

ver1 2015



ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025, ISO 21930 and EN 15804

Owner of the declaration:	Knauf A/S
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-356-246-EN
ECO Platform reference number:	00000234
Issue date:	12.10.2015
Valid to:	12.10.2020

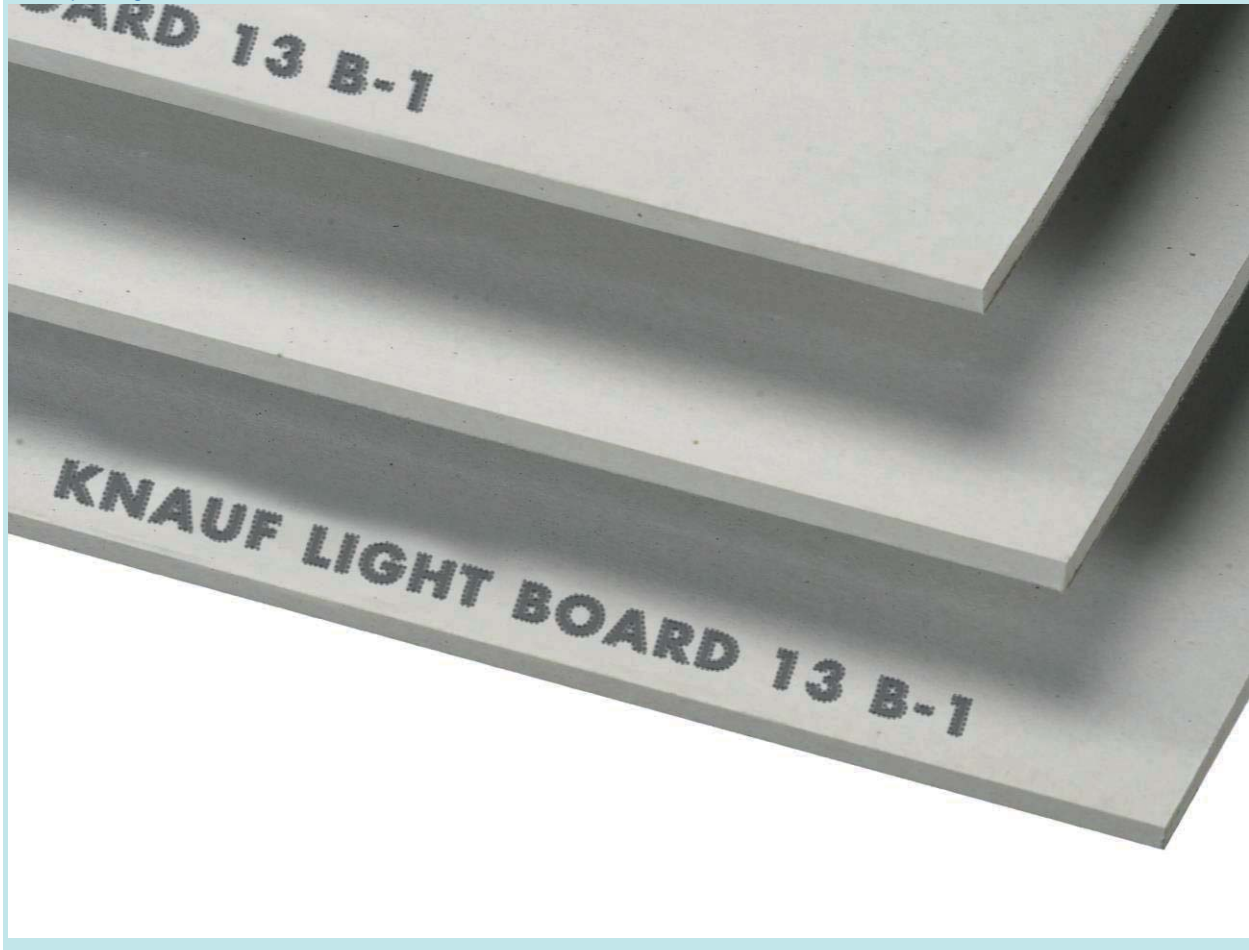
Knauf Light Board

Valid for all the gypsum boards in the product range carrying the Knauf Light Board name.

