

# Introduction to the Bonding and Sealing Technology



## 1.1 Preface



### 1.1.1 Introduction

Since the middle of the 17th century, when the industrial revolution began, the process of manufacture has changed dramatically, in methods and materials. At the time, it was state-of-the-art to assemble boats and ships using traditional methods like wood jointing, nailing and screwing. Riveting and welding followed in later years, but today, we are aware of the limitations of these old methods compared to what is currently available. New lightweight materials as well as sandwich structures need smooth, stress concentration free assembly. Today, time, weight, cost, design freedom and reliability are all greatly enhanced by using chemical bonding, sealing and damping products.

#### Bonding, sealing and damping

Sealants and adhesives share a similar technology. Their functions overlap to a large extent, but as they also have a range of other benefits, the role of elastic bonding is not only to join, but also to waterproof, dampen sound, insulate and prevent galvanic corrosion; all needed to overcome the daily problems in the marine environment.

Some products are specifically for bonding as they exhibit high mechanical strength

(commonly known as rigid adhesives) and feature variable open time to accommodate everything from quick production rates, to the much slower large structural component assembly. Much of their usefulness in absorbing forces and shock stems from the toughness of the cured bond and this, in turn, is a major factor in the durability and reliability of the bond.

#### Flexible bonding and sealing

Flexible bonding and sealing is distinct from bonding with high modulus adhesives. They are applied in a bondline thickness of some millimetres. These products have the high elastic characteristics of both adhesives and sealants. While it does not have the high mechanical strength of rigid bonding adhesives, it has far greater flexibility, which helps to reduce fatigue in the bonded components.

#### Flooring and acoustic damping

Sub decks are not always smooth and level and besides being generally unattractive, they are responsible for the transmission of most of the noise in cabins and compartments.

Modern flooring has elements that improve the marine environment in three ways:

- The deck is levelled and smoothed
- The noise level transmitted through it is reduced
- The cosmetic finish improves the appearance
- Various systems can be used that amplify one or more of these.

Sika works closely with suppliers, universities, research institutions, certification societies but primarily with our customers, to maintain the most relevant level of expertise in bonding sealing and damping. We are continuously developing the product range as new methods, materials and designs emerge or are needed.

All processes concerning application of our products are fully tested and carefully choreographed to ensure 100% reliability every time. This manual explains the processes and describes the procedures necessary to achieve the highest standards. It is therefore essential that the appropriate section is consulted and adhered to for every process undertaken.

From long experience in marine applications, it is highly recommended that Sika (Corporate or local Technical Service) is consulted at the outset of any new projects.

## 1.2 Explanation of Different Fixing Methods



### 1.2.1 Some historical facts

Traditional fixing methods are mechanical fixations. Adhesives have still the nimbus of a low seriousness due to less and/or negative experiences, Adhesive technologies are not accepted voluntarily. The bonded result cannot visually be detected. The resulting prudence is also called Icarus effect. From this story from the greek mythology only the crash of Ikarus is known where Daidalos his succeeding father is less known. Nevertheless Daidalos, a blacksmith, is the “historical father” of the bonding technology as the wings he produced to escape from his prison have been feathers bonded with an adhesive (light weight construction).



Fig. 1 Ikarus and Daidalos. Painting from Carlo Saraceni 1580-1620



Fig. 2 Boeing 787 Dreamliner

Nowadays aircrafts like the Boeing 787 Dreamliner are made out of synthetic carbon fibres. Only the bonding technology can be used for joining such substrates. The bonding technology is state of the art in multiple areas including the naval industry.

Sealing on the other hand has been one of the oldest technologies in the shipbuilding. Caulking boats with cotton robs impregnated with bitumen is one of the used technologies. Nowadays modern products replace this demanding working procedure.

The differences between some mechanical fixations and the bonding technologies outline some advantages of each method.

## 1.2.2 Principal differences of the fixing methods

Production	Riveting / screwing	Spot weld	Rigid bonding	Elastic bonding
Process speed	fast	fast	medium to fast	medium
Substrate preparation	low	low	medium to important	medium to important
Substrate deformation (heatprocess)	low	high	low	none
Tolerance gapping	low	low	low	very good
Calculation of the bondline	yes	yes	possible	possible
Industrial hygiene	low	low	medium	medium
Noise emission during manufacturing	high to low	medium	low	low
Quality control	easy	easy	needs QC	needs QC

### Obtained characteristics

Joining different materials	possible / limited	not possible	possible	possible
Sealing	separate operation	separate operation	yes	very good
Acoustical improvements	no	no	limited	yes
Joining of thin substrates	not recommended	no	possible	ideal method
Durability	danger of corrosion	danger of corrosion	good	good

Adhesive bonding is a modern and highly effective joining technique with a number of innovative performance characteristics, which forms a welcome addition to the standard repertoire of rigid fastening technologies. Through the selective use of these adhesives and careful attention to the specific application techniques associated with them, engineers and designers are now able to design technically sophisticated products that can be manufactured economically.

