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# Guidelines for SINTEF Technical Approval for Combined roofing underlays and wind barriers

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## 1. General information about SINTEF Technical Approval

General information about SINTEF Technical Approval procedures is available at <https://www.sintefcertification.no/portalpage/index/56>

## 2. Properties to be included in the Approval and how the properties are determined

SINTEF Technical Approval for wind barriers and combined roofing underlays and wind barriers shall normally include a documentation of the product properties according to Table 1, 2 and 3.

Requirements concerning material and product properties related to impact on the environment is available at; <https://www.sintefcertification.no/PortalPage/index/56#Miljo>

## 3. Description of the manufacturer's factory production control

As a basis for the Approval, SINTEF must receive a copy of the description of the manufacturer's control plan for the product. This may be the relevant part of the manufacturer's quality control system for the product, or other documentation describing the manufacturer's factory production control. The person responsible for the factory production control shall be identified.

The control plan shall, as a minimum, describe which controls that are performed (included intervals of the controls, how the controls are performed and by whom):

- controls when receiving incoming materials
- controls during the production process
- controls of finished product
- controls of marking and storage

The factory production control description shall also include what measures are taken when faults are observed in the production or in the product.

## 4. Supervisory production control

Supervisory production control normally comprises an annual inspection at the plant performed by an independent body. General description of how the supervisory product and production control are performed is available at; <https://www.sintefcertification.no/portalpage/index/56#Innhold>

However, for wind barriers and roofing underlays in roll form, SINTEF accept normally only a certified quality system, according to ISO 9001, as an adequate supervisory production control. Valid certification shall be verified at issuance, at 5-year revisions, and if the manufacturer, or the manufacturing plant, are changed. The holder of the Approval shall confirm manufacturer and manufacturing plant each year in connection with annual control.

Supervisory production control also includes annual random testing of selected properties. Table 4 to 9 show an overview of annual audit testing for wind barriers and roofing underlays, together with plasterboards.

## 5. Application for SINTEF Technical Approval and project management

Information regarding application and project management for SINTEF Technical Approval is available at; <https://www.sintefcertification.no/file/index/2980>

## 6. More information

Further information about SINTEF Technical Approval can be found on [www.sintefcertification.no](http://www.sintefcertification.no)

## 7. Special conditions and recommendations

### 7.1 Rain tightness for combined roofing underlays and wind barriers

- Sufficient clamping between the counter battens and the rafters is important at all roof pitches. To ensure sufficient clamping, SINTEF recommend counter battens with minimum thickness of 36 mm. It's also recommended to use screws with plain shank through the counter battens (ensures satisfactory clamping over time).
  - Plain round shank nails (for nail guns) are expected to give poor clamping already at assembling and will probably give even poorer clamping after repeatedly shrinkage and swelling.
  - Use of hammer and square nails are assessed to achieve improved clamping both during installation and over time.
  - Screws with plain shank through the counter battens, with maximum thickness of 36 mm, are assessed to ensure most satisfactory clamping over time.
- When using horizontal taped joints (where the tape is not integrated in the product), it must be described which tape is used, and how the tape is installed.
- Use of combined roofing underlays, with durable adhesive joints and tapes, provide for a continuous layer on the roof surface. The possibility for leakage is then reduced to appear only through nail- or screw holes.
- Use of extra sealing strips between the counter battens and the underlayer leads to better security against leakages.
- The "installation-friendliness" of products and details must be assessed. Systems that are highly vulnerable should be given special conditions for use or, at worst, not to be approved.
- The manufacturer must decide which roof pitch the roof underlayer shall be tested at. SINTEF has never stated a lower limit for the roof pitch, but roof pitches down to 10 degrees have earlier been approved. If the manufacturer wants to test at lower roof pitch than 10 degrees, it's OK for SINTEF, but we've per. 2019 not decided if we can state lower roof pitches than 10 degrees in the Approval documents.
- The manufacturer does not necessarily perform retesting at 10 degrees if the roof underlayer earlier is approved at 15 degrees (must be evaluated in each case).

### 7.2 Air tightness construction

Proposed text for Approval documents is given in chapter 8.1.

### 7.3 Wind bracing (lateral bracing)

**If the wind barrier board meets the requirements given in Table 1 in this guideline:**

Proposed text for Approval documents is given in chapter 8.2.

Supplementary explanations of the requirements given in Table 1:

- Strength tested according to NT Build method 362:  
**Calculated design capacity shall be at least 3.0 kN/m** (corresponding to characteristic capacity of 3,3 kN/m)
- Rigidity tested according to NT Build method 362:  
**Horizontal deformation at the top of the wall shall be maximum 15 mm at a load of 2.5**

**kN/m** (corresponding to total load of 6 kN for a tested wall of 2.4 length). The deformation is calculated as a mean value for the tests

Prerequisites:

- Three identical test walls, with standard dimensions as given in NT Build 362, are to be tested
- The tests are performed without vertical load, but vertically secured to avoid uplift as given in NT Build 362
- Horizontal deformation is calculated as the mean value from the three tests, with a load of  $2.5 \text{ kN/m} \cdot 2.4 \text{ m} = 6.0 \text{ kN}$
- Measured capacity is given as maximum applied load

**If the wind barrier board does not meet the requirements given in Table 1 in this guideline:**

Proposed text for Approval documents is given in chapter 8.2.

