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## Guidelines for SINTEF Technical Approval

- Bitumen-Based Roofing Membranes
  - Roofing Membranes of PVC, TPO or rubber
  - Roofing Shingles
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### Contents

1.	General information about SINTEF Technical Approval	2
2.	Properties to be included in the approval and how the properties are determined	2
	Fire technical properties	2
	Material properties	2
	Performance test / Full scale wind load test	2
	Durability	2
	FTIR material characterization	3
	Environmental properties	3
	Declaration of Performance (DoP) and declared values in a Technical Approval	3
	Guidelines for approval and SINTEF's recommended minimum performances	3
	Durability	4
3.	Description of the manufacturer's factory production control	4
4.	Supervisory production control	4
	Annual surveillance control of roofing membranes declared with class B <sub>ROOF</sub> (t2)	5
5.	Application for SINTEF Technical Approval and project management	6
6.	More information	6

## 1. General information about SINTEF Technical Approval

General information about SINTEF Technical Approval procedures is available at <http://www.sintefcertification.no/en-us/PortalPage.aspx?pageid=180>

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

If the product properties have already been tested according to recognised methods, and the results are thoroughly documented, either in English or a Scandinavian language, the documentation should be submitted together with the application. If no such documentation exists, SINTEF will carry out a full type testing in accordance with the methods and criteria mentioned below.

### Fire technical properties

Fire technical classification  $B_{ROOF}(t_2)$  is specified according to EN 13501-5 on a defined underlay, with tests carried out according to CEN/TS 1187:2012 E, Test 2. Approval of the different substrates are determined according to a defined sequence of testing. The testing sequence and consequences of different results are described in organigram in the end of this document.

### Material properties

Material properties on newly manufactured membrane (fresh material) are tested in accordance with methods in the product standard for the current product category. The results must satisfy the minimum values given in Table 1, 2 or 3.

### Performance test / Full scale wind load test

*Bitumen based roofing membranes and Membranes of PVC, TPO or rubber*

Resistance against wind load is tested and documented according to EN 16002; "Determination of the resistance to wind load of mechanically fastened flexible sheets for roof waterproofing". Wind load testing in consistence with EOTA ETAG 006 "Systems of Mechanically Fastened Flexible Roof Waterproofing Membranes" pt. 5.1.4.1 is accepted as supplementary documentation in cases with several system variables.

The test shall be performed in consistence with the rules given in leaflet No. 544.206 in the Byggforsk-series, and TPF Informerer No. 5, published by Takprodusentenes Forskningsgruppe.

*Roofing shingles*

Performance test of roofing shingles concerning water tightness shall be tested and documented according to Method NT Build 421 "Roofs; Water tightness Under pulsating Air Pressure". The test shall be performed in consistence with the rules given in leaflet No. 544.105 in the Byggforsk-series.

### Durability

Durability assessment shall always be performed. It will normally be carried out as accelerated laboratory ageing, where a limited number of properties are tested after ageing. The ageing procedure for bituminous roofing membranes is normally carried out as exposure to elevated temperatures, while durability of membranes of PVC / TPO is tested by artificial ageing by long term exposure to the combination of UV radiation, elevated temperature and water. For roofing shingles the ageing procedure consist of UV-exposure and possible resistance to blistering.

### **FTIR material characterization**

FTIR material characterization shall be tested for the product. The FTIR material characterization is carried out applying an attenuated total reflectance (ATR) accessory (single reflection) with a diamond crystal, in the wavelength range  $4000\text{ cm}^{-1}$  ( $2.5\ \mu\text{m}$ ) to  $400\text{ cm}^{-1}$  ( $25\ \mu\text{m}$ ), in an atmosphere with minimized  $\text{CO}_2$  and  $\text{H}_2\text{O}$  content through purging.