The use of this bonding technology permits to use all kind of substrates permitting an optimised construction. Just to mention some advantages:

- Freedom of styling (use of GRP / plastics / metals to optimise material cost)
- Weight savings (thinner substrates / plastics)
- Sound reduction (especially with elastic adhesives)
- Corrosion resistance (bonding on anti-corrosive paints, no injury of the anti-corrosive layer)

The highest economic and technical benefit of the bonding technology is based on these multiple advantage which is achieved in a single operation.

The bonding technology is a new tool for engineers and designer to realise modern and innovative solutions in the Marine Industry.

## 1.3 Difference Between Rigid and Elastic Adhesives



Elastic adhesives differ in their functionality to the rigid systems. Rigid (high modulus) adhesives are normally used in thin layers of about some hundred microns. In contrast elastic adhesives are used in a thickness of some millimeters. Therefore the expression of thick layer bonding has been created for such application types.

The function of these systems differs in their way to transmit forces. Rigid adhesives transmit forces directly without noticeable deformation. Elastic adhesives lower the forces by bond line deformation and uniform stress distribution over the whole bonding surface.

Both of these systems have their advantages as well as their limitation. The following article describes the principal characteristics, knowing that this classification is not complete as semi flexible products may be situated somewhere in between.

To show the difference, studies have been done at the University of Munich to demonstrate this difference. Tensile lap shear samples of PMMA (Polymethylmetacrylate, ex. Plexiglas) have been bonded and stressed. By using polarized light, lines of different colours (stress levels) could be visualized.

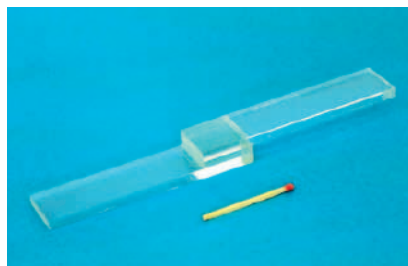


Fig. 1 Test sample. Lap shear test with PMMA substrate bonded with different adhesives. One sample has been screwed

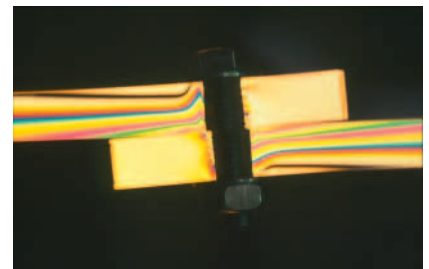


Fig. 2 Screwed sample. The force line indicate a direct transmission of the forces from one part of the sample through the screw to the other part of the sample

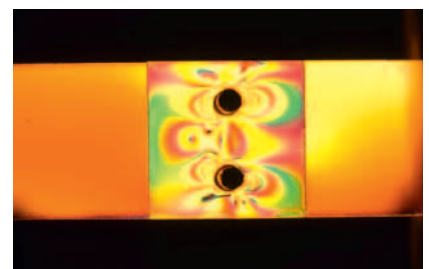


Fig. 3 Same sample plan view. Here stress concentration around the bolts is visible (stress peaks around the screw).

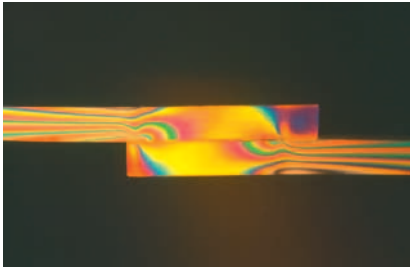


Fig. 4 Thin layer bonded sample with a rigid adhesive. The stress concentration is visible at both ends of the sample.

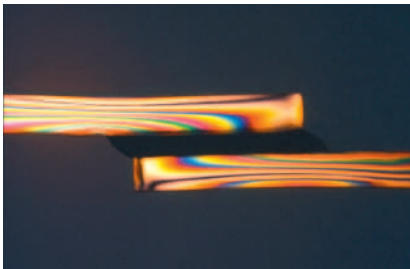


Fig. 5 Thick layer elastic bonded sample. The stress transmission is uniform over the hole bonding area (no stress peaks). The adhesive is not easily visible as it is not transparent.

The uniform stress distribution of the elastic adhesive permits to utilize the whole bonding surface for the force transmission.

Elastic thick layer bonding permits therefore to use thinner substrates, or just to bond directly on painted surfaces for better corrosion resistance, just to mention two of the multiple advantages by using this fixation method.

