High Performance Building

European Building Envelope Weatherproofing Manual

DOWSIL™

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Introduction

Building performance is dependent on the ability of the envelope or skin of the building to successfully prevent the ingress of inclement weather, atmospheric contamination such as CO_2 emissions, and chemical attack from a variety of sources such as salts from entering the structure. One critical element in maintaining a weatherproof building is the performance of joints in the buildings. All buildings require joints, and how you seal these joints will be important in determining the overall performance and durability of the structure.

This manual is intended to give guidance on the correct design and use of DOWSIL™ weatherproofing sealants. The recommendations made in this manual are based on more than 40 years of experience using silicone sealants to seal joints in new and remedial construction applications.

To ensure that a successful application is achieved, these steps must be followed:

1. Selection of the correct sealant for the application
2. Designing and understanding the correct joint design
3. Verifying sealant adhesion through laboratory and/or field adhesion testing
4. Following the recommended practices for surface preparation and sealant application
5. Performing the necessary quality control procedures and documenting results throughout the project

By following the recommendations made in this manual, a building facade or envelope can be fully sealed, ensuring that the life expectancy of the building is maximized and, therefore, the need for corrective maintenance of the building is minimized. Dow and its authorized distributors are available to assist you in achieving this success.

Sealant Selection Considerations

Many types of sealants are available to weatherseal a building envelope. The process and evaluation can be very confusing for a specifier or general contractor. Some of the factors that should be considered when selecting a sealant are:

- Sealant adhesion to a variety of substrates
- Sealant movement capability
- Sealant durability and physical property change after weather exposure
- Effect of the sealant on building aesthetics

Dow is the global leader in silicone technology and has been in the forefront in the research and development of silicone sealants for more than 40 years. The benefits of silicone technology are well-matched to the demands placed upon it by the wide variety of material used for the construction of the building envelope.

Silicone sealants can be formulated to adhere to all common building facade materials, including concrete, natural stone, brick, aluminium, steel and glass. Silicone sealants can be formulated to be high-modulus structural adhesives or low-modulus, high-movement weatherseal sealants. Silicone sealants are inherently resistant to damaging ultraviolet (UV) light from sun, and, when cured, silicone sealants are stable in temperatures from -40°C to 150°C. Silicone sealants can also be formulated to have reduced dirt accumulation and be nonstaining on sensitive porous substrates such as marble or granite.

Organic sealants such as polyurethanes and polysulphides are based upon a carbon polymer backbone and do not have the durability of inorganic sealants such as silicone. Contrary to popular belief, modified silicone (MS) sealants do not actually contain silicone and, therefore, their longterm durability is similar to that of organic sealants. UV light from the sun can degrade an organic sealant and cause the sealant to harden and lose movement capability after several years of outdoor exposure on a building. This degradation and loss of movement capability can cause premature joint failure.

When you are considering sealants for your building, please contact Dow or its authorized distributors to assist you in your specific project needs.

DOWSIL™ Product Offering

Dow offers a full range 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. Specific product information is available at consumer.dow.com/construction.

Weatherproofing Sealants

Dow offers a full range of high performance sealants for weatherproofing applications. Following is a brief description of DOWSIL™ weatherproofing sealants. These sealants are designed and intended to weatherseal building joints and should never be used as structural glazing adhesives or insulating glass sealants.

DOWSIL™ 756 SMS Building Sealant

DOWSIL™ 756 SMS Building Sealant is a onecomponent, low-modulus, neutral-curing silicone sealant designed specifically for weathersealing of sensitive substrates such as natural stone and aluminium panel systems where the aesthetic performance of the sealant is important. This sealant is designed to be nonstaining on natural stone and to attract less dirt and atmospheric contaminants than conventional silicone building sealants. Additionally, many commercial paints achieve excellent adhesion to cured DOWSIL™ 756 SMS Building Sealant.

DOWSIL™ 791 Silicone Weatherproofing Sealant

DOWSIL™ 791 Silicone Weatherproofing Sealant is a fast-skinning, one-component, low-modulus, neutral-curing sealant. It is a specified premium-performance product designed for weathersealing of structurally glazed facades; planar systems; general glazing; curtainwalls; and building facades constructed from brick, stone and traditional building products.

DOWSIL™ 813C Construction and Concrete Silicone

DOWSIL™ 813C Construction and Concrete Silicone is a one-component, low-modulus, neutral-curing silicone sealant designed for use by contractors in general, nonspecified weathersealing applications.

DOWSIL™ C60 Low Modulus Silicone Sealant (UK only)

DOWSIL™ C60 Low Modulus Silicone Sealant is a one-component, low-modulus, neutral-curing silicone sealant designed for use in general, nonspecified sealing applications. Packed in 400 ml cartridges, this product is only available in the United Kingdom.

DOWSIL™ FIRESTOP 700 Sealant

DOWSIL™ FIRESTOP 700 Sealant is a one-component, low-modulus, neutral-curing silicone sealant intended for sealing of expansion joints and penetration seals in fire-rated structures.

DOWSIL™ 757 Weatherproofing Sealant

DOWSIL™ 757 Weatherproofing Sealant is a low-modulus sealant designed for weathersealing of most of the hydrophilic and photocatalytic clean glasses where high movement is expected and high weather resistance is required to withstand increased temperature and UV radiation. Pre-approved compatibility with the following DOWSIL™ structural glazing and insulating glass silicone sealants: DOWSIL™ 993 Structural Glazing Sealant, DOWSIL™ 895 Structural Glazing Sealant, DOWSIL™ 3362 Insulating Glass Sealant and DOWSIL™ 3793 Insulating Glass Sealant.

Structural Glazing Silicone Sealants

The following DOWSIL™ silicone sealants are offered for structural glazing applications. Only the DOWSIL™ 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 DOWSIL™ Silicone Structural Glazing Manual (Form No. 62-0979), which is available at consumer.dow.com/construction.

DOWSIL™ 993 Structural Glazing Sealant

DOWSIL™ 993 Structural Glazing 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 DOWSIL™ 993 Structural Glazing Sealant allow increased production of structurally glazed curtainwall units. DOWSIL™ 993 Structural Glazing Sealant is a high modulus sealant with excellent adhesion to a wide range of materials. DOWSIL™ 993 Structural Glazing Sealant 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.

DOWSIL™ 895 Structural Glazing Sealant

DOWSIL™ 895 Structural Glazing Sealant is a one-component, neutral-curing silicone sealant intended for structural bonding of glass, metal and other materials. DOWSIL™ 895 Structural Glazing Sealant is a high-modulus sealant with excellent adhesion to a wide range of materials. DOWSIL™ 895 Structural Glazing Sealant 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.

DOWSIL™ 995 Silicone Structural Sealant

DOWSIL™ 995 Silicone Structural Sealant is a one-component, neutral-curing silicone sealant intended for structural bonding of glass, metal and other materials. It has been successfully tested for use in protective glazing applications. DOWSIL™ 995 Silicone Structural Sealant has a joint movement capability of +/- 50% and meets the global standards for structural glazing in America, China and Europe.

Insulating Glass Silicone Sealants

The DOWSIL™ silicone sealants offered for insulating glass (IG) applications are described in the DOWSIL™ Insulating Glass Manual (Form No. 62-1374). These products are intended for IG production only and are not approved for use as structural glazing or weatherproofing sealants. For more information on the proper use of silicone sealants in insulating glass applications, please refer to the DOWSIL™ Insulating Glass Manual, which is available at consumer.dow.com./construction.

Cleaners and Primers

Dow offers a range of cleaners and primers that are developed specifically for use with DOWSIL™ sealants. In some instances, a specific cleaner or primer will be required prior to the application of the silicone sealant to achieve optimal adhesion to a specific substrate. For substrate preparation and priming recommendations, please refer to pages 15 through 17 of this manual.

