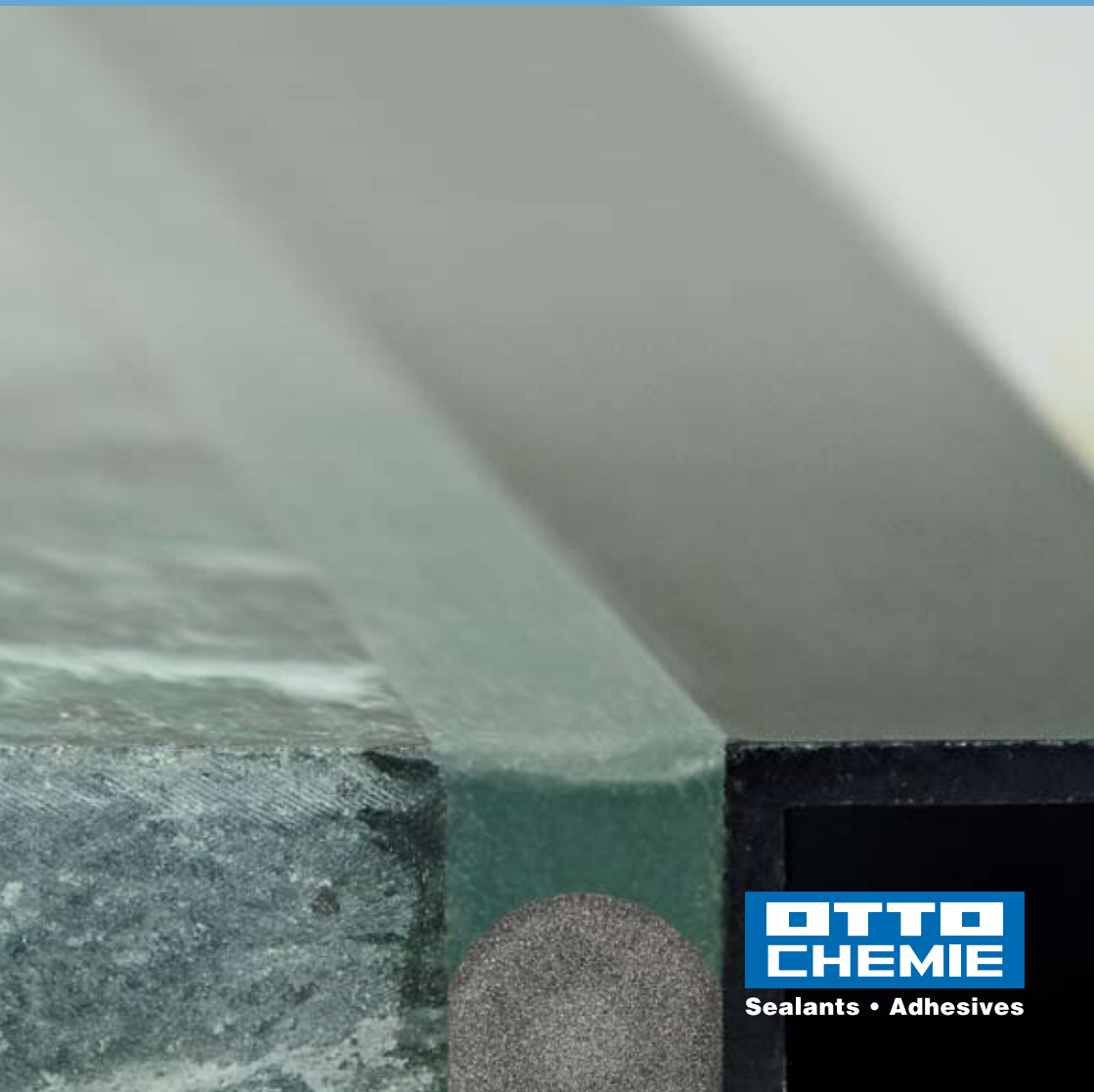
