ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	**Knauf Insulation**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-KNI-20160224-CBD2-EN
ECO EPD Ref. No.	ECO-00000470
Issue date	13.12.2016
Valid to	12.12.2021

SmartRoof Base / SmartRoof Thermal

Rock Mineral Wool for Flat Roofs

Knauf Insulation

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

General Information

Knauf Insulation

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

Declaration number
EPD-KNI-20160224-CBD2-EN

This Declaration is based on the Product Category Rules:
Mineral insulating materials, 07.2014
(PCR tested and approved by the SVR)

Issue date
13.12.2016

Valid to
12.12.2021

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

Dr. Burkhart Lehmann
(Managing Director IBU)

SmartRoof Base / SmartRoof Thermal

Owner of the Declaration
Knauf Insulation
rue de Maestricht 95
4600 Visé
Belgium

Declared product / Declared unit
1 m³ of product

Scope:
The declared unit is 1 m³ SmartRoof Base / SmartRoof Thermal Rock Mineral Wool products for flat roofs. They comply with the requirements of /EN 13162/. The thickness ranges from 40 mm to 200 mm. The manufacturing company is Knauf Insulation - plants Surdulica (Serbia), Skofja Loka (Slovenia) and Nova Bana (Slovakia) - with averages following production share. 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)

Product

Product description
Knauf Insulation manufactures Rock Mineral Wool (RMW) insulation products. They are available as lamellas, slabs or boards, and also possibly rolls. The density range for rock mineral wool goes from 25 to 200 kg/m³. In terms of composition, inorganic rocks are the main components (typically 97%) of stone wool, with a remaining fraction of organic content which is generally a thermosetting resin binder. The binder content is typically less than 4%. The inorganic part is made of volcanic rocks, typically basalt, also dolomite and with an increasing proportion of recycled material in form of slags or briquettes, a mix of stone wool scrap and cement.

Rock mineral wool SmartRoof Base and SmartRoof Thermal are used as a thermal, acoustical and fire insulation product. This EPD has been developed for the most common product sold on the appropriate market .

For the placing on the market in the European Union/EFTA (with the exception of Switzerland), the Regulation /(EU) No 305/2011/ applies. The products need Declaration of performances, DoPs: R4224KPCPR/ R4224LPCPR/ R4238KPCPR/ R4308KPCPR/ R4308LPCPR/ R4309KPCPR/ R4309LPCPR/ taking into consideration the harmonized product standard /EN 13162:2012 + A1:2015 - Thermal insulation products for buildings - Factory made mineral wool (MW) products - Specification/ and the /CE-mark/.

Application
Main applications for the RMW concerned products are thermal and sound insulation of roofs.
For the application and use national regulations apply, in Germany the /*Allgemeine bauaufsichtliche Zulassung Z-23.15-1475/ (building inspection approval) issued by the Deutsches Institut für Bautechnik (DIBt), Berlin*.

Technical Data
The products and their technical characteristics meet a number of technical requirements. The most important ones are summarized in the table here below, which also includes references to testing methods.

Technical characteristics

Name	Value	Unit
Thermal conductivity SmartRoof Thermal /EN 13162/	0.036	W/(mK)
Thermal conductivity SmartRoof Base / EN 13162/	0.035	W/(mK)

Water vapour diffusion resistance factor /SIST EN 13162/	1	-
Water vapor diffusion equivalent air layer thickness /SIST EN 13162/	1	m
Sound absorption coefficient	NA	%
Gross density /DIN 1602/	95 - 115	kg/m³
Reaction to fire /EN 13501-1/	A1	-
Specific heat capacity /EN ISO 10456/	1030	J/kgK
Melting point /DIN 4102 / T17/	>= 1000	°C
Compressive strength SmartRoof Thermal /DIN EN 826/	50	kPa
Compressive strength SmartRoof Base /DIN EN 826/	30	kPa
Tension SmartRoof Thermal /DIN EN 1607/	10	kPa
Tension SmartRoof Base /DIN EN 1607/	7.5	kPa
Point load SmartRoof Thermal /DIN EN 12430	500	N
Point load SmartRoof Base /DIN EN 12430	300	N

Base materials / Ancillary materials
The main raw materials are diabase (a rock that is similar to volcanic rock basalt), dolomite and briquette. The briquette is made of rock mineral wool waste (internal or external), waste of raw materials and cement. Additionally, coke is also added in the cupola as an energy carrier. Further down the manufacturing line, a binder (thermo set resin) is spread onto the fibers. Then, the polymerization contributes to fix the products dimensions and mechanical properties.

