ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A1*

Owner of the Declaration	FDT FlachdachTechnologie GmbH & Co. KG
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-FDT-20200119-IAA1-EN
Issue date	12.07.2020
Valid to	11.07.2025

Rhepanol hfk

FDT FlachdachTechnologie GmbH & Co. KG

Institut Bauen und Umwelt e.V.

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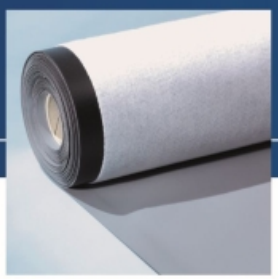


1. General Information

FDT FlachdachTechnologie GmbH & Co. KG

Programme holder
IBU – Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-FDT-20200119-IAA1-EN

This declaration is based on the product category rules:
Plastic and elastomer roofing and sealing sheet systems, 07.2014
(PCR checked and approved by the SVR)

Issue date
12.07.2020

Valid to
11.07.2025

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

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

Rhepanol hfk

Owner of the declaration
FDT FlachdachTechnologie GmbH & Co. KG
Eisenbahnstr. 6-8
68199 Mannheim

Declared product / declared unit
1 m² produced roofing membrane Rhepanol hfk

Scope:
The Declaration applies for Rhepanol hfk roofing membrane, 1.5 mm thick, manufactured in 68199 Mannheim-Neckarau.This document is translated from the German Environmental Product Declaration into English. It is based on the German original version EPD-FDT-20150187-IAA1-DE. The verifier has no influence on the quality of the translation.

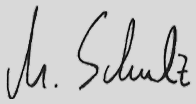
This EPD is an extension of the EPD Rhepanol hfk EPD-FDT-20150187-IAA1-DE (valid from 14.08.2015-13.08.2020) and is completely identical in content to this EPD.

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+A1*. 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 14025:2010*
☐ internally ☒ externally



Matthias Schulz
(Independent verifier appointed by SVR)

2. Product

2.1 Product description/Product definition

Rhepanol hfk is a bitumen-compatible polyisobutylene (PIB) synthetic roofing membrane comprising PIB of high molecular weight, co-polymers and functional additives as well as a synthetic non-woven fleece on the underside. Rhepanol hfk seams are hot air-welded.

Product according to /CPR/ with hEN:
Directive (EU) No. 305/2011 /CPR/ applies for placing the product on the market in the EU/EFTA (with the exception of Switzerland).

Rhepanol hfk has a Declaration of Performance “01 17041” taking consideration of the /DIN EN 13956:2013-03/ and /DIN SPEC 20.000-201: 2015-08/.
Application type: DE/E1 PIB-BV-K-PV-1,5 as well as taking consideration of the /DIN EN 13967:2017-08/ and /DIN SPEC 20.000-202: 2016-03/.
Application type: BA PIB-BV-K-PV-1,5 and CE marking. /FPC/ certificate no.: 1343-CPD-K15-1541.17

2.2 Application

Rhepanol hfk is used for sealing purposes on both flat and inclined roofs in mechanically fastened or adhered layers and for green roofs, pebble or used roofs.
Rhepanol hfk is also used as a moisture barrier (type A) and as a groundwater barrier (type T)

The manufacturer's installation instructions must be observed during processing.

2.3 Technical Data

Structural data

Name	Value	Unit
Water vapour diffusion resistance value µ /DIN EN 1931/ (method B)	≥ 160,000	
Tensile force (Rhepanol hfk) /DIN EN 12311-2/ (method A)	≥ 400	N/50mm
Tensile strain (Rhepanol hfk) /DIN EN 12311-2/ (method A)	≥ 50	%
Seam peel resistance /DIN 12316-2/	≥ 150	N/50 mm
Seam shear resistance /DIN EN 12317-2/	≥ 200 (tearing outside the seam)	N/50 mm
Resistance to abrupt loads, rigid underlay / flexible underlay /DIN EN 12691/	≥ 700 / ≥ 700	mm
Resistance to static loads /DIN EN 12730/ (method A/B)	≥ 20	kg
Hail, rigid underlay / flexible underlay /DIN EN 13583/	≥ 25 / ≥ 35	m/s
Tear resistance /DIN EN 12310-2/	≥ 150	N
Dimensional stability after warm storage /DIN EN 1107-2/	≤ 1	%
Performance when exposed to bitumen /DIN EN 1548/	passed	
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/ (method B)	≥ 400	kPa
Resistance to root penetration (for green roofs) acc. to /DIN EN 13948/ and FLL (roofing membranes)	root- and rootstockproof	-
Ozone resistance (for EPDM/IIR) acc. to /EN 1844/ (roof membranes)	Not of relevance	-

Performance values of the product according to the declaration of performance "01 170 41" with regard to its essential characteristics according to paragraph 2.1

2.4 Delivery status

The nominal thickness of the sealing layer is 1.5 mm; its dimensions are 15 m x 1.50 m / x 1.00 m / x 0.50 m x 2.5 mm (incl. 1.0 mm synthetic non-woven fleece).

