

Environmental Product Declaration

In accordance with ISO 14025 and EN 15804+A1 For:

Divinycell PET grades

From

Diab



General information

Information about the organization

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The EPD owner has the sole ownership, liability, and responsibility for the EPD.

Description of the organisation: Diab is a world leader in high-performance composite core materials. Diab has developed composite core material development for over sixty years, supplying a wide range of markets including marine, wind energy, transport, aerospace and industry.

Diab has ISO 9001- and 14001-certificates

Name and location of production site: Diab produces PET core materials at one location in Longarone, Italy.

About the company

Diab is a global company that develops, manufactures and sells core materials for sandwich composite structures used in for example leisure boats, wind turbine blades and components for aircraft, trains, industrial applications and buildings. The core materials have a combination of characteristics such as low weight, high strength, insulation properties and chemical resistance.

The company has production units in Sweden, Italy, the US and China. Material processing takes place in the production units as in Lithuania and Ecuador as well.

The market for core material is growing due to the underlying demand for energy efficiency, which is leading to a greater need for high-strength, lightweight solutions. Wind turbines, leisure boats and various applications requiring the combination of lightweight and high strength are the main application areas for the material.

Product information

Product name: Divinycell P, PX, PN, PNX, PY

Product identification: PET foam is manufactured from the polymer Polyethylene Terephthalate, PET, which results in a thermoplastic foam.

Product description:
Divinycell PET grade products are available in sheets from approximately 120 mm:s thickness down to 0,5 mm, further it can be milled and

grooved to various structures according to customer request. The PET core is used in various sandwich constructions.

All Divinycell PET grades has good thermal stability and are recyclable.

UN CPC code: 363 (semi-manufactures of plastics)

Geographical scope: Italy

LCA information

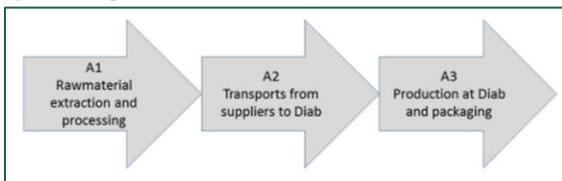
Functional unit / declared unit: 1 kg lightweight PET core material block

Reference service life: Minimum 25 years

Time representativeness: Data representative for production year 2017. For materials, energy and transports generic industry data from Ecoinvent has been used. Assessment time for background data is 2010-16.

Database(s) and LCA software used:
Ecoinvent 3.3 and SimaPro 8.3

System diagram:
This is a cradle to gate EPD. The following life cycle stages are included:



See also table below for modules not declared

Description of system boundaries:
A1: Extraction and processing of raw materials and Generation of electricity, steam and heat from primary energy resources
A2: Transports from suppliers to Diab and in between production units
A3: Manufacturing of the product at Diab and packaging materials used. No co-production

Estimates and assumptions: Heat, electricity use and other energy use as well as waste in production are calculated as an average per produced kg of all products using yearly production data and rate for 2017 from the production location in Italy. Waste information has been taken from both Laholm and Longarone.

There are different grades within the PET product range where the content of substances vary. This EPD represents an average PET product and covers all grades.

Cut off criteria: All major materials, production energy use and waste are included. Materials less than 1% weight in the PET grades are not taken into account.

Data quality: The data quality can be described as fair to good. The primary data collection has been done thoroughly, all relevant flows are considered.

The variation in material composition for different grades will lead to variation in environmental impact. Considering this, it is estimated that the variation in environmental impact is within +/- 5% compared to the figures in this EPD report.

Life cycle environmental information of							Other environmental information
Product stage			Construction process stage		Use stage	End of life stage	
A1	A2	A3	A4	A5	B1-B7	C1-C4	Reuse recovery stage
X	X	X	MND	MND	MND	MND	D
							MND

Description of the system boundary (X = included in LCA; MND = Module Not Declared)

Content declaration

Product

Materials / chemical substances	%
PET	< 100
Cyclopentane	< 4
Talc	< 2
Bis (pentabromophenyl) ethane	0-1

There are no SVHC substances according to REACH in the product or in the waste.

