

WEATHERSEALING MANUAL



What is weathersealing?

Sealing exterior wall joints of facades against the influence of weathering such as UV, rainwater, driving rain, etc. and against influences of various other factors such as chemical and mechanical loads that eventually may cause damage.

There can be many different façade types, for example glass façade systems, precast concrete panels with various types of finishes, brickwork and stonework, metallic cladding, tiles and stone veneer panels, etc.

The key factors that façade element joints need to follow:

- » **Protection from moisture.** The joint needs to prevent access of rainwater and humidity to internal structures.
- » **Resistance to different movements.** The joint needs to be capable to bear movements of the structure that may be caused by different factors: temperature changes, moisture, live loads, material shrinking (concrete), etc.
- » **Esthetic appearance.** The joint needs to preserve esthetical appearance even in the presence of extreme conditions such as UV-radiation, rainwater, polluted air. In addition, it should be easy to clean from dirt.

Choosing the correct weathersealant

Nowadays, there are a number of different types of sealants available, e.g. silicones, PU-sealants, hybrids, etc. Each type of sealant has its advantages and disadvantages, which should be considered before application.

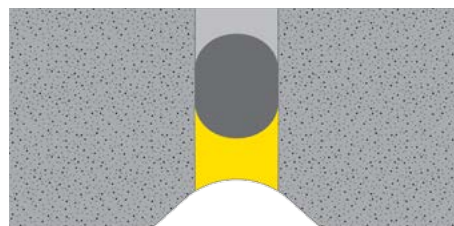
Some of the important things to consider while choosing the weathersealant are:

- » sealant adhesion to substrates
- » sealant movement capability
- » sealant durability after weather exposure
- » sealant compatibility with contact materials
- » workability
- » tooling time
- » impact on environment



Joint design

The correct joint design and dimensioning starts already in the project phase. Based on the used materials, climate conditions, construction stresses, etc. the suitable joint dimensions are being calculated.



Joint width

The width of the joints is mainly determined by the movements of the elements significantly affecting the joint. After the installation, elements are exposed to heat and humidity movements due to environmental influences. The material shrinkage may occur, as well.

The minimum width of the joint, in order to ensure the movement of elements due to the deformation, can be calculated with the following formula:

$$d_{min} = \frac{\Delta d}{M\%} 100 (\%)$$

d_{min} - minimum joint width

Δd - total movement of the joint, due to the thermal and moisture expansion of building parts and other possible conditions (live loads, material shrinking etc.). This value is calculated during the design phase of the building by the corresponding specialist.

$M\%$ - declared sealant movement capability

Example

For a joint, where the total movement is 6 mm and is being sealed with a sealant with 25% movement capability the minimum joint width is 24 mm. In most cases, the recommended width of façade joints is 8-30 mm.

Sealant depth

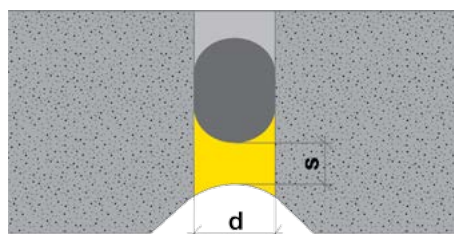
The minimum joint width between the façade elements should be 6 mm and the minimum depth of sealant should be 6 mm.

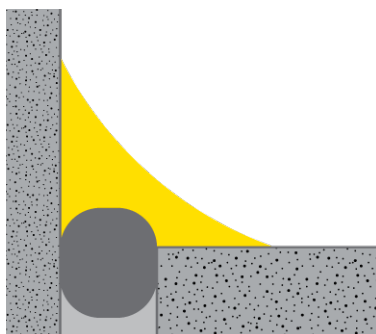
The sealant joint width:depth ratio is in the range from 1:1 to 3:1. The ideal joint has a 2:1 width:depth ratio.

The sealant depth should not exceed 12 mm.

The recommended joint depths of weathersealants are presented in the table below:

Joint width d, mm	The depth of the sealant s, mm
6...12	6...8
12...24	$s = 0,5 d$
24...40	12





Fillet joints are being used between two intersecting elements, for example sealing the window frame perimeters from outside. To assure the sealant adhesion, the contact surface between the sealant and the surface needs to be at least 6 mm.

Sealant consumption

Sealant consumption depends on the joint size. When calculating the total consumption of sealant, the material losses should be taken into the consideration.

