

# Environmental Product Declaration

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

## **Divinycell IPN grades**

From

**Diab**



**Diab**

## General information

### Information about the organization

Owner of the EPD: Per Hökfelt/Eva-Lotta Petersson, [per.hokfelt@se.diabgroup.com](mailto:per.hokfelt@se.diabgroup.com), [eva-lotta.petersson@se.diabgroup.com](mailto:eva-lotta.petersson@se.diabgroup.com), +46 430 163 00, Diab, Box 201, S-312 22 Laholm  
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 materials 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 IPN core materials at three locations, Laholm in Sweden, Longarone in Italy and Zhangjiagang in China.

## 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 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: within IPN grades: Divinycell H, HP, HM, HCP, HT, MX and CY

Product identification: Divinycell IPN grades (Interpenetrating Polymer Network)

Product description:

Divinycell IPN grades is a mixture of thermo-plastic PVC and thermoset polyurea and polyamide. The main products are available in

sheets ranging from approximately 90 mm thickness down to 0,5 mm, further it can be milled and grooved to various structures according to customer request. The IPN core is used in various sandwich constructions

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

Geographical scope: Global

## LCA information

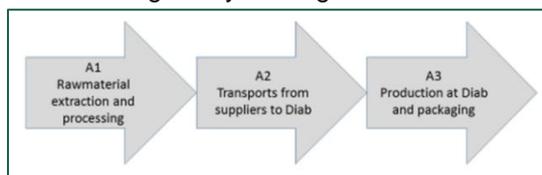
Functional unit / declared unit: 1 kg lightweight Divinycell IPN core material block

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 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 for each production location.

IPN grades are produced at three locations. A weighted average for energy use in production of IPN has been calculated based on the 2017 production output from the three production factories for IPN (Laholm 33%, Longarone 52% and Zhangjiagang 15%). For waste information from Laholm has been taken as representative for Longarone and Zhangjiagang.

There are different grades within the IPN product range where the content of substances vary. This EPD represents an average IPN 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 IPN 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.

Environmental impact from production at the three locations, Laholm, Longarone and Zhangjiagang vary depending on country energy sources. The variation in material composition for different grades will also lead to variation in environmental impact. Taking these factors in consideration it is estimated that the variation in environmental impact is within +/- 10% 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	%
PVC	30-75
Aromatic polyurea	15-50
Polyamide	3-10

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: N/A

### Interpretation of LCA results

Environmental impact for 1 kg Divinycell IPN grade lightweight core material block is mainly caused by extraction and processing of materials like PVC and isocyanates 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. Approximately 80% of the greenhouse warming potential comes from raw materials in the product. For impact factors acidification and eutrophication potential raw materials accounts for more than 90% of the total.

Impact for extraction of natural gas and generation of electricity are also calculated in module A1. Impact from generation of electricity is a mix from Sweden, Italy and China in proportion to the production output from factories in these countries.

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 and 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. Almost 20% of the total greenhouse warming potential comes from natural gas used in the process. For impact factors acidification and eutrophication, natural gas in the process raw materials accounts for less than 5% of the total potential for A1+A2+A3 together.

## Environmental performance

### Potential environmental impact/kg IPN

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Global warming potential (GWP)	kg CO <sub>2</sub> eq.	5,89	0,12	1,59	7,60
Depletion potential of the stratospheric ozone layer, ODP	Kg CFC-11 eq.	7,87x10 <sup>-6</sup>	1,73x10 <sup>-8</sup>	1,88x10 <sup>-7</sup>	8,08x10 <sup>-6</sup>
Acidification potential (AP)	kg SO <sub>2</sub> eq.	2,57x10 <sup>-2</sup>	5,77x10 <sup>-4</sup>	1,49x10 <sup>-3</sup>	2,78x10 <sup>-2</sup>
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> eq.	3,62x10 <sup>-3</sup>	1,38x10 <sup>-4</sup>	2,78x10 <sup>-4</sup>	4,04x10 <sup>-3</sup>
Formation potential of tropospheric ozone (POCP)	kg C <sub>2</sub> H <sub>4</sub> eq.	1,26x10 <sup>-3</sup>	1,41x10 <sup>-5</sup>	1,18x10 <sup>-4</sup>	1,40x10 <sup>-3</sup>
Abiotic depletion potential – Elements	kg Sb eq.	6,72x10 <sup>-2</sup>	7,69x10 <sup>-4</sup>	1,35x10 <sup>-2</sup>	8,15x10 <sup>-2</sup>
Abiotic depletion potential – Fossil resources	MJ, net calorific value	158	1,76	27,6	188