Reference service life
When used correctly, the reference service life of Knauf Insulation rock mineral wool is merely limited by the service life of the components and/or building in which it is incorporated; this is substantiated by current industry findings, for example in case of deconstruction of buildings. As a minimum, we consider a reference service life of 50 years.

LCA: Calculation rules

Declared Unit
The declared unit is 1 m³ of rock mineral wool. The density used for the calculation of the LCA is 105 kg/m³.

Declared unit

Name	Value	Unit
Declared unit	1	m³
Gross density	105	kg/m³
Conversion factor to 1 kg	0.0095	-

System boundary
The system boundary of the EPD follows the modular approach defined by /EN 15804/.
The type of EPD is cradle-to-gate-with options.

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
- 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**.

The construction process stage includes:
- A4 - transport to the construction site and
- A5 - installation into the building.

The transport to the building site (A4) is included in the LCA calculation. For the considered product, the average transport distance is assumed to be 500 km with a truck capacity utilization of 40%.
Module A5 has been included in this EPD. Therefore, the treatment of the packaging waste after the installation of the product has been considered and the loss on construction site (2%).

The use stage
Because they are specific to the building, its use and location, none of the modules related to the building fabric (B1-B5) nor the operation of the building (B6 and B7) have been taken into account in this EPD.

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, but only modules C2 and C4 are reported, as they are considered the most relevant scenarios for rock mineral wool products.
Although rock mineral wool products from Knauf Insulation are partly recycled at end-of-life, there is not yet an established collection system, and as such, the assumption chosen in this study,100% landfilled after the use phase, is the most conservative approach.

Module D includes reuse, recovery and/or recycling potentials.
According to /EN 15804/, 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 and loads are considered (incineration of packagings) in module D and are included in the background model.

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.

LCA: Scenarios and additional technical information

The following information forms the basis for declared modules or can be used for specific scenarios development in building assessment context.

Transport to the building site (A4)

Name	Value	Unit
Litres of fuel	0.0025	l/100km
Transport distance	500	km
Capacity utilisation (including empty runs)	40	%
Gross density of products transported	105	kg/m^3

Installation into the building (A5)

Name	Value	Unit
Output substances following waste treatment on site : plastic foil and rock mineral wool	2.778	kg

Reference service life

Name	Value	Unit
Reference service life	50	a

End-of-life (C1 - C4)

Name	Value	Unit
Landfilling	105	kg
Transport distance	50	km
Capacity utilization	50	%

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

Name	Value	Unit
Plastic foil incinerated	0.6744	kg

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	MND	MND	MND	MND	MND	MND	X	MND	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1m³ SmartRoof Base / SmartRoof Thermal

Parameter	Unit	A1-A3	A4	A5	C2	C4	D
Global warming potential	[kg CO_2-Eq.]	1.25E+2	4.71E+0	4.66E+0	3.61E-1	1.69E+0	-1.34E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	1.89E-9	2.16E-11	1.91E-9	1.66E-12	1.86E-11	-3.41E-10
Acidification potential of land and water	[kg SO_2-Eq.]	7.53E-1	1.31E-2	1.53E-2	2.30E-3	1.01E-2	-1.81E-3
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	4.83E-2	3.10E-3	1.03E-3	5.77E-4	1.37E-3	-1.92E-4
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	5.57E-2	-4.05E-3	1.14E-3	-9.60E-4	9.71E-4	-2.20E-4
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	3.23E-5	3.13E-7	6.58E-7	2.40E-8	5.82E-7	-1.87E-7
Abiotic depletion potential for fossil resources	[MJ]	1.76E+3	6.48E+1	3.46E+1	4.97E+0	2.19E+1	-1.92E+1

