# ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

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|---|---|
| Owner of the Declaration | DBC, EFCC, FEICA, IVK |
| Programme holder | Institut Bauen und Umwelt e.V. (IBU) |
| Publisher | Institut Bauen und Umwelt e.V. (IBU) |
| Declaration number | EPD-FEI-20220108-IBG1-EN |
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| Valid to | 31-05-2027 |

## Products based on polyurethane or silane-modified polymer, group 4

DBC - Deutsche Bauchemie e.V.

EFCC - European Federation for Construction Chemicals

FEICA - Association of the European Adhesive and Sealant Industry

IVK - Industrieverband Klebstoffe e.V.

Institut Bauen und Umwelt e.V.

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# 1. General Information

DBC - Deutsche Bauchemie e.V.
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Products based on polyurethane or silane-modified polymer, group 4

**Programme holder**
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**Owner of the declaration**
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FEICA, Rue Belliard 40, B-1040 Brussels
IVK, Völklingerstr. 4, D-40219 Düsseldorf

**Declaration number**
EPD-FEI-20220108-IBG1-EN

**Declared product / declared unit**
1 kg product based on polyurethane or silane-modified polymer; density 0.85 - 1.8 g/cm³

**This declaration is based on the product category rules:**
Reaction resin products, 07.2014
(PCR checked and approved by the SVR)

**Scope:**
This verified EPD entitles the holder to bear the symbol of the Institut Bauen und Umwelt e.V. It exclusively applies for products produced in Europe and for a period of five years from the date of issue. This EPD may be used by members of DBC, EFCC, FEICA and IVK and their members provided it has been proven that the respective product can be represented by this EPD. For this purpose a guideline is available at the secretariats of the four associations. The members of the associations are listed on the respective websites.

**Issue date**
01-06-2022

**Valid to**
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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.

The EPD was created according to the specifications of *EN 15804+A2*. In the following, the standard will be simplified as *EN 15804*.

**Verification**

The standard *EN 15804* serves as the core PCR

Independent verification of the declaration and data according to *ISO 14025:2011*

☐ internally ☒ externally

Dipl. Ing. Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.))

Matthias Schulz
(Independent verifier)

# 2. Product

## 2.1 Product description/Product definition

This EPD comprises reactive products based on polyurethane (PU) or silane-modified polymer (SMP) with a volatile organic compound (VOC) content >10 % and ≤50 % (VOC definition according to *Decopaint Directive*) and a castor oil-/derivatives content ≤10 %. The one- or two-component reactive PU products are manufactured using polyols and isocyanates. Reactive products based on SMP polymers are usually manufactured as a one-component system from polyols and alkoxysilane in a preliminary stage. The aqueous systems consist of (a) dispersion and are crosslinked by a dispersible isocyanate. The products fulfil manifold, often specific, functions in the construction, furnishing and repair of buildings. The product displaying the highest environmental impacts was used as a representative product for calculating the Life Cycle Assessment results (worst-case approach).

For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) with the exception of Switzerland) products falling under Regulation (EU) No 305/2011 (*CPR*) need a Declaration of Performance taking into consideration either the relevant harmonised European standard or

the European Technical Assessment and the CE marking. For the application and use of the products the respective national provisions apply.

## 2.2 Application

Products based on polyurethane or silane-modified polymer, group 4, are used for the following applications:

**Module 1: Adhesives for parquet and floor coverings**
Parquet adhesives in accordance with *EN ISO 17178* for wooden and parquet floors and flooring adhesives in accordance with *EN ISO 22636* for floor coverings

**Module 2: Reactive products for protecting and repairing concrete structures**
Products for increasing the durability of concrete and reinforced concrete structures as well as for new concrete and for maintenance and repair work (requirements 2.1), products for structural bonding of strengthening materials to an existing concrete structure (requirements 2.2) and products for concrete injection for filling cracks, voids and interstices in concrete (requirements 2.3)

**Module 3: Liquid-applied roof waterproofing kits**
Reactive products for waterproofing roof constructions which are applied on site

**Module 4: Reactive products for liquid-applied bridge deck waterproofing kits**
Products for liquid-applied waterproofing for use on concrete bridge decks

**Module 5: Screed material, floor screeds and decorative floors**
Products for screed/synthetic resin screed for use in floor constructions

**Module 6: Reactive products as an adhesive for tiles**
Tile adhesives for internal and external tile installations on walls, floors and ceilings

**Module 7: Adhesives and sealants**
Reactive products for use as:
· Structural and repair adhesives
· Surface and joint sealants
Applications in accordance with the manufacturer's technical documentation/declaration of performance

**Module 8: Reactive products for watertight covering kits**
Products for waterproofing floors and/or walls in wet rooms inside buildings

**Module 9: Reactive products for liquid-applied waterproofing**
Liquid applied products for waterproofing of buildings

**Module 10: Reactive products for waterproofing and/or for pre-treating mineral substrates**
Applications in accordance with the manufacturer's technical documentation

**Module 11*:* Liquid-applied waterproofing membranes for use beneath ceramic tiling**

**Module 12: One-component foam (OCF)**
One component foam in a can is a one-component, self-expanding, ready to use polyurethane foam used for various construction applications. It consists of a low viscous semi-fluid in a can that leaves the can as a froth and immediately forms a polyurethane foam.
12.1 Window & External Door Sealing & Insulation:
Installing mechanically fixed external windows and doors with an OCF, as part of a system including sealants and tapes
12.2 Door Installation & Fixation:
Fixing interior doors with an OCF
12.3 General Gap Filling:
Filling of regularly and irregularly shaped spaces between at least two surfaces made of typical building materials with a one-component foam (OCF)

**Module 13: Sealants for glazing**
Two component reactive sealants are to be used as the second barrier of the structural hermetic seal in insulating glass units.

