ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	Paul Bauder GmbH & Co. KG
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-BAU-20220210-CBC5-EN
Issue date	10.11.2022
Valid to	09.11.2027

BauderECO S/F

Paul Bauder GmbH & Co. KG

Institut Bauen und Umwelt e.V.

ECO PLATFORM EPD VERIFIED

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

General Information

Paul Bauder GmbH & Co. KG

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-BAU-20220210-CBC5-EN

This declaration is based on the product category rules:

Insulating materials made of foam plastics, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

10.11.2022

Valid to

09.11.2027

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

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

BauderECO S/F

Owner of the declaration

Paul Bauder GmbH & Co. KG
Korntaler Landstraße 63
70499 Stuttgart
Germany

Declared product / declared unit

1 m² BauderECO S/F

Scope:

This declaration applies to 1 m^2 of "BauderECO S/F" manufactured by Paul Bauder GmbH & Co. KG at the plant, located in 06188 Landsberg near Halle.
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

Dr. Eva Schmincke,
(Independent verifier)

Product

Product description/Product definition

BauderECO S/F is a closed-cell ecological rigid foam and factory-made thermal insulating material, which is used in the form of insulation boards for building constructions - pursuant to EN 13165. This EPD refers to ecological rigid foam insulation boards laminated with covering layers of shell limestone on both sides.

The products need a declaration of performance taking into consideration the specification DIN EN 13165:2012+A2:2016 thermal insulation products for buildings - factory made rigid polyurethane foam (PU) products - as well as the CE-marking. The respective national provisions apply to the use of the products. In Germany, the design values for use in building construction are specified in DIN 4108 - 10. Hygrothermal design values are regulated in DIN 4108-4.

Application

The scope of application of BauderECO S/F includes thermal insulation in building construction (e.g., pitched roofs, flat roofs, floors, ceilings and exterior walls (inside and outside)).

Technical Data

For determining technical data, the test methods stated in DIN EN 13165 are used. The gross density of BauderECO S/F with facing layers of shell limestone for building construction is approx. 29-32 kg/m³.

Depending on their thickness, the boards are manufactured with thermal conductivity levels WLS 024 up to WLS 028. These levels are equivalent to thermal conductivity design values from 0.023 W/(m·K) up to 0.027 W/(m·K). In addition to thermal conductivity, the nominal value of the thermal resistance can be specified ranging from R 2.20 (m²·K)/W at 60 mm to 7.80 (m²·K)/W at 180 mm.

Name	Value	Unit
Gross density	≥ 29	kg/m^3
Compressive strength acc. to EN 826	≥ 120	N/mm^2
Tensile strength acc. to EN 826	≥ 80	N/mm^2
Modulus of elasticity acc. to EN 826	≥ 4	N/mm^2
Calculation value for thermal conductivity	0.024 - 0.028	W/(mK)
Water vapour diffusion resistance factor acc. to EN 12088	40 - 200	-
Thermal conductivity acc. to EN 13165	0.023 - 0.027	W/(mK)
Creep behaviour or permanent compressive strength acc. to DIN EN 1606	≥ 0.02	N/mm^2
Short term water absorption acc. to EN 1609	max. 0.1	%
Fire behaviour acc. to EN 13501 – 1	E	

Nominal compressive stress or nominal compressive strength at 10% deformation is 120 kPa (dh) to DIN 4108-10. Higher compressive strength is possible. Nominal tensile strength perpendicular to the insulation board plane is ≥ 80 kPa. Higher tensile strength is possible.

The water vapour diffusion resistance factor μ of BauderECO S/F is between 40 and 200 according to DIN 4108-4.

Maximum moisture absorption of BauderECO S/F at diffusion and condensation is approx. 6 % by volume. Water absorption at total immersion of a 60 mm thick BauderECO S/F with shell limestone facings was measured at 1.3 % by volume after 28 days. Moisture absorption after freezing and thawing was between 2 % and 7 % by volume, measured at insulating material without facings.

BauderECO S/F is a distinctive thermosetting material and therefore cannot be melted.

Base materials/Ancillary materials

The 120 mm thick BauderECO S/F insulation board with shell limestone facing layer consists of 3.48 kg/m² ecological hard foam and 0.55 kg/m² shell limestone layer.

The product composition is shown in the following table:

Name	Value	Unit
Polyol	23 - 28	%
MDI	52 - 55	%
Water	≤ 0,3	%
Pentane	≤ 5	%
Catalyst	≤ 1,5	%
Flame retardants (halogen free)	≤ 2	%
Stabilizer	≤ 0,7	%
Facer	7 - 14	%

The raw material used for producing BauderECO S/F is mainly obtained from biomass undergoing several production stages. The biomass content follows the mass balance approach which is not considered in this EPD. In addition to fossil raw materials, another raw material is obtained from recycled saw and milling dust, which is a by-product of the manufacturing of the BauderECO S/F insulation boards and is partly re-used in a closed-loop. BauderECO S/F does not contain volatile isocyanates.