*Supplementary explanations:*

In case the boards are be used as lateral bracing in other constructions than small buildings up to two floors, the load capacity for lateral bracing, and possible shear strength, must be determined. The given capacities shall be based on test results according to NT Build 362 and shall be given in Table 1 in the Technical Approval.

- The load capacity for lateral bracing shall be given as characteristic capacity in kN/m (load per meter wall)
- The rigidity for wind bracing: Horizontal deformation at a load of 2.5 kN/m is stated. The horizontal deformation is calculated as the mean value of the three tests, with a load of  $2.5 \text{ kN/m} \cdot 2.4 \text{ m} = 6.0 \text{ kN}$  (for a 2.4 m long test wall, 2.5 kN/m corresponds to a test load of 6.0

If testing is performed according to EN 594:2011, the test must be performed with as high vertical load that no uplift appears, and in a way that the wall's horizontal edgewise bending capacity is measured. The deformation at a load of 2.5 kN/m must be recorded (corresponding to 6,0 kN for a 2.4 m long test wall).

#### **7.4 Properties related to fire, wind barriers for walls**

Proposed text for Approval documents is given in chapter 8.3.

#### **7.5 Properties related to fire, proposed text for Approval documents which covers combined roofing underlay and wind barriers on roofs**

Proposed text for Approval documents is given in chapter 8.4.

#### **7.6 Evaluation of durability**

*Generally:*

The durability for the material is evaluated based on tests of fresh, and artificial climate aged material, in laboratory. Changes in material properties after ageing are subjected to the following requirements:

- The properties must not change more than 20 % in relation to the tested fresh product.
- If the change is between 20 % and 30 % of the properties for fresh material, the properties must be more than 15 % below the given control limit for fresh product.
- If the change is larger than 30 %, the properties must be better than, or as good as, the given control limit for fresh product. The durability properties for the product must be evaluated in each case.

- For roll products, low values for elongation can be balanced/compensated with high values for tensile strength and analogous, low values for tensile strength can be compensated with high values for elongation.
  - Use of tape in joints are covered by own guidelines for tapes.
  - If the changes from fresh to aged material are large, it may be necessary to provide special conditions for use (for instance that adhesive joints, or joints with tape, cannot be used crosswise, but along the rafters, and be continuous clamped by counter battens).
- Changes larger than 50 % will basically not be accepted.

#### *Adhesive joints*

The durability for integrated adhesive joints is tested only in connection with the type testing (this means that such joints are not tested in connection with annual control). The reason for this is, among other things, that SINTEF has long and good experience with integrated adhesive joints, and the fact that the joints have two adhesive areas that adheres to each other.

For products that have only one adhesive area sticking against the product, the need for extra follow up controls must be evaluated especially.

### **7.7 Evaluation of durability for combined roofing underlays and wind barriers**

Proposed text for Approval documents is given in chapter 8.5.

Evaluation of durability for UV-wind barriers:

See chapter 7.11, Table 2 and proposed text for Approval documents in chapter 8.8.

### **7.8 Evaluation of durability for wind barrier system of gypsum- og cement-based boards (together with tape/profiles)**

*Generally:*

The durability for the wind-barrier system is assessed based on accelerated artificial climate ageing in laboratory for two or four weeks. Bending strength shall also be tested for the wind barrier board, before and after ageing, according to the principles in EN 520.

Proposed text for Approval documents is given in chapter 8.6.

### **7.9 Accessories**

Optional products (such as tape, sleeves, etc.) that shall be a part of the Approval have always to be evaluated, and maybe tested.

### **7.10 Resistance against thread through**

Proposed text for Approval documents is given in chapter 8.7.

### **7.11 UV wind barriers for use on façades with partly open claddings**

Wind barriers used on façades with partly open claddings (slits  $\leq 20$  mm) shall resist 5000 hours of heat- and UV-ageing according to EN 13859-2 (see also Table 2).

Proposed text for Approval documents is given in chapter 8.8.

