ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Paul Bauder GmbH & Co. KG
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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PVC-P roofing and waterproofing membranes
BauderTHERMOFOL U
BauderTHERMOFOL M

Paul Bauder GmbH & Co. KG

Institut Bauen und Umwelt e.V.

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1. General Information

Paul Bauder GmbH & Co. KG

Programme holder
IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number
EPD-BAU-20220193-IBC1-EN

This declaration is based on the product category rules:
Plastic and elastomer roofing and sealing sheet systems, 11.2017
(PCR checked and approved by the SVR)

Issue date
20.10.2022

Valid to
19.10.2027

Dipl. Ing. Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.))

PVC-P roofing and sealing membranes THERMOFOL U und M

Owner of the declaration
Paul Bauder GmbH & Co. KG
Korntaler Landstraße 63
D-70499 Stuttgart

Declared product / declared unit
The declared unit is the production of 1 m² of the means weighted according to the production quantity for the BauderTHERMOFOL PVC-P roofing and waterproofing membranes fixed mechanically or under ballast, sealed by hot air, including the packaging materials.

Scope:
This document is valid for PVC-P roofing and waterproofing membranes:

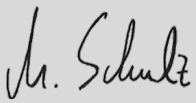
- BauderTHERMOFOL U (12/15/18/20/24),
- BauderTHERMOFOL U (12/15/18/20 FR),
- BauderTHERMOFOL U (15/18/20) V,
- BauderTHERMOFOL M (12/15/18/20)

manufactured in the German BAUDER production plant in Bernsdorf.

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.
The EPD was created according to the specifications of *EN 15804+A2*. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard *EN 15804* serves as the core PCR
Independent verification of the declaration and data according to *ISO 14025:2011*
☐ internally ☒ externally



Matthias Schulz
(Independent verifier)

2. Product

2.1 Product description/Product definition

BauderTHERMOFOL are synthetic roofing and waterproofing membranes based on polyvinyl chloride (PVC-P) with a synthetic fibre core. The product range is divided into the following variants:

- **BauderTHERMOFOL U (12/15/18/20/24)**
  Embedded polyester reinforcement
- **BauderTHERMOFOL U (12/15/18/20) FR**
  Embedded polyester reinforcement and increased fire protection
- **BauderTHERMOFOL U (15/18/20) V**
  Embedded polyester reinforcement, special fleece lamination on the underside
- **BauderTHERMOFOL M (12/15/18/20)**
  Embedded polyester reinforcement

The reported results declare an average over all BauderTHERMOFOL products. The averaging is based on the corresponding production quantities (by area produced).
Regulation (EU) No 305/2011(CPR) applies to the placing on the market of the product in the EU/EFTA (except Switzerland). The product requires a declaration of performance taking into account *DIN EN 13956:2012 Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics and DIN 13967:2012 Flexible sheets for waterproofing - Plastic and rubber damp*

proof sheets including plastic and rubber basement tanking sheet - Definitions and characteristics

The respective national regulations apply to the use.

2.2 Application

The PVC-P roofing and waterproofing membranes are laid in a single layer and hot-air welded at the seams. The wind suction is secured by mechanical fastening, by ballast or by bonding.

Roof waterproofing
Single-ply waterproofing of non-utilized and utilized roofs (e.g., solar roof, green roof) in flat and pitched form.

Building waterproofing
Single-layer waterproofing of non-water-tight structures and building components against soil moisture and non-pressing water.

BauderTHERMOFOL roofing and sealing membranes are used according to requirements:
- mechanically fixed,
- ballasted or
- adhered.

2.3 Technical Data

BauderTHERMOFOL M

BauderTHERMOFOL M

Property	Test method	Unit	Request
Watertightness for type B	EN 1928 method B	kPa / 72h	passed
Joint peel resistance	EN 12316-2	N / 50 mm	≥ 200
Joint shear resistance	EN 12317-2	N / 50 mm	≥ 600, tear-off outside the joint seam
Maximum tensile force	EN 12311-2 A	N / 50 mm	lengthwise: ≥ 1000 crosswise: ≥ 1000
Maximum elongation	EN 12311-2 A	%	lengthwise: ≥ 19 crosswise: ≥ 19
Tear resistance	EN 12310-2	N	> 200
Dimensional stability	EN 1107-2	%	< 0,3
Foldability at low temp.	EN 495-5	°C	< - 30
UV exposure (1000h)	EN 1297	-	fulfilled > 1000h
Water vapour properties	EN 1931	-	approx. 20,000
Resistance to impact	EN 12691	mm	400-1000
Resistance to root penetration	FLL/EN 13948	-	not required
Bitumen compatibility	EN 1548	-	not relevant

