ENVIRONMENTAL PRODUCT DECLARATION

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

Fire-teK BD 912 ALU

From

KNAUF INSULATION

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Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com
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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). Version 2018-11-22
Product group classification:	UN CPC 37
Reference year for data:	2016
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), version 2018-11-22,
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: ☒ EPD process certification ☐ EPD verification
Accredited by: Bureau Veritas certification Sverige AB SE006629-1
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ 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. We operate more than 37 manufacturing sites globally in 15 countries and employ more than 5,000 people. The Headquarters are located in Belgium, in Visé.

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 OHSAS 18001 certified under the scope "Design, Development and Production of Insulation Materials and Systems".

Name and location of production site:

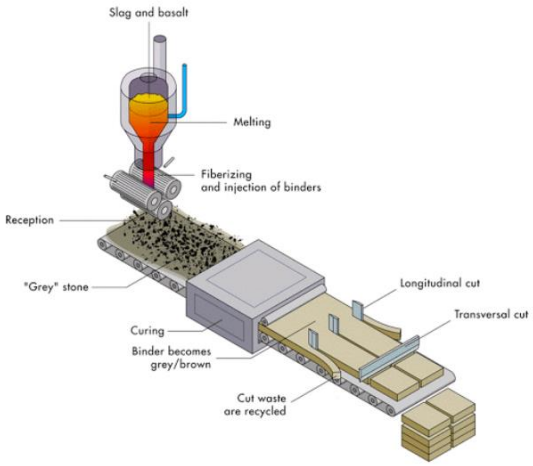
The application in construction of the concerned product is mainly European. The data utilized for the production stage life cycle assessment are related to a production plant located in Novi Marov in Croatia.

Knauf Insulation d.o.o., Varaždinska 140, HR - 42220 Novi Marof, Croatia

Information about Rock Mineral Wool production

The Rock Mineral Wool Products for Technical Solutions are available in the form of pipe sections, lamellas, mats, slabs or boards, rolls and loose wool. 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 bio-organic binder named ECOSE®. The main constituent of the binder is dextrose extracted from plants.



Product information

Product name: Fire-teK BD 912 ALU

Product identification: The declared insulation product is Fire-teK BD 912 ALU, a rock mineral wool faced with aluminium foil of 1 square meter (considered for this EPD). It needs a Declaration of Performance taken into consideration the harmonized product standard EN 14303 and the CE mark.

Product description: The main application for Fire-teK BD 912 ALU is thermal insulation of residential and commercial equipment's in very high temperature environments. Fire-teK BD 912 ALU is used in Heating, Ventilation, Air Conditioning and plumbing installations.

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 Novi Marov in Croatia with Croatian energy mix for electricity. Regarding the market area, the product is mainly marketed in Europe.

Technical Characteristics:

Parameter	Value
Thermal conductivity/ EN ISO 8497	0.040 W/(mK) at 50°C
Water vapor diffusion resistance (EN 14303)	1
Reaction to fire (EN 13501-1)	A1 (EN 1350-1)
Declared density range/ EN 13470	110-130 kg/m³
Melting point of fibers DIN 4102-17	≥ 1000°C

LCA information

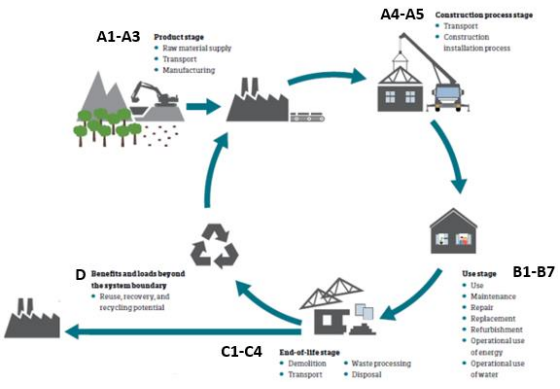
Functional unit / declared unit:
The declared unit is 1 square meter of Rock Mineral Wool faced with aluminium foil Fire-teK BD 912 ALU with a thickness of 60 mm. The declared lambda is 0.040 W/mK at 50°C. The density used for the calculation of this specific LCA is 120 kg/m³.

