

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804+A1 for:

**FKD-S, FKD-S C1, FKD-S C2, SmartWall S C1,
SmartWall S C2, FKD-S Thermal, FKD MAX C1,
FKD MAX C2, SmartWall FireGuard**

From

KNAUFINSULATION



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Programme-related information and verification

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs of construction products may not be comparable if they do not comply with EN 15804+A1 and if the building context, respectively the product-specific characteristics of performance are not taken into account.

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com
EPD registration number:	S-P-01848
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EPD owner	Knauf Insulation Sprl Rue de Maestricht 95 4600 Visé Belgium
Product Category Rules:	PCR 2012:01. Construction products and construction services. Version 2.3 Sub-PCR-I Thermal insulation products (EN 16783: 2017)
Product group classification:	UN CPC 37
Reference year for manufacturing data:	2018
Geographical application scope:	Europe

CEN standard EN 15804+A1 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): Construction products and Construction services, 2012:01, version 2.3, UN CPC 37. Sub-PCR-I Thermal insulation products (EN 16783: 2017)
PCR review was conducted by: The Technical Committee of the International EPD® System
Independent third-party verification of the declaration and data, according to ISO 14025:2006: <input checked="" type="checkbox"/> EPD process certification <input type="checkbox"/> EPD verification
Certified by: Bureau Veritas certification Sverige AB SE006629-1
Procedure for follow-up of data during EPD validity involves third party verifier: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

General information

Information about the company

Description of the organisation:

Knauf Insulation has more than 40 years of experience in the insulation industry and is one of the most respected names in insulation worldwide. Knauf Insulation is manufacturing products and solutions mainly in glass and rock mineral wool, as well as wood wool. We operate more than 37 manufacturing sites globally in 15 countries and employ more than 5,000 people. The Headquarters are located in Visé, in Belgium.

Product-related or management system-related certifications:

All Knauf Insulation sites, including the related site for this EPD, are ISO 9001, ISO 14001, ISO 5001 and ISO 45001 certified under the scope "Design, Development and Production of Insulation Materials and Systems".

Name and location of production site:

The application in construction of the concerned product is Europe. The data utilized for the production stage life cycle assessment are related to three production plants located in Surdulica in Serbia, Nová Baňa in Slovakia and St. Egidien in Germany.

Industrijsko naselje Belo Polje bb, 17530, Surdulica, Serbia

Železničný rad 78/24, 968 01 Nová Baňa, Slovakia

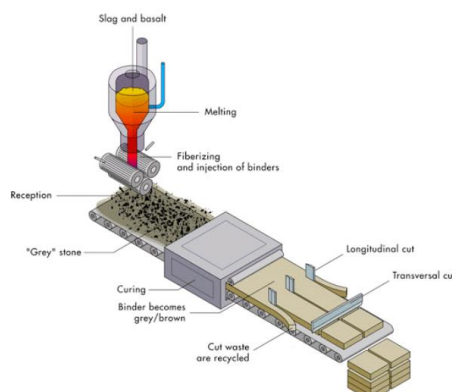
Bahnhofstrasse 25, 09356 St. Egidien, Germany

Information about Rock Mineral Wool production

The Rock Mineral Wool Products for Building Construction are available in the form of slabs, boards, lamellas and rolls. RMW slabs are used as a thermal, acoustical and fire insulation product. Knauf Insulation adopts a "worst case" approach into its EPDs.

In general, the density for rock mineral wool products ranges from 20 to 200 kg/m³. In terms of composition, the inorganic part (92-98%) is composed of volcanic rocks, typically basalt, and some dolomite and with an increasing proportion of recycled material in the form of briquettes, a mix of stone wool scrap, other secondary materials and cement.

The remaining fraction is the thermo set resin binder.



Product information

Product name: FKD-S, FKD-S C1, FKD-S C2, SmartWall S C1, SmartWall S C2, FKD-S Thermal, FKD MAX C1, FKD MAX C2, SmartWall FireGuard

Product identification: The declared insulation product group, which includes FKD-S, FKD-S C1, FKD-S C2, SmartWall S C1, SmartWall S C2, FKD-S Thermal, FKD MAX C1, FKD MAX C2 and SmartWall FireGuard is a compact rock mineral wool, uncoated, one side coated and both sides coated surface, unfaced slab of 1 square meter (considered for this EPD). It needs a Declaration of Performance taken into consideration the harmonized product standard EN 13162 and the CE mark.

