VALIDATED ENVIRONMENTAL PRODUCT DECLARATION

TEXBOND R®

REINFORCEMENT FOR BITUMINOUS MEMBRANES MADE OF RECYCLED STAPLE POLYESTER

EPD®

Revision 1.2 - August 2017
CPC 27922: Nonwovens for other purposes than clothing
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Geographical Scope: Global

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1. DESCRIPTION OF THE COMPANY AND OF THE PRODUCT

1.1 The Global Division Building Materials

The Global Division Building Materials belongs to the Freudenberg Performance Materials Group, world leader in the nonwovens market for different applications. The Global Division's core business, with its headquarters in Italy in Novedrate (Como), is the production of polyester nonwovens, made using both staple and spunbonded technology.

The main market of the Group is the construction sector, where nonwovens of the "Roofing" division are sold as reinforcement for bituminous membranes for roofs waterproofing. The "Construction Materials" division includes a complete range of finished products for different applications: thermal insulation, acoustic insulation, underfloor soundproofing, waterproofing, reinforcement for walls and roads, underslating protection and geotextiles.

The majority of products are manufactured using recycled raw materials, recovered and upgraded in-house, thanks to vertically integrated processes. The production of polyester starts with the recycling of post-consumer PET bottles, which are sorted, washed and ground to flakes. The flakes are then used in the production of fiber or directly in the spunbond process.

Freudenberg Performance Materials belongs to the Freudenberg Group, which comprises 12 Business Groups operating independently on various markets all over the world.

1.2 The production sites

The Global Division Building Materials, with an organizational structure capable of creating products to meet the needs of diverse markets around the world, operates out of six production sites: three in Italy, with two plants at Novedrate (Como) and one at Pisticci (Matera), one in France at Colmar, one in Russia in Nizhniy Novgorod and one in the United States at Macon (Georgia). Completing the organization of the Group are one trading companies in China at Shanghai and a comprehensive sales network.

1.3 Responsibility and the Environment

The Global Division Building Materials operations obtained the following certifications:

- ISO 9001 – Quality Management System
- ISO 14001 – Environmental Management System
- OHSAS 18001 – Health and Safety Management System

In Italy the Group joined Responsible Care, the voluntary programme of the global chemical industry, under which businesses commit themselves to the continuous improvement of products, processes and behaviour in the areas of Safety, Health and the Environment, in order to give a significant contribution to the sustainable development of industry, local communities and society.
All companies in the Global Division Building Materials adopt Corporate Governance rules and **Guiding Principles** (www.freudenberg-pm.com), highlighting responsibility with regard to People, the Environment and Safety in all fields of activity.

1.4 The product

Texbond® is a polyester fiber nonwoven manufactured with staple technology, available in numerous weights capable of meeting a wide range of technical requirements to satisfy the different needs of global markets.

The fiber used is produced in-house by Global Division Building Materials through the recycling of post- consumer PET bottles. The special spinning process makes it possible to give the product excellent levels of resistance and stability.

The version **Texbond® R**, manufactured entirely in the production site in Novedrate (CO), is always a staple polyester nonwoven, reinforced with glass filaments in machine direction.
The combination of the flexibility of polyester with the stability of glass not only allows excellent runnability of the nonwoven, especially at high temperatures and when used on high-speed bitumen lines, but also gives the bituminous membrane outstanding dimensional stability and resistance over time.
Using glass reinforcement also eliminates the phenomenon of thermal memory: once applied to roofs, the membrane is not subject to shrinkage due to temperature changes.
The final application of **Texbond®** is the bituminous membrane, obtained from the process of bitumen impregnation of the nonwoven at the production sites of membrane manufacturers and then used for the waterproofing of roofs. For the LCA study of the finished product reference has to be made to any analysis carried out by bituminous membranes manufacturers.

Nonwovens of the **Texbond®** family are available in numerous weights, both in the standard and the glass reinforced version.

