

# Environmental Product Declaration

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## **Troldekt acoustic wood wool-cement panels**

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This is an environmental product declaration (EPD) in accordance with ISO 14025 and CEN EN 15804 for the product category of construction products.

The EPD format is in accordance with the "Business-to-Business" communication format described in CEN EN 15942. The EPD contains the required data in accordance with the DGNB system, and is intended for DGNB certification.




No: 506813

Date of issue: July 4, 2013

Valid until: July 4, 2018

EPD developer: Danish Technological Institute

## 1 General information

<b>Product</b>	The EPD represents the environmental parameters of an average Troldekt acoustic panel applicable for ceilings and walls. Hence, the EPD covers the entire product series of Troldekt acoustic panels, including painted and natural panels.							
<b>Manufacturer</b>	Troldekt A/S Sletvej 2A DK-8310 Tranbjerg J Denmark  Contact: Tina Kristensen (TKR@troldekt.dk)							
<b>Declared unit</b>	Production of 1 m <sup>2</sup> average Troldekt acoustic wood wool-cement panel.							
<b>Product category</b>	The EPD is based on the product category of construction works accordant to EN 15804. The EPD is a "cradle-to-gate with options" in accordance with the modules necessary for the EPD to be applicable in the DGNB system. As shown in Figure 2 the lifecycle modules included in this EPD are A1-A3, B1, B4, B6 and D.							
<b>Comparability</b>	Environmental product declarations established by a different standard may not be comparable.							
<b>EPD developer</b>	Trine Henriksen Danish Technological Institute (DTI) Gregersensvej 1, 2630 Taastrup, Denmark <a href="http://www.dti.dk">www.dti.dk</a>							
<b>PCR program operator</b>								
<b>Verification</b>	<table><tr><td colspan="2">Independent verification of declaration according to EN ISO 14025: 2010</td></tr><tr><td><input type="checkbox"/> internal</td><td><input type="checkbox"/> external</td></tr><tr><td colspan="2">3. part verifier (if relevant)</td></tr></table>		Independent verification of declaration according to EN ISO 14025: 2010		<input type="checkbox"/> internal	<input type="checkbox"/> external	3. part verifier (if relevant)	
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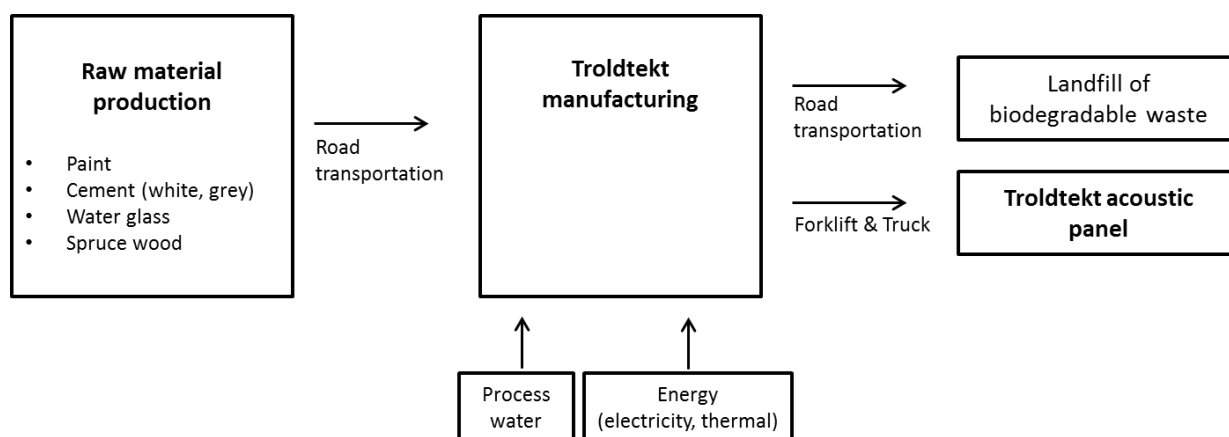
## 2 Product description

