ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	**Low & Bonar GmbH**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-MTX-20130164-IBA1-EN
Issue date	05.09.2013
Valid to	05.09.2018

VALMEX® FR 580

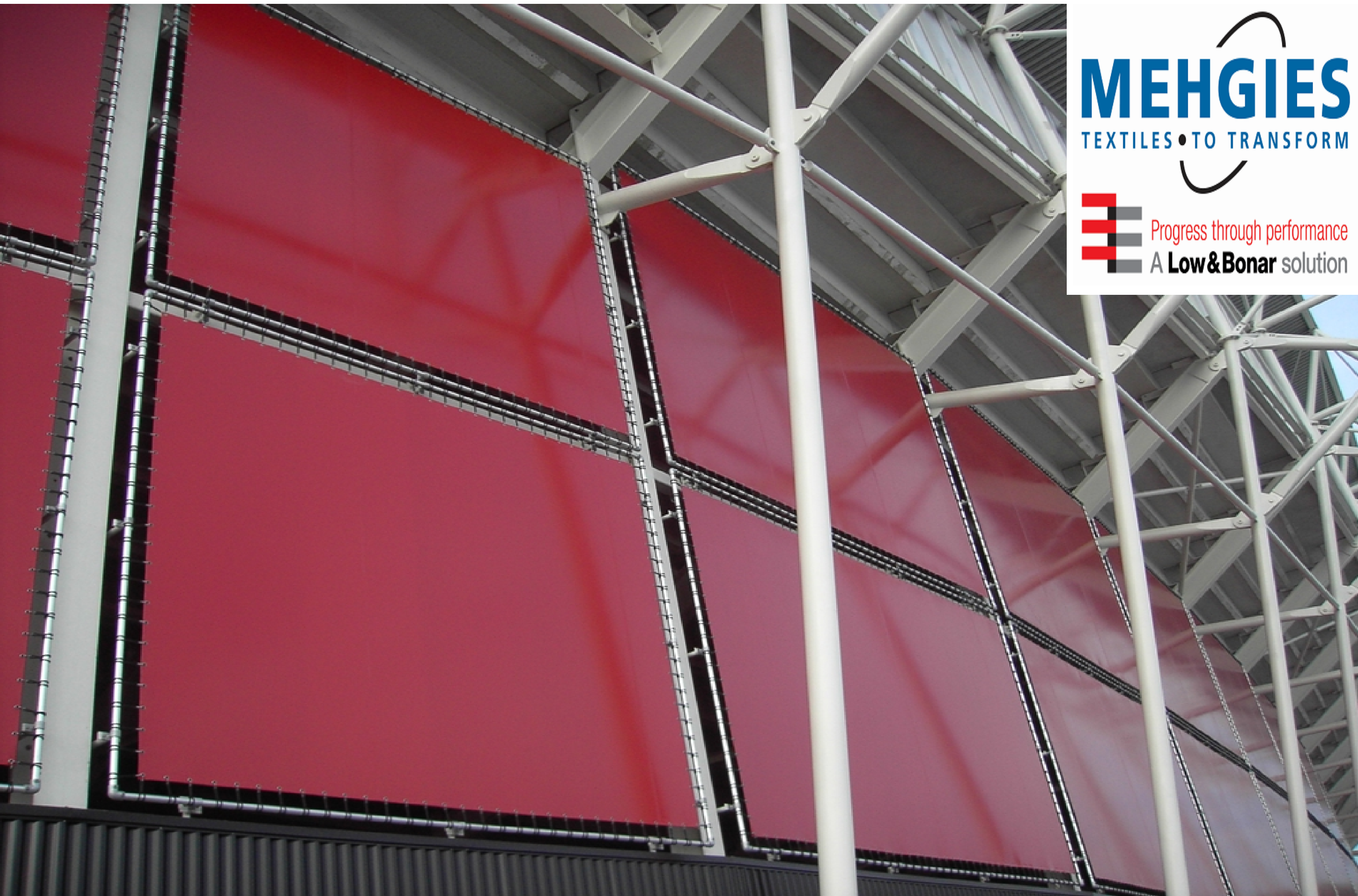
Low & Bonar GmbH

www.bau-umwelt.com / https://epd-online.com

Institut Bauen und Umwelt e.V.

