

ENVIRONMENTAL PRODUCT DECLARATION

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

NaturBoard VENTI GVB, NaturBoard VENTI

From

KNAUFINSULATION



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Programme-related information and verification

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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: 2017)
Product group classification:	UN CPC 37
Reference year for data:	2016 for Novi Marof plant; 2018 for Surdulica plant
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, 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. 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 50001 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 mainly in Europe. The data utilized for the production stage life cycle assessment are related to a production plant located in Novi Marof in Croatia and Surdulica in Serbia.

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

Industrijsko naselje Belo Polje bb, 17530, Surdulica, Serbia

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. 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: NaturBoard VENTI GVB, NaturBoard VENTI

Product identification: The declared insulation products NaturBoard VENTI GVB, NaturBoard VENTI are multifunctional rock mineral wool insulation board which provides excellent technical properties, such as thermal, sound insulation in various building structures. The reference product is a compact rock mineral wool faced slab of 1 m² and 50 mm (considered for this EPD). If indicators values for other thicknesses are required, they may be obtained by linear extrapolation of those values.

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 R4305LPCPR/ R4224LPCPR taking into consideration the harmonized product standard /EN 14064-1/ and the /CE-mark/.

Product description: The reference product Rock mineral wool boards are multifunctional insulation boards used mostly as an insulating filler for thermal, sound and fire protection of building structures, where the insulation is not directly exposed to mechanical loads. They are most often installed as insulation in pitched roofs, partition walls, suspended acoustic ceilings and as insulation of external walls and internal insulation in dry-mounted Knauf walls.

The reference product is also often used in ventilated façades due to increased water repellence.

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 manufactured in Novi Marof in Croatia and Surdulica in Serbia with related country energy mix for electricity. Regarding the market area, the product is mainly 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 13162	0.035 W/(mK)
Water vapor diffusion resistance (EN 12086)	1
Thermal Resistance (ISO 8301)- R	1.43 m ² K/W
Reaction to fire (EN 13501-1)	A1
Declared density range/ EN 1602	50 kg/m ³ (+/-10%)

LCA information

Functional unit / declared unit:

The declared unit is 1 m² of Rock Mineral Wool NaturBoard VENTI GVB, NaturBoard VENTI with a thickness of 50 mm. The declared lambda is 0.035 W/mK. The density used for the calculation of this specific LCA is 50 kg/m³.

Reference service life: The RSL or durability of NaturBoard VENTI GVB, NaturBoard VENTI is as long as the lifetime of the building equipment in which it is used (at least 50 years).

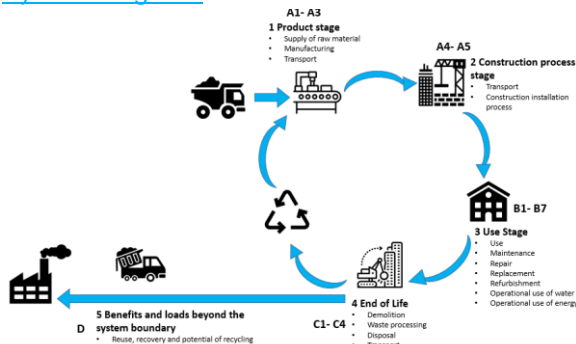
Time representativeness:

Plant data for Surdulica (Serbia) for 2018 complete year while Novi Marof (Croatia) plant data for 2016.

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. Since hardly any datasets are available for Croatia and Serbia, 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	50 kg/m ³
Rock mineral wool weight (without facing weight)	2.5 kg
Surface	1 m ²
Thickness	50 mm
Volume	0.05 m ³
Facing (Glass Black Veil)	0.075 kg
Packaging Plastic sheet	0.08 kg
Packaging Wooden pallet	0.33 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)	20 % of the weight capacity
Loss of materials in construction site	2%
Packaging Wooden pallet	40% recycled, 60% 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 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% weight/weight).

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 2018 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.

Knauf Insulation adopts a "worst case" approach into its EPDs.

Knauf Insulation supports the Ten Principles of the United Nations Global Compact on human rights, labour, environment and anti-corruption.

More information:

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Declared Modules

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 NaturBoard VENTI GVB, NaturBoard VENTI with a thickness of 50 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 CO ₂ eq.	2.61E+00	2.97E-01	7.69E-01	0.00E+00	0.00E+00	8.91E-03	0.00E+00	3.51E-02	-2.65E-01
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.	6.77E-12	4.82E-17	1.44E-10	0.00E+00	0.00E+00	1.47E-18	0.00E+00	1.93E-16	-1.47E-12
Acidification potential (AP)	kg SO ₂ eq.	2.03E-02	5.82E-04	4.77E-04	0.00E+00	0.00E+00	3.80E-05	0.00E+00	2.25E-04	-5.35E-04
Eutrophication potential (EP)	kg PO ₄ ³⁻ eq.	3.10E-03	1.41E-04	7.72E-05	0.00E+00	0.00E+00	9.42E-06	0.00E+00	2.54E-05	-9.64E-05
Formation potential of tropospheric ozone (POCP)	kg C ₂ H ₄ eq.	6.26E-04	6.40E-05	1.79E-05	0.00E+00	0.00E+00	3.45E-06	0.00E+00	1.69E-05	-1.23E-04
Abiotic depletion potential – Elements	kg Sb eq.	6.74E-06	2.44E-08	1.43E-07	0.00E+00	0.00E+00	7.46E-10	0.00E+00	1.35E-08	-6.28E-08
Abiotic depletion potential – Fossil resources	MJ, net calorific value	3.42E+01	4.00E+00	8.47E-01	0.00E+00	0.00E+00	1.22E-01	0.00E+00	4.98E-01	-4.69E+00

*: [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 NaturBoard VENTI GVB, NaturBoard VENTI with a thickness of 50 mm.

