EUROPEAN ASSESSMENT DOCUMENT

EAD 030218-00-0402

December 2016

MEMBRANE FOR USE AS ROOF UNDERLAY

This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

The membranes consist of multilayer flexible sheets. They are diffusion open membranes with increased UV resistance, perforation resistance, resistance to water pressure and tightness of perforations from nails and screws.

The membranes consist of a polyester and a polyacrylate or Polyurethane (TPU) coating. The total weight of the membrane ranges from 230 g/m^2 to 520 g/m^2 depending on the type and build-up.

The product is not covered by a harmonised European standard (hEN) EN 13859-1. The standard provides for three classes of resistance to water penetration, none of which are applicable to the declared performance for the products or intended use covered by the EAD. The standard also does not cover the aspects related to the membrane being exposed to weathering for an extended period of time, since the standard foresees that the membrane will be covered by a roofing.

This EAD includes an assessment of the resistance to artificial weathering in excess of what is covered by the above standard, e.g. UV testing for 5000 h, resistance to perforation from hail and tightness of perforations from nails and screws

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s)

The membranes are intended for use as underlays, which are to be used under roof covering of roofs with roof pitch from 5° to 90°

The membranes are intended to be used in high altitude and to be exposed to weathering (UV, rain and hail) for a defined extended period of time from minimum 3 months up to 24 months depending on the type. The type and correlated exposure time will be given in the ETA.

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the membranes for the intended use of 10 years when installed in the works. These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[1].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

1 The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than the assumed working life.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performances of the membranes are assessed in relation to the essential characteristics.

Table 1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Method of verification and assessment	Type of expression of product performance *(level, class, description)*
Basic Works Requirement 2: Safety in case of fire			
1	Reaction to fire	2.2.1	Class
Basic Works Requirement 3: Hygiene, health and the environment			
2	Resistance to water penetration	2.2.2	Level
3	Water vapour transmission	2.2.3	Level
4	Tensile properties	2.2.4	Level
5	Resistance to tearing	2.2.5	Level
6	Resistance to perforation	2.2.6	Level
7	Dimensional stability	2.2.7	Level
8	Flexibility at low temperature	2.2.8	Level
9	Resistance to artificial ageing: UV resistance 5000h Exposure to heat	2.2.9	Level
10	Resistance to penetration of air	2.2.10	Level
11	Water tightness of seams	2.2.11	Level
12	Emissivity	2.2.12	Level
13	Tightness of perforations from nails and screws	2.2.13	Level

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

Characterisation of products to be assessed shall be done in accordance with available specifications, notably grading, particle size, source, type and properties, and homogeneity.

2.2.1 Reaction to fire

The membranes shall be tested, using the test method(s) relevant for the corresponding reaction to fire class, in order to be classified according to EN 13501-1 and Delegated Regulation 2016/364.

The classification shall be stated in the ETA.

2.2.2 Resistance to water penetration

The resistance to water penetration is determined in accordance with EN 13859-1 section 5.2.3 with the water column specified by the applicant and the determined value for the water column at which the membrane passes the test is stated in the ETA

2.2.3 Water vapour transmission

The water vapour transmission is determined in accordance with EN 13859-1 section 4.3.3 and the level and the method used is stated in the ETA.

2.2.4 Tensile properties

The tensile properties is determined in accordance with EN 13859-1 section 4.3.4 and the level is stated in the ETA.

2.2.5 Resistance to tearing

The resistance to tearing is determined in accordance with EN 13859-1 section 4.3.5 and the level is stated in the ETA..

2.2.6 Resistance to perforation

2.2.6.1 Hail resistance

The hail resistance is determined in accordance with annex A of this EAD and the level is stated in the ETA.

2.2.6.2 Resistance to perforation

The resistance to persons stepping through the membrane is determined in accordance DIN 4426 section 5.2. The declared value before and after ageing is stated in the ETA.

2.2.7 Dimensional stability

The dimensional stability is determined in accordance with EN 13859-1 section 4.3.6 and the level is stated in the ETA.

2.2.8 Flexibility at low temperature

The flexibility at low temperature is determined in accordance with EN 13859-1 section 4.3.7 and the level is stated in the ETA.

