

ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	KEIMFARBEN GMBH
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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Valid to	03.04.2019

Silicate Exterior Paints

KEIMFARBEN GMBH

www.ibu-epd.com / <https://epd-online.com>



1. General Information

KEIMFARBEN GMBH

Programme holder

IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number

EPD-KEI-20170134-IBG1-EN

This Declaration is based on the Product Category Rules:

Coatings with organic binders, 09.2017
(PCR tested and approved by the SVR)

Issue date

09.10.2017

Valid to

03.04.2019



Prof. Dr.-Ing. Horst J. Bossenmayer
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Dr. Burkhard Lehmann
(Managing Director IBU)

Silicate Exterior Paints

Owner of the Declaration

KEIMFARBEN GMBH
Keimstraße 16
86420 Diedorf

Declared product / Declared unit

1kg/1kg; density 1.100 – 1.800 kg/m³

Scope:

This validated declaration gives the entitlement to carry the symbol of the Institute for Construction and Environment e.V. It applies exclusively to the product groups named for members in Germany, for five years from date of issue. This is an individualized collective EPD, in which the environmental impact was calculated for the group of products by choosing the product, which has the biggest environmental impact in this group.

This EPD is based on the sample declaration **EPD-DIV-20140058-IBG1-DE** and applies to the following KEIM products:

KEIM Soldalit
KEIM Granital
KEIM Concretal-W
KEIM Concretal-Lasur
KEIM Design-Lasur
KEIM Restaurolasur
KEIM Unikristalat
KEIM Veramin

This document is translated from the German Environmental Product Declaration into English. It is based on the German original version EPD-KEI-20170134-IBG1-DE. The verifier has no influence on the quality of the translation.

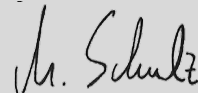
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

The CEN Norm /EN 15804/ serves as the core PCR

Independent verification of the declaration according to /ISO 14025/

internally externally



Matthias Schulz
(Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

The KEIM exterior paint systems described in this declaration comply with DIN EN 1062-1:2004 and fulfil the requirements of DIN 18363:2010-4, para. 2.4.1. The exterior paints use minerals as binding agents and are based on silicate technology. This is based on silification of the binding agent potassium water glass

and silica sol with the underlying masonry in which a chemical reaction with the mineral fraction takes place. Silicate-based exterior paints improve the usability of buildings and extend their useful life. The paint with the greatest environmental impact was taken as a representative product to calculate the results of the environmental impact assessment.



The relevant national regulations at the location where they are being used apply when using the products – in Germany for example these include the state building regulations and the technical specifications based on these regulations.

2.2 Application

The declared products are used as exterior paints.

2.3 Technical Data

- Density in [g/cm³]:
 - Soldalit 1.5-1.7
 - Granital 1.3-1.6
 - Concretal-W 1.5-1.8
 - Concretal-Lasur 1.1-1.3
 - Design-Lasur 1.2-1.3
 - Restauro-Lasur 1.1-1.3
 - Unikristalat 1.4-1.6
 - Veramin 1.3-1.5
- The solid content is between 40% and 65%.
- The pH-value of all exterior paints is approx. 11.
- The water-vapour diffusion current density of all exterior paints is >2000 g/m²d. (/DIN EN ISO 7783-2:1999/).
- The water vapour diffusion equivalent air layer thickness (sd-value) according to /DIN EN ISO 7783-2:1999/ is as follows:
 - Soldalit < 0.01m
 - Granital < 0.01m
 - Concretal-W = 0.011m
 - Concretal-Lasur = 0.02m
 - Design-Lasur < 0.01m
 - Restauro-Lasur < 0.01m
 - Unikristalat < 0.01m
 - Veramin < 0.14m
- The water permeability rate (24h) is <0.1 resp. >1kg/m²h^{0.5}. (/DIN EN 1062-3:2008/).
- With regard to the water vapour diffusion equivalent air film thickness (sd-value) and layer thickness(es), KEIM exterior paints have a water vapour diffusion resistance rating ($\mu = Sd/s$) of about 50.
- The gloss level is between 1 and 1.5 (/DIN EN ISO 2813:1999/).
- For KEIM exterior paints the degree of whiteness (WI) according to CIE is between 75 and 86 and the brightness (brightness reference value, Y-value) is between 88 and 92.

