ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	Sika Deutschland GmbH
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-SIK-20140066-IBG1-EN
Issue date	08.08.2014
Valid to	07.08.2019

PU/SMP-based, solvent-free facade sealants:

SikaHyflex-160 Construction
SikaHyflex-220 Window
SikaHyflex-250 Facade
Sikaflex Construction+
Sikaflex AT Facade
Sikaflex AT Connection
Sikaflex PRO-1

www.bau-umwelt.com / https://epd-online.com

Institut Bauen und Umwelt e.V.

BUILDING TRUST

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1. General Information

Sika Deutschland GmbH

SikaHyflex-160 Construction
SikaHyflex-220 Window
SikaHyflex-250 Facade
Sikaflex Construction+
Sikaflex AT Facade
Sikaflex AT Connection
Sikaflex PRO-1

Programme holder
IBU - Institut Bauen und Umwelt e.V.
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Germany

Owner of the Declaration
Sika Deutschland GmbH
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Declaration number
EPD-SIK-20140066-IBG1-EN

Declared product / Declared unit
1kg reaction resin, polyurethane or SMP-based, filled, solvent-free; density 1.25 - 1.5 kg/cm³

This Declaration is based on the Product Category Rules:
Reaction resin products, 07.2014
(PCR tested and approved by the independent expert committee)

Scope:
This validated declaration entitles the use of the seal of the Institut Bauen und Umwelt e.V. It applies exclusively to the stated product groups for plants in Germany and is valid for five years following the date of issue. This is a collective EPD in which the life cycle assessment has been calculated for the product within a group that represents the highest environmental impact within this group. A list of association members can be found on the website of the association.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Issue date
08.08.2014

Valid to
07.08.2019

Verification

The CEN Norm EN 15804 serves as the core PCR
Independent verification of the declaration according to ISO 14025
☐ internally ☒ externally

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dr. Burkhart Lehmann
(Managing Director IBU)

Matthias Schulz
(Independent tester appointed by SVA)

2. Product

2.1 Product description

SikaHyflex160 Construction, SikaHyflex250 Facade, SikaHyflex-220 Window, Sikaflex Construction+, Sikaflex AT Connection, Sikaflex AT Facade and Sikaflex PRO-1 (hereinafter called Sikaflex and SikaHyflex sealants) are reaction resins that are polyurethane- or SMP-based, filled, and solvent free. The reaction resins are manufactured as a single-component product using polyols (mineral oil-based or using renewable raw materials).
Reaction resins based on silane-modified polymers (SMP) are manufactured analogously from polyols and alkoxy silane precursors, mostly as a single-component product.The aqueous systems can be formulated on the resin or the hardener side as aqueous dispersions. The products meet a variety of often special requirements in the construction, furnishing and refurbishment of buildings.
As a representative product, the product with the greatest environmental impact was selected to use in calculating the life cycle assessment.

2.2 Application

Adhesives and sealants
Sikaflex and SikaHyflex sealants: solvent-free, low-emission joint sealants suitable for interior and exterior construction joints and expansion joints in building envelopes.

2.3 Technical Data

Adhesives and sealants

SikaHyflex 160 Construction, Sikaflex AT Connection and Sikaflex Construction+ conform to the requirements of ISO 11600 F 25HM.

SikaHyflex 250 Facade, SikaHyflex 220 Window, Sikaflex AT Facade and Sikaflex PRO1 conform to the requirements of ISO 11600 F 25LM.

Further information on technical properties and emissions is provided in the Product Date Sheets issued by the Sika companies in each country.

Building Material Data

Name	Value	Unit
Density	1,25-1,5	kg/cm²
Tensile shear strength as per DIN EN 14293	no relevant	N/mm²
Tensile bond strength as per DIN EN 14293	no relevant	N/mm²

2.4 Placing on the market / Application rules

Adhesives and sealants

Prerequisite for placement on the market and use in Europe is the CE label declaring conformity with EN 15651 “Sealants for non-structural use in joints in buildings and pedestrian walkways”.
Sikaflex and SikaHyflex sealants conform to the requirements of EN 15651--1, sealants for facade elements.

2.5 Delivery status

Sealants in aluminium or plastic cartridges and foil packs made of composite foil materials. Typical container sizes hold 290 and 300 ml (cartridges) or 600 ml (foil packs) of material. Barrels containing about 200 kg are available for more extensive applications. For the life cycle assessment, a ratio of 1:2 was used for the proportion of metal to plastic packaging materials.

