General Guidelines
Bonding and Sealing with Sikaflex®
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Purpose and Scope
These Guidelines contain information and recommendations for users on the correct use of Sikaflex® sealants and adhesives in industrial applications. They should be read in conjunction with the relevant Product Data Sheets, Pre-treatment Chart and Working Instructions. This document covers general recommendations, for specific recommendations please contact your local Sika company (www.sika.com).

This document contains important Sika know-how. It is therefore primarily for internal use only and may handed out to qualified customers only. It may never be distributed in electronic format.

1. Introduction
The quality and durability of an adhesive bond or seal is determined by a number of factors. Besides using the correct product and joint design, the most critical steps are proper surface preparation and adherence to specific preparation and application time.

2. Selecting Adhesives and Sealants
The choice should be made based on information supplied in the current Product Data Sheets or upon advice given by the appropriate Sika employees.

3. Design and Dimensions of Adhesive Joints and Seals
For known applications, the design and dimension of adhesive joints and seals should be based upon currently available specifications. For new applications, adhesive joint and seal designs should be based on the product specification and data supplied by Sika. If necessary Sika employees can provide assistance. Given the specific nature of elastic adhesives, particular attention must be paid to the thickness of the adhesive layer.

Other consideration must be given to detailed production schedule, its future use, expected life-span and repairability of the final assembly. All of which may have a critical bearing on joint design and geometry.
4. Working Place Conditions
The working place should be as dust free as possible. No work with silicones, paints or solvents should be performed in the surrounding area. For best practice the work area should be separated from the other areas and provided with corresponding signs.

Ideal conditions are 23°C (73°F) and 50% relative humidity. As these conditions are usually attainable only in a laboratory, try to make plant conditions as close as practicable. Be aware that all values stated in the Product Data Sheets are based on norm conditions (23°C / 50% r.h.).

The optimum application temperature of Sika products and the substrates is between 15 and 25°C (60 and 77°F).

Atmospheric, substrate and Sikaflex® temperatures all play a part in successful applications. If either adhesive, substrate or climate condition are below 10°C (50°F) and less than 20% r.h. or above 35°C (95°F) difficulties could occur. The higher application temperature does not apply to hot applied Sika products.

Application at lower temperatures may lead to reduced adhesion on the substrates. The product is harder to extrude. Curing and the strength development are also slowed down at lower temperatures. Be aware that flash-off time of primers, activators and other pre-treatment agents are longer at lower temperature. For further details consult the corresponding Product Data Sheet.

Caution
Using sealants and adhesives at significantly elevated temperatures may result in poor adhesion due to faster skinning and/or bubbles forming on the interface between the substrate and Sikaflex®.

Due to the different chemical composition of various Sikaflex® sealants and adhesives these are only general recommendations. For detailed information refer to the actual Product Data Sheets or specific Working Instructions for the respective products.

Details on handling, storage, transportation and other safety related issues are available through the corresponding Material Safety Data Sheet (MSDS).

5. Substrates
The Sika® Primer Chart serves as a general guide to the preparation of substrates prior to assembly. It also contains very important and useful indications about substrate characteristics. In any case of assemblies, it is highly recommended to confirm surface preparation procedures by laboratory testing. The surface characteristics of the bond faces are of critical importance in determining the bond strength or adhesion.
Therefore, it is essential to **assure that surface characteristics of all bonded components are constant** and uniform in terms of chemical composition, manufacturing processes, production aids such as mould release agents or preservatives such as waxes, oils, etc. Paint coatings must be carefully analyzed and identified. **The chemical composition of the paint, type of substrate preparation, application parameters, and the presence of additives in the paint to modify texture or finish can affect final adhesion.**

**Important note**
Different colors of the same brand of paint may have also a different adhesion behaviour.

Special attention is necessary if thermo-plastics like PMMA , PC, ABS, etc. have to be bonded. Environmental stress cracking has to be taken in consideration in such a case. Only a few products are released for such pre-treat- and bonding applications. Preliminary test are mandatory.

6. **Surface Preparation Techniques**
Surface preparation typically consists of the following sequence of operations:

6.1 **Pre-cleaning**
Even though it is often not visible, nearly every substrate has loose or chemically unbound substances such as dust, rust deposits, oils, greases, etc. which must be removed. Many substrates can be pre-cleaned by simply scuffing lightly with an abrasive pad. The method used must be selected to suit the specific nature and composition of the substrate. If surface is very dirty and not porous such as metal or glass, clean with solvent such as Sika® Remover-208, paint thinner or other suitable cleaning agents. This is not to be done in place of Sika® Cleaners and Aktivators since those products are adhesion promoters and not just a cleaning agent.