For the placing on the construction products market in the European Union/ EFTA (with exception of Switzerland), the Regulation/ (EU) No 305/2011/ applies. The concerned products need Declarations of Performance /DoP R4238MPCPR /DoP R4238KPCPR /DoP R4308LPCPR taking into consideration the harmonized product standard /EN 13162/ and the /CE-mark/.

Product description: The main application for the concerned product group is thermal and acoustic insulation as well as fire protection in ETICS system.

UN CPC code:

37990: Non-metallic mineral products (including mineral wool, expanded mineral materials, worked mica, articles of mica, non-electrical

articles of graphite or other carbon and articles of peat).

Geographical scope: The product is produced in Surdulica in Serbia, Nová Baňa in Slovakia and Saint Egidien in Germany with related country energy mix for electricity and with related country thermal energy. Regarding the market area, the product is marketed in Europe.

Energy:

Electricity mix and gas are taken from related country datasets with reference year 2015.

Technical Characteristics:

Parameter	Value
Thermal conductivity/ EN 12667 (FKD MAX C1, FKD MAX C2)	0.034 W/(mK) at 10°C
Thermal conductivity/ EN 12667 (FKD S Thermal, SmartWall S C1, SmartWall S C2)	0.035 W/(mK) at 10°C
Thermal conductivity/ EN 12667 (FKD S, FKD S C1, FKD S C2, SmartWall FireGuard)	0.036 W/(mK) at 10°C
Water vapor diffusion resistance (EN 12806)	1
Thermal Resistance (ISO 8301) (FKD MAX C1, FKD MAX C2)	2.94 m ² K/W
Thermal Resistance (ISO 8301) (FKD S Thermal, SmartWall S C1, SmartWall S C2)	2.85m ² K/W
Thermal Resistance (ISO 8301) (FKD S, FKD S C1, FKD S C2, SmartWall FireGuard)	2.75 m ² K/W
Reaction to fire (EN 13501-1)	A1 (EN 1350-1)
Declared density range/ EN 1602	100 kg/m ³ (+/-10%)
Melting point of fibers DIN 4102-17	≥ 1000°C

LCA information

Functional unit / declared unit:

The declared unit is 1 square meter of concerned Rock Mineral Wool product group with a thickness of 100 mm. The declared lambda is 0.035 W/mK. The density used for the calculation of this specific LCA is 100 kg/m³.

Time representativeness:

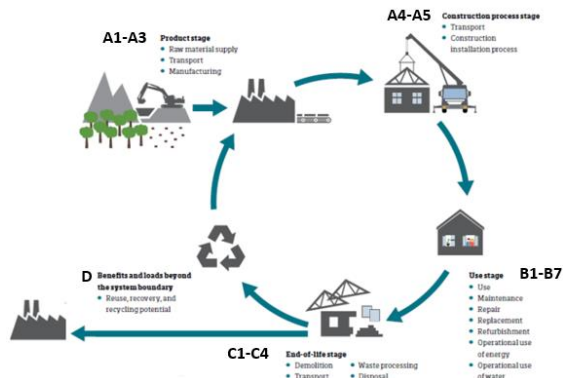
Plant production data for the complete year 2018.

Reference service life: The RSL or durability of concerned product group is as long as the lifetime of the building equipment in which it is used (at least 50 years).

Database(s) and LCA software used:

The LCA model, the data aggregation and environmental impacts are calculated with the software GaBi 9.2 and its Service Pack 40 databases.

System diagram:



Description of system boundaries:

The system boundary of the EPD follows the modularity approach defined by the /EN 15804+A1/.

The type of EPD is cradle-to-grave.

List and explanation of the modules declared in the EPD.

The product stage (A1-A3) includes:

- A1 - raw material extraction and processing, processing of secondary material input (e.g. recycling processes),
- A2 - transport to the manufacturer and
- A3 - manufacturing.

This includes provision of all materials, products and energy, packaging processing and its transport, as well as waste processing up to the end-of-waste state or disposal of final residues during the product stage.