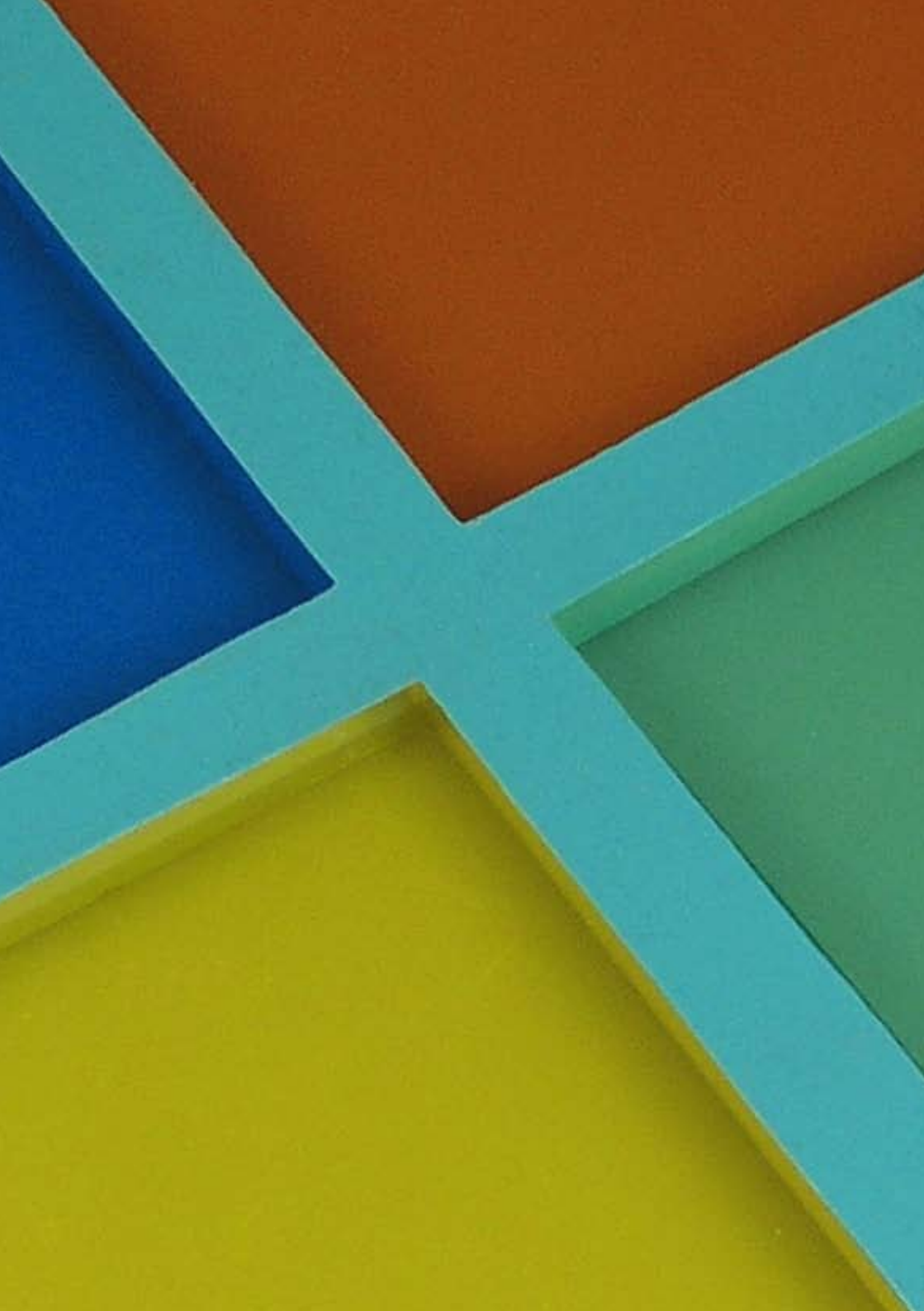
OTTO Professional Guide