2.2.9 Resistance to artificial ageing

The UV resistance after 5000 h UV exposure and the resistance to heat exposure is determined in accordance with EN 13859-2 section 4.3.9 and the level is stated in the ETA.

2.2.10 Resistance to penetration of air

The resistance to penetration of air is determined in accordance with EN 13859-1 section 4.3.9 and the level is stated in the ETA.

2.2.11 Water tightness of seams

The water tightness of seams is determined in accordance with EN 13859-1 section 4.3.10 and the level is stated in the ETA.

2.2.12 Emissivity

The emissivity is determined in accordance with EN 13859-1 section 4.3.11 and the level is stated in the ETA.

2.2.13 Tightness of perforations from nails and screws

The tightness of perforations from nails and screws are determined in accordance with annex B of this EAD and the result of the assessment is described in the EAD.

The tightness of perforations from nails and screws is described in the ETA as either watertight or as a description based on the assessment when there can be no damage to the wood by moisture. This condition must be demonstrated by the assessment in accordance with Annex B (for example Page 18, Evaluation of the simulation results) where the boundary line with the wood moisture content as a function of the temperature is not exceeded.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Decision 99/90/EC and 2001/596/EC

The system is: 3 except for uses subject to regulations on reaction to fire.

For uses subject to regulations on reaction to fire the applicable AVCP systems regarding reaction to fire are 1, or 3, or 4 depending on the conditions defined in the said Decision

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 2.

Table 2 Control plan for the manufacturer; cornerstones

No	Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	Test or control method *(refer to 2.2 or 3.4)*	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [**including testing of samples taken at the factory in accordance with a prescribed test plan**]*					
1	The specifications of all incoming raw materials and components	As defined in control plan	As defined in control plan	As defined in control plan	As defined in control plan
2	Length, width, straightness	As defined in control plan	As defined in control plan	As defined in control plan	As defined in control plan
3	Mass per unit area	As defined in control plan	As defined in control plan	As defined in control plan	As defined in control plan
4	Reaction to fire	2.2.1	As defined in control plan	As defined in control plan	As defined in control plan
5	Resistance to water penetration	2.2.2	As defined in control plan	As defined in control plan	As defined in control plan
6	Water vapour transmission properties	2.2.3	As defined in control plan	As defined in control plan	As defined in control plan

No	Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	Test or control method *(refer to 2.2 or 3.4)*	Criteria, if any	Minimum number of samples	Minimum frequency of control
7	Tensile properties	2.2.4	As defined in control plan	As defined in control plan	As defined in control plan
8	Resistance to tearing	2.2.5	As defined in control plan	As defined in control plan	As defined in control plan
9	Artificial ageing behaviour	2.2.9	As defined in control plan	As defined in control plan	As defined in control plan
10	Resistance to penetration of air	2.2.10	As defined in control plan	As defined in control plan	As defined in control plan

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for membranes for use as roof underlays are laid down in Table 3.

The involvement of the notified body is required only under the conditions defined in 99/90/EC amended by 2001/596/EC – in case of reaction to fire class A1, A2, B, C of the product for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an additional of fire retardants or a limiting of organic material)

Table 3 Control plan for the notified body; cornerstones

Subject/type of control *(product, raw/constituent material, component - indicating characteristic concerned)*	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control				
Initial inspection of the manufacturing plant and of factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire and taking into account a limiting of organic material and/or the addition of fire retardants.	As defined in control plan	As defined in control plan	As defined in control plan	According to the control plan
Continuous surveillance, assessment and evaluation of factory production control				
Continuous surveillance, assessment and evaluation of the factory production control carried out by the manufacturer regarding the constancy of performance related to reaction to fire and taking into account a limiting of organic material and/or the addition of fire retardants.	As defined in control plan	As defined in control plan	As defined in control plan	According to the control plan

4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment, is of relevance.

