

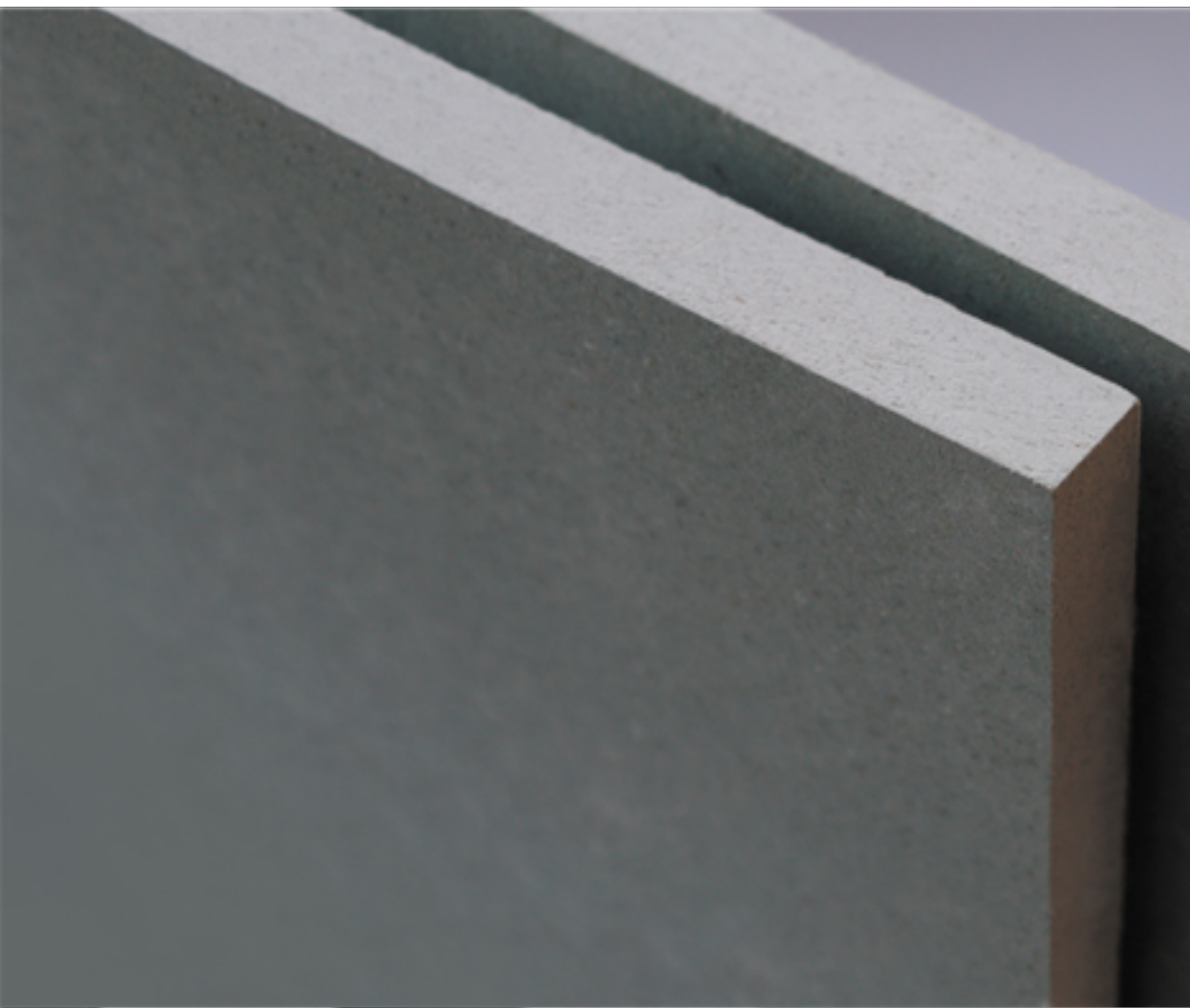
ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A1*

Owner of the Declaration	Knauf Bulgaria EOOD
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-KNB-20190065-IAC1-EN
Issue date	30.09.2019
Valid to	29.09.2024

Knauf Bulgaria EOOD
Gypsum fibreboards

www.ibu-epd.com | <https://epd-online.com>



1. General Information

Knauf Bulgaria EOOD

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number

EPD-KNB-20190065-IAC1-EN

This declaration is based on the product category rules:

Plasterboard, 07.2014
(PCR checked and approved by the SVR)

Issue date

30.09.2019

Valid to

29.09.2024



Dipl. Ing. Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)



Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.)