### **Environmental properties**

SINTEF Technical Approval must always include information about prioritized environmental toxins, inside climate influences, influence of soil and groundwater and waste managing. For roofing membranes it is necessary to perform leaching-test following the Norwegian TEK 10 § 9-2 and limitations 3 "Helse, hygiene og miljø" in the "Building Product Regulation" together with the standard-committee CEN/TC 351 (Construction Products – Assessment of the release of Dangerous Substances / WG 1 Leaching of soil, groundwater and surface water).

Requirements concerning material and product properties related to impact on the environment is available at;

<http://www.sintefcertification.no/en-us/PortalPage.aspx?pageid=180>

### **Declaration of Performance (DoP) and declared values in a Technical Approval**

SINTEF is obliged to control conformity between manufacturer's values in the Declaration of Performance (DoP) and the values declared in the SINTEF Technical Approval.

### **Guidelines for approval and SINTEF's recommended minimum performances**

SINTEF's recommended minimum performances for approval are given in Table 1 for bituminous roofing membranes, Table 2 for roofing membranes of PVC, TPO or rubber, and for roofing shingles in Table 3. For membranes which may also be used for other building purposes special property requirements can be required.

#### *Bitumen-Based Roofing Membranes. See Table 1*

Table 1 lists the type of tests that has to be carried out and recommended performances applicable to membranes used in *mechanically fastened systems, ballasted systems, and systems torched, welded or glued to the underlay systems*. It is a clear advantage for the products used in the last mentioned system to have an elongation larger than 10%. The resistance to artificial ageing by exposure to UV radiation need not be documented for built-in products.

#### *Roofing membranes of PVC, TPO or rubber. See Table 2*

Table 2 lists the type of tests that has to be carried out and recommended performances applicable to roofing membranes of PVC, TPO or rubber used in mechanically fastened systems, or ballasted membranes.

#### *Roofing shingles. See Table 3*

Table 3 lists type of tests that has to be carried out and recommended performances applicable to roofing shingles with mineral and/or synthetic reinforcement. The field of application for the roofing shingles is pitched roofs down to  $15^\circ$ , with ventilated roof boards of wood or plywood.

### *Durability*

The tables give recommended performances to the durability of bituminous roofing membranes, roofing membranes of PVC, TPO or rubber and roofing shingles. The chosen tests after ageing are a basis to make it possible to judge the durability of the membrane as a complete product, but also to evaluate the bituminous coating and the reinforcement. Too large changes of the properties after ageing will not be approved, see points a) to d) below. Recommended minimum performance for aged material given in Table 1, 2 and 3 corresponds to point a) below.

The following guidelines apply to the residual properties for roofing membranes after standard ageing:

- a) The properties shall, as a main rule, not change more than 20% compared to fresh material.
- b) If a) is not fulfilled, but the change lie between 20 and 30 % reduction compared to fresh material, the property shall not exceed 15% below the recommended value for fresh material.
- c) If b) is not fulfilled, but the change is greater than 30%, the property shall not be poorer than the recommended value for fresh material.
- d) Changes greater than 35 % will not be accepted.

## **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:

- control and reception of raw materials
- control and supervision of production
- control of properties for finished product
- control and supervision of marking and storage
- calibration procedures of important instruments used for production and product control
- training of new employees

including the control frequency, how the controls are performed and by whom.

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**

The production shall be subject to a supervisory product and production control performed by an independent body. General description of how the supervisory product and production control is performed is available at;

<http://www.sintefcertification.no/en-us/PortalPage.aspx?pageid=180>

The agreement includes one annual inspection of the production of the product to make sure that the quality system works according to purpose. An independent inspection organ shall perform the inspection. Samples of the approved product are collected once a year for control testing of its properties (on both fresh and aged material, if appropriate). SINTEF or another third party organization shall perform the control testing. In addition, annually control of fire property, according to CEN/TS 1187 test 2, shall be performed by a third party organization.

If annual control does not pass the holder of the Approval will be notified with a letter. Depending on the severity of the nonconformity different corrective actions must be implemented. For the most severe incidents withdrawal of the Technical Approval might be necessary. See examples in paragraph below.

SINTEF's project manager for the surveillance control is responsible for the communication with the holder. Approval manager in SINTEF Certification forwards the formal notice when a Technical Approval is withdrawn.