**Module 14: Bonded glazing sealants**
One and two component reactive sealants are used for the bonding of insulating glass units in the window frame.

## 2.3 Technical Data

The density of the products is between 0,85 and 1,8 g/cm³, other relevant technical data can be found in the manufacturer's technical documentation.

**Module 1: Reactive products as adhesive for parquet and floor coverings**
The minimum requirements of *EN ISO 17178* and *EN ISO 22636* must be maintained.

**Module 2: Reactive products for protecting and repairing concrete structures**
**2.1** The requirements on essential characteristics for all intended uses in accordance with *EN 1504-2*, Tables 1 and 5 must be maintained. These are:
- Permeability to $CO_2$ (*EN 1062-6*)
- Water vapour permeability (*EN ISO 7783-1/-2*)
- Capillary absorption and permeability to water (*EN 1062-3*)
- Adhesive strength by pull-off test (*EN 1542*)

**2.2** Essential characteristics for all intended uses in accordance with *EN 1504-4*, Tables 3.1 and 3.2 (manufacturer's declaration of performance)
**2.3** Requirements on essential characteristics for all intended uses in accordance with *EN 1504-5*, Table 3:
- Injectability (*EN 1771*)
- Viscosity (*EN ISO 3219*)

Further essential characteristics in accordance with the manufacturer's technical documentation/declaration of performance

**Module 3: Liquid-applied roof waterproofing kits**
The minimum requirements of *EAD 030350-00-0402* Liquid-applied roof waterproofing kits must be maintained. The essential characteristics are to be specified in accordance with the European Technical Assessment (ETA, specification no.).

**Module 4: Reactive products for liquid-applied bridge deck waterproofing kits**
The minimum requirements of *ETAG 033* Liquid-applied bridge deck waterproofing kits must be maintained. The essential characteristics are to be specified in accordance with the European Technical Assessment (ETA, specification no.).

**Module 5: Screed material, floor screeds and decorative floors**
The requirements on essential characteristics according to E*N 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*)
Further essential characteristics in accordance with the manufacturer's technical documentation / declaration of performance

**Module 6: Reactive products as an adhesive for tiles**
The requirements on essential characteristics according to *EN12004*, must be maintained. These are:
-Tensile adhesion strength after dry storage (*EN 12004-2*)
-Tensile adhesion strength after water immersion (*EN 12004-2*)
-Tensile adhesion strength after heat ageing *(EN 12004-2*)
-Tensile adhesion strength after freeze/thaw cycles (*EN 12004-2*)
-Open time: Tensile strength (*EN 12004-2*)
Further essential characteristics in accordance with the manufacturer's technical documentation

**Module 7: Adhesives and sealants**
Performance characteristics in accordance with the manufacturer's technical documentation/declaration of performance

**Module 8: Reactive products for watertight covering kits**
The minimum requirements of *EAD 030352-00-0503* Liquid applied watertight covering kits for wet room floors and/or walls must be maintained. The essential characteristics are to be specified in accordance with the European Technical Assessment (ETA, specification no.).

**Module 9*:* Reactive products for liquid-applied waterproofings**
The minimum requirements of the test principles regarding the issuing of general building authority test certificates for liquid-applied products for waterproofing of buildings (*PG-FLK*) must be maintained. The characteristics for the proof of usability are to be specified in accordance with the test principles for granting general building authority test certificates for liquid applied polymer products for waterproofing buildings

**Module 10: Reactive products for waterproofing and/or for pre-treating mineral substrates**

| Name | Value | Unit |
|---|---|---|
| Density acc. to EN ISO 2811-1 | 700 - 1800 | kg/m³ |
| Shore hardness A acc. to ISO 48-4 | >15 | |
| Shore hardness D acc. to ISO 48-4 | >5 | |
| Viscosity acc. to ISO 3219-2 | <100 | Pas |

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

**Module 11: Liquid-applied waterproofing membranes for use beneath ceramic tiling**
The minimum requirements on essential characteristics according to *EN 14891* - Liquid applied water-impermeable products for use beneath ceramic tiling - Definitions, specifications and test methods- must be maintained. These are:
- Initial tensile adhesion strength
- Tensile adhesion strength after water contact
- Tensile adhesion strength after heat ageing
- Tensile adhesion strength after freeze-thaw cycles
- Waterproofing
- Crack bridging ability

**Module 12: One-Component Foams**
Physical data of the one-component foam must be indicated in accordance with the respective product standards; these can include, for example:

12.1 Window & External Door Sealing & Insulation
Tensile Strength E*N 17333-4*, Movement Capability *EN 17333-4*, Curing Pressure *EN 17333-2*, Thermal conductivity *EN 17333-5*, Sound Insulation *EN ISO 717-1*, Post expansion *EN 17333-2*

12.2 Door Installation & Fixation
Shear Strength *EN 17333-4*, Tensile Strength *EN 17333-4*, Compression Strength *EN 17333-4*, Curing pressure *EN 17333-2*

12.3 General Gap Filling
Sagging *EN 17333-3* Other performance characteristics in accordance with the manufacturer's technical documents/declaration of performance.

