ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Declaration holder	**FDT FlachdachTechnologie GmbH & Co. KG**
Publisher	Institute Construction and Environment e.V. (IBU)
Programme holder	Institute Construction and Environment e.V. (IBU)
Declaration number	EDP-FDT-20130060-IAA1-EN
Issue date	04.04.2013
Valid until	03.04.2018

Rhenofol CV, Rhenofol CG

FDT FlachdachTechnologie GmbH & Co. KG

Institut Bauen und Umwelt e.V.

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

FDT FLACHDACH·TECHNOLOGIE

1. General information

FDT FlachdachTechnologie GmbH & Co. KG

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Rheinufer 108
D-53639 Königswinter

Declaration number
EDP-FDT-20130060-IAA1-EN

This Declaration is based on the Product Category Rules:
Plastic and elastomer roofing and sealing membrane systems, 09.07.2012
(PCR tested and approved by the independent Committee of Experts (SVA))

Issue date
04.04.2013

Valid until
03.04.2018

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

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

Rhenofol CV, Rhenofol CG

Holder of the Declaration
FDT FlachdachTechnologie GmbH & Co. KG
Eisenbahnstr. 6-8
D-68199 Mannheim

Declared product/unit
1 m² produced roofing membrane Rhenofol CV and Rhenofol CG

Area of validity:
Rhenofol CV and Rhenofol CG are manufactured in 68199 Mannheim-Neckarau, Germany.

The holder of the Declaration is liable for the information and evidence on which it is based.

Verification

The CEN EN 15804 standard serves as the core PCR.

Verification of the EPD by an independent third party in accordance with ISO 14025

☐ internal ☒ external

Matthias Schulz,
Independent auditor appointed by the SVA

2. Product

2.1 Product description

Rhenofol CV is a bitumen-incompatible PVC-P synthetic roofing membrane in various colours with a central woven or non-woven fabric as reinforcement. Seams are joined by hot air or solvent welding agent.
Rhenofol CG is a bitumen-incompatible PVC-P synthetic roofing sheet system with a central glass fleece as an internal layer. Seams are joined by hot air or solvent welding agent.

2.2 Application

Rhenofol CV is used for sealing in mechanically fastened layers.
Rhenofol CG is suitable for sealing green, gravel ballasted or used roofs. Rhenofol CG is also used as a damp-proof sheet (type A) and as a tanking sheet (type T).
The manufacturer's installation instructions must be observed during processing.

2.3 Technical data

Rhenofol CV bzw. Rhenofol CG

Description	Value	Unit
Water vapour diffusion resistance value µ, DIN EN 1931 (method B)	18,000	
Tensile force (Rhenofol CV), DIN EN 12311-2 (version A)	≥ 1000	N/50 mm
Tensile strength (Rhenofol CG), DIN EN 12311-2 (method B)		
Tensile strain (Rhenofol CV), DIN EN 12311-2 (method A)	≥ 15	%
Tensile strain (Rhenofol CG), DIN EN 12311-2 (method B)	≥ 200	%
Seam peel resistance (Rhenofol CV), DIN EN 12316-2	≥ 250	N/50 mm
Seam peel resistance (Rhenofol CG), DIN EN 12316-2	≥ 600	N/50 mm
Seam shear resistance, DIN EN 12317-2	≥ 900	N/50 mm
Resistance to abrupt loads, rigid underlay / flexible underlay (Rhenofol CV 1.5 mm), DIN EN 12691	≥ 900	mm
Resistance to abrupt loads, rigid underlay / flexible underlay (Rhenofol CG 1.5 mm), DIN EN 12691	≥ 650	mm
Resistance to static loads, DIN EN 12730 (method A/B)	≥ 20	kg
Hail, rigid underlay / flexible underlay, DIN EN 13583	≥ 20 / ≥ 30	m/s
Tear resistance, DIN EN 12310-2	≥ 150	N
Resistance to root penetration (Rhenofol CG), FLL, DIN EN 13948	Root- and rootstock-proof	
Dimensional stability after warm	≤ 0.2	%

