ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	**Verband der deutschen Lack- und Druckfarbenindustrie e.V.**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-VDL-20160265-IAG1-EN
Issue date	21.02.2017
Valid to	20.05.2023

Hybrid Powder Coating

Verband der deutschen Lack- und Druckfarbenindustrie e.V.

Institut Bauen und Umwelt e.V.

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

Verband der deutschen Lack- und Druckfarbenindustrie e.V.

1. General Information

Verband der deutschen Lack- und Druckfarbenindustrie e.V.

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

Declaration number
EPD-VDL-20160265-IAG1-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
21.02.2017

Valid to
20.05.2023

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

Dr. Burkhart Lehmann
(Managing Director IBU)

Hybrid Powder Coating

Owner of the Declaration
Verband der deutschen Lack- und Druckfarbenindustrie e.V.
Mainzer Landstraße 55
60329 Frankfurt am Main
Germany

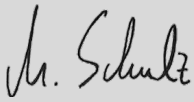
Declared product / Declared unit
1 kg hybrid-based powder coating

Scope:
This is an association EPD for the Verband der deutschen Lack- und Druckfarbenindustrie e.V. (VdL) for hybrid-based powder coating. The formulation declared in the EPD represents an average powder coating with average percentages of pigment and titanium dioxide. This Declaration is based on details provided by members of the Powder Coating sector group in the VdL. It applies exclusively for the representative composition outlined in section 2.6. The members of the VdL are primarily based in Germany which is why Germany was used as a geographic reference in the EPD. Two of the manufacturing companies have their production facilities in Austria and Switzerland, respectively. The validity of this EPD for Austrian and Swiss production is outlined in section 3.3.
This document is translated from the German Environmental Product Declaration into English. It is based on the German original version EPD-VDL-20160265-IAG1-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

This Environmental Product Declaration declares a representative formulation for a hybrid-based powder coating suitable for interior applications and in line with the state of the art. The powder coating under review is an organic-based, thermally-hardening, duroplastic coating material. The powder coating comprises polyester resin, epoxy resin, additives, filler and pigments. This Declaration refers to an average composition which is standard within the sector.

The powder coating under review is essentially used on steel and aluminium substrates in interior applications and primarily serves decorative purposes. Application on radiators in accordance with /DIN 55900/, for example.

2.2 Application

The hybrid powder coating under review here is suitable for most interior applications, primarily on steel and aluminium, requiring decorative and functional properties. In the construction sector, it is most

frequently found in the area of sanitary, heating and air-conditioning technology.

2.3 Technical Data

The powder coating film applied in accordance with the specifications of the applicable technical data sheet (coating thickness, curing conditions) on suitable substrates with the appropriate preliminary treatment displays the following technical properties:

Technical construction data

Name	Value	Unit
Density /EN ISO 8130-2/	1.2 - 1.7	kg/m³
Solids content /EN ISO 14880-2/	100	%
pH value n.r.	-	$-\log_{10}(a_{H+})$
Water vapor diffusion equivalent air layer thickness n.r.	-	m
Water vapour diffusion resistance factor n.r.	-	-
Whiteness n.r.	-	-
Brightness n.r.	-	-
Gloss measuring angle 60° /EN ISO 2813/	30 - 90	%
Viscosity n.r.	-	m^2s^{-1}
Colour change to BFS no. 26 n.r.	-	-
Lifting strength n.r.	-	N/mm²
Salt spray resistance /NSS, /EN ISO 9227/	240 h, dmax 4 mm	-
Sulphur dioxide and moisture condensation test n.r.	-	-
Accelerated weathering n.r.	-	-
Outdoor weathering n.r.	-	-
Theoretical spreading rate in accordance to the layer thickness (powder coatings)	10 - 14	m²/kg
Hardness test (Cupping test) /EN ISO 1520/*	>=3	mm
Mandrel bending test /EN ISO 1519/*	<=10	-
Indentation hardness n.r.	-	-
Curing time	10 - 20	min
Curing temperature	160-180	°C

*refers to applied powder coating film

2.4 Delivery status

The powder coating under review is supplied as ground powder. The powder coating is either packed in cardboard boxes lined with PE bags (contents 15 – 25 kg), in cardboard containers with 20 – 25 bags (contents 400 – 500 kg) or in Big Bags (contents 400 – 700 kg). Other containers are available on request. The various containers are generally transported on wooden pallets which can be re-used. The materials used for packaging and transport should be recycled or thermally utilised where possible.