The LCA results are given in an aggregated form for the product stage, meaning that the modules A1, A2 and A3 are considered as a unique module A1-A3.

Product Parameters	Value
Declared Density	100 kg/m ³
Rock mineral wool weight (without coating weight)	10 kg
Surface	1 m ²
Thickness	100 mm
Volume	0.1 m ³
Coating	0.4 kg
Packaging Plastic sheet	0.1 kg
Packaging Wooden pallet	1 kg

The construction process stage includes:

- A4 - transport to the construction site and
- A5 - installation into the building.

The transport to the building site (A4) and installation (A5) included in this LCA use the following parameters:

Parameter	Value
Average transport distance	600 km
Type of fuel and vehicle consumption or type of vehicle used for transport.	Truck Euro 6 (28 – 32 t / 22 t payload). 33 L for 100 km.
Truck capacity utilization (including 30% of empty returns)	38 % of the weight capacity
Loss of materials in construction site	2%
Packaging Wooden pallet	100% incinerated
Packaging Plastic sheet	40% recycled, 60% incinerated

The treatment of the packaging waste after the installation of the product (A5) has been considered.

The Use stage (B1-B7) includes:

- B1: Use
- B2: Maintenance
- B3: Repair
- B4: Replacement
- B5: Refurbishment
- B6: Operational Energy Use
- B7: Operational Water Use

Once installation is complete, no actions or technical operations are required during the use stages until the end of life. Therefore, the mineral wool has no impacts (excluding potential energy savings) on this stage.

The end-of-life stage includes:

- C1 - de-construction, demolition,
- C2 - transport to waste processing,
- C3 - waste processing for reuse, recovery and/or recycling and
- C4 - disposal.

This includes provision of all transports, materials, products and related energy and water use. The common manual dismantling impact of insulation is considered as very small and can be neglected in C1.

Although Rock Mineral Wool products from Knauf Insulation are partly recycled at their end-of-life, an established collection system does not yet exist. Therefore, the assumption chosen in this study, 100% landfill (C4) after the use phase, is the most conservative approach.

Parameter	Value
Disposal type (mineral wool)	100% landfill
Average transport distance waste (C2)	50 km
Type of fuel and vehicle consumption or type of vehicle used for transport.	Truck-trailer (Euro 3, 34 - 40t gross weight / 27t payload capacity/ 40 L for 100 km.) (if 100 % utilization).
Truck capacity utilization	50 % of the weight capacity

Module D includes reuse, recovery and/or recycling potentials. According to /EN 15804+A1/, any declared benefits and loads from net flows leaving the product system not allocated as co-products and having passed the end-of waste state shall be included in module D. Benefits considered in module D originate from packaging recycling or incineration.

Content Declaration

The product does not contain substances on the "Candidate List of Substances of Very High Concern for Authorisation" under the REACH regulation (if above 0.1% of the mass).

Recycled material

The mineral wool waste that is originating from the manufacturing process is recycled internally through the use of briquettes (mineral wool waste and additional cement) that are reinjected into the batch.

The external recycled waste as raw material is 21.5 % originating (mainly) from slags.

Additional information:

All raw materials for the manufacturing of the declared product, the required energy, water consumption and the resulting emissions are considered into the LCA. Consecutively, the recipe components with a share even less than 1% are included. All neglected processes contribute less than 5% to the total mass or less than 5% to the total energy consumption. For information, the impact of the Rock Mineral Wool plant construction or machines, are not taken into account in the life cycle assessment. No allocation is carried out for this specific product.

More information:

www.knaufinsulation.com
<http://www.knaufinsulation.sk>
<https://www.knaufinsulation.rs>
<https://www.knaufinsulation.de>

Name and contact information of LCA practitioner:

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Life cycle stages as defined in the European standard EN 15978 :2011 and the description of the system boundaries for the reference product LCA (X = included in the LCA, MND = module is not declared).

Product stage			Construction process stage		Use stage								End of life stage				Resource recovery stage
Raw materials	Transport	Manufacturing	Transport	Construction Installation	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	X	X	X	X	X	X	X	X	X	X	X	X	

Environmental performance

Potential environmental impacts: 1 m² of Rock Mineral Wool FKD-S, FKD-S C1, FKD-S C2, SmartWall S C1, SmartWall S C2, FKD-S Thermal, FKD MAX C1, FKD MAX C2, SmartWall FireGuard with a thickness of 100 mm.