Reference service life: The RSL or durability of Fire-teK BD 912 ALU is as long as the lifetime of the building equipment in which it is used (at least 50 years).

Time representativeness:
Plant production data for the complete year 2016.

Database(s) and LCA software used:
The LCA model, the data aggregation and environmental impacts are calculated with the software GaBi 8.7 and its Service Pack 36 databases. Since hardly any datasets are available for Croatia, background data for Europe and/or Germany are used as much as possible.

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	120 kg/m³
Rock mineral wool weigth (without facing weight)	7.2 kg
Length	1 meter
Thickness	60 mm
Volume	0.06 m³
Facing	Alu foil (0.084 kg)
Packging Plastic sheet	0.095 kg
Packaging Wooden pallet	0.43 kg
Packaging galvanized steel	0.042 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 (if 100 % utilization).
Truck capacity utilization (including 30% of empty returns)	40 % of the weight capacity
Loss of materials in site	2%
Packaging Wooden pallet	100% incinerated
Packging Plastic sheet	40% recycled, 60% incinerated
Packaging galvanized steel	100 % recycled

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: Refurbishement
- B6: Operational Energy Use
- B7: Operational Water Use

Once installation is complete, no actions or technical operations are required during the use stages till 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 exist yet. 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 from the "Candidate List of Substances of Very High Concern for Authorisation" under the REACH regulation (above 0.1% weigth/weigth).

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. For 2016 year, no external waste is considered in this specific LCA.

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. Allocation criteria if any are based on mass.

More information:

www.knaufinsulation.com
www.ki4ts.com

Name and contact information of LCA practitioner:

Jean-Pierre Pigeolet
Knauf Insulation Sprl
Rue de Maestricht 95
4600 Visé
Belgium
Contact: Jean-Pierre.Pigeolet@knaufinsulation.com

Environmental performance

Potential environmental impacts : 1 m² of Rock Mineral Wool faced with aluminium foil Fire-teK BD 912 ALU with a thickness of 60 mm.

PARAMETERS	UNIT	TOTAL A1-A3	A4	A5	TOTAL B1-B7	C1	C2	C3	C4	D
Global warming potential (GWP)	kg CO_2 eq.	9.86	0.435	1.1	0	0	0.0251	0	0.116	-0.413
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	8.45E-012	1.18E-014	1.55E-010	0	0	6.93E-016	0	2.63E-014	-7.35E-013
Acidification potential (AP)	kg SO_2 eq.	0.131	0.000819	0.00243	0	0	0.000109	0	0.000686	-0.000629
Eutrophication potential (EP)	kg PO_4^{3-} eq.	0.0251	0.000206	0.0005	0	0	2.74E-005	0	9.48E-005	-7.12E-005
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 eq.	0.00173	9.07E-005	3.1E-006	0	0	9.78E-006	0	5.34E-005	-5.38E-005
Abiotic depletion potential – Elements (ADPe)	kg Sb eq.	1.1E-005	3.55E-008	1.21E-007	0	0	2.08E-009	0	4.45E-008	-1.08E-007
Abiotic depletion potential – Fossil resources (ADPf)	MJ, net calorific value	108	5.88	1.61	0	0	0.345	0	1.5	-6.48

Use of resources : 1 m² of Rock Mineral Wool faced with aluminium foil Fire-teK BD 912 ALU with a thickness of 60 mm.