Gypsum fibreboards

Owner of the declaration

Knauf Bulgaria EOOD
Angelov vrah 27
1618 Sofia
Bulgaria

Declared product / declared unit

Gypsum fibreboards / 1 square meter of gypsum fibre board with a declared thickness of 12.5 mm and average density of 1175 kg/m³.

Scope:

The declaration is valid for four specific fibre board products manufactured by Knauf Bulgaria. Calculations are based on average data applicable for all four products, as production is located at one site in Bulgaria. The declaration covers details of:

- the product definition and relevant technical information
- the raw materials and origin of the raw materials
- the descriptions of the production process and transport
- the results of the life cycle assessment

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.

The EPD was created according to the specifications of *EN 15804+A1*. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard *EN 15804* serves as the core PCR

Independent verification of the declaration and data according to *ISO 14025:2010*

☐ internally ☒ externally



Dr.-Ing. Wolfram Trinius
(Independent verifier)

2. Product

2.1 Information about the enterprise

Knauf, whose history and family business began in Germany in 1932, is now a leader on five continents as a manufacturer and supplier of products of guaranteed quality in the field of construction. Thanks to 35,000 employees in 86 countries around the world, the Knauf trademark offers an extremely wide range of products that are present throughout the modern construction process – from complete energy-efficient systems to finishing works in the interior of buildings.

2.2 Product description/Product definition

Knauf gypsum fibre boards are manufactured from high-quality calcined gypsum reinforced with dispersed cellulose fibers originated from selected types of

recycled paper. Knauf produces four types of gypsum fibre boards: Vidiwall (gypsum fibre boards for lining walls, ceilings, metal and wooden structures, including an impregnated fibre boards (Vidiwall HI) - suitable for wet areas and facade walls), VidiFire A1 (fibre boards with class of reaction to fire A1), Vidifloor (floor boards) and Vidiphonic (gypsum fibre boards with improved sound isolation properties).

The declared unit refers to an average product reflecting the specifications of the four product types which are manufactured with identical substances though with different quantities. Data used in calculations represent site-specific production volumes for 2017 and cover all four product types forming the

average product. There are no by-products resulting from the production line subject to this study. Thus, the EPD is applicable to all four products.

Vidiwall, Vidifloor, Vidifire A1 and Vidiphonic

For the placing on the market of the product in the European Union/ European Free Trade Association (EU/EFTA) (with the exception of Switzerland) Regulation (EU) No. 305/2011 Construction Products Regulation (CPR) applies.

Vidiwall, Vidifloor, Vidifire A1 and Vidiphonic are compliant with the CPR based on /EN 15283-2:2008 + A1:2009/, Gypsum boards with fibrous reinforcement - Definitions, requirements and test methods - Part 2: Gypsum fibre boards

Vidiwall and Vidiwall HI

For the placing of the product on the market in the EU/EFTA (with the exception of Switzerland) the Regulation (EU) No. 305/2011 (CPR) applies. The product needs a Declaration of Performance taking into consideration /ETA.xyz,date, title/ and the CE-marking. For the application and use the respective national provisions apply.

Vidiwall and Vidiwall HI are compliant with the /CPR/ based on the European Technical Assessment: /ETA - 07/ 0086/ (23.03.2018)

2.3 Application

The gypsum fibre boards are used for cladding of structural and non-structural building elements, fire protecting linings, dry floor screeds, sound isolation.

2.4 Technical Data

The gypsum fibre boards are manufactured in according to the following specifications:

Constructional data

Name	Value	Unit
Gross density according to /EN 15283-2:2008 + A1:2009/	1000 - 1450	kg/m ³
Bending strength (longitudinal) according to /ETA 07/0086/	≥5.8	N/mm ²
Modulus of elasticity	3300 - 3900	N/mm ²
Calculation value for thermal conductivity	≤0.30	W/(mK)
Moisture content at 20 °C, 65% humidity	<1.3	M.-%
Surface hardness	<15	mm

The data set out in the /Declaration of Performance/ apply for the average product, subject to this study.

Product according to the /CPR/ based on a EN:

Performance data of Vidifloor, Vidifire A1 and Vidiphonic is in accordance with the Declaration of Performance with respect to its Essential Characteristics according to /EN 15283-2:2008 + A1:2009/, Gypsum boards with fibrous reinforcement - Definitions, requirements and test methods - Part 2: Gypsum fibre boards.