DOWSIL™ R-40 Universal Cleaner

DOWSIL™ R-40 Universal Cleaner is a specially formulated solvent blend designed to clean glass and metal profiles and other nonporous and porous substrates.

DOWSIL™ R41 Cleaner Plus

DOWSIL™ R41 Cleaner Plus is a specially formulated solvent containing a special DOWSIL™ catalyst substance designed to clean and additionally prepare a large variety of substrates for bonding with DOWSIL™ sealants.

DOWSIL™ 1200 OS Primer, UV Traceable

DOWSIL™ 1200 OS Primer, UV Traceable, is a one-part chemical treatment primer designed for use with DOWSIL™ Sealants in a variety of applications. It contains a small amount of UV tracer. This allows tracing correct primer application by using a UV lamp.

DOWSIL™ 1203 3in1 Primer

DOWSIL™ 1203 3in1 Primer is a UV-traceable cleaner and primer for silicone adhesives and sealants.

DOWSIL™ Primer-C

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

DOWSIL™ Construction Primer P

DOWSIL™ Construction Primer P is a one-part film-forming primer designed for use on porous substrates in weather-sealing applications.

Dow Project Support

Dow and its authorized distributors are available to assist you with questions about the design and correct use of DOWSIL™ weatherproofing sealants. Dow will review designs and make product recommendations for any project using our sealants. Dow and its authorized distributors are available to support you at a construction site or a mock-up facility. Inquiries and requests may be directed to your Dow Authorized Distributor, your local Dow Construction Office or through consumer.dow.com/construction.

Product Recommendations

Dow will make a project-specific product recommendation based on the joint design, joint movement, substrate types, adhesion properties and other factors on a building. Often, more than one DOWSIL™ weatherproofing sealant can be used in an application.

Design Reviews

To properly review a weatherseal joint design, Dow should have a drawing and documentation indicating the joint dimensions, joint movement, substrate types and accessory materials. A Project Submittal Form is included in the Documentation section of this manual. Dow will not determine the movement of a specific joint. This information must be provided by the design professional. Dow will review and approve the design in accordance with the guidelines described in later sections of this manual.

Information should be submitted to emeai.cool@dow.com. Joint details should be in .jpeg, .pdf, .doc, .dwg or .tiff formats.

COOL – Dow COnstruction OnLine

A unique Web-based project management system from Dow, COOL is fast, free and easy to use. COOL lets you:

- Create your own project and job information database
- Quickly and easily request print reviews, sample tests and warranties from Dow
- Upload project photos, drawings, logbooks and reports
- Download electronic copies of your test results, recommendations and warranties
- Tap into the collective expertise of Dow's global network of silicone building material experts

COOL tracks the progress of your service requests, giving instant status updates. It lets you see the big picture so you know, at a glance, what you have, what you need and when you'll get it. COOL will even automatically share job details and print review and test results with your Dow contact. COOL is available through the Dow Consumer Solutions website. For access to Dow and for more information on COOL, please contact your local Dow Construction Office. Or, learn more at consumer.dow.com/COOL.

Substrate and Materials Approval

Dow offers to perform adhesion, compatibility or nonstain testing on any material or substrate that is in contact with a DOWSIL™ weatherproofing sealant. For natural stone, nonstain testing in our laboratory is always recommended.

Adhesion Testing

Sealant adhesion to a substrate is an important element of weatherseal joint performance. Upon completion of testing, Dow will provide a written product recommendation, surface preparation and priming recommendation. Testing takes four (4) weeks from receipt of samples. In all cases, adhesion must be verified at the jobsite through field adhesion testing as described later in this manual.

Compatibility Testing

Accessory materials that contact the DOWSIL™ weatherproofing sealant may be incompatible and cause sealant discoloration and/or loss of sealant adhesion. Some highly plasticized organic gaskets or setting blocks, waterproofing membranes or asphalt coatings may be very incompatible with silicone sealants and may not be approved for contact. To minimize the risk of incompatibility problems, representative samples of the materials should be provided to Dow for compatibility testing. Upon completion of testing, Dow will provide a written product recommendation. Testing takes five (5) weeks from receipt of samples.

Nonstain Testing

Dow will test all porous substrates to determine if its sealants will cause staining resulting from the migration of fluids into the substrate. Dow requires that a representative sample of the substrate (granite, marble, limestone or sandstone) be provided to Dow for nonstain testing. Upon completion of testing, Dow will provide a written product recommendation. Testing takes six (6) weeks from receipt of samples.

Other Laboratory Testing

Upon request, Dow may provide nonstandard testing such as analytical or H-piece testing. In such cases, a service fee may be charged. Prior to beginning the project, please contact your local Dow Construction Office for a service fee schedule.

Sample Submission

Dow offers to test any material or substrate used in contact with a DOWSIL™ sealant. Requests for testing may be submitted via Dow COnstruction OnLine (COOL) or with the Dow Project Submittal Form in the Documentation section of this manual. Testing samples should be sent to the following location:

Dow Silicones Belgium S.P.R.L
rue Jules Bordet, parc industriel zone C
7180 Seneffe, Belgium
Attention: Sealants Testing Lab

Construction Site Support

Dow and its authorized representatives are available to assist you at the construction site on either a new or refurbishment construction project. Construction site support could include sealant application techniques and procedures ensuring the correct use of materials, the evaluation of field adhesion test joints, and confirmation of the correct sealant selection.

Field Adhesion Testing

Field adhesion testing should be performed on every project, whether new construction or sealant replacement on a refurbishment. Dow and its authorized representatives can assist in training a sealant applicator on the required procedures to prepare and test field adhesion joints. If required, Dow and its authorized representatives can also evaluate field adhesion test joints.

Field adhesion test joints should be performed as a regular quality control procedure by the contractor. A description of how to perform a field adhesion test is included in the Quality Control section of this manual. All test results should be maintained in a Field Adhesion Test Log such as the one included in the Documentation section of this manual.

Mock-Up Evaluations

Certain projects require a mock-up evaluation at the start up of the project. Mock-up evaluations are small representations of the full building. A mock-up may be for new construction or remedial construction. New construction mock-ups may be at the construction site or at a special mock-up testing facility. During a mockup evaluation, the building facade mock-up may be tested for water penetration, structural performance or other design requirements. If necessary, Dow or a Dow Authorized Distributor can be available to witness a mock-up test and offer recommendations.

Substrate Contamination

In the event that a substrate has been contaminated as a result of fluid migration, leaving a stain that is evident either on the surface or in the body of the substrate, Dow may be able to assist with a removal of this contamination. Dow will require either a representative sample from the contract or a visit to the site.

Warranty

Dow offers project-specific Weatherseal Limited Warranties for new or remedial construction projects using DOWSIL™ weatherproofing sealants. Please contact your Dow Construction Office for more information on the warranties available.

Weatherseal Joint Design

For a sealant to perform as intended, the joint must be designed to allow for successful performance. Correct weatherseal joint design is described in the following section. For new construction, it is possible to follow these design guidelines. For restoration projects, the ability to design a weatherseal joint is more restricted. The following section will consider options for both new and remedial applications.

Joint Movement

All buildings need joints. Regardless of the size and height of a structure, joint movement is inevitable due to various factors: temperature change, seismic movement, elastic frame shortening, creep, live loads, concrete shrinkage, moisture-induced movements, and design error and construction tolerances. Because facade elements move due to these various factors, elements must be separated by joints that allow expansion, contraction and other movements. Failure to install joints will create stress in the facade elements, and ultimately structural problems and failure may occur.

Sealants serve the purpose of filling the joint to stop water and air infiltration. The sealant must function to allow the facade elements to move freely, so the sealant must be flexible. The sealant must also be able to adhere to the joint surfaces as it is being deformed during movement. Additionally, the sealant must maintain a reasonable level of durability since most buildings are exposed to UV light, heat, cold, moisture and other environmental factors.