storage (Rhenofol CV), DIN EN 1107-2		
Dimensional stability after warm storage (Rhenofol CG), DIN EN 1107-2	≤ 0.05	%
Folding at low temperatures, DIN EN 495-5	≤ -30	°C
Resistance to chemicals, DIN EN 1847 (List in Annex C)	fulfilled	
UV radiation, DIN EN 1297	Class 0 (5,000 h)	h
Water tightness, DIN EN 1928 (version B)	≥ 400	kPa

2.4 Placing on the market / Application rules

Rhenofol CV is a bitumen-incompatible PVC synthetic roofing membrane with a central woven or non-woven fabric in accordance with DIN EN 13956 and DIN V 20.000-201: DE/E1 PIB-NB-V-PG-1.5 and DIN V 20.000-202: BA PVC-NB-V-PG-1.5.
FPC certificate no. 1343-CPD-K06-0660.6/1343-CPD-K06 0660.8
Rhenofol CG is a bitumen-incompatible PVC synthetic roofing membrane with a central glass fleece in accordance with DIN EN 13956 and DIN V 20.000-201: DE/E1 PIB-NB-E-GV-1.5 and DIN V 20.000-202: BA PVC-NB-E-GV-1.5.
FPC certificate no. 1343-CPD-K06-0660.3/1343-CPD-K06 0660.5

2.5 Delivery status

Rhenofol CV:
20 m x 2.05 / 1.50 / 1.03 / 0.68 m x 1.2 mm; 20 m x 1.50 m x 1.5 mm; 15 m x 2.05 / 1.03 / 0.68 / 0.50 m x 1.5 mm; 15 m x 2.05 / 1.50 / 1.03 m x 1.8 mm; 15 m x 1.5 m x 2.0 mm.
Rhenofol CG:
20 m x 2.05 m x 1.2 mm; 15 m x 2.05 m x 1.5 / 1.8 / 2.0 mm.

2.6 Base materials / Auxiliaries

Rhenofol CV and Rhenofol CG comprise (45-60)% polyvinyl chloride, (30-40)% phthalate plasticisers, (2-4)% epoxy-enhanced soy bean oil, (0.5-2)% mineral flame retardants, (1-2)% stabilisers, (5-10)% titanium dioxide and (05-20)% carbon black and additives (silicon dioxide and acrylate). Rhenofol CG also contains (0.05-0.15)% of a biocide based on isothiazolinone.

2.7 Production

The PVC mixture for Rhenofol CV and Rhenofol CG is produced via a dry blend. After homogenisation and jellifying in the heating mixer, the mixture is added to the cooling mixer from where it is plastified with an extruder and mixing roll and shaped as foil using calendar technology. A second processing stage involves reinforcement of these foils with a non-woven or woven or an internal layer glass fleece via a doubling calendar to form Rhenofol CV and Rhenofol CG.
Production is subject to the quality management system introduced in accordance with ISO 9001 (certificate register 12 100 22279 TMS). The certification agency is TÜV Süd Management Service.
External quality monitoring and tests are also performed by the State Material Testing Institute in Darmstadt as well as the BBA (British Board of Agreement, certificate no. 98/3491), FM approvals (CV 1.2 and CV 1.5: index no. GE3492F) and Intron Certificatie B.V. (KOMO attest).

2.8 Environment and health during production

Over and beyond national guidelines, environmentally-friendly processes are used in the production of Rhenofol CV and Rhenofol CG, e.g.
> an electric separator is used for waste air which achieves a high degree of waste air purity,
> waste heat for heating and hot water is used in the energy-efficient production processes (EMS as per DIN 50 001) and
> the production waste incurred is redirected to the production circuit in the form of in-company recycling.
In order to ensure the health and safety of employees, workplace designs are continuously improved for the purpose of physical relief and optimised ergonomics and regular seminars are held on the topic of health and safety.