EN 13501-1	Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests
EN 13859-1	Flexible sheets for waterproofing – Definitions and characteristics of underlays – Part 1: Underlays for discontinuous roofing
EN 13859-2	Flexible sheets for waterproofing – Definitions and characteristics of underlays – Part 2: Underlays for walls
DIN 4426	Equipment for building maintenance - Safety requirements for workplaces and accesses - Design and execution

APIB Test Specification No. 00a GENERAL SECTION A (1.02.2014/ 00a-14en, Version 1.02)

APIB Test Specification No. 09 WATERPROOFING MEMBRANES (01.07.2015 / 07-15en, Version 1.03)

APIB Test Specification No. 00b GENERAL SECTION B (01.07.2015 / 00b-15de, Version 1.01.)

VKF Prüfbestimmung Nr. 28 Bespanntes Tragwerk/Membrane covered framework (01.04.2016 / 28-16de, Version 1.03)

ANNEX A HAIL RESISTANCE

A sample of the membrane is installed in a rig with the following build up (from top and down):

- Membrane including a seam zone
- A layer of insulation material with thickness 60 mm. The type and density of the insulation depends on the manufacturers request. The membrane is vertically fastened by wood battens 60 x 40 mm with spacing 700 mm. The insulation is installed between counter battens 80 x 60 mm and corresponding spacing. The wood battens shall be free from wane.
- Bead board panel with thickness18 mm on rafters 120 x 80 mm with spacing 650 mm

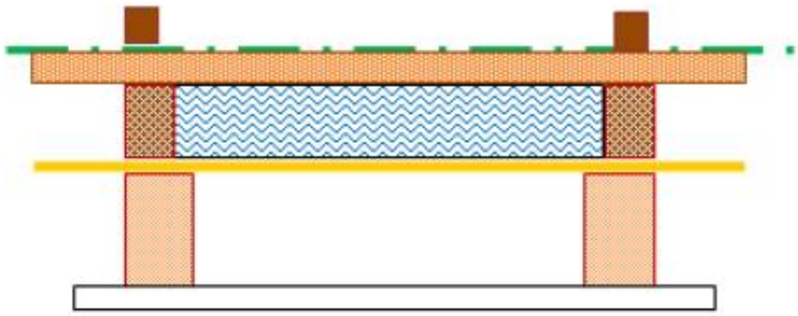


Figure A.1 Principle build up of test rig

The tests for hail resistance are carried out in accordance with APIB Test Specification No. 00a GENERAL SECTION A (1.02.2014/ 00a-14en, Version 1.02).

In exact details of the test, sampling and test rig depends on the declared performance of the manufacturer and the specific details of the solution to be assessed in the ETA.

The testing shall follow the principles in APIB Test Specification No. 09 Dichtungsbahnen/Waterproofing membranes (01.07.2015 / 07-15en, Version 1.03) or VKF Prüfbestimmung Nr. 28 Bespanntes Tragwerk/Membrane covered framework (01.04.2016 / 28-16de, Version 1.03). Where necessary these test methods shall be adapted to fit the specific use requested by the manufacturer.

The results shall be reported in accordance with APIB Test Specification No. 00b GENERAL SECTION B (01.07.2015 / 00b-15de, Version 1.01.)
All of the above documents can be downloaded from www.hagelregister.ch

ANNEX B TIGHTNESS OF PERFORATIONS FROM NAILS AND SCREWS

General

The purpose of the test is to test for the water ingress around penetrations in the membrane coming from the fasteners, e.g. tacking stales and nails. The screws are equated the nails. By creating downforce sizes these perforations are small to be seen from the nails values.

The principle of the test is to establish a model roof element, which is the sprayed with water and at the same time applying a pressure.

Test method

The determination of the water ingress is carried out in accordance with EN 1027/EN 12208 and EN 12154/12155 with a step-by-step increase in the differential pressure up to 600 Pa with an increased total sprinkling period of 3 hours. The sprinkling is applied with approx. 2 l/(m^2 × min.).

The water nozzles are interpreted as follows:

- full cone-shaped beam
- Spray angle 120 °
- Working pressure in the range from 2 bar to 3 bar

A device for measuring the constant or fluctuating positive test pressure, calibrated to an accuracy of ± 5%

A device for measuring the total water consumption with an accuracy of 10%.

The complete test frames have been conditioned in a climate of 23 °C ± 3°C and 50 % ±15 % relative humidity for at least 24 hours.