Products according to the /CPR /based on an /ETA/.

Performance data of Vidiwall is in accordance with the Declaration of Performance with respect to its Essential Characteristics according to the European Technical Assessment: /ETA - 07/ 0086/ (23.03.2018). Use is governed by the respective national regulations.

2.5 Delivery status

The gypsum fibre boards are delivered in different dimensions with thickness varying between 9 and 23 mm, width varying between 600 and 1250 mm and length varying between 600 and 3000 mm. Other sizes are negotiable. Vidiwall boards are manufactured with different shaped edgings.

2.6 Base materials/Ancillary materials

Product main components

Name	Value	Unit
Calcined gypsum	70-93	%
Post-consumer waste paper	7-20	%
Grinding powder	0-10	%
Impregnating substances and others	<7	%

2.7 Manufacture

Production is separated into two phases - the calcination of gypsum and the manufacture of gypsum fibre boards. The raw material for the gypsum production are natural gypsum (mineral calcium sulphate dihydrate) extracted in mines and gypsum generated as by-product during the desulphurization of coal-fired power stations flue gas desulfurization gypsum (FGD gypsum). Both materials are dried and calcined.

In the second stage the calcined gypsum is mixed with the paper fibres produced from shredded post-consumer waste paper and small quantities of glass wool. These constituents are laid onto a moving conveyor belt and water is added. The wet pulp is compressed to form a continuous slab and dried. Next it is polished, impregnated and cut into desired length and formatted to the required board sizes.

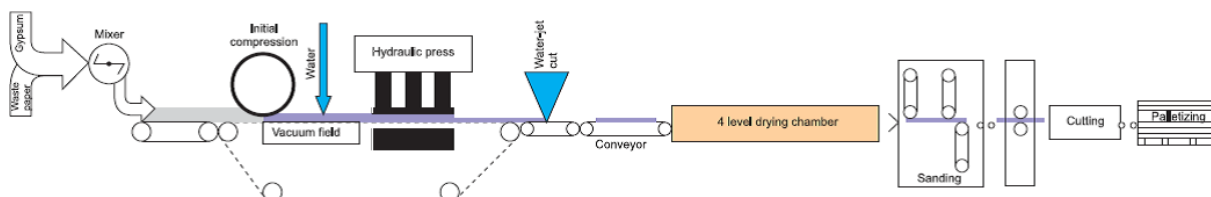


Figure 1: Main process of the manufacturing stage

2.8 Environment and health during manufacturing

The main materials for the production of gypsum fibre boards (gypsum, waste paper, water) are harmless and safe to humans and the environment. Chemicals

are treated according to the product specifications and rules of the management systems. To further improve environmental performance the following measures have been applied:

- Control of effluent and air emissions through periodic sampling and testing by certified laboratories
- Regular change of filter systems
- Wastewater is treated internally and reused in production; negligible amount is discharged
- Use of flue-gas desulfurization gypsum (FGD), generated as by-product in thermal power plants saving natural resources by reducing natural gypsum input
- Reuse of waste from production (reincorporation into the manufacturing process)
- /OHSAS 18001/, Occupational Health- and Safety assessment series, introduced in 2013
- The manufacturing plant has been recertified under /ISO 9001/, Quality management system and /ISO 14001/, Environmental management system.

2.9 Product processing/Installation

Storage

Gypsum fibre boards should be stored indoors on a dry and even floor, only in horizontal position. They should be protected against moisture all-round covering of the boards or components by foil. The fibre boards may risk being damaged (in particular surface and edges) if not stored as indicated (indoors on a dry and even floor, in horizontal position).

Cutting and Installation

Gypsum fibre boards could be notched with a modeling knife and broken on the stand edge. Neat edges may be also obtained by using an electric saw (air aspiration must be applied). Fixing the fibre boards requires the use of appropriate means depending on the basic bearing structure. Boards are installed by means of screws, nails or clamps.

Dust and noise

Dust is produced during the mining of gypsum and during the stages of crushing and calcining. Unlike some types of dust, gypsum dust presents a very low health risk since being soluble and temporary in the environment. During the manufacturing of the product, the implemented health and safety management system minimizes the possible health impacts to employees from cellulose and mineral fibres.