MEHGIES
TEXTILES • TO TRANSFORM

Progress through performance
A Low&Bonar solution



1. General Information

Low & Bonar GmbH

VALMEX® FR 580

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
D-10178 Berlin

Owner of the Declaration
Low & Bonar GmbH
Rheinstraße 11
D-41836 Hückelhoven

Declaration number
EPD-MTX-20130164-IBA1-EN

Declared product / Declared unit
1m² of VALMEX® FR 580 (7213) technical textile.

This Declaration is based on the Product Category Rules:
Technical Textiles, 04-2013
(PCR tested and approved by the independent expert committee)

Scope:
The declaration covers the product VALMEX® FR 580. The product is a technical textile made out of a combination of Polyester and Polyvinylchloride with a polyvinyl fluoride finish. The fully coated fabric weight is 580g/m². The calculations are based on average production data collected during the period 11/2011 to 10/2012.
The producing company is Low & Bonar GmbH. The above named products are produced at the production site in Fulda.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Issue date
05.09.2013

Valid to
05.09.2018

Verification

The CEN Norm EN 15804 serves as the core PCR

Independent verification of the declaration and data according to ISO 14025

☐ internally ☒ externally

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Prof. Dr.-Ing. Hans-Wolf Reinhardt
(Chairman of SVA)

Mr Carl-Otto Neven
(Independent tester appointed by SVA)

2. Product

2.1 Product description
The product is a technical textile made out of a combination of Polyester and Polyvinylchloride with a Polyvinyl fluoride finish. The base fabric is composed of high tenacity multifilament and low wick treated polyester yarns. The coating mass distribution (CMD) ratio is 3:2 asymmetrically distributed (Topside 3 parts: Reverse side 2 parts). On both sides are at least 4 layers of coating, those include adhesion layer, main coating made out of Polyvinylchloride with several additives, Nano-Titanium dioxide primer and top coat made out of a weldable blend of high concentrated polyvinyl fluoride (PVDF) lacquer. The declared product has a weight of 580 g/m².

2.2 Application
The range of application for those products is mainly tensile architecture. These kinds of structures can be easily integrated into regular buildings, can be very variably shaped and adapted to many forms of construction typologies. These can range from roof coverings, sun-shading elements to façade coverings, interior ceilings and divider elements.
A traditional tensile or lightweight structure performs always under tension instead of compression and bending. The material can be used for permanent or temporary applications. Flexible and harmonic forms are characteristic for this type of architecture. These tensile (or tension) structures can be supported mechanically or pneumatically.

2.3 Technical Data

Constructional data

Name	Value	Unit
Yarn density, /DIN EN 1049-2/ - warp/weft	73/85	Yarn count/dm
Yarn count, /DIN EN ISO 2060/	1100	dtex
Total weight, /DIN EN ISO 2286-1/	580	g/m²
Tensile strength, /DIN EN ISO 1421 V1/ - warp/weft	2900/2700	N/5cm
Tear strength, /DIN 53363/ - warp/weft	300/300	N
Stress/strain behaviour, /CEN TC 248 WG 4/ Draft - warp/weft	4/8	13kN/m in %
Adhesion, internal testing method	16	N/cm
Cold resistance, /DIN EN 1876-1/	-40	°C
Heat resistance, internal testing method	+70	°C
Light fastness, /DIN EN ISO 105 B02/	>6	Grade
Crack resistance, /DIN 53359 A/	100.000 no	Visual

	cracks	assessment
Thermal transmittance, /DIN EN ISO 6946/ - vertical/horizontal	5,7/4,8	W/m²K
Light transmittance, /DIN EN 410/ - solar spectral range	12	%
Light reflection, /DIN EN 410/ - solar spectral range	79	%
Light absorption, /DIN EN 410/ - solar spectral range	9	%