2.5 Base materials / Ancillary materials

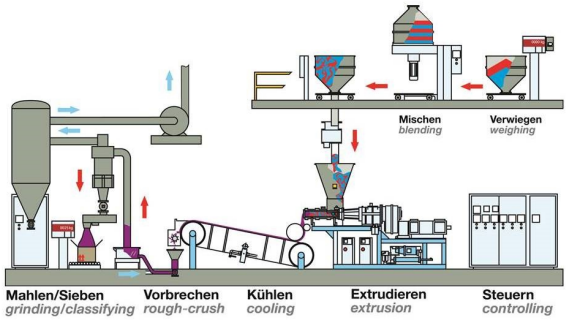
Name	Value	Unit
Binding agents (resins and hardeners)	65	%
Pigments (coloured and effect pigments)	3	%
Titanium dioxide	15	%
Extenders	15	%
Additives	2	%

The Declaration refers to the above composition of powder coating.

2.6 Manufacture

Manufacturing a powder coating involves the following processing steps:

- Weighing the raw materials
- Mechanical premixing
- Melt-homogenising in the extruder
- Rolling, cooling and crushing the extrudate to chips
- Grinding and screening
- Packing and labelling



2.7 Environment and health during manufacturing

In order to ensure protection of the environment and health, the following environmental management systems and legal specifications are considered within the framework of the manufacturing process:

Typical environmental management systems (specific details can be requested from the respective manufacturer):

- /ISO 14004/ General guidelines on principles, systems and supporting the techniques
- /ISO 14001/ International standard for specifying and implementing environmental requirements
- /EMAS/ Implementing and improving environmental performance based on /VO EG 1221/2009/ and /EN ISO 14001/.

As the manufacturing process does not include solvents, no foul air emissions are incurred.

Dust emissions are prevented by state-of-the-art filter technology.

The water used for cleaning the plants is cleaned without adding tensides and redirected to the water cycle.

No soil contamination occurs.

Storage and handling of the raw materials, intermediates and finished products takes consideration of the water hazard classes.

Noise-generating aggregates are exclusively used in noise-insulating form with the result that the national limit values are maintained or fallen short of.

Reducing energy requirements per manufacturing unit is permanently pursued within the framework of an environmental or energy management system.

Where technically possible, the use of hazardous substances is largely avoided. If the use of hazardous substances is technically necessary, it is ensured that the maximum occupational limit values are fallen short of and all statutory protective measures are taken into consideration.

Marking associated with hazardous substances is regulated by the /CLP Regulation/.

As a general rule, the principle of avoidance, reduction and legally-compliant disposal applies for waste.

The relevant legal specifications governing fire safety and explosion protection are maintained.

All employees are trained at regular intervals on the contents of the items listed above.

2.8 Product processing/Installation

In its corresponding formulation, the powder coating under review can be processed on all coating systems available on the market using corona or tribo charging. Effect powder coatings are usually processed by means of corona charging.

Guidelines to be considered:
VDE provisions and the corresponding European standards (DIN EN 12981).

Powder coatings do not contain any solvents.

The overspray can be recovered and re-used using the corresponding plant technology.

2.9 Packaging

The powder coating under review is usually packed in cardboard containers lined with PE bags or Big Bags. The various containers are generally transported on wooden pallets which can be re-used. The materials used for packaging and transport should be recycled or thermally utilised where possible.

2.10 Condition of use

In buildings, powder coatings are used as coatings on facades, metallic surfaces or similar. Powder-coated surfaces display a stable and constant composition during use. The decorative and practical properties displayed by powder coatings in interior or exterior applications permit a long service life on the part of the coated objects.

2.11 Environment and health during use

When powder coatings are processed as designated by the manufacturer and taking consideration of the applicable safety information, no negative impacts are to be anticipated for man or the environment in accordance with the current state of knowledge.

2.12 Reference service life

When processed as designated and taking consideration of the information supplied by the manufacturer (cleaning recommendations, potential restrictions concerning areas of application), the service life of powder-coated surfaces complies with the service life of the coated parts.

2.13 Extraordinary effects

Fire
In line with /EN 13501-1/, “Classification of building products and types by fire performance”, powder-coated construction products are “non-homogenous construction products”. The powder coating and/or coating manufactured is defined as a “non-substantial component” of the construction product. Reaction to fire must be examined individually and classified in a fire class by the manufacturer of the manufactured product.

Water
When the powder coating is processed as designated, a hazard to water is not to be anticipated in accordance with the current state of knowledge in the event of unforeseen contact with water.

