



ELASTIC BONDING

22 FEBRUARY, 2024, GEMA BLANCO
SIKA S.A.U. / TARGET MARKET INDUSTRY

BUILDING TRUST



CORPORATE TRANSPORTATION TRAINING

CONTENT

- Adhesive selection
- Reasons for elastic sealing and bonding
- Sealing application
- Elastic Bonding
- Quality control
- Documents
- Sikaflex[®]-268 system

ADHESIVE SELECTION

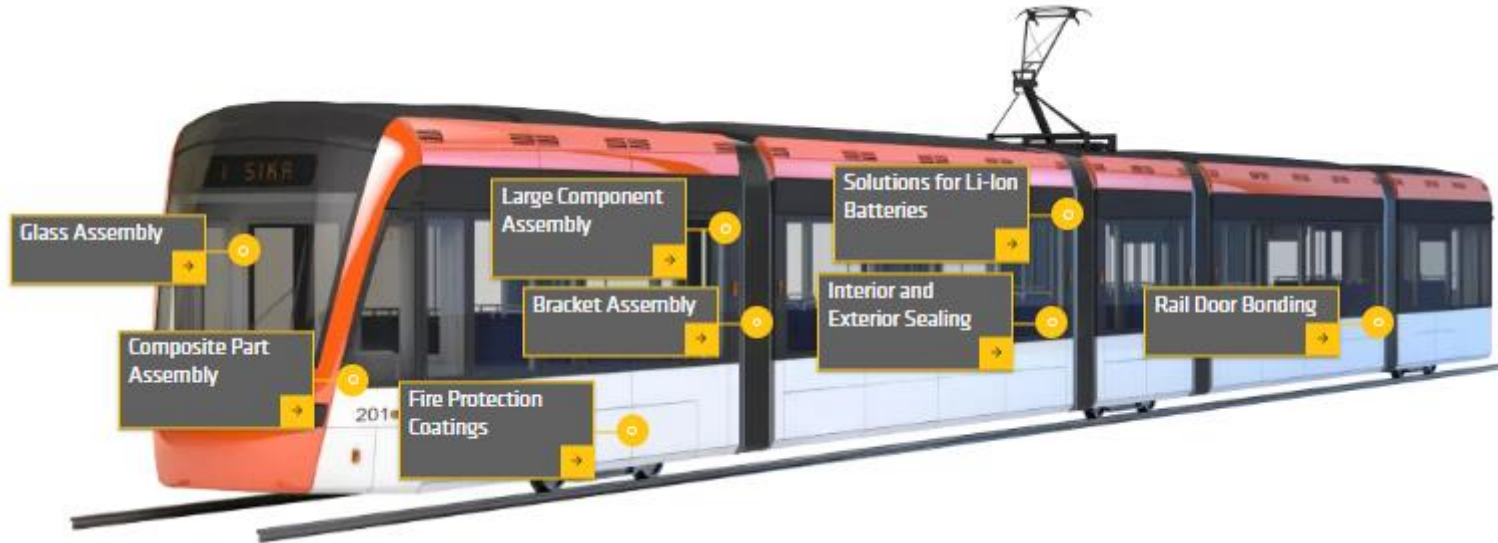


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APPLICATION OVERVIEW

RAIL



For rail vehicle construction, stringent **quality standards** are to be applied, such as the EN 15085 series for welding processes, the **DIN 6701** series for bonding processes and the **EN 45545** series which copes with fire safety issues. Sika has put in place a comprehensive set of data according to DIN 6701-3 requirements, to help its customers verify new designs and applications. The DIN 6701-3 **material card** is continuously monitored to ensure accuracy and quality.

