ECO PLATFORM EPD VERIFIED

EPD®

N° VERIFICATION : S-P-08349

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804:2012+A2:2019/AC:2021 for:
Knauf Fugenfuller Advanced Joint Filler - Gypsum based

> **Programme:**
The International EPD® System
www.environdec.com

> **Programme operator:**
EPD International AB

> **EPD registration number:**
S-P-08349

> **Publication date:**
2023/02/14

> **Valid until:**
2028/02/14

> **Manufacturer:**
Knauf di Knauf S.r.l. S.a.s.
Loc. Treschi - 50050 Gambassi Terme (FI), Italy

KNAUF

1. GENERAL INFORMATION

Manufacturer: Knauf di Knauf S.r.l. S.a.s.
Programme used: The International EPD® System.
For more information see www.environdec.com
EPD registration number/declaration number: S-P-08349
Product / product family name and manufacturer represented: gypsum-based joint filler, namely Fugenfüller Advanced manufactured by Knauf di Knauf S.r.l. S.a.s.
Product description and use: Knauf Fugenfuller Advanced is a gypsum joint-filler, intended for manual filling of Knauf gypsum plasterboard. In addition, Knauf gypsum-based joint-filler is suitable for filling cavities in gypsum plasterboards and for gluing corner or stucco channels.
It is designed for use in the residential sector and for building in general for internal use.
Declaration issued: 2023/02/14
Valid until: 2028/02/14
Owner of the declaration: Knauf di Knauf S.r.l. S.a.s. - Località Treschi 50050, Gambassi Terme (FI). Tel. 0571 6307 - Fax 0571 678014, knauf-it@knauf.com.
EPD prepared by: Ergo S.r.l, www.ergosrl.net
Scope: The LCA is based on first semester 2022 production data for Gambassi Terme manufacturing site in Italy for gypsum-based joint-filler. This EPD covers information modules A1 to C4 (cradle to gate with module C1-C4, module D and optional modules) as defined in EN 15804:2012+A2:2019/AC:2021 for Knauf gypsum-based joint-fillersold and used in Italy.
The use stage (B1-B7) was not considered in this study.
Functional unit/declared unit: The declared unit (DU) is 1 kg of gypsum-based joint-filler (Fugenfüller Advanced) for joint filler with packaging (powder product, not mixed with water).

CEN standard EN 15804 served as the core Product Category Rules - PCR	
PCR:	PCR 2019:14 Construction products and construction services, Version 1.2.5.
Product group classification:	The UN CPC code of the product is 37530 Articles of plaster or of compositions based on plaster
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Claudia A. Peña. email: info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification ☒ EPD verification
Third party verifier:	RINA Services S.p.A. Via Corsica 12, Genova - Italy Tel +39 010-5385306 - www.rina.org ACCREDIA Registration number: 001H REV. 17
Accredited or approved by:	The International EPD® System

According to EN 15804, EPDs of construction products may not be comparable if they do not comply with this standard. It should be noted that EPDs within the same product category from different programs may not be comparable.

2. ABOUT THE COMPANY

Knauf is one of the world's leading manufacturers of modern insulation materials, dry lining systems, plasters and accessories, thermal insulation composite systems, paints, floor screed, floor systems, and construction equipment and tools. With 300 production facilities and sales organizations in over 90 countries, 40.000 employees worldwide, and sales of 12.5 billion Euro (in 2021), the Knauf Group is without doubt one of the big players on the market - in Europe, the USA, South America, Russia, Asia, Africa, and Australia. The company's headquarter in Italy is located in Castellina Marittima (Pisa), specialised for drywall systems production (plasterboards, metal profiles). Additionally, in Gambassi Terme (Florence) plant, Knauf develops, produces and sells traditional and performance premixed joint-fillers used in drywall systems.

3. PRODUCT INFORMATION

3.1 Product description and use

Studied product is a gypsum-based joint-filler for interior application. It is a bindable material ground to powder whose curing process is triggered by the addition of water. Knauf joint-filler Fugenfüller Advanced are intended for manual filling of Knauf gypsum plasterboard joints with HRAK (half-round flattened), HRAK (flat) and AK edges. Knauf fillers are also used for connecting drywall using reinforcing tape, for connecting gypsum fibre boards, for fixing elements based on plaster, as adhesive. In addition, the Fugenfüller Advanced version also has the "Eurofins Indoor Air Comfort Gold" certification which certifies compliance with the strictest European and international standards and belonging to class A+ (according to the French decree), i.e. the most virtuous level of the category in terms of emissions of VOCs (volatile organic compounds). The workability time of the product is 90 minutes.

3.2 Technical data

Technical data referred to Knauf gypsum-based joint-filler are given in Table 1.

Table 1 - Technical information.

UNI EN 13963 Classification	3B
Gross density	800 kg/m^3
Physical form	White powder
Class of reaction to fire performance (according to EN 13963)	A1

3.3 Delivery Status

The EPD refers to 1 kg of product delivered in powder form. The product can be procured in paper sack.

3.4 Base materials / Ancillary materials

The average composition of studied gypsum-based joint-filler, including the packaging materials, is reported in Table 2:

Product components	Weight %	Post-consumer material, weight %	Renewable material, weight %
Calcium sulfate half hydrate	69	0	0
Limestone	30	0	0
Additives[1]	1	0	0
Product components	**Weight %**	**Post-consumer material, weight %**	**Renewable material, weight %**
Sack (paper)	79	0	100
Layer (paperboard)	2	0	100
Plastic film and hood	7	0	0
Wooden pallet	12	0	100

Table 2
Content declaration of gypsum-based joint-filler and relative packaging.

