

Declaration of conformity for products with Model EPDs

The manufacturer association Deutsche Bauchemie, of which Sika Deutschland GmbH is a member, has developed so-called Model Environmental Product Declarations (Model EPDs) and had them independently verified by the Institute Construction and Environment (IBU). These IBU verified Model EPDs have been made publicly available by the Deutsche Bauchemie and the Institute Construction and Environment. Based on the product formulations it was checked if our products were covered by the Model EPDs.

This Declaration confirms that the product

Sikafloor®-235 ESD

is covered by the attached Model EPD „*Reactive resins based on epoxy resin, filled and/or aqueous filled*“, number 3b: *with a low filler material content (Declaration number: EPD-DIV-2012131-E)*. This means that the Life Cycle Assessment (LCA) data and the remaining content of the attached Model EPD apply to the above mentioned product and may thus be used for the evaluation of the sustainability of buildings where the product is applied.

Sika Services AG

A handwritten signature in blue ink, appearing to read "M. Schneider".

Mark Schneider

Head Global Product Sustainability

A handwritten signature in blue ink, appearing to read "Luc Leforestier".

Luc Leforestier

Head Market Field Flooring

Zurich, July 2014

MODEL ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Declaration holder	DBC / IVK / VdL
Publisher	Institut Bauen und Umwelt (IBU)
Programme holder	Institut Bauen und Umwelt (IBU)
Declaration number	EPD-DIV-2012131-E
Issue date	18.11.2012
Validity	17.11.2017

Reactive resins based on epoxy resin, filled and/or aqueous filled
Deutsche Bauchemie e.V. (DBC)
Industrieverband Klebstoffe e.V. (IVK)
Verband der deutschen Lack- und Druckfarbenindustrie e.V. (VdL)

www.bau-umwelt.de



Institut Bauen
und Umwelt e.V.

 **DEUTSCHE
BAUCHEMIE**

 **Industrieverband
Klebstoffe e.V.**

 **Verband der deutschen
Lack- und Druckfarbenindustrie e.V.**



1 General information

<p>Deutsche Bauchemie e.V. Industrieverband Klebstoffe e.V. Verband der deutschen Lack- und Druckfarbenindustrie e.V.</p>	<p>Reactive resins based on epoxy resin, filled and/or aqueous filled</p>
<p>Programme holder IBU - Institut Bauen und Umwelt e.V. Rheinufer 108 D-53639 Königswinter</p>	<p>Holder of the Declaration Deutsche Bauchemie e.V. Mainzer Landstr. 55, D-60329 Frankfurt Industrieverband Klebstoffe e.V. Völklinger St. 4, D-40219 Düsseldorf Verband der deutschen Lack- und Druckfarbenindustrie e.V., Mainzer Landstr. 55, D-60329 Frankfurt</p>
<p>Declaration number EPD-DIV-2012131-E</p>	<p>Declared product/unit 1 kg / 1 kg; density 1.1 - 2.5 g/cm³</p>
<p>This Declaration is based on the Product Category Rules: PCR Reaction Resin Products, 06-2011 (PCR tested and approved by the independent Expert Committee (SVA))</p>	<p>Area of applicability: This validated Declaration entitles the holder to bear the symbol of the Institut Bauen und Umwelt e.V. It exclusively applies for plants in Germany and the product groups referred to for a period of five years from the date of issue. The Declaration holder is liable for the details and documentation upon which the evaluation is based. This involves an association EPD for which the product of a group was selected which displays the highest environmental pollution in this group in order to calculate the Life Cycle Assessment. The members of the associations are indicated on the association homepages.</p>
<p>Issue date 18.11.2012</p>	<p>Verification The CEN DIN EN 15804 standard serves as the core PCR.</p>
<p>Valid until 17.11.2017</p>	<p>Verification of the EPD by an independent third party in accordance with ISO 14025</p>
	<p><input type="checkbox"/> internal <input checked="" type="checkbox"/> external</p>
<p>Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)</p>	
	 Matthias Schulz (Unabhängiger Prüfer vom SVA bestellt)

2 Product

2.1 Product description

Reactive resins based on epoxy resin, filled and/or aqueous filled

The reactive resins are manufactured in a two-component process using reactively-diluted epoxy resins and polyamines. The aqueous systems can be formulated as aqueous dispersions on the resin or hardening agent side.

They comply with multiple, often specific tasks in the construction, fitting and repair of structures. By using reactive resins based on epoxy resin, filled and/or aqueous filled, the fitness for use of structures is decisively improved and their life time significantly extended.

