Geocel®

WEATHERSEALING MANUAL

www.geocel.co.uk

IMPORTANT INFORMATION

The information contained herein is offered in good faith based on Geocel'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 Geocel's products are fully satisfactory for your specific applications. Geocel'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.

Geocel specifically disclaims any other express or implied warranty of fitness for a particular purpose or merchantability, unless Geocel provides you with a specific duly signed endorsement of fitness for use, Geocel disclaims liability for any incidental or consequential damages. Suggestions of use shall not be taken as inducements to infringe any patent.

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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 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 Geocel Sealants. The recommendations made in this manual are based on many years of experience using 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 façade 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. Geocel will assist you in achieving this success.

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

Geocel Products - Sealants

Geocel offers a full range of high performance sealants. Each sealant is developed and tested for a specific application and should only be used as intended unless specifically approved by Geocel. Specific product information is available at www.geocel.co.uk

Geocel 925NS Non Staining High Performance Building Facade Joint Sealant

Geocel 925 is a one part low modulus MS Polymer based joint sealant designed for use on prestige buildings and those highly exposed to extreme weather conditions, aggressive atmospheres and UV light. This sealant has been specifically formulated as a non staining sealant and for application to difficult substrates associated with modern façade construction.

Geocel 945 High Modulus Elastomeric Construction Sealant and Adhesive

Geocel 945 is a one part high modulus MS polymer based sealant and adhesive for building and civil engineering structures including membranes.

Geocel Firex 921 High Performance Elastomeric Intumescent Expansion Joint Sealant

Geocel 921 is a one part fire rated MS Polymer based sealant designed for sealing expansion joints and compression joints where frequent movement is anticipated as part of a fire resistant assembly.

Geocel Products - Cleaners and Primers

Cleaners and Primers

Geocel offers a range of cleaners and primers for use with Geocel sealants. In some instances, a specific cleaner or primer will be required prior to the application of the sealant to achieve optimal adhesion to a specific substrate.

Geocel Surface Cleaner

Geocel Surface Cleaner is a specially formulated solvent blend designed to clean glass and metal profiles and other non-porous and porous substrates.

Dow Corning® R-40 Cleaner

Dow Corning R-40 Cleaner is a specially formulated solvent blend designed to clean porous and non porous surfaces.

Dow Corning® Construction Primer P

Dow Corning Primer P is a one-part film forming primer designed for use on porous substrates.

Geocel Surface Activator

Geocel Surface Activator is a one part chemical designed for use with Geocel Sealants in a variety of applications.

Geocel Project Support

Geocel can assist you with questions about the design and correct use of Geocel Sealants. Geocel will review designs and make product recommendations for any project using our sealants. Geocel is available to support you at a construction site or a mock-up facility.

Product Recommendations

Geocel will make a project specific product recommendation based on the joint design, joint movement, substrate types, adhesion properties and other factors on a building.

Design Reviews

To properly review a weatherseal joint design, Geocel 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. Geocel will not determine the movement of a specific joint. This information must be provided by the design professional. Geocel will review and approve the design in accordance with the guidelines described in later sections of this manual.

Substrate and Materials Approval

Geocel offers to perform adhesion, compatibility or non-stain testing on any material or substrate which is in contact with a Geocel Sealant. For natural stone, non-stain testing in our laboratory is always recommended.

Adhesion Testing

Sealant adhesion to a substrate is an important element of joint performance. Upon completion of testing, Geocel will provide a written product recommendation, surface preparation and priming recommendation. Adhesion 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 Geocel 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 incompatible with sealants and not be approved for contact. To minimize the risk of incompatibility problems, representative samples of the materials should be provided to Geocel for compatibility testing. Upon completion of testing, Geocel will provide a written product recommendation. Testing takes six (6) weeks from receipt of samples.

Non-Stain Testing

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

Construction Site Support

Geocel 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. Geocel representatives can assist in training a sealant applicator on the required procedures to prepare and test field adhesion joints. If required, Geocel 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 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 mock-up evaluation, the building façade mock-up may be tested for water penetration, structural performance or other design requirements.