One of the most contradictory discussion concerns the definition of “Structural bonding” Many authors use this expression in connection with a high strength or modulus of an adhesive. A more practice related definition uses this expression for bonding assemblies which are essential for the functioning to the assembled part. This seems for us a better definition as it will also take in consideration the durability aspects.

Differences between elastic thick layer bonding and rigid thin layer bonding

General Characteristics	Rigid (high modulus) adhesives	Elastic adhesives
<b>Bondline dimension</b>	Thin adhesive layer, small overlapping	Thick layer of at least 2 mm. Higher force transmission may be achieved by increasing the overlap (bonding area)
<b>Temperatur dependency</b>	Glass transition temperature has to be observed. If the bonded object is used over this temperature, mechanical resistance drops and may lead to failures	Elastic adhesives have a glass transition temperature at about minus 40 °C. The dependency of the mechanical strength in the normal application range is minim. However the temperature resistance is limited to 90 °C for elastic Polyurethanes and 120 °C for Silicones
<b>Force transmission</b>	Forces resulted by mechanical stress or differences in thermal expansion coefficient have to be transmitted and result directly from the chosen parameters. In some cases parts may deform during temperature change due to a “Bimetal effect”	Forces applied on an elastic bond line provoke a deformation of the bondline, thus lowering the stress on the substrates
<b>Choc resistance</b>	Normally the choc resistance of a rigid bond line is not very high, especially in the range of the Glass Transition Temperature. However some special formulations have an excellent choc resistance	The choc resistance of elastic bond lines is excellent. The mechanical resistance increases with the applied speed. Under choc resistance, the mechanical resistance is high
<b>Adhesion on painted substrates</b>	The paint adhesion on a substrate is about 7N/mm <sup>2</sup> . High modulus adhesive may lead to stress peaks and cause a break between paint and substrate	The modulus of elastic adhesives is lower than the one of the paint. Therefore application on painted substrate is possible. Thereby the corrosion resistance is not impaired
<b>High strength bonding</b>	Good solution. Rigid adhesives may be combined with mechanical fixation methods	Only possible with larger bonding area

Differences elastic thick layer bonding / rigid thin layer bonding

	Rigid thin layer bonding	Elastic thick layer bonding
<b>Bonding of different metals</b>	Perfect in case of metals with low differences in thermal behavior, good for applications where bondline dimension (thickness / surface) is restricted	Good compensation of thermal movements, good protection against galvanic corrosion, good tolerance gapping
<b>Bonding of metals with plastic</b>	Usable for bonding smaller parts, good for applications where bondline dimension (thickness /surface) is restricted.	Ideal for bonding of GRP with important tolerances, good for shock resistance and acoustical damping
<b>Bonding plastic to plastic</b>	Normally good technique with low surface preparation, ideal for sandwich construction with low modulus core materials	Less interesting solution. ESC has to be taken in consideration. Ideal for bonding duromers (glass reinforced plastics) with important tolerances

Elastic adhesive bonding is a modern and highly effective joining technique with a number of innovative performance characteristics, which forms a welcome addition to the standard repertoire of rigid fastening technologies. Through the selective use of these adhesives and careful attention to the specific application techniques associated with them, engineers and designers are now able to design technically sophisticated products that can be manufactured economically.



Fig. 6 Bonded windows on cruise vessel



Fig. 7 GRP parts and windows bonded on high speed ferry

## 1.4 Bonding Construction Design



### 1.4.1 Principals

Joining of two materials means to connect them to a unit which is capable to transmit forces resulting from dynamic, static or other stress during the use of the subject. Normal joint technologies are mechanical joining methods which are known since long times.

Glues however have been reported to be used about 3000 years before JC. Asphalt and natural resins have been used to tighten up ships and clay has been used to build houses.

However structural bonding, different to glues in an industrial scale, started in the 30ties of this century. One of them is unsaturated polyester which are still in use today. The development of epoxy resins opened up a vast area of bonding applications

Elastic adhesives or sealants started in 1964 in the USA using an elastic adhesive for windscreen bonding. This technology is state of the art in all type of windscreen bonding in all market fields.

In the 80ties elastic bonding was used in busses followed by trains and trams in 1992.

