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ETAG 016

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**GUIDELINE FOR EUROPEAN TECHNICAL APPROVAL
FOR**

**SELF-SUPPORTING COMPOSITE
LIGHTWEIGHT PANELS**

**Part 2: Specific aspects relating to Self-supporting Composite
Lightweight Panels for use in roofs**

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Section one : INTRODUCTION

1. PRELIMINARIES

1.1. Legal basis

The legal basis of the ETA-Guidelines is given in Part 1 - "General" - clause 1.1.
No existing ETA-Guideline is superseded.

1.2. Status of ETAG

The Status of the ETA-Guidelines is given in Part 1 - "General" - clause 1.2 .

2. SCOPE

2.1 Scope

This Part 2 shall be used in conjunction with Part 1 - "General".

This complementary Part (ETA –Guideline Part 2) “ Specific aspects relating to Self-supporting Composite Lightweight Panels for use in roofs” specifies terminology, definitions, verification methods and the specific criteria for the assessment of the panels; they can be used both for flat or inclined roofs. In the framework of this ETA Guideline installed panels having a pitch of 70 degrees or more from the horizontal, are to be considered wall panels.

The panel can either be the outmost of the construction product, protecting the construction against the weather elements, or part of the roof system.

2.2 Use categories

use categories	Level of accessibility	Explanation
A1	Not accessible roofs (not even for installation)	These panels are considered not accessible. Such panels should only be used for inclined roof assemblies, with an additional roof covering (e.g. tiles, slates, etc.).*
A2	Roofs, accessible for installation and maintenance only (always with protective measures)	The accessibility of roof panels depends both on the impact resistance of the panel assembly and on the walkability characteristics of the roof panels. However, access should always be limited to a single person, taking due care. The frequency should be limited to approximately once a month.
A3	Roofs, accessible with protective measures	The accessibility of roof panels depends both on the impact resistance of the panel assembly and on the walkability characteristics of the roof panels. The access on roof panels with protective measures however should always be limited to a single person, taking due care.
A4	Roofs, accessible without protective measures	The accessibility of roof panels depends both on the impact resistance of the panel assembly and on the walkability characteristics of the roof panels. If no protective measures are foreseen, the roof panels should be favourably assessed with reference to walkability. However, access on roof panels should always be limited to a single person, taking due care.

* This use category shall be used, both for roof panels which were not assessed (NPD) and those that do not meet the criteria for accessible roofs.

2.3. Assumptions

The state of the Art does not enable the development, within a reasonable time, of full and detailed verification methods and corresponding technical criteria/guidance for acceptance for some particular aspects or products. This ETAG contains assumptions taking account of the state of art and makes provisions for

appropriate, additional **case-by-case approaches** when examining ETA-applications, within the general framework of the ETAG and under the CPD consensus procedure between EOTA members.

3. TERMINOLOGY

3.1. Common terminology and abbreviations

For the purpose of this Complementary Part of the ETA-Guideline the common terminology and abbreviations as stated in Part 1 - Annex A, apply.

3.2. Terminology and abbreviations specific to this ETAG

For the purpose of this ETA-Guideline Part 2, the following definitions apply:

Finishing (coating)

Prefabricated continuous layer of a product in liquid, paste or powder form that, when applied to a surface, forms a film possessing protective, decorative and/or other specific properties. Internal finishes frequently used are PVC laminates, PVC paint coating and polyester paint. External finishes are plastisol type coatings, PVF₂ and polyester coatings.

Protective measures

Appropriate protective measures shall be taken when installing the roof panels and accessing the roof for maintenance purposes, especially in case of more frequent maintenance (e.g. servicing of equipment on the roof). These measures might consist of wooden boards or planks laid on a number of composite panels, distributing the load uniformly over the surface of the panels.

Side lap

Panel joint made by a folding or profile of one or both the skins, which engages the adjacent panel to form an overlapping joint

Backing board

Calcium silicate panel used to back the specimen that can be placed directly against a free-standing test specimen or at a distance from it

Section two :

GUIDANCE FOR THE ASSESSMENT OF THE FITNESS FOR USE

4 REQUIREMENTS

The performance requirements shall be in accordance with ETAG Part 1 - chapter 4,

5. SPECIFIC METHODS OF VERIFICATION

5.0 General

The methods of verification given in ETAG Part 1 - chapter 5 shall be applied, unless additional specifications are being given below.

5.1 Mechanical resistance and stability

5.1.1 Mechanical resistance

As the panels are non-loadbearing parts of the works, mechanical resistance is considered under ER4 Safety in use. See §5.4.1.

5.2 Safety in case of fire

5.2.1 Reaction to fire

See Annex C1 for specific details on the test methods.

5.2.2 Fire resistance

See ETAG 016 Part 1, General.

5.2.3 External fire performance

See Annex C1 for specific details on the test methods.

5.3 Hygiene, health and environment

5.3.1 Water permeability

The test is only relevant for external roofs system.

See annex C2 for specific details on the test method.

5.3.2 Vapour permeability

See ETAG 016 Part 1, General.

5.3.3 Release of dangerous substances

See ETAG 016 Part 1, General.

5.3.4 Dimensional variation (related to water penetration)

The water permeability of the panels, including joints between the panels, shall be assessed by testing.

See annex C3 for specific details on the test method.

This test is not applicable for part of roof system on which roof covering is added.

5.4 Safety in use

5.4.1 Mechanical resistance

5.4.1.1 Test to determine the mechanical strength of a simply supported panel subject to positive load

See ETAG 016 Part 1, General.

5.4.1.2 Test to determine the mechanical strength of a fixed panel subject to negative load

See ETAG 016 Part 1, General.

5.4.1.3 Thermal effect

The panel shall be tested only if it is the outside part of roof system.

See Annex C8 for specific details on the test method.

5.4.2 Impact resistance

5.4.2.1 Resistance to impact from hard body

See Annex C10 for specific details on the test method.

5.4.2.2 Resistance to impact from soft body

See Annex C4 for specific details on the test method.

5.4.3 Resistance to fixings

5.4.3.1 Resistance of the panels at fixing devices and joints

See ETAG 016 Part 1, General.

5.4.3.2 Resistance to eccentric loads due to objects fixed to the panel

The point loads represent the action from light objects, such as lighting devices hanging from the panel.

The test shall be carried out by applying a point load of 100N perpendicular to the surface of the panel.

The fixing system and the way in which it is being used shall conform to the manufacturer specification.

5.4.4 Walkability

See Annex C5 for specific details on the test method.

5.5 Protection against noise

5.5.1 Direct airborne sound insulation

See ETAG 016 Part 1, General.

5.5.2 Sound absorption

See ETAG 016 Part 1, General.

5.6 Energy economy and heat retention

5.6.1 Thermal insulation

See ETAG 016 Part 1, General.

5.6.2 Air permeability

See ETAG 016 Part 1, General.

5.7 Aspects of durability, serviceability and identification of the products

5.7.1 Durability

5.7.1.1 Creep

The test specified in Annex C6 is relevant when the core materials contributes to the mechanical resistance of the panel.

5.7.1.2 Thermal Agents

5.7.1.2.1 Climatic testing cycles

The appropriate test(s) shall be chosen according to table 1.

Core	Cycle1	Cycle2	Cycle3	EN 29142
MW, EPS, XPS		X		
PUR (adhesive and auto adhesive)	X			
Others Insulating materials	X	X	X	
Others				X

Table 1: Use of the climatic cycles

Where the composition of materials, the compatibility between them is unknown, the Approval Body may require additional tests for the evaluation of products not yet considered in this table.

See Annex C7 for specific details on the test methods.

5.7.1.2.2 Thermal shock

See Annex C9 for specific details on the test method.

Where the durability of the specific materials is not covered by harmonised European standards or European technical Approvals it shall be precisely verified, when relevant, in accordance with appropriate CEN, EOTA, ISO or accepted international (such as UEAtc, RILEM) test methods as far as they exist.

5.7.1.3 Biological agents

The durability of wood-based materials shall be established in accordance to ETAG 019: prefabricated wood-based load-bearing stressed skin panels.

5.7.1.4 Finishes

The durability of coil coated metal finishes shall be established in accordance with the following test methods:

- Salt spray test in accordance with EN 13523-8
- Resistance to humidity in accordance with EN 13523-10
- Resistance to immersion in accordance with EN 13523-9
- Resistance to ageing in accordance with EN 13523-13

Other similar tests shall be used for other finishes.