2.4 Placing on the market / Application rules

Tensile architecture applications or technical textiles in general are not regulated completely compared to other standard construction materials and methods. Consequently, the currently valid and available standards or rules for applications and materials may change and vary from country to country.
As indicative basic standards for construction and use of technical textiles the below listed standards and rules may be considered.

1. The International Association for Shell and Spatial Structures (IASS) working groups 6 and 7
2. /DIN 4134/ - Air-supported structures; structure at design, construction and operation, 1983
3. Technical Standards for Specific Membrane Structure Buildings by Membrane Structures Association of Japan, 1996
4. American Society of Civil Engineers (ASCE), SEI/ASCE 37-02 Design Loads on Structures during Construction, 2002
5. The Design of Air Supported Structures by The Institution of Structural Engineers, London 1984
6. Standards Council of Canada (SCC), CAN3-S367-M81: Air Supported Structures, 1981
7. SS UNI U50.00.299.0:1996 Tents, Tensile Structures, Air-supported Structures - Instructions for the Design, Realization, Verification, Use and Maintenance, 1996
8. European Design Guide on Tensile Surface Structures, 2004
9. The latest version of Eurocodes and CEN Technical Committees 248 and 250.

Other common information and accomplishment related to the correct usage of technical textiles for architectural application are collected in the Low & Bonar Guideline for tensile structures available at www.mehgies.com

2.5 Delivery status

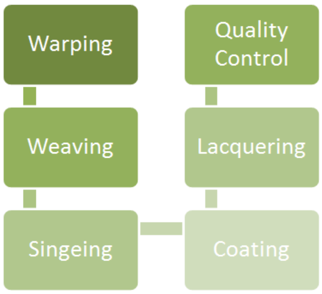
The material is produced as a metre good. The technical textiles are delivered on rolls of different length and width. The amount can be determined by the customer.

2.6 Base materials / Ancillary materials

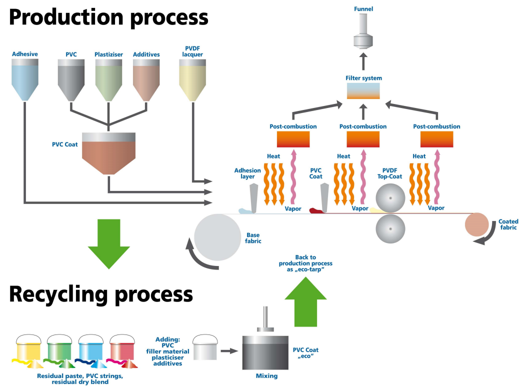
Name	Value	Unit
PVC	35	wt-%
DINP (CAS 28553-12-0)	20	wt-%
PES	30	wt-%
OTHERS including: TiO2 and flame retardants: ATO, ATH	15	wt-%

2.7 Manufacture

During manufacturing the following production steps are processed at Low & Bonar GmbH, Fulda.



The quality management system is certified according to /DIN ISO 9001:2008/.
Low & Bonar GmbH buys yarns to produce warp beams and weaves fabrics at the weaving mill in Fulda. After weaving, the fabrics undergo a quality control plus a singeing process where minimal fabric irregularities can be corrected as well as defects can be eliminated. Due to the computer controlled coating process a stringent quality control is in place. The products are coated by a knife-coating process. The coating, a PVC plastisol, is brought onto the base fabric and later on dried by infrared emitter. To maintain a good adhesion between fabric and PVC coating an adhesion layer is necessary. Afterwards the PVC coated fabrics are finished by the lacquering process.



