnetronically applied to the glass surface. In the pyrolytic method, molten metal or metal oxide is applied at high temperature to the glass by either dipping or spraying. Magnetronic sputtering allows various metal and metal oxide coatings to be applied in thin layers on the glass substrate. This permits a broad range of light reflection, light transmission, infrared reflection and color of the glass surface. Magnetronic sputtering also allows for a combination of heat and sun protective coatings to be applied one on top of the other.
Design and Material Considerations

Hard coatings are usually composed of nickel and chrome elements which are especially suited as sun protective coatings. Sun protective coatings can be applied either pyrolytically or magnetronically.

Soft coatings usually contain silver which has high reflective properties and is especially effective in protection against heat radiation. As a rule, coatings that provide heat reflective properties are magnetronically applied, so that the silver coating which is soft and susceptible to corrosion may be embedded between metal oxide layers such as tin or bismuth oxide.

Depending on the coating type, the coating may have to be removed from the surface area to be sealed. Each individual coating type should be tested by Dow Corning. Please refer to the Dow Corning Europe Adhesion/Compatibility Guide for the most current recommendations. Normally, Insulating Glass Sealants can be applied over all pyrolytic coatings and most hard magnetronic coatings without the need for primer, while heat reflective coatings that contain a soft silver layer must be completely removed.

Polymer Coatings

Various polymer coatings are available for use as spandrel glass coatings. These coatings may be single or multiple components. Polymer coatings which are based on organic polymers such as polyurethane, acrylic, polyester or epoxy are not generally acceptable for structural glazing applications. Inorganic silicone based polymer spandrel coatings are available and may be suitable for structural glazing applications. The coating manufacturer must verify that their polymer coating is durable and has long term adhesion to glass. Specific polymer coatings must be tested for compatibility and long term adhesion with the Dow Corning Insulating Glass Sealant. Please refer to the Dow Corning Europe Adhesion/Compatibility Guide for the most current recommendations.

Glass Coating Removal

Dow Corning Insulating Glass Sealants should only be applied to coatings which exhibit sufficient resistance to chemicals, long term adhesion to glass, durability and integral performance. If a glass coating does not demonstrate these features or is incompatible with the insulating glass sealant, the glass coating must be removed. Also if the Dow Corning Insulating Glass Sealant does not adequately adhere to the glass coating, the coating must be completely removed from the glass surfaces to be bonded. Coating removal should be complete leaving no residue on the glass surface. Should coating residue remain on the glass surface, appropriate tests should be performed to ensure that the residue does not adversely affect adhesion of the Dow Corning Insulating Glass Sealant. Following are the known practices used to remove glass coatings.

Mechanical Stripping

This is the most common method to remove a glass coating. Special grinding tools are used to remove glass coating only on the surfaces to be bonded. Grinding may be done manually or integrated into the production line. The quality of the coating removal is dependent upon the nature of
Design and Material Considerations

the coating, the quality and condition of the grinding machine, as well as the production variables such as feed rate, grinder speed and grinding pressure. Wet grinding may also be effective to remove a glass coating. For some coating types, it is not possible to achieve a completely residue free coating removal by means of mechanical stripping. Accordingly, testing of sealant adhesion to glass surfaces treated by this method is especially important to ensure proper adhesion.

Chemical Removal
This method uses acid in an appropriate concentration to remove a soft coating from glass. This technique is effective in removing a coating completely from glass. Due to the inherent dangers of handling such substances, this technique is rarely used today.

Thermal Removal
This method uses a heat-gun to chemically destroy the glass coating. Once the coating is oxidized, it can be easily wiped from the glass. Due to the inability to control the heat-gun, this method is rarely used today.

Spacer Profile Types

Aluminium Profiles
Aluminium profiles may be either mill finished or anodized in a variety of colors. Aluminium spacers are very common due to their low cost, ease of handling and bending.

Zinc or Galvanized Steel Profiles
Zinc or galvanized steel profiles are low cost and easy to handle. Steel has a lower coefficient of thermal expansion and heat transmission than aluminium which often improves the durability and performance of an IG unit.

Stainless Steel Profiles
Stainless steel profiles are generally higher in cost and more difficult to handle. Handling depends on the dimension of the profile. Stainless steel is very durable and has a lower heat transmission coefficient than aluminium to provide a durable, high performance IG unit. Stainless steel profiles are available in silver or black.

Organic Spacer Profile
This spacer type is a composite of organic polymer and a metallic foil to provide a vapour barrier. Some organic spacer profiles use glass fiber impregnation in the organic polymer to provide stiffening.

Rubber Profile with Self Adhesive Surface
This spacer type is composed of a silicone foam core with a two-sided adhesive, a metallic foil and pre-applied butyl seal to provide a vapour barrier. This profile provides good thermal insulating properties.

