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Rhepanol® hfk roofing membrane for all installation methods

Sustainability data sheet

Rhepanol® hfk is an extremely efficient roofing membrane that can be used for a wide range of applications.

- Mechanically fastened (seam fastening, mechanically fastened in the Gripfix system or in the combination of seam and Gripfix system
- Glued strip-wise or fully bonded
- With ballast (gravel, extensive and intensive greening, terrace coverings, inverted roofs, etc.)
- Building waterproofing (e.g. collecting tanks, firefighting water tank (e.g. for snow cannons, ponds, kitchens)

Rhepanol® hfk is made from the raw material polyisobutylene (PIB) and has an integrated 1.0 mm-thick synthetic fleece and a fleece-free edge. The roofing membranes are joined in the seam area by hot air welding. The fleece additional protects against loads from the substrate.

Tests and approvals

For example for:

- Proof of an environmental product declaration in the form of a product-specific EPD according to ISO 14025 und EN 15804 (www.ibu-epd.com), listed in the DGNB Navigator (www.dgnb-navigator.de) with the declaration number: EPDFDT20200119IAA1DE
- Fire behaviour: building material class B2 according to DIN 4102 or Class E according to EN 13501-1
- Test methods for external fire exposure to roofs DD CEN/TS 1187 and classification according to EN 13501-5: Broof (t1) (for different roof structures, general building supervisory authority test certificate (AbP) or classification reports can be requested separately)
- Root- and rhizome-resistant according to FLL method, without use of herbicides
- European Technical Assessment (ETA 13/0655) for the mechanically fastened roof sealing system "Rhepanol® hfk" according to EAD 030351-00-0402
- Drinking water certification for Rhepanol® hfk according to DVGW worksheet W 270 and KTW guideline of the German Federal Environmental Agency
- DUBOkeur certificate, Nibe Research BV (test of environmental and health aspects)
- Belgian approval (ATG) for Rhepanol® hfk
- Solar Reflectance Index (SRI) according to ASTM E 1980:
  - Rhepanol® hfk white (based on RAL 9016) > 98 (new condition)
  - Rhepanol® hfk grey (based on RAL 7000) > 14 (new condition)

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Rhepanol® hfk leaching test according to DIN CEN/TS 16637-2

The leaching test was carried out by the DVGW Water Technology Centre in Karlsruhe. The test shows that the Rhepanol® hfk roofing membrane does not contain the substances of concern in the list, which therefore cannot be washed out (for results, see negative list).

Substance group	Substance	AT*	Unit	Result
Anions	Ammonium	0.01	mg/L	**< AT**
	Chloride	1	mg/L	**< AT**
	Nitrate	0.5	mg/L	**< AT**
	Sulphate	1	mg/L	**< AT**
	Nitrite	0.01	mg/L	**< AT**
Heavy metals	Arsenic	0.001	mg/L	**< AT**
	Lead	0.001	mg/L	**< AT**
	Cadmium	0.0001	mg/L	**< AT**
	Copper	0.01	mg/L	**< AT**
	Nickel	0.001	mg/L	**< AT**
	Mercury	0,00005	mg/L	**< AT**
	Antimony	0.01	mg/L	**< AT**
	Tin	0.01	mg/L	**< AT**
	Zinc	0.2	mg/L	**< AT**
Cross-linking agent	2-Mercaptobenzothiazole	0.1	µg/L	**< AT**
Halogenated hydrocarbons	Trichloromethane (chloroform)	0.1	µg/L	**< AT**
	Bromodichloromethane	0.1	µg/L	**< AT**
	Dibromochloromethane	0.1	µg/L	**< AT**
	Tribromomethane (bromoform)	0.1	µg/L	**< AT**
	1,2-Dichloroethane	0.1	µg/L	**< AT**
	Trichloroethene	0.1	µg/L	**< AT**
	Tetrachloroethene	0.1	µg/L	**< AT**
Carcinogen	Benzol	0.1	µg/L	**< AT**
PAH (polycyclic hydrocarbons)	Benzo(a)pyrene	0.0005	µg/L	**< AT**
	Benzo(b)fluoranthene	0.001	µg/L	**< AT**
	Benzo(ghi)perylene	0.0005	µg/L	**< AT**
	Benzo(k)fluoranthene	0.001	µg/L	**< AT**
	Indeno(1,2,3-cd)pyrene	0.0005	µg/L	**< AT**
Biocides	IPBC	0.01	µg/L	**< AT**
	Carbendazim	0.01	µg/L	**< AT**
	Diuron	0.01	µg/L	**< AT**
	Irgarol	0.01	µg/L	**< AT**
	Isoproturon	0.01	µg/L	**< AT**
	MCPA	0.01	µg/L	**< AT**
	MCPP (Mecoprop)	0.01	µg/L	**< AT**
	Terbutryn	0.01	µg/L	**< AT**
	4,5-Dichlor-2-n-octyl-3-isothiazolinone	0.01	µg/L	**< AT**
	2-Octyl-3-isothiazolinone	0.01	µg/L	**< AT**
Endocrine disruptors	4-Octylphenol	0.01	µg/L	**< AT**
	Bisphenol A	0.01	µg/L	**< AT**
	Bisphenol F	0.01	µg/L	**< AT**
Antioxidants	2,6-Di-tert-butyl-4-methylphenol	0.1	µg/L	**< AT**
Flame retardants	Tris-(butoxyethyl)-phosphate	0.05	µg/L	**< AT**
	Tris-(2-chloropropyl)-phosphate	0.025	µg/L	**< AT**