Knauf gypsum joint-fillers do not contain SVHC (Substances of Very High Concern). No additives used are classed as substances of concern; substances are not listed specifically to protect proprietary information.

3.5 Packaging

Powder gypsum products must be protected from moisture absorption during transport and storage. The products are packaged in 10 kg paper sacks. Knauf gypsum joint-fillers are then piled up on wooden pallets, separated by cardboard layers, and are protected against damage by plastic film and plastic hood (polyethylene). Packing materials are externally recovered/disposed of.

3.6 Condition of use

If the joint-filler is correctly applied, it should not require any form of maintenance.

3.7 Reference service life

The product is intended for use as a construction product in interior areas. Knauf gypsum joint-filler is expected to last the service life of a building 50 years.

3.8 Recycling / Re-use phase

No recycled materials are used in the product. Waste processing (recycling or disposal) depends on the respective substrate due to the low material hardness displayed by the component.
The actual material is suitable for disposal on landfills.

3.9 Disposal

Knauf joint-fillers have to be disposed of in compliance with the following waste codes of the European Waste Catalogue /EWC/:17 08 02 gypsum-based construction materials.

3.10 Further information

Further information can be found through the enquiry desk:
+39 0571 6307 | E-mail: knauf-it@knauf.com | www.knauf.it

3.11 Manufacture

Knauf joint-filler is manufactured using a continuous production process, showed in the Figure 1 below:

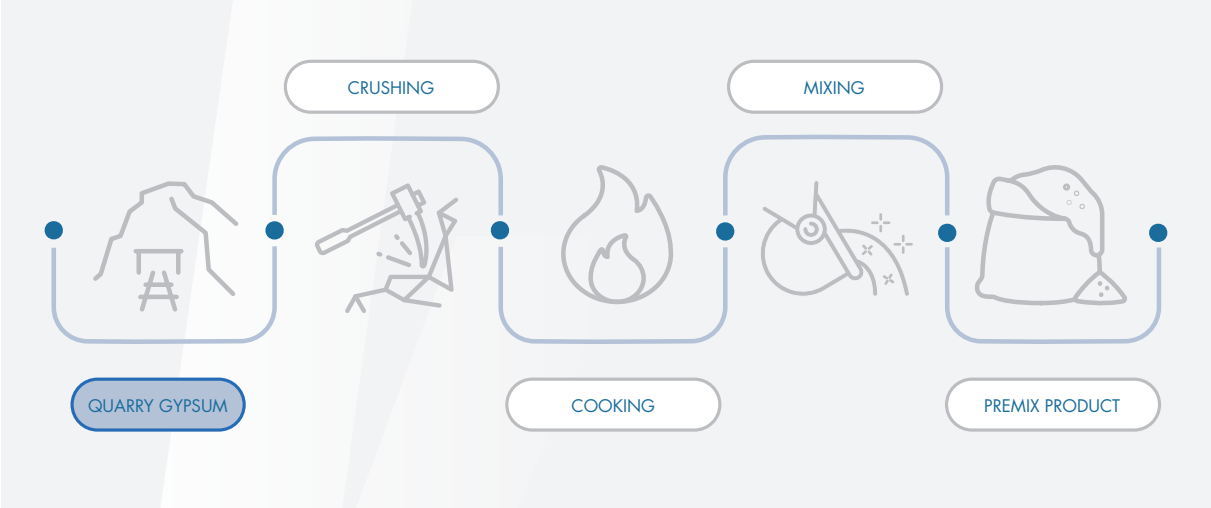


Figure 1 - Gypsum-based joint-filler manufacturing process.

The production process starts from raw materials, that are purchased from external and intercompany suppliers and stored in the plant. Bulk raw materials are stored in specific silos and added automatically in the production mixer, according to the formula of the product. Other raw materials, supplied in bags or big-bags, are stored in the warehouse and added automatically in the mixer. Minor additives are weighed, added and then blended with the gypsum powder to produce a finished product. Finished products are packed in paper sack and placed on a wooden pallet. The joint-filler sacks are weighed and printed with unique codes detailing location, date, time of manufacture and use by date. Then a cardboard layer, plastic film and plastic hood are used for the storage. The quality of final products is controlled before the sale.

3.11 Environment and Health during manufacture

At Knauf, Health and Safety is a core value. The Company's aim is always to be injury-free. A target of zero accidents at work for employees, visitors and contractors is set by the business.
In all aspects of the Company's activities, the Health and Safety rules and relevant regulations must be complied with. In addition, there are a number of definitive Company Safety Procedures and together these determine the minimum standards expected by the Company. In order to achieve this, close co-operation with representatives of the relevant enforcement agencies is ensured.
To ensure that the Company's objectives are achieved, documented safety management systems are employed at site and within the central functions. These include a systematic identification of hazards, assessment of the risks and the development of safe systems of work to eliminate or reduce any risks to an acceptable level. Audits and Inspections are used to monitor standards of safety management, adherence to the law and Company procedures. Knauf plants are managed through ISO 14001, ISO 9001 and BS OHSAS 45001 certified systems.