5.7.2 Serviceability

5.7.2.1 Resistance to impact from hard body

See Annex C10 for specific details on the test method.

5.7.2.2 Resistance to impact from soft body

See Annex C4 for specific details on the test method.

5.7.2.3 Finishes

The serviceability of coil coated metal finishes shall be established in accordance with the following test methods:

- Coating hardness in accordance with EN 13523-4
- Resistance to cracking on bending in accordance with EN 13523-7
- Impact resistance in accordance with EN 13523-5
- Adhesion in accordance with EN 13523-6
- Resistance to staining in accordance with EN 13523-18
- Resistance to chalking in accordance with EN 13523-14
- Pencil hardness with EN 13523-4.

Other similar test shall be used for other finishes.

5.7.3 Aspects of identification of materials and products

5.7.3.1 Nature of the materials or components

See ETAG 016 Part 1, General.

5.7.3.2 Geometry

See ETAG 016 Part 1, General.

5.7.3.3 Density

See ETAG 016 Part 1, General.

5.7.3.4 Mechanical characteristics

See ETAG 016 Part 1, General.

5.7.3.5 Hygroscopic humidity content

See ETAG 016 Part 1, General.

6. ASSESSING AND JUDGING THE FITNESS OF PRODUCTS FOR INTENDED USE.

6.0 General

The requirements given in Part 1 - chapter 6 shall be applied, unless additional specifications are being given below.

6.1 Mechanical resistance and stability

As panels are non-loadbearing parts of the work, mechanical resistance is considered under ER4. See §6.4.1.

6.2 Safety in case of fire

6.2.1 Reaction to fire

See ETAG 016 Part 1, General.

6.2.2 Fire resistance

See ETAG 016 Part 1, General.

6.2.3 External fire performance

See ETAG 016 Part 1, General.

6.3 Hygiene, health and the environment

6.3.1 Water permeability

See ETAG 016 Part 1, General.

6.3.2 Vapour permeability

See ETAG 016 Part 1, General.

6.3.3 Release of dangerous substances:

See ETAG 016 Part 1, General.

6.3.4 Dimensional variations

See ETAG 016 Part 1, General.

6.4 Safety in use

6.4.1 Mechanical resistance:

6.4.1.1 Test to determine the mechanical strength of a simply supported panel subject to positive load

See ETAG 016 Part 1.

6.4.1.2 Test to determine the mechanical strength of a fixed panel subject to negative load

See ETAG 016 Part 1: General.

6.4.1.3 Thermal effect

The radius of curvature and the reaction on the intermediate support, as a function of the temperature difference between the two skins shall be declared.

6.4.2 Impact resistance

The Approval Body shall take into account the following criteria for the evaluation:

use categories	Level of accessibility ¹	Impact resistance		Walkability
		Hard body impact	Soft body impact	
A1	Not accessible roofs (not even for installation)	None	NPD or Fail	NPD or fail
A2	Roofs, accessible for installation and maintenance only (always with protective measures)	ER4: - Serv.: 1 x 5N	ER4:1x1200N.m Serv.:1x700N.m	NPD or fail (visible damage)
A3	Roofs, accessible with protective measures	ER4: - Serv.: 1 x 10N	ER4:1x1200N.m Serv.:5x700N.m	NPD or fail (visible damage)
A4	Roofs, accessible without protective measures	ER4: - Serv.: 1 x 10N	ER4:1x1200N.m Serv.:5x700N.m	Pass

Table 2: classification criteria relating to the level accessibility of the roofs

Note 1: For the definition of "accessibility" see §2.2

6.4.3 Resistance to fixings

6.4.3.1 Resistance of the panels at fixing devices and joints

See ETAG 016 Part 1, General.

6.4.3.2 Resistance to eccentric loads due to objects fixed to the panel

The Approval Body shall take into account the following criteria for the evaluation:

- No pull-out
No functional failure

The Approval body shall check the influence of the fixing system on the other performance characteristics (e.g. fire resistance, water tightness etc..). The solution shall be indicated in the ETA.

6.4.4 Walkability

Table 2 defines the classification criteria relating to the level accessibility of the roofs.

The approval Body shall take into account the possible outcomes of the walkability test (see Table 3).

Outcomes from the test	Classification
The panel carries the applied load without permanent visible damage	Pass
The panel supports the load but with permanent visible damage	Fail, with permanent visible damage
The panel fails to support the load	Fail

Table 3: classification based on the walkability test results

The results of the test shall be declared.

6.5 Protection against noise

6.5.1 Direct airborne sound insulation

See ETAG 016 Part 1, General.

6.5.2 Sound absorption

See ETAG 016 Part 1, General.

6.6 Energy economy and heat retention

6.6.1 Thermal insulation

See ETAG 016 Part 1, General.

6.6.2 Air permeability

See ETAG 016 Part 1, General.

6.7 Aspects of durability, serviceability and identification of the products

6.7.1 Aspects of durability

6.7.1.1 Creep

The creep factors at 500, 1000, 2000 hours shall be declared (when relevant).

6.7.1.2 Thermal Agents

6.7.1.2.1 Climatic testing cycles

6.7.1.2.1.1 Cycle 1

The criteria for acceptance are:

- R_{CYCLE1} shall not be less than 50% of the initial tensile strength value R_0 .
- The 5 % characteristic value of tensile strength R_{24} of the samples with 90 °C shall be not less than 0,04 Mpa.
- The change of thickness of the sections at 90 °C in test procedure cycle 1 shall not be greater than 5 %, in the central and edge regions.

The results of the tests shall be declared.

6.7.1.2.1.2 Cycle 2

The criteria for acceptance are that R_7-R_{28} shall be equal to or smaller than $3*(R_0-R_7)$ and that R_{28} shall not be less than 40% of R_0 .

If this is not fulfilled, specimens shall be exposed to the cycle 2 test for 56 days. The criteria for acceptance shall be that $R_{28}-R_{56}$ shall be less than R_7-R_{28} and $R_{56} \geq 40\%$ of R_0 .
The results of the tests shall be declared.

6.7.1.2.1.3 Cycle 3

The criteria for acceptance are that R_1-R_5 shall be equal to or smaller than $4*(R_0-R_1)$ and that R_5 shall not be less than 40% of R_0

If this is not fulfilled, specimens shall be exposed to 10 further cycles. The criteria for acceptance shall be that R_5-R_{10} shall be less than R_1-R_5 and $R_{10} \geq 40\%$ of R_0 .
The results of the tests shall be declared.

6.7.1.2.2 Thermal shock

The Approval Body shall define the number of cycles (see Table 4) with reference to the assumed working life of the panel:

Assumed working life (years)	N° of cycles
10	5
25	15

Table 4: definition of the number of cycles

The deterioration of mechanical resistance of the panels after ageing tests shall be declared .

The decrease of the mechanical strength of the panel (ultimate state) should be lower than 40% of the corresponding initial value.

The classification criteria with reference to the working life shall be as follows (see Table 5).

	Thermal shock		
	Fail (5 cycles)	Pass (5 cycles)	Pass (15 cycles)
Climatic cycle Pass	10	10	25
Climatic cycle Fail	10	10	10

Table 5: Working life classification

If the panels does not retain its performance after 5 cycles the working life indicated in the ETA is still 10 years, but the ETA-applicant shall indicate an appropriate maintenance plan to reach the assumed working life; if a panel with a declared working life of 25 years does not retain its performance after 15 cycles, the working life indicated in the ETA shall be 10 years.

6.7.1.3 Biological agents

The durability of wood-based products, shall be declared in the ETA according to ETAG 019: prefabricated wood-based load-bearing stressed skin panels.

6.7.1.4 Finishes

The results of the tests shall be declared.

6.7.2 Aspects of serviceability

6.7.2.1 Resistance to impact from hard body

The hard body impact resistance, shall be determined in accordance with §5.7.2.1.

The assembly shall be classified in accordance with table 2 in §6.4.2.

The impactor shall not create a fissure or hole (visual verification) in the panel, related to functional failure (i.e water tightness and air permeability decay).

The test results, including the depth and diameter of the indentation (if any), shall be declared in the ETA.

6.7.2.2 Resistance to impact from soft body

The soft body impact resistance, shall be determined in accordance with §5.7.2.2.