2.6 Base materials / Ancillary materials

Sikaflex and SikaHyflex sealants, single-component reaction resins, polyurethane- or SMP-based, filled and solvent free, which harden in the presence of moisture without the addition of resin components, are made of pre-polymers based on MDI, TDI, HDI, IPDI or such with alkoxy silane end groups.

On average, the products covered by this EPD contain the stated base materials and ancillary materials in the following ranges:
Resin components: 20-40 %
Hardener components: 0-5 %
Plasticizers: 20-40 %
Fillers: 30-50 %
Other: 0-10 %
Additives/Pigments: ~ 0-30 %

More detailed information is available in the manufacturer’s documentation for the various products (e.g. Product Data Sheets).
In individual cases, it may be that a product contains substances in concentrations exceeding 0.1% on the candidate list of substances of very high concern for inclusion in Annex XIV of the REACH regulation. If this is the case, the relevant information can be found in the corresponding Safety Data Sheet in Chapter 15.

2.7 Manufacture

The formulated product components are generally mixed from the constituents in batches in filled into the containers for delivery. In this process, quality and environmental standards in accordance with DIN ISO 9001:2008-12 and provisions of applicable regulations such as the OH&S Law or Emission Control Law are observed.

2.8 Environment and health during manufacturing

In general, environmental measures beyond the legally prescribed ones are not necessary.

2.9 Product processing/Installation

Sikaflex and SikaHyflex sealants are reaction resins (filled) and are normally applied using cartridge and foil pack applicators. In this process, any OH&S measures prescribed in the Safety Data Sheet and indicated by conditions on the site must be implemented and strictly observed.

2.10 Packaging

A detailed description of the packaging is given in Chapter 2.5. Fully emptied containers and unsoiled foils can be recycled. Reusable wooden pallets are taken back by building materials companies (refundable deposit for pallets), who return them to the building material manufacturers, who reuse them in their production process.

2.11 Condition of use

In the use phase, polyurethane- or SMP-based, filled and solvent-free reaction resins have hardened and consist essentially of an inert, three-dimensional network.They are durable products, used as adhesives, coatings or sealants in buildings, thereby contributing to the functionality and preservation of value of buildings.

2.12 Environment and health during use

Option 1

Products for use outside of habitable spaces

During use, polyurethane- or SMP-based, filled and solvent-free reaction resins have lost their reactivity and behave inertly.No known risk to water, air or soil is caused by proper use of the products.

Option 2

Products for use within habitable spaces

Evidence of emission behaviour of building products in contact with indoor air must be provided for applications in habitable spaces. Sikaflex and SikaHyflex facade sealants meet the following internationally recognized assessment schemes: EMICODE® EC1+ of the GEV (Gemeinschaft Emissionskontrollierte Verlegewerkstoffe, Klebstoffe und Bauprodukte e.V., Düsseldorf), the AFFSET VOC Scheme and the A+ VOC Regulation.No further influence of released substances on the environment and health is known.

2.13 Reference service life

Polyurethane- or SMP-based, filled and solvent-free reaction resins meet a variety of often special requirements in the construction or refurbishment of buildings. Their use significantly improves the usability of buildings and significantly extends the original service life.The expected reference service life is dependent upon the specific situation in which the product is applied and the associated exposure. It can be influenced by weathering as well as mechanical or chemical exposure.

2.14 Extraordinary effects

Fire

Even without any special fire-resistance treatment, the polyurethane-based reaction resins meet or exceed the requirements of DIN EN 13501-1 for Fire Class E respectively Efl. Furthermore, in consideration of the amounts of materials used, they have only a minor influence on the fire properties of the building in which they are applied. Cross-linked polyurethane resins do not melt and do not form burning droplets; thus the resins do not contribute to the spread of fire.

Fire protection

Name	Value
Building material class	-
Burning droplets	-
Smoke gas development	-

Water

The polyurethane- or SMP-based, filled and solvent-free reaction resins are chemically inert and are not water soluble. They are commonly used to protect buildings against damaging water infiltration and floodwater damage.

Mechanical destruction

The mechanical destruction of polyurethane- or SMP-based reaction resins does not lead to any decomposition products that endanger the environment or health.