### Use of resources/kg IPN

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3	
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	5,51	9,21x10 <sup>-3</sup>	0,38	5,91
	Used as raw materials	MJ, net calorific value	0	0	0	0
	TOTAL	MJ, net calorific value	5,51	9,21x10 <sup>-3</sup>	0,38	5,91
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	124	1,76	27,5	154
	Used as raw materials	MJ, net calorific value	34,3	0	8,00x10 <sup>-2</sup>	34,3
	TOTAL	MJ, net calorific value	158	1,76	27,6	188
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 <sup>3</sup>	0,62	5,21x10 <sup>-2</sup>	0,21	0,87	

### Waste production and output flows

#### Waste production/kg IPN

PARAMETER	UNIT	A1	A2	A3	TOTAL A1-A3
Hazardous waste disposed	kg	0	0	0	0
Non-hazardous waste disposed	kg	1,20x10 <sup>-2</sup>	6,03x10 <sup>-5</sup>	0,27	0,28
Radioactive waste disposed	kg	4,05x10 <sup>-6</sup>	5,07x10 <sup>-10</sup>	3,20x10 <sup>-6</sup>	7,25x10 <sup>-6</sup>

### Output flows/kg IPN

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	$1,50 \times 10^{-1}$	$1,50 \times 10^{-1}$
Exported energy, electricity	MJ	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0

## Additional product information

Divinycell IPN grades provide excellent mechanical properties to low weight. Other key features of Divinycell IPN grades include adhesion/peel strength, excellent chemical resistance, low water absorption and good thermal/acoustic insulation. Divinycell IPN grades have been widely used and has a proven record of accomplishment in many application areas where sandwich composites are employed including the marine (leisure, military and commercial), land transportation, wind energy, civil engineering/infrastructure, buildings and general industrial markets.

### Technical data

Datasheets and test methods for all specific grades are available for all Divinycell IPN-grades on our website [www.diabgroup.com](http://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 IPN grades are produced from PVC, isocyanates, anhydrides, chemical blowing agents and additives in a process containing the main steps as follows:

- Mixing of raw materials to a homogeneous plastisol.
- Filling the plastisol into moulds followed by putting them into presses and adding heat and pressure. This creates a rubbery small visually solid block, SLAB
- The SLAB is expanded and further cured in heated water / steam environment in different chambers with varying temperatures related to which grades that are produced. Here the final block is created and all chemical reactions are finalized. All the following process steps are pure machining.
- Cutting, sawing and milling of the blocks according to customer specification.
- Some grades for special applications also have a heat treatment step after sawing to sheets in order to further stabilize the dimensions.
- The products are finally packed and shipped to customer.

### Product processing

Divinycell IPN 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. Molten plastic may emit fumes; exposed individuals should be moved to fresh air.

*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 but when machining ensure good ventilation for dust reduction.

When exposed to a direct flame, the material can generate carbon dioxide, CO<sub>2</sub>, hydrogen chloride, HCl and hydrogen cyanide (HCN). As soon as the direct flame is removed, the material self-extinguishes. 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.

### **End of life**

The material is considered chemically inert and is not expected to present a risk if mechanically destructed. If the Divinycell IPN material is dismantled from the sandwich construction it can be taken back to Diab for re-use.

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

Certificate for 100% renewable energy used in Laholm during 2017. Nordic Green Energy

### Contact information:

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