Application	Troldekt acoustic panels are intended for indoor use on ceilings and walls.																																																															
Technical specifications	<p>Troldekt acoustic panels are CE-labelled in accordance with two European norms:</p> <ul style="list-style-type: none"><li>• EN 13168 for wood wool (WW) panels</li><li>• EN 13964 for suspended ceilings</li></ul> <p>Product codes:</p> <table><tr><th>Property/requirement</th><th>Standard WW Panels</th><th>A2 WW Panels</th></tr><tr><td>Standard</td><td>WW-EN 13168</td><td>WW-EN 13168</td></tr><tr><td>Thermal Conductivity</td><td>0,072</td><td>0,074</td></tr><tr><td>Length</td><td>L2</td><td>L2</td></tr><tr><td>Width</td><td>W2</td><td>W2</td></tr><tr><td>Thickness</td><td>T1</td><td>T1</td></tr><tr><td>Squareness</td><td>S3</td><td>S3</td></tr><tr><td>Flatness</td><td>P1</td><td>P1</td></tr><tr><td>Compressive stress or strength</td><td>CS(10)200</td><td>CS(10)200</td></tr><tr><td>Density</td><td>No content</td><td>No content</td></tr><tr><td>Copatibility with other materials</td><td>Cl1</td><td>Cl1</td></tr><tr><td>Dim. Stab.</td><td>No content</td><td>No content</td></tr><tr><td>Reaction to fire</td><td>B-s1, d0</td><td>A2-s1, d0</td></tr></table> <table><tr><th>Property/requirement</th><th>Standard WW Panels</th><th>A2 Panels</th></tr><tr><td>Standard</td><td>WW-EN 13964</td><td>WW-EN 13964</td></tr><tr><td>Thermal Conductivity</td><td>0,072</td><td>0,074</td></tr><tr><td>Reaction to fire</td><td>B-s1, d0</td><td>A2-s1, d0</td></tr><tr><td>Release of Asbestos</td><td>No content</td><td>No content</td></tr><tr><td>Release of formaldehyde</td><td>E1</td><td>E1</td></tr><tr><td>Flexural tensile strength</td><td>Class 3/A No load</td><td>Class 3/A No load</td></tr><tr><td>Durability exposure</td><td>Class C</td><td>Class C</td></tr></table>	Property/requirement	Standard WW Panels	A2 WW Panels	Standard	WW-EN 13168	WW-EN 13168	Thermal Conductivity	0,072	0,074	Length	L2	L2	Width	W2	W2	Thickness	T1	T1	Squareness	S3	S3	Flatness	P1	P1	Compressive stress or strength	CS(10)200	CS(10)200	Density	No content	No content	Copatibility with other materials	Cl1	Cl1	Dim. Stab.	No content	No content	Reaction to fire	B-s1, d0	A2-s1, d0	Property/requirement	Standard WW Panels	A2 Panels	Standard	WW-EN 13964	WW-EN 13964	Thermal Conductivity	0,072	0,074	Reaction to fire	B-s1, d0	A2-s1, d0	Release of Asbestos	No content	No content	Release of formaldehyde	E1	E1	Flexural tensile strength	Class 3/A No load	Class 3/A No load	Durability exposure	Class C	Class C
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Main components and materials	An average Troldekt acoustic wood wool-cement panel contains cement, wood wool (spruce logs shavings) and water based paint. The size of the wood wool may be ultrafine (1 mm), fine (1.5 mm) or coarse (3 mm). See Table 1 for material inputs and quality of applied data.																																																															
Health classifications	Certified and labelled in accordance with Danish Indoor Climate Labelling as well as the Finnish emission class M1 for building materials. Troldekt acoustic panels are CE-labelled and comply with fire proofing requirements. Troldekt acoustic natural panels are cradle-to-cradle certified, since it does not contain substances harmful to human health.																																																															

<b>Reference service life</b>	In accordance with Troldekt A/S the service life of Troldekt acoustic panels is 50 years. This means that the anticipated use period of a panel is 50 years.
<b>Use (module B1)</b>	Module B1 regards the use of the Troldekt panel in terms of any emissions to the environment. The panels are certified and labelled in accordance with Danish Indoor Climate Labelling as well as the Finnish emission class M1 for building materials.
<b>Replacement (module B4)</b>	Since the DGNB system assumes a building lifetime of 50 years, which is equal to the expected service life of Troldekt acoustic panels, no replacement is expected. This is under the assumption of anticipated application.
<b>Operational energy use (module B6)</b>	There is no operational energy use during application of Troldekt acoustic wood wool-cement panels.
<b>Links to explanatory material</b>	<p>General product info: at <a href="http://www.troldekt.com">www.troldekt.com</a> on the page "Products" as well as under "Product generator" more product information is available.</p> <p>CE-labelling: at <a href="http://www.troldekt.com">www.troldekt.com</a> on the download page certificates regarding CE-marked according to EN 13168 as well as EN 13964 are found.</p> <p>Indoor Climate: at <a href="http://www.troldekt.com">www.troldekt.com</a> on the page "Environment", Troldekt's certification according to the best indoor climate categories by Danish Indoor Climate Labelling is found.</p> <p>Efficient fireproofing: at <a href="http://www.troldekt.com">www.troldekt.com</a> on the page "Efficient fireproofing" more info on declared fire classifications of Troldekt acoustic panels is found.</p>

