ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	FDT Flachdach Technologie GmbH
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-FDT-20180019-IAA1-EN
Issue date	26.02.2018
Valid to	25.02.2024

Rhepanol hg

FDT Flachdach Technologie GmbH

Institut Bauen und Umwelt e.V.

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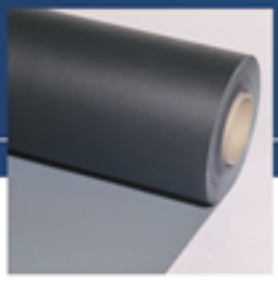

1. General Information

FDT Flachdach Technologie GmbH	Rhepanol hg
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** FDT Flachdach Technologie GmbH Eisenbahnstraße 6-8 68199 Mannheim
Declaration number EPD-FDT-20180019-IAA1-EN	**Declared product / declared unit** 1 m² produced roofing membrane Rhepanol hg 1.8 mm
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)	**Scope:** This Environmental Product Declaration refers to the following products manufactured by FDT Flachdach Technologie GmbH & Co. KG at its Mannheim-Neckerau plant: Rhepanol hg 1.5 mm Rhepanol hg 1.8 mm This Declaration concerns a specific product (Rhepanol hg 1.8 mm). Lower thicknesses can be considered in the LCA results as a worst-case approach. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.
Issue date 26.02.2018	
Valid to 25.02.2024	
	Verification The standard /EN 15804/ serves as the core PCR Independent verification of the declaration and data according to /ISO 14025:2010/ ☐ internally ☒ externally
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	
Dipl. Ing. Hans Peters (Head of Board IBU)	Matthias Schulz (Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

This EPD outlines the technical data on Rhepanol hg; the results of the LCA in section 5 apply to Rhepanol hg 1.8 mm (see also section 6).

Rhepanol hg is a bitumen-compatible polyisobutylene (PIB) synthetic roofing membrane comprising PIB of high molecular weight, co-polymers and functional additives as well as a central glass fleece as an internal layer. Rhepanol hg 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).
Rhenofol hg has a Declaration of Performance “01 15 110 120” taking consideration of the /DIN EN 13956: 2013-03/ and /DIN SPEC 20.000-201: 2015-08/, application type: DE/E1/ PIB-BV-E-GV-1.5
and a Declaration of Performance “01 15 110 120 67” taking consideration of the /DIN EN 13967: 2017-08/ and /DIN SPEC 20.000-202: 2016-03/, application type: BA PIB-BV-GV-1.5/ and CE marking.
/FPC/ Certificate No. 1343-CPD-K06-0660.10, 1343-CPD-K06-0660.11, 1343- CPD-K06-0660.12, 1343-CPD-K06-0660.18.

Use is governed by the respective national regulations.

2.2 Application

Rhepanol hg is suitable for sealing green, gravel ballasted or used roofs. Rhepanol hg is also used as a damp-proof sheet (type A) and as a tanking sheet (type T).

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

2.3 Technical Data

The data in the Declaration of Performance applies.

Other data is outlined below.

Rhepanol hg

Name	Value	Unit
Water vapour diffusion resistance value μ /DIN EN 1931 (method B)/	≥ 160.000	
Tensile strength (Rhepanol hg) /DIN EN 12311-2 (method B)/	≥ 4	N/mm²
Tensile strain (Rhepanol hg) /DIN EN 12311-2 (B)/	≥ 400	%
Seam peel resistance /DIN EN 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/	≥ 20 / ≥ 30	m/s
Tear resistance /DIN EN 12310-2/	≥ 150	N
Resistance to root penetration /FLL, EN 13948/	Root- and rootstock-proof	
Dimensional stability after warm storage /DIN EN 1107-2/	≤ 0,5	%
Folding at low temperatures /DIN EN 495-5/	≤ - 60	°C
Performance when exposed to bitumen /DIN EN 1548/	passed	
Resistance to chemicals /DIN EN 1847 (list in Annex C)/	fulfilled	
UV radiation 7DIN EN 1297/	Class 0 (5000 h)	h
Water tightness /DIN EN 1928 (method B)/	≥ 400	kPa

Product according to /CPR/ with hEN:
The Rhepanol hg product's performance values correspond with the Declaration of Performance "01 15 110 120" and "01 15 110 120 67" in terms of its essential properties in accordance with para. 2.1.

2.4 Delivery status

Rhepanol hg: Nominal thicknesses are 1.5 mm and 1.8 mm; standard membrane dimensions are 15 m x 2.05 m x 1.5 mm and x 1.8 mm.

2.5 Base materials / Ancillary materials

Rhepanol hg comprises (20-30)% high-molecular polyisobutylene, (30-50)% co-polymers, (20-35)% functional, mineralogical aggregates, (5-10)% titanium dioxide, (0.5-2.0)% carbon black and additives.
Rhepanol hg is also reinforced with a glass fleece as an internal layer.
No materials are used which are included in the /REACH/ list of candidates.