Mechanical destruction
When the powder coating is processed as designated, a hazard to water is not to be anticipated in accordance with the current state of knowledge in the event of unforeseen contact with water.

2.14 Re-use phase

Material re-use of hardened powder coatings is not possible. Powder coatings can be removed using mechanical, chemical and thermal processes. Powder coatings removed by mechanical or chemical processes can then be directed to approved plants following thermal utilisation.

2.15 Disposal

/EWC/ (European Waste Code) 080201 The EWC to be applied is to be specified by the waste producer.

Possible disposal methods for powder coating waste are:
1. Material utilisation, e.g. in composite materials
2. Thermal utilisation in approved Systems.

2.16 Further information

More detailed information on the powder coating under review can be found in the respective product information, safety data sheets and on the product manufacturers’ websites.

3. LCA: Calculation rules

3.1 Declared Unit

This Declaration refers to the manufacture of 1 kg powder coating.

The Declaration is based on a representative sample formulation for a powder coating containing hybrid resin as its main component.

Details on declared unit

Name	Value	Unit

Declared unit	1	kg

3.2 System boundary

Type of EPD: cradle to plant gate
The product stage of the powder coating is calculated in terms of its LCA in this Declaration.
The system boundary to the natural environment is defined so that the processes supplying the system with material and energy input, the subsequent manufacturing and transport processes and the treatment of all waste incurred by these processes are parts of the system.
Application of the powder coating is outside the system boundary of this EPD.

3.3 Estimates and assumptions

Data sets on the upstream chains associated with manufacturing basic materials are taken from the /GaBi data base/. Materials for which there are no inventories available are approximated with data sets of similar chemicals or estimated by merging available data sets.
The German power mix applied in the manufacturing phase represents a *worst-case* scenario for most environmental indicators in order for the scope of this EPD to include Austria and Switzerland as well as Germany. This lies in the slightly higher potential environmental impacts of the German power mix compared to the effects attributable to the power mixes for Austria and/or Switzerland. The environmental loads caused by the Swiss power mix are only considered as a *worst-case* scenario for the Ozone Depletion Potential (ODP) and Radioactive Waste for Disposal (RWD) environmental indicators. This methodical approach ensures the validity of the EPD for production in any one of these 3 countries.

3.4 Cut-off criteria

All operating data, i.e. all of the starting materials used in accordance with the formulation, transport thereof to the plant, the thermal and electrical energy used, packaging materials, all direct production waste as well as all emission measurements available were taken into consideration in the analysis. Accordingly, material and energy flows with a share of less than one per cent were also considered. Machinery, plants and infrastructure required in the manufacturing process were not considered.
Transport expenses for packaging and cleaning granulate are not taken into account.
Likewise, special waste accounting for 0.03% and internally recycled powder coating accounting for 0.66% are cut off.

3.5 Background data

GaBi ts 7.3 /GaBi/ - the software system for comprehensive analysis developed by thinkstep AG - was used for modelling the life cycle of the declared product. The respective data base is the /GaBi 2016/, version 6.115.

3.6 Data quality

The data quality can be regarded as good. The primary data was collated in full taking consideration of all relevant flows. The background data was taken from the /GaBi/ data bases. The data bases were last updated in 2016.

3.7 Period under review

Collation of the primary data refers to the period 2015 (annual average).

3.8 Allocation

Primary data
The production process does not produce any by-products. Accordingly, no resources or environmental loads were allocated to ancillary products in the LCA model on which the LCA is based.

Background data
The data sets used are listed in the background report. The allocation methods used in background data (materials and energy) originating from the /GaBi 2016/ data bases are documented online at http://www.gabi-software.com/deutsch/support/gabi/.

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.
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4. LCA: Scenarios and additional technical information

The product is declared including 0.029 kg of paper packaging, 0.005 kg of PE film and 0.036 kg of wood. The packaging made from sustainable raw materials (paper/wood) includes 0.09 kg of bound CO_2.

