

Declaration of conformity

KÖSTER BAUCHEMIE AG
Dieselstraße 1 - 10
26607 Aurich / Germany

*Conformity of the epoxy based material according
to the DIN EN 13813*

KÖSTER LF-BM


*with the classification rules of the
Environmental Product Declaration template*

EPD-DIV-2012111-EN

*The product complies with the classification rules
of the product category 1 (Epoxy resin, solvent free,
with a low content of reactive thinners)*

3.712 Points

*The products meets the requirements of the
AgBB guidelines for VOC free products.*



Johann J. Köster
(Director)

Aurich, 14th of May 2014

KÖSTER is an ISO 9001 certified company and member of



MODEL ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Declaration holder	DBC / IVK / VdL
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Reactive resins based on epoxy resin, unfilled/solvent-free

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, unfilled/solvent-free</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-2012111-E</p>	<p>Declared product/unit 1kg / 1kg; density 1-1.25 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 GEN DIN EN 15804 standard serves as the core PCR. Verification of the EPD by an independent third party in accordance with ISO 14025 <input type="checkbox"/> internal <input checked="" type="checkbox"/> external</p>
<p>Valid until 17.11.2017</p>	<p> Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)</p> <p> Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of the Expert Committee (SVA))</p> <p> Matthias Schulz (Unabhängiger Prüfer vom SVA bestellt)</p>

2 Product

2.1 Product description

Reactive resins based on epoxy resin, unfilled/solvent-free

The reactive resins are manufactured in a two-component process using epoxy resins and hardening agents.

They comply with multiple, often specific tasks in the construction, fitting and repair of structures. By using reactive resins based on epoxy resin, unfilled/solvent-free, 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 resins, unfilled/solvent-free, are used for 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 bonding** for the structural bonding of strengthening materials to an existing concrete structure (Requirements 1.2) and **products for concrete injection for filling cracks**, voids and interstices in concrete (Requirements 1.3)

Module 2: *Reactive resins for liquid-applied bridge deck waterproofing kits*

Products for liquid-applied waterproofing for use on concrete bridge decks

Module 3: Reactive resins for watertight covering kits

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

Module 4: Screed material and floor screeds

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

Module 5: 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

Module 6: 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.

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

2.3 Technical data

Construction products with declarations of performance in accordance with CPR

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

1.3 *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

Module 2: Reactive resins for liquid-applied bridge deck waterproofing kits

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

2.2 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 3: Reactive resins for watertight covering kits

3.1 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.).

3.2 The minimum requirements of 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 applied waterproofing materials (PG-AIV-F)" must be observed.

The performance requirements 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 4: 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 5: 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 following minimum requirements must be complied with:

Property	Standard	Unit	Value
Viscosity	EN ISO 3219	Pa·s	< 100
Shore hardness A	DIN 53505	-	> 15
Shore hardness D	DIN 53505	-	> 10
Density	EN ISO 2811	kg/dm ³	0.8 – 1.5

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

Module 6: *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
- Fire performance EN 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 bridge deck 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. Special applications can also be regulated in accordance with ZTV ING.

Module 3: *Reactive resins for watertight covering kits*

Module 3.1:

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.

Module 3.2:

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. 2.50.

Module 4: *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 re-

spective application rules in Part II of the List of Technical Building Regulations.

Module 5: *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*

DIN 18356 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 6: *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

2.5 Delivery status

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

Typical container sizes contain 1 to 30 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

The reactive resins based on epoxy, unfilled/solvent-free, comprise a resin and a hardening agent component. The resin component (A-component) contains Diglycidylether based on Bisphenol-A or Bisphenol-F resins (MW < 700). Hardening occurs when installed on site with the hardening agent component. To this aim, polyamines, polyamides, polyamine adducts or mixtures of the same are used.

The components can contain so-called reactive diluting agents (glycidether) and other auxiliaries such as accelerators, catalysts, wetting agents, foam regulators and viscosity regulators for fine adjustment of the product properties. M_26_IBU_GrundstoffeHilfsstoffe

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 1a:

Resin component: ~ 60-90%

Hardener component: ~ 5-20%

Reactive diluting agent: ~ 0-30%

Other: ~ <1.5%

For EPD 1b:

Hardener component: ~ 10-25%

Reactive diluting agent: ~ 75-90%

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. More detailed information is provided by the respective manufacturer (e.g. on 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 on 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 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, unfilled/solvent-free, are processed by smoothing/scraping or rolling, pouring, spraying or injecting, whereby health and safety measures (hand and eye protection, ventilation) must be performed and consistently observed in line with the specifications on the safety data sheet and conditions on site. Owing to their composition, epoxy resin products, unfilled/solvent-free, are generally allocated to the GISCODE / GISBAU product code RE1.

Reactive resins based on epoxy, unfilled/solvent-free, react after mixing resin and hardening agent under heat generation (exothermicity). The mixed components must therefore be processed swiftly within the pot life indicated. If larger volumes of the mixture remain in the container, this can lead to overheating and decomposition. In the case of reactively diluted products, exothermicity is particularly strong.

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, unfilled/solvent-free, are hardened and essentially comprise an inert, three-dimensional mesh.

They are durable products which protect our buildings in the form of primer, coatings or sealings and make a significant contribution towards retaining 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, unfilled/solvent-free, 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 scheme, 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, unfilled/solvent-free, 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, unfilled/solvent-free, 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

The reactive resins based on epoxy, unfilled/solvent-free, 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.