2.15 Re-use phase

According to current knowledge, in general, no damaging environmental effects are to be expected from the de-construction and valorisation of building components onto which polyurethane or SMP has hardened, and no detrimental environmental effects are to be expected from disposal in landfills.
When polyurethane or SMP systems can be removed from the building components without considerable expense, thermal utilisation is a sensible valorisation option, in consideration of the embodied energy.

2.16 Disposal

Residual product that cannot be used should be left to harden.Hardened residual product is not special waste.Non-hardened residual product is special waste. Fully emptied and dried out containers (scraped clean and containing no moisture) are to be recycled. Residual product is to be disposed of properly in accordance with local laws and the instructions given in the Safety Dated Sheet.The following EAK/AVV waste codes may apply:

Hardened residual product:

0 080410 Adhesive and sealant waste, except for those in category 08 04 09.

2.17 Further information

Further information can be found in the Product Data Sheets or the Safety Data Sheets issued by the Sika companies in each country. These are available through the websites of the local Sika companies or on request. Useful technical information is also available through the websites of the professional associations.

For example, TKB data sheets are available at www.klebstoffe.com and information provided by Deutsche Bauchemie is available at www.deutsche-bauchemie.de.

3. LCA: Calculation rules

3.1 Declared Unit

The collective EPD applies to the declared unit of 1 kg reaction resin product.

For Sikaflex and SikaHyflex sealants, the volume of product applied depends on the building components being treated.

In this EPD a life cycle analysis for filled, solvent-free, polyol-containing, PU-based reaction resin product has been calculated.
The product with the greatest environmental impact in the product groups has been declared.

Declared unit data

Name	Value	Unit
Declared unit	1	kg
Conversion factor to 1 kg	1	-

3.2 System boundary

The life cycle assessment takes the modules A1/A2/A3, A4, A5 and D into account:

- A1 Manufacture of pre-products
- A2 Transport to the factory
- A3 Production including energy supply, manufacture of packaging, ancillary materials and consumables and waste disposal
- A4 Transport to the building site
- A5 Installation (disposal of packaging as well as emissions during installation)
- D Credits for the incineration of packaging materials and recycling of metal containers

This declaration is of the type “Cradle to gate with options”.

3.3 Estimates and assumptions

Individual recipe components for which no specific GaBi process was available were estimated in consideration of the manufacturer’s documentation or literature.

3.4 Cut-off criteria

No cut-off rules were used in calculating the life cycle assessment. All raw materials that were sent by the associations for the recipes were taken into account.

The manufacturing of the production machines and systems and associated infrastructure used were not taken into account in the LCA.

3.5 Background data

Data from the GaBi 5 database were used as background data. For cases in which no background data was available, additional manufacturer's information and literature research was used.

3.6 Data quality

For this representative EPD, representative products were selected and the LCA calculated for the product in the group with the greatest environmental impact. The data sets are not older than 7 years. The data were extracted from the GaBi 5:2010 database and are therefore consistent as a set.

3.7 Period under review

The period under review is production year 2011.

3.8 Allocation

No allocations were used for production. For the incineration of packaging, a multi-input allocation was used with a credit for electrical and thermal energy, using the simple credit method. Benefits for the disposal of packaging are credited in Module D.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account. In this case, 1 kg of reaction resin was chosen as the declared unit. Depending on the application, an appropriate conversion factor must be used, e.g. specific mass per unit area.

Basically, a comparison or assessment of EPD data is possible only if all data sets to be compared are compiled in accordance with EN 15804 and if the building context, or the product-specific performance characteristics, is taken into account.

4. LCA: Scenarios and additional technical information

The following technical information serves as a basis for the declared modules or can be used for the development of specific scenarios in the context of a building assessment in case the modules are not declared (MND).

Transport to the building site (A4)

Name	Value	Unit
Litres of fuel	0.0016	l/100km
Transport distance	500	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	900 - 1300	kg/m^3
Capacity utilisation volume factor	100	-

Installation into the building (A5)

Name	Value	Unit
Material loss	0.01	kg

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARYS
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement[1)]	Refurbishment[1)]	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg reactive resin based on polyurethane or SMP, filled or aqueous/solvent-free