The product with the most extensive environmental impact was applied as a representative product for calculating the results of the Life Cycle Assessment.

2.2 Application

Reactive resins based on epoxy resin, filled and/or aqueous filled, are used in the following applications:

Module 1: Reactive resins for protecting and repairing concrete structures

Products for **surface protection of concrete**, for increasing the durability of concrete and reinforced concrete structures as well as for new concrete and for maintenance and repair work (Requirements 1.1); products for **structural and non-structural repair** used for restoring the original condition of concrete structures and/or replacing faulty concrete

and providing reinforcements with protection (Requirements 1.2); products for **structural bonding** for the structural bonding of strengthening materials to an existing concrete structure (Requirements 1.3) and **products for concrete injection** for filling cracks, voids and interstices in concrete (Requirements 1.4).

Module 2: Reactive resins for liquid applied roof waterproofing kits

Reactive resins for waterproofing roof constructions which are applied on the construction site

Module 3: Reactive resin primer for bridge waterproofing

Primer for bridge waterproofing for use on bridges made of concrete

Module 4: Reactive resins as adhesive for tiles

Tile adhesives for internal and external tile installations on walls, floors and ceilings.

Module 5: Reactive resins for watertight covering kits

Watertight covering kits for wetroom floors and/or walls inside buildings

Module 6: Reactive resins for liquid applied waterproofings for buildings

Liquid plastics for waterproofing buildings

Module 7: Screed material and floor screeds

Products for screed / synthetic resin screed for use in floor constructions

Module 8: Reactive resins for waterproofing components made of concrete or brickwork and for pre-treating mineral sub-surfaces such as screed or concrete flooring prior to flooring, parquet and tiling work

Applications in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

Module 9: Reactive resins for optical design of concrete components

Products for usually coloured design of concrete accompanied by less-specified surface protection and improved durability of concrete and reinforced concrete surfaces. The same applies for other mineral sub-surfaces such as plaster, stone and brickwork.

On account of the susceptibility of epoxy resin layers to weathering factors (yellowing, whitening after extensive weathering), a final polyurethane-based coating is usually applied to epoxy layers in outdoor applications.

2.3 Technical data

Module 1: Reactive resins for protecting and repairing concrete structures

The minimum requirements must be maintained in accordance with DIN EN 1504 "Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity. These are:

- 1.1 Surface protection systems for concrete – Requirements on performance characteristics for all intended uses in accordance with EN 1504-2, Tables 1 and 5:
 - Permeability to CO₂ (EN 1062-6)

- Water vapour permeability (EN ISO 7783-1/-2)
- Capillary absorption and permeability to water (EN 1062-3)
- Adhesion strength by pull off test (EN 1542)

- 1.2 Products for structural and non-structural repair – Requirements on performance characteristics for all intended uses in accordance with EN 1504-3, Tables 1 and 3:
 - Compressive strength (EN 12190)
 - Chloride content (EN 1015-17)
 - Adhesive bond (EN 1542)

- 1.3 Products for structural bonding– Performance characteristics for all intended uses in accordance with Tables 3.1 and 3.2 (manufacturer's Declaration of Conformity / Declaration of Performance)

- 1.4 Products for concrete injection for filling cracks, voids and interstices in concrete– Requirements on performance characteristics for all intended uses in accordance with EN 1504-5, Table 3:
 - Injectability (EN 1771)
 - Viscosity (EN ISO 3219)
 - Workable life (EN ISO 9514)

- Other performance characteristics in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

Other performance characteristics in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

Module 2: Reactive resins for liquid applied roof waterproofing kits

The minimum requirements of ETAG 005 "Guideline for European technical approval of liquid-applied roof waterproofing kits" must be maintained.

The performance requirements must be indicated in accordance with the European Technical Approval (ETA, no.).

Module 3: Reactive resins for liquid-applied bridge deck waterproofing kits

3.1 The requirements of ZTV ING Part 7, section 3 (ZTV BEL-B, Part 3) must be maintained.

3.2 The minimum requirements of ETAG 033 "Guideline for European technical approval of liquid-applied bridge deck waterproofing kits" must be maintained.

The performance characteristics must be indicated in accordance with the European Technical Approval (ETA, no.).

Module 4: Reactive resins as adhesive for tiles

The minimum requirements in accordance with DIN EN 12004 "Adhesive for tiles – Requirements, evaluation of conformity, classification and designation" must be maintained. These are:

- Initial shear adhesion strength (EN 12003)
- Shear adhesion strength after water immersion (EN 12003)
- Open time: tensile adhesion strength (EN 1346)

Other performance characteristics in accordance with the manufacturer's technical documentation /

Declaration of Performance / Declaration of Conformity

Module 5: Reactive resins for watertight covering kits

5.1 The minimum requirements of the ETAG 022 "Guideline for European technical approval of watertight covering kits for wetroom floors and/or walls" must be maintained.