4. LCA INFORMATION

Figure 2 shows a flow diagram of the system under study. The system boundary covers A1 - A3 product stages referred as 'Raw material supply', 'Transport' and 'Manufacturing'. In addition to the manufacturing phase (modules A1-A3), this EPD contains the transport from the manufacturing to the building site (A4) and the installation into the building site (A5) as well as the End-of-life stage (de-construction and demolition as C1; transport to waste processing as C2; waste processing for reuse, recovery and/or recycling as C3; disposal as C4; benefits and loads beyond the system boundary, as module D). Accordingly, the EPD is a cradle-to-gate declaration with module C1-C4, module D and optional modules. The system boundaries in tabular form for all modules are shown in the Table 3 below.

Table 2 - System boundaries chosen for the LCA (X-module included in LCA. MND - module not included).

	Product stage			**Construction process stage**		**Use stage**							**End of life stage**				**Benefits and loads beyond the system boundaries**
	Raw material supply	Transport	Manufactoring	Transport from the gate to the site	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demo	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
MODULE	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Module declared	X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X
Geography	EU, CN, IN	EU	EU	EU	EU	-	-	-	-	-	-	-	EU	EU	EU	EU	EU

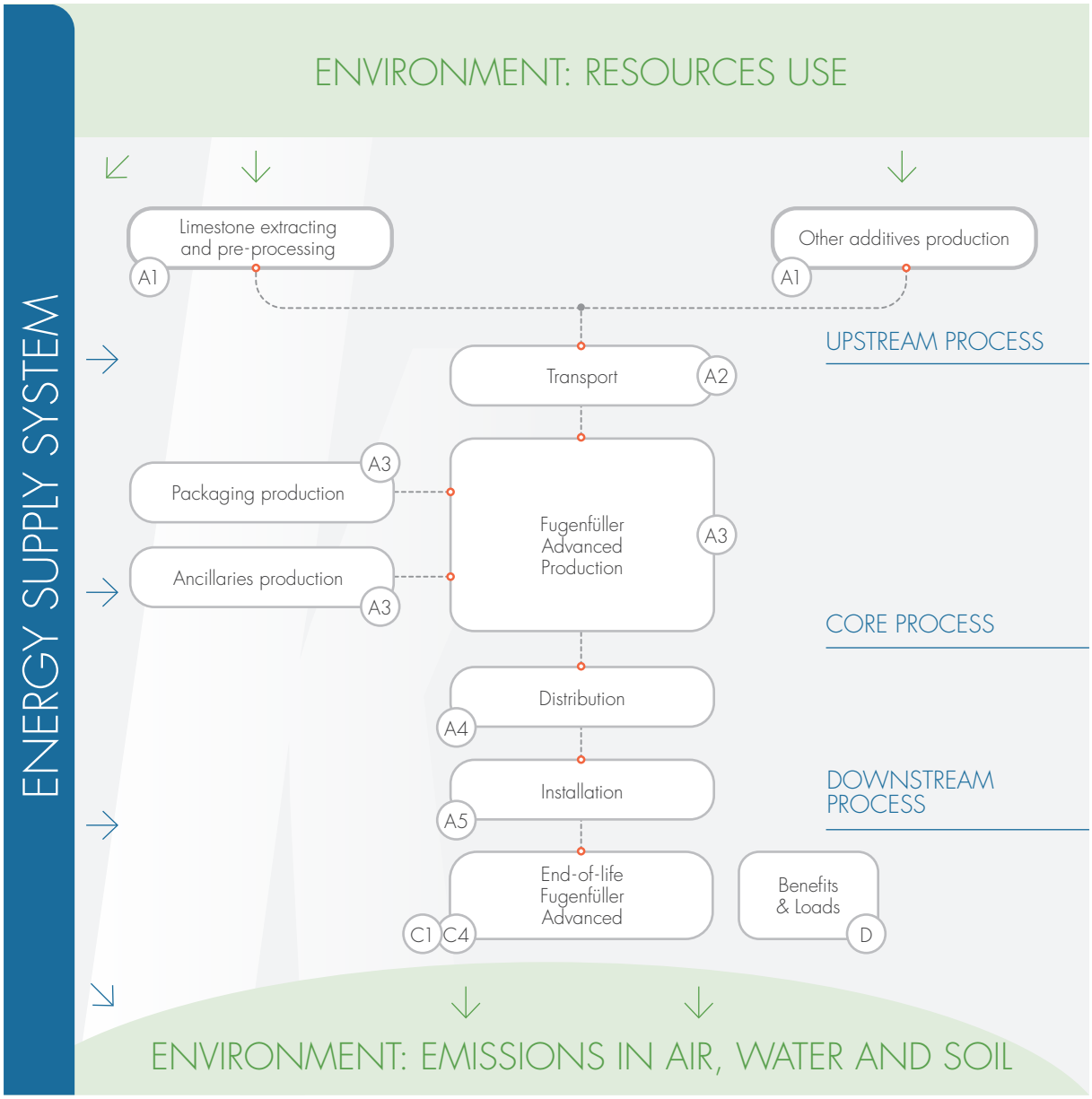


Figure 2 - Flow diagram of system boundary under assessment.

5. LCA CALCULATION RULES

LCA calculation rules are reported in Table 4.

Table 4 - LCA calculation rules.