### **Annual surveillance control of roofing membranes declared with class B<sub>ROOF</sub> (t2)**

The requirement for a passed result at type testing with 3 parallel samples on each wind velocity is maximum damaged length on 800 mm for each single specimen, and maximum 550 mm in average for each wind velocity. See EN 13501-5.

Control testing of B<sub>ROOF</sub>(t2), according to CEN/TS 1187:2012 test 2, is performed annually. The control testing is performed on the current substrate the product is approved for, and with minimum 2 single tests:

- 1 for wind velocity 2 m/ s
- 1 on wind velocity 4 m/ s

Criteria for passed result for a control test ( only 1 single sample on each wind velocity) is not described in the test standard nor the classification standard. But practice has been:

- Passed: Damaged length (l) of membrane or substrate  $l < 550$  mm
- Not clearly passed: Damaged length (l) of membrane or substrate  $550 > l < 800$  mm
- Not passed: Damaged length (l) of membrane or substrate  $l > 800$  mm

When annual control test does not pass the following guidelines apply:

- 1) Damaged length (l) of membrane or substrate  $550 > l < 800$  mm, or missing fire report
  - Holder is notified that a new control test must be performed, respite 2 months
  - Producer is simultaneously asked to find an explanation to the deviation, respite 4 weeks
  - If new control test passes the matter is considered to be sorted
  - If new control testing does not pass holder is notified that the Approval will be withdrawn in 2 weeks unless there is an obvious defect in the production which can be adjusted.New test is performed as a full type test.
- 2) Damaged length (l) of membrane or substrate  $l > 800$  mm
  - Holder is notified that a new control test must be performed, respite 2 months
  - Producer is simultaneously asked to find an explanation to the deviation and to present a plan for possible corrective actions and planned time for new control testing, respite 4 weeks
  - Producer must be asked to consider blocking the stock, or possibly reclassification
  - If new control test passes the matter is considered to be sorted
  - If new control testing does not pass holder is notified that the Approval will be withdrawn in 2 weeks unless there is an obvious defect in the production which can be adjusted.New test is performed as a full type test.
- 3) When test results are worse than 1) and 2), for instance at complete flash-over
  - Holder is notified that a new control test must be performed as a full type testing, with 3 parallel samples on each wind velocity, respite 1 month
  - Holder must immediately order new fire test and simultaneously investigate if there are obvious defects in the production or testing procedure that can be adjusted.
  - Producer must be asked to consider blocking the stock, or possibly reclassification
  - If new type test passes the matter is considered to be sorted
  - If new type testing does not pass holder is notified that the Approval will be withdrawn immediately.

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

Information regarding application and project management for SINTEF Technical Approval is available at;

<http://www.sintefcertification.no/en-us/PortalPage.aspx?pageid=180>

## **6. More information**

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

Table 1. SINTEF's recommended minimum performance to issue a SINTEF Technical Approval for bituminous roofing membranes. Properties according to product standard EN 13707.