The performance characteristics must be indicated in accordance with the European Technical Approval (ETA, no.).

5.2 The minimum requirements of the "Test principles for granting a general building authority approved test certificate for liquid applied waterproofing materials used in conjunction with tiles and paving. Part 1: Liquid waterproofing materials (PG-AIV-F)" must be observed.

The features must be indicated in accordance with the "Test principles for granting a general building authority approved test certificate for liquid waterproofing materials used in conjunction with tiles and paving. Part 1: Liquid waterproofing materials (PG-AIV-F)".

Module 6: Reactive resins for liquid applied waterproofings for buildings

The minimum requirements of the "Test principles for granting a general building authority approved test certificate for waterproofing buildings with liquid plastics" must be maintained.

The performance characteristics for the proof of applicability must be indicated in accordance with the "Test principles for granting a general building authority approved test certificate for waterproofing buildings with liquid plastics".

Module 7: Screed material and floor screeds

The minimum requirements of the EN 13813 "Screed material and floor screeds – Screed materials – Properties and requirements" must be maintained. For synthetic resin screeds, these are:

- Bond strength (EN 13892-8)
- Reaction to fire (EN 13501-1)

Other performance characteristics in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

Module 8: Reactive resins for waterproofing components made of concrete or brickwork and for pre-treating sub-surfaces such as screed or concrete flooring prior to flooring, parquet and tiling work

The following minimum requirements must be complied with:

Property	Standard	Unit	Value
Viscosity	EN ISO 3219	Pa·s	< 200
Shore hardness A	DIN 53505	-	> 50
Shore hardness D	DIN 53505	-	> 25
Density	EN ISO 2811	kg/dm ³	0.9 – 2

Other performance characteristics in accordance with the manufacturer's technical documentation /

Declaration of Performance / Declaration of Conformity

Module 9: Reactive resins for optical design of concrete components

Physical data on the coating material and/or coating must be indicated in accordance with the respective product standards; these can include, for example:

- Viscosity EN ISO 3219
- Density EN ISO 2811
- Pendulum damping ISO 1522
- Reaction to fire 13501-1
- Adhesive pull strength EN 13892-8

Other performance features in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

2.4 Placing on the market / Application rules

Module 1: Reactive resins for protecting and repairing concrete structures

A prerequisite for placing on the market and application in Germany is the CE marking indicating conformity with the DIN EN 1504 "Products and systems for the protection and repair of concrete structures". The contents of the CE marking based on DIN EN 1504 must comply with the respective application rules in Part II of the List of Technical Building Regulations.

Module 2: Reactive resins for liquid applied roof waterproofing kits

A prerequisite for placing on the market and application in Germany is the CE marking indicating conformity with the ETAG 005 "Guideline for European technical approval of liquid applied roof waterproofing kits". The contents of the CE marking based on ETAG 005 must comply with the respective application rules in Part II of the List of Technical Building Regulations.

Module 3: Reactive resins for liquid applied bridge waterproofing kits

A prerequisite for placing on the market and application in Germany is the CE marking indicating conformity with the ETAG 033 "Guideline for European technical approval of liquid applied bridge waterproofing kits". The contents of the CE marking based on ETAG 033 must comply with the respective application rules in Part II of the List of Technical Building Regulations.

Module 4: Reactive resins as adhesive for tiles

A prerequisite for placing on the market and application in Germany is the CE marking indicating conformity with the DIN EN 12004 "Adhesive for tiles". The contents of the CE marking based on DIN EN 12004 must comply with the respective application rules in Part II of the List of Technical Building Regulations.

Module 5: Reactive resins for watertight covering kits

5.1 A prerequisite for placing on the market and application in Germany is the CE marking indicating conformity with the ETAG 022 "Guideline for European technical approval of watertight covering kits for wetroom floors and/or walls". The contents of the CE marking based on ETAG 022 must comply with the respective application rules in Part II of the List of Technical Building Regulations.

5.2 A prerequisite for application in Germany is marking with the compliance symbol ("Ü-Zeichen") based on a general building authority approved test certificate in accordance with Building Rules List A, Part 2, no. 2.50.

Module 6: *Reactive resins for liquid applied waterproofings for buildings*

A prerequisite for application in Germany is marking with the compliance symbol (Ü-symbol) based on a general building authority approved test certificate in accordance with Building Rules List A, Part 2, no. 2.51.