Under the current Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) BauderECO S/F is declared as follows:
- BauderECO S/F contains substances listed in the Candidate List for authorization on 16 January 2020 exceeding 0.1 percentage by mass: no.
- BauderECO S/F 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: no.
- Biocide products were added to this construction product or it has been treated with biocide products (which would be considered a treated product under the definition set out in (EU) Ordinance on Biocide Products No 528/2012): no.

Reference service life

The service life of BauderECO S/F insulation boards corresponds to the service life of the insulated building components when used properly. The function of the insulation material remains without limitations during the service life.

Additional information

Additional information about BauderECO S/F insulation boards can be found at: www.baudereco.de

LCA: Calculation rules

Declared Unit

The declaration refers to 1 m² "BauderECO S/F". For this product, MDI is used in compliance with the mass balance approach. While the results based on the mass balance approach are declared in the annex, the biogenic content of MDI is not considered here.

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Gross density	29	kg/m^3
Grammage product	4.03	kg/m²
Grammage (without lamination)	3.48	kg/m^2
Grammage lamination (shell limestone layer)	0.55	kg/m²
Layer thickness	0.12	m

Type of EPD: Manufacturer EPD 1a) declaration of one specific product from one plant of one manufacturer.

System boundary

Type of EPD: Type of EPD: Cradle to gate with options, modules C1–C4 and module D (A1–A3 + C + D and additional modules: A4, A5). The following modules of the life cycle are shown in the LCA:

Production Stage (A1-A3): The production stage includes:

- A1 Raw material supply and processing, processing of secondary material inputs, (e.g. recycling processes)
- A2 Transport of raw materials to the Manufacturer (reference area Germany)
- A3 Production of of BauderEco S/F in the factory (incl. provision of energy, water and auxiliary materials, disposal of production waste, production of packaging materials)

Construction stage (A4-A5): The cconstruction stage of Paul Bauder GmbH & Co. KG, BauderEco S/F, includes:

- A4 transport to the construction site
- A5 Disposal of the packaging after installation of the insulation board in the building

End-of-life stage (C1-C4): The end-of-life stage of Paul Bauder GmbH & Co. KG, BauderEco S/F, includes:

- C1 Manual de-construction
- C2 Transport to waste processing: 50 km with truck

Transport distance can be adjusted for the specific building if necessary (e.g., for 100 km actual transport distance: multiply LCA values by factor 2)

- C3 100% Thermal recovery
- C4 not relevant

Benefits and loads beyond the System Boundary (D):
Module D includes:
Energy recovery potentials from thermal recycling of the packaging and BauderEco S/F at the end of life.

Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Germany

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 background data comes from the GaBi database /*GaBi software*/Version CUP2022.1

The IBU regulations provide that two EPDs have to be created for products with mass balance approach. The results with mass balance approach are declared in the second EPD, which is published as annex below.

LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

The following technical information provides the basis for the modules declared or can be used to develop specific scenarios as part of a building assessment.

Transport to the building site (A4)

Name	Value	Unit
Transport distance	100	km

Installation into the building (A5)

Production and disposal of the following packaging materials is included in the LCA.

Name	Value	Unit
Shrink film	0.12	kg/m²

End-of-Life (C1-C4)

Deconstruction (C1)

Manual removal of the product from the building (without environmental impact).

Transport to End-of-Life treatment (C2)

Transport to waste treatment: 50 km with truck.

Waste processing (C3)

100% thermal recovery of product from demolishing

Disposal (C4)

Not relevant

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
For energy recovery (product)	4.03	kg
For energy recovery (packaging)	0.12	kg

Module D includes: Energy recovery potentials from thermal recycling of the packaging and BauderEco S/F at the end of life. A waste incineration plant with an R1 value > 0.6 was assumed.