5.1	**Functional unit/ declared unit**	The declared unit is 1 kg of gypsum-based joint filler (Fugenfüller Advanced) with the packaging (powder product, not mixed with water).
5.2	**System boundaries**	Cradle to gate with module C1-C4, module D and optional modules (A4, A5). The modularity and "polluter-pays" principles were followed.
5.3	**Estimates and assumptions**	The use stage (module B1-B7) was assumed have no impacts. The gypsum joint-filler product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. The LCA calculation has been made taking into account the fact that Knauf Gambassi plant purchase 100% renewable electricity. The origin of the renewable electricity status is evidenced by Guarantee of Origin certificates (GOs), valid for the period chosen in the calculation (2022). For the production of additives and packaging materials (and their disposal), generic data have been used, make them country specific whenever possible. Since there is no waste processing at the end of life, module C3 is not applicable. The declared joint-filler is typically disposed of as construction waste which is declared in module C4, therefore module D is not applicable. Module D is only applied to main recovered materials from the packaging of the finished product.
5.4	**Cut-off rules**	All major raw materials and all the essential energy is included. General cut-off criteria are given in standard EN 15804:2012+A2:2019/AC:2021 Clause 6.3.6 In compliance with these criteria, the infrastructure of the manufacturing site and personnel related activities (travel, office operations and supplies) are excluded from the study.
5.5	**Background data**	All primary product data was provided by Knauf S.r.l. S.a.s. - Gambassi Terme plant. All secondary data was retrieved using SIMAPRO 9.4 software, with Ecoinvent 3.8 database.
5.6	**Data quality**	Primary data concern the first semester 2022 and represent the whole annual production. They have been collected at Knauf S.r.l. S.a.s. plant located in Gambassi Terme (IT), whereas selected generic data have been retrieved from Ecoinvent 3.8 database and using the most updated datasets and - as far as possible - those representatives for at least 5 years into the future. The quality level concerning datasets used in the EPD can be considered as "very good" or "good" according to Annex E of the EN 15804 (current version).
5.7	**Period under review**	The data is representative of the manufacturing processes of first semester of the 2022 year (January-June).
5.8	**Allocations**	According to ISO 14040 and 14044, for the allocation procedure physical properties are used to drive flow analysis.
5.9	**Comparability**	A comparison or an evaluation of EPD data is only possible where EN 15804 has been followed, the same building context and product-specific characteristics of performance are taken into account, and the same stages have been included in the system boundary. According to EN 15804, EPD of construction products may not be comparable if they do not comply with this standard. According to ISO 21930, EPD might not be comparable if they are from different programmes.

Description of system boundaries
This EPD evaluates the environmental impacts of 1 kg of gypsum-based joint filler (Fugenfüller Advanced) from cradle to gate with module C1-C4, module D and optional modules. Within the Life Cycle Assessment of the declared board, the following processes are considered:

Product stage, A1-A3

Description of the stage
The product stage of the joint-filler products is subdivided into three modules; A1, A2 and A3 respectively "raw material supply", "transport" and "manufacturing".

A1, raw material supply
This includes the extraction and processing of all raw materials and energy which occur upstream from the manufacturing process.

A2, transport to the manufacturer
Raw materials and additives (e.g. alpha gypsum, limestone, etc) are supplied by truck from manufacturers within Italy or from neighbouring countries.

A3, manufacturing
This module includes the manufacture of products and the production of packaging material. The processing of any waste arising from this stage is also included. Raw materials and additives are weighed, added and then blended with the gypsum powder to produce a finished product. The finished product is packed into sacks and piled up on pallet. Then polyethylene film and hoods is used for the storage.

Construction process stage, A4-A5

Description of the stage
The construction process is divided into two modules: A4, transport to the building site and A5, installation into the building.

A4, transport to the building site
The Table 5 below quantifies the parameters for transporting the product from production gate to the building site. The distance quoted is a weighted average, calculated using company information and the quantity of product transported. For the distribution of the finished products, an average scenario with EURO 5 and EURO 6 articulated trucks has been accounted for. Specific data was not available for capacity utilisation or fuel consumption, therefore generic European values from Ecoinvent database have been assumed. Transportation does not cause losses as product are packaged properly.

Table 5 - Parameters for transporting the product from production gate to the building site.

Parameter	Value (expressed per functional/declared unit)
Type of vehicle	Truck >32 tons, EURO5, EURO 6
Distanceto central warehouse	360.28 km weighted average by truck to all markets 71.87 km weighted average by boat to all markets
Distance to construction site	30.48 km
Fuel/energy consumption	0.02 L diesel fuel per tkm (truck) 0.0002 L diesel fuel per tkm (boat)
Capacity utilization	100%
Bulk density of transported products	800 kg/m^3

A5, installation into the building

Installation into the building, including provision of all materials, products and energy, as well as waste processing up to the end of waste state or disposal of final residues during the construction process stage. These information modules also include all impacts and aspects related to any losses during this construction process stage (i.e. production, transport and waste processing and disposal of the lost products and materials). The accompanying Table 6 quantifies the parameters for installing the product at the building site.

Table 6 - Parameters for transporting the product from production gate to the building site.