**Module 13: Sealants for glazing**
Reactive sealants must comply with *EN 1279-4*
Performance characteristics in accordance with the manufacturer's technical documentation/declaration of performance

**Module 14: Bonded glazing sealants**
Reactive sealants must comply with *RAL-GZ 716* part 2 and *ift-Guideline VE-08/4*.
Performance characteristics in accordance with the manufacturer's technical documentation/declaration of performance

### 2.4 Delivery status
Liquid or pasty in containers made of tinplate or plastic packed in separate or combi-containers for the required mixing ratio. Packages containing one kg of product in different types of containers. Sealants in plastic cartridges and foil packs. Typical container sizes contain 10 to 25 kg of material. For major works, vats containing approx. 200 kg or IBCs (intermediate bulk containers) containing 1 tonne or more are also used. The LCA is based on tinplate, plastic and wood packaging.

### 2.5 Base materials/Ancillary materials
Products based on polyurethane or silane-modified polymer with a VOC content >10 % and ≤50 % and a

castor oil/-derivatives content ≤10 % usually comprise a reactive polymer and a crosslinking system. The polymer component contains polyether and/or polyester polyols. Crosslinking takes place after installation on site. In the case of two-component systems, this involves the use of pre-polymers and polymers based on typically methylene diphenyl diisocyanate (MDI), toluene diisocyanate (TDI), hexamethylene diisocyanate (HDI) or isophorone diisocyanate (IPDI). The resin mixing ratio is adjusted according to the stoichiometric requirements. Crosslinking starts directly after the components have been mixed. There are also one-component reactive polymer formulations based on PU or SMP which crosslink in the presence of moisture. They comprise prepolymers based on e.g. MDI, TDI, HDI, IPDI or those with alkoxy-silane groups in the case of SMP formulations. In formulations with aqueous dispersions, dispersible isocyanates are used for crosslinking. The formulations can contain auxiliary materials such as accelerators, catalysts, wetting agents, foam regulators and viscosity regulators for fine-tuning the product features. Typically, the products covered by this EPD contain the following ranges of base materials and auxiliaries:
Polyol component: up to approx. 50 %
Crosslinking component: up to approx. 95 %
SMP component: up to approx. 80 %
Plasticiser: ~ 0-25 %
Additives / Pigments: ~ 0-30 %
Water: ~ 0-60 %
VOC: >10 % and ≤50 % according to the *Decopaint Directive* (**mandatory**)
Castor oil and derivatives: ≤10 % **(mandatory)**

These ranges are average values and the composition of products complying with the EPD can deviate from these concentration levels in individual cases. More detailed information is available in the respective manufacturer's documentation (e.g. product data sheets).
*Note: For companies to declare their products within the scope of this EPD it is not sufficient to simply comply with the product composition shown above. The application of this EPD is only possible for member companies of DBC, EFCC, FEICA, and IVK member associations and only for specific formulations with a total score below the declared maximum score for a product group according to the associated guidance document.*

**1. substances from the "Candidate List of Substances of Very High Concern for Authorisation" (SVHC)**
If this product contains substances listed in the candidate list (latest version) exceeding 0.1 percentage by mass, the relevant information can be found in the safety data sheet of the relevant product covered by this model EPD.
**2. CMR substances in categories 1A and 1B**
If this product contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass, the relevant information can be found in the safety data sheet of the relevant product covered by this model EPD.
**3. Biocide products added to the construction product**
If this construction product contains biocide products, the active substances, information on the concentration and/or concentration range, the product type together with information on their hazardous properties are listed in the safety data sheet of the respective product.

### 2.6 Manufacture
The components of the formulation are usually mixed batch-wise and packaged for delivery.

### 2.7 Environment and health during manufacturing
As a general rule, no other environmental protection measures other than those specified by law are necessary.

### 2.8 Product processing/Installation
Products based on polyurethane or silane-modified polymer, are processed by trowelling/knife-coating or rolling, pouring, spraying or injection.
Precautions for safe handling and storage (e.g. air exchange, exhaust ventilation, personal protective measures, precautions required in the handling of isocyanates, conditions for safe storage) must be observed in accordance with the information on the safety data sheet.

### 2.9 Packaging
A detailed description of packaging is provided in section 2.4. Empty containers and clean foils can be recycled.

### 2.10 Condition of use
During the use phase, products based on polyurethane or silane-modified polymer are crosslinked and essentially comprise an inert three-dimensional network. They are long-lasting products which protect our buildings in the form of adhesives, coatings or sealants as well as make an essential contribution in retaining their function and long-term value.

### 2.11 Environment and health during use
**Option 1: Products for applications outside indoor areas with permanent stays by people**
During use, the reactive products lose their reactive properties and become inert. No risks are known for water, air and soil if the products are used as designated.
**Option 2: Products for applications inside indoor areas with permanent stays by people**
When used in indoor areas with permanent stays by people, evidence of the emission performance of construction products in contact with indoor air must be submitted according to national requirements (see chapter 7). No further influences by emissions on the environment and health are known.

