Construction

Sikaflex Elastomeric Sealants

Joint Design & Movement Calculation Guide

Sealant Selection & Performance

For satisfactory long-term joint performance in construction and civil engineering applications, an elastomeric sealant must have a combination of the following properties.

(a) Waterproof – It must be impermeable material.

(b) Durability – Not affected by aging, weathering or degradation for a reasonable service life.

(c) Permanent Elasticity – It must be able to sufficiently recover it's original properties and shape after cyclical deformations. Deformation must be able to accommodate movement and rate of movement occurring at the joint.

(d) High Cohesive Strength – Must not tear easily.

(e) High Adhesive Strength – Must remain in intimate contact with the joint faces.

(f) Non toxic – Particularly in food processing areas or water treatment.

(g) User friendly – Easy to handle and install. Ideally one component. Safe for the environment.

(h) Fuel/oil resistant – Especially for roads, airports, oil installations, carparks, etc.

(i) Chemical resistance – Good resistance to dilute acids, dilute alkalis, fats and salt water. Especially in sewage treatment plants, chemical plants, effluent tanks, etc.

It is a matter of selecting a Sikaflex sealant that offers the most suitable combination of properties required for each particular application.

For more information on Sikaflex Sealants & Adhesives, refer to individual Technical Data Sheets or contact a Sika Technical Representative.

Elastomeric Sealant Limitations

(1) Long term Chemical resistance of elastomeric sealants in highly corrosive environments is usually poor.

(2) Joints should be designed to ensure that movement does not exceed the movement capability of the sealant.

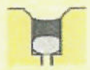
(3) Elastomeric sealants have joint width and joint depth limitations.

Note: For situations where any of the above three criteria cannot be met it is recommended that the Sikadur Combiflex jointing system be considered. Please contact Sika Australia for more information on Sikadur Combiflex.

Criteria to be Observed for Flexible Joint Details

- Joint configurations for general use are:
  For joints up to 12mm wide width:depth ratio = 1:1 i.e. W = D
  For joints over 12mm wide width:depth ratio = 2:1 i.e. W = 2 x D
- Joints subjected to movement should have a minimum depth of 6mm – measured at the middle of the joint.
- Elastomeric sealants should not adhere to the base of a joint. Use a P.E.F. backing rod to form the joint base. If a solid formed joint base already exists, as a result of the construction process, it must be covered with a bondbreaker tape.
- Joints subjected to hydrostatic pressure must have a solid formed base to provide sealant support. Do not use a P.E.F. rod in this situation.

12mm = .48"

Right	Wrong	Remarks
		The edge of the joint is a weak point and is often interspersed with gravel pockets. A chamfer or arris should be employed.
		Three-sided bonding impedes an uninterrupted even deformation of the sealant and leads to tearing of the sealant.
		Corner joints without backing rod or release tape lead to tearing of the sealant.

Joint Movement Calculation

Movement Type	Sealants Behaviour
(1) Expansion of the component	- Compression of the sealant
(2) Contraction of the component	- Elongation (expansion of the sealant)
(3) Displacement (settlement) of the component	- Shear force of the sealant

Thermal Movement

Joints between all building components will be subjected to thermal movement as a result of temperature changes occurring within the element.

This thermal movement can be calculated using the following formula:

$$\Delta L = \alpha \times Lo \times \Delta \mathrm{T}$$

where

ΔL = Change in length (in metres) of the element, due to thermal movement.

α = Co-efficient of thermal movement of the building material.

Lo – the length of the element (or distance between free joints) measured in meters.

ΔT = Temperature of the element measured in °C (difference between the maximum and minimum temperatures expected to occur within the element).

- consideration should be given to geographical locations when determining temperature values.
- It should also be remembered that ambient temperatures are not necessarily the same as temperatures experienced within the element. Dark coloured elements, for example, may encounter higher temperatures.