* Assessment threshold (smallest measurable minimum concentration of a substance).

Sustainable product characteristics

- Due to high quality and above-average service life, the roofing membrane offers sustainable protection of life and assets for future generations
- Free from chlorine, halogens, bitumen and PVC, and resistant to rotting
- No plasticisers
- No lead-based stabilisers, cadmium or organotin substances in concentrations exceeding 0.01% by weight
- This product is a product within the meaning of the Regulation (EC) no. 1907/2006 (REACH). Based on our current level of knowledge, Rhepanol® hfk contains no substances in concentrations exceeding 0.01% by weight that were published in Annex XIV of the REACH regulation or on the candidate list of the European Agency for Chemical Substances (ECHA)
- Postconsumer recycled content: 0 %
- Preconsumer recycled content: approx. 10% on average (only in the bottom layer)
- Extremely weather-resistant, even without additional surface protection
- Resistant to atmospheric influences, e.g. UV radiation as well as industrial and heating exhaust gases
- Outstanding resistance to natural aging
- Suitable as the basis for the source of life (e.g. terraces, playgrounds, green roofs, rooftop gardens, urban farming, biodiversity) and energy generation (e.g. photovoltaic systems, solar heating)
- Easy to dismantle construction product, separable into mono-fractions in the mechanically fastened application area or under ballast
- After it has fulfilled its purpose, the product can be recycled as a plastic or thermally recycled
- Suitable for rainwater retention (retention roof)
- Also suitable for flat surfaces (slope ≤ 2 %)
- Meets the requirements for green roof subsidies (e.g. HH, B) (country specific)
- System-specific repairs are possible over the complete lifetime
- Resistance to roots and rhizomes enables use in areas of both extensive and intensive greening
- Low weight per unit area of just 2.0 kg/m²
- Low operating costs due to long life service life
- Drinking water certification for Rhepanol® hfk
- Resistant to red algae
- Weight loss after action of microorganisms according to ISO 846 methods A and C ≤ 10 % (ATG Belgium)
- Unrestricted use of roof water (e.g. watering of rooftop garden, roof greening, façade greening): since the product contains no root toxins, the soil, surface water and groundwater are protected
- Listed on the portals www.ibu-epd.com and www.dgnb-navigator.de as well as www.baubook.at
- Solar Reflectance Index (SRI) according to ASTM E 1980 in the colour Rhepanol® hfk white (based on RAL 9016) > 98 (new condition)

Building certifications (DGNB, BNB)

DGNB (Version 2018)

(Deutsche Gesellschaft für Nachhaltiges Bauen e. V. [German Sustainable Construction Association])