Warranty

Geocel offers project specific Weatherseal Limited Warranties for new or remedial construction projects using Geocel Sealants. Please contact your Geocel Specification Specialist 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 façade elements move due to these various factors, elements must be separated by joints which allow expansion, contraction and other movements. Failure to install joints will create stress in the façade 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 façade 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 façade elements. Façade 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)

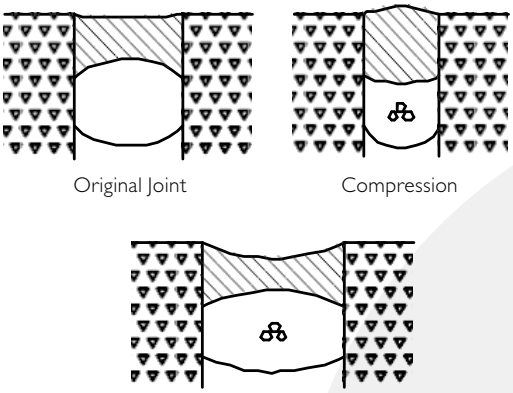
Following is a table with the coefficient of thermal expansion values for some common construction materials:

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.



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

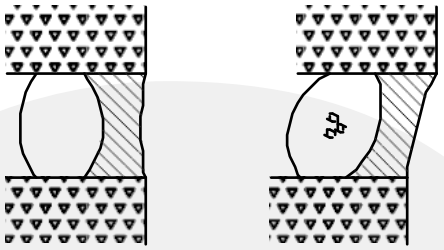
Minimum Joint Width =
[(100/X) (Mt + Mo)] + *T*

X: Sealant movement capability in %
Mt: Movement due to Thermal Expansion
Mo: Other movement, i.e. live loading
T: Construction Tolerances

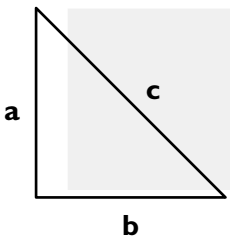
For example, a horizontal joint between an aluminium curtainwall and concrete panel with a thermal movement of 4 mm, a live load of 2 mm, a construction tolerance of 4 mm and a 25% movement capability sealant would require a minimum joint width of 28 mm.

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:



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

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 façade 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 façade. 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 façade elements to extreme temperatures. A wet sealant joint will reduce air infiltration and improve the thermal performance of a façade.
- **Aesthetics** can be greatly improved by reducing shelves and openings which 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.

Proper Joint Design

The following guidelines for proper joint design are based on many years of experience. 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 maintain a minimum of 6 mm of contact or bond surface to ensure adequate adhesion.

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.

Sealant should be applied in a minimum 1½:1 to 2:1 width to depth ratio. The ideal joint has a ratio 2:1.

Sealant depth over the backer material should be a minimum of 6 mm.

Sealant depth over the backer material should be a maximum of 12 mm even if joint width is greater than 24 mm.

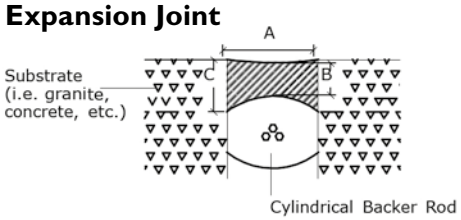
Consult Geocel if joint widths are in excess of 40mm.

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.

Common Joint Types

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

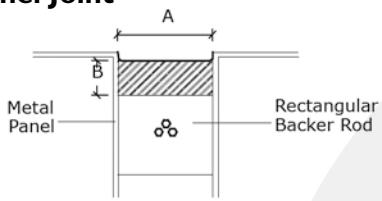
Expansion Joint



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

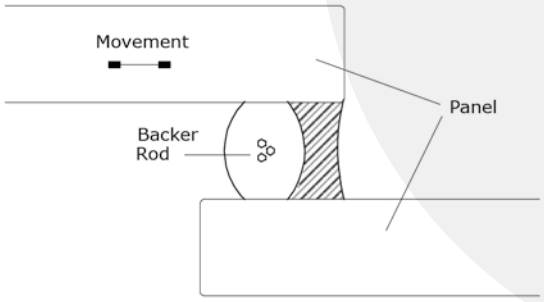
Panel Joint



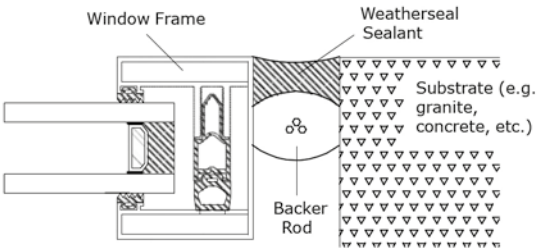
Dimension A - Joint Width
Dimension B - Sealant Depth and Bond Surface