LCA: Results

The following is a summary of the LCA results for BauderECO S/F (without mass-balance approach) PU insulation boards with a basis weight of 4.03 kg/m^2 and a thickness of 120 mm. The results for BauderECO S/F (mass balance) are available in the annex.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = 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	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m² BauderECO (without Mass Balance)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	9.56E+00	2.68E-02	3.77E-01	0	1.39E-02	7.73E+00	0	-3.15E+00
GWP-fossil	kg CO_2 eq	9.64E+00	2.49E-02	3.77E-01	0	1.21E-02	7.73E+00	0	-3.13E+00
GWP-biogenic	kg CO_2 eq	-8.63E-02	1.78E-03	2.06E-05	0	1.77E-03	5.62E-04	0	-1.65E-02
GWP-luluc	kg CO_2 eq	5.32E-03	9.56E-05	6.83E-07	0	4.64E-05	3.25E-05	0	-3.57E-04
ODP	kg CFC11 eq	-2.2E-10	5.09E-15	2.99E-14	0	2.47E-15	6.48E-13	0	-2.19E-11
AP	mol H^+ eq	1.95E-02	2.34E-05	5.76E-05	0	1.13E-05	4.61E-03	0	-4.05E-03
EP-freshwater	kg P eq	4.28E-05	4.95E-08	6.76E-09	0	2.4E-08	2.7E-07	0	-4.47E-06
EP-marine	kg N eq	5.15E-03	7.77E-06	9.18E-06	0	3.77E-06	2.23E-03	0	-1.12E-03
EP-terrestrial	mol N eq	5.24E-02	9.21E-05	2.69E-04	0	4.47E-05	2.56E-02	0	-1.2E-02
POCP	kg NMVOC eq	2.19E-02	2.09E-05	2.49E-05	0	1.01E-05	5.72E-03	0	-3.11E-03
ADPE	kg Sb eq	1.31E-06	2.49E-09	7.38E-10	0	1.21E-09	1.79E-08	0	-4.92E-07
ADPF	MJ	2.63E+02	3.29E-01	5.61E-02	0	1.6E-01	2.23E+00	0	-5.27E+01
WDP	m^3 world eq deprived	1.56E+00	1.07E-04	3.45E-02	0	5.18E-05	8.06E-01	0	-3.15E-01

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 m² BauderECO (without Mass Balance)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	1.2E+01	2.17E-02	1.4E-02	0	1.05E-02	4E-01	0	-1.47E+01
PERM	MJ	0	0	0	0	0	0	0	0
PERT	MJ	1.2E+01	2.17E-02	1.4E-02	0	1.05E-02	4E-01	0	-1.47E+01
PENRE	MJ	1.63E+02	3.3E-01	5.13E+00	0	1.6E-01	9.65E+01	0	-5.27E+01
PENRM	MJ	9.94E+01	0	-5.07E+00	0	0	-9.43E+01	0	0
PENRT	MJ	2.63E+02	3.3E-01	5.61E-02	0	1.6E-01	2.24E+00	0	-5.27E+01
SM	kg	1.36E-01	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0
FW	m^3	6.64E-02	1.68E-05	8.09E-04	0	8.15E-06	1.9E-02	0	-1.36E-02

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 m² BauderECO (without Mass Balance)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	9.21E-08	1.44E-12	5.6E-12	0	6.98E-13	2.92E-10	0	-7.25E-09
NHWD	kg	1.51E-01	5.36E-05	1.52E-03	0	2.6E-05	2.19E-01	0	-2.69E-02
RWD	kg	2.7E-03	4.14E-07	1.55E-06	0	2.01E-07	9.27E-05	0	-4.04E-03
CRU	kg	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0
EEE	MJ	0	0	6.84E-01	0	0	1.33E+01	0	0

EET	MJ	0	0	1.58E+00	0	0	2.38E+01	0	0

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; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m² BauderECO (without Mass Balance)

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Disease incidence	1.65E-07	1.52E-10	3.59E-10	0	7.36E-11	1.43E-08	0	-3.34E-08
IR	kBq U235 eq	3.03E-01	4.21E-05	1.53E-04	0	2.04E-05	1.48E-02	0	-6.76E-01
ETP-fw	CTUe	1.01E+02	2.52E-01	2.2E-02	0	1.22E-01	8.51E-01	0	-1.14E+01
HTP-c	CTUh	2.67E-09	5.06E-12	2.47E-12	0	2.45E-12	5.74E-11	0	-5.33E-10
HTP-nc	CTUh	1.2E-07	2.54E-10	7.98E-11	0	1.23E-10	2.35E-09	0	-2.07E-08
SQP	SQP	3.6E+01	9.87E-02	1.56E-02	0	4.79E-02	4.88E-01	0	-9.56E+00

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

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”. 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.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

References

Standards

DIN 4108-4
DIN 4108-4:2020-11, Thermal insulation and energy economy in buildings - Part 4: Hygrothermal design values.

DIN 4108-10
DIN 4108-10:2015-12, Thermal insulation and energy economy in buildings - Part 10: Application-related requirements for thermal insulation materials - Factory - made products.

DIN EN 826
DIN EN 826:2013-05, Thermal insulating products for building applications - Determination of compression behaviour.

DIN EN 1606
DIN EN 1606:2013-05, Thermal insulating products for building applications - Determination of compressive creep.