When correctly installed no dust will be released during the period of use. Some of the production waste (e.g. grinded powder from gypsum fibre boards cutting captured by filter system) is used as an input material in the production process. Industrial and environmental protections are assured through evacuation plans in case of fire, regular emergency training and coaching staff on fire safety.

As noise reduction measures sound-proved screens and boxes were installed. Noise levels have been measured by an accredited firm attesting conformity to permitted noise levels.

2.10 Packaging

The gypsum fibre boards are palletized on wooden pallets, wrapped with polyethylene foil, polyester strapping tape and strengthened with cardboard angles. During transport and storage Knauf gypsum fibre boards need to be protected from moisture (kept in closed and dry storage places). After use pallets are

usually reused by industry, foil and cardboard angles can be returned for recycling. Cardboard waste (corrugated boxes and other packaging, code 15 01 01) is also fed into the pulping process. Plastic packaging material (polyethylene and polyester) and other materials are classified according to the national waste codes /15 01 02/. Plastics waste is collected by the producer of plastic packaging materials.

2.11 Condition of use

When installed in accordance with specifications, gypsum fibre boards retain their mechanical and physical properties during use period of the product's life cycle. All five types of gypsum fibre boards are suitable for indoor application. Vidiwall HI is designed for exterior use under External Thermal Insulation Composite System /ETICS/.

2.12 Environment and health during use

The gypsum fibre boards are not classified as hazardous as per the local rules and regulations. Gypsum fibre boards are fire- and moisture-resistant, and thus ensure a comfortable indoor climate. However, board particles could cause irritation, cough, discomfort, if enter the human body (e.g. inhaled, swallowed).

2.13 Reference service life

In accordance with the BBSR "Useful lives of components for LCAs in accordance with the Sustainable Building assessment system" the service life of the gypsum fibre boards is expected to be at least 50 years without losing stability and functional properties, in case that conditions for use and maintenance are met. The service life declared according to the BBSR table is not a reference service life according to ISO 15686.

2.14 Extraordinary effects

Fire

Based on tests carried out in accordance with /EN 13823/, /EN ISO 1182/, /EN ISO 1716/ and classification acc.to /EN 13501-1:2007+A1/ all gypsum fibre boards feature the following fire protection values:

Gypsum fibre boards

Name	Value
Vidiwall	-
Building material class	A2
Burning droplets	d0
Smoke gas development	s1
Vidiwall HI	-
Building material class	A2
Burning droplets	d0
Smoke gas development	s1
Vidifloor	-
Building material class	A2
Burning droplets	d0
Smoke gas development	s1
VidiFire & Vidiphonic	-
Building material class	A1
Burning droplets	-
Smoke gas development	-

This means that they can be considered not flammable with negligible smoke gas development and no burning droplets. The VidiFire and VidiPhonic fibre boards qualify for A1 reaction to fire class.

Water

When exposed to water (e.g. flood) the gypsum fibre boards do not break and will recover previous stability after drying. However, if significant quantities of the boards are dissolved in water and entered into the sewage system or waterways (in case of floods for exp.), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) levels might increase due to the waste paper, being a main component of the products.

Mechanical destruction

The fibre boards may risk being damaged (in particular surface and edges) if not stored as indicated (indoors on a dry and even floor, in horizontal position).

2.15 Re-use phase

Discarded products are grinded and used in the production as an input. Installed boards can be reused if they are properly removed from their initial installation and if their edges and surface are not damaged.

2.16 Disposal

The production site is in full compliance with the waste management legislation. The site's waste management plan aims at reducing waste following qualitative and quantitative waste reduction principles. The waste code for production residues (wet waste, dry waste, parings and powdery mass) is 17 08 02. These residues are collected in closed containers and fed into the gypsum calcination plant.

The waste code of waste paper is 20 01 01 and includes old paper clippings from newspapers, magazines and books. It is fed into the pulping process.

2.17 Further information

Additional information is available on <http://www.knauf-gipsfaser.com>.

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is 1 m² of gypsum fibre board. The declared thickness of the board is 12.5 mm (best-selling product type) with a declared average density of 1175 kg/m³. The conversion to 1 m³ is depicted below:

Declared unit

Name	Value	Unit
Declared unit	1	m ²
Conversion factor to 1 kg (in kg/m ³)	16.66	-
Grammage	16.66	kg/m ²
Density as declared	1175	kg/m ³
Layer thickness	0.0125	m

As mentioned in section 2.5, gypsum fibre boards are delivered in different dimensions. In order to properly interpret the results presented in section 5, the LCA results of variations of the declared product shall be scaled linearly in line with the declared thickness.

