

BLUE ANGEL

The German Ecolabel



Roof and sealing sheets

DE-UZ 224

Basic Award Criteria

Edition July 2022

Version 1

The environmental label is supported by the following institutions:



Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

The Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection is the owner of the label. It regularly provides information on the decisions taken by the Environmental Label Jury.



The German Environmental Agency with its specialist department for "Ecodesign, Eco-Labeling and Environmentally friendly Procurement" acts as office of the Environmental Label Jury and develops the technical criteria of the Basic Criteria for Award of the Blue Angel.



The Environmental Label Jury is the independent, decision-making body for the Blue Angel and includes representatives from environmental and consumer associations, trade unions, industry, the trade, crafts, local authorities, academia, the media, churches, young people and the German federal states.



The RAL gGmbH is the awarding body for the Environmental Label. It organises the process for developing the relevant award criteria in independent expert hearings – which involve all relevant interest groups.

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This document is a translation of a German original. In case of dispute, the original document should be taken as authoritative.

1 Introduction

1.1 Preface

In cooperation with the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, the German Environment Agency and considering the results of the expert hearings conducted by RAL gGmbH, the Environmental Label Jury has set up these Basic Criteria for the Award of the Environmental Label. RAL gGmbH has been tasked with awarding the Environmental Label.

Upon application to RAL gGmbH and on the basis of a Contract on the Use of the Environmental Label to be concluded with RAL gGmbH, the permission to use the environmental label may be granted to all products, provided that they comply with the requirements as specified hereinafter. The product must comply with all the legal requirements in the country in which it is to be marketed. The applicant shall declare that the product meets this requirement.

1.2 Background

Roof and sealing sheets (also known as roof and sealing membranes) are used to seal flat and sloping roofs, green roofs, patios, balconies, roof gardens and underground garages against direct exposure to weather and are also installed under a ballast. They are also used to seal sprinkler tanks and ponds. Roof and sealing sheets can be installed loosely (under a ballast), mechanically fastened, fully adhered or adhered in strips. The following materials are used: bitumen, polymer bitumen, plastics and elastomers.

Roof and sealing sheets are installed over large areas and come into contact with soil and (rain) water, why it is desirable that these products release the lowest amount of pollutants possible both during their installation phase and also during and after their usage phase. These Basic award Criteria include a surface leaching test to evaluate the release of pollutants from roof and sealing sheets.

1.3 Objectives of the environmental label

This environmental label may be awarded to products that – above and beyond the legal regulations:

- are manufactured using materials that place less burden on the environment than usual, and are also durable and recyclable,
- are safe for the environment from an ecotoxicological perspective and
- do not contain any harmful substances that have a detrimental impact during the recycling or disposal process.

Therefore, the following benefits for the environment and health are stated in the explanatory box:



2 Scope

These Basic Award Criteria are valid for products produced according to the following standards

- DIN EN 13707 Flexible sheets for waterproofing - Reinforced bitumen sheets for roof waterproofing - Definitions and characteristics,
- DIN EN 13956 Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics,
- DIN EN 13969:2007-03 Flexible sheets for waterproofing - Bitumen damp proof sheets including bitumen basement tanking sheets - Definitions and characteristics or
- DIN EN 13967 Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet - Definitions and characteristics

that are

- loosely installed, mechanically fastened, self-adhesive or
- loosely installed under a ballast or
- installed without a ballast as a durable¹ seal made of 2-layer polymer bitumen sheet that is either welded or bonded in place using hot bitumen
- or installed under a ballast as a seal made of 2-layer polymer bitumen sheet that is either welded or bonded in place using hot bitumen.

The following products and materials are excluded from the scope of these Basic Award Criteria:

- Bitumen sheeting with a copper strip inlay
- Chlorosulfonated polyethylene (CSM or PE-CS)
- Chlorinated polyethylene (PE-C)
- Polyvinyl chloride (PVC)
- Chloroprene rubber (CR)

Products designed for indoor uses are also excluded from the scope of these Basic Award Criteria.