2.5 Base materials/Ancillary materials

Rhepanol hfk comprises a sealing layer with 50-65% polyisobutylene (PIB) and copolymers, 30-45% flame retardants (metal hydroxide) and functional mineralogical aggregates, 2-10% titanium dioxide and 0.5-2.0% carbon black and additives. Rhepanol hfk is also reinforced by a synthetic non-woven fleece on the back. Details can vary depending on the colour.

1) This product/article/at least one partial article contains substances listed in the candidate list (date: dd.mm.yyyy) exceeding 0.1 percentage by mass: **no**

2) This product/article/at least one partial article contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: **no**

3) “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**

2.6 Manufacture

Rhepanol hfk compounds are produced by a continuous operating mixer in which the individual raw materials are combined to form a homogeneous mass before being granulated. The granulate is added to a calendar via another mixing extruder and mixing roll which shapes the membranes. In another process step, the top web is manufactured the same way and applied to the bottom web. The synthetic membrane and polyester non-woven fleece are then joined by friction-locking. The manufacturing process is rounded off with packing the roofing membranes.

Production is subject to the Quality Management system introduced in accordance with /ISO 9001/. The certification agency is TÜV Süd Management Service.

External quality monitoring and tests (are also performed by the State Material Testing Institute in Darmstadt.

2.7 Environment and health during manufacturing

Over and beyond national guidelines, environmentally-friendly processes are used in the production of Rhepanol hfk, 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 (Environment Management system (EMS) as per /DIN 50001/) 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.

2.8 Product processing/Installation

Rhepanol hfk is rolled out on the roof and joined using hot-air welding.

The following must be maintained when cleaning Rhepanol hfk seams with cleaning agents containing solvents:
- 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

No particular measures concerning health and safety are required when hot air welding Rhepanol hfk with weldable seam.

Rhepanol hfk is mechanically fastened, adhered or laid loosely and ballasted e.g. with gravel or paving and

under green areas, for example. More information on installation is outlined in the technical manual.

2.9 Packaging
Nine rolls of Rhepanol hfk are stored on a Euro pallet covered with a PE hood. A protective separating layer made of cardboard is between the Euro pallet and rolls and the top side of the rolls features an additional 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 and re-usable.

2.10 Condition of use
On the basis of long-term experience, there are no relevant changes concerning material composition for the period of use of Rhepanol hfk.

2.11 Environment and health during use
There are no references to possible material emissions during the use phase for Rhepanol hfk.

2.12 Reference service life

Under normal conditions and correct installation, Rhepanol hfk has a life cycle of 35 years and more.

2.13 Extraordinary effects

Fire

Name	Value
Reaction to fire tests /DIN EN 11925-2 / /DIN EN 13501-1/	Class E / passed
Performance in case of external fire exposure to roofs /DIN CEN TS 1187: 2012-03/ /DIN EN 13501-5/	B (t1) / passed

Comments

The B roof (t1) test results in accordance with /DIN CEN TS 1187: 2012-03/ apply for the roof structures tested by FDT.

Water
The materials used for Rhepanol hfk are not water-soluble.

Mechanical destruction
There are no known negative consequences for the environment in the event of unforeseen mechanical destruction of Rhepanol hfk.

2.14 Re-use phase
Rhepanol hfk is not re-used in its original form once the use phase has expired. When separated by type, Rhepanol hfk can be directed to the "ROOFCOLLECT" 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 or re-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 Rhepanol hfk is released and used during incineration.

2.15 Disposal
After Rhepanol hfk has fulfilled its function, it is 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/.

2.16 Further information
More information on Rhepanol hfk in the form of brochures, data sheets, installation instructions and technical manuals can be found on the FDT website (www.fdt.de).

3. LCA: Calculation rules

3.1 Declared Unit
The declared unit is 1 m² Rhepanol hfk 1.5 mm of roofing membrane produced.

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Grammage	-	kg/m^2
Grammage	1.934	kg/m^2
Type of sealing (thermal welding or connection using seam tape and primer)	-	-
Type of sealing (thermal welding or connection using seaming tape and primer)	Thermal welding	-
Conversion factor to 1 kg	-	-
Conversion factor to 1 kg	0.517	-
Declared unit	-	m^2
Thickness	1.5	mm

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
Polybutylene was used as a conservative estimate for polyisobutylene as the exact data record for the polymer was not available. 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 6 2014/. The German power mix was applied.

3.6 Data quality
The data recorded by FDT FlachdachTechnologie GmbH Co. KG for production year 2013 was used for the various recipes for modelling the product stage associated with the synthetic roofing membranes. All other relevant background data sets were taken from the GaBi 6 software data base which was last revised in November 2014. 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 2013. The volumes of raw materials, energy, auxiliaries and consumables used are considered as average annual values in the Mannheim-Neckarau manufacturing plant.

