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The Norwegian EPD Foundation

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14020, ISO 14025, ISO 21930 and EN 15804

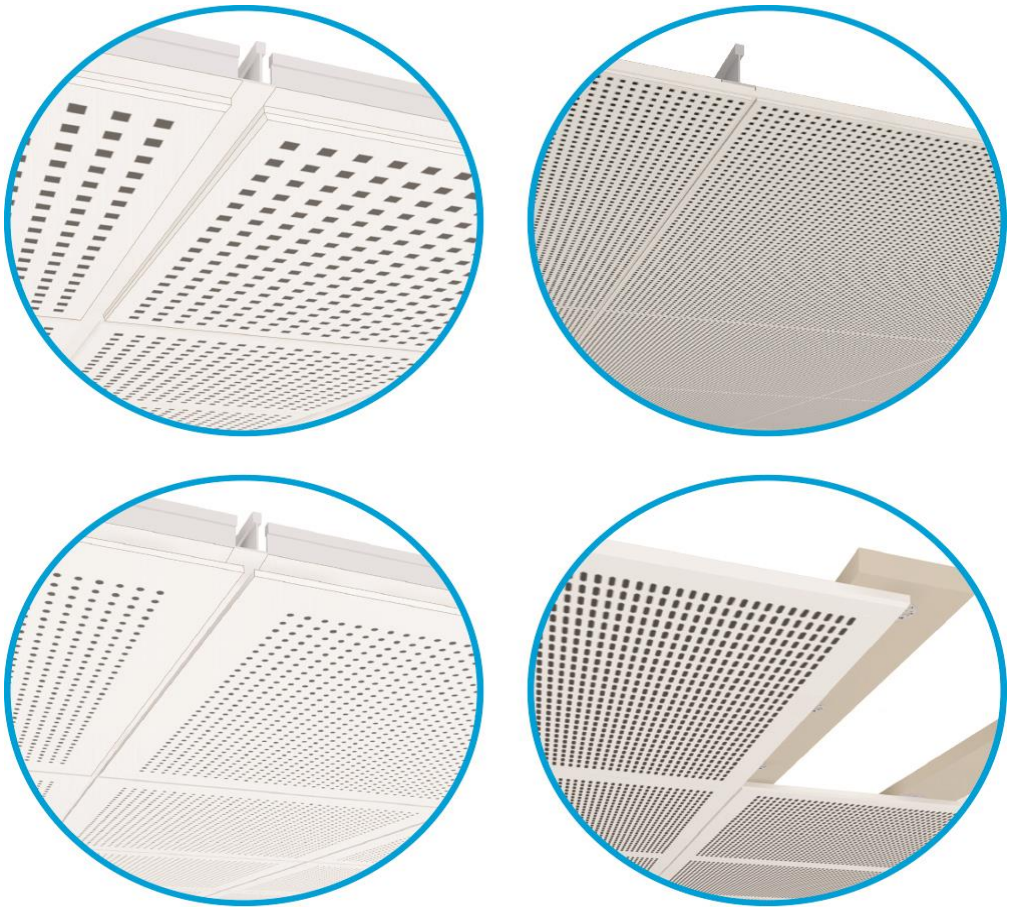
Owner of the declaration:	Knauf A/S
Program operator:	The Norwegian EPD Foundation
Publisher:	The Norwegian EPD Foundation
Declaration number:	NEPD-414-292-EN
ECO Platform reference number:	00000318
Issue date:	25.02.2016
Valid to:	25.02.2021

Knauf Danoline Cleaneo Markant, Contur, Linear and Danopanel (perforated)

Valid for all the gypsum boards in the product range carrying the Knauf Danoline Cleaneo Markant, Contur, Linear and Danopanel (perforated) name.

Knauf A/S

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General information

Product:
Knauf Danoline Cleaneo Markant, Contur, Linear and Danopanel (perforated).

Owner of the declaration:
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Declaration number:
NEPD-414-292-EN

Place of production:
Hobro, Denmark

ECO Platform reference number:
00000318

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

This declaration is based on Product Category Rules:
CEN Standard EN 15804 serves as core PCR
PCR 010 rev 1 Building Boards (12 2013)

Organisation no:
54050313

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.

Issue date:
25.02.2016

Valid to:
25.02.2021

Declared unit:
1m^2 of Markant, Contur, Linear or Danopanel (perforated), from raw material extraction (A1) to the factory gate (A3).

Year of study:
2015

Scope
Cradle to Grave

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

Functional unit:
1m^2 of installed Markant, Contur, Linear or Danopanel (perforated), with a service lifetime of 60 years, from extraction of raw materials (A1) to the end-of-waste state (C3 and C4).