### 2.12 Reference service life
Cured products based on polyurethane or silane-modified polymer fulfil manifold, often specific functions in the construction or refurbishment of building structures. They decisively improve the usability of building structures and significantly extend their original service lives. The anticipated reference service life depends on the specific installation situation and the exposure associated with the product. It can be influenced by weathering as well as mechanical or chemical loads.

### 2.13 Extraordinary effects

**Fire**
Even without any special fire safety features, cured products based on polyurethane or silane-modified polymer comply with at least the requirements of *EN 13501-1* standard for fire classes E and Efl. In terms of the volumes applied, they have only a marginal influence on the fire performance characteristics (e.g. smoke gas development) of the building structure in which they have been installed. As crosslinked polyurethane systems do not melt or drip, they do not contribute towards spreading fire.

**Water**
Cured reactive products based on polyurethane or silane-modified polymer are chemically inert and insoluble in water. They are often used to protect building structures from harmful water ingress or the effects of flooding.

**Mechanical destruction**
Mechanical destruction of cured reactive products based on polyurethane or silane-modified polymer does not lead to any decomposition products which are harmful to the environment or health.

### 2.14 Re-use phase
According to present knowledge, no environmentally harmful effects are generally anticipated in landfilling, for example, as a result of de-construction and recycling of building materials with adherent crosslinked products. If the crosslinked products can be removed from construction products without large effort, thermal recovery 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 the disposal/recycling of the remaining components/building materials.

### 2.15 Disposal
Residual material which cannot be used or recycled must be combined at a specified ratio and hardened. Hardened product residue is not special waste. Non-hardened product residue is hazardous waste. Empty, dried containers (free of drops and scraped clean) are directed to the recycling process. Residue must be directed to proper waste disposal taking into consideration the local guidelines. The following waste codes according to the European List of Waste (*2000/532/EC*) can apply:
Hardened product residue:
European Waste Catalogue (EWC) code 080112 (waste paint and varnish with the exception of that mentioned in 08 01 11)
EWC code 080410 (waste adhesives and sealants other than mentioned in 08 04 09)

### 2.16 Further information
More information is available on the manufacturer's product or safety data sheets and on the manufacturer's websites or on request. Valuable technical information is also available on the associations' websites.

## 3. LCA: Calculation rules

### 3.1 Declared Unit
This EPD refers to the declared unit of 1 kg of product based on polyurethane or silanemodified polymer, group 4; applied into the building with a density of 0.85 - 1.8 g/cm³ in accordance with the *IBU PCR* part B for reaction resin products.
The results of the Life Cycle Assessment provided in this declaration have been selected from the product with the highest environmental impact (worst-case scenario).
Depending on the application, a corresponding conversion factor such as the density to convert volumetric use to mass must be taken into consideration.

The Declaration type is according to *EN 15804*: Cradle to gate with options, modules C1–C3, and module D (A1–A3, C, D) and additional modules.

**Declared unit**

| Name | Value | Unit |
|---|---|---|
| Declared unit | 1 | kg |
| Gross density | 0.85 - 1.8 | g/cm³ |
| Conversion factor to 1 kg | - | - |

### 3.2 System boundary
Modules A1, A2 and A3 are taken into consideration in the LCA:
- 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 site
- A5 Installation, product applied into the building during A5 phase operations and packaging disposal. This stage considers VOC emissions during the installation phase. The declared product does not contain substances in the formulation that directly emit (as) VOC, but VOCs are generated by a chemical reaction that are occurring during this phase. The end of life for the packaging material considered is described below:
  -Incineration, for materials like plastic and wood.
  -Landfill, for inert material like metals (where used).

-C1-C2-C3-D
The building deconstruction (demolition process) takes place in the C1 module which considers energy production and consumption in terms of diesel and all the emissions connected with the fuel-burning process to run the machines. After the demolition, the product is transported to the end-of-life processing (C2 module) where all the impacts related to the transport processes are considered. For precautionary principle and as a worst-case scenario, thermal treatment is the only end-of-life scenario considered. This is modelled by the incineration process (module C3) where the product ends its life cycle.
Module D accounts for potential benefits that are beyond the defined system boundaries. Credits are generated during the incineration of wastes and related electricity produced that are occurring in the A5 module.

### 3.3 Estimates and assumptions

For this EPD formulation and production data defined and collected by FEICA were considered. Production waste was assumed to be disposed of by incineration without credits as a worst-case.
An average of steel and plastic containers, and wooden pallets was considered in the LCA.

### 3.4 Cut-off criteria

All raw materials submitted for the formulations and production data were taken into consideration.
The manufacture of machinery, plant and other infrastructure required for the production of the products under review was not taken into consideration in the LCA.
Transport of packaging materials is excluded.

### 3.5 Background data

Data from the *GaBi* database SP40 (2020) was used as background data.

### 3.6 Data quality

Representative products were applied for this EPD and the product in the group displaying the highest environmental impact was selected for calculating the LCA results. The background data sets used are less than 4 years old.
Production data and packaging are based on details provided by the manufacturer. The formulation used for evaluation refers to a specific product.
The data quality of the background data is considered to be good.

### 3.7 Period under review

Representative formulations are valid for 2021.

### 3.8 Allocation

Mass allocation has been applied when primary data have been used and implemented into the LCA model.