Module 7: *Screed material and floor screeds*

A prerequisite for placing on the market and application in Germany is the CE marking indicating conformity with the DIN EN 13813 "Screed material and floor screeds – Screed materials – Properties and requirements". The contents of the CE marking based on DIN EN 13813 must comply with the respective application rules in Part II of the List of Technical Building Regulations.

Module 8: *Reactive resins for waterproofing components made of concrete or brickwork and for pre-treating mineral sub-surfaces such as screed or concrete flooring prior to flooring, parquet and tiling work*

The DIN or comparable national or international sets of rules (please refer to CEN/TS 14472, Parts 1-4 and CEN/TS 15717) are of relevance for performing parquet or flooring work.

Module 9: *Reactive resins for optical design of concrete components*

If available, the respective standard and/or general technical approval or comparable national or international regulation must be indicated.

Special applications in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

Special applications in accordance with the manufacturer's technical documentation / Declaration of Performance / Declaration of Conformity

2.5 Delivery status

Liquid, pasty or earth-moist in containers made of tinplate or plastic, in separate or combined containers, appropriately packed in the application-friendly mixing ratio.

Typical container sizes contain 1 to 40 kg of material.

For larger applications, vats with approx. volumes of 200 kg or IBCs with a capacity in excess of 1 tonne are also used.

A sheet steel container was modelled for the Life Cycle Assessment.

2.6 Base materials / Auxiliaries

Reactive resins based on epoxy resin, filled and/or aqueous filled, comprise resin and hardening agent components. Aqueous, filled systems can be formulated as aqueous dispersions on the resin or hardening agent side.

The resin component contains low-molecular epoxy resins based on Bisphenol-A and Bisphenol-F Diglycidether. Reactive diluting agents (Glycidether) based on aliphatic alcohol are used for viscosity adjustment. Hardening occurs when installed on site

with the amine component. Polyamines and polyamine adducts based on IPD, MXDA, TMD and TEPA are used for this purpose. The components can contain accelerators, catalysts, wetting agents, foam regulators, inert diluting agents (no solvents) for fine adjustment of the product properties as auxiliaries (restrictions governing application or placing on the market must be observed).

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The mixing ratio for resin and hardener is adjusted in accordance with the stoichiometric requirements. Product hardening starts immediately after mixing the components.

On average, the products covered by this EPD contain the following range of base materials and auxiliaries:

For EPD 3a:

Resin component: ~ 5-50%

Hardener component: ~ 5-15%

Reactive diluting agent: ~ 0-20%

Filler material: 20-70%

Water: 0-10%

Other: ~ <4%

For EPD 3b:

Resin component: ~ 45-65%

Hardener component: ~ 10-15%

Reactive diluting agent: ~ 15-30%

Filler material: 5-15%

Other: ~ <1.5%

The ranges referred to above are average values and the composition of products complying with the EPD can deviate from the concentration volumes referred to in individual cases. Deviations are possible. More detailed information is provided by the respective manufacturer (e.g. product data sheets).

In individual cases, it is possible that substances on the list of particularly harmful substances for inclusion in Annex XIV of the REACH Ordinance are included in concentrations of more than 0.1%. If this is the case, this information can be found in the respective safety data sheet.

2.7 Production

The formulated product components are usually combined in batch mode and packed in the delivery containers, whereby quality and environmental standards to DIN ISO 9001 and the conditions of relevant regulations such as the Ordinance on Industrial Safety and Health or the Pollution Control Act are observed.

2.8 Environment and health during manufacturing

As a general rule, no additional environmental protection measures are required over and beyond those which are specified by law.

2.9 Product processing/installation

Reactive resins based on epoxy resin (filled and/or water-filled) are typically processed by smoothing/scraping or rolling, pouring, spraying or injecting, whereby any possible health and safety measures (ventilation, respiratory equipment) must be performed and consistently observed in line with the

specifications in the safety data sheet and conditions on site.

Owing to their composition, epoxy resin products, filled and/or aqueous filled, are generally allocated to the GISBAU product code RE1 or RE2.

2.10 Packaging

Empty containers and clean foil can be recycled.

Reusable wooden pallets are returned to the building materials trade (reusable pallets against deposits) from where they are returned to the building product manufacturers and redirected into the production process.

2.11 Condition of use

During the use phase, reactive resins based on epoxy resin, filled and/or aqueous filled, are hardened and essentially comprise an inert, three-dimensional mesh.