## 8. Proposed text for Approval documents

### 8.1 Air tightness construction

*When the standardized air flow rate number  $< 0.50 \text{ m}^3 / \text{m}^2\text{h}50\text{Pa}$ :*

*The airtightness of the wind barrier makes it possible to fulfil any requirements regarding airtightness ( $n_{50}$ ) given in the building regulations, and in the Norwegian passive house standards, before the vapour barrier is installed.*

*When the standardized air flow rate number is between  $0.50 \text{ m}^3 / \text{m}^2\text{h}50\text{Pa}$  and  $2,50 \text{ m}^3 / \text{m}^2\text{h}50\text{Pa}$ :*

*The wind barrier is sufficiently airtight to protect the insulation to avoid cooling from wind, but not to fulfil the requirements regarding airtightness ( $n_{50}$ ) given in the building regulations, and in the Norwegian passive house standards, without installing the vapour barrier.*

### 8.2 Wind bracing (lateral bracing)

**If the wind barrier board meets the requirements given in Table 1 in this guideline, the following text can be used under clause *Properties, Load-carrying capacity*:**

*The wind barrier board is not assessed to give sufficient wind bracing for small houses up to two floors. In houses with particular short bracing walls, the wind bracing properties should still be verified.*

**If the wind barrier board does not meet the requirements given in Table 1 in this guideline, the following text can be used under clause *Properties, Load-carrying capacity*:**

*The wind barrier board alone cannot be considered to achieve sufficient wind bracing.*

### 8.3 Properties related to fire, wind barriers for walls

**Wind barriers without reaction to fire classification, or with classification class E or F, which is lower than pre-accepted performance for wind barrier in fire class 1:**

*Field of application*

*The product can be used as wind barrier on walls in hazard class 1-6 in fire class 1 in buildings up to three floors if each dwelling unit has direct access to the ground level (not via stairs or staircases). For other use, a fire safety analysis must be performed.*

*Properties related to fire*

*The wind barrier has a reaction to fire class \_\_\_\_\_ according to EN 13501-1 **or** Reaction to fire performance for the product has not been determined.*

*Special conditions for use and installation*

*(Here is referred to relevant sheets in Byggforskserien, e.g. 520.308 and 520.322.)*

*Basis for the Approval*

*(Here is referred to classification reports. It's not necessary to refer to product standards, or commission decisions, if the property is based on classification reports).*

NOTE Wind barriers with reaction to fire class D and higher are evaluated case by case. Reaction to fire class D and higher, will normally require certification by notified body.

**Wind barriers with at least fire classification C or D, and with additional classification s1, s2 or s3 and d0 (e.g. D-s3,d0 or C-s1,d0):**

*Field of application*

*The product can be used as wind barrier on walls in hazard class 1-6 in fire class 1 in buildings up to three floors if each dwelling unit has direct access to the ground level (not via stairs or staircases). For other use, a fire safety analysis must be performed.*

*Properties related to fire*

*The wind barrier has a reaction to fire class \_\_\_\_\_ according to EN 13501-1 **or** Reaction to fire performance for the product has not been determined.*

*Special conditions for use and installation*

*(Here is referred to relevant sheets in Byggforskserien, e.g. 520.308 and 520.322.)*

*Basis for the Approval*

*(Here is referred to classification reports. It's not necessary to refer to product standards, or commission decisions, if the property is based on classification reports).*

**Wind barriers with at least fire classification A1, A2 or B, and with additional classification s1, s2 or s3 and d0 (for instance A2-s1, d0)**

*Field of application*

*The product can be used as wind barrier on walls in hazard class 1-6 and fire class 1, 2 and 3.*

*Properties related to fire*

*The wind barrier has a reaction to fire class \_\_\_\_\_ according to EN 13501-1, installed on a support of \_\_\_\_\_ (for classification A2 and B2, the support is given in the classification report. Check that the support is relevant for the use of the wind barrier and include this information in the Approval document).*

*Special conditions for use and installation*

*(Here referred to relevant sheets in Byggforskserien, e.g. 520.308 and 520.322.)*

*Basis for the Approval*

*(Here is referred to classification reports. It's not necessary to refer to product standards, or commission decisions, if the property is based on classification reports).*

#### **8.4 Properties related to fire, combined roofing underlay and wind barriers on roofs**

**Roofing underlays or combined roofing underlay with fire classification A1, A2, B, C, D, E, F or no classification (all reaction to fire classes)**

*Field of application*

*The product can be used as combined roof underlayer and wind barrier on roofs in buildings in hazard class 1-6 and fire class 1, 2 and 3.*

*Properties related to fire*

*The product has a reaction to fire class \_\_\_\_\_ according to EN 13501-1, installed on a support of \_\_\_\_\_ (for classification A2, B, C and D, the support is given in the classification report. Check*

*that the support is relevant for the use and include this information in the Approval document if relevant) or Reaction to fire performance for the product has not been determined.*

#### *Fire resistance*

*(If the customer wants to include this property in the Approval, it's possible to retrieve information in EU commission decisions, in product standards for board products or by testing. This property is sometimes necessary, e.g. for roofs above cold attics, but has not to be included in the Approval)*

*The wind barrier has a reaction to fire K<sub>2</sub>10 according to EN 13501-2 or (the section can be deleted)*

#### *Field of application*

*(Here is referred to relevant sheets in Byggforskserien, e.g. 525.102 Isolerte skrå tretak med kombinert undertak og vindsperre, 525.106 Skrå tretak med kaldt loft and/or 525.866 Undertak.)*

#### *Basis for the Approval:*

*Here is referred to classification reports. It's not necessary to refer to product standards, or commission decisions, if the property is based on classification reports*