3 Requirements

3.1 Technical suitability and fitness for use

In accordance with Article 13 of the German Model Building Code (Musterbauordnung), building structures must be fit for their intended use and designed and constructed in such a way that water and moisture cannot cause any hazards or unacceptable nuisance. The product must comply with all of the building inspection requirements for its intended use. The minimum performance requirements that apply to structural components designed for sealing building structures are defined in Table B 2.2.5 of the Model Administrative Rules – Technical Building Regulations (MVV TB) as well as in DIN SPEC 20000-201 and DIN SPEC 20000-202. The requirements for roofs are also defined in section A 2.1.9 and Annex 4 of the MVV TB. These requirements are supplementary to the building inspection regulations.

In addition, the requirements in DIN 18531-1² section 5.1 and DIN 18531-2³ section 4.1 must be complied with as a minimum.

¹ See Paragraph 3.9 Consumer information.

² 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

³ DIN 18531-2:2017-07 Waterproofing of roofs, balconies and walkways - Part 2: Non-utilized and utilized roofs - Materials

Compliance verification

The applicant shall declare that the product complies with the requirements. A declaration of performance according to Regulation (EU) No. 305/2011 must be enclosed with the application.

3.2 Requirements for constituent components

Constituent components are substances added to the product as such or as part of a mixture in order to achieve or influence certain product properties and those required as chemical cleavage products for achieving the product properties.⁴ This does not apply to residual monomers that have been reduced to a minimum. Above and beyond the legal requirements, products certified with the Blue Angel may not contain any substances with the following properties as constituent components:

1. Substances which are identified in the REACH Regulation (EC) No. 1907/2006
 - ♦ as particularly alarming and which have been incorporated into the list drawn up in accordance with Article 59, Paragraph 1 of the REACH Regulation (so-called "candidate list") or
 - ♦ which are classified as persistent, bioaccumulative and toxic (PBT) substances or as very persistent and very bioaccumulative (vPvB) substances.
2. Substances that have been classified according to the CLP Regulation in the following hazard categories or which meet the criteria for such classification:
 - ♦ carcinogenic in categories Carc. 1A or Carc. 1B;
 - ♦ germ cell mutagenic in categories Muta. 1A or Muta. 1B;
 - ♦ reprotoxic (teratogenic) in categories Repr. 1A or Repr. 1B;
 - ♦ acute toxicity (poisonous) in categories Acute Tox. 1 or Acute Tox. 2;
 - ♦ specific target organ toxicity in categories STOT SE 1 or STOT RE 1;
 - ♦ hazardous to water in category Aquatic Chronic 1 or
 - ♦ hazardous to the ozone layer in category Ozone 1.

The following table assigns the stated hazard categories to the corresponding hazard statements (H Phrases) according to the CLP Regulation (EC) No. 1272/2008.

Table 1: Hazard categories, H Phrases and assigned hazard statements

Hazard category	H Phrase	Hazard statement
Carcinogenic substances		
Carc. 1A	H350	May cause cancer
Carc. 1B	H350	May cause cancer
Carc. 1A, 1B	H350i	May cause cancer if inhaled
Germ cell mutagenic substances		
Muta. 1A	H340	May cause genetic defects
Muta. 1B	H340	May cause genetic defects
Reprotoxic (teratogenic) substances		
Repr. 1A, 1B	H360D	May damage the unborn child

⁴ Cross-linking agents and other processing aids in precursors that do not fulfil a function in the final product are not covered.