Key Points:
1. Dimension A must be minimum of 6 mm or greater depending on joint movement
2. Dimension B should be between 6 mm to 12 mm
3. Ratio of A to B should be 2 to 1 or greater

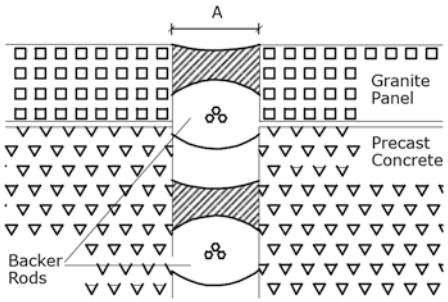
Lap Joint



Perimeter Joint

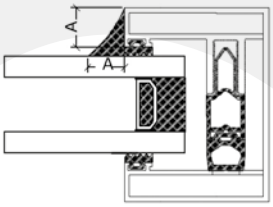


Dual Weatherseal Joint



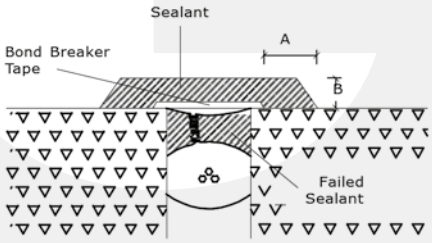
Key Points:
1. Follow standard joint design requirements
2. Dimension A is minimum 18 mm to allow application of interior joint
3. To allow cure of interior joint either allow air space between seals or use open cell polyurethane backer rod for interior sealant joint

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

A sealant weatherseal joint 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, 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 a 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

Façades 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 vapour permeable and this helps moisture-cure sealants, such as one component 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 which use excessive levels of plasticizers, diluents or silicone oils can leach these additives into a porous substrate. 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, Geocel recommends that non-stain testing be performed on representative samples of stone from each individual project. Geocel 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 non staining warranty may be issued for the project. Please contact your local Geocel Specification Specialist for more information.

Concrete

Concrete is a complex material and can come in many forms, i.e. precast, poured, tilt-up panels, concrete blocks and reconstituted or precast aggregate. Concrete surfaces can be sandblasted, mechanically abraded, have a form release or laitance, 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, Dow Corning Construction Primer P is recommended for use with all Geocel MS polymer Sealants on concrete.

Brick

Brick like concrete can have a variety of surface type. 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, Dow Corning Construction Primer P is recommended for use with all Geocel MS polymer Sealants on brick and mortar surfaces.

Stone
Natural occurring stone includes granite, marble, limestone and sandstone.
The variety of stone is limitless. For any application of Geocel Sealants on stone, it is recommended that Geocel 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, Geocel Specification Specialists are available to visit the jobsite and provide project specific recommendations for you.

Other Porous Materials
Other porous substrates may be used on a building façade. In many cases, Geocel Weatherproofing Sealants are appropriate for these materials. Please contact your local Geocel Specification Specialist or Geocel Technical Service for advice on suitability for specific applications, substrate preparation and priming recommendations..

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

Aluminium
Aluminium used in façade construction may be anodised, mill finished, treated with a conversion coating or painted with polyester powder coatings (PPC) or polyvinylidene difluoride (PVDF) based paints. Generally Geocel MS Polymer Sealants achieve excellent long term adhesion to aluminium Given the variety of treaments and coating available please contact Geocel Technical Service for specific advice.

Steel or other Metals
Steel used in façade 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 Geocel 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, bronze may also be suitable substrates for weatherseal applications. Please contact Geocel Technical Service for specific advice on substrate preparation and priming recommendations.

Glass
Geocel MS polymer Sealants generally have excellent primerless adhesion to glass. Concerns relating to glass include special glass edge treatments and glass coatings (intentional applied or overspray). Also consider the use of sealant adjacent to laminated glass, photocatalytic glass or insulating glass units. Please contact Geocel Technical Service for specific advice on substrate preparation and priming recommendations.

Backer and Accessory Materials

Various materials may contact the Geocel 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 and therefore it is the responsibility of the installer to ensure that during the installation the product is not punctured. If this would be the case then a minimum time period of four (4) hours is required to allow for out gassing 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 vapour 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.