The lacquer system is a combination of a primer and a top lacquer. The system contains nano titanium dioxide as well as PVDF. The lacquer is applied on the PVC-polyesters coated base fabric and finally dried by infrared emitters. Thereby the solvents are nearly completely evaporated of the material. The generated vapor is directly treated at post-combustion. Finally, the produced material is inspected and tested according to /DIN ISO 9001:2008/. On customer request a lot certificate and a visual inspection report can be provided.

2.8 Environment and health during manufacturing

The Low & Bonar GmbH production sites are subject to the Gefahrstoffverordnung /GefStoffV/, due to its handling of a variety of chemicals.
Furthermore, regular measurements of air quality and noise levels are done. The results are below the compulsory safety value.
In areas where employees are exposed to lacquers, powders etc., prescribed safety clothes and technical safety devices are provided. Regular health checks are mandatory for employees of production sites.

Further regulations and laws which Low & Bonar GmbH is subject to are:
- Arbeitsschutzgesetz /ArbSchG/
- Betriebssicherheitsverordnung /BetrSichV/
- /Maschinenrichtlinie 2006/42/EG/

2.9 Product processing/Installation

Technical textiles used for architectural application get an interactive functionality with the application performance and need to be handled carefully at several stages, from design to maintenance.

Design:
- Tensile structures are solely subject to tensile stress due to low compressive and bending rigidity. The shape has to be a double curvature to stabilize and distribute the tension, stress and the applied loads on the surface correctly.
- A basic rule in this kind of design is that form follows function
- The structural analysis must be completely integrated into the architectural design. The geometry of the technical textile is established through a "shape generation"(form finding) technique in order to ensure a static equilibrium of the system.
- The pattern of the technical textile is calculated by the deflection finite-element analysis software. During the calculation progressive load deformation is taken into account and consequent compensation or decompensation of the defined fabric pattern geometry is substantial.
- Proper material compensation and application of the biaxial material values are key factors determining project efforts, global costs and long-term performances of the application

Manufacture:
- The production itself can be sub-divided into four phases: intake control and quality inspection of the material, cutting, welding and packing.
- Delivery and quality management consists of practiced good control and re-check of the quality control report. An additional inspection of the material by light tables and seam adhesion tests can be done.
- Once unrolled, the cutting of the patterns can begin. Those are generated using 3D computer models of the whole surface and taking into account the required compensations and the edge corrections for welding seams and edge details. The fabric can be cut by automatic plotting desks or by scissors
- Assembly of the various patterns is done by welding the perimetral edges of the single patterns. Welding is mostly effected by conducting electrical energy in the form of a radio frequency field to the two surfaces that are to be joined together. This stimulates the molecules in the material to move at a speed of approx. 25 million times a second. The friction that arises between the molecules generates the heat that is required to fuse the material layers. A weld seam is thereby created which has the same strength as the surrounding material (tested at 23°C). The fabric can be welded by means of hot air special tools, wherever this operation is mostly chosen for small detail welding processes as corners or on site repairing operation.

Installation:
- The installation of a tensile structure system is a highly specialized field of work requiring experienced staff as well as special and safe access equipment. However the tools and other equipment are standard items used in conventional construction rigging.
- The installation of tensile structures requires reasonable weather conditions. The lightweight of the technical textile, in conjunction with the large surface of exposure, means that work can only proceed at wind speeds of less than 5 m/s. At higher wind speeds lifting operations must be stopped. Installation should also be stopped at temperatures below 10° Celsius.
- The fabric as a secondary structural element is lifted and tied in position by pulling devices and brackets. Afterwards the completed distensile process is secured by linear clamps, steel cables and other permanent fixing devices to the primary structural elements.
- The main task of the technical textile installation team is the approval of the main structure, the installation of the temporary racks, to secure the building site and finally to manage the quality and safety control processes during installation.

