ENVIRONMENTAL PRODUCT DECLARATION
as per /ISO 14025/ and /EN 15804/

<table>
<thead>
<tr>
<th>Owner of the Declaration</th>
<th>Knauf Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme holder</td>
<td>Institut Bauen und Umwelt e.V. (IBU)</td>
</tr>
<tr>
<td>Publisher</td>
<td>Institut Bauen und Umwelt e.V. (IBU)</td>
</tr>
<tr>
<td>Declaration number</td>
<td>EPD-KNI-20170218-CBD1-EN</td>
</tr>
<tr>
<td>ECO EPD Ref. No.</td>
<td>ECO-00000678</td>
</tr>
<tr>
<td>Issue date</td>
<td>31/01/2018</td>
</tr>
<tr>
<td>Valid to</td>
<td>30/01/2023</td>
</tr>
</tbody>
</table>

DP7 - DP8
Multipurpose Rock Mineral Wool insulation

Knauf Insulation
General Information

Knauf Insulation

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

Declaration number
EPD-KNI-20170218-CBD1-EN

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

Issue date
31/01/2018

Valid to
30/01/2023

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

Declared product / Declared unit
1 m³ of product DP7 - DP8

Scope:
The declared unit is 1 m³ of DP7 - DP8 rock mineral wool insulation product. It is manufactured in the form of slabs and complies with the requirements of /EN 13162/. The thickness is ranging from 20 mm to 210 mm. The manufacturing company is Knauf Insulation with production in plants of Skofja Loka (Slovenia), Novi Marov (Croatia) and Nova Bana (Slovakia) - equivalent 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/

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

Dr. Burkart Lehmann
(Managing Director IBU)

Matthias Schulz
(Independent verifier appointed by SVR)

Product

Product description / Product definition
Knauf Insulation manufactures rock mineral wool (RMW) insulation products. They are available in the form of 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 the 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 as slags or in the form of briquettes, a mix of stone wool scrap and cement. DP7 and DP8 are multipurpose boards which are used as thermal, acoustic and fire insulation products. This EPD has been developed for unfaced products.

For the placing on the market of construction products in the European Union/EFTA (with exception of Switzerland), the Regulation (EU) No 305/2011 applies. The products need a Declaration of performance R4305MPCPR, R4308LPCPR, R4309MPCPR taking into consideration the harmonized product standard /EN 13162/ and the CE-mark.

Application
DP7 and DP8 are multipurpose boards which are used as a thermal, acoustic and fire insulation products. For the applications 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 DP7 and DP8 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

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity /EN 12667/</td>
<td>0.035</td>
<td>W/(mK)</td>
</tr>
<tr>
<td>Thermal conductivity /EN 12667/only for DoP R4308LPCPR</td>
<td>0.034</td>
<td>W/(mK)</td>
</tr>
<tr>
<td>Water vapor diffusion equivalent air layer thickness /SIST EN 13162/</td>
<td>1</td>
<td>m</td>
</tr>
<tr>
<td>Sound absorption coefficient</td>
<td>-</td>
<td>%</td>
</tr>
</tbody>
</table>
Environmental Product Declaration Knauf Insulation – Rock Mineral Wool: DP7-DP8

Gross density /DIN 1602/ | 60 - 80 kg/m³
Longit. air-diffusion resist. /EN 29053/ | > 15 kPas/m²
Water absorption WS /EN 1609/ | <= 1 kg/m²
Reaction to fire /EN 13501-1/ | Euroclass A1
Specific heat capacity /EN ISO 10456/ | 1030 J/kgK
Melting point /DIN 4102 / T17/ | > 1000 °C
Acoustic absorption (αw) /EN ISO 354:2003/ | 1 -
Compression strength/resistance | not relevant

Performance data of the product in accordance with the Declaration of Performance with respect to its Essential Characteristics according to /EN 13162:2012 Thermal insulation products for buildings – Factory made mineral wool products (MW) – Specification.

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 70 kg/m³

Declared unit

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared unit</td>
<td>1</td>
<td>m³</td>
</tr>
<tr>
<td>Gross density</td>
<td>70</td>
<td>kg/m³</td>
</tr>
<tr>
<td>Conversion factor to 1 kg</td>
<td>0.0143</td>
<td>-</td>
</tr>
</tbody>
</table>

System boundary
The system boundary of the EPD follows the modular approach defined by the 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 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 DP-7 & DP-8 products, the average transport distance is assumed to be 300 km with a truck capacity utilization of 50%.
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 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 rock mineral wool products.
Although rock mineral wool product from Knauf Insulation is 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. No benefits and loads are considered so module D is not 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 forms the basis for declared modules or can be used for the development of specific scenarios in the context of a building assessment.