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning variability of the production process, geographical representativeness and the influence of background data and preliminary products compared to the environmental impacts caused by actual production.

3.2 System boundary

The EPD uses the cradle to gate approach. The assessment includes the upstream lifecycle product stages raw material extraction, transport and manufacturing. These stages are referred to as A1 – A3 according /EN 15804/.

3.3 Estimates and assumptions

This EPD mainly reflects site specific data related to product manufacturing. LCA results are valid for the

specified technological process, geographical area and time period. The following assumptions regarding other materials and transport have been made:

- additives – due to the lack of datasets, the emission factors for Hexamethyldisilazane and dipropylene glycol monomethyl ether are used as substitutes for potassium methylsilanetriolate and polyethylene glycol monoalkyl ether. Approximation is based on the Chemical Abstracts Service (CAS) numbers and chemical expert judgement.
- it is assumed that 20% of the wood pallets are replaced due to losses and breakage (according to BRIDGE, 2007).
- assumptions applied for transport are summarized below:
 - o transport of waste to the landfill, additives, packaging material is accounted for by selecting data sets representative for the global market, where transport is already included in the final assessment of the impacts.
 - o transport of flows with significant weight (gypsum, wastepaper, wooden pallets, compressed natural gas) is case specific and calculated as per distance, load, type of vehicle. The default Ecoinvent load factors dependent of the lorry class have been used.
 - o The transport of glass fibre is omitted as no further details are available and quantities are less than 0.1% of the total product volume.
 - o The total amount of wastepaper and wooden pallets used in the production of gypsum fibreboards in 2017 is disaggregated proportionally based on the amounts of wastepaper and wooden pallets transported from each location in 2011. A new location (Belgrade) is added as the amounts of wastepaper transported are validated by an expert.
- water use is declared as water from tap and water from well. In the calculations the total amount of

water is classified as tap water, since characterisation factors in /Ecoinvent 3.5 Database/ suitable for tap water withdrawer is not available.

3.4 Cut-off criteria

Since waste paper and FGD gypsum are considered secondary material, the environmental burden from these materials is allocated to the previous system and not included in the system under study. Capital goods, such as buildings (except heating), machinery, vehicles, and infrastructure are not included in the scope of the study. Polyester tape and cardboard angles for packaging is excluded based on the minimum quantity used. Transport of some materials is not considered as specified in section 3.3.

3.5 Background data

Primary data were provided by Knauf Bulgaria describing the manufacturing process and transport conditions. Raw material manufacturer delivered data on raw material extraction (natural gypsum; located in Bulgaria). The electricity mix for Bulgaria 2017 was used. Background data were sourced from /Ecoinvent 3.5 database/, with Europe as a reference area, if dataset is available or global in all other cases.

3.6 Data quality

This study is mainly based on primary data collected from the participating parties and their respective production sites. Data collected is representative for

2017 for all four products, forming the average product. Default assumptions regarding average vehicle load and respective characterization factors are derived from the /Ecoinvent 3.5 database/ report on transport. Missing data on characterization factors for chemicals used is fulfilled by assumptions as described above.

3.7 Period under review

The data set employed in the EPD is based on data collection covering 2017 production data. The entered quantities for raw materials, energy and operating supplies are based on average values of 12 months operations.

3.8 Allocation

The manufacturing site analyzed in this EPD is only producing gypsum fibre boards. There is thus no need for allocation procedures.

3.9 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.

The /Ecoinvent 3.5 database/ is used for this assessment..

4. LCA: Scenarios and additional technical information

The present EPD analyzes the cradle to gate (A1-A3) impacts of gypsum fibre boards. Numerical data regarding use and end-of-life stages is highly diverse and limited. For this reason, no scenarios are developed within the scope of this cradle-to-gate declaration.