Parameter	Unit	A1 - A3	A4	A5	D
Global warming potential	[kg CO_2-Eq.]	4.660E+0	2.580E-2	1.250E-1	-1.250E-1
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	3.400E-8	1.380E-12	4.500E-12	-1.340E-10
Acidification potential of land and water	[kg SO_2-Eq.]	1.430E-2	1.640E-4	1.450E-5	-3.150E-4
Eutrophication potential	[kg $(PO_4)^{3-}$- Eq.]	2.670E-3	4.060E-5	2.940E-6	-2.770E-5
Formation potential of tropospheric ozone photochemical oxidants	[kg Ethen Eq.]	2.500E-3	-7.030E-5	1.300E-6	-4.390E-5
Abiotic depletion potential for non fossil resources	[kg Sb Eq.]	2.550E-5	1.180E-9	1.820E-9	-6.350E-9
Abiotic depletion potential for fossil resources	[MJ]	8.700E+1	3.560E-1	2.960E-2	-1.660E+0

RESULTS OF THE LCA - RESOURCE USE: 1 kg reactive resin based on polyurethane or SMP, filled or aqueous/solvent-free

Parameter	Unit	A1 - A3	A4	A5	D
Renewable primary energy as energy carrier	[MJ]	3.180E+0	-	-	-
Renewable primary energy resources as material utilization	[MJ]	0.000E+0	-	-	-
Total use of renewable primary energy resources	[MJ]	3.180E+0	1.420E-2	2.190E-3	-6.740E-2
Non renewable primary energy as energy carrier	[MJ]	6.940E+1	-	-	-
Non renewable primary energy as material utilization	[MJ]	1.980E+1	-	-	-
Total use of non renewable primary energy resources	[MJ]	8.920E+1	3.560E-1	2.960E-2	-1.660E+0
Use of secondary material	[kg]	0.000E+0	-	-	-
Use of renewable secondary fuels	[MJ]	1.500E-3	3.010E-6	4.010E-7	7.660E-4
Use of non renewable secondary fuels	[MJ]	1.540E-2	3.160E-5	4.200E-6	8.070E-3
Use of net fresh water	[m^3]	2.650E+0	1.320E-3	2.530E-3	-6.090E-2

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg reactive resin based on polyurethane or SMP, filled or aqueous/solvent-free

Parameter	Unit	A1 - A3	A4	A5	D
Hazardous waste disposed	[kg]	-	-	-	-
Non hazardous waste disposed	[kg]	5.880E+0	1.880E-3	5.940E-3	-6.310E-1
Radioactive waste disposed	[kg]	1.940E-3	5.030E-7	1.520E-6	-3.570E-5
Components for re-use	[kg]	-	-	-	-
Materials for recycling	[kg]	-	-	-	-
Materials for energy recovery	[kg]	-	-	-	-
Exported electrical energy	[MJ]	-	-	1.770E-1	-
Exported thermal energy	[MJ]	-	-	4.270E-1	-

Indicator "Hazardous waste to landfill": No declaration as per in accordance SVA resolution of 4.10.2012

6. LCA: Interpretation

Non-renewable primary energy requirements (PENRT) are clearly dominated (> 90%) by the manufacture of pre-products (Module A1). This high percentage is dominated by energy-intensive production of petroleum-based pre-products. In contrast, fillers account for very little PENRT.

The share of **renewable primary energy resources** within total energy consumption is small, about 3%. This low figure is mainly due to the percentage of renewable energy resources in the German electricity mix as well as the wooden pallets used for packing.

The main influencing factor for G**lobal Warming Potential (GWP)** is the provision of the energy-intensive petroleum-based pre-products (up to about 90%). During manufacturing (A3), about 5% of the greenhouse gases are emitted, with the manufacturing of packaging playing greatest role. Carbon dioxide emissions (> 90%), are the main cause of GWP.

Ozone Depletion Potential (ODP) is dominated (> 90%) by the manufacture of pre-products. However, the manufacture of pigment (TiO2) and zeolite can each measurably contribute to ODP, depending on the amounts in the specific recipe. In Module A3, the manufacture of reaction resins also has a significant influence on ODP. All other modules are not relevant to ozone depletion potential. The main drivers in both

cases are halogenated organic emissions from the German electricity mix (chiefly R114).

Causes of **Acidification Potential (AP)** are chiefly nitrogen oxide and SO2, which, as in all other modules, are produced mainly during the manufacture of pre-products (A1) and the products themselves (A3). The petroleum-based pre-products contribute significantly to AP. Module A3 also measurably influences AP, mainly due to the manufacture of packaging materials.