PARAMETERS	UNIT	TOTAL A1-A3 **	A4	A5	TOTAL B1-B2-B3-B4-B5-B6-B7	C1	C2	C3	C4	D*
Global warming potential (GWP)	kg CO2 eq.	10.9	0.735	2.44	0	0	0.036	0	0.142	-0.849
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	1.5E-011	1.19E-016	1.75E-010	0	0	5.96E-018	0	7.81E-016	-3.2E-014
Acidification potential (AP)	kg SO2 eq.	0.0859	0.00138	0.00194	0	0	0.000154	0	0.00091	-0.00102
Eutrophication potential (EP)	kg PO43- eq.	0.00597	0.000331	0.000164	0	0	3.81E-005	0	0.000103	-0.00013
Formation potential of tropospheric ozone (POCP)	kg C2H4 eq.	0.00434	0.000154	0.000106	0	0	1.39E-005	0	6.84E-005	-9.82E-005
Abiotic depletion potential – Elements	kg Sb eq.	8.21E-006	6.04E-008	1.86E-007	0	0	3.01E-009	0	5.47E-008	-1.56E-007
Abiotic depletion potential – Fossil resources	MJ, net calorific value	157	9.91	3.51	0	0	0.494	0	2.01	-12.9

*: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].

** : The indicators results are calculated with a reference product based on annual production volume (following the dedicated market share). The indicators results span between the reference product and the 100% sourced product from each dedicated plant may vary more than 10% (concerning A1- A3).

Use of resources: 1 m² of Rock Mineral Wool FKD-S, FKD-S C1, FKD-S C2, SmartWall S C1, SmartWall S C2, FKD-S Thermal, FKD MAX C1, FKD MAX C2, SmartWall FireGuard with a thickness of 100 mm.

PARAMETER		UNIT	TOTAL A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D*
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	13.375	0.558	0.397	0	0	0.0278	0	0.271	-2.87
	Used as raw materials	MJ, net calorific value	15.625	0	0	0	0	0	0	0	0
	TOTAL	MJ, net calorific value	29.4	0.558	0.397	0	0	0.0278	0	0.271	-2.87
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	154.31	9.94	3.64	0	0	0.496	0	2.07	-15.3
	Used as raw materials	MJ, net calorific value	11.69	0	0.147	0	0	0	0	0	0
	TOTAL	MJ, net calorific value	166	9.94	3.79	0	0	0.496	0	2.07	-15.3
Secondary material	kg	1.99	0	0.0398	0	0	0	0	0	0	0
Renewable secondary fuels	MJ, net calorific value	9.03E-19	0	1.81E-20	0	0	0	0	0	0	-6.18E-25
Non-renewable secondary fuels	MJ, net calorific value	1.06E-017	0	2.12E-19	0	0	0	0	0	0	-7.25E-24
Net use of fresh water	m3	0.0418	0.000646	0.0061	0	0	3.22E-05	0	0.000523	-0.00339	

Waste production and output flows: 1 m² of Rock Mineral Wool FKD-S, FKD-S C1, FKD-S C2, SmartWall S C1, SmartWall S C2, FKD-S Thermal, FKD MAX C1, FKD MAX C2, SmartWall FireGuard with a thickness of 100 mm.

Waste production

PARAMETER	UNIT	TOTAL A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D*
Hazardous waste disposed	kg	3.46E-007	4.62E-007	6.49E-009	0	0	2.31E-008	0	3.16E-008	-5.98E-009
Non-hazardous waste disposed	kg	1.12	0.00152	0.247	0	0	7.59E-005	0	10.4	-0.00634
Radioactive waste disposed	kg	0.00362	1.23E-005	0.000111	0	0	6.14E-007	0	2.36E-005	-0.000967

*: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].

Output flows

PARAMETER	UNIT	TOTAL A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D*
Components for reuse	kg	0	0	0	0	0	0	0	0	0
Material for recycling	kg	0	0	0.042	0	0	0	0	0	0
Materials for energy recovery	kg	0	0	0	0	0	0	0	0	0
Exported energy, electricity	MJ	0	0	0.332	0	0	0	0	0	2.84
Exported energy, thermal	MJ	0	0	1.09	0	0	0	0	0	5.1

*: [Life Cycle D stage covers benefits and loads beyond the system boundary stage (reuse, recovery and recycling potential) therefore, when summing up results, this stage should be considered separately].