During the first hour, the irrigation is carried out without a pressure (0 Pa), then an excess pressure of 50 Pa is established on the irrigated side to 300 Pa every 15 min. to 50 Pa and from 300 Pa to 600 Pa every 15 min to 150 Pa is increased. (NB. In accordance with the standards mentioned above)

Overview: Sprinkling times per differential pressure and observations during sprinkling.

Pressure stage	**Sprinkling duration at approx. 2l/m²min**
[Pa]	[min]
0	60
50	15
100	15
150	15
200	15
250	15
300	15
450	15
600	15
Time:	180

The specimen is inspected for any water penetration on the underside and the water ingress points are documented.

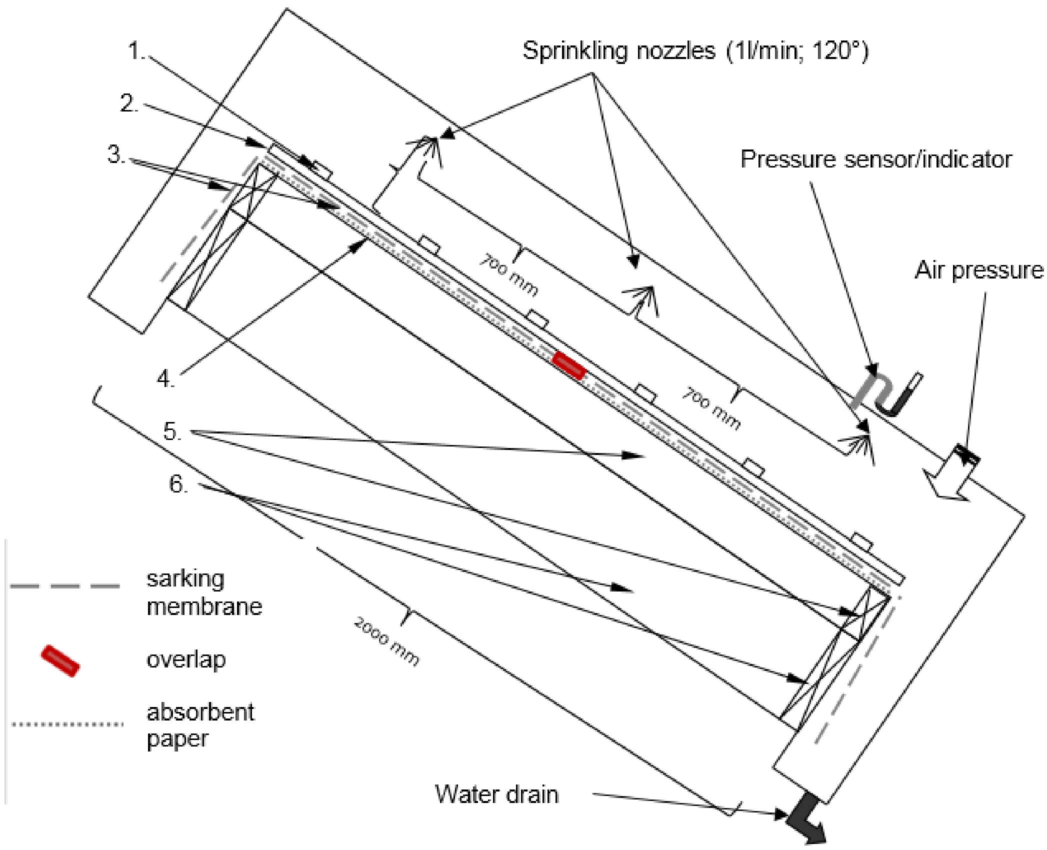
After sprinkling, the test specimen is removed from the rig. One hour (± 10 min.) after removal. Subsequently, the battens and the roof underlay membrane are removed and the test frame is weighed again, together with the paper (Quality of the paper 100 g/m², dry installed). The points at which water ingress is visible on the absorbent paper is documented.

The paper is removed and weighed. After drying to ambient climate, the dry weight of the paper is determined.