ADHESIVE SELECTION

POSSIBLE CRITERIA FOR ADHESIVE SELECTION

PARTS TO BE JOINED

- Material
- Adhesive surfaces
- Tolerances
- Thermal expansion

MECHANICS

- Mechanical stress
- Mechanical load-bearing capacity

PROCESSING

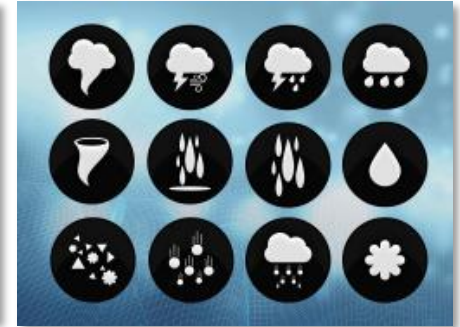
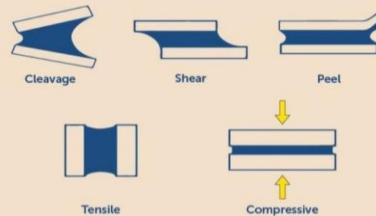
- Application equipment
- Cycle times
- Curing conditions
- Curing speed

ENDURANCE

- Temperature
- UV radiation
- Humidity
- Chemicals
- Fire behaviour

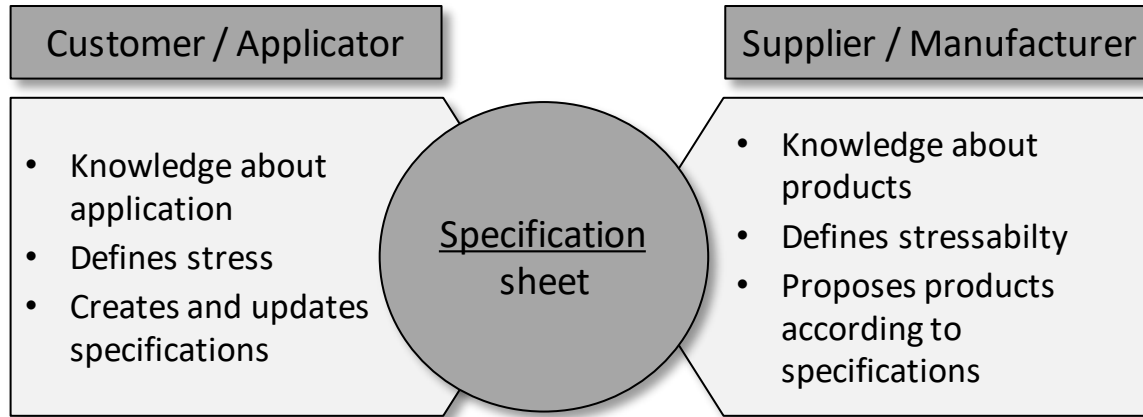


Types of Joint Stress



ADHESIVE SELECTION

PROCEDURE OF PRODUCT SELECTION



ELASTIC SEALING & BONDING



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WHY USE ELASTIC SEALANTS AND ADHESIVES (ES&B)

Elastic sealants and adhesives are commonly in use in the Transportation market

High manufacturing tolerances upto 50mm

ES&B products are applied in high layer thicknesses
→ 2-10 mm

Thickness and elasticity result in good tolerance gapping properties



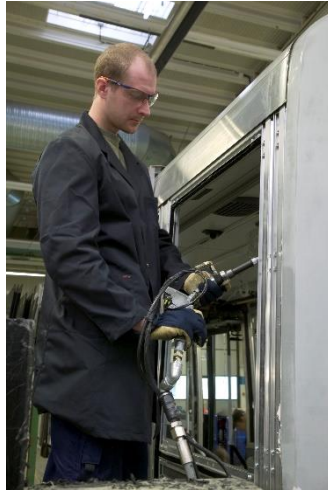
WHY USE ELASTIC SEALANTS AND ADHESIVES (ES&B)

Elastic sealants and adhesives are commonly in use in the Transportation market

Wide range of different substrates in use

Typical substrates may include, metals, plastics, wood that are joint together

Materials show different coefficients of thermal elongation (CTE) – this is absorbed by ES&B



WHY USE ELASTIC SEALANTS AND ADHESIVES (ES&B)

Shocks and deformations must be absorbed

Loads occur on the vehicle when accelerating and breaking
Large vehicles are exposed to torsions during operations