## **8.5 Durability for roofing underlays and wind barriers**

### ***Under clause 4, Durability***

*xx wind barrier / combined roofing underlays is considered to have satisfactory durability based on laboratory testing before- and after accelerated artificial climate ageing. The product must be protected against direct exposure to UV radiation in the complete construction. The product must be covered as soon as possible after installation at roofs and walls, without unnecessary delay.*

## **8.6 Evaluation of durability for wind barrier system of gypsum- og cement-based boards (together with tape/profiles)**

### ***Under clause 4, Durability:***

*The durability for the wind barrier system xx is considered to be satisfactory based on laboratory testing before- and after accelerated artificial climate ageing. The durability for the tape yy's adhesion properties to the wind barrier board is determined based on accelerated artificial climate ageing according to NT Build 495 followed by 12/24 weeks of heat ageing according to EN 1296.*

*Under clause 6, Field of application, it is assessed that the wind barrier system can be exposed to weather for up to 6/12 months before the rain shield is applied.*

### ***Under clause 6, Special conditions for use and installation:***

#### ***Installation***

*It is in general recommended to cover the wind barrier with an external cladding as soon as possible. The wind barrier may be uncovered as indicated in clause 4, provided the building is not subject to unusual large driving rain exposure. It is also a prerequisite that all joints are protected by tape and that all board edges (e.g. along the bottom, sides and top of the wall and around wall penetrations) is protected against rain.*

## **8.7 Resistance against thread through**

*If the thread through resistance is not determined:*

### ***Under clause 4, Properties, Resistance against thread trough:***

*Resistance against tread through is not evaluated for xxx combined roofing underlay and wind barrier.*

## 8.8 UV wind barriers for use on façades with partly open claddings

### ***Under clause 4, Durability:***

*Based on testing before and after artificial climate ageing in laboratory (5000 hours of UV- and heat-ageing), xx is considered to have sufficient durability against UV radiation for use behind partly open claddings when the slits are  $\leq 20$  mm wide.*

### ***Under clause 6, Special conditions for use and installation:***

*xx shall be installed in a way that the wind barrier forms an airtight layer on the outside of heat insulated wooden structure. All joints in the wind barrier, together with transitions between other building components, shall be firmly clamped by battens.*

*The façade must be designed in a way that the wind barrier is exposed for as little UV radiation, and rain, as possible. Horizontal battens have to be sloped at the top edge in a way that incoming water can flow off. For claddings with slits up to 20 mm, the ventilated air gap behind the cladding, should be between 50 to 100 mm. For claddings where the wooden boards are installed close to each other, the ventilated air gap can be reduced. The ventilated air gap shall in any case be well drained in the bottom.*

*In order to protect the wind barrier for too much UV radiation and rain exposure, the shape of the slits (and the thickness of the cladding) should be evaluated.*

*When using the wind barrier behind partly open claddings, the fire class must be at least as good as the cladding. The danger for fire spread in, and on, the façade must be documented by fire safety analysis for each building case. Use of the wind barrier xx behind building integrated solar panel must be evaluated separately.*

**Table 1: Fibreboards, current product standards and SINTEFs minimum required performance**

EN 622-1:2003 Fibreboards Specifications Part 1: General requirements

EN 622-2:2004 Fibreboards Specifications Part 2: Requirements for hardboards, minimum type HB.H

EN 622-4:2009 Fibreboards Specifications Part 4: Requirements for softboards, minimum type SB.H

NS-EN 14964:2007 Rigid underlays for discontinuous roofing Definitions and characteristics