Maintenance:
- Regular inspection of the technical textile has to be undertaken as the fabric can be cut, torn or crushed if subjected to high local 'pinching' loads, caused by bad design or by inappropriate clamping. If damaged, redistribution of load can result in a concentration of stress that could cause a propagation of tears.
- Fabric Inspection and maintenance manual is provided to the customer with shipment of the goods.

2.10 Packaging

The material is rolled on a cardboard roll core. The finished roll is packed in foil and fixed by PVC tape. Rolls are packed with 3 to 5 rolls on pallets. To guarantee that the rolls are not damaged during transportation, they are covered with cardboard and fastened by steel or plastic strapping.

2.11 Condition of use

There are no changes within the material composition during the use of the product, except extraordinary effects occur (e.g. fire). The long term stability can be measured according to /DIN EN ISO 105 B02/.

2.12 Environment and health during use

Low & Bonar GmbH follows a concept that accompanies its products throughout their entire lifecycle, including the incorporation of ecological criteria in the selection of raw materials and the use of environmentally friendly production processes.
Low & Bonar GmbH only uses substances that suppliers have previously registered as REACH compliant with European Chemicals Agency (ECHA), or that have been approved for the respective use. The products contain no restricted substances in a quantity of more than 0.1 mass percent. None of those substances are persistent, bioaccumulative and toxic according to the criteria set out in Annex XIII to the REACH Regulation (PBT substances). No hidden chemicals are released in the processing (e.g. welding) of the materials and Maximum Allowable Concentrations (MAC) are not exceeded by unregistered substances.

2.13 Reference service life

The documentation of the RSL is not required for the EPD of the company Low & Bonar GmbH since not the entire life cycle is declared (without modules B1-B7).

2.14 Extraordinary effects

Fire
/DIN 4102-1: B1/

Water
The declared product is adequate for the outer use. Water has no influence. The product has a good weatherability.

Mechanical destruction
The mechanical destruction of the declared product doesn't lead to a change of the chemical composition.

2.15 Re-use phase
The company Low & Bonar GmbH is conscious of its responsibility for acting in an environmentally compatible manner. Therefore, Low & Bonar GmbH is involved in a range of activities related to recycling and to preserving resources. These activities are participation in external recycling systems like EPcoat, in-house recycling and a sustainable production manner.
Low & Bonar GmbH actively supports the commitment of the Vinyl Plus Committee by the overall goal to recycle 800.000t PVC per year by 2020 and furthermore is a member of the Industrieverband Kunststoffbahnen e.V. (IVK Europe). As a consequence Low & Bonar GmbH is able to use the EPcoat recycling system. The post-consumer PVC coated fabric is recyclable. The material is then shredded and afterwards processed into the recyclate (plastic granulate), which is applied in the production of e.g. windows, pipes and foils. The shredded material is also used in the production of e.g. riding and sport arenas /Schönmackers/.

2.16 Disposal
The waste code of production waste for PVC coated Polyester fabrics is in accordance with the European Waste Index /AVV/ 04 02 09. Within the category of construction waste Technical textiles are not closer specified. Therefore waste code for plastics would apply 17 02 03.

2.17 Further information
Further information about PVC coated Polyester, technical textiles can be found on the companies' homepage.

3. LCA: Calculation rules

3.1 Declared Unit
The functional unit is a production and final treatment of 1 m² of technical textile - product nr **7213** VALMEX® FR 580 with a total weight of 580 g/m².

Declared unit

Name	Value	Unit
Declared unit	1	m²
Conversion factor to 1 kg	1,72413 7931	m²

3.2 System boundary
The analysis of the product life cycle includes production of the basic materials, transport of the basic materials, manufacture of the product and the packaging materials which are declared in module A1-A3.
In this LCA study scenario of end-of-life (EoL) stage is considered. It is incineration of the technical textiles in the incineration plant which burdens accounted in the module C4.
The collection rate of end-of-life stage is 100%.
In this LCA study the transport of the used product to final disposal was modeled (module C2).
Potential credits for electricity and thermal energy resulting from the waste incineration plant are declared in module D.