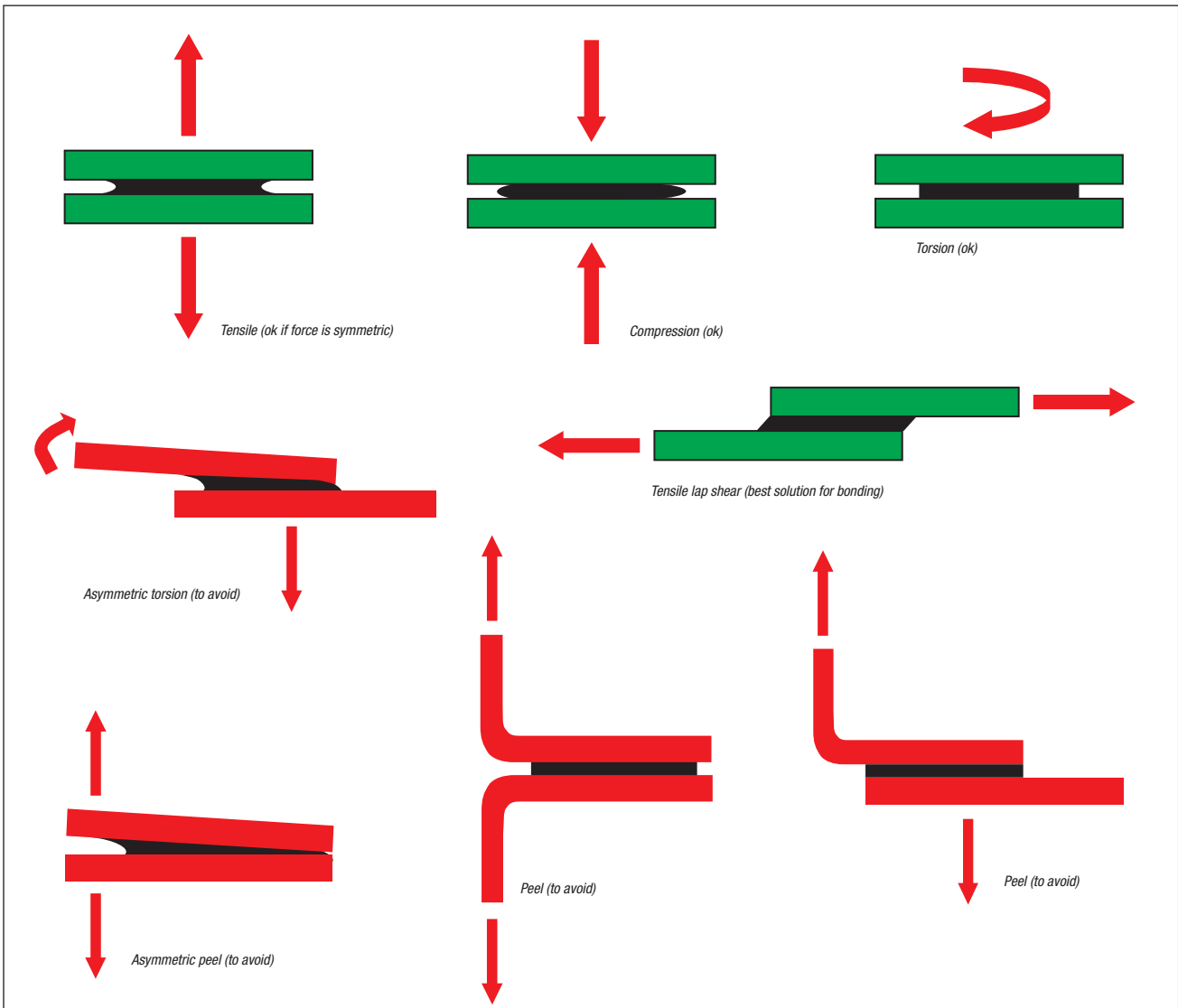
Structural bonding in Marine started at the beginning of the 90ties.

In the meantime, elastic bonding technology was established in other sectors of the manufacturing industry, such as for containers, refrigerators and washing machines, facades, floors, windows and many applications.

The following chapter will help to understand the bonding technology and how to design an adhesive joining case.



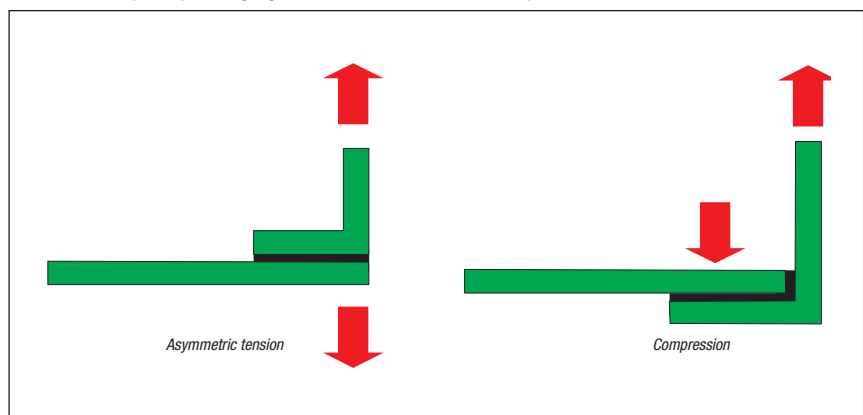
Generally forces which in praxis occur are the following:



The strength of a joint is basically determined by the area of the bond, the inherent strength of the adhesive or the substrate and the stress distribution within the joint. A poorly designed joint can lead to high stress concentrations in the joint itself and/or in the substrates connected, which in turn can lead to premature failure. Good joint design, which takes into account the practicalities of application as well as the geometry of the joint, is essential for a long service life in a demanding Marine environment.