	Texbond® R					**U.o.m.**
Weight	70	120	150	180	270	g/m^2
Thickness	0,65	0,90	1,00	1,10	1,40	mm

This EPD is based on the LCA study carried out on the product **Texbond® R** and reports data of the product with average weight of **150 g/m^2**.

Here below are the technical features of the product **Texbond® R** analyzed in the study:

			Texbond® R 150	U.o.m.
Weight	ISO 9073-1		150	g/m^2
Thickness	ISO 9073-2		1,00	mm
Max. tensile strength	ISO 9073-3	MD CD	33 25	daN/5cm
Elongation at break	ISO 9073-3	MD CD	20 33	%

1.5 Composition – declaration of content

The product does not contain substances that are listed in the "Candidate List of Substances of Very High Concern (SVHC) for authorisation".

Product type	% weight	(thereof) % recycled
Polyester PET	79	100
Synthetic Resins	9	
Bio resin	6	
Glass fibers	6	
Total	**100**	

2. ENVIRONMENTAL PERFORMANCE DECLARATION

The data represented below are based on the Life Cycle Assessment (LCA) study carried out on the product **Texbond® R**, with the aim to inform the public and the interested parties about the environmental performance of their production process.
The methodology used follows the rules described in the norm ISO 14044:2006, in line with the International EPD System.
The reasons of the LCA study arose from the need to have a precise processes accounting and to highlight potential improvements that could be started in order to increase the processes and to reduce even more the environmental impacts. In addition the purpose was to quantify the environmental advantages deriving from the use of non virgin raw material.

2.1 The Evaluation Method

The environmental performance quantification has been carried out as provided by the PCR 2012:01 Construction Products and Construction services (version 2.2) according to the Life Cycle Assessment (LCA) methodology.

2.2 The Declared Unit

The declared unit of the study is represented by **1 m²** of **Texbond® R** in 150 g/m² grammage.
Carbon footprint information is represented for product surface of 1 kg.

2.3 The system boundaries

The LCA developed is a "Cradle to Gate" type, measuring from A1 phase (production of raw materials) to A3 phase (production). The phases from A4 to C4 depend from the applications of the final product.
The Upstream Processes include the phase A1 (raw materials extraction and secondary raw materials treatment).
The Core Processes include the A2 (transportation to the factory) and A3 phase (production).

X= Included MND = Module Not Declared

Product stage			**Construction process stage**		**Use stage**							**End of life stage**				**Recovery stage**
Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction, demolition	Transport	Waste processing	Disposal	Reuse, recycling or energy recovery potentials
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Upstream Processes include:

- extraction and production of raw materials for components and packaging;
- manufacturing of semi-finished goods;
- manufacturing of additives (caustic soda, floating, surface-active, etc.);
- production processes for components and packaging;
- process of post-consumer PET bottles collection and selection (transports included);
- generation of electricity.

Core Processes include:

- transports: from the supply of semi-finished goods and of consumables to the conveyance of waste recovery;
- internal transports;
- manufacturing of input materials;
- manufacturing processes for the production;
- consumption of water.

The Downstream Processes including distribution, use and end of life management, have been considered from a qualitative point of view because of the impossibility to outline a realistic reference scenario with appropriate data.