3.3 Estimates and assumptions
In this LCA study scenario of end-of-life (EoL) stage is considered. In this case the incineration of the technical textiles has been accounted. The burdens of this process are included in the module C4 (waste incineration plant with R1 < 0,6), but the electricity and energy production – that occurs due to the incineration process – as benefits in the module D.
Even then it has to be mentioned that the post-consumer PVC coated fabrics are recyclable materials (more information in chapter 2.15).
The collection rate of end-of-life stage is 100%.
It has been also assumed that the average transport of post-consumer PVC coated fabrics to the incineration plant is 100 km.

3.4 Cut-off criteria
Several flows (raw materials) were excluded from the LCA study. All excluded flows pass the cut-off criteria: they represent less than 1% and are summing up to less than 5% of the total input (mass) and impact of renewable and non-renewable primary energy usage of mandatory modules (A1-A3).
Machines and facilities required during production are neglected.

3.5 Background data
For life cycle modeling of the considered products, the /GaBi 6 2012 Software System/ for Life Cycle Engineering, developed by PE INTERNATIONAL AG, is used. All relevant background datasets are taken from the GaBi 6 software database. The datasets from the database GaBi used are all PE International datasets and are documented in the online documentation /GaBi 6 2012B/. To ensure comparability of results in the LCA, the basic data of GaBi database were used for energy, transportation and auxiliary materials.

3.6 Data quality
The model for the mandatory modules (A1-A3) was based on primary data (in kg or g per m²) provided by Low & Bonar GmbH. Primary data collected covered all the production steps taking place in the production plant: warping, weaving, singeing coating, lacquering, quality control.
All data used in the model is no more than 10 years old.

3.7 Period under review
Data sets are based on 1 year averaged data (time period: November 2011 to October 2012).

3.8 Allocation
The product is produced in one plant. All data were provided by the producer of the product according to 1 m² of technical textile.

The assumptions according EoL of the product are described in the section 3.3.
The modeled thermal utilization of the combustibles in their end-of-life process takes place in a waste-to-energy plant. The allocation is based on a physical classification of the mass flows or calorific values. Benefit and credit for the thermal energy, which is calculated based on country specific "Thermal energy from natural gas" as well as the credit for electricity from the country specific “Power grid mix”, are given in module D.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to EN 15804 and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Scenarios and additional technical information

The following information refer to the declared modules and are the basis for calculations or can be used for further calculations. All indicated values refer to the declared functional unit.

End of life (C1-C4)

Name	Value	Unit
Collected separately	0.58	kg

The collection rate of the post-consumer PVC coated fabrics is 100%. The collected material is incinerated with energy recovery. The average distance to the incineration plant is 100 km.

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)																
PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARYS
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement[1)]	Refurbishment[1)]	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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	MND	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m² VALMEX® FR 580

Parameter	Unit	A1-A3	C2	C4	D
Global warming potential	[kg CO_2-Eq.]	3.46E+0	2.72E-5	1.46E+0	-9.26E-1
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	4.48E-8	5.68E-16	2.11E-11	-2.80E-10
Acidification potential of land and water	[kg SO_2-Eq.]	1.11E-2	1.23E-7	3.54E-4	-1.28E-3
Eutrophication potential	[kg $(PO_4)^{3-}$- Eq.]	1.31E-3	2.98E-8	2.76E-5	-1.44E-4
Formation potential of tropospheric ozone photochemical oxidants	[kg Ethen Eq.]	1.87E-3	-4.23E-8	2.00E-5	-1.18E-4
Abiotic depletion potential for non fossil resources	[kg Sb Eq.]	9.19E-3	1.25E-12	2.10E-7	-9.58E-8
Abiotic depletion potential for fossil resources	[MJ]	6.43E+1	3.72E-4	6.88E-1	-1.22E+1