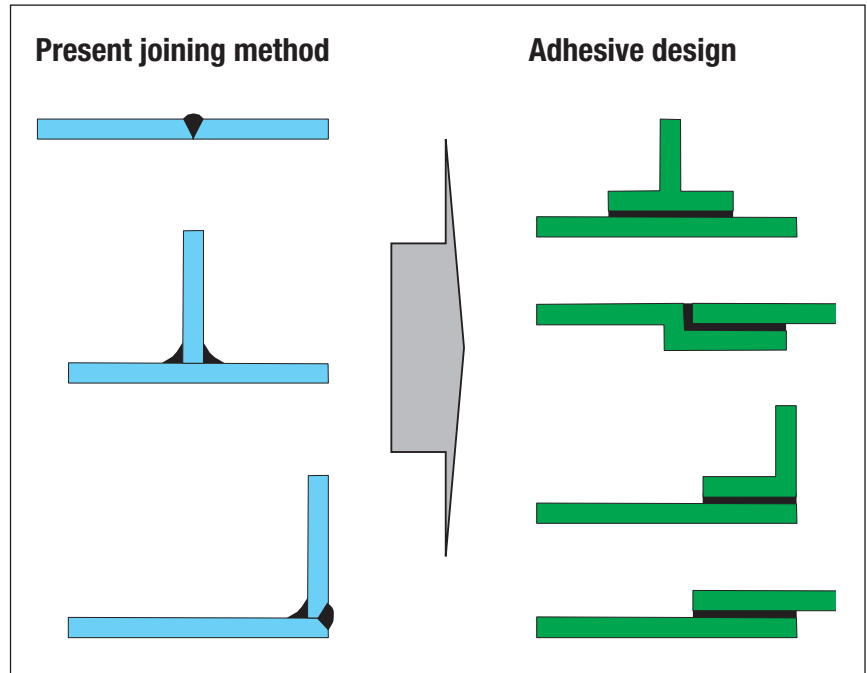
Peel forces are the most difficult to counter and must be avoided by changing the design of the joint.

Here an example: by changing the construction the risk of peel forces could be minimised



Traditional mechanical joint design has to cope with the inherent strength of an adhesive.

The following examples show some of an adhesive alternative to welding.



## 1.4.2 Calculation of the bonding area

The dimensioning of a bond line depends mainly of the forces to be transmitted, and the mechanical resistance of the substrates and adhesives.

One of the most common errors is to calculate the bond line on the bases of the data's in the Product Datasheets. These data's are based on static tests. In praxis a lot of factors have to be considered. Temperature influence, type and frequency of the stress, ageing etc. are factors on which the bond line is subjected.

Detailed calculation procedures can be ordered from your local Sika Industry branch or in appropriated literature (Example: "Elastic bonding, the principles of adhesive technology and a guide to its cost effective use in Industry" Verlag Moderne Industrie)

In praxis a rule of thumb can be used as a first approximation. The lap shear strength has to be reduced to 3% of the Product Datasheet value.

### Example:

Tensile lap shear force needed is 200 kg equal to 2000 Newton.

The Product Datasheet value of a particular adhesive is 2 N/mm<sup>2</sup>

The calculation value for the applicable tensile lap shear strength is only 3% of this Product Datasheet value: 2 N/mm<sup>2</sup> x 0.03 = 0.06 N/mm<sup>2</sup>

The required bond surface is therefore: 2000 N / 0.06 N/mm<sup>2</sup> = 33'000 mm<sup>2</sup> = 330 cm<sup>2</sup>

Considering a bond line width of 15 mm, the required length of the joint is: 330 cm<sup>2</sup> / 1.5 cm = 220 cm  
or 2.2 m

### Note:

For exact calculation with the FEM-Methods we recommend to consult the Technical Service Sika Industry

## 1.5 Cost Advantage of Elastic Bonding



### 1.5.1 Cost compensation

Adhesives compared to riveting or spot welding result in an advantage of the mechanical fixations.

However, a cost comparison has to be done taking all factors of the realisation in consideration. As an example spot welding may increase the expenditure of the filling of a surface prior to painting, thus increasing the overall costs.

The following list gives thought-provoking impulse to realise a correct cost comparison.