Joints
perfectly formed



OTTO CHEMIE
Sealants • Adhesives



Preface

The wish to safeguard one's home from the undesirable impact of nature has existed from time immemorial. Our ancestors used the natural materials they could find to fill and congest joints and cracks.

A modern sealant also has the job of providing protection from dust, wind and water.
By developing special sealants for the respective application, materials have evolved that guarantee reliable joints.

The properties of the sealants are manifold: In addition to the actual connection of the adhesive flanks of the joint, a sealant that is optimally adapted to the job facilitates high resistance to outside influences, compatibility with adjacent materials and absorption of movement, for example thermal elongation of the components. In a nutshell: It seals.

To guarantee a permanent joint, certain things have to be borne in mind. You will learn the basics for producing perfect joints from this OTTO Professional Guide.

Right from the initial planning stage, the right dimensioning of the joints must be taken into account.

This applies equally to connecting joints between floor and wall and to building construction joints in the outer walls. Crucial criteria for well-matched joint dimensions are, among other things:

- Thermal and structural movements of sections owing to their utilisation
- Distance between the expansion joints
- Seasonal and drying movements of the building components
- Movements caused by minor settlements
- Changes of the length of building components owing to moisture
- Manufacturing tolerances of the components
- Execution tolerances of the components
- Maximum permissible total deformation of the joint sealant

Table Joint dimensions

	Joint width		Joint depth[3]	
Distance between joints in m	**Basic dimension[1] jw** in mm	**Minimum dimension[2]** in mm	**jd** in mm	**Limiting dimensions** in mm
up to 2	15	10	8	± 2
above 2 to 3.5	20	15	10	± 2
above 3.5 to 5	25	20	12	± 2
above 5 to 6.5	30	25	15	± 3
above 6.5 to 8	35[4]	30	15	± 3

1) Basic dimensions for the planning
2) Minimum dimension at the time of joint sealing
3) The stated values apply to the final state, whereby the change in volume of the joint sealant must be borne in mind
4) For larger joint widths attention must be paid to the instructions of the sealant manufacturer

Another important issue is the ratio between joint width and joint depth. Detailed information is to be found in chapter 4 “Backfilling for various types of joints”.

Before jointing some basic preliminary work must be carried out. It is imperative that the joint and adhesive flanks are cleaned of dust. If the joint was wet-cleaned, it must definitely be dried or you must wait for it to dry.

In the case of natural stone – and particularly **sandstone** in this instance it is of elementary importance that the joints be masked immediately after they are clean and dry. This type of stone is especially susceptible to staining caused by primers, the smoothing agents or residues from poorly applied sealant. However, it is also advisable to mask the joints well for other types of natural stone in order to obtain an optimal result.

The following pictures show the optimal preparation of a joint taking the jointing of tiles as an example.

We recommend masking **the tiles** prior to priming and grouting.

1. Preliminary cleaning of the adhesive flanks using the appropriate **OTTO Cleaner** and a soft cloth. The joint flanks must be free of dirt, dust and grease.

2. Backfilling the joint with **OTTO PE backup foam rod** in the appropriate size. The foam size must be chosen so that it requires a certain amount of pressure to insert it. Only then the joint is guaranteed to be filled out completely and the joint depth limited, too.

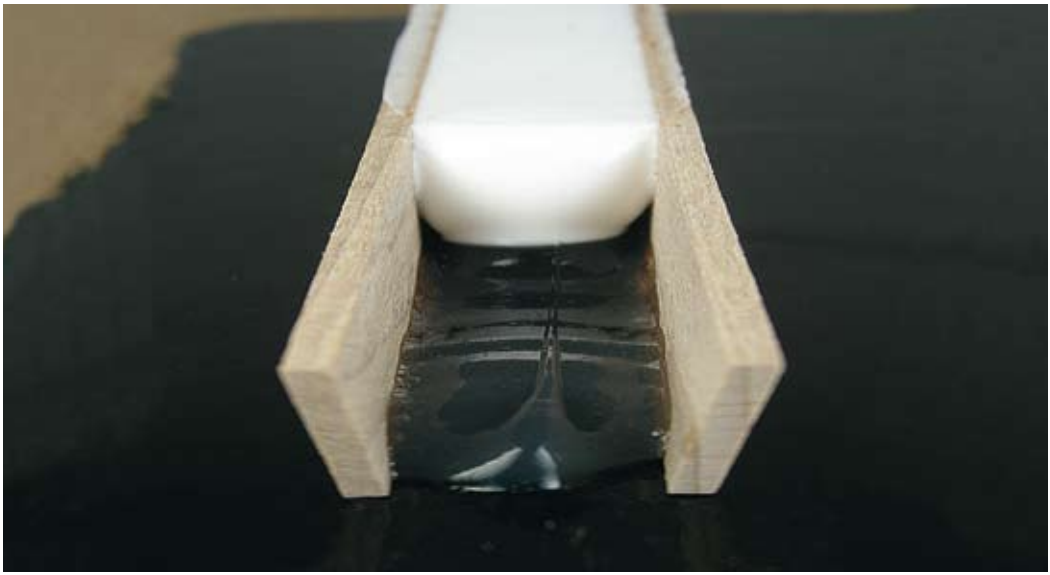
3. Possibly prime the adhesive flanks with the appropriate **OTTO Primer or Cleanprimer** with a soft paintbrush on absorbent substrates or with a soft cloth on non-absorbent substrates.