Parameter	Value (expressed per functional/ declared unit)
Ancillary materials for installation (specified by materials)	None
Water use	0.00077 m^3
Other resource use	None
Quantitative description of energy type (regional mix) and consumption during the installation process	None required
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	Gypsum-based joint-filler: 0.0175 kg Packaging materials: Paper sack: 0.0068 kg Paperboard layer: 0.00020 kg Polyethylene hood: 0.00015 kg Polyethylene film: 0.00042 kg Wooden pallet: 0.0010 kg
Output materials (specified by type) as results ofwaste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	Gypsum-based joint-filler to landfill: 0.0175 kg Packaging materials to landfill: Paper sack: 0.00119 kg Paperboard layer: 0.00003 kg Polyethylene hood: 0.00007 kg Polyethylene film: 0.0002 kg Wooden pallet: 0.0004 kg Packaging materials to energy and material recovery: Paper sack: 0.0056 kg Paperboard layer: 0.00016 kg Polyethylene hood: 0.00008 kg Polyethylene film: 0.00022 kg

Use stage (excluding potential savings), B1-B7

Description of the stage
The use stage is divided into the following:

B1, use or application of the installed product;
B2, maintenance;
B3, repair;
B4, replacement;
B5, refurbishment;
B6, operational energy use;
B7, operational water use.

Description of scenarios and additional technical information
The product has a reference service life of 50 years. This assumes that the product will last in situ with no requirements for maintenance, repair, replacement or refurbishment throughout this period. Knauf joint-filler is a passive building product; therefore, it has no impact at this stage.

End-of-life stage, C1-C4

Description of the End-of-life stage
The end-of-life stage includes:

C1, de-construction, demolition
Deconstruction includes dismantling or demolition of the product from the construction. No on-site sorting of the materials occurs. At the end-of-life, in the demolition phase 100% of the waste is assumed to be collected as mixed construction waste. The demolition process consumes energy in the form of diesel fuel used by building machines.
C2, transport to waste processing
This stage includes the transportation of the discarded joint-fillers to final disposal. Average distance from demolition site to waste processing site for final disposal is assumed to be 50 km.
C3, waste processing for reuse, recovery and/or recycling
Since there is no waste processing at the end of life, modules C3 is not applicable.
C4, disposal
Since gypsum-based joint-fillers cannot be physically separated from the applied surface, they go to the inert waste site with the applied surface or part. For this reason, 100% landfill scenario has been assumed. However, packaging materials can be recycled.

Table 7 - End-of-life stage.

Parameter	Value (expressed per funcional/declared unit)
C1) Collection process specified by type	1 kg collected with mixed deconstruction and demolition waste and transported by truck for landfill
C2) Assumption for scenario development (e.g. transportation)	Diesel consumption 0.04 L per tkm; 50 km from demolition site to waste handle
C3) Recovery system specified by type	None
C4) Disposal specified by type	100% of waste is landfilled

Reuse/recovery/recycling potential, D

Description of the stage
Module D, relating to information on the potential for reuse/recovery/recycling, is assessed considering the benefits of the avoided impact of future extractions and production of raw materials, brought about by the recycling of the packaging materials. The processes necessary to make the materials of the product (at the end of life) new raw materials for subsequent life cycles are considered. Module D for Knauf gypsum joint-filler is not applicable since it is disposed of in landfill.

6. LCA RESULTS

In the following tables, the environmental impacts per declared unit are reported for the environmental categories recommended by the EPD's General Programme Instruction (version 4.0, March 2021) and those indicated in PCR 2019:14 version 1.2.5 for Construction Products and construction services. The LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.
EN 15804+A2 (adapted) method has been used as the impact model. The numbers reported in the following tables are the outcome of rounding. For this reason, total results could slightly differ from the sum of contributions of the different phases.

7. LCA RESULTS INTERPRETATION

The impact assessment phase of LCA is aimed at evaluating the significance of potential environmental impacts using the LCI results. In general, this process involves associating inventory data of specific environmental impact categories with category indicators, thereby attempting to quantify these impacts. The impact assessment and the interpretation of this study are performed according to the ISO 14040 and ISO 14044 guidelines. This document declares the results of Fugenfüller Advanced product.
The main contribution to the environmental impact categories in the product life cycle comes from extraction and processing of raw materials (module A1). Its relative contribution is over 70% in some categories (such as climate change-biogenic, climate change-land use, renewable primary energy resources used as raw material). The production stage (module A3) is relevant especially for the climate change-biogenic, with a negative contribution due to the packaging components, eutrophication freshwater, renewable primary energy resources used as energy carrier. In terms of climate change module A5 gives a relevant contribution especially in the biogenic carbon impact category. This is due to the disposal of the packaging that is the principal responsible of the biogenic carbon content. Distribution of finished product (transport in module A4) has relevant importance in terms of climate change-fossil, ozone depletion, photochemical ozone formation, depletion of abiotic resources- fossils, hazardous waste, radioactive waste.
By contrast, transport in module A2 has an average contribution of 14% whereas the module C2 contributes only 7% at maximum. The installation phase (module A5) has a negligible contribution to the impact categories, less than 2%, except for net use of fresh water and water use where it contributes up to a maximum of 48%. With regard to total energy consumption, the product stage (modules A1 - A3) has the highest contribution to this indicator, with a maximum percentage of 85%. The effect of disposal life cycle stage has a contribution less than 11% on life cycle impacts, except for non-hazardous waste where the contribution of gypsum joint-filler disposal (module C4) to the overall results is 90%.

Additional information

All requirements of German AgBB Testing and Evaluation Scheme (2018), are fully metwith regard to all test criteria:

- $TVOC_{28} \leq 1000\ \mu g/m^3$ (according to EN 16516);
- VOC_{28} without LCI $\leq 100\ \mu g/m^3$;
- Formaldehyde $\leq 10\ \mu g/m^3$.

Table 8 - LCA results of potential environmental impact - mandatory indicators according to EN 15804 referred to declared unit.