Estimated consumption of sealant in linear meters per 600 ml sausage (without material losses)

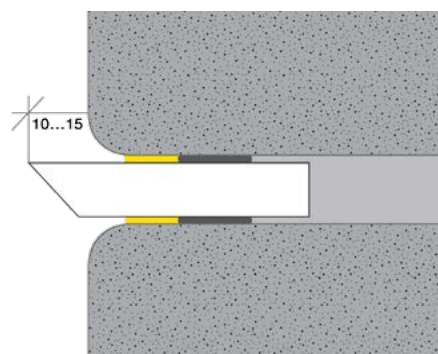
Joint width	6 mm	8 mm	10 mm	12 mm	15 mm	20 mm	25 mm	30 mm	35 mm
Joint depth									
6 mm	16,7	12,5	10,0	8,3	6,7	5,0	4,0	3,3	2,9
8 mm	12,5	9,4	7,5	6,3	5,0	3,8	3,0	2,5	2,1
10 mm	10,0	7,5	6,0	5,0	4,0	3,0	2,4	2,0	1,7
12 mm	8,3	6,3	5,0	4,2	3,3	2,5	2,0	1,7	1,4

Recommended joint sizes.

Joint ventilation

The need for joint ventilation depends on the wall structure and the type of thermal insulation and it should be always be presented in the construction project.

Usually, plastic tubes with an internal diameter of 10 to 15 mm are being used to ensure the correct ventilation of the joint. The spacing of the tubes should be presented in the project. The ventilation tubes must be applied so that the rainwater would not have access to the wall structure and condensed water in the joint could get out if necessary. The compatibility of the ventilation tube and weathersealant should be checked before application.



Sealing of the joints

To achieve the required results and longevity of weathersealant, it is important to follow the general installing requirements described in this manual. Before sealing, it must be ensured that the main volume reduction of the façade elements has been completed and the equilibrium moisture content has been achieved. Since sealants may be applied in many different environments and conditions, additional installation procedures may be required, in addition to the general rules.

Weather conditions while sealing

In terms of the thermal movement of building materials, the sealant should be applied when the ambient air temperature of the substrate is between +5 °C and +30 °C. The most suitable temperature for sealing is the equilibrium temperature at which the joint is in the center position. If possible, sealing should not be done when the daily temperature fluctuation after the sealing is expected to be really high. It also should be avoided extreme temperatures while applying the weathersealant.

If those conditions can't be avoided, additional installation procedures should be applied.

The curing speed of silicone sealants depends on the atmospheric humidity. With higher temperatures and humidity, the sealant cures faster compared to lower temperatures and humidity.

Cleaning

Before sealing, it must be ensured that the joint surfaces are clean, smooth, dry and strong enough. If needed, the porous surfaces should be cleaned with an abrasive material and after that all the loose particles should be removed.

Non-porous surfaces should be cleaned with solvent and a clean, non-fluffy cotton cloth. Solvent rests should be removed before evaporating with a clean cloth.



Priming

If required, the cleaned surfaces should be primed with a suitable primer to improve the adhesion between the sealant and the substrate.

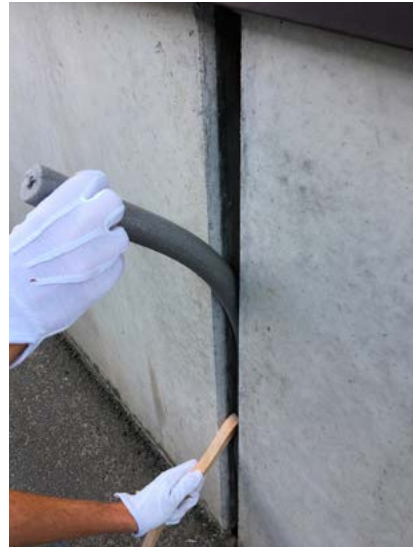


Installing backer material

After priming, backer rod can be installed to the joint. The purpose of the backer rod is to ensure correct joint thickness, avoid three-sided adhesion and give the sealant a correct form (relatively big bonding surface compared to the thinner sealant thickness in the middle of the joint). Depending on the specific situation, either closed cell or open cell backing material is being used.

Backer rod is installed, taking into consideration that it gives the joint sealant the correct depth and shape. When installing the closed cell backer rod, it must be ensured that the surface of the backing material wouldn't be damaged, since it may result in a disadvantageous adhesion and the releasing gases may harm the weathersealant (bubbling). The diameter of the backer rod should be approximately 25% larger than the joint width.

If required, the suitable ventilation accessories should be applied together with backing material.