### 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.

The *GaBi* database SP40 (2020) was used.

## 4. LCA: Scenarios and additional technical information

**Characteristic product properties**
**Information on biogenic Carbon**
The packaging material contains biogenic carbon content which is presented below.

**Information on describing the biogenic Carbon Content at factory gate**

| Name | Value | Unit |
|---|---|---|
| Biogenic Carbon Content in product | 0 | kg C |
| Biogenic Carbon Content in accompanying packaging | 0.016 | kg C |

**Transport to the building site (A4)**

| Name | Value | Unit |
|---|---|---|
| Transport distance | 1000 | km |
| Gross weight | 34 - 40 | t |
| Payload capacity | 27 | t |

**Assembly (A5)**

| Name | Value | Unit |
|---|---|---|
| Other resources for packaging material | 0.1 | kg |
| Material loss | 0.01 | kg |

Material loss regards the amount of product not used during the application phase into the building. This amount is 1% of the product, impacts related to the production of this part are charged to the A5 module. This percentage is considered as waste to disposal and impacts of its end of life have been considered in the LCA model and declared in A5.

**End of life (C1-C3)**

| Name | Value | Unit |
|---|---|---|
| Collected as mixed construction | 0.67 | kg |
| waste | | |
| Incineration | 0.67 | kg |

# 5. LCA: Results

## DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

| PRODUCT STAGE | | | CONSTRUCTION PROCESS STAGE | | USE STAGE | | | | | | | END OF LIFE STAGE | | | | BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw material supply | Transport | Manufacturing | Transport from the gate to the site | Assembly | Use | Maintenance | Repair | Replacement | Refurbishment | 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 | ND | ND | MNR | MNR | MNR | ND | ND | X | X | X | ND | X |

## RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 kg of product based on polyurethane or silane modified polymer, group 4

| Core Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | D |
|---|---|---|---|---|---|---|---|---|
| GWP-total | [kg $CO_2$-Eq.] | 6.36E+0 | 5.27E-2 | 1.96E-1 | 1.87E-4 | 8.29E-3 | 1.48E+0 | -6.53E-1 |
| GWP-fossil | [kg $CO_2$-Eq.] | 6.28E+0 | 5.22E-2 | 1.08E-1 | 1.78E-4 | 7.93E-3 | 1.48E+0 | -6.51E-1 |
| GWP-biogenic | [kg $CO_2$-Eq.] | 7.23E-2 | 1.52E-4 | 8.73E-2 | 8.28E-6 | 3.63E-4 | 5.91E-5 | -1.53E-3 |
| GWP-luluc | [kg $CO_2$-Eq.] | 1.08E-2 | 4.22E-4 | 1.12E-4 | 4.28E-9 | 1.87E-7 | 1.40E-5 | -4.58E-4 |
| ODP | [kg CFC11-Eq.] | 4.06E-9 | 6.27E-18 | 4.06E-11 | 1.90E-20 | 8.30E-19 | 1.75E-16 | -6.83E-15 |
| AP | [mol $H^+$-Eq.] | 1.16E-2 | 1.56E-4 | 1.44E-4 | 2.41E-6 | 2.50E-5 | 8.76E-4 | -9.14E-4 |
| EP-freshwater | [kg P-Eq.] | 1.09E-5 | 1.59E-7 | 1.14E-7 | 3.85E-11 | 1.68E-9 | 2.95E-8 | -8.43E-7 |
| EP-marine | [kg N-Eq.] | 3.39E-3 | 6.96E-5 | 4.22E-5 | 1.10E-6 | 1.15E-5 | 4.23E-4 | -2.36E-4 |
| EP-terrestrial | [mol N-Eq.] | 3.62E-2 | 7.80E-4 | 4.79E-4 | 1.20E-5 | 1.27E-4 | 4.87E-3 | -2.53E-3 |
| POCP | [kg NMVOC-Eq.] | 1.25E-2 | 1.38E-4 | 3.37E-1 | 3.29E-6 | 2.27E-5 | 1.09E-3 | -6.78E-4 |
| ADPE | [kg Sb-Eq.] | 1.34E-5 | 3.74E-9 | 1.35E-7 | 5.40E-12 | 2.36E-10 | 3.11E-9 | -1.07E-7 |
| ADPF | [MJ] | 1.34E+2 | 6.94E-1 | 1.40E+0 | 2.55E-3 | 1.11E-1 | 3.93E-1 | -1.10E+1 |
| WDP | [$m^3$ world-Eq deprived] | 8.54E-1 | 4.66E-4 | 2.21E-2 | 3.53E-7 | 1.54E-5 | 1.46E-1 | -6.78E-2 |

| Caption | GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential |
|---|---|

## RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 kg of product based on polyurethane or silane modified polymer, group 4