ES&B absorb this movements and shocks thanks to its viscoelastic behavior – stress distribution



ELASTIC SEALING AND BONDING TECHNOLOGY RELATED PROPERTIES

| APPLICATION PROPERTIES | PUR | STP | MS | SIL | MMA | EP |
|-----------------------------|-----|-----|----|-----|-----|----|
| Viscosity (extrusion force) | ○ | + | + | ++ | ++ | ○ |
| Non sag | ++ | + | + | + | + | ++ |
| Slip-down (grab) | ++ | + | + | -- | -- | + |
| String | ++ | + | + | + | + | ++ |
| Toolability | + | + | + | + | + | + |

++ excellent, + good , ○ average , - poor, -- very bad

ELASTIC SEALING AND BONDING TECHNOLOGY RELATED PROPERTIES

| REACTIVITY | PUR | STP | MS | SIL | MMA | EP |
|------------------------|-----|-----|----|-----|------|---------|
| Skin time | + | ++ | ++ | + | N.A. | - |
| Curing-through (depth) | + | ○ | + | ○ | ++ | -- (2K) |
| Early strength | + | ○ | + | ○ | - | - |

| MECHANICAL PROPERTIES | PUR | STP | MS | SIL | MMA | EP |
|-----------------------------|-----|-----|----|-----|-----|----|
| Tensile-shear strength | ++ | + | ○ | -- | ++ | ++ |
| Tear propagation resistance | ++ | ++ | ++ | - | - | - |
| Modulus | + | + | ○ | - | ++ | ++ |

++ excellent, + good , ○ average , - poor, -- very bad

ELASTIC SEALING AND BONDING TECHNOLOGY RELATED PROPERTIES

| PRIMERLESS ADHESION | PUR | STP | MS | SIL | MMA | EP |
|-----------------------|-----|-----|----|-----|------|------|
| E-coated steel | ++ | ++ | ++ | ++ | N.A. | N.A. |
| GRP | 0 | + | + | ++ | ++ | (++) |
| PVC | -- | + | + | ++ | ++ | |
| Galvanised steel | - | ++ | ++ | ++ | ++ | ++ |
| Aluminium | 0 | ++ | + | ++ | ++ | ++ |
| Aluminium anodized | 0 | 0 | + | ++ | ++ | ++ |
| Stainless steel | - | ++ | ++ | ++ | ++ | ++ |
| Various paint systems | + | ++ | ++ | ++ | N.A. | N.A. |
| Ceramic screen prints | ++ | ++ | ++ | ++ | N.A. | N.A. |

++ excellent, + good, 0 average, - poor, -- very bad

ELASTIC SEALING AND BONDING TECHNOLOGY RELATED PROPERTIES



Sikaflex®-200 Series

Traditional, high-performance polyurethane adhesives

Need REACH training in EU



Sikaflex®-500 Series

High-performance STP adhesives for sealing and assembly applications

Do not need REACH training in the EU



Sikaflex®-600 Series

High-performance polyurethanes with ultra-low monomer content

SEALING APPLICATIONS



ELASTIC SEALING

SEALING SEGMENTATION

Interior Sealing before paint

- Sealing before paint requires usually different solutions based on paint process / oven temperature
 - ➔ Temperature range RT to 220°C

Interior Sealing after paint

- Sealing after paint may require specific product performance
 - ➔ No temperature exposure due to oven for curing
 - ➔ All interior joints
 - ➔ Anti-flutter

(due to process / mechanical properties)

Exterior Sealing

- Exterior sealing requires specific product performance
 - ➔ No temperature exposure due to oven for curing
 - ➔ All visible exterior joints
 - ➔ Chemical resistance