Transport to the building site (A4)

Name	Value	Unit
------	-------	------

Installation into the building (A5)

Name	Value	Unit
Other resources (wooden pallets, PE per declared unit)	0.19	kg

Use or application of the installed product (B1) see section 2.12 "Use"

Name	Value	Unit
------	-------	------

Maintenance (B2)

Name	Value	Unit
Information on maintenance	-	-
Maintenance cycle	-	Number/ RSL
Water consumption	-	m ³
Auxiliary	-	kg
Other resources	-	kg
Electricity consumption	-	kWh
Other energy carriers	-	MJ
Material loss	-	kg

Repair (B3)

Name	Value	Unit
Information on the repair process	-	-
Information on the inspection process	-	-

Repair cycle	-	Number/ RSL
Water consumption	-	m ³
Auxiliary	-	kg
Other resources	-	kg
Electricity consumption	-	kWh
Other energy carriers	-	MJ
Material loss	-	kg

Replacement (B4) / Refurbishment (B5)

Name	Value	Unit
Replacement cycle	-	Number/ RSL
Electricity consumption	-	kWh
Litres of fuel	-	l/100km
Replacement of worn parts	-	kg

Reference service life

Name	Value	Unit
Reference service life	50	a

Operational energy use (B6) and Operational water use (B7)

Name	Value	Unit
Water consumption	-	m ³
Electricity consumption	-	kWh
Other energy carriers	-	MJ
Equipment output	-	kW

End of life (C1-C4)

Name	Value	Unit
Collected separately	-	kg
Collected as mixed construction waste	-	kg
Reuse	-	kg

Recycling	-	kg
Energy recovery	-	kg
Landfilling	-	kg

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

Name	Value	Unit
------	-------	------

5. LCA: Results

The environmental impacts resulting from the production of 1 m² of gypsum fibreboard are expressed in the following categories:

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

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	MND	MND	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: Gypsum fibreboards /1 square meter of gypsum fibre board with a declared thickness of 12.5 mm and density of 1175kg/m³

Parameter	Unit	A1	A2	A3
Global warming potential	[kg CO ₂ -Eq.]	1.40E-1	6.76E-1	4.49E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	1.20E-8	1.20E-7	5.30E-7
Acidification potential of land and water	[kg SO ₂ -Eq.]	8.80E-4	2.20E-3	1.60E-2
Eutrophication potential	[kg (PO ₄) ³ -Eq.]	6.40E-4	2.50E-3	6.44E-3
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	3.00E-5	1.10E-4	7.30E-4
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	9.90E-4	4.95E-3	3.76E-2
Abiotic depletion potential for fossil resources	[MJ]	1.71E+0	1.09E+1	7.03E+1

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A1: Gypsum fibreboards /1 square meter of gypsum fibre board with a declared thickness of 12.5 mm and density of 1175kg/m³

Parameter	Unit	A1	A2	A3
Renewable primary energy as energy carrier	[MJ]	0.00E+0	0.00E+0	2.32E+0
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	0.00E+0	0.00E+0	2.32E+0
Non-renewable primary energy as energy carrier	[MJ]	1.71E+0	1.09E+1	7.03E+1
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	1.71E+0	1.09E+1	7.03E+1
Use of secondary material	[kg]	0.00E+0	0.00E+0	9.01E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m ³]	0.00E+0	0.00E+0	1.70E-2

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A1: Gypsum fibreboards /1 square meter of gypsum fibre board with a declared thickness of 12.5 mm and density of 1175kg/m³

Parameter	Unit	A1	A2	A3
Hazardous waste disposed	[kg]	0.00E+0	0.00E+0	0.00E+0
Non-hazardous waste disposed	[kg]	0.00E+0	0.00E+0	4.52E+0
Radioactive waste disposed	[kg]	0.00E+0	0.00E+0	0.00E+0
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0

6. LCA: Interpretation

Results are discussed per life cycle stage and environmental impacts. Raw material acquisition comprises of raw gypsum extraction, glass fibre production and water use. Manufacturing process accounts for direct energy use in the production processes (calcination, drying, cutting, etc.), production of packaging and ancillary materials (e.g. additives) and waste management at the production site. Transport includes transport of materials to the manufacturing site.

The manufacturing process dominates the overall environmental impacts due to consumption of fossil energy sources for calcination and drying of the boards. Transport of materials is the second contributor to the overall environmental impacts for all impact categories except for category renewable energy resources. For the latter, the packaging dominates due to the use of wooden pallets.

The greatest contribution to the total use of non-renewable primary energy is associated with the manufacturing stage, mainly due to the use of natural gas and electricity.

The production processes use 50% technical gypsum and wastepaper to manufacture the gypsum fibreboards. Despite the significant amounts of secondary materials used in the production, the positive environmental profile is partially reduced by the longer transportation distances and type of transport.