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | D |
|---|---|---|---|---|---|---|---|---|
| PERE | [MJ] | 8.62E+0 | 3.90E-2 | 6.84E-1 | 8.05E-6 | 3.51E-4 | 5.51E-2 | -2.42E+0 |
| PERM | [MJ] | 5.85E-1 | 0.00E+0 | -5.85E-1 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| PERT | [MJ] | 9.21E+0 | 3.90E-2 | 9.93E-2 | 8.05E-6 | 3.51E-4 | 5.51E-2 | -2.42E+0 |
| PENRE | [MJ] | 1.09E+2 | 6.95E-1 | 1.00E+1 | 2.56E-3 | 1.12E-1 | 1.68E+1 | -1.10E+1 |
| PENRM | [MJ] | 2.50E+1 | 0.00E+0 | -8.60E+0 | 0.00E+0 | 0.00E+0 | -1.64E+1 | 0.00E+0 |
| PENRT | [MJ] | 1.34E+2 | 6.95E-1 | 1.40E+0 | 2.56E-3 | 1.12E-1 | 3.93E-1 | -1.10E+1 |
| SM | [kg] | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| RSF | [MJ] | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| NRSF | [MJ] | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| FW | [$m^3$] | 2.98E-2 | 4.52E-5 | 6.18E-4 | 1.44E-8 | 6.30E-7 | 3.43E-3 | -2.81E-3 |

| Caption | PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water |
|---|---|

## RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 kg of product based on polyurethane or silane modified polymer, group 4

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | D |
|---|---|---|---|---|---|---|---|---|
| HWD | [kg] | 3.35E-5 | 3.23E-8 | 3.35E-7 | 2.48E-13 | 1.08E-11 | 2.24E-10 | -4.41E-9 |
| NHWD | [kg] | 2.74E-1 | 1.06E-4 | 4.85E-2 | 2.61E-7 | 1.14E-5 | 7.42E-3 | -5.12E-3 |
| RWD | [kg] | 2.27E-3 | 8.60E-7 | 2.46E-5 | 2.74E-9 | 1.20E-7 | 1.59E-5 | -8.27E-4 |
| CRU | [kg] | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| MFR | [kg] | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| MER | [kg] | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| EEE | [MJ] | 0.00E+0 | 0.00E+0 | 2.12E-1 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |
| EET | [MJ] | 0.00E+0 | 0.00E+0 | 3.86E-1 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 |

| Caption | HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy |
|---|---|

## RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 kg of product based on polyurethane or silane modified polymer, group 4

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | D |
|---|---|---|---|---|---|---|---|---|
| PM | [Disease Incidence] | ND | ND | ND | ND | ND | ND | ND |
| IRP | [kBq U235-Eq.] | ND | ND | ND | ND | ND | ND | ND |
| ETP-fw | [CTUe] | ND | ND | ND | ND | ND | ND | ND |
| HTP-c | [CTUh] | ND | ND | ND | ND | ND | ND | ND |
| HTP-nc | [CTUh] | ND | ND | ND | ND | ND | ND | ND |
| SQP | [-] | ND | ND | ND | ND | ND | ND | ND |

| Caption | PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index |
|---|---|

Potential Human exposure efficiency relative to U235, Disclaimer 1 – This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and (from) some construction materials is also not measured by this indicator.

ADP minerals & metals, ADP fossil, WDP, ETF-fw, HTP-c, HTP-nc, SQP, Disclaimer 2 – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

**Additional environmental impact indicators** (suggested by *EN15804*, table 4) are not declared in the EPD. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high and as there is limited experience with the indicator (see ILCD classification in EN 15804, table 5). For this reason, results based on these indicators are not considered suitable for a decision-making process and are thus not declared in the EPD.

## 6. LCA: Interpretation

The majority of impacts are associated with the production phase (A1-A3). The most significant contribution to the production phase impacts is the upstream production of raw materials as the main driver. Another substantial contributor in the production phase, in the category of Abiotic depletion potential for nonfossil resources (ADPminerals& metals), is the steel sheet used as a packaging material. Emissions associated with the manufacturing of products also have some influence on the Formation potential of tropospheric ozone (POCP) in the production phase. In all EPDs, $CO_2$ is the most important contributor to Global Warming Potential (GWP). For the Acidification Potential (AP), NOx and $SO_2$ contribute the largest share. In some cases, HCl in water also impacts AP due to the use of $TiO_2$ as a pigment.
The majority of life cycle energy consumption takes place during the production phase (A1-A3). Significant contributions to Primary Energy Demand – Non-renewable (PENRT) come from the energy resources used in the production of raw materials. The largest contributor to Primary Energy Demand – Renewable (PERT) impacts comes from the consumption of renewable energy resources required for the generation and supply of electricity. It should be noted that Primary Energy Demand – Renewable (PERT) generally represents a small percentage of the production phase primary energy demand with the bulk of the demand coming from non-renewable energy resources.
Transportation to the construction site (A4) and the installation process (A5) make a low contribution to all impacts.
The installation phase influences mainly the Photochemical ozone formation indicator, due to the emission of VOC during the operations. These emissions are not only directly related to the pre-products in the resins, but they are related to the reaction products between pre-products and air components (water and oxygen).
The end-of-life phases influence climate change indicators, due to the incineration processes occurring in the C3 module, the process used for modelling the thermal treatment process of the resin.

## 7. Requisite evidence

**VOC**
Special tests and evidence have not been carried out or provided within the framework of drawing up this Model EPD. Some member states require special documentation on VOC emissions into indoor air for specific areas of application. This documentation, as well as documentation for voluntary VOC labelling, has to be provided separately and is specific for product in question.