FUGENFÜLLER ADVANCED- ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Climate Change Total - kg CO_2 eq./DU	9.26E-02	3.55E-02	3.52E-03	-	-	-	-	-	-	-	3.14E-03	8.24E-03	-	5.28E-03	1.73E-02
Climate Change = potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Climate Change' covers three sub-categories: fossil, biogenic, land use and land use change															
Climate Change Fossil - kg CO2 eq./DU	1.16E-01	3.55E-02	5.90E-04	-	-	-	-	-	-	-	3.14E-03	8.23E-03	-	5.27E-03	-2.23E-03
Climate Change = potential change in the earth's climate due to accumulation of greenhouse gases and subsequent trapping of heat from reflected sunlight that would otherwise have passed out of the earth's atmosphere. Greenhouse gas refers to several different gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). For global warming potential, these gas emissions are tracked and their potencies reported in terms of equivalent units of CO_2. The impact category 'Climate Change' covers three sub-categories: fossil, biogenic, land use and land use change.															
Climate Change biogenic - kg CO2 eq./DU	-2.46E-02	3.63E-05	2.93E-03	-	-	-	-	-	-	-	1.18E-06	7.46E-06	-	5.72E-06	1.96E-02
Climate Change-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).															
Climate Change Land use and Land use change kg CO_2 eq./DU	9.44E-04	1.33E-05	5.51E-07	-	-	-	-	-	-	-	3.13E-07	3.26E-06	-	4.97E-06	-1.13E-05
Climate Change-land use and land use change accounts for carbon uptakes and emissions (CO2, CO and CH4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).															
Ozone Depletion (OD) – kg CFC11 eq. /DU	1.56E-08	8.64E-09	1.09E-10	-	-	-	-	-	-	-	6.71E-10	1.91E-09	-	2.13E-09	-4.38E-09
Ozone Depletio = Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then catalytically destroy ozone molecules.															
Acidification - kg mol H+/DU	5.62E-04	1.43E-04	3.30E-06	-	-	-	-	-	-	-	3.26E-05	3.29E-05	-	4.95E-05	-2.65E-05
Acidification = Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.															
Eutrophication acquatic freshwater - kg P eq. /DU	2.66E-06	2.47E-07	2.20E-08	-	-	-	-	-	-	-	1.04E-08	5.82E-08	-	5.52E-08	-2.86E-07
Eutrophication acquatic marine - kg N eq. /DU	1.84E-04	3.77E-05	2.86E-06	-	-	-	-	-	-	-	1.44E-05	9.64E-06	-	1.71E-05	-4.67E-06
Eutrophication terrestrial - mol N eq. /DU	1.81E-03	4.17E-04	9.11E-06	-	-	-	-	-	-	-	1.58E-04	1.06E-04	-	1.88E-04	-5.11E-05
Eutrophication = Excessive enrichment of waters and continental surfaces with nutrients and the associated adverse biological effects.															

FUGENFÜLLER ADVANCED- ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
Photochemical Ozone Formation (POF)- kg NMVOC /DU	4.00E-04	1.42E-04	3.45E-06	-	-	-	-	-	-	-	4.36E-05	3.28E-05	-	5.48E-05	-1.54E-05
	Photochemical ozone formation = Chemical reactions brought about by the light energy of the sun. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.														
Water use, m3 world eq deprived/DU	2.70E-02	1.93E-03	3.32E-02	-	-	-	-	-	-	-	6.74E-05	3.76E-04	-	6.62E-03	-4.04E-03
	Climate Change-fossil covers greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc.).														
Depletion of abiotic resources-minerals and metals, kg Sb eq. /DU*	5.31E-07	8.28E-08	2.26E-09	-	-	-	-	-	-	-	1.62E-09	2.89E-08	-	1.20E-08	-2.51E-08
	Depletion of resources- minerals and metals = Consumption of non-renewable resources, thereby lowering their availability for future generations.														
Depletion of abiotic resources-fossils, MJ, net calorific value/DU*	1.69E+00	5.64E-01	1.05E-02	-	-	-	-	-	-	-	4.31E-02	1.25E-01	-	1.47E-01	-5.70E-02
	Depletion of resources-fossils = Consumption of non-renewable resources, thereby lowering their availability for future generations.														

**Disclaimer: the results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is a limited experienced with the indicator.*

Table 9 - LCA results of potential environmental impact-additional mandatory and voluntary indicators referred to the declared unit.

FUGENFÜLLER ADVANCED- ENVIRONMENTAL IMPACTS															
Parameters	**Product stage**	**Construction process stage**		**Use stage**							**End-of-life stage**				**D Reuse, recovery, recycling**
	A1/A2/A3	**A4 Transport**	**A5 Installation**	**B1 Use**	**B2 Maintenance**	**B3 Repair**	**B4 Replacement**	**B5 Refurbishment**	**B6 Operation energy use**	**B7 Operational water use**	**C1 Deconstruction/ demolition**	**C2 Transport**	**C3 Waste processing**	**C4 Disposal**	
GWP-GHG - kg CO_2 eq./DU	1.18E-01	3.55E-02	3.06E-03	-	-	-	-	-	-	-	3.14E-03	8.24E-03	-	5.27E-03	-2.16E-03
	The indicator includes all greenhouse gases included in Climate Change -total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.														

Table 10 - LCA results of use of resources referred to the declared unit.