2.9 Product processing/installation

Rhenofol CV and Rhenofol CG are rolled out on the roof and joined at the seams by hot air welding or solvent-welding agent.
No particular measures concerning health and safety are required when hot air welding on the roof.
When joining seams with solvent-welding agent, the following points must be observed:
- Avoid contact with the skin and eyes,
- Wear gloves,
- No smoking, no naked flames, avoid sparking,
- Do not inhale vapours; only use outdoors or in well-ventilated rooms.
Rhenofol CV is mechanically fastened.
Rhenofol CG is laid loosely and ballasted e.g. with gravel or tile surfaces and under green areas.
More information on installation is outlined in the technical manual.

2.10 Packaging

Nine rolls of Rhenofol CV or Rhenofol CG are stored on two Euro pallets covered with a PE hood. A protective separating layer made of cardboard is between the Euro pallets and rolls and the top side of the rolls features a protective cardboard sheet. The rolls are secured by four wooden wedges. The pallet is shrink-wrapped in PE stretch foil and bound by four plastic straps.
All packaging materials are recyclable.

2.11 Condition of use

On the basis of long-term experience, there are no relevant changes concerning material composition for the period of use of Rhenofol CV and Rhenofol CG.

2.12 Environment and health during use

There are no references to possible material emissions during the use phase for Rhenofol CV and Rhenofol CG.

2.13 Reference Service Life (RSL)

Under normal conditions and correct installation, Rhenofol CV and Rhenofol CG have a life cycle of 35 years and more; please refer to the attached BBA Agreement Certificate No. 98/3491.

2.14 Extraordinary effects

Fire
Rhenofol CV bzw. Rhenofol CG

Description	Value

Performance in case of external fire exposure to roofs, DIN CEN/TS 1187	Rhenofol CV and CG: B roof (t1) / passed
Reaction to fire tests DIN EN ISO 11925-2 / DIN EN 13501-1	E
Burning drips	-
Development of smoke gas	-

Notes:
Rhenofol CV: The B roof (t1) test results to ENV 1187 apply for the roof build-ups tested on behalf of FDT.
Rhenofol CG: No additional requirements are made on fire safety (ballasted roofs).
Hydrochloric gases and dioxins can arise in the event of a fire.

Water
The materials used for Rhenofol CV and Rhenofol CG are not water-soluble.

Mechanical destruction
There are no known negative consequences for the environment in the event of unforeseen mechanical destruction of Rhenofol CV or Rhenofol CG.

2.15 Re-use phase
Rhenofol CV and Rhenofol CG are not re-used in their original form once the use phase has expired. When separated by type, Rhenofol CV and Rhenofol CG can be directed to the "ROOF COLLECT" collection system (recycling system for synthetic roofing and water-proofing membrane systems). This collection system manufactures a recyclate from the old roofing membranes which can be used for a variety of applications, e.g. for garden slabs or noise-insulating boards.
Thermal utilisation is also possible with the result that the energy contained in Rhenofol CV and Rhenofol CG is released and used during incineration.

2.16 Disposal
After Rhenofol CV and Rhenofol CG have fulfilled their function, they are directed towards thermal utilisation; please refer to 2.15. The roofing membranes can be allocated to number 170904 or 200139 in the List of Wastes Ordinance.

2.17 Further information
More information on Rhenofol CV and Rhenofol CG in the form of brochures, data sheets, installation instructions and technical manuals can be found on the FDT Web site (www.fdt.de).

3. LCA: Calculation rules

3.1 Declared unit
The declared unit is 1 m² Rhenofol CV/CG of roofing membrane produced.

Description	Value	Unit
Declared unit	1	m^2
Basis weight	2.600	kg/m^2
Strength	1.8	mm
Sealing type	Thermal welding	-

3.2 System boundary
This Life Cycle Analysis addresses the life cycle stage of product manufacturing (cradle to gate). The product stage comprises Module A1 (Raw material supply), A2 (Transport), A3 (Production) in accordance with EN 15804 including the provision of all materials, products and energy. Waste indicated in A1-A3 only concerns that which is recycled internally.