Knauf A/S



www.epd-norge.no



General information

Product:

Knauf Light Board

Program operator:

The Norwegian EPD Foundation
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Declaration number:

NEPD-356-246-EN

ECO Platform reference number:

00000234

This declaration is based on Product Category Rules:

CEN Standard EN 15804 serves as core PCR
PCR 010 rev 1 Building Boards (12 2013)

Statement of liability:

The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Declared unit:

1m² of Light Board, from raw material extraction (A1) to the factory gate (A3).

Scope

Cradle to Grave

Functional unit:

1m² of installed Light Board, with a service lifetime of 60 years, from extraction of raw materials (A1) to the end-of-waste state (C3 and C4).

Verification:

The CEN Norm EN 15804 serves as the core PCR. Independent verification of the declaration and data, according to ISO14025:2010

internal external

Third party verifier:

Lars G. F. Tellnes, Norwegian Institute of Wood Technology
(Independent verifier approved by EPD Norway)

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Manufacturer:

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Place of production:

Hobro, Denmark

Management system:

ISO 14001:2004
ISO 9001:2008
OHSAS 18001:2008

Organisation no:

54050313

Issue date:

12.10.2015

Valid to:

12.10.2020

Year of study:

2015

Comparability:

EPD of construction products may not be comparable if they do not comply with EN 15804 and are seen in a building context.

The EPD has been worked out by:

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Approved

Håkon Hauan
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Product

Product description:

The Knauf Light Board is a glass fiber reinforced gypsum plasterboard. The product is used for general indoor building construction of walls and ceilings.

Product specification:

The range of the products carrying the name Knauf Light Board includes products with different edge profiles such as square and beveled edges. This EPD is valid for all variations carrying the Knauf Light Board name, measuring 900 x 2400 x 12.5mm or 900 x 2700 x 12.5mm, with designated name 13 B-1.

The calculations are based on the variation with the highest environmental impact (900 x 2400 x 12.5mm).

Materials	kg	%
Stucco	5.333	79.60
Fibre glass	0.04	0.60
Other Additives	0.091	1.35
Glue for edge	0.0026	0.04
Paper liners	0.32	4.78
Water*	0.913	13.63
<i>Sum of Materials</i>	<i>6.7</i>	<i>100</i>
Packaging		
Polyethylene foil	0.00258	
Installation		
Screws	0.02458	
Tape	0.004	
Jointing material	0.175	
<i>Sum of Additional Materials</i>	<i>0.2</i>	

* In total, 3623kg of water is consumed during the production process. Due to mainly the solidification of the gypsum, 2710kg of water is evaporated during the production process.

In short, the manufacturing process consists of calcinating the gypsum, mixing in water and additives, distributing the slurry across a plasterboard liner and letting it harden and dry before the boards are cut to the correct length.

Gypsum:

The gypsum used for stucco in the Knauf plasterboard production originates from mined gypsum (1 % in 2013), FGD gypsum from flue-gas desulphurisation in coal power plants (81.2 % in 2013) and recycled gypsum (17.8 % in 2013). The recycled gypsum originates from internal waste and from external collection of used gypsum plasterboards.

The internal recycling of gypsum boards in the Knauf factory started in 1991, and since 2004 all internal gypsum waste has been recycled and used. In 1998, Knauf started to use recycled gypsum from gypsum plasterboards collected from building sites.

Technical data:

According to EN 520:2009 the Light Board is classified as type A (plasterboard with a face to which suitable gypsum plasters or decoration may be applied). The mass of the declared unit is 6.7kg and the thickness is 12.5mm.

Market:

The Nordic Countries: Denmark, Norway and Sweden.

Reference service life, product:

Reference service lifetime of the Knauf Light Board is 60 years when applied according to the product description.

Reference service life, building:

A reference service lifetime of 60 years has been assumed for the building in all calculations.