Coefficient of Thermal Expansion

The most significant influence on joint movement is the thermal expansion of facade elements. Facade elements expand and contract as the temperature changes. Cold temperatures cause materials to contract, and hot temperatures cause materials to expand. This ongoing movement must be considered in joint design.

The following equation can be used to determine thermal expansion:

Movement (mm) = CTE x ΔT x Material Length (mm)

CTE: Coefficient of Thermal Expansion (1/°C)

ΔT: Change in Temperature (°C)

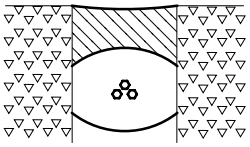
Following is a table with the coefficient of thermal expansion values for some common construction materials:

Material	CTE : 10^{-6}.1/°C
Glass	9.0
Aluminium	23.2 - 23.8
Granite	5.0 - 11.0
Marble	6.7 - 22.1
Concrete	9.0 - 12.6
Stainless Steel	10.4 - 17.3
Acrylic	74.0
Polycarbonate	68.4

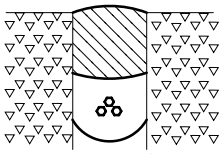
Note: The coefficient of thermal expansion of natural materials (brick, stone, wood, etc.) or fabrications of natural materials can be highly variable. If a specific material is contemplated, then the coefficient of that material should be established and used rather than an average value. Moisture-induced movement of brick masonry will cause the brick to swell and reduce joint sizes over the life of a building.

Extension/Compression

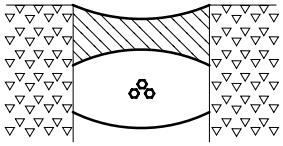
Weatherseal joints typically move in extension and compression. Under extension, the sealant and the bond line of the sealant are subjected to stress as the sealant is extended. Sealant adhesion is important for sealant performance when under extension. Under compression, the sealant will deform and bulge from the joint. The deformation can cause a permanent compression set in a sealant, which may have a detrimental effect on the long-term durability of the sealant. Sealant manufacturers rate their sealant for movement capability based on the behavior of the sealant in extension and compression. Movement capability values are commonly stated as +/-12.5%, +/-25% or +/-50%, for example.



Original Joint



Compression



Extension

Joint movement for extension and compression can be calculated by the following:

Minimum Joint Width = [(100/X) (Mt + Mo)] + T

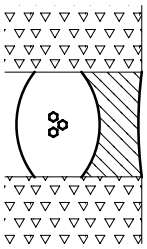
X: Sealant movement capability in %
Mt: Movement due to thermal expansion
Mo: Other movement (i.e., live loading)
T: Construction tolerances

For example, a horizontal joint between an aluminium curtainwall and concrete panel with a thermal movement of 4 mm, a live load of 2 mm, a construction tolerance of 4 mm and a 25% movement capability sealant would require a minimum joint width of 28 mm.

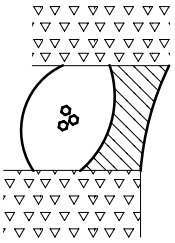
Shear

Weatherseal joints are also subjected to movement in shear. Shear movement on a sealant joint is generally not as demanding as extension movement because the overall extension on the sealant is less. The real extension is the difference between the original sealant width and the new sealant width after shear movement. This real extension can be used in joint design.

To calculate the real extension that a sealant is subjected to under shear, the Pythagorean Theorem can be used as described in the following equation:

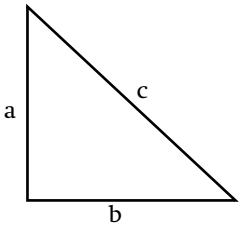


Original Joint



Shear

Available at consumer.dow.com/construction is a calculator that can be used to determine joint movement for extension, compression and shear.



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

where
a = original sealant width
b = joint movement in shear
c = new sealant width

Benefits of Wet Sealant Weatherseals

It is a fact that all buildings need joints, but in some cases a sealant is not used to seal these joints. Sealants are often excluded from a facade, and this is a potential problem for the performance of the building. Wet sealant weatherseals can bring substantial benefit to the performance of a building facade. Key benefits include:

- **Protection** of the building elements from moisture. The use of a wet sealant weatherseal minimizes the damaging effect of water on steel anchors, fasteners, membranes, masonry substructure, insulating glass and other structural elements.
- **Thermal performance** of the building is enhanced by reducing exposure of internal facade elements to extreme temperatures. A wet sealant joint will reduce air infiltration and improve the thermal performance of a facade.
- **Aesthetics** can be greatly improved by reducing shelves and openings that can collect dirt and cause unsightly streaks on the building. A wet sealant weatherseal in a glass facade allows fast and easy cleaning and maintenance. The use of a surface-modified silicone sealant, such as DOWSIL™ 756 SMS Building Sealant, can provide an aesthetically pleasing as well as a functioning weatherseal joint.

Proper Joint Design

The following guidelines for proper joint design are based on more than 40 years of experience by Dow. These guidelines are consistent with standard industry guidelines. By following these recommendations, you will help to ensure that your sealant weatherseal joints will have the best performance possible.

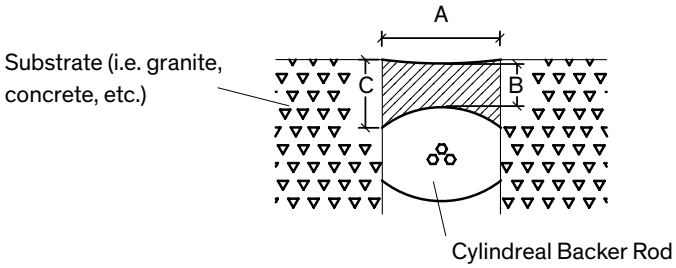
Guidelines for Proper Joint Design

- Sealant weatherseals must always have a minimum of 6 mm of contact or bond surface to ensure adequate adhesion.
- Sealant depth over the backer rod should be a minimum of 6 mm.
- Sealant joint width should always be a minimum of 6 mm to allow proper surface preparation and joint filling. Greater joint widths may be required depending on joint movement.
- One-component sealants must be exposed to atmospheric moisture to cure. Application of sealant in a fully concealed joint is not recommended.
- The sealant depth over the backer material should be a maximum of 12 mm.
- The sealant should be applied in a minimum 1:1 and maximum 3:1 width:depth ratio. The ideal joint has a 2:1 ratio.
- Avoid three-sided adhesion. Sealant should only bond to the joint substrates and not the back of the joint. Standard backer materials or bond breaker tapes should be used to prevent three-sided adhesion.
- Consult Dow for all joints outside of these recommendations.

Common Joint Types

In the following section, some common weatherseal joint details are shown, with key points made on each of the details.

Expansion Joint



Dimension A – Joint Width

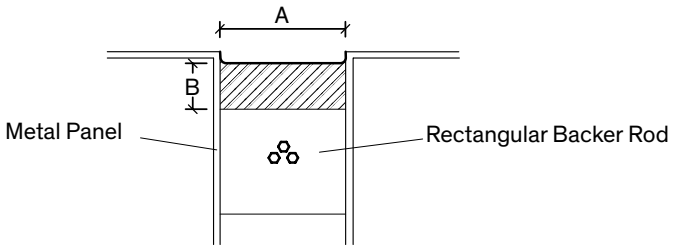
Dimension B – Sealant Depth (over backer rod)

Dimension C – Sealant Contact or Bond Surface

Key Points

1. Dimension A must be a minimum of 6 mm or greater depending on joint movement
2. Dimension B should be between 6 mm to 12 mm
3. Dimension C must be a minimum of 6 mm