Spacer System Components
For successful performance of an IG unit, the spacer system components serve several functions. The spacer profile maintains the cavity dimension and encloses the cavity of the IG unit. The spacer also supports the desiccant which keeps the cavity free of moisture. A primary seal provides a vapour barrier for the cavity of the IG unit. A wide range of spacer system components are available for IG production. There are advantages and disadvantages to all of these materials. Following is a discussion of the different spacer system components available.
Design and Material Considerations

Thermoplastic Spacer
Thermoplastic spacer is applied directly on the glass surface on the automated production line. This material is a one-component hot melt sealant that acts as a spacer, vapour barrier and desiccant in one. This material provides very good thermal insulating properties.

Desiccant
A desiccant is a molecular sieve which is inserted into the spacer profile during IG production. This molecular sieve acts to absorb incidental moisture in the cavity of the IG unit. Proper storage and handling of the desiccant is critical for the performance of the IG unit. Different grades of desiccant need to be used for dry air and gas filled IG units.

Primary Seal
The primary seal in an IG unit provides the vapour and gas barrier between the metallic or organic spacer profile and glass. Polyisobutylene (or PIB) is the common material used as a primary seal in an IG unit. The PIB must be continuous during application and be fully compatible with the adjacent materials including the secondary seal of the IG unit. For successful performance, the PIB must be stable and durable in the climatic environment in which the IG unit will be exposed.
Gas Filled Insulating Glass Units

Due to global demands to lower the levels of carbon dioxide (CO₂) emissions and the fact that domestic emission accounts for 25% of the total CO₂ emissions, modern building construction must provide more thermally efficient window and façade systems. Until recently, windows have been one of the primary sources of thermal loss in building construction. Due to the development of new low emissivity (low-E) coated glass, gas filled IG units and warm edge technologies, windows can now be thermally efficient as well as providing aesthetic appeal to the building construction.

Thermal transfer by conduction and convection in an IG unit can be decreased by substituting air with a gas having lower thermal conductivity (argon, krypton or xenon). Transfer by radiation can be decreased using low emissivity (low-E) glass and the thermal conductivity at the edge can be reduced through warm edge technology. The table below reports the thermal transmittance of a single glass pane and IG units (Ug) with and without low-E coating and gas-filling.

<table>
<thead>
<tr>
<th>Number of Panes</th>
<th>Type</th>
<th>Ug-Value (EN 52619) W/(m² K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single pane</td>
<td>Monolithic float glass, 4mm</td>
<td>5.2</td>
</tr>
<tr>
<td>Double Pane</td>
<td>Float glass (2x4mm glass, 16 mm spacer, air filled)</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Float glass (2 x 4 mm glass, 16 mm spacer, low-E coat (1x), air filled)</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>Float glass (2 x 4 mm glass, 16 mm spacer, low-E coat (1x), argon filled)</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Float glass (2 x 4mm glass, 1 x 16 mm inter-pane space), low-E coat (1x), Krypton-filled</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Silicone Sealant Use in Gas Filled Insulating Glass Units

While the key performance advantage of organic based sealants (polysulphide, polyurethane) for high thermal efficient IG units is their low gas permeability, (which allows them higher workmanship tolerance) their relatively weaker adhesion to glass after exposure to sunlight prohibits their use in structural glazing, roof glazing or any other application that requires high durability, UV exposure and/or extreme weathering resistance.

Silicone sealants, on the other hand, excel in their adhesion durability to glass after sunlight exposure, making them the material of choice for structural and commercial glazing as well as demanding roof glazing applications. With over 25 years of global experience with silicone insulating glass sealants, the excellent performance and service-life of silicone dual-sealed IG units have been demonstrated.

Recent developments have demonstrated that argon-filled, silicone dual-sealed IG units can be manufactured, which reliably
Design and Material Considerations

pass EN 1279-3 requirements. Numerous commercial systems using gas and silicone have been successfully introduced to the market. Consequently, silicone dual-Sealed IG units can today be produced that not only excel in their durability and longevity, but also reliably meet the stringent requirements for gas retention, and therefore provide optimum service-life and insulation value.

Due to the high gas permeability of silicone sealants, special considerations must be taken in the design and manufacture of silicone sealed IG units. The key point is to focus on the gas leakage through the IG unit as a whole, not necessarily through individual components. Indeed, a properly applied polyisobutylene primary seal is so impermeable to inert gases that it alone acts as the main barrier to gas leakage while the secondary seal acts to secure the two glass panes and protect the primary seal from harsh environmental conditions and premature degradation. The table below summarizes overall argon gas permeability of dual seal sealant types.