Relevant requirements according to DGNB criterion ENV1.2 "Risks for the local environment" for new buildings:

1. Criteria matrix row number 36: Synthetic foils on roof and foundation (DGNB, Version 2018, see Annex 1 Criteria matrix)

- Free from lead and organotin compounds (manufacturer's declaration: content < 0.1 %)

Quality level 1: fulfilled
Quality level 2: fulfilled
Quality level 3: fulfilled
Quality level 4: fulfilled

2. Criteria matrix row number 44: Synthetic products (DGNB, Version 2018, see Annex 1 Criteria matrix)

- No SVHC substances (manufacturer's declaration: content < 0.1 %)*

Quality level 1: –
Quality level 2: –
Quality level 3: fulfilled
Quality level 4: fulfilled

Special properties
Rhepanol® hfk synthetic membranes can be used as the basis for green roofs and photovoltaic systems/solar heating – usable roof areas (roof terraces, rooftop gardens, urban farming, playgrounds on the roof, etc.) are considered within the framework of the DGNB criterion SOC1.6.

BNB (Version 2015)

(Bewertungssystem Nachhaltiges Bauen für Büro- und Verwaltungsgebäude [Sustainable building assessment system for office and administration buildings])

Relevant requirements according to BNB criterion 1.1.6 "Risks for the local environment":

The assessment system only contains requirements for roofing membranes made of PVC and polymer bitumen. Products made of PIB are not considered.

Nevertheless, Rhepanol® hfk meets the following requirement:

1. BNB_BN 1.1.6 Annex 1 (Overview table of all quality requirements) row number 29: Synthetic (PVC) building products

- No cadmium, lead or tin stabilisers (cadmium content < 0.01 % according to REACH Annex XVII no. 23 pursuant to footnote c)
- For soft PVC, the rule is: reprotoxic phthalate plasticisers < 0.1 % (see Annex 2, E)

Quality level 1: fulfilled
Quality level 2: fulfilled
Quality level 3: fulfilled
Quality level 4: fulfilled
Quality level 5: fulfilled

2. BNB_BN 1.1.6 Annex 1, row number 44: Bitumen products for sealing

- No use of root penetration inhibiting ingredients such as Mecoprop

Quality level 1: fulfilled
Quality level 2: fulfilled
Quality level 3: fulfilled
Quality level 4: fulfilled
Quality level 5: fulfilled

Rhepanol® hfk contains no root penetration inhibiting ingredients such as Mecoprop

* SVHC = Substance of Very High Concern.

Qualitätssiegel Nachhaltiges Gebäude (QNG) [Quality Seal for Sustainable Buildings]
Within the framework of the Bundesförderung für effiziente Gebäude (BEG) [Federal Funding for Efficient Buildings] the state has subsidised sustainability aspects through a dedicated "NH Class" since 1 July 2021.
The proof required for the granting of the subsidy is provided by the award of the building-related QNG.

Relevant requirements according to the QNG criteria catalogue
"Risks for health and the local environment:

The QNG criteria catalogue only contains requirements for PVC and bitumen roofing membranes. Products made of PIB are not considered. Nevertheless, Rhepanol® hfk meets the requirements for the two quality seals "Nachhaltiges Gebäude Plus"[Sustainable Building Plus] and "Nachhaltiges Gebäude Premium" [Sustainable Building Premium] (residential buildings) regarding the avoidance of harmful substances:

1. Handbook of the Quality Seal for Sustainable Buildings (Annex 3, section 1.3 and appended document 313)

- No tin, cadmium or lead stabilisers
- For soft PVC, the rule is: reprotoxic phthalate plasticiser < 0.1 % (no single compounds from Table 0.5, Annex 3, appended document 313: single compounds with properties of very high concern Group E)
- No use of root penetration inhibiting ingredients such as Mecoprop (Annex 3, appended document 313, point 9.3)

Rhepanol® hfk contains no root penetration inhibiting agents such as Mecoprop or comparable herbicides.