Base materials / Ancillary materials
The main raw materials are diabase (a rock that is similar to the volcanic rock basalt), dolomite, slags and briquettes. The briquette is made of rock mineral wool waste (internal or external) 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 on the fibers which contributes to fix the products dimensions and mechanical properties.

Reference service life
The RSL or durability of DP7-DP8 is as long as the lifetime of the building in which it is used.
## Transport to the building site (A4)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litres of fuel</td>
<td>0.0025</td>
<td>l/100km</td>
</tr>
<tr>
<td>Transport distance</td>
<td>500</td>
<td>km</td>
</tr>
<tr>
<td>Capacity utilisation (including empty runs)</td>
<td>40</td>
<td>%</td>
</tr>
<tr>
<td>Gross density of products transported</td>
<td>70</td>
<td>kg/m³</td>
</tr>
</tbody>
</table>

## Installation into the building (A5)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output substances following waste treatment on site : plastic foil</td>
<td>0.335</td>
<td>kg</td>
</tr>
<tr>
<td>Output substances following waste treatment on site : wooden pallet</td>
<td>4.109</td>
<td>kg</td>
</tr>
<tr>
<td>Output substances following waste treatment on site : 2% rock mineral wool losses</td>
<td>1.4</td>
<td>kg</td>
</tr>
</tbody>
</table>

## End of life (C1 - C4)

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfilling</td>
<td>70</td>
<td>kg</td>
</tr>
<tr>
<td>Transport distance</td>
<td>50</td>
<td>km</td>
</tr>
<tr>
<td>Capacity utilization</td>
<td>50</td>
<td>%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic foil incineration</td>
<td>0.335</td>
<td>kg</td>
</tr>
<tr>
<td>Wooden pallet incineration</td>
<td>4.1</td>
<td>kg</td>
</tr>
</tbody>
</table>
LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

<table>
<thead>
<tr>
<th>PRODUCT STAGE</th>
<th>CONSTRUCTION PROCESS STAGE</th>
<th>USE STAGE</th>
<th>END OF LIFE STAGE</th>
<th>BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material supply</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
</tr>
<tr>
<td>Transport</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m³ DP7-DP8

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>C2</th>
<th>C4</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global warming potential</td>
<td>[kg CO₂-Eq.]</td>
<td>8.94E+1</td>
<td>3.22E+0</td>
<td>1.04E+1</td>
<td>2.41E-1</td>
<td>1.13E+0</td>
<td>-3.4E+0</td>
</tr>
<tr>
<td>Depletion potential of the stratospheric ozone layer</td>
<td>[kg CFC11-Eq.]</td>
<td>5.44E-10</td>
<td>1.08E-12</td>
<td>9.40E-10</td>
<td>8.09E-14</td>
<td>1.14E-12</td>
<td>-6.2E-11</td>
</tr>
<tr>
<td>Acidification potential of land and water</td>
<td>[kg SO₂-Eq.]</td>
<td>4.99E-2</td>
<td>8.46E-3</td>
<td>1.08E-2</td>
<td>1.49E-3</td>
<td>6.68E-3</td>
<td>-5.25E-3</td>
</tr>
<tr>
<td>Eutrophication potential</td>
<td>[kg PO₄-Eq.]</td>
<td>1.23E+3</td>
<td>4.05E-3</td>
<td>1.61E+3</td>
<td>3.33E+0</td>
<td>1.46E+1</td>
<td>-4.84E+1</td>
</tr>
</tbody>
</table>

RESULTS OF THE LCA - RESOURCE USE: 1 m³ DP7-DP8

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1-A3</th>
<th>A4</th>
<th>A5</th>
<th>C2</th>
<th>C4</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable primary energy as energy carrier</td>
<td>[MJ]</td>
<td>1.59E+2</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
</tr>
<tr>
<td>Renewable primary energy resources as material utilization</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
</tr>
<tr>
<td>Total use of renewable primary energy resources</td>
<td>[MJ]</td>
<td>1.59E+2</td>
<td>2.24E+0</td>
<td>2.44E+0</td>
<td>1.68E+1</td>
<td>1.78E+0</td>
<td>-8.4E+0</td>
</tr>
<tr>
<td>Non-renewable primary energy as energy carrier</td>
<td>[MJ]</td>
<td>1.33E+3</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
</tr>
<tr>
<td>Non-renewable primary energy as material utilization</td>
<td>[MJ]</td>
<td>1.05E+2</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
<td>IND</td>
</tr>
<tr>
<td>Total use of non-renewable primary energy resources</td>
<td>[MJ]</td>
<td>1.33E+3</td>
<td>4.47E+1</td>
<td>2.79E+1</td>
<td>3.34E+0</td>
<td>1.51E+1</td>
<td>-5.82E+1</td>
</tr>
<tr>
<td>Use of secondary material</td>
<td>[kg]</td>
<td>1.38E+1</td>
<td>0.00E+0</td>
<td>2.77E-1</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Use of renewable secondary fuels</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Use of non-renewable secondary fuels</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Use of net fresh water</td>
<td>[m³]</td>
<td>3.04E-1</td>
<td>4.18E-3</td>
<td>2.63E-2</td>
<td>3.10E-4</td>
<td>2.88E-3</td>
<td>-1.21E-2</td>
</tr>
</tbody>
</table>