They are durable products which protect our buildings in the form of adhesives, coatings or sealings and make a significant contribution towards their function and long-term value.

2.12 Environment and health during use

Option 1 – Products for applications outside public areas

During use, reactive resins based on epoxy, filled and/or aqueous filled, lose their reactivity and act inertly.

No risks are known for water, air and soil if the products are used as designated.

Option 2 – Products for applications in public areas

Applications in public spaces require the submission of evidence on the emission performance of building products in contact with indoor air. This can be evidence in accordance with the following check schemes, for example: AgBB-VOC scheme, EMICODE® of the GEV (Association for the Control of Emissions in Products for Flooring Installation, Adhesives and Construction Products, Düsseldorf). No further influences on the environment and health by emanating substances are known.

2.13 Reference Service Life (RSL)

Reactive resins based on epoxy resin, filled and/or aqueous filled, comply with various, often specific tasks associated with the construction or refurbishment of building structures. Use thereof decisively improves the usability of building structures and significantly extends their Reference Service Life.

The anticipated Reference Service Life depends on the specific installation situation and associated product exposure. It can be influenced by weather factors as well as by mechanical or chemical loads.

2.14 Extraordinary effects

Fire

Even without any special fire safety fittings, the reactive resins based on epoxy resins, filled and/or aqueous filled, comply with the minimum requirements in accordance with DIN EN 13501-1 for fire class E and E_{fl}. In terms of the quantity used, they only have a subordinate effect on the fire characteristics of a building in which they are installed.

As cross-linked epoxy resins involve a duroplastic material, it does not melt or drip with the result that the resins do not contribute to fire spread, whereas the combustibility of cross-linked epoxy resins is greater than that of other duroplastics. Among other substances, formaldehyde and phenol can form in the event of a fire.

Water

Reactive resins based on epoxy resin, filled and/or aqueous filled, are chemically inert and water-insoluble. They are often used for protecting building structures from harmful water ingress / the effects of flooding.

Mechanical destruction

Mechanical destruction of reactive resins based on epoxy resin does not lead to any decomposition products which are harmful to the environment or health.

2.15 Re-use phase

According to present knowledge, no environmentally-harmful effects are generally anticipated in land-filling, for example, as a result of de-construction and recycling of building materials to which hardened epoxy resin products are adherent.

2.16 Disposal

Individual components which can not be re-used must be mixed and hardened at a specified ratio.

Hardened residual products are not special waste.

Non-hardened residual products are special waste.

Empty, dry containers (non-dripping, scraped) are recycled.

Residual volumes must be disposed of properly under observation of local guidelines.

The following EWC/AVV waste keys can apply:

Hardened residual products:

080112 Waste paint and varnish with the exception of those covered by 08 01 11

080410 Waste adhesives and sealants with the exception of those covered by 08 04 09

2.17 Further information

More information is available in the manufacturers' product or safety data sheets on the manufacturers' Web sites or on request. Key technical information is also available on the associations' Web sites. For example, TKB leaflets are available at www.klebstoffe.com or information can be obtained from Deutsche Bauchemie at www.deutsche-bauchemie.de.

3 LCA: Calculation rules

3.1 Declared unit

The association EPD refers to the declared unit of 1 kg of reaction resin product in the mixing ratio required for processing both components. Consump-

tion per unit of area applied can range from only a few hundred grams to more than 1 kg per m². In the case of products which are injected, the application volume depends on the component to be injected.

For EPD 3a: A Life Cycle Assessment for solvent-free, filled and/or aqueous filled reaction resin products was calculated in this EPD.

For EPD 3b: A Life Cycle Assessment for solvent-free, highly-filled and/or aqueous reaction resin products was calculated in this EPD.

The product with the greatest environmental impact was declared from this product group.

3.2 System boundary

The Life Cycle Assessment takes consideration of Modules A1/A2/A3, A4, A5 and D:

- A1 Production of preliminary products
- A2 Transport to the plant
- A3 Production incl. provision of energy, production of packaging as well as auxiliaries and consumables and waste treatment)
- A4 Transport to the building site
- A5 Installation (disposal of packaging and emissions during installation)
- D Credits from incineration of packaging materials and recycling the metal containers

This EPD therefore involves a Declaration from "cradle to plant gate, with options".

3.3 Estimates and assumptions

Where no specific GaBi processes were available, the individual recipe ingredients were estimated on the basis of information provided by the manufacturer or literary references.

3.4 Cut-off criteria

No cut-off criteria were applied for calculating the Life Cycle Assessment. All raw materials sent by the associations for the formulations were taken into consideration.