Panel Joint



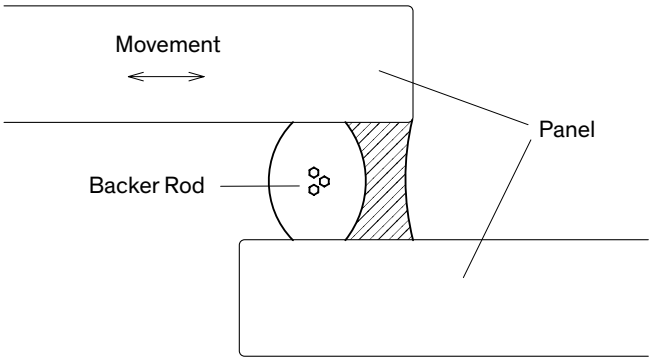
Dimension A – Joint Width

Dimension B – Sealant Depth and Bond Surface

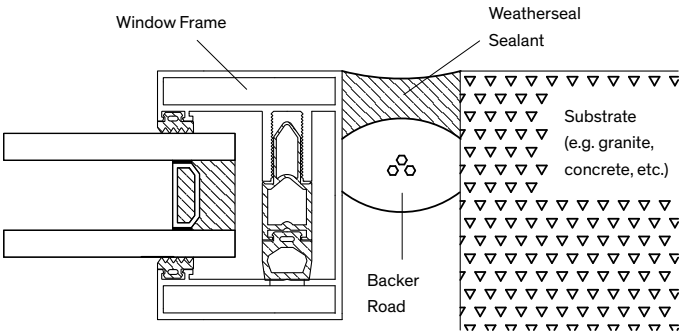
Key Points

1. Dimension A must be a minimum of 6 mm or greater depending on joint movement
2. Dimension B should be between 6 mm to 12 mm

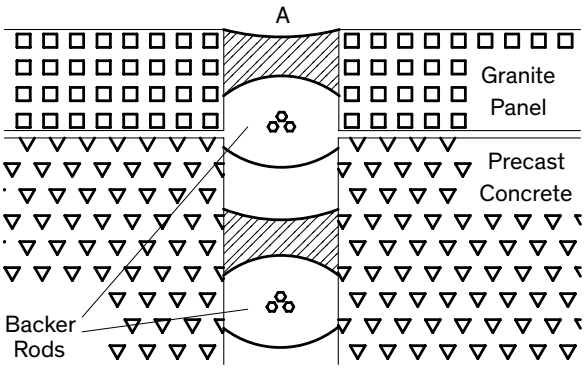
Lap Joint



Perimeter Joint



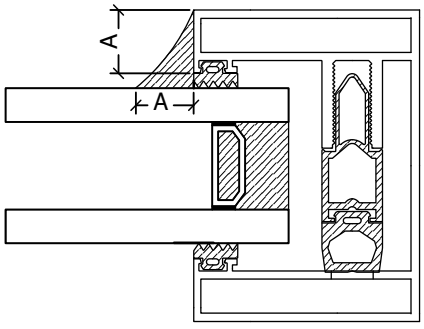
Dual Weatherseal Joint



Key Points

1. Follow standard joint design requirements
2. Dimension A is a minimum of 18 mm to allow application of interior joint
3. To allow cure of interior joint, either allow air space between seals or use open cell polyurethane backer rod for interior sealant joint

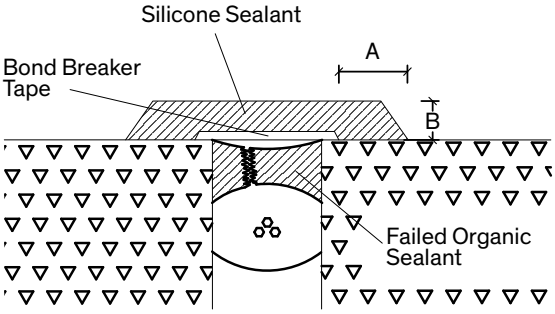
Fillet Joint



Key Points

1. Sealant must maintain a minimum of 6 mm of bond contact (Dimension A)
2. A bond breaker tape or backer rod must be used if movement is anticipated

Bandage Joint



Key Points

1. Use bond breaker tape over failed sealant joint
2. Sealant bond surface (Dimension A) must be a minimum of 6 mm
3. Sealant depth (Dimension B) must be between 6 mm and 12 mm
4. Sealant should be tooled to a smooth, uniform thickness

Sealant Weatherseal Joint Failures

Sealant weatherseal joints can fail for a variety of reasons. Please consider the following when evaluating or attempting to understand the performance of a sealant joint.

Adhesive Failure

Adhesive failure occurs when a sealant loses adhesion to a substrate. This may occur from poor joint design, improper sealant selection or poor workmanship. Adhesion loss can occur when a sealant does not have adequate bonding surface (<6 mm) or is not properly tooled into the joint. Adhesion loss can also occur if bond line stresses are high due to excessive sealant depth. Workmanship issues such as improper cleaning; moisture; or the lack of – or incorrect – priming (when required) may also cause adhesion loss.

Cohesive Failure

Cohesive failure occurs when a sealant tears or splits within the mass of the sealant. This may occur when joint movement exceeds the movement capability of the sealant. Additionally, if the sealant depth is excessive or there is three-sided adhesion, internal stresses in the sealant could cause cohesive failure.

Degradation Failure

Degradation failure may be observed with an organic sealant after exposure to UV light, heat, cold temperatures and/or moisture. An organic polymer can degrade and cause the sealant to harden excessively or, in some cases, revert to an uncured state. UV light commonly causes an organic sealant to chalk and crack on the surface as the sealant becomes brittle. As the joint moves, this hardened sealant has lesser movement capability and fails either adhesively or cohesively – or, in some cases, the high modulus of the sealant causes the substrate to delaminate.

Substrate and Material Considerations

Understanding the characteristics of substrates and accessory materials is important for proper weatherseal joint design and application. It is the responsibility of the sealant applicator to ensure that all substrates are in proper condition prior to weatherseal sealant application. The following section will discuss materials that may contact a weatherseal sealant in a joint.

Porous Substrates

Facades constructed of concrete, brick, granite, marble or other porous materials present a challenge to the building designer. Porous substrates in general have unique properties that need to be considered when designing joints. Porous substrates can crack if subjected to excessive stress. Moisture can also have a detrimental effect particularly if freeze/thaw occurs. Porous substrates, particularly natural stone substrates, are vulnerable to staining from poorly formulated sealants. Porous substrates are vapor-permeable, and this helps moisture-cure sealants, such as one-component silicone sealants, to cure faster. Following are some issues to consider when using porous materials.

Porous Substrate Staining

Substrate staining is very much dependent on the sealant and the substrate. Poorly formulated sealants that use excessive levels of plasticizers can leach plasticizers into a porous substrate. This is known to occur with most generic types of sealant, including polyurethane sealants as well. Staining may also occur if a sealant is exposed to excessive heat for prolonged periods or used beyond the stated “use by” date.

The substrate type is also a factor in whether staining occurs. Porous materials such as marble or limestone are more susceptible to staining than denser granite types. Concrete and brick are not naturally occurring and generally do not stain.

To minimize the risk of staining, Dow recommends that nonstain testing be performed on representative samples of stone from each individual project. Dow offers testing and will automatically provide a letter confirming the acceptable use of a product, as well as any priming recommendations at the conclusion of this testing. Thereafter, and when requested by the customer, a nonstaining warranty may be issued for the project. Please contact your local Dow Construction Office for more information.

Concrete

Concrete is a complex material and can come in many forms (e.g., precast, poured, tilt-up panels, concrete blocks and reconstituted or precast aggregate). Concrete surfaces can be sandblasted or mechanically abraded, have a form release or laitance, or have an aggregate surface and paints and/or coatings applied. For new construction, concrete should be cured at least 28 days. For sealant joint restoration, concrete surfaces along the joint should be mechanically abraded to remove all failed sealant. Due to the variation seen in concrete, each concrete surface type should be evaluated through field adhesion testing. As a standard rule, DOWSIL™ Construction Primer P is recommended for use with all DOWSIL™ weatherproofing sealants on concrete.