Hazard category	H Phrase	Hazard statement
Repr. 1A, 1B	H360F	May damage fertility
Repr. 1A, 1B	H360FD	May damage fertility May damage the unborn child
Repr. 1A, 1B	H360Df	May damage the unborn child Suspected of damaging fertility
Repr. 1A, 1B	H360Fd	May damage fertility Suspected of damaging the unborn child
Acute toxic substances		
Acute Tox. 1 Acute Tox. 2	H300	Fatal if swallowed
Acute Tox. 1 Acute Tox. 2	H310	Fatal in contact with skin
Acute Tox. 1 Acute Tox. 2	H330	Fatal if inhaled
Substances with specific target organ toxicity		
STOT SE. 1	H370	Causes damage to organs
STOT RE. 1	H372	Causes damage to organs through prolonged or repeated exposure
Environmental hazards		
Aquatic Chronic 1	H410	Very toxic to aquatic life with long-lasting effects
Ozone 1	H420	Harms public health and the environment by destroying ozone in the upper atmosphere.

3. Substances that are classified in TRGS 905 as:

- ◆ Carcinogenic (K1A, K1B)
- ◆ Germ cell mutagenic (M1A, M1B)
- ◆ Reprotoxic (R_F1A, R_F1B)
- ◆ Teratogenic (R_D1A, R_D1B)

The requirements for constituent components not only apply to the roof and sealing sheets but also to any products that are required for the installation of the products according to the installation instructions issued by the manufacturer, such as a splice wash and activator.

Compliance verification

The applicant shall declare compliance with the requirements in Annex 1 and submit corresponding declarations from the manufacturer/suppliers (Annex 3), installation instructions, technical data sheets and safety data sheets for all of the primary products and installation products used. If the term of validity of the Basic Award Criteria is extended, new declarations from the manufacturer and suppliers shall be submitted.

3.3 Flame retardants

If flame retardants are used, they must be named by the applicant (name, CAS no).

Compliance verification

The applicant shall declare in Annex 1 whether a flame retardant has been added to the product. If this is the case, the applicant shall enclose the name, CAS number and classification of the flame retardant with the application.

3.4 Prohibited substances in roof and sealing sheets, as well as in the products used to install them

3.4.1 Halogens

No halogenated organic compounds may be used in the manufacture of the products.

3.4.2 Biocides and herbicides

The use of biocides according to Regulation (EU) No 528/2012 is not permitted. The use of herbicides in the sense of Regulation (EC) No 1107/2009 as root resistance agents is not permitted.

3.4.3 Pigments

Pigments containing lead compounds may not be added.

3.4.4 Plasticisers

Products that contain plasticising substances from the group of phthalates or group of organophosphates may not be added.

3.4.5 Organotin compounds

The use of organotin compounds is not permitted.

3.4.6 Recycled materials made of waste oil

Substances made of waste oil shall not be used (e.g. EINECS number 274-625-9 (alternatively 265-057-8)).

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1.

3.5 Ecotoxicity

A laboratory sample of the product is required for testing its ecotoxicity in an eluate. In addition to any standard permeable packaging, this sample should be supplied in a hermetically sealed packaging. Two test specimens (each measuring between 250 and 500 cm²) must be produced from the laboratory sample and then eluted in accordance with CEN/TS 16637-2⁵ for 24 hours. The test must be carried out in such a way that only the intended outer surface of the roof and sealing sheet comes into contact with water (see Annex B). Only those products that have a homogeneous design (i.e. there is no difference between the outer and inner surfaces) are

⁵ DIN CEN/TS 16637-2 Construction products - Assessment of release of dangerous substances - Part 2: Horizontal dynamic surface leaching test

permitted to come into full contact with the water during the test (see Annex B). The leaching test must be carried out at a ratio of water volume to surface area of the test specimen exposed to water (L/A) of 25 l/m². The dimensions of the test specimen must be adjusted so that the height of the water in the test vessel is at least 20 mm above the surface of the test specimen at this L/A ratio and a sufficient volume of eluate is produced for the required ecotoxicity tests (including a blind test) and other analyses (pH value, conductivity, possibly also DOC and Mecoprop/MCPA measurements) of the eluate.

The ecotoxicity of the eluate must be tested in accordance with CEN/TR 17105⁶ (mixture of the first two eluates produced according to CEN/TS 16637-2 from the two test specimens). The eluate must comply with the criteria in the following table.