<table>
<thead>
<tr>
<th>Sealant Type</th>
<th>Single Permeability (cm²/(s·cmHg))</th>
<th>Dual Permeability (cm²/(s·cmHg))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyisobutylene (PIB)</td>
<td>$5 \times 10^{-11}$</td>
<td>n/a</td>
</tr>
<tr>
<td>Polysulphide</td>
<td>$1.5 \times 10^{-10}$</td>
<td>$6.82 \times 10^{-11}$</td>
</tr>
<tr>
<td>Polyurethane (Polybutadien)</td>
<td>$8.0 \times 10^{-10}$</td>
<td>$8.00 \times 10^{-11}$</td>
</tr>
<tr>
<td>Polyurethane (Polyether)</td>
<td>$2.8 \times 10^{-9}$</td>
<td>$8.24 \times 10^{-11}$</td>
</tr>
<tr>
<td>Silicone</td>
<td>$3.7 \times 10^{-4}$</td>
<td>$8.33 \times 10^{-11}$</td>
</tr>
</tbody>
</table>

Design Considerations

Design is a primary element affecting whether an IG unit will pass gas loss requirements. The loss of gas can be reduced by increasing the resistance to gas leakage. Gas leakage can be slowed by decreasing the area available for gas transmission and increasing the path length required for gas transmission.

Bent spacer-frame corners, gas-filling techniques integrated into the IG assembling process (rather than filling via holes drilled into the spacer), improved semi-automatic PIB application equipment and in-line (heated) PIB primary seal presses have all substantially contributed to the reduction of gas loss and helped to improve the quality and service-life of IG units.

It has been demonstrated that IG edge-seal systems which have the ability to accommodate some movement within the spacer itself, place less stress on the primary seal and thus ensure low gas loss rates under accelerated and actual service-life conditions. Examples of such spacers include thermoplastic spacers or rubber profile spacers.
Design and Material Considerations

Insulating glass edge-seal systems that minimize differential thermal movement or minimize primary seal movement, especially within the sensitive corner region, tend to perform significantly better in terms of gas loss rates than systems with high thermal movement. For example, IG units of different designs, but based on stainless steel spacers, have better gas loss rates than IG units using aluminium spacers.

In the case of rigid spacers, the degree to which the primary seal is strained during periods of positive pressure differential and the time during which extension in the primary seal occurs are determined by the modulus and elastic recovery of the secondary seal. A secondary seal which has high modulus and high elastic recovery will reduce the strain on the primary seal. In practice, positive pressure differentials occur at low atmospheric pressures or at high temperature, whereby temperature is responsible for most pressure differentials. Therefore, the tensile stress behavior (Young’s modulus) of secondary sealants at elevated temperatures must be considered as well as elastic recovery properties of the sealant.

*Dow Corning* 3362 HD has been developed specifically to provide the high modulus and elastic recovery requirements of this application.

Workmanship Considerations

Workmanship plays an important role in determining the success of gas filling, much as it does in ensuring success of manufacturing a standard air-filled IG unit. Following are some practices which will assist in the qualification and production of IG units which pass gas-filling requirements:

- Glass panes and spacers must be properly cleaned to ensure that the primary and secondary sealants achieve satisfactory adhesion.

- Spacers must be properly aligned. Failure to do so will result in less than desired secondary seal depths. PIB primary seal stressing and failure can occur if insufficient secondary seal is present to maintain structural integrity of the IG unit. Bent corners are recommended to maintain a solid, uniform spacer function.

- Corner keys and any probe holes located in the spacer should be injected with PIB to eliminate voids or openings of any kind through which gas could migrate. Any voids or openings will act as a channel through which the gas will migrate with minimal resistance.

- The PIB primary seal cannot contain voids or skips. Any voids or skips will act as an open door for gas migration. The PIB primary seal must be applied in a uniform and continuous depth and thickness along the entire perimeter of the IG unit. The PIB must be homogeneous and fully wet both the glass and spacer during IG production.
Design and Material Considerations

- The secondary seal must also be free of voids or skips. Any inconsistencies may allow undue stressing or failure of the PIB seal, the primary barrier to gas leakage. Two-part sealants must be properly mixed and used at the proper mix ratio. Please refer to the Product Quality section of this manual for proper guidelines.

*Dow Corning* can assist the IG manufacturer to optimize their design and production processes to meet current European gas loss testing requirements. For more information, please contact your *Dow Corning* Technical Service Engineer.

**Insulating Glass with Warm Edge**

Insulating glass manufacturers have made efforts in recent years to minimize heat flux through the IG edge area. Optimization of spacer cross sections and heat conduction properties will improve the insulating properties of the spacer system. Examples include the use of a thermoplastic spacer with low heat conduction values (about 0.2-0.5 W/mK) or the use of ultra thin stainless steel spacers.

Heat conductive values of between 0.25 and 0.70 W/mK for the edge seal of an IG unit are possible. *Dow Corning* Insulating Glass Sealants were measured by an independent test institute according to DIN 52612. *Dow Corning* 3362 Insulating Glass Sealant has a heat conduction value of 0.27 W/mK. *Dow Corning* 3793 Insulating Glass Sealant has a heat conduction value of 0.33 W/mK.

To manufacture a “warm edge” IG unit, it is recommended to use a spacer system which is optimized for low heat conduction. Stainless steel spacers perform better than aluminium spacers. Some organic spacers show significantly better performance as well. The geometric design of the IG unit edge should be developed considering the heat flux properties but also the static functionality to reduce the risk of gas leakage. Finally consider the use of a silicone secondary seal with a low heat conduction value, long term durability, resistance to sunlight and stability in extreme temperatures.