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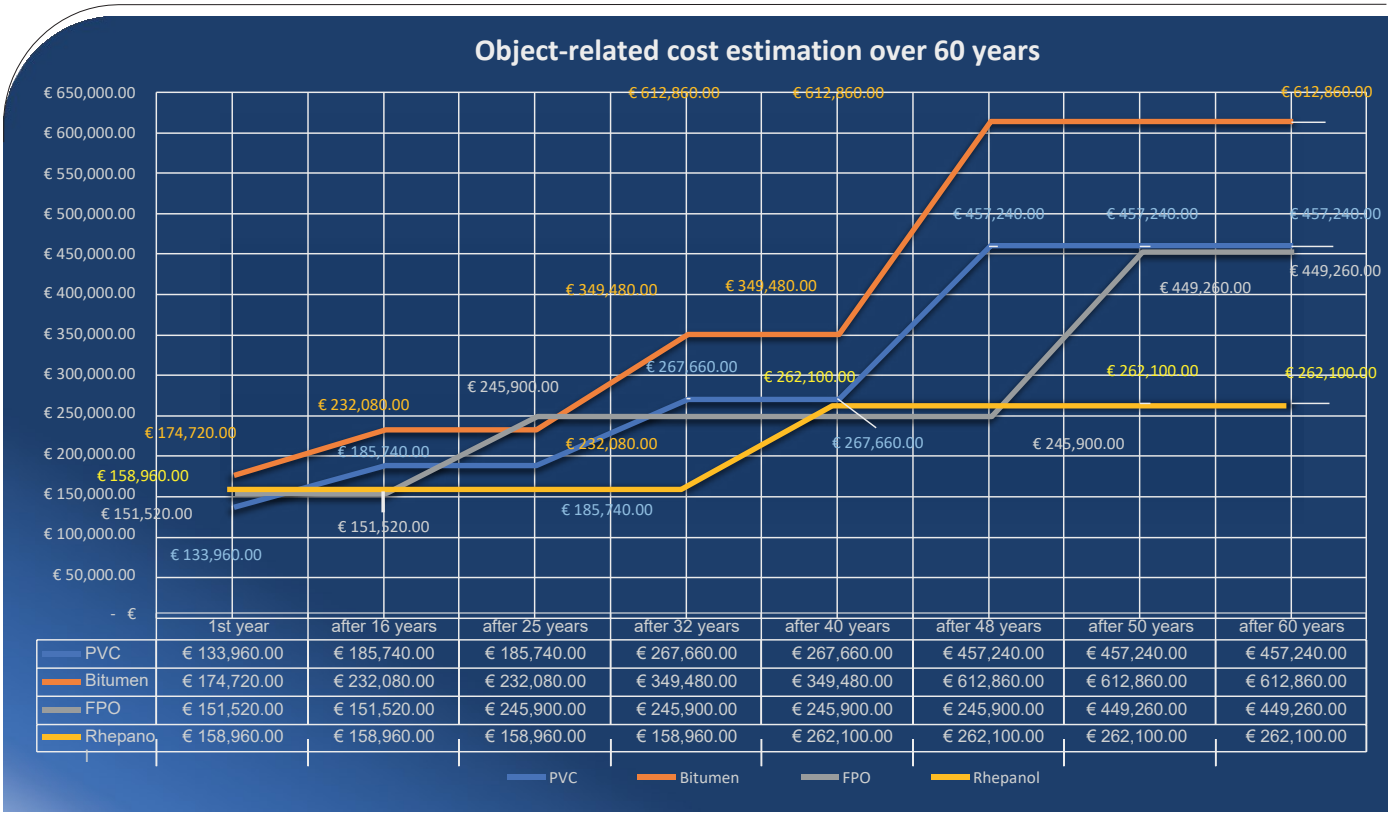
Durability of Rhepanol® roofing membranes

Our current oldest reference for Rhepanol® (formerly Prevanol) is located in Eggenstein-Leopoldshafen and was installed in 1956. The PIB roofing membrane installed at the time is still performing its sealing function with flying colours today (more than 65 years later). As far as we are aware, the PIB synthetic membrane is the oldest synthetic roofing membrane reference in Europe.