In the case of **bituminous substrates** below the joint it is extremely important to seal this layer towards the silicone joint. The surfaces and joints must be free of grease and loose parts. To form the barrier between the bitumen layer and the silicone joint **OTTOSEAL® A 250** is applied directly onto the bitumen layer. The joint is filled up with **OTTOSEAL® A 250** to about 1/3 of its height. In this case the width of the joint is limited to between 5 and 15 mm. It is mandatory to wait the whole hour it takes to dry before applying the silicone. **OTTOSEAL® S 100** and **OTTOSEAL® S 110** have been tested and are compatible with fully cured **OTTOSEAL® A 250**.

OTTOSEAL® A 250 contains solvent and around 1 minute after application it forms a skin. This makes it rainproof from the very beginning. When using it indoors care must be taken to provide sufficient ventilation. It should not be used near an open fire or other ignition sources. In order not to stimulate too much solvent evaporation, when applying it out of doors it is advisable not to perform the jointing work in strong sunshine. Otherwise cracks might form in the material of the joint, which - on the other hand – can easily be eliminated by working it over again with **OTTOSEAL® A 250**.

It should be introduced with the correct nozzle end bit and the gun must be used steadily to avoid excess material which, because of the exceptional power of adhesion of **OTTOSEAL® A 250**, is hard to remove. **OTTOSEAL® A 250** can be smoothed while using an ample quantity of water. The surface retains a certain degree of tackiness even after curing has taken place. Tools etc. can be cleaned with OTTO Cleaner T.

In the case of joints backed with **EPDM**, we ask you to contact our technical department because reliable information can only be given after carrying out applications and material-related tests.



The optimal relation of joint width to joint depth is an important basis for the longevity of jointing. Most joints are too deep as produced on-site. It is therefore absolutely necessary to limit the depth of the joint.

This is achieved by means of the closed-cell **OTTO PE back-up foam rod,** the diameter of which must be large enough that it requires pressure to be introduced to the joint, remaining there in an oval shape (fig. 1). Sharp objects should not be used to insert it in order to prevent the closed-cell surface from being impaired.

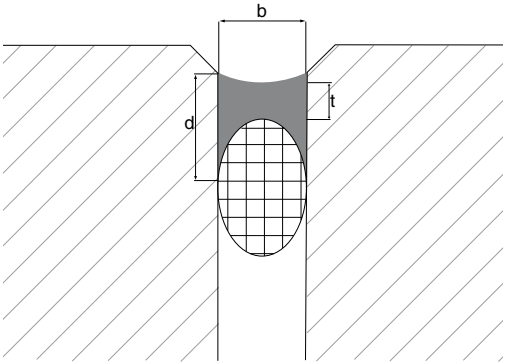


Fig. 1

If there is not sufficient space for a back-up foam rod in flat joints, a PE foil must be inserted to prevent adhesion of the three flanks (fig. 3). The adhesive surfaces, i.e. the two partners to be joined by the sealant must meet the constructional and function-related prerequisites. The sealant must be able to move freely between the two joint flanks to compensate the pull and push movements of the two joint partners. Therefore the sealant must remain free to move on its rear side, i.e. its third side. If this is not so, cracks develop in the corners, which may cause the sealant to tear completely or to lose its adhesion (fig. 2).

Fig. 2

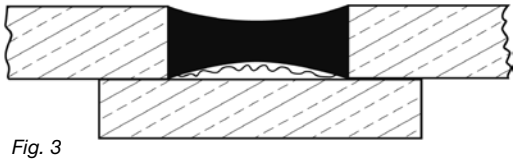


Fig. 3

Joint shapes and how they are produced
Floor to wall joints, rectangular and triangular joints

Narrow joints are the result of the normal practice of sealing by means of liquid foils and laying ceramics in a thin bed. In this instance it is no longer possible to implement a rectangular joint. The only opportunity that presents itself is when producing a triangular joint (fig. 4). In this case a sealant is required with a high (25 %) “maximum permissible total deformation” such as **OTTOSEAL® S 100**. When the screed settles it deforms causing the joints eventually to rip off when the maximum permissible total deformation of the sealant is exceeded. These type of joints are classified as inspection joints (for definition refer to page 13).