Packaging

Distribution packaging: Corrugated board and PE packaging film

Consumer packaging: Same as distribution packaging

Recycled material

Provenience of recycled materials (pre-consumer or post-consumer) in the product: NA

Interpretation of LCA results

Environmental impact for 1 kg Divinycell PET grade lightweight core material block is mainly caused by extraction and processing of materials like PET used in the recipe of the product (calculated in module A1). Impact in A1 is further increased by product waste from cutting and manufacturing the final product to the desired customer shape. Impact from other waste in the process is insignificant. Impact for extraction of natural gas and generation of electricity are also calculated in module A1.

More than 95% of the greenhouse warming potential comes from raw materials in the product. For impact factors acidification and eutrophication potential raw materials in A1 also accounts for more than 95% of the total.

Sea and land transport is used to ship materials from suppliers to Diab production facilities. Environmental impact from these transports is calculated in module A2 and is small in relation to impact in module A1 but similar to A3.

In module A3, environmental impact from energy use and packaging material is calculated. Impact is mainly coming from use of natural gas in the manufacturing process. Impact from packaging materials leaving the factory with products is low.

Greenhouse warming potential from A2 and A3 is similar and accounts together for less than 5% of the total potential. For impact factors acidification and eutrophication potential A2 and A3 also accounts for less than 5% of the total for A1+A2+A3 together.

Environmental performance

Potential environmental impact/kg PET

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO ₂ eq.	3,99	0,09	0,03	4,12
Depletion potential of the stratospheric ozone layer, ODP	kg CFC-11 eq.	2,13x10 ⁻⁷	1,32x10 ⁻⁸	2,65x10 ⁻⁹	2,28x10 ⁻⁷
Acidification potential (AP)	kg SO ₂ eq.	1,50x10 ⁻²	2,96x10 ⁻⁴	1,11x10 ⁻⁴	1,54x10 ⁻²
Eutrophication potential (EP)	kg PO ₄ ³⁻ eq.	4,17x10 ⁻³	8,30x10 ⁻⁵	5,69x10 ⁻⁵	4,31x10 ⁻³
Formation potential of tropospheric ozone (POCP)	kg C ₂ H ₄ eq.	9,21x10 ⁻⁴	8,87x10 ⁻⁶	5,91x10 ⁻⁶	9,35x10 ⁻⁴
Abiotic depletion potential – Elements	kg Sb eq.	4,77x10 ⁻²	6,06 x10 ⁻⁴	2,72x10 ⁻⁴	4,86x10 ⁻²
Abiotic depletion potential – Fossil resources	MJ, net calorific value	107	1,41	0,61	109

Use of resources/kg PET

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	2,63	1,38x10 ⁻²	0,33	2,97
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	2,63	1,38x10 ⁻²	0,33	2,97
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	56,6	1,41	0,53	58,6
	Used as raw materials	MJ, net calorific value	50,0	0	8,00x10 ⁻²	50,1
	TOTAL	MJ, net calorific value	107	1,41	0,61	109
Secondary material	kg	0	0	0	0	
Renewable secondary fuels	MJ, net calorific value	0	0	0	0	
Non-renewable secondary fuels	MJ, net calorific value	0	0	0	0	
Net use of fresh water	m ³	0,15	7,75x10 ⁻²	8,00x10 ⁻²	0,30	

Waste production and output flows

Waste production/kg PET

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	0	0	0	0
Non-hazardous waste disposed	kg	1,13x10 ⁻²	0	0,26	0,27
Radioactive waste disposed	kg	4,04x10 ⁻⁶	0	3,20x10 ⁻⁶	7,24 x10 ⁻⁶

Output flows/kg PET

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Components for reuse	kg	0	0	0	0
Material for recycling	kg	0	0	$1,10 \times 10^{-2}$	$1,10 \times 10^{-2}$
Materials for energy recovery	kg	0	0	$3,40 \times 10^{-2}$	$3,40 \times 10^{-2}$
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

Additional product information

PET foam, gathered in the different Divinycell grades as P, PX, PN, PNx and PY, is manufactured from the polymer Polyethylene Terephthalate, which results in a thermoplastic foam. The main products are available in sheets from approximately 120 mm:s thickness down to 0,5 mm, further it can be milled and grooved to various structures according to customer request.