Sealing

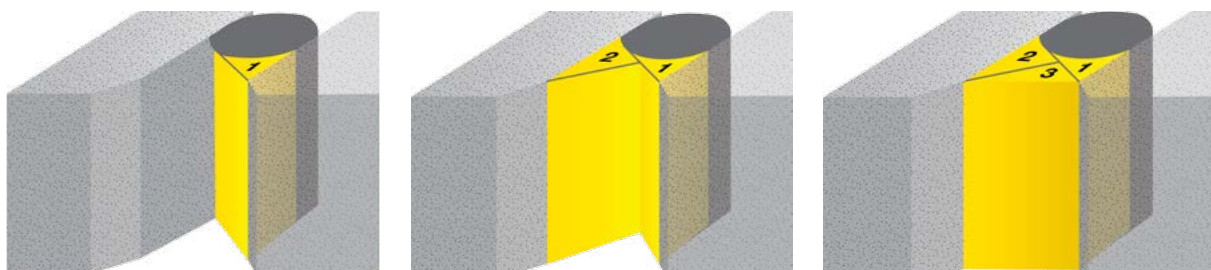
After cleaning, priming (if required) and backing material installation, the sealant can be applied. If necessary, the adjacent surfaces of the joint should be protected to avoid soiling. Usually masking tape is being used for this.

Apply sealant evenly and smoothly in the joint with a suitable silicone gun.

Make sure that there wouldn't stay any airgaps between the sealant and the backer rod nor the sealant and substrate surface. For the best result and especially with wider joints, sealant should be applied in three steps: at first the edges and after that the middle part.



The three-step application of sealant



Tooling

After installing the sealant to the joint, it should be pressed slightly to the backing material and surface sides, to ensure the correct sealant position and shape in the joint. Usually, special tools and spatulas can be used for this. For convenient application, the tools should be kept in tooling aids such as soapy water beforehand. The tooling aid should be applied only to the tooling stick or spatula, but not directly to the substrate or sealant since it can have adverse effect on the adhesion. The compatibility between the tooling aid and sealant should be verified before the application.

All the excessive sealant should be removed and surface of the sealant smoothed. It is extremely important that all the tooling and smoothing would be done, before the sealant forms the skin.

If masking tapes were being used, they should be removed after tooling.



Cold temperature sealing (sealing in cold climates)

In order to achieve proper results, sealing work under low temperature conditions should be generally avoided, as it may entail various risks. In special cases, the façade elements' sealing may be carried out when the temperature drops below +5 °C, under the responsibility of the installer. In cold weather, the following circumstances and requirements must be taken into account in addition to the general rules of sealing.

- » During sealing, the air temperature must be > -5 °C.
- » Sealing may only be carried out in dry weather.
- » The joint surfaces must be dry, clean and free of ice and snow.
- » If necessary, the joint surfaces are heated to enable moisture and ice removal. Excessive heating should be avoided as this may damage the surface of the element.
- » The weathersealant temperature should be kept between +20 °C to +25 °C during application.
- » High temperature fluctuations should be avoided for freshly sealed sealants, otherwise the sealant may rupture.
- » Sealing may be done only if work-related stages of moisture release have been completely finished (concrete drying).
- » In cold temperatures, the sealant cures slower than usual and the adhesion to substrate might be weaker.

High temperature sealing (sealing in hot climates)

In order to achieve proper results, sealing work under high temperature conditions should be generally avoided, as it may entail various risks. In special cases, the façade elements' sealing may be carried out when the temperature rises over +30 °C, under the responsibility of the installer. At higher temperatures, some sealants may form bubbles which can cause negative effect on the joint performance and lead to the joint failure. In hot weather, the following circumstances and requirements must be taken into account in addition to the general rules of sealing:

- » Sealing should not be done when the ambient air temperature or the substrate temperature is more than +40 °C.
- » Sealing should be carried out on the shaded side of the building, to minimize the risk of hot weather.
- » In some cases, sealing should be done only in the early morning, in the evening or at night.
- » The weathersealant temperature should be kept between +20 °C to +25 °C during application.
- » High temperature fluctuations should be avoided for freshly sealed sealants, otherwise the sealant may rupture.
- » In hot temperatures, it must be considered that the sealant cures faster and it leaves less time for tooling.

Maintenance

Cleaning joint

Correctly applied cured sealants in weatherproofing joints or remedial repair joints do not require cleaning in order to functionally perform as a weatherseal. However, the joints may become dirty and it is desired by a building owner to clean them for aesthetic reasons. The cleaning intervals should be decided by the building owner, since it depends on the purpose and location of the building, environmental conditions, etc.