Sample

The configuration of the test fixture and test specimen can be seen in Figure 1 and 2. On the side to be sprinkled, the test fixture is sealed tight with a cover and the test specimen can be subjected to overpressure and even sprinkling at the same time in accordance with EN 12155 (approx. 2 l/(m2 × min.). The sprinkling is performed by 3 rows of nozzles, each containing 3 nozzles with an output of 1 l/min positioned within a 700 mm grid and at a distance of 400 mm from the specimen surface (Figure 1 and 2).

The roof element to be tested had the following configuration, as shown in Figure 1:
Dimensions of the roof surface: 1600 mm x 2000 mm (± 5 mm)
Gradient: 14°
Centre distance in the middle: 80 cm (clear 72 cm), (± 5 mm)



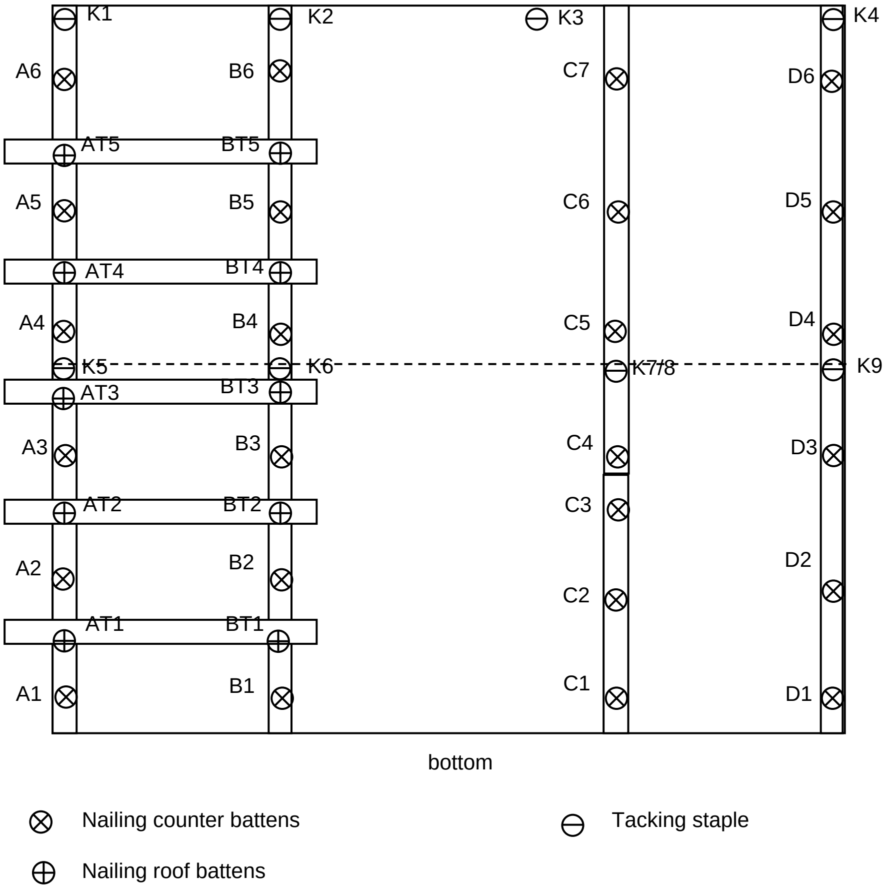
Construction from outside to inside:
1. battens (30 mm x 50 mm, S10 according to DIN 4074-1) only on the left side,
2. counter battens (30 mm x 50 mm, S10 according to DIN 4074-1),
3. sarking membrane with an overlap in the middle, this overlap is glued to the membrane own adhesive zones without additional products
4. absorbent paper for detecting possible water ingress areas,
5. test frame (80/60 mm),
6. beam (80/120 mm).

Figure B1: Test rig configuration (side view).

Assembly:

First, the test frame was laid on absorbent paper to make any water ingress areas apparent (Figure 1). The test frame was then weighed with the paper. The sarking membrane was subsequently laid. The ridge membrane was tacked in place at the top and in the centre, and the top tacking points were glued with the relevant adhesive tape. The overlap in the middle was glued. The counter battens and additionally the roof battens on the left side were subsequently nailed to the structure.

