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-20160052-CBB1-EN
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Valid to	4/11/2021

Mineral Plus 034-035 Slabs

Mineral Plus FCB 035, Mineral Plus FCB 035KD, Mineral Plus EXT 035, Mineral Plus KP 035, Mineral Plus KP 034 and Mineral Plus HB 034

with ECOSE® Technology

Knauf Insulation

www.bau-umwelt.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-20160052-CBB1-EN

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

Issue date
4/12/2016

Valid to
4/11/2021

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

Dr. Burkhart Lehmann
(Managing Director IBU)

Mineral Plus 034-035 Slabs with ECOSE

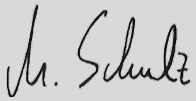
Owner of the Declaration
Knauf Insulation
rue E. Franqui, 7
1435 Mont-Saint-Guibert
Belgium

Declared product / Declared unit
1 m³ of Mineral Plus 034-035 slabs

Scope:
Mineral Plus 034-035 slabs are insulation product faced or unfaced. They are manufactured in the form of slabs and comply with the requirements of /EN 13162/. The thickness is ranging from 40 mm to 240 mm. The manufacturing company is Knauf Insulation - plants Krupka (Czech Republic), Vise (Belgium) and Eskisehir (Turkey).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 mineral wool insulation products such as Mineral Plus FCB 035, Mineral Plus FCB 035KD, Mineral Plus EXT 035, Mineral Plus KP 035, Mineral Plus KP 034 and Mineral Plus HB 034 . Mineral Plus are available in the form of slabs or rolls. The density for Mineral Plus products can range from 10 to 85 kg/m³. In general Mineral Plus products consists of >= 92% inert material. The inert part is made of recycled materials (up to 80% of the composition) and mainly sand and dolomite.
The remaining <= 8% are made of binder components. At Knauf Insulation, the binder used for Mineral Plus products is the ECOSE binder whose origin is plant starch.
Mineral Plus 034-035 slabs are products unfaced or faced with a glass veil, and they are used for their thermal, acoustical and fire characteristics. A faced representative product out of a particular group of produts was selected for the calculation as a worst case scenario.

For the placing on the market of construction products in the European Union and EFTA (with the exception of Switzerland) /Regulation (EU) No 305/2011/ applies. The products need a Declaration of performance (DoP) taking into consideration the harmonized product standard /EN 13162/ and the CE-mark /Regulation (EC) No 765/2008/.

Application
Main applications for Mineral Plus 034-035 slabs are in external walls (ventilated façade, metal cladding, timber frame), pitched roof, internal partition and suspended ceilings. For the applications and use national regulations apply, in Germany the /*Allgemeine bauaufsichtliche Zulassung Z-23.15-1461/ (building inspection approval) issued by the Deutsches Institut für Bautechnik (DIBt), Berlin*.

Technical Data
Mineral Plus 034-035 slabs 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 /EN 12667/	0.034	W/(mK)
Thermal conductivity /EN 12667/	0.035	W/(mK)
Water vapour diffusion resistance factor /EN 13162/	1	-

Gross density /EN 1602/	18 - 21	kg/m³
Longit. air-diffusion resist. /EN 29053/	>=5	kNs/m^4
Water absorption Wp /EN 1609/	< 1	kg/m²
Water absorption Wlp /EN 12087/	< 3	kg/m²
Reaction to fire /EN 13501-1/	A1	-
Specific heat capacity /EN ISO 10456/	850	J/kgK
Acoustic absorption	not relevant	
Compression strength/resistance	not relevant	

Base materials / Ancillary materials
Mineral Wool is an insulation material of mostly inorganic origin intended for thermal and acoustic insulation, as well as for fire prevention in construction as well as industry. Raw materials used in the production of Mineral Plus are sand, limestone, soda ash and high level of recycled materials (up to 80%). A bio-based binder, ECOSE, is spread on the fibers which polymerisation contributes to fix the product dimensions. The cured binder bonds the fibres together thus providing the necessary mat stability and mechanical strength. A glass veil also manufactured with bio-based binder is utilized for mechanical properties.

Reference service life
The RSL or durability of Mineral Plus 034-035 is as long as the lifetime of the building in which it is used.

LCA: Calculation rules

Declared Unit
The declared unit is 1 m³ of mineral wool. The density used for the calculation of the LCA is 19.5 kg/m³.

Declared unit

Name	Value	Unit
Declared unit	1	m³
Gross density	19.5	kg/m³
Conversion factor to 1 kg	0.0513	-

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 and
- A3 - manufacturing.

This includes provision of all materials, products and energy, packaging processing and their 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. The average transport distance is assumed to be 600 km with a truck capacity utilization of 50%.
Module A5 has been included in this EPD with a product loss of 2% on construction site. The treatment of the packaging waste after the installation of the product has also been considered.

The use stage.
Because they are specific for 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 mineral wool products.
Although 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 re-use, 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, for the analyzed product for the packagings, so module D is 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 technical information can be used for the development of specific scenarios in the context of a building assessment.