- Colour resistance according to BFS-Nr. 26: A1/ approved for all exterior paints (/Federal Committee for Paints and the Protection of Objects/).

- Other structural data according to PCR (such as salt, spray resistance, sulphur dioxide resistance, moisture condensation test and brief weathering) are not relevant for the products in this declaration.
- Exterior paints and outdoor weathering: Granital and Soldalit: perfect adhesion and color resistance confirmed; (Test certificate ILF Research- and Development Company Coatings and Paints Ltd. Magdeburg). Due to the similar chemical composition of all exterior paints listed and the silicification process of silicate paints within the masonry, the results of outdoor weathering tests can be applied across the range and also to the above-mentioned glazes.

Rating values of the product in relation to its characteristics based on the relevant technical regulations (no CE-labelling).

2.4 Delivery status

The declared products are transported as liquid, ready for use products in white or various shades of paints in buckets made of polypropylene (5 kg/5 l, 12,5l or 25 kg/15 l).

2.5 Base materials / Ancillary materials

Selected, natural raw materials form the basis for the high quality of KEIM silicate paints.

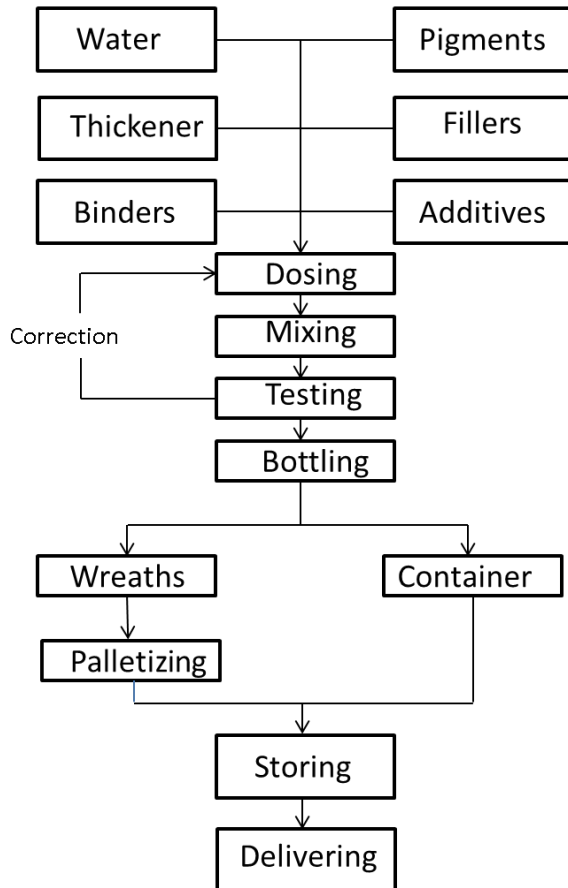
The base materials for all exterior paints are water, silicate binding agents, mineral fillers, inorganic, brightening pigments and additives. For ancillary materials, special fixatives or dilutants are added to particular exterior paints.

Binding agents 25 – 45 %
Fillers 15 – 40 %
Water 15 – 35 %
Pigments 5 – 15 %
Other components 1 – 5 %

2.6 Manufacture

KEIM exterior paints are mixed in non-continuous batch operation, i.e. in individual batches or series of individual batches and filled into delivery containers. Quality standards according to /DIN EN ISO 9001:2008/ and relevant regulations such as the Industrial Safety Ordinance and the Emission Control Act are observed.

Production process



The figure shows the following working process during the production of exterior paint systems:

First, the silos and weighting containers are filled, followed by transportation and adjustment of raw material into the mixer for dispersion. After a quality control, the exterior paints are filled into containers. Then they are loaded and delivered.

KEIMFARBEN GMBH's quality management system has been certified according to ISO 9001:2008.

2.7 Environment and health during manufacturing

KEIMFARBEN GMBH fulfils all required national regulations relating to consumer health and environmental protection.

The environmental management system is certified according to /ISO 14001:2004/.