Breaking the emissions down by production processes shows that fossil fuels burned in the manufacturing and transportation are responsible for more than 50% of the total impact for the following categories – global warming potential, stratospheric ozone depletion, abiotic depletion for fossil and non-fossil resources. Natural gas is consumed in the drying and calcination process, and heating for the buildings. Diesel and liquefied petroleum gas (LPG) are needed for internal and external transport activities. Impacts from transport of materials is dominated by the transport of FGD gypsum, wastepaper and natural gas due to the quantities and transportation distance. The impact from electricity dominates with more than 30% in acidification potential, global warming potential, eutrophication potential, photochemical oxidation, renewable energy resources. Electricity ensures the function of the main system, consumed mainly in the calcination process.

Waste treatment contributed 13-15% to the acidification potential and photochemical ozone creation potential, being just second to energy consumption activities. Between 0.1% and 4% of the environmental impacts across all categories are attributed to raw material supply, dominated by the mining of natural gypsum. Possible reasons for the lower impact from the extraction of gypsum could be the limited availability of characterisation factors of impact category ADP elements for anhydrite and calcite as resources as well as the abundance of this material when expressed in Sb equivalents.

7. Requisite evidence

7.1 Leaching (heavy metals)

Elate analysis according to /DIN 38414/ has tested 8 metals. The results for the tested heavy metals were significantly below statutory limit values. Thus, there is no evidence of a potential contamination through the analyzed substances.

Date: 04.04.2018

Measuring agency: Institut für Baubiologie
Rosenheim GmbH

Protocol: ICP-MS (Inductively coupled plasma mass spectrometry)

Results:

Metals laboratory results

Name	Value	Unit
Arsenic (As)	<0.005	mg/l
Cadmium (Cd)	<0.001	mg/l
Chrome (Cr)	<0.005	mg/l
Copper (Cu)	0.005	mg/l
Mercury (Hg)	<0.001	mg/l
Nickel (Ni)	<0.005	mg/l
Lead (Pb)	<0.001	mg/l

7.2. Radioactivity

Radioactivity of the final product has been tested using the activity concentration index. The resulting ACI value is 0.05.

Date: 04.04.2018

Measuring agency: Institut für Baubiologie
Rosenheim GmbH

Protocol: Activity concentration index (ACI)

Result: The resulting ACI value is 0.05 which is below the statutory limit value of $ACI \leq 1$ as well as the limit value of $ACI \leq 0.75$ as defined by the "Institut für Baubiologie" and the more rigorous value of $ACI \leq 0.5$ applied by "Umweltinstitut München".

7.3 Volatile Organic Compound (VOC) emissions

Date: 04.04.2018

Measuring agency: Institut für Baubiologie
Rosenheim GmbH

Protocol: Acetone liquid extraction

Result: The tested products show results below the established limits of 1mg/kg for saturated and unsaturated aliphatic hydrocarbons, aromatic hydrocarbons, terpenes, aliphatic alcohols, chlorinated hydrocarbons, glycols and glycoethers, esters and phthalates, ketones, aldehydes and below 0.5mg/kg for C6-C12 acids.

VOC emissions test results

Vidiwall - overview of results of 7 days

Name	Value	Unit
TVOC (C6 - C16)	0.057	µg/m ³
Sum SVOC (C16 - C22)	<0.001	µg/m ³
R (dimensionless)	-0.068	-
VOC without NIK	0.05	µg/m ³
Carcinogenic Substances	<0.001	µg/m ³

AgBB overview of results (3 days [µg/m³])

Name	Value	Unit
TVOC (C6 - C16)	-	µg/m ³
Sum SVOC (C16 - C22)	-	µg/m ³
R (dimensionless)	-	-

VOC without NIK	-	µg/m ³
Carcinogenic Substances	-	µg/m ³

Vidifloor – overview of results of 7 days

Name	Value	Unit
TVOC (C6 - C16)	0.013	µg/m ³
Sum SVOC (C16 - C22)	<0.001	µg/m ³
R (dimensionless)	-0.015	-
VOC without NIK	<0.001	µg/m ³
Carcinogenic Substances	<0.001	µg/m ³

8. References

OHSAS 18001

Occupational Health and Safety Assessment Series

EN 13501-1:2007+A1:2009

Fire classification of construction products and building elements. Classification using test data from reaction to fire tests

DIN 38414

DIN 38414-4: German standard methods for the examination of water, waste water and sludge; sludge and sediments (group S); determination of leachability by water (S4)