Property	Test method	SINTEFs minimum required performance <sup>1)</sup>		
		Wind barrier	Combined under-layer roof and wind barrier	Other roof underlays
Watertightness	NS-EN 12467:2012+A12016/ (EN 1928:2000)	Can be determined	Watertight at 20 mm (24 h) / (Watertight at 200 mm (2 h))	Watertight at 20 mm (24 h) / (Watertight at 200 mm (2 h))
Rain tightness construction <sup>2)</sup>	NT Build 421	Can be determined	≥ 300 Pa	Can be determined
Water absorption / condensation <sup>3)</sup>	NT Build 304 or similar	≥ 0,4 kg/m <sup>2</sup> when 0,2 m < sd < 0,5m	≥ 0,4 kg/m <sup>2</sup> when 0,2 m < sd < 0,5m	Can be determined
Air tightness - material	EN 12114:2000	Must be determined to calculate air tightness construction	Must be determined to calculate air tightness construction	-
Air tightness construction <sup>6)</sup> Option 1 <sup>4)</sup> Option 2 <sup>5)</sup>	EN 12114:2000	≤ 0.50 m <sup>3</sup> / m <sup>2</sup> h 50Pa ≤ 2.50 m <sup>3</sup> / m <sup>2</sup> h 50Pa	≤ 0.50 m <sup>3</sup> / m <sup>2</sup> h 50Pa ≤ 2.50 m <sup>3</sup> / m <sup>2</sup> h 50Pa	-
Water vapour resistance <sup>3)</sup> Accredited testing	EN ISO 12572:2016	s <sub>d</sub> -value ≤ 0,20 m s <sub>d</sub> -value ≤ 0,50 m	s <sub>d</sub> -value ≤ 0,20 m s <sub>d</sub> -value ≤ 0,50 m	Can be determined
Thermal resistance	EN 12667:2001	To be determined for soft fibreboards	To be determined for soft fibreboards	-
Swelling in thickness 2h/24h	EN 317:1993	According to standard	According to standard	According to standard
Tensile strength perpendicular to the plane of the board	EN 319:1993	According to standard	According to standard	According to standard
Moisture movement 30 –90 % RH	NT-Build 113/ EN 318:2002	To be determined, result is evaluated	To be determined, result is evaluated	To be determined, result is evaluated
"Tread-through" resistance	SP 0487	-	Can be determined	Can be determined
Flexural strength Bending modulus of elasticity	EN 310:1993	According to standard	According to standard	According to standard
Lateral bracing, 2.4 m high wall <sup>7)</sup>	NT Build 362 (EN 594:2011) (if determined according to EN 594	Design load capacity ≥ 3,0 kN/m, Deformation ≤ 15 mm at load 2.5 kN/m		
Resistance to tearing – nail shank accredited testing	EN 12310-1:1999	To be determined, result is evaluated	To be determined, result is evaluated	To be determined, result is evaluated
Weather resistance plus heat aging	Climate simulator: NT Build 495 Heat ageing: EN 1296:2000, Heat+UV+water: EN 1297:2004	Resist 14 days in climate carousel/ alt. UV-radiation plus resist 12 weeks in heat chamber at 70 °C without noticeable changes to properties		
Moisture resistance	EN 321:1999	Change in thickness swelling and tensile strength perpendicular to the plane of the board must be determined		

<sup>1)</sup> Products with low declared values may be rejected. In such cases appropriate documentation must show that the product is suitable.

<sup>2)</sup> Recommended lowest roof pitch is 10 °. The client must describe the performance of all details in the test section and provide all components which are included in the wind barrier- and roofing underlay system.

<sup>3)</sup> For products with water vapour resistance (s<sub>d</sub> – value) higher than 0,2 m, the water absorption (condensation) **shall** be tested and the absorption has then to be ≥ 0,4 kg/m<sup>2</sup> to approve the product. For products with water vapour resistance (s<sub>d</sub> – value) lower than 0,2 m, the water absorption can be lower than 0,4 kg/m<sup>2</sup> and testing is not necessary.

<sup>4)</sup> Option 1 applies to wind barrier system which makes it possible to fulfil any requirements regarding airtightness (n<sub>50</sub>) given in the building regulations and in the Norwegian passive house standards before the vapour barrier is mounted.

<sup>5)</sup> Option 2 applies to wind barrier system which is sufficiently airtight to protect the insulation to avoid cooling from wind but not to fulfil the requirements regarding airtightness (n<sub>50</sub>) given in the building regulations and the Norwegian passive house standards before the vapour barrier is mounted.

<sup>6)</sup> The client must describe the performance of all details in the test section and provide all components which are included in the wind barrier- and roofing underlay system. Air tightness of the construction is a standardized air flow number that is calculated for a test section of 10 m x 5 m (width x height) and includes both material and joint leakages.

<sup>7)</sup> Only required if the product has lateral bracing effect. Stated values are minimum requirements to achieve sufficient wind bracing for small houses up to two floors. Testing according to EN 594 should be done in a way that the vertical load is high enough to keep the product tight to the sill. The horizontal bracing capacity of the test section can then be determined.

**Table 2: Flexible sheets/ roll products, current product standards and SINTEFs minimum required performance**

EN 13859-1 Flexible sheets for waterproofing Part 1: Underlays for discontinuous roofing