There is no risk to the environment or negative effects on technical production staff during the production process of exterior paints.

2.8 Product processing/Installation

For application, exterior paints are processed manually or mechanically, by different tools. In this context, the following dilution products are used:

- Soldalit --> Soldalit-Fixative
- Granital --> Special-Fixative
- Concretal-W --> Concretal-Fixative
- Concretal-Lasur --> Concretal-Fixative
- Restaurolasur --> Restaurolasur-Fixative
- Design-Lasur --> Design-Base
- Unikristalat --> Fixative
- Veramin --> Special-Fixative

2.9 Packaging

Emptied containers can be recycled.

Returnable wooden pallets are taken back by the building materials trade (money back for returnable pallets using the deposit system), from there they are returned to the building product manufacturers and fed back into the production process.

Exterior paints are packaged as standard in buckets made of Polypropylene (5 l, 12.5 l or 15 l).

2.10 Condition of use

KEIMFARBEN products are durable – this has been proven by innumerable buildings worldwide for more than one hundred years. Their longevity is due to their special properties: The binding agent, potassium silicate, is highly resistant to weathering and chemically reacts with the underlying masonry (silification). The binding agent is stable under UV light and does not become brittle when exposed to sunlight. KEIMFARBEN are characterized by their high water vapour permeability rating. In terms of building physics, the ability of water-vapour diffusion is most important for a good moisture balance.

Due to its ability to diffuse water vapour well, moisture within the building structure can be transmitted quickly and easily to the outside environment. There is no accumulation of moisture between paint and underlying masonry that could cause damage.

The surface of KEIM exterior paints is minerally matt, antistatic and non-thermoplastic.

The mineral pigments used in KEIMFARBEN have a very high colour tone stability (class A1 according to /BFS leaflet 26/). The durability of KEIMFARBEN coatings offer added environmental value, as fewer renovation coats are required over their useful life.

2.11 Environment and health during use

Exterior paints are not subject to requirements for labelling.

They do not release any harmful emissions.

2.12 Reference service life

The reference service life for exterior paint systems of the company KEIMFARBEN GMBH has been determined to 30 years. However, the exterior paints can reach a service life of 100 years.

Due to properties of KEIM exterior paint systems mentioned in point 2.10, premature ageing is delayed.

2.13 Extraordinary effects

Fire

- Soldalit non-flammable
- Granital non-flammable
- Concretal-W non-flammable
- Unikristalat non-flammable
- Veramin non-flammable

The paints are non-flammable. Thus, they fulfil the criteria of class A2 according to /DIN 4102-A2:1998/



and A2-s1-d0 according to /EN 13501-1:2007+A1:2009/.

It can be assumed that varnishes are not flammable either because of their similar chemical composition (Concretal-Lasur, Restauero-Lasur, Design-Lasur). Even during the strongest exposure to flames, KEIM silicate colors do not ignite.

Water

The main constituents of KEIM exterior paints are not hazardous to water or are only mildly hazardous as defined by the Administrative Regulations for Materials Hazardous to Water (VwVwS/).

No negative effects are expected after the curing of the silicate coating material.

Mechanical destruction

The mechanical destruction of cured exterior paints does not lead to decomposition products hazardous to the environment or to health.

2.14 Re-use phase

KEIMFARBEN can reach the life time of buildings.

Exterior paints do not have a real subsequent use stage. Final disposal is carried out in combination with parts of the building. If these are solely construction waste, recycling according to national contexts takes place.

Normally, construction waste is crushed and returned to the economic cycle to be used in place of fillings (road construction, concrete).

2.15 Disposal

Disposal of unprocessed exterior paint, respectively remaining colour, is handled according to official regulations.

The waste code according to the European waste list is: 08 01 12 and is valid for all exterior paints and glazes.

2.16 Further information

Homepage: www.keim.com

Technical data sheets, safety data sheets and further information can be downloaded from the website.

3. LCA: Calculation rules

3.1 Declared Unit

This individualized collective EPD is based on the declared unit of 1 kg exterior paint. The consumption of the products applies over a wide area can be between 40 and 550 g/m². The product with the greatest environmental impact has been declared from each of the product Groups.