ELASTIC SEALING PRODUCT RANGE

| | Interior Sealing after paint | Exterior Sealing | Interior Sealing before paint | | |
|---|---|--|---|---|--|
| Process Conditions | Cold Processing (15-90°C) (cold painting process or use of coated panels) | | Hot Processing 140-220°C (e-coating or powdercoat oven in the process –) | | |
| Bonding Substrates | Metals (Galv. steel, Alu, etc.) | Coated Metals (Primers, Powder, E-Coat, Epoxy) | Plastics (GRP, FRP, ABS) | Non corrosive metals (Galv. steel, Alu, etc.) | Oily metals (Alu, Steel, etc.) |
| SikaPower® 1C EPOXY SEALANTS | | | | X | X |
| Sikaflex® 1C PUR SEALANTS 1C STP SEALANTS | X | X | X | | |

CORPORATE TRANSPORTATION TRAINING

SEALING PORTFOLIO

Interior Sealing before paint

- Sikaflex®-221
- Sikaflex®-529 Evolution
- SikaPower-415 P1
- Sikaflex-621

Interior Sealing after paint

- Sikaflex®-221
- Sikaflex®-268
- Sikaflex-521 UV
- Sikaflex-554
- Sikaflex-668
- Sikaflex-621

Exterior Sealing

- Sikaflex®-268
- Sikaflex®-554
- Sikaflex-668

ELASTIC BONDING



ELASTIC BONDING

DIFFERENT TECHNOLOGIES – DIFFERENT STRENGTHS

| TECHNOLOGY | BENEFITS | DISADVANTAGE |
|--------------------------|--|--|
| 1-C PUR (w/o Booster) | multi purpose, easy to use, fast curing, long open time, high strength | 2 step pretreatments |
| 1-C PUR (PURFORM) | multi purpose, easy to use, fast curing, long open time, high strength, EH&S, Primerless (SF 621), but with Sika Aktivator | 2 step pretreatments (SF 668) |
| MS Polymers / STP's | adhesion properties (galvanized steel), EH&S, bond and seal, also exterior joints | curing speed, mechanical strength, creep, hydrolysis stability |

ELASTIC BONDING

APPLICATION EXAMPLE PER TECHNOLOGY

| TECHNOLOGY | TYPICAL APPLICATIONS | COMPETITON |
|------------|--|------------|
| 1C PUR | Large assemblies that require long open time, this includes floor assemblies, panels and masks (ability to accelerate curing to ensure through cure of large joints and meet process requirements) | MS / STP |



ELASTIC BONDING

APPLICATION EXAMPLE PER TECHNOLOGY

| TECHNOLOGY | TYPICAL APPLICATIONS | COMPETITON |
|------------|---|------------|
| MS / STP | Similar to 1C PUR but used more often in caravan and trailer industry where black primer free pre-treatment is required | 1C PUR |



ASSEMBLY / PANEL BONDING

MOST COMMON SUBSTRATES IN TRANSPORTATION

- Metals
 - ➔ Steel: Stainless, CRS, Black, Galvanized, etc.
 - ➔ Aluminum: Anodized, AlMg, AlMgSi, etc.
- Composites and Plastics
 - ➔ GRP, SMC, ABS, PC, etc.
- Paints
 - ➔ E-coat, Powder coat, 2C, Water based, etc.
- Wood
 - ➔ Plywood, Phenolic coated, Balsa, Bamboo
- Glass



High complexity due to:

- Large amount of different substrates
- Mixed material bonding

ASSEMBLY / PANEL BONDING

SUMMARY CUSTOMER CHALLENGES

- Transportation customers face the following key challenges for assembly bonding



Customers want to have the maximum freedom for design

- New materials are being used (different types of plastics)
- Correct design very important for mixed material bonding (different CTE's)



Fleet operators and commercial vehicle owners demand longevity and durability

- Durable bonding to ensure safety and must cope with wide temperature range
- No cracking, water ingress or corrosion



Adhesives must fit into process

- Suitability with process requirements such as speed and working time
- Compatibility with paints, substrates

ASSEMBLY / PANEL BONDING PORTFOLIO

Flexible Bonding

- Sikaflex®-268 / Booster P-50 / PowerCure
- Sikaflex®-554 + Sika®Booster S-50
- Sikaflex®-668 / Booster P-50 / PowerCure

Rigid Bonding

- SikaPower®-880
- SikaPower®-1277
- SikaFast®-555 L03 / L05 / L10

- SikaForce®-803 L45
- SikaForce®-840 L09 (high elongation)

QUALITY CONTROL

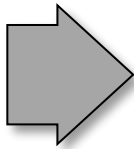


QUALITY CONTROL

AVOIDING MISTAKES: WHEN, HOW AND WHO?

