ENVIROMENTAL PRODUCT DECLARATION

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

Naturoll 032

From

KNAUF INSULATION

Program:
The International EPD® System
Programme operator:
EPD International AB
EPD registration number:
S-P-01717
Publication date:
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Validity date:
2024-12-20
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  
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| EPD registration number: | S-P-01717 |
| Published: | 2019-12-20 |
| Valid until: | 2024-12-20 |
| EPD owner | Knauf Insulation Sprl  
Rue de Maestricht 95  
4600 Visé  
Belgium |
Sub-PCR-I Thermal insulation products (EN 16783). Version 2018-11-22 |
| Product group classification: | UN CPC 37 |
| Reference year for reference data: | 2016 |
| Geographical application scope: | Global |

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 and 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 Belgium, in Visé.

Product-related or management system-related certifications:
All Knauf Insulation sites, including the related sites 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 production plants located in Visé (Belgium), Krupka (Czech Republic), Bernburg (Germany) and Lannemezan (France).

Knauf Insulation, Weststraße 1, 06406 Bernburg (Saale), Germany
Knauf Insulation, Rue de Maestricht 95, 4600 Visé, Belgium
Knauf Insulation, Pod dolní drahou 110, 417 42 Krupka, Czech Republic
Knauf Insulation, 501 Voie Napoleon lli, 65300 Lannemezan, France

Information about Glass Mineral Wool production

The Glass Mineral Wool Products for (GMW) are available in the form of slabs, rolls and boards. The density for glass mineral wool ranges from 10 to 85 kg/m³. In general, glass mineral wool consists of at least 92.5% inert material. The inert part is made of recycled glass (external cullet, up to 80% of the composition) and mainly sand and dolomite.

The remaining fraction (less than or equal to 7.5%) is made of bio-based binder components. At Knauf Insulation, the binder used for the GMW products is the ECOSE binder whose origin is plant starch.
**Product information**

**Product name:** Naturoll 032

**Product identification:** The declared insulation product is Naturoll 032, an unfaced glass mineral wool of one 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.

**Product description:** The main application for Naturoll 032 unfaced rolls are in pitched roofs, partition walls and timber frames.

**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).

**Technical Characteristics:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity/ EN 12667</td>
<td>0.032 W/(mK) at 10°C</td>
</tr>
<tr>
<td>Water vapor diffusion resistance (EN 13162)</td>
<td>1</td>
</tr>
<tr>
<td>Reaction to fire (EN 13501-1)</td>
<td>A1 (EN 1350-1)</td>
</tr>
<tr>
<td>Declared density range/ EN 1602</td>
<td>30-34 kg/m³</td>
</tr>
<tr>
<td>Melting point of fibers DIN 4102-17</td>
<td>≥ 1000°C</td>
</tr>
</tbody>
</table>

**Geographical scope:**
The product is produced in Visé (Belgium), Krupka (Czech Republic), Bernburg (Germany) and Lannemezan (France) with related country energy mix for electricity. Regarding the market area, the product is mainly marketed in Europe.

**LCA information**

**Functional unit / declared unit:**
The declared unit is one square meter of Glass Mineral Wool unfaced Naturoll 032 with a thickness of 100 mm. The declared lambda is 0.032 W/mK at 10°C. The density used for the calculation of this specific LCA is 32 kg/m³.

**Reference service life:** The RSL or durability of Naturoll 032 is as long as the lifetime of the building equipment in which it is used (at least 50 years).

**Time representativeness:**
Plants 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 9.2 and its Service Pack 39 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.

<table>
<thead>
<tr>
<th>Product Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared Density</td>
<td>32 kg/m³</td>
</tr>
<tr>
<td>Glass mineral wool weight</td>
<td>3.2 kg</td>
</tr>
<tr>
<td>(without facing weight)</td>
<td></td>
</tr>
<tr>
<td>Surface</td>
<td>1 m²</td>
</tr>
<tr>
<td>Thickness</td>
<td>100 mm</td>
</tr>
<tr>
<td>Volume</td>
<td>0.1 m³</td>
</tr>
<tr>
<td>Facing</td>
<td>NA</td>
</tr>
<tr>
<td>Packaging Plastic sheet</td>
<td>0.123 kg</td>
</tr>
<tr>
<td>Packaging Wooden pallet</td>
<td>0.215 kg</td>
</tr>
<tr>
<td>Packaging galvanized steel</td>
<td>NA</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average transport distance</td>
<td>600 km</td>
</tr>
<tr>
<td>Type of fuel and vehicle consumption or type of vehicle used for transport.</td>
<td>Truck. Euro 6. 28 – 32 t / 22 t payload. 33 L for 100 km.</td>
</tr>
<tr>
<td>Truck capacity utilization (including 30% of empty returns)</td>
<td>27 % of the weight capacity</td>
</tr>
<tr>
<td>Loss of materials in site</td>
<td>2%</td>
</tr>
<tr>
<td>Packaging Wooden pallet</td>
<td>100% incinerated</td>
</tr>
<tr>
<td>Packaging Plastic sheet</td>
<td>40% recycled, 60% incinerated</td>
</tr>
<tr>
<td>Packaging galvanized steel</td>
<td>NA</td>
</tr>
</tbody>
</table>

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 Glass 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.