Manufacturing of the machinery, plants and other infrastructure required for production of the products under review was not taken into consideration in the Life Cycle Assessments.

3.5 Background data

Data from the GaBi 5 data base was used as background data. Where no background data was available, it was supplemented by manufacturer information and literary research.

3.6 Data quality

Representative products were applied for this model EPD and the product applied for a group for calculating the LCA results which is associated with the greatest environmental impact. The data records are not older than 7 years.

3.7 Period under review

The period under review involves annual production for the year 2011.

3.8 Allocation

No allocations were applied for production. A multi-input allocation with a credit for electricity and thermal energy is used for packaging incineration based on the method of simple credits. The benefits incurred by packaging disposal are credited to Module D.

3.9 Comparability

In this case, 1 kg of reaction resin was selected as the declared unit. Depending on the application, a corresponding conversion factor must be considered such as the specific basis weight, for example.

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data records to be compared have been drawn up in accordance with EN 15804 and the building context and/or product-specific performance features are taken into consideration.

4 LCA: Scenarios and other technical information

The following technical information forms the basis for the declared modules or can be used for developing specific scenarios within the context of a building appraisal if modules are not declared (MND).

Transport to the building site (A4)

Litres of fuel	[type]: 0.00248 l/100 km
Transport distance	500 km
Capacity utilisation (including empty runs)	85%
Volume capacity utilisation factor	100%
Product bulk density	1200 to 2500 kg/m ³

Construction-installation process (A5)

Auxiliaries	0 kg
Water consumption	0 m ³
Other resources	0 kg
Electricity consumption	0 kWh
Other energy carriers	0 MJ
Material loss	0.01 kg
Output materials following waste treatment on the building site	0 kg
Dust emissions	0 kg
NM VOC emissions	0.02 kg

5 LCA: Results

SYSTEM BOUNDARIES (X = INCLUDED IN THE LCA; MND = MODULE NOT DECLARED)

Product stage	Construction process stage	Use stage	End-of-Life stage	Benefits and loads beyond the system boundary

Raw material supply	Transport	Production	Transport	Construction-installation process	Use	Maintenance	Repairs	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / Demolition	Transport	Waste processing	Landfilling	Re-use, recovery or 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

LCA RESULTS: ENVIRONMENTAL IMPACT – 1 kg EP reaction resin, filled and/or aqueous filled

		with a high filler material content				with a low filler material content			
		Production	Installation		Benefit	Production	Installation		Benefit
Parameter	Unit	A1-A3	A4	A5	D	A1-A3	A4	A5	D
GWP	[kg CO ₂ equiv.]	2.66E+00	2.51E-02	9.08E-02	-1.57E-01	6.09E+00	2.51E-02	9.08E-02	-1.57E-01
ODP	[kg CFC11 equiv.]	3.46E-08	1.35E-12	3.84E-12	-6.07E-11	4.42E-08	1.35E-12	3.84E-12	-6.07E-11
AP	[kg SO ₂ equiv.]	5.11E-03	1.59E-04	1.25E-05	-4.91E-04	9.06E-03	1.59E-04	1.25E-05	-4.91E-04
EP	[kg PO ₄ ³⁻ equiv.]	5.84E-04	3.95E-05	2.51E-06	-4.10E-05	1.30E-03	3.95E-05	2.51E-06	-4.10E-05
POCP	[kg ethene equiv.]	1.20E-03	-6.85E-05	7.22E-03	-7.22E-05	1.91E-03	-6.85E-05	7.22E-03	-7.22E-05
ADPE	[kg Sb equiv.]	1.10E-06	1.15E-09	1.64E-09	-6.81E-09	1.19E-05	1.15E-09	1.64E-09	-6.81E-09
ADPF	[MJ]	6.76E+01	3.47E-01	2.55E-02	-1.93E+00	1.20E+02	3.47E-01	2.55E-02	-1.93E+00
Legend	GWP = Global Warming Potential; ODP = Ozone Depletion Potential; AP = Acidification Potential of soil and water; EP = Eutrication Potential; POCP Photochemical Ozone Creation Potential; ADPE = Abiotic Depletion Potential for Elements; ADPF = Abiotic Depletion Potential of Fossil Fuels								