The assembly shall be classified in accordance with table 2 in §6.4.2.

The impactor shall not create a fissure or hole (visual verification), nor residual deflection greater than 5mm or 0.1 % of the span, either in the panel faces or in the assembly. In case of repeated impacts, the additional residual deflection should systematically decrease.

The results of the tests shall be declared in the ETA.

6.7.2.3 Finishes

The results of the tests shall be declared.

6.7.3 Aspects of identification of materials and products

See ETAG 016 Part 1, General.

7. ASSUMPTIONS AND RECOMMENDATIONS UNDER WHICH THE FITNESS FOR USE OF THE PRODUCTS IS ASSESSED

This chapter sets out the assumptions and recommendations for design, installation and execution, packaging, transport and storage, use, maintenance and repair under which the assessment of the fitness for use according to the ETAG can be made (only when necessary and in so far as they have a bearing on the assessment or on the products).

7.1 Design of works

7.1.1 General assumptions

The design of a self-supporting lightweight composite panel, in many important respects, will be specific to the works in which it is to be used.

7.1.2 Assumptions regarding the substrate, support or supporting frame

The assessment of the self-supporting lightweight composite panels shall be carried out under the presumption that the substrate, support or the supporting frame will not jeopardise any of the ERs in an assembled system.

7.1.3 Assumptions regarding auxiliary products

7.1.3.1 General

Auxiliary products need to fulfil specifications for the panel, used in an assembly, to meet the performance characteristics as specified in the ETA-Guideline.

7.1.3.2 Verification methods for fixings

See ETAG 016 Part 1, General.

7.1.3.3 Verification methods for jointing materials (sealants and gaskets)

See ETAG 016 Part 1, General.

7.1.4 Roof access

In case of inaccessible roofs it will be necessary to provide an external structure with appropriate walkways, completely independent from the roof, to allow a safe installation of the panels

Even when the impact resistance and walkability requirements in this ETA-Guideline have been met, most self-supporting composite roof panels will deteriorate when subjected to repeated foot traffic.

When regular traffic is to be expected, it is advisable to provide walkways, either secured to the external face of the roof panel or even completely independent from the roof.

7.1.5 Roof inclination

To prevent stagnation of water, roof panels should always be installed with a sufficient inclination to drain the water.

7.2 Packaging, transport and storage

See ETAG 016 Part 1, General.

7.3 Execution of works

See ETAG 016 Part 1, General.

7.4 Maintenance and repair

See ETAG 016 Part 1, General.

Section three :

ATTESTATION AND EVALUATION OF CONFORMITY (AC)

8. ATTESTATION AND EVALUATION OF CONFORMITY

8.1 EC decision

The decision as given in ETAG 016 Part 1, General.

8.2 Responsibilities

This Complementary Part of the ETA-Guideline has no supplementary or modified procedures with regard to Part 1 – General.

8.3 Documentation

This Complementary Part of the ETA-Guideline has no supplementary or modified procedures with regard to Part 1 – General.

8.4 CE-marking and information

This Complementary Part of the ETA-Guideline gives no additional or different information and/or requirements for CE-marking than those given in Part 1 – General.

Section four:

THE ETA CONTENT

9.

9.1 Exceptions

This Complementary Part of the ETA-Guideline has no supplementary or modified procedures with regard to Part 1 – General.

Annex A

COMMON TERMINOLOGY

See ETAG 019, Part 1: General.

Annex B

LIST OF REFERENCE DOCUMENTS (STANDARDS)

Reference documents used for the ETAG:

ENV 1187:2002 Test methods for external fire exposure to roofs
EN 10169 Continuously organic coated (coil coated) steel flat products
Part 1: General information (definitions, materials, tolerances, test methods)
ENV 10169 Continuously organic coated (coil coated) steel flat products
Part 2: Products for building exterior applications
EN 13523-0 2001: Coil coated metals - Test methods - General introduction and list of test methods.
EN 13523-1 2001: Coil coated metals - Test methods - Coating thickness
EN 13523-2 2001: Coil coated metals - Test methods - Specular gloss
EN 13523-4 2001: Coil coated metals - Test methods - Pencil hardness
EN 13523-5 2001: Coil coated metals - Test methods - Resistance to rapid deformation (impact test)
EN 13523-6 2002: Coil coated metals - Test methods - Adhesion after indentation (cupping test)
EN 13523-7 2001: Coil coated metals - Test methods - Resistance to cracking on bending (T-bend test)
EN 13523-8 2002: Coil coated metals - Test methods - Resistance to salt spray (fog)
EN 13523-9 2001: Coil coated metals - Test methods - Resistance to water immersion
EN 13523-10 2001: Coil coated metals - Test methods - Resistance to fluorescent UV light and water condensation
EN 13523-13 2001: Coil coated metals - Test methods - Resistance to accelerated ageing by the use of heat
EN 13523-14 2001: Coil coated metals - Test methods - Chalking (Helmen method)
EN 13523-18 2002: Coil coated metals - Test methods - Resistance to staining
EN 322: 1993 Wood-based panels. Determination of moisture content
EN 335: 1992 Hazard classes of wood and wood based products against biological attack.
Part 1: Classification of hazard classes
Part 2: Guide to the application of hazard classes to solid wood
Part 3: Application to wood-based panels
EN 350: 1994 Durability of wood and wood-based products. Natural durability of solid wood.
Part 1: Guide to the principles of testing and classification of the natural durability of wood
Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe
EN 460:1994 Durability of wood and wood-based products. Natural durability of solid wood. Guide to the durability requirements for wood to be used in hazard classes
EN 599: 1997 Durability of wood and wood-based products. Performance of preservatives as determined by biological tests.
Part 1: Specification according to hazard class
Part 2: Classification and labelling
EOTA TR 01 Determination of Impact Resistance of Panels and Panel Assemblies
EU database on dangerous substances in construction products:
<http://europa.eu.int/comm/enterprise/construction/internal/hygiene.htm>

Annex C

Test methods

C1 Additional information for tests to determine the fire performance

1.1 Test arrangement for reaction to fire test [Single Burning Item]

All panels shall be tested vertically in the test rig with a vertical panel-to-panel joint on the long wing. The dimensions of the specimens shall be:

Short wing.	Panel size:	(495 ± 5)mm	x 1.5m ± 5mm (height)
Long wing.	Panel sizes	a)	(200 +t ±5)mm
		b)	(800-t ± 5)mm
			x 1.5m ± 5mm (height)
			x 1.5m ± 5mm (height)

Where t = thickness of panel

Maximum thickness that can be accommodated in the rig is 145 mm. This is measured at the thickest point of the panel and allows for a gap and backing board behind the panel.

1.1.2 Preparation and mounting of test specimens

The assembly and corner detail shall be as close as possible to the end use conditions as specified by the manufacturer.

In case of corner flashing (i.e. steel, aluminium, plastic etc) one possible configuration is shown in Figure 1 with the guidance notes.

The type of materials, dimensions, fixing centres, coatings etc shall be recorded on the test report.

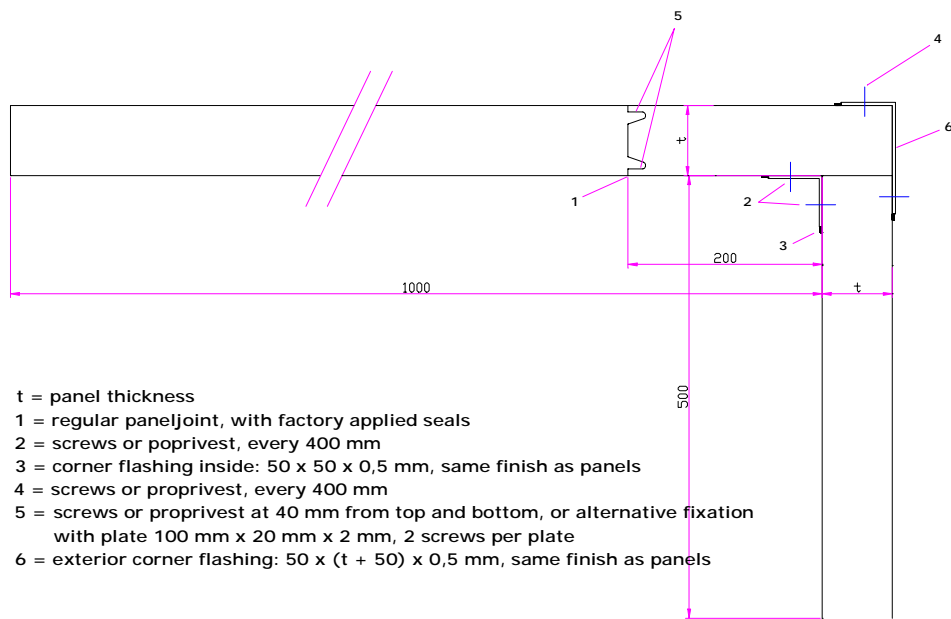


Fig: 1 Assembly and corner detail

The following principles shall apply when securing the panel joint on the long wing:

- panels that are in end use fixed to a structural framework shall be fixed together using rivets or screw fixings to hold the panel joint in place. This represents the tight achieved in end use. Fixings shall be placed 40mm from the top and bottom of the specimen [within the aperture dimensions formed by the upper board and lower 'U' section]. Both internal and external facings shall be secured. The internal face shall be fixed first.
- panels that are normally held together with an internal locking system, (i.e. some cold store panels), shall be fixed together using the locking method. If the locking system does not hold the joint together

over the whole length of the specimen, an additional fixing as in a) and b) above may be used at either the top or bottom of the specimen

1.1.3 Assembly

The two panels forming the long wing shall be assembled with the joint secured as follows:

- The cut edge of the short wing panel shall be placed against the long wing assembly to form an internal corner so that the vertical joint on the long wing is 200mm from the internal corner. The two wings shall then be secured at 90° to each other using internal and external corner flashings and screws or 'pop' type rivets at 400mm spacing (see Figure 1).
- The corner flashings shall have the following dimensions:
 - Internal flashing: 50 x 50mm x 0.5mm thickness
 - External flashing: 50 x [t+50]mm x 0.5mm thickness
- The internal corner flashing shall have the same coating as the panel specimen.
- The cut panel edges at the top and sides of the specimen shall not be covered by flashings, foil or other materials.

Backing boards shall be placed with a minimum 40mm distance between board and the panel sample using a spacer bar at top and bottom. The frame between backing board and specimen shall be open at the sides to allow ventilation into the gap.

1.1.4 Direct field of application with respect to with respect to the Single Burning Item (EN13823)

The Reaction to Fire Classification is only valid for the method of installation tested.

The field of application in the following clauses covers composite panels of the same family i.e. which have the same:

- thickness and profile of facings
- type and thickness of coating [different colours are deemed to have the same properties]
- design of panel to panel joint
- core material

1.1.4.1 Thickness

The test shall be conducted on the panel with the maximum core thickness up to 140mm.

Note: *there is no experience to extend the test results on panels greater than 140mm thickness; this item should be further investigated.*

Where panels of the same family are produced of different thickness the maximum and minimum thickness shall be tested.

The ETA shall contain at least both classifications. A classification, together with related thickness may be declared, if such is possible.

1.1.4.2 Density

Where panels of the same family are produced of different densities the maximum and minimum thickness shall be tested.

The ETA shall contain at least both classifications. A classification, together with related density may be declared, if such is possible.

1.1.4.3 Sealant

Where sealant are incorporated during the manufacture of the sandwich panel they shall be tested as part of the product under EN 13823.

Tests on an assembly incorporating additional sealant (i.e. cold store vapour sealant) are representative for that assembly only and the classification shall be accompanied by the test report reference giving the restricted application for that classification.

1.2 Test arrangement for reaction to fire test EN ISO 11925-2 [Ignitability Test]

The flame shall be applied either to the end (cut edge) representing all applications, or to the surface of the specimen representing the majority of end use applications where the cut edge is protected with site applied flashings.

Note: depending on national regulations the flame shall be applied both to the surface and to the cut edge, even if it is protected with site applied flashing in end use applications

Where the EN ISO 11925-2 test has been carried out on the surface this shall be part of the product marking and the Classification shall be accompanied with the words 'with (insert type i.e. steel, aluminium, plastic etc) flashing details'.

The manufacturer may declare the two alternative classification values with associated definitions.

1.3 Mounting of specimens for external fire performance tests (ENV 1187)

1.3.1 Method 1 Test

First specimen – side lap test:

The panel shall be cut so that the end of the overlap sheet is at least 250mm from cut edge of panel.

Panels shall be fixed to 3 support sections [Top-hat or angles] at top, centre and bottom and side laps shall be stitched every 400mm.

Second specimen – end lap test:

The panels shall be cut to create an end lap so that the cut edge of the upper panel is positioned 750mm from the lower edge of the specimen. The panel at the end lap shall be fixed to a support angle [min. 75mm] in each trough and the overlap sheet shall be stitched in each trough 50mm from the cut edge.

1.3.2 Method 2 Test

Specimens shall be as specified in the relevant standard.

1.3.3 Method 3 Test

First specimen – side lap plus end lap.

The test specimen shall be made up from 2 part-panels with a central standard side-lap joint. The central line shall be the edge of the overlap not the edge of the panel. The left hand panel shall have a standard end lap situated 500 mm from the bottom edge.

The panel at the end lap shall be fixed to a support angle [min. 75mm] in each trough and the overlap sheet shall be stitched in each trough 50mm from the cut edge.

Panels shall be fixed to 3 support sections [Top-hat or angles] at top, centre and bottom and side laps shall be stitched every 400mm.

Second specimen – side lap only.

The test specimen shall be made up from 2 full-length part-panels with a standard side-lap joint. The dimension to the cut edge of the overlap, not the edge of the panel, shall be 785 mm from the left hand edge.

Panels shall be fixed to 3 support sections [Top-hat or angles] at top, centre and bottom and side laps shall be stitched every 400mm.

C2 Water permeability

2.1 Principle

The test rig consists of a negative pressure chamber, of a fan system to create wind outside of the test specimen with minimum pitch angle and of an installation capable of generating rain as well as provisions for observations.

2.2 Pressure chamber

The pressure chamber, independent of the fan system shall be capable of creating a stable negative or positive pressure difference across the test specimen. The pressure difference shall be measured to a maximum inaccuracy of 1% or 5 Pa, whichever is larger.

This pressure difference is not necessary in case of not airtight assembly.

The volume of the pressure chamber shall be sufficient to ensure uniform pressure conditions over the test area. The pressure chamber shall have minimum dimensions of 2 x 2m.

The pressure chamber shall be provided with a transparent under-surface for clear visual observation of the nature and position of leakage which appears on the underside of the test specimen during the test.

To minimise surface tension, absorption and retention of water on the internal surfaces of the pressure chamber, the surface shall be smooth, non absorbent and inclined at a vertical angle of not less than 15° towards the lower collecting apparatus.

2.3 Fan system

The fan system shall be aligned horizontally to the surface of the test specimen. The spatial variation of the wind speed shall be not more than 10 % over the test specimen.

2.3.1 Calibration

2.3.1 Calibration of Flow Over Specimen

To ensure flow uniformity over the whole of the flat boarded specimen area, at a vertical distance 250mm above the surface, the wind speed variation must be less than 10%. The wind speed will be measured to an accuracy of $\pm 0.5\text{m/s}$.

2.3.2 Calibration of Fan System Flow

To ensure flow uniformity of the fan system flow, the wind speed is measured at the following 6 points vertically and laterally at the centre of the test specimen (the wind speed will be measured to an accuracy of $\pm 0.5\text{m/s}$):

Points 1, 2 and 3 are measured 250mm above the surface, at the centre and side edge locations of the test specimen.

Points 4, 5 and 6 are measured 750mm above the surface, at the centre and side edge locations of the test specimen.

The turbulence intensity $t(\%)$ of the flow is expressed as $t=100u/U$, where u is the RMS (root mean square) of the wind speed and U is the mean wind speed. The turbulence intensity is measured at the centre of the test specimen, 500mm above the surface. A measurement instrument (such as a calibrated hot wire anemometer) capable of measuring rapid velocity fluctuations must be used to determine u . The sensitivity of this instrument and any associated electronics must have sufficient frequency range to ensure that all of the fluctuating contributions are accounted for.

2.4 Rain generating device

A rain generating device shall be used, capable of generating a stable precipitation rate. A suitable device could be grid of full circular cone nozzles spray angle 120° spaced uniformly at a distance of 200mm from the surface of the specimen, to give a total amount of $1.6\text{ l/min}\cdot\text{m}^2$

The total amount of the supplied water measured in the test shall not vary by more than 10 %.