Consumption (based on two coats over smooth basecoat):

	Density [kg/m ²]
• Soldalit	0.45
• Granital	0.35
• Concretal-W	0.35
• Concretal-Lasur	0.25
• Design-Lasur	0.04
• Restauero-Lasur	0.17
• Unikristalat	0.55
• Veramin	0.36

These consumption figures are guidelines. Precise consumption figures should be determined by painting a test area.

information about the declared unit

Name	Value	Unit
Declared unit	1	kg
Gross density	1100 - 1800	kg/m ³

3.2 System boundary

The modules A1/A2/A3, A4, A5 and D have been taken into account for the calculation of the life cycle assessment.

- A1 Production of preliminary products
- A2 Transport to the factory

- A3 Manufacturing (incl. energy supply, production of packaging and also ancillary and operating materials and waste treatment)
- A4 Transport to construction site
- A5 Application (waste disposal and also emissions during application)
- D Credits from incineration of packaging materials and recycling of metal Containers

This declaration is therefore based on "from the cradle to the factory gate – with options".

3.3 Estimates and assumptions

If no specific GaBi procedures were available, then the individual recipe components for the formulations were estimated based on information from the manufacturer or in the literature.

3.4 Cut-off criteria

No cut-off rules were used to calculate the environmental impact assessment. All raw materials submitted collectively for the formulations were included.

The production of machinery, equipment and other infrastructure needed for the production of the products in this declaration have not been included in this environmental impact assessment.

3.5 Background data

Data from the /GaBi 6B/ database was used as background data. If no background data was available, then this was supplemented using manufacturer's information and research in the literature.

3.6 Data quality

Both representative products and also the product for a group with the greatest environmental impact were used to calculate the environmental impact assessment for this EPD. The datasets are in general less than 7 years old. Data has been taken from the /GaBi 6B/ databases and are therefore consistent internally.

3.7 Period under review

The selected observation period is the production year 2011.

3.8 Allocation

No allocations were used for the production. The incineration of the packaging uses a multi-input allocation with a credit for electricity and thermal energy according to the simple credit method. The credits from the packaging disposal are taken into account in module D.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Scenarios and additional technical information

Following technical information are basis for the declared modules or can be used for the development of specific scenarios in the context of an evaluation of a building, if modules are not declared (MND).

Transport to construction site (A4)

Name	Value	Unit
Litres of fuel	0.0016	l/100km
Transport distance	500	km
Capacity utilisation (including empty runs)	85	%
Gross density of products transported	1100 - 1800	kg/m ³
Capacity utilisation volume factor	100	%

Application onto the building (A5)

Name	Value	Unit
Auxiliary	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 substances following waste treatment on site	0	kg
Dust in the air	0	kg
VOC in the air	< 0,1	%

5. LCA: Results

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

PRODUCT STAGE		CONSTRUCTION PROCESS STAGE			USE STAGE								END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM 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	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	MND	MND	X	

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg Silicate Exterior Paint

Parameter	Unit	A1-A3	A4	A5	D
Global warming potential	[kg CO ₂ -Eq.]	1.20E+0	2.46E-2	1.59E-1	-7.86E-2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	4.30E-10	5.14E-13	1.00E-12	-2.38E-11
Acidification potential of land and water	[kg SO ₂ -Eq.]	1.25E-2	1.62E-4	1.68E-5	-1.09E-4
Eutrophication potential	[kg (PO ₄) ³⁻ -Eq.]	4.04E-4	4.03E-5	3.44E-6	-1.22E-5
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	8.00E-4	-6.81E-5	1.35E-2	-9.99E-6
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.88E-6	1.14E-9	2.09E-9	-8.14E-9
Abiotic depletion potential for fossil resources	[MJ]	2.25E+1	3.37E-1	2.87E-2	-1.04E+0