BauderTHERMOFOL U/ U FR

Name	Value	Unit
Watertightness for type B according to EN 1928 method B	passed	kPa/72h
Peel resistance of the seam joint according to EN 12316-2	≥ 200	N/50mm
Shear resistance of the seam joint according to EN 12317-2	≥ 600, tear-off outside the joint seam	N/50mm
Maximum tensile strength according to EN 12311-2 A	lengthwise: ≥ 1000 crosswise: ≥ 1000	N/50mm
Maximum elongation according to EN 12311-2 A	lengthwise: ≥ 19 crosswise: ≥ 19	%
Tear resistance according to EN 12310-2	> 200	N
Resistance to root penetration according to EN 13948/FLL	FLL passed	-
Dimensional stability according to EN 1107-2	< 0.3	%
Folding in the cold according to EN 495-5	< - 30	°C
UV exposure (1000h) according to EN 1297	fulfilled > 1000 h	-
Water vapour properties μ according to EN 1931	approx. 20.000	-
Durability of water tightness against ageing according to EN 1296 nach EN 1928	passed	-
Durability of watertightness against chemicals according to EN 1847 nach EN 1928	passed	-
Bitumen compatibility according to EN 1548 (roofing membranes)	Not relevant	-
Resistance to impact loads according to EN 12691 (geomembranes)	400 - 1000	mm
Effects of liquid chemicals incl. water against alkali according to EN 14909, C	passed	-

Other technical properties are not relevant.

Performance values of the product according to the declaration of performance in relation to its essential characteristics in accordance with *DIN EN 13956:2012 Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics* for all BauderTHERMOFOL roofing membranes and *DIN 13967:2012 Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet - Definitions and characteristics.* for BauderTHERMOFOL U/U FR roofing membranes.

2.4 Delivery status

The PVC-P roofing and sealing membranes are wound onto cardboard sleeves and wrapped with shrink bonnets and delivered from the factory on a disposable pallet.

The BauderTHERMOFOL variants have the following dimensions:

THERMOFOL	Lengths [m]	Widths [m]	Thicknesses [mm]	Colours
U12	20	1,5	1,2	light grey
U15	20	1,5	1,5	light grey
U18	20	1,5	1,8	light grey
U20	20	1,5	2,0	light grey
U24	15	1,5	2,4	light grey
U15V	20	1,5	1,5 + fleece	light grey
U18V	20	1,8	1,8 + fleece	light grey
U20V	15	2,0	2,0 + fleece	light grey
U12 FR	20	1,5	1,2	light grey
U15 FR	20	1,5	1,5	light grey
U18 FR	20	1,5	1,8	light grey
U20 FR	20	1,5	2,0	light grey
M12	25	1,5	1,2	light grey
M15	20	1,5	1,5	light grey
M18	20	1,5	1,8	light grey
M20	20	1,5	2,0	light grey
U Cuts	20	0,2 - 1,0	1,2 - 2,0	light grey
M Cuts	20	0,2 - 1,0	1,2 - 2,0	light grey

Other colour versions in anthracite, blue-grey and brick-red are also available on request.

2.5 Base materials/Ancillary materials

Material	Components	Share (mass%)
PVC	Base polymer / produced by suspension polymerisation of vinyl chloride (synthesis)	45 - 55
Plasticiser	Phthalates for flexibilisation of the base polymer / produced by esterification with branched-chain C-10 alcohols (synthesis)	30 - 40
Stabilisers	Calcium and zinc compounds for thermal protection of the base polymer / produced by synthesis	1 - 2
Additive	Acrylate-based polymer compounds as processing aids / produced by polymerisation (synthesis)	2 - 5
Flame protection	Oxide compound of a semimetal to reduce combustibility / produced by synthesis (roasting process)	1 - 2
Colour	Oxide compound of titanium as white pigment and UV protection as well as organic or inorganic pigments / produced by synthesis	2 - 4
Circulation material	Edge trim; chaff / produced from semi-finished and finished goods	0 - 6
Fabric/ Fleece	Synthetic fibres	3 - 5

The product/article/ at least one partial article contains substances on the ECHA Candidate List of Substances of Very High Concern (SVHC) (date 11.04.2022) above 0.1% by mass: **no.**
The product/article/ at least one partial article contains other CMR substances of category 1A or 1B, which are not on the candidate list, above 0.1% by mass in at least one sub-product: **no.**
Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): **no.**
A substance with the functional group of phthalates is used as a plasticiser and acrylate-based polymer compounds are used as additives.