2.5 Run-off water

One row of wide angle flat spray nozzles, spaced horizontally at equal distances to give $1.0\text{ l/min}\cdot\text{m}^2$.

The run-off rate shall not vary more than 10 % over the width of the test specimen. The quantity of run-off water shall be measured to a maximum inaccuracy of 3%.

As a suitable precaution, the sidelaps in the uppermost cut edge of the assembly shall be sealed.

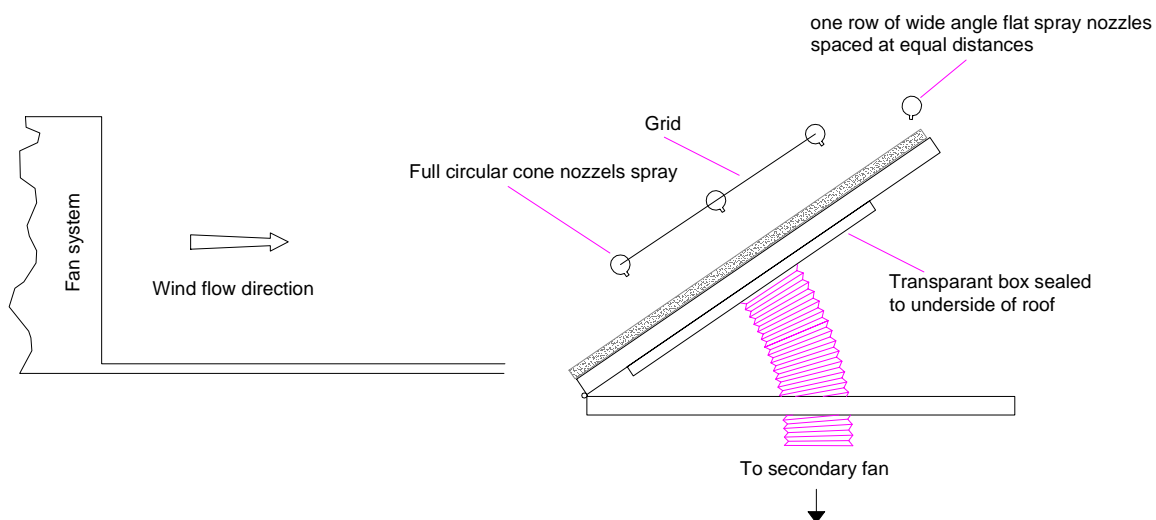


Figure 2: Water permeability apparatus

2.6 Test conditions

The test shall be carried out in laboratory circumstances, at a temperature of $(23 \pm 5)^\circ\text{C}$.

2.7 Test procedure

The assembly (with minimum dimension of 2 x 2m) shall be the most onerous one with the following provisions

- At least a vertical joints between panels;
- The minimum inclination according to the manufacturer's specifications
- A horizontal joint, if this is part of the manufacturer's specifications

It is recommended that the ETA applicant supervises the mounting of the assembly.

The wind speed shall increase from a starting value of 5m/s to 25 m/s in steps of 5m/s, in steps of 5m/s; each step consists of a time period of 5 minutes. The testing is stopped once leakage is detected.

The pressure difference Δp shall be 500 Pa, with the pressure inside the transparent pressure box being less than the pressure in the approaching free stream.

The Water precipitation rate shall be : $1.6l / (min \cdot m^2)$ for the whole duration of the test.

At end of the test a final check shall be done to verify (visual observation) the presence of water inside the assembly.

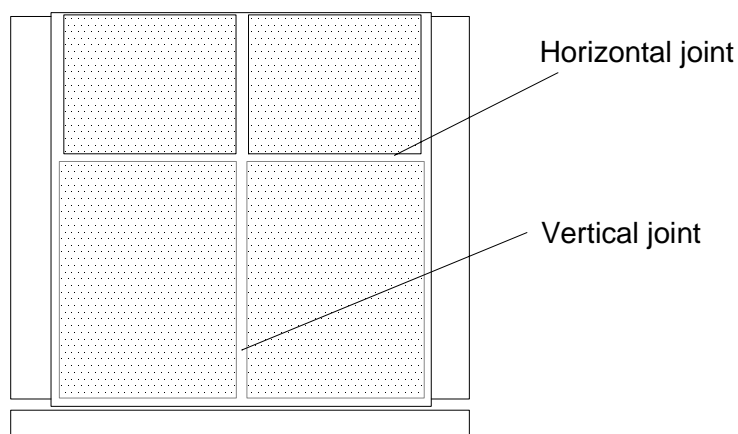


Figure 3: Typical test assembly

2.8 Test report

The test report shall include the following information:

- reference to this EOTA ETA-Guideline, Annex C2
- the name of the testing laboratory
- the name of the ETA-Applicant (and manufacturer of the composite panel)
- date of the test
- description of the test instruments
- identification of the product tested (designation, dimensions and any relevant identification characteristic)
- description of the sample tested, and reference to its marking
- description of conditioning and preparation of the sample (if any)
- description of test conditions (temperature and RH)
- results of the test, including the presence of water (if any)

C3 Dimensional variation

3.1 Principle

This test has the aim to evaluate the effect of a dimensional variation with regard to the water permeability performance of the assembly

3.2 Test conditions

The test shall be carried out in laboratory circumstances, at a temperature of $(23 \pm 5)^\circ\text{C}$.

3.3 Test procedure

The test is performed according to the following steps:

- a) the assembly is tested through a thermal chock: this test shall be carried out according to the test procedure described in Annex C9, applying three cycles;
- b) a water permeability test according to Annex C2 is carried out;

3.4 test report

The test report shall include the following information:

- ◆ reference to this EOTA ETA-Guideline, Annex C3
- ◆ the name of the testing laboratory
- ◆ the name of the ETA-Applicant (and manufacturer of the composite panel)
- ◆ date of the test
- ◆ description of the test instruments
- ◆ identification of the product tested (designation, dimensions and any relevant identification characteristic)
- ◆ description of the sample tested, and reference to its marking
- ◆ description of conditioning and preparation of the sample (if any)
- ◆ description of test conditions (temperature and RH)
- ◆ results of the water permeability test after thermal chock, including the presence of water (if any)

C4 Soft body impact

4.1 Principle

The soft body impact test simulates the impact, resulting from a person accidentally falling against the panel. The soft body is dropped from a height, creating an impact energy, which corresponds with the impact energy released by a person.

The test is conducted with reference to safety in use, i.e. a verification whether the panels would prevent a person falling through and to serviceability, i.e. verification whether the panels would still perform as intended.

4.2 References

This test method is derived from the following reference documents:

ISO 7892:1988 Vertical Building Components - Impact Resistance - Impact Bodies and general Test Procedures

ISO/DIS 7893:1990 Performance Standards in Building - Partitions made from Components - Impact Resistance Tests

M.O.A.T. No 43:1987 UEAtc Directives for Impact Testing - Opaque Vertical Building Components

ETA-Guideline 003 Internal Partition Kits

EN 1195:1998 Timber structure - Test methods - Performance of structural floor decking.

4.3 Test apparatus

The soft body impactor should be a spherical canvas bag of diameter (400 ± 4) mm filled with $(3,0 \pm 0,3)$ mm diameter glass spheres to give a total weight of (50 ± 5) kg.

4.4 Number of tests

4.4.1 Serviceability impact resistance

The test shall be carried out on one test assembly; in case of repeated impacts, they will be carried out at about the same point of impact. The point of impact should be the one deemed most onerous for the assembly under examination.

4.4.2 Safety in use impact resistance

The test shall be carried out on one test assembly, and consists of 1 impact. The point of impact should be the one deemed most onerous for the assembly under examination.
If various impact energies are being tested, new assemblies should be tested for each impact energy.

Note: The functional and safety in use impact test should not be carried out on the same assembly, unless the ETA-applicant of the test so wishes.

4.5 Conditioning and test conditions

The sample conditioning shall be recorded. The conditioning period shall be agreed between the ETA-applicant and the Approval Body.

The test shall be carried out in laboratory circumstances, at a temperature of $(23 \pm 5)^\circ\text{C}$.