Properties	Benefits (manufacturing)
Bond/seal simultaneously	Reduction of process steps/No additional sealant costs
Compensates for tolerances	Less work to prepare substrate
Application at room temperature (no thermal deformation)	Less spatula work/Low energy costs
Curing at room temperature	Lower energy costs
Bonding different substrates	Optimised choice of materials/lightweight construction/No bimetallic plates necessary
No sink marks on thin sheets	Thinner sheets/savings
Less tools	Lower investment costs

Properties	Benefits (enduser)
Not corrosion-prone fixing	Longer life expectancy
Reduced maintenance	Lower costs
Weight-reduction	Lower fuel consumption
No built-in tensions	Increased longevity
Design with low $c_w$ (drag coeff.)	Lower fuel consumption
Application and curing at room temperature	Simple repair
Even surfaces	Easy to clean
Noise reduction	Increased comfort
Freedom of design	Increased brand awareness

# Product Range Overview





## 2.1 Sika Marine Adhesives and Sealants

	Sikaflex®-290i DC	Sikaflex®-291i	Sikaflex®-292i	Sikaflex®-295 UV	Sikaflex®-296	Sikaflex®-298	Sika Fiesil® Marine N	Sikasil® N-Plus	Sikasil® WS-605 S
Product characteristics	Deck caulking compound	Marine sealing compound	Elastic structural adhesive for marine applications	Direct glazing adhesive for organic windows and as weathering resistant sealant	Direct glazing adhesive for mineral glass	Low viscous bedding compound for wood and tile bonding	Fire retardant, fast curing silicone sealant based on a noncorrosive curing mechanism	Fungicide, rapid curing, silicone based sealant with outstanding adhesion	Backfill sealant for bonding insulating glass
Chemical base	1part polyurethane	1part polyurethane	1part polyurethane	1part polyurethane	1part polyurethane	1part polyurethane	1part silicone, neutral curing	1part silicone, neutral curing	1part silicone, neutral curing
Stability (non-sag rating)	Thixotropic slightly sagging	Good	Very good	Good	Very good, with no tendency to sag	Low viscous Slightly sagging	Good	Good	Good
Tack free time 23 °C, 50 % r.h.	70 minutes approx.	60 minutes approx.	40 minutes approx.	60 minutes approx.	45 minutes approx.	100 minutes approx.	120 minutes approx.	15 minutes approx.	120 minutes approx.
Rate of cure <sup>1)</sup>	3 mm per 24 hours approx.	3 mm per 24 hours approx.	4 mm per 24 hours approx.	3 mm per 24 hours approx.	3.5 mm per 24 hours approx.	3 mm per 24 hours approx.	2.5 mm per 24 hours approx.	3 mm per 24 hours approx.	3 mm per 24 hours approx.
Shore A hardness at 23 °C (ISO 868)	40 approx.	40 approx.	50 approx.	35 approx.	45 approx.	30 approx.	25 approx.	18 approx.	20 approx.
Tensile strength (ISO 37)	3 N/mm <sup>2</sup> approx.	1.8 N/mm <sup>2</sup> approx.	3 N/mm <sup>2</sup> approx.	3 N/mm <sup>2</sup> approx.	6.5 N/mm <sup>2</sup> approx.	1.2 N/mm <sup>2</sup> approx.	1,2 N/mm <sup>2</sup> approx.	0.6 N/mm <sup>2</sup> approx.	1 N/mm <sup>2</sup> approx.
Tensile lap-shear strength (ISO 4587)	not applicable	not applicable	2 MPa approx.	1.5 MPa approx.	4.5 MPa approx.	not applicable	not applicable	not applicable	not applicable
Elongation at break (ISO 37)	600 % approx.	500 % approx.	300 % approx.	500 % approx.	450 % approx.	600 % approx.	700 % approx.	300 % approx.	800 % approx.
Application temperature	10 °C to 35 °C	10 °C to 40 °C	10 °C to 40 °C	10 °C to 35 °C	10 °C to 35 °C	10 °C to 35 °C	5 °C to 40 °C	5 °C to 35 °C	5 °C to 40 °C
Service temperature CQP 513-1	-40 °C to 90 °C	-40 °C to 90 °C	-40 °C to 90 °C	-40 °C to 90 °C	-40 °C to 90 °C	-40 °C to 90 °C	-40 °C to 150 °C	-40 °C to 150 °C	-40 °C to 150 °C
Applications	Sealing joints in timber deck planking	General purpose sealing	Structural bonding	Bonding/sealing of plastic materials	Bonding of mineral windows	Bedding and bonding compound typically for teak and other types of wood, tiles, marble, etc.	Sealing of connection and expansion joints requiring fire resistance	Sealant for connection or expansion joints in sanitary applications	Durable sealant for backfilling of insulating glass units

<sup>1)</sup> Note: The rate of cure value is measured after 1 day under normal conditions (23 °C/50 % r.h.). More detailed information's are obtainable in the Product Datasheet

**Important:** This information chart gives an overview of the material properties. For detailed material characteristics refer to the current national Sika Product- and Material Safety Datasheet obtainable through your local Sika company. [www.sika.com](http://www.sika.com)

## 2.2 Tipp's and Tricks, General Advices



### 2.2.1 Surface preparation

#### General remarks

The surface preparation is beside the material choice and the joint dimensioning the key for a long lasting bond. Therefore it is essential to execute the surface preparation very accurately.