3.3 Estimates and assumptions
The lubricant comprises a 50:50 mixture of methyl methacrylate and butyl acrylate. The methyl methacrylate data record with the higher effect was used as a worst-case scenario. This is modelled as 100% for raw material mixtures in which one component accounts for at least 95%.

3.4 Cut-off criteria
All data from the operating data survey was taken into consideration in the analysis, i.e. all starting materials used according to the recipe, the thermal energy used as well as electricity. Transport costs were considered for all inputs and outputs.

3.5 Background data
The primary data was provided by FDT FlachdachTechnologie GmbH Co. KG. The background data was taken from the GaBi software data base offered by PE INTERNATIONAL AG (GaBi 5 2011). The German power mix was applied.

3.6 Data quality
The data recorded by FDT FlachdachTechnologie GmbH Co. KG for production year 2011 was used for the various recipes for modelling the product stage associated with the synthetic roofing membranes. All other relevant background data records were taken from the GaBi 5 software data base and are less than 7 years old. The representativity can be classified as very good.

3.7 Period under review
The data for this Life Cycle Analysis is based on data records from 2011. The volumes of raw materials, energy, auxiliaries and consumables used are considered as average annual values in the Hemsbach and Mannheim-Neckarau manufacturing plants.

3.8 Allocation
Production waste which is re-used internally (the edge trims in production) is modelled as closed-loop recycling in Modules A1-A3.

3.9 Comparability
As a general rule, EPD data can only be compared or evaluated when all of the data records to be compared have been drawn up in accordance with EN 15804 and the building context or product-specific performance features are taken into consideration.

4. LCA: Scenarios and other technical information

Disposal

It can be assumed that in 80% of current roof refurbishments the roofing membranes remains on the

roof and serves as an underlay for a new covering. Accordingly, in most cases disposal of the roofing membranes occurs later when the building is demolished and this subsequent use means that it is no longer within the system boundaries considered here. Under such conditions, disposal as municipal solid waste can therefore be assumed for 20% of waste (25% incineration, 75% landfilling).
No scenarios are considered in this Life Cycle Analysis of synthetic roofing sheet systems.

5. LCA: Results

SYSTEM BOUNDARIES (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 boundaries
Raw material supply	Transport	Manufacture	Transport	Construction installation process	Use / Application	Maintenance	Repairs	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste treatment	Disposal	Re-use, recovery or 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	MND	MND	MND	MND

LCA RESULTS - ENVIRONMENTAL IMPACT: 1 m² roofing sheet system

Parameter	Unit	A1 - A3
Global Warming Potential	[kg CO_2 equiv.]	7.96E+00
Ozone Depletion Potential	[kg CFC11 equiv.]	2.17E-08
Acidification Potential of Soil and Water	[kg SO_2 equiv.]	3.02E-02
Eutrification Potential	[kg PO_4^3 equiv.]	2.48E-03
Photochemical Ozone Creation Potential	[kg ethene equiv.]	5.08E-03
Abiotic Depletion Potential non-Fossil Resources	[kg Sb equiv.]	3.26E-03
Abiotic Depletion Potential Fossil Fuels	[MJ]	1.69E+02

LCA RESULTS - USE OF RESOURCES: 1 m² roofing sheet system

Parameter	Unit	A1 - A3
Renewable primary energy as energy carrier	[MJ]	8.88E+00
Renewable primary energy as material utilisation	[MJ]	0.00E+00
Total use of renewable primary energy sources	[MJ]	8.88E+00
Non-renewable primary energy as energy carrier	[MJ]	1.31E+02
Non-renewable primary energy as material utilisation	[MJ]	4.92E+01
Total use of non-renewable primary energy sources	[MJ]	1.80E+02
Use of secondary materials	[kg]	0.00E+00
Renewable secondary fuels	[MJ]	2.67E-03
Non-renewable secondary fuels	[MJ]	2.79E-02
Net use of fresh water*	[m³]	6.70E-02