2.6 Manufacture

PVC-P roofing and sealing membranes are manufactured in a two-stage process.
In the first step, the raw materials are mixed together and plasticised on an extruder. The plastic mass is rolled out into films on a calender.
In the second step a polyester fabric reinforcement will be embedded. Some of the PVC-P roofing and sealing membranes receive a special fleece lamination on the underside.
After cooling and final edge trimming, the products are made-up.
All production waste is treated internally. Recyclable fractions are recycled and directly reintroduced into the production process. Non-recyclable components are disposed of.
Permanent measurement of product quality and continuous improvement of internal processes is ensured due to *ISO 9001* certified quality management system.

2.7 Environment and health during manufacturing

The maximum workplace concentration (MAK) limits are regularly checked and corresponding limits are not exceeded in the production process. In addition to the general occupational safety measures for commercial enterprises, precautionary measures are offered and implemented.
The national and plant-specific requirements for environmental protection are complied with in the manufacturing process. The cooling water for product cooling is recirculated. Optimal use of raw materials is achieved through in-house recycling.

2.8 Product processing/Installation

PVC-P roofing and sealing membranes can be installed as follows:

- Loosely laid mechanically fastened
The products are loosely laid and mechanically fixed with approved fasteners in the seam or field area. The seam overlaps or cover tapes are homogeneously welded using hot air.

- Loosely laid under ballast
BauderTHERMOFOL U/UFR products are laid loose and secured with a subsequent ballast system of green roof, gravel or slab covering. The seam overlaps are homogeneously welded using hot air.

- Adhered
The fleece-laminated products are partially or fully bonded to the substrate with 1-component polyurethane adhesives. The seam overlaps or cover tapes are homogeneously welded using hot air.

For all types of installation, the relevant standards and guidelines (e.g. *DIN 18531*, *DIN 18532* and Fachregeln des Deutschen Dachdeckerhandwerks - Flachdachrichtlinien) as well as the installation instructions and manufacturer's information must be observed.
Residues of PVC-P roofing and sealing membranes can be reused or disposed of as mixed construction and demolition waste (waste code number 17 09 04 according to the Waste Catalogue Ordinance *AVV*).

2.9 Packaging

The PVC-P roofing and sealing membranes are wound on cardboard sleeves and packed on wooden pallets. The load is secured using polypropylene strapping and polyethylene shrink bonnets. All packaging materials are recyclable.
If the waste is sorted by type, it is taken back via INTERSEROH (INTERSEROH certificate 27113).

2.10 Condition of use

The plasticiser (or the components of the plasticiser that have broken down on the surface) migrates into the environment. The obvious case is that the plasticiser is washed off the roof by rainwater. These very small quantities are easily biodegradable and have very low toxicity to aquatic organisms. This results in a gradual hardening of the PCV-P roofing and waterproofing membranes.

2.11 Environment and health during use

The PVC-P roofing and waterproofing membrane has no negative impact on the environment and the health of users during its service life. For details see *Burkhardt et al. 2020.*

2.12 Reference service life

The service life depends on the thickness of the roofing and sealing membrane and any surface protection used (gravel, green roof).
An average service life was calculated for BauderTHERMOFOL based on the production quantities in 2020. With professional installation an average of 20 years can be assumed.

2.13 Extraordinary effects

Fire

Property	Test method	Requirements
Exposure to fire from the outside	DIN V ENV 1187	passed*
Fire behaviour	DIN EN ISO 11925-2	Class E according to DIN EN 13501-1

*In defined built-ups.

Fire protection

Name	Value
Building material class	E
Burning droplets *	-
Smoke gas development *	-

*not specified for roofing membranes > 1 mm.

Water
The declared PVC-P roofing and sealing membranes are water-insoluble and resistant to the effects of water when used as intended. The watertightness is tested according to *EN 1928.*

Mechanical destruction
When PVC-P roofing and sealing membranes are destroyed, no environmentally harmful products or hazardous waste are produced.

2.14 Re-use phase
PVC-P roofing and sealing membranes are deconstructed and recycled at the end of their useful life.
Loosely laid roof structures are suitable for unmixed deconstruction. In the case of glued roof structures, adhesive residues and fleece adhesions are unavoidable.

After thorough cleaning, the material is recycled by shredding and separation. The used plastics are then returned to the material cycle and used, for example, for floor protection mats.
After the end of the useful life, thermal recycling is also possible. Through use in incineration plants, the energy contained in the declared products can be recovered.

2.15 Disposal
The following lists the waste code numbers according to the European Waste Catalogue in accordance with the Waste Catalogue Ordinance *AVV* for the individual product components.

Packaging
The packaging materials are disposed of via INTERSEHROH AG. The components of the packaging that are produced during installation in the building have the following waste code number:

- 15 01 01: Paper and cardboard packaging
- 15 01 02: Plastic packaging
- 15 01 03: Wood packaging

End of Life
The product at the end of its life has the following waste code number:
- 17 09 04: Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03

In general, material recovery (recycling) is preferable to landfilling (waste incineration plant (WtE) route).