EN 13859-1 Flexible sheets for waterproofing Part 2: Underlays for walls

Property	Test method	SINTEFs minimum required performance <sup>1)</sup>		
		Wind barrier	Combined roof underlayer and wind barrier	Other roof underlayers
Watertightness - material	EN 1928:2000	Watertight at 200 mm (2 h)	Watertight at 200 mm 2 (h)	Watertight at 200 mm 2 (h)
Watertightness, adhesive joints <sup>8)</sup>	EN 1928:2000	-	Watertight at 200 mm 2 (h)	Watertight at 200 mm 2 (h)
Rain tightness –construction <sup>2)</sup>	NT Build 421	Can be determined	To be determined	Can be determined
Water absorption / condensation <sup>3)</sup>	NT Build 304 or similar	≥ 0,4 kg/m <sup>2</sup> when 0,2 m < s <sub>d</sub> < 0,5m	≥ 0,4 kg/m <sup>2</sup> when 0,2 m < s <sub>d</sub> < 0,5m	Can be determined
Air tightness-material	EN 12114:2000	Must be determined to calculate air tightness construction	Must be determined to calculate air tightness construction	-
Air tightness – construction <sup>6)</sup> Alternative 1 <sup>4)</sup> Alternative 2 <sup>5)</sup>	EN 12114:2000	≤ 0.50 m <sup>3</sup> / m <sup>2</sup> h 50Pa ≤ 2.50 m <sup>3</sup> / m <sup>2</sup> h 50Pa	≤ 0.50 m <sup>3</sup> / m <sup>2</sup> h 50Pa ≤ 2.50 m <sup>3</sup> / m <sup>2</sup> h 50Pa	-
Water vapour resistance <sup>3)</sup>	EN ISO 12572:2016	s <sub>d</sub> -value ≤ 0,50 m	s <sub>d</sub> -value ≤ 0,50 m	Can be determined
Dimensional stability	EN 1107-1:1999 (bituminous) EN 1107-2:2001	≤ 2 %	≤ 2 %	≤ 2 %
"Tread-through" resistance	SP 0487	-	Can be determined	Can be determined
Tensile strength <sup>7)</sup>	EN 13859-1:2014 EN 13859-2:2014 EN 12311-1:1999	To be determined	≥ 100 N	≥ 100 N
Fracture elongation <sup>7)</sup>	EN 13859-1:2014 EN 13859-2:2014 EN 12311-1:1999	To be determined	≥ 15 %	≥ 15 %
Resistance to tearing – nail shank	EN 13859-1:2014 EN 13859-2:2014 EN 12310-1:1999	≥ 35 N	≥ 35 N	≥ 35 N
Durability material. Weather resistance and heat aging <sup>9)</sup>	EN 13859-1:2014 EN 13859-2:2014 UV without water: EN 1297:2004 Heat ageing: EN 1296	Resist UV-radiation (without water spraying) for 336 hours (14 days) followed by 12 weeks in heat chamber at 70 °C without noticeable changes in properties  Water tightness and tensile strength and fracture elongation are tested after artificial aging.		
Durability adhesive joints also adhesive tape Weather resistance and heat aging	EN 13859-1:2014 Climate carousel: NT Build 495 Heat ageing: EN 1296	Resist 14 days in climate carousel followed by 24 weeks in heat chamber at 70 °C without noticeable changes in properties Tests done after artificial aging: T-peel resistance in joints EN 12316-2 Shear resistance in joints EN 12317-2 Resistance to water penetration for adhesive joints acc. to EN 13111 (2,25 l water in 3 hours) Requirement: Tight (T-peel and shear resistance in joints can also be carried out after 12 weeks of ageing according to SINTEF's guidelines for tape. However, resistance to water penetration has to be determined after 24 weeks of heat ageing)		

<sup>1)</sup> Products with low declared values may be rejected. In such cases appropriate documentation must show that the product is suitable.

<sup>2)</sup> Recommended lowest roof pitch is 10 °. The client must describe the performance of all details in the test section and provide all components which are included in the wind barrier- and roofing underlay system.

<sup>3)</sup> For products with water vapour resistance (s<sub>d</sub> – value) higher than 0,2 m, the water absorption (condensation) **shall** be tested and the absorption has then to be ≥ 0,4 kg/m<sup>2</sup> to approve the product.

<sup>4)</sup> Option 1 applies to wind barrier system which makes it possible to fulfil any requirements regarding airtightness (n<sub>50</sub>) given in the building regulations and in the Norwegian passive house standards before the vapour barrier is mounted.

<sup>5)</sup> Option 2 applies to wind barrier system which is sufficiently airtight to protect the insulation to avoid cooling from wind but not to fulfil the requirements regarding airtightness (n<sub>50</sub>) given in the building regulations and the Norwegian passive house standards before the vapour barrier is mounted.

<sup>6)</sup> The client must describe the performance of all details in the test section and provide all components which are included in the wind barrier- and roofing underlay system. Air tightness of the construction is a standardized air flow number that is calculated for a test section of 10 m x 5 m (width x height) and includes both material and joint leakages. Simplified SINTEF method can be performed provided that the surface of the wind barrier is about the same as earlier tested, and well known, products.

<sup>7)</sup> Low values for elongation can be balanced/compensated with high values for tensile strength. Analogous can low values for tensile strength be compensated with high values for elongation.

<sup>8)</sup> If the testing according to EN 1928 is impossible, because of unwanted water leakage in the test equipment, watertightness must be tested according to EN 13111 with 200 mm water column. If the joints are declared in class W1 from the manufacturer, the joints have also to be tested for this class both for fresh and aged material.