DIN EN 1607
DIN EN 1607:2013-05, Thermal insulating products for building applications - Determination of tensile strength perpendicular to faces.

DIN EN 12091
DIN EN 12091:2013-06, Thermal insulating products for building applications - Determination of freeze-thaw resistance.

DIN EN 13165
DIN EN 13165:2016-09, Thermal insulation products for buildings – Factory-made rigid polyurethane foam (PU) products - Specification; German version EN 13165:2012. (This norm covers polyurethane rigid foam (PUR) and polyisocyanurate rigid foam (PIR)).

DIN EN 13501-1
DIN EN 13501-1:2019-05, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests; German version EN 13501 1:2007+A1:2010.

EN 12088
EN 12088:2013, Thermal insulatioin for building applications – Determination of long term water absorption by diffusion.

EN 15804
EN 15804+A2:2019+AC:2021, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

ISO 14025
DIN EN ISO 14025:2011-10, Environmental designations and declarations – Type III Environmental Declarations – Basic principles and procedures.

Further references:

AgBB
Evaluation scheme for VOCs from construction products; approach for assessing health risks caused by volatile organic compounds (VOCs and SVOCs) from construction products, version July 2012.

AVV
Regulation on the European List of Waste Materials 2011, last amended by Art. 5, Section 22 of the Law, dated 24 February 2012 (BGBI. I S.212).

CPR
Regulation (EU) No. 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down hamonised condition for the marketing of construction products and repealing Council Directive 89/106/EC.

ECHA
https://echa.europa.eu/candidate-list-table

GaBi software
Sphera Solutions GmbH GaBi Software System and Database for Life Cycle Engineering

CUP Version: 2022.1 University of Stuttgart Leinfelden-Echterdingen

GaBi documentation
GaBi life cycle inventory data documentation (https://www.gabisoftware.com/support/gabi/gabidatabase2020lcidocumentation/)

IBU 2021
Institut Bauen und Umwelt e.V.: General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V., version 2.0., Berlin: Institut Bauen und Umwelt e.V., 2021, http://www.ibu-epd.com

PCR Part A
PCR - Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report, Berlin: Institut Bauen und Umwelt e.V., www.ibu-epd.com, 2020

PCR Part B:
PCR - Part B: Insulating materials made of foam plastics, Institut Bauen und Umwelt e.V. (IBU), 06-2017

REACH
Reach regulation No 1907/2006 of the European Parliament and of the council concerning the registration, evaluation, authorisation and restriction of chemicals(REACH)

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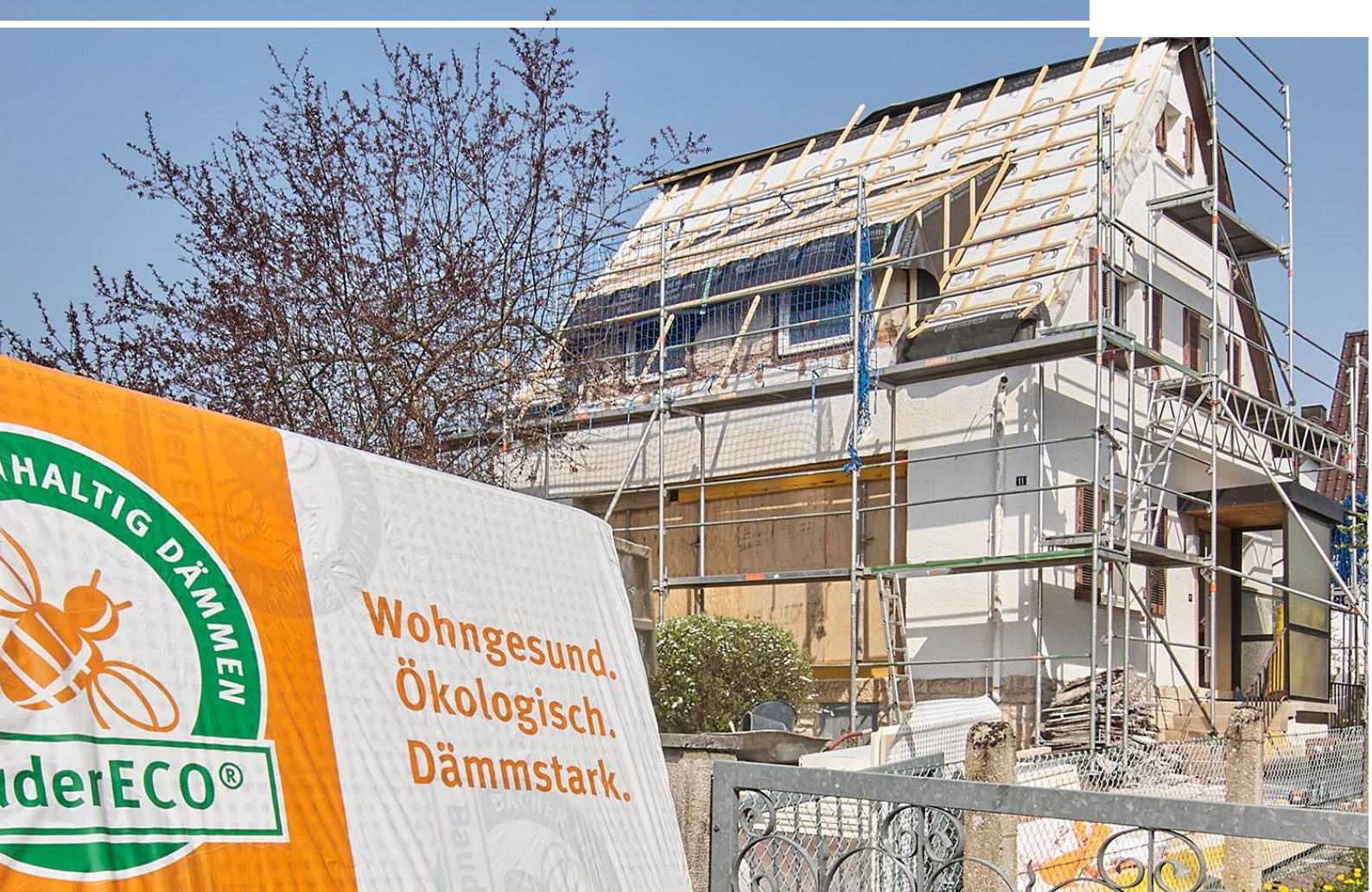
MASS BALANCE PRODUCT INFORMATION