Table 2: Test criteria for ecotoxicity

Test species	Test standard	Endpoint	Criterion
Luminescent bacteria (<i>Vibrio fischeri</i>)	EN ISO 11348-1 ⁷	Light emission	LID _L ≤ 8
Algae (<i>Raphidocelis subcapitata</i> or <i>Desmodesmus subspicatus</i>)	EN ISO 8692 ⁸	Growth	LID _A ≤ 4
Crustaceans (<i>Daphnia magna</i>)	EN ISO 6341 ⁹	Mobility	LID _D ≤ 4
umu test	ISO 13829 ¹⁰	Genotoxicity	LID _{EU} ≤ 1.5

In the case of bitumen sheets or membranes, analytical proof is also required to show that there has been no cross contamination with the root resistance agents Mecoprop or MCPA during production. The concentrations in the eluate must be determined. They must not exceed the relevant limits according to DIN 38407-35¹¹.

Compliance verification

The applicant shall submit a test certificate that verifies compliance with the criteria. The testing laboratory must have implemented a quality assurance system according to DIN EN ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" or a comparable standard (e.g. GLP) and confirm that this is the case in the test report. If the term of validity of the Basic Award Criteria is extended, a new test certificate must be submitted.

⁶ DIN CEN/TR 17105, Construction products - Assessment of release of dangerous substances - Guidance on the use of ecotoxicity tests applied to construction products

⁷ DIN EN ISO 11348-1 Water quality - Determination of the inhibitory effect of water samples on the light emission of *Vibrio fischeri* (Luminescent bacteria test) - Part 1: Method using freshly prepared bacteria

⁸ DIN EN ISO 8692 Water quality - Fresh water algal growth inhibition test with unicellular green algae

⁹ DIN EN ISO 6341 Water quality - Determination of the inhibition of the mobility of *Daphnia magna* Straus (Cladocera, Crustacea) - Acute toxicity test

¹⁰ ISO 13829 Water quality - Determination of the genotoxicity of water and waste water using the umu-test

¹¹ DIN 38407-35 German standard methods for the examination of water, waste water and sludge - Jointly determinable substances (group F) - Part 35: Determination of selected phenoxyalkyl carbonic acids and further acid plant treatment agents - Method using high performance liquid chromatography and mass spectrometric detection (HPLC-MS/MS)

3.6 Solar reflectance

Roof sheets that can be installed in accordance with the manufacturer's instructions without a gravel / green roof / roof slab ballast must have a solar reflectance of at least 0.15.

Compliance verification

The applicant shall submit a test certificate in accordance with DIN EN ISO 22969¹², ASTM E903¹³ or ASTM E1918¹⁴. If no test certificate is submitted, the supplied installation instructions and customer information must clearly indicate that the product may only be used under a ballast or, in the case of wooden roofs, in combination with heavy-duty roof insulation that allows for drying to the interior.

3.7 Environmental Product Declaration (EPD)

A valid EPD according to DIN EN 15804 must be submitted for the product.

Compliance verification

The applicant shall submit a valid Environmental Product Declaration (EPD) according to DIN EN 15804 for the product and state the location where the EPD is publicly accessible in Annex 1.

3.8 Green electricity

At least 50 % of the electricity consumed in the production of the certified product must be sourced from renewable energy sources as defined in Directive 2018/2001/EU on the promotion of the use of energy from renewable sources and this electricity must be labelled accordingly. The electricity consumed in the production of the certified product must correspond to the supplied proofs of origin for the purchased electricity. In addition, the purchased electricity must also promote the production of additional electricity from renewable energies. A different rule applies to manufacturers that produce their products outside of the EU: 50 % of the electricity consumed in the production of the certified product must be sourced from renewable energy sources certified in accordance with the international REC standard (I-REC).

Compliance verification

The applicant shall declare compliance with the requirement on green electricity in Annex 1 and submit the fuel mix disclosure and proof of origin as verification that the consumed green electricity has been certified by the Grüner Strom (Green Electricity) label or the OK Power label. In the case of manufacturers outside of the EU, a certificate in accordance with the international REC standard (I-REC) (<https://www.irecstandard.org/>) will be accepted as proof of origin. This verification must be re-submitted for every year of the term of the contract on the use of the environmental label.