2.16 Further information
Contact details can be found on the back of this declaration. Further product information is available online as a download (www.bauder.de).

3. LCA: Calculation rules

3.1 Declared Unit
The declared unit is the production of 1 m² of the production quantity weighted average for the mechanically or ballasted, hot air sealed BauderTHERMOFOL roofing membrane variants U (12/15/18/20/24), U (12/15/18/20) FR, U (15/18/20) V and M (12/15/18/20) including packaging materials.

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Grammage	2.01	kg/m^2
Conversion factor to 1kg	0,497	m^2/kg
Layer thickness (average)	1,58	mm

3.2 System boundary
Type of EPD: from cradle to gate with options (modules A1-A3, C1-C4 and module D).
The modules A1-A5, C1-C4 and D are declared in accordance with *EN 15804.* The following points were taken into account in the preparation of the life cycle assessment:

Module A1-A3
All upstream chains of the raw materials and materials used as well as their procurement transports.
Production processes including energy and waste flows (cradle to gate). Waste produced is taken into account up to the end-of-waste status.

Module A4-A5
The transports to the construction site and an average installation effort (hot air bonding and resulting offcuts) as well as fastening material. Recycling of the packaging material.

Module C1
Tear off the roofing and waterproofing membrane from the roof.

Module C2-1
Transports as part of the recycling route.

Module C2-2
Transports as part of the energy recovery route.

Module C3-1
Material recovery (recycling) of the product, including processing costs.

Module C3-2
Energy recovery (incineration in a waste incineration plant).

Modules D-1 and D-2
Reporting of credits generated by waste treatment in modules A5, C3-1 and C3-2.

3.3 Estimates and assumptions
No estimates and assumptions were made that would be relevant for the interpretation of the LCA results.

3.4 Cut-off criteria
All material and energy flows entering the product system were taken into account. It can be assumed that the sum of the neglected mass fractions does not exceed 5 % of the results from the impact categories.

3.5 Background data
For modelling the life cycle, the software for holistic balancing (*GaBi* 10.6) was used. All background data sets were taken from various *GaBi* databases and the *ecoinvent* database 3.6.

3.6 Data quality
The current background data sets from the *GaBi databases* were used for the balancing. One *ecoinvent dataset* used exceeds the age of 10 years, but is most suitable for modelling the product system under investigation. This dataset was only used for one ingredient that does not enter the product in large quantities (< 1 %).
Data collection for the products investigated was based on evaluations of internal production and environmental data and the collection of LCA-relevant data within the supplier chain. The geographical reference was taken into account when using the data sets. The data collected was checked for plausibility and consistency, which means that a good level of representativeness can be assumed.

The variants considered in this EPD have a comparable composition and differ mainly in their basis weight. This varies between -24 % and +55 % compared to the weighted average product. Similarly, the potential environmental impacts also vary.

3.7 Period under review
The data collection referred to the analysis period from 01.01.2020 to 31.12.2020.

3.8 Allocation
The material input and output flows were determined on the basis of the corresponding production quantities. The energy input and output flows were taken into account on the basis of the corresponding total quantities from the 2020 calendar year and allocated to production on the basis of consumption measurements.
Credits from modules A5 and C3-1 are reported in module D-1, credits from modules A5 and C3-2 in module D-2.

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.

GaBi software 10.6 with database version 2022.2 was used, as well as *ecoinvent* 3.6.

4. LCA: Scenarios and additional technical information

Characteristic product properties
Information on biogenic carbon
The biogenic carbon content was calculated based on the product components. Biogenic carbon is only found in the packaging (cardboard, paper and wood).

Information describing the biogenic carbon content at the factory gate

Name	Value	Unit
Biogenic carbon content in product	0	kg C
Biogenic carbon content in accompanying packaging	0.0326	kg C

Transport to construction site (A4)

Name	Value	Unit
Transport distance	647	km
Capacity utilisation (including empty runs)	85	%

The transport distance was modelled using the average distance to the customer base. Due to the European distribution routes, European data sets were used.

Installation in the building (A5)

Name	Value	Unit
Auxiliary fastener	0.05	kg
Excipient adhesive	0,02	kg
Electricity consumption	0.049	kWh
Material loss	0.0193	kg

The energy consumption for hot air and drilling machine was calculated, the information on material losses is based on empirical values. The auxiliary materials required for the three different types of installation were taken into account proportionally.

Service life
The service life depends on the thickness of the roofing and sealing membrane and any surface protection used (gravel, green roof). A weighted average value was calculated. The service life is based on the company's experience.