The EPD has been worked out by:
Marianne Rose Inman

Marianne Rose Inman SINTEF

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)

Approved
Håkon Hauan
Managing Director of EPD-Norway

Product

Product description:
The Knauf Danoline Cleaneo Markant, Contur, Linear and Danopanel (perforated) is a glass fiber reinforced gypsum plasterboard with square, bevelled or special edges and a perforated surface. The perforation can vary between different types of patterns and be perforated by up to 40%. The back side is covered by an acoustic tissue and supporting system metal clips are mounted. The face side has a paint finish. The products can be mounted on ceilings or walls. Directly mounted or in a gridsystem as layin panels.

Product specification:
This EPD is valid for all variations carrying the Knauf Danoline Cleaneo Markant, Contur, Linear and Danopanel (perforated) name.

The calculations are based on the variation with the highest environmental impact (article number 3143).

Materials	kg	%
Stucco	8.3174	77.69
Fiber glass	0.0036	0.03
Other Additives	0.1063	0.99
Acoustic Felt	0.0475	0.44
Paint	0.2232	2.09
Steel	0.27	2.52
Glue	0.07	0.66
Paper liners	0.4357	4.07
Water*	1.232	11.51
Sum of Materials	*10.71*	*100*
Packaging		
Polyethylene foil	0.0273	
Cardboard	0.2527	
Ceiling board	0.0727	
Sum of Additional Materials	*0.35*	

Technical data:
The product is made and controlled in accordance with EN 14190:2013 “Plasterboards from reprocessing”. The mass of the declared unit is max. 11.1 kg and the thickness is max. 12.5 mm.

Market:
The Nordic Countries: Denmark, Norway and Sweden.

Reference service life, product:
Reference service lifetime of the Knauf Danoline Cleaneo Markant, Contur, Linear and Danopanel (perforated) 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.

* In total, 5.7178 kg of water is consumed during the production process. Due to mainly the solidification of the gypsum, 4.4858 kg 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 desulphisation 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.

LCA: Calculation rules

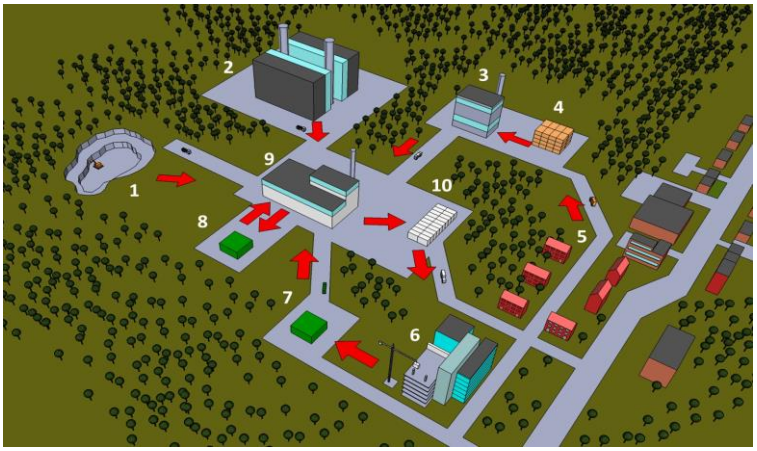
Declared unit:

1m^2 of Markant, Contur, Linear or Danopanel (perforated), 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.



1. Quarry, natural gypsum
2. Power station, flue gas gypsum
3. Paper factory, face and back liner
4. Recycled paper
5. Households collecting paper for recycling
6. Building site (A5)
7. Recycled gypsum from building sites (C3)
8. Internal recycling of gypsum
9. Gypsum plasterboard factory (A3)
10. Gypsum plasterboard products at the gate

See also the system boundary table on page 6 for a tabular presentation of the syst boundaries and the modules included.

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 was substituted with generic data from Ecoinvent v3.1 (2014). No data is 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 and small parts of the packaging 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 in module A1. Similarly, paint and glue has been allocated with a wet weight during the production processs, and with a dry weight during end of life. Waste production in the factory is allocated on the basis of m^2. The end of life waste and output flows include direct use only, upstream end of life waste and upstream output flows are not included. 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 Danoline Cleaneo Markant, Contur, Linear and Danopanel (perforated) 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.

Both the A4 and C2 transport scenarios have been developed closely with Norgips (subsidiary and distributor of Knauf plasterboards in Norway) and Euronorm (transport company used in Denmark) and are considered representative in terms of transportation modes, routes and distances travelled, as well as lorry size and vehicle classification. Specific data was not available for capacity utilisation or fuel consumption, therefore generic European values have been assumed. The bulk density is 600-900kg/m^3, as documented in the product's safety data sheet, and the volume capacity utilisation factor is assumed to be <1.