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	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	MND	MND	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg Hybrid-Pulverlack

Parameter	Unit	A1-A3
Global warming potential	[kg CO_2-Eq.]	5.07
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	3.02E-10
Acidification potential of land and water	[kg SO_2-Eq.]	1.14E-2
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.19E-3
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	1.58E-3
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	2.07E-5
Abiotic depletion potential for fossil resources	[MJ]	98.00

RESULTS OF THE LCA - RESOURCE USE: 1 kg Hybrid-Pulverlack

Parameter	Unit	A1-A3
Renewable primary energy as energy carrier	[MJ]	7.81
Renewable primary energy resources as material utilization	[MJ]	1.05
Total use of renewable primary energy resources	[MJ]	8.86
Non-renewable primary energy as energy carrier	[MJ]	85.80
Non-renewable primary energy as material utilization	[MJ]	17.00
Total use of non-renewable primary energy resources	[MJ]	103.00
Use of secondary material	[kg]	0.00
Use of renewable secondary fuels	[MJ]	0.00
Use of non-renewable secondary fuels	[MJ]	0.00
Use of net fresh water	[m^3]	0.02

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg Hybrid-Pulverlack

Parameter	Unit	A1-A3
Hazardous waste disposed	[kg]	1.19E-7
Non-hazardous waste disposed	[kg]	5.93E-1
Radioactive waste disposed	[kg]	2.20E-3
Components for re-use	[kg]	0.00
Materials for recycling	[kg]	0.00
Materials for energy recovery	[kg]	0.00
Exported electrical energy	[MJ]	0.00
Exported thermal energy	[MJ]	0.00

6. LCA: Interpretation

The loads in the production phase are dominated by the upstream chain associated with the raw material supply. The use of ancillaries and energy has a minor influence. Transport has a negligible influence. The environmental loads within raw material supply (A1) are primarily dominated by the binding agent and titanium dioxide in the various environmental impact categories. Titanium dioxide is the main cause of Acidification Potential of Soil and Water (**AP**) and Abiotic Depletion Potential of non-fossil resources (**ADP e**lements). The binding agent dominates all other impact categories. An exception is represented by the Ozone Depletion Potential (**ODP**) category in which the pigments are the main cause of pollution.

7. Requisite evidence

The powder coating outlined in this EPD is used in interior applications, among others. Evidence in terms of consumer protection inside buildings is not of relevance for powder coatings as they involve preliminary products which are only used following application on a substrate in the building.

8. References

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

EN ISO 8130-2
Determination of density by gas comparison pyknometer (referee method)

EN ISO 14880-2:2007-03
Optics and photonics - Microlens arrays - Part 2: Test methods for wavefront aberrations

EN ISO 2813:2015-02
Determination of gloss value at 20°, 60° and 85°

EN ISO 9227:2012-09
Corrosion tests in artificial atmospheres - Salt spray tests

EN ISO 1520:2007-11
Paints and varnishes - Cupping test

EN ISO 1519:2011-04
Paints and varnishes - Bend test (cylindrical mandrel)

DIN 55900-1:2002-05
Terms, requirements and tests for primers and industrially applied priming coats

EN ISO 14004:2016-08
Environmental management systems - General guidelines on implementation

EN ISO 14001:2015-11
Environmental management systems – Requirements with guidance for use

EMAS
Regulation (EC) No. 761/2001 of the European parliament and of the council of 19 March 2001 allowing voluntary participation by organisations in a Community eco-management and audit scheme (EMAS) in: OJEU: No. L 114 dated 24.4.2001, page 1

Regulation (EC) No. 1221/2009 of the European Parliament and Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No. 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC

Regulation (EC) No. 1272/2008 of the European Parliament and Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No. 1907/2006 (CLP Regulation)

EN 12981:2010-06
Coating plants - Spray booths for application of organic powder coating material - Safety requirements

EN 13501-1:2010-01
Classification of building products and types by fire performance

EWC: 080201
European Waste Code (EWC), No. 080201 – Waste from powder coating, European Waste Catalogue Ordinance (AVV) of 10 December 2001 (Federal Law Gazette I, No. 65 dated 12.12.2001, page 3379), last revised 2012

PCR, Part A
Calculation rules for the Life Cycle Assessment and requirements on the Background Report, 03.2016

PCR Part B
Coatings with organic binding agents, 07.2014

GaBi
GaBi software system and data base for Life Cycle Engineering, Copyright © 1992-2016 AG

The Powder Coating sector group at the Verband der deutschen Lack- und Druckfarbenindustrie e.V. was involved in drawing up the EPD. The association comprises the following companies:

Akzo Nobel Powder Coatings GmbH

Axalta Coating Systems Germany GmbH

BASF Coatings GmbH

CWS Powder Coatings GmbH

Emil Frei GmbH & Co. KG

Ganzlin Beschichtungspulver GmbH

INVER GmbH

Karl Bubenhofer AG Farbenfabrik

Karl Wörwag Lack- und Farbenfabrik GmbH & Co. KG

Rembrandtin Powder Coating GmbH

Teknos Deutschland GmbH

Tiger Coatings GmbH & Co. KG

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