Name	Value	Unit
Life Span according to manufacturer	20	a

End of life (C1-C4)

Scenario 1:
Recycling route (C3-1) 100.0 %

Scenario 2:
Energy recovery route (C3-2) 100.0 %

Name	Value	Unit
Collected separately	1.99	kg
Collected as mixed construction waste	-	kg
Reuse	-	kg

Recycling scenario 1	1.89	kg
Energy recovery scenario 2	1.89	kg
Landfilling	-	kg
Loss (estimated)	5	%

For the modelling of the End of Life, two different scenarios were calculated, each representing a 100 % route, but also allowing a proportional calculation (e.g. Scenario 1 = 30 % / Scenario 2 = 70 %). The end-of-life processes are modelled with data sets that represent the European average. Intra-European transports and recycling rates were taken into account.

Reuse, recovery and recycling potential (D)

In module D, both the credits from energy recovery for the product in the end of life (resulting from modules C3-1 and C3-2) and for the packaging materials (resulting from module A5) are mapped. In order to be able to consider the end-of-life scenarios separately, the results are shown in modules D-1 (credits, resulting from scenario 1) and D-2 (credits, resulting from scenario 2). In the recycling scenario, only the PVC and plasticiser share was credited with a value correction factor of 0.53.

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5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	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	X	X	ND	ND	MNR	MNR	MNR	ND	ND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m² BauderTHERMOFOL U (12/15/18/20/24), U (15/18/20) V und M (12/15/18/20) incl. packaging

Core Indicator	Unit	A1-A3	A4	A5	C1	C2/1	C2/2	C3/1	C3/2	C4	D/1	D/2
GWP-total	[kg CO_2-Eq.]	5.08E+0	7.80E-2	4.85E-1	1.82E-2	2.95E-2	9.06E-3	7.42E-1	5.03E+0	0.00E+0	-1.69E+0	-1.20E+0
GWP-fossil	[kg CO_2-Eq.]	5.20E+0	7.75E-2	3.65E-1	1.82E-2	2.93E-2	8.99E-3	7.42E-1	5.03E+0	0.00E+0	-1.69E+0	-1.20E+0
GWP-biogenic	[kg CO_2-Eq.]	-1.20E-1	-4.65E-7	1.20E-1	4.72E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
GWP-luluc	[kg CO_2-Eq.]	1.77E-3	5.23E-4	2.28E-5	1.18E-6	1.98E-4	6.08E-5	9.56E-5	3.92E-4	0.00E+0	-5.70E-4	-1.26E-4
ODP	[kg CFC11-Eq.]	6.64E-9	7.63E-15	1.45E-10	1.80E-13	2.89E-15	8.86E-16	5.66E-12	4.86E-12	0.00E+0	-1.12E-10	-7.63E-12
AP	[mol H^+-Eq.]	1.55E-2	2.49E-4	7.53E-4	2.67E-5	9.43E-5	2.90E-5	1.03E-3	1.29E-3	0.00E+0	-3.21E-3	-1.62E-3
EP-freshwater	[kg P-Eq.]	4.08E-3	2.77E-7	4.38E-7	8.17E-9	1.05E-7	3.22E-8	7.20E-6	1.24E-6	0.00E+0	-3.86E-6	-1.56E-6
EP-marine	[kg N-Eq.]	3.60E-3	1.13E-4	1.82E-4	7.31E-6	4.29E-5	1.32E-5	2.73E-4	4.23E-4	0.00E+0	-7.45E-4	-4.28E-4
EP-terrestrial	[mol N-Eq.]	4.06E-2	1.27E-3	1.80E-3	7.81E-5	4.81E-4	1.48E-4	2.79E-3	5.27E-3	0.00E+0	-8.00E-3	-4.54E-3
POCP	[kg NMVOC-Eq.]	1.44E-2	2.24E-4	5.73E-4	2.06E-5	8.47E-5	2.61E-5	7.15E-4	1.22E-3	0.00E+0	-4.07E-3	-1.23E-3
ADPE	[kg Sb-Eq.]	1.57E-6	7.83E-9	6.92E-6	2.17E-9	2.96E-9	9.09E-10	1.14E-7	1.19E-7	0.00E+0	-3.92E-7	-3.21E-7
ADPF	[MJ]	1.25E+2	1.02E+0	5.29E+0	3.86E-1	3.86E-1	1.18E-1	1.00E+1	9.01E+0	0.00E+0	-4.52E+1	-1.99E+1
WDP	[m^3 world-Eq deprived]	3.61E+1	8.67E-4	4.60E-2	1.36E-3	3.28E-4	1.01E-4	1.05E-1	3.91E-1	0.00E+0	-2.08E-1	-1.30E-1

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m² BauderTHERMOFOL U (12/15/18/20/24), U (15/18/20) V und M (12/15/18/20) incl. packaging