¹² DIN EN ISO 22969:2021-02 Paints and varnishes - Determination of solar reflectance

¹³ Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres, <https://www.astm.org/standards/e903>

¹⁴ Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field, <https://www.astm.org/e1918-21.html>

3.9 Consumer information, packaging and advertising messages

The following information and recommendations must be enclosed with the product (in printed form or as a link to a website):

- Installation instructions
- Technical data sheet
- Notes on maintenance
- Recommendations for cleaning and caring for the product
- Information on recycling possibilities and proper disposal

Application instructions for achieving the longest possible service life at the intended installation site in order to ensure that the roof lasts for a long time (between 20 and 40 years) must be enclosed. A commercially appropriate minimum service life of the product – in the event of proper planning, selection, execution and maintenance of the roof – must be stated. Products with a stated service life of 20 years may be labelled as long lasting or durable. The application instructions must not recommend the use of any PU adhesives.

Sales packaging¹⁵ for the product may not contain any PVC. Sales packaging must be made of recycled raw materials (post-consumer materials) and contain at least 80% recycled materials. In addition, the sales packaging must comply with the current minimum standard for determining the recyclability of packaging¹⁶.

Advertising messages that contain terms such as “Bio”, “Eco” or “Natural” are not permitted.

Compliance verification

The applicant shall declare compliance with the requirement in Annex 1 and submit the required consumer information and declarations from the manufacturer/suppliers of the sales packaging.

3.10 Outlook

In any future revision of the environmental label, criteria for the recyclability of the product and recycling possibilities and for microplastics should be included and discussed. Adding a requirement for a minimum proportion of recycled materials in the transport packaging will be examined. The fitness for use criteria will be reassessed. Another aim will be to amend the criteria for green electricity and solar reflectance to make them more stringent.

4 Applicants and parties involved

Manufacturers or distributors of products according to Paragraph 2 shall be eligible for application.

Parties involved in the award process are:

- RAL gGmbH to award the Blue Angel environmental label,
- the federal state being home to the applicant’s production site,
- Umweltbundesamt, (German Environment Agency) which after the signing of the contract receives all data and documents submitted in application for the Blue Angel in order to be able to further develop the Basic Award Criteria.

¹⁵ An exception to this requirement is made for transport packaging, such as shrink hoods for pallets.

¹⁶ https://www.verpackungsregister.org/fileadmin/files/Mindeststandard/Mindeststandard_VerpackG_2020.pdf

5 Use of the environmental label

The use of the environmental label by the applicant is governed by a contract on the use of the environmental label concluded with RAL gGmbH.

Within the scope of such contract, the applicant undertakes to comply with the requirements under Paragraph 3 while using the environmental label.

Contracts on the Use of the Environmental Label are concluded to fix the terms for the certification of products under Paragraph 2. Such contracts shall run until 31 December 2026.

They shall be extended by periods of one year each, unless terminated in writing by 31 March 2025 or 31 March of the respective year of extension.

After the expiry of the contract, the Environmental Label may neither be used for labelling nor for advertising purposes. This regulation shall not affect products being still in the market.

The applicant shall be entitled to apply to RAL gGmbH for an extension of the right to use the ecolabel on the product entitled to the label if it is to be marketed under another brand/trade name and/or other marketing organizations.

The Contract on the Use of the Environmental Label shall specify:

- Applicant (manufacturer/distributor)
- Brand/trade name, product description
- Distributor (Label User), i.e. the marketing organization.