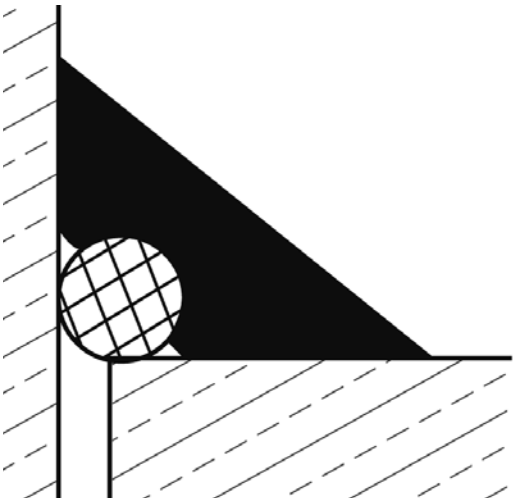


Fig. 4

Connection joints in the sanitary sector

Owing to the narrow joint diameters it is seldom possible to execute rectangular joints in these areas as wall-to-floor joints to run between the wall and the floor tiles with a PE foil to prevent triple-flank adhesion to the wall. In most cases a triangular joint (fig. 4) is formed which is formed expertly by using a back-up foam rod.

Connection joints in the façade area

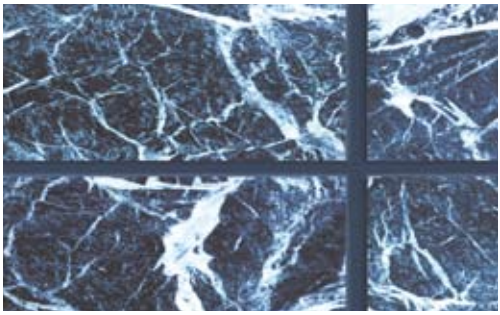
For façades there are two different types of joints to be distinguished. On the one hand there is the actual façade joint, which for example seals the panel elements for cladding the façade.

The formation of these exterior wall joints is subject to the requirements of DIN 18540. These joints can be produced with **OTTOSEAL® P 305** or **OTTOSEAL® M 360**.

On the other hand are to be mentioned the joints separating buildings, such as those that are produced between two sections of a building that are built in sequence. This type of joint is **NOT** sealed with injectable sealants; elastomer tapes are used for the purpose. The requirements of DIN 18540 do not apply here.

Connection joints between natural stones

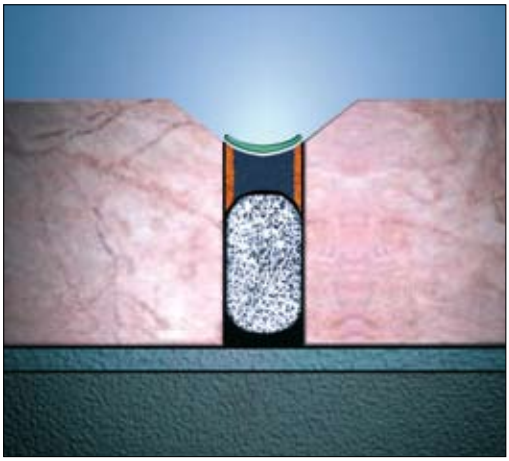
The capillary structure of the surface of natural stone makes it necessary to select a sealant that does not cause any discolouration or permits any constituents thereof to penetrate the stone. In **OTTOSEAL® S 70** OTTO offers a sealant that is **guaranteed not to cause migratory staining.** Owing to the wide variety of stone sorts and types attention must always be paid to the processing instructions and primer tables before jointing takes place. When standard sealants are used for jointing natural stone, concrete blocks and artificial stone, the edge zones may become greasy owing to softener migration.



The **removal of greasy migratory staining from the edge zones** is always a very laborious process. An appropriate material for the purpose is **OTTOSEAL® StainEx.**

Connection joints in the floor area

In the case of floor surfaces (e.g. natural stone, slabs, concrete etc.) attention should always be paid that the sealant is applied flush with the surface. Sealant thicknesses below 10 mm and above 20 mm should be avoided. The width of the joints depends on the size of the individual tiles, the various kinds of load to which the floor is subjected to and the physical properties of the building materials. The danger of edge breakage should also be taken into account for walkable joints.