FUGENFÜLLER ADVANCED – RESOURCES USE														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Use of renewable primary energy excluding renewable primary energy resources used as raw materials MJ/DU	6.71E-01	7.17E-03	7.60E-04	-	-	-	-	-	-	-	2.43E-04	1.77E-03	-	1.28E-03	-1.84E-01
Use of renewable primary energy used as raw materials MJ/DU	8.20E-05	1.27E-06	1.16E-07	-	-	-	-	-	-	-	4.88E-08	3.35E-07	-	2.84E-07	-1.25E-04
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) MJ/DU	6.71E-01	7.17E-03	7.60E-04	-	-	-	-	-	-	-	2.43E-04	1.77E-03	-	1.28E-03	-1.84E-01
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials - MJ/DU	1.67E+00	5.64E-01	1.05E-02	-	-	-	-	-	-	-	4.31E-02	1.25E-01	-	1.47E-01	-5.51E-02
Use of non-renewable primary energy used as raw materials MJ/DU	2.10E-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-1.97E-03
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) - MJ/DU	1.69E+00	5.64E-01	1.05E-02	-	-	-	-	-	-	-	4.31E-02	1.25E-01	-	1.47E-01	-5.70E-02
Use of secondary material kg/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of renewable secondary fuels- MJ/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of non-renewable secondary fuels – MJ/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Use of net fresh water m^3/DU	5.50E-04	5.52E-05	6.15E-04	-	-	-	-	-	-	-	2.21E-06	1.17E-05	-	1.55E-04	-1.03E-04

Table 11 - LCA results of waste categories referred to the declared unit.

FUGENFÜLLER ADVANCED – RESOURCES USE														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Hazardous waste disposed kg/DU	2.95E-06	1.36E-06	1.94E-08	-	-	-	-	-	-	-	1.18E-07	3.26E-07	-	2.22E-07	-8.10E-08
Non-hazardous (excluding inert) waste disposed kg/DU	3.50E-02	5.22E-02	1.96E-02	-	-	-	-	-	-	-	5.75E-05	6.46E-03	-	1.00E+00	-3.68E-04
Radioactive waste disposed kg/DU	5.37E-06	3.82E-06	6.77E-08	-	-	-	-	-	-	-	2.97E-07	8.44E-07	-	9.64E-07	-2.17E-07

Table 12 - LCA results of output flows referred to the declared unit.

FUGENFÜLLER ADVANCED – RESOURCES USE														
Parameters	Product stage	Construction process stage		Use stage							End-of-life stage				D Reuse, recovery, recycling
	A1/A2/A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operation energy use	B7 Operational water use	C1 Deconstruction/ demolition	C2 Transport	C3 Waste processing	C4 Disposal	
Components for re-use kg/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Materials for recycling kg/DU	-	-	5.66E-03	-	-	-	-	-	-	-	-	-	-	-	-
Materials for energy recovery kg/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exported energy MJ/DU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 13 - Information on biogenic carbon content at the factory gate referred to the declared unit.

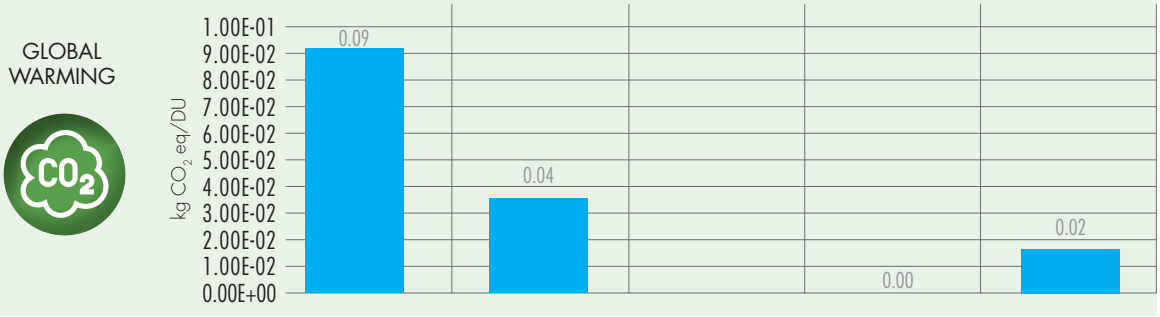
Biogenic Carbon Content**	**Unit**	**Quantity**
Biogenic carbon content in product	kg C	0
Biogenic carbon content in packaging	kg C	3.70E-03

***Note: 1 Kg biogenic carbon is equivalent to 44/12 kg CO_2.*

The images below demonstrate the impact of each life cycle stage on 5 key parameters, producing a clear view of how each stage contributes to the overall environmental impacts of Fugenfüller Advanced.