LCA RESULTS - OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² roofing sheet system

Parameter	Unit	A1 - A3
Hazardous waste for disposal**	[kg]	-
Disposed of, non-hazardous waste**	[kg]	-
Disposed of, radioactive waste**	[kg]	-
Components for re-use	[kg]	-
Materials for recycling	[kg]	-
Materials for energy recovery	[kg]	-
Exported electric energy	[MJ]	-
Exported thermal energy	[MJ]	-

** In accordance with the transition solution approved by the SVA on 4.10.2012, the following applies: LCI information on cardboard packaging does not contain sufficient information for calculating the water volume. This involves a data record in which the data for the "Blue water consumption" method is not available for evaluation. The water value depicted in the table above refers therefore to the system under review but excluding the cardboard packaging. The mass percentage of the overall product accounted for by this packaging is 0.2% for Rhenofol CG 1.8 mm. As this share < 3%, it is not regarded as significant and the parameter can be ignored even if this parameter is associated with increased uncertainty.*

*** The Expert Committee (SVA) at IBU clearly defined the calculation rules for declaration of waste in its last meeting on 4 October 2012. The background data records from the data bases must be revised to that effect. Accordingly, this Environmental Product Declaration follows the transition solution approved by the SVA and is drawn up without a waste declaration.*

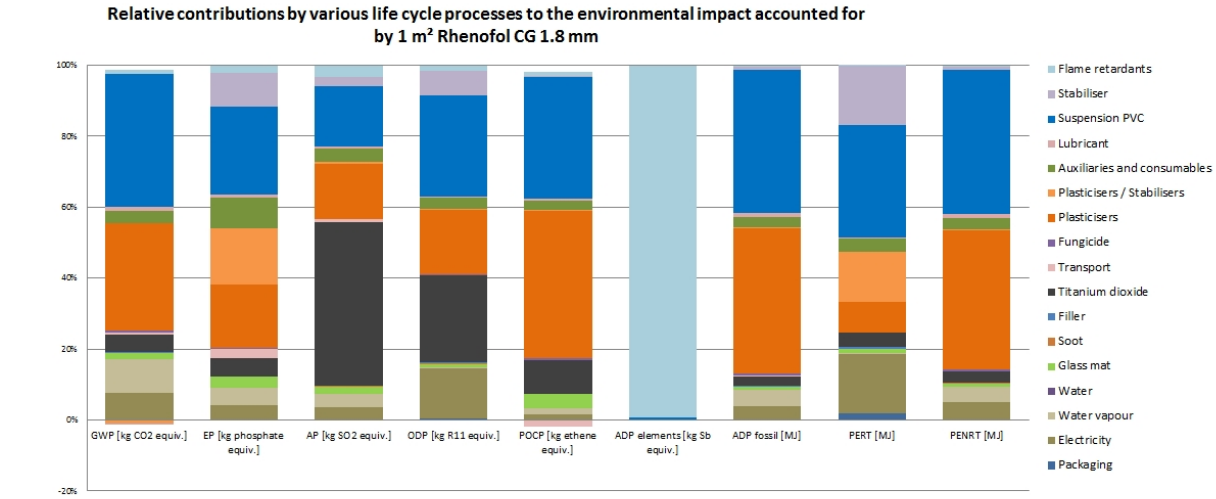
6. LCA: Interpretation

Fig. 6-1 depicts the relative contributions by the individual raw materials and processes to the various environmental impact categories and the use of primary energy in the form of a dominance analysis. This type of presentation can be used to identify the main influential factors in terms of the product's environmental performance.