Property	Method EN	Unit	Type of requirement	SINTEF's recommended minimum performance		
				Underlay	Top layer	Single layer
Width and Width tolerance <sup>6)</sup>	1848-1:2000	m	Minimum	+	+	+
Length and Length tolerance <sup>6)</sup>	1848-1:2000	m	Minimum	+	+	+
Straightness <sup>6)</sup>	1848-1:2000	mm/10 m	Maximum	20	20	20
Weight, Weight tolerance, or Thickness, Thickness tolerance	1849-1:2000	kg/m <sup>2</sup> or mm	Mean value	+	+	+
Visual defects	1850-1:2000	-	-	Pass	Pass	Pass
Dimensional stability	1107-1:1999	%	Maximum	0,6	0,6	0,6
Flexibility at low temperature	1109:2013	°C	Maximum	-15	-15 <sup>1)</sup>	-15
Flow resistance at elevated temperature	1110:2010	°C	Minimum	90	90	90
Watertightness	1928:2000 (A)	-	Tight at 10 kPa	Pass	Pass	Pass
Adhesion of granules <sup>3)</sup>	12039:2000	g	Maximum	-	2.5	2.5
Resistance to tearing (nail shank)	12310-1:2000	N	Minimum	150	-	150
Tensile strength	12311-1:2000	N/50 mm	Minimum	400	400	600
Elongation	12311-1:2000	%	Minimum	10	10	10
Average peel resistance of joints <sup>4)</sup>	12316-1:2000	N/50 mm	Minimum	50	-	50
Shear resistance of joints	12317-1:2000	N/50 mm	Minimum	400	-	600
Resistance to - Impact at +23 °C	12691:2006 (A)	mm	Min. height	500	500	500
- Impact at -10 °C	12691:2001	mm	Max. diameter <sup>5)</sup>	-	-	30
- Static loading	12730:2001 (A)	kg	Minimum	15	15	20
Watertightness after stretching at low temperature	13897:2005	%	Minimum	-	-	10
Durability (Artificial ageing by long term exposure to elevated temperature, EN1296; + 70 °C for 12 weeks). Maximum accepted change will be evaluated in relation to the requirements for fresh products.						
Flexibility at low temperature	1109:2013	°C °C	Maximum Max. change <sup>2)</sup>	-6 + 10	-6 + 10	-6 + 10
Tensile strength	12311-1:2000(A)	N/50 mm %	Minimum Max. change <sup>2)</sup>	400 - 20	400 - 20	600 - 20
Elongation	12311-1:2000(A)	% %	Minimum Max. change <sup>2)</sup>	10 - 20	10 - 20	10 - 20

- not relevant

+ must be documented, but has no requirements

<sup>1)</sup> Only top side out

<sup>2)</sup> Maximum change in relation to fresh product

<sup>3)</sup> Modified to only give the result of weight loss of granules in gram according to EN 544.

<sup>4)</sup> SINTEF does not have requirements for maximum peel resistance of joints, but this value can be used in approval documents if desirable.

<sup>5)</sup> Diameter on puncture tool: 10, 15, 20 and 30 mm

<sup>6)</sup> The property is not necessary to test in connection with type testing. But the results in the producer's FPC must be checked against given tolerances and possible minimum performance in this document.

Additional properties might be necessary to test for products with special fields of application. This must be evaluated in each case.

Table 2. SINTEF's recommended minimum performance to issue a SINTEF Technical Approval for roofing membranes of PVC, TPO or rubber. Properties according to product standard EN 13956.

Property	Method EN	Unit	Type of requirement	SINTEF's recommended minimum performance	
				Mechanically fastened	Ballasted
Width and Width tolerance <sup>5)</sup>	1848-2:2001	m	Minimum	+	+
Length and Length tolerance <sup>5)</sup>	1848-2:2001	m	Minimum	+	+
Straightness <sup>5)</sup>	1848-2:2001	mm/10 m	Maximum	50	50
Flatness	1848-2:2001	mm/10 m	Maximum	10	10
Weight and Weight tolerance or Thickness, Thickness tolerance	1849-2:2001	kg/m <sup>2</sup> or mm	Mean value	+ +	+ +
Visual defects	1850-2:2001	-	-	Pass	Pass
Flexibility at low temperature	495-5:2001	°C	Maximum	-30 <sup>4)</sup>	-30 <sup>4)</sup>
Dimensional stability	1107-2:2001	%	Maximum	0,5	0,5
Watertightness	1928:2000 (A)	-	Tight at 10 kPa	Tight	Tight
Resistance to tearing	12310-2:2000	N	Minimum	180	80
Tensile strength	12311-2:2000 (A)	N/50 mm	Minimum	600	380
Elongation	12311-2:2000 (A)	%	Minimum	10	180
Average peel resistance of joints <sup>3)</sup>	12316-2:2000	N/50 mm	Minimum	150	-
Shear resistance of joints	12317-2:2000	N/50 mm	Minimum	600	380
Resistance to - Impact at +23 °C	12691:2006 (A)	mm	Min. height	400	400
- Impact at -10 °C	12691:2001	mm	Max. diameter <sup>2)</sup>	15	20
- Static loading <sup>6)</sup>	12730:2001 (C) <sup>6)</sup>	kg	Minimum	20	20
- Static loading <sup>7)</sup>	12730:2001 (C) <sup>7)</sup>	kg	Minimum	20	20
Durability (Artificial ageing by long term exposure to the combination of UV radiation, elevated temperature and water, EN 1297). Maximum accepted change will be evaluated in relation to the requirements for fresh material.					
Flexibility at low temperature	495-5:2001	°C	Maximum Max. change <sup>1)</sup>	-20 + 10	-20 + 10
Tensile strength	12311-2:2000 (A)	N/50 mm %	Minimum Max. change <sup>1)</sup>	600 - 20	380 - 20
Elongation	12311-2:2000 (A)	% %	Minimum Max. change <sup>1)</sup>	10 - 20	180 - 20