Avoid mistakes as early as possible

- Correct planning and design, correct product selection
- Correct application



Ongoing training of all staff involved!

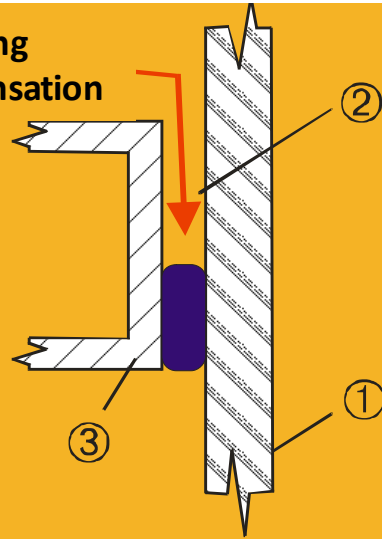


QUALITY CONTROL

CONSTRUCTIVE SOURCES OF ERROR AND THEIR PREVENTION

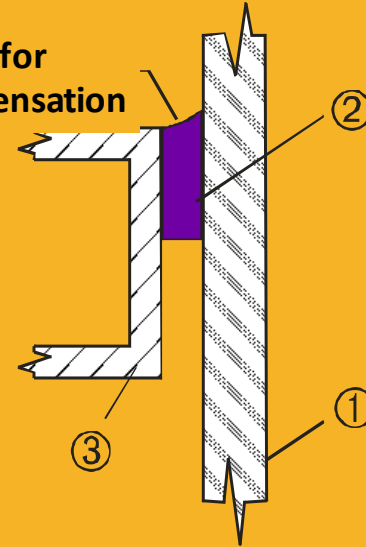
Incorrect
Risk of stagnant water

**Standing
condensation**



Correct
Water drains away

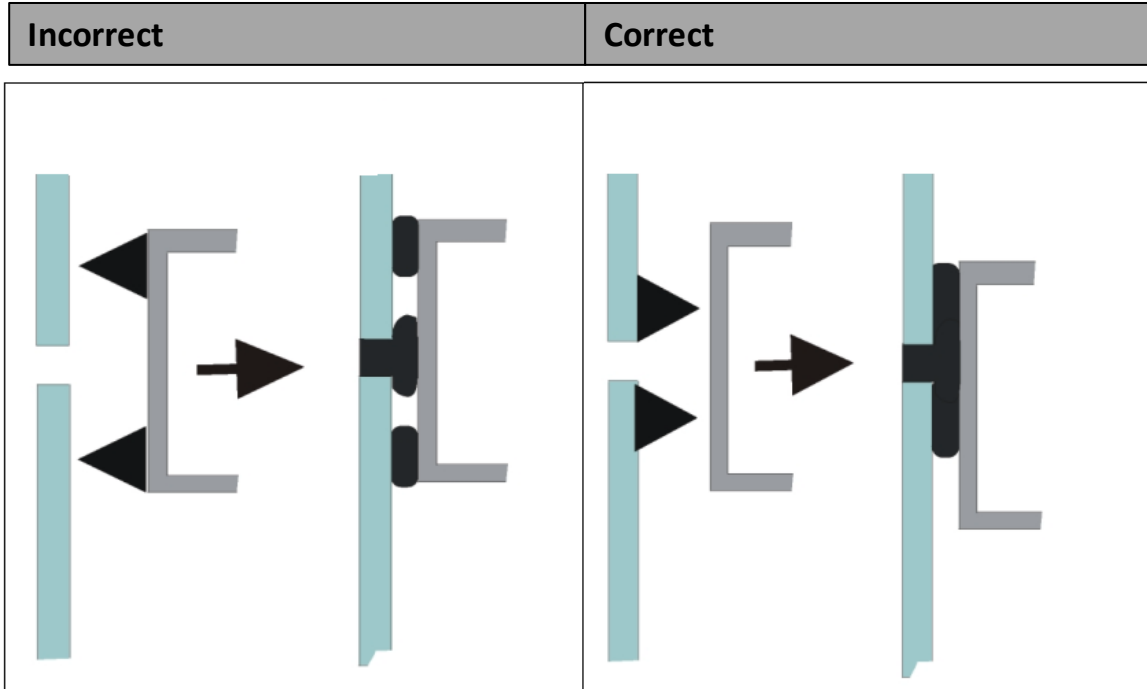
**drain for
condensation**



Correct: apply adhesive "on top" to the profile with correct tooling

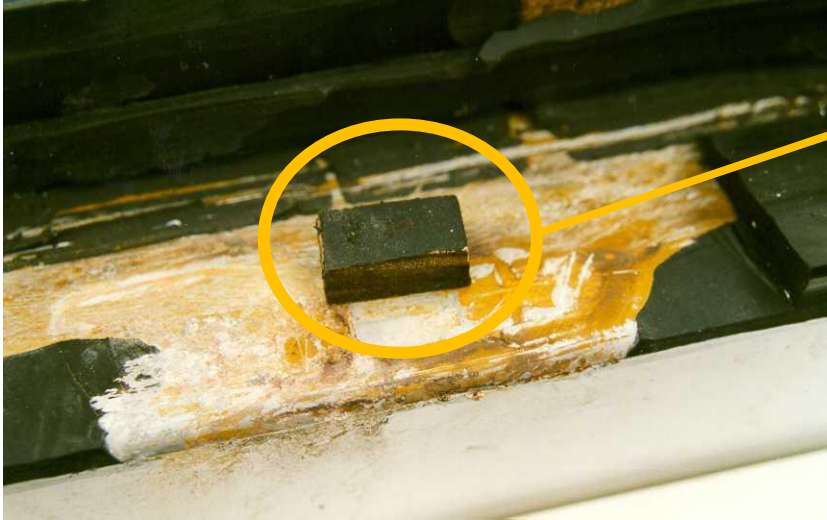
QUALITY CONTROL

AVOIDING OF CAVITIES IN THE GLASS BONDING



QUALITY CONTROL

NOTE ON THE USE OF SPACERS



Incorrect

Use of cyanoacrylate adhesive for mounting the spacer.

Result: Loss of adhesion due to "sweating out" of the cyanoacrylate. Corrosion.

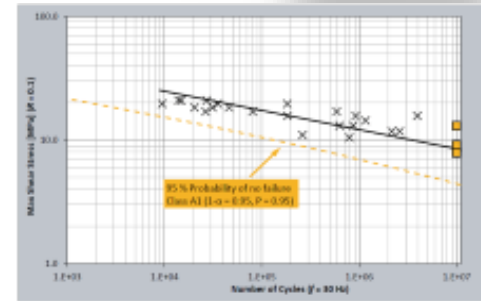
Correct: Use self-adhesive spacers or fix with Sikaflex®.

DOCUMENTS

MATERIAL CARDS AND DATA FOR RECORD KEEPING

Sika offers all necessary mechanical parameters for the calculation

- Thermomechanical behaviour
- Behaviour under quasi-static load at -35°C / 23°C / 70°C
- Fatigue behaviour under cyclic shear load in load case $R=0.1$
- Creep rupture strength and creep strain
- Mitigation factors for environmental impacts
- **All necessary data for verification according to DIN 6701-3/ DIN 2304**