The fully fitted test specimen was installed in the test fixture. The test fixture was tilted through 14°(± 0,2°).



Nailing dimension chain (from bottom to top)											
Counter battens left		Roof battens left		Roof battens right		Counter battens centre left		Counter battens centre right		Counter battens right	
Level A		Level AL		Level BL		Level B		Level C		Level D	
–	cm	–	cm	–	cm	–	cm	–	cm	–	cm
A1	20	AT1	37	BT1	37	B1	20	C1	20	D1	20
A2	34	AT2	34	BT2	34	B2	34	C2	34	D2	34
A3	34	AT3	34	BT3	34	B3	34	C3	10	D3	34
A4	34	AT4	34	BT4	34	B4	34	C4	24	D4	34
A5	34	AT5	34	BT5	34	B5	34	C5	34	D5	34
A6	34						34	C6	34	D6	34
–	–	–		–		–	–	C7	34	–	–

Figure B2: View from top, with specification of the nailing positioning.

Part 2 Procedure and evaluation

Description of the calculation and assessment method for tightness of perforations from nails and screws

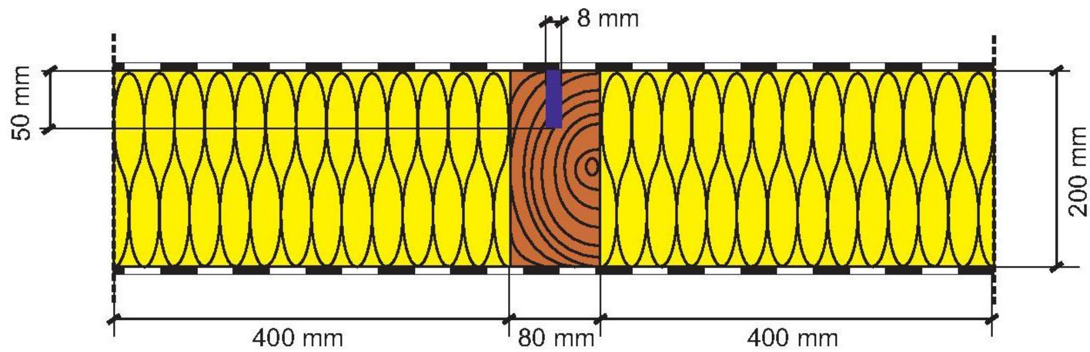
Method:

1. Laboratory tests to determine the water inlet (Part 1 of this annex)
2. Hygrothermal simulation of exposure phase for maximum Outdoor exposure time (temporary roofing without covering) according to manufacturer's specifications.
3. Subsequent hygrothermal simulation with the humidity and temperature conditions after Outdoor exposure time, for a period of 5 years.
4. Evaluation of the simulation results.

Structure of the simulated roof construction

The assessment of whether water penetration leads to the nail or screws points to damage to the underlying rafter is carried out by means of two-dimensional hygrothermal simulation (example WUFI® 2D [1] [2]). For this purpose, a two-dimensional section is defined by the rafters and the insulating region to be examined standard roof construction. On the back of a moderate vapor barrier film with an s_d value of about 6 m is to be arranged. The rafters must consist of softwood / spruce and has the dimensions 200 mm × 80 mm. The insulating region is to insulate the simulation with mineral fibers (WLG 040). Is to be examined underlay with their real s_d value which is possibly to be determined by separate laboratory tests on the outside of the structure.

The structure is exemplified in Figure 1:
Position the moisture source (blue) for the two-dimensional hygrothermal simulation of Outdoor exposure time.



For the simulation of the roof surface is 45 ° to be arranged inclined to the north, since this because of the low solar radiation entry thereby resulting in the lowest surface temperatures, and a more critical drying behavior. The simulation is to simulate the explicit radiation balance on the outer surface. The climate data record used must here have radiation data with sufficient accuracy.

The moisture content should produce a more critical situation, this humidity, the installation of the rafter with 18% by mass should be set slightly higher. The initial moisture content of other materials must be the equilibrium moisture content of 80% r. F. match. This is also a slightly higher value than it is present as a rule in the installed state.