RESULTS OF THE LCA - RESOURCE USE: 1 m² VALMEX® FR 580

Parameter	Unit	A1-A3	C2	C4	D
Renewable primary energy as energy carrier	[MJ]	3.65E+0	IND	IND	IND
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	IND	IND	IND
Total use of renewable primary energy resources	[MJ]	3.65E+0	2.21E-5	6.57E-2	-1.35E+0
Non renewable primary energy as energy carrier	[MJ]	6.15E+1	IND	IND	IND
Non renewable primary energy as material utilization	[MJ]	7.37E+0	IND	IND	IND
Total use of non renewable primary energy resources	[MJ]	6.89E+1	3.73E-4	7.79E-1	-1.41E+1
Use of secondary material	[kg]	0.00E+0	IND	IND	IND
Use of renewable secondary fuels	[MJ]	1.70E-3	2.78E-9	9.62E-6	-2.04E-4
Use of non renewable secondary fuels	[MJ]	1.77E-2	2.90E-8	1.01E-4	-2.14E-3
Use of net fresh water	[m³]	3.71E-2	2.13E-8	3.60E-3	-2.10E-3

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² VALMEX® FR 580

Parameter	Unit	A1-A3	C2	C4	D
Hazardous waste disposed	[kg]	1.65E-2	0.00E+0	1.48E-1	0.00E+0
Non hazardous waste disposed	[kg]	9.61E-2	7.38E-8	2.99E-4	-5.30E-3
Radioactive waste disposed	[kg]	1.85E-3	5.35E-10	3.77E-5	-8.04E-4
Components for re-use	[kg]	IND	IND	IND	IND
Materials for recycling	[kg]	IND	IND	IND	IND
Materials for energy recovery	[kg]	IND	IND	IND	IND
Exported electrical energy	[MJ]	IND	IND	2.83E+0	IND
Exported thermal energy	[MJ]	IND	IND	6.79E+0	IND

6. LCA: Interpretation

Primary energy demand

The total use of renewable primary energy resources as well as the total use of non-renewable primary energy is dominated by the mandatory modules (A1-A3), within which the raw material supply (A1) plays the most significant role. The production site (A3) has the second highest contribution to both.
The share of module D in the total use of renewable primary energy resources (PERT) value is due to the energy production via incineration of the technical textiles.

Global warming potential (GWP)

GWP is dominated by the supply chain (A1) due to production of raw materials especially PET, DINP, antimony, and PVC. The supply chain makes more than 71% of the GWP for the mandatory modules, where the production (A3) makes more than 28%. The end-of-life stage contributes in about 30% into the summed value of GWP. At the same time thanks to combustion of the technical textiles there is a decline in the total GWP in around 19%.

Formation potential of tropospheric ozone photochemical oxidants (POCP)

POCP is dominated by the supply of basic materials (PET, DINP, epoxised soy bean oil, PVC, antimony) and the production (A3). Transportation has a minor but visible impact on the product. The main emissions contributing to this impact category are NMVOCs, benzene, butane, sulfur dioxide, butane, carbon dioxide, and nitrogen oxides. The high benzene emissions, which occur during production of epoxised soy bean oil, make an important contribution into the total POCP value.

Acidification potential (AP)

AP is dominated by the supply of basic materials (e.g. antimony, PET) and the production stage due to the nitrogen dioxide emissions that occur during the lacquering process. Mostly the impact refers to emissions to air: ca. 56% comes from sulfur dioxide and 19% from nitrogen oxides.

Eutrophication potential (EP)

EP is influenced by the supply of basic materials, their transport and the production stage. The nitrogen dioxide emissions from the lacquering process have also a significant contribution to the total EP. Mostly the impact refers to emissions to air (mainly nitrogen oxide and dioxide).