RESULTS OF THE LCA - RESOURCE USE: 1 kg Silicate Exterior Paint

Parameter	Unit	A1-A3	A4	A5	D
Renewable primary energy as energy carrier	[MJ]	1.72E+0	IND	IND	IND
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	IND	IND	IND
Total use of renewable primary energy resources	[MJ]	1.72E+0	2.00E-2	2.91E-3	-1.14E-1
Non-renewable primary energy as energy carrier	[MJ]	2.29E+1	IND	IND	IND
Non-renewable primary energy as material utilization	[MJ]	1.55E+0	IND	IND	IND
Total use of non-renewable primary energy resources	[MJ]	2.45E+1	3.38E-1	3.30E-2	-1.20E+0
Use of secondary material	[kg]	0.00E+0	IND	IND	IND
Use of renewable secondary fuels	[MJ]	1.36E-3	2.51E-6	5.11E-7	-1.73E-5
Use of non-renewable secondary fuels	[MJ]	1.38E-2	2.63E-5	5.34E-6	-1.82E-4
Use of net fresh water	[m ³]	6.45E-3	1.93E-5	3.81E-4	-1.78E-4

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES:

1 kg Silicate Exterior Paint

Parameter	Unit	A1-A3	A4	A5	D
Hazardous waste disposed	[kg]	4.63E-3	0.00E+0	7.77E-4	0.00E+0
Non-hazardous waste disposed	[kg]	1.97E-1	6.68E-5	1.53E-5	-4.50E-4
Radioactive waste disposed	[kg]	8.42E-4	4.85E-7	1.76E-6	-6.82E-5
Components for re-use	[kg]	IND	IND	IND	IND
Materials for recycling	[kg]	IND	IND	IND	IND
Materials for energy recovery	[kg]	IND	IND	IND	IND
Exported electrical energy	[MJ]	IND	IND	2.40E-1	IND
Exported thermal energy	[MJ]	IND	IND	5.77E-1	IND

6. LCA: Interpretation

The main part of the **non renewable primary energy requirement (PENRT)** is caused by the manufacture of preliminary products (>85%). This is explained by the fact that the formulation process is not associated with any major effects, which means that the production of raw materials is comparatively high. The main energy sources used are natural gas and mineral oil, also mainly for the production of the preliminary products. The manufacture of the polypropylene (PP) container contributes approx. 6% of the production.

At approx. 6% (of the total primary energy), the proportion of **renewable primary energy** is very low. This is demonstrated with the production of the preliminary products in particular, the renewable part of the mixed electricity, with the main effect being in A3

with the use of wooden pallets. Solar energy is needed for photosynthesis when wood grows, which explains why it appears here as a renewable source of primary energy.

Up to 75% of the **global warming potential (GWP)** is caused by the manufacture of preliminary products. In A3, which contributes 4% to the GWP, the manufacture of polypropylene containers is particularly important. With the application of the product, the incineration of containers and wooden pallets dominates the GWP (total contribution approx. 10%). The credits from the thermal recycling of the waste reduce the GWP by approx. 5%. In general the GWP is dominated by carbon dioxide emissions (> 90%).

With the **ozone depletion potential (ODP)** it is apparent that most of the impact is caused by the production of preliminary products (approx. 90%), which mainly comes from the halogenated organic emissions from the electricity mix used. Production only contributes approx. 5%, most notably from the manufacture of the packaging materials. The credits from waste incineration reduce the ODP by approx. 5%.

In addition, up to 95% of the **acidification potential (AP)** comes from the manufacture of the preliminary products – mainly by the production of titanium dioxide (approx. 85 %). Production hardly contributes to the acidification potential (<2%). Overall the biggest impact comes from emissions of sulphur oxides (approx.60%) and nitrogen oxides (approx. 25%).

About 90% of the **eutrophication potential (EP)** is caused by emissions into the atmosphere and about 10% by emissions into the water.

Nitrogen oxide emissions are responsible for approx. 70% of the emissions into the atmosphere. Approx. 80-90% of the EP is caused by the manufacture of preliminary products. Production contributes only about 3% of the EP, which can be mainly traced back to the manufacture of the containers. With regard to the EP, the transport to the construction site also strikes due to nitrogen monoxide emissions of 5-10%.

The **summer smog potential (POCP)** is also dominated by the application of paints by >90%, where emissions of non-methane volatile organic compounds (NMVOC) affect POCP. The production of precursors only contributes to about 5-10%.