4.6 Test assembly

The panels shall be mounted in accordance with the manufacturer's installation specifications, so that the test assembly corresponds as much as possible with the end-use conditions. The way in which components are fixed to each other shall reproduce actual conditions of use, particularly with respect to the nature, type and position of the fixings and the distance between them.

If the manufacturer's specifications foresee more than one possible end-use assembly, the Approval Body should at least perform the test on the most onerous one. The manufacturer has the possibility to test additional assemblies, if he claims better performance.

In principle, the most onerous assembly shall be the following:

- Panel: the panel with the highest ratio length (or height) over width in its minimum thickness
- Span: Maximum distance between supports

Note: Maximum span is not always the worst case if the panels are very flexible: in this case impact test should also be carried on the minimum span.

4.7 Test procedure

In this test, the soft body impactor is dropped from a height (h), so that the total impact energy ($E = 9,81 \times h \times m$) corresponds with the energy as specified in § 6.4.2.

The height (h) is measured between the designated point of impact and the height of release of the soft body impactor (barycentre).

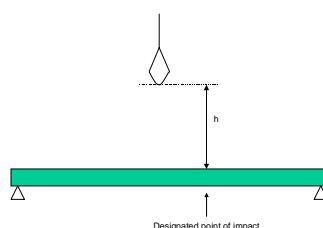


Figure 4: Test arrangements for soft body impact

4.8 Expression of test results

The residual deflection after each impact shall be reported. The residual deflection shall be measured five minutes after the impact. Note shall be made of any damage caused.

For extended application of the test results, the general rule is that test results for the most onerous assembly can be used to reflect the behaviour of other ones.

4.9 Test report

The test report shall include the following information:

- a) reference to this EOTA ETA-Guideline, Annex C4
- b) the name of the testing laboratory
- c) the name of the ETA-Applicant (and manufacturer of the composite panel)
- d) date of the test

- e) description of the test instruments
- f) identification of the product tested (designation, dimensions and any relevant identification characteristic)
- g) surface structure (e.g. smooth, profiled, structured, ...)
- h) description of the sample tested, and reference to its marking
- i) description of conditioning and preparation of the sample (if any)
- j) description of test conditions (temperature and RH)
- k) results of the test, including a description of damage (if any)

C5 Walkability

5.1 Principle

This test provides information regarding the safety in use of roof panels with respect to a single person walking.

5.2 Test specimen

The tests shall be carried out on single span panels of full width. The span shall be the largest envisaged in practice.

5.3 Test procedure

The load shall be applied through a timber block measuring 100 x 100 mm. In order to avoid local stresses, a 10 mm thick layer of rubber or felt shall be placed between the timber block and the top skin of the panel. A load of 1.2 kN shall be applied at mid-span on the edge rib or on the edge of a flat panel.

5.4 Test report

- Reference to this EOTA Guideline – Annex C5
- The name of the testing laboratory
- The name of the ETA applicant (and manufacturer of the panel)
- Date of the test
- Description of test instruments
- Product identification
- Description of conditioning and preparation (if any)
- Description of test conditions (temperature and RH)
- Result of the test, including any damage (if any)

C6 Creep

A single test shall be usually sufficient to determine the creep coefficient for a particular core material.

The Approval Body shall carry out the test on a complete panel on a single span on the most onerous composition, which is in most cases the longest span and the maximum thickness.

The load to be applied is the 30 % of the failure load.

The test shall be carried out under a constant load which shall be sustained undisturbed for a minimum of 2000 hours. During this time, the deflection shall be regularly monitored to give a continuous relationship between deflection and time.

The test shall be carried out by subjecting a simply-supported panel to uniformly distributed dead load. During the placing of the load, the panel shall be propped from below in such a way that the propping can be removed quickly and smoothly in order to initiate the test. Deflection measurements should commence the instant that the full load is applied.

The creep coefficient for the core of a panel shall be determined using the expression:

$$\varphi_t = \frac{w_t - w_0}{w_0 - w_b}$$

- where
- w_t = the deflection measured at time t,
 - w_0 = the initial deflection at the time t = 0 and
 - w_b = the deflection caused by the elastic extension of the faces.

C7 Climatic testing cycles

7.1 Principle

The influence of ageing on panels or their constituent materials is tested by measuring changes in the tensile strength across the depth of the panel on different specimen set subjected to climatic test cycles denoted as Cycle1 and Cycle2 and Cycle3. The Cycle1 is defined in 7.4.3, and Cycle2 in 7.4.4, Cycle3 in 7.4.5.

7.2 Test specimens

7.2.1 Dimensions of test specimens

Testing of tensile strength shall be carried out on core specimens of $100 * 100 \text{ mm}^2$, which are taken from panels-sections of $500 * 500 \text{ mm}^2$. The sections shall be taken from the central area of the panels 4 weeks after production.

The thickness of the samples shall be the full product thickness including, where applicable, any irregular profile.

The specimens shall have a square plan form with squarely cut edges in accordance with EN12085 having sides of 100 mm and an accuracy of 0.5%.

7.2.2 Number of test specimens

Six test specimens shall be used for the determination of the initial tensile strength.

A minimum of five test specimens shall be used for each subsequent part of the test sequence:

cycle 1: Initial set + 3 sets of 5+ specimens

cycle 2: Initial set + 5 sets of 5+ specimens

cycle 3: Initial set + 3 sets of 5+ specimens

All test specimens for the required durability test shall be cut from the same panel. In the case of new panels to be tested under all 3 test methods, the specimens for all the tests shall be taken from the same panel.

7.2.3 Preparation of test specimens

In case of metal facing sheets the cut edges in the samples shall be protected from the effects of corrosion by the application of a layer of water resistant silicone.

Before commencing the tests, the specimens shall be stored for at least 24 ± 0.5 hours at $(23 \pm 5) ^\circ\text{C}$ under normal laboratory conditions.

7.3 Test apparatus

7.3.1 Test apparatus needed for the ageing test in accordance with Cycle1

A test chamber with constant temperature of $(90 \pm 2) ^\circ\text{C}$ and dry conditions.

(Relative humidity not greater than 15%)

7.3.2 Test apparatus needed for the ageing test in accordance with Cycle2

A test chamber with constant conditions: temperature of air $(65 \pm 3) ^\circ\text{C}$ and relative humidity of 100 %. These conditions are achieved by heating up water at the bottom of the chamber.

The test chamber consists of a box in which the water at the bottom of the box is heated roughly up to $+70 ^\circ\text{C}$ (if the box is heated), (see Figure 5).

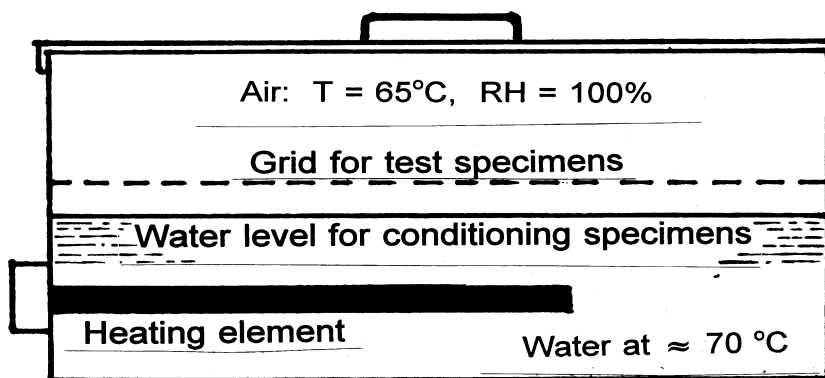


Figure 5: Test chamber for durability test cycle 2.

Note: Normally it is not necessary to provide any accelerated thermal exchange by means of fans in the test chamber. However, circulation of the water may be required

7.3.3. Test apparatus needed for the cyclical ageing test in accordance with Cycle3

A test chamber with constant conditions: temperature $(70 \pm 2) ^\circ\text{C}$ and relative humidity $\geq 90 \%$.

A test chamber with constant temperature of $(90 \pm 2) ^\circ\text{C}$ and dry conditions.

(i.e. relative humidity not greater than 15%).

A test chamber with constant temperature of $(-20 \pm 2) ^\circ\text{C}$.

NOTE These test chambers can be combined

7.4 Test procedure

7.4.1 Tensile strength test

The Tensile strength of the product shall be determined in accordance with Annex C.3 of ETAG 016 Part1 General, using one set of the above test specimens. The strength value obtained is denoted R_0 and is determined as the average strength of the tested specimens.