Abiotic depletion potential (ADP)

The ADP **for non fossil resources** is significantly dominated by production of antimony trioxides.
The ADP **for fossil element** is mainly dominated by the supply of basic materials (A1). The contribution of the benefits and loads due to incineration of post-consumer PVC coated fabrics in the end-of-life stage in the total ADP fossil value is around 19%. The energy consumption plays a crucial rule in the ADP fossil element value. The most important energy sources are lignite, hard coal, and natural gas.

Depletion potential of the stratospheric ozone layer (ODP)

The ODP is most notably influenced the supply of basic materials and mainly the production of the polyvinylidene fluoride (PVDF). This results mainly from the upstream supply chain due to production of dichloro-1-fluoroethane that is used for the PVDF. The relevant emissions are trichloroethane and R141b.

7. Requisite evidence

Environmental information of used chemicals from “Material Safety Data Sheets”.

During the application of the lacquer on the PVC-polyesters the generated vapor is directly treated at post-combustion and emitted emissions verified according BImSchV /TÜV SAAR and BImSchV/.

7.1 VOC emissions
The information of the formaldehyde and VOC emissions by /AgBB schema/ AgBB are not relevant for the product because it is applied outside.

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8. References

AgBB
Ausschuss zur gesundheitlichen Bewertung von Bauprodukten: Vorgehensweise bei der gesundheitlichen Bewertung der Emissionen von flüchtigen organischen Verbindungen (VOC) aus Bauprodukten

ArbSchG
Arbeitsschutzgesetz: Gesetz über die Durchführung von Maßnahmen des Arbeitsschutzes zur Verbesserung der Sicherheit und des Gesundheitsschutzes der Beschäftigten bei der Arbeit

AVV
Abfallverzeichnis-Verordnung: Verordnung über das Europäische Abfallverzeichnis 10. Dezember 2011 (BGBI. I S.3379)

BetrSichV
Verordnung über Sicherheit und Gesundheitsschutz bei der Bereitstellung von Arbeitsmitteln und deren Benutzung bei der Arbeit, über Sicherheit beim Betrieb überwachungsbedürftiger Anlagen und über die Organisation des betrieblichen Arbeitsschutzes

BImSchV
Bundes-Immissionsschutzverordnungen (Federal Emission Control Act)

CAN3-S367-M81
CAN3-S367-M81: Air Supported Structures, 1981

CEN TC 248 WG 4 - Draft
CEN TC 248 WG 4: Coated fabrics, http://www.cen.eu

CEN TC 250 WG 5 - Draft
CEN TC 250 WG 5: Membrane structures, http://www.cen.eu

DIN 4102-1
DIN EN 4102-1: Fire behaviour of building materials and building components - Part 1: Building materials; concepts, requirements and tests

DIN 4134
DIN 4134:1983 Air-supported structures; structure at design, construction and operation

DIN 53359
DIN 53359 A : Testing of artificial leather and similar sheet materials - Flex cracking test

DIN 53363
DIN 53363: Testing of plastic films - Tear test using trapezoidal test specimen with incision

DIN EN 410
DIN EN 410: Glass in building - Determination of luminous and solar characteristics of glazing

DIN EN 1876-1
DIN EN 1876-1: Rubber or plastics coated fabrics - Low temperatures tests - Part 1: Bending test

DIN EN ISO 105 B02
DIN EN ISO 105 B02: Textiles - Tests for colour fastness - Part B02: Colour fastness to artificial light: Xenon arc fading lamp test (ISO 105-B02:1994 + Amd. 1:1998 + Amd. 2:2000)

DIN EN ISO 1421
DIN EN ISO 1421 V1: Rubber- or plastics-coated fabrics - Determination of tensile strength and elongation at break (ISO 1421:1998)

DIN EN ISO 2286-1
DIN EN ISO 2286-1: Rubber- or plastics-coated fabrics - Determination of roll characteristics - Part 1: Method for determination of the length, width and net mass (ISO 2286-1:1998)

DIN EN ISO 6946
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