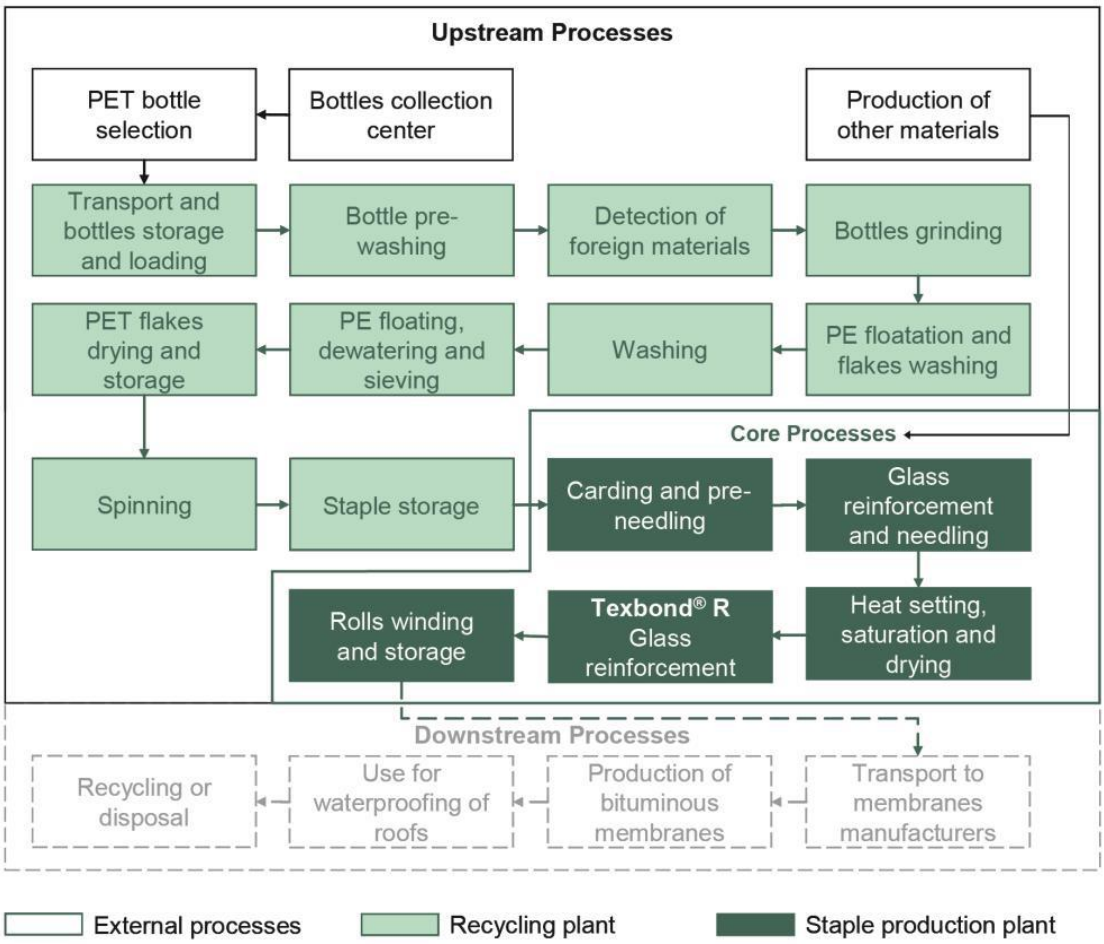

Figure 1. Scheme of the production process of **Texbond® R**

Texbond® is distributed all over the world and the lifecycle of a bituminous membrane, installed on a roof, is estimated to be over 20 years.

In some cases the old damaged roofs are repaired with new additional layers, therefore the lifecycle of the membrane is prolonged and consequently also that of the nonwoven. In other cases the old roof is completely removed and the waste material is recovered mainly sending it to energy valorisation or with the reuse in road applications.
In the case of energy valorisation, each kilo of finished product has a calorific value (feedstock energy) of about 33 MJ which can be converted into useful energy. This feedstock energy is included in the energy from waste present in recycled PET bottles and represents the energy savings that is achieved by using recycled raw materials for the production of the nonwoven.

The use of recycled raw material for the production of nonwovens allows an upstream energy saving. **Texbond®** fits in at the end of a virtuous cycle which increases the value and concretises the activities of the recycling chain and the efforts of citizens in sorting waste.

2.4 Cut-off and allocation principles

The processes contributing for less than 1% of the total environmental impact for each impact category have been omitted from the inventory.
In the study the allocation is used only for the part concerning utilities (electrical energy, thermal power, methane gas) on the basis of the consumption of the distinct departments (see figure 1).