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
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 6/ SP 34 was used as background data base.

4. LCA: Scenarios and additional 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 membrane 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 membrane Systems.

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE 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	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	MND	MND	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 m² roofing membrane

Parameter	Unit	A1-A3
Global warming potential	[kg CO_2-Eq.]	7.63E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	9.62E-10
Acidification potential of land and water	[kg SO_2-Eq.]	2.57E-2
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.65E-3
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	2.98E-3
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	4.11E-5
Abiotic depletion potential for fossil resources	[MJ]	1.47E+2

RESULTS OF THE LCA - RESOURCE USE according to EN 15804+A1: 1 m² roofing membrane

Parameter	Unit	A1-A3
Renewable primary energy as energy carrier	[MJ]	1.44E+1
Renewable primary energy resources as material utilization	[MJ]	0.00E+0
Total use of renewable primary energy resources	[MJ]	1.44E+1
Non-renewable primary energy as energy carrier	[MJ]	9.80E+1
Non-renewable primary energy as material utilization	[MJ]	6.10E+1
Total use of non-renewable primary energy resources	[MJ]	1.59E+2
Use of secondary material	[kg]	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0
Use of net fresh water	[m³]	3.92E-2

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES according to EN 15804+A1: 1 m² roofing membrane

Parameter	Unit	A1-A3
Hazardous waste disposed	[kg]	5.87E-5
Non-hazardous waste disposed	[kg]	4.27E-1
Radioactive waste disposed	[kg]	4.88E-3
Components for re-use	[kg]	0.00E+0
Materials for recycling	[kg]	0.00E+0
Materials for energy recovery	[kg]	0.00E+0
Exported electrical energy	[MJ]	0.00E+0
Exported thermal energy	[MJ]	0.00E+0

6. LCA: Interpretation

A dominance analysis can be used to discuss the main influential factors in terms of the product's environmental performance.

Indicators of the Life Cycle Inventory Analysis and estimated impact

The absolute value of the use of non-renewable energy carriers as primary energy (**PENRT**) is approx. 10 times higher than the use of renewable primary energy carriers (**PERT**).

The dominance analysis for Rhepanol hfk 1.5 mm indicates that, depending on the environmental impact in question, the polymers have a minor to significant influence.

Polymers and flame retardants make the largest contribution to the global warming potential (**GWP**). PES non-woven fleece, the process steam and electricity used have a moderately important influence.

Flame retardants and polymers make the greatest contribution to the eutrification potential (**EP**). The acidification potential (**AP**) is largely caused by flame retardants, titanium dioxide and polymers.

The ozone depletion potential (**ODP**) is significantly attributable to flame retardants with electricity making only a moderate contribution.

Polymers make the greatest contribution to the photochemical ozone creation potential (**POCP**).

Polymers also account for the greatest influence in terms of abiotic depletion of resources – fossil fuels (**ADPF**) and the total use of non-renewable primary energy (**PENRT**). Flame retardants rank second for the ADPF and PENRT.

In the case of total use of renewable primary energy (**PERT**), flame retardants account for half of all contributions while electricity is also responsible for a certain percentage. Flame retardants account for by far the largest share in terms of abiotic depletion of resources - elementary (**ADPE**).

7. Requisite evidence

No evidence is required.

8. References

PCR 2014, Part B: PCR instructions for construction - related products and services in the construction products group pertaining to synthetic and elastomer roofing membrane systems (2014)

GaBi 6:
PE INTERNATIONAL AG; GaBi 6: Software system and data base for comprehensive analysis; copyright, TM Stuttgart, Echterdingen, 1992-2014

GaBi 6D:
GaBi 6 documentation: data sets from the data base for comprehensive analysis; copyright, TM Stuttgart, Echterdingen, 1992-2014. http://documentation.gabi-software.com/

AVV (List of Wastes Ordinance) Issue date: 10.12.2001
No. 17 09 04: Mixed building and demolition rubble with the exception of those covered by 17 09 01, 17 09 02 and 17 09 03
No. 200139: Plastics

DIN EN 495-5:201210
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 1548: 2007-11 Flexible sheets for waterproofing – Plastic and rubber sheets for roof waterproofing – Method for exposure to bitumen

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 1928:2000-07 Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of watertightness

DIN 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 shear 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 13501-1:2010-01 Classification of construction products and methods by reaction to fire – Part 1: Classification with the results of tests on reaction to fire of construction products

DIN EN 13501-5:2010-02, Classification of construction products and methods by reaction to fire – Part 5: Classification using data from external fire exposure to roofs tests

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.

DIN V 20000-201:2006-11 Use of construction products in construction works – 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 construction 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

REACH
Directive (EC) No. 1907/2006 of the European Parliament and Council of 18 December 2006 on the Registration, Evaluation, Authorisation of Chemicals (REACH) for establishing a European Chemicals Agency

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