Evidence pertaining to VOC emissions shall show
- either an attestation of compliance with,
- or documentation of test data that are required in any of the existing regulations or in any of the existing voluntary labelling programs for low-emitting products, as far as these

(1) include limits for the parameters TVOC, TSVOC, carcinogens, formaldehyde, acetaldehyde, LCI limits for individual substances (including but not limited to the European list of harmonized LCIs), and the R value;
(2) base their test methods on *EN 16516*;
(3) perform testing and apply the limits after 28 days of storage in a ventilated test chamber, under the conditions specified in *EN 16516*; some regulations

and programs also have limits after 3 days, on top of the 28 days limits;
(4) express the test results as air concentrations in the European Reference Room, as specified in *EN 16516*.

Examples of such regulations are the *Belgian Royal Decree C-2014/24239*, or the *German AgBB/* ABG. Examples of such voluntary labelling programs are *EMICODE*, *Blue Angel* or *Indoor Air Comfort*.

Relevant test results shall be produced either by an *ISO 17025* accredited commercial test lab or by a qualified internal test lab of the manufacturer.
Examples for the applied limits after 28 days of storage in a ventilated test chamber are:
- TVOC: 1000 µg/m³
- TSVOC: 100 µg/m³
- Each carcinogen: 1 µg/m³
- Formaldehyde: 100 µg/m³
- LCI: different per substance involved
- R value: 1 (meaning that, in total, 100 % of the combined LCI values must not be exceeded).

Informative Annexes (2 tables):
Table 1 shown below is an overview of the most relevant regulations and specifications as of October 2021, as regards requirements after 3 days of storage in a ventilated test chamber.
Table 2 provides an overview of the most relevant regulations and specifications as of October 2021, as regards requirements after 28 days of storage in a ventilated test chamber. Some details may be missing in the table due to lack of space. Values given represent maximum values/limits.

| | TVOC µg/m³ | Sum of carcinogens. C1A,CA2 µg/m³ | Formaldehyde µg/m³ | Acetaldehyde µg/m³ | Sum of Form- and Acetaldehyde |
|---|---|---|---|---|---|
| German AgBB/ABG regulation | 10 000 | 10 | -/- | -/- | -/- |
| Belgian regulation | 10 000 | 10 | -/- | -/- | -/- |
| EMICODE EC1 | 1 000 | 10 | 50 | 50 | 50 ppb |
| EMICODE EC1 PLUS | 750 | 10 | 50 | 50 | 50 ppb |

| | TVOC µg/m³ | TSVOC µg/m³ | Each carcinogen C1A,CA2 µg/m³ | Formalde-hyde µg/m³ | Acetalde-hyde µg/m³ | LCI | R value | Specials | Sum of non-LCI & non-identified µg/m³ |
|---|---|---|---|---|---|---|---|---|---|
| Belgian regulation | 1000 | 100 | 1 | 100 | 200 | Belgian list | 1 | Toluene 300 µg/m³ | -/- |
| French regulations class A+ | 1000 | -/- | -/- | 10 | 200 | -/- | -/- | List of 8 VOCs, 4 CMR | -/- |
| French regulations class A | 1500 | -/- | -/- | 60 | 300 | -/- | -/- | List of 8 VOCs, 4 CMR | -/- |
| French regulations class B | 2000 | -/- | -/- | 120 | 400 | -/- | -/- | List of 8 VOCs, 4 CMR | -/- |
| French regulations class C | >2000 | -/- | -/- | >120 | >400 | -/- | -/- | List of 8 VOCs, 4 CMR | -/- |
| German DIBt/AgBB regulation | 1000 | 100 | 1 | 100 | 300 | German AgBB list | 1 | -/- | 100 |
| EMICODE EC1 | 100 | 50 | 1 | (after 3 days) | (after 3 days) | -/- | -/- | -/- | -/- |
| EMICODE EC1 PLUS | 60 | 40 | 1 | (after 3 days) | (after 3 days) | German AgBB list | 1 | -/- | 40 |
| Finnish M1, sealants | 20 | -/- | 1 | 10 | 300 | EU LCI list | -/- | Ammonia, odour | -/- |
| Finnish M1, adhesives | 200 µg/m²h | -/- | 5 µg/m²h | 50 µg/m²h | 300 | EU LCI list | -/- | Ammonia, odour | -/- |

## 8. References

**ETAG 033**
Liquid applied bridge deck waterproofing kits **ISO 48-4**

ISO 48-4:2018, Rubber, vulcanized or thermoplastic - Determination of hardness- Part 4: Indentation hardness by durometer method (Shore hardness)

**EN ISO 717-1**
EN ISO 717-1:2020 Acoustics - Rating of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation

**EN 1062-3**
EN 1062-3:2008-04, Paints and varnishes - Coating materials and coating systems for exterior masonry and concrete - Part 3: Determination of liquid water permeability

**EN 1062-6**
EN 1062-6:2002-10, Paints and varnishes - Coating materials and coating systems for exterior masonry and concrete - Part 6: Determination of carbon dioxide permeability

**EN 1279-4**
EN 1279-4:2002 Glass in building - Insulating glass units - Part 4: Methods of test for the physical attributes of edge seals

**EN 1504-2**
EN 1504-2:2004-12, Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 2: Surface protection systems for concrete

**EN 1504-4**
EN 1504-4:2004-11, Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity- Part 4: Structural bonding

**EN 1504-5**
EN 1504-5:2004-12, Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 5: Concrete injection

**EN 1542**
EN 1542:1999-07, Products and systems for the protection and repair of concrete structures - Test methods - Measurement of bond strength by pull-off