All Divinycell PET grades have good thermal stability and mechanical properties. However, to achieve physical properties comparable with Divinycell IPN grades and other similar core materials on the market, higher densities needs to be used.

All Divinycell PET grades are recyclable, thermoplastic sandwich core materials. Divinycell PET grades are particularly suited for public transportation, industrial and wind energy applications. The energy efficiency of a Divinycell PET sandwich makes it good for transport applications such as interior panelling, floors and exterior panels for trans, trams, buses and coaches. In the wind energy market the good properties and processing characteristics means it can be used in both blades and nacelles. In the industrial/ construction market, the good mechanical and FST (Fire, Smoke and Toxicity) of Divinycell PET grades allow them to be used for a wide variety of applications such as domes, architectural claddings and industrial housings. They are easily thermoformed and used in pultrusion moulding.

Technical data

Datasheets and test methods for all specific grades are available for all Divinycell PET grades on our website www.diabgroup.com.

Delivery status

The products are delivered as ordered, which varies from standard plain sheet size to complex milled details requiring specially constructed packages.

Base materials and manufacture

Divinycell PET-grades are produced from PET-resin, blowing agent and smaller amounts of additives. Flame retardants are added in Divinycell P grades for FST applications.

The main production steps are as follows:

- The raw materials are continuously added in the beginning of the extruder.
- Dependent on the recipe used and process parameters in the extruder different grades are produced.
- At the end of the extruder, from the dye, the matrix continuously exits and the foam forms immediately.
- The foam is then transported on a long conveyer in order to cool down and the foam is then cut into sheets in desired dimensions.

- Most of the grades are then turned perpendicular to the extruding direction and welded together in order to achieve the most favourable mechanical properties in the right directions.

Product processing

All Divinycell PET grades are core materials used for sandwich structure. These composites are a special class of composite materials with the typical features of low weight, high stiffness and high strength. Sandwich is fabricated by attaching two thin, strong and stiff skins, laminates to a lightweight core.

Packaging

Generally the material is packed using cardboard, stretch film (LLDPE) and packaging tape (PP).

Environment and health during use

Inhalation: No fumes or inhalation hazard at normal use temperatures.

Skin contact: Foam is not irritating to skin.

Eye contact: By direct contact with shaving or dust, irrigate with flowing water. Consult medical personnel if irritation persists.

Ingestion: Material is non-toxic, consult medical personnel if large amounts have been swallowed.

The foam material is *not hazardous* under normal handling and storage conditions.

The primary hazard is dust generation during processing with cutting, sanding and sawing operations. Dust mask protection should be used when performing these types of operations. The dust will ignite if given sufficient ignition source. The dust should be processed in a way to avoid static sparks and accumulation of extra dust in the manufacturing area with good cleaning practices in the manufacturing areas. Molten product adheres to the skin and causes burns.

End of life

The material is considered chemically inert and is not expected to present a risk if mechanically destructed.

The scrap occurring during the internal production phase is recycled in to the process again.

If the Divinycell PET material is dismantled from the sandwich construction it can be taken back to Diab for re-use in recycled Divinycell PET grades or recycled in other external facilities

The foam material is not classified as a hazardous waste material. Consult local authorities when handling larger quantities of waste

- Not flammable organic waste
- Not environmentally hazardous waste
- Waste class: Not hazardous waste
- Waste code (EWC): 07 02 13

References

EN 15804:2010-08 Sustainability of construction works - Environmental Product Declarations
- Core rules for the product category of construction products

Product Category Rule 1201 - Construction products and services V2

Greenhouse Gas Protocol (Dual Reporting) Report for Diab dated Jan. 19, 2018

Ecoinvent 3.3 database, <http://www.ecoinvent.org/>

LCA software SimaPro Analyst 8.3

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