Drivable joints

In this case the edges of the joint partners should be chamfered if possible and the surface of the sealant joint is to be located below the drivable level. The width of the joints should correspond to the table “Joint dimensions” and be limited to maximally 20 mm.

Corrosion of non-ferrous metals

If acetate-curing silicone sealants are used on non-ferrous metals such as copper, untreated steel, iron and zinc, there is a danger that they will have a corrosive effect. Therefore only neutral-curing sealants, such as **OTTOSEAL® S 110** may be used for these metals. This risk does not apply to untreated aluminium, anodised aluminium or stainless steel. In these cases the acetic acid does not attack the surface of the adhesive flanks.

Construction joints between windows, exterior doors and constructional elements

The function of these joints is to seal against weather, wind, vibrations and shocks and noise from the outside as well as compensating the movement between windows and structural parts.

Sealing is carried out according to the principle of **"Inside tighter than outside"** which, (in the case of all sealants that are extruded) means the using the acrylic-based **OTTOSEAL® A 710** on the inside and of the polyurethane **OTTOSEAL® P 720** or the silicone **OTTOSEAL® S 730** on the outside. However, the so-called **RAL mounting guidelines** can also be implemented with the BAB/A Window Tape Exterior and BAB/I Window Tape Interior, which are joined to the body of the building with the acrylic-based adhesive **OTTOCOLL® A 770** and by self-adhesion to the window frame.

When dimensioning the width of the joint the linear expansion coefficients of the components used, described on page 11, must be taken into account. The joint should not be too narrow to ensure that the sealant can absorb the movements of the building.

Seals for glazing

The seal must connect the glass and the casements, forming a weather-resistant joint. The relevant standards for the quality criteria and the categorisation of glazing systems are DIN 18545 and ISO 11 600.

When sealing wooden windows a **sealant which can be painted** must always be used. **OTTOSEAL® S 110** or **OTTOSEAL® S 120** meet this requirement. Care must be taken not to completely paint over the sealant; but an overlap of just 1 mm is permitted. In rooms subject to dampness, such as bathrooms, a colour should be chosen that contains a fungicide.

Heat expansion

By heat expansion we mean the changes in the length and volume of a structure, caused by a change in its temperature. The extent of the elongation of a structure depends on a material or substance-specific constant, which is known as the linear expansion coefficient or heat expansion coefficient.

In order to be able to calculate the elongation of a material in relation to a certain temperature change, the coefficient of linear expansion, represented by α must be known. Essentially this expansion coefficient describes the amount by which a solid body expands or shrinks in relation to the total length at a 1 °C change in temperature. (This is normally calculated as 1K, whereby a change in temperature of 1K can be equated to 1 °C).

The change in the length of a rod when heated or cooled evenly by a specific difference in temperature (ΔT) can be calculated by multiplying the linear expansion coefficient (α) of the rod-shaped material with the total length of the rod (L) and the difference in temperature (ΔT). The following formula is applied:

$$\Delta L = \alpha \times L \times \Delta T$$

Example: Comparison of an aluminium and glass 1.5 m rod (= 1500 mm) at a temperature change of +40 °C

1.) Glass

Linear expansion coefficient (α) glass = 8 mm/mm °C x 10-6 (= 0.000008 mm/mm °C)

Therefore, this would be an elongation of the glass rod amounting to:
ΔL = 0.000008 mm/mm °C x 1500 mm x 40 °C = **0.48 mm**

2.) Aluminium

Linear expansion coefficient (α) aluminium = 23.5 mm/mm °C x 10-6 (= 0.0000235 mm/mm °C). Correspondingly this would be an elongation of the aluminium rod of:
ΔL = 0.0000235 mm/mm °C x 1500 mm x 40 °C = **1.4148 mm**

These results mean that, compared to glass, aluminium expands almost three times as much. The values thus determined for the elongation in relation to changes in temperature are important as soon as different building materials are used together to form a component. Let's stick to the example of aluminium and glass, i.e. an aluminium window. If, for example, the sun shines on the window it can easily heat up by 40 °C and varying degrees of thermal expansion occurs in the building component concerned.