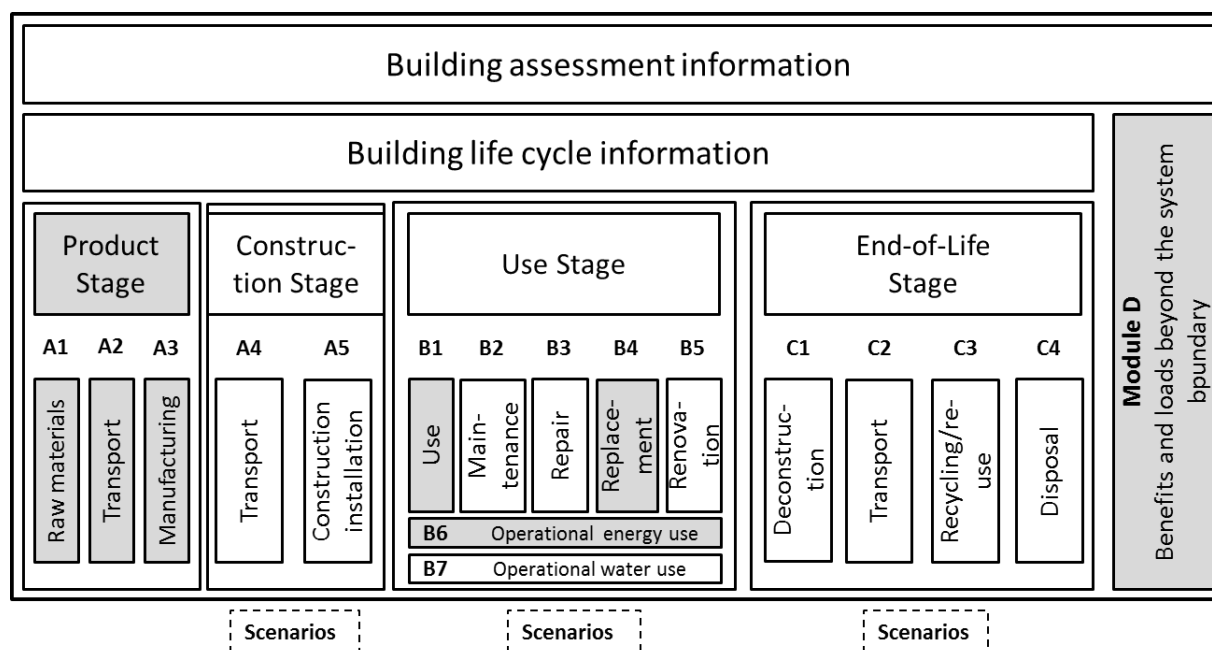
### 3 System boundaries

product manufacturing takes place in Denmark as well as the production of wood wool and cement.



**Figure 1 Overview of the production of Trolldtekt acoustic wood wool-cement panels**

Figure 2 shows the lifecycle modules of construction works, in accordance with EN 15804. The fields marked with grey are included in this EPD.



**Figure 2** Modular framework of EPD's in accordance with EN 15804 for construction works. The grey-colored modules are included in this EPD, which is adapted to the requirements of the DGNB system

## 4 Applied data

Regarding the manufacturing of Troldekt acoustic panels the applied data is based on annual consumption figures from the Troldekt production site. Where specific data from the material suppliers was not available, the GaBi 6.0 software database (version 5.56, service pack 22) was used to provide generic background data.

Table 1 shows the material inputs ending up in an average Troldekt acoustic panel as well as their relative masses in the panel. Furthermore, the quality of the data applied in the EPD is shown, i.e. whether it is specific data provided by producers or generic data taken from GaBi 6.0 software.