The dimensions of all test specimens shall be measured before and after the tests and the dimensional changes for all three directions shall be according to EN12085.

After testing, the specimens shall be visually inspected paying special attention to the failure type (cohesive failure of the core, adhesive bond failure in any of the bonded surfaces, proportional area of the adhesive failure etc.).

If the metal faces of any of the specimens have suffered from general edge corrosion during exposure, and if the corrosion has propagated deeper than 10 mm into the joint between the surface sheet and the core over an edge length longer than 50 % of the specimen perimeter, the specimen shall be rejected and its results shall not be included in the calculation of the test results.

7.4.2 Cycle 1 (Temperature Test)

7.4.2.1 Test conditions

7.4.2.2 Testing procedure

The tensile strength tests shall be made under normal laboratory conditions ($23 \pm 2^\circ\text{C}$, $50 \pm 5\%$ humidity). The tensile strength shall be determined with both faces.

Test Programme:

Initial 1:	Test in original condition after 1 week stored in normal laboratory conditions
Sample 2:	Test after storing for 1 week at $90 \pm 2^\circ\text{C}$
Sample 3:	Test after storing for 3 weeks at $90 \pm 2^\circ\text{C}$
Sample 4:	Test after storing for 6 weeks at $90 \pm 2^\circ\text{C}$
Sample 5:	Test after storing for 12 weeks at $90 \pm 2^\circ\text{C}$
Sample 6:	Test after storing for 24 weeks at $90 \pm 2^\circ\text{C}$

If panels are produced in more than one thickness, the tests shall be made with samples from panels of both maximum and minimum thickness.

The minimum tensile strength obtained is R_{Cycle1} . This minimum value is usually after 24 weeks but can be found earlier in the test. It is therefore necessary to conduct the intermediate tests at 3, 6 and 12 weeks and plot the changes in tensile strength.

7.4.3 Cycle 2 (Humidity Test)

7.4.3.1 Test conditions

The test specimens shall be maintained under constant conditions for 28 days at (65 ± 3) $^\circ\text{C}$ and 100 % RH.

7.4.3.2 Testing procedure

One set of test specimens shall be exposed to the basic Cycle2 test cycle for 7 days. After this ageing test, the samples shall be stored until the mass has stabilised under ambient laboratory conditions. For the purpose of this test constant mass is reached, when the change in mass between two subsequent weightings with a 24 hour interval is smaller than 1 % of the total mass.

The tensile strength value obtained is denoted as R_7 .

A second set of test specimens shall be exposed to the cycle 2 test cycle for 28 days. These specimens shall then be conditioned and the strength of the product measured as above. The tensile strength value obtained is denoted as R_{28} .

If the test results illustrate a continuing decline in tensile strength with time a further set of test specimens shall be exposed to the cycle 2 test cycle for 56 days. These specimens shall then be conditioned and the strength of the product measured as above. The strength value obtained is denoted as R_{56} .

7.4.4 Cycle 3 (Humidity and temperature cycle test)

7.4.4.1 The test cycle

The climatic testing cycle is defined below: The term day means a time period of (24 ± 0.5) hours.

5 days at $+70 \pm 2$ °C and 90 % R.H.

1 day at -20 ± 2 °C

1 day at $+90 \pm 2$ °C under dry conditions

The transfer time from one set of exposure conditions to the next shall not be greater than 5 minutes.

If equipment is used in which the conditions are changed in the same chamber, the change from one condition to another shall be made within 1 hour when the temperature is rising and within 2 hours when the temperature is decreasing.

7.4.4.2 Testing procedure

One set of test specimens shall be exposed to the test cycle. After this ageing test, the samples shall be stored until the mass has stabilised under ambient laboratory conditions. For the purpose of this test constant mass is considered to be reached, when the change in mass between two subsequent weightings with a 24 ± 0.5 hour interval is smaller than 1 % of the total mass.

The tensile strength of the product shall then be determined as above. The strength value obtained is denoted as R_1 .

A second set of test specimens shall then be exposed to five test cycles. These specimens shall then be conditioned and the strength of the product measured as above. The strength value obtained is denoted as R_5 .

If the test results illustrate a continuing decline in tensile strength with time, a further set of test specimens shall be exposed to 10 test cycles. These specimens shall then be conditioned and the strength of the product measured as above. The strength value obtained is denoted as R_{10} .

7.5 Test report on durability tests

The test report shall include the following information:

- Reference to this EOTA Guideline - Annex C7
- The name of the testing laboratory
- The name of the ETA applicant (and manufacturer of the panel)
- Date of the test
- Description of test instruments
- Product identification
 - 1) product name, factory;
 - 2) type of product;
 - 3) packaging;
 - 4) the form in which the product arrived at the laboratory;
 - 5) presence of facing or coating;
 - 6) other information as appropriate, e.g. nominal thickness, nominal density, the conditions under which the product was stored and transported before arriving at the laboratory;
- Test procedure
 - 1) pre-test history and sampling, e.g. Manufacturer and product type.
 - 2) conditioning;
 - 3) any deviations from the test procedures as specified above;
 - 4) general information related to the testing:
 - 5.1) the basic test cycle used
 - 5.2) use, where applicable, of the additional 56 days exposure
 - 5) factors which may have affected the results:
 - 6.1) corrosion of the exposed samples
 - 6.2) interruptions in the cycling test programme and the treatment of specimens during these
 - 6.3) rejection of individual test specimens due to the failure of the edge corrosion protection
- Results
 - 1) all individual and mean values
 - 2) any visual observations of the specimens after testing:
 - 2.1) type of failure of the specimens in tensile testing (cohesive failure of the core, adhesive failure between the surface sheet and core, failure between the surface sheet and its coating etc.)
 - 2.2) any corrosion of the test specimens
 - 3) a statement whether the product has passed or failed the acceptance criteria

C8 Thermal effect

8.1 Principle

This test represents the action of thermal stresses due to climatic effects and to the equipment used, which induce deformations and forces in the panels and in the joints.

8.2 Test apparatus

The test shall be performed using the following equipment:

- ◆ Non deformable metal frame, metal supports to allow the units to be fixed horizontally
- ◆ The apparatus must incorporate three adjustable supports capable of providing the maximum span foreseen for the panel to be tested.
- ◆ An array of infra-red lamps for artificially irradiating the external skin of the test panel.
- ◆ Contact thermocouples set on the internal and external skins to allow control of surface temperatures
- ◆ The intermediate support must be connected to the test frame through a load cell.

8.3 Test specimen

The panel (maximum thickness of panel and minimum thickness of facings, maximum span) shall be fixed only at its edges.

8.4 Test conditions

The test shall be carried out in laboratory circumstances, at a temperature of $(23 \pm 5)^\circ\text{C}$.

8.5 Test method

The external face temperature (t_e) shall be taken as follows:

- | | | | |
|-------|--------------------|------------|------------|
| (i) | very light colours | RG = 75-90 | T1 = +55°C |
| (ii) | light colours | RG = 40-74 | T1 = +65°C |
| (iii) | dark colours | RG = 8-39 | T1 = +80°C |

where RG = degree of reflection relative to magnesium oxide = 100%.

The increase of temperature on the external skin from ambient to the maximum test temperature (t_e) is effected in steps of 10°C at approximately 5 minute intervals.

The test consists of two phases:

The first phase consists of measuring the deformations of the panel, fixed to the end supports only, (see Figure 6), as a function of the temperature difference.

Deflection (f) is measured and the radius of curvature is calculated using the formula: $l^2/8f$

The second phase consists of measuring the deflection of each span and the reaction H on the intermediate support, when the panel is fixed to the three supports, as a function of the temperature difference (see Figure 7).