LCA RESULTS: USE OF RESOURCES – 1 kg EP reaction resin, filled and/or aqueous filled

		with a high filler material content				with a low filler material content			
		Production	Installation		Benefit	Production	Installation		Benefit
Parameter	Unit	A1-A3	A4	A5	D	A1-A3	A4	A5	D
PERE	[MJ]	2.22E+00	-	-	-	3.18E+00	-	-	-
PERM	[MJ]	7.30E-01	-	-	-	0.00E+00	-	-	-
PERT	[MJ]	2.95E+00	1.38E-02	1.87E-03	-3.41E-02	3.18E+00	1.38E-02	1.87E-03	-3.41E-02
PENRE	[MJ]	4.58E+01	-	-	-	9.22E+01	-	-	-
PENRM	[MJ]	2.27E+01	-	-	-	2.88E+01	-	-	-
PENRT	[MJ]	6.85E+01	3.47E-01	2.55E-02	-1.93E+00	1.21E+02	3.47E-01	2.55E-02	-1.93E+00
SM	[kg]	0	-	-	-	0	-	-	-
RSF	[MJ]	3.83E-04	2.94E-06	3.48E-07	1.44E-03	1.22E-03	2.94E-06	3.48E-07	1.44E-03
NRSF	[MJ]	4.00E-03	3.08E-05	3.64E-06	1.51E-02	1.28E-02	3.08E-05	3.64E-06	1.51E-02
FW*	[m ³]	8.45E-01	1.29E-03	2.13E-03	-2.07E-02	2.69E+00	1.29E-03	2.13E-03	-2.07E-02
Legend	PERE = Primary energy, renewable; PERM = Primary energy, renewable, used as raw materials; PERT = Total use of renewable primary energy; PENRE = Primary energy, non-renewable; PENRM = Primary energy, non-renewable, used as raw materials; PENRT = Total use of non-renewable primary energy; SM = Use of secondary materials; RSF = Renewable secondary fuels; NRSF = Non-renewable secondary fuels; FW = Use of fresh water resources								

* In accordance with the transition solution of 4.10.2012 approved by the SVA

LCA RESULTS: OUTPUT FLOWS AND WASTE CATEGORIES – 1 kg EP reaction resin, filled and/or aqueous filled

		with a high filler material content			with a low filler material content				
		Production	Installation		Benefit	Production	Installation		Benefit

Parameter	Unit	A1-A3	A4	A5	D	A1-A3	A4	A5	D
HWD	[kg]	-*	-*	-*	-*	-*	-*	-*	-*
NHWD	[kg]	2.87E+00	1.83E-03	7.73E-02	-9.63E-01	7.51E+00	1.83E-03	7.73E-02	-9.63E-01
RWD	[kg]	8.99E-04	4.90E-07	1.30E-06	-3.57E-06	2.26E-03	4.90E-07	1.30E-06	-3.57E-06
CRU	[kg]	-	-	-	-	-	-	-	-
MFR	[kg]	-	-	-	-	-	-	-	-
MER	[kg]	-	-	-	-	-	-	-	-
EE [electricity]	[MJ]	-	-	1.11E-01	-	-	-	1.11E-01	-
EE [thermal energy]	[MJ]	-	-	2.69E-01	-	-	-	2.69E-01	-
Legend	HWD = Hazardous waste, disposed of; NHWD = Non-hazardous waste, disposed of; RWD = Radioactive waste, disposed of; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Exported energy by type								

* In accordance with the transition solution of 4.10.2012 approved by the SVA

6 LCA: Interpretation

The main share of **non-renewable primary energy requirements** is necessitated by manufacturing of the preliminary products as it almost exclusively involves preliminary products from fossil resources which are usually energy-intensive in terms of manufacturing. The primary energy carriers used are natural gas and crude oil, whereby more than 95% of non-renewable primary energy is required for manufacturing the preliminary products (A1). Amine components in particular are associated with a very energy-intensive manufacturing process while the resin components have fewer effects on primary energy requirements. The share of **renewable primary energy** is proportionately low. The renewable share of the power mix is primarily apparent in A1, whereby the use of wooden pallets in packaging has the greatest impact in A3. Timber growth requires solar energy for photosynthesis which therefore appears as a renewable source of primary energy here.

The **Global Warming Potential (GWP)** is dominated by the manufacture of preliminary products (A1). Production of the actual epoxy resin product also has a tangible influence which is attributable to the energy required. During the installation process, packaging waste is incinerated with the result that the emissions incurred also have an influence on the GWP. The credits in Module D are primarily necessitated by the credit for the sheet steel container redirected to the recycling process and are less attributable to electricity and thermal energy from the packaging incineration process. The GWP is dominated by carbon dioxide emissions (85-90%).

The **Ozone Depletion Potential (ODP)** indicates that the impact is almost exclusively necessitated by

A1 and A3 which is primarily attributable to halogenated organic emissions from the power mix used.