Owner of the document	Paul Bauder GmbH & Co. KG	
Publisher	Institut Bauen und Umwelt e.V. (IBU)	
Document number	MBA-BAU-0001	
Issue date	07.11.2025	
Valid to	28.02.2026	

BauderECO S/F (Mass Balance)
Paul Bauder GmbH & Co. KG

www.ibu-epd.com



General Information

Paul Bauder GmbH & Co. KG

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Hegelplatz 1
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Germany

Document number
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This document is based on the product category rules:
Insulating materials made of foam plastics, 01.08.2021
(PCR checked and approved by the SVR)

Issue date
07.11.2025

Valid to
28.02.2026

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

RA Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.))

BauderECO S/F (Mass Balance)

Owner of the document
Paul Bauder GmbH Co. KG
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Declared product / declared unit
1 m² BauderECO S/F (Mass Balance)

Scope:
This document applies to 1 m² of "BauderECO S/F" manufactured by Paul Bauder GmbH Co. KG at the plant, located in 06188 Landsberg near Halle.

The owner of the document 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 evidence.

For specification of the calculation method see chapter “Mass balance approach (MBA)”

The Product information was created orienting towards the specifications of EN 15804+A2.

For the use of the verified Document please see https://ibu-epd.com/en/update-mass-balance-approaches/

Verification

The standard *EN 15804* serves as the core PCR
Independent verification of the Document and data according to *ISO 14025:2011*
☐ internally ☒ externally

Dr. Eva Schmincke
(Independent verifier)

Product

Product description/Product definition
BauderECO S/F is a rigid foam insulation board made of biomass-balanced polyurethane, which is used for the thermal insulation of building constructions - pursuant to EN 13165. The boards consist of a biomass-balanced insulation core, recycled raw materials and a shell limestone facing on both sides.

The products need a declaration of performance taking into consideration the specification DIN EN 13165:2012+A2:2016 thermal insulation products for buildings - factory made rigid polyurethane foam (PU) products - as well as the CE-marking.

The respective national provisions apply to the use of the products. In Germany, the design values for use in building construction are specified in DIN 4108 - 10. Hygrothermal design values are regulated in DIN 4108-4.

Application
The scope of application of BauderECO S/F includes thermal insulation in building construction (e.g., pitched roofs, flat roofs, floors, ceilings and exterior walls (inside and outside)).

Technical Data
For determining technical data, the test methods stated in DIN EN 13165 are used. The gross density of BauderECO S/F with facing layers of shell limestone for building construction is approx. 29-32 kg/m³.

Depending on their thickness, the boards are manufactured with thermal conductivity levels ranging from λ_D 0.023 to λ_D 0.027. These levels are equivalent to thermal conductivity design values from 0.023 W/(m·K) up to 0.027 W/(m·K). In addition to thermal conductivity, the nominal value of the thermal resistance can be specified ranging from R 2.20 (m²·K)/W at 60 mm to 7.80 (m²·K)/W at 180 mm.