Sustainability consideration of PIB roofing membranes based on the Eggenstein-Leopoldshafen reference with an actual roofing membrane life expectancy of over 60 years. Despite the long reference lifespan of the roofing membrane, a realistic average life expectancy of 40 years is taken for the calculation comparison.

In the following graphic, for example, 4 sealing solutions (PVC, Bitumen, FPO and Rhepanol®) are considered over a time period of 60 years.



	1st year	after 16 years	after 25 years	after 32 years	after 40 years	after 48 years	after 50 years	after 60 years
PVC	€ 133,960.00	€ 185,740.00	€ 185,740.00	€ 267,660.00	€ 267,660.00	€ 457,240.00	€ 457,240.00	€ 457,240.00
Bitumen	€ 174,720.00	€ 232,080.00	€ 232,080.00	€ 349,480.00	€ 349,480.00	€ 612,860.00	€ 612,860.00	€ 612,860.00
FPO	€ 151,520.00	€ 151,520.00	€ 245,900.00	€ 245,900.00	€ 245,900.00	€ 245,900.00	€ 449,260.00	€ 449,260.00
Rhepano	€ 158,960.00	€ 158,960.00	€ 158,960.00	€ 158,960.00	€ 262,100.00	€ 262,100.00	€ 262,100.00	€ 262,100.00

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Calculation basis

	PVC roofing membranes	Bitumen roofing membranes	FPO roofing membranes	Rhepanol® roofing membranes
First installation area 2000 m² (without connections)	■ Concrete ■ Clean the substrate ■ Precoat with bitumen - Bitumen-DS V60 S4 + AL EPS 035, U-value 0.20, dm without slope ■ Raw glass fleece 120 g/m² ■ PVC 1.5 mm, mech. fastened	■ Concrete ■ Clean the substrate ■ Precoat with bitumen - Bitumen-DS V60 S4 + AL EPS 035, U-value 0.20, dm without slope, glued ■ 1st layer KSK ■ 2nd layer top layer	■ Concrete ■ Clean the substrate ■ Precoat with bitumen - Bitumen-DS V60 S4 + AL EPS 035, U-value 0.20, dm without slope ■ Raw glass fleece 120 g/m² ■ FPO 1.5 mm, mech. fastened	■ Concrete ■ Clean the substrate ■ Precoat with bitumen - Bitumen-DS V60 S4 + AL EPS 035, U-value 0.20, dm without slope ■ Raw glass fleece 120 g/m² ■ Rhepanol® hfk 1.5 mm, mech. fastened
	Costs per m² (material + installation)			
	€ 66.98/m²	€ 87.36/m²	€ 75.76/m²	€ 79.48/m²
	Cost estimation for first installation			
	€ 133,960.00	€ 174,720.00	€ 151,520.00	€ 158,960.00
1st renovation measure	**after 16 years** ■ No additional thermal insulation according to GEG (Building Energy Act) exception, therefore only a new sealing layer ■ Raw glass fleece + 1 layer PVC, 1.5 mm, mech. fastened ■ Upstands are not considered	**after 16 years** □ No additional thermal insulation according to GEG (Building Energy Act) exception, therefore only a new sealing layer □ Cleaning + pre-coat + top layer PYE □ Upstands are not considered	**after 25 years** ■ Additional thermal insulation – EPS 035 loose, 60 mm, dm, without slope ■ Raw glass fleece + 1 layer FPO, 1.5 mm, mech. fastened ■ Upstands are not considered	Unnecessary
	Costs per m² (material + installation)			
	€ 25.89/m²	€ 28.68/m²	€ 47.19/m²	€ 0.00/m²
	Cost estimation for 1st renovation measure			
	€ 51.780,00	€ 57,360.00	€ 94,380.00	€ 0.00
2st renovation measure	**after 32 years** ■ Additional thermal insulation - EPS 035 loose, 60 mm, dm, without slope ■ Raw glass fleece + 1 layer PVC, 1.5 mm, mech. fastened ■ Upstands are not considered	**after 32 years** ■ Clean the substrate ■ Additional thermal insulation – EPS 035, glued, 60 mm, dm, without slope, glued ■ 1st layer KSK ■ 2nd layer top layer ■ Upstands are not considered	Unnecessary	Unnecessary
	Costs per m² (material + installation)			
	€ 40.96/m²	€ 58.70/m²	€ 0.00/m²	€ 0.00/m²
	Cost estimation for 2st renovation measure			
	€ 81,920.00	€ 117,400.00	€ 0.00	€ 0.00
3st renovation measure	**after 48 years** ■ Removal of 3 layers of roofing membrane ■ Removal of 2 layers of insulation 180 mm + 60 mm ■ Old vapour barrier is retained ■ Cleaning + preparation ■ Precoat with bitumen - Bitumen-DS V60 S4 + AL ■ New thermal insulation – EPS 035, U-value 0.20, dm without slope ■ Raw glass fleece 120 g/m² ■ PVC 1.5 mm, mech. fastened ■ Upstands are not considered	**after 48 years** ■ Removal of 5 layers of roofing membrane ■ Removal of 2 layers of insulation 180 mm + 60 mm ■ Old vapour barrier is retained ■ Cleaning + preparation ■ Precoat with bitumen - Bitumen-DS V60 S4 + AL ■ New thermal insulation – EPS 035, U-value 0.20 mm, dm without slope, glued ■ 1st layer KSK ■ 2nd layer top layer ■ Upstands are not considered	**after 50 years** ■ Removal of 2 layers of roofing membrane ■ Removal of 2 layers of insulation 180 mm + 60 mm ■ Old vapour barrier is retained ■ Cleaning + preparation ■ Precoat with bitumen - Bitumen-DS V60 S4 + AL ■ New thermal insulation – EPS 035, U-value 0.20, dm without slope ■ Raw glass fleece 120 g/m² ■ FPO 1.5 mm, mech. fastened ■ Upstands are not considered	**after 40 years** ■ Additional thermal insulation - EPS 035 loose, 60 mm, dm, without slope ■ Insulation, raw glass fleece + 1 layer Rhepanol® hfk 1.5 mm, mech. fastened ■ Upstands are not considered
	Costs per m² (material + installation)			
	€ 94.79/m²	€ 131.69/m²	€ 101.68/m²	€ 51.57/m²
	Cost estimation for 3st renovation measure			
	€ 189,580.00	€ 263,380.00	€ 203,360.00	€ 103,140.00
	Total costs after 60 years			
	€ 457,240.00	**€ 612,860.00**	**€ 449,260.00**	**€ 262,100.00**