This formula can also be used to calculate total thermal movement expected to occur in a free joint. It does not, however, make any allowance for long-term drying shrinkage that may occur with cementitious materials.

Example

Concrete element Lo (more than 1 year old) = 3.0m in length (ie 3.0m between joints)

ΔT say = 40°C

α concrete = 10×10^{-6} (approx) mm / mm / °C

ΔL = $\frac{10}{1,000,000} \times 3.0 \times 40$

= $\frac{1200}{1,000,000}$

= 0.00120m

= 1.2mm

For a sealant with total movement capability of 15%, the minimum joint width (B) can be calculated as follows:

B = $\frac{100}{\text{total allowable sealant movement (15\%)}}$ x effective joint movement (1.2mm)

B = $\frac{100}{15} \times 1.2$

B = 8.0mm

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Timing of Sealant Application

This example assumes that the joint can be sealed at a temperature exactly midway between minimum and maximum service temperatures. In practice this will rarely happen, particularly on large projects where joints are sealed progressively during different seasons. A conservative way to allow for this situation, is to add to the calculated joint width (as above) the total calculated thermal movement (ie 1.2mm, using previous example) so:

conservative minimum joint width	=	8.0mm + 1.2mm
	=	9.2m (say 10mm)

A quick rule of thumb calculation to determine the minimum joint width required to accommodate thermal movement between structural components is:

Bmin = L x 3.5mm

where

Bmin = minimum joint width in mm
L = element length (distance between free joints) in metres

so using the previous example:

Bmin = 3.0 x 3.5mm
= 10mm

Long Term Drying Shrinkage of Concrete

When sealing free joints in concrete elements, a figure for long term drying shrinkage must also be added to the calculated joint width. When calculating joint dimensions in concrete components, it must be remembered that long term drying shrinkage will occur over many months and sometimes even years – depending on conditions.

A commonly accepted value for long term drying shrinkage occurring within concrete is approximately 600×10^{-6} (600μ). (This may be much higher in severe drying conditions). Therefore the potential long term drying shrinkage that develops in an element with joints at 5m spacings will be:

$$\text{Shrinkage} = 5 \times \frac{600}{1{,}000{,}000}$$
$$= 0.0030 \text{ metres}$$
$$= 3.0\text{mm}$$

Assume 30% of long term drying shrinkage will occur in 1 month.

So a 6mm width saw cut could easily become 7mm wide after 1 month and 9mm wide after 12 months.

These factors must be taken into consideration, particularly when determining suitable sealants for concrete floor joints.

Summary of Joint Design Considerations

There are many points that need to be taken into consideration when designing joints for flexible sealants.

To ensure the successful performance of any one joint it may be necessary to consider a few, or all of these following factors:

Checklist for sealant joint design:

1. Joint width and type required.
2. Spacing between joints – free joints and fixed joints.
3. Type of sealant needed to satisfy expected requirements.
4. Climatic conditions e.g. Perth or Cooma.
5. Drying shrinkage that will occur in concrete elements.
6. Cyclic shrinkage/swelling due to moisture absorption/evaporation within the component.
7. Change in element length due to thermal movement.
8. Age of concrete when sealant is applied.
9. Time of year when sealant is applied i.e. ambient temperatures.

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NOTE: The information contained in this article is intended for use as a basic guide to joint design and sealant selection. It is the responsibility of the designer to satisfy him/herself that any specified or selected joint sealant can perform in a manner satisfactory to accommodate the conditions to which it will be subjected. The company's liability is limited therefore only to the quality of the goods supplied.

Important Notification

The information, and, in particular, the recommendations relating to the application and end-use of Sika's products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The proprietary rights of third parties must be observed. All orders are accepted subject of our terms and conditions of sale. Users should always refer to the most recent issue of the Technical Data Sheet for the product concerned, copies of which will be supplied on request.

PLEASE CONSULT OUR TECHNICAL DEPARTMENT FOR FURTHER INFORMATION.

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