Transport to the building site (A4)

Name	Value	Unit

Litres of fuel	0.0025	l/100km
Transport distance	600	km
Capacity utilisation (including empty runs)	50	%
Gross density of products transported	19.5	kg/m^3

Installation into the building (A5)

Name	Value	Unit
Auxiliary	0	kg
Water consumption	0	m^3
Other resources	0	kg
Electricity consumption	0	kWh
Other energy carriers	0	MJ
Material loss Mineral Wool	0.444	kg
Output substances following waste treatment on site Packaging	1.452	kg
Dust in the air	0	kg
VOC in the air	0	kg

Reference service life

Name	Value	Unit
Reference service life	50	a

End-of-life (C1 - C4)

Name	Value	Unit
Landfilling	19.5	kg
Transport distance	50	km
Capacity utilization	50	%

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: 1 m³ Mineral Plus 034 - 035 slabs

Parameter	Unit	A1-A3	A4	A5	C2	C4	D
Global warming potential	[kg CO_2-Eq.]	24.90	1.10	3.91	0.07	0.33	-1.69
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	7.09E-9	5.06E-12	1.62E-9	3.08E-13	3.60E-12	-4.66E-10
Acidification potential of land and water	[kg SO_2-Eq.]	2.12E-1	2.92E-3	4.66E-3	1.88E-4	1.96E-3	-2.40E-3
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	3.39E-2	6.83E-4	7.63E-4	4.44E-5	2.66E-4	-2.51E-4
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	1.12E-2	-8.69E-4	2.44E-4	-5.84E-5	1.88E-4	2.79E-4
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.28E-3	7.33E-8	2.58E-5	4.46E-9	1.13E-7	-2.51E-7
Abiotic depletion potential for fossil resources	[MJ]	438.00	15.20	9.47	0.92	4.25	-23.90

RESULTS OF THE LCA - RESOURCE USE: 1 m³ Mineral Plus 034 - 035 slabs

Parameter	Unit	A1-A3	A4	A5	C2	C4	D
Renewable primary energy as energy carrier	[MJ]	59.80	IND	IND	IND	IND	IND
Renewable primary energy resources as material utilization	[MJ]	37.30	IND	IND	IND	IND	IND
Total use of renewable primary energy resources	[MJ]	97.10	0.86	2.02	0.05	0.50	-3.21
Non-renewable primary energy as energy carrier	[MJ]	504.00	IND	IND	IND	IND	IND
Non-renewable primary energy as material utilization	[MJ]	0.00	IND	IND	IND	IND	IND
Total use of non-renewable primary energy resources	[MJ]	504.00	15.20	10.90	0.93	4.40	-28.30
Use of secondary material	[kg]	16.00	0.00	0.33	0.00	0.00	0.00
Use of renewable secondary fuels	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00
Use of non-renewable secondary fuels	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00
Use of net fresh water	[m³]	1.81E-1	2.16E-3	9.12E-3	1.31E-4	8.97E-4	-5.00E-3

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m³ Mineral Plus 034 - 035 slabs

Parameter	Unit	A1-A3	A4	A5	C2	C4	D
Hazardous waste disposed	[kg]	3.42E-5	1.15E-6	6.92E-7	7.00E-8	1.00E-7	-9.84E-9
Non-hazardous waste disposed	[kg]	1.44E+0	1.28E-3	4.48E-1	7.78E-5	2.04E+1	-8.80E-3
Radioactive waste disposed	[kg]	2.61E-2	2.18E-5	5.71E-4	1.32E-6	6.14E-5	-1.73E-3
Components for re-use	[kg]	IND	IND	IND	IND	IND	IND
Materials for recycling	[kg]	IND	IND	IND	IND	IND	IND
Materials for energy recovery	[kg]	IND	IND	IND	IND	IND	IND
Exported electrical energy	[MJ]	IND	IND	4.89	IND	0.00	IND
Exported thermal energy	[MJ]	IND	IND	14.10	IND	0.00	IND

INTERPRETATION

USE OF RESOURCES

The primary energy demand from non-renewable resources is dominated by the production of mineral wool products (especially due to the energy consumption), the packaging and the facing (glass veil).
The renewable energy demand is dominated by the packaging (wood pallets), the binder (bio-based) and production (electricity mix).

ENVIRONMENTAL IMPACT

Every impacts category except ADPe are dominated by the production. This is due to the consumption of energy (electricity and thermal energy) during the production of mineral wool products.
The **Abiotic Depletion Potential elements (ADPe)** is dominated by the raw material consumption (>90%, mainly due to borax), followed by the supply of materials for the facing (glass veil).
The **Abiotic Depletion Potential fossil** (**ADPf)** is dominated by the use of natural gas as energy carrier and the electricity consumption for the production (63%). The plastics used for packaging have also non negligible impact (10%).
The **Global Warming Potential (GWP)** is dominated by the production, mostly due to energy consumption (71%, gas and electricity). The binder (bio-based) has overall no impact. The glass veil used as facing material also has a non-negligible contribution (5%).
The **Ozone Depletion Potential** (**ODP)** is influenced mainly by the production. The production is dominated by the electricity consumption which has a relevant impact on ODP because of cooling systems in power plant.

The **Acidification Potential** (**AP)** is also dominated by the production (77%) due to the emissions related to the processes and the energy consumption. Mostly, the impact refers to emissions to air: sulphur dioxide, amonia and nitrogen oxides.
The **Eutrophication Potential** (**EP)** is significantly influenced by the production (68%) due to emissions from the furnace, curing oven and electricity consumption.
The **Potential of Tropospheric Ozone Photochemical Oxidants** (**POCP)** is particularly dominated by the production (78%, emissions in curing oven, electricity consumption). The glass veil also contributes to POCP (7%). The results from the transport are negative due to the NO emissions; NO counteracts the POCP.

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