6.2 **Surface Activators (e.g. Sika® Cleaner-205, Sika®Aktivator, etc.)**
These products consist essentially of solvents and small quantities of adhesion promoters. Application is done with a clean, lint free linen cloth, or with a paper towel. Apply Sika® Cleaner sparingly to the cloth or towel, wipe onto the surface with a straight light stroke. Do not use a rotary “polishing” action. Turn the cloth to change the wiping surface often. Dispose of soiled cloths in accordance with local environmental regulations. Unlike paints and primers, Sika® Cleaner and Aktivator do not leave a film on the substrate, but a difference in shine of the treated surface can be noticed. Any excess Sika® Cleaner or Aktivator remaining on the surface should be wiped off immediately with a clean, dry cloth or paper towel.

Treat only the bond face. If Sika® Cleaner or Sika®Aktivator is accidentally deposited on surrounding surfaces, wipe off immediately using a clean, dry cloth.

The application of the adhesive or primer (where specified) should take place within the time stated in the relevant Product Data Sheet.
6.3 Priming
Sika® Primers are clear or pigmented liquids that bond well to the substrate and dry to form an ideal surface for adhesion.

Primers are generally applied with a clean, dry brush, a special felt-pad or a piece of open cell elastic polyurethane foam applicator. A broad selection of applicator systems are also available at www.designetics.com. In certain limited instances Sika® Primer can be applied by spray or with rollers. Always contact Sika Technical Service for advice in such cases.

Each Sika® Primer has a minimum and maximum drying time prior to applying the adhesive. This time must be strictly observed. If the adhesive is applied too quickly, solvents in the primer do not fully evaporate. Also, surface contamination can occur if the maximum time is exceeded. If longer open time is needed contact Sika Technical Service for advice. Detailed information is available from the relevant Product Data Sheets.

Surfaces that have been treated with Sika® Cleaner and/or Sika® Primers must be protected from recontamination or soiling prior to application. To avoid cross-contamination, foreign products such as silicone sealants, paints, solvents and cleaning agents should be kept well away from the working area.

**Important note**
Primers and activators are not designed to protect against corrosion. Depending on exposure and service conditions, components must be protected against corrosion by applying paint coatings specifically formulated for this purpose.

6.4 Reactivation
In case of exceedance of the flash-off time surfaces have to be pretreated again or reactivated. For further details consult Technical Service.
7. Application of Adhesive and Assembly

Sika adhesives and sealants supplied in cartridges and unipacks are applied with a pneumatic-, electric- or manually operated application gun. They may also be dispensed from drums and pails through a pump system. For more controlled dosage and limiting air entrapment, adhesives are best applied in the form of a triangular bead.

Do not exceed the tack free (skin formation time) or open time published on the Product Data Sheet. Cold temperature and low humidity slows the tack free time down considerably. Conversely high temperature and relative humidity accelerate the reaction resulting in faster tack free time. In this case the assembly time after the application is reduced significantly. Skinning of the adhesive prior to assembly impairs adhesion. Where skinning has occurred, it is necessary to remove the bead and repeat the adhesive application.

The components are assembled by applying uniform pressure to the joint, either by hand or with the aid of a suitable clamping device, until the adhesive bead has been compressed to the specified thickness. The use of rubber spacer, with a Shore A hardness similar to the adhesive is advised. The spacers should either be embedded completely into the adhesive or positioned slightly away from the bead. We recommend half spheric self adhesive bumpers from 3M. In this case the spacers have to be positioned in the bead and be completely covered with adhesive to prevent any lack of tightness of the bead. Compatibility between spacers and adhesive must be checked in advance. Do not use “superglue” (cyanoacrylates based adhesives) to secure spacers (there is an adverse chemical reaction between the polyurethane and cyanoacrylate adhesive leading to loss of adhesion).

The advantage of using spacers is that heavy components can be bonded together without compressing the adhesive below the required minimum thickness.

Caution

If the adhesive has been compressed below the required thickness, do not pull back to the correct thickness (risk of opening up gaps and reducing contact area). Either leave it or take it apart and repeat bonding procedure. Waiting and curing times must be strictly observed before the bonded assembly is released for further processing. Waiting times are determined by the load on the adhesive joint and the climatic condition.