DOCUMENTS

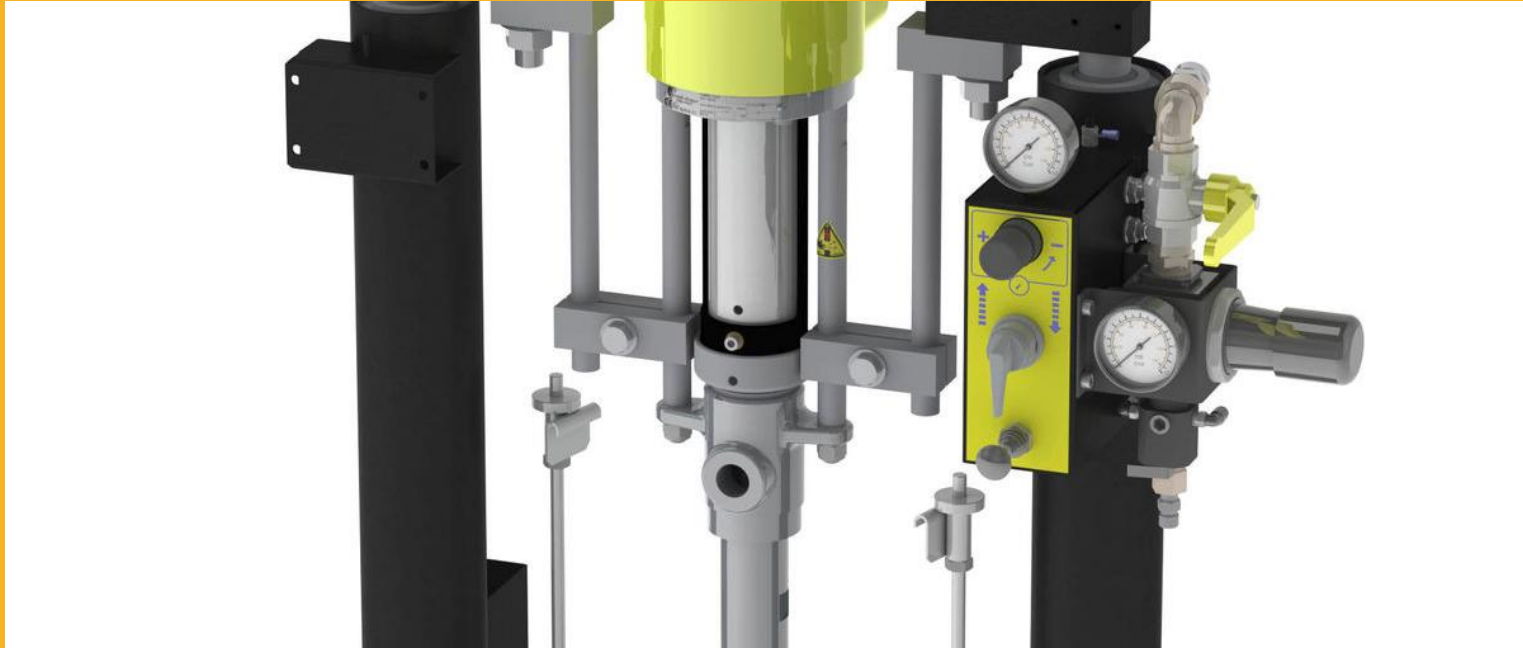
PRODUCT DATA SHEET, SAFETY DATA SHEET, API, ATI

Documents from Sika

- Product data sheets
- Safety data sheets
- General guidelines
- Additional Product Information (API)
- Additional Technical Information (ATI)



SIKAFLEX® -268/BOOSTER/POWERCURE



ACCELERATED SYSTEMS

- Sikaflex®-268 is a complete system which incorporates...
 - single component use
 - accelerated with pump equipment by using Sika® Booster Paste-P50
 - accelerated with dynamic mixing system using PowerCure® for manual use at line or repair applications
- No matter what system is used, same final properties are achieved
 - same mechanical properties
 - identical resistance against weathering, heat and cleaning agents

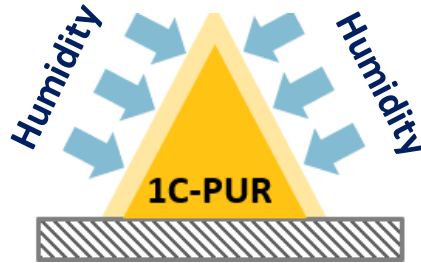


PROCESS REQUIREMENTS

ACCELERATION WITH SIKA® BOOSTER

Standard 1C PUR:

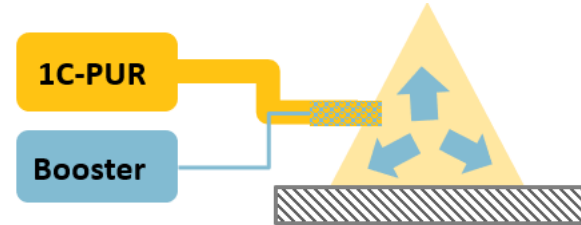
- Moisture diffusion into the adhesive



- Curing from the outside to the inside

Sika® Booster:

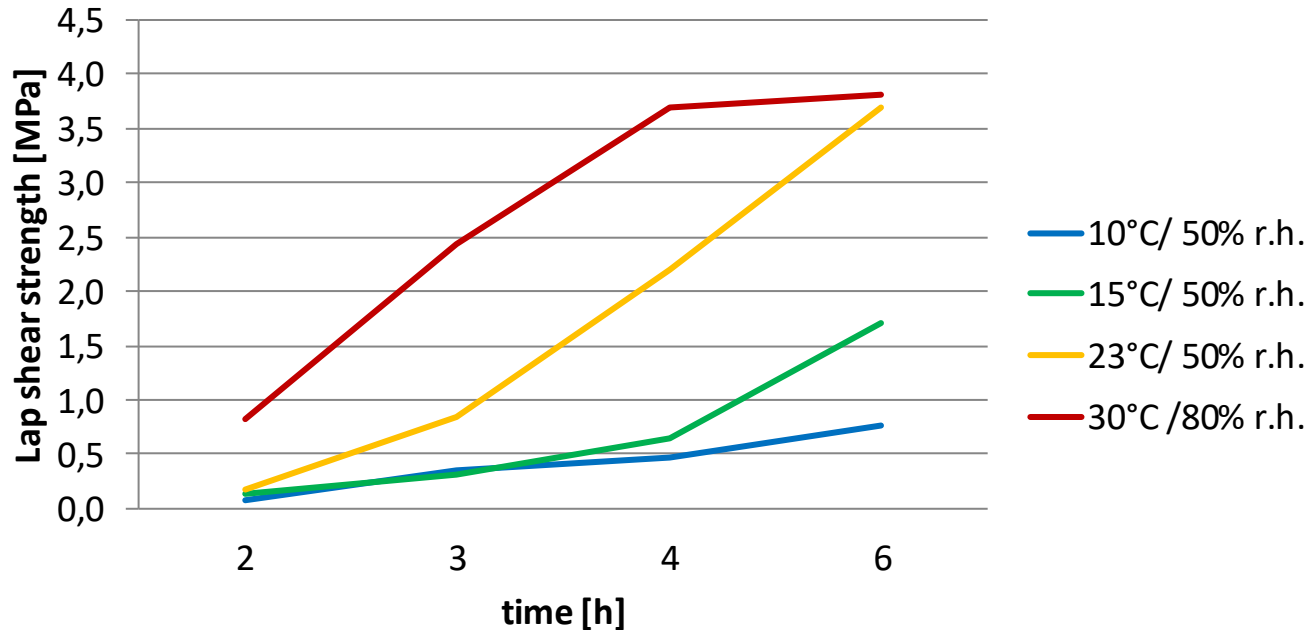
- Adding approx. 2% of an accelerating paste



- Curing acceleration
- Largely climate-independent
- No change in the mechanical parameters
- High mixing tolerance

REACTIVITY – EARLY LAP SHEAR STRENGTH

SIKAFLEX®-268 + BOOSTER-20 S AT DIFFERENT CLIMATES



SIKA POWERCURE SYSTEM INNOVATION



- Quick and easy replacement of the nozzle
- Small volume of the dynamic mixer
- Very reliable dosing technology



13 patents applied for



POWERCURE SYSTEM PACKAGING CONCEPT



14 x



588 ml Klebstoff +
12 ml Beschleuniger



50 x



40 x





THANK YOU FOR YOUR ATTENTION

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