For more information or assistance in developing a more thermally efficient insulating glass unit, please contact your *Dow Corning* Technical Service Engineer.
Product Quality

*Dow Corning* performs extensive quality assurance testing in our manufacturing facilities in accordance with ISO 9001 standards. 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 *Dow Corning* Insulating Glass 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. Factory production control procedures for insulating glass production are also described in various industry standards such as EN 1279, Part 6. If you have questions regarding any of the following procedures or recommendations, please contact your local *Dow Corning* Construction Office or your *Dow Corning* Technical Service Engineer prior to using the *Dow Corning* sealant.

**General considerations**

**Material storage and handling**

*Dow Corning* 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 recommendation on the proper use of dispensing equipment for two-component silicone sealants.

**Shelf life**

*Dow Corning* 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.

**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 insulating glass sealant. These procedures should be understood and completely followed by the sealant user.

**Quality Control**

*Dow Corning* 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 Corning* provides quality control logs which can be used by the sealant user. *Dow Corning* will assist you in the development of a comprehensive quality control program. *Dow Corning* will also audit a production facility and make recommendations for improvement if necessary.
One-Component Sealants

Storage Temperature and Conditions

*Dow Corning* Insulating Glass Silicone Sealants must be stored at a temperature below 30°C. 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.

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.

1. Spread a 2 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 2 hours, do not use this material and contact your *Dow Corning* Construction Office.

4. Allow the sealant to cure for 48 hours. After 48 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 *Dow Corning* Construction Office.

5. Record results in your Quality Control log. A sample Quality Control log is available in the Documentation section of this manual. The completed log should be retained and be available for review by *Dow Corning* upon request.
Product Quality

Two-Component Sealants

Storage Temperature and Conditions

*Dow Corning* Insulating Glass Silicone Sealants must be stored at temperatures below 30°C. An expiry date is clearly marked on the product packaging for the curing agent and base. 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. Containers of curing agent and base are not lot-matched. For practical purposes it is best to use the oldest container of material first.

Two-Component Dispensing Equipment Guidelines

*Dow Corning*® 3362 Insulating Glass Silicone Sealant is a high performance material, which is certified and approved by official authorities and test institutes for use as an insulating glass sealant in structural glazing applications. Properly applied, *Dow Corning* 3362 provides excellent long-term adhesion and durability, which is necessary for IG applications.

*Dow Corning* 3362 Insulating Glass 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 Corning* 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 Corning* recommends that the sealant user understands and complies with the following best practices:

Maintain Proper Production Facility Temperature

Ambient temperature in the production facility must be between 10°C and 40°C. For best performance, maintain a temperature of between 18°C to 30°C. At colder temperatures, between 10°C and 18°C, cure rate and adhesion development will be slower. In higher temperatures, between 30°C and 40°C, working time will be shorter.

Provide Proper Sealant Storage Conditions

Sealant containers must be stored below the sealant's recommended storage temperature of 30°C. Sealant can be used at temperatures of up to 40°C. If a sealant container is kept in a production facility at a temperature of greater than 30°C for one week, replace the material. Containers should be stored in their original unopened containers.

Avoid Excessively High Humidity

In higher relative humidity, the sealant will cure faster and have a shorter working time. Excessively high humidity (>80%) could cause moisture on the substrate surface and adversely affect sealant adhesion. To minimize the damage of moisture on the individual sealant components, pails and drums must be kept airtight during storage and after being placed on the dispensing equipment. When using a pressure pot, the air inside the drum or pail must be filtered and dried (silica gel filters are recommended).
Product Quality

Curing Agent Must Be Homogeneous
Prior to placing material on the dispensing equipment, the curing agent should be visually inspected and agitated in the pail to ensure homogeneity. Do not incorporate excessive air during mixing of the curing agent. Low and medium viscosity curing agents (Standard & HV) are more likely to show separation and should be mixed prior to use. High viscosity curing agent (HV/GER) does not generally require mixing but it should be checked in all cases before use. It is recommended to mix the curing agent one to three days before the pail needs to be changed to allow the curing agent to de-air.

Properly Maintain Sealant Dispensing Equipment
It is essential that the sealant user establish a quality program that will ensure that the sealant dispensing equipment is functioning properly. Because there are many different manufacturers of dispensing equipment, maintenance requirements will differ. Requirements common to all equipment manufacturers include:

- Sealant must be dispensed free from exposure to air. Dow Corning 3362 Insulating Glass Sealant must be processed in a closed system free from exposure to air. Air introduced 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 gasket. Proper maintenance and cleaning of the mixer helps to ensure properly mixed sealant. Filters 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 Dow Corning 3522 Cleaning Solvent Concentrated for cleaning 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 Dow Corning 3362 Insulating Glass Silicone Sealant. The equipment supplier should also provide a schedule for regular replacement of gaskets. Please contact your Dow Corning Technical Service Engineer if you need specific recommendations.
Product Quality

Surface Preparation and Sealant Application

Insulating glass production requires a diligent and thorough procedure to ensure that glass and accessory materials are properly cleaned prior to sealant application. The following procedures should be followed for IG production.