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Anhang A Quoted laws and standards, literature

DIN SPEC 20000-201 Application of construction products in structures - Part 201: Application standard for flexible sheets for waterproofing according to European product standards for the use as waterproofing of roofs

DIN SPEC 20000-202 Application of construction products in structures - Part 202: Adaption standard for flexible sheets for waterproofing according to European standards for the use as waterproofing of elements in contact with soil, of indoor applications and of tanks and pools

DIN EN 13707 Flexible sheets for waterproofing - Reinforced bitumen sheets for roof waterproofing

DIN EN 13956 Flexible sheets for waterproofing - Plastic and rubber sheets for roof waterproofing

DIN EN 13969:2007-03 Flexible sheets for waterproofing - Bitumen damp proof sheets including bitumen basement tanking sheets

DIN EN 13967 Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet

DIN 18531-1:2017-07 Waterproofing of roofs, balconies and walkways

DIN 18531-2:2017-07 Waterproofing of roofs, balconies and walkways

DIN CEN/TS 16637-2 Construction products - Assessment of release of dangerous substances

DIN EN SO/IEC 17025 „General requirements for the competence of testing and calibration laboratories“

DIN CEN/TR 17105, Construction products - Assessment of release of dangerous substances - Guidance on the use of ecotoxicity tests applied to construction products

DIN EN ISO 11348 1 Water quality - Determination of the inhibitory effect of water samples on the light emission of *Vibrio fischeri* (Luminescent bacteria test)

DIN EN ISO 8692 Water quality - Fresh water algal growth inhibition test with unicellular green algae

DIN EN ISO 6341 Water quality - Determination of the inhibition of the mobility of *Daphnia magna* Straus (Cladocera, Crustacea)

DIN EN ISO 22969:2021-02 Paints and varnishes - Determination of solar reflectance

DIN 38407-35 German standard methods for the examination of water, waste water and sludge - Jointly determinable substances (group F)

DIN EN 15804 Nachhaltigkeit von Bauwerken – Umweltproduktdeklarationen– Grundregeln für die Produktkategorie Bauprodukte“

ISO 13829 Water quality - Determination of the genotoxicity of water and waste water using the umu-test

German Model Building Code (Musterbauordnung)

Model Administrative Rules – Technical Building Regulations (MVV TB)

Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources

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, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC

Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006

Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products Text with EEA relevance

Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and repealing Council Directives 79/117/EEC and 91/414/EEC

Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC Text with EEA relevance

section 21 VerpackG

minimum standard for measuring the recyclability of packaging subject to system participation pursuant to section 21 paragraph 3 VerpackG, Foundation Central Agency Packaging Register

Anhang B Leaching test according to DIN CEN/TS 16637-2 for roof and sealing sheets

The following test setup should be used for the leaching test described in Paragraph 3.5.