Simulation of Outdoor exposure time:

On the outside of the roof structure are for hygrothermal simulations to set the hourly climate data of critical country-specific reference location. (For Germany this is for example the hygrothermal reference year (HRY) the location Holzkirchen to be set. This location is considered by its location on a plateau in front of the Alps (690 m above sea level) as critical representative of the climate in Germany up to comparable altitudes and below including the border Glaser and conditions.)
The indoor air is accordingly of the site according to EN 15026 [3] from the outside air used to derive and to housing conditions comply with normal occupation. This applies regardless of the authorization process of whether the building is occupied or not. The simulation is to begin in October. The average outdoor air temperature is already low this time of year and reduces the solar radiation available. In the outdoor exposure time (time after the manufacturer's specifications for the permissible outdoor exposure) thereby takes place less re-drying of construction in the fall and winter months.

During weathering without covering the radiation parameters of the roof membrane are on the outer surface to be set. If these values are not known, they are either to be determined from laboratory studies or it is a critical parameter to set the following values.

absorptivity a: 0,65 [-]
emissivity γ: 0,91 [-]

After completion of the hygrothermal simulation the two-dimensional humidity and temperature profile of the entire construction is standard output. This should be recognized as the start profile for, subsequent to the outdoor exposure time, drying phase.

Moisture ingress into the rafters during the outdoor exposure time:

Tests have shown that the water to its end penetrates directly to the edges of the nail in the rafters during transverse to the direction of the grain and on the rafter surface hardly water absorption can be observed [4] Based on these results, the position of the source of moisture for the hygrothermal simulation set. The moisture source with 8 mm width and 50 mm depth is in the nail area of the rafter (blue area in picture 1) to place.

To view a critical situation as possible, the assumption is made that in the incident outdoor exposure time total annual rainfall of critical country-specific reference location on the lower roof.
Using the example of Germany, this corresponds annual rainfall of 1185 mm, the rainy location Holzkirchen (driving rain stress group III according to DIN 4108-3 [5]).

During the laboratory tests is over the entire test period a rainfall total of 360 mm apply water. The resulting humidity entries that are determined according to the test (Part 1 Annex B) in the test paper of the entire test area should be reported on the annual precipitation as follows.

$$\textit{Total moisture entry Outdoor exposure time}\ [kg] = \frac{\textit{Annual rainfall reference site}\ [mm]}{\textit{Rainfall laboratory tests}: 360\ [mm]} \cdot \textit{Determined water entry indicatorp.}\ [kg]$$

This mathematically calculated total moisture entry of outdoor exposure time is completely focused on the simulation on a 2 m long rafters. This assumption compared to laboratory experiments in which four rafters are installed under the test area, in turn, an extreme situation is the amount of water which must be recognized per meter rafters during outdoor weathering simulation as a moisture source one hour each day give off.:

$$\textit{Strength of the moisture source} \left[\frac{kg}{m \cdot s}\right] = \frac{\textit{Total moisture entry Outdoor exposure time}\ [kg]}{\textit{rafter length}\ 2\ [m]\ \cdot\ \textit{weathering phase}\ [days] \cdot 1 \left[{}^{h}/_{Tag}\right] \cdot 3600 \left[{}^{s}/_{h}\right]}$$

The determined amount is to be introduced during the simulation of weathering phase respectively over one hour daily 6:00 to 7:00 p.m. by the moisture source in the rafters. The time of introduction in turn represents the most critical case scenario, as can be expected at this time with the least solar radiation values and thus with the lowest surface temperatures and the lowest return drying potential. In the simulation, thus take place every day an exceptional, one-hour rain event during weathering.

Simulation of the drying phase, over 5 years

In the subsequent drying phase, the simulation of the roof with a red roof covering ([-] absorption coefficient a = 0.77 for example [6]) has to be made on battens and counter battens. For the ventilated covering the effective heat transfer parameters on the critical eaves position for normally ventilated roof constructions are to be used [6].

Wooden structures which include pitched roofs include, are never completely airtight. By currents lead next ventilation heat losses to an additional moisture entry into the structure of DIN 68800-2 [7] in the wet technical assessment (hygrothermal simulation) must be considered. When carrying out simulations of this effect (for example, the infiltration model of IBP [8]) is considered by appropriate models.