8.6 Test report

The test report shall include the following information:

- Reference to this EOTA Guideline – Annex C8
- The name of the testing laboratory
- The name of the ETA applicant (and manufacturer of the panel)
- Date of the test
- Description of test instruments
- Product identification
- Description of conditioning and preparation (if any)
- Description of test conditions (temperature and RH)

Result of the test, including:

- the deflection across the intermediate support when t_e is reached and maintained,
- the calculated radius of curvature R ,
- the force H daN/m on intermediary support

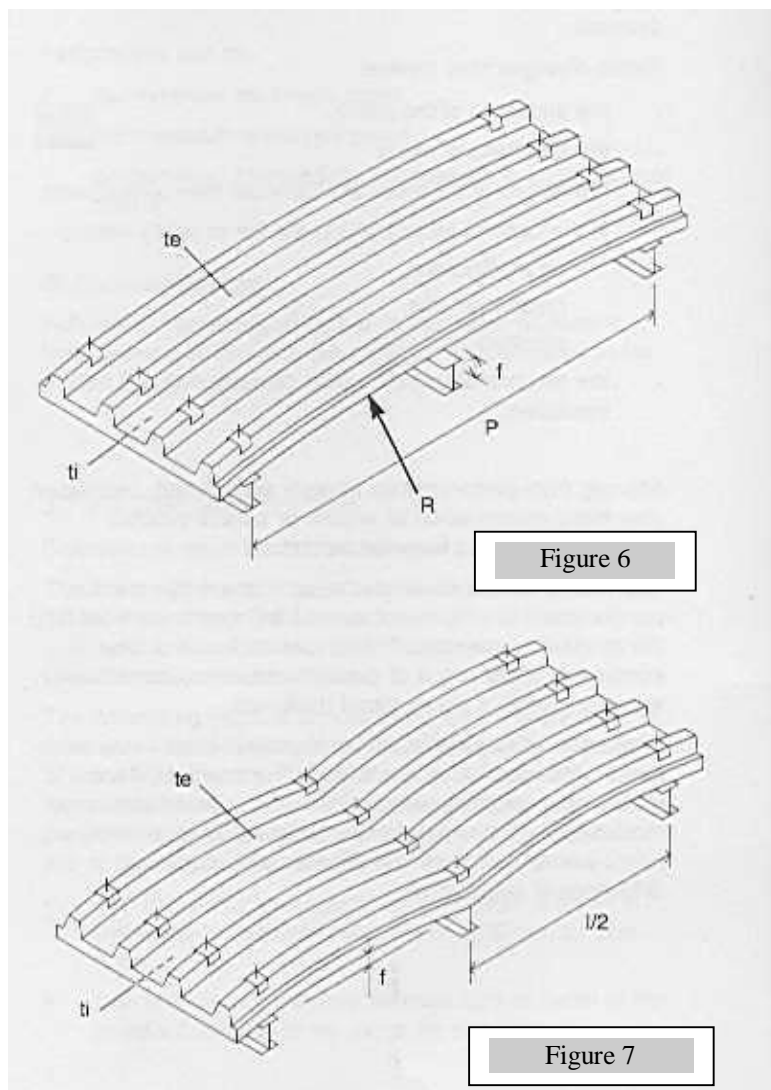


Figure 6

Figure 7

C9 Thermal shock

9.1 Principle

The aim is to assess the performance of panels under the effect of thermal shocks.

9.2 Test apparatus

The performance is examined experimentally on the apparatus described in C8, the panel being fixed as indicated in Figure 6 (maximum thickness of panel, minimum thickness of facings and maximum span).

9.3 Test conditions

The test shall be carried out in laboratory circumstances, at a temperature of $(23 \pm 5)^\circ\text{C}$.

9.4 Test procedure

The external face temperature (t_e) shall be taken as follows:

- | | | | |
|-------|--------------------|------------|------------|
| (i) | very light colours | RG = 75-90 | T1 = +55°C |
| (ii) | light colours | RG = 40-74 | T1 = +65°C |
| (iii) | dark colours | RG = 8-39 | T1 = +80°C |

where RG = degree of reflection relative to magnesium oxide = 100%.

Apply the cycle in the following manner:

- ◆ increase temperature to t_e , in 10°C increments
- ◆ maintain t_e for three hours
- ◆ switch off the radiation system and induce thermal shock by applying cold water spray at $10^\circ\text{-}15^\circ\text{C}$
- ◆ stabilise at ambient conditions for a minimum of 2 h.

Check the reproducibility of deformations (f) as a function of the temperature t_e during the successive cycles and during temperature stabilisation.

The number of cycles is chosen according to the declared working life (see table 4)

9.5 Test report

The test report shall include the following information:

- Reference to this EOTA Guideline – Annex C9
- The name of the testing laboratory
- The name of the ETA applicant (and manufacturer of the panel)
- Date of the test
- Description of test instruments
- Product identification
- Description of conditioning and preparation (if any)
- Description of test conditions (temperature and RH)
- Result of the test, including:
 - detachments,
 - curling of the skin,
 - residual deformation of the panel after the test cycles.

C10 Hard body impact

10.1 Principle

The hard body impact test simulates the impact, resulting from an object accidentally falling against the panel. The hard body is dropped from a height, creating an impact energy, which corresponds with the impact energy released when furniture or alike impacts with the panel.

The test is conducted with reference to safety in use, i.e. a verification whether the panels would prevent an object falling through and to serviceability, i.e. verification whether the panels would still perform as intended (e.g. with reference to water vapour tightness).

10.2 References

This test method is derived from the following reference documents:

ISO 7892:1988	Vertical Building Components - Impact Resistance - Impact Bodies and general Test Procedures
ISO/DIS 7893:1990	Performance Standards in Building - Partitions made from Components - Impact Resistance Tests
M.O.A.T. No 43:1987	UEAtc Directives for Impact Testing - Opaque Vertical Building Components
ETA-Guideline 003	Internal Partition Kits

10.3 Test apparatus

For Safety in use, the hard body impactor should be a steel ball, with a diameter of $(63,5 \pm 0,5)$ mm, with a mass of (1030 ± 30) g (1kg steel ball). For serviceability, it should be a steel ball, with a diameter of $(50,0 \pm 0,5)$ mm, with a mass of (514 ± 14) g (0,5kg steel ball).

10.4 Number of tests

10.4.1 Serviceability impact resistance

The test shall be carried out on one test panel, and consists of one impact.

The point of impact should be the one deemed most onerous for the assembly under examination.

10.4.2 Safety in use impact resistance

The test shall be carried out on one test panel, and consists of 1 impact. The point of impact should be the one deemed most onerous for the assembly under examination.

Note: The serviceability and safety in use impact test should not be carried out on the same panel, unless the ETA-applicant of the test so wishes.

10.5 Conditioning and test conditions

The sample conditioning shall be recorded. The conditioning period shall be agreed between the ETA-applicant and the Approval Body.

The test shall be carried out in laboratory circumstances, at a temperature of $(23 \pm 5)^\circ\text{C}$.

10.6 Test assembly

The panel shall be mounted in accordance with the manufacturer's installation specifications, with regard to the intended use (floor, wall or ceiling panel), so that the test assembly corresponds as much as possible with the end-use conditions. The way in which components are fixed to each other shall reproduce actual conditions of use, particularly with respect to the nature, type and position of the fixings and the distance between them.

If the manufacturer's specifications foresee more than one possible end-use assembly, the Approval Body should at least perform the test on the most onerous one. The manufacturer has the possibility to test additional assemblies, if he claims better performance.

In principle, the most onerous assembly shall be the following:

- Panel: the panel with the highest ratio length (or height) over width in its minimum thickness
- Span: Maximum distance between supports

10.7 Test procedure

In this test, the hard body impactor is dropped from a height (h), so that the total impact energy ($E = 9,81 \times h \times m$) corresponds with the energies as specified in table 2:

The height (h) is measured between the designated point of impact and the height of release of the hard body impactor.

10.8 Expression of test results

For safety in use, the test result is pass/fail, depending on the fact that the ball passes through the panel face or faces, as the case may be. In the case of a positive result, the report shall indicate any damages.

For serviceability, the diameter and maximum indentation after each impact and the residual diameter and indentation shall be reported. Note shall be made of any damage caused.

For extended application of the test results, the general rule is that test results for the most onerous assembly can be used to reflect the behaviour of other ones.

10.9 Test report

The test report shall include the following information:

- a. reference to this EOTA ETA-Guideline, Annex C10
- b. the name of the testing laboratory
- c. the name of the ETA-Applicant (and manufacturer of the composite panel)
- d. date of the test
- e. description of the test instruments
- f. identification of the product tested (designation, dimensions and any relevant identification characteristic)
- g. surface structure (e.g. smooth, profiled, structured, ...)
- h. description of the sample tested, and reference to its marking
- i. description of conditioning and preparation of the sample (if any)
- j. description of test conditions (temperature and RH)
- k. results of the test, including a description of damage (if any)