Brick

Brick, like concrete, can have a variety of surface types. Every brick type should be evaluated separately through field adhesion testing. Of particular concern with brick are the mortar joints between the bricks. Often, sealant is not adequately tooled into the mortar joints, so special attention needs to be taken. As a standard rule, DOWSIL™ Construction Primer P is recommended for use with all DOWSIL™ weatherproofing sealants on brick and mortar surfaces.

Stone

Naturally occurring stone includes granite, marble, limestone and sandstone. The variety of stone is limitless. Generally speaking, DOWSIL™ weatherproofing sealants require the use of DOWSIL™ 1200 OS Primer, UV Traceable, on the denser stone types (e.g., granite and marble). On less dense stone types (e.g., limestone and sandstone), DOWSIL™ Construction Primer P is generally recommended. For any application of DOWSIL™ weatherproofing sealants on stone, it is recommended that Dow performs laboratory adhesion testing and provides specific cleaning and priming recommendations. On a restoration project where the stone cannot be removed from the building, field adhesion testing is essential. For any restoration or sealant replacement project, Dow and its authorized representatives are available to visit the job site and provide project-specific recommendations for you.

Other Porous Materials

Other porous substrates, such as ceramic tile, Exterior Insulation and Finish Systems (EIFS), stucco or rendering, wood, etc., may be used on a building facade. In most cases, DOWSIL™ weatherproofing sealants are appropriate for these materials. Please contact your local Dow Construction Office or Technical Service Engineer for assistance.

Nonporous Substrates

Nonporous substrates, such as aluminium, steel and glass, are commonly associated with windows or curtainwall systems. Nonporous substrates, like porous substrates, can present some unique challenges. Nonporous substrates are not moisture-permeable and generally are not susceptible to moisture damage, cracking or staining like porous substrates. Following are considerations for nonporous substrates.

Aluminium

Aluminium used in facade construction may be anodized, mill finished, treated with a conversion coating, or painted with polyester powder coatings (PPC) or polyvinylidene difluoride (PVDF)-based paints. Generally DOWSIL™ weatherproofing sealants achieve excellent long-term adhesion to aluminium and painted aluminium. Refer to pages 15 through 17 of this manual for substrate preparation and priming recommendations.

Steel or Other Metals

Steel used in facade construction may be stainless, brush finished, cold rolled, galvanized or coated. Some steel types, such as Cor-Ten Steel, may oxidize upon weather exposure and should not be used as a substrate for DOWSIL™ weatherproofing sealants. Other stable steel surfaces can be used, but laboratory and/or field adhesion testing should be used to verify adhesion. Other metal materials, such as copper, lead or bronze, may also be suitable substrates for weatherseal applications. Refer to pages 15 through 17 of this manual for substrate preparation and priming recommendations.

Glass

DOWSIL™ weatherproofing sealants generally have excellent primerless adhesion to glass. Concerns relating to glass include special glass edge treatments and glass coatings (intentionally applied or overspray). Refer to the DOWSIL™ Silicone Structural Glazing Manual (Form No. 62-0979) and DOWSIL™ Insulating Glass Manual (Form No. 62-1374) for more information on glass coatings. Also consider the use of sealant adjacent to laminated glass, self-cleaning glass or insulating glass units.

Backer and Accessory Materials

Various materials may contact the DOWSIL™ weatherproofing sealant in a joint. The most common accessory material in a weatherseal joint is a backer rod. A backer rod serves several functions. First, a backer rod provides resistance to the sealant during installation. This resistance is important because it allows the sealant to fully wet out the sides of the joint when the joint is being tooled. The backer rod also helps to provide a proper joint dimension. Following is a discussion of backer rods and other accessory materials.

Closed Cell Polyethylene

Closed cell polyethylene is the most common backer material and is available in various shapes and sizes, most commonly circular, square and rectangular. This particular type of backer material can be difficult to compress; therefore, it is the responsibility of the installer to ensure that the product is not punctured during the installation. If this would be the case, then a minimum time period of four (4) hours is required to allow for outgassing prior to the application of any sealant. Closed cell polyethylene does not absorb water due to its continuous skin and lack of open cells; it has a low vapor permeability, which is less beneficial to the curing rate of moisture-curing sealants.

Open Cell Polyethylene

Open cell polyethylene is similar to closed cell polyethylene, except it can capture water. Open cell polyethylene may have a continuous skin, which will reduce water absorption. This backer material is easily compressible, does not outgas and is more permeable than closed cell polyethylene.

Open Cell Polyurethane

Open cell polyurethane readily absorbs water, which is perceived as a negative by many. This backer material is beneficial in that it is highly vapor-permeable to allow faster sealant cure, easily compressible and easy to install. Open cell polyurethane backer rods have been used successfully with DOWSIL™ weatherproofing sealants for many years.

Bond Breaker Tape

A bond breaker tape is necessary in many joint designs to prevent adhesion to the back surface of the joint. A backer rod should be used where possible, but in some designs, such as panel joint, there is not sufficient cavity space to install a backer rod. In such cases, a bond breaker tape should be used. Common bond breaker materials are polyethylene, Teflon, wax or masking tape. Bond breaker tapes or materials should be pre-tested to confirm that the sealant does not achieve adhesion to the material. When using wax, caution must be taken to apply the wax only to the proper surface.

Other Accessory Materials

Other accessory materials, such as extruded gaskets, joint fillers, setting blocks, waterproofing membranes, protective coatings or paints, may contact the DOWSIL™ weatherproofing sealants. Highly plasticized materials, such as waterproofing membranes and some gaskets and setting blocks, may discolor the DOWSIL™ sealant. In some cases, an extruded gasket or plastic material is used as a backer to a weatherseal joint. It is important that the sealant does not adhere and is compatible with this extruded material.

Compatibility With Non-DOWSIL™ Sealants

DOWSIL™ weatherproofing sealants may contact other sealants, either silicone or organic. As a rule, different sealants should not contact each other wet to wet. Sealant cure properties may be affected by interactions between the products. Generally, silicone sealants adhere well to cured organic sealants, but organic sealants never adhere to cured silicone sealants.

Surface Preparation and Sealant Application

This surface preparation and sealant application procedure outlines general requirements for installing DOWSIL™ weatherproofing sealants. By following these procedures closely, you will ensure good sealant performance. Since sealants are applied in many different environments and conditions, these procedures are not intended to be a complete and comprehensive quality assurance program.

The basic steps for joint preparation and sealant application are:

1. **Clean –** Joint surfaces must be clean, dry, dust-free and frost-free.
2. **Prime –** If required, primer is applied to the clean surfaces.
3. **Pack –** Backer rod or bond breaker tape is installed.
4. **Seal –** Sealant is applied into the joint cavity.
5. **Tool –** Apply pressure to sealant to create a flush joint and ensure adhesion and proper joint dimensions.

Cold-Temperature Application

Silicone sealants have the unique ability to be used year-round, including the middle of winter. Silicone sealants, due to their flexible polymer, can be extruded easily in temperatures well below 0°C without heating. On the other hand, organic sealants cannot be applied at temperatures below 5°C to 10°C. DOWSIL™ 791 Silicone Weatherproofing Sealant, DOWSIL™ 756 SMS Building Sealant and DOWSIL™ 813C Construction and Concrete Silicone are approved for application at temperatures to -25°C.