1. Inspect glass, spacer profiles, U-profile inserts, etc. prior to use. The materials used in production must be representative of the materials that were tested and approved by Dow Corning. The substrates should be in good condition and not damaged by outdoor weathering.

2. Clean glass and accessory substrates including spacers, U-profile extrusions, etc. During automated IG production, glass is cleaned through an automated washing process. The IG manufacturer must ensure that joint surfaces 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 joint surfaces to receive sealant if required by Dow Corning.

4. Place the spacer system and glass. 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 IG joint cavity. If applied through an automated process, ensure that the joint is completely filled with sealant. If applied manually, push the bead of sealant into the joint in a continuous manner to avoid air entrapment.

6. Tool the sealant joint surface with a tooling device such as a spatula. Many insulating glass dispensing guns use self-tooling nozzles. Ensure that the tooling device provides a completely filled joint without air entrapment.

7. Inspect the finished insulating glass units. Determine whether the entire joints have been properly filled and tooled. The sealant must be continuous and free of voids or gaps. Inspect whether the sealant is curing properly. Ensure that all of the recommended quality control tests are being performed.
Insulating Glass Manual

Product Quality

Substrate Cleaning Procedure
The key to acceptable sealant adhesion is a clean surface. For most IG production, glass is cleaned through an automated washing process. If glass or accessory materials are to be cleaned manually, please use the following recommended procedures:

Non-Porous Substrates
Non-porous substrates such as glass and metallic profiles must be cleaned with a solvent prior to application of sealant. Dow Corning recommends the “two-cloth cleaning method” be used to clean non-porous materials. The “two-cloth cleaning method” is described later in this section. Dow Corning R-40 Cleaner is recommended for solvent cleaning of non-porous substrates. Alternate solvents or cleaning agents will be considered. Please contact your Dow Corning Technical Service Engineer for more information.

Solvent Consideration
The solvents named in this section are recommended based upon our experience with these products. You should always check with the supplier of the substrate to ensure that the cleaning procedures and solvents are compatible with each substrate.

Masking
If aesthetics are important, surface adjacent to the IG 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.

Two-cloth cleaning method
The “two-cloth cleaning method” is a proven technique to clean non-porous surfaces. The use of one cloth to clean a substrate is not a recommended procedure and is not as effective as two cloths. Clean, soft, absorbent, lint-free cloths must be used. This method consists of cleaning the substrate with a solvent saturated cloth followed by a drying wipe with a separate clean cloth. Following is the procedure described in greater detail:

1. Thoroughly clean all surfaces of loose debris.
2. Pour a small quantity of cleaning solvent into a working container. A clear plastic, solvent-resistant, squeeze bottle works best for this purpose. Do not apply solvent directly from the original container.
3. Wipe the joint surfaces with sufficient force to remove dirt and contaminants.
4. Immediately wipe dry the solvent wet surface of the substrate with a separate clean, dry cloth. The second cloth must wipe the substrate before the solvent has evaporated.
5. Visually inspect the second cloth to determine 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.
Substrate Priming Procedure

For most IG production, priming is not required. In some instances, special coated glass types or spacer profiles may require priming. In these non-standard applications, please use the following procedure for primer application:

Before using, verify that the Dow Corning® 1200 OS Primer is within its stated shelf life. The primer should be stored below 25°C in its original unopened container. The primer should be clear and water-like in appearance. If the primer is milky white in appearance, do not use the primer. Red coloured primer is also available.

1. 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 recleaned prior to priming.

2. Pour a small amount of primer into 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. Overpriming is not an acceptable practice and should be stopped immediately. Overprimed surfaces must be recleaned (Dow Corning R-40) and primed in a proper manner.

3. 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. Overpriming is not an acceptable practice and should be stopped immediately. Overprimed surfaces must be recleaned (Dow Corning R-40) and primed in a proper manner.

4. Allow the primer to dry until all of the solvent evaporates. This typically takes from 5 to 30 minutes depending on temperature and humidity.

5. Inspect the surface for dryness and for the appearance of overpriming. A primed non-porous surface will have a slight haze. If red coloured primer is used, the primed surfaces will appear red in color. Primed surfaces must be sealed within the next four (4) hours. Any surfaces primed and not sealed within four hours must be recleaned and reprimed before applying sealant.
Product Quality

**Sealant Application and Quality Control Procedures**

**Sealant Application Procedure**

Sealant should only be applied in IG joints which have been cleaned and primed by the recommended procedures. Sealant must be applied to clean, dry, dirt-free and frost-free surfaces. Sealant adhesion may be harmed by an improperly cleaned or primed joint surface. Sealant must also completely fill the IG joint. The performance of the IG unit is dependent on having sufficient sealant depth or bite. An underfilled secondary seal in an IG unit may jeopardize the performance of the IG unit.