- not relevant

+ must be documented, but is not required

<sup>1)</sup> Maximum change in relation to fresh product

<sup>2)</sup> Diameter on puncture tool: 10, 15, 20 and 30 mm

<sup>3)</sup> SINTEF does not have requirements for maximum peel resistance of joints, but this value can be used in approval documents if desirable.

<sup>4)</sup> For thickness 1,2 mm: -30 °C,  
For thickness ≥ 1,5 mm: -25 °C

<sup>5)</sup> The property is not necessary to test in connection with type testing. But the results in the producer's FPC must be checked against given tolerances and possible minimum performance in this document.

<sup>6)</sup> Modified to give **no** limitation to downward movement of ball on puncturing tool. Modified method is required by SINTEF in connection with annual control testing and type testing.

<sup>7)</sup> Testing with 10 mm limited downward movement of ball on puncturing tool according to standard is performed in connection with type testing

Additional properties might be necessary to test for products with special fields of application. This must be evaluated in each case.



Table 3. SINTEF's recommended minimum performance to issue a SINTEF Technical Approval for roofingshingles. Properties according to product standard EN 544.

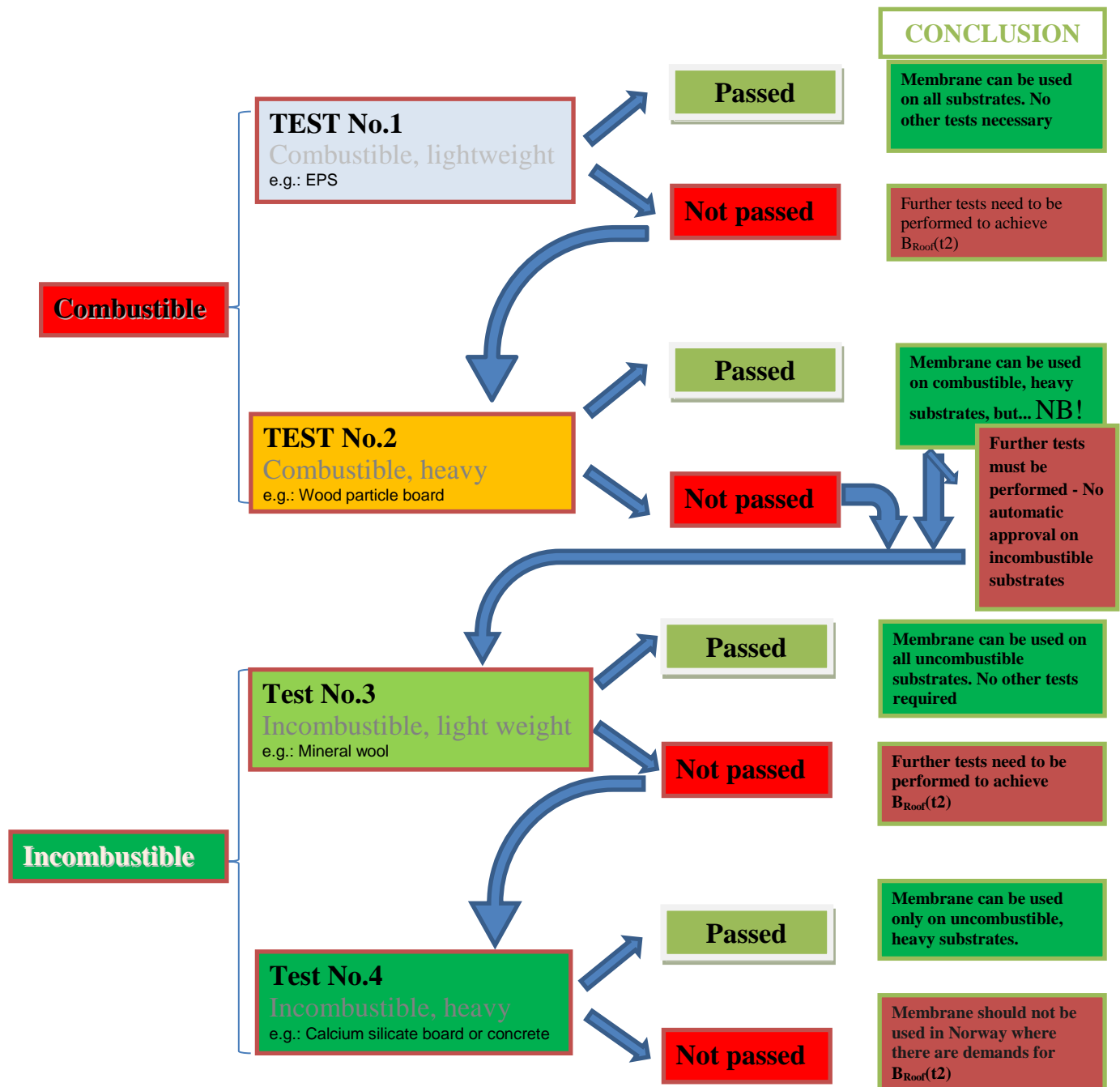
Property	Method EN	Unit	Type of requirement	SINTEF's recommended minimum performance
Width and Width tolerance <sup>2)</sup>	544:2005	mm	Maximum	1200 ± 3
Height and Height tolerance <sup>2)</sup>	544:2005	mm	Minimum	250 ± 3
Mass of bitumen	544:2005	g/m <sup>2</sup>	Minimum	1300