2.5 Data quality

Data refer to the year 2016 and were collected in Global Division Building Materials site in Novedrate (CO), Italy. The calculation model adopted is SimaPro and the database Ecoinvent.
The contribution of the other generic data to each impact category is below 3%.
Data concerning energy aspects refers to cogeneration plant, with the exception of the process for the realization of part of raw materials, for which reference was made to the European mix.
The data collection was conducted in compliance with the modalities contained in the ISO 14044:2006 and the EN 15804:2012+A1:2013.

2.6 Environmental profile of the product

To have univocal environmental information the impact categories have been analyzed in line with what requested by the indications of the Environmental Product Declaration (EPD) and referred to the production process illustrated in Figure 1.

The following table shows the environmental performances relevant to the production of **Texbond® R**, divided into information about the natural resources consumed (energetic and otherwise).

Use of Resources Texbond R	Unit of measure	Results per 1 m^2				Results per 1 kg
		A1 Raw material supply	A2 Transport	A3 Manufacturing	TOTAL	TOTAL
Renewable primary energy (raw materials)	MJ	0,000	0,000	0,000	0,000	0,000
Renewable primary energy (excl. raw materials)	MJ	0,216	0,000	0,002	0,218	1,454
Total use of renewable primary energy	**MJ**	**0,216**	**0,000**	**0,002**	**0,218**	**1,454**
Non-renewable primary energy (excl. raw materials)	MJ	4,753	0,011	0,739	5,503	36,697
Non-renewable primary energy (raw materials)	MJ	0,110	0,000	0,000	0,110	0,732
Total use of non-renewable primary energy	**MJ**	**4,863**	**0,011**	**0,739**	**5,613**	**37,429**
Use of secondary material	kg	0,119	0,000	0,000	0,119	0,790
Use of renewable secondary fuels	MJ	0,000	0,000	0,000	0,000	0,000
Use of non-renewable secondary fuels	MJ	0,000	0,000	0,000	0,000	0,000
Use of net fresh water	m3	0,001	0,000	0,000	0,001	0,004

Table 1. Total consumption of resources associated to the production of **Texbond® R**

The results of the characterization of the impacts are shown in the following table 2.

Potential Environmental Impacts Texbond R	Unit of measure	Results per 1 m^2				Results per 1 kg
		A1 Raw material supply	A2 Transport	A3 Manufacturing	TOTAL	TOTAL
Global warming (GWP_{100})	kg CO2eq	0,279	0,000	0,043	0,322	2,148
Ozone depletion	kg CFC11eq	0,000	0,000	0,000	0,000	0,000
Photochemical ozone creation	g C2H4 eq	0,039	0,000	0,003	0,042	0,278
Acidification	g SO2 eq	0,570	0,000	0,037	0,607	4,050
Eutrophication	g PO4---eq	0,210	0,000	0,006	0,216	1,443
Depletion of abiotic resources (elements)	kg Sb-eq	0,000	0,000	0,000	0,000	0,000
Depletion of abiotic resources (fossil)	MJ	6,454	0,011	0,000	6,465	43,106

Table 2. Potential contribution to the main environmental effects for the production of **Texbond® R**.

3. OTHER ENVIRONMENTAL INFORMATION

In the description of the environmental impacts of a product it is important to take into consideration the waste generation. For what concerns **Texbond® R**, table 3 shows the total waste generated in the different processes.

Waste Terbond R	Unit of measure	Results per 1 m^2				Results per 1 kg
		A1 Raw material supply	A2 Transport	A3 Manufacturing	TOTAL	TOTAL
Hazardous waste disposed	kg	0,002	0,000	0,000	0,002	0,014
Non-hazardous waste disposed	kg	0,057	0,000	0,008	0,065	0,436
Radioactive waste disposed/stored	kg	0,000	0,000	0,000	0,000	0,000
Total waste	**kg**	**0,059**	**0,000**	**0,008**	**0,067**	**0,450**

Table 3. Total production of hazardous and non hazardous wastes during the production process of the **Texbond® R** nonwoven (data expressed in kg)

For the production of 1 kg of **Texbond® R** are needed 1,21 kg of post consume PET bottles.