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 Geocel Sealants. Highly plasticised materials such as waterproofing membranes and some gaskets and setting blocks may discolour the Geocel 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. For specific advice regarding compatibility and testing of a representative sample of accessory material, please contact Geocel Technical Service.

Compatibility with Non-Geocel Sealants

Geocel 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 MS polymer sealants adhere well to cured organic sealants but not silicone sealants. For more information on sealant to sealant compatibility please contact Geocel Technical Service.

Product Quality

Surface Preparation and Sealant Application

This surface preparation and sealant application procedure outlines general requirements for installing Geocel 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 are installed
4. **Seal** – Sealant is applied into the joint cavity
5. **Tool** – Apply pressure to sealant to create a flush joint, ensure adhesion and proper joint dimensions.

Cold Temperature Application

MS Polymer sealants can be applied at temperatures down to 5°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). 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 MS polymer sealant will cure at a much slower rate. Ultimately, the sealant will achieve full physical properties. In practical terms, application of sealant in winter time is beneficial if you consider that joint width is greatest during winter time. 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.

High Temperature Application

Geocel sealants should not be applied when the ambient air temperature or the substrate temperature is in excess of 40°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 minimise 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 time. Also, in hot climates, ensure that the sealant is stored in a cooler environment. Exposing a MS polymer to high temperatures for prolonged periods of time will cause premature degradation and the sealant may not cure properly.

Joint Movement During Cure

Geocel one component 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 12mm. For specific advise please contact your local Geocel Specification Specialist.
- 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

Some 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. Following are the recommended procedures to replace sealant joints.

Sealant Joint Replacement Method

Failed sealants can be effectively resealed with Geocel Sealants. It is a good practice to first understand why the sealant failed. Geocel Specification Specialists 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 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. If a silicone sealant has been used in the joint be especially careful to remove all traces of residue and contamination from the joint surface, otherwise the replacement sealant will not adhere properly.
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.

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 weathersealing 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.

Non-porous Substrates

Non-porous 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. Geocel Surface Cleaner (IPA) is the preferred cleaning solvent for most non-porous substrates.

Two-Cloth Cleaning Method

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

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 their material. In all cases, follow the safe handling recommendation of the solvent manufacturer and local or national regulations regarding solvent use.

Primer application procedures

For weathersealing applications, Geocel typically recommends the use of either Dow Corning Construction Primer P or Geocel Surface Activator. These two primers are very different in handling and behaviour.

Dow Corning Construction Primer P is typically recommended for use on concrete, brick, mortar and other porous substrates. Dow Corning Construction Primer P is a film forming primer that leaves behind a thin film on a surface.

Geocel Surface Activator is a chemical treatment primer that activates a surface to provide better sealant adhesion. Generally, Geocel Surface Activator is used on difficult to adhere smooth non porous substrates.

If a substrate is of a fragile or friable nature or the joint is subjected to prolonged water immersion then Dow Corning Primer P may be used. Please refer to product data sheets for more information.

Below are recommended procedures for application of primers:

Dow Corning Primer P

Before using, verify that the Dow Corning 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.

Geocel Surface Activator

Before using, verify that the Geocel Surface Activator 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.

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 (Geocel Surface 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 non- porous surface will have a slight haze.
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.

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. 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

Course 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 that 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 develop adhesion properly. 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).

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 accessability 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 one component 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.

- 12 mm x 6 mm joint – 27 x 290 ml cartridges
- 12 mm x 6 mm joint – 20 x 380 ml cartridges
- 18 mm x 9 mm joint – 59 x 290 ml cartridges
- 18 mm x 9 mm joint – 45 x 380 ml cartridges
- 24 mm x 12 mm joint – 105 x 290 ml cartridges
- 24 mm x 12 mm joint – 80 x 380 ml cartridges

Quality Control

Geocel 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 Geocel Sealants. An effective quality control program is important for the application of Geocel Sealants.

Storage Temperature and Handling

Geocel one component sealants should be stored below +30°C. 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 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.