The **Acidification Potential (AP)** is primarily attributable to nitric oxides and sulphur dioxide which are in turn incurred during manufacturing of the preliminary products in particular. In A3, they are necessitated by electricity and manufacturing the container. Transport to the building site is also apparent here where nitric oxide emissions in particular have an influence on acidification.

In terms of the **Eutrophication Potential (EP)**, nitric oxide is once again obvious in emissions into air (approx. 80%) although the emissions into water also make a significant contribution accounting for approx. 10-15% by ammonium and nitrates. This is primarily accounted for by the provision of energy.

Only the **Summer Smog Potential (POCP)** is not dominated by manufacturing of preliminary products. A1 only accounts for 10-20% of the POCP. The main share (> 80%) is incurred during installation of the epoxy resin product in the form of emissions of benzyl alcohol.

Highly-filled systems are associated with lower environmental impact as filler material in general is less complex to manufacture and therefore reduces the loads on the system as a whole. It must however be noted that evaluations here refer to 1 kg of product. Reference must be made to the correct functional unit for certain applications (e.g. an area with a certain basis weight) in order to comply with the requisite function.

7 Requisite evidence

7.1 VOC

Special tests and evidence have not been carried out or provided within the framework of development of this model Environmental Product Declaration.

In so far as the products are used in an area of application (e.g. public space) in which the test/evidence of VOC emissions into such public

spaces is required, such evidence should be presented in the individual EPDs.

Evidence of VOC emissions can be provided for selected products or applications (e.g. public spaces). The following limit values (maximum values in [$\mu\text{g}/\text{m}^3$]) apply:

Classification / EMICODE	EC1 PLUS	EC1	EC2	RAL UZ 113 (*)	DIBt/AgBB
TVOC (C ₆ -C ₁₆) (as per 3 / 28 d)	750 / 60	1000 / 100	3000 / 300	1000/100	10000 / 1000
TSVOC (C ₁₆ -C ₂₂) (as per 28 d)	40	50	100	50	100
C1, C2 Substances * Total as per 3 d, ** each individual substance as per 28 d	10* / 1**	10* / 1**	10* / 1**	10/1**	10 / 1**
Total formaldehyde / acetaldehyde [ppb] (as per 3 d)	50/50	50/50	50/50	50/50	- / -
Total VOC excl. NIK and non-identified substances (as per 28 d)	40	-	-	40	100
R-value (as per 28d)	1	-	-	1	1

(*) e.g. for flooring adhesives; other RAL UZ may be of relevance for other dispersion-based products.

Measuring process: GEV test method for determining the emission 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 as well as TVOC/TSVOC after 3 and 28 days.

M_7_Nachweis_3_Text

The corresponding test certificate applies as **evidence** (e.g. EMICODE licence, Blue Angel as per RAL 113). If necessary, the results must be indicated in the form of the emission class.

M_7_Nachweis_2_Text

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Institut Bauen
und Umwelt e.V.

Publisher

Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel. +49 (0)2223 296679-0
Fax +49 (0)2223 296679-0
E-mail info@bau-umwelt.com
Web www.bau-umwelt.com



Institut Bauen
und Umwelt e.V.

Programme holder

Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel. +49 (0)2223 296679-0
Fax +49 (0)2223 296679-0
E-mail info@bau-umwelt.com
Web www.bau-umwelt.com



Holder of the Declaration

Deutsche Bauchemie e.V.
Mainzer Landstrasse 55
60329 Frankfurt
Germany

Tel. +49 (0)69 2556-1318
Fax +40 (0)69 2556-1319
E-mail info@deutsche-bauchemie.de
Web www.deutsche-bauchemie.de



Holder of the Declaration

Industrieverband Klebstoffe e.V.
Völklinger Strasse 4
40219 Düsseldorf
Germany

Tel. +49 (0)211 67931-10
Fax +49 (0)211 67931-33
E-mail info@klebstoffe.com
Web www.klebstoffe.com



Holder of the Declaration

Verband der deutschen Lack-
und Druckfarbenindustrie e.V.
Mainzer Landstrasse 55
60329 Frankfurt
Germany

Tel. +49 (0)69 2556-1411
Fax +40 (0)69 2556-
E-mail vdI@vci.de
Web www.lackindustrie.de



Author of the Life Cycle Assessment

PE INTERNATIONAL AG
Hauptstrasse 111 - 113
70771 Leinfelden-Echterdingen
Germany

Tel. +49 (0)711 341817-0
Fax +49 (0)711 341817-25
E-mail info@pe-international.com
Web www.pe-international.com