At temperatures below the dew point or freezing, the potential for condensation or frost on the substrate surface is greater. Only moisture on the surface of a substrate matters. Moisture within the mass of a substrate, such as a concrete block or brick, is less important than the surface moisture. Concern about surface moisture can be alleviated by following a few simple procedures:

- Cold-temperature application is best done when humidity is lower. Do not apply sealant in rain, freezing rain, snow or heavy fog.
- Always solvent clean (and prime if required) immediately prior to sealant application. Use a water-soluble solvent, such as isopropyl alcohol (IPA); Methyl Ethyl Ketone (MEK); or, preferably, DOWSIL™ R-40 Universal Cleaner or DOWSIL™ R41 Cleaner Plus. Water-soluble solvents will absorb moisture and help to dry the substrate.
- Do not apply sealant if the substrate is visibly wet or has the presence of frost. Apply a tissue to the substrate surface prior to sealant application to determine if liquid moisture is present. If so, further solvent cleaning should be performed.
- Do not heat the joint with a forced air dryer or direct flame.
- Perform field adhesion tests on a frequent basis to verify sealant adhesion. With slower cure rates, the sealant may require 14 to 28 days for full cure and adhesion.

At colder temperatures, a silicone sealant will cure at a much slower rate. Ultimately, the sealant will achieve full physical properties. In practical terms, application of sealant in winter is beneficial if you consider that joint width is greatest during winter. Sealant applied at maximum joint width will be under compression during most of its life, and this condition produces less stress on the sealant adhesive bond.

The fact that silicone sealants have been used successfully at sub-freezing temperatures for many years is evidence that this is an acceptable practice. This unique benefit of silicone allows building construction and weatherproofing to proceed during the winter months. This increased production capability will provide greater profit with no added risk.

High-Temperature Application

Silicone sealants should not be applied when the ambient air temperature or the substrate temperature is in excess of 50°C. At these temperatures, the sealant may form bubbles at the bond line between the sealant and the substrate during curing, which can have a detrimental effect on the adhesion and joint performance. In some cases, this bubbling condition can only be identified through field adhesion testing.

To minimize risk in hot climates, apply the sealant on the shaded side of the building first. In some situations, sealant application may need to be performed in the early morning, in the evening or at night. Also, in hot climates, ensure that the sealant is stored in a cooler environment. Exposing a silicone to high temperatures for prolonged periods of time will cause premature degradation, and the sealant may not cure properly.

Joint Movement During Cure

One-component silicone sealants cure by reacting with moisture in the atmosphere. Cure occurs from the surface down and if the joint is moving during cure, the sealant may wrinkle or deform on the surface. Movement during cure is dependent on the joint width and percentage of daily joint movement resulting from the panel dimensions and daily temperature change. In some joint designs, this condition cannot be avoided. To minimize sealant deformation from movement during cure, the following steps should be considered:

- Use an open cell polyurethane backer rod to increase the rate of sealant cure.
- Seal the joint at the median daily temperature to reduce the overall daily movement on the joint.
- Maintain a sealant depth that is not greater than a two to one (2:1) ratio or a maximum of 12 mm. For specific advice, please contact your local Dow Sales Office.
- Priming will provide faster adhesion build-up. If priming has not been recommended, this added step can help to ensure a successful application when there is excessive joint movement during cure.

Sealant Joint Replacement Considerations

Organic sealants, such as polyurethane, MS polymer and polysulphide sealants, will degrade and require replacement after some period of time. Once this sealant deterioration and failure occurs, new sealant will need to be installed. In some cases, a silicone joint may require replacement. Following are the recommended procedures to replace sealant joints.

Organic Sealant Joint Replacement Method

Failed polyurethane or polysulphide sealants can be effectively resealed with DOWSIL™ weatherproofing sealants. It is a good practice to first understand why the sealant failed. DOWSIL™ and its authorized distributors are available to offer expertise and advice prior to any sealant replacement. It is a good practice, prior to starting any sealant joint replacement, to install field adhesion test joints using an acceptable joint preparation procedure. Often, these test joints will include several sealants and primers in the evaluation. Based on the results of these test joints, a surface preparation and sealant recommendation can be made.

Following is a standard recommended joint replacement method for organic sealants:

1. Cut away the old sealant as close to the joint edges as possible. Discard old sealant, backer rod, etc.
2. Remove all remaining residue of old sealant from the joint surfaces to be resealed. Removal may be accomplished by several means: abrasion with a wire brush (power or hand), grinding, saw-cutting or solvent cleaning.
3. Blow out dust and loose particles with moisture-free and oil-free compressed air.
4. After cleaning, the joint surfaces must be thoroughly dry, clean and free of residual sealant.
5. Follow the surface preparation and sealant application procedures described later in this section.

Silicone Sealant Joint Replacement Method

A properly designed and installed silicone sealant joint should last many years without special maintenance. In the event that the joint has been damaged or requires replacement for some other reason, the following procedure should be followed to replace a silicone sealant:

1. If the silicone sealant is sound, of similar cure chemistry and has excellent adhesion to the substrate, it does not need to be completely removed. New silicone sealant will adhere to old silicone sealant, provided the surfaces are clean. To ensure a clean surface, use the following procedure:
    a. Cut away the old sealant, leaving a 1 to 2 mm thickness of silicone sealant on the joint surface.
    b. Newly cut surfaces of silicone sealant do not need to be cleaned, but solvent cleaning of the old silicone sealant can be performed if desired or if there is concern that the old silicone has gotten dirty.
    c. Apply sealant as described in the following section.
2. If the silicone sealant does not have acceptable adhesion, or if there is concern with the workmanship or installation of the sealant, the silicone sealant should be completely removed.

The following procedure should be followed:

a. Cut away the old sealant as close to the joint edges as possible. Discard the old sealant, backer rod, etc.

b. Remove all remaining residue of old sealant from the joint surfaces to be resealed. Removal may be accomplished by several means: Abrasion with a wire brush (power or hand), grinding, saw-cutting or solvent cleaning.

c. Blow out dust and loose particles with moisture-free and oil-free compressed air.

d. After cleaning, the joint surfaces must be thoroughly dry, clean and free of residual sealant.

e. Follow the surface preparation and sealant application procedures described later in this section.

Substrate Cleaning Procedures

This section provides information on proper cleaning procedures for porous and non-porous substrates and considerations for the use of solvents. Substrate cleaning is an important element of any successful joint weather-sealing application. The key to good sealant adhesion is a clean joint surface.

Porous Substrates

Due to the variety of surfaces for porous substrates, cleaning may or may not be easy. Smoother surfaces, such as cut edges of granite or marble, can be cleaned using the two-cloth cleaning method described below. Rough surfaces, such as an aggregate precast, limestone, and brick and mortar surfaces, may be difficult to clean using a cloth. These rougher surfaces may require abrasion cleaning to remove dust and/or laitance. Abrasion cleaning can be followed by the use of a stiff bristle brush, vacuuming or blowing with water and oil-free compressed air. The porous substrate must be sound and free from loose debris, dirt or laitance. It is important that the sealant bond to a sound, clean and dry surface.

Nonporous Substrates

Nonporous surfaces are typically smooth and should be cleaned using the two-cloth cleaning method described below. Selection of solvent may be affected by local regulations. DOWSIL™ R-40 Universal Cleaner and DOWSIL™ R41 Cleaner Plus are the preferred cleaning solvents for most nonporous substrates.

Two-Cloth Cleaning Method

The "two-cloth cleaning method" is a proven technique to clean smooth porous and nonporous 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.

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.

Solvent Considerations

Some solvents may damage certain substrate types, so please consult with the substrate manufacturer to verify the suitability of a specific solvent with that manufacturer's material. In all cases, follow the safe handling recommendation of the solvent manufacturer and local or national regulations regarding solvent use.

Primer Application Proceduress

For weathersealing applications, Dow typically recommends the use of either DOWSIL™ 1200 OS Primer, UV Traceable, or DOWSIL™ Construction Primer P. These two primers are very different in handling and behavior. DOWSIL™ 1200 OS Primer, UV Traceable, is a chemical treatment primer that activates a surface to provide better sealant adhesion. Generally, DOWSIL™ 1200 OS Primer, UV Traceable, is preferred on nonporous or smooth porous substrates. DOWSIL™ Construction Primer P is a film-forming primer that leaves behind a thin film on a surface. DOWSIL™ Construction Primer P is typically recommended for use on concrete, brick, mortar and other porous substrates. Please refer to product data sheets for more information.