PARAMETER		UNIT	TOTAL A1-A3**	A4	A5	TOTAL B1-B2-B3-B4-B5-B6-B7	C1	C2	C3	C4	D*
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	5.16E+00	2.25E-01	3.35E-01	0.00E+00	0.00E+00	6.89E-03	0.00E+00	6.72E-02	-1.72E+00
	Used as raw materials	MJ, net calorific value	6.54E+00	0.00E+00	3.08E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	1.17E+01	2.25E-01	3.66E-01	0.00E+00	0.00E+00	6.89E-03	0.00E+00	6.72E-02	-1.72E+00
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	3.37E+01	4.01E+00	9.53E-01	0.00E+00	0.00E+00	1.23E-01	0.00E+00	5.13E-01	-5.32E+00
	Used as raw materials	MJ, net calorific value	3.60E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	3.73E+01	4.01E+00	9.53E-01	0.00E+00	0.00E+00	1.23E-01	0.00E+00	5.13E-01	-5.32E+00
Secondary material		kg	3.15E-01	0.00E+00	6.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-01
Renewable secondary fuels		MJ, net calorific value	3.18E-18	0.00E+00	6.37E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-5.09E-25
Non-renewable secondary fuels		MJ, net calorific value	3.74E-17	0.00E+00	7.48E-19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-5.97E-24
Net use of fresh water		m ³	9.80E-03	2.61E-04	1.52E-03	0.00E+00	0.00E+00	7.98E-06	0.00E+00	1.29E-04	-1.09E-03

*: [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).

Waste production and output flows: 1 m² of Rock Mineral Wool NaturBoard VENTI GVB, NaturBoard VENTI with a thickness of 50 mm.

Waste production

PARAMETER	UNIT	TOTAL A1-A3**	A4	A5	TOTAL B1-B2-B3-B4-B5-B6-B7	C1	C2	C3	C4	D*
Hazardous waste disposed	kg	1.07E-07	1.87E-07	4.90E-09	0.00E+00	0.00E+00	5.71E-09	0.00E+00	7.82E-09	-1.83E-08
Non-hazardous waste disposed	kg	2.71E-01	6.13E-04	6.11E-02	0.00E+00	0.00E+00	1.88E-05	0.00E+00	2.58E+00	-5.70E-03
Radioactive waste disposed	kg	1.22E-03	4.96E-06	4.14E-05	0.00E+00	0.00E+00	1.52E-07	0.00E+00	5.83E-06	-2.50E-04

*: [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).

Output flows

PARAMETER	UNIT	TOTAL A1- A3**	A4	A5	TOTAL B1- B2-B3-B4- B5-B6-B7	C1	C2	C3	C4	D*
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	0.00E+00	0.00E+00	2.80E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	2.43E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	7.73E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	1.80E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

*: [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).

Differences Versus Previous Versions

Environmental Indicator	Previous Version	Current Version	Percentage Change (%)
Global Warming Potential (GWP)	3.754	3.720	0.91%
Ozone Depletion Potential (ODP)	0.000	0.000	0.00%
Acidification Potential for Soil and Water (AP)	0.022	0.022	1.60%
Eutrophication Potential (EP)	0.003	0.003	0.97%
Formation potential of tropospheric Ozone (POCP)	0.001	0.001	2.64%
Abiotic Depletion Potential (ADPE)	0.000	0.000	0.01%
Abiotic Depletion Potential (ADPF)	39.345	39.667	-0.82%

LCA interpretation

ENVIRONMENTAL IMPACTS

All impact categories, except the Abiotic Depletion Potential Element and the Ozone Depletion Potential, are dominated by the manufacturing 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 manufacturing processes impact (70%). Mostly due to the CO₂ emissions by the cupola furnace and the energy consumption at different levels. The coke is unfortunately generating quite a lot of CO₂ during the melting process. CO₂ is also generated upstream during the electricity production. However, the bio-based binder allows some sequestration of CO₂ thanks to CO₂ capture during plants growth. The transport to construction site has however an impact of less than 10%.

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 manufacturing 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 manufacturing, especially due to the ammonia emission during binder application into the plant.

The Photochemical Ozone Creation Potential (POCP) is dominated by the manufacturing (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 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 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 main impact on **Primary Energy Demand from Non-Renewable** resources is from the manufacturing process of rock mineral wool products, especially due to the energy carrier, the coke, and the global energy consumption (gas and electricity).

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

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 16783: 2017

Thermal insulation products - Product category rules (PCR) for factory made and in-situ formed products for preparing environmental product declarations

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 13162:2012 + A1:2015

EN 13162:2012 + A1:2015 - Thermal insulation products for buildings - Factory made mineral wool (MW)

EN 1602

EN 1602: 2013 Thermal insulating products for building applications - Determination of the apparent density

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.

EN 15978: 2011

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

ISO 8301:1991

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

EN 14064-1:2018

Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals

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