If the component infiltration Derived from the building tightness, as is the case with infiltration model of the IBP [8], the calculations must flow through the envelope of a typical building with a q50- value of min. 3.0 $m^3 / (m^2 \cdot h)$ underlie to produce critical possible constraints.

As the amount of relevant for the thermal lift, related-the sky is dependent upon the amount of 10 m, which corresponds approximately to the height of a three-story building, to be set. The moisture source in the two-dimensional simulation is to be placed in the outer 20 mm of mineral fiber insulation where regarding critical temperature conditions. The dew point has been reached.

Evaluation of the simulation results

A positive evaluation of the simulation results is present, if the following criteria 1) and 2) or 1) and 3) are fulfilled:

1. The total water content or the moisture content of the complete rafter cross section over the entire calculation period of 5 years shows a downward trend.

The total water content of the rafter dries from the initial 18% by mass, at best, even during the weathering time out. This leads to the conclusion that registered on the nail points amounts of moisture in the present simulation methodology, with the decisions taken extremely critical conditions have little effect on the moisture content of the entire rafter. If the water content during the weathering time on, it has to show a downward trend at the latest on termination of the simulated weathering time. Directs the moisture contrast across the entire period under a rising trend, this is due to moisture accumulation with the inevitable reach critical wood moisture conditions to be considered as an exclusion criterion.

2. The water content and the moisture content in the critical area of the nail point (moisture source) shows the latest after the first simulation year a downward trend.

The highest water contents in the rafters make a right around the nail body. This critical area in the rafters is identical to the field of moisture source (Figure 1) during the weathering. In the weathering phase a temporary increase in the moisture content of up to 3 months above the limit of 20% by mass of DIN 68800-2 [7] is permissible.

If the limit value of 20 M .-% longer than 3 months exceeded must also be checked criterion 3).

3. The correlating daily averages between temperature and pore humidity in the nail place (moisture source) allowed over the entire simulation period of 5 years are at no time above the limit value curve for wood-destroying processes by WTA 6-8 [9] or [10].

Wood-destroying operations are not dependent solely on the moisture content, but also on the temperature. At low temperatures, therefore, higher moisture contents than the mentioned 20 M-% are possible without any degradation of the wood takes place. In the DIN 68800-2 [5], this correlation of the moisture content is not taken into consideration with the temperature.

The limits for this are in solid wood in a range of 95% at 0 ° C and at 86% by mass at 30 ° C [9].

Figure 2 shows the limit value curve of the relative pore humidity over the corresponding temperature is displayed as a red line.

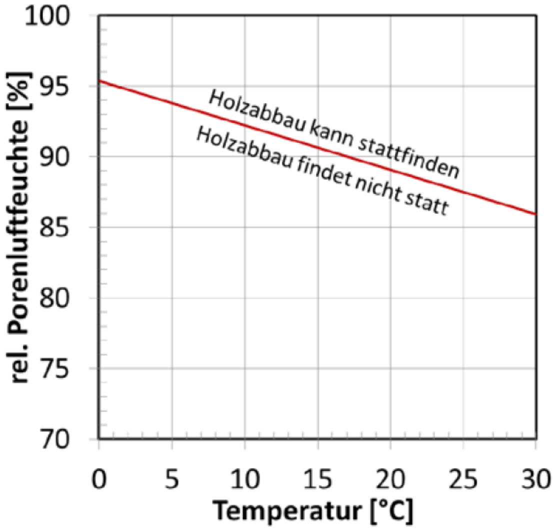


Figure 2 Grenzkurve der rel. Porenluftfeuchte bezogen auf die Temperatur nach WTA 6-8 [9].

If the evaluation criteria results in a positive result a nail sealing strip under the battens is not mandatory. The self-sealing Underlay / undercover sheet is therefore suitable for use specified by the manufacturer as a provisional outdoor exposure time without nail sealing tape. To ensure this, in addition to a technically correct execution of the specified by the manufacturer outdoor exposure time must be respected.

LITERATURE referred in this annex

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