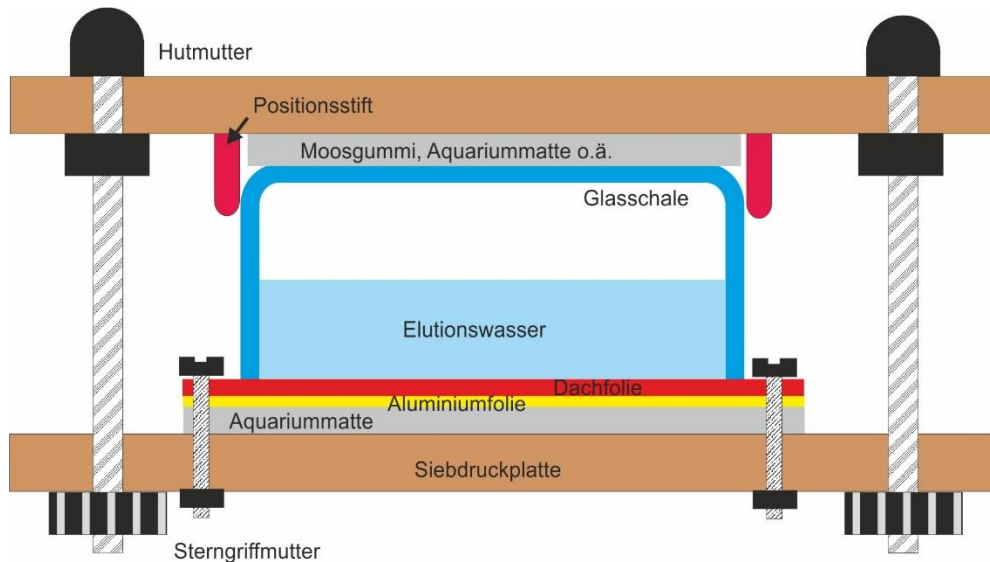


Fig.: Diagram of the holding fixture viewed from the side

- A rectangular glass bowl made out of borosilicate glass should be used as the sample container (approx. DIN A5). Use wooden pegs to ensure that the glass vessel can be reproducibly positioned.
- Secure the roof sheet (membrane) to the base plate using rails or similar to prevent it moving out of position. This will ensure that the same surface of the roof sheet is eluted after replacing the water.
- Place a soft aquarium mat (or moss rubber mat) underneath the roof sheet for sealing purposes (glass film). Insert a layer of aluminium foil between the roof sheet and the aquarium mat. This will create a barrier that prevents any compounds in the aquarium mat from diffusing into the roof sheet.
- For roof sheets with a rough surface, use a carving knife to remove the mineral layer of the sheet where the rim of the glass container touches the roof sheet. It will be impossible to create a seal without this preparation work. The internal area relevant for the elution process will remain practically untouched by this measure.

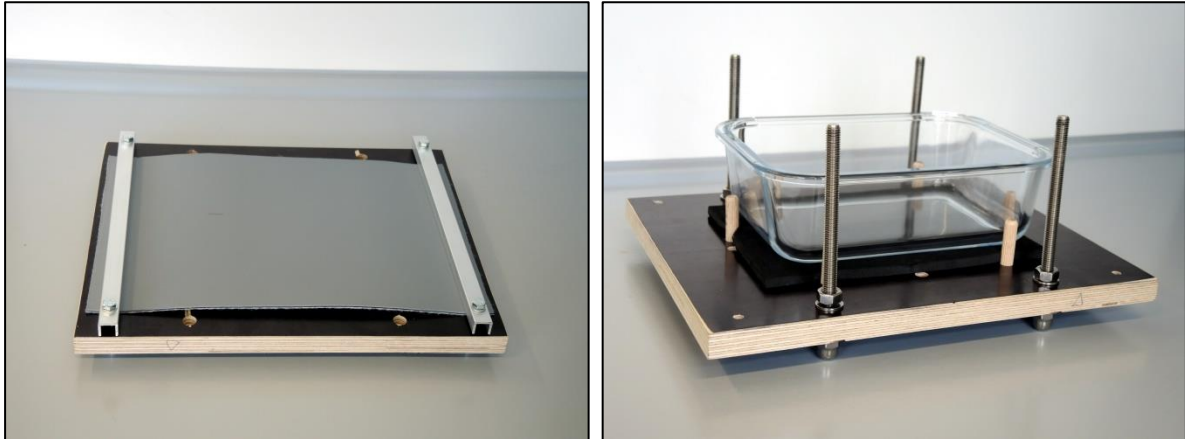


Fig.: The glass bowl is placed onto a soft underlay and held in position by wooden pegs. The roof sheet is fixed to the board using two aluminium rails. This ensures precise positioning of the glass container on the same section of the roof sheet after replacing the water.