The following are recommended procedures for application of three DOWSIL™ primers:

DOWSIL™ 1200 OS Primer, UV Traceable

Before using, verify that the DOWSIL™ 1200 OS Primer, UV Traceable, 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-colored 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 container. Do not pour more than a 10 minute supply of primer into the working container. Replace and tighten the cap on the container immediately after dispensing the primer. Excessive exposure of the primer to atmospheric moisture will cause it to deteriorate and turn milky white in the container.
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 (DOWSIL™ R-40 Universal Cleaner) and primed in a proper manner.
4. Allow the primer to dry until all of the solvent evaporates. This typically takes from 10 to 30 minutes, depending on temperature and humidity. Once dry, backer rod and sealant may be installed.
5. Inspect the surface for dryness and for the appearance of overpriming. A primed nonporous surface will have a slight haze. If red-colored primer is used, the primed surfaces will appear red in color. When DOWSIL™ 1200 OS Primer, UV Traceable, or DOWSIL™ 1203 3in1 Primer is used, it is possible to use a UV lamp to trace the correct application of the primer for quality assurance. The UV tracer will be visible for several days and automatically disappears with time.
6. 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.

DOWSIL™ 1203 3in1 Primer

Before using, verify that the DOWSIL™ 1203 3in1 Primer is within its stated shelf life. The primer should be stored below 25°C in its original unopened container. For obtaining best results, the following steps should be followed on all surfaces except silicone rubber.

1. Thoroughly clean the surface by brushing away any loose material.* Joint surfaces must be dry and dust-free.
2. Pour a small amount of primer into a buffer container to avoid any contamination of fresh product in the original bottle. Replace and tighten the cap on the container immediately after dispensing the primer.
3. Pour a small amount of DOWSIL™ 1203 3in1 Primer from the buffer container onto a clean, dry, lint-free cloth and wipe all joint surfaces with sufficient force.
4. Immediately wipe dry with a separate clean, dry cloth.
5. Pour a small amount of DOWSIL™ 1203 3in1 Primer from the buffer container onto a clean, dry, lint-free cloth and gently wipe a thin film on all joint surfaces.
6. Allow the primer to dry until all of the solvent evaporates. This typically takes five (5) to 30 minutes, depending on temperature and humidity. The optimal drying time for a specific area should be determined prior to use. As a general rule, drying times of more than four (4) hours at normal temperatures and humidity should be avoided.
7. For quality assurance, it is possible to use a UV lamp to trace the correct application of the primer. The UV tracer will be visible for several days and will automatically disappear with time.
8. Apply silicone sealant from Dow.

DOWSIL™ Construction Primer P

Before using, verify that the DOWSIL™ Construction Primer P is within the stated "Use By" date on the container. The primer should be stored between 5°C and 25°C in its original unopened container.

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 container and apply primer from the container rather than directly from the can.
3. Apply a thin, uniform layer of primer by brush to the surfaces to be primed. Avoid areas that will not be sealed.
4. Allow the primer to dry for a minimum of 30 minutes, and inspect for dryness. Once dry, backer rod and sealant may be installed.
5. Sealant should be applied within 8 hours of primer application.

Primer Usage Rate

Primer usage rates will vary with the roughness and porosity of the substrate. Usage rates can typically be assessed during the commencement of a project. For an indication of primer usage rates, please refer to consumer.dow.com/construction, where a primer estimator can be found. Primer usage is based on primer applied to approximately 25 mm of substrate depth on two joint surfaces:

- Smooth surfaces: Approximately 800 linear meters of joint/liter
- Coarse surfaces: Approximately 400 linear meters of joint/liter

Backer Installation

Following cleaning and priming, the backer rod or bond breaker material can be installed. A backer material is important to ensure proper joint dimension, prevent three-sided adhesion and provide a material to tool against effectively. To assure proper backer installation:

- Backer rods should be sized approximately 25% larger than the joint opening to ensure that the backer rod is not displaced during sealant installation and tooling. Only new and clean backer rod should be used.
- The backer rod should be positioned in the joint opening so the tooled sealant joint will have the correct width-to-depth ratio after tooling. An improperly positioned backer rod will cause incorrect joint depth.

Sealant Application Procedures

After cleaning, priming (if required) and backer material installation, the sealant may then be installed into the joint. It is essential that the sealant fully fills the joint opening and the joint is tooled to ensure full wetting with the sides of the joints. This "wetting" of the substrate surfaces is necessary for the sealant to properly develop adhesion. Following are the proper steps for sealant application:

1. Prior to sealant application, masking tape may be used to keep excess sealant from contacting areas adjacent to the sealant joint.
2. Apply the sealant in a continuous operation using a caulking gun or pump. A positive pressure, adequate to fill the entire joint depth and width, should be used. This can be accomplished by "pushing" the sealant ahead of the application nozzle.
3. After verifying that the joint is completely filled, tool the sealant with light pressure against the back up material and sides of the joint. Tooling should be done before the sealant begins to form a skin (5 to 20 minutes).
4. If masking tape has been used, it should be removed before the sealant skins over (within 15 minutes after tooling).

*For very dirty surfaces, additional cleaning with a cleaning solvent is necessary.

It is preferred that the sealant be tooled without the use of tooling aids, such as water, soap or solvent. However, due to aesthetic reasons, the accessibility of the joint or the substrate type, "wet tooling" may be necessary to ensure that the sealant has made the required good contact to the substrate. Tooling aids can have an adverse effect on the adhesion of the sealant, and it is critical that any tooling aid only be applied to the tooling stick, spatula or block and not applied directly to the substrate or sealant. If wet tooling is used, then it should be verified that there is compatibility between the tooling aid and the sealant.

Sealant Cure Requirements

All 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.

Sealant Usage Rate

Sealant usage rates will depend on the joint dimensions for a specific project. Following are estimates of sealant usage for several common joint dimensions. These estimates are per 100 linear meters of joint and assume a 5% material waste.

The following are recommended procedures for application of three DOWSIL™ primers:

• 12 mm x 6 mm joint – 25 x 310 ml cartridges

• 18 mm x 9 mm joint – 55 x 310 ml cartridges

• 24 mm x 12 mm joint – 98 x 310 ml cartridges

Available at consumer.dow.com/construction is a calculator to estimate sealant usage for different joint dimensions.

Quality Control

Dow performs extensive quality assurance 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 proper storage, handling and quality control of DOWSIL™ weatherproofing sealants. An effective quality control program is important for the application of DOWSIL™ Weather Proofing sealants.

One-Component Sealants Storage Temperature and Handling

DOWSIL™ one-component sealants should be stored below +30°C. An expiration date is clearly marked on the product packaging. Sealant should only be used if it is within the expiration 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 for 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.

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 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 Construction Office.

Record results in your Quality Control Log. A sample Quality Control Log is available in the Documentation section of this manual.

Two-Component Sealants

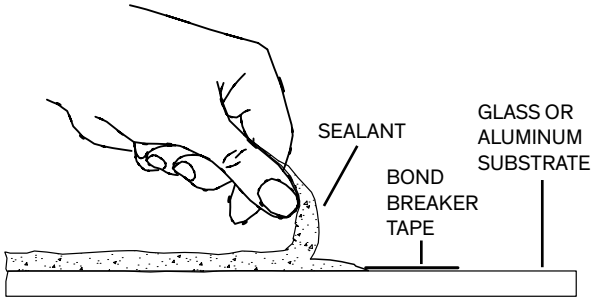
Two-component sealants, such as DOWSIL™ 993 Structural Glazing Sealant, may be used as a weatherseal in a curtain-wall. Consider that the movement capability of a two-component structural silicone sealant will be less than a one-component weatherseal sealant. For information on the proper handling and quality control of two-component sealants, please refer to the DOWSIL™ Silicone Structural Glazing Manual (Form No. 62-0979).