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. If applied through an automated process, ensure that the IG joint is completely and continuously filled.

2. Tool the sealant with light pressure before a skin forms on the sealant. This is typically within 5 to 15 minutes. Most automated operations use a self tooling nozzle. Ensure that this tooling nozzle provides adequate pressure to complete fill of the IG joint.

3. Avoid the use of wet tooling aids such as soaps or solvents during tooling. Dry tooling is recommended. Do not scoop sealant since 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 IG joint has been masked, remove the masking at this time.

**Sealant Cure Requirements**

Silicone sealants require exposure to atmospheric moisture to cure. In a closed container or concealed joint that is not exposed to atmospheric moisture, sealant cure will be slow to nonexistent. Sealant adhesion will only occur if the sealant is allowed to cure to its full physical properties. Please ensure that the tooled sealant joint is fully exposed to the environment.
Product Quality

Factory Glazing Cure Requirements

*Dow Corning* only supports the production of insulating glass with *Dow Corning* Insulating Glass Silicone Sealants in a factory environment. Production of insulating glass at the construction site is not supported by *Dow Corning*.

*Dow Corning* one-component insulating glass sealants typically require 7 to 21 days to cure in a production facility environment. Cure rate depends on the sealant used, sealant joint depth, temperature and humidity. IG units which use one component insulating glass sealants should not be shipped 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).

*Dow Corning* two-component insulating glass sealants cure in deep section within 3 to 4 hours depending on temperature and humidity. The sealant generally achieves full adhesion (100% cohesive failure) in 1 to 3 days depending on the glass type. IG units should not be shipped 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. These procedures are described in greater detail later in the next section.
Quality Control Test Procedures

General Considerations
Quality Control is an important element of successful IG production. This section of the manual should be fully understood and continually reviewed by the sealant user. The procedures and recommendations made in this section are the foundation of a comprehensive quality control program. In the Documentation section of this manual, Dow Corning provides quality control logs which you can use for the development of a comprehensive quality control program by the sealant user. Dow Corning will assist you in the development of a comprehensive quality control program specifically for your organization. Dow Corning will also audit a production facility and make recommendations for improvement if necessary.

Sealant Production Quality Control
During production, periodic quality control should be performed on Dow Corning 3362 Insulating Glass Silicone Sealant produced through two component dispensing equipment. These test procedures help to ensure the sealant is being properly mixed at the correct ratio. These tests and their recommended frequency are shown in the following table:

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

Product Quality

Glass Test
The Glass Test is a procedure used to evaluate the mix quality of Dow Corning 3362 Insulating Glass 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 Dow Corning 3362 Insulating Glass Sealant, 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, white or custom colored Dow Corning 3362 Insulating Glass Silicone Sealant is being used, please contact your Dow Corning 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 10 cm x 10 cm. Place another clean, clear glass sample on top of the silicone, pressing the two pieces of glass together. Please refer to the diagram below. 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 Corning Technical Service Engineer.
Product Quality

Butterfly Test
The Butterfly Test is a procedure that is similar to the Glass Test. This test is performed at each pump start-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 Dow Corning 3362 Insulating Glass Sealant, the sealant base is grey 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, white or custom colored Dow Corning 3362 Insulating Glass Silicone Sealant is being used, please contact your Dow Corning 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 paper together compressing the sealant into a thin film.

4. Pull the paper apart and visually inspect the sealant for indications of poor mix
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. Mixed sealant will handle like a one-component sealant until the chemical reaction between the base material and curing agent begins to occur. The sealant will in a matter of minutes begin to “snap” and begin to show elastomeric or rubber properties.

Following is a procedure for the Snap Time Test:

1. Fill a small container with mixed Dow Corning 3362 Insulating Glass Sealant.
2. Place a small stick or spatula into the sealant. Record the time.
3. 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”. Record this time.

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. Later in this section is a figure which shows the effect of temperature on 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. Highly unusual snap time values could be an indication of a problem with the pump. The most important determination from snap time is that the sealant does cure. If the sealant does not cure, then further investigation is required.
Product Quality

Mixing Ratio Test
The Mixing Ratio Test is not a test that is required by Dow Corning as a daily test. This test is useful to determine whether the sealant is mixing at the recommended ratio of 10 to 1 by weight. Most two-component silicone dispensing machines provide a set of valves which allow the mixing ratio to be checked. Following is a procedure to perform the Mixing Ratio Test:

1. 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 pumps. Pressure valves needs to be adjusted in such a way that they equalize the pressure on both components.

2. Weigh the two cups, minus the weight of the cup itself. The weight ratio between the two components should be between 9 to 1 and 11 to 1.

The Mixing Ratio Test is a useful test if there are concerns with the mix of the sealant or the snap time. This test method is a very good diagnostic test and along with the glass test or butterfly test and the snap test, should be useful in the investigation of equipment problems. Dow Corning Technical Service Engineers are available to assist you if there is concern with mixing or cure of Dow Corning 3362 Insulating Glass Sealant.