Constructional data

Name	Value	Unit
Gross density	≥ 29	kg/m³
Compressive strength EN 826	≥ 120	N/mm²
Tensile strength EN 826	≥ 80	N/mm²
Modulus of elasticity EN 826	≥ 4	N/mm²
Calculation value for thermal conductivity DIN 4108 - 4	0.024 - 0.028	W/(mK)
Water vapour diffusion resistance factor EN 12088	40 - 200	-
Thermal conductivity EN 13165	0.023 - 0.027	W/(mK)
Creep behaviour or permanent compressive strength EN 1606	≥ 0.02	N/mm²
Long term water absorption acc. to EN 12087	max. 3	%
Short term water absorption acc. to EN 1609	max. 0.1	%
Fire behaviour acc. to EN 13501 - 1	E	

Nominal compressive stress or nominal compressive strength at 10% deformation is 120 kPa (dh) according to DIN 4108-10. Higher compressive strength is possible. Nominal tensile strength perpendicular to the insulation board plane is 80 kPa. Higher tensile strength is possible.

The water vapour diffusion resistance factor μ of BauderECO S/F is between 40 and 200 according to DIN 4108-4. Maximum moisture absorption of BauderECO S/F at diffusion and condensation is approx. 6 % by volume. Water absorption at total immersion of a 60 mm thick BauderECO S/F with shell limestone facings was measured at 1.3 % by volume after 28 days. Moisture absorption after freezing and thawing was between 2 % and 7 % by volume, measured at insulating material without facings.

BauderECO S/F is a distinctive thermosetting material and therefore cannot be melted.

Base materials/Ancillary materials
The 120 mm thick BauderECO S/F insulation board with shell limestone facing layer consists of 3.48 kg/m² hard foam and 0.55 kg/m² shell limestone layer.

The product composition is listed in the following table:

Name	Value	Unit
Polyol	23 - 28	%
MDI (Mass-Balance)	52 - 55	%
Water	≤ 0,3	%
Pentane	≤ 5	%
Catalyst	≤ 1,5	%
Flame retardants (halogen free)	≤ 2	%
Stabilizer	≤ 0,7	%
Facer	7 - 14	%

The MDI used for producing BauderECO S/F is based on the biomass-balance approach. An independent third-party assessment is conducted annually by RedCert to ensure that sufficient biomass-balanced MDI is purchased. In addition to fossil raw materials, another raw material is sourced from recycled saw and milling dust, which is a by-product of the manufacturing process for the BauderECO S/F insulation boards and is partly reused in a closed-loop system. BauderECO S/F does not contain volatile isocyanates.

Under the current Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) BauderECO S/F is declared as follows:
• BauderECO S/F contains substances listed in the Candidate List for authorization on 27 July 2024 exceeding 0.1 percentage by mass: no.
• BauderECO S/F 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: no.
• Biocide products were added to this construction product or it has been treated with biocide products (which would be considered a treated product under the definition set out in (EU) Ordinance on Biocide Products No 528/2012): no.

Reference service life
The service life of BauderECO S/F insulation boards corresponds to the service life of the insulated building components - which according to BBSR is equal or more than 50 years, when used properly.

LCA: Calculation rules

Declared Unit
The document refers to 1 m² "BauderECO S/F" (Mass Balance). For this product, MDI is used in compliance with the mass balance approach.

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Gross density	29	kg/ m^3
Grammage product	4.03	kg/ m^2
Grammage without lamination	3.48	kg/ m^2
Grammage lamination	0.55	kg/ m^2
Layer thickness	0.12	m

Declaration of one specific product from one plant of one manufacturer.

Available Masses
The integration of the BauderECO S/F (mass balance) LCA results into a building life cycle assessment is only permitted if the specific REDcert² certificate 900-36600100 is available. This certificate confirms that the sales volume of BauderECO S/F corresponds to the amount of allocated mass-balanced raw materials.

System boundary

Type of the Declaration: Cradle to gate with options, modules C1–C4 and module D (A1–A3 + C + D and additional modules: A4, A5). The following modules of the life cycle are shown in the LCA:

Production stage (A1–A3):
- A1 Raw material supply and processing, processing of secondary material inputs
- A2 Transport of raw materials to the manufacturer (reference area Germany)
- A3 Production of BauderEco S/F in the factory (incl. provision of energy, water and auxiliary materials, disposal of production waste, production of packaging materials)

Construction stage (A4–A5):
- A4 Transport to the construction site
- A5 Disposal of the packaging after installing the insulation board in the building

End-of-Life stage (C1–C4):
- C1 Manual de-construction
- C2 Transport to waste processing: 50 km by truck. Transport distance can be adjusted for the specific building if necessary (for 100 km actual transport distance: multiply LCA values by factor 2)
- C3 100 % thermal recovery
- C4 not relevant

Benefits and loads beyond system boundary (D):
- D Energy recovery potentials from thermal recycling of the packaging and BauderECO S/F at the end of life.