**Table 1** The table shows 1) the relative masses of materials in Troldekt acoustic wood wool-cement panels; 2) Quality of data applied: "Specific" (provided by Troldekt A/S or material supplier) or "Generic" (data from GaBi 6.0 database)

Materials in Troldekt acoustic panel and data quality				
	Relative mass (%)	Data quality		
		<i>Raw material production</i>	<i>Amount of material</i>	<i>Manufacturing process</i>
Wood, spruce logs	28-34	Generic	Specific	Generic
Cement	43-52	Specific	Specific	Specific
Water glass (Sodium Silicate)	1	Generic	Specific	Generic
Water	5-10	Generic	Specific	Specific
Paint, water based	1-2	Generic	Specific	Generic

## 5 Environmental profile

### 5.1 Environmental impacts

The input data to the EPD constitute the inventory used to estimate potential environmental impacts from the production of 1 m<sup>2</sup> average Troldekt acoustic panel. The environmental impacts are caused by the transportation, consumption of natural resources and the emissions linked to the production processes including transportation. The results are shown in Table 2.

Seven different impact categories are included in accordance with the guidelines in CEN EN 15804. The units of the seven categories differ, thus comparison across impact categories is not possible. Section 7 gives an explanation of the seven impact categories.

Table 2 Potential environmental impacts from the production of 1 m<sup>2</sup> Troldekt acoustic wood wool-cement panel

Environmental impacts per m <sup>2</sup> panel		
Impact category	Unit	Value
Global warming (GWP)	[kg CO <sub>2</sub> -eq.]	6.11
Ozone layer depletion (ODP)	[kg CFC-11-eq.]	2.99·10 <sup>-9</sup>
Acidification of soil and water (AP)	[kg SO <sub>2</sub> -eq.]	2.63·10 <sup>-2</sup>
Eutrophication (EP)	[kg PO <sub>4</sub> -eq.]	6.55·10 <sup>-3</sup>
Photochemical oxidants creation (POCP)	[kg ethen-eq.]	2.08·10 <sup>-3</sup>
Depletion of abiotic elements (ADP-elements)	[kg Sb-eq.]	6.10·10 <sup>-6</sup>
Depletion of abiotic, fossil resources (ADP-fossil)	[MJ, net calorific]	72.7

### 5.2 Resource consumption

Renewable and non-renewable resources are consumed in order to produce Troldekt acoustic panels. Table 3 shows the consumption of energy and material resources. The term "secondary" refers to resources recovered from previous use or waste. Secondary materials substitute primary materials extracted from natural, primary sources.

Table 3 Consumption of resources in the production of 1 m<sup>2</sup> Troldekt acoustic wood wool-cement panel

Resource consumption per m <sup>2</sup> panel		
Type of resource	Unit	Value
Renewable energy, primary	[MJ]	101
Non-renewable energy, primary	[MJ]	74.4
Renewable energy, secondary	[MJ, net calorific]	3.67
Non-renewable energy, secondary	[MJ, net calorific]	4.82
Secondary material	[kg]	0.710
Water	[m <sup>3</sup> ]	1.56

### 5.3 Waste

Regarding waste three different categories are included in accordance with CEN EN 15804; hazardous waste, non-hazardous waste and radioactive waste. Table 4 shows the generation of waste in all processes from extraction of raw materials to the production of Troldekt acoustic panels.

Table 4 Waste leaving the production system of Troldekt A/S per m<sup>2</sup> Troldekt acoustic wood wool-cement panel

Waste per m <sup>2</sup> panel		
Waste category	Unit	Value
Hazardous waste	[kg]	$1.30 \cdot 10^{-2}$
Non-hazardous waste	[kg]	5.41
Radioactive waste*	[kg]	$9.16 \cdot 10^{-4}$

\*Radioactive waste comes from the generic data of the GaBi software based on information provided by average German or European industrial processes, which includes the use of nuclear power for electricity (production of nuclear power generates radioactive waste). CEN EN 15941 ("Methodology for selection and use of generic data") states that there is no agreed approach available as yet for radioactive waste. This means that this value is highly uncertain and should not be taken literally to represent the Troldekt production.

### 5.4 Other output flows

Besides waste, output flows that are applicable for reuse, recycling or energy recovery can be generated. Table 5 shows the output flows from the production of Troldekt acoustic panels.