Typical Snap Time vs. Temperature for Dow Corning® 3362 Structural Glazing Sealant

Snap Time vs. Temperature for Dow Corning 3362 Structural Glazing Sealant
Product Quality

Adhesion and Cure Quality Control Tests

The following adhesion and cure quality tests should be used to provide consistent and reliable sealant quality during IG production. Each test is valuable in its own way and must be considered as part of your comprehensive quality control program. Peel adhesion testing is recommended as the daily test to verify sealant adhesion. H-piece testing is recommended as a test to verify proper cured sealant properties. Butterfly adhesion test is an alternate adhesion test of an actual IG production unit.

*Dow Corning* requires the adhesion and cure quality control tests be performed by the sealant user at the frequency recommended in the following chart:

<table>
<thead>
<tr>
<th>Sealant Adhesion and Cure QC Test</th>
<th>Frequency of Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>After Each Pump Start-Up</td>
</tr>
<tr>
<td>Peel Adhesion Test</td>
<td>Required</td>
</tr>
<tr>
<td>H-Piece Test</td>
<td>Alternate to Peel Adhesion Test</td>
</tr>
<tr>
<td>Butterfly Adhesion Test</td>
<td>Alternate to H-Piece Test</td>
</tr>
</tbody>
</table>
Product Quality

Peel Adhesion Test
The 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 Corning.
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 20 cm. long, 1.5 cm. wide and 6 mm. thick. At least 4 cm 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 1 to 2 cm 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 Corning Construction Office.

Peel Adhesion Test: Cohesive Failure
Peel Adhesion Test: Adhesive Failure
Product Quality

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 Dow Corning 3362 Insulating Glass Sealant. Testing can conclude once the peel adhesion test shows full adhesion or 100% cohesive failure. For Dow Corning one component insulating glass sealants, peel adhesion tests should be performed at 7 day intervals.

- Once samples achieve full adhesion, samples can be immersed in room temperature water for one day to seven days and tested again for cohesive failure. Local authorities may require that this additional procedure be taken.

**Important:** Insulating Glass Units should only be shipped to the jobsite once full adhesion has been verified by successful peel adhesion tests (100% cohesive failure).
**Product Quality**

**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 Corning may not require H-piece testing as a part of a comprehensive quality control program if other procedures such as peel adhesion and butterfly adhesion 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. The glass 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 Dow Corning 3362 Insulating Glass Sealant and 7 to 14 days for Dow Corning one-component insulating glass silicone sealants, depending on joint sealant depth, temperature and humidity. 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:
Product Quality

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 tensiometer 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 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 Quality Control Log is included in the Documentation section of this manual.
Butterfly Adhesion Test

The Butterfly Adhesion Test is an alternate procedure to evaluate adhesion of the sealant to glass. This test can be performed as an alternative or in addition to the H-piece test. This test may be performed on a test mock up sample or directly on an actual IG production unit.

To perform this test, score then break the glass at the midpoint of the pane. Bend the two halves outward at a 180° angle. Inspect the adhesion of the secondary seal. There should be no greater than 5% adhesive failure on the glass surfaces.

1. Dow Corning Insulating Glass Silicone Sealants
2. Spacer system
3. Float glass scored then broken at midpoint

If an actual production unit is used in this test, note the quality of the sealant application. Note whether the sealant fill is complete and free of voids or bubbles. Observe the quality and continuity of the PIB application. This procedure provides an opportunity to evaluate the overall quality of the IG unit application.
Product Quality

Documentation

The sealant user is responsible for developing proper quality control documentation for their project. *Dow Corning* 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.

A comprehensive quality control manual for production of IG units for a structural glazing project should include the following:

- Insulating glass joint dimension details that were reviewed and approved by *Dow Corning*
- *Dow Corning* IG joint dimensioning approval letter(s)
- Project substrate and materials descriptions and specifications
- *Dow Corning* adhesion and compatibility approval letter(s)
- In-house IG production and quality control procedures
- Completed sealant production quality control logs with glass test, butterfly test, snap time test and mix ratio test results
- Completed sealant adhesion and cure quality control logs with peel adhesion test, H-piece test and butterfly adhesion test results
- Traceability documentation which allows each IG 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 IG unit 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 Corning* 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.
Production and Quality Control Audit

*Dow Corning* will audit the IG production and quality control operations of any user of *Dow Corning* Insulating Glass Sealants. During this audit, the sealant user’s production operations, quality control procedures and documentation will be evaluated. Below are some of the important elements that *Dow Corning* will be evaluating during an audit:

**Production Facility Operations and Safety**

- Clean production facility
- Production facility temperature and humidity
- Proper sealant storage and handling
- Properly operating and well maintained sealant dispensing equipment
- Proper substrate handling
- Compliance with *Dow Corning* 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 Corning* 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 Corning* adhesion and cure quality control procedures: peel adhesion test, H-piece test, butterfly adhesion test
- Properly completed adhesion and cure quality control log
- Traceability documentation in accordance with *Dow Corning* recommendations
- Commitment by management to train personnel and implement a comprehensive quality control program.
**Product Quality**