LCA: Calculation rules

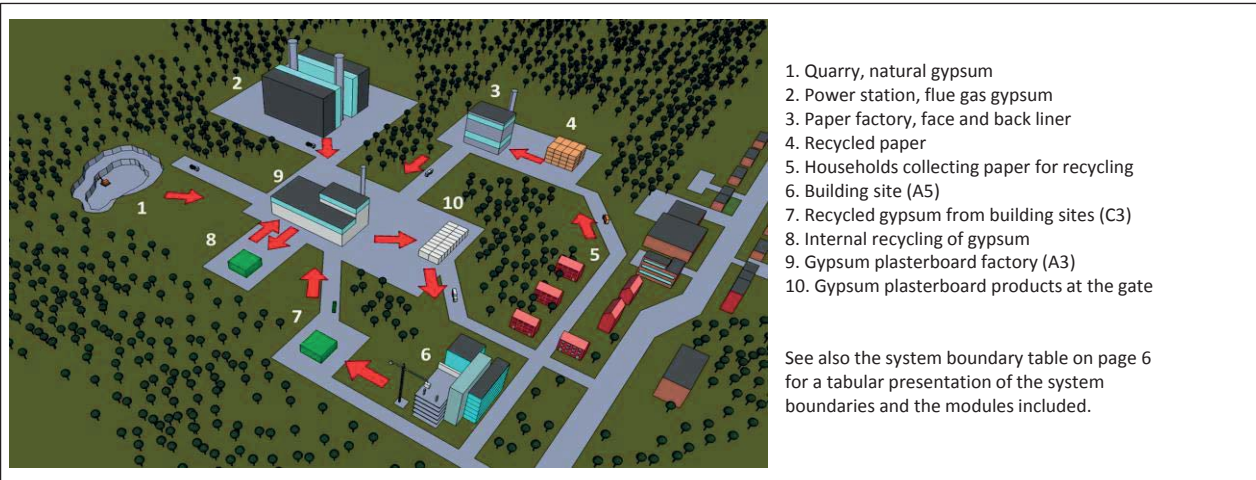
Declared unit:

1m² of Light Board, from raw material extraction (A1) to the factory gate (A3).

System boundary:

Figure 1 shows a flow diagram of the value chain, including the system boundaries from A1 - C4. Biogenic carbon is also included in the system boundaries.

Figure 1: A flow diagram showing the value chain and the system boundaries.



Data quality:

The data requirements are according to PCR 010 rev1 Building Boards (12 2013) clause 7.3.6. Specific data collected from contractors is applied for the most important raw materials in A1. Specific data from the 2013 production at the manufacturing site is applied in A3. Missing data were substituted with generic data from Ecoinvent v2.2 (2010) and v3.1 (2014). No data are more than 5 years old.

Cut-off criteria:

All major raw materials and all the essential energy is included. General cut-off criteria are given in standard EN 15804:2012 clause 6.3.5. In compliance with these criteria, the infrastructure of the manufacturing site, small parts of the packaging and the electricity used to fasten screws are excluded from the study. No potentially hazardous materials have been excluded.

Allocation:

The allocation is made in accordance with the provisions of EN 15804:2012. Energy and water consumption in the factory is allocated to the FU through mass allocation. The water consumption is allocated to module A3 and only includes direct factory use, upstream water use is not included. Waste production in the factory is allocated on the basis of m². Effects of primary production of recycled materials is allocated to the main product in which the material was used. The recycling process of the Knauf Light Board is allocated to module C3.

LCA: Scenarios and additional technical information

The following information describes the scenarios in the different modules of the EPD.

Important Note

This EPD yields for both the Danish and the Norwegian/Swedish markets. There is only one important difference in the two markets, namely the transport distance from the manufacturing site in Hobro, Denmark, to the building site, module A4. The Norwegian main storage, also serving the Swedish market, is situated in Drammen, Norway. Two scenarios for transport are therefore given. In the results tables for environmental impact and resource use, the Danish A4 results are shown under A4 D, whilst the Norwegian/Swedish results are shown under A4 N, for the user to choose.

Transport from production place to user (A4) in Denmark

Type	Destination	Type of vehicle	Distance km	Capacity Utilisation* (incl. return) %
Truck	Building site in Denmark	16-32 tons, EURO5	192	18 - 30

Transport from production place to user (A4) in Norway/Sweden

Type	Destination	Type of vehicle	Distance km	Capacity Utilisation* (incl. return) %
Truck	Hirtshals, Denmark	16-32 tons, EURO5	120	18 - 30
Boat	Kristiansand, Norway	Freight ship	140	65
Truck	Drammen, Norway	16-32 tons, EURO5	422	18 - 30
Truck	Building site in Norway/Sweden	16-32 tons, EURO3	360	18 - 30

The plasterboard is considered installed when it is attached with screws in its designated place in the building, and the connection between two boards is finished with tape and jointing material (A5). There is no demand for raw materials, energy or other resources during the use phase (0 value in B1 - B5). Painting is optional and left out of this EPD.