PARAMETER		UNIT	TOTAL A1-A3	A4	A5	TOTAL B1-B7	C1	C2	C3	C4	D
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	26.5	0.325	0.654	0	0	0.0191	0	0.193	-1,19
	Used as raw materials	MJ, net calorific value	9.64	0	0	0	0	0	0	0	0
	TOTAL	MJ, net calorific value	36.2	0.325	0.654	0	0	0.0191	0	0.193	-1,19
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	118	5.9	1.98	0	0	0.346	0	1.56	-7,75
	Used as raw materials	MJ, net calorific value	4.97	0	0	0	0	-0	0	0	0
	TOTAL	MJ, net calorific value	123	5.9	1.98	0	0	0.346	0	1.56	-7,75
Secondary material		kg	0	0	0	0	0	0	0	0	0
Renewable secondary fuels		MJ, net calorific value	1.18E-011	3.18E-029	2.35E-013	0	0	1.87E-030	0	2.36E-023	-5.46E-025
Non-renewable secondary fuels		MJ, net calorific value	1.38E-010	4.83E-028	2.76E-012	0	0	2.84E-029	0	2.77E-022	-6.41E-024
Net use of fresh water		m3	0.0384	0.000599	0.003	0	0	3.52E-005	0	0.000297	-0.00167

Waste production and output flows : 1 m² of Rock Mineral Wool faced with aluminium foil Fire-teK BD 912 ALU with a thickness of 60 mm.

Waste production

PARAMETER	UNIT	TOTAL A1-A3	A4	A5	TOTAL B1-B7	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.78E-007	3.41E-007	6.8E-009	0	0	2E-008	0	2.68E-008	-2.99E-009
Non-hazardous waste disposed	kg	0.815	0.000494	0.166	0	0	2.9E-005	0	7.3	-0.00278
Radioactive waste disposed	kg	0.00568	8.07E-006	0.000144	0	0	4.74E-007	0	2.25E-005	-0.000505

Output flows

PARAMETER	UNIT	TOTAL A1-A3	A4	A5	TOTAL 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	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	0.294	0	0	0	0	0	1.1
Exported energy, thermal	MJ	0	0	0.966	0	0	0	0	0	1.98

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 clearly dominated by the production processes impact (70%). Mostly due to the CO_2 emissions by the cupola furnace and the energy consumption at different levels. The coke is unfortunately generating quite a lot of CO_2 during the melting process. CO_2 is also generated upstream during the electricity production. However, the bio-based binder allows some sequestration of CO_2 thanks to CO_2 capture during plants growth. The transport to construction site has however an impact of less than 5%.

The Ozone layer Depletion Potential (ODP) is mostly influenced by construction site installation by considering plastic packaging incineration with energy valorisation.

The Acidification Potential (AP) is dominated by the production due to the emissions related to the raw materials melting process for example sulphur dioxides emissions and the energy consumption.

The Eutrophication Potential (EP) is mostly due to the production, especially due to the ammonia emission during binder application into the plant.

The Photochemical Ozone Creation Potential (POCP) is dominated by the production (emissions in the cupola furnace and energy consumption). The main emissions contributing to this impact category are sulphur dioxide and nitrogen oxides.

The Abiotic Depletion Potential Element (ADPe) is mainly due here indirectly by the packaging with some protective corners in steel, the facing with aluminium is also responsible for a representative part of the impact. The impact of the raw materials, like the volcanic rock basalt, is very minor as the material very abundant on Earth.

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

The mains impact on **Primary Energy Demand from Non-Renewable** resources is from the production process of rock mineral wool products, especially due to the energy carrier, the coke, and the global energy consumption (gas and electricity) and the facing (aluminium facing).

The **Primary Energy Demand from Renewable** resources is dominated by the bio-based binder and the packaging, especially the wooden pallets.

For the **Use of Secondary Material,** there is no secondary materials taken into account, as the internal recycling cannot be considered.

References

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Contact information:

EPD owner:	Knauf Insulation Rue de Maestricht 95 4600 Visé Belgium www.knaufinsulation.com Contact: jean-pierre.pigeolet@knaufinsulation.com
LCA support:	Université de Liège – Laboratory of Chemical Engineering PEPs - Products, Environment and Processes Allée du 6 août 15, Bat B6 4000 Liège Belgium Thinkstep Hauptstraße 111-113 70771 Leinfelden-Echterdingen Germany
Programme operator:	EPD International AB info@environdec.com