If epoxy systems can be removed from construction products without any noticeable effort, thermal utilisation is a practical recycling variant on account of their energy content.

Minor adhesion is not taken into consideration during disposal. It does not interfere with disposal.

al/recycling of the remaining components / building materials.

2.16 Disposal

Individual components which cannot 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. Consumption 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 1a: A Life Cycle Assessment for solvent-free, unfilled reaction resin products with a low content of reactive diluting agents was calculated in this EPD.

For EPD 1b: A Life Cycle Assessment for solvent-free, unfilled reaction resin products with a high content of reactive diluting agents 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 sample 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	0.00248 l/100 km
Transport distance	500 km
Capacity utilisation (including empty runs)	85%
Volume capacity utilisation factor	100%
Product bulk density	1000 to 1200 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	Manufacture	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	MND	X

LCA RESULTS: ENVIRONMENTAL IMPACT – 1 kg EP reaction resin, solvent-free, unfilled

		with a low reactive diluting agent content				with a high reactive diluting agent content			
		Production	Installation		Benefit	Production	Installation		Benefit
Parameter	Unit	A1-A3	A4	A5	D	A1-A3	A4	A5	D
GWP	[kg CO ₂ equiv.]	5.99E+00	2.51E-02	9.08E-02	-1.57E-01	1.23E+01	2.51E-02	9.08E-02	-1.57E-01
ODP	[kg CFC11 equiv.]	4.75E-08	1.35E-12	3.84E-12	-6.07E-11	2.06E-08	1.35E-12	3.84E-12	-6.07E-11
AP	[kg SO ₂ equiv.]	9.00E-03	1.59E-04	1.25E-05	-4.91E-04	1.65E-02	1.59E-04	1.25E-05	-4.91E-04
EP	[kg PO ₄ ³⁻ equiv.]	1.27E-03	3.95E-05	2.51E-06	-4.10E-05	2.82E-03	3.95E-05	2.51E-06	-4.10E-05
POCP	[kg ethene equiv.]	1.89E-03	-6.85E-05	7.22E-03	-7.22E-05	3.30E-03	-6.85E-05	7.22E-03	-7.22E-05
ADPE	[kg Sb equiv.]	1.14E-05	1.15E-09	1.64E-09	-6.81E-09	3.18E-05	1.15E-09	1.64E-09	-6.81E-09
ADPF	[MJ]	1.20E+02	3.47E-01	2.55E-02	-1.93E+00	2.03E+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 = Eutrophication 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, solvent-free, unfilled									
		with a low reactive diluting agent content				with a high reactive diluting agent content			
		Production	Installation		Benefit	Production	Installation		Benefit
Parameter	Unit	A1-A3	A4	A5	D	A1-A3	A4	A5	D
PERE	[MJ]	3.03E+00	-	-	-	7.32E+00	-	-	-
PERM	[MJ]	0.00E+00	-	-	-	0.00E+00	-	-	-
PERT	[MJ]	3.03E+00	1.38E-02	1.87E-03	-3.41E-02	7.32E+00	1.38E-02	1.87E-03	-3.41E-02
PENRE	[MJ]	9.20E+01	-	-	-	1.73E+02	-	-	-
PENRM	[MJ]	3.00E+01	-	-	-	3.00E+01	-	-	-
PENRT	[MJ]	1.22E+02	3.47E-01	2.55E-02	-1.93E+00	2.03E+02	3.47E-01	2.55E-02	-1.93E+00
SM	[kg]	0	-	-	-	0	-	-	-
RSF	[MJ]	1.16E-03	2.94E-06	3.48E-07	1.44E-03	3.14E-03	2.94E-06	3.48E-07	1.44E-03
NRSF	[MJ]	1.22E-02	3.08E-05	3.64E-06	1.51E-02	3.29E-02	3.08E-05	3.64E-06	1.51E-02
FW*	[m³]	2.53E+00	1.29E-03	2.13E-03	-2.07E-02	7.07E+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, solvent-free, unfilled									
		with a low reactive diluting agent content				with a high reactive diluting agent content			
		Production	Installation		Benefit	Production	Installation		Benefit
Parameter	Unit	A1-A3	A4	A5	D	A1-A3	A4	A5	D
HWD	[kg]	-*	-*	-*	-*	-*	-*	-*	-*
NHWD	[kg]	7.20E+00	1.83E-03	7.73E-02	-9.63E-01	1.72E+01	1.83E-03	7.73E-02	-9.63E-01
RWD	[kg]	2.20E-03	4.90E-07	1.30E-06	-3.57E-06	4.77E-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 therefore 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.

On account of the complexity associated with manufacturing the preliminary products applied, the other components have a minor influence on the final result.

The share of **renewable primary energy** is relatively low at < 4% (of total primary energy). 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). The amine components also have a significant influence on the overall GWP result. Production of the actual epoxy resin product also has a tangible influence which is attributable to the energy required. During the installation process, packaging is incinerated with the result that the emissions incurred are also listed here. The credits are primarily necessitated by the credit for the sheet steel container which is 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.

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 oxides are once again obvious in emissions into air (80%) although the emissions into water also make a significant contribution accounting for approx. 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 < 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.

If a reactive diluting agent is primarily or exclusively used as a resin component, all of the indicators under review are subject to higher impact as it is very energy-intensive. The epichlorhydrin used for manufacturing thereof is associated with a particularly high environmental impact.

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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