<sup>9)</sup> UV Wind barriers used on façades with partly open claddings (slits ≤ 20 mm) shall resist 5000 hours of heat- and UV-ageing according to EN 13859-2

**Table 3 Gypsum boards, current product standards and SINTEFs minimum required performance**

-EN 520 Gypsum plasterboards Definitions, requirements and test methods

NS-EN 15283-1:2008+A1:2009 Gypsum boards with fibrous reinforcement Definitions, requirements and test methods

Part 1: Gypsum boards with mat reinforcements

NS-EN 15283-2:2008+A1:2009 Gypsum boards with fibrous reinforcement Definitions, requirements and test methods

Part 2: Gypsum fibre boards

Property	Test method	SINTEFs minimum required performance <sup>1)</sup>		
		Wind barriers of gypsum board Type E and H according to EN 520	Wind barriers of gypsum board with mat reinforcement Type GM-H according to EN 15283-1	Wind barriers of reinforced gypsum board Type GF-H according to EN 15283-2
Watertightness-material	EN 12467:2002 +A1:2016 / EN 1928:2000	Can be determined	Can be determined	Can be determined
Rain tightness – construction <sup>2)</sup>	EN 1027:2016	Necessary testing must be evaluated in each case	Necessary testing must be evaluated in each case	Necessary testing must be evaluated in each case
Air tightness material	EN 12114:2000	Must be determined to calculate air tightness construction	Must be determined to calculate air tightness construction	Must be determined to calculate air tightness construction
Air tightness – construction <sup>3)</sup> Alternative 1 <sup>4)</sup> Alternative 2 <sup>5)</sup>	EN 12114:2000	≤ 0.50 m <sup>3</sup> /m <sup>2</sup> h 50Pa ≤ 2.50 m <sup>3</sup> /m <sup>2</sup> h 50Pa	≤ 0.50 m <sup>3</sup> /m <sup>2</sup> h 50Pa ≤ 2,50 m <sup>3</sup> /m <sup>2</sup> h 50Pa	≤ 0.50 m <sup>3</sup> /m <sup>2</sup> h 50Pa ≤ 2,50 m <sup>3</sup> /m <sup>2</sup> h 50Pa
Water vapour resistance Accredited testing	EN ISO 12572:2016	≤ 0.5 m	≤ 0,5 m	≤ 0,5 m
Lateral bracing. 2.4 m high wall <sup>6)</sup>	NT Build 362 EN 594:2011	To be determined. Result must be evaluated	To be determined. Result must be evaluated	To be determined. Result must be evaluated
Bending strength	NS-EN 520:2004+ A1:2009 EN 15283-1/2	Ch. 4.1.2 in the product standard	Ch. 4.1.1 in the product standard	Ch. 4.1.2 in the product standard
Dimensions: length. width. thickness. squareness	NS-EN 520:2004+ A1:2009 EN 15283-1/2	Ch. 4.9.1.1/2/3/4 in the product standard	Ch. 4.9.1.1/2/3/4 in the product standard	Ch. 4.9.1.1/2/3/4 in the product standard
Water absorption	NS-EN 520:2004+ A1:2009 EN 15283-1/2	Ch. 4.10 in the product standard Class H1. H2. H3	Ch. 4.8 in the product standard Class H1, H2	Ch. 4.9 in the product standard Class GF-H
Shear strength	NS-EN 520:2004+ A1:2009 EN 15283-1/2	Ch. 5.13 in the product standard	The product standard refers to EN 520	Ch. 4.1.1 in the product standard
Properties related to fire	NS-EN 13501-1:2007 +A1:2009	To be determined	To be determined	To be determined
Fire classification	EN 13501-2:2016	Can be determined	Can be determined	Can be determined
Weather resistance	Climate simulator: NT-Build 495	Resist 14 days in climate carousel Visual evaluation and testing of bending strength according to the principles in EN 520		

<sup>1)</sup> Products with low declared values may be rejected. In such cases appropriate documentation must show that the product is suitable.

<sup>2)</sup> The client must describe the performance of all details in the test section and provide all components which are included in the wind barrier system.

<sup>3)</sup> The client must describe the performance of all details in the test section and provide all components which are included in the wind barrier system. Air tightness of the construction is a standardized air flow number that is calculated for a test section of 10 m x 5 m (width x height) and includes both material and joint leakages.

<sup>4)</sup> Option 1 applies to wind barrier system which makes it possible to fulfil any requirements regarding airtightness ( $n_{50}$ ) given in the building regulations and in the Norwegian passive house standards before the vapour barrier is mounted.

<sup>5)</sup> Option 2 applies to wind barrier system which is sufficiently airtight to protect the insulation to avoid cooling from wind but not to fulfil the requirements regarding airtightness ( $n_{50}$ ) given in the building regulations and the Norwegian passive house standards before the vapour barrier is mounted.

<sup>6)</sup> Only required if the product has lateral bracing effect. Testing according to EN 594 should be done in a way that the vertical load is high enough to keep the product tight to the sill. The horizontal bracing capacity of the test section can then be determined.

<sup>7)</sup> The property shall be documented either through testing or evaluation. When using profiles and/or tape in the joints, testing must be carried out. Using battens and nails with head diameter of min. 8 mm is in most cases acceptable.