Mass balance approach (MBA)
BauderECO S/F uses the raw material MDI, which has been calculated according to the mass balance approach for biomass. An annual independent audit by RedCert ensures that enough quantity of the biomass-balanced raw materials is purchased.

Additional Information
The IBU guidelines stipulate that a corresponding EPD must be created for products with a mass balance approach. The results without mass balance approach are declared in the EPD, which was published under EPD-BAU-20220210-CBC2-EN. A fossil based BauderECO S/F variant is not manufactured.

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

The background data is retrieved from the GaBi database/GaBi software/version CUP 2022.1

LCA: Scenarios and additional technical information

Information on biogenic carbon
Biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon in product	1.627	kg/m^2
Biogenic carbon in packaging	0	kg/m^2

The following technical information can be used to develop specific scenarios for a building assessment.

Transport to the construction site (A4)

Name	Value	Unit
Transport distance	100	km

Assembly (A5)
Production and disposal of the following packaging materials is included in the LCA.

Name	Value	Unit
Shrink film	0,12	kg/m^2

End of life (C1-C4)

Deconstruction (C1)
Manual removal of the product from the building

Transport to End-of-Life treatment (C2)
Transport to waste treatment: 50 km with truck.

Thermal Recovery (C3)
100% thermal recovery of product from demolishing

Disposal (C4)
Not relevant.

Reuse, recovery and recycling potential (D)

Name	Value	Unit
Energy recovery (product)	4.03	kg
Energy recovery (packaging)	0.12	kg

A waste incineration plant with an R1 value > 0.6 was assumed.

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LCA: Results

The following is a summary of the LCA results for BauderECO S/F (Mass Balance) PU insulation boards with a basis weight of 4.03 kg/m² and a thickness of 120 mm.

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

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m² BauderECO S/F (Mass Balance)

Core Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2-Eq.	2.93E+00	2.68E-02	3.77E-01	0	1.39E-02	7.42E+00	0	-3.15E+00
GWP-fossil	kg CO_2-Eq.	8.32E+00	2.49E-02	3.77E-01	0	1.21E-02	2.03E+00	0	-3.13E+00
GWP-biogenic	kg CO_2-Eq.	-5.4E+00	1.78E-03	2.06E-05	0	1.77E-03	5.4E+00	0	-1.65E-02
GWP-luluc	kg CO_2-Eq.	1.04E-02	9.56E-05	6.83E-07	0	4.64E-05	3.25E-05	0	-3.57E-04
ODP	kg CFC11-Eq.	7.21E-11	5.09E-15	2.99E-14	0	2.47E-15	6.48E-13	0	-2.19E-11
AP	mol H^+-Eq.	2.54E-02	2.34E-05	5.76E-05	0	1.13E-05	4.61E-03	0	-4.05E-03
EP-freshwater	kg P-Eq.	5E-05	4.95E-08	6.76E-09	0	2.4E-08	2.7E-07	0	-4.47E-06
EP-marine	kg N-Eq.	7.54E-03	7.77E-06	9.18E-06	0	3.77E-06	2.23E-03	0	-1.12E-03
EP-terrestrial	mol N-Eq.	8.1E-02	9.21E-05	2.69E-04	0	4.47E-05	2.56E-02	0	-1.2E-02
POCP	kg NMVOC-Eq.	2.68E-02	2.09E-05	2.49E-05	0	1.01E-05	5.64E-03	0	-3.11E-03
ADPE	kg Sb-Eq.	1.83E-06	2.49E-09	7.38E-10	0	1.21E-09	1.79E-08	0	-4.92E-07
ADPF	MJ	1.34E+02	3.29E-01	5.61E-02	0	1.6E-01	2.23E+00	0	-5.27E+01
WDP	m^3 world-Eq deprived	1.33E+00	1.07E-04	3.45E-02	0	5.18E-05	8.06E-01	0	-3.15E-01

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 m² BauderECO S/F (Mass Balance)

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	2.88E+02	2.17E-02	1.4E-02	0	1.05E-02	5.76E+01	0	-1.47E+01
PERM	MJ	5.72E+01	0	0	0	0	-5.72E+01	0	0
PERT	MJ	3.45E+02	2.17E-02	1.4E-02	0	1.05E-02	4E-01	0	-1.47E+01
PENRE	MJ	9.23E+01	3.3E-01	5.13E+00	0	1.6E-01	3.94E+01	0	-5.27E+01
PENRM	MJ	4.22E+01	0	-5.07E+00	0	0	-3.71E+01	0	0
PENRT	MJ	1.35E+02	3.3E-01	5.61E-02	0	1.6E-01	2.24E+00	0	-5.27E+01
SM	kg	1.36E-01	0	0	0	0	0	0	0
RSF	MJ	1.31E-16	0	0	0	0	0	0	0
NRSF	MJ	1.77E-15	0	0	0	0	0	0	0
FW	m3	6.53E-02	1.68E-05	8.09E-04	0	8.15E-06	1.9E-02	0	-1.36E-02