This gives rise to mechanical tension, which in extreme cases may cause damage or the destruction of the building component. So, to compensate the tensions that arise, it is necessary to join the individual building materials to one another, or rather to design the building component in away that an elastic sealant can compensate the anticipated movements in the relevant component.

The following pictures show the application and smoothing of the sealant taking tile jointing as an example.

1. **Extruding the sealant**
   After backfilling the joint with the appropriate OTTO PE back-up foam rod the remaining cross-section filled-in with **OTTOSEAL® S 100**. The joint should be filled as evenly as possible.

2. **Smoothing the joints**
   A clean container is filled with OTTO Smoothing Agent in order to moisture the OTTO Fugenboy while working on the joints. After choosing an OTTO Fugenboy corresponding in size with the joint's edge the moistened OTTO Fugenboy is drawn over the filed-in joint exerting an even pressure and withdrawing the excess sealant. The excess sealant is wiped off the tool into a waste container. With the anew moistened OTTO Fugenboy the joint is drawn off again, resulting in a perfectly shaped joint.
   Note: Please always use OTTO Marble Smoothing Agent when working with marble or natural stone.

Please pay attention that the joints do not result being concave arise during smoothing. Only a proper triangular chamfer guarantees that – for example in sanitary areas – no residual body care products or cleaning agents remain on the joint, representing an optimal breeding ground for mildew.

If joints have a mould infestation that is impossible to remove with **OTTO Anti-Mildew Spray**, the joint must be replaced.

The following images illustrate step-by-step the rejointing workflow.

1. A joint affected by mould formation in a sanitary area must be repaired.

2. Careful removal of the affected sealant with a sharp blade.

3. Apply a thick layer of **OTTOSEAL® SilOut** to the area to be treated - at least 5mm. After the **OTTOSEAL® SilOut** has taken effect, remove the dissolved silicone masswith a spatula and a damp cloth.

4. Clean the joint with **OTTO Cleaner T.** Prior to this, let the joint edges and supporting surface dry sufficiently.

5. Kill the remaining mould spores with OTTO Anti-Mildew Spray. Please note the minimum soaking time of 10 minutes. The spray film must be dried before the next step.

6. Back-filling of the cavity by inserting the appropriate **OTTOCORD PE-B2 backer rod.**

7. Prepare the joint edges with **OTTO Cleanprimer 1101.**

8. Apply the sanitary silicone OTTOSEAL® S 100.

9. Stripping and smoothing the joint with **OTTO Fugenfux** ur, and the **OTTO soapy solution.**

Maintenance of silicone joints always includes conscientious cleaning of the joints, e.g. the elimination of residual soap, using a normal domestic cleaner. For preference use neutral or alkaline cleaning agents, because mildew proliferates more in an acid environment. At certain intervals the elastic joints should be treated with normal commercial disinfectants, such as “Sagrotan”.

Good room ventilation to reduce air humidity is also a necessary measure. Another element of maintenance work is regular use of **OTTO Anti-Mildew Spray** as a precaution against an attack of mildew. Please also take note of IVD leaflet (Leaflet of the Association of property consultants, estate agents and property management companies) no. 15 “Inspection joints”.

If the joints should nevertheless be attacked by mildew and it can no longer be removed with OTTO Anti-Mildew Spray, the joint must be renewed. The first step if restoration is necessary is to completely remove the old silicone joint. The sealant is first removed mechanically and then using **OTTOSEAL® SilOut**.

The new jointing process is carried out as described in chapter 2 “Preparing the joint”, and from there on.

In rare cases the silicone joint may become yellowed. This may occur due to cleaning agents containing strong dyes or owing to incompatibility with materials adjacent to the joint. If you have any questions, please contact our Technical Service.

Definition of inspection joints according to DIN 52460 (refer also to IVD leaflet No. 15)

A maintenance joint is a joint exposed to strong chemical and/or physical influences, the sealant of which is inspected at regular intervals and which has to be renewed if necessary to prevent consequential damage. There are limits to the stability of sealants, which are usually not reached or indeed exceeded in normal use. However, there are areas in which they are used or individual cases where excessive strain and hence damaging of the sealant must be anticipated and therefore also, depending on the actual strain, causing a much shorter service life.