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

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.

Recycled material
The mineral wool waste that is originating from the manufacturing process in the cutting lines is recycled internally and reinjected into the mineral wool production mattress. For 2016 year, cullet external waste are considered into this specific LCA for each plant considered.

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 Glass Mineral Wool plant construction or machines is not taken into account in the life cycle assessment. Allocation criteria with by-products (mineral wool for ceiling tiles) are based on cost.

More information:
www.knaufinsulation.com
www.knaufinsulation.be
www.knaufinsulation.fr
www.knaufinsulation.cz
www.knaufinsulation.de

Name and contact information of LCA practitioner:
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Knauf Insulation Sprl
Rue de Maestricht 95
4600 Visé
Belgium
Contact: yaprak.nayir@knaufinsulation.com

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).
**Potential environmental impacts:** 1 m² of Glass Mineral Wool Naturoll 032 with a thickness of 100 mm.

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>UNIT</th>
<th>TOTAL A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>TOTAL B1-B2-B3-B4-B5-B6-B7</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>D*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming potential (GWP)</td>
<td>kg CO₂ eq.</td>
<td>3.36</td>
<td>0.346</td>
<td>0.945</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00972</td>
</tr>
<tr>
<td>Depletion potential of the stratospheric ozone layer (ODP)</td>
<td>kg CFC 11 eq.</td>
<td>5.31E-012</td>
<td>5.69E-017</td>
<td>2.71E-010</td>
<td>0</td>
<td>0</td>
<td>1.6E-018</td>
<td>0</td>
<td>5.22E-014</td>
<td>-7.11E-014</td>
</tr>
<tr>
<td>Acidification potential (AP)</td>
<td>kg SO₂ eq.</td>
<td>0.0186</td>
<td>0.000279</td>
<td>0.000507</td>
<td>0</td>
<td>0</td>
<td>8.74E-006</td>
<td>0</td>
<td>0.000305</td>
<td>-0.000711</td>
</tr>
<tr>
<td>Eutrophication potential (EP)</td>
<td>kg PO₄³⁻ eq.</td>
<td>0.00366</td>
<td>6.35E-005</td>
<td>9.76E-005</td>
<td>0</td>
<td>0</td>
<td>2.01E-006</td>
<td>0</td>
<td>4.16E-005</td>
<td>-8.45E-005</td>
</tr>
<tr>
<td>Formation potential of tropospheric ozone (POCP)</td>
<td>kg C₂H₄ eq.</td>
<td>0.00129</td>
<td>4.7E-005</td>
<td>3.69E-005</td>
<td>0</td>
<td>0</td>
<td>-4.58E-008</td>
<td>0</td>
<td>2.4E-005</td>
<td>-6.81E-005</td>
</tr>
<tr>
<td>Abiotic depletion potential – Elements</td>
<td>kg Sb eq.</td>
<td>0.000202</td>
<td>2.65E-008</td>
<td>4.14E-006</td>
<td>0</td>
<td>0</td>
<td>7.47E-010</td>
<td>0</td>
<td>1.85E-008</td>
<td>-1.03E-007</td>
</tr>
<tr>
<td>Abiotic depletion potential – Fossil resources</td>
<td>MJ, net calorific value</td>
<td>61.6</td>
<td>4.67</td>
<td>1.72</td>
<td>0</td>
<td>0</td>
<td>0.131</td>
<td>0</td>
<td>0.668</td>
<td>-9.45</td>
</tr>
</tbody>
</table>

*: [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].
**Use of resources:** 1 m² of Glass Mineral Wool Naturoll 032 with a thickness of 100 mm.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>UNIT</th>
<th>TOTAL A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>C2</th>
<th>C4</th>
<th>D*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary energy resources – Renewable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use as energy carrier</td>
<td>MJ, net calorific value</td>
<td>17.98</td>
<td>0</td>
<td>0.56154</td>
<td>0.00765</td>
<td>0.0806</td>
<td>-1.35</td>
</tr>
<tr>
<td>Used as raw materials</td>
<td>MJ, net calorific value</td>
<td>5.22</td>
<td>0</td>
<td>0.01146</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>MJ, net calorific value</td>
<td>23.2</td>
<td>0.272</td>
<td>0.573</td>
<td>0.00765</td>
<td>0.0806</td>
<td>-1.35</td>
</tr>
<tr>
<td><strong>Primary energy resources – Non-renewable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use as energy carrier</td>
<td>MJ, net calorific value</td>
<td>76.6</td>
<td>4.68</td>
<td>2.13</td>
<td>0.132</td>
<td>0.691</td>
<td>-10.7</td>
</tr>
<tr>
<td>Used as raw materials</td>
<td>MJ, net calorific value</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>MJ, net calorific value</td>
<td>76.6</td>
<td>4.68</td>
<td>2.13</td>
<td>0.132</td>
<td>0.691</td>
<td>-10.7</td>
</tr>
<tr>
<td><strong>Secondary material</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazardous waste disposed</td>
<td>kg</td>
<td>1.42E-007</td>
<td>2.62E-007</td>
<td>8.74E-009</td>
<td>7.37E-009</td>
<td>1.09E-008</td>
<td>-3.89E-009</td>
</tr>
<tr>
<td>Non-hazardous waste disposed</td>
<td>kg</td>
<td>0.144</td>
<td>0.00381</td>
<td>0.0751</td>
<td>1.07E-005</td>
<td>3.21</td>
<td>-0.00323</td>
</tr>
<tr>
<td>Radioactive waste disposed</td>
<td>kg</td>
<td>0.0059</td>
<td>6.35E-006</td>
<td>0.00159</td>
<td>1.79E-007</td>
<td>9.43E-006</td>
<td>-0.000484</td>
</tr>
</tbody>
</table>