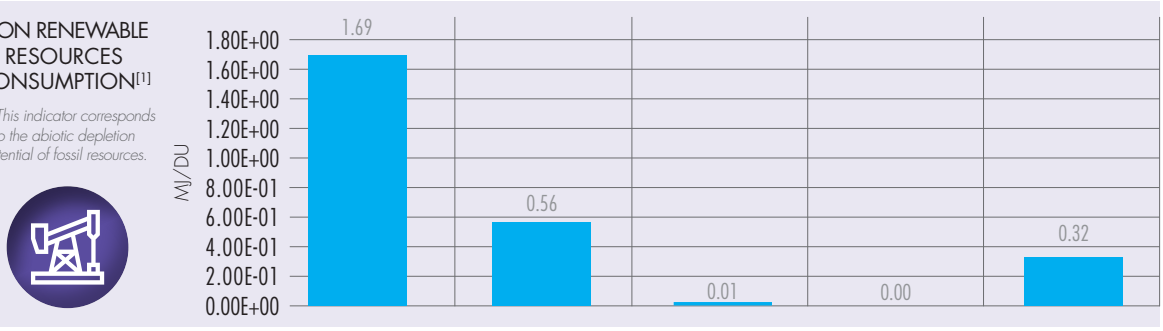
Gypsum-based joint-filler (Fugenfüller Advanced)	Product (A1-A3)	Transport (A4)	Installation (A5)	Use (B)	End-of-life (C)

GLOBAL WARMING



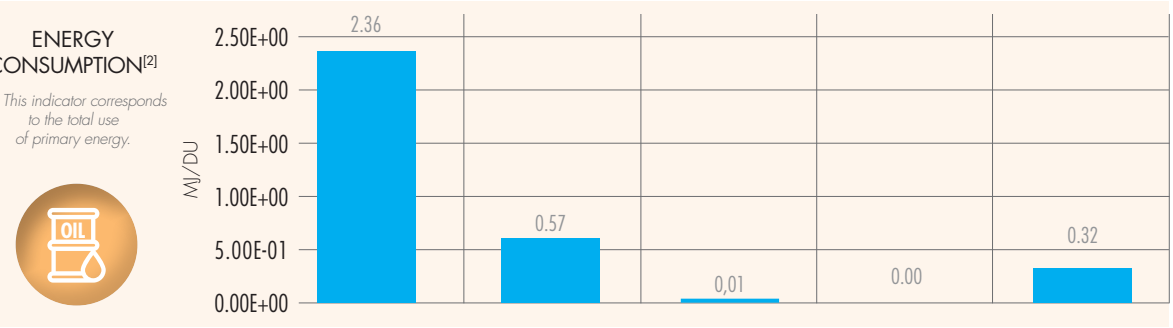
NON RENEWABLE RESOURCES CONSUMPTION[1]

[1] This indicator corresponds to the abiotic depletion potential of fossil resources.



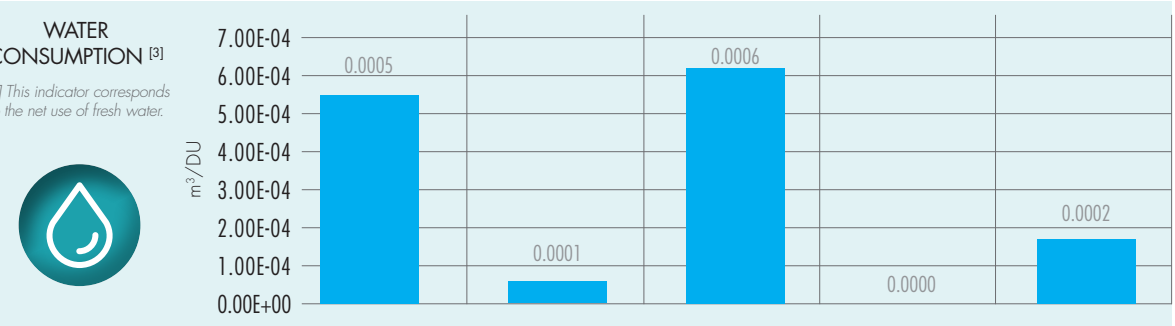
ENERGY CONSUMPTION[2]

[2] This indicator corresponds to the total use of primary energy.



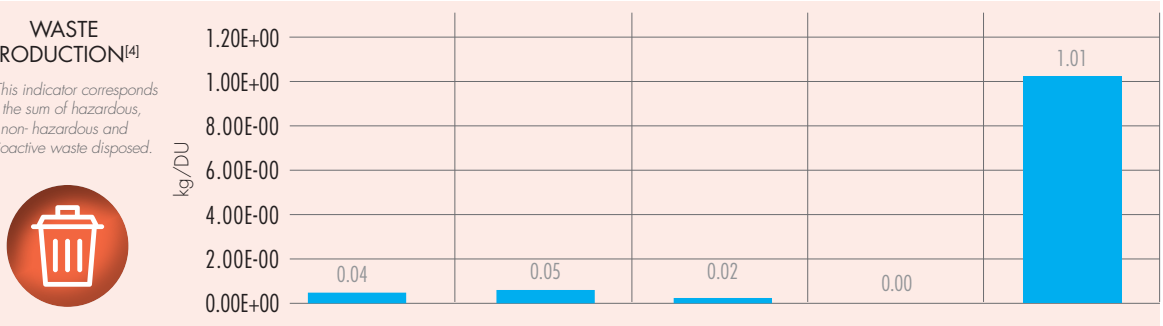
WATER CONSUMPTION [3]

[3] This indicator corresponds to the net use of fresh water.



WASTE PRODUCTION[4]

[4] This indicator corresponds to the sum of hazardous, non- hazardous and radioactive waste disposed.



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For the realisation of this EPD and the LCA study, which constitutes its scientific basis, Knauf di Knauf S.r.l. S.a.s., Gambassi Terme manufacturing plant availed itself of the technical and methodological support of a research and management consulting team of Ergo S.r.l., spin off company of the Scuola Superiore Sant'Anna di Pisa, coordinated by Prof. Francesco Testa and composed of Andrea Fontanella and Fabiana Corcelli.

Le nostre certificazioni

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02/2023

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