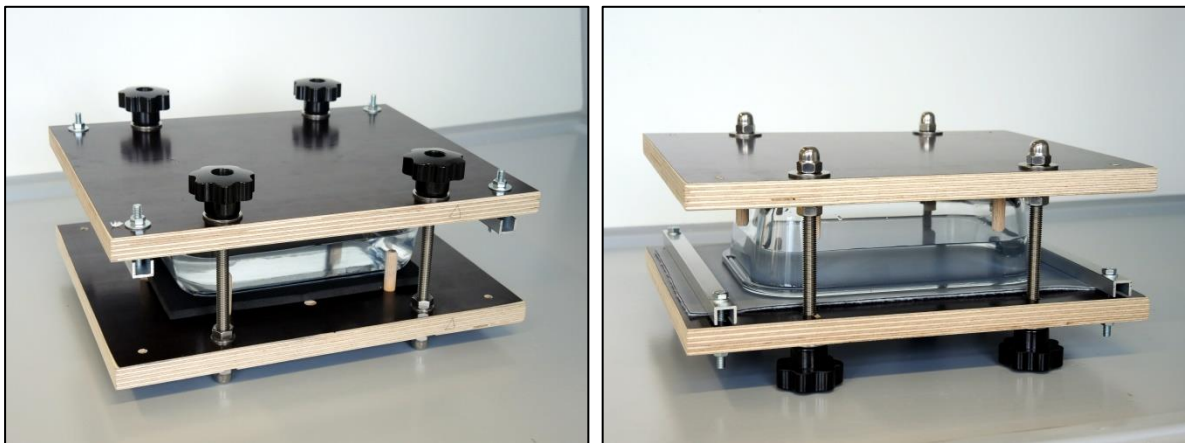


Fig.: After placing the lid on top, the holding fixture is screwed together using the star grip nuts and then turned upside down.

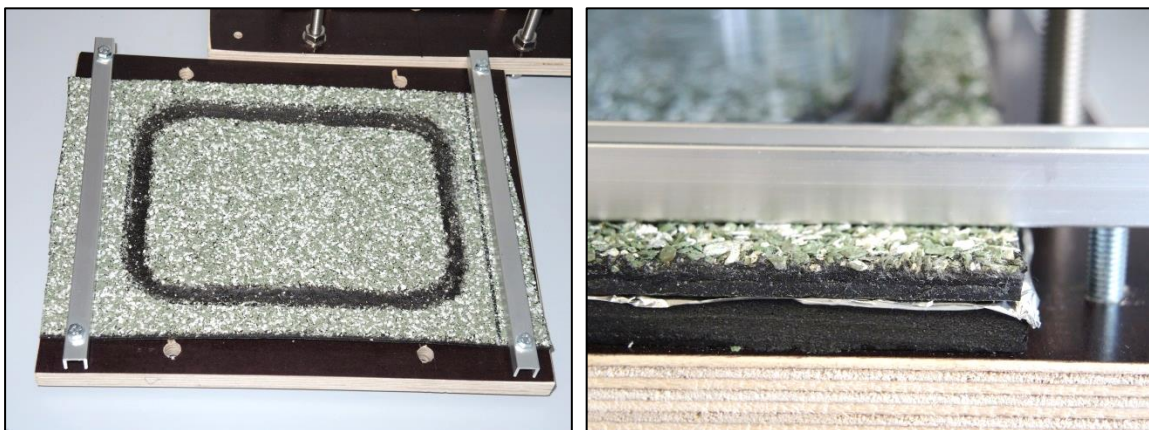


Fig.: For roof sheets with a rough surface, the rough layer of the sheet where the rim of the glass container touches the roof sheet is cut away. A soft aquarium mat is also required underneath the roof sheet for sealing purposes. An intermediate layer of aluminium foil is used to separate the two materials.

- ◆ Test specimens: In the example setup described here, test specimens measuring approx. 18 cm x 27 cm are fixed to the holding board by two rails (aluminium U-shaped profiles) screwed to the board.
- ◆ Water volumes: The L/A ratio should be set to 25. The active surface area of the glass bowl depicted here is 225 cm². The maximum volume of water (L/A = 25) is thus 562.5

mL. A water volume of 500 mL can be used here for practical reasons and the L/A ratio will thus be 22.

Reference: M. Burkhardt, M. Rohr, I. Heisterkamp, S. Gartiser, Rainwater from synthetic roofing membranes – leaching from construction materials and its ecotoxicity for aquatic organisms (Niederschlagswasser von Kunststoffdachbahnen – Auslaugung von Stoffen und deren Ökotoxizität für aquatische Organismen), KW "Korrespondenz Wasserwirtschaft", 2020, 13(8), 418-424.