**Waste production and output flows:** 1 m² of Glass Mineral Wool Naturoll 032 with a thickness of 100 mm.

**Waste production**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>UNIT</th>
<th>TOTAL A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>C2</th>
<th>C4</th>
<th>D*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous waste disposed</td>
<td>kg</td>
<td>1.42E-007</td>
<td>2.62E-007</td>
<td>8.74E-009</td>
<td>7.37E-009</td>
<td>1.09E-008</td>
<td>-3.89E-009</td>
</tr>
<tr>
<td>Non-hazardous waste disposed</td>
<td>kg</td>
<td>0.144</td>
<td>0.00381</td>
<td>0.0751</td>
<td>1.07E-005</td>
<td>3.21</td>
<td>-0.00323</td>
</tr>
<tr>
<td>Radioactive waste disposed</td>
<td>kg</td>
<td>0.0059</td>
<td>6.35E-006</td>
<td>0.00159</td>
<td>1.79E-007</td>
<td>9.43E-006</td>
<td>-0.000484</td>
</tr>
</tbody>
</table>

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## Output flows

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>UNIT</th>
<th>TOTAL A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>C2</th>
<th>C4</th>
<th>D*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Components for reuse</td>
<td>kg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Material for recycling</td>
<td>kg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Materials for energy recovery</td>
<td>kg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.381</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Exported energy, electricity</td>
<td>MJ</td>
<td>0</td>
<td>0</td>
<td>1.26</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Exported energy, thermal</td>
<td>MJ</td>
<td>0</td>
<td>0</td>
<td>3.03</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*: [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].
LCA interpretation

ENVIRONMENTAL IMPACTS

All impact categories except the ADPE and the ODP are dominated by the production. This is mainly due to the consumption of energy (electricity and natural gas) during the production of glass mineral wool.

The Global Warming Potential (GWP) is clearly dominated by the production, mostly due to energy consumption (electricity and natural gas).

The Ozone layer Depletion Potential (ODP) seems highly influenced by the installation step, mostly due to plastics packaging incineration scenario resulting in emissions of halogenated compounds.

The Acidification Potential (AP) is also dominated by the production due to the processes emissions and the electricity consumption. Most of impact is by emissions of sulphur dioxide, ammonia and nitrogen oxides.

The Eutrophication Potential (EP) is significantly influenced by production due to emissions from curing oven, furnace and other unit processes. The glucose for the binder production also has an impact because of crops fertilizers use.

The Photochemical Ozone Creation Potential (POCP) is dominated by the production due to emissions in the curing oven and in other unit processes but also energy consumption.

The Abiotic Depletion Potential Element (ADPe) is dominated by the raw materials production.

The Abiotic Depletion Potential Fossil (ADPf) is dominated by natural gas use and the electricity consumption for the production. The packaging and the binder have also a non-negligible impact. The installation stage has a “positive” contribution thanks to energy recovery from incineration of a percentage of plastic packaging and the avoidance production of new plastic production thanks to a percentage of recycling plastic packaging.

RESOURCES USE

Total Use of Non-Renewable Primary Energy Resources (PENRT) is dominated by the production of glass mineral wool products (especially due to the energy consumption) and with the little influence of raw materials, binder and packaging.

Total Use of Renewable Primary Energy Resources (PERT) is dominated by the binder (bio-based), the production (electricity mix) and the packaging (wooden pallets).

For the Use of Secondary Material (SM), there is a lot of external cullet used into the batch process (recycled glass from windows and bottles) up to 80% depending on plants.
References

International EPD® System
Sub-PCR-I Thermal insulation products (EN 16783). Version 2018-11-22

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

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.
### Contact information:

| EPD owner: | Knauf Insulation  
Rue de Maestricht 95  
4600 Visé  
Belgium  
www.knaufinsulation.com  
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|---|---|
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