Transport from production place to user (A4) in Denmark

Type	Capacity Utilisaton %	Destination	Type of vehicle	Distance (km)	Fuel / Energy Consumption	Value (l/t)
Truck	53	Building site, Denmark	>32 tons, EURO5	192	0,02 l/tkm	3,8

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

Type	Capacity Utilisation %	Destination	Type of vehicle	Distance (km)	Fuel / Energy Consumption	Value (l/t)
Truck	53	Hirtshals, Denmark	>32 tons, EURO5	120	0,02 l/tkm	2,4
Boat	65	Kristiansand, Norway	Freight ship	140	0,003 l/tkm	0,4
Truck	53	Drammen, Norway	>32 tons, EURO5	422	0,02 l/tkm	8,4
Truck	53	Building site, Norway	>32 tons, EURO3	360	0,017 l/tkm	6,1

The plasterboard is considered installed when it is attached in its designated place in the building (A5). There is no demand for raw materials, energy or other resources during the use phase (0 value in B1 - B5).

Assembly (A5)

	Unit	Value
Material loss*	%	15

* A4 transport of material loss is based on the Danish scenario

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	Capacity Utilisation %	Destination	Type of vehicle	Distance (km)	Fuel / Energy Consumption	Value (l/t)
Truck	53	Recycling facilities	>32 tons, EURO4	50	0,02 l/tkm	1,0
Truck	53	Landfill	>32 tons, EURO4	50	0,02 l/tkm	1,0

LCA: Results

The calculations are based on the Markant, Contur, Linear and Danopanel (perforated) product variation with the highest environmental impact (see product specification). The LCA results of the other products in the Knauf Danoline Cleaneo Markant, Contur, Linear and Danopanel (perforated) 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 11.1 kg.

The GWP includes biogenic carbon uptake and emissions, calculated according to EN 16485: 2014 whereby 0.752 kg CO_2 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			Assemby 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	1,87	0,37	1,43	0,18	0,86	0,76	0,04	0,05	0,46	0,69
ODP	kg CFC11-eqv	4,1E-07	6,8E-08	1,6E-08	3,4E-08	1,6E-07	8,3E-08	6,7E-09	8,8E-09	1,22E-09	1,2E-08
POCP	kg C_2H_4-eqv	8,9E-04	6,4E-05	6,7E-05	3,1E-05	1,6E-04	1,6E-04	7,5E-06	8,1E-06	3,38E-06	1,3E-05
AP	kg SO_2-eqv	1,3E-02	1,2E-03	9,4E-04	6,3E-04	4,0E-03	2,5E-03	2,8E-04	1,9E-04	7,17E-05	2,65E-04
EP	kg PO_4^{3-}-eqv	2,3E-03	1,6E-04	1,6E-04	9,6E-05	6,4E-04	4,3E-04	6,0E-05	3,1E-05	8,5E-06	4,4E-05
ADPM	kg Sb-eqv	6,9E-06	1,0E-06	1,69E-07	4,0E-07	1,9E-06	1,3E-06	1,2E-08	1,0E-07	3,4E-08	4,3E-08
ADPE	MJ	52,4	5,58	4,0	2,78	13,4	10,1	0,54	0,72	0,27	0,97

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	11,7	0,08	0,94	0,04	0,20	1,94	2,9E-03	0,01	0,09	0,02
RPEM	MJ	6,08	INA	3,32	INA	INA	1,41	INA	INA	INA	INA
TPE	MJ	17,8	0,08	4,26	0,04	0,20	3,35	0,00	0,01	0,09	0,02
NRPE	MJ	57,2	5,69	4,1	2,84	13,7	10,9	0,54	0,74	0,32	0,99
NRPM	MJ	INA	INA	0,82	INA	INA	0,12	INA	INA	INA	INA
TRPE	MJ	57,2	5,69	4,9	2,84	13,7	11,0	0,54	0,74	0,32	0,99
SM	kg	1,50	INA	3,03E-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	8,05	0,23	0,78	0,12	0,58	1,41	0,01	0,03	0,14	0,03

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	0,015	INA	INA	INA	INA	INA	4,42	6,64
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	2,91E-03	INA	INA	INA	INA	INA	4,42	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 E-03 = $9{,}0*10^{-3}$ = 0,009

Additional Norwegian requirements

Greenhous 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 prosess (A3).

Data source	Amount	Unit
Econinvent v3.1 (July 2014)	0.139	kg CO_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 (Avfallsforskiften, Annex III), see table.

Transport
Transport from the place of production to a central warehouse in Norway: 682 km
The product is transported from a central warehouse to the building site. This is declared in module A4.

Indoor environment
Ceiling Board is covered by the Danish Indoor Climate Labelling, Certificate no. 007.
http://knaufdanoline.com/wp-content/uploads/DIM_007-KnaufDanogips-UK_Finished1.pdf

Carbon footprint
Carbon footprint has not been worked out for the product.

Bibliography

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ISO 14025:2010	*Environmental labels and declarations - Type III environmental declarations - Principles and procedures*
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EN 15804:2012+A1:2013	*Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products*
ISO 21930:2007	*Sustainability in building construction - Environmental declaration of building products*
ISO 14001:2004	*Environmental management systems - Requirements with guidance for use*
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