Differences Versus Previous Versions

Environmental Indicator	Previous Version	Current Version	Percentage Change (%)
Global Warming Potential (GWP)	14.253	13.9691	-2.03%
Ozone Depletion Potential (ODP)	1.90001E-10	1.90001E-10	0.00%
Acidification Potential for Soil and Water (AP)	0.090284	0.094545	4.51%
Eutrophication Potential (EP)	0.0066061	0.0069871	5.45%
Formation potential of tropospheric Ozone (POCP)	0.0046823	0.0046795	-0.06%
Abiotic Depletion Potential (ADPE)	8.51411E-06	8.44132E-06	-0.86%
Abiotic Depletion Potential (ADPF)	172.924	170.055	-1.69%

LCA interpretation

ENVIRONMENTAL IMPACTS

All impact categories, except the Abiotic Depletion Potential Element and the Ozone Depletion Potential, are dominated by the production processes. This can be explained by the huge impact of the energy use (electricity, natural gas and coke) for Rock Mineral Wool production.

The Global Warming Potential (GWP) is dominated by the production in the cupola, mostly due to CO₂ emissions from raw materials and energy consumption (50%). The production of the binder represents more than 15% of the impact.

The Ozone layer Depletion Potential (ODP) results are under the high influence of the selected scenario for plastic sheets packaging incineration.

The Acidification Potential (AP) is also dominated by the production due to the emissions related to the processes and the energy consumption.

The Eutrophication Potential (EP) is significantly influenced by the production due to emissions from cupola furnace, curing oven and other unit processes.

The Photochemical Ozone Creation Potential (POCP) is particularly dominated by the production (emissions in the cupola furnace and other unit processes).

The Abiotic Depletion Potential Element (ADPe) is mainly due to the cement utilized in the briquettes production process in order to recycle secondary materials from the lines, the briquettes are reinjected into the melting batch. The impact of the raw materials in general, like the volcanic rock basalt, is very minor as this material is very abundant on Earth. The thermo set resin binder has also an important impact on ADPe indicator due to the fossil origin.

The Abiotic Depletion Potential Fossil (ADPf) is dominated by the use of coke as energy carrier. Next to the coke, we have also the impact of natural gas and upstream the electricity energy mix.

RESOURCES USE

Total Use of Non-Renewable Primary Energy Resources (PENRT) is dominated by the production of rock mineral wool products (especially due to the energy carrier, coke) and the binder.

Total Use of Renewable Primary Energy Resources (PERT) is dominated by the production, mostly due to electricity consumption and packaging.

For the Use of Secondary Material (SM), it consists of slags and some minor mineral wool waste.

References

International EPD® System

General Programme Instructions of the International EPD® System. Version 2.5.

Product Category Rules PCR 2012:01. Construction products and construction services. Version 2.3

Sub-PCR-I Thermal insulation products (EN 16783: 2017)

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

GaBi 9.2

GaBi 9.2: Software and database for life cycle engineering. LBP, University of Stuttgart and PE INTERNATIONAL AG, 2019.

EN 1602:

EN1602: 2013 Thermal insulation products for building applications – Determination of the apparent density

EN 12667

EN 12667: 2001 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance

EN 13162

EN 13162:2012 Thermal insulation products for buildings - Factory made mineral wool (MW) products - Specification

EN 13501-1

EN 13501-1: 2009 Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests.

DIN 4102 / T17

DIN 4102 / T17: 1990 Fire behaviour of building materials and elements; determination of melting point of mineral fibre insulating materials; concepts, requirements and testing.

EN 12086

EN 12086: 2013 Thermal insulating products for building applications – determination of water vapour transmission properties.

ISO 8301:1991

Thermal insulation — Determination of steady-state thermal resistance and related properties — Heat flow meter apparatus.



EN 15978: 2011

EN 15978: 2011 Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method.

DoP R4238MPCPR /DoP R4238KPCPR /DoP R4308LPCPR




Declaration of Performance

<https://www.knaufinsulation.com/iframe-cprdop>



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