**EN 1771**
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**ISO 2811-1**
ISO 2811-1:2016, Paints and varnishes - Determination of density - Part 1: Pycnometer method

**EN ISO 3219**
EN ISO 3219:1994-10, Plastics - Polymers/resins in the liquid state or as emulsions or dispersions - Determination of viscosity using a rotational viscometer with defined shear rate

**ISO 3219-2**
ISO 3219-2:2021, Rheology - Part 2: General principles of rotational and oscillatory rheometry

**EN ISO 7783**
EN ISO 7783:2019-02, Paints and varnishes - Determination of water-vapour transmission properties - Cup method

**EN 12004**
EN12004:2012, Adhesives for ceramic tiles

**EN 12004-1**
EN 12004-1:2017, Adhesives for ceramic tiles – Part 1: Requirements, assessment and verification of constancy of performance, classification and marking

**EN 12004-2**
EN 12004-2:2017, Adhesives for ceramic tiles - Part 2: Test methods

**EN 13501-1**
EN 13501-1:2018, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

**EN 13813**
EN 13813:2002-10, Screed material and floor screeds - Screed materials - Properties and requirements

**EN 13892-8**
EN 13892:2003-02, Methods of test for screed materials - Part 8: Determination of bond strength

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

**EN 14891**
EN 14891:2012-04, Liquid applied water impermeable products for use beneath ceramic tiling - Definitions, specifications and test methods

**EN 15804**
EN 15804:2019+A2, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

**EN 16516**
EN 16516:2017
Construction products - Assessment of release of dangerous substances - Determination of emissions into indoor air

**EN ISO 17025**
EN ISO 17025:2018-03
General requirements for the competence of testing and calibration laboratories

**EN ISO 17178**
EN ISO 17178:2020-06, Adhesives - Adhesives for bonding parquet to subfloor - Test methods and minimum requirements

**EN 17333-2**
EN 17333-2:2020+AC:2020, Characterisation of one component foam - Part 2: Expansion characteristics

**EN 17333-3**
EN 17333-3:2020, Characterisation of one component foam - Part 3: Application

**EN 17333-4**
EN 17333-4:2020, Characterisation of one component foam - Part 4: Mechanical strength

**EN 17333-5**
EN 17333-5:2020, Characterisation of one component foam - Part 5: Insulation

**EN ISO 22636**
EN ISO 22636:2020, Adhesives - Adhesives for floor coverings - Requirements for mechanical and electrical performance

**EAD 030350-00-0402**
EAD 030350-00-0402:2018-08**,** Liquid Applied Roof Waterproofing Kits

**EAD 030352-00-0503**
EAD 030352-00-0503:2019-01, Liquid applied watertight covering kits for wet room floors and/or walls

**2000/532/EC**
Commission decision dated 3 May 2000 replacing decision 94/3/EC on a waste directory in accordance with Article 1 a) of Council Directive 75/442/EEC on waste and Council decision 94/904/EC on a directory of hazardous waste in terms of Article 1, paragraph 4 of Directive 91/689/EEC on hazardous waste

**Belgian Royal Decree C-2014/24239**
Belgisch Staatsblad 8 MEI 2014, p. 60603. — Koninklijk besluit tot vaststelling van de drempelniveaus voor de emissies naar het binnenmilieu van bouwproducten voor bepaalde geoogde gebruiken

**Blue Angel**
Environmental label organised by the federal government of Germany www.blauer-engel.de

**CPR**
CPR Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

**Decopaint Directive**
Directive 2004/42/CE of the European Parliament and the council of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC

**EMICODE**
EMICODE, GEV – Gemeinschaft Emissionskontrollierte Verlegewerkstoffe, Klebstoffe und Bauprodukte e. V. (pub.).www.emicode.de

**GaBi 10 software & documentation**
Data base for Life Cycle Engineering LBP, University of Stuttgart and Sphera, documentation of GaBi 10 data sets http://documentation.gabi-software.com/, 2020

**German AgBB**
Committee for Health-related Evaluation of Building Products: health-related evaluation of emissions of volatile organic compounds (VOC and SVOC) from building products; status: June 2012 www.umweltbundesamt.de/produkte/bauprodukte/agbb.htm

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**Indoor Air Comfort**
Product certification by Eurofins, Hamburg, Germany www.eurofins.com

**PCR Part A**
Product Category Rules for Building-Related Products and Services, Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project report, Version 1.1, Institut Bauen und Umwelt e.V., 2021-01

**PCR Part B**
Product Category Rules for Construction Products, Part B: Reaction resin products, Institut Bauen und Umwelt e.V., 2019-01

**RAL-GZ 716**
RAL-GZ 716:2019-04 part 2, Kunststoff-Fensterprofilsysteme - Gütesicherung

**REACH**
Directive (EG) No. 1907/2006 of the European Parliament and of the Council dated 18 December 2006 on the registration, evaluation, approval and restriction of chemical substances (REACH), for establishing a European Agency for chemical substances, for amending Directive 1999/45/EC and for annulment of Directive (EEC) No. 793/93 of the Council, Directive (EC) No. 1488/94 of the Commission, Guideline 76/769/EEC of the Council and Guidelines 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC of the Commission.

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