**Table 4 Audit testing of soft fibreboards used as combined roofing underlay and wind barrier**

Property	Test method	Frequency
Thickness	EN 324-1:1993	Examination of the manufacturer's internal control once each year (alternatively control testing once each second year)
Length	EN 324-1:1993	
Width	EN 324-1:1993	
Squareness	EN 324-2:1993	
Edge straightness	EN 324-2:1993	
Flexural strength and bending modulus of elasticity	EN 310:1993	Once each second year
Air tightness material	EN 12114:2000	Once each second year
Thermal resistance	EN 12667:2001	Once each fifth year
Water vapour resistance*	EN ISO 12572:2016	Once each second year
Water tightness	NS-EN 12467:2012+A1:2016	Once each fifth year

\*Accredited testing

**Table 5 Audit testing of hard fibreboards used as roofing underlay**

Property	Test method	Frequency
Thickness	EN 324-1:1993	Examination of the manufacturer's internal control once each year (no control testing)
Length	EN 324-1:1993	
Width	EN 324-1:1993	
Squareness	EN 324-2:1993	
Edge straightness	EN 324-2:1993	
Flexural strength and bending modulus of elasticity	EN 324-2:1993	
Tensile strength perpendicular to the plane of the board	EN 319:1993	Once each year
Tensile strength perpendicular to the plane of the board after boiling test	EN 319:1993	Once each year
Swelling in thickness 24h	EN 317:1993	Once each year
Water tightness	NS-EN 12467:2012+A1:2016	Once each fifth year

**Table 6 Audit testing of hard fibreboards used as combined roofing underlay and wind barrier**

Property	Test method	Frequency
Thickness	EN 324-1:1993	Examination of the manufacturer's internal control once each year (no control testing)
Length	EN 324-1:1993	
Width	EN 324-1:1993	
Squareness	EN 324-2:1993	
Edge straightness	EN 324-2:1993	
Flexural strength and bending modulus of elasticity	EN 310:1993	
Tensile strength perpendicular to the plane of the board	EN 319:1993	Once each year
Tensile strength perpendicular to the plane of the board after boiling test	EN 319:1993	Once each year
Swelling in thickness 24h	EN 317:1993	Once each year
Water vapour resistance *	EN ISO 12572:2016	Once each fifth year
Water tightness	NS-EN 12467:2012+A1:2016	Once each fifth year

\*Accredited testing

**Table 7: Audit testing of wind barriers and roof underlays in roll form**

Property	Test method	Control limit	Value	Frequency
Water vapour resistance *	EN ISO 12572:2016		s <sub>d</sub> - value m	Usually once every year, but can be done once every second year when several annual test results show good consistency
Resistance to air penetration material	EN 12114:2000		m <sup>3</sup> /(m <sup>2</sup> h50Pa)	One of these properties once every year
Resistance to water penetration	EN 1928:2000		Tight	
Tensile strength * -Longitudinal -Transversal	EN 13859-1:2014 EN 13859-2:2014 EN 12311-1:1999		N/50 mm	Once every year
Elongation at break * -Longitudinal -Transversal	EN 13859-1:2014 EN 13859-2:2014 EN 12311-1:1999		%	Once every year
Products with adhesive strip (seems) - T-peel * - Water tightness	EN 12316-2:2013 EN 13111:2010	Tight	-N/50 mm -2,25 l water for 3 hours (50 mm water column)	One of these properties alternately each year
Products with adhesive strip (seems) (aged material) - Water tightness	EN 13111:2010	Tight	2,25 l water for 3 hours (50 mm water column)	Each fifth year, preferably the year before each 5-year revision

\*Accredited testing

**Table 8: Audit testing of gypsum boards with surface of paper board**

Property	Test method	Control limit	Value	Frequency
Water vapour resistance *	EN ISO 12572:2016		s <sub>d</sub> - value m	Once every second year
Bending strength	EN 520:2004/ NS-EN 15283-1:2008+A1:2009 NS-EN 15283-2:2008+A1:2009		N/mm <sup>2</sup>	Once every second year
Water absorption	EN 520:2004/ NS-EN 15283-1:2008+A1:2009 NS-EN 15283-2:2008+A1:2009		%	Once every year
Shear strength	EN 520:2004/ NS-EN 15283-1:2008+A1:2009 NS-EN 15283-2:2008+A1:2009		N	Once every second year

\*Accredited testing

**Table 9: Audit testing of gypsum boards with surfaces of other materials than paper board**

Property	Test method	Control limit	Value	Frequency
Water vapour resistance *	EN ISO 12572:2016		s <sub>d</sub> - value m	Once every second year
Resistance to air penetration material **	EN ISO 12114:2000		m <sup>3</sup> /m <sup>2</sup> h50Pa	Once every second year
Bending strength	EN 520:2004/ NS-EN 15283-1:2008+A1:2009 NS-EN 15283-2:2008+A1:2009		N/mm <sup>2</sup>	Once every second year
Water absorption	EN 520:2004/ NS-EN 15283-1:2008+A1:2009 NS-EN 15283-2:2008+A1:2009		%	Once every year
Shear strength	EN 520:2004/ NS-EN 15283-1:2008+A1:2009 NS-EN 15283-2:2008+A1:2009		N	Once every second year

\*Accredited testing

\*\*The need for testing has to be evaluated in each case