Table 5 Output flows leaving the production system of Troldekt acoustic A/S per m<sup>2</sup> Troldekt acoustic wood wool-cement panel

Other output flows per m <sup>2</sup> panel		
Flow category	Unit	Value
Materials for reuse	[kg]	$1.64 \cdot 10^{-3}$
Materials for recycling*	[kg]	0.670
Materials for energy recovery	[kg]	0

\*Reuse of excess paint

\*\*Compost applied as soil improver; comes from composting the cement-containing fraction of waste from the Troldekt production

## 6 Additional environmental information

This section covers relevant environmental benefits and loads that go beyond the system boundary of the EPD (corresponds to Module D in the modularity framework of EN 15804, see Figure 2).

### 6.1 Climate partnership with DONG Energy A/S

Troldtekt A/S and DONG Energy A/S have established a climate partnership, which is effectuated as of July 1 2013.

In the climate partnership Troldtekt A/S purchases RECS<sup>1</sup>-proofs from DONG Energy A/S. The number of RECS-proofs corresponds to 100 % of the electricity consumption at the Troldtekt production site. RECS-proofs ensure that the origin of the electricity purchased is renewable. In the climate partnership, DONG Energy A/S obliges to invest their net income, from Troldtekt A/S's purchase of RECS-proofs, in new wind power plants; creating additional renewable energy.

The climate partnership is included in the EPD, i.e. the EPD includes that 100 % of the electricity consumed at the Troldtekt production site comes from wind power.

For more elaborate description about the climate partnership, see Troldtekt A/S web page.

### 6.2 Cradle-to-cradle certification

Troldtekt acoustic natural (i.e. not painted) wood wool-cement panels obtained a Cradle-to-Cradle certificate (C2C) within the silver category. The international sustainability concept of C2C awarded Troldtekt natural acoustic panels with a silver category certification, since the panels do not contain harmful substances and can return to the environment as compost after use.

The C2C concept emphasizes the impacts of a product on human health and the environment as well as the potential of a product to be integrated in a future cycle of industrial materials.

For more information, see Troldtekt A/S web page.

### 6.3 CO<sub>2</sub> uptake in the life time of cement based products

It is documented that cement based products absorb CO<sub>2</sub> from the atmosphere by the carbonation process. Carbonation thus leads to reduced total CO<sub>2</sub> emissions when considering the entire lifecycle of cement based products. Pade and Guimaraes (2007) find that a proportion of the CO<sub>2</sub> emissions from the cement production (calcination of limestone) are absorbed back into the concrete over its lifetime. Troldtekt acoustic panels contain cement and it is expected that carbonation occurs in their thin layers of cement.

Reference: Pade C., Guimaraes M. (2007): The CO<sub>2</sub> uptake of concrete in a 100 year perspective. *Cement and Concrete Research*, 37, page 1348-1356.

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<sup>1</sup> RECS = renewable energy certificate systems

## 7 List of words

Environmental impact category	Explanation
Global warming (GWP)	Increase in the global atmospheric mean temperature. Caused by increased concentration of greenhouse gases, which absorb and reflect heat from the Earth surface.
Ozone layer depletion (ODP)	Ozone layer depletion in the upper part of the atmosphere. Caused by emission of substances, e.g. CFCs, which have long life times in the atmosphere and are ozone degradable.
Acidification of soil and water (AP)	Drop in the pH value of natural terrestrial and water systems. Caused by emitted acids and acidifying substances.
Eutrophication (EP)	Disturbed nutrition balance in soil and water recipients due to increased emissions of nutrients, e.g. nitrogen. This may lead to oxygen depletion.
Photo chemical oxidants creation (POCP)	Ozone generation (smog) in lower part of the atmosphere, which is toxic to human beings and vegetation.
Depletion of abiotic elements (ADP-elements)	Non-renewable resources are metals and minerals. Consumption is relative to the amount of available Sb-reserves; Sb is an atom designated Stibium.
Depletion of abiotic, fossil resources (ADP-fossil)	Fossil fuels such as oil, gas and coal, which originates from underground material. The characterization factors are the net calorific value at the point of extraction of the fossil fuel.
<b>Other</b>	
Re-use	Direct application of a used product/material in its original form, e.g. reuse of bottles.
Recycling	Application of a used product/material in new form, e.g. after melting.
Energy recovery	Recovery of a used product/material's energy content, e.g. via waste combustion.
Hazardous waste	Covers a range of fractions which constitute fire, health and environmental hazards.
Non-hazardous waste	Covers household waste and industrial waste similar to household waste.
Radioactive waste	Contains atoms that are able to emit ionizing radiations, e.g. waste from nuclear power plants.