EN 14044

ISO 14044:2006, Environmental management — Life cycle assessment — Requirements and guidelines

EN 13823

BS EN 13823:2010:Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item

ISO 9001: 2015

Quality management system - Requirements

ISO 14001: 2015

Environmental management systems – Requirements with guidance for use

ISO 1182

ISO 1182:2010: Reaction to fire tests for products -- Non-combustibility test

ISO 1716

ISO 1716:2010 Reaction to fire tests for products -- Determination of the gross heat of combustion (calorific value)

ISO 15686

ISO 15686 Buildings and constructed assets — Service life planning

Construction Products regulation

Directive (EU) No. 305/2011 of the European Parliament and Council dated 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC (Text with EEA relevance); Official Journal of the European union, EU L88/5 dated 4.4.2011

BBSR Reference Service Life

BBSR table "Service lives of components for LCA in accordance with BNB", "Sustainable Building Information Portal" by the Federal Ministry of the Interior, Building and Community, Available at: <https://www.nachhaltigesbauen.de/baustoff-und-gebaeuedaten/nutzungsdauern-von-bauteilen.html>

EN 15283-2:2008 + A1:2009

Declarations of product performance according to EN 15283-2:2008 + A1:2009, Gypsum boards with fibrous reinforcement - Definitions, requirements and test methods - Part 2: Gypsum fibre boards.

ETA - 07/ 0086

Declarations of product performance according to European Technical Assessment: ETA - 07/ 0086 (23.03.2018)

CML 2001

Method "Centrum voor Milieukunde", Leiden, NL

Certificate for Biological safety of Vidiwall fibre boards certified by the Institute for Building Biology in Rosenheim, Germany, April 2018

BRIDGE. (2007).

BRIDGE. Returnable transport items: The market for EPCglobal applications. Brussels: Building Radio frequency IDentification solutions for the Global Environment. 2007.

Ecoinvent 3.5 Database

Ecoinvent Database, Swiss Centre for Life Cycle Inventories, Data Version 3.5

European manufacturers of gypsum products

Living with Gypsum: From Raw Material to Finished Products, 2008, Brussels
External thermal insulation composite system (ETICS)
www.ea-etics.eu

Declaration of Performance

Knauf Bulgaria, 2018, Declaration of Performance of Vidiwall, in accordance with EU Regulation 305/2011

Knauf Bulgaria, 2018, Declaration of Performance of Vidiwall HI, in accordance with EU Regulation 305/2011

Knauf Bulgaria, 2017, Declaration of Performance of Vidifire, in accordance with EU Regulation 305/2011

Knauf Bulgaria, 2016, Declaration of Performance of Vidifloor, in accordance with EU Regulation 305/2011

Knauf Bulgaria, 2016, Declaration of Performance of Vidiphonic, in accordance with EU Regulation 305/2011

PCR 2012, Part B

Institut Bauen und Umwelt e.V. PCR Guidance-Texts for Building-Related Products and Services From the range of Environmental Product Declarations of Institute Construction and Environment e.V. (IBU); Part B: Requirements on the EPD for Plasterboard
www.bau-umwelt.de

Ordinance on main requirements and conformity assessment of construction products

Ordinance on main requirements and conformity assessment of construction products (Bulgarian

legislation: НАРЕДБА за съществените изисквания към строежите и оценяване съответствието на строителните продукти Приета с ПМС № 325 от 06.12.2006 г.; обн., ДВ, бр. 106 от 2006 г.)

Waste codes

17 08 02 gypsum-based construction materials other than those mentioned in 17 08 01

10 13 07 sludges and filter cakes from gas treatment

10 13 99 wastes not otherwise specified

20 01 01 paper and cardboard

15 01 01 paper and cardboard packaging

Seal of approval guidelines

Institut für Baubiologie, Rosenheim GmbH, 2012, Germany

**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**

denkstatt Bulgaria OOD
Arsenalski blvd 115
1421 Sofia
Bulgaria

Tel +359 2 470 75 08
Fax +359 2 416 5611
Mail office@denkstatt.bg
Web <http://denkstatt.bg/>

**Owner of the Declaration**

Knauf Bulgaria EOOD
Angelov vrah 27
1618 Sofia
Bulgaria

Tel 0700 300 03
Fax (+359) 2 850 2194
Mail info@knauf.bg
Web <http://knauf.bg>