While cleaning the sealant joints the following should be taken into consideration:

- » The sealant should be completely cured before any cleaning activities.
- » The sealant should not be cleaned mechanically with abrasive materials, since it can damage the surface of sealant.
- » Strong solvent-based cleaning agents should be avoided, since they can cause the discoloration and change in properties.
- » Neutral cleaning agents are recommended, e.g. IPA (undiluted or diluted in water). In order to be sure of the compatibility of sealant and cleaning agent, a prior test on small surface is strongly suggested.
- » Cleaning agents should be removed from the sealant surface with clean water as soon as possible.
- » If the sealant has been covered with paint or any other finishing material, then the recommendations of paint producer should be followed.

Damages of the joint

The condition of facade joints should be monitored and evaluated on a regular basis and, if necessary, the damages should be eliminated. With quick repairing of joints, it is possible to prevent major damages in the structure significantly.

The main damages of sealed joints are the adhesion loss from the substrate or cohesive failure of the weather-sealant, sealant cracking or turning too brittle. Joint failures can cause water and moisture damages to the building, damages to the external or internal surface finishing, deterioration of thermal insulation and changes in the appearance of the building.

Common mistakes that may cause joint damages:

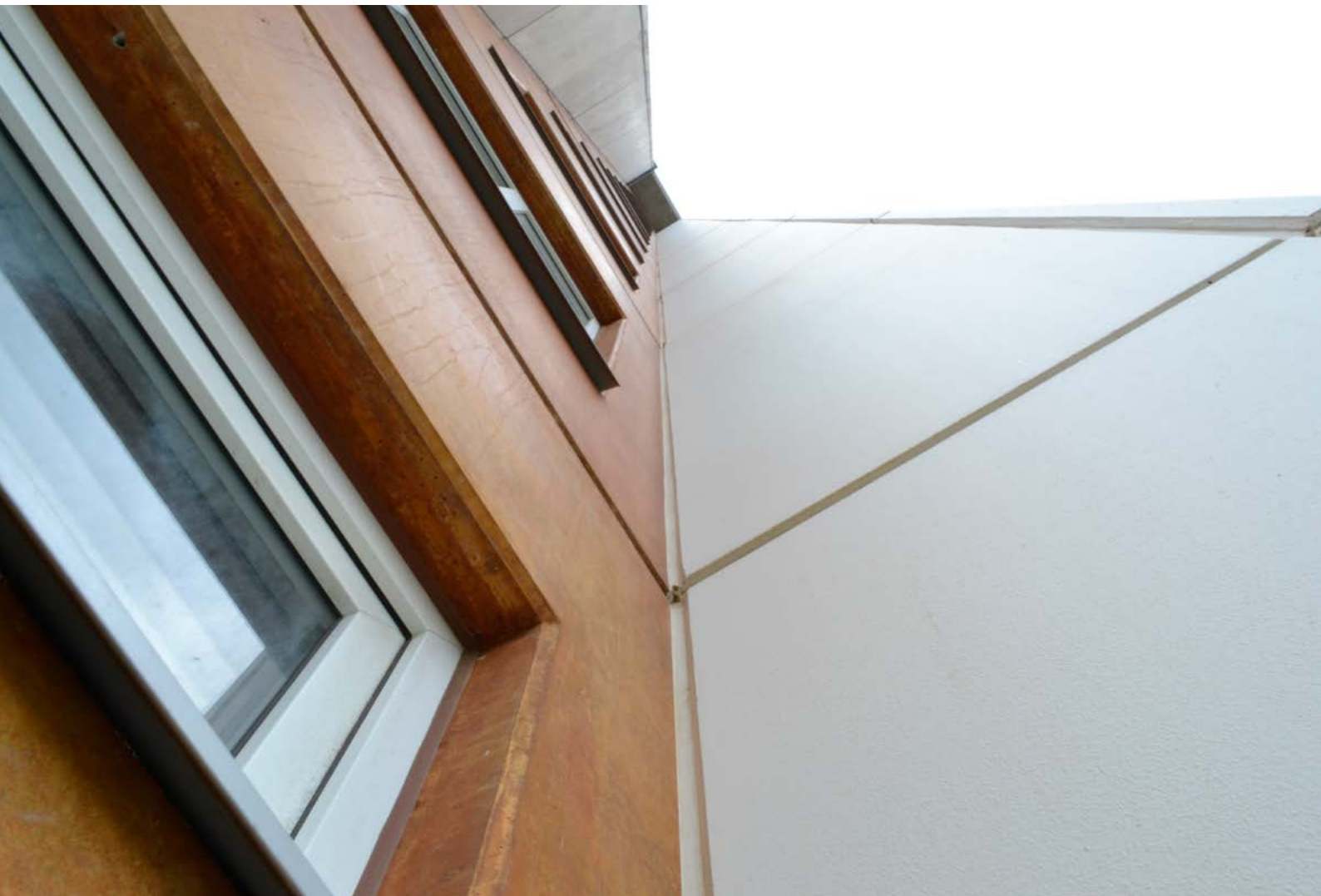
- » façade element installation or design flaws
- » incorrectly selected weathersealant or other materials
- » the construction structures are too humid
- » the surfaces have not been cleaned properly
- » poorly executed sealing
- » the ageing of weathersealant