2.6 Manufacture

Rhepanol hg compounds are produced by a continuous operating mixer in which the individual raw materials are combined to form a homogeneous mass and granulated through a perforated plate. The granulate is then added to a calender via another plasticising mixing extruder and mixing roll which shapes the membranes. A doubling calender then merges two membranes with the central glass fleece or polyester woven or non-woven fabric. The roofing membranes are packed at the end of the doubling calender.
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.

2.7 Environment and health during manufacturing

Over and beyond national guidelines, environmentally-friendly processes are used in the production of Rhepanol hg, 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.

2.8 Product processing/Installation

Rhepanol hg is rolled out on the roof and joined overlapping at the seams using hot-air welding.
When cleaning seams with cleaning agents containing solvents, the following points must be maintained:

- 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 hg.

Rhepanol hg 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.

2.9 Packaging

Nine rolls of Rhepanol hg 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 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 hg.

2.11 Environment and health during use
There are no references to possible material emissions during the use phase for Rhepanol hg. Accordingly, there are no indications of impacts on health and the Environment.

2.12 Reference service life

Under normal conditions and correct installation, empirical values indicate that Rhepanol hg has a life cycle of 35 years and more; please refer to the attached.

2.13 Extraordinary effects

Fire

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

Comments:

Rhepanol hg:
No additional requirements are made on fire safety (ballasted roofs).

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

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

2.14 Re-use phase
Rhepanol hg is not reused in its original form once the use phase has expired. When separated by type, Rhepanol hg 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 hg is released and used during incineration.

2.15 Disposal
After Rhepanol hg has fulfilled its function, it is directed towards thermal utilisation; please refer to 2.14. 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 hg 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 hg 1.8 mm of roof membrane produced.

Declared unit

Name	Value	Unit
Declared unit	1	m^2
Grammage	1.97	kg/m^2
Type of sealing Thermal welding	Thermal welding	-
Conversion factor to 1 kg	0.507614213	-
Thickness	1,8	mm

For IBU core EPDs (where clause 3.6 is part of the EPD): for average EPDs, an estimate of the robustness of the LCA values must be made, e.g. concerning variability of the production process, geographical representatively and the influence of background data and preliminary products compared to the environmental impacts caused by actual production.

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 relevant background data was taken from the /GaBi 8/ data base. The German power mix was applied.

3.6 Data quality
The representativity can be classified as very good. Manufacturing of the synthetic roofing membrane systems was modelled using primary data from FDT FlachdachTechnologie GmbH Co. KG. All other

relevant background data records were taken from the /GaBi 8/ software data base and are less than 7 years old.

3.7 Period under review

The volumes of raw materials, energy, auxiliaries and consumables used are considered as average annual values in the Hemsbach manufacturing plant. FDT Flachdach Technologie GmbH & Co. KG has confirmed that the data continues to be valid in 2017 as there have been no essential changes made since data collation in 2017 in terms of:

· product composition,
· production-related energy consumption and energy sources used,
· direct process emissions, e.g. into air,
· types and volumes of waste and
· production technology.

The site of the production facility remains unchanged.

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.

The used background database has to be mentioned. The used background database is /GaBi database version SP34/.

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.

Packaging

The following packaging materials were declared for the analysis of 1 m^2 roofing membrane:

- 1 g PE stretch foil
- 6 g cardboard packaging box

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM 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: 1 m² Dachbahn Rhepanol hg

Parameter	Unit	A1-A3
Global warming potential	[kg CO_2-Eq.]	6.04E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	1.19E-11
Acidification potential of land and water	[kg SO_2-Eq.]	1.68E-2
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	1.20E-3
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	2.26E-3
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	4.90E-6
Abiotic depletion potential for fossil resources	[MJ]	1.33E+2

RESULTS OF THE LCA - RESOURCE USE: 1 m² Dachbahn Rhepanol hg

Parameter	Unit	A1-A3
Renewable primary energy as energy carrier	[MJ]	1.06E+1
Renewable primary energy resources as material utilization	[MJ]	7.00E-2
Total use of renewable primary energy resources	[MJ]	1.07E+1
Non-renewable primary energy as energy carrier	[MJ]	7.35E+1
Non-renewable primary energy as material utilization	[MJ]	6.50E+1
Total use of non-renewable primary energy resources	[MJ]	1.38E+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]	2.39E-2

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² Dachbahn Rhepanol hg

Parameter	Unit	A1-A3
Hazardous waste disposed	[kg]	8.00E-8
Non-hazardous waste disposed	[kg]	5.12E-2
Radioactive waste disposed	[kg]	2.33E-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

Indicators of the Life Cycle Inventory Analysis

The primary energy used for 1 m² average roofing membrane comprises approx. 138 MJ/m2 from non-renewable primary energy sources (**PENRT**). Primary energy use decreased by 7% compared to the results of 2013. The manufacture of polymers (PIB 30%) and PP polymers (44%) has a relevant influence. A certain influence is represented by the supply of electricity (11%) and thermal energy from coal (10%) used directly by the primary system.
Approx. 10.7 MJ/m2 are procured from renewable primary energy (**PERT**), which is double the value of 2013 (factor of 2.2), of which the electricity required has a significant influence (45%), while the manufacture of PP polymers (17%) and PIB polymers (11%) has a certain influence.