#### Surface cleaning

Dirty surfaces have to be pre cleaned. For oily or fatty surfaces, steam cleaning with detergents and consecutive rinsing with clean water are recommended for large areas. Smaller areas may be pre cleaned with solvents such as Sika® Remover-208.

Dust on surfaces is best removed with a vacuum cleaner. Compressed air as alternative can be used if it is deoiled.



Fig. 1 Steam cleaner



Fig. 2 Deoiler for compressed air

Rust, other oxides or loose paints have to be eliminated mechanically.

Methods are sandblasting, and grinding. In case of sandblasting the type of blasting material has to be chosen according to substrate to clean. If necessary contact a abrasive producer.

Grinding with sand paper may be done with belt grinder, excentric grinder, rotation grinder or manually. The grit to choose depends on the material to eliminate. Usually grit 40-80 is used.

After grinding the dust has to be eliminated with a vacuum cleaner.



Fig. 3 Sandblasting



Fig. 4 Excenter grinder



Fig. 5 Rotative grinder



Fig. 6 Belt grinder

### Surface treatment

The additional surface treatment may be the use of an aktivator or/and a primer. Detailed informations are given on the Marine Pre-Treatment Chart.

## 2.2.2 Storage of the products

### Storage unopened cartridge or unipack

Sikaflex® and Sikasil® products should be stored at a temperature under 25°C

The best of use data is indicated on each packaging units.

If the product is stored at higher temperature, viscosity of Sikaflex® rises up to a moment where it is hard to extrude and show a slight elastic behavior. In this case do not use it anymore as the wetting of the substrate is not ensured anymore.

Sikasil® reacts different. After the expiry date the reactivity slows down and the physical strength is lower than indicated in the Product Datasheet. The viscosity (extrusion behavior) of the product is not changing.

### Storage of an opened cartridge

If a cartridge is opened and not used for some days, the nozzle has to remain on the cartridge and just changed with a new one before reuse of the cartridge.

If the product will not be used for a longer period, we recommend removing the nozzle and covering the cartridge opening with an aluminium foil. Screw a new nozzle over this foil. When reused after elimination of the foil, the beginning of the extrusion needs a high force. Once the plunger starts to move, the extrusion force drops down to a normal level.

### Storage of Aktivators and Primers

These products should be stored at lower temperatures than 25°C.

Once opened bottles should be closed immediately after use. Maximum storage life after opening is 3 months.

## 2.2.3 Product application

### General advice

Respect the recommendation in the actual Product Safety Sheet concerning collective and personal protection.

Use only products within the best before date

Never use thinners or solvents to dilute Aktivators or Primers



Fig. 7 Best before date cartridge



Fig. 8 Best before date unipack

## Application of activators and Primers

**Activators** should be applied like a solvent. It is applied on non-porous substrates only! Wet a paper tissue sparingly with the corresponding Aktivator and wipe the surface in one direction. Turn the tissue to a proper side and continue cleaning. Dry the area with a dry tissue (wipe on /wipe off method) Discard the tissues when dirty according to legal legislation.

Close Activator bottles immediately after use.



Fig. 9 Outer and inner cap



Fig. 10 Close inner cap immediately after use

If you transfer the Activator in a separate can, discard the rest at the end of the day according to legal legislation to prevent inactivation of it.

Do not use an Activator which is cloudy or which show an unusual aspect.

Respect the minimum and maximum waiting time until the adhesive or sealant is applied. Consult the Pre-Treatment Chart Marine.

**Primers** are applied like paint. Use a clean dry brush, a felt or dauber to apply a Primer.

Sika® Multiprimer Marine may also be applied with a paper tissue.

Pigmented primer like Sika® Primer-206 G+P or Sika® Primer-209 D have to be shaken until the metal ball in the can be heard. Shake for another minute until the primer is completely homogen.



Fig. 11 Shake



Fig. 12 Outer and inner cap



Fig. 13 Close inner cap immediately after use

If you transfer the primer for use in a separate can, discard the rest of it at the end of the day according to national legislation. With this action inactivation or jellification will be prevented.

Respect the minimum and maximum waiting time until the adhesive or sealant is applied.