Repair methods

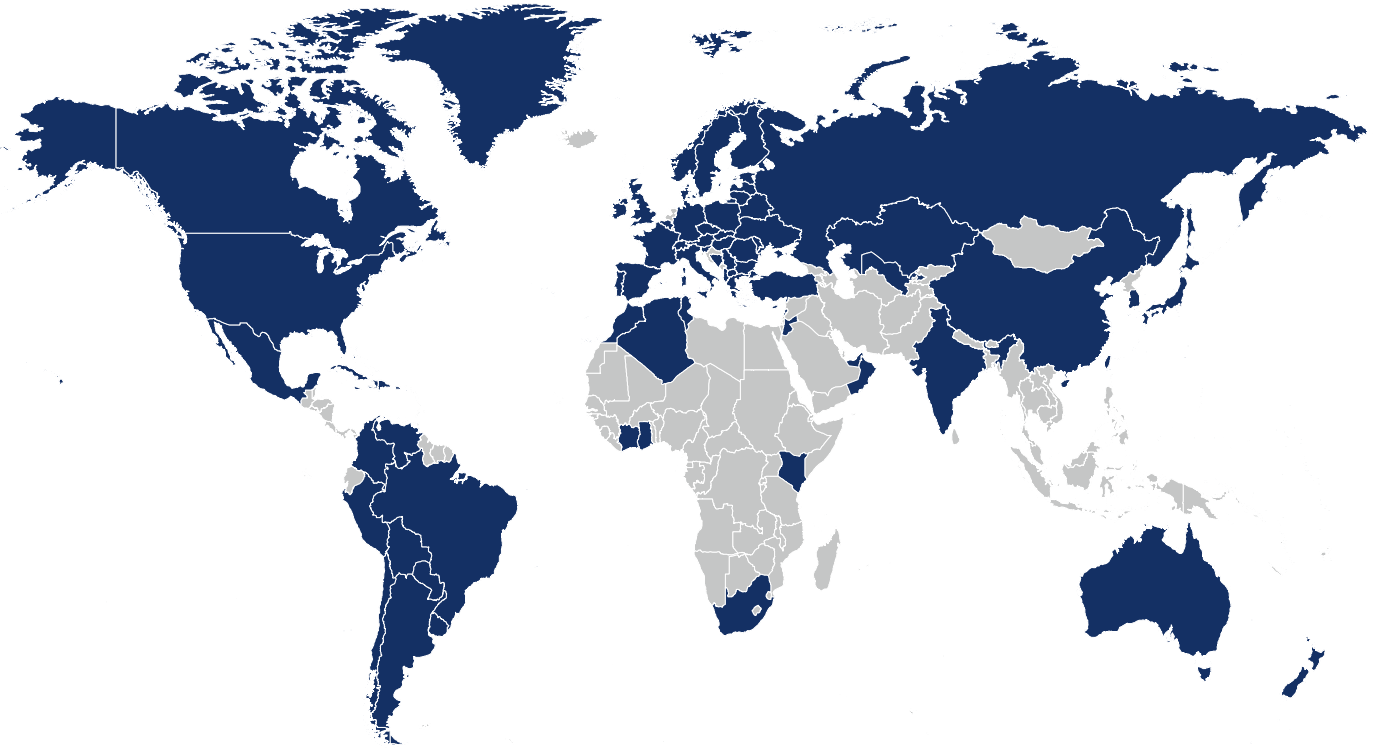
The repairing of the joints depends on the degree and spread of damages. The joints may be repaired either partially or by renewing all the joints of entire facade. Sometimes it may be necessary to change the method of weathersealing and to repair or refine façade elements before sealing.

It is reasonable to make partial repairs of the joints when the spread of damaged joints is limited and the cause of the damage can be eliminated during joint repairs. It is practical to make joint repairs with the same type of sealant that was used initially. The old sealant must be removed and the joints should be cleaned (e.g. by grinding).

Repairing of all facade joints is practical when most of the joints are damaged or the spread of damage to is not possible to avoid by partial repairing. The renewal of joints may also be useful to do when façade surface finishing is renewed, if the joints are more than 15 years old or the sealant has significantly turned too brittle compared to the original.



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