Assembly (A5)

	Unit	Value
Material loss	%	15
Tape	kg	0.004
Screws	kg	0.025
Jointing material	kg	0.175

Use (B1)

	Unit	Value
Consumption of raw material		0
Consumption of energy		0
Consumption of other resources		0
Waste		0
Emissions to air, water and soil		0

Maintenance (B2)/Repair (B3)

	Unit	Value
Consumption of raw material		0
Consumption of energy		0
Consumption of other resources		0
Waste		0
Emissions to air, water and soil		0

Replacement (B4)/Refurbishment (B5)

	Unit	Value
Consumption of raw material		0
Consumption of energy		0
Consumption of other resources		0
Waste		0
Emissions to air, water and soil		0

B6 and B7 are not relevant according to PCR 010 rev1 Building Boards. The end of life scenario is based on the current situation in Norway, from 2015. It is assumed that the same scenario applies to Denmark.

Operational energy (B6) and water consumption (B7)

	Unit	Value
Modules not relevant according to PCR		

End of Life (C1, C3, C4)

	Unit	Value
Hazardous waste disposed	%	0
Collected mixed construction waste	%	0
Reuse	%	0
Recycling	%	40
Energy recovery	%	0
To landfill	%	60

Transport to waste processing (C2)

Type	Destination	Type of vehicle	Distance km	Capacity Utilisation* (incl. return) %
Truck	Recycling facilities	16-32 tons, EURO4	50	18 - 30
Truck	Landfill	16-32 tons, EURO4	50	18 - 30

*Capacity utilisation factors are from Ecoinvent v2.2 report 14: Transport Services (Kolle et al., 1991) (Knørr et al., 2000)

LCA: Results

The calculations are based on the Light Board product variation with the highest environmental impact (see product specification). The LCA results of the other products in the Knauf Light Board product range are estimated to be between 0 and 5% lower than the results below.

When interpreting the results, it is important to note that a 15% product loss is accounted for in A5, that A3 energy consumption is composed of Danish el-mix and natural gas, and that mass of the declared unit is 6.7kg.

The GWP includes biogenic carbon uptake and emissions, calculated according to EN 16485:2014 whereby 0.467kgCO₂ is taken up in A1 and emitted again in C3 and C4, so that the net value is zero within the system boundaries.

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	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	x	x	x	x	x	x	x	MNR	MNR	x	x	x	x	MND

Environmental impact

Parameter	Unit	A1	A2	A3	A4 D	A4 N	A5	C1	C2	C3	C4
GWP	kg CO ₂ -eqv	-0,03	0,18	1,37	0,22	1,06	0,35	0,02	0,06	0,20	0,34
ODP	kg CFC11-eqv	3,8E-08	2,7E-08	1,6E-07	3,4E-08	1,7E-07	4,1E-08	2,9E-09	9,0E-09	7,64E-10	1,4E-08
POCP	kg C ₂ H ₄ -eqv	1,1E-04	2,6E-05	1,2E-04	2,6E-05	1,5E-04	7,4E-05	4,6E-06	7,0E-06	2,12E-06	5,0E-03
AP	kg SO ₂ -eqv	2,0E-03	7,4E-04	1,8E-03	6,5E-04	4,2E-03	1,1E-03	1,8E-04	2,2E-04	4,49E-05	0,12
EP	kg PO ₄ ³⁻ -eqv	9,2E-04	1,7E-04	6,0E-04	1,7E-04	1,1E-03	4,7E-04	4,2E-05	5,8E-05	2,0E-05	8,2E-05
ADPM	kg Sb-eqv	1,0E-06	4,4E-07	5,07E-07	5,9E-07	2,8E-06	9,7E-07	4,9E-09	1,6E-07	2,2E-08	7,0E-08
ADPE	MJ	7,74	2,71	21,3	3,34	16,4	6,12	0,34	0,89	0,17	1,32

GWP Global warming potential; ODP Depletion potential of the stratospheric ozone layer; POCP Formation potential of tropospheric photochemical oxidants; AP Acidification potential of land and water; EP Eutrophication potential; ADPM Abiotic depletion potential for non fossil resources; ADPE Abiotic depletion potential for fossil resources