## Application of adhesives and sealants

The application is done with a good quality type of gun. Cheap guns may fail especially with higher viscous adhesives such as Sikaflex®-292i or -296.

Apply the product with a triangle shaped nozzle of the appropriate dimension, holding the gun in a vertical position.



Fig. 14 Adhesive application

Insert spacers (see page 4) beside the adhesive bead

Join the parts together, applying a uniform pressure until the final position of the parts is reached. Use a flat rod to press flexible parts uniformly to the desired thickness.

In case of vertical application use distance blocks<sup>1)</sup> or adhesive tapes to hold the part in position until the adhesive get sufficient strength.

For additional sealing operation, protect the sides with adhesive tapes. Apply the sealant watching a complete filling of the space to prevent air inclusions between adhesive and sealant. Tool the sealant with a flexible spatula. Remove the adhesive tapes as soon as the tooling has been done before skinning of the sealant occurs.



## 2.2.4 Removal of adhesives and sealants

### Fresh uncured Products

On non-porous substrate, remove the sealant or adhesive with a spatula. Clean the left over with a tissue or rag and Sika® Remover-208.

Do not use other solvents as they can react with Sikaflex® forming a permanently sticky surface

On porous substrate it is best to let the product cure and remove it after hardening with mechanical means.

### Cured product

Cured Sikaflex® can only be eliminated with mechanical means. Solvents do not dissolve the hardened Sikaflex® but may soften it for easier removal (use acetone or isopropyl alcohol)

Note: Never use Sika® Aktivator for cleaning

### Cleaning of hands and skin

Contact with Sikaflex® should be avoided. Use personal and collective protection means, such as gloves etc.

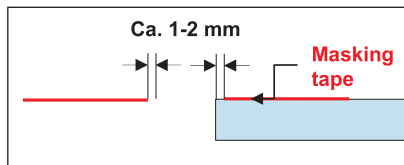
Never use solvents to clean the skin. Best is Sika® Handclean towel or other water based cleaning pastes.

Detailed information's about the physiology of the products are available in the national Material Safety Datasheet, available on the Internet. [www.sika.com](http://www.sika.com)

## 2.2.5 Auxiliary materials

### Masking tape

Masking tapes are to be used to protect the substrate against soiling. Apply the masking tape about 1 mm away from the joint area (see illustration). After application and tooling of the adhesives, the masking tape should be eliminated as soon as possible before skinning of the adhesive or sealant occurs.



### Spacers

Spacers are used to assure a defined thickness of the bond line. They should be softer (shore hardness) than the cured adhesive.

Suitable materials are self-adhesive bumpers. Other possibility is to produce a small bead or sheet of the Sikaflex® adhesive in the desired thickness. After curing cut it in small parts of approx. 5x10 mm.

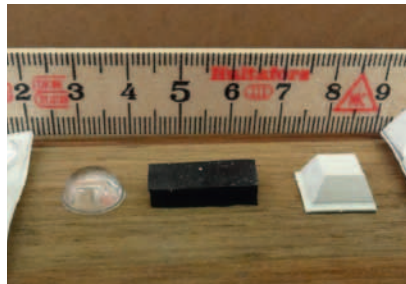


Fig. 15 Example of spacers

Fix the spacer on the substrate. If an adhesive is needed we recommend to use a small dot of Sikaflex®. Never use superglue as they exhale vapors which impair a good adhesion of the Sikaflex® adhesive on the substrate.

### Distance blocks

Distance blocks are used to fix temporarily a vertical bonded part against sliding down.

They are best made on plastics or wood. Never use metals. After sufficient curing of the adhesive (about 2 times the skinning time in the corresponding Product Datasheet) They can be eliminated to permit the consecutive sealing (backfill) of the remaining joint.

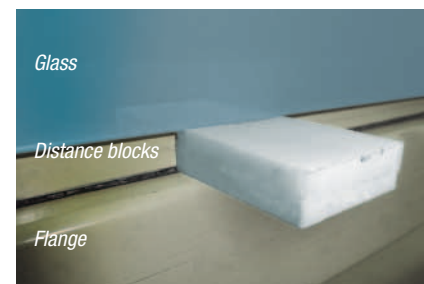


Fig. 16 Distance block

## 2.2.6 How to avoid corrosion

The best corrosion resistance is achieved with suitable paint systems which are designed for the marine conditions.

- Aluminium and ordinary steel have to be protected with such systems. (ISO 12499-3)
- In addition enclosed air pockets or other closed areas (example between adhesive and backfill sealant) have to be avoided. In case of cold application temperature, the viscosity can be decreased warming up the adhesive or sealant in a water bath. (Up to about 40°C)
- Interrupt the bead to allow occasionally entered water.

Note: Sika® Primers give a very limited corrosion resistance and should be used only for adhesion purposes.