Important note

In applications where the bonding and subsequent sealing of components are carried out in separate stages, it may be necessary to clean the substrate prior to the sealant application. It is vital to ensure that no voids are formed between the adhesive and sealant layers, either by making sure that the sealant completely fills the joint slot, or by designing the joint in such a way that condensed humidity can escape from any voids formed between the adhesive and sealant layers (by using an interrupted bead or ventilation holes).
8. Tooling / Smoothing
Tooling is performed using the most suitable tool for the desired appearance, such as spatula, spoon or cut potato having a even edge. The operation may be optimised using an appropriate tooling liquid. We recommend Sika® Tooling agent N.

Important note
Tooling products such as solvents, concentrated detergents or other cleaners may cause tacky surfaces or accelerated aging of the smoothed surface. Never under any circumstances use alcohol or alcohol containing products as a tooling agent (it prevents the polyurethane from curing).

9. Clean-Up
Excess uncured Sikaflex® can be cleaned up with Sika® Remover-208 or mineral spirits with the exception of porous substrates. Alcohol based cleaning agents are not suitable because they permanently prevent Sikaflex® from curing. Once hardened Sikaflex® products can only be removed mechanically.

Never use solvents to clean hands. Instead use Sika® Handclean tissues or other similar products. Additional information are available in the respective Material Safety Data Sheet.

10. Waste Disposal
Disposal of waste materials is often regulated by government regulations, which must be strictly complied with. Consult your national Material Safety Data Sheet for further details.

In their fully cured state, Sikaflex® sealants and adhesives may normally be disposed of as domestic waste.

Cleaners and primers are generally classified as semi-hazardous waste requiring special treatment, and should be disposed of accordingly.
11. Quality Assurance

Quality assurance measures play a vital role in adhesive bonding technology. These include the following points:

- Monitoring the substrate materials for consistency and assure information flow from purchasing department in case of changes of substrates or material suppliers. Laboratory analysis or empirical bonding tests may be necessary to verify it.
- Detailed Working Instructions must be clearly displayed in the workplace. Instructions should be easy to read and preferably based on the use of pictograms (there are no language problems and the information is easier to understand).
- A responsible person must be appointed to monitor compliance with these instructions. Regular audits will be carried out and recorded in writing.
- Periodic training for staff (internal and external). It is important to ensure that all adhesive bonding operations are carried out by trained staff only.
12. Practical Testing Procedures to Evaluate the Quality of the Adhesion

12.1 Adhesion Test
Apply a triangular bead on an original substrate which has been prepared in accordance with the Primer Chart or Working Instructions (see pic. 1). Use release paper, wax paper or polypropylene foil to press bead down approximately half of the bead height (see pic. 2 and 3). Allow the bead to cure for 7 days at room temperature (23°C/50% relative humidity).

Using a sharp razor knife, separate the first 3 cm of the leading edge of the bead from the substrate (see pic. 4). Grip the separated portion of the bead with a pair of needle nose pliers and slowly turn the bead (applying peel stress) attempting to separate it from the substrate. Cut the adhesive frequently on the bottom down to the substrate as shown in picture 4 and 5.

There are three distinct types of failure as shown in picture 6.

- Adhesion failure occurs when the Sikaflex® pulls cleanly off the substrate
- Substrate failure occurs when the substrate itself tears
- Cohesive failure, which is optimum, occurs when the Sikaflex® itself tears

If Sikaflex, which has a known strength is the weakest link, a baseline for joint strength is determined and can be calculated. A combination of failure modes is also possible.

95% or greater cohesive failure is considered excellent adhesion (see pic 6 left side). 75% cohesive failure is considered acceptable in many circumstances.
12.2 Through Hardening Test for Booster Applied Products
A thick bead of about 3 cm diameter and 100 mm length is applied on cardboard.

After 2 hours at 23°C/50% relative humidity, the bead is cut with a razor knife to determine if the entire bead has cured. If not fully cured, repeat every half hour until curing is complete.

13. Additional Information
These General Guidelines must be read and interpreted in conjunction with Sika’s Product Data Sheets, Material Safety Data Sheets and instructions for use current at the time of the application. For further details contact your local Sika company.
Legal Notes
The information contained herein and any other advice 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 accordance with Sika’s recommendations. The information only applies to the application(s) and product(s) expressly referred to herein and is based on laboratory tests which do not replace practical tests. In case of changes in the parameters of the application, such as changes in substrates etc., or in case of a different application, consult Sika’s Technical Service prior to using Sika products. The information contained herein does not relieve the user of the products from testing them for the intended application and purpose. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.