Waste

Radioactive waste (**RWD**) originates from the power mix (approx. 59%), the PP polymer (17%) and the PIB polymer (13%). Non-hazardous waste for disposal (**NHWD**) is accounted for by the power mix (28%), the requisite thermal energy (18%), glass non-woven fleece (14%), PP polymer (14%) and PIB polymer (13%). Hazardous waste for disposal (**HWD**) is accounted for by diesel for the transport processes (30%), thermal energy from coal (19%), PP polymers (14%), the power mix (12%) and PIB polymers (10%).

Indicators of estimated impacts

In the dominance analysis for Rhepanol hg 1.8 mm, it is apparent that the electricity used as well as thermal

energy and the polymers used represent the main drivers in the various environmental categories.

Half of the global warming potential (**GWP**) is incurred by the various polymers (24% PIB, 26% PP), 23% is incurred by thermal energy and 20% by the power mix. A relevant influence on the ozone depletion potential (**ODP**) is accounted for by the power mix (37%), PIB (23%), the pigments used (18%) and PP (13%). The acidification potential (**AP**) is accounted for by the PP polymers (25%), PIB (23%), thermal energy (19%) and the power mix (17%). 24% of the eutrophication potential (**EP**) is incurred by the power mix, 22% by the main PIB polymer, 22% by the PP polymers and 18% by thermal energy. The photochemical ozone creation potential (**POCP**) is primarily caused by NMVOC emissions, but also nitrogen oxide, methane, sulphuric oxide and carbon monoxide. The manufacture of PIB accounts for a relevant share of 57%. Other polymers account for 19%. Pigments have a certain influence (13%). The abiotic depletion potential of fossil resources (**ADP fossil**) is primarily caused by the manufacture of polymers, accounting for a total of 76% (of which 31% is attributable to PIB). The abiotic depletion potential of non-fossil resources (**ADP Elementary**) is caused by the power mix (37%), polymers (31%) and pigments (28%).

7. Requisite evidence

No evidence is required.

8. References

/IBU 2016/
IBU (2016): General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V., Version 1.1 Institut Bauen und Umwelt e.V., Berlin.
www.ibu-epd.de

/ISO 14025/
DIN EN /ISO 14025:2011-10/, Environmental labels and declarations — Type III environmental declarations — Principles and procedures

/EN 15804/
/EN 15804:2012-04+A1 2013/, Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

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, version 1.3, 07-2014

IBU 2017, Part A
PCR – Part A: Calculation rules for the LCA and requirements on the Background Report, Version 1.6, Institut Bauen und Umwelt e.V., www.bau-umwelt.com, 2017

AVV: 2001-12, Ordinance on the List of Wastes dated 10 December 2001 (BGBl. I p. 3379), last amended by Article 2 of the Directive dated 17 July 2017 (BGBl. I, p. 2644)

CPR (Construction Products Regulation): Directive (EU) No. 305/2011 of the European Parliament and Council dated 9 March 2011 on specifying harmonised conditions for marketing building products (Construction Products Regulation)

DIN EN 495-5:2013-08, 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, Wooden materials – Determining formaldehyde emissions – 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 water vapour transmission properties

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

ISO 9001:2015-11, 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 12311-2:2013-11, Flexible sheets for waterproofing – Determination of tensile properties – Part 2: Flexible sheets for waterproofing

DIN EN 12316-2:2013-08, 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 12703:2012-06, 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 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 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 13956:2013-03, 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 EN ISO 50001:2011-12, Energy management systems – Requirements with guidance for use

DIN V 20000-201:2015-08, 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 20000-202:2016-03, Use of construction products in construction works – Part 202: Adaptation standard for flexible sheets for waterproofing according to European standards for use as waterproofing

FPC certificate: EC certificate of conformity of factory production control (FPC)

GaBi 8: thinkstep AG; GaBi 8: software and data base for comprehensive analysis; copyright, TM Stuttgart, Echterdingen, 1992-2018

GaBi data base, version SP34: documentation of GaBi 8 data sets in the Data Base for Comprehensive Analysis; copyright, TM Stuttgart, Echterdingen, 1992-2018

REACH: Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency

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