Flow resistance at elevated temperature, 90°C	1110:2010	mm	Maximum	2
Adhesion of granules	12039:2000	g	Maximum	2,5
Resistance to tearing (nail shank)	12310-1:2000	N	Minimum	100
Tensile strength L <sup>3)</sup> /T	12311-1:2000	N/50 mm	Minimum	600/400
<b>Durability</b>				
Water absorption	544:2005	%	Maximum	2
Resistance to blistering <sup>1)</sup>	544:2005	-	Visual	No blisters
Resistance to UV radiation	1297:2004	-	Visual	No cracks/damages

<sup>1)</sup> Resistance to blistering is only relevant for shingles with other reinforcement than glass (type 3 and 4), polyester (type 6) and glass/polyester (type 7) according to EN 544.

<sup>2)</sup> The property is not necessary to test in connection with type testing. But the results in the producer's FPC must be checked against given tolerances and possible minimum performance in this document

<sup>3)</sup> Longitudinal (L) = Direction of production

## Organigram for fire testing of exposed<sup>\*1</sup> roofing membranes of bitumen and PVC/ TPO



\*1 – Roofings embedded in constructions or lying under pebble ballast do not need any class  $B_{Roof}(t_2)$

\*2 – Exposed roofings in scattered small house settlements do not need to achieve  $B_{Roof}(t_2)$

**Remarks:**

- If the membrane does not pass EPS as a substrate, both mineral wool and wood particle board must be tested.
- Mineral wool is often more difficult to pass than wood particle board, even if mineral wool is described as uncombustible, lightweight.
- Uncombustible, heavy substrates are normally not tested.