As an indication, here below the values of **Carbon Footprint** are represented for the different weights for m^2 of product (table 4):

Texbond R®	120	**150**	170	180	220	250	270	g/m^2
Global warming potential (GWP_{100})	0,26	**0,32**	0,36	0,39	0,47	0,54	0,58	$kgCO_2eq/m^2$

Table 4. GWP_{100} for different weights for m^2 of product

4. SIGNIFICANT CHANGES FROM THE PREVIOUS VERSION

Compared to the previous EPD version, in this document, the new PCR was adopted.

5. INFORMATION ABOUT THE ORGANIZATION AND THE VERIFIER

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For further information
Further information about The Global Division Building Materials and the product **Texbond®** are available on the web www.freudenberg-pm.com.
Further information about International EPD® system is available on the web www.environdec.com.

Present EPD and the PCR (PCR 2012:01 Construction products and Construction services version 2.2) are available on the internet site www.environdec.com.

EPD of construction products may not be comparable if they do not comply with EN 15804. Environmental product declarations within the same product category from different programs may not be comparable.

The LCA study and the present EPD have been issued by GIFIN srl with the technical scientific support of the University of Basilicata Matera (Italy) and of the Eng. Francesca Intini.

CEN standard EN 15804 served as the core PCR	
PCR:	PCR 2012:01 Construction products and construction services, Version 2.2
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact: info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification ☒ EPD verification
Third party verifier:	Adriana Del Borghi adry@unige.it
Accredited or approved by:	“The International EPD® System”

6. REFERENCES

1. Life Cycle Assessment (LCA) applied for the product **Texbond® R**, rev. 1.2, August 2017.
2. IEC (2015), General Programme Instructions for Environmental Product Declarations, EPD. The International EPD Corporation. Document version 2.5. Available at www.environdec.com.
3. PCR 2012:01 Construction products and construction services, ver. 2.2, 2017-05-30. www.environdec.com
4. ISO 14040:2006, Environmental management - Life cycle assessment - Principles and framework.
5. ISO 14025:2006 Type III – Environmental labels and declarations – Type III environmental declaration – Principles and procedures.
6. ISO 21930, Environmental declaration of building products.
7. EN 15804:2012+A1:2013, Sustainability of construction works — Environmental product declarations
8. Publications on International Journal of Life Cycle Assessment.

7. GLOSSARY

The Global Warming Potential (GWP100) is a measure of the greenhouse effect and it indicates the ratio between the warming caused by a certain type of greenhouse gas in a period of 100 years and the warming caused by the same mass of carbon dioxide (whose GWP is by definition 1) in the same period. The GWP is measured in $kgCO_2eq$.

The stratospheric **Ozone Depletion Potential** is the indicator of the gradual degradation of the stratosphere ozone layer, referring to the presence in the atmosphere of a number of chemical compounds attacking ozone. The substance used as comparison to evaluate the effect of the other substances is CFC-11 (chlorofluorocarbons), therefore CFC-11 eq.

Acidification is a phenomenon in which atmospheric precipitations have a lower pH (measuring the acidity of water) than normal, causing damages to forests and cultivated crops, as well as to aquatic ecosystems and objects. It is measured with the factor of Acidification Potential (AP) estimated for each substance in terms of SO_2 eq.

Photochemical ozone formation is the production of compounds which as a result of the effects of light may encourage an oxidisation reaction leading to the production of ozone in the troposphere. The indicator is the Photochemical Ozone Creation Potential (POCP), including mainly VOC (volatile organic compounds) and is expressed as grams of equivalent ethylene (g C_2H_4eq).

The **Eutrophication** is the excessive growth of aquatic plant organisms, due to the presence in the water ecosystem of excessive quantities of nourishing substances like nitrogen, phosphorus or sulphur from either natural or anthropic sources (fertilizers, some types of detergents, civil or industrial wastes) and the consequent degradation of the environment, becoming asphyxiated. The indicator is the Eutrophication Potential (EP) and is expressed in terms of impoverishment in PO_4^{---} (phosphate).