Indicator	Unit	A1-A3	A4	A5	C1	C2/1	C2/2	C3/1	C3/2	C4	D/1	D/2
PERE	[MJ]	9.80E+0	7.07E-2	1.05E+0	5.58E-2	2.67E-2	8.21E-3	3.89E+0	2.40E+0	0.00E+0	-3.20E+0	-5.24E+0
PERM	[MJ]	7.00E-1	0.00E+0	-7.00E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PERT	[MJ]	1.05E+1	7.07E-2	3.50E-1	5.58E-2	2.67E-2	8.21E-3	3.89E+0	2.40E+0	0.00E+0	-3.20E+0	-5.24E+0
PENRE	[MJ]	8.80E+1	1.02E+0	5.45E+0	3.86E-1	3.87E-1	1.19E-1	4.69E+1	4.59E+1	0.00E+0	-4.52E+1	-1.99E+1
PENRM	[MJ]	3.70E+1	0.00E+0	-1.45E-1	0.00E+0	0.00E+0	0.00E+0	-3.69E+1	-3.69E+1	0.00E+0	0.00E+0	0.00E+0
PENRT	[MJ]	1.25E+2	1.02E+0	5.30E+0	3.86E-1	3.87E-1	1.19E-1	1.00E+1	9.02E+0	0.00E+0	-4.52E+1	-1.99E+1
SM	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.35E+0	3.49E-2
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m^3]	8.51E-1	8.16E-5	1.34E-3	8.45E-5	3.09E-5	9.47E-6	4.12E-3	1.02E-2	0.00E+0	-7.96E-3	-5.29E-3

Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m² BauderTHERMOFOL U (12/15/18/20/24), U (15/18/20) V und M (12/15/18/20) incl. packaging

Indicator	Unit	A1-A3	A4	A5	C1	C2/1	C2/2	C3/1	C3/2	C4	D/1	D/2
HWD	[kg]	6.53E-4	5.42E-12	3.03E-10	2.76E-11	2.05E-12	6.29E-13	1.15E-9	7.00E-10	0.00E+0	-2.93E-4	-2.63E-9
NHWD	[kg]	2.34E-1	1.67E-4	3.64E-2	8.20E-5	6.31E-5	1.94E-5	2.09E-1	3.10E+0	0.00E+0	-6.01E-3	-1.33E-3
RWD	[kg]	1.91E-3	1.90E-6	1.59E-4	6.42E-5	7.19E-7	2.21E-7	1.11E-3	2.85E-4	0.00E+0	-6.08E-4	-1.51E-3
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.99E+0	3.49E-2	0.00E+0	0.00E+0	0.00E+0
MER	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	[MJ]	0.00E+0	0.00E+0	1.66E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.84E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	2.99E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.83E+0	0.00E+0	0.00E+0	0.00E+0

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional:
1 m² BauderTHERMOFOL U (12/15/18/20/24), U (15/18/20) V und M (12/15/18/20) incl. packaging

Indicator	Unit	A1-A3	A4	A5	C1	C2/1	C2/2	C3/1	C3/2	C4	D/1	D/2
PM	[Disease Incidence]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
IRP	[kBq U235-Eq.]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETP-fw	[CTUe]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HTP-c	[CTUh]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HTP-nc	[CTUh]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SQP	[-]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