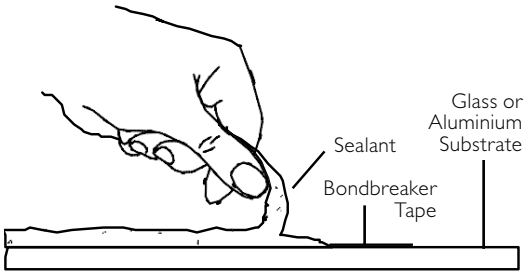
1. Spread a 2 mm. thick layer of sealant on a polyethylene sheet.
2. Every few minutes, touch the sealant film lightly with your finger.
3. When the sealant no longer adheres to your finger, the skin-over time has been reached. If the skin-over time is greater than 2 hours, do not use this material and contact Geocel.
4. Allow the sealant to cure for 48 hours.
5. 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 Geocel.
6. Record results in your Quality Control Log. A sample Quality Control Log is available in the Documentation section of this manual.

Peel Adhesion Test Method

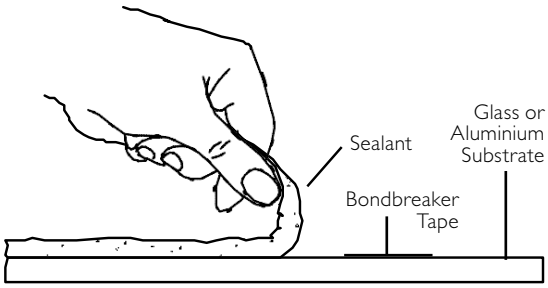
The peel adhesion test is an effective test to verify sealant adhesion to a substrate particularly in a production shop. The peel adhesion test is not a substitute for a field adhesion test for field applications of Sealants. The field adhesion test is the preferred quality control test on a construction 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 Geocel.
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 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.



Peel Adhesion Test: Cohesive Failure



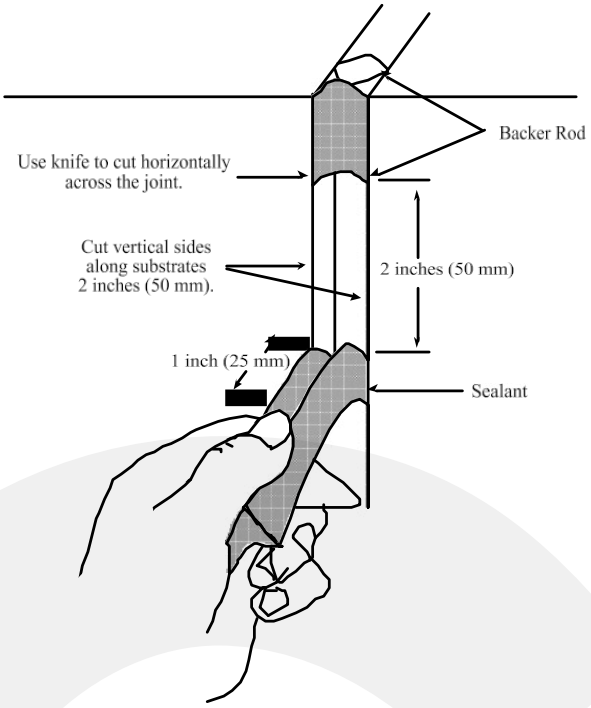
Peel Adhesion Test: Adhesive Failure

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 time, sealant cure may take longer.

Field adhesion testing should be performed frequently through the project. It is suggested that approximately five 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 surface.
3. Grasp the tab of sealant approximately 25 mm from the end of the horizontal cut as shown in the detail below.
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 over 3 times the maximum specified elongation of the sealant without adhesive failure. For example, a 25% movement sealant must be able to extend 75% or greater without adhesive failure.
6. The sealant test sample should be inspected for voids, irregular joint fill, improper joint dimension 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

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 Geocel. 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 Geocel warranties.

Product Quality

Project Submittal Form

Project Name & Location:	
Project Description:	
Customer Name & Location:	
Customer Contact, Phone & Email	
Substrate	
Description	
Manufacturer	
Surface(s) to Test	
Sealant(s) to Test (circle)	925 945 Other:
Solvent (circle)	IPA Other:
Substrate	
Description	
Manufacturer	
Surface(s) to Test	
Sealant(s) to Test (circle)	925 945 Other:
Solvent (circle)	IPA Other:
Substrate	
Description	
Manufacturer	
Surface(s) to Test	
Sealant(s) to Test (circle)	925 945 Other:
Solvent (circle)	IPA Other:

Product Quality

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**

Product Quality

Field Adhesion Testing Log

Project Name & Location:					
Date Applied	**Date Tested**	**Test Location**	**Primed Y/N**	**Sealant**	**Field Adhesion Test Result**

Notes

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