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m³ DP7-DP8

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>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>1.19E-2</td>
<td>2.35E-6</td>
<td>1.86E-4</td>
<td>1.75E-7</td>
<td>2.39E-7</td>
<td>-1.36E-6</td>
</tr>
<tr>
<td>Non-hazardous waste disposed</td>
<td>[kg]</td>
<td>1.57E+1</td>
<td>3.42E-3</td>
<td>1.73E+0</td>
<td>2.55E-4</td>
<td>7.01E+1</td>
<td>-2.03E-2</td>
</tr>
<tr>
<td>Components for re-use</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Materials for recycling</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Materials for energy recovery</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Exported electrical energy</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>1.11E+1</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
<tr>
<td>Exported thermal energy</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>2.75E+1</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
</tr>
</tbody>
</table>

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 the 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 of rock mineral wool products. The ADP elements are dominated by the binder production, followed by the supply of basic materials such as cement for briquettes.

The GWP is dominated by the production, mostly due to CO₂ emissions from raw materials and energy consumption. The production of the binder represents more than 15% of the impact.

The ODP is most notably influenced by the production and the binder. The 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 of sulphur dioxide and nitrogen oxides. The EP is significantly influenced by the production due to emissions from the cupola furnace, curing oven and other unit processes.
The 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.

References

Institut Bauen und Umwelt
Institut Bauen und Umwelt e.V., Berlin (pub.): Generation of Environmental Product Declarations (EPDs);

General Principles
for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2015/10
www.ibu-epd.de

/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/, Sustainibility of construction works — Environmental Product Declarations — Core rules for the product category of construction products

IBU 2013, PCR, Part A
PCR -Part A: Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report. 2013/04

IBU 2014 Part B
PCR -Part B: Requirements on the EPD for Mineral insulating materials (in german „Anforderungen an die EPD für Mineralische Dämmstoffe“), Version 1.6
Institut Bauen und Umwelt e.V., www.bau-umwelt.com, 07/2014

GaBi 8 2017

GaBi 8 2017
GaBi 8: Documentation of GaBi8-Datasets for life cycle engineering. LBP University of Stuttgart and PE INTERNATIONAL AG, 2017.
http://documentation.gabi-software.com/

SoFi 6 2014
SoFi 6 database for Enterprise Sustainability Performance. PE INTERNATIONAL AG, Leinfelden-Echterdingen, 2014

EN 305
EN 305:2011 Harmonised conditions for the marketing of construction products

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

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

ISO 10456
ISO 10456: 2007 Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values

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

DIN 4108-10

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

ISO 354:2003

EN 1609
EN 1609: 2013 Thermal insulating products for building applications - Determination of short term water absorption by partial immersion

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 R4305MPCPR/ R4308LPCPR/ R4238KPCPR/ R4309MPCPR/
Declaration of Performance
Publisher
Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany
Tel +49 (0)30 3087748-0
Fax +49 (0)30 3087748-29
Mail info@ibu-epd.com
Web www.ibu-epd.com

Programme holder
Institut Bauen und Umwelt e.V.
Panoramastr 1
10178 Berlin
Germany
Tel +49 (0)30 - 3087748-0
Fax +49 (0)30 – 3087748 - 29
Mail info@ibu-epd.com
Web www.ibu-epd.com

Author of the Life Cycle Assessment
Thinkstep
Hauptstrasse 111
70771 Leinfelden-Echterdingen
Germany
Tel +49 (0)7113418170
Fax +49 (0)71134181725
Mail info@thinkstep.com
Web www.thinkstep.com

Owner of the Declaration
Knauf Insulation
rue de Maestricht 95
4600 Visé
Belgium
Tel 003243790415
Fax 003243790415
Mail jean-pierre.pigeolet@knaufinsulation.com
Web www.knaufinsulation.com