INA = Indicator not assessed

Resource use

Parameter	Unit	A1	A2	A3	A4 D	A4 N	A5	C1	C2	C3	C4
RPEE	MJ	4,50	0,04	1,27	0,05	0,22	1,03	0,00	0,01	0,06	0,03
RPEM	MJ	4,15	INA	0,00	INA	INA	0,62	INA	INA	INA	INA
TPE	MJ	8,6	0,04	1,27	0,05	0,22	1,65	0,00	0,01	0,06	0,03
NRPE	MJ	8,9	2,73	20,5	3,35	16,5	6,46	0,33	0,89	0,20	1,38
NRPM	MJ	INA	INA	0,08	INA	INA	0,01	INA	INA	INA	INA
TRPE	MJ	8,9	2,73	20,6	3,35	16,5	6,5	0,33	0,89	0,20	1,38
SM	kg	1,28	INA	2,92E-03	INA	INA	INA	INA	INA	INA	INA
RSF	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
NRSF	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
W	m ³	INA	INA	3,62E-03	INA	INA	INA	INA	INA	INA	INA

The packaging, paper liner, 17.8% of the gypsum and some additives originate from recycled materials.

RPEE Renewable primary energy resources used as energy carrier; RPEM Renewable primary energy resources used as raw materials; TPE Total use of renewable primary energy resources; NRPE Non renewable primary energy resources used as energy carrier; NRPM Non renewable primary energy resources used as materials; TRPE Total use of non renewable primary energy resources; SM Use of secondary materials; RSF Use of renewable secondary fuels; NRSF Use of non renewable secondary fuels; W Use of net fresh water

End of life - Waste

Parameter	Unit	A1	A2	A3	A4 D	A4 N	A5	C1	C2	C3	C4
HW	kg	INA	INA	1,30E-04	INA	INA	INA	INA	INA	INA	INA
NHW	kg	INA	INA	1,48E-02	INA	INA	INA	INA	INA	2,68	4,22
RW	kg	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA

HW Hazardous waste disposed; NHW Non hazardous waste disposed; RW Radioactive waste disposed

End of life - Output flow

Parameter	Unit	A1	A2	A3	A4 D	A4 N	A5	C1	C2	C3	C4
CR	kg	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
MR	kg	INA	INA	2,92E-03	INA	INA	INA	INA	INA	2,68	INA
MER	kg	INA	INA	1,19E-02	INA	INA	INA	INA	INA	INA	INA
EEE	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA
ETE	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA	INA

CR Components for reuse; MR Materials for recycling; MER Materials for energy recovery; EEE Exported electric energy; ETE Exported thermal energy

Reading example: $9,0 \text{ E-}03 = 9,0 \cdot 10^{-3} = 0,009$

Additional Norwegian requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase

National Danish production mix from import, low voltage (production of transmission lines, in addition to direct emissions and losses in grid) of applied electricity for the manufacturing process (A3).

Data source	Amount	Unit
Econinvent v3.1 (July 2014)	0.139	kgCO ₂ -eqv/MJ

EPDs from other program operators other than the Norwegian EPD Foundation are not necessarily comparable.

Dangerous substances

- The product contains no substances given by the REACH Candidate list or the Norwegian priority list
- The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0,1 % by weight.
- The product contain dangerous substances, more then 0,1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiten, Annex III), see table.

Indoor environment





No tests have been carried out on the product concerning indoor climate.

Carbon footprint

Carbon footprint has not been worked out for the product.

Bibliography

ISO 14025:2010	<i>Environmental labels and declarations - Type III environmental declarations - Principles and procedures</i>
ISO 14044:2006	<i>Environmental management - Life cycle assessment - Requirements and guidelines</i>
EN 15804:2012+A1:2013	<i>Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products</i>
ISO 21930:2007	<i>Sustainability in building construction - Environmental declaration of building products</i>
ISO 14001:2004	<i>Environmental management systems - Requirements with guidance for use</i>
ISO 9001: 2008	<i>Quality management system - Requirements</i>
OHSAS 18001: 2007	<i>Occupational health and safety management systems. Requirements</i>
EN 520: 2009	<i>Gypsum Plasterboards. Definitions, requirements and test methods</i>
EN 16485: 2014	<i>Round and sawn timber. Environmental Product Declarations. Product Category Rules for wood and wood-based products.</i>
Pre Consultants	<i>Ecoinvent v2.2 and v3.1 Database, 2014</i>
Spielmann, M., Bauer, C., Dones, R., Tuchschnid, M.	<i>Ecoinvent report no.14: Transport Services, 2007</i>
Schlanbusch, Reidun Dahl & Inman, Marianne Rose	<i>LCI/LCA Report: Six Gypsum Plaster Building Boards, SINTEF Building and Infrastructure, Knauf A/S, Report number SBF2015F0324, 2015</i>
The Norwegian EPD Foundation	<i>PCR 010 rev1 Building Boards, December 2013</i>

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