Eutrophication Potential (EP) is dominated (> 90%) by the manufacture of pre-products, with petroleum-based pre-products playing the main role. In Module A3, which has only a very minor influence on EP, most emissions are attributed to the manufacture of packaging materials and electricity use. The main causes of EP are various nitrogen oxide emissions in the air and acid emissions in the water.

Photochemical **Ozone Creation Potential (POCP)** is also dominated by the manufacture of petroleum-based pre-products, with results > 85%.

7. Requisite evidence

7.1 VOC Evidence

Special testing and evidence was not conducted or collected as part of this representative Environmental Product Declaration.
If the products are to be used in an application area (e.g. habitable indoor spaces) in which testing/evidence of VOC emissions within a habitable space is required, then basically the evidence should be stated in the separate EPDs.
For selected products or applications (e.g. use in habitable spaces) VOC evidence can be provided. The following limiting values apply (maximum values in [µg/m³]):

Measurement methods: GEV test methods to determine emissions of volatile organic compounds from building products in accordance with DIN EN ISO 16000 Part 3, Part 6, Part 9, Part 11 in a test chamber.

Testing for CMR substances and TVOC/TSVOC after 3 and 28 days.

The corresponding test certificate (e.g. EMICODE certificate, *Blauer Engel* in accordance with RAL 113) serves as **evidence**. The findings are to be stated in terms of emissions classes. Compare with Chapter 2.12.

Classification /EMICODE
EC 1 PLUS

Name	Value	Unit
TVOC (C6 - C16)	750/60	µg/m³
Sum SVOC (C16 - C22)	40	µg/m³
R (dimensionless)	1	-
VOC without NIK	40	µg/m³
Carcinogenic Substances	50/50	µg/m³

8. References

Institut Bauen und Umwelt
Institut Bauen und Umwelt e.V., Berlin (pub.): Generation of Environmental Product Declarations (EPDs);

ISO 14025
DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804
EN 15804:2012-04+A1 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

ISO 7389
Building construction — Jointing products — Determination of elastic recovery of sealants

ISO 8340
Building construction — Sealants — Determination of tensile properties at maintained extension

ISO 11600
Building construction — Jointing products — Classification and requirements for sealants

DIN EN 14293
Adhesives –
Adhesives for bonding parquet to subfloor –
Test methods and minimum requirements;

EN 15651-1
Sealants for non-structural use in joints in buildings and pedestrian walkways – Part 1: Sealants for facade elements

PCR 2011, Teil A
Institut Bauen und Umwelt e.V., Königswinter (Hrsg.): Product Category Rules for construction products from the programme for Environmental Product Declarations
of the Institut Bauen und Umwelt (IBU) Part A: Calculation rules
for Life Cycle Assessments and requirements for background reports. 2011-07
www.bau-umwelt.de

PCR 2011, Teil B:
Product Category Rules for construction products Part B: Requirements for EPDs for reaction resin products. 2012-10
www.bau-umwelt.de

DIN EN 13501-1:
Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests; German version EN 13501-1:2007 + A1:2009.

DIN EN ISO 9001:
Quality management systems – Requirements (ISO 9001:2008) trilingual version
EN ISO 9001:2008

DIN EN ISO 16000-3:
Indoor air - Part 3: Measurement of formaldehyde and other carbonyl compounds; Sampling with a pump (ISO 16000-3:2001)

DIN EN ISO 16000-6:
Indoor air - Part 6: Determination of VOCs in indoor air and in test chambers, sampling on TENAX TA®, thermal desorption and gas chromatography with MS/FID (ISO 16000 - 6:2004)

DIN EN ISO 16000-9:
Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method (ISO 16000-9:2006); German version EN ISO 16000-9:2006

DIN EN ISO 16000-11:
Indoor air - Part 11: Determination of the emission of volatile organic compounds from building products and furnishing - Sampling, storage of samples and preparation of test specimens (ISO 16000-11:2006); German version EN ISO 16000-11:2006

GaBi 5 2010
GaBi 5: Software and database for life cycle assessments.
LBP, Stuttgart University and PE International, 2011.

GaBi 5 2010b
GaBi 5: Documentation of the GaBi 5 data sets of the database for life cycle assessments. LBP, Stuttgart University and PE International, 2011.
http://documentation.gabi-Software
SMP= silane-modified polymers
MDI = Methyl endiphenyl diisocyanate
TDI = Toluene diisocyanate
HDI = Hexamethylene diisocyanate
IPDI = Isophorone diisocyanate

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