Indicators of the life cycle inventory analysis

The absolute value of the use of non-renewable as primary energy carrier (PENRT) is approx. 21 times higher than the use of renewable primary energy carriers (PERT).
In the case of Rhenofol CG 1.8 mm, approx. 40% of the PENRT is accounted for by plasticisers, approx. 40% by PVC and approx. 10% by electricity and steam vapour. In terms of the PERT, approx. 32% is accounted for by PVC, 17% by electricity, approx. 9% by the plasticisers and 17% by stabilisers.

Indicators of estimated impacts
The dominance analysis for Rhenofol CG 1.8 mm indicated that the plasticisers, PVC and titanium dioxide represent the main drivers in the various environmental categories. The flame retardants account for practically all ADP Elements. The plasticisers account for a total of 30-50% of the POCP, ADPF and GWP. These plasticisers account for 15-20% of the other impact categories. PVC makes a 40% contribution to the POCP, ADPF and GWP. PVC accounts for 17-30% of the other impact categories. Titanium dioxide R-TC 30 accounts for the greatest influence in terms of AP (46%) and ODP (24%).



7. Requisite evidence

No evidence is required.

8. References

Institut Bauen und Umwelt e.V., Königswinter (pub.): General Principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2011-06

Product Category Rules for building products Part A: Calculation rules for the Life Cycle Assessment and requirements on the background report, 2012-09

PCR 2012, Part B: PCR instructions for building-related products and services in the building products group pertaining to synthetic and elastomer roofing sheet systems (2012).

DIN EN 495-5:2012-10 Flexible sheets for waterproofing – Determination of foldability at low temperature – Part 5: Plastic and rubber sheets for roof waterproofing

DIN EN 1107-2: 2001-04, Flexible sheets for waterproofing - Determination of dimensional stability – Part 2: Plastic and rubber sheets for roof waterproofing

DIN CEN TS 1187: 2012-03 Test methods for external fire exposure to roofs

DIN EN 1297: 2004-12 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

DIN EN 1847:2010-4 Flexible sheets for waterproofing – Plastics and rubber sheets for roof waterproofing – Methods for exposure to liquid chemicals, including water

DIN EN 1928:2000-4 Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of water-tightness

EN 1931:2001-03 Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of water vapour transmission properties

ISO 9001:2008-12 Quality management systems – Requirements

DIN EN ISO 11925-2:2011-02 Reaction to fire tests – Ignitability of products subjected to direct impingement of flame

DIN EN 12310-2:2000-12 Flexible sheets for waterproofing – Determination of resistance to tearing – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12311-2:2010-12 Flexible sheets for waterproofing – Determination of tensile properties – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12316-2:2012-10 Flexible sheets for waterproofing – Determination of peel resistance of

joints – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12317-2:2010-12 Flexible sheets for waterproofing – Determination of peel resistance of joints – Part 2: Plastic and rubber sheets for roof waterproofing

DIN EN 12691:2006-06 Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of resistance to impact

DIN EN 12703:012-06 Adhesives for paper and board, packaging and disposable sanitary products – Determination of low temperature flexibility or cold crack temperature

DIN EN 13501-1:2010-01 Classification of building products and methods by fore performance - Part 1: Classification with the Results of Tests on Fire Performance of Building Products

DIN EN 13583:2012-10 Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of hail resistance

DIN EN 13948:2008-01 Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing - Determination of resistance to root penetration

DIN EN 13956:2012-05 Flexible sheets for waterproofing – Plastic and rubber sheets for roof waterproofing – Definitions and characteristics

DIN EN ISO 14025:2009-11 Environmental labels and declarations – Type III environmental declarations – Principles and procedures.

EN 15804:2012-04 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

DIN V 20000-201:2006-11, Application of Building Products in Buildings – Part 201: Adaptation standard for flexible sheets for waterproofing according to European standards for use as waterproofing of roofs

DIN V 20000-202:2007-12 Use of building products in construction works – Part 202: Adaptation standard for flexible sheets for waterproofing according to European standards for use as waterproofing

DIN EN ISO 50001:2011-12 Energy management systems – Requirements with guidance for use

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