RESULTS OF THE LCA - RESOURCE USE: 1m³ SmartRoof Base / SmartRoof Thermal

Parameter	Unit	A1-A3	A4	A5	C2	C4	D
Renewable primary energy as energy carrier	[MJ]	9.00E+1	-	-	-	-	-
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	-	-	-	-	-
Total use of renewable primary energy resources	[MJ]	9.00E+1	3.68E+0	1.85E+0	2.82E-1	2.58E+0	-2.35E+0
Non-renewable primary energy as energy carrier	[MJ]	1.91E+3	-	-	-	-	-
Non-renewable primary energy as material utilization	[MJ]	1.10E+2	-	-	-	-	-
Total use of non-renewable primary energy resources	[MJ]	2.02E+3	6.51E+1	3.77E+1	4.99E+0	2.27E+1	-2.23E+1
Use of secondary material	[kg]	3.04E+1	0.00E+0	5.91E-1	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	-	-	-	-	-	-
Use of non-renewable secondary fuels	[MJ]	-	-	-	-	-	-
Use of net fresh water	[m³]	4.54E-1	9.23E-3	1.07E-2	7.07E-4	4.63E-3	-3.66E-3

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1m³ SmartRoof Base / SmartRoof Thermal

Parameter	Unit	A1-A3	A4	A5	C2	C4	D
Hazardous waste disposed	[kg]	1.50E-2	4.92E-6	2.40E-4	3.77E-7	5.19E-7	-7.46E-9
Non-hazardous waste disposed	[kg]	1.03E+1	5.47E-3	5.42E+0	4.19E-4	1.05E+2	-6.62E-3
Radioactive waste disposed	[kg]	6.17E-2	9.30E-5	1.22E-3	7.13E-6	3.17E-4	-1.26E-3
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	3.56E+0	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	1.17E+1	0.00E+0	0.00E+0	0.00E+0

INTERPRETATION

RESOURCES USE

The primary energy demand from non-renewable resources is dominated by the production of rock mineral wool products (especially due to the energy carrier, coke) and the binder.
The renewable energy demand regarding the product is dominated by the production, mostly due to electricity consumption, and packaging.

ENVIRONMENTAL IMPACT

Every impact category except the abiotic **ADP** elements is dominated by the production. This is due to the consumption of energy (electricity and thermal energy) during the production.
The **Abiotic Depletion Potential elements** (ADPe) are dominated by the supply of raw materials such as cement for briquettes.
The **Global Warming Potential** (GWP) is dominated by the production in the cupola, mostly due to CO_2 emissions from raw materials and energy consumption (50%). The production of the binder represents more than 15% of the impact.
The **Ozone Depletion Potential** (ODP) is most notably influenced by the production and the binder.
The **Acidification Potential** (AP) is also dominated by the production due to the emissions related to the processes and the energy consumption. Mostly, the impact refers to emissions to air: 75% from dioxide and 20% from nitrogen oxides.

The **Eutrophication Potential** (EP) is significantly influenced by the production due to emissions from the cupola furnace, curing oven and other unit processes.
The **Potential Ozone Photochemical Oxidants** (POCP) is particularly dominated by the production (emissions in the cupola furnace and other unit processes). The results from the transport are negative due to the NO emissions; NO counteracts the POCP.

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Zulassung Z-23.15-1475 /[BF1]
Zulassung Z-23.15-1475 /[BF1] Allgemeine bauaufsichtliche (building inspection approval) issued by the Deutsches Institut für Bautechnik (DIBt), Berlin.

DoPs R4224KPCPR/ R4224LPCPR/ R4238KPCPR/ R4308KPCPR/ R4308LPCPR/ R4309KPCPR/ R4309LPCPR/
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