Peel Adhesion Test Method

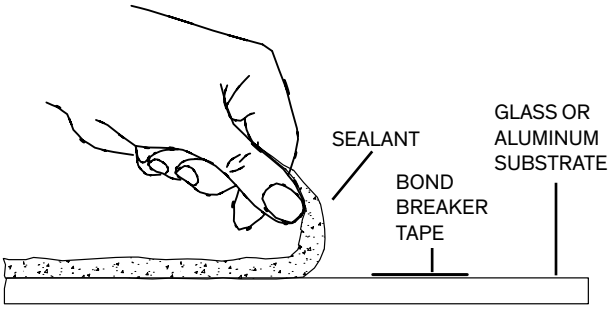
The peel adhesion test is an effective test to verify sealant adhesion to a substrate, particularly in a production shop. The peel adhesion test is not a substitute for a field adhesion test for field applications of DOWSIL™ weatherproofing sealants. The field adhesion test is the preferred quality control test on a construction site. The peel adhesion test can be used effectively to evaluate new materials prior to use on a project.

Following is a description of the peel adhesion test:

1. Clean and prime the substrate as recommended by Dow.
2. Place a piece of polyethylene sheet or bond breaker tape across the flat surface.
3. Apply a bead of sealant and tool it to form a strip approximately 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 embed 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 that 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.



Peel Adhesion Test: Cohesive Failure



Peel Adhesion Test: Adhesive Failure

Field Adhesion Test Method

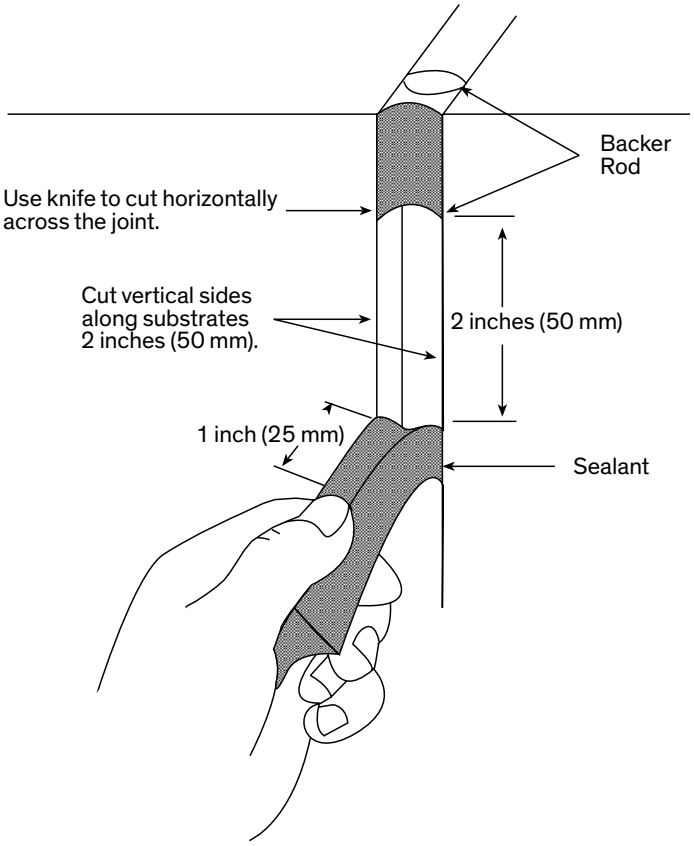
The field adhesion test is a simple method to evaluate the adhesion and installation of a weatherseal joint. Problems such as poor adhesion, improper cleaning, poor primer application, joint underfill or overfill, improper backer rod placement, and improper tooling can all be identified with a field adhesion test. The field adhesion test is the primary test that should be used by the sealant applicator to verify that sealant is being installed correctly. This test should be performed at the start of a project and ongoing throughout the project. For refurbishment projects, this test should be performed before the project begins to identify the best surface preparation and sealant for the project. This test is normally performed 7 to 21 days after the sealant is installed. In winter, sealant cure may take longer.

Field adhesion testing should be performed frequently through the project. It is suggested that approximately 5 tests be performed in the first 300 linear meters of joint. Subsequently, one test every 300 linear meters of joint or one test per floor per elevation should be performed. The field adhesion test method is described below:

1. Cut horizontally across the joint with a knife.
2. Starting at the horizontal cut, make two equivalent 75 mm vertical cuts along both joint surfaces.
3. Grasp the tab of sealant approximately 25 mm from the end of the horizontal cut as shown in the illustration.
4. Pull the sealant slowly at a 90° angle from the substrate.
5. The sealant is considered to have acceptable adhesion if it either fails cohesively or is extended more than three times the maximum specified elongation of the sealant without adhesive failure. For example, a 50% movement sealant must be able to extend 150% or greater without adhesive failure.
6. The sealant test sample should be inspected for voids, irregular joint fill, improper joint dimensions and other workmanship issues.
7. Results should be recorded in the Field Adhesion Testing Log in the Documentation section of this manual.

Repair of Field Adhesion Test Area

The field adhesion test area can easily be repaired by applying new sealant into the test area. The test sample should be removed. The new sealant will fully bond to the existing sealant surfaces in the joint, so further cleaning is not required.



Documentation

Included in the following section are a Project Submittal Form, Product Quality Control Log and Field Adhesion Testing Log. The Project Submittal Form can be used to submit samples for project testing to Dow. The Product Quality Control Log can be used to document sealant quality control testing during the project. The Field Adhesion Testing Log can be used to document field adhesion testing results. Completed documents may be required for specific Dow warranties.

Project Submittal Form

Project Name & Location:	
Project Description:	
Customer Name & Location:	
Customer Contact, Phone & Email Address:	

Substrate					
Description					
Manufacturer					
Surface(s) to Test					
Sealant(s) to Test (circle)	756[1]	757[2]	791[3]	Other	________
Solvent (circle)	R40[4]	R41[5]	IPA	Other	________

Substrate					
Description					
Manufacturer					
Surface(s) to Test					
Sealant(s) to Test (circle)	756[1]	757[2]	791[3]	Other	________
Solvent (circle)	R40[4]	R41[5]	IPA	Other	________

Substrate					
Description					
Manufacturer					
Surface(s) to Test					
Sealant(s) to Test (circle)	756[1]	757[2]	791[3]	Other	________
Solvent (circle)	R40[4]	R41[5]	IPA	Other	________

[1] 756 = DOWSIL™ 756 SMS Building Sealant

[2] 757 = DOWSIL™ 757 Weatherproofing Sealant

[3] 791 = DOWSIL™ 791 Silicone Weatherproofing Sealant

[4] R40 = DOWSIL™ R-40 Universal Cleaner

[5] R41 = DOWSIL™ R41 Cleaner Plus

Product Quality Control Log

Project Name & Location:

Date	Sealant	Lot Number	Storage Temp & Humidity	Skin- Over Time	Elastomeric Test (P/F)	Peel Adhesion Test Result

Field Adhesion Testing Log

Project Name & Location:

Date Applied	Date Tested	Test Location	Primed Y/N	Sealant	Field Adhesion Test Result

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

Images: dow_40452827334, dow_40488955475, dow_43184119704

HANDLING PRECAUTIONS

PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED IN THIS DOCUMENT. BEFORE HANDLING, READ PRODUCT AND SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION. THE SAFETY DATA SHEET IS AVAILABLE ON THE DOW WEBSITE AT WWW.CONSUMER.DOW.COM, OR FROM YOUR DOW SALES APPLICATION ENGINEER, OR DISTRIBUTOR, OR BY CALLING DOW CUSTOMER SERVICE.

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Dow's sole warranty is that our products will meet the sales specifications in effect at the time of shipment.

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S2D 91656/E87712 Form No. 62-1471-01 F