7. Requisite evidence

7.1 VOC evidence

The exterior paints described in this EPD contain less than 5% organic components. An /AgBB/ assessment is not required for exterior products.

7.2 Leaching

The use of silicate-based products in outdoor areas does not take place in areas in contact with surface water or the water table. There are currently no European or national assessment criteria or emission scenarios for a scenario where building sections are exposed to rainwater. This means that it is not possible to provide technical confirmation in the same way as in indoor areas (/AgBB/ diagram).

7.3 Toxicity of combustion fumes

KEIM paints are non-flammable. They do not ignite, even where flames are at their strongest, which means that if there is a fire: maximum safety and no toxic gases.

8. References

Waste code 080112: Regulation on the European Waste Directory, 2016-03

AgBB: Committee for health assessment of building products, 20012-06

Biocide Regulations: Regulation (EU) no. 528/2012 of the European Parliament and the European Council dated 22nd May 2012 about licensing for the market and the use of biocides, 2012-05

ChemVOCFarbV: Chemicals regulation for limiting the emissions of volatile organic compounds (VOC) by restricting the introduction into circulation of solvent-based paints and varnishes (solvent-based paint and varnish regulation ChemVOCFarbV), 2004-12

Decopaint Guideline 2004/42/EC: Guideline 2004/42/EG of the European Parliament and the European Council dated 21st April 2004 for limiting the emissions of volatile organic compounds due to the use of organic solvents in specific paints and varnishes and in products used in respraying vehicles as well as amending the guideline 1999/13/EC, 2005-04

DIN 18363: VOB Procurement and Contract Regulations for Building Services - Part C: General Technical Contract Conditions for Building Services

(ATV) – Painting and Varnishing Work – Coatings, 2012-09

DIN EN 1062: Coating materials - Coating materials and coating systems for exterior mineral-based masonry and concrete - Part 1: sub-division; German version EN 1062-1:2004, 2004-08

DIN EN 15804: Sustainability of buildings - environmental product declarations – basic rules for the building products category; German version EN 15804:2012+A1:2013, 2014-07

DIN EN ISO 7783-2:1999 Determination and categorization of the water vapour diffusion flow density (permeability)

DIN EN ISO 2813:1999 Coating materials - Determining the gloss rating below 20°, 60° and 85°

EN 13501-1:2007+A1:2009 Classification of building products and construction types by their behaviour in a fire - Part 1: Classification with the results from the assessments of how building products behave in a fire

DIN EN ISO 9001: Quality management systems - requirements; 2009-12

DIN EN ISO 14025: Environmental labelling and –declarations – Type III Environmental declarations – principles and procedures, 2011-10

GaBi 6 2012: GaBi 6: Software and database for integrated accounting. LBP, University of Stuttgart and PE International, 2012

GaBi 6 2012B: GaBi 6: Documentation for GaBi 4-datasets in the database for integrated accounting. LBP, University of Stuttgart and PE International, 2012 <http://documentation.gabi-software.com/>

GISBAU Information: Product code for paints and varnishes from the Hazardous Products Information System of the Construction Industry Trade Association, 2013-01

PCR 2013, Part A: Product category rules for building products Part A: Rules for calculating the Environmental Impact Assessment and requirements for the background report, 2013-04

PCR 2014, Part B: Product category rules for building products Part B: Requirements for the EPD for coatings with organic binding agents, 2014-07

REACH Regulation: Regulation (EU) no. 1907/2006 of the European Parliament and the European Council dated 18th December 2006 for the Registration, evaluation, authorisation and restriction of chemicals

(REACH), to create a European Chemicals Agency, to amend the guideline 1999/45/EU and to lift regulation (EEC) no. 793/93 of the Council, regulation (EU) no. 1488/94 of the Commission, guideline 76/769/EEC of the Council as well as guidelines 91/155/EEC, 93/67/EEC, 93/105/EU und 2000/21/EU of the Commission, 2006-12

VwVwS: Administrative Regulations for Materials Hazardous to Water. 1999-05

Institut Bauen und Umwelt

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

General Principles

for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2015/10
www.ibu-epd.de

/ISO 14025/

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

/EN 15804/

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



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