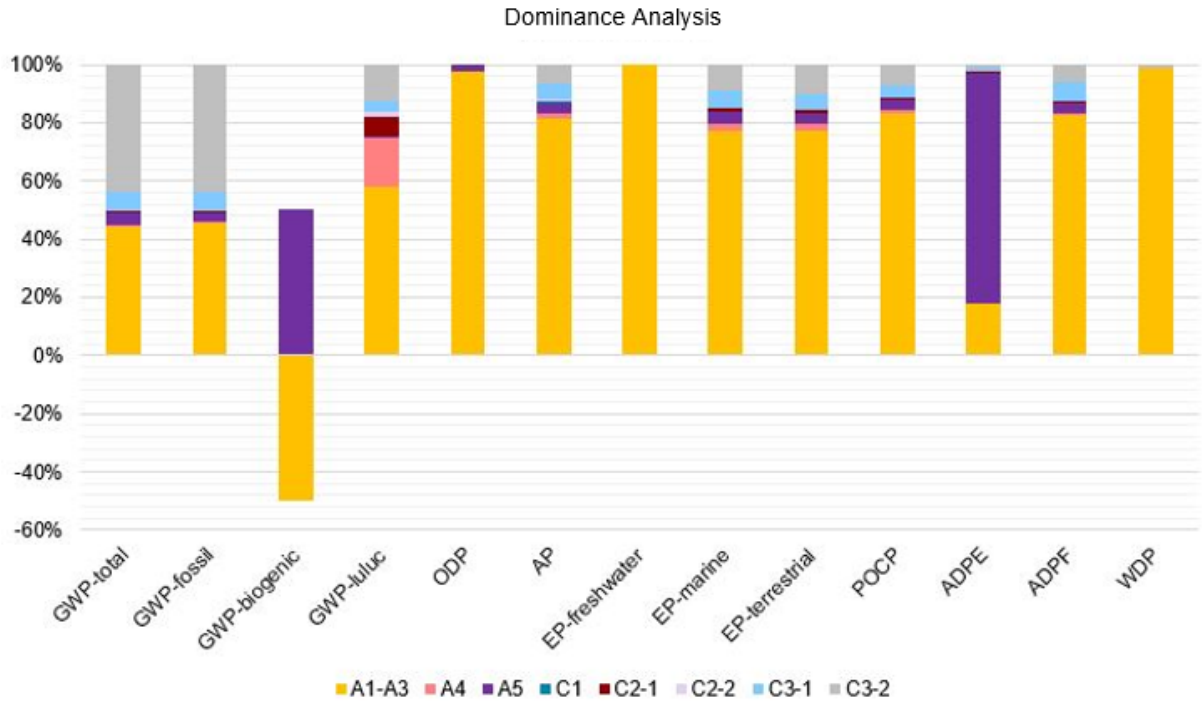
Caption	PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Restriction notice
Concerning the indicators: potential for depletion of non-fossil abiotic resources (ADPE), potential for depletion of abiotic fossil fuels (ADPF), water use (WDP): The results of these environmental impact indicators need to be used with caution, as the uncertainties in these results are high or as there is limited experience with the indicator. The indicators PM, IR, ETP-fw, HTP-c, HTP-nc and SQP are voluntary and have not been declared due to the remaining uncertainties in these results.

Note
The impact assessment results are only relative statements that do not make any statements about endpoints of the impact categories, exceedances of threshold values, safety margins or about risks. For all indicators mentioned, the characterisation factors of EK-JRC were applied.

6. LCA: Interpretation

The evaluation of the environmental impacts allows the following interpretation:



Module A1-A3 has a dominant influence on almost all environmental impacts. In the following, the environmental impacts are analysed using the example of global warming potential (GWP-total) in order to identify the responsible sources along the life cycle. The manufacturing phase (module **A1-A3**) implies a contribution to the total global warming potential of 44 %. Here, the manufactured PVC mixture dominates the total emissions of the module with 85 %. Here again, the PVC granulate is the main driver with about 39 %, followed by the plasticiser with 30 %. The colour mix and electricity each contribute 7 %. All other materials contribute less than 6 % to the manufacturing phase. Transport to the customer has no major relevance in terms of GWP (**A4**). Product installation at the construction site (**A5**) has a contribution of 4 %. The negative contribution to GWP-biogenic in A1-A3 and the positive contribution in A5 can be explained by the use of packaging, such as cardboard and wood, in which biogenic carbon is bound.
The disposal transports (**C2-1/ C2-2**) have hardly any influence on the result. The recycling of the product at the end of life implies a low environmental impact of 6 % (**C3-1**), while the energy recovery of the product and

the associated emissions from the incineration plants (**C3-2)** make a significantly high contribution to the overall result (approx. 44 %).
Since the composition of the different products is very similar, hardly any variances in the percentage contributions are to be expected. The absolute values vary depending on the thickness of the product. GWP-total shows a variance of -24 % and +55 % with respect to A1-A3 compared to the average product.

7. Requisite evidence

No evidence required.

8. References

Standards

EN 495-5
DIN EN 495-5:2013, Flexible sheets for waterproofing - Determination of foldability at low temperature - Part 5: Plastic and rubber sheets for roof waterproofing.

EN 1107-2
DIN EN 1107-2:2001, Flexible sheets for waterproofing - Determination of dimensional stability - Part 2: Plastic and rubber sheets for roof waterproofing.

DIN CEN TS 1187
DIN CEN TS 1187, Test methods for external fire exposure to roofs.

EN 1296:
DIN EN 1296:2000, Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterprofing - Method for artificial ageing by long term exposure to elevated temperature.

EN 1297
DIN EN 1297, Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Method of artificial ageing by long term exposure to the combination of UV radiation, elevated temperature and water.

EN 1548
DIN EN 1548, Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Method for exposure to bitumen.

EN 1928
DIN EN 1928, Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of watertightness.

EN 1931
DIN EN 1931, Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of water vapour transmission properties; German version EN 1931:2000.

ISO 9001
DIN EN ISO 9001:2015, Quality management systems - Requirements.