**Sealant Production Quality Control Log**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Temp. &amp; Humidity</th>
<th>C/A Lot Number</th>
<th>Base Lot Number</th>
<th>Glass Test</th>
<th>Snap Time Test</th>
<th>Mix Ratio Test</th>
<th>Tester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Product Quality

### Sealant Adhesion Quality Control Log (Peel Adhesion Test)

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Temp. &amp; Humidity</th>
<th>C/A Lot Number</th>
<th>Base Lot Number</th>
<th>Peel Adhesion Test (% Cohesive Failure)</th>
<th>Tester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Day 1</td>
<td>Day 2</td>
</tr>
</tbody>
</table>

Company Name & Location:

Project Name & Location:

Dispensing Pump Type & Location:

Cleaning Solvent: Primer

Substrates: Primer Lot Number:
# Product Quality

## Sealant Cure Quality Control Log (H-Piece Test, Butterfly Adhesion Test & Elastomeric Test)

<table>
<thead>
<tr>
<th>Company Name &amp; Location:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name &amp; Location:</td>
<td></td>
</tr>
<tr>
<td>Dispensing Pump Type &amp; Location:</td>
<td></td>
</tr>
<tr>
<td>Cleaning Solvent:</td>
<td>Primer</td>
</tr>
<tr>
<td>Substrates:</td>
<td>Primer Lot Number:</td>
</tr>
<tr>
<td><strong>Date</strong></td>
<td><strong>Time</strong></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Your Dow Corning Construction contact details:

**Toll Free Numbers:**

<table>
<thead>
<tr>
<th>Country</th>
<th>Number</th>
<th>All other countries:</th>
</tr>
</thead>
<tbody>
<tr>
<td>From Belgium</td>
<td>0800 80 522</td>
<td>For English</td>
</tr>
<tr>
<td>From France</td>
<td>0805 54 04 39</td>
<td>For French</td>
</tr>
<tr>
<td>From Germany</td>
<td>0800 52 50 258</td>
<td>For German</td>
</tr>
<tr>
<td>From Italy</td>
<td>800 92 83 30</td>
<td>For Italian</td>
</tr>
<tr>
<td>From Spain</td>
<td>900 813161</td>
<td>For Spanish</td>
</tr>
<tr>
<td>From United Kingdom</td>
<td>0800 91 72 071</td>
<td>For Russian</td>
</tr>
</tbody>
</table>

Fax number from all countries: +32 64 88 86 86

**Your Dow Corning contact details (e-mails):**

<table>
<thead>
<tr>
<th>Inquiries</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical inquiries</td>
<td><a href="mailto:eutech.info@dowcorning.com">eutech.info@dowcorning.com</a></td>
</tr>
<tr>
<td>Marketing</td>
<td><a href="mailto:construction.marketing@dowcorning.com">construction.marketing@dowcorning.com</a></td>
</tr>
<tr>
<td>Quality Bond</td>
<td><a href="mailto:qualitybond@dowcorning.com">qualitybond@dowcorning.com</a></td>
</tr>
<tr>
<td>EHS inquiries</td>
<td><a href="mailto:europe.ehs@dowcorning.com">europe.ehs@dowcorning.com</a></td>
</tr>
<tr>
<td>Reach inquiries</td>
<td><a href="mailto:reachsupport@dowcorning.com">reachsupport@dowcorning.com</a></td>
</tr>
</tbody>
</table>

Your Dow Corning Sites:

**EUROPEAN AREA HEADQUARTERS**

Dow Corning Europe S.A.
Parc Industriel Zone C
Rue Jules Bordet
B-7180 Seneffe, Belgium
Tel: +32 64 88 80 00
Fax: +32 64 88 84 01

Dow Corning GmbH
Rheingaustraße, 34
D-65201 Wiesbaden, Germany
Tel: +49 611 23 71
Fax: +49 611 237 601

Other European Sites:

**TURKEY**
DOW CORNING NG K MYA SANAY
VE T CARET L M TED RKET
Halk Sokak Pakpen Plaza No: 44 Kat:9-10
34734 Kozyata 1 / istanbul, Türkiye
Tel: +90 216 4677645
Fax: +90 216 4673909

**RUSSIAN FEDERATION**
Dow Corning Representation Office
17/23 Taganskaya Street
Moscow 109147, Russia
Tel: +7 495 783 6648
Fax: +7 495 783 6652

**POLAND – CENTRAL EASTERN EUROPE**
Dow Corning Polska Sp.z o.o
15 Marynarska Street
02 - 674 Warszawa, Poland
Tel: +48 22 36 04 100
Fax: +48 22 36 04 114

**GREATER GULF COUNTRIES**
Dow Corning Representation Office
Meral Building
Office Numbers 61.62 & 63
Building No.2572, Road No.2833, Block No.428
Seef District
Kingdom of Bahrain
Office Reception +973 17 562686
Office Fax +973 17 582052

Visit us on: dowcorning.com/construction