Notes: The calculation shown is a practical example based on the illustrated reference and was drawn up to the best of our knowledge. Legal claims cannot be derived from it. The calculation considers the material and installation costs that would probably be incurred for the covering of a 2000 m² sample roof area over a period of 60 years. The product prices taken are based on the price level as of April 2022. The renovation measures 1 to 3 are also based on the price level as of April 2022. Price increases were not considered. The complete removal in the third renovation phase in variants 1 to 3 was preferred over a new layer by the roofing companies surveyed. Reason: after 48 years, shrinkage, old fastenings, bubbles, moisture, etc. could have damaged the lower layers. The prices taken were calculated by mid-size roofing companies. Junctions, scaffolding, site equipment etc. were not considered. The expenses/costs for these would have an additional disadvantage, especially in the case of variants 1 to 3.

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Summary

There are many factors that determine how long a roof will last before it needs renovation, e.g. roof construction, quality of materials and workmanship, location of the building, weather conditions, etc. One and the same product may have entirely different life expectancies in different installation situations. Therefore, we have selected times for the estimated renovation measures that correspond to our many years of experience. Even if the individual renovation measures are postponed or advanced a few years, or in the case of a shorter consideration period of, for example, 35 years, the variant with Rhepanol® roofing membranes still convinces as the most cost-effective and sustainable solution.

Further ecological and economic benefits

- Reducing resource consumption preserves our environment
- Lower lifecycle costs (e.g. maintenance costs, renovation costs, removal costs, disposal costs)
- Waste avoidance
- Simple removal possible without any problems when separated by type
- Improvement in cost-effectiveness
- As a rule, lower construction and operating costs over periods under consideration of > 35 years

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