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 m² BauderECO S/F (Mass Balance)

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	4.43E-08	1.44E-12	5.6E-12	0	6.98E-13	2.92E-10	0	-7.25E-09
NHWD	kg	1.57E-01	5.36E-05	1.52E-03	0	2.6E-05	2.19E-01	0	-2.69E-02
RWD	kg	4.23E-03	4.14E-07	1.55E-06	0	2.01E-07	9.27E-05	0	-4.04E-03
CRU	kg	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0
EEE	MJ	0	0	6.84E-01	0	0	1.33E+01	0	0
EET	MJ	0	0	1.58E+00	0	0	2.38E+01	0	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; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m² BauderECO S/F (Mass Balance)

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Disease incidence	2.24E-07	1.52E-10	3.59E-10	0	7.36E-11	1.43E-08	0	-3.34E-08
IR	kBq U235 eq	4.49E-01	4.21E-05	1.53E-04	0	2.04E-05	1.48E-02	0	-6.76E-01
ETP-fw	CTUe	5.8E+01	2.52E-01	2.2E-02	0	1.22E-01	8.51E-01	0	-1.14E+01
HTP-c	CTUh	2.95E-09	5.06E-12	2.47E-12	0	2.45E-12	5.74E-11	0	-5.33E-10
HTP-nc	CTUh	9.58E-08	2.54E-10	7.98E-11	0	1.23E-10	2.35E-09	0	-2.07E-08
SQP	SQP	4.82E+01	9.87E-02	1.56E-02	0	4.79E-02	4.88E-01	0	-9.56E+00

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

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”.
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 nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”.
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 experienced with the indicator.

Disclaimer 3 – Mass Balance Approach in the sense of a virtual allocation is not allowed within EN15804+A2. The underlaying calculation is oriented on the EN15804 but uses allocation methods described in the chapter “Mass balance approach (MBA)”. IBU cannot guarantee that this document will be accepted as evidence by third parties.

References

DIN 4108-4
DIN 4108-4:2020-11, Thermal insulation and energy economy in buildings - Part 4: Hygrothermal design values.

DIN 4108-10
DIN 4108-10:2015-11, Thermal insulation and energy economy in buildings – Part 10: Application-related requirements for thermal insulation materials – Factory-made products.

DIN EN 826
DIN EN 826:2013-05, Thermal insulating products for building applications - Determination of compression behaviour.

DIN EN 1606
DIN EN 1606:2013-05, Thermal insulating products for building applications - Determination of compressive creep.

DIN EN 1609
DIN EN 1609:2013-05, Thermal insulating products for building applications – Determination of short-term water absorption by partial immersion.

DIN EN 12087
DIN EN 12087:2013-06, Thermal insulating products for building applications – Determination of long-term water absorption by immersion.

DIN EN 12091
DIN EN 12091:2013-06, Thermal insulating products for building applications - Determination of freeze-thaw resistance.

DIN EN 13165
DIN EN 13165:2016-09, Thermal insulation products for buildings – Factory-made rigid polyurethane foam (PU) products - Specification; German version EN 13165:2012.

DIN EN 13501-1
DIN EN 13501-1:2019-05, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.

EN 12088
EN 12088:2013, Thermal insulation for building applications-Determination of long-term water absorption by diffusion**.**

EN 15804
EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works — Document — Core rules for the product category of construction products.

ISO 14025
EN ISO 14025:2011, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.

PCR Part A
Product category rules for building-related products and services. Part A: LCA calculation rules and project report requirements pursuant to EN 15804+A2:2019 (v1.2), Berlin: Institut Bauen und Umwelt e.V., www.ibu-epd.com, 2021.

PCR Part B: Insulation materials made of foam plastics Product category rules for building-related products and services. Part B: EPD requirements for insulating materials made of foam plastics, version 1.2 Berlin: Institut Bauen und Umwelt e.V. (IBU), 06-2017.

IBU 2021
Institut Bauen und Umwelt e.V.: General Instructions for the Document programme of Institut Bauen und Umwelt e.V., Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021
www.ibu-epd.com

GaBi software
Sphera Solutions GmbH
GaBi Software System and Database for Life Cycle Engineering
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University of Stuttgart
Leinfelden-Echterdingen.

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