ISO 11925-2
DIN EN ISO 11925-2:2020: Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test.

EN 12310-2
DIN EN 12310-2:2018, Flexible sheets for waterproofing - Determination of resistance to tearing - Part 2: Plastic and rubber sheets for roof waterproofing.

EN 12311-2
DIN EN 12311-2:2013 Flexible sheets for waterproofing - Determination of tensile properties - Part 2: Plastic and rubber sheets for roof waterproofing.

EN 12316-2
DIN EN 12316-2:2013, Flexible sheets for waterproofing - Determination of peel resistance of joints - Part 2: Plastic and rubber sheets for roof waterproofing.

EN 12317-2
DIN EN 12317-2:2010, Flexible sheets for waterproofing - Determination of shear resistance of joints - Part 2: Plastic and rubber sheets for roof waterproofing.

EN 12691
DIN EN 12691:2018-05, Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of resistance to impact.

EN 13501-1
DIN EN 13501-1:2018, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.

EN 13948
DIN EN 13948:2007, Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of resistance to root penetration.

EN 13956
DIN EN 13956:2012, Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics.

EN 13967
DIN EN 13967:2017, Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet - Definitions and characteristics.

ISO 14025
DIN EN ISO 14025:2011, Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

EN 14909

DIN EN 14909:2012, Flexible sheets for waterproofing - Plastic and rubber damp proof courses - Definitions and characteristics.

EN 15804
DIN EN 15804:2012+A2:2019 + AC:2021, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

DIN 18531-1
DIN 18531-1:2017-07, Waterproofing of roofs, balconies and walkways - Part 1: Non-utilized and utilized roofs - Requirements and principles for execution and design.

DIN 18531-2
DIN 18531-2:2017-07, Waterproofing of roofs, balconies and walkways - Part 2: Non-utilized and utilized roofs - Materials.

DIN 18531-3
DIN 18531-3:2017-07, Waterproofing of roofs, balconies and walkways - Part 3: Non-utilized and utilized roofs - Selection, execution and detailing.

DIN 18531-4
DIN 18531-4:2017-75, Waterproofing of roofs, balconies and walkways - Part 4: Non-utilized and utilized roofs – Maintenance.

DIN 18531-5
DIN 18531-5:2017-07, Waterproofing of roofs, balconies and walkways.

DIN 18532
DIN 18532-1 to 6:2017-07, Waterproofing of concrete areas trafficable by vehicles.

Further literature

AVV
List of Wastes Ordinance (AVV) of 10 December 2001 (BGBl. I p. 3379), last amended by Article 1 of the Ordinance of 30 June 2020 (BGBl. I p. 1533).

Burkhardt et al. 2020
Burkhardt, M., Rohr, M., Heisterkamp, I. and Gartiser, S.: Niederschlagswasser von Kunststoffdachbahnen - Auslaugung von Stoffen und deren Ökotoxizität für aquatische Organismen. Korrespondenz Wasserwirtschaft 2020 (13) No. 8.

ecoinvent
ecoinvent 3.6: Life Cycle Inventory Database (Life Cycle Inventory Data), Version 3.6. Swiss Centre for Life Cycle Inventories, St. Gallen.

FLL
Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau (FLL-Richtlinie):Dachbegrünungsrichtlinie 2008: FLL-Verfahren zur Untersuchung der Wurzelfestigkeit von Bahnen und Beschichtungen für Dachbegrünungen; 2008.

GaBi
GaBi 10.6: Software and Database for Life Cycle Engineering, Sphera Solutions GmbH, Leinfelden-Echterdingen, 2022.

IBU 2021
Institut Bauen und Umwelt e.V., Berlin (ed.): Die Erstellung von Umwelt-Produktdeklarationen (EPD); Allgemeine EPD-Programmanleitung des Institut Bauen und Umwelt e.V. (IBU). Version 2.0. 2021. www.ibu-epd.com

PCR Part A
Institut Bauen und Umwelt e.V., Berlin (ed.): Produktkategorie-Regeln gebäudebezogene Produkte und Dienstleistungen. Part A: Calculation rules for life cycle assessment and requirements for the background report according to EN 15804+A2:2019 (v1.2), 2021-01.

PCR: Dach- und Dichtungsbahnsysteme aus Kunststoffen und Elastomeren
PCR-Anleitungstexte für gebäudebezogene Produkte und Dienstleistungen. Teil B: Anforderungen an die Umwelt-Produktdeklaration für Dach- und Dichtungsbahnsysteme aus Kunststoffen und Elastomeren, Version 1.6 (2022-07). Institut Bauen und Umwelt e.V., Berlin (Hrsg.).

Regulation (EU) No 305/2011
Regulation (EU) No 305/2011, laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC.

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