Please note that a joint must be defined as an inspection joint BEFORE the work is carried out, i.e. in the quotation, and is therefore not covered by the general warranty. It is not possible to define inspection joints after the work has been carried out.

Skin-forming time

The skin-forming time is the period after the sealant has been applied up to the time when a dry surface film has formed that can no longer be smoothed. The skin-forming time differs from one type of sealant to another. Furthermore the skin-forming time changes according to the ambient conditions (temperature, relative air humidity).

Acrylic for dispersion, e.g. OTTOSEAL® A 205:	app. 10 minutes at 23 °C and 50 % relative air humidity
Polyurethane, e.g. OTTOSEAL® P 305:	app. 120 minutes at 23 °C and 50 % relative air humidity
Silicone, e.g. OTTOSEAL® S 100:	app. 10 minutes at 23 °C and 50 % relative air humidity
Hybrid, e. g. OTTOSEAL® M 360:	app. 40 minutes at 23 °C and 50 % relative air humidity

Permissible total deformation

The expansion capacity is not known until the sealant has fully cured. The maximum permissible total deformation is the maximum permanent expansion and compression set of the sealant in relation to the width of the joint. It differs from one type of sealant to another:

Acrylic for dispersion, e.g. OTTOSEAL® S 205:	18 % maximum permissible total deformation
Solvent – acrylic e.g. OTTOSEAL® S 250:	10 % maximum permissible total deformation
Polyurethane, e.g. OTTOSEAL® P 305:	25 % maximum permissible total deformation
Silicone, e.g. OTTOSEAL® S 100:	25 % maximum permissible total deformation
Hybrid, e. g. OTTOSEAL® M 360:	25 % maximum permissible total deformation

Elastic recovery

Recovery is the degree to which the sealant recovers with at defined expansion rate. Elastic sealants can absorb expansions, compression sets and shear stress better and more frequently than plastoelastic or elastoplastic sealants. Hence they better recover their original shape.

Abrasion resistance

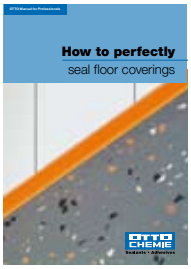
The abrasion resistance of the sealant used is very important for glazing. The sealant must be resistant to commercial cleaning agents, i.e. there must be no streaks on the pane of glass. **OTTOSEAL® S 110 and S 120** has been tested according to the relevant DIN 18545 standard and meets the requirements of stress group E.

Bibliographical Notes

DIN EN ISO 11600	building construction – joint sealants – classification and requirements for Sealing compounds
DIN 18540 12	Sealing of outside wall joints in building construction with joint sealants, 2006-
DIN 18545	Sealing of glazing with sealants (T1 to T3)
DIN 52460	Sealing joints and glass – Terms, 2000-02
IVD leaflets	No. 1 to Nr. 16 to be ordered from: Industrieverband Dichtstoffe, Düsseldorf www.ivd-ev.de

EN 15651

Praxishandbuch Dichtstoffe; Industrieverband Dichtstoffe Düsseldorf, 5. revised and enlarged edition 2004



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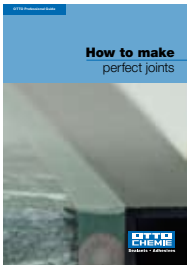

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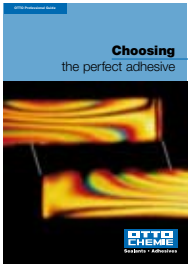

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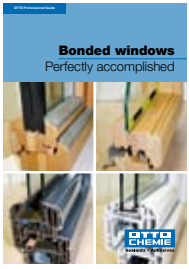

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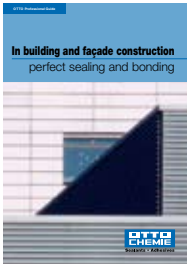

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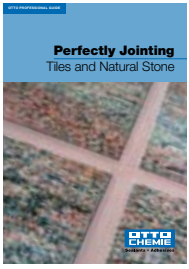

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Part n° 9999596

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The information in the present document corresponds to the status quo on going to print, refer to the index. With a new edition this edition becomes invalid. Due to the many possible influences during and after application, the customer always has to carry out trials first. Please observe the respective technical data sheet! This information is available on the Internet at www.otto-chemie.com. Errors and typographical errors are excepted.

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